



# XMC Motion Controller



MOTION CONTROLLER

## Motion Controller (with embedded I/O)

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

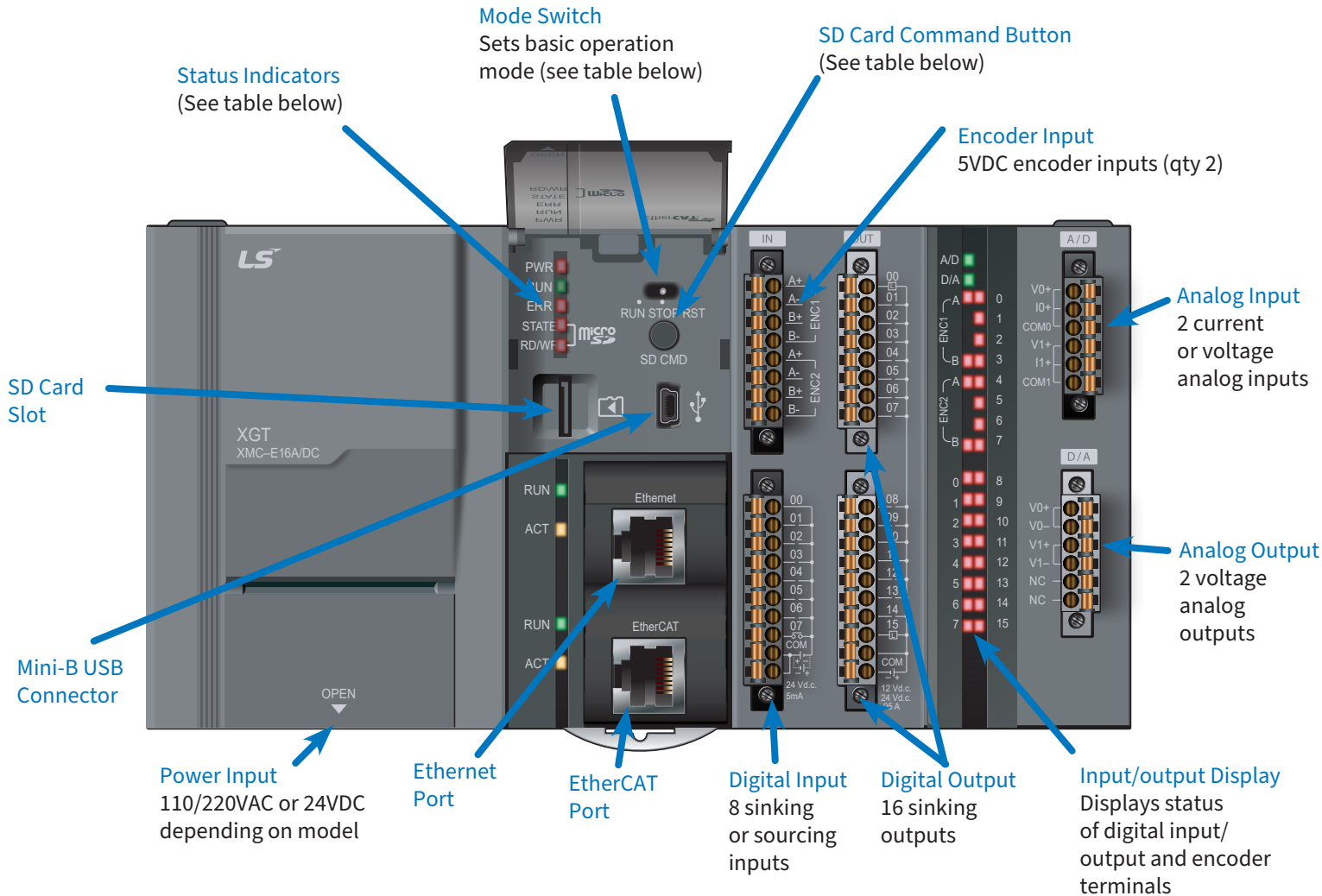
- EtherCAT port supports up to 16 motion axis and 32 slave devices (depending on XMC model)
- Ethernet port supports ModbusTCP and socket programming.
- 8 digital inputs
- 16 digital outputs
- 2-channel analog inputs
- 2-channel analog outputs
- 2-channel encoder inputs
- For additional IO, use XEL-BSSCT 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*			USB	Ethernet	Max EtherCAT Slaves	Memory Backup	Online Editing	Drawing
		EtherCAT Motion Axis	Inputs	Outputs						
<a href="#">XMC-E08A</a>	\$779.00	8	8	16	Yes	Yes	16	Memory: Non-Volatile RAM RTC: 6 month backup (MS920T battery)	Yes	<a href="#">PDF</a>
<a href="#">XMC-E08A-DC</a>	\$779.00	8								<a href="#">PDF</a>
<a href="#">XMC-E16A</a>	\$871.00	16								<a href="#">PDF</a>
<a href="#">XMC-E16A-DC</a>	\$871.00	16								<a href="#">PDF</a>

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

## XMC Configuration



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

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

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



# XMC Motion Controller

## Performance Specifications

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



# XMC Motion Controller

## Built-in Functions

Specification		Part Number			
		XMC-E08A	XMC-E16A	XMC-E08A-DC	XMC-E16A-DC
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 <sup>1</sup> , 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, Delta			
SD Memory	Memory Type	Micro 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			
	Communication Distance	Max. 100m between 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 ≤ 1.79769313486232e+308



