

# MOTION CONTROLLER & ETHERCAT SMART I/O

Programmable Logic Controller

**LS**

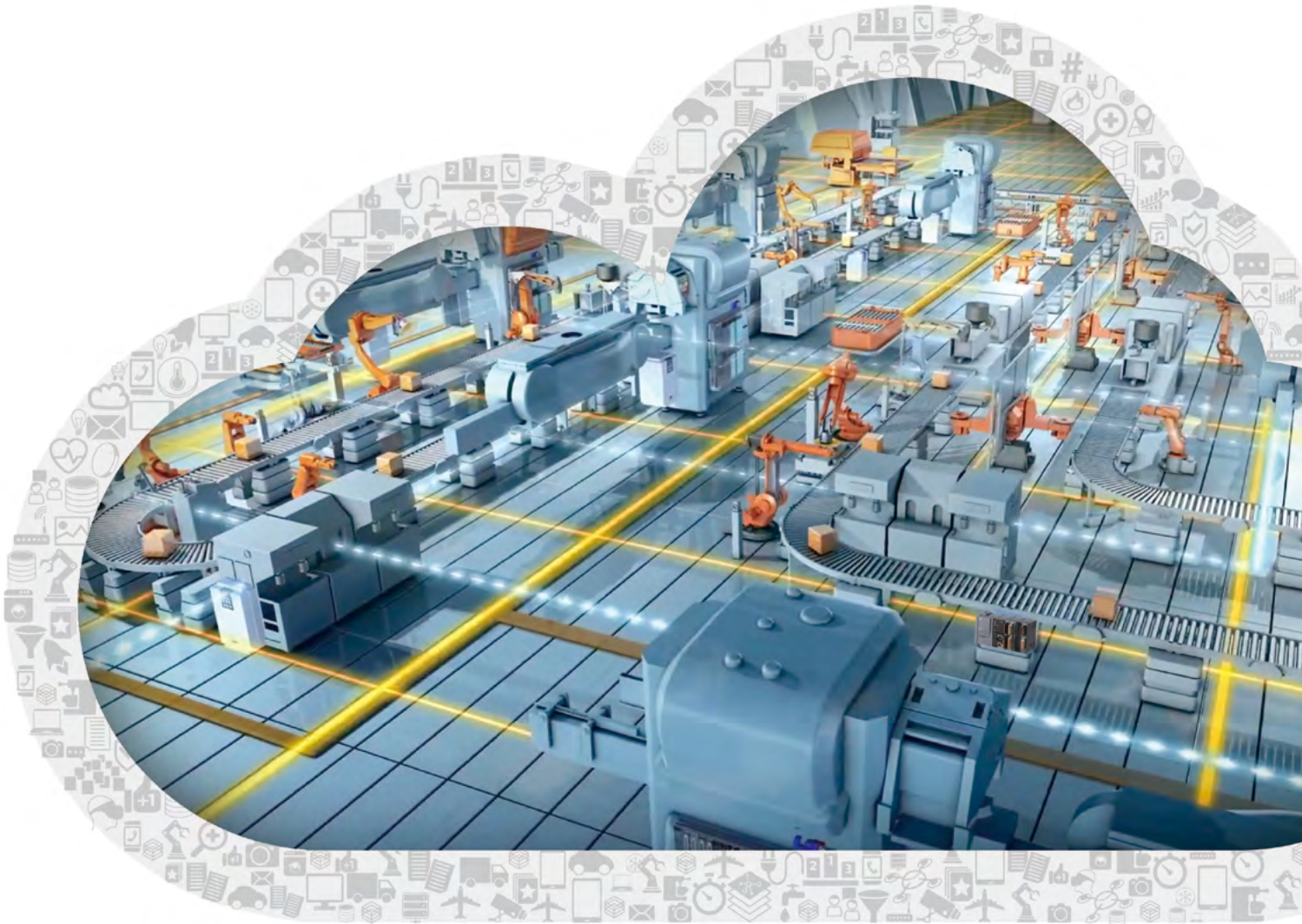


**ANIRO**



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# MOTION CONTROLLER



XMC-E32A

## True Realization of Smart Factory Automation We Have Dreamed of! Innovative Motion Control Solution to Introduce Future of Factory Automation

The XMC-E32A programmable motion controller realizes automation of manufacturing industries with a cost-effective yet easy and user friendly engineering solution.

The XMC-E32A delivers high performance EtherCAT-based motion control functions along with a variety of embedded functions and high-tech capabilities specialized for numerical control and robots. In addition to LSIS PLC, HMI and servo products, the XMC-E32A will help you create an even better and optimal solution.



# Feature

## Take Your First Step into New Future of Smart Motion

Innovation of the 4th Industrial Revolution, Innovation of smart motion that leads to innovation and new future, LSIS Motion Controller



### Professional

- CAM control: Up to 32 CAM profiles (32,768 points / 32 CAM profiles)
- Supports G-code
- Robot control: Delta3, Delta3R, Linear Delta and etc.



### Productivity

- High-speed program processing: 6.25ns (Basic command)
- EtherCAT-based high speed cycle times: 0.5/1/2/4ms (Same as main task's cycle time)
- Built-in Digital and Analog IO



### Efficiency

- Integration with a variety of EtherCAT devices
  - Servo Drive (Up to 32 axes), Remote I/O (Up to 32 I/Os), AC Drives, Robots and etc.
- Various built-in functions
  - 8 digital inputs / 16 digital outputs, Encoder inputs (2 ch), Ethernet Analog Input (2 ch)/Output (2 ch)\_E32A RS-232C/RS-485\_E32C



