



Digitized Automation for a Changing World

Delta Motion Control Solution Based on CODESYS



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Delta Motion Control Solution Based on CODESYS

Automation and digitalization play important roles in smart manufacturing. To enhance competitiveness, machine makers around the world are seeking solutions to quickly expand equipment development and applications, and save construction time and labor.

Delta is cooperating with the CODESYS® group to utilize its motion control development system and offer a brand new motion control solution based on CODESYS. The CODESYS platform is a user-friendly integration interface compliant with IEC 61131-3 standards. It provides a wide range of applications for global users with strong motion control functions, and can be easily implemented into existing equipment.

Delta's motion control solution based on CODESYS integrates the control functions of PLCs, HMIs, and motion controllers into one platform, and features a variety of new products, including the PC-based Host Motion Controller AX-8 series Series and PLC-based Host Motion Controller AX-3 series.

The solution also supports EtherCAT communication to simultaneously control field devices, such as the Delta AC Servo Drive ASDA-A3-E, ASDA-B3-E, ASDA-A2-E Series, High Performance Compact Drive MH300 Series, Compact Drive MS300 Series, General Vector Control Drive C2000 Plus Series and Remote Module R1-EC, R2-EC Series & DVP EtherCAT Remote I/O. Delta's motion control solution based on CODESYS fulfills various application demands with its complete and integrated offerings.



**PC-Based
Motion Controller
AX-8 series**



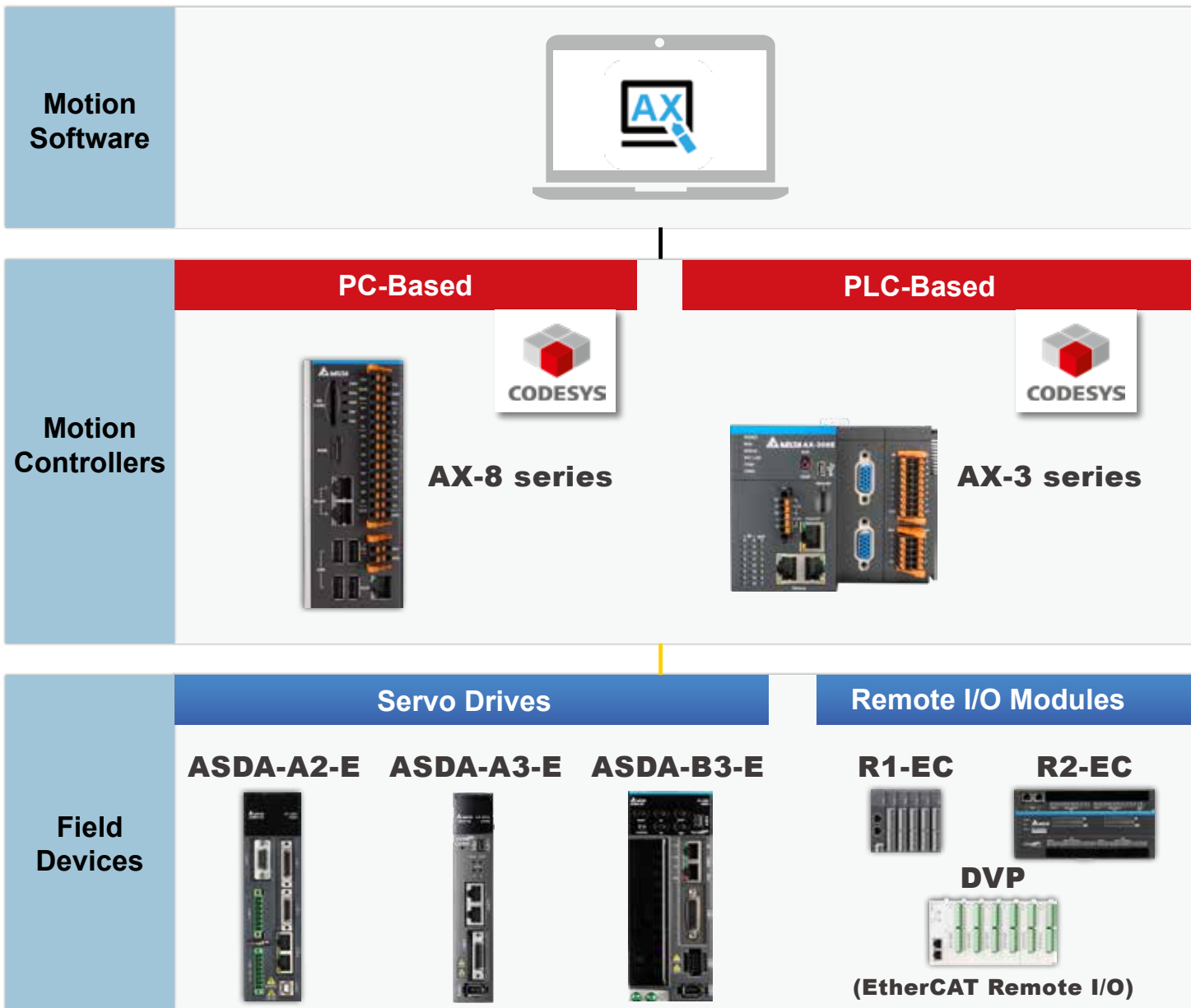
**PLC-Based
Motion Controller
AX-3 series**

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Delta Motion Control Solution Based on CODESYS





Features

- ▶ **Standardized programming:**
IEC 61131-3 compliant software provides a standardized programming and controller development platform
- ▶ **Unified integrated software:**
Programs all Delta's automation products in a single platform to shorten development time and cost
- ▶ **Open and modular platform:**
Allows secondary development for customized functionalities and components by users with industry know-how
- ▶ **Single PLC/Motion platform:**
CODESYS runtime supports Windows, VxWork, and Linux operating systems, and provides a unified IEC 61131-3 compliant software and editing platform with different (PC-based or PLC-based) controllers
- ▶ **Supports EtherCAT high-speed fieldbus:**
Highly efficient, precise and instant motion control enhances productivity
- ▶ **Tag sharing between HMI and controllers based on CODESYS:**
Easy and simple variable sharing saves editing time and labor
- ▶ **Various peripheral devices for applications:**
Suitable for industrial robots, woodworking, printing and packaging applications



Products for Motion Control Solution Based on CODESYS Motion Controllers

PC-Based Motion Controller AX-8 Series

Supports EtherCAT communications and CODESYS-based program to provide a comprehensive and integrated motion control solution for multiple industrial applications

- Based on the CODESYS SoftPLC program (compliant with the IEC 61131-3 standard) and SoftMotion
- Up to 64 servo axes control
- Fan-less and compact design
- Intel x86 CPU
- Built-in security IC system for enhanced software and hardware security
- Low-voltage detection and data overwriting functions
- 8 high-speed digital local inputs / outputs
- Provides a wide range of practical accessories, meeting requirements of robot arms, woodworking, printing, packaging, and various applications



PLC-Based Motion Controller AX-3 Series

Provides a real-time and flexible motion solution for various applications with CODESYS-based program and EtherCAT communication

- AX-308E CPU supports up to 8 axes EtherCAT servos (Min. sync. time: 2 ms for 8 axes)
- AX-364EL CPU supports 64 positioning axes
- Supports PLC AS series' power, DIO, AIO and temperature expansion modules (Max. 32 modules)
- High performance: min. execution time of basic instruction is 5ns
- Provides most popular instructions like position, velocity, torque, multi-axis interpolation, E-gear, E-Cam, and more.
- Built-in 16DI, 8DO, incremental encoder (×2), SSI absolute encoder, RS232/485, Ethernet and EtherCAT interfaces



AC Servo Systems

Compliant with IEC 61158 and IEC 61800-7; supports all the modes of the CoE device profile based on CiA402 and all command types of EtherCAT

