LS ELECTRIC

XMC Motion Controller

LS XMC ETHERCAT
MOTION CONTROLLER

Motion Controller (with embedded I/O)

- **XMC-E08A**
- **XMC-E08A-DC**
- **XMC-E16A**
- **XMC-E16A-DC**

The XMC programmable motion controller pairs advanced automation with a cost-effective and user-friendly engineering solution. The XMC series delivers high performance EtherCAT-based motion control functions along with a variety of embedded functions and high-tech capabilities specialized for various motion tasks.

The XMC series delivers an optimized solution to a system that has a need for motion control. With 8 digital inputs / 16 digital outputs, analog inputs (2ch) / analog outputs (2ch), encoder inputs (2ch) and an EtherCAT port, many applications can be deployed rapidly and easily. A built-in SD card slot is available for saving programs, downloading programs, and logging data. The XMC series is capable of high-speed program processing of 6.25 ns for a basic command. EtherCAT cycle times of 0.5/1/2/4 ms can be achieved depending on system setup.

XMC-E16A supports up to 16 EtherCAT servos and 32 EtherCAT slaves total. XMC-E08A supports up to 8 EtherCAT servos and 16 EtherCAT slaves total. EtherCAT devices such as I/O, AC drives, stepper drives, encoders, and robots may be connected to an XMC. The XMC series gives you advanced functionality by supporting CAM profiles, G-code, and robot control (Delta3, Delta 3R, Linear Delta, and others).

The XMC series offers an advanced level of programming, featuring the IEC61131-3 standard capable of Ladder and Structured Text. Motion programming is compliant to the PLCopen standard. All development and commissioning are done within the free-to-download XG5000 programming software. XG5000's various bult-in motion control and CNC control functions can be applied to a wide range of machines including packaging machines, dedicated CNC, XYZ cartesian coordinate systems and Delta robots.
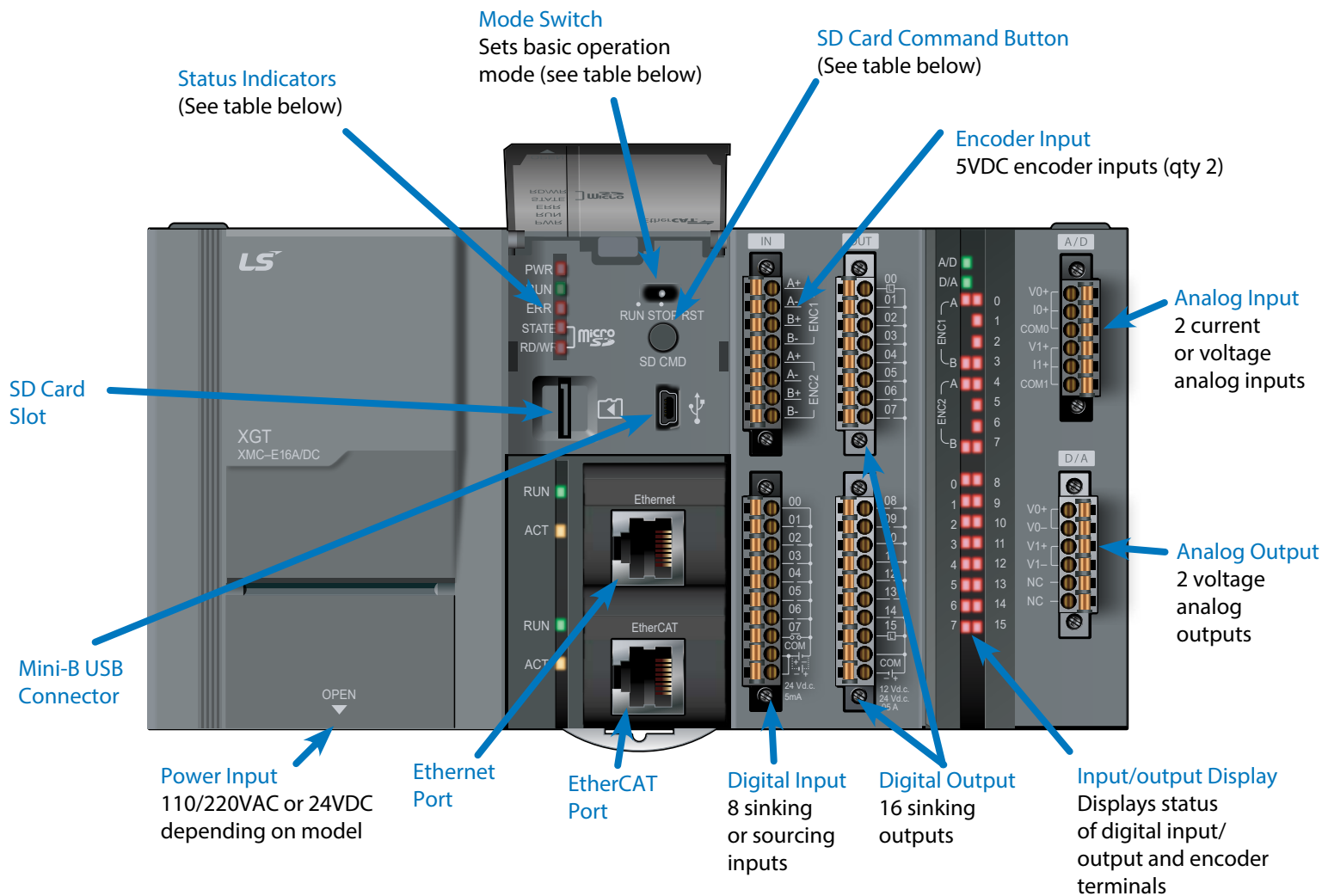
Features

- EtherCAT port supports up to 16 motion axis and 32 slave devices (depending on XMC model)
- Ethernet port supports ModbusTCP and socket programming.
- 8 digital inputs
- 16 digital outputs
- 2-channel analog inputs
- 2-channel analog outputs
- 2-channel encoder inputs
- For additional IO, use XEL-BSSCT with XGB IO
- Built-in SD card slot
- XG5000 software with IEC 61131 programming languages (Ladder, Structured Text), User Defined tags/ function blocks, 64 bit data types, and motion axis graphing
- Motion function blocks compliant to the PLCopen standard.
- G-code and robot control supported
- PID control available with XG5000 function block
- DIN-rail mountable

Motion Controller Feature Breakdown

Part Number	Price	Built-in I/O* EtherCAT Motion Axis	Inputs	Outputs	USB	Ethernet	Max EtherCAT Slaves	Memory Backup	Online Editing	Drawing
XMC-E08A	$857.00	8					16	Memory: Non-Volitale RAM RTC: 6 month backup (MS920T battery)	Yes	PDF
XMC-E08A-DC	$857.00	8	8	16	Yes	Yes				PDF
XMC-E16A	$959.00	16					32			PDF
XMC-E16A-DC	$959.00	16								PDF

* To add additional I/O, use XEL-BSSCT bus coupler and XGB series I/O modules.

LS ELECTRIC

XMC Motion Controller

XMC Configuration

Mode Switch
Sets basic operation mode (see table below)

SD Card Command Button
(See table below)

Status Indicators
(See table below)

Encoder Input
5VDC encoder inputs (qty 2)

Analog Input
2 current or voltage analog inputs

SD Card Slot

Analog Output
2 voltage analog outputs

Mini-B USB Connector

Power Input
110/220VAC or 24VDC depending on model

Ethernet Port

EtherCAT Port

Digital Input
8 sinking or sourcing inputs

Digital Output
16 sinking outputs

Input/output Display
Displays status of digital input/output and encoder terminals

Status Indicators	
Indicator	**Function**
PWR	Red LED is illuminated when power is ON.
RUN	Green LED is illuminated when XMC is in RUN mode.
ERR	Red LED is illuminated to indicate program error(s).
STATE	Red LED is illuminated when SD card is installed or flickering for an SD card error.
RD/WR	Red LED is flickering during SD card read/write.

