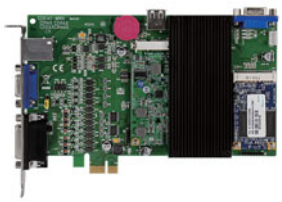
EtherCAT
Motion Control Solution



Vol. EC_3.23.11_EN

EMP-9000-Impeccable EtherCAT Motion Controllers

EMP-9000 uses a compact 3U rackmount metal chassis design with Windows 10 IoT operation system, are ideal for performing a wide range of tasks in many different sectors. Due to EMP-9000 does not have the huge size of IPC and can support Windows and PLC program development at the same time. EMP-9000 also includes several industrial Ethernet ports, allowing users to combine control and data applications and perform a variety of motion control functions. One solution for any applications, allowing you to maximize EtherCAT performance.

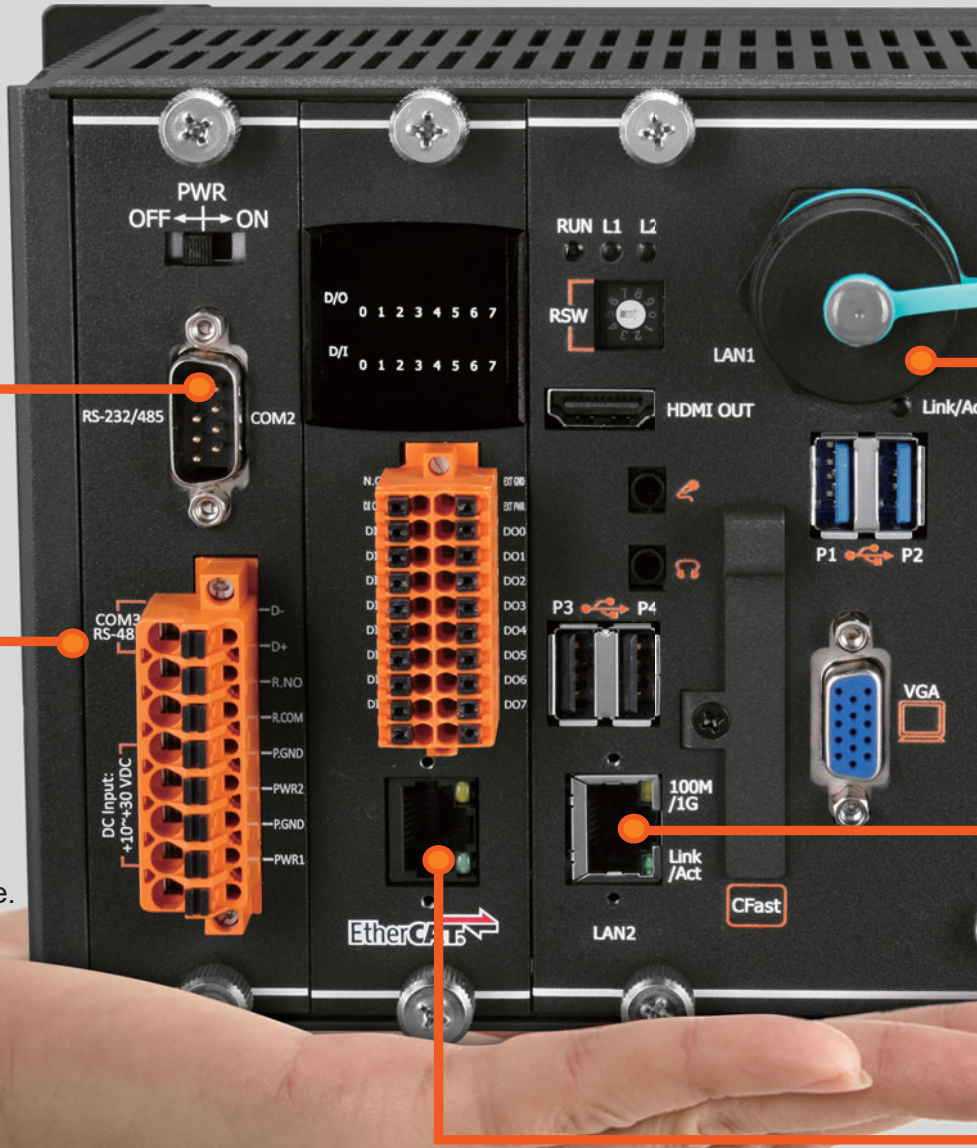
Communication

- Equipped with a serial port
- Supports Modbus RTU and DCON

Case

- Full-metal casing prevent noise interference and stable operations in all kinds of demanding working environments..
- The design of the 3U cabinet saves a significant amount of wasted space.

EMP-9000



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Powerful Intel Multi-core Processor

Intel multi-core processor with Windows 10 IoT operating system, allowing you to be unbeatable in a wide range of industrial applications.

Hardware Design

- Intel Atom E-class and Core i5 multi-core CPU
- Built-in USB port and CFast card slots
- Built-in memory of up to 16GB
- FLASH memory with a capacity of up to 64GB is built-in (mSATA)

Communication

- Equipped with a Ethernet port and a waterproof Ethernet port
- Supports Modbus/TCP

Factory & Enterprise Network

- Programming
- Other Mechanical Control
- HMI/SCADA
- IT System
- Standard Protocols and Services: TCP/IP, FTP, etc.
- Database Connections: SQL etc...

Control EtherCAT®

Machine Network

- Servos
- Inverters
- Robotics
- Vision systems
- Distributed I/O
- Sensors

- Robust RJ-45 EtherCAT Port Motion Control
- 16/32 Motion Control Axis
- Maximum Number of Slave Stations: 512

EMP-2848M-Compact EtherCAT Motion Controller

EMP-2848M is equipped with a high-performance quad-core Cortex-A53 processor, which delivers high speed that traditional PLCs cannot compete. It features compact size, cost-effective, flexibility, and excellent performance. It is an ideal partner for small and medium-sized motion control applications where cost and space-constrains is a deciding factor. ICP DAS EtherCAT engine allows PLC tasks to be controlled with higher efficiency in real-time, and can easily implement coordinated control among various industrial control components.

EMP-2000

Control EtherCAT®

- Robust RJ-45 EtherCAT Port Motion Control
- Motion control up to 16 axes, supports up to 128 slaves

Machine Network

- Servos
- Vision systems
- Sensors
- Inverters
- Distributed I/O

Hardware Design

- High-performance quad-core Cortex-A53 processor
- Built-in microSD card slots
- Built-in memory of up to 1GB
- Built-in FLASH memory of up to 8GB (eMMC)

Communication

- Supports Modbus TCP
- Supports Modbus RTU/ASCII

Case

- Metal casing is effective against noise
- Compact size, can be mounted on DIN-Rail

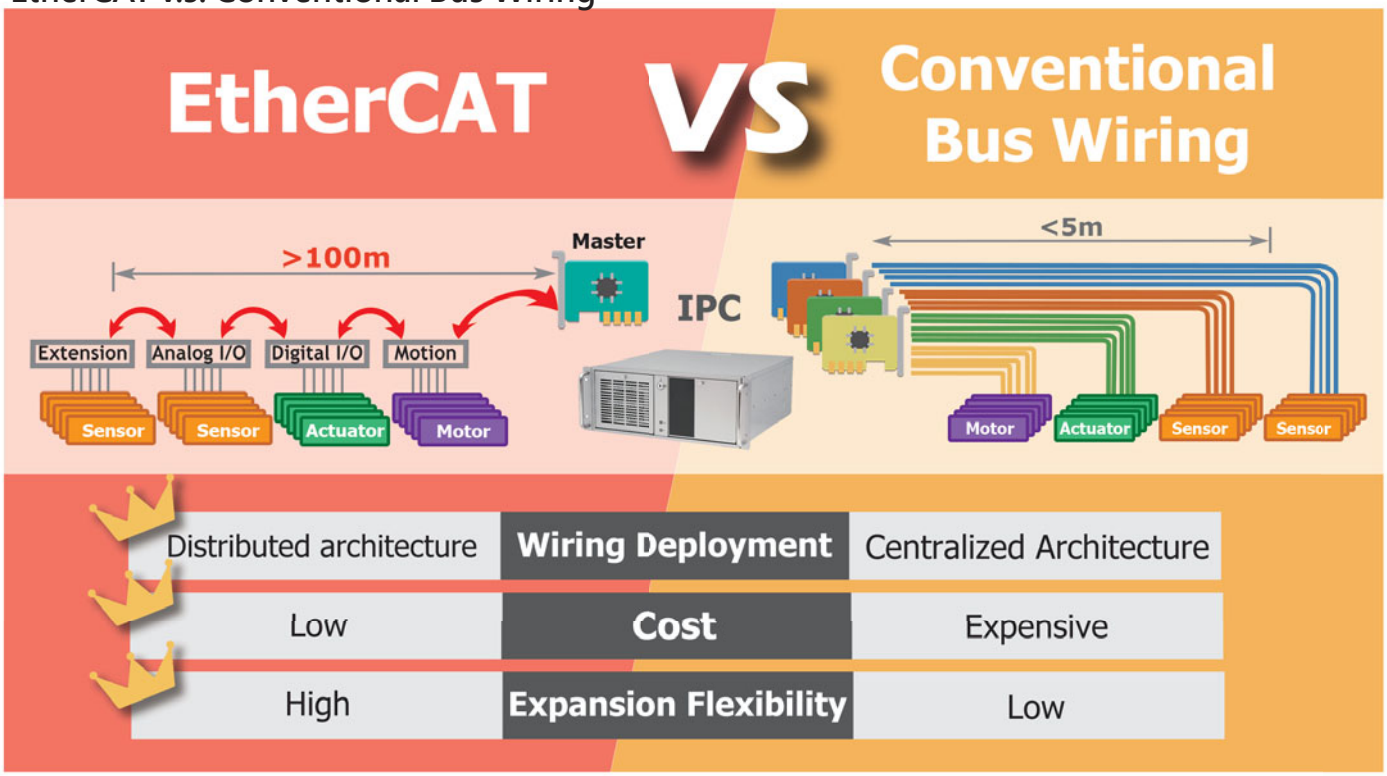
Table of Contents

CH1
EtherCAT Technology

1-1 Why Choose EtherCAT ?

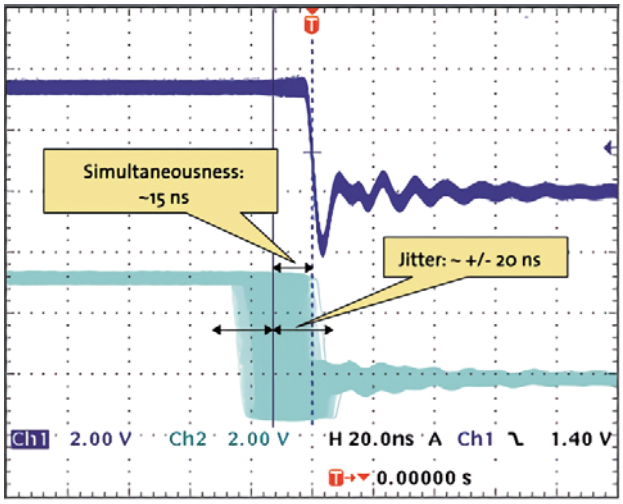
As the advance of technology, the system architecture of automation equipment has gradually changed from conventional centralized control (that is, using plug-in card for expansion) to distributed control. In response to this trend, many distributed communication protocols have been developed and published, and among them, EtherCAT communication technology features the advantages of "openness, high synchronization, good real-time performance, low hardware cost and easy deployment", and has won the global recognition. It has also been introduced to lots of major automation system and equipment manufacturers. Compared with the conventional expensive motion control card and heavy wiring which is with high cost and difficult wiring deployment, EtherCAT actually achieves better performance.

EtherCAT v.s. Conventional Bus Wiring



EtherCAT Distributed Clock Synchronization

The distributed clock (DC) can make all EtherCAT devices share the same system time, so that it can control the synchronous execution of each device, and make the time jitter less than 1µs. And the DC function of the slave can be used to interrupt control or trigger the digital input/ output, especially in multi-axis synchronous operations.



For these reasons, EtherCAT is widely used in:

- Robot
- Packaging Machine
- Printing Machine
- Plastic Manufacturing Machine
- Semiconductor Manufacturing Machine
- Test Benche
- Testing System
- Pick and Place Machine
- Baggage Delivery System
- Stage Control System
- Automated Assembly System
- Pulp and Paper Machine
- Tunnel Control System
- Welding Machine
- Cranes and Lifts
- Farm Machine
- Sawmills
- Building Control System
- Steel Mill
- Fans
- Furniture Production Equipment
- Milling Machine

Ultra High Speed Motion Control Solutions - EtherCAT Fieldbus

EtherCAT (Ethernet Control Automation Technology) is a series of Ethernet-based industrial communication buses. It has established the mainstream in the industrial automation industry pursuing high precision, high efficiency, and low cost due to its high-speed communication performance and instant communication system.

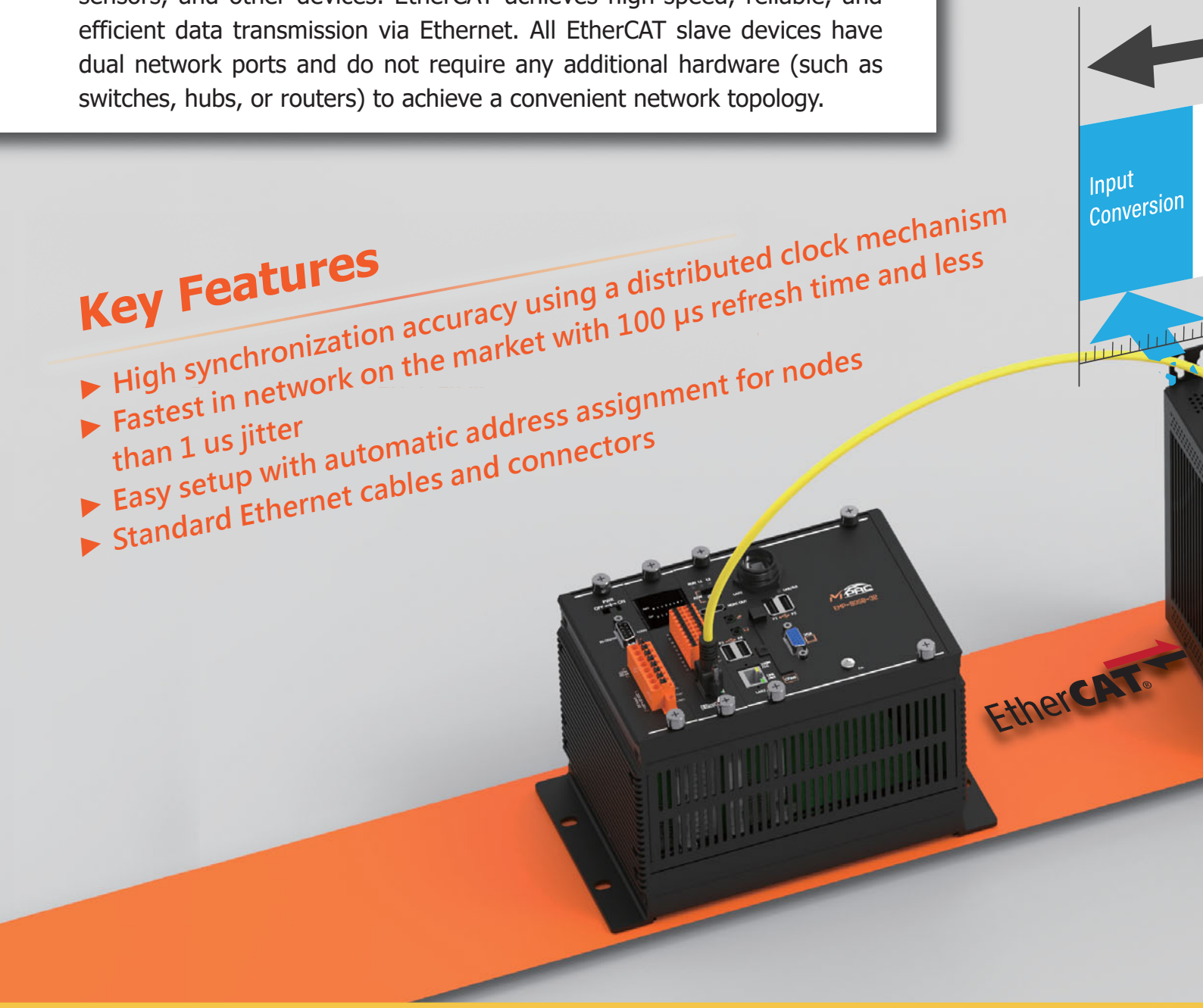
Not only do ICP DAS's EtherCAT solutions support all EtherCAT master functions, but they can also update multiple sets of slave devices in a millisecond cycle, including motion control for 64 axes. It offers complete control of various single-axis and multi-group motion functions in terms of motion control. Furthermore, the IEC 61131 Soft PLC function is available for purchase, making it simpler and faster for users to integrate various EtherCAT slave devices.

1-2 EtherCAT Features

EtherCAT is the fastest industrial network for machine automation, it can connect to I/O, servo motors, stepping motors, encoders, smart sensors, and other devices. EtherCAT achieves high-speed, reliable, and efficient data transmission via Ethernet. All EtherCAT slave devices have dual network ports and do not require any additional hardware (such as switches, hubs, or routers) to achieve a convenient network topology.

Key Features

- High synchronization accuracy using a distributed clock mechanism
- Fastest in network on the market with 100 µs refresh time and less than 1 us jitter
- Easy setup with automatic address assignment for nodes
- Standard Ethernet cables and connectors



EtherCAT is industrial Ethernet

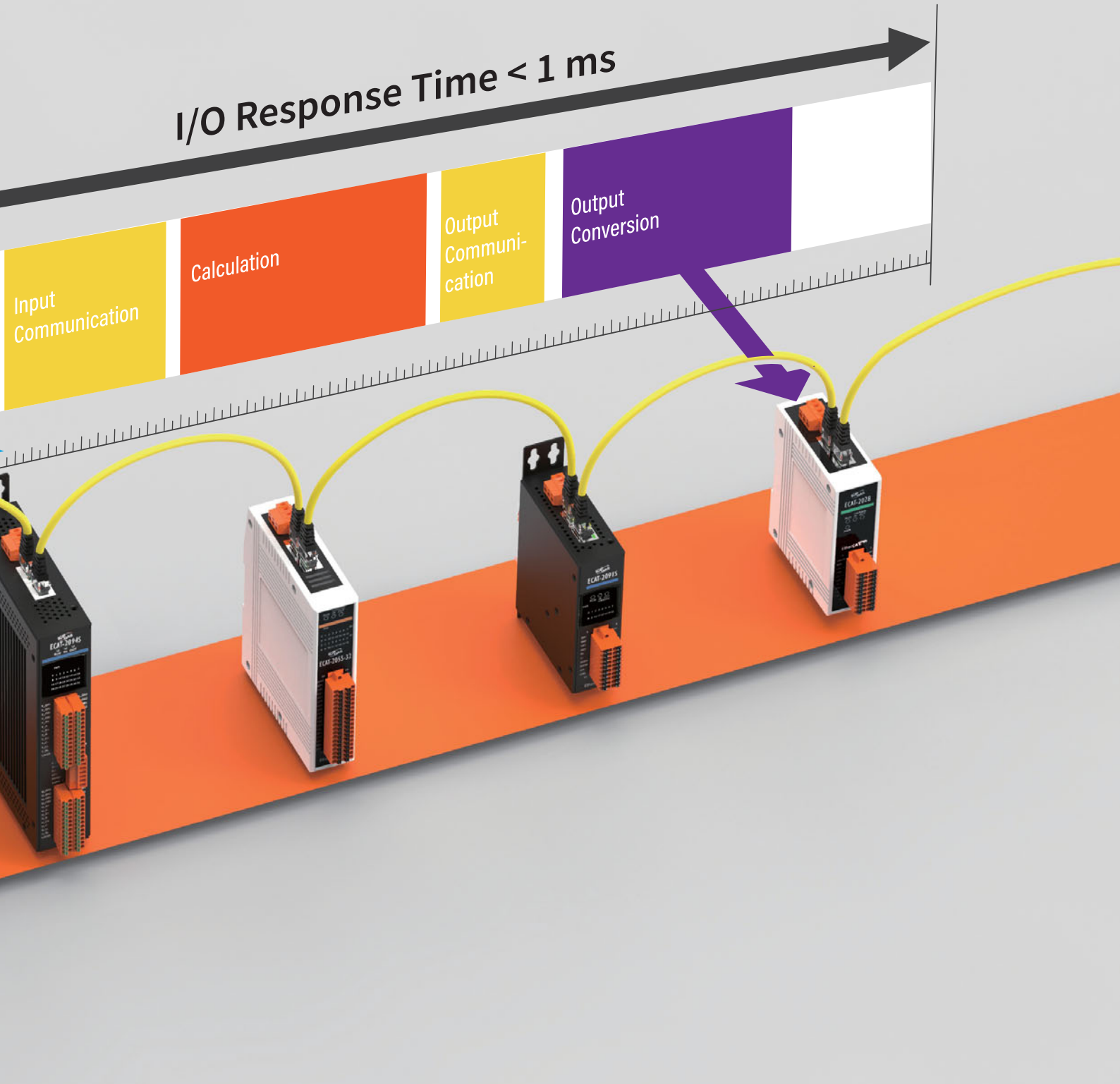
The optimized EtherCAT data is included in the IEEE 802.3 Ethernet frame. The frame travels through the media at 100 Mbps in full-duplex mode.

Flexible Topologies

With two EtherCAT ports on all devices, no additional switches are required to create a linear network. EtherCAT junction slaves can be used to build tree and star topologies.

Distributed Clocks

The EtherCAT node slave measures the time difference between incoming and returning frame - timestamp-. With these timestamps the master can determine the propagation delay offset to the individual slave accurately. This mechanism ensures accurate synchronization between devices with less than 1 µs jitter.



Simple cabling: 100Base-TX

EtherCAT uses standard 100BASE-TX Ethernet communication very efficiently, over standard shielded Ethernet cables and connectors. No need for network switches.

Easy use, easy connect

When compared to a classic fieldbus system, EtherCAT is the obvious choice: node addresses can be set automatically, there's no need for network tuning, and onboard diagnostics with fault localization make pinpointing errors a snap. Despite these advanced features, EtherCAT is also easier to use than Industrial Ethernet: there are no switches to configure, and no complicated handling of MAC or IP addresses is required.

Processing on the fly

The slave devices extract and/or insert data on the fly. This method assures the highest possible throughput.

1-3 ICP DAS EtherCAT Solution Guide

ICP DAS offers a full range of EtherCAT product components, including master cards, master motion controllers, and dozens of different slave stations: including I/Os for general purposes, splitters, converters, gateways, and motion control modules, etc. Optimizing the real-time performance of your EtherCAT system allows you to effectively reduce system load, improve control efficiency and accuracy, and bring higher quality production efficiency.

Real-time & Reliability

- Up to 64 synchronized axes control
- Communication cycle time: 500 µs (min.)
- Powerful embedded ICP DAS motion engine

Compatibility

- Supports 3rd Master and Slave
- Provides ESI files

Easy Use

- Dedicated API that satisfies rapid development requirements
- Easy configuration with ECAT Utility

Services

- Professional customer service team consultation
- Customized motion control function

List of Common Drivers and Motors That Have Been Market Tested

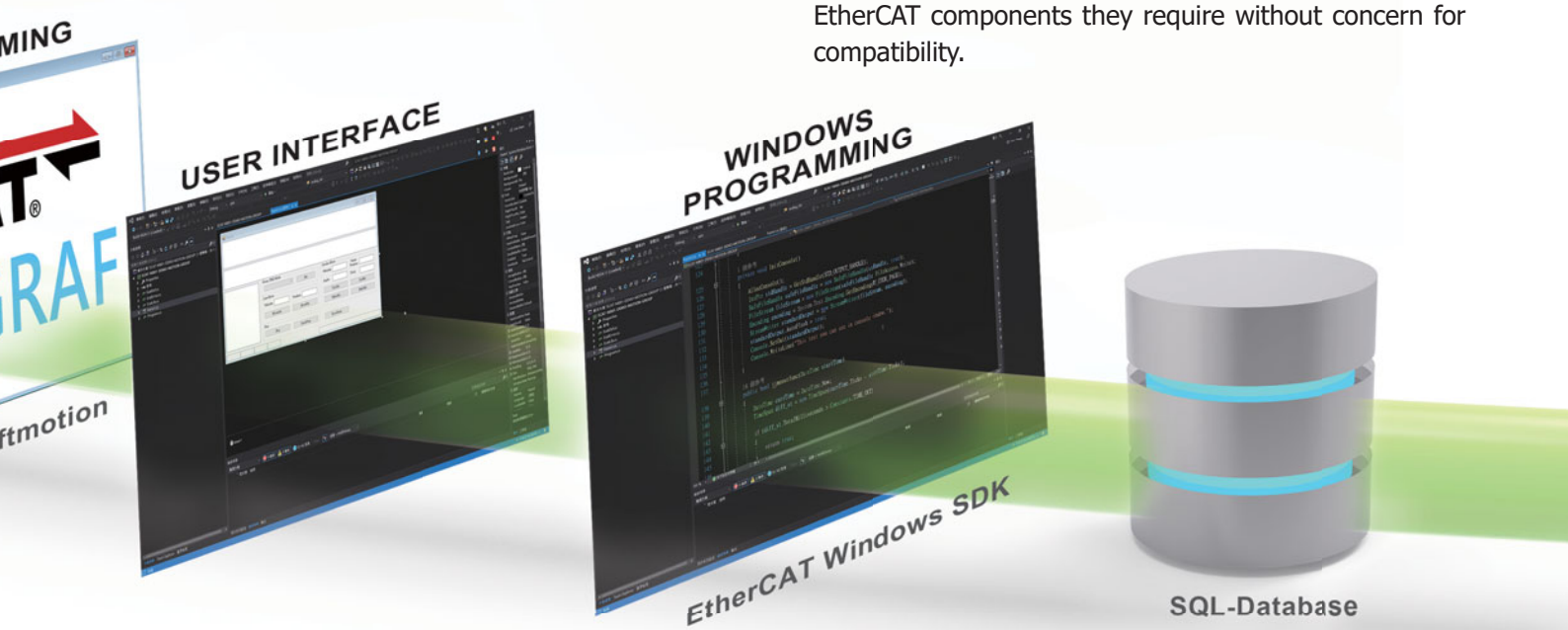
Company	Drivers	Types of Motors
Delta	ASDA A2-E series	AC Servo Motor
Hiwin	D2 series	AC Servo Motor
Moons'	STF/RS series	Two-phase Stepper Motor
Mitsubishi	MR-JET	AC Servo Motor
Oriental Motor	AZ series multi-axis	Closed loop Stepper Motor
Panasonic	A5B/A6B series	AC Servo Motor
Shihlin	SDP series	AC Servo Motor
Sanyo Denki	R series	AC Servo Motor
Teco	JSDG2/JSDG2S	AC Servo Motor
Yaskawa	Sigma 7 series	AC Servo Motor

Ease of development

All of ICP DAS's Master products include a complete and simple-to-use C language library that supports the majority of programming language tools on the market, and user only need to call the corresponding function API function to significantly reduce development time.

Compatible with a wide variety of 3rd party EtherCAT component

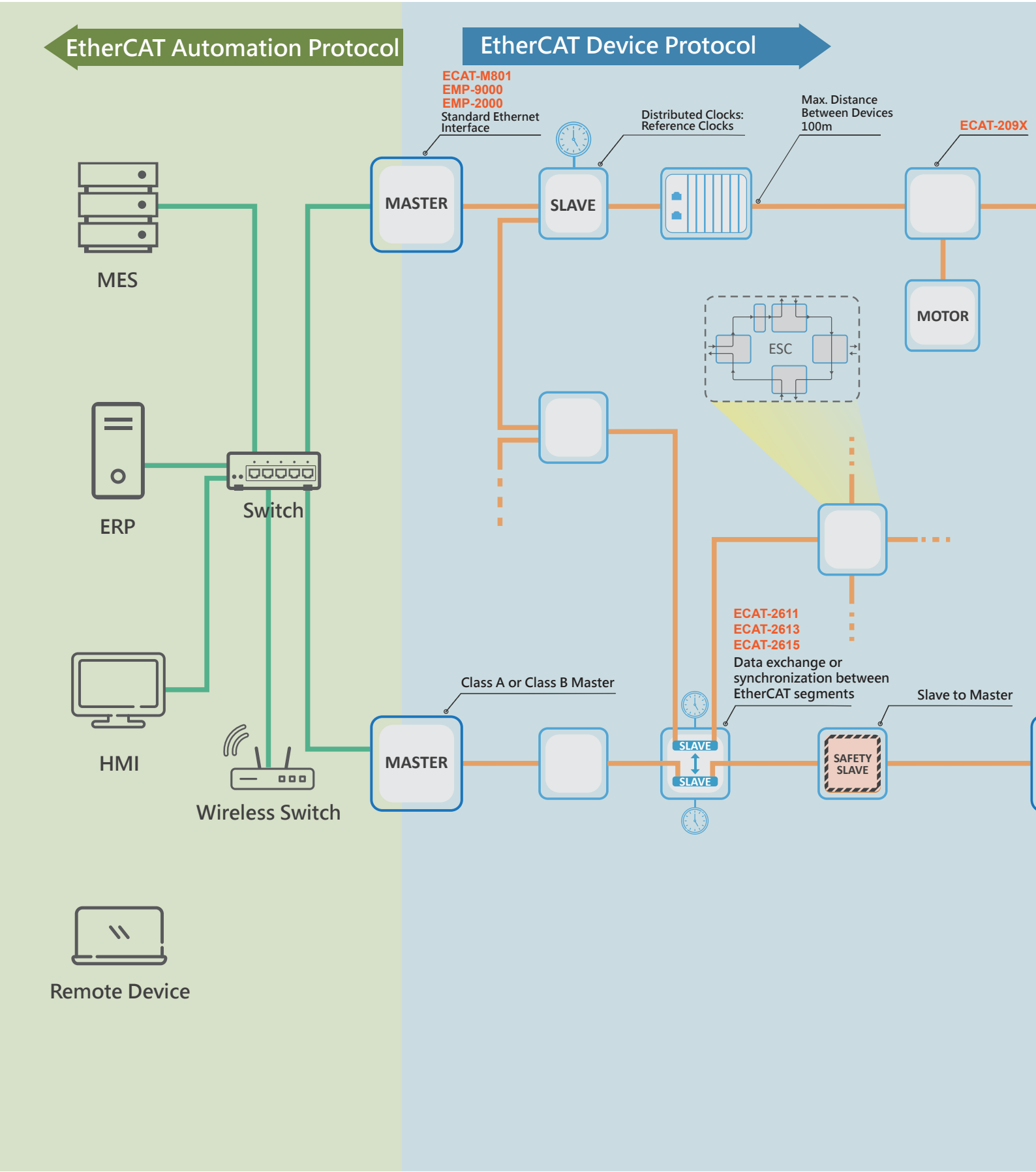
The EtherCAT Conformance Test Tool (CTT) has validated ICP DAS' EtherCAT solution to ensure the interoperability of various EtherCAT servo drives and third-party EtherCAT products. Users can select any EtherCAT components they require without concern for compatibility.



1-4 EtherCAT - System Overview

EtherCAT Factory Network

EtherCAT Device Control Network



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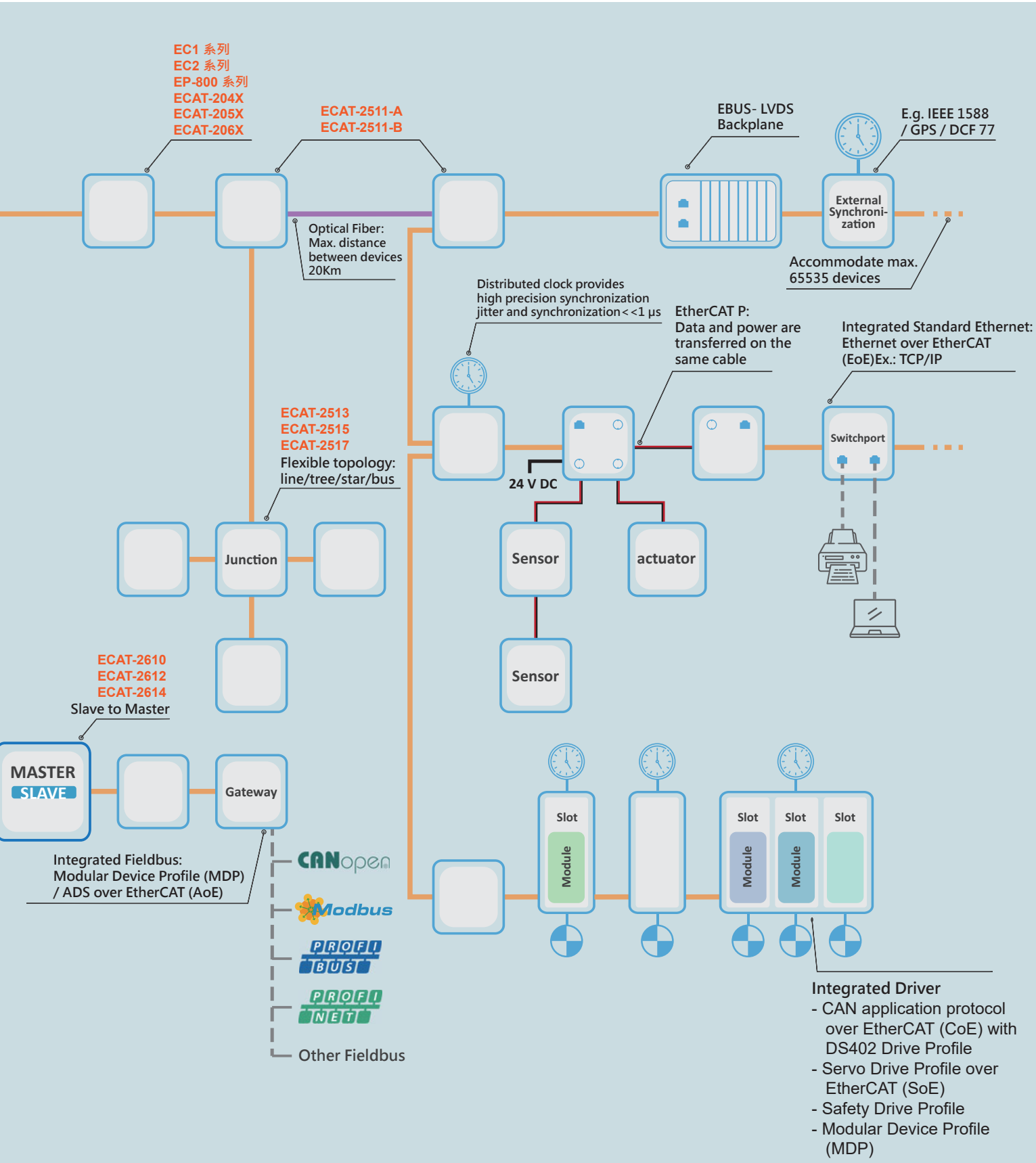

EC1 系列
EC2 系列
EP-800 系列
ECAT-204X
ECAT-205X
ECAT-206X
ECAT-2511-A
ECAT-2511-B
EBUS- LVDS Backplane
E.g. IEEE 1588 / GPS / DCF 77
External Synchroni-zation
Optical Fiber: Max. distance between devices 20Km
Accommodate max. 65535 devices
Distributed clock provides high precision synchronization jitter and synchronization<<1 µs
EtherCAT P: Data and power are transferred on the same cable
Integrated Standard Ethernet: Ethernet over EtherCAT (EoE)Ex.: TCP/IP
Switchport
ECAT-2513
ECAT-2515
ECAT-2517
Flexible topology: line/tree/star/bus
24 V DC
Junction
Sensor
actuator
Sensor
ECAT-2610
ECAT-2612
ECAT-2614
Slave to Master
MASTER
SLAVE
Gateway
Slot
Module
Slot
Module
Slot
Module
Slot
Integrated Fieldbus: Modular Device Profile (MDP) / ADS over EtherCAT (AoE)
CANopen
Modbus
PROFIBUS
PROFINET
Other Fieldbus
Integrated Driver
- CAN application protocol over EtherCAT (CoE) with DS402 Drive Profile
- Servo Drive Profile over EtherCAT (SoE)
- Safety Drive Profile
- Modular Device Profile (MDP)

CH2
EtherCAT Master

2-1 EtherCAT Motion Control Master Overview

ICP DAS combines high-performance processing technology with independent hardware controllers to provide stable and reliable motion control in real-time. In addition to general basic motion functions like point-to-point, interpolation, semiconductor management, and even vertical group movement command control functions on robot control, etc. With high precision and speed, as well as synchronous motion control, it significantly reduces the operational complexity and development cycle of industrial applications in all fields.