- CODESYS Certification
- Passes the EtherCAT conformance test by EtherCAT Technology Group (ETG)
- Supports absolute type and incremental type servo motors
- Supports the high speed position latch (Capture) function
- Integrated Safe Torque Off (STO) safety function according to the standard of SIL2 (IEC EN 61508 & IEC 62016) / Cat.3 PL=d (ISO 13894-1) for ASDA-A3-E and ASDA-A2-E

ASDA-A3-E

- High-end servo system
- 3.1 kHz bandwidth enhances productivity
- Flexible compensation diagnosis and vibration suppression function ensures machine stability and reduces settling time
- Compact and space-saving
- Power range: 200 V 50 W ~ 15 kW



ASDA-B3-E

- Standard servo system
- 3.1 kHz bandwidth, settling time decreased by 40 %
- Easy gantry control with high-speed inter-axis data exchange
- Compatible with the A2/B2/A3 series motors for easier replacement
- Power range: 200 V 100 W ~ 3 kW



ASDA-A2-E

- Advanced servo system
- Short cycle time, ideal for high-speed synchronous multi-axis control
- Supports absolute type and incremental type ECMA Series motors
- Power range: 200 V 100 W ~ 3 kW, and 400 V 400 W ~ 7.5 kW



Products for Motion Control Solution Based on CODESYS Field Devices

High Performance/Standard Compact Drive MH300 / MS300

Compact size with built-in STO function, EMC filter and integrated PLC, and supports various communications and I/O expansion modules

- Power range: 115V 0.2kW~0.75kW, 230V 0.2kW~15kW and 460V 0.4kW~22kW
- Supports IM and PM motors, open/closed loop control
- Max. output frequency: up to 2000Hz/1500Hz
- Built-in Safe Torque Off (STO) safety function according to the standard of SIL2 (IEC EN 61508 & IEC 62016) / Cat.3 PL d (ISO 13894-1)
- Integrated PLC program with 5K/2K steps capacity
- Various communications: Modbus, CANopen, EtherCAT, PROFIBUS DP, DeviceNet, Modbus TCP, EtherNet/IP



High Performance Vector Control Drive C2000 Plus

Features precise speed/torque/position control functions and built-in PLC functions, suitable for sensors/sensorless synchronous/asynchronous motors

- Power range: 230V_{AC} 0.75kW~90kW, 460V_{AC} 0.75kW~560kW
- Heavy duty overload capability: 150%/60sec, 180%/3sec., suitable for constant torque applications
- Supports remote I/O: built-in DI terminals × 10 (MI), DO terminals × 4 (MO & RY); up to DO terminals × 10 (MO & RY) after installing option cards
- Supports standard motion control protocol CiA402: HM, CSP, PP, VL modes
- Supports homing, positioning for single point, multi-point, and external pulse
- Built-in Modbus and CANopen (specific models only), supports optional communication cards: CANopen, EtherCAT, ProfiNet, Profibus DP, DeviceNet, EtherNet/IP, Modbus TCP



Remote I/O Module

R1-EC

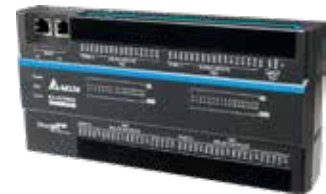
Rugged and compact gateway type E-bus slave modules for high precision and demanding industrial applications



- Power coupler: connects EtherCAT slave module with 100baseTX EtherCAT
- Digital input module: 16 ports Sink/Source DI module; provides 0.1 ms and 2ms response time models
- Digital output module: 16 ports DO module; output current: 0.5A/each port for sink type model and 0.25A/each port for source type model
- ADC modules: 4-channel 16-bit A/D input; DAC module: 4-channel 16-bit D/A output
- Motion module: single-axis pulse output
- MPG input module: one channel MPG input, 4/6 axis control

R2-EC

High-performance remote I/O bus system



- EtherCAT remote control 32-channel DI / 32-channel DO (relay) expansion module

PLC DVP Slim RTU Solution

RTU-ECAT

The best compact EtherCAT remote I/O solution for various applications



- EtherCAT coupler RTU-ECAT: built-in EtherCAT (2-port switch) and supports up to 8 DVP slim I/O modules.
- Digital input modules: supports 8/16/32 points with NPN/PNP input
- Digital output modules: supports 8/16/32 points with NPN/PNP/relay output
- Digital I/O modules: supports 8 DI points and 8 DO points with different in/out type
- Analog input modules: supports 4/6 channels with mA/V input
- Analog output modules: supports 2/4 channels with mA/V output
- Analog I/O modules: supports 4AI channels and 2AO channels with mA/V in/out type
- Temperature modules: supports 2/4/6/8 channels with RTD, thermocouple and NTC input

(Note: please refer to Delta's DVP Series PLC catalog for detail information)

Products for Motion Control Solution Based on CODESYS Field Devices



Extended I/O Module PLC AS Series I/O for AX-308E / AX-364EL

The optimized system with CAN bus protocol greatly enhances communication stability and speed; rackless DIN-rail installation for easy installation



- Digital input modules: 8~64 DI module; 1ms response time
- Digital output modules: 8~64 module; transistor (sink/source) for 1ms and relay for 10ms response time
- Digital I/O modules: 8DI/8DO module; transistor (sink/source) for 1ms and relay for 10ms response time
- Analog input modules: 4 and 8 channels; 16-bit differential signal
- Analog output modules: 4 and 6 channels; 12-bit differential signal
- Load cell modules: 2 channels; 24 bit ADC resolution, selectable signal input range
- Pulse modules: 2 channels differential and 4 channels open collector; 200 kHz input / output
- High speed counter modules: 2 channels differential / open collector; 200 kHz with incremental and absolute (SSI)
- Temperature modules: 4~8 channels; 0.1 °C/0.1 °F resolution



Human Machine Interface

Human Machine Interface

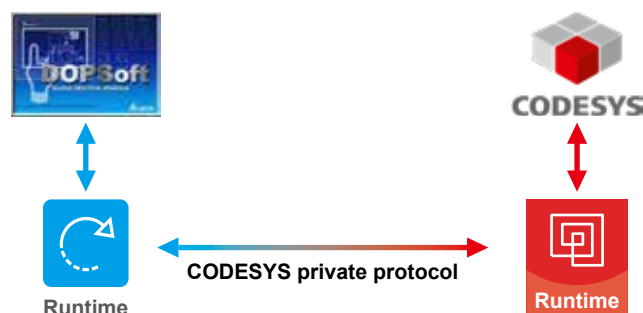
DOP-100

Tag Sharing with the CODESYS-Based Controller

Adopts the latest Cortex-A8 / Dual Core high-speed processor, multimedia functions and built-in Ethernet communication to help customers build an IoT structure for smart machines and smart manufacturing