### Convenience

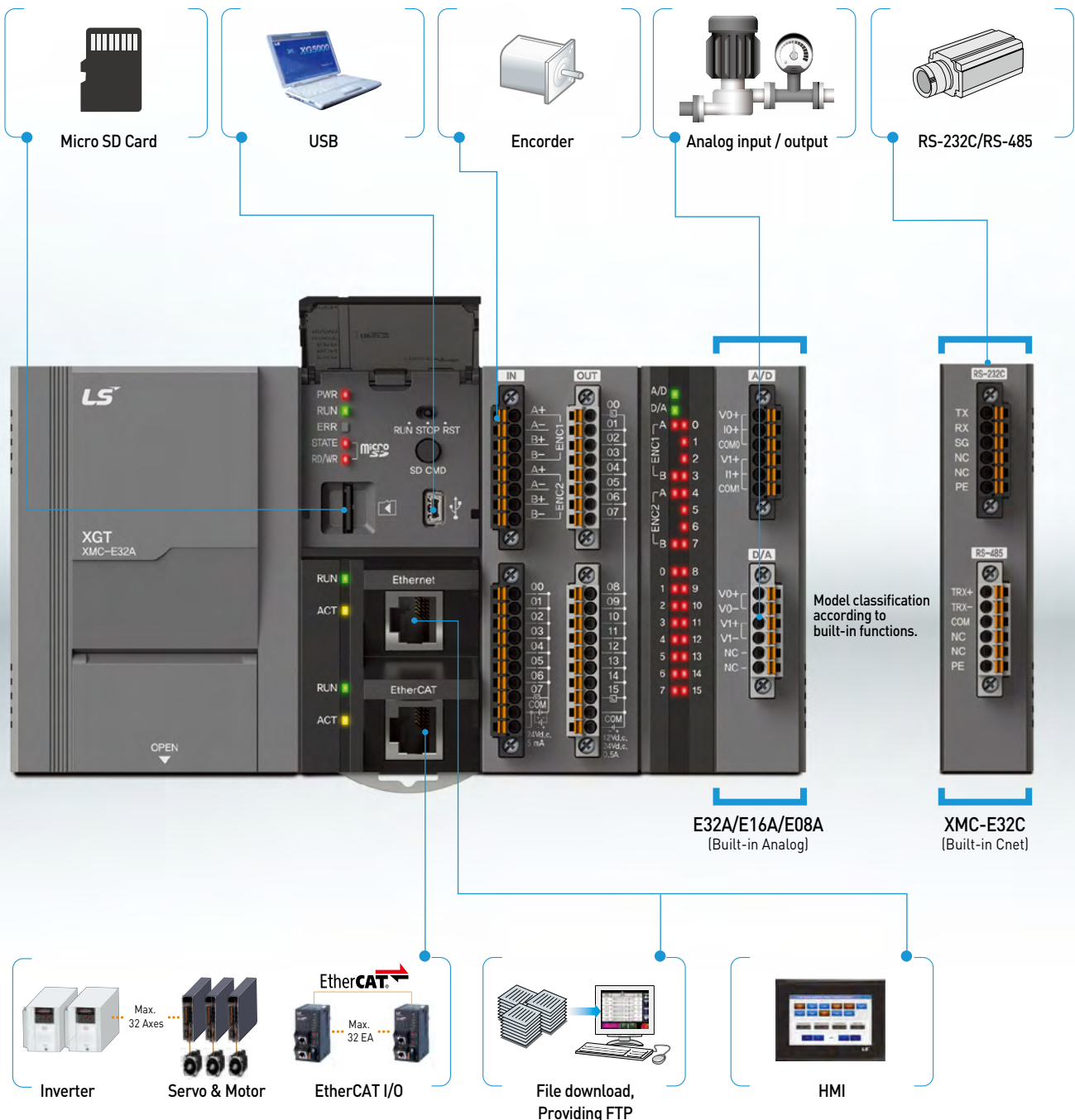
- XG5000 software for programming and monitoring
  - Sole, integrated architecture for programming, diagnosing and simulating for both motion controller and PLC
  - IEC standard Motion Function Blocks
- SD card slot (SD card not included)
  - Saving and executing programs, Data Logging



# System Configuration XMC-E32A/E16A/E08A/E32C

## EtherCAT-based Motion Control System Ensures Efficient System Environment

Motion Controller delivers an optimized solution to a system that has a need for motion control. With 8 digital inputs / 16 outputs, 2 analog Inputs / Output (XMC-E32A/E16A/E08A only), 2 encoder inputs, RS-232C/RS-485(XMC-E32C only), and EtherCAT devices (Servo Drive, INV, EtherCAT I/O, Robot), all can be connected rapidly and easily.



