The right choice for the ultimate yield!

LS ELECTRIC strives to maximize your profits in gratitude for choosing us as your partner.

Programmable Logic Control

Network Positioning Module

XGT Series

User Manual

XBF-PN04B
XBF-PN08B

Safety Instructions

- Read this manual carefully before installing, wiring, operating, servicing or inspecting this equipment.
- Keep this manual within easy reach for quick reference.

LS ELECTRIC

Before using the product …

For your safety and effective operation, please read the safety instructions thoroughly before using the product.

- Safety Instructions should always be observed in order to prevent accident or risk with the safe and proper use the product.

- Instructions are divided into “Warning” and “Caution”, and the meaning of the terms is as follows.

⚠ **Warning**	This symbol indicates the user is expected risk of death or serious injury in case of incorrect handling
⚠ **Caution**	This symbol indicates the user is expected risk of injury or property damage only in case of incorrect handling

Moreover, even classified events under its caution category may develop into serious accidents relying on situations. Therefore we strongly advise users to observe all precautions properly just like warnings.

- The marks displayed on the product and in the user’s manual have the following meanings.
  - ⚠ Be careful! Danger may be expected.
  - ⚠ Be careful! Electric shock may occur.

- The user’s manual even after read shall be kept available and accessible to any user of the product.

Safety Instructions for design process

⚠ Warning

- **Please install a protection circuit on the exterior of PLC so that the whole system may operate safely regardless of failures from external power or PLC.** Any abnormal output or operation from PLC may cause serious problems to safety in whole system.
  - Install protection units on the exterior of PLC like an interlock circuit that deals with opposite operations such as emergency stop, protection circuit, and forward/reverse rotation or install an interlock circuit that deals with high/low limit under its position controls.
  - If any system error (watch-dog timer error, module installation error, etc.) is detected during CPU operation in PLC, all output signals are designed to be turned off and stopped for safety. However, there are cases when output signals remain active due to device failures in Relay and TR which can't be detected. Thus, you are recommended to install an addition circuit to monitor the output status for those critical outputs which may cause significant problems.

- **Never overload more than rated current of output module nor allow to have a short circuit**. Over current for a long period time may cause a fire.

- **Never let the external power of the output circuit to be on earlier than PLC power**, which may cause accidents from abnormal output or operation.

- **Please install interlock circuits in the sequence program for safe operations in the system when exchange data with PLC or modify operation modes using a computer or other external equipments** Read specific instructions thoroughly when conducting control operations with PLC.

Safety Instructions for design process

⚠ Caution

- **I/O signal or communication line shall be wired at least 100mm away from a high-voltage cable or power line.** Fail to follow this instruction may cause malfunctions from noise

Safety Instructions on installation process

⚠ Caution

- **Use PLC only in the environment specified in PLC manual or general standard of data sheet.** If not, electric shock, fire, abnormal operation of the product may be caused.

- **Before install or remove the module, be sure PLC power is off.** If not, electric shock or damage on the product may be caused.

- **Be sure that every module is securely attached after adding a module or an extension connector.** If the product is installed loosely or incorrectly, abnormal operation, error or dropping may be caused. In addition, contact failures under poor cable installation will be causing malfunctions as well.

- **Be sure that screws get tighten securely under vibrating environments.** Fail to do so will put the product under direct vibrations which will cause electric shock, fire and abnormal operation.

- **Do not come in contact with conducting parts in each module**, which may cause electric shock, malfunctions or abnormal operation.

Safety Instructions for wiring process

⚠ Warning

- **Prior to wiring works, make sure that every power is turned off.** If not, electric shock or damage on the product may be caused.

- **After wiring process is done, make sure that terminal covers are installed properly before its use.** Fail to install the cover may cause electric shocks.

⚠ Caution

- **Check rated voltages and terminal arrangements in each product prior to its wiring process.** Applying incorrect voltages other than rated voltages and misarrangement among terminals may cause fire or malfunctions.

- **Secure terminal screws tightly applying with specified torque.** If the screws get loose, short circuit, fire or abnormal operation may be caused. Securing screws too tightly will cause damages to the module or malfunctions, short circuit, and dropping.

- **Be sure to earth to the ground using Class 3 wires for PE terminals which is exclusively used for PLC**. If the terminals not grounded correctly, abnormal operation or electric shock may be caused.

- **Don't let any foreign materials such as wiring waste inside the module while wiring,** which may cause fire, damage on the product or abnormal operation.

- **Make sure that pressed terminals get tighten following the specified torque. External connector type shall be pressed or soldered using proper equipments.**

Safety Instructions for test-operation and maintenance

⚠ Warning

- **Don't touch the terminal when powered**. Electric shock or abnormal operation may occur.
- **Prior to cleaning or tightening the terminal screws, let all the external power off including PLC power.** If not, electric shock or abnormal operation may occur.
- **Don't let the battery recharged, disassembled, heated, short or soldered**. Heat, explosion or ignition may cause injuries or fire.

⚠ Caution

- **Do not make modifications or disassemble each module.** Fire, electric shock or abnormal operation may occur.
- **Prior to installing or disassembling the module, let all the external power off including PLC power.** If not, electric shock or abnormal operation may occur.
- **Keep any wireless equipment such as walkie-talkie or cell phones at least 30cm away from PLC**. If not, abnormal operation may be caused.
- **When making a modification on programs or using run to modify functions under PLC operations, read and comprehend all contents in the manual fully.** Mismanagement will cause damages to products and accidents.
- **Avoid any physical impact to the battery and prevent it from dropping as well.** Damages to battery may cause leakage from its fluid. When battery was dropped or exposed under strong impact, never reuse the battery again. Moreover skilled workers are needed when exchanging batteries.

Safety Instructions for waste disposal

⚠ Caution

- **Product or battery waste shall be processed as industrial waste.** The waste may discharge toxic materials or explode itself.

Revision History

Version	Date	Remark	Revised position
V 1.0	2015.2	First Edition	-
V1.1	2015.4	XBF-PN04B module added	-
V1.2	2015.7	Domain address and CI changed	-
		General specifications changed by reason of changed IEC specifications	2-1
V1.3	2016.8	Chapter4 Basic parameter - axis type: virtual axis is added	4-2, 4-7, 4-8
		Chapter4 Input Signal Parameter is added	4-27
		Chapter4 Input filter of external input signal is revised	4-34, 4-35
		Chapter5 Operation Stats Bit info. is revised	5-7
		Chapter5 User define position/speed is revised	5-10
		Chapter6 Command: XSTC is added	6-87
		Chapter6 Command: PHASING is added	6-89
		Chapter6 Command: XSSSD is added	6-91
		Chapter6 Command: XSSSPD is added	6-93
		Chapter7 Command: XPM_STC is added	7-44
		Chapter7 Command: XPM_PHASING is added	7-45
		Chapter7 Command: XPM_SSSD is added	7-46
		Chapter7 Command: XPM_SSSPD is added	7-47
		Chapter9 Phasing correction control is added	9-174
		Chapter9 User defined position/speed display is added	9-177
		Chapter9 Basic Parameter Teaching - virtual axis is added	9-186
		Chapter9 Full-closed control is added	9-188
		OS Ver. information for each CMD is included.	-
		Appendix 1 - Error code 741~776, 811, 821 is added	A1-2
		Appendix 5 Virtual Axis is added	A5-1
V1.4	2018.8	Chapter3 L7NH Servo connect information is added	3-4
		Chapter6 Command: XSETOVR is added	6-95
		Chapter6 Command: XCAMA is added	6-97
		Chapter7 Command: XPM_SETOVR is added	7-50
		Chapter7 Command: XPM_CAMA is added	7-52
		Chapter9 Speed Acc./Dec. override is added	9-168
		Chapter9 Absolute positioning CAM operation is added	9-147
		Chapter5 External input signal modified	5-5
V1.7	-	Version management of Network Position Module	-

Version	Date	Remark	Revised position
V1.8	2019.7	Chapter2 Wiring information has added	2-7
		Chapter5 axis information added	5-9
		Chapter6 Command: XTPROBE is added	6-103
		Chapter6 Command: XABORTT is added	6-105
		Chapter6 Command: XTRQSL is added	6-106
		Chapter6 Command: XGEARIP is added	6-107
		Chapter7 Function Block: XPM_TPROBE is added	7-73
		Chapter7 Function Block: XPM_ABORTT is added	7-75
		Chapter7 Function Block: XTRQSL is added	7-36
		Chapter7 Function Block: XGEARIP is added	7-51
		Chapter9 Command: TouchProbe is added	9-184
		Chapter9 Command: Syn.SpeedDesignatingSync.Position are added	9-149
		Chapter9 Command: Homing method (0x6098) modified	9-3~7
		APPENDIX 1 Error code 752~756, 791, 792 is add	App1
V1.9	2020.7	Format and contents modification according to the change of company name(LSIS → LS ELECTRIC)	-
V2.0	2022.8	Domain name change (http://www.lselectric.co.kr → http://www.lselectric.com)	-
V2.1	2023.9	Chapter3 Fix wiring example	3-4~3-10

Thank you for purchasing PLC of LS ELECTRIC Co., Ltd.
Before use, make sure to carefully read and understand the User's Manual about the functions, performances, installation and programming of the product you purchased in order for correct use and importantly, let the end user and maintenance administrator to be provided with the User's Manual.

The User's Manual describes the product. If necessary, you may refer to the following description and order accordingly. In addition, you may connect our website (http://www.lselectric.com/) and download the information as a PDF file.
Relevant User's Manuals

Title	Description
XG5000 User's Manual (for XGK, XGB)	XG5000 software user manual describing online function such as programming, print, monitoring, debugging by using XGK, XGB CPU
XGK/XGB Instructions & Programming User's Manual	User's manual for programming to explain how to use instructions that are used PLC system with XGK, XGB CPU.
XGB Hardware User's Manual	It describes how to use the specification of power/input /output/expansion modules, system configuration and built-in High-speed counter for XGB main unit.
XGB IEC Hardware User's Manual	It describes how to use the specification of power/input /output/expansion modules, system configuration and built-in High-speed counter for XGB IEC main unit.
XG-PM Manual	Describes the function and handling methods of XG-PM that is the software operating the positioning module corresponding to the CPU of XGT PLC series.

The User's Manual is based on XBF-PN08B.
This manual is based on the following versions.

Product name	OS version
XBF-PN08B/PN04B	V1.80
XBCU	V1.90
XECU	V1.90
XBMHP,XBMH2	V2.20
XEMHP,XEMH2	V2.20
XG5000(XG-PM:V2.8)	V4.29

◎ Table of Content ◎

Chapter 1 Overview

This manual describes the specification, installation, method to use each positioning function, programming and the wiring with external equipment of XBF-PN04B/XBF-PN08B (Hereinafter referred to as positioning module).

1.1 Features

The characteristics of positioning are as follows.

(1) It can be used by installing it to XGB series high-performance CPU system.

(2) Various positioning control function

It has various functions needed for positioning system such as positioning control, speed control.

(a) The operation data including positioning address and operation method, operation pattern is available to set up to 400 for each axis. With this operation data of 400 set, positioning for each axis is available.

(b) Various sing-axis operations are available.

1) Position control
2) Speed Control
3) Feed Control
4) Multi-axis Synchronous Start
5) Point operation

(c) Various Multi-axis operations are available.

1) Circular Interpolation (Circular interpolation in 4 groups, up to 2 axes each)
2) Linear interpolation (up to 8-axis)
3) Helical interpolation
4) Ellipse interpolation

(d) Switching control is possible while operating.

1) Position/Speed control switch
2) Speed/Position Control switch.
3) Position/Torque Control switch

(e) Cam Control is available.

It is available to create up to 8 kinds of cam data with various cam profile of XG-PM.

(f) Various Homing Control function.

1) The Homing method supported by each servo drive model can be used in XBF-PN08B.
(Setting in Servo Parameter)
2) Positioning control from an arbitrary position to the machine homing (floating homing setting) can be used.

(g) For the Acceleration/Deceleration method, it is available to select trapezoid or S curve.

(3) High speed of start process

By speeding up the processing at the start of positioning operation, the start processing time has been shortened to 1ms (1-2 axes), 2ms (3-5 axes), and 3ms (6-8 axes).

In addition, there is no delay time between axes in Simultaneous start and interpolation start.

(4) IO device connection with the servo driver through EtherCAT

(a) You can directly connect up to 8 servo drives and 32 IO devices through EtherCAT.

(b) The connection between the positioning module and the servo drive is made with an Ethernet cable, so wiring is simple.

(c) You can easily check and set servo drive information and parameters in the positioning module.

(d) Connection is possible up to 100m.

(5) It is possible to implement an absolute position system.

An absolute position system can be implemented simply by connecting to a servo drive using an absolute position encoder, and the current position of motor can be recognized without the need of reset the homing even when the power is turned on /off.

(6) Easy maintenance.

Since various data, including positioning data, parameters, are saved in the NRAM (Magnetic Random Access Memory) within positioning module, data can be saved without delay, and there is no limit to the number of writes.

(However, cam data is saved in flash memory)

(7) Self-diagnosis, monitoring and test are available with powerful XG-PM software package.

(a) Monitoring function (module and servo drive)

(b) Trace function

(c) Trend function

(d) Reading and saving module parameter/operation data

(e) Reading and saving servo parameter

(f) Servo tuning function (L7NH series support)

(g) Cam data generation function

(i) Simulation function

(j) Provides detailed information and measurements for various errors.

(j) Providing various type print function.

(k) Editing operation data in Excel program is available

※ Constraints on system installation

(a) Can only be installed in an environment that provides high-speed expansion I/F.

- Supported main module: XBC-DxxxU/UA/UP, XEC-DxxxU/UA/UP, XBM-DxxxH2/HP, XEM-DxxxH2/HP)

(b) Up to 2 high-speed I/F expansion modules can be installed on the system.

(c) Can only be installed in extension slot 2, 3

(d) Cannot be installed behind a general expansion module

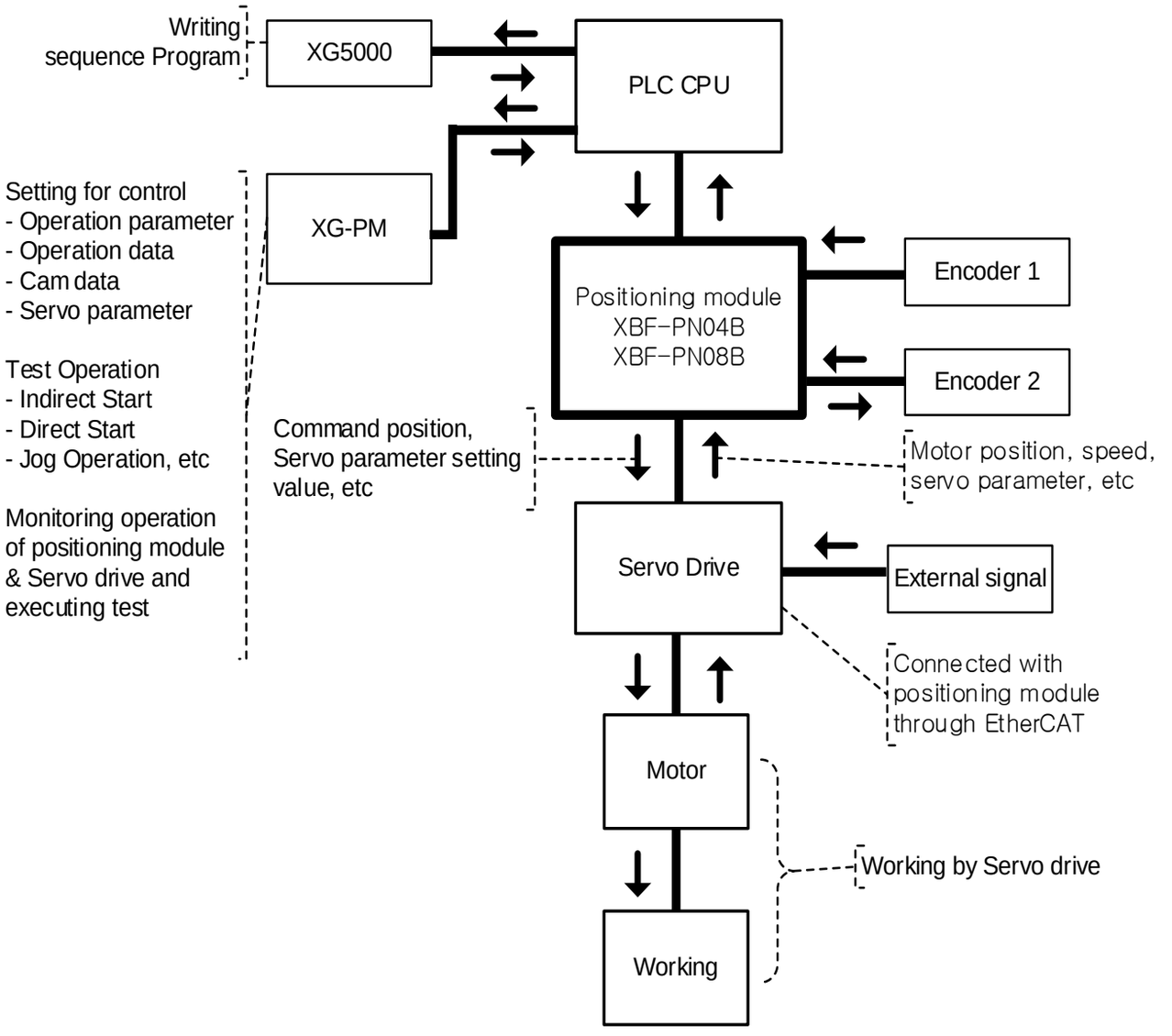
- When installing in slot 3, slot 2 should be the network positioning module.

Notes

1. What is EtherCAT?
   EtherCAT, Open Industrial Ethernet Solution, is developed by Beckhoff at 2002 and at 2003, November EtherCAT Technology Group (ETG-http://www.ethercat.org) is organized and it opens its technology. At 2005, February, that is authorized as IEC standard specification. Currently, it is being quickly applied to industrial sites and its performance is being proven due to its extremely fast control speed and Industrial Ethernet features including ease of use, and convenient maintenance.
   In the positioning module, data communication with server driver is done with master-slave method through EtherCAT, and electric Ethernet cable is used.

1.2 Signal flow of positioning module

Various software and external devices in a PLC system using a positioning module operates as shown below.



1.3 Function overview of positioning module

Describe Representative functions of APM module (Coordinate and Linear Interpolation, Circular Interpolation and Stop) briefly.

1.3.1 Position control

Execute positioning control for the designated axis from the starting position (current position) to goal position (the position to move to).

(1) Control by absolute coordinates

(a) Execute positioning control from starting position to goal position designated in motion function block.

(b) Positioning control is executed based on position (the homing position) specified in the homing.

(c) Moving direction is decided by starting position and goal position.

■ Starting Position < Goal Position: Forward positioning control operation

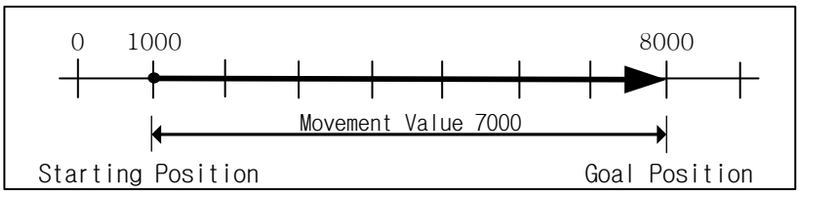
■ Starting Position > Goal Position: Reverse positioning control operation

[Example]

■ Starting Position: 1000,

■ Goal Position: 8000

The transfer amount to forward direction shall be 7000 (7000=8000-1000).



(2) Control by Incremental coordinates

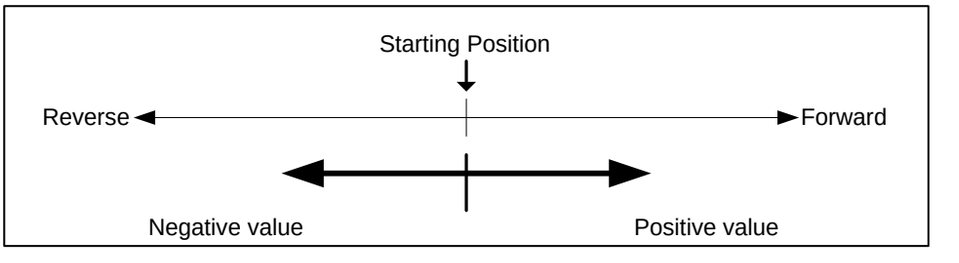
(a) Execute positioning control from starting position as much as goal movement value.

Unlike the absolute coordinate method, in this case, the value specified for the target position is not the position value but the movement amount.

(b) Moving direction depends on sign of movement value.

■ Positive value (+ or 0): positioning operation with forward direction

■ Negative value (-): positioning operation with reverse direction.

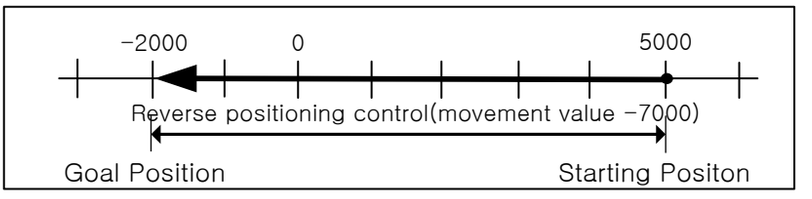


[Example]

■ Starting Position: 5000,

■ Goal Position: -7000

In this condition, it moves reversely and operates positioning at -2000.



1.3.2 Interpolation control

(1) Linear Interpolation Control

Performs linear interpolation control from the starting position (currently stopped position) using the specified axis.

Combination of interpolation axis is unlimited and maximum 8 axes linear interpolation control is available.

(a) Linear interpolation by absolute coordinates

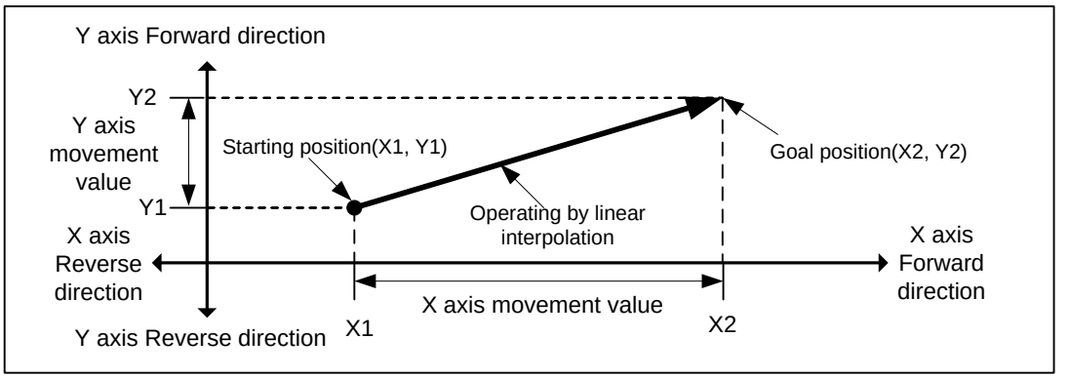
(1) Executes linear interpolation from starting position to the target position designated on positioning data.

2) Positioning control is executed based on designated position in homing.

3) The direction of movement depends on the starting position and the goal position for each axis.

■ Starting Position < Goal Position: Forward positioning control operation

■ Starting Position > Goal Position: Reverse positioning control operation

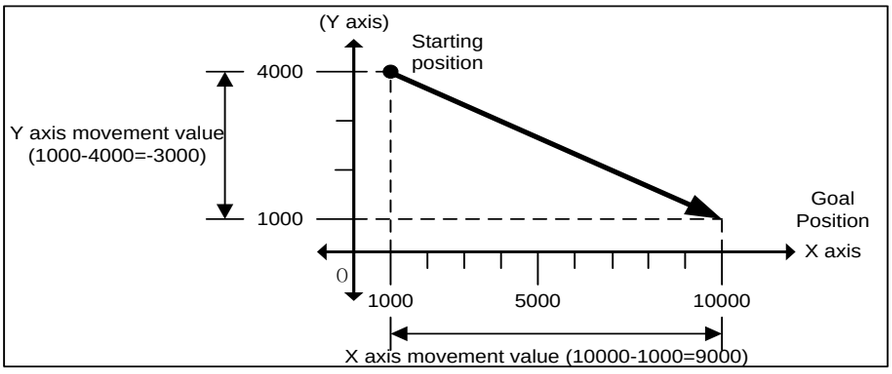


[Example]

■ Starting position (1000, 4000).

■ Target position (10000, 1000)

The action is as follows in the condition above



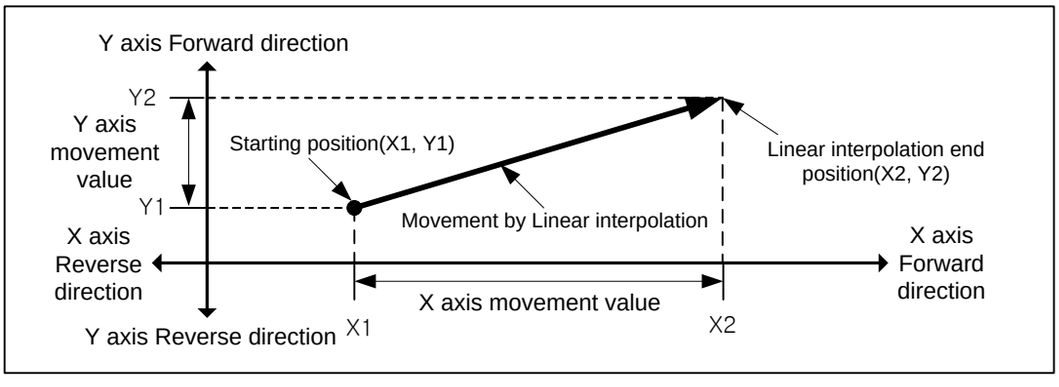
(b) Linear Interpolation by incremental coordinates type

1) Linear interpolation is performed from the start address to the position including the target movement direction and movement amount for each axis.

2) Moving direction depends on the sign of the goal position.

■ When the sign of movement distance is positive (+ or no sign): Positioning operation in forward direction (starting position increase direction)

■ The sign is negative (-): Positioning operation in reverse

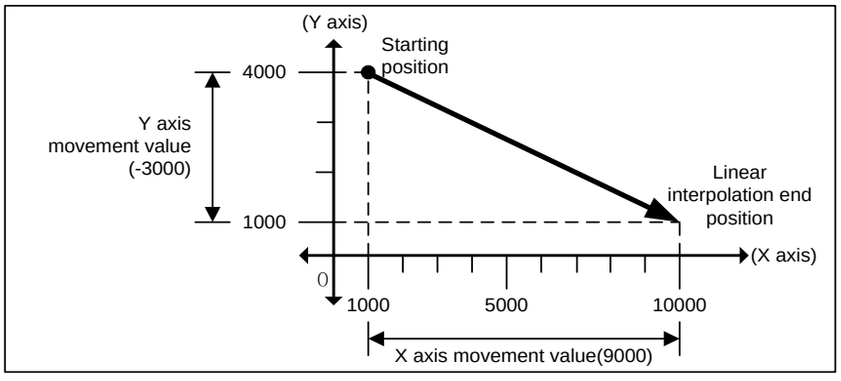


[Example]

■ Starting position (1000, 4000).

■ Target position (9000, -3000)

The action is as follows in the condition above



(2) Circular Interpolation Control

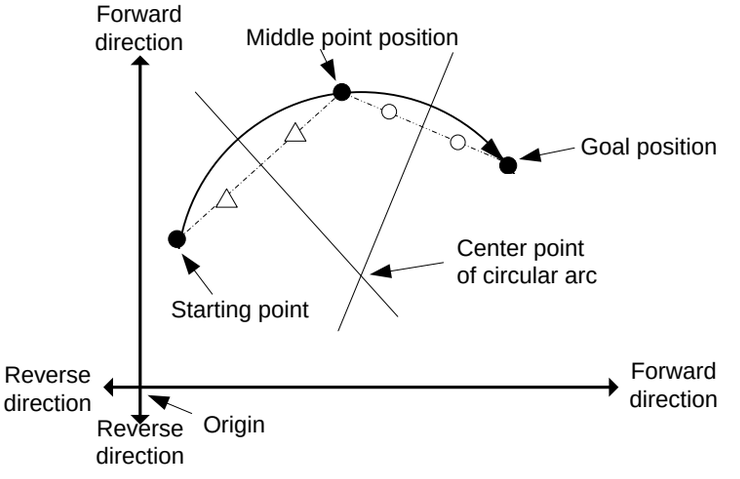
Execute interpolation operation along the trace of circle with 2 axes in forward direction that already designated for each axis.

Circular interpolation has 3 types according to auxiliary point, Middle point method passing auxiliary point, Center point method using auxiliary point as center of circle and Radius method using auxiliary point as radius of circle. Also, it is available to be executed more than 360° circular interpolation depending on the multiturn setting.

There is no limitation for the combination of 2 axes that used in circular interpolation. (Available to use any 2 of 1~8 axis)

(a) Circular interpolation with middle point designation form.

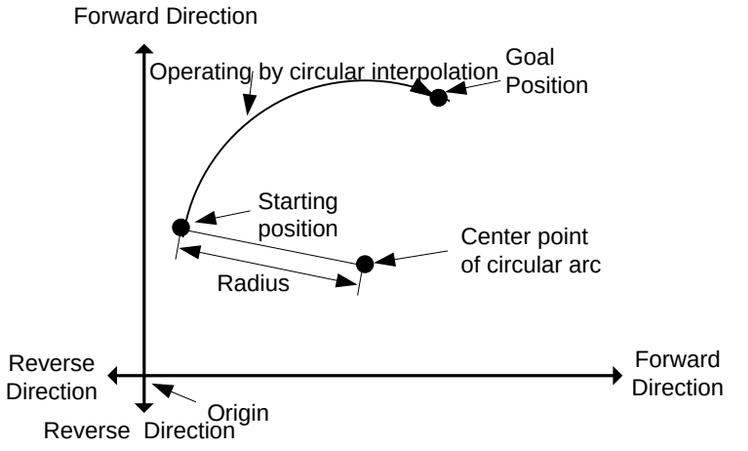
1) Starts operating at starting position and executes circular interpolation through the designated middle point.
2) There will be a circular arc whose center point is crossing point of perpendicular bisection between starting position and middle point or middle point and goal position.



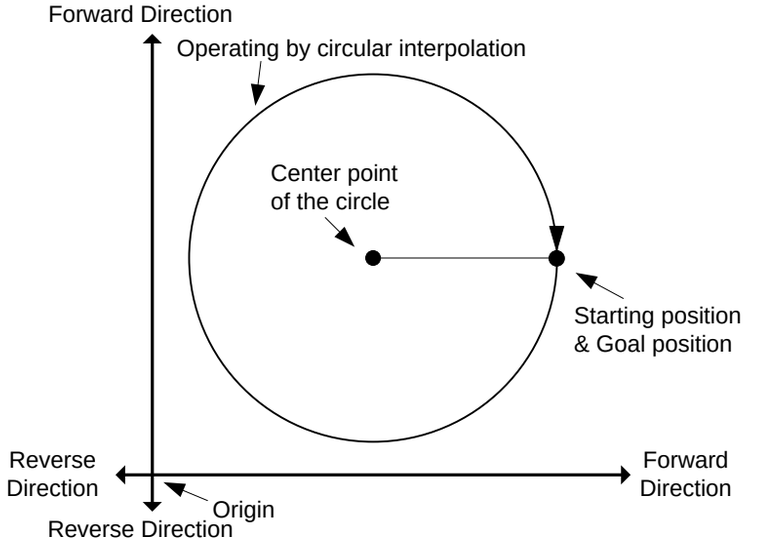
3) Control unit “degree” is not available to be used for circular interpolation control.
4) Movement direction is decided automatically depends on set target position and auxiliary point of circular interpolation.

(b) Circular interpolation with center point designation form

1) Starts operating from starting position and execute circular interpolation along trace of circle that has distance from starting point to designated center point as radius.



2) If the goal position is same as starting position, it is available to have an operation like a circle that has distance from starting point to auxiliary point as its radius

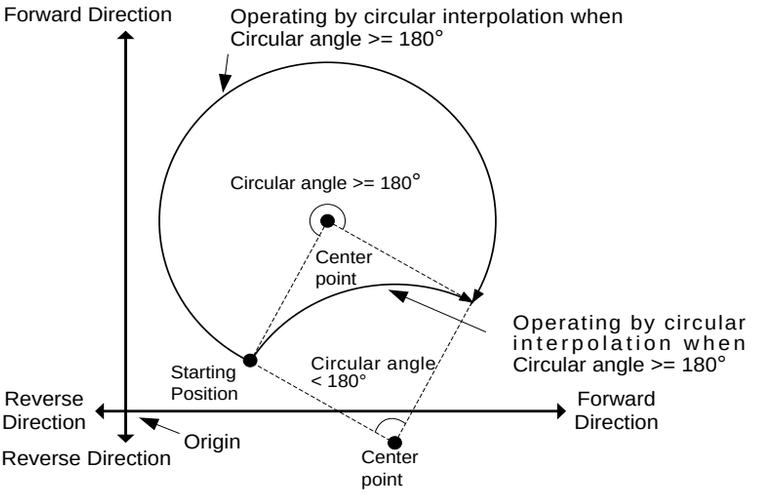


3) Control unit “degree” is not available to be used for circular interpolation control.

4) Direction is determined in setting of “circular interpolation mode' (Center point CW, Center point CCW).

(c) Circular interpolation with radius designation form

1) Starts operating from starting position and execute circular interpolation along trace of circular arc that has value designated in auxiliary point of main axis as it radius. Depending on size setting of circular arc (<180°,>=180°), center point of circular arc will be different.



2) In radius designation form, goal position cannot be set the same as starting position.

3) Control unit “degree” is not available to be used for circular interpolation control.

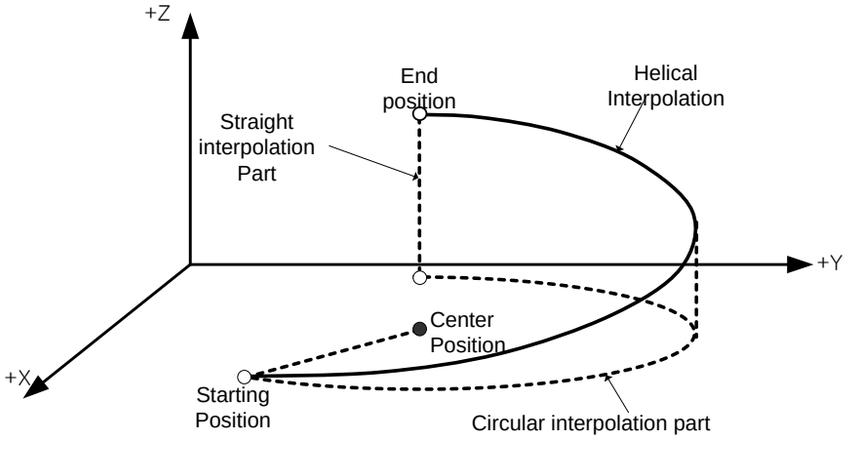
4) The operational direction and circular’s size are depending on setting value in “circular Interpolation mode” of the operating data (radius, CW, arc <180 degrees / radius, CW, arc > = 180 degrees / radius, CCW, arc < 180 degrees / radius, CCW, arc >= 180 degrees).

(3) Helical Interpolation Control

(a) Moves along the designated trace of circular arc depending on circular arc interpolation setting and executes linear interpolation synchronously.

(b) It is available to execute helical interpolation of more than 360°depending on multiturn setting value.

(c) The combination of axis that used for helical interpolation control is unlimited, 3 axes among axis1 ~ 8 are used.



1.3.3 Speed Control

(1) It is executed by positioning operation start command (Direct start, indirect start, Simultaneous start) and keeps operating with designated speed until Dec. stop command.

(2) Speed control has forward operation and reverse operation.

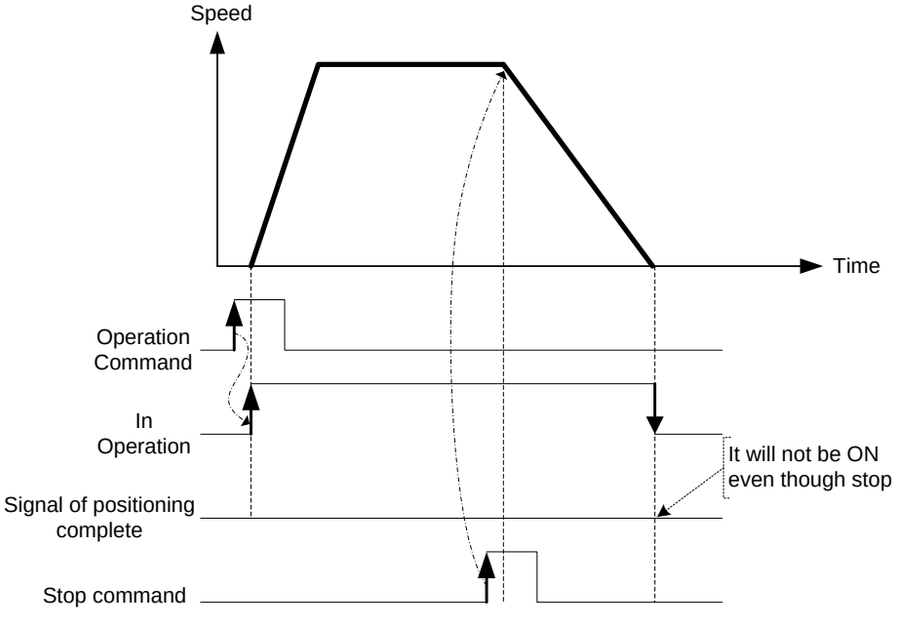
(a) Forward direction: when position value is greater than equal to 0.

[b] Reverse direction: when position value is negative number (-)

(3) In case of speed control, M code will be on' only when M code mode is 'With'.

If the servo drive supports CSP (Cyclic Synchronous Position) operation mode or CSV (Cyclic Synchronous Velocity) operation mode among the EtherCAT CiA 402 drive profile modes, speed control is possible in CSP or CSV operation mode.

(4) Operation timing



1.3.4 FEED control

(1) After executed by positioning start, reset the current position as 0 and start positioning as much as movement value already set.

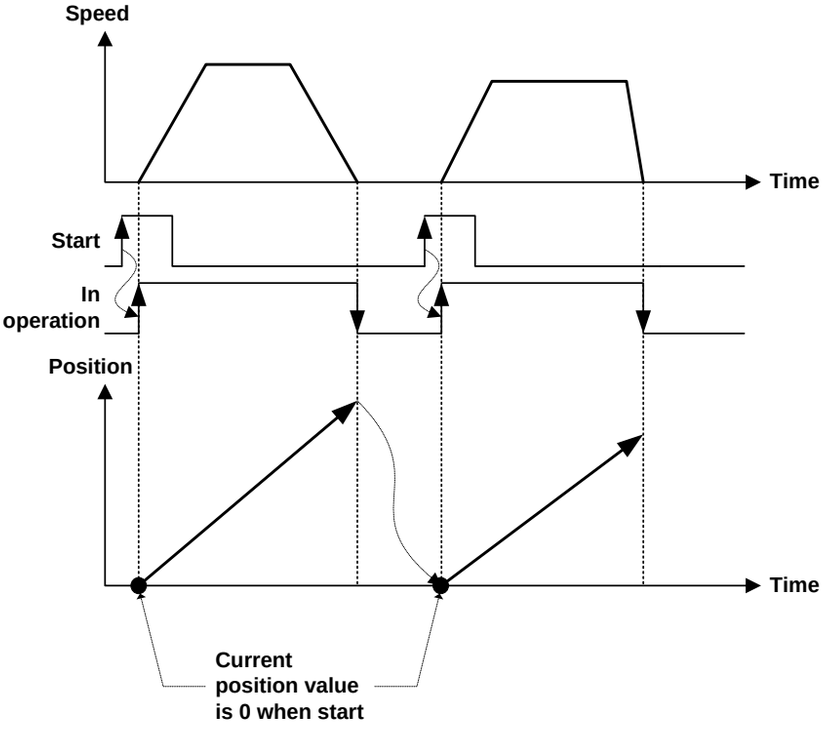
(2) Movement direction is decided by movement value.

(3) FEED control has forward direction operation and reverse direction operation.

Forward: when position value is greater than equal to 0.

Reverse: when position value is negative number (-)

(4) Operation timing is as follows.



Chapter2 Specifications

2.1 General specifications

The following table shows the general specification of XGT series.

<table>
<tr><th>No.</th><th>Item</th><th colspan="6">Specifications</th><th>Relevant specifications</th></tr>
<tr><td>1</td><td>Ambient temperature</td><td colspan="6">0 ~ 55 ℃</td><td>-</td></tr>
<tr><td>2</td><td>Storage temperature</td><td colspan="6">-25 ~ +70 ℃</td><td>-</td></tr>
<tr><td>3</td><td>Ambient humidity</td><td colspan="6">5 ~ 95%RH (Non-condensing)</td><td>-</td></tr>
<tr><td>4</td><td>Storage humidity</td><td colspan="6">5 ~ 95%RH (Non-condensing)</td><td>-</td></tr>
<tr><td rowspan="8">5</td><td rowspan="8">Vibration resistance</td><td colspan="4">In case of occasional vibration</td><td>-</td><td>-</td></tr>
<tr><td colspan="2">Frequency</td><td>Acceleration</td><td>Amplitude</td><td>Count</td><td rowspan="7">IEC61131-2</td></tr>
<tr><td colspan="2">5 ≤ f < 8.4Hz</td><td>–</td><td>3.5mm</td><td rowspan="5">10 times for each direction of X, Y and Z</td></tr>
<tr><td colspan="2">8.4 ≤ f ≤ 150Hz</td><td>9.8m/s²{1G}</td><td>–</td></tr>
<tr><td colspan="4">In case of continuous vibration</td></tr>
<tr><td colspan="2">Frequency</td><td>Acceleration</td><td>Amplitude</td></tr>
<tr><td colspan="2">5 ≤ f < 8.4Hz</td><td>–</td><td>1.75mm</td></tr>
<tr><td colspan="2">8.4 ≤ f ≤ 150Hz</td><td>4.9m/s²{0.5G}</td><td>–</td></tr>
<tr><td>6</td><td>Shock resistance</td><td colspan="6">Maximum shock acceleration: 147 m/s²{15G}
Duration: 11ms
Pulse waveform: Half-sine (3 times for each direction of X, Y and Z)</td><td>IEC61131-2</td></tr>
<tr><td rowspan="5">7</td><td rowspan="5">Noise resistance</td><td>Square wave impulse noise</td><td colspan="4">AC: ± 1,500 V
DC: ± 900 V</td><td>Internal test standard of LS ELECTRIC .</td></tr>
<tr><td>Electrostatic discharge</td><td colspan="4">Voltage : 4kV (contact discharging)</td><td>IEC61131-2
IEC61000-4-2</td></tr>
<tr><td>Radiated electromagnetic field noise</td><td colspan="4">80 ~ 1,000 ㎒, 10 V/m</td><td>IEC61131-2,
IEC61000-4-3</td></tr>
<tr><td rowspan="2">Fast transient /Burst noise</td><td>Classification</td><td>Power Module</td><td colspan="2">Digital/analog I/O, Communication Interface</td><td rowspan="2">IEC61131-2
IEC61000-4-4</td></tr>
<tr><td>Voltage</td><td>2kV</td><td colspan="2">1kV</td></tr>
<tr><td>8</td><td>Operating atmosphere</td><td colspan="6">Free from corrosive gases and excessive dust</td><td>-</td></tr>
<tr><td>9</td><td>Altitude</td><td colspan="6">Up to 2,000m</td><td>-</td></tr>
<tr><td>10</td><td>Pollution degree</td><td colspan="6">Less than equal to 2</td><td>-</td></tr>
<tr><td>11</td><td>Cooling</td><td colspan="6">Air cooling</td><td>-</td></tr>
</table>

Notes

1) IEC (International Electrotechnical Commission)
An international nongovernmental organization which promotes internationally cooperated standardization in electric/electronic field, publishes international standards and manages applicable estimation system related with.

2) Pollution degree
An index indicating pollution degree of the operating environment which decides insulation performance of the devices. For instance, Pollution degree 2 indicates the state generally that only non-conductive pollution occurs. However, temporary conduction occurs in this state due to dew formation

2.2 Performance Specifications

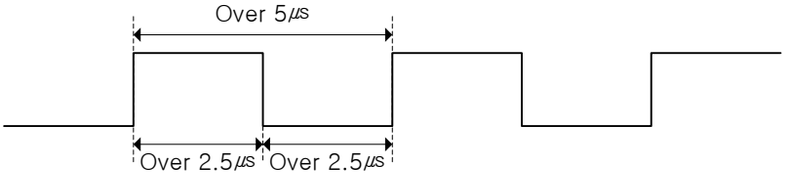
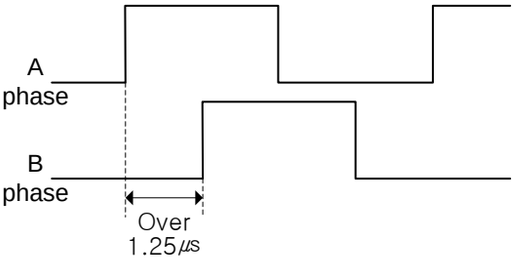
The following table shows the performance specifications, encoder input specifications of XGB network positioning module.

2.2.1 Performance specifications

<table>
<tr><th colspan="2">Item</th><th>Specifications</th></tr>
<tr><td colspan="2">No. of control axis</td><td>4 axes(XBF-PN04B), 8axes(XBF-PN08B)</td></tr>
<tr><td colspan="2">Interpolation function</td><td>2~8 axes linear interpolation, 2 axes circular interpolation, 3 axes helical interpolation</td></tr>
<tr><td colspan="2">Control method</td><td>Position control, Speed control, Speed/Position control, Position/Speed control, Position/Torque control, Feed control</td></tr>
<tr><td colspan="2">Control unit</td><td>pulse, ㎜, inch, degree</td></tr>
<tr><td colspan="2">Positioning data</td><td>Each axis can have up to 400 operation data .(Operation step number : 1 ~ 400)
Setting through XG-PM or program</td></tr>
<tr><td rowspan="3">XG-PM</td><td>Connection type</td><td>Connection through USB of CPU module.</td></tr>
<tr><td>Configuration Data</td><td>Common, Basic, Extended, Manual operation, servo parameter, Operation data, Cam data, Command information</td></tr>
<tr><td>Monitor</td><td>Operation information, Trace, Input terminal information, Error information</td></tr>
<tr><td colspan="2">Back-up</td><td>Save parameters , operation data to MRAM (No battery required)</td></tr>
<tr><td rowspan="4">Positioning</td><td>Positioning method</td><td>Absolute/Incremental</td></tr>
<tr><td>Position address range</td><td>
<table>
<tr><th></th><th>Absolute</th><th>Incremental</th><th>Speed/Position, Position/Speed Switching control</th></tr>
<tr><td>㎜</td><td>-214748364.8~ 214748364.7(㎛)</td><td>-214748364.8~ 214748364.7(㎛)</td><td>-214748364.8~ 214748364.7(㎛)</td></tr>
<tr><td>Inch</td><td>-21474.83648 ~ 21474.83647</td><td>-21474.83648 ~ 21474.83647</td><td>-21474.83648 ~ 21474.83647</td></tr>
<tr><td>degree</td><td>-21474.83648 ~ 21474.83647</td><td>-21474.83648 ~ 21474.83647</td><td>-21474.83648 ~ 21474.83647</td></tr>
<tr><td>pulse</td><td>-2147483648 ~ 2147483647</td><td>-2147483648 ~ 2147483647</td><td>-2147483648 ~ 2147483647</td></tr>
</table>
</td></tr>
<tr><td>Speed range</td><td>
<table>
<tr><td>㎜</td><td>0.01 ~ 20000000.00(㎜/minute)</td></tr>
<tr><td>Inch</td><td>0.001 ~ 2000000.000(Inch/minute)</td></tr>
<tr><td>degree</td><td>0.001 ~ 2000000.000 degree/minute)</td></tr>
<tr><td>pulse</td><td>1 ~ 20,000,000(pulse/sec)</td></tr>
<tr><td>rpm</td><td>0.1 ~ 100000.0(RPM)</td></tr>
</table>
</td></tr>
<tr><td>Acc./Dec. processing</td><td>Trapezoid type, S-Curve</td></tr>
<tr><td>Increasing/Decreasing time</td><td>1 ~ 2,147,483,647 ㎳, Select among 4 types of acceleration/deceleration patterns.</td></tr>
<tr><td colspan="2">Manual Operation</td><td>Jog Operation, MPG Operation, Inching Operation</td></tr>
<tr><td colspan="2">Homing method</td><td>Refer to each servo drive support method</td></tr>
<tr><td colspan="2">Speed change function</td><td>Speed change (absolute/percent)</td></tr>
<tr><td colspan="2">Torque unit</td><td>Designates % of rating torque</td></tr>
<tr><td colspan="2">Absolute position system</td><td>Available (When using an absolute encoder type servo drive)</td></tr>
<tr><td rowspan="5">External Encoder Input</td><td>Channel enable</td><td>1 channel</td></tr>
<tr><td>Max. speed</td><td>Up to 200 Kpps</td></tr>
<tr><td>Input method</td><td>Line drive input (RS-422A IEC specification),
Open collector output type encoder can be connected(5V, 24V available)</td></tr>
<tr><td>Input type</td><td>CW/CCW, Pulse/Dir, Phase A/B</td></tr>
<tr><td>Connector</td><td>9 point connector</td></tr>
</table>

Item		Specifications
External Input Signal	Input point	3 points (input signal A,B,Z)
	Input specification	Same as external Encoder input specifications (5V, 24V)
	Connector	9 point connector (common to external Encoder input terminal)
Communication cycle		1 ㎳
Max. transfer distance		100 m
Communication cable		CAT. 5 or more STP (Shielded Twisted-pair) cable
Error display		Indicated by LED
Communication's status display		Indicated by LED
Input/output occupied point		Variable: 16 points, fixed: 64 points
Current Consumption(mA)		510mA
Weight		115g

2.2.2 Encoder Input Specification

Item	Specifications		
	Open collector		Line driver
Input voltage	DC5V (4.5V ~ 5.5V)	DC24V (19.2V ~ 26.4V)	In accordance with RS-422A Line Driver Level (5V level)
input current	8㎃ ~ 11㎃	8mA ~ 11mA	
Minimum on warranty voltage	4.1V	17.0V	
Maximum off warranty voltage	1.7V	4.5V	
Input pulse	1) Pulse width  2) Phase difference  When A phase input pulse is ahead of B phase input pulse : Position value increases When B phase input pulse is ahead of A phase input pulse : Position value decreases		

2.2.3 External input signal specifications

Since external input signal is used in common with encoder Input terminal, the input specification are the same as the encoder Input Specifications.

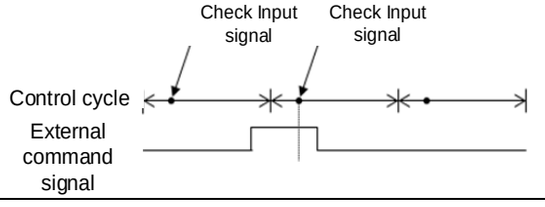
Item	Specifications	
Input voltage	DC5V (4.5V ~ 5.5V)	DC24V (19.2V ~ 26.4V)
input current	8㎃ ~ 11㎃	8mA ~ 11mA
Minimum on warranty voltage	4.1V	17.0V
Maximum off warranty voltage	1.7V	4.5V

Notes

The positioning module's recognition of external command signals is processed in software. Therefore, after the external input signal is turned on, the voltage level must be maintained for at least one control cycle for it to be recognized as an on signal.
The control cycle is as follows depending on the number of axes.

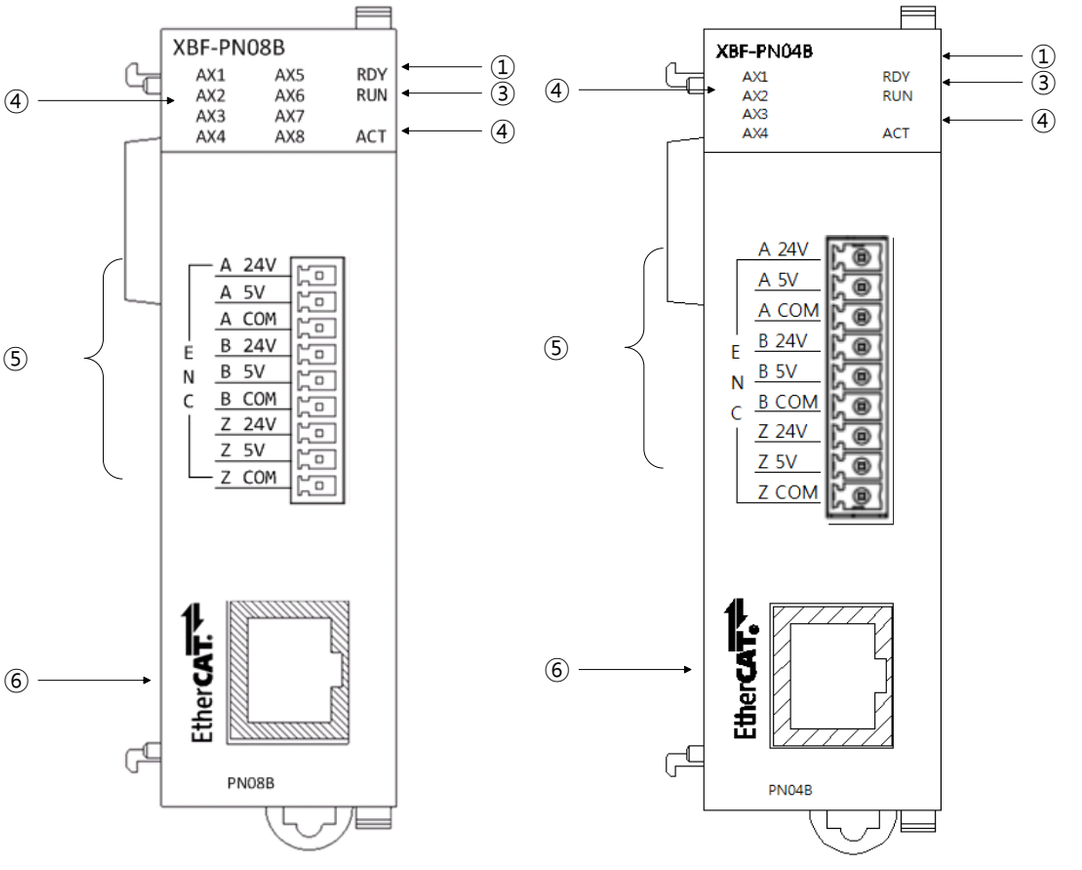
1~2 axis: 1ms ,3~4 axes: 2ms

Even though external input signal is less than 1 control cycle, it can be recognized as an On signal if the external input signal is in the high status at the time of 'checking input signal' during the software processing process.



2.3 Part names

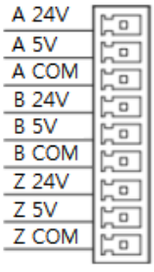
2.3.1 Part names



No.	Name	Content
①	Module ready signal	On: positioning module normal steady status Off: Power off or CPU Module reset status Flicker: positioning module error status
②	Run display LED (AX1 ~ AX8)	On: running for corresponding axis Off: stop for corresponding axis Flicker: error status for corresponding axis
③	Communication status display LED	On: communication with servo drive is connected Off: communication with servo drive is disconnected. Flicker: an error occurred while communication with servo drive.
④	Transmission/reception status LED	On: wiring with servo drive is connected. Off: wiring with servo drive is disconnected. Flicker: communicates with servo drive. (Sending and receiving data)
⑤	Encoder wiring connector	Connector to connect with encoder (the encoder connector is shared when using external input signal function)
⑥	RJ-45 Connector	RJ-45 Connector for connecting to servo drive

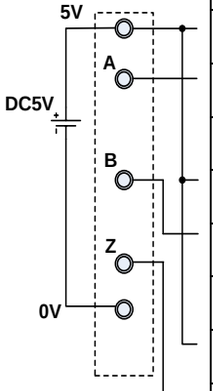
2.3.2 External Equipment and Interface Specifications

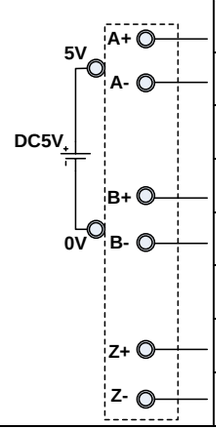
(1) Pin Array of Connector

Pinout	Pin No.	Signal name		Signal direction
	1	A 24V	Encoder phase A 24V	Input
	2	A 5V	Encoder phase A 5V	
	3	A COM	Encoder phase A input COM	
	4	B 24V	Encoder phase B 24V	
	5	B 5V	Encoder phase B 5V	
	6	B COM	Encoder phase B input COM	
	7	Z 24V	Encoder phase Z 24V input	
	8	Z 5V	Encoder phase Z 5V input	
	9	Z COM	Encoder phase Z input COM	

※ When used as an external input signal function, encoder phase A is used as input signal A, encoder phase B is used as input signal B, and encoder Z phase is used as input signal Z.

(2) Internal circuit

Classification	Pin No.	Signal	
 *Note1	1	A 24V	Encoder phase A 24V
	2	A 5V	Encoder phase A 5V
	3	A COM	Encoder phase A input COM
	4	B 24V	Encoder phase B 24V
	5	B 5V	Encoder phase B 5V
	6	B COM	Encoder phase B input COM
	7	Z 24V	Encoder phase Z 24V input
	8	Z 5V	Encoder phase Z 5V input
	9	Z COM	Encoder phase Z input COM

Classification	Pin No.	Signal	
*Note2 	1	A 24V	Encoder phase A 24V
	2	A 5V	Encoder phase A 5V
	3	A COM	Encoder phase A input COM
	4	B 24V	Encoder phase B 24V
	5	B 5V	Encoder phase B 5V
	6	B COM	Encoder phase B input COM
	7	Z 24V	Encoder phase Z 24V input
	8	Z 5V	Encoder phase Z 5V input
	9	Z COM	Encoder phase Z input COM

Caution

* Note 1

The encoder wiring is an example for the 5V voltage output type (open collector).

When using a 24V typed manual pulse generator (MPG), change the input voltage from 5V to 24V and connect the power (pin 1, pin 4, pin 7) to the 24V input terminal (A 24V, B 24V, Z 24V). (No need to add pull-up resistor (included internally))

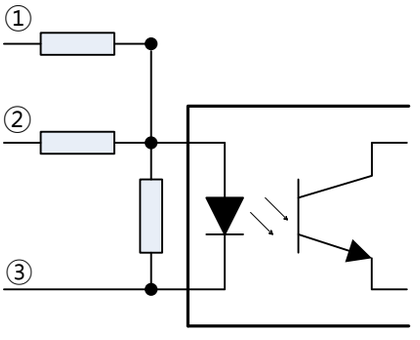
When using a 12V typed manual pulse generator (MPG), change the input voltage to 12V and connect power (pin 2, pin 5, pin 8) using a 1kΩ pull-up resistor at 5V input terminals (A 5V, B 5V, Z 5V). .

When using a 5V typed manual pulse generator (MPG), change the input voltage to 5V and connect the power (pin 2, pin 5, pin 8) to the 5V input terminal (A 5V, B 5V, Z 5V). (No need to add pull-up resistor (included internally))

* Note 2

The encoder wiring is an example for the 5V voltage output type (line driver).

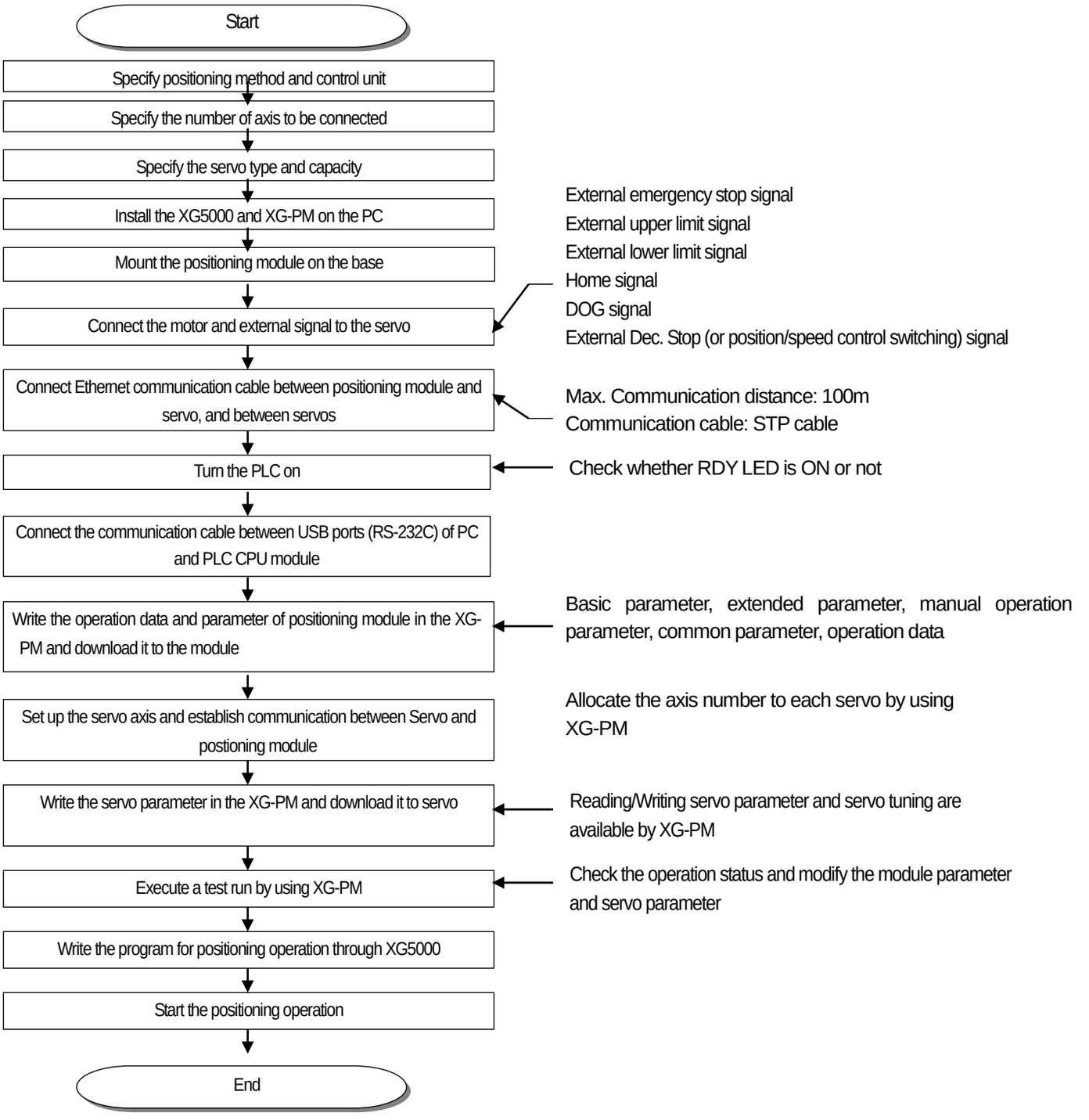
This describes the internal circuit of the module when connecting the encoder.

Input/Output classification	Internal circuit	No.	Terminal block	Pin Number Encoder	Signal name
Input		①	A 24V	1	A Phase 24V Pulse input+
		②	A 5V	2	A Phase 5V pulse input-
		③	A COM	3	A Phase COM input-
		①	B 24V	4	B Pulse 24V pulse input+
		②	B 5V	5	B Pulse 5V pulse input-
		③	B COM	6	B Phase COM input-
		①	Z 24V	7	Z Phase 24V pulse input+
		②	Z 5V	8	Z Phase 5V pulse input-
		③	Z COM	9	Z Phase COM input-

Chapter 3 Operation Order and Installation

3.1 General specifications

This chapter describes the Operation order in case of positioning operation by embedded positioning.



3.2 Installation

3.2.1 Installation Environment

This device has a good reliability regardless of installation environment but make sure to keep the following cautions to guarantee the reliability and safety of the system.

(1) Environment Condition
- Install the control panel available for water-proof, anti-vibration.
- The place free from continuous impact or vibration.
- The place not exposed to direct rays.
- The place with no dew phenomena by rapid temperature change.
- The place where surrounding temperature maintains 0-55℃.

(2) Installation Environment
- In case of processing the screw hole or wiring, cares should be taken not to put the wiring remnants to PLC inside.
- Install on the good place to operate.
- Do not install the high voltage machine on the same Panel.
- The distance from duct or surrounding module shall be more than 50mm.
- Ground to the place where surrounding noise environment is good enough.

3.2.2 Handling Precautions

It describes the cautions for handling from unpacking to installation.
(1) Do not fall down or apply the strong impact.
(2) Do not remove PCB from the case. Doing so may cause failure of the module and/or printed-circuit board.
(3) In wiring, cares should be taken not to put the wiring remnants or foreign materials to the upper part of module. If something entered, it should be removed.
(4) The removal of module in the status of power ON is prohibited.

3.3 Precautions in Wiring

3.3.1 Precautions in wiring

(1) The length of connecting cable between Position module Servo Drive devices shall be as short as possible.

(2) Use separate cables for the communication line between the positioning module and the servo drive, the encoder input signal line of the positioning module, and the signal line input to the servo drive so that they are not affected by surge or induced noise generated on the AC side.

(3) The wire should be selected by considering the ambient temperature and allowable current, and the maximum size of the wire should be AWG22(0.3㎟) or higher.

(4) In wiring, if it is too close to the high temperature machine or material or it is directly contacted to the oil for a long time, the short-circuit will occur that may cause the damage or malfunction.

(5) Make sure to check the polarity before applying the external contact signal to the terminal board.

(6) In case of wiring the high voltage cable and power cables together, the induction noise occurs that may cause the malfunction or failure.

(7) In case of wiring by the pipe, the grounding of pipe is required.

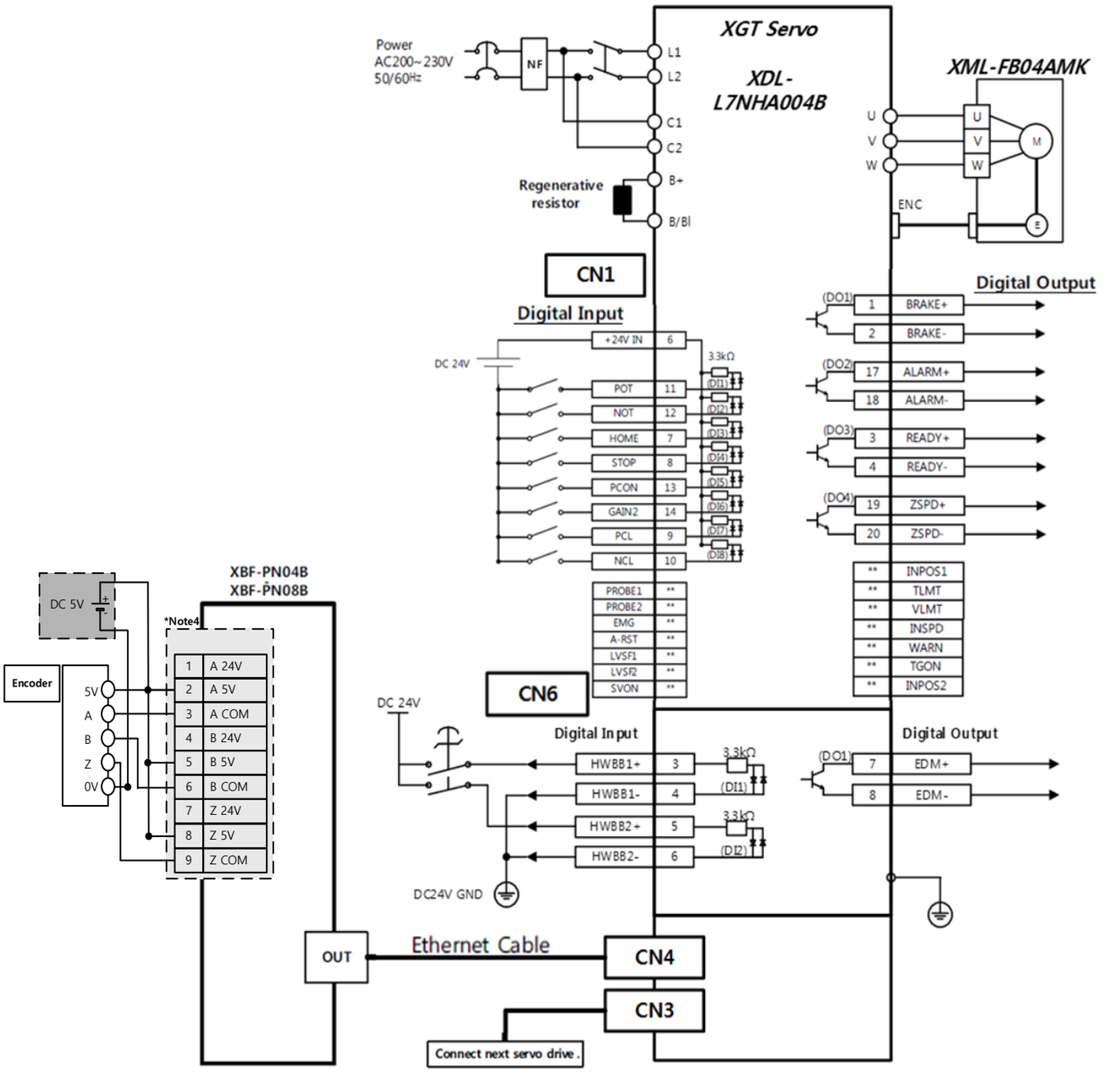
(8) Connect the line between positioning module and servo drive by using more than STP CAT-5 in wiring between controller and drive unit.

(9) If a communication error occurs during Positioning Module operation, noise interference may be the cause of the wiring between the positioning module and the drive device. Please operate by attaching a ferrite core to the communication cable connecting the positioning module and the drive device.

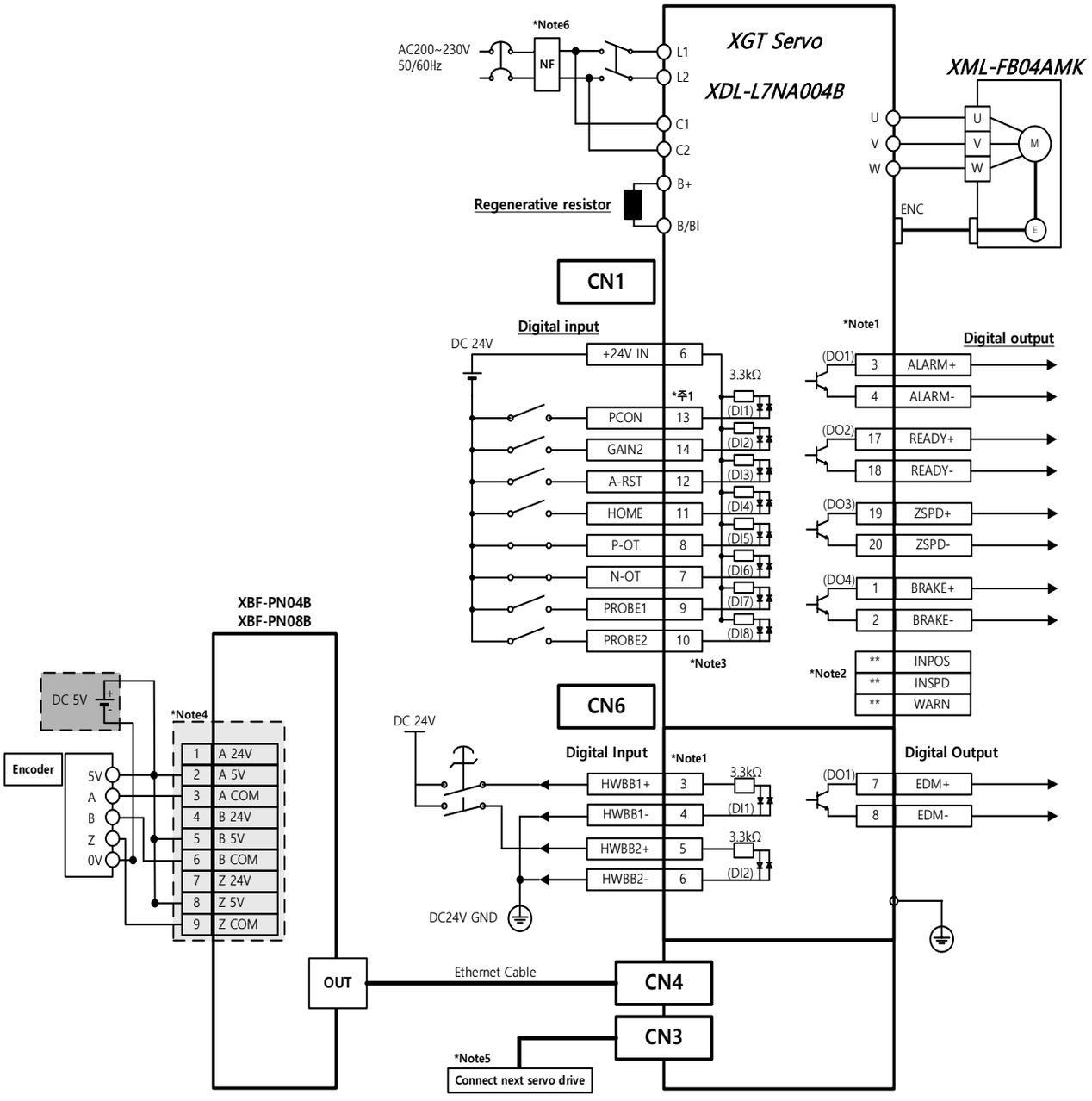
(10) High speed electrical signals flow through communication cable and encoder input cable of the positioning module Therefore, high frequency noise waves are radiated from this cable. To ensure CE Standard compliance, attach the ferrite core to communication cables and encoder input cables.

3.3.2 Connection of Servo Drive

(1) This is a wiring example connecting the XGT servo drive (XDL-L7NH)/motor with the network positioning module (XBF-PN04B/XBF-PN08B). For detail on installation and wiring, refer to the driver user manual.



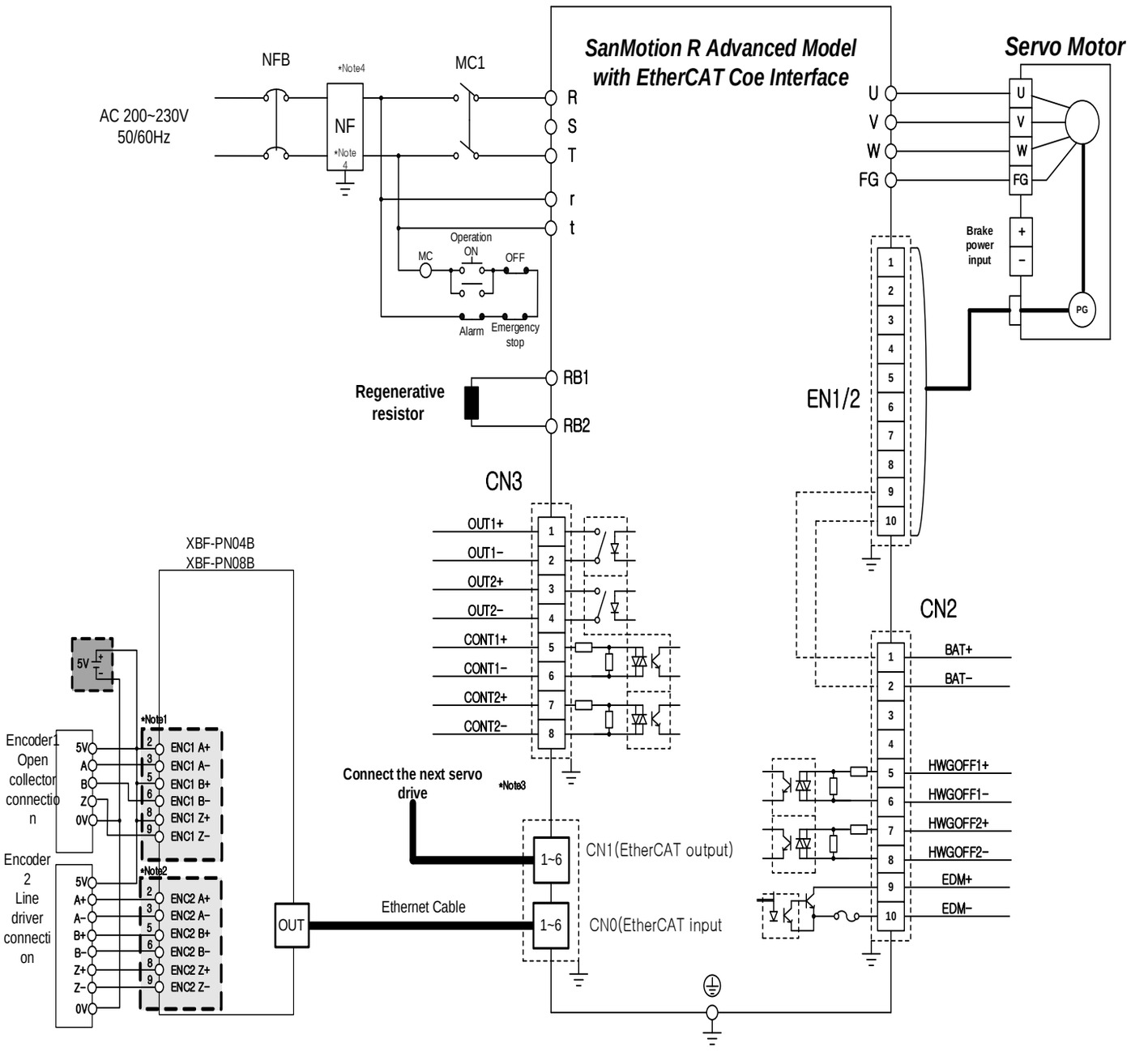
(2)This is a wiring example connecting the XGT servo drive (XDL-L7NH)/motor with the network positioning module (XBF-PN04B/XBF-PN08B). For detail on installation and wiring, refer to the driver user manual.



Caution

* Note 1
The input signals DI1 - DI8 and output signals DO1 - DO4 are the factory default signals.
* Note 2
** Unassigned signals. It is available to change the contact point by setting the output signal allocation. For further details, please refer to the XGT servo drive user manual.
* Note 3
Input signal D17 and D18 are always allocated regardless of input signal allocation setting and operate as PROBE1, PROBE2 input signals.
* Note 4
The encoder wiring is an example for the 5V voltage output type (open collector).
* Note 5
When connecting more than 2 servo drivers, connect first servo drivers IN to the positioning modules OUT and for other servo drivers, connect previous servo drivers OUT to next servo driver's IN. Last servo driver's OUT doesn't need to be connected. Also, the connection order is not related to the axis order.
* Note 6
NF is abbreviation of Noise Filer. It is necessary to prevent the noise from coming in.

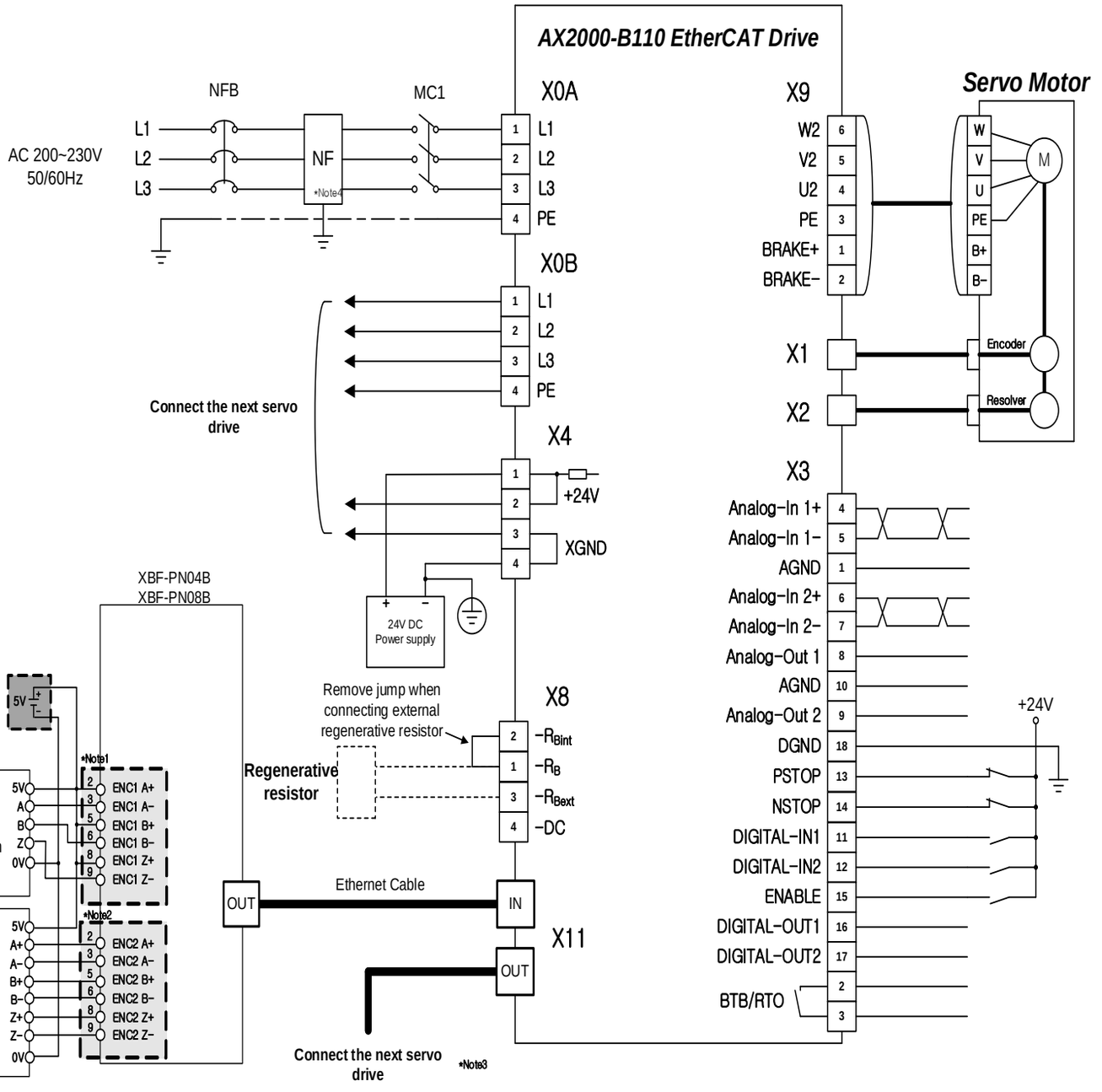
(3) This is a wiring example connecting the SanMotion R Advanced Model EtherCAT servo drive/motor with the network positioning module (XBF-PN04B/XBF-PN08B). For detail on installation and wiring, refer to the driver manual.



Caution

* Note 1
The encoder wiring is an example for the 5V voltage output type (open collector).
* Note 2
When connecting more than 2 servo drivers, connect first servo driver's IN to the positioning module's OUT and for other servo drivers, connect previous servo driver's OUT to next servo driver's IN. Last servo driver's OUT doesn't need to be connected. Also, the connection order is not related to the axis order.
* Note 3
NF is abbreviation of Noise Filer. It is necessary to prevent the noise from coming in.

(4) This is a wiring example connecting the BeckHoff AX2000 Servo drive /motor with the network positioning module (XBF-PN04B/XBF-PN08B). For detail on installation and wiring, refer to the driver manual.



Caution

* Note 1

Wiring of encoder 1 is an example about 5V voltage output (open collector) type.

* Note 2

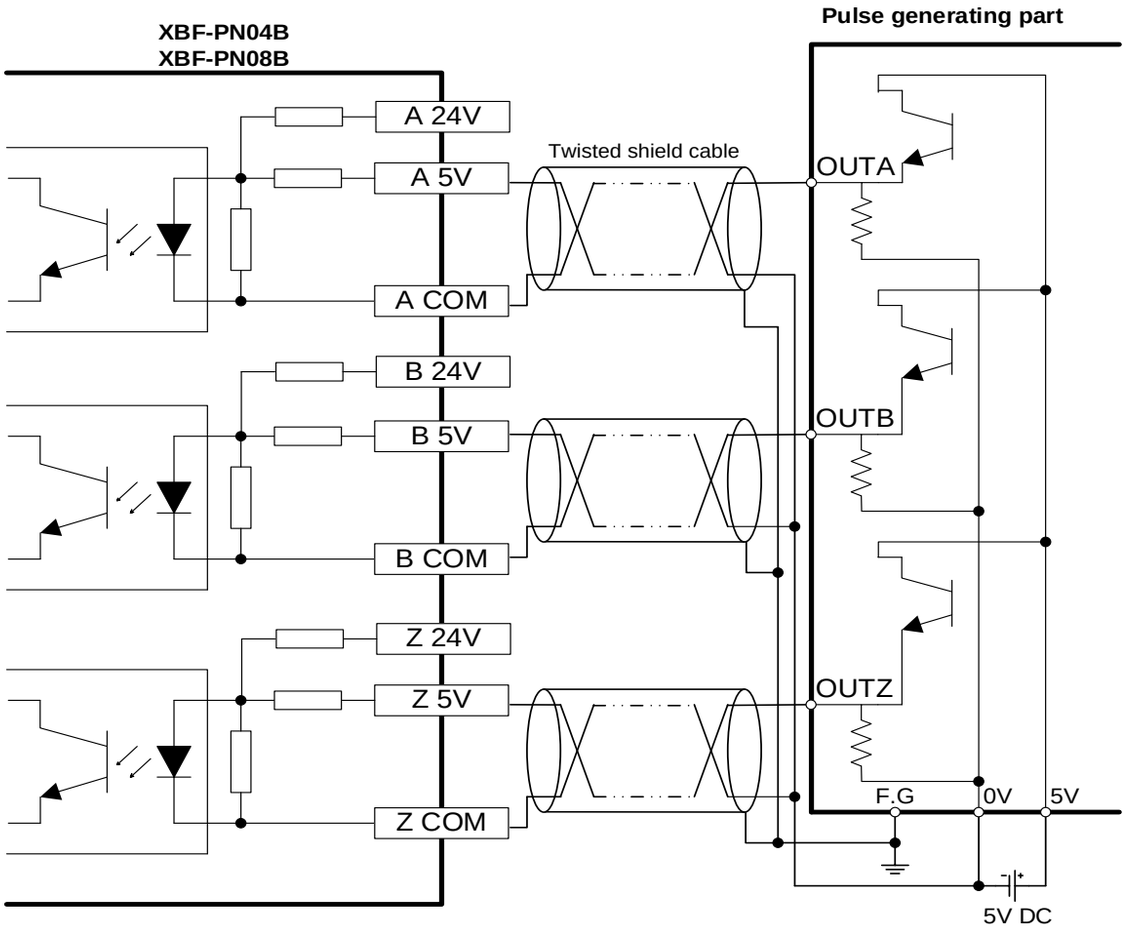
When connecting more than 2 servo drivers, connect the first servo driver's IN to the Position Control module's OUT and for other servo drivers, connect previous servo driver's OUT to next servo driver's IN. Last servo driver's OUT doesn't need to be connected. Also, the connection order is not related to the axis order.

* Note 3

NF is abbreviation of Noise Filer. It is necessary to prevent the noise from coming in.

3.3.3 Wiring example of Encoder Input (DC 5V voltage output)

When Pulse Generator is a Voltage Output type, wiring example of positioning module is as follows.
In case that pulse generator is totem-pole output which is used as voltage output, wiring method is same with above.

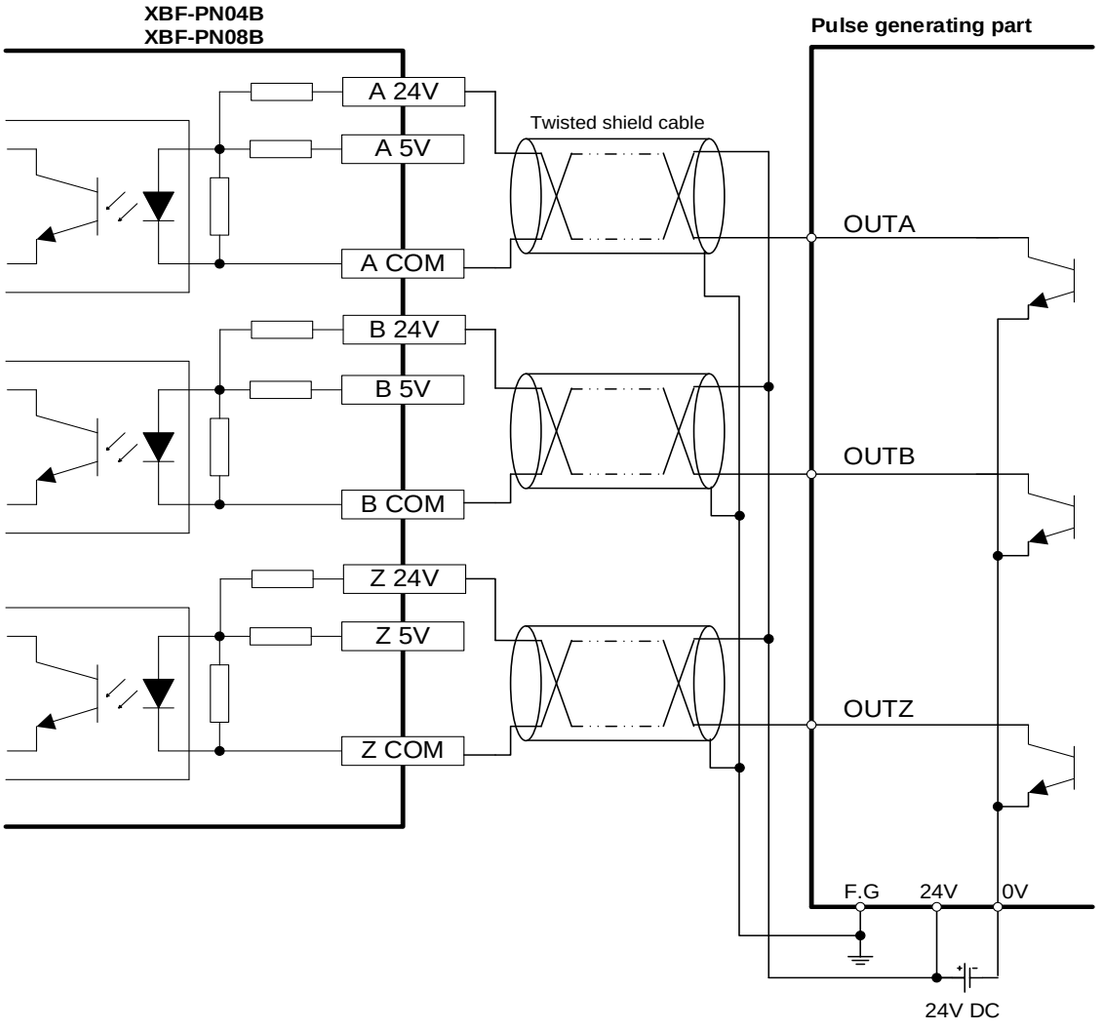


Notes

Before Wiring, please consider maximum output distance of pulse generator.

3.3.4 Wiring example of Encoder Input (DC 24V NPN open collector output)

This is an example of wiring with a pulse generator (encoder or manual pulse generator) of NPN open collector output type.

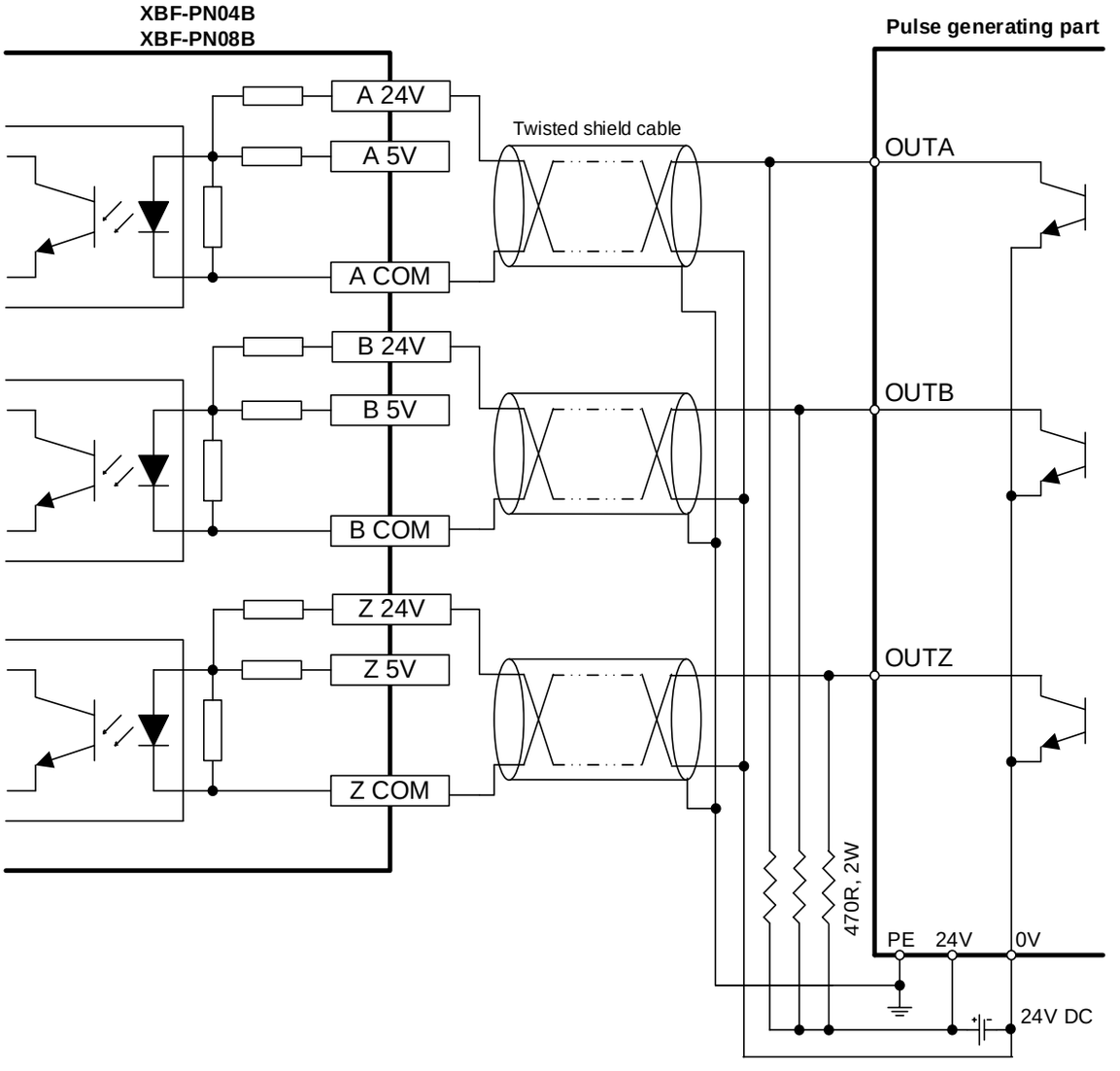


Notes

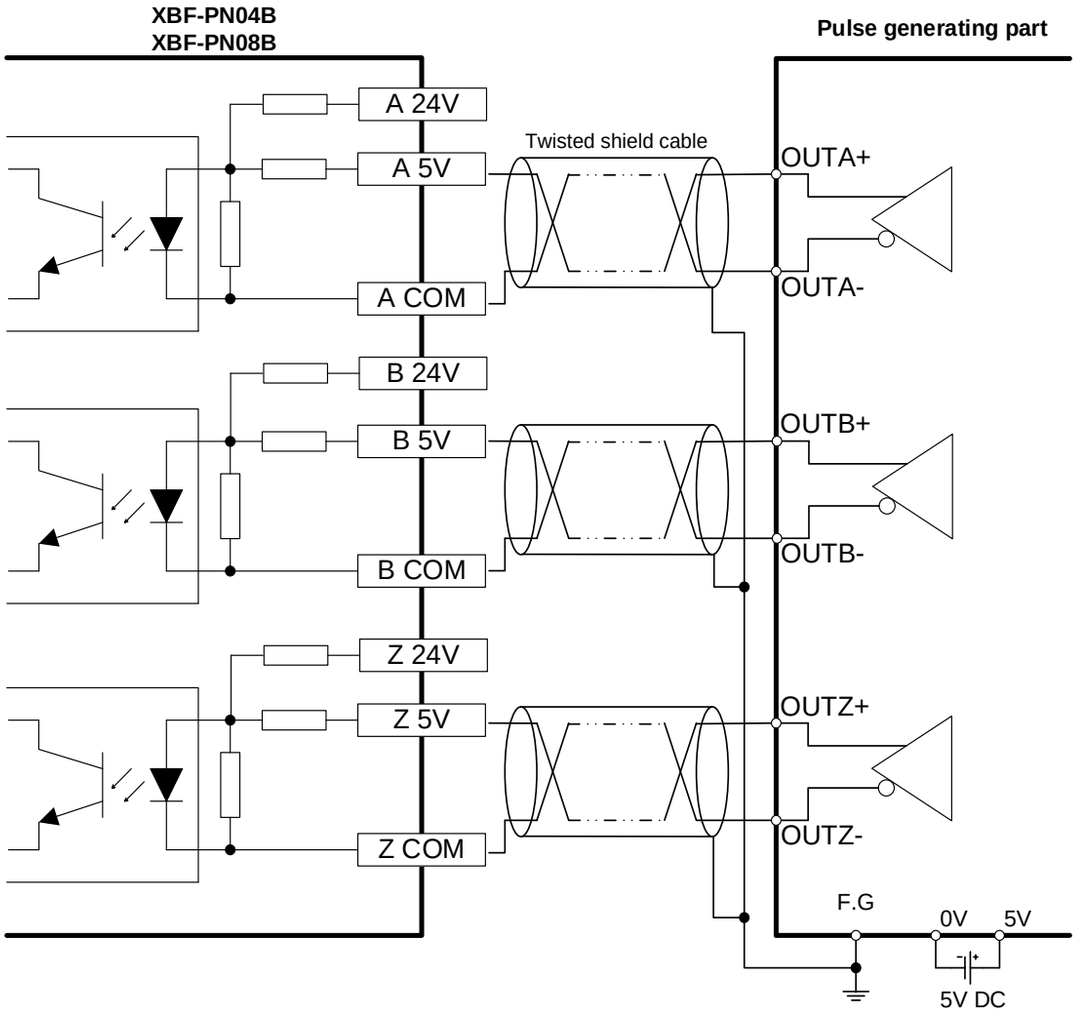
Before Wiring, please consider maximum output distance of pulse generator.

Notes

In an environment with external line noise, please install a pull-up resistor when wiring the pulse generator (encoder or manual pulse generator) and encoder input to prevent malfunction due to noise. For detailed wiring, please refer to the following wiring example. (Please use the external pull-up resistor in accordance with the specifications of the external load device.)



3.3.5 Wiring example of Encoder Input (5V Line Driver Output)



Notes

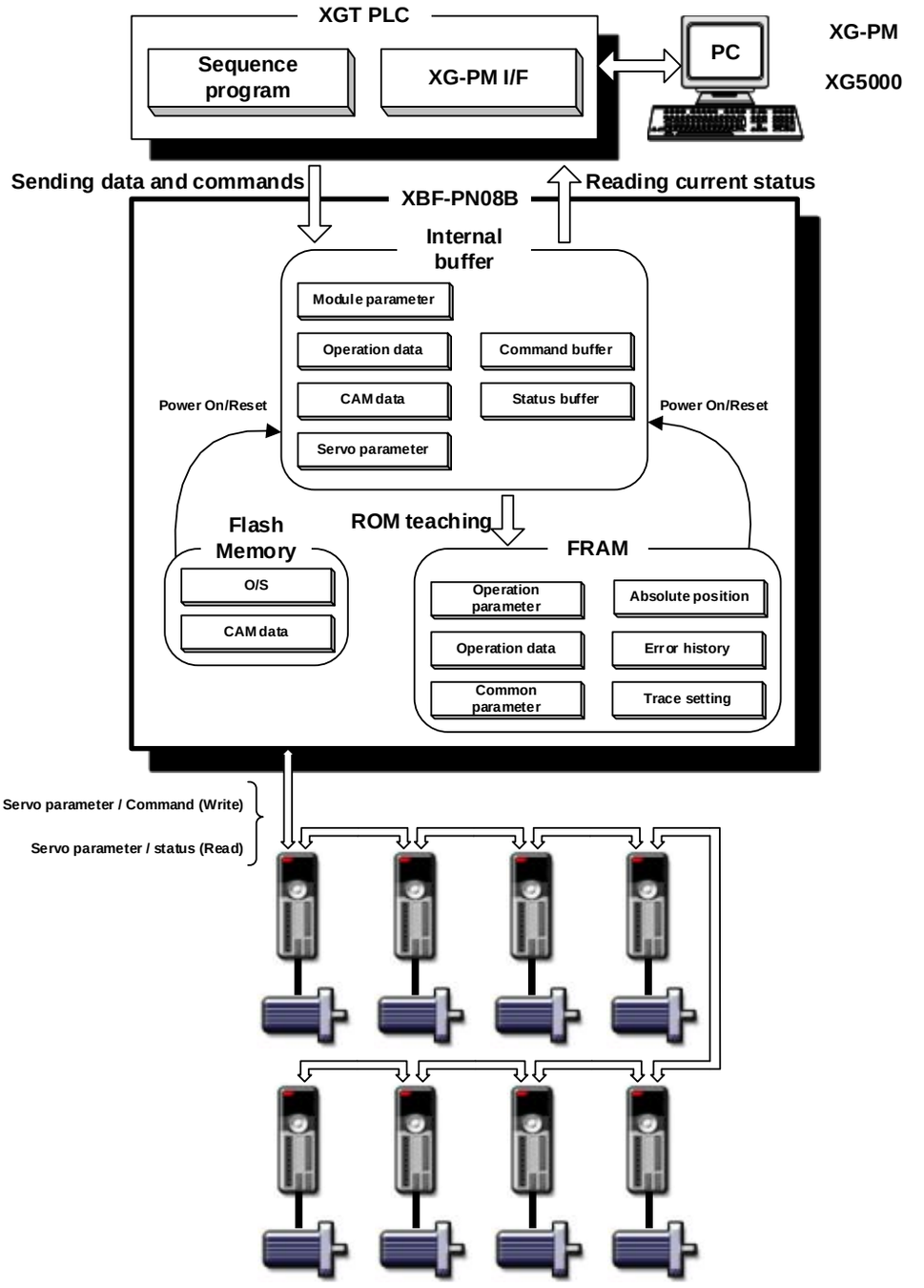
Before Wiring, please consider maximum output distance of pulse generator.

Chapter4 Positioning Parameter and Operation Data

This chapter describes parameter and operation data to be set by software package with positioning module.

4.1 Parameter and Operation Data process

This picture describe process of parameter and operation data saved in the positioning module.

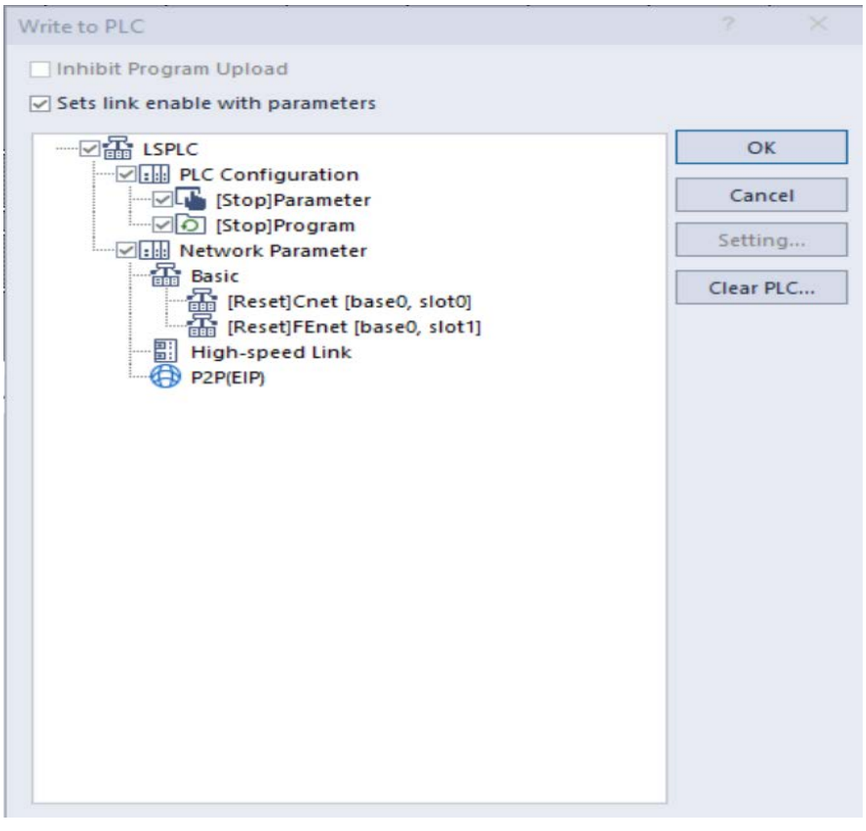


Writing Parameter and Operation data

Users can set parameters and operation data in XG-PM and transfer them to the module.

(1) Sequence

1) Select “Menu [Online]->[Connect]”connect with module by online.
2) Select “Menu [Online]->[Write]”
3) Select the data to be transmitted to the module and press OK to transmit the selected parameters and operation data to the module.
4) Dialog box



Notes

1. Even when the axis is in operation, common parameters and axis operation parameters can be transferred to the module. However, parameters changed during operation do not affect the operation of the axis currently in operation.
2. When the axis is in operation, the time when changed parameters are reflected is as following.
   (1) Axis run parameter
   It is reflects promptly as operation of current operating axis is completed. Afterwards, it operates with the changed axis operation parameters.
   (2) Common parameter
   It is reflects promptly as operation of current operating mode axis is completed. Afterwards, it operates with the changed common parameter.
3. Version information that supports the parameter writing function during axis run is as follows.

Item	Supported version
XG5000	V4.51 or higher
XBF-PN04B, XBF-PN08B	V2.10 or higher

Parameter and operation data backup and restoration

Parameter and operation data are backed up and restored as follows.

(2) Data backup

1) When writing parameters and operation data to the module by selecting menu [Online]-> [Write] in XG-PM, they are automatically saved in backup memory,
2) User do not need to operate any additional operation for data backup.
3) However, servo parameter is not saved in the module, but in the backup memory of the servo drive.

(3) Data restoration

1) The parameters and operation data stored in the backup memory of the positioning module are restored to operation area of module when the module boots or when the PLC reset after power is applied to the PLC.
2) If the PLC power is turned off during data backup and the backup operation is not completed properly, the following error occurs when restoring data.

Error code	Error Description	Measurement
1500	The PLC power was turn off while backing up common parameters.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1501	The PLC power was turn off while backing up network parameters.	
1502	The PLC power was turn off while backing up CAM data.	
1511	The PLC power was turn off while backing up 1-axis operation parameters.	
:	:	
1526	The PLC power was turn off while backing up 16-axis operation parameters.	
1531	The PLC power was turn off while backing up 1-axis operation data.	
:	:	
1546	The PLC power was turn off while backing up 16-axis operation data.	

3) If the backup operation is not completed properly or the data is physically damaged due to backup memory failure, the following error occurres.

Error code	Error Description	Measurement
1550	Common Parameter Setting data is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions,Please contact customer center at 1544-2080.
1551	Network parameter setting data is abnormal.	
1552	Cam data setting data is abnormal.	
1561	Axis 1 operation parameter settings data is abnormal.	
:	:	
1576	Axis 16 operation parameter settings data is abnormal.	
1581	Axis 1 operation data setting data is abnormal.	
:	:	
1596	Axis 16 operation data settings data is abnormal.	

4.2 Basic Parameter

It describes about Basic parameter of positioning module.

4.2.1 Basic Parameter Content

Basic parameter Items		Setting range
Speed limit value		㎜ : 1 ~ 2,147,483,647 [X10^{-2}㎜/minute] inch : 1~ 2,147,483,647 [X10^{-3}Inch/minute] degree : 1 ~ 2,147,483,647 [X10^{-3} degree/minute] pulse : 1 ~ 2,147,483,647 [pulse/sec]
Acceleration time 1		0 ~ 2147483647 [ms]
Acceleration time 2		
Acceleration time 3		
Acceleration time 4		
Acceleration time 1		0 ~ 2147483647 [ms]
Deceleration time 2		
Deceleration time 3		
Deceleration time 4		
Deceleration time for EMG stop		0 ~ 2147483647 [ms]
Pulse per revolution		1 ~ 200000000
Travel per revolution		
Control word 1	Axis type (bit 0)	0: Real axis, 1: Virtual axis
	Current position compensation amount rate (bit 1)	0: x1, 1: x100
	Unit (bit 2 ~ 3)	0: pulse, 1: mm, 2: inch, 3:degree
	Unit multiplier (bit 4 ~ 5)	0: x 1, 1: x 10, 2: x 100, 3: x 1000
	Speed command unit (bit 6)	0: Unit/Time, 1: rpm
	Encoder selection (bit 7)	0:Incremental encoder , 1: Absolute encoder
	Current position compensation amount (bit 8~ 15)	0 ~ 255
Control wordⅡ	User specified position display ratio (bit 0~ 2)	0 ~ 7
	User specified velocity display ratio (bit 3~ 5)	0 ~ 7
	Torque command unit (bit 6)	0: 1%, 1: 0.1%
	Current speed filter time constant (bit 7 ~ 13)	0 ~ 100 [ms]
	Speed synchronization mode(bit 14 ~ 15)	0: CSP(command position), 1: CSP(current position)(not supported), 2: CSV(command speed), 3: CSV(current speed)

Notes

1. For Deceleration time, when it stops by DEC. stop, DEC. time set in command is applied. At this time, if DEC. time is set as 0 in command, DEC. time set in basic parameter is applied. In case it stops by EMG stop because of internal factor, not external factor," EMG stop deceleration time' in basic parameter is applied.
2. User specified position display ratio and User specified speed display are supported in os Version 1.10 or higher.
3. Virtual axis selection is supported in module os version 1.20 or higher.

4.2.2 Basic Parameter Setting

(1) Unit

(a) You can set the command unit for positioning control according to control object. The command unit (mm, inch, pulse, degree) can be set for each axis separately.

(b) In case of changing the unit setting, as the value of other parameter and operation data does not change, the value of parameter or operation data should be set within the setting range of the unit to be changed.

[Example]

mm, inch, pulse : X-Y table, conveyor

degree : turntable(360degree/rotation)

(2) Number of pulses per rotation

(a) Only when using mm, inch, degree as the positioning command unit, you should set the number of pulse per motor rotation.

(b) if this values is set incorrectly,the command and actual motor operation may differ.

Travel per pulse = travel distance per rotation (Al) / the number of pulse per rotation (Ap)

(3) Travel amount per rotation and unit multiplier

(a) Only when using mm, inch, degree as a positioning command unit, you should set travel distance per motor rotation and unit multiplier.

(b) Actual Machine's travel distance per rotation of motor is determined by the structure of machine.

If the lead of ball screw (mm/rev) is PB and the rate of deceleration is 1/n,

Transfer amount per rotation (AL) = PB ×1/n.

.

(c) However, the settable Travel distance per rotation (Al) is as below.

Setting unit	mm	Inch	degree
Travel distance per rotation	0.1 ~ 20000000.0 um	0.00001 ~ 2000.00000 inch	0.00001 ~ 2000.00000 degree

In case transfer amount per rotation (AL) exceeds the travel distance range, the travel distance per rotation (Al) and unit multiplier (Am) should be set as follows:

Transfer amount per rotation (AL) = PB ×1/n.

= travel distance per rotation (Al) × unit multiplier (Am)

[Note]

In case unit is mm, unit multiplier (Am) can be 1,10,100,1000. If the value of"PB ×1/n" exceeds 20,000,000.0㎛, it is r equired to adjust the unit multiplier so that the travel distance per rotation (Al) does not exceed 20,000,000.0㎛.

ex1) if transfer amount per rotation (AL) = PB ×1/n = 2500000.0㎛ (= 2500㎜),

Transfer amount per rotation (AL) = (Al) × (Am) 1

= 25000000× 1

ex2) if transfer amount per rotation (AL) = PB ×1/n = 25000000.0㎛ (= 25000㎜),

Transfer amount per revolution (AL) = (Al) × (Am) 1

= 25000000× 10

= 2500000× 100

(4) Speed Limit, Acceleration Time, Deceleration Time

(a) Speed limit

The Speed limit means available maximum speed of positioning operation

All of the operating speed in positioning operation should be set to be lower than speed limit.

(b) Acceleration time

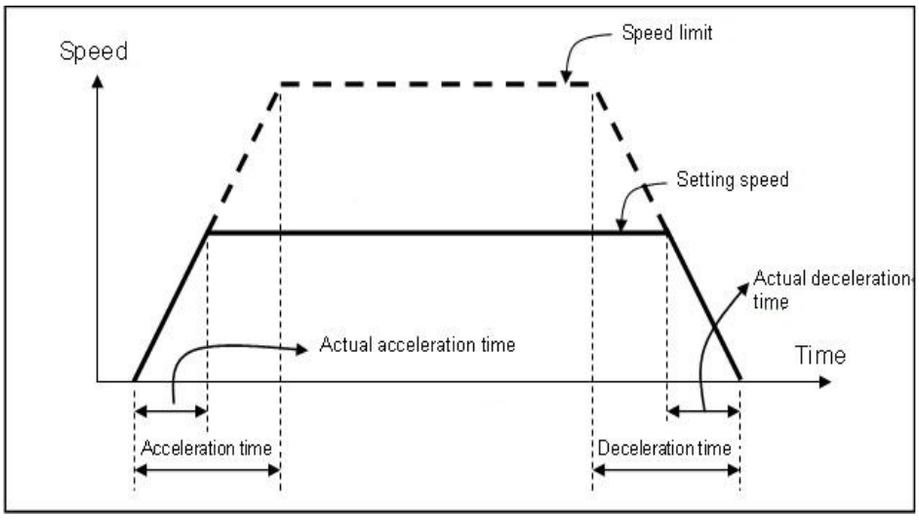
Acceleration Time is the time required to reach the limit speed which is set by parameter from zero speed (stop state).

(It does not mean the time require to reach the operation speed)

(c) Deceleration time

Deceleration time is the time required to reach zero speed 1 to stop state) from the speed limit which is set by basic parameter.

(It does not mean the time require to reach zero speed from the operation speed.)



(5) Encoder selection

(a) Set the type of encoder to be used. When using an absolute position system, select 1: absolute encoder.

(b) The following shows the setting of 「 Encoder select」

Item	Setting value	Content
Encoder select	0: Incremental Encoder	The previous position of servo motor do not keep after power turn on/off. Homing status is always off after power turn on/off.
	1: Absolute encoder	The absolute position system is activated. The previous position of servo motor keep after power turn on/off. Homing status also keep last status before power turn on/off.

(6) Current position compensation amount and Current position compensation amount rate

(a) The current position compensation amount is a parameter used to display current position as command position when servo motor's current position is not display as fix value but changes slightly depending on user application and gain settings.

(b) When it is not in operation and if the difference of the command position and the current position is within case the amount of compensation, the current position is displayed as a command position value. When it is in operation, current position compensation amount is not reflected, and the actual position value is displayed.

(c) The stable values as current position compensation amount are as follows.

Setting unit	pulse	mm	INCH	degree
Current pos. compensation amount	0 ~ 255	0.0 ~ 25.5 um	0.0 ~ 0.00255 inch	0.0 ~ 0.00255 degree

(d) The current pos. compensation amount can be applied to larger values than setting value by setting the current pos. c ompensation amount.

(e) The values that can be set as 'current pos. compensation amount rate' and the final compensation amount range with the magnification applied are as follows.

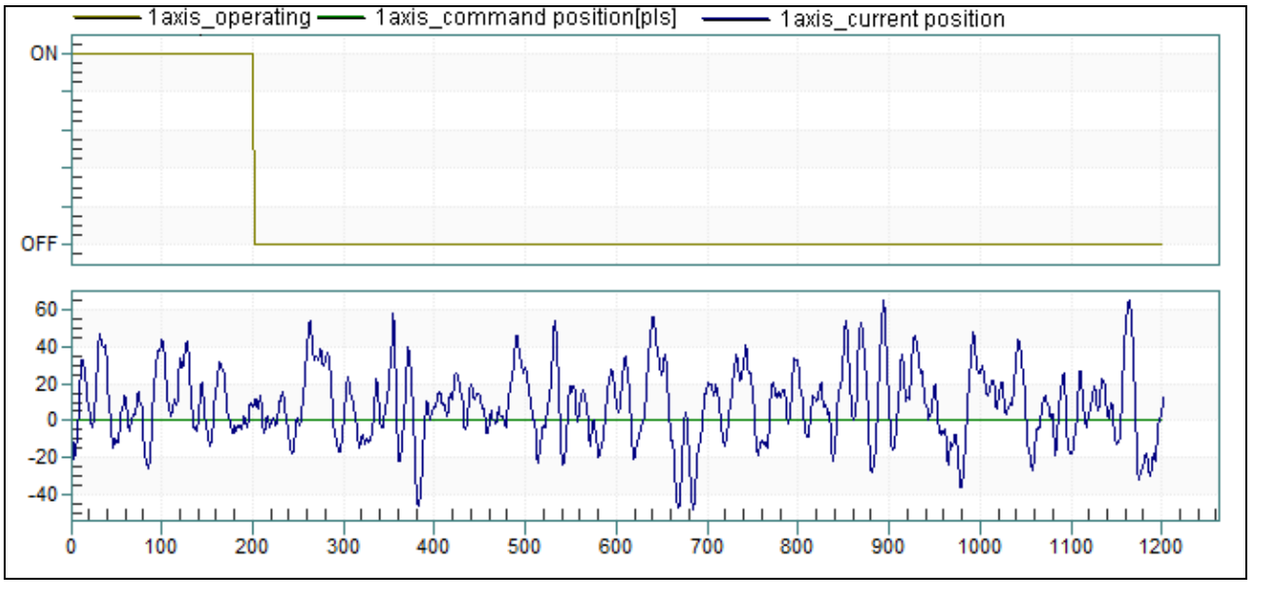
Current pos. compensation amount rate	pulse	mm	Inch	degree
0: x1	0 ~ 255 pls	0.0 ~ 25.5 um	0.0 ~ 0.00255 inch	0.0 ~ 0.00255 degree
1: x100	0 ~ 25500 pls	0 ~ 2550 um	0.0 ~ 0.255 inch	0.0 ~ 0.255 degree

(f) The following is an example of example of current position compensation amount according to the value of current pos ition compensation amount when the command position is 0'.

(Current pos. compensation amount rate is supposed to be '0: 0x1')

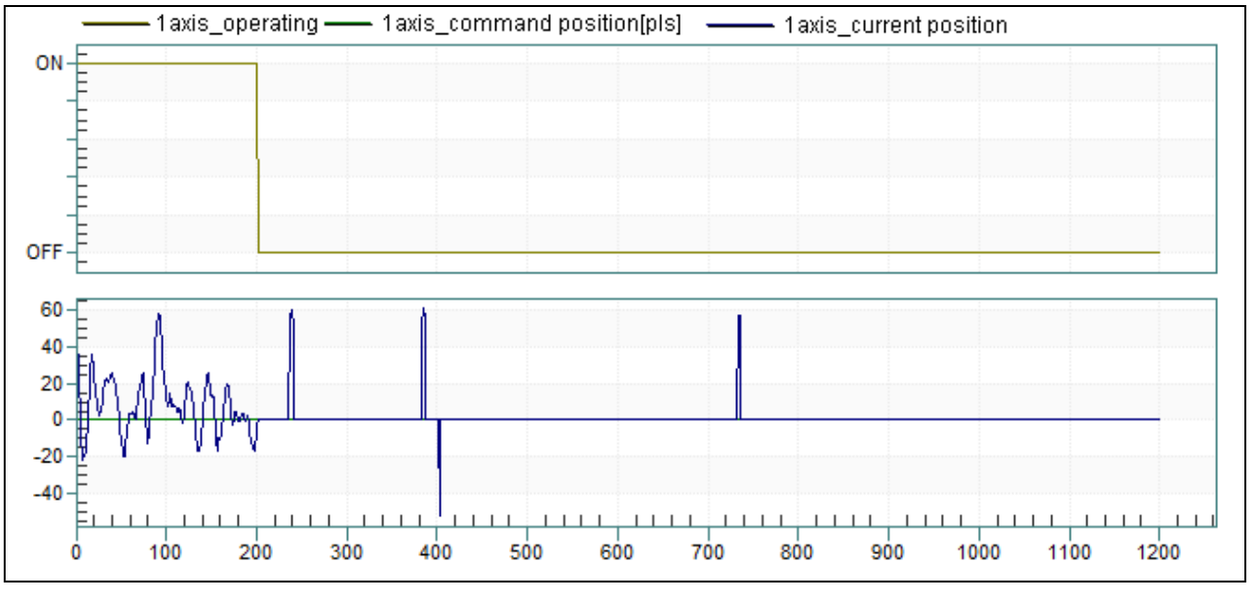
① Current pos. compensation amount = 0 pls

- The position value of the actual motor is displayed as the actual position value even after the end of operati on.



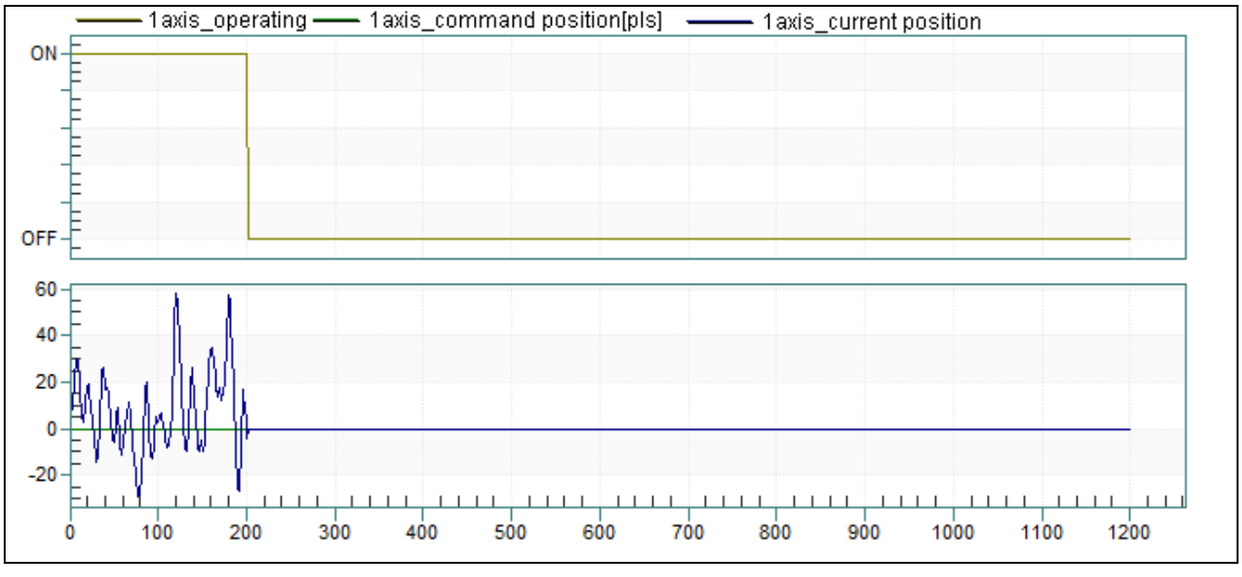
② Current pos. compensation amount = 50 pls

- If the current position value is within ±-50 of command position after the end of operation, it is displayed as the command position value.



③ Current pos. compensation amount = 100 pls

- If the current position value is within ±-100 of command position after the end of operation, it is displayed a s the command position value.



The version information that can use the current pos. compensation amount rate function is as follows

	Current pos. compensation amount rate
XBF-PN04B OS	V2.30 or higher
XBF-PN08B OS	V2.30 or higher
XG5000	.

(7) Speed command unit

(a) The base unit of the speed values used for position control command is set. If it is set to '0: unit/ Time', it is applied by the rate of change per second the position of the relevant unit set in the 「unit」 parameter. For example, if the setting of the 「unit」 is in mm, the unit of the speed command is 'mm/s'. When set to '1: rpm', speed command unit is applied as the rpm.

(b) If the speed command unit is rpm and it is internally changed to the unit speed, values set in the 「no. of pulse per rotation」 and 「Travel distance per rotation」 parameters are used.

When changing the setting of the speed command unit, other parameters or variable values are not changed. Therefore, the related parameters must also be reset according to the setting range of the relevant unit.

(8) User specified position ratio

(a) Users can set the desired magnification for position and speed as position and can use by changing as user specified position, user specified speed value.

(b) The user specified position rate is value used when calculating 'user specified current position', 'user specified command position with respect to the current position and command position, and is reflected in the calculation as follows.

User specified position = unit position x 10^{-N} (integer, anything below decimal point is rounded off.)

※ Unit position: current position or command position integer read by operation status read command

※ N: basic parameter's 'user specified position display ratio' (0 ~ 7)

※ In case of N=0, user specified position and unit position values are the same.

(c) The range of settable values as user specified position display ratio is 0~7.

(d) The version information that can use the user specified position display ratio function is as follows.

Item	Supported version
XG5000	V4.07 or higher
XBC	V1.50 or higher
XBF-PN04B	V1.10 or higher
XBF-PN08B	V1.10 or higher

(9) User specified Velocity ratio

(a) The user specified speed rate is value used when calculating 'user specified current speed', 'user specified command speed with respect to the current speed and command speed, and is reflected in the calculation as follows.

User specified speed = unit speed x 10^{-N} (integer, anything below decimal point is rounded off.)

※ Unit speed: current speed or command speed integer read by operation status read command

※ N: basic parameter's 'user specified speed display ratio' (0 ~ 7)

※ In case of N=0, user specified speed and unit speed values are the same.

(b) The range of settable values as user specified speed display ratio is 0~7.

(c) The version information that can use the user specified speed display ratio function is as follows.

Item	Supported version
XG5000	V4.07 or higher
XBC	V1.50 or higher
XBF-PN04B	V1.10 or higher
XBF-PN08B	V1.10 or higher

(10) Axis Type

(a) To use a virtual axis, set whether to use the virtual axis to use a virtual axis. If set to '1: virtual axis', it operates as if controlling the motor as virtually even if there is no servo drive or motor actually connected.

(b) Commands that can not be used on virtual axis are as follows except for the relevant command, the virtual axis can be executed as the command axis.

Command	XBC Instructions	XEC function block
Position/Torque Switch Control	XPTT	XPM_PTT
The external position/torque control switch torque	XSEST	XPM_SIPT
Servo error information read	-	XPM_SVERD
Servo alarm reset	XSCLR	XPM_SRST
Servo Error History Reset	XSECLR	XPM_SHRST
Servo drive parameter read	XSVPRD	XPM_SVPRD
Servo parameter write	XSVPWR	XPM_SVPWR
Servo parameter save	XSVSAVE	XPM_SVSAVE
Torque control	XTRQ	XPM_TRQ
Latch position data read	XLRD	XPM_LRD
Latch reset	XLCLR	XPM_LCLR
Latch setting	XLSET	XPM_LSET
Torque Synchronization	XSTC	XPM_STC

Version information supporting virtual axis is as follows.

Item	Supported version
XG5000	V4.09 or higher
XBF-PN04B	V1.20 or higher
XBF-PN08B	V1.20 or higher

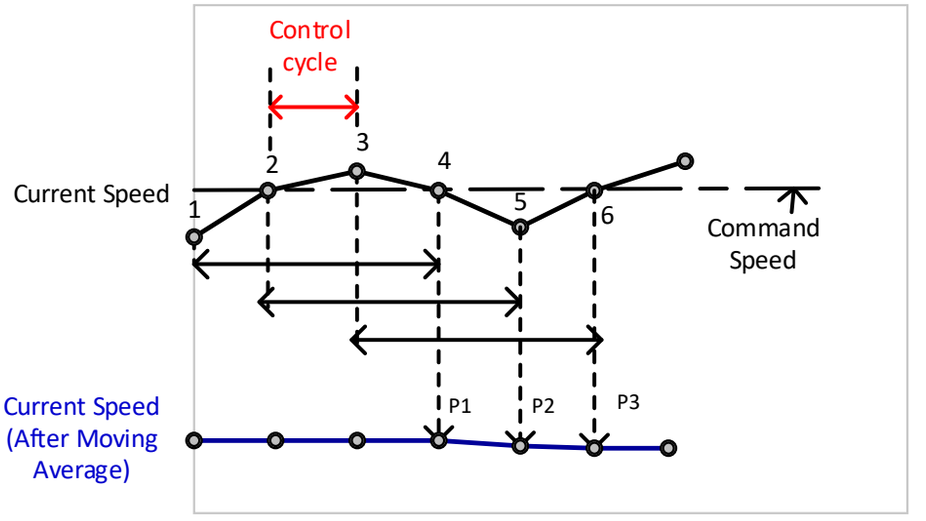
(11) Current Speed filter time constant

(a) Set the time to calculate the moving average of the current speed.

The Sample time unit is the control cycle when calculating moving averages. The control cycle changes depending on the 'control cycle' setting of common parameter and the number of axes, so refer to '9.5.13 control cycle user setting and control time information'. If the control cycle of the common Parameter is set '0: automatic setting'. The control cycle depending on the number of axes are as follows.

Control cycle	XBF-PN0B	XBF-PN08B
1ms	Axis 1~2	Axis 1~2
2ms	Axis 3~4	Axis 3~5
3ms	-	Axis 6~8

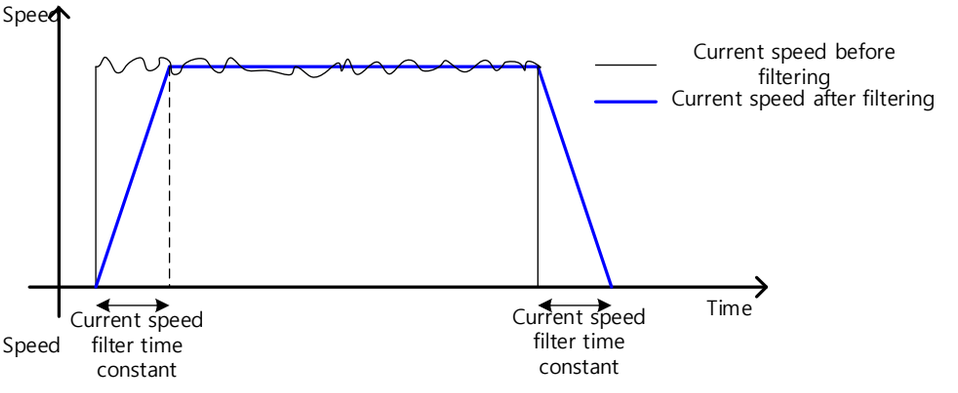
(c) for example, the control cycle is 1ms when using axis 1 and a total 4 sample[(filter time constant/control cycle) + 1]are calculated to moving average when current speed filter time constant is set to 3ms. Each time the most recently sampled value come in, the oldest sampling data is discarded one by one and averaged.



P1=(1+2+3+4)/4
P2=(2+3+4+5)/4
P3=(3+4+5+6)/4

(d) If set'0' or a time shorter than control cycle (unit: ms), the moving average is not calculated.

(e) If the current speed fluctuates a lot, applying a moving average can help you achieve a stable speed.



(12) If Speed Synchronization mode

(a) When controlling the relevant axis in speed synchronous, this is a parameter set to select the control standard.

4.3 Extended Parameter

It describes about extended parameter of positioning module.

4.3.1 Extended Parameter

Extended parameter Items		Setting range
S/W upper limit		㎜: -2147483648 ~ 2147483647[X10^{-4}㎜] Inch: -2147483648 ~ 2147483647[X10^{-5}Inch] degree: -2147483648 ~ 2147483647[X10^{-5}degree] pulse: -2147483648 ~ 2147483647[pulse]
S/W low limit		
Backlash compensation amount		mm: 0 ~ 65,535[X10-4㎜] inch: 0 ~ 65,535[X10-5Inch] degree: 0 ~ 65,535[X10-5degree] pulse: 0 ~ 65,535[pulse]
Infinite running repeat position		mm: 1 ~ 2147483647[X10^{-4}㎜] Inch: 1 ~ 2147483647[X10^{-5}Inch] degree: 1 ~ 2147483647[X10^{-5}degree] pulse: 1 ~ 2147483647[pulse]
Positioning completion time (ms)		0 ~ 65,535[ms]
S-curve ratio (%)		1 ~ 100
Command Inposition range		mm: 0 ~ 2147483647[X10^{-4}㎜] Inch: 0 ~ 2147483647[X10^{-5}Inch] degree: 0 ~ 2147483647[X10^{-5}degree] pulse: 0 ~ 2147483647[pulse]
Arc insertion position in 2-axis linear interpolation continuous operation		
Control word	Cam restart operation (bit 0)	0:disabled,1:enabled
	Acceleration/Deceleration pattern (bit 1)	0:Trapezoid operation, 1:S-Curve operation
	M Code mode(bit 2 ~ 3)	0: NONE, 1: WITH, 2: AFTER
	Software upper/Lower limit during speed control(bit 5)	0: Not detect , 1 : Detect
	Interpolation speed selection (bit 4)	0: main axis speed, 1:synthetic speed
	Software upper/Lower limit during speed control(bit 5)	0: Not detect , 1 : Detect
	External command select (bit 6)	0: External speed/position control switching, 1: external stop command
	External command (bit 8)	0:disabled,1:enabled
	Speed/position switching coordinate(bit 9)	0:Relative, 1:Absolute

	Positioning completion condition(bit 10 ~ 11)	0:Dwell time 1:In position 2:Dwell time and In position 3:Dwell time or In position
	Infinite running repeat(bit 12)	0:disabled,1:enabled
	Positioning method of interpolation continuous operation(bit 13)	0:Target position passage, 1:Near target position passage
	Arc insertion in 2-axis linear interpolation continuous operation (bit 14)	0:No circular arc addition, 1:Circular arc addition continuous operation
	Position specified speed override coordinate (bit 15)	0: Absolute coordinate ,1: Relative coordinate
Control word Ⅱ	Operation when main axis ' errors occurs during synchronous control (bit 0 ~ bit 1)	0: keep synchronous control, 1: release synchronous when main axis's servo alarms occurs. 2: release synchronous when main axis's axis error occurs.
	Drive absolute position error detect(bit 2)	1: not detect , 1: initialize Homing status

Notes

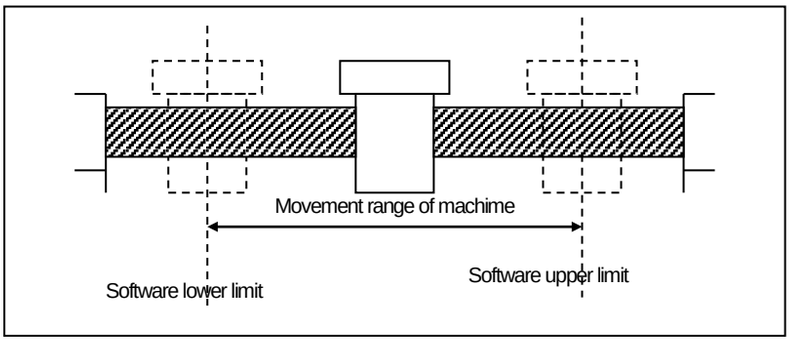
For XBF-PN04B/XBF-PN08B, external command selection and command items apply only when using L7N, L7NH servo drives. The L7N servo drive use the D1#1 as an external command. For using the D1#1 of L7N servo drive as external command signal, DI#1 should not be assigned to another function in the servo parameter input signal definition(0x2200, 0x2201) item.
The L7NH servo drive use the D1#8 as an external command. For using the D1#8 of L7NH servo drive as external command signal, D#8 should not be assigned to another function in the servo parameter input signal definition(0x2200, 0x2201) item.

4.3.2 Extended Parameter Setting

(1) S/W upper/Lower Limit

(a) The function is designed so that the machine does not execute the positioning operation out of the range by setting the range of machine available to move through software upper limit and software lower limit. That is, this function is used to prevent any breakaway by incorrect operation position setting and incorrect operation by user program fault.

(b) For range other than the software upper/lower limit, external input upper and lower limit are used.



(c) The range check of software upper/lower limit is done at the start of operation and during operating.

(d) If the software upper/lower limit is detected, error (Software upper limit error: 501, Software lower limit error: 502) occurs and

positioning module stop the motor with emergent stop.

Therefore, when you want to operate again, it is required to reset error and release the output inhibition before using.

(e) Setting range

Unit	Software upper/lower limit range
pulse	-2147483648~2147483647[pulse]
㎜	-2147483648~2147483647[X10^{-4}㎜]
Inch	-2147483648~2147483647[X10^{-5}Inch]
degree	-2147483648~2147483647[X10^{-5}degree]

Software upper limit value always should be higher than or equal to the software lower limit.

(f) If the software upper/lower limit was set by default value (upper limit: 2,147,483,647, lower limit: -2,147,483,648) or same values, then it would nnot detect upper/lower limit.

(2) Backlash compensation amount

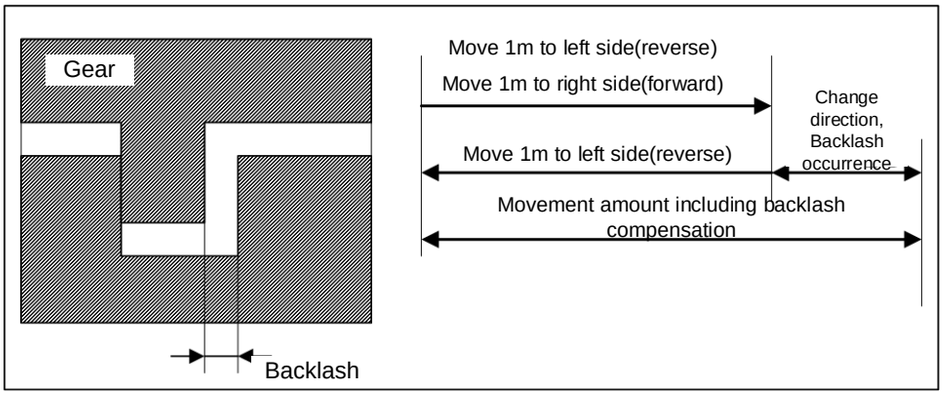
(a) The error that causes the machine to not operate due to wear when the direction of rotation changes when the motor shaft is combined with gears and screws is called backlash. Therefore, when you change the rotation direction, it is r equired to add the backlash compensation amount to the positioning amount.

(b) This is used for positioning operation, inching operation and jog operation

(c) Setting range.

Unit	Backlash setting range
pulse	0 ~ 65,535[pulse]
㎜	0 ~ 65,535[X10^{-4}㎜]
Inch	0 ~ 65,535[X10^{-5}Inch]
degree	0 ~ 65,535[X10^{-5}degree]

(d) In the picture below, if you move the position 1m the right and then 1m to the left, if the original position can not be reached due to backlash, backlash compensation must be added.



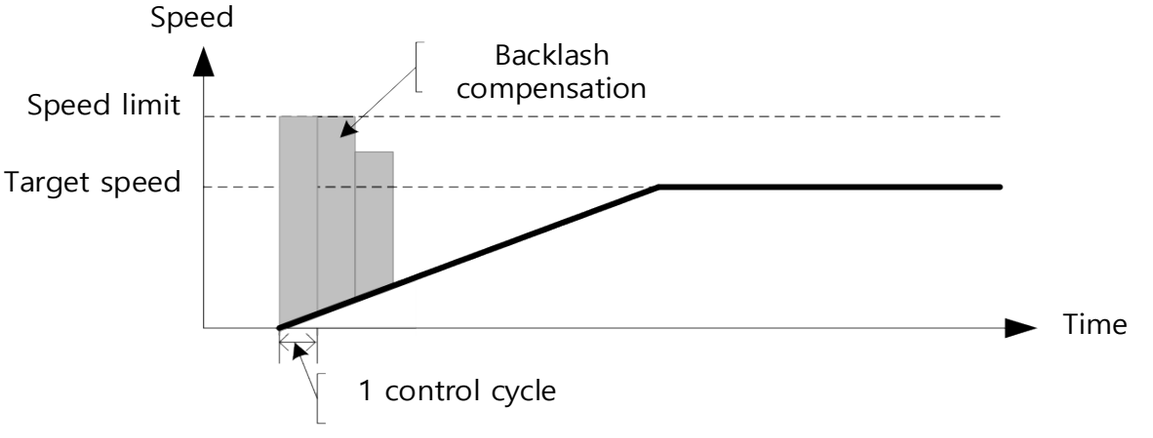
Notes

"Operation when the backlash compensation is larger than the maximum position amount (speed limit x control cycle)"

For example, in case that speed limit is 100000 and backlash compensation amount is 250, backlash compensation amount is bigger than Max. Position amount of 1 control cycle (100000pps x 0.001s = 100), executes backlash operation in several control cycles as shown below.

The backlash compensation per control cycle may be differed by acceleration time setting.

Maximum reflected backlash compensation per control cycle= maximum position amount - acceleration time position amount per control cycle

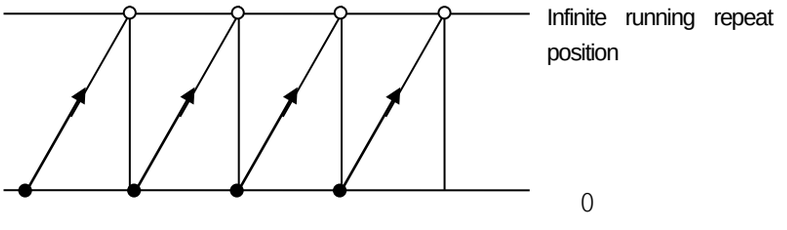


(3) Infinite repeat position

(a) When using Infinite running repeat mode, it sets the repeated position value.

(b) The extended parameter is applied when"Infinite running repeat" parameter is "1:: enable." When this parameter setting value is"0: Disable" command position and current position is expressed within position expression range according to value set in" Unit"of basic parameter.

(c) When the "infinite running repeat" parameter is"1: Enable", the command position and current position is indicated as 0~"infinite running repeat position of -1.



(d) Setting range

Unit	Infinite running repeat position range
pulse	1~2147483647[pulse]
㎜	1~2147483647[X10^{-4}㎜]
Inch	1~2147483647[X10^{-5}Inch]
degree	1~2147483647[X10^{-5}degree]

(4) Infinite Repeat position

(a) It sets whether to enable or disable 'Infinite running repeat'.

(b) When you set “Infinite running Repeat to“1: enable", command position and current position refreshes within the range set in Infinite running repeat position periodically.

(c) You must set it to“0: Disable” when you are not using the infinite running repeat operation function.

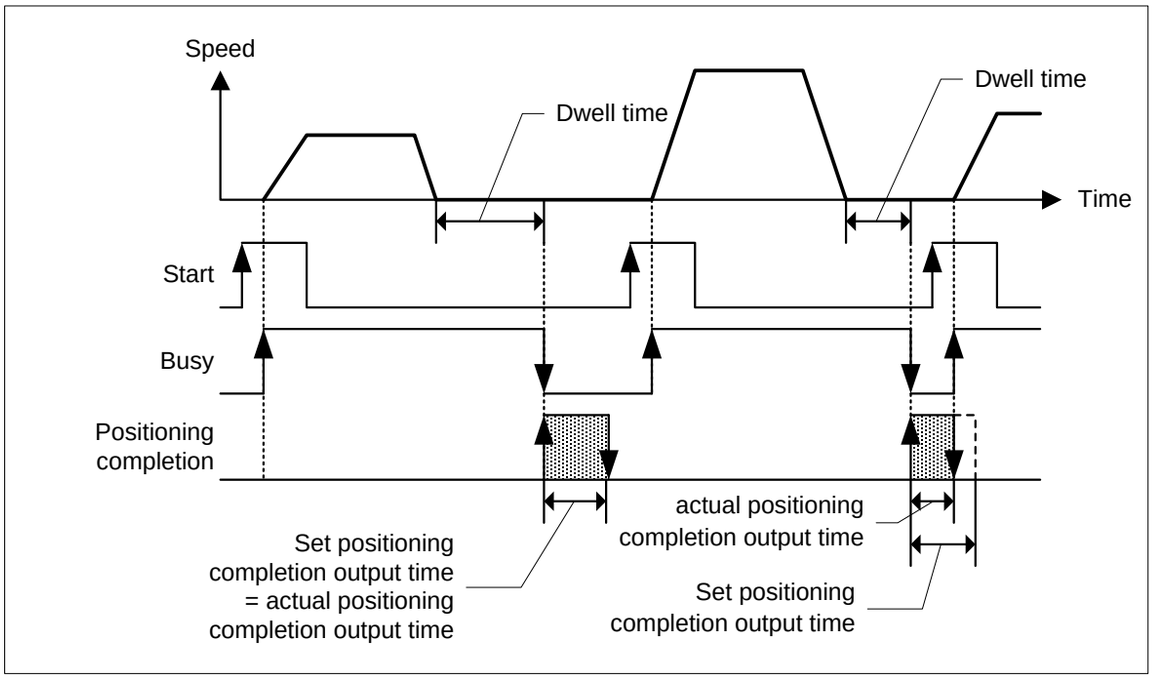
(5) Positioning completion time

(a) Positioning completion signal shall be OFF after sustaining ON for positioning completion time after positioning is compl eted and positioning completion signal is On in single operation, repeat operation, keep operation, continuous operation, linear interpolation operation, circular interpolation operation, speed/position switching control operation, inching operation. At this time, if all start command is executed while positioning completion signal ON, completion signal shall be OFF i mmediately.

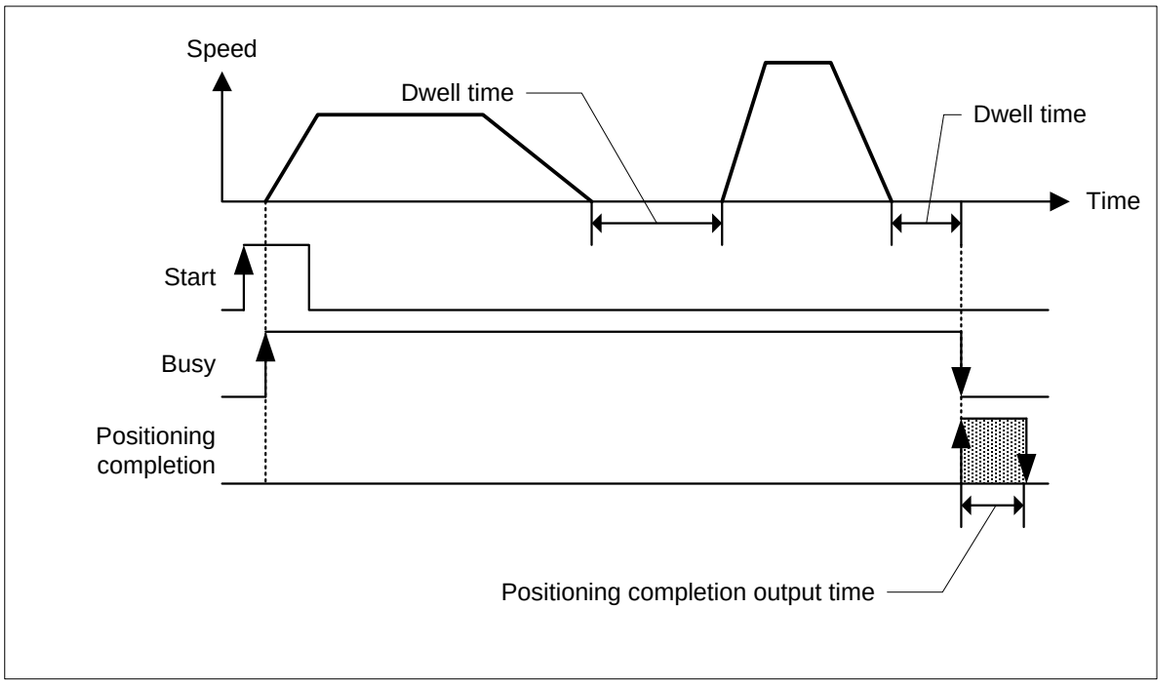
In case of keep operation and continuous mode operation, positioning completion signal will be on after all steps end.

(b) The setting range is 0 ~ 65,535 (unit: 1 1 ㎳).

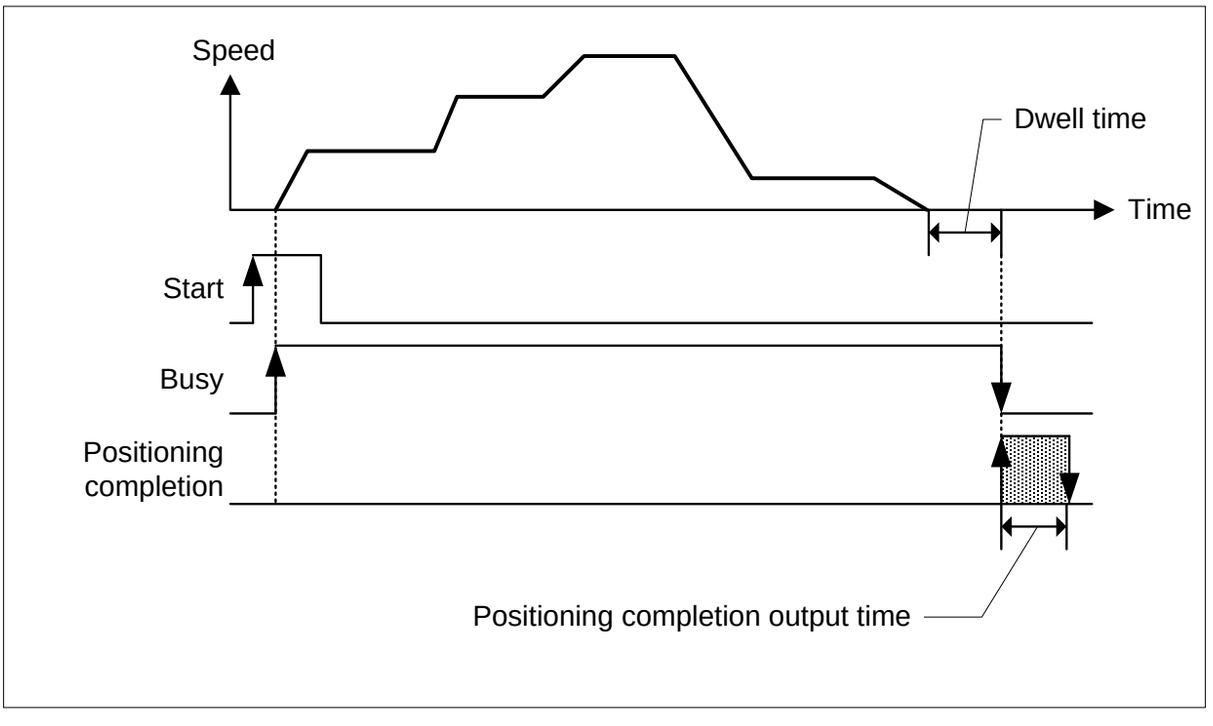
(c) The action of single operation mode is as follows.



(d) The action of Keep operation mode is as follows.



(e) The action of Continuous operation mode is as follows.



(6) M Code Output

(a) M code mode set by parameter shall be applied to all positioning data of the corresponding axis.

(b) Available to set M code number differently at each operation step no. of positioning data.

(c) M code number setting range: 1 ~ 65,535

(d) Available to read and use M code for the identification of operation step no. in operation and the execution of auxiliary works (Clamp, Drill rotation, tool change etc).

(e) M code signal occurring during the operation shall be reset by 'MOF" command.

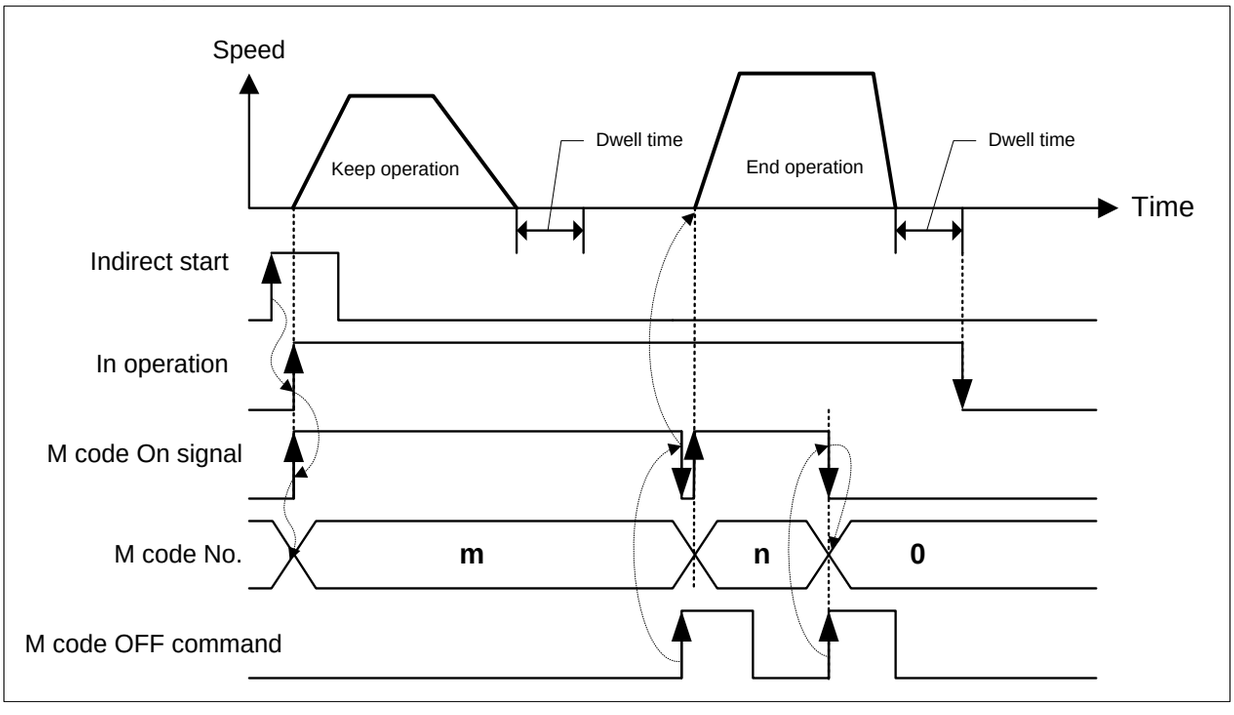
Notes

If you execute the next step after the positioning is completed and M code signal is ON, the next operation step no. does not work and the error code (233) will occur. Therefore, in order to execute the positioning of the next operation step number, M code signal should be 'OFF' by 'MOF" command

(f) There are two kinds of M code mode according to the output timing of M code signal: With mode and after mode (In case of setting NONE, There is no M code signal, even if M code No. was set.)

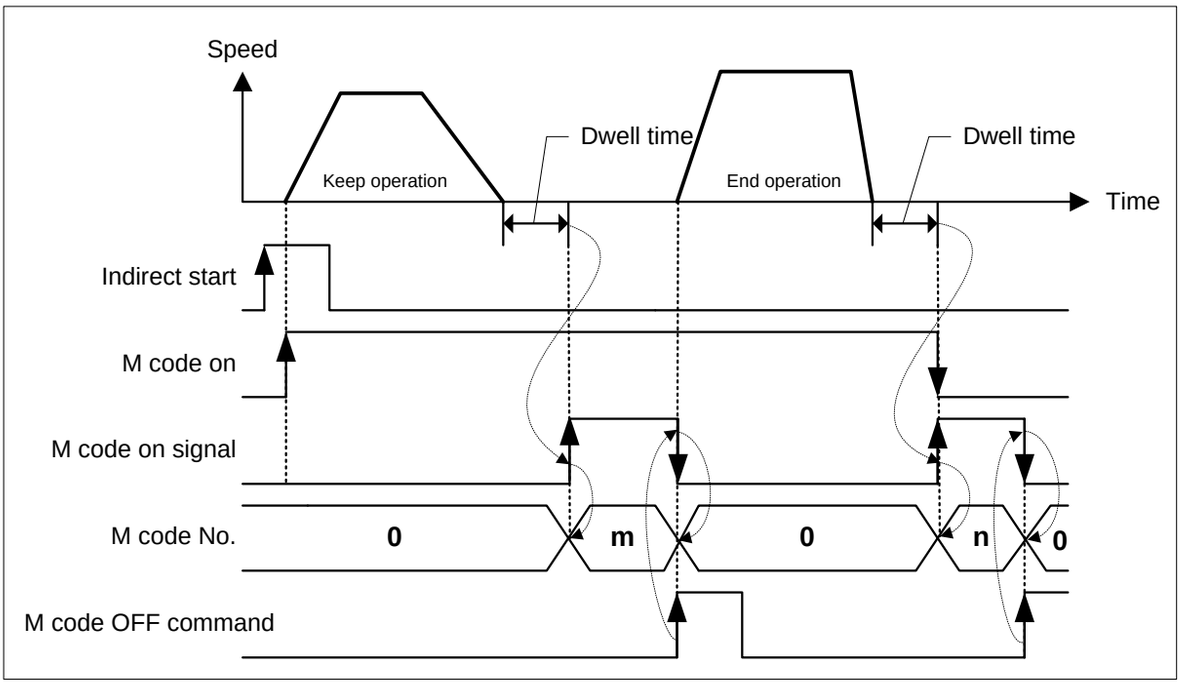
1) With mode

This is a mode that outputs the M code number set in the position data along with the start command for positionin g operation (indirect start, direct start, and simultaneous start) and turns on the M code signal at the same time.



2) After mode

This is a mode in which the M code number set in the position data is output and the M code signal is turned on a t the same time after positioning is completed by a start command (indirect start, direct start, simultaneous start).



(7) External command

(a) When using one external speed/position control switching, external stop command, external latch command among ext ernal command selection, the external command enable/disable setting should be set to “enable”.

(b) If it is set to “disable”,it will not operate even though you select one of “external speed/position control switching”, “exte rnal stop command”,””external latch command”in the external command selection.

(c) It is possible to select between “external speed/position control switch” and”external stop command”in the external com mand selection parameter of the extended parameter. An external latch command is possible using the touch probe 1 signal rather than the external command signal of the servo drive, so there is no need to select a separate parameter.

(d) For XBF-PN04B/XBF-PN08B, this function is only valid when using the L7N/L7NH servo drive. The D1#1 signal of the L7N servo drive is used as an external command. For using the D1#1 as external command signal, DI#1 should not be assigned to another function in the L7N servo parameter input signal definition (0x2200, 0x2201) item.

The D1#1 signal of L7N servo drive use as an external command. For using the D1#1 as external command signal, DI#8 should not be assigned to another function in the N7NH servo parameter input signal definition (0x2200, 0x2201) i tem.

Notes

The input signal definition "basic settings of L7N servo drive are as follows.

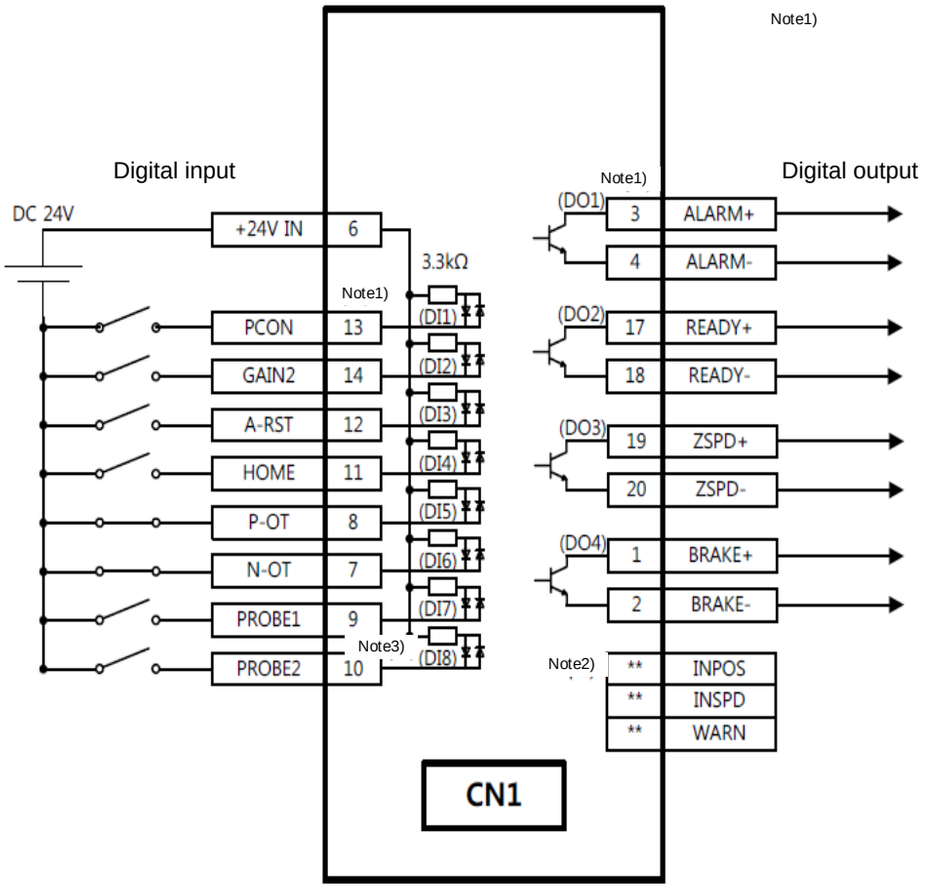
Object		Input	CN1 pin default assignment number						Standard
Index	Bit	Signal	DI#6(7)[Note]	DI#5(8)	DI#4(11)	DI#3(12)	DI#2(14)	DI#1(13)	settings
0x2200	0~3	PCON	-	-	-	-	-	1	0x400
0x2200	4~7	GAIN2	-	-	-	-	2	-	
0x2200	8~11	A-RST	-	-	-	3	-	-	
0x2200	12~15	HOME	-	-	4	-	-	-	
0x2201	0~3	P-OT	-	5	-	-	-	-	0x065
0x201	4~7	N-OT	6	-	-	-	-	-	

Note) The numbers in parentheses are the Pin numbers of CN1.

(g) For XBF-PN04B/XBF-PN08B module, the latch function operates using the touch probe 1 input signal of servo drive, r ather than using an external command signal.

Notes

The L7N servo drive operates the latch function using the touch probe1 input signal. The touch probe1 input signal uses pin 9 of the CN1 connector. For further information refer to the picture below. The V0.10 or higher of L7N servo drive is supported.



(8) External command Select

(a) set whether to use the external command as “external speed/position control switch”,”external stop command”,or “ external latch command”.

(b) In order for the command set in external command selection to be operated by an external signal, external command enable/disable item should be set to “enable”.

(c) This function is only valid when using the L7N/L7NH servo drive. The D1#1 signal of the L7N servo drive is used as an external command. For using the D1#1 as external command signal, DI#1 should not be assigned to another function in the L7N servo parameter input signal definition (0x2200, 0x2201) item.

The D1#1 signal of L7N servo drive use as an external command. For using the D1#1 as external command signal, DI#8 should not be assigned to another function in the N7NH servo parameter input signal definition (0x2200, 0x2201) item.

(d) The latch function operates using the touch probe 1 input signal of servo drive, rather than using an external command signal.

(8) Software upper/lower limit detect enable/disable during speed control

(a) This function is used when you want to stop the motor when software upper/lower limits are detected even during constant speed operation by speed control.

(b) If the software upper/lower limit is set as default value (upper limit: 2,147,483,647, lower limit: -2,147,483,648) or same value, it would not detect software upper/lower limit.

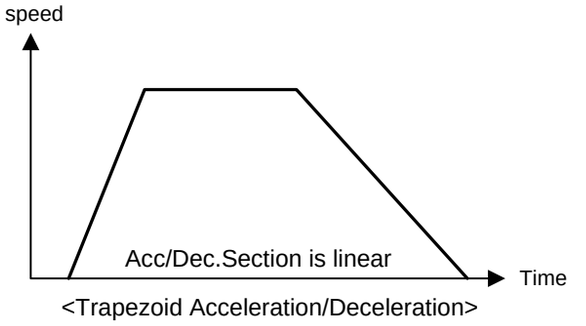
(9) Acceleration/deceleration pattern

(a) There are 2 kinds of acceleration/deceleration operation pattern: Trapezoid operation and S-Curve operation.

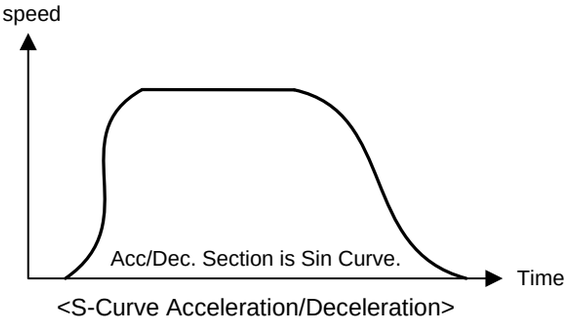
(b) In case of positioning operation, it is available to select operation pattern either trapezoid operation or S-Curve operation at the section of acceleration and deceleration.

(c) As it is not possible to use S-Curve operation pattern in case of continuous operation mode and speed override, care should be taken in setting.

(d) By using S-Curve acceleration/deceleration, it is available to protect the motor from the load effect at the point that the motor starts to move the moving object and stops it.



<Trapezoid Acceleration/Deceleration>



<S-Curve Acceleration/Deceleration>

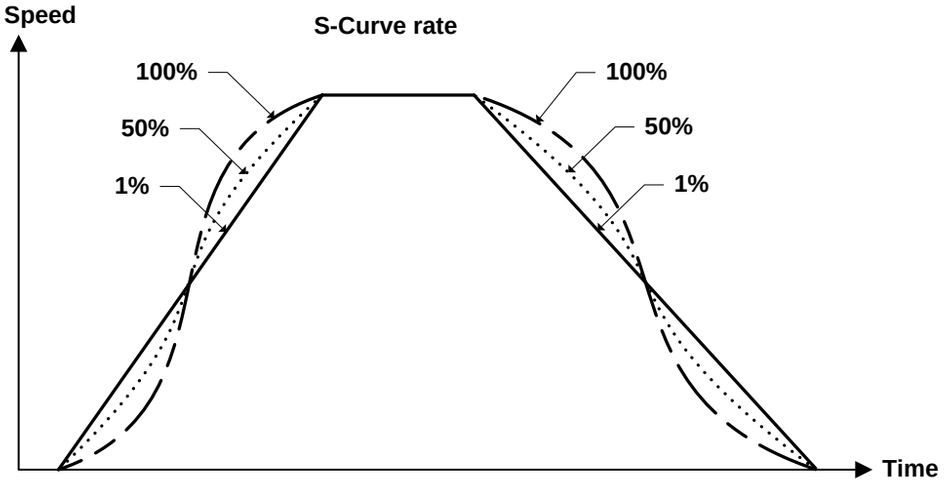
(10) S-curve ratio

(a) In case of selecting S-Curve operation as an acceleration/deceleration pattern, S-Curve rate (1~100%) should be set.

(b) According to S-Curve rate, S-Curve operation pattern shall be formed in accordance with Sinusoidal curve.

(C) If the s-curve ratio set to 1% ,it is closer to trapezoid operation and if s-curve ratio set to higher to 100% , accelerati on/deceleration operation becomes to a sine curve. In other words, when set to 100%, it becomes closest to a sine c urve.

(d) The figure as below shows the example of S-Curve rate setting

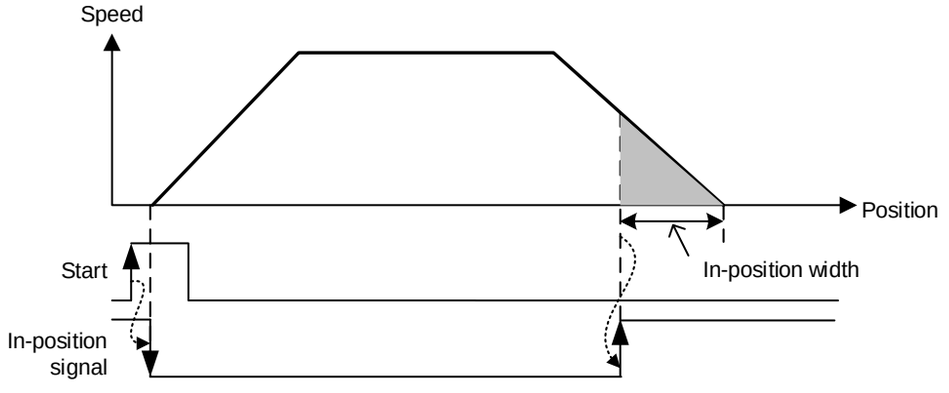


(11) Command Inposition range

(a) This item sets the distance to target position where the Inposition signal (external signal bit11) is on.

(b) The Inposition signal is off when positioning control is started, and the Inposition signal is on when the current position is within the “command in-position range” from the target position.

(c) The Inposition signal can be used as a trigger when executing other auxiliary tasks before the positioning is completed.



(d) Inposition will not be checked in the following cases.

1) When stopped by a deceleration stop, emergency stop command.

2) Speed control operating

(e) The inposition signal is turned off in the following cases.

1) Executing the origin setting command
2) Executing the current position preset command
3) When servo is off
4) Operating positioning control

f) Setting range

Unit	Command inposition range setting range
pulse	0~2147483647[pulse]
㎜	0~2147483647[X10^{-4}㎜]
Inch	0~2147483647[X10^{-5}Inch]
degree	0~2147483647[X10^{-5}degree]

(12) Positioning completion condition

(a) The positioning completion signal is a signal that the set operation is completed without any stopping factor after the positioning operation.

(b) There are 4 type for the positioning completion condition.

1) Method by dwell time
2) Method by inposition signal
3) Method to view dwell time and inposition signal simultaneously.
4) Method to view either dwell time or inposition signal.

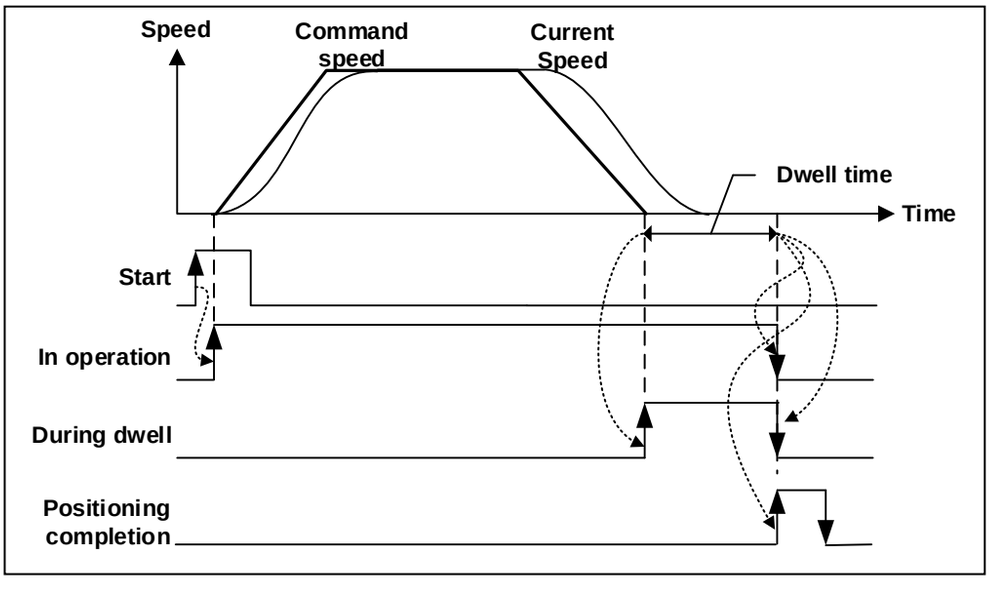
(c) Until the positioning completion condition is met, even if the target position is reached and the positioning operation is completed.it keeps operating status and if the positioning completion condition is met, the operating signal is off and the positioning completion status is reached.

(d) The positioning completion signal of interpolation operation configuration axis follows the positioning completion condition of main axis. When all axes satisfy the positioning completion condition of main axis, positioning completion of related interpolation operation configuration axes completed simultaneously.

(e) This is timing diagram of each method.

1) Method by dwell time

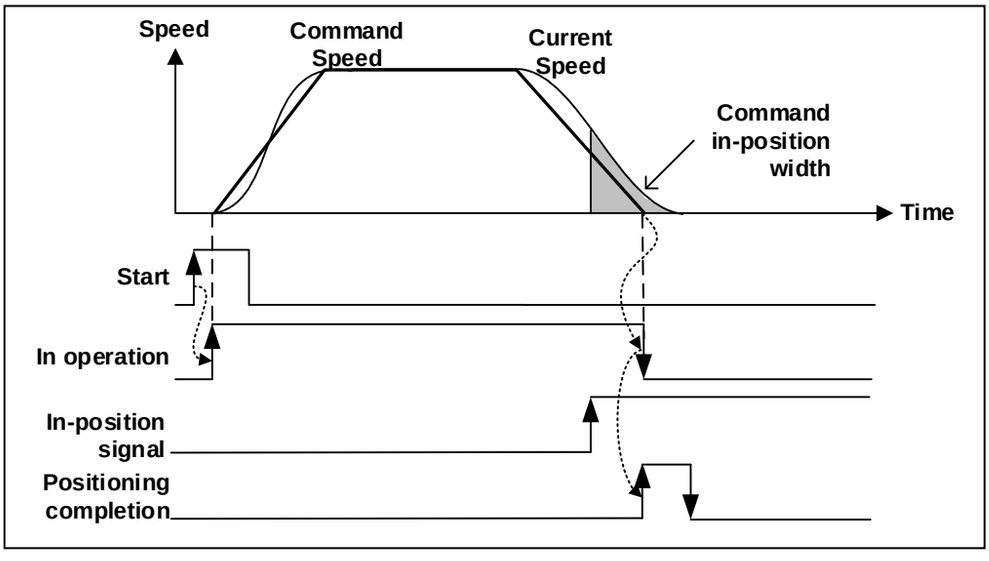
When the positioning completes by reaching the target position, the positioning completion signal is on after the dwell time has elapsed.



2) Method by inposition signal

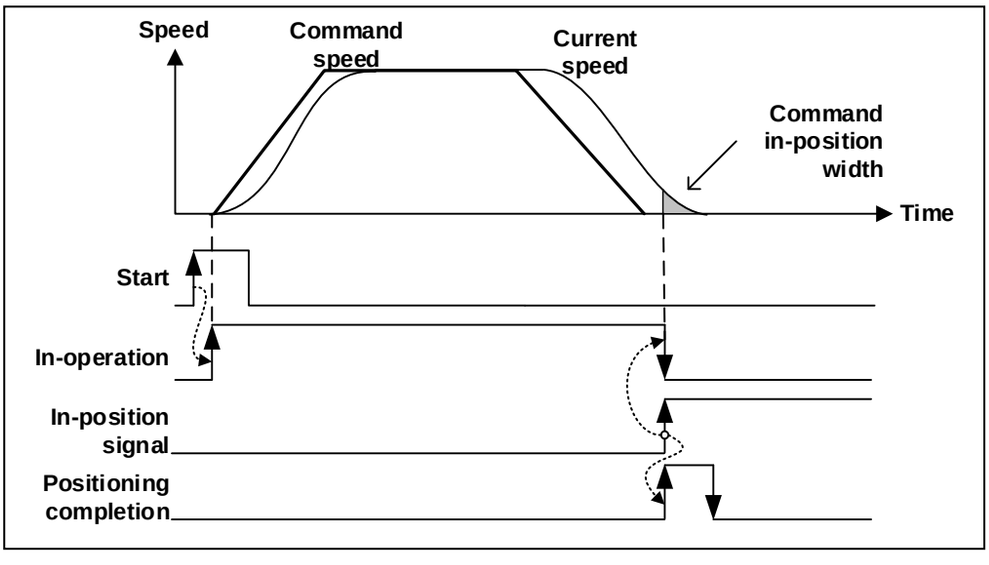
a) When the in-position signal is on before the positioning completion.

The positioning completion signal turns on when the target position is reached and is completed.



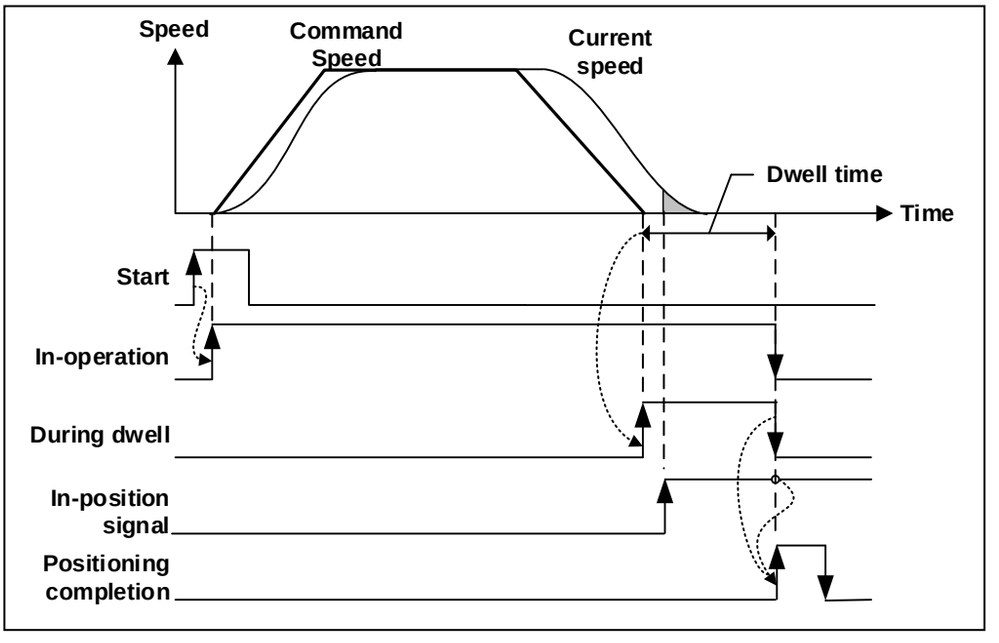
b) When the in-position signal is on after the positioning completion.

After reaching the target position and completing positioning, it wait utill the in-position signal turn on. When in-position signal turns on the positioning completion signal turns on.

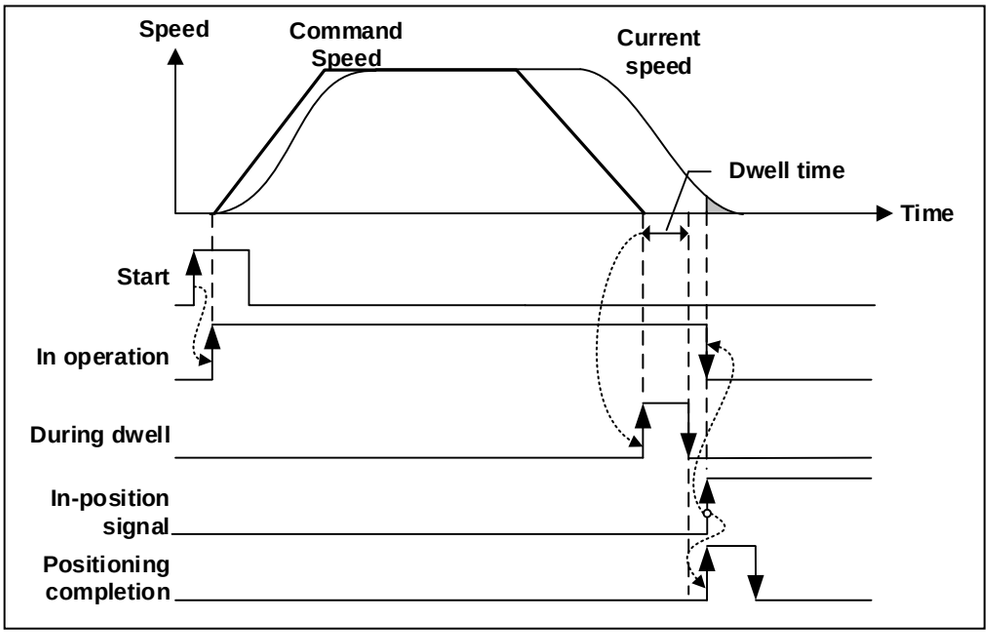


3) Method to view dwell time and inposition signal simultaneously.(AND)

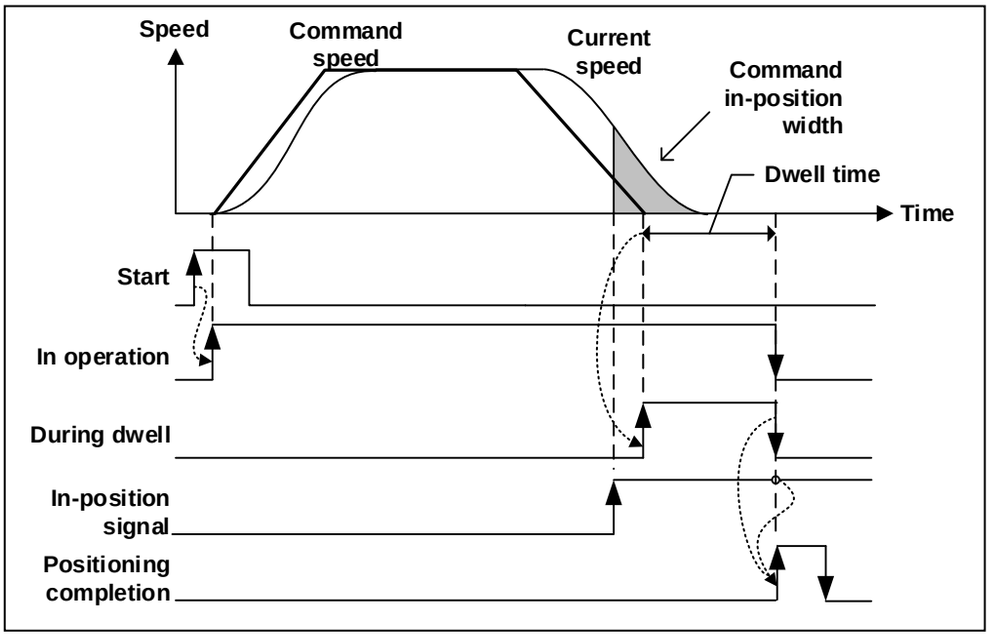
a) When the inposition signal occurs before the dwell time completes.



b) When the inposition signal occurs after the dwell time completes.

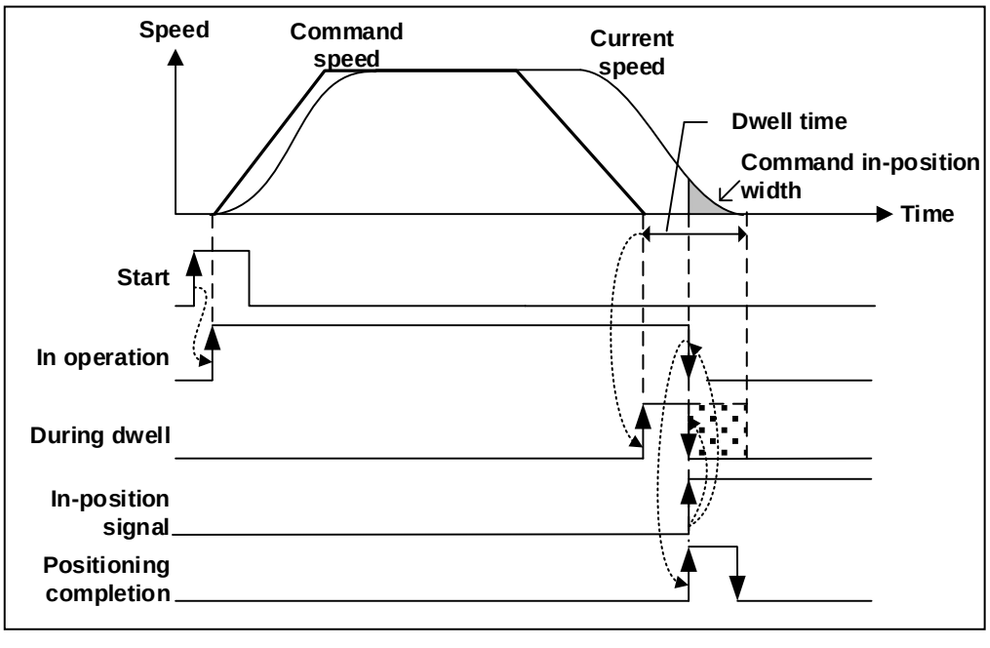


c) When the inposition signal occurs during pulse output.

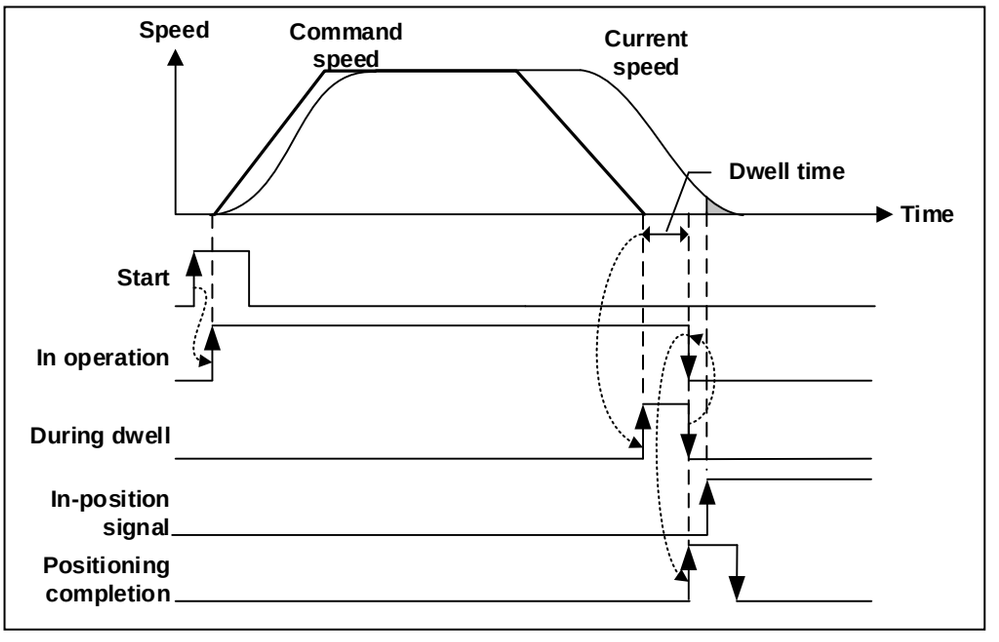


4) Method to view either dwell time or inposition (OR)

a) When the inposition signal occurs before the dwell time completes.



b) When the inposition signal occurs after the dwell time completes.



(13) Positioning method of interpolation continuous operation

When control method is linear or circular interpolation and operation method is Continuous, positioning operation is diff erent according to the setting value by extended parameter of 「Continuous interpolation positioning method」. There are two methods of interpolation.One is「Passing Goal Position」which passes through the specified goal position and the other is「Near Passing」which proceed to the next step at near position not to exceed a specified goal position.

Setting of the 'Interpolation continuous operation positioning method' is as follows.

Item	Setting value	Content
Continuous inter polation positioning meth od	0: Pass target posi tion	Execute Continuous Operation which passes exact goal position of current step which set on operation data.
	1: Near Passing	In case of continuous operation from current step to next step, it p asses near target position of current step

For further information, please refer to operation mode (4) continuous operation of 9.2.2 positioning control.

(14) Axes 2 linear interpolation continuous operating circular insertion

Confirm the execution of 2 axes linear interpolating continuous operation with circular arc interpolation when linear interpolation starts.

The follows describes the setting for 「2-axis linear interpolation continuous operating circular insertion」

Setting item	Setting Value	Content
Axes 2 linear Interpolation Continuous operating circular insertion	0: not circular insertion	When executing it, interpolate circular arc
	1: circular insertion continuous operating	When executing 2-axis linear continuous interpolation, doesnot inserts arc..

For further information about axes 2 linear interpolation continuous operating circular insertion, please refer to (4) 2 line

ar interpolation continuous operating circular insertion in 9.2.6 axes 2 linear interpolation control.

(15) Axes 2 linear interpolation continuous operating circular insertion Position

When‘「Axes 2 linear interpolation continuous operating circular insertion」 was set 'circular insertion continuous operating', confirm the position where it was set in「axes 2 linear interpolation continuous operating circular insertion position」 and resetting the start position of circular interpolation (target position of linear trace 1) and target position(start position of linear trace 2).

The follows describes the setting for 「2-axis linear interpolation continuous operating circular insertion position」

Setting item	Setting Value	Content
2-axis linear interpolation continuous operation circular insertion position	0 ~ 2147483647	Set the position that circular will be inputted. This value means the relative distance from the goal position of linear trace 1.

For further information about axes 2 linear interpolation continuous operating circular insertion, please refer to (4) 2 line ar interpolation continuous operating circular insertion in 9.2.6 axes 2 linear interpolation control.

(16) Position assign speed override coordinate

Positioning speed override command operates by changing the speed to the set operating speed when reaching the designated position during position operating. At this time, the operation varies depending on whether the position valu e at which the speed override is executed is executed as an absolute position in absolute coordinate or as relative p osition values from the position where operation started. When executing position assign speed override command in the position assign speed override coordinate, setting whether to view the position values as an absolute position or a relative position.

The following shows the settings for “Positioning speed override coordinates”

Item	The Setting of Position assign speed override coordinate is as follows.	Content
Position assign spee d override coordinate	0: Absolute	Speed override is executed in the designated absol ute position
	1: Relative	The speed override start at increased by the set v alue from the position where the current operation i s started.

For further information, refer to 9.5.6 position assigned speed override.

(17) Speed/ position switching Coordinates

The setting axis by positioning start carries out the speed control and is switched from speed control to position contr ol when speed/position switching signal is entered to the positioning module inside or outside, and then carries out th e positioning as much as s position value at target position. At this time, this sets whether to consider the target posit ion as absolute position value or incremental position value.

This is the setting of 「Position assign speed override coordinate」.

Item	Setting value	Content
Speed/Position switching coordinate	0: Relative	Executes positioning as far as the set value from position where speed/position switching command is executed.
	1: Absolute	Considers the set value as absolute position and executes positioning into the set absolute position.

For further information, refer to 9.2.14 speed/position switching control.

(18) Interpolation speed selection

When operating linear interpolation, select whether to perform interpolation operation using speed set as the main axis's speed or interpolation operation using the synthetic speed.

For comparison either using main axis speed or using the synthetic speed, refer to the example of calculating speed in linear Interpolation in 9.2.5 and 9.2.7.

(19) Operation when main axis 'errors occurs during synchronous control

Set to be taken by the subordinate axis (axis error or servo alarm) occurs in the main axis during operating using synchronous control function.

The following shows setting of "Operation when main axis 'errors occurs during synchronous control".

Item	Setting value	Content
Operation when main axis ' errors occurs during synchronous control	0: maintains synchronous control	Maintains synchronous control when main axis error occurred.
	1: release synchronous when main axis's servo alarm occurs.	Release synchronous when main axis's servo alarm occurs.
	2: release synchronous when main axis's axis error occurs.	Release synchronous when main axis's axis error occurs.

For more information, please refer to 9.4.8 Operation function when main axis error occurs during synchronous control.

The s/w version and drive Information that support operation function when main axis error during synchronous control are as follows.

	Version
XGF-PN4B	V2.50 or higher
XGF-PN8B	V2.50 or higher
XGF-PN16B	V2.50 or higher
XG5000	V4.75 or higher

(20) Drive absolute position error detection

When homing is competed status using the homing function and drive ‘s absolute position is damaged (ex. encoder c able open),set whether to initialize the homing status by detecting that the drive’s absolute position valid signal change s on to off.

The following shows the setting of “Drive absolute position error detection”.

Item	Setting Value	Content
Drive absolute position error detection	0: not detection	Do not detect drive absolute position error.
	1: homing status init ialization	The drive's absolute position valid signal is detected and If an absolute position error is detected, initializes the homing status.

For more details, refer to 9.1.4 Drive absolute position error detection function.

S/W version information that supports drive absolute position error detection function is as follows.

	Version
XGF-PN4B	V2.50 or higher
XGF-PN8B	V2.50 or higher
XGF-PN16B	V2.50 or higher
XG5000	V4.75 or higher

4.4 Manual Operation Parameter

It describes about basic parameter of positioning module.

Manual operation parameter uses manual operation JOG, Inching operation.

4.4.1 Manual Operation Parameter

Manual operating parameter item	Setting range
Jog high speed	㎜ : 1 ~ 2,147,483,647 [X10^{-2}㎜/minute] Inch : 1 ~ 2,147,483,647 [X10^{-3}Inch/minute] degree : 1 ~ 2,147,483,647 [X10^{-3} degree/minute] pulse : 1 ~ 2,147,483,647 [pulse/second]
Jog low speed	
Jog acceleration speed (ms)	0 ~ 2147483647 [ms]
Jog deceleration speed (ms)	
Inching speed	㎜ : 1 ~ 65,535[X10^{-2}㎜/minute] Inch : 1 ~ 65,535[X10^{-3}Inch/minute] degree : 1 ~ 65,535[X10^{-3} degree/minute] pulse : 1 ~ 65,535[pulse/second]

4.4.2 Manual Operation Parameter Settings

(1) Jog high speed

(a) Jog speed is related to speed during jog operation, which is one of the manual operation and jog operation includes Jog low speed operation and Jog high speed operation.

(b) For further information, please refer to 9.3.1 JOG Operation.

(c) JOG high speed operation has operation pattern as acceleration, constant speed, deceleration section. Therefore, acceleration section and deceleration section is controlled by JOG acceleration/deceleration time.

(d) Jog high speed setting range

All of the control by positioning module are executed within speed limit. Therefore, jog high speed cannot exceed speed limit. And jog high speed must be larger than or same with jog low speed.

Jog Low Speed ≤ Jog High Speed ≤ Speed Limit

(2) Jog low speed

(a) JOG low speed operation has operation pattern as acceleration, constant speed, deceleration section.

(b) JOG low speed setting range: 1 ~ Jog high speed

(3) JOG Acceleration/Deceleration Time

(a) This means JOG acceleration/deceleration time during Jog high speed and low speed operation.

(b) JOG acceleration/deceleration time setting range: 0 ~ 2,147,483,647 [ms]

In case of setting 0, operates according to acceleration time 1 and deceleration time 1 of basic parameter.

(4) Inching speed

(a) Set the speed required for inching operation.

(b) Inching speed setting range: 1 ~ 65,535[unit/time]

4.5 Input Signal Parameter

It describes about Input signal parameter of positioning module. The input signal parameter is a parameter used for command function by external input signal when the external input terminal selection item is selected as '1: external input signal A,B,Z'.

4.5.1 Input Signal Parameter

Input signal parameter items	Setting range
Input signal A function selection	0: not used 1: speed/position control switch. 2: Position/torque control switch 3: external start
Input signal B function selection	
Input signal Z function selection	
Input signal A logic selection	Contact A, Contact B
Input signal B logic selection	
Input signal Z logic selection	
External position/torque control switch torque	-32768 ~ 32767

4.5.2 Input Signal Parameter Settings

(1) Input signal A,B,Z function selection

(a) The input signal A,B,Z function selection sets the function to use the external command signal. The settable commands include speed/position control switching, position torque control switch and external start.

0: speed/position control switch.

- Switches from speed control to position control by input signal.

1: position/torque control switch

- Switches from position control to torque control by input signal.

2: external start

- Starts operation data of current step number by input signal.

(b) The function set in this parameter is executed when the input signal values change Off to on after reflecting the contact condition set in input signal A,B,Z logic selection.

(c) To validate the function set for logic selection of input signal A,B,Z, the external input terminal function selection item in the common parameter should be set to"1: external input signals A,B,Z.

(2) Input signal A,B,Z logic selection

(a) Select the logic of input signal A,B,Z input to the module from outside.

(b) When selected as contact B select, if no current flows to input signal terminal, the module recognizes it as on. And if current flows, the module recognizes it as off.

(c) If the input signal logic selection is set incorrectly, normal operation will not be possible when the user wants, so be careful to change the setting.

(3) External position control switching torque

(a) If the input signal function selection is set to "2: position/torque control switch", the torque value is set changing to torque control.

(b) The unit is % and the torque values can be set from -32768% to 32767%.

4.6 Common Parameter

It describes about common parameter of positioning module.
The parameter which was related with embedded positioning is applied to all of the parameter.

4.6.1 Common Parameter

Common Parameter Item		Setting range
Control word Ⅰ	Encorder1 pulse input (bit0 ~ bit 2)	0:CW/CCW 1 multiplication 1:PULSE/DIR 1 multiplication 2:PULSE/DIR 2 multiplication 3: PHASE A/B 1 multiplication 4: PHASE A/B 2 multiplication 5: PHASE A/B 4 multiplication
	Encoder1 phase Z clear (bit 3)	0:disabled,1:enabled
	Speed override (bit 8)	0: % designate, 1 : Speed designate
	Position specified speed synchronous “target position coordinates” (bit 10)	0:Relative, 1:Absolute
	Encoder 1 average count (bit 11 ~ 12)	0: Not use,1:5 times, 2:10 times, 3:20 times
	External input terminal function selection (bit 15)	0: encoder signal phase A,B,Z 1: external input signal A,B,Z
	External input signal input filter (bit 9)	0: not use, 1: use
Encoder1 Max. value		-2147483648 ~ 2147283647
Encoder1 Min. value		
Control word Ⅱ	Control cycle (bit 0/1/2)	0: auto setting 1: 1ms 2: 2ms 3: 3ms 4: 4ms
	Torque synchronization control reference value (bit 14)	0: Current Actual Value 1: Torque Demand Value
	Error reset mode (bit 15)	0: module 1: module/servo

4.6.2 Common Parameter Settings

(1) Encoder pulse input mode.

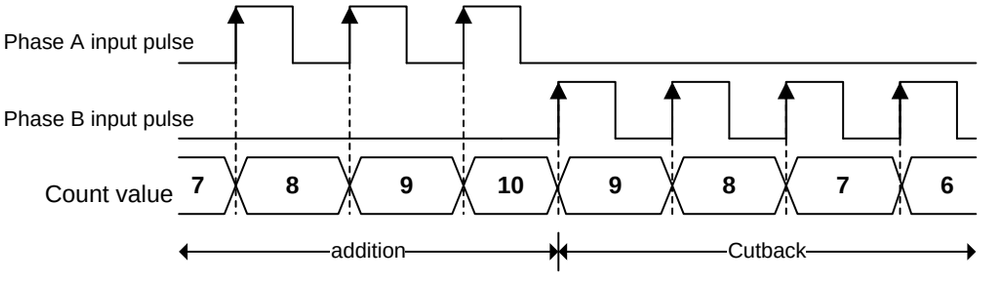
(a) If you want to use by signal of a manual pulse generator or encoder, be sure to select suitable signal of a manual p ulse generator or encoder for using.

(b) You must be selected and set among CW/CCW 1 multiplication, PULSE/DIR 1 multiplication, PULSE/DIR 2 multiplicati on, PHASE A/B 1 multiplication, PHASE A/B 2 multiplication and PHASE A/B 4 multiplication as encoder input signal.

1) CW/CCW 1 multiplication

A count operation is executes when the A-phase input pulse rises or when B-phase input pulse rises and increase the count value if B-phase input is Low state at the rising edge of A-phase input and decrease the count value if A-phase input is Low state at the rising edge of B-phase input.

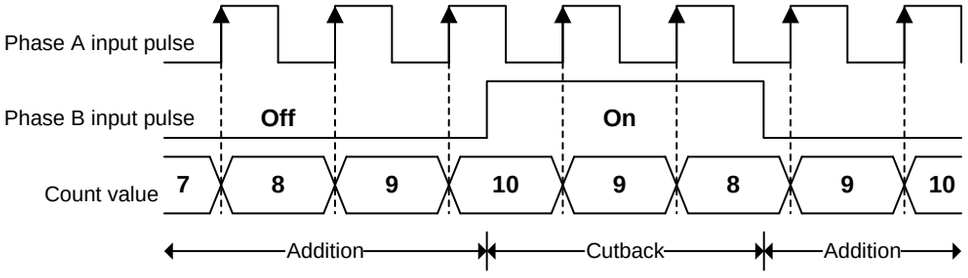
Increasing/Decreasing classification	A- phase input pulse High	A-phase input pulse Low
B-phase input High	-	decreasing count
B-phase input pulse Low	Increasing count	-



2) PULSE/DIR 1 multiplication

Counts at the rising edge of A-phase input. Counting direction will be decided by B-phase.

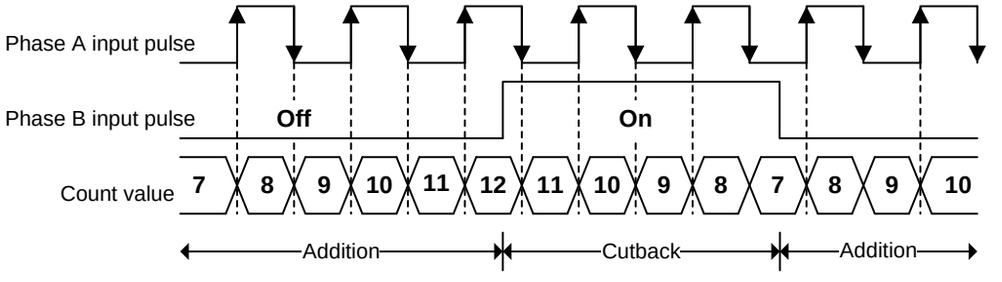
Increasing/decreasing classification	A-phase input pulse rising	A-phase input pulse falling
B-phase input pulse off	Increasing count	-
B-phase input pulse on	decreasing count	-



3) PULSE/DIR 2 multiplication

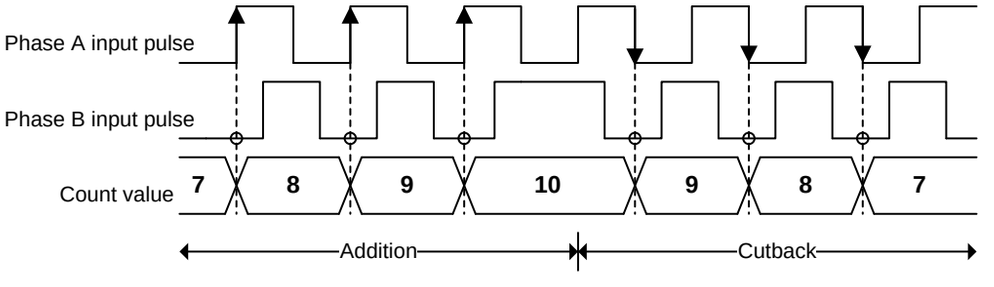
A count operation is performed when phase A input pulse is rising or falling and whether to be added or subtracted is determined by the phase B.

Increasing/decreasing classification	A-phase input pulse rising	A-phase input pulse falling
B-phase input pulse off	Increasing count	Increasing count
B-phase input pulse on	decreasing count	decreasing count



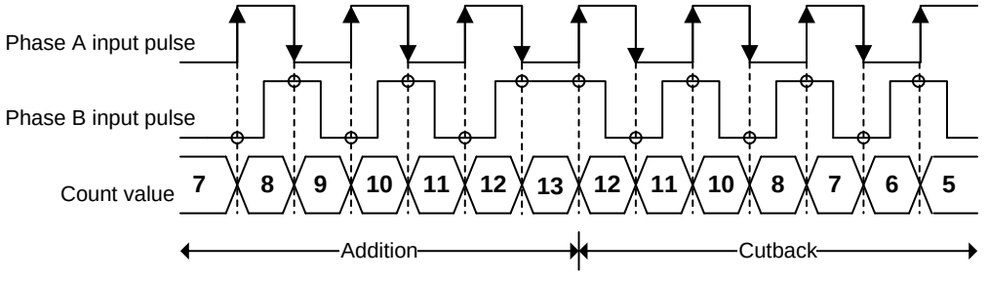
4) PHASE A/B 1 multiplication

Add operation is performed in case of the increase in A phase pulse when the phase of A phase input pulse is ahead of B phase input pulse, and subtraction operation is performed in case of the decrease in A phase pulse when the phase of B phase input pulse is ahead.



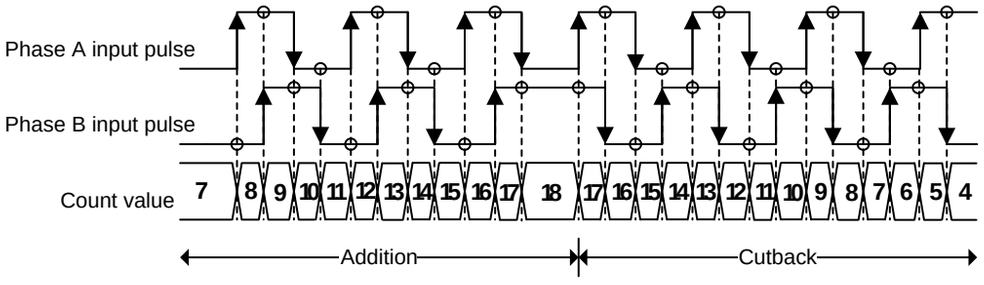
5) PHASE A/B 2 multiplication

The count operation is performed when both increase and decrease in a phase input pulse. Add operation is performed when the phase of A phase is input ahead of B phase, and subtraction operation is performed when the phase of B phase is input ahead of A phase.



6) PHASE A/B 4 multiplication

The count operation is performed when rising and falling of phase A input pulse or rising, and falling of phase B input pulse. Increasing count executes when phase A input in phase ahead of phase B, and decreasing count executes when phase B input in phase ahead of phase A.



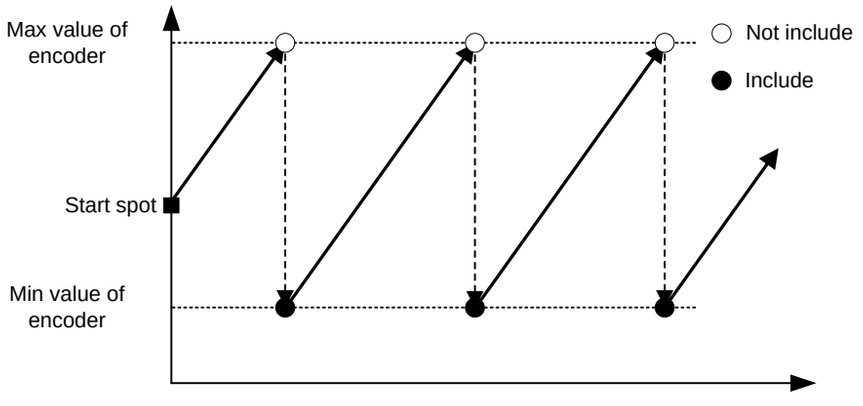
(c) To operate motor synchronized with manual pulse generator (MPG), operates by setting main axis to encoder in the s peed Synchronization command. The Synchronization ratio can be either “encoder ≤ motor” or”encoder ≥ motor”.

(2) Max/Min value of encoder

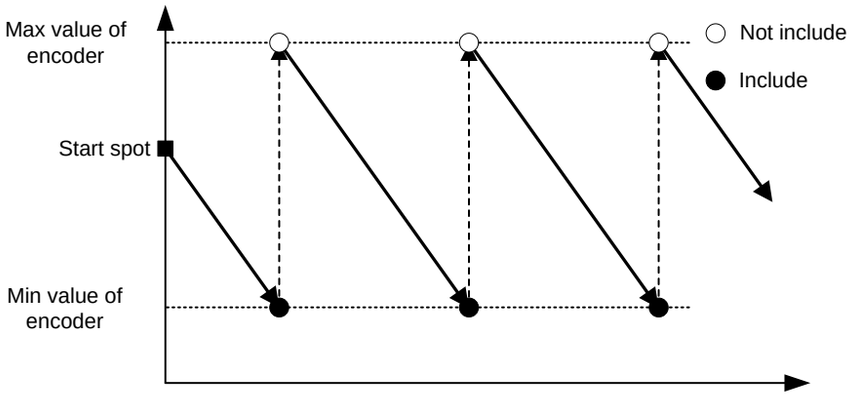
(a) When counting inputted pulse from a manual pulse generator or encoder signal of servo drive and displaying as enco der value, the count range need to be set to Max/Min value of encoder.

(b) Operations are as shown in the figure below.

1) When encoder value increases



2) When encoder value decreases



(C) If the range of encoder Max/Min value do not include encoder current position, an error (error code: 148) occurs when writing common parameter to the module. In this case, the encoder Max/Min value ranges operate at the previous setting values. If you use the encoder preset command to set the encoder preset position within encoder Max/Min value range, the newly set encoder Max/Min value are reflected as parameters.

(3) Speed override

(a) When operate a speed change command (Speed override, Position specified speed override, etc), set changing speed either speed values or % of target speed.

(b)In the operating speed of main of setting percentage (%) can set each from 0.01% to 655.35% (unit: 0.01%).

(4) Position specified speed synchronous target position coordinate

(a) When performing a Position specified speed synchronous control command, set whether to use the 'target position' as a relative position or as an absolute position at the time of the command.

(b) The values which are available to be set is as follows.

0: Relative, 1: Absolute

(5) Encoder average count

(a) During synchronous operation with the encoder as main axis, to reduce speed discontinuity of the subordinate axis due to changing in encoder input speed, you can set the number of time to average the encoder input values.

(b) The values which are available to be set is as follows.

0: Not use, 1:5 times, 2:10 times, 3:20 times

(6) External input terminal function selection

(a) Set what function to use the external input terminal for.

(b) The function which are available to be set is as follows.

0: encoder signal phase A,B.Z

1: external input signal A,B,Z

(c) If the external input external function selection is "1: external input signal A,B,Z, the encoder position value is displayed as 0. When executing encoder preset command, it do not operate and encoder position value maintains 0.

(d) If the external input terminal function selection changes to "0: encoder signal phase A,B.Z", encoder position values verifies encoder Max/Min parameter values and set the initial position (0 if the max/min values contain 0, Min if they do not).

(e) If the external input terminal function selection is changed to "0: encoder signal phase A,B.Z, all external input signal status of status information are displayed as off.

(7) External input signal input filter

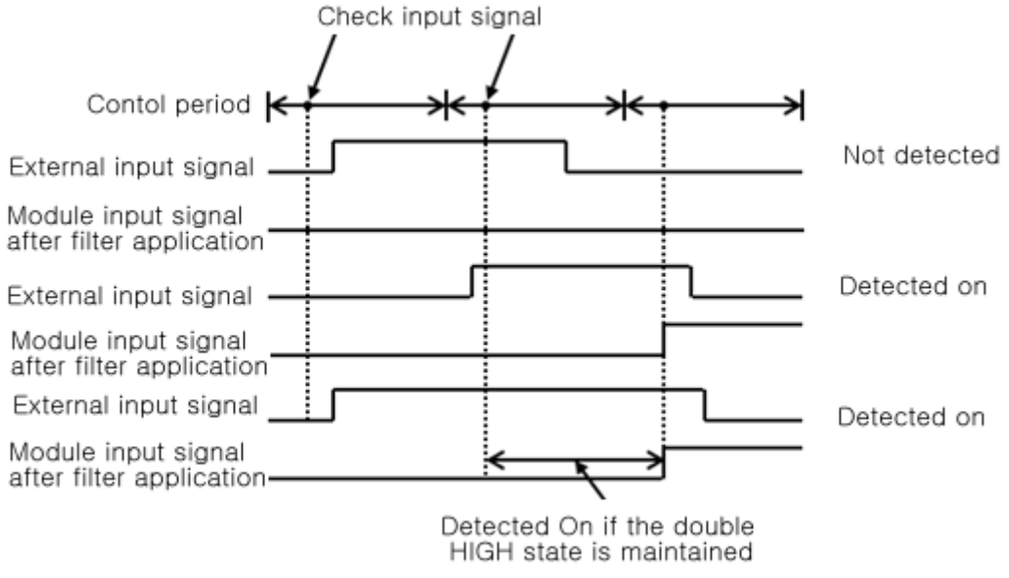
(a) if the external input terminal function selection is "1: external input signal A,B,Z, set whether to apply S/W filter to the input signal.

(b) The values which are available to be set is as follows.

0: not use, 1: use

Notes

1. If applying an external input signal filter, a filter time of 2 control cycle is applied, so signals shorter than 2 control cycle are not recognized as on. However, even if a signal shorter than 2 control cycle is input , if the HIGH state maintains 2 times at the time of checking input signal, it recognized as on even after applying the input filter.



2. The control cycle changes depending on the 'control cycle' setting of common parameter and the number of axes, so refer to '9.5.13 control cycle user setting and control time information confirm'. If the control cycle of the common Parameter is set '0: automatic setting'. The control cycle depending on the number of axes are as follows.
   1ms: Axis 1~2
   2ms: Axis 3~5
   3ms: Axis 6~8

3. The signal range that can recognize an external input signal as on or off is as follows.

	input filter 0: not applied		input filter 1: apply	
Control cycle	**Unrecognizable**	Recognizable	**Unrecognizable**	Recognizable
1ms	-	Signal width > 1.05ms	Signal width < 1.9ms	Signal width > 2.1ms
2ms	-	Signal width > 2.1ms	Signal width < 3.8ms	Signal width > 4.2ms
3ms	-	Signal width > 3.15ms	Signal width < 5.7ms	Signal width > 6.3ms

(8) Control Cycle

(a) Set the control cycle to perform basic function of module including positioning command process and position/speed/torque control.

(b) The values which are available to be set is as follows.

0: auto setting

1: 1ms

2: 2ms

3: 3ms

4: 4ms

(c) If the control cycle set to " o: auto setting" the control cycle is determined as follows according to the number of "virtual axis+ real axis' during EtherCAT connection. If EtherCAT is not connected or the virtual axis is not exist, it operates with a 1ms control cycle.

Control cycle	XBF-PN04\B	XBF-PN08B
1ms	Axis 1~2	Axis 1~2
2ms	Axis 3~4	Axis 3~5
3ms	-	Axis 6~8

(d) The version information supporting control cycle setting is as follows.

Item	Supported version
XG5000	4.52 or higher
XBF-PN04B	V2.10 or higher
XBF-PN08B	V2.10 or higher

(e) When connecting an EtherCAT I/O device as slave, the control cycle may change depending on network Configuration and setting, for more information refer to "9.5.13 control cycle user setting and control time information confirmation"

(9) Torque Synchronization control reference value

(a) Sets the control reference of all torque Synchronization that is executed by module.

(b) When set to "0: real torque values", the subordinate axis is controlled based on the measured torque values that the main axis is actually controlled. When set to "1: required torque values", the subordinate axis is controlled based on the required torque values that commanded to the main axis.

(10) Error reset mode

(a) When performing error reset, set the range of error reset.

(b) If set to '0: module error is initialized and if set to '1: module/servo ' both module error and servo drive error are initialized.

4.7 Operation Data

Here describes Operation Data of positioning module.

Can set 400 operation data per each axis, operation of circular interpolation and linear interpolation in accordance with information of operation data.

4.7.1 Operation Data

<table>
<tr><th colspan="2">Operation data item</th><th>Setting range</th></tr>
<tr><td colspan="2">Target Position</td><td rowspan="2">㎜ : -2147483648 ~ 2147483647 [X10^{-4}㎜]
Inch : -2147483648 ~ 2147483647 [X10^{-5}Inch]
degree : -2147483648 ~ 2147483647 [X10^{-5}degree]
pulse : -2147483648 ~ 2147483647 [pulse]</td></tr>
<tr><td colspan="2">Circular interpolation auxiliary position*1</td></tr>
<tr><td colspan="2">Operation speed</td><td>㎜ : 0 ~ 2,147,483,647 [X10^{-2}㎜/minute]
Inch : 0 ~ 2,147,483,647 [X10^{-3}Inch/minute]
degree : 0 ~ 2,147,483,647 [X10^{-3} degree/minute]
pulse : 0 ~ 2,147,483,647 [pulse/second]</td></tr>
<tr><td colspan="2">Dwell time</td><td>0 ~ 65,535[ms]</td></tr>
<tr><td colspan="2">M Code no.</td><td>0 ~ 65535</td></tr>
<tr><td colspan="2">Sub axis setting</td><td>Bit unit setting<table><tr><td>Bit 7</td><td>Bit 6</td><td>Bit 5</td><td>Bit 4</td><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr><tr><td>Axis 8</td><td>Axis 7</td><td>Axis 6</td><td>Axis 5</td><td>Axis 4</td><td>Axis 3</td><td>Axis 2</td><td>Axis 1</td></tr></table></td></tr>
<tr><td colspan="2">Helical interpolation axis</td><td>0, axis1 ~ axis4 (0: circular interpolation)</td></tr>
<tr><td colspan="2">No. of circular interpolation turn</td><td>0~65,535</td></tr>
<tr><td rowspan="9">Control WORD</td><td>Coordinate (bit 0)</td><td>0:absolute, 1:incremental</td></tr>
<tr><td>Control Method (bit 1~3)</td><td>0:Single axis positioning, 1: Single axis speed control
2: Single Feed control, 3:Linear interpolation, 4:Circular interpolation</td></tr>
<tr><td>Operation method (bit 4)</td><td>0:Single , 1:Repeat</td></tr>
<tr><td>Operation pattern (bit 5~6)</td><td>0:End, 1:Keep, 2: Continuous</td></tr>
<tr><td>Circular arc size (bit 7)</td><td>0:Circular arc<180 , 1:Circular arc>=180</td></tr>
<tr><td>Acc. No. (bit 8~9)</td><td>0 ~ 3</td></tr>
<tr><td>Deceleration No. (bit 10~11)</td><td>0 ~ 3</td></tr>
<tr><td>Circular interpolation method(bit 12~13)</td><td>0:midpoint, 1:central point, 2:radius</td></tr>
<tr><td>Circular Interpolation direction (bit 14)</td><td>0:CW, 1:CCW</td></tr>
</table>

Notes

The circular interpolation can not be executed in degree unit. Therefore it is idle to set value at the circular interpolating auxiliary position item.

4.7.2 Operation Data Setting

(1) Step number

(a) The setting range of positioning data as serial no. is 1 ~ 400.

(b) The first starting step of operation data is no.1 step when power is appied to the positioning module.

Notes

In case of designating step number as 0 with indirect start, Simultaneous start, Position synchronous start, it means current operation step.

(2) Coordinate

(a) Coordinate of position data includes absolute coordinate and incremental coordinate.

1) Control by absolute coordinates

a) This carries out the positioning control from the current position to the goal position (the goal position assigned by positioning data).

b) Positioning is carried out based on the assigned position of homing (homing completion address).

c) Moving direction is decided by current position and goal position.

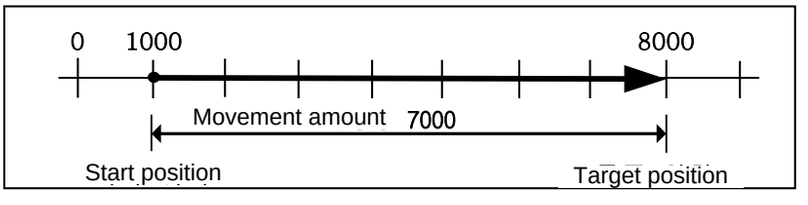
■ Starting Position < Goal Position: Forward Positioning operation

■ Starting Position > Goal Position: Reverse Positioning operation

[Example]

■ When current position: 1000, Goal position: 8000, forward direction transfer amount is 7000(8000-1000).

■ positioning result



Notes

Positioning by Absolute method (Absolute coordinate) can start only in the state that the origin is determined. If starting in the state that the origin is not determined, Error will occur.

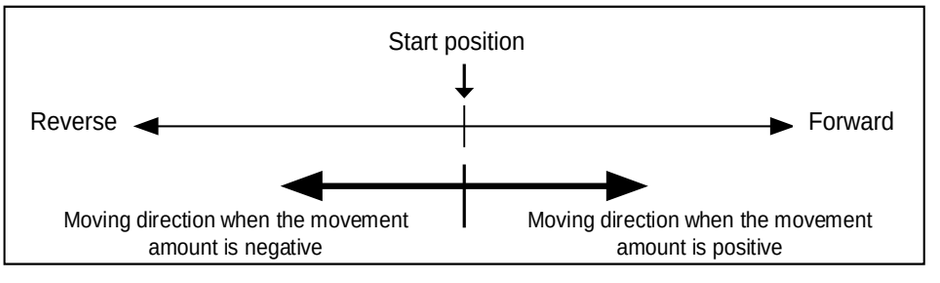
2) Incremental method

a) Execute positioning control from current position as much as goal movement value.

b) Moving direction depends on sign of movement value.

■ Positive value (+ or 0): positioning operation with forward direction

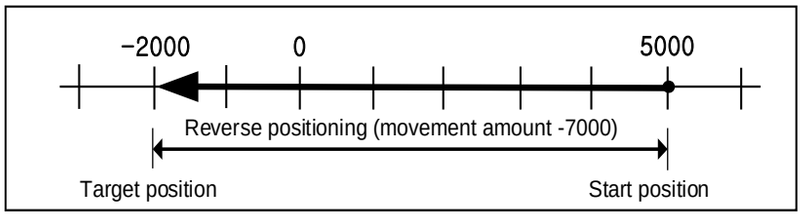
■ Negative value (-): positioning operation with reverse direction.



[Example]

■ When current position: 5000, Goal position: -7000, the positioning shall be done at -2000 position.

■ positioning result



(3) Control method

(a) The control Method include single-axis position control, single-axis speed control, single-axis feed control, linear interpolation, circular interpolation. Select control method that is suitable to positioning operation.

(b) For further information, please refer to 9.2 positioning control of Chapter 9 Function.

Notes

Set coordinate and control method in all at the same time in“control method” item with positioning software package. And the software package“Control Method” item is same as follows

Absolute, Single axis position control/Absolute, Single axis speed control/Absolute, Single axis feed control/Absolute, Linear Interpolation/Absolute, Circular interpolation/

Relative, Single axis position control/Relative, Single axis speed control/Relative, Single axis feed control/Relative, Linear Interpolation/Relative, Circular interpolation

(4) Operation Pattern (End/Keep/Continuous)

(a) Operation pattern is setting item, how can step of operation data connect with next step and operate.

(b) Select one operation pattern from End, Keep, and Continuous operation according to the desired positioning operation in the operation pattern.

(c)C For further information, please refer to 9.2.2 Operation mode of positioning control of Chapter 9 Function.

(5) Operation Method (Single/Repeat)

(a) Operating Method is an option for selecting an operating step after finish operating step of the operation data setting step.

(b) In case of setting singular, it will be select next step after finish operating setting step. If you set by Repeat, It will be select setting repeat step after finish operating setting step.

(b) Select one positioning operation pattern from Single, Repeat operation.

(C) For further information, please refer to 9.2.2 Operation mode of positioning control of Chapter 9 Function.

Notes

Set operation pattern and operation method at the 'operation method” item in Positioning software software package. 'Operation method’ item of software package is as follows.

Single, End/single, Keep/single, Continuous/repeat, End/repeat, Keep/repeat, Continuous

(6) Target position

(a) This is the area to set the transfer amount for positioning operation as 'position value'.

(C) The setting range is -2,147,483,648 ~ 2,147,483,647[unit] depending on unit of setting axis.

(7) M Code

(a) Output mode of M code is applied to the whole axis in a bundle by M code mode set by extended parameter and is given to each operation step no. as a Number within the setting range to use at program.

(b) The setting range is 1 ~ 65,535

(c) M code no. can be identified in program by using operation state read.

(d) For further information, please refer to 4.3.2. M code mode.

(8) Acceleration/Deceleration No

(a) The dual acceleration/deceleration time setting is available by setting the acceleration/deceleration time 1/2/3/4 of basic parameter as acceleration/deceleration no. 1/2/3/4 respectively.

(9) Operation speed

(a) Operation speed is the target speed which it is applied when it operate positioning.

(b) Operation speed is set within the range that does not exceed Speed limit of basic parameter.

(10) Dwell time

(a) This is the waiting time before carrying out the next positioning operation after completing one positioning operation.

(b) Setting range is 0 ~ 65,535 (㎳).

(c) Especially, in case of using SERVO motor, this is the data to set the waiting time by the stable stop state as positioning module is in the stop state but actual SERVO motor does not reach to the target position or in transition state.

(d) While dwell time is active, the corresponding axis of positioning module maintains 'ON of the 'Busy Flag' and if dwell time proceeds, 'Busy Flag' becomes OFF and the positioning end signal becomes 'ON.

(11) Slave Axis setting

(a) This is an option for axis of subordinate of driving shaft when should operate at least over 2 axis such as linear interpolation or circular interpolation.

(b) Setting each bit from 1 axis to 8 axis. Each bit is as follows

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Axis 8	Axis 7	Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1

(c) Multiple selections are possible. For example, If select axis 2 and axis 4 axes 4 as subordinate axis, set “008A ” by hexadecimal in setting of subordinate axis.

(12) Circular interpolation auxiliary position

(a) This is an option for setting auxiliary data when the circular interpolation operates.

(b) According to circular interpolation, mean of circular interpolating auxiliary position is decided. It means midpoint which is through by circular arc in midpoint method. It is central point of circular arc in central point method. And It is radius of circular arc in radius method.

(c) In case that circular interpolation method is radius, be valid only value of circular interpolating auxiliary position of main axis axis.

(d) For further information, please refer to 8.2.9 ~ 8.2.11 Circular interpolation control.

(13) Circular Interpolation Method

(a) This is an option for method setting from circular interpolating operation.

(b) There are three method for circular interpolation; midpoint, central point, radius.

(d) For further information, please refer to 8.2.9 ~ 8.2.11 Circular interpolation control.

(14) Circular interpolation direction

(a) This is an option for setting direction of drawing circle from circular interpolation operation when the operation starts.

(b) Circular interpolation direction is based on drawing circular interpolation when the main axis is axis 'X' and the subordinate axis is axis 'Y'.

(c) This option is ignored from circular interpolation of midpoint because circular interpolation direction is selected by position of midpoint.

(c) For further information, please refer to 8.2.9 ~ 8.2.11 Circular interpolation control.

(15) Arc Size

(a) When circular interpolating method is set by radius method, User can select one of 2 circular arcs.

(b) Select one of bigger than 180-degree circular interpolation or less than 180-degree circular interpolation.

(c) This option is ignored in the circular interpolation of midpoint method and central point method.

(d) For further information, please refer to 8.2.9 ~ 8.2.11 Circular interpolation control.

Notes

Positioning software package set all at the same time; - circular arc method, circular interpolation direction, circular arc size with 'Circular interpolation mode'. Software package“Circular interpolation mode' is as follows.

Midpoint/Central point, CW/Central point, CCW/Radius, CW, circular<180-degree / Radius, CW, circular>=180-degree / Radius, CCW, circular<180-degree /Radius, CCW, circular>=180-degree.

(16) No. of circular interpolation turn

(a) This is an option setting the number of rotation of circular arc operation when operating over the 360-degree.

(b) Setting range is 1 ~ 65,535.

(17) Helical Interpolation Axis

(a) It is item which is setting axis for linear operation in helical interpolation operation.

(b) Settled axis from helical interpolation operates linear interpolation to settled position at the target position among the step operation data for that axis.

(c) For further information, please refer to 9.2.12 helical interpolating control.

Chapter 5. Internal Memory and I/O Signal

5.1 Internal Memory

Here describes the internal memory of positioning module using XGK CPU Main unit.

Internal memory is used when executing direct Data read/write between positioning module and PLC CPU by using PUT(PUTP), GET(GETP) command instead of using the dedicated command. For Data read/write using the dedicated command, please refer to 6.2 Dedicated Command

5.1. 1 Point operation step data

(1) Memory Address of POINT operation step data

Memory address								Content
Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	
2A1	321	3A1	421	4A1	521	5A1	621	Point Start Step 1
2A2	322	3A2	422	4A2	522	5A2	622	Point Start Step 2
2A3	323	3A3	423	4A3	523	5A3	623	Point Start Step 3
2A4	324	3A4	424	4A4	524	5A4	624	Point Start Step 4
2A5	325	3A5	425	4A5	525	5A5	625	Point Start Step 5
2A6	326	3A6	426	4A6	526	5A6	626	Point Start Step 6
2A7	327	3A7	427	4A7	527	5A7	627	Point Start Step 7
2A8	328	3A8	428	4A8	528	5A8	628	Point Start Step 8
2A9	329	3A9	429	4A9	529	5A9	629	Point Start Step 9
2AA	32A	3AA	42A	4AA	52A	5AA	62A	Point Start Step 10
2AB	32B	3AB	42B	4AB	52B	5AB	62B	Point Start Step 11
2AC	32C	3AC	42C	4AC	52C	5AC	62C	Point Start Step 12
2AD	32D	3AD	42D	4AD	52D	5AD	62D	Point Start Step 13
2AE	32E	3AE	42E	4AE	52E	5AE	62E	Point Start Step 14
2AF	32F	3AF	42F	4AF	52F	5AF	62F	Point Start Step 15
2B0	330	3B0	430	4B0	530	5B0	630	Point Start Step 16
2B1	331	3B1	431	4B1	531	5B1	631	Point Start Step 17
2B2	332	3B2	432	4B2	532	5B2	632	Point Start Step 18
2B3	333	3B3	433	4B3	533	5B3	633	Point Start Step 19
2B4	334	3B4	434	4B4	534	5B4	634	Point Start Step 20

(2) Setting

(a) The dedicated commands for setting the POINT start step data is XPWR.

(b) For XPST, the Point start command, and XPWR, the Point start step data setting command, for XGK, Refer to 6.3.43 POINT Start Step Data Setting Command.

(c) In PLC program, POINT start data setting during POINT start should be done in the step before POINT start command is executed.

5.1.2 Teaching data

(1) Memory Address of Teaching Data

Memory address								Content
Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	
280	300	380	400	480	500	580	600	Teaching Data1(Lower)
281	301	381	401	481	501	581	601	Teaching Data1(Upper)
282	302	382	402	482	502	582	602	Teaching Data2(Lower)
283	303	383	403	483	503	583	603	Teaching Data2(Upper)
284	304	384	404	484	504	584	604	Teaching Data3(Lower)
285	305	385	405	485	505	585	605	Teaching Data3(Upper)
286	306	386	406	486	506	586	606	Teaching Data4(Lower)
287	307	387	407	487	507	587	607	Teaching Data4(Upper)
288	308	388	408	488	508	588	608	Teaching Data5(Lower)
289	309	389	409	489	509	589	609	Teaching Data5(Upper)
28A	30A	38A	40A	48A	50A	58A	60A	Teaching Data6(Lower)
28B	30B	38B	40B	48B	50B	58B	60B	Teaching Data6(Upper)
28C	30C	38C	40C	48C	50C	58C	60C	Teaching Data7(Lower)
28D	30D	38D	40D	48D	50D	58D	60D	Teaching Data7(Upper)
28E	30E	38E	40E	48E	50E	58E	60E	Teaching Data8(Lower)
28F	30F	38F	40F	48F	50F	58F	60F	Teaching Data8(Upper)
290	310	390	410	490	510	590	610	Teaching Data9(Lower)
291	311	391	411	491	511	591	611	Teaching Data9(Upper)
292	312	392	412	492	512	592	612	Teaching Data10(Lower)
293	313	393	413	493	513	593	613	Teaching Data10(Upper)
294	314	394	414	494	514	594	614	Teaching Data10(Lower)
295	315	395	415	495	515	595	615	Teaching Data11(Upper)
296	316	396	416	496	516	596	616	Teaching Data11(Lower)
297	317	397	417	497	517	597	617	Teaching Data12(Upper)
298	318	398	418	498	518	598	618	Teaching Data13(Lower)
299	319	399	419	499	519	599	619	Teaching Data13(Upper)
29A	31A	39A	41A	49A	51A	59A	61A	Teaching Data14(Lower)
29B	31B	39B	41B	49B	51B	59B	61B	Teaching Data14(Upper)
29C	31C	39C	41C	49C	51C	59C	61C	Teaching Data15(Lower)
29D	31D	39D	41D	49D	51D	59D	61D	Teaching Data15(Upper)
29E	31E	39E	41E	49E	51E	59E	61E	Teaching Data16(Lower)
29F	31F	39F	41F	49F	51F	59F	61F	Teaching Data16(Upper)

(2) Setting

(a) The dedicated commands for setting the Teaching data is XTWR.

(b) For XTEAA, the Teaching command, and XTWR, the Teaching data setting command for XGK, Refer to “6.3.30 Teaching array command”.

(c) In PLC program, in order to carry out the normal action of Teaching command, the Teaching data setting should be done in the step before Teaching command is executed.

5.1. 3 Simultaneous start step data

(1) Simultaneous start step data memory address

Memory address								Content
Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	
2B6	336	3B6	436	4B6	536	5B6	636	Simultaneous start Axis1 step no.
2B7	337	3B7	437	4B7	537	5B7	637	Simultaneous start Axis2 step no.
2B8	338	3B8	438	4B8	538	5B8	638	Simultaneous start Axis3 step no.
2B9	339	3B9	439	4B9	539	5B9	639	Simultaneous start Axis4 step no.
2BA	33A	3BA	43A	4BA	53A	5BA	63A	Simultaneous start Axis5 step no.
2BB	33B	3BB	43B	4BB	53B	5BB	63B	Simultaneous start Axis6 step no.
2BC	33C	3BC	43C	4BC	53C	5BC	63C	Simultaneous start Axis7 step no.
2BD	33D	3BD	43D	4BD	53D	5BD	63D	Simultaneous start Axis8 step no.

(2) Setting

(a) The command for Simultaneous start step data setting is XSWR.

(B) For XSST, the Simultaneous start command, and XSWR, the Simultaneous start step data setting command, for XGK, Refer to “6.3.6 Simultaneous start step setting command”.

(c) In PLC program, in order to carry out the normal action of Simultaneous Start, the Step data setting of Simultaneous Start should be done in the step before Simultaneous Start command is executed.

5.1.4 Parameter Direct Read/ Write

(1) Parameter direct Read/ Write memory address

	Axis 1		Axis 2		Axis 3		Axis 4		Axis 5		Axis 6		Axis 7		Axis 8		Content
	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	
Basic parameter .	0	0	64	40	128	80	192	C0	256	100	320	140	384	180	448	1C0	Speed limit(low)
	1	1	65	41	129	81	193	C1	257	101	321	141	385	181	449	1C1	Speed limit(high)
	2	2	66	42	130	82	194	C2	258	102	322	142	386	182	450	1C2	Accel. Time 1(low)
	3	3	67	43	131	83	195	C3	259	103	323	143	387	183	451	1C3	Accel. time 1(high)
	4	4	68	44	132	84	196	C4	260	104	324	144	388	184	452	1C4	Accel. Time 2(low)
	5	5	69	45	133	85	197	C5	261	105	325	145	389	185	453	1C5	Accel. time 2(high)
	6	6	70	46	134	86	198	C6	262	106	326	146	390	186	454	1C6	Accel. time 3(low)
	7	7	71	47	135	87	199	C7	263	107	327	147	391	187	455	1C7	Accel. time 3(high)
	8	8	72	48	136	88	200	C8	264	108	328	148	392	188	456	1C8	Accel. time 4(low)
	9	9	73	49	137	89	201	C9	265	109	329	149	393	189	457	1C9	Accel. time 4(high)
	10	A	74	4A	138	8A	202	CA	266	10A	330	14A	394	18A	458	1CA	Decel. time 1(low)
	11	B	75	4B	139	8B	203	CB	267	10B	331	14B	395	18B	459	1CB	Decel. time 1(high)
	12	C	76	4C	140	8C	204	CC	268	10C	332	14C	396	18C	460	1CC	Decel. time 2(low)
	13	D	77	4D	141	8D	205	CD	269	10D	333	14D	397	18D	461	1CD	Decel. time 2(high)
	14	E	78	4E	142	8E	206	CE	270	10E	334	14E	398	18E	462	1CE	Decel. 3(low)
	15	F	79	4F	143	8F	207	CF	271	10F	335	14F	399	18F	463	1CF	Decel. time 3(high)
	16	10	80	50	144	90	208	D0	272	110	336	150	400	190	464	1D0	Decel. time 4(low)
	17	11	81	51	145	91	209	D1	273	111	337	151	401	191	465	1D1	Decel. time 4(high)
	18	12	82	52	146	92	210	D2	274	112	338	152	402	192	466	1D2	Dec. time for EMG stop (Low)
	19	13	83	53	147	93	211	D3	275	113	339	153	403	193	467	1D3	Dec. time for EMG stop (High)
	20	14	84	54	148	94	212	D4	276	114	340	154	404	194	468	1D4	Pulse per rotation (low)
	21	15	85	55	149	95	213	D5	277	115	341	155	405	195	469	1D5	Pulse per rotation (High)
	22	16	86	56	150	96	214	D6	278	116	342	156	406	196	470	1D6	Travel per revolution(Low)
	23	17	87	57	151	97	215	D7	279	117	343	157	407	197	471	1D7	Travel per revolution(High)
	24	18	88	58	152	98	216	D8	280	118	344	158	408	198	472	1D8	CONTROL WORD1
	25	19	89	59	153	99	217	D9	281	119	345	159	409	199	473	1D9	CONTROL WORD2
Extended parameter .	26	1A	90	5A	154	9A	218	DA	282	11A	346	15A	410	19A	474	1DA	Soft upper limit(Low)
	27	1B	91	5B	155	9B	219	DB	283	11B	347	15B	411	19B	475	1DB	Soft upper limit(High)
	28	1C	92	5C	156	9C	220	DC	284	11C	348	15C	412	19C	476	1DC	Soft lower limit(Low)
	29	1D	93	5D	157	9D	221	DD	285	11D	349	15D	413	19D	477	1DD	Soft lower limit(High)
	30	1E	94	5E	158	9E	222	DE	286	11E	350	15E	414	19E	478	1DE	Backlash compensation amount
	31	1F	95	5F	159	9F	223	DF	287	11F	351	15F	415	19F	479	1DF	Positioning completion time
	32	20	96	60	160	A0	224	E0	288	120	352	160	416	1A0	480	1E0	S-curve ratio
	33	21	97	61	161	A1	225	E1	289	121	353	161	417	1A1	481	1E1	Control word
	34	22	98	62	162	A2	226	E2	290	122	354	162	418	1A2	482	1E2	Command Inposition range(Low)
	35	23	99	63	163	A3	227	E3	291	123	355	163	419	1A3	483	1E3	Command Inposition range(High)
	36	24	100	64	164	A4	228	E4	292	124	356	164	420	1A4	484	1E4	Arc insertion position in 2-axis linear interpolation continuous operation(Low)
	37	25	101	65	165	A5	229	E5	293	125	357	165	421	1A5	485	1E5	Arc insertion position in 2-axis linear interpolation continuous operation(High)
	38	26	102	66	166	A6	230	E6	294	126	358	166	422	1A6	486	1E6	Infinite repeat position(Low)
	39	27	103	67	167	A7	231	E7	295	127	359	167	423	1A7	487	1E7	Infinite repeat position(High)

	Axis 1		Axis 2		Axis 3		Axis 4		Axis 5		Axis 6		Axis 7		Axis 8		Content
	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	
Manual Operation parameter .	40	28	104	68	168	A8	232	E8	296	128	360	168	424	1A8	488	1E8	JOG high speed (Low)
	41	29	105	69	169	A9	233	E9	297	129	361	169	425	1A9	489	1E9	JOG high speed (High)
	42	2A	106	6A	170	AA	234	EA	298	12A	362	16A	426	1AA	490	1EA	JOG low speed (Low)
	43	2B	107	6B	171	AB	235	EB	299	12B	363	16B	427	1AB	491	1EB	JOG low speed (High)
	44	2C	108	6C	172	AC	236	EC	300	12C	364	16C	428	1AC	492	1EC	JOG acc. time (Low)
	45	2D	109	6D	173	AD	237	ED	301	12D	365	16D	429	1AD	493	1ED	JOG acc. time (High)
	46	2E	110	6E	174	AE	238	EE	302	12E	366	16E	430	1AE	494	1EE	JOG dec. time (Low)
	47	2F	111	6F	175	AF	239	EF	303	12F	367	16F	431	1AF	495	1EF	JOG dec. time (High)
	48	30	112	70	176	B0	240	F0	304	130	368	170	432	1B0	496	1F0	Inching speed
	49	31	113	71	177	B1	241	F1	305	131	369	171	433	1B1	497	1F1	-
-	50	32	114	72	178	B2	242	F2	306	132	370	172	434	1B2	498	1F2	-
	51	33	115	73	179	B3	243	F3	307	133	371	173	435	1B3	499	1F3	
	52	34	116	74	180	B4	244	F4	308	134	372	174	436	1B4	500	1F4	
	53	35	117	75	181	B5	245	F5	309	135	373	175	437	1B5	501	1F5	
	54	36	118	76	182	B6	246	F6	310	136	374	176	438	1B6	502	1F6	
	55	37	119	77	183	B7	247	F7	311	137	375	177	439	1B7	503	1F7	
	56	38	120	78	184	B8	248	F8	312	138	376	178	440	1B8	504	1F8	
	57	39	121	79	185	B9	249	F9	313	139	377	179	441	1B9	505	1F9	
	58	3A	122	7A	186	BA	250	FA	314	13A	378	17A	442	1BA	506	1FA	
	59	3B	123	7B	187	BB	251	FB	315	13B	379	17B	443	1BB	507	1FB	
	60	3C	124	7C	188	BC	252	FC	316	13C	380	17C	444	1BC	508	1FC	
	61	3D	125	7D	189	BD	253	FD	317	13D	381	17D	445	1BD	509	1FD	
	62	3E	126	7E	190	BE	254	FE	318	13E	382	17E	446	1BE	510	1FE	
	63	3F	127	7F	191	BF	255	FF	319	13F	383	17F	447	1BF	511	1FF	
Common parameter .	-														512	200	Control word
															513	201	-
															514	202	Encoder 1 max. value (Low)
															515	203	Encoder 1 max. value (High)
															516	204	Encoder1 Min. value(Low)
															517	205	Encoder1 Min. value(High)
															518	206	Encoder 2 max. value (Low)
															519	207	Encoder 2 max. value (High)
															520	208	Encoder2 Min. value(Low)
															521	209	Encoder2 Min. value(High)

The contents are different from ‘Appendix 2.1 Parameter Memory Address’. If the address is entered wrong, be careful because the value will be entered into an unintended parameter.

- How to set the control word value, refer to “appendix 2.1 Parameter memory address”.

(2) Setting

(a) The dedicated command for setting the parameter direct read/write value is XGET/XPUT, XPM_GET/XPM_PUT.

(b) If the value written by the parameter direct write command is out of the range, the written value is written to the module’s memory address and a parameter range error occurs. The start command cannot be executed before the error is cleared.

(c) If parameter are changed during operation, they are save after operation is completed.

5.1.5 Status information

(1) Memory Address and content of Status Information

XSRD Command Device Offset	Memory address								Content
	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	
0	2C0	340	3C0	440	4C0	540	5C0	640	Operation state bit information (Lower)
1	2C1	341	3C1	441	4C1	541	5C1	641	Operation state bit information (Upper)
2	2C2	342	3C2	442	4C2	542	5C2	642	Axis information
3	2C3	343	3C3	443	4C3	543	5C3	643	External I/O Signal State
4	2C4	344	3C4	444	4C4	544	5C4	644	Current position(lower)
5	2C5	345	3C5	445	4C5	545	5C5	645	Current position(Upper)
6	2C6	346	3C6	446	4C6	546	5C6	646	Current speed(Lower)*2
7	2C7	347	3C7	447	4C7	547	5C7	647	Current speed(Upper)*2
8	2C8	348	3C8	448	4C8	548	5C8	648	step no.
9	2C9	349	3C9	449	4C9	549	5C9	649	M code
10	2CA	34A	3CA	44A	4CA	54A	5CA	64A	Error information
11	2CB	34B	3CB	44B	4CB	54B	5CB	64B	Error info.1 (Error history)
12	2CC	34C	3CC	44C	4CC	54C	5CC	64C	Error info.2 (Error history)
13	2CD	34D	3CD	44D	4CD	54D	5CD	64D	Error info.3 (Error history)
14	2CE	34E	3CE	44E	4CE	54E	5CE	64E	Error info.4 (Error history)
15	2CF	34F	3CF	44F	4CF	54F	5CF	64F	Error info.5 (Error history)
16	2D0	350	3D0	450	4D0	550	5D0	650	Error info.6 (Error history)
17	2D1	351	3D1	451	4D1	551	5D1	651	Error info.7 (Error history)
18	2D2	352	3D2	452	4D2	552	5D2	652	External input signal lower*1
19	2D3	353	3D3	453	4D3	553	5D3	653	External input signal upper*1
20	2D4	354	3D4	454	4D4	554	5D4	654	Servo error information
21	2D5	355	3D5	455	4D5	555	5D5	655	Encoder1 values (lower)
22	2D6	356	3D6	456	4D6	556	5D6	656	Encoder1 values (upper)
23	2D7	357	3D7	457	4D7	557	5D7	657	-
24	2D8	358	3D8	458	4D8	558	5D8	658	-
25	2D9	359	3D9	459	4D9	559	5D9	659	Command position (lower)
26	2DA	35A	3DA	45A	4DA	55A	5DA	65A	Command position (upper)
27	2DB	35B	3DB	45B	4DB	55B	5DB	65B	Command speed(lower)
28	2DC	35C	3DC	45C	4DC	55C	5DC	65C	Command speed(upper)
29	2DD	35D	3DD	45D	4DD	55D	5DD	65D	Torque
30	2DE	35E	3DE	45E	4DE	55E	5DE	65E	Common error information

*1 : External input signal

- Display status information of the Servo drive digital input (Digital Input, 0x60FD Object).
- For using this information, please check in XG-PM (Network parameter → servo information → server setting information → input signal information) whether or not to use. (The Servo drive enrolled in XG-M are cheeked for use by default.)
- For the detailed for information on external input signal, refer to each servo user manual.
- The external input signal consist of 32bits, of which the lower 16bits displays as external input signal lower and the upper 16bits displays as external input signal upper.

- For example, the L7NH includes the information below.

Bit	Description	Content
0	NOT (negative limit switch)	0: Off 1: On
1	POT (positive limit switch)	0: Off 1: On
	HOME (origin sensor input)	0: Off 1: On
3 to 15	Reserved	
16	DI #1(I/O pin 11)	0: Switch Off (Open), 1: Switch On (Close)
17	DI #2(I/O pin 12)	0: Switch Off (Open), 1: Switch On (Close)
18	DI #3(I/O pin 7)	0: Switch Off (Open), 1: Switch On (Close)
19	DI #4(I/O pin 8)	0: Switch Off (Open), 1: Switch On (Close)
20	DI #5(I/O pin 13)	0: Switch Off (Open), 1: Switch On (Close)
21	DI #6(I/O pin 14)	0: Switch Off (Open), 1: Switch On (Close)
22	DI #7(I/O pin 9)	0: Switch Off (Open), 1: Switch On (Close)
23	DI #8(I/O pin 10)	0: Switch Off (Open), 1: Switch On (Close)
24~30	Reserved	
31	STO(Safe Torque Off)	

*2: Current speed

- If the command speed is operated less than 1pulse per control cycle, the actual current speed display may be displayed above the command speed.

  Ex) If the command speed is 200pulse/s operation and four servo drive are connected to the network, control cycle is 2mss and position movement per control cycle is 0.4 pulse. In the actual servo drive, If this movement accumulates and exceeds 1 pulse it moves by 1 pulse, and the actual current speed at this time is displayed 500 pulse/s (= 1 pulse / 2ms).

- If there is actual velocity values (0x606C Object) in the TxPD0 of the servo drive, it displays the value of corresponding Object. If you use a third-party servo drive and the actual speed value Object is enrolled in TxPDO and the speed unit is not pulse/s (rpm etc.), the value displayed in the current speed is displayed in the speed unit that the servo drive provides and it may look different from the unit of the command speed value.

(2) Setting

(a) The area of state information of internal memory is the Read only area. Therefore, when using the XGK CPU, it can only be used for reading using the GET/GETP command. (Writing for Using PUT/PUTP command is prohibited in this area)

(b) The dedicated commands for status information read is XSRD. (Refer to 6.3.42 Operation Status Reading commands.)

(c) If you use only command XSRD, the information of axis status is read at the same time.

(d) If you want to choose to read among the status information, it is available to read memory address of above table using by GET/GETP.

(e) Status Information details

1) Bit contents of Operation Status Information (lower)

Memory address								Content
Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	
2C0	340	3C0	440	4C0	540	5C0	640	Operation state bit information (Lower)

Bit 0	**In Operation**	**[0: Stop, 1: In Operation]**
Bit 1	**Error State**	**[0: No Error, 1: Errors]**
Bit 2	**Positioning Completed**	**[0: Positioning not completed, 1: Positioning completed]**
Bit 3	**M Code Signal**	**[0: M Code Off, 1: M Code On]**
Bit 4	**Homing State**	**[0: Homing not completed 1: Homing completed]**
Bit 5	**Common error state**	**[0: No common error, 1: common error occured]**
Bit 6	**Stop State**	**[0: Stop State not by Stop Command, 1: Stop State by Stop Command]**
Bit 7	**Now reading/writing variable data**	**[0: reading/writing variable data completed, 1: now reading writing]**
Bit 8	**Upper limit detection**	**[0: No Detection, 1: Detection]**
Bit 9	**Lower limit detection**	**[0: No Detection, 1: Detection]**
Bit 10	**Emergency Stop State**	**[0: Normal, 1: Emergency Stop]**
Bit 11	**Forward/Reverse**	**[0: Forward, 1: Reverse]**
Bit 12	**Acceleration State**	**[0: No Accelerating, 1: Accelerating]**
Bit 13	**Constant Speed State**	**[0: Not Under Constant , 1: Under Constant]**
Bit 14	**Deceleration State**	**[0: No Decelerating, 1: Decelerating]**
Bit 15	**Dwell State**	**[0: No Dwelling , 1: Dwelling]**

2) Bit contents of Operation Status Information (upper)

Memory address								Content
Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	
2C1	341	3C1	441	4C1	541	5C1	641	Operation state bit information (Upper)

Bit 0	**In Operation**	**[0: Stop, 1: In Operation]**
Bit 1	**Error State**	**[0: No Error, 1: Errors]**
Bit 2	**Positioning Completed**	**[0: Positioning not completed, 1: Positioning completed]**
Bit 3	**M Code Signal**	**[0: M Code Off, 1: M Code On]**
Bit 4	**Homing State**	**[0: Homing not completed 1: Homing completed]**
Bit 5	**Common error state**	**[0: No common error, 1: common error occured]**
Bit 6	**Stop State**	**[0: Stop State not by Stop Command, 1: Stop State by Stop Command]**
Bit 7	**Now reading/writing variable data**	**[0: reading/writing variable data completed, 1: now reading writing]**
Bit 8	**Upper limit detection**	**[0: No Detection, 1: Detection]**
Bit 9	**Lower limit detection**	**[0: No Detection, 1: Detection]**
Bit 10	**Emergency Stop State**	**[0: Normal, 1: Emergency Stop]**
Bit 11	**Forward/Reverse**	**[0: Forward, 1: Reverse]**
Bit 12	**Acceleration State**	**[0: No Accelerating, 1: Accelerating]**
Bit 13	**Constant Speed State**	**[0: Not Under Constant , 1: Under Constant]**
Bit 14	**Deceleration State**	**[0: No Decelerating, 1: Decelerating]**
Bit 15	**Dwell State**	**[0: No Dwelling , 1: Dwelling]**

Notes

*1
RTP: return to Manual operation previous position

3) Axis Information

Memory address								Content
Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	
2C2	342	3C2	442	4C2	542	5C2	642	Axis information

Bit 0	Main axis informaion	1 ~ 8: 1 ~ 8 Axis 9: Encoder1 10: Encoder2
Bit 1		
Bit 2		
Bit 3		
Bit 4	Axis status	[0: Sub-axis, 1: Main-axis]
Bit 5	Trigger Completed*3	
Bit 6	Latch Completed*1	[0: Not completed, 1: Completed]
Bit 7	Not writing to servo driver EEPROM	
Bit 8	Not used	[0]
~		
Bit 12		
Bit 13	CAM1 cycle completed status signal	
Bit 14	Now writing to module Flash memory	[0: Not writing, 1: Writing]
Bit 15	Speed synchronizing*2	[0: Not synchronizing, 1: Synchronizing]

*1: If only using the XBF-PN04B/XBF-PN08B module, you can check the latch completion status information in the corresponding bit.

*2: If only using the XBF-PN04B/XBF-PN08B module, you can check the latch completion status information in the corresponding bit.

*3: If only using the XBF-PN04B/XBF-PN08B module, you can check the trigger completion status information in the corresponding bit. When all set triggers are latched, you can check the completion status.

*4: If only using the XBF-PN04B/XBF-PN08B module, you can check the execute status information in the corresponding bit.

4) External signal bit content

Memory address								Content
Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	
2C3	343	3C3	443	4C3	543	5C3	643	External I/O Signal State

Bit 0	**External EMG Stop**	**[0: External EMG stop Off, 1: External EMG stop On]**
Bit 1	**Not used**	**[0]**
Bit 2		
Bit 3		
Bit 4	**External upper limit signal**	**[0: External upper limit signal Off, 1: External upper limit signal On]**
Bit 5	**External lower limit signal**	**[0: External lower limit signal Off, 1: External lower limit signal On]**
Bit 6	**Home signal*2**	**[0: Home signal Off, 1: Home signal On]**
Bit 7	**DOG signal**	**[0: DOG signal Off, 1: DOG signal On]**
Bit 8	**External command signal*1**	**[0: External command signal Off, 1: External command signal On]**
Bit 9	**Servo On signal**	**[0: Servo Off, 1: Servo On]**
Bit 10	**Servo alarm signal**	**[0: Servo driver normal, 1: Servo driver error occurs]**
Bit 11	**In-position signal**	**[0: Not In-position section, 1: In-position section]**
Bit 12	**External input signal A**	**[0: External input signal A Off, 1: External input signal A ON]**
Bit 13	**External input signal B**	**[0: External input signal B Off, 1: External input signal B ON]**
Bit 14	**External input signal Z**	**[0: External input signal Z Off, 1: External input signal Z ON]**
Bit 15	Communication error	**[0: EtherCAT Comm. normal, 1: EtherCAT Comm. error]**

Notes

*1 Absolute position valid signal: This is signal that displays whether the absolute position of servo drive is valid, and normal operation (OFF when the absolute position is invalid, ON when it is valid) occurs only for drive that support corresponding function. For servo drive or virtual axis that do not support this function, the signal is always On.

*2 External command signal: According to “external command signal” setting in the extended parameter, it operates in one of two ways:”external speed/position control switching” and “external decelerating stop”.

5.1.6 User Specified Position and Speed Information

(1) Memory Address and content

GET command Device Offset	Memory address								Content
	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	
0	B8	F8	138	178	1B8	1F8	238	278	User specified current position (lower)
1	B9	F9	139	179	1B9	1F9	239	279	User specified current position (Upper)
2	BA	FA	13A	17A	1BA	1FA	23A	27A	User specified current position (lower)
3	BB	FB	13B	17B	1BB	1FB	23B	27B	User specified current position (Upper)
4	BC	FC	13C	17C	1BC	1FC	23C	27C	User specified current position (lower)
5	BD	FD	13D	17D	1BD	1FD	23D	27D	User specified current position (Upper)
6	BE	FE	13E	17E	1BE	1FE	23E	27E	User specified current position (lower)
7	BF	FF	13F	17F	1BF	1FF	23F	27F	User specified current position (Upper)

(2) Setting

(a) The area of user specified position /speed information of internal memory is the Read only area. Therefore, when using the XGK CPU, it can only be used for reading using the GET/GETP command. (Writing for Using PUT, PUTP command is prohibited in this area)

(b) If you want to choose to read among the status information, it is available to read memory address of above table using by GET/GETP.

5.1.7 Time Information

(1) Memory Address and content

GET command Device Offset	Memory address	Content
0	36C	Control cycle setting (unit - 0.1ms)
1	36D	Control cycle exceeded (0: Off, 1: On)
2	36E	Current control time (unit - 0.1ms)
3	36F	Max control time (unit - 0.1ms)

(2) Setting

(a) The area of control time information of internal memory is the Read only area. Therefore, when using the XGK CPU, it can only be used for reading using the GET/GETP command. (Writing for Using PUT/PUTP command is prohibited in this area)

(b) If you want to choose to read among the status information, it is available to read memory address of above table using by GET/GETP.

5.1.8 EtherCAT Status Information

(1) Memory Address and content

GETM command Device Offset	Memory Address	Item	Content
0	3E1	EtherCAT Connection Information	Bit.0 - Link up/down Information Bit.1 - communication connection status Bit.2 - communication timeout error Bit.3- communication connection / processing disconnection
		EtherCAT error information	EtherCAT operation related error code
1	3E2	Number of EtherCAT Slave connection	Number of slave connected to network
		EtherCAT slave ready (Slave 1~8)	Bit.0 – Slave 1 ready status : Bit.7 – Slave 8 ready status
2	3E3	EtherCAT slave ready (Slave 17~32)	Bit.0 – Slave 17 ready status : Bit.15 – Slave 32 ready status
		EtherCAT slave ready (Slave 33~48)	Bit.0 – Slave 33 ready status : Bit.15 – Slave 48 ready status
3	3E4	EtherCAT slave SDO processing busy (Slave 1~8)	Bit.0 – Slave 1 SDO read/write processing : Bit.7 – Slave 8 SDO read/write processing
		EtherCAT slave SDO processing busy (Slave 17~32)	Bit.0 – Slave 17 SDO read/write processing : Bit.15 – Slave 32 SDO read/write processing
4	3E5	EtherCAT slave SDO processing busy (Slave 33~48)	Bit.0 – Slave 33 SDO read/write processing : Bit.15 – Slave 48 SDO read/write processing
		EtherCAT slave SDO processing error (Slave 1~8)	Bit.0 – Slave 1 SDO read/write error : Bit.7 – Slave 8 SDO read/write error
5	3E6	EtherCAT slave SDO processing error (Slave 17~32)	Bit.0 – Slave 17 SDO read/write error : Bit.15 – Slave 32 SDO read/write error
		EtherCAT slave SDO processing error (Slave 33~48)	Bit.0 – Slave 33 SDO read/write error : Bit.15 – Slave 48 SDO read/write error
6	3E7	EtherCAT PDO error count - current	PDO constant period communication error occurring information
		EtherCAT PDO errpr count - Max continuous occurred count	
7	3E8	EtherCAT PDO error count- accumulated	
		EtherCAT connection error slave (connection order)	EtherCAT connection fail error information
8	3E9	EtherCAT connection error slave AL Status	

		EtherCAT connection error slave AL Status Code	

(2) Setting

(a) EtherCAT Status information area can be used for read-only by the GETM/GETMP or ARY_GETM command due to read-only area.