# XMC Motion Controller

## EtherCAT Communication Specifications

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

## Environmental Specifications, all XMC Series Modules

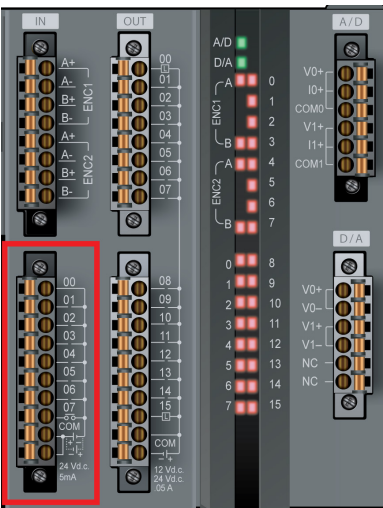
Item	Specification	Reference			
<b>Ambient Operating Temperature</b>	0–55°C (32–131°F)	-			
<b>Storage Temperature</b>	-25–70°C (-13–158°F)				
<b>Ambient Operating Humidity</b>	5–95% relative humidity (non-condensing)				
<b>Storage Humidity</b>	5–95% relative humidity (non-condensing)				
<b>Vibration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

1 - Vibration of 10 times each direction (X, Y, and Z)

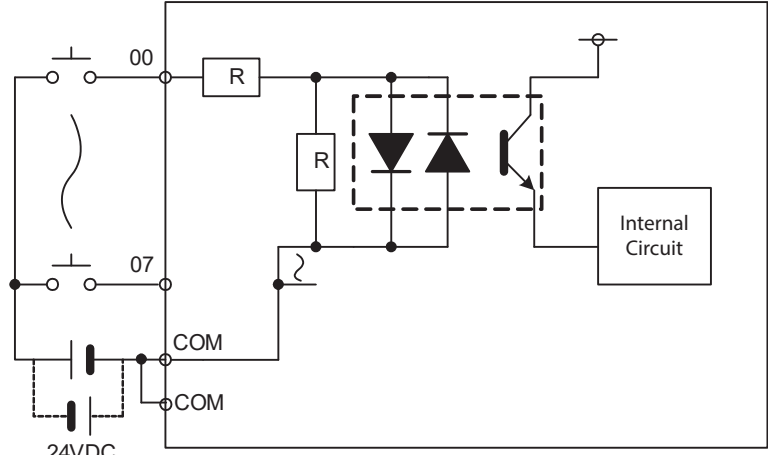
2 - Normally only nonconductive pollution occurs. Temporary conductivity caused by condensation is to be expected.

## Digital Input Specifications

8-point 24VDC Input (Sink/Source Type) Specifications				
Model	XMC-E08A	XMC-E16A	XMC-E08A-DC	XMC-E16A-DC
<b>Input Point</b>	8 points			
<b>Insulation Method</b>	Photocoupler Insulation			
<b>Rated Input Voltage</b>	24VDC			
<b>Rated Input Current</b>	About 5mA			
<b>Operation Voltage Range</b>	20.4–28.8 VDC (within ripple rate 5%)			
<b>On Voltage</b>	19VDC or higher			
<b>On Current</b>	3mA or higher			
<b>Off Voltage</b>	6VDC or less			
<b>Off Current</b>	1mA or less			
<b>Input Resistance</b>	About 4.7 kΩ			
<b>Response Time</b>	Off → On	0.5/1/3/5/10/20/70/100 ms (set by I/O parameter)		
	On → Off	Default: 3ms		
<b>Insulation Pressure</b>	AC560Vrms / 3 cycle (altitude 2000m)			
<b>Insulation Resistance</b>	10MΩ or more by MegOhmMeter			
<b>Common Method</b>	8 point / COM			

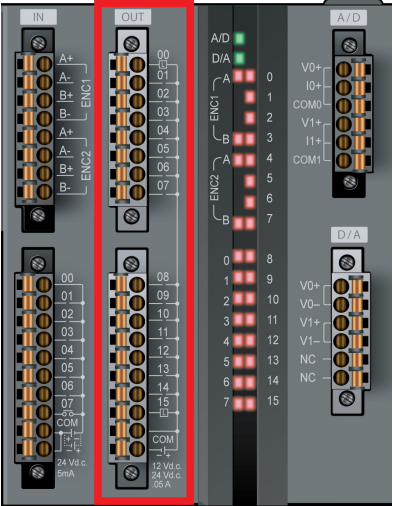


**Note:** Red box highlights pins of the CPU inputs.

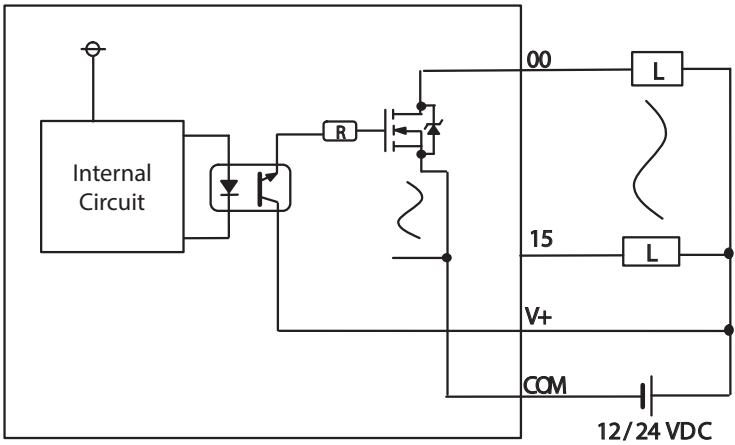
8-point 24VDC Input (Sink/Source Type) Circuit Configuration			
Circuit Configuration	XMC Pin#	I/O Direct Variable	Description
	00	%IX0.0.0	General Input
	01	%IX0.0.1	
	02	%IX0.0.2	
	03	%IX0.0.3	
	04	%IX0.0.4	
	05	%IX0.0.5	
	06	%IX0.0.6	
	07	%IX0.0.7	
COM	-	Common	
COM	-		