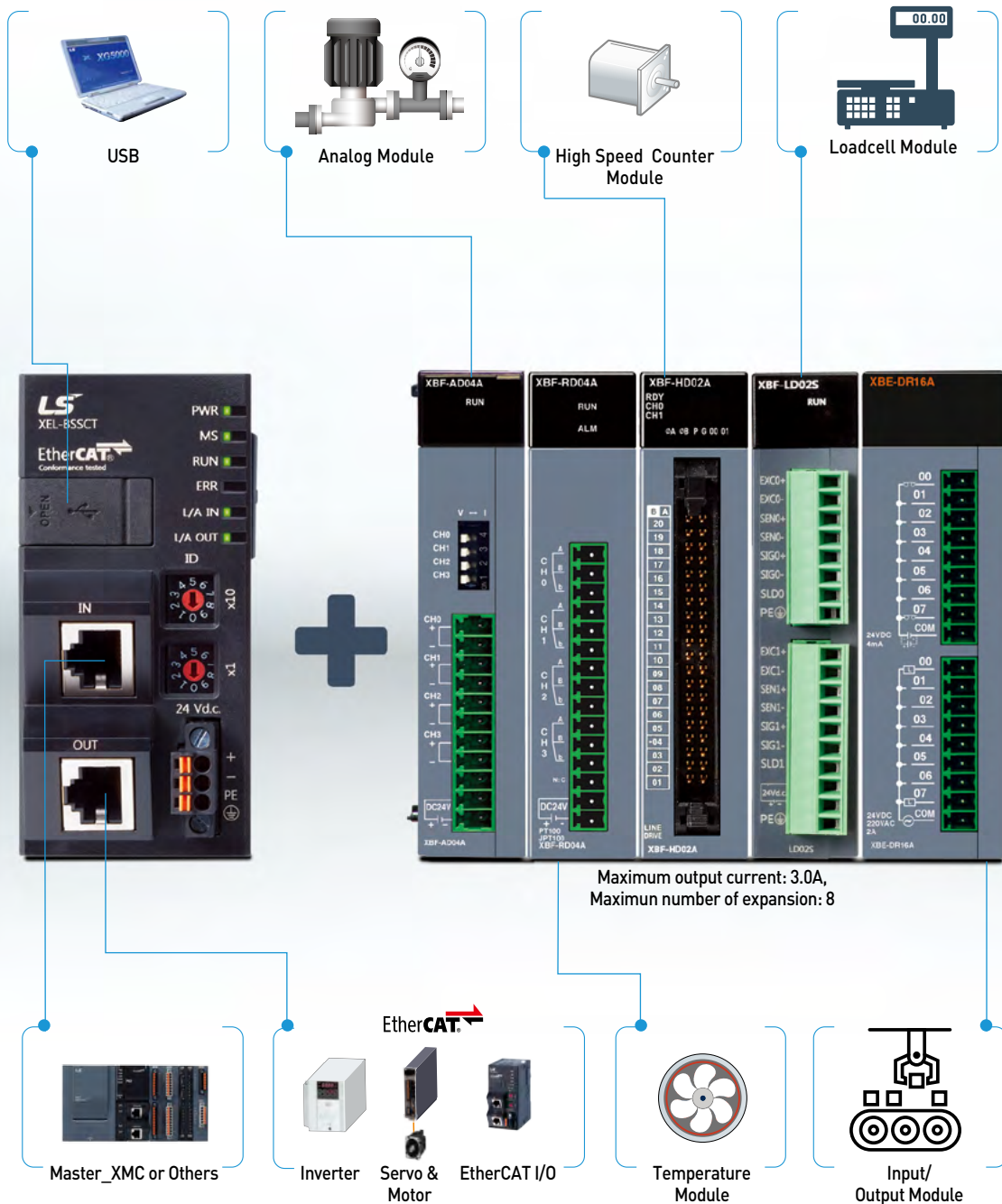
\* Refer to page 8 (Performance Specification) for supported axis information.



# System Configuration XEL-BSSCT

## EtherCAT-based Connectivity

Connectivity with EtherCAT master (XMC-E32A/16A/08A/E32C) offers a total motion solution with devices such as sensors and analog modules





# XMC-E32A/E16A/E08A/E32C

## General Specification

Item	Specification				Related specifications
Ambient temperature	0~55°C				-
Storage temperature	-25 ~ +70°C				-
Ambient humidity	5~95RH (Non-condensing)				-
Storage humidity	5~95RH (Non-condensing)				-
Vibration resistance	Ocasional vibration			-	IEC61131-2
	Frequency	Acceleration	Amplitude	How many times	
	5 ≤ f < 8.4Hz	-	3.5mm	10 times each directions (X, Y and Z)	
	8.4 ≤ f ≤ 150Hz	9.8m/s <sup>2</sup> (1G)	-		
	For continuous vibration				
	Frequency	Acceleration	Amplitude		
5 ≤ f < 8.4Hz	-	1.75mm			
8.4 ≤ f ≤ 150Hz	4.9m/s <sup>2</sup> (0.5G)	-			
Shock resistance	Peak acceleration : 147 m/s <sup>2</sup> (15G) Duration : 11ms Half-sine, 3 times each direction per each axis				IEC61131-2
Noise resistance	Square wave Impulse noise	AC: ±1,500 V DC: ±900 V			LSIS standard
	Electrostatic discharge	Voltage : 4kV (contact discharging)			IEC61131-2 IEC61000-4-2
	Radiated electromagnetic field noise	80~1,000MHz, 10 V/m			IEC61131-2, IEC61000-4-3
	Fast transient /bust noise	Segment	Power supply module	Digital/analog input/output communication interface	IEC61131-2 IEC61000-4-4
Voltage		2kV	1kV		
Environment	Free from corrosive gasses and excessive dust				-
Altitude	Up to 2,000m				-
Pollution degree	Less than equal to 2				-
Cooling	Air-cooling				-

## Power Specification

Item		Specification			Remark
Input	Rated input voltage	AC100V~AC240V			
	Input frequency	50/60Hz			
	Input current	0.7A or less			AC110V
		0.4A or less			AC240V
	Inrush current	120A <sub>peak</sub> or less			AC240V, Phase 90 degree
	Leakage current	3mA or less			
	Efficiency	65% or more			
Permitted momentary power failure	10ms or less				
Output	Output voltage	Voltage	Output voltage ripple range	Current	
		+5V	4.90~5.20V	4A	
	+24V	21.1~26.9V	0.4A		
	Ripple & Noise	Voltage	10ms or	Noise	
		+5V	100mVpp or less	200mVpp or less	
		+24V	400mVpp or less		
	Protecting overcurrent	Voltage	Current		
+5V		4.4A or more			
+24V	0.44A or more				