The motion controllers and master cards from ICP DAS are compatible with 3rd party EtherCAT I/O slave devices. It allows users to provide optimized synchronization between motion and I/O control, therefore maximizing application throughput. With professional motion control team, ICP DAS's customized motion control function service creates optimized automation control system for you. As the market leader, ICP DAS offers software, hardware, and services three-in-one EtherCAT solutions.

PC-Based Solution

ECAT-M801 Series
ECAT-M808 Series
EtherCAT PCIe Master Cards

Highlights

Supports up to 64 axes, integrated API function and a built-in comparison trigger.

Benefits

I/O control and high-precision motion.

Advantages

Simple wiring, easy to use, and saves a lot of development time.

PAC Motion Controllers

EMP-9000 Series
EMP-2000 Series
EtherCAT Motion Controllers

Highlights

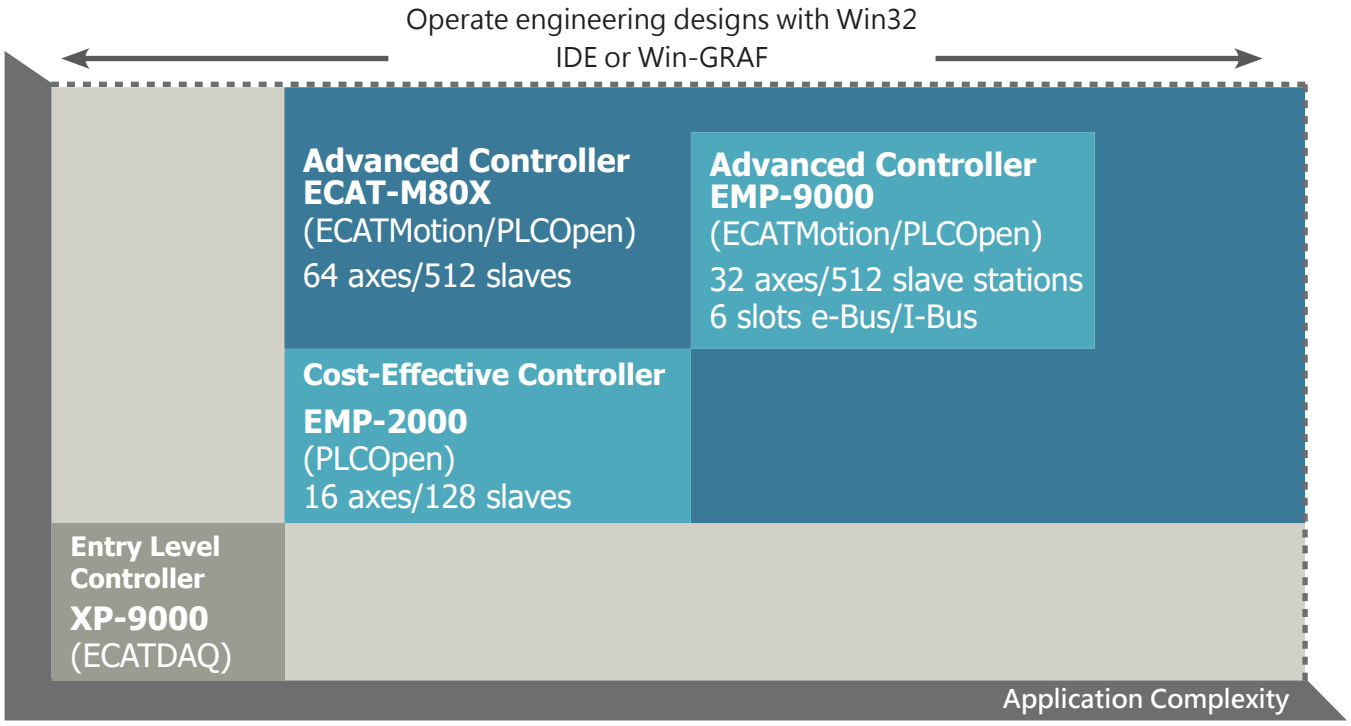
Provide IEC 61131-3 for integrating Win-GRAF Soft PLC with EtherCAT solutions.

Benefits

To facilitate the integration of various IoT applications, an open platform and a standard interface are provided.

Advantages

Compact size, improved equipment intelligence & stability, and maintenance efficiency.



ICP DAS provides a variety of controllers to meet a wide range of automation requirements. The new generation of EtherCAT motion controllers include Cost-Effective, Advanced and Premium models, leading other products of the same type in the market with its scalability, stability and high performance.

Motion Controller

	EMP-9000	EMP-2000	XP-9000
Type	PAC/PLC	PLC	PAC
Support 3rd Party Slave	V		-
No. of Slaves Nodes	512	128	20
No. of Motion Control Axes	64 Axes (Max.)	16 Axes	8 Axes
Windows API	ECATMotion	-	ECATDAQ
PLC Open	V		-

Motion Control Card

	ECAT-M801	ECAT-M808
Type	PCI Express	
Support 3rd Party Slave	V	
No. of Slaves Nodes	512	
No. of Motion Control Axes	64 Axes (Max.)	
Windows API	ECATMotion	
PLC Open	V	

EtherCAT Motion Control Master Selection Guide

Model		Type	No. of Axes	Preloaded EtherCAT Win-GRAF	Software
PAC Controller - The EtherCAT Motion Control Master is competitive in terms of performance, size and price.					
	**EMP-9091-16**	Motion Controller	16	-	Windows API
	EMP-9091-32		32	-	
	EMP-9098-16		16	V	
	EMP-9098-32		32	V	
	EMP-9051-16		16	-	
	EMP-9051-32		32	-	
	EMP-9058-16		16	V	
	EMP-9058-32		32	V	
	EMP-9251-16		16	-	
	EMP-9251-32		32	-	
	EMP-9258-16		16	V	
	EMP-9258-32		32	V	
PLC controller - A compact and efficient motion controller that can communicate with all EtherCAT slaves without programming					
	**EMP-2848M**	Motion Controller	16	Win-GRAF Runtime	Soft PLC
PCI Express Card - Compatible with IPC of various brands. PCI Express can transform the device into a high-efficiency EtherCAT master.					
	**ECAT-M801-8AX**	PCI Express Master	8	-	Windows API
	ECAT-M801-16AX		16	-	
	ECAT-M801-32AX		32	-	
	ECAT-M801-64AX		64	-	

Built-in Motion Control Commands

Single-axis Motion Control

- Supports CiA402 driver and ICP DAS stepper motor drivers
- Auto Homing function
- Point to point and constant velocity motion
- Virtual axes
- Supports CiA402 servo drives Touch Probe function

Multi-axis Group Motion Control

- Add/Remove axis from a group easily
- Multi-axis interpolation motion (PV/PT/PVT mode)
- 2/3-axis Circular interpolation, Helical interpolation, Profile motion control
- Continuous Interpolation motion (Up to 7000 data buffered)
- Supports Buffered/Aborting/Blending and other commands
- Up to eight groups of simultaneous control

Provide Sample Programs in a variety of Programming Languages

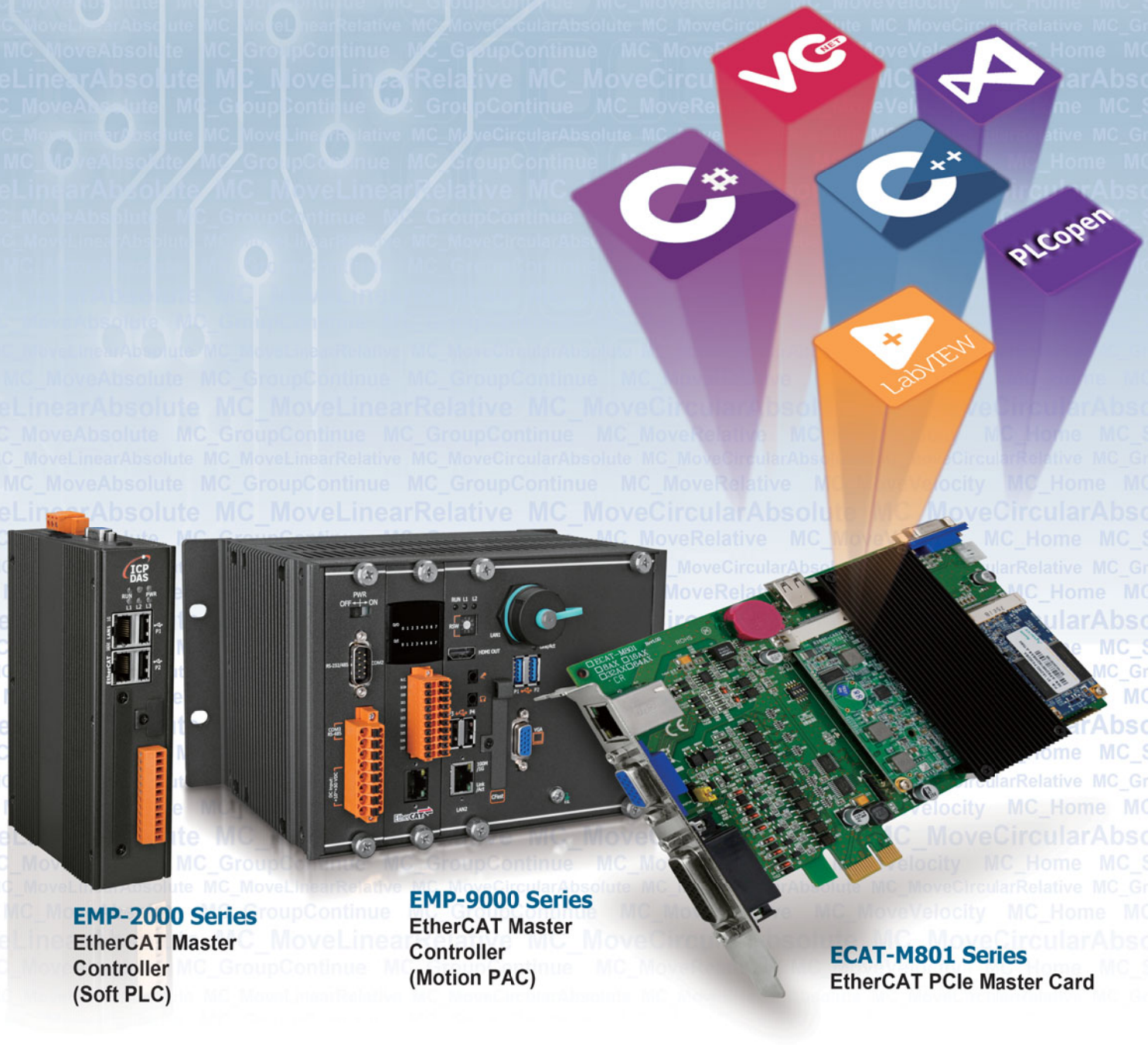
- Python
- Visual C++.NET
- Visual C#.NET
- Visual Basic.NET
- Borland C Builder
- LabVIEW

List of Common Motion Control Commands That Are Supported

Module	EMP-9000 series	EMP-M801 series
3D Circular	V	V
3D Helical	V	V
Continuous Compare	V	V
T/S Curve	V	V
Trigger	V	V
Position Limit	V	V
Velocity Feed Forward	V	V
Position Reset	V	V
Speed Reset	V	V
Linear Interpolation	V	V
Circular Interpolation	V	V
Continuous Interpolation	V	V

2-2 EtherCAT Development Environment

ICP DAS provides standard Windows API (Dynamic Link Library) and Win-GRAF Workbench to support the development of automatic control applications in a variety of programming languages. All ICP DAS EtherCAT master and slave devices, including 3rd party slave device, can be configured and tested by using software-ECAT utility. The EtherCAT development kit includes standard Windows API (Dynamic Link Library) for use with IDEs like Python, .NET, and LabVIEW. To speed up the development cycle, it provides development platform developers with a more user-friendly development environment, such as intuitive and simple example programs. Win-GRAF Workbench for ECAT-M801 and EMP-9000 series is an interface designed for developers who are accustomed to programming, simulation, and debugging on PLC development platforms that share a variable database. The Win-GRAF environment allows developers to directly access all system elements, eliminating the traditional data synchronization bottleneck encountered in the programming environment.

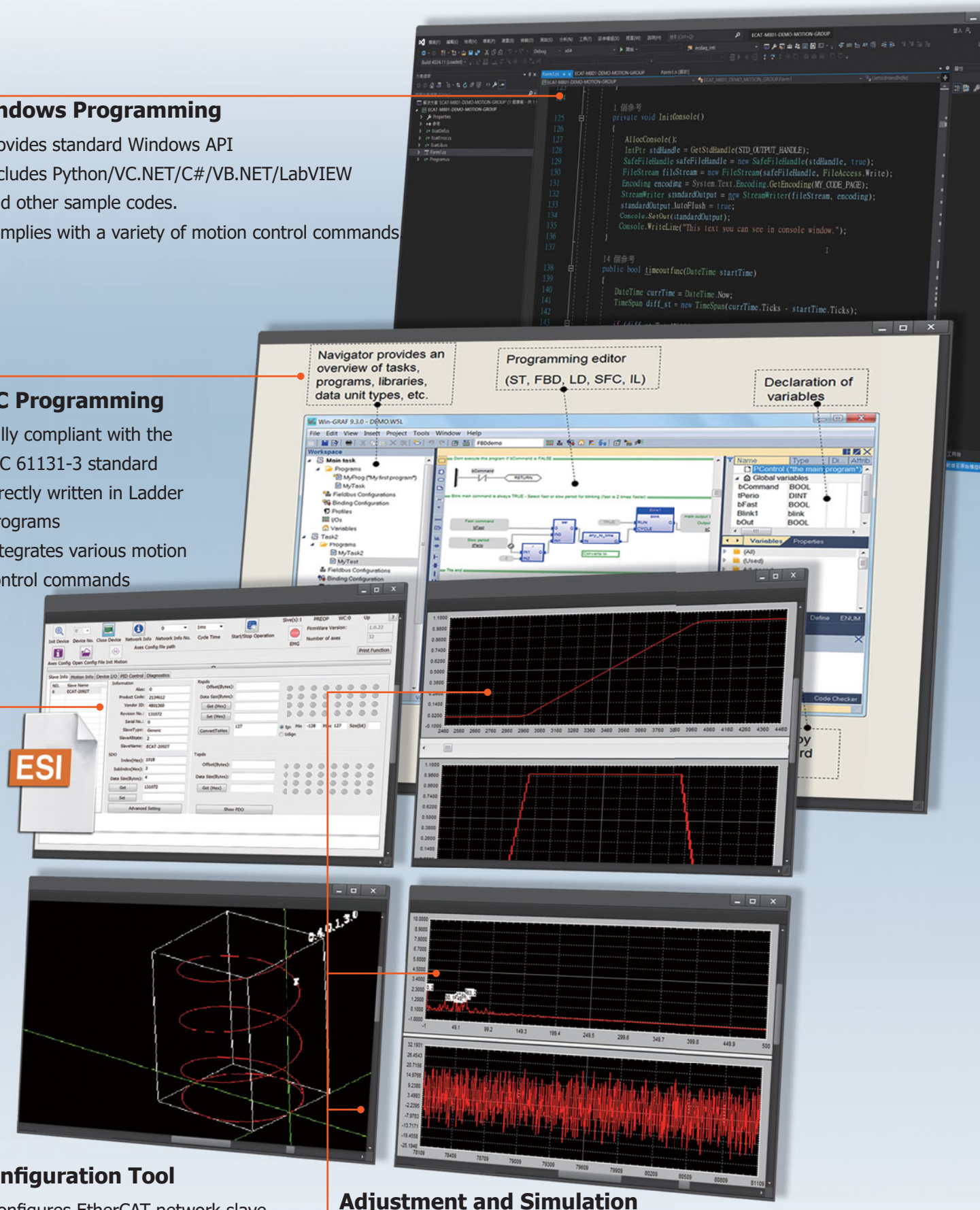


Windows Programming

- Provides standard Windows API
- Includes Python/VC.NET/C#/VB.NET/LabVIEW and other sample codes.
- Complies with a variety of motion control commands

PLC Programming

- Fully compliant with the IEC 61131-3 standard
- Directly written in Ladder programs
- Integrates various motion control commands



Configuration Tool

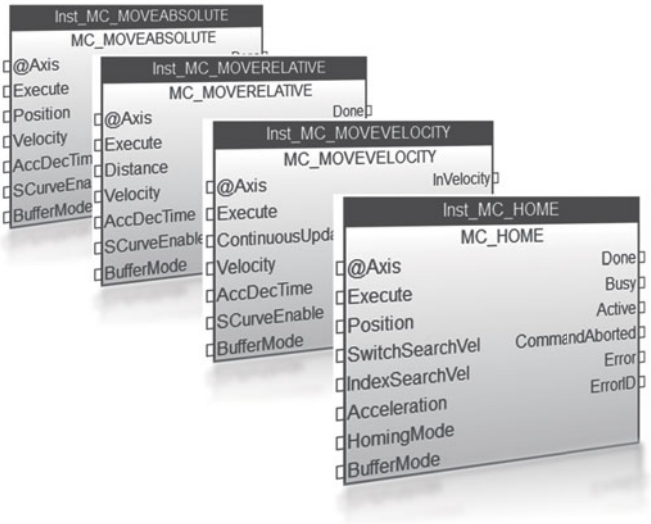
- Configures EtherCAT network slave topologies
- Configures EtherCAT slave settings
- Configures EtherCAT Servo settings

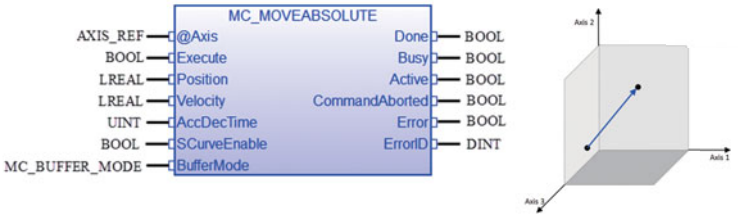
Adjustment and Simulation

- Simulate analog signal on waveform diagram
- Simulate digital signal on LED object
- Simulate and adjustment motion path and diagram for motion control commands

Win-GRAF PLCopen Library

- Supports up to 32 axes
- The built-in real-time operating system's high-performance motion engine ensures consistent performance

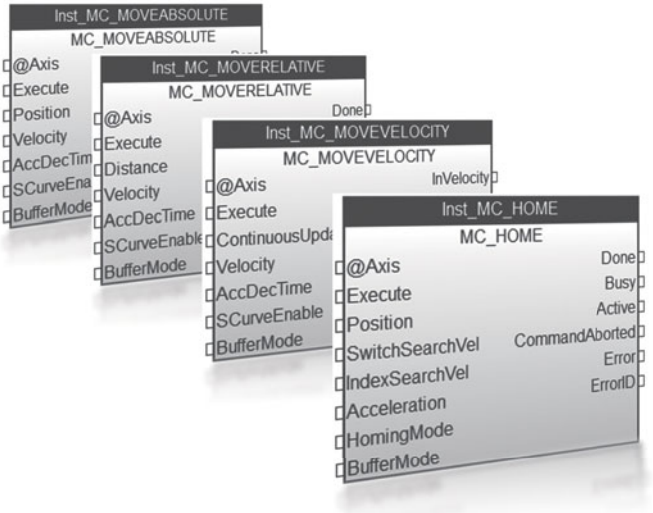


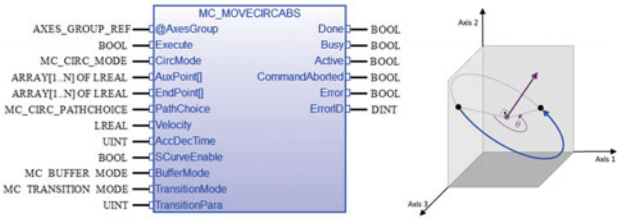


▲The Straight Path

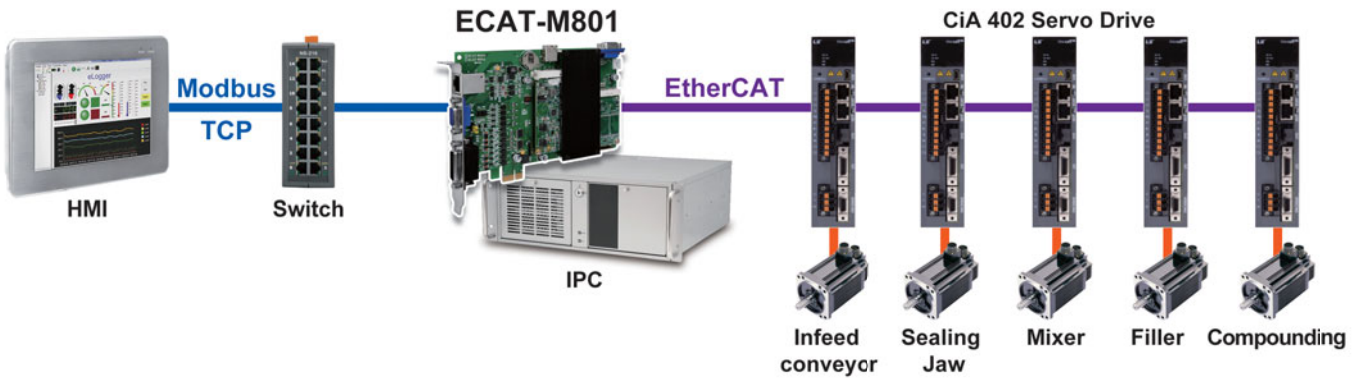
Supports EtherCAT servos and stepper motors with CiA402 drive configuration

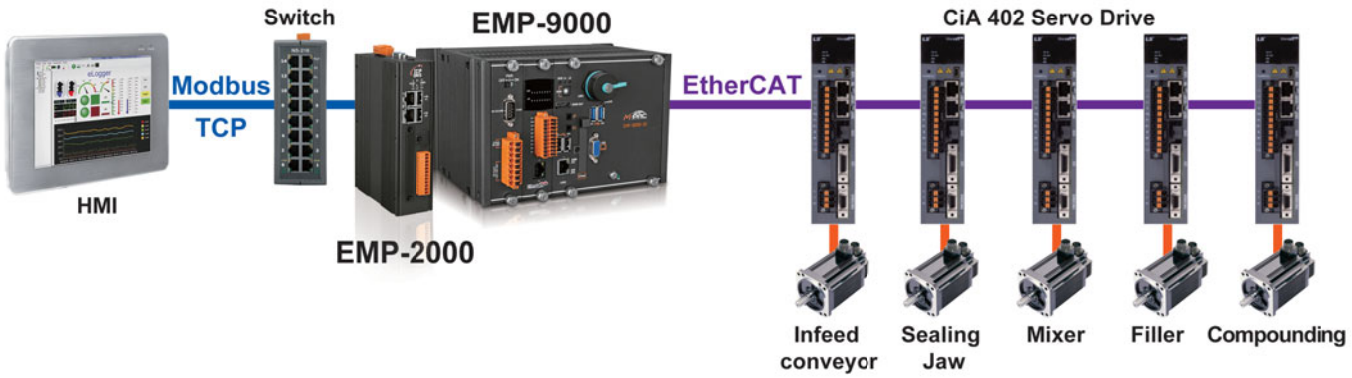
- Supports Cyclic Synchronous Position (CSP) and Cyclic Synchronous Velocity (CSV) modes
  The synchronization cycle time can be customized
- Once the axis is added to the configuration, the axis position is automatically mapped to PDO

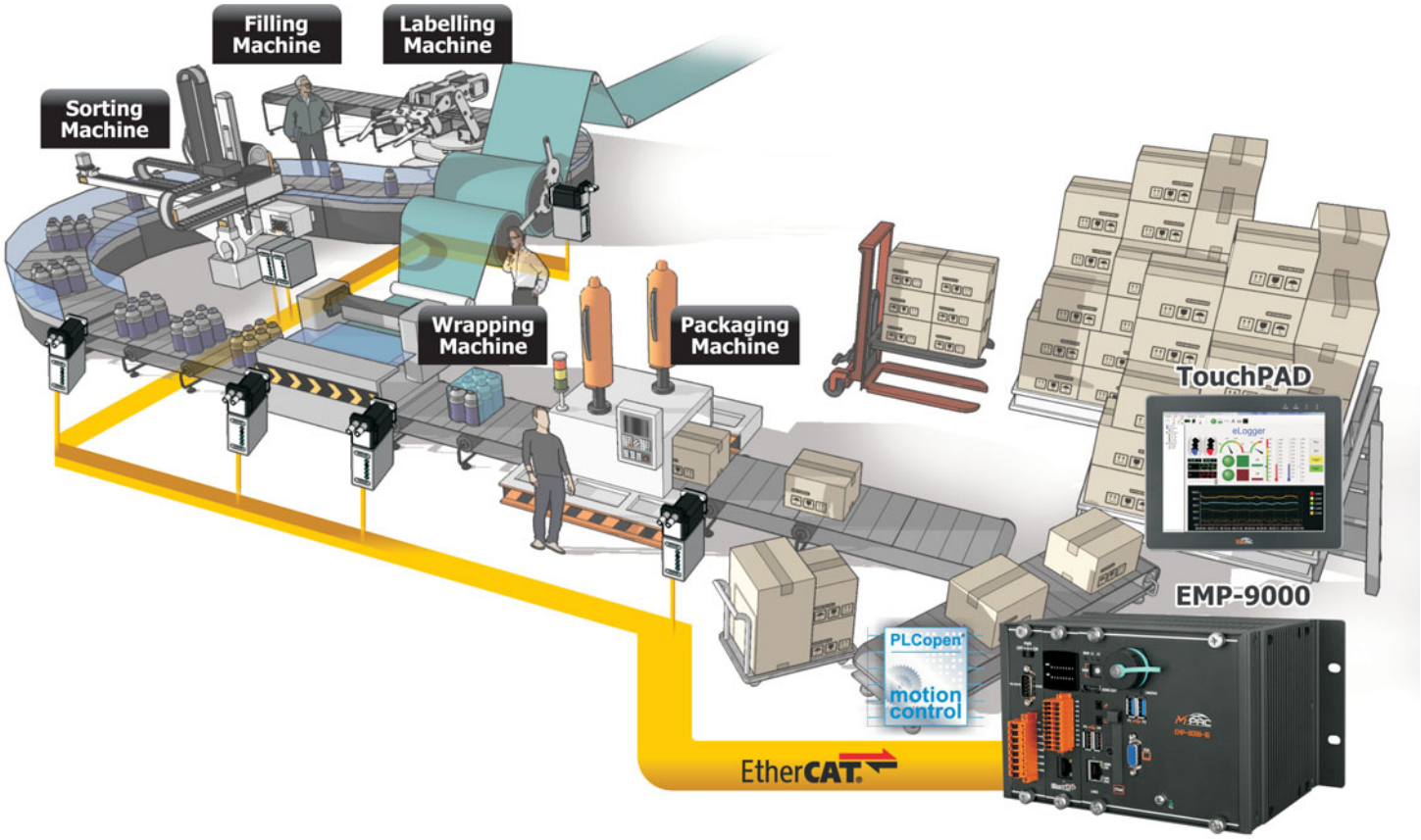




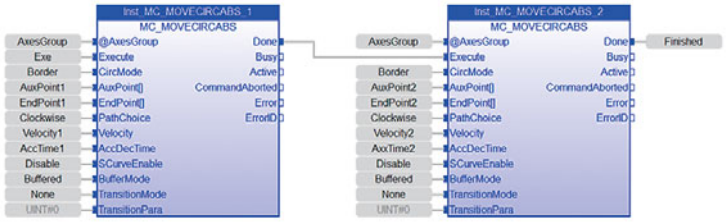
▲The Arc Path







Applications of Motion Control



★ Access to Parts and Components

- Transfer and stacking device
- Gantry pick and place
- Pick, place, measure, and sort components automatically

★ Conveying System

- Positioning of the workpiece on the conveyor
- Handling and transportation equipment
- Product inspection
- Online Pallet Stacker
- Labeling machine

★ Parts Assembly System

- Precision spot welding machine
- Sealing, gluing, joining applications
  - Add glue on the surface to connect parts
  - Sealing: apply sealant on the joint surface of the parts
  - Dispenser: gluing

★ Warehousing

- Automated storage and retrieval system
- Automatically store and retrieve pallets from the storage cabinet

★ Applications of Cutting, Grinding and Pressing

★ Semiconductor Manufacturing

- IC inspection
- IC chip installation and assembly
  - Pick up components and place them on the printed circuit board
- Camera Detection:
  - Check with a mobile camera.
  - Use the camera to conduct multi-point inspections

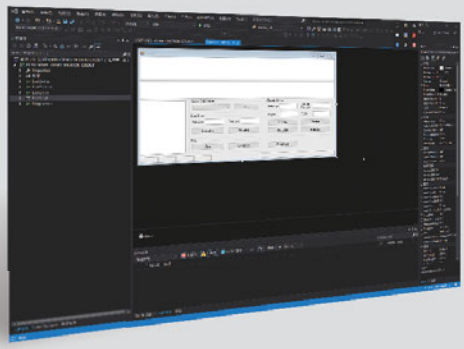
★ Robot Control

- Control single axis robot
- Control multiple single-axis robots for spraying applications
- Dual drives: synchronize and move two single-axis robots of the same type

2-3 EMP-9000 EtherCAT Motion Controller (PAC Based)

The EtherCAT compact motion controller from ICP DAS has a full-metal case and fits into a 3U rackmount. It has a high-strength structure, improved anti-noise capability, and a compact size, making it more suitable for use in harsh and complex environments. There is also a local I/O module slot, and e-9K/I-9K/97K modules can be expanded for more diverse applications. The EtherCAT motion control function can control 64 servo axes at once and 512 slave devices simultaneously as the slave node moves. 64-axis linear motion, 32-axis individual motion, 3D linear/circular interpolation, multi-axis synchronous movement, follow-up movement, and electronic cams are some of the motion functions available.

ICP DAS EMP-9_



50% of Development Time Saved

80% Saved space

Get Started Quickly without Prior EtherCAT Knowledge

- Provides a simple API for motion control
- Code samples in a variety of programming languages
  Visual C++/C#/VB.NET/BCB/LabVIEW/Python
- Dedicated ICP DAS I/O module functions
- Provides Win-GRAF PLC

3U Rack-mount Case

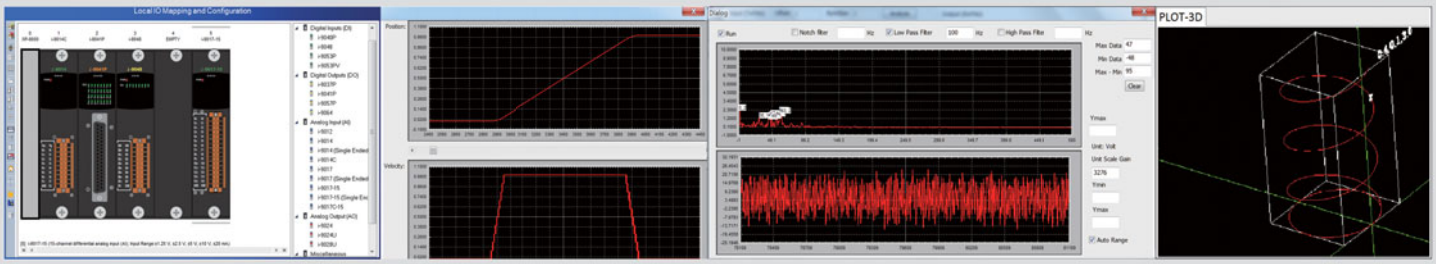
- Can be installed on a 3U cabinet
- Expandable e-9K/I-9K/97K I/O modules
- x86 architecture CPU
- Efficient anti-interference metal outer case

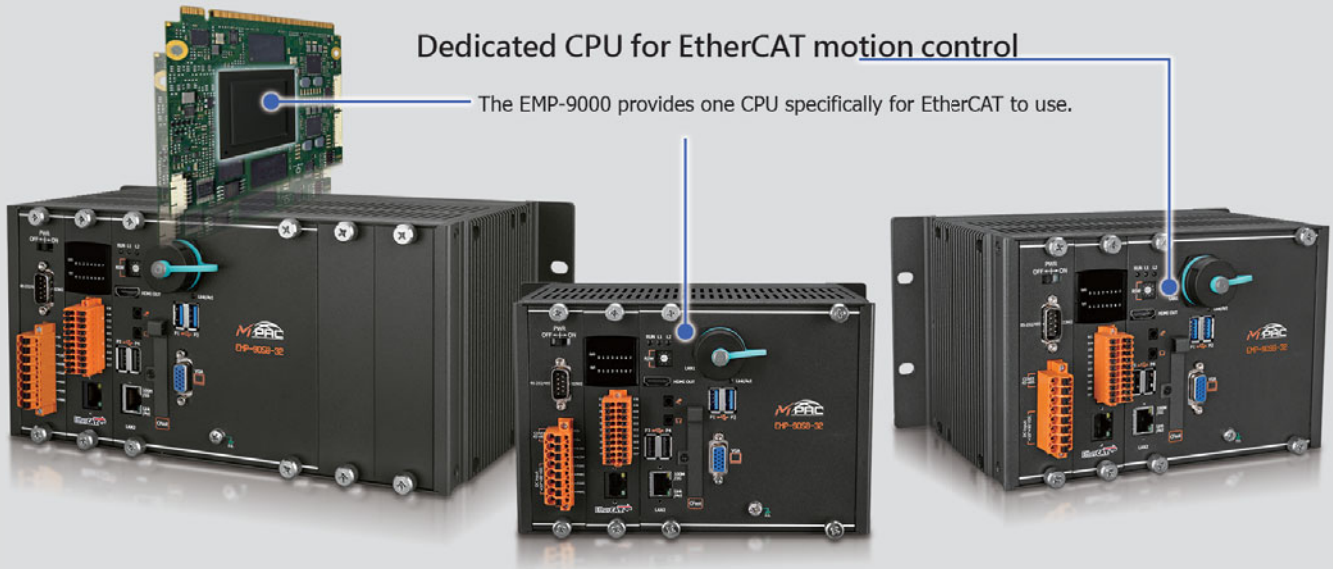
High Efficiency

- Cycle times up to 500 μs
- Supports Windows 10 IoT
- Supports 32-bit and 64-bit operating systems
- Independently developed EtherCAT engine by ICP DAS
- Single axis motion control
- Multi-axis group motion control commands

Easy Configuration Program

- One-key configuration of EtherCAT slaves
- Compatible with third-party slave ESI files
- Includes simple troubleshooting
- Supports slave alias writing function





▲The EMP-9000 series EtherCAT motion controller with an all-metal case meets users' most stringent requirements for anti-interference capability and system size.