5.2 I/O Signal

Here describes the contents and functions of I/O signal for the exchange of data between positioning module and XGK CPU.

5.2.1 I/O Signal

(1) I/O signal of positioning module uses 16 bits input and 32 bits output.

(2) Positioning module operation ready signal (Uxx.00.F) becomes 'On' only If the modules are in normal state in H/W and it always keeps 'On' regardless of PLC operation mode.

(3) The operation ready signal for each axis turns on only for the connected axis when connected through EtherCAT communication between the positioning module and the servo drive, regardless of PLC's operation mode.

(4) Output signal

This is the signal which transfers to positioning module from PLC CPU.

Signal direction: PLC CPU□ □ positioning module					
Axis	**Output signal**	**Content**	**Axis**	**Output signal**	**Content**
Axis 1	Uxx.01.0	Axis1 Forward Jog	Axis 5	Uxx.02.0	Axis5 Forward Jog
	Uxx.01.1	Axis 1 Reverse Jog		Uxx.02.1	Axis 5 Reverse Jog
	Uxx.01.2	Axis1 Jog Low/High Speed		Uxx.02.2	Axis5 Jog Low/High Speed
	Uxx.01.3	No use		Uxx.02.3	No use
Axis 2	Uxx.01.4	Axis2 Forward Jog	Axis 6	Uxx.02.4	Axis6 Forward Jog
	Uxx.01.5	Axis 2 Reverse Jog		Uxx.02.5	Axis 6 Reverse Jog
	Uxx.01.6	Axis2 Jog Low/High Speed		Uxx.02.6	Axis6 Jog Low/High Speed
	Uxx.01.7	No use		Uxx.02.7	No use
Axis 3	Uxx.01.8	Axis3 Forward Jog	Axis 7	Uxx.02.8	Axis7 Forward Jog
	Uxx.01.9	Axis 3 Reverse Jog		Uxx.02.9	Axis 7 Reverse Jog
	Uxx.01.A	Axis3 Jog Low/High Speed		Uxx.02.A	Axis7 Jog Low/High Speed
	Uxx.01.B	No use		Uxx.02.B	No use
Axis 4	Uxx.01.C	Axis4 Forward Jog	Axis 8	Uxx.02.C	Axis8 Forward Jog
	Uxx.01.D	Axis 4 Reverse Jog		Uxx.02.D	Axis 8 Reverse Jog
	Uxx.01.E	Axis4 Jog Low/High Speed		Uxx.02.E	Axis8 Jog Low/High Speed
	Uxx.01.F	No use		Uxx.02.F	No use

(5) Input signal

This is a signal transmitted from the positioning module to the PLC CPU.

Axis	Signal direction: PLC CPU ← Positioning module	
	Input Signal	Content
Axis 1	Uxx.00.0	Operation Ready of axis 1
Axis 2	Uxx.00.1	Operation Ready of axis 2
Axis 3	Uxx.00.2	Operation Ready of axis 3
Axis 4	Uxx.00.3	Operation Ready of axis 4
Axis 5	Uxx.00.4	Operation Ready of axis 5
Axis 6	Uxx.00.5	Operation Ready of axis 6
Axis 7	Uxx.00.6	Operation Ready of axis 7
Axis 8	Uxx.00.7	Operation Ready of axis 8
-	Uxx.00.8	No use
-	Uxx.00.9	No use
-	Uxx.00.A	No use
-	Uxx.00.B	No use
-	Uxx.00.C	No use
-	Uxx.00.D	No use
Common	Uxx.00.E	Link up/down information
Common	UXX.00.F	Positioning module operation ready

5.2.2 Use of I/O Signal

(1) Axis operation ready signal

(a) The axis operation ready signal corresponding to the connected axis is turned on when the servo drive is connected to positioning module using EtherCAT communication.

(b) EtherCAT communication connection is made using the“XECON”command or “XPM_ECON” function block.

(c) When disconnecting communication between positioning module and servo drive using the“XECON”command or “XPM_ECON” function block, all axes operation ready signal are turned off.

(d) When giving a command to axis, check whether related axis operation ready signal is on.

(e) In “Uxx.00.zz”that displays the signal, U refers to U device in PLC CPU, xx refers to the stalling position of positioning module, and zz refers to the bit of input signal.

(2) Link up/down information

(a) Link up/down information turns on when the network cable is physically attached to the motion control module, and turns off when the network cable is physically removed.

(b) If using execution condition contact of servo connection command (XECON, XPM_ECON), the servo connection command is not executed when the network cable is not connected, and servo connection command is executed when the network cable is connected, and unnecessary error occur is prevented.

(3) Jog operation

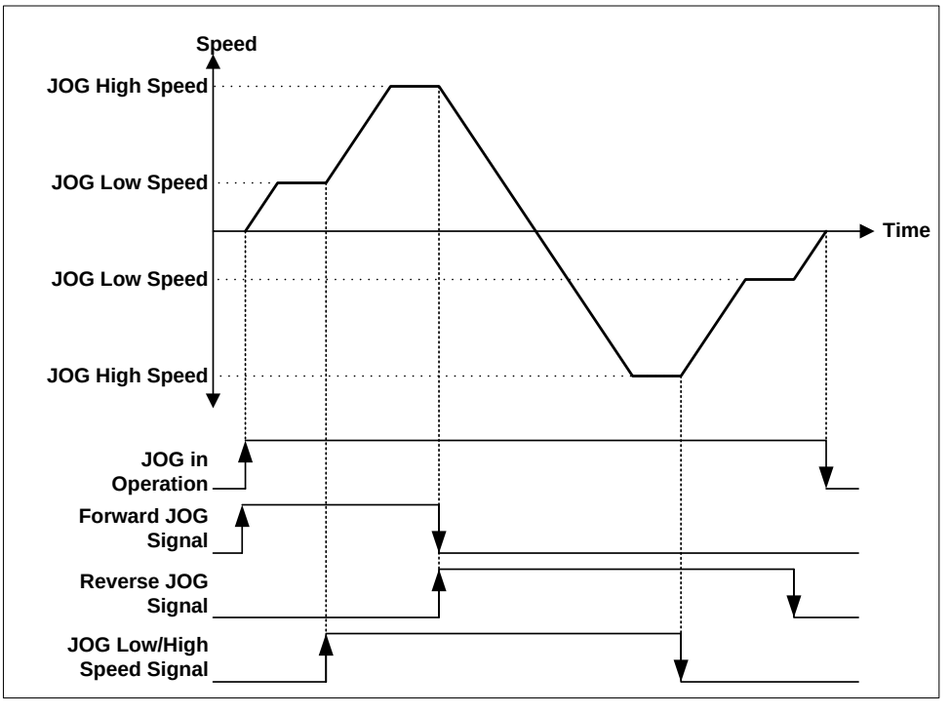
(a) The forward jog signal and reverse jog signal each indicate the direction of jog operation. When the forward jog signal is On, forward jog operation is performed, and when the reverse jog signal is On, reverse jog operation is performed. When both signals Off, it stops Jog Signals. When both signals On, it does Forward Jog Signal.

Forward Jog Signal	Reverse Jog Signal	Jog Operation Status
On	Off	Forward Jog Operation
Off	On	Reverse Jog Operation
Off	Off	Stop
On	On	Forward Jog Operation

(b) If Jog direction is changed during Jog operation, it slows down at first and then operates as the direction it changed.

(c) According to value of Jog low/high Signals, it could operate with low/high speed. When jog low/high signals Off, it operates with low speed and when they are ON, it operates with high speed.

(d) If you change jog low/high speed during Jog operation, there will be no stop and apply the speed as you changed.



Chapter 6 Command

It descries the commands of positioning module using the XGB-XBCU main unit.

6.1 General Command

Com mand	Command	Command condition
PUT	Internal memory write (Level)	Base, memory address, save device leading address, data number to write at one time
PUTP	Internal memory write (Edge)	Base, memory address, save device leading address, data number to write at one time
GET	Internal memory read (Level)	Base, memory address, save device leading address, number of data to Read at one time
GETP	Internal memory read (Edge)	Base, memory address, save device leading address, number of data to Read at one time

6.1.1 Internal Memory Read (GET, GETP Command)

Form	Content	Available area
n1	Base and slot No. mounting with special module	Constant
n2	Leading address of special module internal memory to	Constant
D	Leading address of device to save the data to read	M, P, K, L, U, N, D, R
n3	Word number of data to read	M, P, K, L, constant

(1) Difference between GET Command and GETP Command

(a) GET command

Always execute when operating condition is ON. (Level)

That is, when execute condition is ON, it operates continuously.

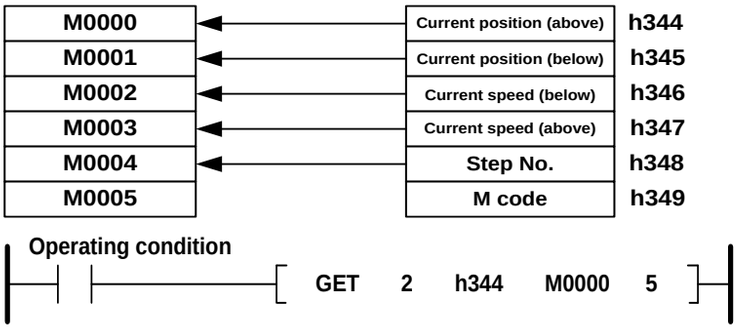
(b) GETP command

Execute with operation start of execute condition. (Edge).

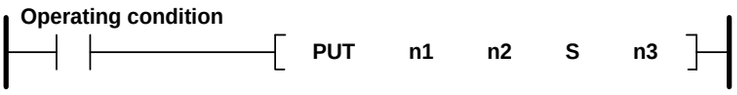
That is, when execute condition is ON, it operates only one time. To operate again, execute condition should be off and on again.

[Example]

The case is that read current position, current speed and step number from axis 2 state information of positioning module installed on base 0, slot 2 to PLC CPU M0000. Set the number of data as 5 to read 5 Word from current position to step number.



6.1.2 Internal Memory Write (PUT, PUTP Command)



Form	Content	Available area
n1	Base and slot No. mounting with special module	Constant
n2	Leading address of special module internal memory to write a	Constant
S	Leading address of device that the data to Write is saved	M, P, K, L, U, N, D, R
n3	Word number of data to write	M, P, K, L, constant

(1) Difference between PUT Command and PUTP Command

(A) PUT command

Always execute when operating condition is ON. (Level)

That is, when execute condition is ON, it operates continuously.

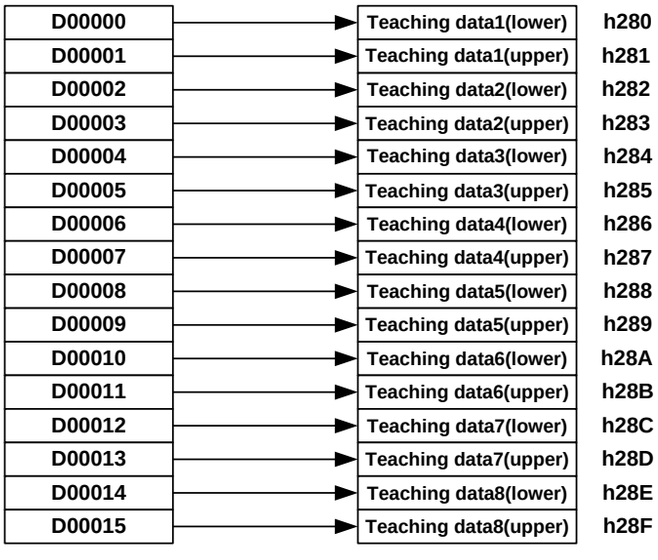
(b) PUTP command

Execute with operation start of execute condition. (Edge).

That is, when execute condition is ON, it operates only one time. To operate again, execute condition should be off and on again.

[Example]

The is the case of writing 16 Words data of D00000~D00015 in the axis 5 teaching data area of positioning module installed on base number 0, slot number 2.



6.2 Dedicated Commands

6.2.1 Instruction List

Command	Command	Command condition	Table of Contents
XOR	Homing start	Slot, axis command	6.3.1
XFLT	Floating origin setting	Slot, axis command	6.3.2
XDST	Direct start	Slot, axis command, position, speed, dwell Time, m code, control word	6.3.3
XIST	Indirect start	Slot, axis command, step number	6.3.4
XSST	Simultaneous start	Slot, axis command, Simultaneous start axis setting	6.3.5
XSWR	Simultaneous start step setting	Slot, axis command, step number device, step number	6.3.6
XELIN	Ellipse interpolation	Slot, axis command, step number, ellipse ratio, operating degree	6.3.7
XVTP	Speed/position switching control	Slot, axis command	6.3.8
XVTPP	Position specified speed/position switching control	Slot, axis command, position	6.3.9
XPTV	Position/ speed switching control	Slot, axis command	6.3.10
XPTT	Position/torque switching control	Slot, axis command, torque values	6.3.11
XSTP	Deceleration stop	Slot, axis command, deceleration time	6.3.12
XSKP	Skip operation	Slot, axis command	6.3.13
XSSP	Position synchronous start	Slot, axis command, main axis position, step number, main axis setting	6.3.14
XSSS	Speed Synchronization	Slot, axis command, main axis ratio, subordinate axis ratio, main axis setting	6.3.15
XSSSP	Speed synchronous start by position	Slot, axis command, main axis ratio, subordinate axis ratio, main axis setting, target position	6.3.16
XCAM	Cam operation	Slot, axis command, main axis setting, cam block number	6.3.17
XCAMO	Main axis offset-specified CAM operation	Slot, axis command, main axis setting, cam block number, main axis offset	6.3.18
XPOR	Position override	Slot, axis command, position	6.3.19
XSOR	Speed override	Slot, axis command, speed	6.3.20
XPSO	Position specified speed override	Slot, axis command, position, speed	6.3.21
XNMV	Continuous operation	Slot, axis command	6.3.22
XINCH	Inching operation	Slot, axis command, inching movement amount	6.3.23
XRTP	Manual operation previous position return	Slot, axis command	6.3.24
XSNS	Start step No. change	Slot, axis command, step number	6.3.25
XSRS	Repeat step No. change	Slot, axis command, step number	6.3.26
XMOF	M code release	Slot, axis command	6.3.27
XPRS	Current position preset	Slot, axis command, position	6.3.28
XEPRS	Encoder preset	Slot, position, encoder number	6.3.29
XTEAA	Teaching Array	Slot, axis command, step number, RAM/ROM, position/speed, number of teaching	6.3.30
XTWR	Teaching array data setting	Slot, axis command, teaching data device, number of teaching	6.3.31

XSBP	Basic Parameter Teaching	Slot, axis command, basic parameter change values, item to change, RAM/ROM	6.3.32
XSEP	Extended Parameter Teaching	Slot, axis command, extended parameter values, item to change, RAM/ROM	6.3.33
XSES	Input signal parameter settings	Slot, axis command, parameter value, setting method	6.3.34
XSEST	Input signal parameter - external position/torque control switching torque setting	Slot, axis command, torque value, setting method	6.3.35
XSMP	Manual Operation Parameter Teaching	Slot, axis command, manual operation parameter change values, item to change, RAM/ROM	6.3.36
XSCP	Common Parameter Teaching	Slot, axis command, common parameter change values, item to change, RAM/ROM	6.3.37
XSMD	Operation data teaching	Slot, axis command, operation data value, operation data item, step number, RAM/ROM	6.3.38
XVRD	Variable data reading	Slot, axis command, read address, block option, number of block	6.3.39
XVWR	Variable data writing	Slot, axis command, data device, writing address, block offset, block size, number of block	6.3.40
XWRT	Parameter/operation data save	Slot, axis command, axis information	6.3.41
XEMG	Emergency stop	Slot, axis command	6.3.42
XCLR	Error reset	Slot, axis command, command error reset	6.3.43
XECLR	Error history reset	Slot, axis command	6.3.44
XPST	Point run	Slot, axis command, number of step	6.3.45
XPWR	Point start step data setting	Slot, axis command, step data device, number of step	6.3.46
XSRD	Operation state reading	Slot, axis command, operation status save device, device number	6.3.47
XECON	Servo connection	Slot, axis command	6.3.48
XDCON	Servo disconnection	Slot, axis command	6.3.49
XSVON	Servo On	Slot, axis command	6.3.50
XSVOFF	Servo Off	Slot, axis command	6.3.51
XSCLR	Servo alarm reset	Slot, axis command	6.3.52
XSECLR	Servo Error History Reset	Slot, axis command	6.3.53
XRSTR	Restart	Slot, axis command	6.3.54
XSVPRD	Servo drive parameter read	Slot, axis command, Index,Sub-Index, data size	6.3.55
XSVPWR	Servo drive parameter write	Slot, axis command, Index,Sub-Index, data size, data, RAM/ROM	6.3.56
XSVSAVE	Servo parameter save	Slot, axis command, save axis	6.3.57
XTRQ	Torque control	Slot, axis command, torque value, inclination	6.3.58
XLRD	Latch position data read	Slot, axis command, latch position data save device number	6.3.59
XLCLR	Latch reset	Slot, axis command, latch reset item	6.3.60
XLSET	Latch setting	Slot, axis command, latch enable/disable, latch mode	6.3.61
XSTC	Torque Synchronization	Slot, axis command, main axis torque ratio, subordinate axis torque ratio, main axis speed ratio, subordinate axis speed ratio, main axis	6.3.62
XPHASING	Phase compensation	Slot, axis command, phase compensation, target speed, accel. Time, decel. time, main axis	6.3.63
XSSSD	32Bit Speed synchronization	Slot, axis command, main axis ratio, subordinate axis ratio, main axis setting	6.3.64

XSSSPD	32-bit Position specified speed synchronization	Slot, axis command, main axis ratio, subordinate axis ratio, main axis setting, target position	6.3.65
XSETOVR	Speed/Acceleration/Deceleration Override	Slot, axis command, speed,acceleration ,deceleration, S-curve, operation direction	6.3.66
XCAMA	Absolute position cam operation	Slot, axis command, main axis setting, cam block number, synchronous start position, main axis offset, subordinate axis offset	6.3.67
XTPROBE	Touch probe	Slot, axis command, trigger signal, trigger mode Window mode enable start position, Window mode enable end position	6.3.68
XABORTT	Trigger release	Slot, axis command, trigger signal, trigger reset item	6.3.69
XTRQSL	Speed limit torque control	Slot, axis command, torque value, inclination, speed limit	6.3.70
XGEARIP	Synchronous position specified speed Synchronization	Slot, axis command, main axis synchronous position, subordinate axis synchronous position, main axis synchronous start position, control word	6.3.71
XPLOOPON	Master position control loop execution	Slot, axis command, proportional gain, integral gain, speed FF gain, output limit	6.3.72
XPLOOPOFF	Master position control loop release	Slot, axis command	6.3.73
XCCCON	Cross-coupled control execution	Slot, axis command, pair axis, proportional gain, slave operation mode selection (not used)	6.3.74
XCCCOFF	Cross-coupled control disable	Slot, axis command, pair axis	6.3.75
XORGM	Touch probe homing return	Slot, axis command, trigger signal, homing direction, homing position, homing compensation amount restart/dwell time	6.3.76
XPTP	PTP operation	Slot, axis command, position 1, position 2, speed, dwell time, repeat count, control word	6.3.72
XTTP	Position specified torque/position switching control	Slot, axis command, position, speed, dwell time, m code, control word	6.3.73
XREADPDO	EtherCAT slave PDO read	Slot, start address, save device, count	6.3.74
XWRITEPDO	EtherCAT slave PDO Write	Slot, start address, writing device, count	6.3.75
XREADSDO	EtherCAT slave SDO read	Slot, EtherCAT slave number, SDO Index, SDO Sub-Index, data size	6.3.76
XWRITESDO	EtherCAT slave SDO Write	Slot, EtherCAT slave number, SDO Index, SDO Sub-Index, device, data size	6.3.77
XSAVESDO	EtherCAT slave SDO save	Slot, EtherCAT slave number	6.3.78

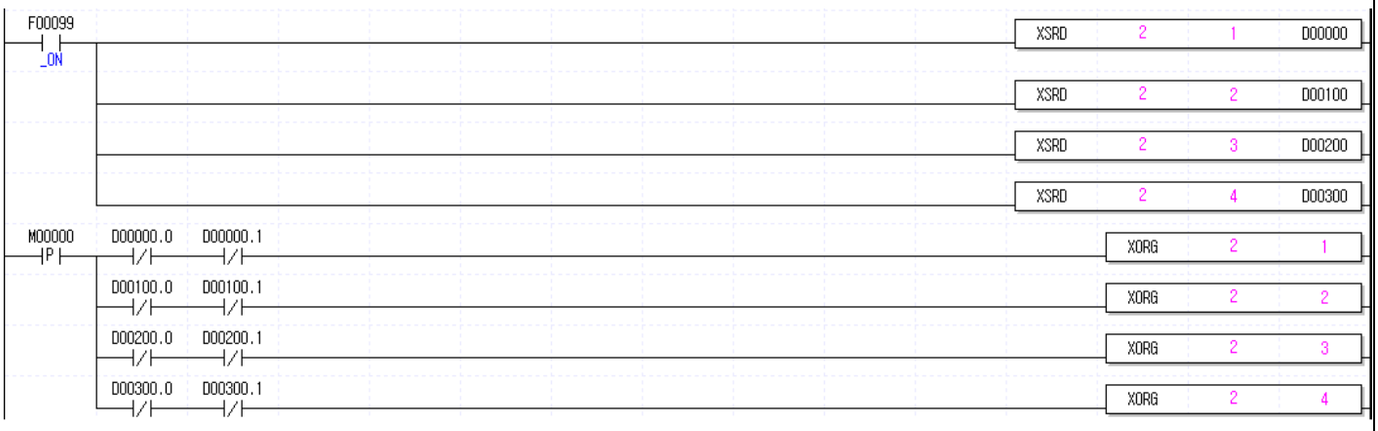
6.2.2 Precautions to use a command

Notes

1. The dedicated command acts at rising edge. That is, when the input condition is “On, the operation is performed only once for the first time, and to perform the operation again, the input condition must be “Off and “then On again.
SRD just execute High level action. When input condition is "'On' it keeps operating and it does not operate when it's '" Off'.
2. The command execution time is as follows.
 (1) XWRT: 15ms (per axis1)
 (2) All commands except XWRT
 2 ms (when using axes 3) to 4 ms (when using axes 8)
3. More than two XVRD and XVWR commands can not executed at the same time. After one command operation is finished, another command must be executed. Be careful not executes command at same time even though they are the same or different command axis.

Notes

▶ This is the method used with the operation state bit(in operation, error state) read by using XSRD as the program operation condition



※ D00000.0: axis 1 operating, D00000.1: axis 1 error status

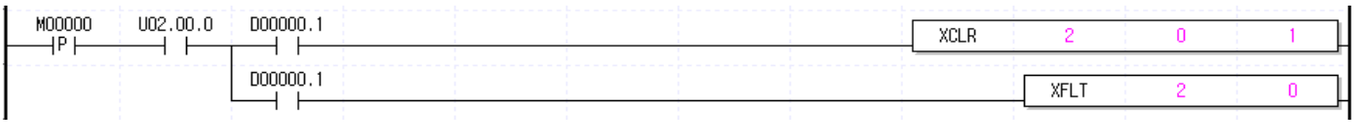
D00100.0: axis 2 operating, D00100.1: axis 2 error status
D00100.0: axis 3 operating, D00100.1: axis 3 error status
D00100.0: axis 4 operating, D00100.1: axis 4 error status

▶ The example program for command in this Chapter 8 also uses the operation state bit as the program operation condition as the above

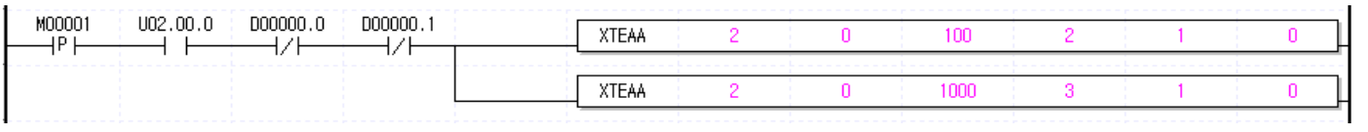
Notes

▶ Except XSRD, XPWR, XSWR, XTWR, and XLRD, only one dedicated commands must be executed for the command execution axis within one scan. if it is used like the below example program, a command does not work properly.

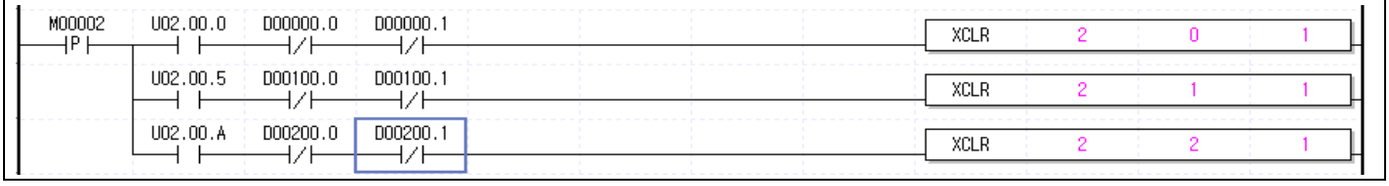
If executing other command



If executing same command



▶ A same command can be executed for other axis.



6.2.3 Checking information when occurring command overlap execution error

After executing positioning module dedicated command in PLC Program, if executing another command is executed on the same axis, while the command is not completed, command overlap execution error (error code: 811)is occurred. When an error occurs, the user can check which commands were executed repeatedly by reading internal memory area of “command duplication execution information”.

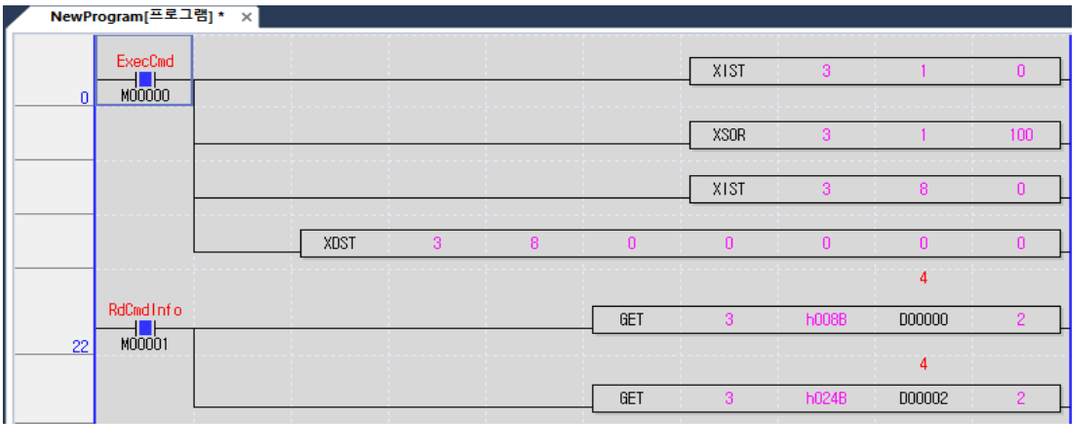
(1) Command overlap execution information

Memory address								Content
Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	
8B	CB	10B	14B	18B	1CB	20B	24B	Previous executed command code
8C	CC	10C	14C	18C	1CC	20C	24C	Overlap executed command code

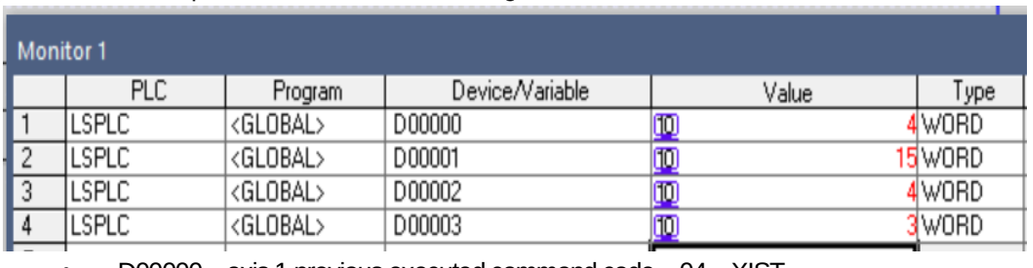
※ For information on how to read internal memory of module, refer to “6.1.1 internal memory read (GET, GETP command)”.

(2) Example

1) Executing command overlap and reading command overlap execution information on axis1, axis8.



2) Command overlap execution information reading results



	PLC	Program	Device/Variable	Value	Type
1	LSPLC	<GLOBAL>	D00000	4	WORD
2	LSPLC	<GLOBAL>	D00001	15	WORD
3	LSPLC	<GLOBAL>	D00002	4	WORD
4	LSPLC	<GLOBAL>	D00003	3	WORD

- D00000 – axis 1 previous executed command code – 04 – XIST
- D00001 – axis 1 overlap executed command code – 15 – XSOR
- D00002 – axis 8 previous executed command code – 04 – XIST
- D00003 – axis 8 overlap executed command code – 03 – XDST

※ For the command information related to command code, refer to (2) command code as follows.

(3) Command Code

Code	Command	Description
1	XORG	Homing start
2	XFLT	Floating origin setting
3	XDST	Direct start
4	XIST	Indirect start
7	XSST	Simultaneous start
8	XVTP	Speed/position switching control
9	XPTV	Position/speed switching control
10	XSTP	Deceleration stop
11	XSKP	Skip operation
12	XSSP	Position synchronous start
13	XSSS	Speed synchronization
14	XPOR	Position override
15	XSOR	Speed override
16	XPSO	Position specified speed override
17	XNMV	Continuous operation
18	XINCH	Inching operation
19	XRTP	Manual operation previous position return
20	XSNS	Start step No. change
21	XSRS	Repeat step No. change
22	XMOF	M code release
23	XPRS	Current position preset
26	XEPRS	Encoder preset
28	XTEAA	Teaching Array
35	XEMG	Emergency stop
36	XCLR	Error reset
37	XECLR	Error history reset
38	XPST	Point run
51	XWRT	Parameter/operation data save
54	XPTT	Position/torque switching control
55	XELIN	Ellipse interpolation
56	XSBP	Basic Parameter Teaching
57	XSEP	Extended Parameter Teaching
59	XSMP	Manual Operation Parameter Teaching
60	XSES	Input signal parameter setting
61	XSCP	Common Parameter Teaching
62	XSMD	Operation data reaching

Code	Command	Description
71	XSTC	Torque Synchronization
72	XTRQ	Torque control
73	XLCLR	Latch reset
74	XLSET	Latch setting
75	XSEST	Input signal parameter - External position/Torque control switch torque setting
76	XPHASING	Phase compensation
77	XSSSD	32-bit speed synchronization
78	XSSSPD	32-bit Position specified speed synchronization
79	XCAMA	Absolute position cam operation
80	XSETOVR	Speed/Acceleration/Deceleration Override
81	XTPROBE	Touch probe
82	XABORTT	Trigger release
83	XTRQSL	Speed limit torque control
84	XGEARIP	Synchronous position specified speed synchronization
85	XORGM	Touch probe home return
95	XPTP	PTP operation
96	XTTP	Position specified torque/position switching control
100	XECON	Servo connection
101	XSVON	Servo On
102	XSVOFF	Servo Off
103	XDCON	Servo disconnect
104	XSCLR	Servo alarm reset
105	XSECLR	Servo Error History Reset
106	XSVPWR	Servo parameter write
107	XSVSAVE	Servo parameter save
108	XSVPRD	Servo drive parameter read
112	XREADDSDO	Slave SDO parameter read
113	XWRITESDO	Slave SDO parameter write
114	XSAVESDO	Save SDO data save

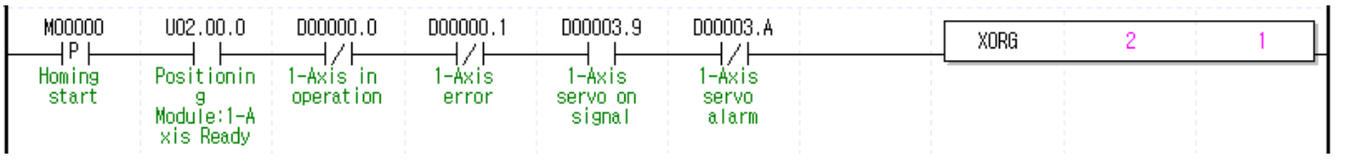
63	XCAM	Cam operation			
64	XSSSP	Speed synchronous start by position			
65	XVRD	Variable data reading			
66	XVWR	Variable data writing			
67	XVTPP	Position specified speed/position switching control			
68	XCAMO	Main axis offset-specified CAM operation			
69	XRSTR	Restart			

6.3 Using dedicated commands of positioning module

When the positioning module is mounted in slot 2, explain how to use the command for axis 1. The position and speed use the units of pulse and pulse/sec [pps], respectively.

6.3.1 Home Start (command: XORG)

(1) Program



(2) Descritionn

Device	Description
M00000	Axis1 homing start input
U02.00.0	Operation Ready of axis 1
D00000.0	Axis1 signal in operation
D00000.1	axis1 error state
D00003.9	Axis1 servo on signal
D00003.A	Axis1 servo error status

Command	XORG				Homing start
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1~4) XBF-PN08B (1~8: axis1~8)

※ PMLK means P, M, L and K areas

(a) If homing start command is executed, it carries out homing operation by the homing return parameter setting in servo parameter, if homing return is completed by external input signal, the homing determination signal (bit) is 'ON'.

(b) Please refer to“9.1 Homing return' about detailed explanation of Homing return.

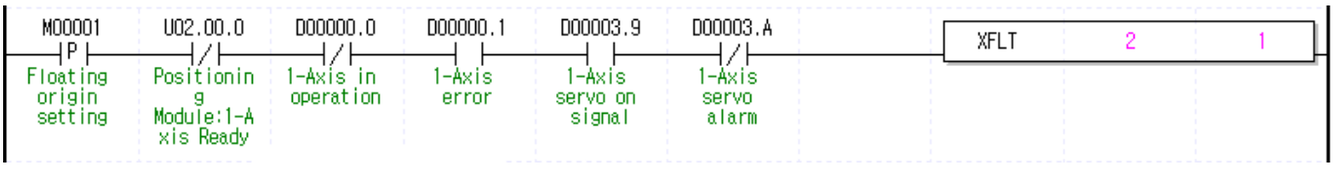
(c) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

(d) After completing homing completion of servo drive, homing operation is differing depending on the movement [0x201E] setting. (The L7N servo drive does not have movement setting function after homing completion)

Move[0x201E] setting after homing completion	Servo drive start after homing completion
0 (default)	After homing completion with “homing method [0x6098]”, the motor does not rotate and the”Home offset [0x607C] value becomes the current position value.
1	After homing completion with “homing method [0x6098]”, the motor rotates “home offset [0x607C] and the current position value is 0 at the position rotated as much as the“home offset [0x607C]”.

6.3.2 Floating Home Setting (command: XFLT)

(1) Program



(2) Explain

Device	Description
M00001	axis1 homing start input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D00003.9	Axis1 servo on signal
D00003.A	Axis1 servo error status

Command	XFLT				Floating origin setting
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis 1~4) XBF-PN08B (1~8: axis 1~8)

※ PMLK means P, M, L and K areas

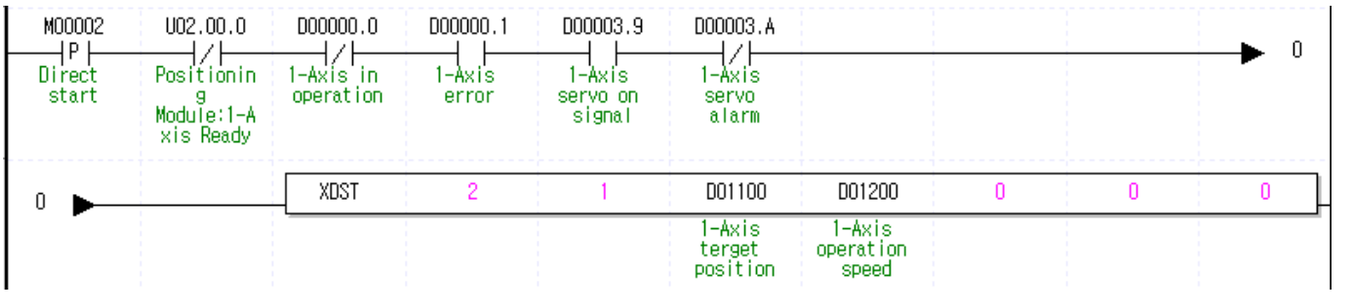
(a) When the floating home setting command is executed, the current position is changed to 0, which is the home position and the home determination signal (bit) is ON.

(b) Floating home setting that different from homing return is set at the current position and can not be set in operation.

(c) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.3 Direct Start (command: XDST)

(1) Program



(2) Explain

Device	Description
M00002	axis1 direct start input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D00003.9	Axis1 servo on signal
D00003.A	Axis1 servo error status

Command	XDST				Direct start
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1~4) XBF-PN08B (1~8: axis1~8)
	OP3	Target position	PMLK,constant,D,Z,R,ZR	DINT	Target position (-2147483648~2147483647)
	OP4	Goal speed	PMLK,constant,D,Z,R,ZR	DWORD	Goal speed
	OP5	Dwell time	PMLK,constant,D,Z,R,ZR	WORD	Dwell time (0~65535)
	OP6	M code	PMLK,constant,D,Z,R,ZR	WORD	M Code(0~65535)
	OP7	control word	PMLK,constant,D,Z,R,ZR	WORD	

※ PMLK means P, M, L and K areas

(a) Details of control word (OP7) for each Bit are as follows.

15 ~ 12	11 ~ 10	9 ~ 8	7 ~ 5	4	3 ~ 2	1 ~ 0
-	Deceleration time	Acceleration time	-	0:Absolute 1:Relative	-	0: Position control 1: Speed control 2: Feed control 3: Shortest distance control

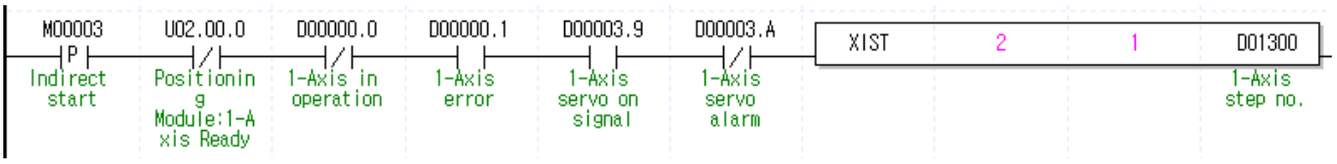
(b) If control word is h0012, it shall be set by Feed control, relative, acc./dec. time 1.

(c) 2~3, 5~7, and 12~15th bit of control word is the unused area and does not affect the setting.

(d) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.4 Indirect Start (Command: XIST)

(1) Program



(2) Explain

Device	Description
M00003	Axis1 indirect start input
U02.00.0	Operation Ready of axis 1
D00000.0	Axis1 signal in operation
D00000.1	Axis1 error state
D01300	Axis1 step no.
D00003.9	Axis1 servo on signal
D00003.A	Axis1 servo error status

Command	XIST				Indirect start
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1~4) XBF-PN08B (1~8: axis1~8)
	OP3	Operation step	PMLK,constant,D,Z,R,ZR	WORD	Operation step No.(0~400)

※ PMLK means P, M, L and K areas

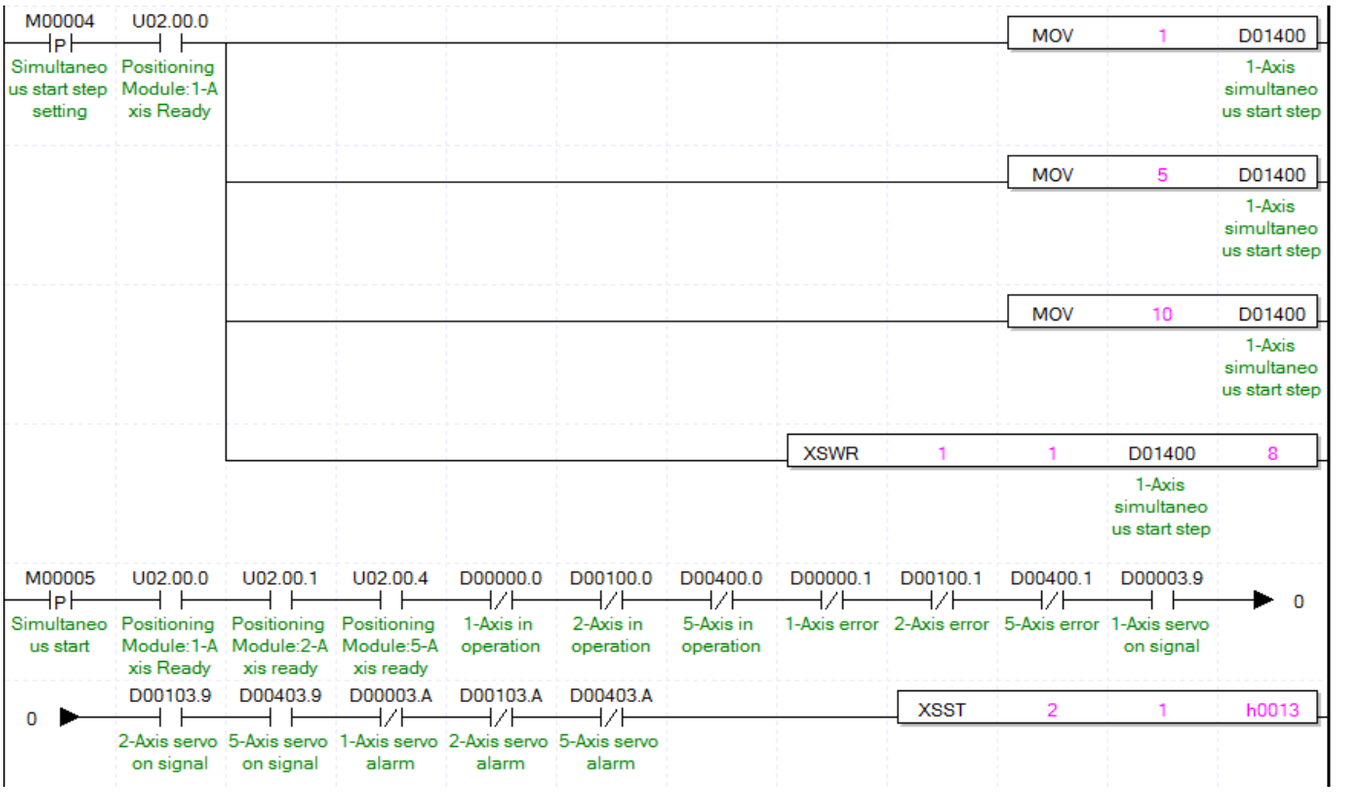
(a) If operation step No. is set as 0 in indirect start, it will be operated as current step No. If other number except 0 is set as the operation step number, it operates only for step no. set.

(b) According to the operation pattern (end, keep, continuous) of the operated step, If the operation pattern is set to keep or continuous, several steps can be operated by one indirect start command.

(c) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.5 Simultaneous Start (Command: XSST)

(1) Program



(2) Explain

Device	Description
M00004	Simultaneous Start Step Setting
M00005	Simultaneous start input
U02.00.0	Operation Ready of axis 1
U02.00.1	Operation Ready of axis 2
U02.00.4	Operation Ready of axis 5
D00000.0	Axis1 signal in operation
D00000.1	axis1 error state
D00003.9	Axis1 servo on signal
D00003.A	Axis1 servo error status
D00100.0	Axis2 signal in operation
D00100.1	Axis2 error state
D00103.9	Axis2 servo on signal
D00103.A	Axis2 servo error status
D00400.0	Axis5 signal in operation
D00400.1	Axis5 error state
D00403.9	Axis5 servo on signal
D00403.A	Axis5 servo error status
D01400	Axis1 simultaneous start step
D01401	Axis2 simultaneous start step

D01404	Axis5 simultaneous start step

Command	XSST				Simultaneous start
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1~4) XBF-PN08B (1~8: axis1~8)
	OP3	Operation axis	PMLK,constant,D,Z,R,ZR	WORD	Axis setting to operate start

※ PMLK means P, M, L and K areas

(a) Set the axis settings by setting each bit of axis.

15 ~ 8 Bit	7Bit	6Bit	5Bit	4Bit	3Bit	2Bit	1Bit	0Bit
Do Not Use	Axis 8	Axis 7	Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1

That is, axis5, axis2, axis1 will be set if set as h0023

But, the axis which command simultaneous start is basically included without being set in operating axis.

(b) In the example program above, axis1 operates step no.1, axis2 operates step no.5, 5 axes operates step no.10.

(c) To set steps of axis for simultaneous start, use XSWR command or PUT/PUTP command to set simultaneous start step no. on simultaneous start step memory address. This must be complete before simultaneous start executes.

(d) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.6 Simultaneous Start Step Setting (Command: XSWR)

(1) Program

Refer to the chapter 6.3.5 for example program.

(2) Explain

Refer to the chapter 6.3.5 for example program.

Command	XSWR				Simultaneous start step setting
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1~4) XBF-PN08B (1~8: axis1~8)
	OP3	Device	PMLK,D,Z,R,ZR	WORD	The device leading no. has simultaneous start step no.
	OP4	Number of step	PMLK,constant,D,Z,R,ZR	WORD	The number of step to use.

※ PMLK means P, M, L and K areas

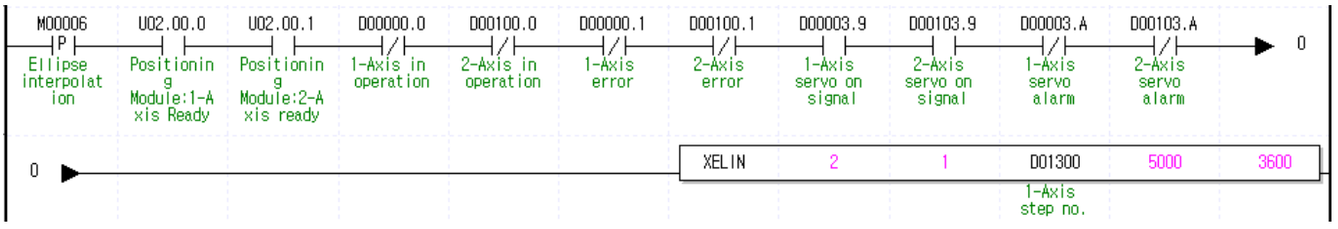
(a) In the example program above, axis1 operates step no.1, axis2 operates step no.5, 5 axes operates step no.10.

(b) To set steps of axis for simultaneous start, use XSWR command or PUT/PUTP command to set simultaneous start step no. on simultaneous start step memory address. This must be complete before simultaneous start executes.

(c) When using PUT command to set simultaneous start, refer to the memory address of“5.1.3 simultaneous start step data” and“6.1.2 internal memory writing”.

6.3.7 Ellipse Interpolation (command: XELIN)

(1) Program



(2) Explain

Device	Description
M00006	axis1/axis2 ellipse interpolation input
U02.00.0	Operation Ready of axis 1
U02.00.1	Operation Ready of axis 2
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D00003.9	Axis1 servo on signal
D00003.A	Axis1 servo error status
D00100.0	Axis2 signal in operation
D00100.1	Axis2 error state
D00103.9	Axis1 servo on signal
D00103.A	Axis1 servo error status
D01300	axis1 operation step

Command	XELIN				Ellipse Interpolation
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1~8) XBF-PN08B (1~8: axis1~8)
	OP3	Operation step	PMLK,constant,D,Z,R,ZR	WORD	Step no. to execute ellipse interpolation
	OP4	Ellipse ratio	PMLK,constant,D,Z,R,ZR	WORD	Ratio of ellipse (%)
	OP5	Operation degree	PMLK,constant,D,Z,R,ZR	WORD	Degree for ellipse interpolation

※ PMLK means P, M, L and K areas

(a) Ellipse interpolation distorts operation data which set as circular arc interpolation by ratio set on ellipse ratio and executes ellipse operation by set degree on OP5. Therefore, step of operation data set on operation step (OP3) must be set as circular arc interpolation control.

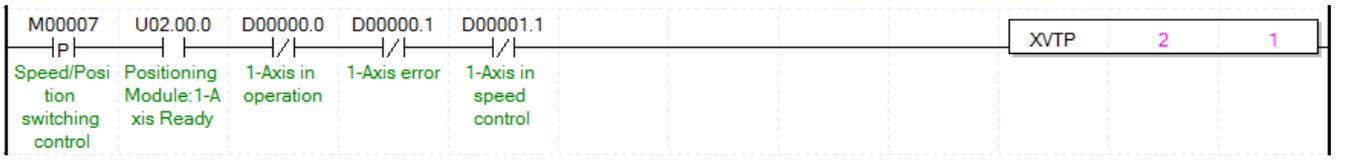
(b) Ellipse ratio is able to be set from 1 to 65535, has [[$X10^{-2}$%] unit. That is, 65535 will be 655.35%.

(c) Operation degree is able to be set from 1 to 65535, has [$X10^{-1}$ degree] unit. That is, 3650 will be 365.0 degree.

(d) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.8 Speed/Position Switching Control (command: XVTP))

(1) Program



(2) Explain

Device	Description
M00007	axis1 speed/position switching control input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D00001.1	axis1 signal in speed control

Command	XVTP				Speed/position switching control
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)

※ PMLK means P, M, L and K areas

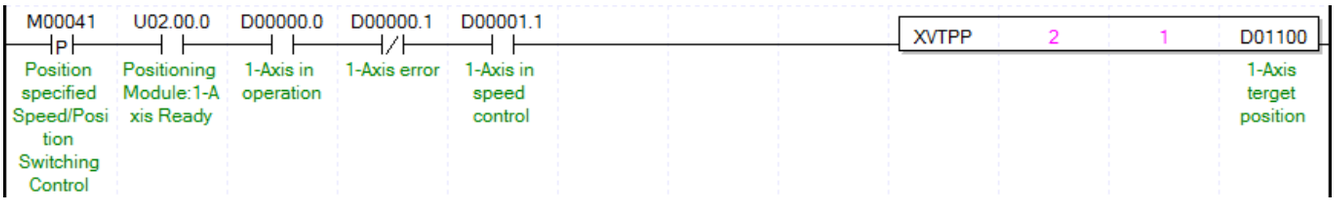
(a) If speed/position switching control is executed in the state of speed control operation, it shall be switched to position control and positioning operation is executed with the position set in the speed control.

(b) For detail description about speed/position switching control, refer to“9.2.14 Speed/Position Switching Control”.

(c) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.9 Position Specified Speed/Position Switching Control (command: XVTPP))

(1) Program



(2) Explain

Device	Description
M00007	axis1 speed/position switching control input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D00001.1	axis1 signal in speed control
D01100	axis1 target position

Command	XVTPP				Speed/position switching control
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Target position	PMLK,constant,D,Z,R,ZR	DINT	Transfer amount after position control switching

※ PMLK means P, M, L and K areas

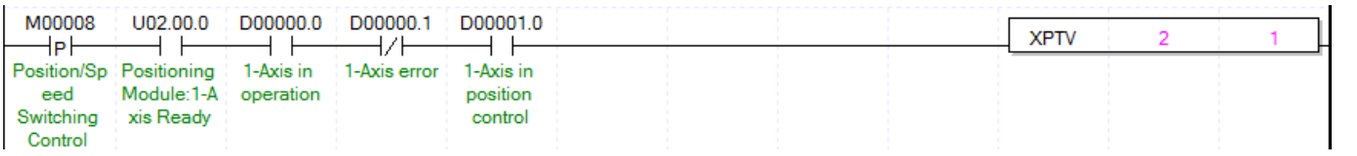
(a) If the position specified speed/position switching control is executed in the state of speed control operation, it shall be switched to position control and positioning operation is executed with the position movement amount assigned in OP3.

(b) For detail description about position specified speed/position switching control, refer to“9.2.15 position specified speed/position switching control”.

(c) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.10 Position/Speed Switching Control (command: XPTV)

(1) Program



(2) Explain

Device	Description
M00008	axis1 position/speed switching control input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D00001.0	axis1 signal in position control

Command	XPTV				Position/speed switching control
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)

※ PMLK means P, M, L and K areas

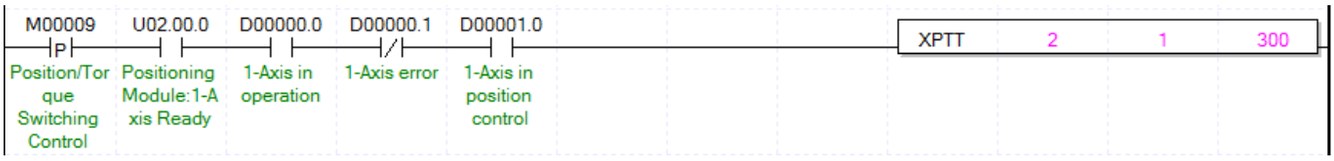
(a) If position/speed switching control is executed during position control operation, it is converted to speed control, operates at the speed set during position control and stops by executing deceleration stop.

(b) For the detail description about position/speed switching control, refer to“9.2.16 Position/Speed Switching Control”.

(c) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.11 Position/Torque Switching Control (command: XPTT)

(1) Program



(2) Explain

Device	Description
M00009	axis1 position/ torque switching control input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D00001.0	axis1 signal in position control

Command	XPTT				Position/torque switching control
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Torque	PMLK,constant,D,Z,R,ZR	INT	Torque values to operation(-32768 ~ 32767)

※ PMLK means P, M, L and K areas

(a) When position/torque switch control is executed while the position control is in operation, it switches to the torque control of the set torque value (OP3) and maintains torque control until a stop such as deceleration stop occurs.

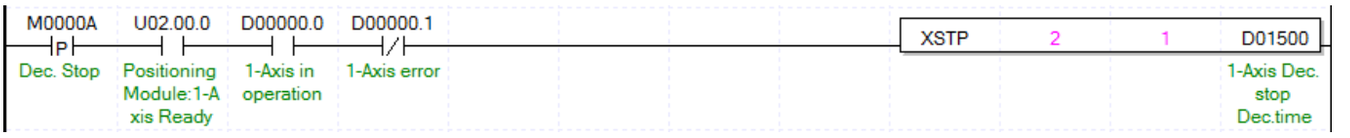
(b) The range of torque value is -32768 ~ 32767 and the unit is [%]. The allowable range of torque value depends on the type of servo drive connected. Generally, the target torque value is limited to the maximum torque setting.

(c) For more information, refers to 9.2.7 Position/ Torque Switching Control.

(d) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.12 Deceleration Stop (command: XSTP)

(1) Program



(2) Explain

Device	Description
M0000A	axis1 deceleration stop input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D01500	axis1 deceleration stop time set

Command	XSTP				Deceleration stop
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Deceleration time	PMLK,constant,D,Z,R,ZR	DWORD	deceleration time (0 ~ 2,147,483,647 ms)

※ PMLK means P, M, L and K areas

(a) The deceleration stop carry out the command in deceleration, acceleration and constant speed area.

(b) Deceleration time means the time required from deceleration start to stop and it is available to set from 0 ~ 2,147,483,647ms. But, if setting as '0', it stops only by deceleration time set at the beginning of operation.

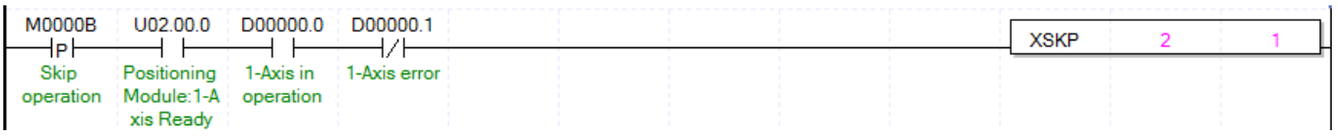
(c) Deceleration time means the time required from the speed limit of basic parameter on operation axis to stop.

(d) If deceleration stop command is executed in speed sync., position sync. or CAM operation, it stops speed sync., position sync. or CAM operation depending on current operation control state.

(e) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.13 Skip Operation (command: XSKP)

(1) Program



(2) Explain

Device	Description
M0000B	axis1 deceleration stop input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state

Command	XSKP				Skip operation
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)

※ PMLK means P, M, L and K areas

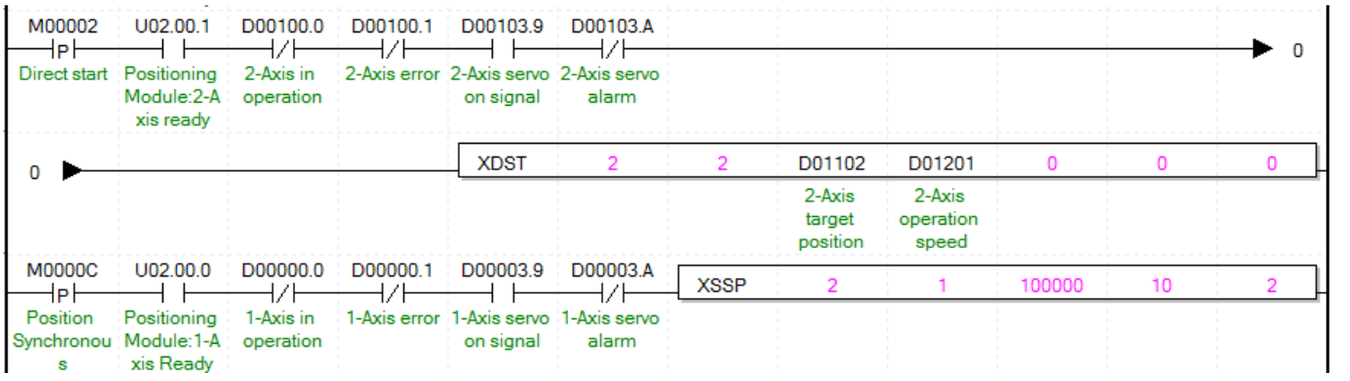
(a) This ends and stops the operation of step which is in operation currently and then continues to operate the next step.

(b) For the detail description about inching operation, refer to“9.5.3 Skip operation”.

(c) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.14 Position Synchronization (command: XSSP)

(1) Program



(2) Explain

Device	Description
M0000C	Axis1 position synchronous input
M0000D	Axis2 direct start input
U02.00.0	Operation Ready of axis 1
U02.00.1	Operation Ready of axis 2
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D00003.9	Axis1 servo on signal
D00003.A	Axis1 servo error status
D00100.0	Axis2 signal in operation
D00100.1	Axis2 error state
D00103.9	Axis2 servo on signal
D00103.A	Axis2 servo error status

Command	XSSP				Position synchronous start
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Main axis position	PMLK,constant,D,Z,R,ZR	DINT	Position of sub axis to operate
	OP4	Operation step	PMLK,constant,D,Z,R,ZR	WORD	Sub axis operation step No. (0~ 400)
	OP5	Main axis	PMLK,constant,D,Z,R,ZR	WORD	Main axis XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8) 9: encoder 1

※ PMLK means P, M, L and K areas

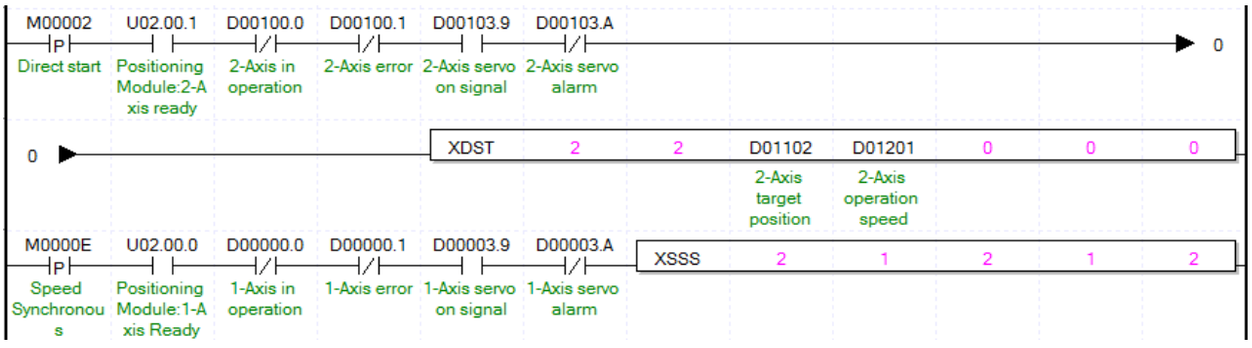
(a) In the example program above, if the position synchronous command is executed, axis1 (subordinate axis) is indicated as 'in operation' but the motor does not operate. At the point that axis2 as main axis setting starts and its current position is 1000, axis1 will start and the motor will operate.

(b) For the detail description about position synchronous start, refer to“9.4.2 position synchronous control”.

(c) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.15 Speed Synchronization (command: XSSS)

(1) Program



(2) Explain

Device	Description
M0000E	Axis1 speed synchronous input
M0000D	Axis2 direct start input
U02.00.0	Operation Ready of axis 1
U02.00.1	Operation Ready of axis 2
D00000.0	Axis1 signal in operation
D00000.1	Axis1 error state
D00003.9	Axis1 servo on signal
D00003.A	Axis1 servo error status
D00100.0	Axis2 signal in operation
D00100.1	Axis2 error state
D00103.9	Axis2 servo on signal
D00103.A	Axis2 servo error status

Command	XSSS				Speed synchronization
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Main axis ratio	PMLK,constant,D,Z,R,ZR	DINT	Speed synchronization Master axis -2,147,483,648 ~ 2,147,483,647)
	OP4	Subordinate axis ratio	PMLK,constant,D,Z,R,ZR	DINT	Speed synchronization subordinate rate ratio(-2,147,483,648 ~ 2,147,483,647)
	OP5	Main axis	PMLK,constant,D,Z,R,ZR	WORD	Main axis XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8) 9: Encoder 1

※ PMLK means P, M, L and K areas

(a) In the example program above, if the speed synchronous command is executed, axis1 (subordinate axis) is indicated as 'in operation' but the motor does not operate. If operating axis2 set as the main axis, axis1 (subordinate axis) is operated depending on the designated ratio between main axis (OP3) and sub axis (OP4).

(b) For subordinate axis operation direction if the speed synchronization ratio (sub axis ratio / main axis ratio) is positive, operating main axis operation direction, and if it is negative, operating opposite direction of main axis.

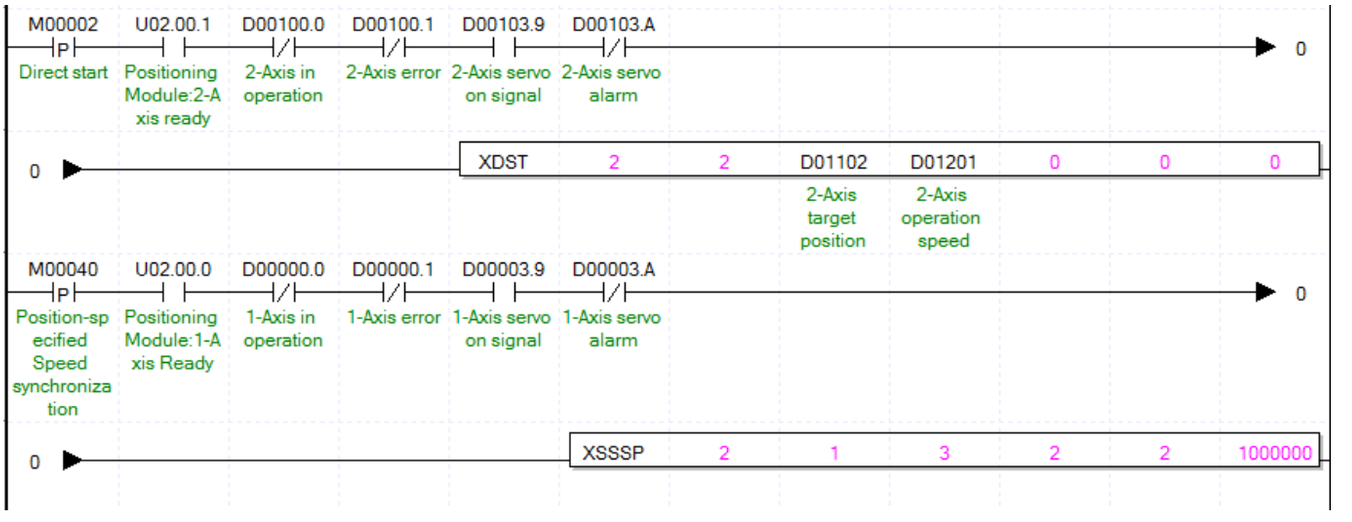
(c) For example, if main axis ratio is 3, sub axis ratio is 2, when main axis moves by 3000, sub axis moves 2000.

(d) For the detail description about speed sync., refer to"9.4.1 Speed Synchronous control".

(e) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.16 Position Specified Speed Synchronization (command: XSSSP)

(1) Program



(2) Explain

Device	Description
M00040	axis1 speed synchronous start input by position
M0000D	Axis2 direct start input
U02.00.0	Operation Ready of axis 1
U02.00.1	Operation Ready of axis 2
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D00003.9	Axis1 servo on signal
D00003.A	Axis1 servo error status
D00100.0	Axis2 signal in operation
D00100.1	Axis2 error state
D00103.9	Axis2 servo on signal
D00103.A	Axis2 servo error status

Command	XSSSP				Speed synchronous start by position
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted

	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Main axis ratio	PMLK,constant,D,Z,R,ZR	DINT	Speed Synchronization Master axis ratio(-2,147,483,648 ~ 2,147,483,647)
	OP4	Subordinate axis ratio	PMLK,constant,D,Z,R,ZR	DINT	Speed Synchronization subordinate rate ratio(-2,147,483,648 ~ 2,147,483,647)
	OP5	Main axis	PMLK,constant,D,Z,R,ZR	WORD	Main axis XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8) 9: Encoder 1
	OP6	Target position	PMLK,constant,D,Z,R,ZR	DINT	Target position of Speed synchronous start with position

※ PMLK means P, M, L and K areas

(a) In the example program above, if the position specified speed synchronization command executes, axis1 (subordinate axis) is indicated as in operation but the motor does not operate. If operating axis2 set as the main axis, axis1 (subordinate axis) is operated depending on the designated ratio between main axis (OP3) and sub axis (OP4). After the subordinate axis 1 executes SSSP command, when operating position is same as target position (OP6), speed synchronization ends and stops immediately at that position.

(b) For subordinate axis operation direction if the speed synchronization ratio (sub axis ratio / main axis ratio) is positive, operating main axis operation direction, and if it is negative, operating opposite direction of main axis.

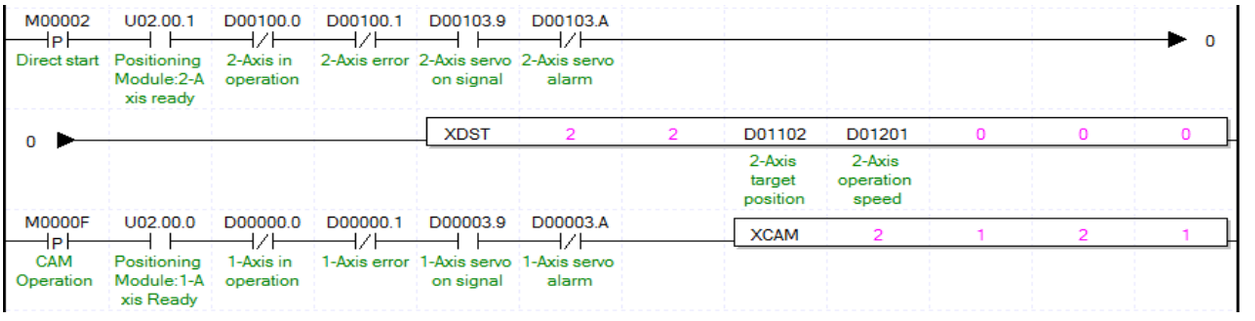
(c) For example, if main axis ratio is 3, sub axis ratio is 2 and target position is 1,000,000, when main axis moves by 3000, sub axis moves 2000. It stops by where position of main axis is at 1,000,000.

(d) For the detail description about speed sync., refer to“9.4.1 Speed Synchronous control”.

(e) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.17 CAM Operation (command: XCAM)

(1) Program



(2) Explain

Device	Description
M0000F	axis1 cam operation input
M0000D	Axis2 direct start input
U02.00.0	Operation Ready of axis 1
U02.00.1	Operation Ready of axis 2
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D00003.9	Axis1 servo on signal
D00003.A	Axis1 servo error status
D00100.0	Axis2 signal in operation
D00100.1	Axis2 error state
D00103.9	Axis2 servo on signal
D00103.A	Axis2 servo error status

Command	XCAM				Cam Operation
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Main axis	PMLK,constant,D,Z,R,ZR	WORD	Main axis XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8) 9: Encoder 1
	OP4	CAM block	PMLK,constant,D,Z,R,ZR	WORD	Cam data block to apply to operation (1 ~ 9)

※ PMLK means P, M, L and K areas

(A) In the example program above, if cam operation command is executed, axis1 (sub axis) is indicated as in operation but the motor does not operate actually. When axis2 starts operating as a main axis, motor of axis1 starts operating toward sub axis location depending on data which set on cam block (OP4).

(b) Maximum number of cam data block is 9. (Set on positioning package)

(c) Cam data is set on positioning package but has to be downloaded at positioning module before cam operation.

(d) For the detail description about cam operation, refer to“9.4.3 Cam Operation”.

(e) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

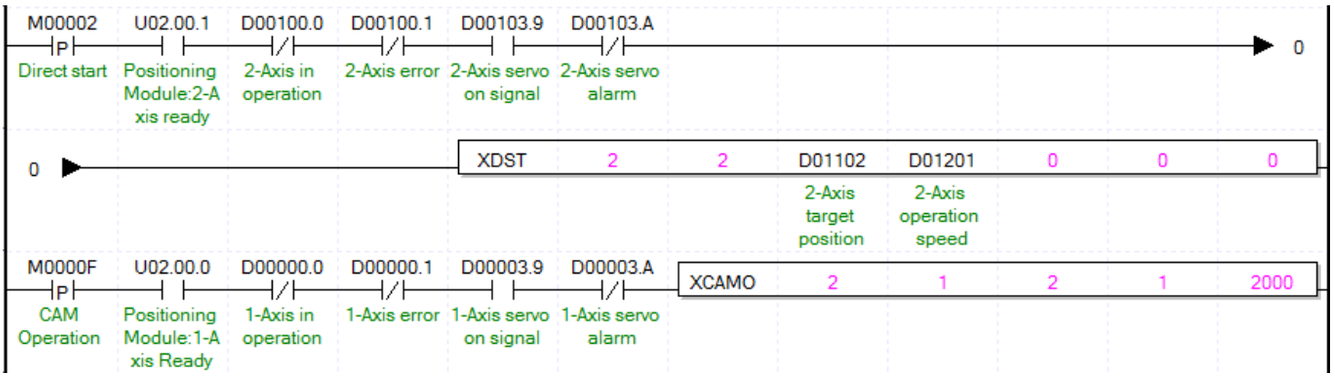
(f) In order to use user CAM operation, you have to set CAM block number 9.

(g) In case of user cam operation, user cam data can be change by variable data write command even during operation.

(h) For the detail description about cam (CAM) operation, refer to"9.4.4 Use Cam Operation".

6.3.18 Main Axis Offset Specified CAM Operation (command: XCAMO)

(1) Program



(2) Explain

Device	Description
M0000F	axis1 cam operation input
M0000D	Axis2 direct start input
U02.00.0	Operation Ready of axis 1
U02.00.1	Operation Ready of axis 2
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D00003.9	Axis1 servo on signal
D00003.A	Axis1 servo error status
D00100.0	Axis2 signal in operation
D00100.1	Axis2 error state
D00103.9	Axis2 servo on signal
D00103.A	Axis2 servo error status

Command	XCAMO				Cam Operation
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Main axis	PMLK,constant,D,Z,R,ZR	WORD	Main axis XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8) 9: Encoder 1
	OP4	CAM block	PMLK,constant,D,Z,R,ZR	WORD	Cam data block to apply to operation (1 ~ 9)

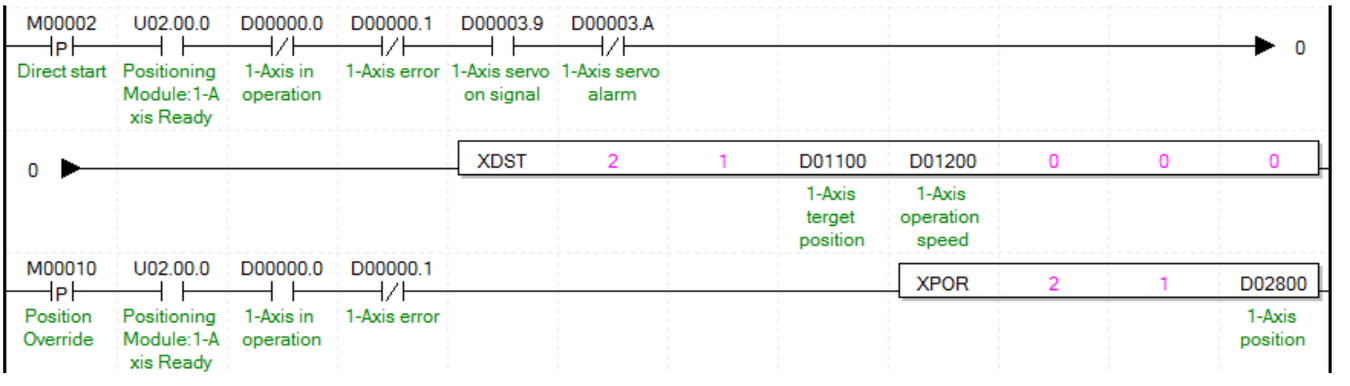
	OP5	Main axis offset	PMLK,constant,D,Z,R,ZR	DINT	Main axis position to start CAM operation

※ PMLK means P, M, L and K areas

(a) In the example program above, if cam operation command is executed, axis1 (sub axis) is indicated as In operation but the motor does not operate actually. After axis2 starts operating as a main axis and transfer amount becomes 2000, motor of axis1 starts operating toward sub axis location depending on data which set on cam block (OP4).
(b) Maximum number of cam data block is 9. (Set on positioning package)
(c) Cam data is set on positioning package but has to be downloaded at positioning module before cam operation.
(d) For the detail description about cam operation, refer to“9.4.3 Cam Operation”.
(e) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.
(f) In order to use user CAM operation, you have to set CAM block number 9.
(g) For the detail description about cam (CAM) operation, refer to“9.4.4 Use Cam Operation”.

6.3.19 Position Override (command: XPOR)

(1) Program



(2) Explain

Device	Description
M00010	axis1 position override input
M0000D	axis1 direct start input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D00003.9	Axis1 servo on signal
D00003.A	Axis1 servo error status
D01100	Target position
D02800	Position override value

Command	XPOR				Position override
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted

	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Position value	PMLK,constant,D,Z,R,ZR	DINT	Target position value to change (Absolute coordinate)

※ PMLK means P, M, L and K areas

(a) If position override is executed before reaching goal position, goal position shall be changed where set at D02800 for positioning operation. If executing position override after passing a position to execute position override, once stops at the current position. And then moving back to position where set at D02800.

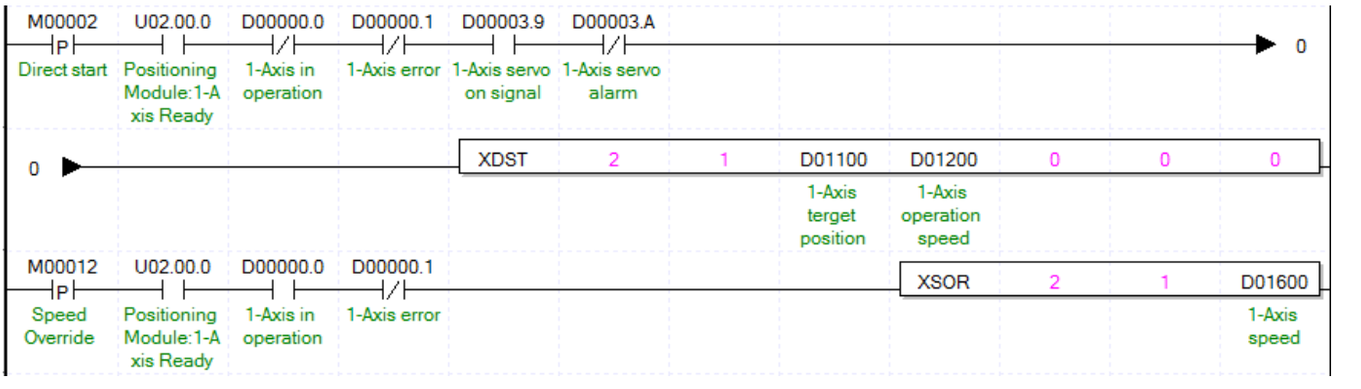
(b) Position override set on position override value is absolute coordinate position.

(c) For the detail description about position override, refer to"9.5.4 Position Override".

(d) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.20 Speed Override (command: XSOR)

(1) Program



(2) Explain

Device	Description
M00012	axis1 speed override input
M0000D	axis1 direct start input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D00003.9	Axis1 servo on signal
D00003.A	Axis1 servo error status
D01200	Goal speed value
D01600	Speed override value

Command	XSOR				Speed override
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted

	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Speed value	PMLK,constant,D,Z,R,ZR	DWORD	Goal speed value to change

※ PMLK means P, M, L and K areas

(a) Speed override value (OP3) will be set as '%' or 'Speed value' depending on the value which set on 'speed override' in common parameter.

(b) If unit of speed override value is %, the setting area is from 1 to 65,535, it means 0.01% ~ 655.35%.

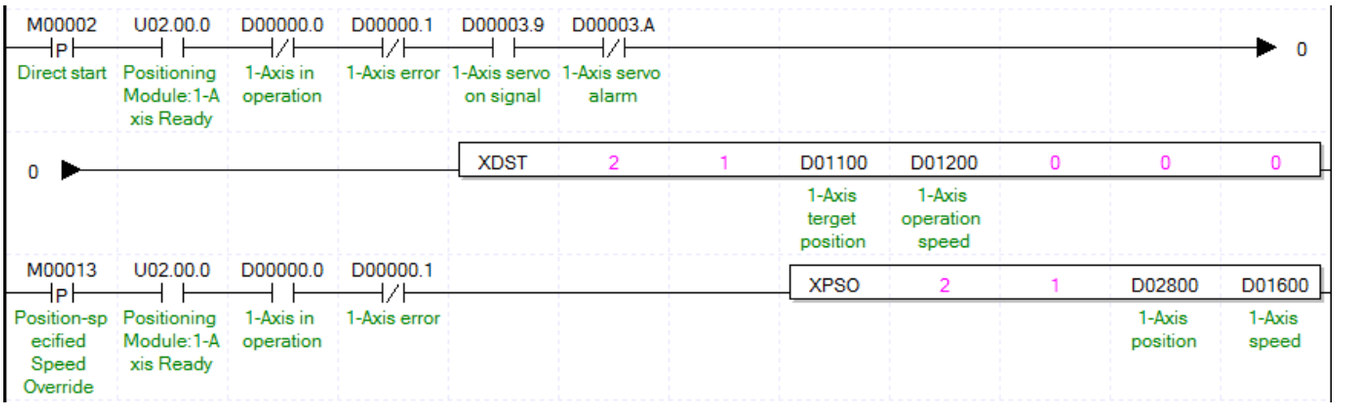
(c) If unit of speed override value is speed value, setting area is from 1 to speed limit value. The speed limit value is set on Speed limit value of basic parameter and unit of speed override value depends on unit of axis.

(d) For the detail description about speed override operation, refer to“9.5.5 Speed Override”.

(e) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.21 Position Specified Speed Override (command: XPSO)

(1) Program



(2) Explain

Device	Description
M00013	axis1 position assigned speed override input
M0000D	axis1 direct start input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D00003.9	Axis1 servo on signal
D00003.A	Axis1 servo error status
D01200	Goal speed value
D01600	Speed override value
D02800	Position value to execute speed change

Command	XPSO				Position assigned speed override
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Position value	PMLK,constant,D,Z,R,ZR	DINT	Position value to execute speed change
	OP4	Speed value	PMLK,constant,D,Z,R,ZR	DWORD	Goal speed value to change

※ PMLK means P, M, L and K areas

(a) Speed override value (OP4) will be set as '%' or 'Speed value“depending on the value which set on 'speed override” in common parameter“

(b) If the unit of speed value is %, the setting area is from 1 to 65,535, it means 0.01% ~ 655.35%.

(c) If unit of speed override value is speed value, setting area is from 1 to speed limit value. The speed limit value is set on Speed limit value of basic parameter and unit of speed override value depends on unit of axis.

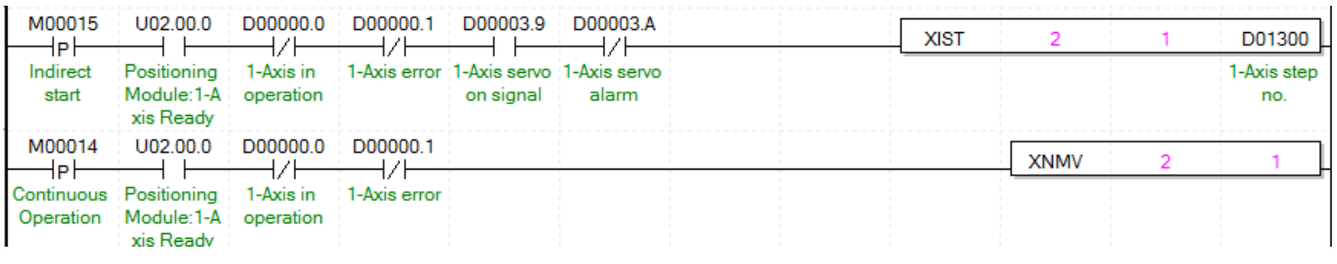
(d) In the example program above, axis1 position specified speed override input(M00013) become is On' to execute position specified speed override after axis1 direct start input (M0000) become on when the position of axis1 is located at the position where set at D02800, the speed will be changed to the value set at D01600.

(e) For the detail description about position specified speed override operation, refer to“9.5.6 Position specified Speed Override'.

(f) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.22 Continuous Operation (command: XNMV)

(1) Program



(2) Explain

Device	Description
M00014	axis1 continuous operation input
M00015	axis1 indirect start input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D00003.9	Axis1 servo on signal
D00003.A	Axis1 servo error status
D01300	axis1 operation step

Command	XNMV				Continuous operation
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)

※ PMLK means P, M, L and K areas

(a) If continuous operation command is executed, the step No. is changed from the step in current operation to the next step No. and operates positioning operation to the speed and the target position of the next step. Connection with the next step is executed by continuous operation pattern.

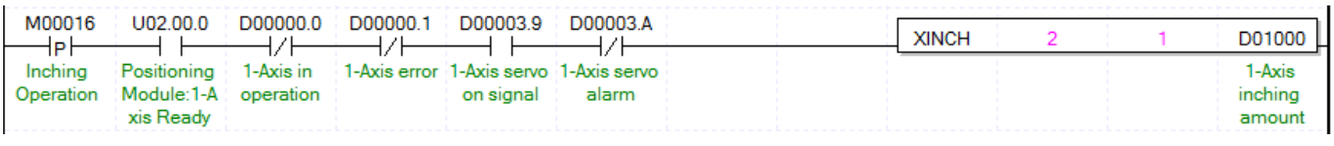
(b) Continuous operation command changes the only current operation pattern in operation, not changes the operation data.

(c) For the detail description about continuous operation, refer to“9.5.2 Continuous Operation”.

(d) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.23 Inching Operation (command: XINCH)

(1) Program



(2) Explain

Device	Description
M00016	axis1 inching operation input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D00003.9	Axis1 servo on signal
D00003.A	Axis1 servo error status
D01000	axis1 inching value

Command	XINCH				Inching operation
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Position value	PMLK,constant,D,Z,R,ZR	DINT	Position value to move for inching operation

※ PMLK means P, M, L and K areas

(a) It executes the relative coordinate operation by inching operation speed set in manual operation parameter as much as

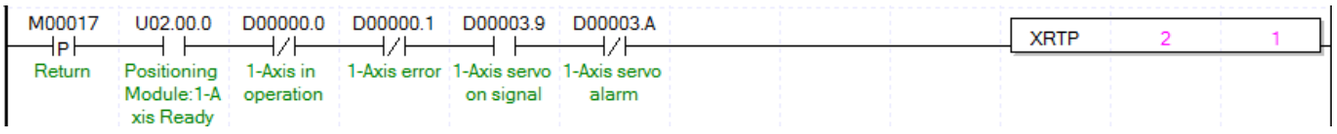
position value (OP3).

(b) For the detail description about inching operation, refer to“9.3.2 Inching Operation”.

(c) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.24 Return to the Previous Position of Manual Operation (command: XRTP)

(1) Program



(2) Explain

Device	Description
M00017	axis1 return to the previous manual operation position start input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D00003.9	Axis1 servo on signal
D00003.A	Axis1 servo error status

Command	XRTP				Manual operation previous position return
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)

※ PMLK means P, M, L and K areas

(a) If the current position is changed as external axis speed sync. Operation, inching operation, Jog operation after completing the positioning, it returns to the previous position of manual operation.

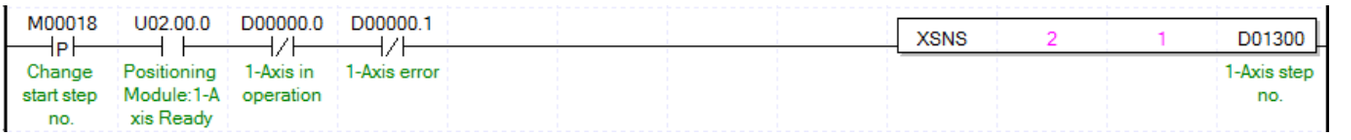
(b) If manual operation is not executed, the position return command before manual operation is ignored.

(c) The detail description about return to the previous position of manual operation, refer to“9.3.3 Return to the Previous Position of Manual Operation'.

(d) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.25 Start Step Number Change (command: XSNS)

(1) Program



(2) Explain

Device	Description
M00018	axis1 start step No. change input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D01300	axis1 start step no. to change

Command	SNS				Start step No. change
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	step no.	PMLK,constant,D,Z,R,ZR	WORD	step No. to change with start step (1~400)

※ PMLK means P, M, L and K areas

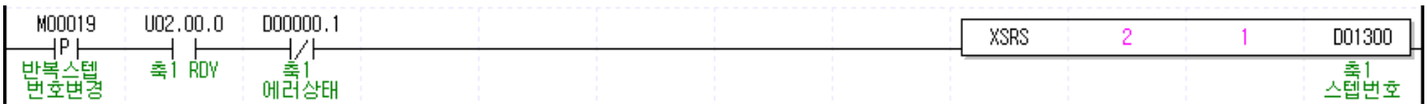
(a) Change the current step into the step value which set on step no.(OP3)

(b) It is not available to be executed in operation.

(c) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.26 Repeat Step No. Change (command: XSRS)

(1) Program



(2) Explain

Device	Description
M00019	axis1 start step No. change input
U02.00.0	Operation Ready of axis 1
D00000.1	axis1 error state
D01300	axis1 repeat step no. to change

Command	XSRS				Repeat step No. change
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	step no.	PMLK,constant,D,Z,R,ZR	WORD	Step No. to change into repeat step (0~400)

※ PMLK means P, M, L and K areas

(a) Change repeat step into the step value which set on step no. (OP3).

(b) It is available to be executed in operation.

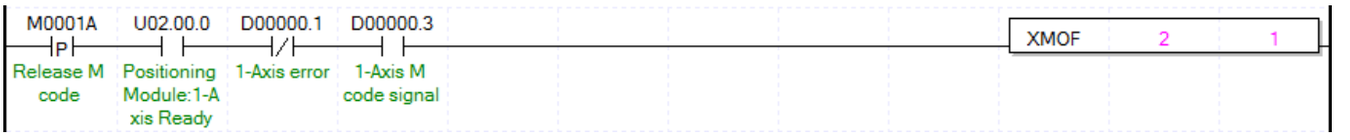
(c) Set the step to be designated as the next operation after operating the set step repeatedly among the operation methods (single, repeat).

(d) The detail description about“9.5.10 Repeat Operation Step no. Change”.

(e) D device signal (axis1 Signal in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.27 M code Off (command: XMOF)

(1) Program



(2) Explain

Device	Description
M0001A	axis1 M code release input
U02.00.0	Operation Ready of axis 1
D00000.1	axis1 error state
D00000.3	axis1 M code signal

Command	XMOF				M code Off
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)

※ PMLK means P, M, L and K areas

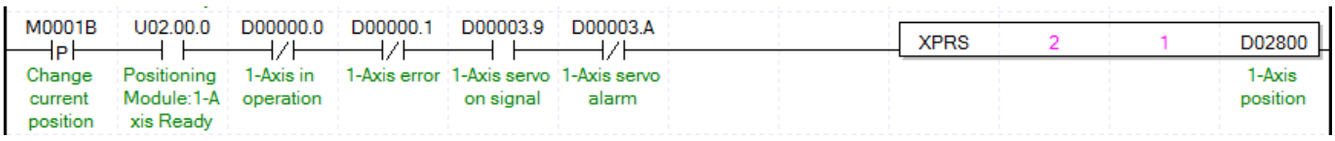
(a) When M code occurs, M code signal and M code No. are released at the same time M code and M code No. are changed to OFF and 0, respectively.

(b) It is available to be executed in operation.

(c) D device signal (axis1 Signal in Operation, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.28 Current Position Preset (command: XPRS)

(1) Program



(2) Explain

Device	Description
M0001B	axis1 current position preset input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D00003.9	Axis1 servo on signal
D00003.A	Axis1 servo error status
D02800	axis1 preset position value

Command	XPRS				Current position preset
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)d
	OP3	Position value	PMLK,constant,D,Z,R,ZR	DINT	Current position value to change

※ PMLK means P, M, L and K areas

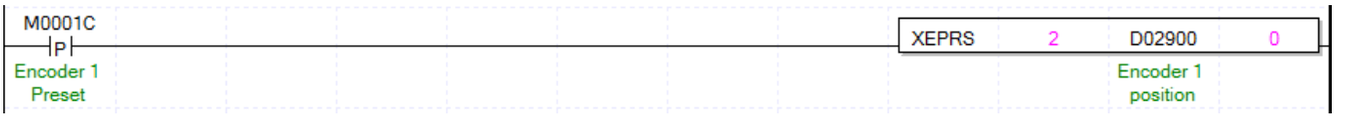
(a) The command that change the current position value to the designated position (OP3).

(b) If current position preset command is executed in the origin unsettled state, positioning state signal (bit) is ON and the current position is changed by setting value (OP3).

(c) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.29 Encoder Preset (command: XEPRS)

(1) Program



(2) Explain

Device	Description
M0001C	Encoder preset input(encoder)
D02900	Encoder 1 preset position value

Command	XEPRS				Encoder preset
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Position value	PMLK,constant,D,Z,R,ZR	DINT	Changing Encoder Position
	OP3	Encoder	PMLK,constant,D,Z,R,ZR	WORD	-

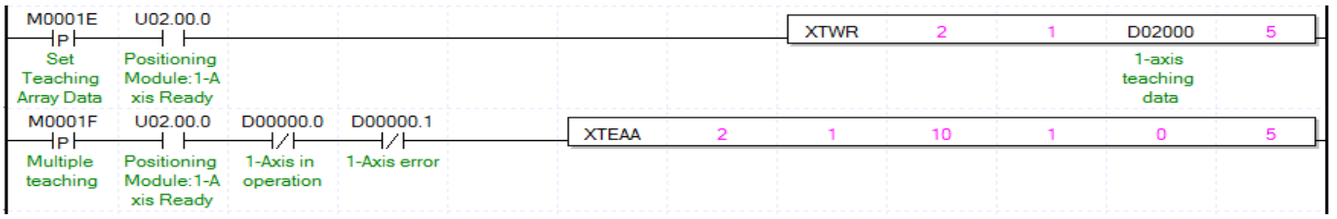
※ PMLK means P, M, L and K areas

※ As the positioning module has 1 encoder input terminal, it operates regardless of the OP3 encoder setting items.

(a) This is the command that changes the current position of encoder to the designated position (OP2).

6.3.30 Teaching Array (command: XTEAA)

(1) Program



(2) Explain

Device	Description
M0001E	axis1 teaching data setting input
M0001F	axis1 teaching array input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D02000	axis1 teaching array data leading address

Command	XTEAA				Teaching Array
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Teaching step	PMLK,constant,D,Z,R,ZR	WORD	leading step No. for teaching (0~400)
	OP4	Teaching method	PMLK,constant,D,Z,R,ZR	WORD	0: RAM teaching, 1: ROM teaching
	OP5	Teaching items	PMLK,constant,D,Z,R,ZR	WORD	0: Position teaching, 1: Speed teaching
	OP6	Number of Teaching	PMLK,constant,D,Z,R,ZR	WORD	Number of step for Teaching (1~16)

※ PMLK means P, M, L and K areas

(a) This is the command that change the goal position or goal speed (OP5) among the operation data to the number as many as from the designated step (OP3) to the number of teaching (OP6). In the case of operating RAM teaching according to the teaching method (OP3), the changed value is maintained during PLC is connected to power. In the case of operating ROM teaching, it is maintained without power connection of PLC.

(b) Teaching Array command is available to be executed when the axis is operating. But, teaching data of operating step do not apply instantly. Operating step data will apply end of present step operation and the data of the remaining steps are changed immediately.

(c) The number of times for ROM teaching is not limited because operation data is saved on MRAM Memory.

(d) Before executing teaching array, teaching data should be set in the teaching array setting area. For teaching array data setting, refer to TWR command.

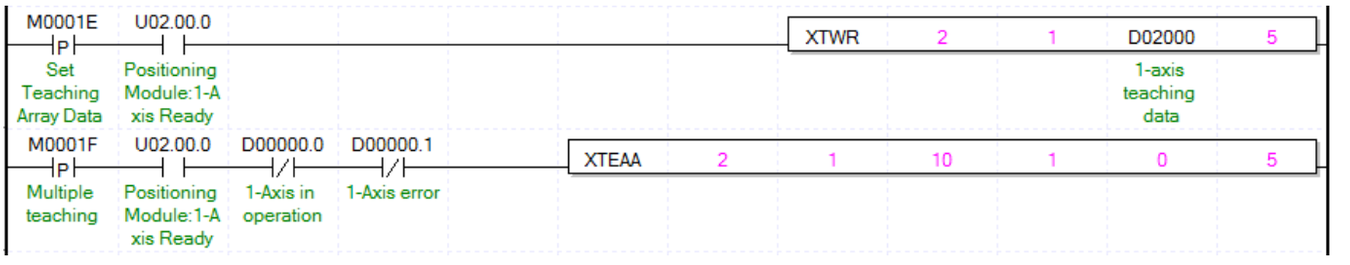
(e) In the example program above, execute ROM teaching for position data between no.10 step and no.14 step of axis1

operation data using 5 axis1 teaching data.

(f) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.31 Teaching Array Data Setting (command: XTWR)

(1) Program



(2) Explain

Device	Description
M0001E	axis1 teaching data setting input
M0001F	axis1 teaching array input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D02000	axis1 teaching array data leading address

Command	XTWR				Teaching array data setting
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R, ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Device	PMLK,D,Z,R,ZR	DWORD	Leading device No. with teaching array data
	OP4	The number of data	PMLK,constant,D,Z,R, ZR	WORD	Number of data to save

※ PMLK means P, M, L and K areas

(a) Before executing teaching array, teaching data should be set in the teaching array setting area. For teaching array data setting, refer to TWR command.

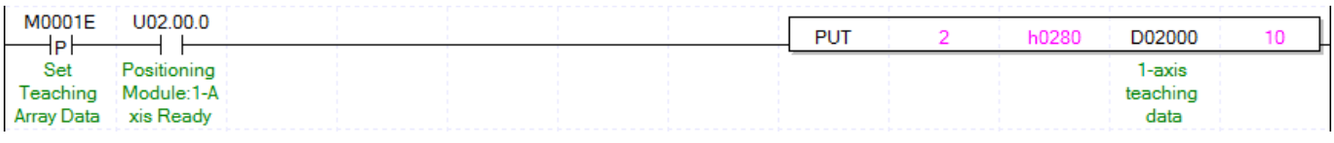
(b) Teaching array is not executed only by executing teaching array data setting command. Please refer to teaching array command (TEAA).

(c) In the example program above, execute ROM teaching for position data between no.10 step and no.14 step of axis1 operation data using 5 axis1 teaching data.

(d) According to the leading No. of device, the data are set in teaching array data area as follows

Quantity	Device number	Teaching array data
1	Device + 0	Teaching array data 1
2	Device + 2	Teaching array data 2
3	Device + 4	Teaching array data 3
4	Device + 6	Teaching array data 4
5	Device + 8	Teaching array data 5
6	Device + 10	Teaching array data 6
7	Device + 12	Teaching array data 7
8	Device + 14	Teaching array data 8
9	Device + 16	Teaching array data 9
10	Device + 18	Teaching array data 10
11	Device + 20	Teaching array data 11
12	Device + 22	Teaching array data 12
13	Device + 24	Teaching array data 13
14	Device + 26	Teaching array data 14
15	Device + 28	Teaching array data 15
16	Device + 30	Teaching array data 16

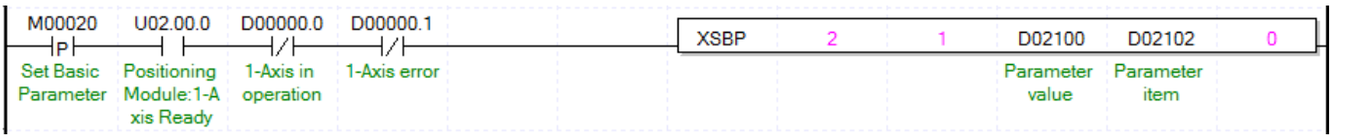
(e) Teaching array data can be set by using PUT command. For this, refer to “5.1.2 Teaching data memory address” and“6.1.2 Internal Memory Writing”. If use PUT command in the example program above, it displayed like the picture below.



(f) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.32 Basic Parameter Setting (Command: XSBP)

(1) Program



(2) Explain

Device	Description
M00020	axis1 basic parameter setting input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D02100	Parameter value
D02102	Parameter item

Command	XSBP				Basic parameter setting
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R ,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Parameter value	PMLK,constant,D,Z,R ,ZR	DWORD	Parameter value to change
	OP4	Parameter item	PMLK,constant,D,Z,R ,ZR	WORD	Parameter item to change (1~ 17, 255)
	OP5	Setting Method	PMLK,constant,D,Z,R ,ZR	WORD	0:RAM setting, 1:ROM setting

※ PMLK means P, M, L and K areas

(a) This is the command that changes the value of the item (OP4) which already set among basic parameter items to setting value (OP3). In the case of RAM setting by the setting method (OP5), the changed value is maintained during PLC is being connected to power. In the case of ROM setting, it is maintained without the power connection of PLC.

(b) The number of times for ROM teaching is not limited because operation data is saved on MRAM Memory.

(c) The basic parameter setting command is unavailable when the axis is operating.

(d) The basic parameter items are as follows.

Setting Value	Item	Setting range
1	Speed limit value	㎜ : 1 ~ 2,147,483,647 [X10^{-2}㎜/minute] Inch : 1 ~ 2,147,483,647 [X10^{-3}Inch/minute] degree : 1 ~ 2,147,483,647 [X10^{-3} degree/minute] pulse : 1 ~ 2,147,483,647 [pulse/second]
2	Acceleration time 1	0 ~ 2147483647 [ms]
3	Acceleration time 2	
4	Acceleration time 3	
5	Acceleration time 4	
6	Deceleration time 1	0 ~ 2147483647 [ms]
7	Deceleration time 2	
8	Deceleration time 3	
9	Deceleration time 4	
10	Dec. time of Emergent stop	0 ~ 2147483647 [ms]
11	Pulse number /revolution	1 ~ 200000000
12	Transfer distance per 1 rotation	
13	Unit	0: pulse, 1: mm, 2: inch, 3:degree
14	Unit multiplier	0: x 1, 1: x 10, 2: x 100, 3: x 1000
15	Speed command unit	0: Unit/Time, 1: rpm
16	Encoder select	0:Incremental encoder , 1: Absolute encoder
17	Current pos. compensation amount	0 ~ 255
18	User specified position display ratio	0 ~ 7
19	User specified speed display ratio	0 ~ 7
20	Axis type	0: Real axis, 1: Virtual axis
21	Torque command unit	0: 1%, 1: 0.1%
23	Control mode*4 during speed synchronization	0: CSP – command position 1: CSP – command position (not support) 2: CSV – command speed 3: CSV – command speed
24	Current pos. compensation amount rate	0: x1, 1: x100

(e) For the change value (OP3) setting range of each basic parameter item (OP4) which already set, refer to“4.1.1 Basic Parameter Content”.

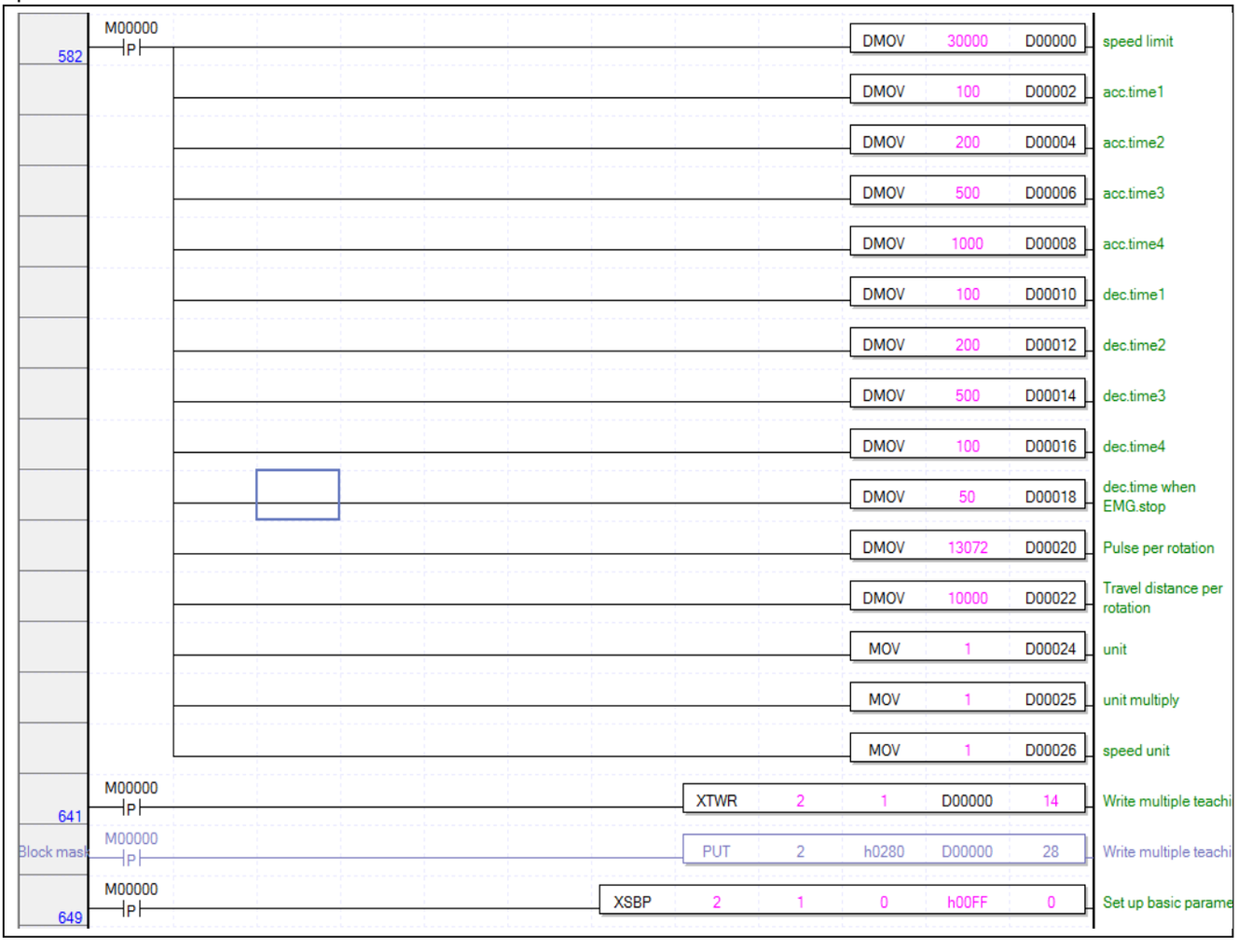
(f) In the example program above, it changes the item that saved on D02102 of axis1 basic parameter to the value that saved on D02100 using RAM setting method. In the case of D02102=10, D02100=100, it sets sudden stop time as” 100ms“using RAM setting method.

(g) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

(h) To set all of the basic parameter with one XSBP command, hFF(255) value must be set to OP4 parameter. At this time, the items of basic parameter should be saved first in the multiple teaching memory address below. Data can be set by PUT command or XTWR command.

Memory address								Content
Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	
280	300	380	400	480	500	580	600	Speed Limit
281	301	381	401	481	501	581	601	
282	302	382	402	482	502	582	602	Acceleration time 1
283	303	383	403	483	503	583	603	
284	304	384	404	484	504	584	604	Acceleration time 2
285	305	385	405	485	505	585	605	
286	306	386	406	486	506	586	606	Acceleration time 3
287	307	387	407	487	507	587	607	
288	308	388	408	488	508	588	608	Acceleration time 4
289	309	389	409	489	509	589	609	
28A	30A	38A	40A	48A	50A	58A	60A	Deceleration time 1
28B	30B	38B	40B	48B	50B	58B	60B	
28C	30C	38C	40C	48C	50C	58C	60C	Deceleration time 2
28D	30D	38D	40D	48D	50D	58D	60D	
28E	30E	38E	40E	48E	50E	58E	60E	Deceleration time 3
28F	30F	38F	40F	48F	50F	58F	60F	
290	310	390	410	490	510	590	610	Deceleration time 4
291	311	391	411	491	511	591	611	
292	312	392	412	492	512	592	612	Dec. time of Emergent stop
293	313	393	413	493	513	593	613	
294	314	394	414	494	514	594	614	No. of pulse per 1 rotation
295	315	395	415	495	515	595	615	
296	316	396	416	496	516	596	616	Transfer distance per 1 rotation
297	317	397	417	497	517	597	617	
298	318	398	418	498	518	598	618	Unit
299	319	399	419	499	519	599	619	Unit multiplier
29A	31A	39A	41A	49A	51A	59A	61A	Speed command unit
29B	31B	39B	41B	49B	51B	59B	61B	Encoder select
29C	31C	39C	41C	49C	51C	59C	61C	Current pos. compensation amount
29D	31D	39D	41D	49D	51D	59D	61D	-
29E	31E	39E	41E	49E	51E	59E	61E	-
29F	31F	39F	41F	49F	51F	59F	61F	-

The following is an example program that changes all items of basic parameters with one XSBP command.
When M00000 is on, the data set in D00000 ~ D00030 is saved in the teaching memory, and the command to set all basic parameters is executed.

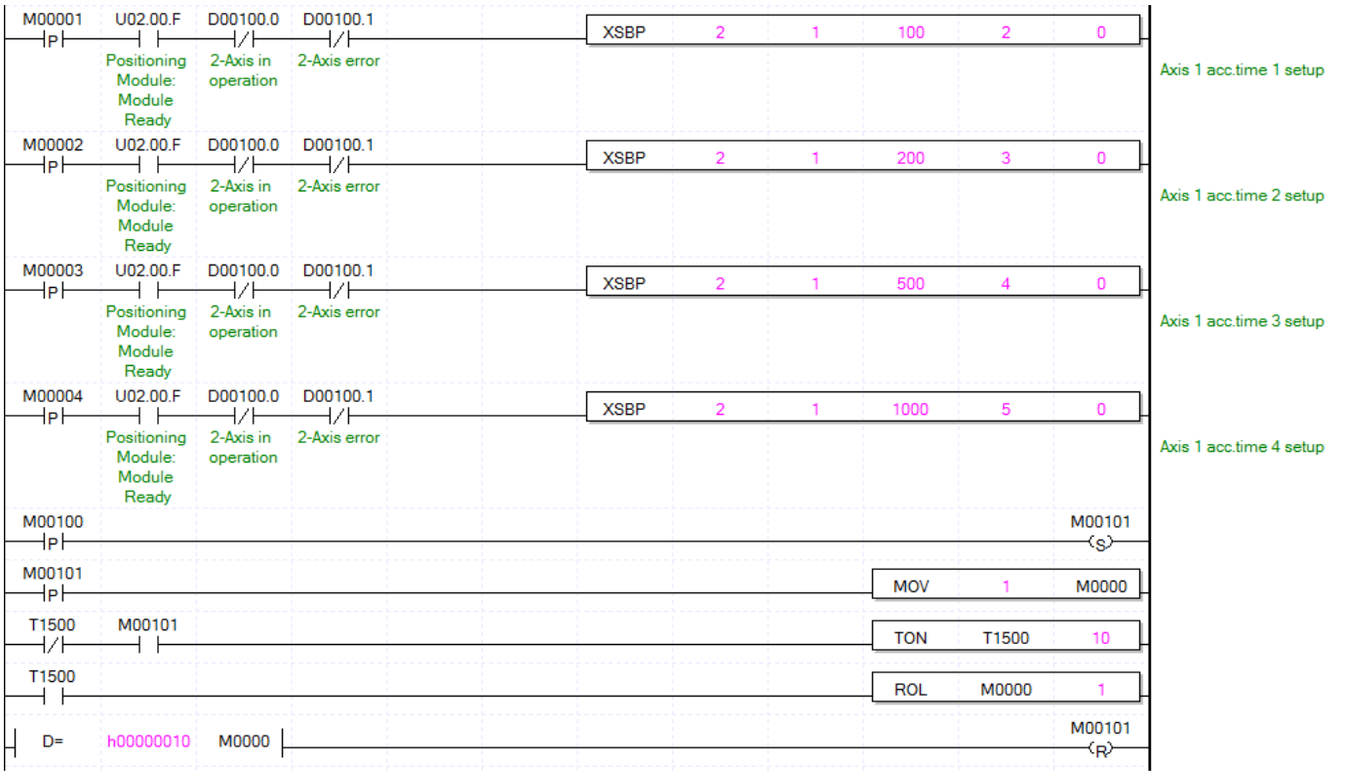


Notes

1. When using plural parameter settings commands to change plural parameter items, program the time interval for each command to be at least the execution time of the next parameter setting command. If you program by connecting plural commands to PLC contacts under the same condition, it will not operates normally.

※ Parameter setting command execution time
- 2 ms (when using 3 axes) to 4 ms (when using 8 axes)

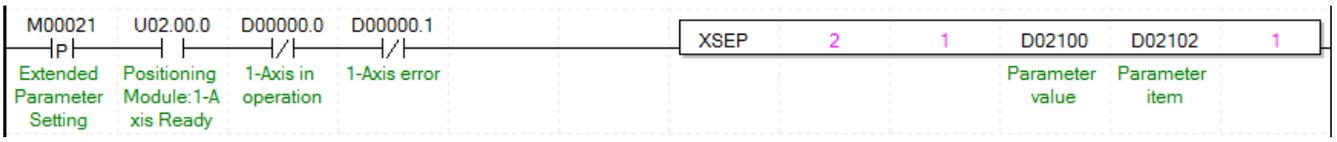
※[Ex] When changing the basic parameter Acceleration time 1~4, you can change it in the following method.



After turning M00100 on, the basic parameter setting command are sequentially executed from item 2 to item 5 of the basic parameter starting from the scan.

6.3.33 Extended Parameter Setting (Command: XSEP)

(1) Program



(2) Explain

Device	Description
M00021	axis1 extended parameter setting input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D02100	Parameter value
D02102	Parameter item

Command	XSEP				Extended parameter setting
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Parameter value	PMLK,constant,D,Z,R,ZR	DINT	Parameter value to change
	OP4	Parameter item	PMLK,constant,D,Z,R,ZR	WORD	Items to changed parameter (1 ~ 2, 4 ~ 20, 255)
	OP5	Setting Method	PMLK,constant,D,Z,R,ZR	WORD	0:RAM setting, 1:ROM setting

※ PMLK means P, M, L and K areas

(a) This is the command that changes the value of the item (OP4) which already set among extended parameter items to setting value (OP3). In the case of RAM setting by the setting method (OP5), the changed value is maintained during PLC is being connected to power. In the case of ROM setting, it is maintained without the power connection of PLC.

(b) The number of times for ROM teaching is not limited because operation data is saved on MRAM Memory.

(c) The extended parameter setting command is unavailable when the axis is operating.

(d) The extended parameter items are as follows.

Setting Value	Item	Setting range
1	S/W upper limit	㎜: -2147483648 ~ 2147483647[X10^{-4}㎜] Inch:-2147483648 ~ 2147483647[X10^{-5}Inch] degree:-2147483648 ~ 2147483647[X10^{-5}degree] pulse:-2147483648 ~ 2147483647[pulse]
2	S/W low limit	
3	-	-
4	Position completion time	0 ~ 65535 [ms]
5	S-curve ratio	1 ~ 100
6	Command in-position range	mm: 0 ~ 2147483647[X10^{-4}㎜] Inch: 0 ~ 2147483647[X10^{-5}Inch] degree: 0 ~ 2147483647[X10^{-5}degree] pulse: 0 ~ 2147483647[pulse]
7	Arc insertion position in 2-axis linear interpolation continuous operation	mm: 0 ~ 2147483647[X10^{-4}㎜] Inch: 0 ~ 2147483647[X10^{-5}Inch] degree: 0 ~ 2147483647[X10^{-5}degree] pulse: 0 ~ 2147483647[pulse]
8	Acceleration/Deceleration Pattern	0:Trapezoid operation, 1:S-Curve operation
9	M Code mode	0: None, 1: With, 2: After
10	Detection of upper and lower limits during speed control	0: Not detect , 1 : Detect
11	Positioning completion condition	0:Dwell time 1:In position 2:Dwell time and In position 3:Dwell time and In position
12	Positioning method of interpolation continuous operation	0:Target position passage, 1:Near target position passage
13	Arc insertion in 2-axis linear interpolation continuous operation	0:No circular arc addition, 1:Circular arc addition continuous operation
14	External command selection#	0:External speed/position control switch, 1 :External stop command,
15	External command	0:disabled,1:enabled
16	Positioning speed override coordinate	0: Absolute coordinate ,1: Relative coordinate
17	Infinite running repeat position	mm: 1 ~ 2147483647[X10^{-4}㎜] Inch: 1 ~ 2147483647[X10^{-5}Inch] degree: 1 ~ 2147483647[X10^{-5}degree] pulse: 1 ~ 2147483647[pulse]
18	Infinite running repeat	0:disabled,1:enabled
19	Speed/Position switching coordinate	0:Relative, 1:Absolute
20	Interpolation speed selection	0: main axis speed, 1:synthetic speed
21	CAM restart	0:disabled,1:enabled
22	Operation when main axis ' errors occurs during synchronous control	0: maintains synchronous control, 1: release synchronous when main axis's servo alarm occurs.

		2: release synchronous when main axis's axis error occurs.
23	Drive absolute position error detection	0: not detect, 1: Homing status initialization

(e) For the change value (OP3) setting range of each extended parameter item (OP4) which already set, refer to"4.2.1 Extended Parameter Content".

(f) In the example program above, it changes the item that saved on D02102 of axis1 basic parameter to the value that saved on D02100 using RAM setting method. In the case of D02102=9, D02100=1, it sets sudden stop time as 'With' using RAM setting method.

(g) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

(h) To set all of the expansion parameter with one XSEP command, hFF (255) value must be set to OP4 parameter. At this time, the items of extended parameter should be saved first in the multiple teaching memory address below. Data can be set by PUT command or XTWR command.

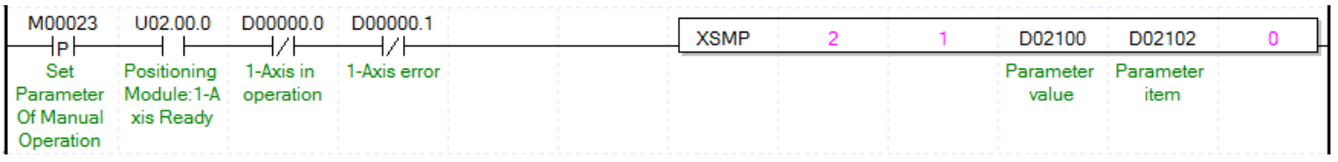
Memory address								Content
Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	
280	300	380	400	480	500	580	600	S/W upper limit
281	301	381	401	481	501	581	601	
282	302	382	402	482	502	582	602	S/W low limit
283	303	383	403	483	503	583	603	
284	304	384	404	484	504	584	604	-
285	305	385	405	485	505	585	605	Position completion time
286	306	386	406	486	506	586	606	S-curve ratio
287	307	387	407	487	507	587	607	Command in-position range
288	308	388	408	488	508	588	608	
289	309	389	409	489	509	589	609	Arc insertion position in 2-axis linear interpolation continuous operation
28A	30A	38A	40A	48A	50A	58A	60A	
28B	30B	38B	40B	48B	50B	58B	60B	Acceleration/Deceleration Pattern
28C	30C	38C	40C	48C	50C	58C	60C	M Code mode
28D	30D	38D	40D	48D	50D	58D	60D	Detection of upper and lower limits during speed control
28E	30E	38E	40E	48E	50E	58E	60E	Positioning completion condition
28F	30F	38F	40F	48F	50F	58F	60F	Positioning method of interpolation continuous operation
290	310	390	410	490	510	590	610	Arc insertion in 2-axis linear interpolation continuous operation
291	311	391	411	491	511	591	611	External command selection
292	312	392	412	492	512	592	612	External command
293	313	393	413	493	513	593	613	Positioning speed override coordinate
294	314	394	414	494	514	594	614	Infinite running repeat position
295	315	395	415	495	515	595	615	
296	316	396	416	496	516	596	616	Infinite running repeat
297	317	397	417	497	517	597	617	Speed/Position switching coordinate
298	318	398	418	498	518	598	618	Interpolation speed selection
299	319	399	419	499	519	599	619	-
29A	31A	39A	41A	49A	51A	59A	61A	-
29B	31B	39B	41B	49B	51B	59B	61B	-
29C	31C	39C	41C	49C	51C	59C	61C	-

29D	31D	39D	41D	49D	51D	59D	61D	-
29E	31E	39E	41E	49E	51E	59E	61E	-
29F	31F	39F	41F	49F	51F	59F	61F	-

The following is an example program that changes all items of extended parameters with one XSEP command.
When M00000 is on, the data set in D00000 ~ D00024 is saved in the teaching memory, and the command to set all extended parameters is executed.

6.3.34 Manual Operation Parameter Teaching (Command: XSMP)

(1) Program



(2) Explain

Device	Description
M00023	axis1 manual operation parameter setting input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D02100	Parameter value
D02102	Parameter item

Command	XSMP				Manual operation parameter setting
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Parameter value	PMLK,constant,D,Z,R,ZR	DWORD	Parameter value to change
	OP4	Parameter item	PMLK,constant,D,Z,R,ZR	WORD	Parameter item to change (1~ 5, 255)
	OP5	Setting Method	PMLK,constant,D,Z,R,ZR	WORD	0:RAM setting, 1:ROM setting

※ PMLK means P, M, L and K areas

(a) This is the command that changes the value of the item (OP4) which already set among manual operation parameter items to setting value (OP3). In the case of RAM setting by the setting method (OP5), the changed value is maintained during PLC is being connected to power. In the case of ROM setting, it is maintained without the power connection of PLC.

(b) The number of times for ROM teaching is not limited because manual operation parameter is saved on MRAM Memory.

(c) The manual operation parameter setting command is unavailable when the axis is operating.

(d) The manual operation parameter items are as follows.

Setting Value	Item	Setting range
1	Jog high speed	㎜ : 1 ~ 2,147,483,647 [X10^{-2}㎜/minute] Inch : 1 ~ 2,147,483,647 [X10^{-3}Inch/minute] degree : 1 ~ 2,147,483,647 [X10^{-3} degree/minute] pulse : 1 ~ 2,147,483,647 [pulse/second]
2	Jog low speed	
3	Jog acc. time	0 ~ 2147483647 [ms]
4	Jog deceleration time	
5	Inching speed	㎜ : 1 ~ 65,535[X10^{-2}㎜/minute] Inch : 1 ~ 65,535[X10^{-3}Inch/minute] degree : 1 ~ 65,535[X10^{-3} degree/minute] pulse : 1 ~ 65,535[pulse/second]

(e) For the change value (OP3) setting range of each manual operation parameter item (OP4) which already set, refer to“4.3.1

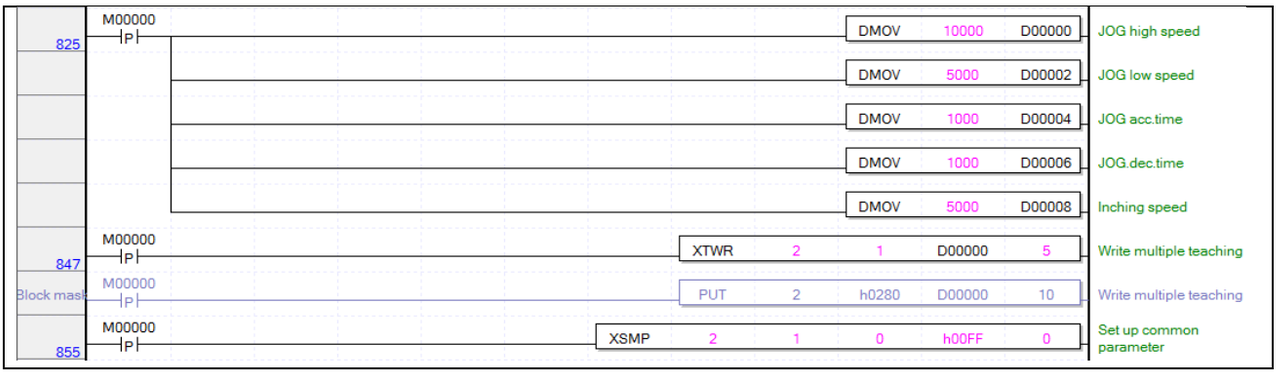
Manual Operation Parameter Content".

(f) In the example program above, it changes the item that saved on D02102 of axis1 manual operation parameter to the value that saved on D02100 using RAM setting method. In the case of D02102=3, D02100=500, it sets jog acc. time as" 500ms"using RAM setting method.

(g) To set all of the manual operation parameter with one XSMP command, hFF(255) value must be set to OP4 parameter. At this time, the items of manual operation parameter should be saved first in the multiple teaching memory address below. Data can be set by PUT command or XTWR command.

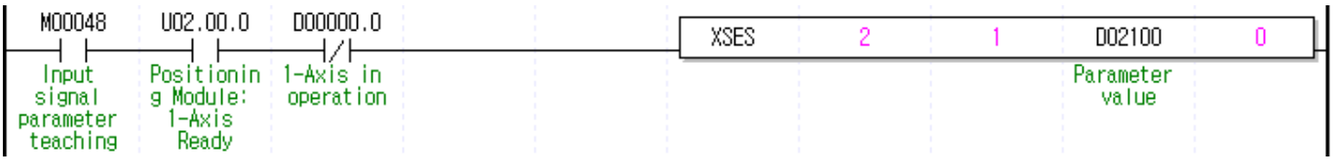
Memory address								Content
Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	
280	300	380	400	480	500	580	600	Jog high speed
281	301	381	401	481	501	581	601	
282	302	382	402	482	502	582	602	Jog low speed
283	303	383	403	483	503	583	603	
284	304	384	404	484	504	584	604	Jog accel. time
285	305	385	405	485	505	585	605	
286	306	386	406	486	506	586	606	Jog dec. time
287	307	387	407	487	507	587	607	
288	308	388	408	488	508	588	608	Inching speed
289	309	389	409	489	509	589	609	-
28A	30A	38A	40A	48A	50A	58A	60A	-
28B	30B	38B	40B	48B	50B	58B	60B	-
28C	30C	38C	40C	48C	50C	58C	60C	-
28D	30D	38D	40D	48D	50D	58D	60D	-
28E	30E	38E	40E	48E	50E	58E	60E	-
28F	30F	38F	40F	48F	50F	58F	60F	-
290	310	390	410	490	510	590	610	-
291	311	391	411	491	511	591	611	-
292	312	392	412	492	512	592	612	-
293	313	393	413	493	513	593	613	-
294	314	394	414	494	514	594	614	-
295	315	395	415	495	515	595	615	-
296	316	396	416	496	516	596	616	-
297	317	397	417	497	517	597	617	-
298	318	398	418	498	518	598	618	-
299	319	399	419	499	519	599	619	-
29A	31A	39A	41A	49A	51A	59A	61A	-
29B	31B	39B	41B	49B	51B	59B	61B	-
29C	31C	39C	41C	49C	51C	59C	61C	-
29D	31D	39D	41D	49D	51D	59D	61D	-
29E	31E	39E	41E	49E	51E	59E	61E	-
29F	31F	39F	41F	49F	51F	59F	61F	-

The following is an example program that changes all items of Manual operation parameters with one XSMP command. When M00000 is on, the data set in D00000 ~ D00008 is saved in the teaching memory, and the command to set all extended parameters are executed.



6.3.35 Input Signal Parameter Setting (Command: XSES)

(1) Program



(2) Explain

Device	Description
M00048	axis1 input signal parameter setting input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D02100	Parameter value

Command	XSES				Input signal parameter setting
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R ,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Parameter value	PMLK,constant,D,Z,R ,ZR	WORD	Parameter value to change
	OP4	Setting Method	PMLK,constant,D,Z,R ,ZR	WORD	0:RAM setting, 1:ROM setting

※ PMLK means P, M, L and K areas

(a) This is a command that changes the input signal parameter of the corresponding axis to the set value (OP3). In the case of RAM setting by the setting method (OP4), the changed value is maintained during PLC is being connected to power. In the case of ROM setting, it is maintained without the power connection of PLC.

(b) The number of times for ROM teaching is not limited because input signal parameters are saved on MRAM Memory.

(c) The input signal parameter setting command is unavailable when the axis is operating.

(d) The meaning of each bit of the input signal parameter setting value is as follows.

15	14	13	12	11 ~ 8	7 ~ 4	3 ~ 0
-	Input signal Z logic selection	Input signal B logic selection	Input signal A logic selection	Input signal Z function selection	Input signal B function selection	Input signal A function selection

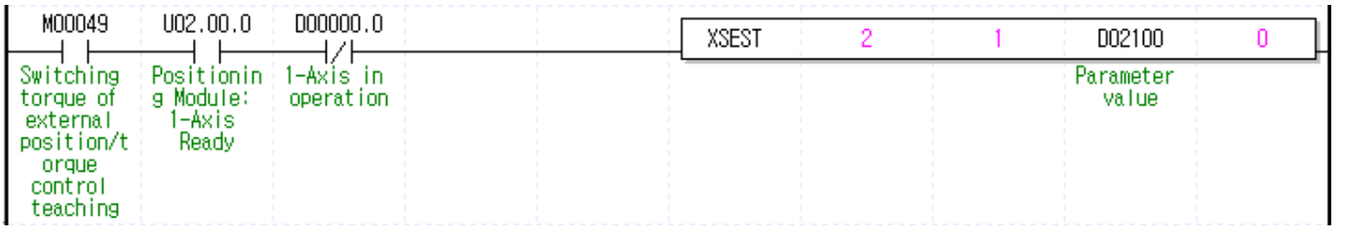
(e) The setting value of each item is listed below.

Input signal parameter items	Setting range
Input signal A function selection	0: not used 1: Speed/position control switch 2: Position/torque control switch 3: External start
Input signal B function selection	
Input signal Z Function selection	
Input signal A logic selection	Contact A, Contact B
Input signal B logic selection	
Input signal Z logic selection	
External position/torque control switch torque	-32768 ~ 32767

(f) The example program above changes the axis 1 input signal parameters to the values saved in D02100. In case of D02100=h0123, input signal A is set to'3: external start', input signal B is set to '2: position/torque control switch', and input signal Z is set to '1: speed/position control switch.

6.3.36 Input Signal Parameter - external position/torque control switching torque setting (command: XSEST)

(1) Program



(2) Explain

Device	Description
M00049	1 Axis external position control switching torque setting input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D02100	Parameter value

Command	XSEST				External position/torque control switch torque setting
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Torque values	PMLK,constant,D,Z,R,ZR	INT	Position/Torque control switch torque values to change
	OP4	Setting Method	PMLK,constant,D,Z,R,ZR	WORD	0:RAM setting, 1:ROM setting

※ PMLK means P, M, L and K areas

(a) This is a command to change'External position/torque control switch torque of input signal parameter of related axis to setting Value(OP3) In the case of RAM setting by the setting method (OP54, the changed value is maintained during PLC is being connected to power. In the case of ROM setting, it is maintained without the power connection of PLC.

(b) The number of times for ROM teaching is not limited because input signal parameters are saved on MRAM Memory.

(c) The external position/torque control switch torque setting command is unavailable when the axis is operating.

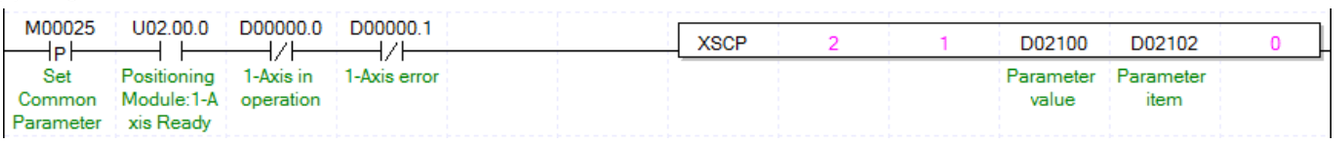
(d) The setting range of the torque value is as follows.

-32768 % ~ 32767 %

(f) The example program above changes the axis 1 input signal parameters to the values saved in D02100. In case of D02100=5 , the external position/torque control switch torque value set to 5%.

6.3.37 Common Parameter Setting (Command: XSCP)

(1) Program



(2) Explain

Device	Description
M00025	Common parameter setting input
U02.00.0	Operation Ready of axis 1
D02100	Parameter value
D02102	Parameter item

Command	XSCP				Common parameter setting
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R ,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Parameter value	PMLK,constant,D,Z,R ,ZR	DINT	Parameter value to change
	OP4	Parameter item	PMLK,constant,D,Z,R ,ZR	WORD	Parameter items to change (1~5, 10~11, 17, 255)
	OP5	Setting Method	PMLK,constant,D,Z,R ,ZR	WORD	0:RAM setting, 1:ROM setting

※ PMLK means P, M, L and K areas

(a) This is the command that changes the value of the item (OP4) which already set among common parameter items to setting value (OP3). In the case of RAM setting by the setting method (OP5), the changed value is maintained during PLC is being connected to power. In the case of ROM setting, it is maintained without the power connection of PLC.

(b) The number of times for ROM teaching is not limited because the common parameters are saved on MRAM Memory.

(c) The value to be set in parameter item is as follows.

Setting Value	Item	Setting range
1	Speed override	0: % designate, 1 : Speed designate
2	Encorder1 pulse input	0:CW/CCW 1 multiplication 1:PULSE/DIR 1 multiplication

		2:PULSE/DIR 2 multiplication 3: PHASE A/B 1 multiplication 4: PHASE A/B 2 multiplication 5: PHASE A/B 4 multiplication
3	Encoder1 Max. value	-2147483648 ~ 2147283647
4	Encoder1 Min. value	
5	Encoder1 phase Z clear	0:disabled,1:enabled
10	Position specified speed synchronization target position coordinates	0:Relative, 1:Absolute
11	Encoder average count	0:Not Use 1: 5times 2: 10times 3: 20times
13	External input terminal function selection	0: encoder signal phase A,B.Z 1: external input signal A,B.Z
14	External input signal input filter	0:Not Use 1: Use
15	Error reset mode	0: Module 1: Module/Servo
16	Torque synchronization control reference value	0: Actual torque value 1: Torque demand value
17	Control cycle	0: auto setting 1: 1ms 2: 2ms 3: 3ms 4: 4ms

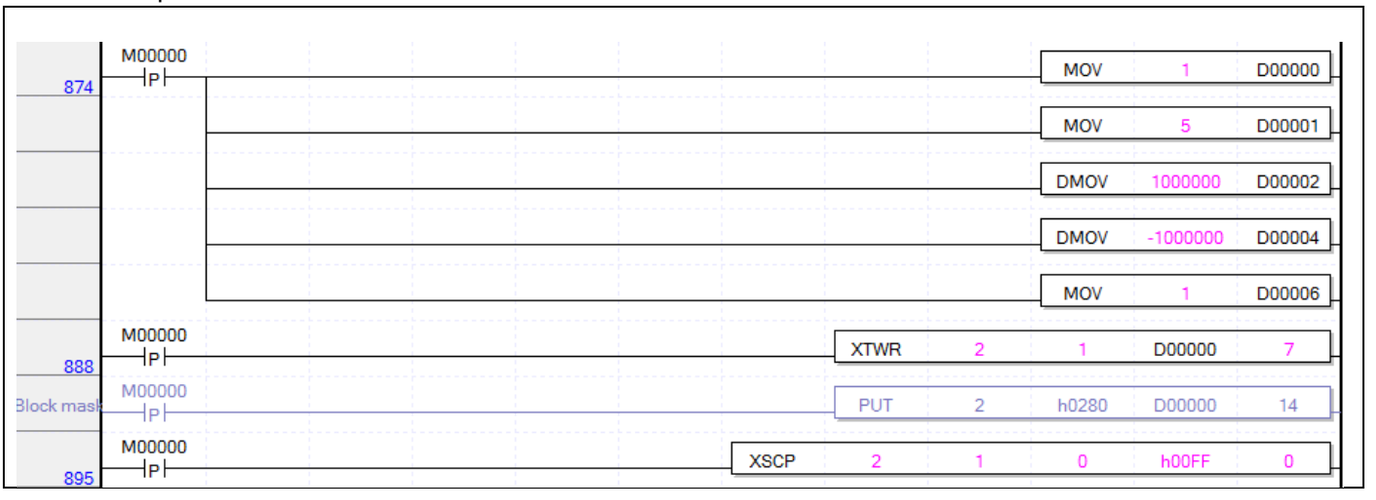
(d) For the change value (OP3) setting range of each common parameter item (OP4) which already set, refer to“4.6.1 Common Parameter Content”.

(e) In the example program above, it changes the item that saved on D02102 of common parameter to the value that saved on D02100 using RAM setting method. In the case of D02102=1, D02100=1, it sets speed override method time as '1: speed setting“ using RAM setting method.

(f) To set all of the common parameter with one XSCP command, hFF(255) value must be set to OP4 parameter. At this time, the items of common parameter should be saved first in the multiple teaching memory address below. Data can be set by PUT command or XTWR command.

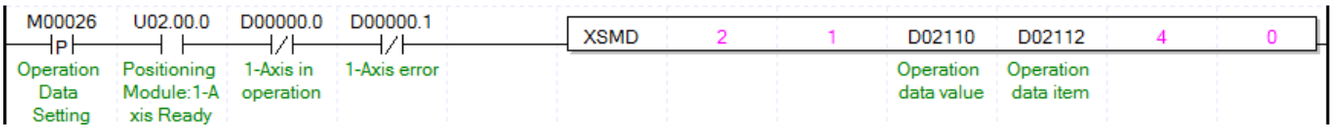
emory address								Content	Teaching array data
Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8		
280	300	380	400	480	500	580	600	Speed override	1
281	301	381	401	481	501	581	601	Encorder1 pulse input	
282	302	382	402	482	502	582	602	Encoder1 Max. value	2
283	303	383	403	483	503	583	603		
284	304	384	404	484	504	584	604	Encoder1 Min. value	3
285	305	385	405	485	505	585	605		
286	306	386	406	486	506	586	606	Encoder1 phase Z clear	4
287	307	387	407	487	507	587	607	Position specified speed synchronization target position coordinates	
288	308	388	408	488	508	588	608	Encoder 1 average count	5
289	309	389	409	489	509	589	609	External input terminal function selection	
28A	30A	38A	40A	48A	50A	58A	60A	External input signal input filter	6
28B	30B	38B	40B	48B	50B	58B	60B	Error reset mode	
28C	30C	38C	40C	48C	50C	58C	60C	Torque synchronization control reference value	7
28D	30D	38D	40D	48D	50D	58D	60D	Control cycle	
28E	30E	38E	40E	48E	50E	58E	60E	-	
28F	30F	38F	40F	48F	50F	58F	60F	-	
290	310	390	410	490	510	590	610	-	
291	311	391	411	491	511	591	611	-	
292	312	392	412	492	512	592	612	-	
293	313	393	413	493	513	593	613	-	
294	314	394	414	494	514	594	614	-	
295	315	395	415	495	515	595	615	-	
296	316	396	416	496	516	596	616	-	
297	317	397	417	497	517	597	617	-	
298	318	398	418	498	518	598	618	-	
299	319	399	419	499	519	599	619	-	
29A	31A	39A	41A	49A	51A	59A	61A	-	
29B	31B	39B	41B	49B	51B	59B	61B	-	
29C	31C	39C	41C	49C	51C	59C	61C	-	
29D	31D	39D	41D	49D	51D	59D	61D	-	
29E	31E	39E	41E	49E	51E	59E	61E	-	
29F	31F	39F	41F	49F	51F	59F	61F	-	

The following is an example program that changes all items of common parameter with one XSCP command.
When M00006 is on, the data set in D00010 ~ D00020 is saved in the teaching memory, and the command to set all common parameters are executed.



6.3.38 Operation Data Setting (command: XSMD)

(1) Program



(2) Explain

Device	Description
M00026	axis1 Operation data setting input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D02110	Operation data value
D02112	Operation data item

Command	XSMD				Operation data setting
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Operation data value	PMLK,constant,D,Z,R,ZR	DINT	Operation data value to change
	OP4	Operation data item	PMLK,constant,D,Z,R,ZR	WORD	Operation data Item No. to change (1~ 17, 256)
	OP5	step no.	PMLK,constant,D,Z,R,ZR	WORD	Operation data step No. to change (0~400)

	OP6	Setting Method	PMLK,constant,D,Z,R,ZR	WORD	0:RAM setting, 1:ROM setting

※ PMLK means P, M, L and K areas

(a) This is the command that changes the item (OP4) of a step which already set on OP5 among operation data items to setting value (OP3). In the case of RAM setting by the setting method (OP6), the changed value is maintained during PLC is being connected to power. In the case of ROM setting, it is maintained without the power connection of PLC.

(b) The number of times for ROM teaching is not limited because the operation data to are saved on MRAM Memory.

(c) The operation data setting command is available to be run when the axis is operating. But, when changing the operation data of currently operating step, it will be reflected after the operation of current step is finished.

(d) The values to be set in operation data item are as follows

Setting Value	Item	Setting range
1	Target position	㎜ : -2147483648 ~ 2147483647 [X10^{-4}㎜] Inch : -2147483648 ~ 2147483647 [X10^{-5}Inch] degree : -2147483648 ~ 2147483647 [X10^{-5}degree] pulse : -2147483648 ~ 2147483647 [pulse]
2	Circular interpolation auxiliary position	
3	Operating speed	㎜ : 0 ~ 2,147,483,647 [X10^{-2}㎜/minute] Inch : 0 ~ 2,147,483,647 [X10^{-3}Inch/minute] degree : 0 ~ 2,147,483,647 [X10^{-3} degree/minute] pulse : 0 ~ 2,147,483,647 [pulse/second]
4	Dwell time	0 ~ 65535 [ms]
5	M code No.	0 ~ 65535
6	Sub axis setting	Bit unit setting Bit 7: Axis 8 / Bit 6: Axis 7 / Bit 5: Axis 6 / Bit 4: Axis 5 / Bit 3: Axis 4 / Bit 2: Axis 3 / Bit 1: Axis 2 / Bit 0: Axis 1
7	Helical interpolation axis	0, axis1 ~ axis4 (0: circular interpolation)
8	No. of circular interpolation turn	0~65,535
9	Coordinate	0:absolute, 1:incremental
10	Control method	0:Single axis positioning, 1: Single axis speed control 2:Shortening Feed control, 3:Linear interpolation, 4:Circular arc interpolation
11	Operation method	0:Single , 1:Repeat
12	Operating pattern	0:End, 1:Keep, 2: Continuous
13	Circular arc size	0:Circular arc<180 , 1:Circular arc>=180
14	Acc. No.	0 ~ 3
15	Deceleration No.	0 ~ 3
16	Circular interpolating method	0:midpoint, 1:central point, 2:radius
17	Circular interpolating direction	0:CW, 1:CCW

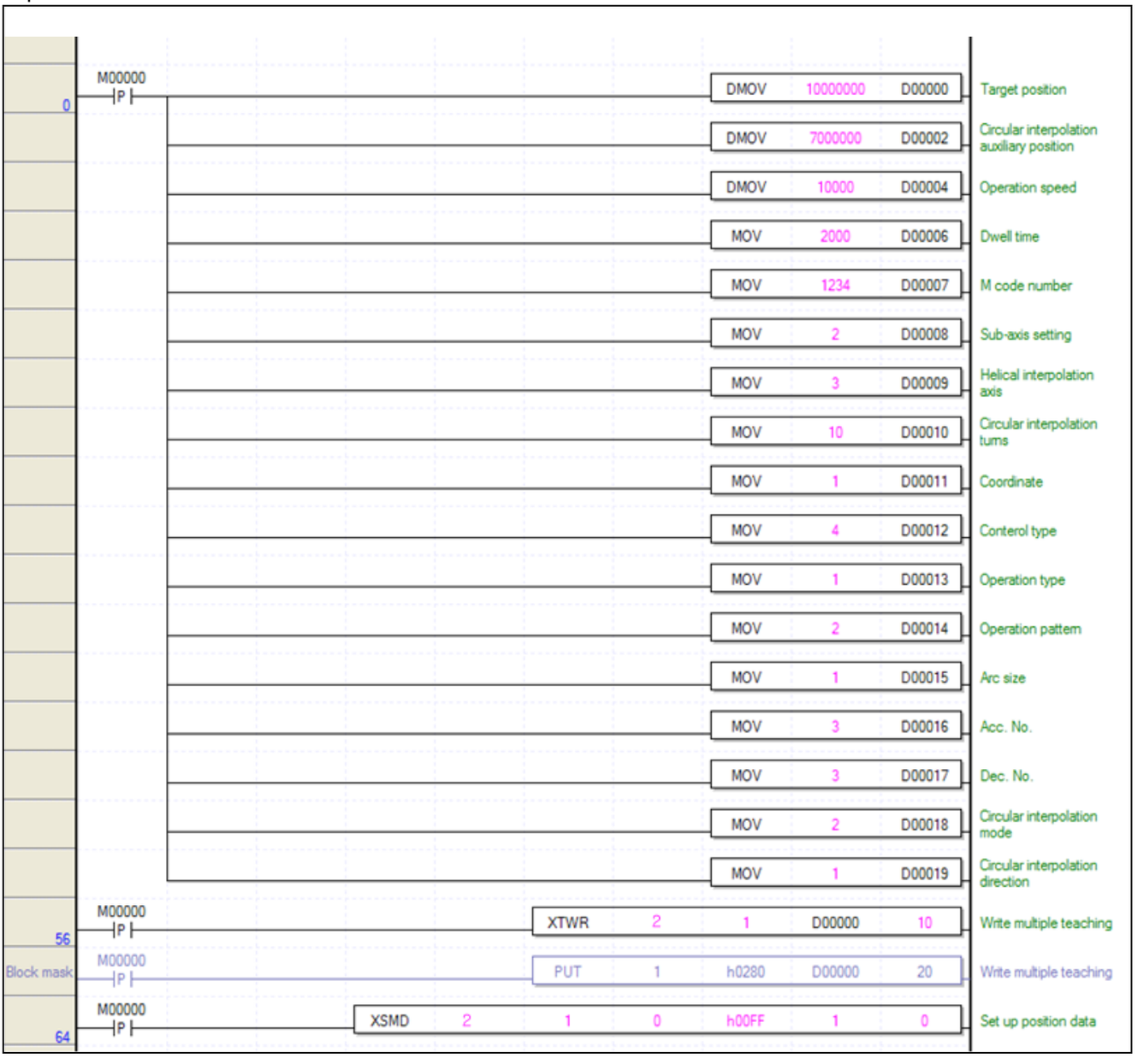
(e) For the change value (OP3) setting range of each position data item (OP4) which already set, refer to“4.7.1 Operation Data Content”.

(f) In the example program above, it changes the item that saved on D02112 of axis1 operation to the value that saved on D02100 using RAM setting method. In the case of D02112=5, D02100=125, it changes M code no. of step no.4 to” 125“ using RAM setting method.

(g) To set all of the operation parameter with one XSMD command, hFF(255) value must be set to OP4 parameter. At this time, the items of operation data should be saved first in the multiple teaching memory address below. Data can be set by PUT command or XTWR command.

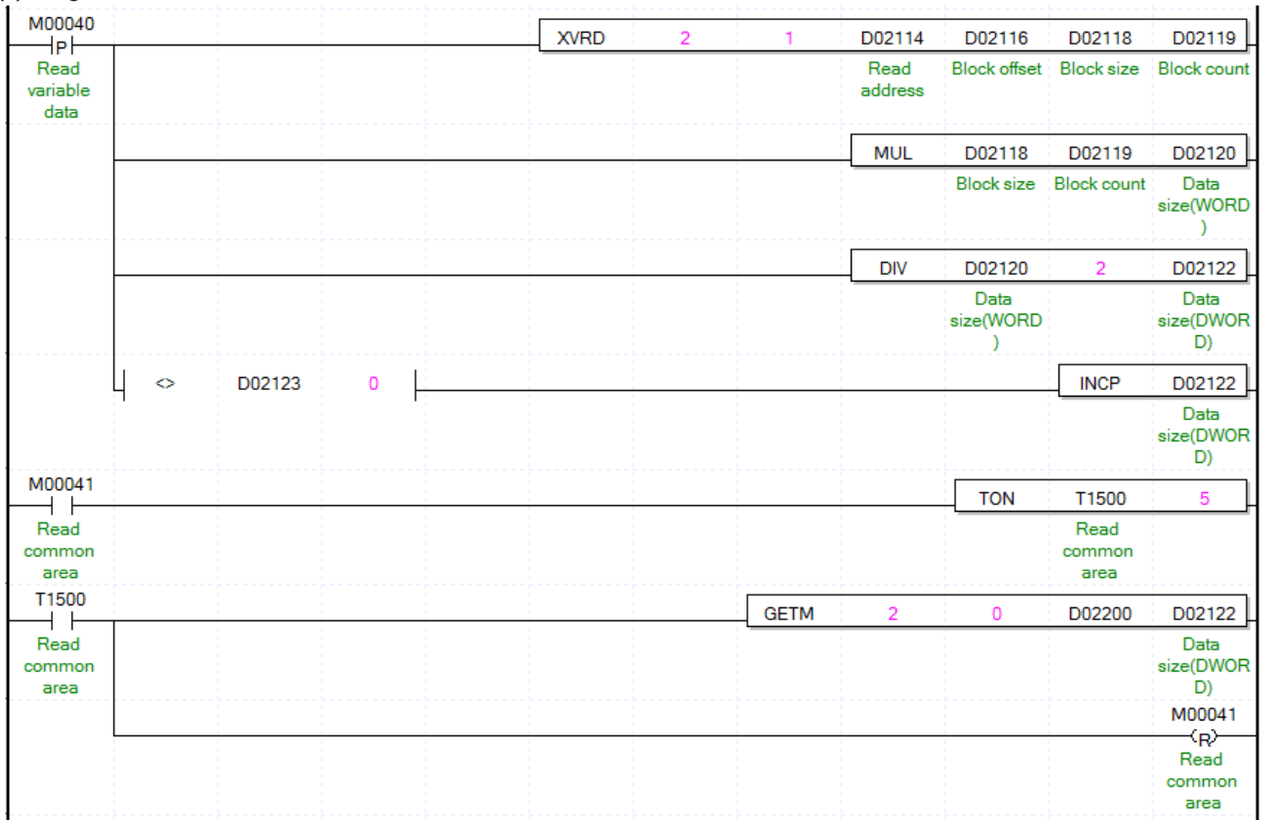
Memory address								Content
Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	
280	300	380	400	480	500	580	600	Target position
281	301	381	401	481	501	581	601	
282	302	382	402	482	502	582	602	Circular interpolation auxiliary position
283	303	383	403	483	503	583	603	
284	304	384	404	484	504	584	604	Operating speed
285	305	385	405	485	505	585	605	
286	306	386	406	486	506	586	606	Dwell time
287	307	387	407	487	507	587	607	M code No.
288	308	388	408	488	508	588	608	Sub axis setting
289	309	389	409	489	509	589	609	Helical interpolation axis
28A	30A	38A	40A	48A	50A	58A	60A	No. of circular interpolation turn
28B	30B	38B	40B	48B	50B	58B	60B	Coordinate
28C	30C	38C	40C	48C	50C	58C	60C	Control method
28D	30D	38D	40D	48D	50D	58D	60D	Operation method
28E	30E	38E	40E	48E	50E	58E	60E	Operating pattern
28F	30F	38F	40F	48F	50F	58F	60F	Circular arc size
290	310	390	410	490	510	590	610	Acc. No.
291	311	391	411	491	511	591	611	Deceleration No.
292	312	392	412	492	512	592	612	Circular interpolating method
293	313	393	413	493	513	593	613	Circular interpolating direction
294	314	394	414	494	514	594	614	-
295	315	395	415	495	515	595	615	-
296	316	396	416	496	516	596	616	-
297	317	397	417	497	517	597	617	-
298	318	398	418	498	518	598	618	-
299	319	399	419	499	519	599	619	-
29A	31A	39A	41A	49A	51A	59A	61A	-
29B	31B	39B	41B	49B	51B	59B	61B	-
29C	31C	39C	41C	49C	51C	59C	61C	-
29D	31D	39D	41D	49D	51D	59D	61D	-
29E	31E	39E	41E	49E	51E	59E	61E	-
29F	31F	39F	41F	49F	51F	59F	61F	-

The following is an example program that changes all items of operation data step 1 with one XSMD command.
When M00000 is on, the data set in D00000 ~ D00008 is saved in the teaching memory, and the command to set all operation data are executed.



6.3.39 Read Variable Data (Command: XVRD)

(1) Program



(2) Explain

Device	Description
M00040	Input to read variable data
M00041	Ready flag to read common area (ready flag to save in internal device by GETM after executing command reading variable data)
D02114	Head address of data in module internal memory to read
D02116	Block offset
D02118	Block size
D02119	Number of blocks
D02120	Size of data to read (WORD)
D02122	Size of data to read (DWORD)
D02123	Remaining (after changing WORD to DWORD)
D02200	Head device to save data

Command	XVRD				Operation data setting
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R, ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Read address	PMLK,constant,D,Z,R, ZR	DWORD	Head address of data in module internal m emory to read (0 ~ 72768)
	OP4	Block offset	PMLK,constant,D,Z,R, ZR	DWORD	Offset between blocks (0 ~ 73801)
	OP5	Block size	PMLK,constant,D,Z,R, ZR	WORD	Size of one block (1 ~ 128)
	OP6	Number of blocks	PMLK,constant,D,Z,R, ZR	WORD	No. of block to read (1 ~ 128)

※ PMLK means P, M, L and K areas

(a) This is command that reads data among parameter, operating data, CAM data by WORD unit from“Read address” into CPU. The number of data is set in“Block size”. In case“No. of block“set in OP6 is more than 2, it reads multiple blocks. At this time, head address of next block is“Block offset” apart from head address of current block.

(b) Max data size (Block size X No. of block) can be read with one command is 128 WORD.

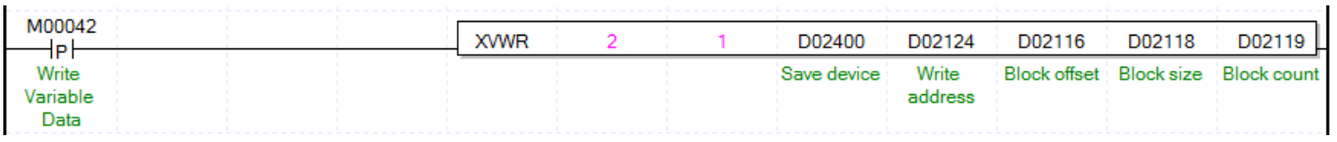
(c) ” Variable data read“ can be executed in operation.

(d) If you execute Read variable data, the data read from positioning module will be saved in common area. In order to save in device for using in program, use GETM command [Read address: h280, data size: read data size (DWORD) as program example after executing Read variable data' command

(f) In the above program, it reads data starting“Read address” set in D02114 by WORD unit into CPU. The number of data is D02118. If the number of “blocks” set in D02119 is 2 or more, blocks that are separated from the “read address“ set in D02114 by the “block offset” set in D02116 are read in order of “number of blocks”set in D02119 -1 times. In the above program, saves the read data in D02200 5ms after executing Read variable data command. You have to execute GETM command minimum 2ms after executing 'Variable data read’ to save the read data in common.

6.3.40 Write Variable Data (Command: XVWR)

(1) Program



(2) Explain

Device	Description
M00042	Input to write variable data
D2400	Head address where data to write is saved.
D2124	Write address
D2116	Block offset
D2118	Block size
D2119	Number of blocks

Command	XVWR				Operation data setting
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R ,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Data device	PMLK,constant,D,Z,R ,ZR	WORD	Head address where data to write is saved.
	OP4	Write address	PMLK,constant,D,Z,R ,ZR	DWORD	Head address to write module internal mem ory data (0 ~ 73801)
	OP5	Block offset	PMLK,constant,D,Z,R ,ZR	DWORD	Offset between blocks (0 ~ 72768)
	OP6	Block size	PMLK,constant,D,Z,R ,ZR	WORD	Size of one block (1 ~ 128)
	OP7	Number of blocks	PMLK,constant,D,Z,R ,ZR	WORD	No. of block to write (1 ~ 128)

※ PMLK means P, M, L and K areas

(a) This is command that writes data starting "Write address“ set in OP4 among parameter of positioning module internal memory, operation data, CAM data to internal memory address starting OP3. The number of data to write is“Block size” OP6. In case“No. of block' is more than 2, writes multiple blocks” At this time, head address of next block is“Block offset” OP5 apart from head address of current block.

(b) Max data size (Block size X No. of block) that can be written with one command is 128 WORD.

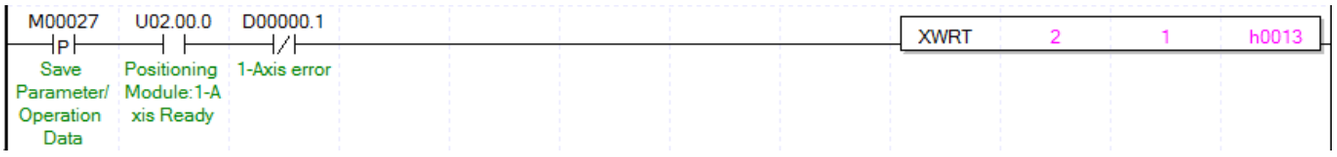
(c)“Variable data write” command cannot be executed in operation.

(d) In case you execute "Write variable data', the changed value is kept during power on. So, to save the data, execute 'Save Parameter/Operation data (XWRT)” command.

(f) In the above program example, writes data starting from D02400 to internal memory address starting form D2124 in order by WORD unit. The number of data is“Block size”. In case 'No. of Block' set in D02119 is larger than 2“ writes multiple blocks” At this time, head address of next block is“Block offset” OP5 apart from head address of current block.

6.3.41 Parameter/Operation Data Save (Command: XWRT)

(1) Program



(2) Explain

Device	Description
M00027	axis1 parameter/operation data save input
U02.00.0	Operation Ready of axis 1
D00000.1	axis1 error state

Command	XWRT				Parameter/operation data save
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z, R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Selection axis	PMLK,constant,D,Z, R,ZR	WORD	Axis to save data

※ PMLK means P, M, L and K areas

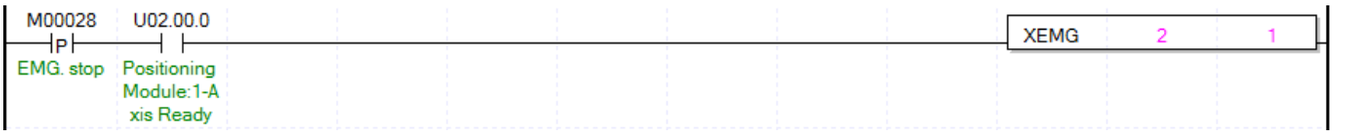
(a) This command saves the parameters and operation data set in the selected axis in MRAM.
(b) The current parameters and operation data of the set axis are saved in MRAM and hold even when the power is turned off.
(c) There is no limit to the number of execution of parameter/operation data save command.
(d) Parameter/operation data save command is unavailable to be executed when the relevant axis is operating.
(e) Set the selection axis by setting each bit of axis.

Bit 15 ~ 8	7Bit	6Bit	5Bit	4Bit	3Bit	2Bit	1Bit	0Bit
Do Not Use	Axis 8	Axis 7	Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1

That is, if set h0002, axis5, axis2, axis1 will be set to execute parameter/operation data save.
(f) In the example program above, save parameter/operation data of 1 axes 1, axis2, and axis5 on MRAM memory.
(g) If CAM data changed by XVWR command, these data is saved to flash memory when XWRT command is executed

6.3.42 Emergency Stop (command: XEMG)

(1) Program



(2) Explain

Device	Description
M00028	axis1 internal emergency stop input
U02.00.0	Operation Ready of axis 1

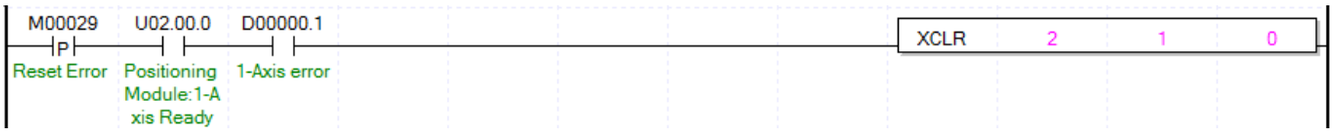
Command	XEMG				Emergency stop
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z, R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)

※ PMLK means P, M, L and K areas

(a) Execute internal emergency stop command to command axis.
(b) Dec. time in emergency stop become the time which set on 'Emergency stop dec. time' item of each basic parameter.
(c) The example program above issues ab emergency stop command to axis1.

6.3.43 Error Reset (Command:XCLR)

(1) Program



(2) Explain

Device	Description
M00029	axis1 error reset input
U02.00.0	Operation Ready of axis 1
D00000.1	axis1 error state

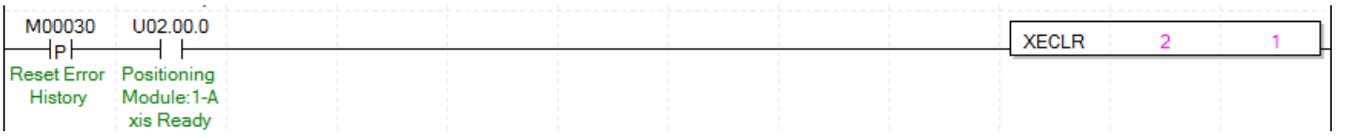
Command	XCLR				Error reset
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Common error	PMLK,constant,D,Z,R,ZR	WORD	0: axis error reset, 1: common/servo error reset

※ PMLK means P, M, L and K areas

(a) This is the command that reset the error occurred on command axis.
(b) if a common/servo error rather than axis error occurs and when executes command by “common/servo error” item as 1 , occurred error is cleared.
(c) The example program above is that reset the error occurred on axis1

6.3.44 Error History Reset (command: XECLR)

(1) Program



(2) Explain

Device	Description
M00030	axis1 error history reset input
U02.00.0	Operation Ready of axis 1

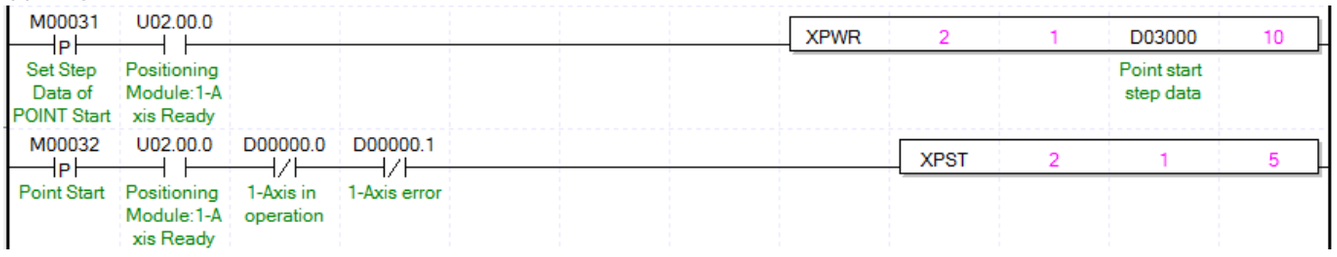
Command	XECLR				Error history reset
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z, R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)

※ PMLK means P, M, L and K areas

(a) This is the command that reset the error history about command axis.
(b) The positioning module in each axis saves 10 (Maximum) error histories.
(c) The example program above is that reset error history of axis1.

6.3.45 Point Start (Command: XPST)

(1) Program



(2) Explain

Device	Description
M00031	axis1 point start step data setting input
M00032	axis1 point start input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 operating state
D00000.1	axis1 error state
D03000	Point start step data setting leading device

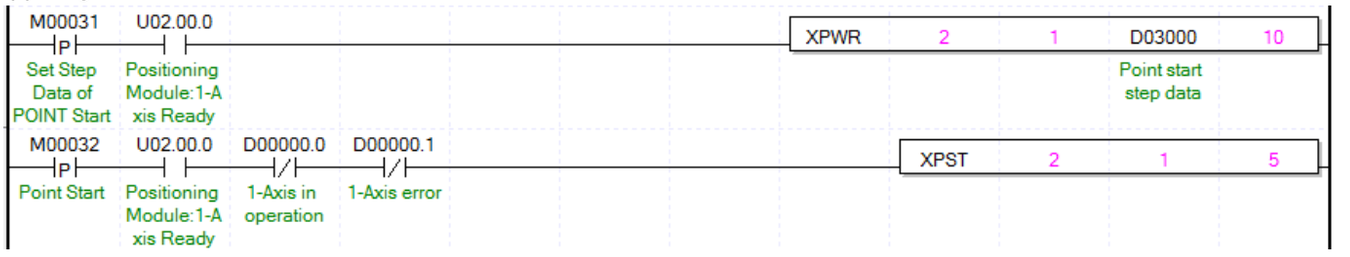
Command	XPST				Point run
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Point operation No.	PMLK,constant,D,Z,R,ZR	WORD	Point operation step No. (1~20)

※ PMLK means P, M, L and K areas

(a) This is the command that execute point start of command axis.
(b) It is unavailable to be executed when the axis is operating.
(c) It is able to set maximum 20 point start step.
(d) The step data must be set in point start data area before execute point start. For the point start step data setting, refer to the next page about PWR command.
(e) For the detail description about operation of point start, refer to“9.2.18 Positioning start (4) Point start”.
(f) The example program above sets 10 point steps from D03000 on axis1 and executes point start to 5 point steps which already set.

6.3.46 POINT Start Step Data Setting (Command: XPWR)

(1) Program



(2) Explain

Device	Description
M00031	axis1 point start step data setting input
M00032	axis1 point start input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 operating state
D00000.1	axis1 error state
D03000	Point Start Step Data Setting Leading Device No.

Command	XPWR				Point start step data setting
Operand	OP 1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP 2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP 3	Device	PMLK,D,Z,R,ZR	WORD	Leading No. of device with POINT Start Step Data
	OP 4	The number of data	PMLK,constant,D,Z,R,ZR	WORD	Number of data to save (1 ~ 20)

※ PMLK means P, M, L and K areas

(a) This is the command that sets step which set on device of point step area of command axis.

(b) The point start will not be executed by only point start step data setting command. Refer to the previous page about PST command.

(c) It is able to set maximum 20 point start step.

(d) The point start step data will be set like item below depending on the leading no. of device.

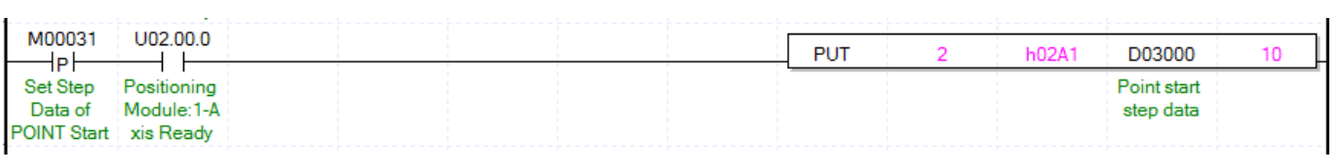
Quantity	Device number	Point start step data
1	Device + 0	Point start step data 1
2	Device + 1	Point start step data 2
3	Device + 2	Point start step data 3
4	Device + 3	Point start step data 4
5	Device + 4	Point start step data 5
6	Device + 5	Point start step data 6
7	Device + 6	Point start step data 7
8	Device + 7	Point start step data 8
9	Device + 8	Point start step data 9
10	Device + 9	Point start step data 10
11	Device + 10	Point start step data 11
12	Device + 11	Point start step data 12
13	Device + 12	Point start step data 13
14	Device + 13	Point start step data 14
15	Device + 14	Point start step data 15
16	Device + 15	Point start step data 16
17	Device + 16	Point start step data 17
18	Device + 17	Point start step data 18
19	Device + 18	Point start step data 19
20	Device + 19	Point start step data 20

(e) The step data must be set in point start data area before execute point start.

(f) For the detail description about operation of point start, refer to“9.2.18 Positioning start (4) Point start”.

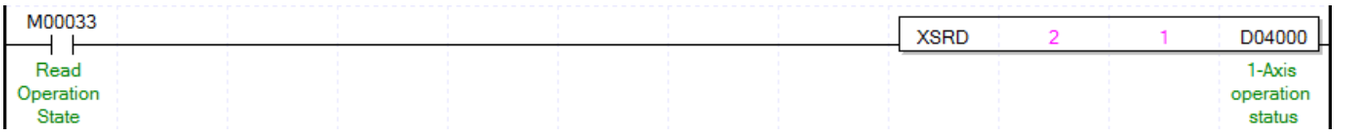
(g)The example program abovesets 10 point steps from D03000 on axis1 and executes point start to 5 point steps which already set.

(h) It is possible to set point operation step with PUT command. For this, refer to “5.1.2 Memory Address of POINT operation step data” and“6.1.2 Internal Memory Writing”. If use PUT command in the example program above, it displayed like the picture below.



6.3.47 Operation State Reading (Command: XSRD)

(1) Program



(2) Explain

Device	Description
M00033	Always ON Flag
D04000	Head address to save the operation status of axis 1

Command	XSRD				Operation state reading
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z, R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ axis4) XBF-PN08B (1~8: axis1 ~ axis8)
	OP3	Device	PMLK,D,Z,R,ZR	WORD	Leading No. of device to read and save the current state value

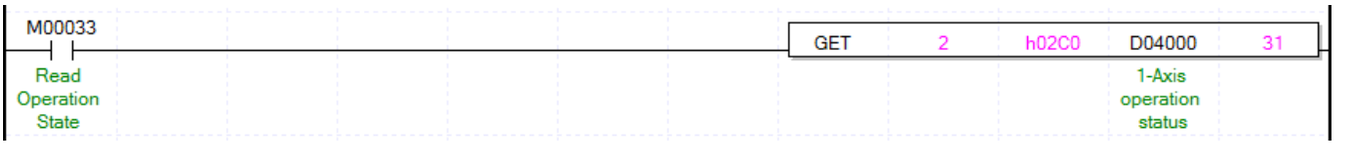
※ PMLK means P, M, L and K areas

(a) This is the command that checks the operation state of command axis and save it on designated device.

(b) The current state will be saved like items below depending on leading no. of device.

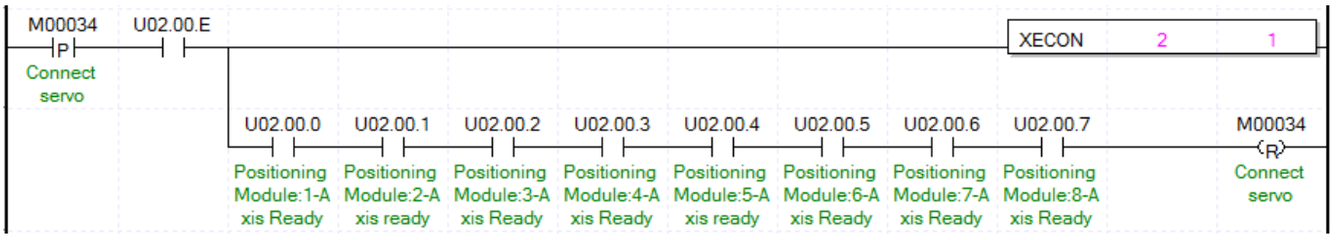
Device number	Size	Status type
Device	WORD	Operation State Information (Lower)
Device + 1	WORD	Operation State Information (Upper)
Device + 2	WORD	Axis information
Device + 3	WORD	External input signal status
Device + 4	DINT	Current Position
Device + 6	DWORD	Current Speed
Device + 8	WORD	Step No.
Device + 9	WORD	M code No.
Device + 10	WORD	Error information
Device + 11 ~ Device + 17	WORD	Error History 1 ~ 7
Device + 18	WORD	External input lower
Device + 19	WORD	External input upper
Device + 20	WORD	Servo error information
Device + 21	DINT	Encoder 1 value
Device + 23	DINT	-
Device + 25	DINT	Command position
Device + 27	DWORD	Command speed
Device + 29	WORD	Torque
Device + 30	WORD	Common error information

(c) It is able to read the current state of axis with GET command. At this time, refer to “5.1.4 Memory Address of Status Information” and“6.1.1 Internal Memory Reading”. If use GET command in the example above, it is as follows. In addition, it is able to read the states that you need with GET command.



6.3.48 Servo Connect (Command: XECON)

(1) Program



(2) Explain

Device	Description
M00034	Servo connection input
U02.OO.E	Positioning module: Link up/down information

Command	XECON				Servo connection
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)

※ PMLK means P, M, L and K areas

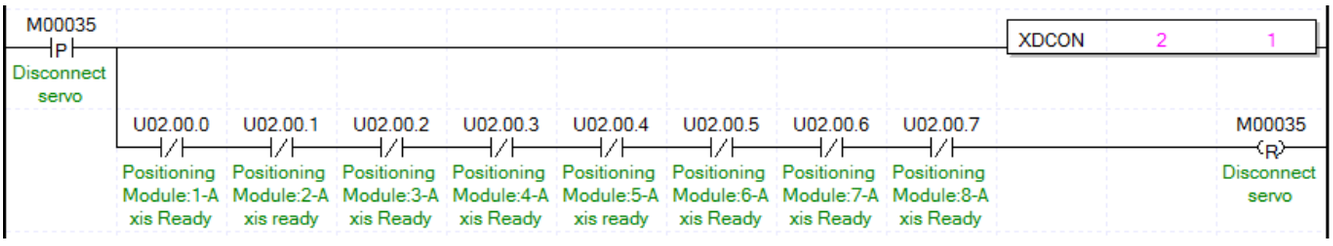
(a) This command is for communication connection between positioning module and servo drive disconnected by Ethernet cable.
(b) If the servo drive is connected normally, the bit corresponding to the connected axis of the U device is set.

Axis	Signal direction: PLC CPU□ positioning module	
	Input Signal	Content
Axis 1	Uxx.00.0	Operation Ready of axis 1
Axis 2	Uxx.00.1	Operation Ready of axis 2
Axis 3	Uxx.00.2	Operation Ready of axis 3
Axis 4	Uxx.00.3	Operation Ready of axis 4
Axis 5	Uxx.00.4	Operation Ready of axis 5
Axis 6	Uxx.00.5	Operation Ready of axis 6
Axis 7	Uxx.00.6	Operation Ready of axis 7
Axis 8	Uxx.00.7	Operation Ready of axis 8

(c) If the link up/down information is used as the input condition contact of the servo connection command, the servo connection command can be executed only when the network cable is connected.
(d) In the program, the servo connection command is not executed for each axis, but only for one command axis of the 1 to 8 axes.

6.3.49 Servo Disconnection (command: XDCON)

(1) Program



(2) Explain

Device	Description
M00035	Servo disconnect input

Command	XDCON				Servo disconnect
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R ,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ axis4) XBF-PN08B (1~8: axis1 ~ axis8)

※ PMLK means P, M, L and K areas

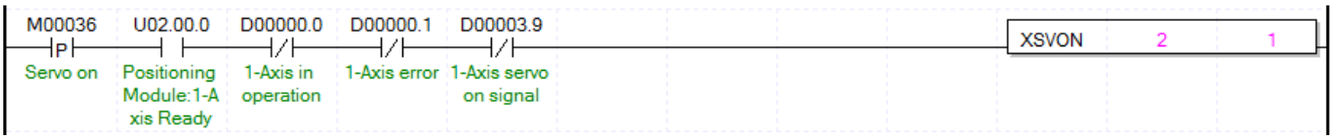
(a) This command is to disconnect communication between positioning module and servo drive.
(b) If the servo Disconnect connected normally, the bit corresponding to the connected axis of the U device is clear.

Axis	Signal direction: PLC CPU□ positioning module	
	Input Signal	Content
Axis 1	Uxx.00.0	Operation Ready of axis 1
Axis 2	Uxx.00.1	Operation Ready of axis 2
Axis 3	Uxx.00.2	Operation Ready of axis 3
Axis 4	Uxx.00.3	Operation Ready of axis 4
Axis 5	Uxx.00.4	Operation Ready of axis 5
Axis 6	Uxx.00.5	Operation Ready of axis 6
Axis 7	Uxx.00.6	Operation Ready of axis 7
Axis 8	Uxx.00.7	Operation Ready of axis 8

(c) In the program, the servo disconnection command is not executed for each axis, but only for one command axis of the 1 to 8 axes.

6.3.50 Servo On (Command: XSVON)

(1) Program



(2) Explain

Device	Description
M00036	Servo On input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 operating state
D00000.1	axis1 error state
D00003.9	Axis1 servo on signal

Command	XSVON				Servo On
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R ,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)

※ PMLK means P, M, L and K areas

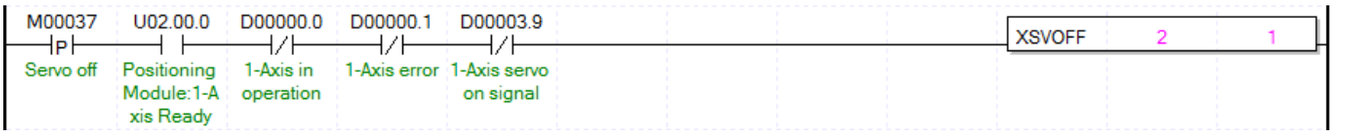
(a)This is a command to “servo on” the servo drive of the corresponding axis among servo drives connected to the positioning module.

(b) To start the motor, servo on signal should be on.

(c) The example program above executes servo on operation for axis 1.

6.3.51 Servo off (Command: XSVOFF)

(1) Program



(2) Explain

Device	Description
M00037	Servo off input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 operating state
D00000.1	axis1 error state
D00003.9	Axis1 servo on signal

Command	XSVOFF				Servo Off
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R ,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)

※ PMLK means P, M, L and K areas

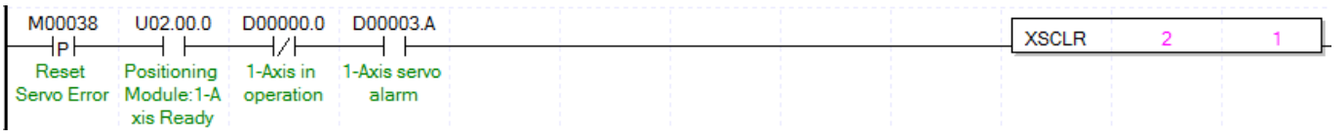
(a) This is a command to “servo off” the servo drive of the corresponding axis among servo drives connected to the positioning module.

(b) To start the motor, servo on signal should be on.

(c) The example program above executes servo off operation for axis 1.

6.3.52 Servo Error Reset (Command: XSCLR)

(1) Program



(2) Explain

Device	Description
M00038	Servo Error reset Input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 operating state
D00003.A	Axis1 servo Alarm signal

Command	XSCLR				Servo alarm reset
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R ,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ axis4) XBF-PN08B (1~8: axis1 ~ axis8)

※ PMLK means P, M, L and K areas

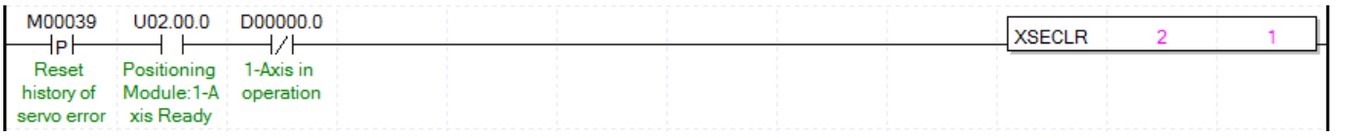
(a) This is a command to “clear alarm” the servo drive of the corresponding axis among servo drives connected to the positioning module.

(b) If the servo error reset command is giving without eliminating the cause of the servo drive alarm, the servo drive alarm may not be cleared. Therefore, the cause of the servo drive alarm must be eliminated and the servo error reset command must be executed.

(c) The example program above resets servo alarm that occurs on axis 1.
There are servo errors that cannot be reset depending on the type of error among EtherCAT servo drives, so please refer to the servo drive user manual.

6.3.53 Servo Error History Reset (Command: XSECLR)

(1) Program



(2) Explain

Device	Description
M00039	Servo Error History Reset Input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 operating state

Command	XSECLR				Servo Error History Reset
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R ,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)

※ PMLK means P, M, L and K areas

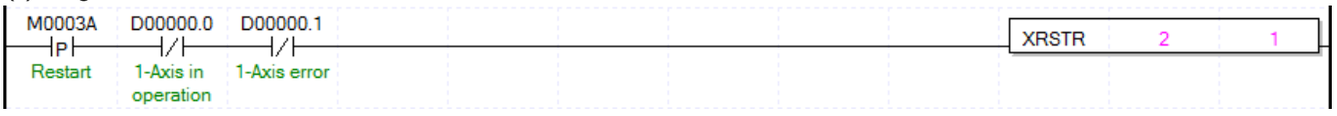
(a) This is a command to “clear alarm” the servo drive of the corresponding axis among servo drives connected to the positioning module.

(b) The servo drive stores up to 10 servo alarm histories.

(c) The alarm history of servo drive can be checked in XG-PM. For more details, refers to the XG-PM user manual.

6.3.54 Restart (Command: XRSTR)

(1) Program



(2) Explain

Device	Description
M00034	axis1 restart command input

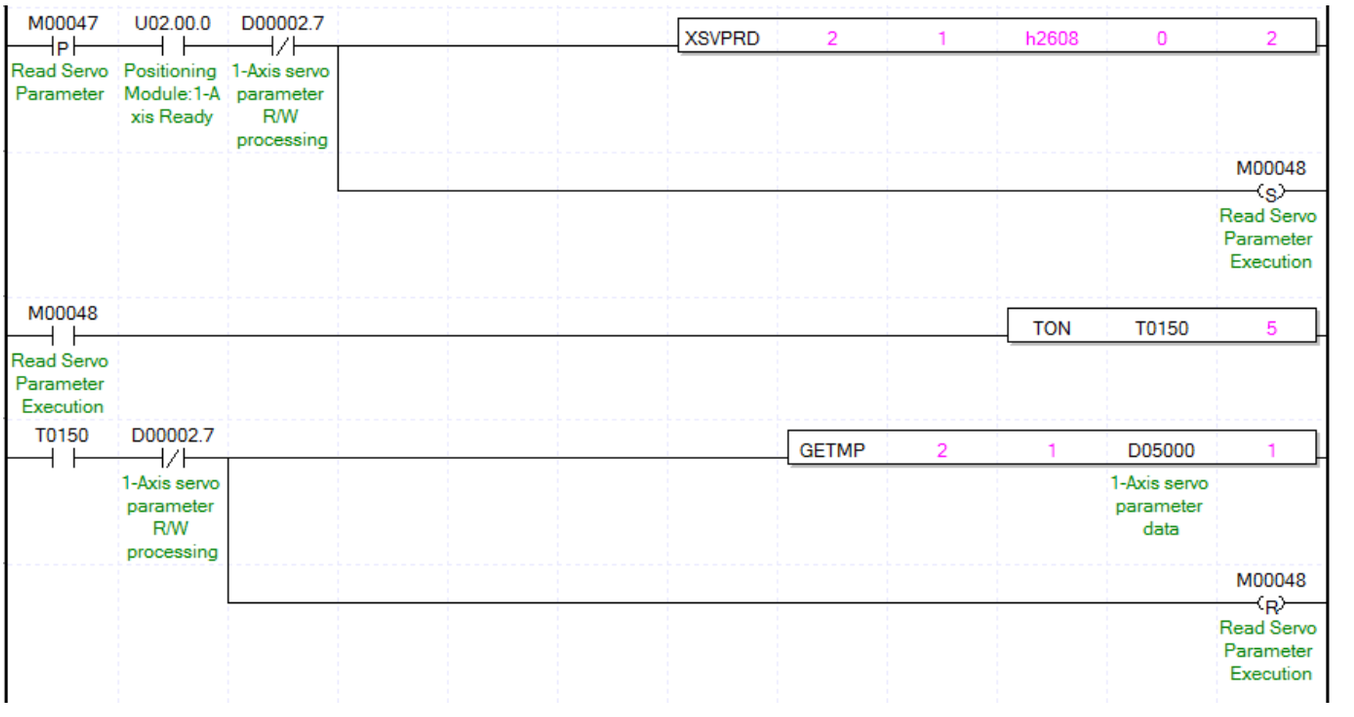
Command	XRSTR				Restart
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R ,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)

※ PMLK means P, M, L and K areas

(a) This is the command that makes the servo restart with position data set up at previous operation after it stops with DEC. stop
(b) It is unavailable to be executed when the axis is operating.
(c) If you start the axis with commands other than restart after it stops with DEC. stop, Restart will not be executed.
(d) In example above, it gives the command to 1-axis
For explain of the Restart operation, refers to “9.2.20 Restart item”.

6.3.55 Servo Parameter Read (command: XSVPRD)

(1) Program



(2) Explain

Device	Description
M00047	Axis1 servo parameter read input
D00002.7	Axis1 servo parameter read/write processing
D05000	Axis1 servo parameter reading data

Command	XSVPRD				Servo parameter read
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R ,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Index	PMLK,constant,D,Z,R ,ZR	WORD	Servo parameter Index (0x1000 ~ 0x9FFF)
	OP4	Sub-Index	PMLK,constant,D,Z,R ,ZR	WORD	Servo parameter Subindex (0x00 ~ 0xFF)
	OP5	Data size	PMLK,constant,D,Z,R ,ZR	WORD	Servo parameter Length (Byte) (1~4)

※ PMLK means P, M, L and K areas

(a) This command is for reading the CoE Object value of the servo drive connected to Commands positioning module.
(b) Executes the command to read the parameter (CoE Object) value specified by OP3, OP4, OP5 among the servo parameters of the command axis of the positioning module.
(c) It is available to be executed when the axis is operating.
(d) The values that can be set for OP is as follows.

Setting Value	Content
0x1000 ~ 0x1FFF	Communication Profile Area
0x2000 ~ 0x5FFF	Manufacturer Specific Profile Area
0x6000 ~ 0x9FFF	Standardized Device Profile Area

(e) The values that can be set for OP4 is as follows.

Setting Value	Content
0x0 ~ 0xFF	Servo parameter Object Subindex

(f) OP5 is used to set the data length. The values that can be set for OP5 are as follows.

Setting Value	Content
1~4	Servo parameter Object Byte Length

(g) When the servo parameter read command is executed, the positioning module reads data from the servo drive and stores it in the data common area. To save to device for use in PLC program, use GETM or GETMP command after executing the servo parameter read command. The data common area address specified by the GETM or GETMP command are as follows.

Setting address	Content
0	Axis 1 Servo parameter index(lower) / Subindex (Upper)
1	Axis 1 Servo parameter data value
2	Axis 2 Servo parameter index(lower) / Subindex (Upper)
3	Axis 2 Servo parameter data value
4	Axis 3 Servo parameter index(lower) / Subindex (Upper)
5	Axis 3 Servo parameter data value
6	Axis 4 Servo parameter index(lower) / Subindex (Upper)
7	Axis 4 Servo parameter data value
8	Axis 5 Servo parameter index(lower) / Subindex (Upper)
9	Axis 5 Servo parameter data value
10	Axis 6 Servo parameter index(lower) / Subindex (Upper)
11	Axis 6 Servo parameter data value
12	Axis 7 Servo parameter index(lower) / Subindex (Upper)
13	Axis 7 Servo parameter data value
14	Axis 8 Servo parameter index(lower) / Subindex (Upper)
15	Axis 8 Servo parameter data value

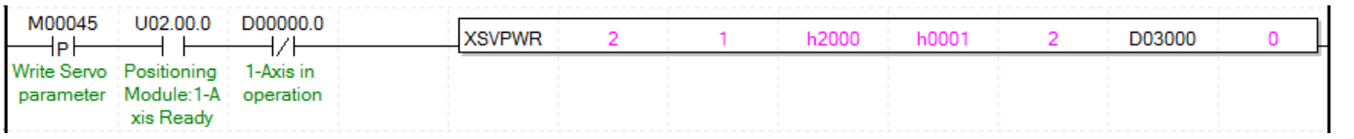
(h) The example program above reads the h2606 (DCLink voltage) parameter and saves it in the D05000 device, after the servo parameter read command is executed. At example program, when the status of Servo parameter R/W processing is Off after 5 ms after executing the servo parameter read command (Servo parameter read complete status), save the axis 1 servo parameter data value of the common area in D05000. When the status of Servo parameter R/W processing is Off after at least 4ms after executing the servo parameter read command, the GETM (or GETMP) instruction must be executed.After the data read from the module is updated in the data common area, the reflected value can be read.

(i) If you want to check the index and subindex of the read servo parameters, set the read address of above GETMP to 0, and set the number of data to read to 2.

(j) This action can be completed in multiple scans.

6.3.56 Servo Parameter Write (Command: XSVPWR)

(1) Program



(2) Explain

Device	Description
M00040	Axis1 servo parameter write
D00000.0	Axis1 operating
D03000	Servo parameter data save device

Command	XSVPWR				Server parameter write
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Index	PMLK,constant,D,Z,R,ZR	WORD	Servo parameter Index (0x2000 ~ 0x9FFF)
	OP4	Sub-Index	PMLK,constant,D,Z,R,ZR	WORD	Servo parameter Subindex (0x00 ~ 0xFF)
	OP5	Data size	PMLK,constant,D,Z,R,ZR	WORD	Servo parameter Length (Byte) (1~4)
	OP6	Data	PMLK,constant,D,Z,R,ZR	DINT	Write data(Object change value among servo parameters)
	OP7	Write method	PMLK,constant,D,Z,R,ZR	WORD	Write method setting (0:RAM teaching, 1:ROM teaching)

※ PMLK means P, M, L and K areas

(a) This command is for changing the parameter (CoE Object) of the servo drive connected to the positioning module.
(b) This command changes designated object as OP3, OP4, OP5 among the servo parameter of command axis to Op6.
(c) It is unavailable to be executed when the axis is operating.
(d) The values that can be set for OP is as follows.

Setting Value	Content
0x64 ~ 0x400	Servo parameter address
0x2000 ~ 0x5FFF	Manufacturer Specific Profile Area
0x6000 ~ 0x9FFF	Standardized Device Profile Area

(e) The values that can be set for OP4 is as follows.

Setting Value	Content
0x0 ~ 0xFF	Servo parameter Object Subindex

(f) The values that can be set for OP5 is as follows.

Setting Value	Content
1 ~ 4	Servo parameter Object Byte Length

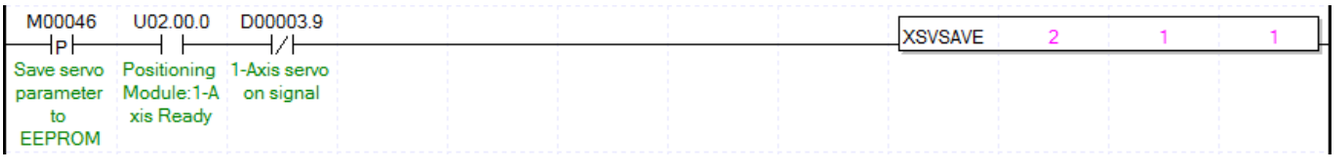
(g) The values that can be set for OP7 is as follows.

Setting Value	Teaching method
0	RAM Teaching
1	ROM teaching

(h) This action can be completed in multiple scans.

6.3.57 Save Slave Parameter to EEPROM (command: XSVSAVE)

(1) Program



(2) Explain

Device	Description
M00041	Axis1 servo parameter save
U02.00.0	Axis 1 Ready
D00003.9	Axis1 servo on signal

Command	XSVSAVE				Save slave parameter to EEPROM
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Save axis	PMLK,constant,D,Z,R,ZR	WORD	Axis to store servo parameters

※ PMLK means P, M, L and K areas

(a) This command saves the parameters of the servo drive connected to the positioning module to the EEPROM inside the servo drive.

(b) The command axis set in OP2 is separate from the axis storing the servo parameters. Therefore, to save the servo parameter, the bit of the corresponding axis must be set to OP3 bit.

(c) Save the servo drive parameters of the axis set in OP3

(d) It is unavailable to be executed when the axis is Servo on status.

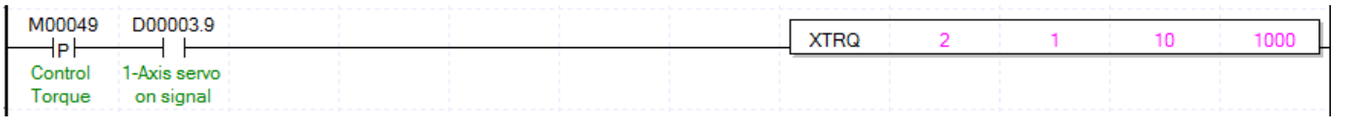
(3) Each bit of OP3 value means each axis as below. To select the axis, set the bit of the related axis.

15 ~ 8 Bit	7Bit	6Bit	5Bit	4Bit	3Bit	2Bit	1Bit	0Bit
Do Not Use	Axis 8	Axis 7	Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1

(f) This action can be completed in multiple scans.

6.3.58 Torque Control (command: XTRQ)

(1) Program



(2) Explain

Device	Description
M00042	Axis 1 torque control command
D00003.9	Axis1 servo on signal

Command	XTRQ				Torque control
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Torque values	PMLK,constant,D,Z,R,ZR	INT	Torque values (unit:%, -32768 ~ 32767)
	OP4	Slope	PMLK,constant,D,Z,R,ZR	WORD	Torque Inclination (unit:ms, 0 ~ 65535ms)

※ PMLK means P, M, L and K areas

(a) This command is a Torque control command to the positioning module. Torque control is executed by setting the torque value and torque slope.

(b) Set the torque value (%) to be operated in OP3. The torque value operates as a percentage of the rated torque. (1 = 1% of rated torque)
For example, set 200 to perform torque control with 200% torque.

※ The allowable range of torque value depends on the type of servo drive connected. Generally, the target torque value is limited to the maximum torque setting.

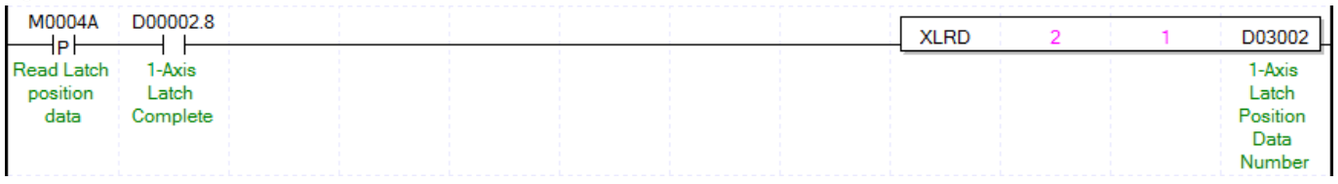
(c) Set the time to reach the target torque at OP4. When the command is is executed, the torque increases to the torque value of the target torque at the set slope.

(d) It is unavailable to be executed when the axis is operating other than torque control.

(e) This action can be completed in multiple scans.

6.3.59 Latch Position Data Read (command: XLRD)

(1) Program



(2) Explain

Device	Description
M00043	Axis 1 latch data read command
D00002.8	Axis 1 latch completion
D3002	Axis 1 Number of latch position data

Command	XLRD				Torque control
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Device	PMLK,D,Z,R,ZR	WORD	Leading address of device to save the latch data

※ PMLK means P, M, L and K areas

(a) This command is used to read the number of latch data and latch position data stored by the external latch command signal of the positioning module.

(b) The latch data of specified axis as OP2 of the positioning module specified as OP1 (slot number of positioning module) is read and save in the specified device as OP3.

(c) The values saved in the device area specified in OP3 are as follows.

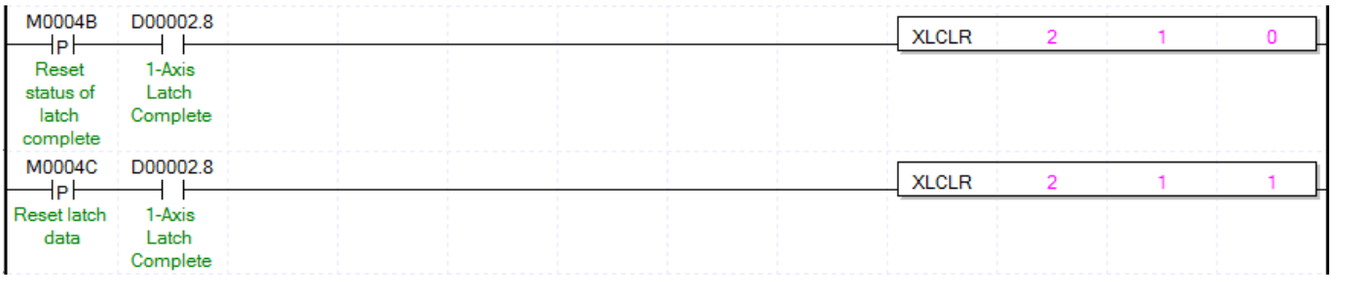
Device number	Size	Content
Device	WORD	Number of latch position data
Device +1	WORD	-
Device +2	DINT	Latch position data 1
Device +4	DINT	Latch position data 2
Device +6	DINT	Latch position data 3
Device +8	DINT	Latch position data 4
Device +10	DINT	Latch position data 5
Device +12	DINT	Latch position data 6
Device +14	DINT	Latch position data 7
Device +16	DINT	Latch position data 8
Device +18	DINT	Latch position data 9
Device +20	DINT	Latch position data 10

(d) The latch position data read command is a level command, and every scan is executed when the contact of the input condition is on.

(e) This action can be completed in multiple scans.

6.3.60 Latch Reset (Command: XLCLR)

(1) Program



(2) Explain

Device	Description
M00044	1 Axis latch completion status reset
M00045	Axis 1 latch data reset
D00002.8	Axis 1 latch completion

Command	XLCLR				Torque control
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Item	PMLK,constant,D,Z,R,ZR	WORD	Latch reset item

※ PMLK means P, M, L and K areas

(a) This command is used to initialize the number of latched data stored in the positioning module, latch position data and latch completion status.

(b) The latch data of specified axis as OP2 of the positioning module specified as OP1 (slot number of positioning module) is reset.

(c) The following items are reset according to the latch reset item specified in OP3.
0: Latch completion status reset
1: Latch position data and latch completion status reset
(Values above 1 are treated the same as “1”)

(d) If 1 is set to OP3 and the latch reset command is executed, the latch position data is read with the latch position data read command (XLRD), and all the data becomes 0.

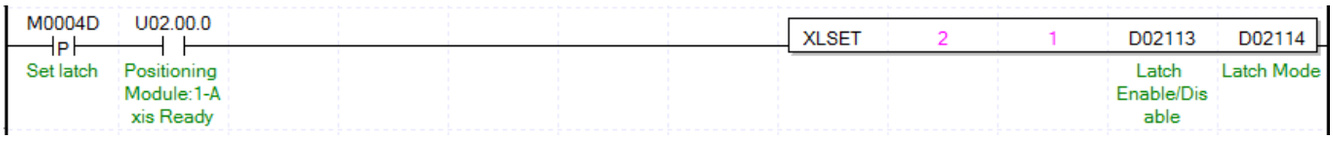
(e) This action can be completed in multiple scans.

Notes

The XBF-PN04B/XBF-PN08B module supports 2 type latch mode. When setting single trigger among latch mode, after the first touch probe 1 signal is input and latched, in order to the latch function to operate a the next touch probe 1 signal, the latch reset command must always be used to enable latch.
In other words, in the latch reset single trigger of XBF-PN04B/XBF-PN08B, the latch reset command function to active the next latch trigger after the touch probe 1 signal is input and the latch position is saved.
(Even if the latch setting commands is set to allow latch and then executed again, it operates the same way.)

6.3.61 Latch Setting (command: XLSET)

(1) Program



(2) Explain

Device	Description
M00046	Axis 1 latch setting
U02.00.0	Axis 1 Ready
D02113	Latch enable/disable
D02114	Latch mode

Command	XLCLR				Torque control
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Enable/disable	PMLK,constant,D,Z,R,ZR	WORD	Latch enable/disable(0:disabled, 1:enable)
	OP4	Mode	PMLK,constant,D,Z,R,ZR	WORD	Latch mode (0: single trigger, 1 : continuous trigger)

※ PMLK means P, M, L and K areas

(a) This command is used to enable/disable the external latch function of the positioning module or to set the latch mode.

(b) Enable/disable the latch function of the axis specified axis as OP2 of positioning module as OP1 (slot number of positioning module) or set the latch mode.

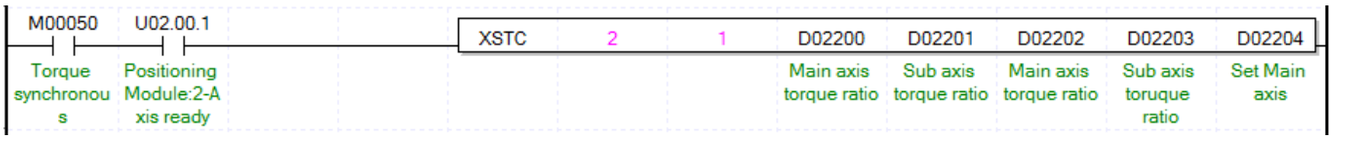
(c) The operation according to the allow/prohibit latch items specified in OP3 is as follows.
0: Latch disable
1: Latch Enable
(Values above 1 are treated the same as “1”)

(d) The operation according to the latch mode item specified in OP4 is as follows.
0: Single trigger (After the latch is allowed, the current position is latched on the first touch probe 1 signal input.)
1: Continuous trigger (latch is allowed, the current position is latched for each touch probe 1 signal.)
(Values above 1 are treated the same as “1”)

(e) This action can be completed in multiple scans.

6.3.62 Torque Synchronization (command: XSTC)

(1) Program



(2) Explain

Device	Description
M00047	Axis 2 torque synchronization
U02.00.1	Axis 2 Ready
D02200	Main axis torque rate
D02201	Subordinate axis torque rate
D02202	Main axis speed rate
D02203	Main axis speed rate
D02204	Main Axis Setting

Command	XSTP				Torque control
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant, D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Main axis torque ratio	PMLK,constant, D,Z,R,ZR	WORD	Main axis torque ratio
	OP4	Subordinate axis torque ratio	PMLK,constant, D,Z,R,ZR	WORD	Subordinate axis torque ratio
	OP5	Main axis speed ratio	PMLK,constant, D,Z,R,ZR	WORD	Main axis speed ratio
	OP6	Subordinate axis speed ratio	PMLK,constant, D,Z,R,ZR	WORD	Subordinate axis speed ratio
	OP7	Main axis setting	PMLK,constant, D,Z,R,ZR	WORD	Main Axis Setting XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)

※ PMLK means P, M, L and K areas

(a) This command is that is the When the torque synchronization to the corresponding axis of the positioning module.

(b) The torque synchronization command is executed on the axis specified by OP2 of the positioning module specified by OP1 (slot number of the positioning module).

(c) The command execution axis executes torque synchronization with the axis set in OP7 as the main axis.

(d) The command execution axis operates torque synchronous operation with the torque ratio set in OP3, OP4 and the speed ratio set in OP5, OP6.

Subordinate axis torque = (OP4/OP3) * main axis torque

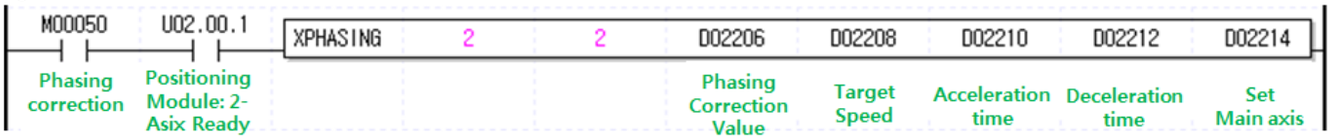
Subordinate axis torque synchronization speed = (OP6/OP5) * Main axis speed

(e) This action can be completed in multiple scans.

(f) The torque control reference value of the main with which the subordinate axis is synchronized can be selected between actual torque and required torque.
Select the torque synchronization control reference value of common parameter from 0: actual torque value or 1: required torque value.
(It can be set by XG-PM or common parameter teaching command (XSCP/XSCPEX))

6.3.63 Phase Compensation (command: XPHASING)

(1) Program



(2) Explain

Device	Description
M00050	Axis 2 phase compensation
U02.00.1	Axis 2 Ready
D02206	Phase compensation
D02208	Phase compensation speed
D02210	Accel. time
D02212	deceleration time
D02214	Main Axis Setting

Command	XPHASING				Phase compensation
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R, ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Phase compensation	PMLK,constant,D,Z,R, ZR	DINT	Phase compensation (-2,147,483,648 ~ 2,147,483,647)
	OP4	Target speed	PMLK,constant,D,Z,R, ZR	DWORD	Phase compensation speed(Relative speed to main axis speed)
	OP5	Acceleration time	PMLK,constant,D,Z,R, ZR	DWORD	Acc. time (0 ~ 2,147,483,647 ms)
	OP6	Deceleration time	PMLK,constant,D,Z,R, ZR	DWORD	deceleration time (0 ~ 2,147,483,647 ms)
	OP7	Main axis	PMLK,constant,D,Z,R, ZR	WORD	Main axis XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8) 9: Encoder 1

※ PMLK means P, M, L and K areas

(a) This command is that executes phase compensation to the corresponding axis of the positioning module.
(b) The axis designated as OP2 of the positioning module designated as OP1 (slot number of the positioning module)

executes phase compensation operation using the phase compensation speed, acceleration time, and deceleration time set in OP4~OP6 as much as the phase compensation amount designated as OP3.

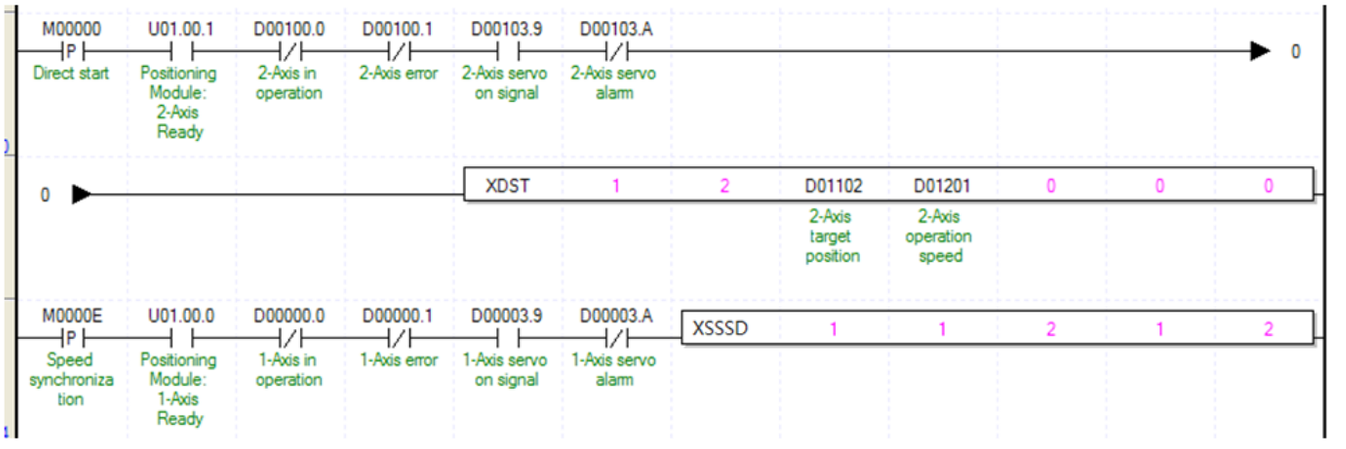
(c) The command execution axis executes phase compensation operation with the axis set in OP7 as the main axis.

(d) It can be operated only when the axis is in speed synchronous operation or cam operation

(e) This action can be completed in multiple scans.

6.3.64 32 bit Speed Synchronization (command: XSSSD)

(1) Program



(2) Explain

Device	Description
M0000E	axis1 speed synchronous start input
M0000D	Axis2 direct start input
D00003.9	Axis1 servo on signal
D00103.9	Axis2 servo on signal

Command	XSSSD				32-bit speed synchronization
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	XBF-PN04B(1~4: axis1 ~ 4) XBF-PN08B(1~8: axis1 ~ 8)
	OP3	Main axis ratio	PMLK,constant,D,Z,R,ZR	DINT	Speed synchronization main axis ratio (-2,147,483,648 ~ 2,147,483,647)
	OP4	Subordinate axis ratio	PMLK,constant,D,Z,R,ZR	DINT	Speed synchronization subordinate ratio(-2,147,483,648 ~ 2,147,483,647)
	OP5	Main axis	PMLK,constant,D,Z,R,ZR	WORD	Main axis XBF-PN04B(1~4: axis1 ~ 4) XBF-PN08B(1~8: axis1 ~ 8) 9: Encoder 1

※ PMLK means P, M, L and K areas

(a) This command gives a 32-bit speed synchronization command to the positioning module. The values of the main axis ratio and the sub axis ratio can be set to a 32-bit integer range.

(b) In the example program above, if the command of synchronous start by speed is executed, axis1 (subordinate axis) is

indicated as 'in operation' but the motor does not operate. If operating axis2 set as the main axis, axis1 (subordinate axis) is operated depending on the designated ratio between main axis (OP3) and sub axis (OP4).

(c) For subordinate axis operation direction if the speed sync. Ratio (sub axis ratio / main axis ratio) is positive, operating main axis operation direction, and if it is negative, operating opposite direction of main axis.

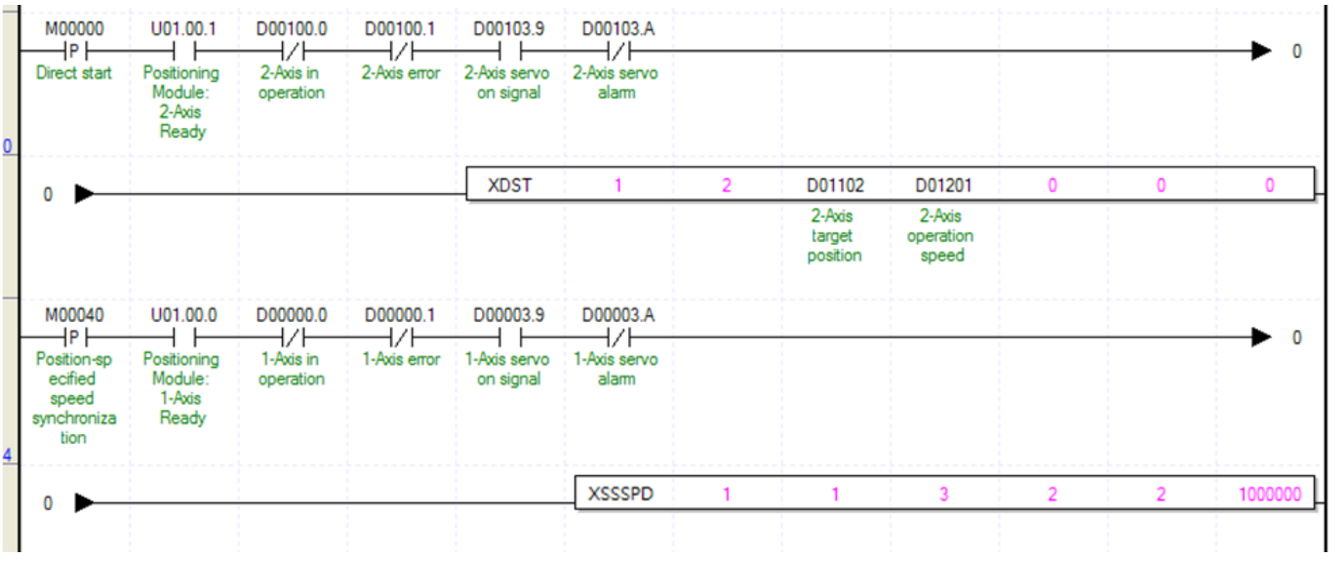
(d) For example, if main axis ratio is 100000, sub axis ratio is 123456, when main axis moves by 100000, sub axis moves 123456.

(e) For the detail description about speed sync., refer to"9.4.1 Speed Synchronous control".

(f) D device signal (axis1 in servo on signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.65 32-bit Position Specified Speed Synchronization (Command: XSSSPD)

(1) Program



(2) Explain

Device	Description
M00040	axis1 speed synchronous start input by position
M0000D	Axis2 direct start input
D00003.9	Axis1 servo on signal
D00103.9	Axis2 servo on signal

Command	XSSSPD				32-bit Position specified speed synchronization
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	XBF-PN04B(1~4: axis1 ~ 4) XBF-PN08B(1~8: axis1 ~ 8)
	OP3	Main axis ratio	PMLK,constant,D,Z,R,ZR	DINT	Speed synchronization main axis ratio (-2,147,483,648 ~ 2,147,483,647)
	OP4	Subordinate axis ratio	PMLK,constant,D,Z,R,ZR	DINT	Speed synchronization subordinate ratio(-2,147,483,648 ~ 2,147,483,647)
	OP5	Main axis	PMLK,constant,D,Z,R,ZR	WORD	Main axis XBF-PN04B(1~4: axis1 ~ 4) XbF-PN08B(1~8: axis1 ~ 8) 9: Encoder 1

	OP6	Target position	PMLK,constant,D,Z,R,ZR	DINT	Target position of Speed synchronous start with position

※ PMLK means P, M, L and K areas

(a) This command gives a 32-bit Position specified speed synchronization command to the positioning module. The values of the main axis ratio and the sub axis ratio can be set to a 32-bit integer range.

(b) In the example program above, if the position specified speed synchronization command executes, axis1 (subordinate axis) is indicated as in operation but the motor does not operate. If operating axis2 set as the main axis, axis1 (subordinate axis) is operated depending on the designated ratio between main axis (OP3) and sub axis (OP4). After the subordinate axis 1 executes XSSSPD command, when operating position is same as target position (OP6), speed synchronization ends and stops immediately at that position.

(c) For subordinate axis operation direction if the speed sync. ratio (sub axis ratio / main axis ratio) is positive, operating main axis operation direction, and if it is negative, operating opposite direction of main axis.

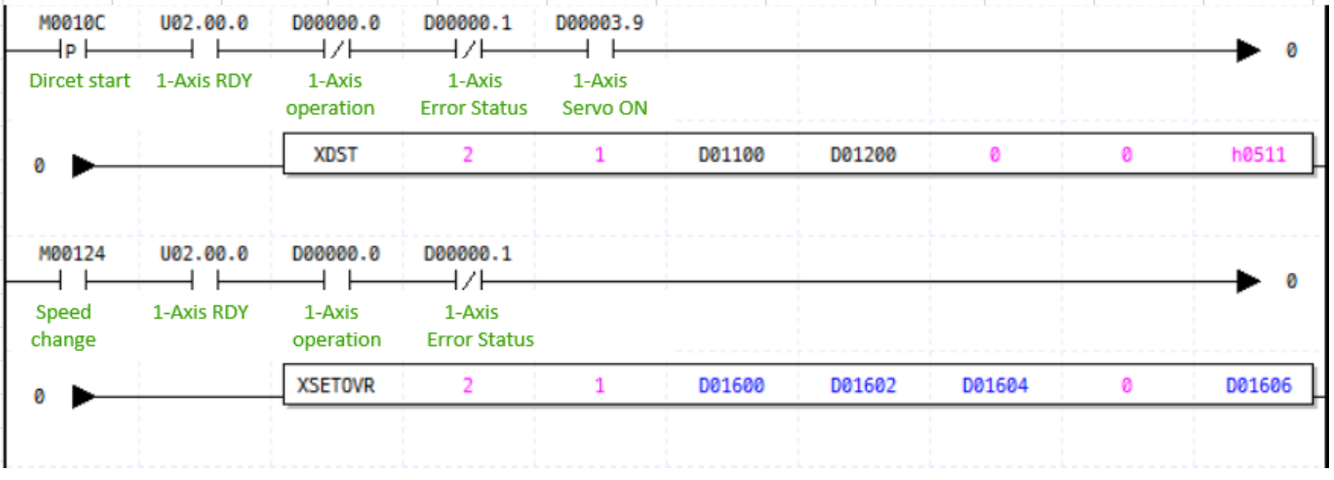
(d) For example, if main axis ratio is 100,000, sub axis ratio is 123,456 and target position is 1,000,000, when main axis moves by 100000, sub axis moves 123456. It stops by where position of main axis is at 1,000,000.

(e) For the detail about position specified speed synchronization operation, refer to"9.4.1 Speed Synchronous Start Control".

(f) D device signal (axis1 in servo on signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

6.3.66 Speed Acceleration/Deceleration Override (command: XSETOVR)

(1) Program



(2) Explain

Device	Description
M00124	axis1 speed override input
M0010C	axis1 direct start input
U02.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D00003.9	Axis1 servo on signal
D01200	Goal speed value
D01600	Speed override rate(or command speed)
D01602	Accel. Time override rate(or command accel. time)

D01604	Decel. Time override rate(or command decel. time)
D01606	Operation Direction

Command	XSETOVR				Speed Acceleration/Deceleration Override
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Speed	PMLK,constant,D,Z,R,ZR	DINT	Speed override rate(or command speed)
	OP4	Acceleration	PMLK,constant,D,Z,R,ZR	UDINT	Accel. Time override rate(or command accel. time)
	OP5	Deceleration speed	PMLK,constant,D,Z,R,ZR	UDINT	Decel. Time override rate(or command decel. time)
	OP6	S-curve	PMLK,constant,D,Z,R,ZR	DINT	Unused S-curve ratio (0=Trapezoid, 1~100=S-Curve ratio)
	OP7	Operation Direction	PMLK,constant,D,Z,R,ZR	DINT	Direction to operate (1~3: 1-forward direction,2-reverse direction,3- current direction)

※ PMLK means P, M, L and K areas. (a) OP3 means speed override item when the “speed override” item of the common parameter is “0% specified ” and setting range is 65,535 to +65,535 , which means -655.35% ~ 655.35% In case of “1: speed specified” it means command speed and the setting range is -(speed limit value of operation parameter item) to + (speed limit value of operation parameter item).

(b) OP4 means the acceleration time override ratio when the ‘Speed Override’ item of the common parameter is ‘0:% specified’, and the setting range is -65,535 ~ +65,535, which means -655.35% ~ 655.35%. In case of‘1; speed specified’, it means command accel. time and the setting range is 0 ~ 4,294,967,295.

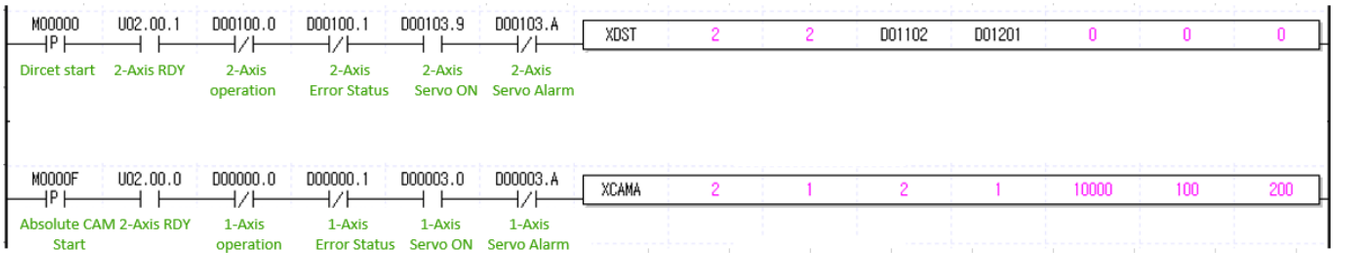
(c) OP5 means the deceleration time override ratio when the ‘Speed Override’ item of the common parameter is ‘0:% specified’, and the setting range is -65,535 ~ +65,535, which means -655.35% ~ 655.35%. In case of‘1; speed specified’, it means command accel. time and the setting range is 0 ~ 4,294,967,295.

(d) For the detail about speed override operation, refer to“9.5.5 Speed Override”.

(e) The operation direction (OP7) can only be set to 1 (forward), 2 (reverse), and 3 (current direction).

6.3.67 Absolute Position CAM Operation (command: XCAMA)

(1) Program



(2) Explain

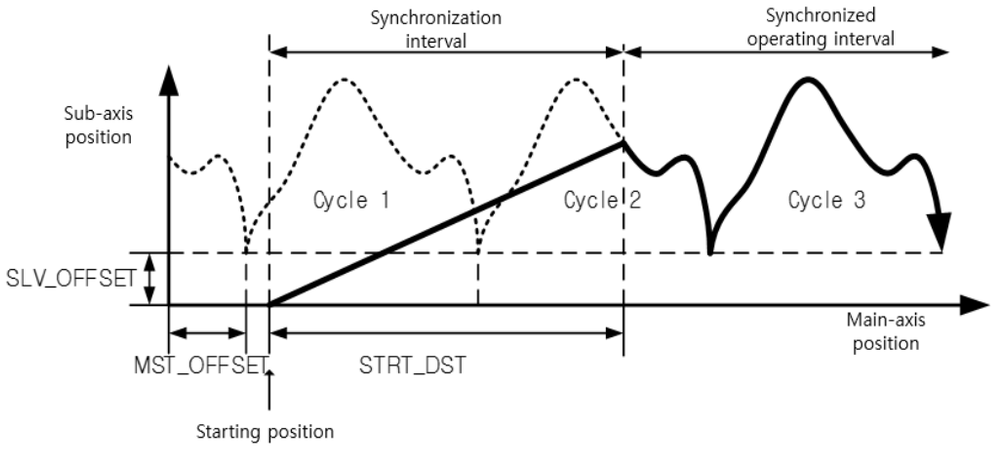
Device	Description
M0000F	axis1 cam operation input
M0000D	Axis2 direct start input
U02.00.0	Operation Ready of axis 1
U02.00.1	Operation Ready of axis 2
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D00003.9	Axis1 servo on signal
D00003.A	Axis1 servo error status
D00100.0	Axis2 signal in operation
D00100.1	Axis2 error state
D00103.9	Axis2 servo on signal
D00103.A	Axis2 servo error status

Command	XCAM				Cam Operation
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D, Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Main axis	PMLK,constant,D, Z,R,ZR	WORD	Main axis XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8) 9: Encoder 1
	OP4	CAM block	PMLK,constant,D, Z,R,ZR	WORD	Cam data block to apply to operation (1 ~ 9)
	OP5	Cam operation start movement amount	PMLK,constant,D, Z,R,ZR	DINT	Cam operation start movement amount
	OP6	main axis offset	PMLK,constant,D, Z,R,ZR	DINT	main axis offset
	OP7	Subordinate axis offset	PMLK,constant,D, Z,R,ZR	DINT	Subordinate axis offset

※ PMLK means P, M, L and K areas

(a) In the example program above, if absolute position CAM operation command is executed, axis1 (sub axis) is indicated as In operation but the motor does not operate actually. When starting axis 2 set as main axis, linear Interpolation is performed to reach synchronous position while main axis reached synchronous start position (OP5). Depending on the setting of main axis offset (OP6) and subordinate axis offset (Op7) values, the subordinate position of subordinate axis moves.

(b) When the main axis operates as mun as cam operation start movement amount (op5), operation begins to the position of subordinate axis related to position of axis main axis according to the data value of the cam data block set in the cam block (OP4).



(c) Maximum number of cam data block is 9. Data of cam data block set in cam block (OP4)

(d) Cam data is set on positioning package but has to be downloaded at positioning module before cam operation.

(e) For the detail about cam operation, refer to“9.4.3 Cam Operation”.

(f) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

(g) In order to use user CAM operation, you have to set CAM block number 9.

(h) In case of user cam operation, user cam data can be change by variable data write command even during operation.

(i) For the detail about user cam (CAM) operation, refer to“9.4.4 User Cam Operation”.

6.3.68 Touch Probe (command: XTPROBE)

(1) Program

(2) Explain

Device	Description
M00125	Axis1 Touch probe set
U01.00.0	Axis 1 Ready
D02115	Trigger signal
D02116	Trigger mode
D02117	Window mode
D02118	Window mode enable start position
D02119	Window mode enable end position

Command	XTPROBE				Touch Probe
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Trigger signal	PMLK,constant,D,Z,R,ZR	WORD	Signal to use as trigger input
	OP4	Trigger mode	PMLK,constant,D,Z,R,ZR	WORD	Trigger mode (0: single trigger, 1 : continuous trigger)
	OP5	Window mode	PMLK,constant,D,Z,R,ZR	WORD	Window mode (0: disable, 1: enable)
	OP6	Window mode enable area start position	PMLK,constant,D,Z,R,ZR	DINT	Window mode enable area start position value (-2,147,483,648 ~ 2,147,483,647)
	OP7	Window mode enable area end position	PMLK,constant,D,Z,R,ZR	DINT	Window mode enable area end position value (-2,147,483,648 ~ 2,147,483,647)

※ PMLK means P, M, L and K areas

(a) This command is used to set the external touch probe function of the positioning module.

(b) The touch probe function set the on the axis specified by OP2 of the positioning module specified by OP1 (slot number of the positioning module).

(c) The signal to be used as the trigger input specified in OP3 can be specified as follows.

0: Touch probe 1 rising edge
1: Touch probe 2 rising edge
2: Touch probe 1 falling edge
3: Touch probe 2 falling edge
4: Touch probe 1 index (Z) pulse
5: Touch probe 2 index (Z) pulse

※ The rising or falling edge of each touch probe and the index (Z) pulse cannot be executed simultaneously.

(d) The operation according to the Trigger mode item specified in OP4 is as follows.
0: Single trigger (after the trigger mode is setting, the current position is latched on the first touch probe 1 signal input.)
1: Continuous trigger (after the trigger mode is setting, the current position is latched for each touch probe 1 signal.)
(Values above 1 are treated the same as "1")

(e) The operation according to the window mode item specified in OP5 is as follows. When window mode is enabled, it works only as a single trigger.
0: window mode disable
1: Window mode enable

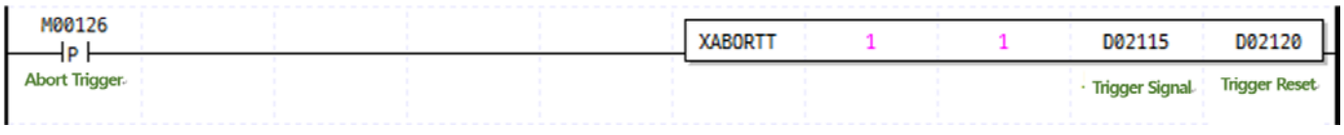
(f) This action can be completed in multiple scans.

(g) The version information to use the touch probe setting command is as follows.

	Version
XBF-PN04B OS	V1.80 or higher
XBF-PN08B OS	V1.80 or higher
XBCU CPU	V1.90 or higher
XBMHP,H2 CPU	V2.20 or higher
XG5000	V4.28 or higher

6.3.69 Trigger Off (command: XABORTT)

(1) Program



(2) Explain

Device	Description
M00126	Axis 1 trigger off
D02115	Trigger signal
D02120	Trigger reset item

Command	XABORTT				Trigger off
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Trigger signal	PMLK,constant,D,Z,R,ZR	WORD	Trigger reset signal
	OP4	Trigger reset item	PMLK,constant,D,Z,R,ZR	WORD	Trigger reset item

※ PMLK means P, M, L and K areas

(a) This command is used to release the external trigger function of the positioning module.

(b) Releases the trigger function of the axis specified by OP2 of the positioning module specified by OP1 (slot number of the positioning module).

(c) The signal to be released for trigger specified in OP3 can be specified as follows.
0: Touch probe 1 rising edge
1: Touch probe 2 rising edge
2: Touch probe 1 falling edge
3: Touch probe 2 falling edge
4: Touch probe 1 index (Z) pulse
5: Touch probe 2 index (Z) pulse

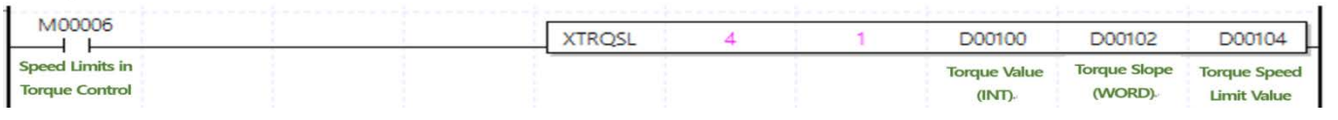
(d) The signal to be reset for trigger specified in OP4 can be specified as follows.
0: Trigger completion status reset
1: Trigger position data and trigger completion status reset

(e) The version information to use the command is as follows.

	Version
XBF-PN04B OS	V1.80 or higher
XBF-PN08B OS	V1.80 or higher
XBCU CPU	V1.90 or higher
XBMHP,H2 CPU	V2.20 or higher
XG5000	V4.26 or higher

6.3.70 Speed limit Torque Control (command: XTRQSL)

(1) Program



(2) Explain

Device	Description
M00006	Axis 1 speed limit torque control command execution
D00100	Torque values
D00102	Torque slope
D00104	Torque speed limit values

Command	XTRQSL				Speed limit torque control
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Torque values	PMLK,constant,D,Z,R,ZR	INT	Torque values (unit: 0.1%, -32768 ~ 32767)
	OP4	Slope	PMLK,constant,D,Z,R,ZR	WORD	Torque slope(unit: ms, 0~65535ms)
	OP5	Speed Limit	PMLK,constant,D,Z,R,ZR	WORD	Speed limit (unit: rpm, 0~6000)

※ PMLK means P, M, L and K areas

(a) This command is used to execute torque control at a speed below the limited speed of Command positioning module. This command only applies to the LS ELECTRIC servo drive family.

(b) The speed limit torque control command set the on the axis specified by OP2 of the positioning module specified by OP1 (slot number of the positioning module).

(c) Set the torque value (%) to be operated in OP3. The torque value operates 0.1% unit of the rated torque. (1 = 0.1% of rated torque)

For example, set 2000 to perform torque control with 200.0% torque.

(d) Set the time to reach the target torque at OP4. When the command is is executed, the torque increases to the torque value of the target torque at the set slope.

(e) The speed limit of OP5 is set by “speed limit value during torque control” parameter and operates at the maximum speed value during torque operation.

(e) It is unavailable to be executed when the axis is operating other than torque control.

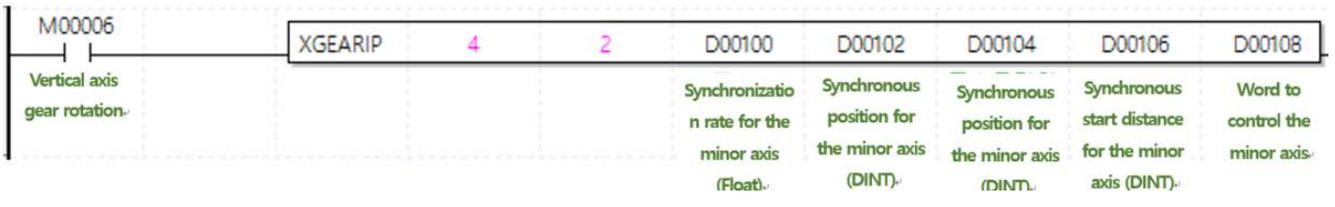
(f) This action can be completed in multiple scans.

(g) The version information to use the command is as follows.

	Version
XBF-PN04B OS	V1.80 or higher
XBF-PN08B OS	V1.80 or higher
XBCU CPU	V1.90 or higher
XBMHP,H2 CPU	V2.20 or higher
XG5000	V4.28 or higher

6.3.71 Sync Position Specified Speed Synchronization (command: XGEARIP)

(1) Program



(2) Explain

Device	Description
M00006	Axis 2 sync position specified speed synchronization command execution
D00100	Sync ratio
D00102	Main axis synchronous position
D00104	Subordinate axis synchronous position
D00106	Main axis synchronous start distance
D00108	Control word

Command	XGEARIP				Synchronous position specified speed synchronization
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN04B (1~4: axis1 ~ 4) XBF-PN08B (1~8: axis1 ~ 8)
	OP3	Sync ratio	PMLK,constant,D,Z,R,ZR	REAL	Synchronous ratio(Subordinate axis ratio/Main axis ratio)

	OP4	Main axis synchronous position	PMLK,constant,D,Z,R,ZR	DINT	Main axis position to be synchronized
	OP5	Subordinate axis synchronous position	PMLK,constant,D,Z,R,ZR	DINT	Subordinate axis position to be synchronized
	OP6	Main axis synchronous start position	PMLK,constant,D,Z,R,ZR	DINT	Distance of main axis to start synchronous operation
	OP7	Control word	PMLK,constant,D,Z,R,ZR	WORD	Main axis number

※ PMLK means P, M, L and K areas

(a) This command is used to start speed synchronization operation at the specified position of the positioning module and executes speed synchronization operation that can specify the location where speed synchronization is executing.

(b) The synchronous positions specified speed synchronization command set the on the axis specified by OP2 of the positioning module specified by OP1 (slot number of the positioning module).

(c) Set the synchronous ratio in OP3. If the synchronous ratio is positive, it operates in the direction of the main axis, and if it is negative, it operates in the opposite direction of the main axis.

(d) For example, if the sync ratio is set to 0.5, when the main axis moves 3000, the sub axis moves 1500.

(e) Details of control word (OP7) for each Bit are as follows.

1) XBF-PN04B, XBF-PN08B

15 ~ 13	12 ~ 8	7 ~ 6	5 ~ 4	3 ~ 0
-	-	Deceleration time	Acceleration time	Main axis

(a) Main axis

- XBF-PN04B: 1 ~ 4(axis1 ~ 4), 9: encoder1, 10: encoder2
- XBF-PN08B: 1 ~ 8(axis1 ~ 8), 9: encoder1, 10: encoder2

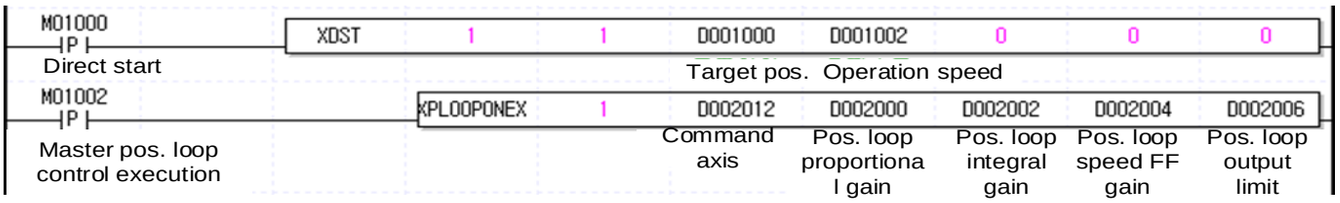
(f) This action can be completed in multiple scans.

(g) The version information to use the command is as follows.

	Version
XBF-PN04B OS	V1.80 or higher
XBF-PN08B OS	V1.80 or higher
XBCU CPU	V1.90 or higher
XBMHP,H2 CPU	V2.20 or higher
XG5000	V4.28 or higher

6.3.72 Master Position Control Loop Execution (command: XPLOOPON)

(1) Program



(2) Explain

Device	Description
M01000	Direct start
M01002	Master position loop control execution
D001000	Target position
D001002	Operating speed
D002000	Position loop position gain
D002002	Position loop integral gain
D002004	Position loop speed FF gain
D002006	Position loop output limit
D002012	Command axis

Command	XPLOOPON				Master position control setting
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XGF-PN4B (1~4: axis1 ~ 4) XGF-PN8B (1~8: axis1 ~ 8)
	OP3	Proportional gain	PMLK,constant,D,Z,R,ZR	DWORD	Master position control proportional gain (unit: 1/1000)
	OP4	Integral gain	PMLK,constant,D,Z,R,ZR	DWORD	Master position control integral gain (unit: 1/1000)
	OP5	Speed FF gain	PMLK,constant,D,Z,R,ZR	DINT	Master position control speed Feedforward gain (unit: 1/ 1000)
	OP6	Output limit	PMLK,constant,D,Z,R,ZR	DWORD	Master position control Output limit

※ PMLK means P, M, L and K areas

(a) This command is command to execute the position loop control being executed on the servo drive connected as a slaves in positioning module.

(b) When the command is executed, the execution mode of the servo drive set to the OP2 is changed to CSV mode, and the difference (position error) between the command position and the current position of the axis is input to the PI-FF controller command speed by the master. The PDO Object must have a target speed (0x60FF).

(c) It can be executed on any axis that can be commanded, and after execution, the axis can be operated with an existing start command. It is unavailable when the axis is operating.

(d) To update the gain during executing command, change the operand of commands and executes it again. The control gain can be updated during operation.

(e) The unit of master position control proportional gain specified in OP3 is 1/1000 and can specified as follows.
0 ~ 4294967295

(f) The unit of master position control integral gain specified in OP4 is 1/1000 and can specified as follows.
0 ~ 4294967295

(g) The unit of master position control speed Feed forward gain specified in OP5 is 1/1000 and can specified as follows.
-2147483648 ~ 2147483647

(h) For the master position control output limit specified in OP6, the input value is applied as output upper limit, and the negative of input value is applied as the lower output limit. If both the master position control loop output limit and Integral gain are not 0, integral control anti wind-up operates. Specify below. 0 ~ 4294967295

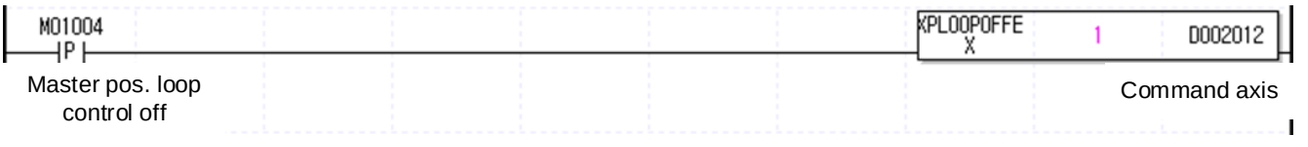
(i) If the gain of the master position control loop execution is not appropriate, the system may become unstable.

(j) The version information to use the master position control loop command is as follows.

	Version
XBF-PN04B OS	V2.10 or higher
XBF-PN08B OS	V2.10 or higher
XBCU CPU	V1.90 or higher
XBMHP,H2 CPU	V2.20 or higher
XG5000	V4.50 or higher

6.3.73 Master Position Control Loop Off (command: XPLOOPOFF)

(1) Program



(2) Explain

Device	Description
M01004	Master position loop control off
D002012	Command axis

Command	XPLOOPOFF				Master position control setting
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XGF-PN4B (1~4: axis1 ~ 4) XGF-PN8B (1~8: axis1 ~ 8)

※ PMLK means P, M, L and K areas

(a) The command is used to release the position control loop execution being executing by the CPU of the positioning module.

(b) Change from CSV mode to CSP mode so that the position control loop (executing in the positioning module CPU) of the axis specified as OP2 is executed in the slave.

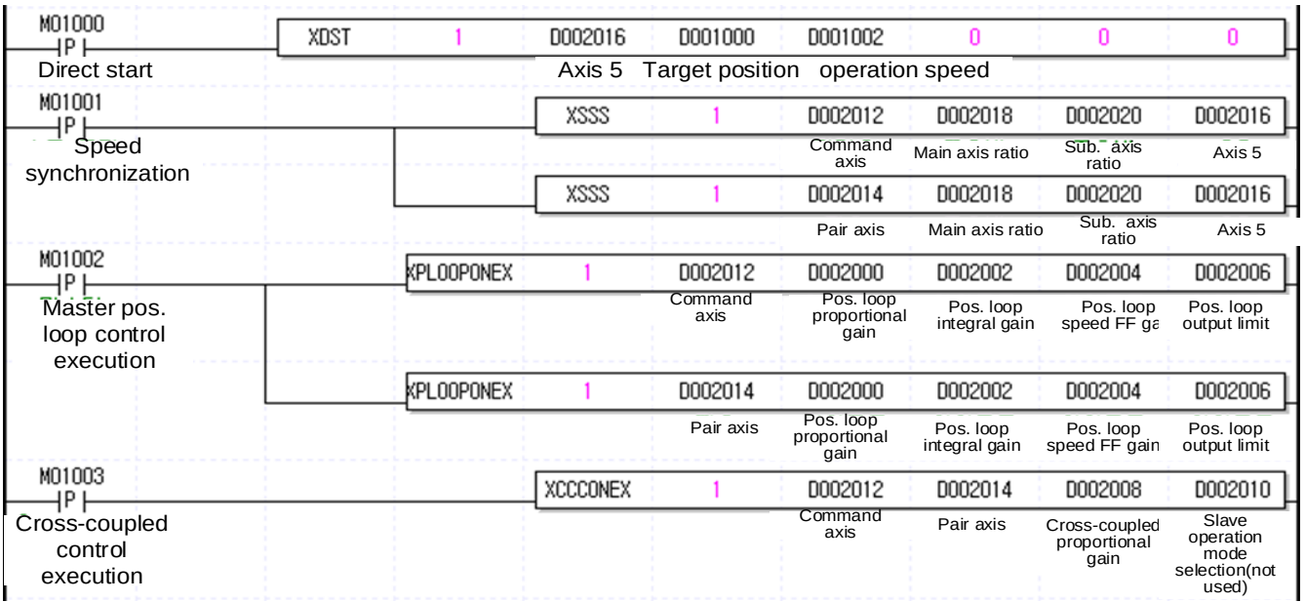
(c) If the axis specified OP2 is operating, the position control loop cannot be off.

(d) The version information to use the master position control setting command is as follows.

	Version
XBF-PN04B OS	V2.10 or higher
XBF-PN08B OS	V2.10 or higher
XBCU CPU	V1.90 or higher
XBMHP,H2 CPU	V2.20 or higher
XG5000	V4.50 or higher

6.3.74 Cross-coupled Control Execution (command: XCCCON)

(1) Program



(2) Explain

Device	Description
M01000	Direct start
M01001	Speed synchronization
M01002	Master position loop control execution
M01003	Cross-coupled control execution
D001000	Target position
D001002	Operating speed
D002000	Position loop position gain
D002002	Position loop integral gain
D002004	Position loop speed FF gain
D002006	Position loop output limit
D002008	Cross-coupled proportional gain
D002010	Slave operation mode selection(not used)
D002012	Command axis
D002014	Couple axis
D002016	Axis 5
D002018	Main axis ratio
D002020	Subordinate axis ratio

Command	XCCCON				Master position control setting
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XGF-PN4B (1~4: axis1 ~ 4) XGF-PN8B (1~8: axis1 ~ 8)
	OP3	Couple axis	PMLK,constant,D,Z,R,ZR	WORD	Axes executing cross-coupled control XGF-PN4B (1~4: axis1 ~ 4) XGF-PN8B (1~8: axis1 ~ 8)
	OP4	Proportional gain	PMLK,constant,D,Z,R,ZR	DWORD	Master position control proportional gain (unit: 1/1000)
	OP5	Slave operation mode selection	PMLK,constant,D,Z,R,ZR	WORD	Select slave operation mode during cross coupled control (Unused) 0: CSV

※ PMLK means P, M, L and K areas

(a) This command is used to decrease the difference between position errors of two servo drives connected slaves as slave.

(b) Cross-coupled control execution command do not operates single and only operates the axis where the master position control loop execution command is operating.(Axis status information)

(c) Specify axis 1 to OP2 and specified axis 2(couple axis) to OP3 If you specified same axis for OP2 andOp3, an error occurs.

(d) The unit cross- coupled control proportional gain specified in OP4 is 1/1000 and can specified as follows.
0 ~ 4294967295

(e) To update the gain during executing command, change the operand of commands and executes it again. The control gain can be updated during operation.

(f) The slave operation mode selection specified OP5 is unused item and it is an operand reserved in advance for the next planing functions. No matter what value you enter, cross-coupled control is operating as CSV mode.

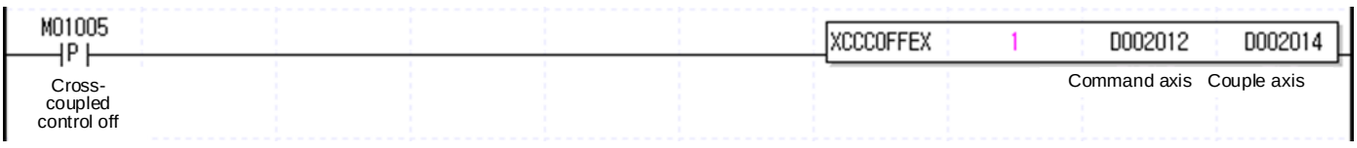
(g) If the gain of cross-coupled control executing is not appropriate, the system may become unstable.

(h) The version information to use Cross- coupled position control command is as follows.

	Version
XBF-PN04B OS	V2.10 or higher
XBF-PN08B OS	V2.10 or higher
XBCU CPU	V1.90 or higher
XBMHP,H2 CPU	V2.20 or higher
XG5000	V4.50 or higher

6.3.75 Cross-coupled Control Off (command: XCCCOFF)

(1) Program



(2) Explain

Device	Description
M01005	Cross-coupled control off
D02012	Command axis
D02014	Couple axis

Command	XCCCOFF				Master position control setting
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XGF-PN4B (1~4: axis1 ~ 4) XGF-PN8B (1~8: axis1 ~ 8)
	OP3	Couple axis	PMLK,constant,D,Z,R,ZR	WORD	Axes executing cross-coupled control XGF-PN4B (1~4: axis1 ~ 4) XGF-PN8B (1~8: axis1 ~ 8)

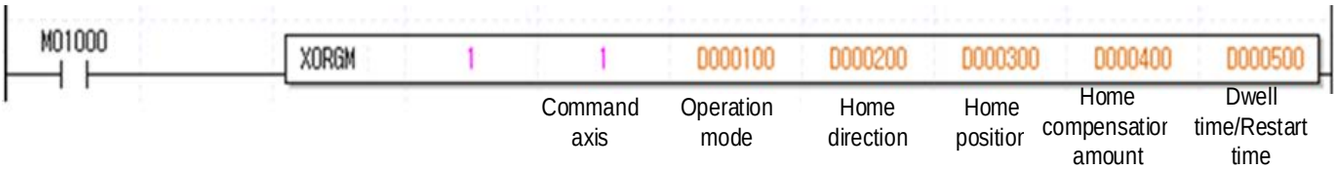
※ PMLK means P, M, L and K areas

(a) This command is used to release the set in the Cross-coupled control.
(b) When inputting the axis that cross-coupled control execution command is not executed, it will not be executed.
(c) Specify axis 1 (axis) on which cross-coupled control is being executed to OP2 and axis 2 (paired axis) to OP3.
(d) The version information to use Cross- coupled control execution command is as follows.

	Version
XBF-PN04B OS	V2.10 or higher
XBF-PN08B OS	V2.10 or higher
XBCU CPU	V1.90 or higher
XBMHP,H2 CPU	V2.20 or higher
XG5000	V4.50 or higher

6.3.76 Touch Probe Home (command: XORGM)

(1) Program



Command	XORGMEX				Touch probe home return
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XGF-PN4B (1~4: axis1 ~ 4) XGF-PN8B (1~8: axis1 ~ 8)
	OP3	Operation mode	PMLK,constant,D,Z,R,ZR	WORD	0: Touch probe1 rising edge, 1:touch probe2 rising edge 2: Touch probe1 falling edge, 3:touch probe2 falling edge 4: Touch probe1 index(Z) pulse 5: Touch probe2 index(Z) pulse
	OP4	Home direction	PMLK,constant,D,Z,R,ZR	WORD	Bits 0 home direction (0:forward direction , 1:reverse direction)
	OP5	Home position	PMLK,constant,D,Z,R,ZR	DINT	Pulse: -2,147,483,648 ~ 2,147,483,647
	OP6	Home compensation amount	PMLK,constant,D,Z,R,ZR	DINT	Pulse: -2,147,483,648 ~ 2,147,483,647
	OP7	Dwell time/ Restart time	PMLK,constant,D,Z,R,ZR	DWORD	Lower 16bit: dwell time (0~65,535ms) Upper 16bit: Restart standby time (0~65,535ms)

※ PMLK means P, M, L and K areas

※ The home high/low speed and acceleration/deceleration time of XORGM is set by the jog high/low speed, acceleration/deceleration time of manual operation parameters.

※ This commands only applies to servo product of LS electric.

(a) This command receives servo signals (touch probe or index (Z) pulse) and executes home operation in the module.
- Home (XORG) provided by network position controls home return in the servo, but this command controls home operation in the module.

(b) OP1 is the slot number of module and is the command axis to execute as OP2.

(c) OP3 is specified operation mode, and receive touch probe signal of servo.

(d) Determine the home direction in OP4. The home direction is forward in which the position values increases.

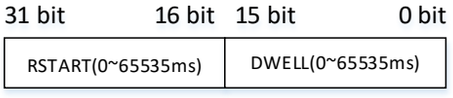
(e) Specify the home position values in OP5 after operation is completed.

(f) Specify the home complementation amount to move in OP6 after operation is completed. In case of positive, it moves in

the same direction as home

In case of negative, it moves to the opposite direction as home

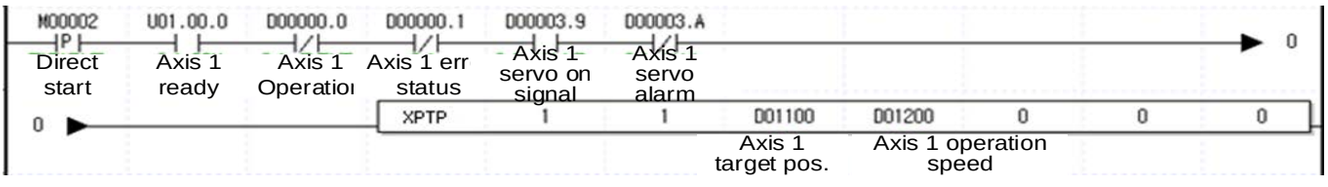
(g) Dwell time in OP7 is standby time after operation completion and the restart standby time is waiting time from the stop point before executing home operation execution after meeting all upper/lower limit. Saves divided by each 16 bit.



	supported version
XBF-PN08B OS	V2.10 or higher
XB(E)C-U	V2.00 or higher
XB(E)M-HP/H2	V2.20 or higher

6.3.77 PTP Operation (command: XPTP)

(1) Program



(2) Explain

Device	Description
M00002	PTP operation input
U01.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D00003.9	Axis1 servo on signal
D00003.A	Axis1 servo error status

Command	XDST				Direct start
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XGF-PN4B(1~4: axis1 ~ 4) XGF-PN8A/XGF-PN8B(1~8: axis1 ~ 8) XGF-PN16B(1~16: axis1 ~ 16)
	OP3	Target position 1	PMLK,D,Z,R,ZR	DINT	Target position 1(-2147483648~2147483647), Target position 2(-2147483648~2147483647)
	OP4	Goal speed	PMLK,constant,D,Z,R,ZR	DWORD	Target Velocity (0~ 4294967295)
	OP5	Dwell time	PMLK,constant,D,Z,R,ZR	WORD	Dwell time (0 ~ 65535ms)

	OP6	Repeat Count	PMLK,constant,D,Z,R,ZR	WORD	Repeat Count(0 ~ 65535)
	OP7	control word	PMLK,constant,D,Z,R,ZR	WORD	

※ PMLK means P, M, L and K areas

(a) Details of control word (OP8) for each Bit are as follows.

15 ~ 12	11 ~ 10	9 ~ 8	7 ~ 5	4	3 ~ 0
-	Deceleration time	Acceleration time	-	0:Absolute 1:Relative	0:Position control 3: Shortest distance control

(b) If control word is h0013, it shall be set by shortest distance control, relative, acc./dec. time 1.

(c) 5~7, and 12~15th bit of control word is the unused area and does not affect the setting.

(d) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

(e) The first target position is the device sett in command, and the second target position is the next device to the device set in the first target position. For example, if the D01100 device is entered as target position of axis 1, the value saved in D01102 device value becomes target position 2.

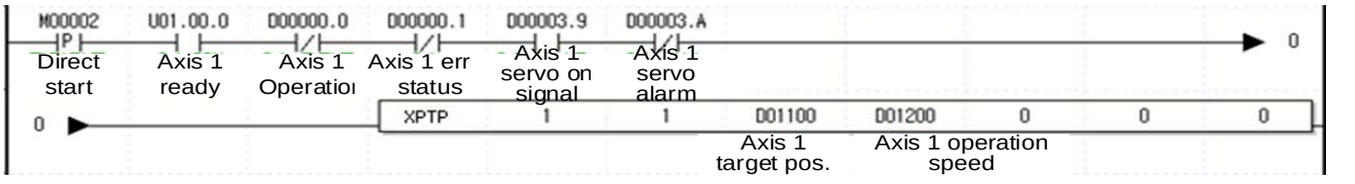
(e) Bit 4 of control word 0: if set to absolute coordinate, a round trip operation is executed between target position 1 and target position 2 as many times as the number of repetitions. 1: if set to relative coordinate, a round trip operation is executed between the current position moved by target position 1 and the target position 1 moved by target position 2 as many times as the number of repetitions.

(f) From the current position where operation begins to target position 1, it is not included the number of repetitions. If the number of repetition is an even number, operation is finished at target position 1, and if the number of repetition is odd number, operation is finished at target position 2.

(g) PTP operation enables shortest distance control and restart operation. During restart operation, operation is executed for the remaining number of repetitions.

6.3.78 Position Specified Torque/Position Switching Control (command: XTTP)

(1) Program



(2) Explain

Device	Description
M00002	TTP operation input
U01.00.0	Operation Ready of axis 1
D00000.0	axis1 signal in operation
D00000.1	axis1 error state
D00003.9	Axis1 servo on signal
D00003.A	Axis1 servo error status

Command	XTTP				Position specified torque/position switching control
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Axis	PMLK,constant,D,Z,R,ZR	WORD	Axis of command execution XBF-PN4B(1~4: axis1 ~ 4) XBF-PN8B(1~8: axis1 ~ 8)
	OP3	Target position	PMLK,D,Z,R,ZR	DINT	Target position (-2147483648~ 2147483647)
	OP4	Goal speed	PMLK,constant,D,Z,R,ZR	DWORD	Target Velocity (0~ 4294967295)
	OP5	Dwell time +M code	PMLK,constant,D,Z,R,ZR	DWORD	Dwell time (0 ~ 65535ms), M code(0 ~ 65535)
	OP6	Absolute/relative	PMLK,constant,D,Z,R,ZR	WORD	0: Absolute coordinate ,1: Relative coordinate
	OP7	control word	PMLK,constant,D,Z,R,ZR	DWORD	Acceleration Time, Deceleration Time

※ PMLK means P, M, L and K areas

(a) Details of control word (OP7) for each Bit are as follows.

31 ~ 16	15 ~ 0
Deceleration time	Acceleration ti me

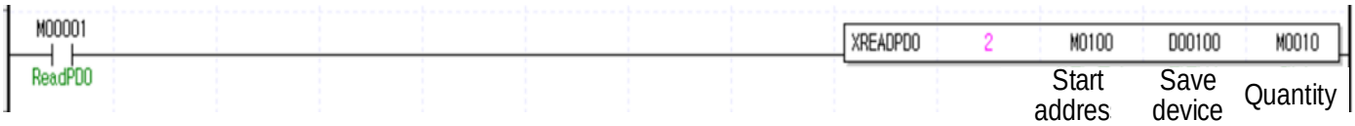
(b) Acceleration time and deceleration time can be set in the range of 0~65535ms.

(c) D device signal (axis1 in operation signal, etc) which used in the example above is an assumption that saving the axis state value in D device area with XSRD command.

(d) If set to absolute coordinate, the target position is absolute position value and if set to relative coordinate, the target position is the movement amount from the command point.

6.3.79 EtherCAT Slave PDO Data Read (command: XREADPDO)

(1) Program



Command	XREADPDO				EtherCAT slave PDO data read
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Start address	PMLK,constant,D,Z,R,ZR	WORD	PDO data start address to read
	OP3	Save device	PMLK,constant,D,Z,R,ZR	WORD	The first address of device to save reading data
	OP4	Quantity	PMLK,constant,D,Z,R,ZR	WORD	the number of PDO data to read (reference of DWORD) (1~160)

※ PMLK means P, M, L and K areas

(a) This command reads the data set through XG-PM among TxPDO data of the EtherCAT slave.
(b) OP1 is the slot number of module.
(c) OP2 is the starting address of data to read.

	Slave 17	**Slave 18**	**Slave 19**	**Slave 20**	**Slave 21**	**Slave 22**	**Slave 23**	**Slave 24**
Data 1	0	5	10	15	20	25	30	35
Data 2	1	6	11	16	21	26	31	36
Data 3	2	7	12	17	22	27	32	37
Data 4	3	8	13	18	23	28	33	38
Data 5	4	9	14	19	24	29	34	39
	Slave 25	**Slave 26**	**Slave 27**	**Slave 28**	**Slave 29**	**Slave 30**	**Slave 31**	**Slave 32**
Data 1	40	45	50	55	60	65	70	75
Data 2	41	46	51	56	61	66	71	76
Data 3	42	47	52	57	62	67	72	77
Data 4	43	48	53	58	63	68	73	78
Data 5	44	49	54	59	64	69	74	79
	Slave 33	**Slave 34**	**Slave 35**	**Slave 36**	**Slave 37**	**Slave 38**	**Slave 39**	**Slave 40**
Data 1	80	85	90	95	100	105	110	115
Data 2	81	86	91	96	101	106	111	116
Data 3	82	87	92	97	102	107	112	117
Data 4	83	88	93	98	103	108	113	118
Data 5	84	89	94	99	104	109	114	119

	Slave 41	Slave 42	Slave 43	Slave 44	Slave 45	Slave 46	Slave 47	Slave 48
Data 1	120	125	130	135	140	145	150	155
Data 2	121	126	131	136	141	146	151	156
Data 3	122	127	132	137	142	147	152	157
Data 4	123	128	133	138	143	148	153	158
Data 5	124	129	134	139	144	149	154	159

(d) Set the CPU device leading address to store the read data in OP3.
(e) Set the number of data to read in OP4.

Item	Supported version
XG5000	4.75 or higher
XBF-PN04B	V2.50 or higher
XBF-PN08B	V2.50 or higher

6.3.80 EtherCAT Slave PDO Data Write (command: XWRITEPDO)

(1) Program

Command	XWRITEPDO				EtherCAT slave PDO data write
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Start address	PMLK,constant,D,Z,R,ZR	WORD	PDO data start address to write
	OP3	Drive to write	PMLK,constant,D,Z,R,ZR	WORD	Device leading address saving data to write
	OP4	Quantity	PMLK,constant,D,Z,R,ZR	WORD	The number of PDO data to write(reference of DWORD) (1~160)

※ PMLK means P, M, L and K areas

(a) This command write the data set through XG-PM among RxPDO data of the EtherCAT slave.
(b) OP1 is the slot number of module.
(c) OP2 is the starting address of data to write.

	Slave 17	Slave 18	Slave 19	Slave 20	Slave 21	Slave 22	Slave 23	Slave 24
Data 1	0	5	10	15	20	25	30	35
Data 2	1	6	11	16	21	26	31	36
Data 3	2	7	12	17	22	27	32	37
Data 4	3	8	13	18	23	28	33	38

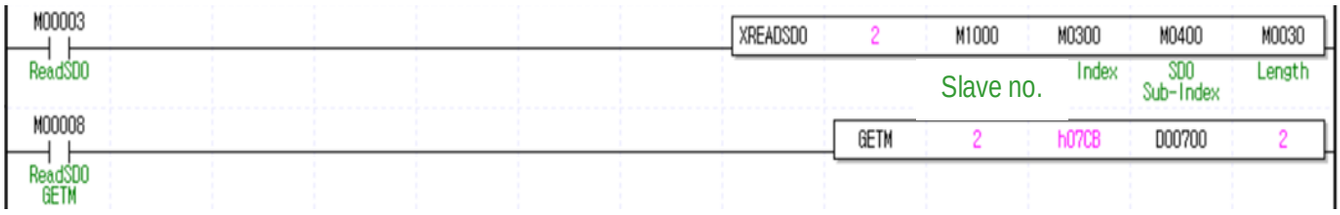
Data 5	4	9	14	19	24	29	34	39
	Slave 25	**Slave 26**	**Slave 27**	**Slave 28**	**Slave 29**	**Slave 30**	**Slave 31**	**Slave 32**
Data 1	40	45	50	55	60	65	70	75
Data 2	41	46	51	56	61	66	71	76
Data 3	42	47	52	57	62	67	72	77
Data 4	43	48	53	58	63	68	73	78
Data 5	44	49	54	59	64	69	74	79
	Slave 33	**Slave 34**	**Slave 35**	**Slave 36**	**Slave 37**	**Slave 38**	**Slave 39**	**Slave 40**
Data 1	80	85	90	95	100	105	110	115
Data 2	81	86	91	96	101	106	111	116
Data 3	82	87	92	97	102	107	112	117
Data 4	83	88	93	98	103	108	113	118
Data 5	84	89	94	99	104	109	114	119
	Slave 41	**Slave 42**	**Slave 43**	**Slave 44**	**Slave 45**	**Slave 46**	**Slave 47**	**Slave 48**
Data 1	120	125	130	135	140	145	150	155
Data 2	121	126	131	136	141	146	151	156
Data 3	122	127	132	137	142	147	152	157
Data 4	123	128	133	138	143	148	153	158
Data 5	124	129	134	139	144	149	154	159

(d) Set the CPU device leading address to store the write data in OP3.
(e) Set the number of data to write in OP4.