# XMC-E32A/E16A/E08A/E32C

## Performance Specification

Item		Specification	
Operation method		Main task/Periodic task: Fixed cyclic operation, repetitive operation. Initial task: Only once at the time of entering the RUN	
Control period		Main task cyclic time: 0.5ms, 1ms, 2ms, 4ms Periodic task cyclic time: Multiple setting of main task	
I/O Control method		Synchronized update with main task cycle (Refresh method)	
Program language		Ladder Diagram (Function block), Structured Text, G-Code	
Number of instruction	Operator	18	
	Basic function	202	
	Basic function block	174	
	Special function block	97	
Processing speed	Basic	6.25ns or more (General point/coil)	
	Move	5ns or more (Word type)	
	Arithmetic	30ns or more (Word type)	
Program	number	Max. 256	
	Capacity	10MB (Motion program), 10MB (NC program)	
Data area	Symbolic variable (A)	4.096KB (Retain setting available up to 2,048KB)	
	Input variable (I)	16KB	
	Output variable (Q)	16KB	
	Direct variable (M)	2,048KB (Retain setting available up to 1,024KB)	
	Flag variable	F	128KB
		K	18KB
		U	1KB
L		22KB <small>Note1</small>	
N		49KB <small>Note1</small>	
Timer		No limit in number of I/O points, Time range: 0.001~4,294,967,295sec (1,193hour)	
Counter		No limit in number of I/O points, Counter range: 64 bit range	
Program		Initial program, Main task program, Periodic task program, NC program	
Operation mode		RUN, STOP	
Restart mode		Cold, Warm	
Self-diagnosis function		Task cycle error, Task time occupancy rate exceed, memory abnormal, power abnormal, etc.	
Back-up method		Retain area setting in basic parameter or retain variable setting.	
Number of control axis	XMC-E32A, E32C	32 axes (Real/Virtual axis), 4axis (Virtual axis), 64 slaves (Max 32 slaves in case of 32 axes (Serov, INV) control)	
	XMC-E16A	16 axes (Real/Virtual axis), 2axis (Virtual axis), 32 slaves (Max 16 slaves in case of 16 axes(Serov, INV) control)	
	XMC-E08A	8 axes (Real/Virtual axis), 1axis (Virtual axis), 16 slaves (Max 8 slaves in case of 8 axes(Serov, INV) control)	
CAM operation	XMC-E32A, E32C	32 profiles/32,768 points	
	XMC-E16A	16 profiles/16,384 points	
	XMC-E08A	8 profiles/8,192 points	
Communication		EtherCAT (CoE: CANopen over EtherCAT, FoE: File Access over EtherCAT)	
Communication/Control period		0.5ms, 1ms, 2ms, 4ms (Same with main task period)	
Servo drive		EtherCAT servo drive which supports CoE	
Control unit		Pulse, mm, inch, degree	
Control method		Position, Velocity, Torque (Servo drive support), Synchronous, Interpolation	
Range of position / Velocity		± LREAL, 0	
Torque unit		Rated torque % designation	
Acc./Dec. profile		Trapezoidal, S-curve(Regarding Jerk value set by function block)	
Rage of Acc/Dec		± LREAL, 0	
Manual operation		JOG operation	
Absolute system		Available (When using absolute encoder type servo drive)	
Encoder input	Channel	2 channels	
	Max.input	500kpps	
	Input method	Line drive input (RS-422A IEC specification), Available open collector output type encoder	
	Input type	CW/CCW, Pulse/Dir, Phase A/B	

Note1 "L and N" area are supported by XMC-E32C only.

## Performance Specification

Item		Specification
Input / Output	Digital input / Output	8 point / 16 points (Tr. output)
	Analog input / Output <sup>Note1)</sup>	Channels: 2ch In, 2ch Out Input/Output voltage range: -10~10V / 0~10V / 1~5V / 0~5V Input current range : 4~20mA / 0~20mA Max, resolution : 14bit (1/16000), Accuracy: 0.2% (25℃), 0.3% (0~55℃) Conversion speed: 0.5ms / channel Absolute maximum input: Voltage 15 VDC, Current 30mADC
Coordinate systems	Applicable robot	Cartesian, Delta
	Settings	XG5000
	Control language	Function block
SD Memory	Type	Micro SD/SDHC
	File system	FAT32
	Capacity	Max. 32GB installation (Memory over 8GB can use only 8GB of overall area)
	Service	Program back-up/Restoration, Booting operation , Data log
Embedded ethernet	Communication speed	Auto/10Mbps/100Mbps
	Communication port	1 port
	Communication distance	Max. distance between nodes: 100m
	Service	Loader service (XG5000) XGT Protocol (LS protocol), Modbus TCP FTP Server: Able to read/Write SD Memory files from other devices SNTP Client: Network time synchronization with server
Embedded cnet <sup>Note2)</sup>	Communication port	Ch 1: RS-232C, Ch 2: RS-485
	Service	XGT Protocol, Modbus Protocol, User-defined Protocol LS Bus (LS AC drive) Protocol
USB	Performance	USB 2.0, 1 port
	Service	Loader service (XG5000)
Error indication		Indicated by LED
Weight		790g

<sup>Note1)</sup> Analog Input/Output are supported by XMC-E32A/E16A/E08A

<sup>Note2)</sup> Built-in Cnet communication is supported by XMC-E32C

## EtherCAT Communication Specification

Item	Specification
Communication protocol	EtherCAT
Support specification	CoE (CANopen over EtherCAT)
Physical layer	100BASE-TX
Communication speed	100Mbps
Topology	Daisy chain
Communication cable	Over cat. 5 STP (Shielded Twisted-pair) cable
Communication period	0.5ms/1ms/2ms/ 4ms
Synchronous jitter	Under 1us
Synchronous communication	PDO (Process Date Object) Mapping through CoE
Non-Synchronous communication	SDO (Service Data Object) Communication through CoE
Communication setting	Set the communication configuration using XG5000