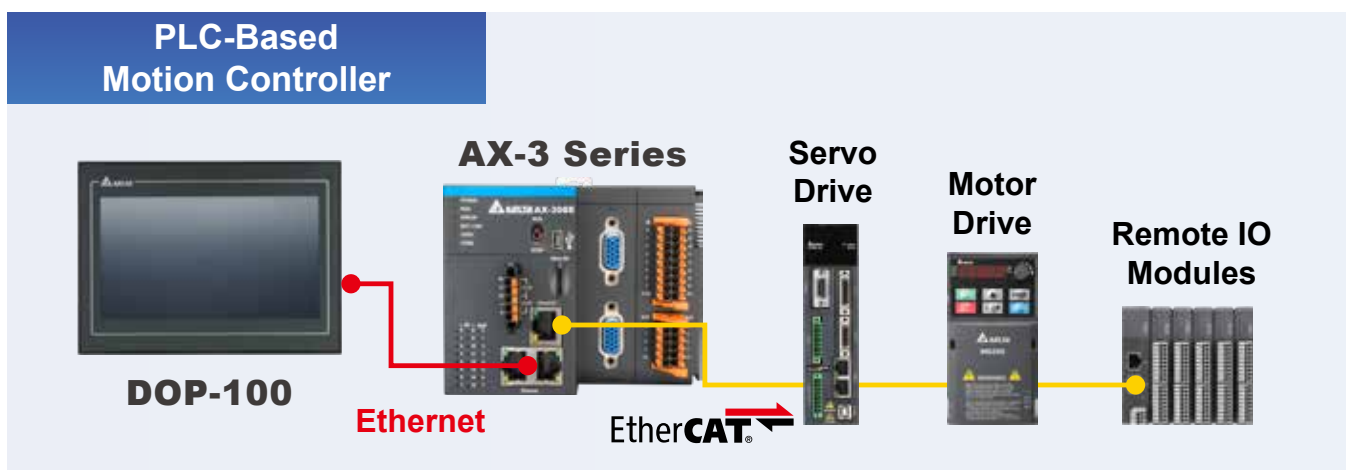
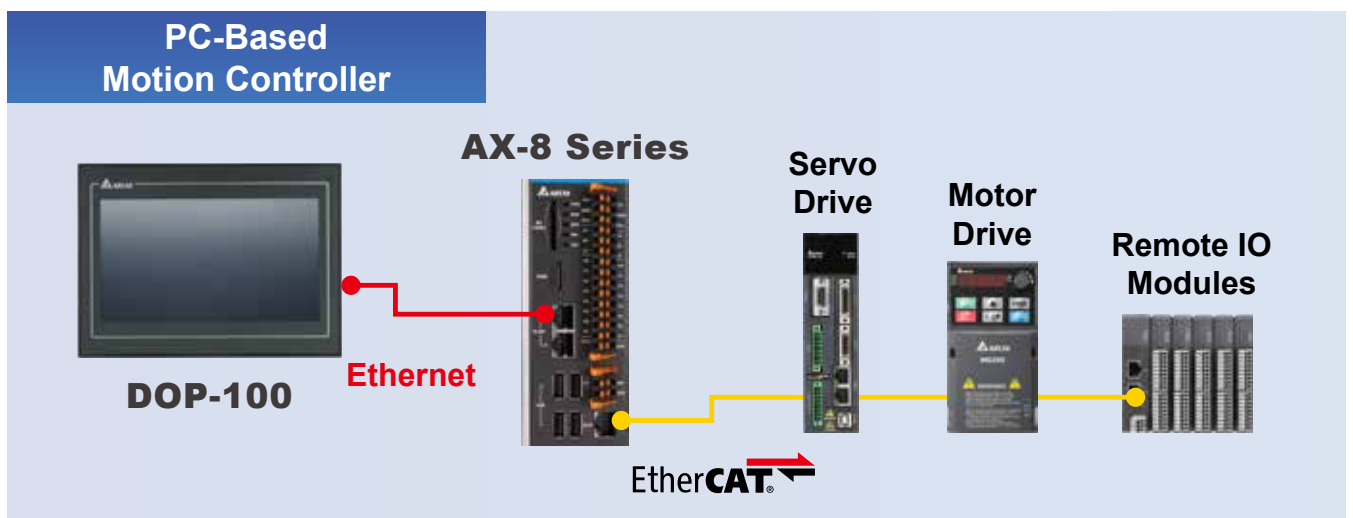
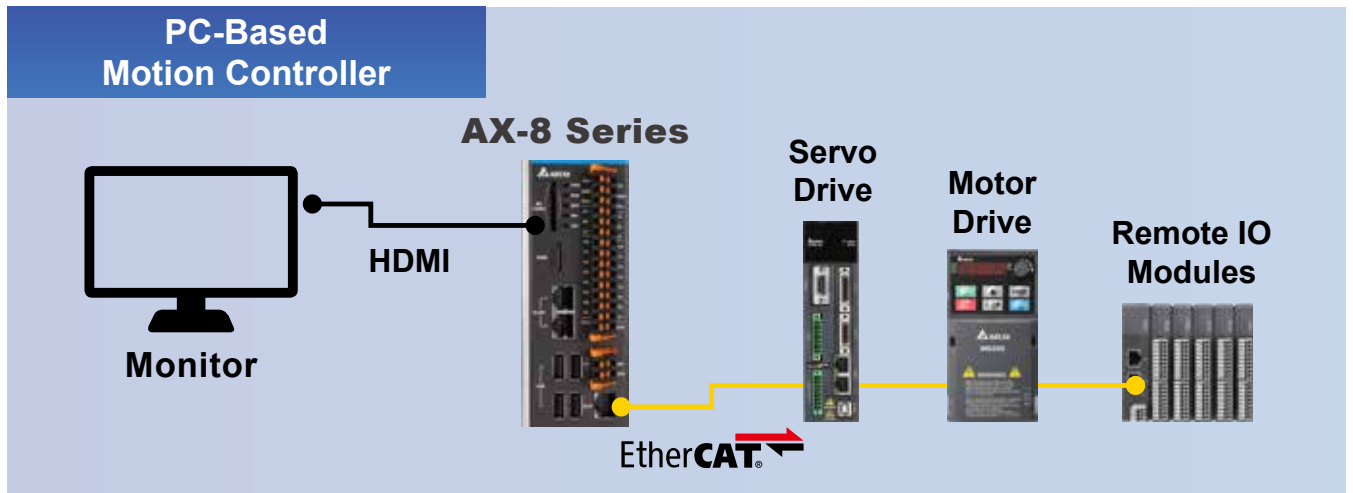


- Various display dimensions: from 4.3” to 15.1”
- Building connection with the CODESYS-based controllers
- Able to access the controllers based on CODESYS for variable value exchange
- Compact and narrow frame design to save installation space
- VNC function enables remote control via remote devices such as mobile phones and laptops
- Supports PDF documents
- Robust hardware protection: power, power board and communication isolation
- Multimedia functions: analog and IP camera connections, video play and event trigger functions
- Supports 2D and 3D recipe grouping, flexible in building recipe database
- Supports 8 levels of authorities, and allows 8 accounts (account name/password) for each level
- Supports 16 languages input to achieve localized operation for global customers



Products for Motion Control Solution Based on CODESYS Human Machine Interface

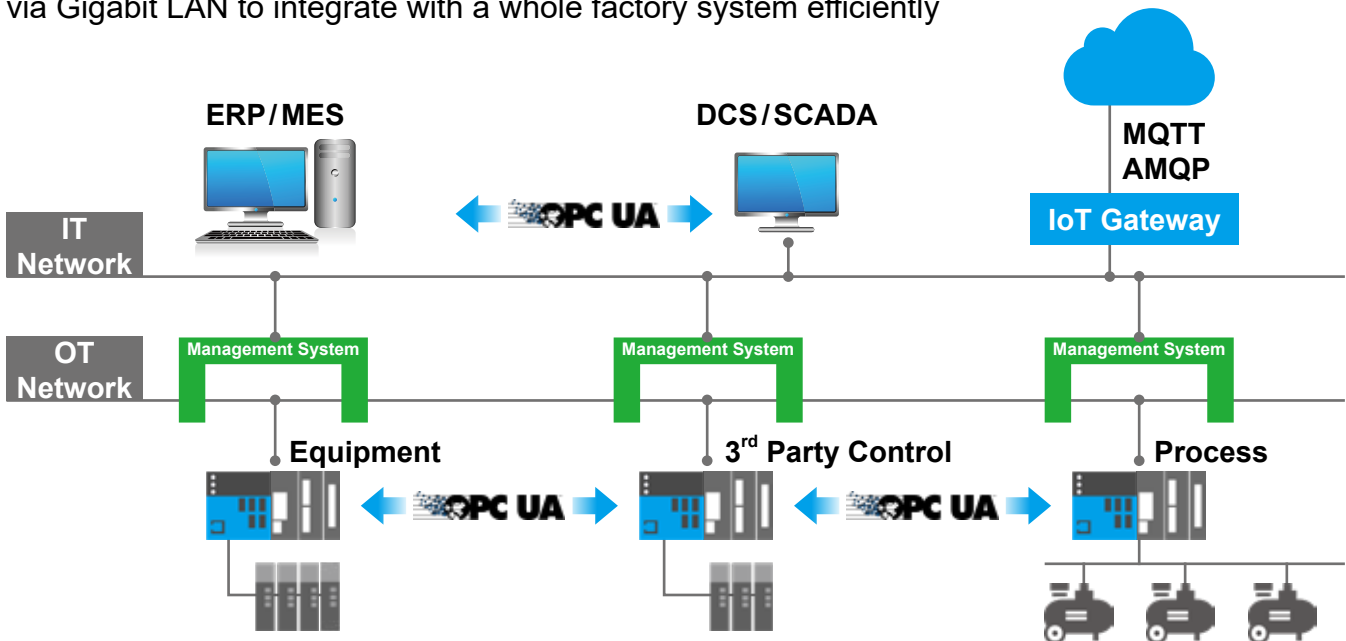
Tag Sharing between HMI and Controllers based on CODESYS