	EMP-9000 (PAC/PLCs)	Conventional IPC + EtherCAT master card in the market
Development Platform	Developers can use PLC Open or standard Windows API to develop the program.	Provides only Windows API library
Reduce development time	ECATMotion API and PCL Open functions are easy to use. Provides professional consultation from motion control technical service team.	Provides only Windows API library
Size	Save 80% space of conventional IPC.	Big and heavy
Expandability	Provide 0/2/6 slot expansion modules, which can install high-performance e-9K and PAC I/O modules	Available in conventional PCI or PCIe slots only

ICP DAS Exclusive Features

- Built-in 10 groups of PID control loops
- High-speed data logger
- Analog module filter
- Event trigger control
- Gantry control parameter adjustment program
- Stewart Platform

- **Boost the efficiency of your development**
- **It can be programmed in a variety of languages**
- **EtherCAT motion controller with the highest level of dependability**
- **3U rack-mounted design saves space and wiring**

EMP-9 X X X - XX

I/O Slot
0/2

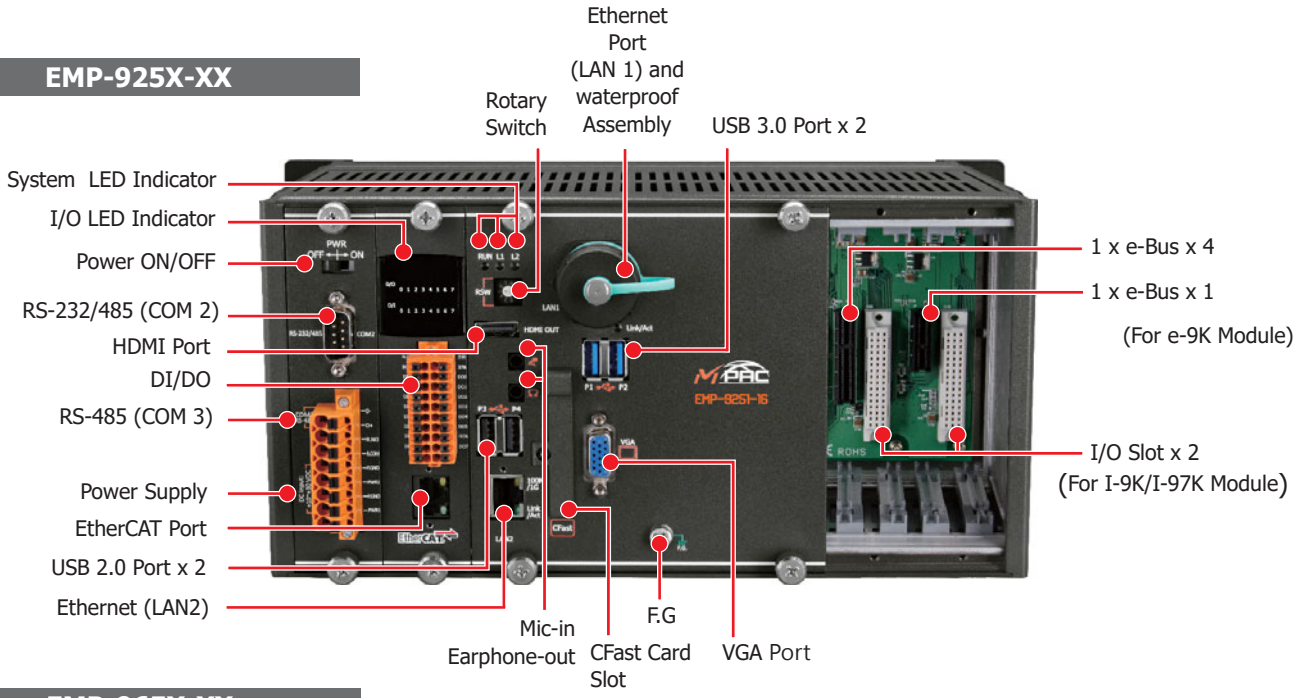
CPU
5: i5-8365UE
9: E3950

Version
1: Standard
8: Win-GRAF

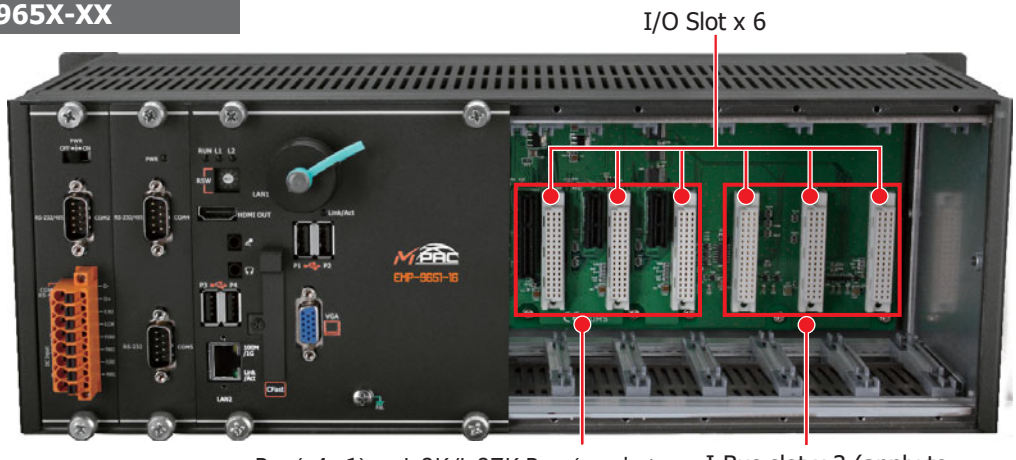
Number of axes
16: 16 axes
32: 32 axes

EMP-909X-XX / EMP-905X-XX

EMP-925X-XX



EMP-965X-XX



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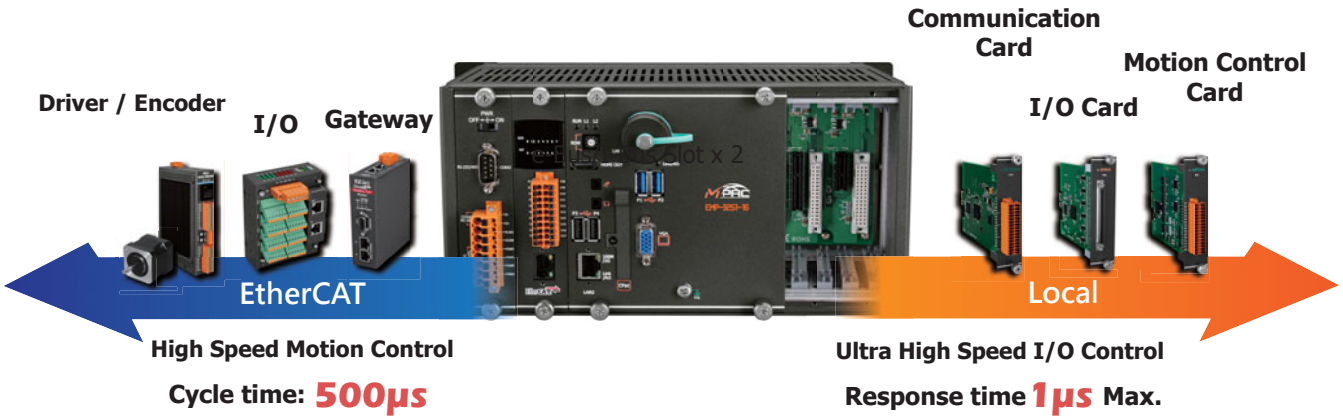
Windows 10 IoT **Standard Edition** (Built-in ICP DAS EtherCAT Win32 Library)

Model	CPU	RAM	e-Bus/I-Bus Expansion Slot (Shared)	Cycle Time	EtherCAT Slaves	Motion Axes
EMP-9051-32	i5-8365UE (1.6 ~ 4.1 GHz, 4C8T)	16 GB	-	0.5/1/2/4/8 ms	512	32
EMP-9051-16						16
EMP-9251-32			2			32
EMP-9251-16						16
EMP-9651-32			6			32
EMP-9651-16						16
EMP-9091-32	E3950 (1.6 ~ 2.0 GHz, 4C4T)	8 GB	-			32
EMP-9091-16						16

Windows 10 IoT **Win-GRAF** Version (Built-in ICP DAS EtherCAT Win32 Library and Win-GRAF EtherCAT PLC Software)

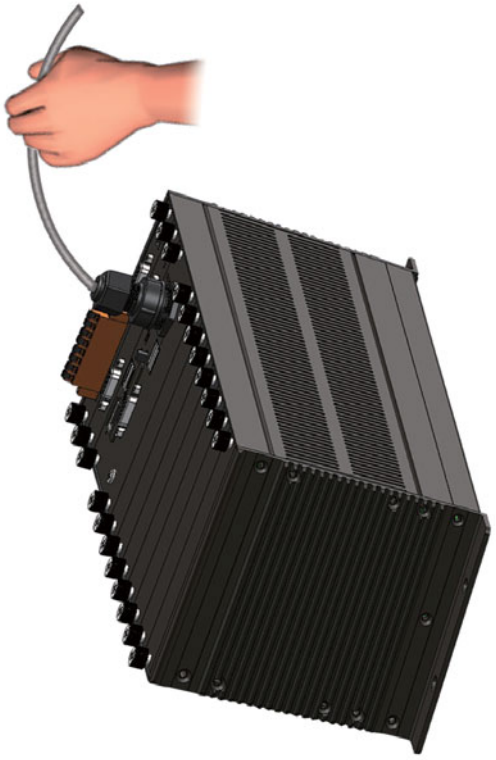
Model	CPU	RAM	e-Bus/I-Bus Expansion Slot (Shared)	Cycle Time	EtherCAT Slaves	Motion Axes
EMP-9058-32	i5-8365UE (1.6 ~ 4.1 GHz, 4C8T)	16 GB	-	0.5/1/2/4/8 ms	512	32
EMP-9058-16						16
EMP-9258-32			2			32
EMP-9258-16						16
EMP-9658-32			6			32
EMP-9658-16						16
EMP-9098-32	E3950 (1.6 ~ 2.0 GHz, 4C4T)	8 GB	-			32
EMP-9098-16						16



▲ Flexible system design capabilities, can be used with a variety of applications and the use of devices to choose, to enhance the freedom of design.

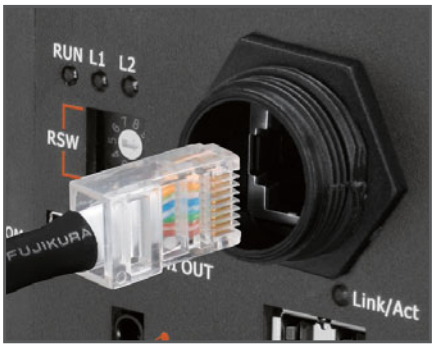
Securing the Ethernet Cable

ICP DAS provides two types of RJ-45 network port designs, which can secure the Ethernet cable, avoid poor communication caused by vibration and pulling, and increase the reliability of RJ-45 cable connector.



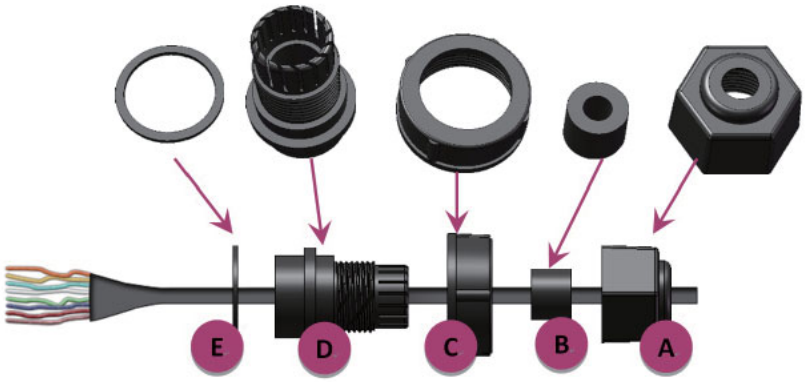
• Secured RJ45 connector

This RJ45 connector not only can be used with the regular network cable, but also can add a secured connector. Besides, the package allows the regular network connector to get the most reliable locking force.

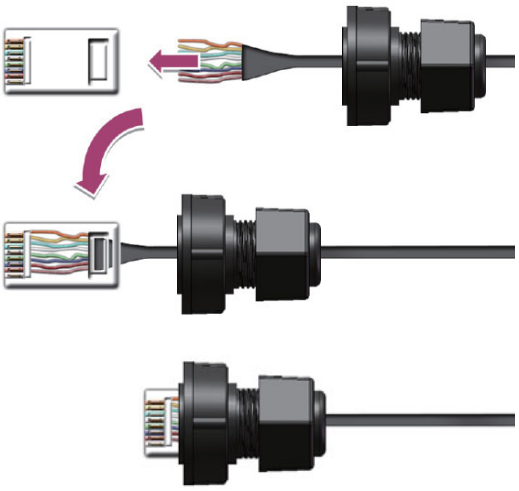


▲Regular Ethernet Cable

▲Secured RJ45 Connector Kit



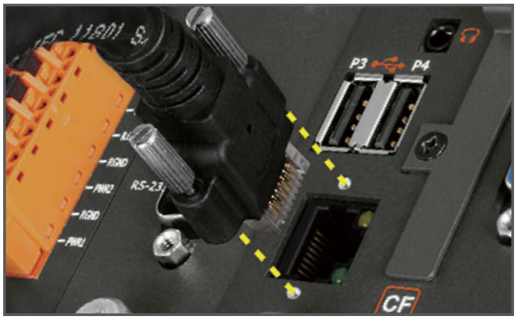
▲Waterproof Connector Kit



• RJ45 Screw-lockable Connectors

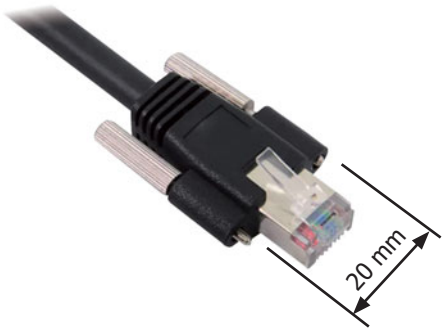
Screw holes (spaced 20 mm) are located on both sides of the RJ45 connectors. Screw holes can also be used in addition to standard network cables.

The wire-locked network cable lessens the possibility of the network cable falling off due to vibration.



▲ Screw-lockable RJ45 Connector

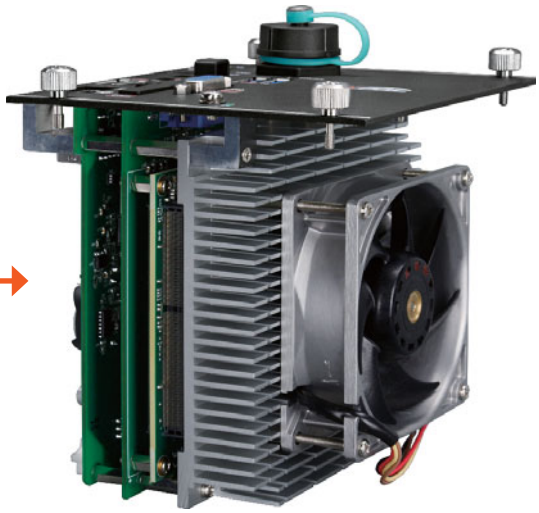
▲ General Ethernet Cable



▲ Ethernet Cable with a Screw-on Lock

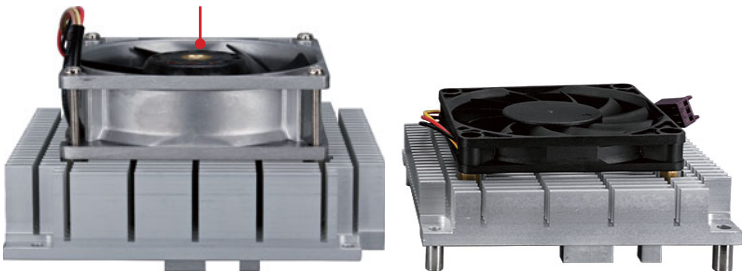
High-Efficiency Heat Dissipation CPU

Design of CPU Heat Dissipation



The temperature of the entire CPU can be reduced by another 10°C with larger heat sinks and fans, extending the service life of electronic components. The fan has been specially selected for the long-life type, with a lifespan of 180,000 hours (about 20 years).

▲ CPU with Long-life Heat Dissipation

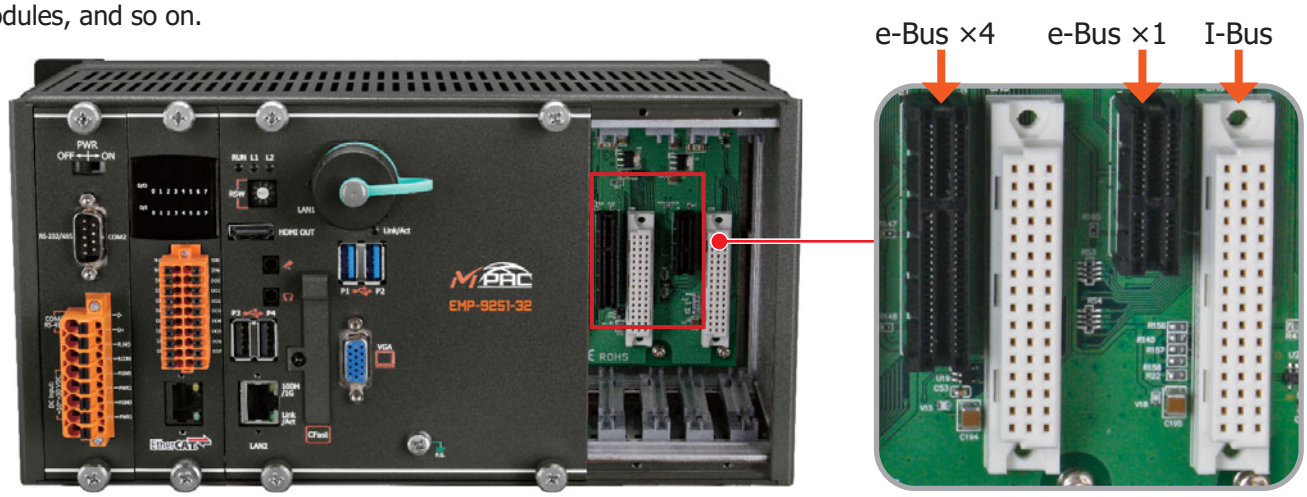


▲ Long Life Design

▲ Regular Design

Expandable I/O Slot Design

The EMP-9000 series offers a variety of I/O expansion options. User can directly integrate e-9K/I-9K/97K series modules via the expansion slot. The e-9K/I-9K/97K high-speed data transmission module can meet the needs of high-speed and stable data acquisition by providing a variety of analog, digital input and output modules, encoder input modules, and so on.

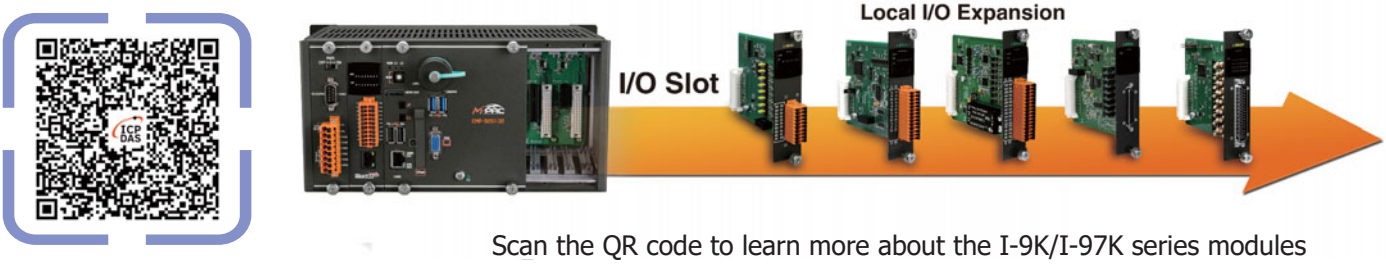


The I/O Module's Communication Interface

The EMP-9000 series can support I/O and communication expansion modules from the e-9K/I-9K/97K series

- The e-9K (e-bus) utilizes PCIe 3.0 communication, has an x1 or x4 communication interface, and has a speed of 500 MB/s or 2 GB/s.
- I-9K uses 8-bit parallel communication, with speeds ranging from 200 to 500 KB/s depending on CPU level.
- The I-97K (I-bus) uses uart communication at 115 kbit/s.

I-9K/97K Series (I-bus)



Scan the QR code to learn more about the I-9K/I-97K series modules

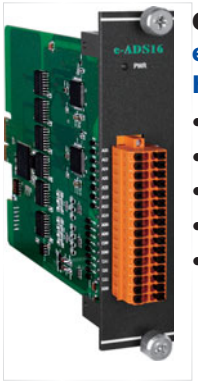
● e-9K Series , DAQ Modules (e Bus)

Model	e-Bus	Description
e-LCell4	e-Bus x1	High-speed LoadCell (24-bit, 15KHz) module , 4-channel, Terminal Block
e-ADS16	e-Bus x1	High-speed AI module , 16-channel, 16-bit, 200KHz, Sample & Hold, Terminal Block
e-D96S	e-Bus x1	High-speed bidirectional DIO module , 96-channel, SCSI II 96-pin connector
e-AR300T	e-Bus x1	Accelerometers input , 3-port IEPE interface , 1 channel thermistor input
e-AR400	e-Bus x1	Accelerometers input , 4-port IEPE interface
e-USB400	e-Bus x1	4-port USB3.0 expansion module. 500 MB/s total bandwidth
e-USB404	e-Bus x4	4-port USB3.0 expansion module. 2 GB/s total bandwidth
e-PoE204	e-Bus x4	2-port PoE (10/100/1000 Mbps) expansion module
e-PoE404	e-Bus x4	4-port PoE (10/100/1000 Mbps) expansion module

e-LCell4

e-Bus, 24-bit High-precision Load Cell Input Card

- e-Bus x1
- 4-channel 24-bit load cell input
- 4-channel 24-bit analog input
- 15 kHz sampling frequency



e-A16SH

e-Bus, 200 kS/s, 16 Channels and 16 bits High-speed Analog Input Card

- e-Bus x1
- Simultaneous sampling
- 16-bit 16-channel single-ended analog input
- 2k WORD FIFO
- 16-channel simultaneous sampling single-ended analog input

e-D96S

e-Bus, 96-channel Digital I/O Card

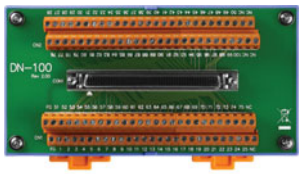
- e-Bus x1
- 96 channels of Digital I/O
- I/O response time 500kHz
- SCSI-II terminal

CA-SCSI100-15

SCSI-II 100-pin Cable, 1.5M

100-pin

DN-100



100-pin SCSI II Female I/O Connector Block

e-AR300T

e-Bus, 3-channel Accelerometer

- e-Bus x1
- 3 channels with 16-bit simultaneous sampling
- 3 IEPE input ports, drive current is 3 mA
- 1 channel thermistor input
- Up to 125kHz sampling frequency
- Signal dynamic range: ±10V
- There are several trigger modes available, including button trigger, time schedule trigger, threshold trigger, digital input trigger, and remote tool software trigger

e-AR400

e-Bus, 4-channel Accelerometer

- e-Bus x1
- 4 channels 16-bit simultaneous sampling
- 4 IEPE input ports, with 3 mA drive current
- Up to 125kHz sampling frequency
- Signal dynamic range: ±10V
- There are several trigger modes available, including button trigger, time schedule trigger, threshold trigger, digital input trigger, and remote tool software trigger

e-USB400

e-Bus, 4-port USB3.0 Expansion Module

- e-Bus x1
- 4-port USB3.0 host module that is backward compatible with USB2.0/1.1/1.0
- 500 MB/s total bandwidth
- Each port has a maximum current supply of 900 mA.
- USB Camera Supported

e-PoE204

e-Bus, 4-port PoE Expansion Module

- e-Bus x4
- Supports IEEE 802.3at PoE
- 4 ports 10/100/1000 Mbps Ethernet
- Supports PoE power management and monitoring
- Supports PoE Camera

e-USB404

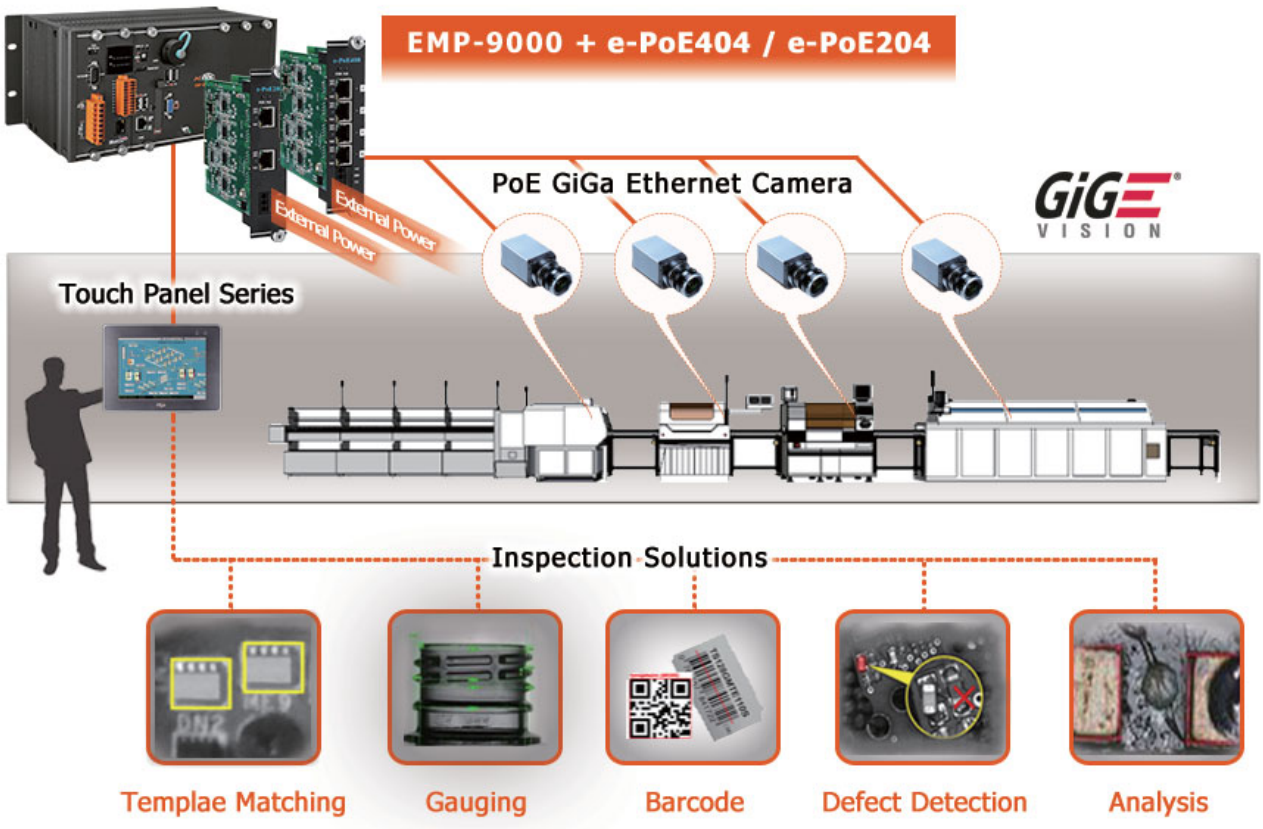
e-Bus, 4-port USB3.0 Expansion Module

- e-Bus x4
- 4-port USB3.0 host module that is backward compatible with USB2.0/1.1/1.0
- 2 GB/s total bandwidth
- Each port has a maximum current supply of 900 mA.
- USB Camera Supported

e-PoE404

e-Bus, 4-port PoE Expansion Module

- e-Bus x4
- Supports IEEE 802.3at PoE
- 4 ports 10/100/1000 Mbps Ethernet
- Supports PoE power management and monitoring
- Supports PoE Camera



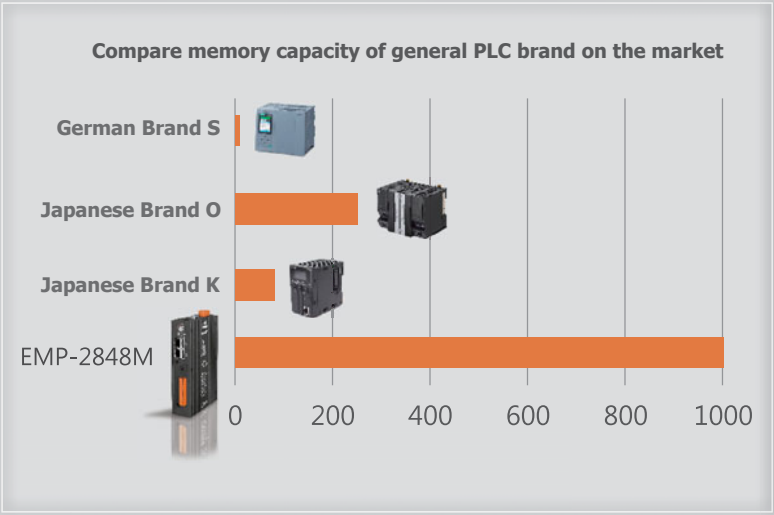
2-4 EMP-2848M EtherCAT Motion Controller (Soft PLC Based)

ICP DAS compact EtherCAT motion controller is with metal casing and can fit in a 3U cabinet. It features durable structure and strong anti-noise ability. It is compact and perfect for use under harsh environments. And the network topology and settings of the modules can be done by the built-in web page.

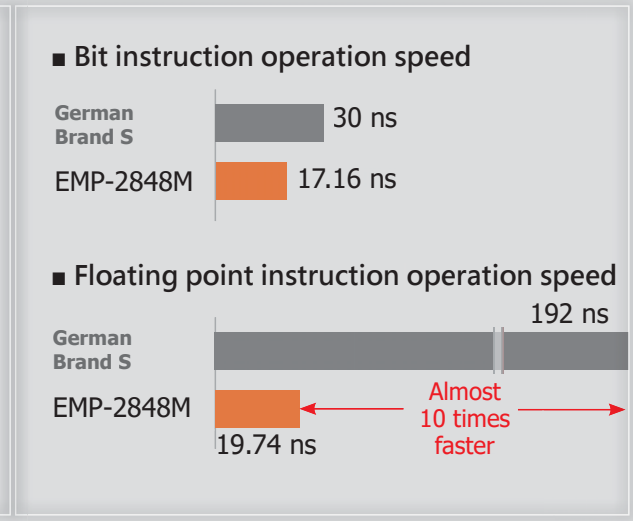
EMP-2000 can integrate control, data processing and network connection into one control platform. It provides Win-GRAF that supports IEC 61131-3 PLC programming language which can meet multi-purpose and high expansion requirements of the automation applications. It can control 16 servo axes and 128 slaves for motion control at the same time.

ICP DAS EMP-2848

Large memory capacity for easy to use



EMP-2848M is really fast!



Support multiple networks

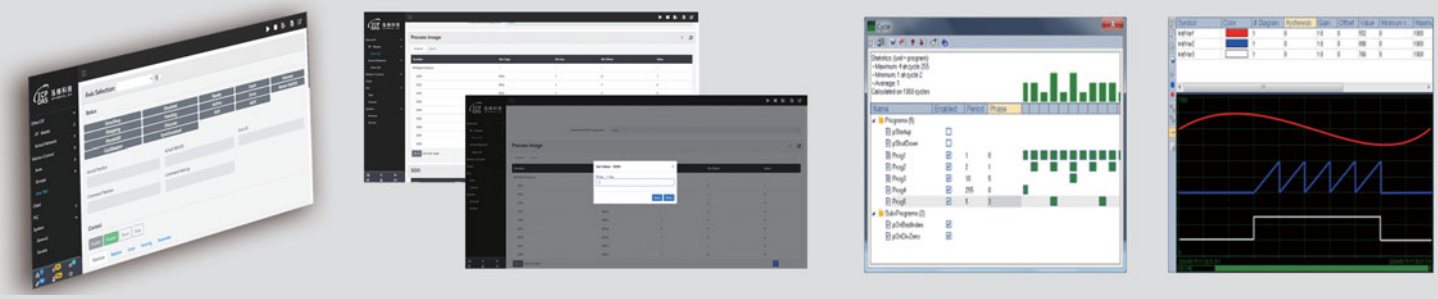
- Support EtherCAT Master
- Support Modbus TCP (Master/Slave)
- Support Modbus RTU/ASCII (Master/Slave)
- Support OPC UA (Available soon)

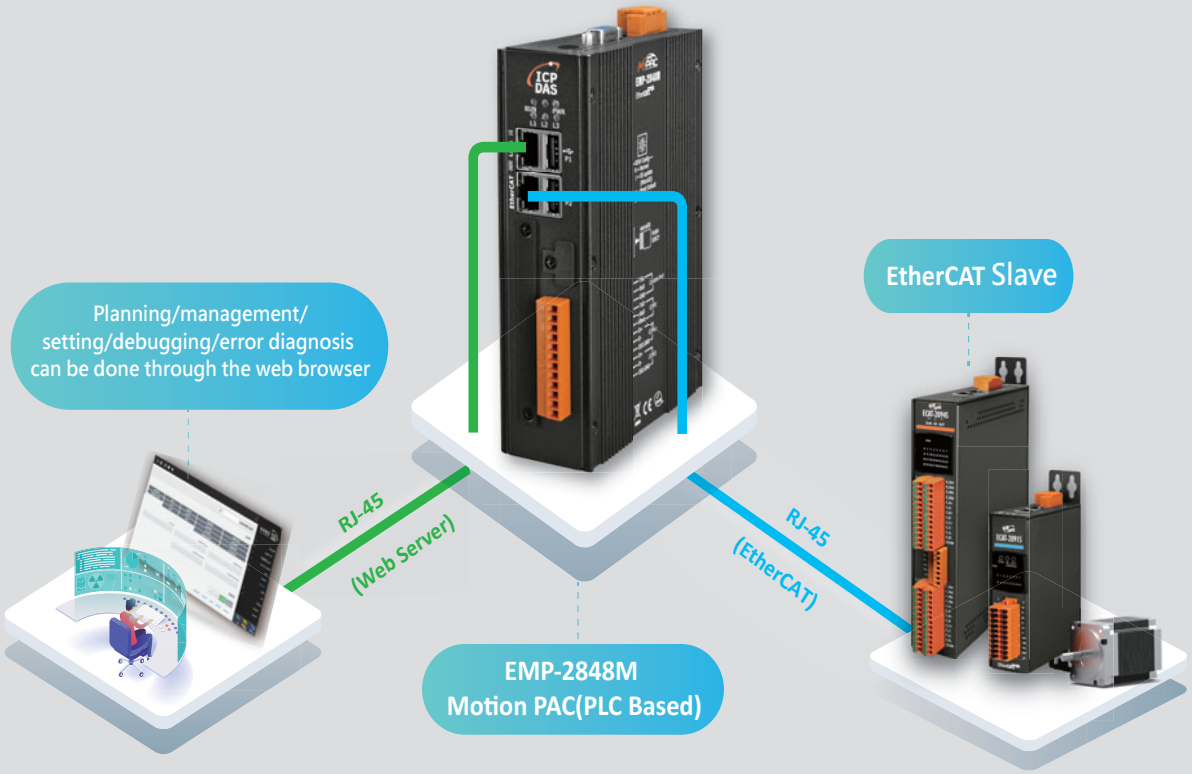
High efficiency and high protection

- Cortex-A53 1.6GHz quad-core processor
- Control cycle up to 500 μs
- EtherCAT engine independently developed by ICP DAS
- Single axis motion control
- Metal casing is effective against noise
- Built-in 1G large capacity memory

Built-in integrated web page

- Get EtherCAT network topology with one click
- Compatible with ESI files from third-party slave
- Easy troubleshooting
- Perform commissioning of the motion controller
- Configure slave module parameters
- Support virtual slave ID memory function





▲ The EMP-2000 series is with a metal casing and features anti-interference and compact in system and space. It lowers the barrier in development and configuration, and take all factors such as compact size, safety, stability, and convenience into account.