Item	Supported version
XG5000	4.75 or higher
XBF-PN04B	V2.50 or higher
XBF-PN08B	V2.50 or higher

6.3.81 EtherCAT Slave SDO Data Read (command: XREADSDO)

(1) Program



Command	XREADSDO				EtherCAT slave SDO data read
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Slave	PMLK,constant,D,Z,R,ZR	WORD	Slave number to execute command XBF-PN04B (17~32: slave 17 ~ 32) XBF-PN08B (17~48: slave 17 ~ 48)
	OP3	SDO Index	PMLK,constant,D,Z,R,ZR	WORD	SDO Index to read
	OP4	SDO Sub-Index	PMLK,constant,D,Z,R,ZR	WORD	SDO Sub-Index to read
	OP5	Data size	PMLK,constant,D,Z,R,ZR	WORD	SDO data size to read(Byte)

※ PMLK means P, M, L and K areas

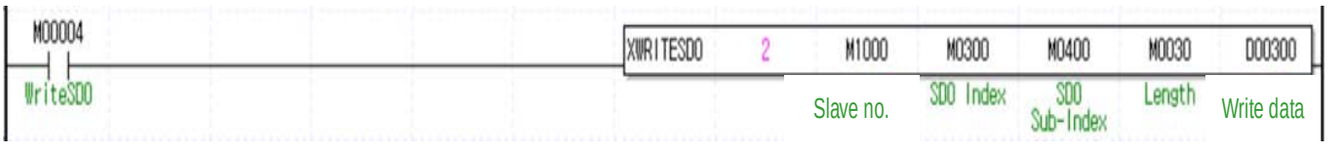
(a) This command reads the value of the selected SDO address among SDO data of the EtherCAT slave.
(b) OP1 is the slot number of module and is the slot number to execute as OP2.
(c) OP3 is the index of SDO to read.
(d) OP4 is the Sub-index of SDO to read.
(e) OP5 set the data size of the SDO to read.
(F) XREADSDO requires the operation of reading the SDO data read after executing the command to the CPU using the GETM command.
The data address and meaning to be read through GETM are as follows.

	Data
0x7CB	SDO Index
	SDO Sub-Index
0x7CC	Reading data(lower word)
	Reading data(upper word)

Item	**Supported version**
XG5000	4.75 or higher
XBF-PN04B	V2.50 or higher
XBF-PN08B	V2.50 or higher

6.3.82 EtherCAT Slave SDO Data Write (command: XWRITESDO)

(1) Program



Command	XWRITESDO				EtherCAT slave SDO data write
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Slave	PMLK,constant,D,Z,R,ZR	WORD	Slave number to execute command XBF-PN04B (17~32: slave 17 ~ 32) XBF-PN08B (17~48: slave 17 ~ 48)
	OP3	SDO Index	PMLK,constant,D,Z,R,ZR	WORD	SDO Index to write
	OP4	SDO Sub-Index	PMLK,constant,D,Z,R,ZR	WORD	SDO Sub-Index to write
	OP5	Data size	PMLK,constant,D,Z,R,ZR	WORD	SDO data size(Byte) to write
	OP6	Data to write	PMLK,constant,D,Z,R,ZR	DINT	Data to write

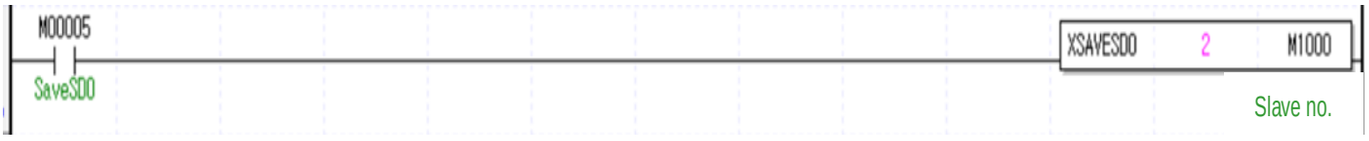
※ PMLK means P, M, L and K areas

(a) This command setting the value of the selected SDO address among SDO data of the EtherCAT slave.
(b) OP1 is the slot number of module and is the slot number to execute as OP2.
(c) OP3 is the index of SDO to write.
(d) OP4 is the Sub-index of SDO to write.
(e) OP5 set the data size of the SDO to write.
(f) OP6 is data to write.

Item	Supported version
XG5000	4.75 or higher
XBF-PN04B	V2.50 or higher
XBF-PN08B	V2.50 or higher

6.3.83 EtherCAT Save SDO Data Save (command: XSAVESDO)

(1) Program



Command	XSAVESDO				EtherCAT slave SDO data save
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Slave	PMLK,constant,D,Z,R,ZR	WORD	Slave number to execute command XBF-PN04B (17~32: slave 17 ~ 32) XBF-PN08B (17~48: slave 17 ~ 48)

※ PMLK means P, M, L and K areasthe

(a) This command executes the operation of saving SDO data value of EtherCAT slave.
If the command is executed, the SDO data value of the current related slave is saved in the slave.

(b) OP1 is the slot number of module and is the slave number to execute as OP2.

Item	Supported version
XG5000	4.75 or higher
XBF-PN04B	V2.50 or higher
XBF-PN08B	V2.50 or higher

Chapter 7 Function Block

7.1 Common Elements of Function Blocks

The functions and usage methods of the input/output variable names below are common to the positioning function blocks.

Classification	Variable name	Data type	Content
Input	REQ	BOOL	Request the execution of function block - During program execution, if the condition connected to this area is established and goes from “0 to 1” (edge or level), the function block is executed.
	Base	USINT	Base position number - This is the area to set the number of the base on which the positioning module is mounted. - Setting range: 0 (Please set it to 0 in XGB.)
	SLOT	USINT	Base position number - This is the area to set the number of the Slot on which the positioning module is mounted. - Setting range: 2 to 3
	Axis	USINT	User axis number - 1 ~ 8: Axis 1~ 8 -“Error 6” occurs when setting a value outside the setting range.
Output	Done	BOOL	Displays the completion status of function block execution. - If the function block is completed without an error, “1” is output. “1”Is keep until the ext execution, if an error occurs, “0”is output.
	STAT	UINT	Error status display - If an error is occurred while the function block executes, this is the area where the error number is output.

Errors occurring in STAT variable of positioning function block are as follows.

STAT	Content	Description
0	Normal operation	In case function block is normally executed, “DONE=1, STAT=0”are output.
1	Base number setting error	It occurs when the base number setting values is out of range. The setting range of the CPUs are as follows. Setting range: 0
3	Slot number setting error	This occurs when the slot number setting values is out of the range (2~3).
4	Empty slots error	This occurs when the module is not mounted in specified location by Base or Slot.
5	Positioning module mismatch	This occurs when a module other than the positioning module is mounted in specified location by specified location.
6	Axis number error	This occurs when the command axis number setting values is out of the range (1~8).
10	Function block duplicate execution error	This occurs when the positioning module is not yet read executed function block before the currently executed function block. After the positioning module read the previous executed function block and then executes another function block. It takes up to 2~4ms before positioning module is reading after function block execution.
11	Input variables value setting error	This occurs when the variable setting values other than BASE, SLOT and AXIS are out of range. Please check the range of variable setting values in each function block.
22	Base skip error	Please check the base skip setting.
24	Slot Skip Error	Please check the Slot Skip setting.

STAT	Content	Description
101 : 821	Positioning module error	This is an error the occurred in the positioning module as a results of function block execution.

(2) The position and speed setting range of the positioning function block is as follows, and in this chapter, the position is pulse unit and speed is pulse/sec unit.

Classification	Setting unit	Setting range
Position	pulse	-2,147,483,648 ~ 2,147,483,647[pulse]
	mm	-2,147,483,648 ~ 2,147,483,647[x 10^{-4}mm]
	inch	-2,147,483,648 ~ 2,147,483,647[x 10^{-5}inch]
	degree	-2,147,483,648 ~ 2,147,483,647[x 10^{-5}degree]
Speed	pulse/second	1 ~ 2,147,483,647 [pulse/second]
	mm/minute	1 ~ 2,147,483,647 [X10^{-2}㎜/minute]
	inch/minute	1 ~ 2,147,483,647 [X10^{-3}Inch/minute]
	degree/minute	1 ~ 2,147,483,647 [X10^{-3} degree/minute]

(3) For data type and size that used in positioning function block, refer to the table below.

No.	Reserved word	Data type	Size(Bit)	Range
1	BOOL	Boolean	1	0,1
2	SINT	Short Integer	8	-128 ~ 127
3	USINT	Unsigned Short Integer	8	0 ~ 255
4	INT	Integer	16	-32768 ~ 32767
5	UINT	Unsigned Integer	16	0 ~ 65535
6	DINT	Double Integer	32	-2147483648 ~ 2147483647
7	UDINT	Unsigned Double Integer	32	0 ~ 4294967295

7.2 Positioning Module Function Block

No.	Name	Details	Trigger condition	Table of Contents
1	XPM_CRD	Operation state code information read	Level	7.3.1
2	XPM_SRD	Operation state bit information read	Level	7.3.2
3	XPM_ENCRD	Encoder value read	Level	7.3.3
4	XPM_SVERD	Servo error information read	Level	7.3.4
5	XPM_LRD	Latch position data read	Level	7.3.5
6	XPM_SBP	Basic Parameter Teaching	Edge	7.4.1
7	XPM_SEP	Extended Parameter Teaching	Edge	7.4.2
8	XPM_SMP	Manual Operation Parameter Teaching	Edge	7.4.3
9	XPM_SIP	Input Signal Parameter Teaching	Edge	7.4.4
10	XPM_SIPT	Input signal parameter teaching-external position/torque control switching torque	Edge	7.4.5
11	XPM_SCP	Common Parameter Teaching	Edge	7.4.6
12	XPM_SMD	Operation data teaching	Edge	7.4.7
13	XPM_ATEA	Position/speed teaching(ROM, RAM) (Array type)	Edge	7.4.8
14	XPM_VRD	Variable data reading	Edge	7.4.9
15	XPM_VWR	Variable data writing	Edge	7.4.10
16	XPM_WRT	Parameter/operation data save	Edge	7.4.9
17	XPM_ORG	Homing start	Edge	7.5.1
18	XPM_DST	Direct start	Edge	7.5.2
19	XPM_IST	Indirect start	Edge	7.5.3
20	XPM_ELIN	Ellipse interpolation operation	Edge	7.5.4
21	XPM_SST	Simultaneous start	Edge	7.5.5
22	XPM_PST	Point operation start	Edge	7.5.6
23	XPM_STP	Deceleration stop	Edge	7.5.7
24	XPM_EMG	Emergency stop	Edge	7.5.8
25	XPM_RSTR	Restart	Edge	7.5.9
26	XPM_TR	Torque control	Edge	7.5.10
27	XPM_TRQSL	Speed limit torque control	Edge	7.5.11
28	XPM_JOG	Jog start	Level	7.6.1
29	XPM_INC	Inching start	Edge	7.6.2
30	XPM_RTP	Manual operation previous position return	Edge	7.6.3
31	XPM_SSP	Position synchronous start	Edge	7.7.1
32	XPM_SSS	Speed synchronization	Edge	7.7.2
33	XPM_SSSP	Speed synchronous start by position	Edge	7.7.3
34	XPM_CAM	CAM start	Edge	7.7.4
35	XPM_CAMO	Master axis offset designated CAM start	Edge	7.7.5
36	XPM_STC	Torque synchronization	Edge	7.7.6
37	XPM_PHASING	Phase compensation	Edge	7.7.7
38	XPM_SSSD	32-bit speed synchronization	Edge	7.7.8
39	XPM_SSSPD	32-bit position specified speed synchronization	Edge	7.7.9
40	XPM_CAMA	Absolute position cam operation	Edge	7.7.10
41	XPM_GEARIP	Synchronous position specified speed synchronization	Edge	7.7.11
42	XPM_POR	Position override	Edge	7.8.1
43	XPM_SOR	Speed override	Edge	7.8.2

No.	Name	Details	Trigger condition	Table of Contents
44	XPM_PSO	Position speed override	Edge	7.8.3
45	XPM_PTV	Position/Speed Control Switching	Edge	7.8.4
46	XPM_VTP	Speed/Position Control Switching.	Edge	7.8.5
47	XPM_VTPP	Position specified speed/position control switch	Edge	7.8.6
48	XPM_PTT	Position/torque control switching	Edge	7.8.7
49	XPM_SKP	Skip operation	Edge	7.8.8
50	XPM_NMV	Continuous operation	Edge	7.8.9
51	XPM_SNS	Start step number specified	Edge	7.8.10
52	XPM_SRS	Start step number specified during repeat operation	Edge	7.8.11
53	XPM_PRS	Current position preset	Edge	7.8.12
54	XPM_EPRE	Encoder value preset	Edge	7.8.13
55	XPM_SETOVR	Speed/Acceleration/Deceleration Override	LEVEL	7.8.14
56	XPM_RST	Error reset	Edge	7.9.1
57	XPM_HRST	Error history reset	Edge	7.9.2
58	XPM_FLT	Floating origin point setting	Edge	7.10.1
59	XPM_MOF	M code Off	Edge	7.10.2
60	XPM_LCLR	Latch reset	Edge	7.10.3
61	XPM_LSET	Latch setting	Edge	7.10.4
62	XPM_TPROBE	Touch probe setting	Edge	7.10.5
63	XPM_ABORTT	Trigger off	Edge	7.10.6
64	XPM_ECON	Servo communication connection	Edge	7.11.1
65	XPM_DCON	Servo communication disconnection	Edge	7.11.2
66	XPM_SVON	Servo On	Edge	7.11.3
67	XPM_SVOFF	Servo Off	Edge	7.11.4
68	XPM_SRST	Servo alarm reset	Edge	7.11.5
69	XPM_SHRST	Servo Error History Reset	Edge	7.11.6
70	XPM_SVIRD	Servo external input information read	Level	7.11.7
71	XPM_SVPRD	Servo drive parameter read	Edge	7.11.8
72	XPM_SVPWR	Servo parameter write	Edge	7.11.9
73	XPM_SVSAVE	Servo parameter save	Edge	7.11.10
74	XPM_PLOOPON	Master position control loop execution	Edge	7.10.7
75	XPM_ PLOOPOFF	Master position control loop off	Edge	7.10.8
76	XPM_CCCON	Cross-coupled control execution	Edge	7.10.9
77	XPM_CCCOFF	Cross-coupled control off	Edge	7.10.10
78	XPM_ORGMEX	Touch probe homing	Edge	7.10.11
79	XPM_JOGD	Direct input jog operation	Level	7.6.4
80	XPM_PTP	PTP operation	Edge	7.5.12
81	XPM_TTP	Position specified torque/position switching control	Edge	
82	XPM_READPDO	EtherCAT slave PDO read	Level	7.11.11
82	XPM_WRITEPDO	EtherCAT slave PDO write	Level	7.11.12
84	XPM_READSDO	EtherCAT slave SDO read	Edge	7.11.13
85	XPM_WRITESDO	EtherCAT slave SDO write	Edge	7.11.14
86	XPM_SAVESDO	EtherCAT slave SDO save	Edge	7.11.15

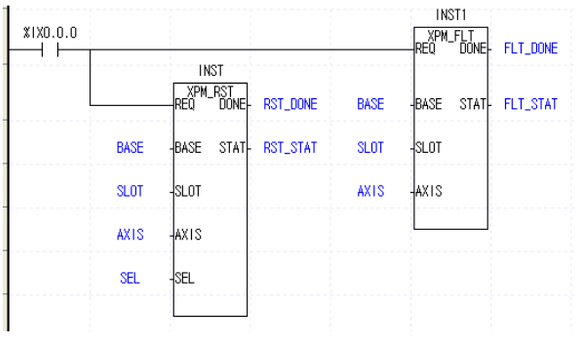
Notes

1. The dedicated command acts at rising edge. That is, when the input condition is On, the operation is executed only once for the first time, and to execute the operation again, the input condition must be Off and then On again.
   XPM SRD executes at high level. When input condition is 'On' it keeps operating and does not operate when it's 'Off'.
2. The XPM command execution time is as follows.
   (1) XPM_WRT : 15ms (per axis)
   (2) All commands except XPM_WRT
   2ms (when using 2 axes) to 6ms (when using 8 axes)
3. More than two XPM_VRD and XPM_VWR commands cannot executed at the same time. After one command operation is finished, sequential command must be executed. Be careful not executes command at same time even though they are the same or different command axis.

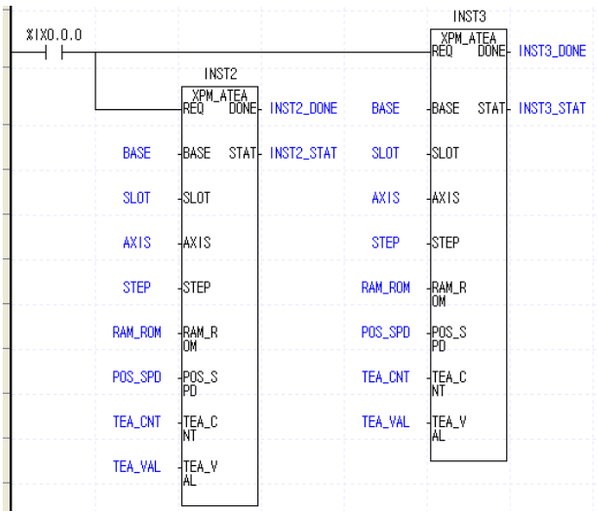
Notes

▷ Only one positioning function block should be executed for the function block execution axis within 1 scan, except XPM_SRD, XPM_CRD, XPM_ENCRD, XPM_SVERD, XPM_SVIRD, XPM_LRD. If it is used like the below example program, the function block does not work properly.

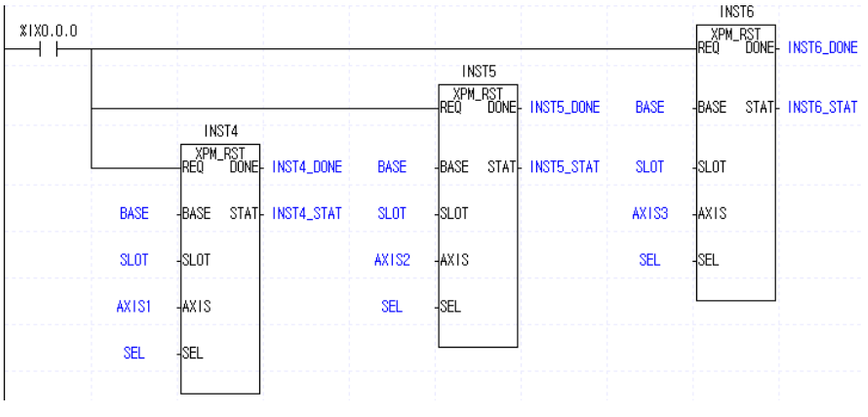
When executing different function blocks



When executing the same function blocks

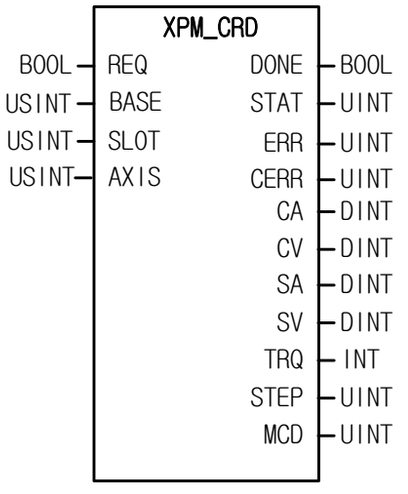


▷ A same function block cannot be executed for other axis.



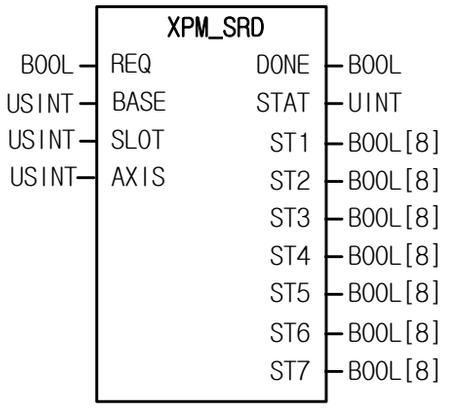
7.3 Module Information Read Related Function Block

7.3.1 Operating Information Read (XPM_CRD)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing. ERR : Display axis error CERR : Display common error CA : Display command position CV : Display command speed SA : Display current position SV : Display current speed TRQ : Display current torque STEP : Display current operation data step number MCD : Display current M-Code value

(1) Read the current operation status of specified axis in positioning module that is specified by Base and slot.
(2) The read operation information is saved in the variable set in the output of the function block.
(3) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)
(4) The command position, command speed, current position, current speed, torque, Operation data number, and M code values of the set axis can be read and monitored or used as conditions in the user program.

7.3.2 Current Operation Status bit Information Read (XPM_SRD)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing. ST1 : status 1 ST2 : status 2 ST3 : status 3 ST4 : status 4 ST5 : status 5 ST6 : status 6 ST7 : status 7

(1) Read the current operation status bit information of specified axis in positioning module that is specified by base and slot.

(2) The read current operation status bit information saved in the variables set in ST1 to ST7.

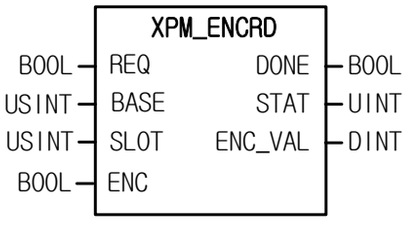
(3) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(4) The contents of output variables ST1 to ST7 of current operation status bit read function block are informant information that must be applied in program.

	Bit	Description	Bit	Description
ST1	[0]	In operation(0: stop, 1: BUSY)	[4]	Homing status (0:not determined, 1: completion)
	[1]	Error status	[5]	Common error status
	[2]	Positioning completion	[6]	Stop status
	[3]	MCode On signal(0:Off, 1:On)	[7]	Variable data reading/writing
ST2	[0]	Upper limit detection	[4]	Accelerating
	[1]	Lower limit detection	[5]	At constant speed
	[2]	Emergency stop status	[6]	Decelerating
	[3]	Direction 0: forward, 1: reverse)	[7]	Dwelling
ST3	[0]	axis1 in position control	[4]	In circular interpolation operation
	[1]	axis1 in speed control	[5]	In homing operation
	[2]	In linear interpolation operation	[6]	In position synchronization operation
	[3]	-	[7]	In speed synchronization operation
ST4	[0]	In jog operation	[4]	In manual operation previous position return operation
	[1]	-	[5]	In CAM control operation
	[2]	In Inching operation	[6]	In Feed control operation
	[3]	-	[7]	In ellipse interpolation operation
ST5	[0]	Main axis information*1 1 ~ 8: Axis 1~ 8 9: Encoder 1	[4]	Axis status(0: subordinate axis, 1: main axis)
	[1]		[5]	-
	[2]		[6]	-
	[3]		[7]	Servo parameter read/write processing (0: not R/W processing, 1: R/W processing)
ST6	[0]	Emergency stop signal	[4]	Upper limit signal
	[1]	-	[5]	Lower limit signal
	[2]	-	[6]	Home signal
	[3]	-	[7]	DOG signal
ST7	[0]	External command signal	[4]	-
	[1]	Servo on signal	[5]	-
	[2]	Servo alarm signal	[6]	-
	[3]	In-position signal	[7]	Communication error status (0:normal, 1:error)

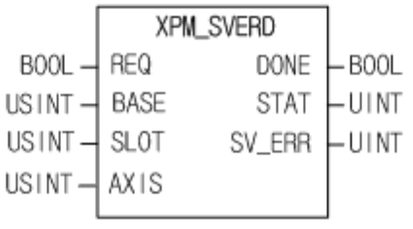
*1 : For instance, if ST5 Value is h09 as hexadecimal, which means encoder 1,and h04 mean axis 4.

7.3.3 Encoder Value Read (XPM_ENCRD)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted ENC : Encoder No. 0: Encoder 1 **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing. ENC_VAL : Current value of encoder

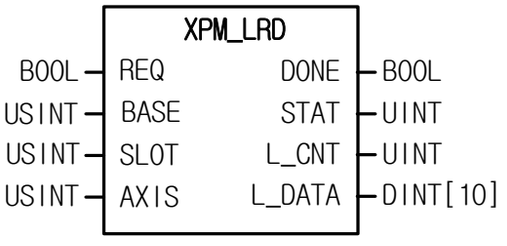
(1) Read the current encoder values in positioning module that is specified by Base and slot.
(2) The current values of encoder that read in ENC_VAL is displayed.
(3) Set the encoder to read in ENC and set the following values.
0: Encoder 1

7.3.4 Servo Error Information Read (XPM_SVERD)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4), XBF-PN08B : 1 ~ 8 (axis1 ~ 8) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing. SV_ERR : Servo error information

(1) Read the servo error information specified axis in positioning module that is specified by base and slot.
(2) The currently read servo error information is save in variable set in SV_ERR.
(3) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.3.5 Latch Position Data Read (XPM_LRD)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing. L_CNT : Number of latch position data L_DATA : Latch position data 1 to 10

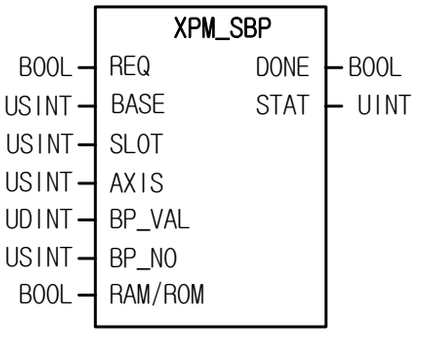
(1) This command is used to read the number of latch data and latch position data stored by the external latch command signal of the positioning module.

(2) Read the latch data, the number of latched position data is stored in L_CNT and the latch position data is stored in L_DATA of specified axis in positioning module that is specified by base and slot.

(3) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.4 Parameter/Operation Data Change Related Function Block

7.4.1 Basic Parameter Teaching (XPM_SBP)

Function Block type	Content
	Input REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) BP_VAL : Basic parameter to change BP_NO : Basic parameter item number to change RAM/ROM : Parameter save method 0: Saves in RAM 1: Saves in ROM Output DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives the basic parameter setting command to be specified axis in positioning module that is specified by base and slot.

(2) Parameter values modified with basic parameter teaching commands by setting “0” in RAM/ROM and are valid while power is on. To maintain parameter values revised with the basic parameter teaching command when power is turned off, set “1” in RAM/ROM, and executes the basic parameter teaching command or save revised parameter values in MRAM using parameter/operation data save command (XPM_WRT) after basic parameter teaching.

(3) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

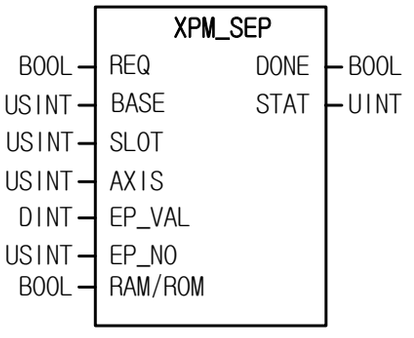
(4) The basic parameter setting command is unavailable when the axis is operating.

(5) Setting values for basic parameter item number are as follows.

Setting Value	Item	Setting range
1	Speed limit value	㎜ : 1 ~ 2,147,483,647 [X10-2㎜/minute] Inch : 1 ~ 2,147,483,647 [X10^{-3}Inch/minute] degree : 1 ~ 2,147,483,647 [X10^{-3} degree/minute] pulse : 1 ~ 2,147,483,647 [pulse/second]
2	Acceleration time 1	0 ~ 2147483647 [ms]
3	Acceleration time 2	
4	Acceleration time 3	
5	Acceleration time 4	
6	Deceleration time 1	0 ~ 2147483647 [ms]
7	Deceleration time 2	
8	Deceleration time 3	
9	Deceleration time 4	
10	Dec. time of Emergent stop	0 ~ 2147483647 [ms]
11	Pulse number /revolution	1 ~ 200000000
12	Transfer distance per 1 rotation	
13	Unit	0: pulse, 1: mm, 2: inch, 3:degree
14	Unit multiplier	0: x 1, 1: x 10, 2: x 100, 3: x 1000
15	Speed command unit	0: Unit/Time, 1: rpm
16	Encoder select	0:Incremental encoder , 1: Absolute encoder
17	Current pos. compensation amount	0 ~ 255
18	User specified position display ratio*2	0 ~ 7
19	User specified speed display ratio*3	0 ~ 7
20	Axis type*4	0: Real axis, 1: Virtual axis
23	Control mode*5 during speed synchronization	0: CSP – command position 1: CSP – current position (not supported) 2: CSV – command speed 3: CSV – current speed
24	Current position display compensation ratio	0: x1, 1: x100

*1,2,3,4,5 : XBF-PN04B/XBF-PN08B dedicated

7.4.2 Extended Parameter Teaching (XPM_SEP)

Function Block type	Content
	Input REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) EP_VAL : extended parameter values to change EP_NO : extended parameter item number to change RAM/ROM : Parameter save method 0: Saves in RAM, 1: Saves in ROM Output DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives the extended parameter teaching command to be specified axis in positioning module that is specified by base and slot.

(2) Parameter values modified with expansion parameter setting commands by setting “0” in RAM/ROM and are valid while power is on. To maintain parameter values revised with the extended parameter setting command when power is turned off, set “1” in RAM/ROM, and executes the extended parameter teaching command or save revised parameter values in MRAM using parameter/operation data save command (XPM_WRT) after extended parameter teaching.

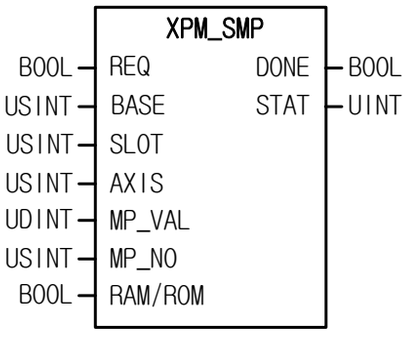
(3) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(4) The extended parameter setting command is unavailable when the axis is operating.

(5) Setting values for extended parameter item number are as follows.

Setting Value	Item	Setting range
1	S/W upper limit	㎜: -2147483648 ~ 2147483647[X10-4㎜] Inch: -2147483648 ~ 2147483647[X10-5Inch] degree: -2147483648 ~ 2147483647[X10-5degree] pulse: -2147483648 ~ 2147483647[pulse]
2	S/W low limit	
3	Backlash function	mm: 0 ~ 65,535[X10-4㎜] inch: 0 ~ 65,535[X10-5Inch] degree: 0 ~ 65,535[X10-5degree] pulse: 0 ~ 65,535[pulse]
4	Position completion time	0 ~ 65,535[ms]
5	S-curve ratio	1 ~ 100
6	Command in-position range	mm: 0 ~ 2147483647[X10-4㎜] Inch: 0 ~ 2147483647[X10-5Inch] degree: 0 ~ 2147483647[X10-5degree] pulse: 0 ~ 2147483647[pulse]
7	Arc insertion position in 2-axis linear interpolation continuous operation	mm: 0 ~ 2147483647[X10-4㎜] Inch: 0 ~ 2147483647[X10-5Inch] degree: 0 ~ 2147483647[X10-5degree] pulse: 0 ~ 2147483647[pulse]
8	Acceleration/Deceleration Pattern	0:Trapezoid operation, 1:S-Curve operation
9	M Code mode	0: None, 1: With, 2: After
10	Detection of upper and lower limits during speed control	0: Not detect , 1 : Detect
11	Positioning completion condition	0: dwell time ,1: in position, 2: dwell time AND in position, 3: dwell time OR in position
12	Positioning method of interpolation continuous operation	0:Target position passage, 1:Near target position passage
13	Arc insertion in 2-axis linear interpolation continuous operation	0:No circular arc addition, 1:Circular arc addition continuous operation
14	External command selection	0:External speed/position control switch, 1 :External stop command,
15	External command	0:disabled,1:enabled
16	Positioning speed override coordinate	0: Absolute coordinate ,1: Relative coordinate
17	Infinite running repeat position	mm: 1 ~ 2147483647[X10^{-4}㎜] Inch: 1 ~ 2147483647[X10^{-5}Inch] degree: 1 ~ 2147483647[X10^{-5}degree] pulse: 1 ~ 2147483647[pulse]
18	Infinite running repeat	0:disabled,1:enabled
19	Speed/Position switching coordinate	0:Relative, 1:Absolute
20	Interpolation speed selection	0: main axis speed 1:synthetic speed
21	Cam restart	0:disabled,1:enabled
22	Operation when main axis ' errors occurs during synchronous control	0: maintains synchronous control, 1: release synchronous when main axis's servo alarm occurs, 2: release synchronous when main axis's axis error occurs.
23	Drive absolute position error detection	0: not detection, 1: Homing status initialization

7.4.3 Manual Operation Parameter Teaching (XPM_SMP)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) EP_VAL : manual operation parameter values to change EP_NO : manual operation parameter item number to change RAM/ROM : Parameter save method 0: Saves in RAM 1: Saves in ROM **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives the manual operation parameter teaching command to be specified axis in positioning module that is specified by base and slot.

(2) Parameter values modified with manual operation parameter teaching commands by setting “0” in RAM/ROM for the valid while power is on. To maintain parameter values revised with the manual operation parameter setting command when power is turned off, set “1” in RAM/ROM, and executes the manual operation parameter teaching command or save revised parameter values in MRAM using parameter/operation data save command (XPM_WRT) after manual operation parameter teaching.

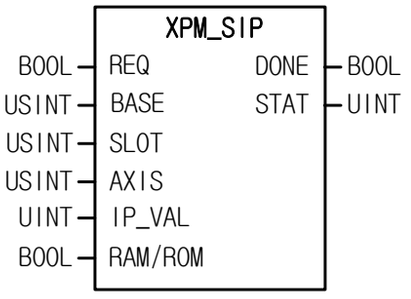
(3) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(4) The manual operation parameter setting command is unavailable when the axis is operating.

(5) Setting values for manual operation parameter item number are as follows.

Setting Value	Item	Setting range
1	Jog high speed	㎜ : 1 ~ 2,147,483,647 [X10^{-2}㎜/minute] Inch : 1 ~ 2,147,483,647 [X10^{-3}Inch/minute] degree : 1 ~ 2,147,483,647 [X10^{-3} degree/minute] pulse : 1 ~ 2,147,483,647 [pulse/second]
2	Jog low speed	
3	Jog acc. time	0 ~ 2147483647 [ms]
4	Jog deceleration time	
5	Inching speed	㎜ : 1 ~ 65,535[X10^{-2}㎜/minute] Inch : 1 ~ 65,535[X10^{-3}Inch/minute] degree : 1 ~ 65,535[X10^{-3} degree/minute] pulse : 1 ~ 65,535[pulse/second]

7.4.4 Input Signal Parameter Teaching (XPM_SIP)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) EP_VAL : input signal parameter values to change RAM/ROM : Parameter save method 0: Saves in RAM 1: Saves in ROM **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives the input signal parameter teaching command to be specified axis in positioning module that is specified by base and slot.

(2) Parameter values modified with Input signal parameter teaching commands by setting “0” in RAM/ROM for the valid while power is on. To maintain parameter values revised with the input signal parameter setting command when power is turned off, set “1” in RAM/ROM, and executes the input signal parameter teaching command or save revised parameter values in MRAM using parameter/operation data save command (XPM_WRT) after input signal parameter teaching.

(3) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(4) The input signal parameter setting command is unavailable when the axis is operating.

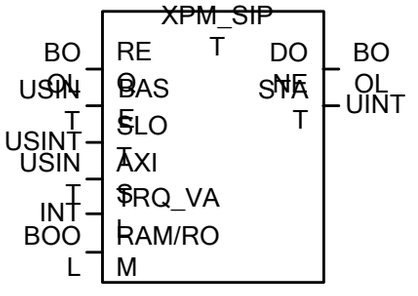
(5) The meaning of each bit of the input signal parameter setting value is as follows.

15	14	13	12	11 ~ 8	7 ~ 4	3 ~ 0
-	Input signal Z logic selection	Input signal B logic selection	Input signal A logic selection	Input signal Z function selection	Input signal B function selection	Input signal A function selection

(6) The setting value of each item is listed below.

Input signal parameter items	Setting range
Input signal A function selection	0: not used 1: speed/position control switch 2: position/torque control switch 3: external start
Input signal B function selection	
Input signal Z function selection	
Input signal A logic selection	Contact A, Contact B
Input signal B logic selection	
Input signal Z logic selection	
External position/torque control switch torque	-32768 ~ 32767

7.4.5 Input Signal Parameter - external position/torque control switch torque (XPM_SIPT)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) TRQ_VAL: position/torque control switch torque values to change (Unit :%, -32768 ~ 32767) RAM/ROM : Parameter save method 0: Saves in RAM 1: Saves in ROM **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives the external position/torque control switch torque teaching command among input signal parameter be specified axis in positioning module that is specified by base and slot.

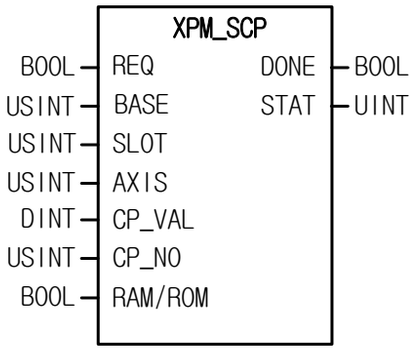
(2) Parameter values modified with external position/torque control switch torque teaching commands by setting “0” in RAM/ROM for the valid while power is on. To maintain parameter values revised with the external position/torque control switch torque teaching command when power is turned off, set “1” in RAM/ROM, and executes the external position/torque control switch torque teaching command or save revised parameter values in MRAM using parameter/operation data save command (XPM_WRT) after parameter setting.

(3) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(4) The external position/torque control switch torque teaching command is unavailable when the axis is operating.

(5) The setting range of the torque value is as follows.
-32768 % ~ 32767 %

7.4.6 Common Parameter Teaching (XPM_SCP)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) BP_VAL : common parameter values to change CP_NO : common parameter values item number to change (1~17) RAM/ROM : Parameter save method 0: Saves in RAM 1: Saves in ROM **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives the common parameter teaching command to be specified axis in positioning module that is specified by base and slot.

(2) Parameter values modified with common parameter teaching commands by setting “0” in RAM/ROM and are valid while power is on. To maintain parameter values revised with the common parameter teaching command when power is turned off, set “1” in RAM/ROM, and executes the common parameter teaching command or save revised parameter values in MRAM using parameter/operation data save command (XPM_WRT) after the common parameter teaching.

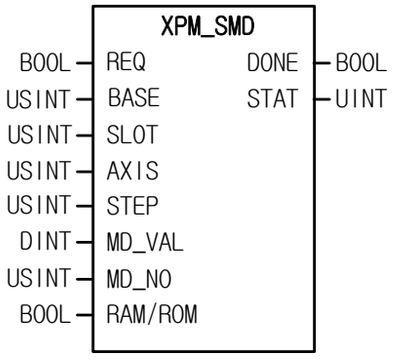
(3) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(4) Setting values for common parameter item number are as follows.

Setting Value	Item	Setting range
1	Speed override	0: % designate, 1 : Speed designate
2	Encorder1 pulse input	0:CW/CCW 1 multiplication 1:PULSE/DIR 1 multiplication 2:PULSE/DIR 2 multiplication 3: PHASE A/B 1 multiplication 4: PHASE A/B 2 multiplication 5: PHASE A/B 4 multiplication
3	Encoder1 Max. value	-2147483648 ~ 2147283647
4	Encoder1 Min. value	
5	Encoder1 phase Z clear	0:disabled,1:enabled
10	Position specified speed synchronization target position coordinates	0:Relative, 1:Absolute
11	Encoder 1 average count	0: Not use,1:5 times, 2:10 times, 3:20 times
13	External input terminal function selection	0: encoder signal phase A,B.Z 1: external input signal A,B,Z
14	External input signal input filter	0:Not Use 1: Use
15	Error reset mode	0: module 1: module/ servo

16	Torque synchronization control reference value	0: Actual torque value 1: Torque demand value
17	Control cycle	0: auto setting 1: 1ms 2: 2ms 3: 3ms 4: 4ms

7.4.7 Operation Data Teaching (XPM_SMD)

Function Block type	Content
	**Input** REQ : Request the execution of function block Slot : Setting slot number on which module is mounted Base : Setting base number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) STEP : Operation step number to change 0 ~ 400 BP_VAL : Operation data value to change BP_NO : Operation data item number to change RAM/ROM : Parameter save method 0: save to RAM, 1: save to ROM **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives the operation data setting command to be specified axis in positioning module that is specified by base and slot.

(2) Operation data values modified with operation data teaching commands by setting “0” in RAM/ROM and are valid while power is on. To maintain operation data values revised with the operation data teaching command when power is turned off, set “1” in RAM/ROM, and executes the operation data teaching command or save revised parameter values in MRAM using parameter/operation data save command (XPM_WRT) after operation data teaching.

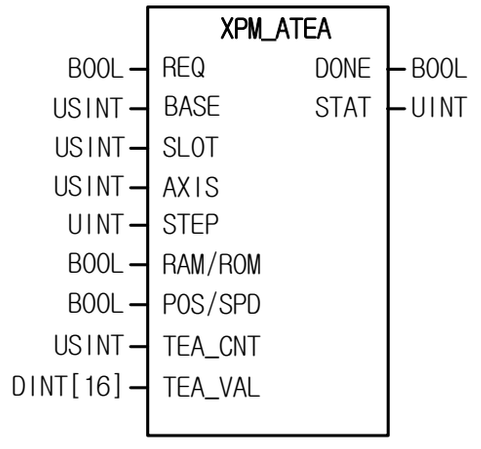
(3) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(4) The operation data setting command is available to be run when the axis is operating. But, when changing the operation data of currently operating step, it will be reflected after the operation of current step is finished.

(4) Setting values for operation data item number are as follows.

<table>
<tr><th>Setting Value</th><th>Item</th><th>Setting range</th></tr>
<tr><td>1</td><td>Target position</td><td>㎜ : -2147483648 ~ 2147483647 [X10^{-4}㎜]
Inch : -2147483648 ~ 2147483647 [X10^{-5}Inch]
degree : -2147483648 ~ 2147483647 [X10^{-5}degree]
pulse : -2147483648 ~ 2147483647 [pulse]</td></tr>
<tr><td>2</td><td>Circular interpolation auxiliary position</td><td></td></tr>
<tr><td>3</td><td>Operating speed</td><td>㎜ : 0 ~ 2,147,483,647 [X10^{-2}㎜/minute]
Inch : 0 ~ 2,147,483,647 [X10^{-3}Inch/minute]
degree : 0 ~ 2,147,483,647 [X10^{-3} degree/minute]
pulse : 0 ~ 2,147,483,647 [pulse/second]</td></tr>
<tr><td>4</td><td>Dwell time</td><td>0 ~ 65535 [ms]</td></tr>
<tr><td>5</td><td>M code No.</td><td>0 ~ 65535</td></tr>
<tr><td>6</td><td>Sub axis setting</td><td>Bit unit setting
<table>
<tr><td>Bit 7</td><td>Bit 6</td><td>Bit 5</td><td>Bit 4</td><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr>
<tr><td>Axis 8</td><td>Axis 7</td><td>Axis 6</td><td>Axis</td><td>Axis 4</td><td>Axis 3</td><td>Axis 2</td><td>Axis 1</td></tr>
</table></td></tr>
<tr><td>7</td><td>Helical interpolation axis</td><td>0, axis1 ~ axis8 (0: circular interpolation)</td></tr>
<tr><td>8</td><td>No. of circular interpolation turn</td><td>0~65,535</td></tr>
<tr><td>9</td><td>Coordinate</td><td>0:absolute, 1:incremental</td></tr>
<tr><td>10</td><td>Control method</td><td>0: Single axis positioning control, 1: Single axis speed control
2: Shortening Feed control, 3: Linear interpolation, 4: Circular arc interpolation</td></tr>
<tr><td>11</td><td>Operation method</td><td>0:Single , 1:Repeat</td></tr>
<tr><td>12</td><td>Operating pattern</td><td>0:End, 1:Keep, 2: Continuous</td></tr>
<tr><td>13</td><td>Circular arc size</td><td>0:Circular arc<180 , 1:Circular arc>=180</td></tr>
<tr><td>14</td><td>Acc. No.</td><td>0 ~ 3</td></tr>
<tr><td>15</td><td>Deceleration No.</td><td>0 ~ 3</td></tr>
<tr><td>16</td><td>Circular interpolating method</td><td>0:midpoint, 1:central point, 2:radius</td></tr>
<tr><td>17</td><td>Circular interpolating direction</td><td>0:CW, 1:CCW</td></tr>
</table>

7.4.8 Teaching Array (XPM_ATEA)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) STEP : Step number setting for teaching 0 ~ 400 RAM/ROM : RAM teaching and ROM teaching type selection 0: RAM teaching, 1: ROM teaching POS/SPD : Position teaching and speed teaching type selection 0: Position teaching, 1: Speed teaching TEA_CNT : Setting the number of data for teaching 1 ~ 16 TEA_VAL : Teaching value setting **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives the teaching array command to be specified axis in positioning module that is specified by base and slot.

(2) Speed teaching can be used when the user wants to use an arbitrary speed value in the operation data of a specific step, and position teaching can be used when the user wants to set an arbitrary position value in the operation data of a specific operation step.

(3) This is used when you want to change up to 16 target positions or speed values at once using a teaching array function block.

(4) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

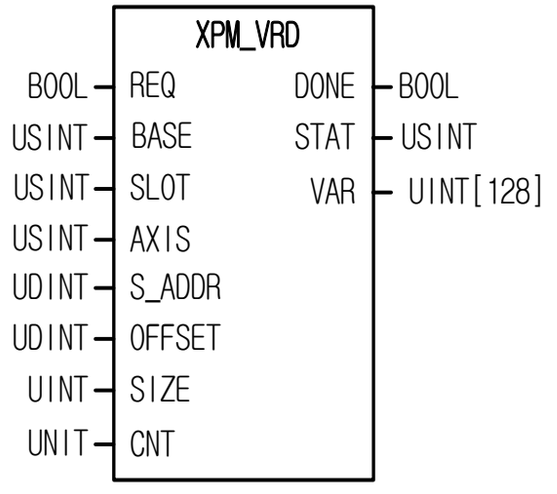
Teaching Array command is available to be executed when the axis is operating. But teaching data of operating step do not apply instantly. Operating step data will apply end of present step operation and the data of the remaining steps are changed immediately.

(6) In STEP, set the step number of operation data to be teaching and the values can be set from 0 to 400. If a value other than the set value is set, “Error 11” occurs.

(7) In TEA_CNT, set the number of data to be teaching and up to 16 can be teaching. If a value other than the set value is set, “Error 11” occurs.

(8) Operation data values modified with teaching commands by setting “0” in RAM/ROM and are valid while power is on. To maintain operation data values revised with the teaching command when power is turned off, set “1” in RAM/ROM, and executes the teaching command or save revised parameter values in MRAM using parameter/operation data save command (XPM_WRT) after teaching.

7.4.9 Variable Data Read (XPM_VRD)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) S_ADDR : Module internal memory leading address to read data 0 ~ 73801 OFFSET : Offset between data blocks to read 0 ~ 73801 SIZE : Size of data block to read 1 ~ 128 CNT : Number of data block to read 1 ~ 128 **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing. VAR : PLC device where read data is saved

(1) This command is to directly read parameters, operation data, CAM data to the positioning module.
It can be used to read desired data by directly specifying the module's internal memory address for parameter, operation data, and CAM data.

(3) This is a command to read as much as "size" from the position set in "S_ADDR" of positioning module's internal memory among parameters, operation data, and cam data of the positioning module to the device specified in "VAR" in WORD units specified by base and slot . If 'CNT" is over 2, blocks that are "OFFSET "away from "S_ADDR" location "are sequentially read are as many times as "CNT"-1 and save in the device specified in " VAR".

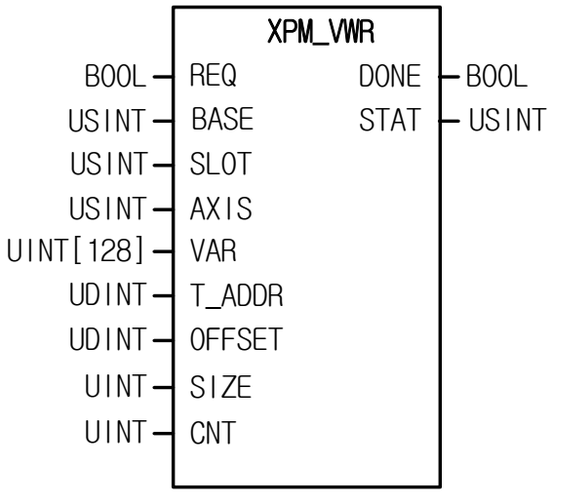
(4) The Max data size (SIZE X CNT) that can be read with one command is 128 WORD.

(5)" Variable data read "can be executed in operation.

(6) Set the axis to give command and can set the following values. If a value other than the set value is set, "Error 6" occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

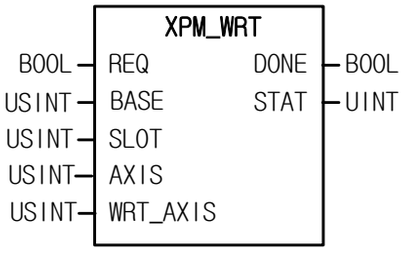
(7) If the data size to read (SIZE x CNT) is "0" or lager than 128 word, Error "11" occurs in STAT.

7.4.10 Variable Data Write (XPM_VWR)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) VAR : PLC device where write data is saved T_ADDR : Module internal memory leading address to write data 0 ~ 73801 OFFSET : Offset between data blocks to write 0 ~ 73801 SIZE : Size of data block to write 1 ~ 128 CNT : Number of data block to write 1 ~ 128 **Output** DONE : Maintain 1(on) after initial operation STAT : Error number occurred while function block is executing.

(1) This command is to directly write parameters, operation data, CAM data to the positioning module.
(2) It can used to write the desired data by directly specifying the module's internal memory address for parameter, operation data, and CAM data.
(3) This is a command to write data as much as "SIZE" from the "T_ADDR" position among the parameters, operation data, and cam data of the positioning module's internal memory in WORD units to the data specified in "VAR" in the PLC program specified by base and slot. If the number of block "CNT"' is over 2, the remaining data is written sequentially starting from the block located in "T_ADDR" to block spaced "OFFSET" apart by "CNT"-1 times.
(4) The Max data size (SIZE X CNT) that can be write with one command is 128 WORD.
(5) "Variable data write" command cannot be executed in operation.
(6) Set the axis to give command and can set the following values. If a value other than the set value is set, "Error 6" occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)
(7) If the data size to read (SIZE x CNT) is "0" or lager than 128 word, Error "11" occurs in STAT.
(8) If the number of blocks (CNT) is over 2 and block offset is smaller than block size (CNT), error "11" occurs in STAT as module internal block to write data is duplicated with each other.

7.4.11 Parameter/Operation Data Save (XPM_WRT)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) WRT_AXIS : stored axis setting (setting by each bit to set) 0bit ~ 7bit: axis1 ~ 8 **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives a parameter/operation data save command to be specified axis in positioning module for the specified by base and slot.

(2) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(4) When the function block is executed normally, the currently operating parameters and operation data of the axis set in WRT_AXIS are saved in MRAM so that they can be maintained even when the module's power is turned off.

(4) WRT_AXIS is set by setting the bit related to each axis.

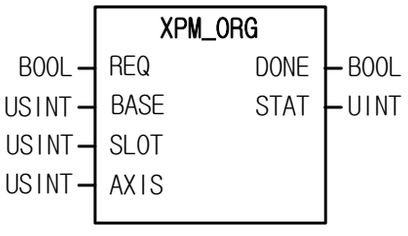
15 ~ 8 Bit	7Bit	6Bit	5Bit	4Bit	3Bit	2Bit	1Bit	0Bit
Do Not Use	Axis 8	Axis 7	Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1

For example, If select axis 3 and axis 5 axes 6, set# 34 ” by hexadecimal.

(5) If variable data writ (CAM) data changed by XPM_VWR command, these changed data is saved to flash memory when XPM_WRT command is executed.

7.5 Start and Stop Related Function Block

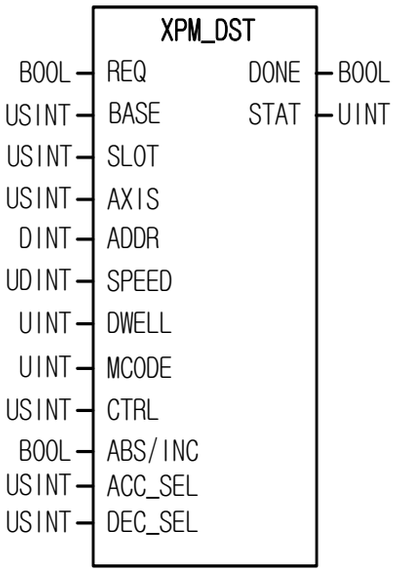
7.5.1 Homing Start (XPM_ORG)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) This command is a homing command to the positioning module.
(2) This is an operation command that homing operation is executed by homing related parameter set in the servo parameter of each axis and finds machine origin.
(3) Gives homing command to be specified axis in positioning module that is specified by base and slot.
(4) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)
(5) If the homing command is executed normally, the homing is starting with the method set in “homing method “of servo parameter.
(6) After completing homing completion of servo drive, homing operation is differing depending on the movement [0x201E] setting.
(The L7N servo drive does not have movement setting function after homing completion)

Move[0x201E] setting value after homing completion	Servo drive start after homing completion
0 (initial)	After homing completion with “homing method [0x6098]”, the motor does not rotate and the “home offset [0x607C] value becomes the current position value.
1	After homing completion with “homing method [0x6098]”, the motor rotates “home offset [0x607C] and the current position value is 0 at the position rotated as much as the “home offset [0x607C]”.

7.5.2 Direct Start (XPM_DST)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN04B : 1 ~ 8 (axis1 ~ 8) ADDR : Target position address setting -2147483648 ~ +2147483647 SPEED : Target speed setting DWELL : Dwell time setting 0 ~ 65535[ms] MCODE : M Code value setting CTRL : Control method setting 0: position control, 1: speed control, 2: Feed control, 3: Shortest distance control, 4: Speed control(CSV), 5: Not specified: forward 7: reverse, 8: Current direction ABS/INC: Absolute coordinate/Relative coordinate setting 0: Absolute coordinate ,1: Relative coordinate ACC_SEL: Acceleration number setting 0: Acceleration time 1, 1: Acceleration time 2 2: Acceleration time 3, 3: Acceleration time 4 DEC_SEL: Deceleration time number setting 0: Deceleration time 1, 1: Deceleration time 2 2: Deceleration time 3, 3: Deceleration time 4 **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

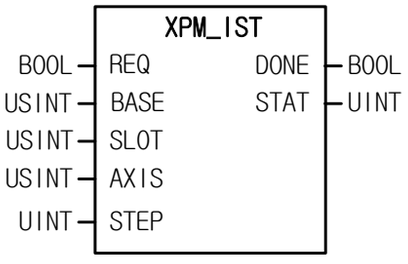
(1) Gives direct start command to be specified axis in positioning module that is specified by base and slot.

(2) It is used when you want to operate directly by setting target position address, operation speed, dwell time, M code number, control modes, coordinate and acceleration/deceleration time number regardless of operation data.

(3) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

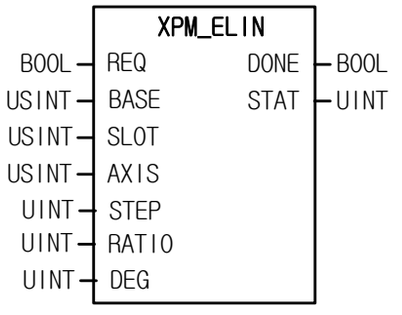
(4) If the values set in SPEED, CTRL, TIME_SEL exceed the setting range, error 11 occurs in STAT.

7.5.3 Indirect Start (XPM IST)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN04B : 1 ~ 8 (axis1 ~ 8) STEP : Step number to operate 0 ~ 400 **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives Indirect start command to be specified axis in positioning module that is specified by base and slot.
(2) This is used when you operate by specifying the operation step number of setting axis as operation data.
(3) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)
(4) If the value set in STEP exceeds the setting Range (0 ~ 400), error 11 occurs in STAT.
(5) If you set 0 in STEP, the current step will is operated
(6) Linear interpolation, circular Interpolation and helical interpolation are executed with indirect start commands by setting the control method in the operation data.

7.5.4 Ellipse Interpolation (XPM_ELIN)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN04B : 1 ~ 8 (axis1 ~ 8) STEP : Step number to operate RATIO : Ellipse ratio (%) DEG : operation degree **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives ellipse Interpolation command to be specified axis in positioning module that is specified by base and slot.

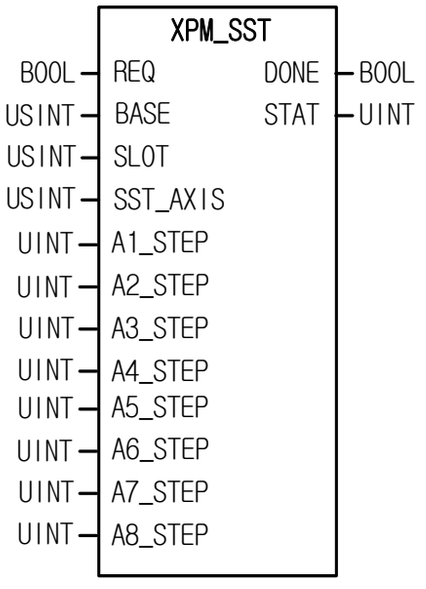
(2) The ellipse interpolation is executed on the steps specified in STEP and the ratio in RATIO and degree in DEG of specified axis. The ellipse interpolation distorts operation data to which set as circular interpolation by ratio set on ellipse ratio and executes ellipse operation by set degree in DEG. Therefore, the step of operation data set on operation step (STEP) must be set as circular Interpolation control.

(4) The ellipse ratio is able to be set from 1 to 65535, has [$X10^{-2}$ %] unit. That is, 65535 will be 655.35%.

(5) Operation degree is able to be set from 1 to 65535, has [$X10^{-1}$ degree] unit. That is, 3650 will be 365.0 degree.

(6) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.5.5 Simultaneous Start (XPM_SST)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted SST_AXIS : Simultaneous start axis setting XBF PN04B : 0bit ~ 3bit (axis1 ~ 4) XBF- PN08B: 0bit ~ 7bit (axis1 ~ 8) Select by setting the bit related to each axis A1_STEP : Axis1 step number to start A2_STEP : Axis2 step number to start A3_STEP : Axis3 step number to start A4_STEP : Axis4 step number to start A5_STEP : Axis5 step number to start A6_STEP : Axis6 step number to start A7_STEP : Axis7 step number to start A8_STEP : Axis8 step number to start **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives simultaneous start command to be specified SST_AXIS in positioning module mode of the servo specified by base and slot.

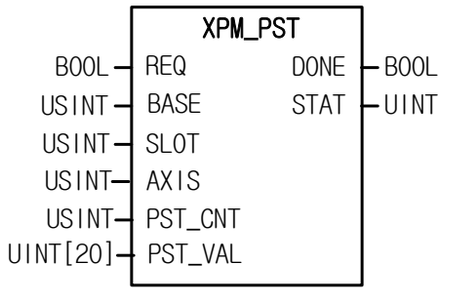
(2) This is used when you start operation of 2 or more axes simultaneously.

(3) If you set a value other than the setting value in SST_AXIS, error6 will occur. Set each bit as follows.

7bit	6bit	5bit	4bit	3bit	2bit	1bit	0bit
Axis 8	Axis 7	Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1

(4) In A1 step to A8 step, set step the number of steps to be operated by simultaneous start of each axes from axis1 to axis8.

7.5.6 Point Operation (XPM_PST)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) PST_CMT : Set the number of point operation step 0 ~ 19 PST_VAL : Set the point operation step number 0 ~ 400 **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

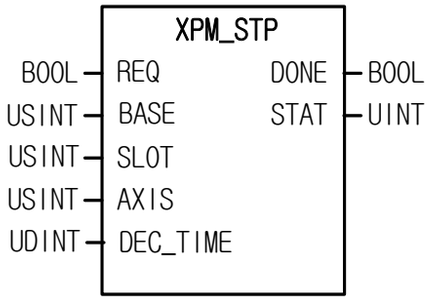
(1) Gives a point operation start command to be specified axis in positioning module for the specified by base and slot.

(2) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(3) During PTP (Point to Point) operation, up to 20 operation step can be set and used to operate continuously without stopping with a single command ,
If you set a values other than the setting value in PST_CNT or PST_VAL, error6 will occur.

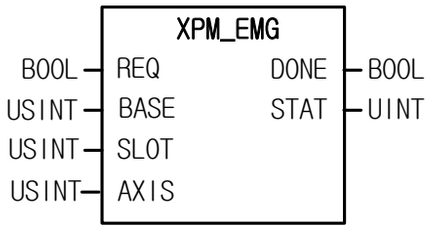
(4) The point operation can be operated with up to 20 point steps. Therefore, you can use a UINT array type variable with 20 elements in PST_VAL.

7.5.7 Deceleration Stop (XPM STP)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) DEC_TIME : Deceleration stop time 0: Acceleration/deceleration time applied during starting operation. 1 ~ 2147483647: 1 ~ 2147483647ms **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

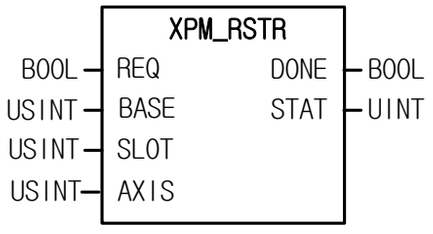
(1) Gives decelerating stop command to be specified axis in positioning module that is specified by base and slot.
If a stop command is meet during operation using operation data, operation executes by start command after deceleration stop.
(3) If the deceleration stop command is executed in speed sync. Position sync. Or CAM operation, it stops speed sync., position sync. Or CAM operation depending on current operation control state.
(4) The deceleration stop command is executed not only in acceleration and constant speed areas, but also in deceleration areas.
The deceleration time means the time required from deceleration start to stop and it is available to set from 0 ~ 2,147,483,647ms. But if setting as '0', it stops only by deceleration time set at the beginning of operation.
(6) Deceleration time means the time required from the speed limit of basic parameter on operation axis to stop.
(7) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.5.8 Emergency Stop (XPM_EMG)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives emergency stop command to the axis in positioning module that is specified by base and slot.
(2) It is used when you want to immediately stop operation in emergency situation, the axis on which command is executed is in a stop status.
(3) The deceleration time in emergency stop become the time which set on 'Emergency stop deceleration time' item of each basic parameter.
(4) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.5.9 Restart (XPM_RSTR)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the error number that occurred while function block executes.

(1) Gives restart command to the axis in positioning module that is specified by base and slot.

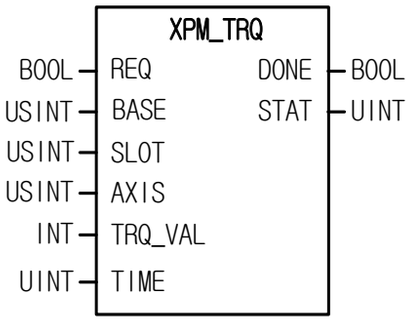
(2) It is used to restart an axis that has deceleration stop during operation, and the axis on which this command is executed operates again with the previous operating Information.

(3) If the axis executes different operation before restarting after decelerating stop, the restart command is not executed.

(4) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(5) For explanation of the restart operation, refers to “9.2.20 Restart item”.

7.5.10 Torque Control (XPM_TRQ)

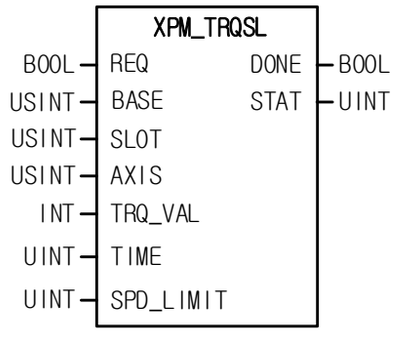
Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) TRQ_VAL : Torque values (unit:%, -32768 ~ 32767) TIME : Torque slope (unit: ms, 0 ~ 65535ms) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the error number that occurred while function block executes.

(1) Gives torque control command to the axis in positioning module that is specified by base and slot.
(2) Torque control is executed by setting the torque value and torque slope.
(3) Set the torque value (%) to operate in TRQ_VAL TRQ. The torque value operates as a percentage of the rated torque. (1 = 1% of rated torque)
For example, set 200 to execute torque control with 200% torque.

※ The allowable range of torque value depends on the type of servo drive connected. Generally, the target torque value is limited to the maximum torque setting.

(4) Time is set the time to reach the target torque When the command is executed, the torque increases with this slope up to the torque value set in the RQ_VA.
(5) It is unavailable to be executed when the axis is operating other than torque control.
(6) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)
For explanation of the torque control operation, refers to “9.2.21 Torque control”.

7.5.11 Speed Limit Torque Control (XPM_TRQSL)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B: 1~4(axis1 ~ 4) XBF-PN08B: 1 ~ 8(axis1 ~ 8) TRQ_VAL : Torque values (unit 0.1%, -32768 ~ 32767) TIME : Torque slope (unit: ms, 0 ~ 65535ms) SPD_LIMIT : Speed limit (unit: rpm, 0~6000) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the error number that occurred while function block executes.

(1) Gives torque control command with less than setting speed to the axis in positioning module that is specified by base and slot.
(2) Torque control is executed by setting the torque value and torque slope and speed limit.

※ This command only applies to the LS ELECTRIC servo drive family.

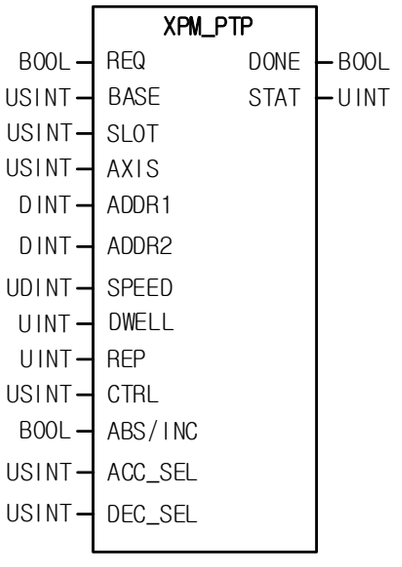
(3) Set the torque value (%) to operate in TRQ_VAL TRQ. The torque value operates 0.1% to be of the rated torque. (1 = 0.1% of rated torque)
For example, set 2000 to execute torque control with 200% torque.

※ The allowable range of torque value depends on the type of servo drive connected. Generally, the target torque value is limited to the maximum torque setting.

(4) Time is set the time to reach the target torque When the command is executed, the torque increases with this slope up to the torque value set in the RQ_VA.
(5) The SPD_LIMIT is speed limit and is set as speed limit value parameter during torque control of servo drive and operates maximum speed value during torque operation.
(6) It is unavailable to be executed when the axis is operating other than torque control.
(7) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
(8) XBF-PN04B: 1~4(axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)
(9) The OS versions that support related commands are as follows

	Version
XBF-PN04B OS	V1.80 or higher
XBF-PN08B OS	V1.80 or higher
XBCU OS	V1.90
XBMH2/HP	V2.20
XG5000	V4.28 or higher

7.5.12 PTP Operation (XPM_PTP)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08A/PN08B: 1 ~ 8(axis1 ~ 8) ADDR 1: Target position 1 address setting -2147483648 ~ +2147483647 ADDR 2: Target position 2 address setting -2147483648 ~ +2147483647 SPEED : Target speed setting DWELL : Dwell time setting 0 ~ 65535 [ms] REP : Repeat count setting 0 ~ 65535 CTRL : Control method setting 0: Position control, 3: Shortest distance control ABS/INC: Absolute coordinate/Relative coordinate setting 0: Absolute coordinate ,1: Relative coordinate ACC_SEL: Acceleration number setting 0: Acceleration time 1, 1: Acceleration time 2 2: Acceleration time 3, 3: Acceleration time 4 DEC_SEL: Deceleration time number setting 0: Deceleration time 1, 1: Deceleration time 2 2: Deceleration time 3, 3: Deceleration time 4 **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives PTP operation command to be specified axis in positioning module that is specified by base and slot.

(2) It is used when you want to operate repeat by setting target position address1, target position address2, operation speed, dwell time, repeat count, control modes, coordinate and acceleration/deceleration time number regardless of operation data.

(3) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(4) If the values set in SPEED, CTRL, TIME_SEL exceed the setting range, error 11 occurs in STAT.

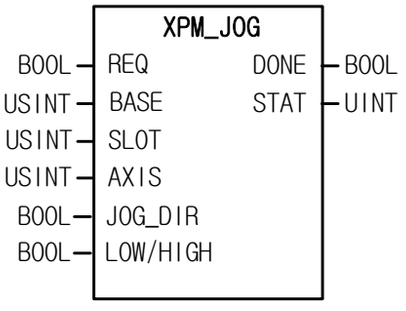
(5) Absolute coordinate/Relative coordinate setting to 0: if set to absolute coordinate, a round trip operation is executed between target position 1 and target position 2 as many times as the number of repetitions. 1: if set to relative coordinate, a round trip operation is executed between the current position moved by target position 1 and the target position 1 moved by target position 2 as many times as the number of repetitions.

(6) From the current position where operation begins to target position 1, it is not included the number of repetitions. If the number of repetition is an even number, operation is finished at target position 1, and if the number of repetition is odd number, operation is finished at target position 2.

(7) PTP operation enables shortest distance control and restart operation. During restart operation, operation is executed for the remaining number of repetitions.

7.6 Manual Operation Related Function Block

7.6.1 Jog Operation (XPM_JOG)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) JOG_DIR : Rotation direction setting when operating jog 0:forward direction , 1:reverse direction LOW/HIGH : Jog speed setting when operating jog 0: Jog low speed operation, 1:Jog high speed operation **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives jog operation command to be specified axis in positioning module that is specified by base and slot.

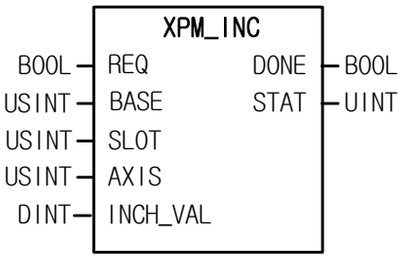
(2) This is used to check position address for system operation, wiring status check and teaching as manual operation function to test. The speed can be divided into high and low speed.

(3) The operation condition of jog operation function block is in level type. In other words, when the connection condition of input variables REQ is on, the pulse is output by set value and stop when it is off.

When the operation condition is on status (in jog operation), if the value set in LOW/ HIGH is changed, speed change occurs without stop in jog, and if the value set in JOG_DIR is changed, jog is continued by changing the direction after the deceleration pause.

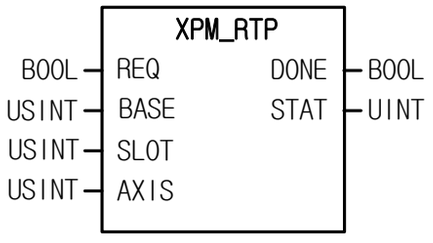
(5) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.6.2 Inching Operation (XPM_INC)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) INCH_VAL : Movement amount moved by inching operation -2,147,483,648~ 2,147,483,647 **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives inching operation command to be specified axis in positioning module that is specified by base and slot.
(2) The inching operation that is one of manual operation is used when operating minute movement into quantitative operation.
(3) The inching operation speed is set in the manual operation parameters.
(4) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.6.3 Manual Operation Previous Position Return (XPM_RTP)

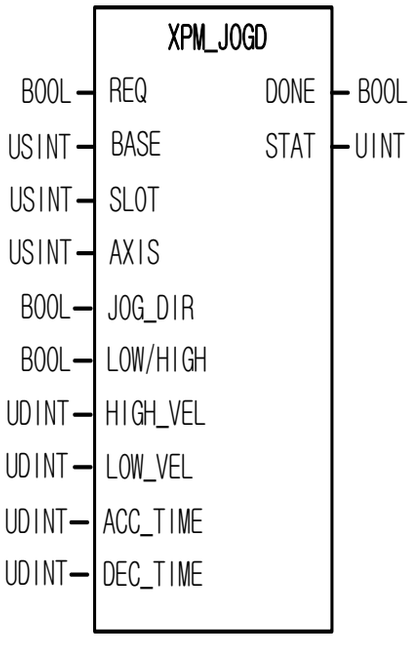
Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives the return to position command before manual operation to be specified axis in positioning module that is specified by base and slot.

(2) This command is used when returning to the position before manual operation when position is changed by manual operation after positioning.

(3) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.6.4 Direct Input Jog Operation (XPM_JOGD)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 4 (axis1 ~ 8) JOG_DIR : Rotation direction setting when operating jog 0:forward direction , 1:reverse direction LOW/HIGH : Jog speed setting when operating jog 0: Jog low speed operation, 1:Jog high speed operation HIGH_VEL : high speed operation speed LOW_VEL : low speed operation speed ㎜: 1 ~ 2,147,483,647 [X10-2㎜/minute] Inch : 1 ~ 2,147,483,647 [X10-3Inch/minute] degree : 1 ~ 2,147,483,647 [X10-3 degree/minute] pulse : 1 ~ 2,147,483,647 [pulse/second] ACC_TIME: Acceleration time (0 ~ 2,147,483,647 ms) DEC_TIME: Deceleration time (0 ~ 2,147,483,647 ms) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives direct input jog operation command to be specified axis in positioning module that is specified by base and slot. The XPM_JOG command operates with reference to jog high speed, jog low speed, jog acceleration time and jog deceleration time of manual operation parameters, but the XPM_JOGDEX command executes jog operation with reference to function block input values.

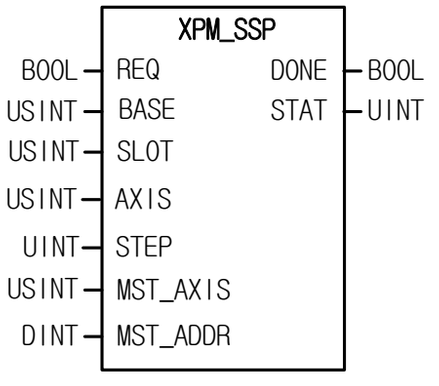
(2) This is used to check position address for system operation, wiring status check and teaching as manual operation function to test. The speed can be divided into high and low speed.

(3) The operation condition of jog operation function block is in level type. In other words, when the connection condition of input variables REQ is on, the pulse is output by set value and stop when it is off.
When the operation condition is on status (in jog operation), if the value set in LOW/ HIGH is changed, speed change occurs without stop in jog, and if the value set in JOG_DIR is changed, jog is continued by changing the direction after the deceleration pause. If you change the values set in HIGH_VEL, LOW_VEL, ACC_TIME, and DEC_TIME, jog operation executed by accelerating/decelerating to the values set in ACC_TIME or DEC_TIME at the speed set in HIGH_VEL or LOW_VEL depending on OW/HIGH setting values.

(5) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.7 Synchronous Operation Related Function Block

7.7.1 Position Synchronization (XPM_SSP)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) STEP : Step number to operate 0 ~ 400 MST_AXIS : Position synchronization main axis setting XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) 9: Encoder 1 MST_ADDR : Main axis positioning setting to execute positioning synchronization -2,147,483,648~ 2,147,483,647 **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

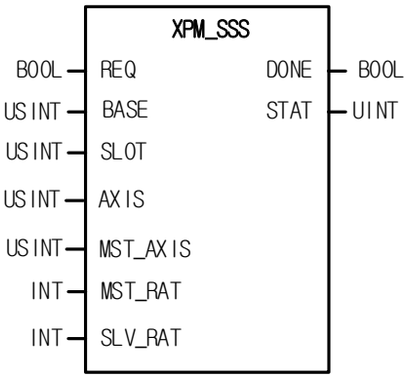
(1) Gives the position synchronization command to be specified axis in positioning module that is specified by base and slot.

(2) The axis that give the command is set as subordinate axis and when the axis set as main axis reaches the set synchronous position, the operation step set by the command axis is operated.

(3) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(4) If set main axis of position synchronization in MST_AXIS and the following values can be set. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8), 9: encoder 1

7.7.2 Speed Synchronization (XPM_SSS)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) MST_AXIS : Speed synchronization main axis setting XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) 9: Encoder 1 MST_RAT : Speed ratio setting of main axis -32768 ~ 32767 SLV_RA T : Speed ratio setting of subordinates axis -32768 ~ 32767 **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives the speed synchronization command to be specified axis in positioning module that is specified by base and slot.

(2) This is used when you want to control the operation speed between two axes at a set ratio.

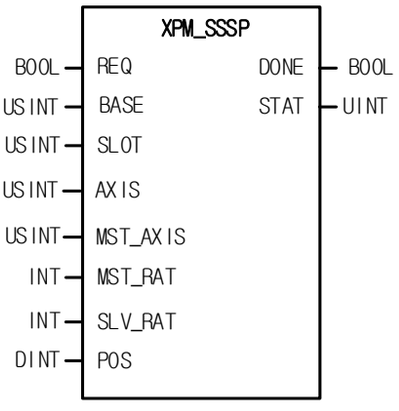
(3) There is no rule regarding the size between the main axis speed ratio and the subordinate axis speed. In other words, if main axis speed ratio is greater than the subordinate axis speed ratio, the main axis moves faster than the subordinate axis, and if subordinate axis speed ratio is greater than the main axis speed ratio, the subordinate axis moves faster than the main axis.

(4) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1 ~ 4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(5) If set main axis of speed synchronization in MST_AXIS and the following values can be set. If a value other than the set value is set, “Error 11” occurs.
XBF-PN04B: 1 ~ 4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8), 9: encoder 1

(6) For subordinate axis operation direction if the speed synchronization ratio (sub axis/main axis) is positive, operating main axis operation direction, and if it is negative, operating opposite direction of main axis.

7.7.3 Position Specified Speed Synchronization (XPM_SSSP)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) MST_AXIS : Speed synchronization main axis setting XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) 9: Encoder 1 MST_RAT : Speed ratio setting of main axis -32768 ~ 32767 SLV_RA T : Speed ratio setting of subordinates axis -32768 ~ 32767 POS: Target position -2,147,483,648 ~ 2,147,483,647 **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives position specified speed synchronization command to be specified axis in positioning module that is specified by base and slot.

(2) This is used when you want to control the operation speed between two axes at a set ratio. When the position to which the subordinate axis moves reaches the position specified in PODS after executing XPM_SSSP, speed synchronization is completed and it stops.

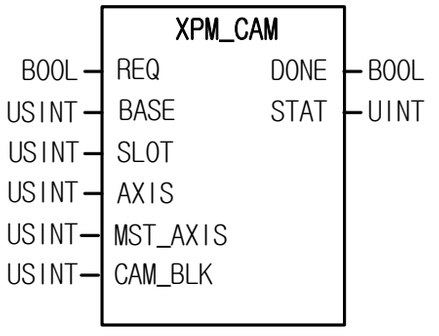
(3) There is no rule regarding the size between the main axis speed ratio and the subordinate axis speed. In other words, if main axis speed ratio is greater than the subordinate axis speed ratio, the main axis moves faster than the subordinate axis, and if subordinate axis speed ratio is greater than the main axis speed ratio, the subordinate axis moves faster than the main axis.

(4) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(5) If set main axis of speed synchronization in MST_AXIS and the following values can be set. If a value other than the set value is set, “Error 11” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8), 9: encoder 1

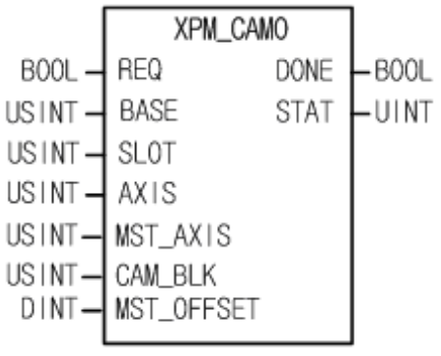
(6) For subordinate axis operation direction if the speed synchronization ratio (sub axis/main axis) is positive, operating main axis operation direction, and if it is negative, operating opposite direction of main axis.

7.7.4 CAM Operation (XPM_CAM)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) MST_AXIS : Main axis setting XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) CAM_BLK : CAM block setting 1 ~ 9 : Block 1 ~ 9 **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives cam operation command to be specified axis in positioning module that is specified by base and slot.
(2) CAM operation is executed by using CAM main axis and CAM data block of the related axis
(3) When a CAM operation command is executed, the subordinate axis (axis set in AXIS) is displays as in operation status but motors do not operates. When the axis set as the main axis starts operation, the motor starts operating to subordinate axis position that related to main axis position depending on CAM block data values block set in cam block (CAM_BLK).
(4) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)
(5) If set main axis of CAM operation in MST_AXIS and the following values can be set. If a value other than the set value is set, “Error 11” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8), 9: encoder 1
(6) In CAM_BLK, set the CAM block number to be executed and can set the following values. If a value other than the set value is set, “Error 11” occurs.
1 ~ 9: Block 1 ~ Block 9
(7) You can write CAM data in the positioning package and up to 8 blocks (block1 to block8) can be set.
(8) In order to use user CAM operation, you have to set CAM block number 9.
(9) For the detail about user cam (CAM) operation, refer to“9.4.4 User Cam Operation”.

7.7.5 Main Axis Specified CAM Operation (XPM_CAMO)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) MST_AXIS : Main axis setting XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) CAM_BLK : CAM block setting 1 ~ 9 : Block 1 ~ 9 MST_OFFSET : main axis offset position movement amount setting -2147483648 ~ 2147483647 **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives CAM operation command to be specified axis in positioning module that is specified by base and slot.

(2) CAM operation is executed by using CAM main axis, CAM data block, and main axis offset of the related axis.

(3) When a CAM operation command is executed, the subordinate axis (axis set in AXIS) is displays as in operation status but motors do not operates. After the axis set as the main axis starts operation and if it moves by main axis offset position movement amount set in MST_OFFSET, the motor starts operating to subordinate axis position that related to main axis position depending on CAM block data values block set in cam block(CAM_BLK).

(4) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(5) If set main axis of CAM operation in MST_AXIS and the following values can be set. If a value other than the set value is set, "Error 11” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8), 9: encoder 1

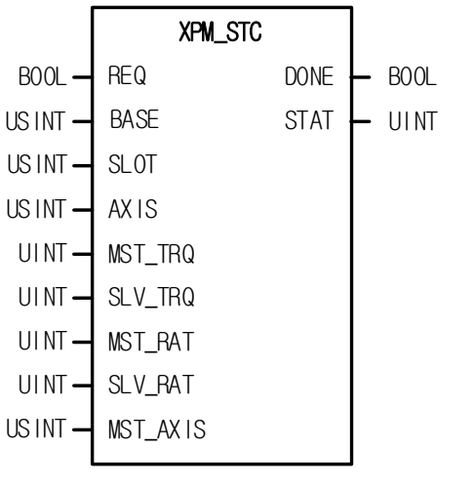
(6) In CAM_BLK, set the CAM block number to be executed and can set the following values. If a value other than the set value is set, "Error 11” occurs.
1 ~ 9: Block 1 ~ Block 9

(7) You can write CAM data in the positioning package and up to 8 blocks (block1 to block8) can be set.

(8) In order to use user CAM operation, you have to set CAM block number 9.

(9) For the detail about user cam (CAM) operation, refer to“9.4.4 User Cam Operation”.

7.7.6 Torque Synchronization (XPM_STC)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN08B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) MST_TRQ : Torque ratio setting of main axis 1 ~ 65535 SLV_TRQ : Torque ratio setting of subordinates axis 1 ~ 65535 MST_RAT : Speed ratio setting of main axis No use SLV_RAT : Speed ratio setting of subordinates axis No use MST_AXIS : Torque synchronization main axis setting XBF-PN08B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) This function block is to give a torque synchronization command to related axis of servo drive connected to the positioning module.

(2) Gives torque synchronization command to be specified axis in positioning module that is specified by base and slot.

(3) The axis that executes the command executes in torque synchronization operation with the axis set in MST_AXIS as the main axis

(4) The axis that executes the command executes torque synchronization operation with the torque ratio set in MST_TRQ, SLV_TRQ.

Subordinate axis torque = (SLV_TRQ/MST_TRQ) * main axis torque

(5) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.

XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(6) If set main axis of torque synchronization in MST_AXIS and the following values can be set. If a value other than the set value is set, “Error 11” occurs.

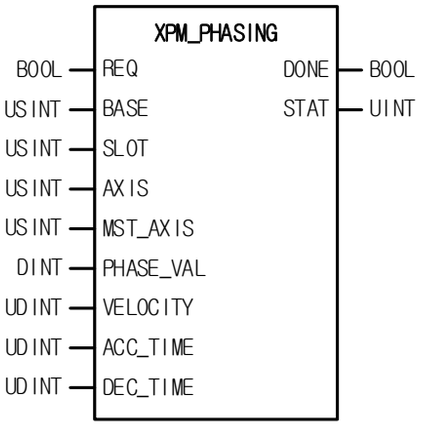
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(7) The torque control reference value of the main with which the subordinate axis is synchronized can be selected between actual torque and required torque.

Select the torque synchronization control reference value of common parameter from 0: actual torque value or 1: required torque value.

(It can be set by XG-PM or common parameter teaching command (XPM_SCP/XPM_XSCPEX))

7.7.7 Phase Compensation (XPM_PHASING)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN08B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) MST_AXIS : Phase compensation main axis setting XBF-PN08B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) 9: Encoder 1 PHASE_VAL : Phase compensation vales VELOCITY : Phase compensation speed(Relative speed to main axis speed) ACC_TIME: Acceleration time (0 ~ 2,147,483,647 ms) DEC_TIME: Deceleration time (0 ~ 2,147,483,647 ms) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the error number that occurred while function block executes.

(1) This function block executes phase compensation on the main axis position specified by axis in the AXIS of positioning module and allows the subordinate axis to execute synchronous operation with respect to the position of the compensated main axis.

(2) Gives phase compensation with the values set in VELOCITY, ACC_TIME, DEC_TIME as much as the phase compensation amount set in HAS_VAL for the main axis set in MST_AXIS specified axis in positioning module that is specified by base and slot.

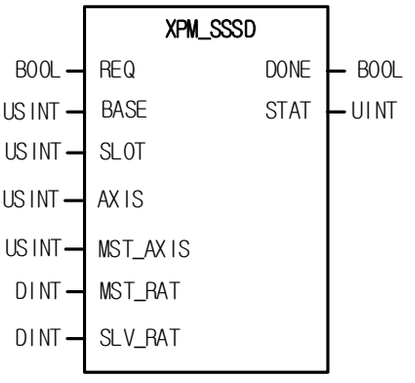
(3) Set the axis to give command and can set the following values. If a value other than the set value is set, "Error 6" occurs.

1) XBF-PN08B
   1 ~ 8: Axis 1~ 8
2) XBF-PN04B
   1 ~ 4: Axis 1~ 4

(4) If set main axis of phase compensation in MST_AXIS and the following values can be set. If a value other than the set value is set, "Error 11" occurs.

1) XBF-PN08B
   1 ~ 8: axis 1 ~ axis 8, 9: encoder 1
2) XBF-PN04B
   1 ~ 4: axis 1 ~ axis 4, 9: encoder 1

7.7.8 32-bit Speed Synchronization (XPM_SSSD)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) MST_AXIS : Speed synchronization main axis setting XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) 9: Encoder 1 MST_RAT : Speed ratio setting of main axis -2,147,483,648 ~ 2,147,483,647 SLV_RAT : Speed ratio setting of subordinates axis -2,147,483,648 ~ 2,147,483,647 **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives the speed synchronization command to be specified axis in positioning module that is specified by base and slot.

(2) This is used when you want to control the operation speed between two axes at a set ratio. The values of the main axis ratio and the sub axis ratio can be set to a 32-bit integer range.

(3) There is no rule regarding the size between the main axis speed ratio and the subordinate axis speed. In other words, if main axis speed ratio is greater than the subordinate axis speed ratio, the main axis moves faster than the subordinate axis, and if subordinate axis speed ratio is greater than the main axis speed ratio, the subordinate axis moves faster than the main axis.

(4) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.

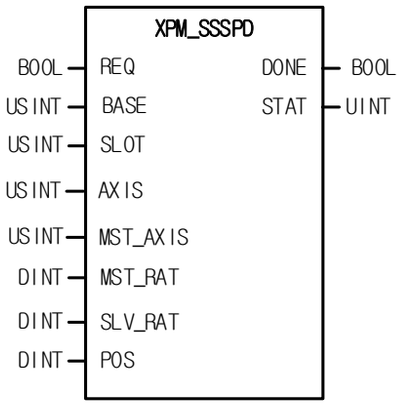
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(5) If set main axis of speed synchronization in MST_AXIS and the following values can be set. If a value other than the set value is set, “Error 11” occurs.

XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8), 9: encoder 1

(6) For subordinate axis operation direction if the speed synchronization ratio (sub axis/main axis) is positive, operating main axis operation direction, and if it is negative, operating opposite direction of main axis.

7.7.9 32-bit Position Specified Speed Synchronization (XPM_SSSPD)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) MST_AXIS : Speed synchronization main axis setting XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) 9: Encoder 1 MST_RAT : Speed ratio setting of main axis -2,147,483,648 ~ 2,147,483,647 SLV_RAT : Speed ratio setting of subordinates axis -2,147,483,648 ~ 2,147,483,647 POS: Target position -2,147,483,648 ~ 2,147,483,647 **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives position specified speed synchronization command to be specified axis in positioning module that is specified by base and slot.

(2) This is used when you want to control the operation speed between two axes at a set ratio. The values of the main axis ratio and the sub axis ratio can be set to a 32-bit integer range. When the position to which the subordinate axis moves reaches the position specified in PODS after executing XPM_SSSPD, speed synchronization is completed and it stops.

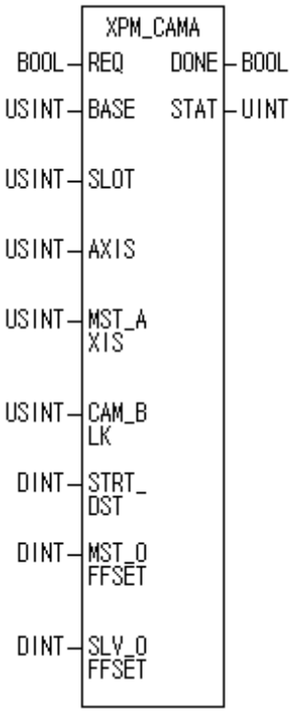
(3) There is no rule regarding the size between the main axis speed ratio and the subordinate axis speed. In other words, if main axis speed ratio is greater than the subordinate axis speed ratio, the main axis moves faster than the subordinate axis, and if subordinate axis speed ratio is greater than the main axis speed ratio, the subordinate axis moves faster than the main axis.

(4) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(5) If set main axis of speed synchronization in MST_AXIS and the following values can be set. If a value other than the set value is set, “Error 11” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8), 9: encoder 1

(6) For subordinate axis operation direction if the speed synchronization ratio (sub axis/main axis) is positive, operating main axis operation direction, and if it is negative, operating opposite direction of main axis.

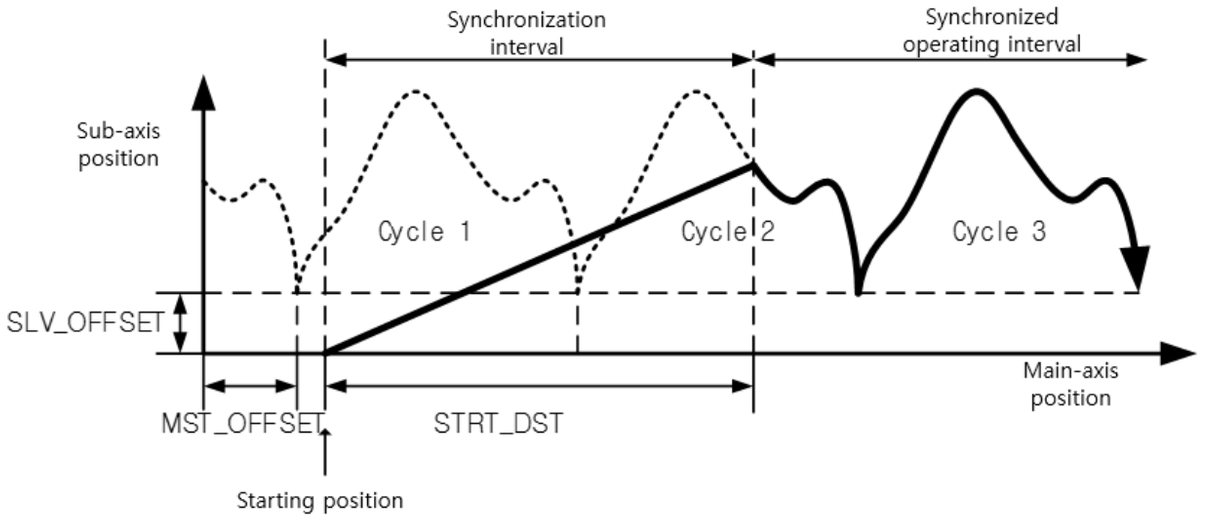
7.7.10 Absolute Position CAM Operation (XPM_CAMA)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) MST_AXIS : Main axis setting XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) 9: Encoder 1 CAM_BLK : CAM block setting 1 ~ 9 : Block 1 ~ 9 STRT_DST : CAM operation start movement amount setting -2147483648 ~ 2147483647 MST_OFFSET : main axis offset position movement amount setting -2147483648 ~ 2147483647 SLV_OFFSET : Subordinate axis offset position movement amount setting -2147483648 ~ 2147483647 **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives absolute position cam operation command to be specified axis in positioning module that is specified by base and slot.

(2) CAM operation is executed by using CAM main axis, CAM data block, CAM operation start position, main axis offset, subordinate axis offset of the related axis.

(3) When an absolute position CAM operation command is executed and the axis set in main axis starts, it operates to reach the synchronization position until it moves the distance set in STRT_DST. When the main axis is in STRT_DST, the synchronization position can move to the position on subordinate's axis depending on the cam data value set in the CAM block (CAM_BLK) according to the settings of MST_OFFSET and SLV_OFFSET values. When the main axis reach the distance set as STRT_DST motor operates to subordinate axis position that related to main axis position depending on CAM block data values block set in cam block (CAM_BLK).



(4) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(5) If set main axis of CAM operation in MST_AXIS and the following values can be set. If a value other than the set value is set, “Error 11” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8), 9: encoder 1

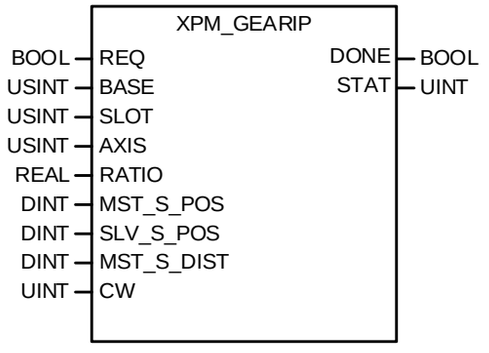
(6) In CAM_BLK, set the CAM block number to be executed and can set the following values. If a value other than the set value is set, “Error 11” occurs.
1 ~ 9: Block 1 ~ Block 9

(7) You can write CAM data in the positioning package and up to 8 blocks (block1 to block8) can be set.

(8) In order to use user CAM operation, you have to set CAM block number 9.

(9) For the detail about user cam (CAM) operation, refer to“9.4.4 User Cam Operation”.

7.7.11 Synchronization Position Specified Speed Synchronization (XPM_GEARIP)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded RATIO : Synchronization ratio setting MST_S_POS : Main axis position setting to execute synchronization status SLV_S_POS : Subordinate axis position setting to execute synchronization status MST_S_DIST: Distance of main axis to start synchronous operation CW : Control word(main axis number) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives the speed synchronization command to be specified axis in positioning module that is specified by base and slot.

(2) This is used when you want to control the operation speed between two axes at a set ratio.

(3) If main axis speed ratio is greater than the subordinate axis speed ratio, the main axis moves faster than the subordinate axis, and if subordinate axis speed ratio is greater than the main axis speed ratio, the subordinate axis moves faster than the main axis.

(4) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.

XBF-PN04B: 1~4(axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(5) Details of CW (Control word) for each bit are as follows.

1) XBF-PN04B, XBF-PN08B

15 ~ 13	12 ~ 8	7 ~ 6	5 ~ 4	3 ~ 0
-	-	Deceleration time	Acceleration time	Main axis

(a) Main axis

- XBF-PN04B: 1 ~ 4(axis 1~ 4), 9: encoder 1, 10: encoder 2
- XBF-PN08B: 1 ~ 8(axis 1 ~ 8), 9: encoder 1, 10: encoder 2

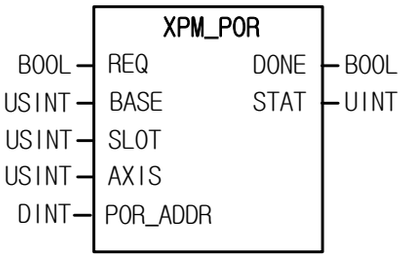
(6) The operating direction of the subordinate axis is operated in the direction of the main axis if the synchronization ratio is a positive, and in the opposite direction to the main axis if the synchronization ratio is negative.

(7) The version information to use the synchronous position specified speed synchronization command is as follows.

	Version
XBF-PN04B OS	V1.80 or higher
XBF-PN08B OS	V1.80 or higher
XBCU OS	V1.90
XBMH2/HP	V2.20
XG5000	V4.28 or higher

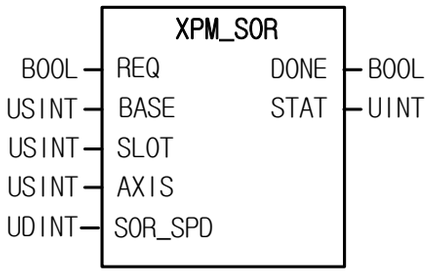
7.8 Change Related Function Blocks

7.8.1 Position Override (XPM_POR)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) POR_ADDR : New target position setting -2,147,483,648 ~ 2,147,483,647 **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

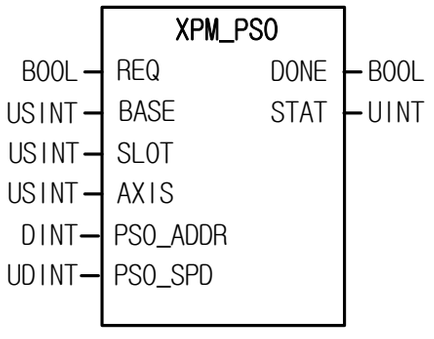
(1) Gives the position override command to be specified axis in positioning module that is specified by base and slot.
(2) This is used when changing the target position while the command is in operation status
(3) If executing position override after passing a position to execute position override, once stops at the current position. And then moving back to position where set at POR_ADDR.
(4) The target position to change is set in POR_ADDR.
(5) Position override set on position override value is absolute coordinate position.
(6) Set the axis to give command and can set the following values. If a value other than the set value is set, "Error 6" occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.8.2 Speed Override (XPM_SOR)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) SOR_SPD : New operation speed values setting **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

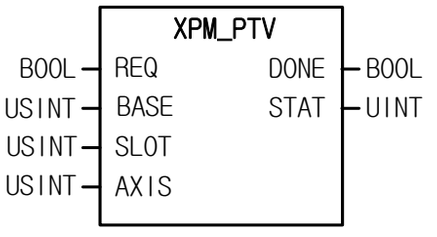
(1) Gives the speed override command to be specified axis in positioning module that is specified by base and slot.
(2) This is used when changing operation speed while the command axis is in operation status.
(3) SOR_SPD can be set to"% "or "speed values (unit/time)" depending on the values set in "speed override" of common parameter.
(4) If unit of speed override value is %, the setting area is from 1 to 65,535, it means 0.01% ~ 655.35%.
(5) If unit of speed override value is speed value, setting area is from 1 to speed limit value. The speed limit value is set on Speed limit value of basic parameter and unit of speed override value depends on unit of axis.
(6) Set the axis to give command and can set the following values. If a value other than the set value is set, "Error 6" occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.8.3 Position Specified Speed Override (XPM_PSO)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) PSO_ADDR : Position for executing speed change -2,147,483,648~ 2,147,483,647 PSO_SPD : New operation speed values setting **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives the speed override command to be specified axis in positioning module that is specified by base and slot.
(2) This is used when changing operation speed after reaching a certain position while the command axis is in operation status.
(3) The speed values to set in PSO_SPD is became to “% specified“ or “speed value specified” depending on the value set in speed override of common parameter.
(4) If the unit of speed value is %, the setting area is from 1 to 65,535, it means 0.01% ~ 655.35%.
(5) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.8.4 Position/Speed Switching Control (XPM_PTV)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

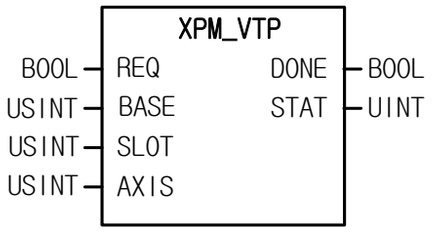
(1) Gives position/speed control switching command to be specified axis in positioning module that is specified by base and slot.

(2) If a specified axis receives a position/speed control switching command while operating position control operation with a specified movement amount, it switches from position control to speed control and operates until a stop factor like deceleration stop occurs.

(3) When this command is executing, the home is undetermined at the moment of executing and speed control operation is executed.

(4) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

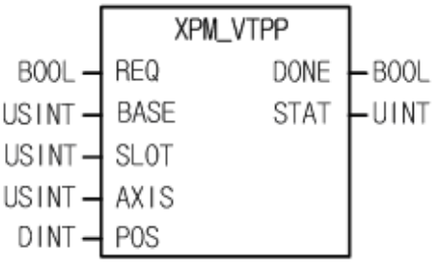
7.8.5 Speed/Position Switching Control (XPM_VTP)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives speed/position control switching command to be specified axis in positioning module that is specified by base and slot. If a specified axis receives a speed/position control change command while operating speed control operation, it switches from speed control to position control and operates positioning with the set position values set when starting speed control.

(3) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

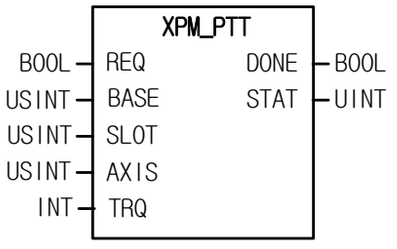
7.8.6 Position Specified Speed/Position Switching Control (XPM_VTPP)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) POS : Position movement amount -2,147,483,648 ~ 2,147,483,647 **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives position specified speed/position change control change command to be specified axis in positioning module that is specified by base and slot. If a specified axis receives a position specified speed/position change control command while operating speed control operation, it switches from speed control to position control and operates positioning as much as position movement amount specified in POS.

(2) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.8.7 Position/Torque Switching Control (XPM_PTT)

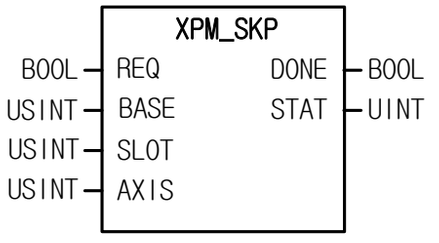
Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN09B : 1 ~ 8 (axis1 ~ 8) TRQ : Torque values **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives position/torque control change command to be specified axis in positioning module that is specified by base and slot. If a specified axis receives a position/torque control change command while operating position control operation, it switches from position control to torque control and operates torque values set in TRQ, maintaining torque control until a stop factor like deceleration stop occurs.

(3) The range of torque value is -32768 ~ 32767 and the unit is [%]. The allowable range of torque value depends on the type of servo drive connected. Generally, the target torque value is limited to the maximum torque setting.

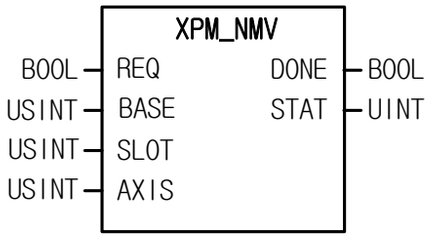
(4) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.8.8 Skip Operation (XPM_SKP)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

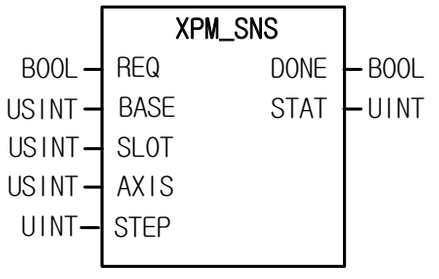
(1) Gives the skip operation command to be specified axis in positioning module that is specified by base and slot.
(2) It is used when executing to move the next step without executing the operation step. In other words, the operation of the currently operating step is stopped and finished, and operation keeps to the next step.
(3) Each time tit is executed, the current operation step is skipped and the next operation step is operated.
(4) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.8.9 Continuous Operation (XPM_NMV)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

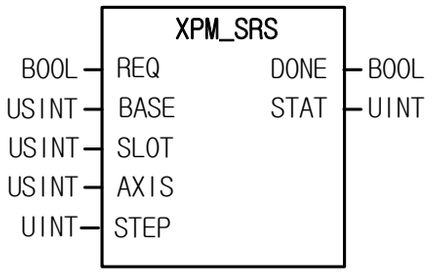
(1) Gives the continuous operation command to be specified axis in positioning module that is specified by base and slot.
(2) It is used when the command axis is not stopped at the current operation step and change operation to the next step.
(3) If continuous operation command is executed, the step No. is changed from the step in current operation to the next step No. and operates positioning operation to the speed and the target position of the next step. Connection with the next step is executed by continuous operation pattern.
(4) Continuous operation command changes the only current operation pattern in operation, not changes the operation data.
(5) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.8.10 Start Step Change (XPM_SNS)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) STEP : Operation step number setting to operate 1 ~ 400 **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives the start step change command to be specified axis in positioning module that is specified by base and slot.
(2) This is used when changing the operation step of command axis.
(3) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)
(4) In STEP, set the step number to operate. The setting range is 1 to 400, and “error 11 occurs when setting other than the setting value.

7.8.11 Repeat Step Number Change (XPM_SRS)

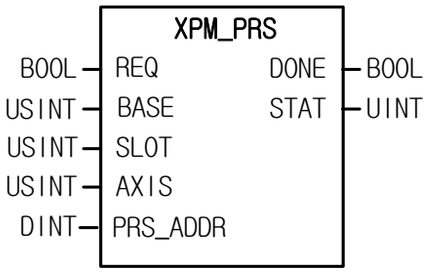
Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) STEP : Repeat step number setting to change 1 ~ 400 **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives the repeated step change command to be specified axis in positioning module that is specified by base and slot. It is used when start operation at specified operation step by specified the start step number of repeat operation during repeating operation, which return to the repetitive operation is met while operating with operation data.

(3) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs. XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

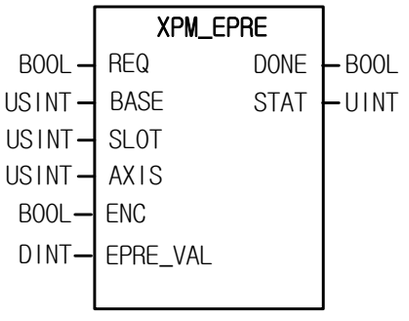
(4) In STEP, set the step number to operate repeat operation. The setting range is 1 to 400, and “error 11 occurs when setting other than the setting value.

7.8.12 Current Position Change (XPM_PRS)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) PRS_ADDR : Current position value setting to change. -2,147,483,648~ 2,147,483,647 **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

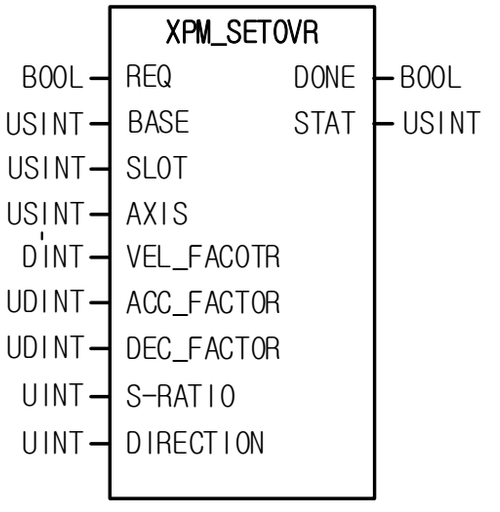
(1) Gives the current position preset command to be specified axis in positioning module that is specified by base and slot.
(2) This is a command used when changing command of command axis to an arbitrary position, if executing home undetermined status, home determination signal (bit) is on and the current position is changed to the setting value (PRS_ADDR).
(3) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.8.13 Encoder Value Preset (XPM_EPRE)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) ENC : Encoder No. 0: Encoder 1 EPRE_VAL : Encoder preset values setting -2147483648 ~ 2147483647 **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives encoder preset command to be specified axis in positioning module that is specified by base and slot.
(2) This is a command to change current values of encoder to the value set in EPRE_VAL.
(3) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.8.14 Speed Acceleration/Deceleration Override (XPM_SETOVR)

Function Block type	Content
	Input REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) VEL_FACTOR: Speed override ratio (or command speed) ACC_FACTOR: Acceleration override ratio (or command Acceleration Time) DEC_FACTOR: Deceleration speed override ratio (or command Deceleration Time) S_RATIO : not used (S-s-curve ratio(0= trapezoid, 1~100: S-curve ratio)) Direction : operate direction (1~3: 1-forward, 2-reverse, 3- current) Output DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives the speed acceleration/deceleration override command to be specified axis in positioning module that is specified by base and slot.

(2) This is used when using to change operation speed, acceleration/deceleration, and direction while the command axis is in operation status.

(3) VEL_FACTOR, ACC_FACTOR, DEC_FACTOR can be set to"% "or "speed values (unit/time)" depending on the values set in "speed override" of common parameter.

(4) When the unit of speed override values is %, the setting area is -65,535 to 65,535, which means -655.35% to 655.35%. And it operates reverse, if it is a negative number.

(5) When the unit of speed override value is speed value, the setting area is - speed limit to speed limit, and in this case, the speed limit is the values set in speed limit item of basic parameter. The speed limit value is set on Speed limit value of basic parameter and unit of speed override value depends on unit of axis.

(6) If unit of acceleration override and deceleration override values is %, the setting area is from 0 to 65,535, which means 0% ~ 655.35%.

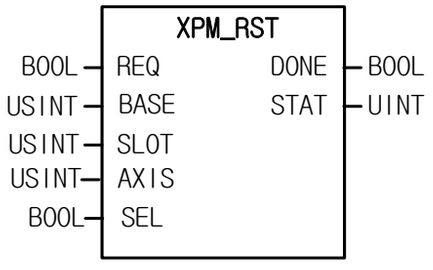
(7) If unit of acceleration override and deceleration override values is speed values, the setting area is from 0 to 4,294,967,295.

(8) The operation direction values can only be input 1 to 3, with 1 meaning forward, 2 meaning reverse, and 3 meaning the current direction.

(9) Set the axis to give command and can set the following values. If a value other than the set value is set, "Error 6" occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.9 Error Related Function Blocks

7.9.1 Error Reset (XPM_RST)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) SEL : Axis error/common error selection 0: Axis error 1: Common / servo error **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

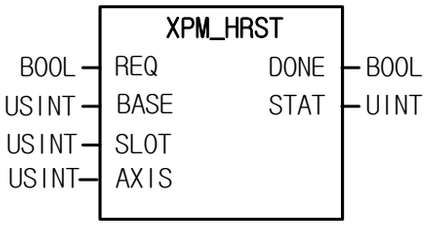
(1) Gives the error reset command to be specified axis in positioning module for the specified by base and slot.

(2) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(3) It is used to reset error that occurred when the parameter setting range is exceeded or in operation.

(4) Select the error type to reset in SEL If it is “0”, reset the error that occurred in command axis by axis. When set to “1” and the command is executed, it reset errors that occurred all module and servo drive other than common parameter related errors or error by axis during communication connection.

7.9.2 Error History Reset (XPM_HRST)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

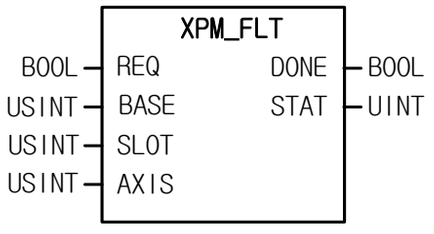
(1) Gives an error history reset command to be specified axis in positioning module for the specified by base and slot.

(2) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(3) It save up to 10 error in the module when exceeded setting range of parameter or occurred error in operation. This is used to reset the error history.

7.10 Module Related Other Function Block

7.10.1 Floating Home Setting (XPM_FLT)

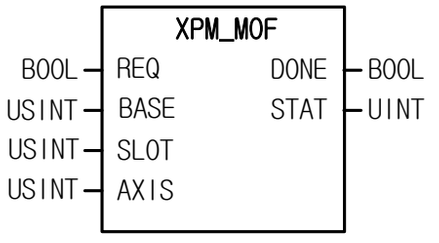
Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives the floating home command to be specified axis in positioning module that is specified by base and slot.

(2) This command is used to set current position to home (0) without executing homing operation of machine and the current position is “0”.

(3) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.10.2 M code Off (XPM_MOF)

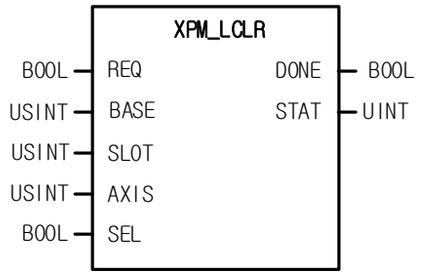
Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives the M code release command to be specified axis in positioning module that is specified by base and slot.

(2) If M code is set to With or After Mode in parameter of each axis, it is use to this signal M code and M code No. are changed to OFF and 0, respectively.

(3) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.10.3 Latch Reset ((XPM_LCLR)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN04B : 1 ~ 8 (axis1 ~ 8) SEL : Latch reset item selection **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) This command is used to initialize the number of latched data stored in the positioning module, latch position data and latch completion status.

(2) Gives latch reset command depending on specified item in SEL to be specified axis in positioning module depends on after triggering specified by base and slot.

(3) The following items are reset according to the latch reset item specified in SEL.

0: Latch completion status reset

1: Latch data and latch completion status reset

If 1 is set to SEL and the latch reset command is executed, the latch position data is read with the latch position data read command (XPM_LRD), and all the data becomes 0.

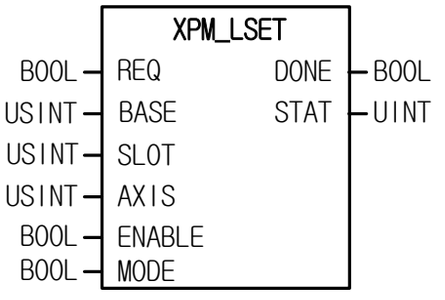
(5) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.

XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

Notes

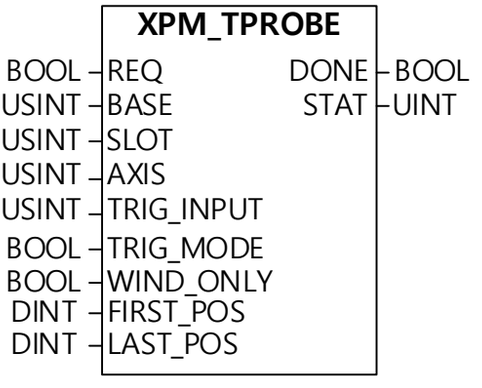
The XBF-PN04B/XBF-PN08B module supports 2 type latch mode. When setting single trigger among latch mode, after the first touch probe 1 signal is input and latched, in order to the latch function to operate a the next touch probe 1 signal, the latch reset command must always be used to enable latch.
In other words, in the latch reset single trigger of XBF-PN04B/XBF-PN08B, the latch reset command function to active the next latch trigger after the touch probe 1 signal is input and the latch position is saved.
(Even if the latch setting commands is set to allow latch and then executed again, it operates the same way.)

7.10.4 Latch Setting (XPM_LSET)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) ENABLE : Latch enable/disable MODE : Latch mode **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) This command is used to enable/disable the external latch function of the positioning module or to set the latch mode.
(2) Gives command to latch enable/disable depending on specified item in ENABLE, to set latch mode depending on specified item in MODE to be specified axis in positioning module depends on after triggering specified by base and slot.
(3) The operation according to the allow/prohibit latch items specified in ENABLE is as follows.
0: Latch disable
1: Latch enable
(4) The operation according to the latch mode items specified in MODE is as follows.
0: Single trigger
1: Continuous trigger
(5) Set the axis to give the command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.10.5 Touch Probe (XPM_TPROBE)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specified axis to command 4 axes supported product: 1~4(axis1 ~ 4) 8 axes supported product: 1~8(axis1 ~ 8) TRIG_INPUT : signal to be used as trigger 0: Touch probe 1 rising edge 1: Touch probe 2 rising edge 2: Touch probe 1 falling edge 3: Touch probe 2 falling edge 4: Touch probe 1 index(Z) pulse 5: Touch probe 2 index(Z) pulse TRIG_MODE : Trigger mode setting 0: Single trigger 1: Continuous trigger WIND_MODE : Window mode setting 0: Disable 1: Enable FIRST_POS : Window mode enable area start position -2,147,483,648 ~ 2,147,483,647 LAST_POS : Window mode enable area end position -2,147,483,648 ~ 2,147,483,647 **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) This command is used to set the touch probe function of the positioning module.

(2) Gives command to set touch probe 1/2, rising/falling edge depending on TRIG_INPUT, to set trigger mode depending on specified item in TRIG_MODE to be specified axis in positioning module depends on after triggering specified by base and slot.

(3) The operation according to the trigger input signal specified in TRIG_INPUT is as follows. If a value other than the set value is set, “Error 756” occurs.

0: Touch probe 1 rising edge
1: Touch probe 2 rising edge
2: Touch probe 1 falling edge
3: Touch probe 2 falling edge
4: Touch probe 1 index (Z) pulse
5: Touch probe 2 index (Z) pulse

※ The rising or falling edge of each touch probe and the index (Z) pulse cannot be executed simultaneously.

(4) The operation according to the trigger mode items specified in TRIG_MODE is as follows.

0: Single trigger
1: Continuous trigger

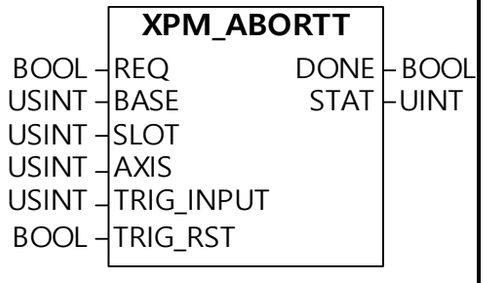
(5) If enable the WIND_MODE, it can be set enable area that received trigger signal of axis When window mode is enabled, it works only as a single trigger.

(6) Set the axis to give the command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4(axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(7) The versions that support related commands are as follows.

	Version
XBF-PN04B OS	V1.80 or higher
XBF-PN08B OS	V1.80 or higher
XBCU OS	V1.90
XBMH2/HP	V2.20
XG5000	V4.28 or higher

7.10.6 Trigger Off (XPM_ABORTT)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specified axis to command 4 axes supported product: 1~4(axis1 ~ 4) 8 axes supported product: 1~8(axis1 ~ 8) TRIG_INPUT : signal to release the trigger 0: Touch probe 1 rising edge 1: Touch probe 2 rising edge 2: Touch probe 1 falling edge 3: Touch probe 2 falling edge 4: Touch probe 1 index(Z) pulse 5: Touch probe 2 index(Z) pulse TRIG_RST : Trigger reset item setting 0: Trigger completion status reset 1: Trigger position data and trigger completion status reset **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) This command is used to release the trigger function of the positioning module.

(2) Gives command to set touch probe 1/2, rising/falling edge depending on TRIG_INPUT, to set trigger reset item depending on specified item in TRIG_RST to be specified axis in positioning module depends on after triggering specified by base and slot.

(3) The operation according to the trigger input signal specified in TRIG_INPUT is as follows. If a value other than the set value is set, “Error 756” occurs.

0: Touch probe 1 rising edge
1: Touch probe 2 rising edge
2: Touch probe 1 falling edge
3: Touch probe 2 falling edge
4: Touch probe 1 index (Z) pulse
5: Touch probe 2 index (Z) pulse

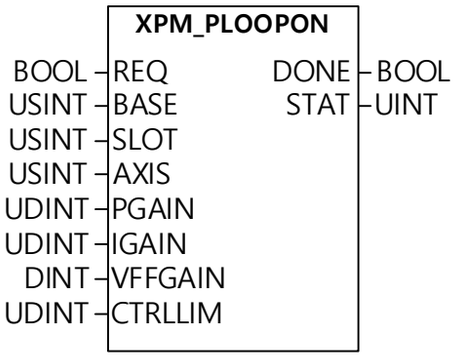
(4) The operation according to the trigger reset items specified in TRIG_RST is as follows.

0: Trigger completion status reset
1: Trigger position data and trigger completion status reset

(5)The version that support related commands are as follows

	Version
XBF-PN04B OS	V1.80 or higher
XBF-PN08B OS	V1.80 or higher
XBCU OS	V1.90
XBMH2/HP	V2.20
XG5000	V4.28 or higher

7.10.7 Master Position Control Loop Execution (XPM_PLOOPON)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) PGAIN : Master position loop control proportional gain 0 ~ 4294967295(unit: 1/ 1000) IGAIN : Master position loop control integral gain 0 ~ 4294967295(unit: 1/ 1000) VFFGAIN: Master position loop control speed FF gain -2147483648 ~ 2147483647(unit: 1/ 1000) CTRLLIM : Master position loop control output limit 0 ~ 4294967295 **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) This command is command to execute the position loop control being executed on the servo drive connected as a slaves in the positioning module's CPU.

(2) When the command is executed, the execution mode of the servo drive set to the OP2 is changed to CSV mode, and the difference (position error) between the command position and the current position of the axis is input to the PI-FF controller by the master. The PDO Object must have a target speed (0x60FF).

(3) It can be executed on any axis that can be commanded, and after execution, the axis can be operated with an existing start command. It is unavailable when the axis is operating.

(4) To update the gain during executing command, change the operand of commands and executes it again. The control gain can be updated during operation.

(5) For the master position control output limit specified in CTRLLIM, the input value is applied as output upper limit, and the negative of input value is applied as the lower output limit. If both the master position control loop output limit and Integral gain are not 0, integral control anti wind-up operates.

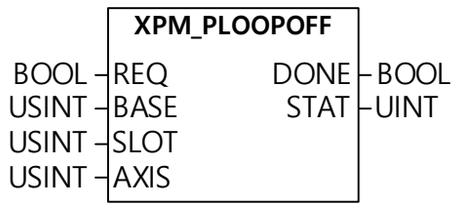
(6) The master position control loop execution command is dedicated command for XBF-PN04B, XBF-PN08B.

(7) If the gain of the master position control loop execution is not appropriate, the system may become unstable.

(8) The version information to use the master position control loop command is as follows.

	Version
XBF-PN04B OS	V2.10 or higher
XBF-PN08B OS	V2.10 or higher
XBCU OS	V1.90
XBMH2/HP	V2.20
XG5000	V4.50 or higher

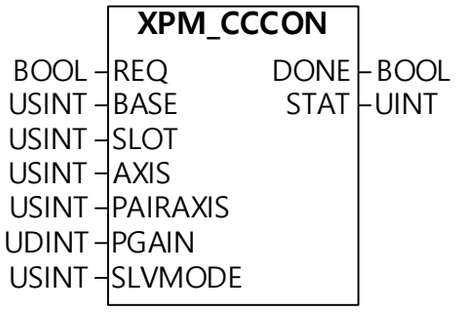
7.10.8 Master Position Control Loop Off (XPM_PLOOPOFF)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) The command is used to release the position control loop execution being executing by the CPU of the positioning module.
(2) Change from CSV mode to CSP mode so that the position control loop (executing in the positioning module CPU) of the axis specified as AXIS is executed in the slave.
(3) If the axis specified AXIS is operating, the position control loop cannot be off.
(4) The master position control loop off command is dedicated command for XBF-PN04B, XBF-PN08B.
(5) The version information to use the master position control loop off command is as follows.

	Version
XBF-PN04B OS	V2.10 or higher
XBF-PN08B OS	V2.10 or higher
XBCU OS	V1.90
XBMH2/HP	V2.20
XG5000	V4.50 or higher

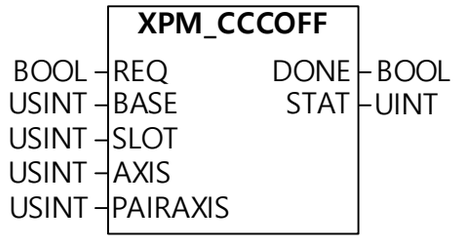
7.10.9 Cross-Coupled Control Execution (XPM_CCCON)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) PAIRAXIS : Control axis in pair with AXIS XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) PGAIN : CROSS-COUPLED control proportional gain 0 ~ 4294967295(unit: 1/ 1000) SLVMODE : Slave operational mode selection 0 : CSV 1 : CSP **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) This command is used to decrease the difference between position errors of two servo drives connected slaves as slave.
(2) Cross-coupled control execution command do not operates single and only operates the axis where the master position control loop execution command is operating.
(3) Specify axis 1 to AXIS and specify axis 2(couple axis) to PAIRAXIS. If you specified same axis for AXIS and PAIRAXIS, an error occurs.
(4) The slave operational mode selection is unused item and it is an operand reserved in advance for the next planning functions. No matter what value you enter, cross-coupled control is operating as CSV mode.
(5) To update the gain during executing command, change the operand of commands and executes it again. The control gain can be updated during operation.
(6) The Cross-coupled control execution command is dedicated command for XBF-PN04B, XBF-PN08B.
(7) If the gain of cross-coupled control executing is not appropriate, the system may become unstable.
(8) The version information to use Cross- coupled control execution command is as follows.

	Version
XBF-PN04B OS	V2.10 or higher
XBF-PN08B OS	V2.10 or higher
XBCU OS	V1.90
XBMH2/HP	V2.20
XG5000	V4.50 or higher

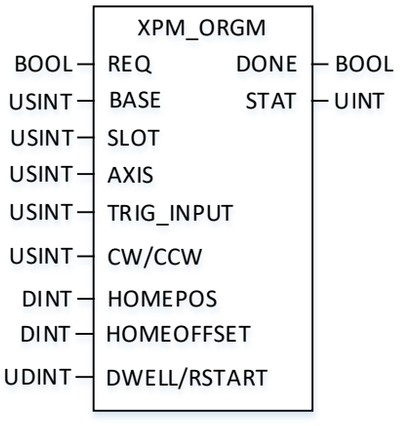
7.10.10 Cross-Coupled Control Off (XPM_CCCOFF)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) PAIRAXIS : Axis controlled in pair with AXIS XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) This command is used to release the set in the Cross-coupled control.
(2) When inputting the axis that cross-coupled control execution command is not executed, it will not be executed.
(3) Specify axis 1 (axis) on which cross-coupled control is being executed to AXIS and specify axis 2 (paired axis) to PAIRAXIS.
(4) The Cross-coupled control off command is dedicated command for XBF-PN04B, XBF-PN08B.
(5) The version information to use Cross- coupled control off command is as follows.

	Version
XBF-PN04B OS	V2.10 or higher
XBF-PN08B OS	V2.10 or higher
XBCU OS	V1.90
XBMH2/HP	V2.20
XG5000	V4.50 or higher

7.10.11 Touch Probe Homing (XPM_ORGM)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specified axis to command XBF-PN04B: 1~4(axis1 ~ 4) XBF-PN08B: 1~8(axis1 ~ 8) MODE : Operational mode 0: Touch probe 1 rising edge 1: Touch probe 2 rising edge 2: Touch probe 1 falling edge 3: Touch probe 2 falling edge 4: Touch probe 1 index(Z) pulse 5: Touch probe 2 index(Z) pulse CW/CCW : forward/reverse direction 0:forward direction , 1:reverse direction HOMEPOS: home position -2,147,483,648 ~ 2,147,483,647 HOMEPOFFSET: home compensation amount -2,147,483,648 ~ 2,147,483,647 DWELL/RSTART: Lower 16bit- dwell time(0~65,535ms) Upper 16bit- restart standby time(0~65,535ms) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

※ The home return high/low speed and acceleration/deceleration time of XPM_ORGM is set by the jog high/low speed, acceleration/deceleration time of manual operation parameters.

※ This commands only applies to servo product of LS electric.

(1) This command receives servo signals (touch probe or index (Z) pulse) and executes home return operation in the module.
- Home return (XPM) provided by network position controls home return in the servo, but this command controls home return operation in the module.

(2) Base is the base number and SLOT is the slot number of positioning module. AXIS is axis to execute.

(3) The operation according to the trigger input signal specified in TRIG_INPUT is as follows. If a value other than the set value is set, “Error 756” occurs.

(4) CW/CCW determines the homing direction. The home direction is forward in which the position values increases.

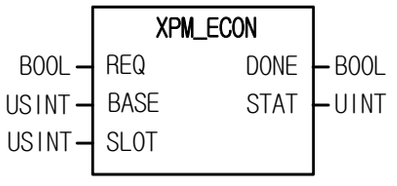
(5) HOMEPOS specifies home position values after operation completion.

(6) HOMEOFFSET specifies the home complementation amount to move after operation is completed. In case of positive, it moves in the same direction as home. In case of negative, it moves in the opposite direction as home.

(7) The dwell time is standby time after operation completion in DWELL/RSTART, and the restart standby time is standby time from stop point before executing homing operation again after meeting both the upper/lower limit. Saves divided by each 16 bit.

7.11 Servo Drive Related Function Block

7.11.1 Servo Communication Connection (XPM_ECON)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

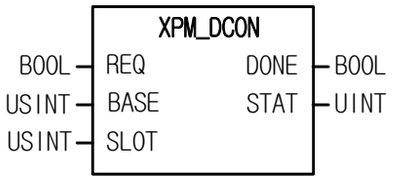
(1) Gives command to connect communication with servo to positioning module that is specified by base and slot.

(2) If the servo drive is connected normally, the bit corresponding to the connected axis of automatic registered variables are set.

	Automatic registration variable	Content
Axis 1	_xxyy_A1_RDY	Operation Ready of axis 1
Axis 2	_xxyy_A2_RDY	Operation Ready of axis 2
Axis 3	_xxyy_A3_RDY	Operation Ready of axis 3
Axis 4	_xxyy_A4_RDY	Operation Ready of axis 4
Axis 5	_xxyy_A5_RDY	Operation Ready of axis 5
Axis 6	_xxyy_A6_RDY	Operation Ready of axis 6
Axis 7	_xxyy_A7_RDY	Operation Ready of axis 7
Axis 8	_xxyy_A8_RDY	Operation Ready of axis 8

(* “xx” is base number, which installed module and “yy” is slot Number.

7.11.2 Servo Communication Disconnection (XPM_DCON)

Function Block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

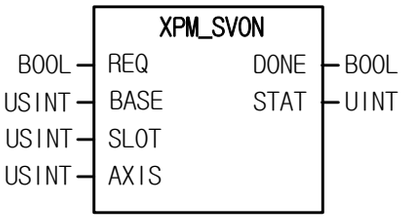
(1) Gives command to disconnect communication with servo to positioning module that is specified by base and slot.

(2) If the servo drives disconnected, the bit corresponding to the connected axis of automatic registered variables are clear.

	Automatic registration variable	Content
Axis 1	_xxyy_A1_RDY	Operation Ready of axis 1
Axis 2	_xxyy_A2_RDY	Operation Ready of axis 2
Axis 3	_xxyy_A3_RDY	Operation Ready of axis 3
Axis 4	_xxyy_A4_RDY	Operation Ready of axis 4
Axis 5	_xxyy_A5_RDY	Operation Ready of axis 5
Axis 6	_xxyy_A6_RDY	Operation Ready of axis 6
Axis 7	_xxyy_A7_RDY	Operation Ready of axis 7
Axis 8	_xxyy_A8_RDY	Operation Ready of axis 8

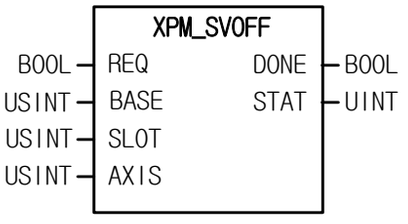
(* “xx” in _xxyy is the base number, where the module mounted and “yy” is the slot number.)

7.11.3 Servo On (XPM_SVON)

function block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

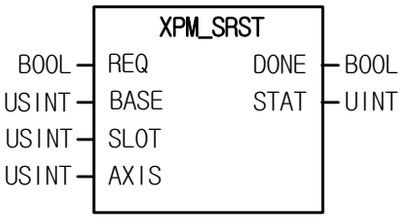
(1) Gives the servo on command to be specified axis in positioning module that is specified by base and slot.
(2) Give a servo on command to the servo related to the selected axis among the servo connect to module.
(3) To start the motor, servo on signal should be on.
(4) Set the axis to give command and can set the following values. If a value other than the set value is set, "Error 6" occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.11.4 Servo Off (XPM_SVOFF)

function block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives the servo off command to be specified axis in positioning module that is specified by base and slot.
(2) Give the servo off command to the servo related to the selected axis among the servo connect to module.
(3) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.11.5 Servo Error Reset (XPM_SRST)

function block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN09B : 1 ~ 8 (axis1 ~ 8) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives the servo error reset command to be specified axis in positioning module that is specified by base and slot.

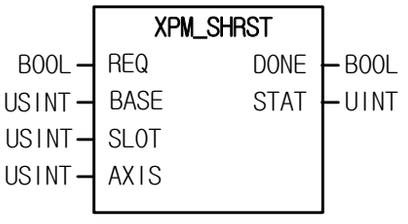
(2) Give a command to reset the error currently occurring in the servo related to the selected axis among the servos connected to the module.

(3) If the servo error reset command is giving without eliminating the cause of the servo drive alarm, the servo drive alarm may not be cleared. Therefore, the cause of the servo drive alarm must be eliminated and the servo error reset command must be executed.

(4) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

In the case of XBF-PN08B 의, there are servo errors that cannot be reset depending on the type of error among EtherCAT servo drives, so please refer to the servo drive user manual.

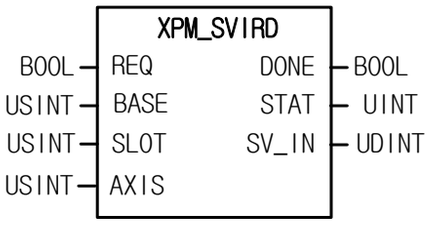
7.11.6 Servo Error History Reset (XPM_SHRST)

function block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) Gives the servo error history reset command to be specified axis in positioning module that is specified by base and slot.
(2) Give alarm history reset command occurred in the servo related to the selected axis among the servos connected to the module.
(3) The servo drive saves up to 10 servo alarm histories.
(4) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

Notes
The servo error history reset command supports different servo drives depending on the module version.
V2.4 or less: Available in L7N servo drive
V2.5 or higher: Available in all servo drive of LS

7.11.7 Servo External Input Information Read (XPM_SVIRD)

function block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing. SV_IN: Servo input signal information

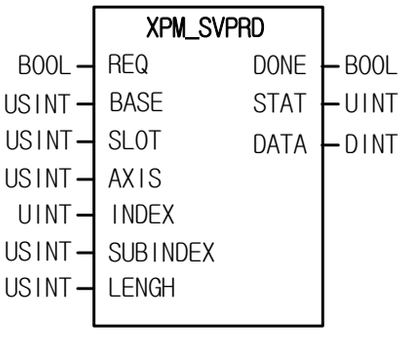
(1) Gives the servo external input information read command to be specified axis in positioning module that is specified by base and slot.

(2) Give servo drive input signal status read command in the servo related to the selected axis among the servos connected to the module.

(3) Output the input signal status information read from SV_IN.

(4) Set the axis to give command and can set the following values. If a value other than the set value is set, "Error 6" occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

7.11.8 Servo Parameter Read (XPM_SVPRD)

function block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) INDEX: servo parameter object index to change SUBINDEX: servo parameter object sub-index to change LENGTH: servo parameter object size to change 1 ~ 4 Byte **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing. DATA : Servo parameter data value read

(1) This is a function block that reads servo drive parameter (CoE Object) values connected to the positioning module.
(2) Gives the servo parameter read command to be specified axis in positioning module that is specified by base and slot.
(3) Reads the data value in the data type set in LENTH of the servo parameter address specified as INDEX in the axis specified as AXIS and saves in the DATA in the positioning module that is specified by base and slot.
(4) Read the values DATA of LENGTH size in servo parameter object specified as INDEX, SUBINDEX in axis slave specified as AXIS in positioning module that is specified by base and slot.
(5) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)
(6) INDEX value can be set as below. If a value other than the set value is set, “Error 11” occurs in STAT.

Setting Value	Content
0x1000 ~ 0x1FFF	Communication Profile Area
0x2000 ~ 0x5FFF	Manufacturer Specific Profile Area
0x6000 ~ 0x9FFF	Standardized Device Profile Area

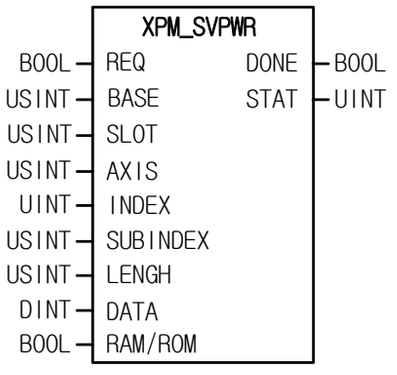
(7) The values that can be set in SUBINDEX are as follows. If a value other than the set value is set, “Error 11” occurs in STAT.

Setting Value	Content
0x0~0xFF	Servo parameter Object Subindex

(8) The values that can be set in LENGTH are as follows. If a value other than the set value is set, “Error 11” occurs in STAT.

Setting Value	Content
1~4	Servo parameter Object Byte Length

7.11.9 Servo Parameter Write (XPM_SVPWR)

function block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) INDEX: servo parameter object index to change SUBINDEX: servo parameter object sub-index to change LENGTH: servo parameter object size to change 1 ~ 4 Byte DATA : servo parameter values to change RAM/ROM : Parameter save method 0: save to RAM, 1: save to ROM **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) This is a function block change of parameter (CoE Object) values of servo drive connected to the positioning module.

(2) Gives the servo parameter write to PLC command to be specified axis in positioning module that is specified by base and slot.

(3) To save to the ROM inside the servo drive using the servo drive write command, set RAM/ROM to 1 and execute the command, or set RAM/ROM to 0 to execute the write and then later execute the XPM_SVSAVE command to save it to the servo drive EEPROM.

(4) Save the DATA of LENGTH size in the servo parameter object specified as INDEX, SUBINDEX specified as AXIS in positioning module that is specified by base and slot.

(5) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(6) INDEX value can be set as below. If a value other than the set value is set, “Error 11” occurs in STAT.

Setting Value	Content
0x2000 ~ 0x5FFF	Manufacturer Specific Profile Area
0x6000 ~ 0x9FFF	Standardized Device Profile Area

(7) The values that can be set in SUBINDEX are as follows. If a value other than the set value is set, “Error 11” occurs in STAT.

Setting Value	Content
0x0~0xFF	Servo parameter Object Subindex

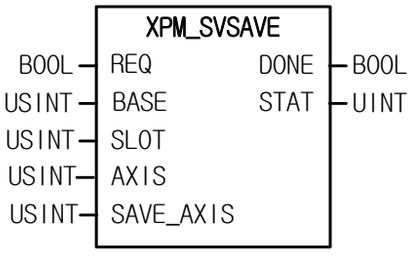
(8) The values that can be set in LENGTH are as follows. If a value other than the set value is set, “Error 11” occurs in STAT.

Setting Value	Content
1~4	Servo parameter Object Byte Length

(9) The values that can be set for RAM/ROM is as follows.

Setting Value	Teaching method
0	RAM Teaching
1	ROM teaching

7.11.10 Servo Parameters Save (XPM_SVSAVE)

function block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted AXIS : Specify the axis to be commanded XBF-PN04B : 1 ~ 4 (axis1 ~ 4) XBF-PN08B : 1 ~ 8 (axis1 ~ 8) SAVE_AXIS : Specify save axis Specify each bit to set (bit0~7: axis1~8) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) This is a function block that saves the parameter of servo drive connected to the positioning module in the EEPROM inside the servo drive.

(2) Gives a servo drive parameter save to axis to be specified axis in positioning module that is specified by base and slot.

(3) This is a command to save the parameters of the servo drive selected among the servos connected to the module to the EEPROM inside the servo drive.

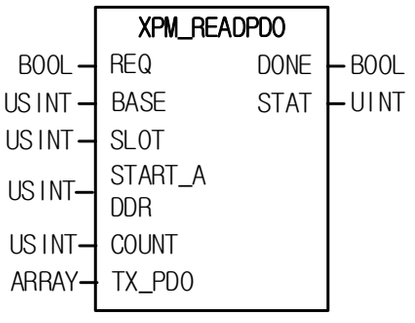
(4) Set the axis to give command and can set the following values. If a value other than the set value is set, “Error 6” occurs. The command axis is separate from the axis where the actual servo parameters are saved and to save servo parameters of command axis, you must set the bit of the related axis in SAVE_AXIS.

XBF-PN04B: 1~4 (axis1 ~ 4), XBF-PN08B: 1 ~ 8(axis1 ~ 8)

(5) Set the axis of servo drive to save in SAVE_AXIS as bit. If the setting is “0”, “Error 11” occurs.

Bit 0 ~ 7: Axis 1~ 8

7.11.11 PDO Data Read (XPM_READPDO)

function block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted START_ADDR: Specify start address to read COUNT : Specify the number to reads (DWORD) (1~160) TX_PDO : Specify variable to save read data **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

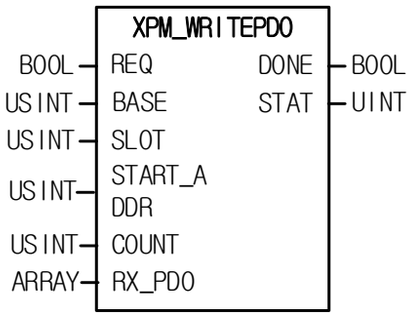
(1) This is a function block that reads the TxPDO data values of EtherCAT slave connected to positioning module and saves in the CPU internal variables.
(2) Gives PDO data read command to positioning module that is specified by base and slot.
(3) The PDO data to read is set in the slave Information of XG-PM.
(4) START_ADDR is the starting address of PDO data to be read, and starting from this address, the number set in COUNT is read and save in the CPU variable set in TX_PDO.

	Slave 17	Slave 18	Slave 19	Slave 20	Slave 21	Slave 22	Slave 23	Slave 24
Data 1	0	5	10	15	20	25	30	35
Data 2	1	6	11	16	21	26	31	36
Data 3	2	7	12	17	22	27	32	37
Data 4	3	8	13	18	23	28	33	38
Data 5	4	9	14	19	24	29	34	39
	Slave 25	**Slave 26**	**Slave 27**	**Slave 28**	**Slave 29**	**Slave 30**	**Slave 31**	**Slave 32**
Data 1	40	45	50	55	60	65	70	75
Data 2	41	46	51	56	61	66	71	76
Data 3	42	47	52	57	62	67	72	77
Data 4	43	48	53	58	63	68	73	78
Data 5	44	49	54	59	64	69	74	79
	Slave 33	**Slave 34**	**Slave 35**	**Slave 36**	**Slave 37**	**Slave 38**	**Slave 39**	**Slave 40**
Data 1	80	85	90	95	100	105	110	115
Data 2	81	86	91	96	101	106	111	116
Data 3	82	87	92	97	102	107	112	117
Data 4	83	88	93	98	103	108	113	118
Data 5	84	89	94	99	104	109	114	119

	Slave 41	Slave 42	Slave 43	Slave 44	Slave 45	Slave 46	Slave 47	Slave 48
Data 1	120	125	130	135	140	145	150	155
Data 2	121	126	131	136	141	146	151	156
Data 3	122	127	132	137	142	147	152	157
Data 4	123	128	133	138	143	148	153	158
Data 5	124	129	134	139	144	149	154	159

Item	Supported version
XG5000	4.75 or higher
XBF-PN04B	V2.50 or higher
XBF-PN08B	V2.50 or higher

7.11.12 PDO Data Write (XPM_WRITEPDO)

function block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted START_ADDR: Specify start address to write COUNT : Specify the number to write (DWORD) (1~160) TX_PDO : Specify variable to save write data **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

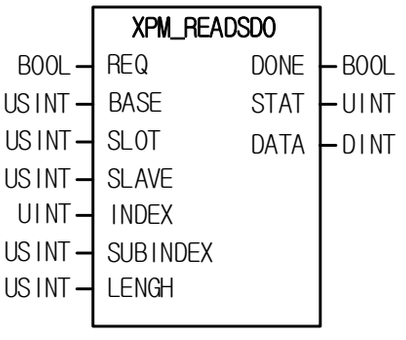
(1) This is a function block that writes the RxPDO data values of EtherCAT slave connected to positioning module as the value of the CPU internal variables.
(2) Gives PDO data write command to positioning module that is specified by base and slot.
(3) The PDO data to write is set in the slave Information of XG-PM.
(4) START_ADDR is the starting address of PDO data to write, and the value of the CPU variable set in RX_PDO is written as much as the number set in COUNT.

	Slave 17	Slave 18	Slave 19	Slave 20	Slave 21	Slave 22	Slave 23	Slave 24
Data 1	0	5	10	15	20	25	30	35
Data 2	1	6	11	16	21	26	31	36
Data 3	2	7	12	17	22	27	32	37
Data 4	3	8	13	18	23	28	33	38
Data 5	4	9	14	19	24	29	34	39
	Slave 25	**Slave 26**	**Slave 27**	**Slave 28**	**Slave 29**	**Slave 30**	**Slave 31**	**Slave 32**
Data 1	40	45	50	55	60	65	70	75
Data 2	41	46	51	56	61	66	71	76
Data 3	42	47	52	57	62	67	72	77
Data 4	43	48	53	58	63	68	73	78
Data 5	44	49	54	59	64	69	74	79
	Slave 33	**Slave 34**	**Slave 35**	**Slave 36**	**Slave 37**	**Slave 38**	**Slave 39**	**Slave 40**
Data 1	80	85	90	95	100	105	110	115
Data 2	81	86	91	96	101	106	111	116
Data 3	82	87	92	97	102	107	112	117
Data 4	83	88	93	98	103	108	113	118
Data 5	84	89	94	99	104	109	114	119

	Slave 41	Slave 42	Slave 43	Slave 44	Slave 45	Slave 46	Slave 47	Slave 48
Data 1	120	125	130	135	140	145	150	155
Data 2	121	126	131	136	141	146	151	156
Data 3	122	127	132	137	142	147	152	157
Data 4	123	128	133	138	143	148	153	158
Data 5	124	129	134	139	144	149	154	159

Item	Supported version
XG5000	4.75 or higher
XBF-PN04B	V2.50 or higher
XBF-PN08B	V2.50 or higher

7.11.13 EtherCAT Slave SDO Parameter Read (XPM_READSDO)

function block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted SLAVE : Specify the slave to be commanded XBF PN04B : 17 ~ 32 (axis17 ~ 32) XBF PN04B : 17 ~ 48 (axis17 ~ 48) INDEX: SDO parameter object index to read SUBINDEX: SDO parameter object sub- index to read LENGTH: SDO parameter object size to read 1 ~ 4 Byte **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing. DATA : SDO parameter data value to read

(1) This is a function block that reads parameter (CoE Object) values of SDO drive connected to the positioning module.

(2) Gives the SDO parameter read command of EtherCAT Slave specified as SLAVE in positioning module that is specified by base and slot.

Reads the data value in the data type set in LENTH to the SDO parameter address specified as INDEX in the EtherCAT Slave specified as SLAVE and saves in the DATA in the positioning module that is specified by base and slot. (4)

(4) Set the EtherCAT slave to give a command in SLAVE and can set the following values. If a value other than the set value is set, “Error 6” occurs.

XBF-PN04B: 17~32(slave 17~32), XBF-PN08B: 17 ~ 48(slave 17~ 48)

(6) INDEX value can be set as below. If a value other than the set value is set, “Error 11” occurs in STAT.

Setting Value	Content
0x1000 ~ 0x1FFF	Communication Profile Area
0x2000 ~ 0x5FFF	Manufacturer Specific Profile Area
0x6000 ~ 0x9FFF	Standardized Device Profile Area

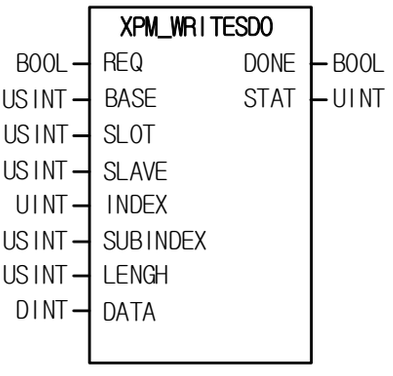
The values that can be set in SUBINDEX are as follows. If a value other than the set value is set, “Error 11” occurs in STAT.

Setting Value	Content
0x0~0xFF	SDO parameter Object Subindex

(8) The values that can be set in LENGTH are as follows. If a value other than the set value is set, “Error 11” occurs in STAT.

Setting Value	Content
1~4	SDO parameter Object Byte Length

7.11.14 EtherCAT Slave SDO Parameter Write (XPM_WRITESDO)

function block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted SLAVE : Specify the slave to be commanded XBF PN04B : 17 ~ 32 (slave 17 ~ 32) XBF PN08B : 17 ~ 48 (slave 17 ~ 48) INDEX: SDO parameter object index to change SUBINDEX: SDO parameter object sub-index to change LENGTH: SDO parameter object size to change 1 ~ 4 Byte EP_VAL : SDO parameter values to change **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) This is a function block change of parameter (CoE Object) values of EtherCAT slave connected to the positioning module.

(2) Gives the SDO parameter write command of EtherCAT slave specified as SLAVE in positioning module that is specified by base and slot.

(3) To save to the servo drive internal's ROM using SDO parameter write command, you should executes XPM_SAVESDO command

(4) DATA of LENGTH size is saved in SDO parameter object specified as INDEX, SUBINDEX in the EtherCAT slave specified as SLAVE in positioning module that is specified by base and slot.

(5) Set the EtherCAT slave to give a command in SLAVE and can set the following values. If a value other than the set value is set, "Error 6" occurs.

XBF-PN04B: 17~32(slave 17 ~ 32), XBF-PN08B: 17 ~ 48(slave 17 ~ 48)

(6) INDEX value can be set as below. If a value other than the set value is set, "Error 11" occurs in STAT.

Setting Value	Content
0x2000 ~ 0x5FFF	Manufacturer Specific Profile Area
0x6000 ~ 0x9FFF	Standardized Device Profile Area

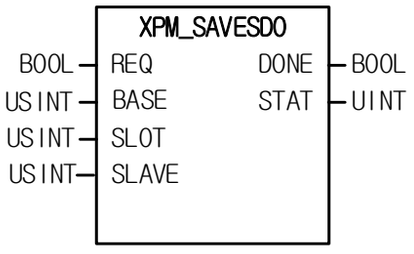
The values that can be set in SUBINDEX are as follows. If a value other than the set value is set, "Error 11" occurs in STAT.

Setting Value	Content
0x0~0xFF	SDO parameter Object Subindex

The values that can be set in LENGTH are as follows. If a value other than the set value is set, "Error 11" occurs in STAT.

Setting Value	Content
1~4	Servo parameter Object Byte Length

7.11.15 EtherCAT Slave SDO Parameter Save (XPM_SAVESDO)

function block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted SLAVE : Specify the slave to be commanded XBF-PN04B : 17 ~ 32 (slave 17 ~ 32) XBF-PN08B : 17 ~ 48 (slave 17 ~ 48) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(1) This is a function block that saves the SDO parameter of EtherCAT slave connected to positioning module to the EEPROM inside the EtherCAT slave.
(2) Gives the SDO drive parameter write command of EtherCAT slave specified as SLAVE in positioning module that is specified by base and slot.
(3) This is a command to saves parameters of the selected slave among the EtherCAT slaves connected to the module to the EEPROM inside the EtherCAT slave.
(4) Set the EtherCAT slave to give a command in SLAVE and can set the following values. If a value other than the set value is set, “Error 6” occurs.
XBF-PN04B: 17~32(slave 17 ~ 32), XBF-PN08B: 17 ~ 48(slave 17 ~ 48)

Item	Supported version
XG5000	4.75 or higher
XBF-PN04B	V2.50 or higher
XBF-PN08B	V2.50 or higher

Chapter 8 Program

This chapter describes the basic program that operate positioning module case by using its commands.

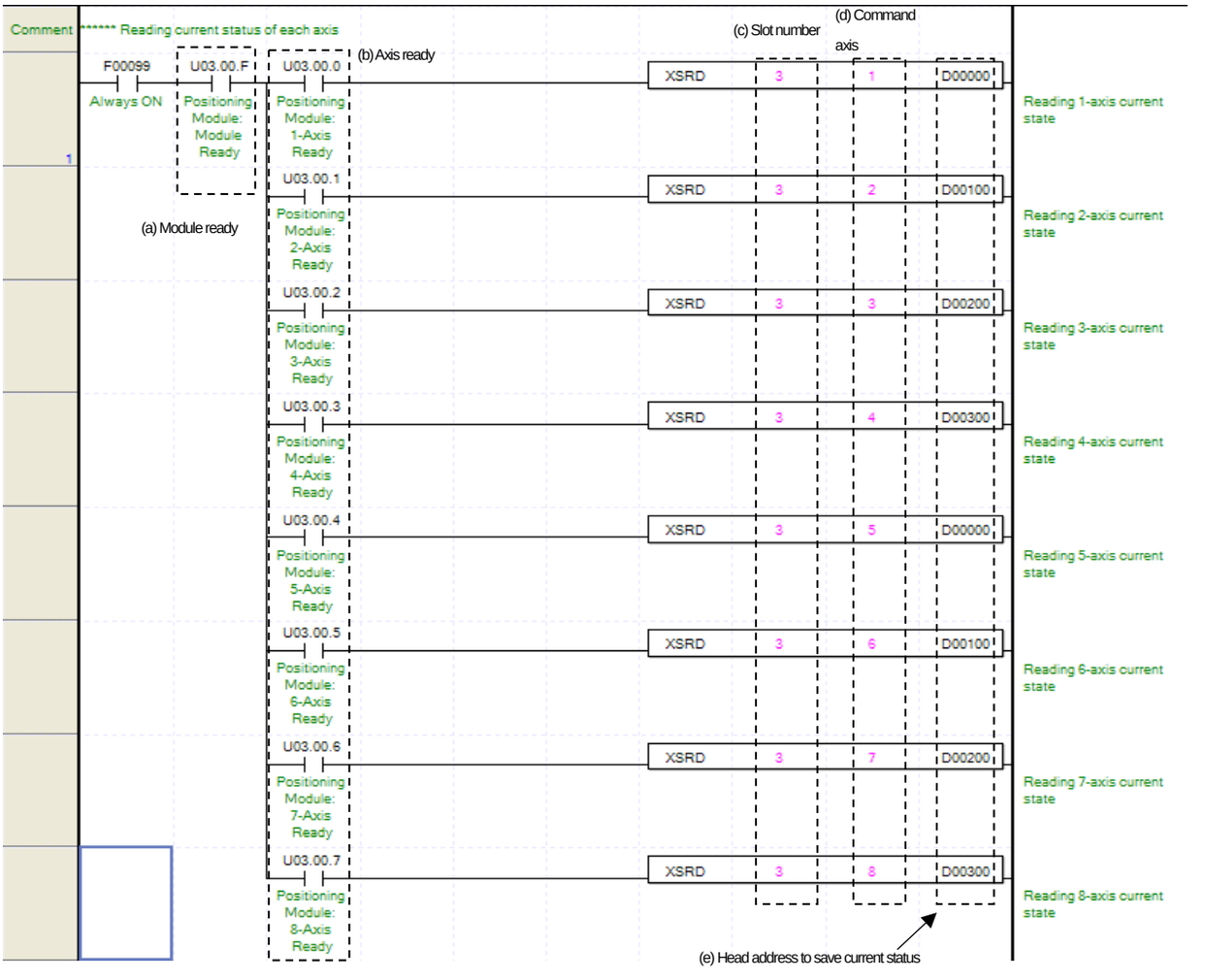
8.1 XBC Program Example

8.1.1 Common description

In this chapter, the example program is written assuming that the positioning module is mounted in slot 3 of base 0.
In the real usage, you need to change its value according to your system configuration.

8.1.2 Current status read

(1) Using XSRD command



(a) Module ready status

When the positioning module is ready to receive command without any problems after power is turned on, it turns on

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned

on. In the example program, F00099 (always On), positioning module ready (Uxx.00.F), the ready status for each axis (Uxx.00.0 ~ Uxx.00.7) were used, so the positioning module is not error status. The axis of servo drive connected to the module is reading the status of each scan.

(c) The mounting position of positioning module.

For give a command, set the position where the positioning module to command is mounted. In the example, the positioning module is mounted in slot3.

(d) Axis to give command

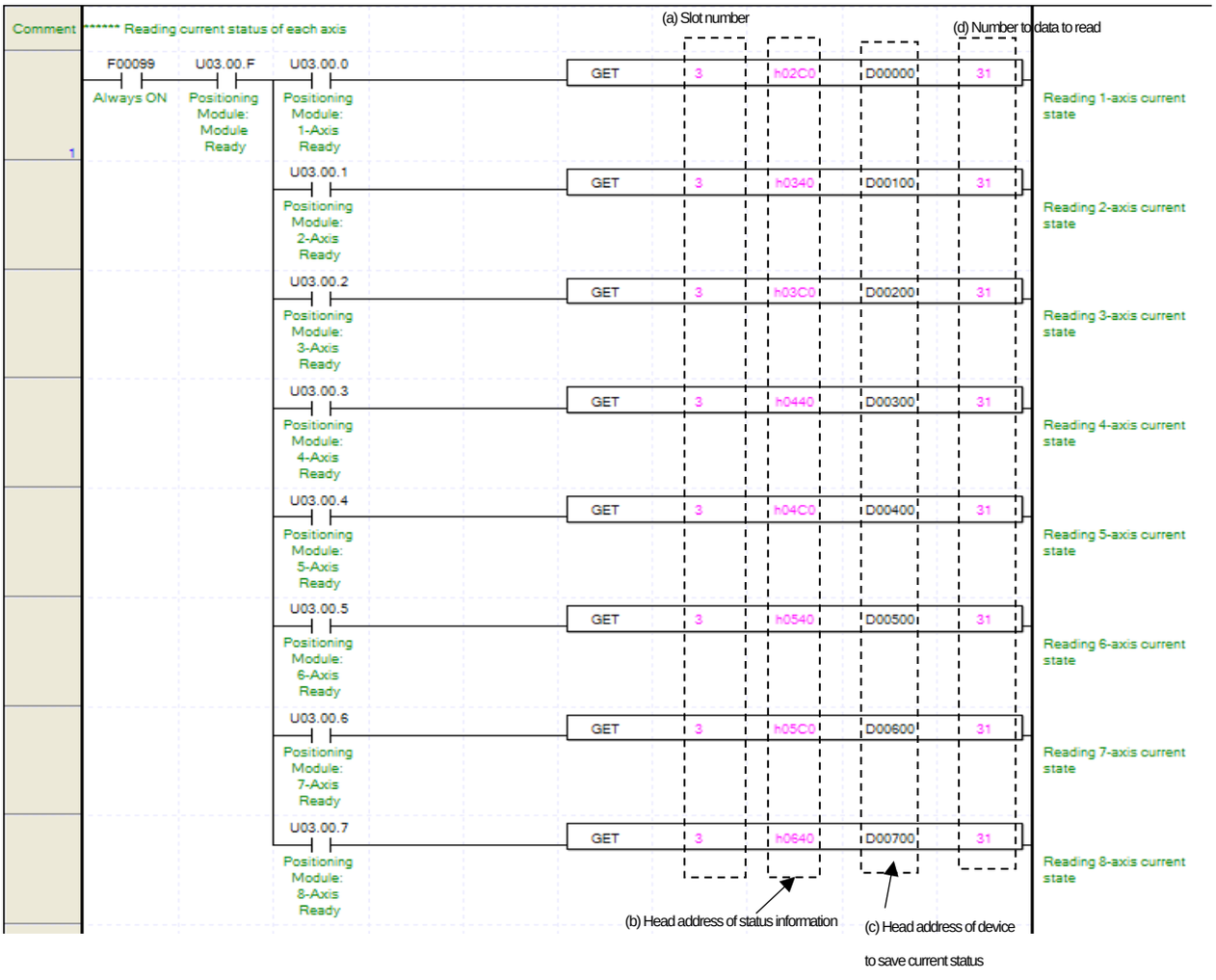
When giving a command for each axis, set the axis to give command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the command, command axis 1~8 means axis 1 to axis 8.

(e) Leading address of the device to save current status of axis.

This is the leading address of the device where the status values read from the positioning module using XSRD will be saved. This device can be used as a condition in a sequence program. For example, in this program above, the condition of axis 1 will be saved from D00000 to D00022. For the detailed information for saved devices, refer to 'Chapter 6.3.44 Operation State Reading (command: XSRD)'.

(f) Among status information saved to the device, the bit information can be used as a condition for another operation. For instance, if using in operation signal of axis1 in the example program above, set it to D00000.0. Also, if applying the error status of axis 2, set it to D00000.1

(2) Using GET command



(a) The mounting position of positioning module.

(B) The status information leading memory address of axis to give a command.

You can setup the memory address of condition information case by axis. For example, in this program above, h02C0 is memory address of the status information area of axis 1. For the memory address of status information for each axis, refer to “Chapter 5.1.4 State information”.

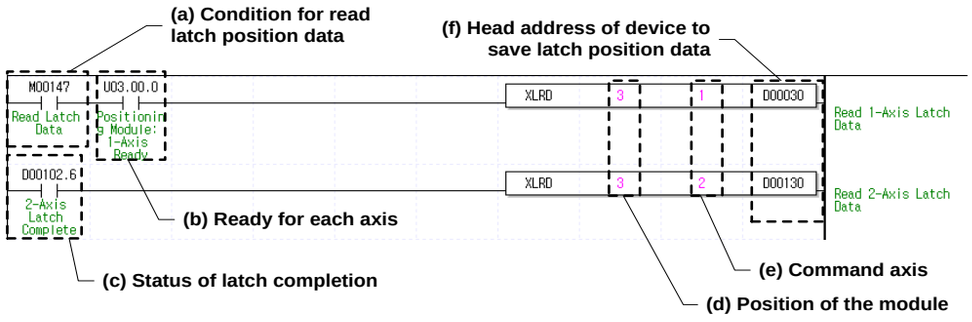
(c) Leading address of the device to save current status of axis.

(d) Number of data word to read

To read status information using the GET command, the number of data to read can be specified in word size. Therefore, you can read only the data that you want.

(e) Among status information saved to the device, the bit information can be used as a condition for another operation. For instance, if using in operation signal of axis1 in the example program above, set it to D00000.0. Also, if applying the error status of axis 2, set it to D00000.1

(3) Latch position data read



(a) Latch position data read execution condition

This is the condition for executing the latch position data read command (XLRD). For axis1, when M00147 is turned on after axis 1 connected to the network, the latch position data read command is always executed.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on. In the example program, axis1 ready status (Uxx.00.0) was used, so when M00147 (latch data read execution condition) is turned on after the axis is connected to the module, the latch position data is read.

(c) Latch completion status

When applying example program of “8.1.2 current status read”, the axis is in a “latch completion status”. When the external latch command signal of related axis is input and latch is completed, it turn on. When D00102.6 (latch completion status) turns on in axis2, the latch position data read command of axis 2 is executed.

(D) Positioning module mounting position

For give a command, set the position where the positioning module to command is mounted. In the example, the positioning module is mounted in slot3.

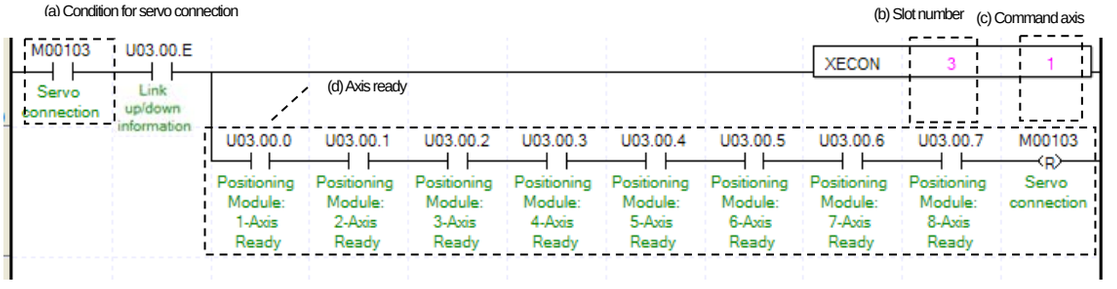
(e) Axis to give a command

You can set an axis for executing the latch position data read command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command” item of latch position data read command (XLRD), it can set 1 to 8 meaning axis1 to axis8.

(f) This is the leading address to save latch data values of axis read from positioning module, using a leading address XLRD of device to save the latch position data of an axis. This device can be used in a sequence programs. For instance, in the example program above, the number of latch position data of axis 1 is saved in D00030, and latch position data 1 to 10 are saved from D10032 to D00050. For the detailed information for saved devices, refer to ‘Chapter 6.3.56 Latch position data read command (command: XLRD)'.

8.1.3 Preparation for operation

(1) Servo drive connection



(a) Servo connection condition

This is the condition for the servo connection command (XECON).

(b) Positioning module mounting position

For give a command, set the position where the positioning module to command is mounted. In the example, the positioning module is mounted in slot3.

(c) Axis to give a command

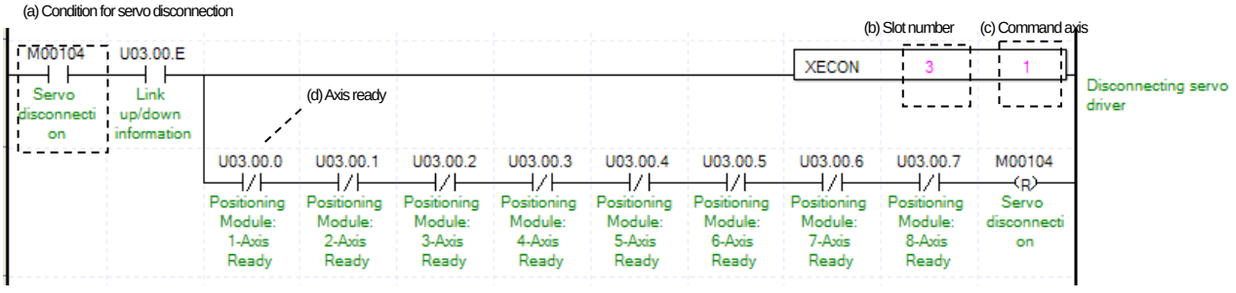
If giving a command for each axis, set the axis to give command. Up to 8 axes can be connected, and connect axis 1 to 8 mean axis 1 to axis8.

(d) Ready status for each axis

When connection with servo drive is completed, the signal related to each connected axis turns on. In the example, the module is set to have 8 axes connected. Set only the connected axes depending on applicable system. When the connection is completed and all signal related to each axis turns on, the servo connection condition is reset.

(e) If the link up/down information is used as the input condition contact of the servo connection command, the servo connection command can be executed only when the network cable is connected.

(2) Servo drive disconnect



(a) Servo disconnect condition

This is the condition for the servo disconnection command (XDCON).

(b) Positioning module mounting position

(c) Axis to give a command

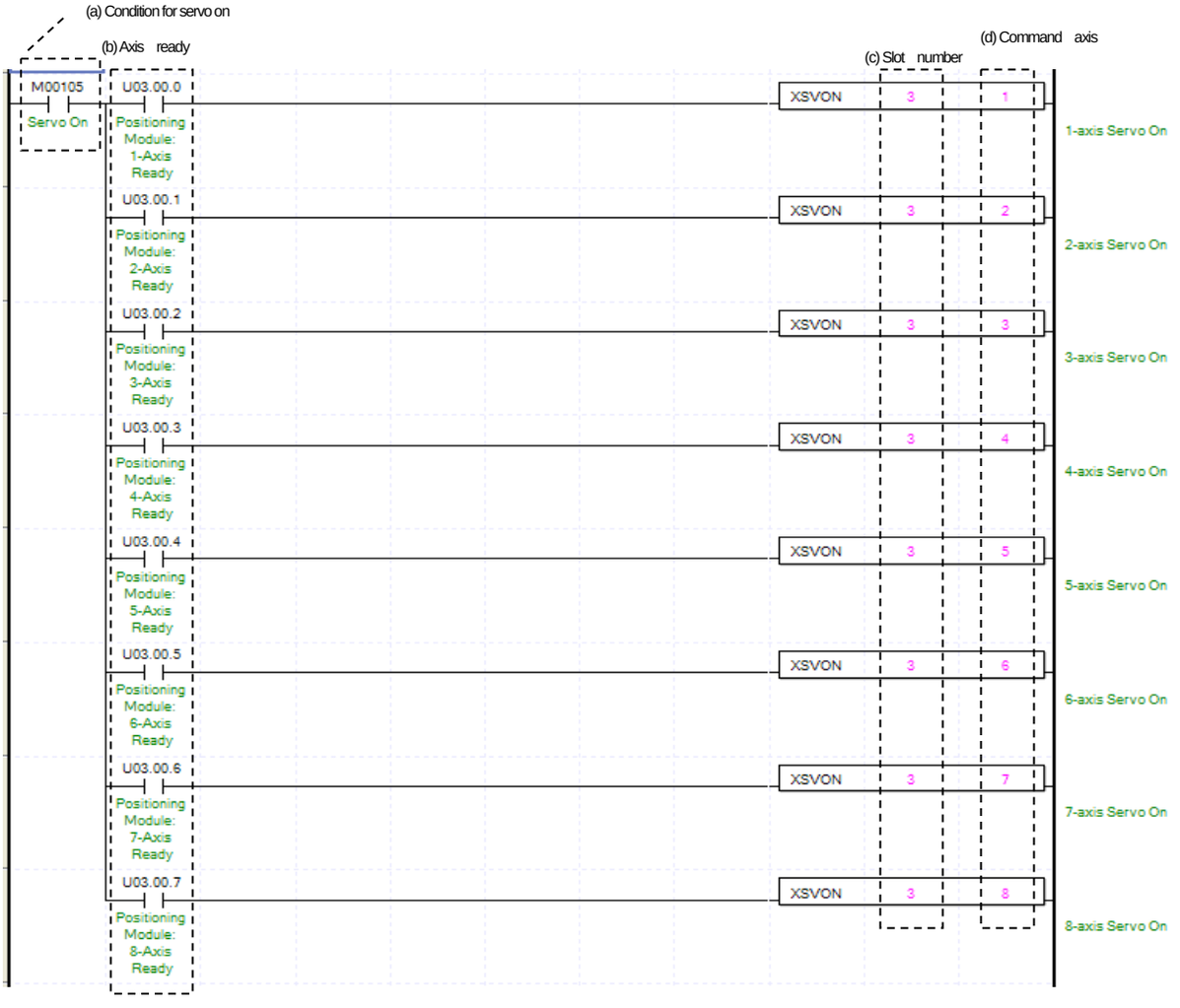
If giving a command for each axis, set the axis to give command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes in the command, command axis 1~8 means axis 1 to axis 8.

(d) Ready status for each axis

When disconnection with servo drive is completed, the signal related to each connected axis is turns off. In the example, the module is set to have 8 axes connected. Set only the connected axes depending on applicable system. When the connection is completed and all signal related to each axis turns off, the servo disconnection condition is reset.

(e) If the link up/down information is used as the input condition contact of the servo disconnection command, the servo disconnection command can be executed only when the network cable is connected.

(3) Servo on



(a) Servo on execution condition

It is the condition to execute the servo on command (XSVON).

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

In the example program, when the servo on condition is on, a servo on command is given to the connected axis. According to system, the command of axis that is not connected can be removed.

(c) The mounting position of positioning module.

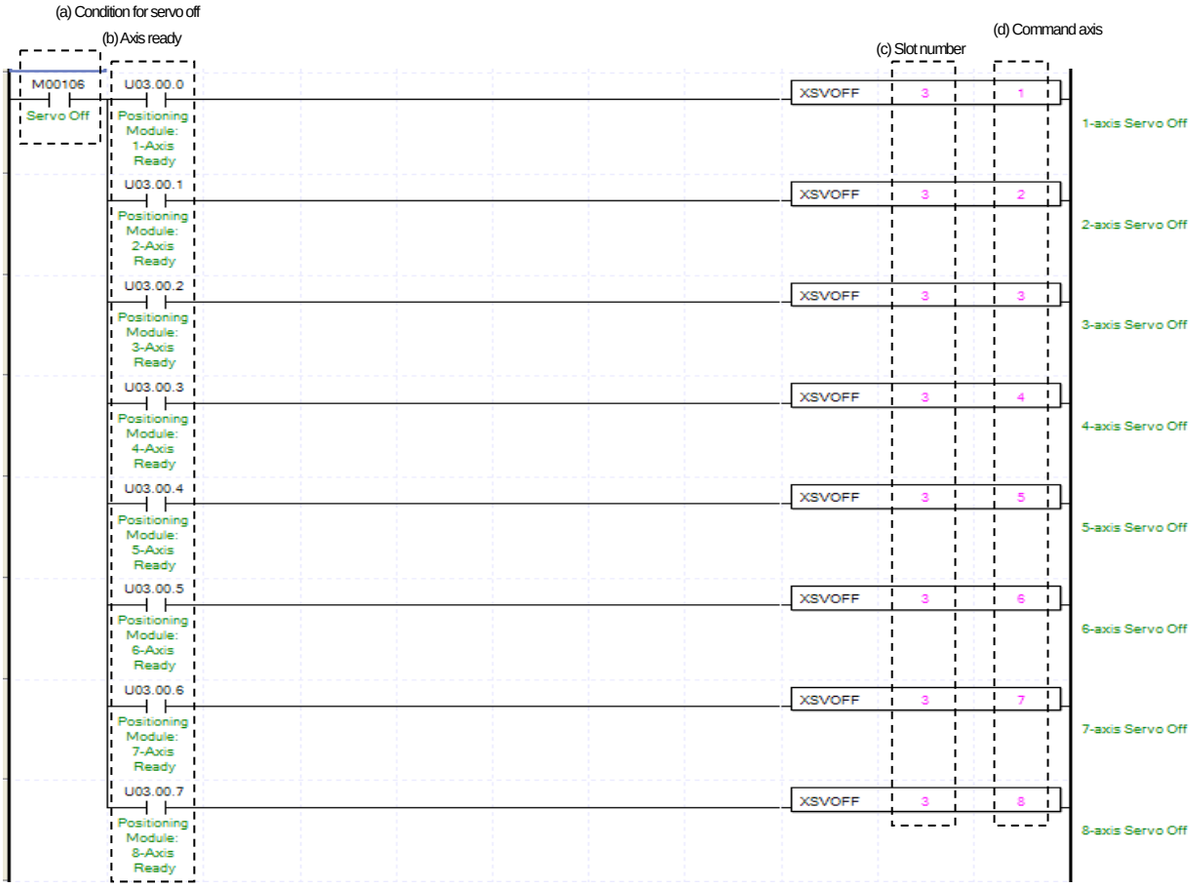
In the example, the positioning module set to be mounted in slot 3 of base 0.

(d) Axis to give a command

You can set an axis to execute the servo on command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command” item of servo on command, it can set 1 to 8 meaning axis1 to axis8.

(e) When the servo on command is executed, servo drive set to the axis where the command was executed is in the servo on status.

(4) Servo off



(a) Servo off execution condition

It is the condition to execute the servo off command (XSVOFF).

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on. In the example program, when the servo off condition is on, a servo off command is given to the connected axis. According to system, the command of axis that is not connected can be removed.

(c) The mounting position of positioning module.

In the example, the positioning module set to be mounted in slot 3 of base 0.

(d) Axis to give a command

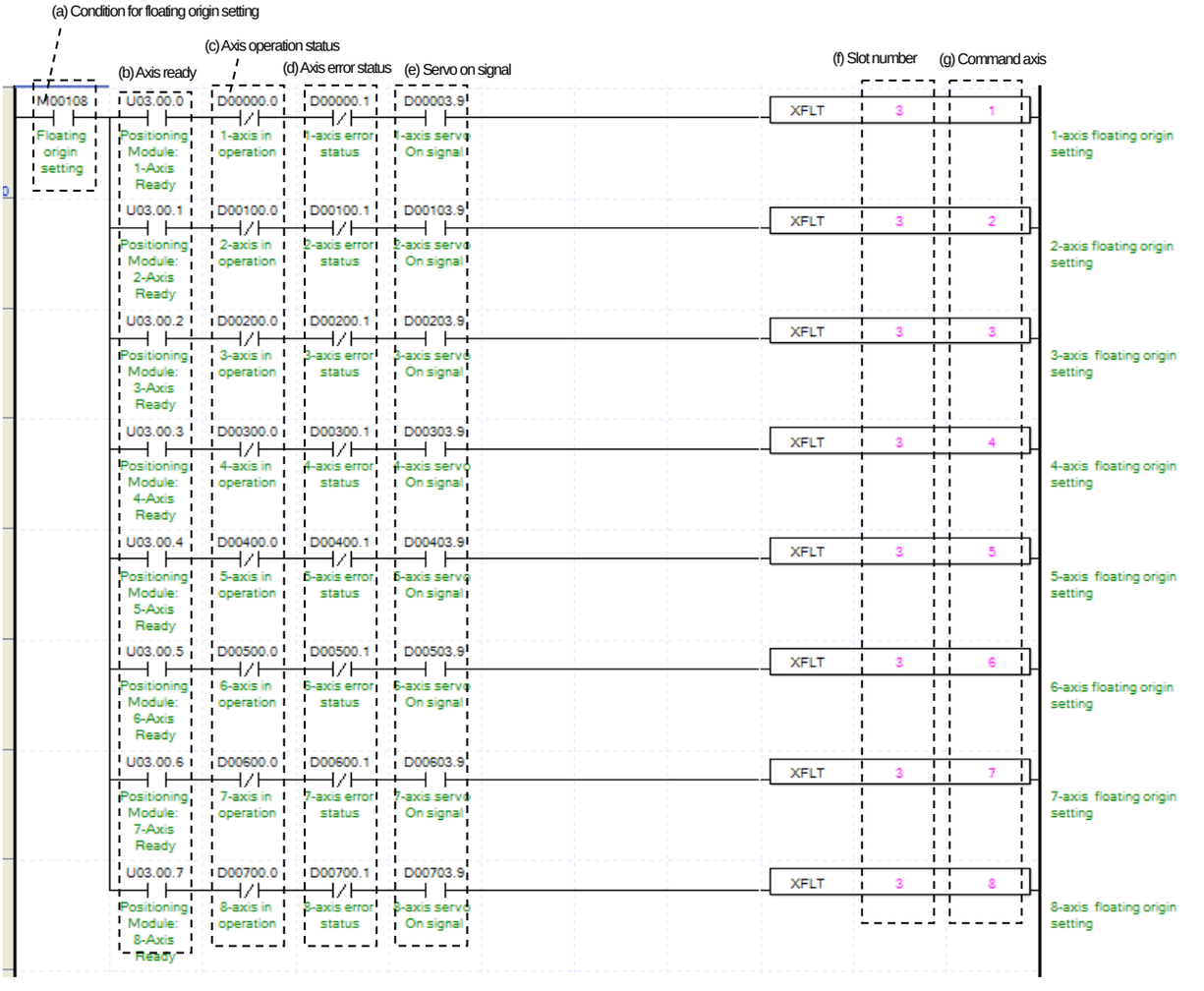
You can set an axis to execute the servo off command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command” item of servo off command, it can set 1 to 8 meaning axis1 to axis8.

(e) When the servo off command is executed, servo drive set to the axis where the command was executed is in the servo off status.

8.1.4 Test Operation

(1) Floating home setting

Decide origin of current motor's position without set a machinery origin.



(a) Floating point setting execution condition

It is condition to execute the floating point setting (XFLT) command.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. The floating home setting command cannot be configured while it is operating hence the condition will only be configured when it is not operation. If you execute floating home setting command while it is operating, the error 211 would be appeared.

(d) Error status for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. The floating home setting command cannot be executed when axis is not servo on, hence the condition is set to execute when it is servo on. If you execute floating home setting command while axis is not servo on status, error 212 would be appeared.

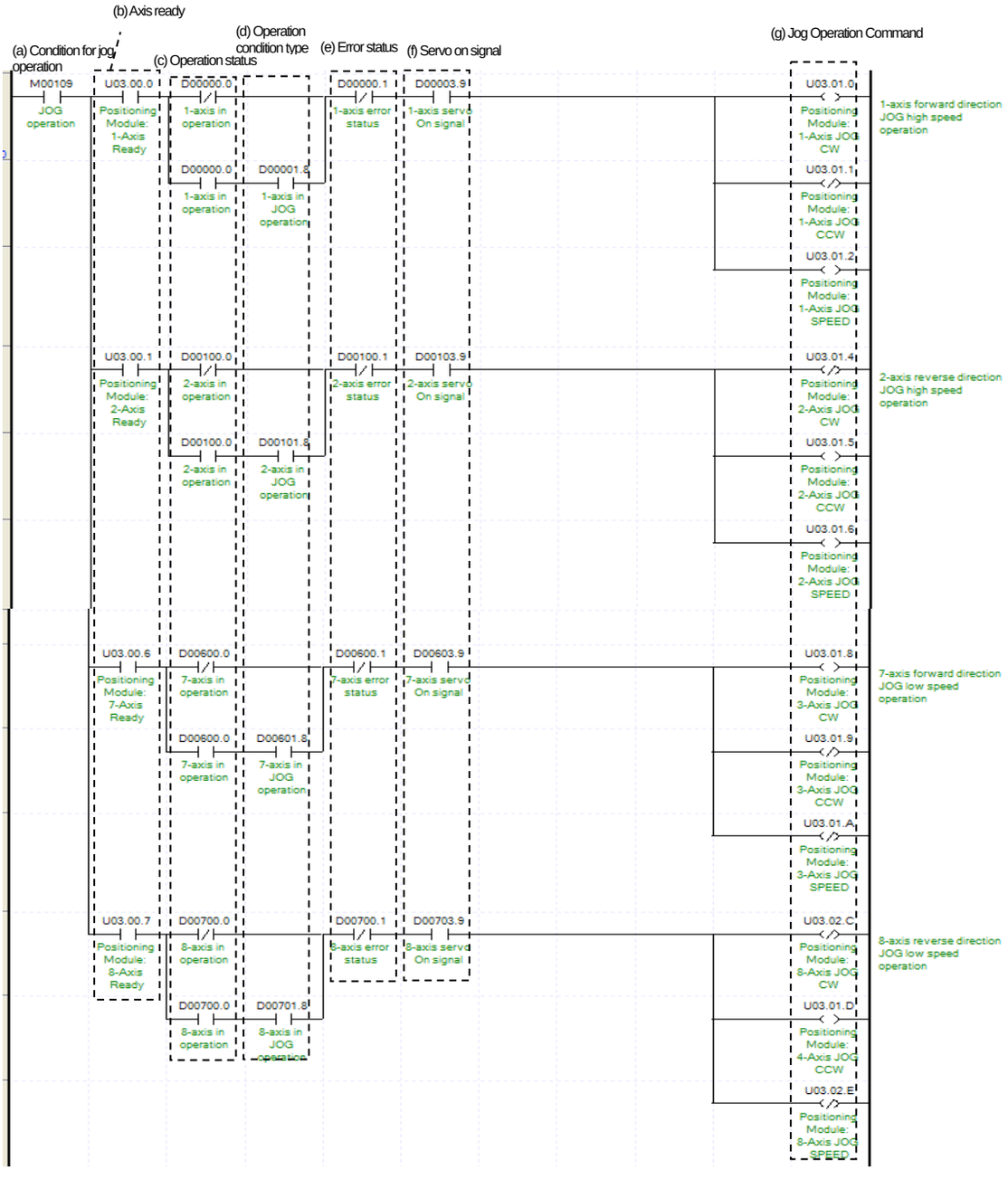
(f) Positioning module mounting position

In the example, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

You can set an axis for Floating Origin Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the "axis to command" item of floating home setting command (XLRD), it can set 1 to 8 meaning axis1 to axis8.

(2) Jog operation



(a) Condition of Jog Operation

Condition of Jog Operation Command

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

Jog Operation can only be working when the state of axis set as Jog Operation. In this example above, specific axis set as Jog Operation otherwise it is not operating.

(d) Operation control type for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in jog operation'. If a relevant axis is in jog operation, it becomes 'on'. Jog Operation configuration can be changed while it is operating.

(e) Error status for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

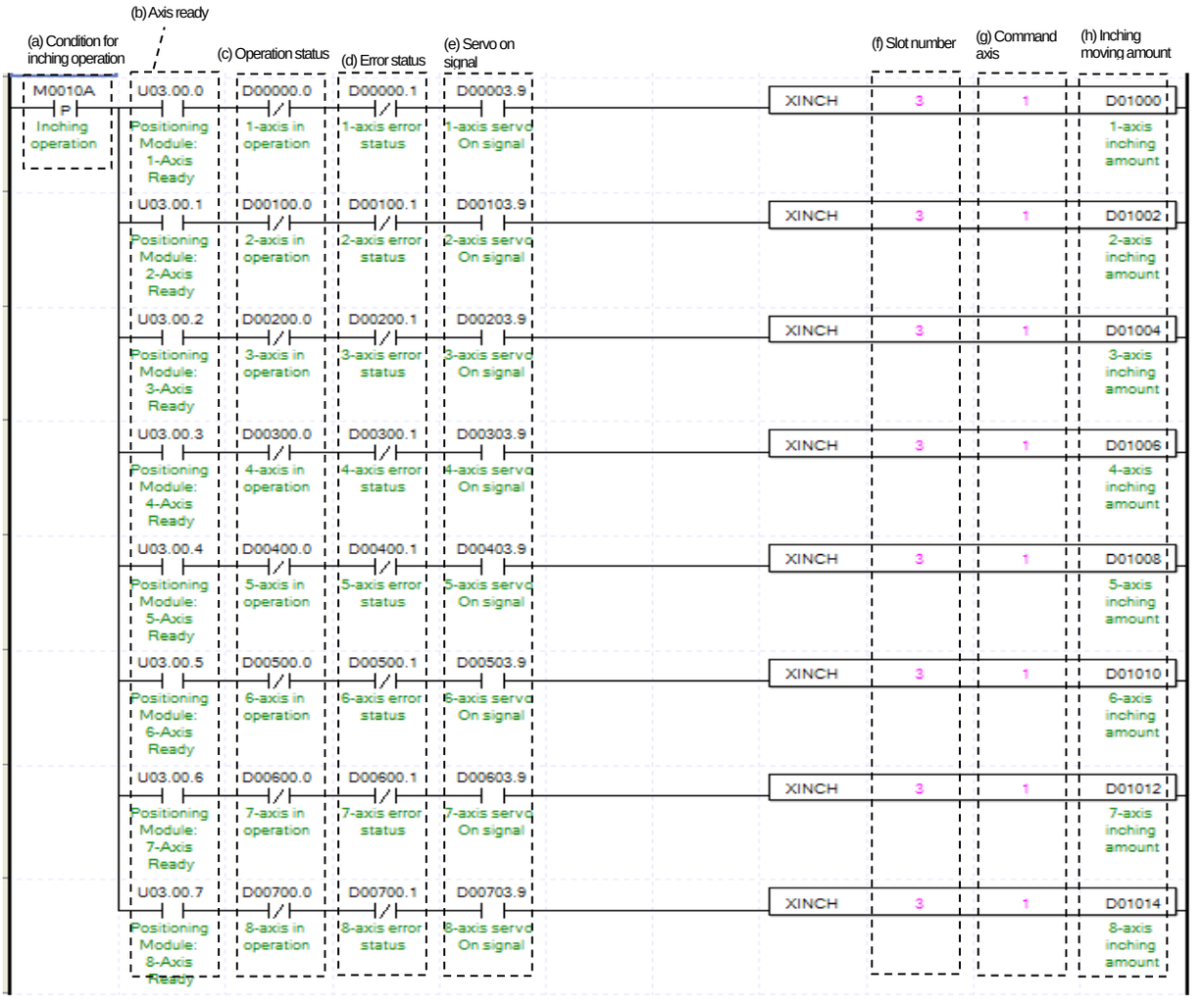
(f) Servo on status for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. The jog operation cannot be executed when axis is not servo on, hence the condition is set to execute when it is servo on. If you execute jog operation while axis is not servo on status, error 413 would be appeared.

(g) Jog operation command for each axis

Jog Operation works by setting or clearing directly its considered bit from U device not by a command. In this example above, look at the axis 1, once Jog Operation conditions are satisfied, clockwise jog bit becomes 'On' count clockwise jog bit becomes Off, and jog speed bit becomes 'On' Everything together Jog Operation works clock wisely with high speed. For detail information about Bit of U device, refer to "Chapter 5.2.1 Contents of input/output signal'. The value of U device refreshed used only in from the scan end of sequence program.

(3) Inching operation



(a) Condition of inching operation

Condition of Inching Operation Command (XINCH)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Inching Operation cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Inching Operation while it is running, the error 401 would be appeared.

(d) Error status for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. The inching operation command cannot be executed when axis is not servo on, hence the condition is

set to execute when it is servo on. If you execute inching operation command while axis is not servo on status, error 403 would be appeared.

(f) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

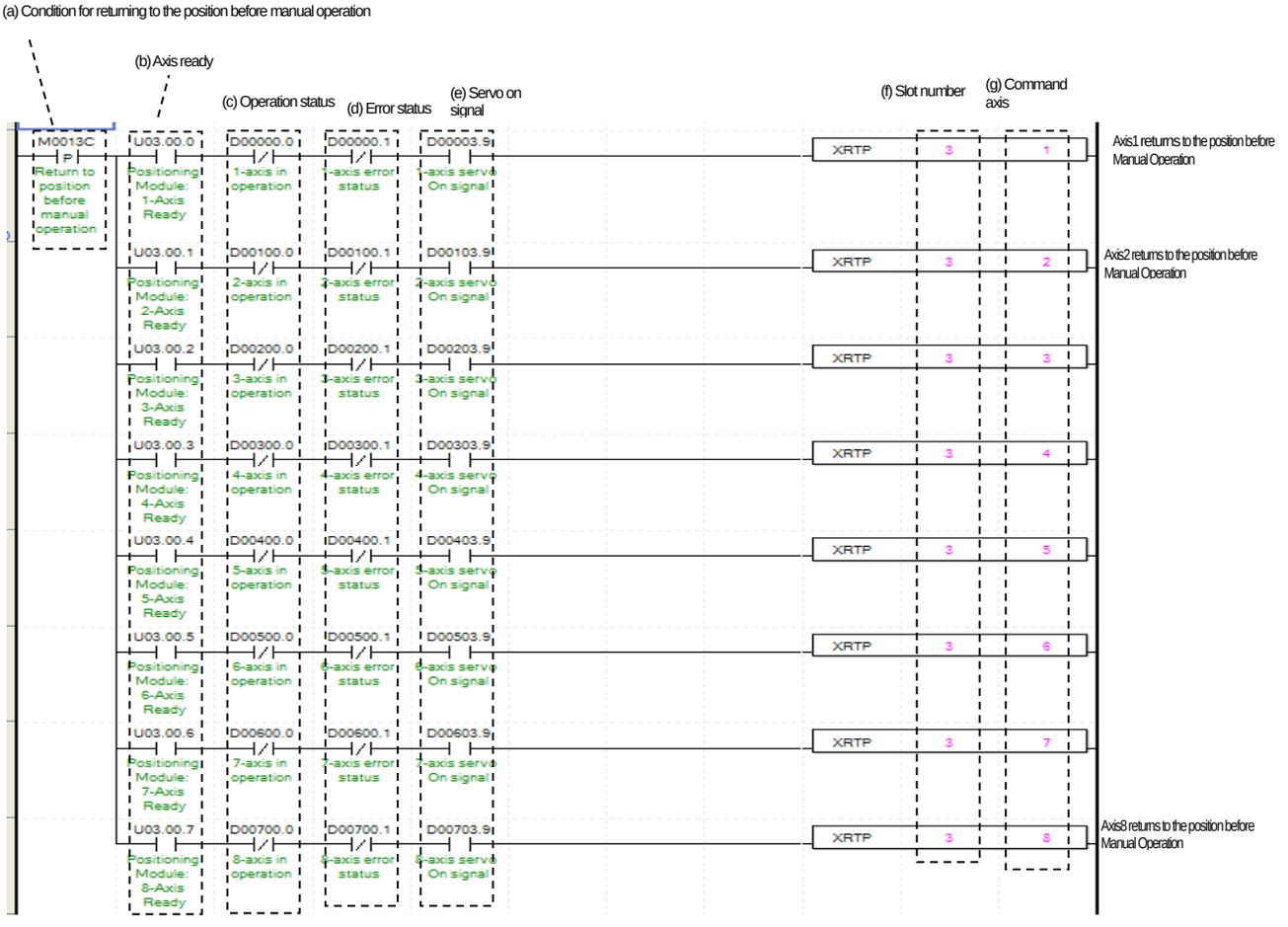
You can set an axis for Inching Operation. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command” item of inching operation command (INCH), it can set 1 to 8 meaning axis1 to axis8.

(h) Amount of Inching movement for each axis

Measure the amount of moving range by Inching Operation.

(j) For the detail description about inching operation, refer to“9.3.2 Inching Operation”.

(4) Manual operation previous position return



(a) Condition of return to the position before manual operation

Condition of Return to the position before Manual Operation Command (XRTP)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Inching Operation cannot be configured while it is running hence configuration will only be

configured when it is not running. If you execute Manual Operation while it is running, the error 431 would be appeared.

(d) Error status for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. The return to the position before Manual Operation command cannot be executed when axis is not servo on, hence the condition is set to execute when it is servo on. If you execute the return to the position before Manual Operation command while axis is not servo on status, error 434 would be appeared.

(f) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

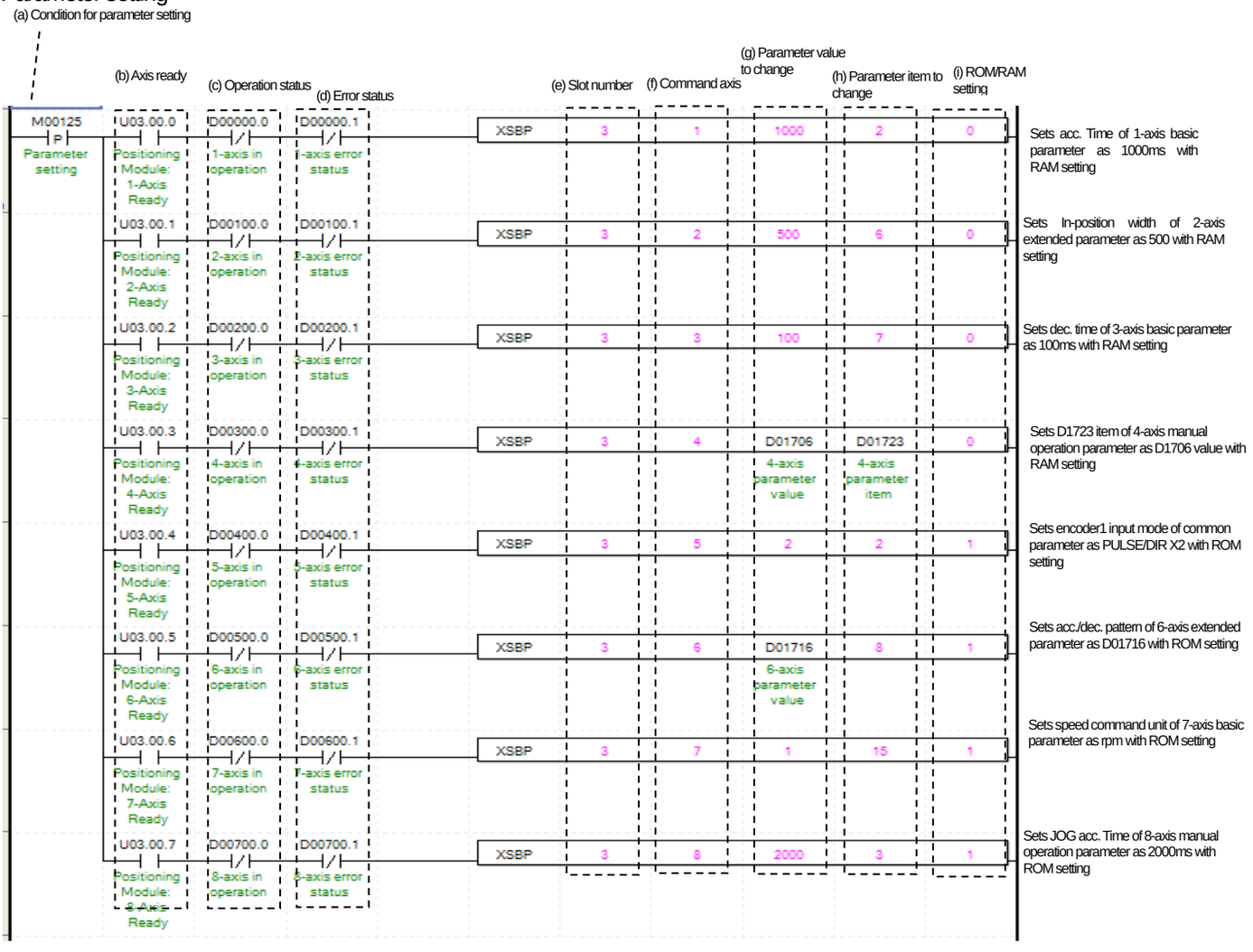
(g) Axis to give a command

You can set an axis for Inching Operation. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the "axis to command" item of the return to the position before Manual Operation command (XRTP), it can set 1 to 8 meaning axis1 to axis8.

(h) When the return to the position before Manual Operation command is executing, the related axis moves to the position before manual operation such as jog operation and Inching operation is executed. For more information, refer to "Chapter 9.3.3 Return to the position before manual operation'.

8.1.5 Parameter and Operation Data Setting

(1) Parameter setting



(a) Condition of parameter setting execution

Condition of Parameter Setting Command (XSBP, XSEP, XSMP, XSCP)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. The parameter setting command except common parameter setting command cannot be configured while it is operating hence condition be configured when axis is not operating. If you execute Parameter Setting while it is running, the error 471 would be appeared.

(d) Error status for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(f) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command” item of the parameter setting command, it can set axis 1 to 8 meaning axis1 to axis8.

(g) Parameter value to change

You can set a value of changing parameter. For more information, refer to each parameter setting command of 'Chapter 6. Command”.

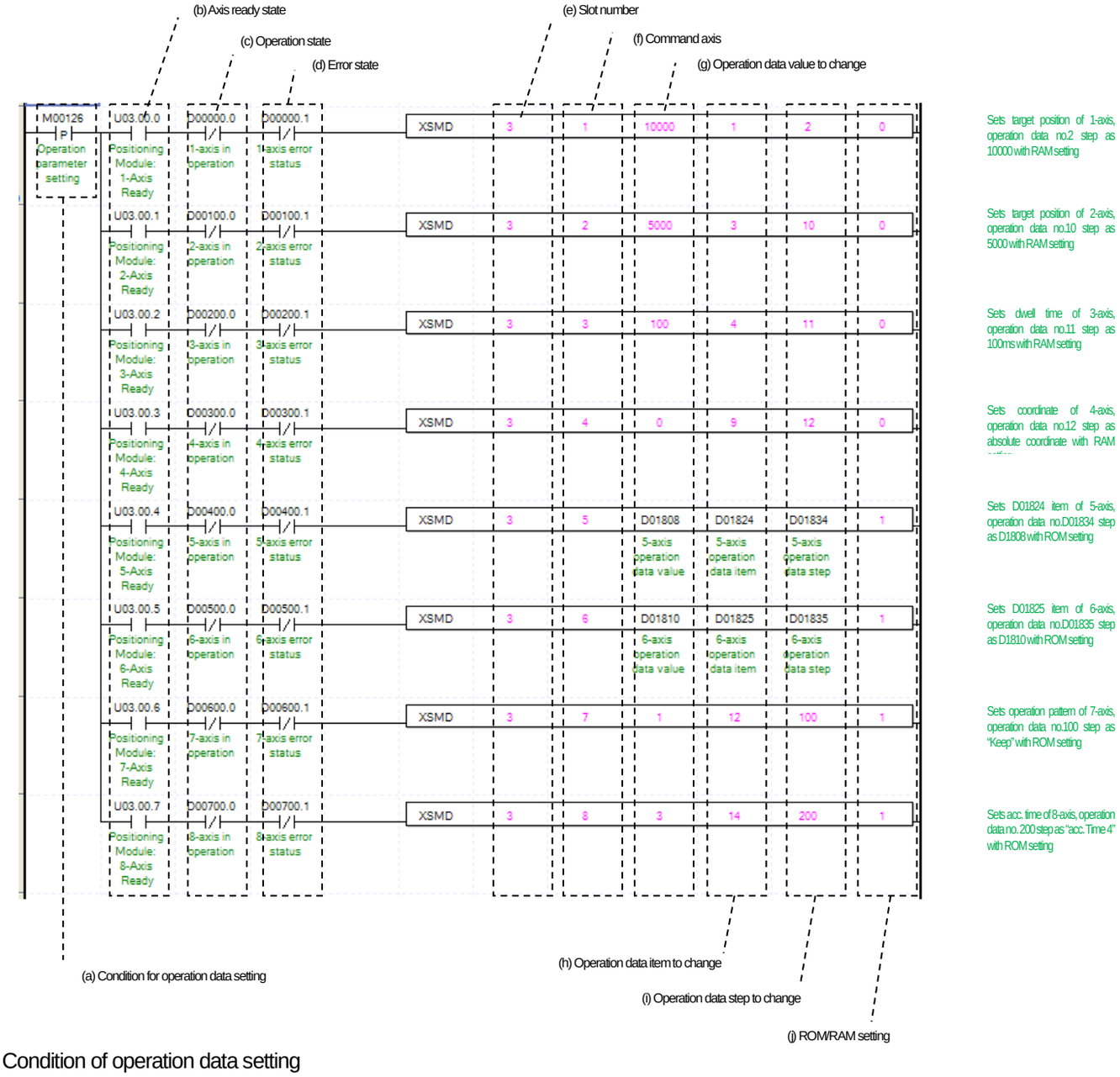
(h) Parameter items to change

Set the list to be changed with the parameter value (g) set in command. Once operating is working, this value will change to parameter value (g). For more information, refer to each parameter setting command of “Chapter 6. Command”.

(i) ROM/ RAM setting

This function sets whether you save value of changing parameter to ROM or RAM. If you choose ROM the data will be saved regardless of power and if you save in the RAM the data will be vanished when powers off. This parameter sets as 1 means ROM saved, and sets as 0 means RAM saved. Since the parameter of positioning module are saved in MRAM, there is no limit to the number of times parameter ROM settings are executed.

(2) Operating Data Setting



(a) Condition of operation data setting

Condition of Operating Data Command (XSMD)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operation data setting command is available when the related axis is in operation. But, when changing the operation data of currently operating step, it will be reflected after the operation of current step is finished.

(d) Error status for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any

error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(f) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command” item of the operation data setting command, it can set axis 1 to 8 meaning axis1 to axis8.

(g) Operation data value to change

You can set a value of changing parameter.

(h) Position data items to change

Set the operation data item to be changed with the operation data value (g) set in the command. When command is executing, the operation data value set in this item changes to the set operation data values (g). Each value of Operating Data is listed below. For example, if you put 1000 for value of changing operating data and “4 for operating data item then the value of dwell time is changing to “1000ms”.

Setting Value	Item
1	Target position
2	Circular interpolation auxiliary position
3	Operating speed
4	Dwell time
5	M code No.
6	Sub axis setting
7	Helical interpolation axis
8	No. of circular interpolation turn
9	Coordinate
10	Control method
11	Operation method
12	Operating pattern
13	Circular arc size
14	Acc. No.
15	Deceleration No.
16	Circular interpolating method
17	Circular interpolating direction

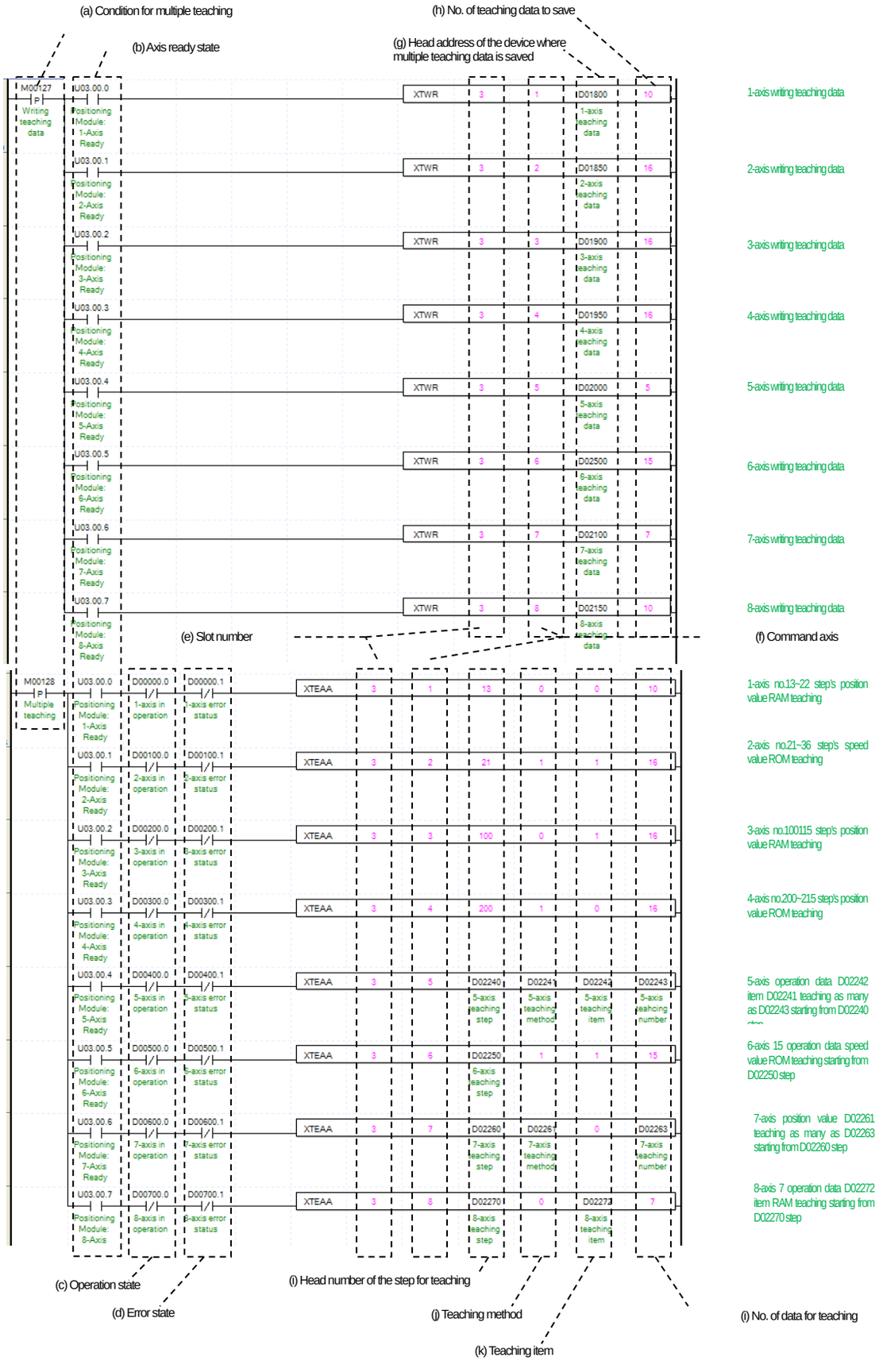
(I) Operation data step to change

You can configure the changing operating data step number by using the operating data step command. 400 step operation data for each axis can be set. This value supports from number 0 to 400. The numbers are considered as a step meaning number 1~400 are same as 1~400 steps. “When set to”0', it means the current step of operation data of related axis.

(j) ROM/ RAM setting

This function sets whether you save changed operation data values to ROM or RAM. If you choose ROM the data will be saved regardless of power and if you save in the RAM the data will be vanished when powers off. This parameter sets as 1 means ROM saved, and sets as 0 means RAM saved. The number of times for operation data ROM setting of positioning module is not limited because operation data is saved on MRAM Memory.

(3) Operation data teaching array



(a) Condition related to teaching array

Condition Teaching Array Command (XTWR, XTEAA)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. The plural teaching command is available to be executed when the axis is operating. But teaching data of operating step do not apply instantly. Operating step data will apply end of present step operation and the data of the remaining steps are changed immediately.

(d) Error status for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(f) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command” item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(g) Leading address of device where teaching array data are saved.

To execute teaching array, you need to set a specific value first. The teaching data write command (XTWR) are using for set up teaching array data. It has to be done before actual Teaching Array operation. Teaching Data will be set up depends on number of first device as below table.

Quantity	Device number	Teaching array data
1	Device + 0	Teaching array data 1
2	Device + 2	Teaching array data 2
3	Device + 4	Teaching array data 3
4	Device + 6	Teaching array data 4
5	Device + 8	Teaching array data 5
6	Device + 10	Teaching array data 6
7	Device + 12	Teaching array data 7
8	Device + 14	Teaching array data 8
9	Device + 16	Teaching array data 9
10	Device + 18	Teaching array data 10
11	Device + 20	Teaching array data 11
12	Device + 22	Teaching array data 12
13	Device + 24	Teaching array data 13
14	Device + 26	Teaching array data 14
15	Device + 28	Teaching array data 15
16	Device + 30	Teaching array data 16

(h) Number of saving teaching data

Decide how many data will be saved by using XTWR command. Maximum 16 data can be saved. In this example above, 10 Teaching data saved in the axis 1. Therefore those teaching data from D01800~D01818 saved in the module.

Step leading address to teaching

You can setup the first number of Teaching Step among the Operating Data step. In this example above, Teaching Array of axis

1 will be operate from 22th step, which is 10th step away from 13th step, hence it will be operate between 13th step and 22th step.

(j) Teaching method

This function sets whether you save changed operation data values to ROM or RAM. If you choose ROM the data will be saved regardless of power and if you save in the RAM the data will be vanished when powers off. This parameter sets as 1 means ROM saved, and sets as 0 means RAM saved. The number of times for ROM teaching is not limited because operation data is saved on MRAM Memory.

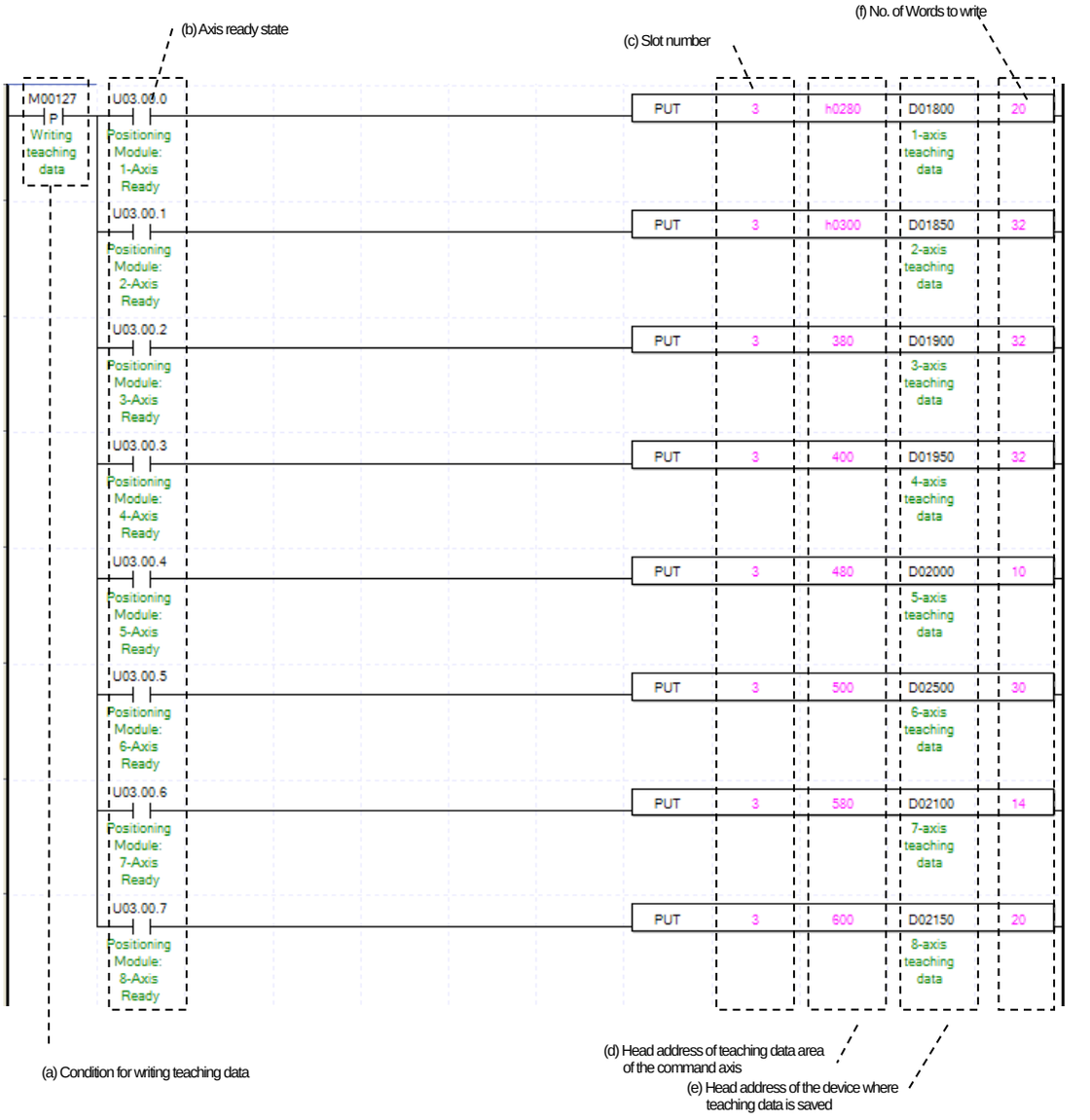
(k) Teaching items

You can set a data with Teaching Method among the Operating Data. Both" target position' and 'operation speed' can be changed by Teaching Array. When its value set"0" means set a target position and"1" means set an operation speed.

(i) Number of teaching

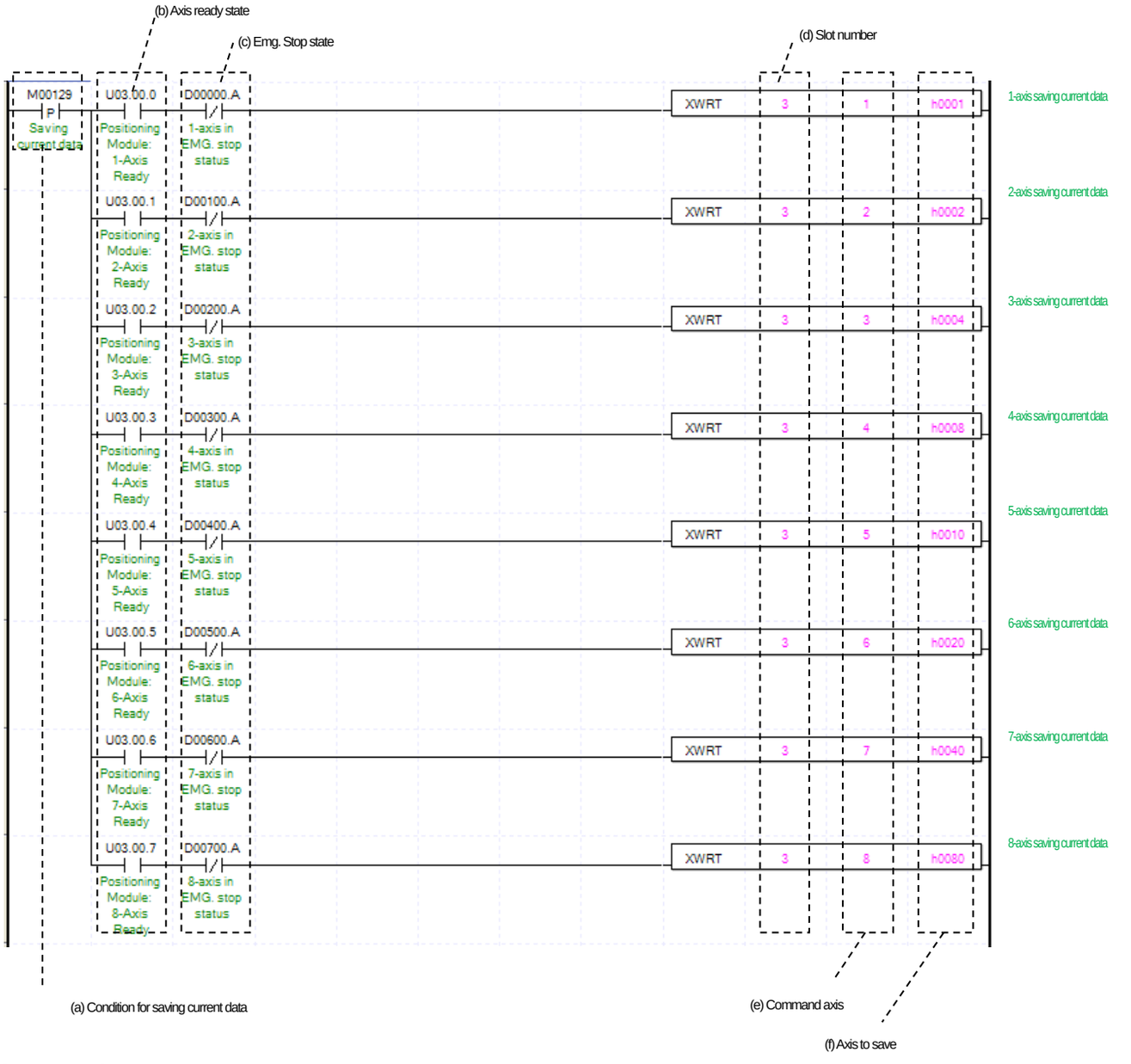
Decide how many steps will be operated using by Teaching Method. Maximum 16 data can be saved. For more information about teaching array operation, refer to " 9.7.1 teaching array" item.

(m) This example above can also be operated, using command PUT from XTWR as below.



For more information about saving teaching data for each axis, refer to 'Chapter 5.1.2 Teaching data' item. When you are using a command PUT you need to setup a type of data as a WORD not a DINT considered its size

(4) Saving current data



(a) Condition of saving current data

Condition of Saving Current Data Command (XWRT). When current saving data operated, those values of module parameter and operating data would be saved in MRAM Memory. Therefore, since changing data by RAM setting or RAM teaching are saved MRAM, It maintains whether power is on or not.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Emergency stop status for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'Emergency stop status'. It turns on when it is Emergency stop. Emergency Stop cannot be configured while it is running hence configuration will only be configured when it is not running.

(d) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(e) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command” item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

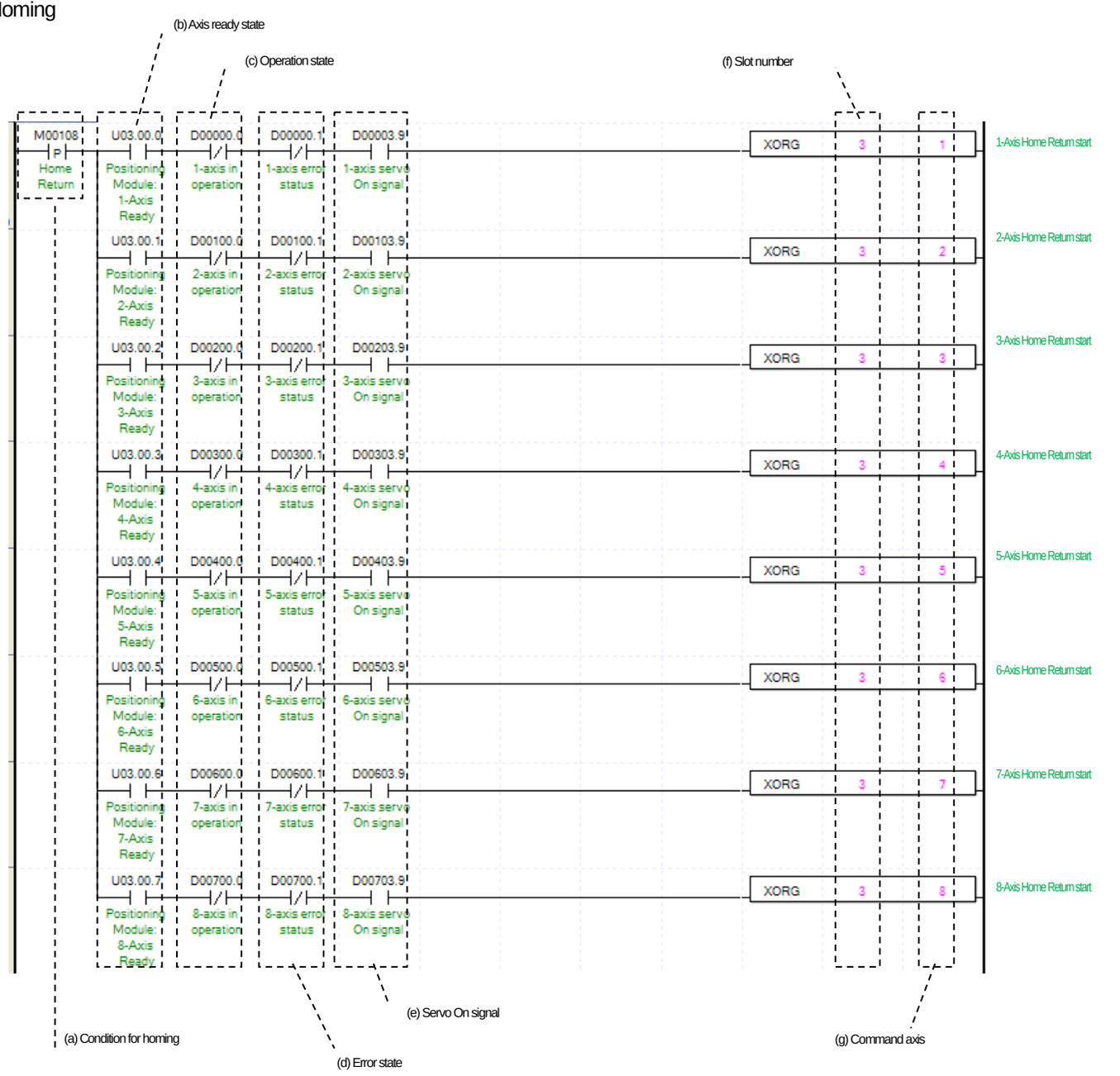
(f) Axis to save

Configure current data operation setting. Choosing axes are configured follow by below table. Therefore even if those axis are not operated as it programmed, saving axis can be saved in Array. The current data of the axis that current data save command is executed saved in MRAM, which maintains constantly whether its power is on or not.

15 ~ 8 Bit	7Bit	6Bit	5Bit	4Bit	3Bit	2Bit	1Bit	0Bit
Do Not Use	Axis 8	Axis 7	Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1

8.1.6 Positioning Operation

(1) Homing



(a) Condition of homing

Condition of Homing Command (XORG)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Homing command cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Homing while it is running, the error 201 would be appeared.

(d) Error status for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. The homing command cannot be executed when axis is not servo on, hence the condition is set to execute when it is servo on. If you execute homing command while axis is not servo on status, error 203 would be appeared.

(f) Positioning module mounting position

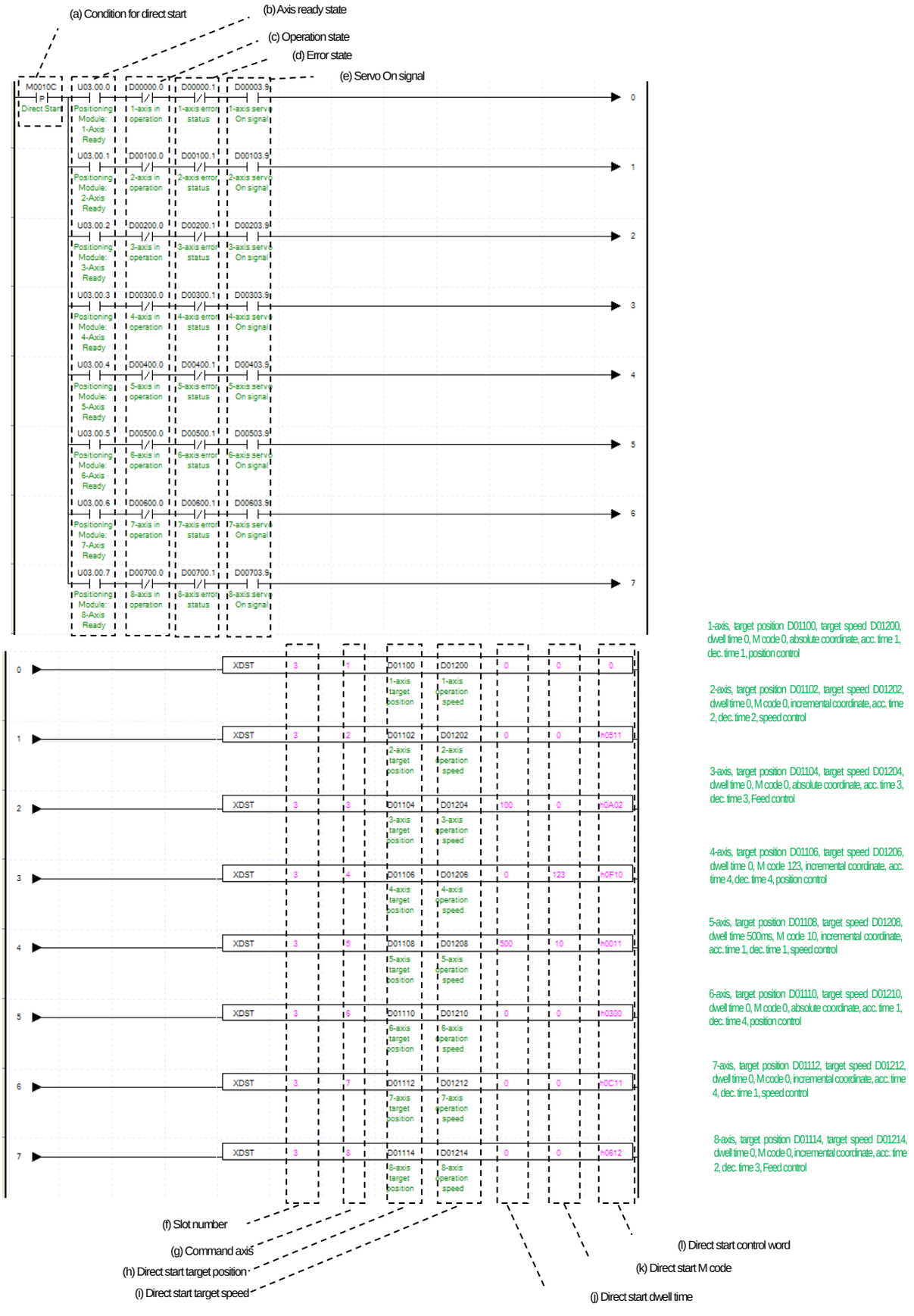
In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

You can set an axis for Inching Operation. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command homing” item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(h) For more information, refer to“9.1 Homing'

(2) Direct start



1-axis, target position D01100, target speed D01200, dwell time 0, M code 0, absolute coordinate, acc. time 1, dec. time 1, position control

2-axis, target position D01102, target speed D01202, dwell time 0, M code 0, incremental coordinate, acc. time 2, dec. time 2, speed control

3-axis, target position D01104, target speed D01204, dwell time 0, M code 0, absolute coordinate, acc. time 3, dec. time 3, Feed control

4-axis, target position D01106, target speed D01206, dwell time 0, M code 123, incremental coordinate, acc. time 4, dec. time 4, position control

5-axis, target position D01108, target speed D01208, dwell time 500ms, M code 10, incremental coordinate, acc. time 1, dec. time 1, speed control

6-axis, target position D01110, target speed D01210, dwell time 0, M code 0, absolute coordinate, acc. time 1, dec. time 4, position control

7-axis, target position D01112, target speed D01212, dwell time 0, M code 0, incremental coordinate, acc. time 4, dec. time 1, speed control

8-axis, target position D01114, target speed D01214, dwell time 0, M code 0, incremental coordinate, acc. time 2, dec. time 3, Feed control

(a) Condition of direct start

Condition of Direct Start Command (XDST)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Direct Start command cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Direct Start while it is running, the error 221 would be appeared.

(d) Error status for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. The direct start command cannot be executed when axis is not servo on, hence the condition is set to execute when it is servo on. If you execute direct start command while axis is not servo on status, error 225 would be appeared.

(f) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

You can set an axis for Inching Operation. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the "axis to command direct start" item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(H) Target position of direct start

Decide changing position of Direct Start command. In this example above, the initialized value is device, but you can also change it with constant numbers, which data type is " DINT".

(I) target speed of direct start

Set the target speed to be used when executing the axis to perform a direct start command to the set target position. In this example above, the initialized value is device, but you can also change it with constant numbers, which data type is " UDINT".

(j) Direct start dwell time

Dwell Time consider as a total amount of time from beginning of Direct Start operation that reach to the goal position and make output of Positioning Done Signal. That means after done its operation, direct start will make a positioning done signal. The unit is "ms" and the data type is "UINT"

(k) Direct start M code

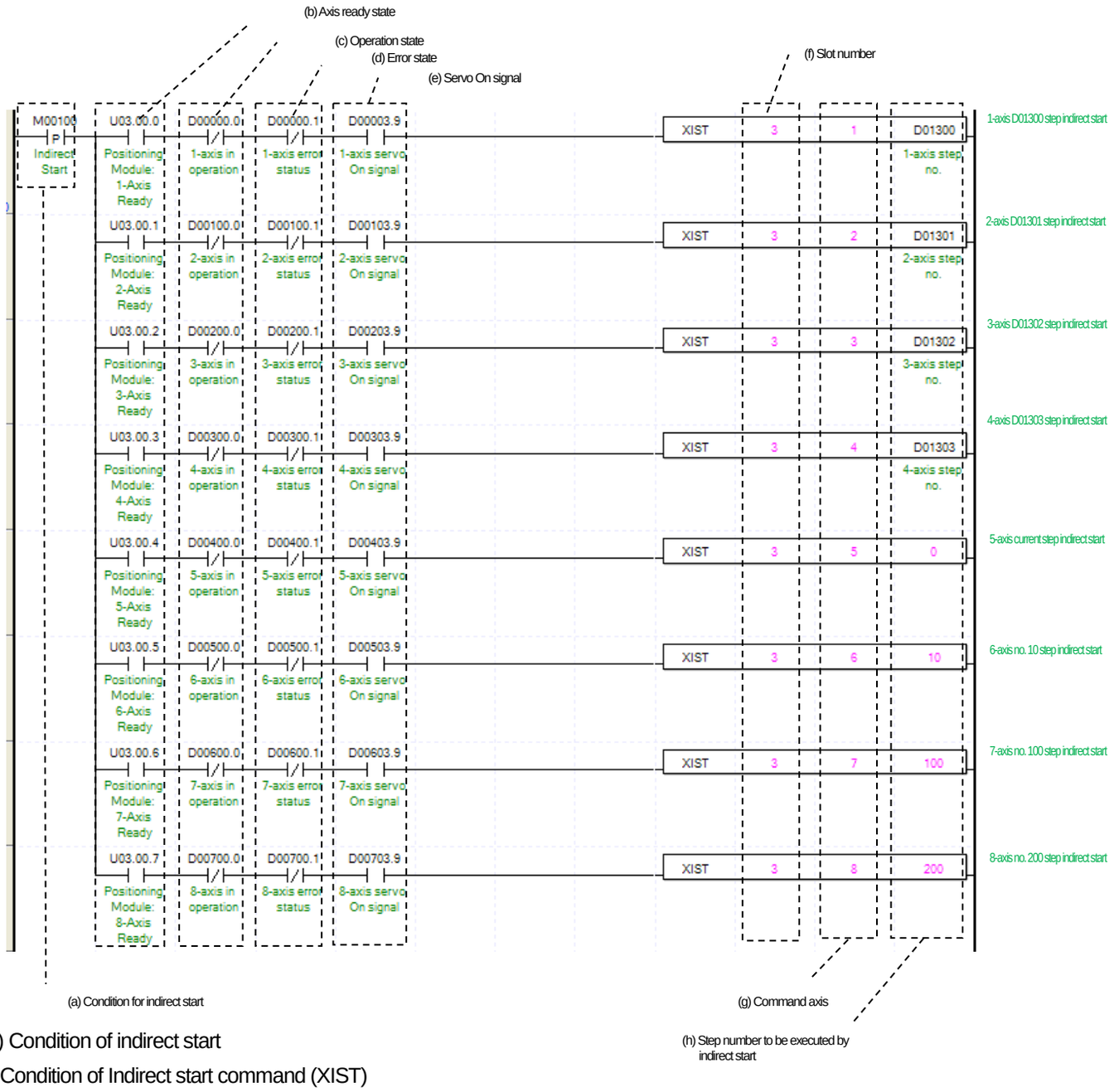
You can set a value of M code which are displaying of Operating Parameter by Direct Start. The output method of M code is set to one of three type , 'None',' With' and 'After' depending on" M code mode in expansion parameters", when value other than "none "is set, the M code will be output. For more information, refer to 'Chapter 4.2.2 Extended parameter setting".

(i) Direct start control word

These are list of setting values in a form of Word by Bit for Direct Start. The details of bits are in the table below.

15 ~ 12	11 ~ 10	9 ~ 8	7 ~ 5	4	3 ~ 0
-	Deceleration time	Acceleration time	-	0:Absolute 1:Relative	0:Position control 1:Speed control 2: FEED control 3: Shortest distance control 4: speed control(CSV)

(3) Indirect start



(a) Condition of indirect start

Condition of Indirect start command (XIST)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Indirect Start while it is running, the error 231 would be appeared.

(d) Error status for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. The indirect start command cannot be executed when axis is not servo on, hence the Indirect condition is set to execute when it is servo on. If you execute indirect start command while axis is not servo on status, error 235 would be appeared.

(f) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

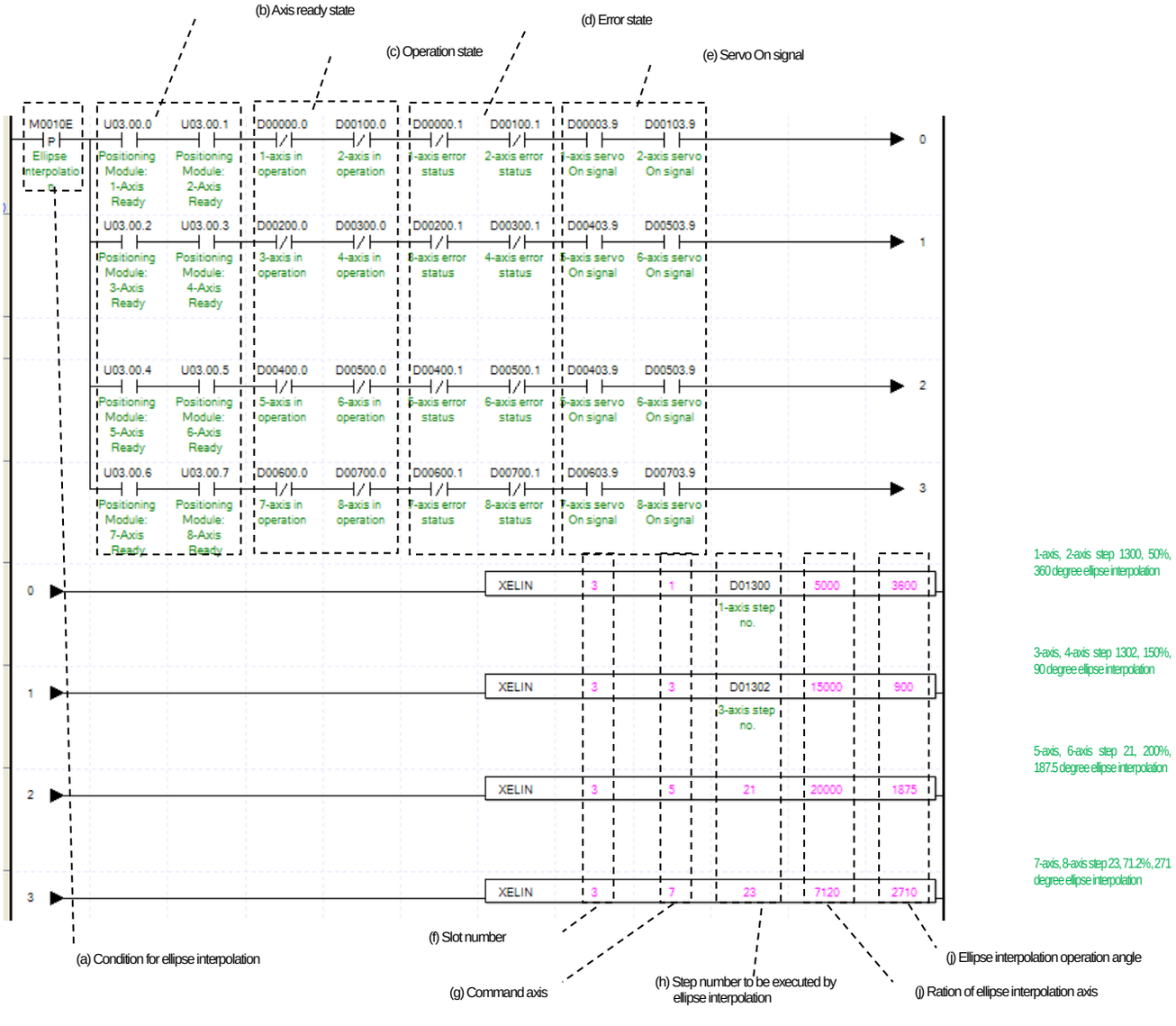
You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the "axis to command indirect start" item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(h) Operating step number by Indirect Start

Set the operating step number by indirect start for main command axis.

(i) Indirect start operates by appointing step of position data for each axis. Therefore it could run those commands of Positioning control, Speed control, Feed control, linear interpolation control, circular Interpolation control depends on control method set in position data. For more information, refer to " 4.7 Operating Data".

(4) Ellipse Interpolation



(a) Condition Ellipse Interpolation

Condition of Ellipse Interpolation Command (ELIN)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on. Since ellipse interpolation is operated on two axes of main axis and subordinate axis, the ready status signal of two axes should be turned on.

(c) Operating state for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Ellipse Interpolation while it is running, the error 541 would be appeared.

(d) Error status for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. The ellipse interpolation command cannot be executed when the main axis and subordinate axis are not servo on, hence the condition is set to execute when it is servo on. If the ellipse Interpolation command is executed while the main axis is not servo on status, the error 549 would be appeared. If the ellipse Interpolation command is executed while the subordinate axis is not servo on status, the error 550 would be appeared

(f) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the "axis to command ellipse Interpolation" item of the command, it can set axis 1 to 8 meaning axis1 to axis8. The axis to give command becomes the main axis.

(h) Operating step number by ellipse Interpolation

Set the operating step number by Ellipse Interpolation. The setting of main operating step and subordinate step is the same.

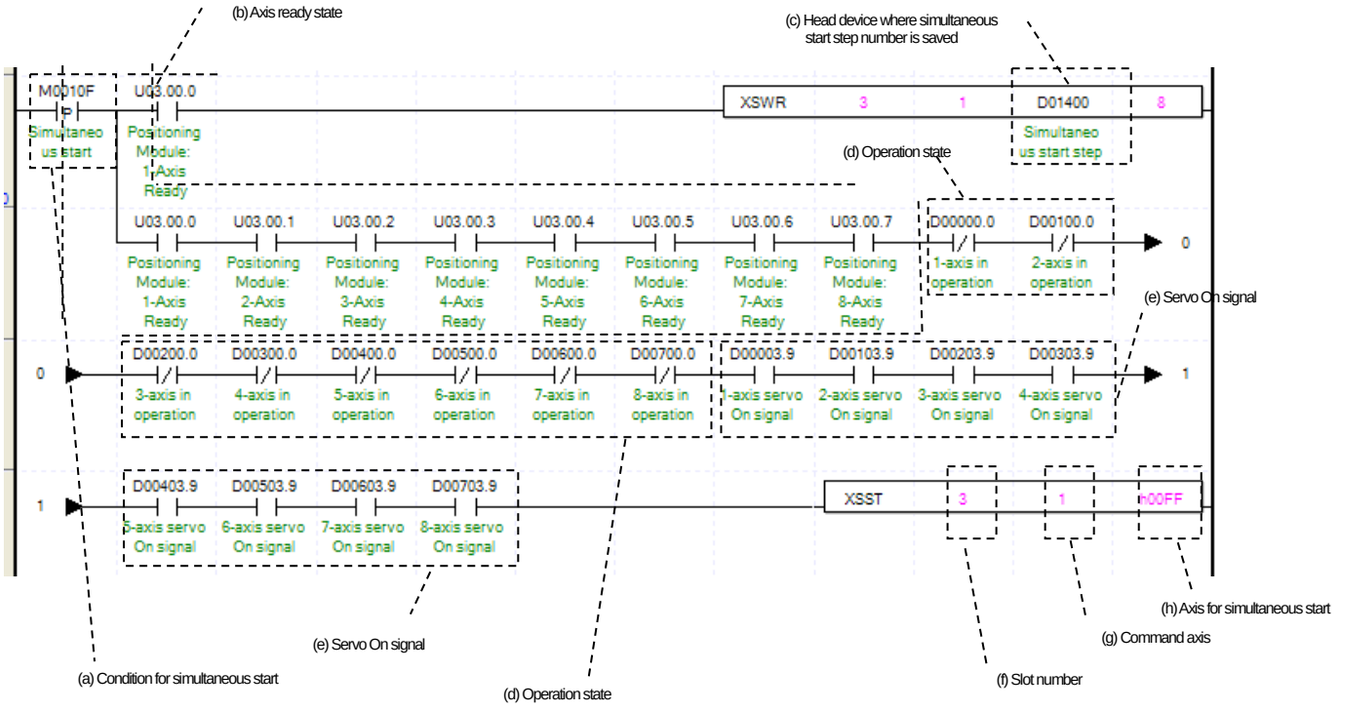
(I) Ratio of ellipse Interpolation axis

Set both ratio values for main and subordinate axis of set operates data from circular interpolation locus. It is to change circular locus into ellipse locus by using ratio of main and subordinate axis. Unit is [$X10^{-2}$ %]. For more information, refer to"9.2.13 Ellipse Interpolation control'.

(j) Degree of ellipse interpolating operation

Set the degree for Ellipse Interpolating Operation. Unit is [$X10^{-1}$ degree]. For more information, refer to"9.2.13 Ellipse Interpolation control'.

(5) Simultaneous start



(a) Condition of simultaneous start

Condition of Simultaneous Start Command

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on. The simultaneous start is operating more than two axes simultaneously, so all axes to be operated by simultaneous start should be ready status.

(c) The device leading address where step numbers for simultaneous start of each axis are saved

To execute a Synchronous Start, set data steps for each axis. XSWR commands are using for set up those step data for Simultaneous Start. Set the step number of each axis for each device and executes the XSWR command. It has to be done before actual Simultaneous Start operation. Simultaneous Start will be set up depends on number of first device as below table.

Quantity	Device number	Content
1	Device + 0	Axis1 simultaneous start step
2	Device + 1	Axis2 simultaneous start step
3	Device + 2	Axis3 simultaneous start step
4	Device + 3	Axis4 simultaneous start step
5	Device + 4	Axis5 simultaneous start step
6	Device + 5	Axis6 simultaneous start step
7	Device + 6	Axis7 simultaneous start step
8	Device + 7	Axis8 simultaneous start step

(d) Operating state for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Axis1 Simultaneous Start while it is running, the error 291 would be appeared.

(e) Servo on signal for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on

when it is servo on status. The simultaneous start command cannot be executed when axis is not servo on, hence condition is set to execute when it is servo on. If you execute simultaneous start command while the axis among simultaneous start axes is not servo on status, the error 295 would be appeared.

(f) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command simultaneous start” item of the command, it can set axis 1 to 8 meaning axis1 to axis8. The axis to give command becomes the main axis.

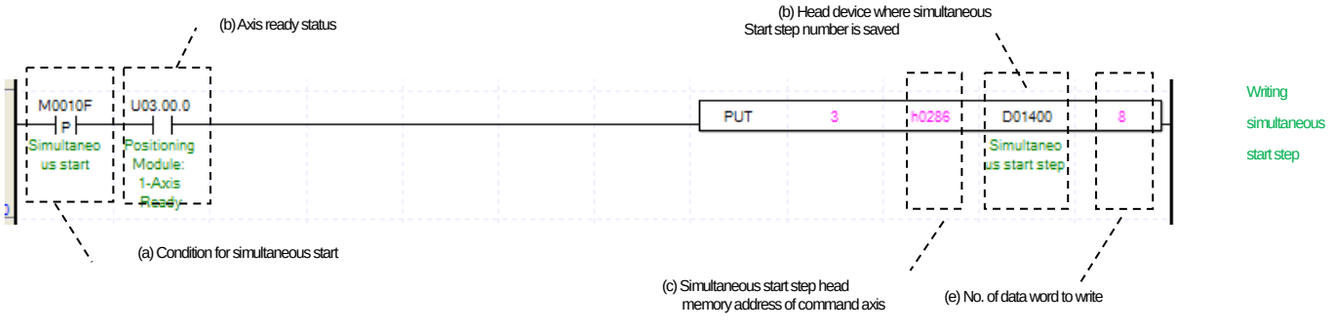
(h) Axis for synchronous start

Set axis for Synchronous Start. The axis for synchronous start uses a bit from WORD data setting as a“1” for each axis. Axis for each bits are as below.

15 ~ 8 Bit	7Bit	6Bit	5Bit	4Bit	3Bit	2Bit	1Bit	0Bit
Do Not Use	Axis 8	Axis 7	Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1

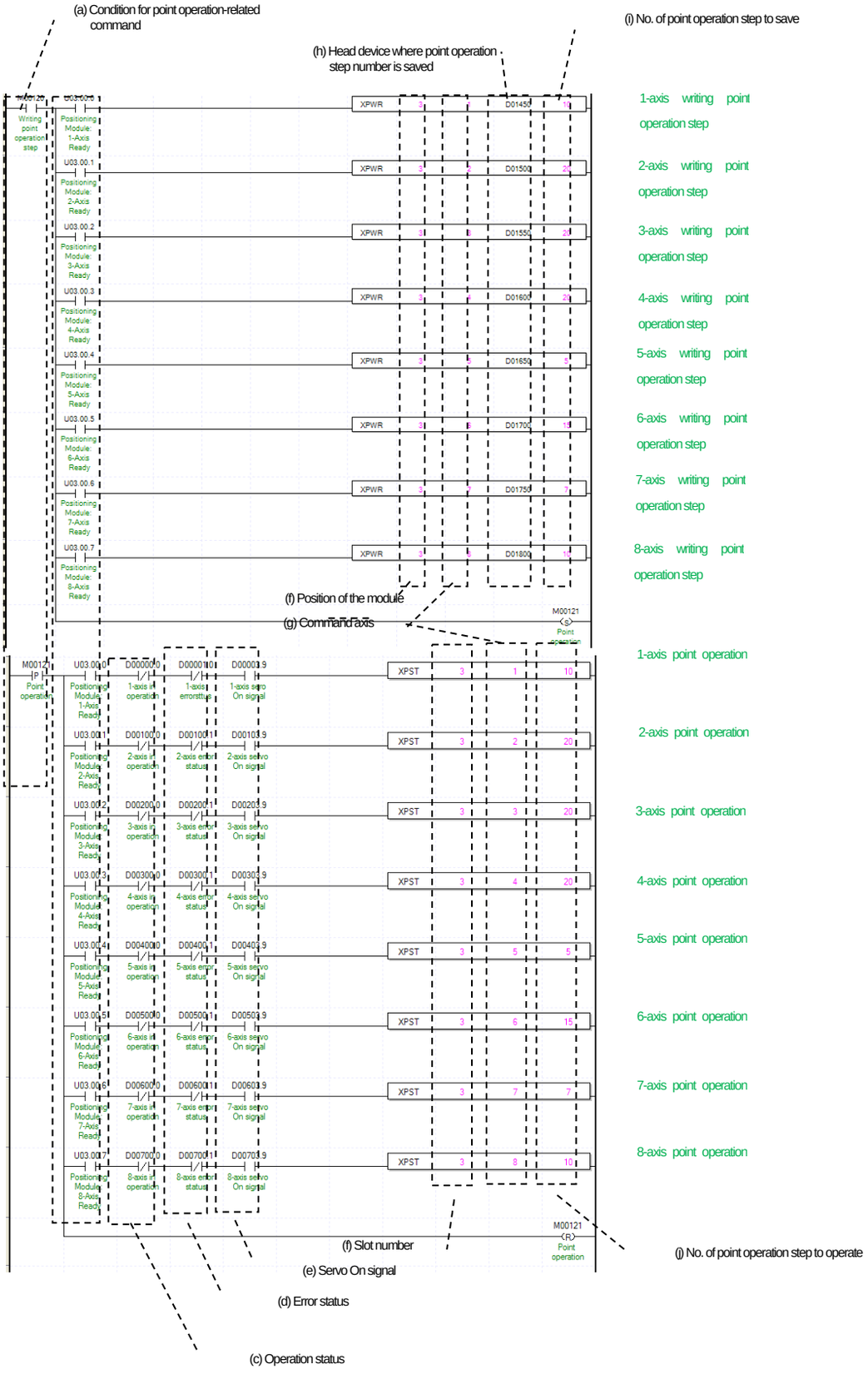
In this program, since it is set to “hFF”, all axes1 to 8 are set to operate as simultaneously.

(i) In this program above, you can use command PUT instead of simultaneous start step write command (XSWR).



(j) Setting a memory address for each axis of Synchronous Start step number, refer to 'Chapter 5.1.3 Simultaneous start step data Item'.

(6) Point operation



(a) Condition of point operation

There are the condition for executing point operation step write (XPWR) and point operation (XPST). Before executing point operation, writing of point operation step must be done first.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Point Operation while it is running, the 'error 231 would be appeared.

(d) Error status for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. The point operation start command cannot be executed when axis is not servo on, hence the indirect condition is set to execute when it is servo on.

(f) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the point operation step write command (XPWR) and point operation start command (XPST), axis to command item can set axis 1 to 8 which meaning axis1 to axis8.

(h) The device leading number where the point operation step number are saved.

To execute a Point Operation, you need to set a specific value first. XPWR commands are using for set up those Point Operation steps. It has to be done before actual Point Operation. Point start step data will be set like item below depending on the leading no. of device.

Quantity	Device number	Point start step data
1	Device + 0	Point start step data 1
2	Device + 1	Point start step data 2
3	Device + 2	Point start step data 3
4	Device + 3	Point start step data 4
5	Device + 4	Point start step data 5
6	Device + 5	Point start step data 6
7	Device + 6	Point start step data 7
8	Device + 7	Point start step data 8
9	Device + 8	Point start step data 9
10	Device + 9	Point start step data 10
11	Device + 10	Point start step data 11
12	Device + 11	Point start step data 12
13	Device + 12	Point start step data 13
14	Device + 13	Point start step data 14
15	Device + 14	Point start step data 15

Quantity	Device number	Point start step data
16	Device + 15	Point start step data 16
17	Device + 16	Point start step data 17
18	Device + 17	Point start step data 18
19	Device + 18	Point start step data 19
20	Device + 19	Point start step data 20

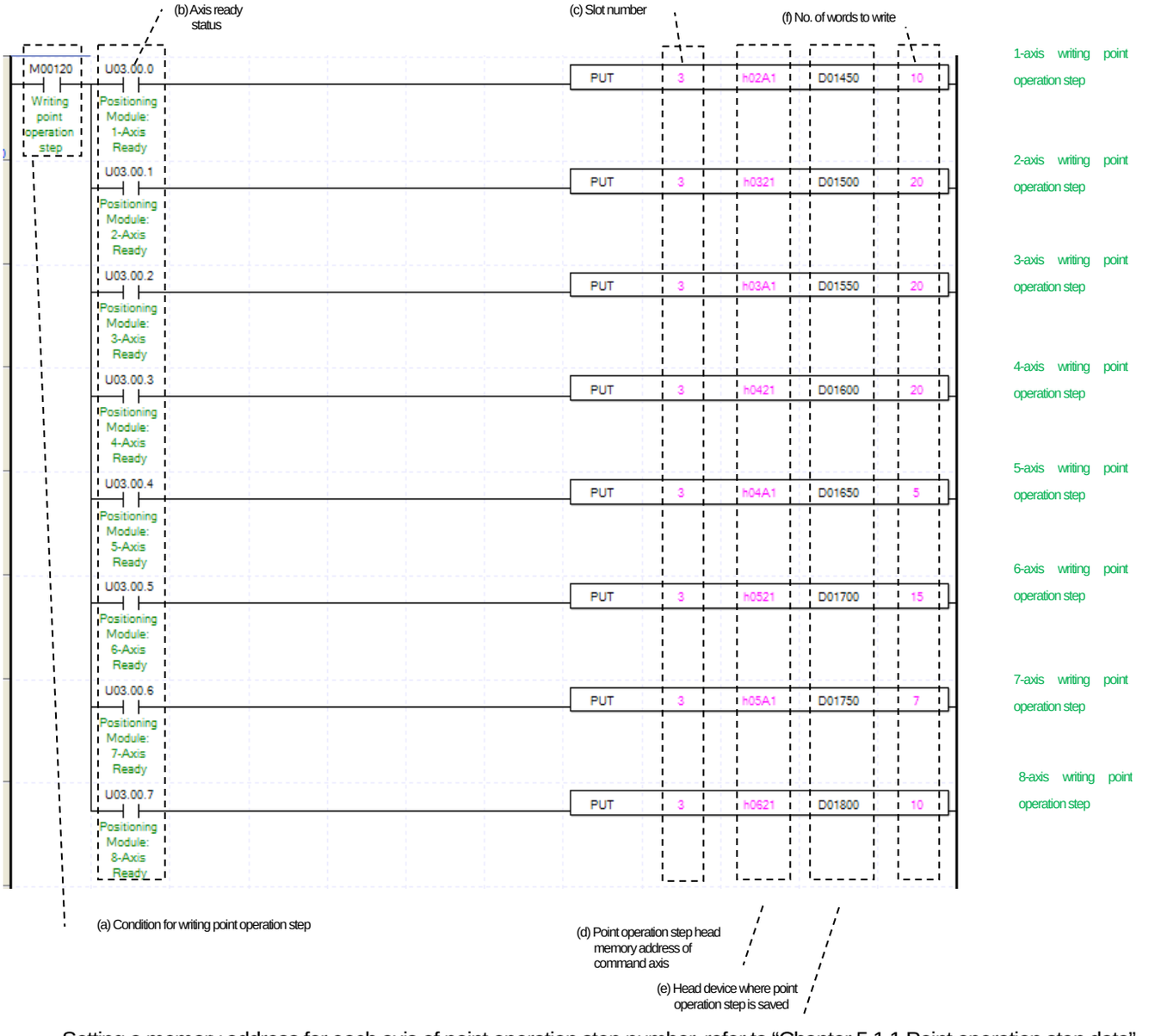
(i) Number of point operation steps to save

Decide how many data will be saved by using XTWR command. In this example above, 10 Point Operation steps are saved in the axis 1. Therefore those Step data from D01450~D01459 are saved in the module.

(j) Number of operation to operate

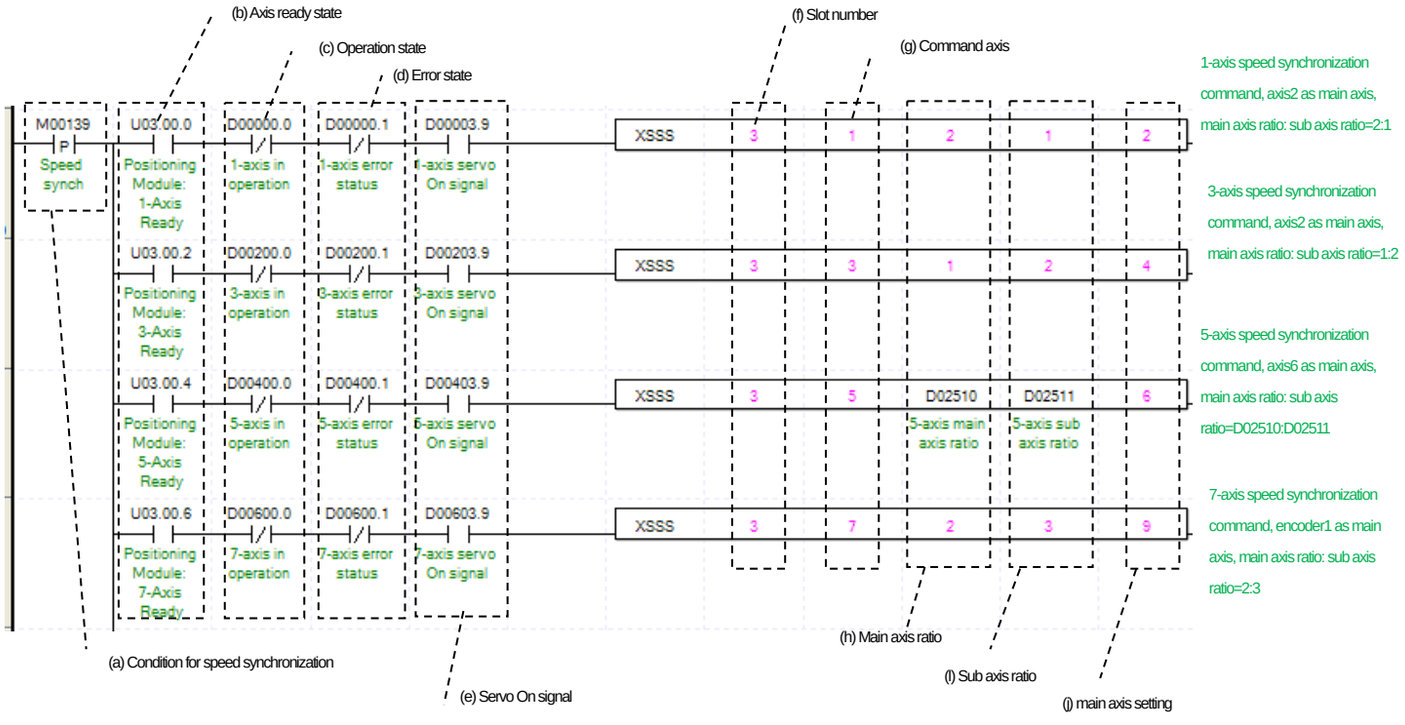
Set the number of saving Step numbers by Point Operating Writing command. For more information, refer to (4) Point operation item of “Chapter 9.2.18 positioning start”.