# XEL-BSSCT

## Performance Specification

Classification	Item		Specification	
Performance specification of adapter	Maximum number of expansion		8	
	Operation mode		RUN, STOP (The test operation through the XG5000 is only available in STOP mode.)	
	Refresh time		DC Sync0 time x refresh time (0 ~ 100)	
	Standard input filter		1, 3, 5, 10, 20, 70, 100ms	
	Self-diagnosis function		Indication of a current error and warning	
	EEPROM	Self-recovery function		Enable/disable automatic recovery
		EEPROM size		4 KB
	Memory	System flag area	F	2 KB
		Extension module mapping area	I	2 KB
			Q	2 KB
			U	1 KB
External connection terminal	Programming port		USB 1 channel	
	Communication port		RJ45 2 ports (Response to shield)	
	Power port		3-Pin push-in/screw fixing type connector	
Status indicator LED		6 types including PWR, MS, RUN, ERR, IN and OUT		
Communication specification of EtherCAT	Maximum number of expansion modules to be mounted		8 modules	
	Communication protocol		EtherCAT	
	Data transfer speed		100Mbps	
	Physical layer		100BASE-TX (IEEE 802.3)	
	Topology		Conforms to the specification of EtherCAT master.	
	Transmission media		STP (Shielded Twisted-pair) cable with Category 5 or higher	
	Transmission distance		100m or less between the nodes	
	Size of PDO data for transmission and reception		Input: Up to 1,024 byte, output: Up to 1,024 byte	
	Size of mailbox data		Input: Up to 256 byte, output: Up to 256 byte	
	Mailbox support command		SDO requests, SDO information	
	Refresh method		Free-Run, Refresh Sync mode (For LSIS Co., Ltd. only)	
	Node address setting method		Rotary switch, master, PADT	
	Node address setting range		Explicit ID(1 ~ 99)	
Alias Address(1 ~ 65535)				
Applies the EEPROM value set by the master when setting PADT 0				

## Power Specification

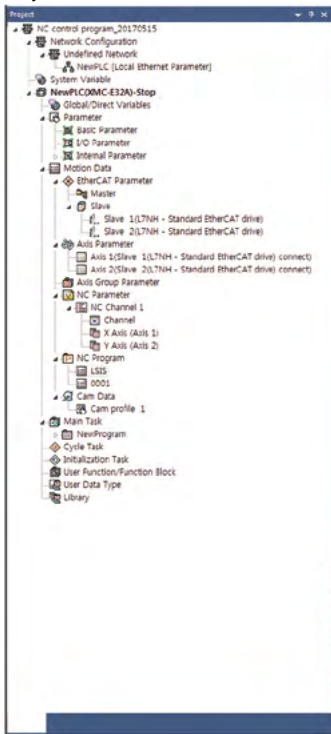
	Item	Specification	Condition
Input	Rated input voltage	DC24V	
	Input voltage range	DC20.4 ~ 28.8V(-15%, +20%)	Within -15% and +20% of the rated input
	Input current	Less than 1.3A (Typ.1A)	Input +DC28.8V, maximum load
	Inrush current	50A peak or less	Input +DC28.8V, maximum load
	Efficiency	80 % or more	Input +DC28.8V, maximum load
	Permitted instantaneous interruption	Within 10 ms	Input +DC28.8V, maximum load
Output	Rated output voltage	DC5V (±2%)	
	Output current	3.0A	
Indication of voltage status		LED On when the output voltage is normal	
Cable specification		22 ~ 20 AWG (0.3 ~ 0.5mm <sup>2</sup> )	

# Motion Solution

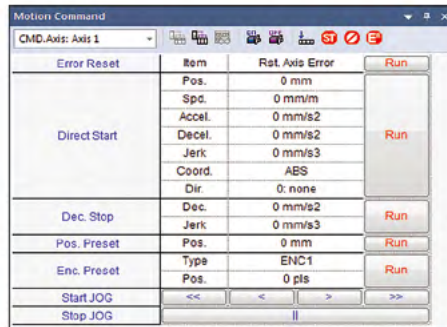
## XG5000: All You Need for both PLC Programming and Motion Control

All the control windows, that is, project, program editor, motion control commands and status monitor, are implemented in a single tool, XG5000.

Project Tree



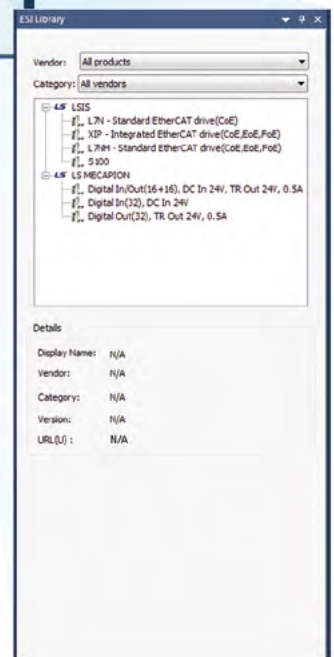
Motion Command



Status Monitor



Program Editor



ESI Library

# Motion Solution

## G-code Commands Available for Controlling CNC Equipments

Control CNC equipments such as packing machine and cutting machine easily with G-code commands.

### Choose NC channel & axis

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

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

```
1 G90
2 G00 X0 Y0
3 G01 X100 Y100 F1000
4 X0 Y200
5 X-100 Y100
6 X0 Y0
7
8 H98 F0001
9
10 M98
    M99 Comment: Auxiliary Program Call
```

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

Main program

Sub program

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





## Robot Control: Innovative Control Function for Smart Solution

With the support of group motion in coordinate system, it is possible to control various types of robots such as Cartesian, Delta3, Delta3R and Linear Delta.