## Digital Output Specifications

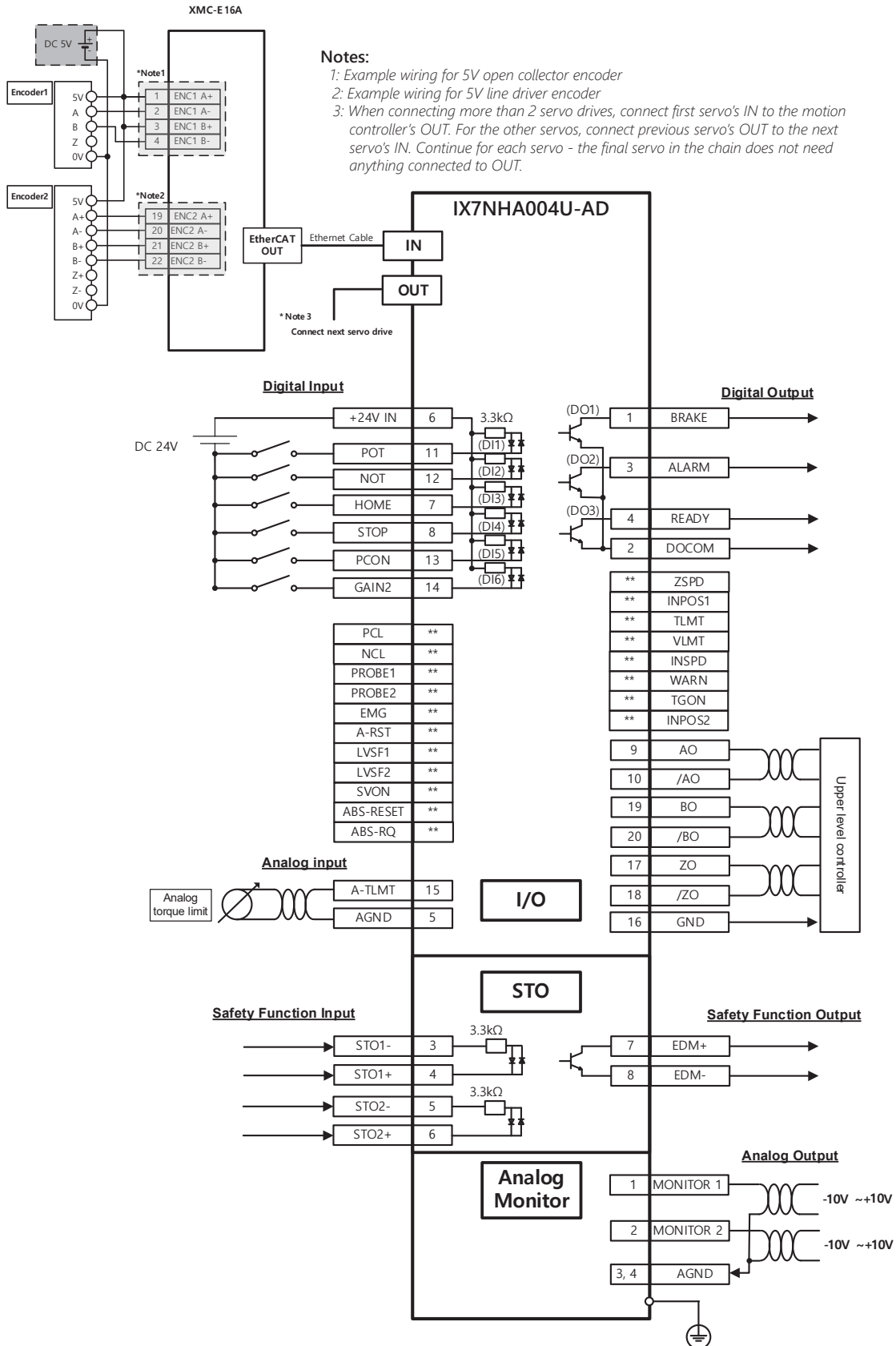
16-point Transistor Output (Sink Type) Specifications				
Model	XMC-E08A	XMC-E16A	XMC-E08A-DC	XMC-E16A-DC
Output Point	16 points			
Insulation Method	Photocoupler Insulation			
Rated Load Voltage	12VDC / 24VDC			
Operation Load Voltage Range	10.2–26.4 VDC			
Max. Load Current	0.5 A / 1 point, 2A / 1COM			
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.