(k) In this program above, you can use command PUT instead of the point operation step write (XPWR).



Setting a memory address for each axis of point operation step number, refer to “Chapter 5.1.1 Point operation step data”.

(7) Speed synchronization



(a) Condition of speed synchronization

Condition of Speed Synchronization Command (XSSS)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Speed Synchronization while it is running, the error 351 would be appeared.

(d) Error status for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. The speed synchronization command cannot be executed when axis is not servo on, hence the indirect condition is set to execute when it is servo on. If you execute speed synchronization command while axis is not servo on status, error 354 would be appeared.

(f) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the axis to command speed synchronization command (XSSS) item of the command, it can set axis 1 to 8 meaning axis1

to axis8.

(h) Ratio of main axis

Set value for Ratio of Main Axis to execute a Speed Synchronization.

(i) Ratio of subordinate axis

Set value for Ratio of Subordinate Axis to execute a Speed Synchronization. In this example above, the ratio of main and subordinate axis is 2:1. Meaning that operational speed ratio of those axes is 2 to 1. So, if main axis is operating in speed of 10000, subordinate axis will be operating in speed of 5000.

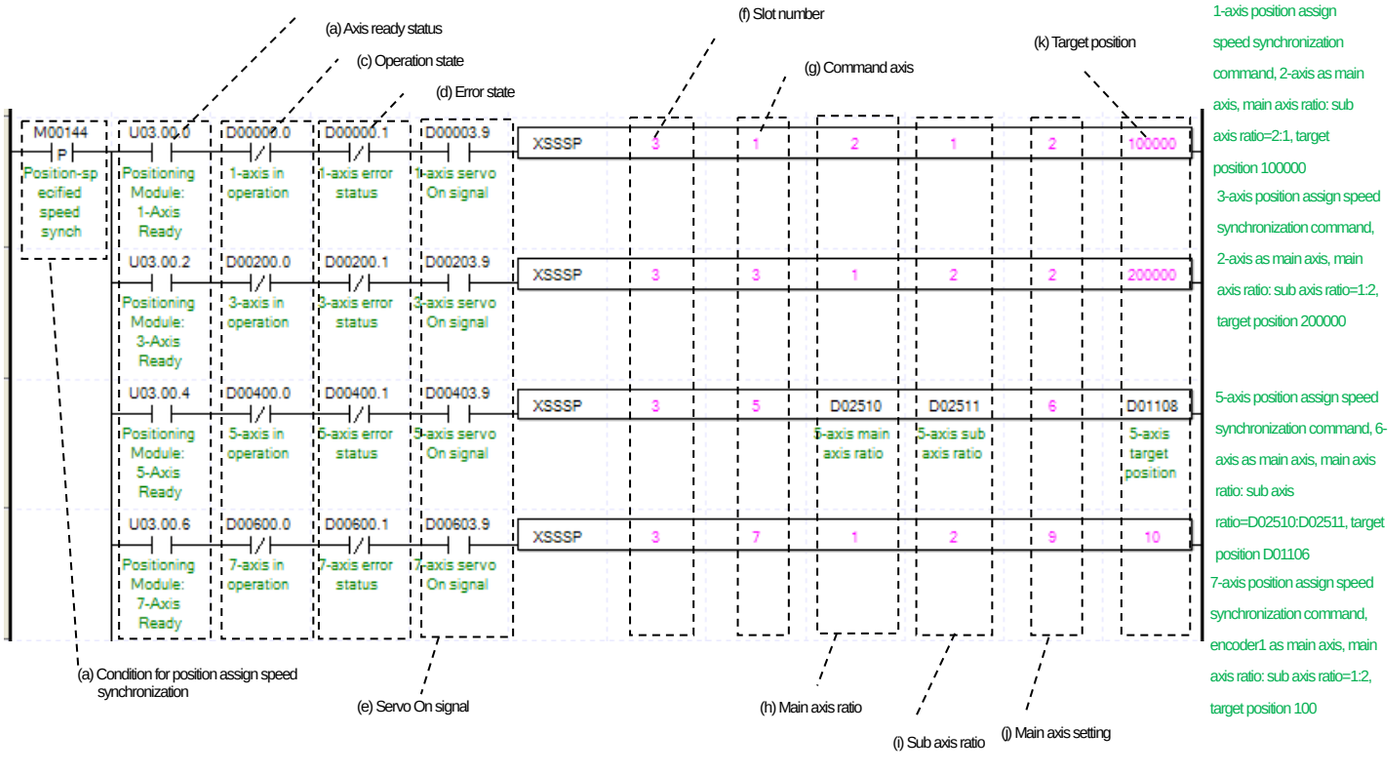
(j) Main axis setting

Setting of main axis to operate Speed Synchronization. This setting is for main axis of Speed Synchronization. This setting cannot be set as same value as command axis, and possible setting values are as below.

Setting Value	Main axis
1	Axis 1
2	Axis 2
3	Axis 3
4	Axis 4
5	Axis 5
6	Axis 6
7	Axis 7
8	Axis 8
9	Encoder 1

(k) For more information, refer to “Chapter 9.4.1 Speed Synchronization control “.

(8) Position specified speed synchronization



(a) Condition of position specified speed synchronization

Condition of Position Assign Speed Synchronization Command (XSSSP)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Speed Synchronization while it is running, the error 351 would be appeared.

(d) Error status for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. The speed synchronization command cannot be executed when axis is not servo on, hence the indirect condition is set to execute when it is servo on. If you execute speed synchronization command while axis is not servo on status, error 354 would be appeared.

(f) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the axis to command speed synchronization command (XSSS) item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(h) Ratio of main axis

Set value for Ratio of Main Axis to execute a Speed Synchronization.

(i) Ratio of subordinate axis

Set value for Ratio of Subordinate Axis to execute a Speed Synchronization. In this example above, the ratio of main and subordinate axis is 2:1. Meaning that operational speed ratio of those axes is 2 to 1. So, if main axis is operating in speed of 10000, subordinate axis will be operating in speed of 5000.

(j) Main axis setting

Setting of main axis to operate Speed Synchronization. This setting is for main axis of Speed Synchronization. This setting cannot be set as same value as command axis, and possible setting values are as below.

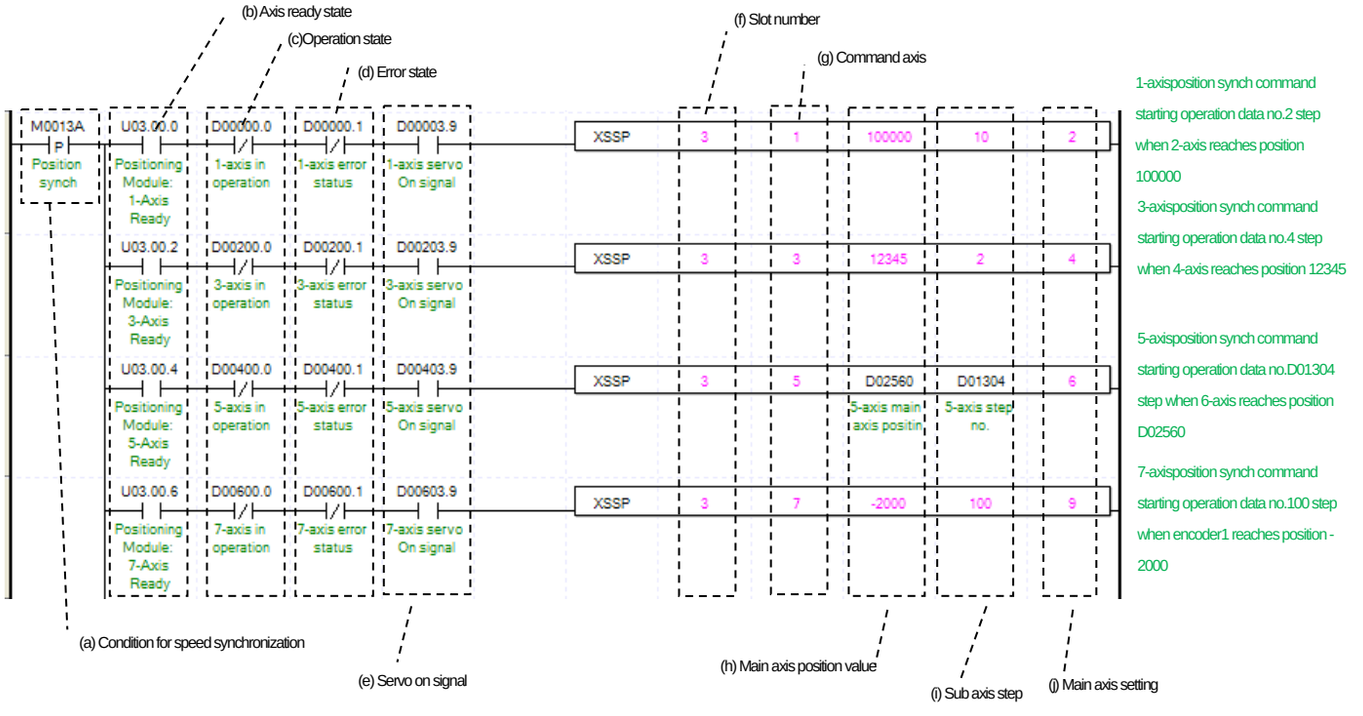
Setting Value	Main axis
1	Axis 1
2	Axis 2
3	Axis 3
4	Axis 4
5	Axis 5
6	Axis 6
7	Axis 7
8	Axis 8
9	Encoder 1

(k) Target position

Set goal of Position Assign Speed Synchronization. Once command axis reaches the goal position, Speed Synchronization ends and operation will be stop immediately.

(i) For more information, refer to “Chapter 9.4.1 (5) Position specified speed synchronization”.

(9) Position synchronous



(a) Condition of position synchronous

Condition of Synchronous Start by Position Command (XSSP)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Synchronous Start by Position while it is running, the error 341 would be appeared.

(d) Error status for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. The position synchronization command cannot be executed when axis is not servo on, hence the indirect condition is set to execute when it is servo on. If you execute position synchronization command while axis is not servo on status, error 345 would be appeared.

(f) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the axis to command position synchronization command (SSP) item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(h) Main axis position values

Set value for Main Axis to execute Synchronous Start by Position. Therefore main axis will be executed the command when the subordinate axis reaches this set value.

(i) Subordinate axis operation step

Set step number for Subordinate Axis to execute a Speed Synchronization.

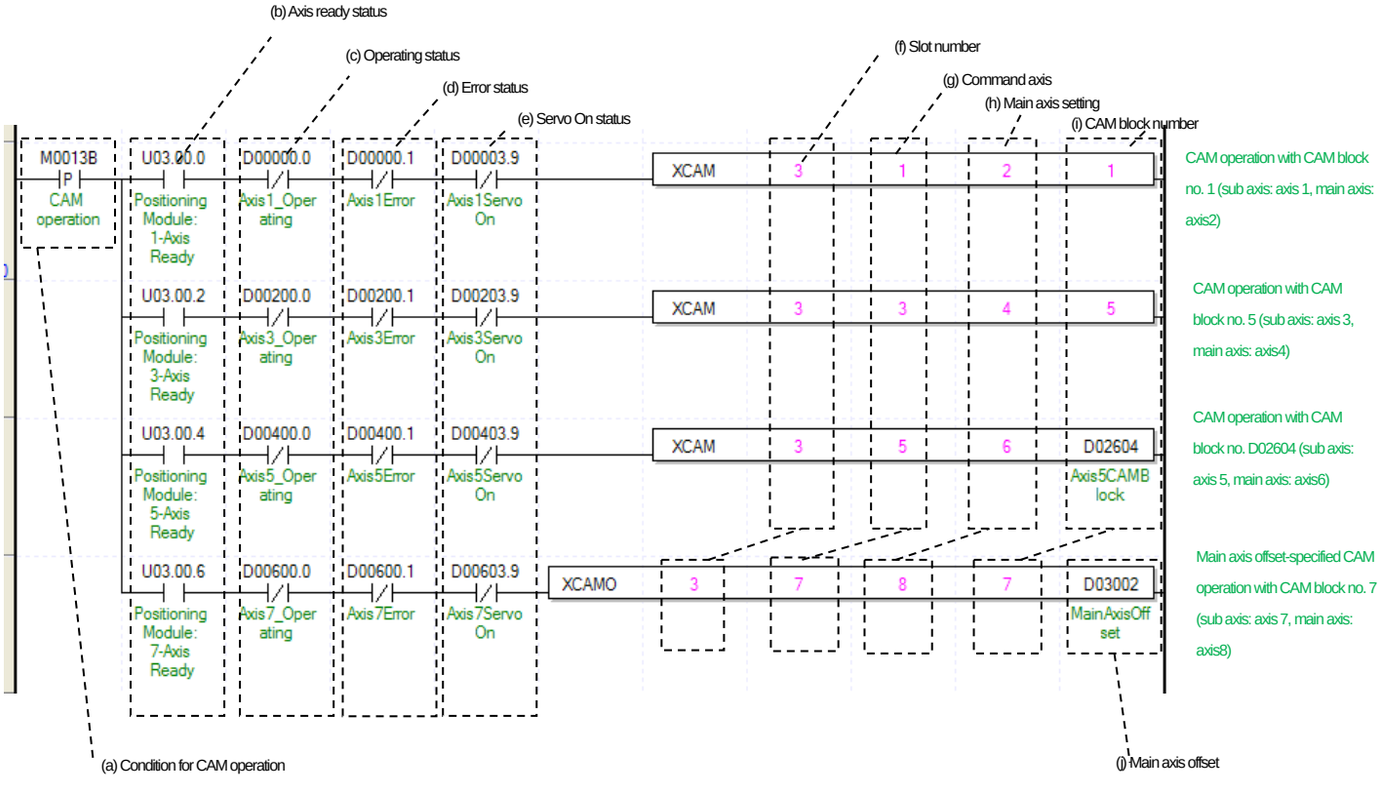
(j) Main axis setting

Setting of main axis to operate Speed Synchronization. This setting is for main axis of Speed Synchronization. This setting cannot be set as same value as command axis, and possible setting values are as below.

Setting Value	Main axis
1	Axis 1
2	Axis 2
3	Axis 3
4	Axis 4
5	Axis 5
6	Axis 6
7	Axis 7
8	Axis 8
9	Encoder 1

(k) For more information, refer to “Chapter 9.4.2 Position synchronous control”.

(10) CAM operation



(a) Condition of CAM operation

Condition of CAM Operation Command (XCAM)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute CAM Operation while it is running, the error 701 would be appeared.

(d) Error status for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. The CAM operation command cannot be executed when axis is not servo on, hence the condition is set CAM execute when it is servo on. If you execute CAM operation command while axis is not servo on status, error 703 would be appeared.

(f) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command inching operation (XCAM)” item of the command, it can set 1 to 8 meaning axis1 to axis8.

(h) Main axis setting

Setting of main axis to operate .This setting is for main axis of CAM Operating. This setting cannot be set as same value as command axis. Can set a value 1 to 8, which means from axis 1 to axis 8.

(i) CAM block numbers

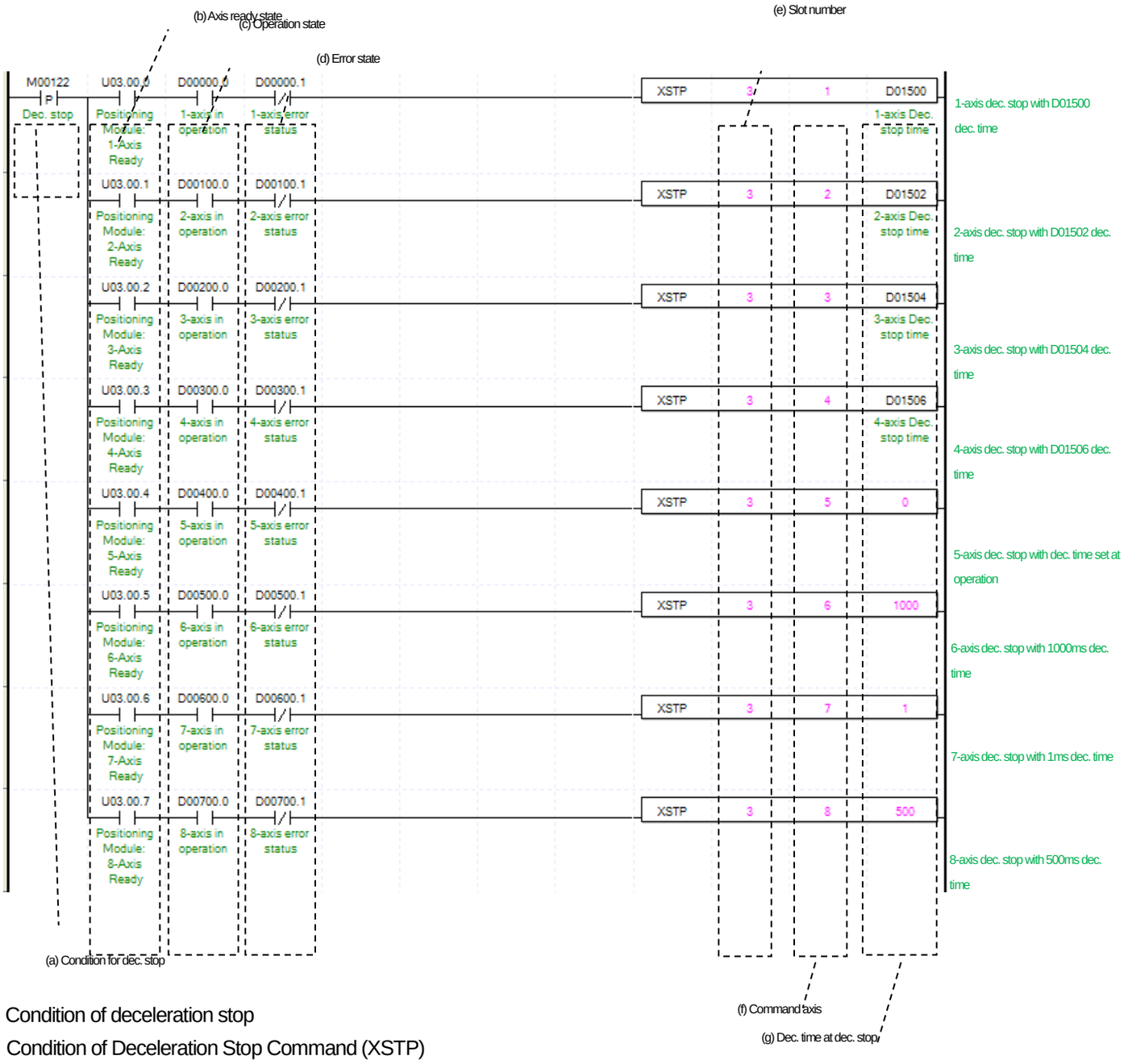
Setting for Block Numbers of CAM data to operate CAM operation. Setting to 9 CAM blocks, the CAM data for each block would be downloaded to module written from Software Package.

(j) Main axis option

For main axis option specified CAM operational command (XCAMO), the subordinate axis sets the main axis’s offset position to start CAM. After executing command, the subordinate axis starts CAM operation after main axis move as much as the position set in the main axis offset.

(k) For more information, refer to of “Chapter 9.4.3 CAM Operation”.

(11) Deceleration stop



(a) Condition of deceleration stop

Condition of Deceleration Stop Command (XSTP)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running.

(d) Error status for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant

axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

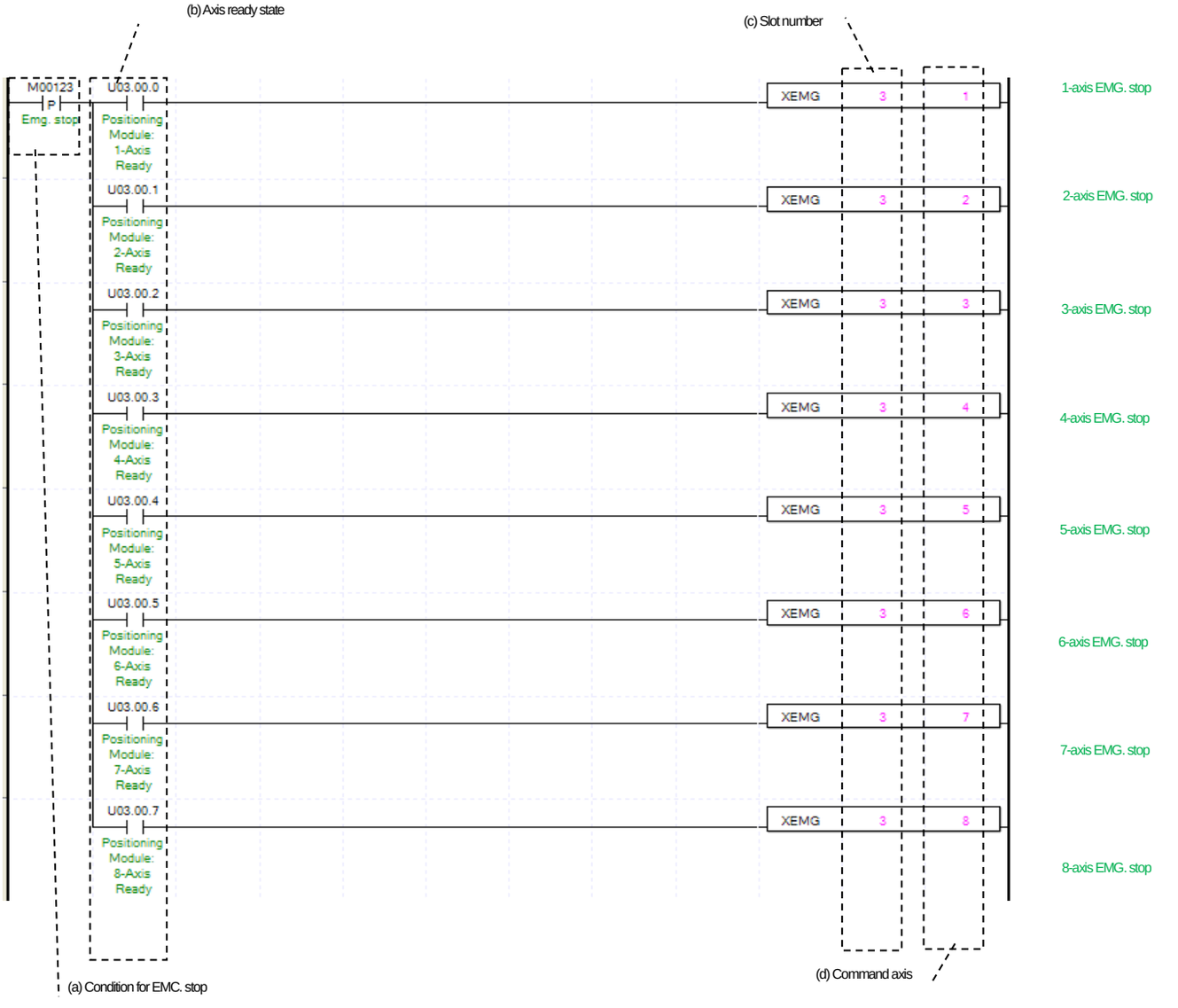
(f) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command deceleration stop” item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(g) Deceleration time of deceleration stop

Setting a deceleration time of Deceleration Stop operation. Unit of Deceleration Stop is [ms]. Since this time refers deceleration time from the speed limit, there might be little difference between Deceleration Stop set time and actual stop time. The range of deceleration time is“0~2,147,483,674”. “1~2,147,483,674 means deceleration time set as 1ms ~ 2,147483674ms. If it set as 0' it will be operated with set deceleration value. Addition, It use to stop speed synchronous operation or CAM operation while speed and CAM operation. During this time Deceleration Time is meaningless, CAM Operation Is just canceled. For more information, refer to (2) deceleration stop of “Chapter 9.2.19 Positioning stop”.

(12) Emergency Stop



(a) Condition of emergency stop

Condition of Emergency Stop Command (XEMG)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) The mounting position of positioning module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

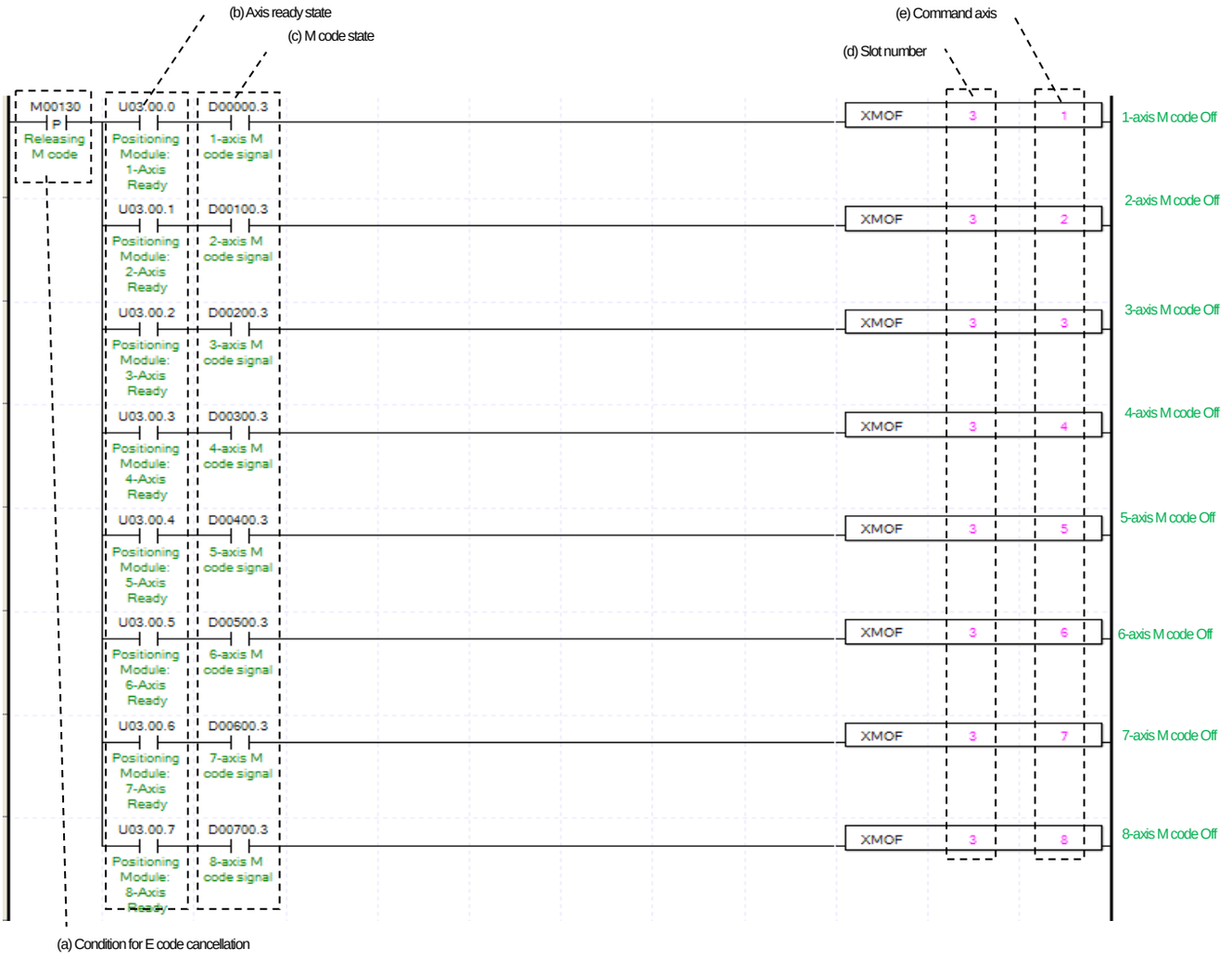
(d) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command deceleration stop” item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(e) Emergency stop is operating by each axis. Once emergency stop command executes, the error 481 would be occurred. With the set value for deceleration time, it will be decelerated and stop the operation.

(f) For more information, refer to (4) emergency stop of “Chapter 9.2.19 Positioning stop”.

(13) M code off



(a) Condition of M code off

Condition of M code Cancellation (XMOF). Once M code cancellation command executed, number of M code would be change to” 0' and signal of M code to Off.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) M code status for each axis

"In case that an example program of "8.1.2 Read Current Status" is applied, this is M code signal for each axis. If an M code occurred on the related axis, it becomes 'on'. M code cancellation command can only be valid once M code are generated. The condition for execution is operation possible when it is On.

(D) Positioning module mounting position

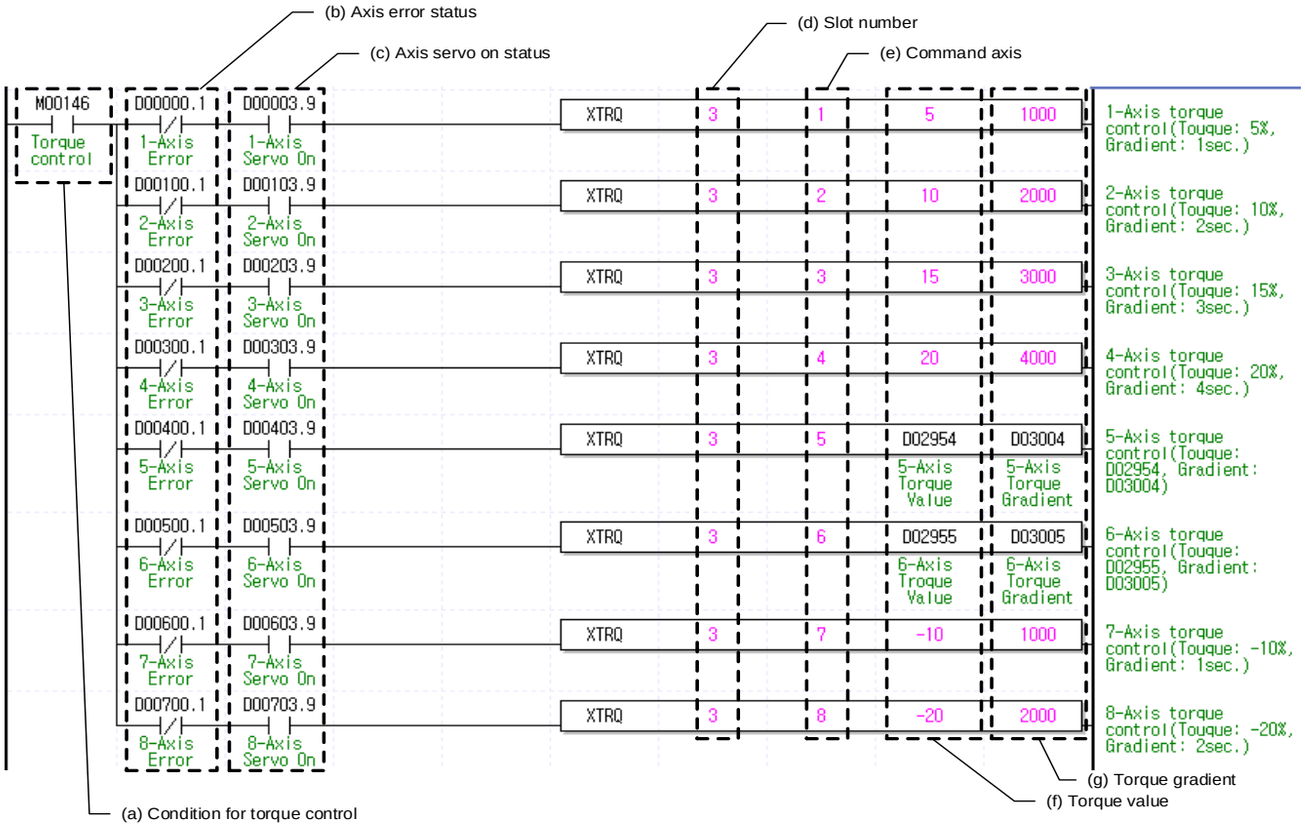
In the example above, the positioning module set to be mounted in slot 3 of base 0.

(e) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the "axis to command M code off command (XCAM)" item of the command, it can set 1 to 8 meaning axis1 to axis8.

(f) For more information, refer to "Chapter 9.6.2 M code".

(14) Torque Control



(a) Condition of torque control

Condition of torque control command (XTRQ) when executing command, the axis executes torque control with the set torque values and torque slope.

(b) Error state for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(c) Servo on signal for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. Torque control operation command cannot be executed when axis is not servo on, hence the condition is set CAM execute when it is servo on. If you execute torque control command while axis is not servo on status, error 743 would be appeared.

(d) The mounting location of Positioning Module.
In the example above, the positioning module set to be mounted in slot 3 of base 0.

(e) Axis to give commands

You can set an axis to execute torque control command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command torque control command “item of the command, it can set 1 to 8 meaning axis1 to axis8.

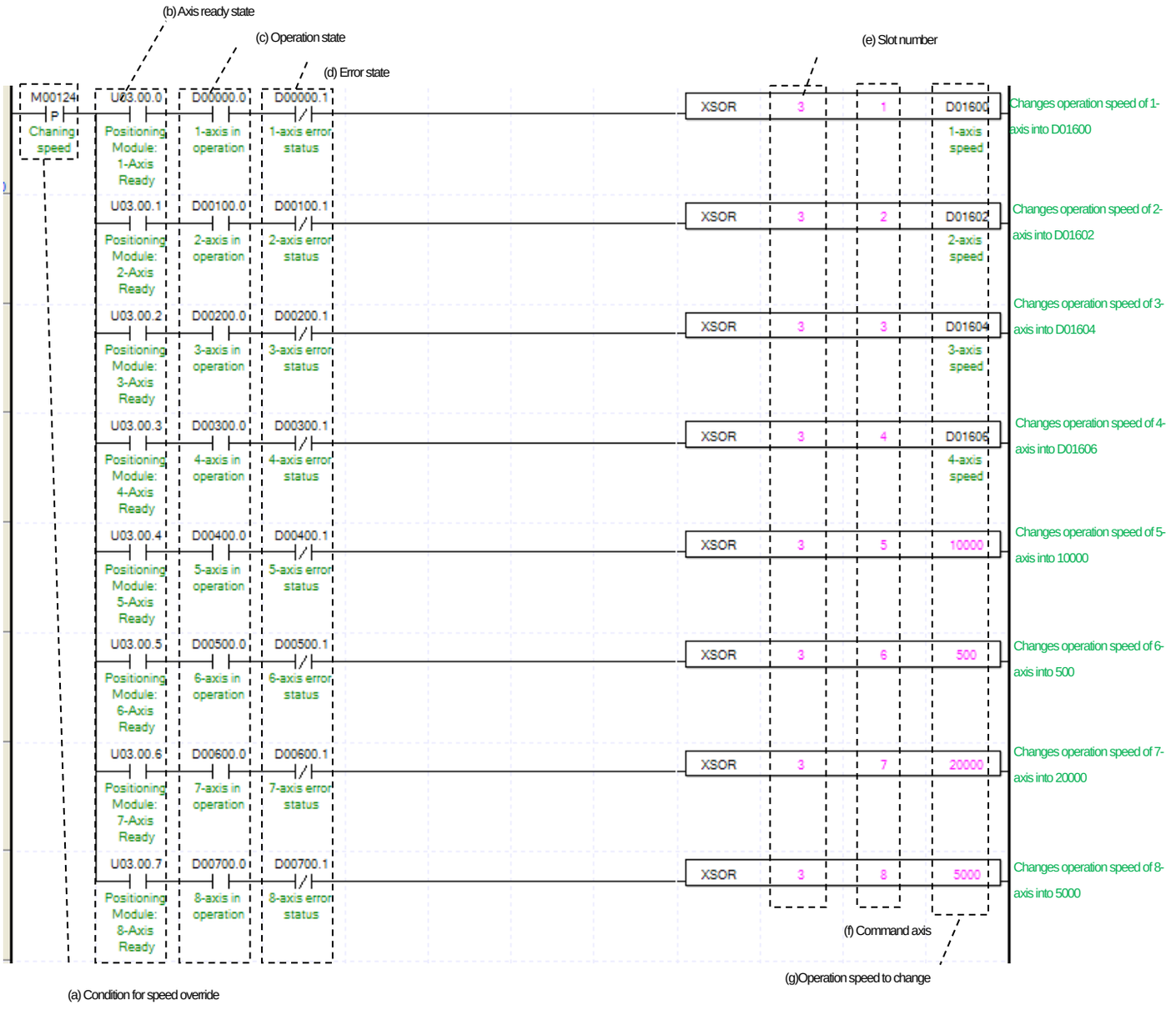
(f) After executing the torque control command, set the torque values to operate torque control. The range of torque values is -32768 ~ 32767%.

(g) Set the slope to the target torque in hours. The inclination range is 0~ 65535ms.

(h) For more information about operation of the torque control command, refers to “9.2.21 Torque control”.

8.1.7 Operation Setting Change while Operating

(1) Speed override



(a) Condition of Speed Override

Condition of Speed Override Command (XSOR)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state by axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Speed Override while it is running, the error 371 would be appeared.

(d) Error state for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error

takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(f) Axis of command execution

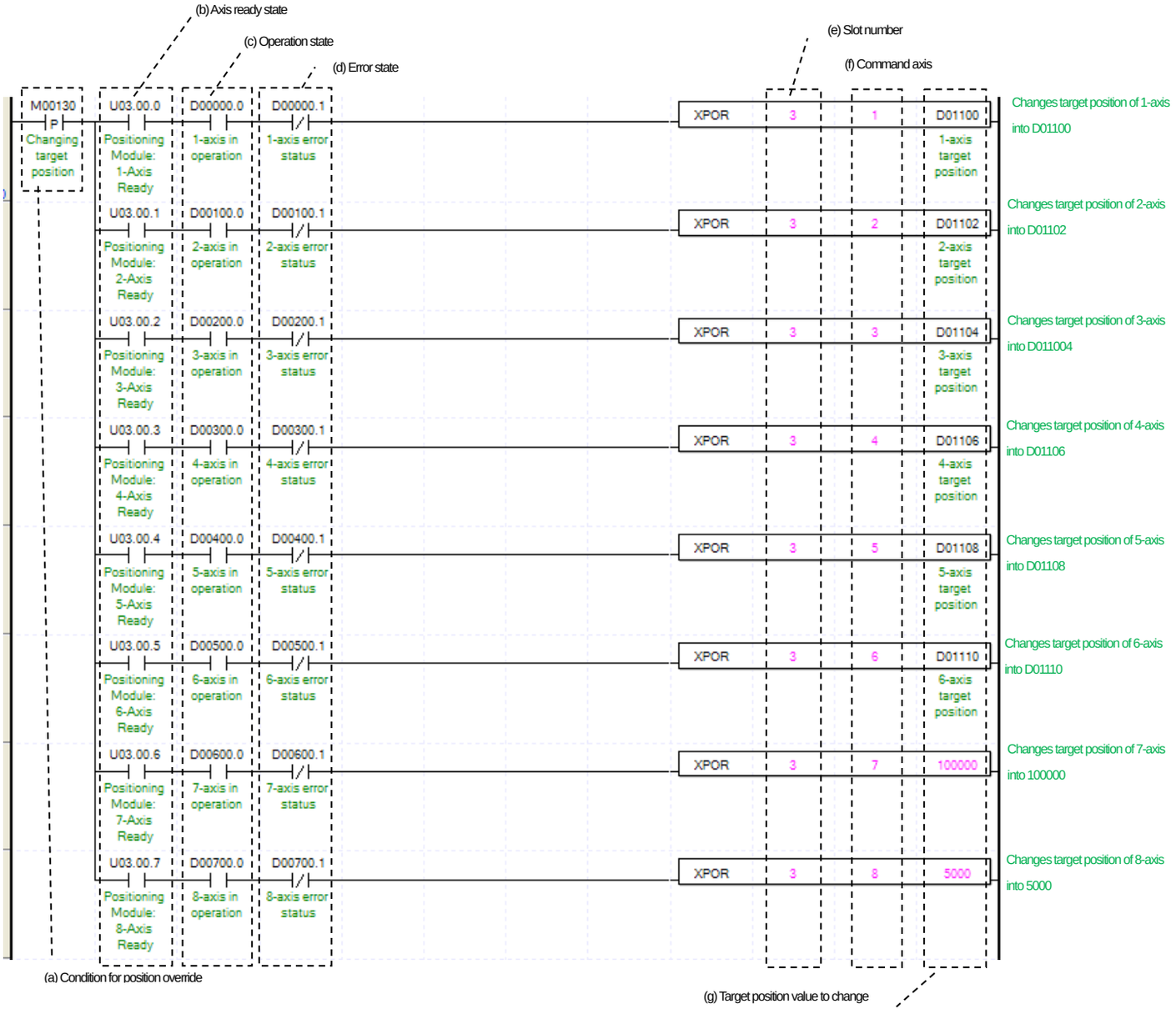
You can set an axis for Speed Override command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command speed override command “item of the command, it can set 1 to 8 meaning axis1 to axis8.

(g) Value Change for Operation speed

Setting Value Change for Operation speed. According to Speed Override from common parameters “it is a signal of "%" or "Speed Value“%” depends on setting of category. Also, when the speed override of common parameter set as speed value, it means “unit/time” or “rpm” depends on speed command unit from basic parameters. If a changing operation speed value is '%' then the unit would be [$X10^{-2}$%]. If it is 'rpm' then the unit would be [$X10^{-1}$rpm].

(h) For more information, refer to “Chapter 9.5.5 speed override”.

(2) Position override



(a) Condition of Position Override
Condition of Position Override Command (XPOR)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state by axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Position Override while it is running, the error 361 would be appeared.

(d) Error state for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(f) Axis of command execution

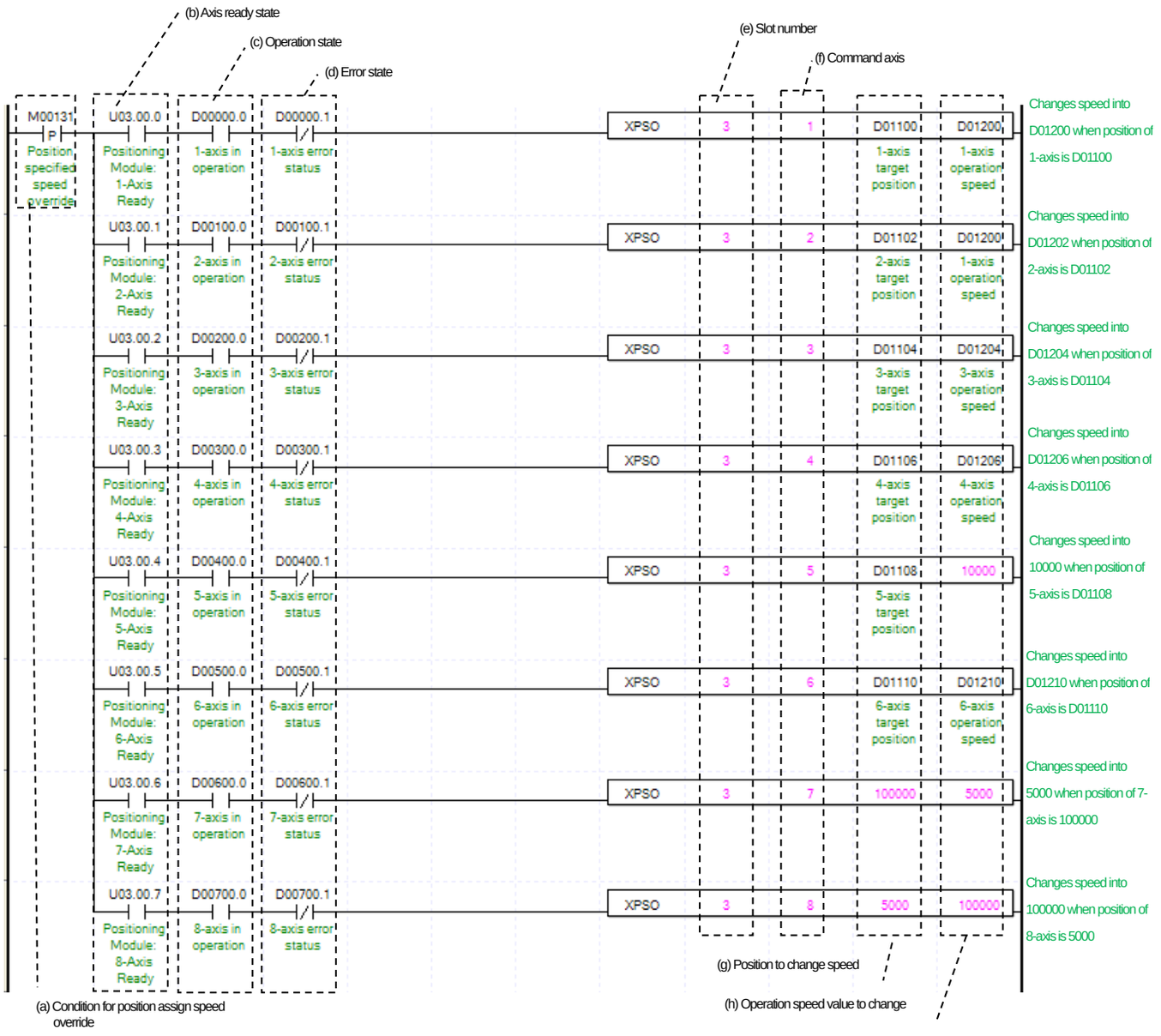
You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command position override command” item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(g) Target position value to change

Setting Value Change for Goal Position Value. The unit of this value depends on 'Unit' category. Once Position Override commands are executed, the goal position of executed axis will be changed to set goal position.

(h) For more information, refer to “Chapter 9.5.4 position override”.

(3) Position specified speed override



(a) Condition of Position Assign Speed Override

Condition of Position Assign Speed Override Command (XPSO)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state by axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Position Assign Speed Override while it is running, the error 381 would be appeared.

(d) Error state for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(f) Axis of command execution

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command position specified speed override command” item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(g) Position of Speed Change Execution

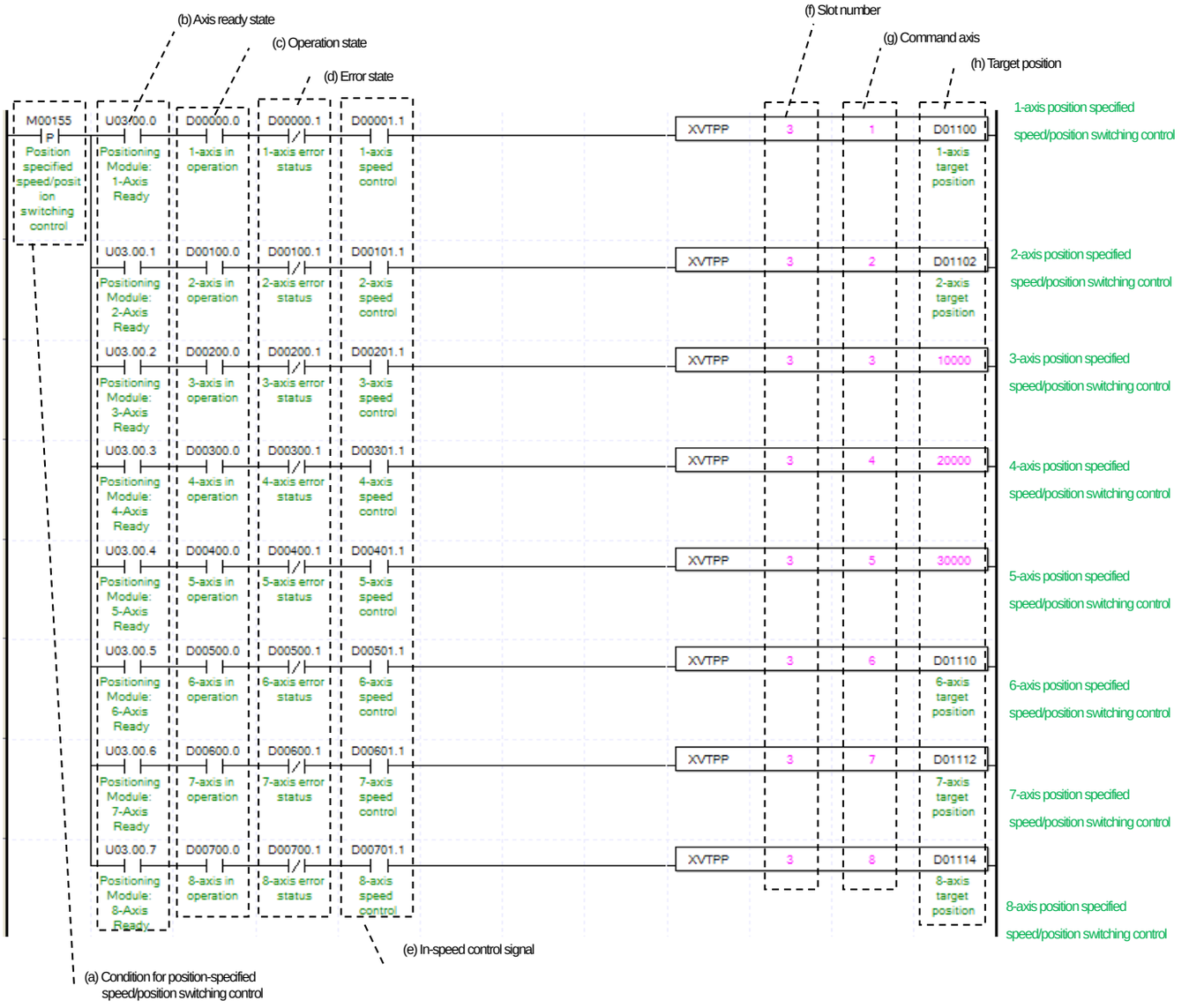
Setting position of Speed Change. Once the actual position located at set position with speed override command running, the speed change commands are executed. The unit depend on the setting value in “unit “in the basic parameter.

(h) Value Change for Operation speed

Setting Value Change for Operation speed. According to Speed Override from common parameters “it is a signal of "%" or "Speed Value“%” depends on setting of category. Also, when the speed override of common parameter set as speed value, it means “unit/time” or “rpm” depends on speed command unit from basic parameters. If a changing operation speed value is '%' then the unit would be [$X10^{-2}$%]. If it is 'rpm' then the unit would be [$X10^{-1}$rpm].

(i) For more information, refer to “Chapter 9.5.6 Positioning specified speed override”.

(4) Speed/position switching control



(a) Condition of Speed/Position Switching Control
Condition of Speed/Position Switching Control Command (XVTP)

(b) Ready status for each axis
When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state by axis
“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Speed/Position Switching Control while it is running, the error 301 would be appeared.

(d) Error state for each axis
“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

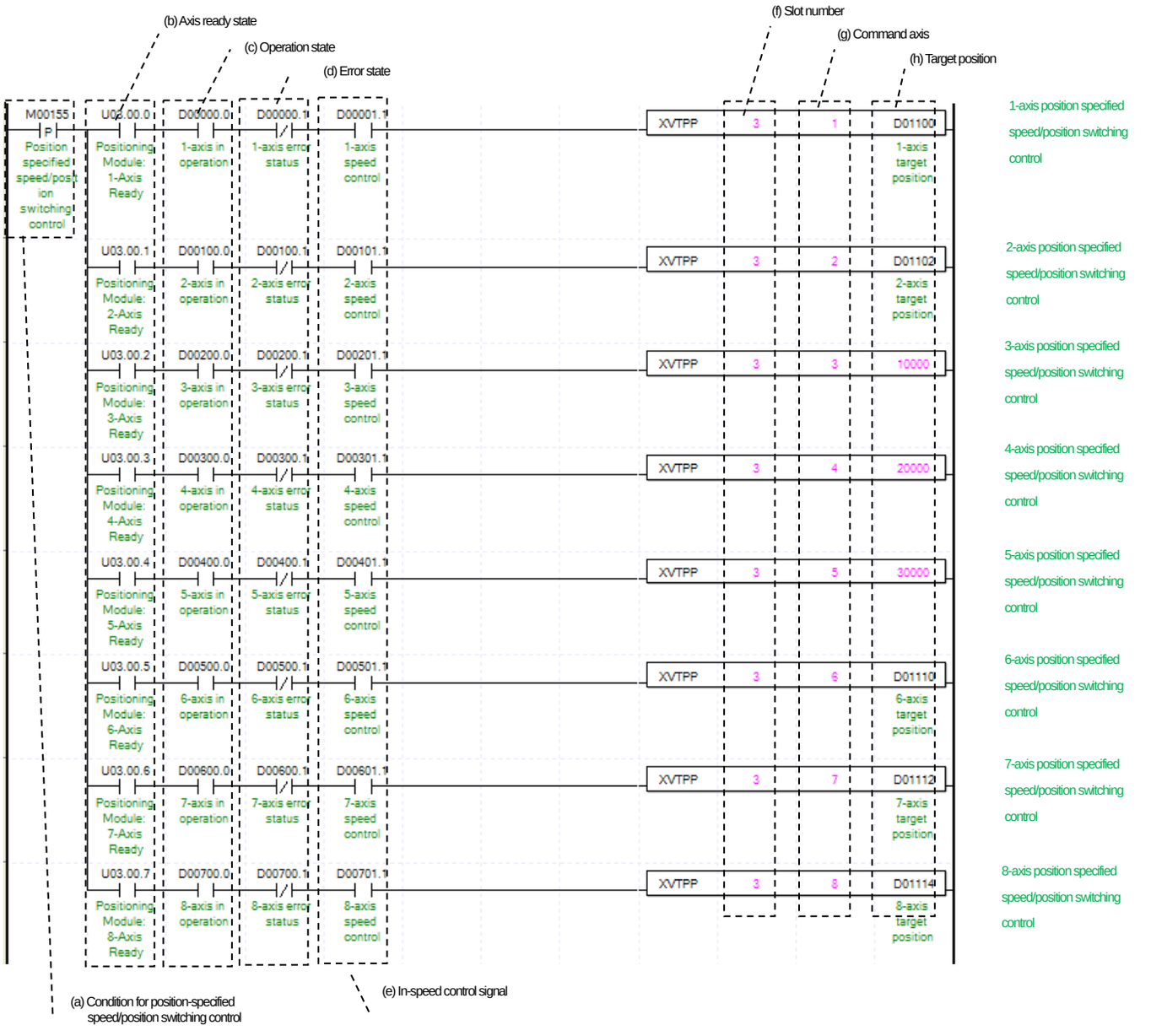
(e) Speed Control Signal for each axis
“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'controlling its speed“. If the relevant axis is running under speed control, it becomes 'On'. Speed/Position Switching Control Setting can only be configured while it is running. If you execute Speed/Position Switching Control while it is not running, the error 302 would be appeared.

(f) The mounting location of Positioning Module.
In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis of command execution
You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command speed/position switching control command” item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(h) For more information, refer to “Chapter 9.2.14 Speed/position switching control”.

(5) Position specified speed/position switching control



(a) Condition to execute position specified speed/position switching control

Condition to perform control command (XVTPP) for position-specified speed/position switching

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state by axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Speed/Position Switching Control while it is running, the error 301 would be appeared.

(d) Error state for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Speed Control Signal for each axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'controlling its speed". If the relevant axis is running under speed control, it becomes 'On'. A condition has been set to make the control command for position specified speed/position switching control valid only when the relevant axis is in a speed control status. If the control command is carried out when the relevant axis is not in a speed control status, No.302 Error will take place.

(f) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis of command execution

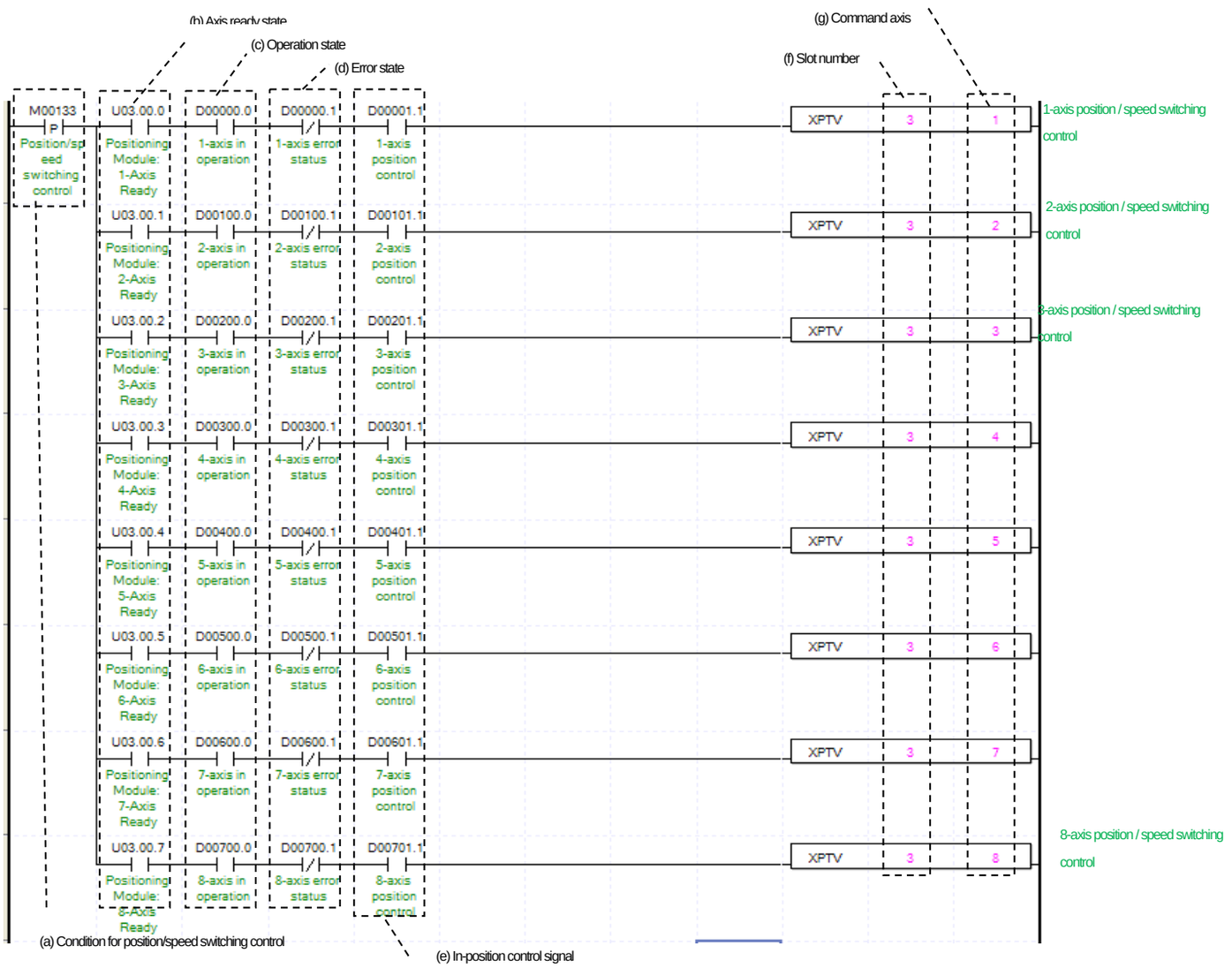
Decide an axis that will execute the control command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the "axis to command position specified speed/position switching control command" item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(h) Target position

After the control command for position specified speed/position control switching is executed, convert from speed control to position control and moves by transfer amount. The position values set at the time of speed control start is ignored.

(i) For details on the operation of position specified speed/position switching control, refer to "9.2.15 Position specified speed/position switching control".

(6) Position/speed switching control



(a) Condition of Position/ Speed Switching Control
Condition of Position/ Speed Switching Control Command (XPTV)

(b) Ready status for each axis
When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state by axis
“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Position/ Speed Switching Control while it is running, the error 311 would be appeared.

(d) Error state for each axis
“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

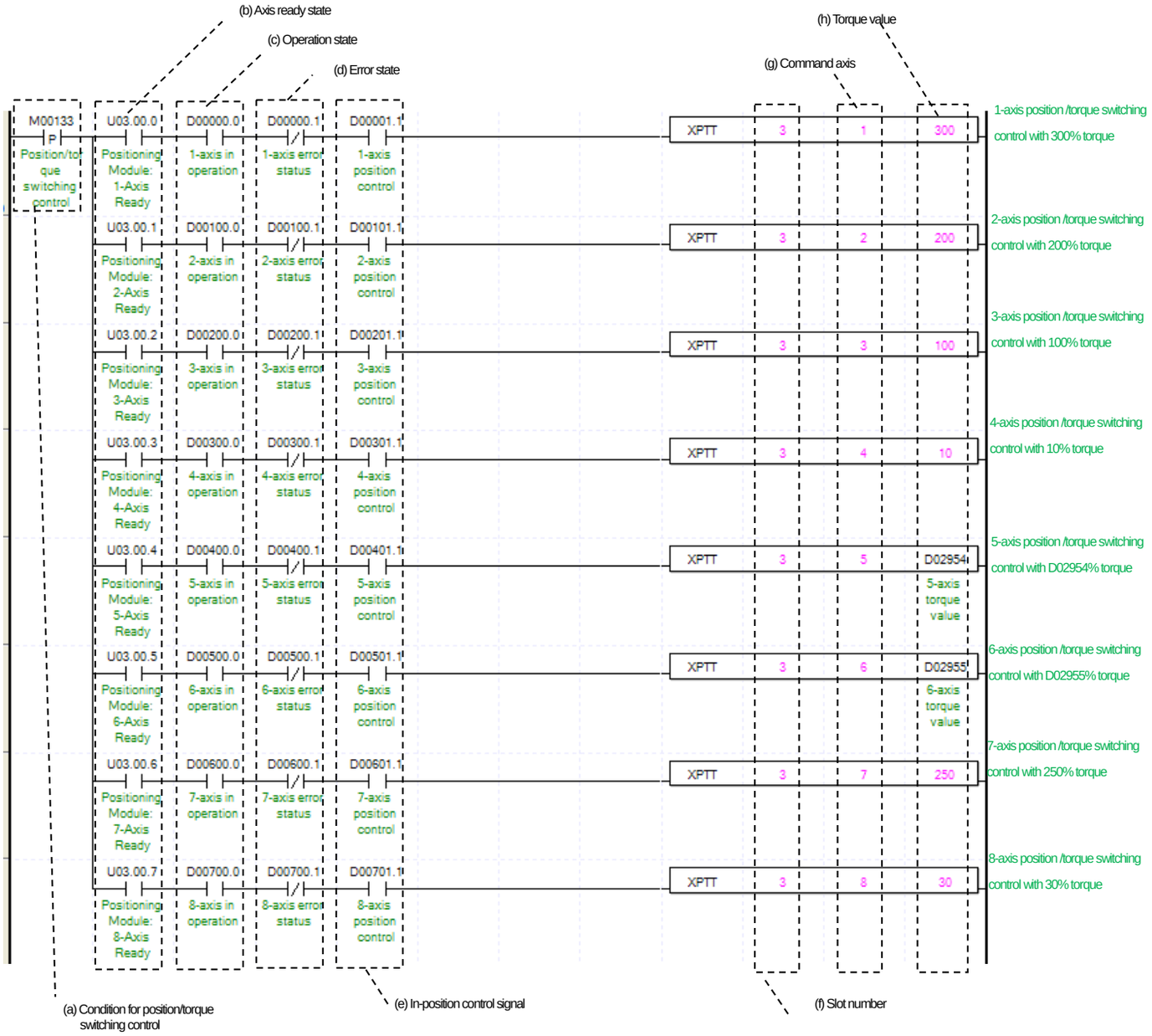
(e) Signal from Position Control by each Axis
“In case that an example program of '8.1.2 Read Current State' is applied, it is in position control signal for each axis. If the relevant axis is operating under position control, it becomes 'On'. Position/ Speed Switching Control Setting can only be configured while it is running. In the example program, it is executed only when the related axis is in the position control. If you execute Position/Speed Switching Control while it is not running, the error 317 would be appeared.

(f) The mounting location of Positioning Module.
In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis of command execution
You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command position/speed switching control command” item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(h) For more information, refer to “Chapter 9.2.16 Position/speed switching control”.

(7) Position/torque switching control



(a) Condition of position/ torque switching control

Condition of position/ torque switching control command (XPTT) when executing command, the axis executes torque control with the current operating speed and set torque values.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state by axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. The position/torque switching control is valid command only when the axis is operating, the condition is set to execute only when the axis is operating. If you execute position/torque switching control while it is running, the error 561 would be appeared.

(d) Error state for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error

takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Signal from Position Control by each Axis

"In case that an example program of '8.1.2 Read Current State' is applied, it is in position control signal for each axis. If the relevant axis is operating under position control, it becomes 'On'. Position/torque switching control command can only be configured while it is running. In the example program, it is executed only when the related axis is in the position control. If you execute position/torque switching control command while it is not running, the error 317 would be appeared.

(f) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

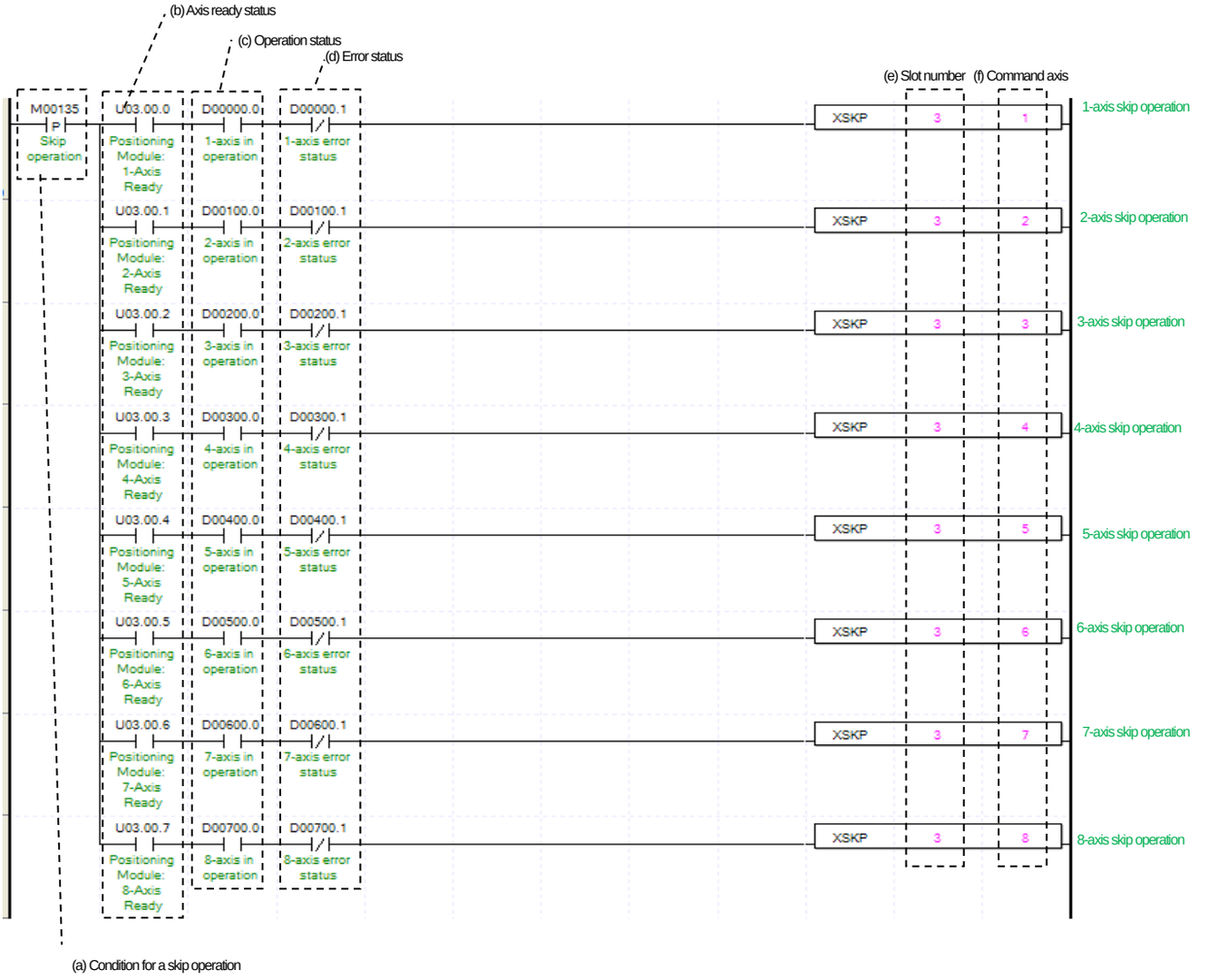
(g) Axis of command execution

You can set an axis to execute position/torque switching control command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the "axis to position/torque switching control command "item of the command, it can set 1 to 8 meaning axis1 to axis8.

(h) After executing the position/torque switching control command, set the torque values to operate torque control. The range of torque values is -300 ~ 300%.

(i) For more information, refer to "Chapter 9.2.17 Position/speed switching control".

(8) Skip operation



(a) Condition of Skip Operation

Condition of skip operation command (XSKP). When skip operation is executed, the axis stops the current operating step and operates the next step.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state by axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Skip Operation while it is running, the error 331 would be appeared.

(d) Error state for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) The mounting location of Positioning Module.

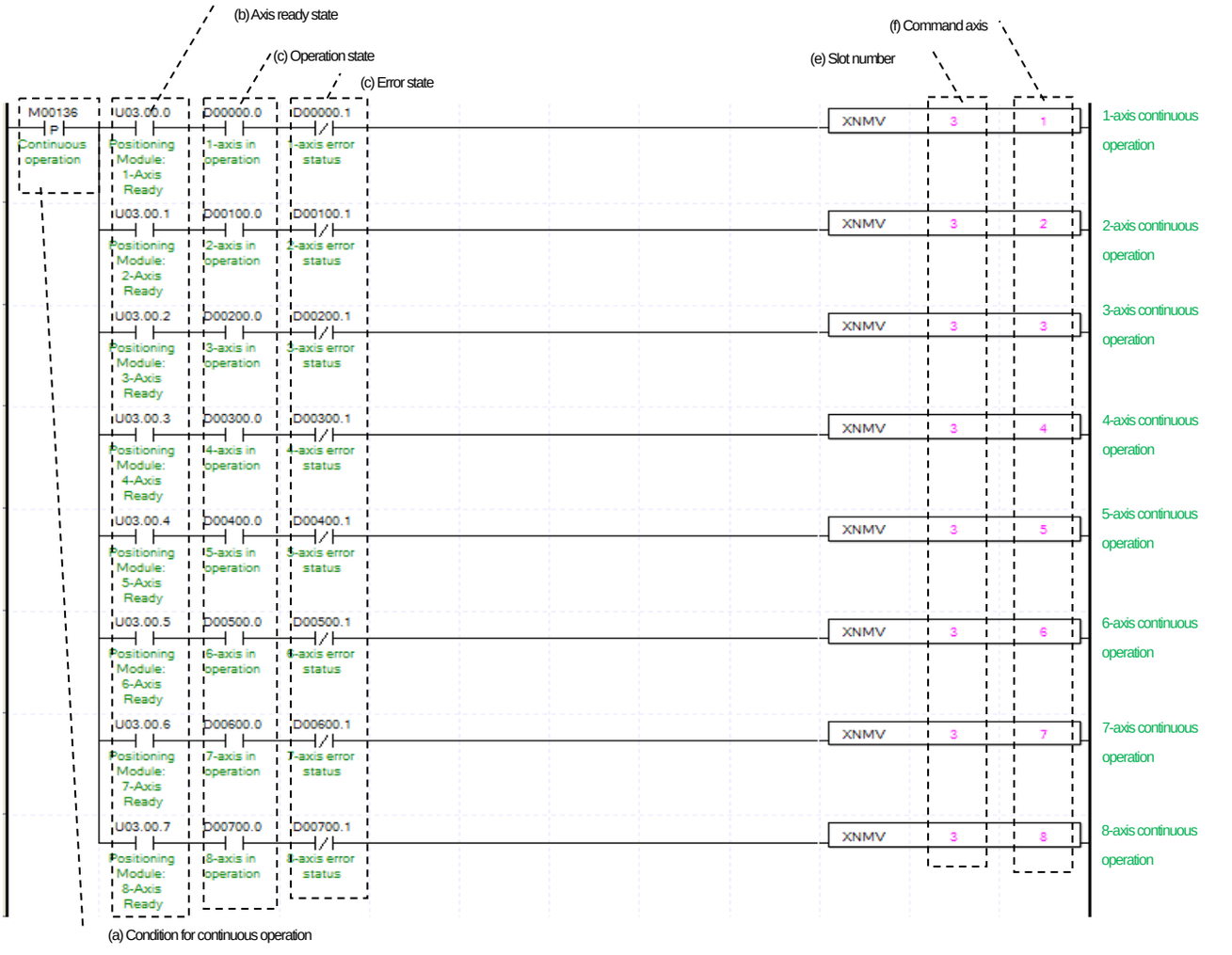
In the example above, the positioning module set to be mounted in slot 3 of base 0.

(f) Axis of command execution

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command skip operation command” item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(g) For more information, refer to “Chapter 9.5.3 Skip operation”.

(9) Continuous operation



(a) Condition of Continuous Operation

Condition of Continuous Operation Command (XNMV). Once Continuous Operation is executed, current operation step and next operation step would be operated continuously.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state by axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Continuous Operation while it is running, the error 391 would be appeared.

(d) Error state for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) The mounting location of Positioning Module.

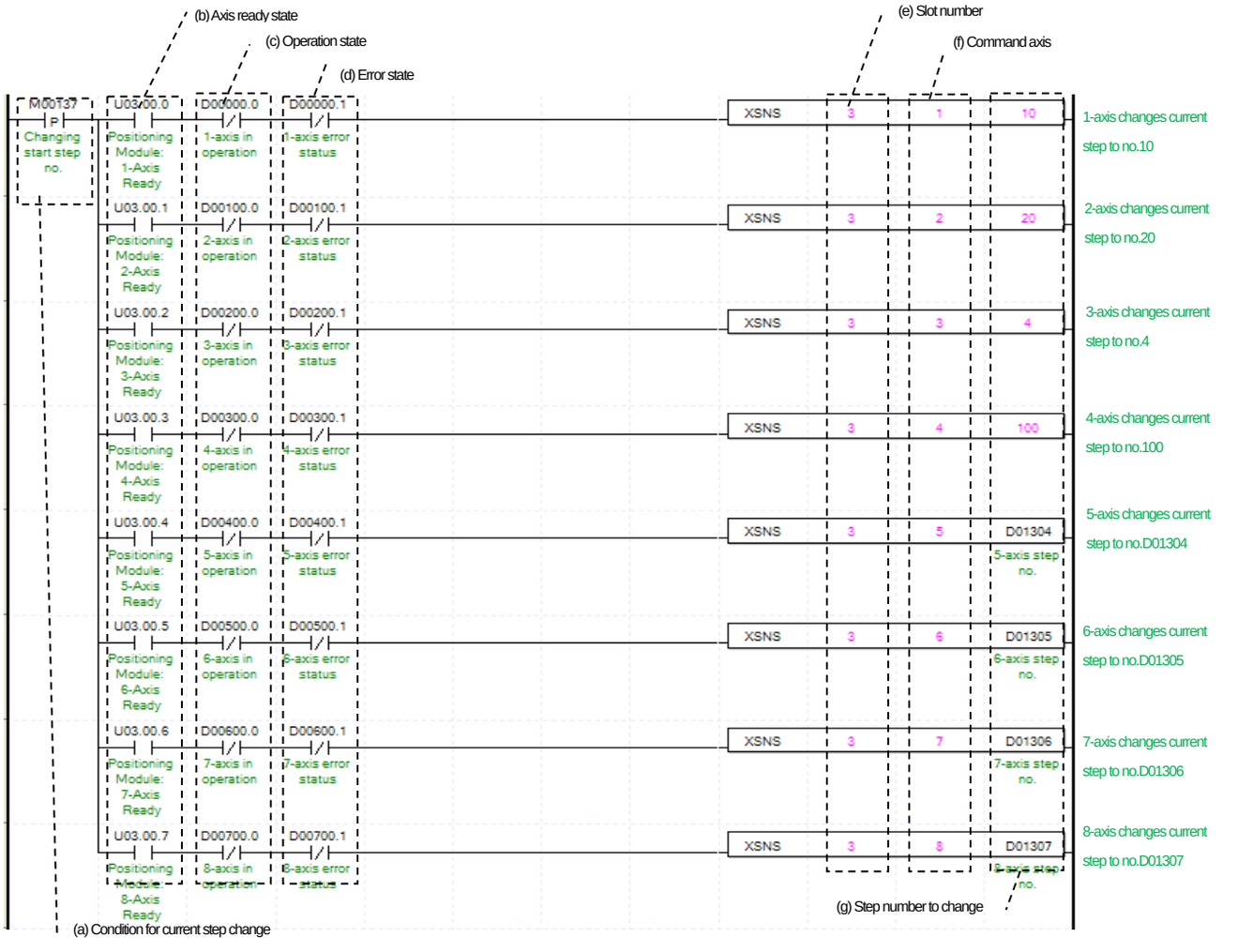
In the example above, the positioning module set to be mounted in slot 3 of base 0.

(f) Axis of command execution

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command continuous operation command” item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(g) For more information, refer to “Chapter 9.5.2 continuous operation”.

(10) Current Step Change (Start Step Number Change)



(a) Condition of start step number change
Condition of Current Step Change Command (XSNS). Once Current Step Change is executed, current operation step will move set step.

(b) Ready status for each axis
When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis
“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Current Step Change while it is running, the error 441 would be appeared.

(d) Error status for each axis
“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

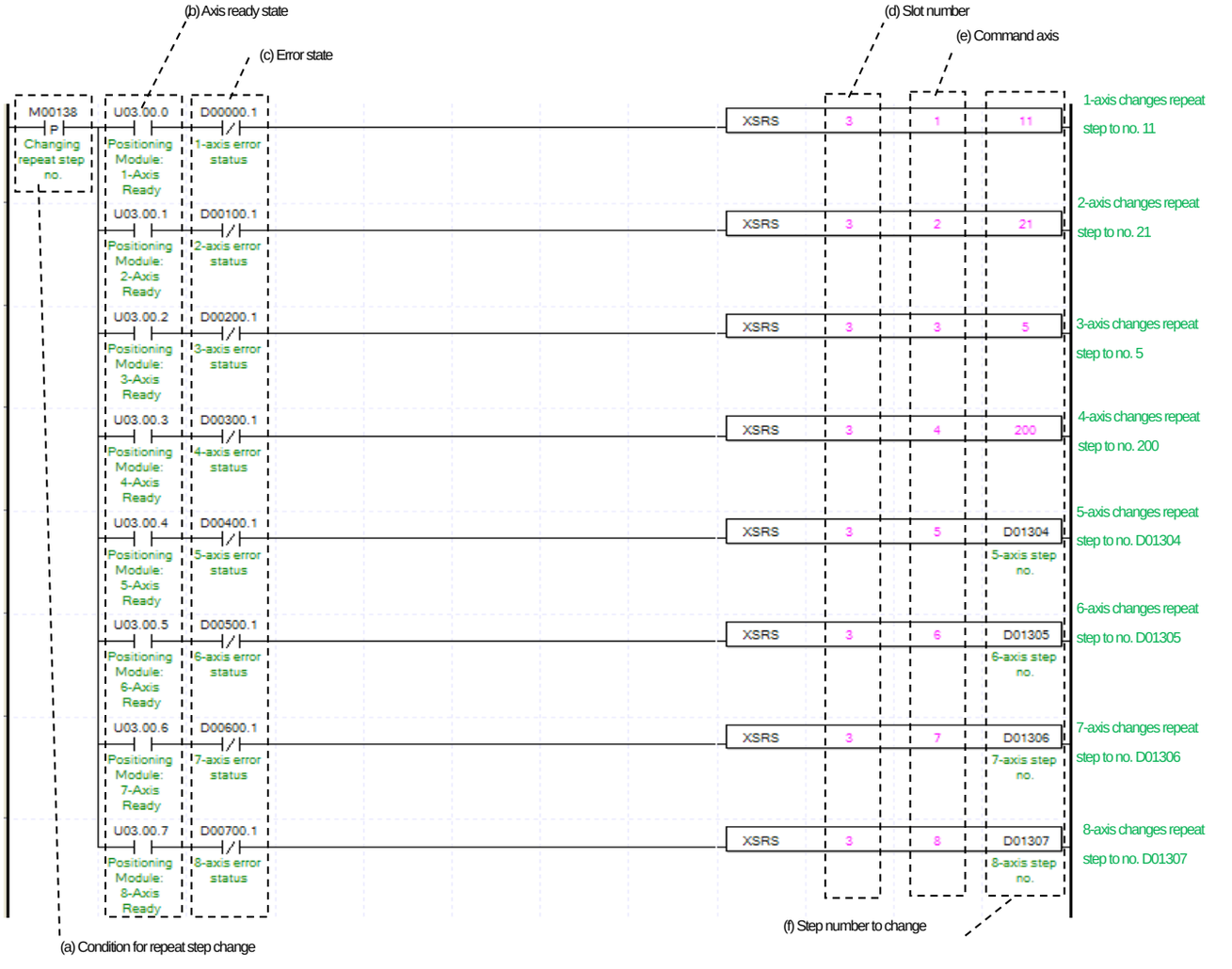
(e) Positioning module mounting position
In the example above, the positioning module set to be mounted in slot 3 of base 0.

(f) Axis to give a command
You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command start step number change command” item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(g) Step number to change
Set change step number by Current Step Change. 400 step operation data for each axis can be set. Therefore, the range of step number setting of Current Step Change is 1~400.

(h) For more information, refer to “Chapter 9.5.9 Start step number change”.

(11) Repeat Step No. Change



(a) Condition of Repeat Step No. Change

Condition of Repeat Step No. Change Command (XSRS). Once Repeat Step No. Change is executed, current operation step will move set step. When the operation method of operation data in repeat step completed step operation set by repetition, it means step set by next step.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Error state for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(d) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(e) Axis of command execution

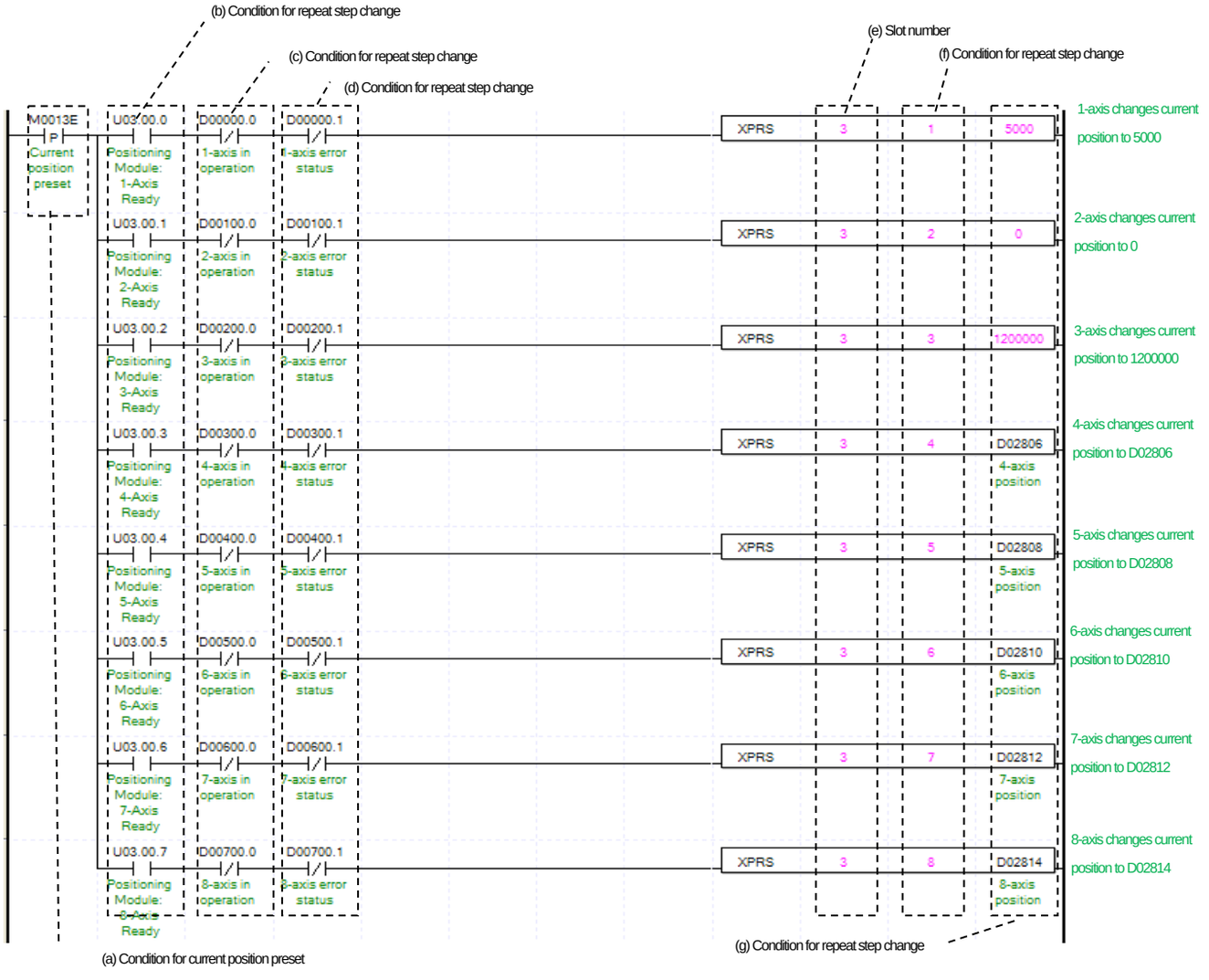
You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command repeat step No. change command “item of the command, it can set 1 to 8 meaning axis1 to axis8.

(f) Change Step Number

Set the step number to be changed as repeat step. 400 step operation data for each axis can be set. Therefore, the setting range of repeat step numbers change command is 1~400.

(g) For more information, refer to “Chapter 9.5.10 Repeat step number change”.

(12) Current position preset



(a) Condition of Current Position Preset

Condition of Current Position Preset Command (XSNS). Once Current Position Preset is executed, current operation step will move to set step. If the origin has not set yet, the origin would be set to origin decided.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state by axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Current Position Preset while it is running, the error 451 would be appeared.

(d) Error state for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(f) Axis of command execution

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8

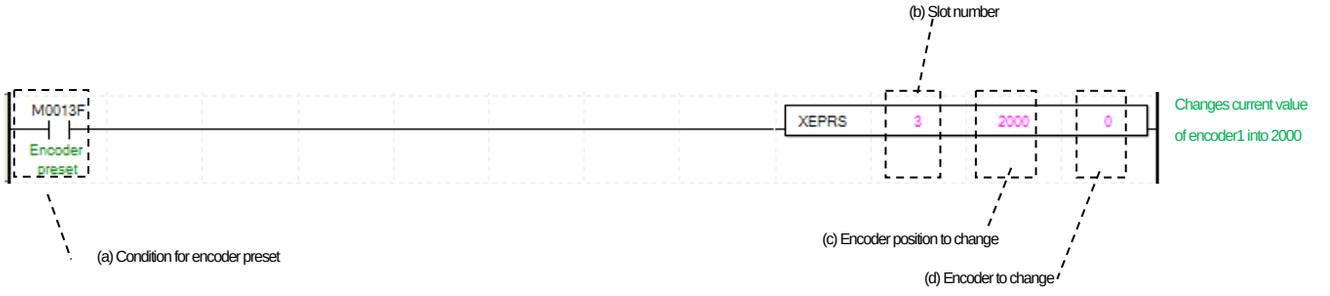
axes. In the “axis to command current position preset command “item of the command, it can set 1 to 8 meaning axis1 to axis8.

(g) Change Current Position

Set change current position by Current Position Preset. The unit is the value from 'unit' of basic parameter.

(h) For more information, refer to “Chapter 9.5.7 Current position preset”.

(13) Encoder preset



(a) Condition of Encoder Preset

Condition of Encoder Preset Command (XEPRS). Once an encoder preset is executed, the current value of encoder is changed to the set values.

(b) The mounting location of Positioning Module.

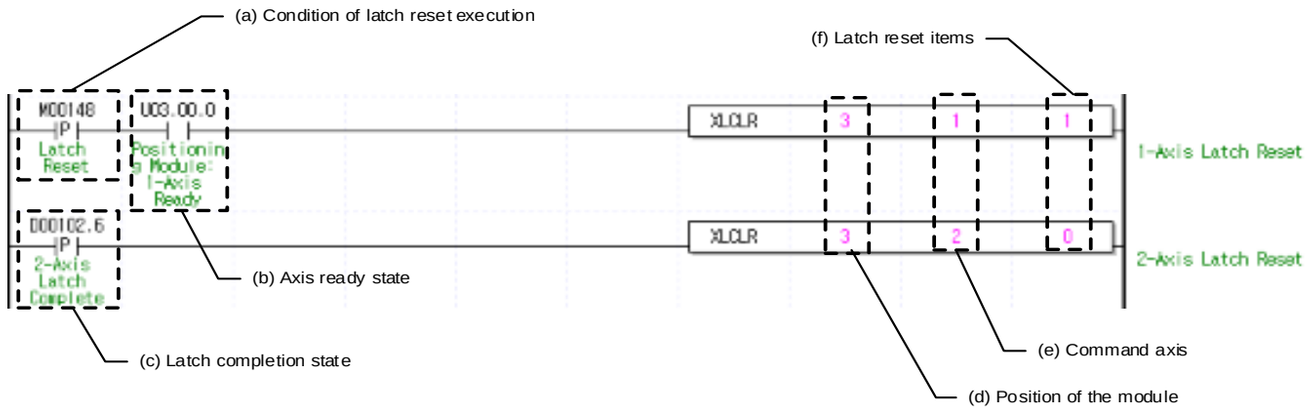
In the example above, the positioning module set to be mounted in slot 3 of base 0.

(c) Changing Encoder Position

Set for Changing Encoder Position

(d) For more information, refer to “Chapter 9.5.8 Encoder preset”.

(14) Latch reset



(a) Condition of error history reset

This is the condition for executing the latch position reset command (XLCLR). In the case of axis1, the latch reset command is executed when M00148 (latch reset) is turned on after axis 1 is connected to the network.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on. In the example program, the ready state (Uxx.00.0) for each axis was used, so the latch reset command is executed when M00148 (latch reset) is turned on after axis is connected to the network.

(c) Latch completion status

When applying example program of “8.1.2 Current status read”, the axis 2 is in a “latch completion status”. When the external latch command signal of related axis is input and latch is completed, it turn on. In case of axis 2, the latch reset item is executed when D00102.6 (axis 2 latch completion) is turned on. To read latch data whenever the external latch signal of the axis is input and the latch is completed, executed the latch position data read command and then program by setting the latch completion status as the input conditions of the latch reset command.

(D) Positioning module mounting position

For give a command, set the position where the positioning module to command is mounted. In the example, the positioning module is mounted in slot3.

(e) Axis to give a command

You can set the axis to execute latch reset command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to latch reset command (XLCLR)” item of the command, it can set 1 to 8 meaning axis1 to axis8.

(f) Latch reset item

The following items are reset according to the specified latch reset item.

0: Latch completion status reset

1: Latch position data and latch completion status reset

In the example program, when axis 1 executes latch reset command, latch position data and latch completion status are reset. And when axis 2 executes the latch reset command, the latch completion status is reset.

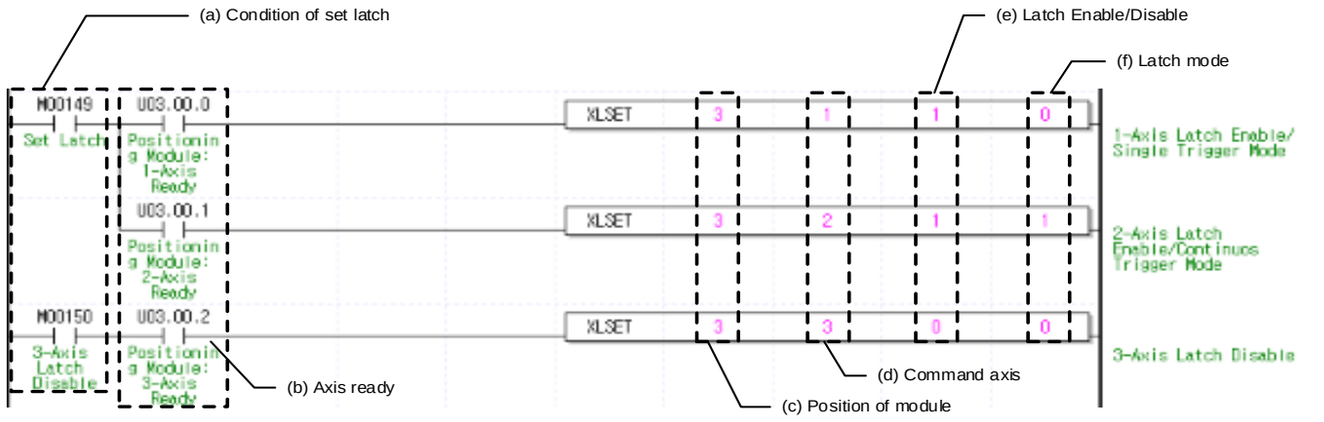
Notes

The XBF-PN04B/XBF-PN08B module supports 2 type latch mode. When setting single trigger among latch mode, after the first touch probe 1 signal is input and latched, in order to the latch function to operate a the next touch probe 1 signal, the latch reset command must always be used to enable latch.

In other words, in the latch reset single trigger of XBF-PN04B/XBF-PN08B, the latch reset command function to active the next latch trigger after the touch probe 1 signal is input and the latch position is saved.

(Even if the latch setting commands is set to allow latch and then executed again, it operates the same way.)

(15) Latch setting



(a) Condition of latch setting execution

This is the condition to execute the latch setting command (XLSET). After an axis is connected to the network, when M00149(latch setting)is turned in, latch setting command is executed on axis1, axis2 ,when M00150(axis 3 latch disable) is turned on, latch setting command is executed on axis 3.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on. In the example program, the ready state (Uxx.00.0) for each axis was used, so the latch setting command is executed when the condition of latch setting execution is turned on after axis is connected to the module.

(c) The mounting position of positioning module.

For give a command, set the position where the positioning module to command is mounted. In the example, the positioning module is mounted in slot3.

(d) Axis to give a command

You can set an axis to execute latch setting command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to latch setting command (XLSET)” item of the command, it can set 1 to 8 meaning axis1 to axis8.

(e) Latch enable/disable item

The operation according to the specified latch allow/prohibit items is as follows.

0: Disable

1: Enable

In the example program, axis 1, axis 2 latch are enable and axis 3 latch is disable.

(f) Latch mode item

The operation according to the specified latch mode is as follows.

0: Single trigger (after the latch is allowed, the current position is latched on the first touch probe 1 signal input.)

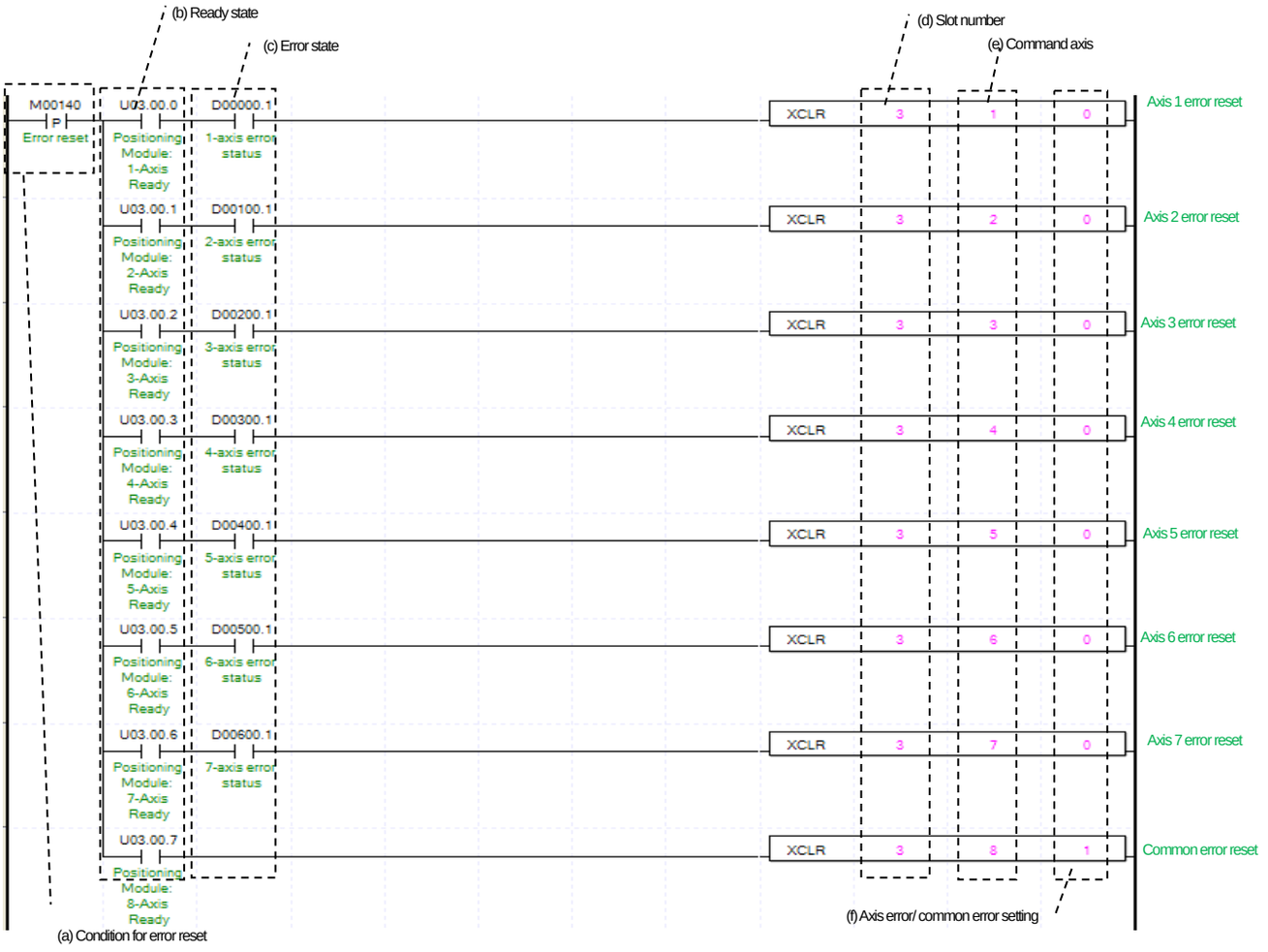
1: Continuous trigger (latch is allowed, the current position is latched for each touch probe 1 signal.)

In the example program, axis 1 is set to latch single trigger mode when the latch setting command is executed and axis 2 is set to continuous trigger mode.

(g) The Latch setting command is dedicated command for XBF-PN04B/ XBF-PN08B.

8.1.8 Error

(1) Error reset



(a) Condition of error history reset

Condition of Error Reset Command (XCLR). Once error reset is executed, it erases common errors of module and axis error for each axis.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Error status for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(d) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

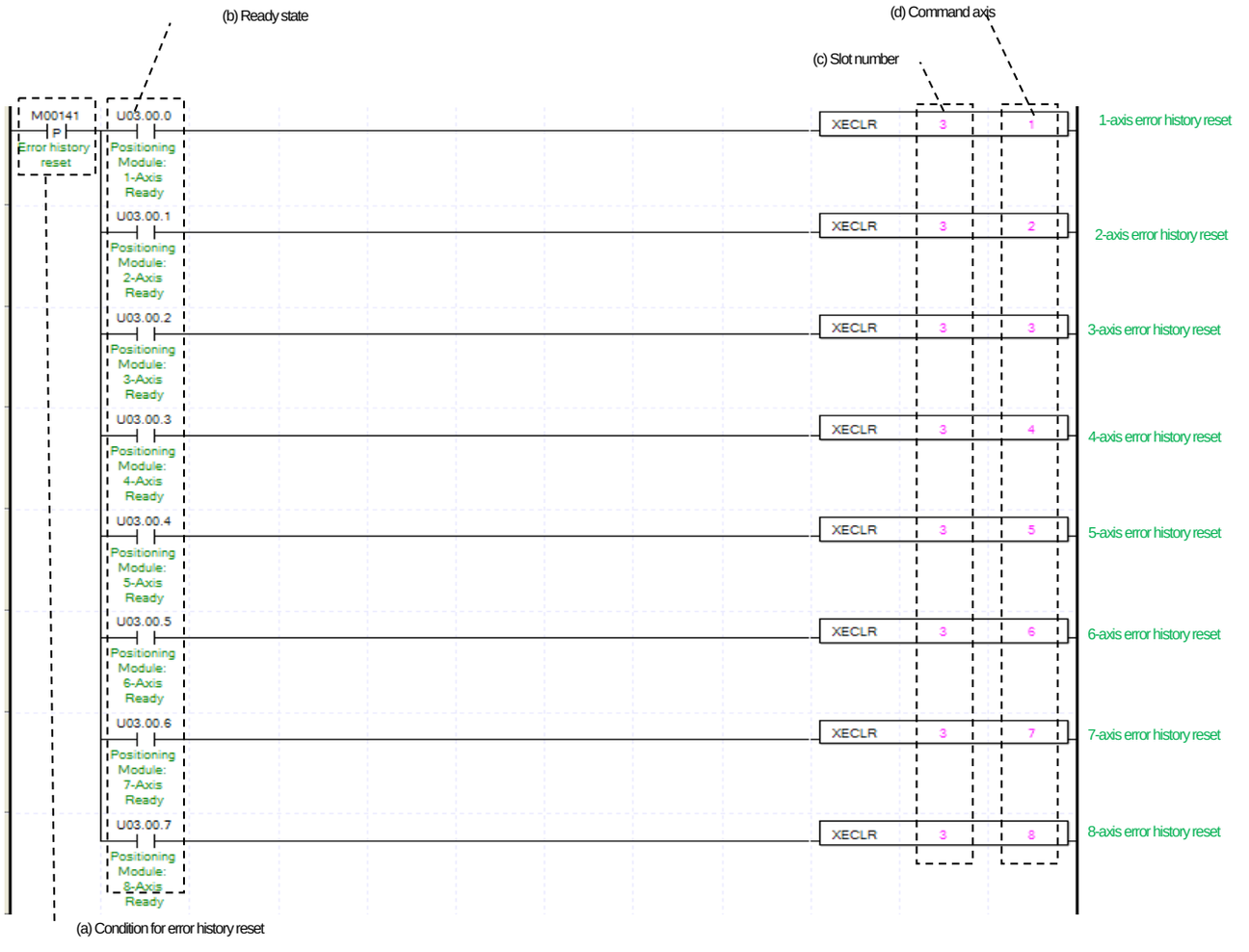
(e) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command error reset command (XCLR)” item of the command, it can set 1 to 8 meaning axis1 to axis8.

(f) Error setting of error/common by axis

According to error type, if set by “0”, errors for each axis that occurred during command execution will be erased. If set by “1”errors that commonly occur in the module, such as common parameters or communication errors, will be erased.’

(2) Error history reset



(a) Condition of error history reset

Condition of error history reset command (XECLR). Once Error Reset is executed, it erases history of generated errors of module. Each axis has up to 10 error histories. It will be saved to MRAM memory, remain still even there is no power.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

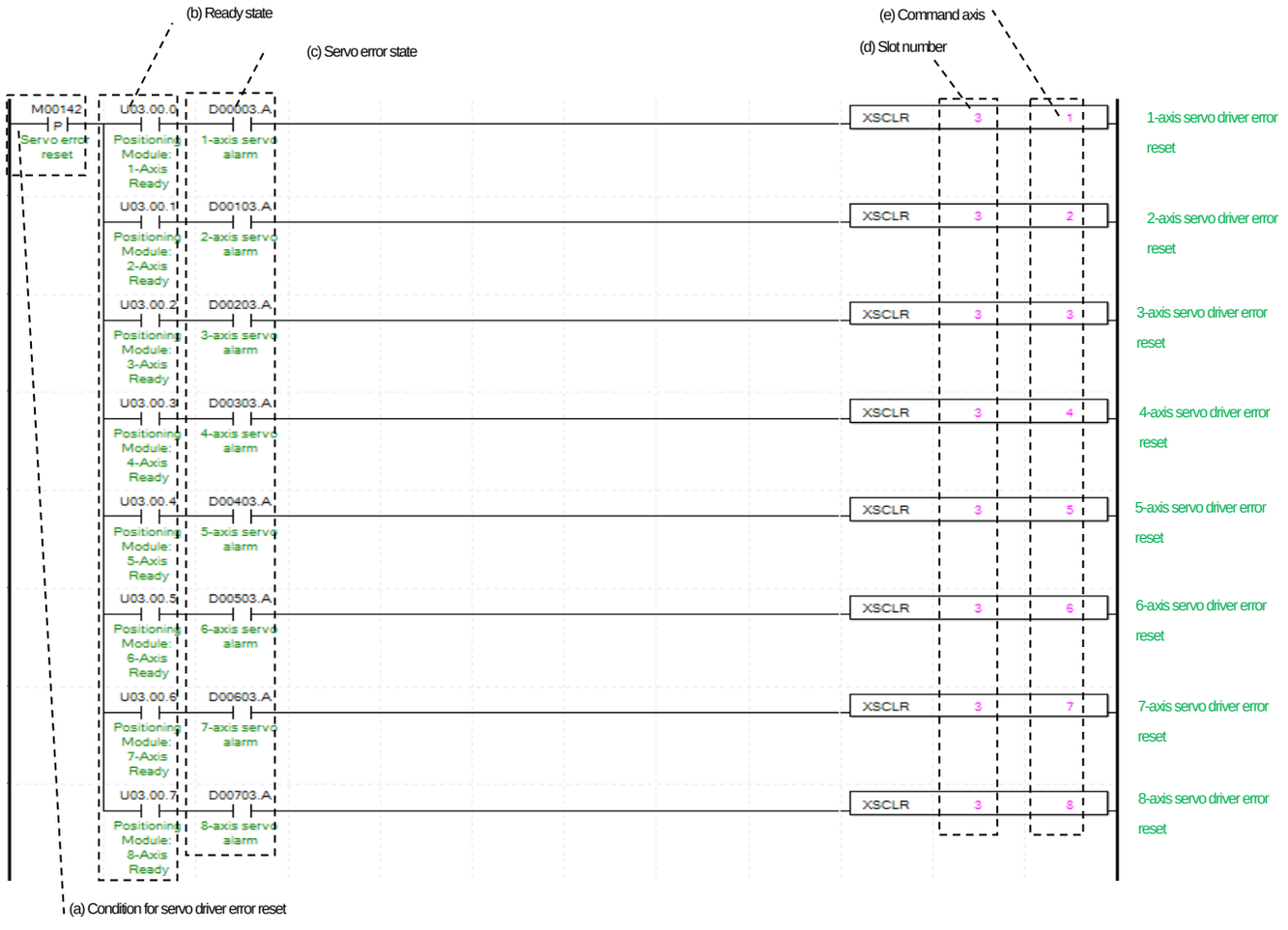
(c) The mounting position of positioning module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(d) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command error history reset command (XECLR)” item of the command, it can set 1 to 8 meaning axis1 to axis8.

(3) Servo drive error reset



(a) Condition of servo drive error reset

Condition of servo drive error reset command (XSCLR). When a servo drive error reset is executed, error occurring in the servo drive connected to related axis are erased. When servo drive error reset is executed without eliminating the cause of the servo drive error, error may remain in the servo drive.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Servo error status for each axis

“In case that an example program of '8.1.2 Current status read' is applied, it is a servo error status signal of servo drive connected to each axis. It is turned on when error occurs in the servo drive connected to the related axis. Set to execute a command when an error is occurred the related axis connected to servo drive. If you want to operate a system regardless of errors, you can just inactivate the function.

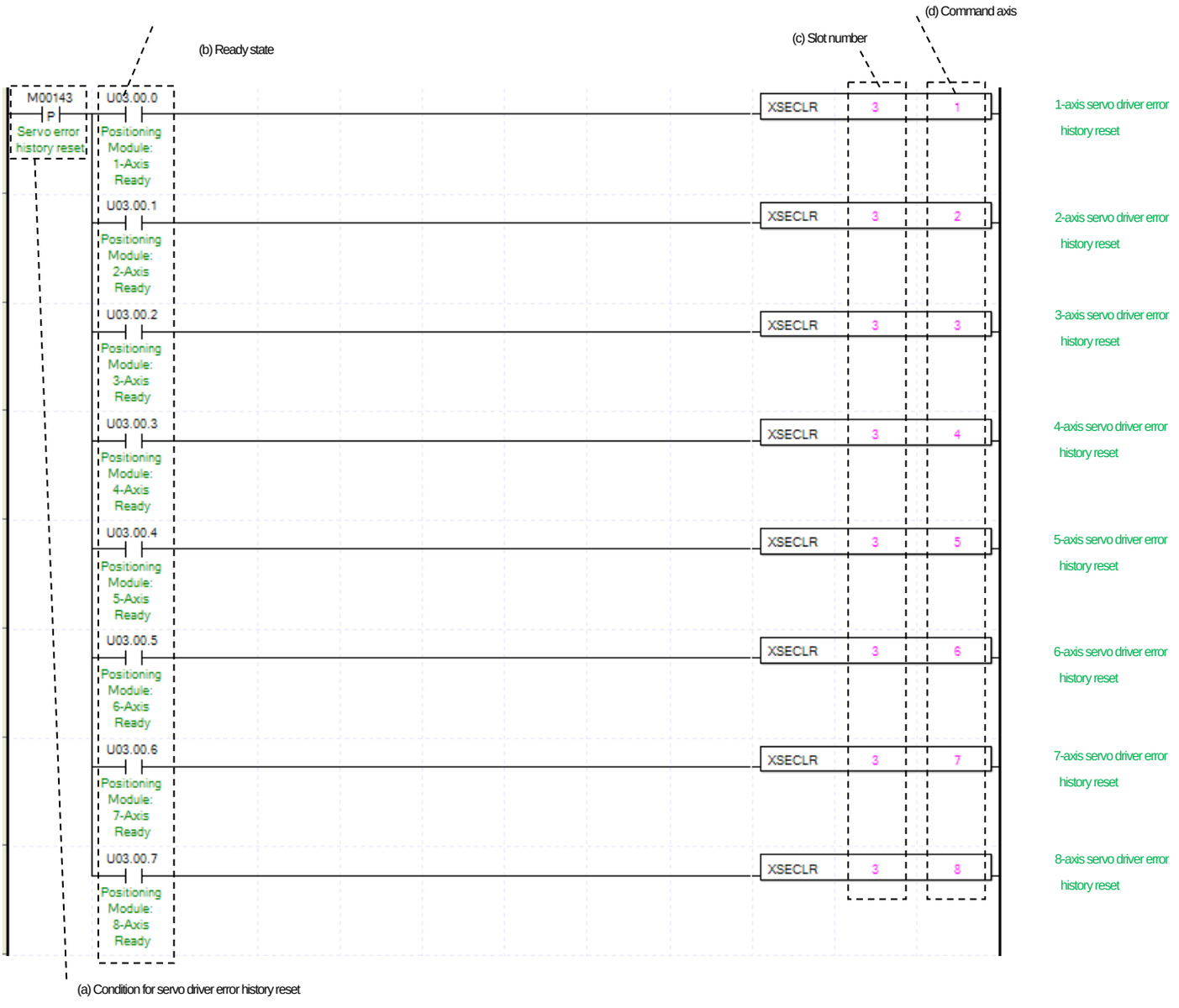
(d) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(e) Axis to give a command

You can set an axis for executing servo drive error reset command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command servo drive error reset command (XSCLR)” item of the command, it can set 1 to 8 meaning servo drive 1 to 8 connected to axis.

(4) Servo drive error history reset



(a) Condition of servo drive error history reset

Condition of servo drive error history reset command (XSECLR). When a servo drive error history reset is executed, error histories saved in the servo drive connected to related axis are erased. The servo drive stores up to 10 errors histories.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) The mounting location of Positioning Module.

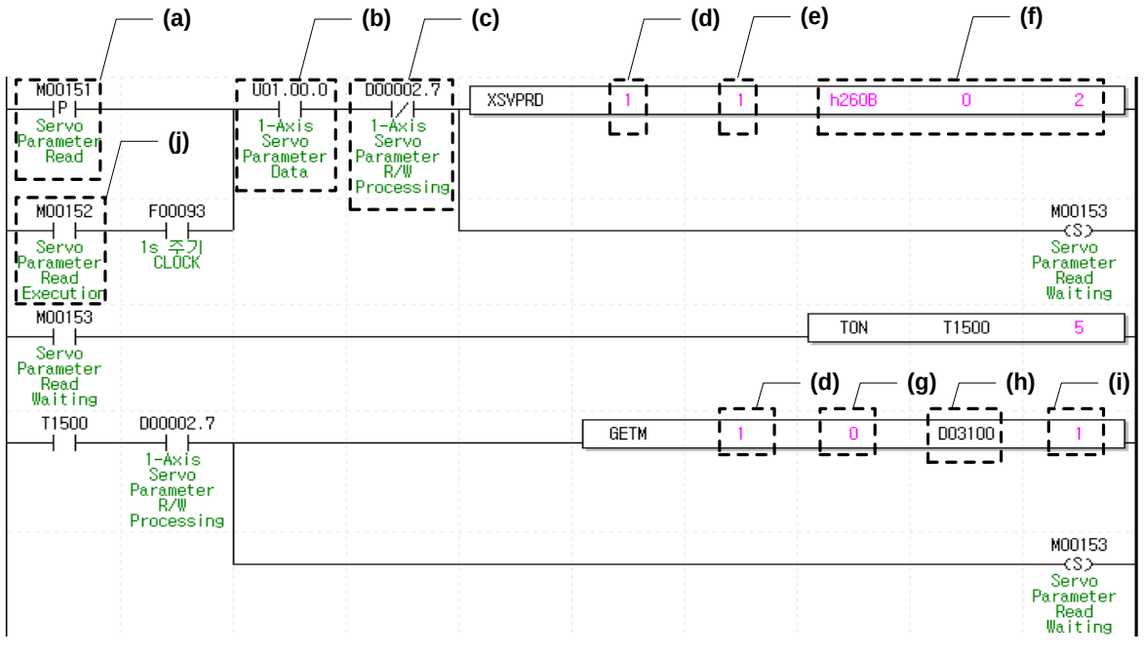
In the example above, the positioning module set to be mounted in slot 3 of base 0.

(d) Axis of command execution

You can set an axis for executing servo drive error history reset command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command servo drive error history reset command (XSECLR)” item of the command, it can set 1 to 8 meaning servo drive 1 to 8 connected to axis.

8.1.9 Servo Drive Parameter (XBF-PN08B)

(1) Servo drive parameter read



(a) Condition of servo drive parameter read

Condition to execute servo drive parameter read command (XSVPRD) when a servo drive parameter read command is executed, read the values of related servo drive parameter Object and save in specified address of the data common area.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Servo drive read/write processing status

It displays whether the servo drive parameter read / write or EEPROM save command is being executed. Set to the command to be executed when the servo drive read/ write is not being processed.

(d) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(e) Axis of command execution

You can set an axis to execute command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command axis item “, it can set 1 to 8 meaning axis1 to axis8.

(f) Servo drive parameter settings

Among the servo drive parameter, specify the index number, Subindex number, size (Byte)) of reading parameter object.

In the example, read the servo drive internal temperature of 2byte size specified as h2610:00.

(g) Data common area address

When the servo parameter read command is executed, the positioning module reads data from the servo drive and stores it in the data common area. To save to device for use in PLC program, use GETM or GETMP command after executing the servo parameter read command. The data common area address specified by the GETM or GETMP command are as follows.

Setting address	Content
0	Axis 1 servo parameter index(lower) / Subindex (Upper)
1	Axis 1 servo parameter data value
2	Axis 2 servo parameter index(lower) / Subindex (Upper)
3	Axis 2 servo parameter data value

Setting address	Content
4	Axis 3 servo parameter index(lower) / Subindex (Upper)
5	Axis 3 servo parameter data value
6	Axis 4 servo parameter index(lower) / Subindex (Upper)
7	Axis 4 servo parameter data value
8	Axis 5 servo parameter index(lower) / Subindex (Upper)
9	Axis 5 servo parameter data value
10	Axis 6 servo parameter index(lower) / Subindex (Upper)
11	Axis 6 servo parameter data value
12	Axis 7 servo parameter index(lower) / Subindex (Upper)
13	Axis 7 servo parameter data value
14	Axis 8 servo parameter index(lower) / Subindex (Upper)
15	Axis 8 servo parameter data value

(h) Common data save device

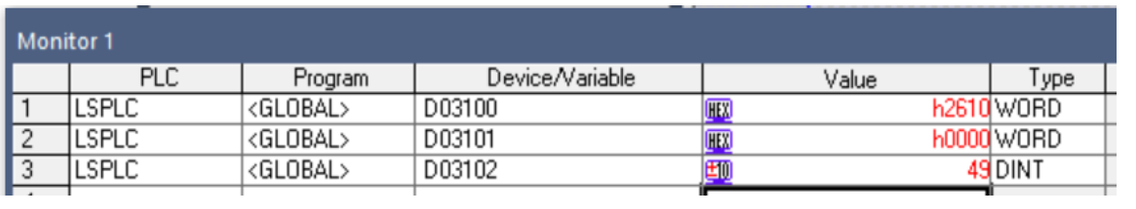
After reading data by GETMP command, specify device leading number to be saved. In the example program, read data of D03100.

(i) Data size

Specifies reading data (DWORD) size from the data common area with the GETMP command. In the example program, reads 2 DWORDs

The above example program, read h2610 (servo drive internal temperature) parameter and save it to D03100 device after servo parameter read command is executed. When the status of servo parameter R/W processing is Off after 5 ms later executing the servo parameter read command (Servo parameter read complete status), save the axis 3 Servo parameter index/Subindex and data values of common area into D03100 and D03102 of the common area in D05000. When the status of servo parameter R/W processing is Off after at least 4ms later executing the servo parameter read command, the GETM (or GETMP) command must be executed. After the data read from the module is updated in the data common area, the reflected value can be read.

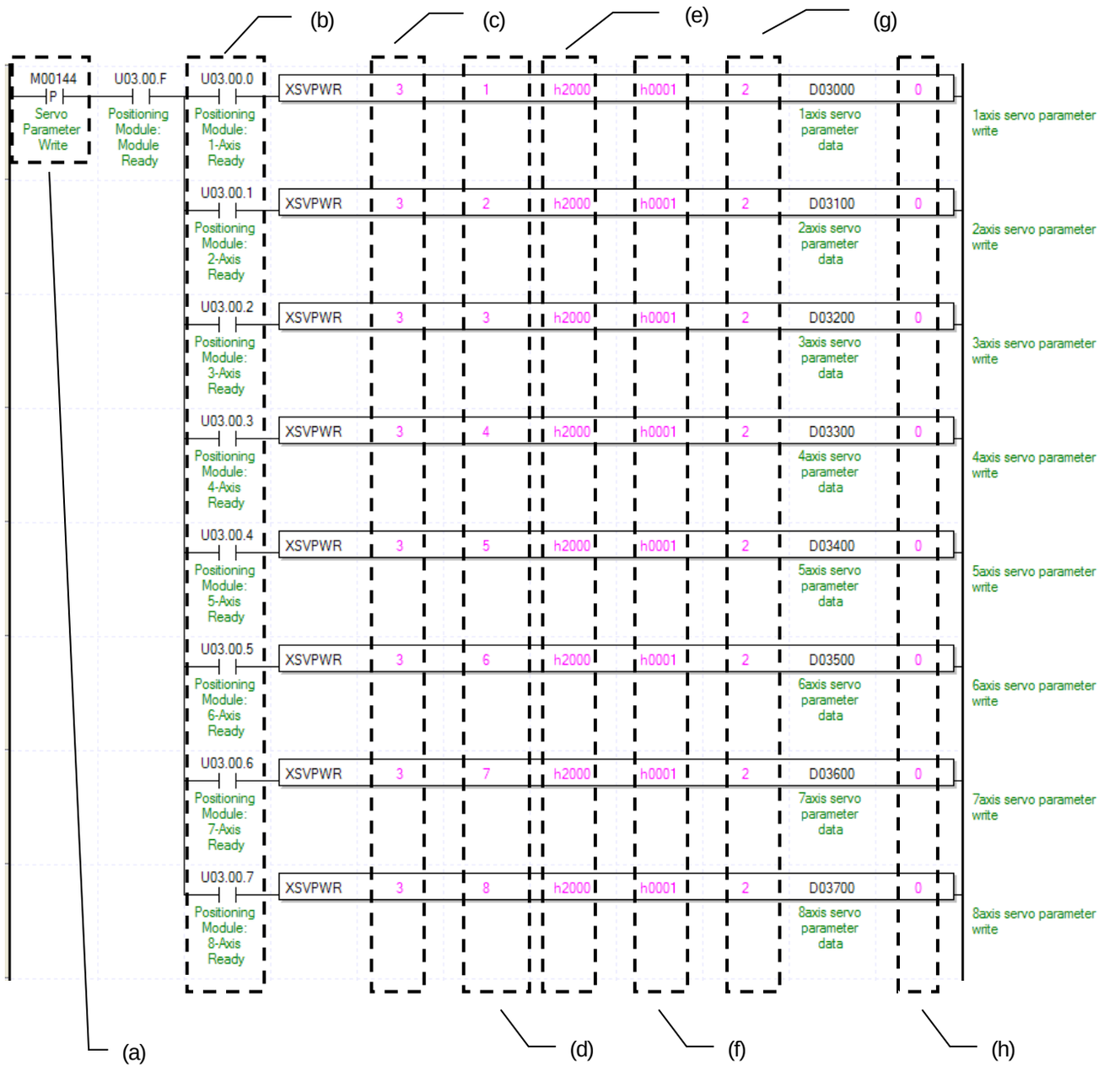
In the below, it displayed read data value using the servo parameter read command.



(j) Condition of servo drive parameter constant read execution

When the constant period read contact of servo parameter is turned on, the servo parameter read command is executed once per second accordance with “1s cycle Clock”. It can be used when you want to periodically monitor servo parameters. If the cycle is set too quickly, errors may occur as commands are executed repeatedly while servo parameter reading is not completed.

(2) Servo drive parameter write



(a) Condition of servo drive parameter write execution

Condition of servo drive Write parameter command (XSVPWR). When servo drive parameter write command is executed, the parameter object values of related servo drive is changed to the setting values.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(d) Axis of command execution

You can set an axis to execute command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command axis item “, it can set 1 to 8 meaning axis1 to axis8.

(e) Servo drive parameter Index

This is the index number of parameter object to be changed among the parameters of servo drive. It can be set as below.

Setting Value	Content
0x2000 ~ 0x5FFF	Manufacturer Specific Profile Area
0x6000 ~ 0x9FFF	Standardized Device Profile Area

(f) Servo drive parameter Sub-Index

This is the sub-index number of parameter object to be changed among the parameters of servo drive. It can be set as below.

Setting Value	Content
0x0~0xFF	Servo parameter Object Subindex

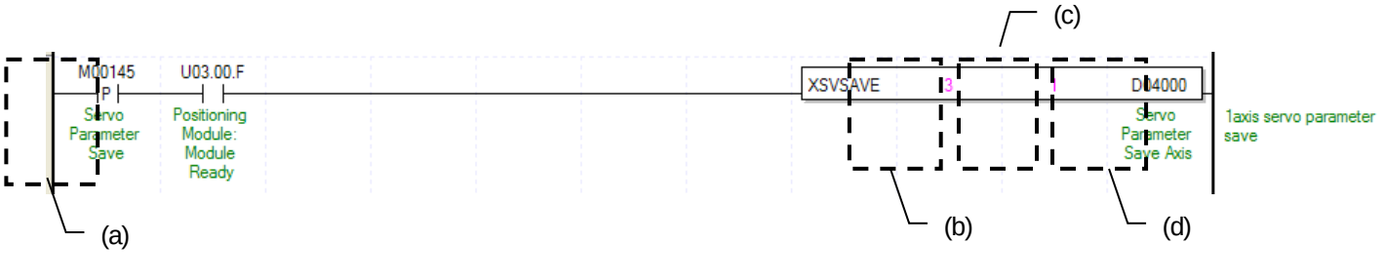
(g) Servo drive parameter size

Set the size of servo drive parameter to write. Set 1 to 4 byte with 1 to 4.

(h) Servo drive parameter write method

Selects whether to save the servo drive parameter to be written in the RAM inside the servo drive or the EEPROM inside the servo drive. If set to 0, It is saved in RAM, and if set to 1, It is saved in EEPROM. When saving to EEPROM, it takes several scan to execute according to the servo drive model, you can tell whether writing of the servo drive parameters has been completed using Bit 7 in the axis information of the module. (Refer to 5.4.1 status information)

(3) Servo drive parameter save (XSVSAVE)



(a) Condition of servo drive parameter save execution

Condition of servo drive parameter save command (XSVSAVE). When servo drive parameter save command is executed, the parameter of related servo drive is saved to EEPROM inside the servo drive.

(b) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(c) Axis of command execution

You can set an axis to execute command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command axis item “, it can set 1 to 8 meaning axis1 to axis8.

(d) Servo drive parameter save axis

Among the connecting servo drive, set the servo drive whose parameters will be saved in EEPROM. Set each bit as shown below to select the servo drive of the related axis.

15 ~ 8 Bit	7Bit	6Bit	5Bit	4Bit	3Bit	2Bit	1Bit	0Bit
Do Not Use	Axis 8	Axis 7	Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1

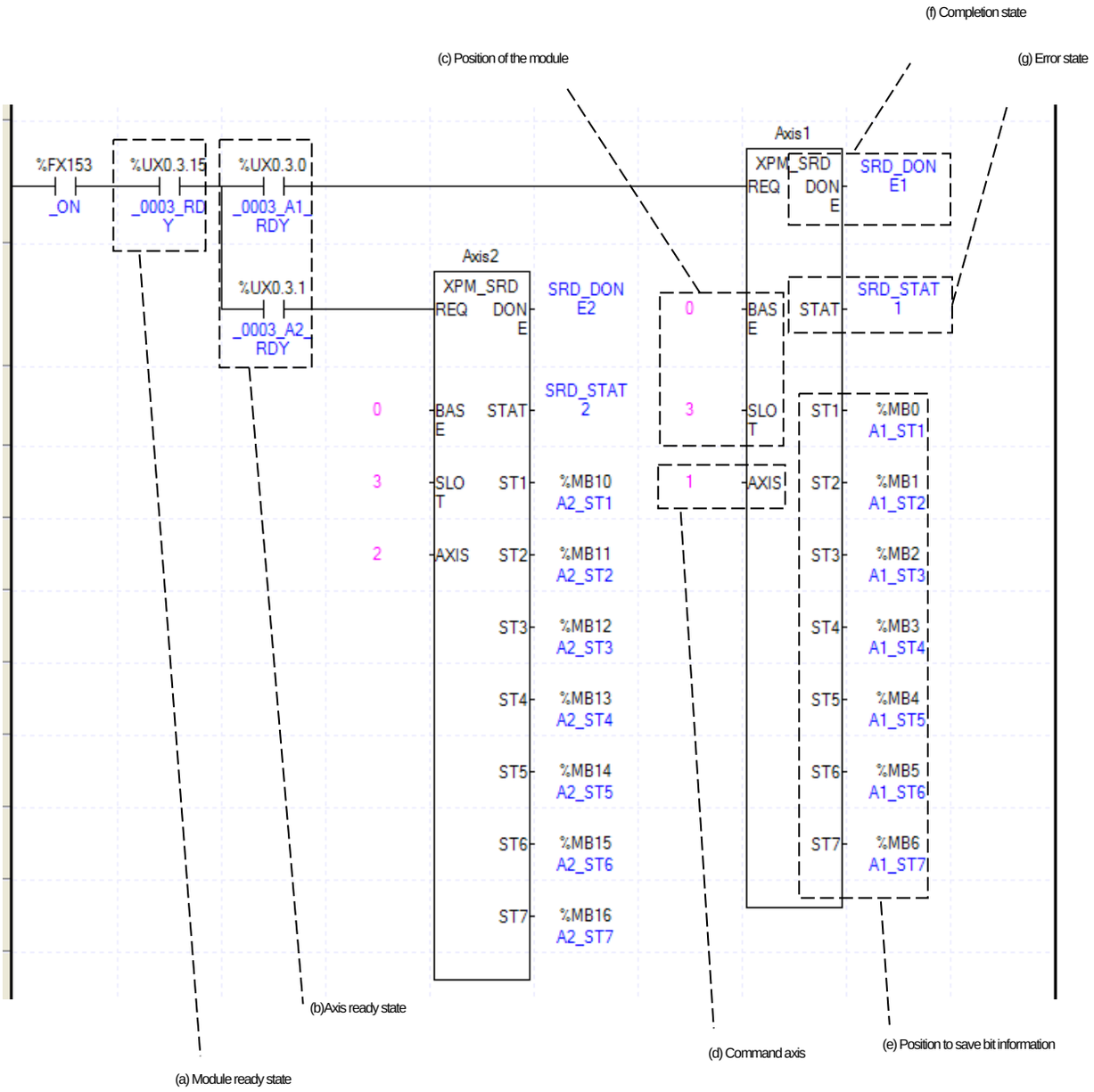
8.2 XEC(IEC) Program Example

8.2.1 Common Description

In this chapter, the example program is written assuming that the positioning module is mounted in slot 3 of base 0. Also, assume that two servo drive, axis1 and axis 2, are installed in the network.
In the real usage, you need to change its value according to your system configuration.

8.2.2 Current Status Read

(1) Operating status bit information read (XPM_SRD)



(a) Module ready status

When the positioning module is ready to receive command without any problems after power is turned on, it turns on

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on. In the example program, _ON (always On), positioning module ready (Ux0.3.15), and the ready status for each axis (Ux0.3.0 ~ Ux0.3.1) were used, so the positioning module is not error status. The axis of servo drive connected to the module is reading the status of each scan.

(c) The mounting position of positioning module.

For give a command, set the position where the positioning module to command is mounted. In the example, the positioning module is mounted in slot3 of base 0.

(d) Axis to give a command

If giving a command for each axis, set the axis to give command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In command, command axis 1~8 means axis 1 to axis 8.

(e) Position to save bit information

Using the XPM_SRD, set the device to save the Bit status values of axis read from positioning module. This device can be used as a condition in a sequence program. For example, in this program above, the BIT condition of axis 1 will be saved from %MB0 to %MB6. For the detailed information for saved devices, refer to 'Chapter 7.3.2 Current operation bit information read (XPM_SRD)'. Bit information saved in the device can be used as a condition for executing other command. For instance, if using in operation signal of axis1 in the example program above, set it to %MB0.0. Also, if applying the error status of axis 2, set it to %MB10.1.

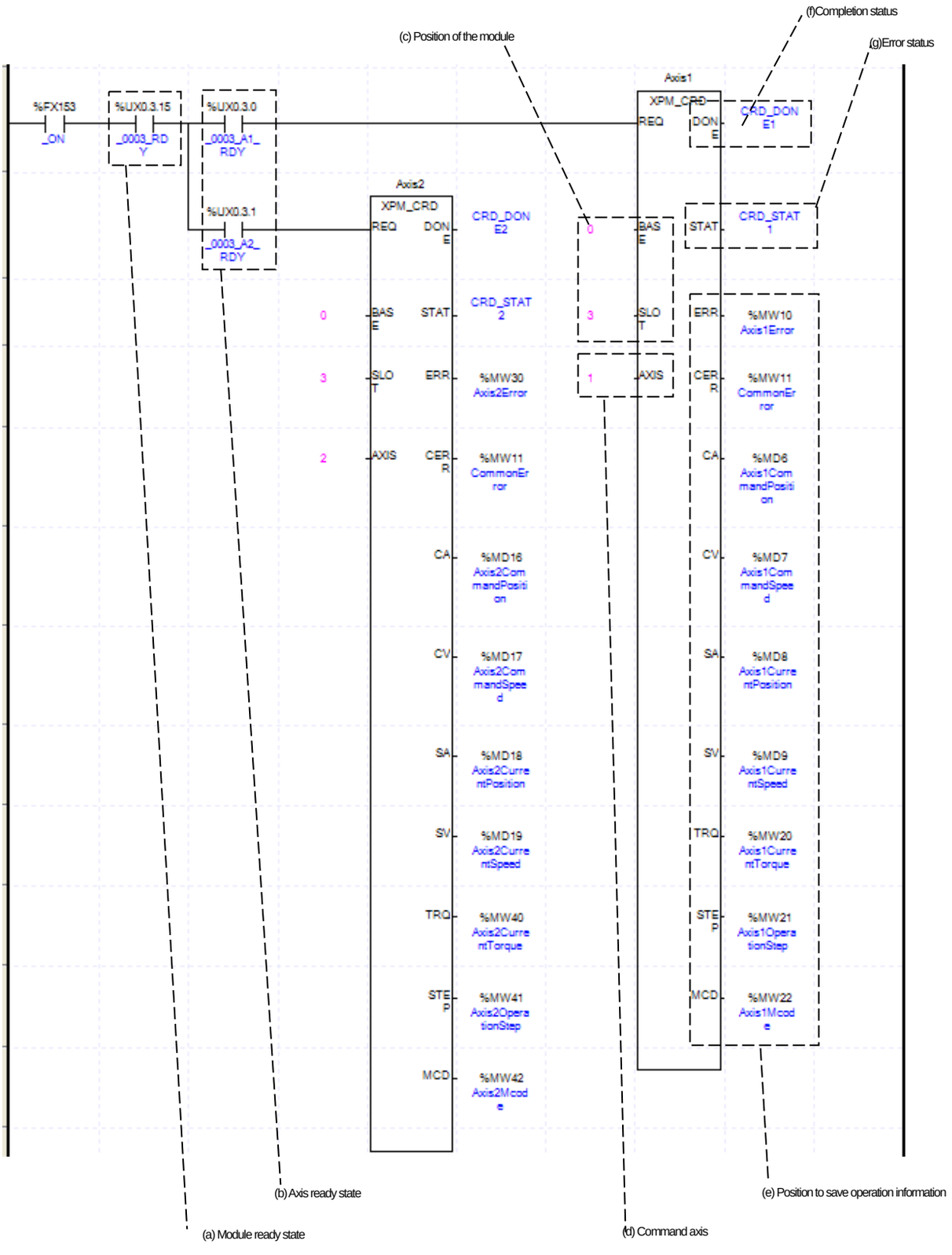
(f) Execution completion status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(g) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(2) Current operating Information read



(a) Module ready status

When the positioning module is ready to receive command without any problems after power is turned on, it turns on

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on. In the example program, _ON(always On), positioning module ready(Ux0.3.15),and the ready status for each axis(Ux0.3.0 ~ Ux0.3.1) were used, so the positioning module is not error status. The axis of servo drive connected to the module is reading the status of each scan.

(c) The mounting position of positioning module.

For give a command, set the position where the positioning module to command is mounted. In the example, the positioning module is mounted in slot3 of base 0.

(d) Axis to give a command

If giving a command for each axis, set the axis to give command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In command, command axis 1~8 means axis 1 to axis 8.

(e) Position to save operation information

Using the XPM_CRD, set the device to save the operating status values of axis read from positioning module. This device can be used as monitoring value in a sequence program. For example, in this program above, the position value of axis 1 will be saved in %MD8. For more information about saved devices, refer to “Chapter 7.3.1 Operation Information reading (XPM_CRD)'.

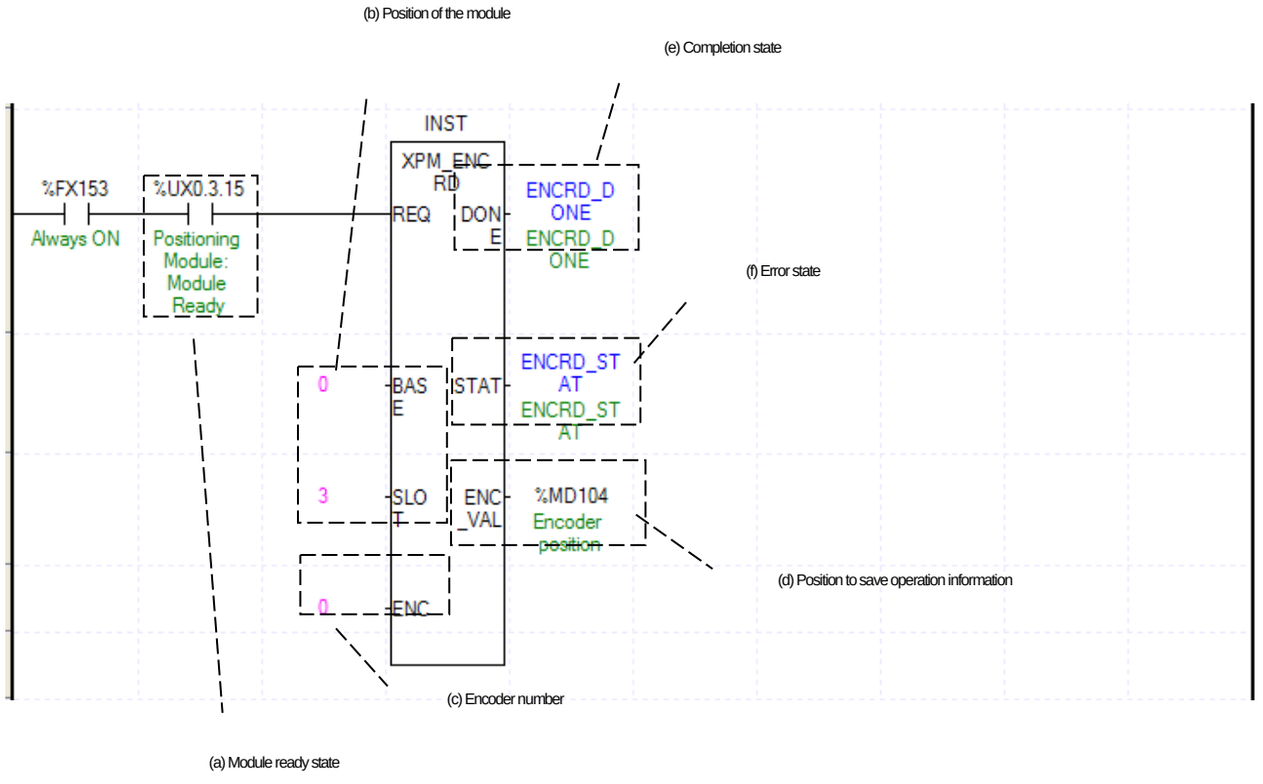
(f) Execution completion status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(g) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(3) Encoder value read



(a) Module ready status

When the positioning module is ready to receive command without any problems after power is turned on, it turns on

(b) Positioning module mounting position

For give a command, set the position where the positioning module to command is mounted. In the example, the positioning module is mounted in slot3 of base 0.

(c) Encoder number

Set the encoder number to read encoder value.

0: Encoder 1

(d) Encoder values

The present value of read encoder is displayed.

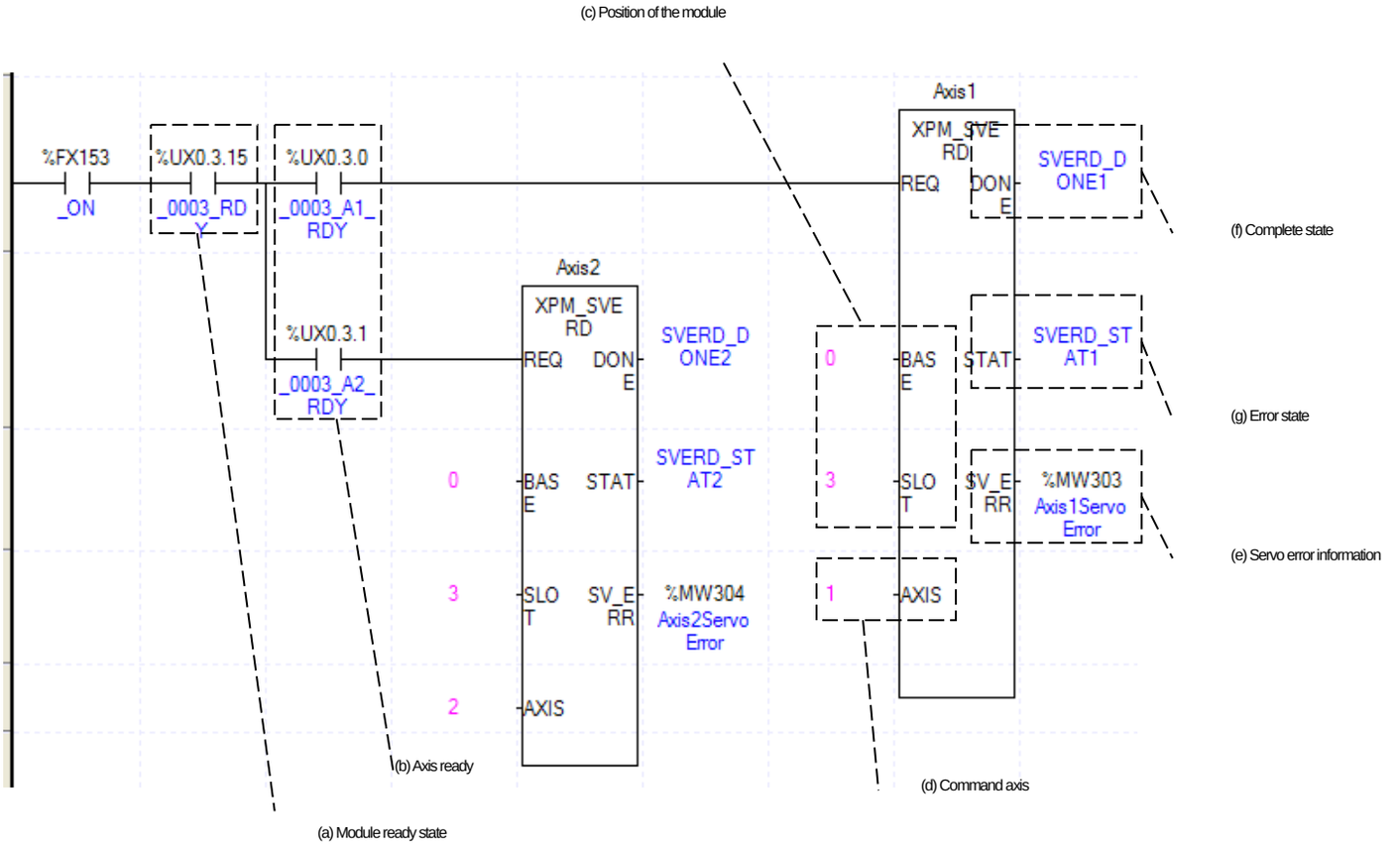
(e) Execution completion status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(f) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(4) Servo error information read (XPM_SVERD)



(a) Module ready status

When the positioning module is ready to receive command without any problems after power is turned on, it turns on

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on. In the example program, _ON(always On), positioning module ready(Ux0.3.15),and the ready status for each axis(Ux0.3.0 ~ Ux0.3.1) were used, so the positioning module is not error status. The axis of servo drive connected to the module is reading the status of each scan.

(c) The mounting position of positioning module.

For give a command, set the position where the positioning module to command is mounted. In the example, the positioning module is mounted in slot3 of base 0.

(d) Axis to give a command

If giving a command for each axis, set the axis to give command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In command, command axis 1~8 means axis 1 to axis 8.

(e) Servo error information

Using the XPM_SVERD, set the device to save the servo error information of the axis read from positioning module. This device can be used as a condition in a sequence program. For example, in this program above, the current servo error information of axis 1 will be saved in %MW303.

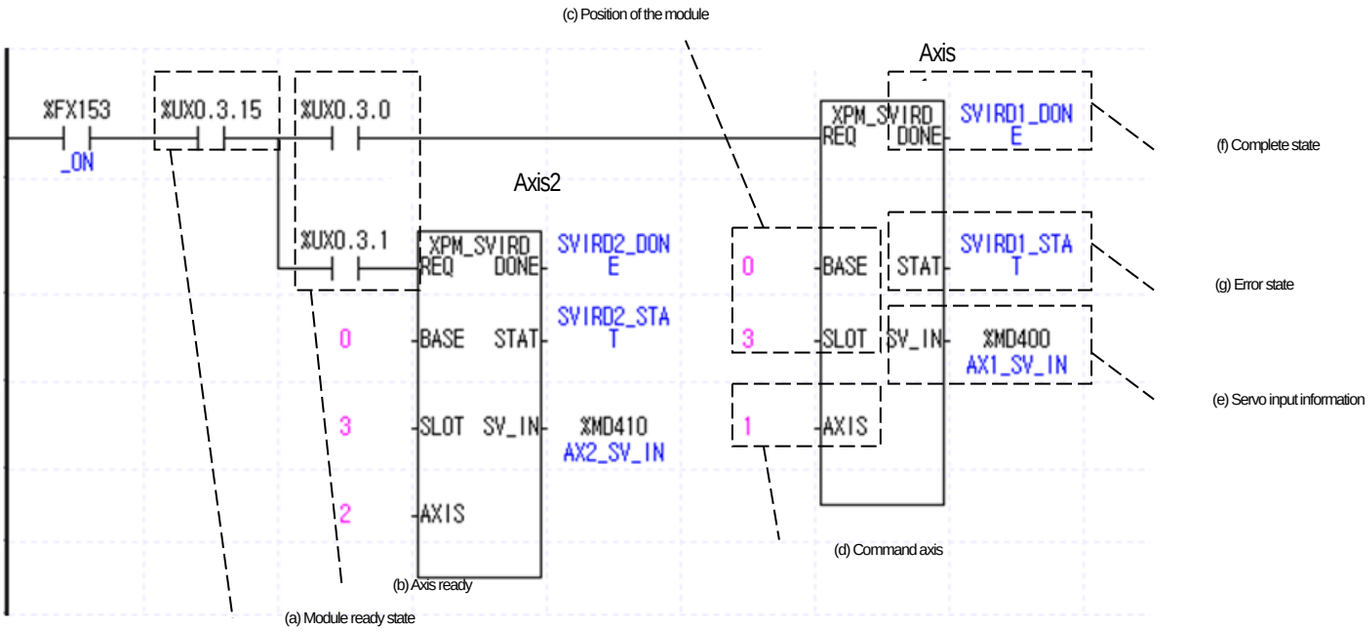
(f) Execution completion status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(g) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(5) Servo Input information read (XPM_SVIRD)



(a) Module ready status

When the positioning module is ready to receive command without any problems after power is turned on, it turns on

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on. In the example program, _ON(always On), positioning module ready(Ux0.3.15),and the ready status for each axis(Ux0.3.0 ~ Ux0.3.1) were used, so the positioning module is not error status. The axis of servo drive connected to the module is reading the status of each scan.

(c) The mounting position of positioning module.

For give a command, set the position where the positioning module to command is mounted. In the example, the positioning module is mounted in slot3 of base 0.

(d) Axis to give a command

If giving a command for each axis, set the axis to give command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In command, command axis 1~8 means axis 1 to axis 8.

(e) Servo input information

Using the XPM_SVIRD, set the device to save the Input Signal information of the axis read from positioning module. This device can be used as a condition in a sequence program. For example, in this program above, the servo input signal information of axis 1 will be saved in %MD400.

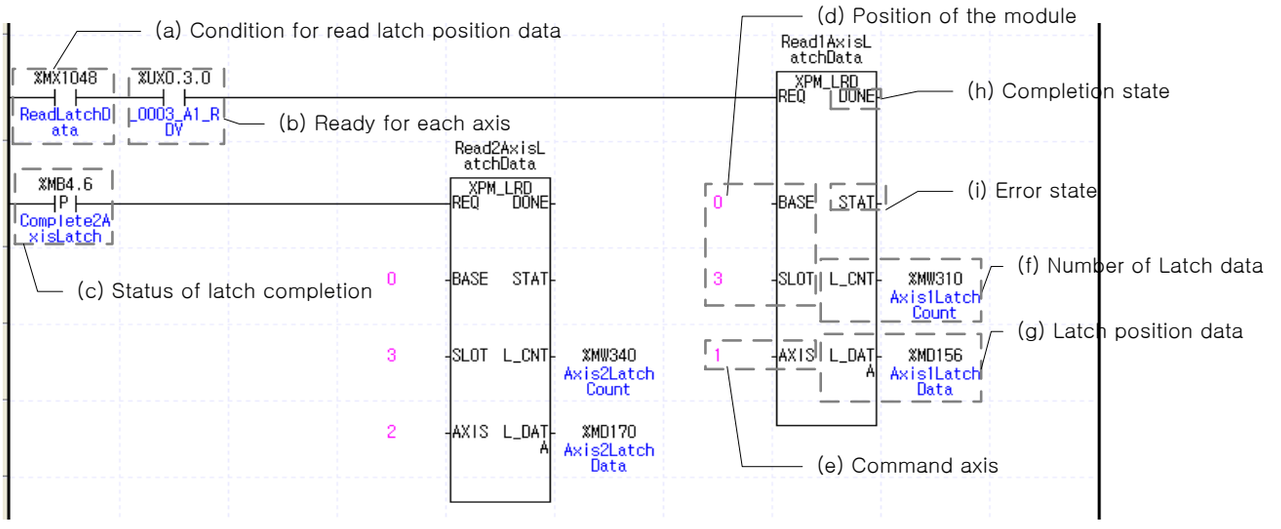
(f) Execution completion status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(g) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(6) Latch position data read (XPM_LRD)



(a) Latch position data read execution condition

This is the condition for executing the latch position data read command(XLRD). For axis1, when %MX1048(latch position data read) is turned on after axis 1 connected to the network, the latch position data read command is always executed.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on. In the example program, axis1 ready status (UX0.3.0) was used, so when %MX1048(latch position data read) is turned on after the axis is connected to the module, the latch position data is read.

(c) Latch completion status

When applying example program of “8.2. 2(1) Operation status bit information read”, the axis is in a “latch completion status”. When the external latch command signal of related axis is input and latch is completed, it turn on. When %MB4.6 (latch completion status) turns on in axis2, the latch position data read command of axis 2 is executed.

(d) Positioning module mounting position

For give a command, set the position where the positioning module to command is mounted. In the example, the positioning module is mounted in slot3 of base 0.

(e) Axis to give a command

If giving a command for each axis, set the axis to give command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In command, command axis 1~8 means axis 1 to axis 8.

(f) Number of latch position data

Using the XPM_LRD, set the device to save the number of currently latch position data of the axis read from positioning module. This device can be used in a sequence programs. For example, in this program above, the number of latch position data of axis 1 will be saved in %MW310.

(g) Latch position data

Using the XPM_LRD, set the device to save latch position data of the axis read from positioning module. This device can be used in a sequence programs. For example, in this program above, the latch position data of axis 1 will be saved from %MD156 to %MD165.

(h) Execution completion status

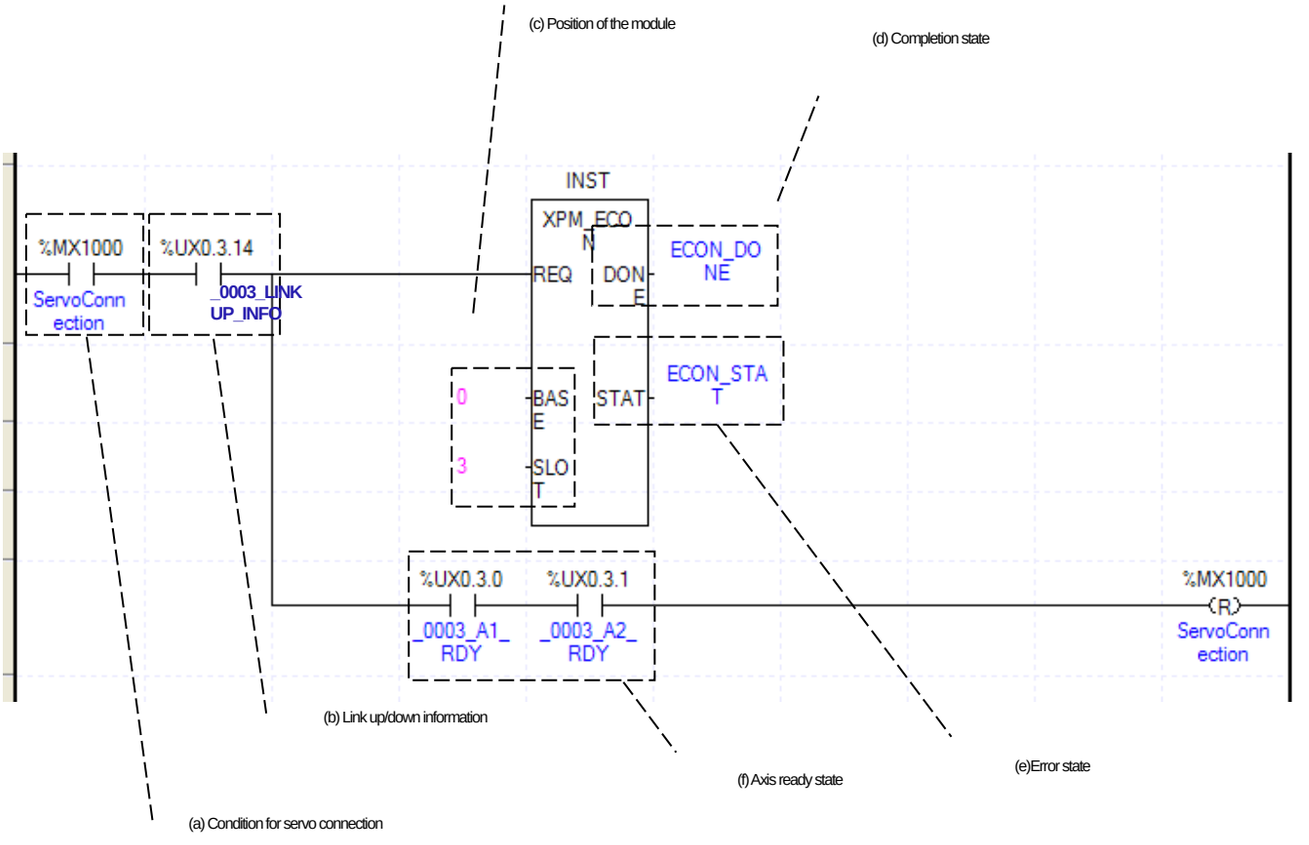
If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(i) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

8.2.3 Preparation for Operation

(1) To connect servo drive



(a) Servo connection condition

This is the condition for the servo connection command (XPM_ECON).

(b) Link up/down information

If the link up/down information is used as the input condition contact of the servo connection command, the servo connection command can be executed only when the network cable is connected.

(c) The mounting position of positioning module.

For give a command, set the position where the positioning module to command is mounted. In the example, the positioning module is mounted in slot3.

(d) Execution completion status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

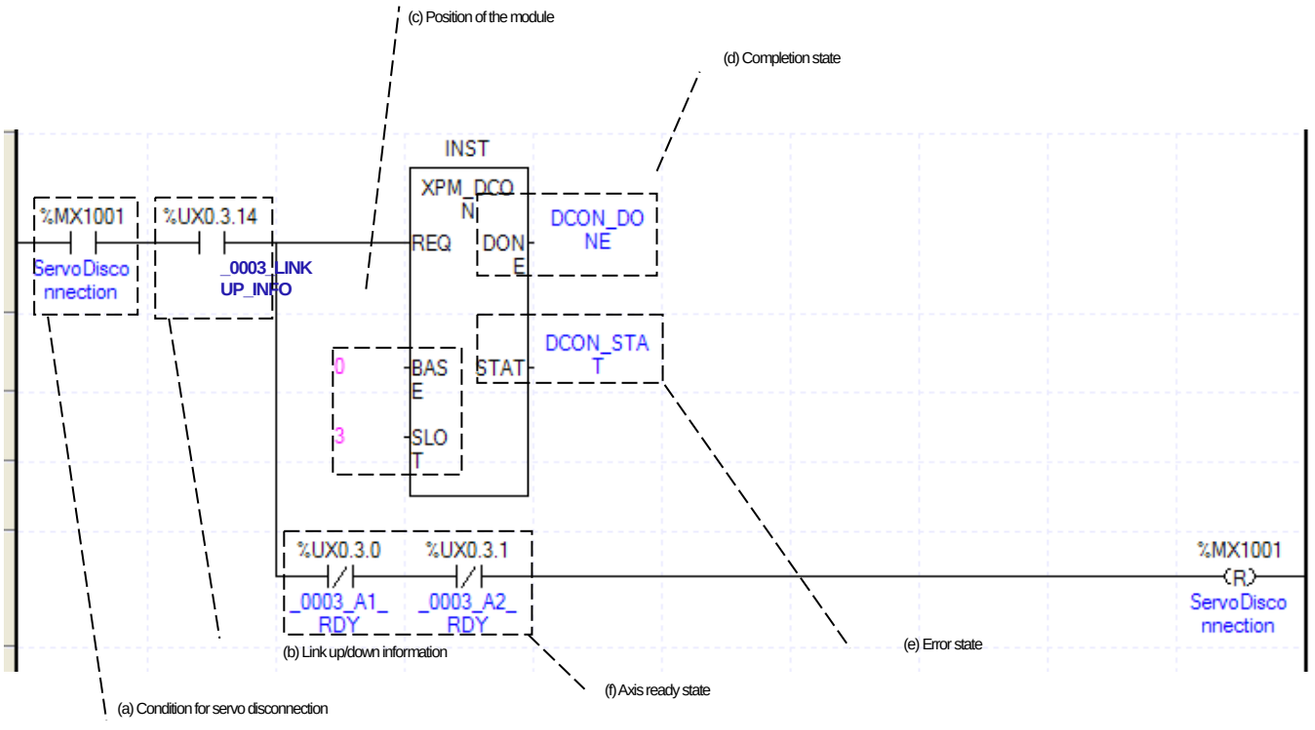
(e) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(f) Ready status for each axis

When connection with servo drive is completed, the signal related to each connected axis turns on. In the example, the module is set to have 2 axes connected. Set only the connected axes depending on applicable system. When the connection is completed and all signal related to each axis turns on, the servo connection condition is reset.

(2) Servo drive disconnect



(a) Servo disconnect condition

This is the condition for the servo disconnection command (XPM_DCON).

(b) Link up/down information

If the link up/down information is used as the input condition contact of the servo disconnection command, the servo disconnection command can be executed only when the network cable is connected.

(c) The mounting position of positioning module.

For give a command, set the position where the positioning module to command is mounted. In the example, the positioning module is mounted in slot3.

(d) Execution completion status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

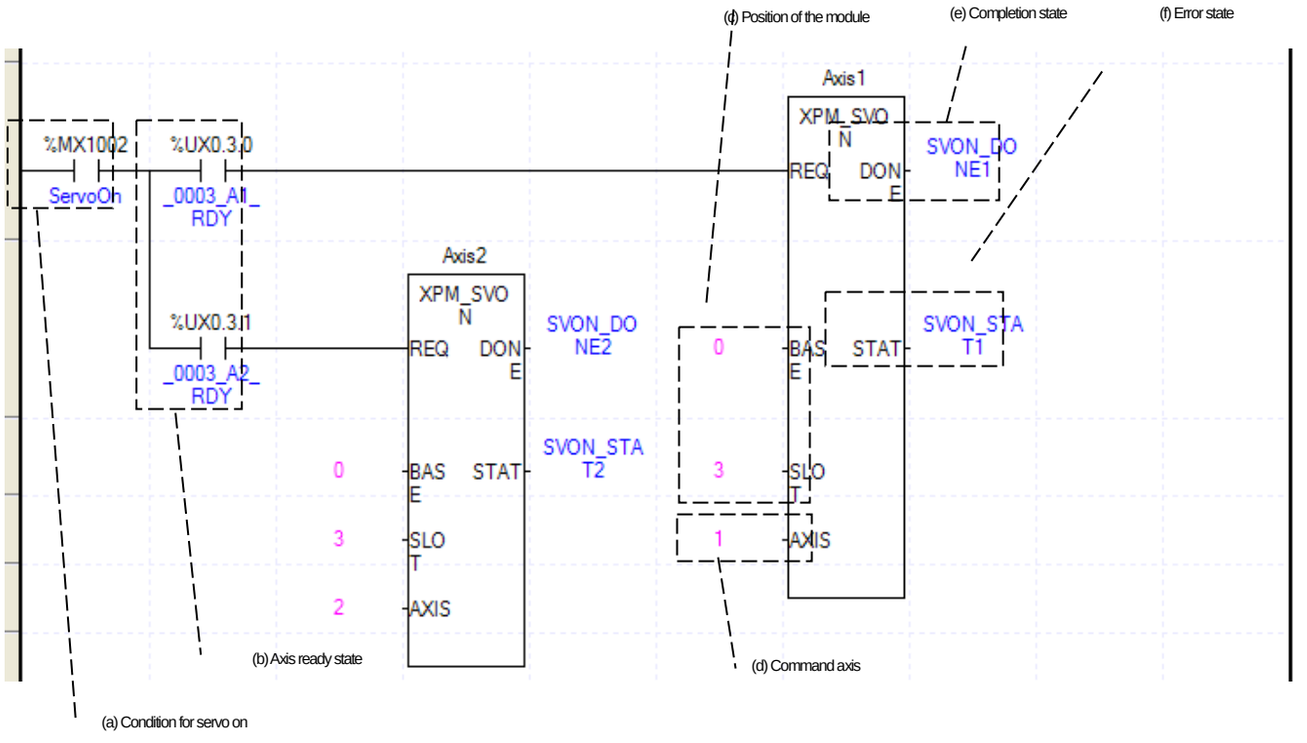
(e) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(f) Ready status for each axis

When disconnection with servo drive is completed, the signal related to each connected axis is turns off. In the example, the module is set to have 2 axes connected. Set only the connected axes depending on applicable system. When the connection is completed and all signal related to each axis turns off, the servo disconnection condition is reset.

(3) Servo On



(a) Servo on execution condition

It is the condition to execute the servo on command (XPM_SVON).

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on. In the example program, when the servo on condition is on, a servo on command is given to the connected axis. According to system, the command of axis that is not connected can be removed.

(c) The mounting position of positioning module.

In the example, the positioning module set to be mounted in slot 3 of base 0.

(d) Axis to give a command

You can set an axis to execute the servo on command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command” item of servo on command, it can set 1 to 8 meaning axis1 to axis8.

(e) Execution completion status

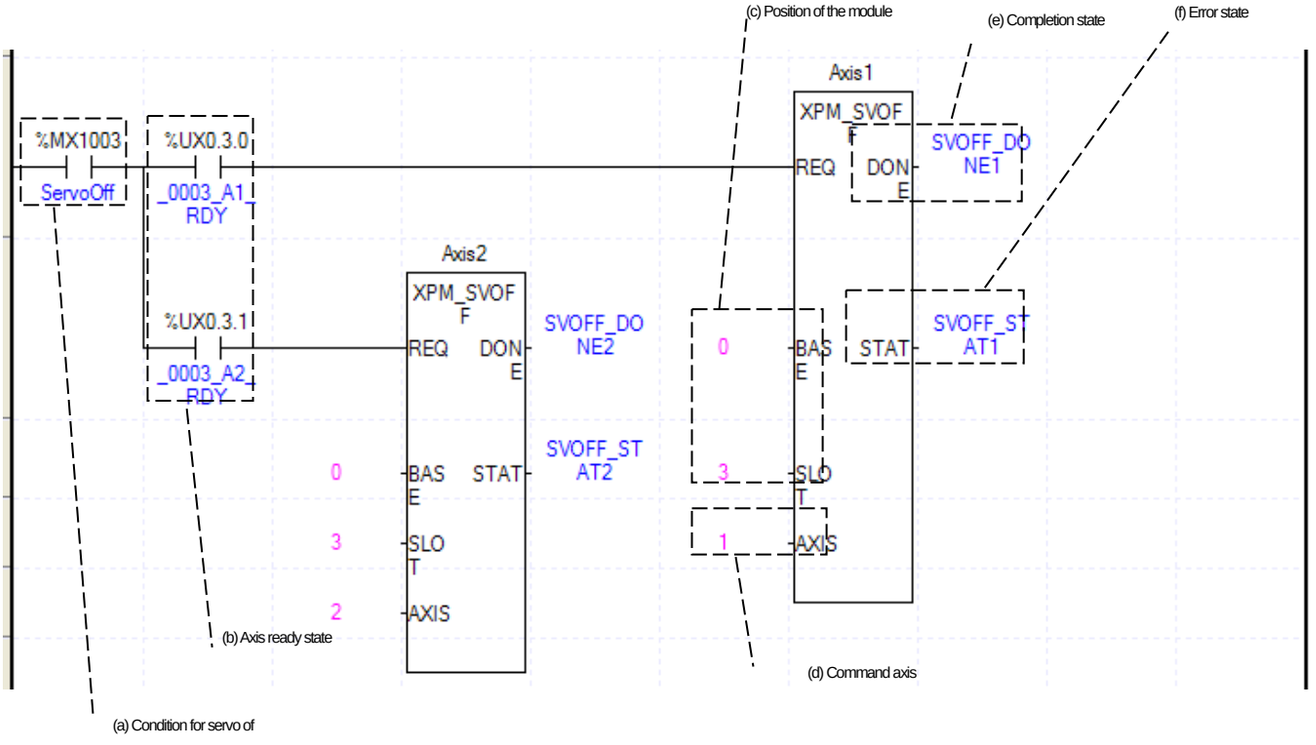
If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(f) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(g) When the servo on command is executed, servo drive set to the axis where the command was executed is in the servo on status.

(4) Servo off



(a) Servo off execution condition

It is the condition to execute the servo off command (XPM_SVOFF).

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on. In the example program, when the servo off condition is on, a servo off command is given to the connected axis. According to system, the command of axis that is not connected can be removed.

(c) The mounting position of positioning module.

In the example, the positioning module set to be mounted in slot 3 of base 0.

(d) Axis to give a command

You can set an axis to execute the servo off command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command” item of servo off command, it can set 1 to 8 meaning axis1 to axis8.

(e) Execution completion status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(f) Error status

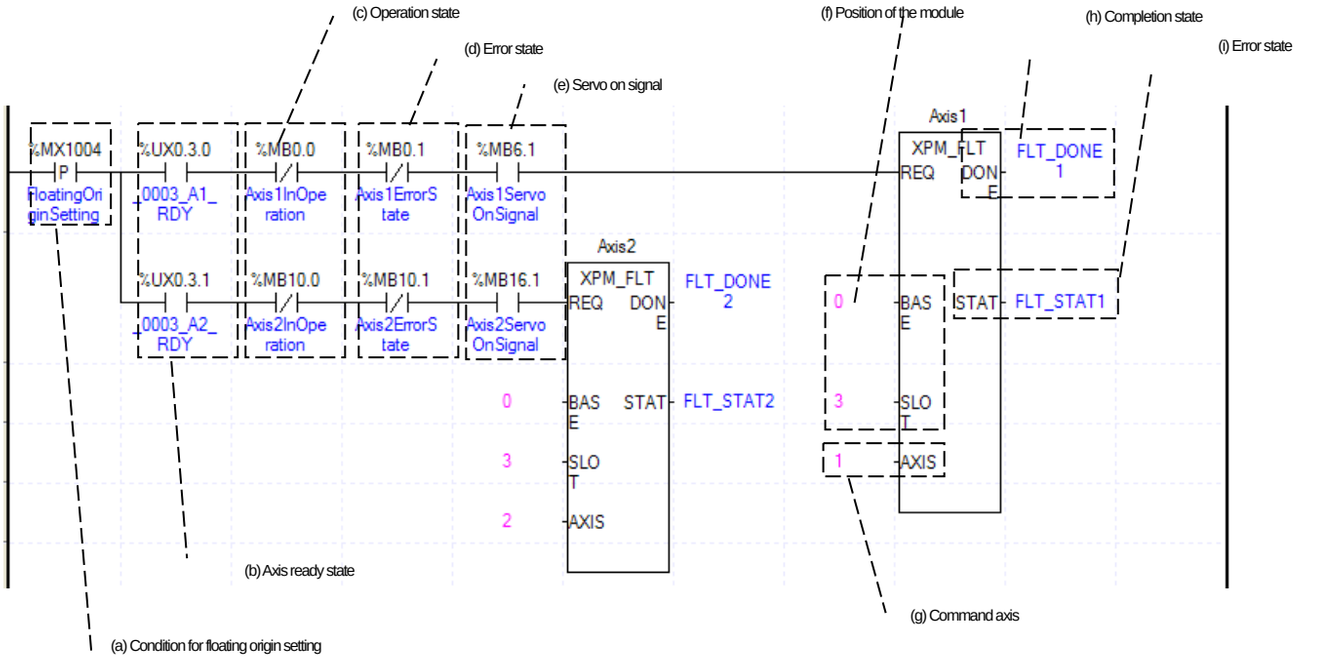
If an error is occurred while the function block executes, this is the area where the error number is output.

(g) When the servo off command is executed, servo drive set to the axis where the command was executed is in the servo off status.

8.2.4 Test operation

(1) Floating origin setting

Decide origin of current motor's position without set a machinery origin.



(a) Condition of floating home setting execution

It is condition to execute the floating home setting (XPM_FLT) command.

(b) Ready status for each axis

(c) Operating state for each axis

"In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Floating home setting command cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute floating home setting command while it is running, the error 211 would be appeared.

(d) Error status for each axis

"In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

"In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. Floating home setting command cannot be executed when axis is not servo on, hence the condition is set CAM execute when it is servo on. If you execute floating home setting command while axis is not servo on status, error 212 would be appeared.

(f) Positioning module mounting position

In the example, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

You can set an axis to execute the servo off command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command” item of servo off command, it can set 1 to 8 meaning axis1 to axis8.

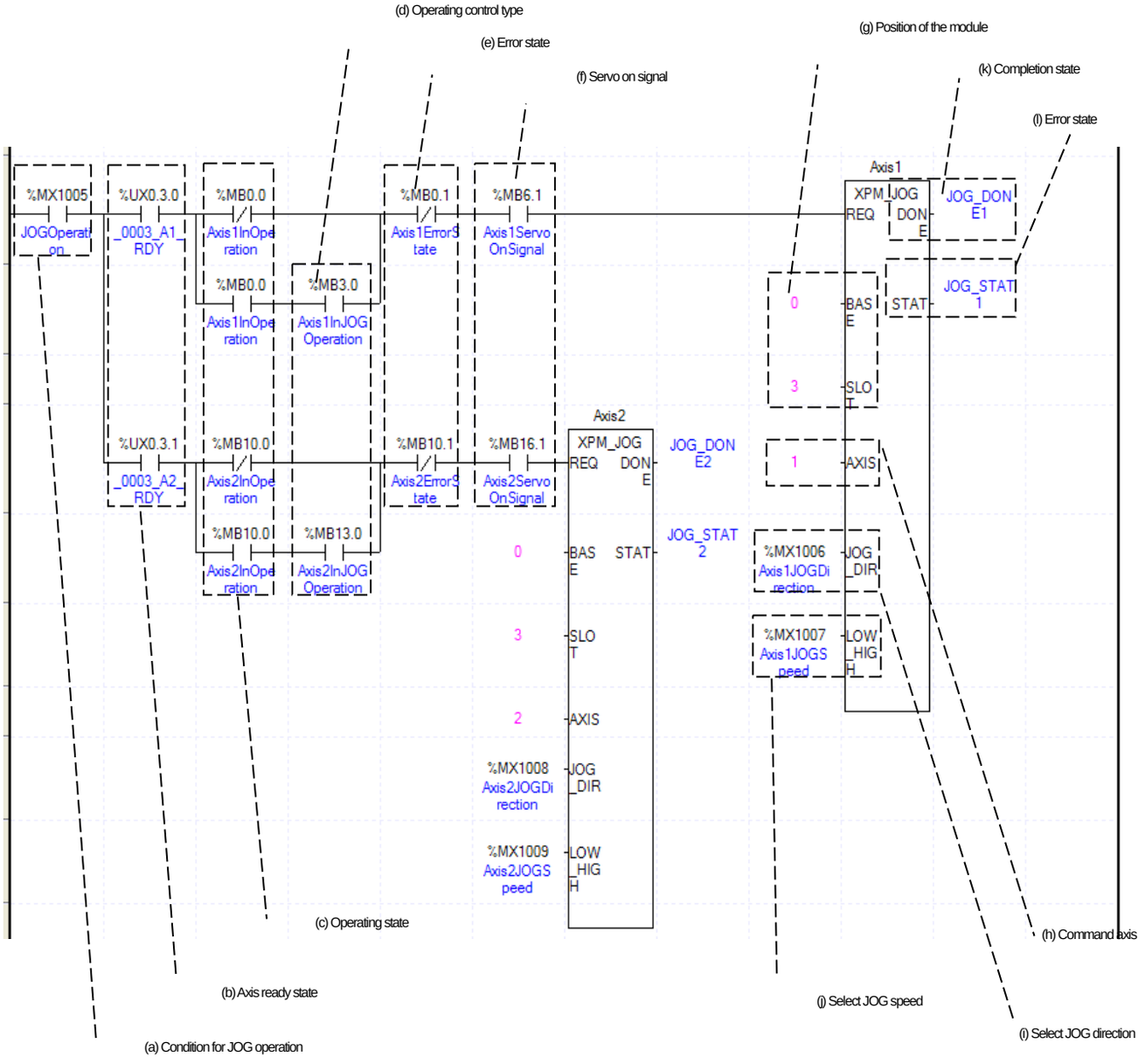
(h) Execution completion status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(i) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(2) JOG Operation



(a) Condition of Jog Operation

Condition of Jog Operation Command

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

Jog Operation can only be working when the state of axis set as Jog Operation. In this example above, specific axis set as Jog Operation otherwise it is not operating.

(d) Operation control type for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in jog operation'. If a relevant axis is in jog operation, it becomes 'on'. Jog Operation configuration can be changed while it is operating.

(e) Error status for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(f) Servo on status for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. The jog operation cannot be executed when axis is not servo on, hence the condition is set to execute when it is servo on. If you execute jog operation while axis is not servo on status, error 413 would be appeared.

(g) Positioning module mounting position

In the example, the positioning module set to be mounted in slot 3 of base 0.

(h) Axis to give a command

You can set an axis to execute the servo off command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command” item of servo off command, it can set 1 to 8 meaning axis1 to axis8.

(i) Jog direction selection

Set the direction of jog operation. When the input value is 0, jog operation start in forward direction, when the input value is 1, jog operation start in reverse direction. You can change the direction while jogging.

(j) Jog speed selection

Set speed of jog operation. When the input values is 0, it operate at jog low speed, when the input values is 1, it operate at jog high speed. You can change the operating speed while jogging.

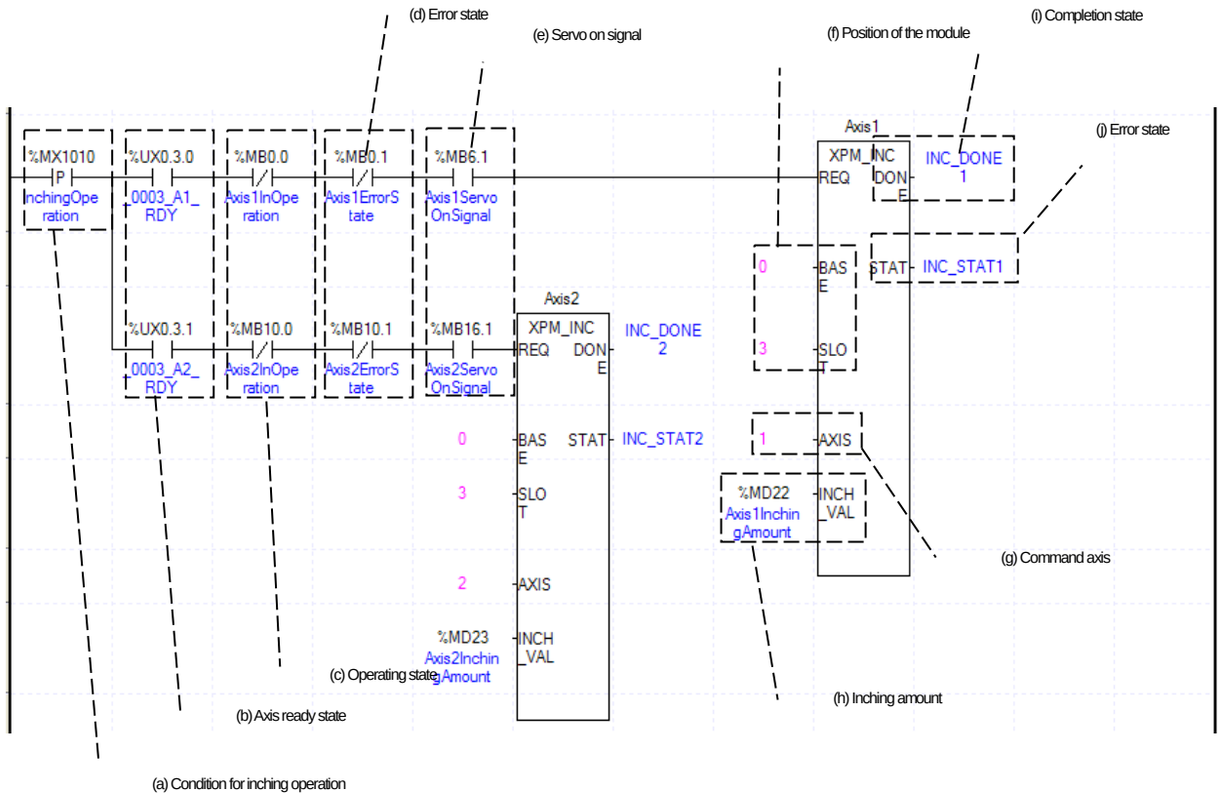
(k) Execution completion status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(i) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(3) Inching operation



(a) Condition of inching operation

Condition of Inching operation command (XPM_INC)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Inching Operation cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Inching Operation while it is running, the error 401 would be appeared.

(d) Error status for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'On'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. The inching operation command cannot be executed when axis is not servo on, hence the condition is set to execute when it is servo on. If you execute inching operation command while axis is not servo on status, error 403 would be appeared.

(f) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

You can set an axis for Inching Operation. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command” item of inching operation command (INCH), it can set 1 to 8 meaning axis1 to axis8.

(h) Amount of Inching movement for each axis

Measure the amount of moving range by Inching Operation.

(i) Execution completion status

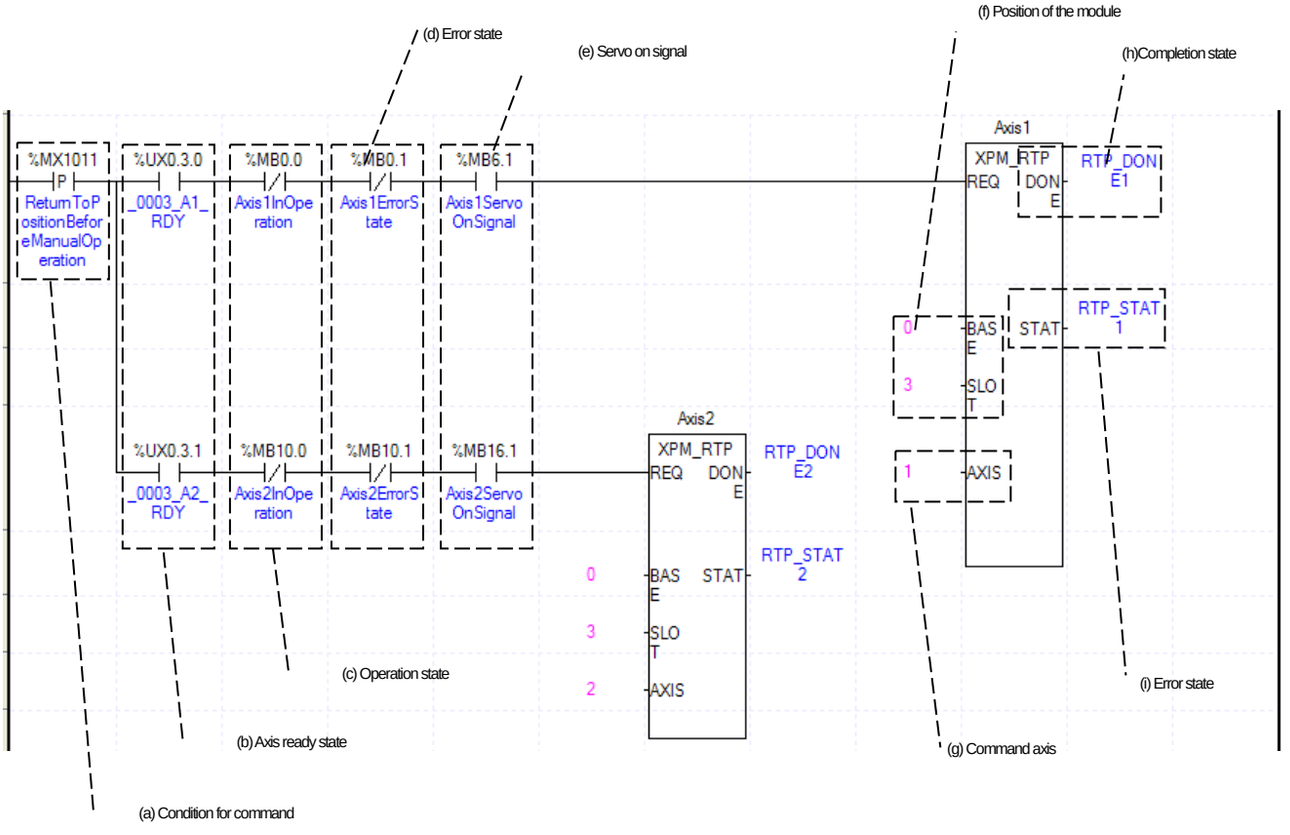
If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(j) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(k) For the detail description about inching operation, refer to“7.6.2 Inching Operation”.

(4) Manual operation previous position return



(a) Condition of return to the position before manual operation

Condition of return to position before manual operation command (XPM_RTP)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Inching Operation cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Manual Operation while it is running, the error 431 would be appeared.

(d) Error status for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'On'. A condition has been set to perform a control command only when there is no error with the relevant

axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

"In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when the related axis is servo on status. The return to the position before Manual Operation command cannot be executed when axis is not servo on, hence the condition is set to execute when it is servo on. If you execute the return to the position before Manual Operation command while axis is not servo on status, error 434 would be appeared.

(f) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

You can set an axis for Inching Operation. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the "axis to command" item of the return to the position before Manual Operation command (RTP), it can set 1 to 8 meaning axis1 to axis8.

(i) Execution completion status

If the function block is completed without an error, "1" is output. "1"is maintained until the next execution, if an error occurs, "0"is output.

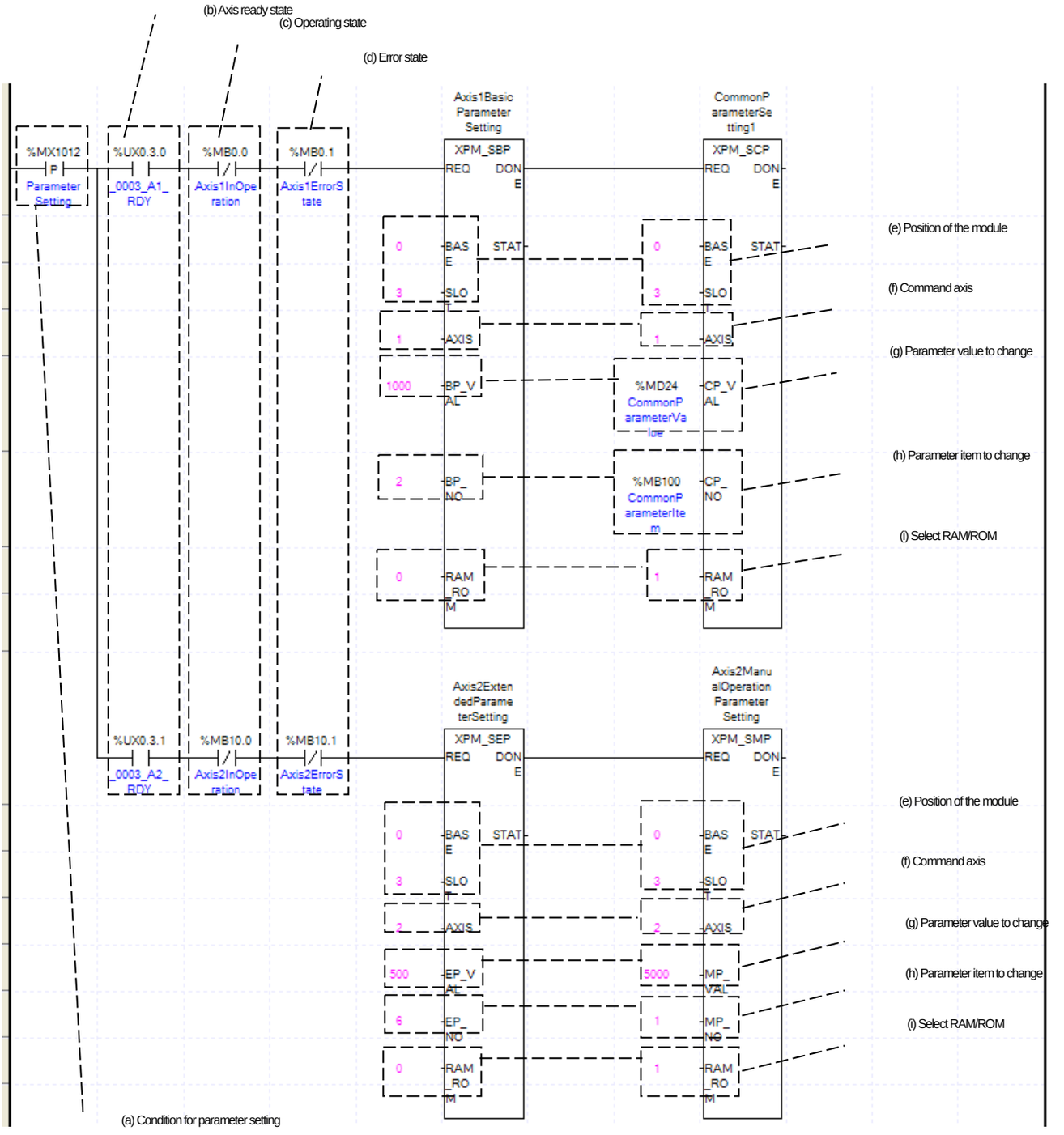
(j) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(h) When the return to the position before Manual Operation command is executing, the related axis moves to the position before manual operation such as jog operation and Inching operation is executed. For more information, refer to "Chapter 7.6.3 Return to the position before manual operation".

8.2.5 Parameter and Operation Data Setting

(1) Parameter setting



(a) Condition of parameter setting execution

Condition of parameter setting command (XPM_SBP, XPM_SEP, XPM_SMP, XPM_SCP).

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. The parameter setting command except common parameter setting command cannot be configured while it is operating hence condition be configured when axis is not operating. If you execute Parameter Setting while it is running, the error 471 would be appeared.

(d) Error status for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(f) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command” item of the parameter setting command, it can set axis 1 to 8 meaning axis1 to axis8.

(g) Parameter value to change

You can set a parameter value to change. For more information about parameter item, refer to “Chapter 7. Function block”.

(h) Parameter items to change

Set the list to be changed with the parameter value (g) set in command. Once operating is working, this value will change to parameter value (g). For more information about parameter item, refer to “Chapter 7. Function block”.

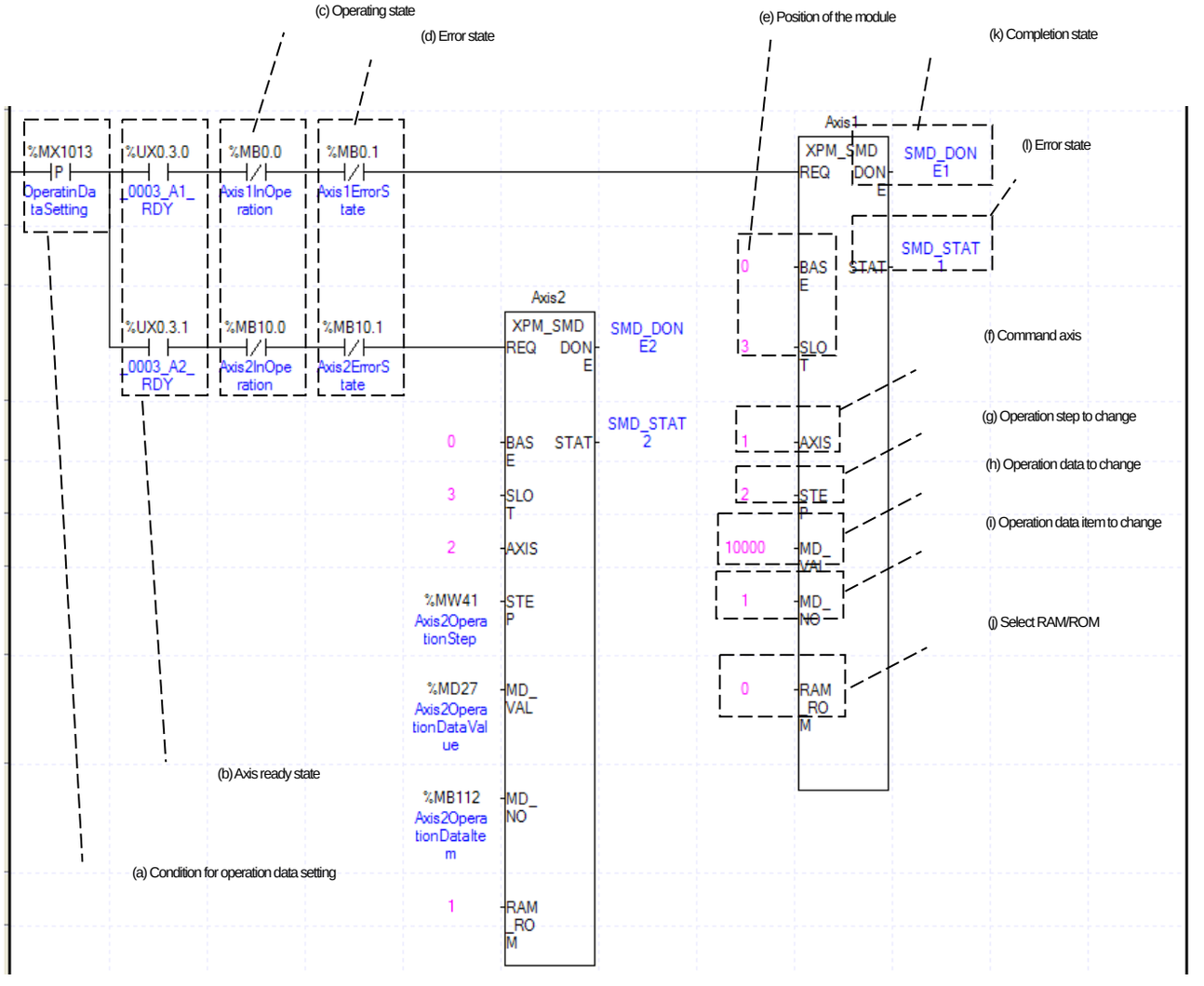
(i) RAM/ ROM setting

This function sets whether you save value of changing parameter to Rom or Ram. If you choose ROM the data will be saved regardless of power and if you save in the ram the data will be vanished when powers off. This parameter sets as 1 means ROM saved, and sets as 0 means RAM saved. Since the parameter of positioning module are saved in MRAM, there is no limit to the number of times parameter ROM settings are executed.

(j) The execution details of each function block are as follows.

XPM_SBP: set acceleration time 1 of axis 1 basic parameter to 1000ms in RAM
XPM_SEP: set internal in-position range of axis2 extended parameter to 500 in RAM
XPM_SMP: set jog high speed of axis 2 manual operation parameter to 5000 in ROM
XPM_SCP: set %MB100 item of common parameter to %MD24 value in ROM

(2) Operation data setting



(a) Condition of operation data setting

Condition of operating data setting command (XPM_SMD)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operation data setting command is available when the axis is operating. But, when changing the operation data of currently operating step, it will be reflected after the operation of current step is finished.

(d) Error status for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(f) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command” item of the operation data setting command, it can set axis 1 to 8 meaning axis1 to axis8.

(g) Operation data step to change

You can configure the changing operating data step number by using the operating data step command. 400 step operation data for each axis can be set. This value supports from number 0 to 400. The numbers are considered as a step meaning number 1~400 are same as 1~400 steps. “When set to”0', it means the current step of operation data of related axis.

(h) Position data values to change

You can set a value of changing parameter.

(i) Operation data Item to change

Set the operation data item to be change with the operation data value (h) set in the command. When command is executing, the operation data value set in this item changes to the set operation data values (h). Each value of Operating Data is listed below. For example, if you put 1000 for value of changing operating data and “4 for operating data item then the value of dwell time is changing to “1000ms”.

Setting Value	Item
1	Target position
2	Circular interpolation auxiliary position
3	Operating speed
4	Dwell time
5	M code No.
6	Sub axis setting
7	Helical interpolation axis
8	No. of circular interpolation turn
9	Coordinate
10	Control method
11	Operation method
12	Operating pattern
13	Circular arc size
14	Acc. No.
15	Deceleration No.
16	Circular interpolating method
17	Circular interpolating direction

(j) RAM/ ROM setting

This function sets whether you save changed operation data values to ROM or RAM. If you choose ROM the data will be saved regardless of power and if you save in the RAM the data will be vanished when powers off. This parameter sets as 1 means ROM saved, and sets as 0 means RAM saved. The number of times for operation data ROM setting of positioning module is not limited because operation data is saved on MRAM Memory.

(k) Execution completion status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(i) Error status

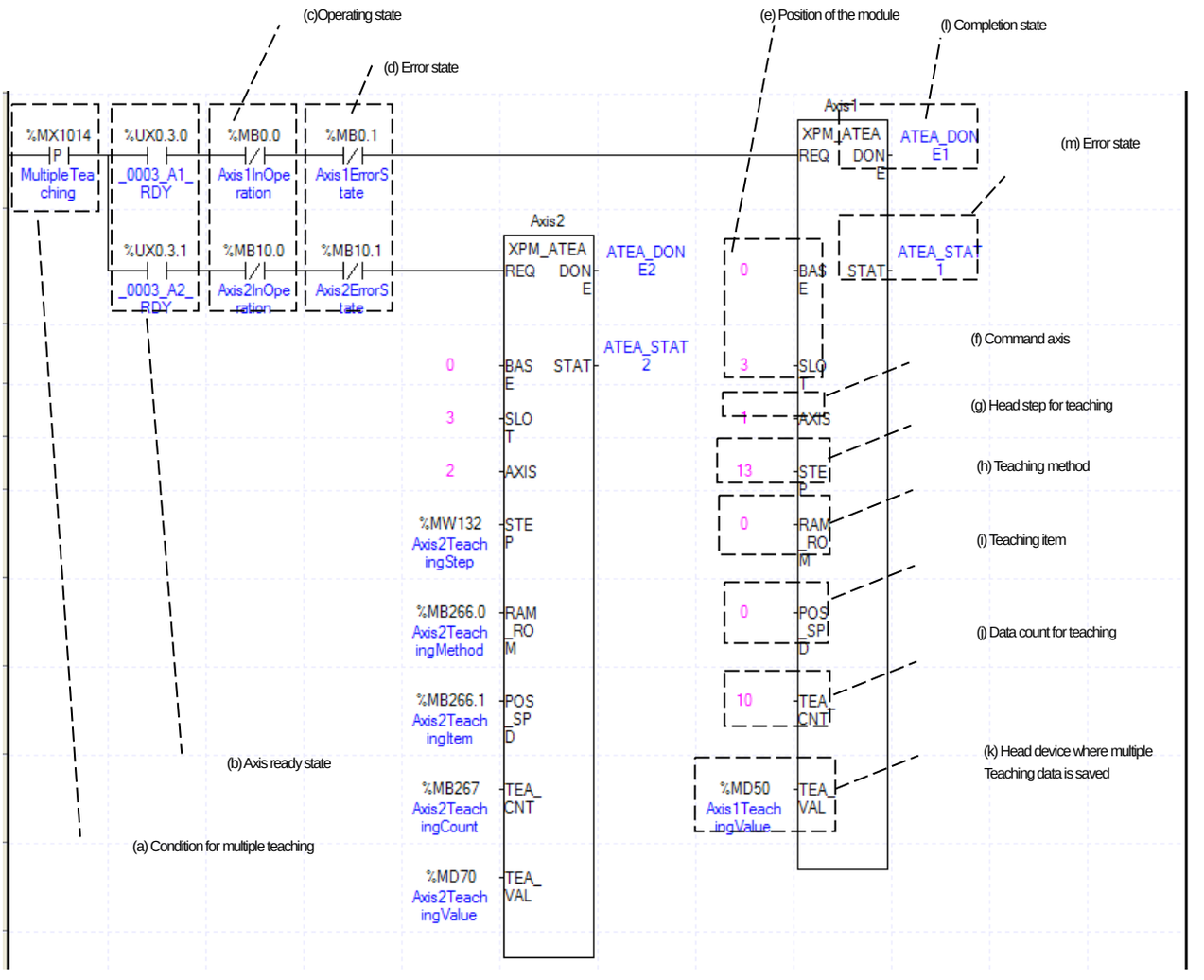
If an error is occurred while the function block executes, this is the area where the error number is output.

(m) The execution details of each function block are as follows.

Axis 1 operation data setting: set the target position of axis 1 operation data step 2 to 10000 in RAM.

Axis 2 operation data setting: set the %MB112 (axis2 operation data item) of axis 2 operation data %MW41(axis2 operation step) step to %MD27(axis2 operation data value) in ROM.

(3) Operation Data Teaching Array



(a) Condition to teaching array

Condition of teaching array (XPM_ATEA)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. The plural teaching command is available to be executed when the axis is operating. But teaching data of operating step do not apply instantly. Operating step data will apply end of present step operation and the data of the remaining steps are changed immediately.

(d) Error status for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(f) Axis to give a command

Set the axis to execute teaching array (XPM_ATEA) command The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command” item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(g) Step leading address to teaching

You can set the leading step number of steps to execute teaching among the operating data step. In this example above, Teaching Array of axis 1 will be operate from 22th step, which is 10th step away from 13th step, hence it will be operate between 13th step and 22th step.

(h) Teaching method

This function sets whether you save changed operation data values to ROM or RAM. If you choose ROM the data will be saved regardless of power and if you save in the RAM the data will be vanished when powers off. This parameter sets as 1 means ROM saved, and sets as 0 means RAM saved. The number of times for ROM teaching is not limited because operation data is saved on MRAM Memory.

(I) Teaching items

You can set a data with Teaching Method among the Operating Data. Both” target position' and 'operation speed' can be changed by Teaching Array. When its value set“0” means set a target position and “1” means set an operation speed.

(i) Number of teaching

Set number to execute teaching. Maximum 16 data can be saved. For more information about teaching array operation, refer to “7.4.6 teaching array” item.

(k) Leading address of device where teaching array data are saved.

To execute teaching array, you need to set a specific value first. Teaching Data will be set up depends on number of first device as below table.

Quantity	Device number	Teaching array data
1	Device + 0	Teaching array data 1
2	Device + 1	Teaching array data 2
3	Device + 2	Teaching array data 3
4	Device + 3	Teaching array data 4
5	Device + 4	Teaching array data 5
6	Device + 5	Teaching array data 6
7	Device + 6	Teaching array data 7
8	Device + 7	Teaching array data 8
9	Device + 8	Teaching array data 9
10	Device + 9	Teaching array data 10
11	Device + 10	Teaching array data 11
12	Device + 11	Teaching array data 12
13	Device + 12	Teaching array data 13
14	Device + 13	Teaching array data 14
15	Device + 14	Teaching array data 15
16	Device + 15	Teaching array data 16

(l) Execution completion status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(m) Error status

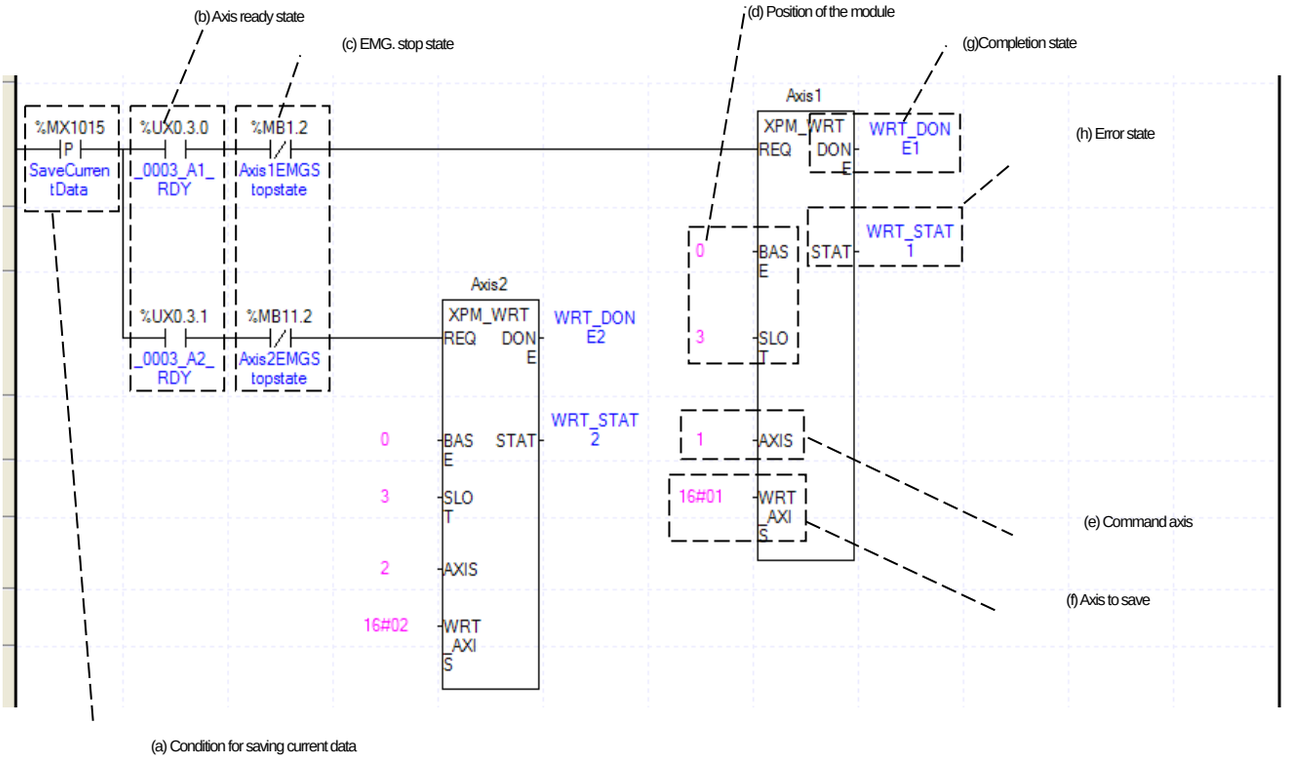
If an error is occurred while the function block executes, this is the area where the error number is output.

(n) The execution details of each function block are as follows.

Axis 1 teaching array: RAM teaching the position values of axis 1 from 13 to 10 steps as the values saved in %MD50 to %MD59.

Axis 2 teaching array: Starting from the %MW132 (axis 2 teaching step) step of axis 2, teach the %MB2666.1 item using the %MB266.0 method with %MB267 saved values from %MD70.

(4) Saving Current Data



(a) Condition of saving current data

Condition of saving current data command (XPM_WRT). When current saving data operated, those values of module parameter and operating data would be saved in MRAM Memory. Therefore, since changing data by RAM setting or RAM teaching are saved MRAM, It maintains whether power is on or not.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Emergency stop status for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'Emergency stop status'. It turns on when it is Emergency stop. The current data save command cannot be executed when the axis is an emergency stop status, so set the condition to execute when the axis is not emergency stop status.

(D) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(e) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command” item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(f) Axis to save

Configure current data operation setting. Choosing axes are configured follow by below table. Therefore even if those axis are not operated as it programmed, saving axis can be saved in Array. The current data (operation data, operation parameter) of the axis that current data save command is executed saved in MRAM, which maintains constantly whether its power is on or not.

15 ~ 8 Bit	7Bit	6Bit	5Bit	4Bit	3Bit	2Bit	1Bit	0Bit
No use	Axis 8	Axis 7	Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1

(g) Execution complete status

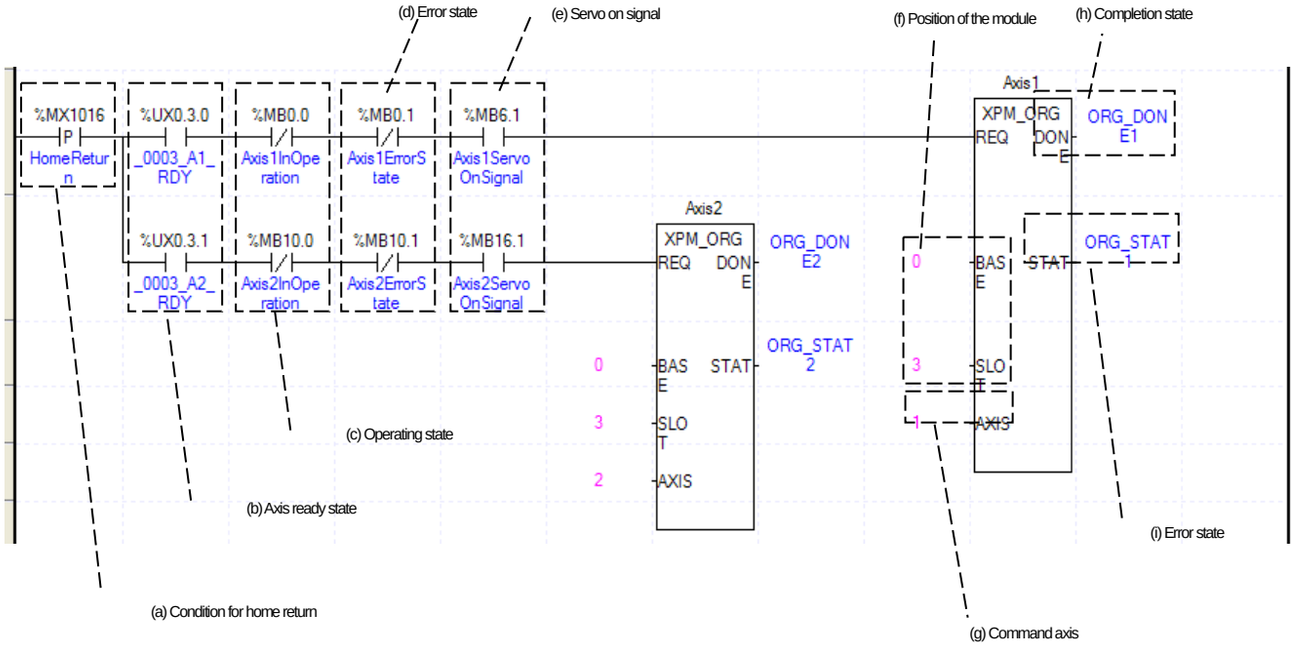
If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(h) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

8.2.6 Positioning Operation

(1) Homing



(a) Condition of homing

Condition of homing command (XPM_ORG)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Homing command cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Homing while it is running, the error 201 would be appeared.

(d) Error status for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'On'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. The homing command cannot be executed when axis is not servo on, hence the condition is set to execute when it is servo on. If you execute homing command while axis is not servo on status, error 203 would be appeared.

(f) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

You can set an axis for Inching Operation. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command” homing item of the command, it can set 1 to 8 meaning axis1 to axis8.

(h) Execution complete status

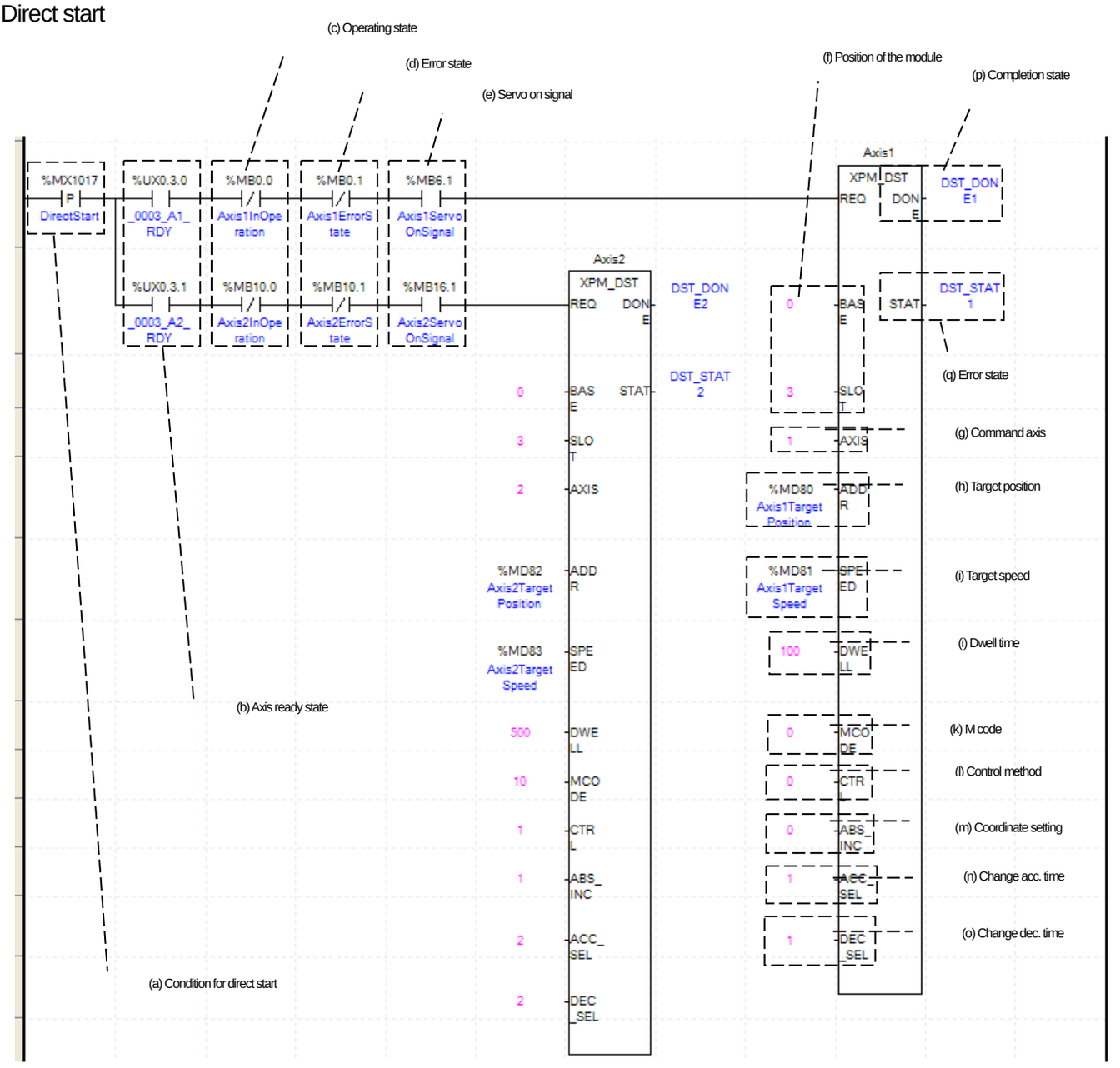
If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(I) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(j) For more information, refer to“9.1 Homing'

(2) Direct start



(a) Condition of direct start

Condition of direct start command (XPM DST)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Direct Start command cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Direct Start while it is running, the error 221 would be appeared.

(d) Error status for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. The direct start command cannot be executed when axis is not servo on, hence the condition is set to execute when it is servo on. If you execute direct start command while axis is not servo on status, error 225 would be appeared.

(f) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

You can set an axis for Inching Operation. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command direct start” item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(H) Target position of direct start

Decide changing position of Direct Start command. In this example above, the initialized value is device, but you can also change it with constant value. The data type is DINT.

(I) target speed of direct start

Set the target speed to be used when executing the axis to perform a direct start command to the set target position. In this example above, the initialized value is device, but you can also change it with constant value. The data type is UDINT.

(j) Direct start dwell time

Dwell Time consider as a total amount of time from beginning of Direct Start operation that reach to the goal position and make output of Positioning Done Signal. That means after done its operation, direct start will make a positioning done signal. The unit is “MS “and the data type is “UINT”.

(k) Direct start M code

You can set a value of M code which are displaying of Operating Parameter by Direct Start. The output method of M code is set to one of three type, 'None',' With’ and 'After' depending on them code mode in expansion parameters”, when value other than “none “is set, the M code will be output. For more information, refer to 'Chapter 4.2.2 Extended parameter setting”.

(l) Control method

Set the control method of direct start. The following operation is executed by the setting value.

0: position control 1: speed control 2: FEED control 3: shortest distance control 4: speed control (CSV)

(m) Coordinate setting

Set the operation coordinate of direct start. The following operation is executed by the setting value.

0: absolute coordinate 1: relative coordinate

(N) Acceleration time number

Set the acceleration time No. to use positioning control. Acceleration operation is executed with related acceleration time of basic parameter depending on setting value.

0: Acceleration time1 1: Acceleration time2 2: Acceleration time3 3: Acceleration time4

(o) Deceleration time number

Set the deceleration time number to use positioning control. Deceleration operation is executed with related acceleration time of basic parameter depending on setting value.

0: Deceleration time1 1: Deceleration time22: Deceleration time3 3: Deceleration time4

(p) Execution complete status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(q) Error status

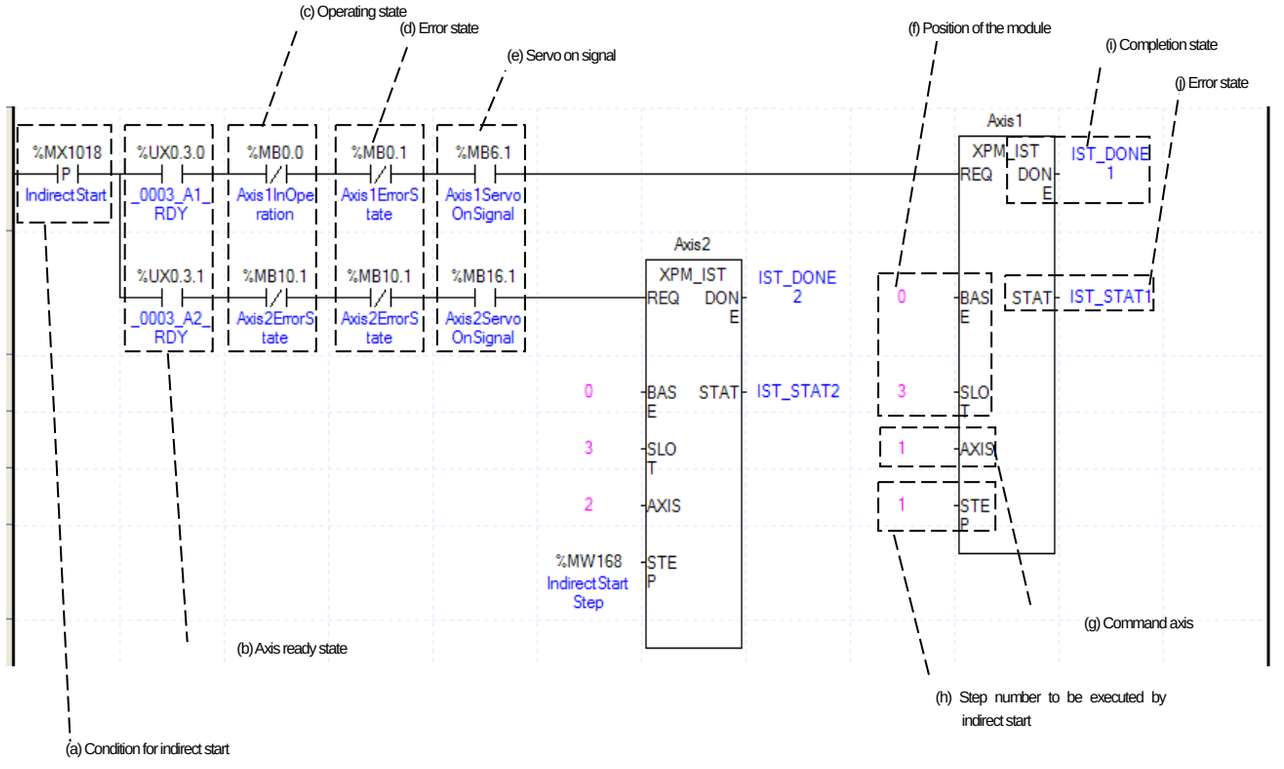
If an error is occurred while the function block executes, this is the area where the error number is output.

(r) The function block operation used in example are as follows.

Executes position control as axis1 direct start: axis1 target position %MD80 (axis1 target position), target speed %MD81 (axis1 target speed), dwell time 100ms, M code 0, absolute coordinate, acceleration time1, deceleration time1.

Executes speed control as axis2 direct start: axis2 target position %MD82 (axis2 target position), target speed %MD83 (axis2 target speed), dwell time 500ms, M code 10, relative coordinate, acceleration time2, deceleration time2.

(3) Indirect start



(a) Condition of indirect start

Condition of Indirect start command (XPM IST)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

"In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Indirect Start while it is running, the error 231 would be appeared.

(d) Error status for each axis

"In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

"In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when the related axis is servo on status. The indirect start command cannot be executed when axis is not servo on, hence the indirect condition is set to execute when it is servo on. If you execute indirect start command while axis is not servo on status, error 235 would be appeared.

(f) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the "axis to command indirect start" item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(h) Operating step number by indirect start

Set the operating step number by indirect start for main command axis.

(i) Execution complete status

If the function block is completed without an error, "1" is output. "1"is maintained until the next execution, if an error occurs, "0"is output.

(j) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

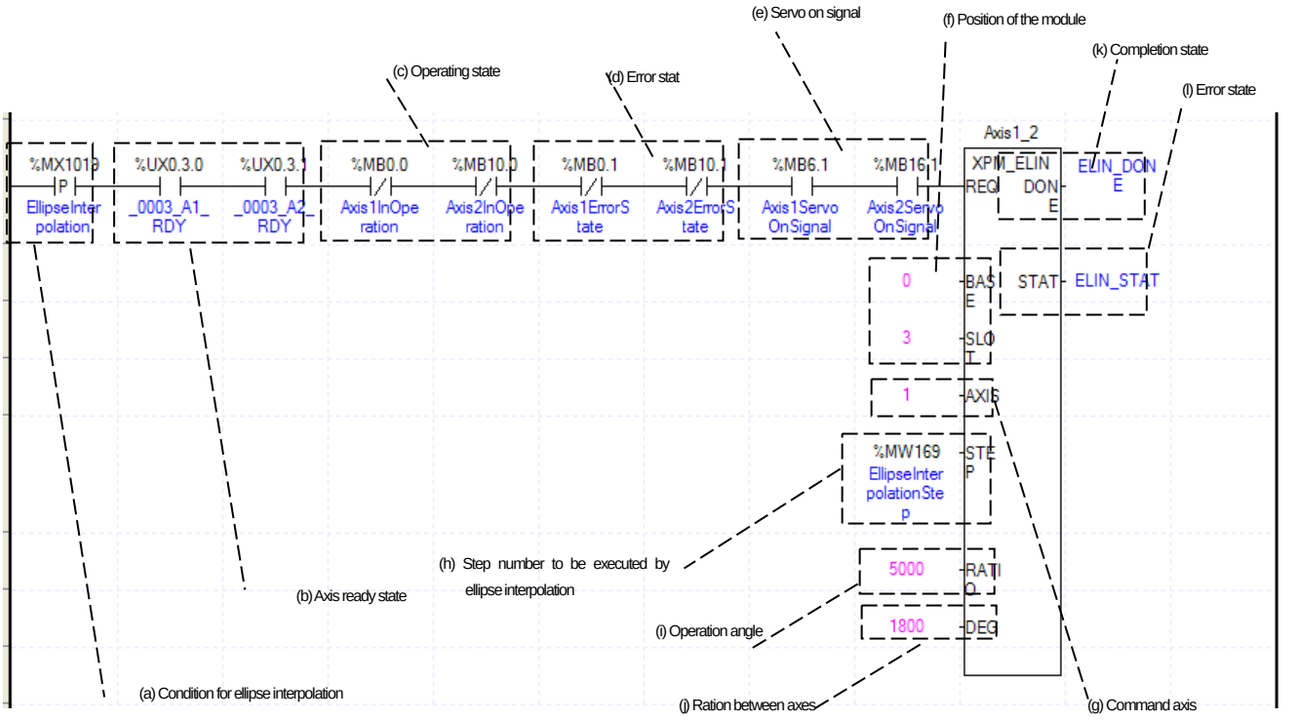
(k) Indirect start operates by appointing step of position data for each axis. Therefore it could run those commands of Positioning control, Speed control, Feed control, Linear circular interpolation depends on setting of positioning data. For more information, refer to "chapter 4.6 Operating Data".

(l) The function block operation used in example are as follows.

Axis1 indirect start: executes indirect start of step1 of axis 1.

Axis2 indirect start: executes indirect start of step %MW168 (indirect start step) of axis 2.

(4) Ellipse Interpolation



(a) Condition ellipse interpolation

Condition of ellipse interpolation command (XPM_ELIN)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on. Since ellipse interpolation is operated on two axes of main axis and subordinate axis, the ready status signal of two axes should be turned on.

(c) Operating state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Ellipse Interpolation while it is running, the error 541 would be appeared.

(d) Error status for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. The ellipse interpolation command cannot be executed when the main axis and subordinate axis are not servo on, hence the condition is set to execute when it is servo on. If the ellipse Interpolation command is executed while the main axis is not servo on status, the error 549 would be appeared. If the ellipse Interpolation command is executed while the subordinate axis is not servo on status, the error 550 would be appeared.

(f) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

You can set an axis for Inching Operation. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command direct start” item of the command, it can set axis 1 to 8 meaning axis1 to axis8. The axis to give

command becomes the main axis.

(h) Operating step number by ellipse Interpolation

Set the operating step number by Ellipse Interpolation. The setting of main operating step and subordinate step is the same.

(I) Ratio of ellipse Interpolation axis

Set both ratio values for main and subordinate axis of set operates data from circular interpolation locus. It is to change circular locus into ellipse locus by using ratio of main and subordinate axis. Unit is [$X10^{-2}$ %]. For more information, refer to"9.2.13 Ellipse Interpolation control'.

(j) Degree of ellipse interpolating operation

Set the degree for Ellipse Interpolating Operation. Unit is [$X10^{-1}$ degree]. For more information, refer to"9.2.13 Ellipse Interpolation control'.

(k) Execution completion status

If the function block is completed without an error, "1" is output. "1"is maintained until the next execution, if an error occurs, "0"is output.

(i) Error status

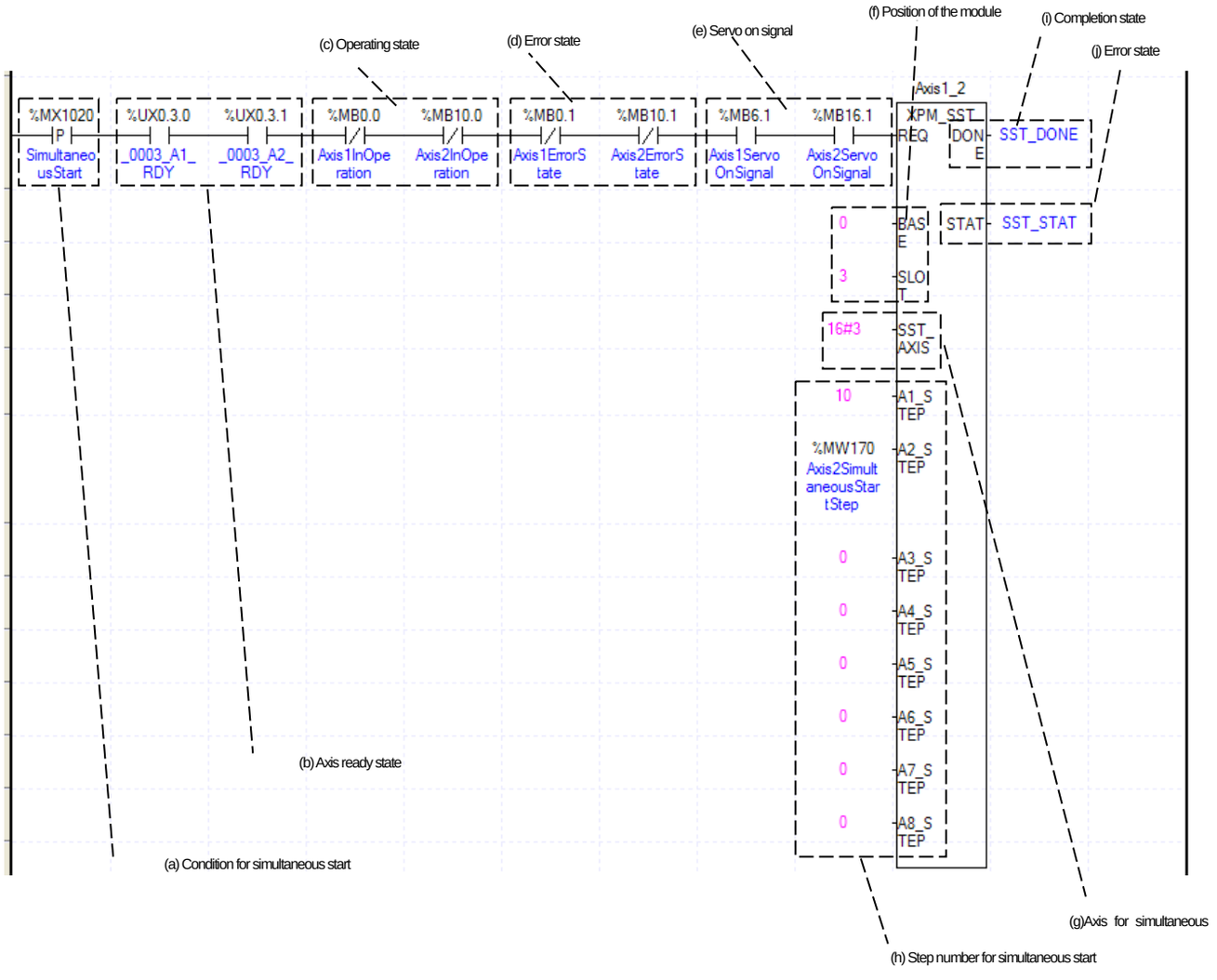
If an error is occurred while the function block executes, this is the area where the error number is output.

(m) Indirect start operates by appointing step of position data for each axis. Therefore, depends on the control method set in the position data, not only positioning control, speed control, Feed control, but also linear circular interpolation, circular interpolation can be executed. For more information, refer to "chapter 4.7 Operating Data".

(n) The function block operation used in example are as follows.

Axis1_2 ellipse interpolation: with axis 1 as the main axis and axis 2 as the sub axis, elliptical interpolation with an axis-to-axis ratio of 50% and a size of 180 degrees is executed using the operation data of step %MW169 (ellipse interpolation step).

(5) Simultaneous start



(a) Condition of simultaneous start

Condition of Simultaneous Start Command

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on. The simultaneous start is operating more than two axes simultaneously, so all axes to be operated by simultaneous start should be ready status.

(c) Operating state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Axis1 Simultaneous Start while it is running, the error 291 would be appeared.

(d) Error status for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

"In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. The simultaneous start command cannot be executed when axis is not servo on, hence condition is set to execute when it is servo on. If you execute simultaneous start command while the axis among simultaneous start axes is not servo on status, the error 295 would be appeared.

(f) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis for synchronous start

Set axis for Synchronous Start. The axis for synchronous start uses a bit from WORD data setting as a"1" for each axis. Axis for each bits are as below.

15 ~ 8 Bit	7Bit	6Bit	5Bit	4Bit	3Bit	2Bit	1Bit	0Bit
Do Not Use	Axis 8	Axis 7	Axis 6	Axis 5	Axis 4	Axis 3	Axis 2	Axis 1

In this program, as it is set to "16# 03", set axis 1 and 2 to operate simultaneous start.

(h) Simultaneous start step number for each axis

Set the step number to execute simultaneous start for each axis.

(i) Execution complete status

If the function block is completed without an error, "1" is output. "1"is maintained until the next execution, if an error occurs, "0"is output.

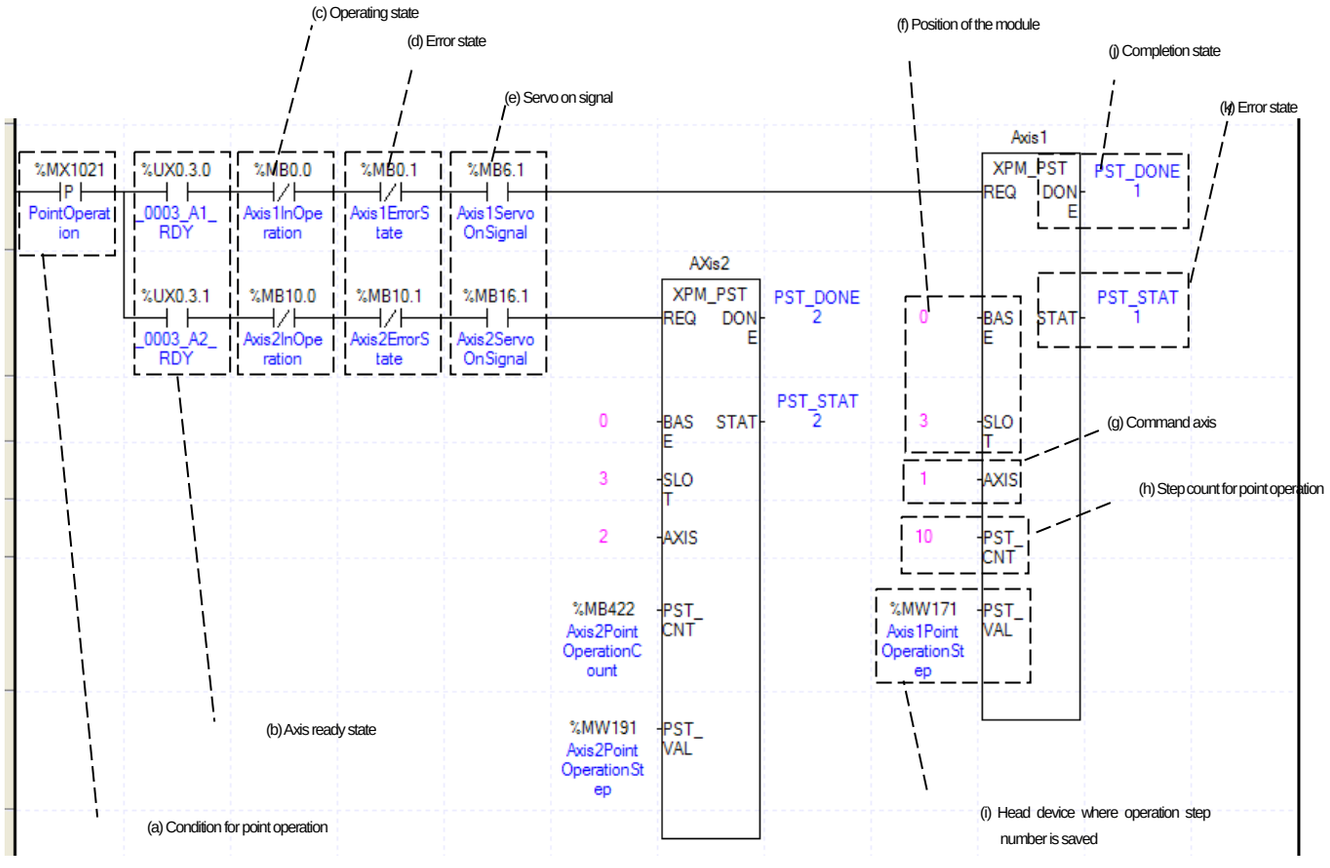
(j) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(k) The function block operation used in example are as follows.

Axis1_2 simultaneous start: executes operation step 10 of axis1 and operation step %MW170 (axis2 simultaneous start step) of axis2 simultaneously.

(6) Point Operation



(a) Condition of point operation

Condition of point operation (XPM PST).

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Point Operation while it is running, the 'error 231 would be appeared.

(d) Error status for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. The point operation start command cannot be executed when axis is not servo on, hence the indirect condition is set to execute when it is servo on.

(f) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the axis to command point operation start (XPM PST) item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(h) Number of point operation steps to operate

Set the number of saving Step numbers by Point Operating Writing command. In this example above, 10 Point Operation steps are set in the axis 1. Therefore, the step number saved in %MW171 to %MW180 are executed as a point operation. For more information, refer to (4) Point operation item of “Chapter 9.2.18 positioning start”.

(I) Leading address of device where step numbers of point operation is saved.

To execute a Point Operation, you need to set a specific value first. Point start step data will be set like item below depending on the leading no. of device.

Quantity	Device number	Point start step data
1	Device + 0	Point start step data 1
2	Device + 1	Point start step data 2
3	Device + 2	Point start step data 3
4	Device + 3	Point start step data 4
5	Device + 4	Point start step data 5
6	Device + 5	Point start step data 6
7	Device + 6	Point start step data 7
8	Device + 7	Point start step data 8
9	Device + 8	Point start step data 9
10	Device + 9	Point start step data 10
11	Device + 10	Point start step data 11
12	Device + 11	Point start step data 12
13	Device + 12	Point start step data 13
14	Device + 13	Point start step data 14
15	Device + 14	Point start step data 15
16	Device + 15	Point start step data 16
17	Device + 16	Point start step data 17
18	Device + 17	Point start step data 18
19	Device + 18	Point start step data 19
20	Device + 19	Point start step data 20

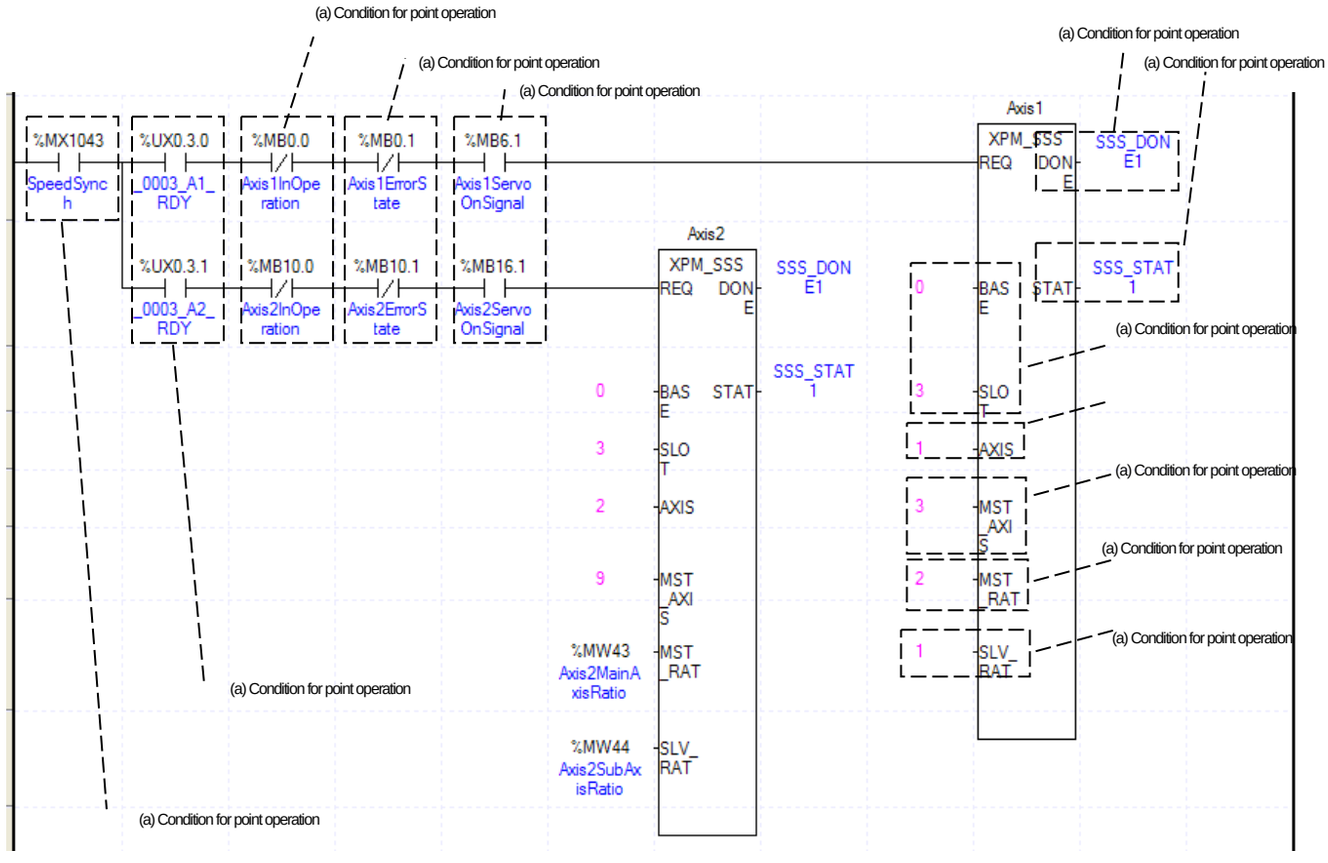
(i) Execution complete status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(j) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(7) Speed synchronization



(a) Condition of speed synchronization

Condition of speed synchronization command (XPM_SSS)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Speed Synchronization while it is running, the error 351 would be appeared.

(d) Error status for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. The speed synchronization command cannot be executed when axis is not servo on, hence the indirect condition is set to execute when it is servo on. If a Servo on signal is not set as 'ON' the 'error 354' would be appeared.

(f) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the axis to command speed synchronization command (XPM_SSS) item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(h) Main axis setting

Setting of main axis to operate Speed Synchronization. This setting is for main axis of Speed Synchronization. This setting cannot be set as same value as command axis, and possible setting values are as below.

Setting Value	Main axis
1	Axis 1
2	Axis 2
3	Axis 3
4	Axis 4
5	Axis 5
6	Axis 6
7	Axis 7
8	Axis 8
9	Encoder 1

(i) Main axis ratio

Set value for Ratio of Main Axis to execute a Speed Synchronization.

(j) Subordinate axis ratio

Set value for Ratio of Subordinate Axis to execute a Speed Synchronization. In this example above, the ratio of main and subordinate axis is 2:1. This means that subordinate axis is operated so that the speed of main axis (axis 1) and speed of subordinate axis (axis 3) have a ratio of 2:1. So, if main axis is operating in speed of 10000, subordinate axis will be operating in speed of 5000.

(k) Execution completion status

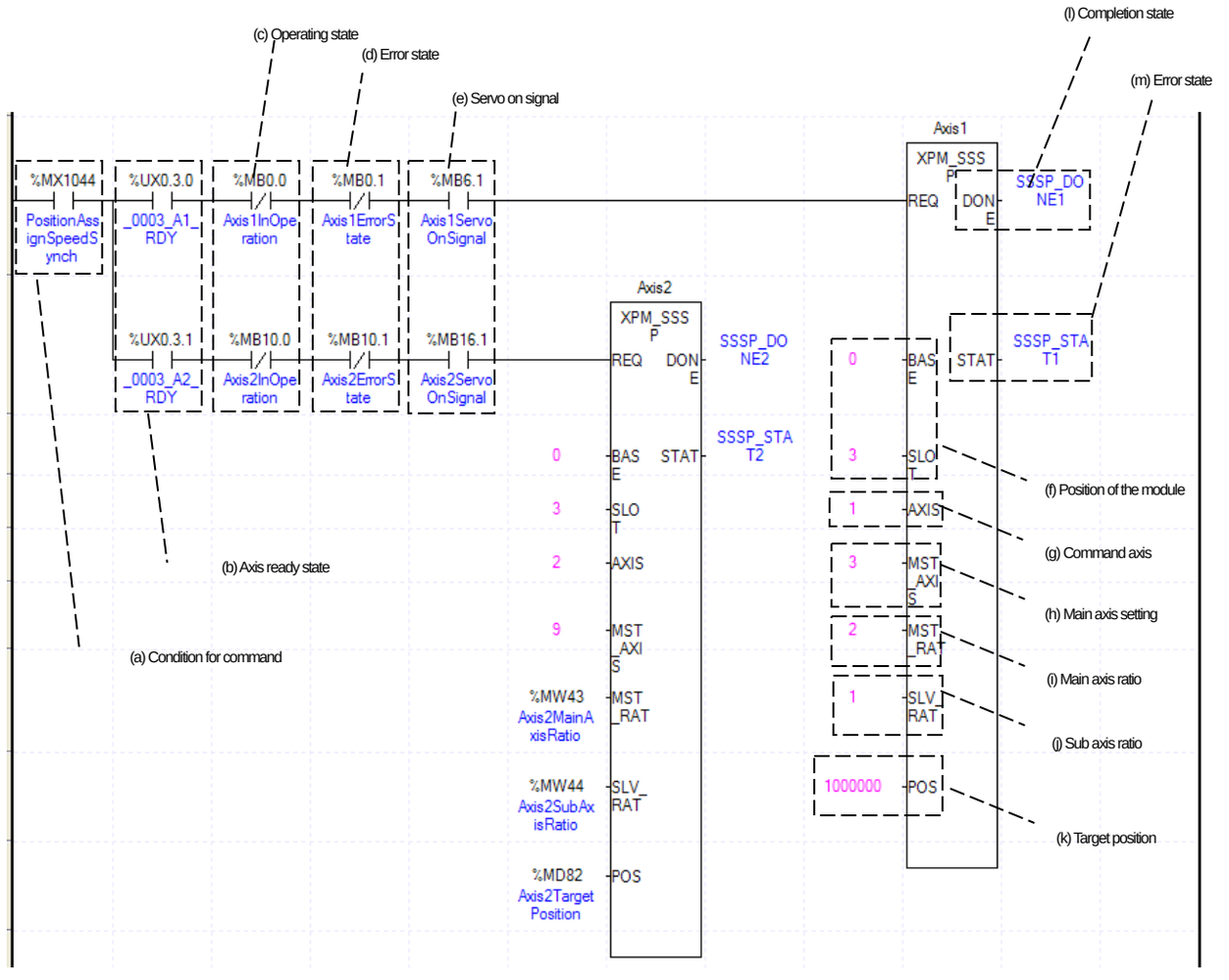
If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(i) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(m) For more information, refer to “Chapter 9.4.1 Speed Synchronization control “.

(8) Speed synchronous start by position



(a) Condition of position specified speed synchronization

Condition of position specified speed synchronization command (XPM_SSSP)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Position specified speed synchronization command cannot be executed while it is operating hence configuration will only be configured when it is not operation. If you execute position specified speed synchronous while it is operating, the error 351 would be appeared.

(d) Error status for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. The position specified speed synchronization command cannot be executed when axis is not servo on,

hence the condition is set to execute when it is servo on. If position specified speed synchronization command is executed while Servo on signal is not set as 'ON', the 'error 354' would be appeared.

(f) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the axis to command position specified speed synchronization (XPM_SSS) item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(h) Main axis setting

Setting of main axis to operate Speed Synchronization. This setting is for main axis of Speed Synchronization. This setting cannot be set as same value as command axis, and possible setting values are as below.

Setting Value	Main axis
1	Axis 1
2	Axis 2
3	Axis 3
4	Axis 4
5	Axis 5
6	Axis 6
7	Axis 7
8	Axis 8
9	Encoder 1

(i) Main axis ratio

When setting value for ratio of main axis and subordinate axis to execute a speed specified speed synchronous, this is the ratio of related main axis.

(j) Subordinate axis ratio

Set value for Ratio of Subordinate Axis to execute a Speed Synchronization. In this example above, the ratio of main and subordinate axis is 2:1. Meaning that operational speed ratio of those axes is 2 to 1. So, if main axis is operating in speed of 10000, subordinate axis will be operating in speed of 5000.

(k) Target position

Set goal of Position Assign Speed Synchronization. Once command axis reaches the goal position, Speed Synchronization ends and operation will be stop immediately. In the example above, if target position of axis 1 is 1000000 while operating speed synchronization, it completed speed synchronization and stops.

(l) Execution complete status

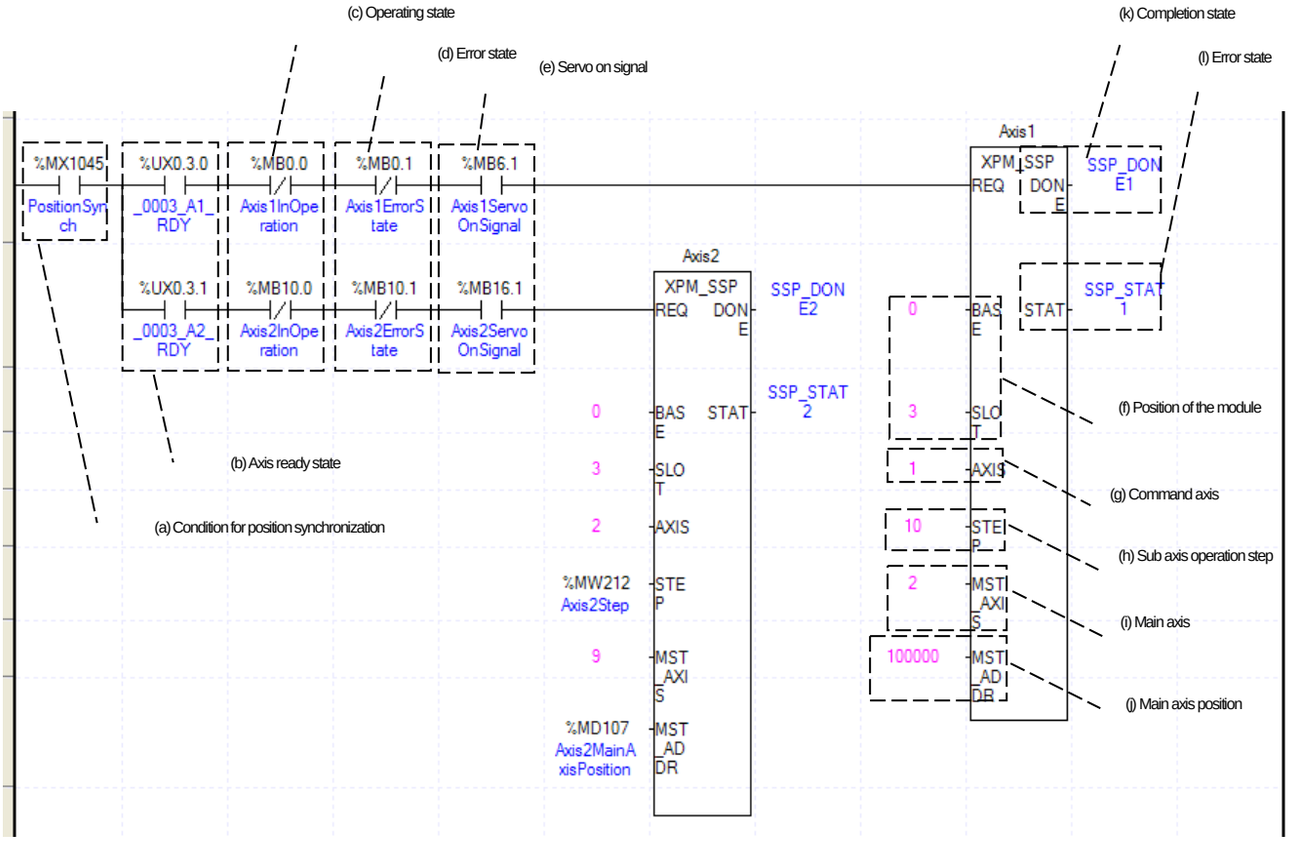
If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(m) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(n) For more information, refer to “Chapter 9.4.1 (5) Position specified speed synchronization control”.

(9) Position synchronous start



(a) Condition of position synchronous

Condition of position synchronous command (XPM_SSP)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Synchronous Start by Position while it is running, the error 341 would be appeared.

(d) Error status for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. The position synchronization command cannot be executed when axis is not servo on, hence the indirect condition is set to execute when it is servo on. If position synchronization command is executed while Servo on signal is not set as 'ON', the 'error 354' would be appeared.

(f) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the axis to command position synchronization command (XPM_SSP) item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(h) Main axis position values

Set value for Main Axis to execute Synchronous Start by Position. Therefore main axis will be executed the command when the subordinate axis reaches this set value.

(i) Subordinate axis operation step

Set step number for Subordinate Axis to execute a Speed Synchronization.

(j) Main axis setting

Setting of main axis to operate Speed Synchronization. This setting is for main axis of Speed Synchronization. This setting cannot be set as same value as command axis, and possible setting values are as below.

Setting Value	Main axis
1	Axis 1
2	Axis 2
3	Axis 3
4	Axis 4
5	Axis 5
6	Axis 6
7	Axis 7
8	Axis 8
9	Encoder 1

(k) Execution completion status

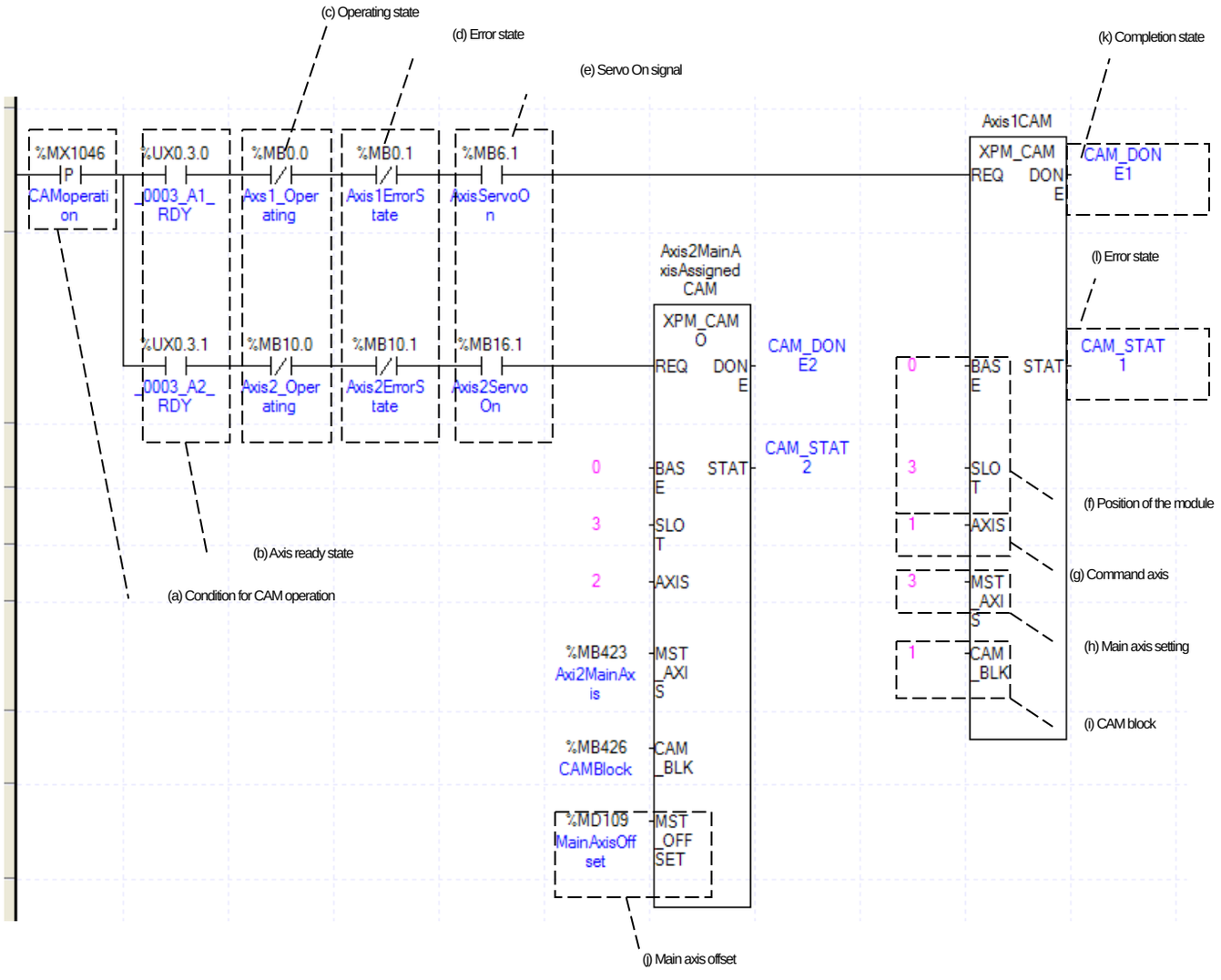
If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(i) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(m) For more information, refer to “Chapter 9.4.2 Position synchronous control”.

(10) CAM operation



(a) Condition of CAM operation

Condition of CAM operation command (XPM_CAM)) and main axis offset specified CAM operation command (XPM_CAMO)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute CAM Operation while it is running, the error 701 would be appeared.

(d) Error status for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Servo on signal for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on

when it is servo on status. The CAM operation command cannot be executed when axis is not servo on, hence the condition is set CAM execute when it is servo on. If CAM operation command is executed while Servo on signal is not set as 'ON', the 'error 703' would be appeared.

(f) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command CAM operation (XPM_CAM)” item of the command, it can set 1 to 8 meaning axis1 to axis8.

(h) Main axis setting

Setting of main axis to operate .This setting is for main axis of CAM Operating. This setting cannot be set as same value as command axis. Can set for the 1~8, meaning from axis 1 to axis 8 and 9 meaning encoder1.

(i) CAM block numbers

Setting for Block Numbers of CAM data to operate CAM operation. Setting to 8 CAM blocks, the CAM data for each block would be downloaded to module written from Software Package.

(j) Main axis option

For main axis offset specified CAM operational command (XPM_CAMO), the subordinate axis sets the main axis’s offset position to start CAM. After executing command, the subordinate axis starts CAM operation after main axis move as much as the position set in the main axis offset.

(k) Execution completion status

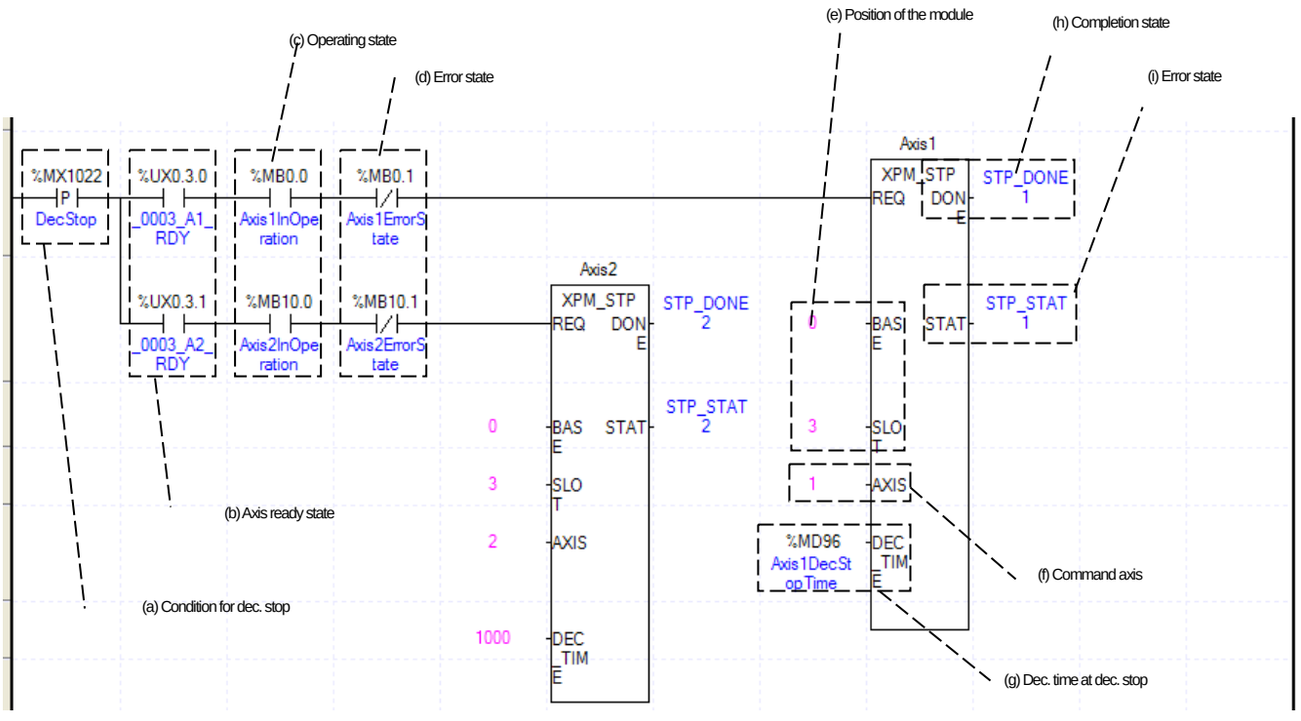
If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(i) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(m) For more information, refer to Chapter 9.4.3 CAM Operation”.

(11) Deceleration stop



(a) Condition of deceleration stop

Condition of deceleration stop command (XPM_STP)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running.

(d) Error status for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(f) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command deceleration stop” item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(g) Deceleration time of deceleration stop

Setting a deceleration time of Deceleration Stop operation. Unit of Deceleration Stop is [ms]. Since the unit of deceleration stop time is [ms], means deceleration time from speed limit, it may be differ from the actual deceleration time. The range of deceleration time is“0~2,147,483,674”. “1~2,147,483,674 means deceleration time set as 1ms ~ 2,147483674ms. If it set as 0' it will be operated with set deceleration time. Addition, It use to stop speed synchronous operation or CAM operation while speed and CAM operation. At the moment, if deceleration stop is executed, speed deceleration and CAM operation is off and deceleration stop at the set

deceleration time.