Mode Switch	
Position	**Function**
RUN	Executes user program.
STOP	Normal program load position. Allows for Remote Run from XG5000.
RST	Reset program operation.

SD Card Command Button	
Action	**Function**
Press less than 3 seconds	SD Card additional functions such as program back-up, program recovery, and program comparison.
Press more than 3 seconds	Enable or Disable SD card.
Pressing while Powering Up	Performs SD Card boot operations.

LS ELECTRIC

XMC Motion Controller

Performance Specifications

<table>
<tr><th rowspan="2" colspan="3">Specification</th><th colspan="4">Part Number</th></tr>
<tr><th>XMC-E08A</th><th>XMC-E16A</th><th>XMC-E08A-DC</th><th>XMC-E16A-DC</th></tr>
<tr><td rowspan="21">Power Specifications</td><td rowspan="6">Input</td><td colspan="2">Input Voltage Range</td><td colspan="2">100–240 VAC (50/60Hz)</td><td colspan="2">19.2–28.8 VDC</td></tr>
<tr><td colspan="2">Input Current</td><td colspan="2">0.7 A or less (110VAC)
0.4 A or less (120VAC)</td><td colspan="2">1.6 A or less</td></tr>
<tr><td colspan="2">Inrush Current</td><td colspan="2">120A peak or less (240VAC, Phase 90 degree)</td><td colspan="2">100A peak or less (28.8 VDC)</td></tr>
<tr><td colspan="2">Leakage Current</td><td colspan="4">3mA or less</td></tr>
<tr><td colspan="2">Efficiency</td><td colspan="4">65% or more</td></tr>
<tr><td colspan="2">Acceptable External Power Drop</td><td colspan="4">10ms or less</td></tr>
<tr><td rowspan="15">Output</td><td rowspan="2">Output Voltage Ripple Range</td><td>+5V</td><td colspan="2">4.90–5.20 V</td><td colspan="2">5.90–5.15 V</td></tr>
<tr><td>+24V</td><td colspan="2">21.1–26.9 V</td><td colspan="2">–</td></tr>
<tr><td rowspan="2">Output Current</td><td>+5V</td><td colspan="4">4A</td></tr>
<tr><td>+24V</td><td colspan="2">0.4A</td><td colspan="2">–</td></tr>
<tr><td rowspan="2">Ripple</td><td>+5V</td><td colspan="4">100mVpp or less</td></tr>
<tr><td>+24V</td><td colspan="2">400mVpp or less</td><td colspan="2">–</td></tr>
<tr><td rowspan="2">Noise</td><td>+5V</td><td colspan="4">200mVpp or less</td></tr>
<tr><td>+24V</td><td colspan="2">400mVpp or less</td><td colspan="2">–</td></tr>
<tr><td rowspan="2">Overcurrent Protection</td><td>+5V</td><td colspan="4">4.4 A or higher</td></tr>
<tr><td>+24V</td><td colspan="2">0.44A or higher</td><td colspan="2">–</td></tr>
<tr><td colspan="3">Operation Method</td><td colspan="4">Main task/Periodic task: Fixed cyclic operation, initialization task: executed when entering RUN mode.</td></tr>
<tr><td colspan="3">Control Cycle Time</td><td colspan="4">Main task time: 0.5 ms, 1ms, 2ms, 4ms. Periodic task time: multiple setting of main task.</td></tr>
<tr><td colspan="3">I/O Control method</td><td colspan="4">Synchronized with main task</td></tr>
<tr><td colspan="3">Programming Languages</td><td colspan="4">LD (Ladder Diagram), ST (Structured Text), G-Code</td></tr>
<tr><td colspan="3">Special Features/Instructions</td><td colspan="4">User Defined Data Type, User Defined Functions/Function Blocks</td></tr>
<tr><td rowspan="3">Calculation Processing Speed</td><td colspan="2">Basic</td><td colspan="4">6.25 ns or more (general point/coil)</td></tr>
<tr><td colspan="2">MOVE</td><td colspan="4">5ns or more (Word type)</td></tr>
<tr><td colspan="2">Arithmetic</td><td colspan="4">30ns or more (Word type)</td></tr>
<tr><td rowspan="2">Program Memory</td><td colspan="2">Quantity</td><td colspan="4">Maximum 256</td></tr>
<tr><td colspan="2">Capacity</td><td colspan="4">10MB (motion program), 10MB (NC program)</td></tr>
<tr><td rowspan="8">Data Memory</td><td colspan="2">Symbolic Variable (A)</td><td colspan="4">4,096 kB (retain setting available up to 2,048 kB)</td></tr>
<tr><td colspan="2">Input Variable (I)</td><td colspan="4">16kB</td></tr>
<tr><td colspan="2">Output Variable (Q)</td><td colspan="4">16kB</td></tr>
<tr><td colspan="2">Direct Variable (M)</td><td colspan="4">2,048 kB (configurable up to 1,024 kB)</td></tr>
<tr><td rowspan="3">Flag Variable</td><td>F</td><td colspan="4">128kB</td></tr>
<tr><td>K</td><td colspan="4">18kB</td></tr>
<tr><td>U</td><td colspan="4">1kB</td></tr>
<tr><td colspan="3">Timer</td><td colspan="4">Time range: 0.001–4,294,967.295 seconds (1,193 hours)</td></tr>
<tr><td colspan="3">Counter</td><td colspan="4">Counting range: 64-bit range</td></tr>
<tr><td colspan="3">Available Program Types</td><td colspan="4">Initialization program, main task program, periodic task program, NC program</td></tr>
<tr><td colspan="3">Operation Mode</td><td colspan="4">RUN, STOP</td></tr>
<tr><td colspan="3">Restart Mode</td><td colspan="4">Cold, Warm</td></tr>
<tr><td colspan="3">Diagnostic Functions</td><td colspan="4">Cyclic error monitoring, program watchdog time, memory monitoring, power monitoring, etc.</td></tr>
<tr><td colspan="3">Data Retention in Case of Power Failure</td><td colspan="4">Retained memory and variables are backed up when power failure is detected.</td></tr>
</table>

LS ELECTRIC

XMC Motion Controller

Built-in Functions

Specification		XMC-E08A	XMC-E16A	XMC-E08A-DC	XMC-E16A-DC
		Part Number			
EtherCAT Control	**Real/Virtual Axes**	8	16	8	16
	Dedicated Virtual Axis	1	2	1	2
	Slave (including real axes)	16	32	16	32
Supported EtherCAT Devices		CoE: CANopen over EtherCAT, FoE: File Access over EtherCAT			
Communication Period		0.5 ms, 1ms, 2ms, 4ms (same as the Main Task period)			
Servo Drive Support		Only EtherCAT servo drives that use CANopen over EtherCAT (CoE)			
Control Unit		Pulse, mm, inch, degree			
Control Method		Position, Velocity, Torque (servo drive support), Synchronous, Interpolation Control			
Position Address Range		± LREAL, 0			
Speed Range		± LREAL, 0			
Torque Unit		Rated torque % designation			
Acceleration/Deceleration Processing		Trapezoid type, S-type (setting by specifying Jerk at a function block)			
Range of Acceleration/Deceleration		+ LREAL[1], 0			
Manual Operation		JOG Operation			
Cam Operation		8 profiles, 8,192 points	16 profiles, 16,384 points	8 profiles, 8,192 points	16 profiles, 16,384 points
Absolute Position System		Available (when using an absolute encoder type servo drive)			
Digital I/O	**Digital Input**	8 points			
	Digital Output	16 points (transistor)			
	Encoder Input	2 channels Max input: 500Kpps Input method: Line drive, Voltage input Input Type: CW/CCW, Pulse/Direction, Phase A/B			
Analog Input/ Output	**Analog Input**	2 channels Voltage input range: -10 to 10VDC / 0 to 10VDC / 1 to 5VDC / 0 to 5VDC Current input range: 4–20mA / 0–20mA Max. resolution: 14 bit (1/16,000)			
	Analog Output	2 channels Voltage output range: -10 to 10VDC / 0 to 10VDC / 1 to 5VDC / 0 to 5VDC Max. resolution: 14 bit (1/16,000)			
Coordinate System (Robot)		Cartesian, Detla			
SD Memory	**Memory Type**	Mirco SDHC			
	File System	FAT32			
	Maximum Capacity	32GB (memory over 8GB can only use 8GB of overall area)			
	Functions	Program back-up/restoration, booting operation, data logging			
Ethernet	**Communication Speed**	Auto / 10Mbps / 100Mbps			
	Communication Port	1 port			
	Commmunication Distance	Max. 100m betwen slaves			
	Service	Loader service (XG5000) LS Electric protocol supported (XGT, MODBUS TCP) FTP server: read and write files from the SD card SNTP client			
USB		USB 2.0, 1 channel			
Error Indication		Indicated by LED			
Weight		790g [1.74 lbs]			