Easy to Develop

- Support Win-GRAF Workbench according to IEC 61131-3 PLC Language
- Multiple Soft PLC languages (FBD/LD/IL/ST/SFC)

Support multitasking function

- Up to 4 tasks can be executed simultaneously
- Different communication protocols can be used separately
- Don't worry about the timing of different protocols

EMP-2848M

Thinner than a dictionary!

- **Make programming development more efficient**
- **Programmable in standard PLC language**
- **Most reliable EtherCAT motion controller**
- **Compact and robust, saving space and wiring**

Convenient web management interface

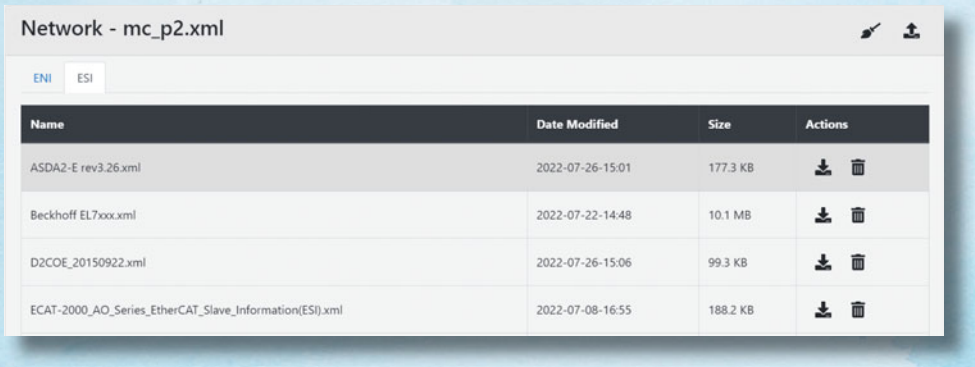
Open the webpage through the browser to plan the topology settings and debug the slave module. When an unusual event occurs, the error diagnosis can be performed in real time.

Simultaneous control of up to 16 axes

Control 16 axes synchronously in real time through the standard EtherCAT protocol. The fastest control cycle can reach 0.5ms

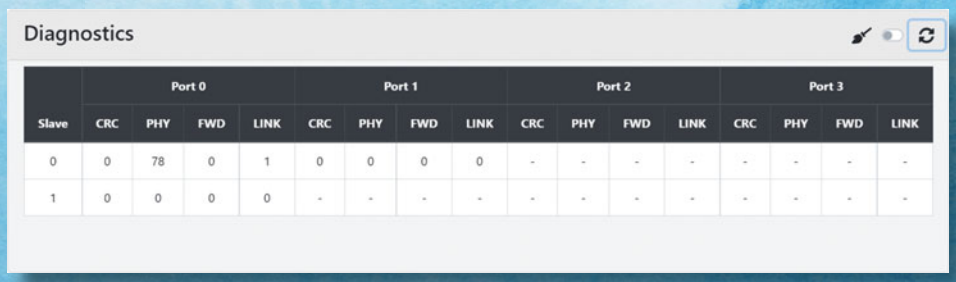
Compatible with all ICP DAS slave stations and third-party slaves

EMP-2848M supports ESI file configuration, ESI file can be imported through the web interface to be compatible with all slaves.



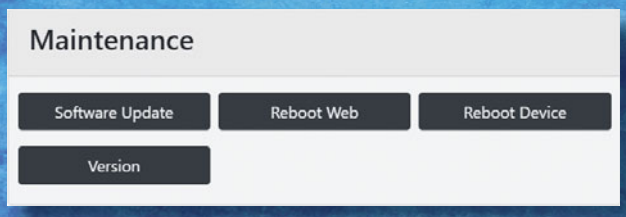
Network Connection Diagnosis Interface

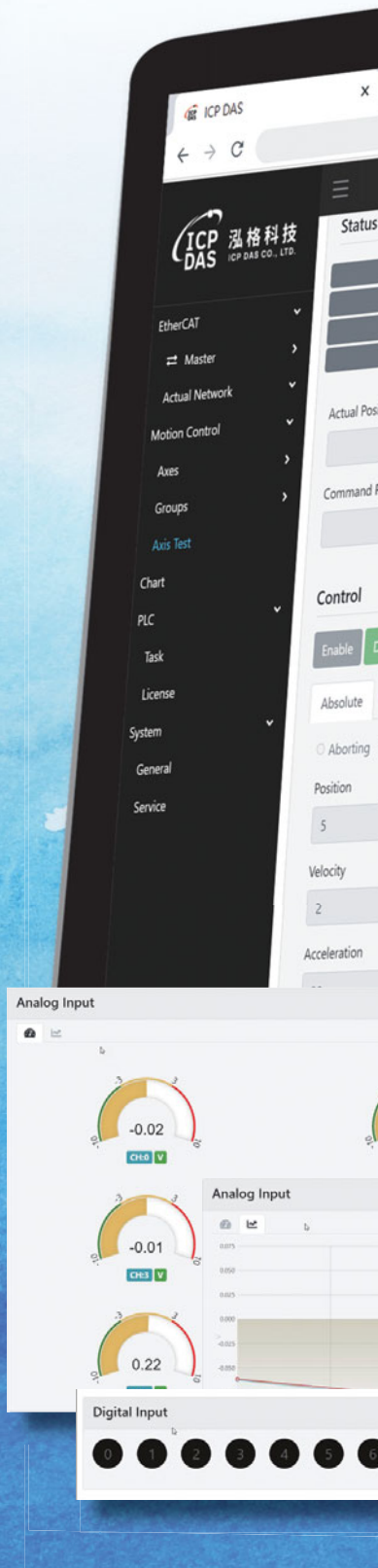
Provide an interface to show error, counter, and connection status of each port of the slaves.



Update firmware function

Users can update the firmware at local side through the Maintenance page of the EMP-2848M web interface for function update and problem solving.





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Task1 EtherCAT
Task2 Modbus RTU
Task3 Modbus TCP
Task4 OPC UA

Multitask function

Users can assign tasks of different communication protocols to different task blocks to run the tasks simultaneously, which can greatly reduce the complexity of communication terminals and program development.

CiA402 PDO Automatic assignment function

Provides CiA402 slave station module PDO automatic assignment function, which will automatically assign the PDO configuration of the slave module according to different motion control functions.

Visual Module Data Interface

Users can easily control or obtain DAQ module data.

EtherCAT®

Each Pac supports multiple open networks.

The EMP-2848M also has all kinds of interfaces to support various networks at any time, unlike other PLCs that require expansion modules.

EtherCAT® Modbus OPC® FOUNDATION

- Supports EtherCAT, Modbus TCP, Modbus RTU/ASCII, and OPC UA
- Provides EtherCAT, Ethernet and serial ports

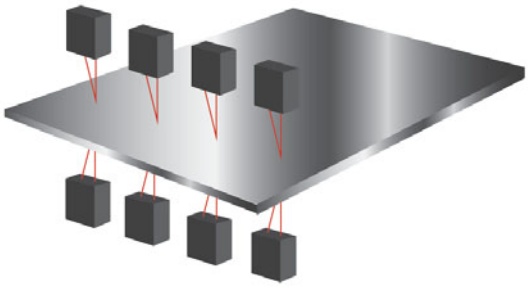
High real-time behavior and deterministic

The EMP-2848M provides WinGRAF SoftPLC to solve the problem of other brands being interfered by operating systems, network cards and other systems.

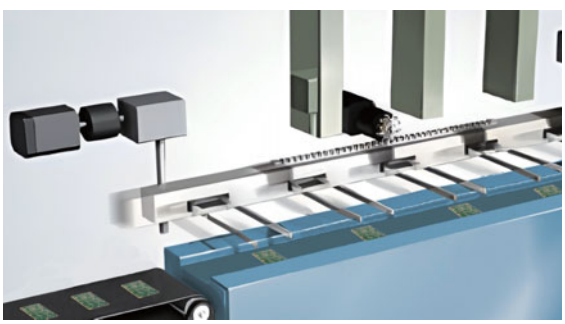
- Cortex-A53 1.6GHz quad-core processor
- Reliable Real-Time Linux (RT-Preempt) for enhanced real-time and deterministic

Controlling various motors by wiring-saving

- Connect up to 16 axes and is mapped to PLC variables to the motion control axes, and then easily control them through PLC language.
- Synchronized motion control is as simple as point-to-point control.



▲ Import analog values for multiple channels at the same time.

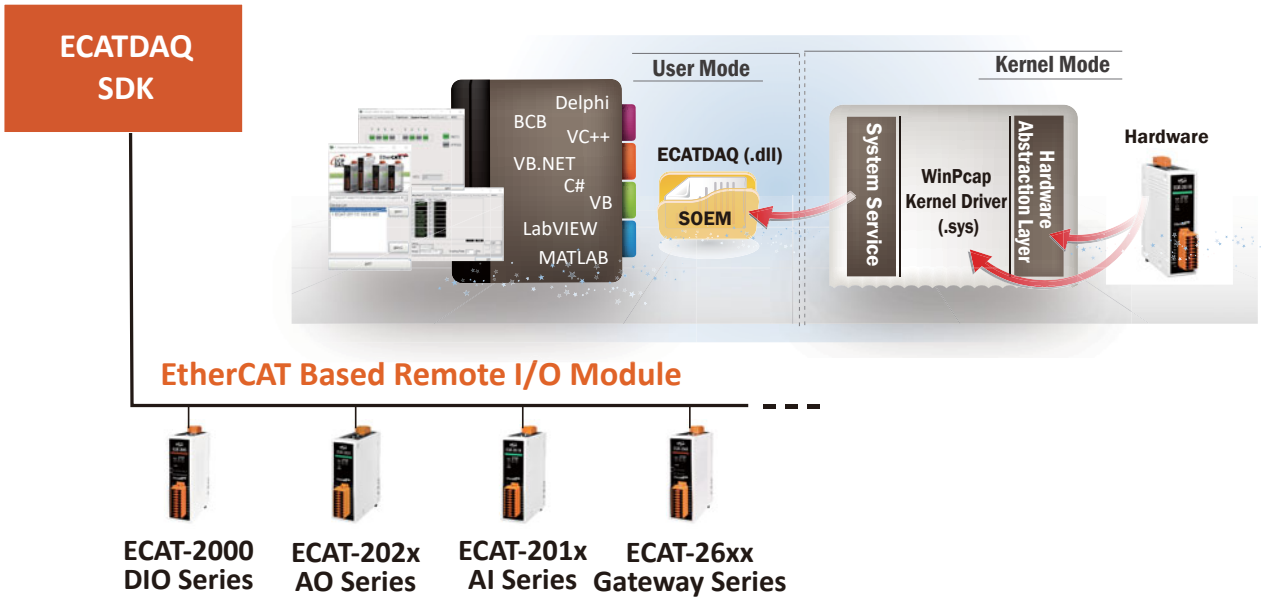


▲ Simultaneous activation of multi-axis motors

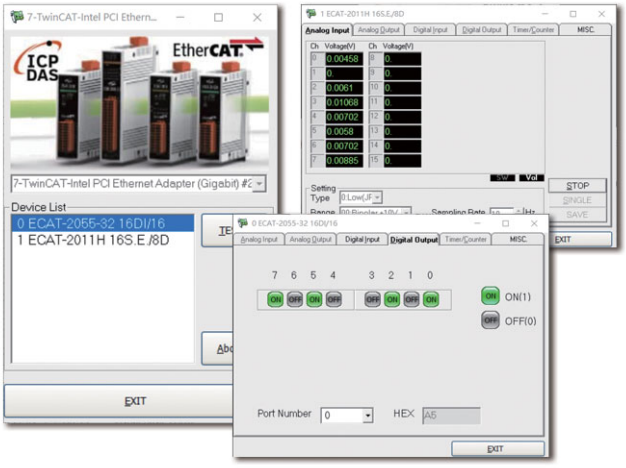
2-5 ECATDAQ Lightweight EtherCAT Master Library

ECATDAQ is a library (DLL function) for developing EtherCAT Master control programs on XP-9K-IoT (Win10-based) programmable automation controllers or PCs. It reduces the complexity of programming EtherCAT Master and thus helps users quickly develop applications for connecting and controlling ECAT-2000 I/O and motion control modules.

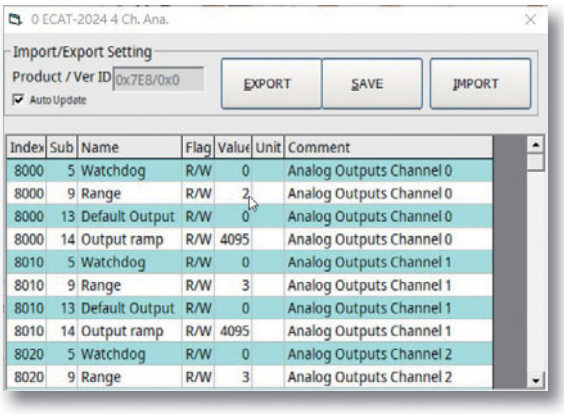
- Can use General network port (EtherCAT master card not required)
- Provides Windows API functions, which can be used in Windows system.
- ESI files are not required
- VC/VB6/C# Example Programs
- Supports ICP DAS slaves (third-party slaves are not supported).
- Lightweight EtherCAT applications
- Supports Free-Run mode
- Control cycle 20ms
- 8-axis (single-axis linear interpolation)
- Slave Stations: 20



▲ AXP/XP-9000 or general PCs can develop relevant ECAT-2000 applications through the ECATDAQ library.



▲ iECAT Utility ICP DAS EtherCAT Module Validation and Debug Tool



Index	Sub	Name	Flag	Value	Unit	Comment
8000	5	Watchdog	R/W	0		Analog Outputs Channel 0
8000	9	Range	R/W	2		Analog Outputs Channel 0
8000	13	Default Output	R/W	0		Analog Outputs Channel 0
8000	14	Output ramp	R/W	4095		Analog Outputs Channel 0
8010	5	Watchdog	R/W	0		Analog Outputs Channel 1
8010	9	Range	R/W	3		Analog Outputs Channel 1
8010	13	Default Output	R/W	0		Analog Outputs Channel 1
8010	14	Output ramp	R/W	4095		Analog Outputs Channel 1
8020	5	Watchdog	R/W	0		Analog Outputs Channel 2
8020	9	Range	R/W	3		Analog Outputs Channel 2

▲ Export/Import Module Settings

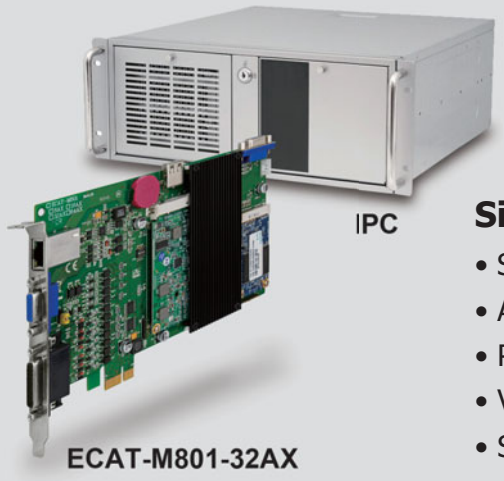
2-6 EtherCAT Master Card (PC Based)

ICP DAS offers EtherCAT network motion control cards that are compatible with Windows and Linux operating systems, allowing you to enjoy convenient and efficient real-time motion control on any computer and platform by plugging in a card. Up to 64 servo axes and 512 slave devices can be controlled synchronously for movement, and a variety of common movement control functions are provided to speed up software development.

EMP-M801

Model	Axes	Slaves	Function
ECAT-M801-8AX	8	512	Full
ECAT-M801-16AX	16	512	Full
ECAT-M801-32AX	32	512	Full
ECAT-M801-64AX	64	512	Linear

Module	Number of axes	Number of Stations
ECAT-2094S	4	1
ECAT-2091S	1	1
ECAT-2513	0	2
ECAT-2515	0	4
ECAT-2517	0	5
ICP DAS I/O Module	0	1



Single Axis Motion Control

- Supports CiA402 driver and ICP DAS stepper motor drivers
- Auto Homing function
- Point to point and constant velocity motion
- Virtual axes
- Supports CiA402 servo drives Touch Probe function

High Performance

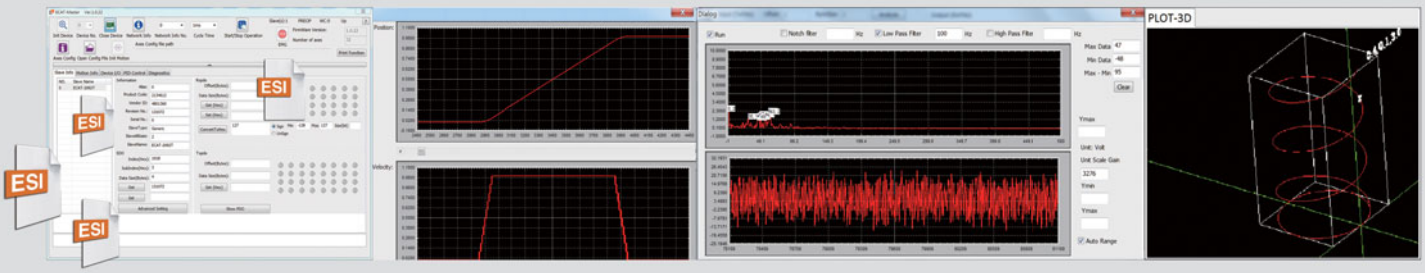
- Cycle times of up to 500 µs
- Supports Windows 10 and Linux operating systems
- Supports 32 and 64-bit operating systems

Local I/O Interface

- 13 isolated digital I/O channels
- PCI Express x1
- Card ID
- 2-axis encoder
- Supports compare trigger

Multi-axis Group Motion Control

- Add/Remove axis from a group easily
- Multi-axis interpolation motion (PV/PT/PVT mode)
- 2/3-axis Circular interpolation, Helical interpolation, Profile motion control
- Continuous Interpolation motion (Up to 7000 data buffered)
- Supports Buffered/Aborting/Blending and other commands
- Up to eight groups of simultaneous control



▲ ECAT-M801 handles motion control, allowing the PC system to focus on other tasks

3D Circular | 3D Helical | Continuous Path
T/S Curve | Compare Trigger | Position Limit
Velocity Feedforward | Position Reset | Speed Reset
Linear | Helical | Continuous

Quick Deployment without Knowing EtherCAT

- Supports a DLL library
- Supports a simple motion control API
- Code samples in a variety of programming languages
C++/C#/VB.NET/BCB/LabVIEW/Python
- Special ICP DAS I/O module functions

Quick Configuration Tools

- Easy configure the slave device
- Compatibility with 3rd party slave device
- An easy-to-use troubleshooting function
- Supports the slave alias name function

Exclusive ICP DAS Features

- Built-in 10 groups of PID control loops
- High-speed data logger
- Analog input filter
- Event trigger
- Gantry control parameter adjustment program
- Stewart Sports Platform

- **Improve the efficiency of your development**
- **Can be programmed in a variety of languages**
- **Allow the ECAT-M801 to assist the system in performing more real-time actions such as motion control, measurement, and so on**

CH3
EtherCAT Motion

3-1 EtherCAT Stepper Motor Controllers/Drivers

ICP DAS stepping motor controllers are specially designed to drive two-phase bipolar stepping motors by using open loop control, which eliminates the need for a running quantity sensor or an encoder. It uses pulse signal to switch the current trigger without requiring a feedback device for position detection and speed detection, so that it allows the stepper motor to rotate in proportion to the pulse signal. As a result, more precise position and speed control, as well as greater stability can be achieved.

ECAT-2094DS / ECAT-2094S / ECAT-2091S

Accurate and Stable Stepping Motor Control

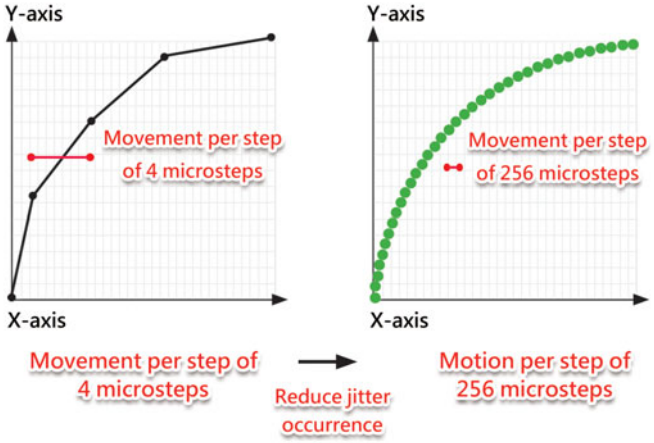
- Support two-phase bipolar stepping motor
- Support CiA402 protocol
- Open loop processing
- Programmable current control, up to 3.3A
- Programmable step resolution
- Up to 256 microsteps per full step

Built-In Multiple I/O Interfaces

- Diff erential encoder (A, B, Z)
- Digital input (limit switch/latch/general function)
- Digital output

High precision

- Offers up to 256 microsteps to enhance stability



Reliable Protection Function

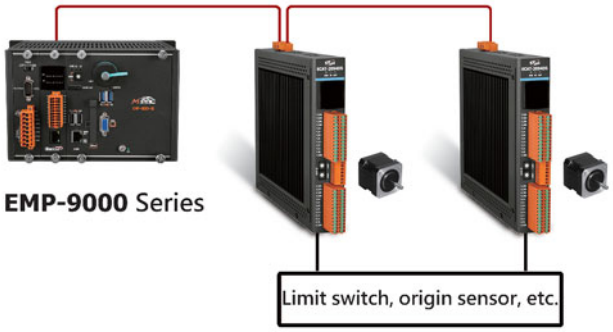
- Built-in driver over temperature and short circuit protection mechanism
- I/O terminal isolation protection
- Automatic rectifi cation prevents the motor from overheating
- Provides fault indicator lights for I/O and motor status.

EtherCAT Communication Interface

- Free-Run/SM/DC mode support
- Cycle time of 0.5 ms
- Four-axis synchronized control

Compact size and easy wiring

The ECAT-209X series can use only one network cable to connect the controller and the stepper driver, which can reduce the wiring compared with pulse control. A space to slip in a book is enough to host a four-axis stepper driver.

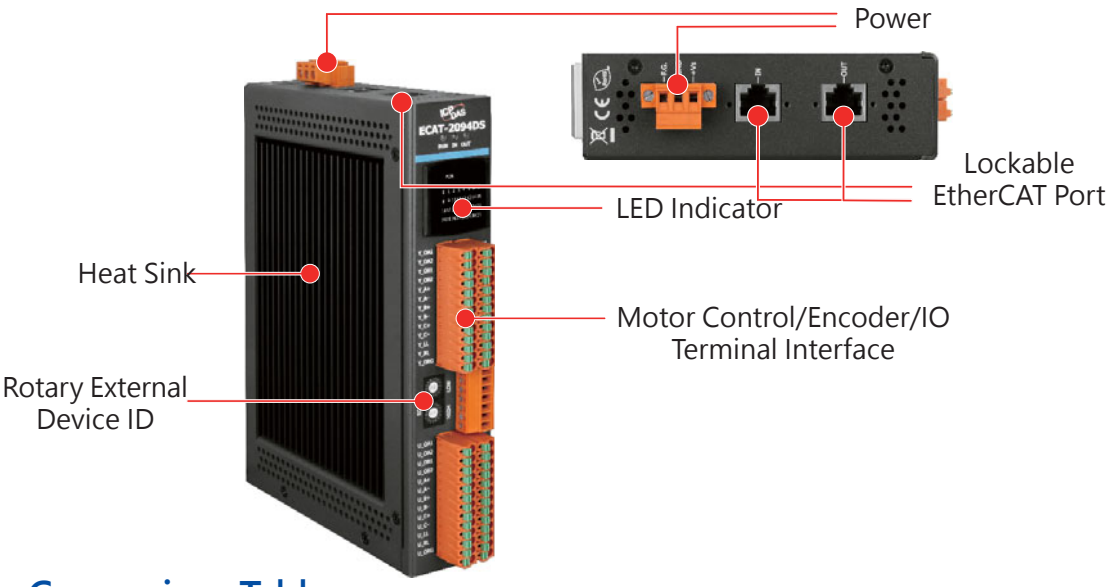


ECAT-209 Y XXX - XX

Y — axes/channels:
1: 1-axis
2: 2-axis
4: 4-axis
8: 8-axis

XXX — Driver/Encoder Type
S:Stepper Motor (DS402 is not supported)
DS:Stepper Motor
BL:Brushless Driver
P:Pulse
CS:Closed Loop Stepper Driver

XX — N/A: Below 4A
8A: 8.0A



Comparison Table:

Model	EtherCAT		Motor output				Encoder input		Digital I/O
	Cycle Time	Support CiA402	Axis	Control Mode	Output current	Microsteps Per Step	Channels	Frequency (MHz)	Channels
ECAT-2091S	0.5 ms	-	1x stepper motor (2 phases)	Open Loop	Peak 1.5A	256 128 64 32 16 8 4 2	1	1	2 DI 1 DO (Sink)
ECAT-2094S	1-axis: 1 ms 2-axis: 2 ms 3-axis: 3 ms 4-axis: 4 ms	-	4x stepper motor (2 phases)	Open Loop			4	4	8 DI 2 DO (Sink)
ECAT-2091DS	0.5 ms	v	1x stepper motor (2 phases)	Open Loop	Peak 3.3A		1	1	3 DI
ECAT-2094DS	0.5 ms	v	4x stepper motor (2 phases)	Open Loop	Peak 3.3A		4	4	12 DI
ECAT-2094P	0.5 ms	v	4x Pulse Output	Open Loop	-		4	4	8 DI 2 DO(Sink)
ECAT-2092CS	0.5 ms	-	2x Stepper motor (2 phases)	Closed Loop	Peak 3.3A		2	2	4 DI 2 DO(Sink)
ECAT-2092DS-8A	0.5 ms	-	2x Stepper motor (2 phases)	Open Loop	Peak 8A		2	2	4 DI 2 DO(Sink)
ECAT-2092BL	0.5 ms	v	1x BLDC motor (2 phases)	Closed Loop	Peak 3.3A		2	2	4 DI 2 DO(Sink)

*All models support DC mode

Stepper Motor Controller/Driver DS Series

ECAT-2091DS
ECAT-2094DS
ECAT-2092DS-8A

- Up to 4-axis motion control
- Fully Digital Microstepping Technology
- Wide motor voltage range: 9-29VDC
- Open loop processing
- Maximum current 8A
- Anti-interference design
- Support CiA402 protocol

Stepper Motor Controller/Driver S Series

ECAT-2091S
ECAT-2094S

- Up to 4-axis motion control
- Fully Digital Microstepping Technology
- Wide motor voltage range: 6-46VDC
- Open loop processing
- Maximum current 1.5A
- Anti-interference design

Closed-Loop Stepping Motor Driver CS Series

ECAT-2092CS

- Up to 2-axis motion control
- Fully Digital Microstepping Technology
- Voltage range of the motor: 9-29V
- Closed loop processing
- Maximum current 3.3A
- Anti-interference design
- Support CiA402 protocol

Pulse Output Driver P Series

ECAT-2094P

- 4-axis independent control
- Support hand wheels and inching function
- Pulse output up to 4MHz
- Anti-interference design
- Support CiA402 protocol

Brushless Motor Driver BL Series

ECAT-2092BL

- Up to 2-axis motion control
- Support PWM
- Support potentiometer speed control
- Drive all types of brushless motors
- Anti-interference design
- Support CiA402 protocol

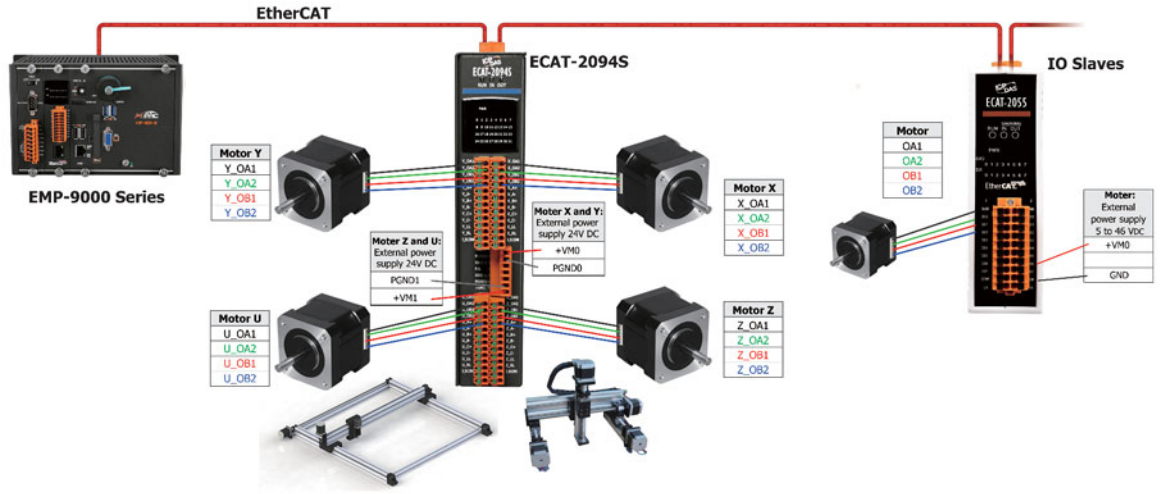
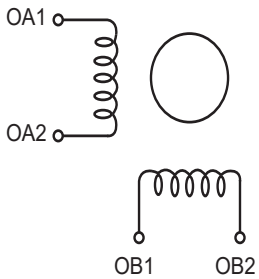
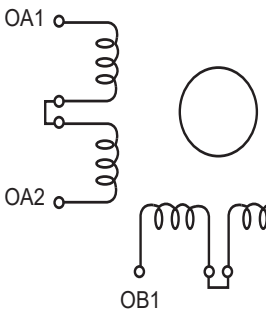
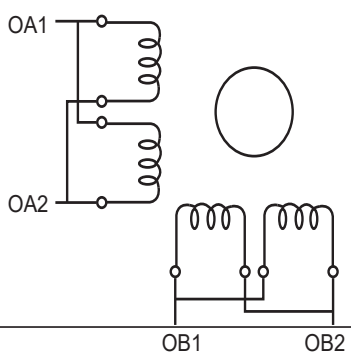


Diagram of ECAT-2094S and ECAT-2091S in EtherCAT Network

Four-lead bipolar motor wiring diagram	Six or Eight-lead unipolar motor wiring diagram (serial)	Eight-lead bipolar motor wiring diagram (parallel)
		

3-2 EtherCAT Encoder

The EtherCAT encoder converts the device's original signals into EtherCAT communication signals, enabling the control system to take full advantage of EtherCAT's nanosecond-precision synchronization, flexible topology, and other benefits, thus achieving precise and reliable control at a lower cost. It allows you to obtain more accurate values faster in the fields of frequency, displacement, and angle measurement.

ECAT-207 E Y - X

E — Channels:
2:2 channel
3:3 channel
4:4 channel

Y — Encoder Type
I: Incremental
A: Absolute

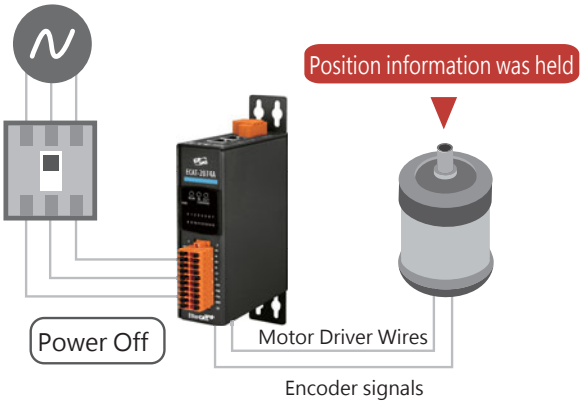
X — Function
T: Comparison Trigger

Comparison Table

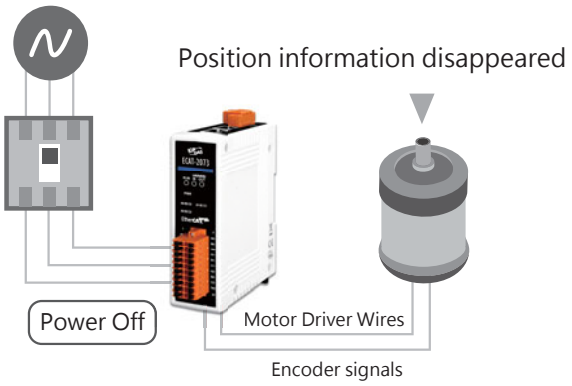
Model	EtherCAT		Encoder Input					External Latch Input	Compare Trigger Output
	Cycle Time	DC	Type	Channels	Resolution/ Serial Input	Frequeency (MHz)	Counting Mode	Channels	Channels
ECAT-2072IT	0.5 ms	v	Incremental	2	32-bit	4 MHz	AB Phase CW/CCW Pulse/Dir	2	2
ECAT-2073I	0.5 ms		Incremental	3				3	-
ECAT-2074A	0.5 ms		Absolute	4	40-bit	10 MHZ	BiSS-C SSI	-	-

Absolute VS Incremental Encoder

Incremental encoders increase or decrease the number of pulses according to the direction of motion to provide the relative position and direction of motion. Absolute encoders provide non-repetitive encoding of position or angle, giving the current accurate position even when power is turned off and on again. Please select the suitable encoder type and match it with the right module.



Absolute Encoder System



Incremental Encoder System

EtherCAT Absolute Encoder Counters

ECAT-2074A

- 4 channel absolute encoder
- Support SSI and BiSS-C modes
- Anti-interference design

Encoder Input	
Encoder Input Number	4 encoder counters (D+,D-,Cl+,Cl-) differential
Counter Resolution	40 bit
Encoder Mode	SSI, BiSS-c
Maximum transmission pulse frequency	10 MHz

The ECAT-2074A absolute encoder can be connected to an absolute encoder with SSI (Synchronous Serial Interface)/ BiSS-C. Both single-turn and multi-turn encoders are supported. The 5V power supply for the encoder can be supplied via the terminal connection points. A wide range of parameterizations allows adaptation to different encoder types.

EtherCAT Incremental Encoder Counters

ECAT-2073I

- 3 channel encoder
- Support multiple counting modes
- Differential signal interface for anti-interference
- Built-in digital filter

Encoder Input	
Encoder Input Number	3 encoder counters (A, B, Z), differential or single action
Counter Resolution	32 bit
Encoder Mode	A/B Phase, CW/CCW, Pulse/Dir
Maximum transmission pulse frequency	4 MHz
Programmable Digital Filter	1 ~ 250 μs
External Latch Input	
Channel	3 (use the Z signal)
Input Level	Z signal interface

ECAT-2073I is a three-channel high-speed encoder interface module designed for reading the pulse sequence generated by the incremental encoder, which is primarily used for position feedback. If you require the position latch function, you can use the phase C signal to trigger it, but there is no dedicated DI to trigger it.