MC_SETKINTRANSFORM			
BOOL	Execute	Done	BOOL
UINT	AxesGroup	AxesGroup	UINT
UINT	KinType	Busy	BOOL
UINT	KinParam	Active	BOOL
ABSVAL OF LREAL	KinParam	CommandAbort	BOOL
LREAL	ToolOffSetX	Error	BOOL
LREAL	ToolOffSetY	ErrorID	WORD
LREAL	ToolOffSetZ		

or

Coordinate system configuration	
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
Coordinate system parameter6	0

Coordinate system and tool setting via MC\_SETKINTRANSFORM  
(Set in axis group parameter)  
XYZ/Delta3/Delta3R/Linear Delta

MC_SETCARTESIANTRANSFORM			
BOOL	Execute	Done	BOOL
UINT	AxesGroup	AxesGroup	UINT
LREAL	TransX	Busy	BOOL
LREAL	TransY	Active	BOOL
LREAL	TransZ	CommandAbort	BOOL
LREAL	RotAngleA	Error	BOOL
LREAL	RotAngleB	ErrorID	WORD
LREAL	RotAngleC		

or

PCS Configuration	
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

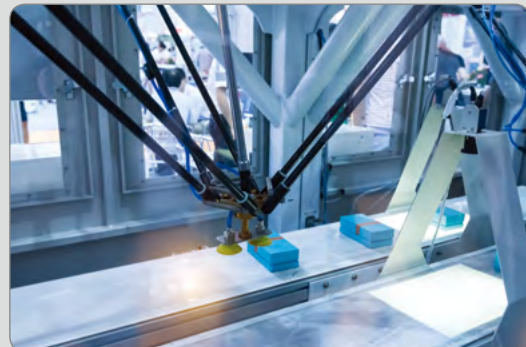
LS_SETWORKSPACE			
BOOL	Execute	Done	BOOL
UINT	AxesGroup	AxesGroup	UINT
UINT	WorkspaceType	Busy	BOOL
BOOL	WorkspaceErrorLevel	Active	BOOL
ABSVAL OF LREAL	WorkspaceParam	CommandAbort	BOOL
LREAL		Error	BOOL
LREAL		ErrorID	WORD

or

Workspace configuration	
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.