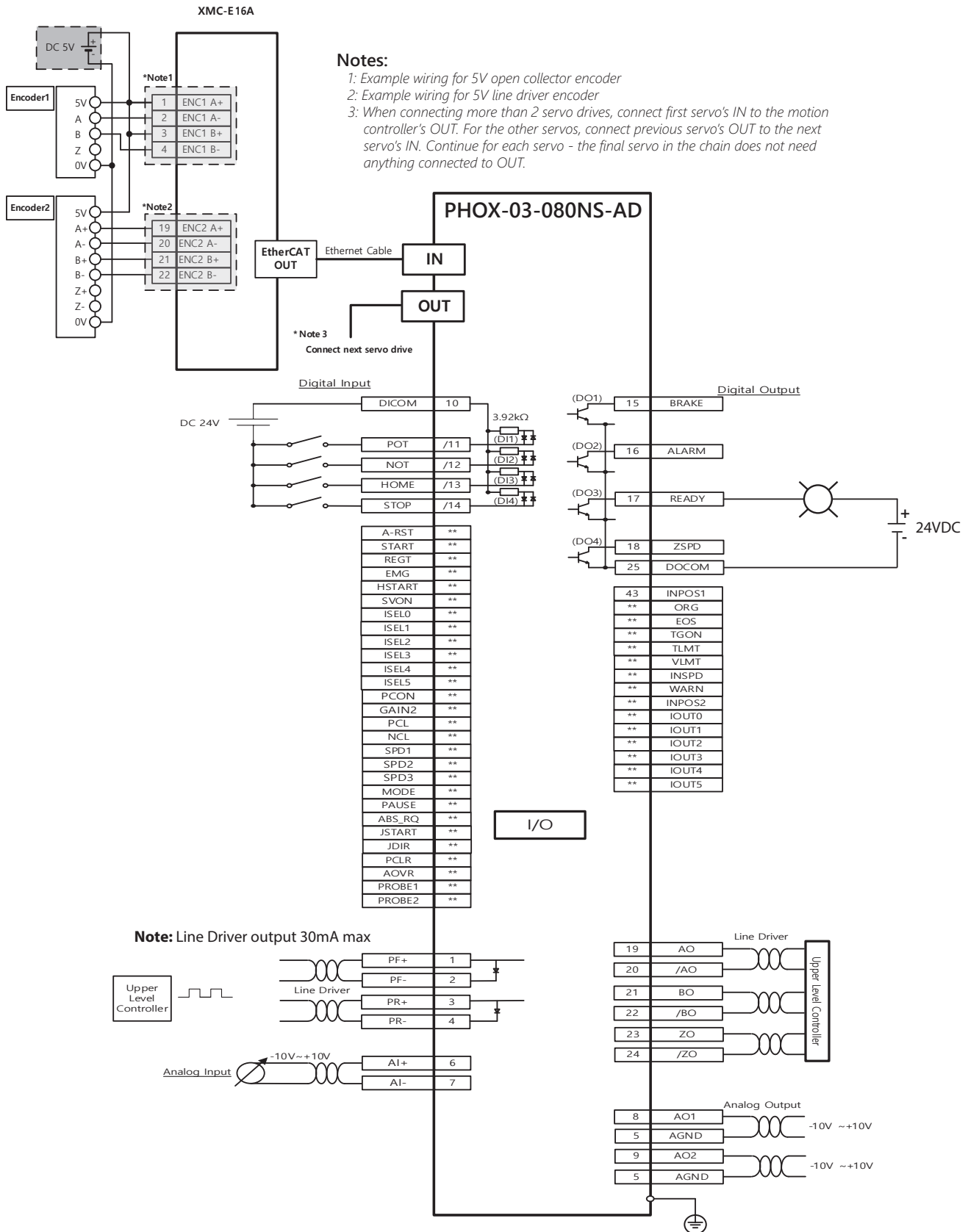
16-point Transistor Output (Sink Type) Circuit Configuration			
Circuit Configuration	XMC Pin#	I/O Direct Variable	Description
	00	%QX0.0.0	General Output 0.5 A / pt
	01	%QX0.0.1	
	02	%QX0.0.2	
	03	%QX0.0.3	
	04	%QX0.0.4	
	05	%QX0.0.5	
	06	%QX0.0.6	
	07	%QX0.0.7	
	08	%QX0.0.8	
	09	%QX0.0.9	
	10	%QX0.0.10	
	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

## Example Wiring with iX7NH Servo



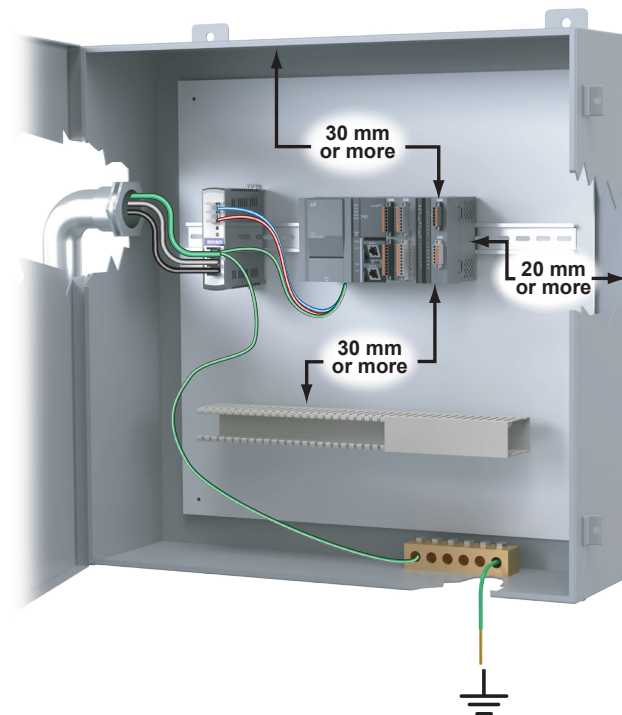


## Example Wiring with PHOX Servo



## 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.



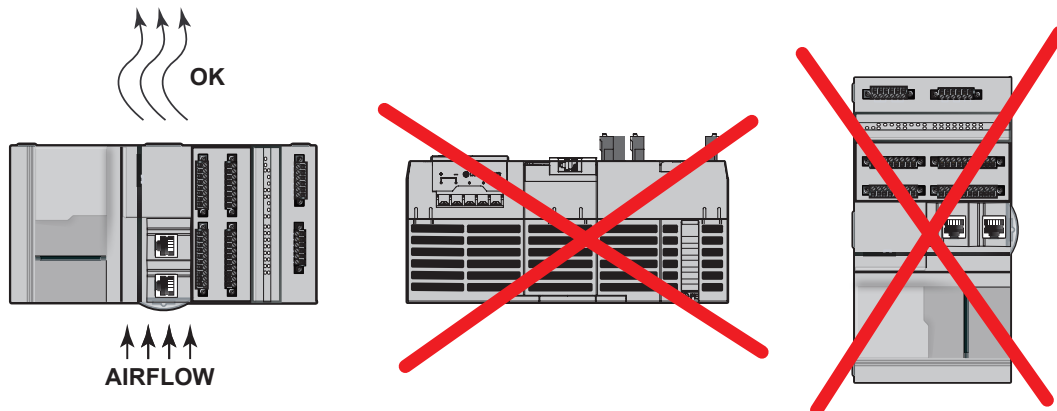
### **Additional Clearance Distances:**

- 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.





# XMC Motion Controller

## Motion Function Blocks

MC function blocks are compliant to the PLCopen standard.