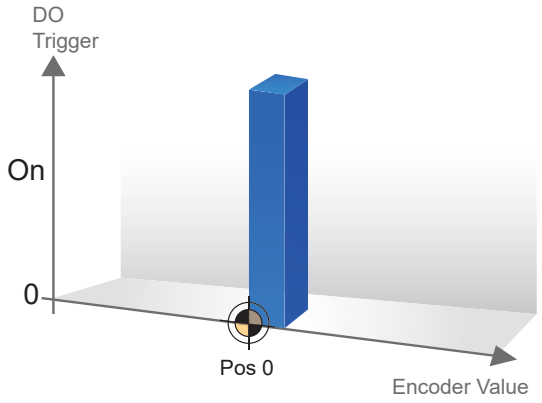
ECAT-2072IT

- 2 channel encoder
- Support Multiple counting modes
- Differential signal interface for anti-interference
- Built-in digital filter
- 2 comparison trigger channels

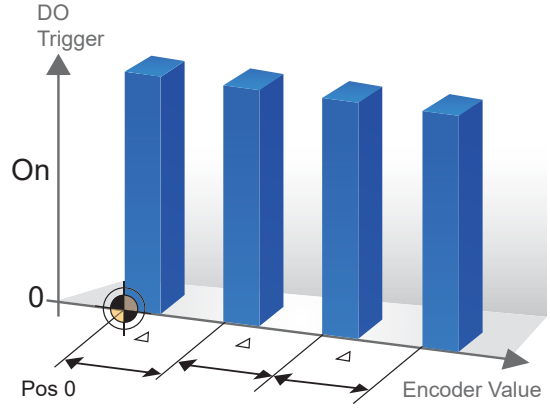
Encoder Input	
Encoder Input Number	2 encoder counters (A, B, Z), differential or single action
Counter Resolution	32 bit
Encoder Mode	A/B Phase, CW/CCW, Pulse/Dir
Maximum Input Frequency	4 MHz
Programmable Digital Filter	1 ~ 250 μs
External Latch Input	
Channel	2 (Use dedicated DI)
Input Level	5V / 12V / 24V (jumper optional)
Compare Trigger Output	
Channels	2
Trigger Output	Open Collector, 5 V ~ 48 V
Pulse width trigger	2 ~ 32,767 μs
Trigger Method	Fixed distance or set array distance data
Enable / Disable	Software command or DI hardware control

The ECAT-2072IT is a two-channel high-speed encoder module. In addition to reading the encoder position, it has a dedicated DI trigger that can record the position when triggered. When the encoder counter reaches the comparison position, the comparison function can be executed by triggering the dedicated DO output. The comparison trigger function enables the user to control external devices such as the camera to take images and the pulse width of the pulse laser to control the emission energy. The trigger output pulse width must be set before the comparison operation can begin.

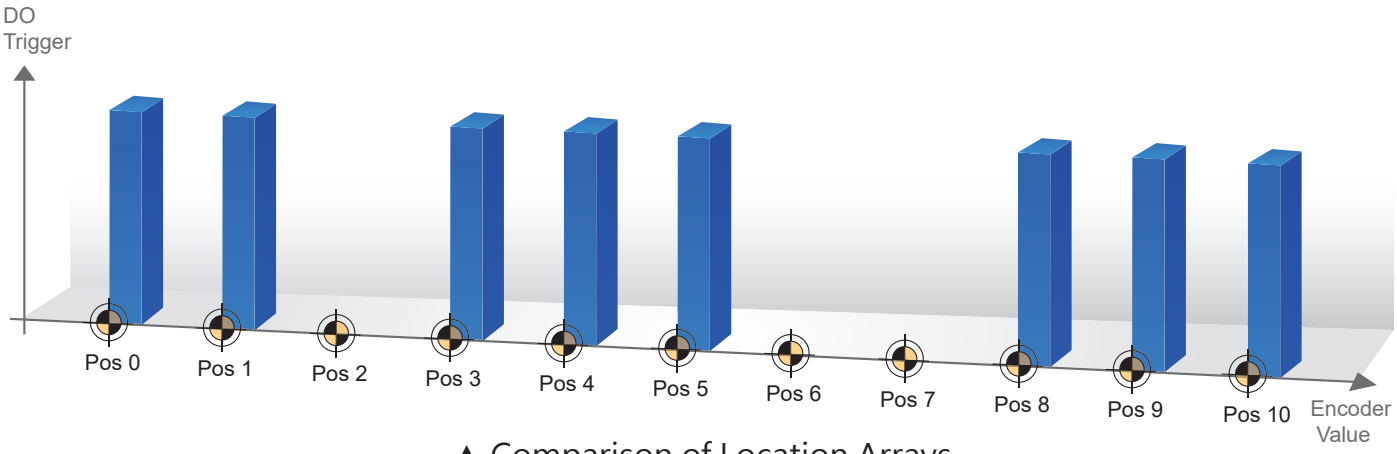
ECAT-2072IT Supports Three Different Types of Position Comparison Trigger Functions



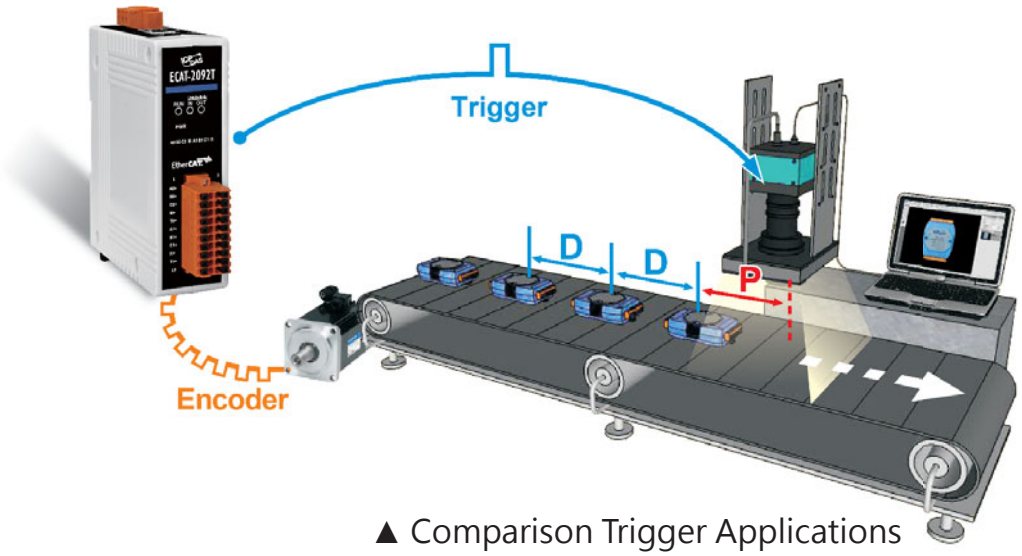
▲ Comparison of Single Point Location



▲ Comparison of Automatic Incremental



▲ Comparison of Location Arrays



▲ Comparison Trigger Applications

The location comparison function can be accessed via software or through a dedicated DI. By connecting its DO to the DI of the ECAT-2072IT, an external PLC or controller can enable/disable the comparison function of the ECAT-2072IT. The image on the left depicts a simple location comparison application with a comparison function that can be enabled/disabled via software or hardware.

The ECAT-2072IT is ideal for industrial inspection applications that require continuous high-speed trigger signals, such as control surface and line scan cameras. Its array comparison function is extremely useful for area scanning cameras that need to check specifi c parts. It is also used in other fi elds, such as laser micromachining for photomask repair or semiconductor repair trigger control.

CH4

EtherCAT I/O

4-1 EtherCAT I/O Overview

ICP DAS provides a full range of fieldbus modules that ranges from general bus terminal modules to high anti-noise protection modules for all common input/output signals and fieldbus systems. In addition to modules for conventional bus systems, ICP DAS also offers integrated product line that helps to optimize EtherCAT systems.

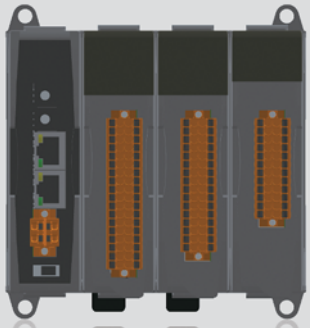
ECAT-2_

ECAT-2000 Series

EC1 Series

EC2 Series

EP-800 Series



Distributed Module

- Independent module design
- Compact
- Can be installed in the chassis

Plug-in Module

- Compact EtherCAT I/O system that can be plugged into the signal distribution board
- Optimize mass production
- A dedicated port can be planned for specific application
- Use integrated cable to avoid wiring errors and save wiring time

Compact Expansion Module

- I/O expandable system that is open & independent to fieldbus
- Nearly 10 different Bus Terminals
- Compact chassis provides 4/6/8 slots for expansion

+886-3-597-3366 info@icpdas.com / sales2@icpdas.com

Comparison table for ICP DAS slave stations:

Module				
Series	**EC1 Series**	**EC2 Series**	**ECAT-2000 Series**	**EP-800 Series**
Type	Plug-in	Distributed	Distributed	Central- distributed
Casing	Metal(Anti-interference)	Metal(Anti-interference)	Plastic	Plastic
Interface	ICP DAS plug-in terminal	RJ45 x 2	RJ45 x 2	RJ45 x 2
Performance	100 µs (Typical)	100 µs (Typical)	1 ms (Typical)	100 µs (Typical)
I/O points	DIO: max. 32	DIO: max. 32	DIO: max. 32 AI: max. 16 AO: max. 8	DIO: max. 32*11 AI: max. 16*11 AO: max. 8*11
FOE online update	V	V	-	V
Explicit Device ID	V	V	-	V
Connector	-	Detachable	Detachable	Detachable
LED Indicator	V	V	V	V
Lockable RJ45	user-designed	V	-	-
Dimensions (WxLxH)	20 x 98 x 84 mm	83 x 112 x 65 mm	33 x 127 x 108 mm 31 x 157 x 126 mm	

Efficient Distributed Modules

- Independent modular design
- Compact
- Can be installed in the chassis
- Metal casing provides high anti-noise ability
- Fastest control cycle can reach 100 us

Customized modules

- Specific casing can be customized
- Specific I/O channel numbers can be customized
- Specific functions can be customized
- EtherCAT I/O slave planning consultation

- **Comprehensive modular I/O for all signal types and fieldbus systems**
- **Offer universal product lines to optimize EtherCAT applications**
- **As a professional provider in I/O, ICP DAS develops a variety of terminal modules**

EtherCAT I/O Slaves

ICP DAS offers a variety of I/O slave modules that can be freely combined to integrate with EtherCAT motion control system based on requirements. ICP DAS develops digital modules that features isolation protection and are available with 8, 16, or 32 channels, while analog modules have 1, 3, 4, 8, or 16 channels.

■ Modular Design
Reduce the size of the system
W x H x D (mm) : 33×127×108

■ The Most Cost-Effective and Efficient Wiring
Each station of Industrial-grage Ethernet cable (CAT5e Shielded protection) can be connected up to 100 meters apart, provieing nearly limitness scalability. Up to 65535 I/O modules can be connected in series.

■ Ultra-high Speed I/O
Cycle time up to 100 us.

■ LED indicator
With the help of indicator lights, the I/O status can be verified and corrected.

4-2 EtherCAT I/O Features

ICP DAS provides ECAT-2000 series I/O modules, and continues to design more advanced, fast and convenient EC series I/O modules for users to choose.

Faster and faster

In order to meet the faster application requirements of ICP DAS users, the EC series supports a faster 100 µs Cycle time.

Screw-lockable RJ45 connector

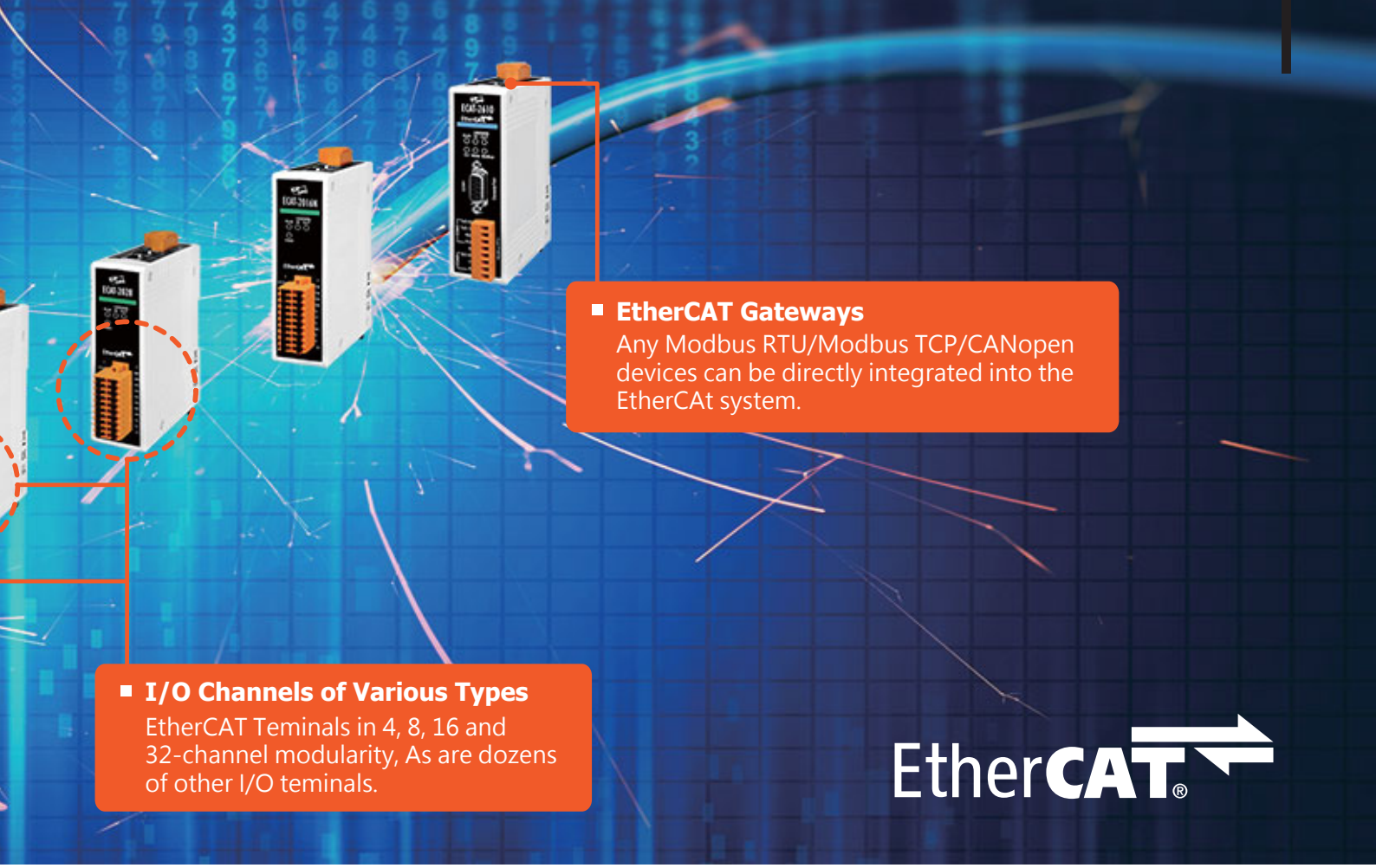
There are screw holes (20 mm spacing) on both sides of the RJ45 connector. In addition to the general network cable, the network cable with screw locking can also be used to reduce the risk of the network cable falling off due to vibration.

Easy and fast firmware update

EC series modules all provide FOE online firmware update function. When your module encounters a situation that requires immediate firmware update to solve the problem, you can solve the problem immediately with just one click.

Explicit Device ID

Explicit Device ID is one of the ways to identify the module, and a unique ID number can be set through the external rotary switch of the module. This feature can be used to connect and disconnect products in certain applications and to prevent incorrect cable installation during EtherCAT wiring work.



EtherCAT Gateways
Any Modbus RTU/Modbus TCP/CANopen devices can be directly integrated into the EtherCAt system.

I/O Channels of Various Types
EtherCAT Teminals in 4, 8, 16 and 32-channel modularity, As are dozens of other I/O teminals.

EtherCAT®

Support ICP DAS and third-party masters

Provides ESI files in XML format that is compatible with a variety of EtherCAT masters.

Output Disconnect Retention

If the module is disconnected due to unknown reasons or switched to other operation modes, the previous settings of the working mode can still be retained.

Power-On Value

Users can customize the initial values of DO and AO according to the working characteristics of the device when the module is powered on, so as to ensure the normal operation of the device and improve the safety.

Programmable Digital Filter

Programmable digital filters can filter out noise, interference and spikes from digital input port as well as jitter signals generated from switches or relays. In industrial environments with high levels of noise interference, they can prevent erroneous readings caused by noise.

Isolated Protection

Each channel provides isolation protection. When the user accidentally connects the wrong wire or applies high voltage to the terminal, the core of the module will not be damaged. This feature significantly reduces maintenance costs.

Automatic Memory of Settings

The module will automatically remember the user's settings and will not lose the settings due to power-on or power-off. It saves a lot of time and cost for reconfiguration.

4-3 EtherCAT Plug-in Modules EC1 Series

Novel I/O solution using PCB Bus Terminals

Plug-in I/O modules can be connected directly to custom PCBs, combining the advantages of standard and customized I/O modules.

The EC1 series EtherCAT plug-in module enables more efficient medium to large-scale production. The EC1 series EtherCAT plug-in modules are electronically based on the well-known EtherCAT I/O system and their design allows them to be directly plugged into a circuit board. The circuit board is a specific signal distribution board that distributes signals and power supply to individual plug connectors in order to connect the controller to other machine modules. Elaborate manual wiring of single wires, common in conventional control cabinet construction, is replaced by simply plugging in prefabricated cable harnesses. The labor cost in wiring deployment and installation can be reduced and the risk of incorrect wiring can be minimized to the least by using coded components. In addition, the EC1 series EtherCAT plug-in module adopts a full-metal housing design, which is more resistant to noise in complex and harsh environments. The EC1 series, combined with the signal distribution board and pre-assembled cables, can truly implements the concept of plug-and-play.

EC1-P32

EtherCAT Plug-In I/O Module with Isolated 32-ch DI

- ICP DAS plug-in terminal
- 32-channel digital input
- I/O status LED indicator
- Cycle time up to 100 µs

EC1-C32

EtherCAT Plug-In I/O Module with Isolated 32-ch DO

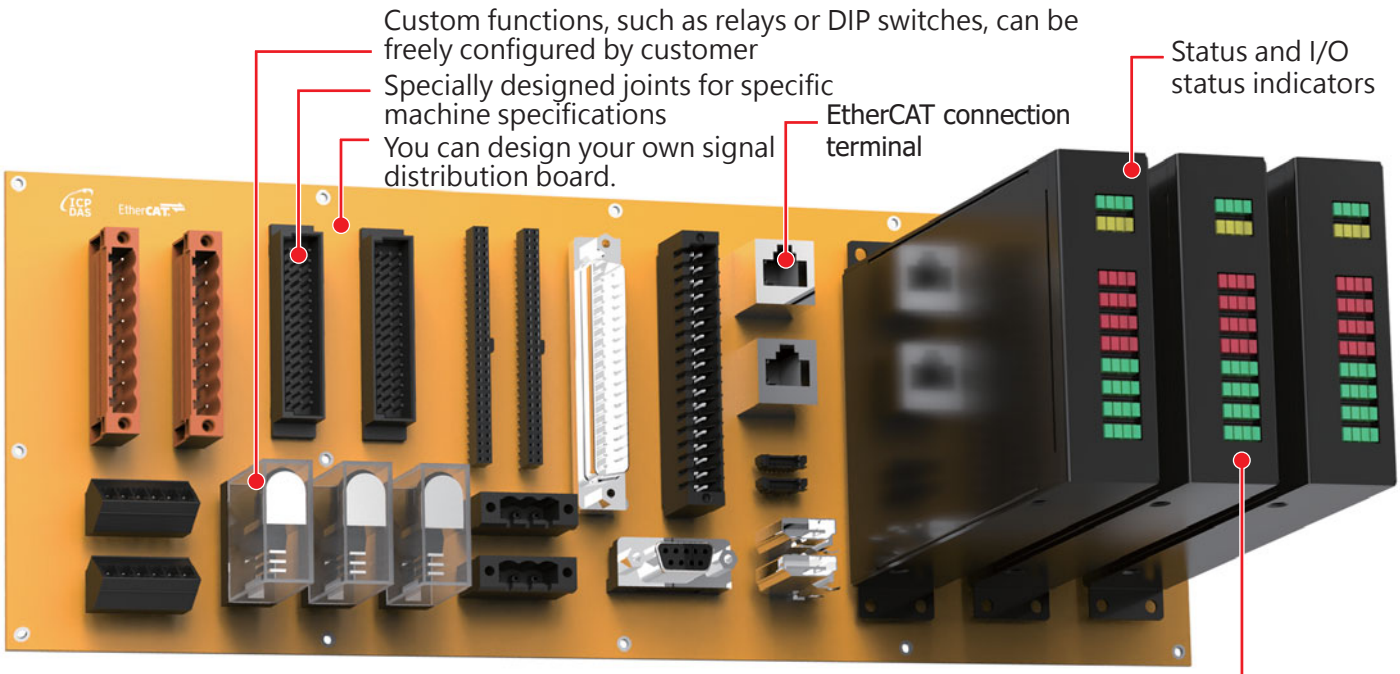
- ICP DAS plug-in terminal
- 32-channel digital output (Sink Type)
- I/O status LED indicator
- Cycle time up to 100 µs

EC1-P16C16

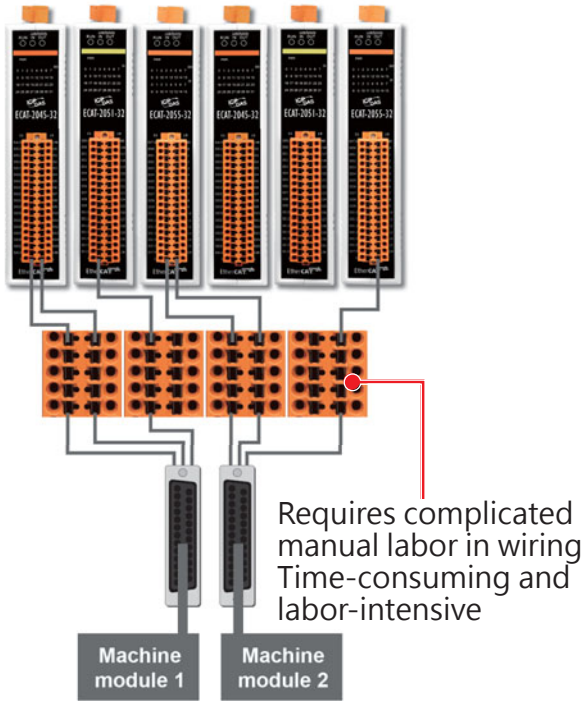
EtherCAT Plug-In I/O Module with Isolated 16-ch DI and Isolated 16-ch DO

- ICP DAS plug-in terminal
- 32-channel digital output (Sink type)
- 16-channel digital input
- I/O status LED indicator
- Cycle time up to 100 µs

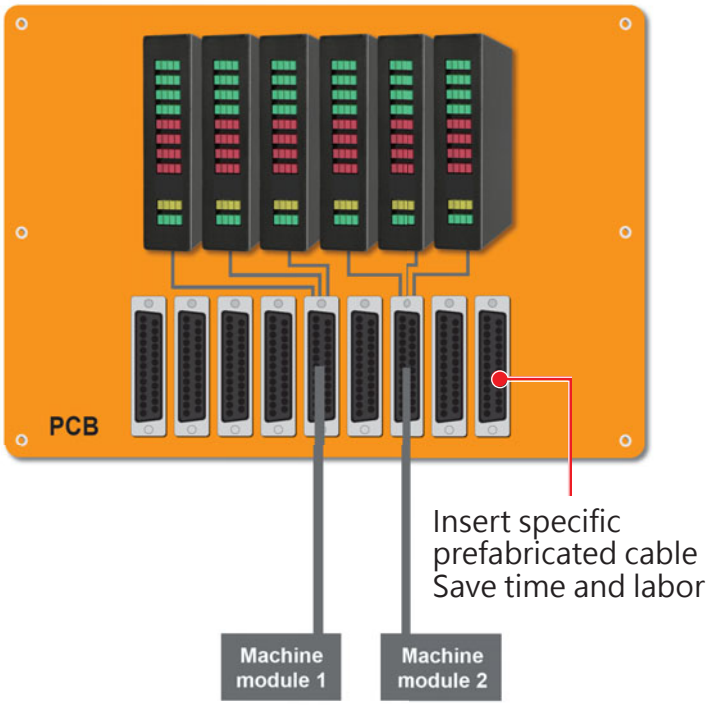
EC1 series modules are installed on user-designed signal distribution boards.



Comparison of Different Wiring Method



▲ Traditional EtherCAT Slave Module



▲ Plug-in EtherCAT Slave Module

The Benefits

- Reduce equipment costs
- Reduce installation time
- Save the cabinet space
- Enhance troubleshooting efficiency

4-4 ECAT-2000/EC1/EC2 Series Selection Guide

ECAT-2000 Series I/O Modules

ECAT-2012H

ECAT-2028

ECAT-2045


ECAT-2055-32

Features

ECAT-2000 Series with the structure of distributed modules allow users to expand in every application field.

Advantage

Provide more than 30 types of digital or analog I/O, splitter, and gateway for users to select.

Analog Input Modules

Model	Channels	Resolution	Input Range	Sensor	Accuracy	Sampling Rate
ECAT-2011H	8 Diff/ 16 S.E	12-bit	0 ~ 10 V, ±10 V, ±5 V, ±2.5 V, 0 ~ 20 mA, ±20 mA, 4 ~ 20 mA or ±4 ~ 20 mA (Software selectable)	-	0.2% LSB	1k Hz (per channel)
ECAT-2012H		16-bit			0.05% LSB	1k Hz (Max. for 6 channel enable)
ECAT-2016N	1 (Strain Gauge)		±1.25 V, ±600 mV, ±300 mV, ±125 mV, ±80 mV, ±60 mV, ±40 mV, ±30 mV, ±20 mV, ±15 mV, ±10 mV	Full-Bridge	±0.1% FSR	1k Hz (per channel)
ECAT-2016-3	3 (Strain Gauge)		±10 V, ±5 V, ±2.5 V, ±1.25 V, ±625 mV, ±312 mV, ±200 mV, ±100 mV, ±50 mV, ±25 mV			
ECAT-2019H	8		J, K, T, E, R, S, B, N, C, L, M, LDIN43710, ±20 mA, 0 ~ +20 mA, +4 ~ +20 mA, ±15 mV, ±50 mV, ±150 mV, ±500 mV, ±1 V, ±2.5 V, ±5 V, ±10 V	-		10 Hz (per channel)

Analog Output Modules

Model	Channels	Resolution	Input Range	Accuracy	Output Capacity
ECAT-2024	4	12-bit	±10 V, ±5 V, 0 ~ 10 V, 0 ~ 5 V	± 2 LSB	10 V @ 5mA
ECAT-2028	8				

Digital I/O Modules

Model	Digital Input Channel		Digital Output Channel		
	Channels	Mode	Channels	Mode	Max.Load
ECAT-2057	-	-	16	Source (PNP)	100 mA
ECAT-2057P	-	-	16	Source (PNP)	500 mA
ECAT-2057-32	-	-	32	Source (PNP)	100 mA
ECAT-2057-NPN	-	-	16	Sink (NPN)	100 mA
ECAT-2057-8P8N	-	-	8	Sink (NPN)	100 mA
			8	Source (PNP)	100 mA
ECAT-2045	-	-	16	Sink (NPN)	700 mA
ECAT-2045-32	-	-	32		600 mA

Model	Digital Input Channel		Digital Output Channel		
	Channels	Mode	Channels	Mode	Max.Load
ECAT-2051	16	Dry (Source) Wet (Sink/Source) ON:+3.5V ~ 50 V OFF:+2V Max.	-	-	-
ECAT-2051-32	32		-	-	-
ECAT-2050	13		4	Sink (NPN) ; Source (PNP) (Jumper Selectable)	100 mA
ECAT-2052	8	Wet (Sink/Source) ON:+3.5V ~ 50 V OFF:+2V Max.	8	Source (PNP)	100 mA
ECAT-2052-NPN				Sink (NPN)	
ECAT-2053	16		-	-	-
ECAT-2055	8	Dry (Source) Wet (Sink/Source) ON:+3.5V ~ 50 V OFF:+2V Max.	8	Sink (NPN)	700 mA
ECAT-2055-32	16		16		
ECAT-2060	6		6	Relay, Form A (SPST-NO)	5 A
ECAT-2061	-	-	16		

EC1 Series I/O Modules

Features

The circuit board can be designed by users themselves. The space can be effectively and flexibly used and the terminal head can be integrated through the plug-in module of ICP DAS.

Advantage

Decrease cost and space of devices, massively reduce time of installation and wiring and increase the effectiveness of the troubleshooting.

Model	Digital Input Channel		Digital Output Channel	
	Channels	Mode	Channels	Mode
EC1-P16C16	16	Dry (Source), Wet (Sink/Source) ON:+3.5V ~ 50 V, OFF:+2V Max.	16	Sink (NPN)
EC1-P32	32		-	-
EC1-C32	-	-	32	Sink (NPN)

EC2 Series I/O Modules

Features

It’ s convenient to expand with the distributed structure. Based on ECAT-2000 Series, the full metal covering design level up the efficiency and shrink the size.

Advantage

10 times efficiency than ECAT-2000 and with higher anti-noise ability. Provide an abundant of setting function such as Power on Value and DO disconnect retain to fullfill diversity applications of users.

Model	Digital Input Channel		Digital Output Channel	
	Channels	Mode	Channels	Mode
EC2-P16C16	16	Dry (Source), Wet (Sink/Source) ON:+3.5V ~ 50 V, OFF:+2V Max.	16	Sink (NPN)
EC2-P32	32		-	-
EC2-C32	-	-	32	Sink (NPN)

Model	Analog Input Channel	Analog Output Channel	Digital Input Channel
	Channels		
EC2-AI8AO4	8	4	12

4-5 EP-800 Series Expansion Unit

This flexible EtherCAT slave solution is the ideal choice for applications that emphasize scalability, robustness and flexibility, and cover multi-channel measurement and multi-axis motion control applications. The rugged hardware makes it ideal for multi-axis, high-channel-count and distributed applications in the field.

ICP DAS EC8_

EP-800 series expansion unit:

Model	Description
EP-801	1-slot EtherCAT I/O Expansion Unit
EP-802	2-slot EtherCAT I/O Expansion Unit
EP-803	3-slot EtherCAT I/O Expansion Unit
EP-805	5-slot EtherCAT I/O Expansion Unit
EP-809	9-slot EtherCAT I/O Expansion Unit
EP-811	11-slot EtherCAT I/O Expansion Unit

EC8 series model:

Model	Description
EC8-P32	32-ch Digital Input Module
EC8-C32	32-ch Digital Output Module
EC8-P16C16	16-ch DO and 16-ch DI Module
EC8-AD16	16-ch Analog Input Module
EC8-DA8/DA16	8/16-ch Analog Output Module
EC8-STEP2	2-axis Stepper Motor Controller
EC8-ENC2	2-axis Encoder Input Module (Incremental Type)
EC8-TC8/TC16	8/16-ch Thermocouple Measurement Module
EC8-RTD8/RTD12	8/12-ch Resistance Thermometer Module
EC8-LC1/LC3	1/3-ch Force Sensing Module
EC8-MRTU	Modbus RTU Gateway Module
EC8-MTCP	Modbus TCP Gateway Module
EC8-CAN	Canopen Gateway Module
EC8-J10	Expansion Module

System Expansion Capability

The EP-800 Series expansion unit combined with EC8 modules can be integrated into a EtherCAT Slave station to achieve virtually limitless expansion effectiveness.

Compact and Durable Design

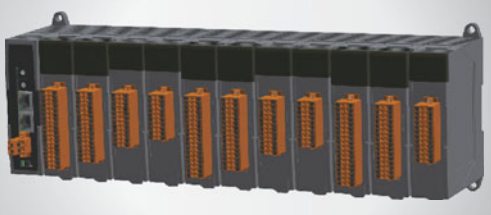
Durable EC8 slave station I/O series would stand operation temperature from -25°C to +75°C and can be used in extreme environment.

Compact Expansion Module

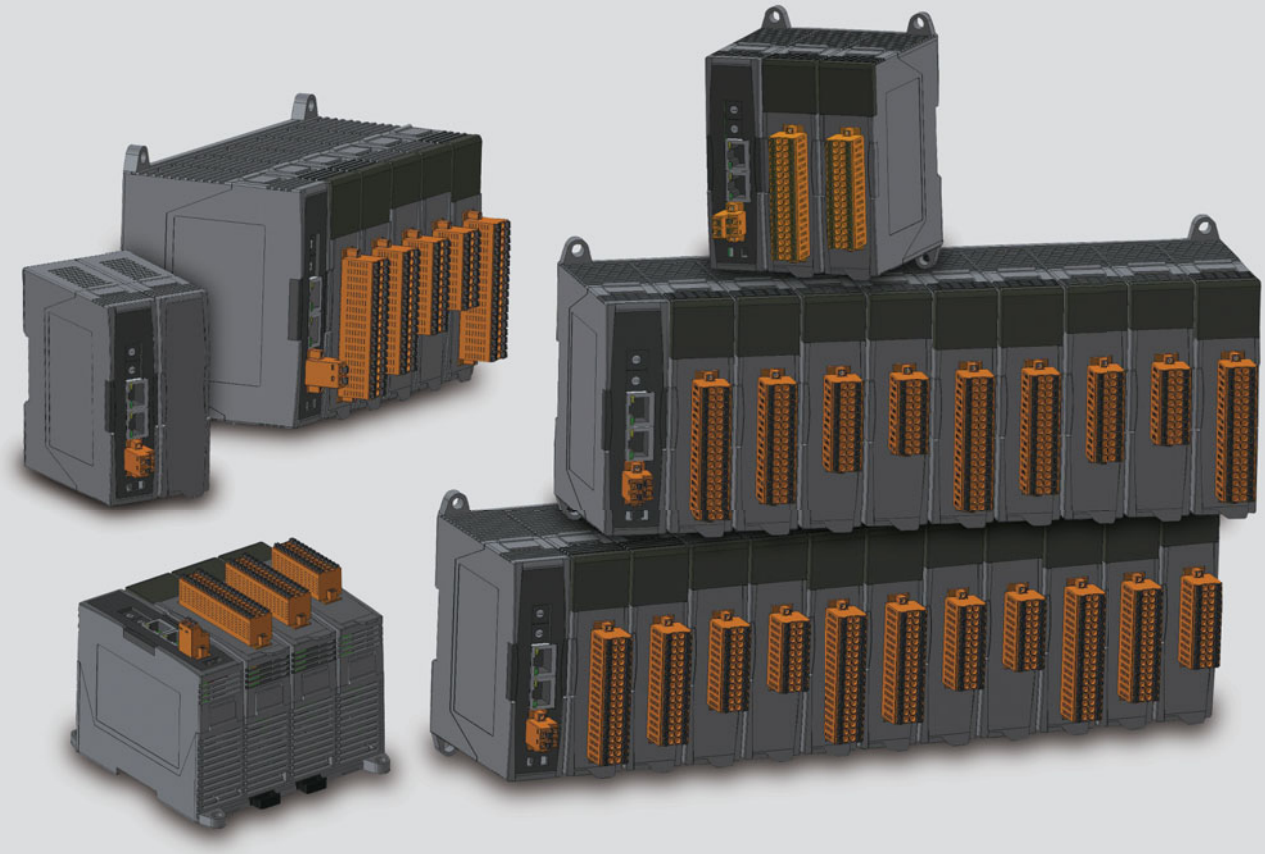
We have nearly 10 different bus terminal modules, with a compact chassis with 1/2/3/5/9/11 expandable slots. Simply mix and match these modules to create an accurate and repeatable system for any measurement need.