(h) Execution complete status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

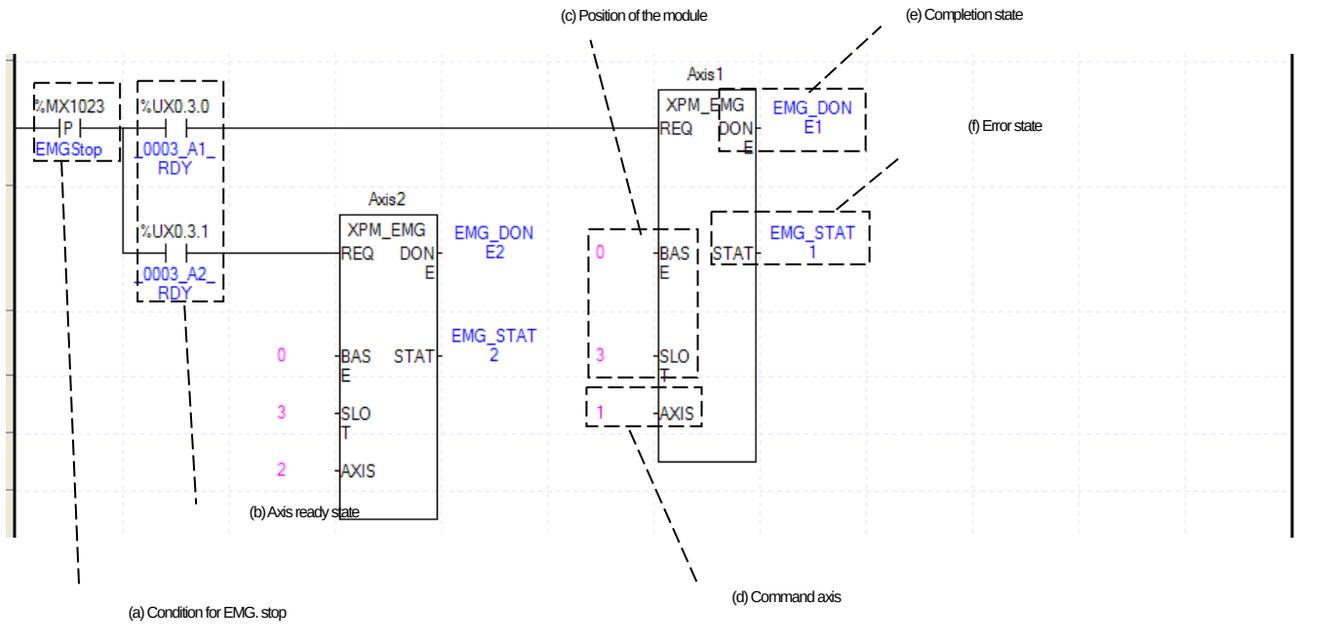
(I) Error status

If an error is occurred while the function block executes, this is the area where the error number is output. For more information, refer to (2) deceleration stop of “Chapter 9.2.19 Positioning stop”.

(k) The execution details of each function block are as follows.

Axis 1 deceleration stop: if axis 1 is operating, it decelerates to the %MD96 (axis1 deceleration stop time) deceleration time and then stop. Axis 2 deceleration stop: if axis 2 is operating, it decelerates to 1000ms deceleration time and then stop.

(12) Emergency stop



(a) Condition of emergency stop

Condition of emergency stop command (XPM_EMG)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) The mounting position of positioning module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(d) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command” emergency stop item of the command, it can set 1 to 8 meaning axis1 to axis8.

(e) Execution completion status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

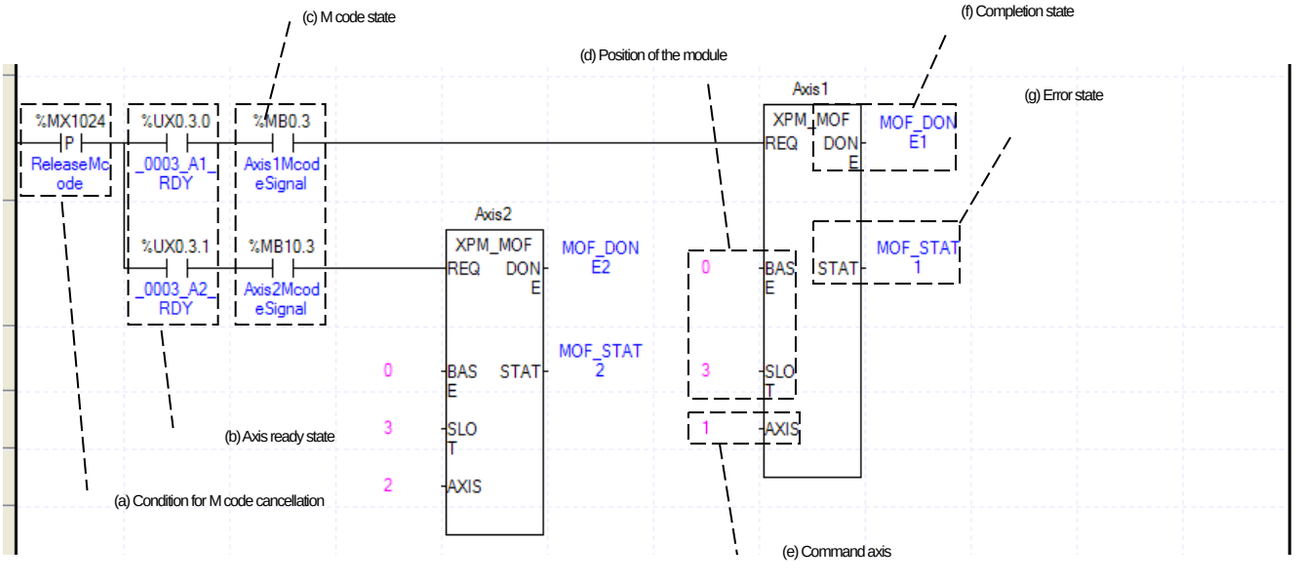
(f) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(g) Emergency stop is operating by each axis. Once emergency stop command executes, the error 481 would be occurred. With the set value for deceleration time, it will be decelerated and stop the operation.

(h) For more information, refer to (4) emergency stop of “Chapter 9.2.19 Positioning stop”.

(13) M code Off



(a) Condition of M code off

Condition of M code off command (XPM_MOF). Once M code cancellation command executed, number of M code would be change to” 0' and signal of M code to Off.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) M code status for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, this is M code signal for each axis. If M code occurred on the related axis, it becomes 'on'. M code Cancellation command can only be valid once M code are generated. The condition for execution is operation possible when it is 'On'.

(D) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(e) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command M code off command (XCAM)” item of the command, it can set 1 to 8 meaning axis1 to axis8.

(f) Execution completion status

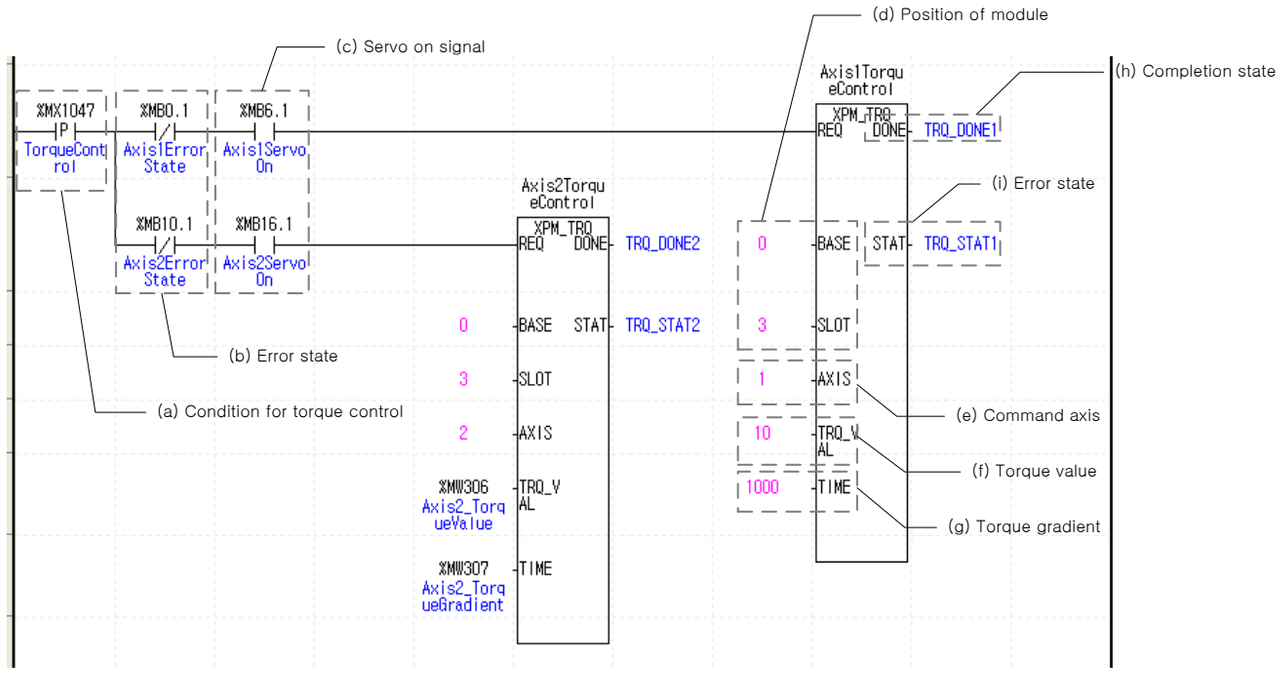
If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(g) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(h) For more information, refer to “Chapter 9.6.2 M code”.

(14) Torque control



(a) Condition of torque control

Condition of torque control command (XPM_TRQ) when executing command, the axis executes torque control with the set torque values and torque slope.

(b) Error state for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(c) Servo on signal for each axis

“In case that an example program of '8.1.2 Read Current State' is applied, it is a signal showing each axis is 'servo on'. It turns on when it is servo on status. Torque control command cannot be executed when axis is not servo on, hence the condition is set CAM execute when it is servo on. If you execute torque control command while axis is not servo on status, error 743 would be appeared.

(d) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(e) Axis of command execution

You can set an axis to execute torque control command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command torque control command “item of the command, it can set 1 to 8 meaning axis1 to axis8.

(f) After executing the torque control command, set the torque values to operate torque control. The range of torque values is -32768 ~ 32767%.

(g) Set the slope to the target torque in hours. The inclination range is 0~ 65535ms.

(h) Execution complete status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

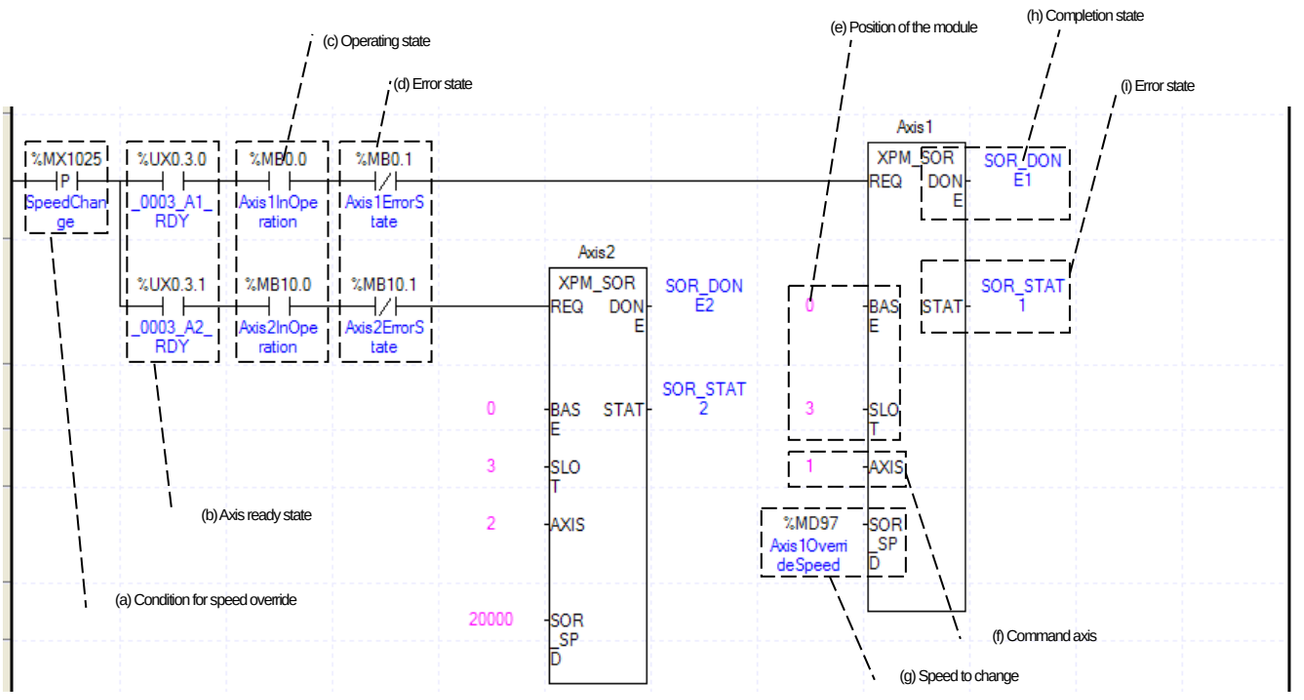
(i) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(j) For more information about operation of the torque control command, refers to “9.2.21 Torque control”.

8.2.7 Operation Setting Change while Operating

(1) Speed override



(a) Condition of Speed Override

Condition of speed override command (XPM_SOR)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state by axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Speed Override while it is running, the error 371 would be appeared.

(d) Error state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(f) Axis of command execution

You can set an axis for Speed Override command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command speed override command “item of the command, it can set 1 to 8 meaning axis1 to axis8.

(g) Value Change for Operation speed

Setting Value Change for Operation speed. According to speed override from common parameters, it is a signal of "%" or "Speed Value“%” depends on setting of category. Also, when the speed override of common parameter set as speed value, it means “unit/time” or “rpm” depends on speed command unit from basic parameters. If a changing operation speed value is '%' then the unit would be [$X10^{-2}$%]. If it is 'rpm' then the unit would be [$X10^{-1}$rpm].

(h) Execution complete status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(i) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

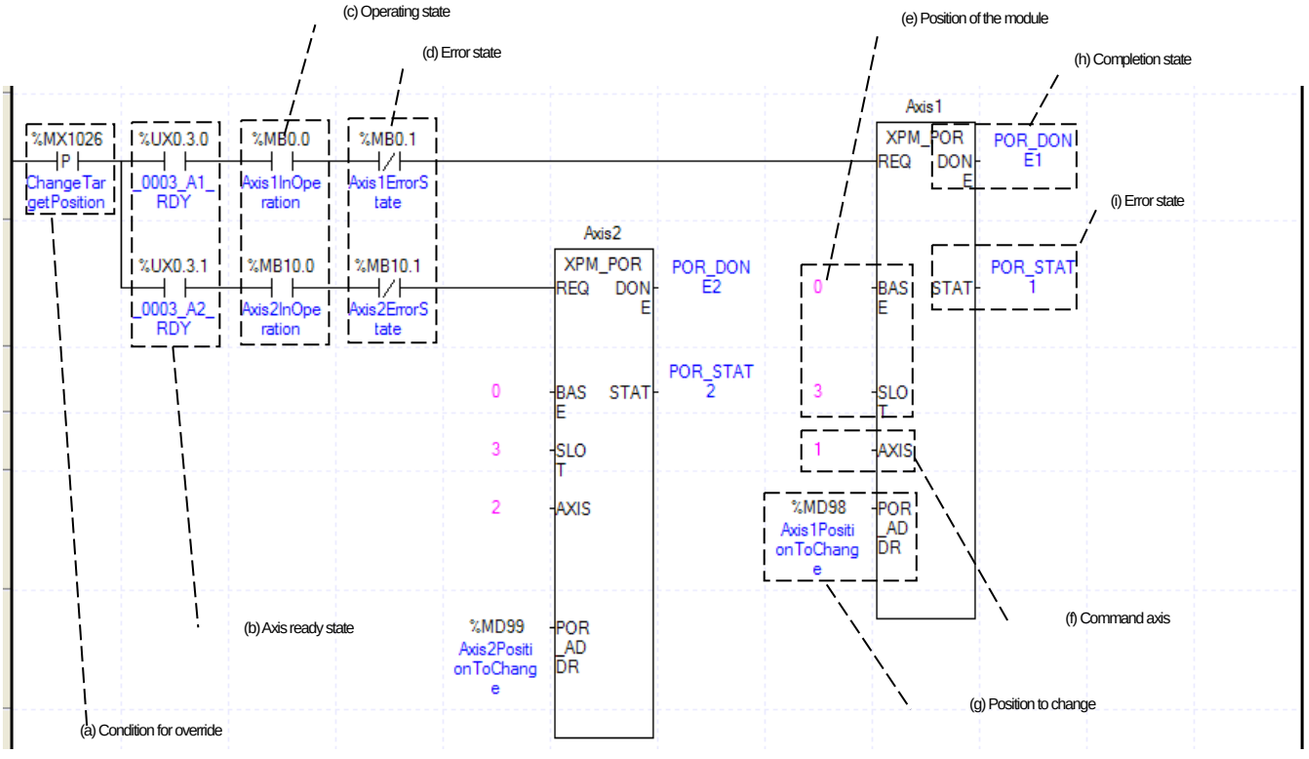
(j) In the example above, the function block operation are as follows.

Axis1 speed override: the operation speed of axis 1 is changed to the speed values saves in %Md97 (axis 1 override speed).

Axis 2 speed override: the operation speed of axis 2 is changes to 20000 and operates.

(k) For more information, refer to “Chapter 9.5.5 speed override”.

(2) Position override



(a) Condition of Position Override

Condition of position override command (XPM_POR)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state by axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Position Override while it is running, the error 361 would be appeared.

(d) Error state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(f) Axis of command execution

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command position override command” item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(g) Target position value to change

Setting Value Change for Goal Position Value. The unit of this value depends on 'Unit' category. Once Position Override commands are executed, the goal position of executed axis will be changed to set goal position.

(h) Execution complete status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(i) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

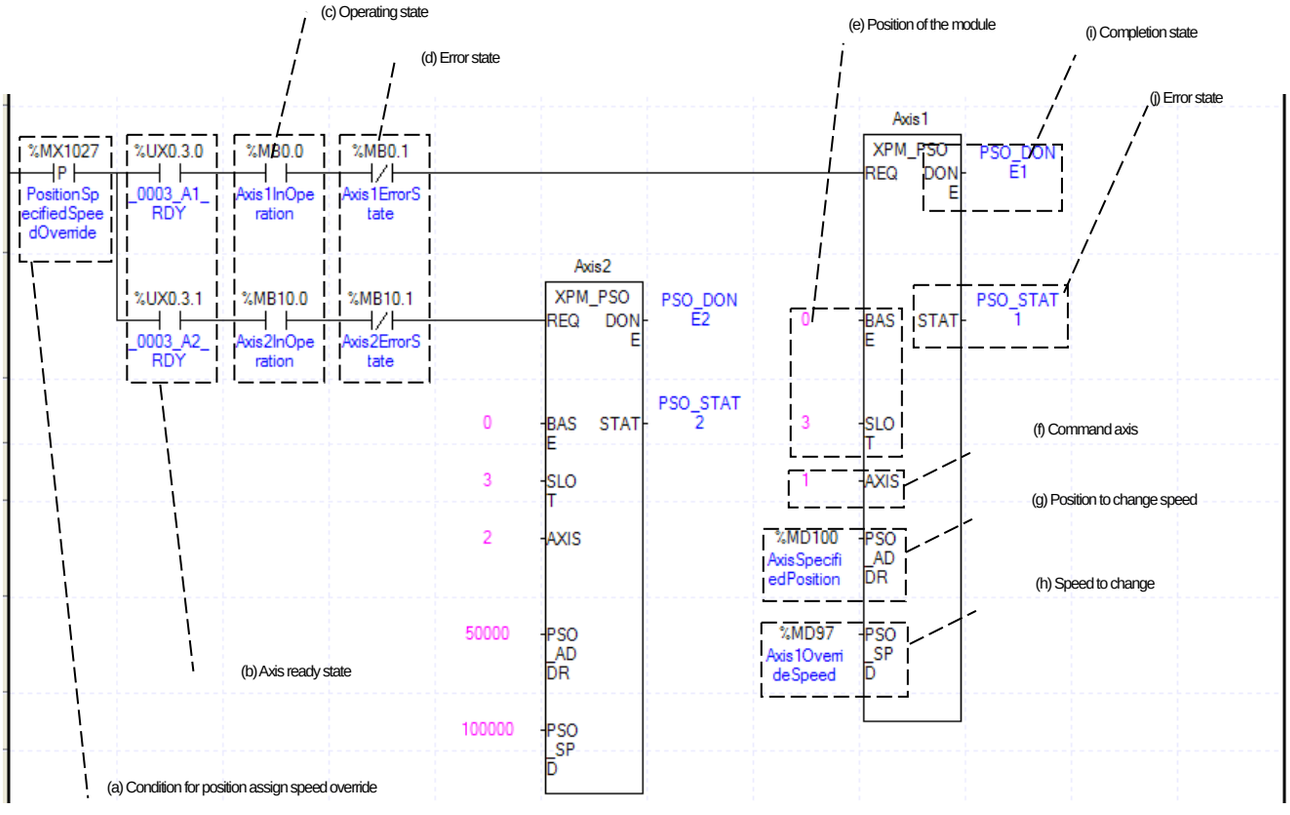
(j) In the example above, the function block operation are as follows.

Position override of axis 1: target position of axis 1 is changed to position values saved in %MD98 (axis 1 changing position).

Position override of axis 2: target position of axis 2 is changed to position values saved in %MD99 (axis 2 changing position).

(k) For more information, refer to “Chapter 9.5.4 position override”.

(3) Position specified speed override



(a) Condition of Position Assign Speed Override

Condition of position specified speed override command (XPM_PSO)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state by axis

"In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Position Assign Speed Override while it is running, the error 381 would be appeared.

(d) Error state for each axis

"In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(f) Axis of command execution

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the "axis to command position specified speed override command" item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(g) Position of Speed Change Execution

Setting position of Speed Change. Once the actual position located at set position with speed override command running, the speed change commands are executed. The unit depend on the setting value in "unit "in the basic parameter.

(h) Value Change for Operation speed

Setting Value Change for Operation speed. According to Speed Override from common parameters "it is a signal of "%" or "Speed Value"%" depends on setting of category. Also, when the speed override of common parameter set as speed value, it means "unit/time" or "rpm" depends on speed command unit from basic parameters. If a changing operation speed value is '%' then the unit would be [$X10^{-2}$%]. If it is 'rpm' then the unit would be [$X10^{-1}$rpm].

(i) Execution complete status

If the function block is completed without an error, "1" is output. "1"is maintained until the next execution, if an error occurs, "0"is output.

(j) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

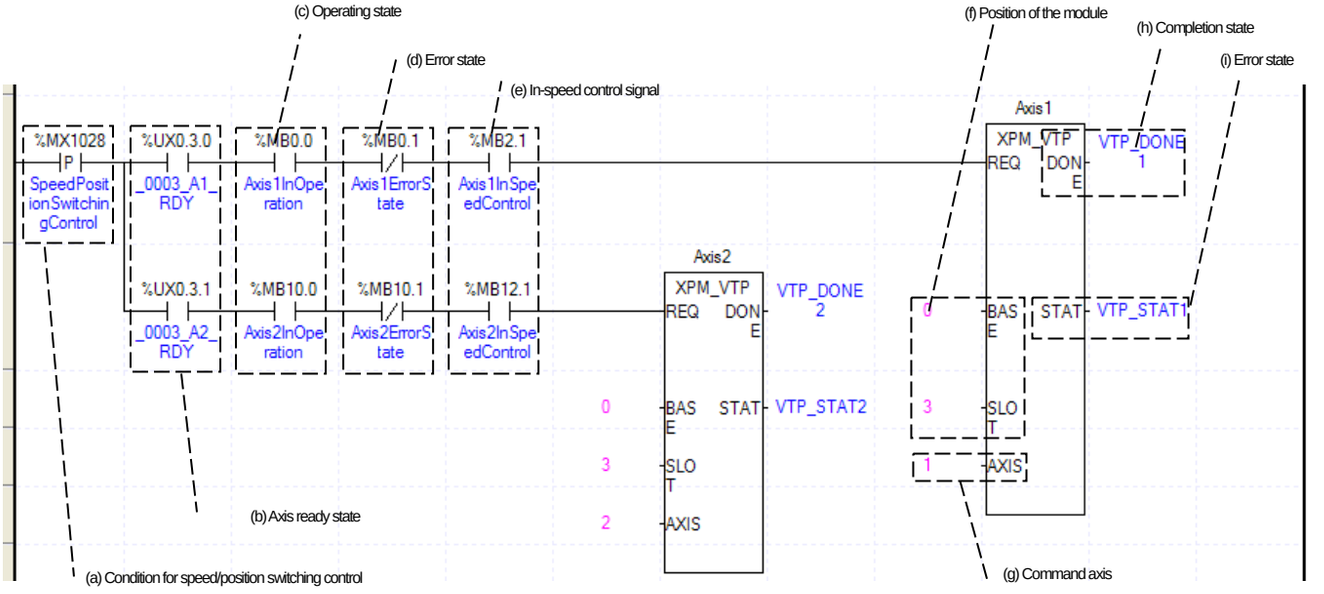
(k) In the example above, the function block operation are as follows.

Axis 1 position specified speed override: when the current position of axis 1 reaches the position where %MD100 (axis1 specified position) is saved, it is changed to the speed values saved %MD92 (axis1 override speed) and is operated.

Axis 2 position specified speed override: when the current position of axis 1 reaches 50000, it is changed to 100000 and is operated.

(l) For more information, refer to"9.5.6 Position Specified Speed Override".

(4) Speed/position switching control



(a) Condition to execute speed/position switching control

Condition of speed/position switching control command (XPM VTPP)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Speed/Position Switching Control while it is running, the error 301 would be appeared.

(d) Error status for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Signal for speed control for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'controlling its speed“. If the relevant axis is operating under speed control, it becomes 'On'. Speed/Position Switching Control Setting can only be configured while it is running. If you execute Speed/Position Switching Control while it is not running, the error 302 would be appeared.

(f) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command speed/position switching control command” item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(h) Execution complete status

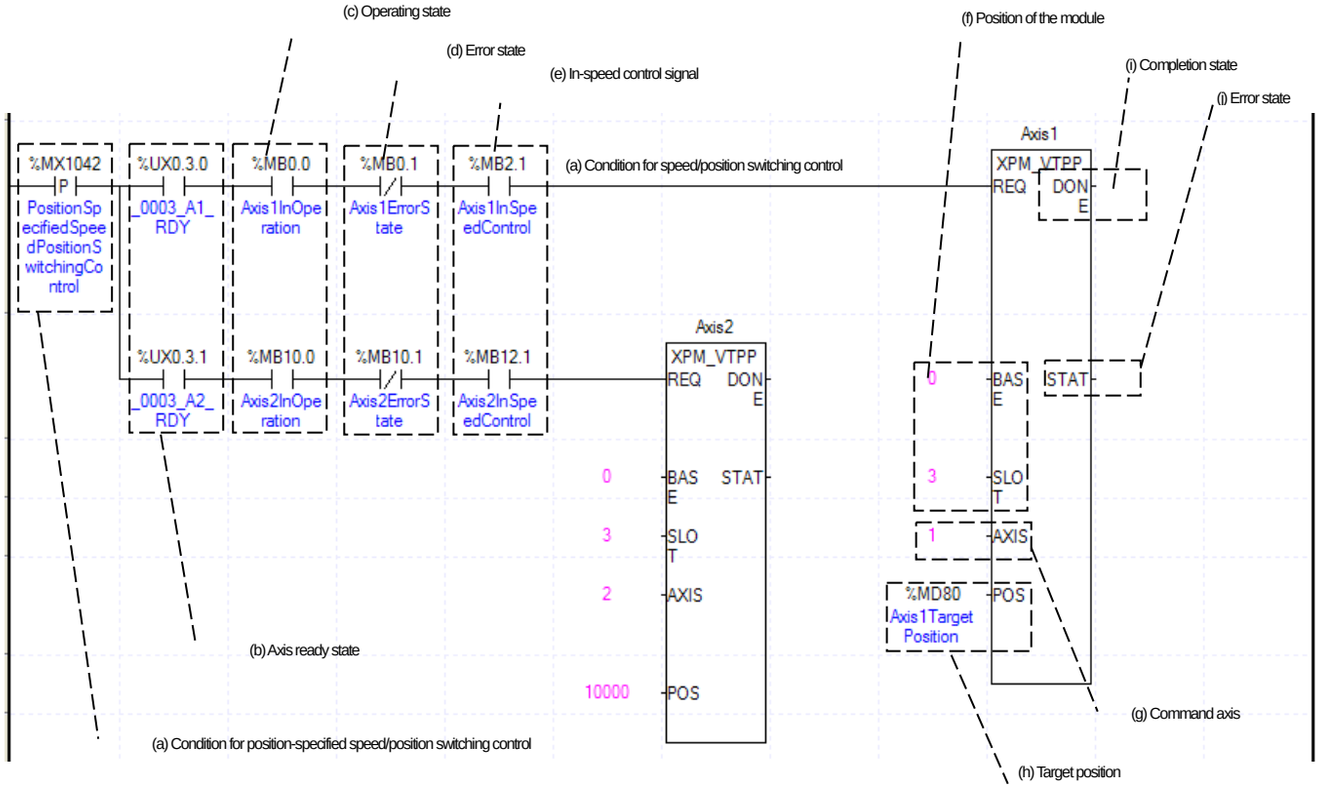
If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(I) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(j) For more information, refer to “Chapter 9.2.14 Speed/position switching control”.

(5) Position specified speed/position switching control



(a) Condition to perform position-specified speed/position switching control.

Condition to execute position specified speed/position switching control command (XPM VTPP)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state by axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. A condition has been set to make the control command for position specified speed/position switching valid only when the relevant axis is running. If the control command for position specified switching is carried out when the relevant axis is not running, No.301 Error will take place.

(d) Error state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Speed Control Signal for each axis

"In case that an example program of '8.2.2 Current Status Read' is applied, it is a signal "in speed control "for each axis. If the relevant axis is operating under speed control, it becomes 'On'. A condition has been set to make the control command for position specified speed/position switching control valid only when the relevant axis is in a speed control status. If the control command is carried out when the relevant axis is not in a speed control status, No.302 Error will take place.

(f) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis of command execution

Decide an axis that will execute the control command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the "axis to command position specified speed/position switching control command" item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(h) Target position

After the control command for position specified speed/position control switching is executed, convert from speed control to position control and moves by transfer amount. The position values set at the time of speed control start is ignored.

(i) Execution complete status

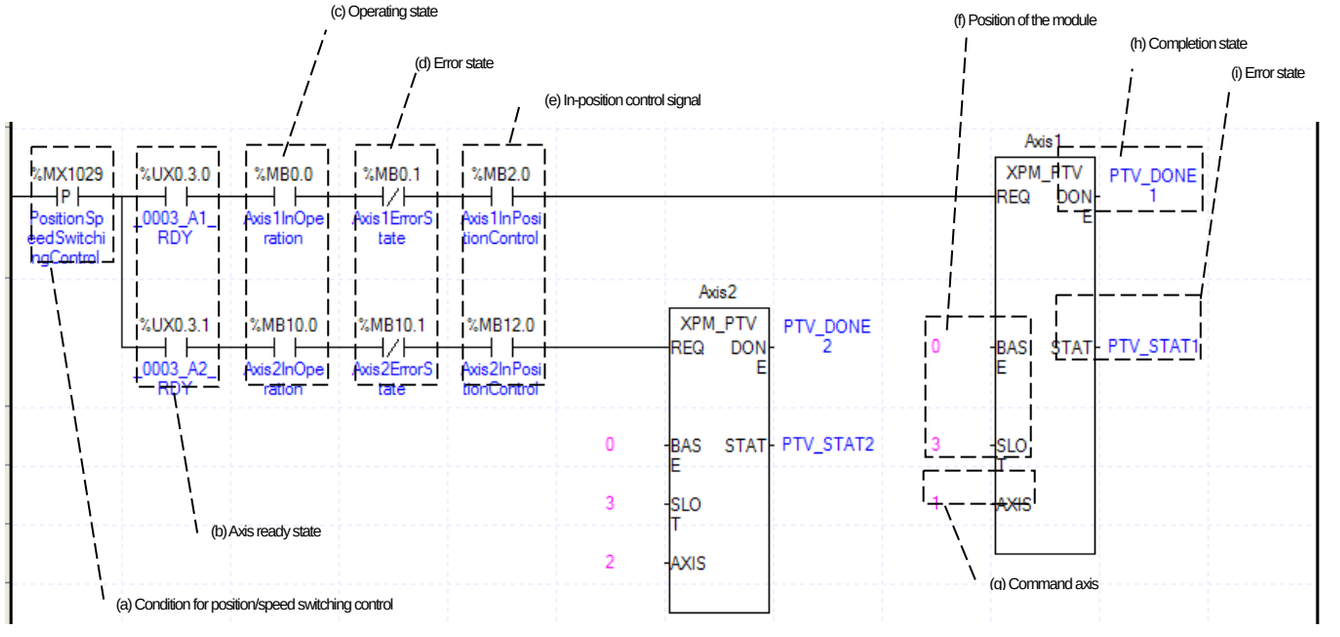
If the function block is completed without an error, "1" is output. "1"is maintained until the next execution, if an error occurs, "0"is output.

(j) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(k) For details on the operation of position specified speed/position switching control, refer to "9.2.15 Position specified speed/position switching control".

(6) Position/speed switching control



(a) Condition of position/ speed switching control

(b) Condition of position/speed switching control command (XPM)

(c) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(d) Operating state for each axis

"In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Position/ Speed Switching Control while it is running, the error 311 would be appeared.

(e) Error status for each axis

"In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(f) Signal from position control for each axis

"In case that an example program of '8.2.2 Read Current State' is applied, it is in position control signal for each axis. If the relevant axis is operating under position control, it becomes 'On'. Position/ Speed Switching Control Setting can only be configured while it is running. In the example program, it is executed only when the related axis is in the position control. If you execute Position/Speed Switching Control while it is not running, the error 317 would be appeared.

(g) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(h) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the "axis to command position/speed switching control command" item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

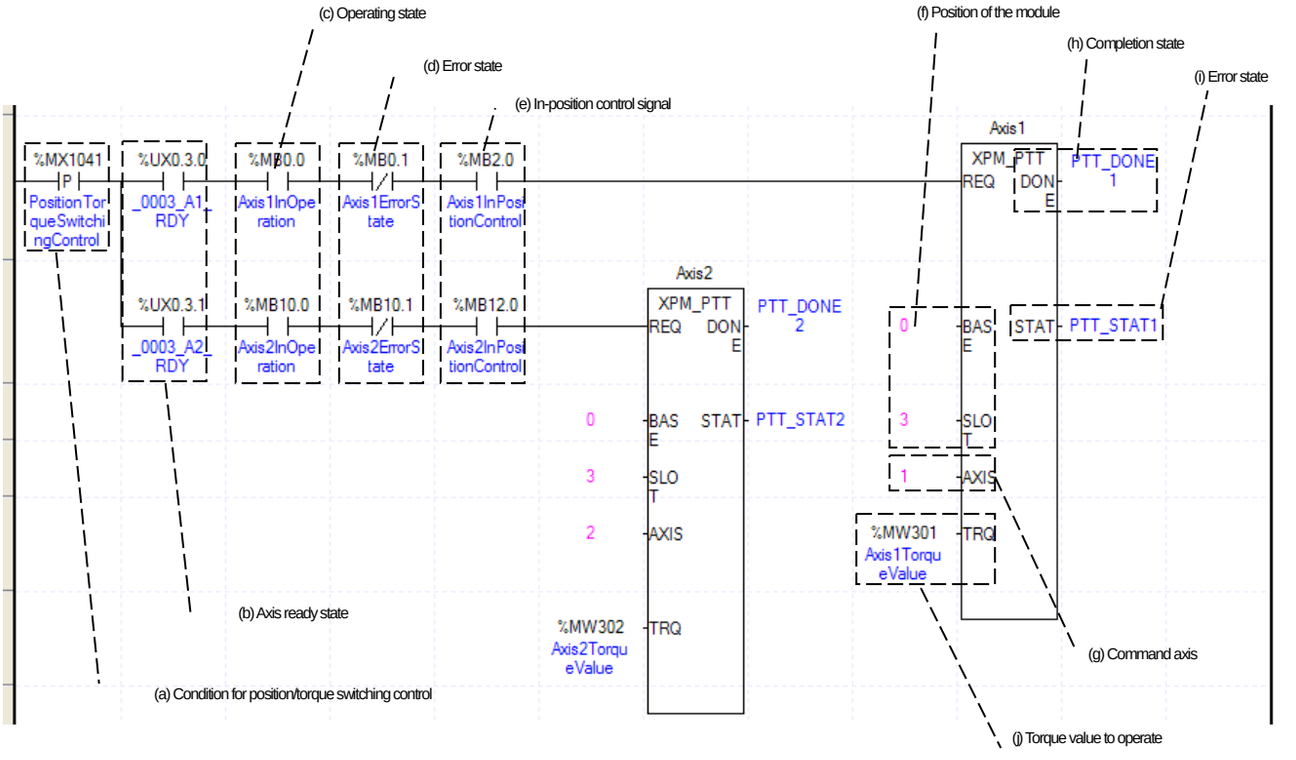
(i) Execution complete status

If the function block is completed without an error, "1" is output. "1"is maintained until the next execution, if an error occurs, "0"is output.

(j) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.
For more information, refer to "Chapter 9.2.16 Position/speed switching control".

(7) Position/torque switching control



(a) Condition of position/ torque switching control

Condition of position/ torque switching control command (XPM_PTT)

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state by axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. The position/torque switching control is valid command only when the axis is operating, the condition is set to execute only when the axis is operating. If you execute position/torque switching control while it is running, the error 561 would be appeared.

(d) Error state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Signal from Position Control by each Axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is in position control signal for each axis. If the relevant axis is operating under position control, it becomes 'On'. Position/torque switching control command can only be configured while it is running. In the example program, it is executed only when the related axis is in the position control. If you execute position/torque switching control command while it is not running, the error 317 would be appeared.

(f) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(g) Axis of command execution

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command position/torque switching control” item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(h) Execution complete status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

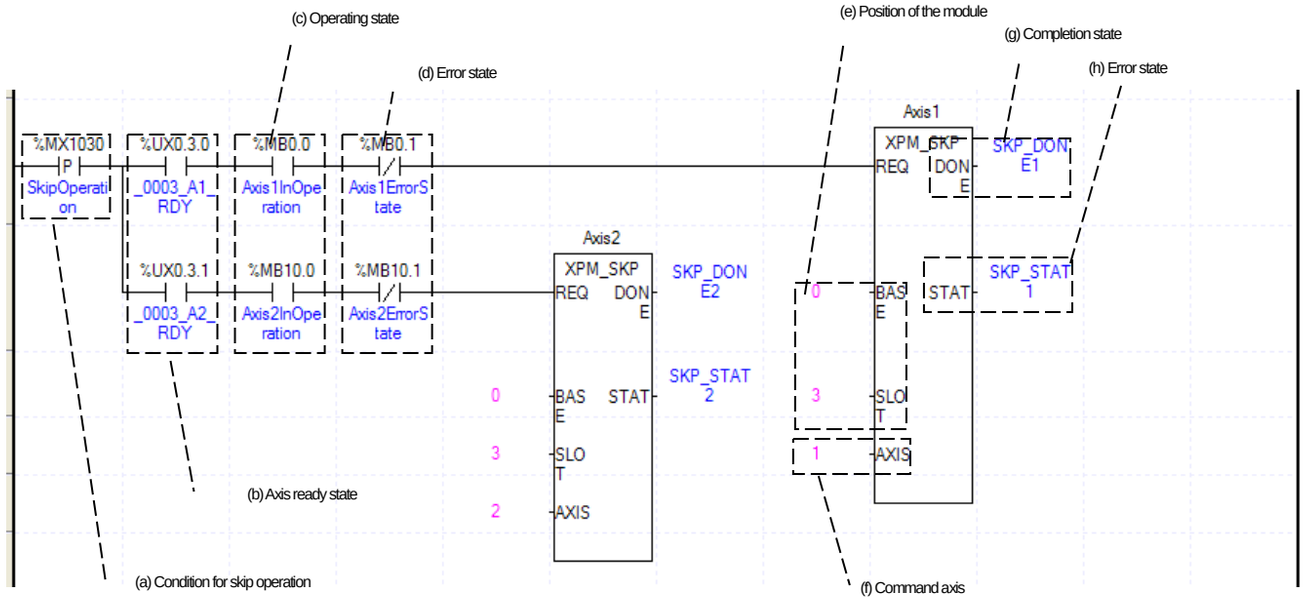
(i) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(j) After changing to torque control with operating torque values, this is area to set torque values to execute

(k) For more information, refer to “Chapter 9.2.17 Position/Torque switching control”.

(8) Skip operation



(a) Condition of skip operation

Condition of skip operation command (XPM_SKP). When skip operation is executed, the axis stops the current operating step and operates the next step.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Skip Operation while it is running, the error 331 would be appeared.

(d) Error status for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(f) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command skip operation command” item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(g) Execution complete status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is

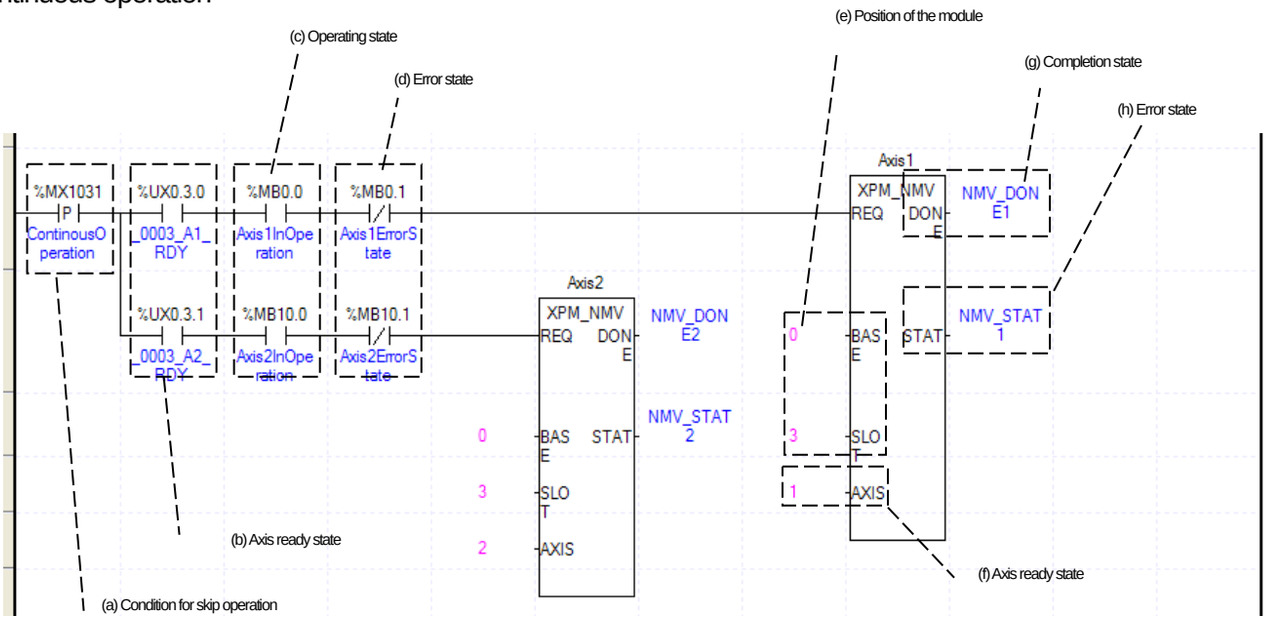
output.

(h) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

For more information, refer to “Chapter 9.5.3 Skip operation”.

(9) Continuous operation



(a) Condition of Continuous Operation

Condition of continuous operation command (XPM_NMV). Once Continuous Operation is executed, current operation step and next operation step would be operated continuously.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state by axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Continuous Operation while it is running, the error 391 would be appeared.

(d) Error state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(f) Axis of command execution

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command continuous operation command” item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(g) Execution complete status

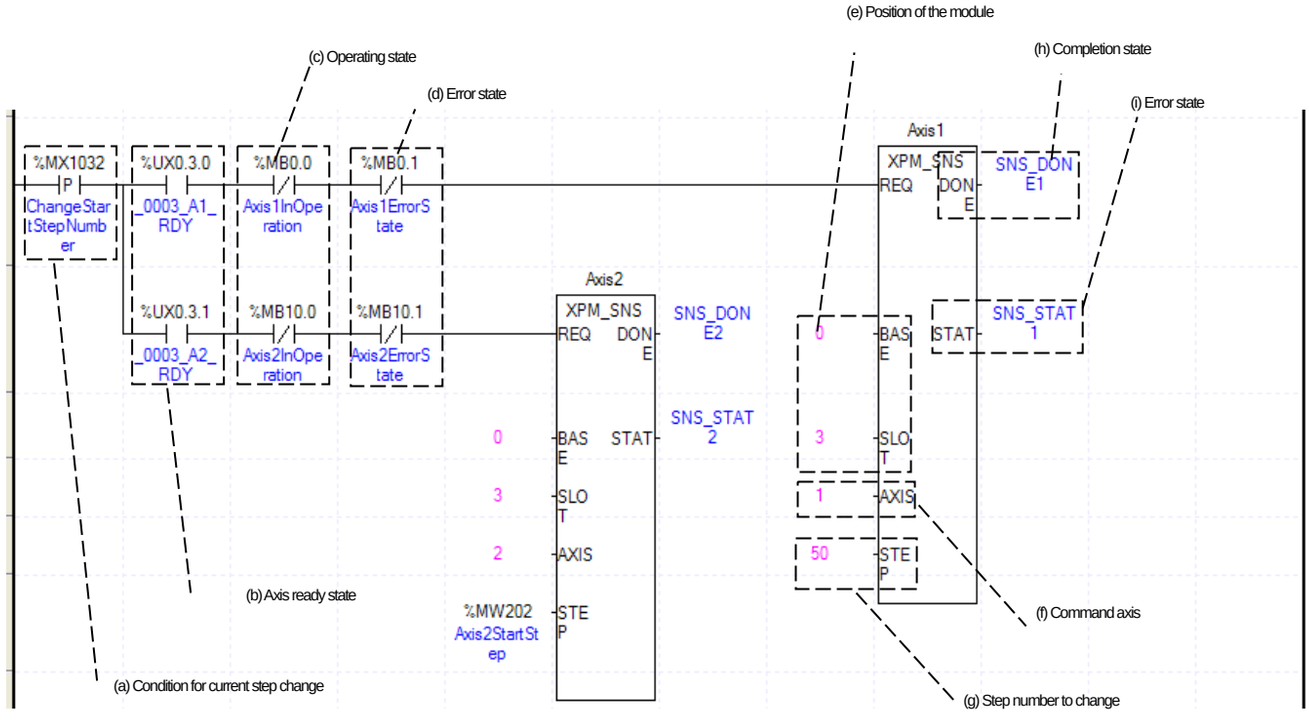
If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(h) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(i) For more information, refer to “Chapter 9.5.2 continuous operation”.

(10) Current Step Change (Start Step Number Change)



(a) Condition of Current Step Change

Condition of start step number change command (XPM SNS). Once Current Step Change is executed, current operation step will move set step.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state by axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Current Step Change while it is running, the error 441 would be appeared.

(d) Error state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(f) Axis of command execution

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command start step number change command” item of the command, it can set axis 1 to 8 meaning axis1 to axis8.

(g) Change Step Number

Set change step number by Current Step Change. 400 step operation data for each axis can be set. Therefore, the range of step number setting of Current Step Change is 1~400. In example, the current step for axis 1 is changed to step 50, and for axis 2, the

current step is changed to the step saved in %MW202 (axis 2 start step).

(h) Execution complete status

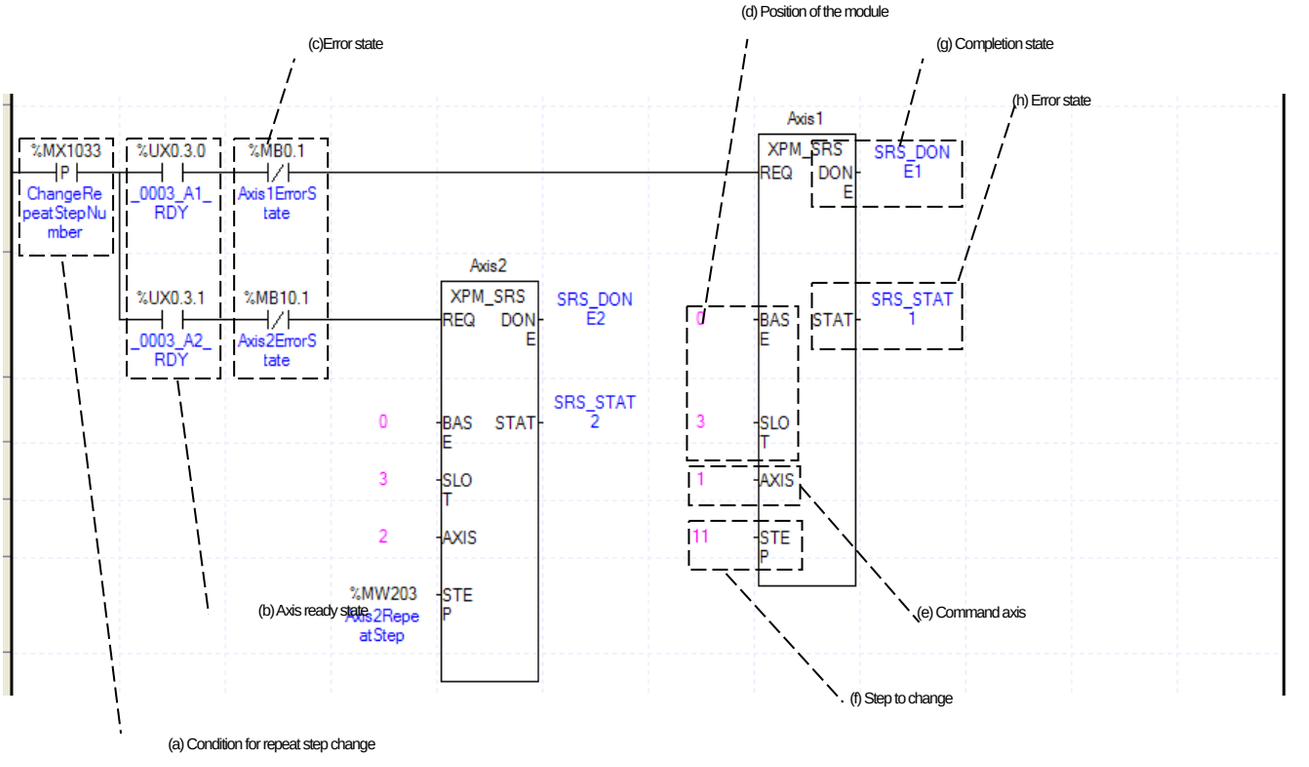
If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(i) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(j) For more information, refer to “Chapter 9.5.9 Start Step Number Changing”.

(11) Repeat Step No. Change



(a) Condition of repeat step number change

Condition of step number change command (XPM_SRS). Once Repeat Step No. Change is executed, current operation step will move set step. When the operation method of operation data in repeat step completed step operation set by repetition, it means step set by next step.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Error status for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(D) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(e) Axis to give a command

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command repeat step No. change command “item of the command, it can set 1 to 8 meaning axis1 to axis8.

(f) Step number to change

Set the step number to be changed as repeat step. 400 step operation data for each axis can be set. Therefore, the setting range of repeat Step No. change command is 1~400. In example, the current step for axis 1 is changed to step 11, and for axis 2, the current step is changed to the step saved in %MW203 (axis 2 repeat step).

(g) Execution complete status

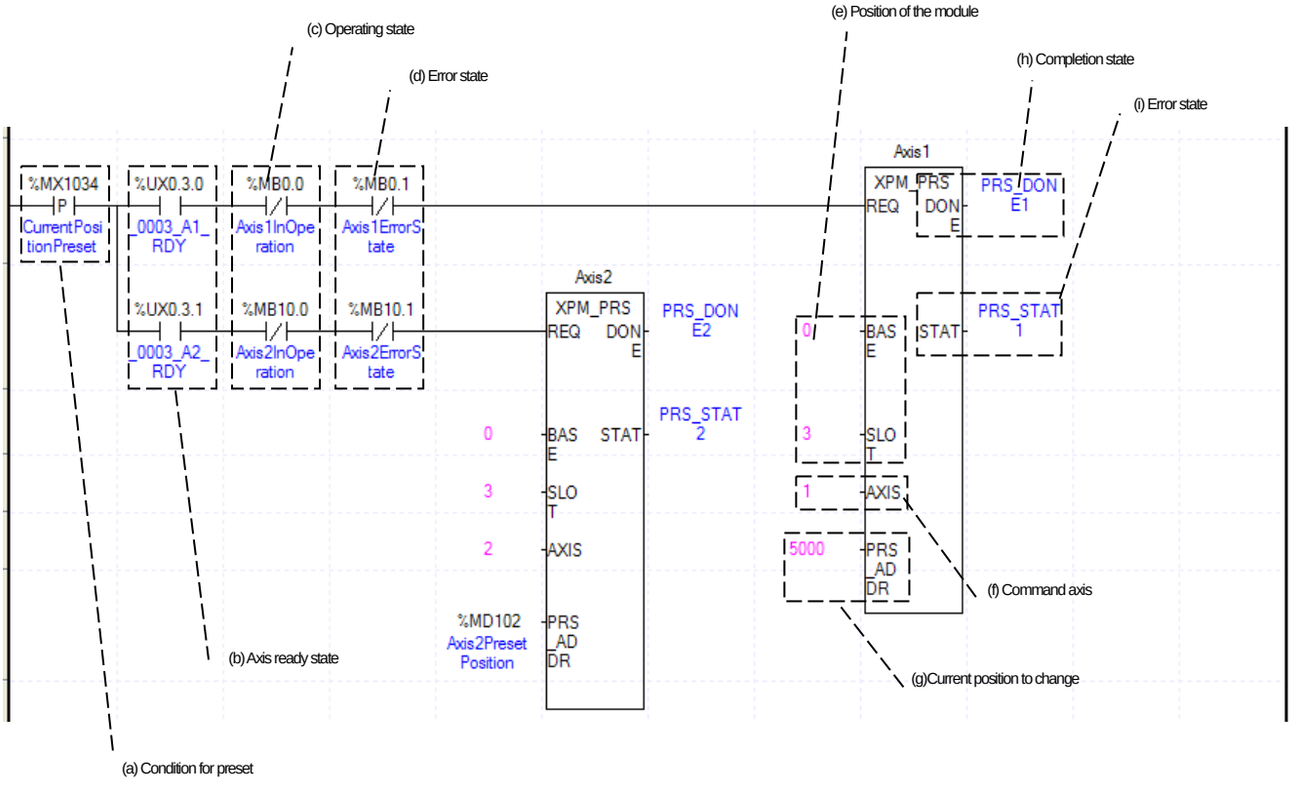
If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(h) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

For more information, refer to “Chapter 9.5.10 Repeat step number change”.

(12) Current position preset



(a) Condition of Current Position Preset

Condition of current position preset command (XPM_PRS). Once Current Position Preset is executed, current operation step will move to set step. If the origin has not set yet, the origin would be set to origin decided.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Operating state by axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'in operation'. If a relevant axis is in operation, it becomes 'on'. Operating Data Setting cannot be configured while it is running hence configuration will only be configured when it is not running. If you execute Current Position Preset while it is running, the error 451 would be appeared.

(d) Error state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error

takes place, it becomes 'on'. A condition has been set to perform a control command only when there is no error with the relevant axis. If you want to operate a system regardless of errors, you can just inactivate the function.

(e) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(f) Axis of command execution

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command current position preset command “item of the command, it can set 1 to 8 meaning axis1 to axis8.

(g) Change Current Position

Set change current position by Current Position Preset. The unit is the value from 'unit' of basic parameter. In example, the current position for axis 1 is changed to 5000, and for axis 2, the current step is changed to for the saved in %MD102 (axis 2 preset position).

(h) Execution complete status

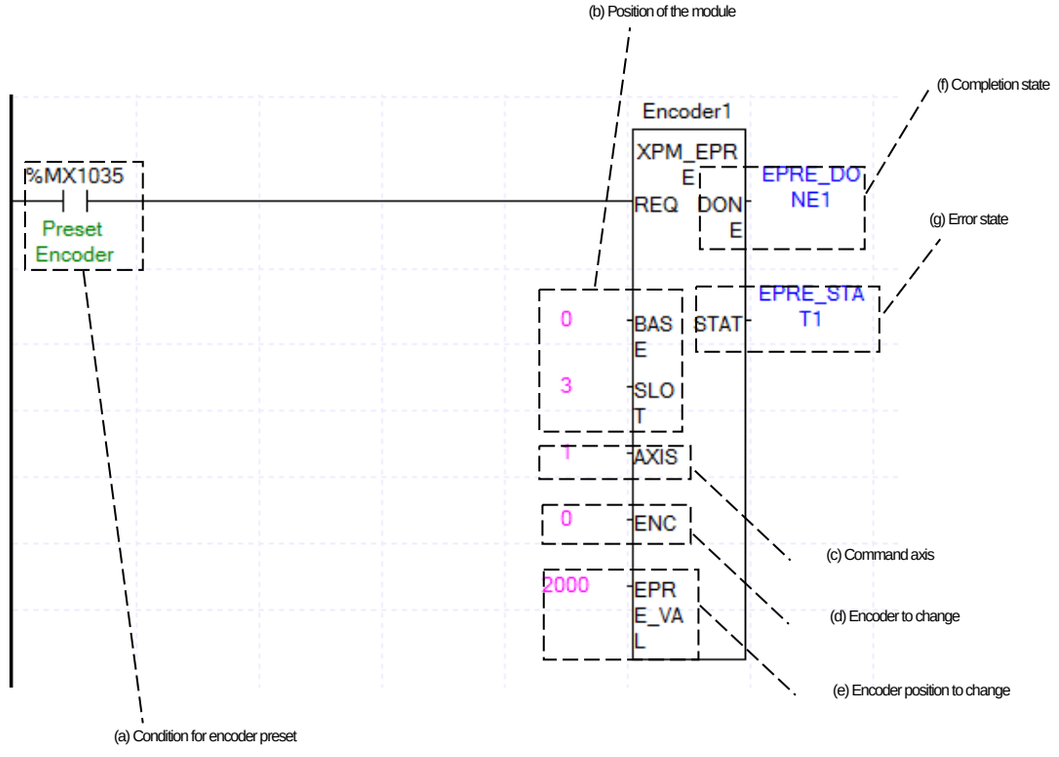
If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(i) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(j) For more information, refer to “Chapter 9.5.7 Current position preset”.

(13) Encoder preset



(a) Condition of encoder preset

Condition of encoder preset command (XPM_EPRE). Once an encoder preset is executed, the current value of encoder is changed to the set values.

(b) Positioning module mounting position

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(c) Axis to give a command

Set an axis to execute preset command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command” encoder item of the command, it can set 1 to 8 meaning axis1 to axis8.

(d) Encoder to change

Set Changing Encoder to execute a preset. O means “encoder 1”.

(e) Encoder position to change

Set for Changing Encoder Position In example, change the encoder position to the values saved as 2000 for encoder 1.

(f) Execution completion status

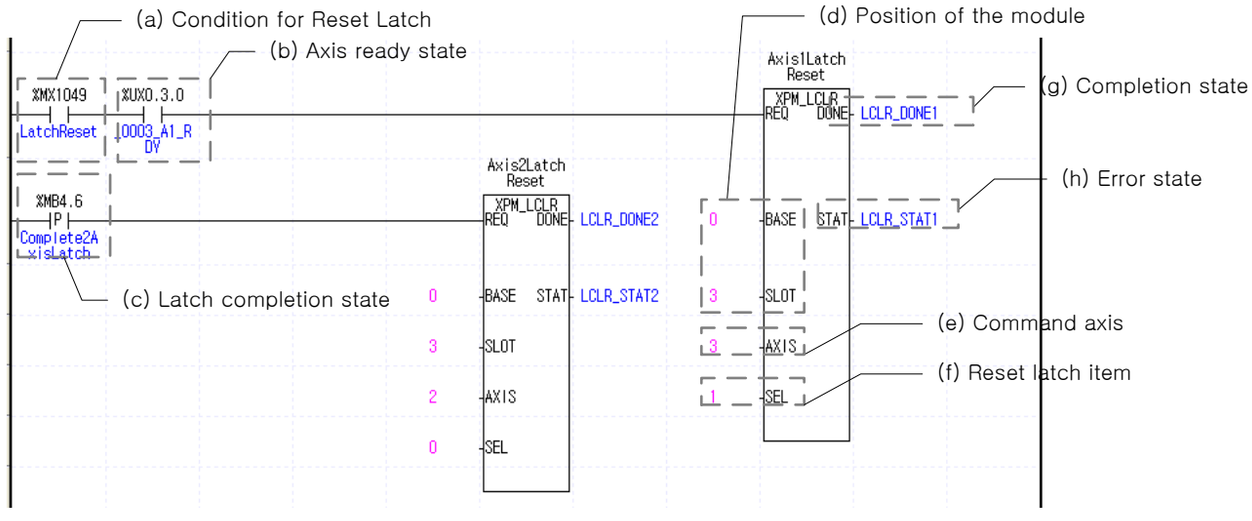
If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(g) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(i) For more information, refer to “Chapter 9.5.8 Encoder preset”.

(14) Latch reset



(a) Condition of latch reset

Condition of latch reset command (XPM_LCLR). If the latch reset is executed, latch reset item is latch completion status or reset the latch data.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on. In the example program, axis 1 the ready state (UX0.3.0) of axis 1 was used, so the latch reset command is executed when %MX1048 (latch reset) is turned on after axis is connected to the network.

(c) Latch completion status

When applying example program of “8.2. 2 (1) Current status read”, the axis 2 is in a “latch completion status”. When the external latch command signal of related axis is input and latch is completed, it turn on. In case of axis 2, the latch reset item is executed when %Mb4.6 (axis 2 latch completion) is turned on. To read latch data whenever the external latch signal of the axis is input and the latch is completed, executed the latch position data read command and then program by setting the latch completion status as the input conditions of the latch reset command.

(d) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(e) Axis of command execution

You can set the axis to execute latch reset command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command” latch reset of the command, it can set 1 to 8 meaning axis1 to axis8.

(f) Latch reset item

The following items are reset according to the specified latch reset item.

0: Latch completion status reset

1: Latch position data and latch completion status reset

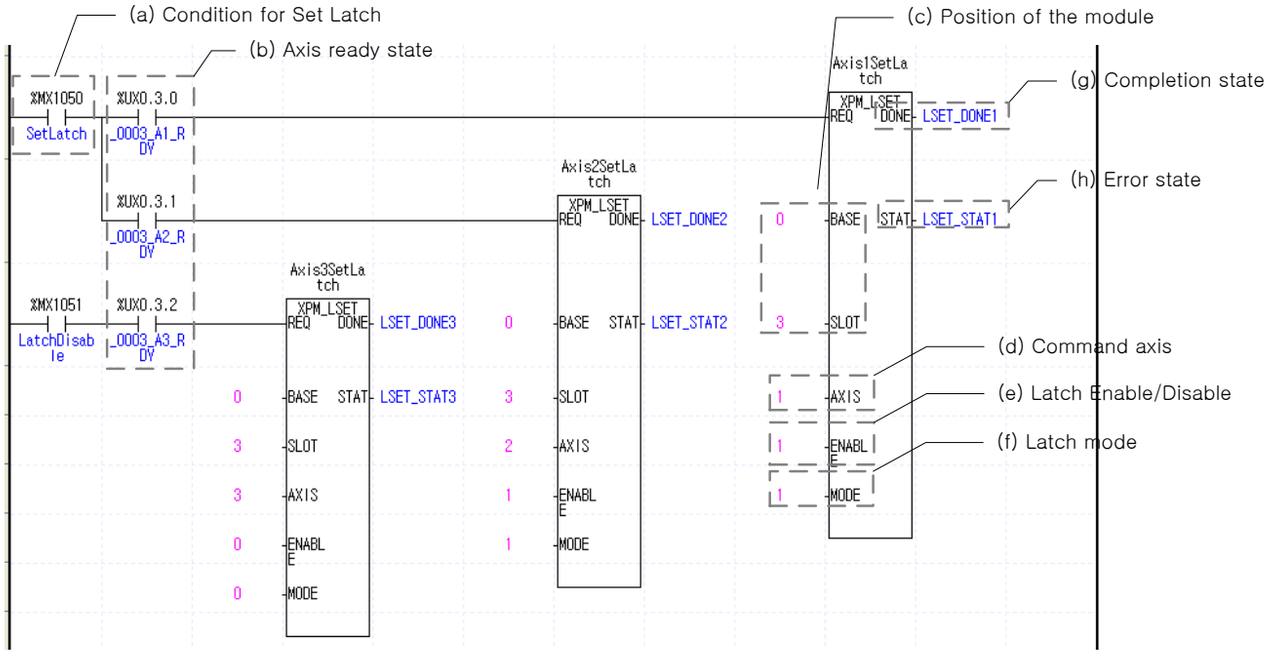
(g) Execution complete status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(h) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(15) Latch setting



(a) Condition of latch setting execution

This is the condition to execute the latch setting command (XPM_LSET). After an axis is connected to network, when %MX1050(latch setting)is turned on, latch setting command is executed on axis1, axis2 ,when %MX1051(axis 3 latch disable) is turned on, latch setting command is executed on axis 3.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on. In the example program, the ready state (UX0.3.0 ~ UX0.3.2)) for each axis was used, so the latch setting command is executed when the condition of latch setting execution is turned on after axis is connected to the module.

(c) The mounting position of positioning module.

For give a command, set the position where the positioning module to command is mounted. In the example, the positioning module is mounted in slot3.

(d) Axis to give a command

You can set the axis to execute latch reset command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command “latch setting” item of the command, it can set 1 to 8 meaning axis1 to axis8.

(e) Latch enable/disable item

The operation according to the specified latch allow/prohibit items is as follows.

0: disabled, 1: enabled

In the example program, axis 1, axis 2 latch are enable and axis 3 latch is disable.

(f) Latch mode item

The operation according to the specified latch mode is as follows.

0: Single trigger (After the latch is allowed, the current position is latched on the first touch probe 1 signal input.)

1: Continuous trigger (latch is allowed, the current position is latched for each touch probe 1 signal.)

In the example program, axis 1 is set to latch single trigger mode when the latch setting command is executed and axis 2 is set to continuous trigger mode.

(g) Execution complete status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

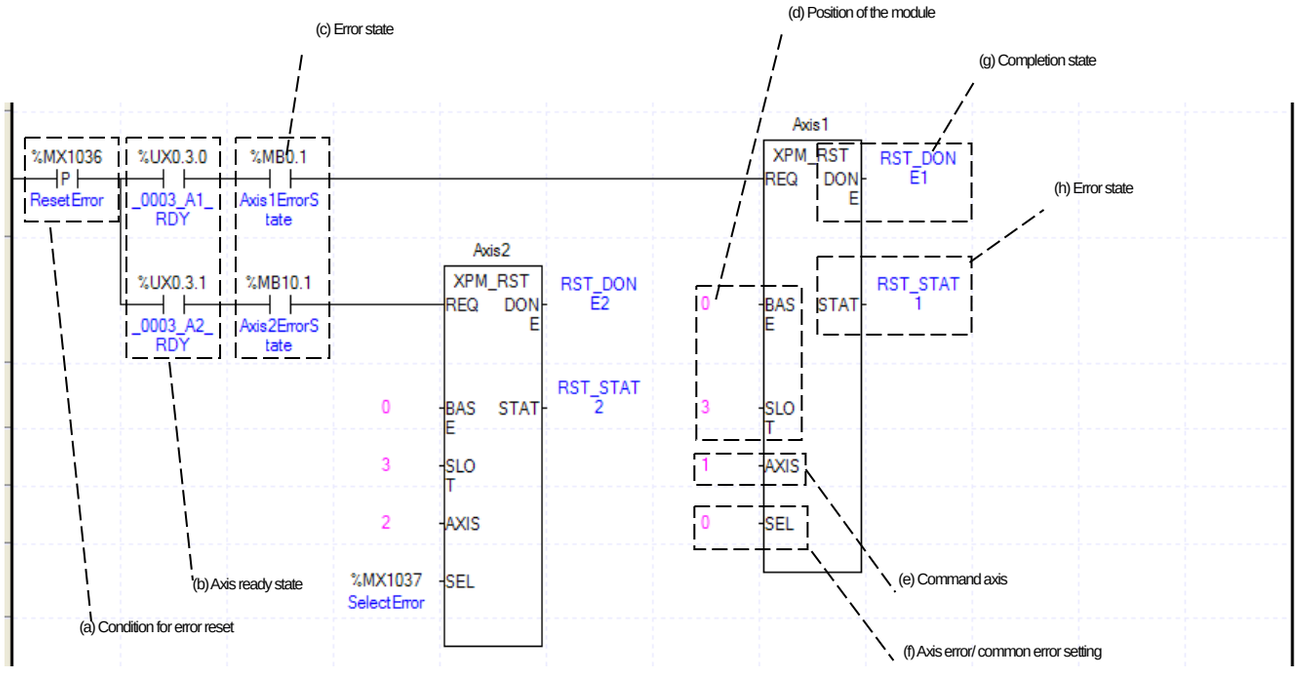
(h) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(I) The latch setting command is dedicated command for XBF-PN04B/ XBF-PN08B.

8.2.8 Error

(1) Error reset



(a) Condition of Error Reset

Condition of error reset command (XPM_RST). Once error reset is executed, it erases common errors of module and axis error for each axis.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Error state for each axis

“In case that an example program of '8.2.2 Read Current State' is applied, it is a signal showing each axis is 'error status'. If any error takes place, it becomes 'on'. Operation will only work when there is no error. If you want to operate a system regardless of errors, you can just inactivate the function.

(d) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(e) Axis of command execution

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command error reset command (RST)” item of the command, it can set 1 to 8 meaning axis1 to axis8.

(f) Error setting of Error/Common by axis

According to error type, if set by “0”, errors for each axis that occurred during command execution will be erased. If set by “1”errors that commonly occur in the module, such as common parameters or communication errors, will be erased.’ In example, reset error of axis 1, If the value in %MX1037 (error select) is “0”, the error of axis 2 is reset, and if the values is “1”, the common error is reset.

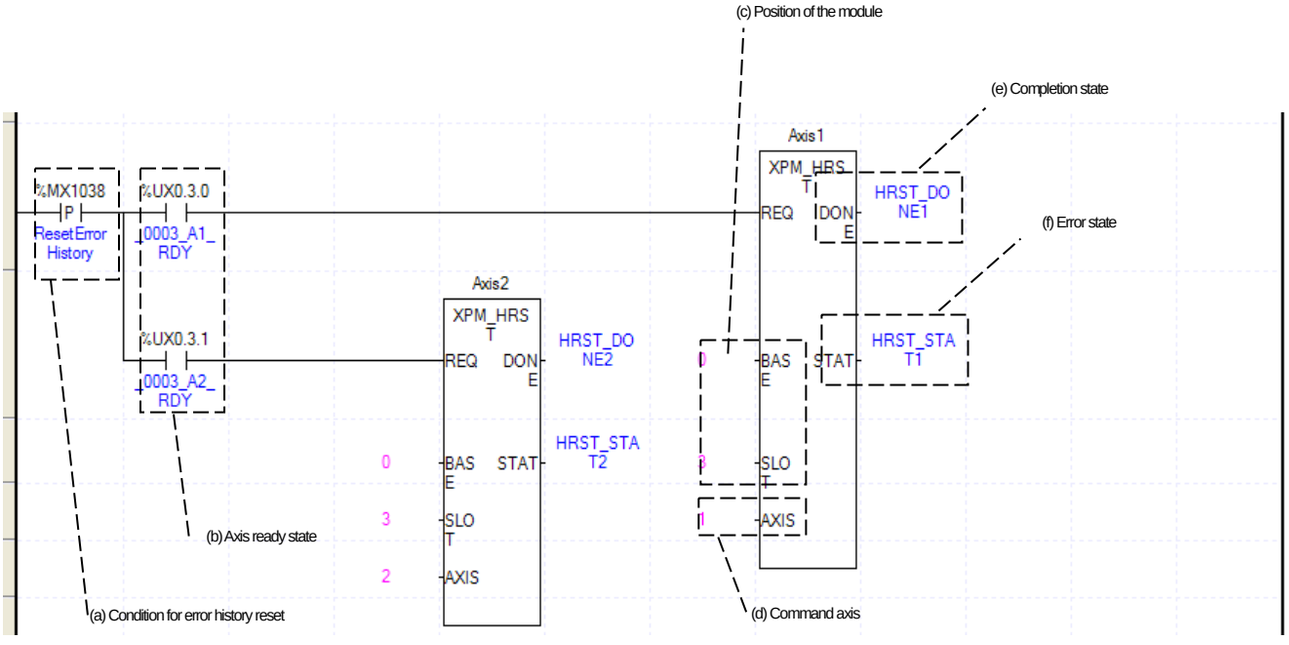
(g) Execution complete status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(h) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(2) Error history reset



(a) Condition of Error History Reset

Condition of error history reset command (XPM_HRST). Once Error Reset is executed, it erases history of generated errors of module. Each axis has up to 10 error histories. It will be saved to MRAM memory, remain still even there is no power.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(d) Axis of command execution

You can set an axis for Parameter Setting. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command error history reset command (XPM_HRST)” item of the command, it can set 1 to 8 meaning axis1 to axis8.

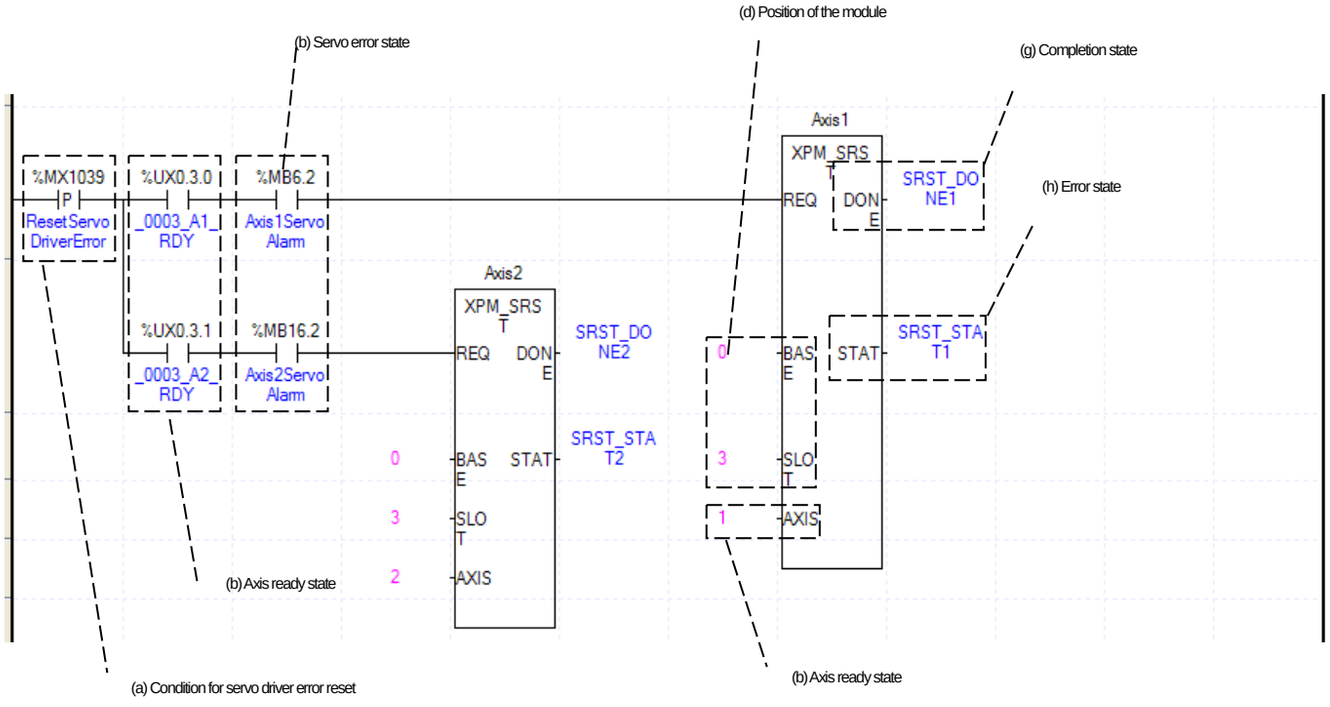
(e) Execution complete status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(f) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(3) Servo drive error reset



(a) Condition of servo drive error reset

Condition of servo drive error reset command (XPM_SRST). When a servo drive error reset is executed, error occurring in the servo drive connected to related axis are erased. When servo drive error reset is executed without eliminating the cause of the servo drive error, error may remain in the servo drive.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Servo error status for each axis

“In case that an example program of '8.2.2 Current status read' is applied, it is a servo error status signal of servo drive connected to each axis. It is turned on when error occurs in the servo drive connected to the related axis. Set to execute command when an error occurs in the servo drive connected to relate axis s no servo drives connected error. If you want to operate a system regardless of errors, you can just inactivate the function.

(d) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(e) Axis of command execution

You can set an axis for executing servo drive error reset command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command servo drive error reset (XPM)” item of the command, it can set 1 to 8 meaning servo drive 1 to 8 connected to axis.

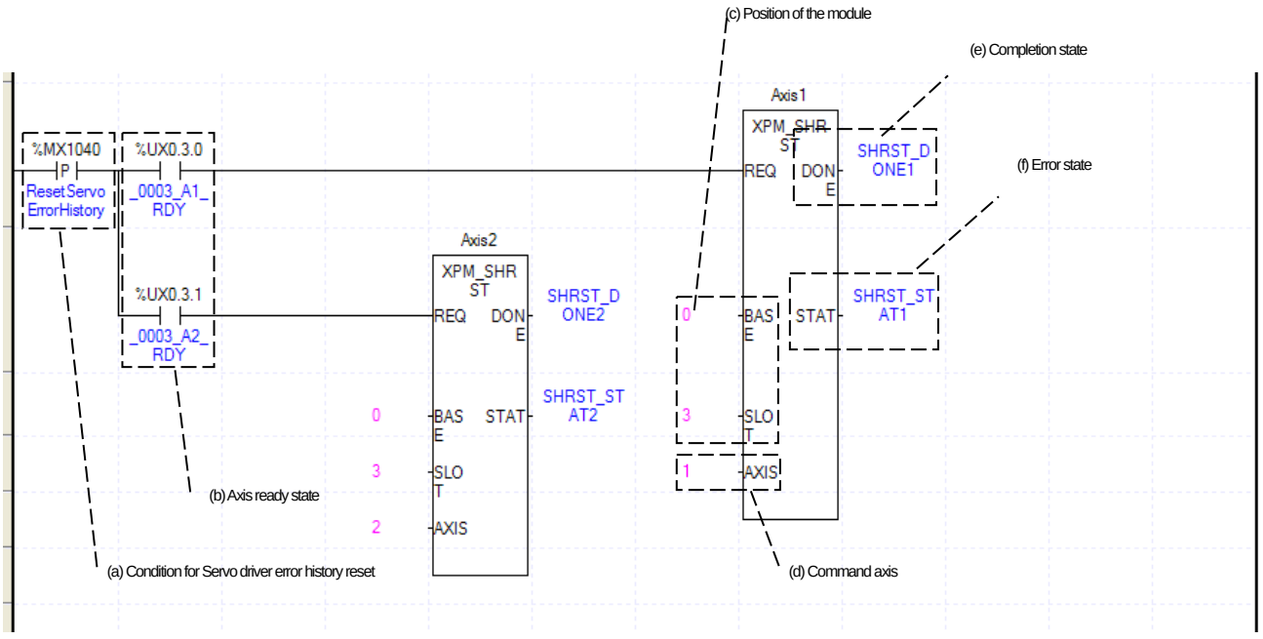
(f) Execution complete status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(g) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(4) Servo drive error history reset



(a) Condition of servo drive error history reset

Condition of servo drive error history reset command (XPM_SHRST). When a servo drive error history reset is executed, error histories saved in the servo drive connected to related axis are erased. The servo drive stores up to 10 errors histories.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(d) Axis of command execution

You can set an axis for executing servo drive error history reset command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command servo drive error history reset (XPM)” item of the command, it can set 1 to 8 meaning servo drive 1 to 8 connected to axis.

(e) Execution complete status

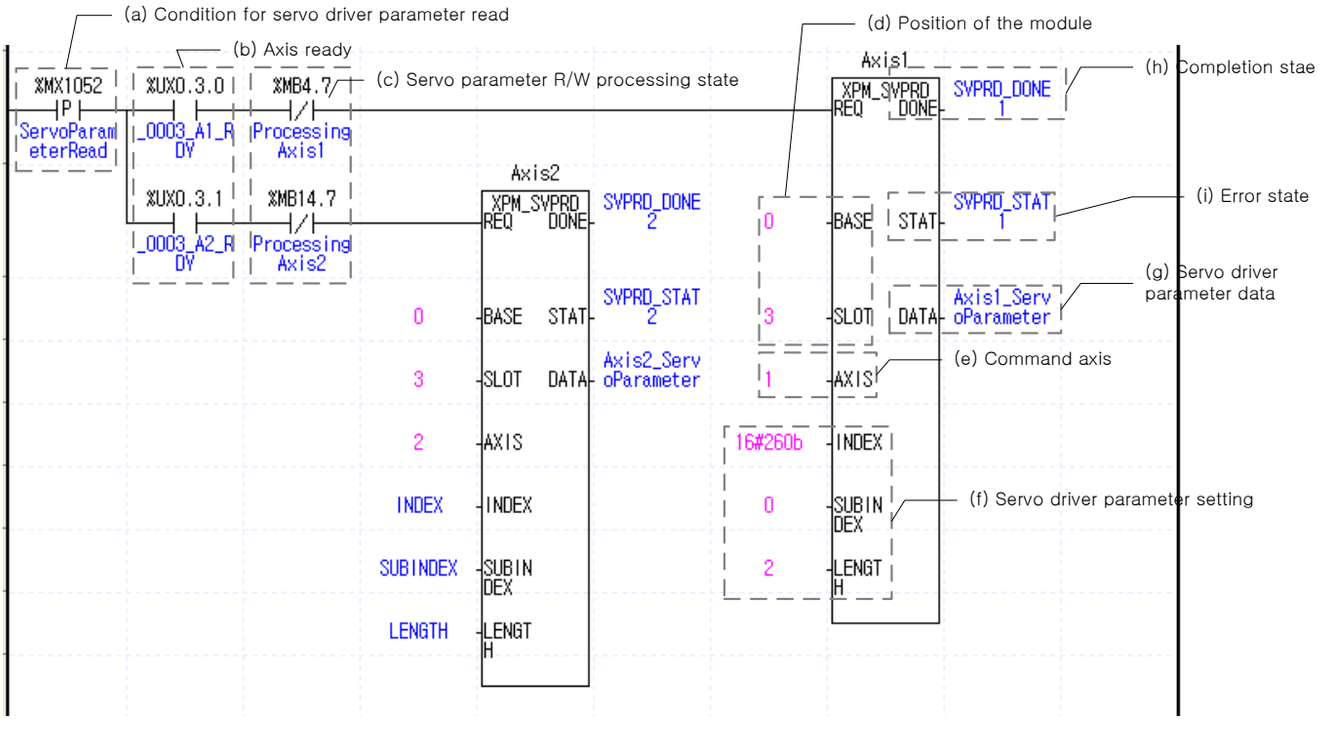
If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(f) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

8.2.9 Servo Drive Parameter

(1) Servo drive parameter read



(a) Condition of servo drive parameter read

Condition to execute servo drive parameter read command (XPM_SVPRD) When a servo drive parameter read command is executed, read the values of related servo drive parameter object and save in the output DATA.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) Servo drive read/write processing status

It displays whether the servo drive parameter read / write or EEPROM save command is being executed. Set to the command to be executed when the servo drive read/ write is not being processed.

(d) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(e) Axis of command execution

You can set an axis to execute command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command axis item “, it can set 1 to 8 meaning axis1 to axis8.

(f) Servo drive parameter settings

Among the servo drive parameter, specify the index number, Subindex number, size (Byte)) of reading parameter object.

In example, axis 1 reads DC Link voltage of 2 byte size specified h260b:00, and saved in axis 1 servo parameter. Axis 2 reads servo parameter of length size specified INDEX, SUBINDEX, and saved in axis 2 servo parameter.

(g) Servo drive parameter data

Set the devices saved read data value, after the servo drive parameter read command is executed.

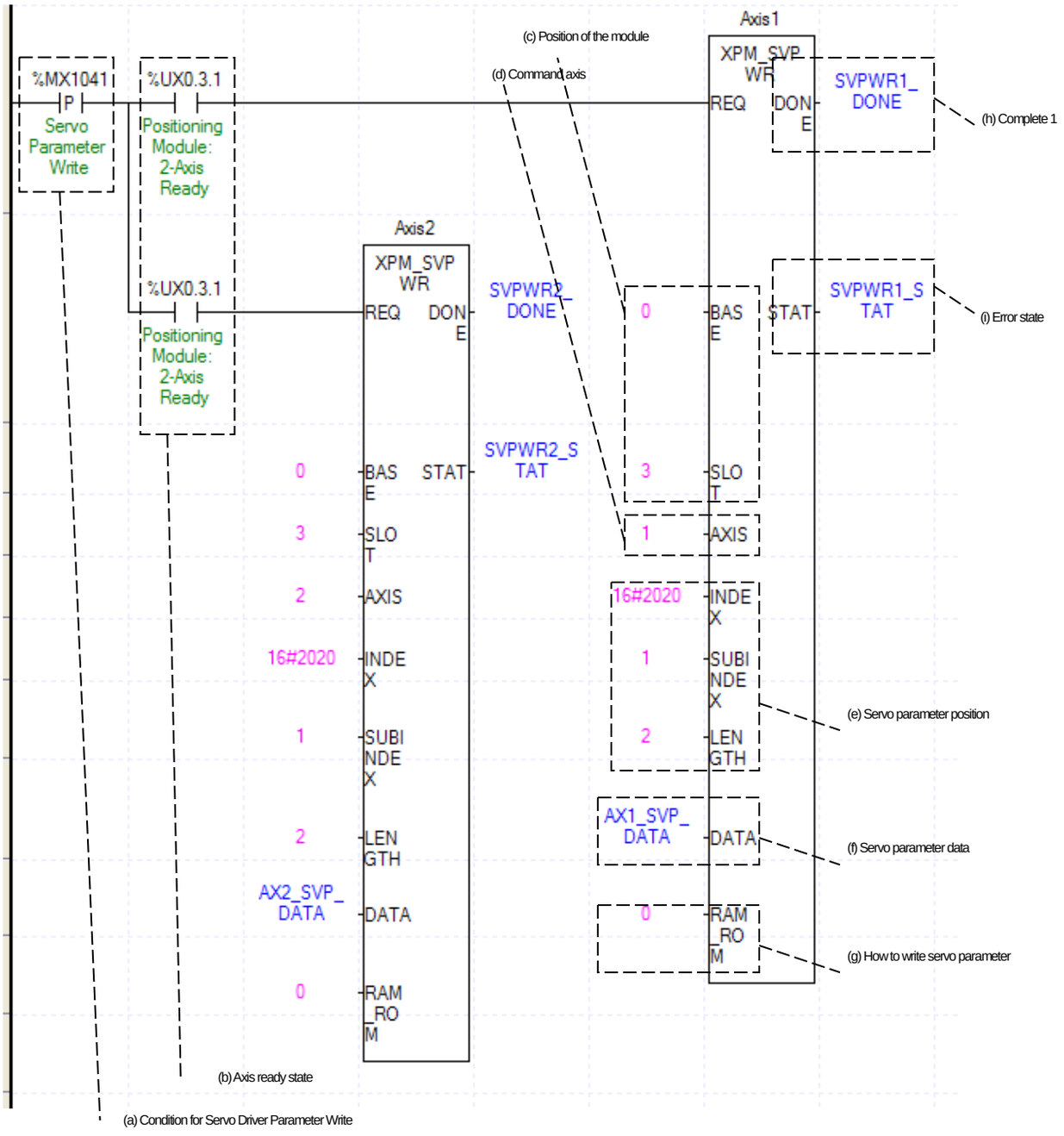
(h) Execution complete status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(i) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(2) Servo parameter write



(a) Condition of servo drive parameter writing

Condition to execute servo drive parameter writing command (XPM_SVPWR) When a servo drive parameter writing command is executed, the set parameter values of related servo drive is changed to the setting data.

(b) Ready status for each axis

When communication of positioning module connected to servo drive is normal operation, the signal of connected axis is turned on.

(c) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(d) Axis of command execution

Set an axis to execute servo drive parameter writing command The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command” servo drive parameter writing (XPM_SVPWR)” item of the command, it can set 1 to 8 meaning axis1 to axis8.

(e) Servo parameter position

Set the position of servo parameter to write. Set the index number of servo parameter object in INDEX, set the Sub-index number of servo parameter object in SUBINDEX and set the length of servo parameter to write with byte unit in LENGTH.

(f) Servo parameter data

Set data value to write servo parameter.

(g) Servo parameter write method

Set the writing method for servo drive parameter. If set to “0”, servo parameter is written in RAM inside the servo drive, if set to “1”, servo parameter is written in EEPROM inside the servo drive.

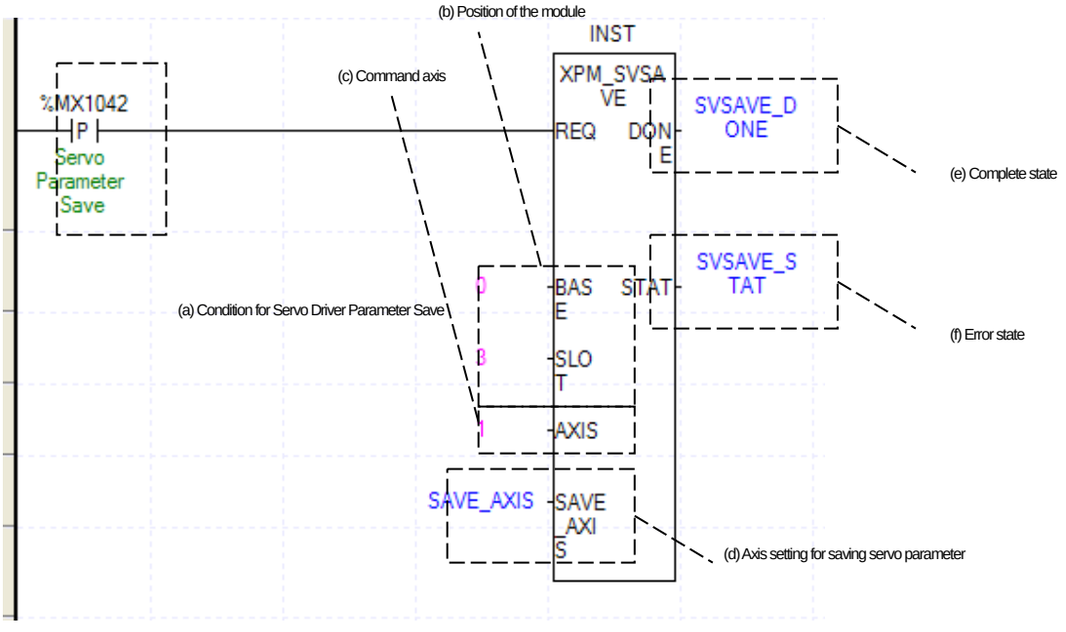
(h) Execution complete status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

(i) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

(3) Servo parameter save



(a) Condition of servo drive parameter saving

Condition to execute servo drive parameter saving command (XPM_SVSAVE) when a servo drive parameter saving command is executed, the values of all parameter of related servo drive saves EEPROM inside the servo drive. Saving time is different depending on servo drive model.

(b) The mounting location of Positioning Module.

In the example above, the positioning module set to be mounted in slot 3 of base 0.

(c) Axis of command execution

Set an axis to execute servo drive parameter saving command. The XBF-PN04B can connect up to 4 axes and The XBF-PN08B can connect up to 8 axes. In the “axis to command” servo drive parameter saving (XPM_SVSAVE)” item of the command, it can set 1 to 8 meaning axis1 to axis8.

(d) Servo parameters saving axis setting

Set an axis of servo drive to save each axis from axis 1 to 8 is assigned bits 0 to 7 and are selected by setting the related bit.

(e) Execution complete status

If the function block is completed without an error, “1” is output. “1”is maintained until the next execution, if an error occurs, “0”is output.

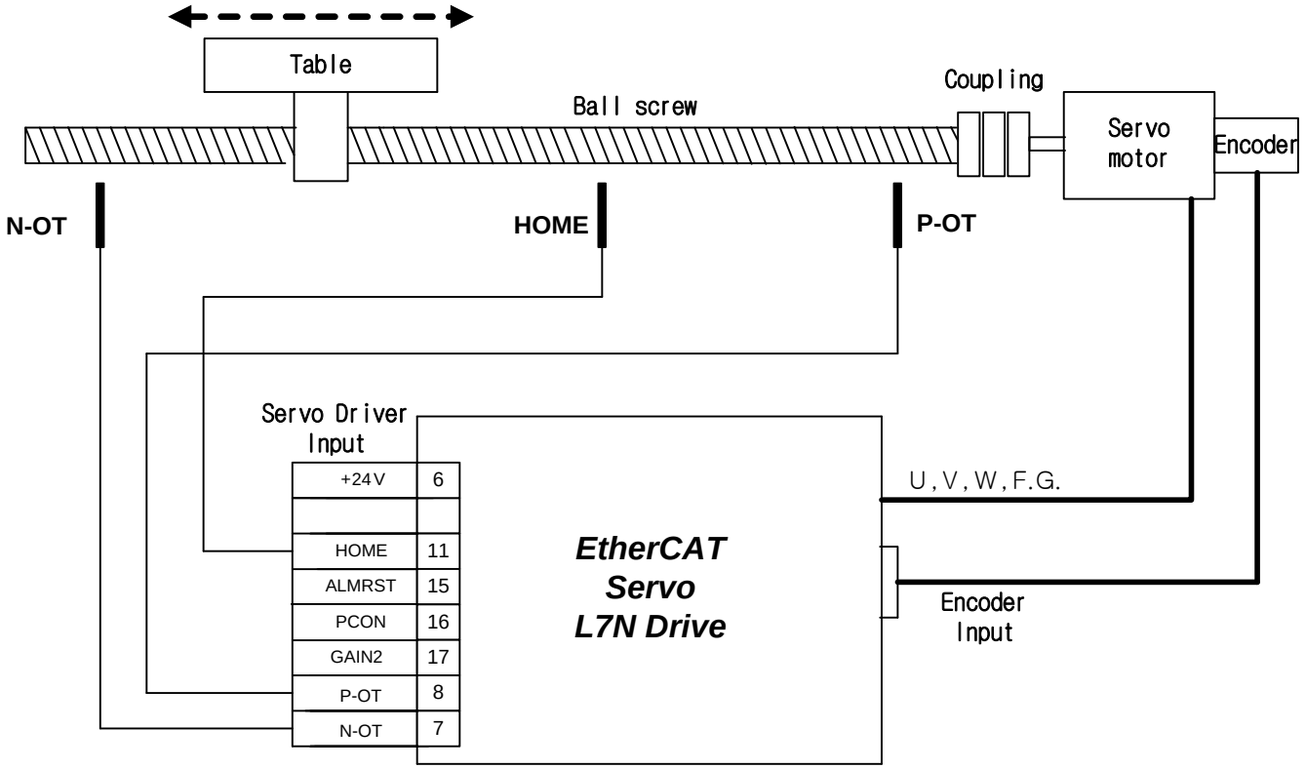
(f) Error status

If an error is occurred while the function block executes, this is the area where the error number is output.

Chapter 9 Function

9.1 Homing

Homing is carried out to confirm the home of the machine when applying the power. Before operating homing, it is required to set parameter related to homing of servo parameter for each axis. If the home position is determined by homing, the home detection signal is not recognized during positioning operation.
On homing, the contact point is input through the connector of servo drive (servo drive supporting EtherCAT CoE).



To execute homing, you must select a homing operation mode (EtherCAT CoE-supported drive: refer to the corresponding drive manual) appropriate for your system.
In motion control module, actual operation after starting homing is performed in servo drive, and homing method to support complies with servo drive. Before setting homing, it is required to set parameter related to homing of servo parameter for axis.
On homing, the current position values is displayed the same as command position in the status information.

■ Example for homing parameter setting

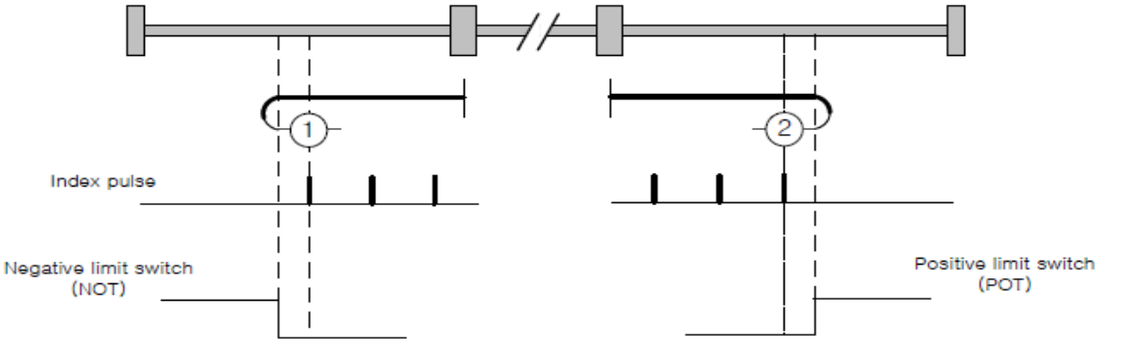
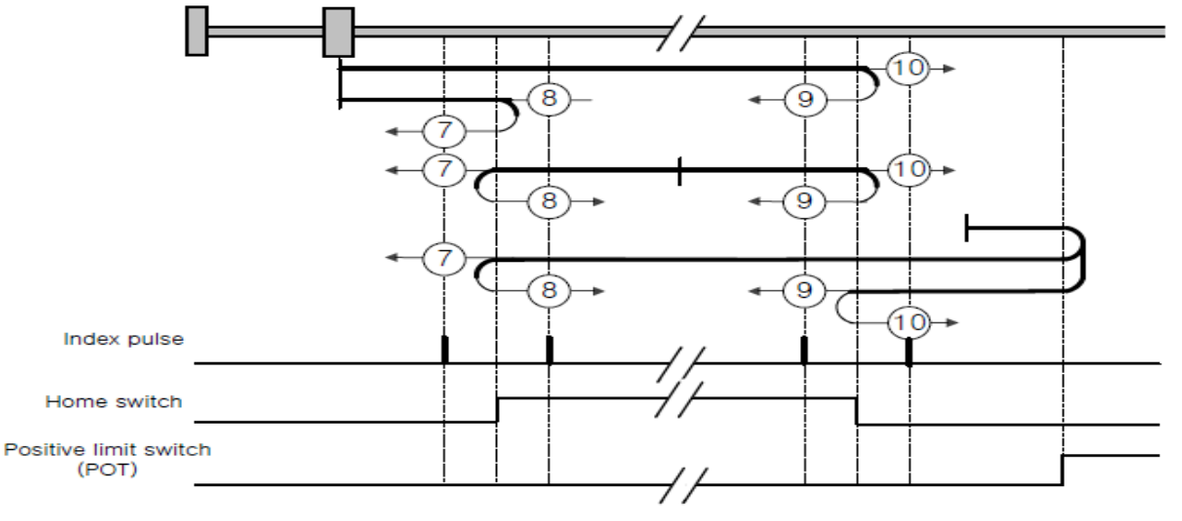
Index	Name	Unit	Current Value	Initial Value	Access
6098	Homing Method	-	34	34	rw
6099:00	Homing Speeds	-	2	2	rw
6099:01	Speed during search for switch	Vel,Unit	160	160	rw
6099:02	Speed during search for zero	Vel,Unit	32	32	rw
609A	Homing Acceleration	Acc,Unit	50000	50000	rw

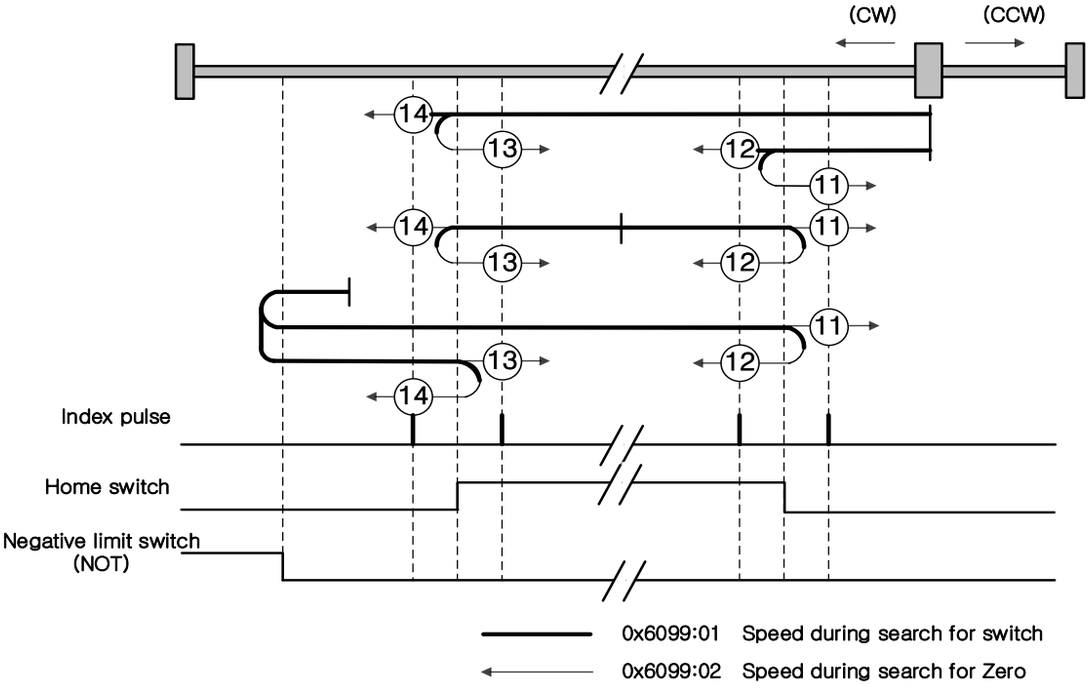
(1) Homing parameters

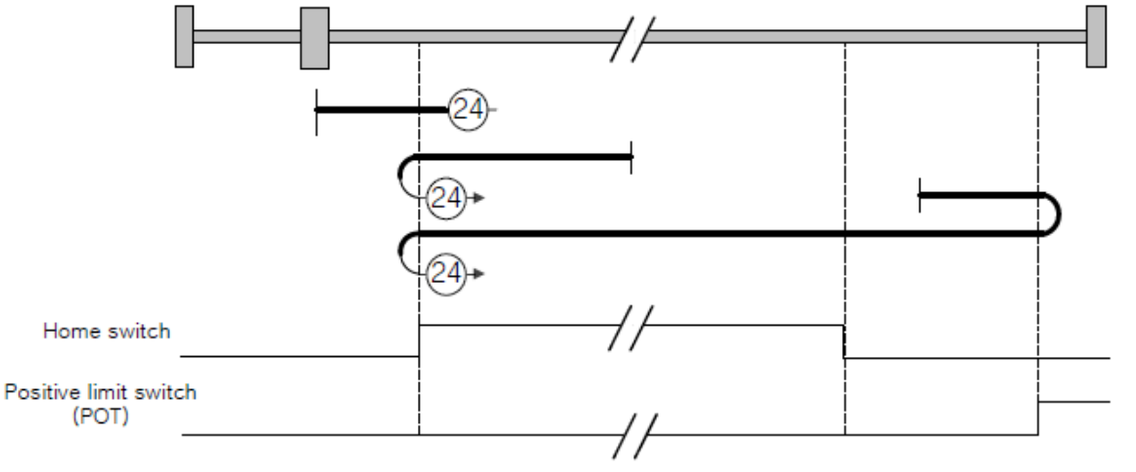
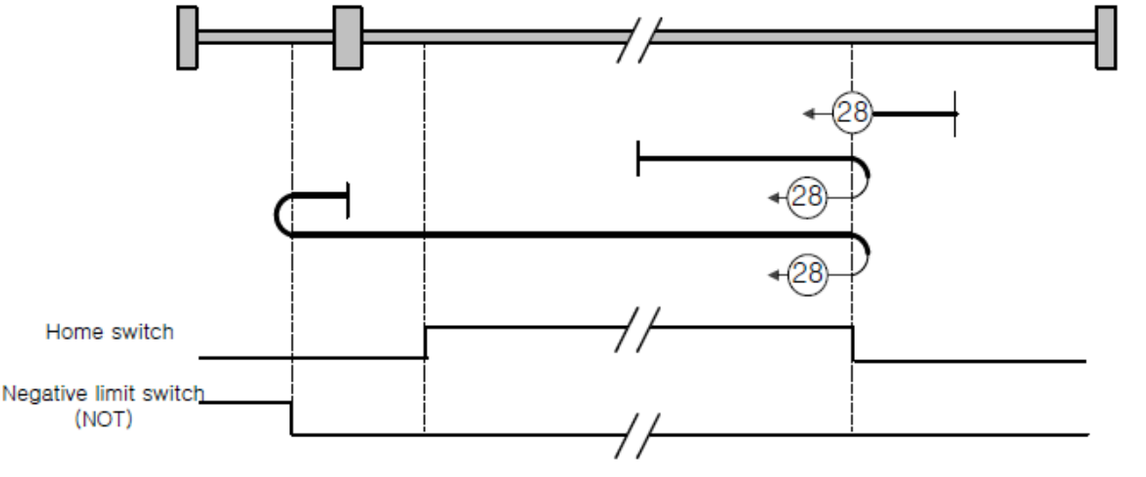
Index	Sub	Name	Data Type	Unit
0x6040	-	Control word	UINT	-
0x6041	-	Status word	UINT	-
0x607C	-	Home offset	DINT	[pls]
0x6098	-	Homing method	SINT	-
0x6099	-	Homing speed	-	-
	0	Number of item	USINT	-
	1	Speed during search for switch	UDINT	[pls/s]
	2	Speed during search for zero	UDINT	[pls/s]
0x607D	-	Software Position Limit	-	-
	0	Number of item	USINT	-
	1	Position limit minimum	DINT	[pls]
	2	Position limit maximum	DINT	[pls]
0x609A	-	Homing acceleration	UDINT	[pls/s^2]

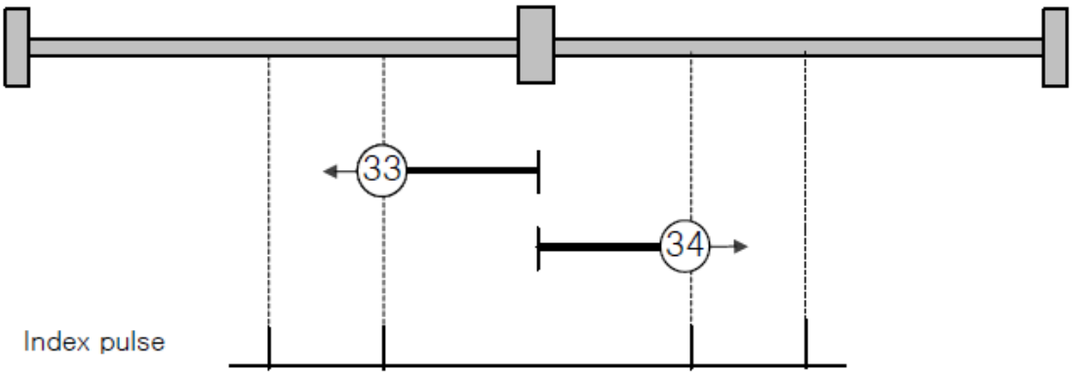
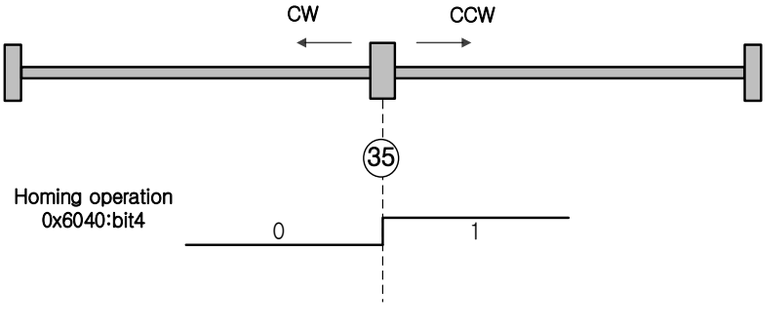
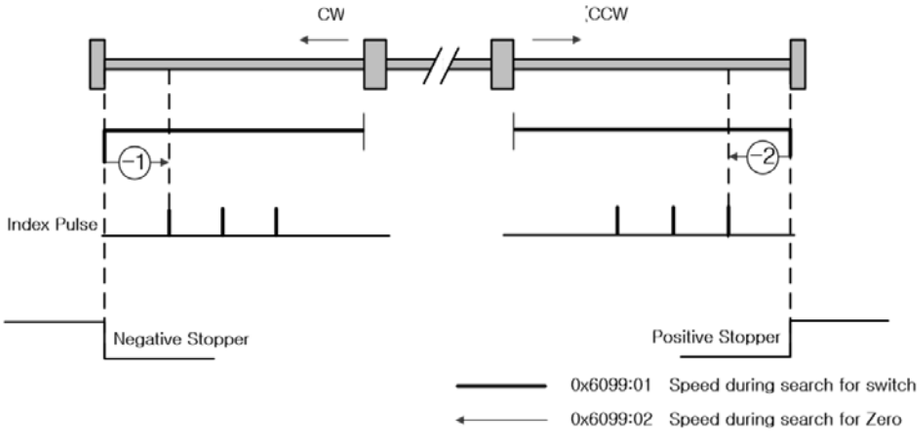
Homing method (0x6098)	Details
1	The drive returns to the homing with the negative limit switch (NOT) and the Index (Z) pulse while driving in the reverse direction.
2	The drive returns to the homing with the positive limit switch (POT) and the Index (Z) pulse while driving in the forward direction.
7,8,9,10	The drive returns to the homing with the home switch (HOME) and the Index (Z) pulse while driving in the forward direction. When the forward limit switch (POT) is input during homing, the drive will switch its driving direction.
11,12,13,14	The drive returns to the homing with the home switch (HOME) and the Index (Z) pulse while driving in the reverse direction. When the reverse limit switch (NOT) is input during homing, the drive will switch its driving direction.
24	The drive returns to the homing with the home switch (HOME) while driving in the forward direction. When the forward limit switch (POT) is input during homing, the drive will switch its driving direction.
28	The drive returns to the homing with the home switch (HOME) while driving in the reverse direction. When the reverse limit switch (NOT) is input during homing, the drive will switch its driving direction.
33	The drive returns to the homing with the Index (Z) pulse while driving in the reverse direction.
34	The drive returns to the homing with the Index (Z) pulse while driving in the forward direction.
35	Sets the current position as the home.
-1	The drive returns to the homing with the reverse stopper and the Index (Z) pulse while driving in the reverse direction.
-2	The drive returns to the homing with the forward stopper and the Index (Z) pulse while driving in the forward direction.
-3	The drive only returns to the homing with the reverse stopper while driving in the reverse direction.
-4	The drive only returns to the homing with the forward stopper while driving in the forward direction.
-5	It returns to the homing only by the home switch (HOME) while driving in the reverse direction.
-6	It returns to the homing only by the home switch (HOME) while driving in the forward direction.

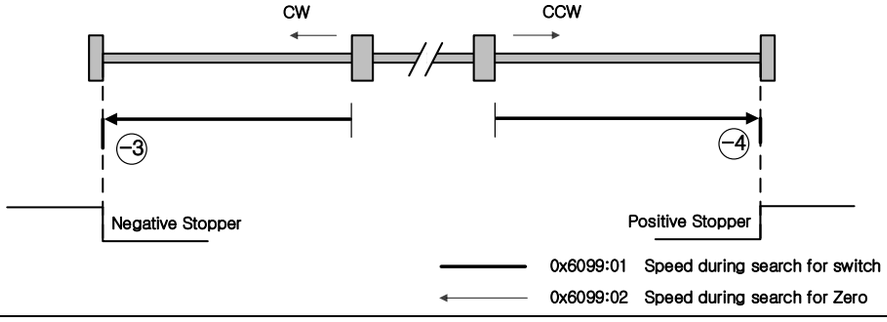
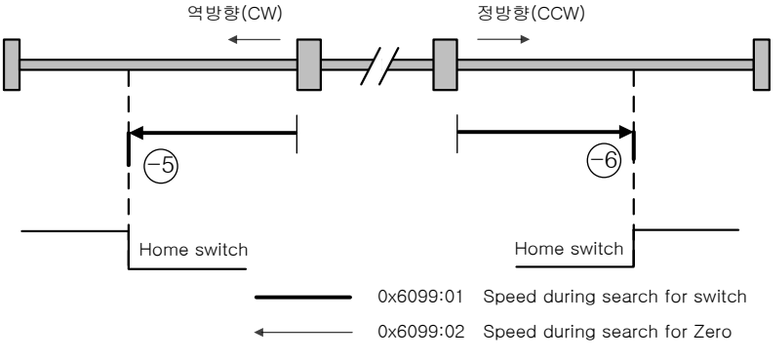
(2) Homing method (0x6098)

Value	Description
1,2	(1) If NOT switch is Off, the initial movement direction becomes CW. If NOT switch is On, change of direction is made. The position that meets the first index pulse during operation in CCW after NOT switch is On becomes the home position. (1) If POT switch is Off, the initial movement direction becomes reverse direction (CCW). If POT switch is On, change of direction is made. The position that meets the first index pulse during operation in CW after POT switch is On becomes the home position. 
7~10	Through (7) to (10) methods, the home is determined by the home switch and POT switch. (7) Upper figure: If POT switch is Off, operation is made at switch search velocity, and the initial movement direction becomes CCW. If the home is On, switching direction is made. Afterwards, the position where the first index pulse is me during CW operation becomes home position, and operating at Zero detection speed. (7) Middle figure: If POT switch is Off, and the home switch is On, operation is made at switch search speed, and the initial movement direction becomes CW. If home switch is Off, it switches to Zero search speed. Afterwards, the position where the index pulse is first encountered during CW operation becomes the home position. (7) Lower figure: If POT switch is Off, and the home switch is On, operation is made at switch search speed, and the initial movement direction becomes CCW. If POT switch is On, change of direction is made. When the home switch changes from on to off, the position where the index pulse is encountered is home position during operating Zero search speed and operating CW continuously. Method (8) to (10) differ only in the operation according to the initial operating direction and home switch polarity, but the positioning concept during homing is the same as the 7 methods above. Refer to the figure below. 

Value	Description
11~14	For homing using the Homing method 14, the speed profile according to the sequence is as follows. (14) Upper figure: the initial moving direction is CW direction and operates at switch search speed. When the Negative Home switch is turned off, the drive will decelerate to Zero search speed and then continue to operate. While operating at the Zero search speed, the drive detects the first index pulse to move to the index position (Home). (14) Middle figure: since the Home signal is on, the drive will operate at the switch search speed in the direction of the Negative Home Switch (CW). It might not reach the switch search speed depending on the start position of homing. When the Home switch is turned off, the drive will decelerate to Zero search speed, and then continue to operate. While operating at the Zero search speed, the drive detects the first index pulse to move to the index position (Home). (14) Lower figure: The initial direction is reverse (CW). The motor operates at the switch search speed. When the negative limit switch (NOT) is turned on, the drive will operate at the switch search seed in the forward direction (CCW) after deceleration stop. When the Negative Home Switch is turned on, the drive will decelerate to the Zero search speed, and then switches its direction to the reverse direction (CW). While operating at the Zero search speed, the drive detects the first index pulse to move to the index position (Home). 

Value	Description
24	The Home position is determined as the method (24) but index pulse is not used. In addition, the point where the home switch is On/Off becomes the home position. 
28	The Home position is determined as the method (28) but index pulse is not used. In addition, the point where the Home switch is On/Off becomes the Home position. 

Value	Description
33,34	The location that meets index pulse first during movement in the CCW/CW becomes the home position. 
35	Homing operation starting point becomes the Home position. 
-1. -2	(-1) The initial direction is CW, The drive operates at the switch search speed. If it collides with a reverse stopper (Negative Stopper), it waits according to the torque limit value (0x2409) when returning to the home using the stopper and the time set value (0x240A) when returning to the home using the stopper, and then changes direction. While operating at the Zero search speed, the drive detects the first index pulse to move to the index position (Home). (-2) The initial direction is CCW, The drive operates at the switch search speed. When the drive hits the positive stopper, it will stand by according to the torque limit value (0x2409) and the time setting value (0x240A) at the time of homing using stopper and then direction is switched. While operating at the Zero search speed, the drive detects the first index pulse to move to the index position (Home). 

Value	Description
-3,-4	(-3) The initial direction is CW, The drive operates at the switch search speed. If it collides with a reverse stopper (Negative Stopper), it waits according to the torque limit value (0x2409) when returning to the origin using the stopper and the time set value (0x240A) when returning to the origin using the stopper, and then the return to the home is completed. **(-4) The initial direction is CCW, The drive operates at the switch search speed.** When the drive collides with a positive stopper, it will stand by according to the torque limit value (0x2409) and the time setting value (0x240A) at the time of homing using stopper and then homing is completed. 
-5,-6	Homing Methods -5, -6 uses only Home switch to return to home. (-5) The initial direction is CW, The drive operates at the switch search speed. When the positive home switch is on, the drive is deceleration stop and then home is completed (-6) The initial direction is CCW, The drive operates at the switch search speed. When the positive home switch is on, the drive is deceleration stop and then home is completed 

Note) ▬ : switch search speed (0x6099:01), → : Zero search speed(0x6099:02)

Notes

1. When using servo drive (except L7N, L7N servo drive does not have a moving setting function after returning home), homing operation is differing depending on the movement [0x201E] setting after homing completion.

Move[0x201E] setting after homing completion	Servo drive start after homing completion
0 (default value)	After homing completion with “homing method [0x6098]”, the motor does not rotate and the”Home offset [0x607C] value becomes the current position value.
1	After homing completion with “homing method [0x6098]”, the motor rotates “home offset [0x607C] and the current position value is 0 at the position rotated as much as the“home offset [0x607C]”.

9.1.1 XGF-PN4B/XGF-PN8B Touch Probe Homing Function

During homing, homing is executed using a touch probe to the trigged position.

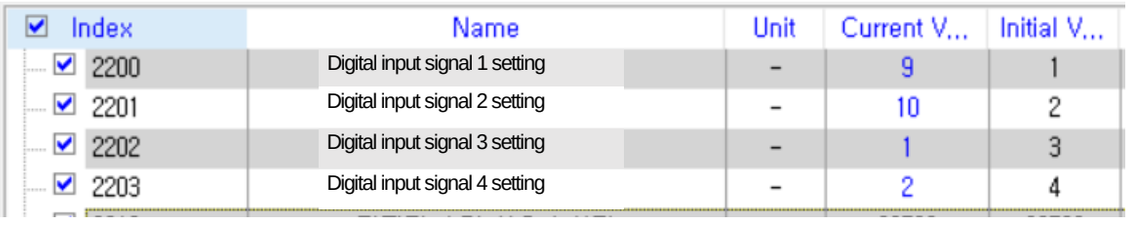
(1) Previous setting item

(a) The object to trigger should be included in the PDO setting of slave parameters.

Trigger input	RxPDO	TxPDO
Touch probe 1 rising edge	0x60B8:0 Touch probe function	0x60B9: 0 Touch probe state 0x60BA: 0 touch probe 1 forward direction position values
Touch probe 2 rising edge	0x60B8:0 Touch probe function	0x60B9: 0 Touch probe state 0x60BC: 0 touch probe 2 forward direction position values
Touch probe 1 falling edge	0x60B8:0 Touch probe function	0x60B9: 0 Touch probe state 0x60BB: 0 touch probe 1 reverse direction position values
Touch probe 2 falling edge	0x60B8:0 Touch probe function	0x60B9: 0 Touch probe state 0x60BD: 0 touch probe 2 reverse direction position values

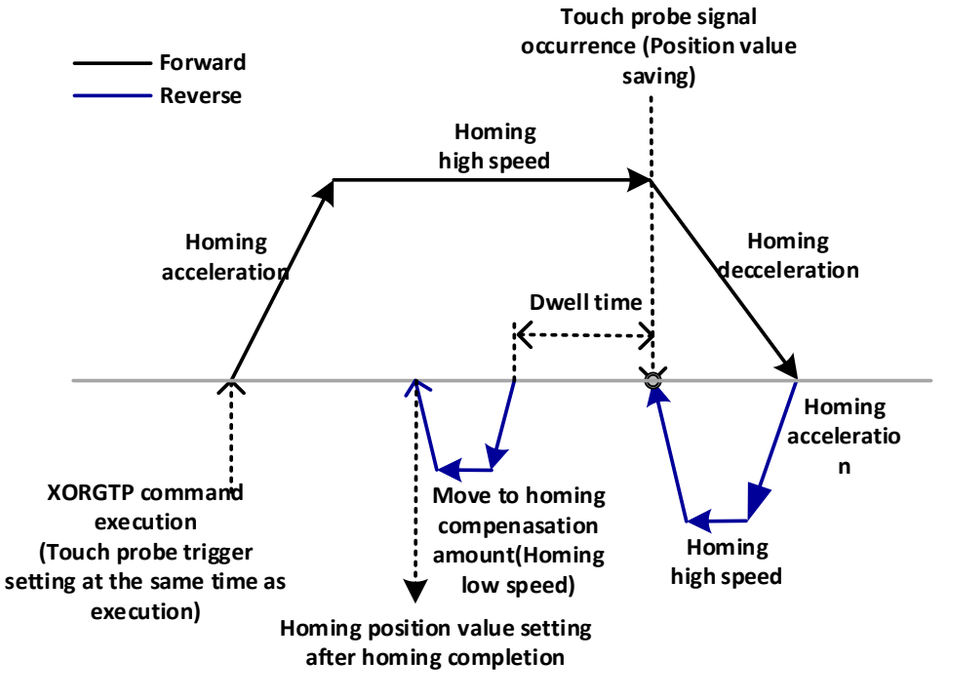
(b) The touch probe input signal should be set in servo parameter.

- As shown below, the input signals of the L7NH series servo must be set to 9 (TPROBE1), 10 (TPROBE2), 1 (upper limit), and 2 (lower limit), respectively.



Index	Name	Unit	Current V...	Initial V...
2200	Digital input signal 1 setting	-	9	1
2201	Digital input signal 2 setting	-	10	2
2202	Digital input signal 3 setting	-	1	3
2203	Digital input signal 4 setting	-	2	4

(2) Homing method



The upper picture is an example of homing forward operation. The touch probe trigger is set when starting homing command. Operates at high speed in the homing direction. When a touch probe signal occurs, it is decelerating stop, the position of latched touch probe can be read by the position data read command (XLRD, XPM_LRD). After deceleration stop at the high speed in the reverse direction and complete the operation at the position where the touch probe signal occurred. When setting home compensation amount, it moves by home compensation amount and change to the home position values when the final homing is completed.

(3) Parameter Description

(a) Trigger signal

The trigger signal is the same as the touch probe command. It operates with a single trigger. For more details, refer to "9.6.5 Touch Probe"

(b) Homing direction

1) There are 2 kinds of homing direction, forward direction and reverse direction.

2) In case of homing command was set by forward, begin to homing operation to currently increasing direction of position, searching needed external signal for homing.

3) In case of homing command was set by reverse, begin to homing operation to currently decreasing direction of position, searching needed external signal for homing.

(c) Home position

1) When homing is completed by homing command, the value set by homing address shall be used to change present address value. In other words, it is item to set home position values.

2) Setting range:-2,147,483,648~ 2,147,483,647 (units)

(d) Home compensation amount

1) If the machine home is deviated slightly, the difference between the setting value and the actual transfer amount caused by the mechanical tolerance, this is used to compensate the tolerance.

2) If home compensation amount is set, PLC outputs additional pulses as much as data amount set as origin compensation amount after detecting origin. If home compensation amount is (+), it moves to the homing direction by the amount of home compensation

amount. If origin compensation amount is (-), it moves to the opposite direction of homing and completes homing.

3) Home compensation amount setting range:-2,147,483,648~ 2,147,483,647 (units)

(e) Homing high speed

1) After executing touch probe homing, it operates at high speed before occurring trigger and when returning to the touch probe trigger occurrence position.

2) The related values is set by jog high speed/jog low speed, acceleration time of manual operation parameters.

(f) Homing low speed

1) When operating the home compensation amount, it operates at low speed.

2) The related values is set by jog high speed/jog low speed, deceleration time of manual operation parameters.

(g) Homing restart time

1) If the home is not detected during homing and the homing operation is automatically restarted due to external input upper and lower limit signals, etc., this is the waiting time before restarting the homing operation.

2) Motor do not move actually during settling time by restart time.

(h) Homing accelerating speed/ deceleration speed time

1) When operates by homing command, it will be accelerate or decelerate by the homing acceleration time and homing deceleration time".

2) Available range is 0 ~ 2,147,483,647 [ms], if it is set by "0", It will be accelerate or decelerate according to acceleration/deceleration time1 of basic parameter when homing.

(i) Homing dwell time

1) This is the time needed to maintain the precise stop accuracy of servo motor when using the servo motor for homing.

2) The dwell time is time to require to eliminate residual pulse of deviation counter after completing positioning and in particular, the dwell time during homing is called the homing dwell time.

3) Setting range of homing dwell time: 0 ~ 65,535(unit: 1㎳)

9.1.2 Drive Absolute Position Error Detection Function

In case of initializing homing completion status when an absolute position error is detected in the drive, you can initialize homing completion status by using drive absolute position error detection function. It can be used only with drives that support absolute position valid signal (external signal bit) and the supported drive are as follows.

	Drive
LS	L7NH, PEGASUS, iX7NH
FESTO	CMMT-AS

(1) Control features

(a) When absolute position of drive is damaged in the homing status (ex, encoder cable open), it is used to initialize the homing status and prevent malfunction caused by absolute position error.

(b) The function operates only drives that support absolute position valid signals.

(c) Extended parameter 「drive absolute position error detection」 is 1: the function operates when set homing status initialization is set.

(d) When detecting that the absolute position valid signal changes from on to off through EtherCAT communication, homing status of the axis is initialized and axis error (absolute position error detection error: 860)is occurred.

(e) When communication is connected through the EtherCAT connection command, if the absolute position valid signal is off, the homing status of the axis is initialized.

(f) When changing the extended parameter 「drive absolute position error detection」 from 0: no detection to 1: drive absolute position error detection, if the absolute position valid signal of the axis is off, the homing status of the axis is initialized and axis error (absolute position error detection error during parameter writing) is occurred.

(g) If the floating origin setting function is executed while the drive absolute position valid signal of the axis is off, an axis error (absolute position error detection error during executing the floating origin setting function: 213) will occur.

(h) If the current position preset function is executed while the drive absolute position valid signal of the axis is off, an axis error (absolute position error detection error during executing the current position preset function: 453) will occur.

■ Setting related parameter (expansion parameter)

Item	Setting Value	Content
Drive absolute position error detection	0 ~ 1	Set whether to use drive absolute position error detection.

S/W version information that supports drive absolute position error detection function is as follows.

	Version
XGF-PN4B	V2.50 or higher
XGF-PN8B	V2.50 or higher
XGF-PN16B	V2.50 or higher
XG5000	V4.75 or higher

9.2 Positioning Control

Positioning control execute using data which set on the「Operation Data」. Types of positioning control include single axis position control, single axis speed control, single axis Feed control, Interpolation control, speed/position switching control, position/speed switching control, position/torque switching control.
Each control method is set in control method of 「operation data」 settings items Depending on the setting of control method, the following controls can be executed.

Positioning Control		Control method	Operation
Positioning	Single-axis Position Control	Absolute, Single axis position control Incremental, single-axis Position Control	Execute positioning control for the designated axis from the starting position (current position) to goal position (movement amount).
	Single axis FEED control	Absolute, single axis Feed Control Incremental, Single-axis Feed Control	The starting position (the current stop position), changes to 0 and executes positioning control as much as setting amount of movement.
	Linear Interpolation	Absolute, Linear Interpolation Relative, Linear Interpolation	Linear interpolation control is executed from the start address (current stop position) to the target position (movement amount) using the designated axis (more than 2 axes).
	Circular Interpolation	Absolute, circular arc interpolation Incremental, Circular Interpolation	Execute positioning control until goal position by the trajectory of arc and control sub-axis as using 2 axes according to data of main axis.
	Helical interpolation		Set by helical interpolation axis, execute linear interpolation control until goal position by the trajectory of arc and control sub-axis as using 3 axes according to data of main axis.
	Ellipse interpolation		Execute positioning control until goal position by trajectory angle of the ellipse is set to operate and control sub-axis as using 2 axes according to data of main axis.
Speed control		Absolute, Single axis speed control Incremental, Single-axis Speed Control	Execute Speed control as setting speed until deceleration stop command is entered.
Speed/position switching control		Absolute, Single axis speed control Incremental, Single-axis Speed Control	Speed controlling and then speed / position switching command or speed / position control switching input signal is entered, speed control switch to position control and execute positioning control as much as target position.
Position/Speed Switching Control		Absolute, Single axis position control Incremental, single-axis Position Control	Position controlling and then position / speed switching command is executed, position control switch to speed control and execute speed control as setting speed until deceleration stop command is entered.
Position/ torque switching control		Absolute, Single axis position control Incremental, single-axis Position Control	Position/torque switching command is executed during position control, position control switches to torque control and execute torque control as torque values set in auxiliary data of position/torque switching command until deceleration stop command is inputed.

9.2.1 Operation Data for Positioning Control

Describe the Operation data and Setting to execute positioning control.

Operation data	Setting content
Control method	Set the Type of control and Standard coordinates of Positioning control.
Program control method	Set the control method of continuous operation data.
Target position	Set the absolute target position or distance of positioning control.
Operation speed	Set the value of operation speed during operation control.
Acc. No.	Set the operation number of operation control during acceleration time. Acceleration Number is selected from basic parameters which are Acceleration Number1, 2, 3, and 4.
Deceleration No.	Set the operation number of operation control during deceleration time. Deceleration Number is selected from basic parameters which are Deceleration Number1, 2, 3, and 4.
M code	Set the M Code when using the code number for sub operation of positioning control.
Dwell time	After complete the positioning control, set the time until servo drive complete positioning control.
Sub axis setting	Set the sub axis during interpolation control.
Auxiliary point of circular arc interpolation	Set the secondary data (middle point, center point and radius) during circular interpolation.
Circular interpolation mode	Set the generating method of arc (middle point, center point and radius) during circular interpolation.
No. of circular interpolation turn	Set the number of arcs to draw during circular interpolation.
Helical interpolation	Set the axis to run linear operation during helical interpolation.

Notes

It is available to set the operation data each of 1~400 steps and axis1~8.

9.2.2 Operation Mode of Positioning Control

Operation mode describes various configurations for how to operate the positioning data using several operation step no. and how to determine the speed of position data.

Operation mode types are as follows

Control method	Operation method	Operating pattern	Executable	Operation
Single-axis Position Control	Single	End	○	Finish after the completion of the current step position control
		Continue	○	Continue to the next step after the completion of the current step position control
		Continuous	○	Continue to the next step continuously without stop.
	Repeat	End	○	Change the step No. to the Repeat step No. after the completion of the current step position control.
		Continue	○	Continue to the repeat step No. after the completion of the current step position control
		Continuous	○	The current step and the repeat step No. continuously without stop
Single axis speed control	Single	End	○	Speed control using current step's DATA.
		Continue	○	Speed control using current step's DATA. If VTP command executed, continue to the next step after the completion of the current step's positioning.
		Continuous	X	Occurrence of errors
	Repeat	End	○	Speed control using current step's DATA.
		Continue	○	Speed control using current step's DATA. If VTP command executed, continue to the repeat step No. after the completion of the current step's positioning.
		Continuous	X	Occurrence of errors
Single axis FEED control	Single	End	○	Finish after the completion of the current step's FEED control
		Continue	○	Continue to the next step after the completion of the current step FEED control
		Continuous	X	Occurrence of errors
	Repeat	End	○	Change the step No. to the Repeat step No. after the completion of the current step FEED control.
		Continue	○	Continue to the repeat step No. after the completion of the current step FEED control
		Continuous	X	Occurrence of errors
Linear Interpolation	Single	End	○	Finish after the completion of the current step's linear interpolation
		Continue	○	Continue to the next step after the completion of the current step s linear interpolation
		Continuous	○	Continue to the next linear interpolation step continuously without stop

	Repeat	End	○	Change the step No. to the Repeat step No. after the completion of the current step linear interpolation.
		Continue	○	Continue to the repeat step No. after the completion of the current step linear interpolation
		Continuous	○	Continue to the repeat step No. after the completion of the current step linear interpolation
Circular Interpolation	Single	End	○	Finish after the completion of the current step's circular interpolation
		Continue	○	Continue to the next step after the completion of the current step circular interpolation
		Continuous	○	Continue to the next circular interpolation step continuously without stop
	Repeat	End	○	Change the step No. to the Repeat step No. after the completion of the current step circular interpolation.
		Continue	○	Continue to the repeat step No. after the completion of the current step circular interpolation
		Continuous	○	Continue to the repeat step No. after the completion of the current step circular interpolation

Notes

1. Operation mode shall be set from PLC program or operation data of XG-PM.
2. Operation data can be set up to 400 from operation step no. 1 ~ 400 at each axis.
3. With one time start command, positioning operation method by one operation step positioning data and positioning operation method by several operation step in order shall be determined by operation mode of each positioning data set.

(1) End Operation (Single)

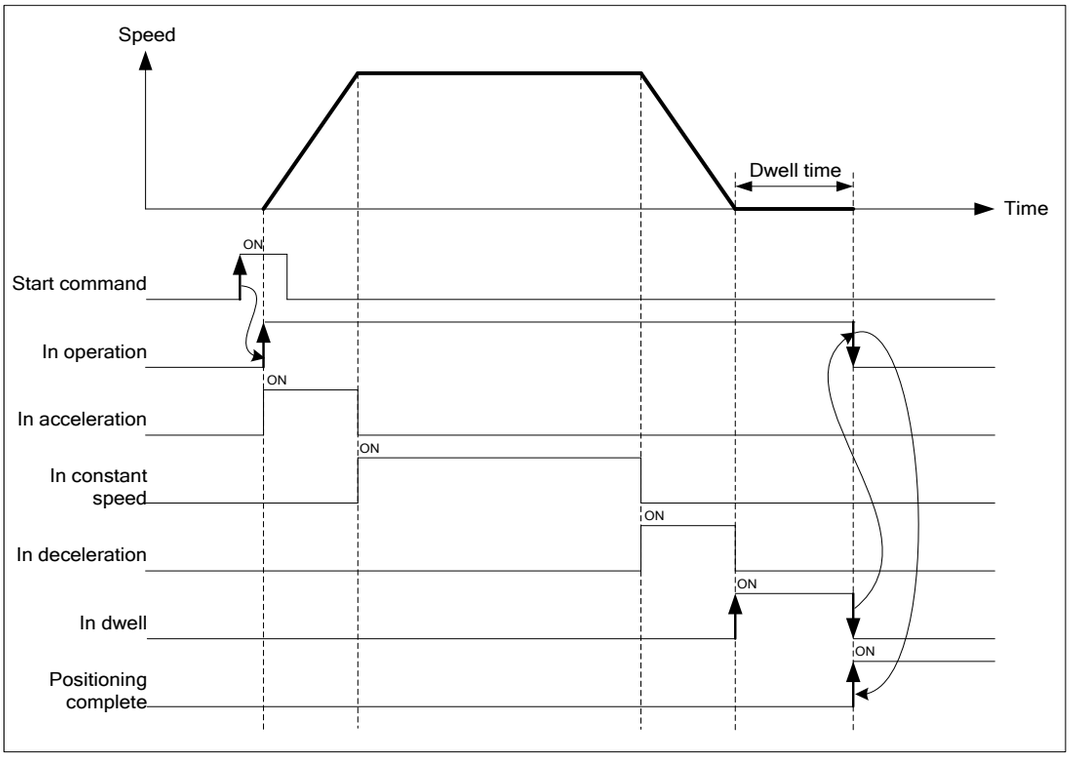
(a) With one timestart command, the positioning is executed to target position and the positioning shall be completed at the same time as the dwell time proceeds.

(b) It is used as the last operation data of continuous operation mode, continuous operation mode. (t stop after executing operation data set to End.

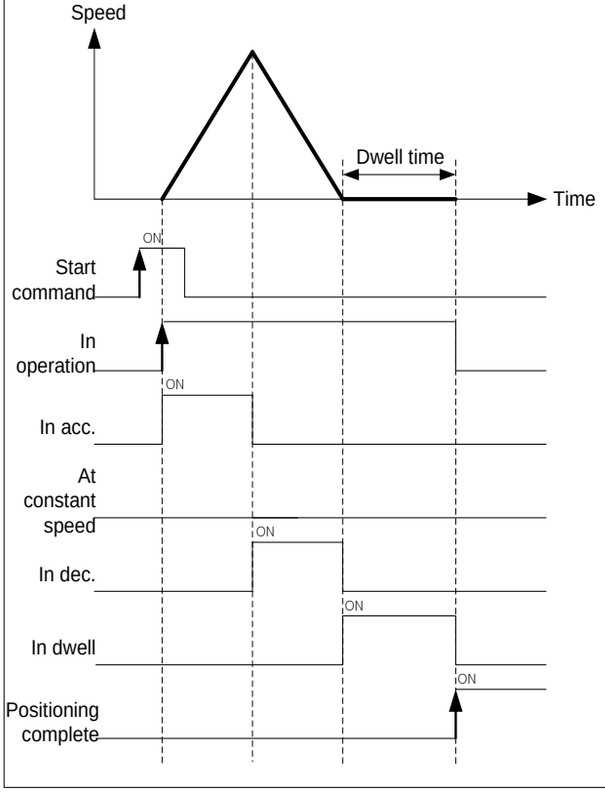
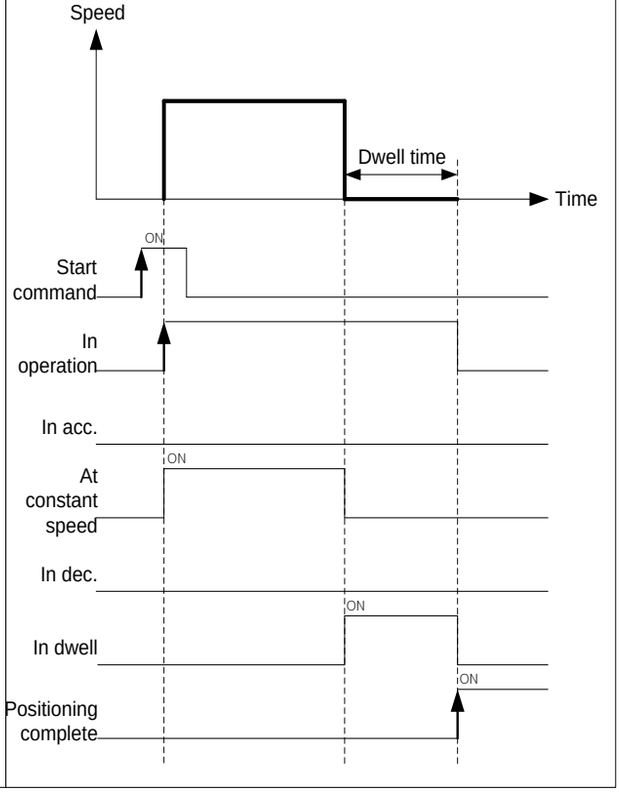
(c) Operation direction shall be determined by setting valueof target position.

(d) Operation action is trapezoid (or S-Curve) type operation that has acceleration, constant, deceleration section according to the setting speed and target position but the operation pattern of follow type can be occurred according to values set in targetposition.

1) Normal Operation Patterns



2) Abnormal Operation Patterns

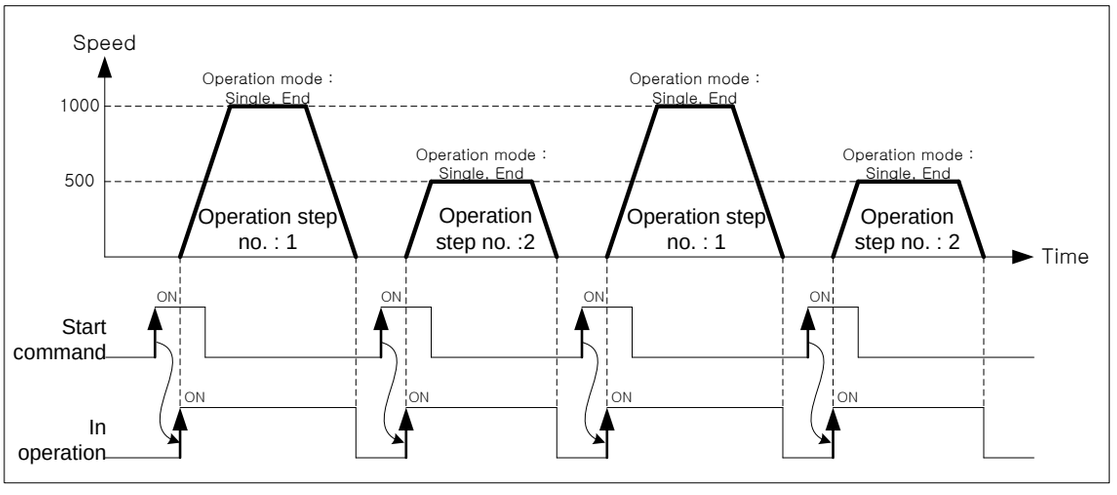
The operation speed is large compared with moving amount	Acc. time = 0, Dec. time = 0
	

[Ex] The start command is executed after the step number of indirect start command is set to '0'.
Starting command execute total four times.

■ Setting of XG-PM

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Absolute, Single axis position control	Single,End	10000	1000	No.1	No.1	0	0
2	Absolute, Single axis position control	Single,End	15000	500	No.1	No.1	0	0
3	Absolute, Single axis position control	Single,End	25000	1000	No.1	No.1	0	0
4	Absolute, Single axis position control	Single,End	30000	500	No.1	No.1	0	0

■ Operation Patterns



The operating step for each starting command will be [1] → [2] → [3] → [4].

(2) End Operation (Repeat)

(a) With one time start command, the positioning to the goal position is executed and the positioning shall be completed at the same time as the dwell time proceeds.

(b) Theoperation mode of repeat operation pattern is same as that of single operation but the different thing is to determine next operation by operation step no. assigned by repeat step no. change command after positioning completion of repeat operation mode.

(c) Therefore, if repeatstep no. changecommand was not executed, the step no. “1” shall be assigned after positioning completion of repeat operation mode and operated at next start command“Thus, this operation can be used for the structure that several operation steps are repeated.

(d) If operation step is set to a value other than 0 (1~400) in indirecting start after executing repeat operation mode, positioning operation is executed using the set step number regardless of the current operation step number. However, if changing step number to 0, positioning is executed with the current step number changed by the repeat operation mode.

(e) Operation direction shall be determined by setting value of goal position.

(f) Repeat operation step no. change command is available to execute during operation.

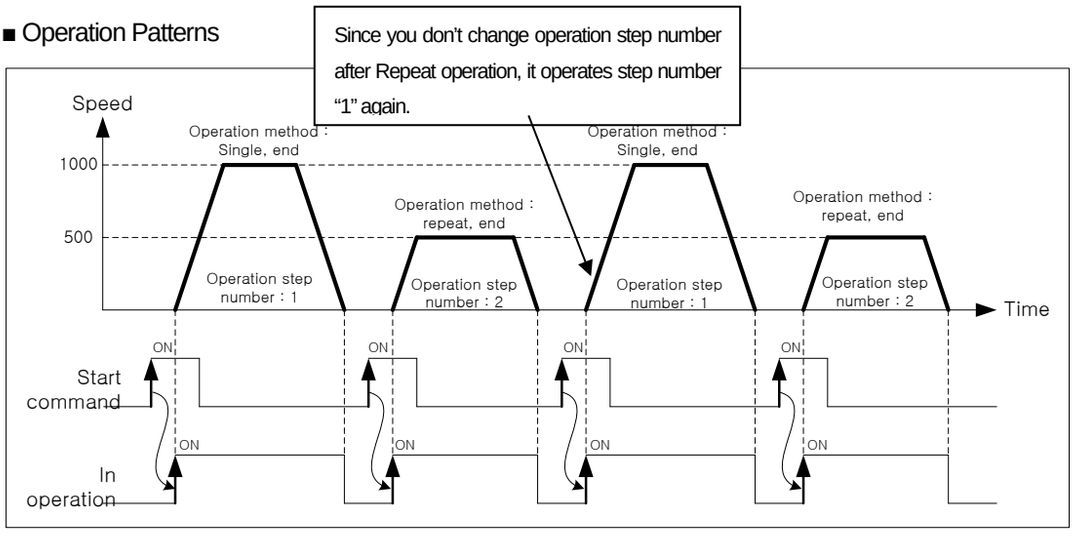
[Ex1] when operating by start command

- The start command is executed after the step number of indirect start command is set to '0'.
- Starting command execute total four times.

■ Setting of XG-PM

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Absolute, Single axis position control	Single,End	10000	1000	No.1	No.1	0	0
2	Absolute, Single axis position control	Repeat,End	15000	500	No.1	No.1	0	0
3	Absolute, Single axis position control	Single,End	25000	1000	No.1	No.1	0	0
4	Absolute, Single axis position control	Repeat,End	30000	500	No.1	No.1	0	0

■ Operation Patterns



The operating step for each starting command will be [1] → [2] → [1] → [2].
The operating step3 and step4 will not be executed

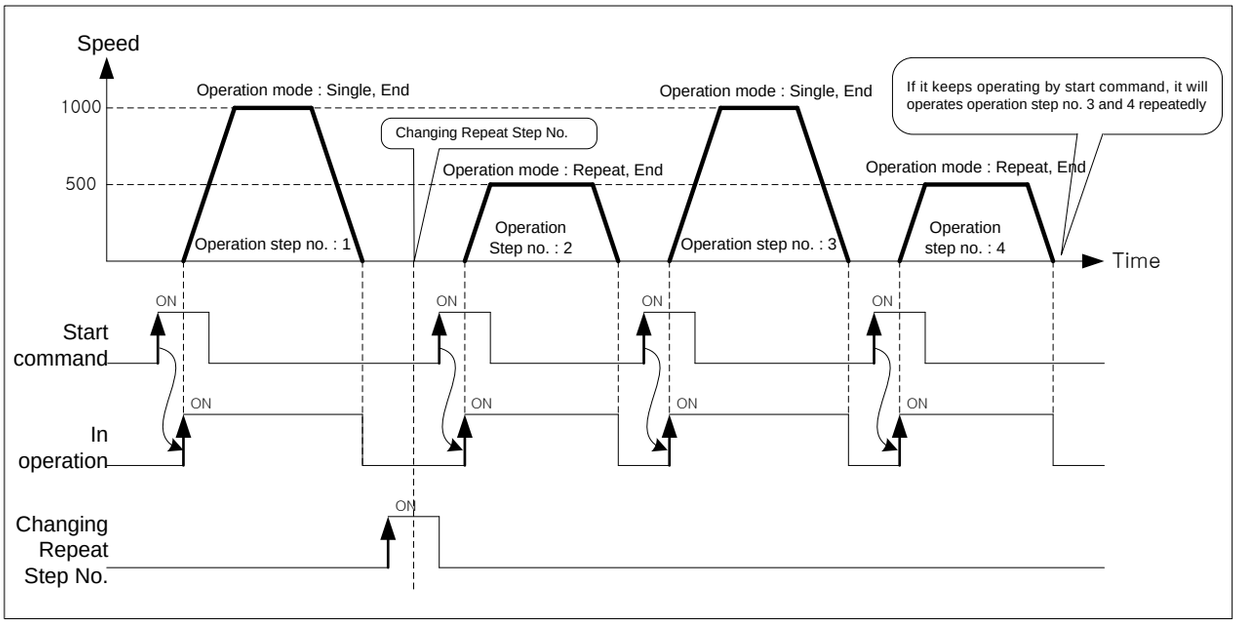
[Ex2] Operating by specified the start command and repeat operation step number.

- The start command is executed after the step number of indirect start command is set to '0'.
- After the first starting command, change repeat operation step number as“3” by repeat step number change command.
- Execute starting command 3 times.

■ Setting of XG-PM

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Absolute, Single axis position control	Single,End	10000	1000	No.1	No.1	0	0
2	Absolute, Single axis position control	Repeat,End	15000	500	No.1	No.1	0	0
3	Absolute, Single axis position control	Single,End	25000	1000	No.1	No.1	0	0
4	Absolute, Single axis position control	Repeat,End	30000	500	No.1	No.1	0	0

■ Operation Patterns



The operating step for each starting command will be [1] → [2] → [3] → [4].

(3) Keep Operation

(a) With one time start command, the positioning to the target position of operation step is executed and the positioning shall be completed at the same time as dwell time proceeds and without additional start command, the positioning of operation step for (currentoperation step no. +1) shall be done.

(b) Keep operation mode is available to execute several operation steps in order because it automatically executes positioning ofthe next number.

(c) Set the operation pattern by 'End' when executing the last step of Keep operation.

(d) When operation pattern is Keep, continue operation until operation pattern come out as 'End'. Therefore, if there is no "END" operation pattern, execute until operation step No. 400. And if operation pattern of step 400 is not "End"', error occurs and operation will be stop. When operation pattern of step 400 is 'Repeat, Keep', execute operation data of Repeat Step Number.

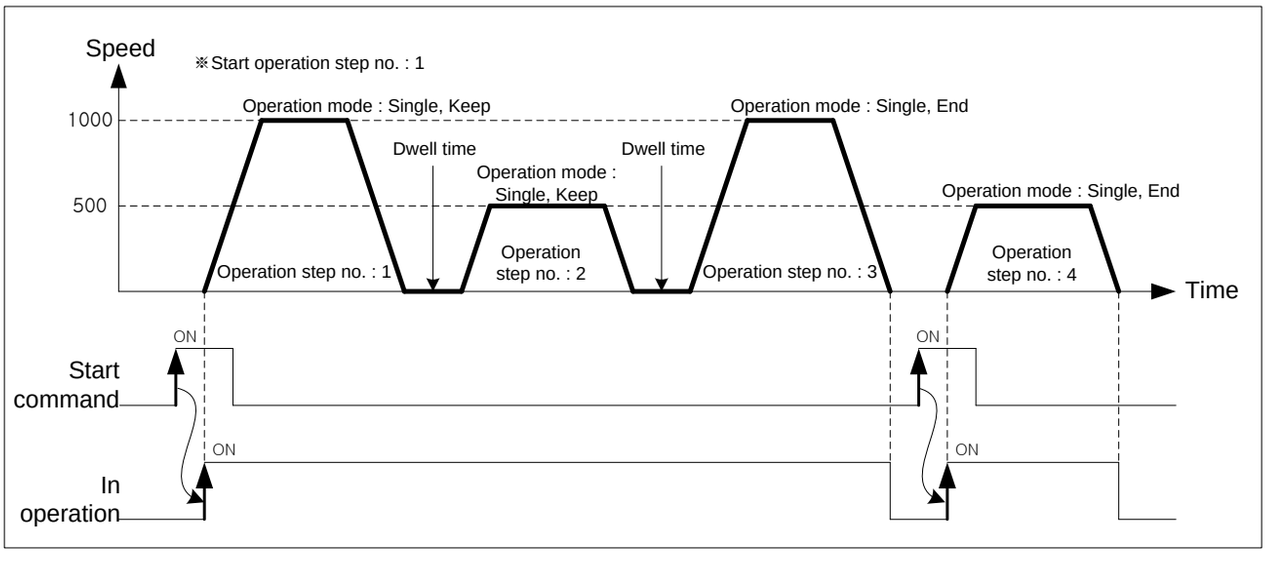
(e) Operation direction shall be determined by setting value of goal position.

[Ex] The start command is executed after the step number of indirect start command is set to '0'.
Start command execute total two times.

■ Setting of XG-PM

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Absolute, Single axis position control	Single,Keep	10000	1000	No.1	No.1	0	0
2	Absolute, Single axis position control	Single,Keep	15000	500	No.1	No.1	0	0
3	Absolute, Single axis position control	Single,End	25000	1000	No.1	No.1	0	0
4	Absolute, Single axis position control	Single,End	30000	500	No.1	No.1	0	0

■ Operation Patterns



The operating step for each starting command will be [1 → [2 → [3] → 42].

(4) Continuous operation

(a) Continuous operation overview

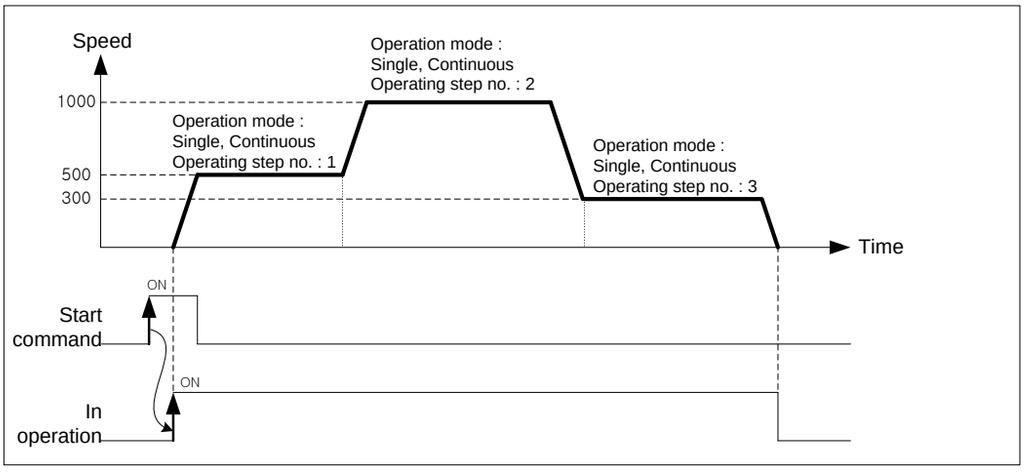
1) With one time Start command, the positioning for operation step set by continuous operation mode is executed to the goal position without stop and the positioning shall be completed at the same time as dwell time proceeds.
2) If the moving amount of next operation step is smaller than the deceleration distance from current position, the "Look ahead control" is activated to avoid immediate stop at operation speed ≠ 0].
3) Steps of dwell time set as 'Continuous' operation mode is ignored, steps of dwell time set as 'End' operation pattern is valid.
4) When you execute 'Continuous' operation mode, always set as 'End' for the very last operation step.
5) When operation pattern is continuous (or Keep),'keep operation until operation pattern come out as 'End'. If there is no "END" operation pattern, execute until operation step No. 400. And if operation pattern of step 400 is not "End"', error occurs and operation will be stop. When operation pattern of step 400 is 'Repeat, continuous', execute operation data of Repeat Step Number.
6) Operation direction shall be determined by setting value of goal position.
7) If you want to operate with the position and speed of next step position and speed before the current operation step reaches the target position, the operation by the continuous operation」(XNMV) command is available.
8) 「continuous operation」(XNMV) command can be executes in the acceleration, constant speed, deceleration section of continuous operation.

[Ex] The start command is executed after the step number of indirect start command is set to '0'.
Starting command execute one time.

■ Setting of XG-PM

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Absolute, Single axis position control	Single, Continuous	10000	500	No.1	No.1	0	0
2	Absolute, Single axis position control	Single, Continuous	30000	1000	No.1	No.1	0	0
3	Absolute, Single axis position control	Single,End	40000	300	No.1	No.1	0	0

■ Operation Patterns



Operating step that execute according to starting command order will be [1 → 2 → 3].

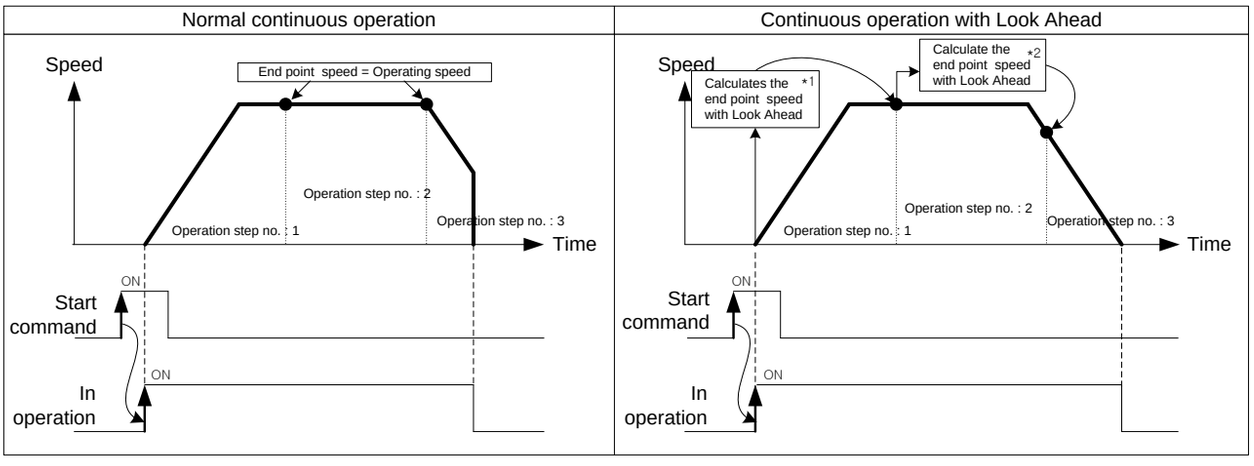
Notes

1. When operation method is continuous, sometimes it can be changed to next operation step speed before reaching the amount of movement current step's goal position. This is operation to change operating speed continuously, The remained moving amount of current step is operated in next step. (The remaining distance below the driving speed is less than the distance that can be traveled in 1 control cycle (between 1 and 4 ms) at the speed before reaching the target position.)
2. When control method is linear or circular interpolation and operation method is continuous, positioning operation is different according to the setting value by extended parameter of 「interpolation continuous positioning method」. Refer to continuous operation of interpolation control for detail.

(b) Look Ahead

1) If the moving amount of next operation step is smaller than the deceleration distance from current position, the "Look ahead control" is activated to avoid immediate stop at operation speed ≠ 0.
2) Look Ahead is control that calculates in advance the allowable entry speed for operation in the next step using not only the current operation step but also the target position (movement amount) of the operation steps to be executed next and uses it as the end point speed in the current step. If the target position (movement amount) of the next operation steps are small, available entry speed (operation speed of current step) of next steps and always, stop speed is always 0.
3) Calculates the "Look Ahead" using target position (movement amount) of total 3 steps including current step.

The difference of general continuous operation and Look Ahead control is as below.



* 1: moving amount of Step 2 and Step 3 is more than the deceleration stop distance from operation speed. So, endpoint speed = operation speed.

* 2: When moving amount of step 3 is smaller than deceleration stop distance from operation speed of step 2. Therefore, it calculate speed that stop speed of step 3 is 0, and use the endpoint speeds of step 2.

(c) Continuous operation of interpolation control

When control method is linear or circular interpolation and operation method is Continuous, positioning operation is different according to the setting value by extended parameter of 「Continuous interpolation positioning method」. There are two methods of interpolation. One is「Passing Goal Position」which passes through the specified goal position and the other is「Near Passing」which proceed to the next step at near position not to exceed a specified goal position.

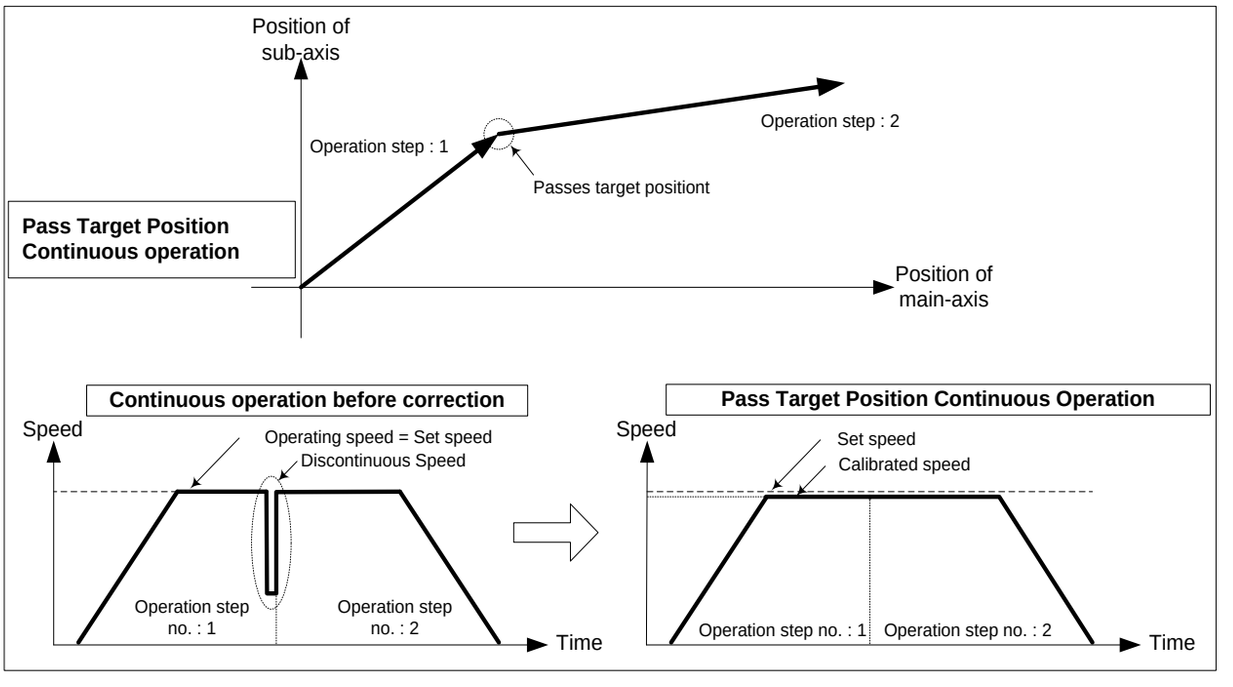
「continuous interpolation positioning method」 Setting of expanded parameter is as below.

Item	Setting Value	Content
Continuous interpolation positioning method	0: passing target position	Execute Continuous Operation which passes exact goal position of current step which set on operation data.
	1: Near Passing	In case of continuous operation from current step to next step, it passes near target position of current step

1) Passing Goal Position Continuous Operation

「Passing Goal Position」 Continuous Operation must be passing by goal position to the data set on goal position when changing from current step to next step. In the interpolation control, when execute a continuous operation from current step to next step, there can be mechanical vibration caused by discontinuous operating speed because of remaining moving amount. Positioning module use the speed compensation. It can solve mechanical vibration problem and execute Continuous operation which user set by from goal position to next step.

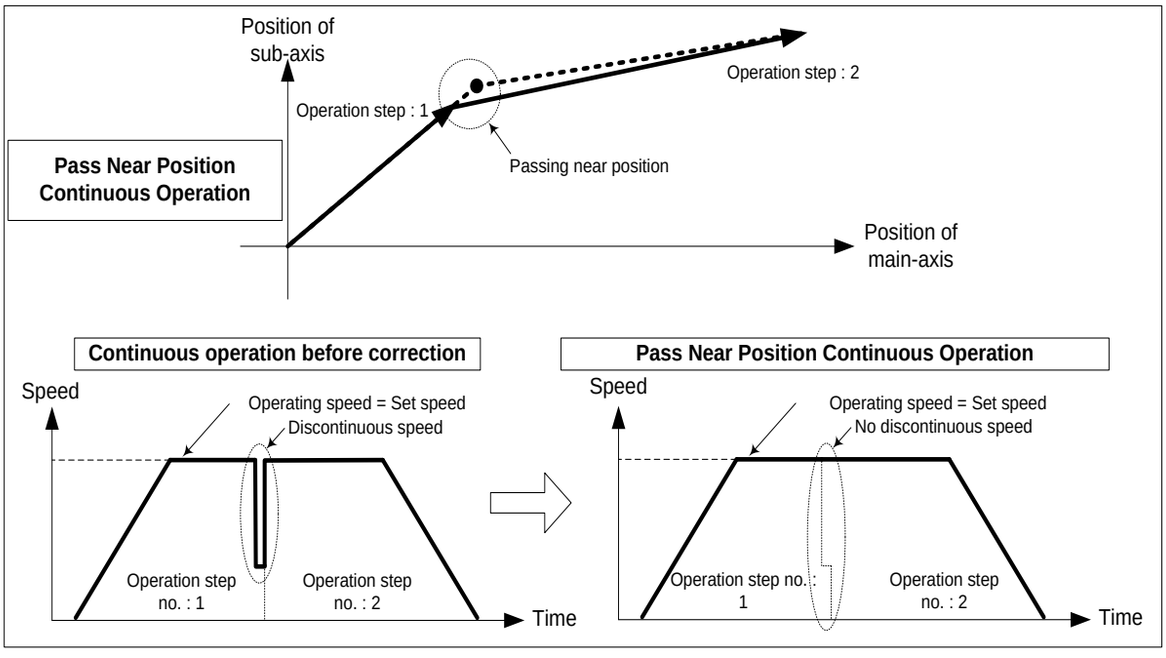
Next, describing the principle of「passing goal position」Continuous operation



It decrease speed of acceleration, constant speed section as much as remaining amount of movement at the last section of current step to compensate position if operates as passing goal position operation. Because next step can start with compensated speed, can avoid occurrence of discontinuous operating speed.

2) Near Passing Continuous Operation

It changes to the next step at near position not exceeding goal position of current step. This is the way to eliminate discontinuous operating speed which occurs by remaining amount of movement data at the last of current step. Next, describing the principle of「Near Passing」Continuous operation.



In the picture above, during general Continuous Operation, Occurring speed discontinuity because of remaining amount of movement at the last operation step NO.1. 「Near Passing」Continuous Operation, you can move the remaining amount of movement to next step and execute Continuous Operation without speed discontinuity.

Notes

When using「Near passing」continuous operation, sometimes it operates with next step speed before reaching the amount of movement set on goal position to remove the discontinuity of speed. However in the case of Interpolation Continuous Operation control, it can have a gap with trajectory data which user set if it operates speed of the next step before reaching the goal position. The following is the maximum difference of position for each axis.
Maximum position difference for each axis <(speed of each axis (pls / s) x control cycle (= 1ms or 5ms))
For further information refer to above picture.

(d) Deceleration Stop of Continuous Operation

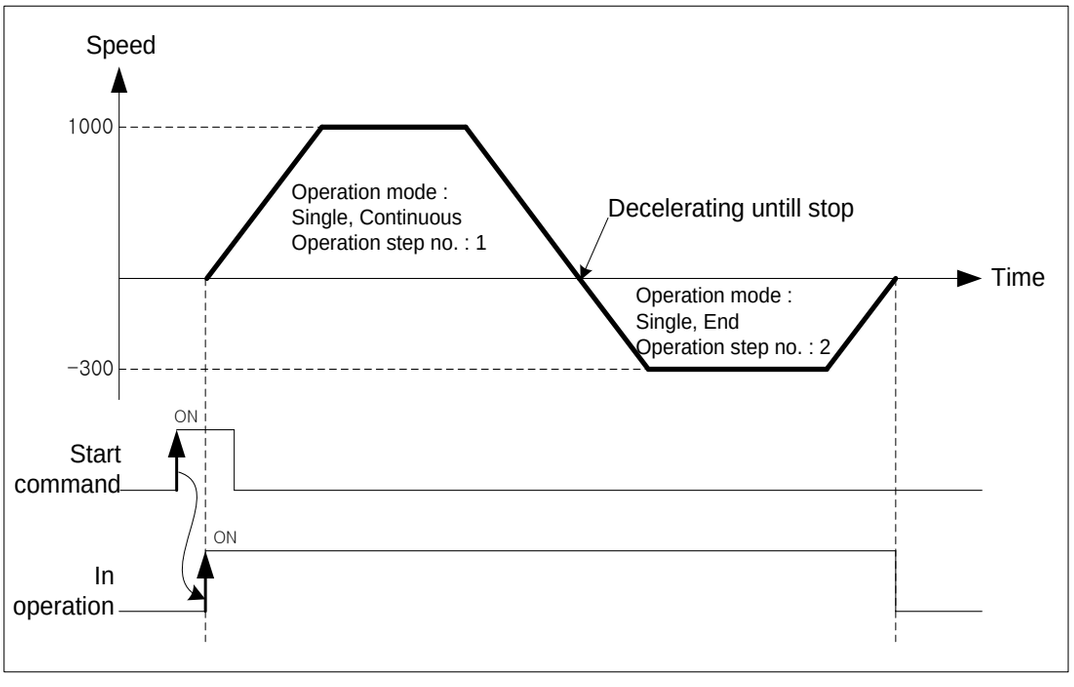
Continuous operation control is decelerating and positioning completed during the 'End' operation step. However, as following cases, it keeps next step operation after the speed becomes o after decelerating stop.

1) When the moving direction of current executing operation step and the moving direction of next step is different (the case of single positioning control only)

■ Setting of XG-PM

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Absolute, Single axis position control	Single, Continuous	10000	1000	No.1	No.1	0	0
2	Absolute, Single axis position control	Single,End	3000	700	No.1	No.1	0	0

■ Operation Patterns



The step1 will be operated by the start command and be decelerating stop by 0 since moving direction changes from 10000 → 3000 at the target position of next step and then operate step2 to a opposite direction.

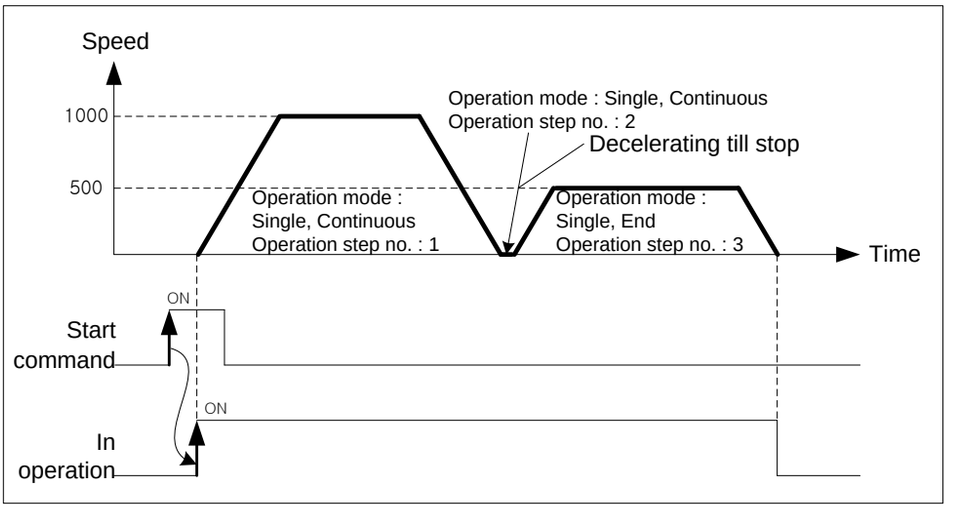
2) When the moving amount of next step is 0

When the next step's moving amount is 0, operation speed will be 0 during one control period.

■ Setting of XG-PM

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Absolute, Single axis position control	Single, Continuous	10000	1000	No.1	No.1	0	0
2	Absolute, Single axis position control	Single, Continuous	10000	1000	No.1	No.1	0	0
3	Absolute, Single axis position control	Single,End	15000	500	No.1	No.1	0	0

■ Operation Patterns



The step1 will be operated by the start command. However, because the moving amount of next step is 0, it stops after deceleration, and then operates step3.

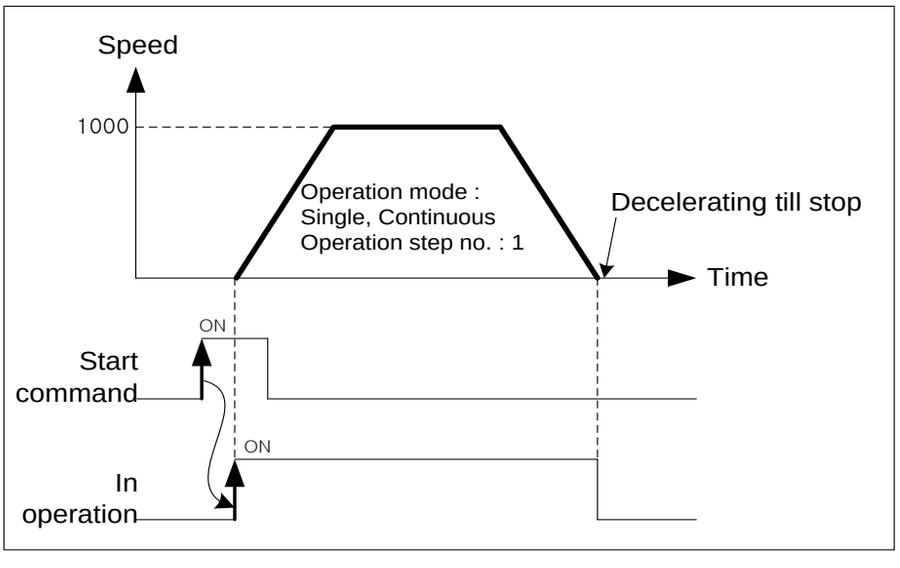
3) If there is an error on the operation data of next step

If the operation speed of next step is 0 or if the operation method of current step is「Single-axis Positioning Control」but operation method of next step is 「Single-axis FEED Control」), it stops after deceleration after current step's operation, and then completes operation.

■ Setting of XG-PM

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Absolute, Single axis position control	Single, Continuous	10000	1000	No.1	No.1	0	0
2	Absolute Single-axis Feed Control	Single, Continuous	20000	1000	No.1	No.1	0	0
3	Absolute, Single axis position control	Single,End	30000	1000	No.1	No.1	0	0

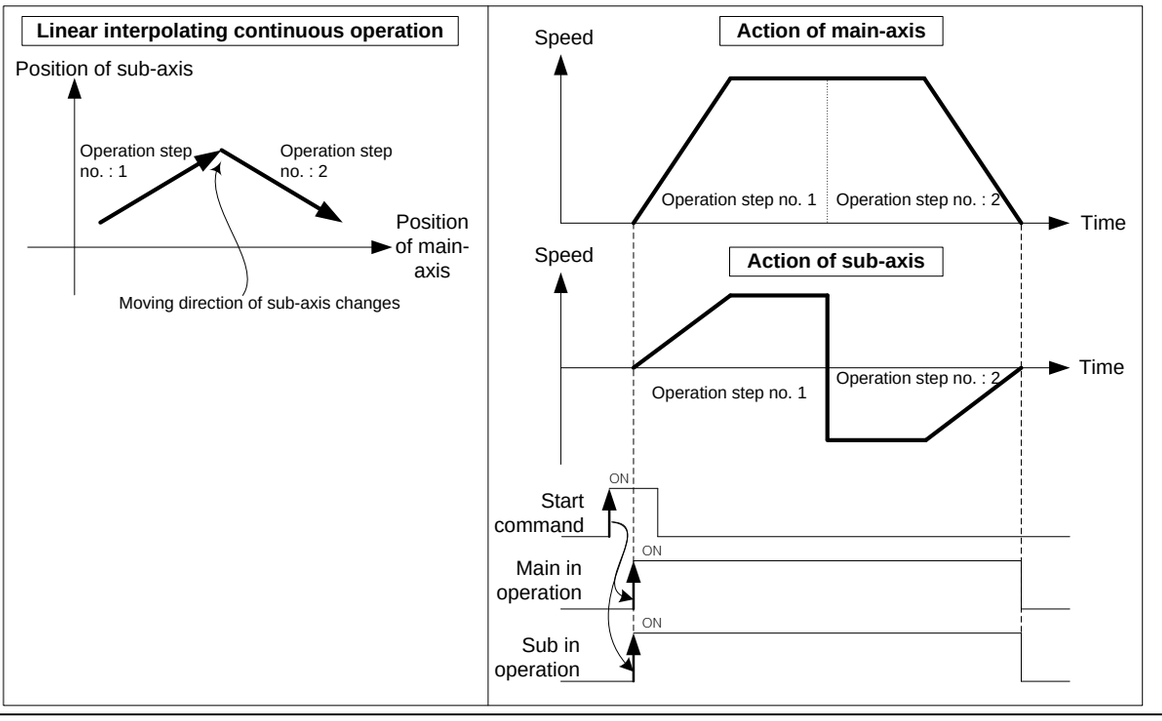
■ Operation Patterns



Notes

During Continuous Operation of Linear interpolation or circular interpolation, because the PLC does not check the direction of movement, does not deceleration stop even if the moving direction is changed? Therefore, if there is opposite direction of target position set on operation data, it may cause damages to machine because of rapid direction changing.

In this case, use the operation method of 「Keep」 to prevent the damage for system.



9.2.3 Single-axis Position Control

After executed by the start positioning operation command (「Direct start」, 「Indirect start」, 「Simultaneous start」), positioning control from specified axis (the current stop position) to goal position (the position to move).

(1) Control by Absolute method (Absolute coordinate) (「Absolute, Single-axis Positioning Control」)

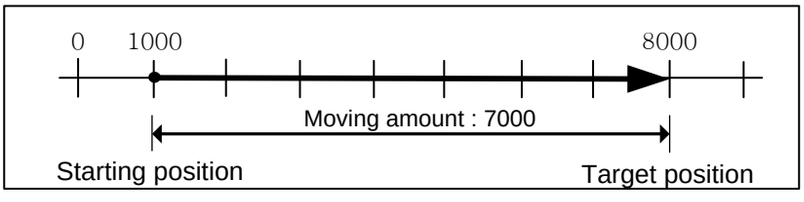
(a) Positioning control from start position to goal position (the position assigned by positioning data). Positioning control is carried out based on the position assigned (origin position) by homing.

(b) Moving direction shall be determined by start position and goal position.

- ■ Starting Position < Goal Position: Forward positioning control operation
- ■ Starting Position > Goal Position: Reverse positioning control operation

[Example] Executes Absolute coordinate, single-axis position control with the following setting

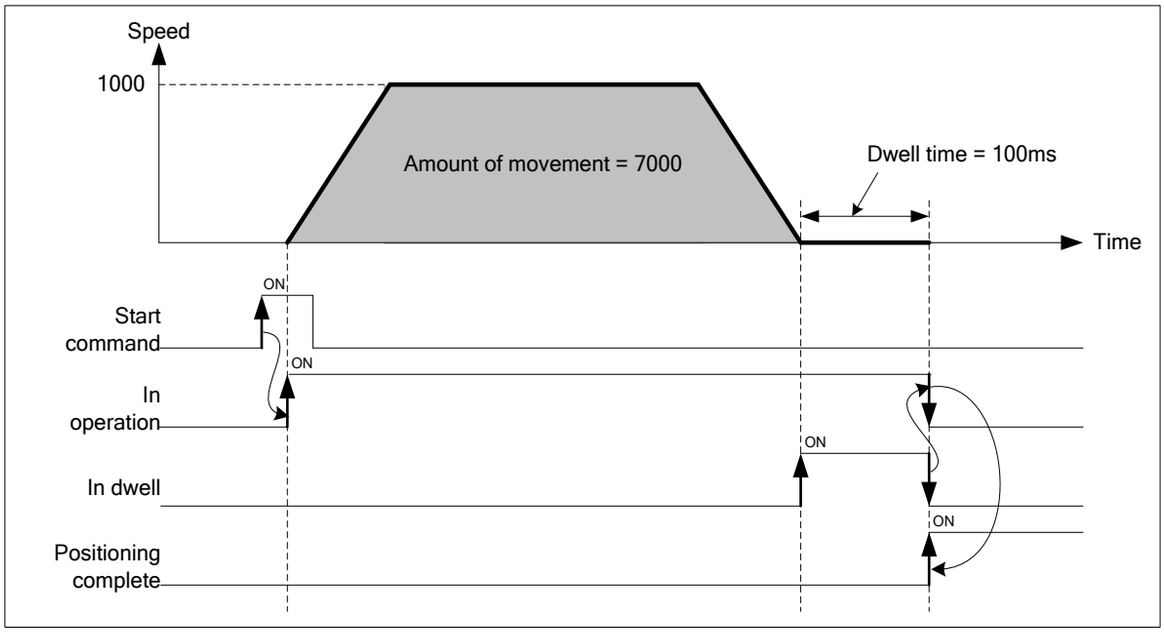
■ Starting Position: 1000
Target position: 8000
The transfer amount to forward direction shall be 7000 (7000=8000-1000).



■ Setting of XG-PM

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Absolute, Single axis position control	Single,End	8000	1000	No.1	No.1	0	100

■ Operation Patterns



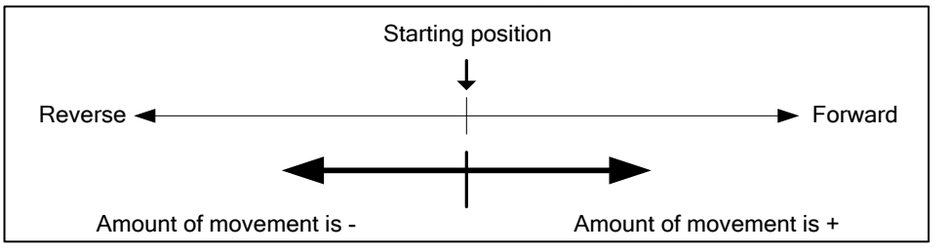
(2) Control by Incremental method (Relative coordinate) (「Relative, Single-axis Positioning Control」)

(a) Positioning control is executed from the starting position (current stop position) to the amount of movement set at the target position. Unlike the absolute coordinates of target position, it is not a value of specified on target position; it is a moving amount of current position.

(b) Transfer direction shall be determined by the sign of transfer amount.

■ Transfer direction (+) or no sign: forward direction positioning (starting position increases)

■ Transfer direction (-) : reverse direction positioning (starting position decreases)

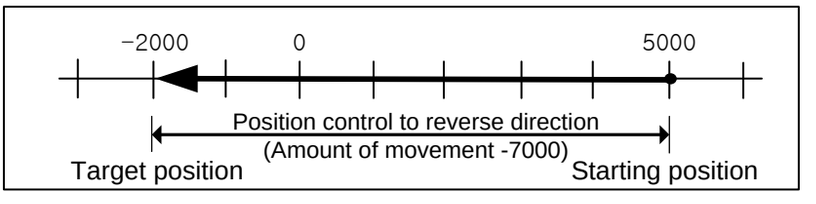


[Example] Executes Absolute coordinate, single-axis position control with the following setting

■ Starting position: 5000,

Target position: -7000

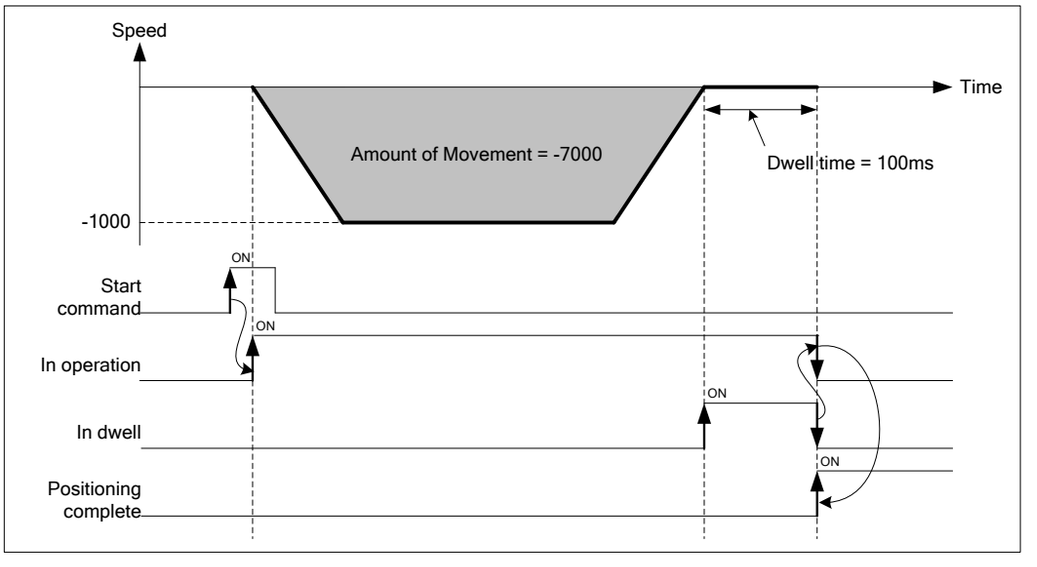
In this condition, it moves reversely and operates positioning at -2000.



■ Setting of XG-PM

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Incremental, single-axis Position Control	Single,End	-7000	1000	No.1	No.1	0	100

■ Operation Patterns



9.2.4 Single-axis Speed Control

After executed by the start positioning operation command (「Direct start」, 「Indirect start」, 「Simultaneous start」), this controls the speed by the setting speed until deceleration stop command is entered.

(1) Control features

(a) Speed control contains forward direction operation and reverse direction operation depending on the set operation speed.

■ Forward operation: when position value is greater than or equal to 0.

■ Reverse operation: when position value is negative number (-)

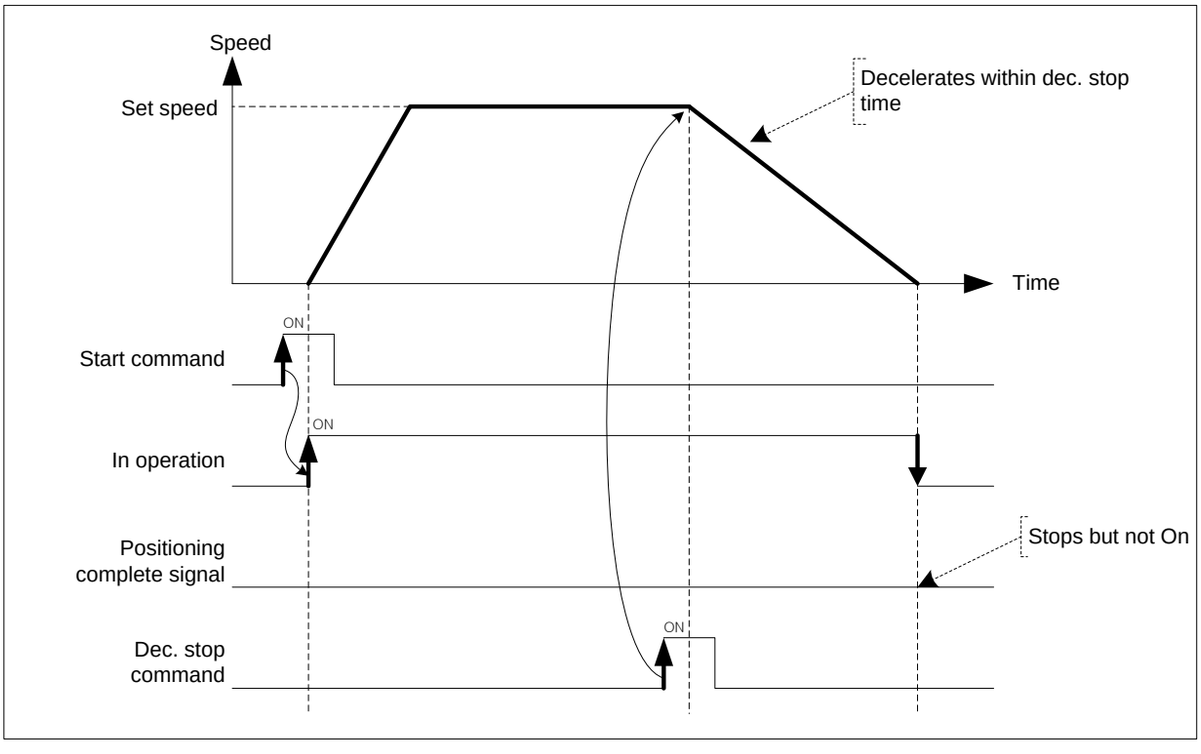
(b) In case of using speed control, the following items of operation data do not affect.

■ Coordinate, operation mode, dwell time

■ “Absolute, single axis speed control”and “relative, single axis speed control”executes the same operation

(c) Accelerating operation of speed control operates with acceleration number and time on setting data, decelerating operation operate with deceleration stop time of deceleration stop command.

(2) Operating Timing



(3) Restrictions

(a) Set the operation pattern of sepeed control as“End” or“Keep”. If “Continuous” is set as, error (error code: 236) arises and speed control may not be executed.

(b) Using as speed control, only when 「M code mode」 of extended parameteris ‘with’, M code is output and M Code signalis 'On. (“When using "After mode", M code signal is not output and M code on signal is not On.)

(c) The software upper/lower limit checking of speed control changes according to the software upper/lower limit item of speed control of extended parameter.

Item	Setting Value	Content
Software limit during speed	0: Not detect	During Speed Control, do not operate to check the range of upper/lower limit of software

control	1: Detect	During Speed Control, operate to check the range of upper/lower limit of software

(4) Setting of XG-PM

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Absolute, Single axis speed control	Single,End	100	1000	No.1	No.1	0	0

9.2.5 Single axis FEED control

After executed by the start positioning operation command (「Direct start」, 「Indirect start」, 「Simultaneous start」), change current stop position as "0", positioning control until setting goal position.

(1) Control features

(a) The value set on target position is moving amount. That is, moving direction is decided by the sign of setting target position.

■ Forward operation: when position value is greater than or equal to 0.

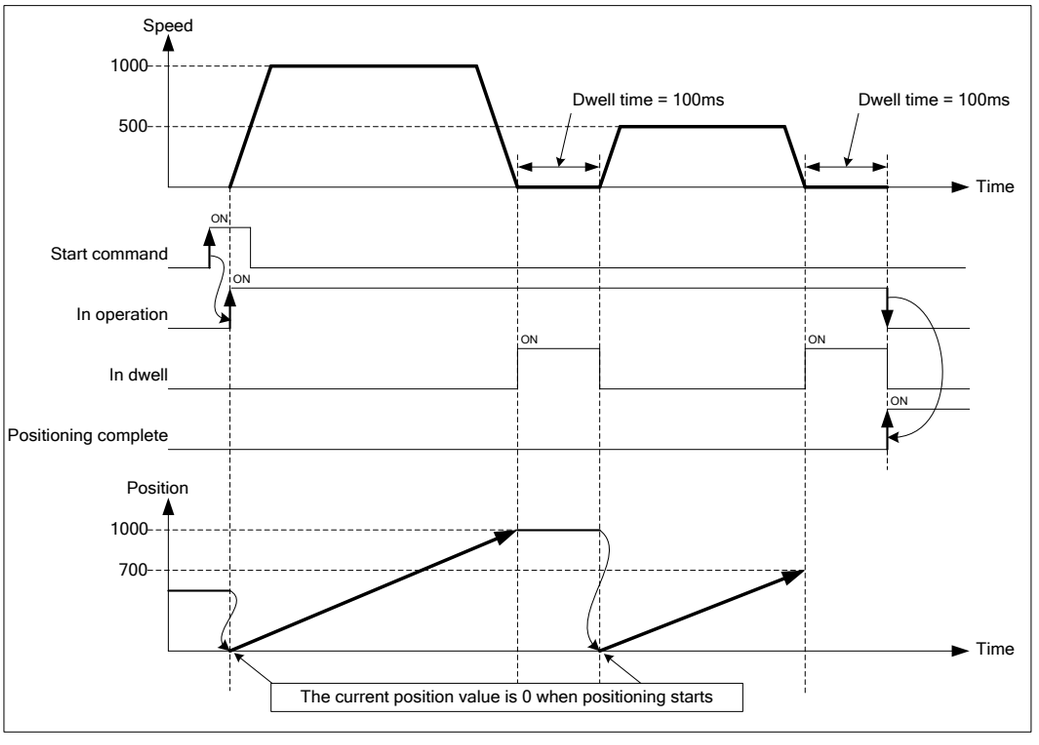
■ Reverse operation: when position value is negative number (-)

(b) In case of using Single-axis FEED Control, the following items of operation data do not affect.

■ coordinate

■ “Absolute, single axis speed control”and “relative, single axis speed control”executes the same operation.

(2) Operating Timing



(3) Restrictions

Set theoperation pattern of FEED control as“End” or“Keep”. “When it is set on "Continuous", error occurs (error code: 230) and can not execute FEED control.

(4) Setting of XG-PM

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Absolute single axis Feed control	Single,Keep	1000	1000	No.1	No.1	0	100
2	Absolute single axis Feed control	Single,End	700	500	No.1	No.1	0	100

9.2.6 Linear Interpolation Control with 2 axes

After executed by positioning operation start command (「Indirect start」, 「Synchronous start」), then executing interpolation control from starting position (current stop position) to the target position with interpolation axis set as the main axis and sub axis.

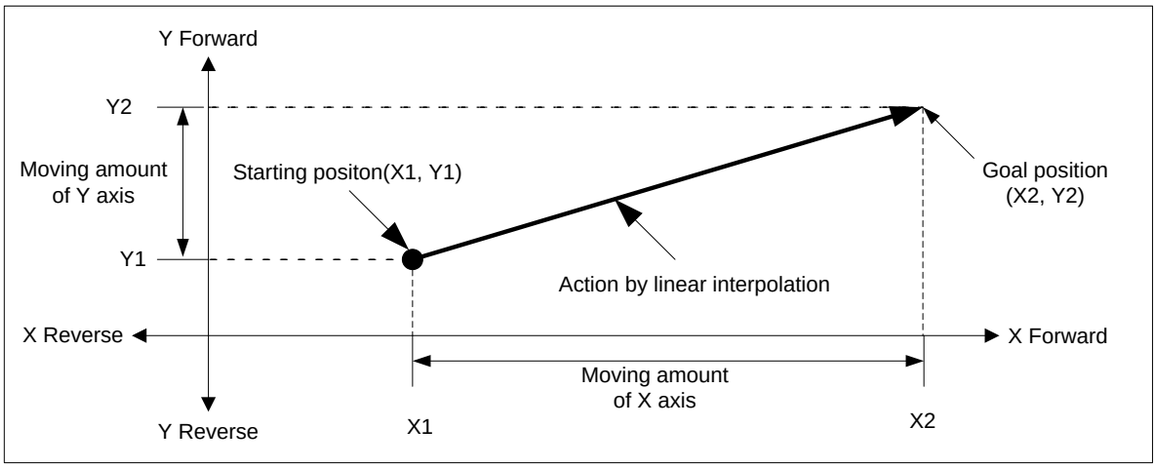
(1) Linear interpolation control with absolute coordinates (「Absolute, Linear Interpolation」)

(a) Executes linear interpolationfromstartingposition to the target (position designated on positioning data). Positioning control is executed based on designated position in homing.

(b) The direction of movement depends on the starting position and the target position for each axis.

■ Starting Position < target position: Forward positioning control operation

■ Starting Position > target position: Reverse positioning control operation



(c) Restrictions of using

Linear interpolation with 2 axes may not be executed in the case below.

■ 「Subordinate axis setting」 error (error code: 253)

▪ 「Subordinate axis setting」 value of main axis operation data is 'No axis setting'

▪ 「Subordinate axis setting」 value of main axis operating data is same as the main axis no.

▪ When the "subordinate axis setting" value of the main axis operation data is the axis number not currently connected to the network.

Notes

Because more than 2 axes are in action, so need user to pay attention

1. Auxiliary operations available are as follows.
   ▪ Speed override, deceleration stop, emergency stop, skip operation, continuous operation
2. The commands unavailable in linear interpolation are as follows.
   ▪ Position/ speed switching control, position override
3. The parameter item which is operated by set value of each axis is as follows.
   ▪ Software high limit, software low limit among extended parameter items.

(d) Example of operation data setting

Setting item	Main axis (axis1) setting	Sub axis (axis 2) setting	Content
Control method	Absolute, Linear Interpolation	Absolute, Single axis position control	When linear interpolation control is executed by the method of absolute coordinates, set 「 Absolute, Linear interpolation」 on the main axis Set the coordinate of subordinate axis setting to 「absolute」.
Program control method	Single,End	- *1	Set the operating method to execute linear interpolation
Target position [pls]	10000	5000	Set the target position for positioning on the main axis and sub axis.
Operation speed [pls/s]	1000	-	Use speed-designated method of main axis for linear interpolation Set the speed to operate main axis.
Acc. No.	No.1	-	Set the acceleration time No. for acceleration. (No.1 ~ 4)
Deceleration No.	No.2	-	Set the deceleration time No. for deceleration. (No.1 ~ 4)
M code	0	-	When need to execute auxiliary work synchronizing with linear interpolation
Dwell time	500	-	Set the dwell time (ms) until the output position signal.
Sub axis setting	Axis 2	-	Set the axis to be used as the subordinate axis among the axis set in the current network in main axis operation data.

-* 1: Do not need setting. Whatever value is set as, it does not affect linear interpolation.

Notes

Linear interpolation control is executed on the basis of operating data of main axis.
Only 「target position」 item of subordinate axis setting affect linear interpolation. In other words, whatever value is set as, it does not affect the action and no errors occurred.
However,as the coordinate setting of subordinate axis control mode indicates whether target position of subordinate axis is absolute coordinate or relative coordinate,so when executing linear interpolation control using absolute coordinate mode, the coordinate of subordinate axis must be set to absolute.

[Ex] linear interpolation is executed using axis1 as main axis and axis2 as subordinate axis respectively as follows.

■ Start position (1000, 4000), target position (10000, 1000)

The action is as follows in the condition above

■ Setting of XG-PM

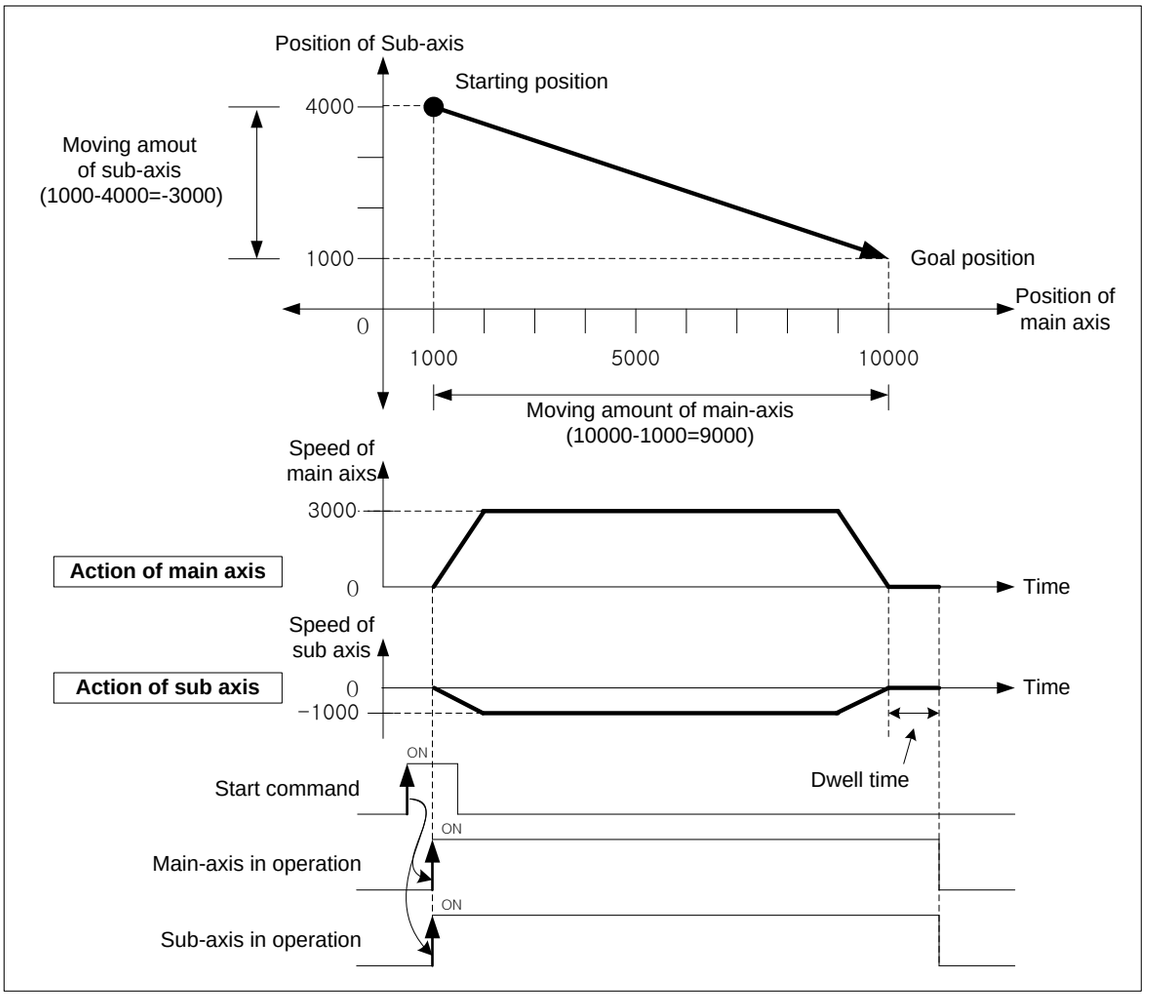
▪ Main axis (axis1) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting
1	Absolute, Linear Interpolation	Single,End	10000	3000	No.1	No.1	0	100	Axis 2

▪ Subordinate axis (axis2) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting
1	Absolute, Single axis position control	Single,End	1000	0	No.1	No.1	0	0	No axis setting

■ Operation Patterns



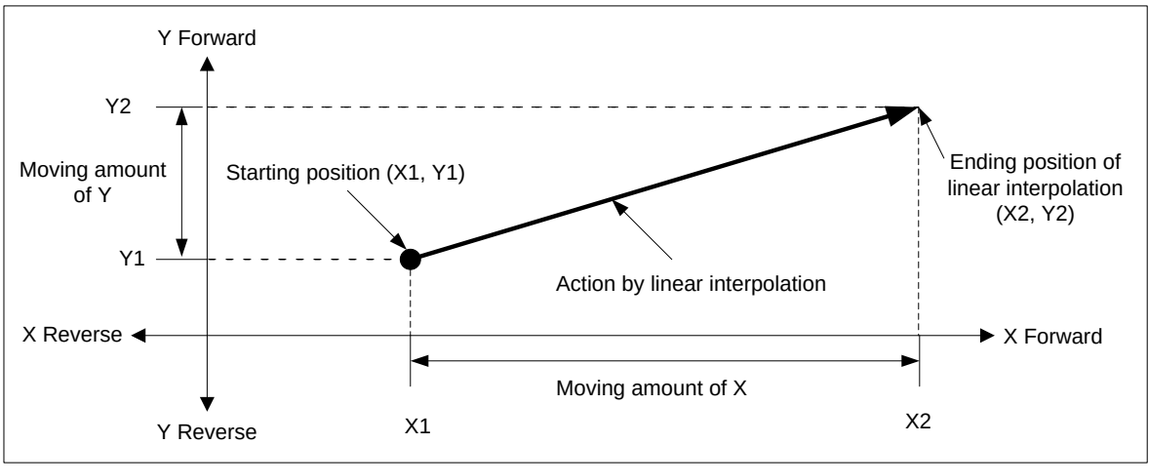
(2) Linear interpolation control with relative coordinates (「Relative, Linear Interpolation」)

(a) Execute 2 axes linear interpolation from starting position to the goal position. Positioning control is on basis of the current stop position.

(b) Moving direction depends on the sign of the goal position (Moving amount)

■ When the sign of movement distance is positive (+ or no sign): Positioning operation in forward direction (starting position increase direction)

■ The sign is negative (-): Positioning operation in reverse



(c) Restrictions

Linear interpolation with 2 axes may not be executed in the case below.

■「Subordinate axis setting」error (error code: 253)

▪「Subordinate axis setting」value of main axis operation data is 'No axis setting'

▪「Subordinate axis setting」value of main axis operating data is same as the main axis no.

▪ When the "subordinate axis setting" value of the main axis operation data is the axis number not currently connected to the network.

(d) Example of operation data setting

Setting item	Main axis (axis1) setting	Sub axis (axis 2) setting	Content
Control method	Relative, Linear Interpolation	Incremental, single-axis Position Control	When linear interpolation control is executed by the method of relative coordinates, set 「Relative, linear interpolation」on the main axis . Set the coordinate of subordinate axis setting to 「absolute」.
Program control method	Single,End	- *1	Set the operating method to execute linear interpolation
Target position [pls]	10000	5000	Set the goal position to position on main-axis and sub-axis
Operation speed [pls/s]	1000	-	Use speed-designated method of main axis for linear interpolation Set the speed to operate main axis.
Acc. No.	No.1	-	Set the acceleration time No. for acceleration. (No.1 ~ 4)
Deceleration No.	No.2	-	Set the deceleration time No. for deceleration. (No.1 ~ 4)
M code	0	-	When need to execute auxiliary work synchronizing with linear interpolation
Dwell time	500	-	Set the dwell time (ms) until the output position signal.
Sub axis setting	Axis 2	-	Set the axis to be used as the subordinate axis among the axis set in the current network in main axis operation data.

-* 1: Do not need setting. Whatever value is set as, it does not affect linear interpolation.

Notes

Linear interpolation control is executed on the basis of operating data of main axis.

Only 「target position」 item of subordinate axis setting affect linear interpolation. In other words, whatever value is set as, it does not affect the action and no errors occurred.

However, as the coordinate setting of subordinate axis control mode indicates whether target position of subordinate axis is absolute coordinate or relative coordinate, so when executing linear interpolation control using relative coordinate mode, the coordinate of subordinate axis must be set to relative.

[Ex] linear interpolation is executed using axis1 as main axis and axis2 as subordinate axis respectively as follows.

■ Current stop position (1000, 4000), target position set (9000, -3000)

The action is as follows in the condition above

■ Setting of XG-PM

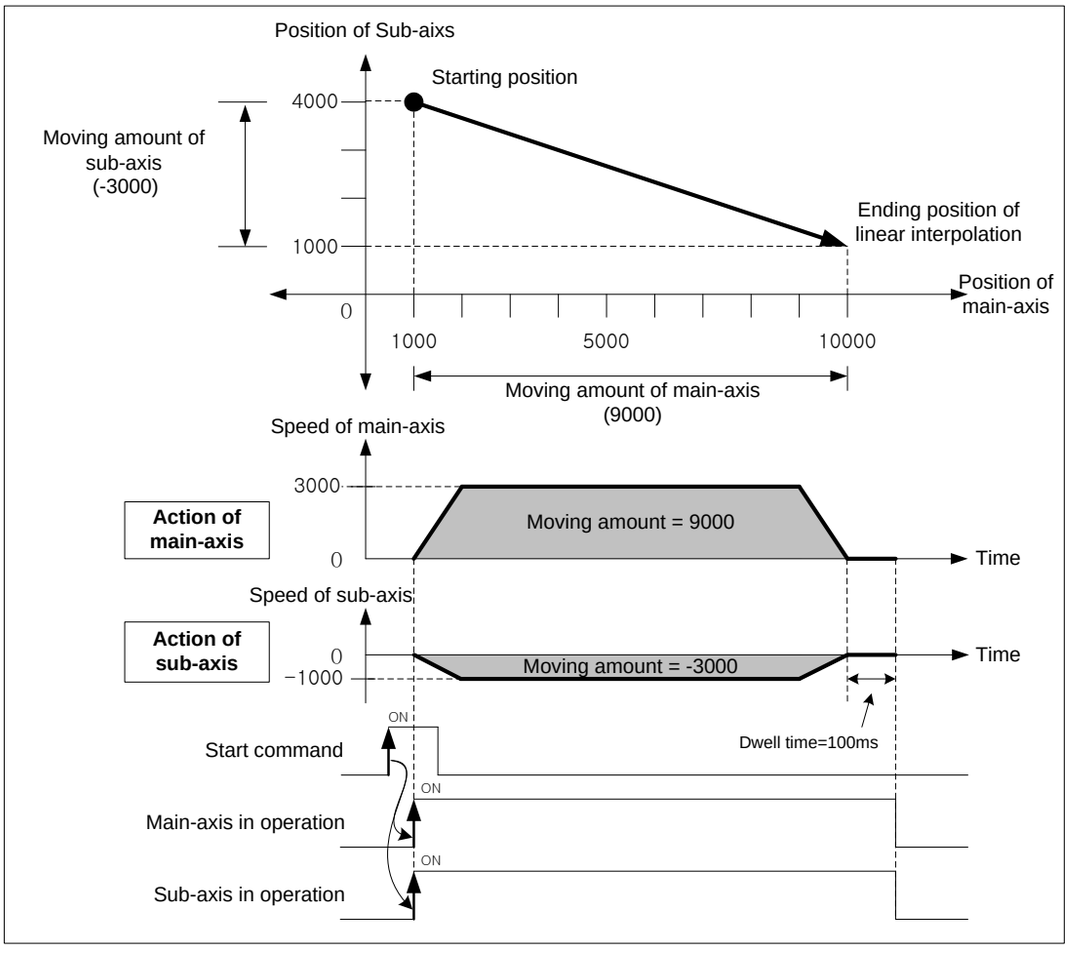
▪ Main axis (axis1) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting
1	Relative, Linear Interpolation	Single,End	9000	3000	No.1	No.1	0	100	Axis 2

▪ Subordinate axis (axis2) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting
1	Relative, single axis positioning control	Single,End	-3000	0	No.1	No.1	0	0	No axis setting

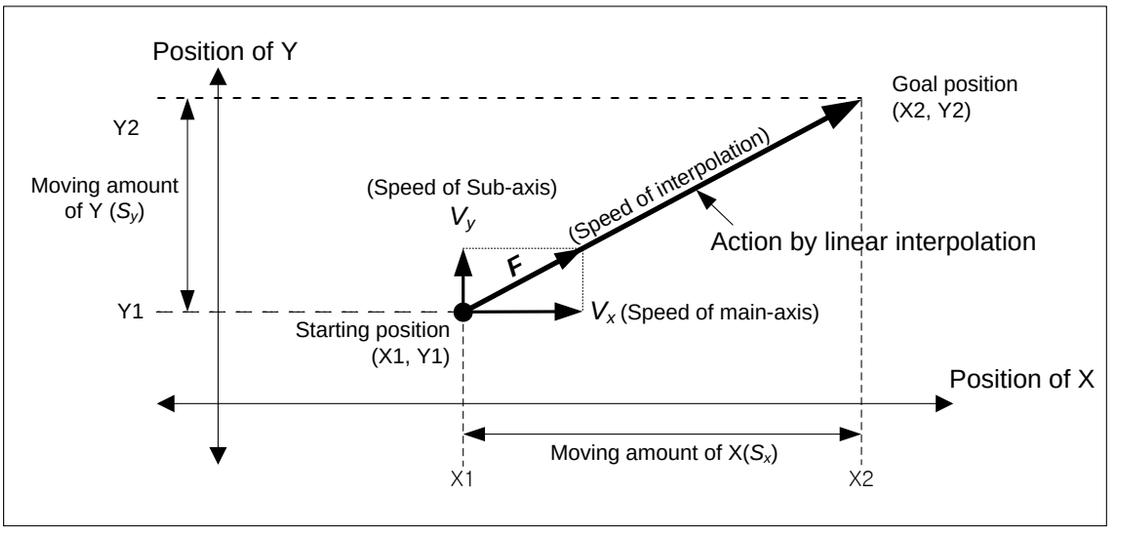
■ Operation Patterns



(3) Speed in 2 axes linear interpolation control

Operating speed in linear interpolation is according to the method of main-axis designating. After operating speed is set on command axis (main), the designated axis for interpolation is operated by embedded positioning module's calculating each moving amount. Speed of sub-axis and actual speed of machine are calculated as follows.

■ Speed in 2 axes linear interpolation (when the interpolation speed is selected as the main axis speed)



$$\text{Speed of sub}(V_y) = \text{Speed of main}(V_x) \times \frac{\text{Moving amount of Sub}(S_y)}{\text{Moving amount of Main}(S_x)}$$

$$\text{Interpolating speed}(F) = \sqrt{V_x^{\,2} + V_y^{\,2}}$$

[Example]

■ Starting Position (2000, 1000).

■ Target position (6000, 4000)

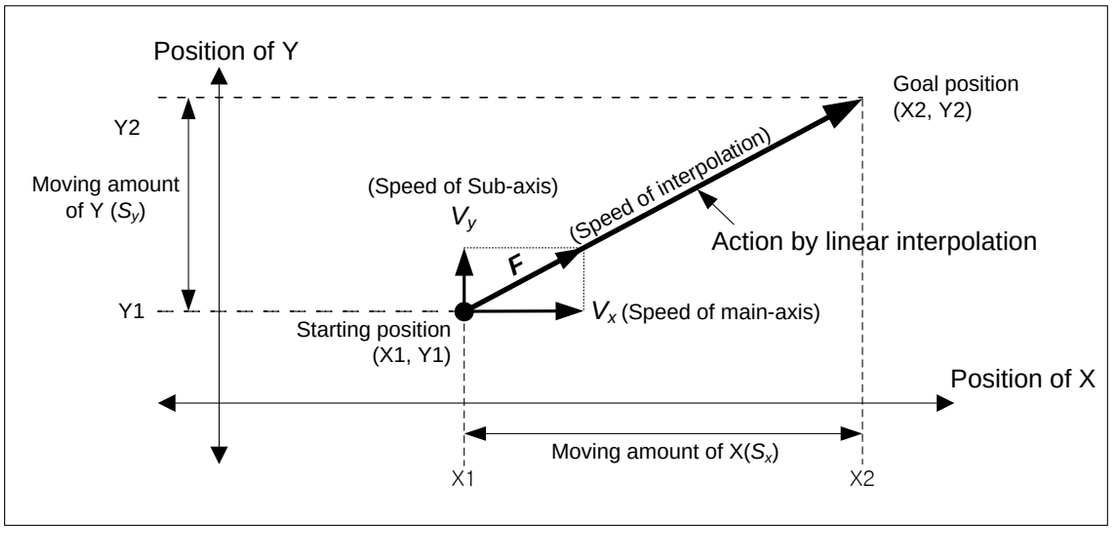
■ Operation Speed: 400[pls/s]

Speed of subordinate axis and interpolating speed are as follows.

Subordinate axis speed= $400 \times \frac{3000}{4000} = 300$ [pls/s]

Interpolation speed = $\sqrt{400^2 + 300^2} = 500$ [pls/s]

■ Speed in 2 axes linear interpolation (when synthetic speed is selected)



$$Interpolatingspeed\ (F) = Operationspeedsetinpositiondata$$

$$Interpolatingmovingamount\ (S) = \sqrt{S_x{}^2 + S_y{}^2}$$

$$Mainaxisspeed\ (V_x) = \text{int}\,erpolatingspeed\ (F) \times \frac{Mainaxismovingamount\ (S_x)}{Interpolatingmovingamount\ (S)}$$

$$Subaxisspeed\ (V_y) = Interpolatingspeed\ (F) \times \frac{Mainaxismovingamount(S_y)}{Interpolatingmovingamount\ (S)}$$

[Example]

■ Starting Position (2000, 1000).

■ Target position (6000, 4000)

■ Synthetic speed: 400[pls/s]

Main axis speed and subordinate axis speed are as follows.

Interpolating moving amount= $\sqrt{4000^2 + 3000^2}$ = 5000

Main axis speed = $400 \times \frac{4000}{5000} = 320$ [pls/s]

Subordinate axis speed= $400 \times \frac{3000}{5000} = 240$ [pls/s]

Notes

1. Speed limit for Sub-axis

When using linear interpolation control, moving distance of main axis < moving distance of subordinate axis, it can be occurred that sub-axis speed calculated by positioning module exceeds 「Speed limit」 of basic parameter. In this case, error (error code: 261) occurs and main axis speed is recalculated that subordinate axis speed not exceed main the speed limit and operated. To prevent that errors occurs, lower the main axis operation speed so that the subordinated axis speed do not exceed the speed limit.

2. The speed when the moving distance of main axis is 0

When the distance main-axis moved is 0, the operating speed of main-axis operating data becomes actual interpolating speed. In the case that the distance main-axis moved is 0 and executing 2 axes linear interpolation, only sub-axis operates at the speed set on command axis.

■ Setting of XG-PM

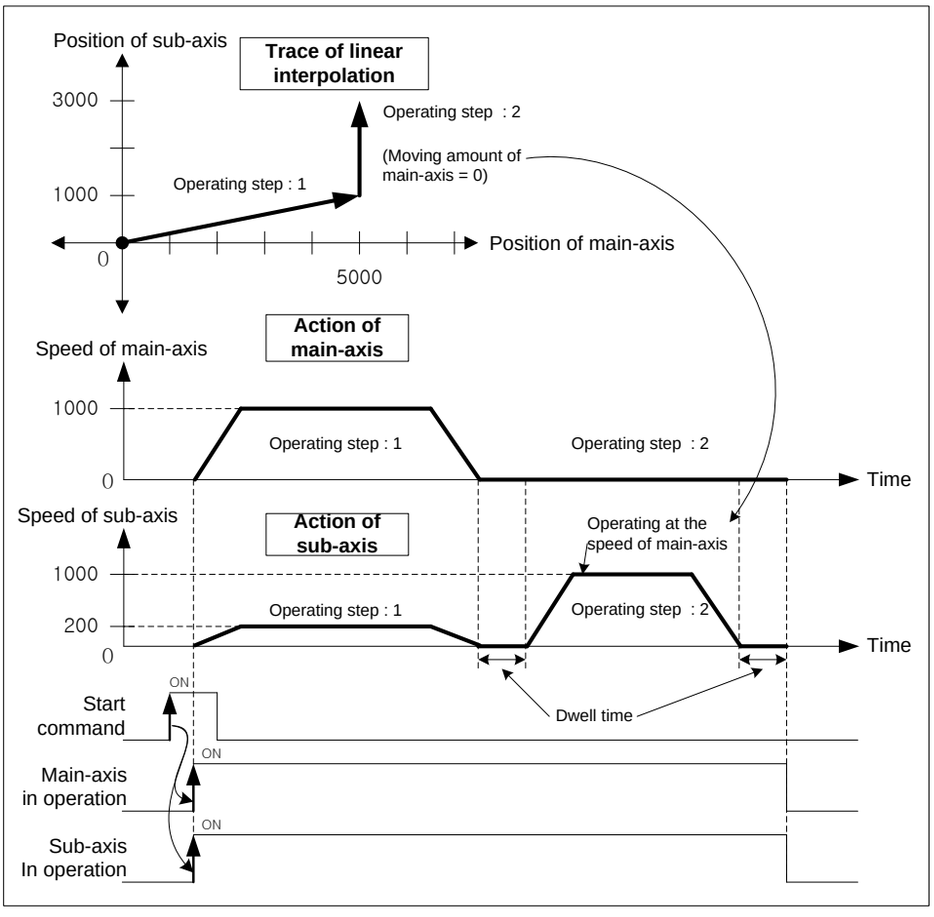
▪ Main axis(axis1) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting
1	Absolute, Linear Interpolation	Single,Keep	5000	1000	No.1	No.1	0	100	Axis 2
2	Absolute, Linear Interpolation	Single,End	5000	1000	No.1	No.1	0	100	Axis 2

▪ Subordinate axis(axis2) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting
1	Absolute, Single axis position control	Single,End	1000	0	No.1	No.1	0	0	No axis setting
2	Absolute, Single axis position control	Single,End	3000	0	No.1	No.1	0	0	No axis setting

■ Operation Patterns



(4) 2 axes Linear Interpolationcontinuous operation circular insertion

When the operation method is set as continuous and the direction of movement changes rapidly, machine is possible to be damaged. When it does not have to position to the goal position, user may interpolate circular interpolating operation between two trace to make operation softer and smoother.

(a) Operation order

1) Confirm the execution of 2 axes linear interpolating continuous operation with circular arc interpolation when linear interpolation starts. It may be set in 「2 axes linear interpolating continuous operation with circular arc interpolation」 of extended parameter.

Setting item	Setting Value	Content
Axis 2 linear interpolation Continuous operating arc insertion	0: not arc insertion	When executing it, interpolate circular arc
	1: arc insertion continuous operating	When executing 2-axis linear continuous interpolation, doesn't inserts arc.

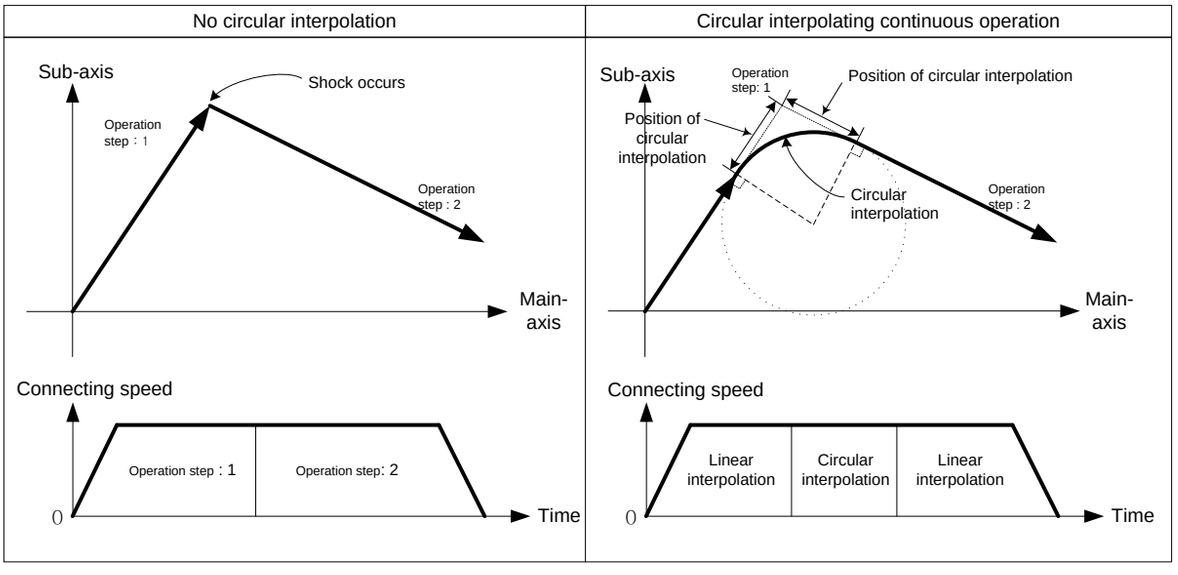
2) Reset the starting position of arc interpolation (target position of linear trace 1) and the target position (starting position of linear trace 2) through checking the position where the arc is inserted. The position circular arc will be interpolation at may be set in 「Circular arc interpolating position」 of extended parameter.

Setting item	Setting Value	Content

2 axes linear interpolation continuous operation Circular insertion position	0 ~ 2147483647	Set the position that circular will be inputted. This value means the relative distance from the goal position of linear trace 1.

3) Execute linear interpolation to the starting position of circular arc and continue to execute circular interpolation at the same speed as linear interpolation. After finish the circular interpolation, continue to execute linear interpolation at the same speed.

(b) Operating pattern



(c) Restrictions

Circular interpolation is not executed in the case below but linear interpolation is executed to the goal position.

- Operating method of operation data is 'End' or 'Continue'.
- Position of circular arc interpolating is bigger than linear trace 1, 2 (Error code: 262)
- Trace of both linear interpolations are on the same line

[Example] Execute linear interpolation when the extended parameter setting is same as follows at the current position (0,0)

Extended parameter	Setting Value
Arc insertion in 2-axis linear interpolation continuous operation	1: Arc insertion continuous operating
2 axes linear interpolation continuous operation	2000

■ Setting of XG-PM

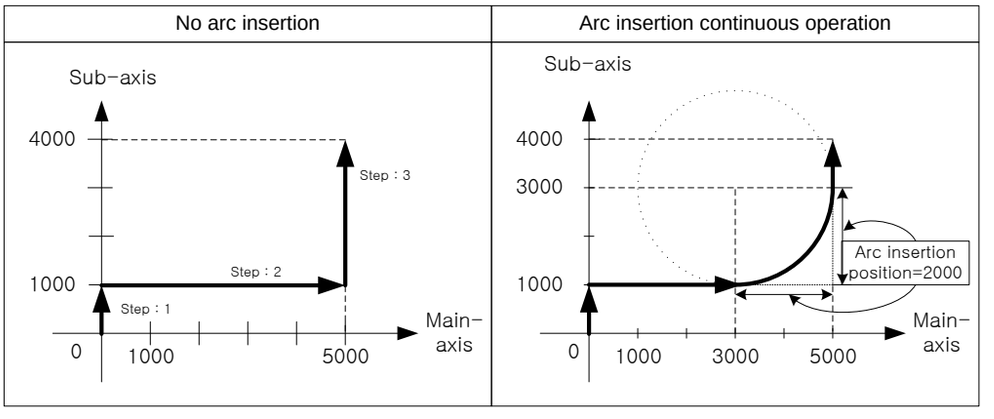
▪ Main axis (axis1) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting
1	Absolute, Linear Interpolation	Single, Continuous	0	3000	No.1	No.1	0	0	Axis 2
2	Absolute, Linear Interpolation	Single, Continuous	5000	3000	No.1	No.1	0	0	Axis 2
3	Absolute, Linear Interpolation	Single,End	5000	3000	No.1	No.1	0	100	Axis 2

▪ Subordinate axis (axis2) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting
1	Absolute, Single axis position control	Single,End	1000	0	No.1	No.1	0	0	No axis setting
2	Absolute, Single axis position control	Single,End	1000	0	No.1	No.1	0	0	No axis setting
3	Absolute, Single axis position control	Single,End	4000	0	No.1	No.1	0	0	No axis setting

■ Operation Patterns



■ Description of operation

When executing operation step no.1, execute linear interpolation to original goal position (0,1000) without circular arc interpolation because position to interpolate circular arc(2000) is bigger than the length of line 1(1000).

When finishing linear interpolation to goal position of operation step no.1 and executing operation step no.2, because position to interpolate circular arc(2000) is smaller than line length of step no.2(5000) and no.3(3000), so recalculate the starting position (Goal position of linear trace no.1) and the goal position (Starting position of linear trace no.2) of circular interpolation.

After continue to execute linear interpolation to the recalculated goal position of operation step no.2 (3000,1000), then execute circular interpolation to recalculated starting position of operation step no.3(5000,3000).

After circular interpolation, execute linear interpolation to the target position of operation step no.3 (5000,4000), positioning will be complete.

9.2.7 Linear Interpolation Control with 3 axes

After executed by positioning operation start command (「Indirect start」, 「Synchronous start」), the interpolation axes set as subordinate axes are used to move 3 axes from starting position (current stop position) to the target position with interpolation axis set as the main axis and sub axis.

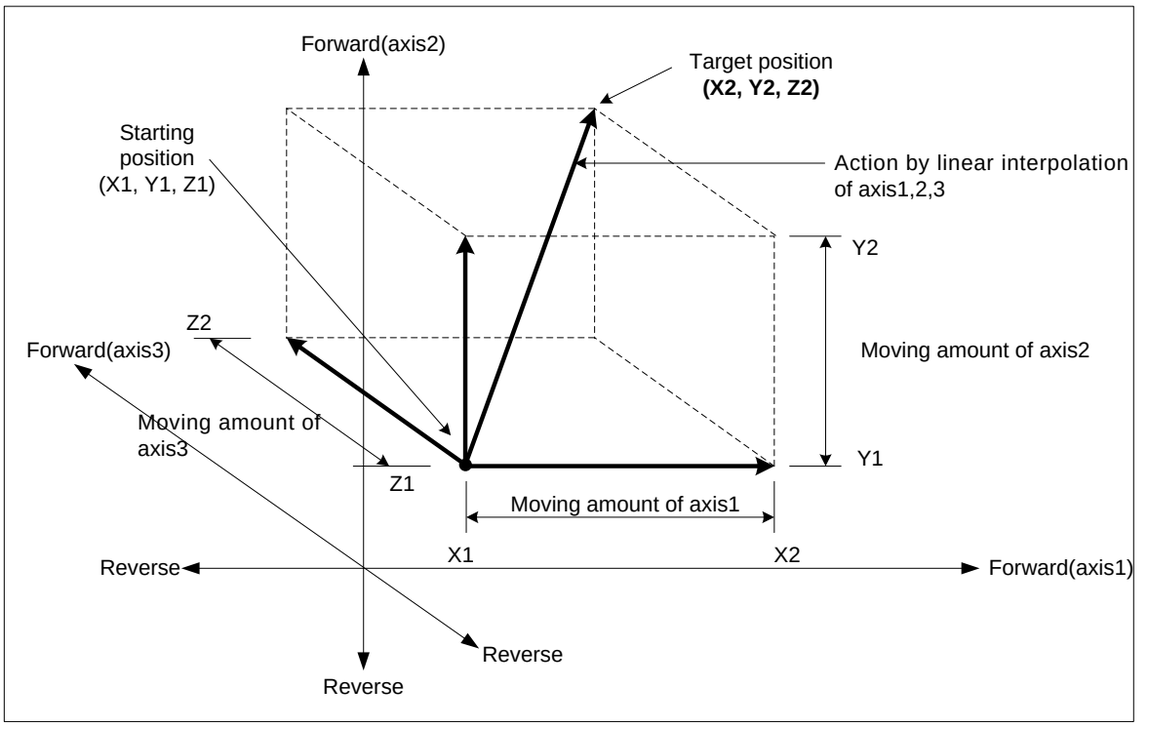
(2) Linear interpolation control with absolute coordinates (「Absolute, Linear Interpolation」)

(a) Execute linear interpolation with 3 axes from starting position to the target position designated on positioning data. Positioning control is executed based on origin designated in homing.

(b) The direction of movement depends on the starting position and the target position for each axis.

■ Starting Position < target position: Forward positioning control operation

■ Starting Position > target position: Reverse positioning control operation



(c) Restrictions

Linear interpolation with 3 axes may not be executed in the case below.

■「Subordinate axis setting」error (error code: 253)

- 「Subordinate axis setting」value of main axis operation data is 'No axis setting'
- 「Subordinate axis setting」value of main axis operating data is same as the main axis no.
- When the "subordinate axis setting" value of the main axis operation data is the axis number not currently connected to the network.

■ If only one axis is set as sub axis, execute 'linear interpolation control with 2 axes'.

(d) Example of operation data setting

Setting item	Main axis(axis1)	Sub axis(axis2)	Sub axis(axis3)	Content
Control method	Absolute, Linear Interpolation	Absolute, Single axis position control	Absolute, Single axis position control	When linear interpolation control is executed by the method of absolute coordinates, set「Absolute, Linear interpolation」on the main axis Set the coordinate of subordinate axis setting to 「absolute」.
Program control method	Single,End	- *1	- *1	Set the operating method to execute linear interpolation
Target position [pls]	5000	6000	4000	Set the target position for positioning on the main axis and sub axis.
Operation speed [pls/s]	1000	-	-	Use speed-designated method of main axis for linear interpolation Set the speed to operate main axis.
Acc. No.	No.1	-	-	Set the acceleration time No. for acceleration. (No.1 ~ 4)
Deceleration No.	No.2	-	-	Set the deceleration time No. for deceleration. (No.1 ~ 4)
M code	0	-	-	When need to execute auxiliary work synchronizing with linear interpolation
Dwell time	500	-	-	Set the dwell time (ms) until the output position signal.
Sub axis setting	Axis 2, axis 3	-	-	Set the axis to be used as the subordinate axis among the axis set in the current network in main axis operation data.

-* 1: Do not need setting. Whatever value is set as, it does not affect linear interpolation.

Notes

Linear interpolation control is executed on the basis of operating data of main axis.

Only 「target position」 item of subordinate axis setting affect linear interpolation. In other words, whatever value is set as, it does not affect the action and no errors occurred.

However, as the coordinate setting of subordinate axis control mode indicates whether target position of subordinate axis is absolute coordinate or relative coordinate, so when executing linear interpolation control using absolute coordinate the coordinate of subordinate axis must be set to absolute.

[Example] axis1 is main axis, axis2 and axis3 are sub axis. Execute linear interpolation by the setting as follows.

■ Starting position (2000, 1000, 1000)

Target position (5000, 6000, 4000)

The action is as follows in the condition above

■ Setting of XG-PM

▪ Main axis (axis1) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting
1	Absolute, Linear Interpolation	Single,End	5000	1000	No.1	No.1	0	100	Axis 2

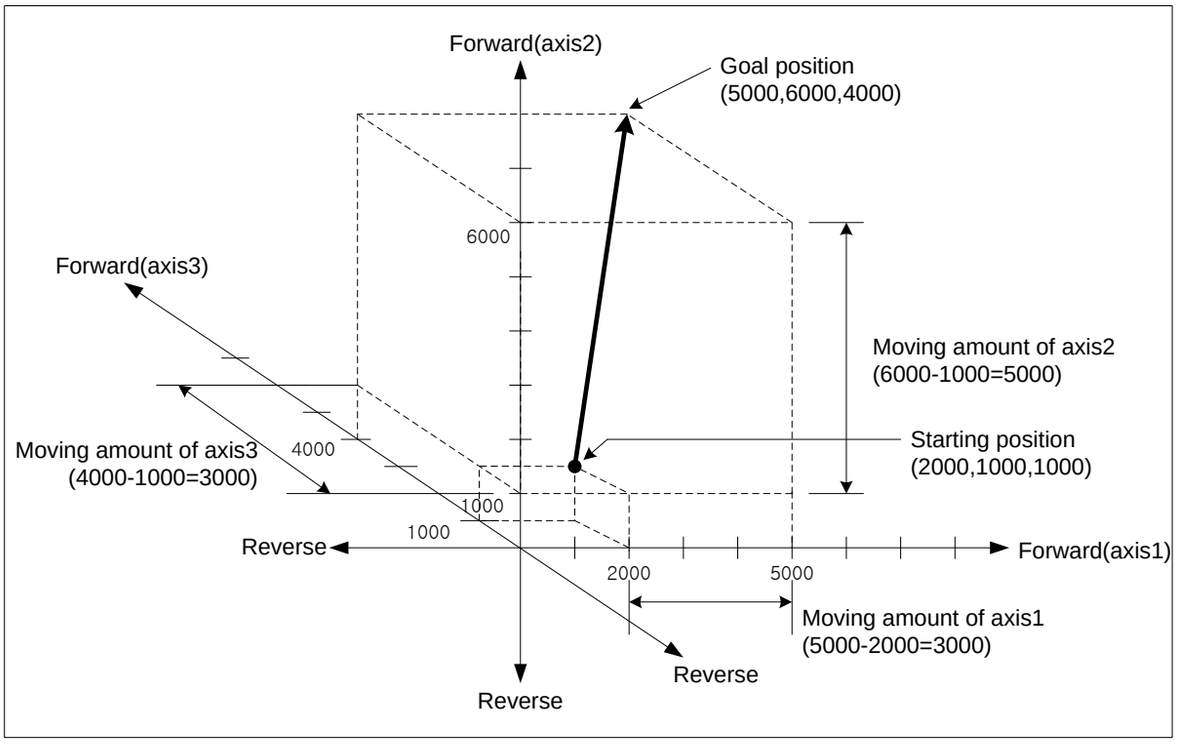
▪ Subordinate axis 1(axis2) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting
1	Absolute, Single axis position control	Single,End	6000	0	No.1	No.1	0	0	No axis setting

▪ Subordinate axis 2(axis3) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting
1	Absolute, Single axis position control	Single,End	4000	0	No.1	No.1	0	0	No axis setting

■ Operation Patterns



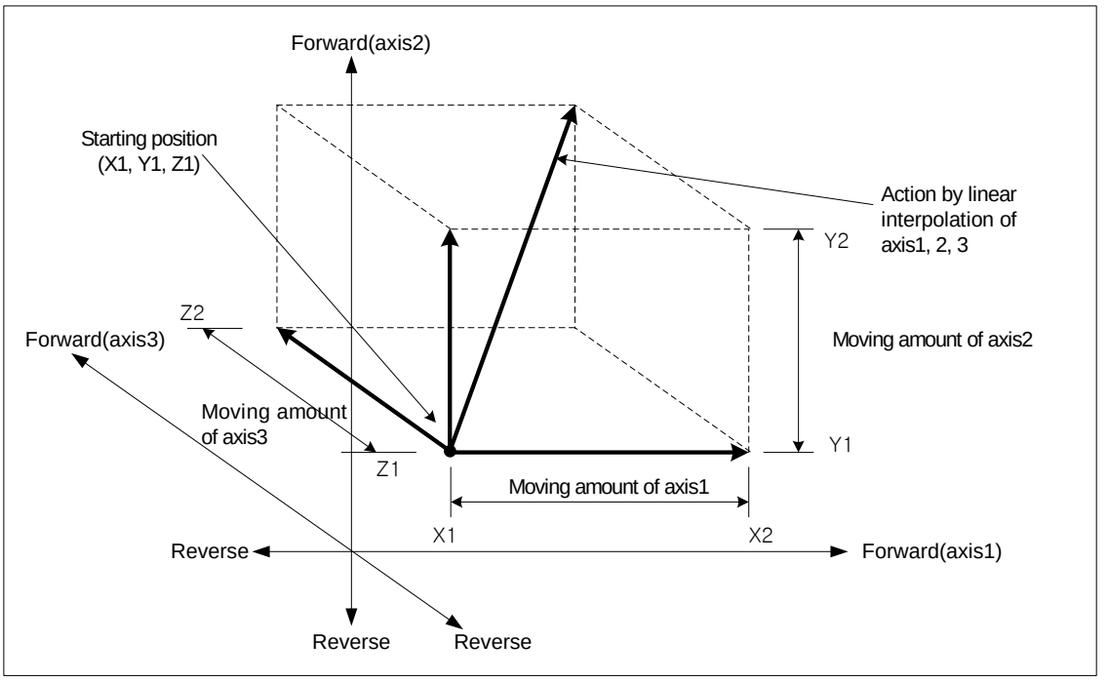
(2) Linear interpolation control with relative (「Relative, Linear Interpolation」)

(a) Execute 3 axes linear interpolation from starting position to the target position. Positioning control is on basis of the current stop position.

(b) The direction of movement depends on the starting position and the target position for each axis.

■ When the sign of movement distance is positive (+ or no sign): Positioning operation in forward direction (starting position increase direction)

■ The sign is negative (-): Positioning operation in reverse



(c) Restrictions

Linear interpolation with 3 axes may not be executed in the case below.

■「Subordinate axis setting」error (error code: 253)

- 「Subordinate axis setting」value of main axis operation data is 'No axis setting'
- 「Subordinate axis setting」value of main axis operating data is same as the main axis no.
- When the "subordinate axis setting" value of the main axis operation data is the axis number not currently connected to the network.

■ If only one axis is set as sub axis, execute 'linear interpolation control with 2 axes'.

(d) Example of operation data setting

Setting item	Main axis(axis1)	Sub axis(axis2)	Sub axis(axis3)	Content
Control method	Relative, Linear Interpolation	Incremental, single-axis Position Control	Incremental, single-axis Position Control	When linear interpolation control is executed by the method of relative coordinates, set 「 Relative, Linear interpolation」 on the main axis Set the coordinate of subordinate axis setting to 「relative」.
Program control method	Single,End	- *1		Set the operating method to execute linear interpolation
Target position [pls]	5000	6000	4000	Set the goal position to position on main-axis and sub-axis
Operation speed [pls/s]	1000	-	-	Use speed-designated method of main axis for linear interpolation Set the speed to operate main axis.
Acceleration number	No.1	-	-	Set the acceleration time No. for acceleration. (No.1 ~ 4)
Deceleration number	No.2	-	-	Set the deceleration time No. for deceleration. (No.1 ~ 4)
M code	0	-	-	When need to execute auxiliary work synchronizing with linear interpolation
Dwell time	500	-	-	Set the dwell time (ms) until the output position signal.
Sub axis setting	Axis 2, axis 3	-	-	Set the axis to be used as the subordinate axis among the axis set in the current network in main axis operation data.

-* 1: Do not need setting. Whatever value is set as, it does not affect linear interpolation.

Notes

Linear interpolation control is executed on the basis of operating data of main axis.
Only 「target position」 item of subordinate axis setting affect linear interpolation. In other words, whatever value is set as, it does not affect the action and no errors occurred.
The parameter items operating on the basis of setting value on each axis are as follows, Backlash correction in extended parameter, Software high/low limit, Software low limit

[Example] axis1 is main axis, axis2 and axis3 are sub axis. Execute linear interpolation by the setting as follows.

■ Current stop position (2000, 1000, 1000)

Target position setting (10000, 5000, 5000)

The action is as follows in the condition above

■ Setting of XG-PM

▪ Main axis (axis1) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting
1	Relative, Linear Interpolation	Single,End	10000	1000	No.1	No.1	0	100	Axis 2

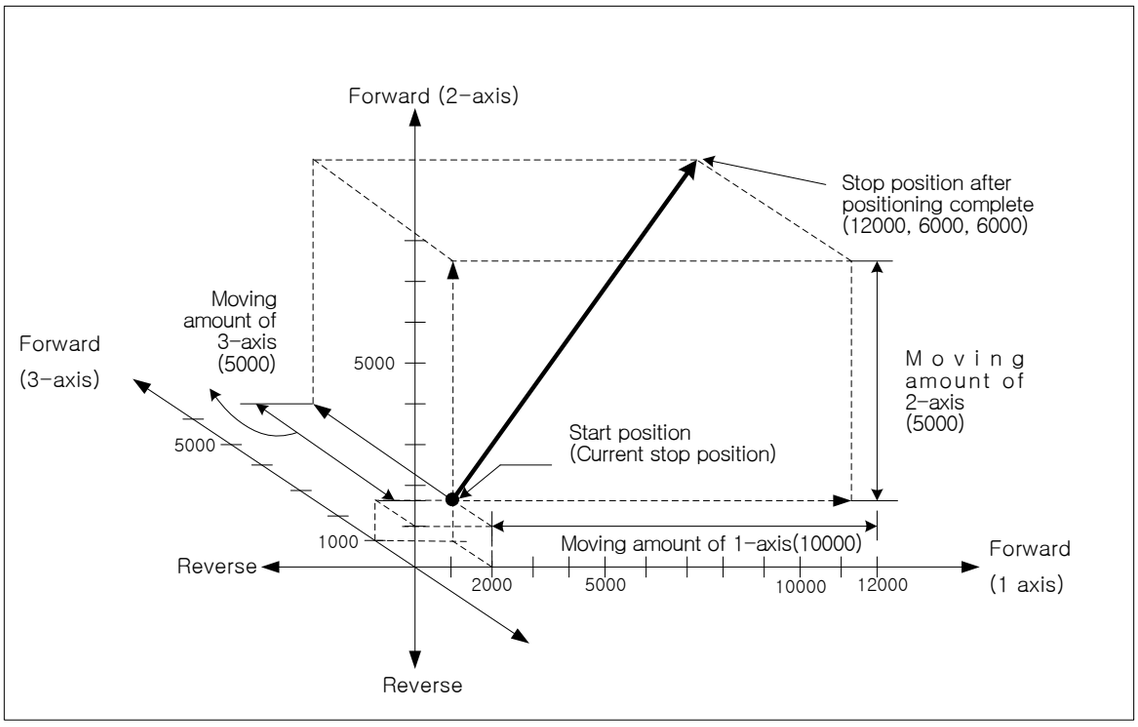
▪ Subordinate axis 1(axis 2) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting
1	Incremental, single-axis Position Control	Single,End	5000	0	No.1	No.1	0	0	No axis setting

▪ Subordinate axis 2(axis3) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting
1	Incremental, single-axis Position Control	Single,End	5000	0	No.1	No.1	0	0	No axis setting

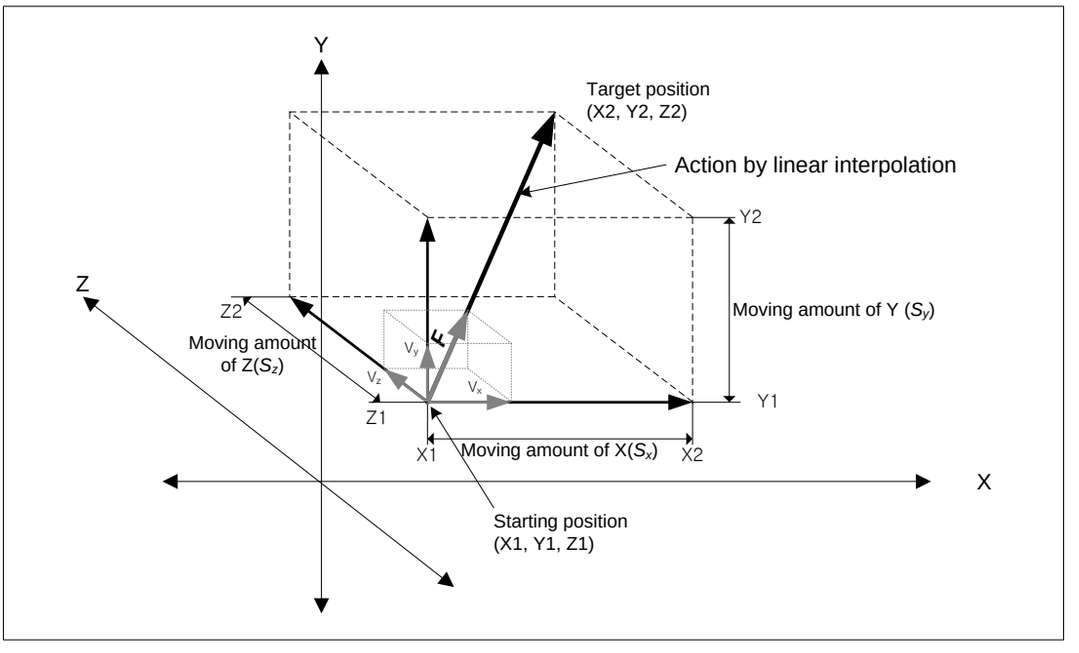
■ Operation Patterns



(3) Speed in 3 axes linear interpolation control

The operation speed during linear interpolation control uses the method of specifying the main axis speed or synthetic speed selected in the interpolation speed selection item of the extended parameter as the operation data target speed of the main axis. After operating speed is set on command axis (main), the designated axis for interpolation is operated by embedded positioning module's calculating each moving amount. Speed of sub-axis and actual speed of machine are calculated as follows.

■ Speed in 3 axes linear interpolation (when the interpolation speed is selected as the main axis speed)



$$\text{Speed of sub}(V_y) = \text{Speed of main}(V_x) \times \frac{\text{Moving amount of Sub}(S_y)}{\text{Moving amount of Main}(S_x)}$$

$$\text{Speed of sub}(V_z) = \text{Speed of main}(V_x) \times \frac{\text{Moving amount of sub}(S_z)}{\text{Moving amount of main}(S_x)}$$

$$\text{Interpolating speed}(F) = \sqrt{V_x^{\,2} + V_y^{\,2} + V_z^{\,2}}$$

[Example]

■ Starting position (2000, 2000, 1000),

■ Target position (6000, 5000, 6000)

■ Operation Speed: 400[pls/s]

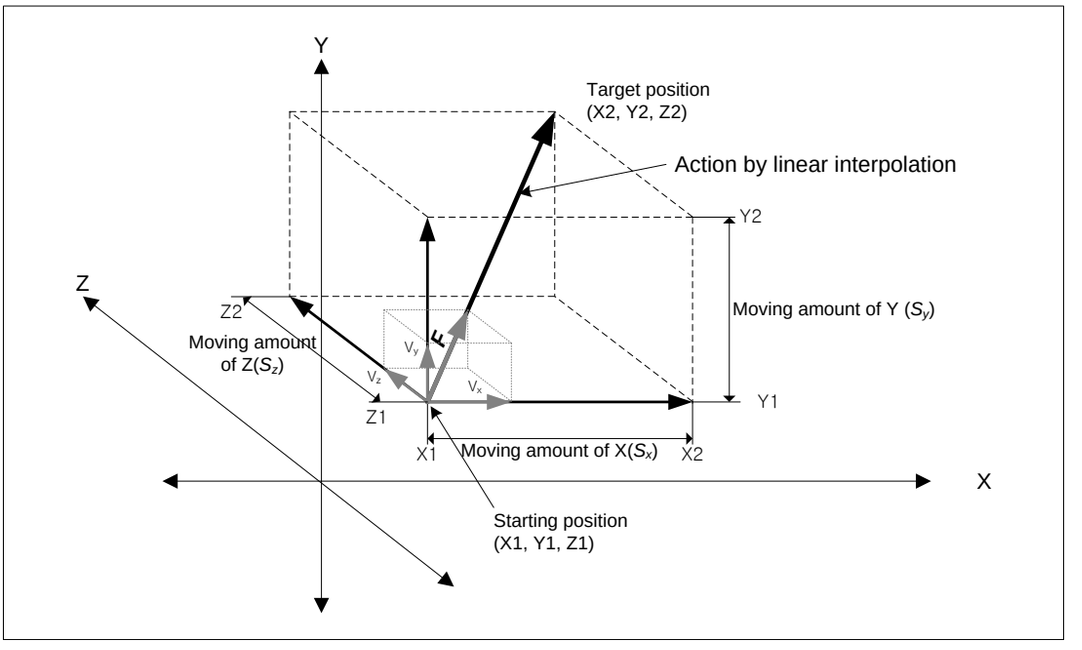
Speed of subordinate axis and interpolating speed are as follows. (Axis X: main axis/ axis Y,Z: subordinate axis)

Speed of sub-axis1 = $400 \times \frac{3000}{4000} = 300$ [pls/s]

Speed of sub-axis2 = $400 \times \frac{5000}{4000} = 500$ [pls/s]

Interpolation speed = $\sqrt{400^2 + 300^2 + 500^2} \approx 707$ [pls/s]

■ Speed in 3 axes linear interpolation (when synthetic speed is selected)



$$Interpolatinspeed\ (F) = Operationspeedsetinpositiondata$$

$$Interpolatingmovingamount(S) = \sqrt{S_x{}^2 + S_y{}^2 + S_z^2}$$

$$Mainaxisspeed(V_x) = Interpolatingspeed\ (F) \times \frac{Main\ axismovingamount(S_x)}{Interpolatingmovingamount\ (S)}$$

$$Sub-axis1\,\text{speed}\ (V_y) = Interpolatingspeed\ (F) \times \frac{Sub-axis1movingamount\ (S_y)}{Interpolatingmovingamount(S)}$$

$$Sub-axis2\,\text{speed}\ (V_z) = Interpolatingspeed\ (F) \times \frac{Sub-axis2\ movingamount\ (S_z)}{Interpolatingmovingamount\ (S)}$$

[Example]

■ Starting position (2000, 1000, 1000),

■ Target position (6000, 5000, 6000)

■ Synthetic speed: 400[pls/s]

Main axis speed and subordinate axis speed are as follows. (Axis X: main axis/ axis Y,Z: subordinate axis)

Interpolating moving amount= $\sqrt{4000^2 + 4000^2 + 5000^2} \approx 7549.8$

Main axis speed= $400 \times \frac{4000}{7549.8} \approx 211.9$

Speed of sub-axis1 = $400 \times \frac{4000}{7549.8} \approx 211.9$ [pls/s]

Speed of sub-axis2 = $400 \times \frac{5000}{7549.8} \approx 264.9$ [pls/s]

Notes

1. Speed limit for Sub-axis

   When using linear interpolation control, interpolation speed selection is main axis and moving distance of main axis < moving distance of subordinate axis, it can be occurred that sub-axis speed calculated by positioning module exceeds 「Speed limit」 of basic parameter. In this case, error (error code: 261) occurs and main axis speed is recalculated that subordinate axis speed not exceed main the speed limit and operated. To prevent that errors occurs, lower the main axis operation speed so that the subordinated axis speed do not exceed the speed limit.

2. The speed when the distance main-axis moved is 0

   When the distance main-axis moved is 0, the operating speed of main-axis operating data is in becomes actual interpolating speed.

   In case of linear interpolation with more than 3 axes, the speed of sub-axis is calculated by the formula below.

$$Speed\ of\ sub-axis(V_y) = Interpolating\ speed(F) \times \frac{Moving\ amount\ of\ sub-axis(S_y)}{Merged\ moving\ amount\ (S_f)}$$

$$Speed\ of\ sub-axis(V_z) = Interpolating\ speed(F) \times \frac{Moving\ amount\ of\ sub-axis(S_z)}{Merged\ moving\ amount(S_f)}$$

9.2.8 Multi-axis line Linear Interpolation Control

After executed by positioning operation start command (「Indirect start」, 「Synchronous start」), then executing interpolation control from starting position to the goal position with interpolation axis set as the main axis and sub axis.
Combination of interpolation axis is unlimited and maximum 8 axes linear interpolation control is available.
Characteristics of action are same as linear interpolation control with 3 axes. For the details, refer to linear interpolation control with 3 axes.

(1) Linear interpolation control with absolute coordinates (「Absolute, Linear Interpolation」)

(a) Executes linear interpolation with multi axis starting position to the target position (designated positioning by positioning data) data. Positioning control is executed based on origin designated in homing.

(b) The direction of movement depends on the starting position and the target position for each axis.

■ Starting Position < target position: Forward positioning control operation

■ Starting Position > target position: Reverse positioning control operation

(2) Linear interpolation control with relative (「Relative, Linear Interpolation」)

(a) Executes linear interpolation with multi axis from starting position to the goal position. Positioning control is on basis of the current stop position.

(b) The direction of movement depends on the starting position and the target position for each axis.

■ When the sign of movement distance is positive (+ or no sign): Positioning operation in forward direction (starting position increase direction)

■ The sign is negative (-): Positioning operation in reverse

(3) Speed in multi linear interpolation control

Operating speed in linear interpolation is according to the method of main-axis designating. After operating speed is set on command axis (main), the designated axis for interpolation is operated by embedded positioning module's calculating each moving amount. Speed of sub-axis and actual speed of machine are calculated as follows.

■ When the interpolation speed is selected as the main axis speed

$$Sub-axis(\ 2\text{axis})\ \text{speed}\ (V_2) = Main\ \ \text{axis speed}\ \ (V_1) \times \frac{Sub-axis\ movingamount(S_2)}{Main-axismovingamount\ (S_1)}$$

$$Sub-aixs(3axis)\ \ \text{speed}\ (V_3) = Main-axis\ speed\ (V_1) \times \frac{Sub-axismovingamount\ (S_3)}{Main-axismovingamount\ (S_1)}$$

:

:

$$Sub-axis\ (8\text{axis})\ \ \text{speed}\ (V_8) = Main-axisspeed\ (V\ ) \times \frac{Sub-axismovingamount\ (S_8)}{Main-axismovingamount\ (S_1)}$$

$$Interpolatingspeed(F) = \sqrt{V_1^{\ 2} + V_2^{\ 2} + V_3^{\ 2} + \ldots + V_8^{\ 2}}$$

■ When the interpolation speed is selected as the synthetic speed

$$Interpolating speed\ (F) = Operation speed set in position data$$

$$Interpolating moving amount\ (S) = \sqrt{S_1{}^2 + S_2{}^2 + S_3^2 + \cdots + S_8^2}$$

$$Main-axis speed\ (V_1) = Interpolating speed\ (F) \times \frac{main-axis\ moving amount(S_1)}{Interpolating moving amount\ (S)}$$

$$Sub-axis1 speed\ (V_2) = Interpolating speed\ (F) \times \frac{Sub-axis1 moving amount(S_2)}{Interpolating moving amount\ (S)}$$

$$Sub-axis2\ \text{speed}\ (V_3) = Interpolating speed\ (F) \times \frac{Sub-axis2\ \ moving amount(S_3)}{Interpolating moving amount\ (S)}$$

$$\vdots$$

$$\vdots$$

$$Sub-axis7\ \text{speed}\ (V_8) = Interpolating speed\ (F) \times \frac{Sub-axis7\ moving amount\ (S_8)}{Interpolating moving amount\ (S)}$$

9.2.9 Middle Point Specified Circular Interpolation

It was progressed by start command of positioning operation (「Indirect start」, 「direct start」) and operate interpolation following the path of circular which is through middle point that is set by 2 axes.

And, Can progress circular interpolation of over 360 degrees by the set number of circular interpolation.

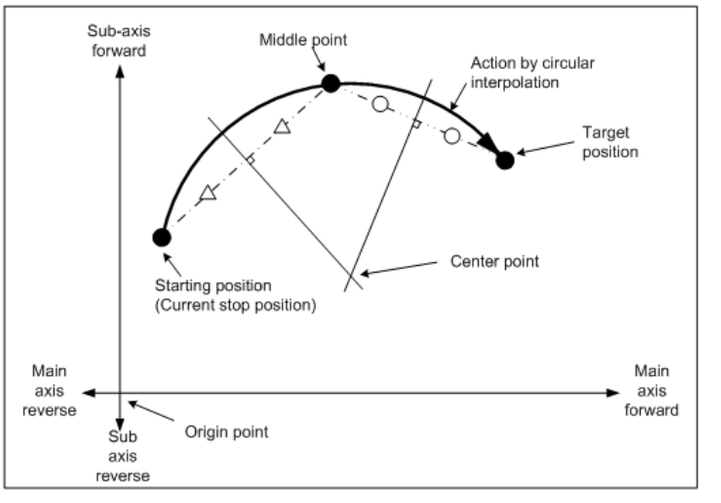
There are no restrictions on the combination of 2 axes used for arc interpolation control. User can select 2 axes from axis1 to axis 8 randomly.

(1) Control of circular interpolation by absolute coordinate, middle point sepecified (Absolute, circular interpolation)

(a) Operate circular interpolation from starting point and pass the middle point that is set operation data to target point.

(b) To be made path of circular interpolation with start position, middle point and a crossing which is perpendicular divide equally position of middle point and target position.

(c) Movement direction is decided automatically depends on set target position and auxiliary point of circular interpolation.



(d) Restrictions

■ Can not draw circle which starting point is the same with last point on the arc interpolation of the method of middle point specified. If user wants to draw an exact circle, use circular interpolation with center point method.

■ In this following case, it will be error and can not working arc interpolation of method of middle point specified.

▪ 「Subordinate axis setting」 error (error code: 279)

- 「Subordinate axis setting」 value of main axis operation data is 'No axis setting'
- 「Sub-axis setting」 value of main axis operating data is same as the main axis no.
- When the "subordinate axis setting" value of the main axis operation data is the axis number not currently connected to the network.