1 - LREAL range: 2.22507385585072e-308 to 1.79759313486232e+308. Long real number (+LREAL) positive range: $0 < x \leq 1.79769313486232e+308$

LS ELECTRIC

XMC Motion Controller

EtherCAT Communication Specifications

Item	Specifications
Communication Protocol	EtherCAT
Support Specification	CoE (CANopen over EtherCAT)
Physical Layer	100BASE-TX
Communication Speed	100Mbps
Topology	Daisy chain
Communication Cable	Cat 5 STP (Shielded Twisted-pair) cable
Max Number of Slaves	E16A / E16A-DC = 32 (max 16 motion axes) E08A / E08A-DC = 16 (max 8 motion axes)
Communication Period	0.5 ms / 1ms / 2ms / 4ms
Synchronous Jitter	Less than 1µs
Synchronous Communication	PDO (Process Data Object) mapping through CoE
Communication Setting	Set the communication configuration using XG5000
Maximum Transmission Distance	100m
Communication Status Indicator	LED

Environmental Specifications, all XMC Series Modules

Item				Specification	Reference
Ambient Operating Temperature				0–55℃ (32–131°F)	–
Storage Temperature				-25–70℃ (-13–158°F)	
Ambient Operating Humidity				5–95% relative humidity (non-condensing)	
Storage Humidity				5–95% relative humidity (non-condensing)	
Vibration[1]	Occasional Vibration	Frequency	$5 \leq f < 8.4\ Hz$	3.5 mm pulse width	IEC61131-3-2
			$8.4 \leq f < 150Hz$	$9.8\ m/s^2$ (1G)	
	Continuous Vibration		$5 \leq f < 8.4\ Hz$	1.75 mm pulse width	
			$8.4 \leq f < 150Hz$	$4.9\ m/s^2$ (0.5G)	
Shocks		Peak Acceleration		$147\ m/s^2$ (15G)	
		Duration		11ms	
		Pulse Wave Type		Half-sine (3 times each direction per each axis)	
Noise Resistance	Square Wave Impulse Noise			±1,500VAC ±900VDC	LS Electric standard
	Electrostatic Discharge			Voltage: 4kV (contact discharge)	IEC61131-3-2 IEC61000-4-2
	Radiated Electromagnetic Field Noise			80–1,000 MHz, 10 V/m	IEC61131-3-2 IEC61000-4-3
	Fast Transient / Burst Noise	Classification		Voltage	IEC61131-3-2 IEC61000-4-4
		Power Supply		2kV	
		Digital/Analog Input/Output Communication Interface		1kV	
Environment				Free from corrosive gases and excessive dust	–
Attitude				Up to 2,000m	
Pollution Degree				Less than or equal to 2 (see note 2)	
Cooling Method				Air-cooling	

1 - Vibration of 10 times each direction (X, Y, and Z)
2 - Normally only nonconductive pollution occurs. Temporary conductivity caused by condensation is to be expected.

LS ELECTRIC

XMC Motion Controller

Digital Input Specifications

8-point 24VDC Input (Sink/Source Type) Specifications

Model	XMC-E08A	XMC-E16A	XMC-E08A-DC	XMC-E16A-DC
Input Point	8 points			
Insulation Method	Photocoupler Insulation			
Rated Input Volage	24VDC			
Rated Input Current	About 5mA			
Operation Voltage Range	20.4–28.8 VDC (within ripple rate 5%)			
On Voltage	19VDC or higher			
On Current	3mA or higher			
Off Voltage	6VDC or less			
Off Current	1mA or less			
Input Resistance	About 4.7 kΩ			
Response Time — Off → On / On → Off	0.5/1/3/5/10/20/70/100 ms (set by I/O parameter) Default: 3ms			
Insulation Pressure	AC560Vrms / 3 cycle (altitude 2000m)			
Insulation Resistance	10MΩ or more by MegOhmMeter			
Common Method	8 point / COM			
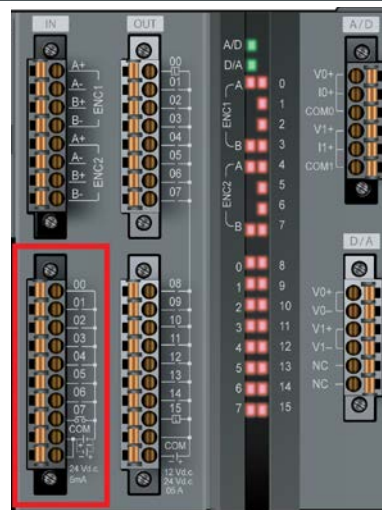
Note: Red box highlights pins of the CPU inputs.

8-point 24VDC Input (Sink/Source Type) Circuit Configuration

Circuit Configuration	XMC Pin#	I/O Direct Variable	Description
	00	%IX0.0.0	General Input
	01	%IX0.0.1	
	02	%IX0.0.2	
	03	%IX0.0.3	
	04	%IX0.0.4	
	05	%IX0.0.5	
	06	%IX0.0.6	
	07	%IX0.0.7	
	COM	–	Common
	COM	–	

LS *ELECTRIC*

XMC Motion Controller

Digital Output Specifications
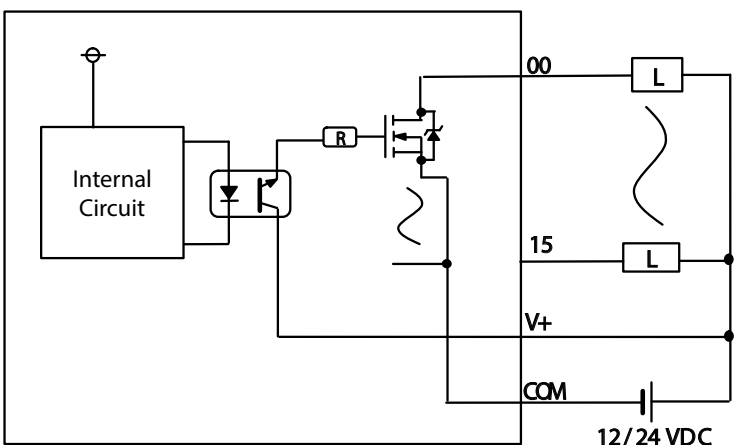
16-point Transistor Output (Sink Type) Specifications

Model		XMC-E08A	XMC-E16A	XMC-E08A-DC	XMC-E16A-DC
Output Point		16 points			
Insulation Method		Photocoupler Insulation			
Rated Load Volage		12VDC / 24VDC			
Operation Load Voltage Range		10.2–26.4 VDC			
Max. Load Current		0.5 A / 1 point, 2A / 1COM			
Off Leakage Current		0.1 mA or less			
Max. Inrush Current		4A / 10ms or less			
Max. Voltage Drop when On		0.4 VDC or less			
Over Voltage Protection		Zener diode			
Response Time	**Off → On**	1ms or less			
	On → Off	1ms or less (rated load, resistive load)			
Common Method		16 point / COM			
External Power	**Voltage**	12VDC / 24VDC ± 10% (ripple voltage 4 Vp-p or less)			
	Current	10mA or less (when connecting 24VDC)			
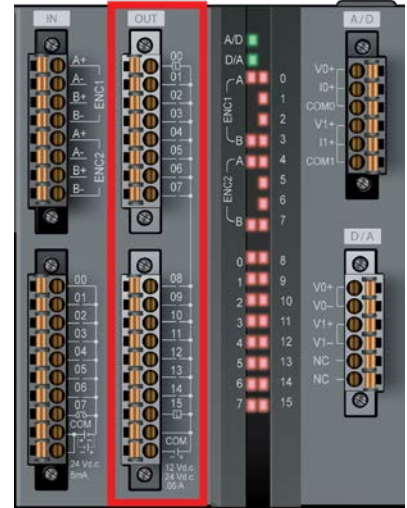
Note: Red box highlights pins of the CPU outputs.