EP-805

EP-809



EP-811



▲ EP-800 Series expansion units provide numbers of variety slots for users to select the most suitable one depending on the space.

High-efficiency Distributed Module

- Provide FOE online firmware update function
- Provide Explicit Device ID
- Cycle time up to 100 μs

Customized Modules

- Special I/O channel numbers can be customized
- Special functions can be customized
- Consult for planning EtherCAT I/O slave stations

- **Comprehensive modular I/O for all signal types and fieldbus systems**
- **Optimized Universal product series for EtherCAT**
- **ICP DAS is an I/O expert, developing various terminal modules**

Create Your Own I/O Modules

Maximize your I/O system and application in a limited space

Examples of suitable applications

Support IoT

Connect the sensors easily through Modbus/ Canopen

Recommend Modules:

EC8-MRTU
EC8-MTCP
EC8-CAN
EC8-IOLINK

Servo Stamping

High-speed, high-precision press-fits using load cells

Recommend Modules:

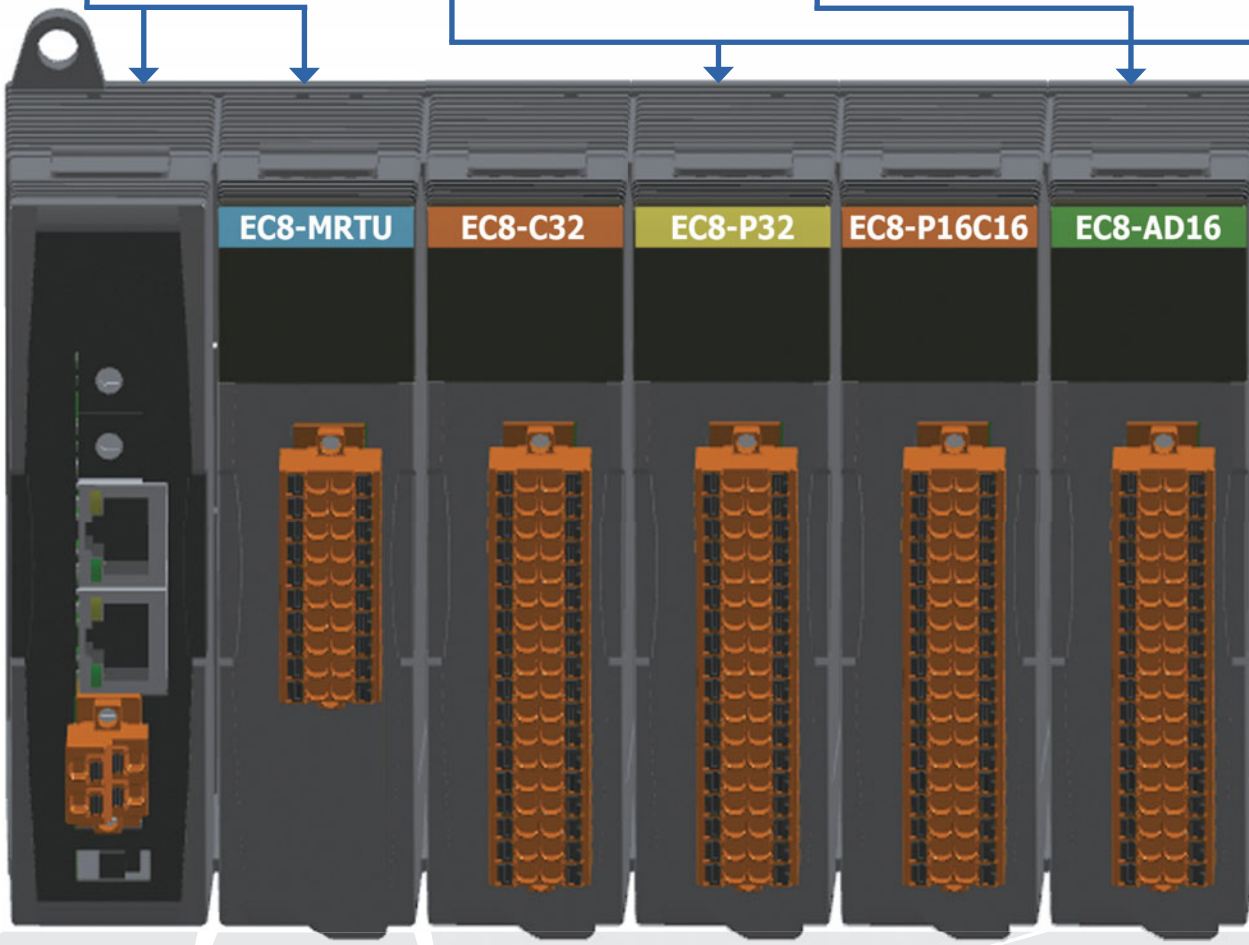
EC8-LC1
EC8-LC3
EC8-P16C6

Signal measurement application

Quickly measure and check voltage and current through analog

Recommend Modules:

EC8-AD16



Communication Coupler

- EtherCAT
- ID Switch for 256

Communication Gateway

- Modbus RTU
- Modbus TCP
- Canopen
- IO-Link

Digital I/O

- 32-ch Digital Input Unit
- 32-ch Digital Output Unit
- 32-ch Mixed I/O Unit
- 16-ch Relay Output Unit
- Ultra Speed Module

Analog I/O

- 8/16-ch Analog Input Unit
- 8/16-ch Analog Output Unit
- General or High Performance Module
- Single-ended or Differential Input Module
- Voltage or Current Output Module

Weight Measurement Application

High-precision weighing with load cell sensors

Recommend Modules:

EC8-LC1
EC8-LC3

Temperature Measurement Application

Measure various types of temperature using temperature sensors

Recommend Modules:

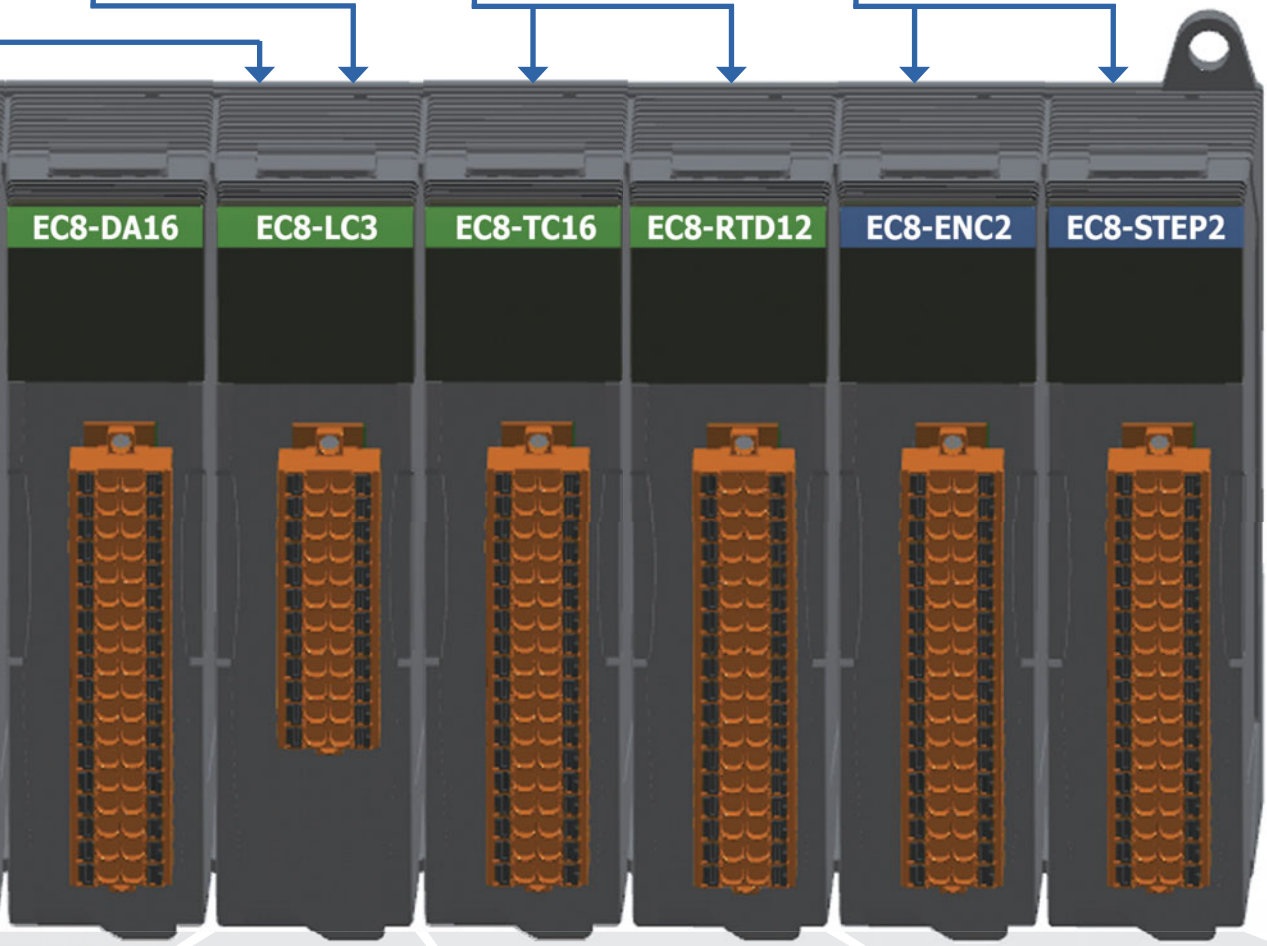
EC8-RTD8
EC8-RTD12
EC8-TC8 / EC8-TC16

Motion Control Application

Build aposition control systems using stepper/pulse input motors

Recommend Modules:

EC8-STEP2
EC8-ENC2



Strain Measurement

- 1 or 3 channels Strain Unit
- Ultra-high-speed conversion cycle time of 1ms

Temperature Measurement

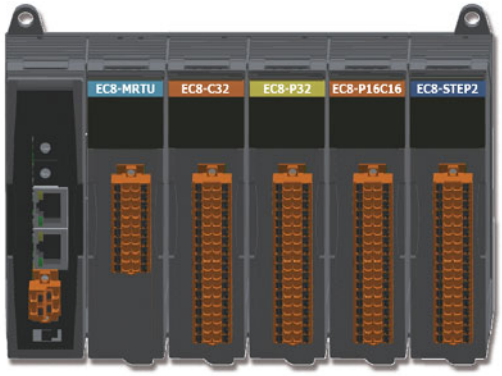
- 8/16-ch Thermocouple measurement unit
- 8/12-ch Resistance temperature measurement unit
- Conversion time 10 ms, 25 ms or 50 ms

Configuration Interface

- 2-axis encoder input unit
- 2-axis stepper drive unit
- 2-axis pulse output unit
- Support incremental or absolute encoder input

4-6 EP-800 and EC8 Series Selection Guide

EP-800 Expansion Unit and EC8 I/O Modules



Features

Users can create the most suitable application in a limited space through a dedicated centralized expansion unit.

Advantage

Users can freely choose from more than 10 modules such as I/O, temperature measurement, strain, motion control, etc., that is suitable for use in various automation fields.

EP-800 Expansion Unit Box

Model	Slot	Explicit Device ID	Interface	Port
EP-801	1	Max. 256	RJ-45	2
EP-802	2			
EP-803	3			
EP-805	5			
EP-809	9			
EP-809	11			

DC Digital I/O Modules

Model	Digital Input		Digital Output		
	Channel	Mode	Channel	Mode	Max. Load
EC8-C32	-	-	32	Open Collector (Sink)	500 mA per channel
EC8-P32	32	Dry (Source), Wet (Sink/Source)	-	-	-
EC8-P16C16	16		16	Open Collector (Sink)	700 mA per channel

Analog Output Module

Model	Channel	Resolution	Output Range	Accuracy	Voltage Output Capability
EC8-DA8	8	12-bit	±10 V, ±5 V, 0 ~10 V, 0 ~ 5 V	± 2 LSB	10 V @ 5mA
EC8-DA16	16				

Analog Input Module

Model	Channel	Resolution	Sampling Rate	Input Range	Sensors
EC8-AD16	8 Diff/ 16 S.E	12-bit	1 kHz (per channel)	0 ~ 10 V, ±2.5 V, ±5 V, ±10 V	-
EC8-LC1	1 (Strain Gauge)	16-bit		±1.25 V, ±600 mV, ±300 mV, ±125 mV, ±80 mV, ±60 mV, ±40 mV, ±30 mV, ±20 mV, ±15 mV, ±10 mV	Full-Bridge
EC8-LC3	3 (Strain Gauge)			±10 V, ±5 V, ±2.5 V, ±1.25 V, ±625 mV, ±312 mV, ±200 mV, ±100 mV, ±50 mV, ±25 mV	

Temperature Measurement

Model	Channel	Resolution	Sampling Rate	Input Range	Sensors
EC8-TC8	8	16-bit	100 Hz (per channel)	(Additional 125 Ω Resistor Required) Thermocouple (J, K, T, E, R, S, B, N, C, L, M, 與 LDIN43710	-
EC8-TC16	16				
EC8-RTD8	8			Pt100, Pt1000, Ni120	
EC8-RTD12	12				

Gateway

Model	Description
EC8-MRTU	EtherCAT Slave to Modbus RTU Master Gateway
EC8-MTCP	EtherCAT Slave to Modbus TCP Master Gateway
EC8-CAN	EtherCAT Slave to Canopen Master Gateway

Stepper Motor Controller/Driver

Model	EtherCAT			Motor Output		
	Cycle Time	DC Mode	Support CiA402	Axis	Output Current	Microsteps per step
EC8-STEP2	0.5 ms	v	v	2x stepper motor (2 phases)	Peak 3.3A	256 128 64 32 16 8 4 2

Encoder/Counter

Model	Type	Channel	Resolution	Frequency	Counter Mode
EC8-ENC2	Incremental	■ 2 × Encoder/Counter Input ■ 2 × SSS Latch Input	32-bit	4 MHz	CW/CCW , Pulse/Direction, A/B Phase

4-7 ICP DAS EtherCAT I/O List

A wide variety of slave modules allow the user to deal with all situations.

Digital I/O Modules

Input Modules
►P50,56

ECAT-2051-32
36-pin push-in terminal block

32-Channel Optical Isolation Input Module

ECAT-2051
20-pin push-in terminal block

16-Channel Optical Isolation Input Module

ECAT-2053
20-pin push-in terminal block

16-ch Optically Isolated Input Module

EC1-P32

32-ch Optically Isolated Input Module

EC2-P32

32-ch Optically Isolated Input Module

EC8-P32
For EP-800 series

32-ch Optically Isolated Input Module

Output Modules
►P50

ECAT-2045-32
36-pin push-in terminal block

32-ch Transistor (SINK) Output Module

ECAT-2045
20-pin push-in terminal block

16-ch Transistor (SINK) Output Module

ECAT-2057
20-pin push-in terminal block

16-ch Transistor (SOURCE) Output Module

ECAT-2057-NPN
20-pin push-in terminal block

16-ch Transistor (SINK) Output Module

ECAT-2057-8P8N
20-pin push-in terminal block

16-ch Transistor (MIXED) Output Module

ECAT-2057P
20-pin push-in terminal block

16-ch Transistor (SOURCE) Output Module

ECAT-2057-32
36-pin push-in terminal block

32-ch Transistor (SOURCE) Output Module

ECAT-2061
20-pin push-in terminal block

16-Channel Relay Output Module

►P50,56

EC1-C32

32-ch Transistor (SINK) Output Module

EC2-C32

32-ch Transistor (SINK) Output Module

EC8-C32

For EP-800 series

32-ch Transistor (SINK) Output Module

Input/output mixing Module

►P50,56

ECAT-2050

20-pin push-in terminal block

13-ch Optically Isolated Input + 4-ch Transistor (Selectable) Output Module

ECAT-2055-32

36-pin push-in terminal block

16-ch Optically Isolated Input + 16-ch Transistor (SINK) Output Module

ECAT-2052

20-pin push-in terminal block

8-ch Optically Isolated Input + 8-ch Transistor (SOURCE) Output Module

ECAT-2052-NPN

20-pin push-in terminal block

8-ch Optically Isolated Input + 8-ch Transistor (SINK) Output Module

ECAT-2055

20-pin push-in terminal block

8-ch Optically Isolated Input + 8-ch Transistor (SINK) Output Module

ECAT-2060

20-pin push-in terminal block

6-ch Optically Isolated Input + 6-ch Relay Output Module

EC1-P16C16

16-ch Isolated Input + 16-ch Transistor (SINK) Output Module

EC2-P16C16

16-ch Isolated Input + 16-ch Transistor (SINK) Output Module

EC8-P16C16

For EP-800 series

16-ch Isolated Input + 16-ch Transistor (SINK) Output Module

Analog Output Modules

►P50,56

ECAT-2024
20-pin push-in terminal block

4-ch Voltage Output Module

ECAT-2028
20-pin push-in terminal block

8-ch Voltage Output Module

EC8-DA8
For EP-800 series

8-ch Voltage Output Module

EC8-DA16
For EP-800 series

16-ch Voltage Output Module

Analog/Strain/ Temperature Mesurement Modules

►P50

ECAT-2011H
20-pin push-in terminal block

16-ch, 12-bit Analog Input Module

ECAT-2012H
20-pin push-in terminal block

16-ch, 12-bit Analog Input Module

ECAT-2016N
20-pin push-in terminal block

1-ch, 16-bit Strain Gauge Input Module

ECAT-2016-3
20-pin push-in terminal block

1-ch, 16-bit Strain Gauge Input Module

Temperature measurement Modules

►P56

EC8-TC8
For EP-800 series

8-ch, 16-bit Thermocouple Measurement Module

EC8-TC16
For EP-800 series

16-ch, 16-bit Thermocouple Measurement Module

EC8-RTD8
For EP-800 series

8-ch, 16-bit RTD Input Module

EC8-RTD12
For EP-800 series

12-ch, 16-bit RTD Input Module

Gateway Modules

►P62

ECAT-2610

EtherCAT Slave to Modbus RTU Master Gateway

ECAT-2611

EtherCAT Slave to Modbus RTU Slave Gateway

ECAT-2612

EtherCAT Slave to Modbus TCP Master Gateway

ECAT-2613

EtherCAT Slave to Modbus TCP Master Gateway

ECAT-2614C

EtherCAT Slave to Canopen Master Gateway

ECAT-2615C

EtherCAT Slave to Canopen Master Gateway

EC8-MRTU

For EP-800 series

EtherCAT Slave to Modbus RTU Master Gateway

EC8-MTCP

For EP-800 series

EtherCAT Slave to Modbus TCP Master Gateway

EC8-CAN

For EP-800 series

EtherCAT Slave to Canopen Master Gateway

EC8-IOLINK

For EP-800 series

EtherCAT Slave to IO-Link Master Gateway

Node / Converter Module

►P64

ECAT-2513

4-Port Diverter

ECAT-2515

6-Port Diverter

ECAT-2517

8-Port Diverter

EC8-J10

For EP-800 series

1 Port EtherCAT Expansion Module

ECAT-2511-A

EtherCAT Single Mode Fiber Converter

ECAT-2511-B

EtherCAT Single Mode Fiber Converter

CH5
Gateway

5-1 EtherCAT Gateway Modules

EtherCAT gateways enable seamless communication between industrial devices that use different communication protocols. The EtherCAT gateway is designed specifically for the integration and extension of other reliable fieldbus protocols, as well as seamless integration with existing network equipment. It offers a solution for effectively converting data of the devices that use various protocols.

Upgrading or retro-fit existing devices

Avoid unnecessary investment by prolonging the life of a wellperforming serial/Ethernet/CAN-based device. By using the ICP DAS EtherCAT gateway, you can connect it to any fieldbus or Industrial Ethernet network.

Highly cost-effective connection solution

With just one ICP DAS EtherCAT gateway, you can connect to many nodes/devices in a multi-drop scenario. This allows inexpensive fieldbus/Ethernet connection to your devices.

Multiple command modes available

Provides various command modes according to different conditions, such as power on value, status change trigger, constant output, byte-swap, word-swap, and emergency stop command.

No hardware or software changes

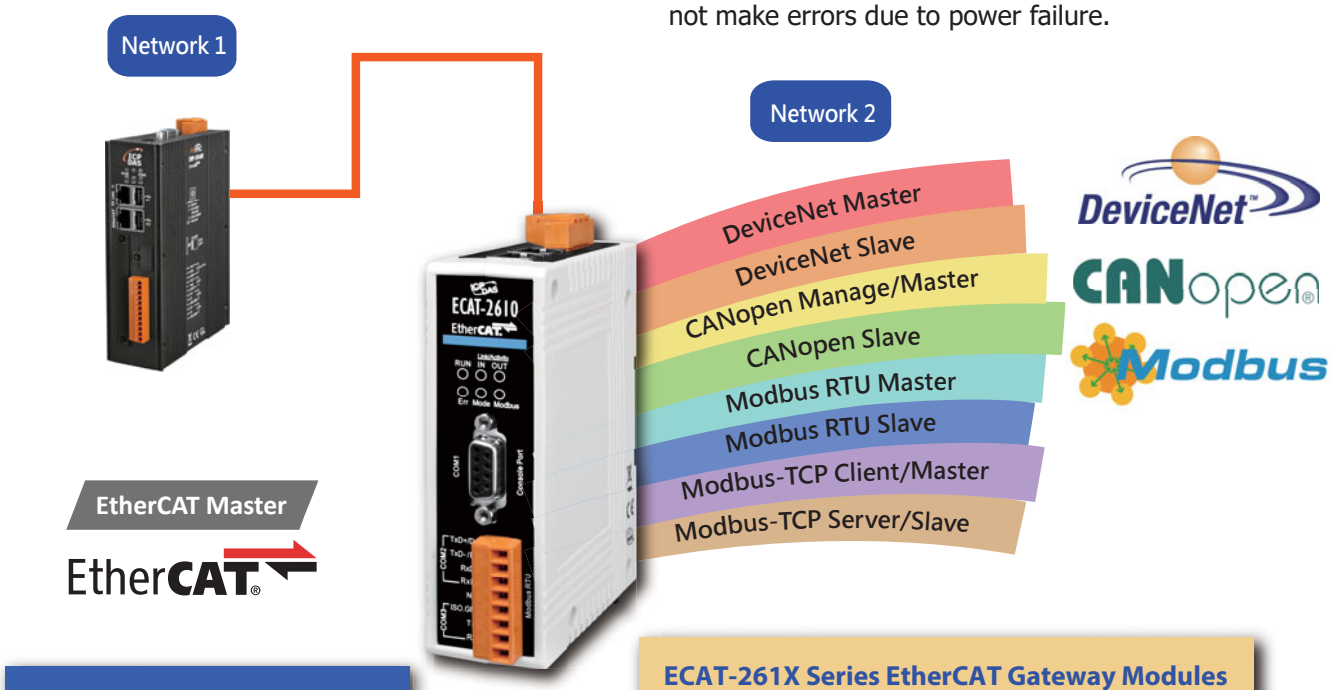
By using ICP DAS EtherCAT gateway to connect to your devices, no software or hardware modifications to the devices is required. All data/protocol conversion can be achieved and can be mapped to other networks within the gateway.

Easily convert your devices to another protocol

The flexibility of the ICP DAS EtherCAT Gateway allows you to convert freely among protocols such as: Modbus RTU, Modbus TCP and CAN-based. The Communicator requires no PLC function blocks or any programming. Just connect, configure and you're done.

Switch to disconnec mode

Command hold or stop can be selected when EtherCAT communication changes. Ensure that the system does not make errors due to power failure.



- No need to change equipment settings
- Up to 256 In/Out WORDs
- Configuration using a XML format file
- Provides quick configuration tools

Applications

- Energy Industry
- Building automation
- Industrial Automation
- Automotive Communication
- Transportation
- photovoltaic

ECAT-261X Series EtherCAT Gateway Modules

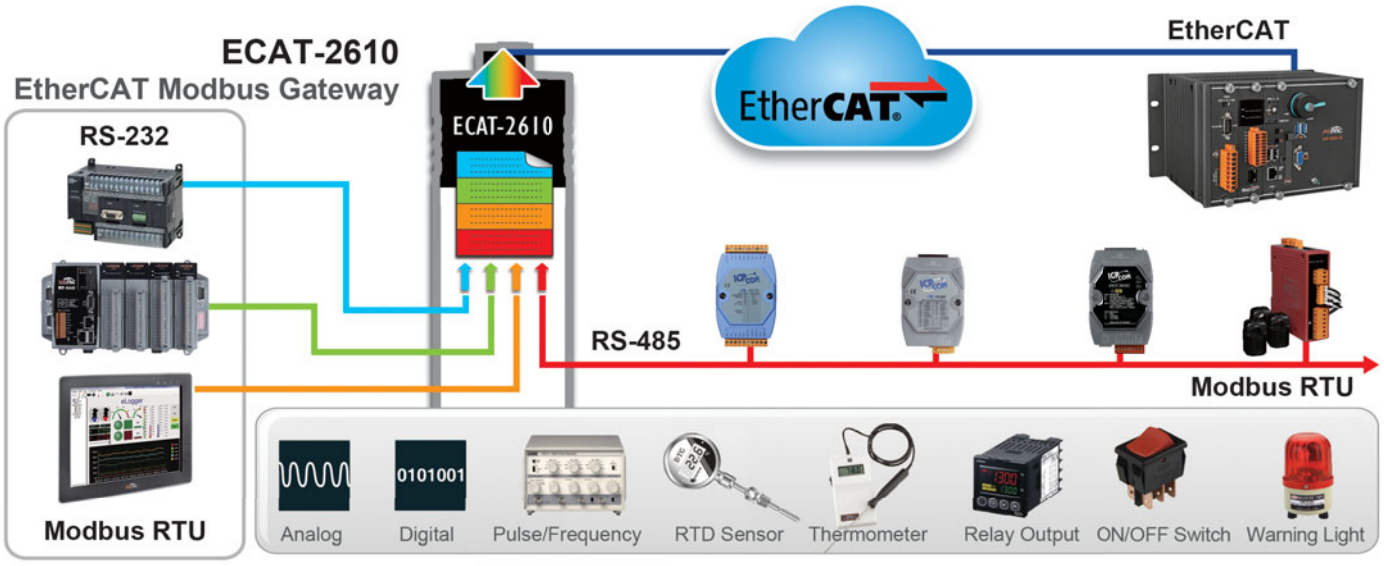
Connect to any EtherCAT Industrial Ethernet - Fieldbus or Industrial Networks

The ECAT-261X series of EtherCAT gateways help you to simply connect industrial networks and PLC systems to achieve stabilized information flow throughout the factory. You can quickly transfer I/O data between two similar or dissimilar networks,
avoiding the complex calculations by the PLC.
ECAT-261X series has been tested and certified by all major PLC manufacturers, such
as Siemens, AB, Schneider Electric, Mitsubishi, ABB, Omron, Hitachi, Pepperl+Fuchs, and so on.

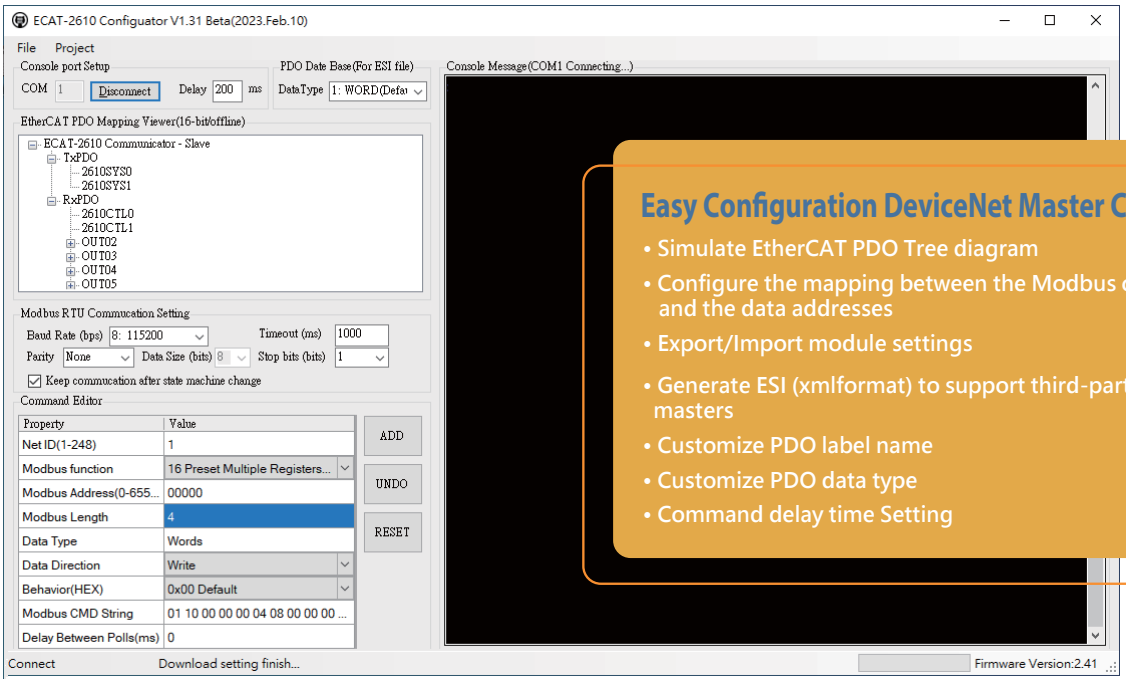
5-2 Connecting Modbus RTU to EtherCAT

ECAT-2610(M)

- Supports Modbus RTU
- RS-232/422/485 interface
- 115200 bps. maximum baudrate
- No need to change equipment Settings
- Up to 256 In/Out WORDs
- Configuration using a XML format file
- Provides quick configuration tools



▲Anything can be connected to the EtherCAT master via ECAT-2610 as long as it is a Modbus RTU device



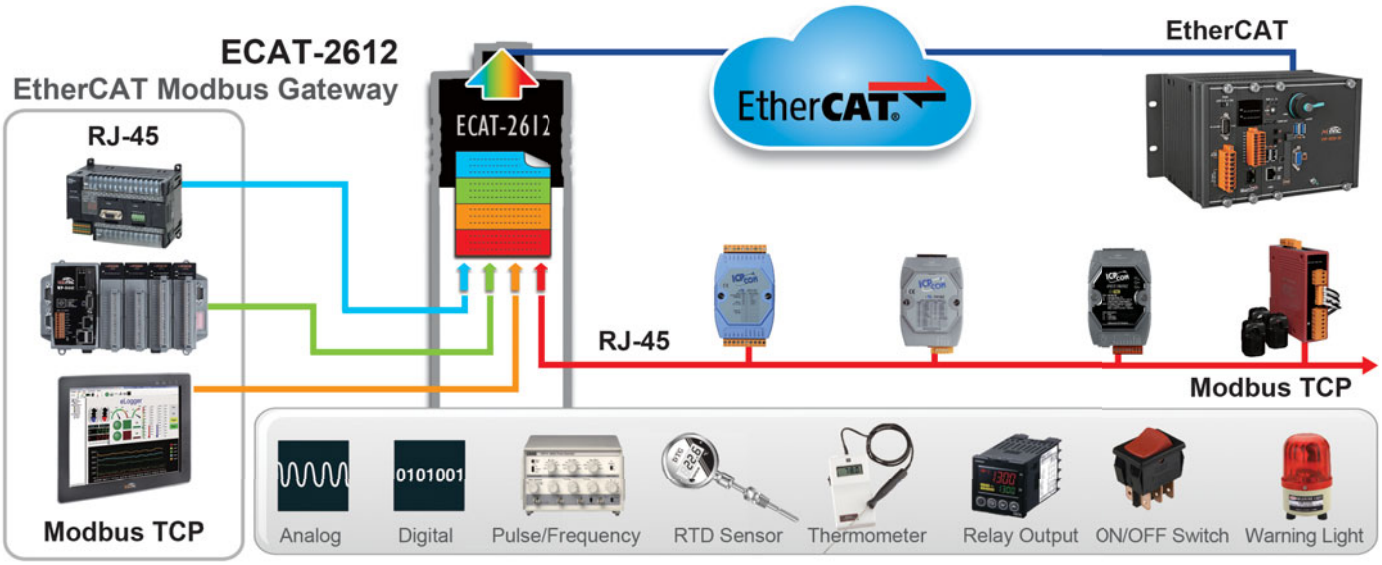
Easy Configuration DeviceNet Master Command

- Simulate EtherCAT PDO Tree diagram
- Configure the mapping between the Modbus commands and the data addresses
- Export/Import module settings
- Generate ESI (xmlformat) to support third-party EtherCAT masters
- Customize PDO label name
- Customize PDO data type
- Command delay time Setting

5-3 Connecting Modbus TCP to EtherCAT

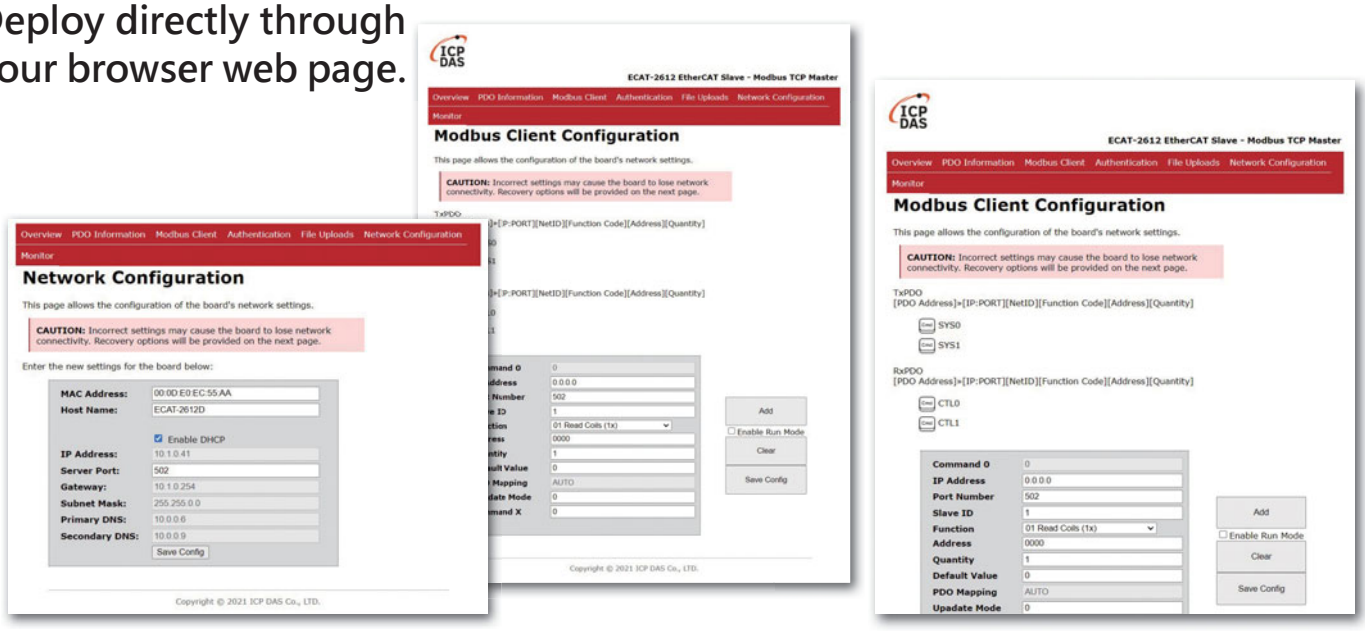
ECAT-2612 Available Soon

- Supports Modbus TCP
- Ethernet interface
- Up to 72 connections
- No need to change equipment Settings
- Up to 256 In/Out WORDs
- Configuration using a XML format file
- Provides quick configuration tools



▲Anything can be connected to the EtherCAT master via ECAT-2612 as long as it is a Modbus TCP device

Deploy directly through your browser web page.