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

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

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

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



# XMC Motion Controller

## CNC Control Codes and Commands

G-code	
G-code	Function
<b>G00</b>	Rapid positioning control
<b>G01</b>	Linear interpolation feed control
<b>G02</b>	Clockwise circular / helical interpolation
<b>G03</b>	Counter clockwise circular / helical interpolation
<b>G04</b>	DWELL function
<b>G09</b>	Exact Stop
<b>G17</b>	Select the circular interpolation plane (XY plane)
<b>G18</b>	Select the circular interpolation plane (ZX plane)
<b>G19</b>	Select the circular interpolation plane (YZ plane)
<b>G20</b>	Inch input
<b>G21</b>	Metric input
<b>G22</b>	Stroke check function ON
<b>G23</b>	Stroke check function OFF
<b>G27</b>	Homing check
<b>G28</b>	Automatic homing
<b>G29</b>	Return at the auto-origin
<b>G30</b>	Automatic 2nd and 3rd homing
<b>G31</b>	Skip function
<b>G40</b>	Cancel compensation of tool diameter
<b>G41</b>	Compensate the tool diameter to the left
<b>G42</b>	Compensate the tool diameter to the right
<b>G43</b>	Compensate the tool length in the direction of +
<b>G49</b>	Cancel compensation of the tool length
<b>G52</b>	Set the local coordinate system
<b>G53</b>	Select the machine coordinate system
<b>G54</b>	Select the workpiece coordinate system 1
<b>G55</b>	Select the workpiece coordinate system 2
<b>G56</b>	Select the workpiece coordinate system 3
<b>G57</b>	Selecting the workpiece coordinate system 4
<b>G58</b>	Selecting the workpiece coordinate system 5
<b>G59</b>	Selecting the workpiece coordinate system 6
<b>G60</b>	Single direction positioning
<b>G90</b>	Absolute command
<b>G91</b>	Incremental command
<b>G92</b>	Set the workpiece coordinate system
<b>G94</b>	Feed mode command per minute
<b>G95</b>	Feed mode command per revolution
<b>G107</b>	Cylindrical interpolation mode setting
<b>G112</b>	Interpolation mode of the polar coordinate ON
<b>G113</b>	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
<b>M00</b>	Program stop
<b>M01</b>	Optional stop
<b>M02</b>	Program END
<b>M03</b>	Forward rotation of the main axis
<b>M04</b>	Reverse rotation of the main axis
<b>M05</b>	Main axis stop
<b>M06</b>	Tool change
<b>M08</b>	Coolant ON
<b>M09</b>	Coolant OFF
<b>M30</b>	End of the program
<b>M98</b>	Auxiliary program call
<b>M99</b>	End of the auxiliary program

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

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

## 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

Item	Rst. Axis Error	Run
Pos.	0 mm	
Spd.	0 mm/m	
Accel.	0 mm/s <sup>2</sup>	
Decel.	0 mm/s <sup>2</sup>	
Jerk	0 mm/s <sup>3</sup>	
Coord.	ABS	
Dir.	0: none	
Dec. Stop	Dec. 0 mm/s <sup>2</sup>	Run
Jerk	0 mm/s <sup>3</sup>	
Pos. Preset	Pos. 0 mm	Run
Enc. Preset	Type ENC1	Run
Pos.	0 pls	
Start JOG	<< < > >>	
Stop JOG		

Status Monitor

Status/Axis	
Current axis	1
Axis type	Real axis
Connected slave	Slave 1(L7NH - Standard EtherCAT drive)
Servo ready	ON
Servo on	OFF
Pos/Spd Unit	mm,mm/m
Command position	-7.6293945312500000e-005
Command speed	0.0000000000000000e+000
Command torque	0.0000000000000000e+000
Actual position	-7.6293945312500000e-005
Actual speed	1.1444091796875000e-002
Actual torque	0.0000000000000000e+000
Error Code	0x0000
Master axis	1
Master/Slave opr. Type	Master axis
Opr. Status	
Positioning completion	
Home completion	ON
Control Pattern	
Stop	
Upper Limit	
Lower Limit	
Ext. Input	0000 0000 0000 0000 0000 0000 0000 0000

Vendor: All products  
Category: All vendors

- LSIS
  - L7N - Standard EtherCAT drive(CoE)
  - XIP - Integrated EtherCAT drive(CoE,EdE,FoE)
  - L7NH - Standard EtherCAT drive(CoE,EdE,FoE)
  - S100
- LS MECAPION
  - Digital In/Out(16+16), DC In 24V, TR Out 24V, 0.5A
  - Digital In(32), DC In 24V
  - Digital Out(32), TR Out 24V, 0.5A

Details  
Display Name: N/A  
Vendor: N/A  
Category: N/A  
Version: N/A  
URL(I): N/A

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

Channel	Axis
1	X
2	Y
3	Z
4	A
5	B
6	C
7	U
8	V
9	W
10	S

### NC programming by G-code & M-code

**Main program**

```

1 G00
2 G00 X0 Y0
3 G01 X100 Y100 F1000
4 X0 Y200
5 X-100 Y100
6 X0 Y0
7
8
9
10 M98 P0001
    M98 M99
    M99 Comment: Auxiliary Program Call
    
```