16-point Transistor Output (Sink Type) Circuit Configuration

Circuit Configuration		XMC Pin#	I/O Direct Variable	Description
		00	%QX0.0.0	
		01	%QX0.0.1	
		02	%QX0.0.2	
		03	%QX0.0.3	
		04	%QX0.0.4	
		05	%QX0.0.5	
		06	%QX0.0.6	
		07	%QX0.0.7	General Output 0.5 A / pt
		08	%QX0.0.8	
		09	%QX0.0.9	
		10	%QX0.0.10	
		11	%QX0.0.11	
		12	%QX0.0.12	
		13	%QX0.0.13	
		14	%QX0.0.14	
		15	%QX0.0.15	
		V+	–	+24VDC from supply
		COM	–	0VDC from supply

LS ELECTRIC

XMC Motion Controller

Example Wiring with iX7NH Servo

Notes:

1: Example wiring for 5V open collector encoder
2: Example wiring for 5V line driver encoder
3: When connecting more than 2 servo drives, connect first servo's IN to the motion controller's OUT. For the other servos, connect previous servo's OUT to the next servo's IN. Continue for each servo - the final servo in the chain does not need anything connected to OUT.
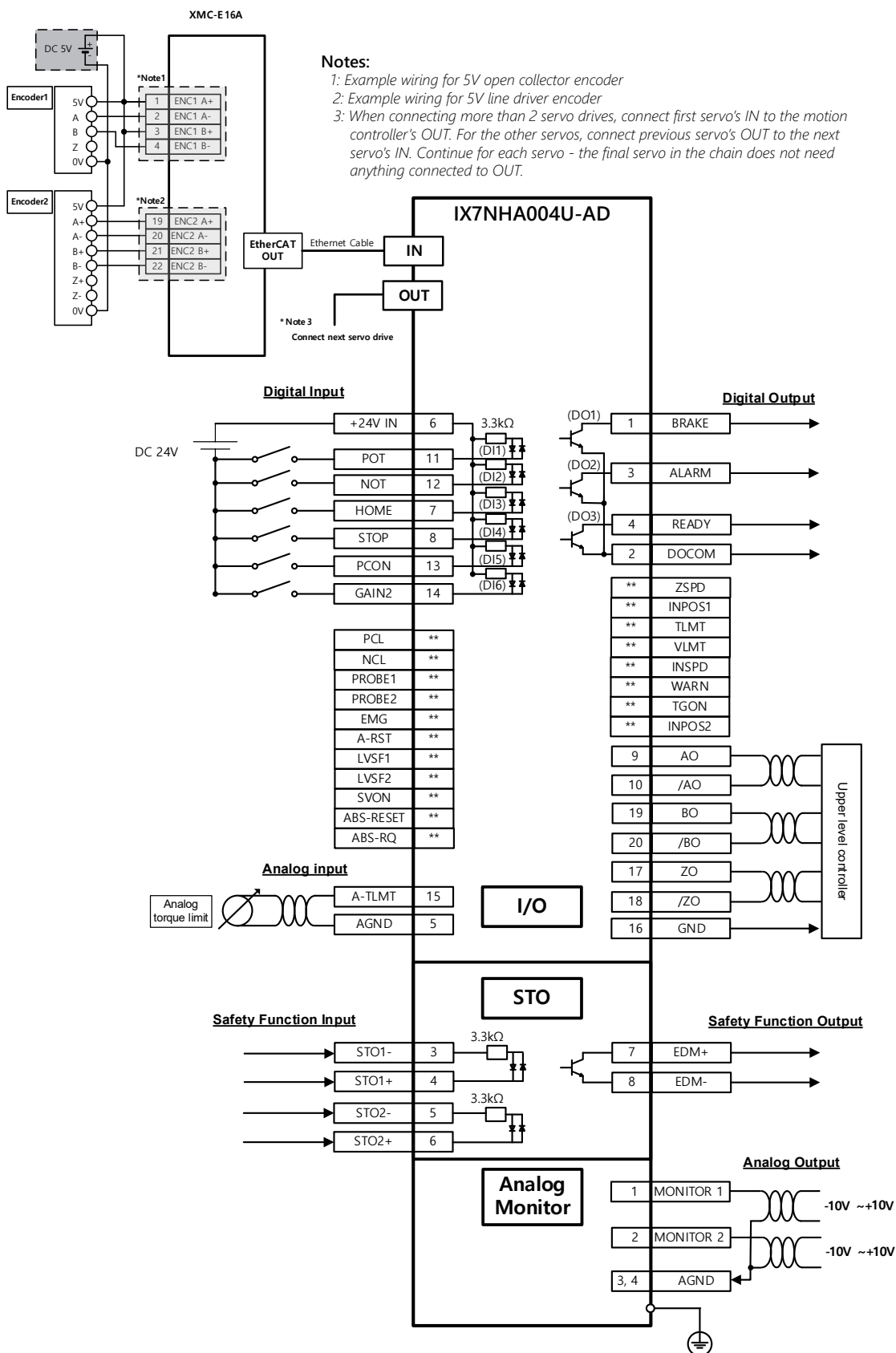
Example Wiring with PHOX Servo

Notes:
1: Example wiring for 5V open collector encoder
2: Example wiring for 5V line driver encoder
3: When connecting more than 2 servo drives, connect first servo's IN to the motion controller's OUT. For the other servos, connect previous servo's OUT to the next servo's IN. Continue for each servo - the final servo in the chain does not need anything connected to OUT.

PHOX-03-080NS-AD

XMC-E16A

DC 5V

Encoder1
5V	1	ENC1 A+
A	2	ENC1 A-
B	3	ENC1 B+
Z	4	ENC1 B-
0V		

*Note1

Encoder2
5V		
A+	19	ENC2 A+
A-	20	ENC2 A-
B+	21	ENC2 B+
B-	22	ENC2 B-
Z+		
Z-		
0V		

*Note2

EtherCAT OUT — Ethernet Cable — **IN**

OUT

* Note 3
Connect next servo drive

Digital Input

DC 24V

DICOM	10	
POT	/11	(DI1)
NOT	/12	(DI2)
HOME	/13	(DI3)
STOP	/14	(DI4)

3.92kΩ

A-RST	**
START	**
REGT	**
EMG	**
HSTART	**
SVON	**
ISEL0	**
ISEL1	**
ISEL2	**
ISEL3	**
ISEL4	**
ISEL5	**
PCON	**
GAIN2	**
PCL	**
NCL	**
SPD1	**
SPD2	**
SPD3	**
MODE	**
PAUSE	**
ABS_RQ	**
JSTART	**
JDIR	**
PCLR	**
AOVR	**
PROBE1	**
PROBE2	**

Digital Output

(DO1)	15	BRAKE
(DO2)	16	ALARM
(DO3)	17	READY
(DO4)	18	ZSPD
	25	DOCOM

24VDC

43	INPOS1
**	ORG
**	EOS
**	TGON
**	TLMT
**	VLMT
**	INSPD
**	WARN
**	INPOS2
**	IOUT0
**	IOUT1
**	IOUT2
**	IOUT3
**	IOUT4
**	IOUT5

I/O

Note: Line Driver output 30mA max

Upper Level Controller

Line Driver

PF+	1
PF-	2
PR+	3
PR-	4

Analog Input -10V~+10V

AI+	6
AI-	7

Line Driver

19	AO
20	/AO
21	BO
22	/BO
23	ZO
24	/ZO

Upper Level Controller

Analog Output

8	AO1	-10V ~+10V
5	AGND	
9	AO2	-10V ~+10V
5	AGND	

LS ELECTRIC

XMC Motion Controller

Mounting the Motion Controller

When mounting the completed XMC controller to your structure, keep the distances shown in the diagram below to maintain proper ventilation and allow easy detachment and attachment.