▪ In case of 'degree' is set as control unit of main axis or sub axis, (Error code: 282(Main axis), 283(Sub axis))

▪ In case of middle point which is designated as auxiliary point is same with start position and target position. (Error code: 284)

▪ When the starting position and target position are the same (Error code: 285)

▪ When the calculated radius of circular arc exceed 2147483647pls (error code: 286)

▪ When start position, auxiliary position, and target position are in a straight line, (Error code: 287)

Notes

Should be careful during starting circular interpolation, because 2 axes act at a time.

1. Auxiliary operations available are as follows.
   - Speed override, Deceleration stop, Emergency stop, Skip operation
2. The commands may not be used in circular interpolating operation are as follows.
   - Position/Speed switching control, Position override, Continuous operation
3. The parameter item which is operated by set value of each axis is as follows.
   - Software high limit, software low limit among extended parameter items.

(e) Example of operation data setting

Setting item	Main axis (axis1) setting	Sub axis (axis 2) setting	Content
Control method	Absolute, circular arc interpolation	Absolute, Single axis position control	Set 「absolute, circular interpolation」 on main axis, when control circular interpolation by absolute coordinates. Set the coordinate of subordinate axis setting to 「absolute」.
Program control method	Single,End	- *1	Set operation method for circular interpolation.
Target position [pls]	10000	0	Set the target position for positioning on the main axis and sub axis.
Operation speed [pls/s]	1000	-	Circular interpolation use method of composition speed specified. Set composition speed on the main axis.
Acceleration number	No.1	-	Set the acceleration time No. for acceleration. (No.1 ~ 4)
Deceleration number	No.2	-	Set the deceleration time No. for deceleration. (No.1 ~ 4)
M code	0	-	Set it when users want to progress other auxiliary action with circular interpolation operation.
Dwell time	500	-	Set the dwell time (ms) until the output position signal.
Sub axis setting	Axis 2	-	Set the axis to be used as the subordinate axis among the axis set in the current network in main axis operation data.
Auxiliary point of circular arc interpolation	5000	5000	Set middle point for passing circular arc on the method of the middle point specified.
Circular interpolation mode	Middle point	-	If use center-point-designation method, set 「center-point」 on main-axis
Number of circular interpolation turns	0	-	When user want to draw circle which is over 360 degrees, set the number of rotations of circular arc.
Helical interpolation	Do Not Use	-	When using arc interpolation, set 'not use'on the main axis.

- *1 : Do not need setting. Whatever value is set as, it does not affect arc interpolation.

Notes

Circular interpolation of method of middle point specified is depends on item that it is set on operation data of main axis (command axis).

When circular interpolation operation of the method of middle point specified, there is no effect except for「Target position」, 「Auxiliary point of circular interpolation」on the axis of setting. In other words, whatever value is set as, it does not affect the action and no errors occurred.

However,as the coordinate setting of subordinate axis control mode indicates whether target position of subordinate axis is absolute coordinate or relative coordinate,so when executing arc interpolation control using absolute coordinate mode, the coordinate of subordinate axis must be set to absolute.

[Example] Operate circular interpolation of middle point specified and absolute coordinate (main axis; axis 1, sub axis; axis 2)

■ Start position (0, 0), target position (10000, 6000), auxiliary point (2000, 6000)

The action is as follows in the condition above

■ Setting of XG-PM

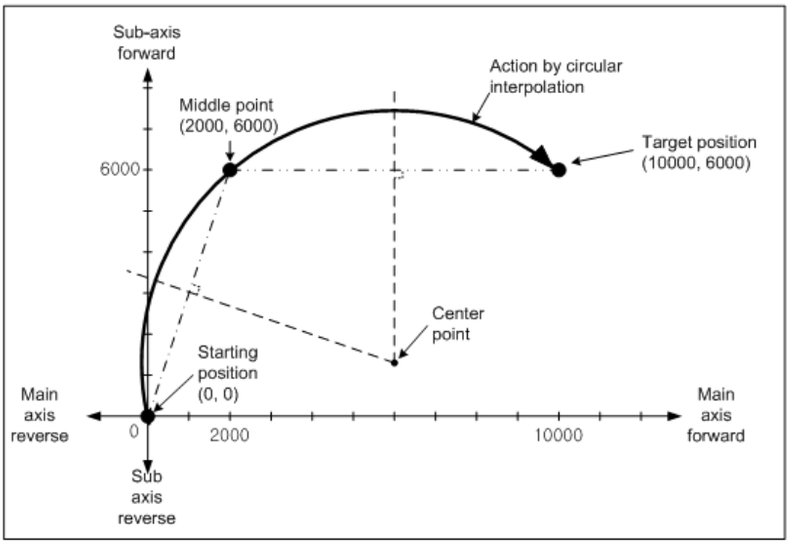
▪ Main axis (axis1) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting	Auxiliary point of circular arc interpolation	Circular interpolation mode	Number of circular interpolation turns	Helical interpolation
1	Absolute, circular arc interpolation	Single,End	10000	1000	No.1	No.1	0	100	Axis 2	2000	Middle point	0	Do Not Use

▪ Subordinate axis (axis2) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting	Auxiliary point of circular arc interpolation	Circular interpolation mode	Number of circular interpolation turns	Helical interpolation
1	Absolute, Single axis position control	Single,End	6000	0	No.1	No.1	0	0	No axis setting	6000	Middle point	0	Do Not Use

■ Operation Patterns



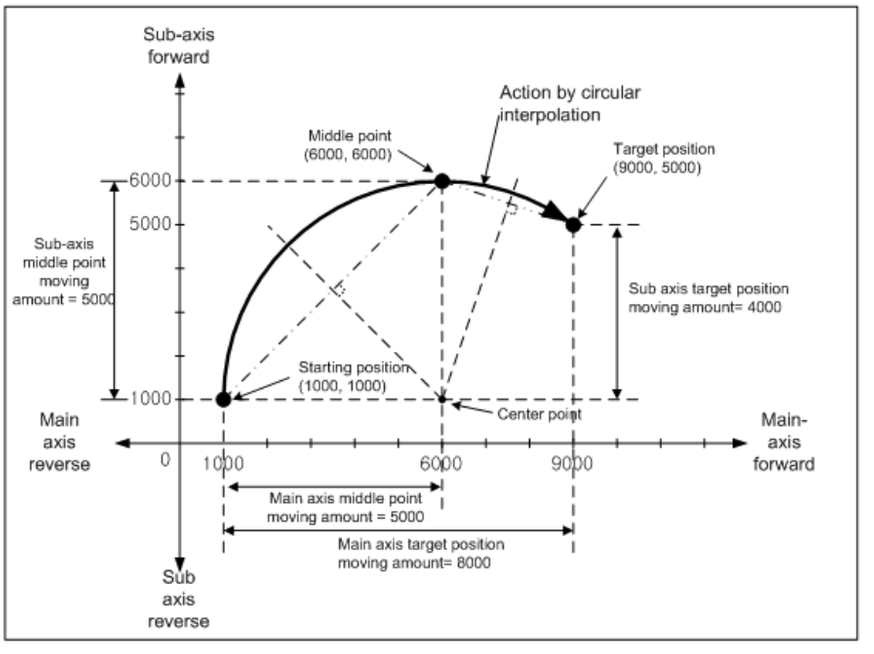
(2) Circular interpolation by relative coordinates, the method of middle point specified (Relative, circular interpolation)

(a) Operate circular interpolation from start position and go through middle point to target position as amount of set movement.

(b) Middle point position is the incremented position as set value on 「the circular interpolation auxiliary point」 from current stop position.

(c) An arc trajectory is created with the intersection point as the center point created by vertically bisecting the starting position, the middle point position, and the position incremented by the value set in the target position from the middle point position and the current stop position.

(d) Movement direction is decided automatically depends on set target position and auxiliary point of circular interpolation.



(e) Restrictions

■ Can not draw circle which starting point is the same with last point on the arc interpolation of the method of middle point specified. If user wants to draw an exact circle, use circular interpolation with center point method.

■ In this following case, it will be error and can not working arc interpolation of method of middle point specified.

▪ 「Subordinate axis setting」 error (error code: 279)

- 「Subordinate axis setting」 value of main axis operation data is 'No axis setting'
- 「Sub-axis setting」 value of main axis operating data is same as the main axis no.
- When the "subordinate axis setting" value of the main axis operation data is the axis number not currently connected to the network.

▪ In case of 'degree' is set as control unit of main axis or sub axis, (Error code: 282(Main axis), 283(Sub axis))

▪ In case of middle point which is designated as auxiliary point is same with start position and target position. (Error code: 284)

▪ When the starting position and target position are the same (Error code: 285)

▪ When the calculated radius of circular arc exceed 2147483647pls (error code: 286)

▪ When start position, auxiliary position, and target position are in a straight line, (Error code: 287)

(f) Example of operation data setting

Setting item	Main axis (axis1) setting	Sub axis (axis 2) setting	Content
Control method	Relative, Arc Interpolation	Incremental, single-axis Position Control	When control circular interpolation by relative coordinates, set 「relative, circular interpolation」on main axis. Set the coordinate of subordinate axis setting to 「relative」.
Program control method	Single,End	- *1	Set operation method for circular interpolation.
Target position [pls]	10000	0	Set target position as the amount of increment of stop position for positioning on the main axis, sub axis.
Operation speed [pls/s]	1000	-	Circular interpolation use method of composition speed specified. Set composition speed on the main axis.
Acc. No.	No.1	-	Set the acceleration time No. for acceleration. (No.1 ~ 4)
Deceleration No.	No.2	-	Set the deceleration time No. for deceleration. (No.1 ~ 4)
M code	0	-	Set it when users want to progress other auxiliary action with circular interpolation operation.
Dwell time	500	-	Set the dwell time (ms) until the output position signal.
Sub axis setting	Axis 2	-	Set the axis to be used as the subordinate axis among the axis set in the current network in main axis operation data.
Auxiliary point of circular arc interpolation	5000	5000	Set the middle point that the arc with mid-point specified method would pass by as an increment from the current stop position
Circular interpolation mode	Middle point	-	If use center-point-designation method, set 「center-point」on main-axis
Number of circular interpolation turns	0	-	When user want to draw circle which is over 360 degrees, set the number of rotations of circular arc.
Helical interpolation	Do Not Use	-	When using arc interpolation, set 'not use'on the main axis.

-* 1: Do not need setting. Whatever value is set as, it does not affect arc interpolation.

Notes

Circular interpolation of method of middle point specified is depends on item that it is set on operation data of main axis (command axis).

When arc interpolation operation of the method of middle point specified, there is no effect except for「Coordinates of「Target position」, 「Auxiliary point of arc interpolation」on the arc interpolation operation. In other words, whatever value is set as, it does not affect the action and no errors occurred.

However, as the coordinate setting of subordinate axis control mode indicates whether target position of subordinate axis is absolute coordinate or relative coordinate, so when executing arc interpolation control using relative coordinate mode, the coordinate of subordinate axis must be set to relative.

[Example] Operate arc interpolation of relative middle point specified (main axis; axis 1, sub axis; axis 2)

■ Starting Position: (1000, 1000)

Target position setting: (8000, 4000)

Auxiliary point (amount of movement) setting: (5000, 5000)

The action is as follows in the condition above

■ Setting of XG-PM

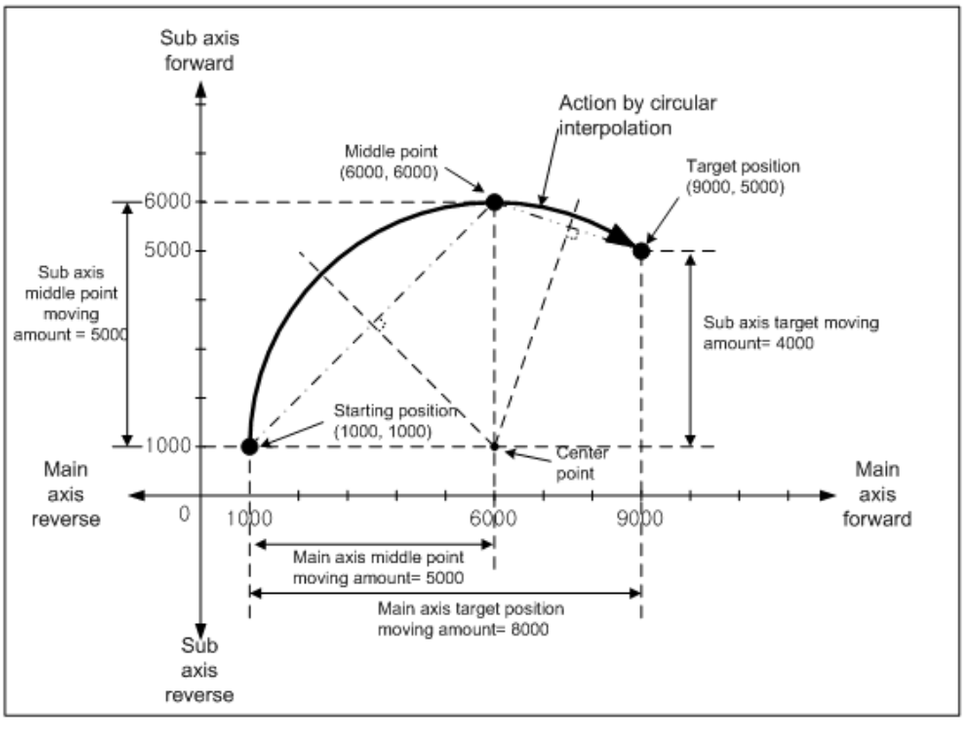
▪ Main axis (axis1) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting	Auxiliary point of circular arc interpolation	Circular interpolation mode	Number of circular interpolation turns	Helical interpolation
1	Incremental, Circular Interpolation	Single,End	8000	1000	No.1	No.1	0	100	Axis 2	5000	Middle point	0	Do Not Use

▪ Subordinate axis (axis2) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting	Auxiliary point of circular arc interpolation	Circular interpolation mode	Number of circular interpolation turns	Helical interpolation
1	Incremental, single-axis Position Control	Single,End	4000	0	No.1	No.1	0	0	No axis setting	5000	Middle point	0	Do Not Use

■ Operation Patterns



9.2.10 Center Point Specified Circular Interpolation

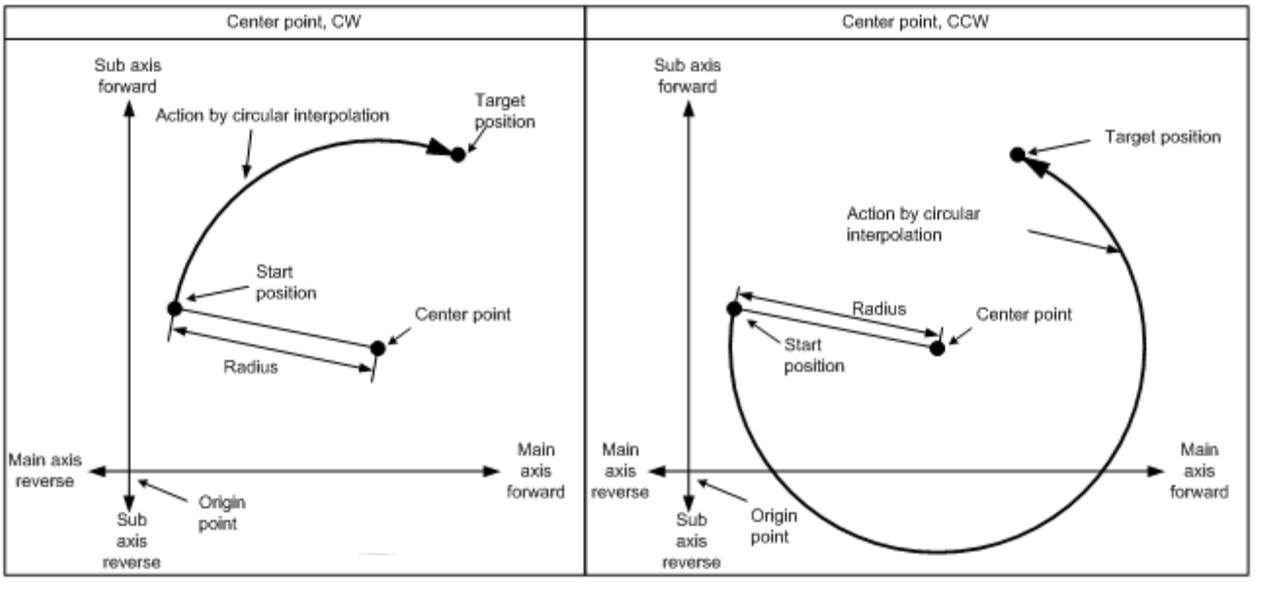
Operate interpolation up to trace of the circle after operate by starting command of positioning operation (「indirect start」, 「Start at a time」). And then, Center point is center of circle and it is move to rotation direction of circular interpolation. According to「The turn no. of circular interpolation」, circular interpolation which is bigger than 360° is available to be executed. There are no restrictions on the combination of 2 axes used for arc interpolation control. User can select 2 axes from axis1 to axis 8 randomly.

(1) Circular interpolation by method of absolute coordinate, Center point spcified (Absolute, Circular interpolation)

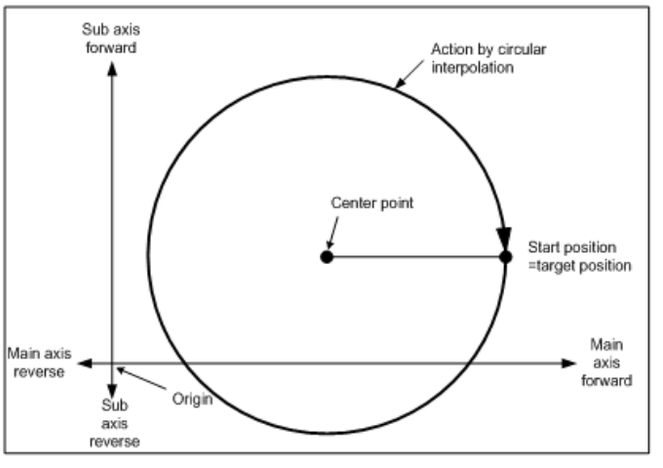
(a) Starts operating from starting position and execute circular interpolation along trace of circle that has distance from starting point to designated center point as radius. 「Circular interpolation auxiliary point」is Center point of this circle.

(b) Moving direction depends on set direction on 'arc interpolation mode" of operation data"

- 「Center-point, CW」 - Arc interpolation go clockwise from current position.
- 「Center-point, CCW」- Arc interpolation go counterclockwise from current position.



(c) If you set the target position to be the same as the starting position, you can execute arc interpolation that draws a perfect circle with the starting position and the center point of the arc as the radius.



(d) Restrictions

■ In this following case, it will be error and can not working arc interpolation of method of Center Point specified.

▪「Subordinate axis setting」error (error code: 279)

-「Subordinate axis setting」value of main axis operation data is 'No axis setting'

-「Sub-axis setting」value of main axis operating data is same as the main axis no.

- When the "subordinate axis setting" value of the main axis operation data is the axis number not currently connected to the network.

▪ In case of 'degree' is set as control unit of main axis or sub axis, (Error code: 282(Main axis), 283(Sub axis))

▪ In case of center point which is designated as auxiliary point is same with start position and target position. (Error code: 284)

▪ When the calculated radius of circular arc exceed 2147483647pls (error code: 286)

Notes

Should be careful during starting circular interpolation, because 2 axes act at a time.

1. Auxiliary operations available are as follows.
   ▪ Speed override, Deceleration stop, Emergency stop, Skip operation
2. The commands may not be used in circular interpolating operation are as follows.
   ▪ Position/Speed switching control, Position override, Continuous operation
3. The parameter item which is operated by set value of each axis is as follows.
   ▪ Software high limit, software low limit among extended parameter items.

(e) Example of operation data setting

Setting item	Main axis (axis1) setting	Sub axis (axis 2) setting	Content
Control method	Absolute, circular arc interpolation	Absolute, Single axis position control	Set 「absolute, circular interpolation」on main axis, when control circular interpolation by absolute coordinates. Set the coordinate of subordinate axis setting to 「absolute」.
Program control method	Single,End	- *1	Set operation method for circular interpolation.
Target position [pls]	10000	0	Set the target position for positioning on the main axis and sub axis.
Operation speed [pls/s]	1000	-	Circular interpolation use method of composition speed specified. Set composition speed on the main axis.
Acceleration number	No.1	-	Set the acceleration time No. for acceleration. (No.1 ~ 4)
Deceleration number	No.2	-	Set the deceleration time No. for deceleration. (No.1 ~ 4)
M code	0	-	Set it when users want to progress other auxiliary action with circular interpolation operation.
Dwell time	500	-	Set the dwell time (ms) until the output position signal.
Sub axis setting	Axis 2	-	Set the axis to be used as the subordinate axis among the axis set in the current network in main axis operation data.
Auxiliary point of circular arc interpolation	5000	-5000	Set the center-point on the method of center-point specified.
Circular interpolation mode	Center point, CW	-	In case of using the method of center-point specified, set the 「center-point, CW」or 「center-point, CCW」 by moving direction of circular arc.
Number of circular interpolation turns	0	-	When user want to draw circle which is over 360 degrees, set the number of rotations of circular arc.
Helical interpolation	Do Not Use	-	When using arc interpolation, set 'not use'on the main axis.

-* 1: Do not need setting. Whatever value is set as, it does not affect arc interpolation.

Notes

Arc interpolation of method of center point specified is depends on item that it is set on operation data of main axis (command axis).

During arc interpolation operation using the center point designation method, items other than “target position” and “circular interpolation auxiliary point” during the setting of the ordinate axis do not affect the arc interpolation operation. In other words, whatever value is set as, it does not affect the action and no errors occurred.

However,as the coordinate setting of subordinate axis control mode indicates whether target position of subordinate axis is absolute coordinate or relative coordinate,so when executing arc interpolation control using absolute coordinate mode, the coordinate of subordinate axis must be set to absolute.

[Example] Operate arc interpolation of Center point specified and absolute coordinate (main axis; axis 1, sub axis; axis 2)

■ Start position (0, 0), target position (0, 0), auxiliary point (1000, 1000), direction of rotation: CW

The action is as follows in the condition above

■ Setting of XG-PM

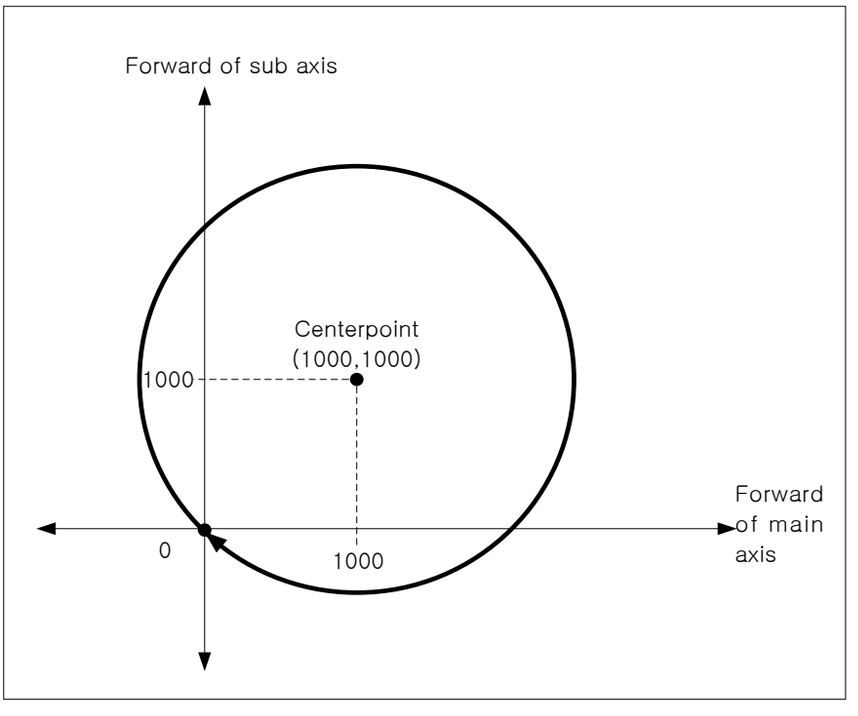
▪ Main axis (axis1) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting	Auxiliary point of circular arc interpolation	Circular interpolation mode	Number of circular interpolation turns	Helical interpolation
1	Absolute, circular arc interpolation	Single,End	0	1000	No.1	No.1	0	100	Axis 2	1000	Center point, CW	0	Do Not Use

▪ Subordinate axis (axis2) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting	Auxiliary point of circular arc interpolation	Circular interpolation mode	Number of circular interpolation turns	Helical interpolation
1	Absolute, Single axis position control	Single,End	0	0	No.1	No.1	0	0	No axis setting	1000	Middle point	0	Do Not Use

■ Operation Patterns

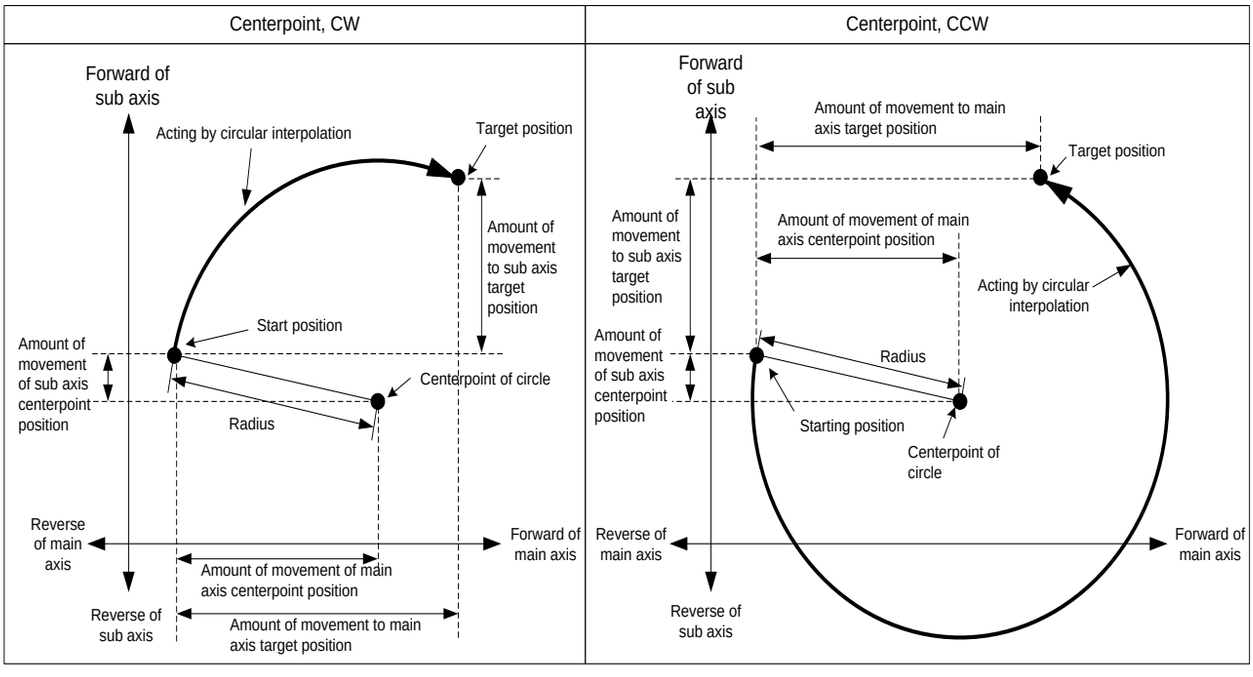


(2) Circular interpolation control by the method of relative coordinate, center-point specified (「Relative, Circular interpolation」)

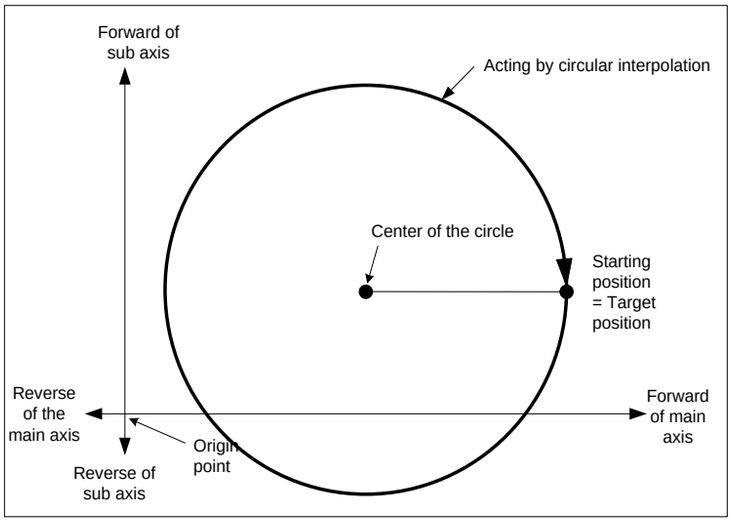
(a) Start operating at starting position and then execute circular interpolation by moving amount already set, along the trace of the arc which has a distance between starting position and designated mid-point as radius. 「Circular interpolation auxiliary point」 means the moving amount between the current position and mid-point.

(b) Moving direction depends on set direction on 'arc interpolation mode" of operation data"

- 「Center-point, CW」 - Arc interpolation go clockwise from current position.
- 「Center-point, CCW」 - Arc interpolation go counterclockwise from current position.



(c) If set target position of main axis and sub axis as 0, than starting position will be same with target position and can progress circular interpolation that it is drawing circle. The radius of the circle is distance from starting position to center point of the arc.



(d) Restrictions

■ In this following case, it will be error and can not working arc interpolation of method of center point specified.

▪「Subordinate axis setting」error (error code: 279)

-「Subordinate axis setting」value of main axis operation data is 'No axis setting'

-「Sub-axis setting」value of main axis operating data is same as the main axis no.

- When the "subordinate axis setting" value of the main axis operation data is the axis number not currently connected to the network.

▪ In case of 'degree' is set as control unit of main axis or sub axis, (Error code: 282(Main axis), 283(Sub axis))

▪ In case of center point which is designated as auxiliary point is same with start position and target position. (Error code: 284)

▪ When the calculated radius of circular arc exceed 2147483647pls (error code: 286)

(e) Example of operation data setting

Setting item	Main axis (axis1) setting	Sub axis (axis 2) setting	Content
Control method	Incremental, Circular Interpolation	Incremental, single-axis Position Control	When control circular interpolation by relative coordinates, set 「relative, circular interpolation」on main axis. Set the coordinate of subordinate axis setting to 「relative」.
Program control method	Single,End	- *1	Set operation method for circular interpolation.
Target position [pls]	10000	0	Set target position as the amount of increment of stop position for positioning on the main axis, sub axis.
Operating speed [pls/s]	1000	-	Circular interpolation use method of composition speed specified. Set composition speed on the main axis.
Acceleration number	No.1	-	Set the acceleration time No. for acceleration. (No.1 ~ 4)
Deceleration number	No.2	-	Set the deceleration time No. for deceleration. (No.1 ~ 4)
M code	0	-	Set it when users want to progress other auxiliary action with circular interpolation operation.
Dwell time	500	-	Set the dwell time (ms) until the output position signal.
Sub axis setting	Axis 2	-	Set the axis to be used as the subordinate axis among the axis set in the current network in main axis operation data.
Auxiliary point of circular arc interpolation	5000	-5000	Set the center-point position by amount of increment of current stop position on the method of center-point specified.
Circular interpolation mode	Center point, CW	-	In case of using the method of center-point specified, set the 「center-point, CW」or 「center-point, CCW」 by moving direction of circular arc.
Number of circular interpolation turns	0	-	When user want to draw circle which is over 360 degrees, set the number of rotations of circular arc.
Helical interpolation	Do Not Use	-	When using arc interpolation, set 'not use'on the main axis.

- *1 : Do not need setting. Whatever value is set as, it does not affect arc interpolation.

Notes

Arc interpolation of method of center point specified is depends on item that it is set on operation data of main axis (command axis).

There is no effect to circular interpolation operation except for 「Target position」and「Circular interpolation auxiliary point」, when operate circular interpolation of method of center point specified. In other words, whatever value is set as, it does not affect the action and no errors occurred.

However, as the coordinate setting of subordinate axis control mode indicates whether target position of subordinate axis is absolute coordinate or relative coordinate, so when executing arc interpolation control using relative coordinate mode, the coordinate of subordinate axis must be set to relative.

[Example] Operate arc interpolation of relative, center pint specified (main axis; axis 1, sub axis; axis 2)

■ Starting Position: (0, 0)

Target position setting: (2000, 0)

Auxiliary point (amount of movement) setting: (1000, 0)

Rotation direction: CW

The action is as follows in the condition above

■ Setting of XG-PM

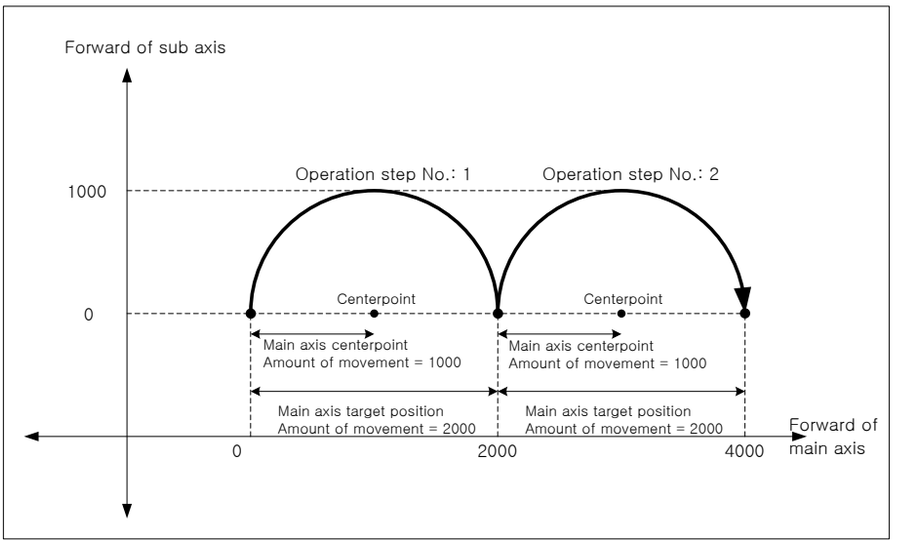
▪ Main axis (axis1) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting	Auxiliary point of circular arc interpolation	Circular interpolation mode	Number of circular interpolation turns	Helical interpolation
1	Incremental, Circular Interpolation	Single,Keep	2000	1000	No.1	No.1	0	100	Axis 2	1000	Center point, CW	0	Do Not Use
1	Incremental, Circular Interpolation	Single,End	2000	1000	No.1	No.1	0	100	Axis 2	1000	Center point, CW	0	Do Not Use

▪ Subordinate axis (axis2) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting	Auxiliary point of circular arc interpolation	Circular interpolation mode	Number of circular interpolation turns	Helical interpolation
1	Incremental, single-axis Position Control	Single,End	0	0	No.1	No.1	0	0	No axis setting	0	Middle point	0	Do Not Use
1	Incremental, single-axis Position Control	Single,End	0	0	No.1	No.1	0	0	No axis setting	0	Middle point	0	Do Not Use

■ Operation Patterns

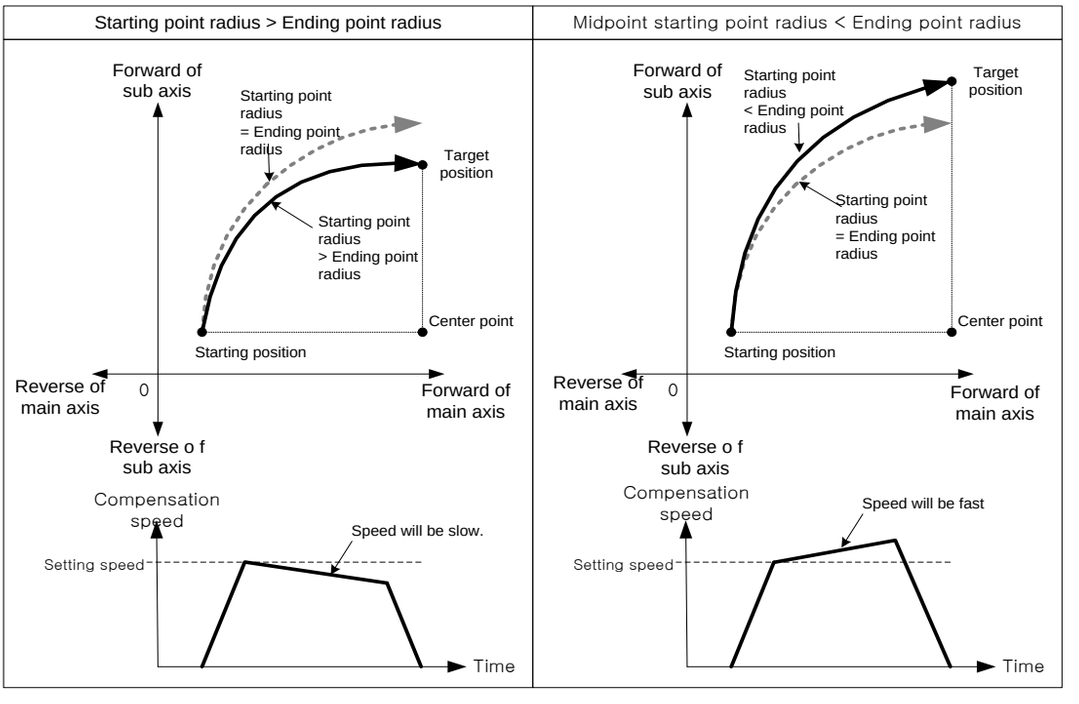


(3) Circular interpolation control which radius of starting point is different with radius of ending point. (「Relative, Circular interpolation」)

(a) According to set value of target position, distance which it is distance from start point to center point is different with distance which it is distance from target position to center point (End point, Radius) on circular interpolation control of the method of center point specified do not operate normally. When starting point radius have difference with end point radius, calculate each speed on the set operation speed,in proportion to this angular speed, arc interpolation control is executed to the target position while compensating for the difference between the starting point radius and the ending point radius.

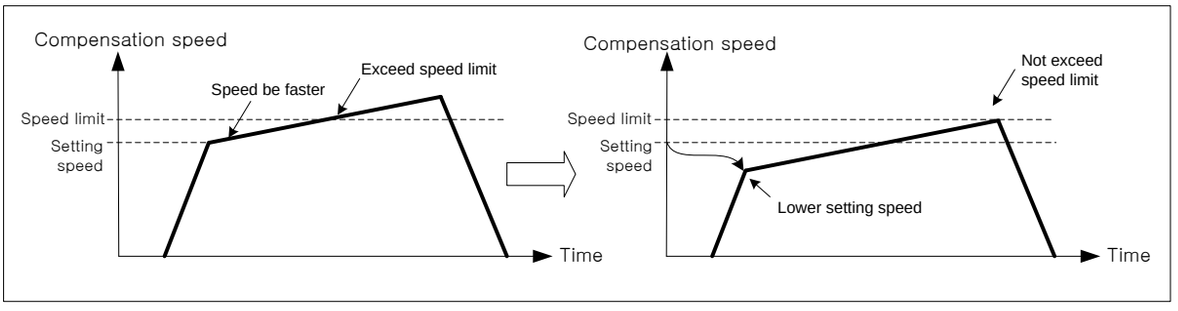
(b) In case of starting point radius has some difference with ending point radius, compensating speed is as follows:

- Radius of starting point > Radius of ending point: The more near from target position, the slower.
- Radius of starting point < Radius of ending point: The more near from target position, the faster.



Notes

In case of Starting point radius < Ending point radius, the more operate arc interpolation, the speed is faster, so it can exceed the 'Speed limit」 of basic parameter. When operate arc interpolation, in case of starting point radius shorter than ending point radius, lower speed for never exceeding 「Speed limit」. Can operate no exceed 「Speed limit」, even if it is near to target position.



(4) Absolute coordinate function of the number of circular interpolation turns

(a) In case of circular interpolation setting exceed 1 on circular interpolation control of the method of absolute coordinate, center point specified. To set of the number of circular interpolation's rotations operate the number of rotations at the absolute coordinate of first start.

(b) Even if decelerate and stop, operate origin circular interpolation by restart.

(c) Restrictions

In this following case position is changed after deceleration stop command. The number of circular interpolation's rotation is not the number of absolute rotations. It operate by the number of relative rotations.

▪ After operate positioning command except for current step indirect start (Directing start, Jog operation, Inching operation, Sync. operation, etc),

▪ After progress current position changing command

▪ After servo off command execution

[Example] Operate arc interpolation of relative, center pint specified (main axis; axis 1, sub axis; axis 2)

■ In this case of Starting position (100, 500), Target position (600, 300), Auxiliary position (600, 500), Direction of rotations: CW

The action is as follows in the condition above

■ Setting of XG-PM

▪ Main axis (axis1) operation data

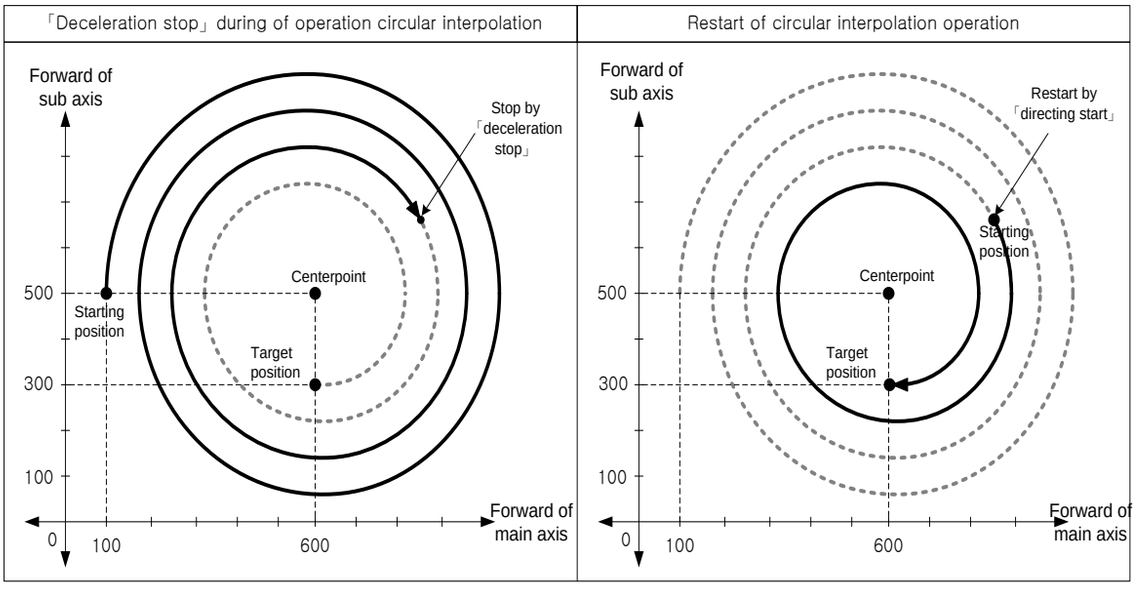
step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting	Auxiliary point of circular arc interpolation	Circular interpolation mode	Number of circular interpolation turns	Helical interpolation
1	Absolute, circular arc interpolation	Single,End	600	1000	No.1	No.1	0	100	Axis 2	600	Center point, CW	3	Do Not Use

▪ Subordinate axis (axis2) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting	Auxiliary point of circular arc interpolation	Circular interpolation mode	Number of circular interpolation turns	Helical interpolation

1	Absolute, Single axis position control	Single,End	300	0	No.1	No.1	0	0	No axis setting	500	Middle point	0	Do Not Use

■ Operation Patterns



When decelerating in circular interpolation by dec. stop command and restart the same step no., not that executing circular interpolation after circular interpolation being executed 3 times, but that positioning at the goal position after going around 1 time, because 2 times of circular interpolation was executed in former operation.

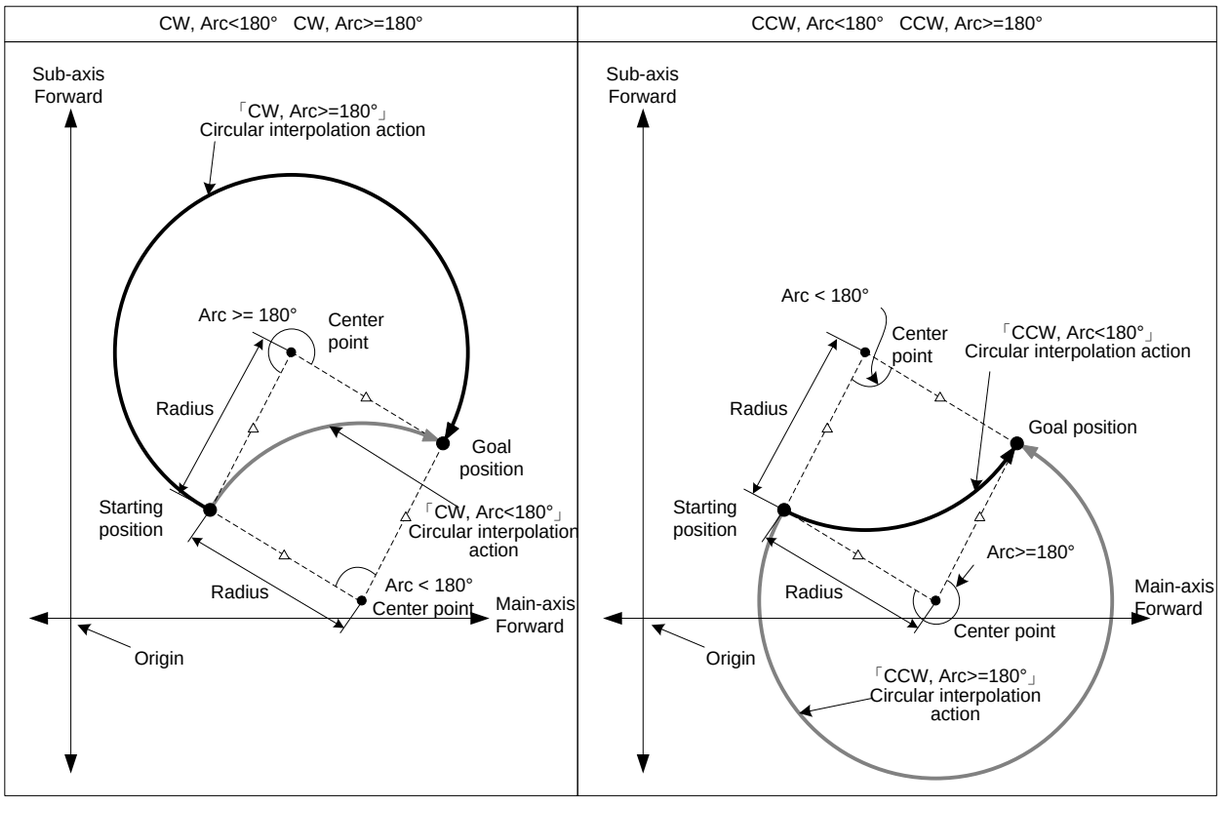
9.2.11 Circular interpolation control with Radius Specified

After being executed by positioning operation start (「Indirect start」, 「Sync. start」), then it operates along the trace of the circle made by circular interpolation with 2 axes. According to「The turn no. of circular interpolation」, circular interpolation which is bigger than 360° is available to be executed. There are no restrictions on the combination of 2 axes used for arc interpolation control. User can select 2 axes from axis1 to axis 8 randomly.

(1) Circular interpolation by method of absolute and radius specified(「Absolute, Circular interpolation」)

(a) Start operating at starting position and execute circular interpolation along the trace of the circle which has radius set on circular interpolation auxiliary point of main-axis operating data. The arc was drew with different central points depends on the turning direction (CW, CCW) of 'arc interpolation mode' and size setting of arc (arc<180°, arc>=180°).

Arc interpolation mode	Content
Radius, CW, Arc<180°	Execute circular interpolation with center-point of arc which smaller than 180°in direction of CW
Radius, CW, Arc>= 180°	Execute circular interpolation with center-point of arc which bigger than 180°in direction of CW
Radius, CCW, Arc<180°	Execute circular interpolation with center-point of arc which smaller than 180°in direction of CCW
Radius, CCW, Arc>= 180°	Execute circular interpolation with center-point of arc which bigger than 180°in direction of CWW



(b) Restrictions

■ Arc interpolation with radius specified method may not draw an exact circle that the starting position and ending position are same. If user wants to draw an exact circle, use circular interpolation with center point method.

■ In this following case, it will be error and can not working arc interpolation of method of center point specified.

▪ 「Subordinate axis」 error (error code: 279)

- 「Subordinate axis setting」 value of main axis operation data is 'No axis setting'
- 「Sub-axis setting」 value of main axis operating data is same as the main axis no.
- When the "subordinate axis setting" value of the main axis operation data is the axis number not currently connected to the network.

▪ In case of 'degree' is set as control unit of main axis or sub axis, (Error code: 282(Main axis), 283(Sub axis))

▪ When the starting position and target position are the same (Error code: 285)

▪ Radius value of arc interpolation of main-axis operating data is smaller than half of the length from starting position to target position.

- Radius < (R x 0.8): Error (error code: 270)
- (R x 0.8) <= radius < R

: Execute arc interpolation after reset the radius to R. In other words, execute circular interpolation by setting the center of the line from starting position to goal position as center point.

Notes

Should be careful during starting circular interpolation, because 2 axes act at a time.

1. Auxiliary operations available are as follows.
   ▪ Speed override, Deceleration stop, Emergency stop, Skip operation
2. The commands may not be used in circular interpolating operation are as follows.
   ▪ Position/Speed switching control, Position override, Continuous operation
3. The parameter item which is operated by set value of each axis is as follows.
   ▪ Software high limit, software low limit among extended parameter items.

(c) Example of operation data setting

Setting item	Main axis (axis1) setting	Sub axis (axis 2) setting	Content
Control method	Absolute, circular arc interpolation	Absolute, Single axis position control	Set 「absolute, circular interpolation」on main axis, when control circular interpolation by absolute coordinates. Set the coordinate of subordinate axis setting to 「absolute」.
Program control method	Single,End	- *1	Set operation method for circular interpolation.
Target position [pls]	10000	0	Set the target position for positioning on the main axis and sub axis.
Operation speed [pls/s]	1000	-	Circular interpolation use method of composition speed specified. Set composition speed on the main axis.
Acceleration number	No.1	-	Set the acceleration time No. for acceleration. (No.1 ~ 4)
Deceleration number	No.2	-	Set the deceleration time No. for deceleration.(No.1 ~ 4)
M code	0	-	Set it when users want to progress other auxiliary action with circular interpolation operation.
Dwell time	500	-	Set the dwell time (ms) until the output position signal.
Sub axis setting	Axis 2	-	Set the axis to be used as the subordinate axis among the axis set in the current network in main axis operation data.
Auxiliary point of circular arc interpolation	7000	-	Set the radius on main-axis
Circular interpolation mode	Radius, CW, Arc<180°	-	If use radius designation method, set「Radius」on main-axis and set moving direction of arc and size of arc
Circular Interpolation The number of turn	0	-	When user want to draw circle which is over 360 degrees, set the number of rotations of circular arc.
Helical interpolation	Do Not Use	-	When using arc interpolation, set 'not use'on the main axis.

- *1 : Do not need setting. Whatever value is set as, it does not affect arc interpolation.

Notes

1. Circular interpolation control of Radius designation method is executed on the basis of the items set on operating data. When it is executed, only「Goal position」can affect circular interpolation. In other words, whatever value is set as, it does not affect the action and no errors occurred. However,as the coordinate setting of subordinate axis control mode indicates whether target position of subordinate axis is absolute coordinate or relative coordinate,so when executing arc interpolation control using absolute coordinate mode, the coordinate of subordinate axis must be set to absolute.
2. When setting the circular interpolating auxiliary point (radius) of main-axis, it must be bigger than the half of the length between starting position and goal position. If it is smaller than the half(R) and the value is higher than 80% of R, circular interpolation which has middle point between starting position and goal position as center-point is executed. If a radius setting less than 80% of R value, error (error code: 270) occurs and arc interpolation is not executed.

[Example] Operate arc interpolation of relative, center pint specified (main axis; axis 1, sub axis; axis 2)

■ Start position (1000, 1000), target position (9000, 1000), auxiliary point (5000, 0)

Rotation direction of arc: CW, Size of arc: Arc >= 180°

The action is as follows in the condition above

■ Setting of XG-PM

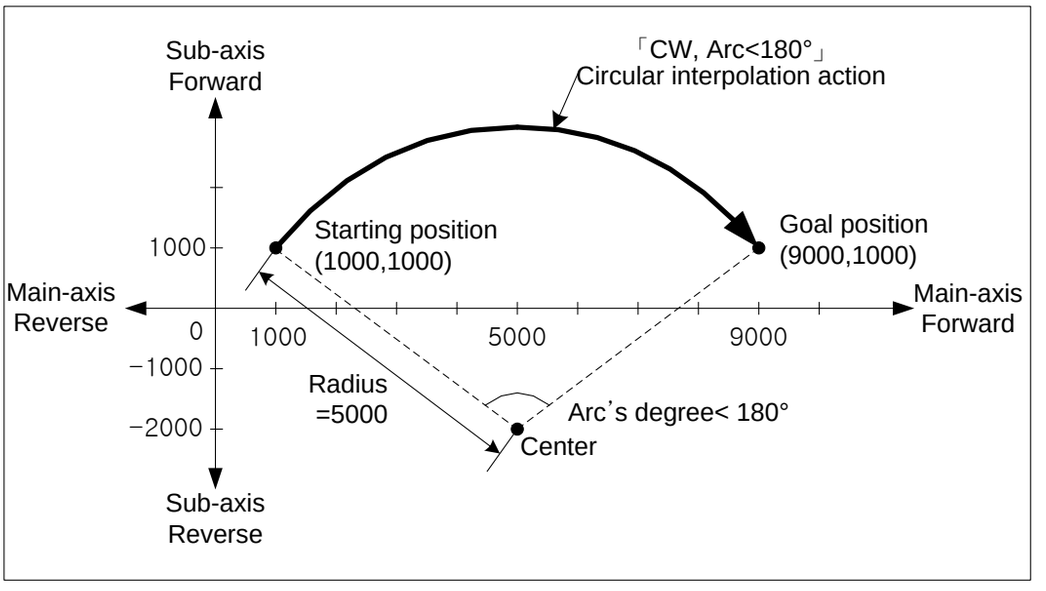
▪ Main axis (axis1) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting	Auxiliary point of circular arc interpolation	Circular interpolation mode	Number of circular interpolation turns	Helical interpolation
1	Absolute, circular arc interpolation	Single,End	9000	1000	No.1	No.1	0	100	Axis 2	5000	Radius, CW, Arc<180°	0	Do Not Use

▪ Subordinate axis (axis2) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting	Auxiliary point of circular arc interpolation	Circular interpolation mode	Number of circular interpolation turns	Helical interpolation
1	Absolute, Single axis position control	Single,End	1000	0	No.1	No.1	0	0	No axis setting	0	Middle point	0	Do Not Use

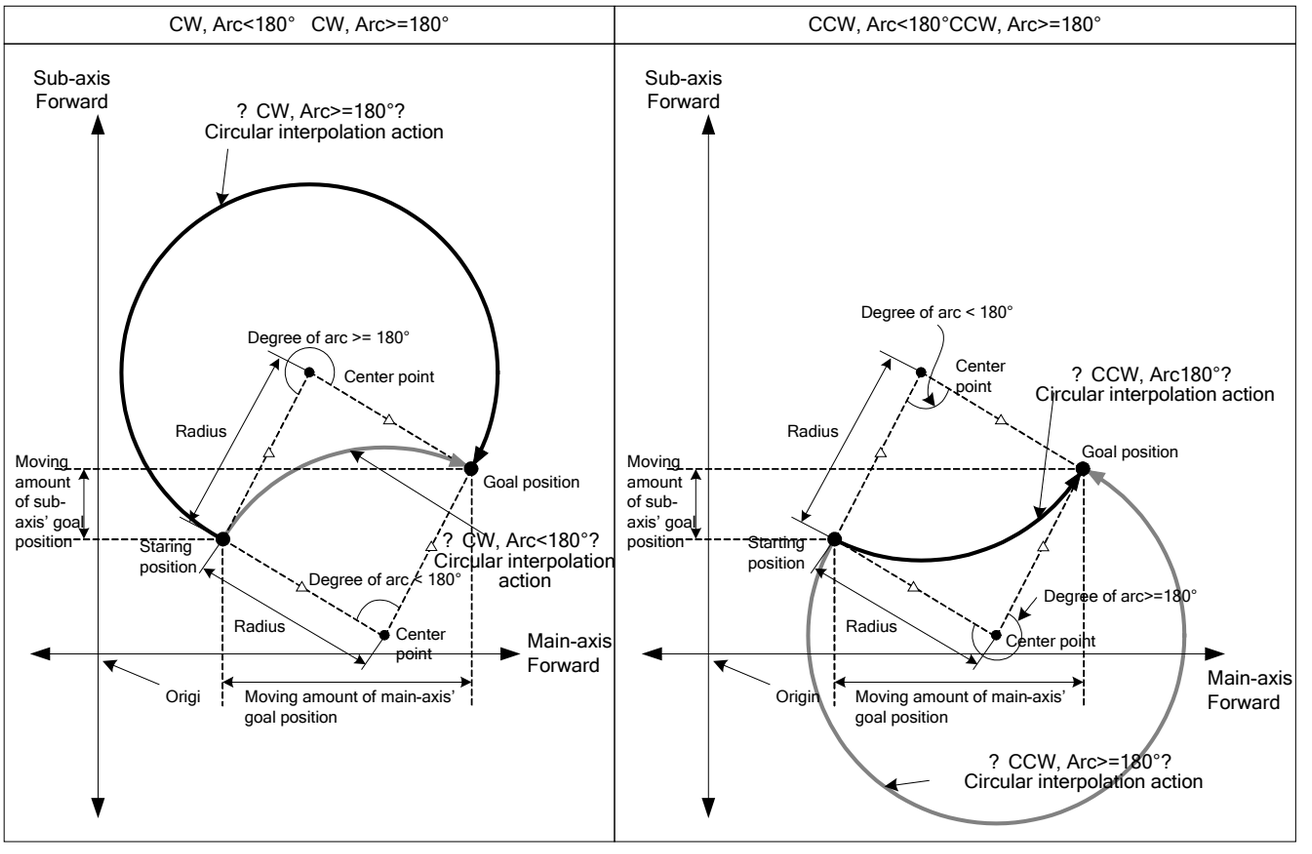
■ Operation Patterns



(2) Circular interpolation by method of relative and radius specified (「Relative, Circular interpolation」)

(a) Start operating from starting position and then execute circular interpolation by increment set on goal position along the trace of the circle which has the value set on circular interpolation auxiliary point of main-axis operation data as a radius. The arc was drew with different central points depends on the turning direction (CW, CCW) of 'arc interpolation mode' and size setting of arc (arc<180°, arc>=180°).

Circular interpolation mode	Content
Radius, CW, Arc<180°	Execute circular interpolation with center-point of arc which smaller than 180°in direction of CW
Radius, CW, Arc>= 180°	Execute circular interpolation with center-point of arc which bigger than 180°in direction of CW
Radius, CCW, Arc<180°	Execute circular interpolation with center-point of arc which smaller than 180°in direction of CCW
Radius, CCW, Arc>= 180°	Execute circular interpolation with center-point of arc which bigger than 180°in direction of CWW



(b) Restrictions

■ Arc interpolation with radius specified method may not draw an exact circle that the starting position and ending position are same. If user wants to draw an exact circle, use circular interpolation with center point method.

■ In this following case, it will be error and can not working arc interpolation of method of center point specified.

▪ 「Subordinate axis」 error (error code: 279)

- 「Subordinate axis setting」 value of main axis operation data is 'No axis setting'
- 「Sub-axis setting」 value of main axis operating data is same as the main axis no.
- When the "subordinate axis setting" value of the main axis operation data is the axis number not currently connected to the network.

▪ In case of 'degree' is set as control unit of main axis or sub axis, (Error code: 282(Main axis), 283(Sub axis))

▪ When the starting position and target position are the same (Error code: 285)

▪ Radius value of arc interpolation of main-axis operating data is smaller than half of the length from starting position to target position.

- Radius < (R x 0.8): Error (error code: 270)
- (R x 0.8) <= radius < R

: Execute arc interpolation after reset the radius to R. In other words, execute circular interpolation by setting the center of the line from starting position to goal position as center point.

(c) Example of operation data setting

Setting item	Main axis (axis1) setting	Sub axis (axis 2) setting	Content
Control method	Incremental, Circular Interpolation	Incremental, single-axis Position Control	When executing circular interpolation with absolute coordinates, set「Relative, Circular interpolation」on main Set the coordinate of subordinate axis setting to 「relative」.
Program control method	Single,End	- *1	Set operation method for circular interpolation.
Target position [pls]	10000	0	Set target position as the amount of increment of stop position for positioning on the main axis, sub axis.
Operation speed [pls/s]	1000	-	Circular interpolation use method of composition speed specified. Set composition speed on the main axis.
Acceleration number	No.1	-	Set the acceleration time No. for acceleration. (No.1 ~ 4)
Deceleration number	No.2	-	Set the deceleration time No. for deceleration. (No.1 ~ 4)
M code	0	-	Set it when users want to progress other auxiliary action with circular interpolation operation.
Dwell time	500	-	Set the dwell time (ms) until the output position signal.
Sub axis setting	Axis 2	-	Set the axis to be used as the subordinate axis among the axis set in the current network in main axis operation data.
Auxiliary point of circular arc interpolation	7000	-	Set the radius on main-axis
Circular interpolation mode	Radius, CW, Arc<180°	-	If use center-point-designation method, set 「center-point」on main-axis
Number of circular interpolation turns	0	-	When user want to draw circle which is over 360 degrees, set the number of rotations of circular arc.
Helical interpolation	Do Not Use	-	When using arc interpolation, set 'not use'on the main axis.

- *1 : Do not need setting. Whatever value is set as, it does not affect arc interpolation.

Notes

1. Circular interpolation control of Radius designation method is executed on the basis of the items set on operating data. When it is executed, only「Goal position」can affect circular interpolation. In other words, whatever value is set as, it does not affect the action and no errors occurred. However, as the coordinate setting of subordinate axis control mode indicates whether target position of subordinate axis is absolute coordinate or relative coordinate,so when executing arc interpolation control using relative coordinate mode, the coordinate of subordinate axis must be set to relative.
2. When setting the circular interpolating auxiliary point (radius) of main-axis, it must be bigger than the half of the length between starting position and goal position. If it is smaller than the half(R) and the value is higher than 80% of R, circular interpolation which has middle point between starting position and goal position as center-point is executed. If a radius setting less than 80% of R value, error (error code: 270) occurs and arc interpolation is not executed.

[Example] Operate arc interpolation of relative, radius specified (main axis; axis 1, sub axis; axis 2)

■ Starting Position (1000, 1000).

Target position setting (8000, 0)

Auxiliary point (5000, 0)

Rotation direction of arc: CCW, Size of arc: Arc >= 180°

The action is as follows in the condition above

■ Setting of XG-PM

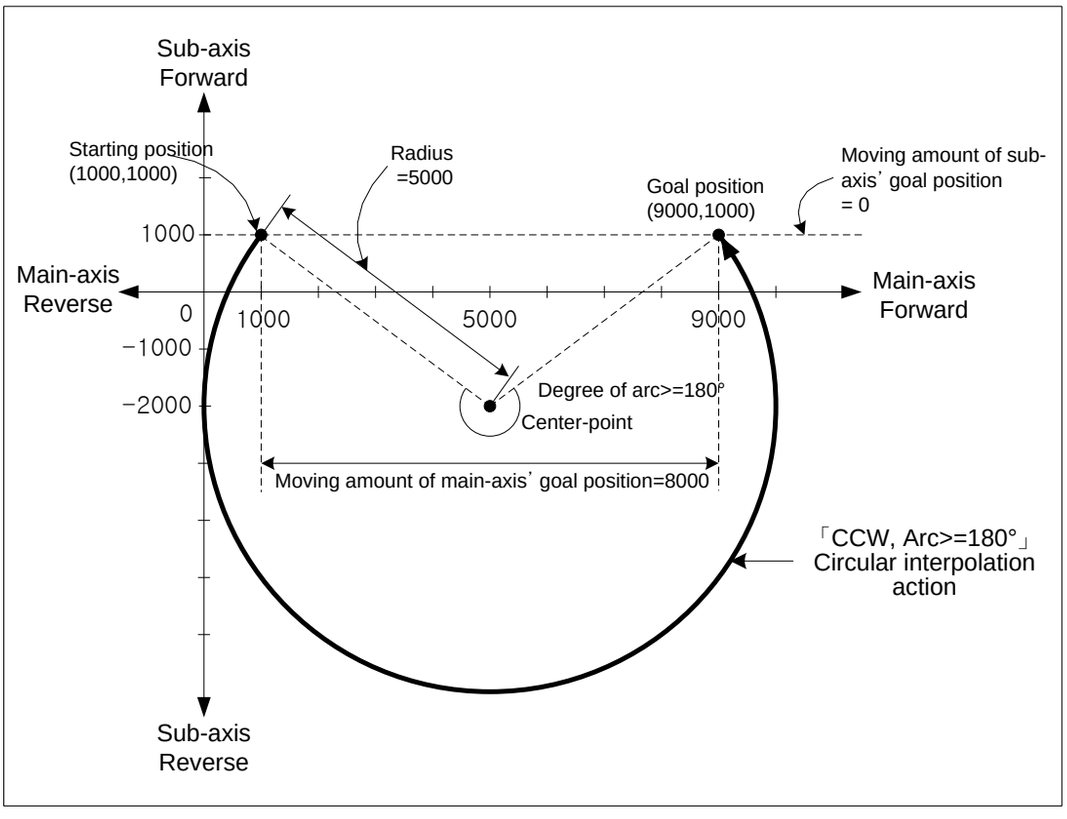
▪ Main axis (axis1) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting	Auxiliary point of circular arc interpolation	Circular interpolation mode	Number of circular interpolation turns	Helical interpolation
1	Incremental, Circular Interpolation	Single,End	8000	1000	No.1	No.1	0	100	Axis 2	5000	Radius, CCW, Arc>= 180°	0	Do Not Use

▪ Subordinate axis (axis2) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting	Auxiliary point of circular arc interpolation	Circular interpolation mode	Number of circular interpolation turns	Helical interpolation
1	Incremental, single-axis Position Control	Single,End	1000	0	No.1	No.1	0	0	No axis setting	0	Middle point	0	Do Not Use

■ Operation Patterns



9.2.12 Helical Interpolation Control

After executed by positioning operation start command (Indirect, Synchronous), 2 axes move along the circular arc, an axis execute linear interpolation synchronizing with circular interpolation.
It is available to execute helical interpolation of more than 360°depending on 'arc interpolation turns' setting.
The combination of axis that used for helical interpolation control is unlimited, 3 axes among axis1 ~ 8 are used.

(1) Control features

(a) After setting operating data to arc interpolation, when setting a helical interpolation axis on the item 'Helical interpolation, the helical interpolation will be executed.

(b) The direction of circular arc depends on the goal position and the mode of circular interpolation, the direction of helical axis depends on the coordinates setting and the goal position.

■ The case of「Absolute, arc interpolation」

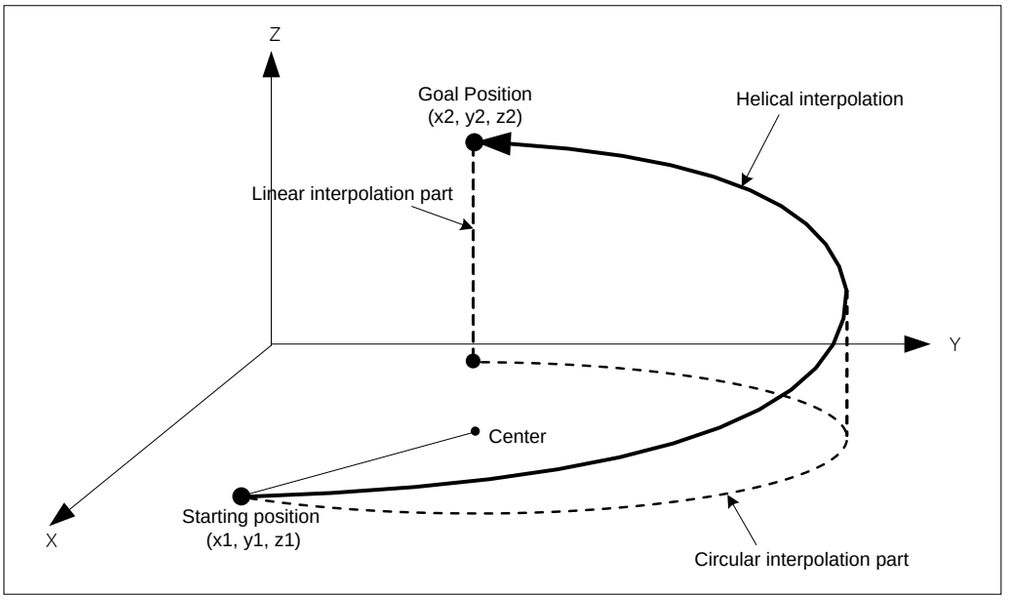
Starting position < Goal position: Positioning operation in forward direction

Starting position > Goal position: Positioning operation in reverse direction

■ The case of「Relative, arc interpolation」

When the sign of movement distance is positive (+ or no sign): Positioning operation in forward direction (starting position increase direction)

The sign is negative (-): Positioning operation in reverse



(2) Restrictions

(a) The restrictions of helical interpolation are same as various kinds of arc interpolation depending on the mode of arc interpolation.

(b) If user sets「helical interpolation」to 'Not use', it will be same as the action of arc interpolation.

(c) If user sets the goal position of helical interpolation axis to the same starting position, it will be same as the action of circular interpolation.

Notes

If executing helical interpolation, 3 axes will operate at the same time. Need user to pay attention.

1. Auxiliary operations available are as follows.
   - Speed override, Deceleration stop, Emergency stop, Skip operation
2. The commands may not be used in circular interpolating operation are as follows.
   - Position/Speed switching control, Position override, Continuous operation
3. The parameter item which is operated by set value of each axis is as follows.
   - Software high limit, software low limit among extended parameter items.

(3) Example of operation data setting

Setting item	Main axis (axis1) setting	Sub axis (axis 2) setting	Helical axis (axis 3) setting	Content
Control method	Absolute, circular arc interpolation	Absolute, Single axis position control	Absolute, Single axis position control	Circular interpolation must be set when executing helical interpolation
Program control method	Single,End	- *1	- *1	Set operation method for helical interpolation
Target position [pls]	10000	0	10000	Set the goal position on main, sub, helical axis for executing positioning.
Operation speed [pls/s]	1000	-	-	Helical interpolation designates composition speed of circular interpolation part
Acceleration number	No.1	-	-	Set the acceleration time No. for acceleration. (No.1 ~ 4)
Deceleration number	No.2	-	-	Set the deceleration time No. for deceleration. (No.1 ~ 4)
M code	0	-	-	Set it when user needs to synchronize another auxiliary operation with helical interpolation.
Dwell time	500	-	-	Set the dwell time (ms) until the output position signal.
Sub axis setting	Axis 2	-	-	Set the axis to be used as the subordinate axis among the axis set in the current network in main axis operation data.
Auxiliary point of circular arc interpolation	5000	5000	-	Set auxiliary data of circular interpolation action
Circular interpolation mode	Middle point	-	-	Set circular interpolation mode to be used in circular action of helical interpolation
Number of circular interpolation turns	0	-	-	Set the no. of turn of circular arc when user need to execute helical interpolation of bigger degree than 360°
Helical interpolation	Axis 3	-	-	Set an axis to be used as helical interpolation axis from set in current network in main axis operation data.

-* 1: Do not need setting. Whatever value is set as, it does not affect arc interpolation.

Notes

Helical interpolation control is executed on the item basis set on operation data of main axis.
When executing circular interpolation of helical interpolation, only 'Goal position', 'Auxiliary point of circular interpolation' items of sub axis setting and '; Goal position' item of helical axis setting affect helical interpolation. In other words, whatever value is set as, it does not affect the action and no errors occurred.
However,as the coordinate setting of subordinate axis control mode indicates whether target position of subordinate axis is absolute coordinate or relative coordinate,so when executing helical interpolation control using absolute coordinate mode, the coordinate of subordinate axis must be set to absolute.

[Example] Execute helical interpolation of absolute coordinates, center point specified method and axis1 as main axis, axis2 as subordinate axis, and axis3 are helical axis.

■ Start position (650, 400, 0), target position (400, 1200, 350), auxiliary point (800, 400)

The action is as follows in the condition above

■ Setting of XG-PM

▪ Main axis (axis1) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting	Auxiliary point of circular arc interpolation	Circular interpolation mode	Number of circular interpolation turns	Helical interpolation
1	Absolute, circular arc interpolation	Single,End	400	1000	No.1	No.1	0	100	Axis 2	800	Center point, CCW	0	Axis 3

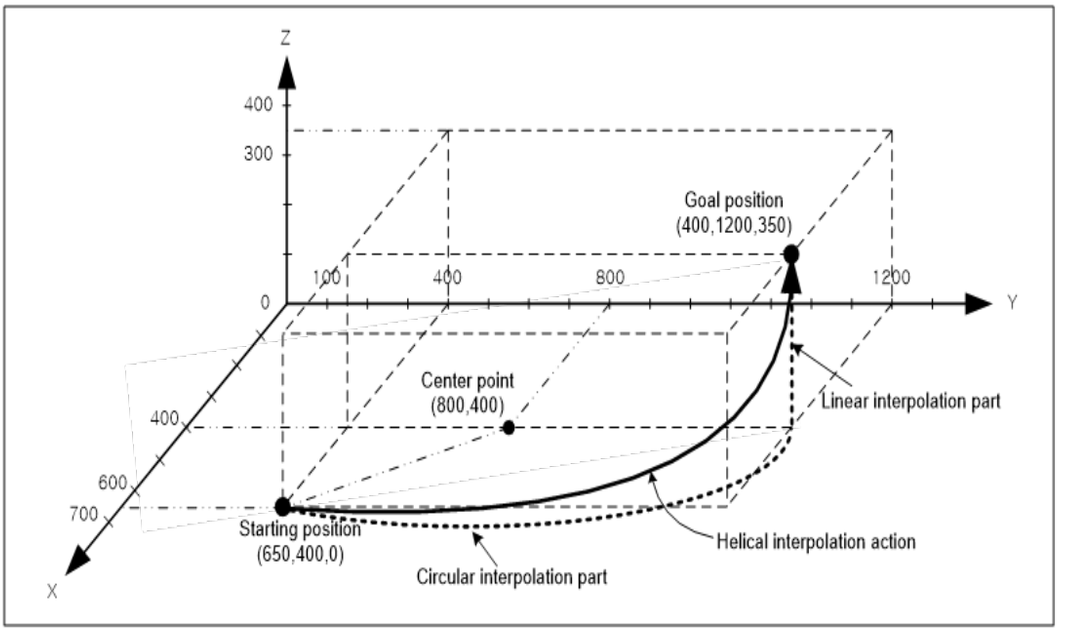
▪ Subordinate axis (axis2) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting	Auxiliary point of circular arc interpolation	Circular interpolation mode	Number of circular interpolation turns	Helical interpolation
1	Absolute, Single axis position control	Single,End	1200	0	No.1	No.1	0	0	No axis setting	400	Middle point	0	Do Not Use

▪ Operation data of helical axis (axis3)

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting	Auxiliary point of circular arc interpolation	Circular interpolation mode	Number of circular interpolation turns	Helical interpolation
1	Absolute, Single axis position control	Single,End	350	0	No.1	No.1	0	0	No axis setting	0	Middle point	0	Do Not Use

■ Operation Patterns



9.2.13 Ellipse Interpolation Control

Execute ellipse interpolation at ellipse rate and the moving angle of circular interpolation operating data and ellipse interpolation command. Combinations of axis to be used in ellipse interpolation control are unlimited and 2 axes from axis1~8 are used.

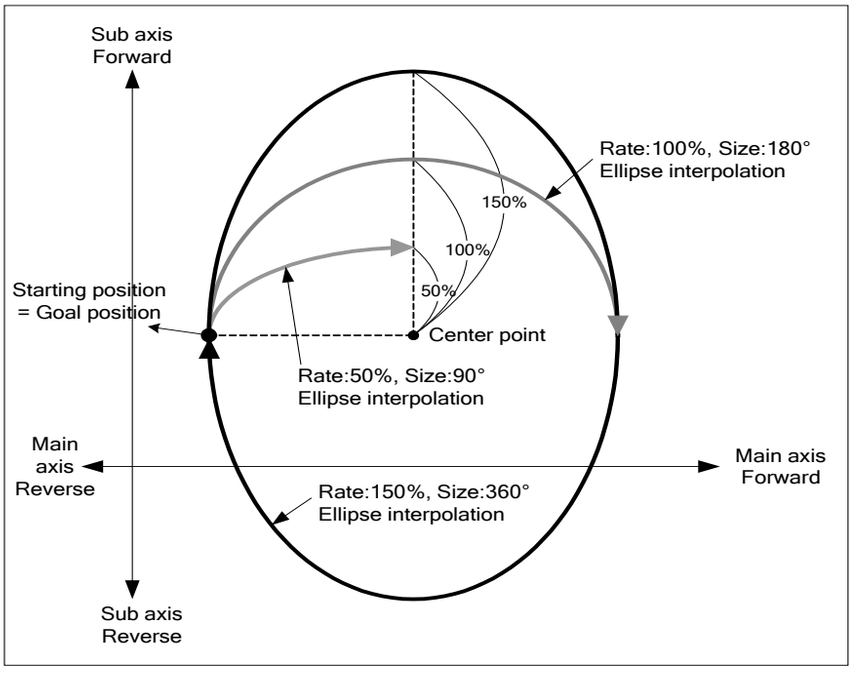
(1) Control features

(a) The ellipse interpolation is set as circular interpolation using the center point designation method in the operation data, and the ratio and size of the ellipse are set as auxiliary data for the "ellipse interpolation" command.

Auxiliary data	Setting Value	Content
Ratio of ellipse (%)	0 ~ 65535	Set the ratio of horizontal axis and vertical axis with the ratio to the circle (1= 0.01%)
Size(Degree) of ellipse	0 ~ 65535	Set the degree of ellipse's movement (1 = 0.1°)

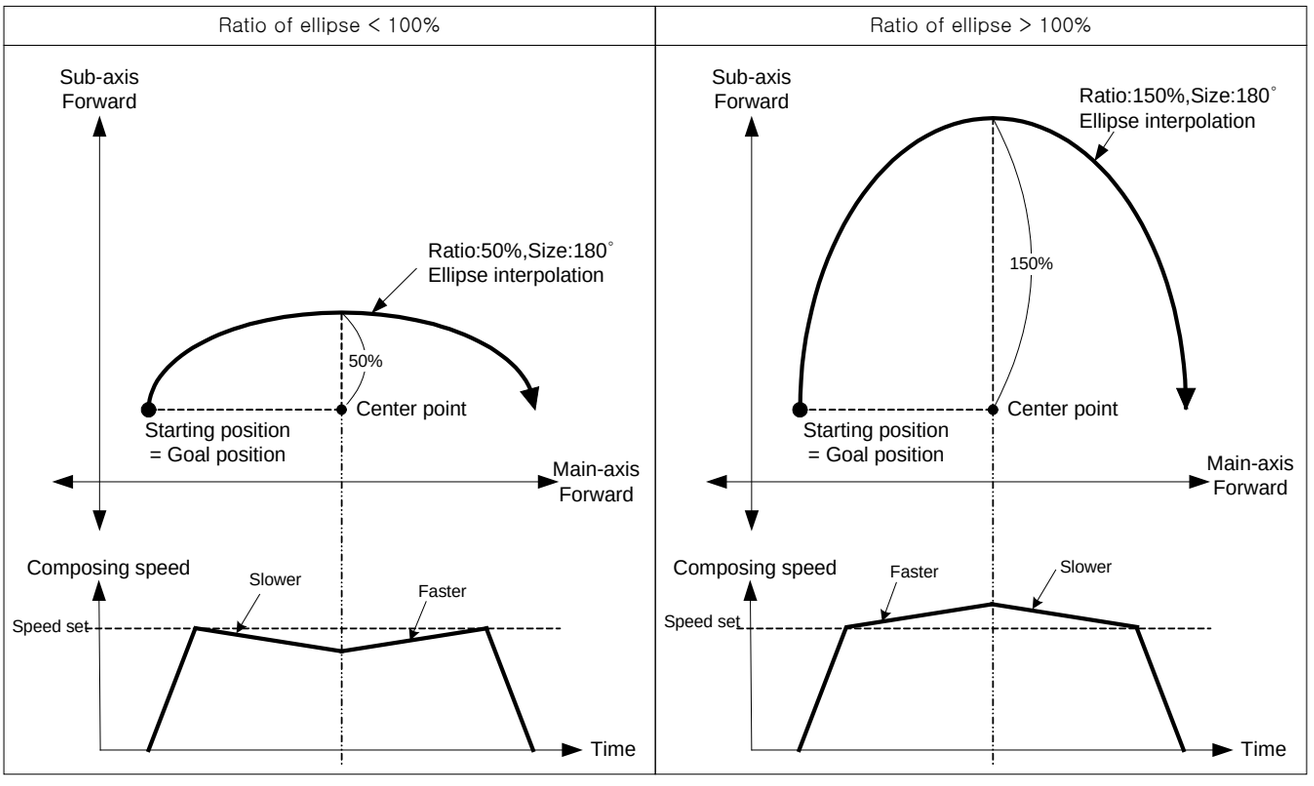
(b) Moving direction of ellipse is decided by the direction set on 'arc interpolation mode' of operation data.

- 「Center-point, CW」 - ellipse interpolation go clockwise from current position.
- 「Center-point, CCW」- ellipse interpolation go counterclockwise from current position.



(c) Starting position and goal position must be same when executing ellipse interpolation.

(d) When executing ellipse interpolation, the radius changes continuously and composing speed also changes depending on the ratio of ellipse. When the ratio of ellipse is bigger than 100%, operating speed of sub axis and composing speed get faster. So it calls user's attention. Sub axis of ellipse interpolation is not limited by 'speed limit', so user must set operating speed below limit.



(2) Restrictions

(a) Ellipse interpolation may not be executed in the case below.

- 「Subordinate axis」 error (error code: 547)
  - 「Subordinate axis setting」 value of main axis operation data is 'No axis setting'
  - 「Sub-axis setting」 value of main axis operating data is same as the main axis no.
  - When the "subordinate axis setting" value of the main axis operation data is the axis number not currently connected to the network.
  - An axis of helical interpolation is set.
- In case of 'degree' is set as control unit of main axis or sub axis, (Error code: 551(Main axis), 552(Sub axis))
- In case of center point which is designated as auxiliary point is same with start position and target position. (Error code: 553)
- When the calculated radius of circular arc exceed 2147483647pls. (Error code: 554)
- The operating method is keep or continuous. (Error code: 556)
  If user executes ellipse interpolation, End operation must be set before use.
- When the starting position and target position are different (Error code: 558)
- Size of ellipse (Moving degree) is 0. (Error code: 559)

Notes

Need user to heed the synchronous operation of 2 axes in ellipse interpolation start.

1. Auxiliary operations available are as follows.
   - Speed override, Deceleration stop, Emergency stop, Skip operation
2. The commands unavailable in ellipse interpolating operation are as follows.
   - Position/Speed switching control, Position override, Continuous operation
3. The parameter item which is operated by set value of each axis is as follows.
   - Software high limit, software low limit among extended parameter items.

(3) Example of operation data setting

Setting item	Main axis (axis1) setting	Sub axis (axis 2) setting	Content
Control method	Absolute, circular arc interpolation	Absolute, Single axis position control	Set circular interpolation when executing ellipse interpolation
Program control method	Single,End	-	End must be set in ellipse interpolation
Target position [pls]	10000	0	Set the goal position on main, sub, helical axis for executing positioning.
Operation speed [pls/s]	1000	-	Designate composing speed for circular interpolation part in ellipse interpolation
Acceleration number	No.1	-	Set the acceleration time No. for acceleration. (No.1 ~ 4)
Deceleration number	No.2	-	Set the deceleration time No. for deceleration. (No.1 ~ 4)
M code	0	-	Set it when executing another auxiliary operation synchronizing with ellipse interpolation
Dwell time	500	-	Set the dwell time (ms) until the output position signal.
Sub axis setting	Axis 2	-	Set the axis to be used as the subordinate axis among the axis set in the current network in main axis operation data.
Auxiliary point of circular arc interpolation	5000	5000	Set the center point of ellipse
Circular interpolation mode	Center point, CW	-	Must be set center point when using ellipse interpolation
Number of circular interpolation turns	-	-	The no. of turn is not operated in ellipse interpolation
Helical interpolation	Do Not Use	-	Set axis of helical interpolation as 'Not Use' in ellipse interpolation

- *1: Do not need setting. Whatever value is set as, it does not affect arc interpolation.

Notes

Ellipse interpolation control is executed by the standard set on operating data of main-axis.

When executing ellipse interpolation, only「Goal position」and「Auxiliary point of circular interpolation」affect the operation of ellipse interpolation. In other words, whatever value is set as, it does not affect the action and no errors occurred.

However,as the coordinate setting of subordinate axis control mode indicates whether target position of subordinate axis is absolute coordinate or relative coordinate,so when executing ellipse interpolation control using absolute coordinate mode, the coordinate of subordinate axis must be set to absolute.

[Example] Execute ellipse interpolation with 20% of ellipse ratio, 360°of movement degree and relative coordinates.

■ Starting Position: (100, 100),

Target position setting: (0, 0)

Auxiliary point (amount of movement) setting: (500, 200)

Rotation direction: CW

■ Setting of XG-PM

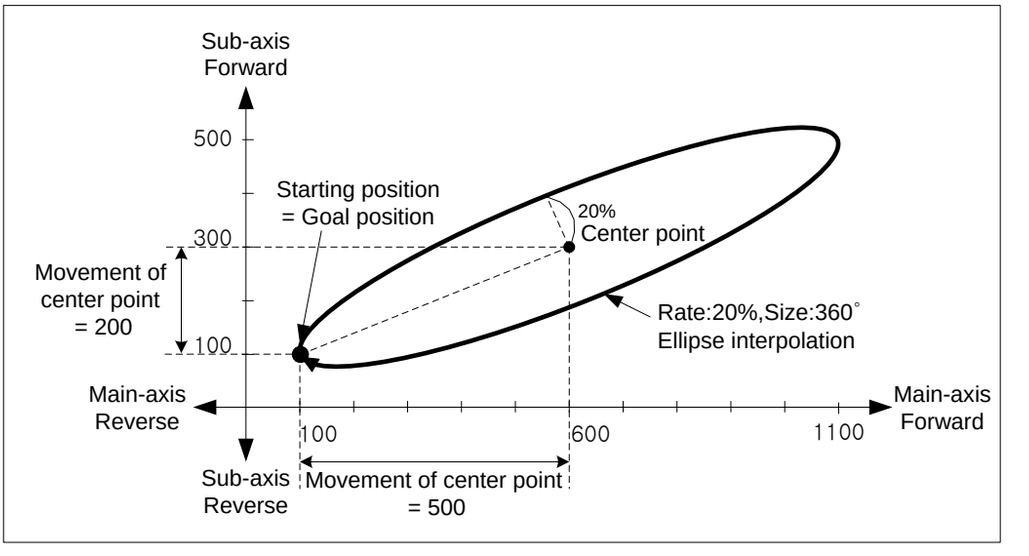
▪ Main axis (axis1) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting	Auxiliary point of circular arc interpolation	Circular interpolation mode	Number of circular interpolation turns	Helical interpolation
1	Incremental, Circular Interpolation	Single,End	0	1000	No.1	No.1	0	100	Axis 2	500	Center point, CW	0	Do Not Use

▪ Subordinate axis (axis2) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time	Sub axis setting	Auxiliary point of circular arc interpolation	Circular interpolation mode	Number of circular interpolation turns	Helical interpolation
1	Incremental, single-axis Position Control	Single,End	0	0	No.1	No.1	0	0	No axis setting	200	Middle point	0	Do Not Use

■ Operation Patterns



Notes

1. If the degree of ellipse is not 360°, the goal position and actual position after stop operating are not same.
2. If the ratio of ellipse is 0%, the trace of ellipse interpolation is shown as straight line. Ratio of ellipse need to be set to above 0.

9.2.14 Speed/Position Switching Control

The setting axis by positioning start carries out the speed control and is switched from speed control to position control when speed/position switching signal is entered to the positioning module inside or outside, and then carries out the positioning as much as s position value at target position.

(1) Control features

(a) The control method of operation data or direct start is set to “single speed control”, and positioning control is performed with the “speed/position switching” command during speed control operation.

(b) The direction of movement is determined by the sign of the targetposition value.

■ Forward operation: When the position value is positive (+)

■ Reverse operation: When the position value is negative (-)

(c) Set the external command selection item of extended parameter and external command item to use external command as 「speed/position switching」 signal.

Item	Setting Value	Content
External command selection	0: speed/position control switch	When inputing an external command, it is used as “an external speed/position control switching” signal.
	1: External stop command	When inputing an external command, it is used as “an external stop command” signal.
External command	0: Disable	An external command signal is ignored and have no effect on operation.
	1: Enable	When inputting external command signal, operates as the signal set in external command selection item.

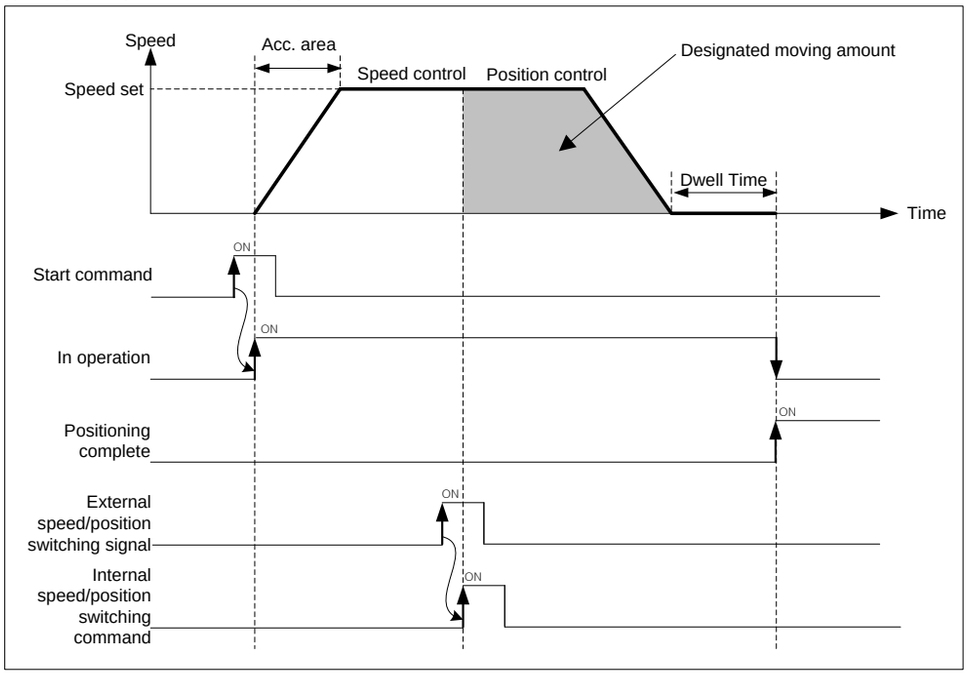
(d) In the case of speed/position switching, set the speed/position switching coordinates as to whether the position value should be the relative position value or absolute position value at the time the speed/position switching command is executed.

Item	Setting Value	Content
Speed/Position switching coordinate	0: Relative	Executes positioning as far as the set value from position where speed/position switching command is executed.
	1: Absolute	Considers the set value as absolute position and executes positioning into the set absolute position.

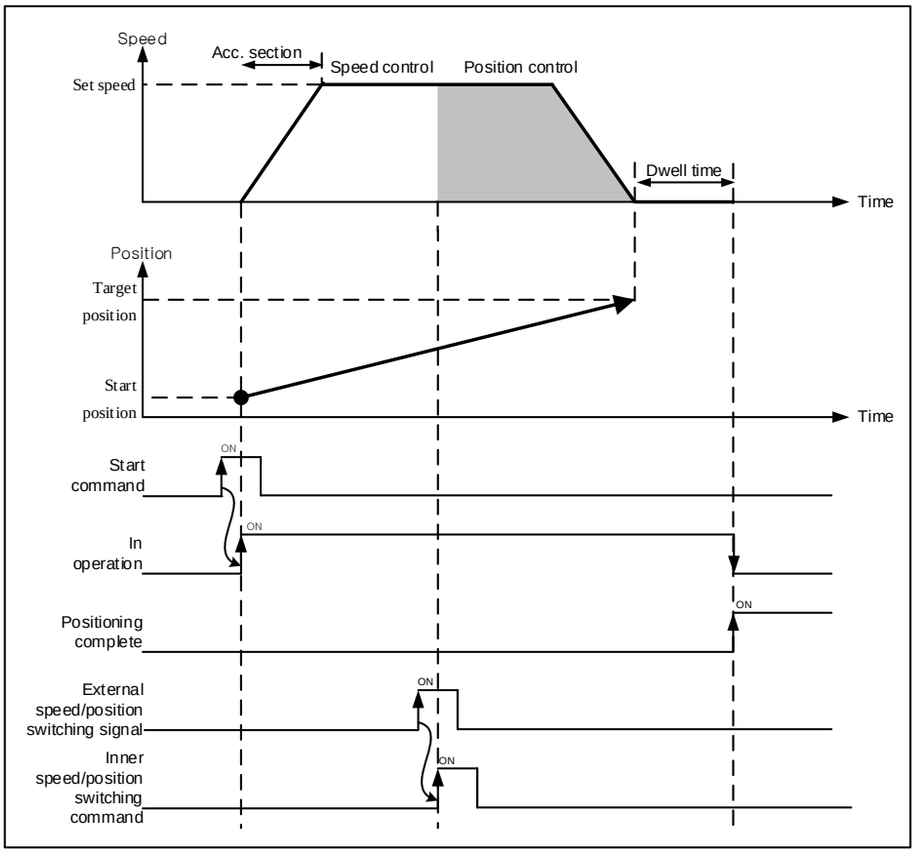
(e) In speed/position switching control, setting of coordinate values during speed control execution does not affect operation. In other words, actions of “Absolute, Single axis speed control” and “Relative, Single axis speed control” are same.

(2) Operating Timing

1) Speed/position switching coordinate= 0: Incremental



2) Speed/position switching coordinate= 1: Absolute



(3) Restrictions

(a) Set the operation pattern of speed control as“End” or“Keep”. If “Continuous” is set as, error (error code: 236) arises and speed control may not be executed.

(b) When Speed/position switching coordinates = "0: Relative" and the operation data or the target position setting value of direct start is 0, If a speed/position switching command does not operate and an error occurs(error code:304). In this case, it continues to operate with speed control.

(4) Example of operation data setting

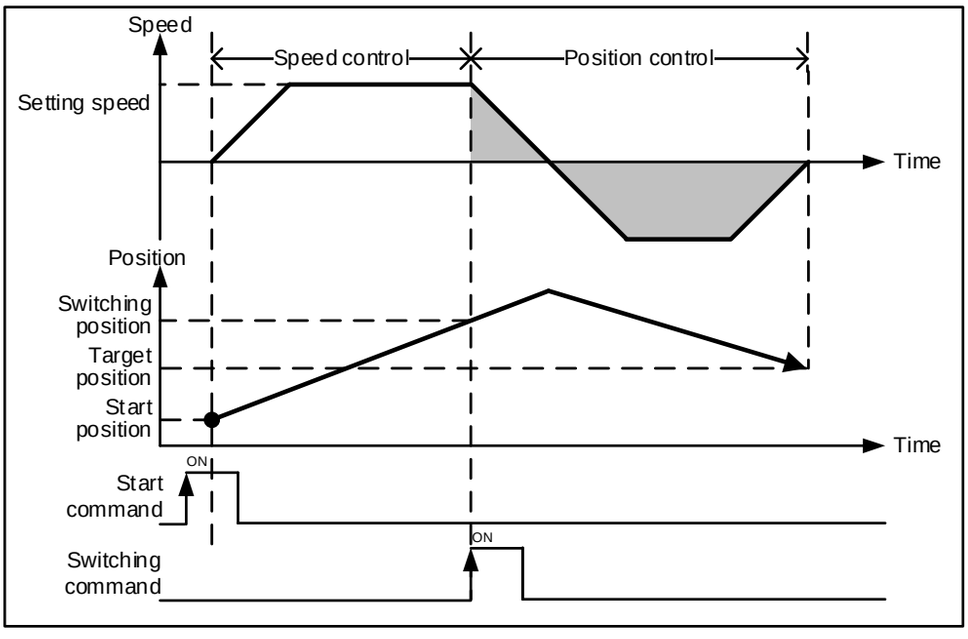
Setting item	Setting Value	Content
Control method	Absolute, Single axis speed control	When executing speed/position switching control, set single axis speed control
Program control method	Single,End	When executing speed/position switching control, set end or 'continuous'.
Target position [pls]	10000	After inputting speed/position switching control, set moving amount to position.
Operation speed [pls/s]	1000	Set the operating speed of speed/position switching control
Acceleration number	No.1	Set the acceleration time No. for acceleration. (No.1 ~ 4)
Deceleration number	No.2	Set the deceleration time No. for deceleration. (No.1 ~ 4)
M code	0	Set it when user needs to execute another auxiliary work synchronizing with speed/position switching control
Dwell time	500	Set dwell time (ms) between switching commands inputting and positioning completions outputting.

Notes

When the speed/position switching command is “1”, if the target position is smaller than the current position when executing the speed/position switching command, the operation varies depending on enable/disable of the infinite running repeat function.

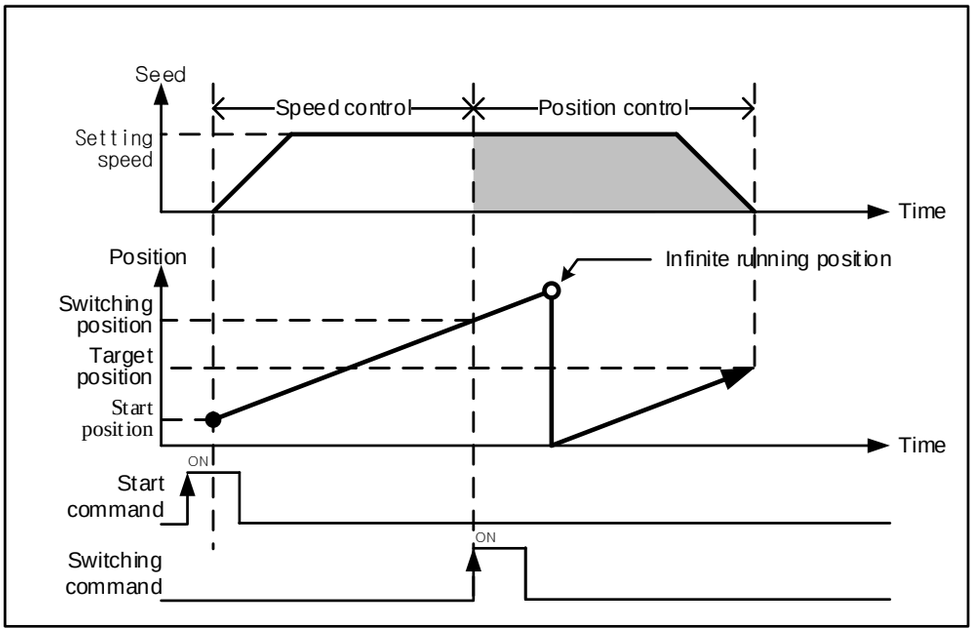
1. Infinite running repeat =0 : disable

   - After deceleration stop, it operates in the opposite direction and executes positioning operation to the target position.



2. Infinite running repeat =0 : enable

   - It operates in the same direction and executes positioning operation to the target position within the next repeated infinite running.



9.2.15 Position Specified Speed/Position Switching Control

The setting axis by positioning start carries out the speed control and is switched from speed control to position control when speed/position switching signal is entered to the positioning module, and then carries out the positioning by transfer amount.

(1) Control features

(a) The control method of operation data or direct start is set to “single speed control”, and positioning control is executed with the “position specified speed/position switching” command during speed control operation.

(b) In the case of speed/position switching, set the speed/position switching coordinates as to whether the position value should be the relative position value or absolute position value at the time the speed/position switching command is executed.

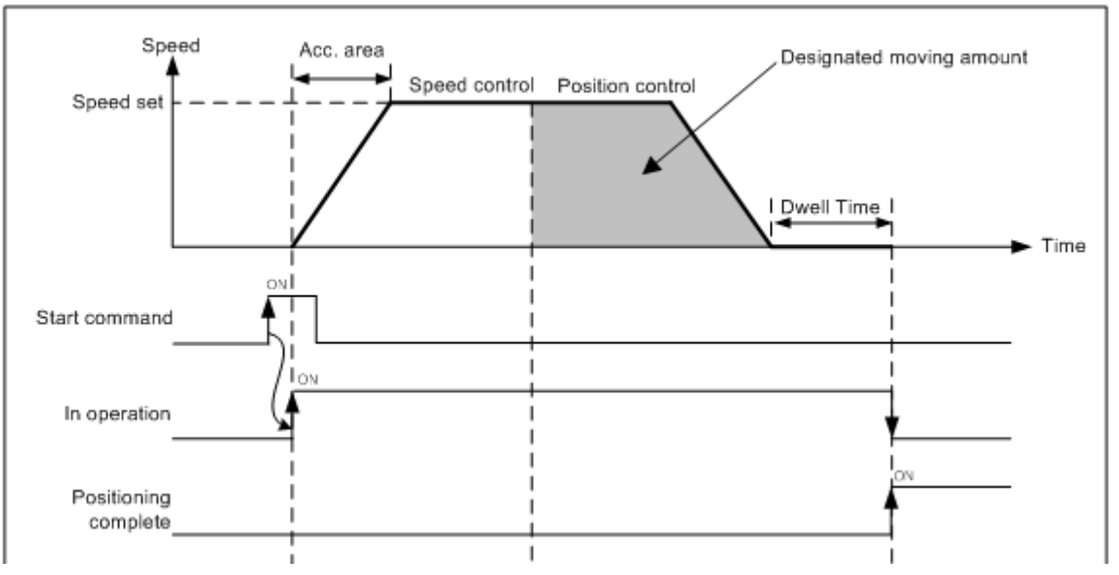
Item	Setting Value	Content
Speed/Position switching coordinate	0: Relative	Executes positioning as far as by the value set value from position where speed/position switching command is executed.
	1: Absolute	Considers the set value as absolute position and executes positioning into the set absolute position.

(c) In the position specified speed/position switching control, the setting of the operation data or coordinate values of direct start while executing speed control does not affect the operation. In other words, actions of “Absolute, Single axis speed control” and “Relative, Single axis speed control” are same.

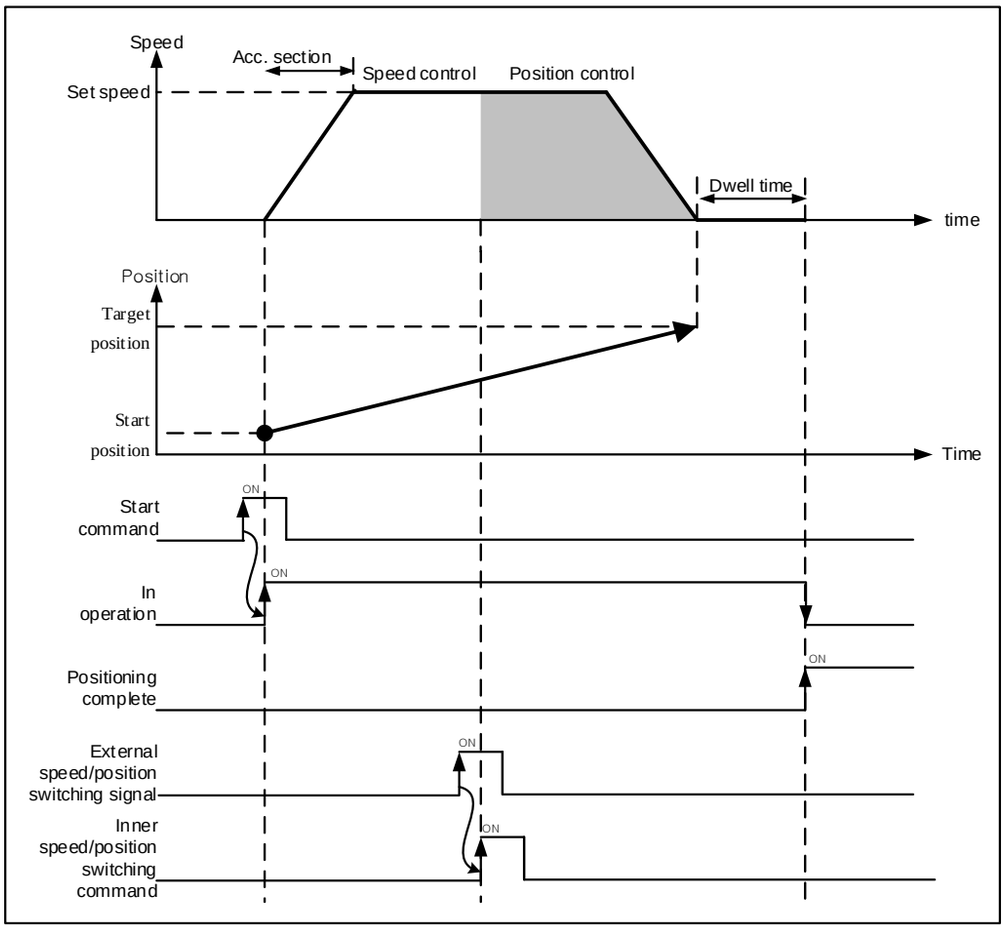
(d) Position specified speed/position switching control ignores the operation data or the value set in the target position of direct start, and executes positioning with the value set in the target position operand of the "position specified speed/position switching" command.

(2) Operating Timing

1) Speed/position switching coordinate= 0: Relative



2) Speed/position switching coordinate= 1: Absolute



(3) Restrictions

(a) Set the operation pattern of speed control as“End” or“Keep”. If it is set to continuous, error (error code: 236) occurs and speed control may not be executed.

(b) Speed/position switching coordinate= 0: If the target position operand setting value of the "position specified speed/position switching" command is 0 in relative, the positioning speed/position switching command does not work. In this case, error occurs and it continues to operate with speed control.

(c) Infinite running repeat =1 : enable,speed/position switching coordinate= 1 : If you set the position opposite to the operating direction from absolute to the position operand of the position specified speed/position switching command, an error (error code:306) occurs and operation continues with speed control. (When setting the (-) position value for forward speed control operation or Setting the (+) position value for reverse speed control operation).

(4) Example of operation data setting

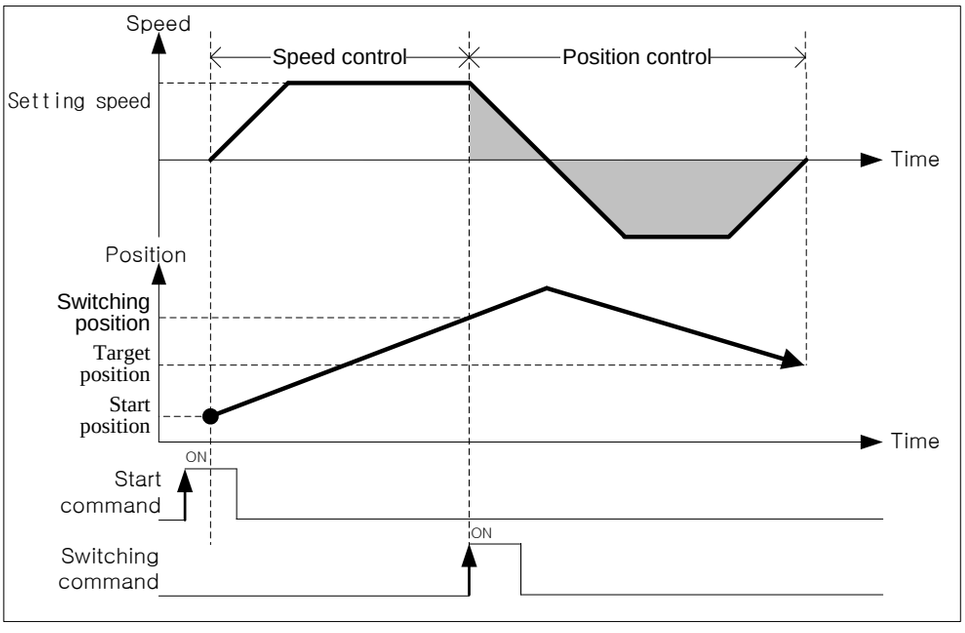
Setting item	Setting Value	Content
Control method	Absolute, Single axis speed control	When executing speed/position switching control, set single axis speed control
Program control method	Single,End	When executing position specified speed/position switching control, set end or 'continuous'.
Target position [pls]	10000	After inputting speed/position switching control, set moving amount to position. Position specified speed/position switching control ignores the set target position, executes positioning with position values set in target position operand of position specified speed/position switching command.
Operation speed [pls/s]	1000	Set the operating speed of position specified speed/position switching control.
Acceleration number	No.1	Set the acceleration time No. for acceleration. (No.1 ~ 4)
Deceleration number	No.2	Set the deceleration time No. for deceleration. (No.1 ~ 4)
M code	0	Set it when user needs to execute another auxiliary work synchronizing with speed/position switching control
Dwell time	500	Set dwell time (ms) between inputting the position specified speed/position switching command and outputting positioning completion signal.

Notes

When the speed/position switching command is "「1", if the target position is smaller than the current position when executing the speed/position switching command, the operation varies depending on enable/disable of the infinite running repeat function.

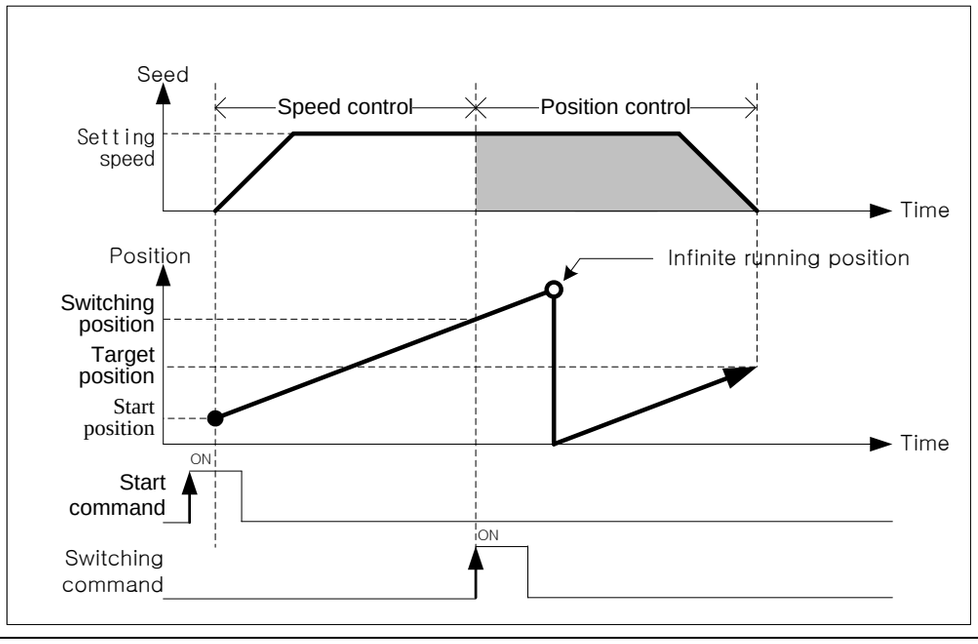
1. Infinite running repeat =0 : disable

   - After deceleration stop, it operates in the opposite direction and executes positioning operation to the target position.



2. Infinite running repeat =0 : enable

   - It operates in the same direction and executes positioning operation to the target position within the next repeated infinite running.



9.2.16 Position/Speed Switching Control

If the axis set in positioning start controls the positioning, and position /speed switching command input internally to the positioning modules, it switches position control to speed control. With torque control, it can be stopped by "deceleration stop" or "skip operation" during operation, or the next operation can be continued.

(1) Control features

(a) Set control method of operating data as 'Single axis position control' and user may change position control to speed control with 'Speed/Position Switching'.

(b) The direction of movement is determined by the values set in the coordinates and the target position.

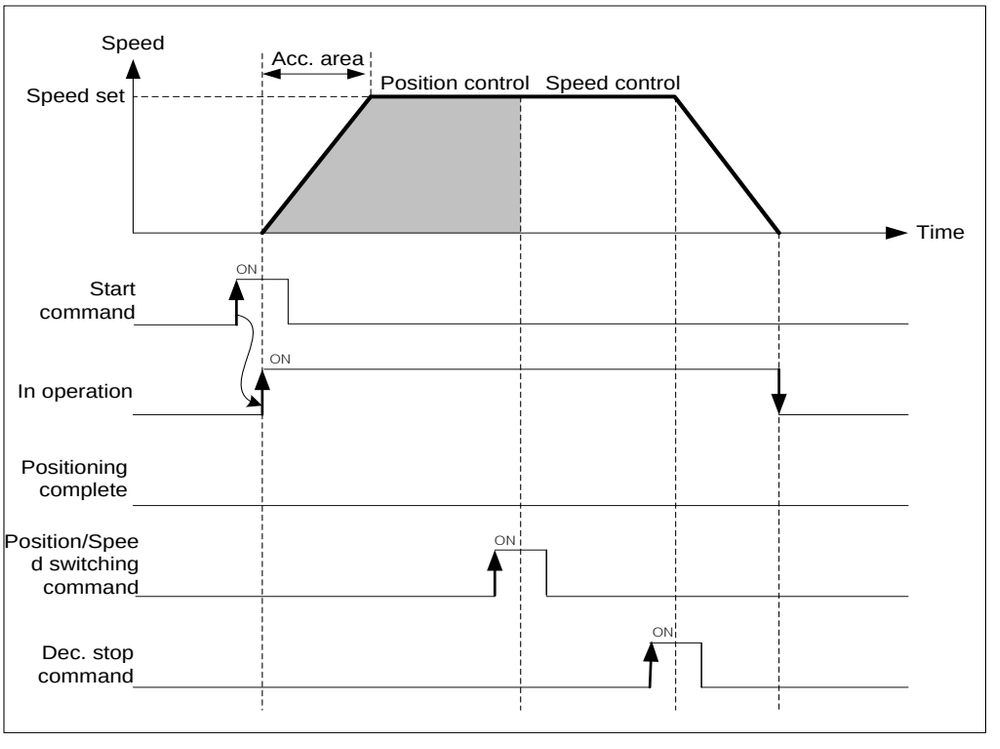
■ In the case of 「Absolute, Single axis position control」

- Starting position < target position: Forward positioning control operation
- Starting position > target position: Reverse positioning control operation

■ 「Relative, Single axis position control」

- Transfer direction (+) or no sign: forward direction positioning (starting position increases)
- Transfer direction (-): reverse direction positioning (starting position decreases)

(2) Operating Timing



(3) Restrictions

(a) Position/speed switching command is not inputted before positioning to the goal position, it stops by deceleration and finishes the positioning.

(b) After position/speed switching, software high/low limit check during speed control depends on 'Soft high/low limit in speed control' of extended parameter.

Item	Setting Value	Content
Software limit during speed control	0: not detection	During Speed Control, do not operate to check the range of upper/lower limit of software
	1: Detect	During Speed Control, operate to check the range of upper/lower limit of software

(4) Example of operation data setting

Setting item	Setting Value	Content
Control method	Absolute, Single axis position control	When executing position/speed switching control, set single axis speed control
Program control method	Single,End	Set operating method for position control
Target position [pls]	10000	Set the value of goal position for position control
Operation speed [pls/s]	1000	Set the operating speed of position/speed switching control
Acceleration number	No.1	Set the acceleration time No. for acceleration. (No.1 ~ 4)
Deceleration number	No.2	Set the deceleration time No. for deceleration. (No.1 ~ 4)
M code	0	Set it when user needs to execute another auxiliary work synchronizing with speed/position switching control
Dwell time	500	When it is executed with position control and without position/speed switching command, set dwell time between positioning and complete signal's outputting.

9.2.17 Position/Torque Switching Control

If the axis set in positioning start controls the positioning, and position /torque switching command input internally to the positioning modules, it switches position control to torque control. With torque control, it can be stopped by "deceleration stop" or "skip operation" during operation, or the next operation can be continued.

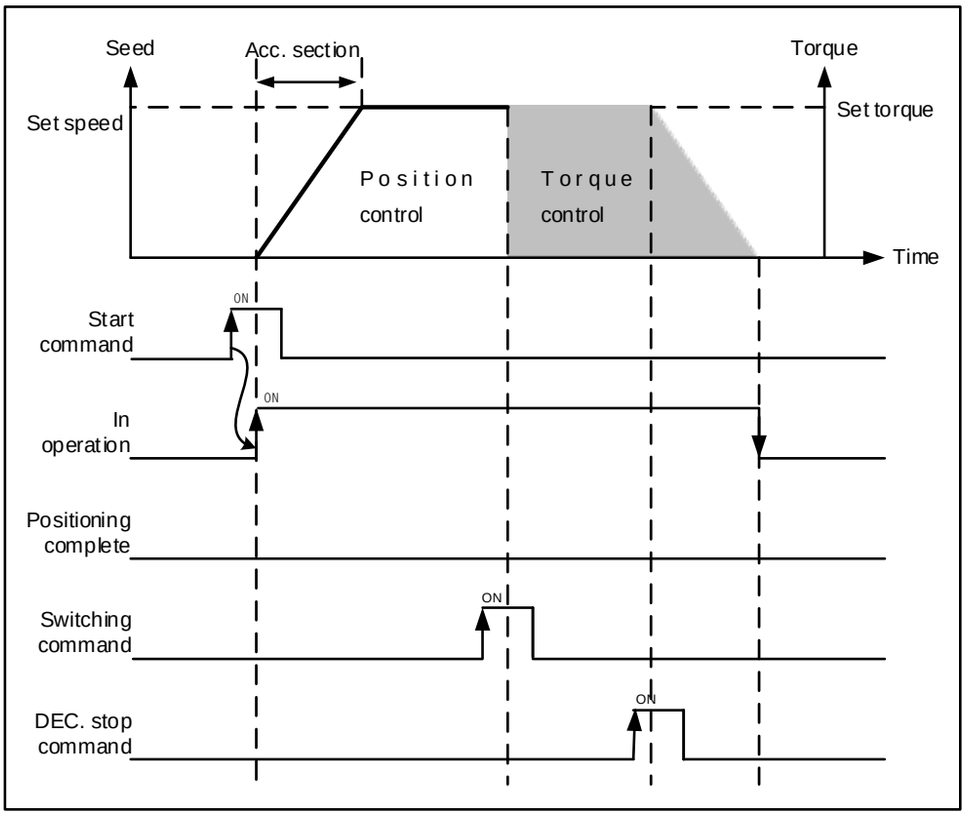
(1) Control features

(a) Set control method of operating data as 'Single axis position control' and user may change torque control using position/torque switching during position control operation.

(b) The direction is determined by the setting of torque values, which is the auxiliary data of the position/torque switching command.

- Torque value is positive (+): positioning operation in the forward direction (current position increasing direction)
- Torque value is negative (-): positioning operation in the reverse direction (current position decreasing direction)

(2) Operating Timing



(3) Restrictions

(a) When position/ torque switching command is not inputted until executing positioning to the setting target position, it executes deceleration stop and finishes the positioning.

(4) Example of operation data setting

Setting item	Setting Value	Content
Control method	Absolute, Single axis position control	When executing position/speed switching control, set single axis speed control
Program control method	Single,End	Set operating method for position control
Target position [pls]	10000	Set the value of goal position for position control
Operation speed [pls/s]	1000	Set the operating speed of position/speed switching control
Acceleration number	No.1	Set the acceleration time No. for acceleration. (No.1 ~ 4)
Deceleration number	No.2	Set the deceleration time No. for deceleration. (No.1 ~ 4)
M code	0	Set it when user needs to execute another auxiliary work synchronizing with speed/position switching control
Dwell time	500	When it is executed with position control and without position/speed switching command, set dwell time between positioning and complete signal's outputting.

9.2.18 Start of Positioning

In case of stop in action of dynamic positioning, can positioning by restart. Three Starting types are general start, Simultaneous start, point operation.

Operating signal is have to OFF, when it start.

(1) Direct start

(a) Do not use operating data, directly input positioning data by auxiliary data and perform positioning control.

(b) Setting auxiliary data of direct start.

Setting item	Content
Target position	Set target position of control.
Operating speed	Set operating speed of control.
Dwell time	Set dwell time (ms) that it is from positioning to outputting signal of positioning. (0~65535)
M code	Set for performing auxiliary action which is depending on set control. (0~65535)
Acc. No.	Set the acceleration time No. for acceleration. (No.1 ~ 4)
Deceleration No.	Set the deceleration time No. for deceleration. (No.1 ~ 4)
Coordinate	Set coordinate about target position of set control. (Absolute, relative)
Control method	Set the type of control to execute start. (0: position control, 1: speed control, 2: FEED control, 3: Shortest distance control, 5: Not specified, 6: Forward direction, 7:Reverse direction, 8: Current direction)

Notes

Direct start only can use when it is single operation. In case that Interpolation operation, use indirect starts.

(2) Indirect start

(a) Start control of positioning by designating step number of operation data which was saved in positioning module.

(b) Setting auxiliary data of indirect start

Setting item	Content
Operation step	Set the step number of the operation data to be executed. (0 or 1~ 400)

Notes

When 0 is set in the operation step of indirect start and then the indirect start command is executed, it is executed with the operation data stored in the current step number.

(3) Simultaneous start

(a) According to axis information and setting step, Simultaneous start positioning operation data of axis 2 ~ axis 8.

(b) When Input stop command, only it decelerates and stops on the corresponding axis. In case of Simultaneous start setting step number is current operating step number. Input start command, and then according to relative coordinate and absolute coordinate, operate positioning.

(c) Restrictions

In these cases can not operate all of the axes which were set simultaneous start by error.

▪ When an error occurs in the operation data even in one of the simultaneous start setting axes.
- Output error code to the axis.
- Error code: 297 is output to the Axis where the simultaneous start command is executed.
- All axis set to simultaneous start do not start.

▪ When axis setting of simultaneous start command was wrong.(Error code :296)
- When only the command axis is set (must be set more than 2 axes.)
- Among the setting axes, there is one that is not currently connected to the network.
- When there is linear Interpolation or circular interpolation among operation data of setting axes, when subordinate axis of operation data includes the same axis as the simultaneous start axis.

[Example] Set Simultaneous start of axis 1, axis 2, axis 3 is as follows.

■ Axis1 current position: 0, operation step: 1
Axis2 current position: 0, operation step: 3
Axis3 current position: 0, operation step: 10

■ Setting of XG-PM

▪ Axis 1 operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Absolute, Single axis position control	Single, Continuous	1000	1000	No.1	No.1	0	0
2	Absolute, Single axis position control	Single,End	1800	800	No.1	No.1	0	100

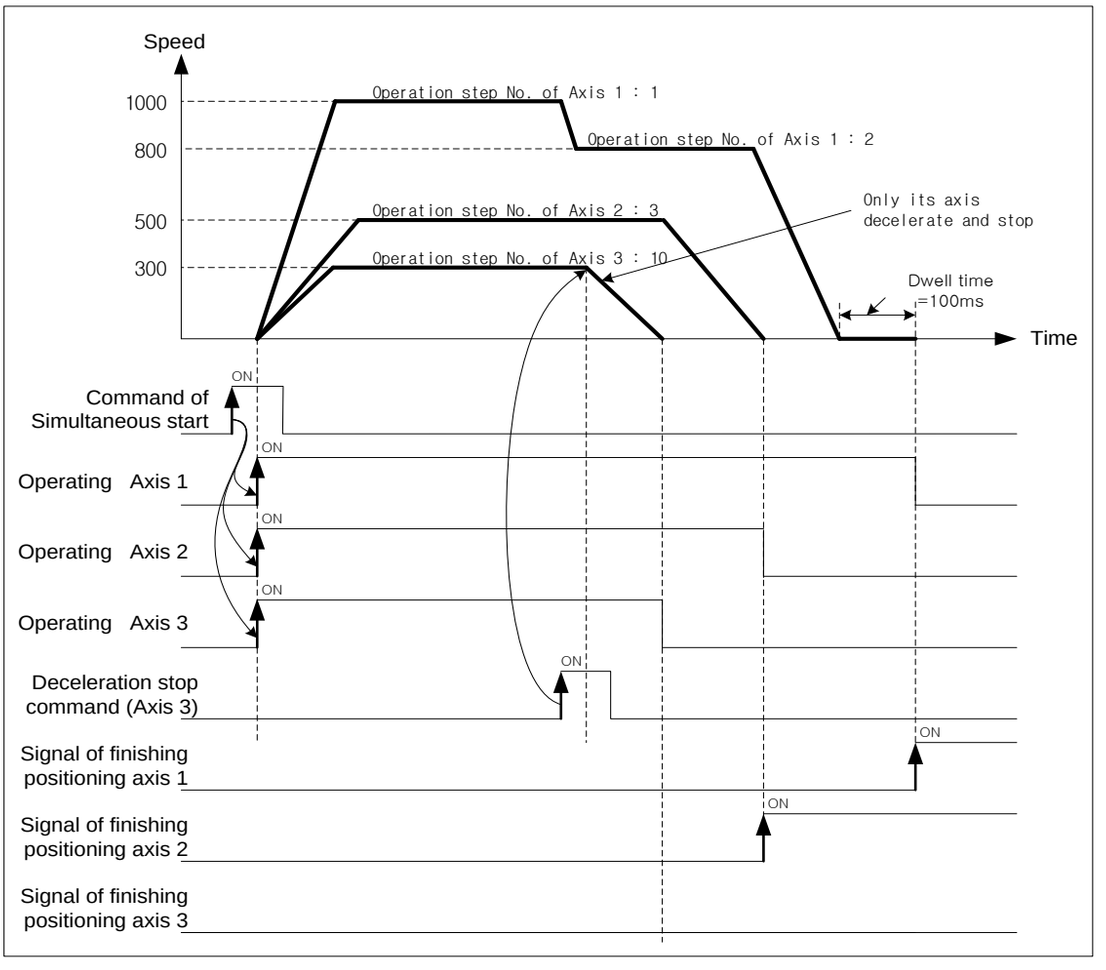
▪ Axis 2 operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
3	Absolute, Single axis position control	Single,End	900	500	No.2	No.2	0	0

▪ Axis 3 operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
10	Absolute, Single axis speed control	Single,End	1000	300	No.3	No.3	0	100

■ Operation Patterns



(4) Point Operation

(a) Point maneuvering is a positioning drive also called ptp drive. Which processes the sequential data of user defined steps in order.

(b) It can be appointed 20 steps by point operation.

(c) Regardless of the end, keep, or continuous operation mode, points are operated as many as the set number of points from step setting (point 1). At this time step setting should be set to the step number that operates first in the case of keep or continuous operation mode.

[Example] Point operation of axis 1 is as follows.

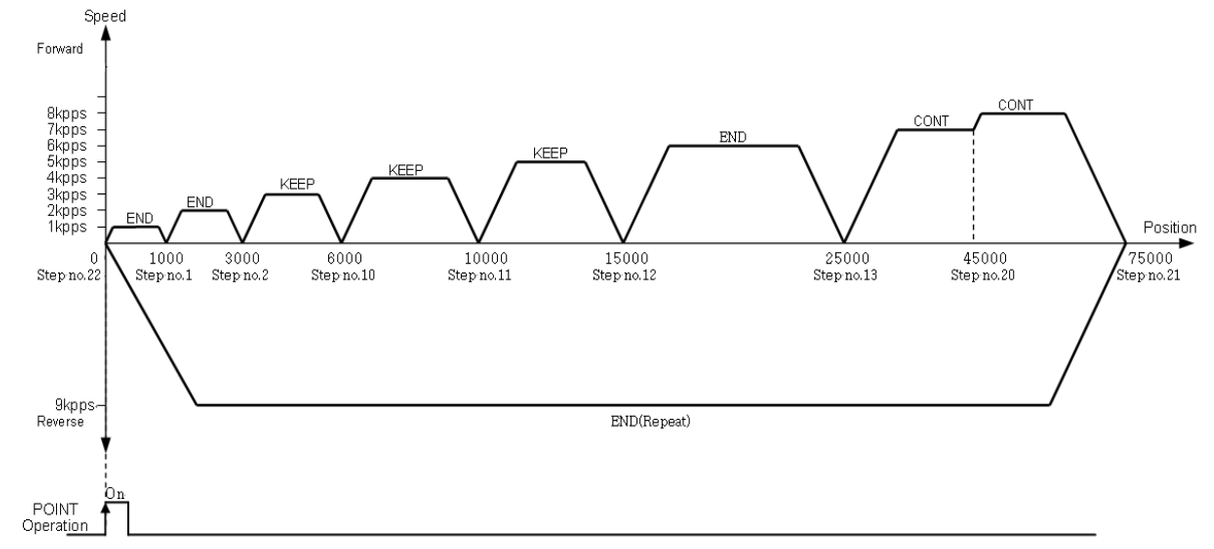
■ The number of point operation: 4

Point operation step No. : 1, 2, 10, 20

Axis1 current position: 0

■ Setting of XG-PM

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Absolute, Single axis position control	Single,End	1000	1000	No.1	No.1	0	20
2	Absolute, Single axis position control	Single,End	3000	2000	No.1	No.1	0	20
10	Absolute, Single axis position control	Single,Keep	6000	3000	No.1	No.1	0	20
11	Absolute, Single axis position control	Single,Keep	10000	4000	No.1	No.1	0	20
12	Absolute, Single axis position control	Single,Keep	15000	5000	No.1	No.1	0	20
13	Absolute, Single axis position control	Single,End	25000	6000	No.1	No.1	0	20
20	Absolute, Single axis position control	Single, Continuous	45000	7000	No.1	No.1	0	0
21	Absolute, Single axis position control	Single, Continuous	75000	8000	No.1	No.1	0	0
22	Absolute, Single axis position control	Repeat,End	0	9000	No.1	No.1	0	0



9.2.19 Positioning Stop

Here describes factor which are stop axis during operation.

(1) Stop command and stop factor

The command to stop the axis and stop factor while current positioning operates is as follows and this do not simultaneously stop for all axes but operating for each axis.

(a) In the case of a stop command or stop factor for each axis, only the axis for which the stop command is On or the stop factor is turned on is stopped. But, interpolation control (linear interpolation, Circular interpolation, helical interpolation, elliptic interpolation) In case of there is stop command or stop factor on main axis, operation axes of interpolation control will stop.

Stop factor \ Operation status		Positioning *1	Homing*2	Jog Operation	Speed synchronization cam control	Status of Axis after stop	M code on signal status
Parameter setting *3	Soft upper limit range over	Sudden stop	No Detection	Sudden stop		Error (Error501)	No change
	Exceed soft low-limit	Sudden stop	No Detection	Sudden stop		Error status(Error502)	No change
Sequence program *4	Deceleration stop command	Deceleration stop	Deceleration stop	Error 322 (Operation continuous)	Deceleration stop*5	Stop status on	No change
	Emergency stop command	Sudden stop				Error status (Error481)	Off
External signal	External high limit on	Sudden stop		When operate to forward, sudden stop	Emergent stop *6	Error status(Error492)	No change
	External low limit on	Sudden stop		When operate to reverse, sudden stop	Sudden stop	Error status (Error493)	No change
	Emergency stop on	Sudden stop				Error status(Error491) prohibition output	Off
	External stop on *7	Deceleration stop	Deceleration stop	Error 322(Operation continuous)	Deceleration stop	Stop On	No change
XG-PM software	Deceleration stop command	Deceleration stop	Deceleration stop	Error 322(Operation continuous)	Deceleration stop	Stop On	No change
	Emergency stop command	Sudden stop				Stop On	Off

Notes

* 1: Positioning means position control, speed control, interpolation control, speed/position switching control, position/speed switching control, position/torque control by positioning data.

*2: When complete homing, external input signal (DOG and HOME signal) do not effect to positioning control.
When complete homing, deceleration or emergency stop time operates based on setting values of servo drive.

* 3: Only operating while software high/low limit on the speed control of expansion parameter at the speed control operation mode is set"1: detection".

* 4: Sequence program means XGT program type.

* 5: Speed goes to 0 by decelerating set in the deceleration stop time of auxiliary data of deceleration stop command.

* 6: Speed goes to 0 decelerate by set time as「deceleration time during emergent stop」of basic parameter.

*7: it is valid when「external command selection」of extended parameter is "1" , external stop command/external command is "1".

(2) Deceleration stop

(a) If meet emergency stop while operate indirect start, direct start, simultaneous start, start operation, homing operation, inching operation, it will sudden stop.

(b) Deceleration stop command not different at these sections: acceleration section, constant section, deceleration section.

(c) When decelerating as the deceleration stop, the positioning operation will not be completed to the setting target position.

- The positioning completion signal is not occurred.
- Among M code modes, the M code signal is not On in After mode.

(d) Then, when the indirect start command (step number = current step number) occurs in the stopped state,

- In positioning with absolute coordinates, the system operates with the remaining position value not output fro m the current operation step.
- In positioning with relative coordinates, the target position is operated for the set value.

(e) There are two type of emergency stop: external deceleration stop and internal deceleration stop.

- Internal/external deceleration stop.
  Internal deceleration stop command. It decelerate and stop by XG-PM and「deceleration stop」command of sequence program as set support data.
- External stop command
  In case of external input signal of servo drive is to be On, it will be decelerated and stopped by set deceleration time in current positioning operation. Set the external command selection item of extended parameter and external command item to use external command as「speed/position switching」signal.

Item	Setting Value	Content
External command selection	0: speed/position control switch	When inputing an external command, it is used as "an external speed/position control switching" signal.
	1: External stop command	When inputing an external command, it is used as "an external stop command" signal.
External command	0: Disable	An external command signal is ignored and have no effect on operation.
	1: Enable	When inputting external command signal, operates as the signal set in external command selection item.

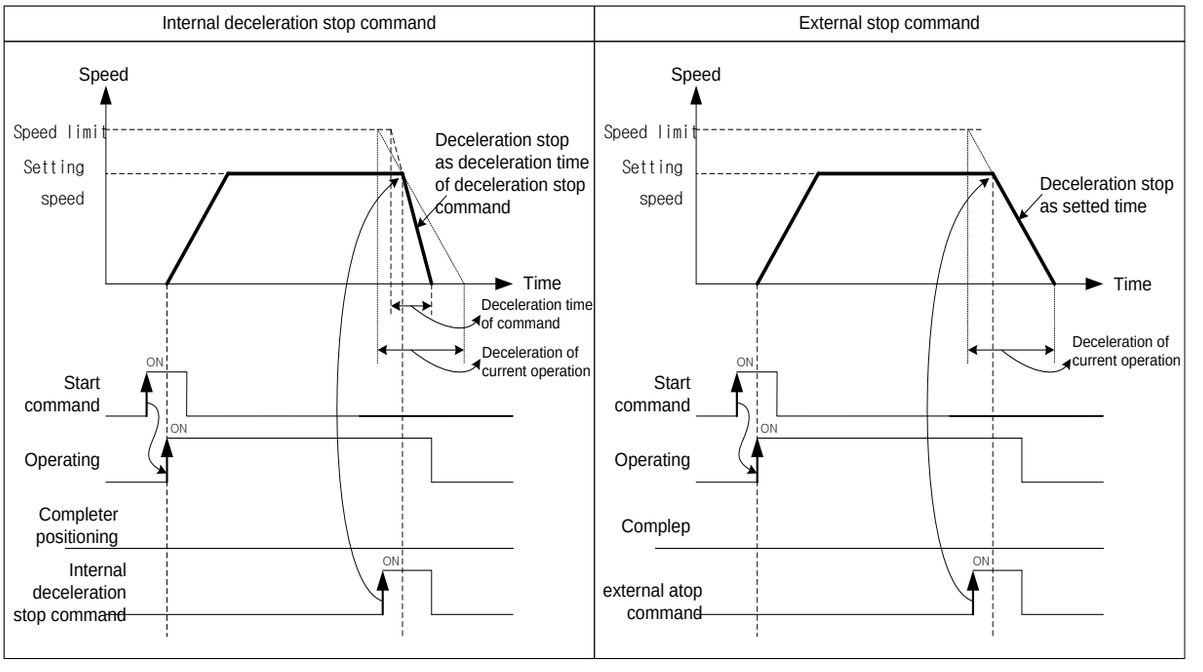
(f) Restrictions

- When command internal deceleration stop, the value of deceleration time can bigger than set value of deceleration time by auxiliary data.
- If deceleration stop command is inputted while operate Jog, error (error code: 322) will be made. Use "Stop Jog"

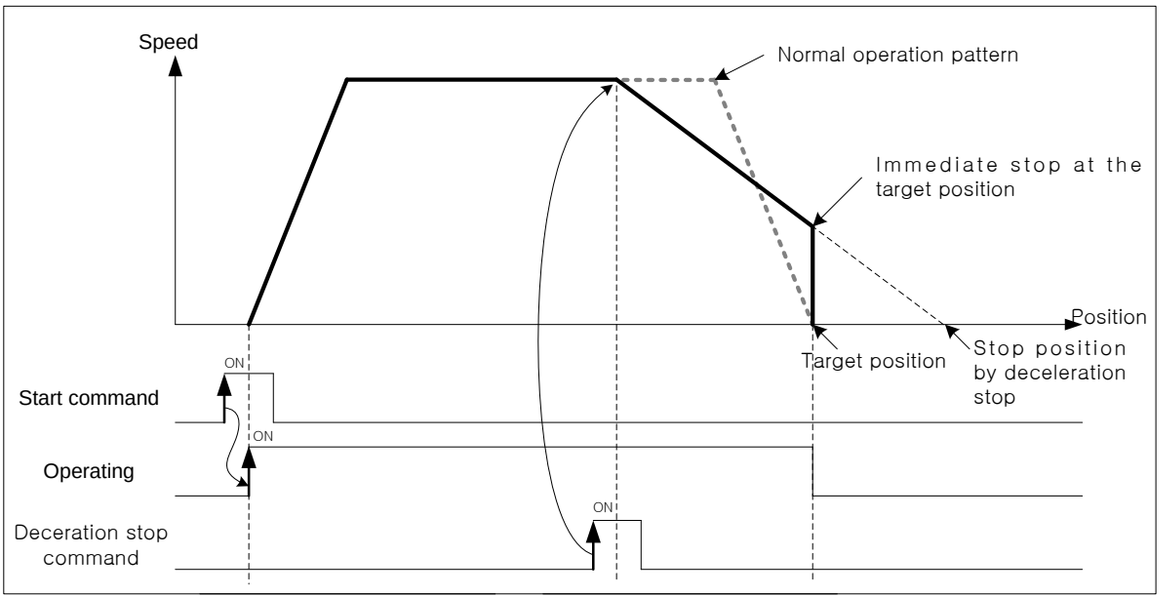
command for Jog operation stop.

▪ If a decelerating stop is executed during stopping, decelerating stop command is ignored without error.

(g) Operating Timing



■ When a deceleration stop command is input during position control operation, if the deceleration distance by the deceleration stop time is greater than the amount of movement to the target position, it immediately stops at the target position.



(3) Emergency stop

(a) It decelerated to stop and occurred error as set time in「deceleration time when it is emergent stop」of basic Parameter during indirect start, direct start, simultaneous start, synchronous operation, homing operation, jog operation, inching operation among start related command.

(b) In case of internal emergency stop, error 481 will occur and in case of external emergency stop, error 491 will occur.

(c) M code signal will be 'Off' after Emergency stop.

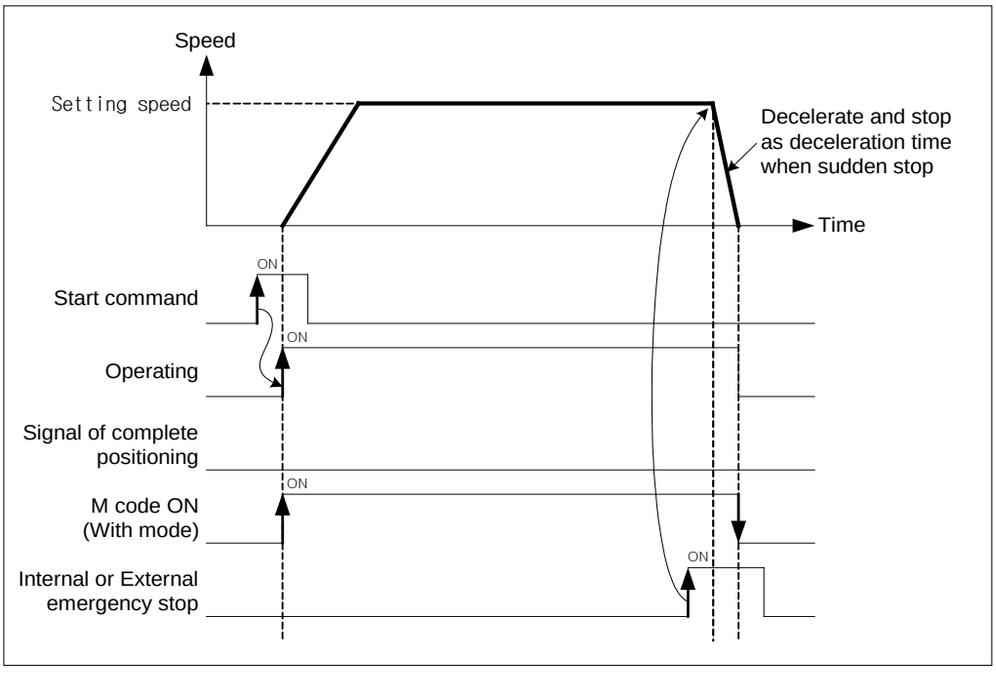
(d) There are two type of Emergency stop: External emergency stop and internal emergency stop.

- Internal emergency stop command
  To be decelerated and stopped by「emergency stop」 command of XG-PM and sequence program as set time in」deceleration time when it decelerate to stop, and error will be occurred.
- External emergency stop signal
  When the emergency stop input signal of the servo drive is On, it decelerates to the time set in "Emergency stop dec. time" of the basic parameter, stops and an error occurs.

■ Setting related parameter (basic parameter)

Item	Setting Value	Content
Dec. time of Emergent stop	0 ~ 2147483647 [ms]	Set deceleration time for using when detect hardware high/low limit signal. The Emergency stop dec. time means the time it takes to decelerate to zero speed from the speed limit.

(e) Operating Timing



(4) Stop hardware by high/low limit

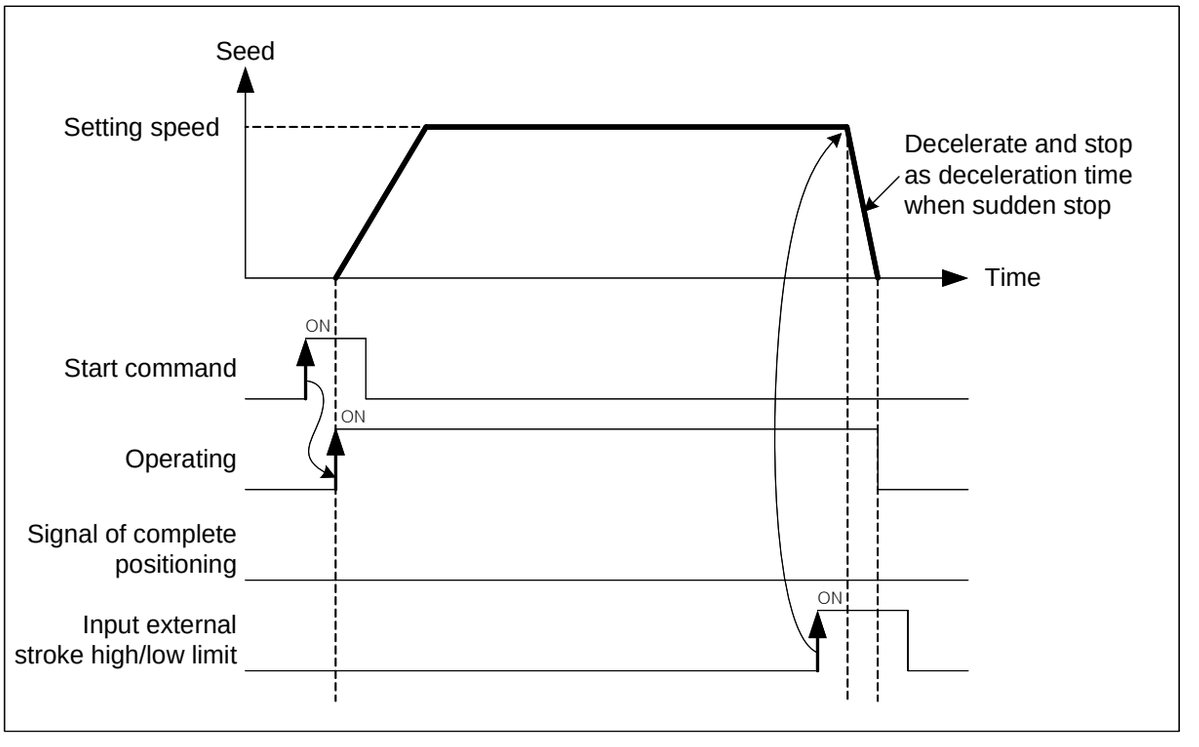
(a) When positioning control, if the signal of hardware high/low limit is inputted, then stop positioning control and it will be decelerated and stopped as set time at「deceleration time when it is suddenly stopped」, and error will be occurred.

(b) In case of external input stroke high limit error, error 492 will occur and in case of external input stroke low limit error, error 493 will occur.

■ Setting related parameter (basic parameter)

Item	Setting Value	Content
Dec. time of Emergent stop	0 ~ 2147483647 [ms]	Set deceleration time for using when detect hardware high/low limit signal. The Emergency stop dec. time means the time it takes to decelerate to zero speed from the speed limit.

(c) Operating Timing



(5) Stop by software high/limit

(a) When positioning control, if value of current command position out of set value of expansion parameter in 「software high limit」 and 「software low limit」, it will promptly be stopped when emergency stop in basic parameter.

(b) If value of command position to be out of software high limit range, will occur error 501, and if it to be out of software low limit range, will occur error 502.

■ Setting related parameter (expansion parameter)

Item	Setting Value	Content
S/W upper limit	-2147483648 ~ 2147483647	Set the position of soft high limit
S/W low limit	-2147483648 ~ 2147483647	Set position of software low limit.

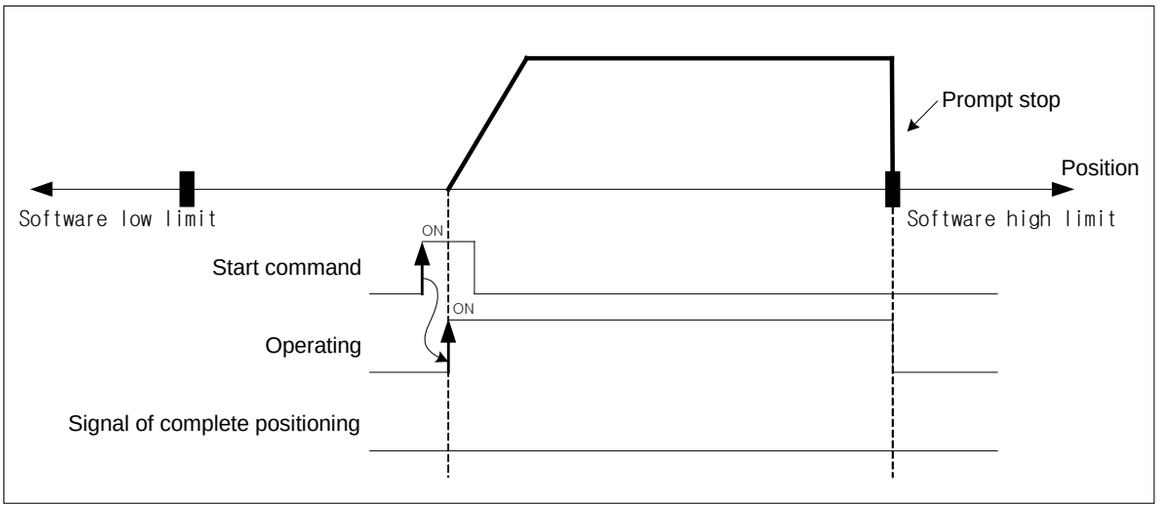
(3) Restrictions

Software high/low limit not to be checked in the following case:

• In case of setting Software high/low limits as maximum (2147483647), minimum (-2147483648)

• In case of software high limit = software low limit

(4) Operating Timing



(6) The priority of stop process

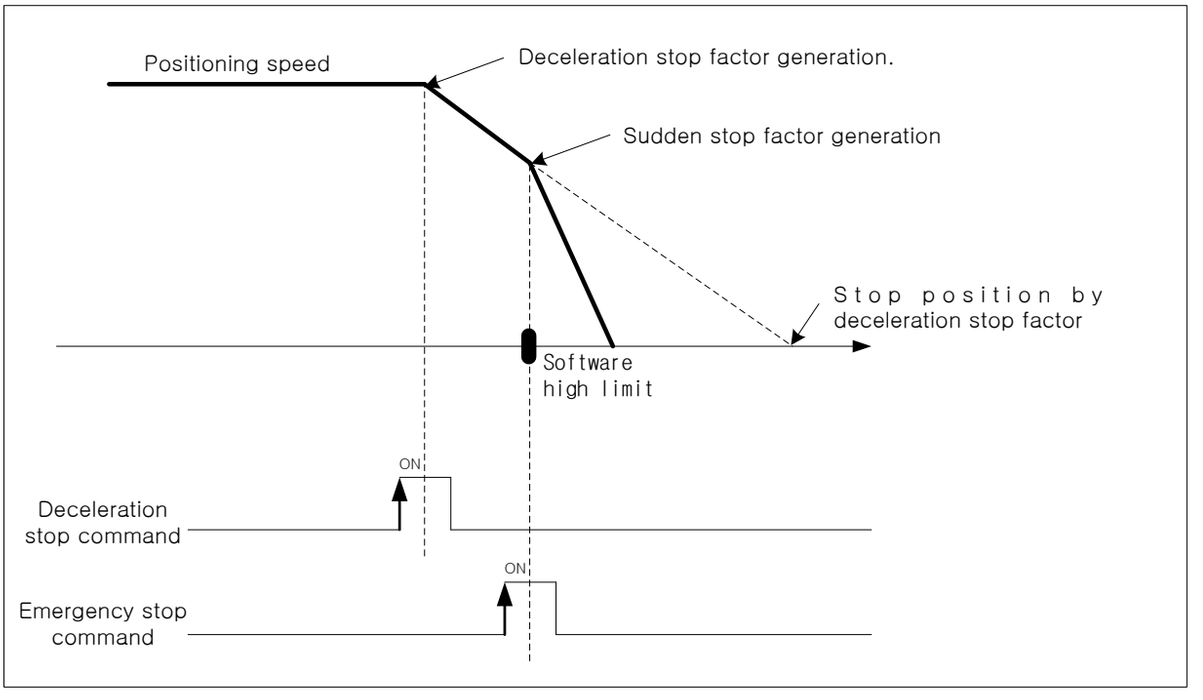
The priority of stop process of positioning module is as follows:

Deceleration stop < Emergency stop

When encounter factor of sudden stop in deceleration stop of positioning, it will be suddenly stopped. In case of sudden top deceleration time bigger than deceleration stop time, it will be decelerated and stopped as set deceleration stop time.

Notes

Process is as follows, when factor of sudden stop is occurred during deceleration stop.



The factor of emergency stop: emergency stop command or software high/low limit

(7) Stop command under interpolation operation

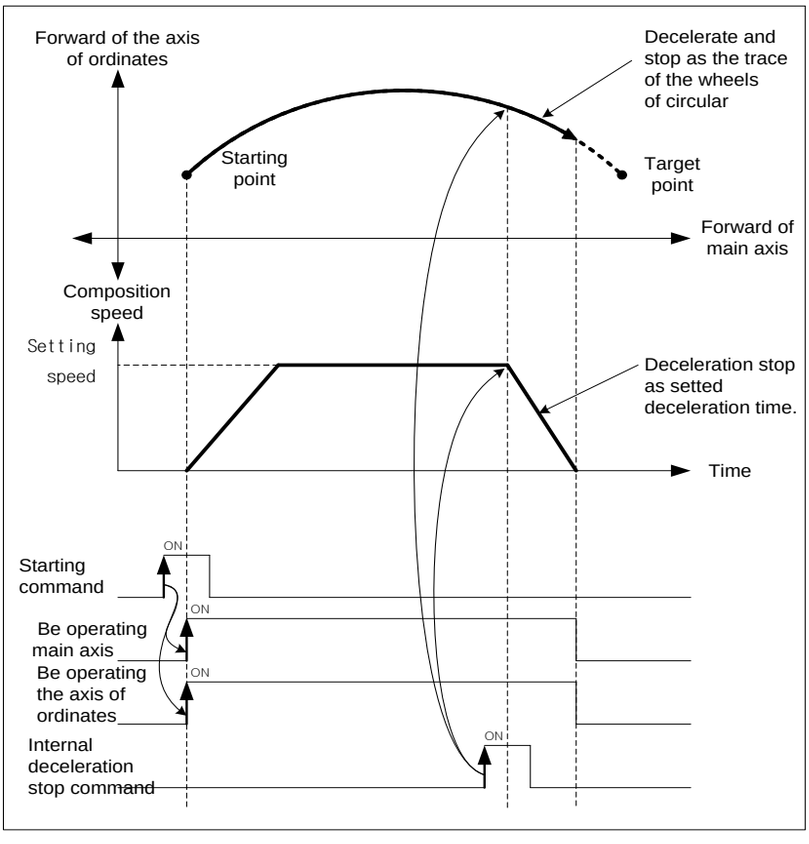
(a) If encounters stop command during interpolation operation (linear interpolation, circular interpolation, helical interpolation, elliptic interpolation), it carries out the deceleration stop. It depends on the trace of wheels of origin.

(b) When it restarts after deceleration stop, indirect start command carries out operation to target position of positioning. And then, operation depends on absolute coordinate and relative coordinate.

(c) Stop command during interpolation operation can external/internal deceleration stop.

(d) Deceleration stop command should be progressed at main axis which is operating for interpolation.

(e) Operating pattern



(8) Restart after positioning stop

(a) Deceleration stop

When indirect start after deceleration stop, operate positioning as set operation step.

In case of using with mode, Signal “On” of M code has to “Off” for restart. Turn off the M code On signal with the 「M code release (XMOF)」 command before starting.

(b) Restart after Internal/External emergency stop

When it is stopped due to an emergency stop, the M code On signal is automatically turned off, so positioning operation can be performed with the set operation step during indirect start.

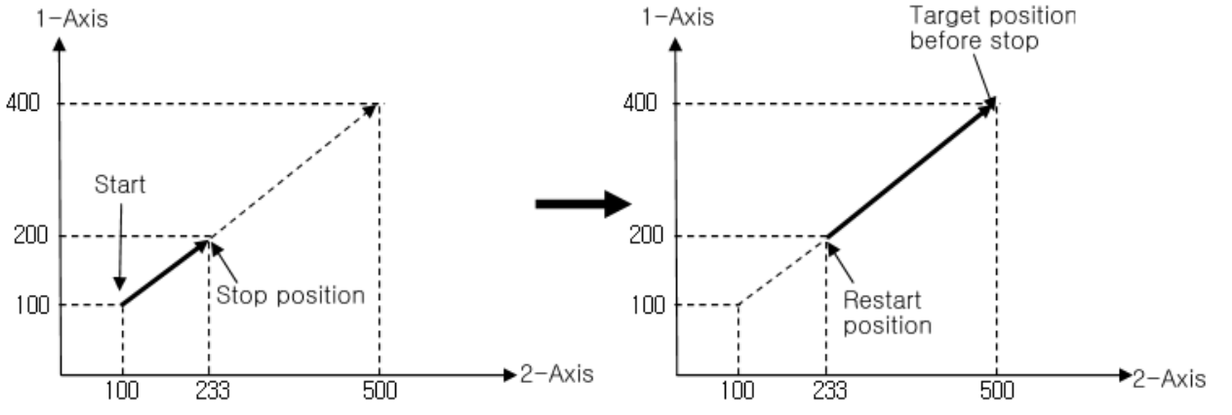
9.2.20 Restart

It explain the restart, which restarts a stopped axis using the deceleration stop during positioning operation.

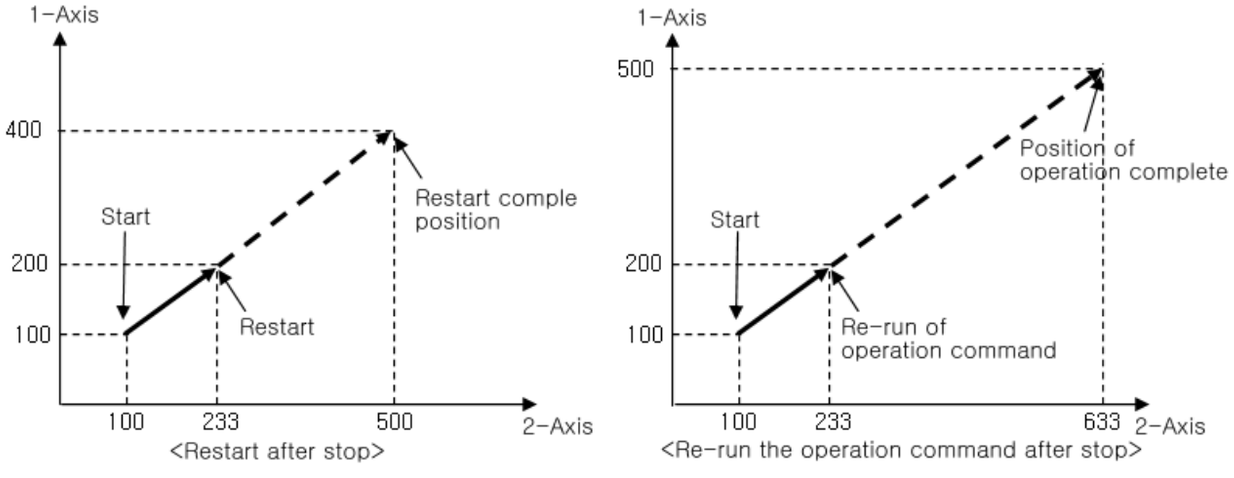
In case of decelerating stop due to the stop factor during positioning operation, operation can be resumed from the position stopped with the “restart” command to the target position with the previous operating conditions.

However, restart is valid when the previous operation was “direct start” and “indirect start” and : PTP operation”..

The picture below explains the restart operation.



The figure below difference between executing restart and restarting the previous operation command when the drive is stopped while driving in relative coordinates.



9.2.21 Torque Control

This command is executed by the "torque control" command and operates at the set torque until the "deceleration stop" command is input.

(1) Control features

(a) Executes torque control using specified torque values (%) and slope (ms).

(b) Set target torque value and slope as an auxiliary data of torque control command.

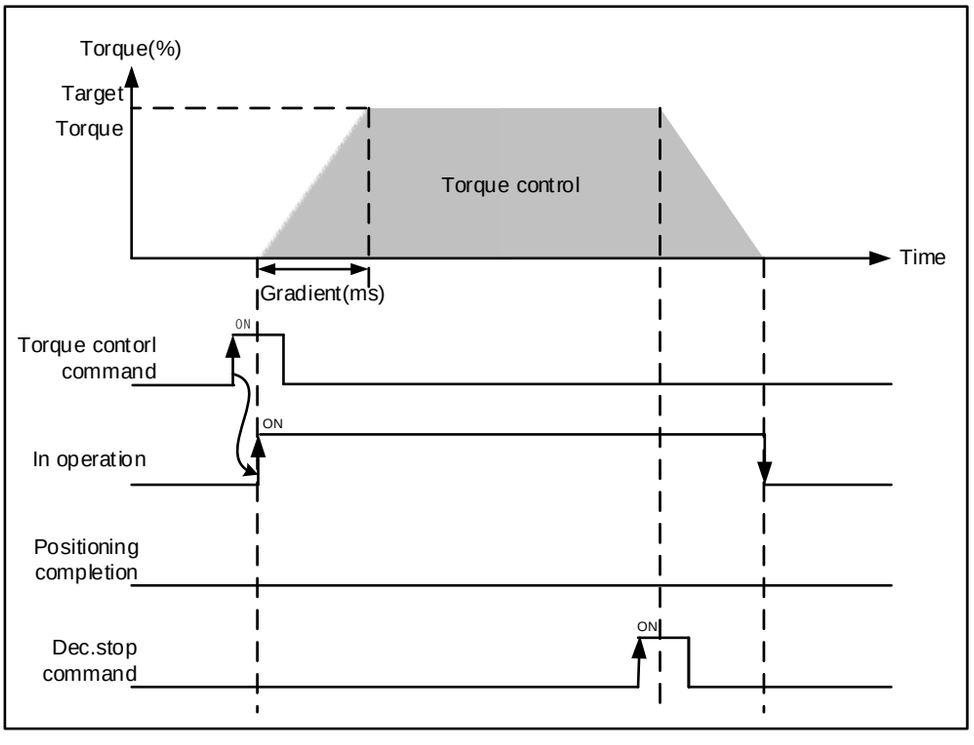
Auxiliary data	Setting Value	Content
Torque (%)	-32768 ~ 32767	Set the torque value that becomes the goal value during torque control. The torque value operates as a percentage of the rated torque. (1 = 1% of rated torque)
Slope(ms)	0 ~ 65535	Set the slope to the target torque in hours.

※ The allowable range of torque value depends on the type of servo drive connected. Generally, the target torque value is limited to the maximum torque setting.

(c) The direction is determined by the setting of the torque value, which is the auxiliary data of the torque command.

- Torque value is positive (+): operation in the forward direction (current position increasing direction)
- Torque value is negative (-): operation in the reverse direction (current position decreasing direction)

(2) Operating Timing



(3) Restrictions

(a) Torque control may not be executed in the case below.

- When a command is executed while in operation other than torque control (error code: 741)
- When a command is executed while M Code ON signal is On status (error code: 742)
- When a command is executed while in Servo off status (error code: 743)
- When the servo drive does not support the torque control mode (error code: 565)

9.2.22 Control by External Input Signal

Start by external input signal is using existing encoder input terminal as external input signal, functions set in input signal parameter are executing when external input signal is input,

(1) Control features

(a) External input signal can use following 3 points.

- External input signal A: [ENC A 24V (or A 5V) – A COM]
- External input signal B: [ENC B 24V (or A 5V) – B COM]
- External input signal Z: [ENC Z 24V (or A 5V) – Z COM]

(b) For using the encoder input signal as an external input signal, common parameters must be set as follows.

	Item	Setting Value
Common parameter	External input terminal function selection	1: external input signal A / B / Z
	External input signal input filter	0:Not Use 1: Use

(c) When input signal A,B,Z, executing function can be set in the input signal parameter.

	Item	Setting Value
Input signal parameter	Input signal A function selection	0: not used 1: Speed/position control switch 2: Position/torque control switch 3: external start
	Input signal B function selection	
	Input signal Z function selection	
	Input signal A logic selection	Contact A, Contact B
	Input signal B logic selection	
	Input signal Z logic selection	
	External position/torque control switch torque	-32768% ~ 32767%

(d) in the“input signal logic selection parameter, the logic of input signal A,B,Z which input from external to module can be selected. When selected as contact B select, if no current flows to input signal terminal, the module recognizes it as on. And if current flows, the module recognizes it as off.

(2) Control type

(a) Speed/Position Control Switching.

Switches from speed control to position control by input signal. If the external input signal input while speed controls do not operating, an error occurs.

For detail description about speed/position switching control, refer to '9.2.14 Speed/Position Switching Control'.

(b) Position/torque control switching

Switches from position control to torque control by input signal. When switching position/torque control, torque value to change is set in the item of “external position/torque control switch torque of input signal parameter.

For more details, refers to 9.2.7 Position/ Torque Switching Control.

(c) External start

Starts operation data of current step number by input signal.

If the input signal function selection parameter is“3: external start”, start operation with step saved in the current step no.the moment an external input signal are input. To start operation data of step desired by user, first changes current step no. With the“start step no. change”command.

Notes

1. If the external input external function selection is “1: external input signal A,B,Z, the encoder position value is displayed as 0. When executing encoder preset command, it do not operate and encoder position value maintains 0.
2. If the external input terminal function selection changes to “0: encoder signal phase A,B.Z”, encoder position values verifies encoder Max/Min parameter values and set the initial position (0 if the max/min values contain 0, Min if they do not).
3. If the external input terminal function selection is changed to “0: encoder signal phase A,B.Z, all external input signal status of status information are displayed as off.

(3) Status Information

- The status of external input signal A,B,Z can be checked in the external I/O signal status of status information area.

Memory address								Content
Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	
2C3	343	3C3	443	4C3	543	5C3	643	External I/O Signal State

Bit 0	**External EMG Stop**	**[0: External EMG stop Off, 1: External EMG stop On]**
Bit 1	**Not used**	**[0]**
Bit 2		
Bit 3		
Bit 4	**External upper limit signal**	**[0: External upper limit signal Off, 1: External upper limit signal On]**
Bit 5	**External lower limit signal**	**[0: External lower limit signal Off, 1: External lower limit signal On]**
Bit 6	**Home signal*2**	**[0: Home signal Off, 1: Home signal On]**
Bit 7	**DOG signal**	**[0: DOG signal Off, 1: DOG signal On]**
Bit 8	**External *1 command signal**	**[0: External command signal Off, 1: External command signal On]**
Bit 9	**Servo On signal**	**[0: Servo Off, 1: Servo On]**
Bit 10	**Servo alarm signal**	**[0: Servo driver normal, 1: Servo driver error occurs]**
Bit 11	**In-position signal**	**[0: Not In-position section, 1: In-position section]**
Bit 12	**External input signal A**	**[0: External input signal A Off, 1: External input signal A ON]**
Bit 13	**External input signal B**	**[0: External input signal B Off, 1: External input signal B ON]**
Bit 14	**External input signal Z**	**[0: External input signal Z Off, 1: External input signal Z ON]**
Bit 15	Communication error	**[0: EtherCAT Comm. normal, 1: EtherCAT Comm. error]**

9.2.23 Position Specified Torque/Position Switching Control

The setting axis by positioning start carries out the torque control and is switched from torque control to position control when torque/position switching signal is entered to the positioning module, and then carries out the positioning by transfer amount.

(1) Control features

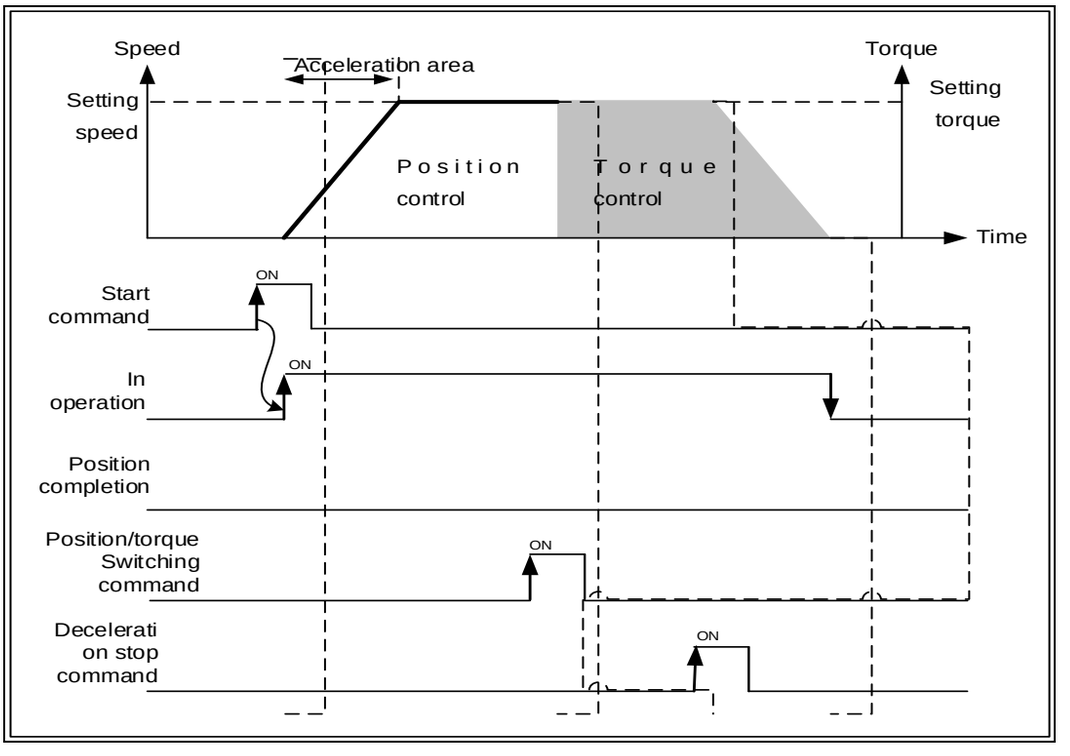
(a) Executes positioning using the “position specified torque/position switching command during torque control operation.

(b) In the case of torque/position switching, set the torque/position switching coordinates as to whether the position value should be the relative position value or absolute position value at the time the torque/position switching command is executed.

Item	Setting Value	Content
Torque/position switching coordinate	0: Relative	Executes positioning as far as by the set value from position where torque/position switching command is executed.
	1: Absolute	Considers the set value as absolute position and executes positioning into the set absolute position.

(c) In position specified torque/position switching control, executes positioning with the values set in target operand of “position specified torque/position switching” command.

(2) Operating Timing



(3) Restrictions

(a) Torque control may not be executed in the case below.

- When a command is executed while not operating (error code: 921)
- When a command is executed while in operation other than torque control (error code: 922)
- When a command is executed synchronized operation Subordinate axis ratio Servo off status (error code: 923)
- When a command is executed while in Servo off status (error code: 924)

9.3 Manual Control

Manual control is a function that execute random positioning according to user's demand without operation data
Manual operations include Jog operation, Manual pulse generator operation, inching operation, previous position movement of manual operation etc.

9.3.1 JOG Operation

(1) Control features

(a) Jog Operation is

- Execute positioning control at jog high/low speed depending is ON the signal of high/low speed during forward/reverse jog start signal is being ON.
- Positioning is started by Jog command from the state that the origin is determined. The value of positioning stars changing, user can monitor it.
- This is a way of manual operation that can be executed before determination of origin.

(b) Acceleration/Deceleration process and Jog speed

The acceleration/deceleration processing is controlled based on the setting time of Jog acceleration/ deceleration time from XG-PM manual operation parameter setting.
Set the Jog speed on Jog high/low speed of XG-PM manual operation parameter setting.
If Jog speed is set out of the setting range, error will occur and the operation does not work.

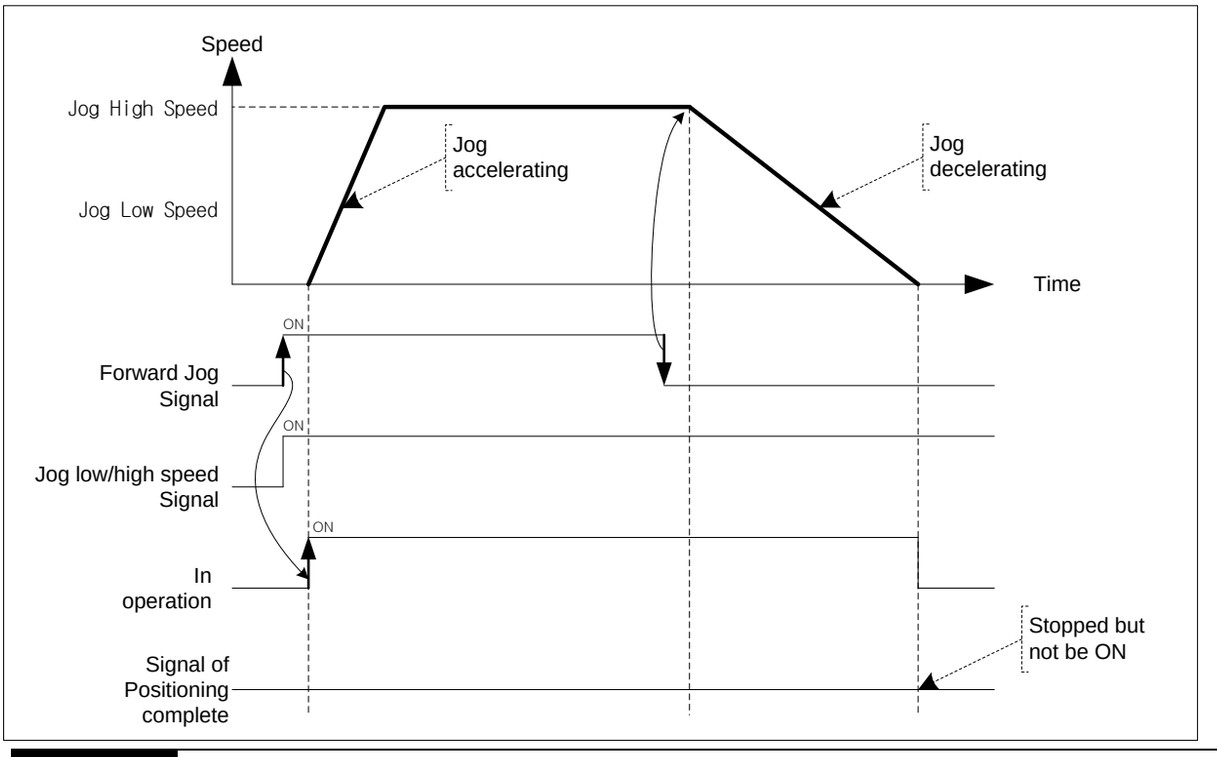
■ Setting related parameter (Manual Operation parameter)

Item	Setting Value	Content
Jog high speed	1 ~ Speed limit value	Set Jog speed. Jog high speed must be set below speed limit
Jog low speed	1~ JOG high speed	Set Jog speed. Jog low speed must be set below Jog high speed
Jog accel. time	0 ~ 2147483647	Set the acc. Time used in acceleration of Jog operation
Jog dec. time	0 ~ 2147483647	Set the dec. time used in deceleration of Jog operation

Notes

If 'Jog Acc. Time' is 0, it operates at 'Acc. Time1' of basic parameter.
If 'Jog Dec. Time' is 0, it operates at 'Dec. Time1' of basic parameter.

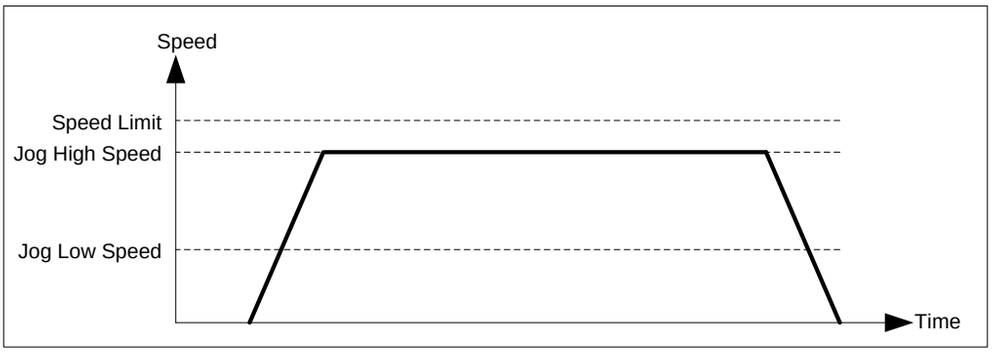
(2) Operating Timing



Notes

Notices for setting Jog speed are as follows.

Jog Low Speed ≤ Jog High Speed ≤ Speed Limit



(3) Restrictions

You can not execute Jog operation in the case as follows.

(a) Value of Jog High Speed exceeds the speed limit of basic parameter (Error code: 121)

(b) Value of Jog Low Speed exceeds the value of Jog high speed.(Error code : 122)

(4) Jog Operation Start

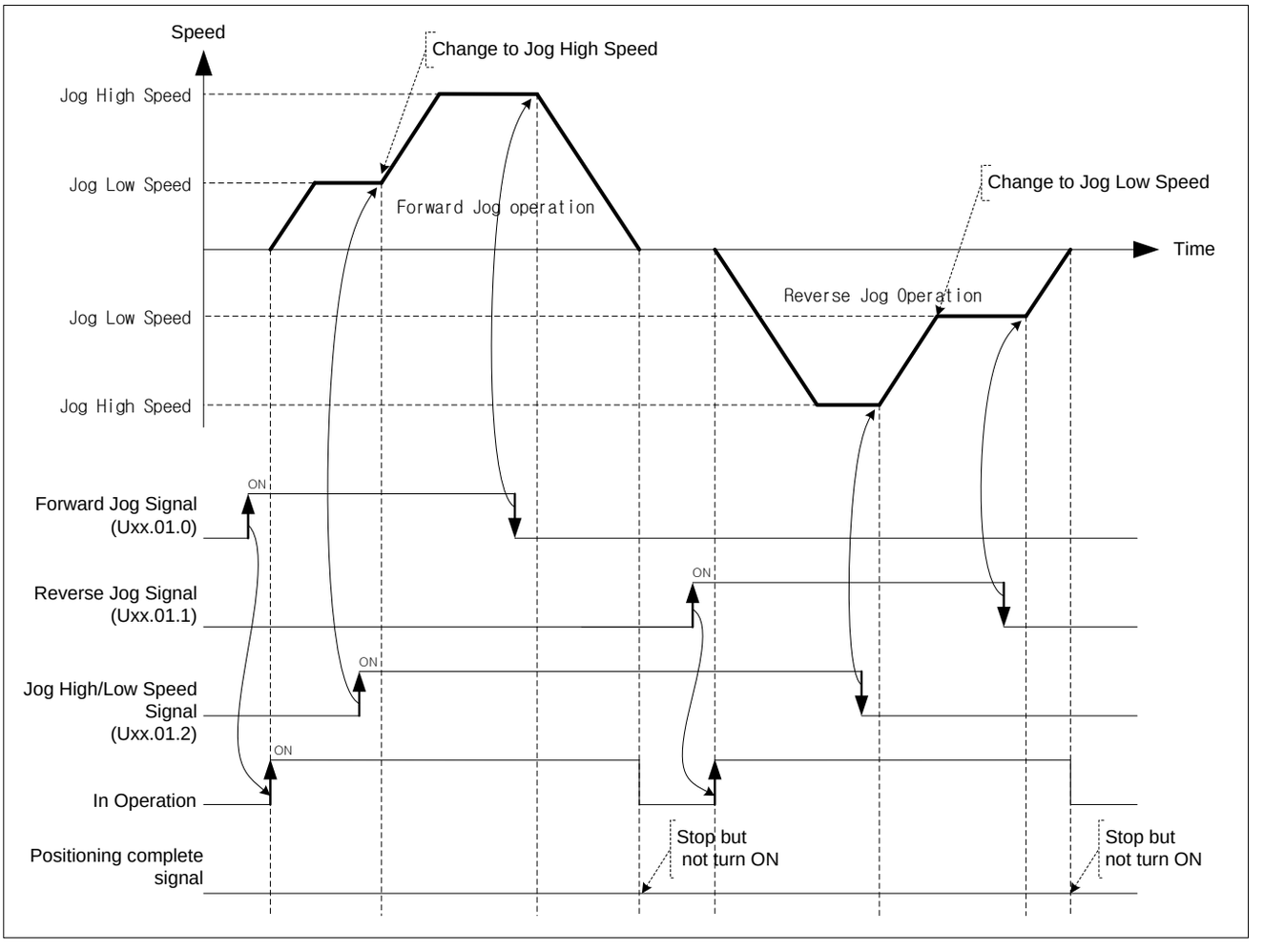
Jog operation start consists of Start by XG-PM and Start by Sequence program. The start by sequence program is that execute Jog operation with output contact of CPU.

Axis	Signal direction: CPU-> positioning module	
	Output signal	Content
Axis 1	UXX.01.0	Axis1 Forward Jog
	UXX.01.1	Axis 1 Reverse Jog
	UXX.01.2	Axis1 Jog Low/High Speed
	UXX.01.3	-
Axis 2	UXX.01.4	Axis2 forward jog
	UXX.01.5	Axis 2 Reverse Jog
	UXX.01.6	Axis2 jog low/high speed
	UXX.01.7	-
Axis 3	UXX.01.8	Axis3 forward jog
	UXX.01.9	Axis 3 Reverse Jog
	UXX.01.A	Axis3 jog low/high speed
	UXX.01.B	-
Axis 4	UXX.01.C	Axis4 forward jog
	UXX.01.D	Axis 4 Reverse Jog
	UXX.01.E	Axis4 jog low/high speed
	UXX.01.F	-
Axis 5	UXX.02.0	Axis5 forward jog
	UXX.02.1	Axis 5 Reverse Jog
	UXX.02.2	Axis5 jog low/high speed
	UXX.02.3	-
Axis 6	UXX.02.4	Axis6 forward jog
	UXX.02.5	Axis 6 Reverse Jog
	UXX.02.6	Axis6 jog low/high speed
	UXX.02.7	-
Axis 7	UXX.02.8	Axis7 forward jog
	UXX.02.9	Axis 7 Reverse Jog
	UXX.02.A	Axis7 jog low/high speed
	UXX.02.B	-
Axis 8	UXX.02.C	Axis8 forward jog
	UXX.02.D	Axis 8 Reverse Jog
	UXX.02.E	Axis8 jog low/high speed
	UXX.02.F	-

[Example] Execute Jog start in the order as follows.

■ Forward jog low operation -> Forward jog high operation -> Jog stop

Reverse Jog High speed Operation -> Reverse Jog Low speed Operation -> Stop



Notes

Dec. stop command will not be executed in Jog Operation.

Jog operation will stop if turn the Jog signal of the current operating direction Off.

(5) Direct input jog operation (XPM_JOGD)

A direct input jog operation execute jog operation using the values entered in the function block without using the manual operation parameter. The other specifications and operation characteristics are the same as “jog operation”

(a) Acceleration/Deceleration process and Jog speed

Acceleration/Deceleration processing is executed basis of inputted ACC_TIME, DEC_TIME in the function block.
Jog speed is set in HIGH_VEL, LOW_VEL of the function block.
If HIGH_VEL, LOW_VEL, ACC_TIME, DEC_TIME are set over the setting range, an error occurs and maintains the previous status. The jog high speed, jog low speed, jog dec. time of manual operation parameter are operated separately, and is not affected.

■ Related parameter setting

Item	Setting Value	Content
HIGH_VEL	1 ~ Speed limit value	Set direct input jog high speed. The direct input Jog high speed must be set below speed limit.
LOW_VEL	1 ~ HIGH_VEL	Set direct input jog low speed. The direct input Jog low speed must be set below speed limit.
ACC_TIME	0 ~ 2147483647	Set the acceleration time to use during accelerating the direct input jog operation.
DEC_TIME	0 ~ 2147483647	Set the deceleration time to use during decelerating the direct input jog operation.

Notes

If 'Jog Acc. Time' is 0, it operates at 'Acc. Time1' of basic parameter.
If 'DEC Time' is 0, it operates at 'Dec. Time1' of basic parameter.

(b) XGK command is not supplied.

(c) Operates the same as jog operation by level operation condition, and if changing setting values in JOG_DIR, LOW/HIGH while operation condition is on status(while jog operation), likewise the speed is changing without stopping jog operation speed and acceleration/deceleration time values is prompted reflected if HIGH_VEL, LOW_VEL, ACC_TIME, DEC_TIME values is changing.

(d) Restrictions

- The value of HIGH_VEL (direct input jog high speed) exceeds speed limit of the basic parameter (Error code: 415).
- When the value of LOW_VEL (direct input jog low speed) is less than 1 or higher than HIGH_VEL (direct input jog high speed).(error code: 416).
- The value of ACC_TIME (direct input jog acc. time) is negative or exceeds 2147483647l (Error code: 417).
- The value of DEC_TIME (direct input jog deceleration time) is negative or exceeds 2147483647l (Error code: 418).

9.3.2 Inching Operation

This is a kind of manual operation and executing positioning at the speed already set on manual operation parameter as much as the amount of movement already set on the data of inching operation command.

(1) Control features

(a) While the operation by ON/OFF of Jog signal is difficult in moving to the correct position as the operation starts and stops according to the command, the inching command enables to set the desired transfer amount easily and reach the goal point.

(b) Thus, it is available to reach the correct goal position by moving fast near the working position by Jog command and operating the detail movement by inching command.

(c) The setting range is -2147483648 ~2147483647 Pulse.

(d) The direction of movement is determined by the sign of the inching amount set as auxiliary data.

■ The amount of inching movement is positive (+): Positioning operation in forward direction

■ The amount of inching movement is negative (-): Positioning operation in reverse direction

Acc./Dec process and Inching speed

The acceleration/deceleration time of inching operation uses the jog acceleration time and jog deceleration time of manual operation.

Set Jog acc./dec. time on 'Jog acc./dec. time' of manual operation parameter setting of XG-PM.

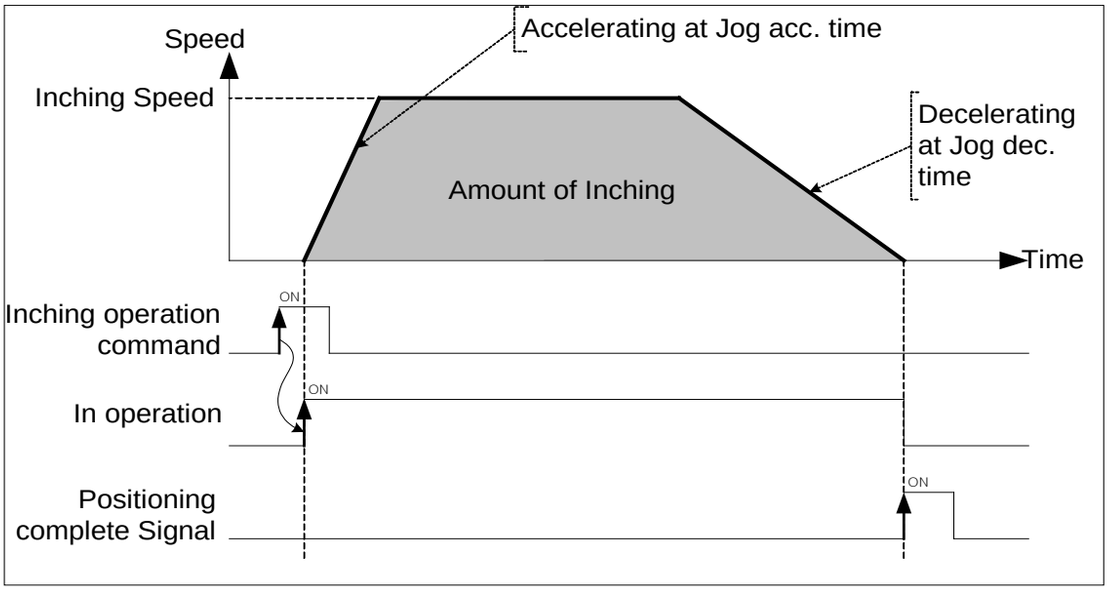
The inching speed is set in the inching speed among the manual operation parameter setting items of XG-PM.

If inching speed is set out of the setting range, error will occur and the operation does not work.

■ Setting related parameter (Manual Operation parameter)

Item	Setting Value	Content
Jog accel. time	0 ~ 2147483647	Set the accelerating time for acceleration of Inching operation
Jog dec. time	0 ~ 2147483647	Set the decelerating time for deceleration of Inching operation
Inching Speed	1 ~ Speed limit value	Set the speed of Inching operation

(2) Operating Timing



9.3.3 Manual Operation Previous Position Return

This positioning control function is used to return to the position address that the positioning is completed before manual operation when the position is changed by manual operation (Jog operation, inching operation).

(1) Control features

(a) Direction of moving depends on the current position and the previous position of manual operation.

■ Starting position < Theprevious position of manual operation: Forward direction

■ Starting position < Theprevious position of manual operation: Reverse direction

(b) Acc./Dec. process and the speed of return

Acc./Dec. time ofmanual operation parameter of manual operation previous position returnis using the jog acc. Jog decel. time of manual operation parameter.

Set Jog acc./dec. time on 'Jog acc./dec. time' of manual operation parameter setting of XG-PM.

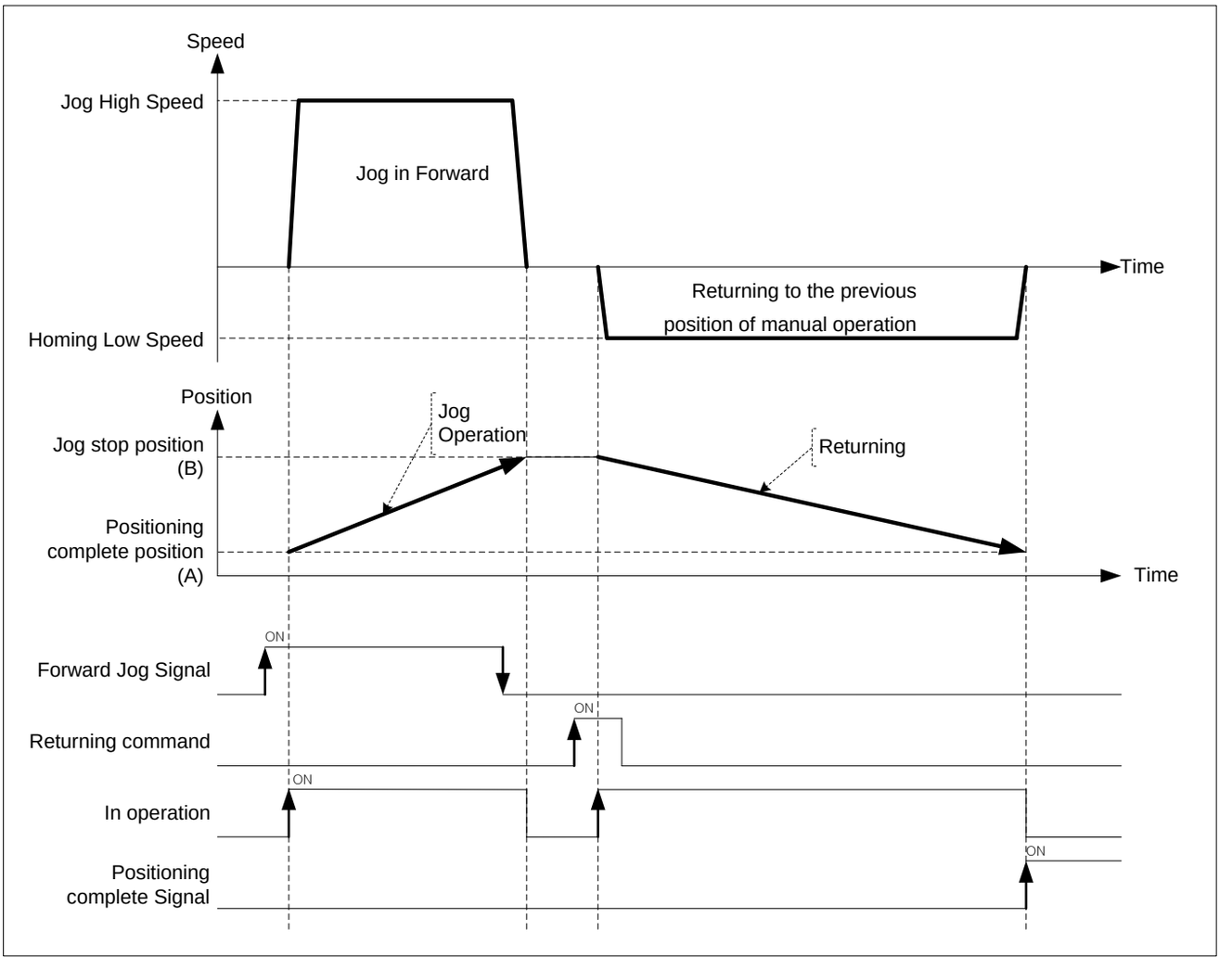
The speed of manual operation previous position returnuses jog low speed among manual operation parameter setting items of XG-PM.

The manual operation previous position return speed is set out of the setting range, error will occur and the operation does not work.

■ Setting related parameter (Manual Operation parameter)

Item	Setting Value	Content
Jog low speed	1 ~ Speed limit value	Set operation speed with manual operation previous position return
Jog accel. time	0 ~ 2147483647	Set acceleration time to be used when accelerating operation to the manual operation previous position return.
Jog dec. time	0 ~ 2147483647	Set deceleration time to be used when accelerating operation to the manual operation previous position return. □ Jog dec. time

(2) Operating Timing



If value of the current position is 'A“ after positioning control operation and the positioning value changed by Jog operation is“B”, execute positioning to 'A' when executing the returning to the previous position of manual operation.

9.4 Synchronous Control

This is the command that control the operation synchronizing with the main axis or operating of encoder. When the speed of subordinated axis during synchronous operation is exceeds speed limit error (error code: 357) occurs and synchronous operation is off.

9.4.1 Speed Synchronous Control

This is the command that synchronize with sub axis in speed and control operation depending on speed synchronous rate already set when main axis starts.

(1) Control features

(a) Start and Stop is repeated depending on operating of main axis after execution of speed synchronous command.

(b) The operating direction of sub axis depends on the ratio of speed sync.. If it is positive, the direction is forward. If it is negative, the direction is reverse.

(c) If execute speed sync. command, it will be the state of operating and remain in the state of speed sync. operation before release of speed sync. command.

(d) Auxiliary data of speed sync. command

The auxiliary data used in speed sync. command is as follows.

Item	Setting Value	Content
Main axis	1(axis 1~ axis 8, 9(encoder)	Set the main axis of speed sync.
Main axis ratio	-32768 ~ 32767	Set the ratio of main axis at speed sync. ratio.
Subordinate axis ratio	-32768 ~ 32767	Set the ratio of sub axis at speed sync. ratio.

Ratio of Speed sync. is calculated as follows.

$$Ratio = \frac{SubAxis}{MainAxis}$$

It is possible to set like Ratio of Main axis (Absolute) < Ratio of Sub axis (Absolute) at setting ratio of speed sync.

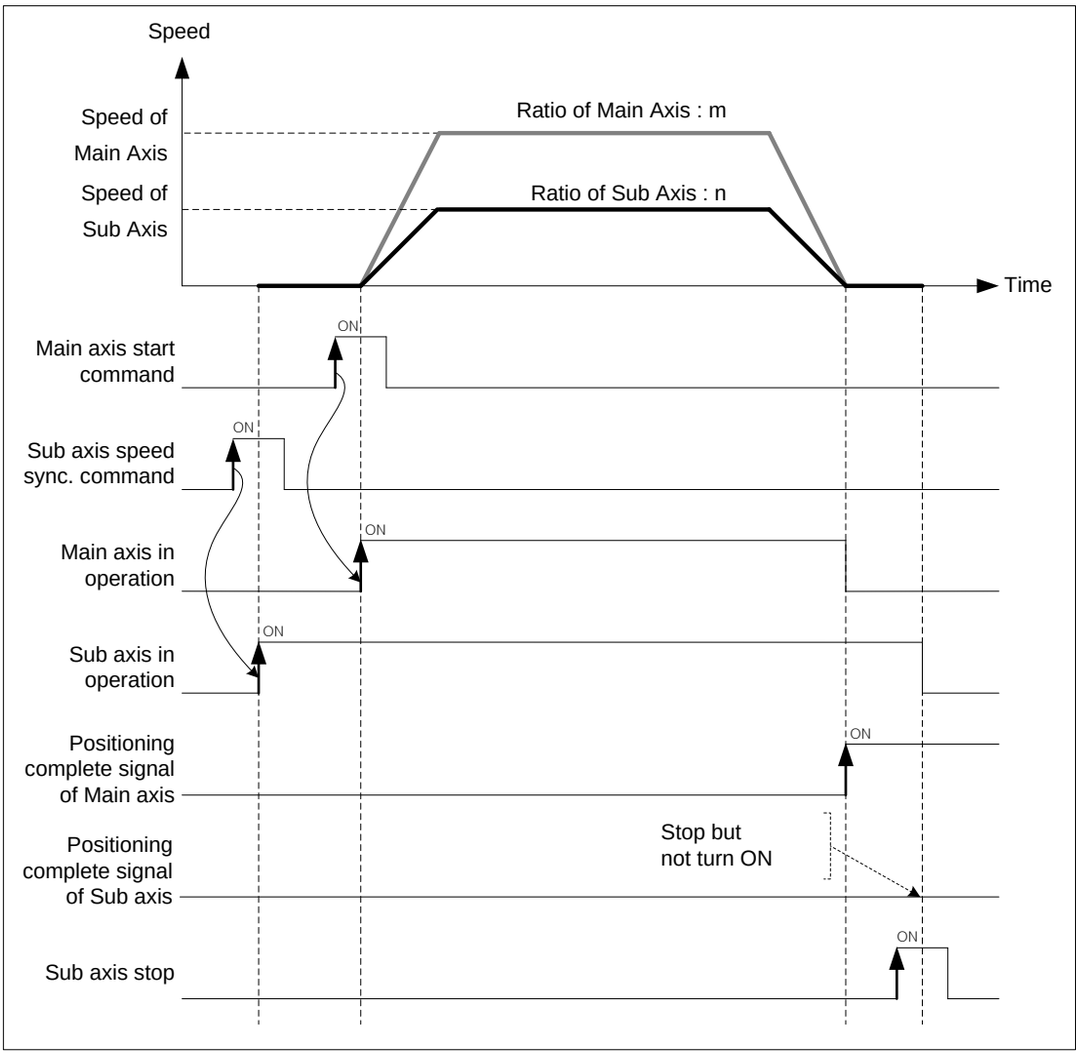
Operating speed of sub axis is calculated as follows.

$$\begin{aligned} Operaing\ \ speed\ \ of\ \ SubAxis &= Operating\ \ Speed\ \ of\ \ MainAxis \times Ratio\ \ of\ \ speed\ \ sync. \\ &= Operating\ \ Speed\ \ of\ \ MianAxis \times \frac{Ratio\ \ of\ \ SubAxis}{Ratio\ \ of\ \ MainAxis} \end{aligned}$$

(e) Modifying the ratio of speed sync. in operation is available.

When modify the ratio, if there is too big gap between the former ratio and the current ratio, the machine is possible to be damaged.

(2) Operating Timing



(3) Restrictions

You can not execute Jog operation in the case as follows.

(a) If speed sync. is executed in being On that contain of M code signal, error (code:353) arises. Make M code “OFF” with “M code release (XMOF)” command before use.

(b) If the current main axis is not connect to current network or main axis setting and command axis are the same axis, error (code: 355) arises. Set the main axis among the axes currently connected to the network.

(c) An error (error code: 357) occurs if the speed of the subordinate axis calculated by speed synchronization ratio exceeds the speed limit. In the case, the speed of main axis has to be down below the speed limit.

(d) In the case that the speed of main axis exceeds the speed limit, error arises and it decelerate in」 Dec. time of emergent stop'.

In case of the main axis is homing operation, executing speed synchronization command or speed synchronization status, an error (error code: 358) is occurs. (Except when the main axis is LS Mecapion L7N/L7NH/ XIP)

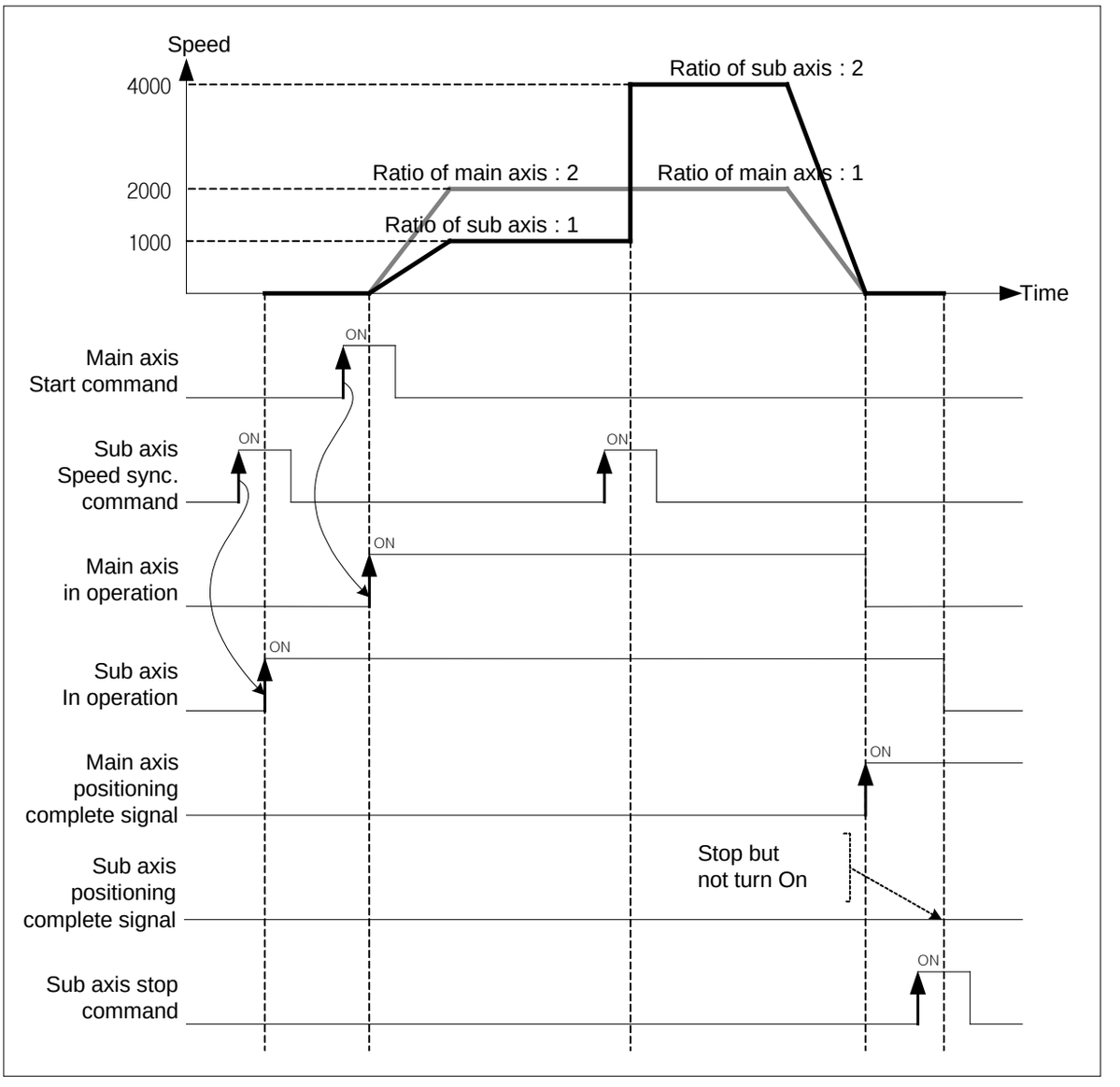
[Example] axis1 is main axis, axis2 is sub axis. Operate at 'ratio of main axis: ratio of sub axis = 2: 1' at the beginning and then execute speed sync. control changing the ratio to 'ratio of main axis : ratio of sub axis = 1 : 2'

■ Setting of XG-PM

▪ Main axis(axis1) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Incremental, single-axis Position Control	Single,End	10000	2000	No.1	No.1	0	0

■ Operation Patterns



(4) Speed synchronous control with encoder

(a) Set encoder 1 to be as the main axis of speed sync. and execute positioning control by ratio of speed sync. that consists of pulse speed from encoder, ratio of main axis and ratio of sub axis.

(b) This command is used in the case that executing thorough positioning manually.

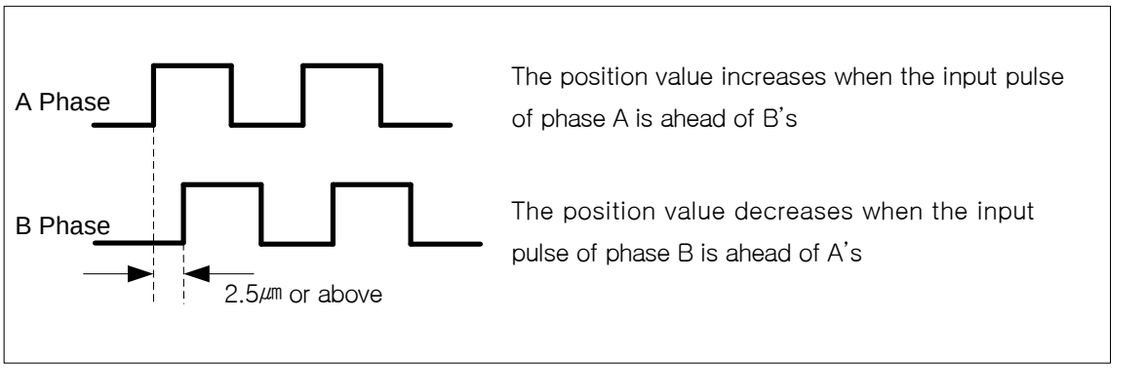
(c) After executed speed sync. command, when the pulse string is inputted, speed sync. control starts.

(d) Operate regardless of the state of origin.

(e) The pulse inputted by encoder increase of decrease encoder 1 of position value of encoder.

(f) The moving direction is determined by the phase gap of the input pulse.

- Positioning in forward direction: Input pulse of A phase is ahead of B
- Positioning in reverse direction: Input pulse of B phase is ahead of A.



- The operating direction of sub axis depends on $Ratio\ of\ speed\ sync.(\frac{Ratio\ of\ SubAxis}{Ratio\ of\ MainAxis})$. If it is positive, operating direction will be forward direction of encoder. If it is negative, operating direction will be reverse direction of encoder.

(g) Related parameter (Common Parameter)

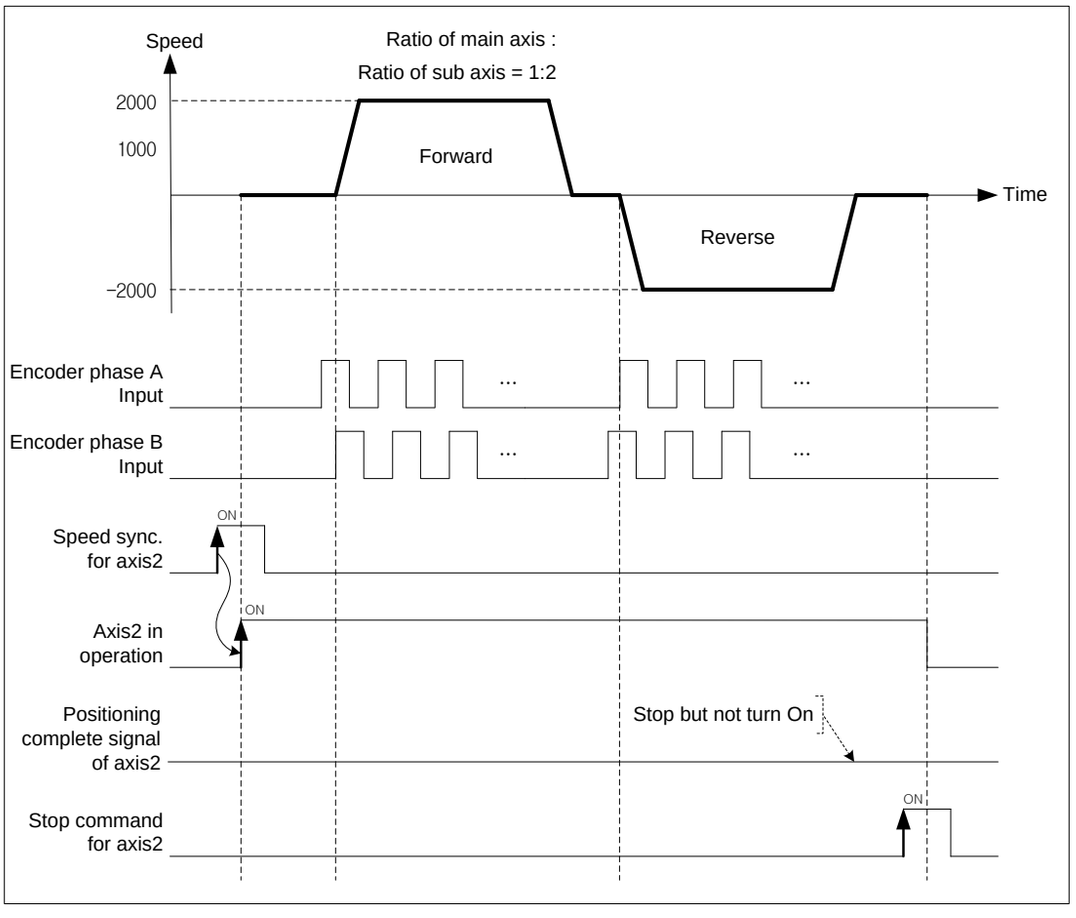
Set parameter related to encoder on common parameter.

Item	Setting Value	Content
Encoder1 Pulse input	0:CW/CCW 1 multiplication 1:PULSE/DIR 1 multiplication 2:PULSE/DIR 2 multiplication 3: PHASE A/B 1 multiplication 4: PHASE A/B 2 multiplication 5: PHASE A/B 4 multiplication	Set the encoder to use in input of encoder
Encoder1 phase Z clear	0: Disable 1: Enable	Set whether to use the phase Z input of encoder 1 as counter clear.
Encoder1 Max. value	-2147483647 ~ 2147483647	Set the count range with max./min. of encoder 1.
Encoder1 Min. value	-2147483647 ~ Encoder 1 Maximum value	

(Ex) Execute speed sync. control with encoder 1 as main axis , axis2 as sub axis and 'the ratio of main axis : sub axis as 1 : 2'.

(The input speed of encoder 1 is 1Kpps)

■ Operation Patterns



(5) Positioning speed sync. control

(a) The basic operation of positioning speed sync. control is similar to speed synchronization. After executing positioning speed sync. command, start and stop are repeated depending on operation of main axis. The operating direction of sub axis and the main's are same.

(b) The operating direction of sub axis depends on the ratio of speed sync.. If it is positive, the direction is forward. If it is negative, the direction is reverse.

(c) If execute speed sync. command, it will be the state of operating and remain in the state of speed sync. operation before release of speed sync. command.

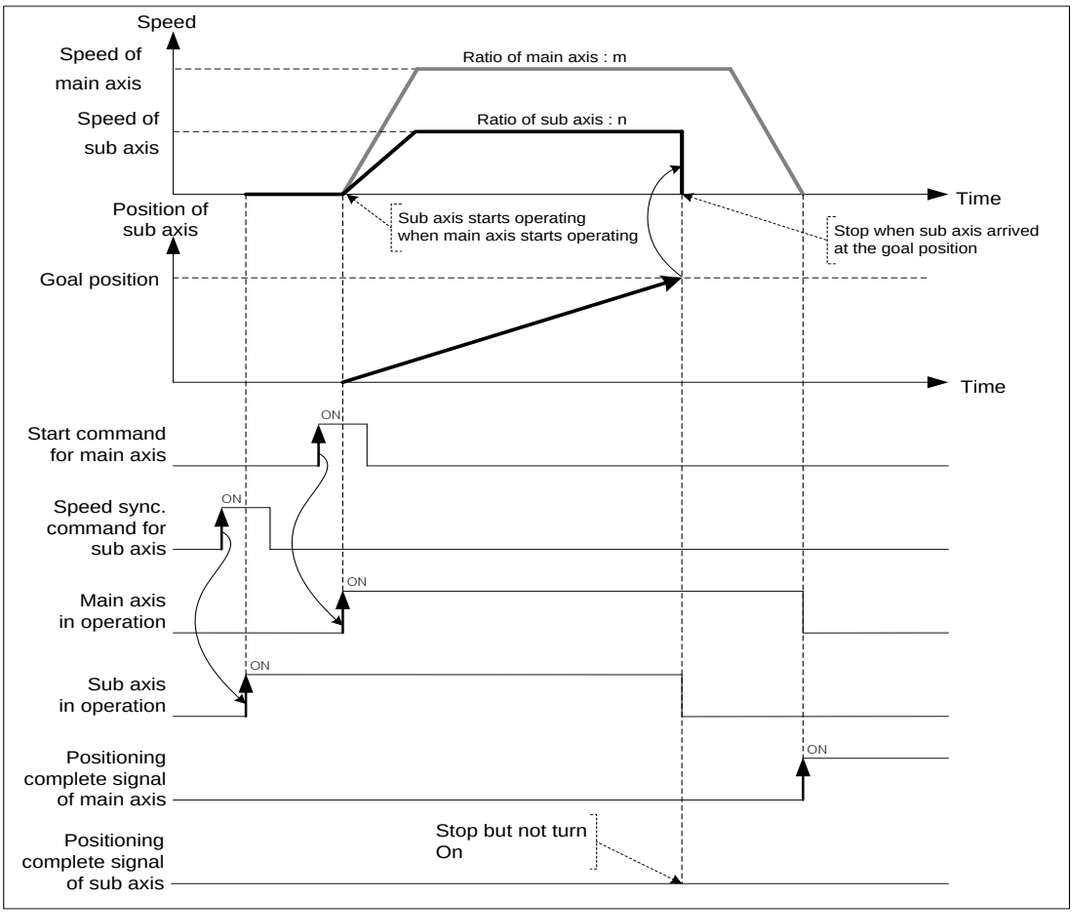
(d) If the current position reaches the target position after the subordinate axis operates, it stops speed sync. and emergency stop at that position. For the details, refer to speed sync. control'.

(e) Auxiliary data of positioning speed sync. command.

The auxiliary data used in speed sync. command is as follows.

Item	Setting Value	Content
Main axis	1(axis 1~ axis 8, 9(encoder)	Set main axis
Main axis ratio	-32768 ~ 32767	Set ratio of main axis
Subordinate axis ratio	-32768 ~ 32767	Set ratio of sub axis
Target position	-2147483648 ~ 2147483647	Set the goal position of positioning speed sync.

(f) Operating Timing



9.4.2 Position Synchronous Control

Start positioning with step no. and operation data when the current position of main axis is same as the position set in position sync.

(1) Control features

(a) Position synchronization command can be executed only when the main axis is in honing status.

(b) The position synchronization command starts in synchronization with the subordinate axis according to the current position of the main axis.

(c) The position synchronization command must be executed on the subordinate axis.

(d) When the position synchronization command is executed, it is in the operating state and the actual operation starts the operation of the subordinate axis when the current position of the main axis matches the set position of the position synchronization.

(e) In case of cancellation after executing the SSP command at the subordinate axis, if you execute the stop command, the SSP command shall be released.

(f) The auxiliary data of position sync. command

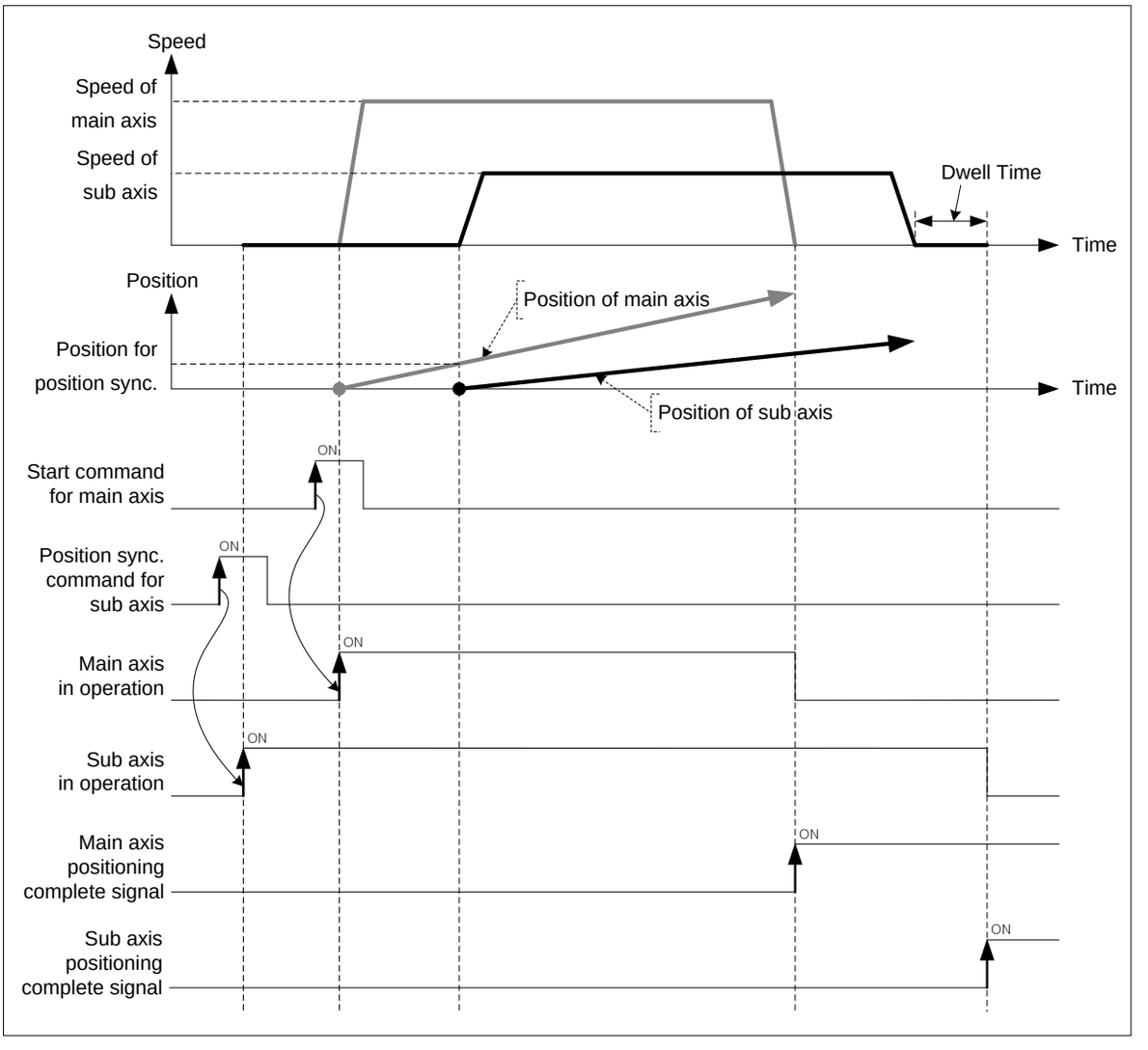
The auxiliary data used in position sync. is as follows.

	Setting Value	Content
Position of position sync.	-2147483648 ~ 2147483647	Set the position of main axis in position sync. control
Operation step	1 ~ 400	Set the step no. to be executed when the main axis arrives at the position for position sync.
Main axis	1(axis 1~ axis 8), 9(encoder)	Set the main axis of position sync.

Notes

Even though the current position of main axis and the setting value set on position sync. are not exactly same, if the current position of main axis is at between the position of main axis of previous scan and the current position of main axis, the sub axis will be executed with the positioning data of step no. set on operation step.

(2) Operating Timing



(3) Restrictions

Position sync. control can be executed in the case below.

(a) If position sync. command is executed in M code signal is On that contain, error (code:343) occurs. Make M code “OFF” with “M code release (XMOF)” command before use.

(b) If the current main axis is not connect to current network or main axis setting and command axis are the same axis, error (code: 355) arises. Set the main axis among the axes currently connected to the network.

[Example] Axis1 is main axis, axis2 is sub axis. The position of main axis for position sync. is 1000, execute position sync. with operation data no.10.

■ Axis1 current position: 0

Axis2 current position: 0

■ Setting of XG-PM

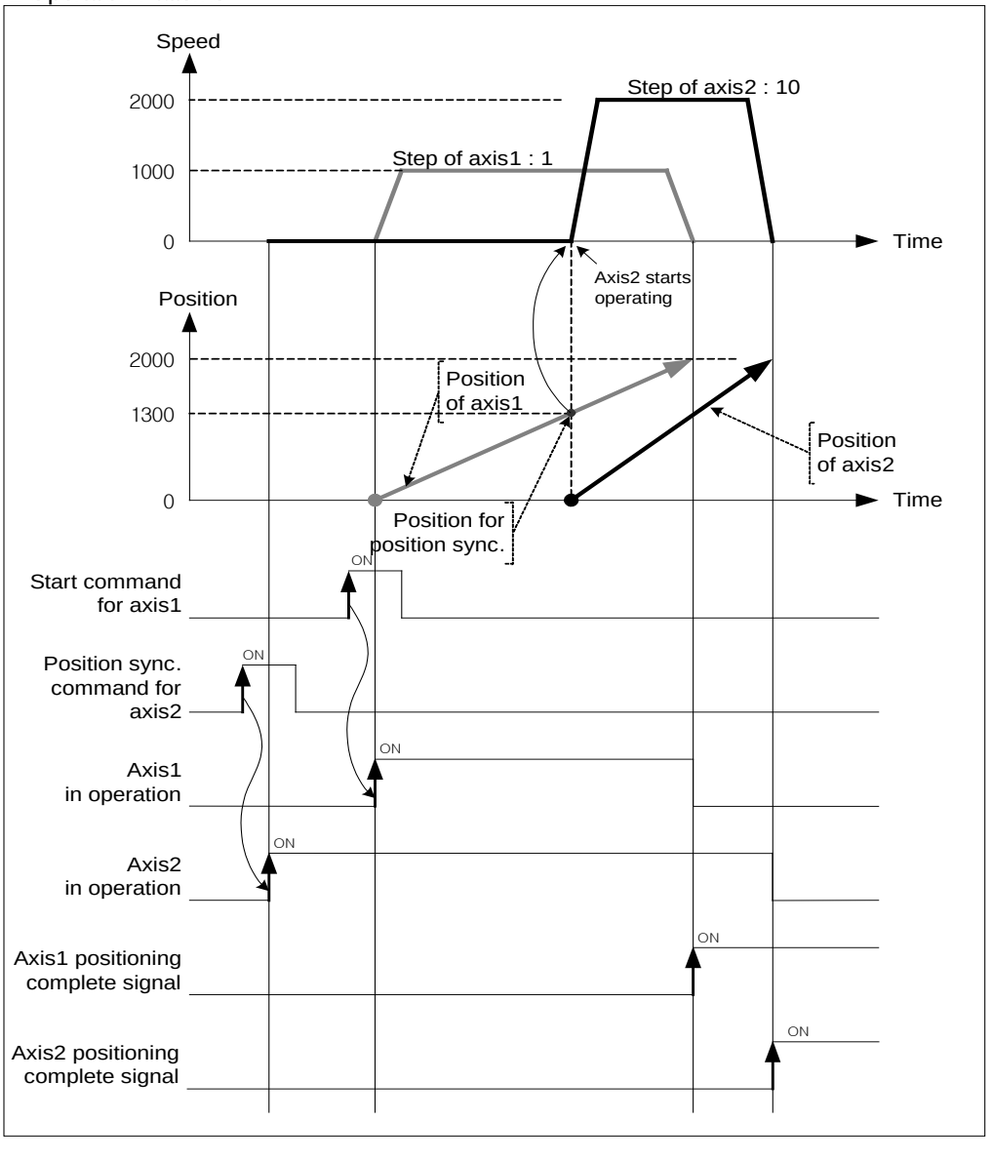
▪ Main axis (axis1) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Incremental, single-axis Position Control	Single,End	2000	1000	No.1	No.1	0	0

▪ Subordinate axis (axis2) operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
10	Incremental, single-axis Position Control	Single,End	2000	2000	No.2	No.2	0	0

■ Operation Patterns

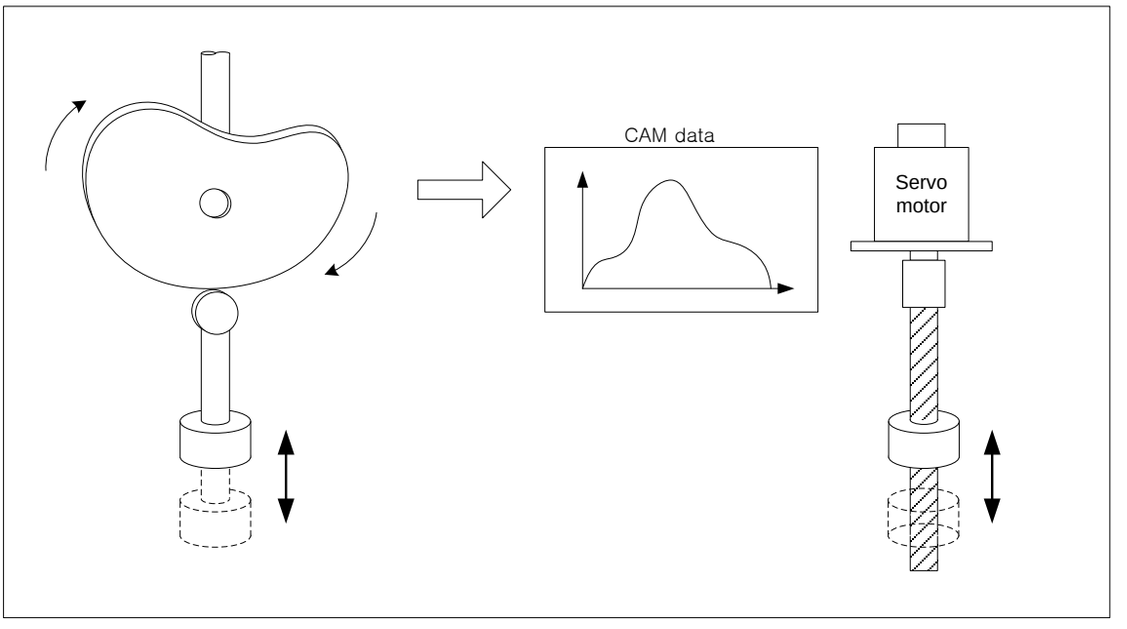


9.4.3 CAM Operation

Cam operation converts mechanical cam motion into cam data represented by cam curves, and executes cam axis control in synchronization with the position of the motor set as the main axis.

(1) Control features

(a) Replace existing mechanical work of CAM with software CAM operation



(b) You may write max. 9 CAM data blocks and apply it to each axis.

(c) Each block consists of 2048 CAM data.

(d) Auxiliary data of CAM command

Item	Setting Value	Content
Main axis	1(axis 1~ axis 8), 9(Encoder 1)	Set the main axis of CAM operation
CAM block	1(No.1)~ 9(No.9)	Set CAM block no.
Main axis offset	-2147483648 ~ 2147483647	Set the position of main-axis position as offset value if main-axis reaches this position, the sub-axis starts CAM operation.

Encoder can not be used as main axis.

You may set different CAM block no. for each axis. In addition, it is possible to execute CAM operation with the same CAM block.In order to use user CAM operation, you have to set CAM block number 9.

(e) In order to use user CAM operation, you have to set up CAM block number as 8. You can make sub-axis start the CAM operation at the specified position of main-axis by setting the 'Main axis offset'.

(f) For using a CAM, you must create CAM data by setting CAM parameter in XG-PM.

(g) After starting CAM operation, the operation of CAM axis (subordinate axis) moves as much as main axis offset position and the output the calculated value as CAM block setting and point unit based on the current value per rotation of main axis. For the detail description refer to '(3) Principle of CAM operation'.

(h) If CAM operation is executed on sub axis, it become 'operating status' and keep executing CAM operation with CAM data according to the position of main axis until stop command.

Notes

When operating CAM with encoder as main axis, Encoder 1 max. /min. Setting value of common parameter should meets the following conditions.

[Encoder 1 max. value – Encoder 1 Min. value] >= [Encoder Max. value pulse input speed(pps) x Control time(s) x 2 x 1.1]

※ The control cycle changes depending on the 'control cycle' setting of common parameter and the number of axes, so refer to '9.5.13 control cycle user setting and control time information'. If the control cycle of the common Parameter is set '0: automatic setting'. The control cycle depending on the number of axes are as follows.

Axis 1~2: 1ms, Axis 3~5: 2ms, Axis 6~8: 3ms

Ex) if the number of axes connected to network is 4 axes and encoder 1 max. pulse input speed is 100 kpps, endoder1 max. value/min value can be set as follows.

[Encoder 1 max. value – Encoder 1 min. value] = 100000 x 0.002 x 2 x 1.1 = 440

- Encoder1 Max. value: 440
- Encoder1 min. value: 0

(2) CAM Parameter

The table below describes the parameter items for writing CAM data.

Item		Setting range	Content
Main/Sub axis parameter	Unit	pulse, mm, inch, degree	Set unit of main/sub axis
	Transfer distance per 1 rotation	Depending on Unit	Set the transfer distance per 1 rotation of main/sub axis.
	Pulse number /revolution	1 ~ 200000000	Set no. of pulse of main/sub axis per 1 rotation
CAM control mode	Control method	Repeat, Increase	Set CAM control method
	Point unit	1~ Number of pulses per rotation	Set the resolution ability of CAM data
CAM block data	Starting position of main axis	Depending on Unit	Set the CAM position of sub axis corresponding to main axis
	Ending position of main axis		
	Starting position of sub axis		
	Ending position of sub axis		
	CAM curve	Straight Line ~ 7th curve	Set the curve of each CAM data step

(a) Main/Sub parameter setting

1) Unit

Set the control unit of main/sub axis. Set the same as the value already set on“Unit” of basic parameter.

Item	Setting range	Note
Unit of main axis	pulse, mm, inch, degree	-
Unit of sub axis	pulse, mm, inch	Degree may not be used.

2) Transfer distance per 1 rotation

Set the transfer distance per 1 rotation of main/sub axis. The unit of transfer distance is according to 1).
If the unit is “mm” or “inch, the value is the maximum last position of main/sub axis.
Transfer distance per 1 rotation is depending on unit.

■ Setting range for transfer distance per 1 rotation

Unit	Setting range	Note
pulse	-	No need to set
mm	0.1 ~ 20000000.0 um	The maximum last position of main/sub axis
inch	0.00001 ~ 2000.00000 inch	The maximum last position of main/sub axis
degree	Fixed to 360.00000	No need to set The maximum last position of main/sub axis

3) No. of pulse per 1 rotation

Set no. of pulse of main/sub axis per 1 rotation
If the unit is“pulse”, the value is the maximum last position of main/sub axis

(b) CAM control mode setting

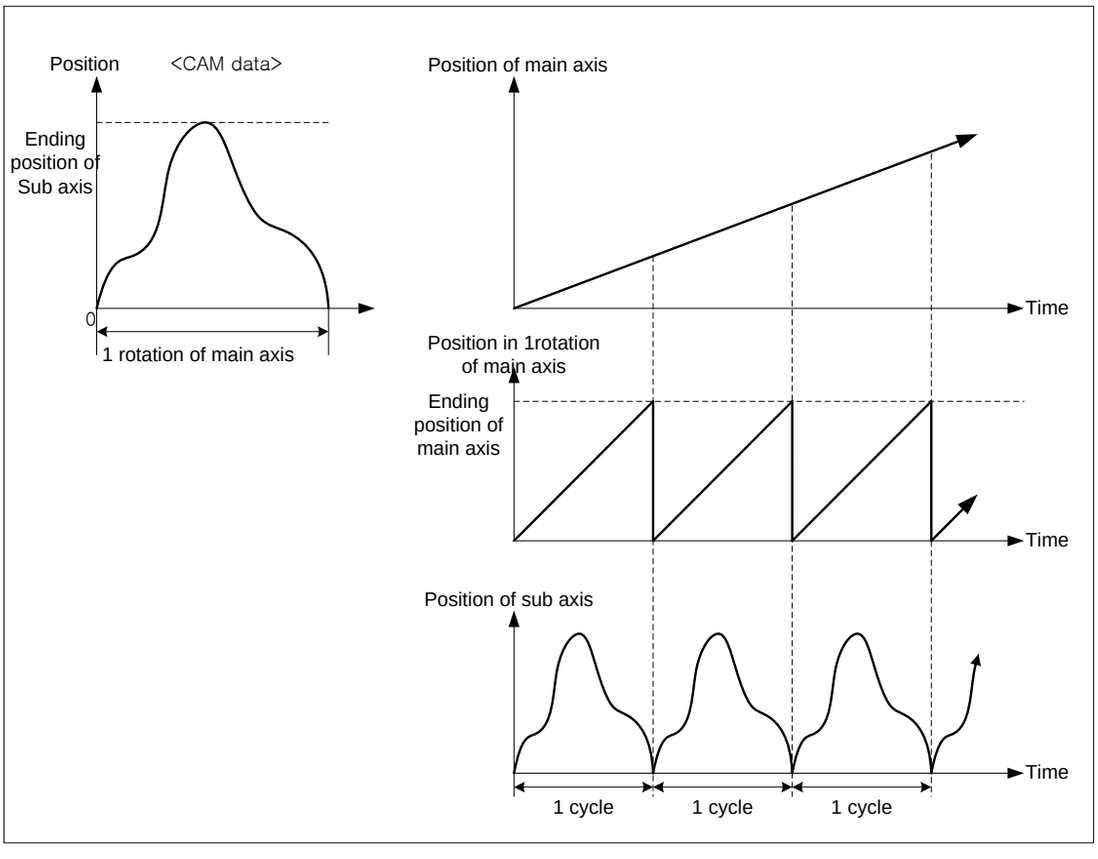
1) Control method

Set the form of CAM repeat pattern. Set by Two-way mode and FEED mode

▪ Two-way mode

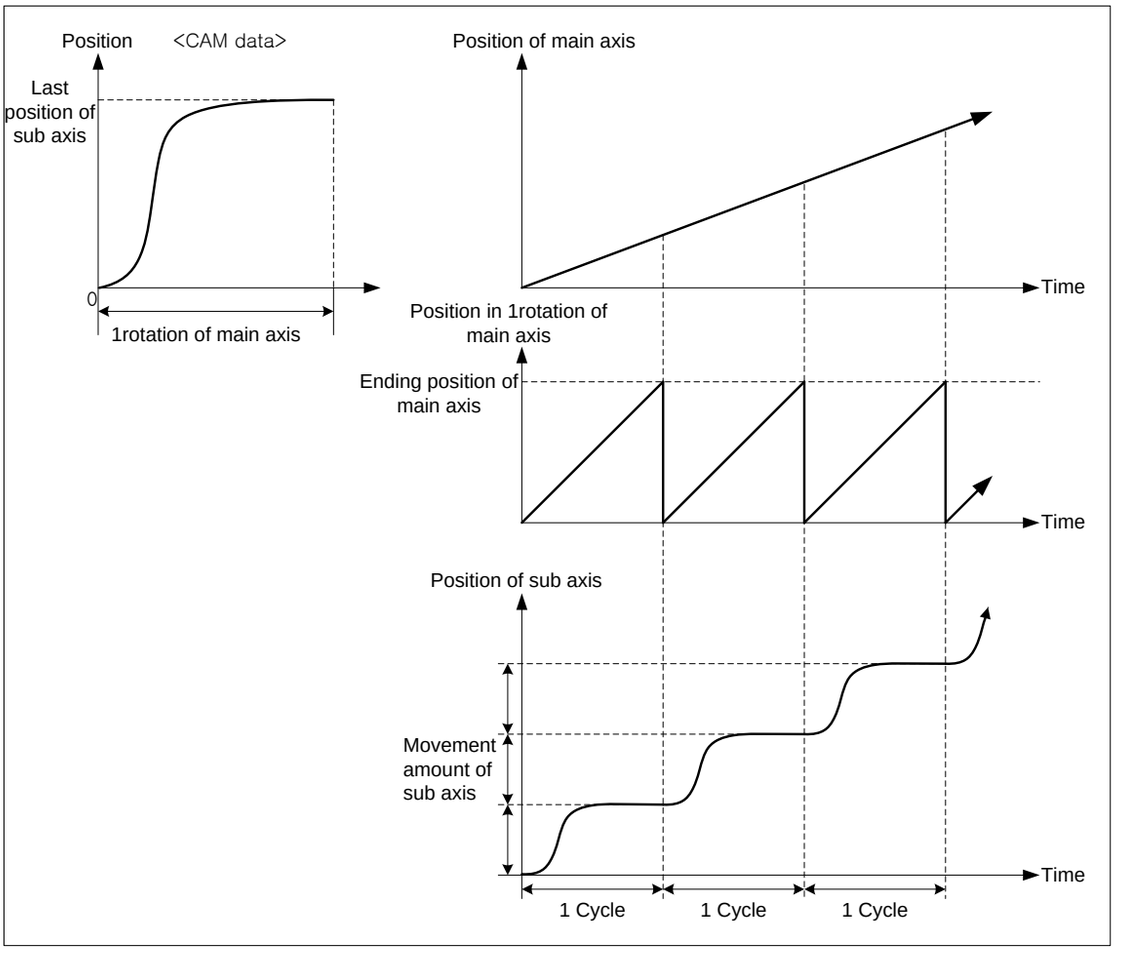
Execute round-trip motion repeatedly in the range already set from starting position of sub axis to ending position according to the position of main axis in 1 rotation.

When CAM data is created in repeat, the ending position of the last step of sub axis user last Setting items must be set as 0.



▪ FEED mode

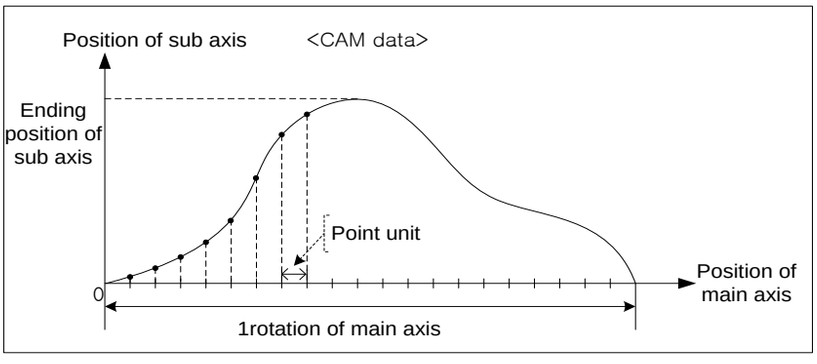
Execute CAM operation from starting position of sub axis to ending position according to the position in 1rotation of main axis.



2) Point unit

Set the resolution ranging from starting position of main axis to ending position of main axis on each step data of CAM block data setting. When CAM data is created, calculate the position of sub axis corresponding to the position of main axis from the starting position of main axis by point unit. The smaller point unit is, the more no. of CAM data is, so you may execute much smoother CAM operation.

If point unit is small, no. of CAM data exceeds 2048, so there is a chance that user can not create CAM data.



Notes

When set CAM block data after point unit setting, 'Ending position of main axis' must be set as positive multiple number of point unit. For example, if the unit of main axis is 'degree' and point unit is 10, 'Ending position of main axis' must be set as multiple number of 10 like 40, 90, 180, ···.

(c) CAM block data setting

Set the 20 data ranges in one CAM block. Each section can be assigned its own characteristic curve.

1) Starting position of main axis

Set the starting position of main axis in designated section. Starting position of main axis is the same as the ending position of main axis in previous section.

2) Ending position of main axis

Set ending position of main axis in designated section. The ending position of main axis in the last section must be set as much as the transfer distance per 1rotation set on main/sub axis parameter.

3) Starting position of sub axis

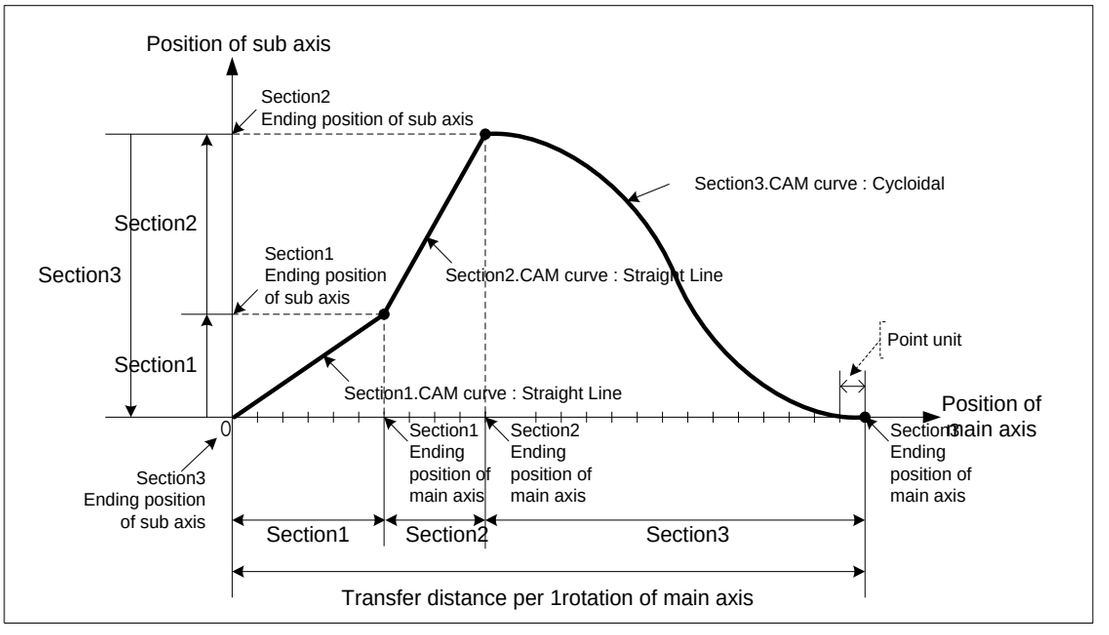
Set the starting position of sub axis corresponding to the starting position of main axis in the designated section. Starting position of sub axis is the same as the ending position of sub axis in previous section.

4) Ending position of sub axis

Set ending position of sub axis corresponding to the ending position of main axis in the designated section. If control method is “Repeat (Two-way mode), the ending position of sub axis in the last section must be 0. If control method is“Increase (FEED mode” the ending position of sub axis in the last section generally has to be set as much as the transfer distance per 1rotation set on main/sub axis parameter.

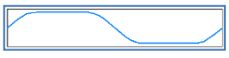
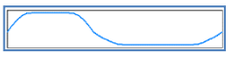
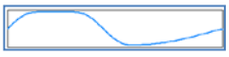
5) CAM curve

Set CAM specific curve to create data ranging from starting position of sub axis to ending position of sub axis in the designated section. The position of sub axis is calculated by characteristic of selected CAM curve, the position of main axis increase by point unit at the same time.



There are 22 kinds of CAM curve.
Describe characteristic of each CAM curve on next page.

■ Characteristic of CAM curve

Name	Acceleration type	Position(S_{max})	Speed(V_{max})	Acceleration(A_{max})	Jerk(J_{max})
Straight Line		1.00000	0.00000	0.00000	0.00000
Constant Acceleration		1.00000	2.00000	4.00000	0.00000
Simple Harmonic		1.00000	1.57076	4.93409	2.46735
No-Dwell Simple Harmonic		1.00000	1.57076	4.93409	2.46735
Double Harmonic		1.00000	2.04047	5.55125	0.10285
Reverse Double Harmonic		1.00000	2.04048	9.86605	4.93455
No-Dwell Modified Constant Velocity		1.00000	1.22203	7.67383	3.83881
Modified Constant Velocity		1.00000	1.27526	8.00947	0.98712
No-Dwell Modified Trapezoid		1.00000	1.71788	4.19885	2.09942
One-Dwell Modified Trapezoid		1.00000	1.91589	4.43866	55.77788
Modified Trapezoid		1.00000	1.99975	4.88812	0.30562
Asymmetrical Modified Trapezoid		1.00000	1.99982	6.11015	0.47620
One-Dwell Cycloidal		1.00000	1.75953	5.52756	0.17345
Cycloidal		1.00000	1.99985	6.28273	0.19715
Asymmetrical Cycloidal		1.00000	1.99989	7.85304	0.30783
One-Dwell Trapecloid		1.00000	1.73636	4.91007	0.30699
Reverse Trapecloid		1.00000	2.18193	6.16975	0.38579
Trapecloid		1.00000	2.18193	6.17044	0.38579
One-Dwell Modified Sine		1.00000	1.65978	5.21368	0.32603
Modified Sine		1.00000	1.75953	5.52697	0.34562
5th Curve		1.00000	1.87500	5.77350	60.00000
7th Curve		1.00000	2.18750	7.51283	41.99646

(3) Principle of CAM operation

(a) When a CAM operation command is executed, the current position of main axis (「current position + main axis offset」position if the main axis offset is not"0") is recognized as "0", which is "current position within main axis 1 rotation of virtual axis.

(b) When the main axis starts operating, 'the current position in 1rotation of main axis' increase to 'no. of pulse per 1rotation (-1)' then become 0. It repeats with the position value of 0 ~ "Number of pulses per revolution-1".

(c) Calculate CAM data step no. corresponding to 'the current position per 1rotation' with 'point unit" of CAM parameter".

$$\text{Cam Data Step no.} = \frac{\text{Current Positio per 1rotation of Main Axis}}{\text{Point Unit}}$$

For example, if the position of main axis at the beginning of CAM operation is 1000, the current position is 10 73 and point unit is 10, the step no. of CAM data is as follows.

$$\text{Cam Data Step no.} = \frac{\text{Current Positio per 1rotation of Main Axis}}{\text{Point Unit}}$$

$$= \frac{1073 - 1000}{10}$$

$$= 7.3$$

(d) Calculate update position of sub axis with CAM data step. If main axis is forward direction, calculate the position of sub axis with the position corresponding to 'the part of positive number of CAM data step no.' and the position corresponding to 'the part of positive number of CAM data step no. +1].

Position of sub axis
= {(Step position of CAM data +1) – (Step position of CAM data)} x Decimal part of CAM data step no.
+ (Step position of CAM data)

For example, if position value of sub axis of step 7 is 395 and step 8's is 475, the position of sub axis is as follows.

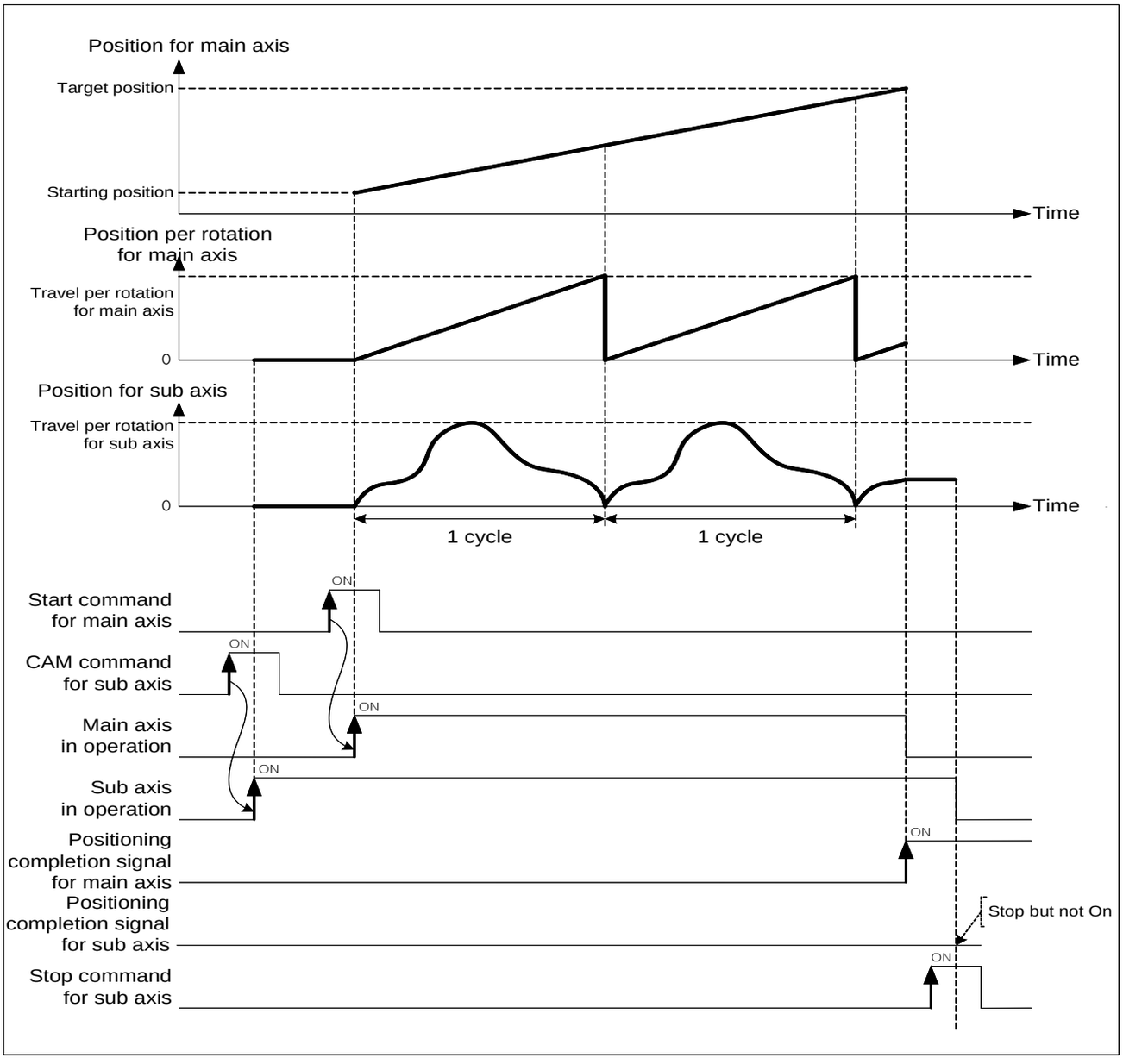
$$\text{Position of sub axis} = 395 + (475 - 395) \times 0.3$$

$$= 395 + 24$$

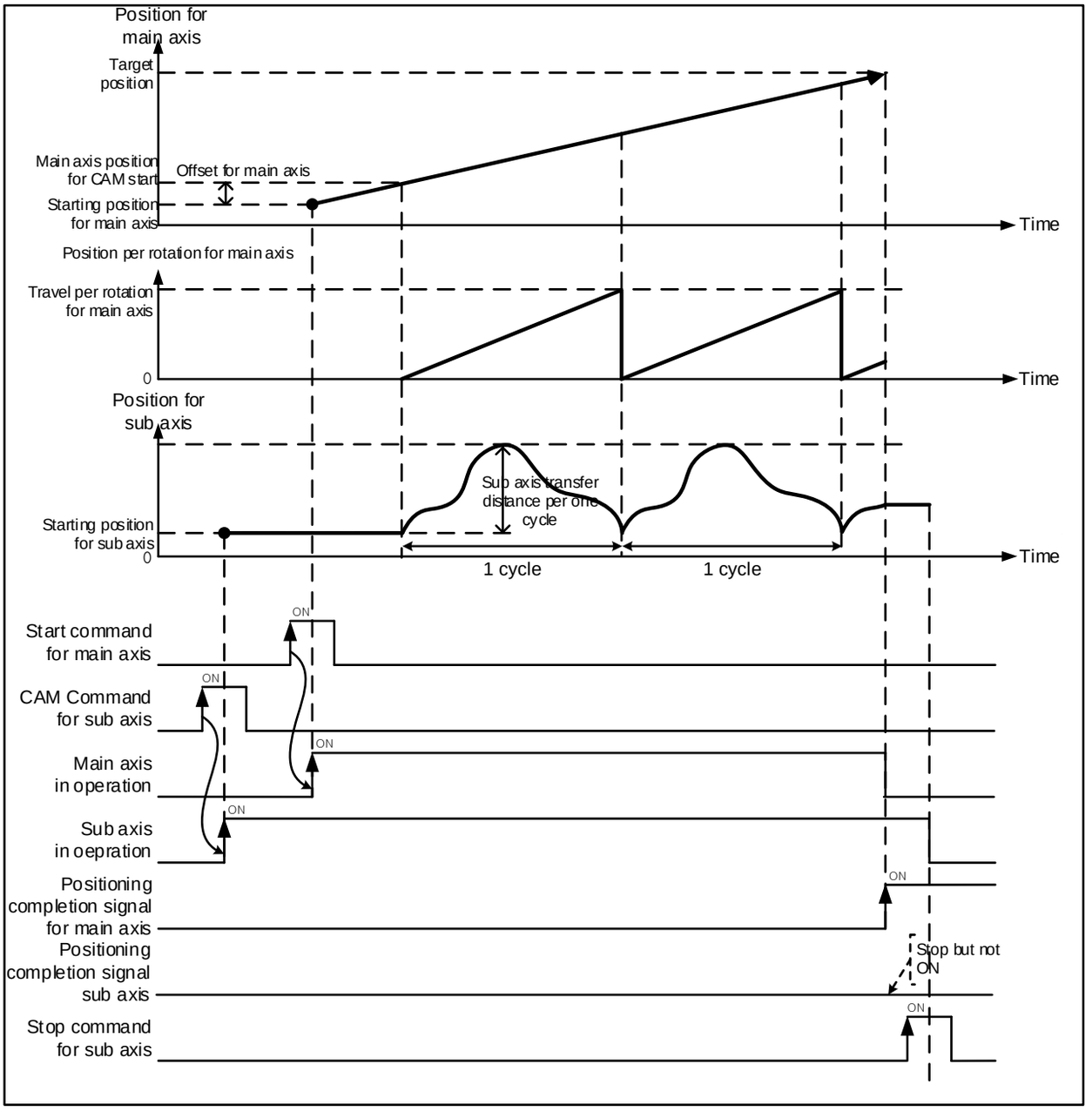
$$= 419$$

(4) Operating Timing

(a) General CAM command



(b)Master axis offset designated CAM command



(5) Restrictions

CAM operation command may not be executed in the cases below.

(a) If execute CAM operation command in being On of M code, error (code: 702) arises. Make M code “OFF” with “M code release (XMOF)” command before use.

(b) If the current main axis is not connect to current network or main axis setting and command axis are the same axis, error (code: 704) arises. Set the main axis among the axes currently connected to the network.

(c) If speed of main axis is too fast and speed of sub axis exceeds speed limit, error (code: 708) arises. In the case, the speed of main axis must operates to lower so that the speed of subordinate do not exceed the speed limit. In the case that the speed of main axis exceeds the speed limit, error arises and it decelerate in deceleration time 1.

(6) Additional functions of CAM operation

The following are additional function related to CAM operation.

(a) When stopping the CAM operation, the function to stop after finishing CAM cycle which executes test operation.

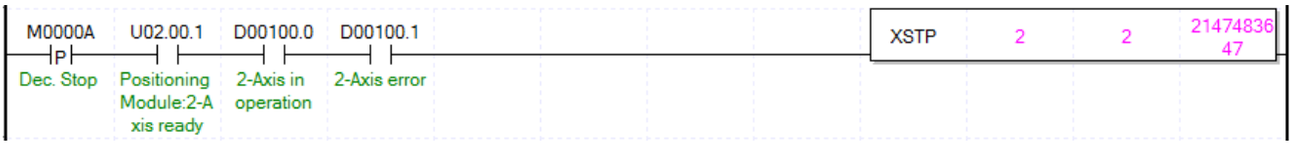
1) Formatting Procedure

If the deceleration stop of deceleration stop (XSTP) command set in 2,147,483,467 and executes deceleration stop command during current operating, it will stop at the end of current operating CAM cycle.

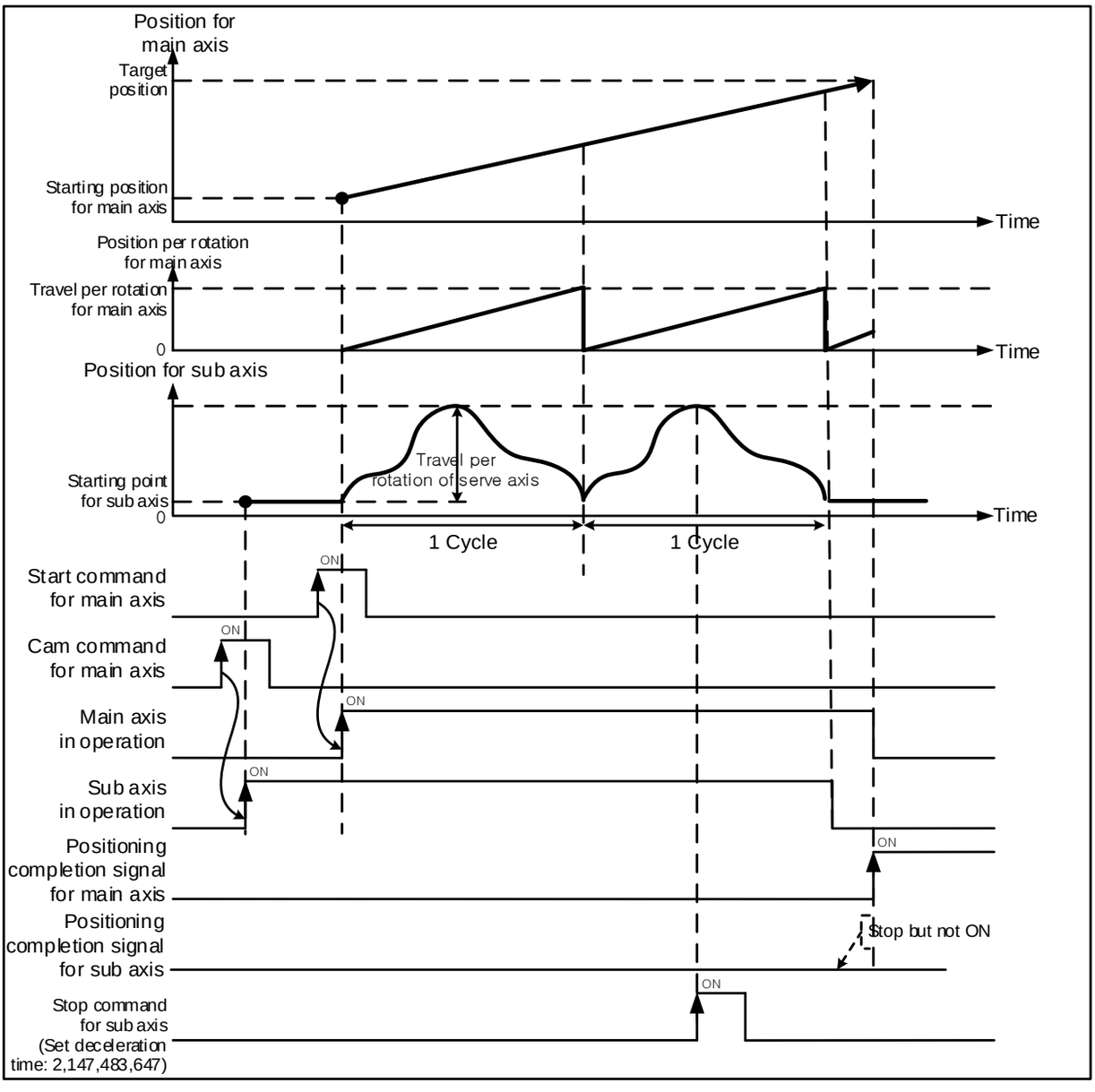
2) Example of program

a) For XGK

■ Position module mounting slot: slot 2 of base 0, CAM operation axis: axis 2, deceleration stop time: 2,147,483,647



It was written assuming that the status information of axis 2 was saved in the D00100 device using the XSRD command.