**Sub program**

```

1 G02 X0 Y0 I0 J100 F1000
2 M98
3 M99 Comment: End of the Auxiliary Program
    
```

**NC program control by NC Function Block (NC\_LOADPROGRAM, NC\_CYCLESTART)**

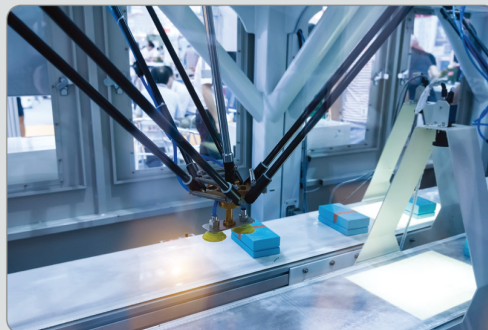


## Innovative Control Function for Robot Control

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

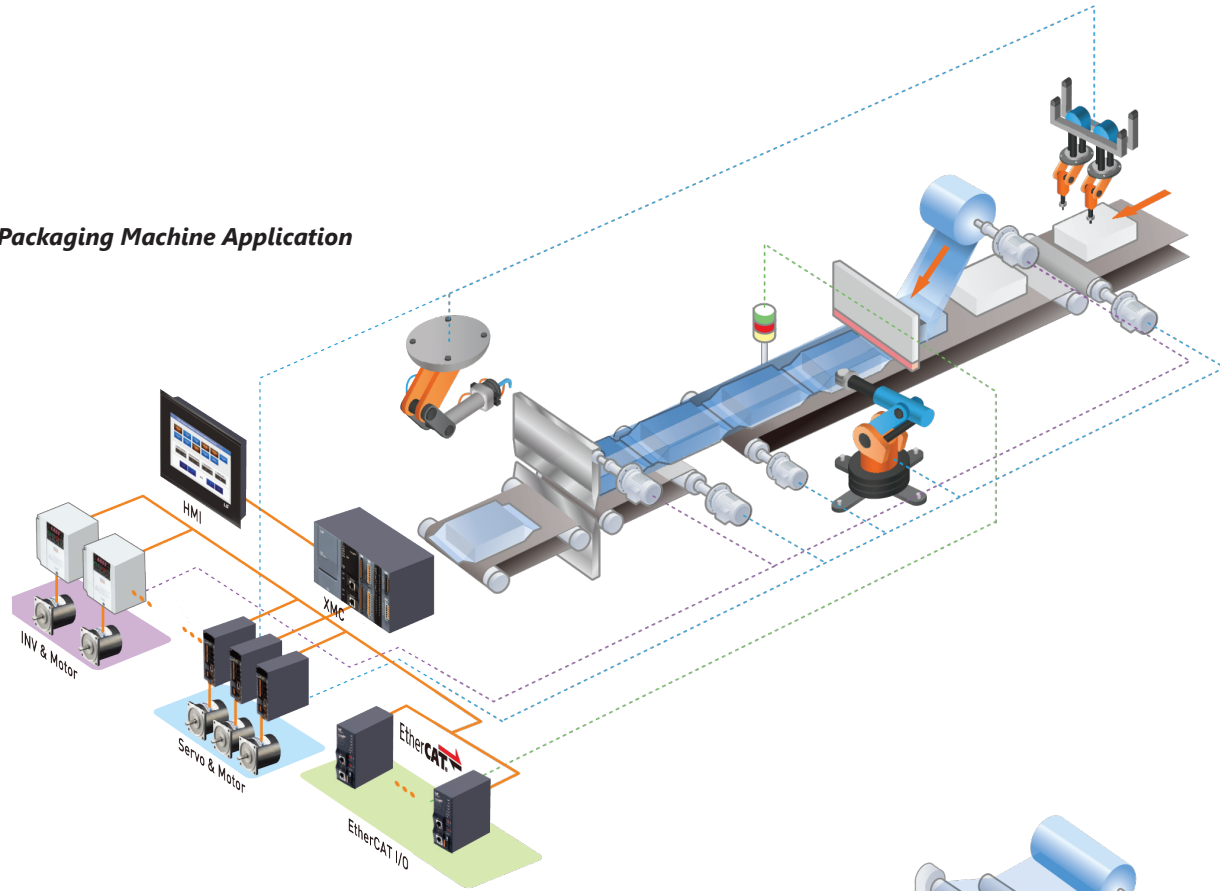
<table border="1"> <thead> <tr> <th colspan="3">MC_SETKINTRANSFORM</th> </tr> </thead> <tbody> <tr> <td>BOOL-Execute</td> <td>Done</td> <td>BOOL</td> </tr> <tr> <td>UINT-AxesGroup</td> <td>AxesGroup</td> <td>UINT</td> </tr> <tr> <td>UINT-ErrType</td> <td>Busy</td> <td>BOOL</td> </tr> <tr> <td>UINT-ErrExtPara</td> <td>Active</td> <td>BOOL</td> </tr> <tr> <td>ABSOLUTE OF LINEAR</td> <td>CommandAborted</td> <td>BOOL</td> </tr> <tr> <td>LINEAR-ToolID1 set1</td> <td>Error</td> <td>BOOL</td> </tr> <tr> <td>LINEAR-ToolID1 setY</td> <td>ErrorID</td> <td>WORD</td> </tr> <tr> <td>LINEAR-ToolID1 setZ</td> <td></td> <td></td> </tr> </tbody> </table>	MC_SETKINTRANSFORM			BOOL-Execute	Done	BOOL	UINT-AxesGroup	AxesGroup	UINT	UINT-ErrType	Busy	BOOL	UINT-ErrExtPara	Active	BOOL	ABSOLUTE OF LINEAR	CommandAborted	BOOL	LINEAR-ToolID1 set1	Error	BOOL	LINEAR-ToolID1 setY	ErrorID	WORD	LINEAR-ToolID1 setZ			or	<table border="1"> <thead> <tr> <th colspan="2">Coordinate system configuration</th> </tr> </thead> <tbody> <tr> <td>Coordinate system Type</td> <td>0: None</td> </tr> <tr> <td>Coordinate system parameter1</td> <td>0: None</td> </tr> <tr> <td>Coordinate system parameter2</td> <td>1: XYZ</td> </tr> <tr> <td>Coordinate system parameter3</td> <td>2: Delta3R</td> </tr> <tr> <td>Coordinate system parameter4</td> <td>3: Delta3R</td> </tr> <tr> <td>Coordinate system parameter5</td> <td>4: LinearDelta3</td> </tr> <tr> <td>Coordinate system parameter6</td> <td>5: LinearDelta3R</td> </tr> <tr> <td></td> <td>0</td> </tr> </tbody> </table>	Coordinate system configuration		Coordinate system Type	0: None	Coordinate system parameter1	0: None	Coordinate system parameter2	1: XYZ	Coordinate system parameter3	2: Delta3R	Coordinate system parameter4	3: Delta3R	Coordinate system parameter5	4: LinearDelta3	Coordinate system parameter6	5: LinearDelta3R		0	<p>Coordinate system and tool setting via <b>MC_SETKINTRANSFORM</b> (Set in axis group parameter) XYZ/Delta3/Delta3R/Linear Delta</p>	
MC_SETKINTRANSFORM																																																	
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Starting operation by coordinate system dedicated command such as **MC\_MOVECIRCULARABSOLUTE2D**, **LS\_MOVELINEARTIMEABSOLUTE**, etc.