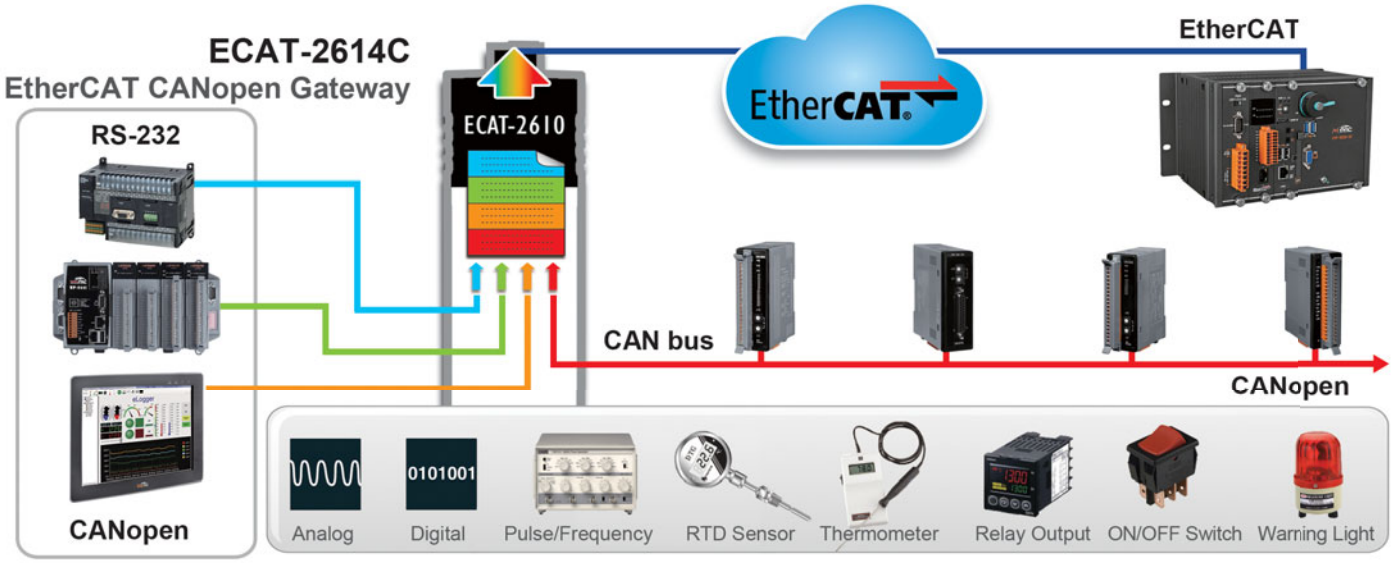


5-4 Connecting CANopen to EtherCAT

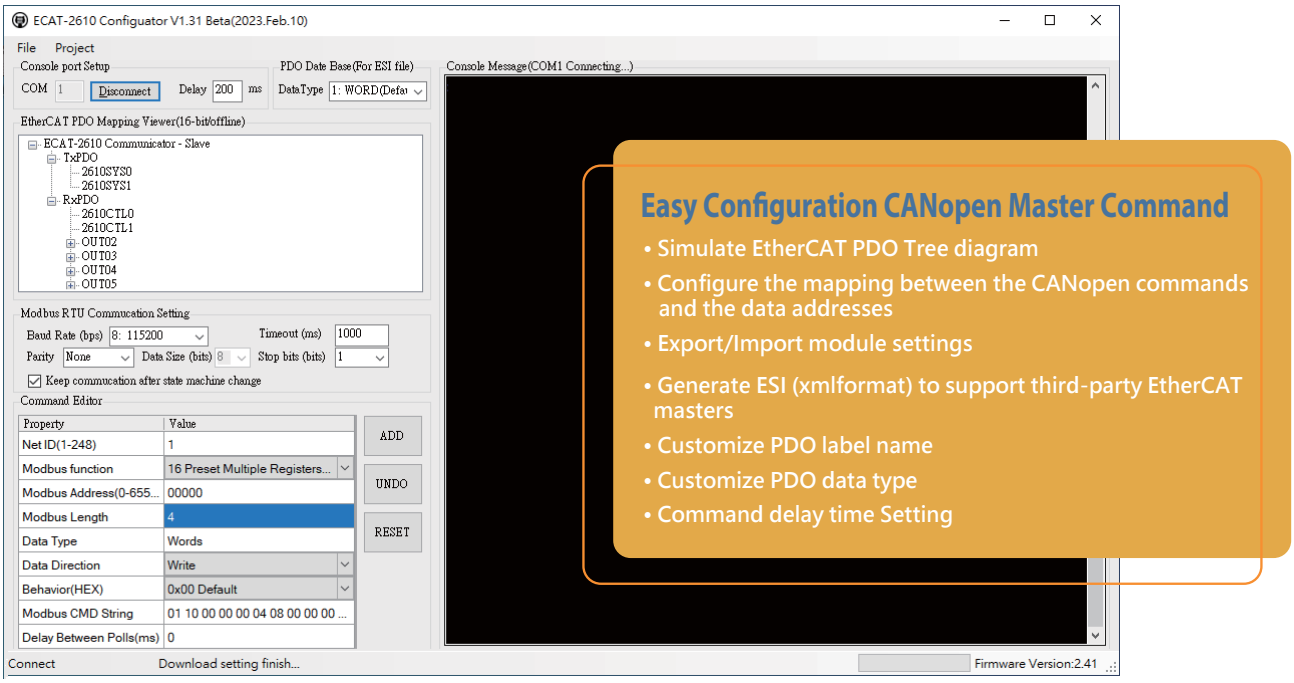
ECAT-2614C

Available Soon

- Supports CANopen
- RS-232/422/485 interface
- 1M bps. maximum baudrate
- No need to change equipment Settings
- Up to 256 In/Out WORDs
- Configuration using a XML format file
- Provides quick configuration tools



▲Anything can be connected to the EtherCAT master via ECAT-2614C as long as it is a Canopen device

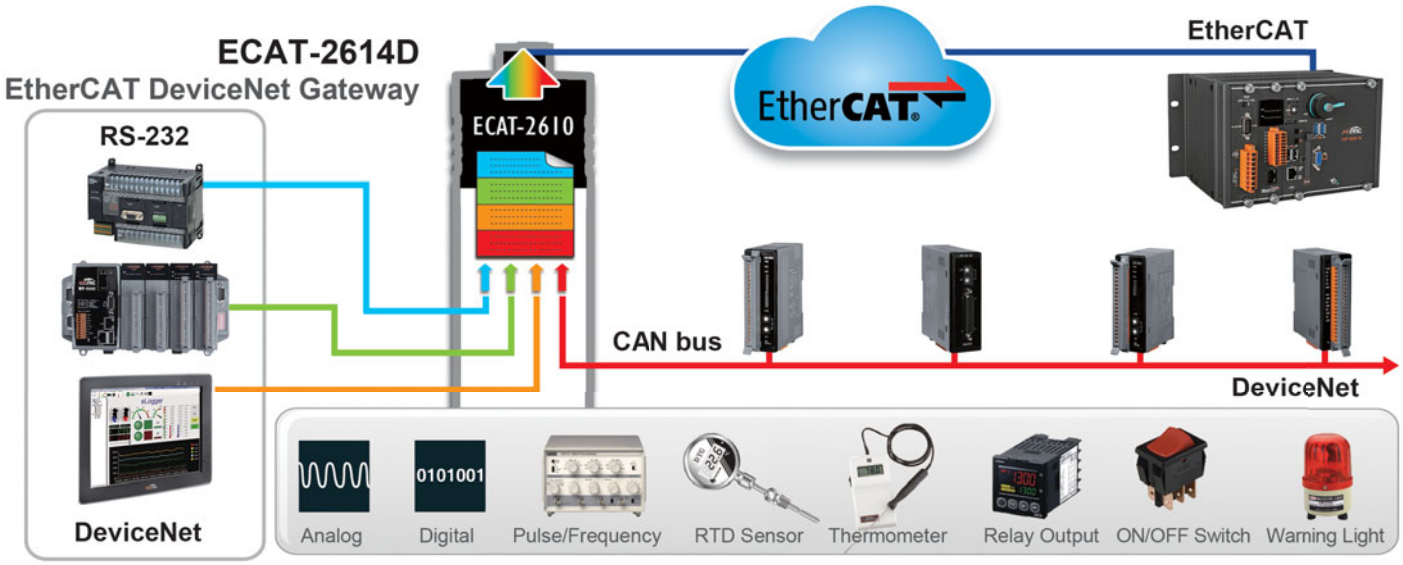


5-5 Connecting DeviceNet to EtherCAT

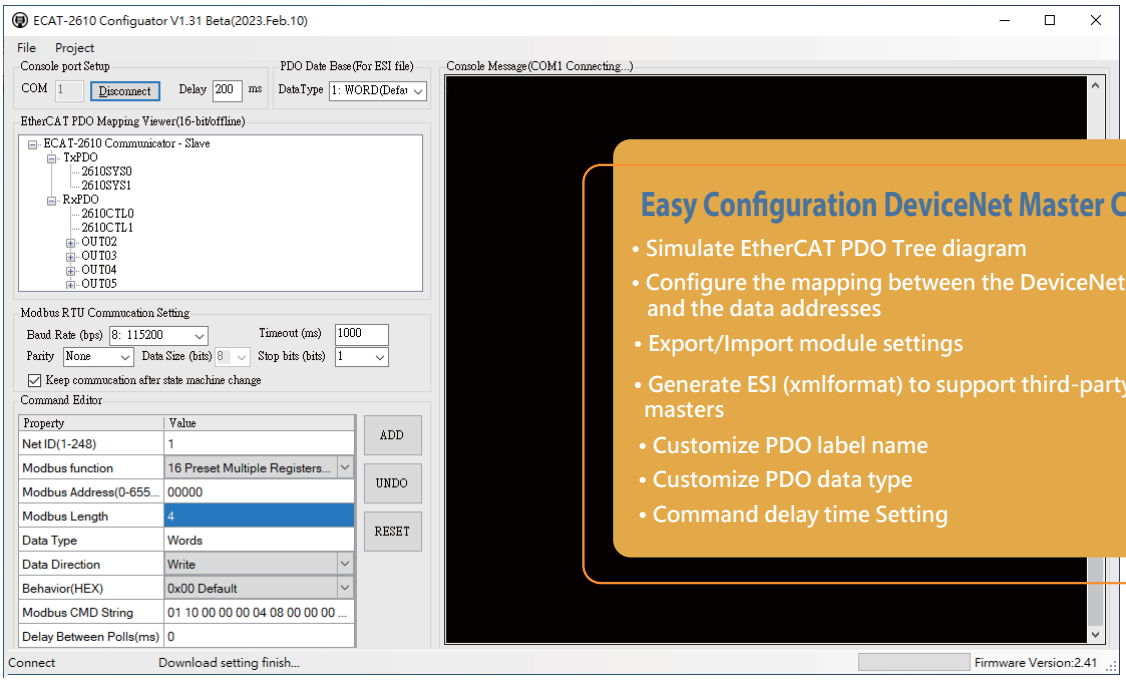
ECAT-2614D

Available Soon

- Supports DeviceNet
- RS-232/422/485 interface
- 500k bps. maximum baudrate
- No need to change equipment Settings
- Up to 256 In/Out WORDs
- Configuration using a XML format file
- Provides quick configuration tools



▲Anything can be connected to the EtherCAT master via ECAT-2614D as long as it is a DeviceNet device

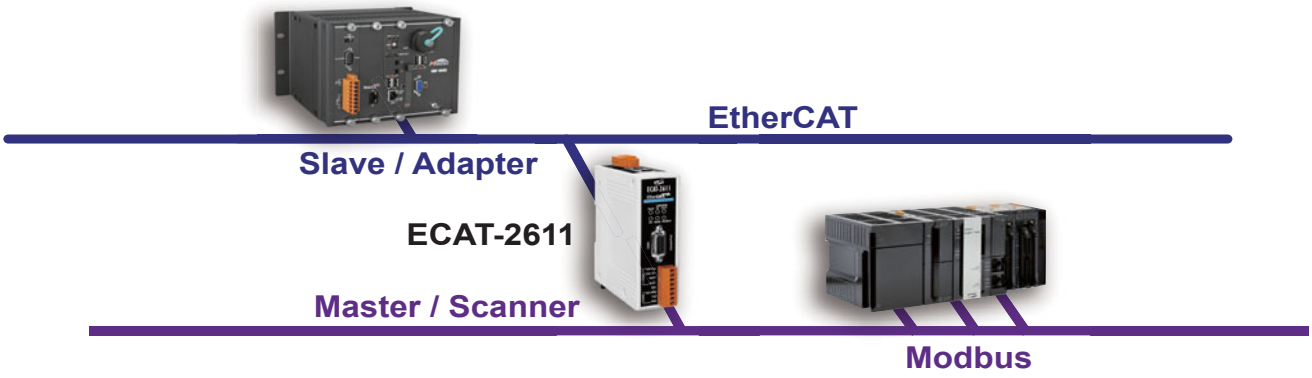


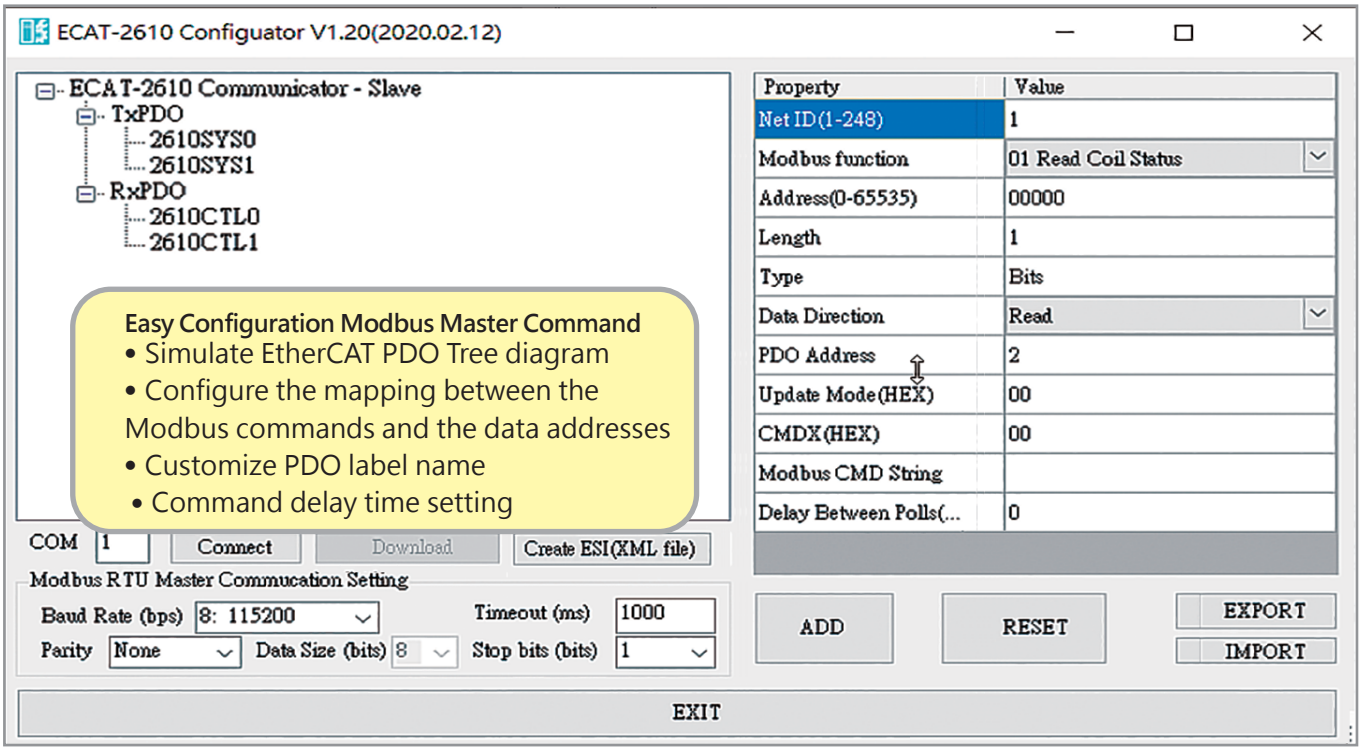
5-6 Data exchange between Modbus RTU and EtherCAT

ECAT-2611(M)

- Supports Modbus RTU
- RS-232/422/485 interface
- 115200 bps. maximum baudrate
- Enabling data exchange between the networks
- Compatible with all leading PLCs
- Up to 256 In/Out WORDs
- No programming required, "one key-click" configuration.

ECAT-2611 Connects the master of EtherCAT and Modbus Industrial Systems Efficiently.





▲ ECAT-2611 provides a Modbus RTU command deployment tool that can be configured in 5 minutes.

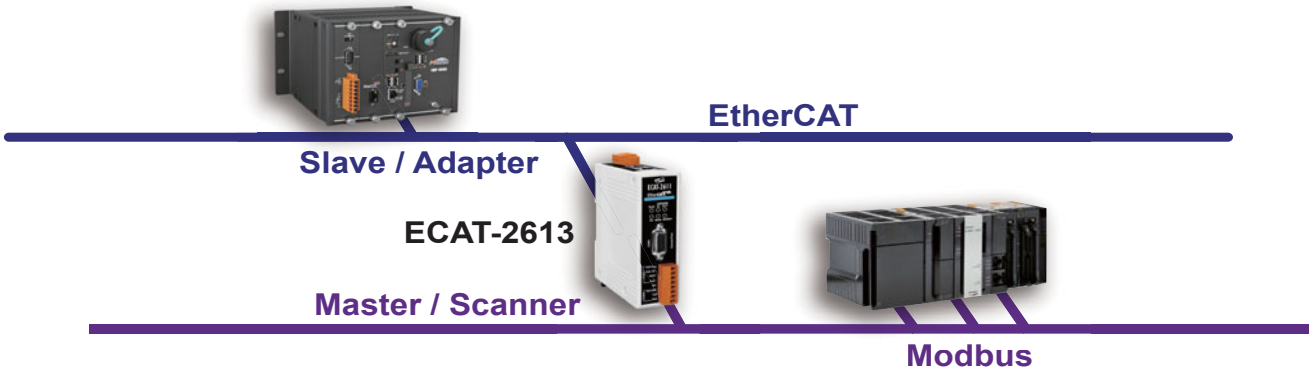
5-7 Data exchange between Modbus TCP and EtherCAT

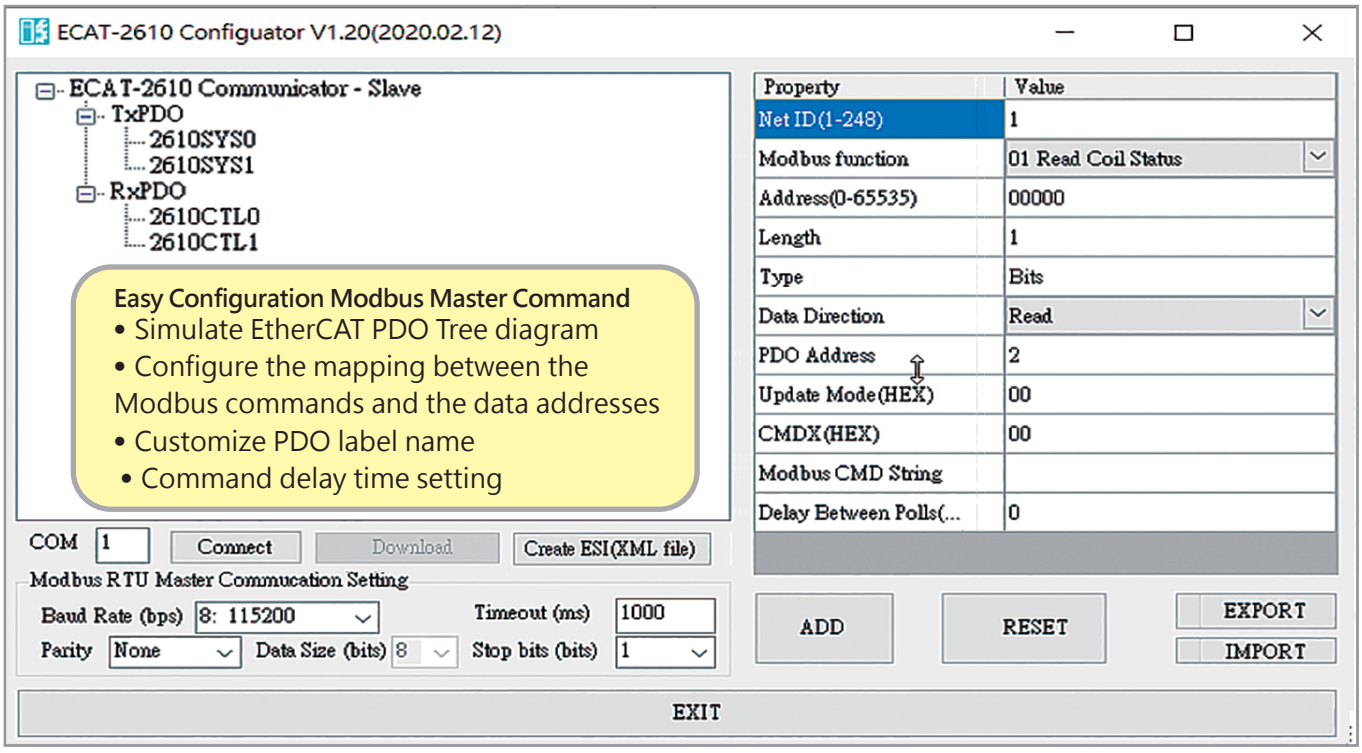
ECAT-2613

Available Soon

- Supports Modbus TCP
- Ethernet interface
- Up to 72 connections
- Enabling data exchange between the networks
- Compatible with all leading PLCs
- Up to 256 In/Out WORDs
- No programming required, "one key-click" configuration.

ECAT-2613 Connects the master of EtherCAT and Modbus Industrial Systems Efficiently.





▲ ECAT-2613 provides a Modbus TCP command deployment tool that can be configured in 5 minutes.

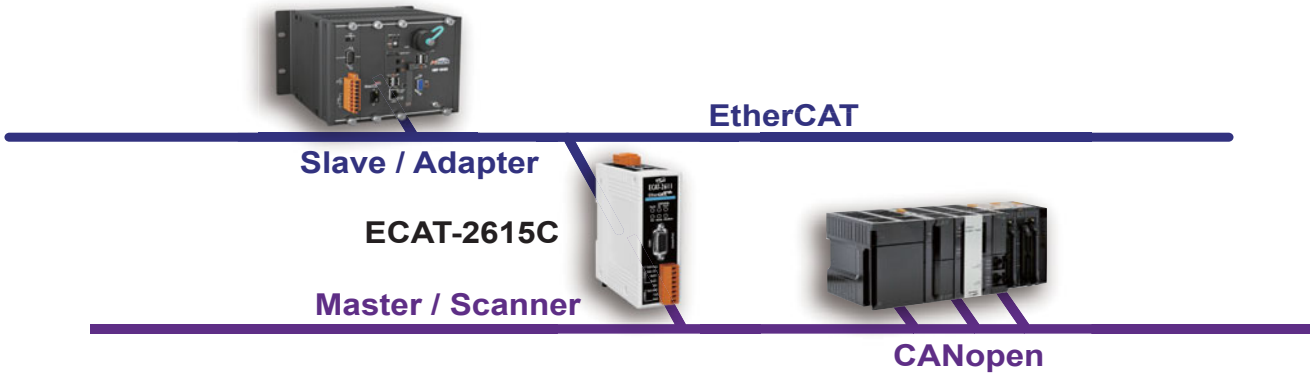
5-8 Data exchange between CANopen and EtherCAT

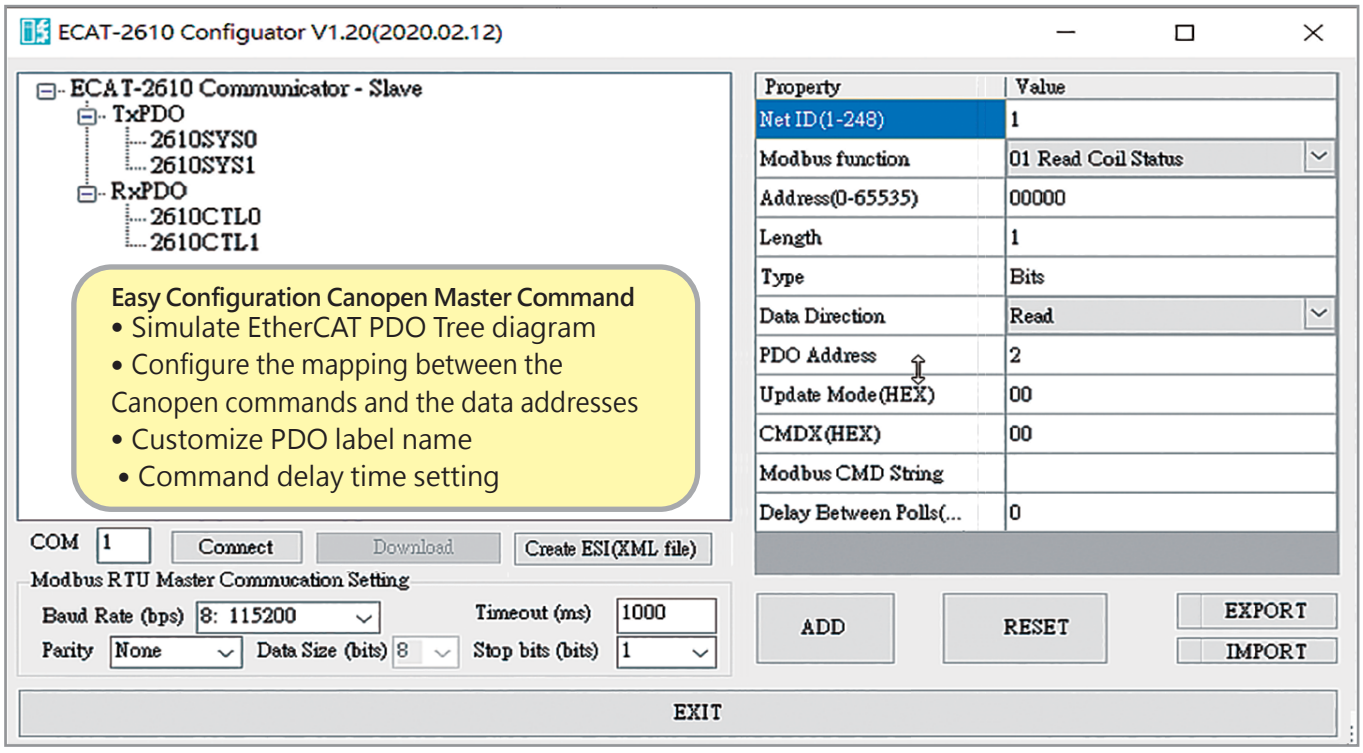
ECAT-2615C

Available Soon

- Supports CANopen
- RS-232/422/485 interface
- 1M bps. maximum baudrate
- Enabling data exchange between the networks
- Compatible with all leading PLCs
- Up to 256 In/Out WORDs
- No programming required, "one key-click" configuration.

ECAT-2615 Connects the master of EtherCAT and CANopen Industrial Systems Efficiently.





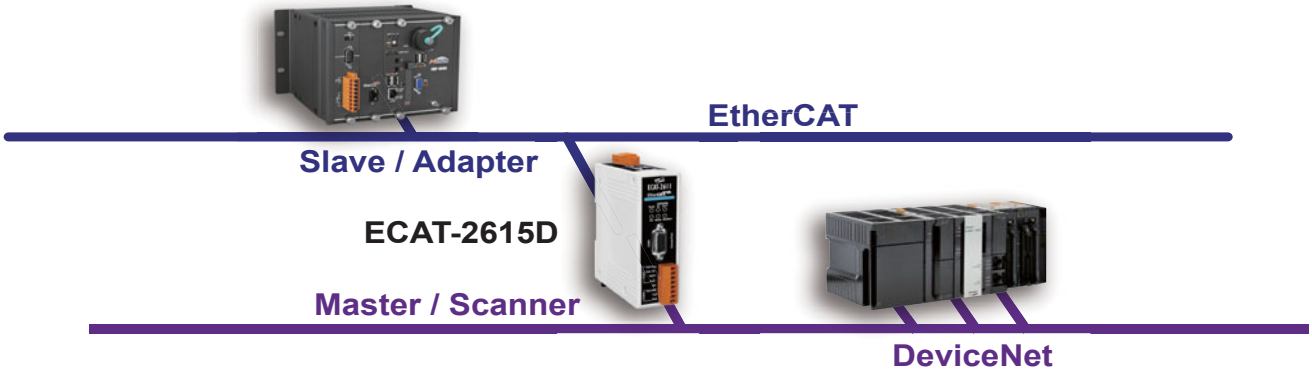
▲ ECAT-2615C provides a Canopen command deployment tool that can be configured in 5 minutes.

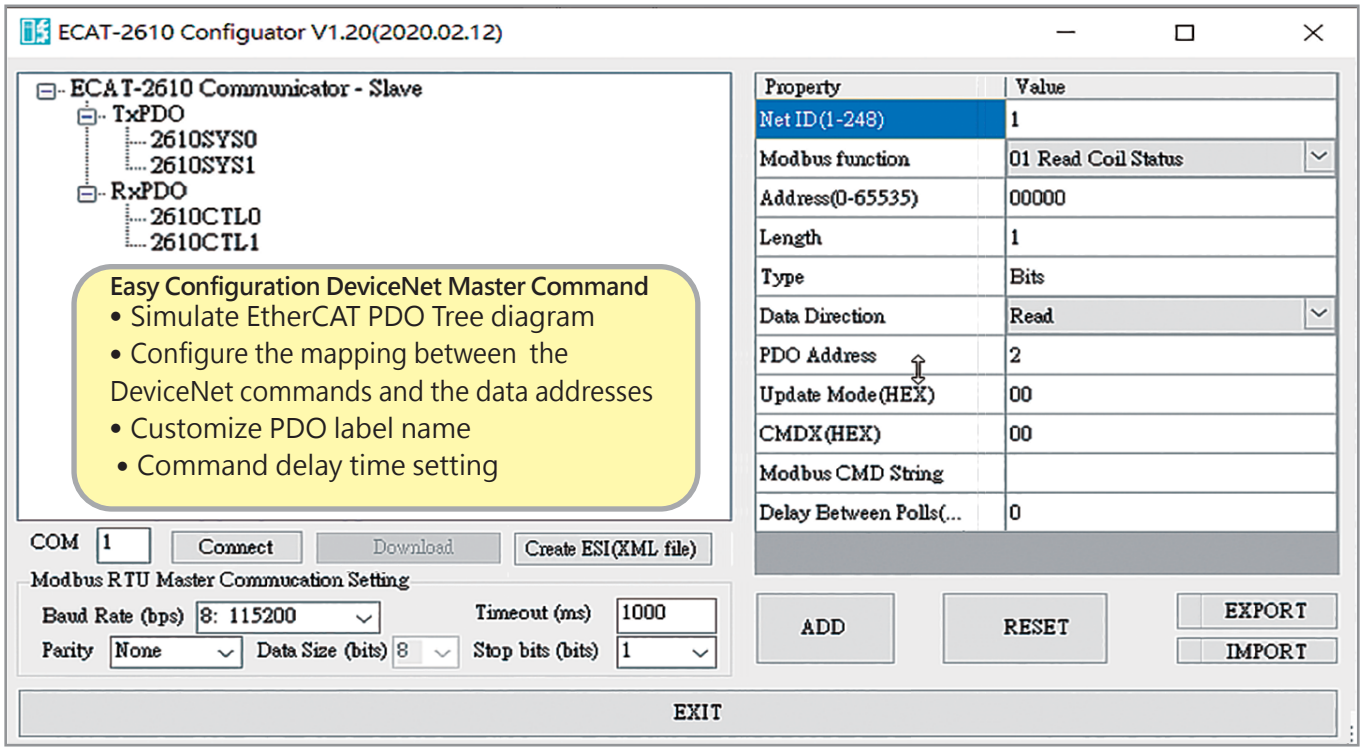
5-9 Data exchange between DeviceNet and EtherCAT

ECAT-2615D Available Soon

- Supports DeviceNet
- RS-232/422/485 interface
- 500k bps. maximum baudrate
- Enabling data exchange between the networks
- Compatible with all leading PLCs
- Up to 256 In/Out WORDs
- No programming required, "one key-click" configuration.

ECAT-2615 Connects the master of EtherCAT and DeviceNet Industrial Systems Efficiently.





▲ ECAT-2615D provides a DeviceNet command deployment tool that can be configured in 5 minutes.

CH6
Junction/Converter

6-1 EtherCAT Junction Modules

The EtherCAT modules can support most topology, including linear, tree, and star. If the star topology necessitates a branch at a specific point, an EtherCAT junction can be used to replace multiple slave devices. The IN port is the network's input port. The OUTx port can be used to connect additional EtherCAT slave modules.

ECAT-2513

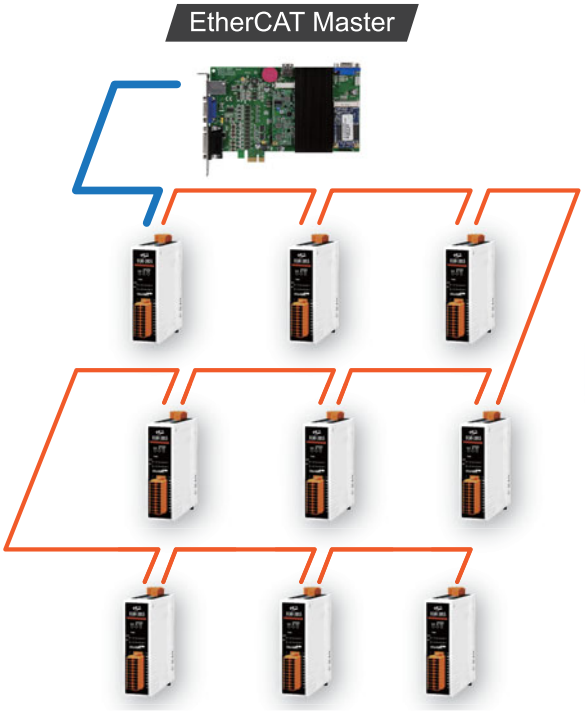
ECAT-2515

ECAT-2517

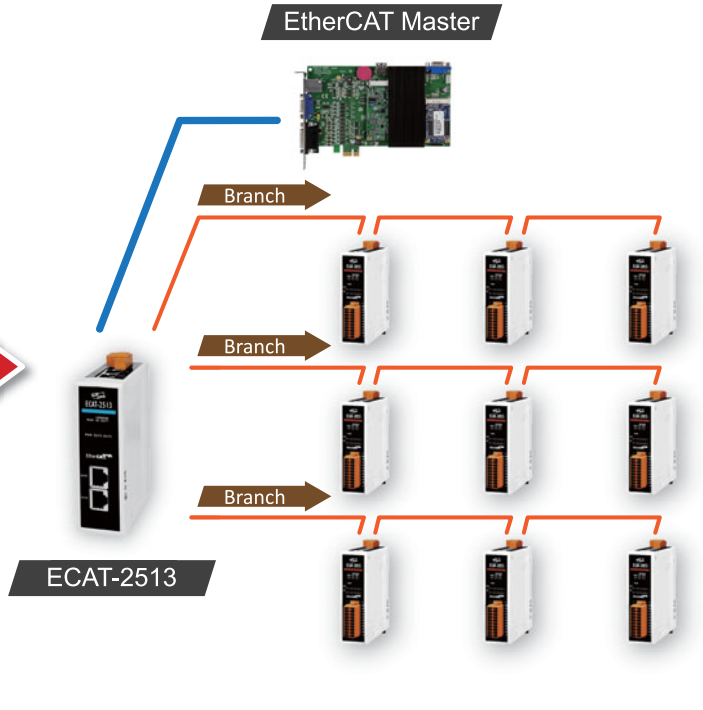
Model	Ports	Nodes	Redundant Cable groups	Distance between Stations	Reverse Polarity Protection	Input Range	Redundant Power Input	Power Consumption
ECAT-2513	4 x RJ-45 (1IN/3OUT)	2	1	Max. 100 m (100BASE-TX)	Yes	+10 ~ +30 VDC	Yes	0.06 A @ 24 VDC
ECAT-2515	6 x RJ-45 (1IN/5OUT)	4	2					
ECAT-2517	8 x RJ-45 (1IN/7OUT)	6	3					

Greatly reduce wiring installation work

Convert the Daisy-Chain multi-way tap topology (Branch) directly using the EtherCAT junction to simplify wiring.