30 mm or more

20 mm or more
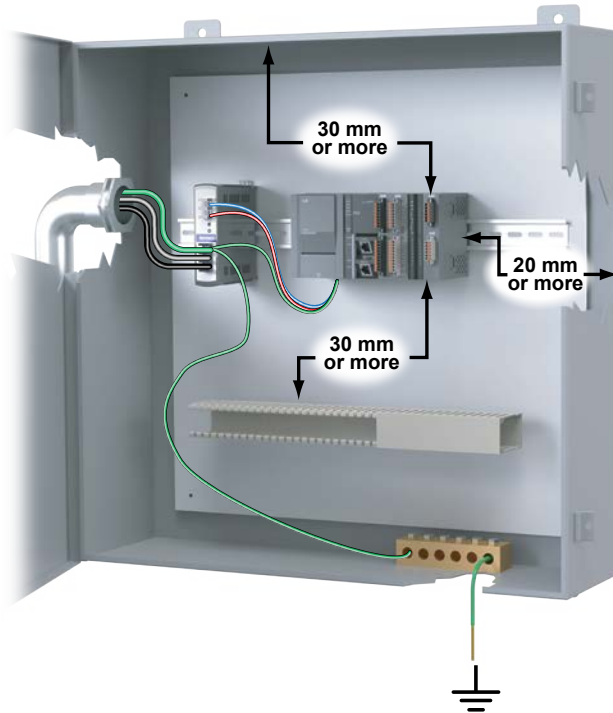
30 mm or more

Additional Clearance Distances:
- Wire duct on the side requires 5mm or more
- Panel wall on the side requires 20mm or more
- Another device on the side requires 50mm or more
- Another device in front requires 100mm or more

DIN Rail Mounting

The motion controller has a hook for DIN rail mounting (35mm). To mount to DIN rail:

- Pull the hook as shown below at the bottom of module and install it at the DIN rail.
- Push the hook to fix the module to the rail after installing.

OK

AIRFLOW

LS ELECTRIC
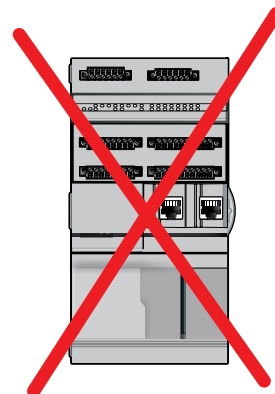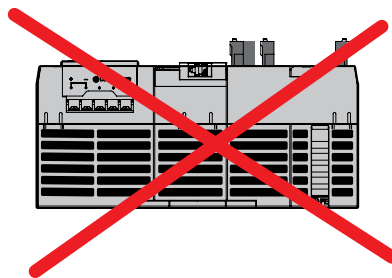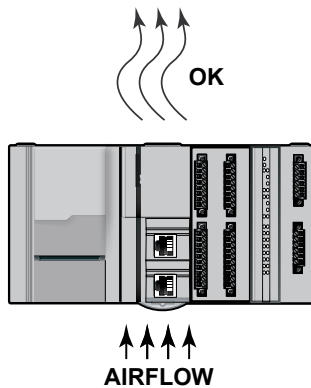
XMC Motion Controller

Motion Function Blocks

MC function blocks are compliant to the PLCopen standard.

Single-axis Command

Single-axis Command	Function
MC_Power	Servo On/Off
MC_Home	Perform the homing procedure
MC_Stop	Stop motion and cancel ongoing commands
MC_Halt	Stop motion
MC_MoveAbsolute	Absolute positioning operation
MC_MoveRelative	Relative positioning operation
MC_MoveAdditive	Additive positioning operation
MC_MoveVelocity	Velocity operation
MC_SyncMoveVelocity	Cyclic Synchronous Velocity control
MC_MoveContinuousAbsolute	Absolute position operation ending with velocity operation
MC_MoveContinuousRelative	Relative position operation ending with velocity operation
MC_TorqueControl	Torque control
MC_ReadParameter	Read Parameter
MC_WriteParameter	Write Parameter
MC_Reset	Reset axis error
MC_TouchProbe	Touch probe and Position Registration
MC_AbortTrigger	Abort trigger events
MC_MoveSuperImposed	SuperImposed operation
MC_HaltSuperImposed	SuperImposed operation halt
MC_SetPosition	Setting the current position
MC_SetOverride	Velocity/Acceleration override

Axis Group Command

Axis Group Command	Function
MC_AddAxisToGroup	Adds one axis to a group
MC_RemoveAxisFromGroup	Removes one axis from a group
MC_UngroupAllAxes	Removes all axes from the group
MC_GroupEnable	Changes the state for a group from GroupDisabled to GroupEnable
MC_GroupDisable	Changes the state for a group to GroupDisabled
MC_GroupPower	Servo ON/OFF for all axes in a group
MC_GroupHome	The AxesGroup to perform their homing procedure
MC_GroupSetPosition	Sets the Position of all axes in a group without moving
MC_GroupStop	Stop a Group immediately
MC_GroupHalt	Stop a Group
MC_GroupReset	Reset a group error
MC_MoveLinearAbsolute	Absolute positioning linear interpolation operation
MC_MoveLinearRelative	Relative positioning linear interpolation operation
MC_MoveCircularAbsolute	Absolute positioning circular interpolation operation
MC_MoveCircularRelative	Relative positioning circular interpolation operation
MC_SetKinTransform	Sets a kinematic transformation between the ACS and MCS
MC_SetCartesianTransform	Sets a Cartesian transformation between the MCS and PCS.
MC_MoveCircularAbsolute2D	Circular interpolation operation for absolute position of coordinate system
MC_MoveCircularRelative2D	Circular interpolation operation for relative position of coordinate system
MC_TrackConveyorBelt	Synchronization setting with a conveyor belt
MC_TrackRotaryTable	Synchronization setting with a rotary table

Multi-axis Command

Multi-axis Command	Function
MC_CamIn	Activate master-slave coupling with CAM profile
MC_CamOut	Deactivate master-slave CAM coupling
MC_GearIn	Activate master-slave linear coupling (gearing)
MC_GearInEx	Activate master-slave gearing with larger value ratios
MC_GearOut	Deactivate master-slave linear coupling (gearing)
MC_GearInPos	Activates master-slave coupling with a specific positional relationship
MC_HomeAll	Perform homing operation for all axes
MC_Phasing	Provides a constant phase shift between master and slave axis
MC_PowerAll	Servo ON/OFF for all axes
MC_Reset2All	Reset all axes errors
MC_SetPositionAll	Set all axes current position
MC_StopAll	Stop motion for all axes

LS Custom Function Blocks

LS Command	Function
LS_Connect	Connect EtherCAT network
LS_Disconnect	Disconnect EtherCAT network
LS_ReadSDO	Read slave SDO data
LS_WriteSDO	Write slave SDO data
LS_SaveSDO	Save slave SDO data
LS_EncoderPreset	Setting encoder current position
LS_Jog	JOG operation
LS_ReadCamData	Read CAM data
LS_WriteCamData	Write CAM data
LS_ReadEsc	Read ESC
LS_WriteEsc	Write ESC
LS_CamSkip	Skip CAM
LS_VarCamIn	Variable CAM operation
LS_VarGearIn	Variable gear operation
LS_VarGearInPos	Variable positioning gear operation
LS_ReadCAMtableSlavePos	Read the slave location of the CAM table
LS_InverterWriteVel	Write inverter speed
LS_InverterReadVel	Read inverter speed
LS_InverterControl	Write inverter control word
LS_InverterStatus1	Read inverter status 1
LS_InverterStatus2	Read inverter status 2
LS_SyncMoveVelocity	Speed control operation (csv mode)
LS_SetWorkSpaceTransform	Work space setting
LS_MoveLinearTimeAbsolute	Time- linear interpolation operation for absolute position of coordinate system
LS_MoveLinearTimeRelative	Time- linear interpolation operation for relative position of coordinate system
LS_RobotJOG	JOG operation of the coordinate system
LS_SetMovePath	Set path operation data
LS_ResetMovePath	Delete path operation data
LS_GetMovePath	Read path operation data
LS_RunMovePath	Perform path operation
LS_RotaryKnifeCamGen	Rotary knife cam profile generation
LS_CrossSealCamGen	Cross sealer cam profile generation