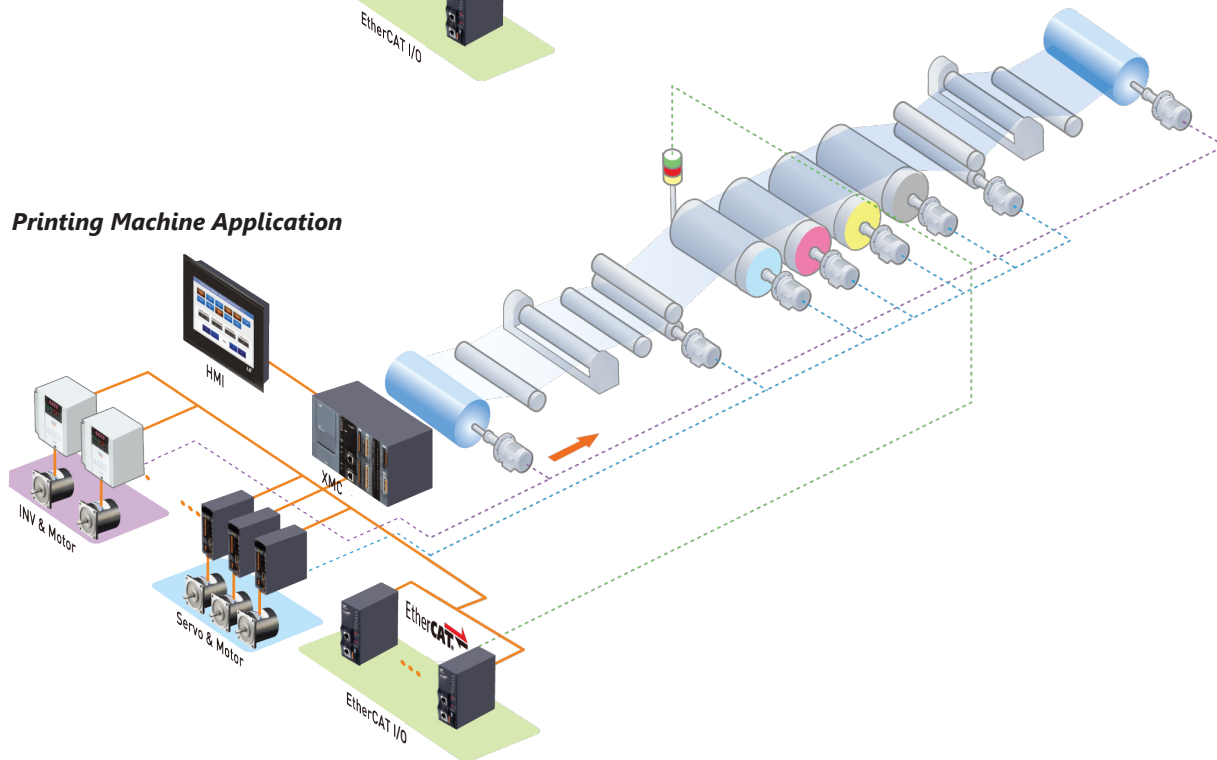


## Example Motion Applications

**Packaging Machine Application**



**Printing Machine Application**







# XMC Accessories

## XMC Motion Controller Replacement Terminals

Part Number	Price	Function	Description	Compatible With
<b><u>XMC-CON-6P</u></b>	\$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
<b><u>XMC-CON-8P</u></b>	\$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.	
<b><u>XMC-CON-10P</u></b>	\$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**



# Controller Software

## XG5000 and XG-PM Software for LS Electric Controllers

XG5000 is a powerful software suite for programming and configuring the XMC programmable 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.



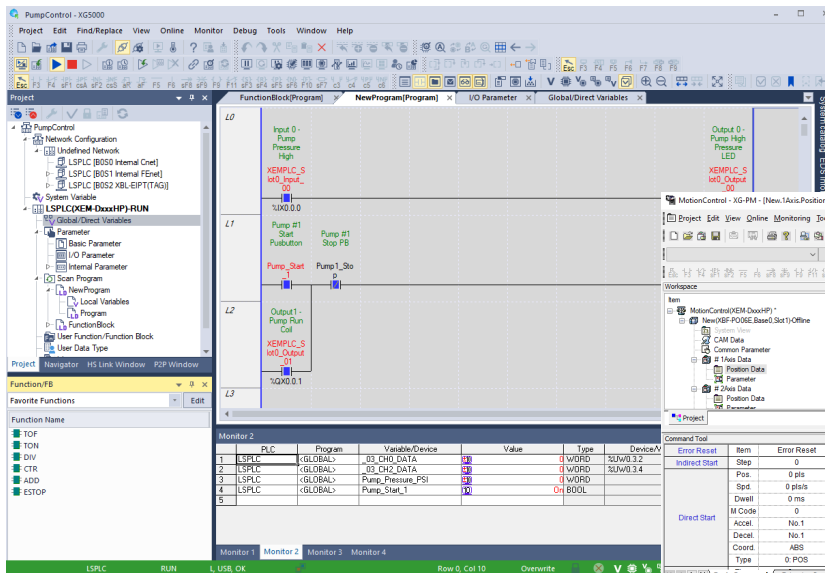
Motion Control Functions	
<b>XGB PLC</b>	Uses LS Electric's custom XPM motion function blocks.
<b>XMC Motion Controller</b>	Uses PLCopen compliant motion function blocks and some custom LS Electric function blocks.