Communication Structure

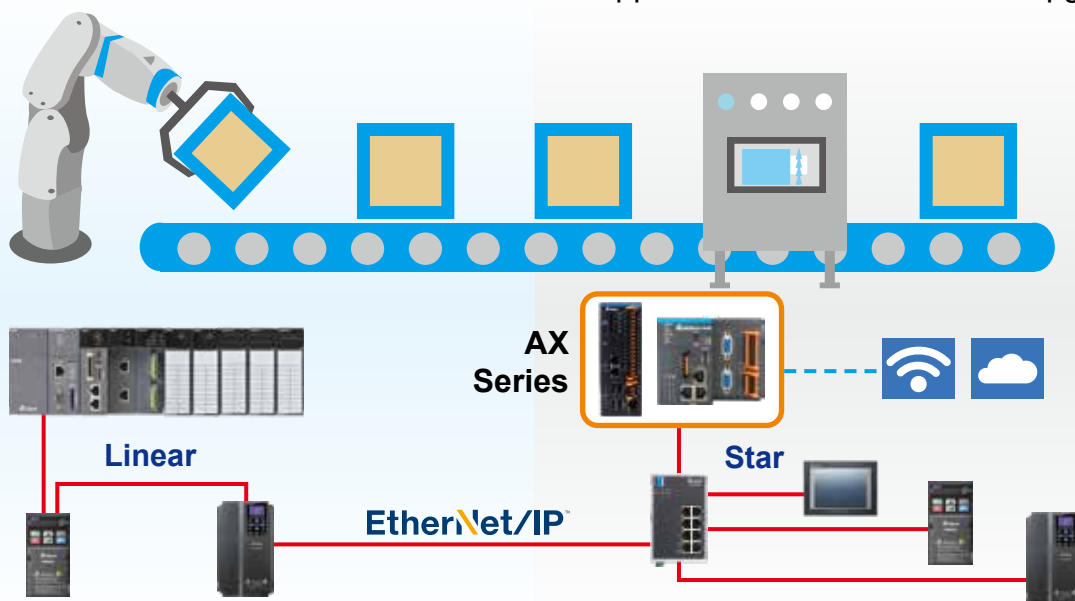
Standard OPC UA Server

Built-in OPC UA Server connects with different systems, such as MES, EPR, or PLC system via Gigabit LAN to integrate with a whole factory system efficiently



Flexible Network System

- Built-in EtherNet/IP to support star and linear network topology for fast expansion and management
- Compatible with IT networks for more automation applications and industrial 4.0 upgrades

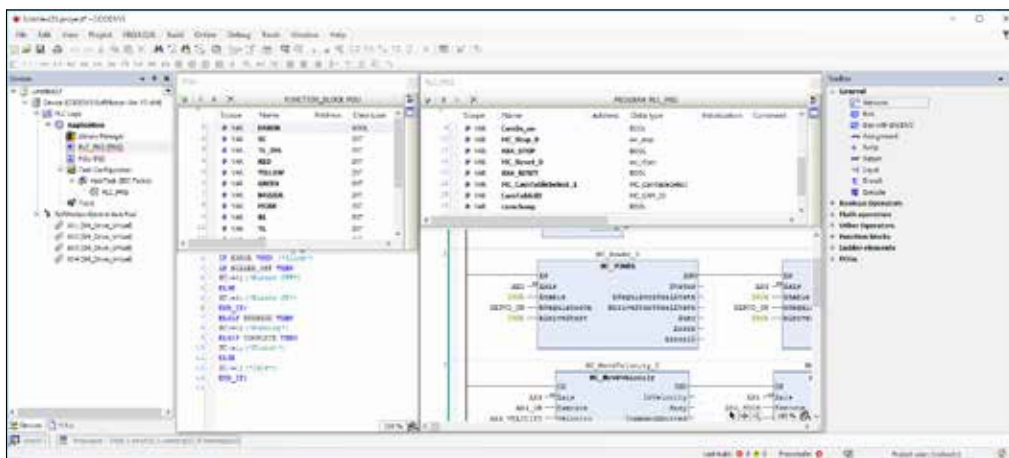


Products for Motion Control Solution Based on CODESYS Software: DIADesigner-AX

Comprehensive functions for configuring, programming, compiling, and debugging; seamlessly integrated for both classic and systematically supported programming

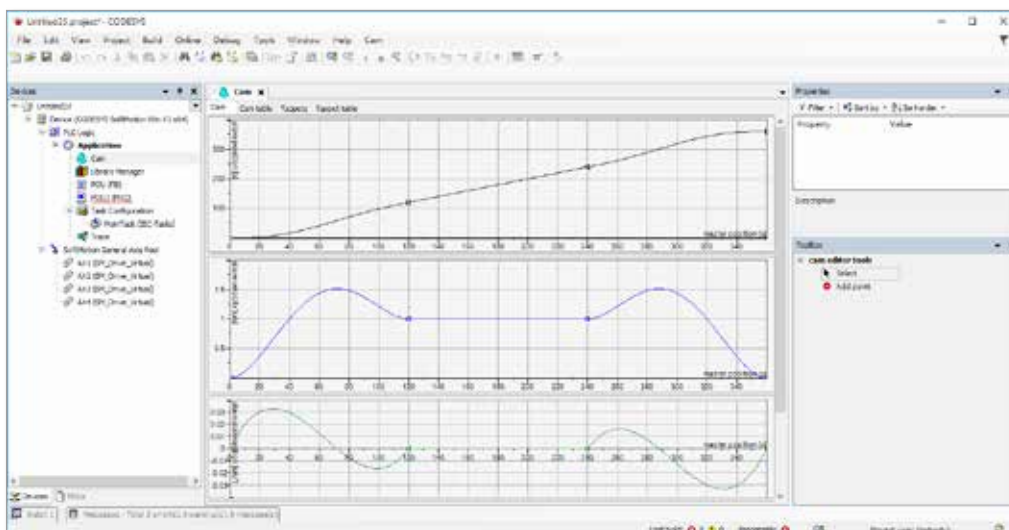
Standard IEC 61131-3 Programming

- Structured Text (ST)
- Ladder Programming (LD)
- Function Chart Programming (FBD)
- Sequential Function Chart (SFC)