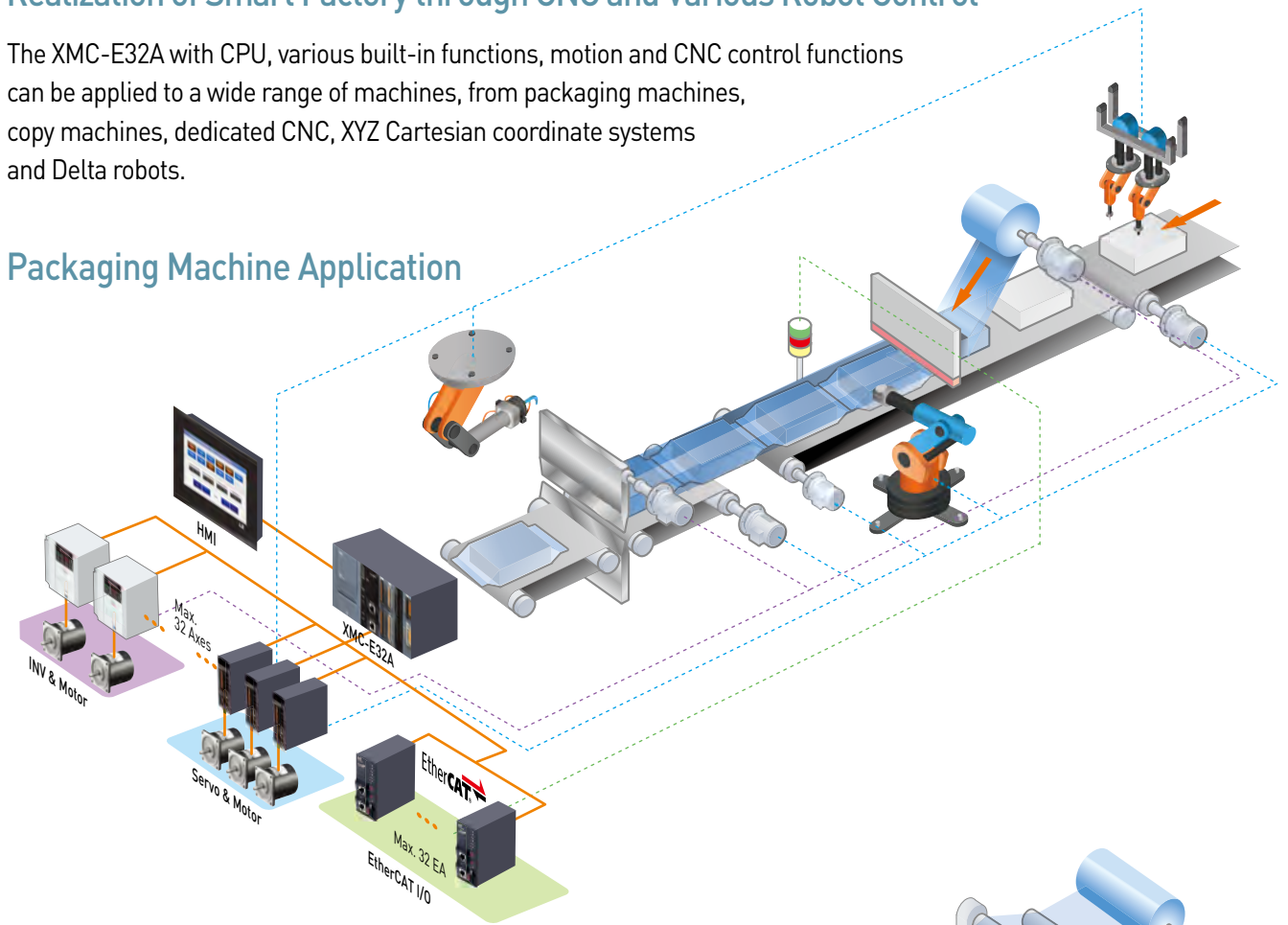


# Application

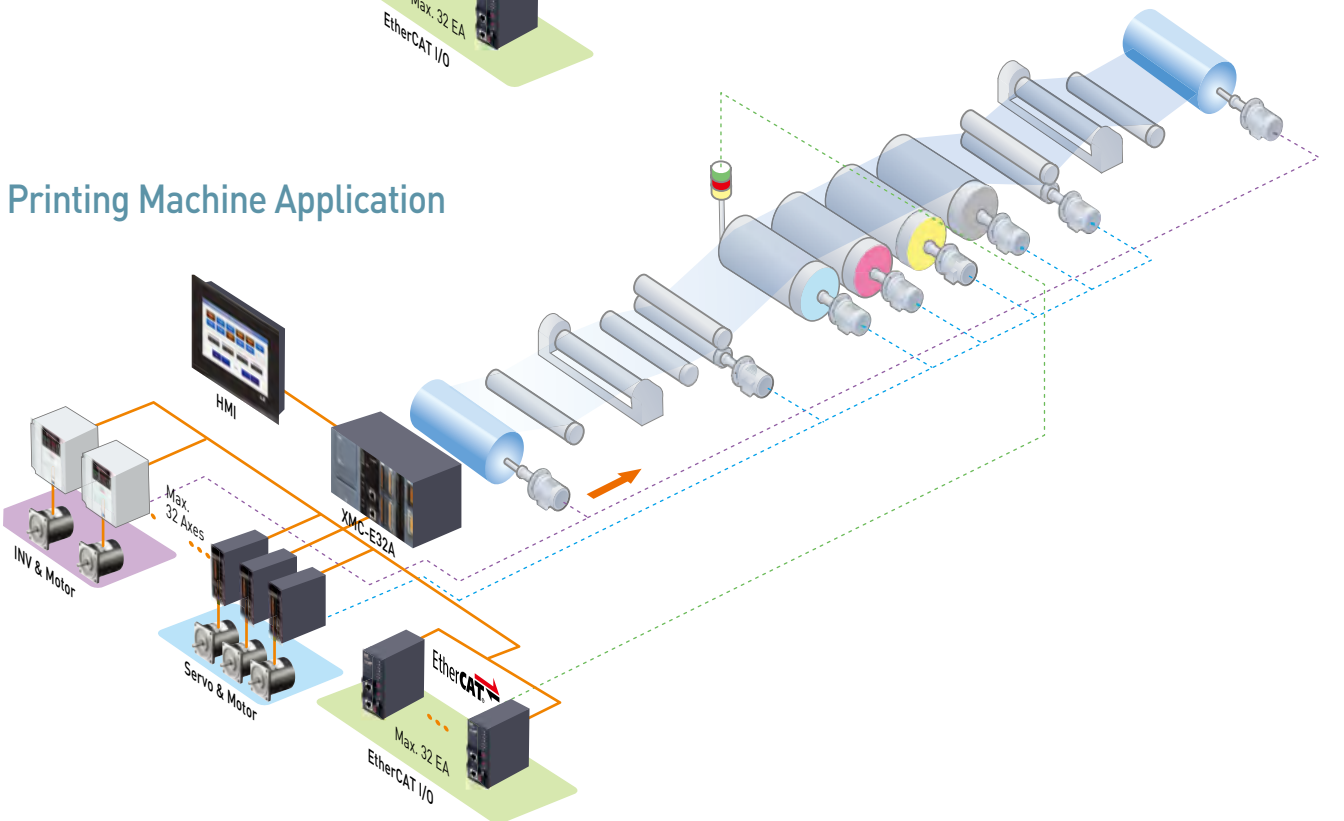
## Realization of Smart Factory through CNC and Various Robot Control

The XMC-E32A with CPU, various built-in functions, motion and CNC control functions can be applied to a wide range of machines, from packaging machines, copy machines, dedicated CNC, XYZ Cartesian coordinate systems and Delta robots.