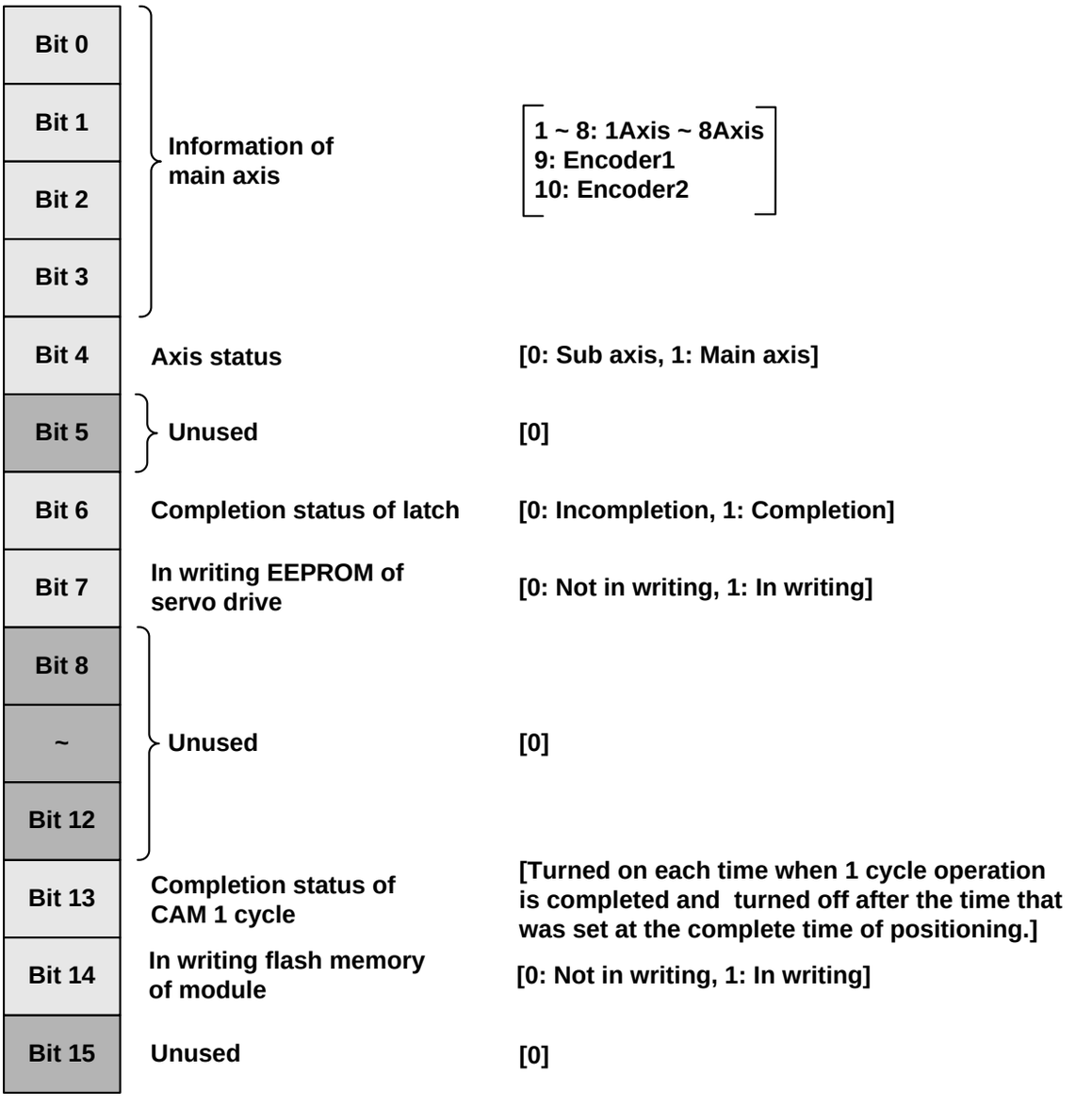
(b) CAM cycle flag

The CAM cycle flag is on whenever 1 cycle of CAM operation is completed and then is off after the time set in the position completion time has passed.

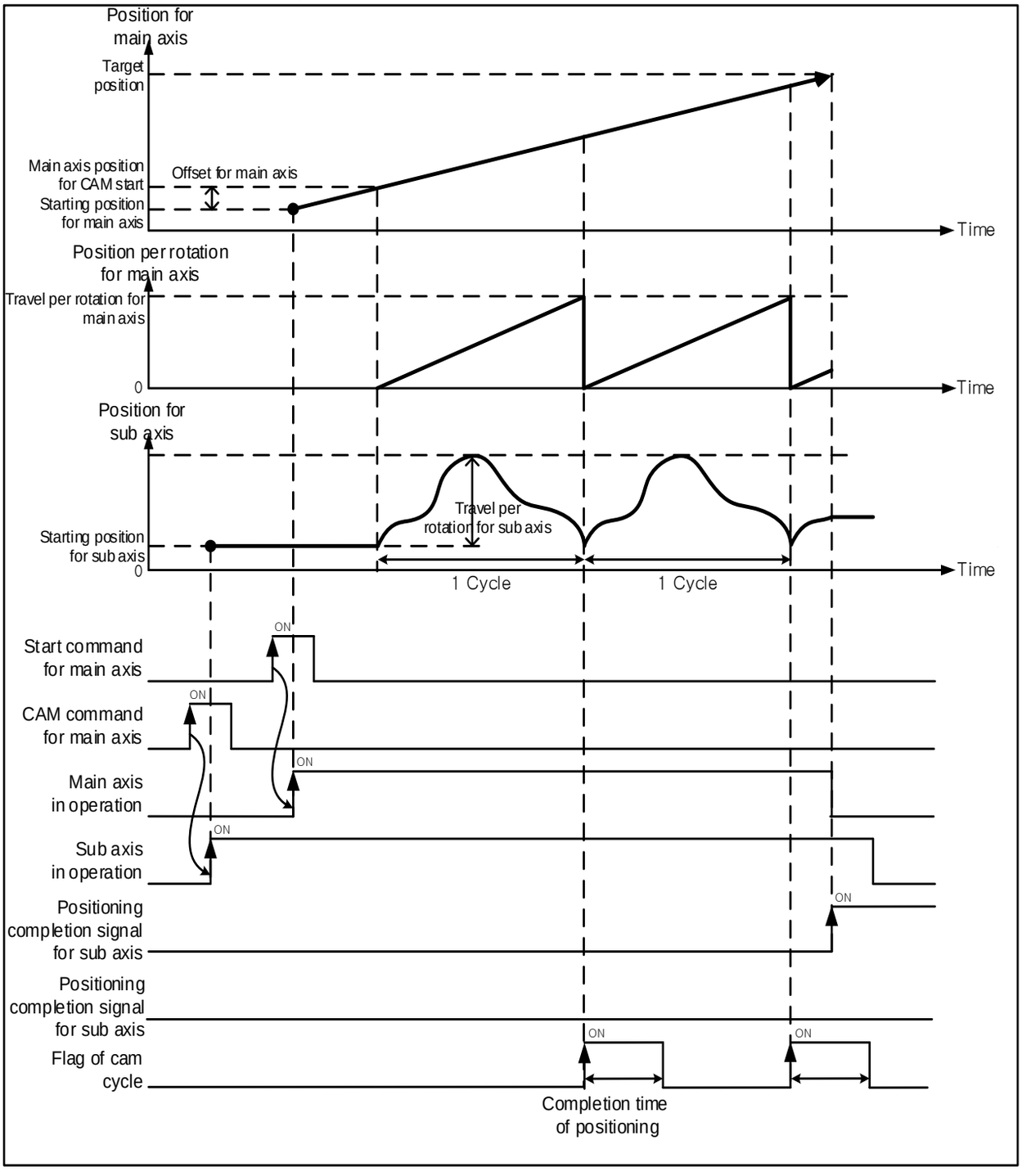
The CAM cycle flag can read and monitor the axis information area using the operation status read (XSRD) command or GET command.

1) Axis Information

Memory address								Content
Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	
2C2	342	3C2	442	4C2	542	5C2	642	Axis information



2) CAM cycle flag operation timing



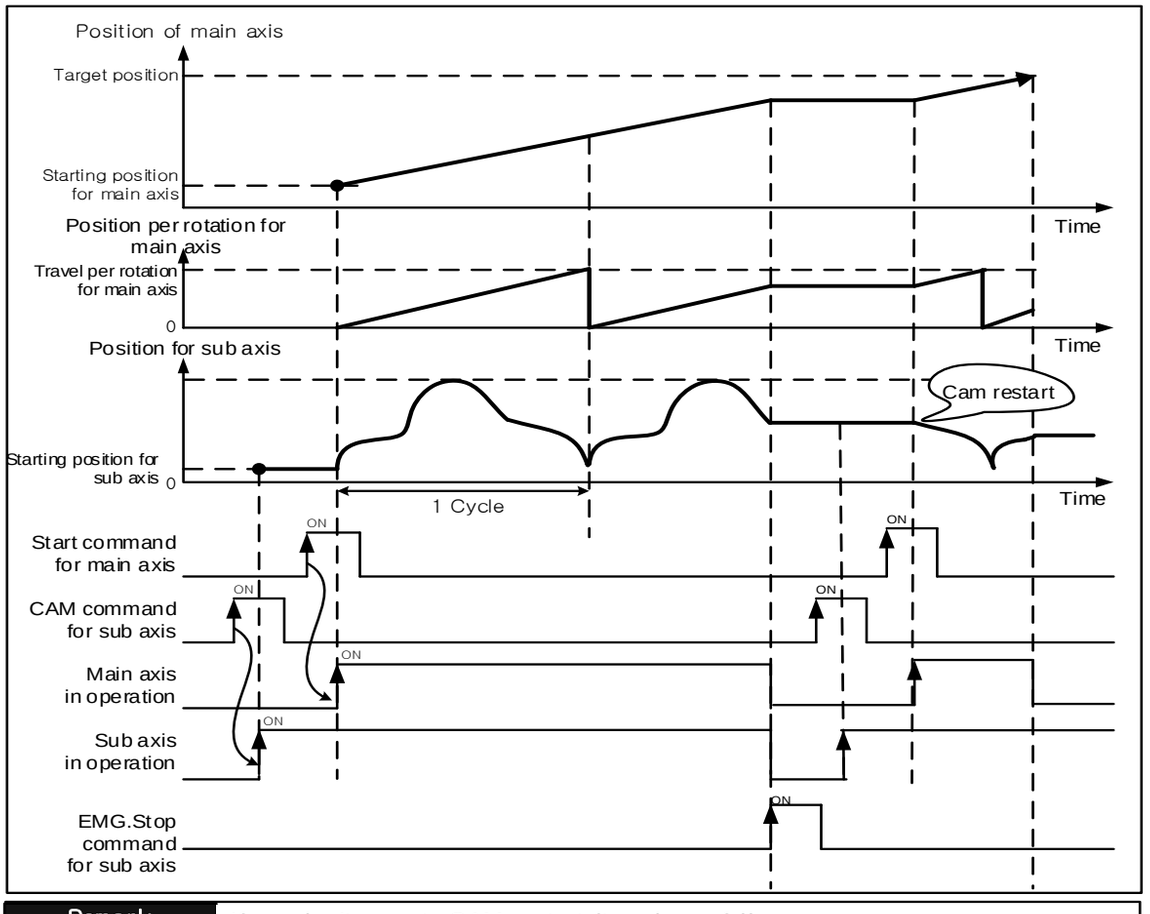
Notes

The time when CAM cycle flag keeps on status apples the time set in “positioning completion time” of extended parameter.

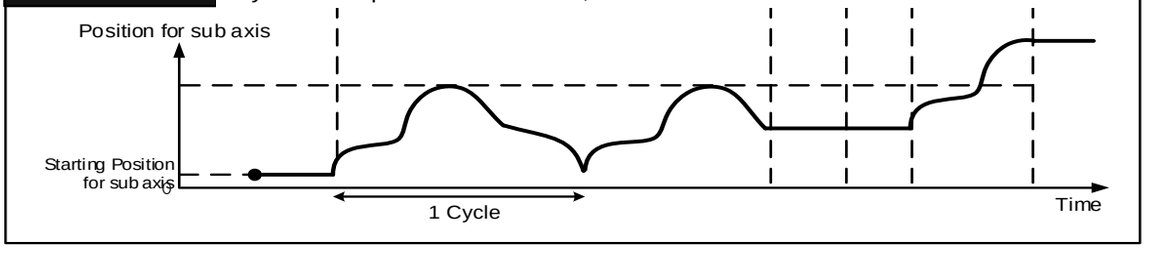
(c) Cam restart function

If the main axis/subordinate axis stop the operation due to error or abnormal operation during CAM operation, this function restart the subordinate axis by continuing the previous CAM operation when CAM operation is started again at the stopped position,

1) Execution condition
   a) The CAM restart operation item of extended parameter should be set to “1: enable.
   b) If CAM operation axis is stopped by abnormal operation such as error, the emergency stop, it executes CAM restart when executing CAM operation again.
   c) If the CAM Operation axis is stopped by abnormal operation and then changed to Homing/Floating origin setting/Current position preset/Undecided homing status, CAM restart operation is not executed even if the Cam operation command is executed again.
   d) If the CAM operation is stooped by decelerating stop of subordinate axis and then CAM Operation command is executed, it do not the restart operation.
   e) If the main axis is encoder, since the position change of encoder is not reflected to synchronous position movement of subordinate axis after restart, so be careful that the encoder axis is not move.
2) CAM restart operation timing



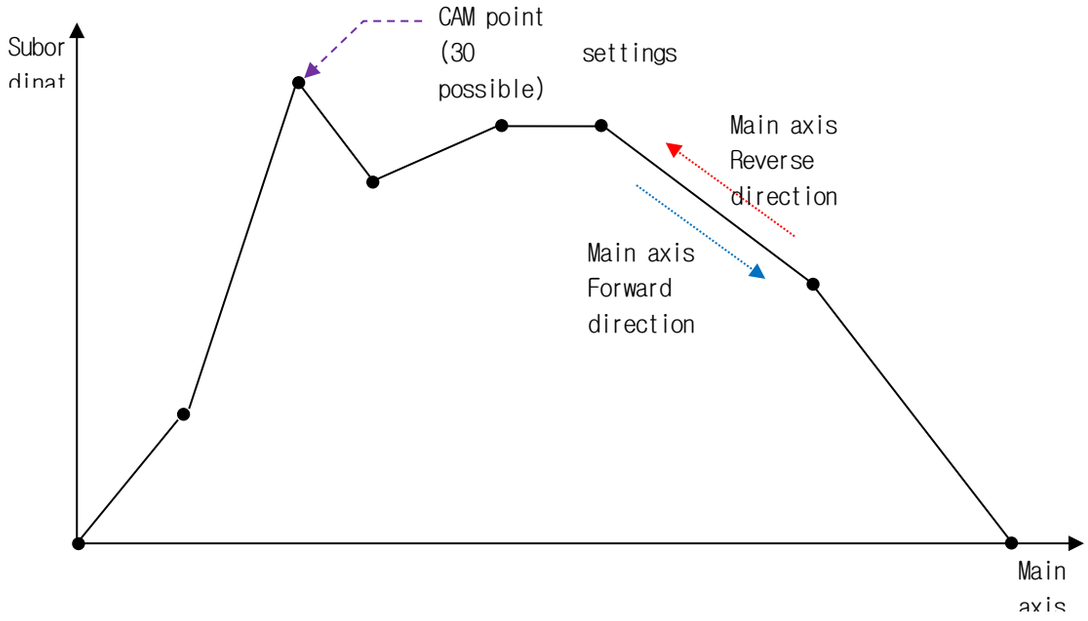
Remark If you don't operate CAM restart, it works as follows.



9.4.4 User CAM Operation

User CAM operation, like CAM operation, executes CAM axis control in which CAM data shown as CAM curve synchronized position of the motor set as main axis. The differences from CAM operation is that the user not sets the CAM data in XG-PM, but set the CAM data in XG5000 and the number of CAM is 30.

(1) Operation



As shown in the picture above, up to 30 CAM data points can be set and CAM curve between each CAM points operates in a Straight Line. CAM points data is set up at sub-axis and as type of (main-axis position, sub-axis position).

CAM Data data point can be saved at the specified memory address of each axis by using Write Variable Data' (XVWR, XPM_XVWR) command.

For memory address to save CAM data point of each axis, refer to Appendix 2.11 User Cam Data data memory address.

Notes

Change of User CAM data is available when the User CAM is operating. The time when the changed user cam data is reflected is after one cycle of the currently operating user cam data is completed.
It can be used in applications where the CAM pattern needs to be changed and operated without stopping during user CAM operation.

9.4.5 Phase Compensation Control

The phase compensation control is function to execute phase compensation to main axis in operating synchronous control. This command executes synchronous operation for the position of the main axis synchronized with the subordinate axis during synchronous control operation and the position of the main axis moved by virtual position movement (phase correction).

(1) Control features

(a) Phase compensation command can be executed with respect to the axes where synchronized operation is underway as in speed synchronization or CAM control.

(b) Even if the phase compensation command is executed, the command position and the current position of the main axis are not changed, and the phase value is executed by correcting the main axis position value that the subordinate axis refers to in synchronous control operation.

(c) The main axis position referenced by the subordinate axis during synchronous operation is “actual main axis position + phase compensation control position”.

(d) The phase compensation speed operates at a speed relative to the speed at which the current main axis is running.

(e) It executes Trapezoid operation or S-curve operation depending on acceleration/deceleration pattern of main axis.

(f) When the main axis is an encoder, it operates using the speed limit value and acceleration/deceleration pattern of the subordinate axis when executing phase compensation control.

(g) If the command is executed again during the phase compensation operation, phase compensation is executed again by the amount of phase compensation at that point. In other words, the phase compensation operates additionally with relative values

(h) When re-executing with the phase compensation amount set to 0 during the compensation operation, the existing phase compensation operation is immediately stopped.

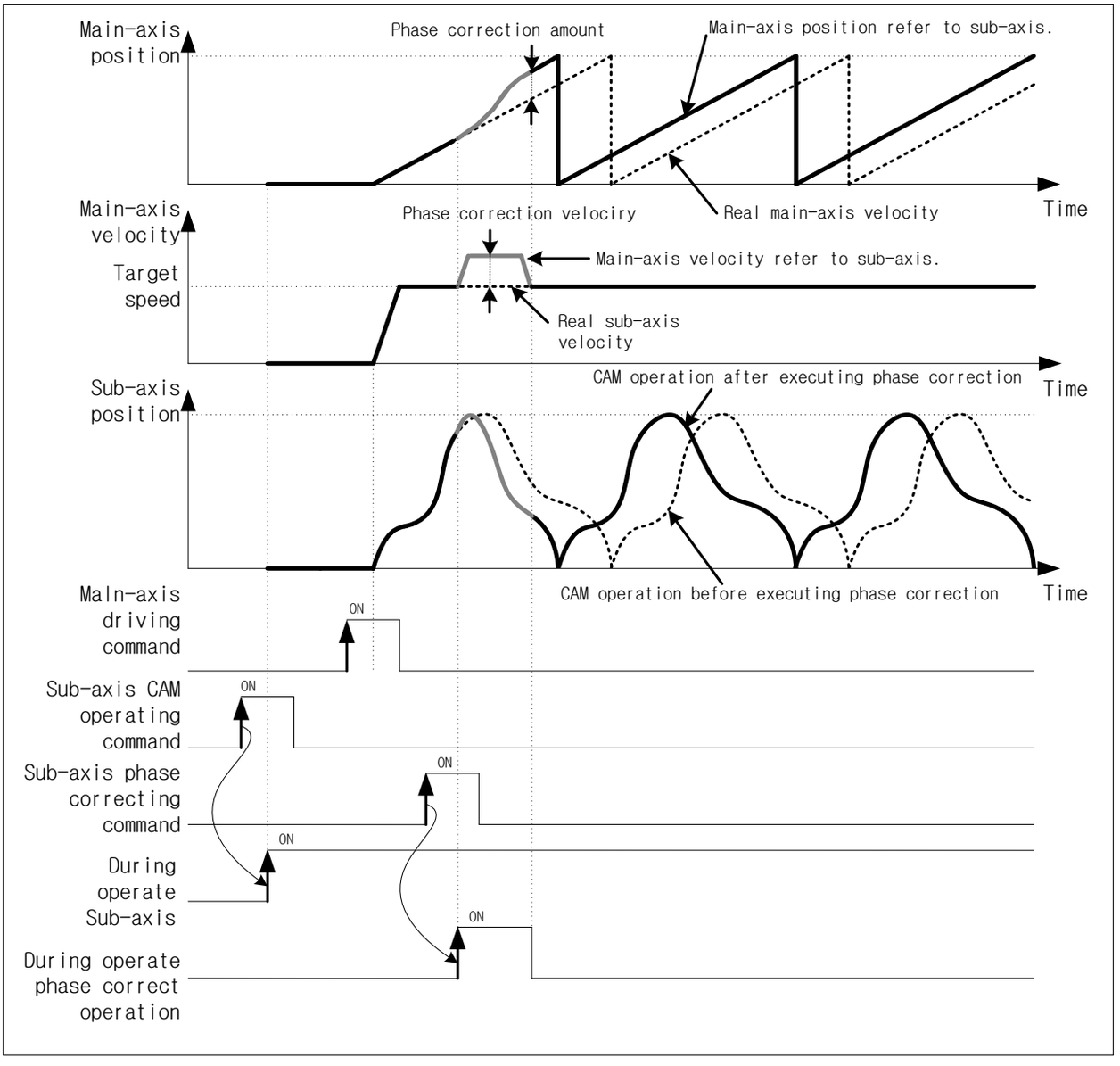
(The status during the phase correction operation of status information is also turned off.)

(i) The auxiliary data of phase compensation command

The auxiliary data used in phase compensation command is as follows.

Item	Setting Value	Content
Main axis	1(axis 1~ axis 8), 9(encoder)	Set the main axis if phase compensation control.
Phase compensation	-2,147,483,648 ~ 2,147,483,647	Set the position compensation amount to execute phase compensation.
Phase compensation speed	0 ~ 2,147,483,647	Set the target speed as relative speed to the main axis speed.
Accel. time	0 ~ 2,147,483,647 ms	Set the accel. time to speed limit of main axis.
deceleration time	0 ~ 2,147,483,647 ms	Set the decel. time to speed limit of main axis.

(2) Operating Timing



(3) Restrictions

Phase compensation control can be executed in the case below.

(a) If the phase compensation command is executed while the subordinate axis is not in synchronous control (speed synchronization, cam) operation, an error (771) occurs.

(b) If the main axis setting is not the main axis of the axis in actual synchronous operation, an error (772) occurs.

(c) If the phase compensation amount of the phase compensation command is set outside the pulse unit position expression range (-2,147,483,648 to 2,147,483,647), an error (773) occurs.

(d) An error (774) occurs when the speed setting value of the phase compensation command is less than or equal to or greater than the speed limit value.

(e) If the acceleration time setting value of the phase compensation command is outside the setting range (0 to 2,147,483,647 ms), an error (775) occurs.

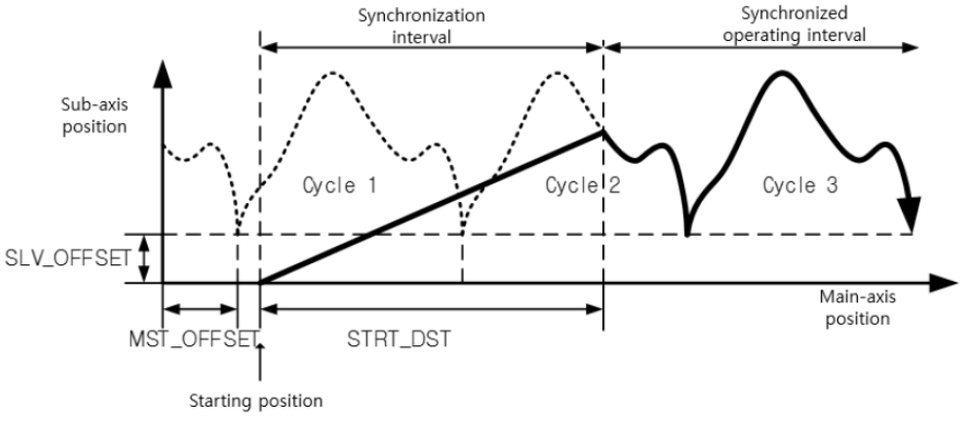
(f) If the deceleration time setting value of the phase compensation command is outside the setting range (0 to 2,147,483,647 ms), an error (776) occurs.

9.4.6 Absolute Position CAM Operation

Absolute position CAM operation executes CAM operation synchronized with absolute position of main axis.

(1) Control features

When the absolute position cam operation command (XCAMA, XPM_CAMA) is executed and the main axis starts operation, the operation is executed to the synchronous position until the main axis reaches the distance set in STRT_DST. The synchronous position is the position of the subordinate axis according to the cam data value set in the cam block from the position when the main axis moves as much as STRT_DST. The synchronous position of the subordinate axis can be moved by SLV_OFFSET and MST_OFFSET values. When the main axis reaches the distance set in STRT_DST, Depending cam operation is performed with the cam data value set in the cam block.



(2) Absolute position CAM parameter

Item	Setting Value	Content
Main axis	1(axis 1~ axis 8), 9(Encoder 1)	Set the main axis of CAM operation
CAM block	1(No.1)~ 9(n0.9)	Set CAM block no.
Start distance	-2147483648 ~ 2147483647	Set the start position of absolute position CAM operation.
Main axis offset	-2147483648 ~ 2147483647	Set the position of main-axis position as offset value if main-axis reaches this position, the sub-axis starts CAM operation.
Subordinate axis offset	-2147483648 ~ 2147483647	Set the main axis position that the subordinate axis starts the CAM operation as offset value of subordinate axis.

(a) Encoder can be used as main axis of absolute position CAM run.

(b) Set different CAM block no. for each axis. In addition, it is possible to execute CAM operation with the same CAM block. In order to use user CAM operation, you have to set CAM block number 9.

(c) By setting the start distance (STRT_DST), the position of the main axis where cam synchronization starts when the cam command is executed can be changed. If the starting distance is set to a small value, a shock may occur because subordinate axis operates rapidly during executing absolute position CAM operation.

(d) By setting the main axis offset and sub axis offset, change the position where the sub axis starts cam operation.

(3) Restrictions

Absolute position CAM operation command may not be executed in the cases below.

(a) If execute CAM operation command in being On of M code, error (code: 702) arises. Make M code “OFF” with “M code release (XMOF)” command before use.

(b) If the current main axis is not connect to current network or main axis setting and command axis are the same axis, error (code: 704) arises. Set the main axis among the axes currently connected to the network.

(c) If speed of main axis is too fast and speed of sub axis exceeds speed limit, error (code: 708) arises. In the case, the speed of main axis must operates to lower so that the speed of subordinate do not exceed the speed limit. In the case that the speed of main axis exceeds the speed limit, error arises and it decelerate in decel. time 1.

9.4.7 Synchronous Position Specified Speed Synchronization Operation

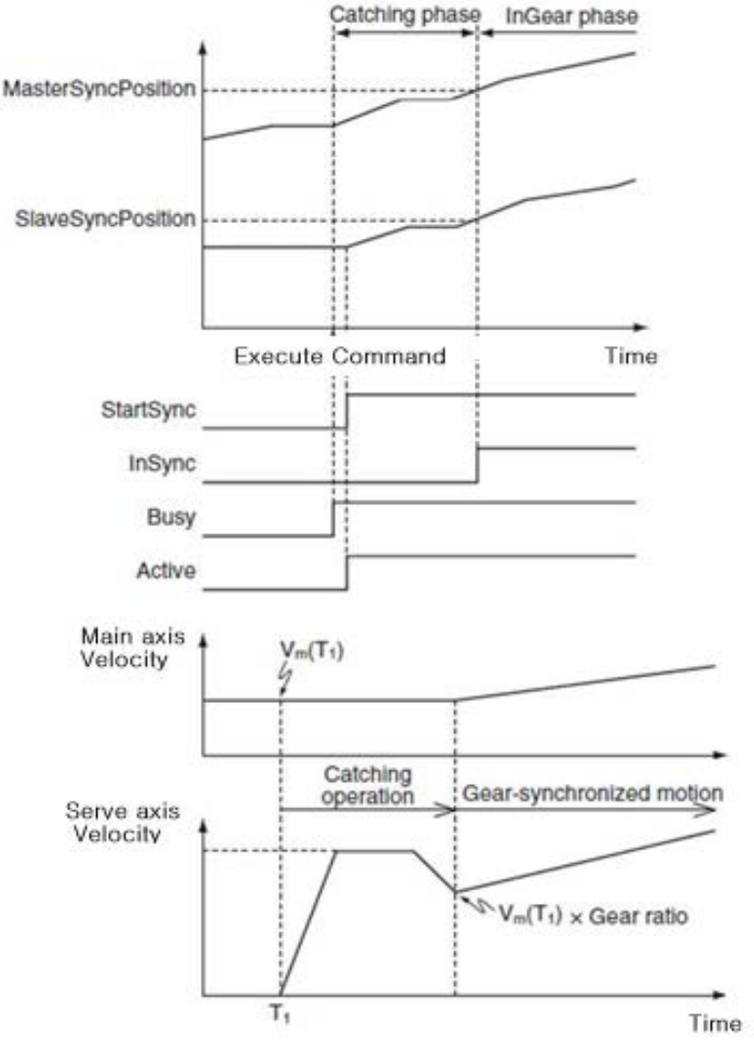
(1) Features

(a) Synchronous position specified speed synchronization basically operates speed synchronization with main axis and subordinate axis depending on the set ratio, which is the same as the speed synchronous operation.

(b) The start positions in which the master axis and the slave axis are synchronized can be specified.

(c) Operations are as shown in the figure below. In the following pictures, MasterSyncPosition is the "main axis synchronous position", SlaveSyncPosition is the"subordinate axis synchronous position". Start position of main axis synchronous is distance from main axis synchronous position. For example, if the main axis synchronous position is 1000, subordinate axis synchronous position is 1000, and the main axis synchronous position is 400, subordinate axis starts operation when the main axis is 600 and it operates at the synchronous ratio set at the main axis at 1000 and the sub axis at 1000.

(2) Operation timing diagram

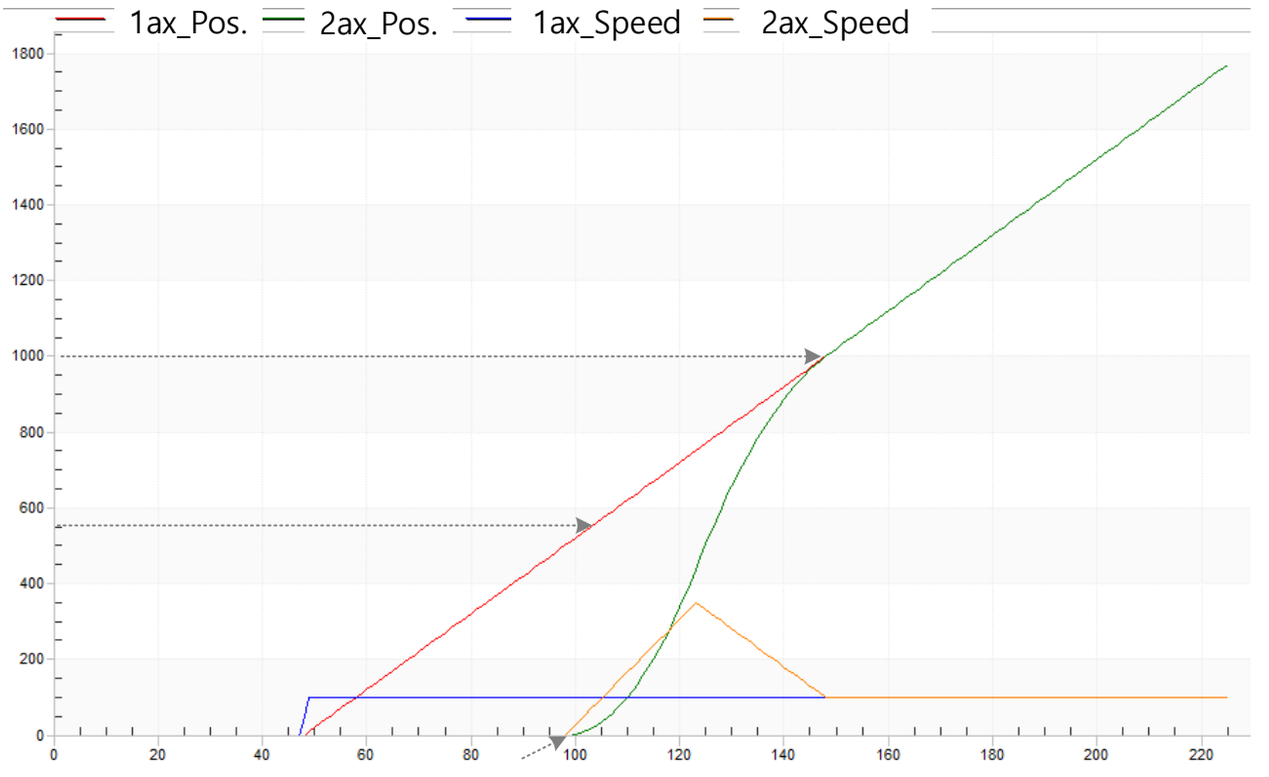


(3) Operation example

The main axis is 1 axis, the subordinate axis is 2 axis

Synchronous ratio: 1, main axis synchronous position: 1,000, subordinate axis synchronous position: 1,000, main axis distance to start synchronous operation: 500

Subordinate axis synchronous starts at 500, subordinate axis adjust speed with synchronous position until main axis and subordinate axis reaches 1000 respectively.

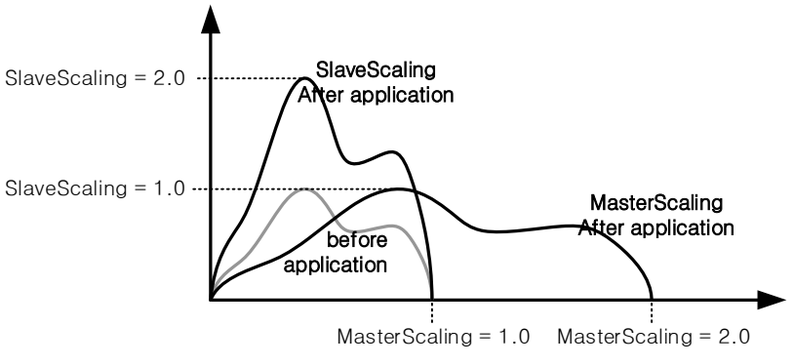


9.4.8 CAM Scale Setting

CAM operation apply range of main axis and subordinate axis can be set by applying scale (ratio) in inputting CAM table for CAM operation and do not modify previously inputted CAM table.

(1) Control features

CAM scale setting are applied to CAM operation (XCAM, XPM_CAM), user CAM operation, Absolute position CAM operation, CAM restart operation. CAM scale is 2 types,MasterScaling and SlaveScaling. MasterScaling sets the rate of the main axis data, and SlaveScaling sets the rate of the subordinate axis data. Refer to the Figure below.



(2) Values setting method

MasterScaling and SlaveScaling values should be set as fraction. Therefore, each denominator and numerator for MasterScaling and SlaveScaling should be inputted as integers (1~65535). If “0” is inputted in the denominator and numerator for MasterScaling and SlaveScaling, an error (error code: 851~854) occurred. Scaling value is inputted to module through 'Write Variable Data' (XVWR, XPM_VWR) command.

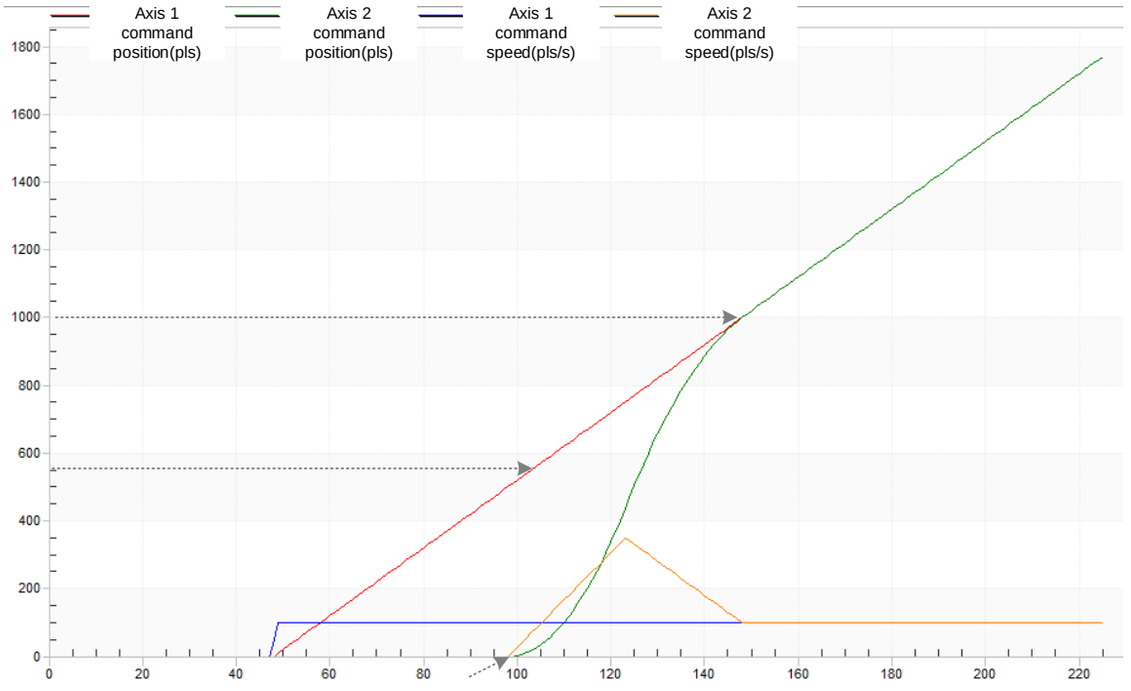
For memory address to set Scaling value of each axis, refer to Appendix 2.12 CAM Scaling memory address.

MasterScaling and SlaveScaling values set in axis are applied automatically during CAM operation of related axis. Scaling values can be changed during operation. Scaling values is not saved during module power is off and is reset to “1” when module power is on. Scaling values is maintained during module status change (Run ↔ Stop).

(3) Operation example

Set main axis as axis 1, subordinate axis as axis 2, synchronous ratio: 1, main axis synchronous position as 1,000, subordinate axis synchronous position as 1,000, main axis distance to start synchronous as 500.

Subordinate axis synchronous starts at 500, subordinate axis adjust speed with synchronous position until main axis and subordinate axis reaches 1000 respectively.


Axis 1 command position(pls)
Axis 2 command position(pls)
Axis 1 command speed(pls/s)
Axis 2 command speed(pls/s)
1800
1600
1400
1200
1000
800
600
400
200
0
0
20
40
60
80
100
120
140
160
180
200
220

9.4.9 Operation when main axis errors occurs during synchronous control

When the main axis error (axis error or servo alarm) occurs while operation executes through synchronous control, if you want to control operation of synchronous control of subordinate axis. You can use the operation function when main axis error occurs during synchronous control to determine the subsequent operation.

(1) Control features

(a) It use to prevent malfunction such as subordinate axis continuing synchronous control regardless of the occurrence of main axis error (axis error or servo alarm0 during synchronous control.

(b) The function operates when the extended parameter “Operation when a main axis error occurs during synchronous control” is set to 1: Release synchronization when a servo alarm occurs on the main axis or 2: Release synchronization when an axis error occurs on the main axis.

(c) When “operation when a main axis error occurs during synchronous control” of extended parameters set to 1: function operates only when servo alarm occurs in main axis in the status set in synchronous off during servo alarm of the main axis.

(d) When “operation when a main axis error occurs during synchronous control” of extended parameters set to 2: function operates only when axis error occurs in main axis in the status set in synchronous off during axis error of the main axis.

(e) If a servo alarm occurs in main axis and the subordinate axis synchronous is off through related function, an axis error (synchronous control off error by servo alarm occurrence of main axis: 573) occurs and decreasing by the time set in deceleration time during emergency stop and speed becomes to “0”.

(f) If an axis error occurs in main axis and the subordinate axis synchronous is off through related function, an axis error (synchronous control off error by axis error occurrence of main axis: 574) occurs and decreasing by the time set in deceleration time during emergency stop and speed becomes to “0”.

(g) If the main axis executes synchronous control command in an error (axis error or servo alarm) status, axis error (speed synchronization execution error in main axis error status: 575) occurs.

■ Setting related parameter (expansion parameter)

Item	Setting Value	Content
Operation when main axis errors occurs during synchronous control	0 ~ 2	When the main axis error occurs during synchronous control, set operation of subordinate axis.
Deceleration time for EMG stop	0 ~ 2,147,483,647	Set the decel. time to be used in case of emergency stop when main axis error occurs during synchronous control. The Emergency stop dec. time means the time it takes to decelerate to zero speed from the speed limit.

The s/w version Information that support operation function when main axis error during synchronous control are as follows.

	Version
XGF-PN4B	V2.50 or higher
XGF-PN8B	V2.50 or higher
XGF-PN16B	V2.50 or higher
XG5000	V4.75 or higher

9.5 Modification Function of Control

9.5.1 Floating Origin Setting

This is used to force to set the current position as the origin without carrying out the homing action of the machine.

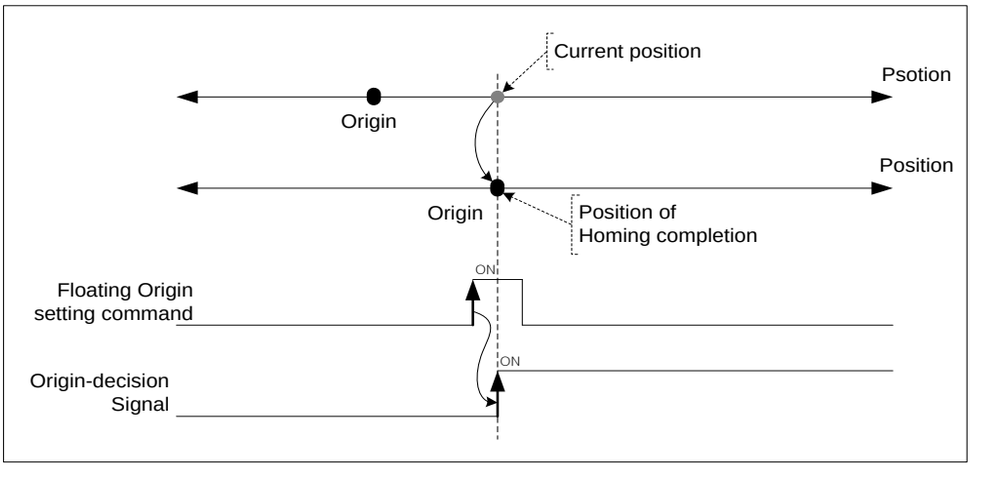
(1) Control features

(a) The current position is changed to the home position, and the homing is completed.

(b) After executing the floating home setting command, the current position is changed to “0”.

> **Notes**
>
> Floating origin setting just executes forced origin decision from the current position to “0” so user need to take notice as follows when using floating origin setting as origin.
>
> 1. When error occurs, clear the cause of error and reset
> 2. Set floating origin again,
> 3. Change the operation step no. to operate with start step no. change command and then execute.

(2) Operating Timing



(3) Restrictions

The floating home setting command occurs an error (error code: 212) in the servo-off state and is not executed. “Servo On” command, and then execute the floating home setting command when the Servo on signal is On.

9.5.2 Continuous Operation

Execute positioning control changing the current operation step no. to the next one.

(1) Control features

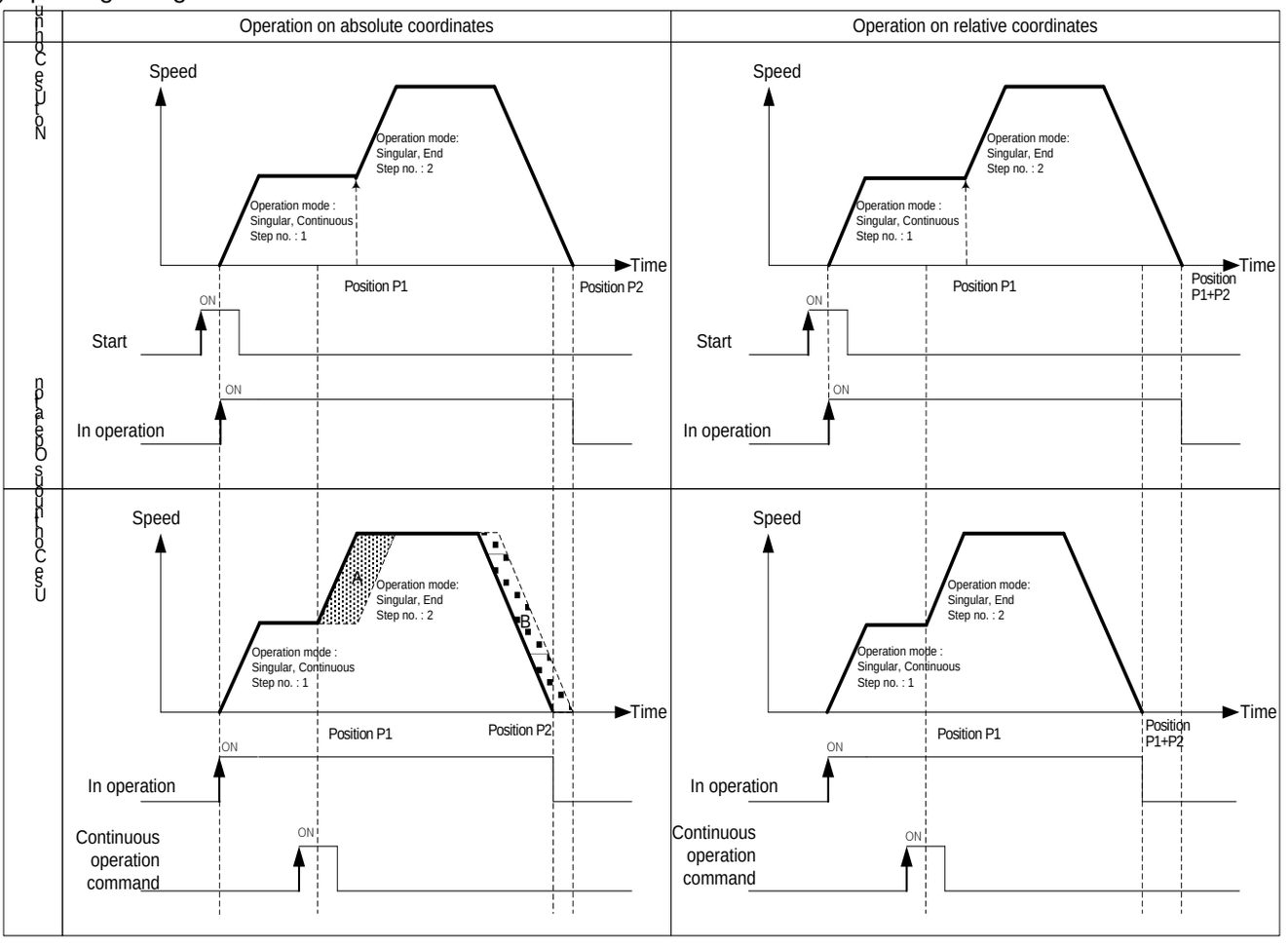
(a) When continuous operation command is executed, operating speed is changed into the speed of next operation step directly.

(b) It can be used when the operation mode is End, Keep or Continuous operation and the operation pattern is in the acceleration, constant speed, and deceleration sections.

(c) If continuous operation command is executed in operation, the current operation step no. is changed to the next step no. and keep operating.

(d) There are differences of operation depending on between absolute coordinates and relative coordinates.

(2) Operating Timing



■ Since the target position of the continuous operation command in absolute coordinates is the same, the target position after executing the continuous operation command is the same as when the continuous operation command is not executed. Therefore, the current position positioned by continuous operation is P2. (An area and B area both are same size)

■ When continuous operation is executed on relative coordinates, the movement amount between current position and target position is the real target position. Therefore, the actual target position is different from the one without continuous operation. In other words, the position positioned by continuous operation is P1 + P2.

(3) Restrictions

In the cases below, continuous operation is not executed and previous operation is being kept.

(a) In the case that acc./dec. pattern of extended parameter is 'S-curve」(error code: 390).

(b) Current status is dwelling (error code: 392)

(c) The current control is not single axis position control or linear interpolation. (error code : 393)

(d) Speed data value of operation step to be executed next is 0 or exceeds the speed limit. (error code: 394)

(e) Execute continuous operation command on the sub axis of linear Interpolation. (error code:395)

User has to execute continuous operation command on main axis in linear interpolation.

(f) Execute continuous operation command on the axis of circular interpolation. (error code:397)

(g) Execute continuous operation command on the sub axis of synchronous operation. (error code:397)

(h) The current operation step no. is the last step (400) of operation data. (error code : 399)

(i) The current axis in operation is executed by direct start command. (error code : 400)

[Example] Execute continuous operation on axis1 operating by absolute, single axis position control

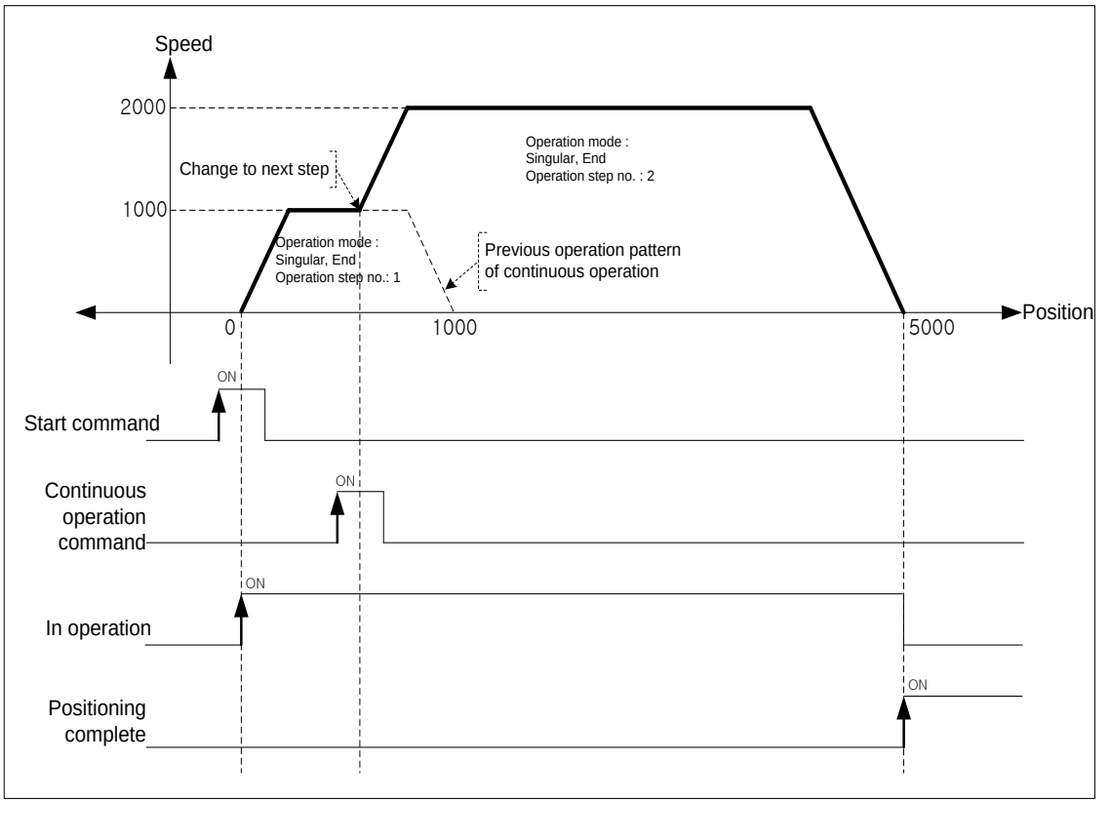
■ Axis1 current position: 0

■ Setting of XG-PM

▪ Axis 1 operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Absolute, Single axis position control	Single,End	1000	1000	No.1	No.1	0	0
2	Absolute, Single axis position control	Single,End	5000	2000	No.1	No.1	0	0

■ Operation Patterns



9.5.3 Skip Operation

Decelerate and stop the current operation step and change to the operation data of next operation step no., then execute positioning control.

(1) Control features

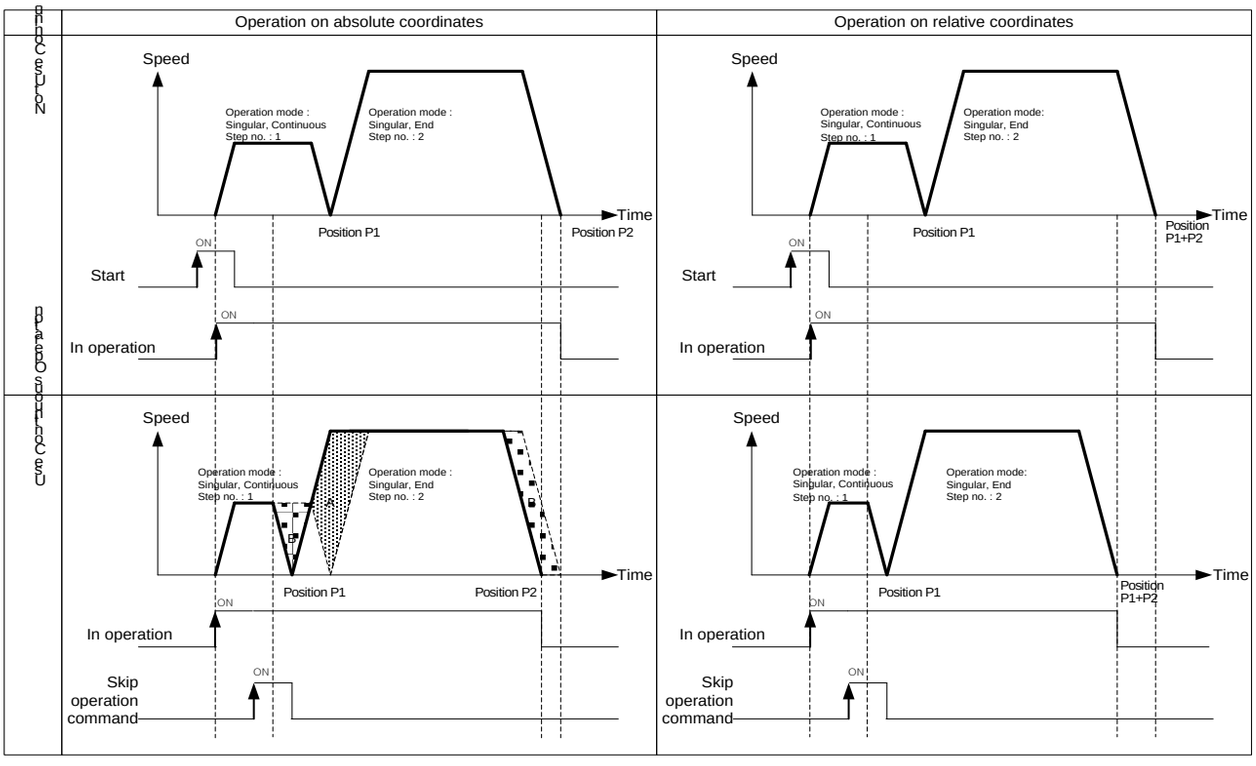
(a) SKIP operation command stops the operation and carries out the operation of next step after executing the command other than Continuous operation command (XNMV).

(b) It can be used when the operation mode is End, Keep or Continuous operation and the operation pattern is in the acceleration, constant speed, and deceleration sections.

(c) If SKIP operation command is executed in the status that the operation data of next step is not yet set, Error (code: 151) occurs.

(d) When set position data, there would be differences on skip operation command depending on absolute coordinates and relative coordinates,

(2) Operating Timing



■ The target position of next operation step after skip operation command is executed on absolute coordinates is the same as the case did not execute skip operation. In other words, the position positioned by skip operation is P1 + P2. (An area and B area both are same size)

■ When skip operation is executed on relative coordinates, the movement amount between current position and target position is the real target position. Therefore, the actual target position is different from the one without skip operation. In other words, the position positioned by skip operation is P1 + P2.

(3) Restrictions

In the cases below, continuous operation is not executed and previous operation is being kept.

(a) Execute skip operation command on the sub axis of linear interpolation. (error code: 332)

Skip operation in linear interpolation operation must be executed on main axis.

(b) Execute skip operation command on the sub axis of synchronous operation. (error code: 333)

(c) Execute skip operation command on the axis in Jog operation.(error code: 335)

(d) The current axis in operation is executed by direct start command. (error code : 336)

(e) Execute skip operation on the axis in Inching operation.(error code: 337)

(f) Execute skip operation command on the sub axis of arc interpolation. (error code: 338)

Skip operation in circular interpolation operation must be executed on main axis.

[Example] Execute skip operation command on axis1 operating by absolute and single axis position control.

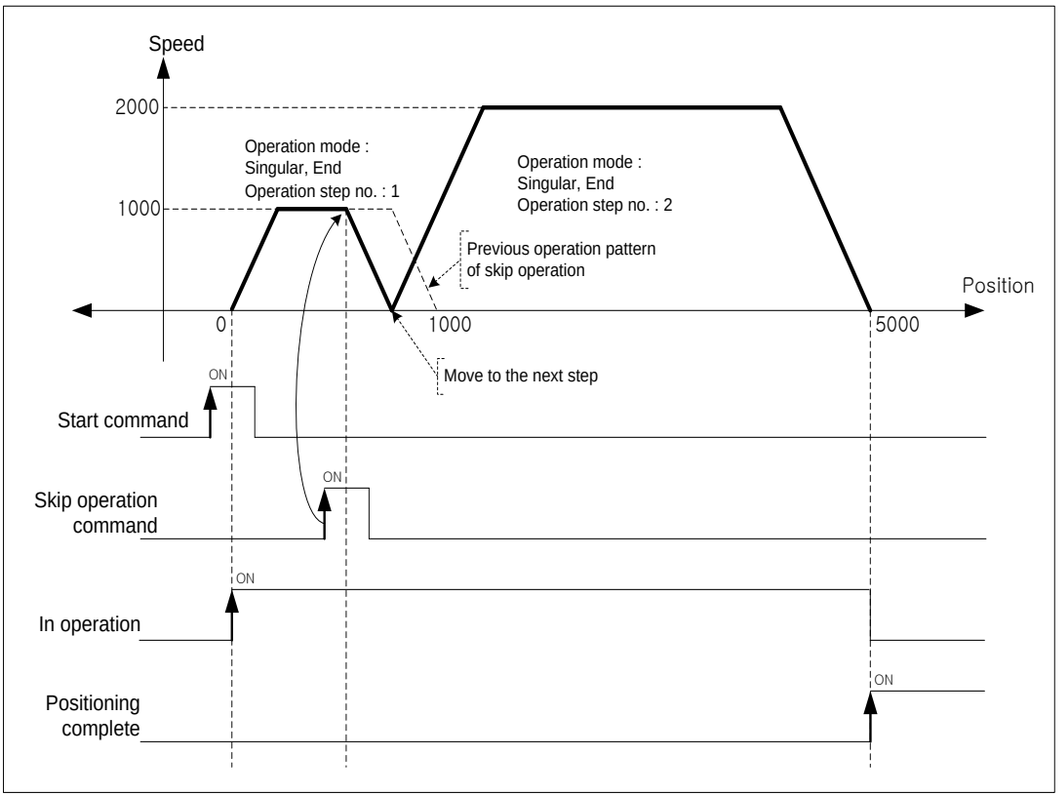
■ Axis1 current position: 0

■ Setting of XG-PM

▪ Axis 1 operation data

step no.	Control method	Operation method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Absolute, Single axis position control	Single,End	1000	1000	No.1	No.1	0	0
2	Absolute, Single axis position control	Single,End	5000	2000	No.1	No.1	0	0

■ Operation Patterns



9.5.4 Position Override

If you want to change the target position during operation by positioning data, change the target position with the position override command.

(1) Control features

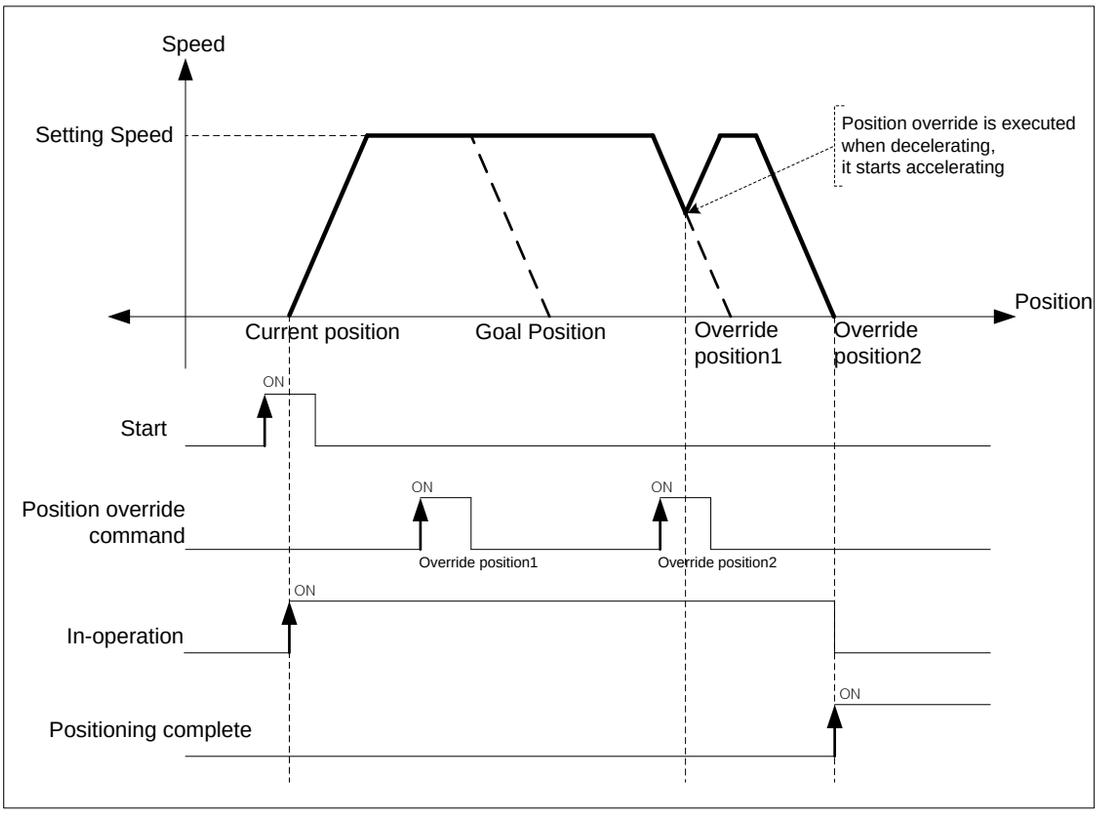
(a) The position override command can be used in the Acceleration, Constant speed, and Deceleration sections of the operation pattern, and the available operation modes are End operation, Keep operation, and Continuous operation.

(b) The position setting range is -2147483648 ~ 2147483647 Pulse.

(c) As the operation is different according to Position Override command during operation, cares should be taken in using. In other words, if position of position override at the moment of commanding position override is bigger than the position it stopped at, the positioning direction would be forward. If it is smaller, the direction would be reverse.

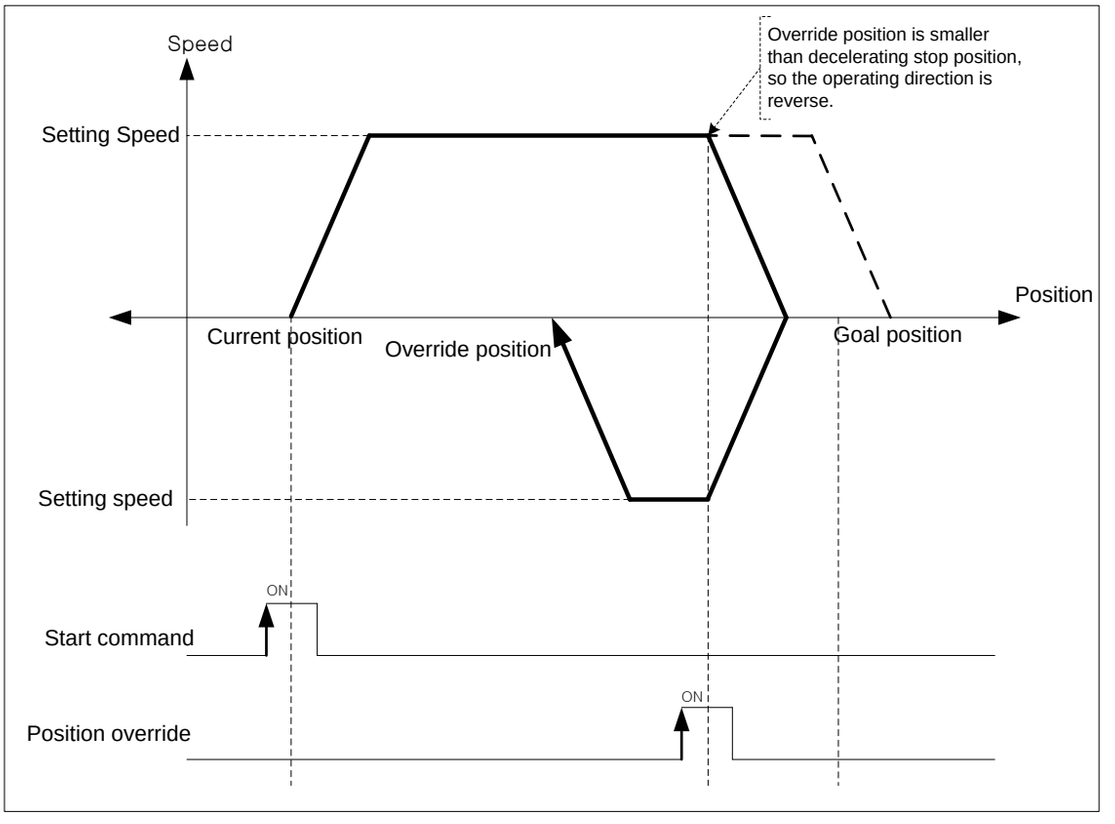
(d) It may be executed several times in operation.

(2) Operating Timing



If position override is executed in operation, the goal position is changed to override position1 and keep operating. If position override for override position2 is executed at dec. area, positioning is finished by acc. speed already set at override position2.

■ The case that override position is smaller than decelerating stop position.



(3) Restrictions

In the cases below, position override is not executed and previous operation is being kept.

(a) Execute position override command in dwell.(error code: 362)

(b) Current operation is not positioning control (single axis positioning, Inching operation). (error code: 363)

(c) Execute position override command on the axis operating linear interpolation.(error code: 364)

(d) Execute position override command on the axis operating circular interpolation.(error code: 365)

(e) Execute continuous operation command on the sub axis of synchronous operation. (error code:366)

[Example] Execute position override on axis1 operating by absolute, single axis position control.

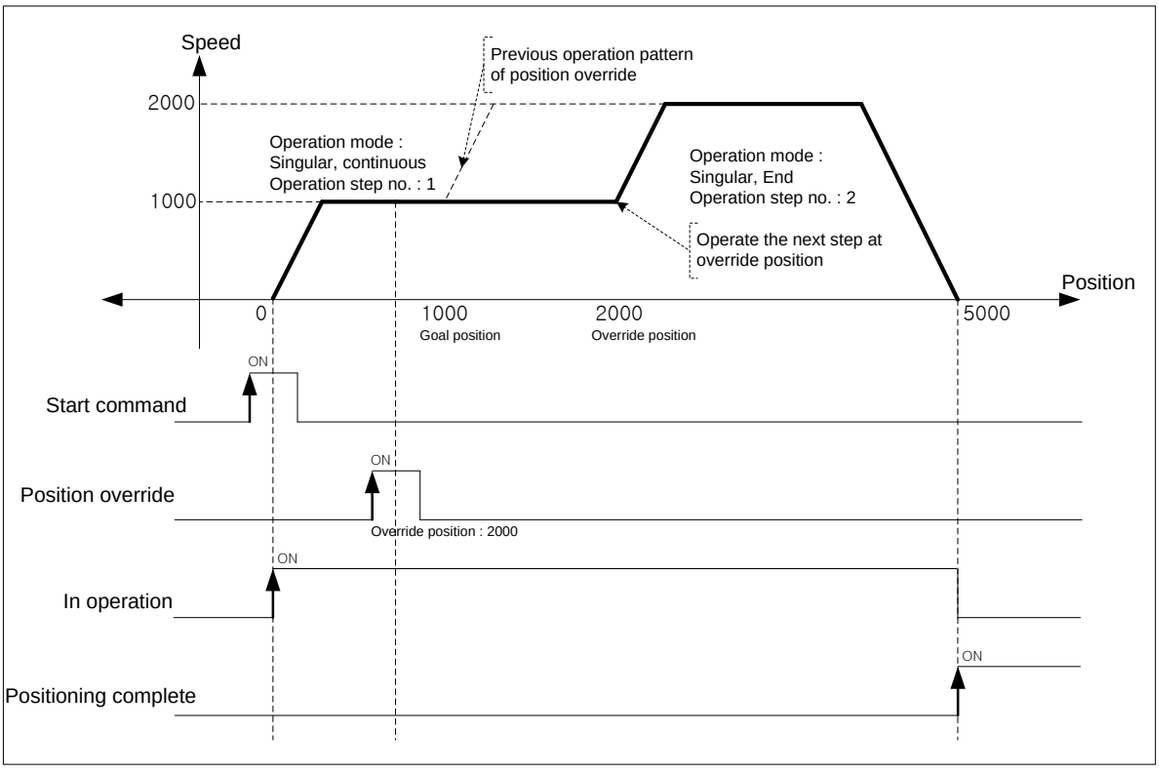
■ Axis1 current position: 0

■ Setting of XG-PM

▪ Axis 1 operation data

step no.	Control method	Operation method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Absolute, Single axis position control	Single, Continuous	1000	1000	No.1	No.1	0	0
2	Absolute, Single axis position control	Single,End	5000	2000	No.1	No.1	0	0

■ Operation Patterns



Notes

If operation pattern is 'continuous' and override position is bigger than target position, keep operating at current speed then continue to operate the next step. If override position is smaller than target position, execute decelerating stop and position in reverse direction, then continue to operate the next step.

9.5.5 Speed Override

When user wants to change the operation speed of positioning control, user may change the speed with speed override command.

(1) Control features

(a) Speed override command is available in acceleration and constant speed section in operation pattern and available operation modes are End, Keep, and Continuous.

(b) It may be executed several times in operation.

(c) User may set speed override value as '%setting" or"speed setting' on [Speed override] of common parameter.

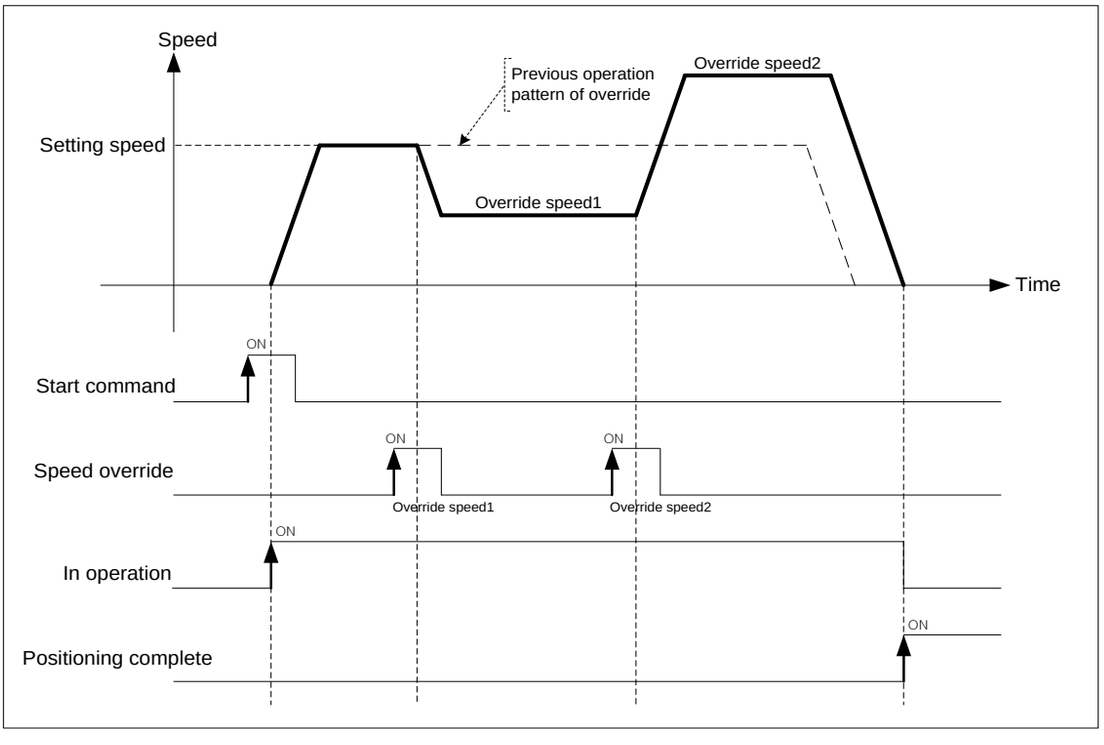
(d) Related parameter setting (common parameter)

Item	Setting Value	Content
Speed override	0: % designate	Set the speed override setting value by %
	1:speed designate	Set the speed override setting value directly to the operating speed.

(e) Auxiliary data of speed override command setting

Item	Setting Value	Content
Speed	1 ~ 65535 (1=0.01%)	If speed override is "%", set the speed by % (If it is 100%, set 10000)
	1 ~ Speed limit value	If speed override is "Exact number", set the speed with exact number

(2) Operating Timing



(3) Restrictions

In the cases below, speed override is not executed and previous operation is being kept.

(a) The value of speed override exceeds speed limit of basic parameter. (error code: 372)

The speed value of speed override must be below speed limit. Override speed of linear interpolation for each axis need to be

below speed limit.

(b) Execute speed override command on the subordinate axis of linear interpolation.(error code: 373)
In linear interpolation, speed override must be executed on main axis.

(c) Execute speed override command on the subordinate axis of circular interpolation.(error code: 374)
In circular interpolation, speed override must be executed on main axis.

(d) Execute speed override command on the subordinate axis of synchronous operation (error code: 375).

(e) Execute speed override command in deceleration area.(error code: 377)

(f) In the case that acc./dec. pattern of extended parameter is 'S-curve」(error code: 378).

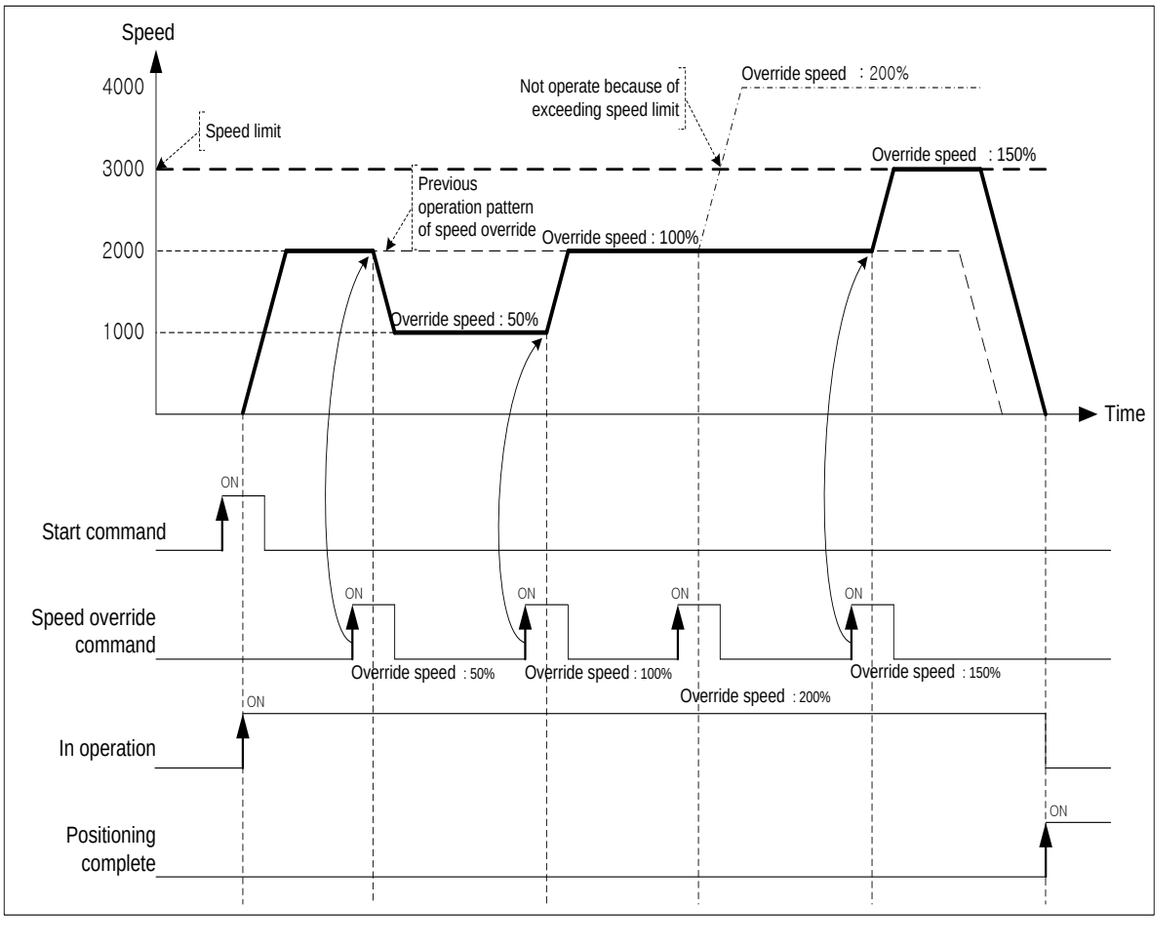
[Example] Execute speed override 50%-> 100%-> 200%-> 150% on axis1 operating by absolute, single axis position control.

■ Axis1 current position: 0
「Speed override」 of common parameter: Set %
「Speed limit of basic parameter」: 3000 [pls/s]

■ Setting of XG-PM
▪ Axis 1 operation data

step no.	Control method	Operation method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Absolute, Single axis position control	Single,End	1000	2000	No.1	No.1	0	0

■ Operation Patterns



9.5.6 Position Specified Speed Override

Positioning speed override command operates by changing the speed to the set operating speed when reaching the designated position during position operating.

(1) Control features

(a) This command is used only in Acceleration and Constant speed section from operation pattern and the available operation mode is End, Keep, Continuous operation.

(b) As this command is not carried out in Deceleration section, cares should be taken in using.

(c) The position setting range is -2147483648 ~ 2147483647 Pulse.

(d) User may set speed override value as '%setting" or"speed setting' on [Speed override] of common parameter.

(e) User may select that consider the designated position value on 「position specified speed override coordinate」 of extended parameter as an absolute position or a relative position.

(f) Related parameter setting

■ Common parameter

Item	Setting Value	Content
Speed override	0: Specify %	Set the speed override setting value by %
	1:speed designate	Set the speed override setting value directly to the operating speed.

■ Extended parameter

Item	Setting Value	Content
Position specified speed Override coordinates	0: Absolute	Speed override is executed in the designated absolute position
	1: Relative	Speed changes at the position as far as the set value from start position.

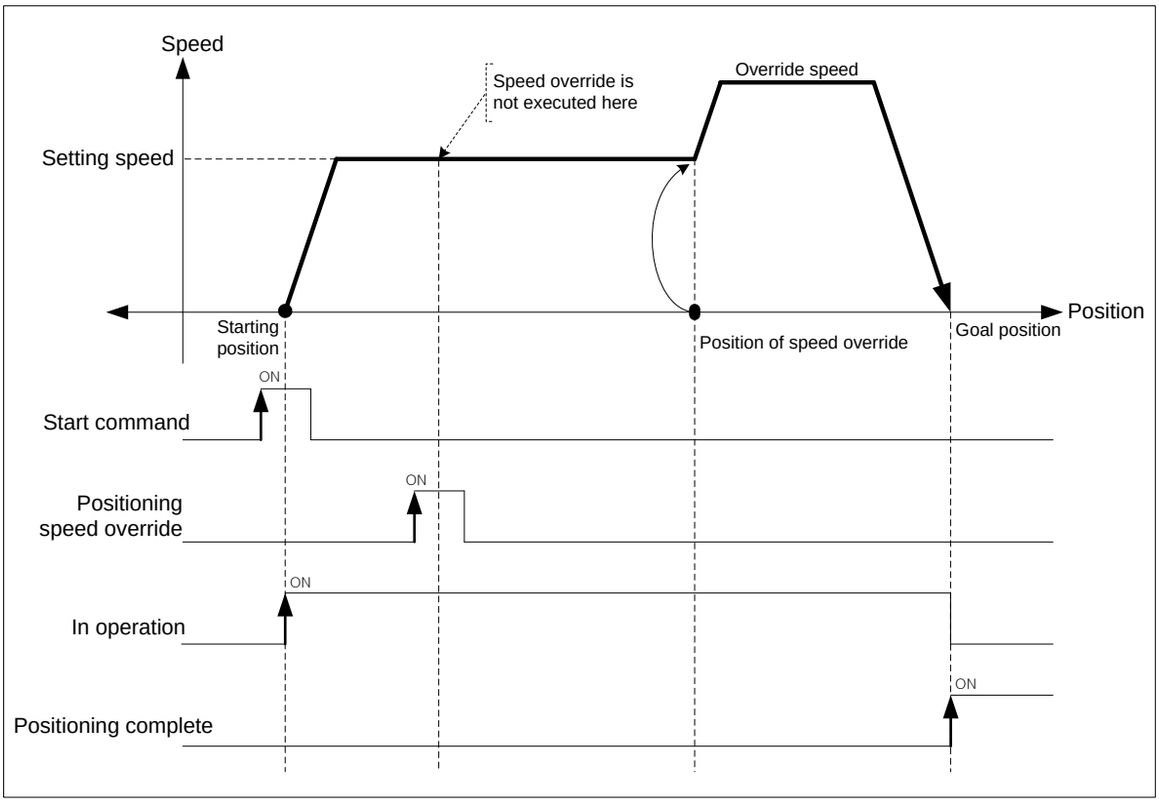
(g) Auxiliary data setting of positioning speed override command

Item	Setting Value	Content
Position	-2147483648 ~ 2147483647	Set the position to start speed override
Speed	1 ~ 65535 (1=0.01%)	If speed override is "%", set the speed by % (If it is 100%, set 10000)
	1 ~ Speed limit value	If speed override is "Exact number", set the speed with exact number

Notes

While the current position is not exactly same as the value set on speed override, if the position of speed override is at between previous scan and current scan, speed override is executed at the speed set.

(2) Operating Timing



(3) Restrictions

In the cases below, positioning speed override is not executed and previous operation is being kept.

(a) Current operation is not positioning control (single axis positioning, Inching operation). (error code:382)

(b) The value of speed override exceeds speed limit of basic parameter. (error code:383)

The speed value of speed override must be below speed limit.

Override speed of linear interpolation for each axis need to be below speed limit.

(c) Execute speed override command on the subordinate axis of linear interpolation.(error code: 384)

In linear interpolation, positioning speed override must be executed on main axis.

(d) Execute speed override command on the subordinate axis of arc interpolation.(error code: 385)

In circular interpolation, positioning speed override must be executed on main axis.

(e) Execute speed override command on the subordinate axis of synchronous operation.(error code: 386)

(f) In the case that acc./dec. pattern of extended parameter is 'S-curve」 (error code: 389).

(g) If execute positioning speed override in dec. area. Although error does not occurred but speed override is not executed. However, if it is not in the deceleration section and executes the positioning speed override command, and it is in the deceleration when it tries to override the speed at the specified position, an error (error code: 377) occurs.

[Example] Execute positioning speed override at 4000 [pls/s] at 2000(position of speed override) on axis1 operating by absolute, single axis position control.

■ Axis1 current position: 0

「Speed override」of common parameter: Speed setting

「Speed limit of basic parameter」: 5000 [pls/s]

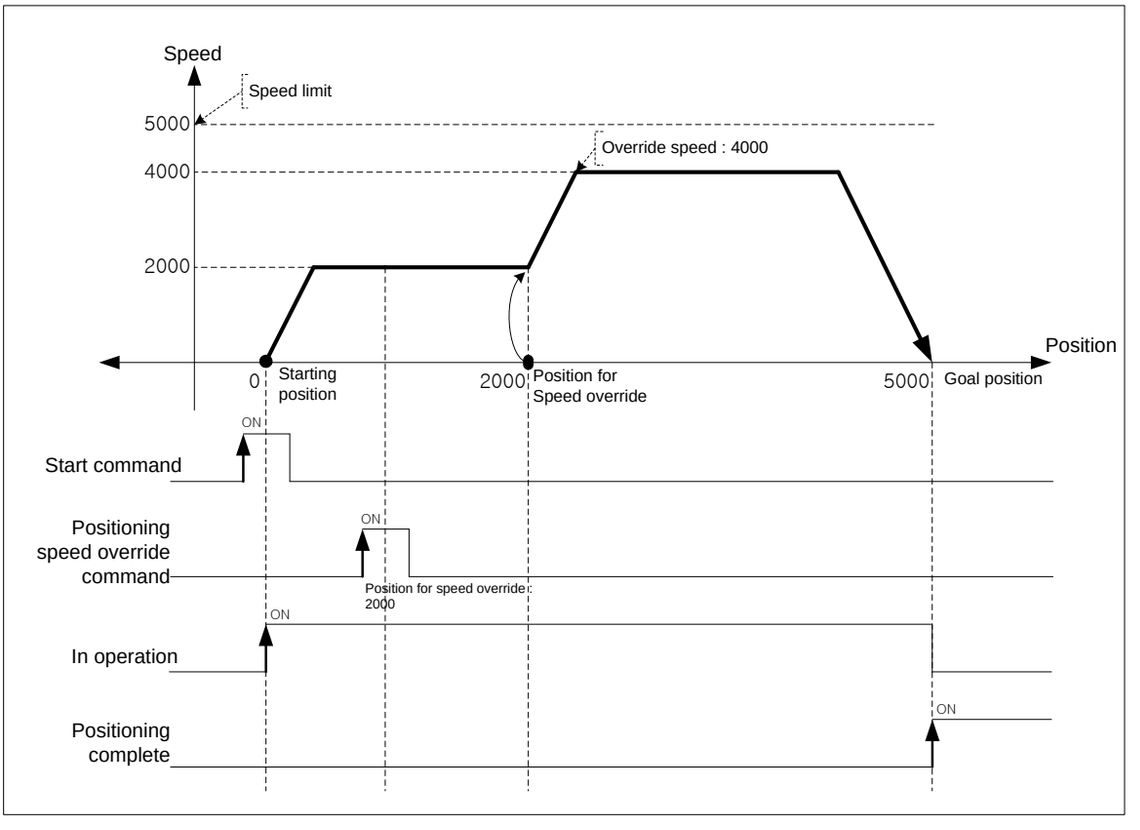
「Coordinates of positioning speed override」of extended parameter: Absolute

■ Setting of XG-PM

▪ Axis 1 operation data

step no.	Control method	Operation method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Absolute, Single axis position control	Single,End	5000	2000	No.1	No.1	0	0

■ Operation Patterns



9.5.7 Current Position Preset

This command is for changing the current position value to the value at user's pleases.

(1) Control features

(a) If you execute the command to change the current position in the undecided homing state, it is changed to the homing state.

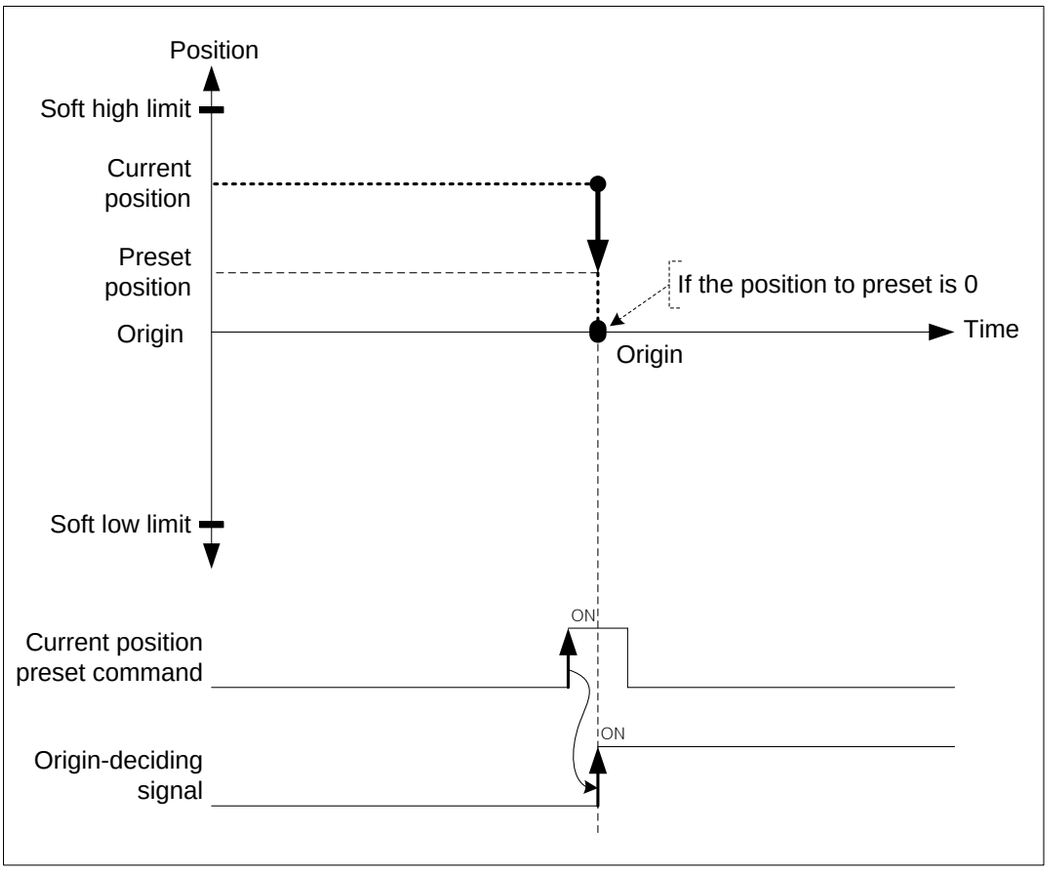
(b) If the current position is changed by the current position change command, the mechanical origin position executed by home return is changed, and when you want to use the mechanical origin position again, you must execute home return again.

(c) The current position preset command cannot be executed in operation due to an error.

(d) Auxiliary data setting of current position preset command.

Item	Setting Value	Content
Position	-2147483648 ~ 2147483647	Set the position to change

(2) Operating Timing



(3) Restrictions

In the cases below, current position preset is not executed and error arises.

(a) Setting value of current position preset exceeds soft high/low limit of extended parameter. (error code:452)

9.5.8 Encoder Preset

This command is for changing the value of current encoder position to the value at user's pleases.

(1) Control features

(a) Encoder 1 of may change the current position value.

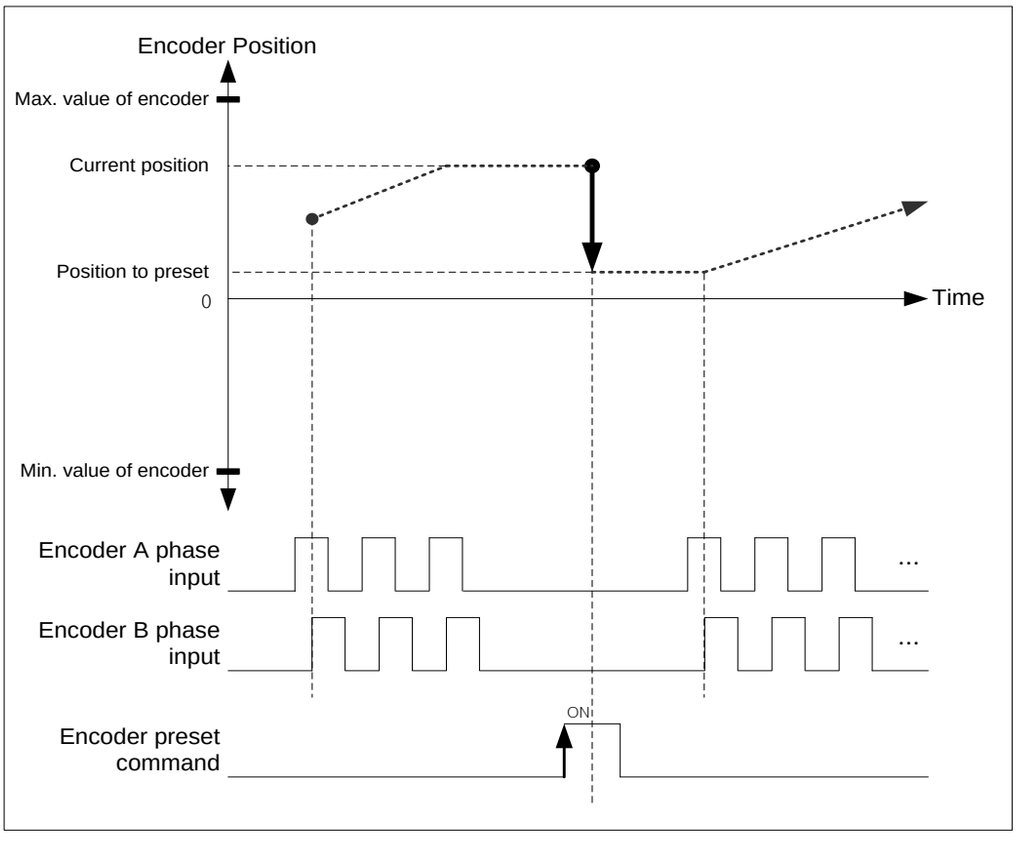
(b) If there is an axis that operates the encoder as the main axis, the speed of the subordinate axis may change rapidly, so the encoder preset command cannot be executed.

(c) Encoder preset command should be executed in the status that external encoder pulse input is not entered.

(d) Auxiliary data setting of encoder preset command

Item	Setting Value	Content
Type	0: Encoder 1	Select encoder to change.
Position	-2147483648 ~ 2147483647	Set the encoder position to change on selected encoder

(2) Operating Timing



(3) Restrictions

In the cases below, encoder preset command may not be executed and error arises.

(a) There is an encoder 1 as a main axis (error code: 532)

(b) Preset position value of encoder 1 exceeds the max./min. value of encoder of common parameter. (Error code: 534)

9.5.9 Start Step No. Change

This command is for changing the current step no. when executing indirect start command.

(1) Control features

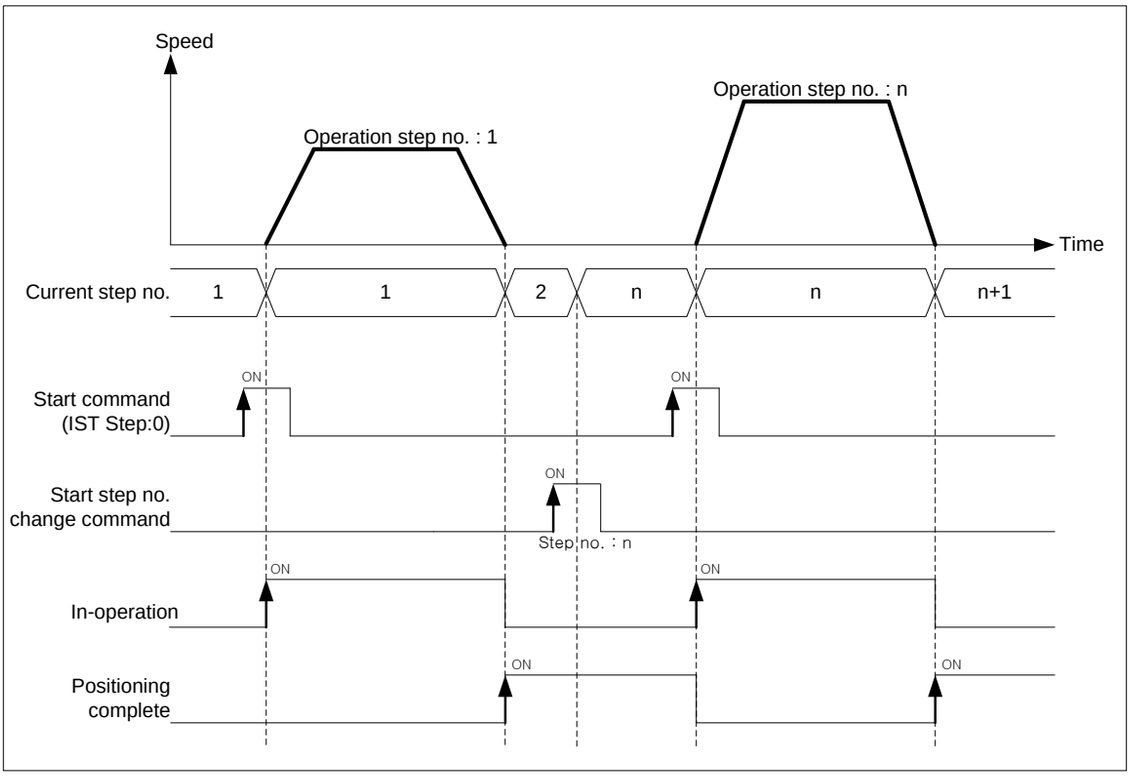
(a) When operating with the step number set to 0 in the indirect start (IST) command, the current operation step number is executed. The step number to be executed can be changed by the operation step number change command.

(b) This command may be only executed in stop motion or error arises.

(c) Auxiliary data setting of start step no. change command.

Item	Setting Value	Content
Step	1 ~ 400	Set the step no. to change

(2) Operating Timing



(3) Restrictions

In the case below, start step no. change command is not executed.

(a) Step no. to change is out of 0 ~ 400. (Error code: 442)

If the step number is 0, the current step number is maintained.

9.5.10 Repeat Operation Step no. Change

This is the function to change the repeat operation step number to be executed next in the position control where the operation method is “Repeat”.

(1) Control features

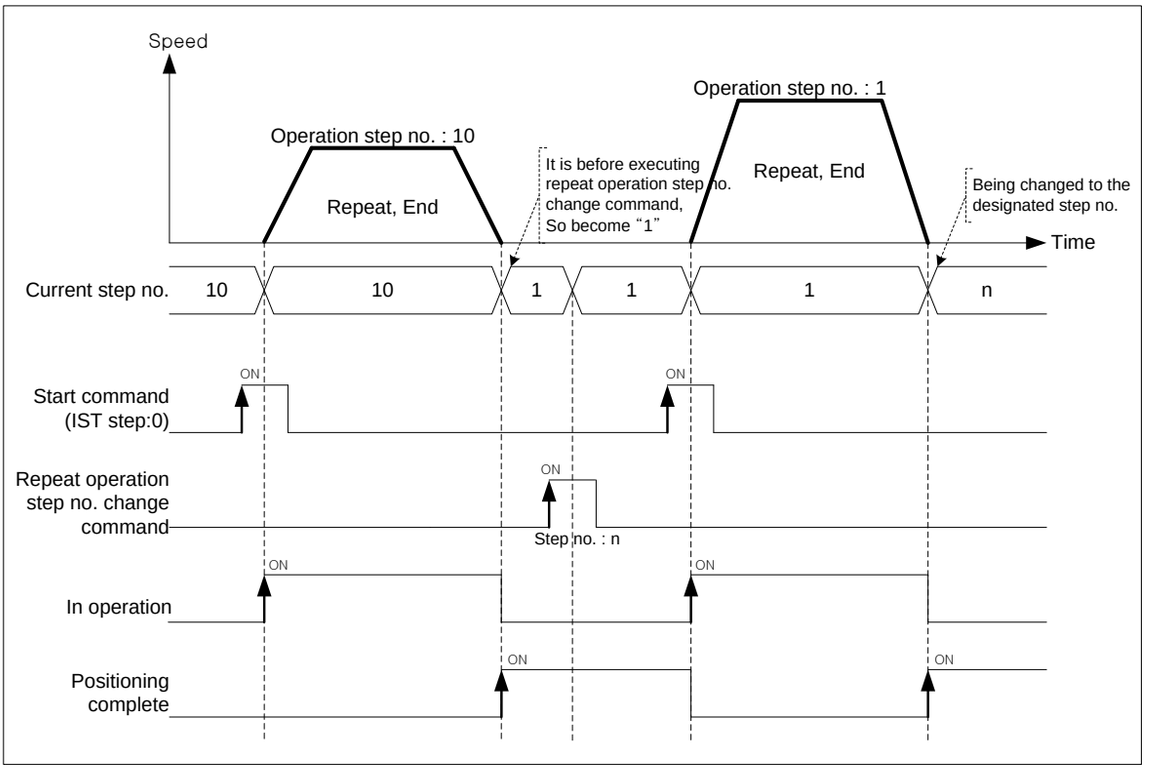
(a) In case of repeat operation mode setting (End, Keep, Continuous operation), the current operation step no. will be changed automatically to operate the step no.1 when repeat operation mode setting step completes the positioning operation but if start step no. change command is executed in repeat operation, the step no. will be changed with the assigned step no. not the step no.1.

(b) The repeat operation step no. change command can be executed during positioning operation.

(c) Auxiliary data setting of repeat operation step no. change command

Item	Setting Value	Content
Step	1 ~ 400	Set the repeat operation step no. to change

(2) Operating Timing



Notes

The repeat step number change command does not change the current operation step at the time of execution, and changes to the step specified by the repeat operation step number change command after the operation of positioning data whose operation method is set to “Repeat” is completed.

(3) Restrictions

In the case below, repeat operation step no. change command is not executed.

(a) Step no. to change is out of 0 ~ 400. (Error code: 442)

If the step no. is 0, keep the previous step no.

[Example] Execute repeat operation step no. change command on axis1 operating by absolute, single axis position control.

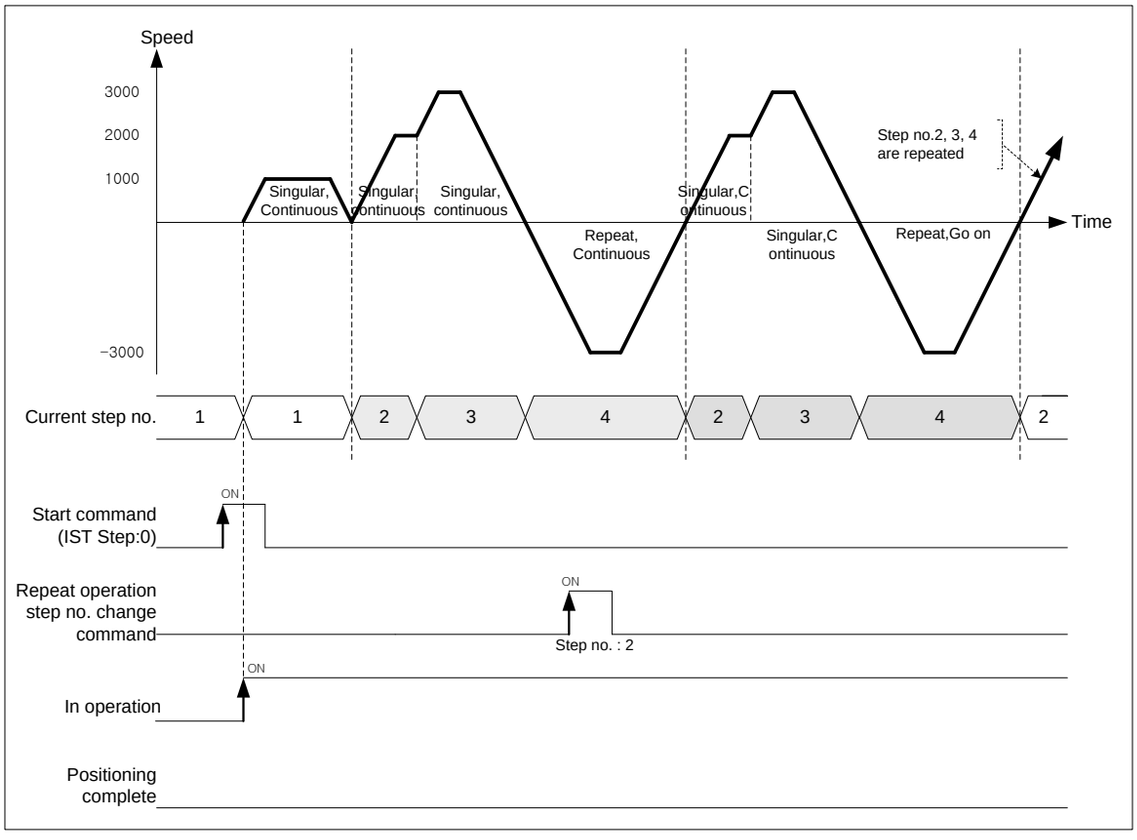
■ Axis1 current position: 0

■ Setting of XG-PM

▪ Axis 1 operation data

step no.	Control method	Operation method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Absolute, Single axis position control	Single,Keep	1000	1000	No.1	No.1	0	0
2	Absolute, Single axis position control	Single, Continuous	2000	2000	No.1	No.1	0	0
3	Absolute, Single axis position control	Single, Continuous	4000	3000	No.1	No.1	0	0
4	Absolute, Single axis position control	Repeat, Continuous	2000	3000	No.1	No.1	0	0
5	Absolute, Single axis position control	Single,End	5000	2000	No.1	No.1	0	0

■ Operation Patterns



9.5.11 Infinite Length Repetition Positioning Function

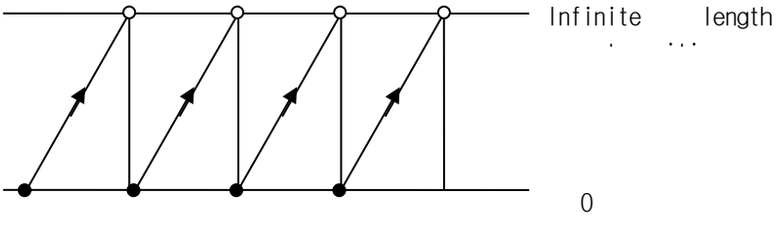
Infinite length repetition function is to execute periodic updates on the display values of the command position and current position automatically with values set in 'infinite length repetition position' among expansion parameters of operating parameters. The use of infinite running repetition positioning function makes it possible to determine the position with repeated position value on the same direction.

(1) Control features

(a) You can use Infinite length repetition positioning function by setting the "infinite length repetition" of extended parameter to "1: enable".

(b) Set the automatically updated position values updated in "infinite length repetition position" of extended parameter.

(c) When the"Infinite running repeat" parameter is"1: Enable", the command position and current position is indicated as 0 ~"infinite running repetition position -1.



(d) The moment the "Infinite running repeat" parameter is set to "1: enable", if the current position is a value outside the infinite running repeat position range, it is automatically changed to a value within the infinite running repeat position.

[Example 1] In case the current position is 32100, and infinite running repetition position 10000
When infinite running repetition "1: Allow" is set, the current position becomes 2100.

[Example 2] In case the current position is -32100, and infinite running repetition position 10000
When infinite running repetition "1: Allow" is set, the current position becomes 7900.

(e) Extended parameter setting related to infinite length repetition positioning function

Item	Setting Value	Content
Infinite running repeat position	pulse: 1~ 2147483647 [pulse] ㎜: 1~2147483647[X10^{-4}㎜] Inch: 1~2147483647[X10^{-5}Inch] degree: 1~2147483647[X10^{-5}degree]	Set the repeat position values that is automatically updated.
Infinite running repeat	0: Disable 1: Enable	It sets whether to enable or disable 'Infinite repetition positioning function.

(f) Shortest distance control

1) In case of absolute coordinate positioning, positioning is executed by automatically determining the direction of rotation possible to move through shorter distance from the current position to target position. In other words, executes positioning by shortest direction from current position to target position.
2) The shortest distance control operates only when the control method of direct start command (XDST, XPM_DST) is set to" 3: shortest distance control".
3) Restrictions
   In the following cases, an error occurs and can not execute the shortest control.
   a) In case of setting to relative coordinate (error code: 226)
   b) When the target position setting is out of the range from 0 to Infinite running repeat position (error code: 227).

(g) When direction setting value is not specified (5)

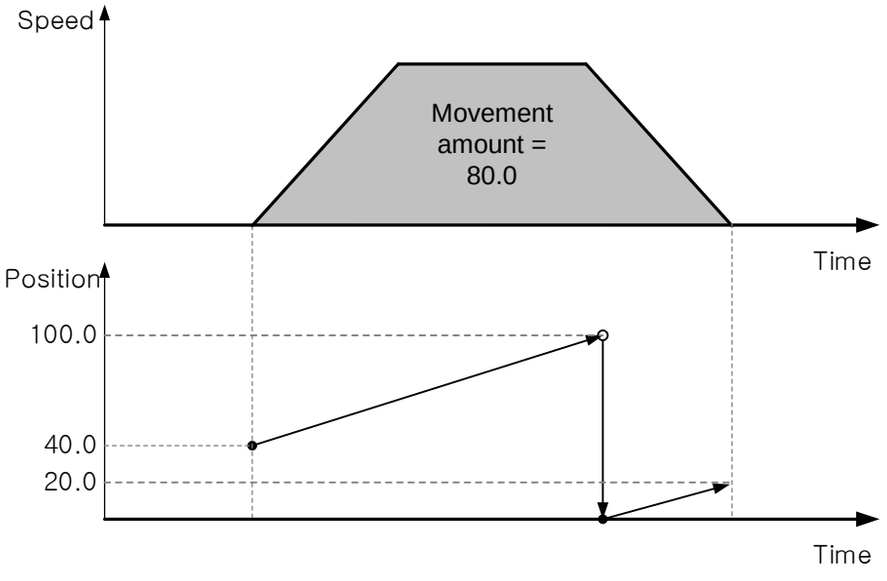
The position value that exceeds repetitive length repetition position can be specified. In case of setting the position value that exceeds the infinite running repetition position, the difference from target position to current position becomes positioning distance. Command position after absolute positioning operation is calculated by the following equation.

Command position = Target position – (Infinite running repetition position x n)

(n: Integer value in which infinite running repetition position x n does not exceed the target position)

[Example] The absolute position operation is executed with the following settings.

- Infinite running repetition position: 100.0
- Current position: 40.0
- Target position: 120.0
- Command position after absolute position operation = 120.0 – (100.0 x 1) = 20.0

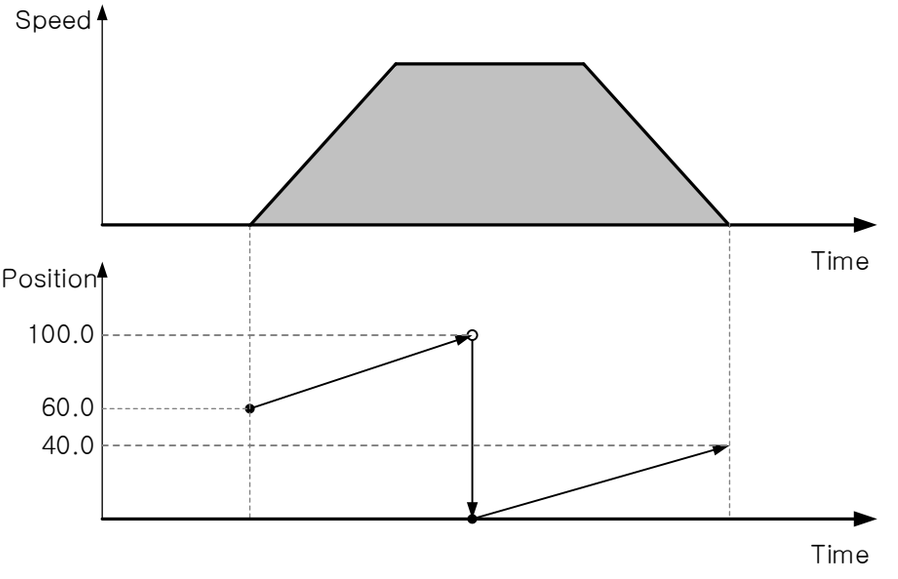


(h) When direction setting value is forward direction (6)

Positioning is executed toward the absolute position of forward direction. In case the target position is set with the range that exceeds infinite running repetition position, error (error code: 229) occurs.

[Example] The absolute position operation is executed with the following settings.

- Infinite running repetition position: 100.0
- Current position: 60.0
- Target position: 40.0

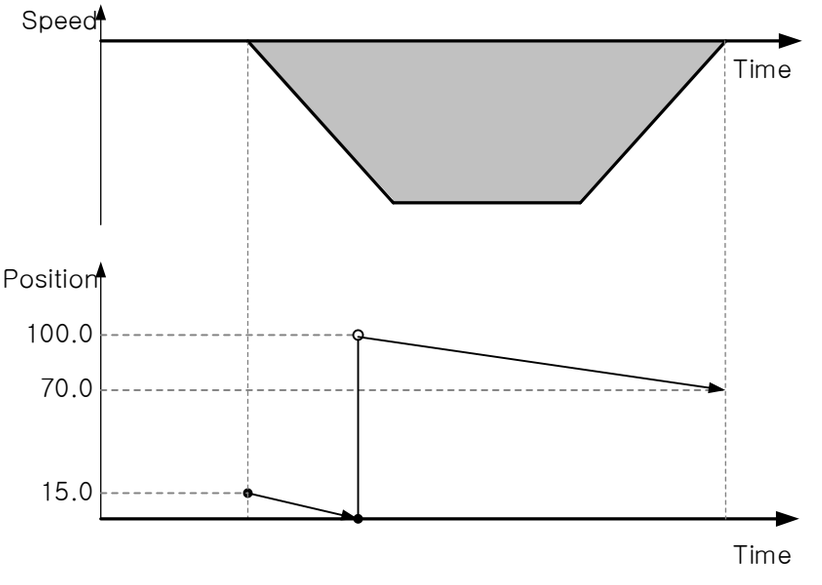


(i) When direction setting value is reverse direction (7)

Positioning is executed toward the absolute position of reverse direction. In case the target position is set with the range that exceeds infinite running repetition position, error (error code: 229) occurs.

[Example] The absolute position operation is executed with the following settings.

- Infinite running repetition position: 100.0
- Current position: 15.0
- Target position: 70.0



(j) When direction setting value is current direction (8)

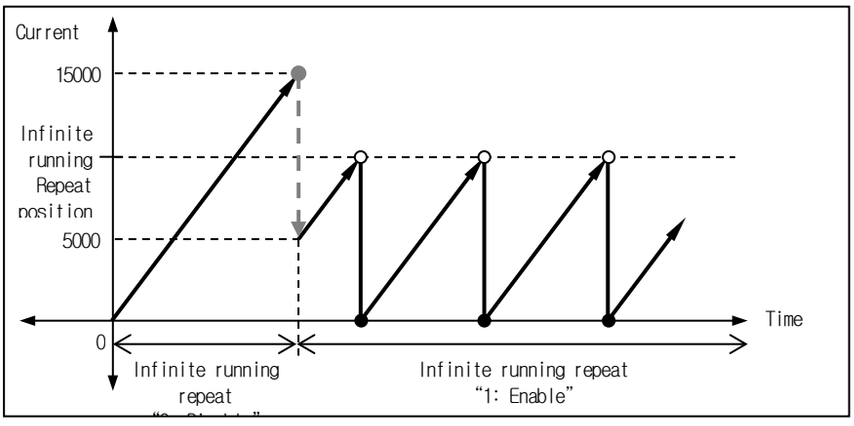
Executes positioning depending on current operational direction.

If the current operational direction is forward direction, it operates the same to the 5- forward direction setting.

If the current operational direction is reverse direction, it operates the same to the 7- reverse direction setting.

(k) If the infinite running repeat is “1: enable” interpolation control can be execute. In case of differing to keep operation, continuous operation do not occur acceleration/deceleration even if step changes and executes operation with continuous speed.

(2) Operation diagram



Notes

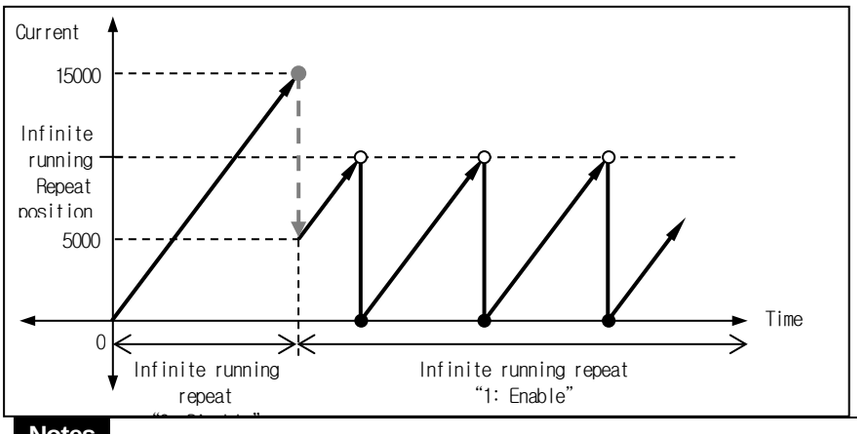
Infinite running repeat setting can not be changed when the axis is operating. If related axis enable the infinite running repeat setting in the stop status, the current position is changed to a values within the infinite running repeat position if the current position values surpassed the repeat position values

(3) Restrictions

When infinite running repeat is set to "1: enable", in the following case, an error occurs.

(a) When operation data operates step of linear interpolation or arc interpolation (Error code: 240).

(4) Operation diagram



Notes

Infinite running repeat setting can not be changed when the axis is operating. If related axis enable the infinite running repeat setting in the stop status, the current position is changed to a values within the infinite running repeat position if the current position values surpassed the repeat position values

(5) Restrictions

When infinite running repeat is set to “1: enable”, in the following case, an error occurs.

(a) When operation data operates set step as single axis position control, continuous (Error code: 239).

(b) When operation data operates step of linear interpolation or arc interpolation (Error code: 240).

(6) Operation example

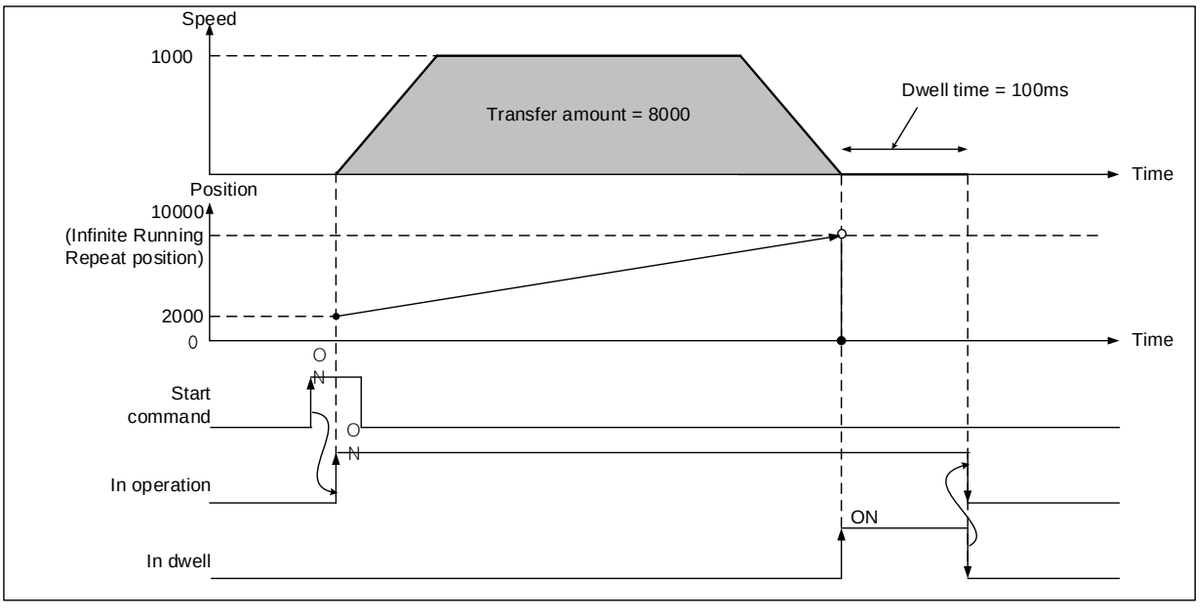
[Example] Executes absolute coordinates, single-axis positioning control in condition of infinite running repeat. pos. = 10000 pulse, infinite running repeat “1: enable”with the following setting.

■ Start position: 2000 pulse, target position: 10000 pulse

■ Setting of XG-PM

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Absolute, Single axis position control	Single,End	10000	1000	No.1	No.1	0	100

■ Operation Patterns



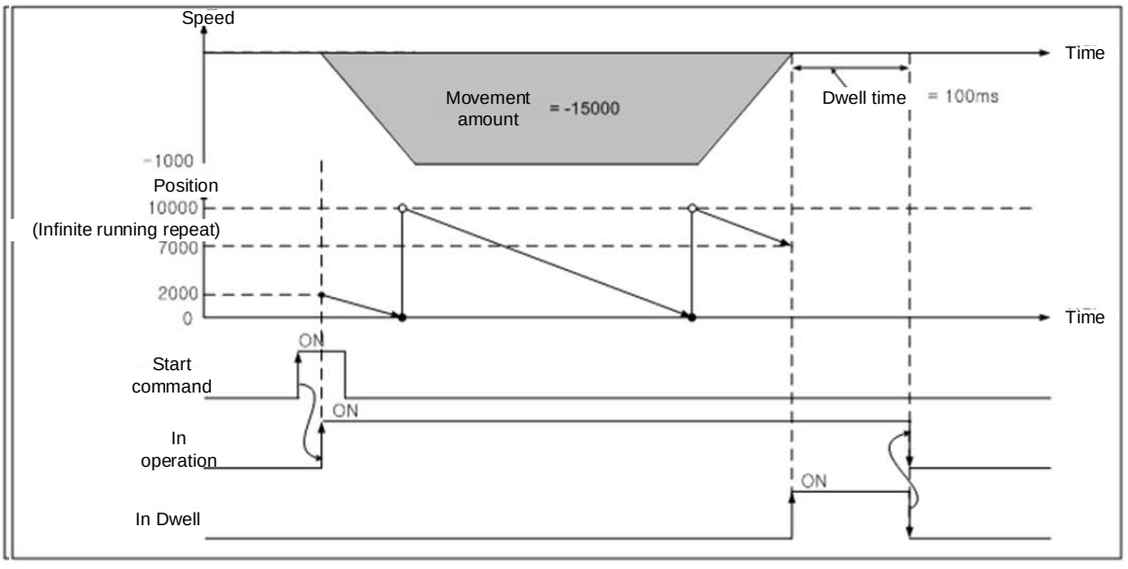
[Example] Executes absolute coordinates, single-axis positioning control in condition of infinite running repeat. pos. = 10000 pulse, infinite running repeat “2: enable”with the following setting.

■ Start position: 2000 pulse, target position: -15000 pulse

■ Setting of XG-PM

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Incremental, single-axis Position Control	Single,End	-15000	1000	No.1	No.1	0	100

■ Operation Patterns



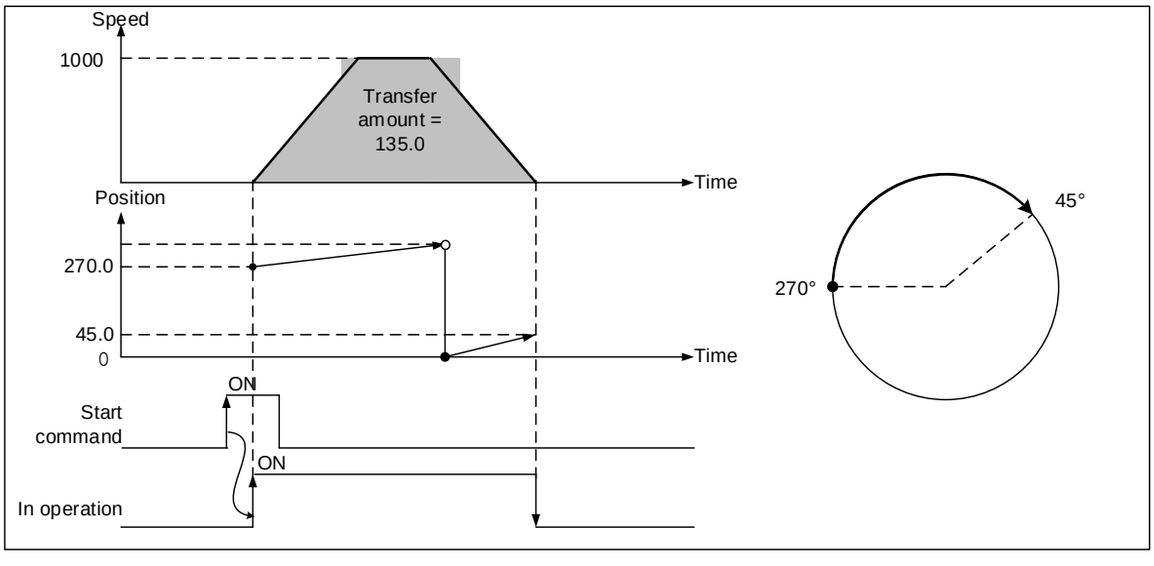
[Example] Executes absolute coordinates, direct start command in condition of infinite running repeat. pos. = 360.0 degree, infinite running repeat "1: enable"with the following setting.

Start position: 270.0 ˚, Target position: 45.0 ˚, Target position: 1000

1) Control word setting of direct start = absolute coordinate, shortest distance control

15 ~ 12	11 ~ 10	9 ~ 8	7 ~ 5	4	3 ~ 2	1 ~ 0
-	Deceleration time	Acceleration time	-	0:Absolute	-	3: Shortest distance control

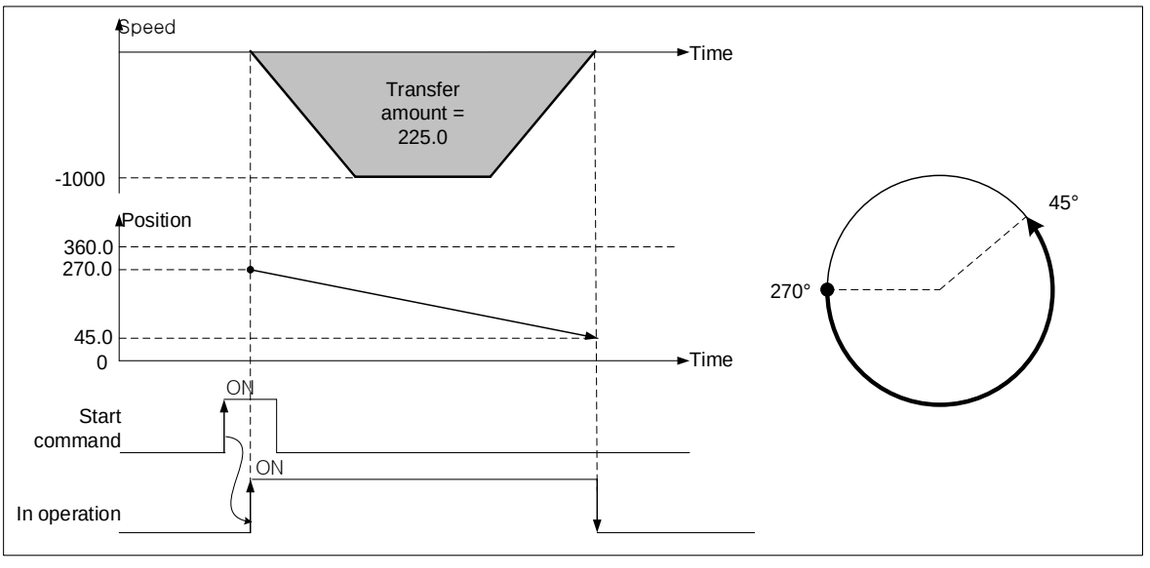
■ Operation Patterns



2) Control word setting of direct start = absolute coordinate, 0: position control

15 ~ 12	11 ~ 10	9 ~ 8	7 ~ 5	4	3 ~ 2	1 ~ 0
-	Deceleration time	Acceleration time	-	0:Absolute	-	0:Position control

■ Operation Patterns



9.5.12 Speed Acceleration/Deceleration Override

If you want to change the operation speed and acceleration/deceleration of the positioning control in operation, user may change the operation speed and acceleration/deceleration using the speed/acceleration/deceleration override command (XSETOVR, XPM_SETOVR).

(1) Control features

(a) Speed and acceleration/deceleration override command is available in Acceleration and Constant speed section and available operation modes are End, Keep, and Continuous.

(b) It may be executed several times in operation.

(c) User may set speed override value as '%setting" or"speed setting' on [Speed override] of common parameter.

(d) Related parameter setting (common parameter)

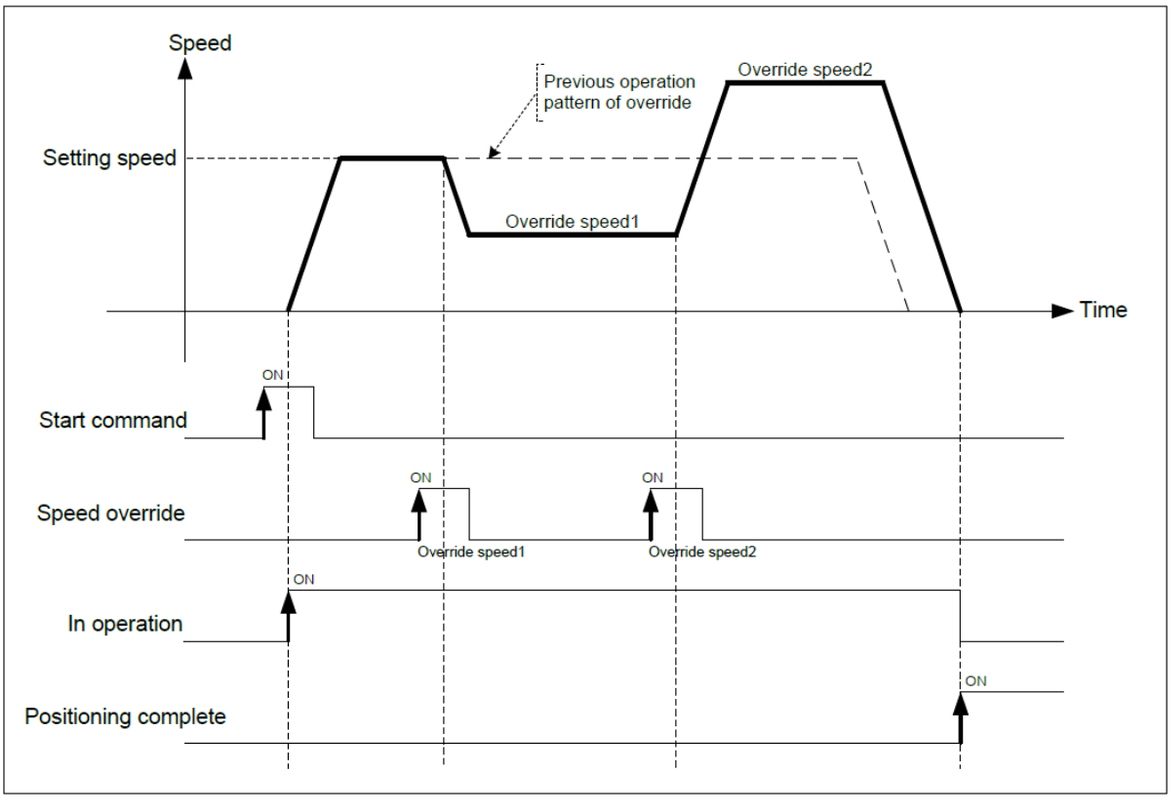
Item	Setting Value	Content
Speed override	0: Specify %	Set the speed override setting value by %
	1:speed designate	Set the speed override setting value directly to the operating speed.

(e) Auxiliary data of speed override command setting

Item	Setting Value	Content
Speed	1 ~ 65535 (1=0.01%)	If speed override is "%", set the speed by % (If it is 100%, set 10000)
	1 ~ Speed limit value	If speed override is "Exact number", set the speed with exact number

(2) Operating Timing

(a) Command/function block



(3) Restrictions

In the cases below, speed override is not executed and previous operation is being kept.

(a) The value of speed override exceeds speed limit of basic parameter. (Error code: 372). The speed value of speed override must be below speed limit. Override speed of linear interpolation for each axis need to be below speed limit.

(b) Execute speed override command on the subordinate axis of linear interpolation. (Error code: 373). In linear interpolation, speed override must be executed on main axis.

(c) Execute speed override command on the subordinate axis of circular interpolation. (Error code: 374). In circular interpolation, speed override must be executed on main axis.

(d) Execute speed override command on the subordinate axis of synchronous operation (error code: 375).

(e) Execute speed override command in deceleration area. (error code: 377)

(f) In the case that acc./dec. pattern of extended parameter is 'S-curve」 (error code: 378).

(g) When entering a value greater than 0 or 3 in the operational direction (error code: 781) (1~3: 1-forward direction, 2- reverse direction, 3- current direction).

(h) In case of specifying negative speed value during position control operation (error code: 782)

(i) When the speed override of the common parameter is "% specified", when the command is executed with a value greater than 65535 for acceleration or deceleration (error code: 783)

9.5.13 Control Cycle User Setting and Control Time Information

Set the control cycle to perform basic function of module including positioning command process and position/speed/torque control. User can check the control time information of currently operating module.
The control cycle operates as a multiple of communication cycle, communication cycle is determined by network configuration and slave parameter settings.

(1) Communication period

(a) In case of following condition, communication cycle is selected as 1ms.

1) A version that can only connect servo drive to the EtherCAT network (OS V2.30 or less).
2) The number of EtherCAT slaves is 8 or less, and data size of PDO communication is 640Byte or less.
3) Even if the number of EtherCAT slave is 9 or more, the number of slave that assigned axis is 7 or less, the PDO communication data size of total slave is 640Byte or less.

(b) In case of following condition, communication cycle is selected as 2ms.

1) The number of EtherCAT slave is 9 or more, slaves assigned to axis is 8.
2) The PDO communication data size of total slave is 640Byte or lmore

※ This apply when using the version that supports I/O device connection to EtherCAT network.

(2) Control cycle setting

(a) Set the control cycle with control cycle item of common parameters.

(b) The values which are available to be set is as follows.

0: auto setting
1: 1ms
2: 2ms
3: 3ms
4: 4ms

(c) if the control cycle set to " o: auto setting" the control cycle is determined as follows according to the number of "virtual axis + real axis' and PDO communication data size during EtherCAT connection. If EtherCAT is not connected or the virtual axis is not exist, it operates with a 1ms control cycle.

1) Communication cycle 1ms

XBF-PN04B	XBF-PN08B	PDO data	Control cycle
Axis 1~2	Axis 1~2	80 x 2 byte or less	1ms
		More than 80 x 2 byte	2ms
Axis 3~4	Axis 3~5	80 x 5 byte or less	2ms
		More than 80 x 5 byte	3ms
-	Axis 6~8	80 x 8 byte or less	3ms

2) Communication cycle 2ms

XBF-PN04B	XBF-PN08B	Control cycle
Axis 1~4	Axis 1~5	2ms
-	Axis 6~8	4ms

(d) Exception condition

If the communication cycle set to 2ms, the control cycle operates as a multiple of the communication cycle, so if the control cycle item of common parameter set to'1: 1ms' or '3: 3ms', real control cycle operates as '2ms' or '4ms'. The real control cycle can be checked the values "(3) control cycle setting of control time information check"below.

(3) Control time information check

(a) User can check the control time information of currently operating module with the GET/GETP command.

(b) Memory address and content

GET Command Device Offset	Memory address	Content
0	36C	Control cycle setting (unit - 0.1ms)
1	36D	Control cycle excess (0: Off, 1: On)
2	36E	Current control time (unit - 0.1ms)
3	36F	Maximum control time (unit - 0.1ms)

(c) If the “current control time is more than the values of“control cycle setting”, “control cycle excess”status is on. For normal control, set the control cycle setting of common parameter to more than the value of maximum control time.

(d) “Control cycle excess” and “ maximum control time” information is initialized during common error reset.

(4) Supported version

(a) The version information that supports control cycle setting and control time information check function is as follows.

Item	Supported version
XG5000	4.52 or higher
XBF-PN04B	V2.10 or higher
XBF-PN08B	V2.10 or higher

(b) The version information that supports I/O device connection to EtherCAT network.

Item	Supported version
XG5000	4.70 or higher
XBF-PN04B	V2.40 or higher
XBF-PN08B	V2.40 or higher

9.6 Auxiliary Function of Control

9.6.1 High/Low limit

Positioning module includes Hardware high/low limit and Software high/low limit.

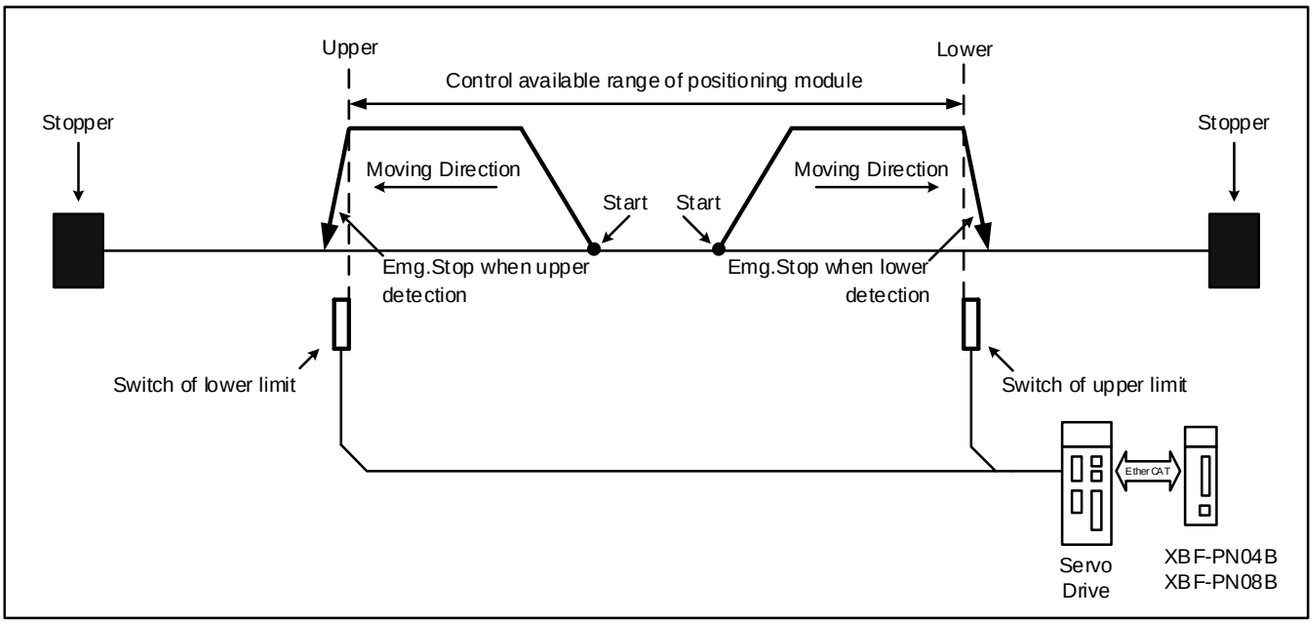
(1) Hardware high/low limit

(a) It is used to make a sudden stop of servo drive before reaching lower limit/upper limit of the device side by installing high/low limit switch in the inside of the high/low limit, the physical operating range of the device side. In this case, if it is out of the high limit, Error 492 will occur and if it is out of the low limit, Error (493 will occur.

(b) The input of high/low limit switch is connected to each servo drive and transferred to the positioning module by network. When positioning module is not in the controllable area, positioning operation is not executed.

(c) If it is stopped by hardware high/low limit detection, move it into the controllable area with Jog operation in reverse direction of detected signal.

(d) Hardware high/low limit is shown as follows.



(e) Emergent stop when hardware high/low limit is detected

When hardware high/low limit is detected, stop the current positioning control and then decelerate within 「Dec. time for Emergent stop'.

■ Setting related parameter (basic parameter)

Item	Setting Value	Content
Dec. time of Emergent stop	0 ~ 2147483647 [ms]	Set deceleration time for using when detect hardware high/low limit signal. The Emergency stop dec. time means the time it takes to decelerate to zero speed from the speed limit.

(2) Software High/Low Limit

(a) This command is for setting the movable range of machine as software high/low limit. If it is out of the range in operation, this is a function that prevents positioning operation using the deceleration time in case of emergency stop of the basic parameters. That is, this function is used to prevent any breakaway by incorrect operation position setting and incorrect operation by user program fault.

(b) If it is out of the range of software high/low limit, set external input high/low limit for use.

(c) Checking range of software high/low limit is executed at the beginning.

(d) If software high/low limit is detected, error arises. (High limit error: 501, Low limit error:502)

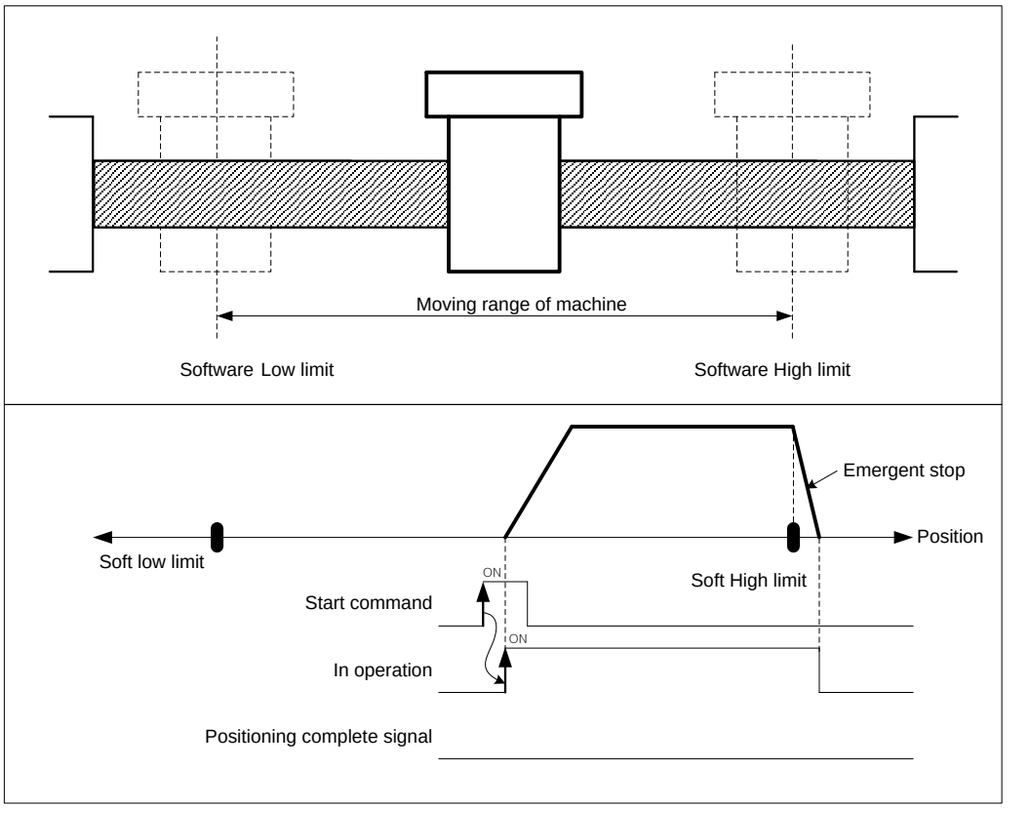
(e) User may set the position value of high/low limit on extended parameter.

■ Setting related parameter (expansion parameter)

Item	Setting Value	Content
S/W upper limit	-2147483648 ~ 2147483647	Set the position of soft high limit
S/W low limit	-2147483648 ~ 2147483647	Set position of software low limit.

(f) If it is stopped by software high/low limit detection, move it into the controllable area with Jog operation in reverse direction of detected signal.

(g) Software high/low limit is shown as follows.



(h) In the case below, software upper/lower limit are not detected.

- In case of setting Software high/low limits as maximum (2147483647), minimum (-2147483648)
- If the soft upper and lower limits are set to the same value (soft upper limit and = soft lower limit)
- When operating speed control while the soft high/low limit during speed control of extended parameter set to “0: Not detect”.

Notes

1. It does not detect software high/low limit in origin-undecided state
2. Not to detect software high/low limit
   If the value of current position becomes 2147483647 in forward operation, the current position becomes -2147483646 and keeps operating in forward direction.
   If the value of current position becomes -2147483647 in reverse operation, the current position becomes 2147483646 and keeps operating in reverse direction.
3. If the software high/low limit is detected and the position maximum value exceeds 2147483647 and and changed to a negative position values after emergency stop, S/W low limit error occurs during jog reverse operation. In this cases, After software high/low limit setting value is set to maximum, maximum to prevent detection, then move into control range using jog reverse operation and reset the software high/low limit.
4. If the software low limit is detected and the position maximum value exceeds -2147483648 and and changed to a positive position values after emergency stop, S/W high limit error occurs during jog forward operation. In this cases, After software high/low limit setting value is set to maximum, maximum to prevent detection, then move into control range using jog forward operation and reset the software high/low limit.

9.6.2 M code

This is used to confirm the current operation step no. and carry out the auxiliary work (Clamp, Drill rotation, Tool change etc.) by reading M Code from the program.

(1) Control features

(a) M code should be set in the M code item of operation data. (Setting range: 1 to 65535)

(b) If M code is set as 0, M code signal will not occur.

(c) If M code occurs, M code no. (1 ~ 65535) and M code signal On will occur simultaneously.

(d) In the continuous operation mode, if the M code number and M code ON signal occur, the operation of the next step is in the standby state, and the M code on signal waits for Off. If executing M code release (MOF) command, it carries out Keep operation to the next step without start command.

(e) In continuous operation mode, even if M code no. and M code On signal occur, not to wait but execute continuous operation to the next step.

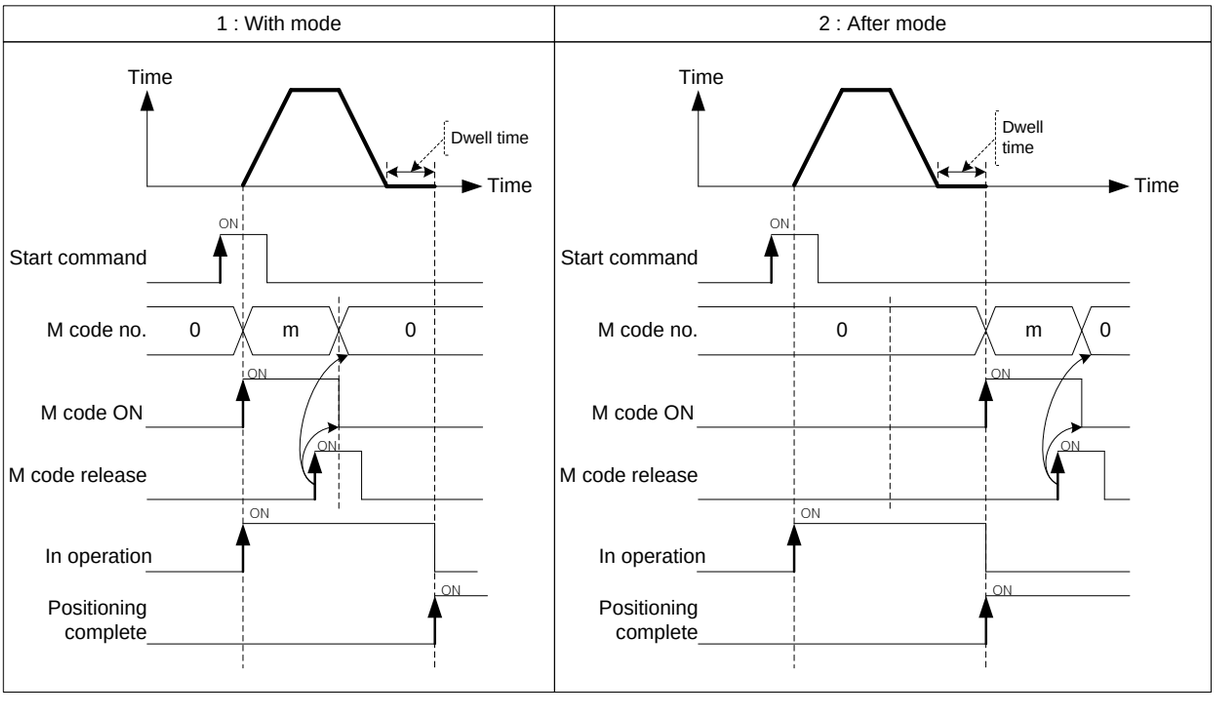
(f) User may turn M code signal off and set M code no. to 0 with M code release command. M code release command can be used even during operation.

(e) M code mode is set from M code output item of extended parameter. (0: NONE, 1: WITH, 2: AFTER)

■ Setting related parameter (expansion parameter)

Item	Setting Value	Content
M code mode	0: None	Not to output M code signal and M code no.
	1: With	Start and turn M code signal 'on' at the same time, then output M code no. set in operation data.
	2: After	After finishing positioning by start command, turn M code signal 'on' and then output M code no. set in operation data.

(2) Operating Timing



[Example] Set M code no. in operation data as follows and execute absolute, single axis positioning control.

■ Axis1 current position: 0

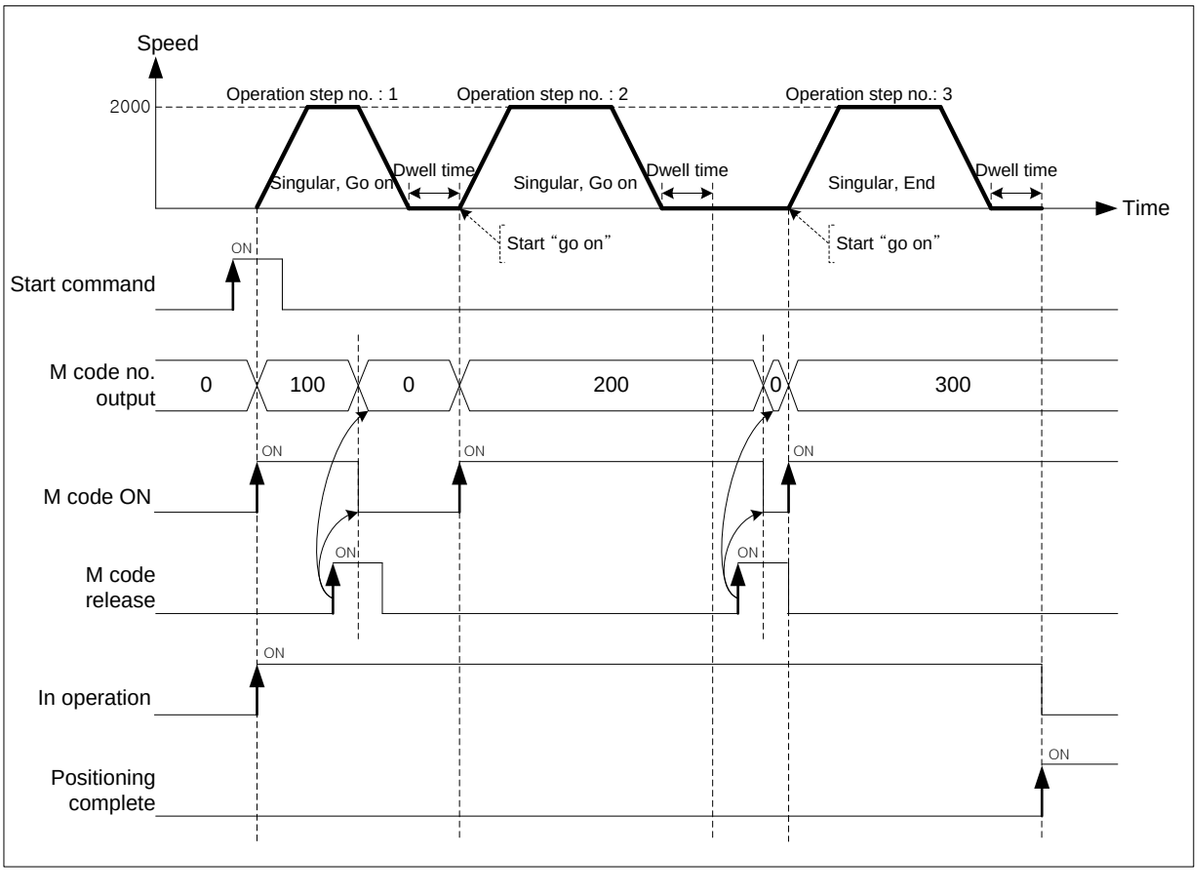
M code mode of basic parameter: With

■ Setting of XG-PM

▪ Axis 1 operation data

step no.	Control method	Program control method	Target position [pls]	Operation Speed [pls/s]	Acceleration number	Deceleration number	M code	Dwell time
1	Absolute, Single axis position control	Single,Keep	1000	2000	No.1	No.1	100	100
2	Absolute, Single axis position control	Single,Keep	3000	2000	No.1	No.1	200	100
3	Absolute, Single axis position control	Single,End	5000	2000	No.1	No.1	300	100

■ Operation Patterns



9.6.3 External Latch

The latch function latches the current position of the servo drive and read the position data latched by the instruction from the CPU when the touch probe (Touch Probe 1) signal of servo drive is inputting.

(1) Control features

(a) To use the latch function, the latch function enable/disable and latch mode must be set using the latch setting command. The auxiliary data used in latch setting command is as follows.

Item	Setting Value	Content
Latch enable/disable	0: Disable	The latch function is disabled. Even if a touch probe 1 signal is input, it is ignored.
	1: Enable	The latch function is enabled. When the touch probe 1 signal is input, it operates in the set trigger mode.
Latch mode	0: Single trigger	After the latch is allowed, the current position is latched on the first touch probe 1 signal input.
	1: Continuous trigger	After the latch is allowed, the current position is latched for each touch probe 1 signal.

(b) When the touch probe 1 (1) signal is turned on, the current position value of the servo is saved as latch position data.

(c) Up to 10 latch position data can be stored. When the latch position data exceeds 10, the oldest latch position data is deleted and the newly latched data is saved. That is, the 10 latest latch position data is maintained.

(d) When the touch probe 1 (Touch Probe 1) signal is turned on and the latch is completed, Bit 8: “Latch Complete” bit of axis information in status information is turned on. “Latch complete” status bit remains on until reset by latch reset command (XLCLR, XPM_LCLR). The auxiliary data used in latch reset command is as follows.

Item	Setting Value	Content
Latch reset item	0: Latch completion status reset	Resets the latch completion bit among axis information in the status information
	1: Latch position data and latch completion status reset	Set the latch completion status to off and resets the latch position data number and latch position data to “0”.

When the latch mode is single trigger, if the latch reset command is executed after the latch function is activat ed on the first touch probe 1 signal, the trigger function can be used again on the next touch probe 1 signal. (Even if the latch setting commands is set to allow latch and then executed again, it operates the same way.)

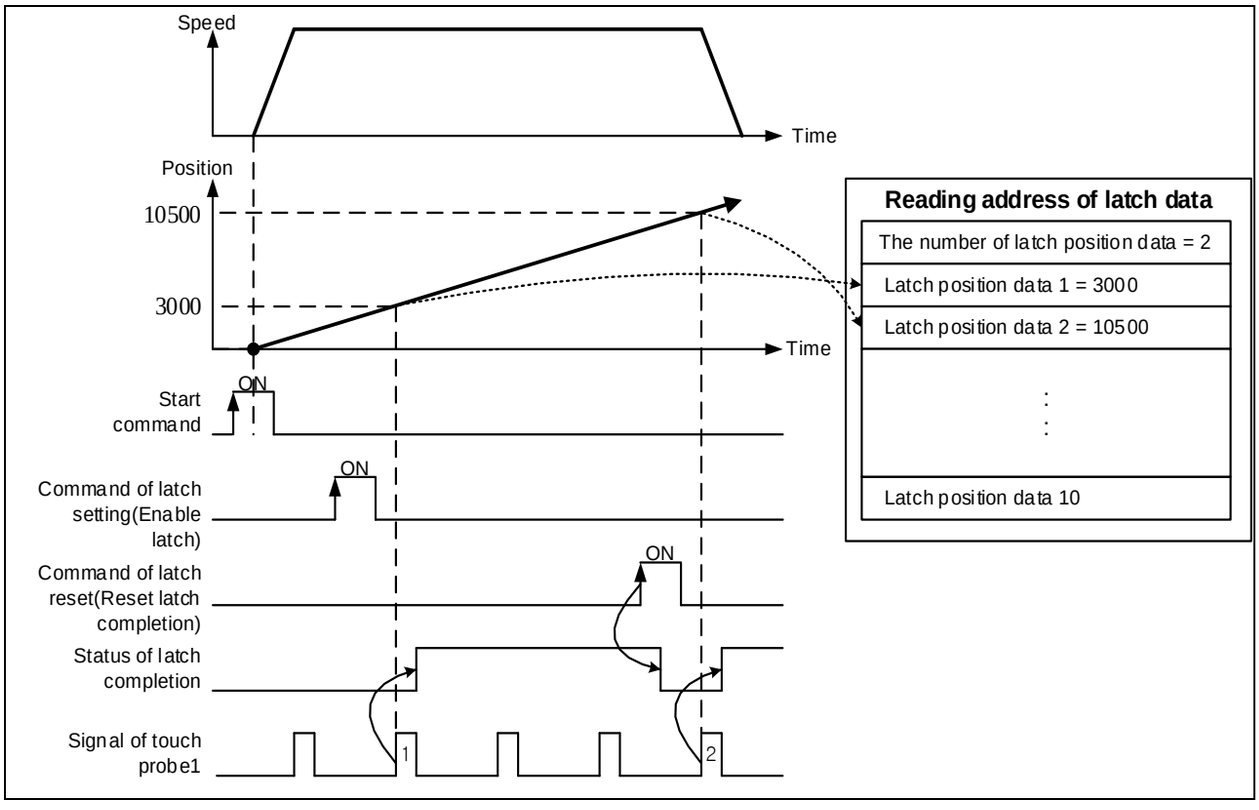
(e) The number of latch position data and latch position data can be read by the latch position data read command (XLRD, XPM_LRD) from CPU. The auxiliary data used in latch position data read commands is as follows.

Item	Setting Value	Content
Retentive Memory (latch area) Device to save	Device	Set the devices where latch position data number and latch position data will be saved.

The values saved in the device area are as follows.

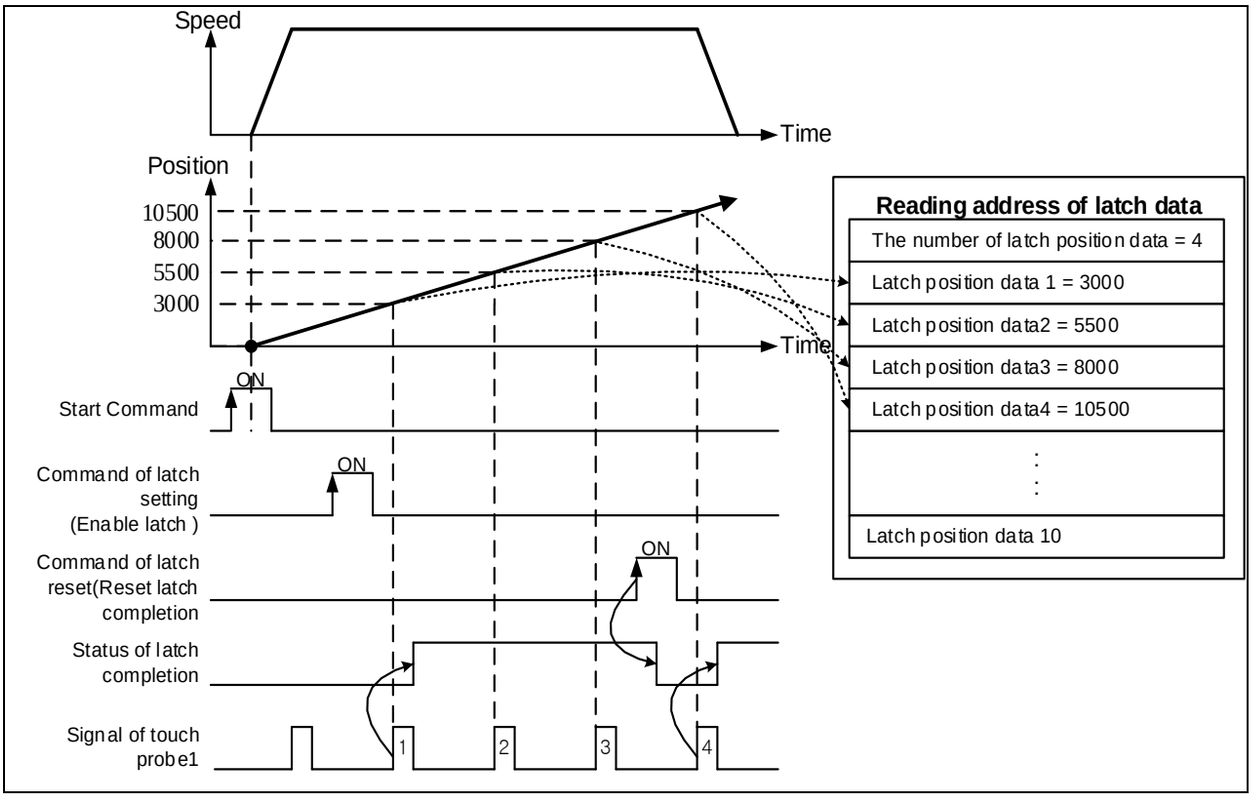
Device number	Size	Content
Device	WORD	Number of latch position data
Device +1	WORD	-
Device +2	DINT	Latch position data 1
Device +4	DINT	Latch position data 2
Device +6	DINT	Latch position data 3
Device +8	DINT	Latch position data 4
Device +10	DINT	Latch position data 5
Device +12	DINT	Latch position data 6
Device +14	DINT	Latch position data 7
Device +16	DINT	Latch position data 8
Device +18	DINT	Latch position data 9
Device +20	DINT	Latch position data 10

(f) Operating timing (single trigger mode)



The latch function is activated in the single trigger mode and then the latch function is operated on the first touch probe 1 signal. The latch function does not operate on the input touch probe 1 signal after triggering, and the latch function operates again on the input touch probe 1 signal after a single trigger function is allowed again with the latch reset command.

(g)Operating timing (continuous trigger mode)



In the continuous trigger mode, after the latch function is allowed, the latch function operates on all input touch probe 1 signals.

9.6.4 Touch Probe

The touch probe function latches current position Data of servo drive reads latched position data by commands from CPU when rising edge or falling edge of touch probe 1(Touch Probe 1) or touch probe 2 (Touch Probe 2) signal of the servo drive is triggered.

(1) Control features

(a) To use touch probe function, set the trigger input signal and trigger mode using touch probe setting command. The auxiliary data used in touch probe setting command is as follows.

Item	Setting Value	Content
Trigger input	0: Touch probe 1 rising edge	Saves position data that triggered on rising edge of touch probe 1.
	1: Touch probe 2 rising edge	Saves position data that triggered on rising edge of touch probe 2.
	2: Touch probe 1 falling edge	Saves position data that triggered on falling edge of touch probe 1.
	3: Touch probe 2 falling edge	Saves position data that triggered on falling edge of touch probe 2.
	4: Touch probe 1 index(Z) pulse	Saves position data that triggered on pulse of touch probe 1 index (Z).
	5: Touch probe 2 index(Z) pulse	Saves position data that triggered on pulse of touch probe 2 index (Z).
Trigger mode	0: Single trigger	The current position is latched only on the inputting first touch probe signal.
	1: Continuous trigger	The current position is latched on each touch probe signal.

(b) When the touch probe or index (Z) pulse signal is turned on, the current position value of the servo drive is saved as latch position data.

(c) When the touch probe or the index (Z) pulse signal is turned on and the latch is completed, information is stored in Bit 5: “Trigger Complete” bit of the axis information of the status information. “Trigger complete” status bit remains on until reset by trigger release command (XABORTT). The auxiliary data used in trigger off command is as follows.

Item	Setting Value	Content
Trigger input	0: Touch probe 1 rising edge	Release the touch probe 1 rising edge trigger setting.
	1: Touch probe 2 rising edge	Release the touch probe 2 rising edge trigger setting.
	2: Touch probe 1 falling edge	Release the touch probe 1 falling edge trigger setting.
	3: Touch probe 2 falling edge	Release the touch probe 2 falling edge trigger setting.
	4: Touch probe 1 index(Z) pulse	Release the touch probe 1 Index (Z) pulse trigger setting.
	5: Touch probe 2 index(Z) pulse	Release the touch probe 2 Index (Z) pulse trigger setting.
Trigger reset item	0: Trigger completion status reset	Resets the trigger completion bit among axis information in the status information
	1: Latch position data and trigger completion status reset	Set the trigger completion status to off and resets the latch position data number and latch position data to “0”.

(d) When the latch mode is single trigger, if the trigger release command is executed after the latch function is activated on the first touch probe or index (Z) pulse signal, the trigger function can be used again on the next touch probe or index (Z) pulse signal.

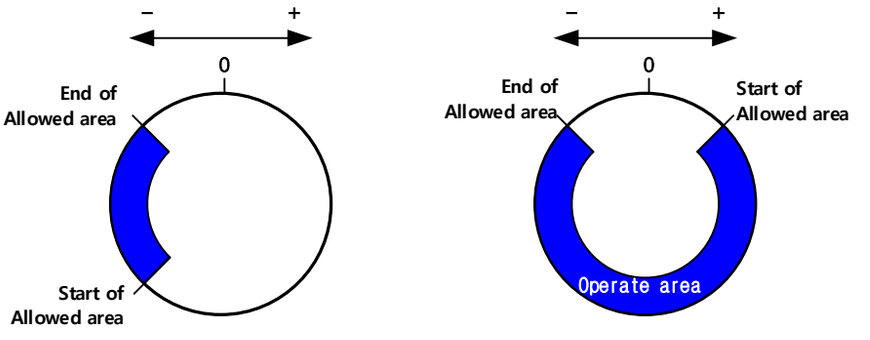
(It works the same when the touch probe setting command is executed again.)

(e) The rising or falling edge of each touch probe and the index (Z) pulse cannot be executed simultaneously.

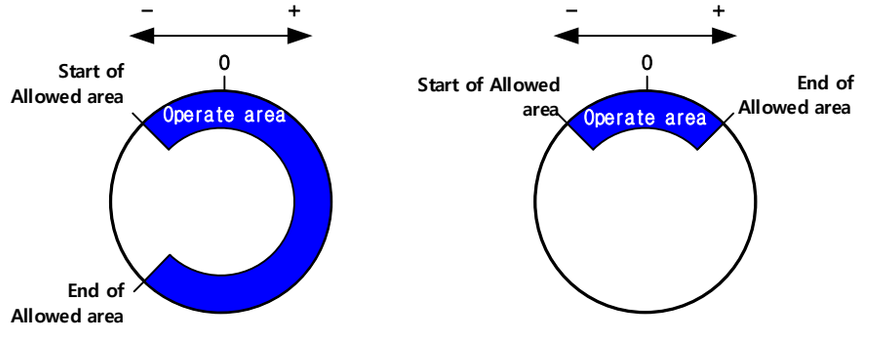
(f) Specify the area where the latch (touch probe) function operates.

- If you specify the allowable area, it operates only within the designated area.
- In the case of infinite length repeat operation (rotary axis), the relationship of the latch (touch probe) operation area according to the start and end positions of the allowable area is as follows.

If the start position of a allowed area < the end



If the start position of a allowed area > the end



(g) To use the latch (touch probe) function, the following objects must be included in the PDO setting of the slave parameter.

Trigger input	RxPDO	TxPDO
Touch probe 1 rising edge	0x60B8:0 Touch probe function	0x60B9: 0 Touch probe state 0x60BA: 0 touch probe 1 forward direction position values
Touch probe 2 rising edge	0x60B8:0 Touch probe function	0x60B9: 0 Touch probe state 0x60BC: 0 touch probe 2 forward direction position values
Touch probe 1 falling edge	0x60B8:0 Touch probe function	0x60B9: 0 Touch probe state 0x60BB: 0 touch probe 1 reverse direction position values
Touch probe 2 falling edge	0x60B8:0 Touch probe function	0x60B9: 0 Touch probe state 0x60BD: 0 touch probe 2 reverse direction position values

(h) When using latch (touch probe) command without object, the following error occurs depending on each trigger input.

Trigger input	Error code
Touch probe 1 rising edge	752
Touch probe 2 rising edge	753
Touch probe 1 falling edge	754
Touch probe 2 falling edge	755

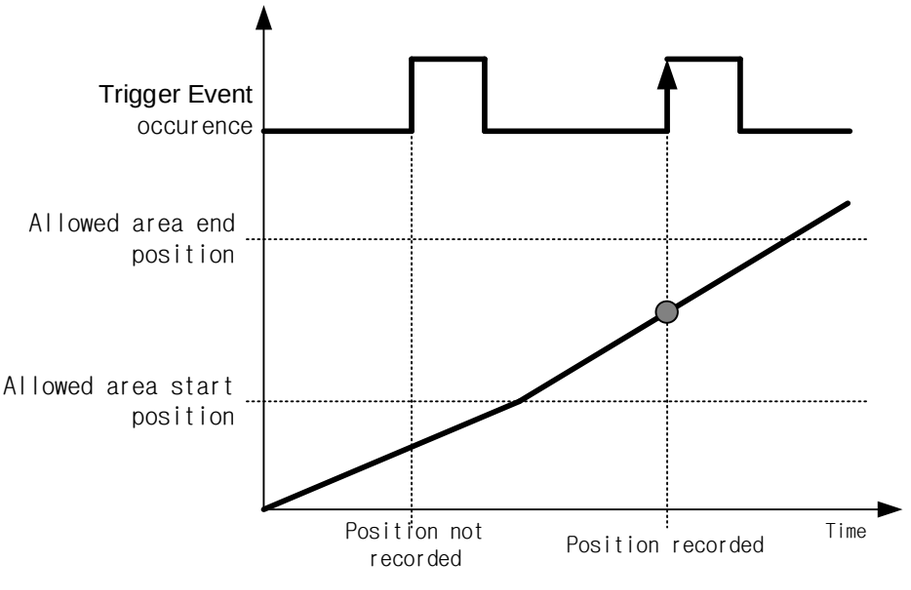
(i) The number of latch position data and latch position data can be read by the latch position data read command (XLRD, XPM_LRD) from CPU. The auxiliary data used in latch position data read commands is as follows.

Item	Setting Value	Content
Retentive Memory (latch area) Device to save	Device	Set the devices where latch position data number and latch position data will be saved.

The values saved in the device area are as follows.

Device number	Size	Content
Device	WORD	Number of touch probes enable (Fixed to 6)
Device +1	WORD	-
Device +2	DINT	Latch position data triggered on rising edge of touch probe 1
Device +4	DINT	Latch position data triggered on rising edge of touch probe 2
Device +6	DINT	Latch position data triggered on falling edge of touch probe 1
Device +8	DINT	Latch position data triggered on falling edge of touch probe 2
Device +10	DINT	Latch position data triggered on pulse of touch probe 1 index(Z)
Device +12	DINT	Latch position data triggered on pulse of touch probe 2 index(Z)
Device +14	DINT	Not used in touch probe commands
Device +16	DINT	
Device +18	DINT	
Device +20	DINT	

(j) Operating Timing



9.7 Data Modification Function

This function is for changing operation data and operation parameter of embedded positioning module.

9.7.1 Teaching Array

This is a function to change the target position value/operation speed value of the step number specified by the user with plural teaching command without directly modifying the positioning operation data in XG-PM.

(1) Control features

(a) This command is for changing operating speed or the goal position on several steps.

(b) User may change maximum 16 data.

(c) RAM teaching and ROM teaching are available depending on the saving position.

- RAM teaching
  When executing teaching to operation data of module and operating module in power connection, user may change speed value or position value but the speed value and position value are not saved in non-power connection.
- ROM teaching
  When executing teaching to operation data of module and operating module in power connection, user may change speed value or position value and operation data is saved permanently even in non-power connection.

(d) The value of target position being changed is position teaching, the value of operating speed being changed is speed teaching.

(e) The axis in operation may be the subject of position teaching or speed teaching.

(f) If user changes the value of goal position or operating speed frequently, this command is very useful for it.

(g) Auxiliary data setting of teaching array command

Item	Setting Value	Content
Step	0 ~ 400	Set the step no. for teaching
Position	0: RAM teaching 1: ROM teaching	Set the teaching method
Data	0: position 1: speed	Set the data items for teaching
Quantity	1 ~ 16	Set the number of operating step

(h) The plural teaching command is available to be executed when the axis is operating. But teaching data of operating step do data (Hundred apply instantly. Operating step data will apply end of present step operation and the data of the remaining steps are changed immediately.

Notes

The plural teaching data must be set in the data setting area for teaching array before plural teaching command is executed. Refer to the teaching array command XTWR.

(2) Restrictions

Teaching array command may not be executed in the case as follows.

(a) The number of teaching array is out of the range (1~16). (Error code: 462)

(b) The number of teaching step is out of the range (1~400). (Error code: 465)
Total number (Teaching step no. + the number of Teaching) must be below 400.

9.7.2 Parameter Change from Program

User may modify the operation parameter set on XG-PM with teaching command for each parameter.

(1) Control features

(a) There are 4 kinds of parameter teaching command including Basic parameter teaching, extended parameter teaching, manual operation parameter teaching, common parameter teaching.

(b) Parameter teaching is not available in operation.

(c) RAM teaching and ROM teaching are available depending on the saving position.

- RAM teaching
  When executing teaching to parameter of positioning module and operating positioning module during power input, user may operate changed parameter, but if power is off, the changed parameter values are lost, and when the power is turned on again, the module operates with previous data stored in non-volatile memory.
- ROM teaching
  When executing teaching to parameter of positioning module and operating positioning module during power input, user may operate changed parameter and even if power is off, when the power is turned off, the previous parameter values save in MRAM (non-volatile memory).

(2) Basic Parameter Teaching

(a) Change the setting value of designated item from basic parameter of module into teaching data.

(b) Auxiliary data setting of basic parameter teaching command

<table>
<tr><th colspan="2">Item</th><th colspan="2">Setting Value</th><th colspan="2">Content</th></tr>
<tr><td colspan="2" rowspan="2">Teaching data</td><td colspan="2" rowspan="2">Refer to setting range</td><td colspan="2">Set the teaching value of parameter selected</td></tr>
<tr><td>Setting range</td><td>-</td></tr>
<tr><td rowspan="14">Teaching items</td><td>1</td><td>Speed limit value</td><td>1 ~ 2147483647</td><td rowspan="14">Select the parameter item to execute teaching</td></tr>
<tr><td>2</td><td>Acceleration time 1</td><td rowspan="9">1 ~ 2147483647</td></tr>
<tr><td>3</td><td>Acceleration time 2</td></tr>
<tr><td>4</td><td>Acceleration time 3</td></tr>
<tr><td>5</td><td>Acceleration time 4</td></tr>
<tr><td>6</td><td>Deceleration time 1</td></tr>
<tr><td>7</td><td>Deceleration time 2</td></tr>
<tr><td>8</td><td>Deceleration time 3</td></tr>
<tr><td>9</td><td>Deceleration time 4</td></tr>
<tr><td>10</td><td>Dec. time of Emergent stop</td></tr>
<tr><td>11</td><td>Pulse number /revolution</td><td>1 ~ 200000000</td></tr>
<tr><td>12</td><td>Transfer distance per 1 rotation</td><td>Depends on setting unit</td></tr>
<tr><td>13</td><td>Unit</td><td>0 pulse
1: mm
2: inch
3: degree</td></tr>
</table>

	14	Unit multiplier	0: x1 1: x10 2: x100 3: x1000	
	15	Speed command unit	0: unit/time 1: rpm	
	16	Encoder select	0: Incremental Encoder 1: Absolute encoder	
	17	Current pos. display Compensation amount	0 ~ 255	
	18	User specified position display ratio	0 ~ 7	
	19	User specified speed display ratio	0 ~ 7	
	20	Axis type	0: Real axis, 1: Virtual axis	
	23	Control mode during speed synchronization	0: CSP – command position, 1: CSP – current position, 2: CSV – command speed, 3: CSV – current speed	
Teaching method	0: RAM teaching 1: ROM teaching		Set the teaching method	

For the details about basic parameter items and setting value, refer to 'Chapter 4 Parameter and operation data for position'.

(3) Extended Parameter Teaching

(a) Change the setting value of designated item from extended parameter of module into teaching data.

(b) Auxiliary data setting of extended parameter teaching command.

Item	Setting Value		Content	
Teaching data	Refer to setting range		Set the teaching value of parameter selected Setting Value	
Teaching items	1	S/W upper limit	-2147483648 ~ 2147483647	Select the parameter item to execute teaching
	2	S/W low limit	-2147483648 ~ 2147483647	
	3	-	-	
	4	Position completion time	0 ~ 65535	
	5	S-curve ratio	1 ~ 100	
	6	Command Inposition range	0 ~ 2147483647	
	7	Axis 2 linear interpolation Continuous operation arc insertion position	0 ~ 2147483647	
	8	Acceleration/Deceleration Pattern	0: Trapezoidal operation 1: S-Curve operation	
	9	M Code mode	0: None 1: With 2: After	
	10	Upper and lower limits during speed control Detection	0: Not detect 1: Detect	
	11	Positioning completion condition	0: Dwell time 1: Inposition 2:Dwell time AND Inposition signal 3:Dwell time OR Inposition signal	
	12	Continuous interpolation positioning method	0: passing target position 1: Near Passing	
	13	Axis 2 linear interpolation Continuous operating arc insertion	0: not arc insertion 1: arc insertion continuous operating	
	14	External command selection	0: external speed/position switch control 1: External stop command	
	15	External command	0:disabled,1:enabled	
	16	Position specified Speed override coordinate	0:absolute, 1:incremental	
	17	Infinite running repeat position	mm: 1 ~ 2147483647[X10-4㎜] Inch: 1 ~ 2147483647[X10-5Inch] degree: 1 ~ 2147483647[X10-5degree] pulse: 1 ~ 2147483647[pulse]	
	18	Infinite running repeat	0:disabled,1:enabled	
	19	Speed/Position switching coordinate	0:Relative, 1:Absolute	
	20	Interpolation speed selection	0: main axis speed 1: synthetic speed	
Teaching method	0: RAM teaching 1: ROM teaching		Set the teaching method	

For the details about extended parameter items and setting value, refer to 'Chapter 4 Parameter and operation data for position'.

(4) Manual Operation Parameter Teaching

(a) Change the setting value of designated item from manual operation parameter of XPM module into teaching data.

(b) Auxiliary data setting of manual operation parameter teaching command.

Item	Setting Value		Content	
Teaching data	Refer to setting range		Set the teaching value of parameter selected Setting range	.
Teaching items	1	Jog high speed	1 ~ Speed limit value	Select the parameter item to execute teaching
	2	Jog low speed	1 ~ Jog high speed	
	3	Jog acc. time	0 ~ 2147483647	
	4	Jog deceleration time		
	5	Inching speed	1 ~ Speed limit value	
Teaching method	0: RAM teaching 1: ROM teaching		Set the teaching method	

The jog high speed values can be set to value less than the jog low speed value using the manual operation parameter teaching command,and the jog low speed values can be set to value larger than the jog high speed value. However, if the jog high speed values can be set to value less than the jog low speed value when executing jog operation, an error (122) occurs.

In other words, when teaching “jog high speed or jog low speed parameter, a mutual comparison check is not executed, but a range check is executed when executing jog operation, so the following conditions must be satisfied before executing jog operation.

Jog Low Speed ≤ Jog High Speed ≤ Speed Limit

For the details about manual operation parameter items and contents, refer to 'Chapter 4 Parameter and opera tion data for position'.

(5) Input Signal Parameter Teaching

(a) Change the setting value of designated item from I/O signal parameter of module into teaching data.

(b) The meaning of setting value for each bit of input signal parameter teaching command.

15	14	13	12	11 ~ 8	7 ~ 4	3 ~ 0
-	Input signal Z logic sele ction	Input signal B logic sele ction	Input signal A logic sele ction	Input signal Z function s election	Input signal B function s election	Input signal A function s election

For the details about input signal parameter items and setting value, refer to 'Chapter 4 Parameter and operation data for position'.

(6) Input signal parameter - external position/torque control switch torque teaching

(a) Change external position/torque control switch torque values of input signal parameter of positioning module to teaching data.

(b) The setting range of the torque value is as follows.

-32768 % ~ 32767 %

For the details about input signal parameter items and setting value, refer to 'Chapter 4 Parameter and operation data for position'.

(7) Common Parameter Teaching

(a) Change the setting value of designated item from common parameter of XPM module into teaching data.

(b) Auxiliary data setting of common parameter teaching command

Item	Setting Value		Content	
Teaching data	Refer to setting range		Set the teaching value of parameter selected Setting range	Set teaching value of parameter
Teaching items	1	Speed override	0: Specify % 1: speed designation	Select the parameter item to execute teaching
	2	Encorder1 pulse input	0:CW/CCW 1 multiplication 1:PULSE/DIR 1 multiplication 1:PULSE/DIR 2 multiplication 3: PHASE A/B 1 multiplication 4: PHASE A/B 2 multiplication 5: PHASE A/B 4 multiplication	
	3	Encoder1 Max. value	-2147483648 ~ 2147483647	
	4	Encoder1 Min. value		
	5	Encoder1 phase Z clear	0: Disable 1: Enable	
	10	Position specified speed synchronization Target position coordinate	0: Relative 1: Absolute	
	11	Encoder 1 average count	0:Not Use 1: 5times 2: 10 times 3: 20 times	
	13	External input terminal function selection	0: encoder signal phase A,B,Z 1: external input signal A,B,Z	
	14	External input signal input filter	0:Not Use 1: Use	
	15	Error reset mode	0: module 1: module/ servo	
	16	Torque synchronization control reference value	0: Actual torque value 1: Demand torque value	
	17	Control cycle	0: auto setting 1: 1ms 2: 2ms 3: 3ms 4: 4ms	
Teaching method	0: RAM teaching 1: ROM teaching		Set the teaching method	

For the details about input common parameter items and setting value, refer to 'Chapter 4 Parameter and operation data for position'.

9.7.3 Operation Data Change from Program

User may modify the positioning operation data set on XG-PM with operation data teaching command.

(1) Control features

(a) Change setting value of designated step and item from PLC's operation data into teaching data.

(b) Operation data setting command is available when the related axis is in operation. But teaching data of operating step do not apply instantly. Operating step data will apply end of present step operation.

(c) RAM teaching and ROM teaching are available depending on the saving position.

■ RAM teaching

When executing teaching to operation data of embedded positioning and operating embedded positioning in power connection, user may change speed value or position value but the speed value and position value are not saved in non-power connection.

■ ROM teaching

When teaching operation data of positioning module and operating positioning module during power input, user may operate changed operation data and even if power is off, when the power is turned off, the previous operation data values save in MRAM (non-volatile memory).

(d) Auxiliary data setting of operation data teaching command

Item	Setting Value		Content	
Teaching data	Refer to setting range		Set the teaching value of selected item in teaching item. Setting range	
Teaching items	1	Target position	-2147483648 ~ 2147483647	Select the parameter item to execute teaching.
	2	Circular interpolation auxiliary position	-2147483648 ~ 2147483647	
	3	Operating speed	1 ~ Speed limit value	
	4	Dwell time	0 ~ 65535	
	5	M code No.	0 ~ 65535	
	6	Sub axis setting	Set it on Bit 0 ~ Bit 7 0: Subordinate axis not set 1: Subordinate axis setting	
	7	Helical interpolation axis	0: Unused 1 ~ 8: Axis 1~ 8	
	8	No. of circular interpolation turn	0 ~ 65535	
	9	Coordinate	0: Absolute 1: Relative	
	10	Control method	0: Single-axis position control 1: Single-axis speed control 2: Single-axis FEED control 3: Linear interpolation control 4: Arc interpolation control	
	11	Program control method	0: Single 1: Repeat	
	12	Operating pattern	0: End 1: Keep 2:Continuous	

	13	Circular arc size	0: Arc < 180 1: Arc >= 180	
	14	Acc. No.	0 ~ 3	
	15	Deceleration No.	0 ~ 3	
	16	Circular interpolating method	0: Middle point 1: Center point 2: Radius	
	17	Circular interpolating direction	0: CW 1: CCW	
step no.	0 ~ 400		Set the step no. of operation data to execute teaching	
Teaching method	0: RAM teaching 1: ROM teaching		Set the teaching method	

For the details and setting value of operation data item, refer to 'Chapter 4 Parameter and operation data for positi on'.

9.7.4 Write/Read Variable Data

Parameter, operation data, CAM data is data can be read by 'Read Variable Data' command and written by 'Write Variable“command directly.

(1) Variable data reading

(a) “You read data you want by designating module internal memory address of parameter” operation data, CAM data directly.

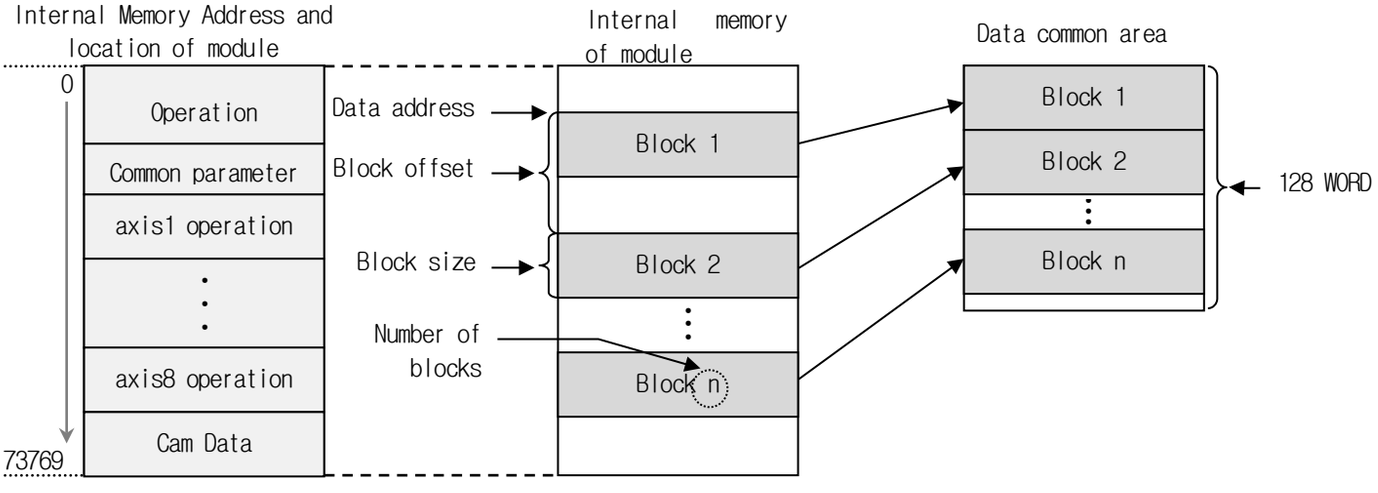
(b) Reads data as many as “Block ” size starting position set in “Read address with WORD unit to CPU among parameter, operation data, Cam Data data. “In case“CNT' is higher than 2, reads blocks with interval of“Block offset” starting 'Read address” as many as 'CNT” -1.

(c) Max data size (Block size X No. of block) can be read with one command is 128 WORD.

(d) ” Variable data read“can be executed in operation.

(e) “Auxiliary data setting of” Read Variable Data' command

Item	Setting Value	Content
Read address	0 ~ 73801	Sets head address of Read Data
Block offset	0 ~ 73801	Sets offset between blocks of Read Data
Block size	1 ~ 128	Sets size of block
Number of blocks	1 ~ 128	Sets No. of Read Block



(f) Restrictions

In the following case, error occurs and cannot execute" Read Variable Data' command

■ Data setting error (Error code: 711)

- Read data size (Block size x No. of block) is 0 or higher than 128 WORD.
- Read data address [Read address + {block offset x (No. of block -1)} + Block size is higher than last address value (73769)

Notes

If you execute Read Variable Data command in XGB PLC, Read data from positioning module is saved in common area. To save in device for using in PLC program, use GETM command [Read address: 0, data size: Read data size (DWORD)] In XEC PLC, read data is saved in register set in function block automatically.

(2) Variable data writing

(a) "You write data you want by designating module internal memory address of parameter" operation data, CAM data directly.

(b) Writes data set in PLC program as many as"Block size" starting position set in"Write address" with WORD unit among parameter, operation data, Cam Data data of positioning module. "In case"No. of block' is higher than 2, writes blocks with interval"OFFSET' starting 'Write address" as many as 'CNT" -1.

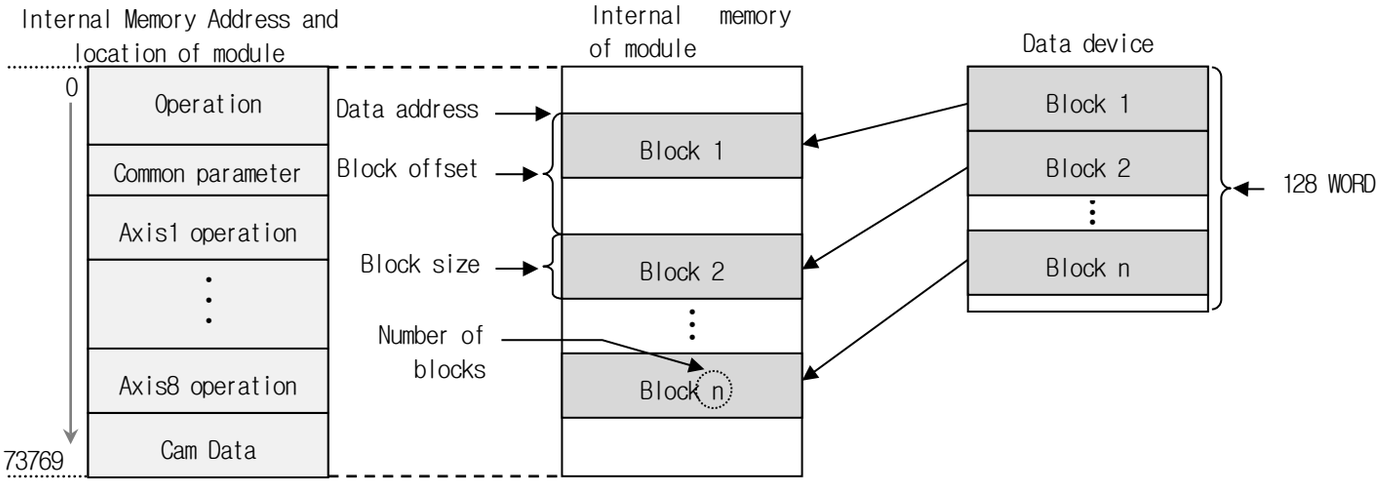
(c) Max data size (Block size X No. of block) that can be written with one command is 128 WORD.

(d) "Variable data write" command cannot be executed in operation. But 'Read Variable Data' command can be executed to User CAM data in User CAM operation.

(e) "After executing" Write Variable Data' command, since the changed value is maintained while power is on, in order to keep the changed value, execute" Save parameter/Operation data' command

(f) "Auxiliary data setting of" Write Variable Data' command

Item	Setting Value	Content
Data device	-	Sets device where data to write to module is saved
Write address	0 ~ 73801	Sets head address of positioning module internal memory
Block offset	0 ~ 73801	Sets offset between blocks of Write data
Block size	1 ~ 128	Sets size of block
Number of blocks	1 ~ 128	Sets No. of Write block



(g) Restrictions

In the following case, error occurs and cannot execute 'Variable data write' command

■ Data range setting error (Error code: 711)

▪ Write data size (Block size x No. of block) is 0 or higher than 128 WORD

▪ Write data address [Write address + {Block offset x (No. of block -1)} + Block size] is higher than last address value (73769)

■ Block overlap error (error code: 713)

▪ In case module internal block to write is overlapped each other
(In case no. of block is higher than 2, block offset is smaller than block size.)

■ Execution inhibition error in operation (Error code: 712)

▪ When one axis of the positioning module is operating

9.7.5 EtherCAT PDO Data Read/Write

TxPDO/RxPDO communication data exchanged between the positioning module and the servo drive through EtherCAT communication can be directly read from the PLC program using the GETM command and directly written using the PUTM command.

Additionally, TxPDO/RxPDO communication data exchanged between the positioning module and the EtherCAT slave through EtherCAT communication can be directly read from the PLC program using the READPDO command and directly written using the WRITEPDO command.

(1) EtherCAT servo drive TxPDO data read

(a) You can read the EtherCAT TxPDO data transmitted from the servo drive to the positioning module using the GETM command in the PLC program.

(b) You can select and read up to 5 objects among objects mapped EtherCAT TxPDO of slave parameters.

(c) During executing the GETM command, data is read in the order in which “CPU read”is checked among the objects mapped to the TxPDO of slave parameter and save to device area set in the command.

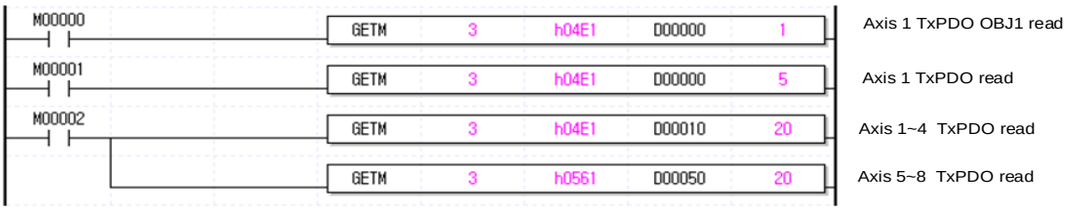
(d) When saving data in the device area by executing GETM command, it is save in 4 bytes size unit regardless of the data Type of objects.

(e) TxPDO read address (hexadecimal) for each axis of GETM command

	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8
Object 1	4E1	4E6	4EB	4F0	561	566	56B	570
Object 2	4E2	4E7	4EC	4F1	562	567	56C	571
Object 3	4E3	4E8	4ED	4F2	563	568	56D	572
Object 4	4E4	4E9	4EE	4F3	564	569	56E	573
Object 5	4E5	4EA	4EF	4F4	565	56A	56F	574

1) TxPDO data of 4 axes canb be read by one GETM command since axes 1~4 and axes 5~8 are continuous memory addresses.

2) Example of program

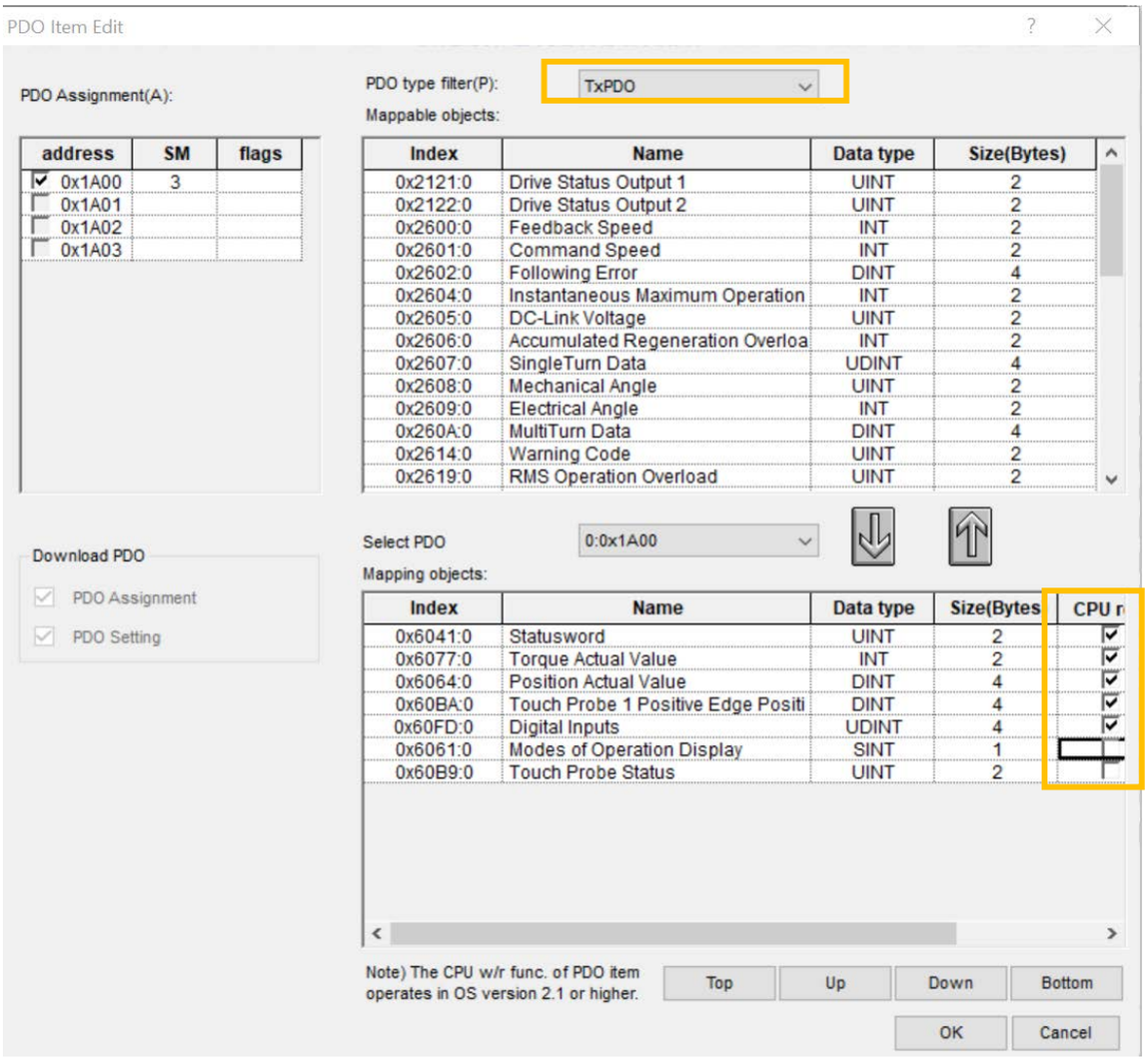


(f) The commands available to read EtherCAT TxPDO data are as follows.

1) XBC
   - GETM, GETMP
2) XEC
   - ARY_GETM

(g) The method to select TxPDO read data item in XG-PM is as follows.

1) Right-click and selects Properties after selecting the slave in XG-PM network parameters.
2) Select Edit buttons in the slave parameter tap.
3) Among the TxPDO mapped objects, select the object you wna to read in the CPU program with the “CPU read check box.



(2) EtherCAT servo drive RxPDO data write

(a) You can write the EtherCAT RxPDO data transmitted from positioning module to servo drive using the PUTM command in the PLC program.

(b) You can select and write up to 5 objects among objects mapped EtherCAT RxPDO of slave parameters.

(c) For control function supplied by positioning module, EtherCAT RxPDO objects managed internally is impossible to write, these objects are disabled so that they are not selected by CPU write' function in XG-PM.

(d) During executing the PUTM command, the data set in the device area of command is saved in the objects mapped to the RxPDO of slave parameters in the order in which "CPU read"is checked.

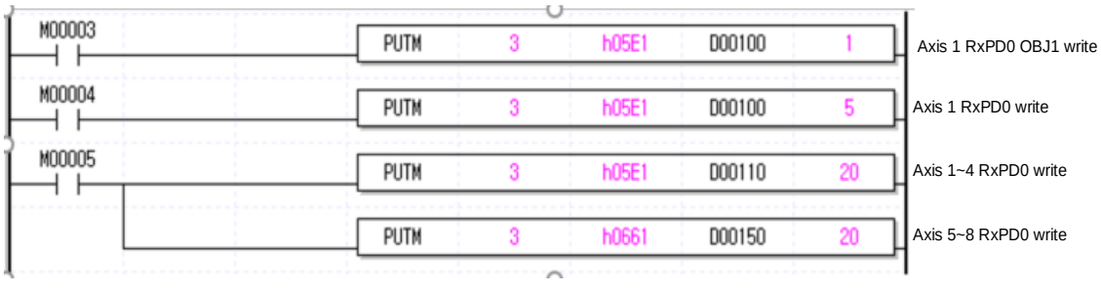
(e) When a UTM command is executed and data is stored in the objects selected in the slave parameters, the data is read from the device area of the command in 4 Bytes size units, regardless of the data type of the object.

(f) RxPDO write address (hexadecimal) for each axis of PUTM command

	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8
Object 1	5E1	5E6	5EB	5F0	661	666	66B	670
Object 2	5E2	5E7	5EC	5F1	662	667	66C	671
Object 3	5E3	5E8	5ED	5F2	663	668	66D	672
Object 4	5E4	5E9	5EE	5F3	664	669	66E	673
Object 5	5E5	5EA	5EF	5F4	665	66A	66F	674

1) RxPDO data of 4 axes can be written by one PUTM command since axes 1~4 and axes 5~8 are continuous memory addresses.

2) Example of program

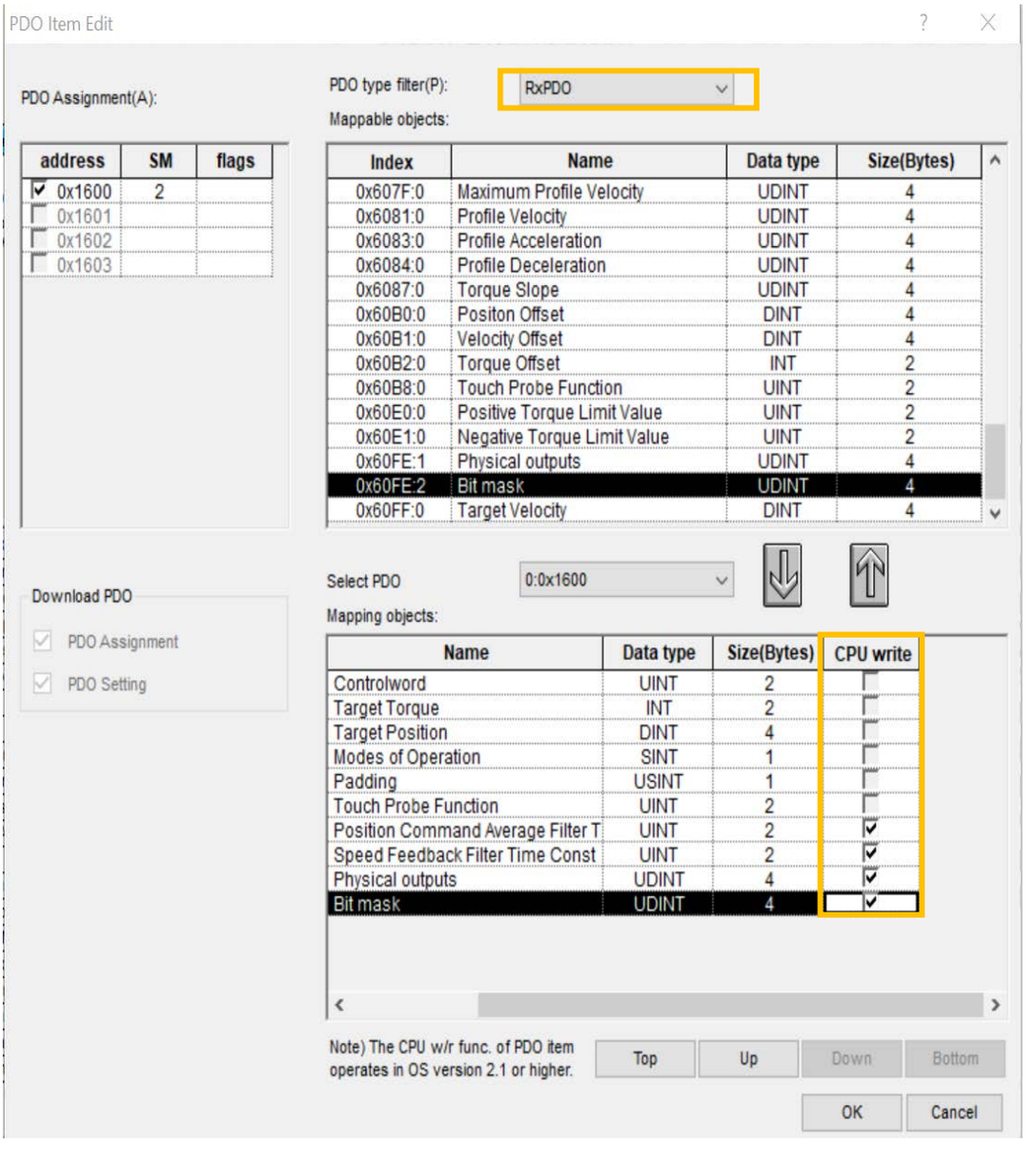


(g) The commands available to write EtherCAT RxPDO data are as follows.

1) XBC
   - PUTM, PUTMP
2) XEC
   - ARY_PUTM

(h) The method to select RxPDO write data item in XG-PM is as follows.

1) Right-click and selects Properties after selecting the slave in XG-PM network parameters.
2) Select Edit buttons in the slave parameter tap.
3) Among the RxPDO mapped objects, select the object you want to write in the CPU program with the “CPU write check box.



(3) EtherCAT servo I/O TxPDO data read

(a) You can read the EtherCAT TxPDO data transmitted from the EtherCAT slave to the positioning module using READPDO command in the PLC program.

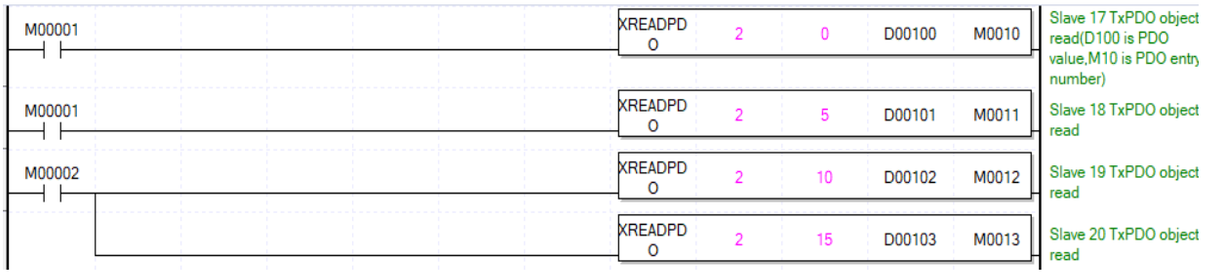
(b) You can select and read up to 10 words size among objects mapped EtherCAT TxPDO of slave parameters.

(c) During executing the READPDO command, data is read in the order in which “CPU read”is checked among the objects mapped to the TxPDO of slave parameter and save to device area set in the command.

(d) TxPDO read address (decimal) for each slave of READPDO command

	Slave 17	**Slave 18**	**Slave 19**	**Slave 20**	**Slave 21**	**Slave 22**	**Slave 23**	**Slave 24**
Data 1	0	5	10	15	20	25	30	35
Data 2	1	6	11	16	21	26	31	36
Data 3	2	7	12	17	22	27	32	37
Data 4	3	8	13	18	23	28	33	38
Data 5	4	9	14	19	24	29	34	39
	Slave 25	**Slave 26**	**Slave 27**	**Slave 28**	**Slave 29**	**Slave 30**	**Slave 31**	**Slave 32**
Data 1	40	45	50	55	60	65	70	75
Data 2	41	46	51	56	61	66	71	76
Data 3	42	47	52	57	62	67	72	77
Data 4	43	48	53	58	63	68	73	78
Data 5	44	49	54	59	64	69	74	79
	Slave 33	**Slave 34**	**Slave 35**	**Slave 36**	**Slave 37**	**Slave 38**	**Slave 39**	**Slave 40**
Data 1	80	85	90	95	100	105	110	115
Data 2	81	86	91	96	101	106	111	116
Data 3	82	87	92	97	102	107	112	117
Data 4	83	88	93	98	103	108	113	118
Data 5	84	89	94	99	104	109	114	119
	Slave 41	**Slave 42**	**Slave 43**	**Slave 44**	**Slave 45**	**Slave 46**	**Slave 47**	**Slave 48**
Data 1	120	125	130	135	140	145	150	155
Data 2	121	126	131	136	141	146	151	156
Data 3	122	127	132	137	142	147	152	157
Data 4	123	128	133	138	143	148	153	158
Data 5	124	129	134	139	144	149	154	159

4) Example of program

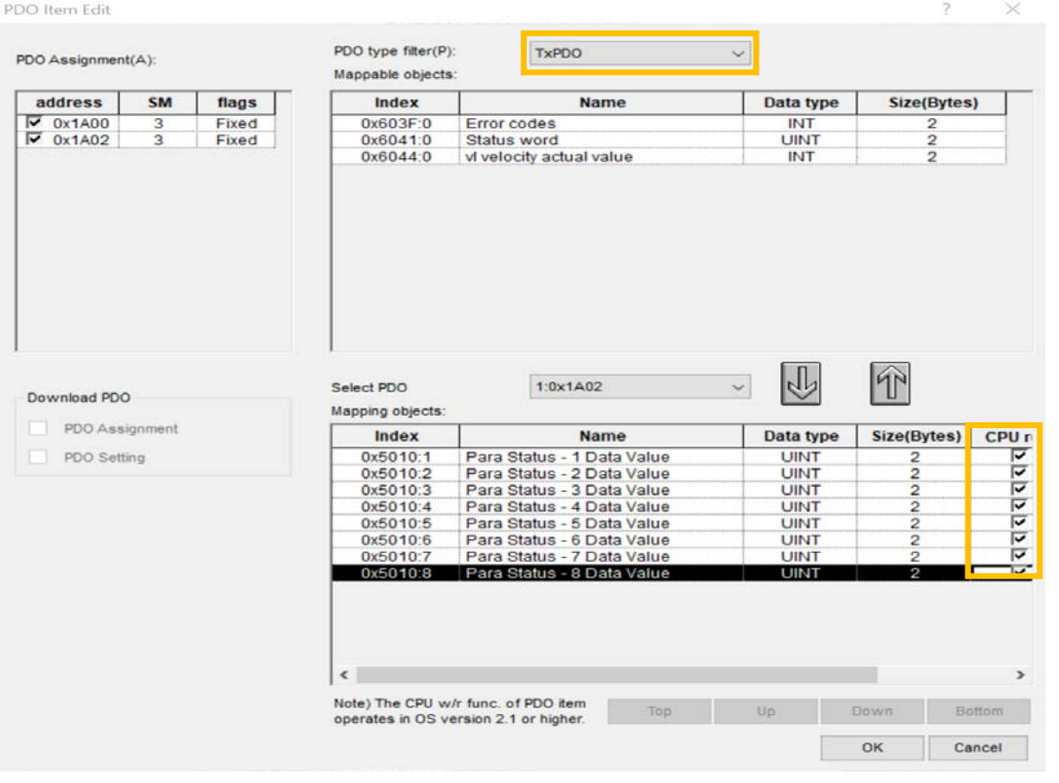


(e) The commands available to read TxPDO data of EtherCAT slave are as follows.

1) XBC
   - XREADPDO
2) XEC
   - XPM_READPDO

(f) The method to select TxPDO read data item in XG-PM is as follows.

1) Right-click and selects Properties after selecting the slave in XG-PM network parameters.
2) Select Edit buttons in the slave parameter tap.
3) Among the TxPDO mapped objects, select the object you want to read in the CPU program with the “CPU read check box.



(4) EtherCAT I/O RxPDO data write

(a) You can write the EtherCAT RxPDO data transmitted from positioning module to EtherCAT slave using the WRITEPDO command in the PLC program.

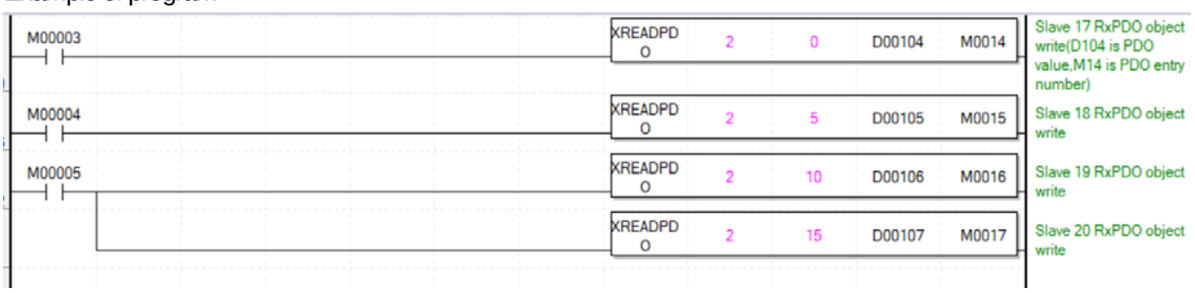
(b) You can select and write up to 10 words among objects mapped EtherCAT RxPDO of slave parameters.

(c) During executing the WRITEPDO command, the data set in the device area of command is saved in the objects mapped to the RxPDO of slave parameters in the order in which “CPU read”is checked.

(d) RxPDO write address (decimal) for each axis of WRITEPDO command

	Slave 17	**Slave 18**	**Slave 19**	**Slave 20**	**Slave 21**	**Slave 22**	**Slave 23**	**Slave 24**
Data 1	0	5	10	15	20	25	30	35
Data 2	1	6	11	16	21	26	31	36
Data 3	2	7	12	17	22	27	32	37
Data 4	3	8	13	18	23	28	33	38
Data 5	4	9	14	19	24	29	34	39
	Slave 25	**Slave 26**	**Slave 27**	**Slave 28**	**Slave 29**	**Slave 30**	**Slave 31**	**Slave 32**
Data 1	40	45	50	55	60	65	70	75
Data 2	41	46	51	56	61	66	71	76
Data 3	42	47	52	57	62	67	72	77
Data 4	43	48	53	58	63	68	73	78
Data 5	44	49	54	59	64	69	74	79
	Slave 33	**Slave 34**	**Slave 35**	**Slave 36**	**Slave 37**	**Slave 38**	**Slave 39**	**Slave 40**
Data 1	80	85	90	95	100	105	110	115
Data 2	81	86	91	96	101	106	111	116
Data 3	82	87	92	97	102	107	112	117
Data 4	83	88	93	98	103	108	113	118
Data 5	84	89	94	99	104	109	114	119
	Slave 41	**Slave 42**	**Slave 43**	**Slave 44**	**Slave 45**	**Slave 46**	**Slave 47**	**Slave 48**
Data 1	120	125	130	135	140	145	150	155
Data 2	121	126	131	136	141	146	151	156
Data 3	122	127	132	137	142	147	152	157
Data 4	123	128	133	138	143	148	153	158
Data 5	124	129	134	139	144	149	154	159

1) Example of program

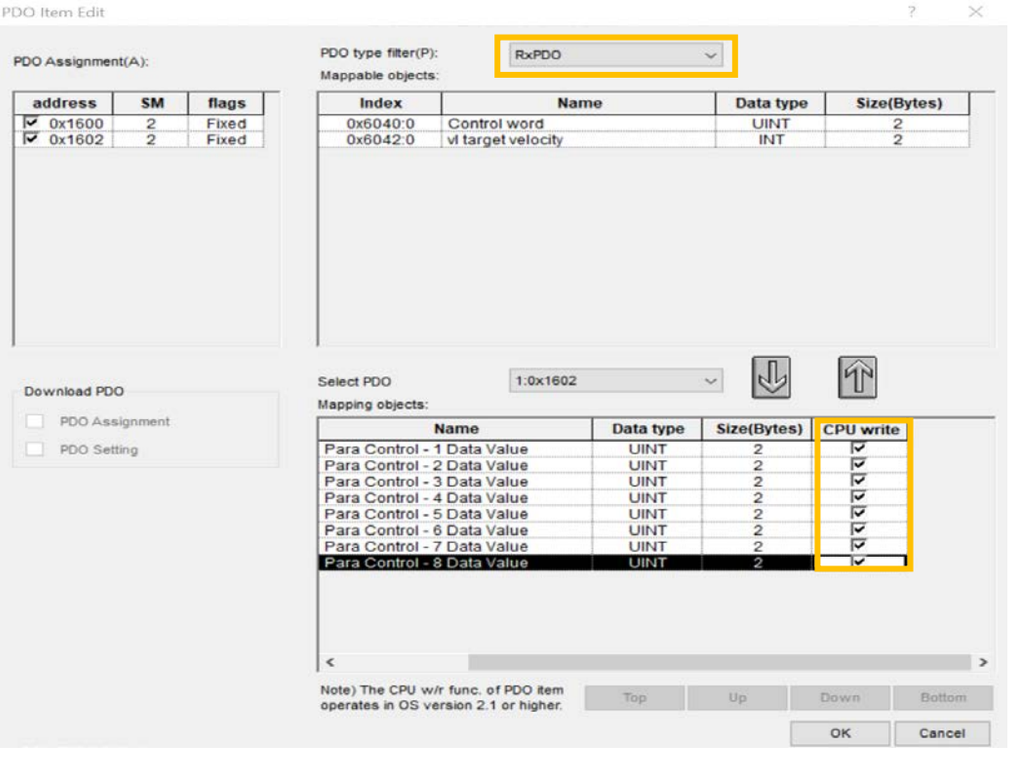


(e) The commands available to write EtherCAT RxPDO data are as follows.

1) XBC
   - XWRITEPDO
2) XEC
   - XPM_WRITEPDO

(f) The method to select RxPDO write data item in XG-PM is as follows.

1) Right-click and selects Properties after selecting the slave in XG-PM network parameters.
2) Select Edit buttons in the slave parameter tap.
3) Among the RxPDO mapped objects, select the object you want to write in the CPU program with the “CPU write check box.



9.8 User Specified Position/Speed Display Function

Users can set the desired magnification for position and speed and can use by changing as user specified position, user specified speed value.

9.8.1 User Specified Position/Speed Reflection Item

The following item among the status information cam be changed to user specified position and speed.

(1) Current position

(2) Current speed

(3) Command position

(4) Command speed

9.8.2 Adding Parameters

The parameters related to user specified position/speed function are as follows.

	Item	Setting Value
Basic Parameter	User specified position display ratio	0 ~ 7
	User specified speed display ratio	0 ~ 7

9.8.3 Operation Principles

User specified position/speed ratio is applied to position and speed as follows.

(1) Position

User specified position = unit position X 10^{-N} (integer, anything below decimal point is rounded off.)

※ 'Unit position': current position and command position integer read by SRD command

※ N: basic parameter's 'user specified position display ratio' (0 ~ 7)

※ In case of N=0, user specified position and unit position values are the same.

※ Unit=mm, Unit position=1000000, User specified position display ratio = 4

	Value	Note
Unit position	1000000	Read values from CPU with SRD command
XG- PM system view	100000.0 um	
User specified position	100	mm unit values

(2) Speed

User specified speed = unit speed X 10^{-N} (integer, anything below decimal point is rounded off.)

※ 'Unit speed': current speed and command speed integer read by SRD command

※ N: basic parameter's 'user specified speed display ratio' (0 ~ 7)

※ In case of N=0, user specified speed and unit speed values are the same.

※ Unit=mm, Unit speed=10000, User specified speed display ratio = 2

	Value	Note
Unit speed	10000	Read values from CPU with SRD command
XG- PM system view	100.00 mm/m	
User specified position	100	mm/m unit values

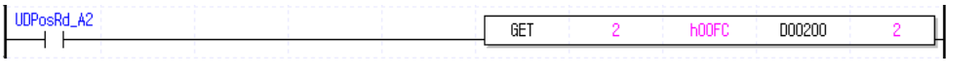
9.8.4 User Specified Position/Speed Check Method

User specified position/speed can be checked by reading the following common memory address with GET command.

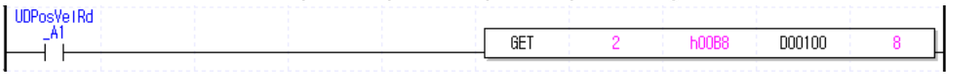
GET Command Device Offset	Memory address								Content
	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8	
0	B8	F8	138	178	1B8	1F8	238	278	User specified current position (lower)
1	B9	F9	139	179	1B9	1F9	239	279	User specified current position (upper)
2	BA	FA	13A	17A	1BA	1FA	23A	27A	User specified current speed (lower)
3	BB	FB	13B	17B	1BB	1FB	23B	27B	User specified current speed (upper)
4	BC	FC	13C	17C	1BC	1FC	23C	27C	User specified command position (lower)
5	BD	FD	13D	17D	1BD	1FD	23D	27D	User specified command position (upper)
6	BE	FE	13E	17E	1BE	1FE	23E	27E	User specified command speed (lower)
7	BF	FF	13F	17F	1BF	1FF	23F	27F	User specified command speed (upper)

(1) Example of usage

1) How to check 2 axes user specified command position of positioning module mounted on BASE=0, SLOT=2.



2) How to check 1 axis user specified position/speed of positioning module mounted on BASE=0, SLOT=2.



Device/Variable	Value	Type	Variable/Device	Comment
D00100		DINT	AX1_CurPos_UD	Axis1 user specified current position
D00102		DINT	AX1_CurVel_UD	Axis 1 user specified current speed
D00104		DINT	AX1_CmdPos_UD	Axis 1 user specified command positi
D00106		DINT	AX1_CmdVel_UD	Axis 1 user specified command spee

(2) Applicable Version

The version information that can use the user specified position/speed function is as follows.

	Version
XBF-PN04B OS	V1.10 or higher
XBF-PN08B OS	V1.50 or higher
XGB CPU	V1.80 or higher
XG5000	V4.07 or higher

9.9 Cross-coupled Control

This is a function that provides stable control when synchronously controlling two physically coupled/connected axes such as Automated Guided Vehicles and Gantry Stages.

9.9.1 Cross-coupled Control

In case of synchronous control of two physically coupled/connected axes, the motor output for controlling one of them may affect the other axis, resulting in poor control performance. In this cases, when cross-coupled control is applied, the position error occurring in each axis is shared so that the position error occurring in others axes does not interfere with control.

Since the cross-coupled control uses a modified position control loop, it is designed to operate only when the master position loop control is executed.

9.9.2 Master Position Control Loop

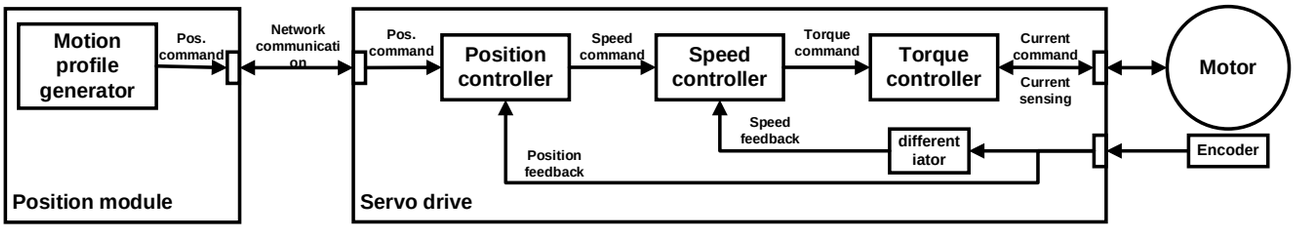
In the conventional operation of the positioning module, the drive operates in CSP mode, entire servo control loop is executed in the drive by passing the position command to drive inputted through the direct start command from the positioning module.

When master position loop control is executed, the drive operates in CSV mode, and the positioning module uses the position command received from the direct start command and compares it with the current position in the positioning module. Transfer the speed command to drive operating CSV mode and executes control servo loops. The position control part of total servo control loops is executed in positioning module.

9.9.3 Operation Principles

(1) Existing control system

The existing position command generated by the motion profile generator of the positioning module is transmitted to the servo drive through network communication. When a position command is transmitted to the servo drive, the entire servo loop for motor control operates within the servo drive.

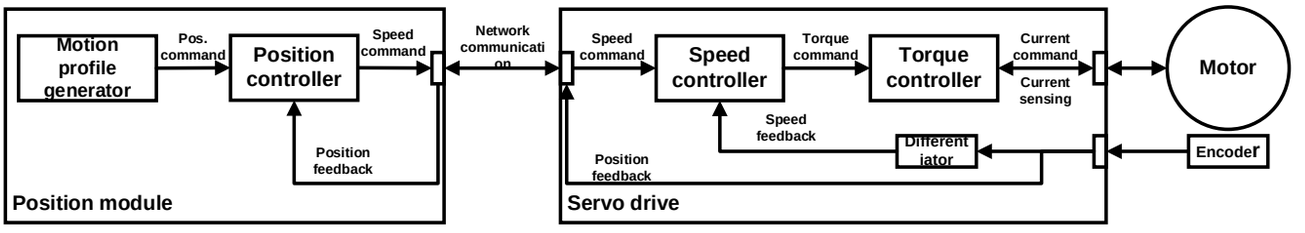


(2) Master position control loop

If the master position control loop is used, the position command generated by the motion profile generator is not directly transmitted to the servo drive, but is input to the position controller inside the positioning module. When the position feedback transmitted through network communication is input to the position controller, the difference (error) between the position command and the position feedback is PI (proportional integral) controlled to execute a speed command. The generated speed command is transmitted to the servo drive through network communication. When a speed command is transmitted to the servo drive, the remaining servo loop for motor control is operated within the servo drive.

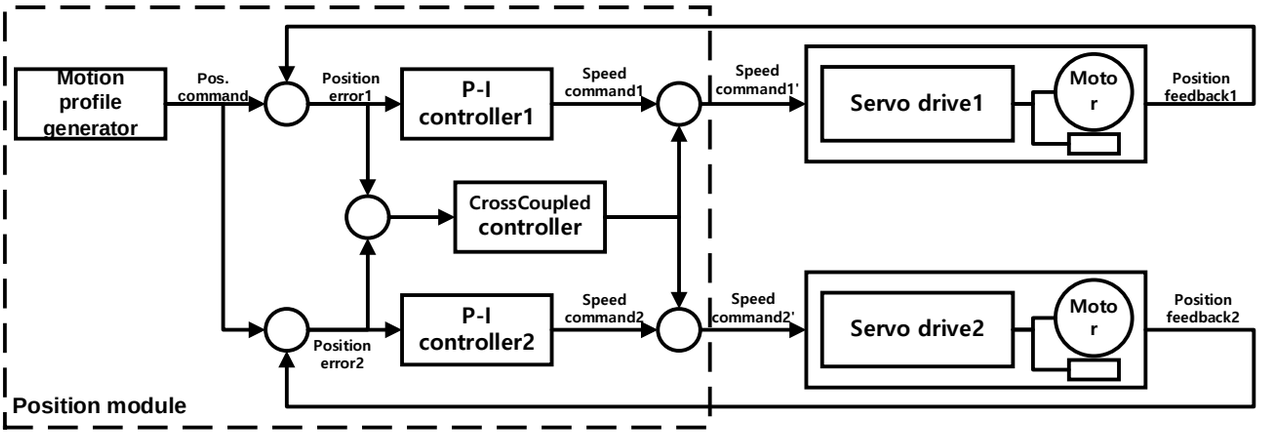
The position control loops is executed in the positioning mode and the servo drive operates as CSV mode. You can operate the motor connected to related axis by a start command

The position controller is a PI controller and Anti wind-up operates “always” Control gain tuning of the position controller is required. During tuning control gain, you do not need to cancel the master position control loop command, but change the gain input to the master position control loop execution command and then turn the following contact on.



(3) Cross-coupled control

Cross-coupled control can be executed when the two connected axes each have the master position control loop activated. A simplified block diagram of cross-coupled control is shown below to make it easier to understand. Cross-coupled control is performed with position error 1 and position error 2 generated in servo system 1 and servo system 2. The cross-coupled controller is a proportional controller and the difference between position error 1 and position error 2 is used as input. Controller proportional gain tuning is required. A speed command in which a cross-coupled control command is added to the speed command generated by the position controller is transmitted to the servo drive. When servo control is executing on one servo drive, the position error information of pair motor is reflected through Cross-coupled control to prevent the output for controlling the pair motors from operating as a disturbance when controlling the motor.



9.9.4 Cross-coupled Control Caution

When the axis is not operating, master position loop control can be executed/disabled. If master position loop control is executed or released while the axis is in operation, an error (841) occurs.

There must be a target speed (0x60FF) object in the RxPDO of the axis where you want to execute master position loop control. If there is no target speed object, an error (842) occurs.

Cross-coupled control can be executed on 2 axes where the master position control loop command is being executed. If the master position control loop command is not activated for the 2 input axes, an error (843) occurs

Cross-coupled control should be executed on different axes. If the axis input in the commands are the same, an error (844) occurs.

If the release command is executed on an axis that is not executing cross-coupled control, an error (845) occurs.

(1) Supported version

The version information to use Cross- coupled control function is as follows.

	Version
XBF-PN04B OS	V2.10 or higher
XBF-PN08B OS	V2.10 or higher
XB(E)C-U	V2.00 or higher
XB(E)M-U/HP	V2.20 or higher
XG5000	V4.52 or higher

9.10 EtherCAT I/O Device Connection

In addition to controlling axis by connecting a servo drive to the EtherCAT Network, you can control the devices by connecting EtherCAT slave product such as inverter or I/O. In PLC Program using dedicated commands, you can read TxPDO data and write RxPDO data of slave assigned to EtherCAT I/O devices. In the slave parameters of the EtherCAT parameters, you can select the TxPDO and RxPDO data Items of EtherCAT I/O device to read/write in the PLC program.

9.10.1 The Relationship between Station No. Setting and Slave Function

Slave function connected to the network is determined depending on the range of station number setting value set in slave parameter of EtherCAT parameter.

(1) Axis

When using and assigning EtherCAT slave to an axis, set the station Number to 1 to 8. In other words, slave in which station number are set to 1 ~8 are operated as axes. At this time, the station number becomes the axis number, it is operated using the axis operation data and axis operation parameters of related number

(2) I/O devices

When using for the assigning EtherCAT slave to an I/O devices, set the station number to 17 to 40. In other words, slave in which station number are set to 17 ~40 are operated as I/O devices. At this time, the station number becomes the I/O device number, it is used as the slave number when reading/writing PDO data or reading/writing SDO parameter of slave in the PLC program.

(3) Station No. setting range

The station number can be set as follows depending on type of product.

Type of product	Axis	I/O	Number of maximum connection slave
XBF-PN04B	1 ~ 4	17 ~ 32	20
XBF-PN08B	1 ~ 8	17 ~ 48	40

(4) Station No. setting method

(a) Auto Connection

When using “online” – “EtherCAT slave” – “auto-connection” function in XG-PM, a station number is assigned automatically according to the path where ESI(EtherCAT Slave Information) library file of the connected slave is located.

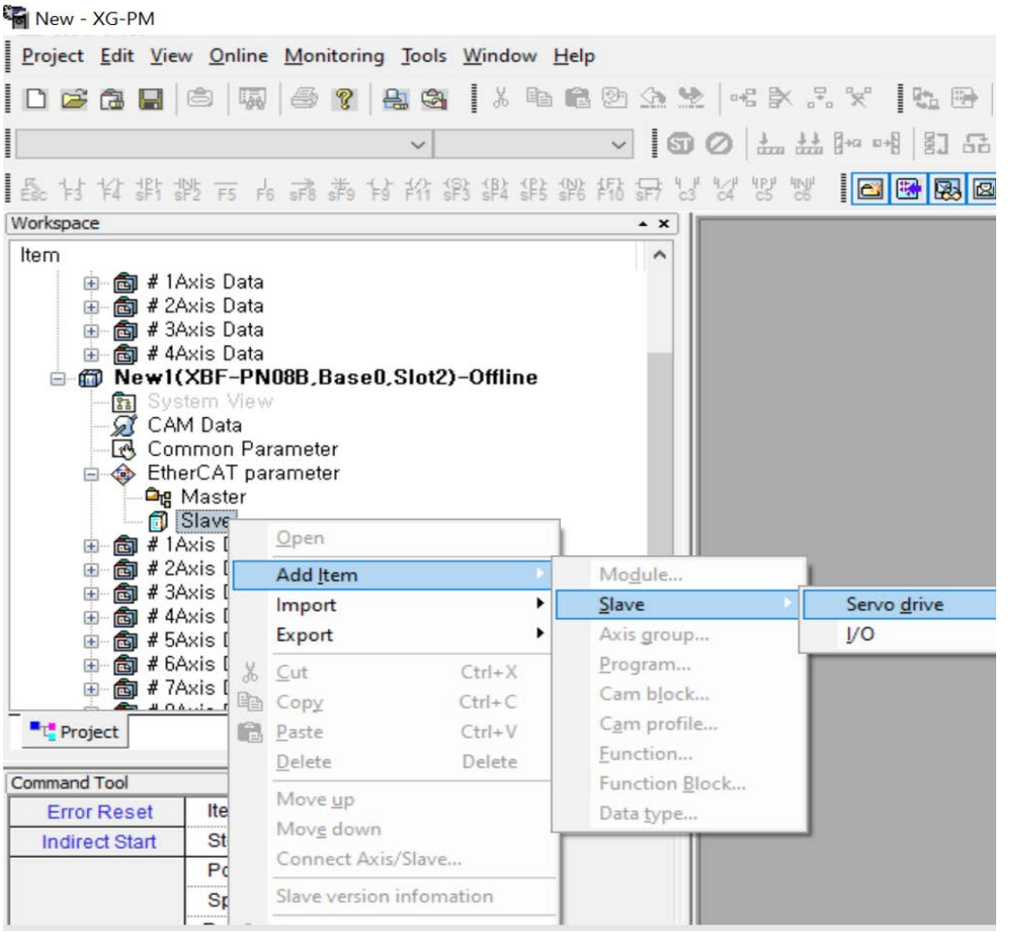
1) If the ESI file is located in the‘DriveInfo’library folder
   - If the slave supports CiA402 profile, the station numbers of the connected slaves are automatically assigned in the connection order within the range of “1 to maximum number of controlled axes”. The station number of slaves that excesses maximum control axis number are automatically assigned in connection order from 17.
   - If the slave do not supports CiA402 profile, the station numbers of the connected slaves are automatically assigned in the connection order from 17.
   - The location of ‘DriveInfo’library folder is ‘XG5000 installation path\XGPM\l.kor\DriveInfo\’.
2) If the ESI file is located in the‘IOInfo’library folder
   - The station numbers of slaves are assigned in order from 17.
   - The location of ‘IOInfo’library folder is ‘XG5000 installation path\XGPM\l.kor\IOInfo\’.

(b) User settings

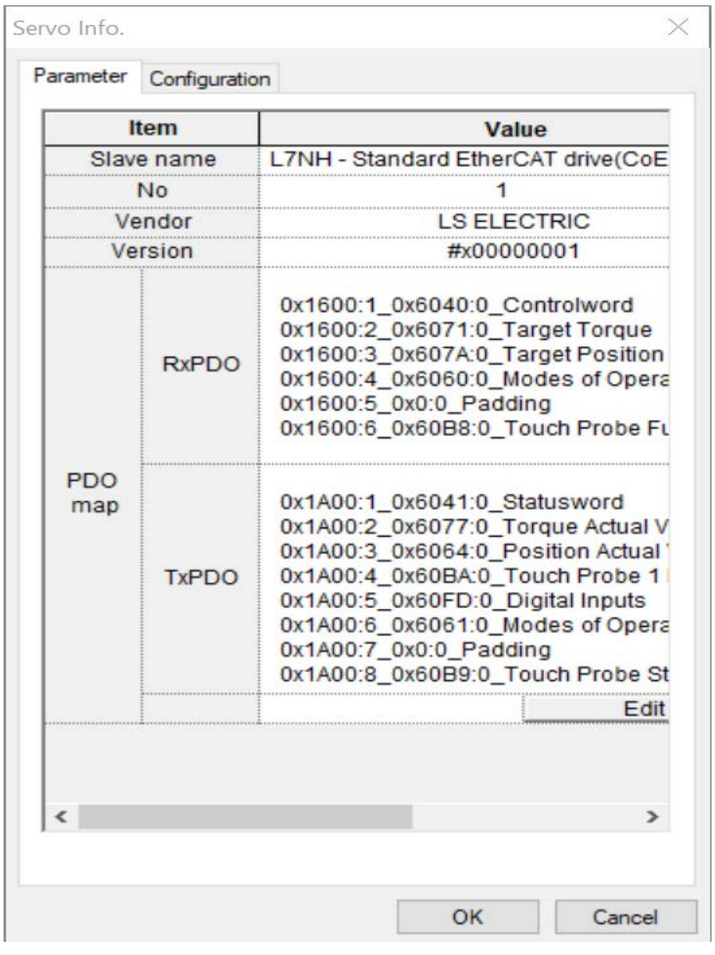
I the EtherCAT Parameter - slave setting of XG-PM project tree, you can select the type of slave you want to connect to the network and then set the station number.

1) Servo drive

- How to add a slave



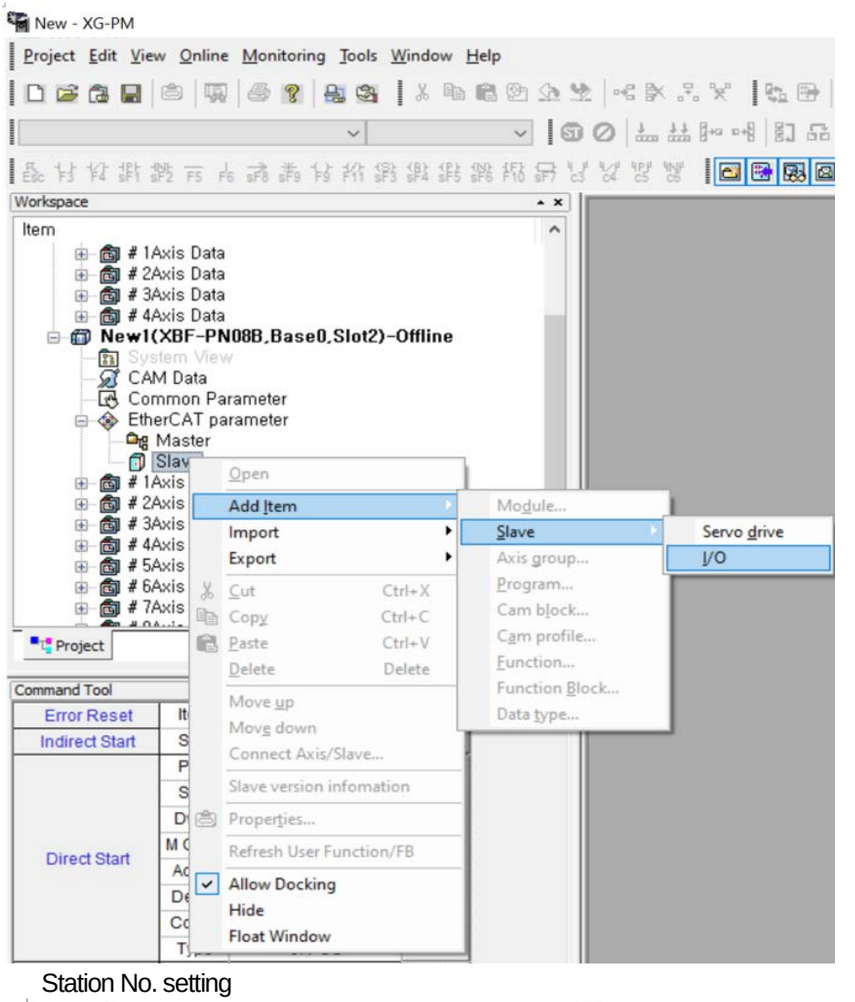
- Station No. setting



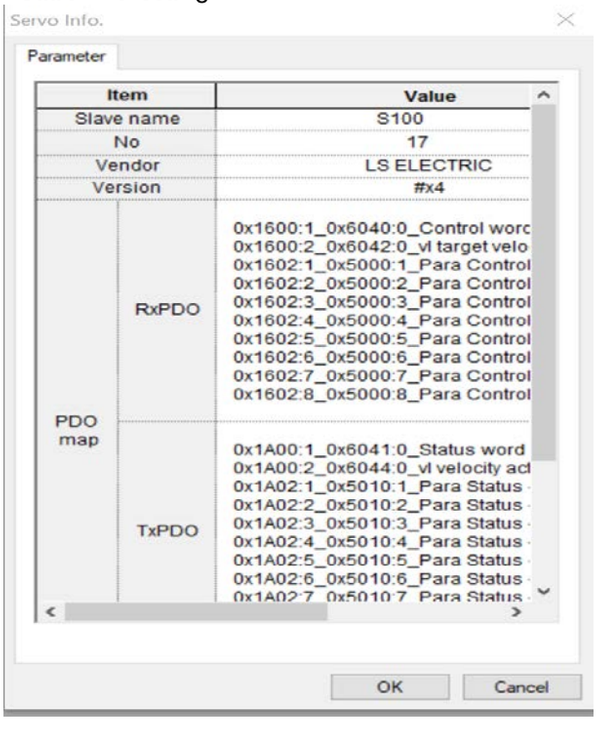
If the station number is set to 1~8, it is assigned to axis, and if it is set to 17~48, it is assigned to an I/O devices.

2) I/O

- How to add a slave



- Station No. setting



The station number can be set in the range 17 ~48, and is assigned and operated as I/O devices.

(5) Slave connection information

The number of EtherCAT Slave connected to the network and slave ready status can be checked in the“EtherCAT status information” internal memory area.

GETM Command Device Offset	Memory address	Item	Content
0	3E1	EtherCAT connection Information	Bit.0 - Link up/down Information Bit.1 - connection connection status Bit.2 - communication timeout error Bit.3 - processing communication connection/disconnection
		EtherCAT error information	EtherCAT operation related error code
1	3E2	Number of EtherCAT Slave connection	Number of slave connected to network
		EtherCAT slave ready (Slave 1~8)	Bit.0 – Slave 1 ready status : Bit.7 – Slave 8 ready status
2	3E3	EtherCAT slave ready (Slave 17~32)	Bit.0 – Slave 17 ready status : Bit.15 – Slave 32 ready status
		EtherCAT slave ready (Slave 33~48)	Bit.0 – Slave 33 ready status : Bit.15 – Slave 48 ready status
3	3E4	EtherCAT slave SDO processing busy (Slave 1~8)	Bit.0 – Slave 1 SDO read/write processing : Bit.7 – Slave 8 SDO read/write processing
		EtherCAT slave SDO processing busy (Slave 17~32)	Bit.0 – Slave 17 SDO read/write processing : Bit.15 – Slave 32 SDO read/write processing
4	3E5	EtherCAT slave SDO processing busy (Slave 33~48)	Bit.0 – Slave 33 SDO read/write processing : Bit.15 – Slave 48 SDO read/write processing
		EtherCAT slave SDO processing error (Slave 1~8)	Bit.0 – Slave 1 SDO read/write error : Bit.7 – Slave 8 SDO read/write error
5	3E6	EtherCAT slave SDO processing error (Slave 17~32)	Bit.0 – Slave 17 SDO read/write error : Bit.7 – Slave 32 SDO read/write error
		EtherCAT slave SDO processing error (Slave 33~48)	Bit.0 – Slave 33 SDO read/write error : Bit.15 – Slave 48 SDO read/write error
6	3E7	EtherCAT PDO error count - current	PDO constant period communication error occurring information
		EtherCAT PDO errpr count - Max continuous occurred count	
7	3E8	EtherCAT PDO error count- accumulated	
		EtherCAT connection error slave (connection order)	Error information when EtherCAT connection fails

8	3E9	EtherCAT connection error slave AL Status	
		EtherCAT connection error slave AL Status codes	

※ The 'EtherCAT status information' internal memory area is dedicated area can be read using the GETM/GETMP or ARY_GETM command.

9.10.2 PDO Data Read/Write of EtherCAT I/O Devices

In PLC Program using dedicated commands, you can read TxPDO data and write RxPDO data of slave assigned to EtherCAT I/O devices.

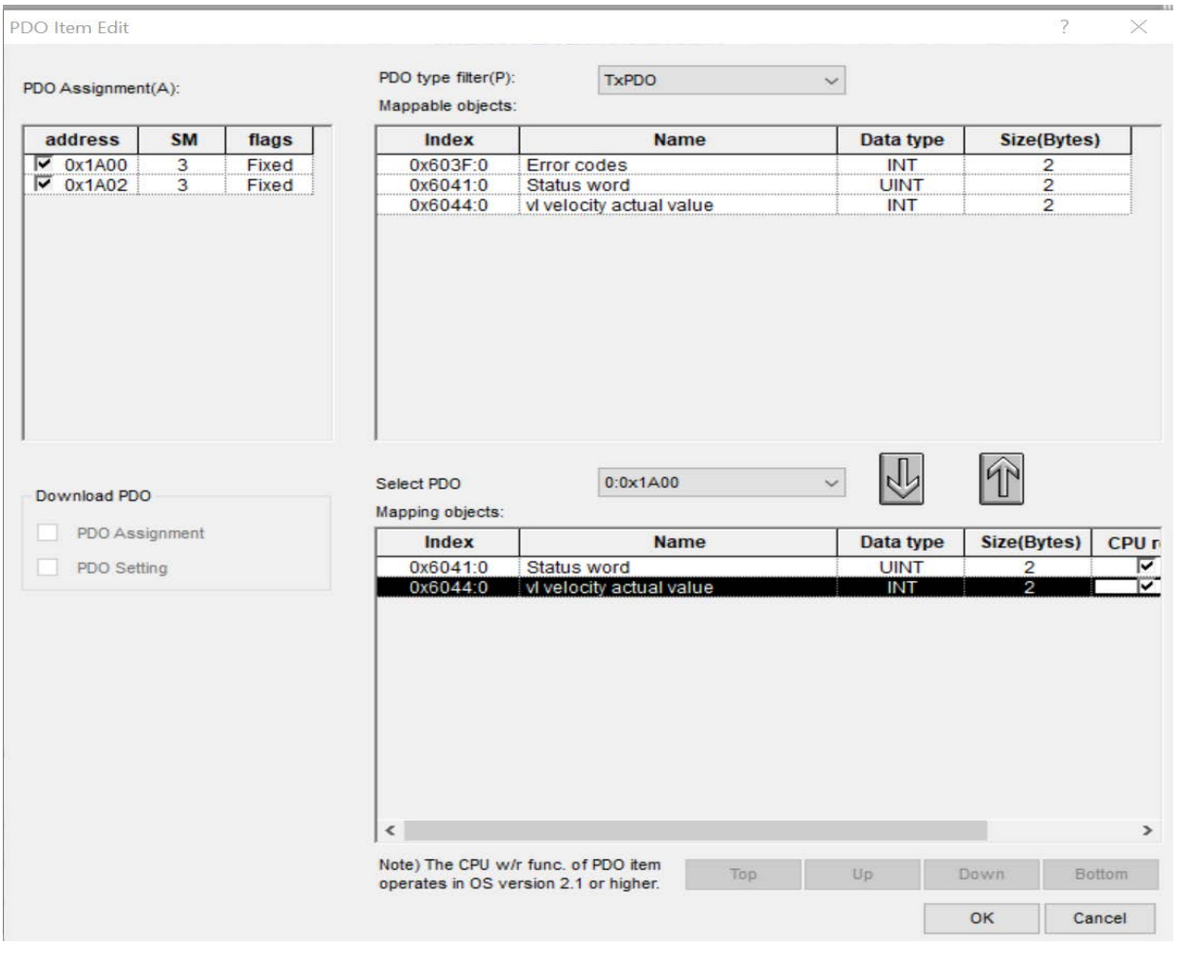
(1) TxPDO data read of EtherCAT I/O devices

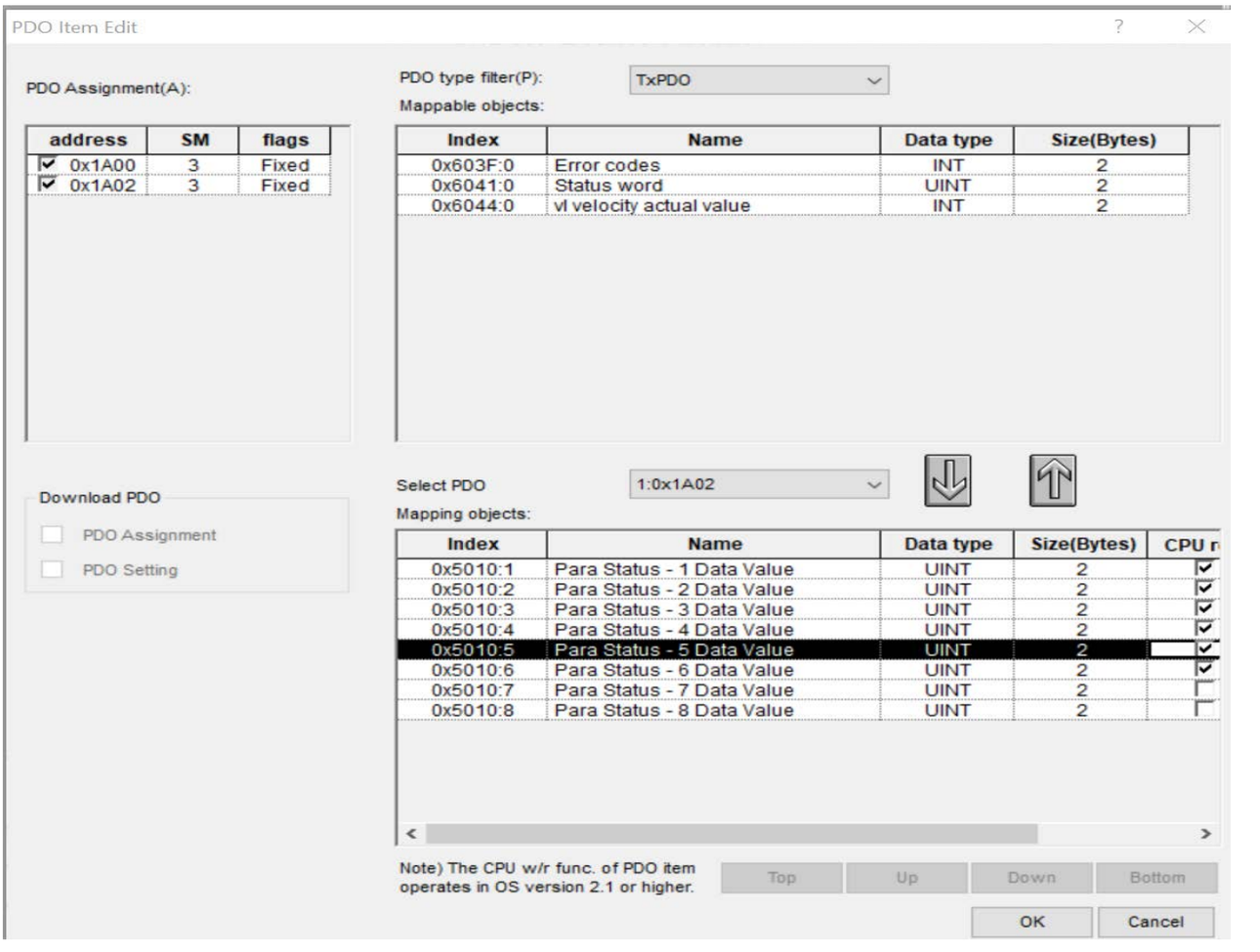
(a) You can read the EtherCAT TxPDO data transmitted from the EtherCAT slave to the positioning module using READPDO command in the PLC program.

(b) You can select and read up to 10 words size among objects mapped TxPDO of slave parameters.

(c) During executing the READPDO command, data is read in the order in which "CPU read"is checked among the objects mapped to the TxPDO of slave parameter and save to device area set in the command.

(d) How to set TxPDO object 'CPU reading' property (ex.LS ELECTRIC S100 inverter)





(e) For more details of TxPDO data read function, refer to (3) EtherCAT I/O TxPDO data read' item of' "9.7.5 EtherCAT PDO data read/write".

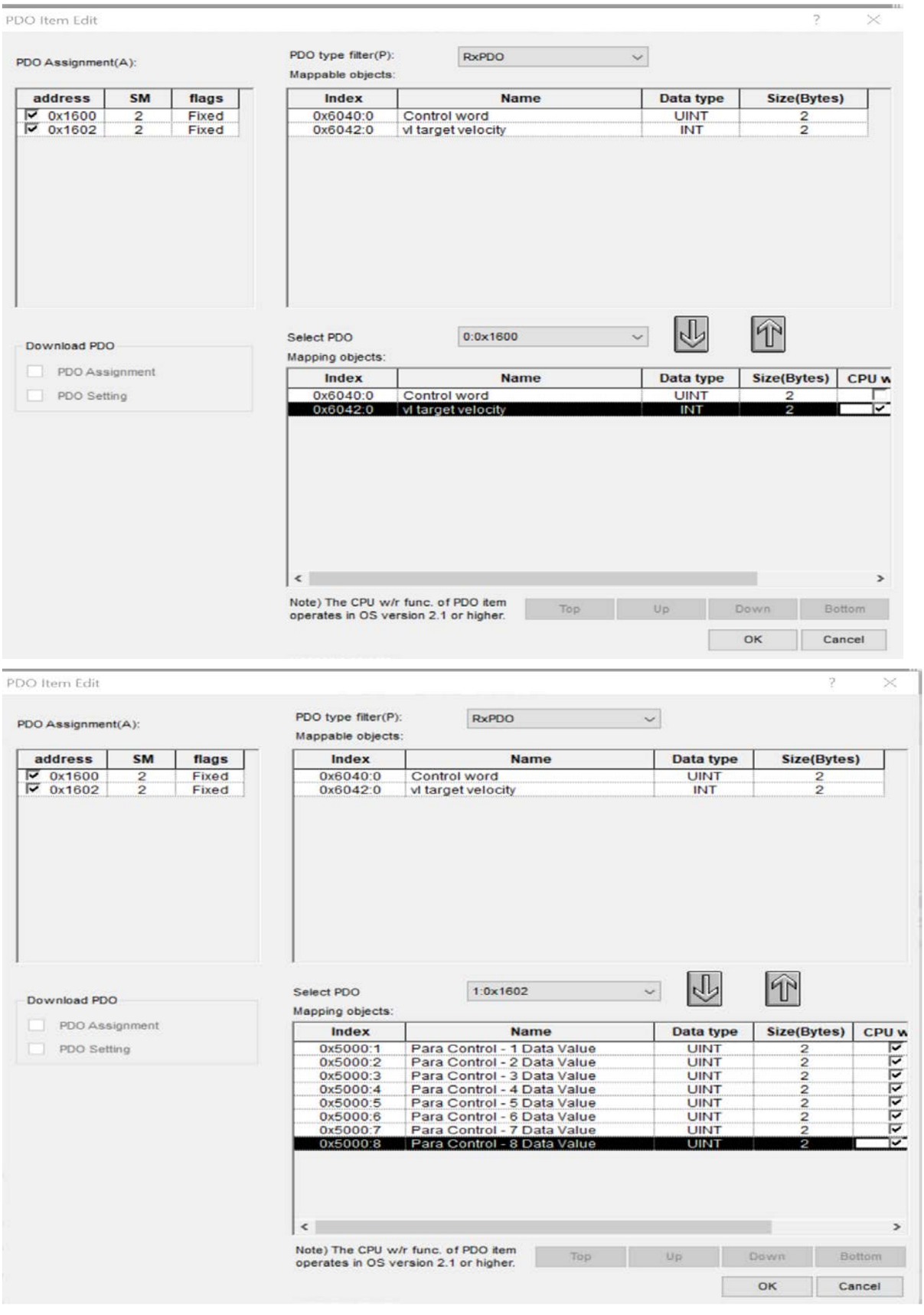
(2) RxPDO data write of EtherCAT I/O devices

(a) You can write the EtherCAT RxPDO data transmitted from positioning module to EtherCAT slave using the WRITEPDO command in the PLC program.

(b) You can select and write up to 10 words among objects mapped RxPDO of slave parameters.

(c) During executing the WRITEPDO command, the data set in the device area of command is saved in the objects mapped to the RxPDO of slave parameters in the order in which "CPU read"is checked.

(d) How to set RxPDO object 'CPU Write' property (ex.LS ELECTRIC S100 inverter)

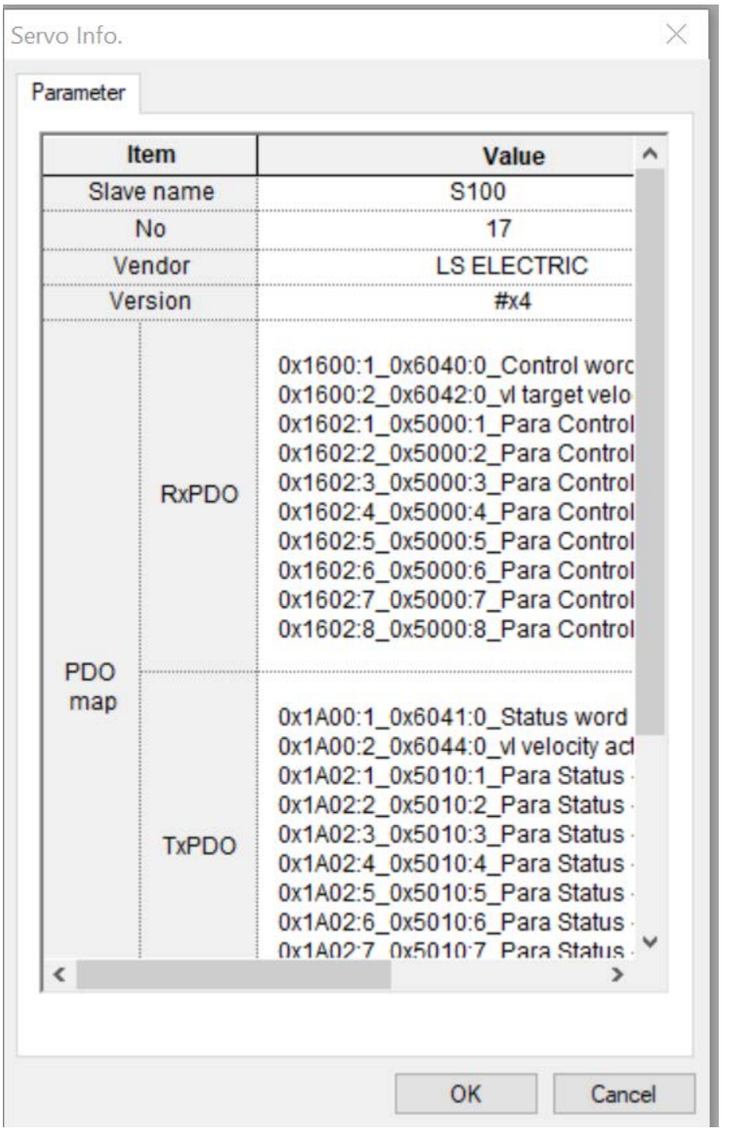


(e) For more details of TxPDO data read function, refer to (4) EtherCAT I/O RxPDO data write' item of' "9.7.5 EtherCAT PDO data read/write".