### XG-PM (for XGB PLC only)

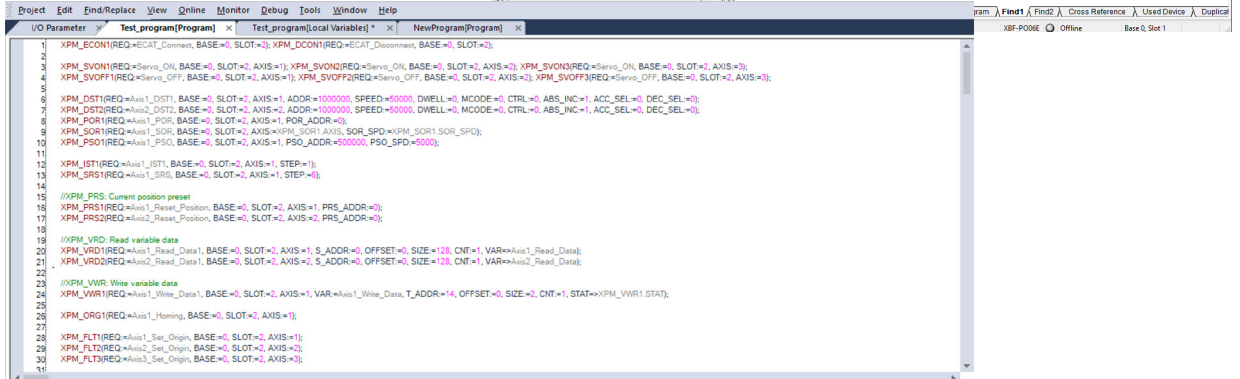
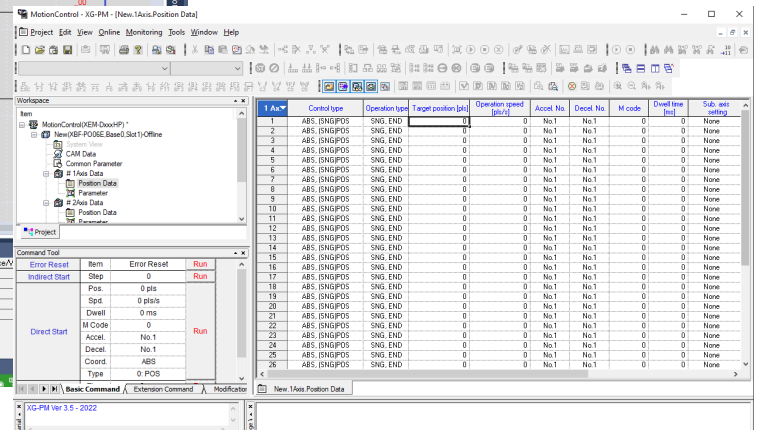
XG-PM Position control software is used to configure the axis parameters of the XGB PLC. The Command Tool allows for quick testing, and online edits make maintenance changes quick and easy. Access XG-PM from the XG5000 Main menu-> Tools -> Position Control.



### XG-PM for XGB PLC Motion Configuration



XG5000 Main Screen



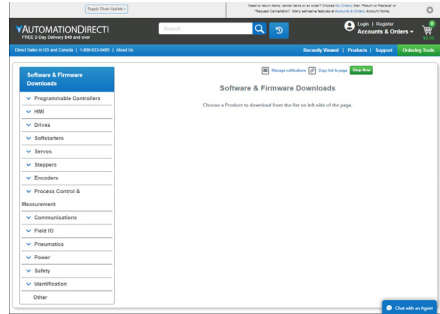
Structured Text Editor

## XG5000 Software Setup

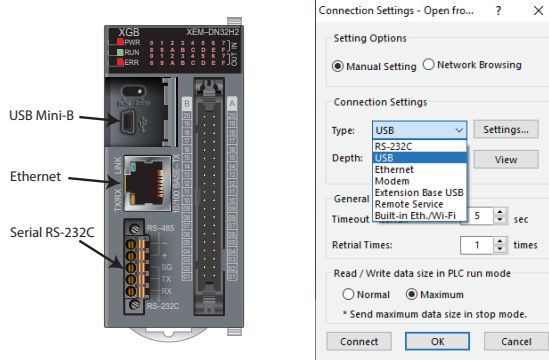
If using an XGB PLC, view the XG5000 overview topic in the LS PLC Interactive Guide here: [Starting an XG5000 Project](#)

If using an XMC Motion Controller, view the XG5000 overview topic in the XMC Interactive Guide here: [Starting an XG5000 Project](#)

- Download and install XG5000 software:  
Download Software



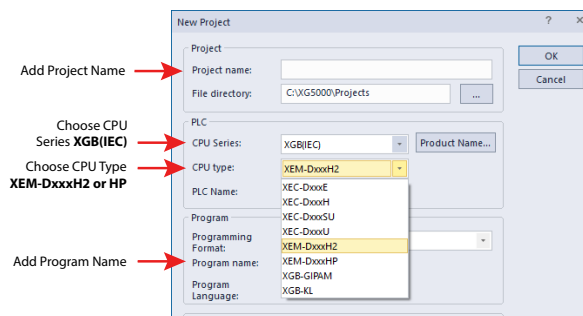
- Connect your processor to a laptop using USB or Ethernet (XGB or XMC), or Serial cable (XGB only). Default IP address in the processor is 192.168.250.120.



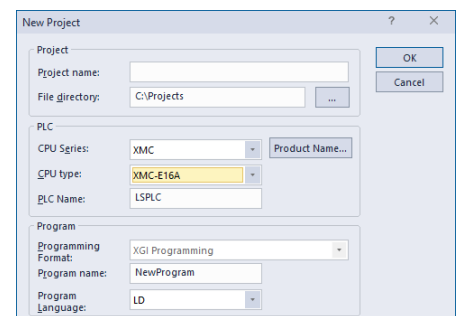
Example shown for XGB PLC setup.

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

Enter a project name, choose your CPU Series XGB(IEC), choose CPU Type XEM-DxxxH2 or HP, Add Program Name



Example XGB Setup



Example XMC Setup

- (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.