LS ELECTRIC

XMC Motion Controller

CNC Control Codes and Commands

G-code	
G-code	*Function*
G00	Rapid positioning control
G01	Linear interpolation feed control
G02	Clockwise circular / helical interpolation
G03	Counter clockwise circular / helical interpolation
G04	DWELL function
G09	Exact Stop
G17	Select the circular interpolation plane (XY plane)
G18	Select the circular interpolation plane (ZX plane)
G19	Select the circular interpolation plane (YZ plane)
G20	Inch input
G21	Metric input
G22	Stroke check function ON
G23	Stroke check function OFF
G27	Homing check
G28	Automatic homing
G29	Return at the auto-origin
G30	Automatic 2nd and 3rd homing
G31	Skip function
G40	Cancel compensation of tool diameter
G41	Compensate the tool diameter to the left
G42	Compensate the tool diameter to the right
G43	Compensate the tool length in the direction of +
G49	Cancel compensation of the tool length
G52	Set the local coordinate system
G53	Select the machine coordinate system
G54	Select the workpiece coordinate system 1
G55	Select the workpiece coordinate system 2
G56	Select the workpiece coordinate system 3
G57	Selecting the workpiece coordinate system 4
G58	Selecting the workpiece coordinate system 5
G59	Selecting the workpiece coordinate system 6
G60	Single direction positioning
G90	Absolute command
G91	Incremental command
G92	Set the workpiece coordinate system
G94	Feed mode command per minute
G95	Feed mode command per revolution
G107	Cylindrical interpolation mode setting
G112	Interpolation mode of the polar coordinate ON
G113	Interpolation mode of the polar coordinates OFF

Note: Please see section 9.3.2 of the XMC User Manual for a complete list of all available G-codes.

M-code	
M-code	*Function*
M00	Program stop
M01	Optional stop
M02	Program END
M03	Forward rotation of the main axis
M04	Reverse rotation of the main axis
M05	Main axis stop
M06	Tool change
M08	Coolant ON
M09	Coolant OFF
M30	End of the program
M98	Auxiliary program call
M99	End of the auxiliary program

NC Command Function Blocks	
NC Command	*Function*
NC_LoadProgram	Specify NC program
NC_CycleStart	Start automatic operation
NC_BlockControl	Specify Block operation
NC_FeedHold	Feed Hold
NC_Emergency	Emergency stop
NC_Reset	reset
NC_RapidTraverseOverride	Rapid traverse override
NC_CuttingFeedOverride	Cutting feed override
NC_SpindleOverride	Spindle override
NC_Home	Homing
NC_McodeComplete	M Code operation completed
NC_ScodeComplete	S Code operation completed
NC_TcodeComplete	T Code operation completed
NC_ReadParameter	Read NC parameters
NC_WriteParameter	Write NC parameters

Note: See section 6.8 of the XMC User Manual for a complete list of all available NC Command Function Blocks.

LS ELECTRIC

XMC Motion Controller

XG5000 PLC Programming and Motion Control

XG5000 is the only tool needed to deploy the XMC. It handles programming, motion control commands, manual commands, and status monitoring.

Project Tree
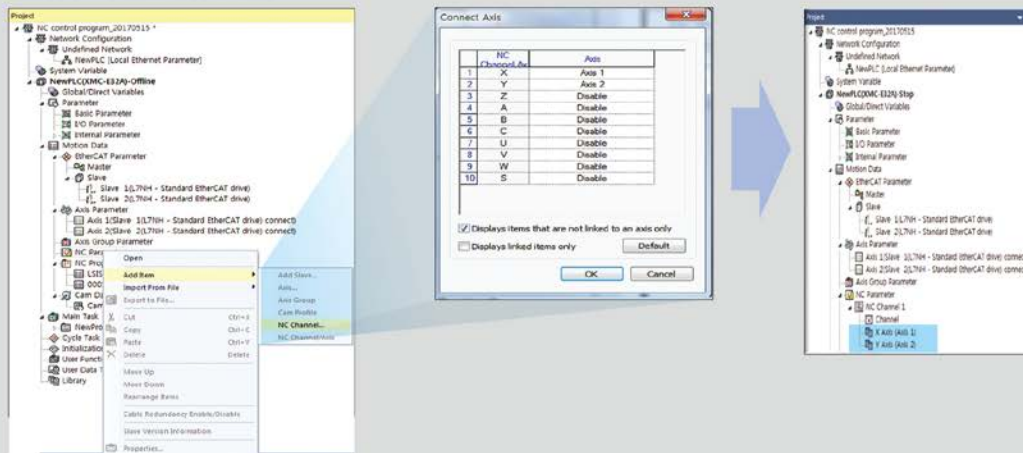
Motion Command

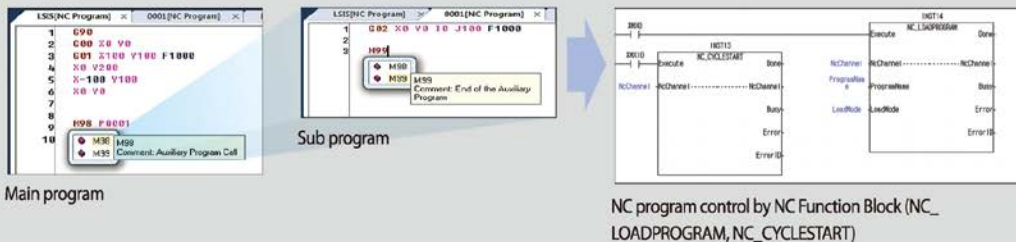**Status Monitor**

Program Editor

ESI Library

G-code Commands for Controlling CNC Equipment

Easily control CNC equipment such as packing and cutting machines with G-code commands.

Choose NC channel & axis

NC programming by G-code & M-code

Main program

Sub program

NC program control by NC Function Block (NC_LOADPROGRAM, NC_CYCLESTART)

LS ELECTRIC

XMC Motion Controller

Innovative Control Function for Robot Control

Control various types of robots using group motion in coordinate systems such as Cartesian, Delta3, Delta3R, and Linear Delta.

MC_SETKINTRANSFORM

Coordinate system Type	0: None
Coordinate system parameter1	0: None
Coordinate system parameter2	1: XYZ
Coordinate system parameter3	2: Delta3
Coordinate system parameter4	3: Delta3R
Coordinate system parameter5	4: LinearDelta3
Coordinate system parameter6	5: LinearDelta3R
	0

Coordinate system and tool setting via **MC_SETKINTRANSFORM**

(Set in axis group parameter)
XYZ/Delta3/Delta3R/Linear Delta

MC_SETCARTESIANTRANSFORM

X-axis feed amount	0 mm
Y-axis feed amount	0 mm
Z-axis feed amount	0 mm
X-axis rotation	0 deg
Y-axis rotation	0 deg
Z-axis rotation	0 deg

PCS setting via **MC_SETCARTESIANTRANSFORM**

(Set in axis group parameter)
Indicate the position of the machine by moving or rotating based on the product coordinate system

LS_SETWORKSPACE

Workspace type	0: Rectangle
Workspace error check	0: Disable
Workspace Parameter1	170 mm
Workspace Parameter2	-170 mm
Workspace Parameter3	170 mm
Workspace Parameter4	-170 mm
Workspace Parameter5	-380 mm
Workspace Parameter6	-580 mm
Workspace Parameter7	0
Workspace Parameter8	0

Work space setting via **MC_SETWORKSPACE**

(Set in axis group parameter)
Safe workspace setting to prevent safety accidents

Starting operation by coordinate system dedicated command such as
MC_MOVECIRCULARABSOLUTE2D, LS_MOVELINEARTIMEABSOLUTE, etc.