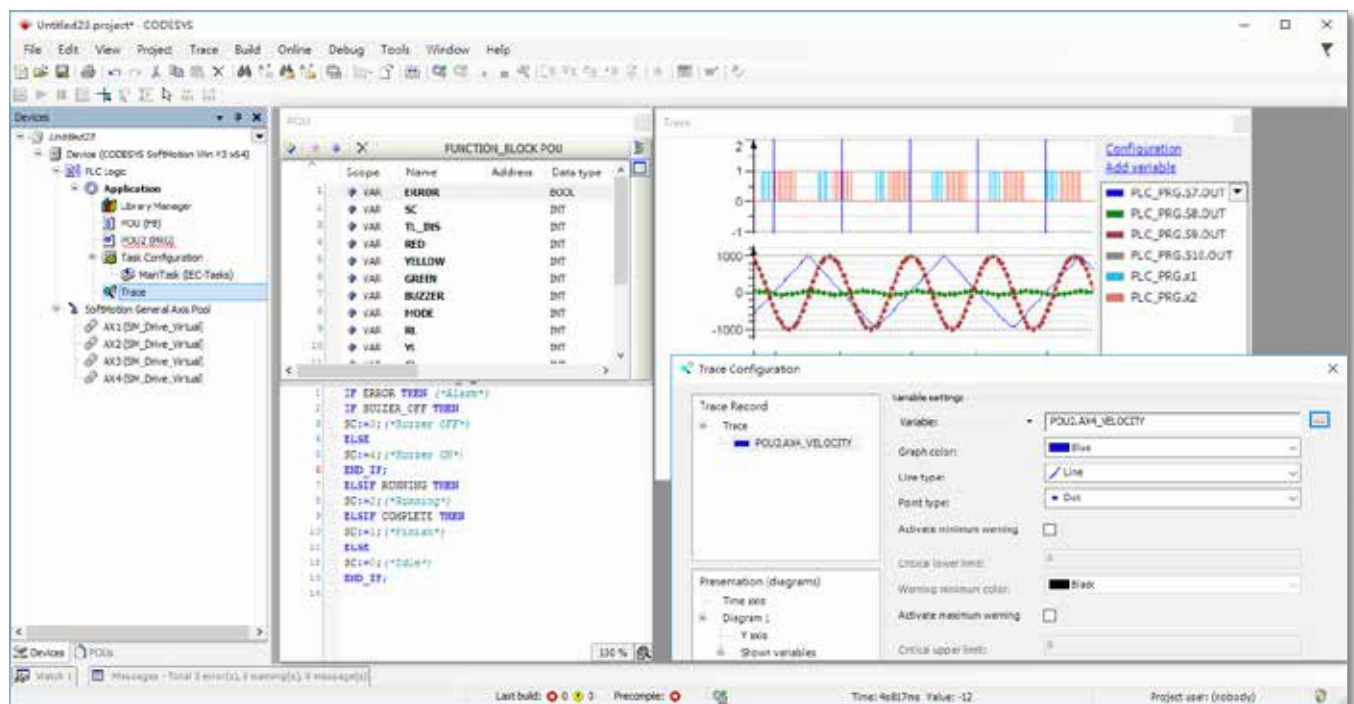
Motion Control Software

- Supports single-axis and coordinated multi-axis traversing motion (e.g. master/slave functions and cams) control
- Library available to use in POU's and programming of motion functions
- Graphical planning with CAM editor



Tasks and Debugger

- Display of application data at runtime in simulation mode on SoftPLC and discrete controllers
- Monitoring of specific values in watchlists
- Reading, writing, and forced setting of variable values, directly in the respective editor
- Execution of code in single step or single cycle





Products for Motion Control Solution Based on CODESYS Software: DIADesinger-AX

Features

- Creates structured and efficient applications from configuration to commissioning with one tool
- Optional object-oriented programming according to IEC 61131-3 (3rd edition), also blended with functional programming within the project
- Description document directly integrated into the tried and tested library for easy development

Benefits

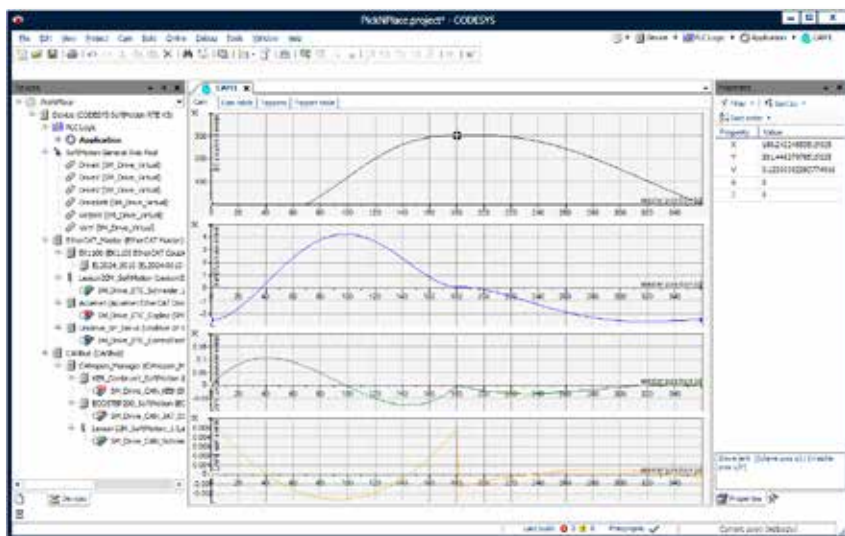
Standard PLCopen

- Single or multi-axis movements with PLCopen motion POU's



Electronic CAM

- Provides E-Cam synchronous control function
- Graphical interface for programming E-Cam curves

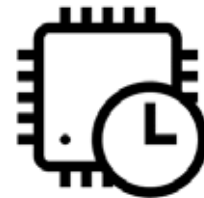




- Multi-platform development and application reusability with exchangeable target system descriptions for all CODESYS-compatible devices
- Versatile extensibility with modular design and available add-ons
- Clear user interface and user-defined windows