(3) [Ex] When the S100 inverter is connected to slave station number 17

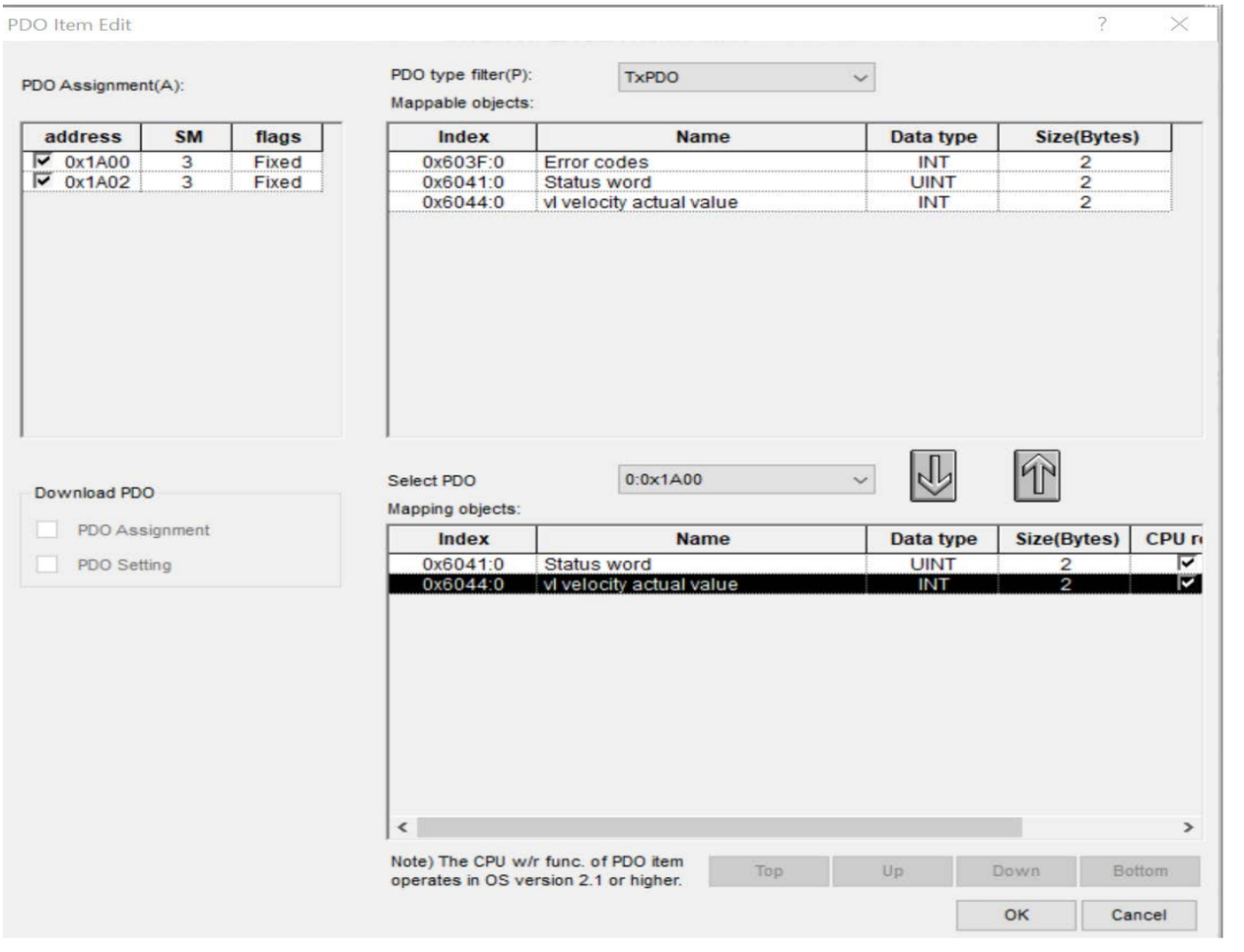
As in the examples in (1) and (2) of previous section, when the CPU read and CPU write properties are check for all TxPDO, RxPDO items, PDO data of inverter assigned to PDO data read area and PDO data write area are as follows.

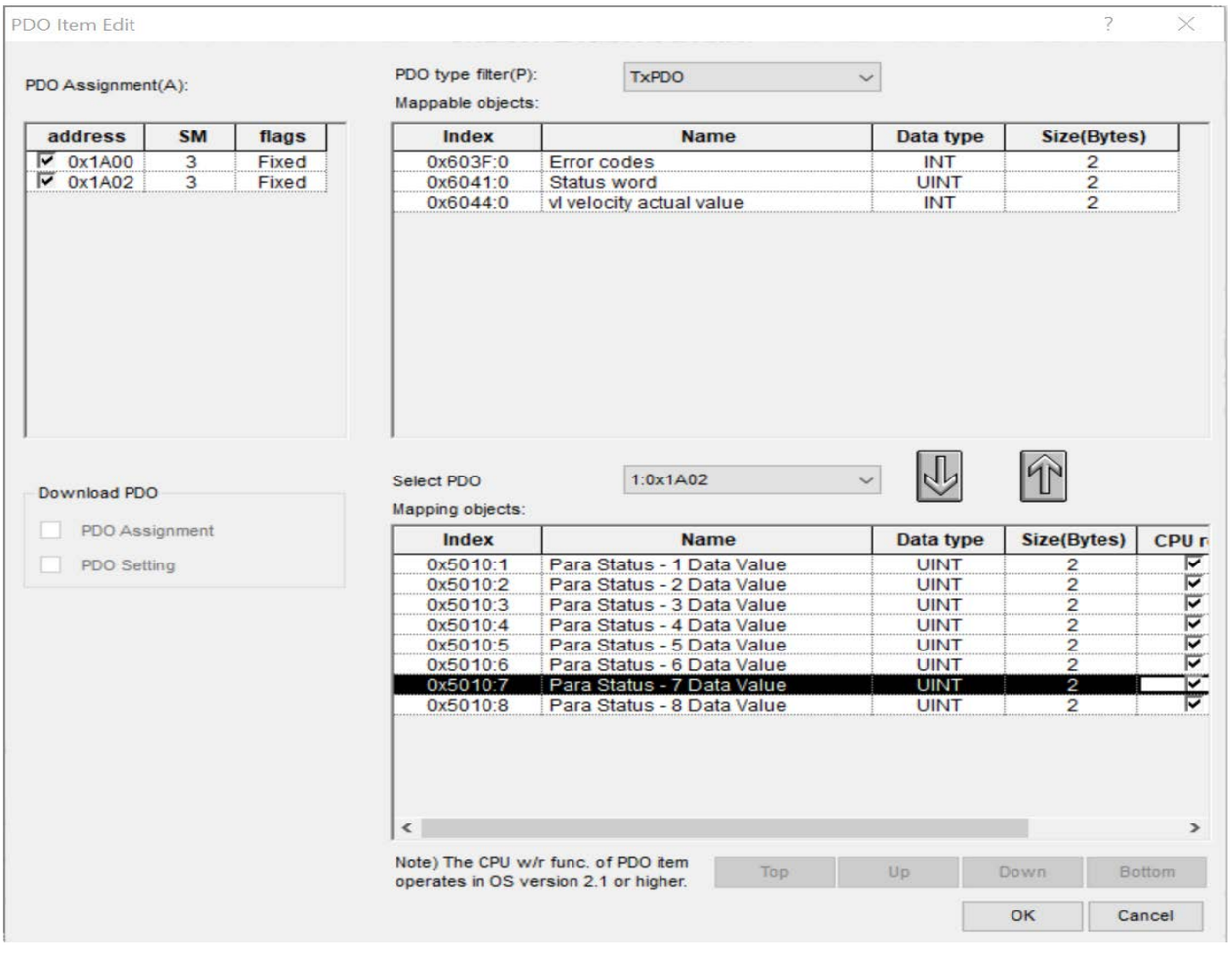
(a) Slave parameter station No. setting and PDO map



(b) PDO data read memory area (TxPDO item of I/O devices is mapping area)

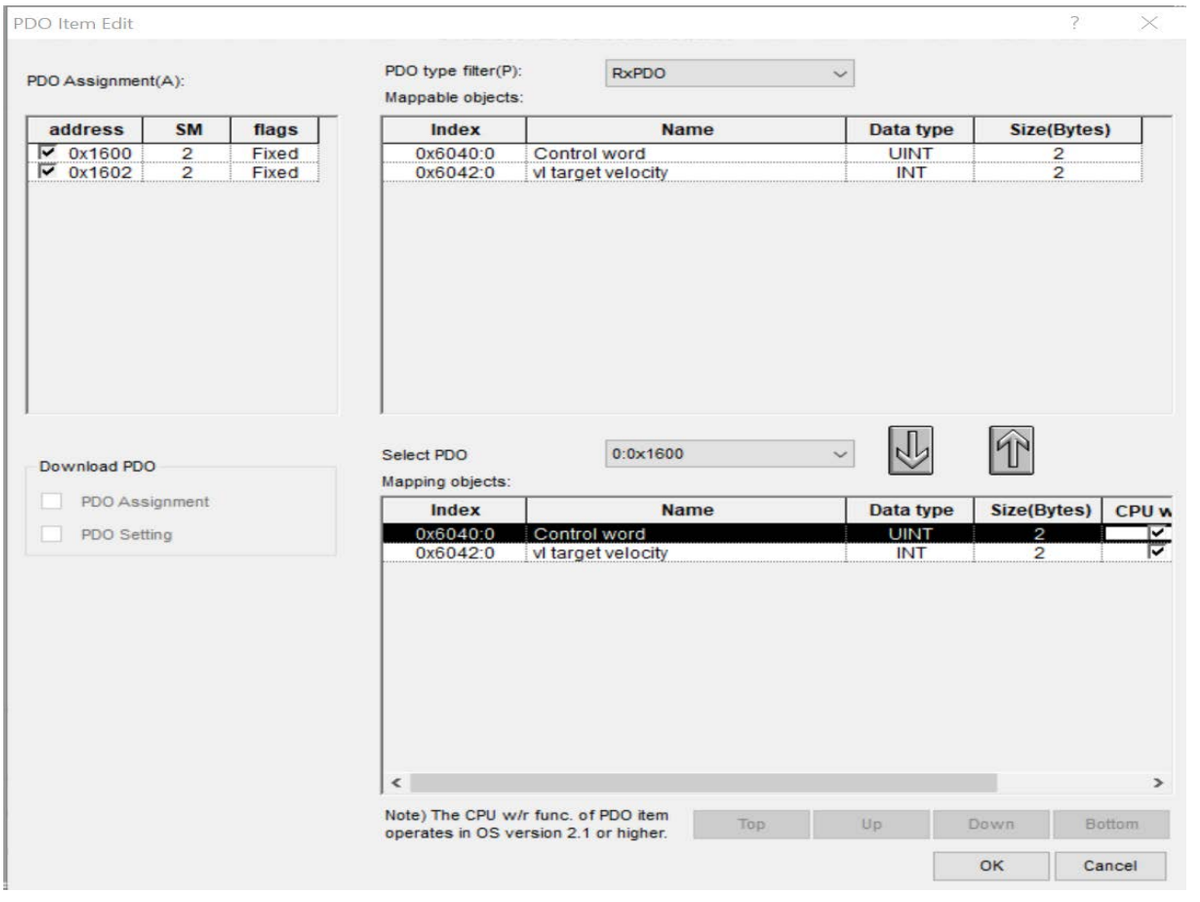
PDO data read command start address	Slave 17 - S100 TxPDO data	Data size
0	0x1A00:1_0x6041:0_Status word	2 Bytes
	0x1A00:2_0x6044:0_vl velocity actual value	2 Bytes
1	0x1A02:1_0x5010:1_Para Status – 1 Data Value	2 Bytes
	0x1A02:2_0x5010:2_Para Status – 2 Data Value	2 Bytes
2	0x1A02:3_0x5010:3_Para Status – 3 Data Value	2 Bytes
	0x1A02:4_0x5010:4_Para Status – 4 Data Value	2 Bytes
3	0x1A02:5_0x5010:5_Para Status – 5 Data Value	2 Bytes
	0x1A02:6_0x5010:6_Para Status – 6 Data Value	2 Bytes
4	0x1A02:7_0x5010:7_Para Status – 7 Data Value	2 Bytes
	0x1A02:8_0x5010:8_Para Status – 8 Data Value	2 Bytes

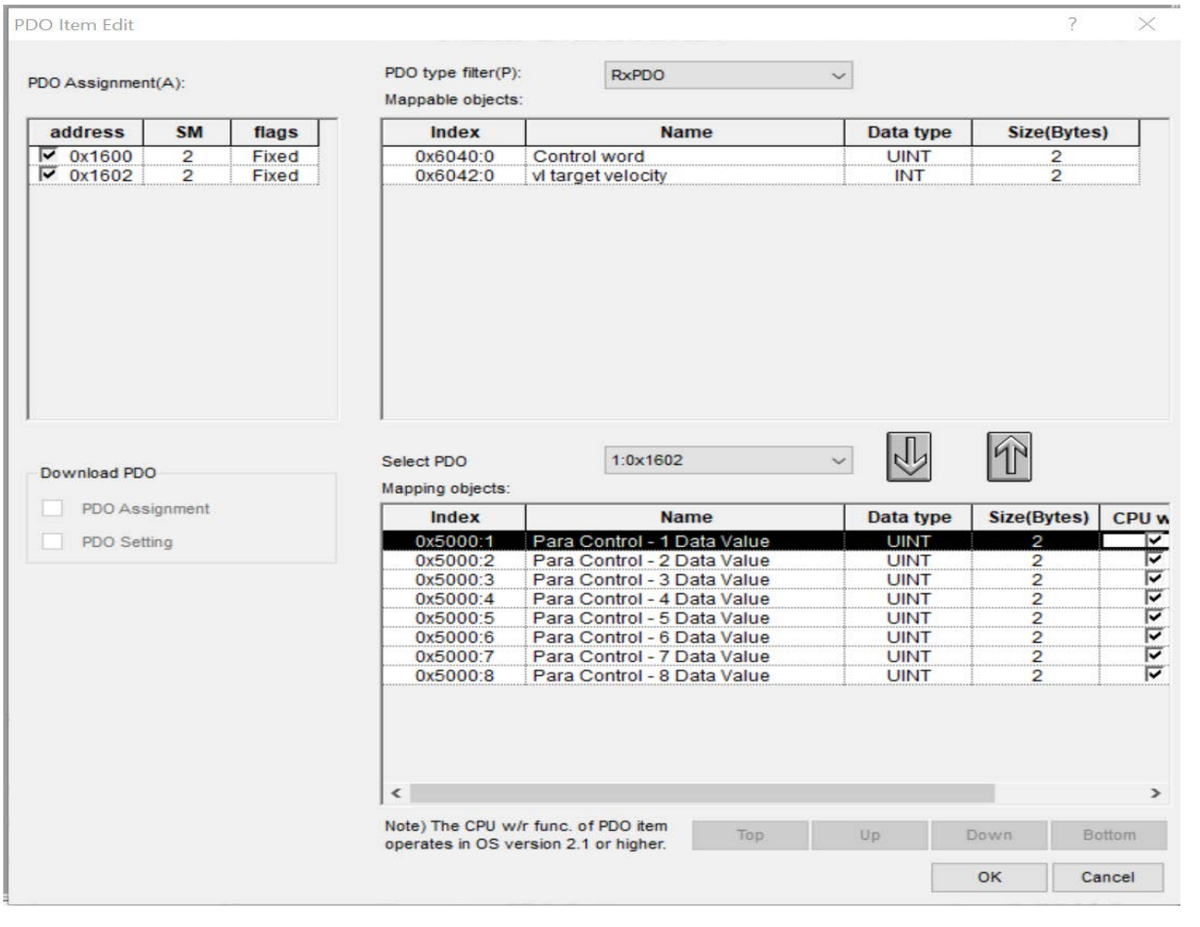




(c) PDO data write memory area (RxPDO item of I/O devices is mapping area)

PDO data write command start address	Slave 17 - S100 RxPDO data	Data size
0	0x1600:1_0x6040:0_Control word	2 Bytes
	0x1600:2_0x6042:0_vl target velocity	2 Bytes
1	0x1602:1_0x5000:1_Para Control – 1 Data Value	2 Bytes
	0x1602:2_0x5000:2_Para Control – 2 Data Value	2 Bytes
2	0x1602:3_0x5000:3_Para Control – 3 Data Value	2 Bytes
	0x1602:4_0x5000:4_Para Control – 4 Data Value	2 Bytes
3	0x1602:5_0x5000:5_Para Control – 5 Data Value	2 Bytes
	0x1602:6_0x5000:6_Para Control – 6 Data Value	2 Bytes
4	0x1602:7_0x5000:7_Para Control – 7 Data Value	2 Bytes
	0x1602:8_0x5000:8_Para Control – 8 Data Value	2 Bytes


PDO Item Edit
PDO Assignment(A):
address SM flags
0x1600 2 Fixed
0x1602 2 Fixed
PDO type filter(P): RxPDO
Mappable objects:
Index Name Data type Size(Bytes)
0x6040:0 Control word UINT 2
0x6042:0 vl target velocity INT 2
Download PDO
PDO Assignment
PDO Setting
Select PDO 0:0x1600
Mapping objects:
Index Name Data type Size(Bytes) CPU w
0x6040:0 Control word UINT 2
0x6042:0 vl target velocity INT 2
Note) The CPU w/r func. of PDO item operates in OS version 2.1 or higher.
Top Up Down Bottom
OK Cancel


PDO Item Edit
PDO Assignment(A):
address SM flags
0x1600 2 Fixed
0x1602 2 Fixed
PDO type filter(P): RxPDO
Mappable objects:
Index Name Data type Size(Bytes)
0x6040:0 Control word UINT 2
0x6042:0 vl target velocity INT 2
Download PDO
PDO Assignment
PDO Setting
Select PDO 1:0x1602
Mapping objects:
Index Name Data type Size(Bytes) CPU w
0x5000:1 Para Control - 1 Data Value UINT 2
0x5000:2 Para Control - 2 Data Value UINT 2
0x5000:3 Para Control - 3 Data Value UINT 2
0x5000:4 Para Control - 4 Data Value UINT 2
0x5000:5 Para Control - 5 Data Value UINT 2
0x5000:6 Para Control - 6 Data Value UINT 2
0x5000:7 Para Control - 7 Data Value UINT 2
0x5000:8 Para Control - 8 Data Value UINT 2
Note) The CPU w/r func. of PDO item operates in OS version 2.1 or higher.
Top Up Down Bottom
OK Cancel

9.10.3 SDO Parameter Read/Write save of EtherCAT I/O Devices

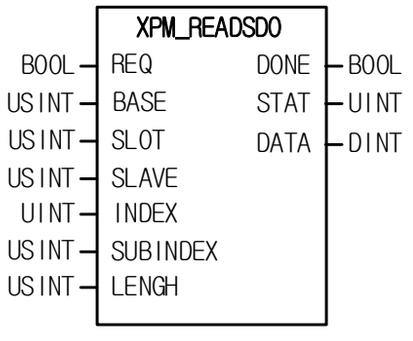
In PLC program using dedicated commands, you can execute read/write/save function for SDO parameter of slave assigned to the EtherCAT I/O devices.

(1) Read SDO parameters

(a) Dedicated command

Command	XREADSDO				EtherCAT slave SDO data read
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Slave	PMLK,constant,D,Z,R,ZR	WORD	Slave number to execute command XBF-PN04B (17~32: slave 17 ~ 32) XBF-PN08B (17~48: slave 17 ~ 48)
	OP3	SDO Index	PMLK,constant,D,Z,R,ZR	WORD	SDO Index to read
	OP4	SDO Sub-Index	PMLK,constant,D,Z,R,ZR	WORD	SDO Sub-Index to read
	OP5	Data size	PMLK,constant,D,Z,R,ZR	WORD	SDO data size(Byte) to read

(b) Special function block

function block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted SLAVE : Specify the slave to be commanded XBF-PN04B: 17 ~ 32 (slave 17 ~ 32) XBF-PN08B: 17 ~ 48 (slave 17 ~ 48) INDEX: SDO parameter object index to read SUBINDEX: SDO parameter object sub- index to read LENGTH: SDO parameter object size to read 1 ~ 4 Byte **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing. DATA : SDO parameter data value to read

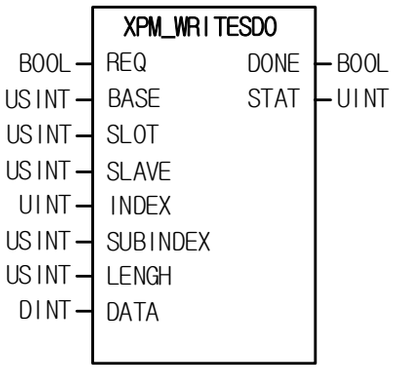
(c) For details of the SDO parameter read command/ function block, refer to chapter 6.3.55/7.11.13 EtherCAT slave SDO parameter read' item

(2) Write SDO parameters

(a) Dedicated command

Command	XWRITESDO				EtherCAT slave SDO data write
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Slave	PMLK,constant,D,Z,R,ZR	WORD	Slave number to execute command XBF-PN04B (17~32: slave 17 ~ 32) XBF-PN08B (17~48: slave 17 ~ 48)
	OP3	SDO Index	PMLK,constant,D,Z,R,ZR	WORD	SDO Index to write
	OP4	SDO Sub-Index	PMLK,constant,D,Z,R,ZR	WORD	SDO Sub-Index to write
	OP5	Data size	PMLK,constant,D,Z,R,ZR	WORD	SDO data size(Byte) to write
	OP6	Data to write	PMLK,constant,D,Z,R,ZR	DINT	Data to write

(b) Special function block

Function block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted SLAVE : Specify the slave to be commanded XBF-PN04B: 17 ~ 32 (slave 17 ~ 32) XBF-PN08B: 17 ~ 48 (slave 17 ~ 48) INDEX: SDO parameter object index to change SUBINDEX: SDO parameter object sub-index to change LENGTH: SDO parameter object size to change 1 ~ 4 Byte EP_VAL : SDO parameter values to change **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

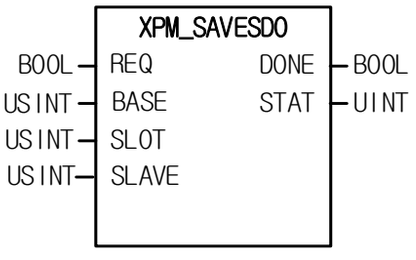
(c) For details of the SDO parameter write command/ function block, refer to chapter 6.3.56/7.11.14 EtherCAT slave SDO parameter write' item

(3) SDO parameter save

(a) Dedicated command

Command	XSAVESDO				EtherCAT slave SDO data save
Operand	OP1	Slot	Constant	WORD	Base and slot number where positioning module is mounted
	OP2	Slave	PMLK,constant,D,Z,R,ZR	WORD	Slave number to execute command XBF-PN04B (17~32: slave 17 ~ 32) XBF-PN08B (17~48: slave 17 ~ 48)

(b) Special function block

Function block type	Content
	**Input** REQ : Request the execution of function block Base : Setting base number on which module is mounted Slot : Setting slot number on which module is mounted SLAVE : Specify the slave to be commanded XBF-PN04B: 17 ~ 32 (slave 17 ~ 32) XBF-PN08B: 17 ~ 48 (slave 17 ~ 48) **Output** DONE : Maintain 1(on) after initial operation STAT : Output the number of error occurred while function block is executing.

(c) For details of the SDO parameter save command/ function block, refer to chapter 6.3.57/7.11.15 EtherCAT slave SDO parameter save' item

(4) Supported version

The version information that can use EtherCAT I/O device connection function is as follows.

Item	Supported version
XG5000	4.75 or higher
XBF-PN04B	V2.50 or higher
XBF-PN08B	V2.50 or higher

9.11 Node Switch Operation Mode

EtherCAT slaves provides the function to set the station number of the slave through the node switch. When performing automatic connection with node switch set, the station number of each slave uses the value set in the node switch of the slave as the slave station number. Afterwards, when executing EtherCAT connection through slave connection or function block command, it provides a function to check whether the slave connection order matches the EtherCAT parameter setting with the slave station number in the node switch and supplies the function to adjust the EtherCAT slave station number setting by node switch. You can set the node switch operation mode when connecting to EtherCAT by setting the node switch operation mode.

9.11.1 Node Switch Operation Mode

(1) Node switch use conditions

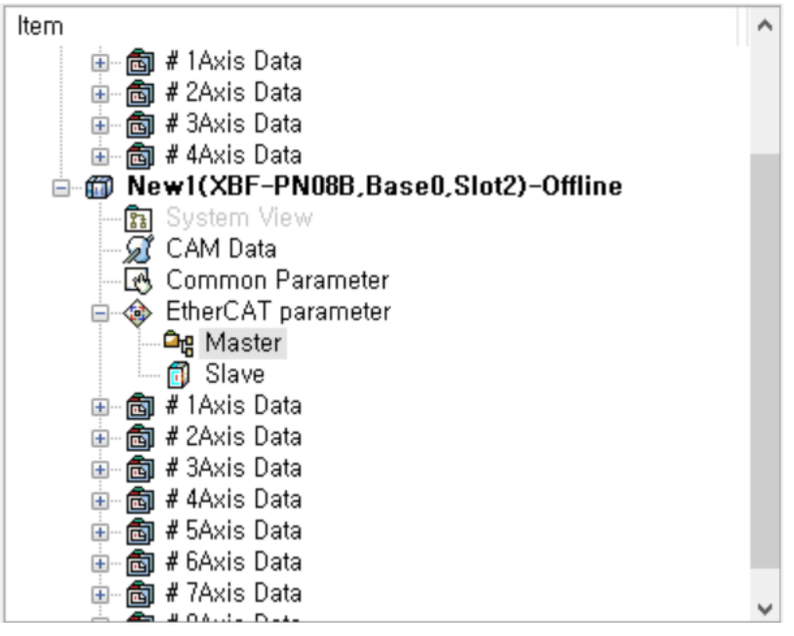
(a) All slaves in the EtherCAT network must set the node switch value.

(b) Node switch setting value of all slave is set to the values within the slave station number range (XBF-PN04B: 1~20, XBF-PN08B: 1~40).

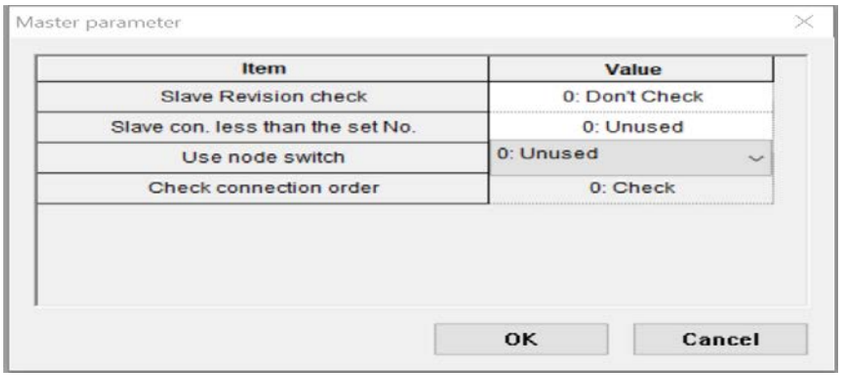
(c) There should be no slaves with duplicate node switch settings

(2) Node switch operation mode setting

(a) Node switch operation mode can be set by selecting EtherCAT Parameter > Master in the project tree.



When opening the master parameter window, you can set the node switch operation mode. Node switch operation mode can be set to 3 types (0: not use node switch / 1: check connection order/ 2: not check the connection order)



(3) Node switch operation mode options

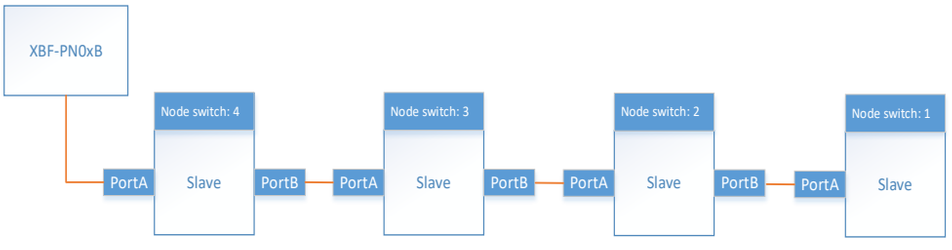
(a) 0: not use node switch: This is an operation mode that does not use the node switches.

(b) 1: check connection order: If the values set in node switch does not the match with station No. of EtherCAT parameter and connection order, an error occurs.

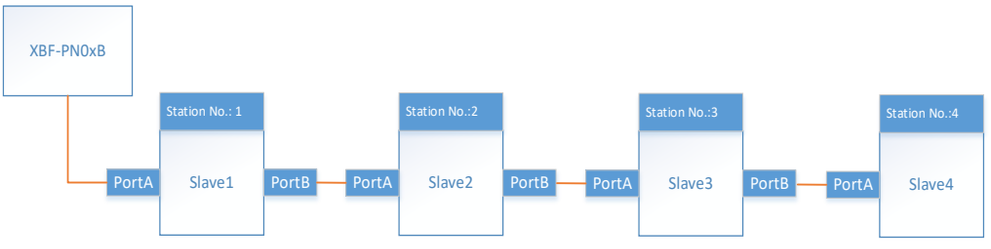
2: not check the connection order: regardless connection order, this is operation mode that connect to the slave setting whose station number matches the values set in node switch. The slaves moved by the node switch setting must use the same slave.

(4) Node switch operation mode differences

Connect 4 identical EtherCAT slaves, set station number 1 to 4 in order from the first slave, and set the node switch to 4 to 1 from the first slave to the connected slave. When each nod switch operation mode is connected to set differently, operation depending on node switch is as follows.

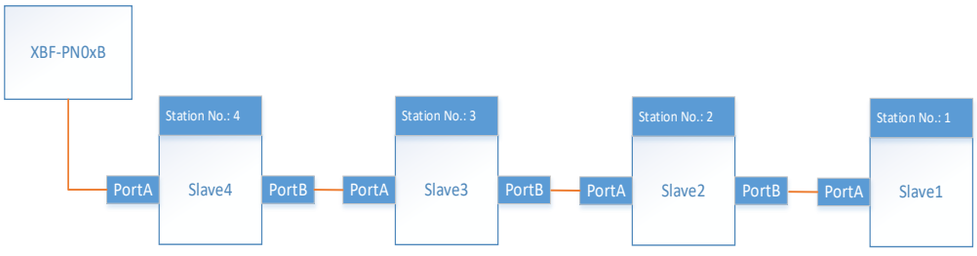


(a) Node switch operation mode‘0: not use node switch’ as a node switch is not used, station number n -slave n are connected in the connection order as set in the EtherCAT parameters and EtherCAT connection is executed



(b) Node switch operation mode‘1: check connection order’since the node switch setting is different from the connection order of the EtherCAT parameters, an error occurs and EtherCAT connection is not executed.

(c) Node switch operation mode ‘2: not check the connection’ regardless connection order,since the station number is set by node switch, the first slave is connected to slave 4,the second slave is connected to slave 3, the third slave is connected to slave 2, and the fourth slave is connected to slave 1.



(5) Supported version

The version information to use the node switch operation mode function is as follows.

	Version
XBF-PN04B OS	V2.40 or higher
XBF-PN08B OS	V2.40 or higher
XG5000	V4.73 or higher

Appendix1 Positioning Error Information and Solutions

Here describes the positioning error types and its solutions.

Appendix 1.1 Error Information of Basic Parameter

Error Code	Error Description	Measurement
101	Max. Speed value of Basic Parameter exceeds the range.	The speed limit of basic parameter input between 1 to 20,000,000 based on pulse unit.
104	Speed limit of basic parameter by degree is bigger than 180 out of range, so circular interpolation can not be executed.	Operate with lower speed limit of Circular Interpolation.
1001	The speed limit values of basic parameter exceeded the setting range.	The speed limit values of basic parameter should be set between 0 and 2147483647.
1002	The acceleration time 1 values of basic parameter exceeded the setting range.	The acceleration time 1 of basic parameter should be set between 0 and 2147483647.
1003	The acceleration time 2 values of basic parameter exceeded the setting range.	The acceleration time 2 values of basic parameter should be set between 0 and 2147483647.
1004	The acceleration time 3 values of basic parameter exceeded the setting range.	The acceleration time 3 values of basic parameter should be set between 0 and 2147483647.
1005	The acceleration time 4 values of basic parameter exceeded the setting range.	The acceleration time 4 values of basic parameter should be set between 0 and 2147483647.
1006	The deceleration time 1 values of basic parameter exceeded the setting range.	The deceleration time 1 values of basic parameter should be set between 0 and 2147483647.
1007	The deceleration time 2 values of basic parameter exceeded the setting range.	The deceleration time 2 values of basic parameter should be set between 0 and 2147483647.
1008	The deceleration time 3 values of basic parameter exceeded the setting range.	The deceleration time 3 values of basic parameter should be set between 0 and 2147483647.
1009	The deceleration time 4 values of basic parameter exceeded the setting range.	The deceleration time 4 values of basic parameter should be set between 0 and 2147483647.
1011	The pulse per revolution values of basic parameter exceeded the setting range.	The pulse per revolution values of basic parameter should be set between 1 and 200000000.
1012	The travel distance per revolution values of basic parameter exceeded the setting range.	The travel distance per revolution values of basic parameter should be set between 1 and 200000000.
1013	The unit setting values of basic parameter exceeded the setting range.	The unit setting values of basic parameter should be set one of '0: pulse', '1: mm', '2: Inch', '3: degree'.
1014	The unit multiplier values of basic parameter exceeded the setting range.	The unit multiplier values of basic parameter should be set one of '0: x 1', '1: x 10', '2: x 100', '3: x 1000'.
1015	The speed command unit setting values of basic parameter exceeded the setting range.	The speed command unit setting values of basic parameter should be set '0: unit/time' or '1: rpm'.
1016	The encoder type setting values of basic parameter exceeded the setting range.	The encoder type setting values of basic parameter should be set '0: incremental encoder' or '1: absolute encoder'.
1017	The current position display compensation amount of	The current position display compensation amount of basic parameter

	basic parameter exceeded the setting range.	should be set between 0 and 255.
1018	The user specified position display ratio values of basic parameter exceeded the setting range.	The user specified position display ratio value of basic parameter should be set between 0 and 7.
1019	The user specified speed display ratio values of basic parameter exceeded the setting range.	The user specified position display ratio value of basic parameter should be set between 0 and 7.
1020	The virtual axis setting values of basic parameter exceeded the setting range.	The virtual axis setting values of basic parameter should be set '0: Real axis' or '1: virtual axis
1021	The torque command unit setting values of basic parameter exceeded the setting range.	The torque command unit setting values of basic parameter should be set '0: 1%' or '1: 0.1%'.
1022	The current speed display time constant values of basic parameter exceeded the setting range.	The current speed display time constant values of basic parameter should be set between 0 and 100.
1023	The control mode setting values during speed synchronous of basic parameter exceeded the setting range.	The control mode setting values during speed synchronous of basic parameter should be set one of '0: position control (CSP)', '1: speed control (CSV, command speed)', '2: speed control (CSV, current speed)'.

Appendix 1.2 Error Information of Expanded Parameter

Error Code	Error Description	Measurement
111	The software upper/lower limits values of the extended parameter are outside the range.	Set the software upper limit value of the extended parameter to be greater than or equal to the software lower limit value.
112	M code mode value of extended parameter exceeds the range.	M Code output of extended parameter is 0: None, 1: With, 2: After. Select one among three.
113	S-curve rate of extended parameter exceeds the range.	Set the S-curve rate of extended parameter to a values between 1 and 100.
1101	The S/W high limit values of expansion parameter exceeded the setting range.	Set the software upper limit value of the extended parameter to be greater than or equal to the software lower limit value between 2147483648 and 2147483647.
1102	The S/W lower limit values of expansion parameter exceeded the setting range.	Set the S/w lower limit value of extended parameter to be smaller than or equal to the S/W high limit value between 2147483648 and 2147483647.
1104	The positioning completion time values of expansion parameter exceeded the setting range.	Set positioning completion time values of the extended parameter to a values between 0 and 65535 ms.
1105	The S-curve rate values of extended parameter exceeds the setting range.	Set S-curve rate values of the extended parameter to a values between 0 and 100 %.
1106	The command in-position range values of expansion parameter exceeded the setting range.	The command in-position range values of expansion parameter should be set between 0 and 2147483647.
1107	The linear Interpolation continuous operating arc insertion position values of expansion parameter exceeded the setting range.	The linear Interpolation continuous operating arc insertion position values of expansion parameter should be set between 0 and 2147483647.
1108	The acceleration/deceleration pattern values of expansion parameter exceeded the setting range.	The acceleration/deceleration pattern values of expansion parameter should be set '0: Trapezoid operation' or '1: S-curve operation'
1109	The M Code mode values of expansion parameter	The M Code mode values of expansion parameter should be set one of

	exceeded the setting range.	'0: NONE', '1: WITH', '2: AFTER'.
1110	The detection of upper and lower limits during speed control of expansion parameter exceeded the setting range.	The detection of upper and lower limits during speed control of expansion parameter should be set '0: Not detect' or '1: Detect'
1111	The positioning completion condition values of expansion parameter exceeded the setting range.	The positioning completion condition values of expansion parameter should be set one of '0: Dwell time', '1: In-position', '2: Dwell time and In-position, '3: Dwel time OR In-position'.
1112	The positioning method of interpolation continuous operation values of expansion parameter exceeded the setting range.	The positioning method of interpolation continuous operation values of expansion parameter should be set '0: target position passage' or '1: near target position passage'
1113	The linear interpolation continuous operation arc insertion values of expansion parameter exceeded the setting range.	The linear interpolation continuous operation arc insertion values of expansion parameter should be set '0: Not arc insertion' or '1: arc insertion continuous operation'
1114	The external command selection values of expansion parameter exceeded the setting range.	The external command selection values of expansion parameter should be set '0: external speed/position control switching' or '1: external stop command'.
1115	The external command enable/disable values of expansion parameter exceeded the setting range.	The external command enable/disable of expansion parameter should be set '0: disable' or '1: enabled'.
1116	The position specified speed override coordinate values of expansion parameter exceeded the setting range.	The position specified speed override coordinate values of expansion parameter should be set '0: absolute coordinate' or '1: relative coordinate.
1117	The infinite running repetition parameter values of expansion parameter exceeded the setting range.	The infinite running repetition parameter values of expansion parameter should be set between 0 and 2147483647.
1118	The infinite running repetition enable/disable of expansion parameter exceeded the setting range.	The infinite running repetition enable/disable of expansion should be set '0: disable' or '1: enabled'.
1119	The speed/position switching coordinate values of expansion parameter exceeded the setting range.	The speed/position switching coordinate of expansion parameter should be set '0: Relative' or '1: Absolute'.
1120	The interpolation speed selection values of expansion parameter exceeded the setting range.	The interpolation speed selection of expansion parameter should be set '0: Main axis speed' or '1: Synthetic speed '.
1121	The CAM start enable/disable values of expansion parameter exceeded the setting range.	The CAM start enable/disable values of expansion should be set '0: disable' or '1: enabled'.

Appendix 1.3 Error Information of Manual Operation Parameter

Error Code	Error Description	Measurement
121	Jog high speed value of manual operation parameter exceeds the range.	Set jog high speed values of manual operation parameter to be greater than or equal to the jog lower speed values of manual operation parameter, and less than or equal to speed limit of basic parameter.
122	Jog low speed value of manual operation parameter exceeds the range.	Set jog low speed values of manual operation parameter to be greater than or equal to 1, and less than or equal to jog high speed limit of manual operation parameter.
123	Inching speed value of manual operation parameter exceeds the range.	Set inching speed values of manual operation parameter to be greater than or equal to 1, and less than or equal to speed limit of basic parameter.

1201	The jog high speed values of manual operation parameter exceeded the setting range.	Set jog high speed values of manual operation parameter to be less than or equal to limit speed between 1 and 2147483647, and greater than to jog low speed.
1202	The jog low speed values of manual operation parameter exceeded the setting range.	Set jog low speed values of manual operation parameter to be less than or equal to jog high speed between 1 and 2147483647.
1203	The jog acceleration time values of manual operation parameter exceeded the setting range.	Set jog acceleration time values of manual operation parameter to a value between 0 and 2147483647 ms.
1204	The jog deceleration time values of manual operation parameter exceeded the setting range.	Set jog deceleration time values of manual operation parameter to a value between 0 and 2147483647 ms.
1205	The inching speed values of manual operation parameter exceeded the setting range.	Set inching speed values of manual operation parameter to be less than or equal to speed limit between 1 and 65535.

Appendix 1.4 Error Information of Common Parameter

Error Code	Error Description	Measurement
141	Encoder pulse input mode value of common parameter exceeded the setting range.	Set encoder pulse input of common parameter to a values be between 0 and 5.
148	Encoder1 minimum value, minimum value range of common parameter exceeded the setting range.	Set the minimum value of encoder 1 of common parameter to be smaller than the maximum value. Also, Set the minimum and minimum value range to include current position of encoder 1.
1301	The speed override mode values of common parameter exceeded the setting range.	Set the speed override mode values of common parameter to '0: % designate', '1: Speed designate'.
1302	The encoder1 pulse input values of common parameter exceeded the setting range.	Set the encoder1 pulse input values of common parameter to one of 0: CW CCW 1 multiplication', '1: PULSE/DIR 1 multiplication', '2: PULSE/DIR 2 multiplication', '3: PHASE A/B 1 multiplication', '4: PHASE A/B 2 multiplication', '5: PHASE A/B 4 multiplication.
1303	The encoder1 maximum setting values of common parameter exceeded the setting range.	Set the encoder1 maximum setting values of common parameter to a value greater than encoder1 minimum value between -2147483648 and 2147483647.
1304	The encoder1 minimum value setting values of common parameter exceeded the setting range.	Set the encoder1 minimum value setting values of common parameter to a value less than encoder1 maximum value between -2147483648 and 2147483647.
1305	The encoder1 phase Z clear values of common parameter exceeded the setting range.	The encoder1 phase Z clear values of common parameter should be set '0: disable' or '1: enabled'.
1310	The position specified speed synchronization target position coordinates values of common parameter exceeded the setting range.	The position specified speed synchronization target position coordinates values of common parameter should be set '0: Relative' or '1: Absolute'.
1311	The encoder1 average count values of common parameter exceeded the setting range.	Set encoder1 average count values of common parameter to one of 0: Not Use', '1: 5 times', '2: 10 times', '3: 20 times'.
1313	The error reset mode values of common parameter exceeded the setting range.	Set error reset mode values of common parameter to '0: Module', or '1: Module/ servo'.

Appendix 1.5 Error Information of Operating Data

Error Code	Error Description	Measurement
151	The operation speed value of operation data can not be set less than “0”.	Set operation speed to value greater than 0.
152	The operation speed of Operation data exceeds max. speed value.	Set operation speed value to value less than or equal to speed limit set in the basic parameters.
155	The operation pattern (End/Keep/Continuous) of operation data is out of range.	Set one from operation pattern (0:End, 1:Go on, 2: Continuous) of operation data to operate
156	Even the operation pattern of operation data set continuous, next command cannot executes continuous operation.	Set for abstract positioning control or speed control. If it is for current step command then next step command should be a interpolation command.
157	Even the operation pattern of operation data set continuous, the subordinate axis of next command is not the same as the subordinate axis of current command.	If operation pattern is continuous, them set both Operation data and next step operation data equally
158	Even the operation pattern set continuous, current command cannot support continuous command.	Continuous operation only can be operated when it is shortening position control, linear interpolation, and circular interpolation. In other commands, set operation option to end or continuous.
159	The goal position of operation data is out of position range.	For positioning control operating change goal position more than 2,147,483,648 and less than 2147483647.
1403	The target speed value of operation data is out of setting range.	Set target speed value of operation data to value less than to speed limit between 0 and 2147483647.
1404	The dwell time value of operation data is out of setting range.	Set dwell time value of operation data to value between 0 and 65535 ms.
1405	The M Code number value of operation data is out of setting range.	Set M code number value of operation data to value between 0 and 65535.
1406	The subordinate axis setting value of operation data is out of setting range.	Set subordinate axis setting value of operation data to value between 0 and 0xFF.
1407	The helical interpolation axis value of operation data is out of setting range.	Set helical interpolation axis value of operation data to value 0(general arc interpolation) or axis 1 t0 8.
1408	The number of arc interpolation turns of operation data is out of setting range.	Set number of arc interpolation turns of operation data to value between 0 and 65535.
1409	The coordinate’s value of operation data is out of setting range.	Set coordinates value of operation data to '0: absolute' or '1: relative.
1410	The control method value of operation data is out of setting range.	Set control method value of operation data to one of '0: single axis positioning, ‘1: single axis speed control', '2: single axis Feed control', '3: linear Interpolation', '4: arc interpolation'.
1411	The operation method value of operation data is out of setting range.	Set operation method value of operation data to '0: single' or '1: repeat’.
1412	The operation pattern value of operation data is out of setting range.	Set operation pattern value of operation data to one of (0: End, ',’1: eep, ',’2: Continuous).

1413	The arc size value of operation data is out of setting range.	Set arc size value of operation data to '0: arc<180' or '1: arc>=180'.
1414	The acceleration number value of operation data is out of setting range.	Set acceleration number value of operation data to value between 0 and 3.
1415	The deceleration number value of operation data is out of setting range.	Set deceleration number of operation data to value between 0 and 3.
1416	The arc interpolation method value of operation data is out of setting range.	Set arc interpolation method value of operation data to one of (0: Middle point, ','1: Center point, ','2: Radius).
1417	The arc interpolation direction value of operation data is out of setting range.	Set arc interpolation direction value of operation data to '0: CW' or '1: CCW'.

Appendix 1.6 Error Information of Data Writing

Error Code	Error Description	Measurement
171	Parameter writing command cannot be done because of start command execution while XG-PM is sending common parameter	Once current operation is done, eliminate error with error-reset command, then execute writing command again. Do not execute start operation while parameter sending.
172	Parameter writing command cannot be done because of start command execution while XG-PM is sending operating parameter.	Once current operation is done, eliminate error with error-reset command, then execute writing command again. Do not execute start operation while parameter sending.
173	Parameter writing command cannot be done because of start command execution while XG-PM is sending operating data.	Once current operation is done, eliminate error with error-reset command, then execute writing command again. Do not execute start operation while operating data sending.
174	Parameter writing command cannot be done because of start command execution while XG-PM is sending CAM data.	Once current operation is done, eliminate error with error-reset command, then execute writing command again. Do not execute start operation while CAM data sending.
175	Start command cannot be executed while writing sending-parameters or operating-data from XG-PM.	Execute again once writing of parameter or operating data are done.
176	Servo parameter writing cannot be completion because of start command execution while sending server parameter in XG-PM.	Once current operation is completed, eliminate error with error-reset command, then execute to write servo parameter again. Do not execute start command while sending servo parameter.

Appendix 1.7 Error Information of basic operation

Error Code	Error Description	Measurement
180	Current control time exceeds the set control cycle	Set the control cycle setting of common parameter to be greater than maximum control time.

Appendix 1.8 Error Information of positioning command and Step control

Error Code	Error Description	Measurement
201	Homing command can be executed during operation.	Execute homing command when main axis is not operating.
203	Homing command can be executed in servo off status.	Execute homing command after making the servo on status with

		servo-on command.
204	Homing method (P3-25) of servo drive is set to “0: not execute’.	Set the homing method (P3-25) to a value other than “0: not execute”in the servo drive parameter, and execute the homing command.
205	Homing cannot be executed because the servo drive does not support homing mode.	The homing command cannot be executed on the relevant servo drive.
206	Home offset read of servo drive was not completed.	Execute homing command after checking the servo drive’s status.
207	An error occurred during home return in the the servo drive.	Execute homing command again after checking whether the homing method set in servo drive is possible to execute currently.
208	Moving information reading was not completed after the home completion of servo drive.	Moving parameter (0x201E) reading was failed after the home completion in SDO parameter. Check whether the relevant parameters exists in servo drive and check servo drive error.
211	Floating origin setting command can not be executed during operation.	Execute Floating origin setting command when command axis is not operating after stop.
212	Floating origin setting command can not be executed in the servo off status.	Execute floating origin setting command after making the servo on status with servo-on command.
213	The floating origin setting command can not be executed if a drive absolute position error is detected while the drive absolute position error detection is set.	Execute the floating origin setting command after drive homing is completed.
221	Direct start command can not be executed during operations.	Execute direct start command when command axis is not operating after stop.
223	Direct start command can not be executed while M code on signal is on status.	Execute direct start command after M code on signal turns off by M code off (MOF) command.
224	Direct start command can not be executed in the absolute coordinate of undecided homing status.	Execute absolute coordinate direct start command after making homing status with homing command or floating origin setting command.
225	Direct start command can not be executed in the servo off status.	Execute direct start command after making the servo on status with servo-on command.
226	The shortest distance control of direct start command can not be executed in relative coordinate.	Execute command after changing positioning coordinate to absolute coordinate.
227	Target position is incorrect during the shortest distance positioning in the infinite running repeat mode.	Set target position to 0 or more and less than or equal to the infinite running repeat position of extended parameter during the shortest distance positioning in the infinite running repeat mode.
228	The control method setting values of direct start command are out of range.	Set control method setting values of direct start command one of 0: position control, 1: speed control, 2: Feed control, 3: shortest distance control, 4: speed control (CSV), 5: not direction designation, 6: forward direction, 7: reverse direction, 8: current direction.
230	The continuous operation of Indirect start command can not be executed in the Feed control.	Execute the indirect start after changing operation pattern to end or keep if the control method is Feed control and the operation pattern is continuous.
231	Indirect start command can not be executed during operations.	Execute the indirect start command when command axis is not operating after stop.
233	Indirect start command can not be executed while M	Execute Indirect start command after M code on signal turns off by M

	code on signal is on status.	code off (MOF) command.
234	Indirect start command can not be executed in the absolute coordinate of undecided homing status.	Execute absolute coordinate Indirect start command after making homing status with homing command or floating origin setting command.
235	Indirect start command can not be executed in the servo off status.	Execute indirect run start command after making the servo on status with servo-on command.
Error Code	**Error Description**	**Measurement**
236	The continuous operation of indirect can not be executed in the speed control.	If the control method is speed control and operation pattern is continuous. Execute the indirect start command after changing operation pattern to end or keep.
237	The step number of point operation could not exceed 0 or 20.	Set step number of point operation to between 0 and 20.
238	The continuous operation of indirect start can not be executed in S-curve acceleration/deceleration pattern.	After changing acceleration/deceleration pattern of command axis's extended parameter to trapezoid operation, execute the indirect start command.
239	The continuous operation of indirect start can not be executed while main axis or subordinate axis is infinite running repeat "enable"status.	Execute the command after setting infinite running repeat setting of main axis or subordinate axis to "0: disable" or changing operation pattern to "end" or Keep".
240	The interpolation operation of indirect start can not be executed while main axis or subordinate axis is infinite running repeat "enable" status.	Execute the command after changing infinite running repeat of main axis or subordinate axis to "0: disable".
241	The linear Interpolation operation can not be executed while the main axis of linear interpolation is in operation status.	Execute the linear interpolation when main axis is not operating.
242	The linear Interpolation operation can not be executed while the subordinate axis of linear interpolation is in operation status.	Execute the linear Interpolation when subordinate axis is not operating after stop.
247	The linear interpolation operation can not be executed while the M code On signal of linear interpolation is on status.	Execute linear Interpolation after M code on signal turns off by M code off (MOF) command.
248	The linear interpolation operation can not be executed while the M code On signal of linear interpolation is on status.	Execute the linear Interpolation after M code on signal turns off by M code off (MOF) command.
250	The absolute coordinate positioning operation can not be executed while the linear Interpolation of main axis is in the undecided homing status.	Execute the linear Interpolation after the main axis is the homing status by homing command or floating origin setting command.
251	The absolute coordinate positioning operation can not be executed while the linear Interpolation of subordinate axis is in the undecided homing status.	Execute the linear Interpolation after the subordinate axis is the homing status by homing command or floating origin setting command.
253	In case that main axis and subordinate axis is set wrong in linear interpolation. (The case that the subordinate axis is not assigned, the case that only one axis is assigned, or the case that axis number is not operating currently.)	Execute the linear Interpolation after setting more than one axis other than main axis among the axis currently connected to the network of subordinate axis setting of linear Interpolation main axis operation data.
254	The linear interpolation main axis can not be executed	Execute the linear Interpolation after making the main axis to servo-on

	while servo off status.	state with the servo-on command.
255	The linear interpolation subordinate axis can not be executed while servo off status.	Execute the linear Interpolation after making the subordinate axis to servo-on state with the servo-on command.
261	Main axis speed of linear interpolation exceeds its speed limit.	Set low for main axis speed so that linear interpolation speed limit would not exceeds.
262	The arc can not be inserted because the position of 2 axis linear Interpolation arc insertion are longer than target position.	Set 2 axes linear interpolation continuous operating arc insertion of extended parameter to be smaller than the length of target position.
263	The arc can not be inserted because the two lines are on a straight line in 2 axes linear interpolation continuous operating arc insertion.	Set target position again to inset an arc or execute linear interpolation after setting 2 axes linear interpolation continuous operating arc insertion setting of extended parameter to “0: not arc insertion”.
264	The arc can not be inserted because the radius of arc to be inserted exceeds 2147483647pulse in 2 axes linear interpolation continuous operating arc insertion.	Execute the linear interpolation after resetting the target position so that the two straight lines are not located almost in a straight line or setting 2 axes linear interpolation continuous operating arc insertion setting of extended parameter to “0: not arc insertion”.
Error Code	Error Description	Measurement
265	Not possible to insert the circular because the radius of 2axis continuous linear interpolation arc insertion are rarely small or its speed limits are too high.	Make bigger for arc insert position and less for speed limit or set '0:Not insert arc' for 2 axis linear interpolation continuous operating arc insertion then execute linear interpolation.
266	Not possible to insert the circular because the circular of 2axis continuous linear interpolation circular insertion are at the same position from where it is supposedly located.	Execute the linear interpolation after resetting the target position so that the two straight lines are not located almost in a straight line or setting 2 axes linear interpolation continuous operating arc insertion setting of extended parameter to “0: not arc insertion”.
267	The interpolation operation can not executed when the subordinate axis has an upper/lower limit error or emergency stop status.	Executes the command after removing upper/lower limit error of subordinate axis or releasing emergency stop status.
270	Error of radius setting from radius circular interpolation.	Set radius setting from circular interpolation main axis operating data for 80% bigger than its half distance of beginning point to end point.
271	The arc interpolation cannot be operated when main axis of arc interpolation is in operation	Execute the arc interpolation hen the main axis has stopped and is not in operation.
272	Arc interpolation cannot be executed when circular interpolation subordinate axis is in operation.	Execute the arc interpolation hen the subordinate axis has stopped and is not in operation.
275	The arc interpolation operation can not be executed when the M code On signal of arc interpolation is on status.	Execute the arc interpolation after M code on signal turns off by M code off (MOF) command.
276	The arc interpolation operation can not be executed when the M code On signal of arc interpolation subordinate axis is on status.	Execute the arc interpolation after M code on signal of subordinate axis turns off by M code off (MOF) command.
277	The absolute coordinate positioning operation can not be executed when the arc interpolation main axis is in the undecided homing status.	Execute the arc interpolation after making the main axis to homing status status by homing command or floating origin setting command.
278	The absolute coordinate positioning operation can not be executed when the arc interpolation subordinate axis is in the undecided homing status.	Execute the arc interpolation after making the subordinate axis to homing status by homing command or floating origin setting command.

279	The main axis and subordinate axis setting is incorrect in arc interpolation. (The case that the subordinate axis is not assigned, the case that only helical interpolation axis setting is incorrect, or the case that axis number is not possible to operating currently.)	Execute arc interpolation after setting an axis other than main axis among axes connected to current network in subordinate axis of arc interpolation main axis operation data and setting axis other than main axis and subordinate an axis among axes connected to current network in helical interpolation setting during executing helical interpolation.
280	The arc interpolation main axis can not be executed while servo off status.	Execute the arc interpolation after making the main axis to servo-on state with the servo-on command.
281	The arc interpolation subordinate axis can not be executed while servo off status.	Execute the arc interpolation after making the subordinate axis to servo-on state with the servo-on command.
282	Not possible to carry out degree operation in circular interpolation.	Execute the arc interpolation after changing basic parameter unit of arc interpolation main axis to the value other than degree.
283	Not possible to carry out operation when the unit of subordinate axis is degree in arc interpolation.	Execute the arc interpolation after changing the basic parameter unit of arc interpolation subordinate to the value other than degree.
284	Not possible to execute the operation if start point = center point (middle point) or center point (middle point) = end point in the arc interpolation.	Execute the arc interpolation after setting center point (middle point) to start point (end point) and different position in arc interpolation.
285	The start point and end point is not possible to be same in the middle point (radius) method of arc interpolation.	Execute the arc interpolation after setting position of start point and position of end point to different when setting the arc interpolation method to middle point(radius).
Error Code	**Error Description**	**Measurement**
286	Radius setting error in circular interpolation.	The radius of circle to execute arc interpolation operation is between 1 and 2,147,483,647pulse. Execute the arc interpolation after resetting radius (arc interpolation auxiliary point of main operation data) within the setting range.
287	Not possible to execute the linear profile in the arc interpolation.	Execute the arc interpolation, after changing middle point (arc interpolation auxiliary point of operation data) so that it is not located on a straight line between the start and end points in case of the circular interpolation midpoint method.
290	Exact circle cannot be draw because of degree of arc interpolation is larger than 90°	Set operation speed lower than 90° for arc Interpolation angular velocity.
291	Not possible to execute simultaneous start command in operation status.	Execute simultaneous start command when all axes set to simultaneous start is stop and not operation.
293	Not possible to execute simultaneous start command when M Code on signal turns On.	Not possible to execute simultaneous start command when M Code on signal turns On.
294	Not possible to execute synchronous start command in the absolute coordinate of undecided homing.	Execute simultaneous start command after making axis that occurs error undecided homing with homing command or floating origin setting.
295	Not possible to execute the simultaneous start command in the Servo off status.	Execute simultaneous start command after making axis that occurs error servo on status with servo on command,
296	The axis setting of simultaneous start command is incorrect.	Execute simultaneous start command after setting axis designation of simultaneous start command to two or more axes. The axis assignment address means 0 bit: axis 1, 1 Bit: axis 2 …, 7 bit : axis 8 and each bit is set as '1' for axis assignment.

297	An error occurred from axis of synchronous start operating.	Execute synchronous start after eliminate an error element from error occurred axis.
301	Not possible to execute speed/position switching command while not in operation.	Execute the position/speed switching command while the command axis is in positioning operation.
302	Not possible to execute speed/position switching command while not in speed control.	Execute speed/position switching command while the command axis is in speed control.
303	Not possible to execute speed/position switching command in subordinate axis of synchronous operation.	The speed/position switching command does not operated on the axis operating as the synchronous operations subordinate axis.
304	Not possible to execute the speed/position switching command if the target position amount is “0”.	The speed /position switching command is not executed if the target position amount is “0” during operating speed control. Set target position amount to the values other than “0”.
306	For "position specified speed/position switching command", when "Unlimited length repetition= enable" and "speed/position switching coordinate=absolute", the position value which makes the object go in the opposite direction is not valid.	For "position specified speed/position switching command", input the positive position value for the forward direction and the negative position value for the reverse direction.
Error Code	**Error Description**	**Measurement**
311	Not possible execute position/speed switching command while not in operation.	Execute the position/speed switching command while the command axis is in positioning operation.
312	Not possible to execute position/speed switching command in the subordinate axis of synchronous operation.	The speed/position switching command does not operated on the axis operating as the synchronous operations subordinate axis.
313	Not possible to execute the position/speed switching command during arc (ellipse) interpolation operation.	The position/speed switching command does not operated in the axis operating arc (ellipse) interpolation operation.
314	Not possible to execute position/speed switching command during the linear interpolation operation.	The position/speed switching command does not operated on the axis operating as the linear interpolation operation.
316	Not possible to carry out Position/Speed switching command in the state of decreasing section.	Execute Position/Speed switching command before the decreasing of axis, while in increasing section or regular section.
317	Not possible to execute the position/speed switching command when it is not either the positioning control or inching operation.	Execute Position/Speed switching command while the commanding axis is positioning control or inching operation
321	Not possible to execute decelerating stop operation command while not operation.	Execute the deceleration stop command while the command axis is in positioning operation.
322	Not possible to execute deceleration stop command in the Jog operation.	The deceleration stop command is not operation during Jog operation. Use Jog stop to stop Jog operation.
324	Deceleration time setting from deceleration stop commands are out of range.	The deceleration time setting value of deceleration stop command is between 0 and 2147483647. Execute deceleration stop command after resetting the deceleration time within setting range.
331	Not possible to execute skip operation command while not in operation.	Execute the skip operation command while the command axis is in positioning operation.

332	Not possible to execute skip operation command for subordinate axis of linear interpolation operation.	Execute skip operation command for linear interpolation main axis.
333	Not possible to execute skip operation command for subordinate axis of synchronous operation.	The skip operation command does not operated in the axis operating as the synchronous operations subordinate axis.
335	Not possible to execute the skip operation command in the state of Jog operation.	The skip operation command is not operation in the axis operating as the jog operation.
336	Not possible to execute skip operation command in the state of direct start operation.	The skip operation command does not operated in the axis operating as the direct start.
337	Not possible to execute the skip operation command in the state of Inching operation.	The skip operation command is not operation in the axis operating as the Inching operation.
338	Not possible to execute the skip operation command for subordinate axis of the arc (ellipse) interpolation operation.	Execute skip operation command for the main axis of arc (ellipse) interpolation operation.
339	Not possible to execute the skip operation command in the state of torque control.	The skip operation command is not operation for axis operating as torque control.
340	Not possible to execute the skip operation command in the state of csv mode speed control.	Whether the relevant axis is csv mode speed control during executing the skip operation command, and do not execute skip operation during csv mode speed control operation.
Error Code	**Error Description**	**Measurement**
341	Not possible to execute position synchronization command in the state of in operation.	Execute the position synchronization command when command axis is stop and not operating.
343	Not possible to execute the position synchronization command while M code on signal is on status.	Execute position synchronization command after M code on signal turns off by M code off (MOF) command.
344	Not possible to execute position synchronization command in the absolute coordinate of undecided homing.	Execute position synchronization command after set command axis to a state of homing with homing command or floating origin setting.
345	Not possible to execute position synchronization command in the state of servo off.	Execute the position synchronization command after making the command axis into the servo-on state with the servo-on command.
346	Not possible to execute position synchronization command in the state that the origin of main axis is not settled.	Execute Position Synchronization interpolation command after setting main axis to homing status with homing command or floating origin setting.
347	There is error in setting main axis/subordinate axis of Synchronous Start by Position command.	Set the main axis setting of the position synchronization command among the axes connected to the network to the command axis, other axis or the encoder. Main axis is set by writing 1~8(Axis1 ~ Axis8), 9(Encoder 1) 10(Encoder 2) to the setting address.
350	Not possible to carry out Synchronous Start by Speed command in the state of in operation of main axis.	Execute speed synchronization command while the main axis of speed synchronization is not operating.
351	Not possible to execute the speed synchronization command in the state of in operation.	Execute speed synchronization command when the command axis is not operation as speed synchronization after stop. Execute speed synchronization command after setting the main axis as the same axis with current set main axis while the command axis is operation as speed synchronization operation.
353	Not possible to carry out speed synchronization command in the state of M Code ON	Execute speed synchronization command after M code on signal turns off by M code off (MOF) command.

354	Not possible to execute speed synchronization command in the state of Servo off.	Execute the speed synchronization command after making the command axis into the servo-on state with the servo-on command.
355	There is error in setting main/subordinate axis of speed synchronization command.	Set the main axis setting of the speed synchronization command among the axes connected to the network to the command axis, other axis or the encoder. Main axis is set by writing 1~8(Axis1 ~ Axis8), 9(Encoder 1) 10(Encoder 2) to the setting address.
356	There is error in main/subordinate axis setting of speed synchronous command.	The main axis ratio of speed synchronization command cannot be set to 0. Set a value between -32768 and 32767 excluding zero.
357	The speed of speed synchronous command cannot exceeds its speed limit.	Set low for main axis ratio/second axis ratio values so The value would not exceed its limitation.
358	Not possible to execute speed synchronization command when when the main axis is in homing operation. (Except when the main axis is LS Mecapion L7N/L7NH/ XIP)	Execute the speed synchronization command while the main axis is not homing operation status.
360	Not possible to execute position specified speed synchronization command as csv mode.	Check whether the relevant axis is csv mode speed control during executing the position specified speed synchronization command, and do not execute position specified speed synchronous command during csv mode speed control operation.
Error Code	**Error Description**	**Measurement**
361	Not possible to execute position override command while not in the state of operation.	Execute the position override command while the command axis is in operation.
362	The position override command cannot be executed in dwell status.	Execute the position override command while the command axis is not in dwell status.
363	The position override command cannot be executed when not in positioning operation status.	Execute the position override command while the command axis is in operation as position control.
364	The position override command cannot be executed for the axis that operate the linear interpolation.	The position override command does not operated on the axis that operates the linear interpolation.
365	The position override command cannot be executed for the axis that operates the arc (ellipse) interpolation.	The position override command does not operated for the axis that operates arc (ellipse) interpolation operation.
366	The position override command cannot be executed for the synchronous operation subordinate axis.	The position override command does not operated for the axis that operate as subordinate axis of synchronous operation.
371	The speed override command cannot be executed while not operation.	Execute the speed override command while the command axis is in operation.
372	Exceeds the range of speed override value.	Set the speed values of speed override command between 0 and speed limit value of basic parameter.
373	The speed override command cannot be executed for the linear Interpolation subordinate axis.	Execute the speed override command for linear interpolation main axis.
374	The speed override command cannot be executed for arc (ellipse) interpolation subordinate axis.	Execute speed override command for the main axis of arc (ellipse) interpolation.
375	The speed override command cannot be executed for synchronous operation subordinate axis.	Execute the speed override command to synchronous operation main axis to execute speed override for synchronous operation subordinate axis.
377	The speed override command cannot be executed in	Execute the speed override command during acceleration section or

	deceleration section.	constant speed section before the axis is deceleration operation.
378	The speed override command cannot be executed in the S curve acceleration/deceleration pattern.	Execute the speed override command after changing the acceleration/deceleration pattern of extended parameter to the trapezoid operation.
381	Any position/speed override command is not executed while not in operation.	Execute the any position/speed override command while the command axis is in operation.
382	Any position/speed override command is not executed while not in positioning operation.	Any position/speed override command is not executed while operating speed control.
383	Exceeds the speed override value range of any position/speed override command.	The speed value of any position/speed override command set between 0 and speed limit of basic parameter.
384	Any position/speed override command is not executed for the linear interpolation subordinate axis.	Execute any position/speed override command for linear interpolation main axis.
385	Any position/speed override command is not executed for the arc (ellipse) interpolation operation subordinate axis.	Execute any position/speed override command for the main axis of arc (ellipse) interpolation.
386	Any position/speed override command is not executed for the synchronous operation subordinate axis.	Any position/speed override command is not executed while operating synchronous operation subordinate axis.
389	Any position/speed override command is not executed for the S curve acceleration/deceleration pattern.	Execute any speed override command after changing the acceleration/deceleration pattern of extended parameter to the trapezoid operation.
Error Code	**Error Description**	**Measurement**
390	The continuous operation command is not executed for the S curve acceleration/deceleration pattern.	Execute the continuous operation command after changing the acceleration/deceleration pattern of extended parameter to the trapezoid operation.
391	The continuous operation command is not executed while not operating.	Execute the continuous operation command while the command axis is in operation.
392	The continuous operation command is not executed while operating dwell.	Execute the continuous operation command while the command axis is not in dwell.
393	The continuous operation command is not executed while not positioning operation.	The continuous operation command is not executed while operating speed control.
394	The speed data value of next step of continuous operation command exceeded the allowable range.	Execute the continuous operation command after setting speed values of next step between 0 and the speed limit of basic parameter when executing continuous operation command.
395	The continuous operation command is not executed for subordinate axis of linear interpolation operation.	Execute the continuous operation command for linear Interpolation main axis.
396	The continuous operation command cannot be executed for the arc (ellipse) interpolation operation axis.	The continuous operation command is not executed while operating arc (ellipse) interpolation operation.
397	The continuous operation command cannot be executed for the subordinate axis of synchronous operation.	The continuous operation command is not executed while operating synchronous operation subordinate axis.
399	The continuous operation command is not executed at the last step of operation data.	The continuous operation command is not executed while operating 400th step.

400	The continuous operation command is not executed while operating direct start	The continuous operation command is not executed to the axis that is operating direct start.
401	The inching operation command can not be executed during operations.	Execute Inching operation command when main axis is stop and not operating.
403	The inching command can not be executed in the servo off status.	Execute the inching operation command after making the command axis into the servo-on state with the servo-on command.
411	The jog start command can not be executed during operations.	Execute the jog command when command axis is stop and not operating.
413	The jog start command can not be executed in the servo off status.	Execute the jog operation command after making the command axis into the servo-on state with the servo-on command.
415	The jog high speed values of direct input jog operation is out of range.	Set the jog high speed values of direct input jog operation function block less than speed limit of basic parameter.
416	The jog low speed values of direct input jog operation is out of range.	Set the jog low speed values of direct input jog operation function block between 1 and jog high speed values of of direct input jog operation function block.
417	The jog acceleration time of direct input jog operation is out of range.	Set the jog acceleration time of direct input jog operation function block between 0 and 2147483647.
418	The jog deceleration time of direct input jog operation is out of range.	Set the jog deceleration time of direct input jog operation function block between 0 and 2147483647.
Error Code	**Error Description**	**Measurement**
431	The manual operation previous position return command can not be executed during operations.	Execute the manual operation previous position return command when command axis is stop and not operating.
434	The manual operation previous position return command can not be executed in the servo off status.	Execute the manual operation previous position return command after making the command axis in the servo-on state with the servo-on command.
441	The start step no. change command can not be executed during operations.	Execute the start step no. change command when main axis is stop and not operating.
442	Exceeds the step assignment range of start step no. change/repeat operation start step no. assignment command.	Execute the start step no. change command or repeat step no. change command after setting step setting value between 1 and 400.
451	The current position preset command can not be executed during operations.	Execute the current position preset command when command axis is stop and not operating.
452	The current position preset or floating origin setting command can not set to exceed the range of software high/low limit.	Check if the position value of current position preset or floating origin setting command is within the range of soft high /low limit set in extended parameter.
453	The current position preset command can not be executed if a drive absolute position error is detected while the drive absolute position error detection is set.	Execute the current position preset command after drive homing is completed.
461	The position teaching command can not be executed	Execute the position teaching command when the current operating

	when teaching step is in operation.	step is stop and not operation.
462	The teaching number of array teaching command has been exceeded (16).	Execute the array teaching command after setting a data number of array teaching command between 1 and 16.
463	The speed teaching command can not be executed when teaching step is in operation.	Execute the speed teaching command when the current operating step is stop and not operation.
465	This is a step number specified error to execute array teaching command.	Execute the teaching command after setting a step between 1 and 400.
466	Teaching list error for array teaching command.	Execute teaching command after setting teaching data item to one of 0: position or 1: speed.
467	Teaching method error for multi teaching command.	Execute teaching command after setting teaching method one of 0: RAM teaching or 1: ROM teaching.
471	The parameter teaching command cannot be executed during in operation.	Execute the parameter teaching command when command axis is stop and not operating.
Error Code	**Error Description**	**Measurement**
472	The operation data teaching command cannot be executed during in operation.	Execute the operation data teaching command when command axis is stop and not operating.
473	Set data cannot be teaching.	Execute teaching command after setting right value for parameter teaching data or operating data teaching list.
474	The parameter/operation data saving commands cannot be done while the axis is operating.	Check whether the axis was not operating when parameter/operation data saving commands are executing. Execute the parameter/operation command when all axis are not operating.
475	Error of value for teaching data is out of range.	Execute teaching command after setting value of parameter teaching or operating data teaching data among its set range.
476	Error of value for teaching method is out of range.	Execute teaching command after setting value of parameter teaching or operating data teaching data for 0(RAM teaching) or 1(ROM teaching).
477	It is possible to loss the parameter/operation data since the power turns off during saving the parameter/operation data.	Write parameter/operation data using " project write" command in XG-PM.
478	It is possible to loss the CAM data since the power turns off during saving the CAM data.	Write the CAM data using "project write" command in XG-PM.
481	This is an internal emergency stop error.	Eliminate the emergency stop factor and execute the error reset command to clear the error.
491	This is an external emergency stop error.	Eliminate the emergency stop factor and execute the error reset command to clear the error.
492	This is a hard high limit error.	Clear the error by executing the error reset command after out of the external upper limit signal range using the reverse jog command.
493	This is a hard low limit error.	After being out of external low limit signal range by using forward jog command, execute an error reset command to clear the error.
501	This is a hard high limit error.	After being out of software upper limit range using the reverse jog

		command, execute an error reset command to clear the error.
502	This is a soft lower limit error.	After being out of soft lower limit range by using forward jog command, execute an error reset command to clear the error.
511	Inappropriate command	Check the commands are appropriate. Refer command part of the user manual.
512	The auxiliary data step number is out of allowable range.	A step number bigger than 400 has been set in command. Set it between 1 and 400.
521	The command cannot be executed due to an error in the servo drive during operation.	After removing the cause of the servo error, clear the servo error with the servo error reset command.
522	The command cannot be executed because the servo is off during operation.	Execute the command again after making the command axis to servo-on state with the servo-on command.
523	The command cannot be executed when the"Quick Stop" function is actived during the operation.	Check whether the"Quick Stop" function of servo drive is actived due to inputting like emergency stop.
Error Code	**Error Description**	**Measurement**
531	This is encoder number excess error during encoder preset command.	Execute an encoder preset command after setting encoder number to “0(encoder 1) or 1(encoder 2).
532	The preset command cannot be executed because there is an axis with encoder 1 as the main axis.	Execute an encoder preset command when a axis that operates encoder 1 as the main axis is stop and not operating.
533	The preset command cannot be executed because there is an axis with encoder 2 as the main axis.	Execute an encoder preset command when a axis that operates encoder 2 as the main axis is stop and not operating.
534	The encoder preset position exceeds maximum or minimum value’s range of encoder 1.	Execute encoder preset command after set the value of encoder position preset between encoder 1 minimum value and encoder 1 maximum value of common parameter.
535	The encoder preset position exceeds maximum or minimum value’s range of encoder 2.	Execute encoder preset command after set the value of encoder position preset between encoder 2 minimum value and encoder 1 maximum value of common parameter.
541	Ellipse interpolation cannot be operated while main axis of circular interpolation is operating.	Execute the Ellipse interpolation command when main axis is not operating.
542	Ellipse interpolation cannot be operated while support axis of circular interpolation is operating.	Execute the circular interpolation command when subordinate axis is not operating
543	The ellipse interpolation operation can not be executed when the M code On signal of the ellipse interpolation is on status.	Execute the ellipse interpolation command after setting M code on signal of main axis to off with the M code off (MOF) command.
544	The ellipse interpolation operation can not be executed when the M code On signal of the ellipse interpolation subordinate axis is on status.	Execute the ellipse interpolation command after M code on signal turns off by M code off (MOF) command.
545	The absolute coordinate positioning operation can not be executed when the ellipse interpolation main axis is undecided homing status.	Execute the ellipse interpolation command after set main axis as homing status with homing command or floating origin setting.
546	The absolute coordinate positioning operation can not be executed when the ellipse interpolation subordinate	Execute the ellipse interpolation command after set subordinate axis as homing status with homing command or floating origin setting.

	axis is undecided homing status.	
547	The main and subordinate axis setting are incorrect in the ellipse interpolation.(if the subordinate axis is not specified, if the helical interpolation axis is specified, and if the axis number is not possible to operate currently)	Execute the ellipse interpolation command after setting one axis other than main axis among axes connected to network of subordinate axis, and setting an ellipse interpolation setting to not use.
548	The ellipse interpolation cannot be operated with middle point and radius method.	The ellipse interpolation only can operate in center point method. Execute the ellipse interpolation after changing an arc interpolation mode of operation data to center point method.
549	The ellipse interpolation main axis can not be executed while servo off status.	Execute the ellipse interpolation command after making the main axis to servo-on state with the servo-on command.
550	The ellipse interpolation subordinate axis can not be executed while servo off status.	Execute the ellipse interpolation command after making the subordinate axis to servo-on state with the servo-on command.
551	Operation cannot be executed if the unit of the main axis is degree in ellipse interpolation.	Execute an ellipse interpolation command after changing basic parameter unit of an ellipse interpolation main axis to the value other than degree.
552	Operation cannot be executed if the unit of the subordinate axis is degree in ellipse interpolation.	Execute an ellipse interpolation command after changing basic parameter unit of an ellipse interpolation subordinate axis to the value other than degree.
553	Operation cannot be executed if in an ellipse interpolation, start point = center point (middle point) or center point (middle point) = end point.	Execute an ellipse interpolation command after setting position of center point and start point (or end point) differently in ellipse interpolation.
Error Code	**Error Description**	**Measurement**
554	This is radius setting error in an ellipse interpolation.	The range of circle that an ellipse interpolation can execute is between 0 and 2147483647. Set radius of circle between 0 and 2147483647 pulse by changing position of center point.
555	Exact circle cannot be draw because degree of an ellipse interpolation is bigger than 90°	Set lower for operation speed so that degree of an ellipse interpolation is smaller than 90°
556	Keep or continuous operation cannot executed in an ellipse interpolation.	Execute an ellipse interpolation after setting operation pattern of ellipse interpolation operation step to end.
557	An ellipse interpolation only can be operated when control method is arc interpolation.	Execute an ellipse interpolation after setting control method of ellipse interpolation operation step to arc interpolation.
558	Operation cannot be executed when start point and end point of ellipse interpolation are different.	Execute an ellipse interpolation command after setting the target position of ellipse interpolation operation step to be the same as the current position.
559	Operation cannot be executed when operation degree of an ellipse interpolation is 0.	Set the value of operating degree for an ellipse interpolation to a values greater than 0. (1~65535)
561	The position/torque switching command cannot be executed when not operating.	Execute position/torque switching command when command axis is stop and not operating.
562	The position/torque switching command cannot be executed in subordinate axis of synchronous operation.	The position/torque switching command is not executed while operating synchronous operation subordinate axis.
563	The position/torque switching command cannot be executed when operating arc (ellipse) interpolation.	The position/torque switching command is not executed in the axis while operating arc (ellipse) interpolation.

564	The position/torque switching command cannot be executed when operating linear interpolation.	The position/torque switching command is not executed in the axis while operating linear interpolation.
565	The torque control cannot be executed because the servo drive does not support torque control mode.	The torque control command cannot be executed in the relevant servo drive.
571	Operation cannot be executed because error of subordinate axis errors with the current axis as the main axis.	Check whether an error has occurred in the subordinate axis with the current axis as the main axis when the current axis is operating.
572	The interpolation operation cannot be executed because an error has occurred in subordinate axis with one of interpolation axis as main axis.	Check whether an error has occurred in the subordinate axis with one of interpolation operation as main axis during the interpolation operation.
573	When the main axis error is occurred during synchronous control with the operation parameter set to 1 or 2, the synchronous control was released due to servo alarm of main axis is occurred.	Check whether the servo alarm of main axis is occurred during operating status.
574	When the main axis error is occurred during synchronous control with the operation parameter set to 1 or 2, the synchronous control was released due to axis error of main axis is occurred.	Check whether the axis error of main axis is occurred during operating status.
575	When the main axis error occurs during synchronous control with the operation parameter set to 1 or 2, the speed synchronization command cannot execute when the main axis is servo alarm or axis error status.	Check whether the servo alarm or axis error of the main axis has occurred.
576	When the main axis error occurs during synchronous control with the operation parameter set to 1 or 2, the position synchronization command cannot execute when the main axis is servo alarm or axis error status.	Check whether the servo alarm or axis error of the main axis has occurred.
577	When the main axis error occurs during synchronous control with the operation parameter set to 1 or 2, the cam command cannot execute when the main axis is servo alarm or axis error status.	Check whether the servo alarm or axis error of the main axis has occurred.
578	When the main axis error occurs during synchronous control with the operation parameter set to 1 or 2, the phase compensation command cannot execute when the main axis is servo alarm or axis error status.	Check whether the servo alarm or axis error of the main axis has occurred.
579	When the main axis error occurs during synchronous control with the operation parameter set to 1 or 2, the synchronization position specified speed synchronous command cannot execute when the main axis is servo alarm or axis error status.	Check whether the servo alarm or axis error of the main axis has occurred.
582	The target position setting is incorrect during the shortest distance positioning in the infinite running repeat mode.	Set target position to 0 or more and less than or equal to the infinite running repeat position of extended parameter during the shortest distance positioning in the infinite running repeat mode.
591	The servo parameter write command cannot be	Execute the servo parameter write command when command axis is

	executed while operating.	stop and not operating.
592	The data range including servo parameter index, subindex is out of the range.	Check whether data setting values including servo parameter index, subindex is out of the range.
593	Abort occurred during servo parameter write command.	Check whether parameter writing is possible item or parameter number and setting data are within the allowable range. Cannot write corresponding parameter depending on servo drive status.
594	There is no response of the servo drive for servo parameter write command.	Check whether the status of servo drive is in normal.
595	The servo parameter EEPROM saving command can not be executed in the servo on status.	Execute the servo parameter EEPROM saving command after making servo off status by the servo off command.
Error Code	**Error Description**	**Measurement**
596	Abort has occurred during saving servo parameter EEPROM.	Check the status of the servo drive. The servo parameter EEPROM saving command can not be executed in the specific status.
597	There is no response of the servo drive for servo parameter EEPROM Save command.	Check whether the status of servo drive is in normal.
598	The servo parameter EEPROM saving axis is currently not connected.	The servo parameter EEPROM saving command can execute for the connected axis to current network.
599	Other commands cannot be executed while saving servo parameter write or servo parameter EEPROM saving.	Execute command after the servo parameter write or servo parameter EEPROM saving command is completed.
600	Abort occurred during servo parameter read command.	Check whether parameter read is possible item or parameter number data are within the allowable range. Cannot read corresponding parameter depending on servo drive status.
601	There is no response of the servo drive to the servo parameter read command.	Check whether the status of servo drive is in normal.
602	The servo parameter read/write or servo parameter EEPROM saving command can be executed during executing the servo parameter read command.	Execute command after the servo parameter read command is completed.
603	The maximum number of command is exceeded to execute servo parameter read or write buffering command.	The maximum number of servo parameter read or write buffering command that can be executed simultaneously is 10 per axis. Adjust the command execution timing so that the number of buffering commands executed simultaneously does not exceed 10.
701	The CAM command can be executed during operating status.	Execute CAM command when main axis is not operating.
702	The CAM command can not be executed while M code on signal is on status.	Execute CAM command after M code on signal turns off by M code off (MOF) command.
703	The CAM command can not be executed in the servo off status.	Execute the CAM operation command after making the command axis into the servo-on state with the servo-on command.
704	There is error in setting main/subordinate axis of CAM command.	Set main axis setting of CAM command to an axis different from the command axis among connected axes. Set main axis to 1(axis 1) to 8(axis 8)

706	Error of CAM block setting from CAM command.	Execute CAM command after set a CAM block from CAM command as bigger than 1 and smaller than 8.
707	Error for CAM data of appointed block from CAM command.	Execute CAM command after set right data for appointed block from CAM command.
708	The speed of subordinate axis from CAM command cannot exceed its speed limit.	Set lower speed for main axis so that speed of subordinate axis from CAM data which is calculated by subordinate position would not exceed its speed limit.
709	The CAM command cannot be executed if the main axis is encoder and the main axis unit of CAM data is not pulse.	When setting the main axis of CAM data to an encoder, set the main axis unit of relevant CAM block to pulse.
710	The speed of the main axis of cam command is so high that moving position per control period exceeds the main axis range.	After slow down the speed of the main axis then operate the axis.
711	Data area setting value (block size and no. of block) of variable data read/write command is out of range.	Set the block size and no. of block for [block size X no. of block] to be 1~128.
712	Variable data write command cannot be executed during operation.	Check whether any axis is under operation when executing the variable data write command
Error Code	**Error Description**	**Measurement**
713	Block area of variable data write command is overlapped so writing is unavailable.	In case the number of block is more than 2, set the block offset to be larger than block size. (Or set the block size to be smaller than block offset.)
721	Restart command is impossible, after the operation that do not support restart like arc interpolation.	Before using restart command, check if the operation that do not support restart is used.
722	The restart command can be executed during operating status.	Execute restart command when command axis is not operating.
732	The torque synchronization command only can execute when the command axis is not operating or operating torque synchronization operation.	Execute command, when the main axis is not operating or operating torque synchronization operation.
733	The torque ratio and speed ratio of torque synchronization command cannot be set to 0.	Set the torque ratio and speed ratio of torque synchronization command to values greater than 0.
734	There is error in main axis/subordinate axis setting of torque synchronization command.	Set main axis setting of torque synchronization command to an axis different from the command axis among connected axes. Set main axis to 1(axis 1) to 8(axis 8)
735	The torque synchronization command can not be executed in the servo off status.	Execute torque synchronization command after making axis that occurs error in servo on status with servo on command.
741	The torque control command can be executed during operating other than torque control.	Execute torque control command when the command axis is stop and not operating.
742	The torque control command can not be executed while M code on signal is on status.	Execute the torque control command after M code on signal of axis that occurred an errors turns off by M code off (MOF) command.
743	The torque control command can not be executed in the servo off status.	Execute torque control command after making axis that occurred an errors servo on status by M code on command.

751	The servo drive cannot execute latch setting command because of the latch (Touch Probe) function is not supported.	The latch setting command cannot be executed in the relevant servo drive.
752	The servo drive cannot execute latch setting command because the latch (Touch Probe 1 rising edge) function is not supported.	Execute command after set a touch probe 1 rising edge PDO in relevant servo drive
753	The servo drive cannot execute latch setting command because the latch (Touch Probe 2 rising edge) function is not supported.	Execute command after set a touch probe 2 rising edge PDO in relevant servo drive
754	The servo drive cannot execute latch setting command because the latch (Touch Probe 1 falling edge) function is not supported.	Execute command after set a touch probe 1 falling edge PDO in relevant servo drive
755	The servo drive cannot execute latch setting command because the latch (Touch Probe 2 falling edge) function is not supported.	Execute command after set a touch probe 2 falling edge PDO in relevant servo drive
756	The touch probe signal input values are out of range.	Execute the command again after setting the touch probe signal input values to the available values.

Error Code	Error Description	Measurement
761	The CAM restart operation cannot be executed while the main axis is in operation.	Execute the CAM operation command when the main axis is stop.
762	The CAM restart operation cannot be continued when the main axis is operating while the subordinate axis is moving to the subordinate axis synchronization position.	After starting the CAM restart operation and the subordinate axis is moving to the subordinate axis synchronization position, make sure that the main axis does not executed.
771	The phase compensation command is not executed while the command axis is operating synchronous control (CAM, speed synchronization).	Execute the phase compensation command while the command axis is operating synchronous control operation.
772	There is error in the main axis setting of phase compensation command.	Execute command after setting the main axis setting of phase compensation command to be the same with the main axis of current synchronous operation.
773	The phase compensation amount of phase compensation command is out of the position range.	Execute command after setting phase compensation between -2147483648 and 2147483647 in the pulse unit.
774	The speed setting values range of phase compensation command are out of range.	Execute command after setting the speed values of phase compensation between 1 and speed limit of main axis.
775	The acceleration time setting values of phase compensation command are out of range.	Execute command after setting the acceleration time setting values of phase compensation command between 0 and 2147483647.
776	The deceleration time setting values of phase compensation command are out of range.	Execute command after setting the deceleration time setting values of phase compensation command between 0 and 2147483647.
781	It is not an available values in operational direction of speed override command.	For operation direction, only 1(forward), 2(reverse), 3(current) can be inputted. Set it to an imputable values.
782	Negative number can be inputted in the speed values of speed override command during the	The speed values of speed override command must be less than or equal to the setting speed limit in basic parameter during the

	positioning.	positioning. Check the speed value.
783	It is not an available range of acceleration/deceleration values of speed override command.	Set the acceleration/deceleration values of speed override command to 0 or more. (0~65535 when specifying %)
784	The operational directions of peed/acceleration/deceleration override command can not be set opposite direction of current operational direction during positioning control.	Execute command after setting operation direction of speed, acceleration/deceleration override to be the same direction with current operational direction or “3: current direction”.
791	The speed required to follow speed synchronization position has exceeded the speed limit of subordinate axis.	Execute command after setting main axis synchronous position and subordinate axis synchronous position of position specified speed synchronization to be longer.
792	The acceleration/deceleration time and speed to follow speed synchronization position can be calculated.	Execute command after setting main axis synchronous position and subordinate axis synchronous position of position specified speed synchronization to be longer.
801	The command axis is axis that is not connected to the current network.	Be sure that the command axis is axis that is connected to the current network. Execute command on an axis connected to the current network.
811	Previous command is not processed. It is impossible to execute command additionally.	Check previous command is executed. If the process is finished, execute other command additionally
821	It command cannot be executed on an axis set in virtual axis.	Check whether the command axis is a virtual axis. Execute command on an axis connected to the current network.
831	The csv mode speed control command cannot be executed while it’s operating other than speed control.	Execute csv mode speed control command while the relevant axis is not in operation.
832	The csv mode speed control command cannot be executed while M code signal is on status.	Execute csv mode speed control command while the M Code signal of relevant axis is off status.
833	The csv mode speed control command cannot be executed while the servo off status.	Execute csv mode speed control command while the relevant axis is servo on status.
834	The servo drive of does not support the csv mode.	The csv mode speed control command cannot be executed since the relevant servo drive does not support csv mode.
835	The csv mode speed control command cannot be executed since the target speed (0x60FF) does not set in PDO entry.	Execute command after adding target speed (0x60FF) to PDO entry for the relevant servo drive and applying the relevant PDO entry with downloading network parameters.
841	The master position control loop command cannot be enabled/disabled when axis is in operation.	The master position control loop command cannot be enabled/disabled when command axis is stop and not in operation.
842	The master position control loop command cannot be executed because the target speed (0x60FF) object is not set in PDO entry.	Execute the master position control loop command after adding target speed (0x60FF) object in RxPDO.
843	To operate cross-coupled control, the master position position control loop command must be operating.	Execute the Cross-coupled control during the master position control loop is executing.

844	To operate cross-coupled control, the command axis and paired axis must be different axes.	Input the different axis for command axis and paired axis.
845	A disable command is inputted on the axis where the cross-coupled control does not executing.	Execute the disable command on the axis where cross-coupled control is being executed.
851	The master scale values is 0 since inputting “0” in the CAM scale operation master scale numerator.	Input the non-zero integer in the master scale numerator.
852	The master scale values is Infinite since “0” input in the CAM scale operation master scale denominator.	Input the non-zero integer in the master scale denominator.
853	The slave scale values is“0” since “0” input in the CAM scale operation slave scale numerator.	Input the non-zero integer in the slave scale numerator.
854	The slave scale values is Infinite since “0” input in the CAM scale operation slave scale denominator.	Input the non-zero integer in the slave scale denominator.
860	The homing status is initialized since absolute position error of drive is detected	Measure the cause of the absolute position valid signal of drive being turned off and executes homing again.
861	The homing status is initialized since the absolute position valid signal of drive is off and the homing status of relevant axis is on when the writing drive absolute position error detection parameter from 0 to 1.	Measure the cause of the absolute position valid signal of drive being turned off and executes homing again.
910	The PTP operation command cannot be executed while operating.	Execute the PTP operation command when command axis is stop and not operating.
911	The shortest distance control of PTP operation command can not be executed in relative coordinate.	Execute command after changing positioning coordinate to absolute coordinate.
912	The target position setting is incorrect during the shortest distance positioning in the infinite running repeat mode of PTP operation command.	Set target position between 0 and the infinite running repeat position of extended parameter during the shortest distance positioning in the infinite running repeat mode.
913	PTP operation command can not be executed in the absolute coordinate of undecided homing status.	Execute absolute coordinate PTP operation command after making homing status with homing command or floating origin setting command.
914	The control method setting values of PTP operation command are out of range.	Set control method setting value to one of the following: 0: position control, 3: shortest distance control.
915	The PTP operation command cannot be executed in the Servo off status.	Execute the PTP operation command after making the servo on status with servo-on command.
921	The position specified torque/position switching command cannot be executed when not operating.	Execute the position specified torque/position switching command when the command axis is operating as torque control.
922	The position specified torque/position switching command cannot be executed while not in torque control.	Execute the position specified torque/position switching command when the command axis is operating as torque control.
923	The position specified torque/position switching command cannot be executed in subordinate axis of	Execute the command after disabling synchronous operation.

	synchronous operation.	
924	The position specified torque/position switching command cannot be executed while Servo off status.	Execute the position specified torque/position switching command after making the servo on status with servo-on command.
925	The position specified torque/position switching command cannot be executed with the origin unsettled.	Execute absolute coordinate position specified torque/position specified switching control after making homing status with homing command or floating origin setting command.
6000	The data range of the slave No.1 SDO parameter Index, SubIndex are out of the range.	Check whether data setting values including slave No.1 index, subindex are out of the range.
6047	The data range of the slave No.48 SDO parameter Index, SubIndex are out of the range.	Check whether data setting values including slave No.48 index, subindex are out of the range.
6048	Abort occurred during the slave No 1 SDO parameter write command.	Check whether the slave No.1 SDO parameter is possible writing or parameter number and setting data are within the allowable range. Cannot write corresponding parameter depending on slave status.
6095	Abort occurred during the slave No 48 SDO parameter write command.	Check whether the slave No.48 SDO parameter is possible writing or parameter number and setting data are within the allowable range. Cannot write corresponding parameter depending on slave status.
6096	There is no slave response for slave No.1 SDO parameter write command.	Check whether slave No. 1 status is normal.
6143	There is no slave response for slave No.48 SDO parameter write command.	Check whether slave No. 48 status is normal.
6144	Abort occurred during the slave No 1 EEPROM saving.	Check the status of slave No. 1. The SDO parameter EEPROM saving command can not be executed in the specific status.
6191	Abort occurred during the slave No 48 EEPROM saving.	Check the status of slave No. 48. The SDO parameter EEPROM saving command can not be executed in the specific status.
6192	There is no slave response for slave No.1 EEPROM saving command.	Check whether the slave No. 1 status is normal.
6239	There is no slave response for slave No.48 EEPROM saving command.	Check whether the slave No. 48 status is normal.
6240	The EEPROM saving command cannot be executed becaue the slave No 1 is not connected currently.	The SDO parameter EEPROM saving command cannot be executed for the connected slave to current network.
6287	The EEPROM saving command cannot be executed becaue the slave No 48 is not connected currently.	The SDO parameter EEPROM saving command cannot be executed for the connected slave to current network.
6288	The SDO parameter writing or SDO parameter EEPROM saving command is being executed on	Execute the command after the SDO parameter writing or SDO parameter EEPROM saving command is completed on slave 1.

	slave 1.	
6335	The SDO parameter writing or SDO parameter EEPROM saving command is being executed on slave 48.	Execute the command after the SDO parameter writing or SDO parameter EEPROM saving command is completed on slave 48.
6336	Abort occurred during the slave No 1 SDO parameter read command.	Check whether the slave No.1 SDO parameter is possible read or parameter number a are within the allowable range. Cannot read corresponding parameter depending on slave status.
6383	Abort occurred during the slave No 48 SDO parameter read command.	Check whether the slave No.48 SDO parameter is possible read or parameter number are within the allowable range. Cannot read corresponding parameter depending on slave status.
6384	There is no slave response for slave No.1 SDO parameter read command.	Check whether the slave No. 1 status is normal.
6431	There is no slave response for slave No.48 SDO parameter read command.	Check whether the slave No. 48 status is normal.
6432	SDO parameter read command is executing in slave No 1. The SDO parameter read/write or SDO parameter EEPROM saving command cannot be executed.	Execute the command after the SDO parameter read command is completed on the slave No. 1.
6479	SDO parameter read command is executing in slave No 48. The SDO parameter read/write or SDO parameter EEPROM saving command cannot be executed.	Execute the command after the SDO parameter read command is completed on the slave No. 48.
6480	The maximum number of command is exceeded to execute SDO parameter read ir write buffering command on the slave No 1.	The maximum number of servo parameter read or write buffering command that can be executed simultaneously is 10 per slave. Adjust the command execution timing so that the number of buffering commands executed simultaneously does not exceed 10.
6527	The maximum number of command is exceeded to execute SDO parameter read ir write buffering command on the slave No 48.	The maximum number of servo parameter read or write buffering command that can be executed simultaneously is 10 per slave. Adjust the command execution timing so that the number of buffering commands executed simultaneously does not exceed 10.
6528	The slave No. 1 does not connect to current network or does not executing command.	Check whether the slave No. 1 connects to current network, and execute command on slave connected to network.
6575	The slave No. 48 is not connect to current network or is not executing command.	Check whether the slave No. 48 connects to current network, and execute command on slave connected to network.
6576	The command code number executed in slave No. 1 is not reserved number.	Use the specified command (or function block). Refer to command part of user manual.
6623	The command code number executed in slave No. 48 is not reserved number.	Use the specified command (or function block). Refer to command part of user manual.

6624	During executing slave No.1 SDO parameter read command, SDO parameter read can be completed because the EtherCAT connection was disconnected.	Check whether the slave No. 1 connects to current network, and execute command on slave connected to network.
6671	During executing slave No.48 SDO parameter read command, SDO parameter read cannot be completed because the EtherCAT connection was disconnected.	Check whether the slave No. 48 connects to current network, and execute command on slave connected to network.
6672	During executing slave No.1 SDO parameter write command, SDO parameter write cannot be completed because EtherCAT connection was disconnected.	Check whether the slave No. 1 connects to current network, and execute command on slave connected to network.
6719	During executing slave No.48 SDO parameter write command, SDO parameter write cannot be completed because EtherCAT connection was disconnected.	Check whether the slave No. 48 connects to current network, and execute command on slave connected to network.
6720	During executing slave No.1 SDO parameter EEPROM saving command, SDO parameter EEPROM saving can be completed because the EtherCAT connection was disconnected.	Check whether the slave No. 1 connects to current network, and execute command on slave connected to network.
6767	During executing slave No.1 SDO parameter EEPROM saving command, SDO parameter EEPROM saving can be completed because the EtherCAT connection was disconnected.	Check whether the slave No. 48 connects to current network, and execute command on slave connected to network.
6768	The previous executed command on slave No.1 is not executed by the module.	Execute a new command after the previous command execution is completed.
6815	The previous executed command on slave No.48 is not executed by the module.	Execute a new command after the previous command execution is completed.

Appendix 1.9 Error Information of XG- PM

Error code	Error Description	Measurement
900	The command data range sent from XG-PM is out of the allowed value.	The version of current module and XG-PM art not compatible. Check which version supports this function and contact our customer support team.
901	The OS file, which is larger than possible download size in current version tried to download.	First, update OS to a version which supports size of OS file to download For details, please contact our customer support team.
902	The version of current module and XG-PM art not compatible.	Please update the OS or XG5000 (XG-PM). For further questions, Please contact customer center at 1544-2080.
903	The version of current module and XG-PM art not compatible.	Please update the OS or XG5000 (XG-PM). For further questions, Please contact customer center at 1544-2080.
904	The module initialization cannot be executed because there is an axis activated as EtherCAT or virtual axis.	Execute the module initialization with no axis activated after executing the servo connection disconnection command.
905	The network parameter data downloaded from on XG-PM is abnormal.	Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
906	The OS file, which is not compatible with H/W version of module tried to download.	The OS file, which is compatible with H/W version of module tried to download. For details, please contact our customer support team.

Appendix 1.10 Error Information of parameter teaching

Error code	Error Description	Measurement
1317	It is range over error for the teaching data setting value of common parameter control cycle item.	Execute the teaching command after setting within the value of control cycle item data setting values in common parameter.

Appendix 1.11 Error Information of check by module backup data Item

Error code	Error Description	Measurement
1500	The PLC power was turn off while backing up common parameters.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1501	The PLC power was turn off while backing up network parameters.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1502	The PLC power was turn off while backing up CAM data.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1511	The PLC power was turn off while backing up 1-axis operation parameters.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1512	The PLC power was turn off while backing up 2-axis operation parameters.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1513	The PLC power was turn off while backing up 3-axis operation parameters.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1514	The PLC power was turn off while backing up 4-axis operation parameters.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1515	The PLC power was turn off while backing up 5-axis operation parameters.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.

Error code	Error Description	Measurement
1516	The PLC power was turn off while backing up 6-axis operation parameters.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1517	The PLC power was turn off while backing up 7-axis operation parameters.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1518	The PLC power was turn off while backing up 8-axis operation parameters.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1519	The PLC power was turn off while backing up 9-axis operation parameters.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1520	The PLC power was turn off while backing up 10-axis operation parameters.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1521	The PLC power was turn off while backing up 11-axis operation parameters.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1522	The PLC power was turn off while backing up 12-axis operation parameters.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1523	The PLC power was turn off while backing up 13-axis operation parameters.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1524	The PLC power was turn off while backing up 14-axis operation parameters.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1525	The PLC power was turn off while backing up 15-axis operation parameters.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1526	The PLC power was turn off while backing up 16-axis operation parameters.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1531	The PLC power was turn off while backing up 1-axis operation data.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1532	The PLC power was turn off while backing up 2-axis operation data.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1533	The PLC power was turn off while backing up 3-axis operation data.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.

Error code	Error Description	Measurement
1534	The PLC power was turn off while backing up 4-axis operation data.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1535	The PLC power was turn off while backing up 5-axis operation data.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1536	The PLC power was turn off while backing up 6-axis operation data.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1537	The PLC power was turn off while backing up 7-axis operation data.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1538	The PLC power was turn off while backing up 8-axis operation data.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1539	The PLC power was turn off while backing up 9-axis operation data.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1540	The PLC power was turn off while backing up 10-axis operation data.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1541	The PLC power was turn off while backing up 11-axis operation data.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1542	The PLC power was turn off while backing up 12-axis operation data.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1543	The PLC power was turn off while backing up 13-axis operation data.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1544	The PLC power was turn off while backing up 14-axis operation data.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1545	The PLC power was turn off while backing up 15-axis operation data.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1546	The PLC power was turn off while backing up 16-axis operation data.	If the PLC power is turned off during data backup and the backup operation is not completed properly, retry writing the data in which the problem occurred.
1550	Common Parameter Setting data is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.

Error code	Error Description	Measurement
1551	Network parameter setting data is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1552	Cam data setting data is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1561	Axis 1 operation parameter settings data is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1562	Axis 2 operation parameter settings data is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1563	Axis 3 operation parameter settings data is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1564	Axis 4 operation parameter settings data is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1565	Axis 5 operation parameter settings data is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1566	Axis 6 operation parameter settings data is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1567	Axis 7 operation parameter settings data is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1568	Axis 8 operation parameter settings data is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1569	Axis 9 operation parameter settings data is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.

Error code	Error Description	Measurement
1570	Axis 10 operation parameter settings data is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1571	Axis 11 operation parameter settings data is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1572	Axis 12 operation parameter settings data is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1573	Axis 13 operation parameter settings data is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1574	Axis 14 operation parameter settings data is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1575	Axis 15 operation parameter settings data is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1576	Axis 16 operation parameter settings data is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1581	Axis 1 operation data settings is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1582	Axis 2 operation data settings is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1583	Axis 3 operation data settings is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1584	Axis 4 operation data settings is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.

Error code	Error Description	Measurement
1585	Axis 5 operation data settings is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1586	Axis 6 operation data settings is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1587	Axis 7 operation data settings is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1588	Axis 8 operation data settings is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1589	Axis 9 operation data settings is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1590	Axis 10 operation data settings is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1591	Axis 11 operation data settings is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1592	Axis 12 operation data settings is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1593	Axis 13 operation data settings is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1594	Axis 14 operation data settings is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
1595	Axis 15 operation data settings is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.

1596	Axis 16 operation data settings is abnormal.	It is assumed that backup operation did not complete properly or the backup memory failed. Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.

Appendix 1.12 Error Information of communication

Error code	Error Description	Measurement
5000	The number of EtherCAT slave connected to network exceeds the maximum number that can be connected.	Execute connection command after configuring the network with less than the number of EtherCAT slave that can be possible to maximum connection.
5001	There is no servo connected to the current network.	Check whether the servo power connected network is turned on or whether the communication cable is correctly installed between the module and the first servo drive connected to network during connecting the servo drive.
5002	It is servo communication initialization error.	Check whether the communication cable is correctly installed or whether the communication cable is disclosed to noise.
5003	It is servo communication initialization error.	Check whether the communication cable is correctly installed or whether the communication cable is disclosed to noise.
5004	It is servo communication initialization error.	Check whether the communication cable is correctly installed or whether the communication cable is disclosed to noise.
5005	It is servo communication initialization error.	Check whether the communication cable is correctly installed or whether the communication cable is disclosed to noise.
5008	It is constant period communication error.	Check whether the servo power is turned off, whether the communication cable is correctly installed or whether the communication cable is disclosed to noise during communication.
5009	It is communication setting error.	Check whether the servo power is turned off, whether the communication cable is correctly installed or whether the communication cable is disclosed to noise during communication.
5010	It is servo axis number setting error.	There is the same axis number among servo drive connected to current network. Set axis number of servo drive again.
5011	It is a single servo parameter write error.	Check whether the communication cable is correctly installed or whether the communication cable is disclosed to noise.
5012	It is a single servo parameter read error.	Check whether the communication cable is correctly installed or whether the communication cable is disclosed to noise.
5013	It is servo communication initialization error.	Check whether the communication cable is correctly installed or whether the communication cable is disclosed to noise.
5014	It is servo communication initialization error.	Check whether the communication cable is correctly installed or whether the communication cable is disclosed to noise.
5015	It is servo parameter write communication error.	Check whether the communication cable is correctly installed or whether the communication cable is disclosed to noise.
5016	The servo drive parameter read cannot be completed because the EtherCAT connection is	After executing the servo connection command to enter the EtherCAT constant period communication status, execute the

	disconnected when executing the servo drive parameter read command.	command again.
5017	The servo drive parameter write cannot be completed because the EtherCAT connection is disconnected when executing the servo drive parameter write command.	After executing the servo connection command to enter the EtherCAT constant period communication status, execute the command again.
5018	The servo drive parameter saving cannot be completed because the EtherCAT connection is disconnected when executing the servo drive parameter saving command.	After executing the servo connection command to enter the EtherCAT constant period communication status, execute the command again.
5020	There is no setting information for the servo drive connected to current network.	Execute all servo connection command after executing the network parameter write by adding the relevant servo drive on network parameter.
5021	There is no data set in network parameter.	Execute all servo connection command after executing the network parameter write by setting the network parameter.
5022	The servo drive information set in the network parameters and the connected servo drive information are different.	Set the number and information of servo drive connected to network parameter to be the same.
5023	Failed to change the operation mode of the servo drive to position control mode.	Check whether the status of servo drive is in normal.
5070	The status of the EtherCAT slave connected to the Node ID is abnormal.	Execute the EtherCAT connection again.
5071	The node ID and EtherCAT parameter setting of EtherCAT slave is different.	Set the EtherCAT slave node ID connected to relevant axis and EtherCAT parameter setting to be the same
5072	The node ID setting of EtherCAT slave is duplicated.	Set the EtherCAT slave node ID connected to relevant axis so that it does not overlap.
5073	The node ID setting read of EtherCAT slave is failed.	Execute EtherCAT connection again after re-powering the EtherCAT slave.

Error Code	Error Description	Measurement
5024	Failed to change the operation mode of the servo drive to home return (Homing) mode.	Check whether the status of servo drive is in normal.
5025	Failed to change the operation mode of the servo drive to torque control mode.	Check whether the status of servo drive is in normal.
5026	Servo on could not be completed because the servo drive could not be changed to "Switched on" status.	Check the status of the servo drive. The servo on command can not be executed in the specific status.
5027	Servo on could not be completed because the servo, drive could not be changed to "operation enable" status.	Check the status of the servo drive. The servo on command can not be executed in the specific status.
5028	Servo-on cannot be completed because the "Quick Stop" function of the servo drive is activated.	Check whether the"Quick Stop" function of servo drive is actived due to inputting like emergency stop. The servo on command can not be executed in the specific status.
5029	Failed to change the servo drive to CSV ((Cyclic Synchronous Velocity) mode.	Check the connection status with the servo drive.

5031	It is the virtual axis setting error.	The axis currently connected to real axis cannot be setting as a virtual axis Set the virtual axis to an axis that not connected to real axis.
5050	Connection command cannot be executed with EtherCAT parameter error.	Retry data writing in XG-PM and change the module if it fails repeatedly. For further questions, Please contact customer center at 1544-2080.
5051	The EtherCAT connection command cannot be executed while executing EtherCAT connection/disconnection command.	Execute the command after the currently executing EtherCAT connection/disconnection command is completed.
5052	The EtherCAT disconnection command cannot be executed while executing EtherCAT connection/disconnection command.	Execute the command after the currently executing EtherCAT connection/disconnection command is completed.
5053	The EtherCAT all station setting command cannot be executed while executing EtherCAT connection/disconnection command.	Execute the command after the currently executing EtherCAT connection/disconnection command is completed.
5054	The the size of EtherCAT user frame exceeds the maximum allowable frame size.	Delete the slave's PDO item or delete the slave so that EtherCAT frames are created within the maximum allowable frame.
5070	The slave whose position are switched by not check the connection order function is different.	Execute the EtherCAT auto-connection.
5071	The node ID and EtherCAT parameter setting of EtherCAT slave is different.	Set the EtherCAT slave node ID connected to relevant axis and EtherCAT parameter setting to be the same
5072	The node ID setting of EtherCAT slave is duplicated.	Set the EtherCAT slave node ID connected to relevant axis so that it does not overlap.
5073	The node ID setting read of EtherCAT slave is failed.	Execute EtherCAT connection again after re-powering the EtherCAT slave.
5074	The EtherCAT slave node ID is out of normal range.	Set the Node ID of EtherCAT slave within the normal range.

Appendix 1.13 Error Information of H / W

Error Code	Error Description	Measurement
12	The normal operation can not be executed due to a module H/W error.	If it occurs repeatedly when power is re-applied, contact customer center
13	The normal operation can not be executed due to a module H/W error.	If it occurs repeatedly when power is re-applied, contact customer center

Appendix 2. Internal Memory Address of 'Read/Write Variable Data' command

Appendix 2.1 Parameter memory address

	Axis 1		Axis 2		Axis 3		Axis 4		Axis 5		Axis 6		Axis 7		Axis 8		Content
	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	HEX	
Basic parameter	0	0	68	44	136	88	204	CC	272	110	340	154	408	198	476	1DC	Speed limit(low)
	1	1	69	45	137	89	205	CD	273	111	341	155	409	199	477	1DD	Speed limit(high)
	2	2	70	46	138	8A	206	CE	274	112	342	156	410	19A	478	1DE	Accel. Time 1(low)
	3	3	71	47	139	8B	207	CF	275	113	343	157	411	19B	479	1DF	Accel. time 1(high)
	4	4	72	48	140	8C	208	D0	276	114	344	158	412	19C	480	1E0	Accel. time 2(low)
	5	5	73	49	141	8D	209	D1	277	115	345	159	413	19D	481	1E1	Accel. time 2(high)
	6	6	74	4A	142	8E	210	D2	278	116	346	15A	414	19E	482	1E2	Accel. time 3(low)
	7	7	75	4B	143	8F	211	D3	279	117	347	15B	415	19F	483	1E3	Accel. time 3(high)
	8	8	76	4C	144	90	212	D4	280	118	348	15C	416	1A0	484	1E4	Accel. time 4(low)
	9	9	77	4D	145	91	213	D5	281	119	349	15D	417	1A1	485	1E5	Accel. time 4(high)
	10	A	78	4E	146	92	214	D6	282	11A	350	15E	418	1A2	486	1E6	Decel. time 1(low)
	11	B	79	4F	147	93	215	D7	283	11B	351	15F	419	1A3	487	1E7	Decel. time 1(high)
	12	C	80	50	148	94	216	D8	284	11C	352	160	420	1A4	488	1E8	Decel. time 2(low)
	13	D	81	51	149	95	217	D9	285	11D	353	161	421	1A5	489	1E9	Decel. time 2(high)
	14	E	82	52	150	96	218	DA	286	11E	354	162	422	1A6	490	1EA	Decel. time 3(low)
	15	F	83	53	151	97	219	DB	287	11F	355	163	423	1A7	491	1EB	Decel. time 3(high)
	16	10	84	54	152	98	220	DC	288	120	356	164	424	1A8	492	1EC	Decel. time 4(low)
	17	11	85	55	153	99	221	DD	289	121	357	165	425	1A9	493	1ED	Decel. time 4(high)
	18	12	86	56	154	9A	222	DE	290	122	358	166	426	1AA	494	1EE	Dec. time for EMG stop (Low)
	19	13	87	57	155	9B	223	DF	291	123	359	167	427	1AB	495	1EF	Dec. time for EMG stop (High)
	20	14	88	58	156	9C	224	E0	292	124	360	168	428	1AC	496	1F0	Pulse per rotation (low)
	21	15	89	59	157	9D	225	E1	293	125	361	169	429	1AD	497	1F1	Pulse per rotation (High)
	22	16	90	5A	158	9E	226	E2	294	126	362	16A	430	1AE	498	1F2	Travel distance per revolution(Low)
	23	17	91	5B	159	9F	227	E3	295	127	363	16B	431	1AF	499	1F3	Travel distance revolution(High)
	24	18	92	5C	160	A0	228	E4	296	128	364	16C	432	1B0	500	1F4	CONTROL WORD1
	25	19	93	5D	161	A1	229	E5	297	129	365	16D	433	1B1	501	1F5	CONTROL WORD2
Extended parameter	26	1A	94	5E	162	A2	230	E6	298	12A	366	16E	434	1B2	502	1F6	Soft upper limit(Low)
	27	1B	95	5F	163	A3	231	E7	299	12B	367	16F	435	1B3	503	1F7	Soft lower Upper limit(High)
	28	1C	96	60	164	A4	232	E8	300	12C	368	170	436	1B4	504	1F8	Soft lower limit(Low)
	29	1D	97	61	165	A5	233	E9	301	12D	369	171	437	1B5	505	1F9	Soft lower limit(High)
	30	1E	98	62	166	A6	234	EA	302	12E	370	172	438	1B6	506	1FA	
	31	1F	99	63	167	A7	235	EB	303	12F	371	173	439	1B7	507	1FB	Positioning completion time
	32	20	100	64	168	A8	236	EC	304	130	372	174	440	1B8	508	1FC	S-curve ratio
	33	21	101	65	169	A9	237	ED	305	131	373	175	441	1B9	509	1FD	CONTROL WORD1
	34	22	102	66	170	AA	238	EE	306	132	374	176	442	1BA	510	1FE	Command Inposition range(Low)
	35	23	103	67	171	AB	239	EF	307	133	375	177	443	1BB	511	1FF	Command Inposition range(High)
	36	24	104	68	172	AC	240	F0	308	134	376	178	444	1BC	512	200	Arc insertion position in 2-axis linear interpolation continuous operation(Low)
	37	25	105	69	173	AD	241	F1	309	135	377	179	445	1BD	513	201	Arc insertion position in 2-axis linear interpolation continuous operation(High)

	38	26	106	6A	174	AE	242	F2	310	136	378	17A	446	1BE	514	202	Infinite repeat position(Low)
	39	27	107	6B	175	AF	243	F3	311	137	379	17B	447	1BF	515	203	Infinite repeat position(High)

	Axis 1		Axis 2		Axis 3		Axis 4		Axis 5		Axis 6		Axis 7		Axis 8		Content
	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	Dec	Hex	
Manual Operation Parameter	40	28	108	6C	176	B0	244	F4	312	138	380	17C	448	1C0	516	204	JOG high speed (Low)
	41	29	109	6D	177	B1	245	F5	313	139	381	17D	449	1C1	517	205	JOG high speed (High)
	42	2A	110	6E	178	B2	246	F6	314	13A	382	17E	450	1C2	518	206	JOG low speed (Low)
	43	2B	111	6F	179	B3	247	F7	315	13B	383	17F	451	1C3	519	207	JOG low speed (High)
	44	2C	112	70	180	B4	248	F8	316	13C	384	180	452	1C4	520	208	JOG acc. time (Low)
	45	2D	113	71	181	B5	249	F9	317	13D	385	181	453	1C5	521	209	JOG acc. time (High)
	46	2E	114	72	182	B6	250	FA	318	13E	386	182	454	1C6	522	20A	JOG dec. time (Low)
	47	2F	115	73	183	B7	251	FB	319	13F	387	183	455	1C7	523	20B	JOG dec. time (High)
	48	30	116	74	184	B8	252	FC	320	140	388	184	456	1C8	524	20C	Inching speed
	49	31	117	75	185	B9	253	FD	321	141	389	185	457	1C9	525	20D	-
Extended parameter	50	32	118	76	186	BA	254	FE	322	142	390	186	458	1CA	526	20E	CONTROL WORD2
	51	33	119	77	187	BB	255	FF	323	143	391	187	459	1CB	527	20F	
	52	34	120	78	188	BC	256	100	324	144	392	188	460	1CC	528	210	
	53	35	121	79	189	BD	257	101	325	145	393	189	461	1CD	529	211	
	54	36	122	7A	190	BE	258	102	326	146	394	18A	462	1CE	530	212	
	55	37	123	7B	191	BF	259	103	327	147	395	18B	463	1CF	531	213	
	56	38	124	7C	192	C0	260	104	328	148	396	18C	464	1D0	532	214	
	57	39	125	7D	193	C1	261	105	329	149	397	18D	465	1D1	533	215	
	58	3A	126	7E	194	C2	262	106	330	14A	398	18E	466	1D2	534	216	
	59	3B	127	7F	195	C3	263	107	331	14B	399	18F	467	1D3	535	217	
	60	3C	128	80	196	C4	264	108	332	14C	400	190	468	1D4	536	218	
	61	3D	129	81	197	C5	265	109	333	14D	401	191	469	1D5	537	219	
	62	3E	130	82	198	C6	266	10A	334	14E	402	192	470	1D6	538	21A	
	63	3F	131	83	199	C7	267	10B	335	14F	403	193	471	1D7	539	21B	
	64	40	132	84	200	C8	268	10C	336	150	404	194	472	1D8	540	21C	
	65	41	133	85	201	C9	269	10D	337	151	405	195	473	1D9	541	21D	
-	66	42	134	86	202	CA	270	10E	338	152	406	196	474	1DA	542	21E	-
	67	43	135	87	203	CB	271	10F	339	153	407	197	475	1DB	543	21F	
Common parameter	-														544	220	Control word
															545	221	-
															546	222	Encoder 1 max. value (Low)
															547	223	Encoder 1 max. value (High)
															548	224	Encoder1 min. value(Low)
															549	225	Encoder1 min. value (High)
															550	226	
															551	227	
															552	228	
															553	229	

(1) Basic parameter Control Word

ControlWord1

Bit position	Content
Axis type(bit)	0: Real axis, 1: Virtual axis
- (bit 1)	-
Unit (bit 2 ~ 3)	0: pulse, 1: mm, 2: inch, 3:degree
Unit multiplier (bit 4 ~ 5)	0: x1, 1: x10, 2: x100, 3: x1000
Speed command unit (bit 6)	0: Unit/Time, 1: rpm
Encoder selection *(bit 7)	0:Incremental encoder , 1: Absolute encoder
Current position compensation amount (bit 8~ 15)	0 ~ 255

ControlWord2

Bit position	Content
User defined position display ratio(bit 0 ~ 2)	0 ~ 7
User defined position display ratio(bit 3 ~ 5)	0 ~ 7
Torque command unit (bit 6)	0: 1%, 1: 0.1%

(2) Extended parameter Control Word 1

Bit position	Content
CAM restart operation (bit 0)	0:enabled, 1:disabled
Acceleration/Deceleration pattern (bit 1)	0:Trapezoid operation, 1:S-Curve operation
M Code mode(bit 2 ~ 3)	0: None, 1: With, 2: After
Interpolation speed selection (bit 4)	0: main axis speed, 1:synthetic speed
Soft upper Upper/lower limit during speed control(bit 5)	0: Not detect , 1 : Detect
External command selection (bit 6)	0: External speed/position control switch, 1: External stop command,
External command (bit 7)	0:disabled,1:enabled
Positioning completion condition (bit 10 ~ 11)	0: Dwell Time, 1: Inposition, 2: Dwell Time and Inposition, 3:Dwell time or In position
Infinite running repeat(bit 12)	0:disabled,1:enabled
Positioning method of interpolation continuous operation(bit 13)	0: Pass target position, 1: Near Passing
Arc insertion in 2-axis linear interpolation continuous operation (bit 14)	0: No arc addition, 1: Arc addition continuous operation
Position specified speed override coordinate (bit 15)	0:absolute, 1:incremental

ControlWord2

Bit position	Content
Operation when main axis ' errors occurs during synchronous control (Bit0 ~ Bit1)	0: keep synchronous control, 1: disable synchronous when main axis's servo alarms occurs. 2: release synchronous when main axis's axis error occurs.
Drive absolute position error detection(bit 2)	0: not detection, 1: Homing status initialization

(3) Common parameter Control Word

Bit position	Content
Enc pulse input (bit 1 ~ 2)	0:CW/CCW 1 multiplication
	1:PULSE/DIR 1 multiplication
	2:PULSE/DIR 2 multiplication
	3: PHASE A/B 1 multiplication
	4: PHASE A/B 2 multiplication
	5: PHASE A/B 3 multiplication
Encoder1 phase Z clear(bit 3)	0:disabled,1:enabled
Speed override mode (bit 8)	0: % specified, 1: speed specified
Position specified speed Synchronization target position coordinate (bit 10)	0:Relative, 1:Absolute
Encoder 1 average count (bit 11 ~ 12	0:Not Use 1: 5 times 2: 10 times 3: 20 times

Appendix 2.2 Axis 1 operation data memory address

2.2.1 Memory Allocation (formulas)

Step No.	Target position		Auxiliary point of circular arc interpolation		Operating speed		Dwell time	M code	Sub axis setting	Helical interpolation	Number of arc interpolation turns	Control word
	Lower	Upper	Lower	Upper	Lower	Upper						
n Step	542 +12n	543 +12n	544 +12n	545 +12n	546 +12n	547 +12n	548 +12n	549 +12n	550 +12n	551 +12n	552 +12n	553 +12n

2.2.2 Memory allocation (Ex)

Step No.	Target position		Auxiliary point of circular arc interpolation		Operating speed		Dwell time	M code	Sub axis setting	Helical interpolation	Number of arc interpolation turns	Control word
	Lower	Upper	Lower	Upper	Lower	Upper						
1	554	555	556	557	558	559	560	561	562	563	564	565
2	566	567	568	569	570	571	572	573	574	575	576	577
3	578	579	580	581	582	583	584	585	586	587	588	589
4	590	591	592	593	594	595	596	597	598	599	600	601
5	602	603	604	605	606	607	608	609	610	611	612	613
6	614	615	616	617	618	619	620	621	622	623	624	625
7	626	627	628	629	630	631	632	633	634	635	636	637
8	638	639	640	641	642	643	644	645	646	647	648	649
9	650	651	652	653	654	655	656	657	658	659	660	661
10	662	663	664	665	666	667	668	669	670	671	672	673
~ omited ~												
390	5222	5223	5224	5225	5226	5227	5228	5229	5230	5231	5232	5233
391	5234	5235	5236	5237	5238	5239	5240	5241	5242	5243	5244	5245
392	5246	5247	5248	5249	5250	5251	5252	5253	5254	5255	5256	5257
393	5258	5259	5260	5261	5262	5263	5264	5265	5266	5267	5268	5269
394	5270	5271	5272	5273	5274	5275	5276	5277	5278	5279	5280	5281
395	5282	5283	5284	5285	5286	5287	5288	5289	5290	5291	5292	5293
396	5294	5295	5296	5297	5298	5299	5300	5301	5302	5303	5304	5305
397	5306	5307	5308	5309	5310	5311	5312	5313	5314	5315	5316	5317
398	5318	5319	5320	5321	5322	5323	5324	5325	5326	5327	5328	5329
399	5330	5331	5332	5333	5334	5335	5336	5337	5338	5339	5340	5341
400	5342	5343	5344	5345	5346	5347	5348	5349	5350	5351	5352	5353

Appendix 2.3 Axis 2 operation data memory address

2.3.1 Memory Allocation (formulas)

Step No.	Target position		Auxiliary point of circular arc interpolation		Operating speed		Dwell time	M code	Sub axis setting	Helical interpolation	Number of arc interpolation turns	Control word
	Lower	Upper	Lower	Upper	Lower	Upper						
n	5342 +12n	5343 +12n	5344 +12n	5345 +12n	5346 +12n	5347 +12n	5348 +12n	5349 +12n	5350 +12n	5351 +12n	5352 +12n	5353 +12n

2.3.2 Memory allocation (Ex)

Step No.	Target position		Auxiliary point of circular arc interpolation		Operating speed		Dwell time	M code	Sub axis setting	Helical interpolation	Number of arc interpolation turns	Control word
	Lower	Upper	Lower	Upper	Lower	Upper						
1	5354	5355	5356	5357	5358	5359	5360	5361	5362	5363	5364	5365
2	5366	5367	5368	5369	5370	5371	5372	5373	5374	5375	5376	5377
3	5378	5379	5380	5381	5382	5383	5384	5385	5386	5387	5388	5389
4	5390	5391	5392	5393	5394	5395	5396	5397	5398	5399	5400	5401
5	5402	5403	5404	5405	5406	5407	5408	5409	5410	5411	5412	5413
6	5414	5415	5416	5417	5418	5419	5420	5421	5422	5423	5424	5425
7	5426	5427	5428	5429	5430	5431	5432	5433	5434	5435	5436	5437
8	5438	5439	5440	5441	5442	5443	5444	5445	5446	5447	5448	5449
9	5450	5451	5452	5453	5454	5455	5456	5457	5458	5459	5460	5461
10	5462	5463	5464	5465	5466	5467	5468	5469	5470	5471	5472	5473
~ omitted ~												
390	10022	10023	10024	10025	10026	10027	10028	10029	10030	10031	10032	10033
391	10034	10035	10036	10037	10038	10039	10040	10041	10042	10043	10044	10045
392	10046	10047	10048	10049	10050	10051	10052	10053	10054	10055	10056	10057
393	10058	10059	10060	10061	10062	10063	10064	10065	10066	10067	10068	10069
394	10070	10071	10072	10073	10074	10075	10076	10077	10078	10079	10080	10081
395	10082	10083	10084	10085	10086	10087	10088	10089	10090	10091	10092	10093
396	10094	10095	10096	10097	10098	10099	10100	10101	10102	10103	10104	10105
397	10106	10107	10108	10109	10110	10111	10112	10113	10114	10115	10116	10117
398	10118	10119	10120	10121	10122	10123	10124	10125	10126	10127	10128	10129
399	10130	10131	10132	10133	10134	10135	10136	10137	10138	10139	10140	10141
400	10142	10143	10144	10145	10146	10147	10148	10149	10150	10151	10152	10153

Appendix 2.4 Axis 3 operation data memory address

2.4.1 Memory Allocation (formulas)

Step No.	Target position		Auxiliary point of circular arc interpolation		Operating speed		Dwell time	M code	Sub axis setting	Helical interpolation	Number of arc interpolation turns	Control word
	Lower	Upper	Lower	Upper	Lower	Upper						
n Step	10142 +12n	10143 +12n	10144 +12n	10145 +12n	10146 +12n	10147 +12n	10148 +12n	10149 +12n	10150 +12n	10151 +12n	10152 +12n	10153 +12n

2.4.2 Memory Allocation (Example)

Step No.	Target position		Auxiliary point of circular arc interpolation		Operating speed		Dwell time	M code	Sub axis setting	Helical interpolation	Number of arc interpolation turns	Control word
	Lower	Upper	Lower	Upper	Lower	Upper						
1	10154	10155	10156	10157	10158	10159	10160	10161	10162	10163	10164	10165
2	10166	10167	10168	10169	10170	10171	10172	10173	10174	10175	10176	10177
3	10178	10179	10180	10181	10182	10183	10184	10185	10186	10187	10188	10189
4	10190	10191	10192	10193	10194	10195	10196	10197	10198	10199	10200	10201
5	10202	10203	10204	10205	10206	10207	10208	10209	10210	10211	10212	10213
6	10214	10215	10216	10217	10218	10219	10220	10221	10222	10223	10224	10225
7	10226	10227	10228	10229	10230	10231	10232	10233	10234	10235	10236	10237
8	10238	10239	10240	10241	10242	10243	10244	10245	10246	10247	10248	10249
9	10250	10251	10252	10253	10254	10255	10256	10257	10258	10259	10260	10261
10	10262	10263	10264	10265	10266	10267	10268	10269	10270	10271	10272	10273
~ omitted ~												
390	14822	14823	14824	14825	14826	14827	14828	14829	14830	14831	14832	14833
391	14834	14835	14836	14837	14838	14839	14840	14841	14842	14843	14844	14845
392	14846	14847	14848	14849	14850	14851	14852	14853	14854	14855	14856	14857
393	14858	14859	14860	14861	14862	14863	14864	14865	14866	14867	14868	14869
394	14870	14871	14872	14873	14874	14875	14876	14877	14878	14879	14880	14881
395	14882	14883	14884	14885	14886	14887	14888	14889	14890	14891	14892	14893
396	14894	14895	14896	14897	14898	14899	14900	14901	14902	14903	14904	14905
397	14906	14907	14908	14909	14910	14911	14912	14913	14914	14915	14916	14917
398	14918	14919	14920	14921	14922	14923	14924	14925	14926	14927	14928	14929
399	14930	14931	14932	14933	14934	14935	14936	14937	14938	14939	14940	14941
400	14942	14943	14944	14945	14946	14947	14948	14949	14950	14951	14952	14953

Appendix 2.5 Axis 4 operation data memory address

2.5.1 Memory Allocation (formula)

Step No.	Target position		Auxiliary point of circular arc interpolation		Operating speed		Dwell time	M code	Sub axis setting	Helical interpolation	Number of circular interpolation turns	Control word
N step	14942 +12n	14943 +12n	14944 +12n	14945 +12n	14946 +12n	14947 +12n	14948 +12n	14949 +12n	14950 +12n	14951 +12n	14952 +12n	14953 +12n

2.5.2 Memory Allocation (example)

Step No.	Target position		Auxiliary point of circular arc interpolation		Operating speed		Dwell time	M code	Sub axis setting	Helical interpolation	Number of circular interpolation turns	Control word
	Lower	Upper	Lower	Upper	Lower	Upper						
1	14954	14955	14956	14957	14958	14959	14960	14961	14962	14963	14964	14965
2	14966	14967	14968	14969	14970	14971	14972	14973	14974	14975	14976	14977
3	14978	14979	14980	14981	14982	14983	14984	14985	14986	14987	14988	14989
4	14990	14991	14992	14993	14994	14995	14996	14997	14998	14999	15000	15001
5	15002	15003	15004	15005	15006	15007	15008	15009	15010	15011	15012	15013
6	15014	15015	15016	15017	15018	15019	15020	15021	15022	15023	15024	15025
7	15026	15027	15028	15029	15030	15031	15032	15033	15034	15035	15036	15037
8	15038	15039	15040	15041	15042	15043	15044	15045	15046	15047	15048	15049
9	15050	15051	15052	15053	15054	15055	15056	15057	15058	15059	15060	15061
10	15062	15063	15064	15065	15066	15067	15068	15069	15070	15071	15072	15073
~ omitted ~												
390	19622	19623	19624	19625	19626	19627	19628	19629	19630	19631	19632	19633
391	19634	19635	19636	19637	19638	19639	19640	19641	19642	19643	19644	19645
392	19646	19647	19648	19649	19650	19651	19652	19653	19654	19655	19656	19657
393	19658	19659	19660	19661	19662	19663	19664	19665	19666	19667	19668	19669
394	19670	19671	19672	19673	19674	19675	19676	19677	19678	19679	19680	19681
395	19682	19683	19684	19685	19686	19687	19688	19689	19690	19691	19692	19693
396	19694	19695	19696	19697	19698	19699	19700	19701	19702	19703	19704	19705
397	19706	19707	19708	19709	19710	19711	19712	19713	19714	19715	19716	19717
398	19718	19719	19720	19721	19722	19723	19724	19725	19726	19727	19728	19729
399	19730	19731	19732	19733	19734	19735	19736	19737	19738	19739	19740	19741
400	19742	19743	19744	19745	19746	19747	19748	19749	19750	19751	19752	19753

Appendix 2.6 Axis 5 operation data memory address

2.6.1 Memory Allocation (formula)

Step No.	Target position		Auxiliary point of circular arc interpolation		Operating speed		Dwell time	M code	Sub axis setting	Helical interpolation	Number of arc interpolation turns	Control word
	Lower	Upper	Lower	Upper	Lower	Upper						
n Step	19742 +12n	19743 +12n	19744 +12n	19745 +12n	19746 +12n	19747 +12n	19748 +12n	19749 +12n	19750 +12n	19751 +12n	19752 +12n	19753 +12n

2.6.2 Memory Allocation (example)

Step No.	Target position		Auxiliary point of circular arc interpolation		Operating speed		Dwell time	M code	Sub axis setting	Helical interpolation	Number of arc interpolation turns	Control word
	Lower	Upper	Lower	Upper	Lower	Upper						
1	19754	19755	19756	19757	19758	19759	19760	19761	19762	19763	19764	19765
2	19766	19767	19768	19769	19770	19771	19772	19773	19774	19775	19776	19777
3	19778	19779	19780	19781	19782	19783	19784	19785	19786	19787	19788	19789
4	19790	19791	19792	19793	19794	19795	19796	19797	19798	19799	19800	19801
5	19802	19803	19804	19805	19806	19807	19808	19809	19810	19811	19812	19813
6	19814	19815	19816	19817	19818	19819	19820	19821	19822	19823	19824	19825
7	19826	19827	19828	19829	19830	19831	19832	19833	19834	19835	19836	19837
8	19838	19839	19840	19841	19842	19843	19844	19845	19846	19847	19848	19849
9	19850	19851	19852	19853	19854	19855	19856	19857	19858	19859	19860	19861
10	19862	19863	19864	19865	19866	19867	19868	19869	19870	19871	19872	19873
~ omitted ~												
390	24422	24423	24424	24425	24426	24427	24428	24429	24430	24431	24432	24433
391	24434	24435	24436	24437	24438	24439	24440	24441	24442	24443	24444	24445
392	24446	24447	24448	24449	24450	24451	24452	24453	24454	24455	24456	24457
393	24458	24459	24460	24461	24462	24463	24464	24465	24466	24467	24468	24469
394	24470	24471	24472	24473	24474	24475	24476	24477	24478	24479	24480	24481
395	24482	24483	24484	24485	24486	24487	24488	24489	24490	24491	24492	24493
396	24494	24495	24496	24497	24498	24499	24500	24501	24502	24503	24504	24505
397	24506	24507	24508	24509	24510	24511	24512	24513	24514	24515	24516	24517
398	24518	24519	24520	24521	24522	24523	24524	24525	24526	24527	24528	24529
399	24530	24531	24532	24533	24534	24535	24536	24537	24538	24539	24540	24541
400	24542	24543	24544	24545	24546	24547	24548	24549	24550	24551	24552	24553

Appendix 2.7 Axis 6 operation data memory address

2.7.1 Memory Allocation (formula)

Step No.	Target position		Auxiliary point of circular arc interpolation		Operating speed		Dwell time	M code	Sub axis setting	Helical interpolation	Number of arc interpolation turns	Control word
	Lower	Upper	Lower	Upper	Lower	Upper						
N step	24542 +12n	24543 +12n	24544 +12n	24545 +12n	24546 +12n	24547 +12n	24548 +12n	24549 +12n	24550 +12n	24551 +12n	24552 +12n	24553 +12n

2.7.2 Memory Allocation (example)

Step No.	Target position		Auxiliary point of circular arc interpolation		Operating speed		Dwell time	M code	Sub axis setting	Helical interpolation	Number of arc interpolation turns	Control word
	Lower	Upper	Lower	Upper	Lower	Upper						
1	24554	24555	24556	24557	24558	24559	24560	24561	24562	24563	24564	24565
2	24566	24567	24568	24569	24570	24571	24572	24573	24574	24575	24576	24577
3	24578	24579	24580	24581	24582	24583	24584	24585	24586	24587	24588	24589
4	24590	24591	24592	24593	24594	24595	24596	24597	24598	24599	24600	24601
5	24602	24603	24604	24605	24606	24607	24608	24609	24610	24611	24612	24613
6	24614	24615	24616	24617	24618	24619	24620	24621	24622	24623	24624	24625
7	24626	24627	24628	24629	24630	24631	24632	24633	24634	24635	24636	24637
8	24638	24639	24640	24641	24642	24643	24644	24645	24646	24647	24648	24649
9	24650	24651	24652	24653	24654	24655	24656	24657	24658	24659	24660	24661
10	24662	24663	24664	24665	24666	24667	24668	24669	24670	24671	24672	24673
~ omitted ~												
390	29222	29223	29224	29225	29226	29227	29228	29229	29230	29231	29232	29233
391	29234	29235	29236	29237	29238	29239	29240	29241	29242	29243	29244	29245
392	29246	29247	29248	29249	29250	29251	29252	29253	29254	29255	29256	29257
393	29258	29259	29260	29261	29262	29263	29264	29265	29266	29267	29268	29269
394	29270	29271	29272	29273	29274	29275	29276	29277	29278	29279	29280	29281
395	29282	29283	29284	29285	29286	29287	29288	29289	29290	29291	29292	29293
396	29294	29295	29296	29297	29298	29299	29300	29301	29302	29303	29304	29305
397	29306	29307	29308	29309	29310	29311	29312	29313	29314	29315	29316	29317
398	29318	29319	29320	29321	29322	29323	29324	29325	29326	29327	29328	29329
399	29330	29331	29332	29333	29334	29335	29336	29337	29338	29339	29340	29341
400	29342	29343	29344	29345	29346	29347	29348	29349	29350	29351	29352	29353

Appendix 2.8 Axis 7 operation data memory address

2.8.1 Memory Allocation (formula)

Step No.	Target position		Auxiliary point of circular arc interpolation		Operating speed		Dwell time	M code	Sub axis setting	Helical interpolation	Number of arc interpolation turns	Control word
	Lower	Upper	Lower	Upper	Lower	Upper						
N step	29342 +12n	29343 +12n	29344 +12n	29345 +12n	29346 +12n	29347 +12n	29348 +12n	29349 +12n	29350 +12n	29351 +12n	29352 +12n	29353 +12n

2.8.2 Memory Allocation (example)

Step No.	Target position		Auxiliary point of circular arc interpolation		Operating speed		Dwell time	M code	Sub axis setting	Helical interpolation	Number of arc interpolation turns	Control word
	Lower	Upper	Lower	Upper	Lower	Upper						
1	29354	29355	29356	29357	29358	29359	29360	29361	29362	29363	29364	29365
2	29366	29367	29368	29369	29370	29371	29372	29373	29374	29375	29376	29377
3	29378	29379	29380	29381	29382	29383	29384	29385	29386	29387	29388	29389
4	29390	29391	29392	29393	29394	29395	29396	29397	29398	29399	29400	29401
5	29402	29403	29404	29405	29406	29407	29408	29409	29410	29411	29412	29413
6	29414	29415	29416	29417	29418	29419	29420	29421	29422	29423	29424	29425
7	29426	29427	29428	29429	29430	29431	29432	29433	29434	29435	29436	29437
8	29438	29439	29440	29441	29442	29443	29444	29445	29446	29447	29448	29449
9	29450	29451	29452	29453	29454	29455	29456	29457	29458	29459	29460	29461
10	29462	29463	29464	29465	29466	29467	29468	29469	29470	29471	29472	29473
~ omitted ~												
390	34022	34023	34024	34025	34026	34027	34028	34029	34030	34031	34032	34033
391	34034	34035	34036	34037	34038	34039	34040	34041	34042	34043	34044	34045
392	34046	34047	34048	34049	34050	34051	34052	34053	34054	34055	34056	34057
393	34058	34059	34060	34061	34062	34063	34064	34065	34066	34067	34068	34069
394	34070	34071	34072	34073	34074	34075	34076	34077	34078	34079	34080	34081
395	34082	34083	34084	34085	34086	34087	34088	34089	34090	34091	34092	34093
396	34094	34095	34096	34097	34098	34099	34100	34101	34102	34103	34104	34105
397	34106	34107	34108	34109	34110	34111	34112	34113	34114	34115	34116	34117
398	34118	34119	34120	34121	34122	34123	34124	34125	34126	34127	34128	34129
399	34130	34131	34132	34133	34134	34135	34136	34137	34138	34139	34140	34141
400	34142	34143	34144	34145	34146	34147	34148	34149	34150	34151	34152	34153

Appendix 2.9 Axis 8 operation data memory address

2.9.1 Memory Allocation (formula)

Step No.	Target position		Auxiliary point of circular arc interpolation		Operating speed		Dwell time	M code	Sub axis setting	Helical interpolation	Number of arc interpolation turns	Control word
	Lower	Upper	Lower	Upper	Lower	Upper						
N step	34142 +12n	34143 +12n	34144 +12n	34145 +12n	34146 +12n	34147 +12n	34148 +12n	34149 +12n	34150 +12n	34151 +12n	34152 +12n	34153 +12n

2.9.2 Memory Allocation (example)

Step No.	Target position		Auxiliary point of circular arc interpolation		Operating speed		Dwell time	M code	Sub axis setting	Helical interpolation	Number of arc interpolation turns	Control word
	Lower	Upper	Lower	Upper	Lower	Upper						
1	34154	34155	34156	34157	34158	34159	34160	34161	34162	34163	34164	34165
2	34166	34167	34168	34169	34170	34171	34172	34173	34174	34175	34176	34177
3	34178	34179	34180	34181	34182	34183	34184	34185	34186	34187	34188	34189
4	34190	34191	34192	34193	34194	34195	34196	34197	34198	34199	34200	34201
5	34202	34203	34204	34205	34206	34207	34208	34209	34210	34211	34212	34213
6	34214	34215	34216	34217	34218	34219	34220	34221	34222	34223	34224	34225
7	34226	34227	34228	34229	34230	34231	34232	34233	34234	34235	34236	34237
8	34238	34239	34240	34241	34242	34243	34244	34245	34246	34247	34248	34249
9	34250	34251	34252	34253	34254	34255	34256	34257	34258	34259	34260	34261
10	34262	34263	34264	34265	34266	34267	34268	34269	34270	34271	34272	34273
~ omitted ~												
390	38822	38823	38824	38825	38826	38827	38828	38829	38830	38831	38832	38833
391	38834	38835	38836	38837	38838	38839	38840	38841	38842	38843	38844	38845
392	38846	38847	38848	38849	38850	38851	38852	38853	38854	38855	38856	38857
393	38858	38859	38860	38861	38862	38863	38864	38865	38866	38867	38868	38869
394	38870	38871	38872	38873	38874	38875	38876	38877	38878	38879	38880	38881
395	38882	38883	38884	38885	38886	38887	38888	38889	38890	38891	38892	38893
396	38894	38895	38896	38897	38898	38899	38900	38901	38902	38903	38904	38905
397	38906	38907	38908	38909	38910	38911	38912	38913	38914	38915	38916	38917
398	38918	38919	38920	38921	38922	38923	38924	38925	38926	38927	38928	38929
399	38930	38931	38932	38933	38934	38935	38936	38937	38938	38939	38940	38941
400	38942	38943	38944	38945	38946	38947	38948	38949	38950	38951	38952	38953

Appendix 2.10 Operation date-control word

(1) Control word

Bit position	Content
Coordinate (bit 0)	0: Absolute, 1: Relative
Control Method (bit 1~3)	0: Single axis positioning control, 1: Single axis positioning control, 2: Single axis FEED control, 3: Linear interpolation, 4: Arc interpolation
Operation method (bit 4)	0: Single, 1: Repeat
Operation pattern (bit 5~6)	0: End, 1: Keep, 2:Continuous
Arc size (bit 7)	0: Arc < 180, 1: Arc >= 180
Acc. No. (bit 8~9)	0 ~ 3
Deceleration No. (bit 10~11)	0 ~ 3
Arc interpolation mode(bit 12~13)	0: Midpoint, 1: Center point, 2: Radius
Arc Interpolation direction (bit 14)	0: CW, 1: CCW

Appendix 2.11 CAM data memory address

Item		Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
Main axis travel distance per rotation		38954	43184	47414	51644	55874	60104	64334	68564
Main axis pulse per rotation		38956	43186	47416	51646	55876	60106	64336	68566
Sub axis travel distance per rotation		38958	43188	47418	51648	55878	60108	64338	68568
Sub axis pulse per rotation		38960	43190	47420	51650	55880	60110	64340	68570
CAM profile data count(WORD)		38962	43192	47422	51652	55882	60112	64342	68572
Parameter and control mode setting (WORD) Bit 0~1: Main axis unit Bit 2~3: Subordinate axis unit Bit 8: Control method (0: Repeat, 1: Increase)		38963	43193	47423	51653	55883	60113	64343	68573
CAM block data 1	Main axis end pos.	38964	43194	47424	51654	55884	60114	64344	68574
	Sub. Ax. end position	38966	43196	47426	51656	55886	60116	64346	68576
	CAM curve	38968	43198	47428	51658	55888	60118	64348	68578
CAM block data 2	Main axis end pos.	38970	43200	47430	51660	55890	60120	64350	68580
	Sub. Ax. end position	38972	43202	47432	51662	55892	60122	64352	68582
	CAM curve	38974	43204	47434	51664	55894	60124	64354	68584
CAM block data 3	Main axis end pos.	38976	43206	47436	51666	55896	60126	64356	68586
	Sub. Ax. end position	38978	43208	47438	51668	55898	60128	64358	68588
	CAM curve	38980	43210	47440	51670	55900	60130	64360	68590
CAM block data 4	Main axis end pos.	38982	43212	47442	51672	55902	60132	64362	68592
	Sub. Ax. end position	38984	43214	47444	51674	55904	60134	64364	68594
	CAM curve	38986	43216	47446	51676	55906	60136	64366	68596
CAM block data 5	Main axis end pos.	38988	43218	47448	51678	55908	60138	64368	68598
	Sub. Ax. end position	38990	43220	47450	51680	55910	60140	64370	68600
	CAM curve	38992	43222	47452	51682	55912	60142	64372	68602
CAM block data 6	Main axis end pos.	38994	43224	47454	51684	55914	60144	64374	68604
	Sub. Ax. end position	38996	43226	47456	51686	55916	60146	64376	68606
	CAM curve	38998	43228	47458	51688	55918	60148	64378	68608
CAM block data 7	Main axis end pos.	39000	43230	47460	51690	55920	60150	64380	68610
	Sub. Ax. end position	39002	43232	47462	51692	55922	60152	64382	68612
	CAM curve	39004	43234	47464	51694	55924	60154	64384	68614
CAM block data 8	Main axis end pos.	39006	43236	47466	51696	55926	60156	64386	68616
	Sub. Ax. end position	39008	43238	47468	51698	55928	60158	64388	68618
	CAM curve	39010	43240	47470	51700	55930	60160	64390	68620
CAM block data 9	Main axis end pos.	39012	43242	47472	51702	55932	60162	64392	68622
	Sub. Ax. end position	39014	43244	47474	51704	55934	60164	64394	68624
	CAM curve	39016	43246	47476	51706	55936	60166	64396	68626
CAM block data 10	Main axis end pos.	39018	43248	47478	51708	55938	60168	64398	68628
	Sub. Ax. end position	39020	43250	47480	51710	55940	60170	64400	68630
	CAM curve	39022	43252	47482	51712	55942	60172	64402	68632
CAM block data 11	Main axis end pos.	39024	43254	47484	51714	55944	60174	64404	68634
	Sub. Ax. end position	39026	43256	47486	51716	55946	60176	64406	68636
	CAM curve	39028	43258	47488	51718	55948	60178	64408	68638

Item		Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM block data 12	Main axis end pos.	39030	43260	47490	51720	55950	60180	64410	68640
	Sub. Ax. end position	39032	43262	47492	51722	55952	60182	64412	68642
	CAM curve	39034	43264	47494	51724	55954	60184	64414	68644
CAM block data 13	Main axis end pos.	39036	43266	47496	51726	55956	60186	64416	68646
	Sub. Ax. end position	39038	43268	47498	51728	55958	60188	64418	68648
	CAM curve	39040	43270	47500	51730	55960	60190	64420	68650
CAM block data 14	Main axis end pos.	39042	43272	47502	51732	55962	60192	64422	68652
	Sub. Ax. end position	39044	43274	47504	51734	55964	60194	64424	68654
	CAM curve	39046	43276	47506	51736	55966	60196	64426	68656
CAM block data 15	Main axis end pos.	39048	43278	47508	51738	55968	60198	64428	68658
	Sub. Ax. end position	39050	43280	47510	51740	55970	60200	64430	68660
	CAM curve	39052	43282	47512	51742	55972	60202	64432	68662
CAM block data 16	Main axis end pos.	39054	43284	47514	51744	55974	60204	64434	68664
	Sub. Ax. end position	39056	43286	47516	51746	55976	60206	64436	68666
	CAM curve	39058	43288	47518	51748	55978	60208	64438	68668
CAM block data 17	Main axis end pos.	39060	43290	47520	51750	55980	60210	64440	68670
	Sub. Ax. end position	39062	43292	47522	51752	55982	60212	64442	68672
	CAM curve	39064	43294	47524	51754	55984	60214	64444	68674
CAM block data 18	Main axis end pos.	39066	43296	47526	51756	55986	60216	64446	68676
	Sub. Ax. end position	39068	43298	47528	51758	55988	60218	64448	68678
	CAM curve	39070	43300	47530	51760	55990	60220	64450	68680
CAM block data 19	Main axis end pos.	39072	43302	47532	51762	55992	60222	64452	68682
	Sub. Ax. end position	39074	43304	47534	51764	55994	60224	64454	68684
	CAM curve	39076	43306	47536	51766	55996	60226	64456	68686
CAM block data 20	Main axis end pos.	39078	43308	47538	51768	55998	60228	64458	68688
	Sub. Ax. end position	39080	43310	47540	51770	56000	60230	64460	68690
	CAM curve	39082	43312	47542	51772	56002	60232	64462	68692
Point unit		39084	43314	47544	51774	56004	60234	64464	68694
Main axis end pos.		39086	43316	47546	51776	56006	60236	64466	68696

Item	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	Block 7	Block 8
CAM Data[0] (REAL)	39088	43318	47548	51778	56008	60238	64468	68698
CAM Data[1] (REAL)	39090	43320	47550	51780	56010	60240	64470	68700
CAM Data[2] (REAL)	39092	43322	47552	51782	56012	60242	64472	68702
CAM Data[3] (REAL)	39094	43324	47554	51784	56014	60244	64474	68704
CAM Data[4] (REAL)	39096	43326	47556	51786	56016	60246	64476	68706
CAM Data[5] (REAL)	39098	43328	47558	51788	56018	60248	64478	68708
CAM Data[6] (REAL)	39100	43330	47560	51790	56020	60250	64480	68710
CAM Data[7] (REAL)	39102	43332	47562	51792	56022	60252	64482	68712
CAM Data[8] (REAL)	39104	43334	47564	51794	56024	60254	64484	68714
CAM Data[9] (REAL)	39106	43336	47566	51796	56026	60256	64486	68716
CAM Data[10] (REAL)	39108	43338	47568	51798	56028	60258	64488	68718
...								
CAM Data[n](REAL)	39088 +2n	43318 +2n	47548 +2n	51778 +2n	56008 +2n	60238 +2n	64468 +2n	68698 +2n
...								
CAM Data[2040] (REAL)	43168	47398	51628	55858	60088	64318	68548	72778
CAM Data[2041] (REAL)	43170	47400	51630	55860	60090	64320	68550	72780
CAM Data[2042] (REAL)	43172	47402	51632	55862	60092	64322	68552	72782
CAM Data[2043] (REAL)	43174	47404	51634	55864	60094	64324	68554	72784
CAM Data[2044] (REAL)	43176	47406	51636	55866	60096	64326	68556	72786
CAM Data[2045] (REAL)	43178	47408	51638	55868	60098	64328	68558	72788
CAM Data[2046] (REAL)	43180	47410	51640	55870	60100	64330	68560	72790
CAM Data[2047] (REAL)	43182	47412	51642	55872	60102	64332	68562	72792

Appendix 2.12 User CAM data memory address

Item	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8
Number of user CAM data	72794	72916	73038	73160	73282	73404	73526	73648
Main axis position 1	72796	72918	73040	73162	73284	73406	73528	73650
Subordinate axis position 1	72798	72920	73042	73164	73286	73408	73530	73652
Main axis position 2	72800	72922	73044	73166	73288	73410	73532	73654
Subordinate axis position 2	72802	72924	73046	73168	73290	73412	73534	73656
Main axis position 3	72804	72926	73048	73170	73292	73414	73536	73658
Subordinate axis position 3	72806	72928	73050	73172	73294	73416	73538	73660
Main axis position 4	72808	72930	73052	73174	73296	73418	73540	73662
Subordinate axis position 4	72810	72932	73054	73176	73298	73420	73542	73664
Main axis position 5	72812	72934	73056	73178	73300	73422	73544	73666
Subordinate axis position 5	72814	72936	73058	73180	73302	73424	73546	73668
Main axis position 6	72816	72938	73060	73182	73304	73426	73548	73670
Subordinate axis position 6	72818	72940	73062	73184	73306	73428	73550	73672
Main axis position 7	72820	72942	73064	73186	73308	73430	73552	73674
Subordinate axis position 7	72822	72944	73066	73188	73310	73432	73554	73676
Main axis position 8	72824	72946	73068	73190	73312	73434	73556	73678
Subordinate axis position 8	72826	72948	73070	73192	73314	73436	73558	73680
Main axis position 9	72828	72950	73072	73194	73316	73438	73560	73682
Subordinate axis position 9	72830	72952	73074	73196	73318	73440	73562	73684
Main axis position 10	72832	72954	73076	73198	73320	73442	73564	73686
Subordinate axis position 10	72834	72956	73078	73200	73322	73444	73566	73688
Main axis position 11	72836	72958	73080	73202	73324	73446	73568	73690
Subordinate axis position 11	72838	72960	73082	73204	73326	73448	73570	73692
Main axis position 12	72840	72962	73084	73206	73328	73450	73572	73694
Subordinate axis position 12	72842	72964	73086	73208	73330	73452	73574	73696
Main axis position 13	72844	72966	73088	73210	73332	73454	73576	73698
Subordinate axis position 13	72846	72968	73090	73212	73334	73456	73578	73700
Main axis position 14	72848	72970	73092	73214	73336	73458	73580	73702
Subordinate axis position 14	72850	72972	73094	73216	73338	73460	73582	73704
Main axis position 15	72852	72974	73096	73218	73340	73462	73584	73706
Subordinate axis position 15	72854	72976	73098	73220	73342	73464	73586	73708
Main axis position 16	72856	72978	73100	73222	73344	73466	73588	73710
Subordinate axis position 16	72858	72980	73102	73224	73346	73468	73590	73712
Main axis position 17	72860	72982	73104	73226	73348	73470	73592	73714
Subordinate axis position 17	72862	72984	73106	73228	73350	73472	73594	73716
Main axis position 18	72864	72986	73108	73230	73352	73474	73596	73718
Subordinate axis position 18	72866	72988	73110	73232	73354	73476	73598	73720
Main axis position 19	72868	72990	73112	73234	73356	73478	73600	73722
Subordinate axis position 19	72870	72992	73114	73236	73358	73480	73602	73724
Main axis position 20	72872	72994	73116	73238	73360	73482	73604	73726
Subordinate axis position 20	72874	72996	73118	73240	73362	73484	73606	73728

Item	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8
Main axis position 21	72876	72998	73120	73242	73364	73486	73608	73730
Subordinate axis position 21	72878	73000	73122	73244	73366	73488	73610	73732
Main axis position 22	72880	73002	73124	73246	73368	73490	73612	73734
Subordinate axis position 22	72882	73004	73126	73248	73370	73492	73614	73736
Main axis position 23	72884	73006	73128	73250	73372	73494	73616	73738
Subordinate axis position 23	72886	73008	73130	73252	73374	73496	73618	73740
Main axis position 24	72888	73010	73132	73254	73376	73498	73620	73742
Subordinate axis position 24	72890	73012	73134	73256	73378	73500	73622	73744
Main axis position 25	72892	73014	73136	73258	73380	73502	73624	73746
Subordinate axis position 25	72894	73016	73138	73260	73382	73504	73626	73748
Main axis position 26	72896	73018	73140	73262	73384	73506	73628	73750
Subordinate axis position 26	72898	73020	73142	73264	73386	73508	73630	73752
Main axis position 27	72900	73022	73144	73266	73388	73510	73632	73754
Subordinate axis position 27	72902	73024	73146	73268	73390	73512	73634	73756
Main axis position 28	72904	73026	73148	73270	73392	73514	73636	73758
Subordinate axis position 28	72906	73028	73150	73272	73394	73516	73638	73760
Main axis position 29	72908	73030	73152	73274	73396	73518	73640	73762
Subordinate axis position 29	72910	73032	73154	73276	73398	73520	73642	73764
Main axis position 30	72912	73034	73156	73278	73400	73522	73644	73766
Subordinate axis position 30	72914	73036	73158	73280	73402	73524	73646	73768

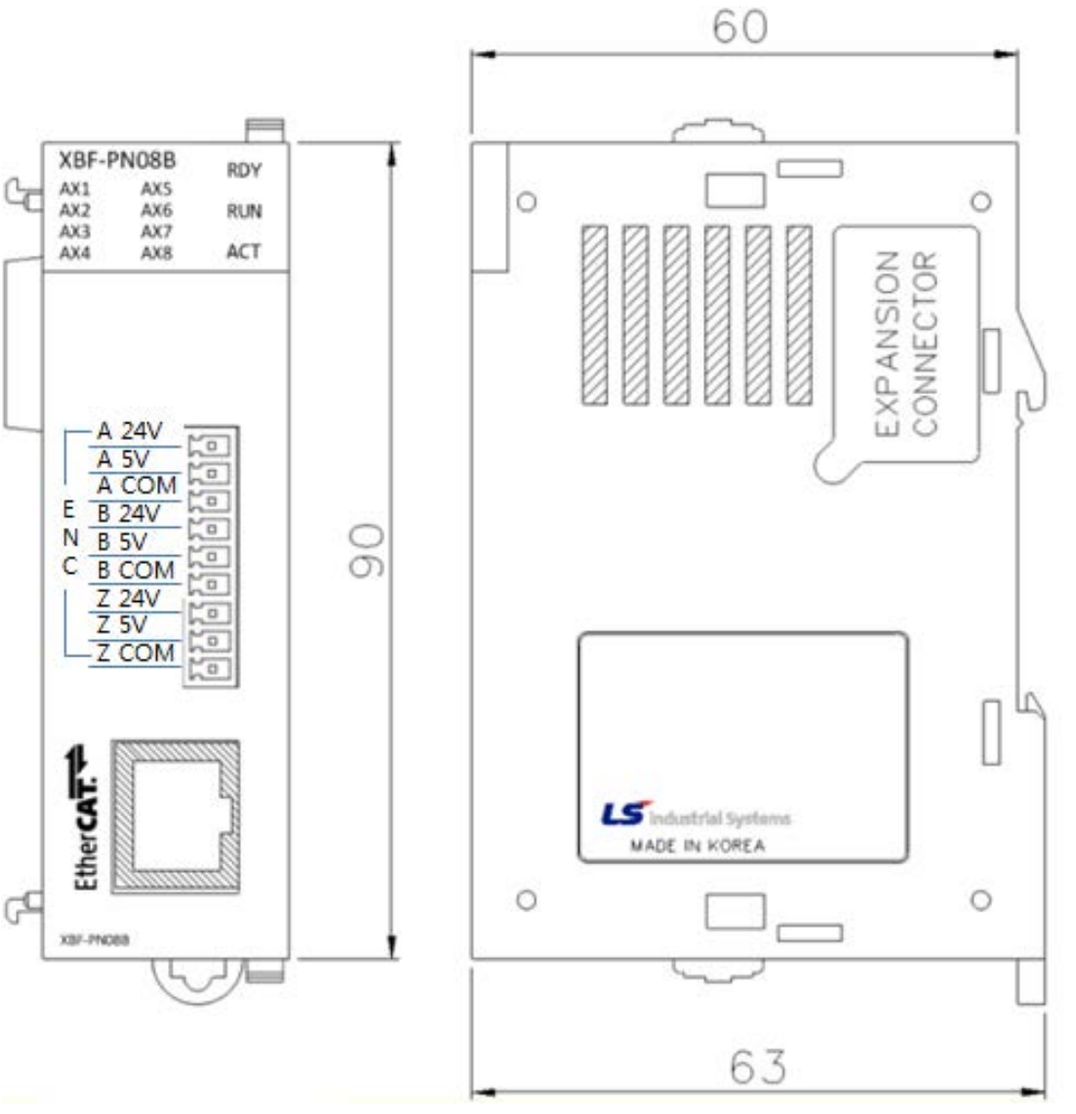
Appendix 2.13 CAM scale memory address

- XGF-PN04/B/XGF-PN08B

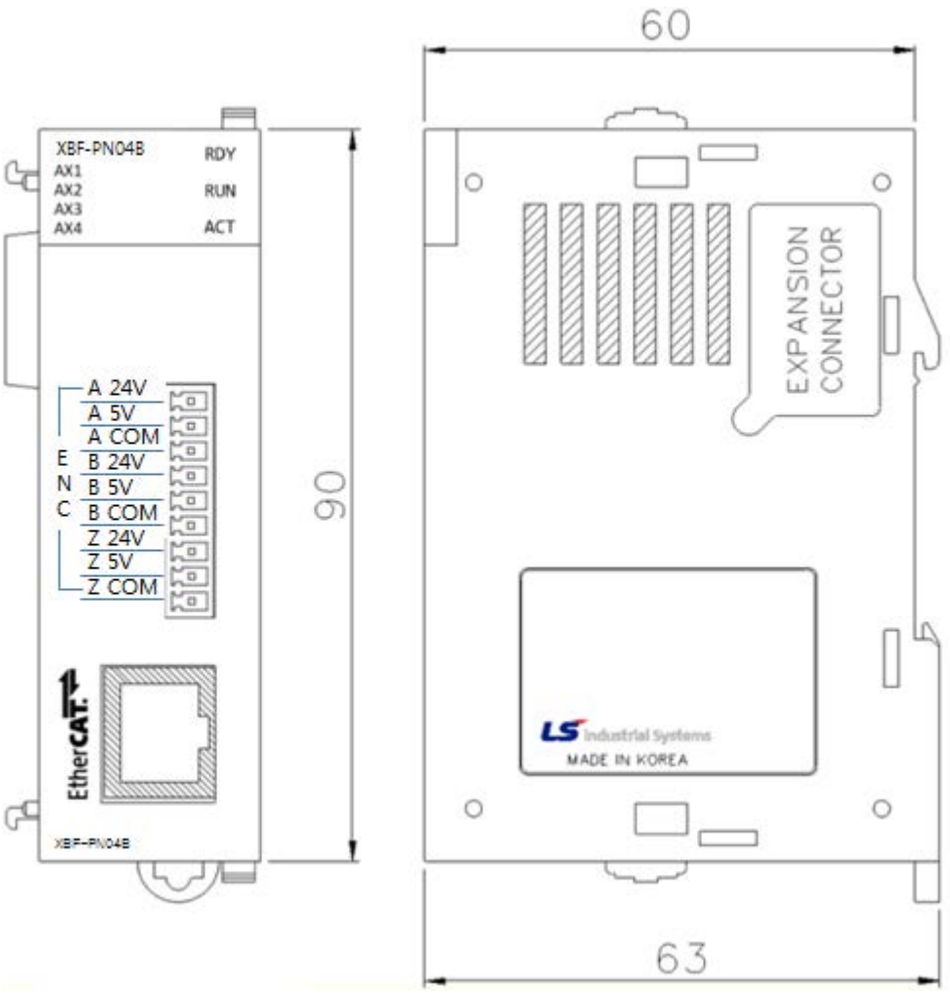
Item	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6	Axis 7	Axis 8
Master Scale denominator	73770	73774	73778	73782	73786	73790	73794	73798
Master Scale numerator	73771	73775	73779	73783	73787	73791	73795	73799
Slave Scale denominator	73772	73776	73780	73784	73788	73792	73796	73800
Slavee Scale numerator	73773	73777	73781	73785	73789	73793	73797	73801

Appendix 3 Dimensions

Appendix 3.1 Dimensions of XBF-PN08B



Appendix 3.2 Dimensions of XBF-PN08B



Appendix 4 Setting Example

It describes how to set when using the positioning module at the beginning.

(1) Install servo drive

Connect the power and motor to the servo drive and connect external signal as necessary.

(2) Install PLC.

Install PLC and mount positioning module. And at the beginning of test-run, for safety, make sure PLC CPU for stop mode.

(3) Connect positioning module and servo drive

Using Ethernet Cable, connect positioning module and the first servo drive and also connect the last servo drives. At this time, the input/output direction of the servo drive's communication port must be correctly identified and connected. In the following, when connecting servo drive of 8 axes to positioning module, connection diagram and servo drive list that basically has network setting information in the current module.

Vendor	Applicable servo drive
LS Mecapion	L7N
BeckhoffAutomation GmbH	AX2000-B110 EtherCAT Drive
Danaher Motion GmbH (KOLLMORGEN)	S300/S400/S600/S700 EtherCAT Drive
	AKD EtherCAT Drive(CoE)
Sanyodenki Co., Ltd	RADVANCED MODEL with EtherCAT Coe Interface
Yaskawa Electric Corporation	SGDV-E1 EtherCAT(CoE) SERVOPACK Rev1, Rev2, Rev3

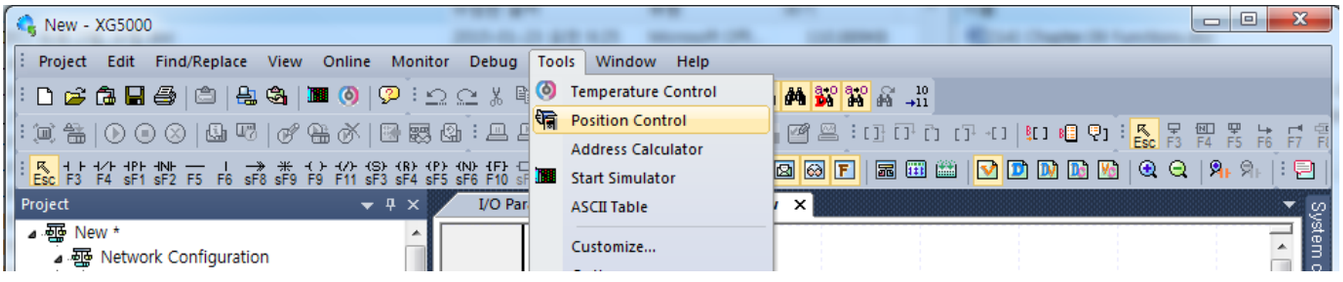
Notes

When the installation of servo drive has completed, make sure to check the following points by using dedicated setting TOOL provided by the servo drive manufacturer; failure to meet the standards requires reset to meet the actual user condition.

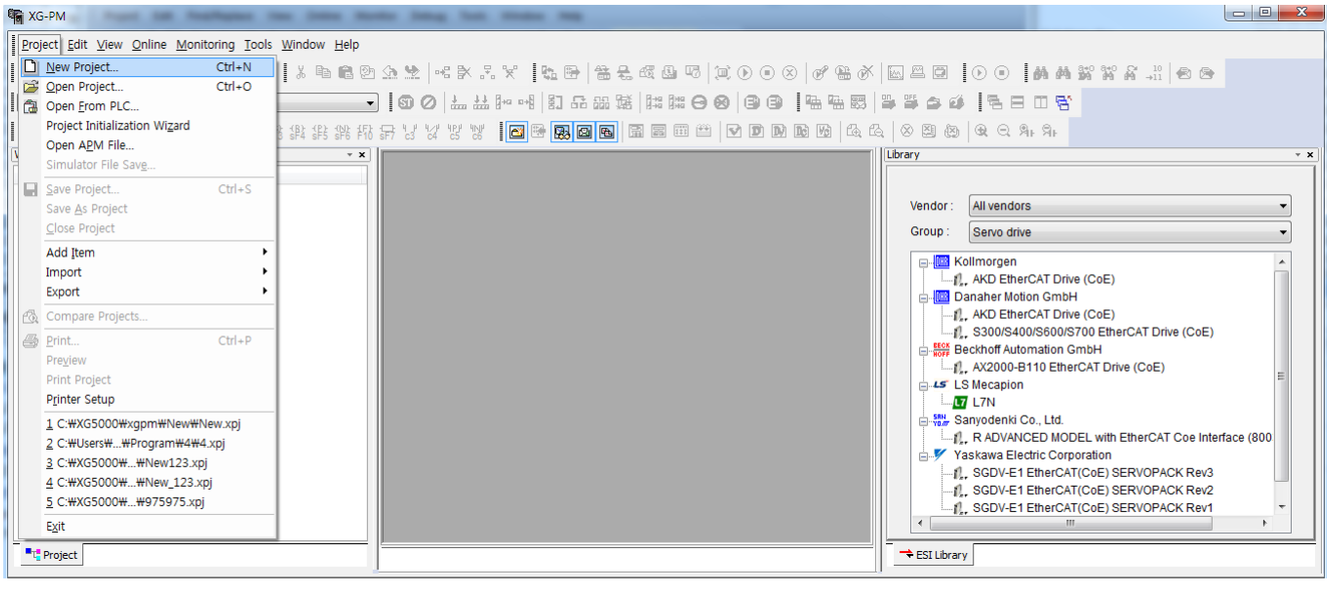
1) Power supply
   Check if the power connected to servo drive and the allowable power conditions are the same.
   (There are instances where no power setting is in parameter depending on the type of servo drive.)
2) The type of motor and encoder(feedback)
   Set the parameter according to the type of encoder and motor connected to servo drive.
3) Command position unit setting
   If it is possible to set the command position unit by servo drive parameter, make sure to set it by pulse unit (Inc. or Counts), and set the encoder resolution value per motor rotation according to the bit number of encoder used.
   (There are instances where no separate setting item exists depending on the type of servo drive)

(4) Install XG5000 at the PC.

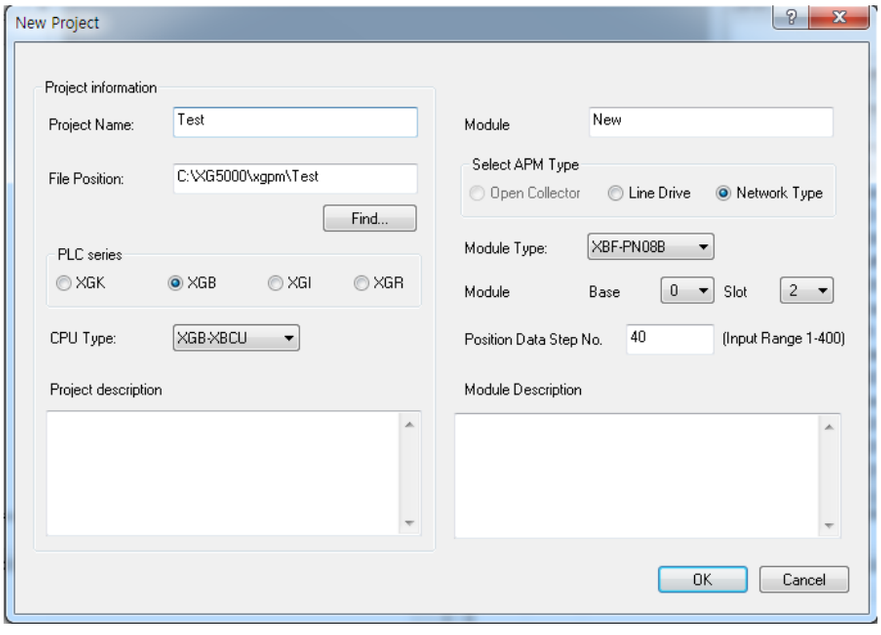
(5) Execute XG5000 and select “Tools- Positioning”on the menu to operate XG-PM.
(XG-PM is used to set the operation parameter and operation data of positioning module and parameter of servo drive or to monitor operation.)



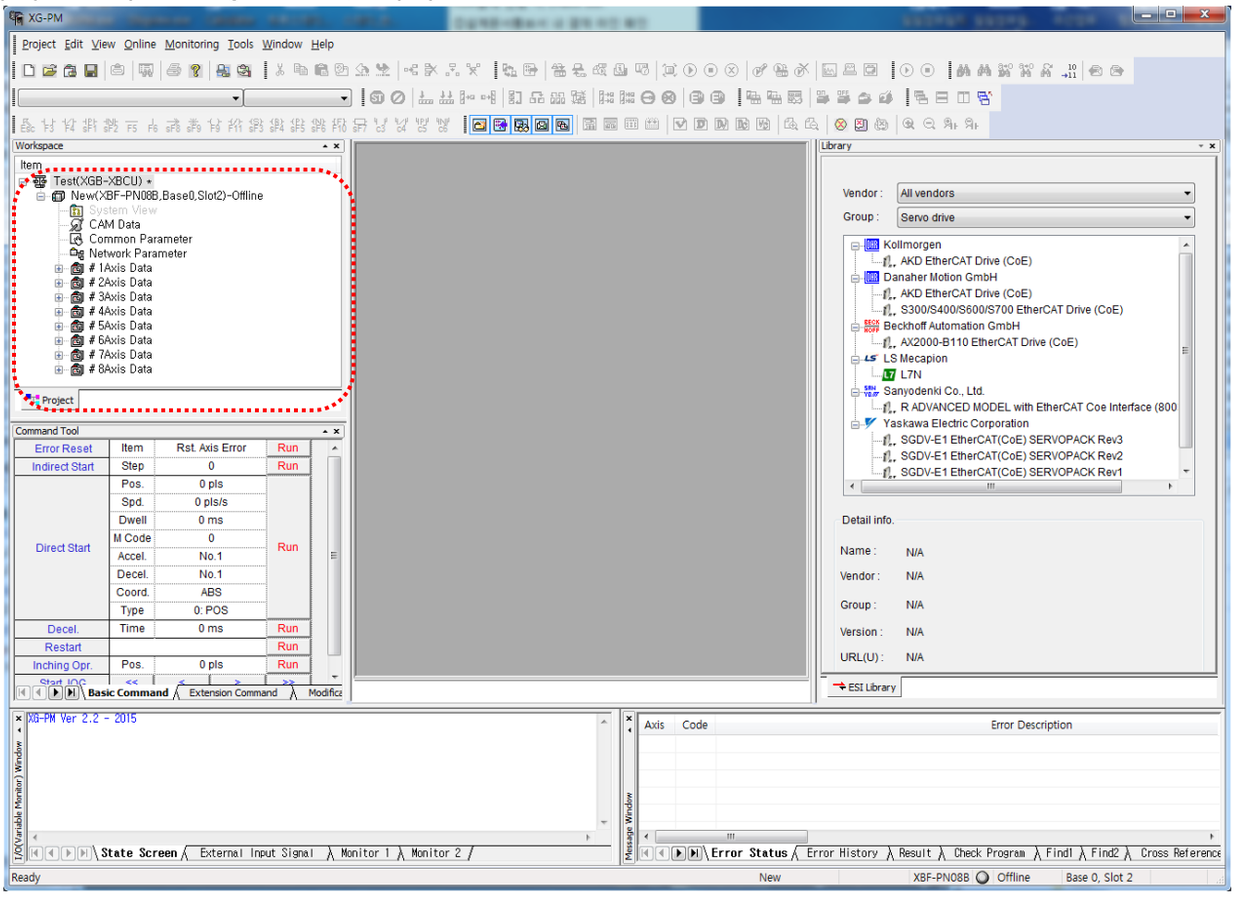
(6) Execute XG5000 and create positioning project by selecting “Project(P) – New Project(N)”



(7) In the figure below, if setting Project name, CPU series, CPU type, module name and Module type on the new project setting window, the new project is created.

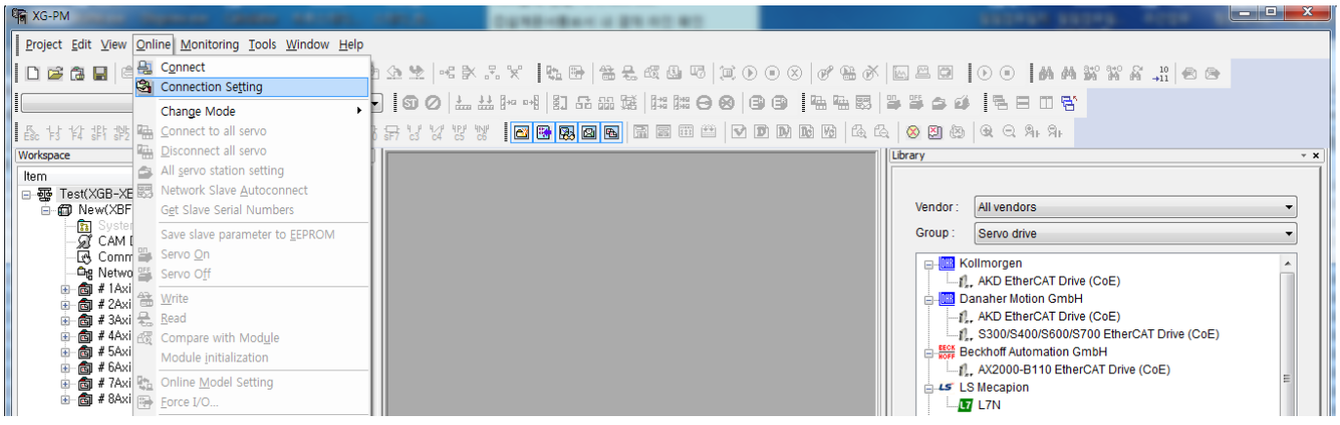


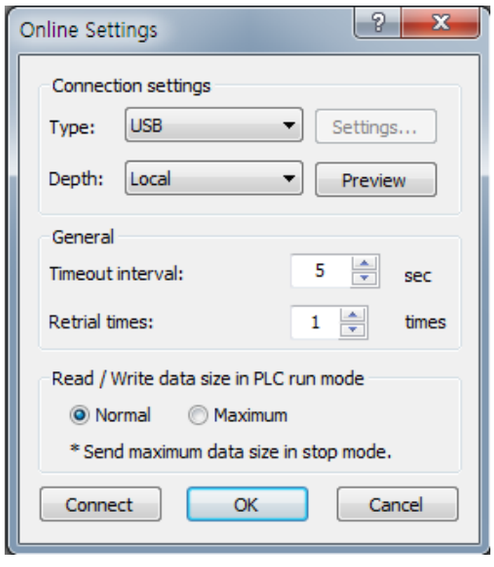
(8) If you set up as the figure above, the project will be created as follows.



(9) Input power to the PLC and servo drive and connect the computer and PLC CPU via USB.

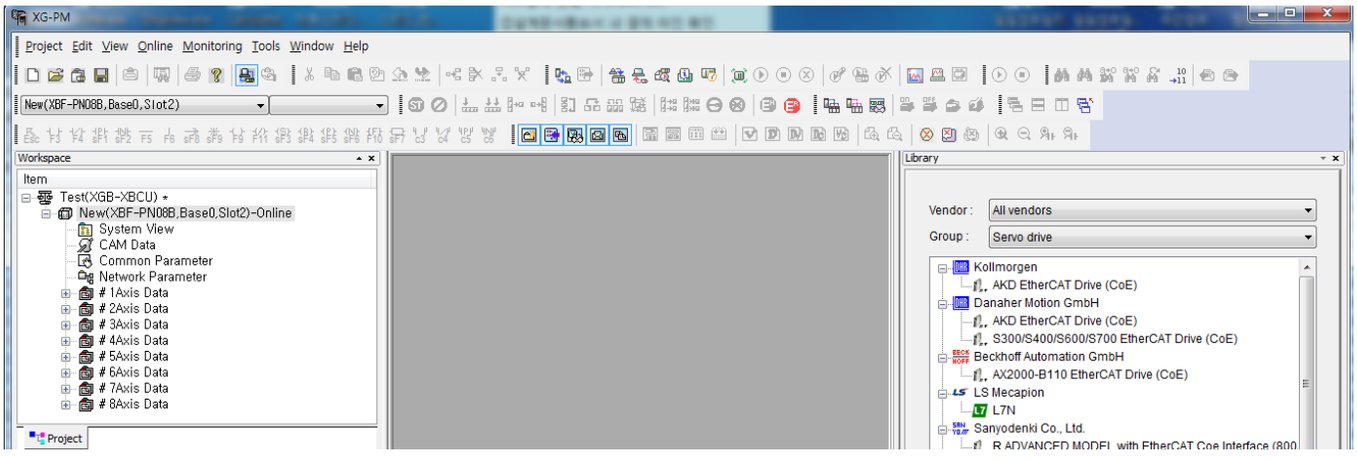
(10) Select “Online(O)- Connection Setting(P)”on the menu to set the connection type between the computer and PLC CPU.





(11) Select “Online (O)-Connection (O)” from the menu to connect the communication between the computer and PLC CPU.

(12) When the connection is completed, the relevant module of project is displayed as online as below.

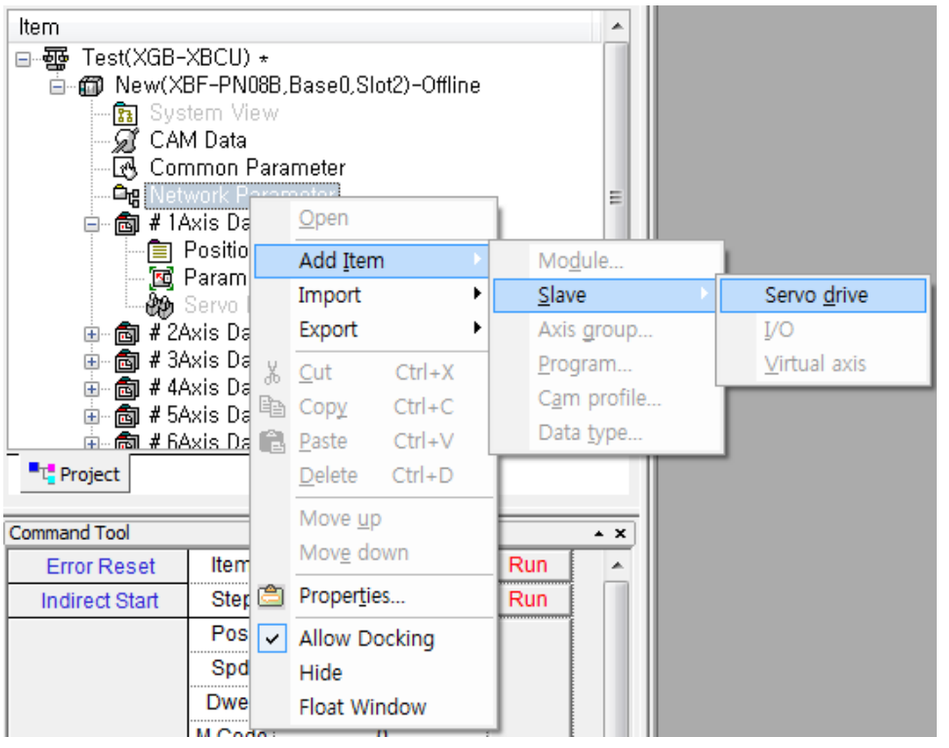


(13) if a module does not connect online but keep “offline”, check whether a module is correctly installed in the relevant slot or whether position information and module type of module has been inputted incorrectly.

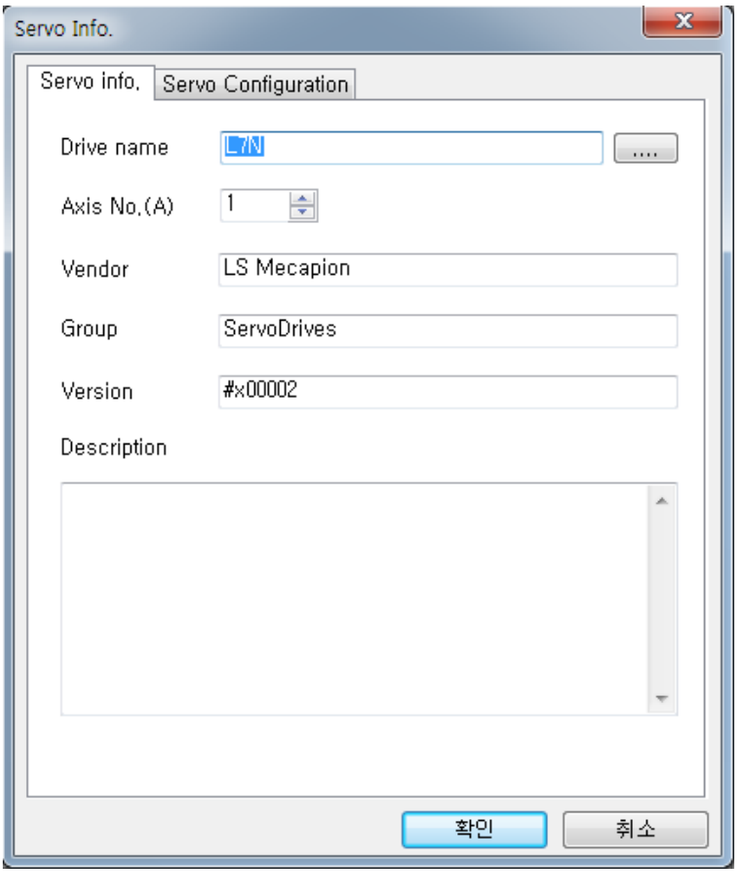
(14) To execute the connection with the servo drive, set servo drive connected network parameter and and write to positioning module. First, check if the relevant module is offline for setting network parameter. In case of online status, execute “ Online(O) -

Disconnecton(N) to change it to offline.

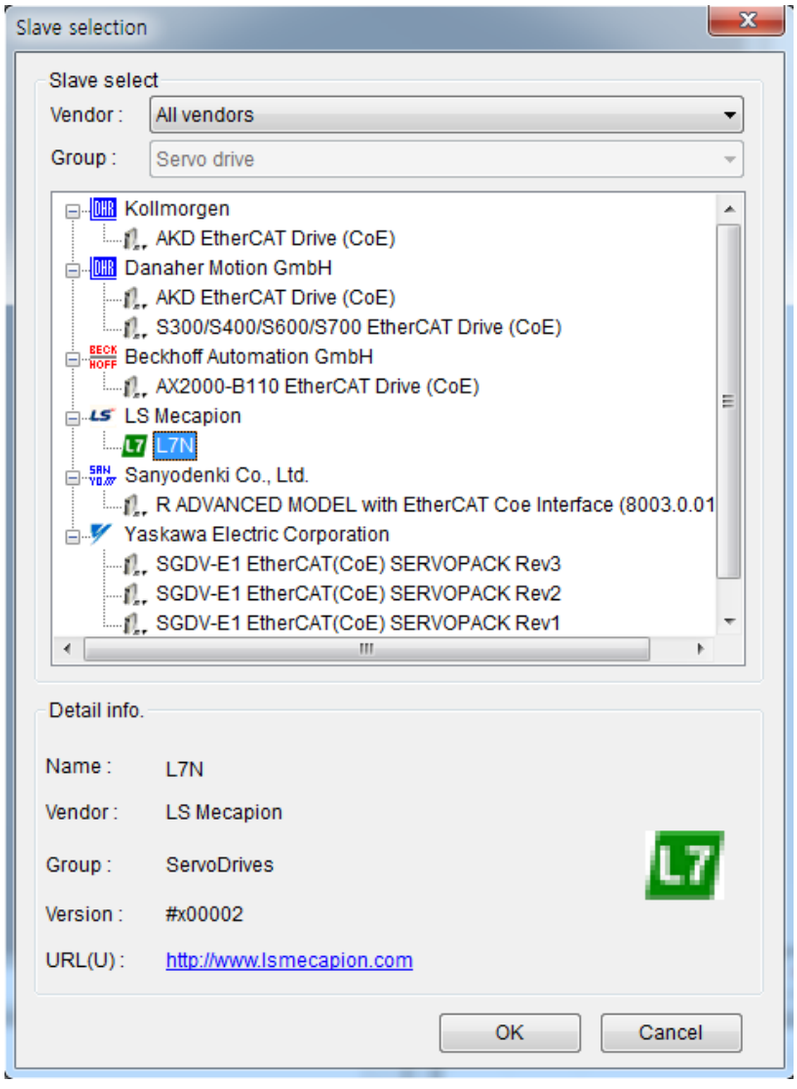
(15)To add a servo drive to network parameters, right-click on the network parameter on project tree and select “Add Item - Add Slave”.



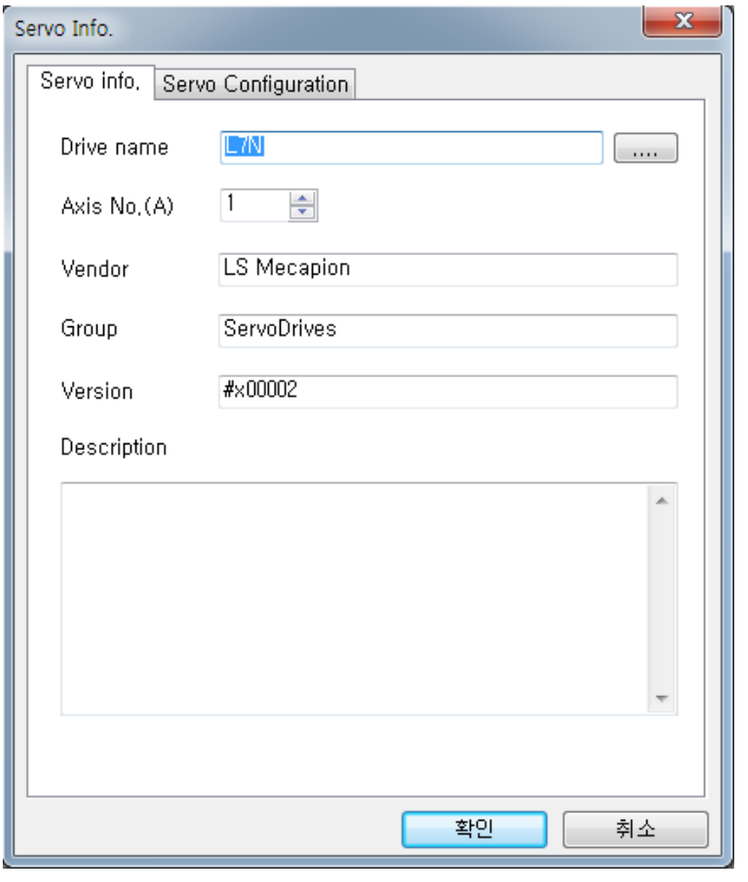
(16) When the servo information window open, click the“…” button next to the drive name.



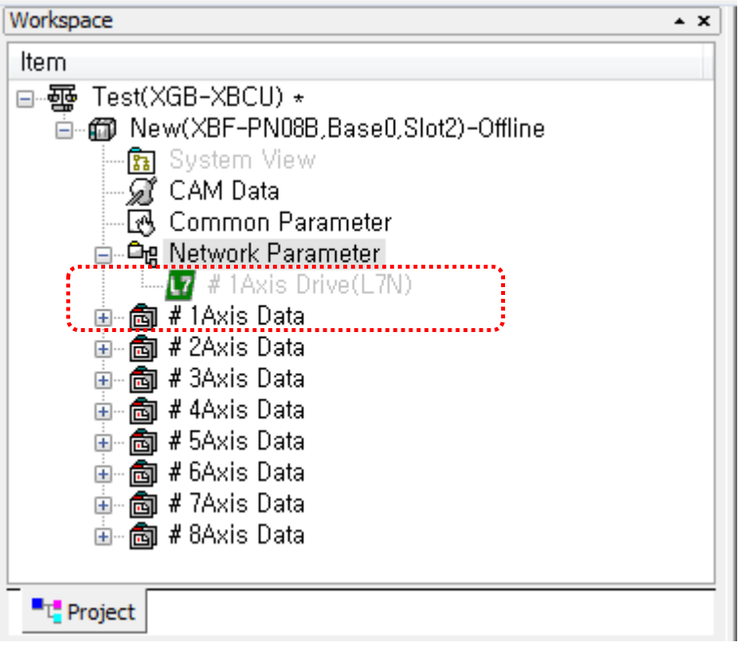
(17) Servo drive window, select the first servo drive connected to the positioning module and click OK.



(18) On servo information window, set axis number of selected drive. The connection order and axis number are not related Axis number set here is the command axis of command/function block during writing CPU program.

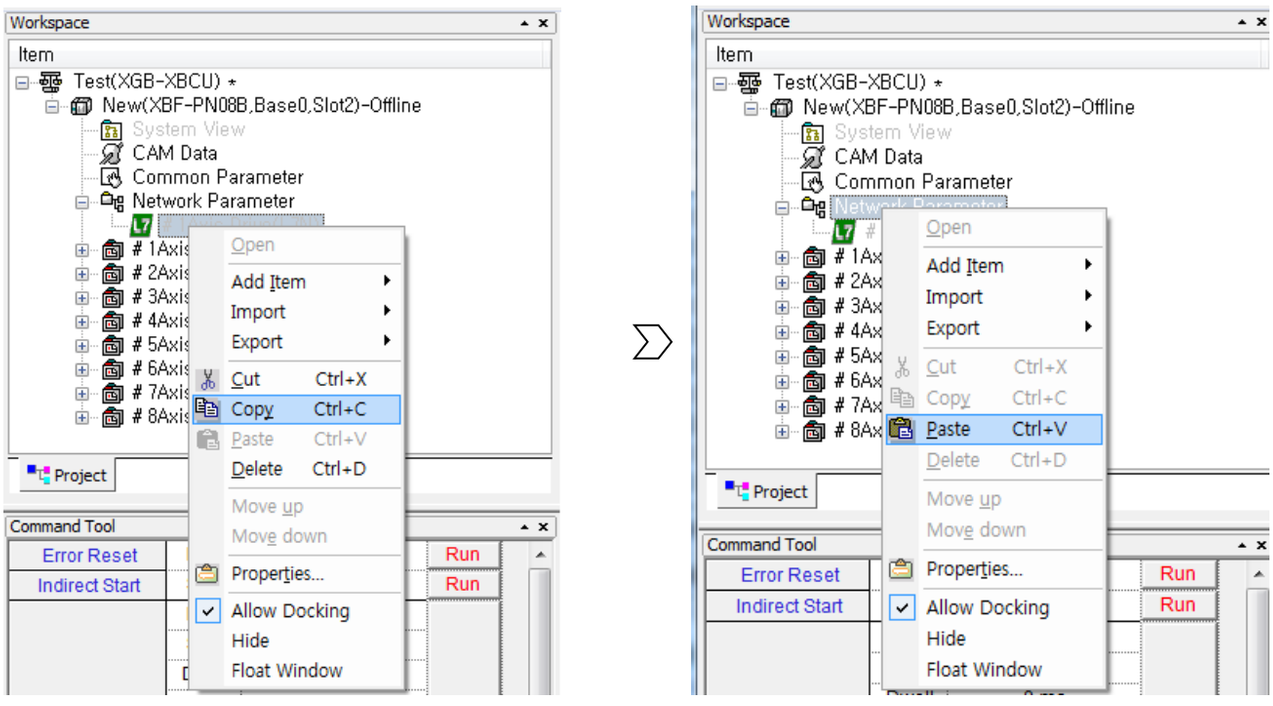


(19) When the axis number is completed, the servo drive adding to network parameter is displayed.

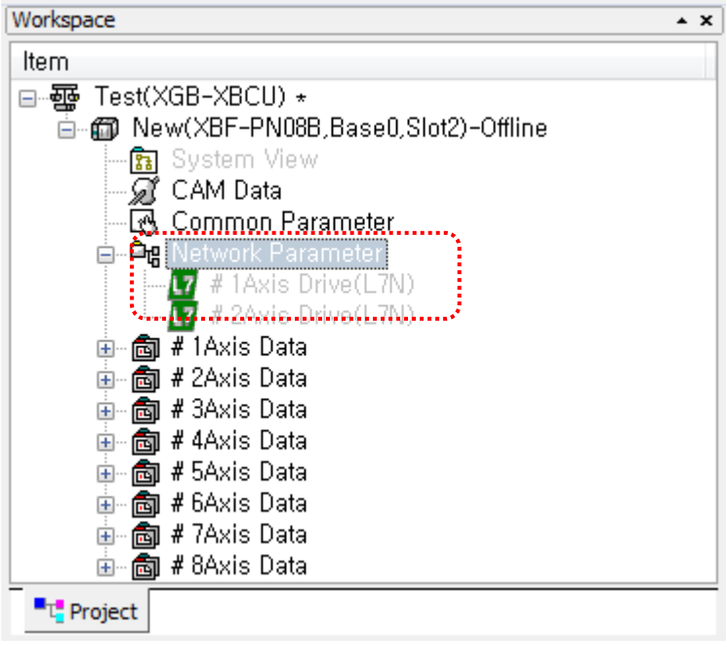


Notes

If the drive type connected to the network is the same, you can use the“Copy(C), Paste(V)”. With the first drive added, like this, select the “Copy(C)” menu as follows, then right-click on the network parameter and execute “Paste(V)”.

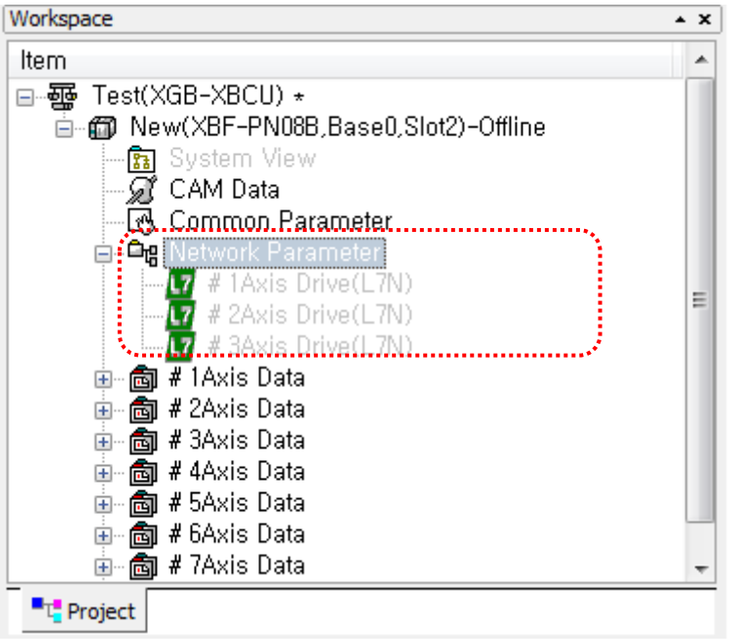


If execute as above, the servo drive with the axis number increased by 1 will be added to the network parameter.

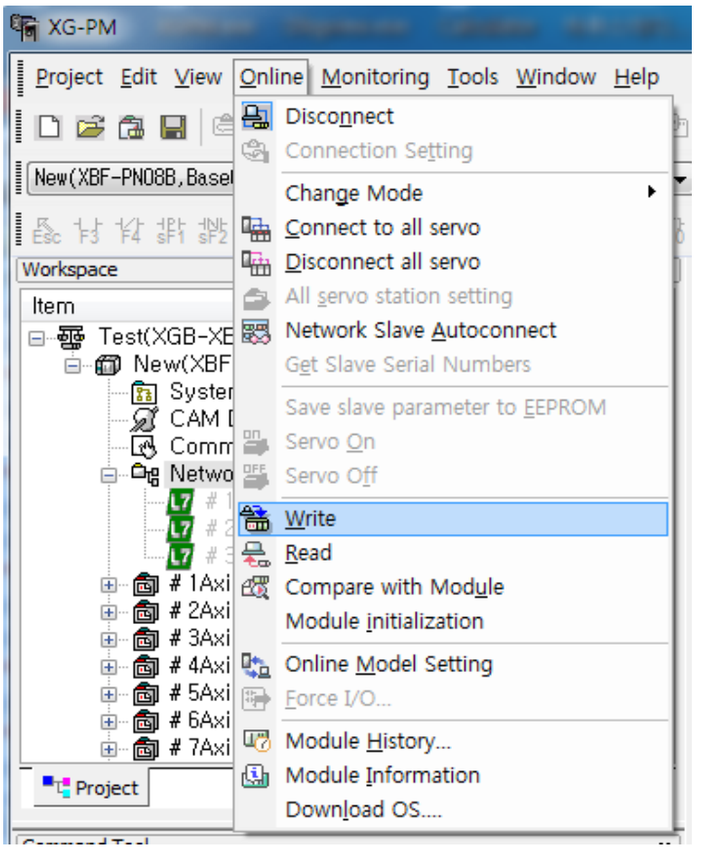


(20) Execute the same servo drive addition task in the same way for the remaining servo drives.

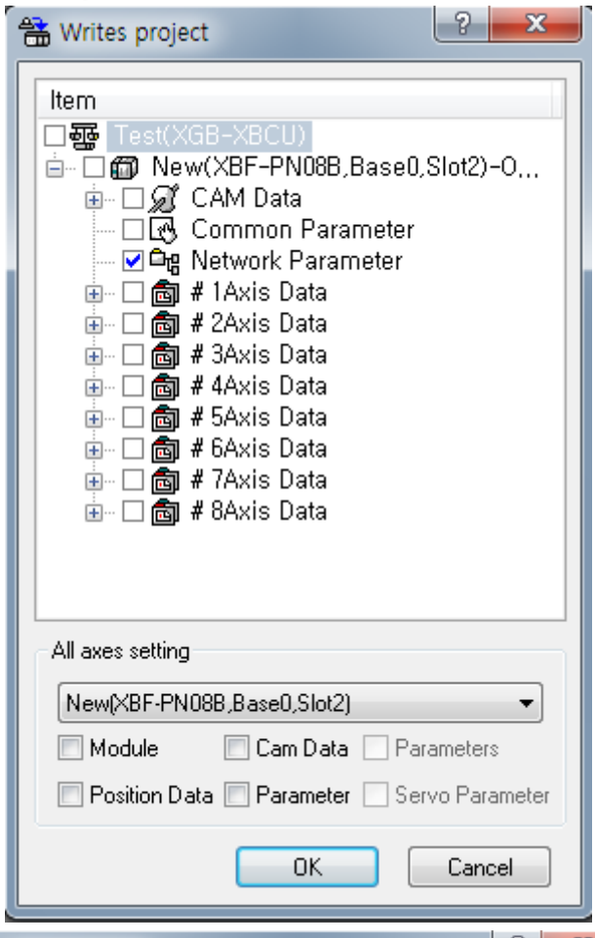
This is a screen where all servo drives connected are added to the network parameters. It is displayed in gray until all servo connection command is executed and then positioning module and servo drive are normally connected.

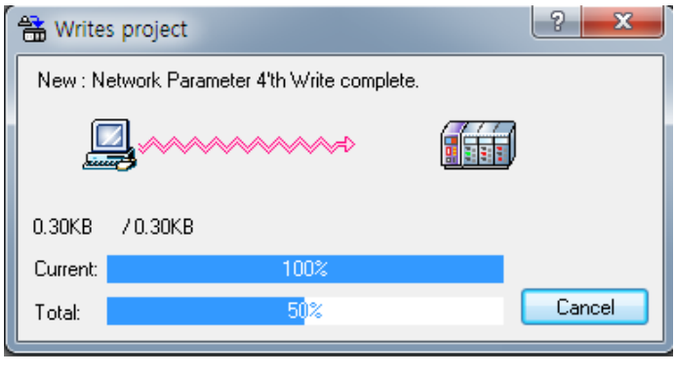


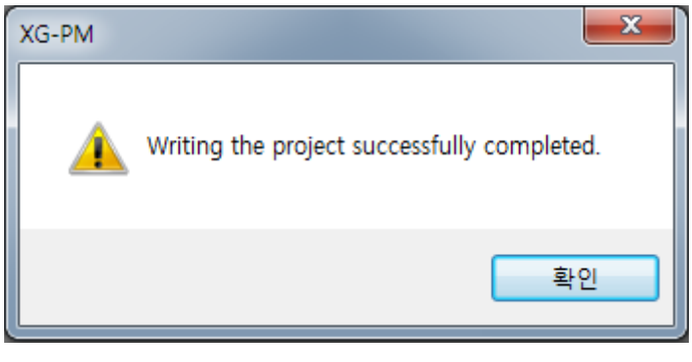
(21) After adding all servo drives connected to the network parameter, execute “Online (O)-Connect (O)” to write the next network parameters to positioning module, then execute the“Online (O)-Write (W)”.



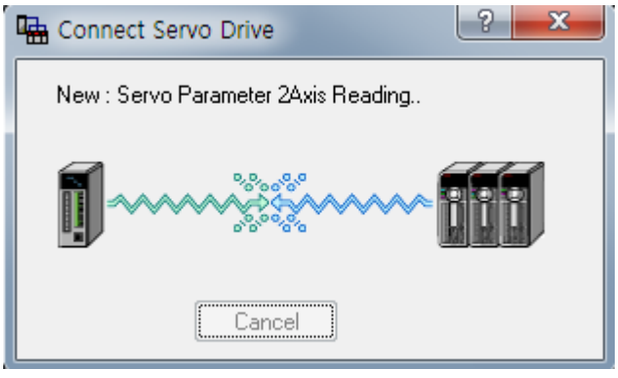
(22) When the project writing window is open, check the network parameters and click the OK button to write. This is the screen until executing project write and then finishing.



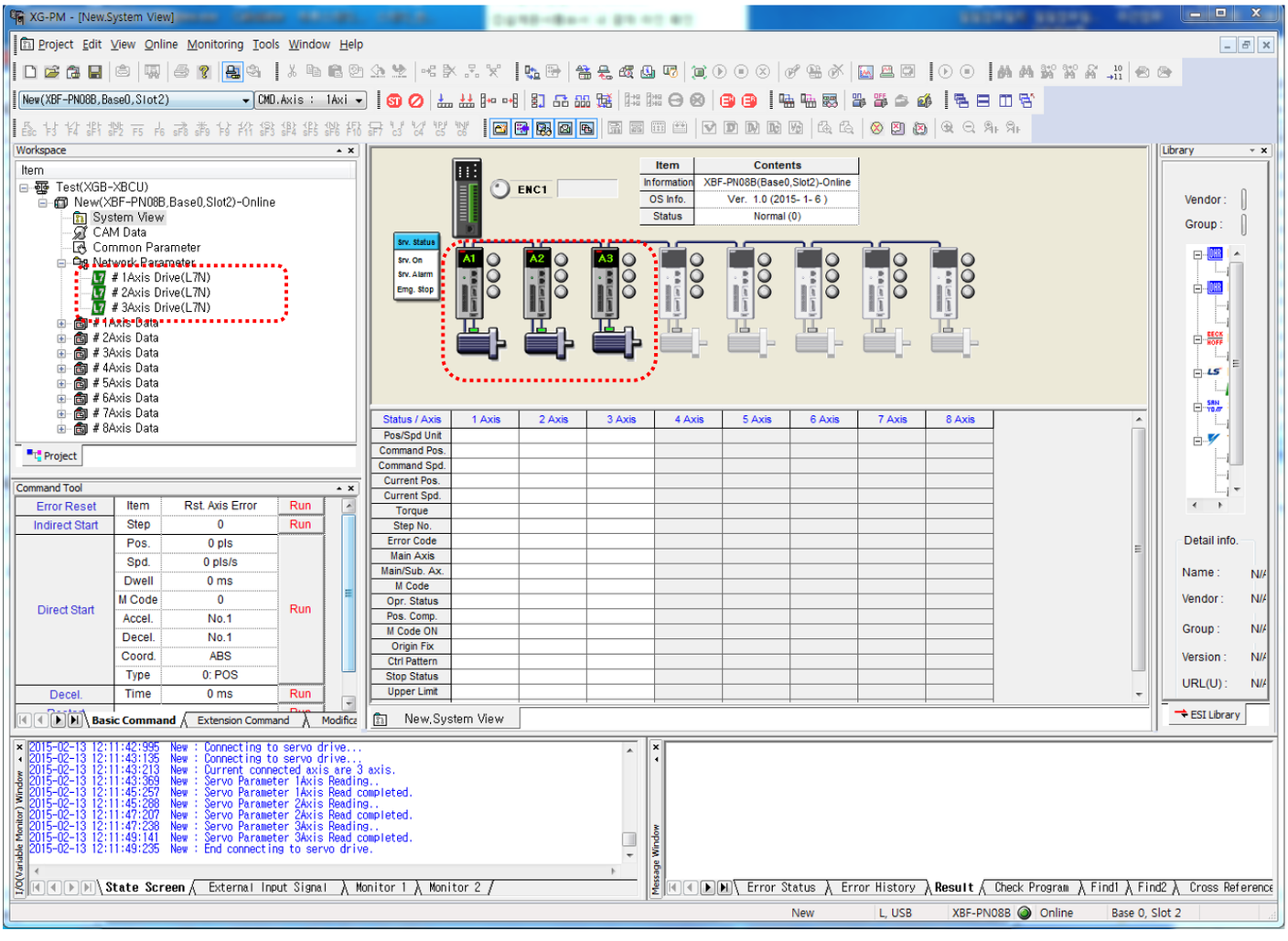




(23) Select “Online (O)- Connect to all Servo(C)” to execute communication connection between positioning module and servo drive.



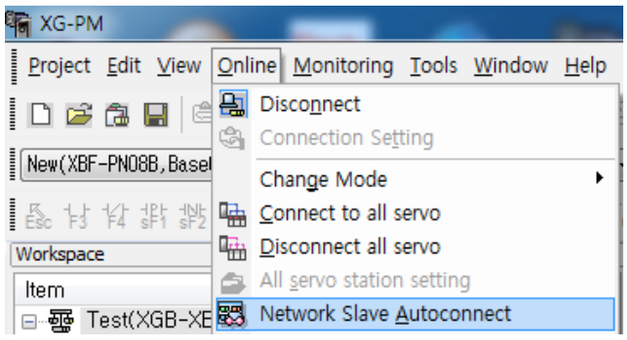
(24) When completing connection, the servo drive name in the network parameter changes from gray to black, and as many servo drive as the number of servo drive connected is activated in the system view window.



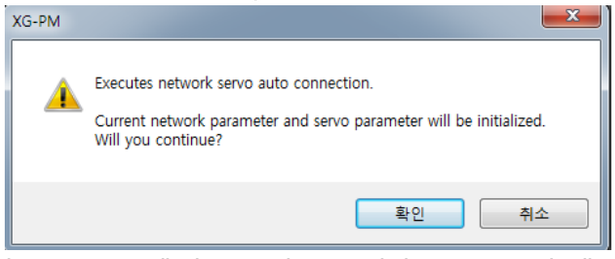
Notes

1. If the connecting to the network for the first time after configuring the system using the XBF-PN04B/PN08B and you use the “Network SlaveAuto Connect” function, you can easily connect to the servo drive without setting the network parameter.
2. In the “Network SlaveAuto Connect” function, if the module version is V2.0 or lower, it supports connection for servo drive that has the network setting information in the module, and in case of V2.1 or higher, it support connection with searching servo drive information connected to library of XG-PM and than setting the network parameter automatically.

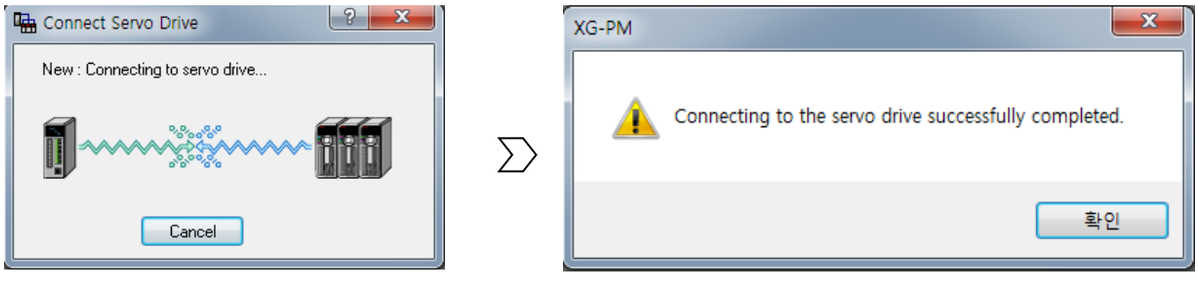
1) Execute “Online (O)- Network SlaveAuto Connect(A)” menu.



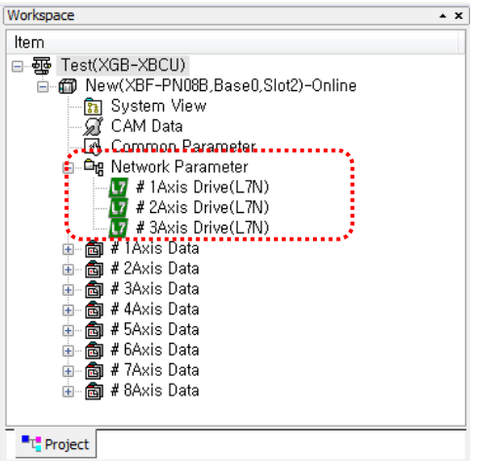
2) The following alarm message occurs. If Network Servo auto-connection is executed and the following warning message occurs, network parameters currently set in XG5000 and positioning module initialized, and servo parameters in XG5000 are also initialized. Check the message and click OK.



3) A servo drive connection message displays, and a completion message is displayed if the connection is normally completed.



4) If the “Slave Auto Connection” command is executed and the connection command is completed normally, the currently connected servo drive Information automatically registered in the network parameter of XG5000.

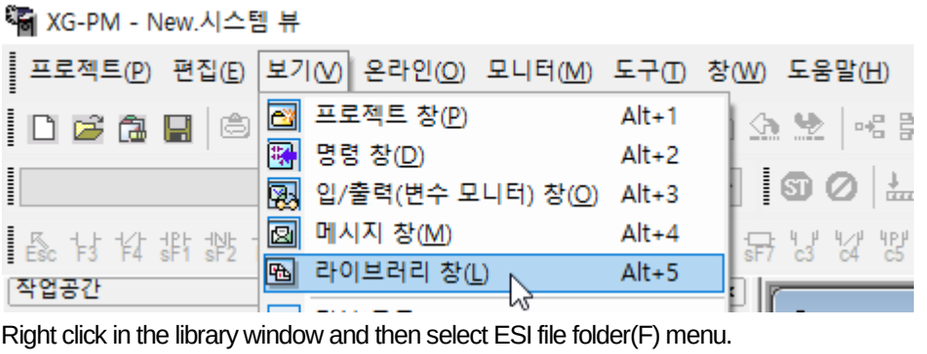


5) When executing connection as “Slave Auto Connection” command, the axis number is automatically assigned in the order in which they are connected to the positioning module. That is, starting with the first servo drive connected to the positioning module, the first axis, second axis, … , becomes 8 axes. If changing the axis number,disconnecting connection, executing network parameter write with changing only axis number in offline status of module, and then execute connection with “Online (O)- Connect to all Servo(C)”command.

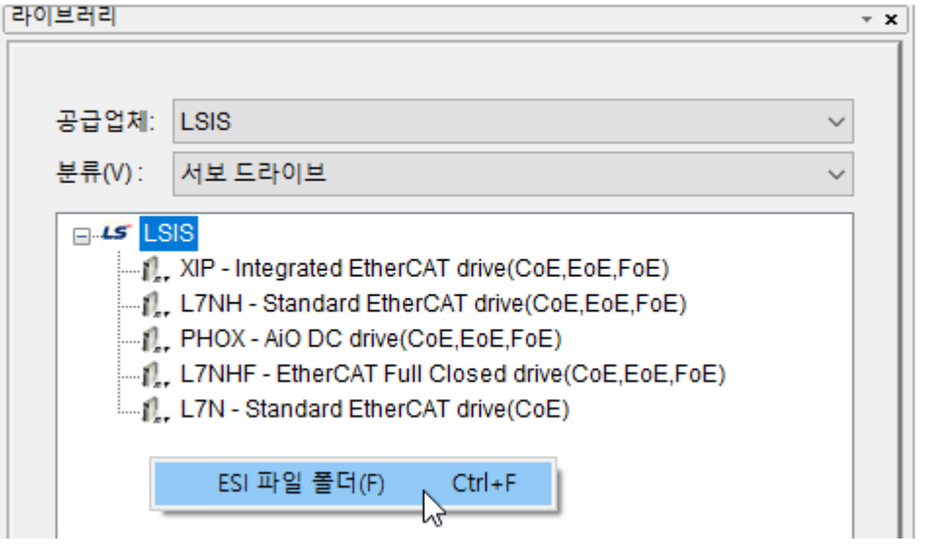
Note 2

1. If trying to connect a new servo drive other than a product supporting connection by default in XG-PM library, adding the ESI (EtherCAT Slave Information) file of servo drive in XG-PM library and then executing connection using Network SlaveAuto Connect” function,

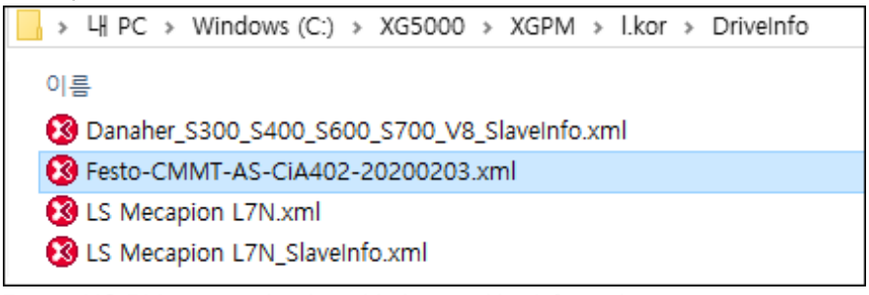
1) Execute the View(V) - Library Window(L) menu.



2) Right click in the library window and then select ESI file folder(F) menu.



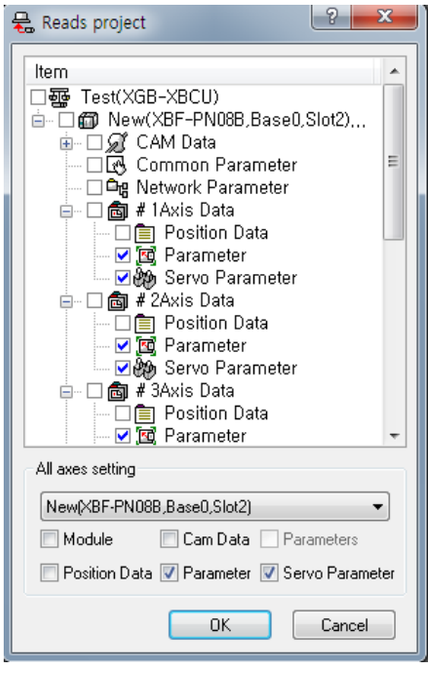
3) When you add the “DriveInfo” ESI file folder, add the ESI file of servo drive.



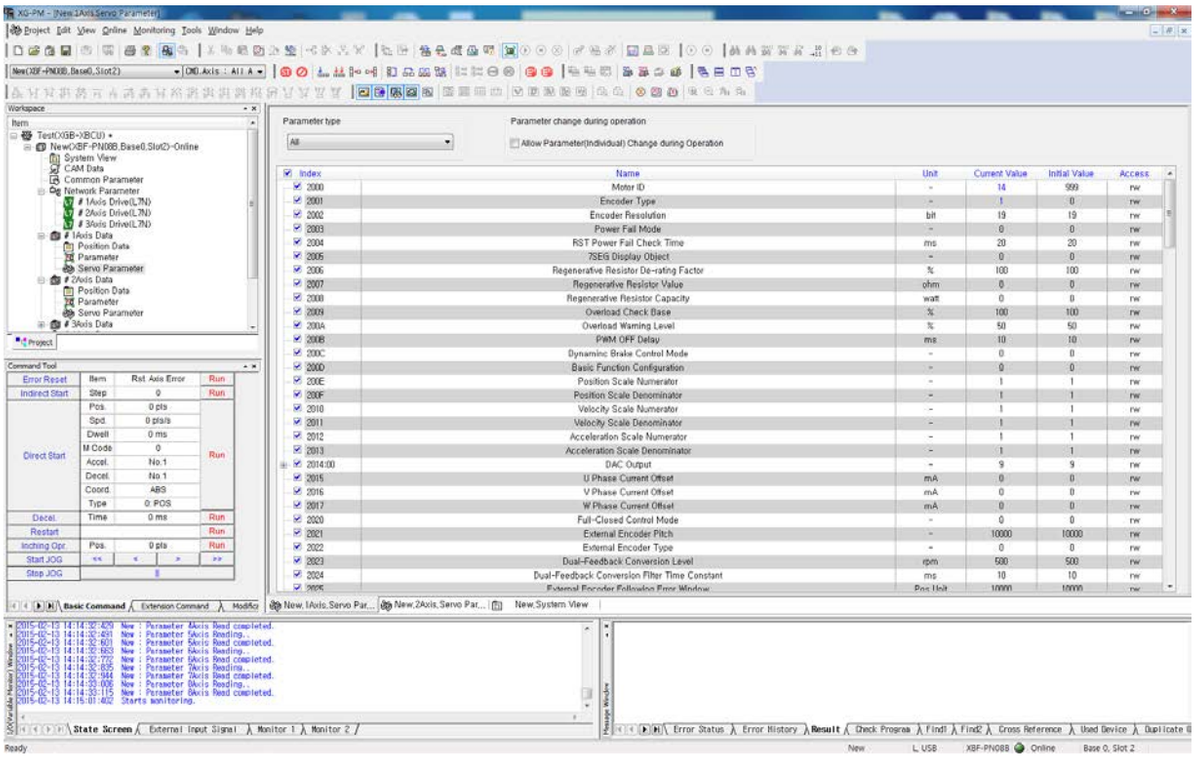
4) Restart XG-PM to recognize the added servo drive Information.
5) The following process is the same with “Notes 1”described above.
6) If executing “Network SlaveAuto Connect” function, searching the connected servo drive Information in XG-PM library and setting the network parameter automatically and then execute connection.
7) The version information that supports the auto connect function by adding ESI file in the XG-PM is as follows.

Item	Supported version
XG5000	V4.51 or higher
XBF-PN04B, XBF-PN08B	V2.10 or higher

(25) Read the parameters to set operation parameters and servo parameter.
You can do this by selecting “Online (O)-Read (R)” in the menu and selecting an item to read.

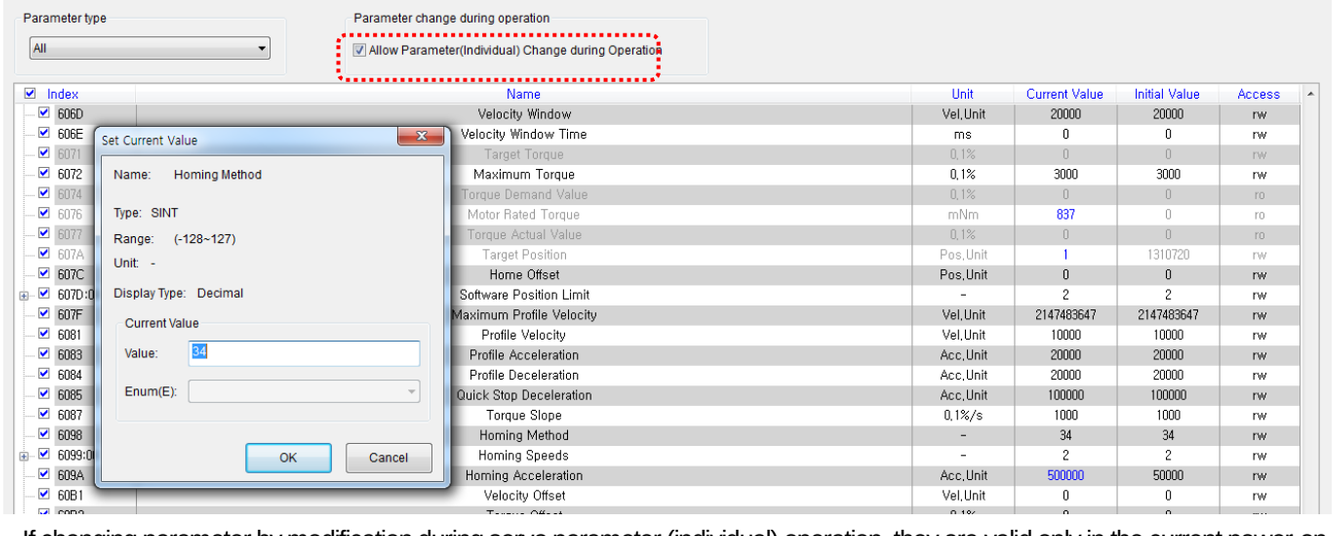


(26) The follows is contents for reading L7N servo parameters. The contents of servo parameters may differ depending on the servo drive type. For details, refer to “the servo drive user manuals”.



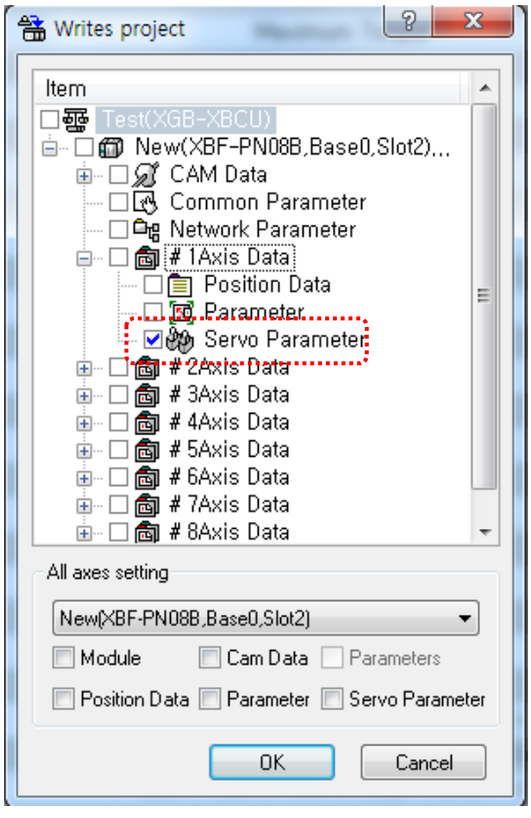
(27) Servo parameters can be set in two ways.

The first method is to change the values of one item among the servo parameter, when selecting ”servo parameter(individual) operating check box” of servo parameter window and setting servo parameter values and then the setting values apples servo parameter immediately. If updating the modified value to the 'current value' column of servo parameter s the value is transferred normally.



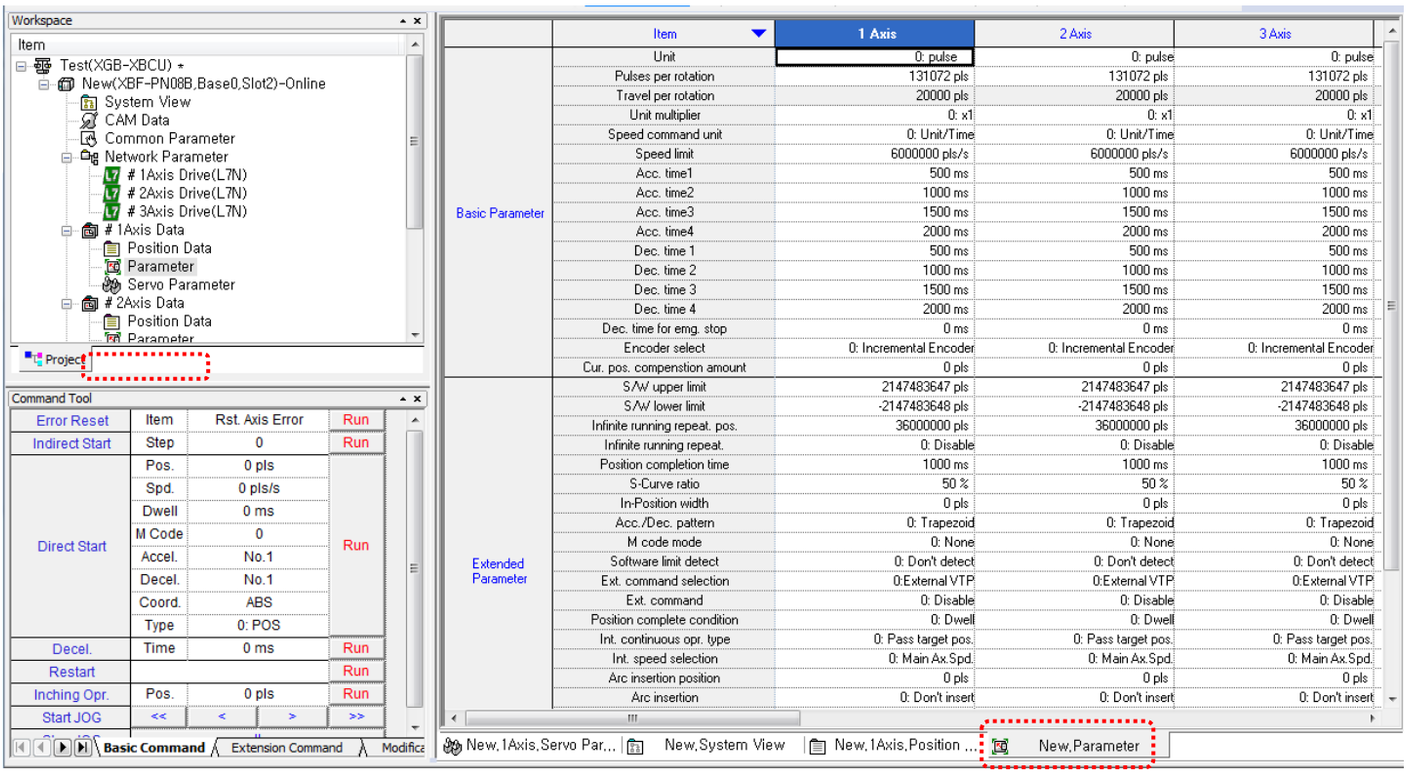
If changing parameter by modification during servo parameter (individual) operation, they are valid only in the current power-on state, to retain data even after power-off of the servo drive, you must execute “Online(O)- Save Slave parameter to EEPROM(E)” command.

The second method is setting all servo parameter to change, and then you can execute the “Online (O) - Write (W)”to write all servo parameter to servo drive at once.



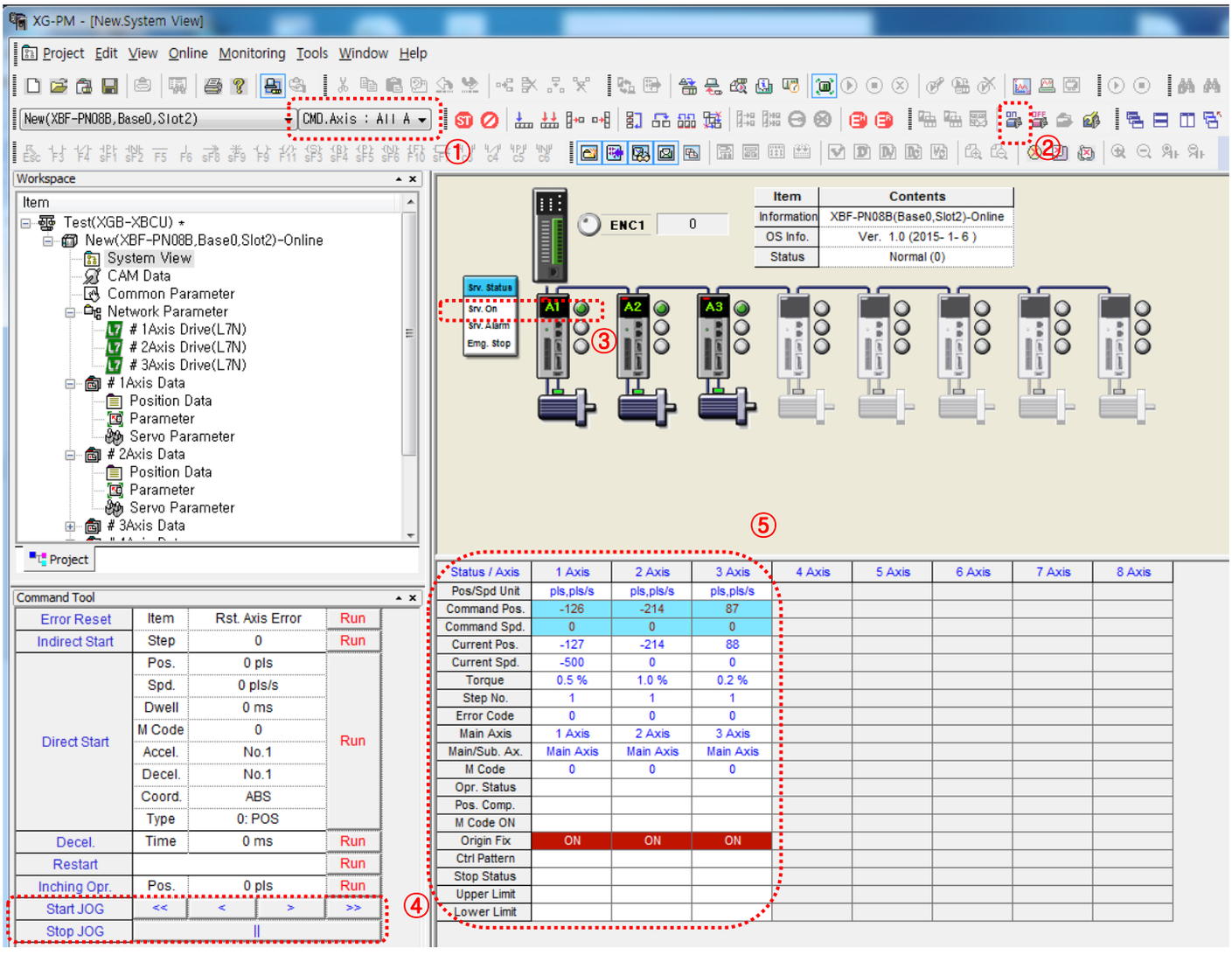
In case of writing all servo parameters, “servo Parameter EEPROM Save” command is automatically executed, so there is no need to separately execute “servo Parameter EEPROM Save” command. Depending on the servo parameter item, the changed setting value may be applied after power on/off, so refer to the corresponding servo drive user manual.

(28) After setting the servo parameter, set the axis parameter of each axis, select the operation parameter of the relevant axis in “Online (O)-Write (W)”, and then write to the module.



(29) If the power for servo drive was turned off and on in step (27), execute “Online (O)- Connect to all Servo(C)]”again to connect the module and servo drive.

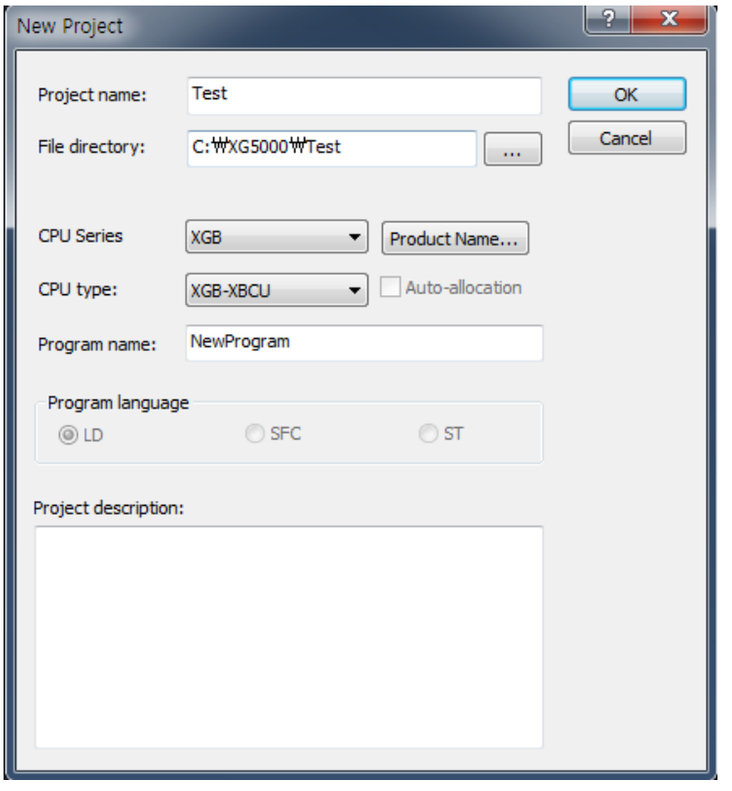
(30) After selecting the command axis and servo-on the relevant axis, check if the relevant axis is in servo-on state and operate the motor with jog, etc. to check if the motor operates normally.



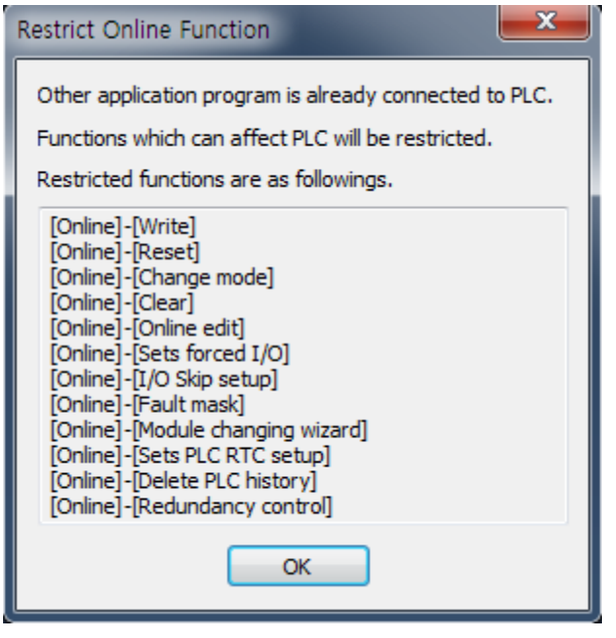
(31) If vibration or noise occurs when the motor is operating, adjust the response, inertia ratio, gain, etc. of the servo parameters and send it to the servo drive. For detailed settings such as auto-tuning, please use the setting tool dedicated to the servo drive.

(32) Write PLC program using XG5000.

(a) Create a new project. Select the“Project(P) – New Project(N) in menu and then set the project name.



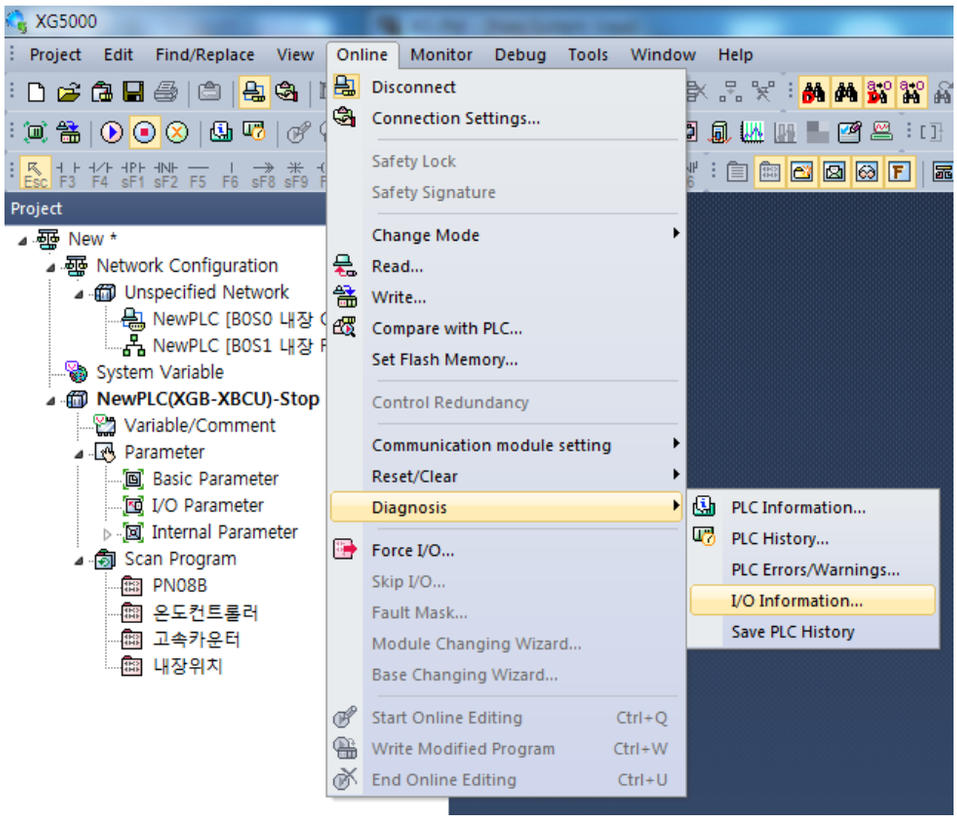
(b) Disconnect online between PLC CPU and XG-PM. If connecting XG5000 while XG-PM is connected, the following dialog box display and PLC function may be restricted. Connecting XG5000, and then connect the XG-PM.



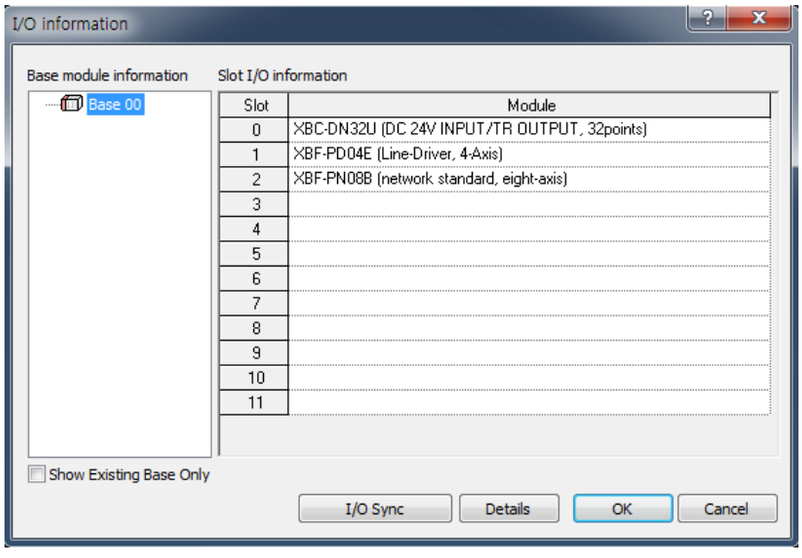
(c) Select “Online(O)- Connection Setting(O)”in XG5000 to select connection method and select“Online (O)-Connection (O)”to connect the PLC CPU.

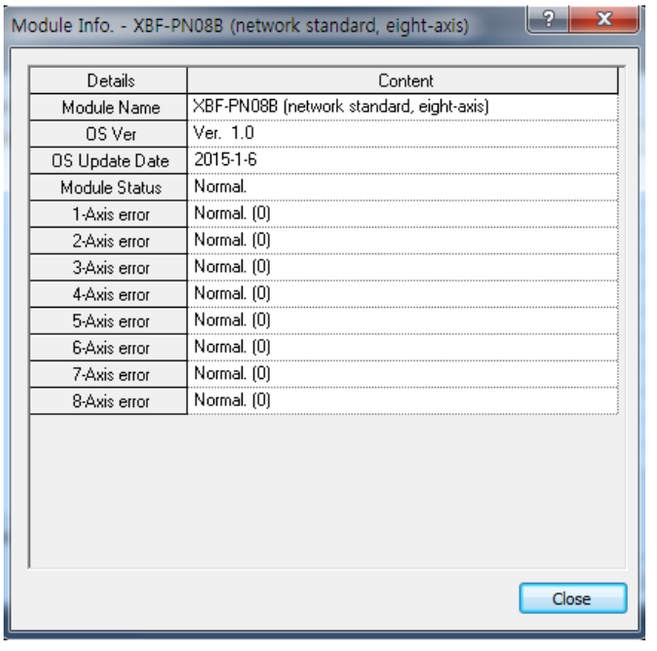
(d) Set the status of PLC CPU to “Stop”.

(e) Select “Online(O) – I/O Information(I)” to check the I/O information mounted in current PLC.

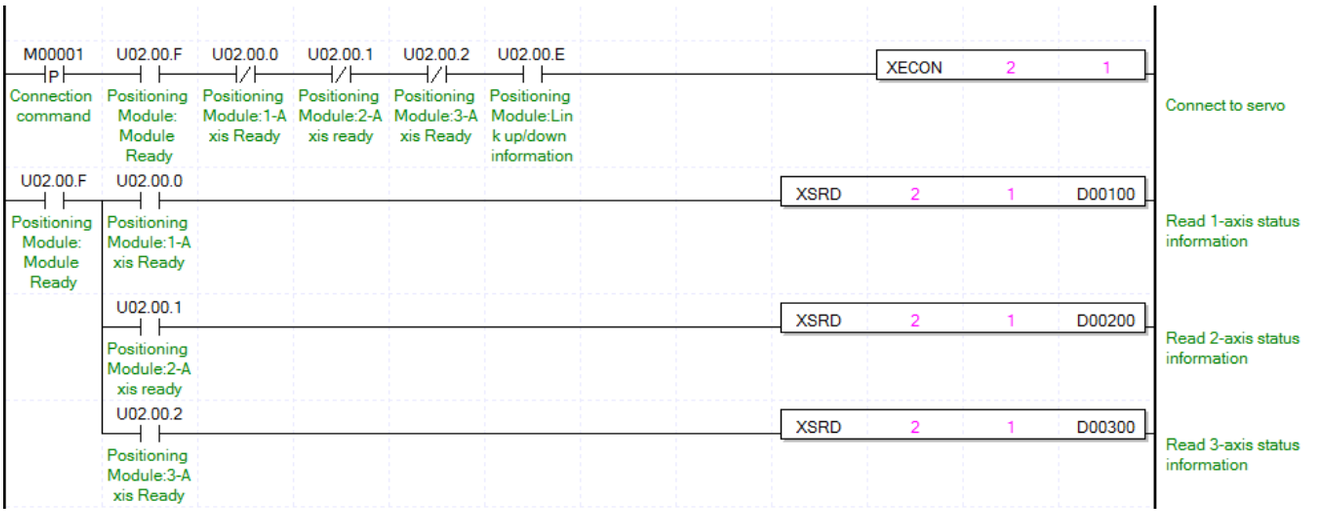


(f) Check whether installation I/O information of XBF-PN08B display correctly in I/O information window to view the version information of relevant module, select relevant module and the click “Detail Information (D)”buttons.





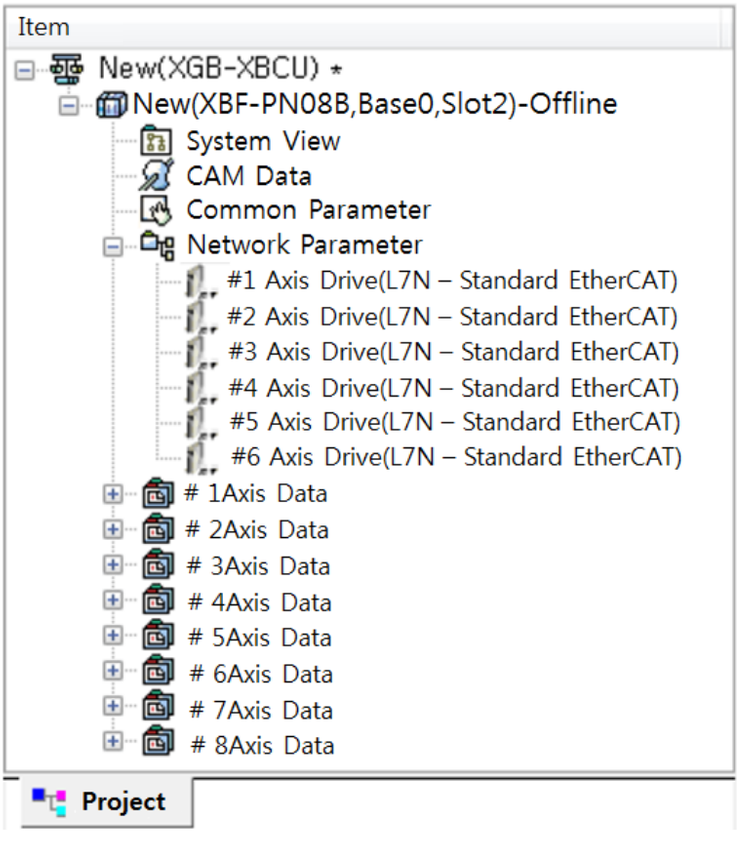
(g) Click " I/O Sync(S)" button in I/O information window to set the I/O parameters.
(h) Select "Edit(E) - U device auto-registration(G) in menu to enroll U devices automatically.
(i) The following example is using XGB-XBCU CPU and setting 2 servo to axis 1 and axis2, and connect using XECON, and read axis' status information of connected axis using XSRD. The rest can be added according to your needs.



Appendix 5 Virtual axis setting

It describes how to set when using the virtual axis the function at the beginning.

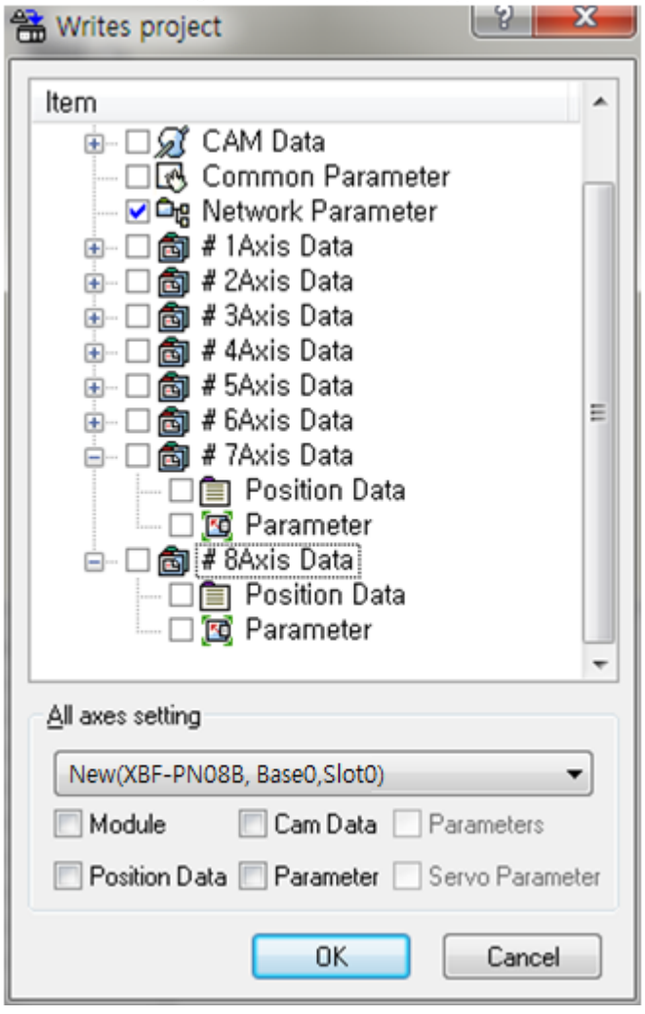
1. Set servo drive before virtual axis setting.



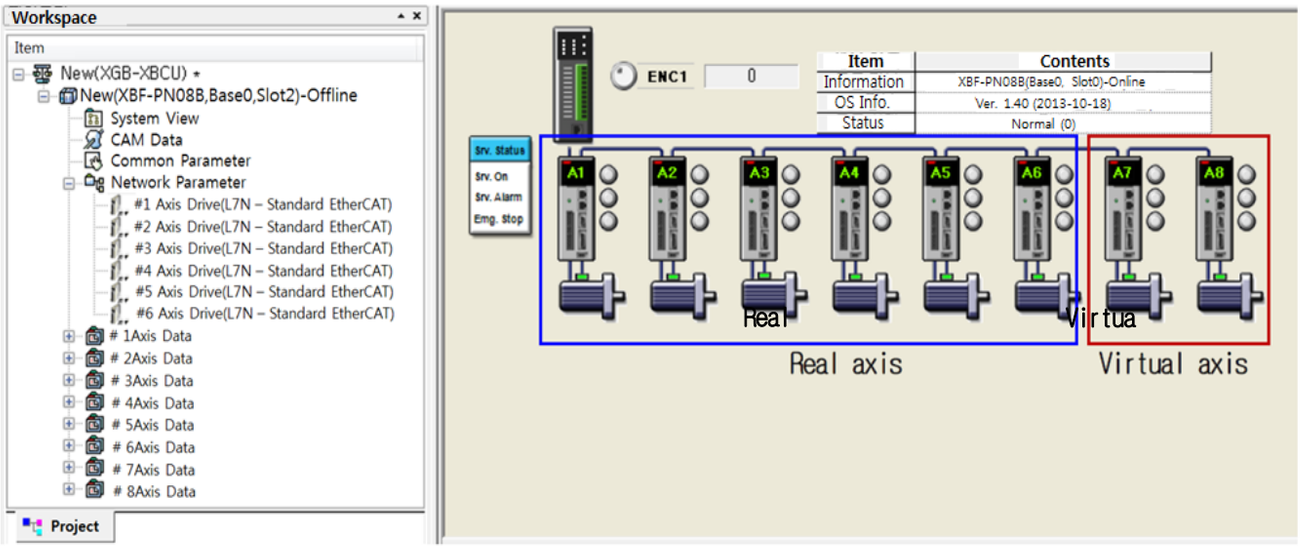
2. Set the virtual axis to ab unused axis that is connected to servo drive. The virtual axis setting can be set in basic parameter of operation parameter. Recommend setting the virtual axis to be set later than the axis. For example, if using 6 servo drives in XBF-PN08B module, axis 1 to axis 6 is set in real axis and axis 7 and axis 8 are set in virtual axes.
   The virtual can set all axis except real axis set within the number of control axis. As shown above, if using 6 axes as real axis in XBF-PN08B module, you can use to set the rest 2 axes as virtual axis.

	Item	6Axis	7Axis	8Axis
Basic Parameter	Axis Type	0: Real Axis	1: Virtual Axis	1: Virtual Axis
	Unit	0: pulse	0: pulse	0: pulse
	Pulse per rotation	524288 pls	524288 pls	524288 pls
	Travel per rotation	20000 pls	20000 pls	20000 pls
	Unit multiplier	0: x1	0: x1	0: x1
	Speed command unit	0: Unit/Time	0: Unit/Time	0: Unit/Time
	Speed limit	20000000 pls/s	20000000 pls/s	20000000 pls/s
	Acc. time1	500 ms	500 ms	500 ms
	Acc. time2	1000 ms	1000 ms	1000 ms
	Acc. time3	1500 ms	1500 ms	1500 ms
	Acc. time4	2000 ms	2000 ms	2000 ms
	Dec. time1	500 ms	500 ms	500 ms
	Dec. time2	1000 ms	1000 ms	1000 ms
	Dec. time3	1500 ms	1500 ms	1500 ms
	Dec. time4	2000 ms	2000 ms	2000 ms
	Dec. time for emg. stop	0 ms	0 ms	0 ms
	Encoder select	0: Incremental Encoder	0: Incremental Encoder	0: Incremental Encoder
	Cur. Pos. compensation amount	0 pls	0 pls	0 pls
	User defined position display magnification	0	0	0
	User defined speed display magnification	0	0	0

3. If the network parameter and operation parameter is completed, connect between PLC and communication to write project. The virtual axis setting can be set in operation parameters.



4. Execute the network connection and check whether the real axis and virtual axis are connected normally. If the real axis set as a virtual axis, error (5031) occurs on the axis during connecting to the network.



5. The commands that does not support in virtual axis is as follows. Except the following commands, it is possible to use the same with real axis.

Unsupported command for virtual axis	XBC Instructions	XEC function block
Position/torque switching control	XPTT	XPM_PTT
The external position/torque control switching torque	XSEST	XPM_SIPT
Servo error information read	-	XPM_SVERD
Servo alarm reset	XSCLR	XPM_SRST
Servo Error History Reset	XSECLR	XPM_SHRST
Servo drive parameter read	XSVPRD	XPM_SVPRD
Servo parameter write	XSVPWR	XPM_SVPWR
Servo parameter save	XSVSAVE	XPM_SVSAVE
Torque control	XTRQ	XPM_TRQ
Latch position data read	XLRD	XPM_LRD
Latch reset	XLCLR	XPM_LCLR
Latch setting	XLSET	XPM_LSET
Torque Synchronization	XSTC	XPM_STC

6. Version information supporting virtual axis is as follows.

Item	Supported version
XG5000	V4.11 or higher
XBF-PN04B	V1.20 or higher
XBF-PN08B	V1.20 or higher

Warranty

1. Warranty Period

The product you purchased will be guaranteed for 18 months from the date of manufacturing.

2. Scope of Warranty

Any trouble or defect occurring for the above-mentioned period will be partially replaced or repaired. However, please note the following cases will be excluded from the scope of warranty.

(1) Any trouble attributable to unreasonable condition, environment or handling otherwise specified in the manual,
(2) Any trouble attributable to others' products,
(3) If the product is modified or repaired in any other place not designated by the company,
(4) Due to unintended purposes
(5) Owing to the reasons unexpected at the level of the contemporary science and technology when delivered.
(6) Not attributable to the company; for instance, natural disasters or fire

3. Since the above warranty is limited to PLC unit only, make sure to use the product considering the safety for system configuration or applications.

Environmental Policy

LS ELECTRIC Co., Ltd supports and observes the environmental policy as below.

Environmental Management

LS ELECTRIC considers the environmental preservation as the preferential management subject and every staff of LS ELECTRIC use the reasonable endeavors for the pleasurably environmental preservation of the earth.

About Disposal

LS ELECTRIC' PLC unit is designed to protect the environment. For the disposal, separate aluminum, iron and synthetic resin (cover) from the product as they are reusable.

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