Example Motion Applications

Packaging Machine Application
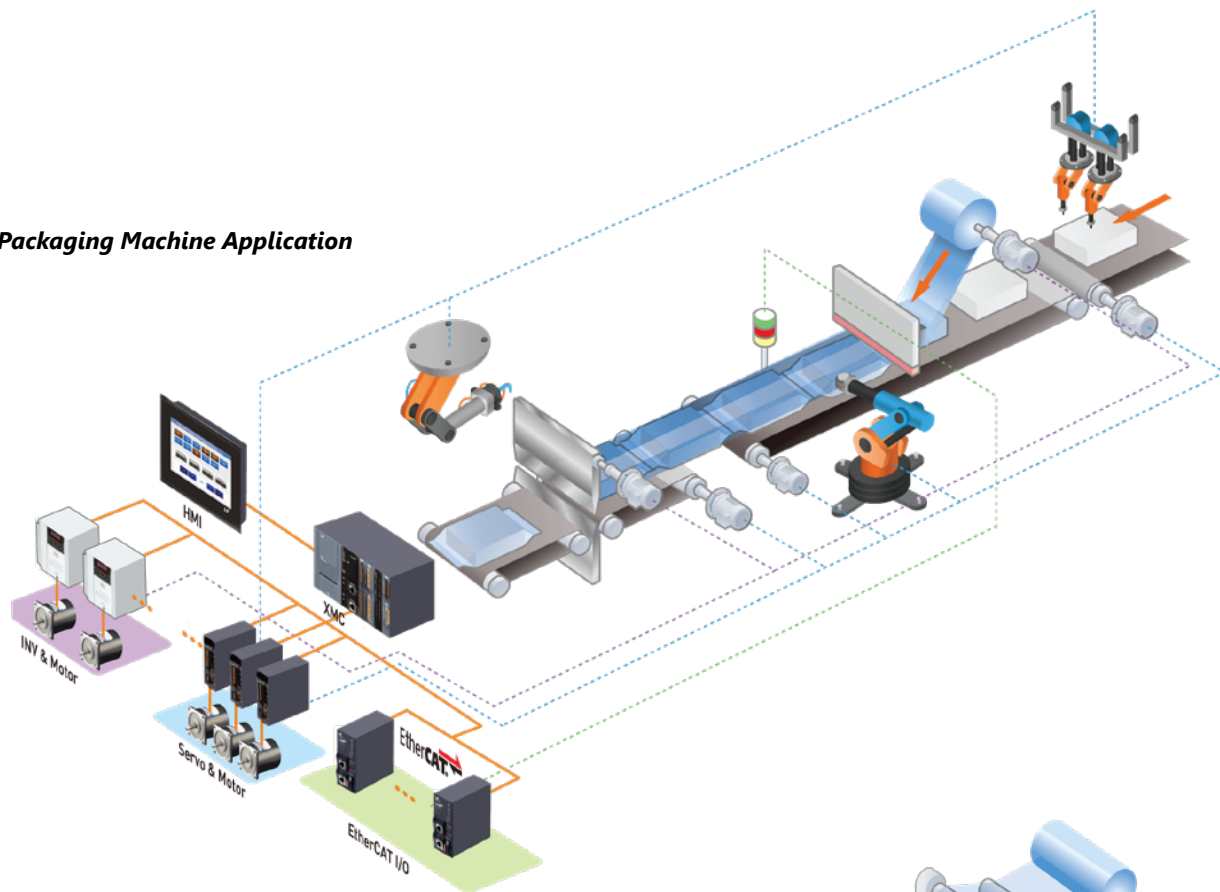
Printing Machine Application

LS *ELECTRIC*
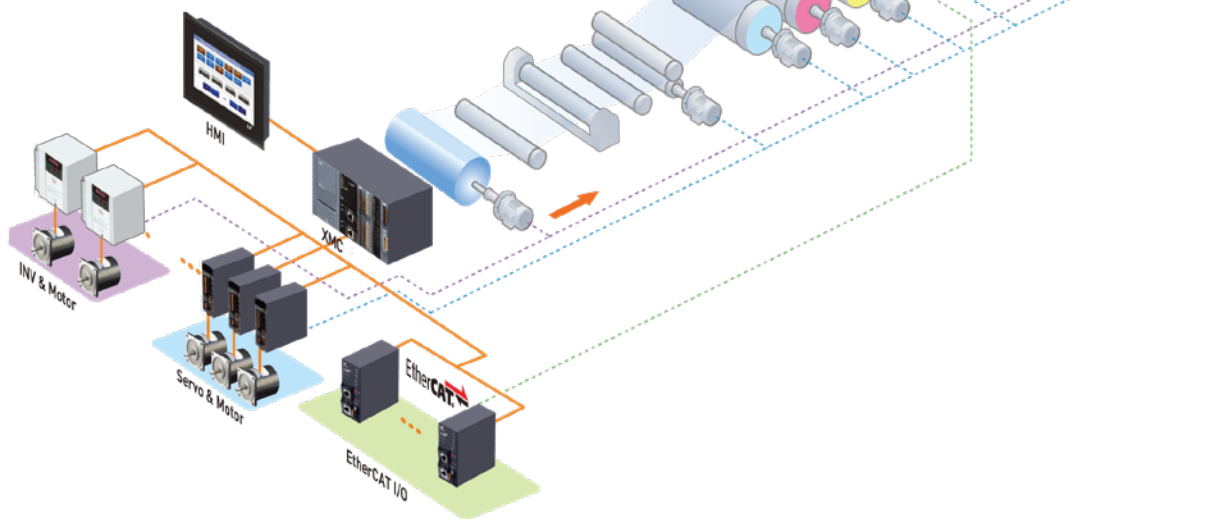
XMC Motion Controller Replacement Terminals

Part Number	Price	Function	Description	Compatible With
XMC-CON-6P	$9.00	LS XMC Motion Controller I/O Connector, 6 Pole	LS Electric XMC terminal block, 6-pin spring clamp, replacement. For use with LS Electric XMC series programmable motion controllers.	XMC-E08A XMC-E08A-DC XMC-E16A XMC-E16A-DC
XMC-CON-8P	$10.00	LS XMC Motion Controller I/O Connector, 8 Pole	LS Electric XMC terminal block, 8-pin spring clamp, replacement. For use with LS Electric XMC series programmable motion controllers.	
XMC-CON-10P	$14.00	LS XMC Motion Controller I/O Connector, 10 Pole	LS Electric XMC terminal block, 10-pin spring clamp, replacement. For use with LS Electric XMC series programmable motion controllers.	

XMC-CON-6P

XMC-CON-8P

XMC-CON-10P

LS ELECTRIC

Controller Software

XG5000 and XG-PM Software for LS Electric Controllers

XG5000 is a powerful software suite for programming and configuring the XMC programable motion controller and the XGB PLC.

XG5000
Offers four languages from the IEC61131-3 PLC programming standard.

- Ladder Diagram (LD): includes many versatile function blocks, including advanced motion control specific blocks, for convenience when programming complex systems.
- Structured Text (ST): a text based language which is a powerful tool for advanced motion programming and data handling.
- Sequential Function Chart (SFC) and Instruction List (IL) are also supported by the XGB PLC.

The software uses Symbolic (also called Automatic) variables created by the user. These can be created as global or local task variables, and can be aliased to direct variables. Variables can be imported/exported for quick editing in spreadsheet format.

Other features include User data types/function blocks, XY Trend for motion visualization, online system information, simulator, EDS file library for EtherNet/IP communications, ESI file library for EtherCAT device configuration, and much more.

| Motion Control Functions	
XGB PLC	Uses LS Electric's custom XPM motion function blocks.
XMC Motion Controller	Uses PLCopen compliant motion function blocks and some custom LS Electric function blocks.