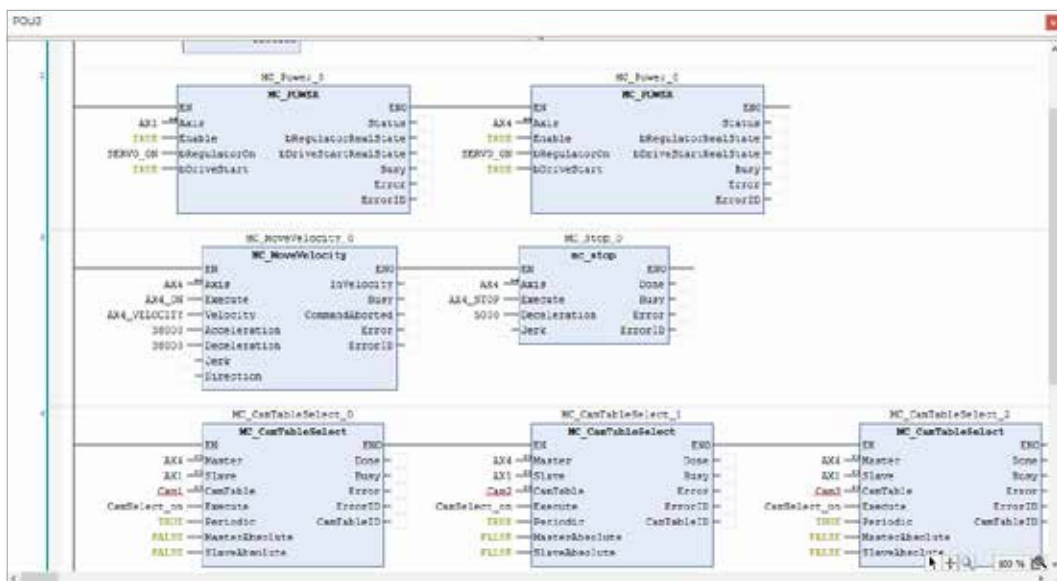
Real-Time System

- 1 ms synchronous cycle to control a total of 64 real and virtual axes



Multi-Axis Function Block

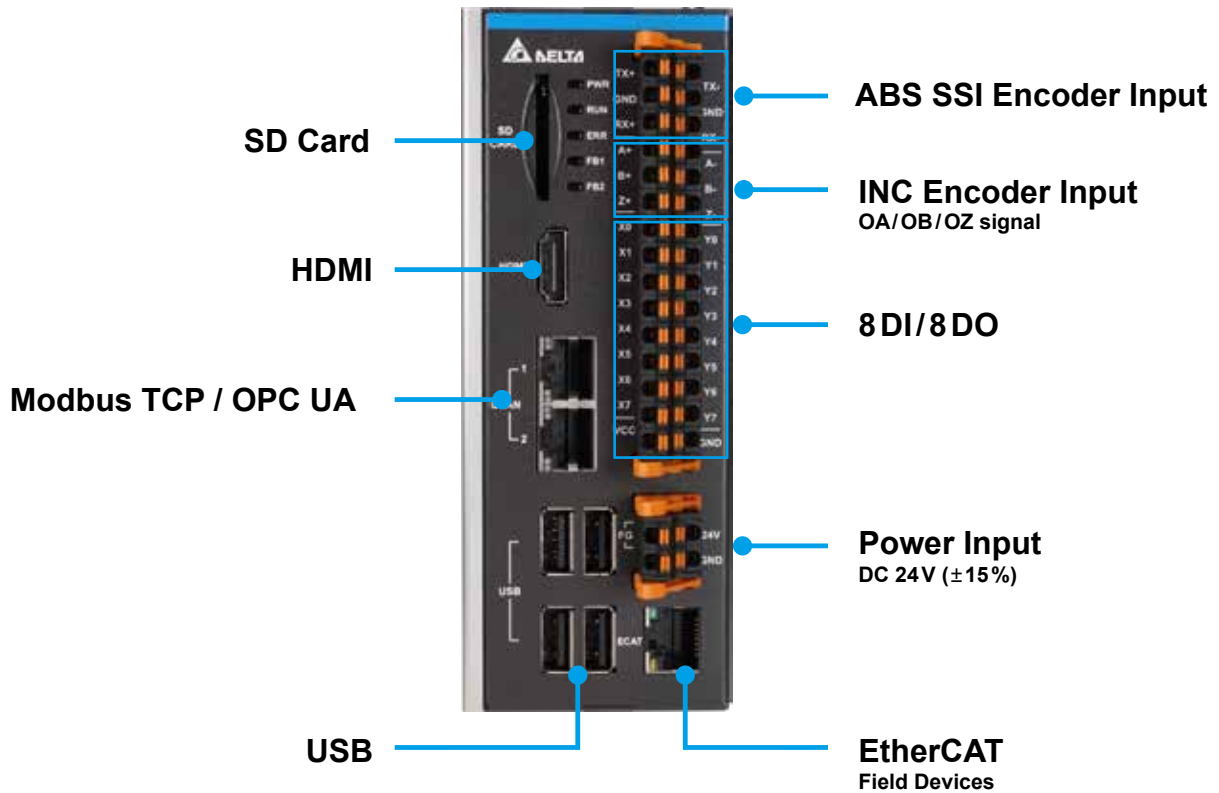
- Motion control using IEC 61131-3 function blocks