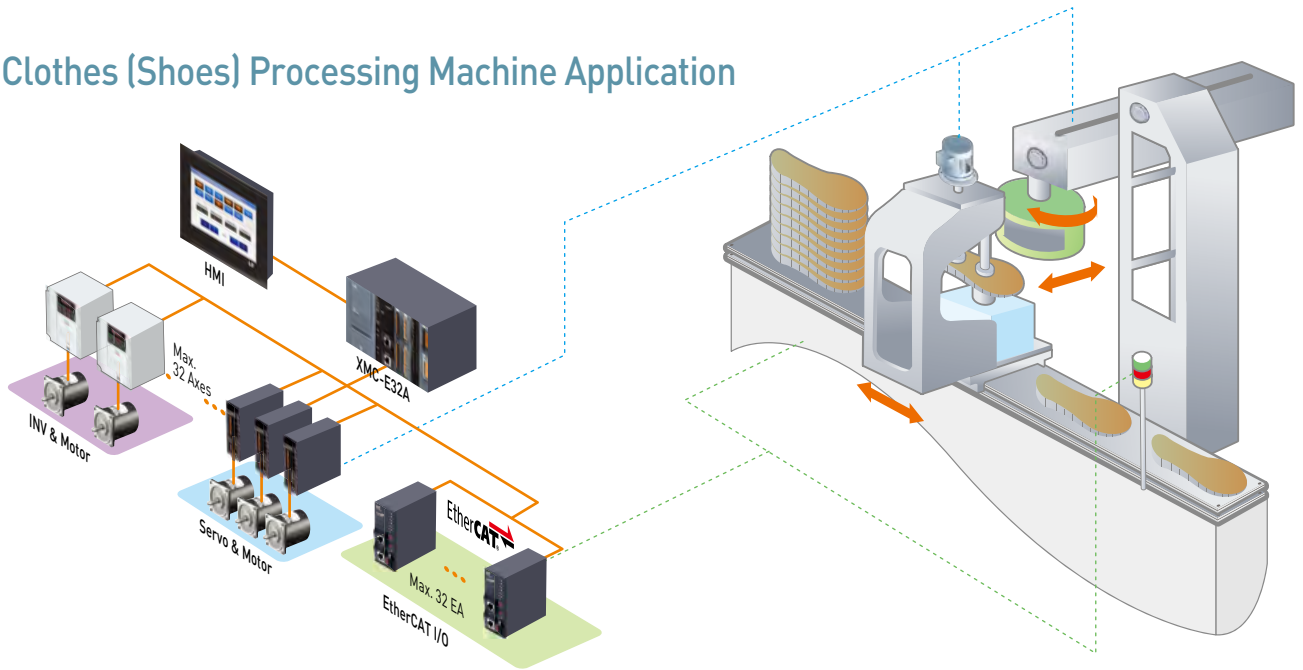
### Packaging Machine Application



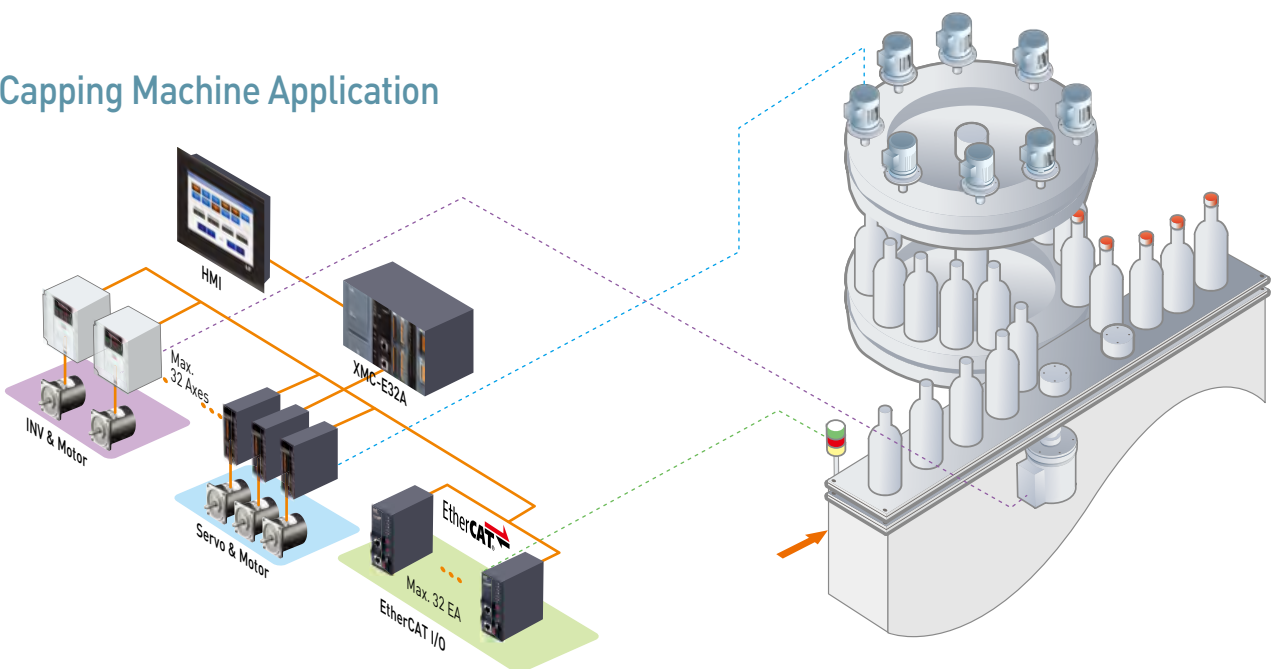
### Printing Machine Application



### Clothes (Shoes) Processing Machine Application



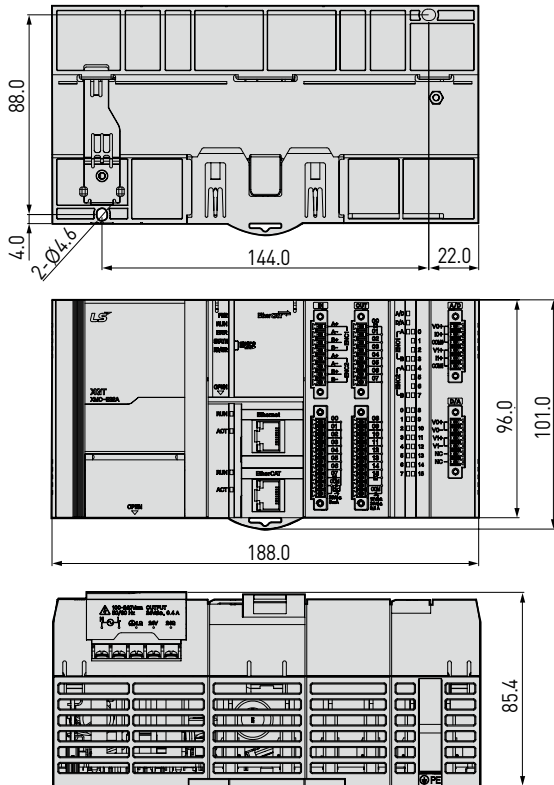
### Capping Machine Application



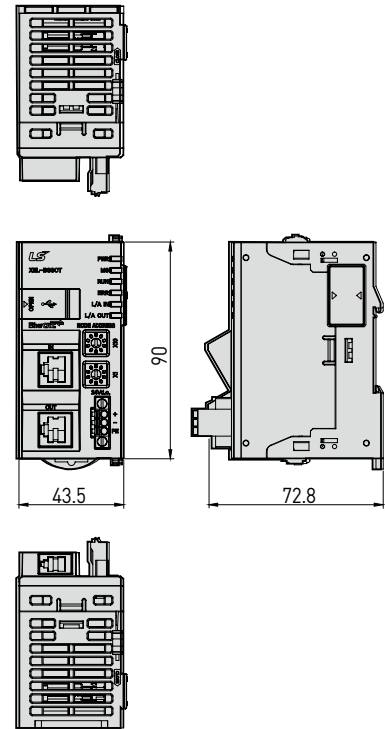
※ Refer to LSIS servo drive/motor catalogue and LSIS planetary gearbox catalogue for further details.



## XMC-E32A/E16A/E08A/E32C



## XEL-BSSCT



• According to The WEEE Directive, please do not discard the device with your household waste.

[www.lsis.com](http://www.lsis.com)



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