XG-PM (for XGB PLC only)
XG-PM Position control software is used to configure the axis parameters of the XGB PLC. The Command Tool allows for quick testing, and online edits make maintenance changes quick and easy. Access XG-PM from the XG5000 Main menu-> Tools ->Position Control.

XG-PM for XGB PLC Motion Configuration
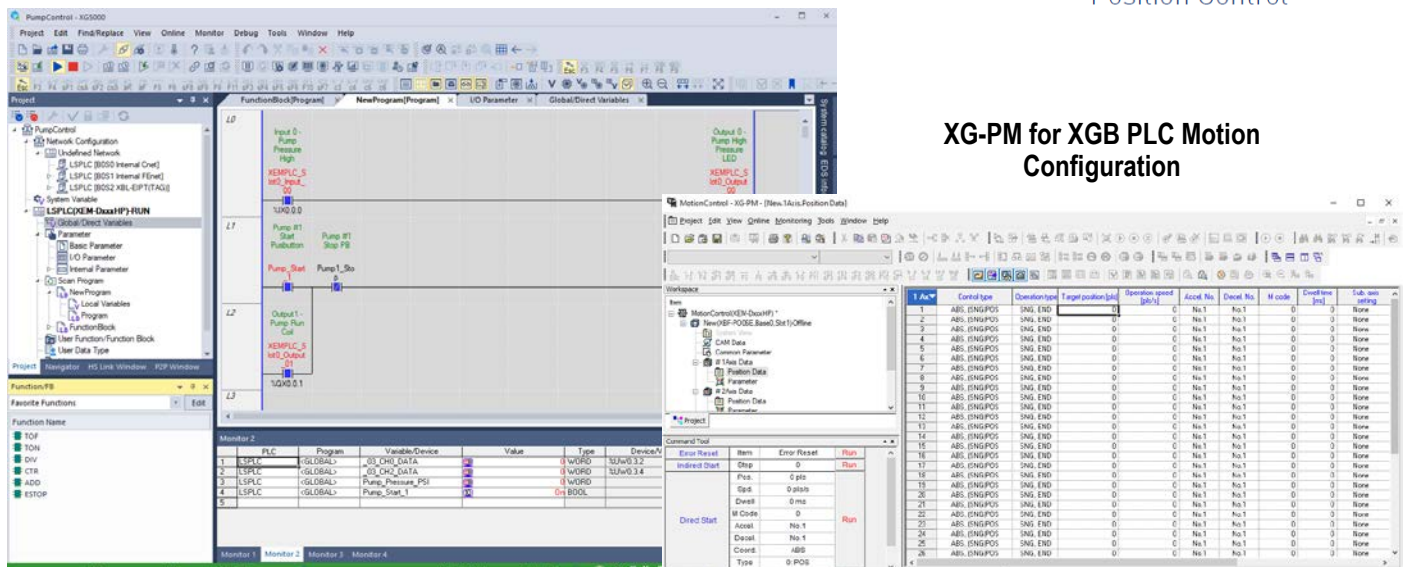
XG5000 Main Screen
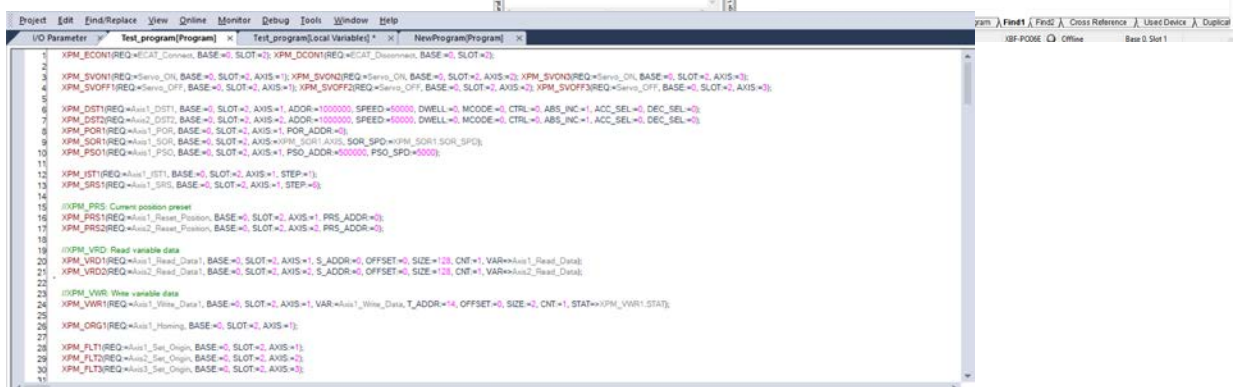
Structured Text Editor

XG5000 Software Setup

If using an XGB PLC, view the XG5000 overview topic in the LS PLC Interactive Guide here: Starting an XG5000 Project

If using an XMC Motion Controller, view the XG5000 overview topic in the XMC Interactive Guide here: Starting an XG5000 Project

**1** Download and install XG5000 software: Download Software
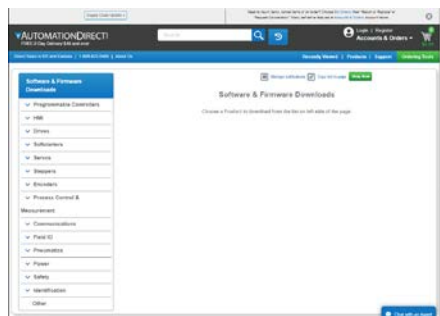
2 Connect your processor to a laptop using USB or Ethernet (XGB or XMC), or Serial cable (XGB only). Default IP address in the processor is 192.168.250.120.
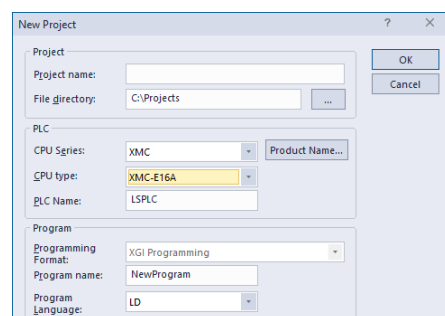
USB Mini-B
Ethernet
Serial RS-232C
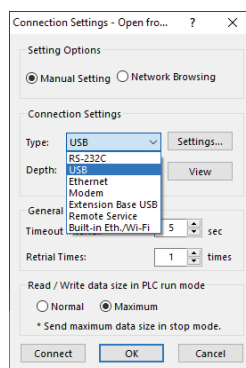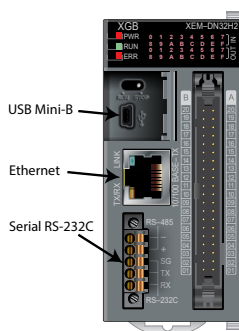
Example shown for XGB PLC setup.

3 Open XG5000. From the top menu select **Project → New Project**.

Enter a project name, choose your CPU, add a program name, then click OK to save.

Add Project Name

Choose CPU Series **XGB(IEC)**

Choose CPU Type **XEM-DxxxH2 or HP**

Add Program Name
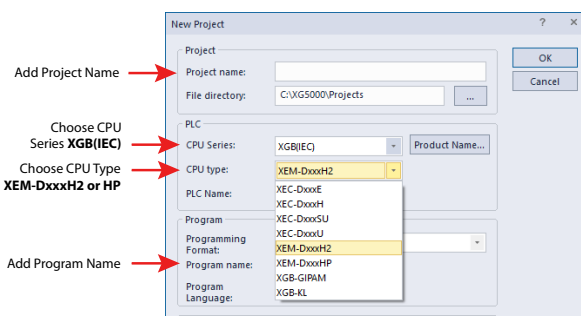
Example XGB Setup

Example XMC Setup

4 *(XGB Only)* Choose **Parameter → I/O Parameter** from the project menu bar.

Select a slot from the bottom menu, then use the drop down under **Module** to add modules.

See the video under Adding Modules for going online and uploading I/O configuration from your rack.