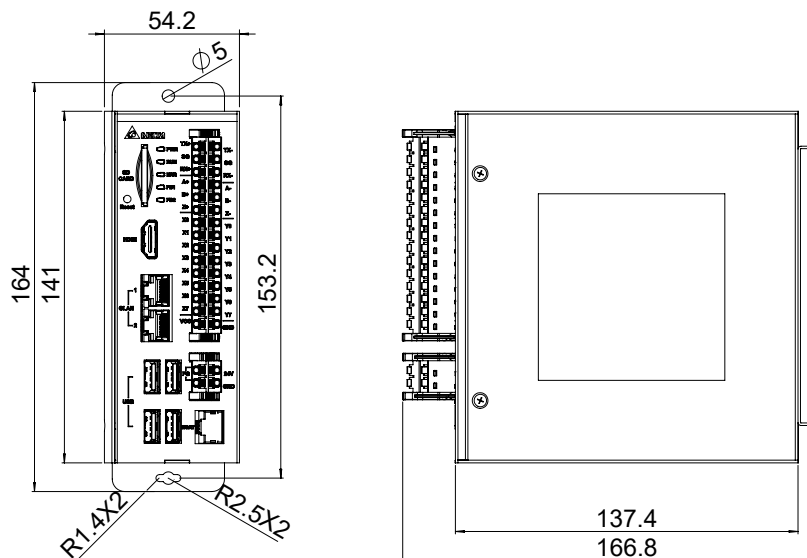
Product Information

PC-Based Motion Controller AX-8 Series

Product Parts



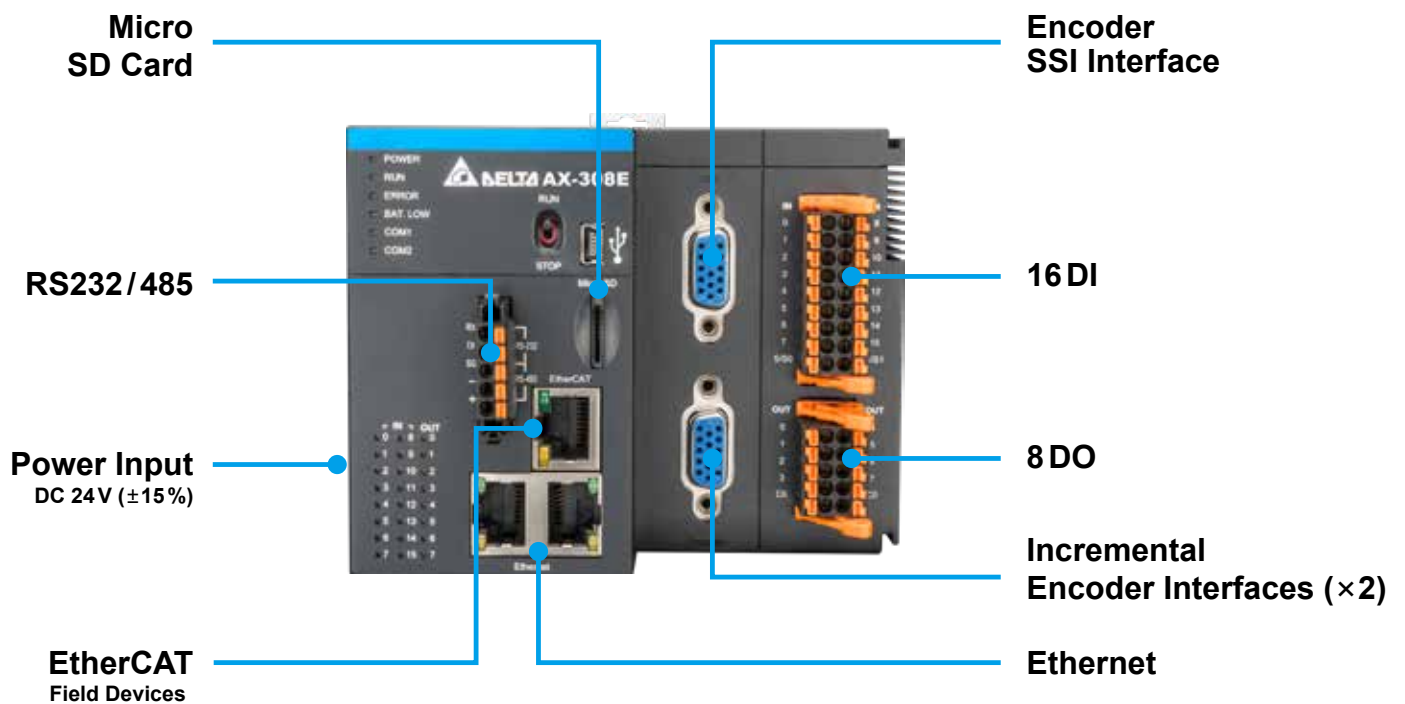
Dimensions Unit: mm



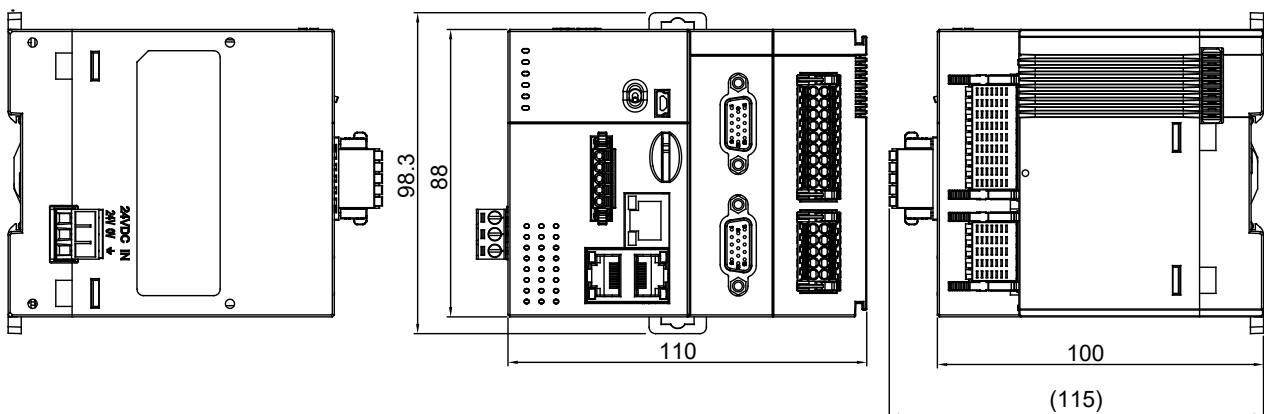
PLC-Based Motion Controller

AX-308E / AX-364EL

Product Parts



Dimensions Unit: mm



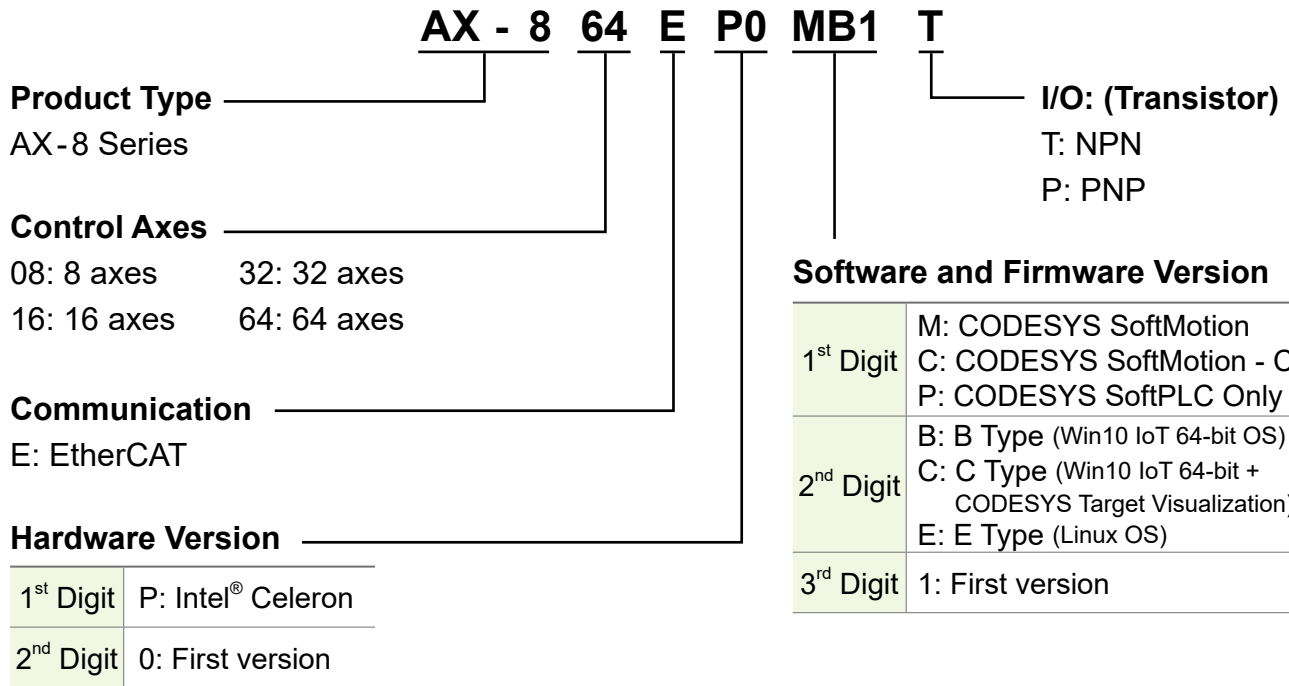
Hardware Specifications

Model		AX-8__EP0_B1_	AX-8__EP0_E1_
Processor	CPU	Intel® Celeron J1900 2.0 GHz Quad. Core	
	BIOS	AMI BIOS	
	Memory	Built-in DDR3L-1333 4 GB	Built-in DDR3L-1333 2 GB
	Non-Volatile Memory	96 KB	
Display	Type	HDMI 1.4a × 1	
Input / Output Port	DI / DO	8DI / 8DO	
	Transistor	PNP; NPN	
Encoder Input	Input Pulse	A± / B± / Z±	
	Communication Type	SSI × 1	
Execution Cycle	Floating-point Number	30 ns	
Storage	Hard Drive	M.2 module × 1 (Built-in SSD 32GB)	EMMC 8GB
	USB	USB 2.0 × 4	
	SD Card	SD card slot × 1	
	Program Capacity	1 G	
	Temp. Data Storage (I/Q/M)	128 KB / 128 KB / 5 MB	
Power	Input Voltage	24 V _{DC} , -15 % / +20 %	
	Rated Power	48 W	
	Max. curr. consumption	2 A	
RTC Backup Battery		BIOS 3V CR2032 lithium battery × 1	
Dimensions (W) × (H) × (D) mm / Weight		54.2 × 141 × 137.5 / 700 g	
Cooling System		Natural	
Axes of Control (1 ms)		64 Axes / 96 Stations	
Operating System		Window 10 IoT	Linux
Communication	Network Port	Ethernet × 2	
	Serial Port	RS422 / 485: 115.2 kbps	
Environment	Ambient Temperature	0 ~ 50 °C	
	Storage Temperature	-20 ~ 70 °C	
	Humidity	5 ~ 95 % RH (non-condensing)	
	Vibration Resistance	IEC 60068-2-6, 5 ≤ f ≤ 8.4 Hz, constant amplitude 3.5 mm, 8.4 ≤ f ≤ 150 Hz, constant acceleration 1G	
	Shock Resistance	IEC 60068-2-27, Waveform: Half-sine 15G ,11 ms	
	Protection Rating	IP20	
	Certifications	CE, UL	

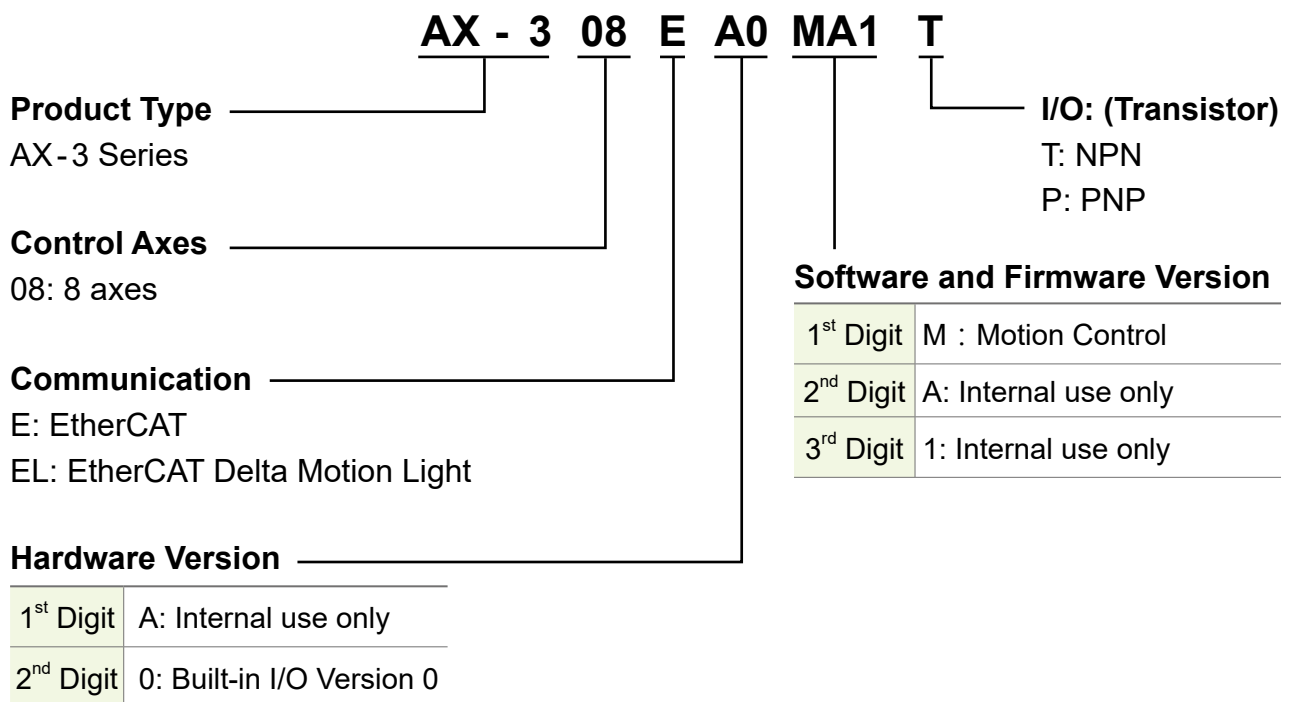
Model		AX-308E / AX-364EL
Instruction Processing Speed	Boolean Operation	5 ns
	Elementary Arithmetic for Integers	5 ns
	Elementary Arithmetic for Floating Point	33 ns
Program Capacity		8 MB
Data Capacity		16 MB
Max. Extension Modules		32 modules (max. 16 analog modules)
Max. Number of Inputs / Outputs		1,024 points (input & output)
CPU Built-in Inputs / Outputs		16DI / 8DO
CPU Built-in Differential Inputs / Outputs		Incremental ×2 / SSI absolute ×1
I/O Devices	I (Input)	8,192 bytes
	Q (Output)	8,192 bytes
Bit Devices	M (Memory)	512k bytes
Pulse Output		Open collector: 4 axes, 200 kHz
High-Speed Counter		General: 6 CHs, 200 kHz
DO Type		NPN
Built-in Communication Port		USB, Ethernet (Switch), RS232, RS485, EtherCAT
Data Backup (w/o battery)	Program	Flash ROM, rewritable up to 100,000 times
	Latched Area	MRAM, no rewriting limit
RTC Backup Battery		CR1620 lithium battery ×1
Power	Input Voltage	24V _{DC} (±10%)
	Internal Power Consumption	150 mA
Dimensions (W) × (H) × (D) mm / Weight		110×88×100 / 420 g
Environment	Operating Temperature	-20~55°C
	Storage Temperature	-40~80°C
	Humidity	5~95% RH (non-condensing)
	Vibration Resistance	IEC 61131-2, IEC 60068-2-6 (TEST Fc); 5 Hz ≤ f ≤ 8.4 Hz, constant amplitude 3.5 mm; 8.4 Hz ≤ f ≤ 150 Hz, constant acceleration 1G
	Shock Resistance	IEC 61131-2, IEC 60068-2-27 (TEST Ea); 15g peak, 11 ms duration, half-sine
	Operating Environment	Non-corrosive gas
	Installation	Inside the control panel
	Pollution Degree	2
	Protection Rating	IP20
Certifications		CE, UL

Model Explanation

PC-Based Motion Controller



PLC-Based Motion Controller



Ordering Information

PC-Based Motion Controller with Windows System			
Model	Description	Model	Description
AX-864EP0MB1T	Basic Motion Controller (64 axes/NPN)	AX-864EP0MC1T	Basic Motion Controller (64 axes/CODESYS TV/NPN)
AX-864EP0MB1P	Basic Motion Controller (64 axes/PNP)	AX-864EP0MC1P	Basic Motion Controller (64 axes/CODESYS TV/PNP)
AX-864EP0CB1T	Advanced Motion Controller (64 axes/NPN)	AX-864EP0CC1T	Advanced Motion Controller (64 axes/CODESYS TV/NPN)
AX-864EP0CB1P	Advanced Motion Controller (64 axes/PNP)	AX-864EP0CC1P	Advanced Motion Controller (64 axes/CODESYS TV/PNP)
AX-832EP0MB1T	Basic Motion Controller (32 axes/NPN)	AX-832EP0MC1T	Basic Motion Controller (32 axes/CODESYS TV/NPN)
AX-832EP0MB1P	Basic Motion Controller (32 axes/PNP)	AX-832EP0MC1P	Basic Motion Controller (32 axes/CODESYS TV/PNP)
AX-832EP0CB1T	Advanced Motion Controller (32 axes/NPN)	AX-832EP0CC1T	Advanced Motion Controller (32 axes/CODESYS TV/NPN)
AX-832EP0CB1P	Advanced Motion Controller (32 axes/PNP)	AX-832EP0CC1P	Advanced Motion Controller (32 axes/CODESYS TV/PNP)
AX-816EP0MB1T	Basic Motion Controller (16 axes/NPN)	AX-816EP0MC1T	Basic Motion Controller (16 axes/CODESYS TV/NPN)
AX-816EP0MB1P	Basic Motion Controller (16 axes/PNP)	AX-816EP0MC1P	Basic Motion Controller (16 axes/CODESYS TV/PNP)
AX-816EP0CB1T	Advanced Motion Controller (16 axes/NPN)	AX-816EP0CC1T	Advanced Motion Controller (16 axes/CODESYS TV/NPN)
AX-816EP0CB1P	Advanced Motion Controller (16 axes/PNP)	AX-816EP0CC1P	Advanced Motion Controller (16 axes/CODESYS TV/PNP)
PC-Based Motion Controller with Linux System			
AX-864EP0ME1T	Basic Motion Controller (64 axes/NPN)	AX-864EP0CE1T	Advanced Motion Controller (64 axes/NPN)
AX-864EP0ME1P	Basic Motion Controller (64 axes/PNP)	AX-864EP0CE1P	Advanced Motion Controller (64 axes/PNP)
AX-832EP0ME1T	Basic Motion Controller (32 axes/NPN)	AX-832EP0CE1T	Advanced Motion Controller (32 axes/NPN)
AX-832EP0ME1P	Basic Motion Controller (32 axes/PNP)	AX-832EP0CE1P	Advanced Motion Controller (32 axes/PNP)
AX-816EP0ME1T	Basic Motion Controller (16 axes/NPN)	AX-816EP0CE1T	Advanced Motion Controller (16 axes/NPN)
AX-816EP0ME1P	Basic Motion Controller (16 axes/PNP)	AX-816EP0CE1P	Advanced Motion Controller (16 axes/PNP)
PLC-Based Motion Controller			
AX-308EA0MA1T	Basic Motion Controller (8 axes/NPN)	AX-364ELA0MA1T	Basic Motion Controller (64 Positioning axes/NPN)
PC-Based Logic Controller			
AX-800EP0PB1T	Logic Controller (NPN)	AX-800EP0PC1T	Logic Controller (CODESYS TV/NPN)
AX-800EP0PB1P	Logic Controller (PNP)	AX-800EP0PC1P	Logic Controller (CODESYS TV/PNP)



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