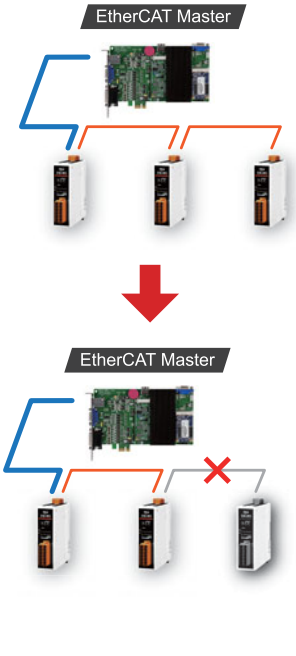
▲Daisy chaining connection



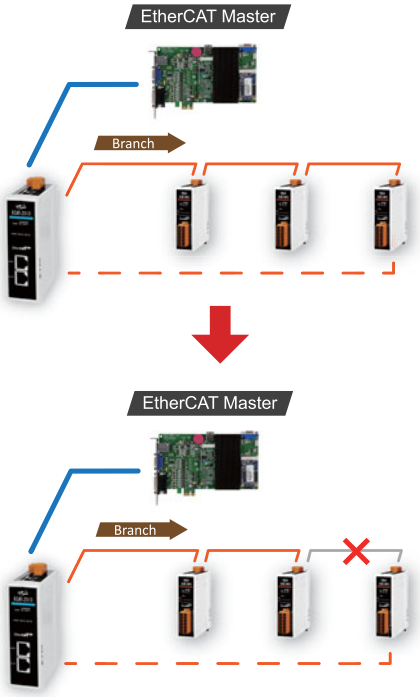
▲Convert to branching connection

Cable redundancy ensures no system downtime

The cable redundancy provides a continuous connection even if part of the EtherCAT network is disconnected.This feature allows you to fix a disconnection without stopping the machine and the production line.

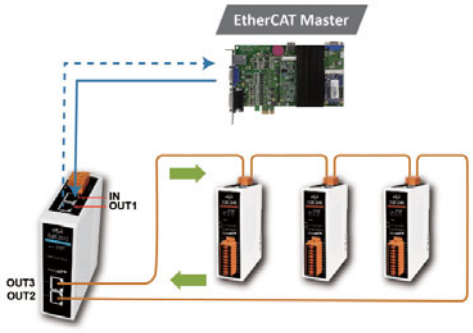


▲If there is no diverter, the module will stop working when the cable disconnects.

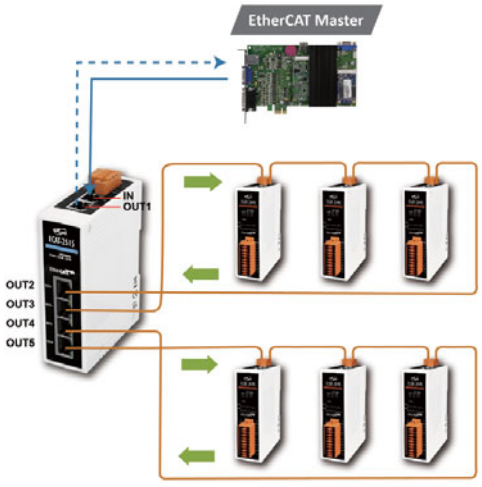


▲When a diverter is available, the module can return to normal operation through cable redundancy.

Provides up to three cable redundant groups

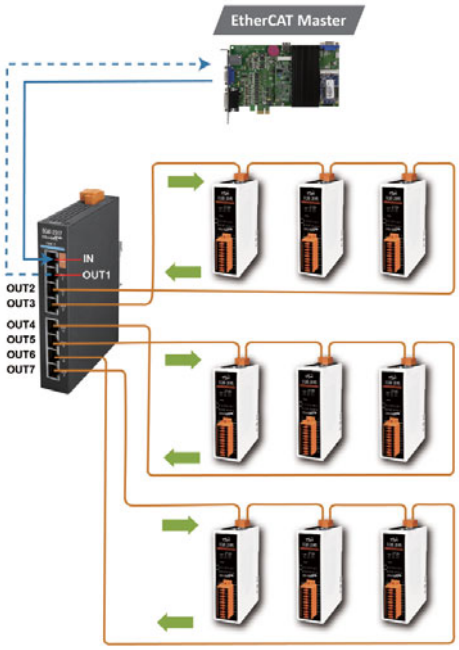


▲ECAT-2513



▲ECAT-2515

Model	Redundant Cable groups (Max.)
ECAT-2513	1
ECAT-2515	2
ECAT-2517	3



▲ECAT-2517

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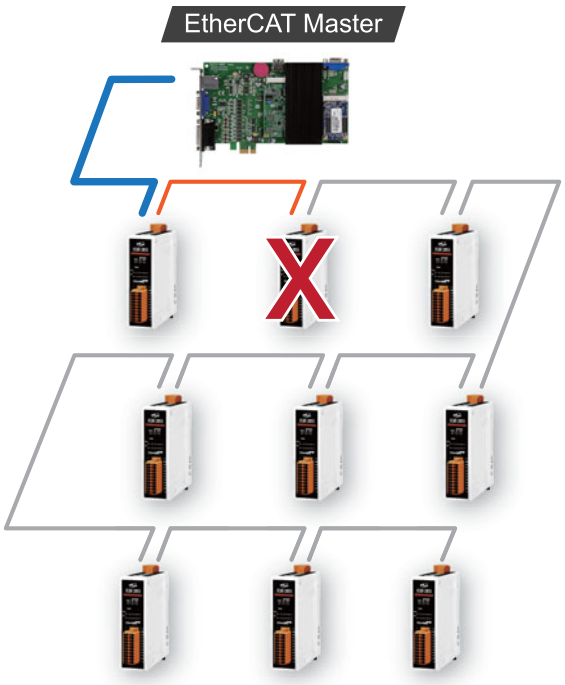
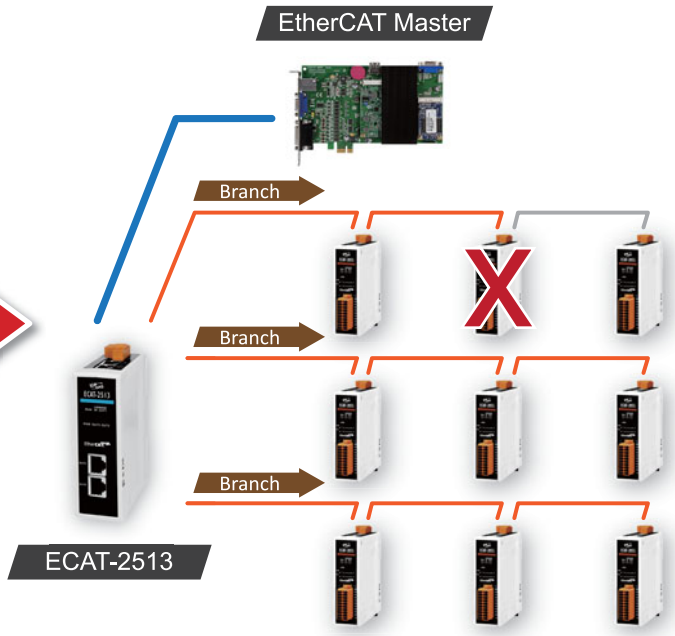
Improve Debugging Efficiency And Reduce Losses

In the daisy chain topology, if one slave device fails, all subsequent devices will shut down. If there is an EtherCAT junction that can help divide the network into different areas, only specific area will be affected, leaving the other areas canbe operate normally. Furthermore, the debugging function can be separated to improve debugging and troubleshooting efficiency.



▲Daisy Chaining connection



▲Convert to branching topology connection

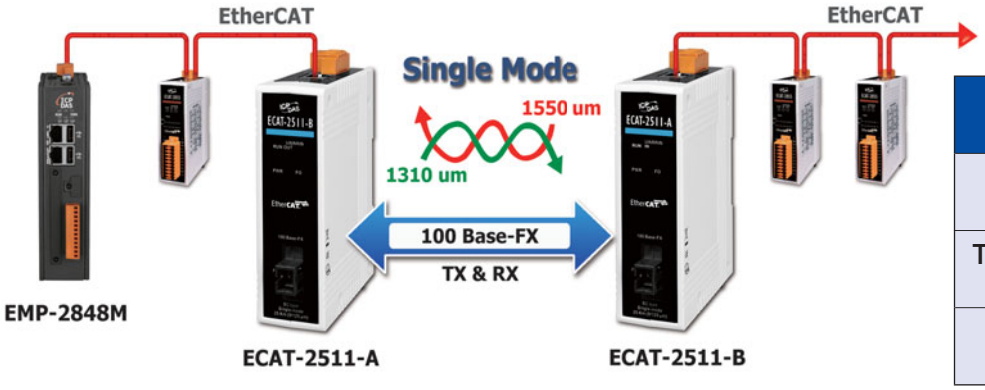
6-2 EtherCAT Fiber Converter Modules

The **ECAT-2511-A** and **ECAT-2511-B** are signal converters that connect EtherCAT to single-mode optical fiber, allowing the optical fiber to extend the transmission distance. Because of the benefits of optical fiber, ECAT-2511-A and ECAT-2511-B transmit data via optical fiber to ensure data transmission safety and to assist the EtherCAT network in avoiding EMS / RFI noise interference.

- EtherCAT category: RJ45, 100 Base-TX
- Fiber type: SC, single mode, 100 Base-FX
- Optical fiber cable: 8.3/125, 8.7/125, 9/125, 10/125 μm
- Maximum transmission distance is 25 kilometers
- Fiber wavelength:

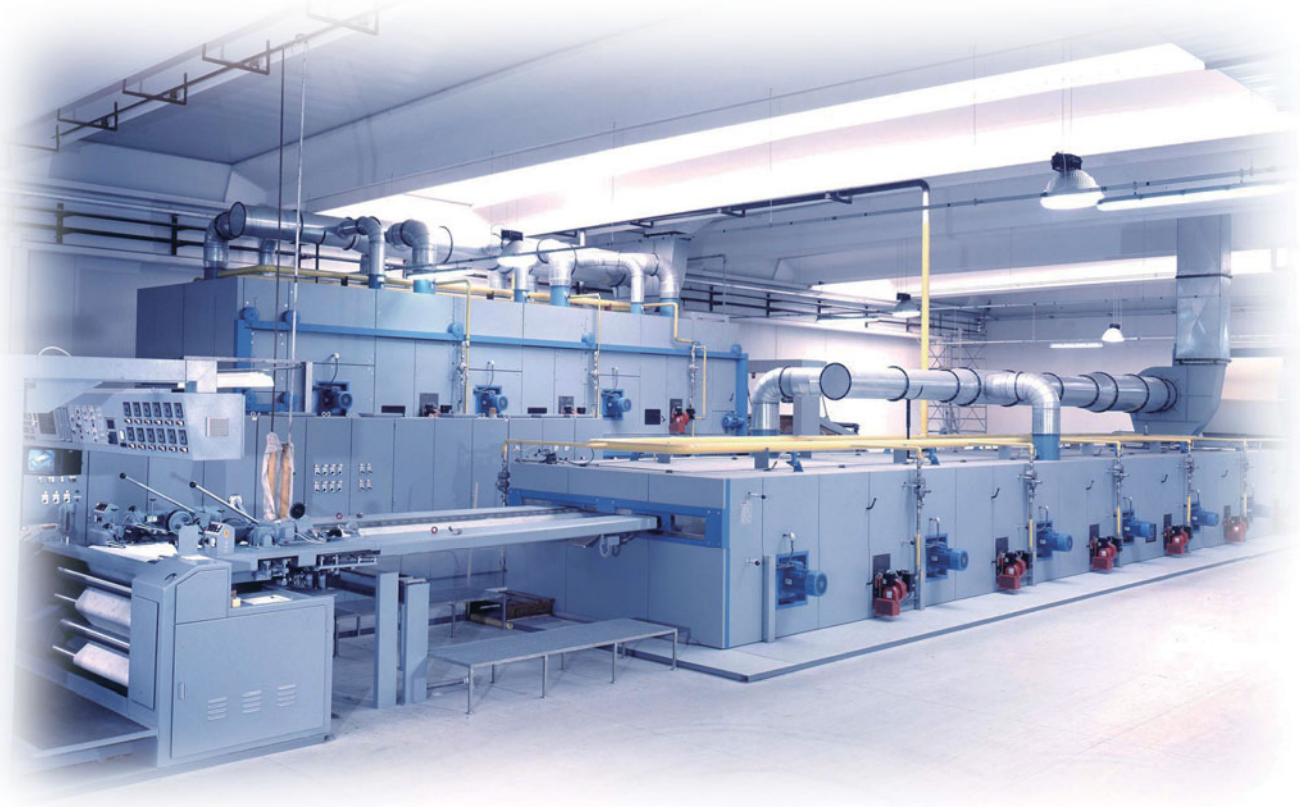
★ Tx: 1310 nm, Rx: 1550 nm (I-2533CS-A)

★ Tx: 1550 nm, Rx: 1310 nm (I-2533CS-B)



Fiber Converter	ECAT-2511-A/B	Other Brands
Fiber Type	Single Mode	Multi Mode
Transmission Distance	Long(up to 25 km)	Short
Wire Costs	Low	High

CH7
Application Story

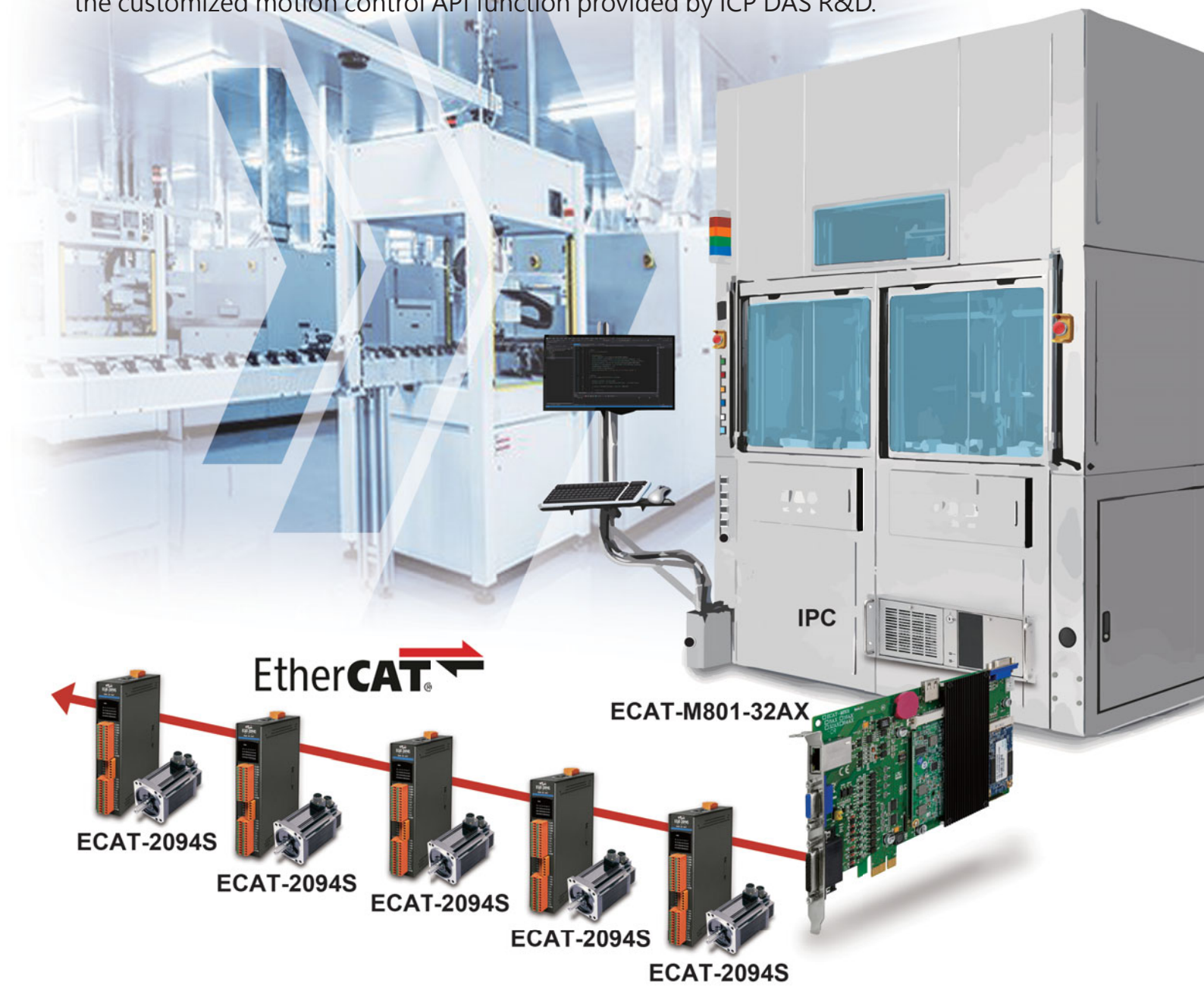


IC Testing & Sorting Machine

EtherCAT features easy development, high expansion and wiring-saving that can easily improve system performance and save space

The IC Testing & Sorting Machine performs the electrical testing, visual recognition, and other final performance tests when the finished semiconductor components are transferred to the inspection location. The tested components are then classified as required (such as: qualified/defective). Because the IC test sorting machine employs a large number of mechanical operations, ICP DAS's EtherCAT solution can significantly improve mechanical operation performance and production efficiency, while also improving test stability and yield. Furthermore, it can save machine space and reduce the machine's floor space in the testing plant, allowing customers to significantly reduce the production costs.

To achieve complete 20-axis motion control in the limited chassis space, the ECAT-M801-32AX EtherCAT master card is inserted into the machine's IPC PCIe slot and matched with 5 sets of ECAT-2094S four-axis stepper motor controllers. In this case, it takes less than two weeks to significantly improve the performance of the IC Testing & Sorting Machine by using the customized motion control API function provided by ICP DAS R&D.



Vacuum Coating Machine

EtherCAT Gateway Module enables rapid industrial upgrading.

A vacuum coating machine can be used for a variety of purposes. The traditional industries involved in the processing of everyday decorative items, the solar photovoltaic industry, optical product industries, and the integrated circuits/sensors/molds used in high-tech semiconductor manufacturing all requires coating with special thin films. To increase coating efficiency, the new generation of coating machines has switched to EtherCAT control. During the coating process, it is crucial to monitor the status of the vacuum pump, as it is the most important part that determines the quality of the coating. Typically, Modbus RTU communication is used, which cannot be easily replaced. However, by using the ECAT-2610 module to convert the vacuum pump's status data into EtherCAT data, the pain point is successfully addressed. This solution saves time in redesigning the equipment or finding for suitable vacuum pumps to perform recalibration.

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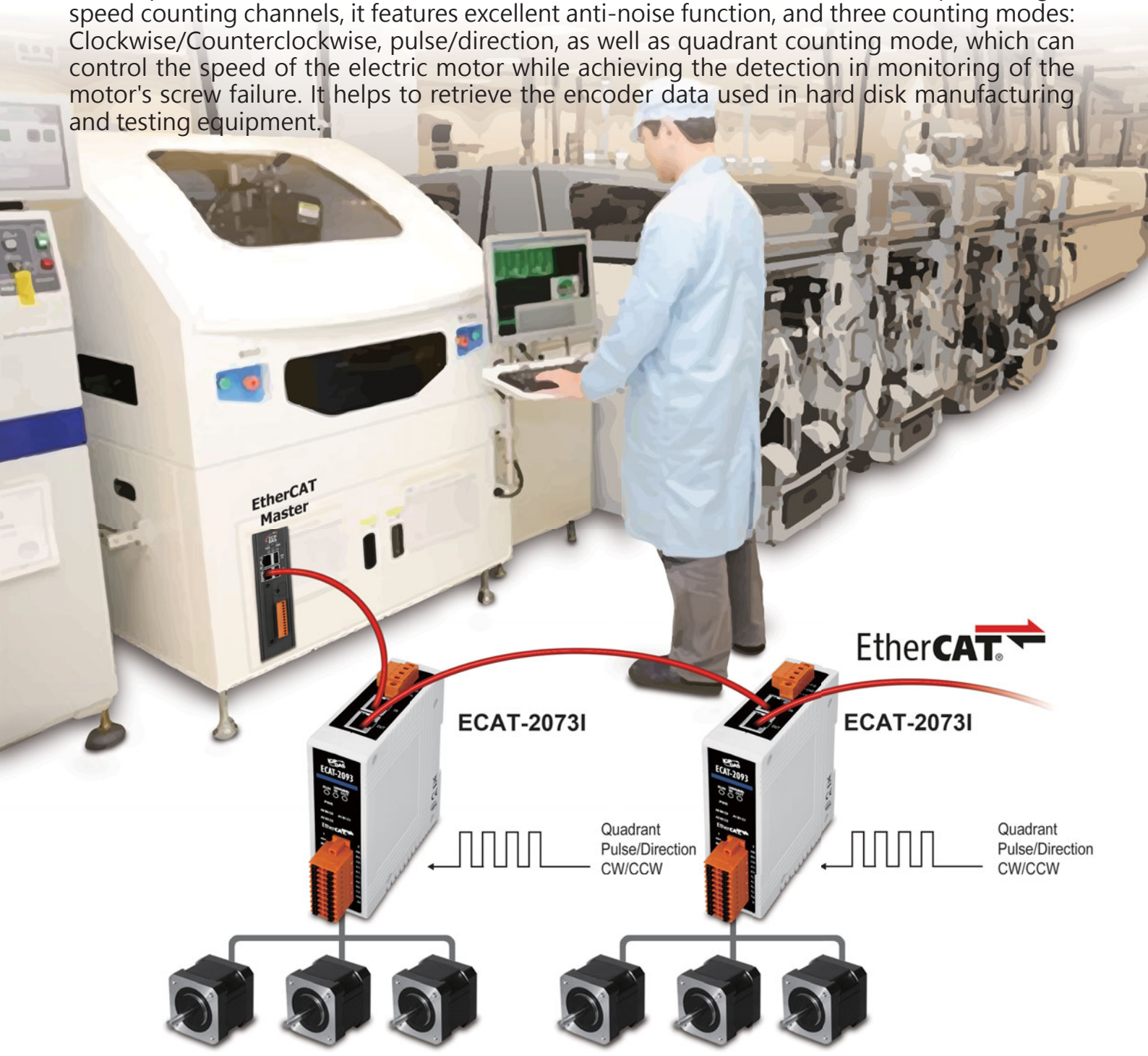
Hard Disk Manufacturing Inspection

Efficiently handle system detection with EtherCAT encoder modules

For hard disk manufacturers, usually the machines that take up most space are not the machines responsible for cutting or assembling, but the machines used for various tests. Before the assembling of the hard drives, the quality control personnel will begin the inspections of each flash chip. And during the process of assembling, more and more tests such as: stress tests of reading and writing, stability under high-temperature operations, and long-term reliability will be performed.

The manufacturer in this case is a well-known hard disk manufacturer. They use ECAT-2093 EtherCAT Three-Channel Incremental Encoder Counter to help with inspection planning on the production line and tests. The ECAT-2093 encoder counter has three separate high-speed counting channels, it features excellent anti-noise function, and three counting modes: Clockwise/Counterclockwise, pulse/direction, as well as quadrant counting mode, which can control the speed of the electric motor while achieving the detection in monitoring of the motor's screw failure. It helps to retrieve the encoder data used in hard disk manufacturing and testing equipment.

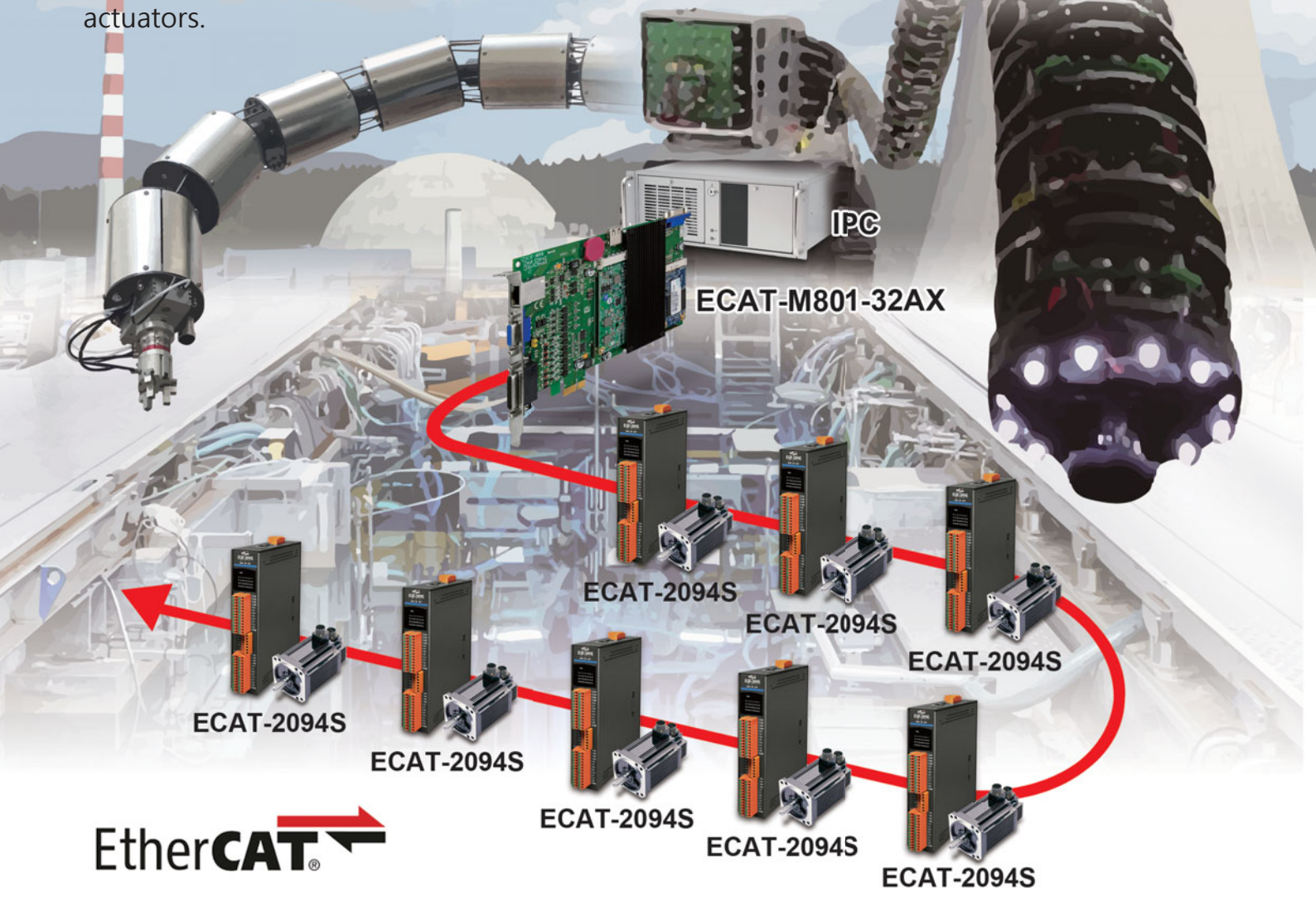


Remotely Controlled Manipulators

Using EtherCAT multi-axis synchronization performance, easy to reach 20-axis synchronization control

In recent years, the government of Taiwan has been committed to fostering a nuclear-free homeland, and several nuclear power plants in Taiwan have announced plans to close in the near future. However, since nuclear power components and pipelines are densely dispersed and structurally complex in nuclear facilities, removal and cleanup operations have become extremely difficult. Furthermore, during the cleanup process, radioactive equipment and high radiation exposure working environment would have a direct effect on construction workers and radiation safety.

In this case, the Institute of Nuclear Energy Research (INER) has been using ICP DAS ECAT-M801-32AX, EtherCAT Master Card, which can support up to 32-axis motion control, together with 8 sets of ECAT-2094S stepper motor controllers to create remote control electrical manipulators. It is to assist in nuclear waste investigation and evaluation, as well as to provide visual information, that allowing nuclear technicians to estimate workload and removal measures more accurately. The electrical manipulators can be processed and transformed into a processing tool for nuclear dismantling work following the completion of the investigation. The INER has developed a snake-shaped electrical manipulator with a high degree of freedom for nuclear facility decommissioning and nuclear waste cleanup. The advantages of the electronic manipulator include its small size, multiple degrees of freedom, flexibility and lightness, simple operation, and ease of installation and maintenance. The ICP DAS EtherCAT multi-axis motion control card, on the other hand, is used to control multi-axis actuators.



Automatic Guided Vehicle (AGV)

Using EtherCAT gateway to freely transfer the data between two systems

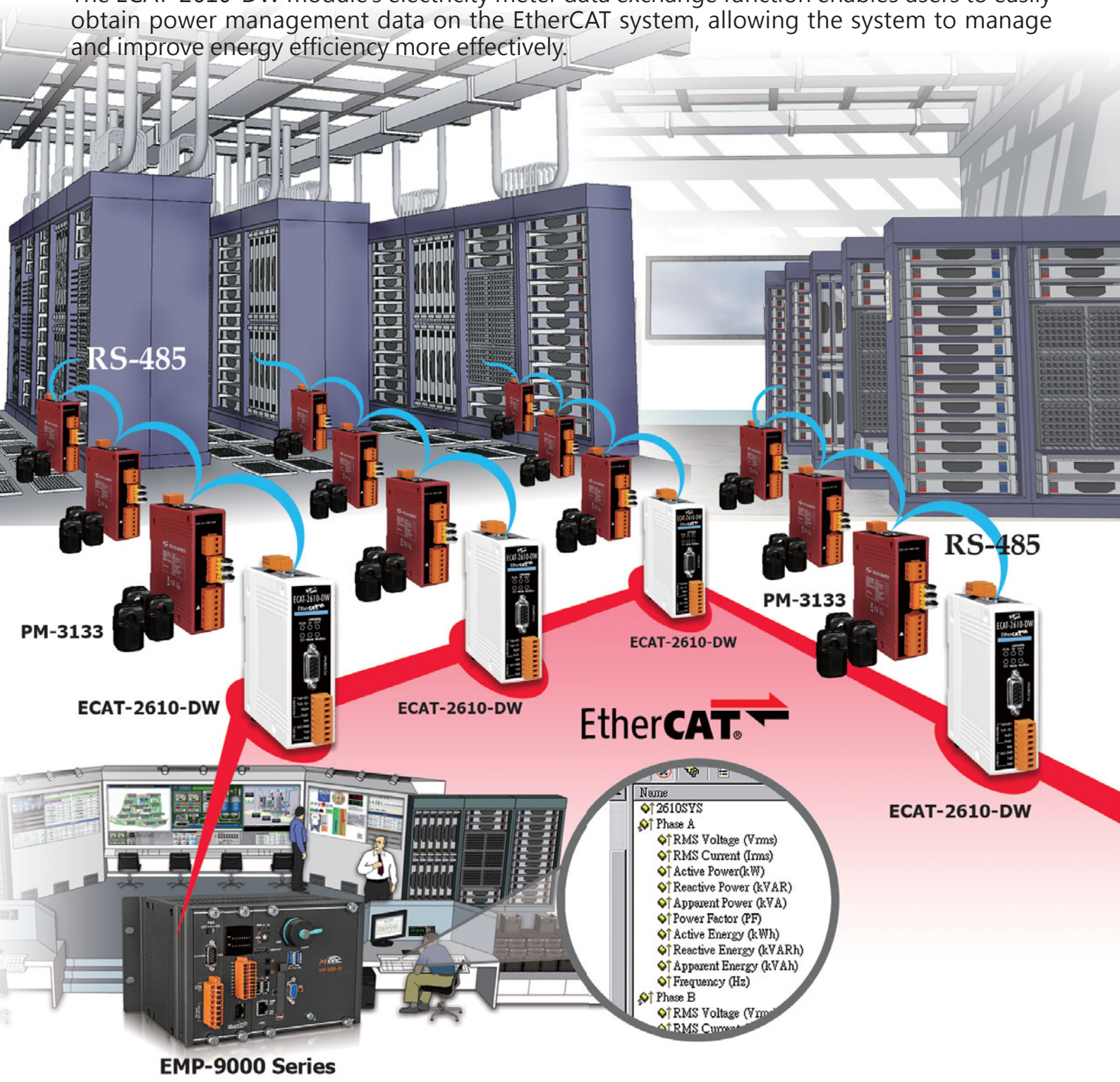
The Automatic Guided Vehicle (AGV) in this case is primarily in charge of comparing test object data and writing the result data. Firstly, the PLC reads the data of the test object via RFID, and then the AGV obtains the RFID data on the PLC via ECAT-2611 EtherCAT Slave to Modbus RTU Slave gateway, and compares the data from the lens. If the data on the lens matches the RFID data, the result would be sent back to the PLC. Finally, the test result is written by the RFID writer.

This client used the ECAT-2611 EtherCAT Slave to Modbus RTU Slave gateway to help a Japanese PLC manufacturer transfer data from Modbus RTU to the EtherCAT network, and the AGV performed the corresponding actions. The ECAT-2611 acts as a Slave between the Masters of two different networks, allowing PLCs and AGVs from different networks to exchange data with the AGV. The data be exchanged easily and quickly between two networks by using the ECAT-2611 without any programming.

Solution for EtherCAT Smart Power Meters

EtherCAT has gradually become the standard industrial bus communication interface as science and technology have advanced. With the increasing awareness of environmental protection and power savings, demands on system power monitoring and optimization of power supply & transmission system performance has increased in tandem. For most communication interfaces already have mature power management solutions, the EtherCAT which has become mainstream protocol unquestionably requires an integrated power management solution to avoid becoming a power management system dead end, and it can also effectively protect energy usage rate.

The ECAT-2610-DW module's electricity meter data exchange function enables users to easily obtain power management data on the EtherCAT system, allowing the system to manage and improve energy efficiency more effectively.

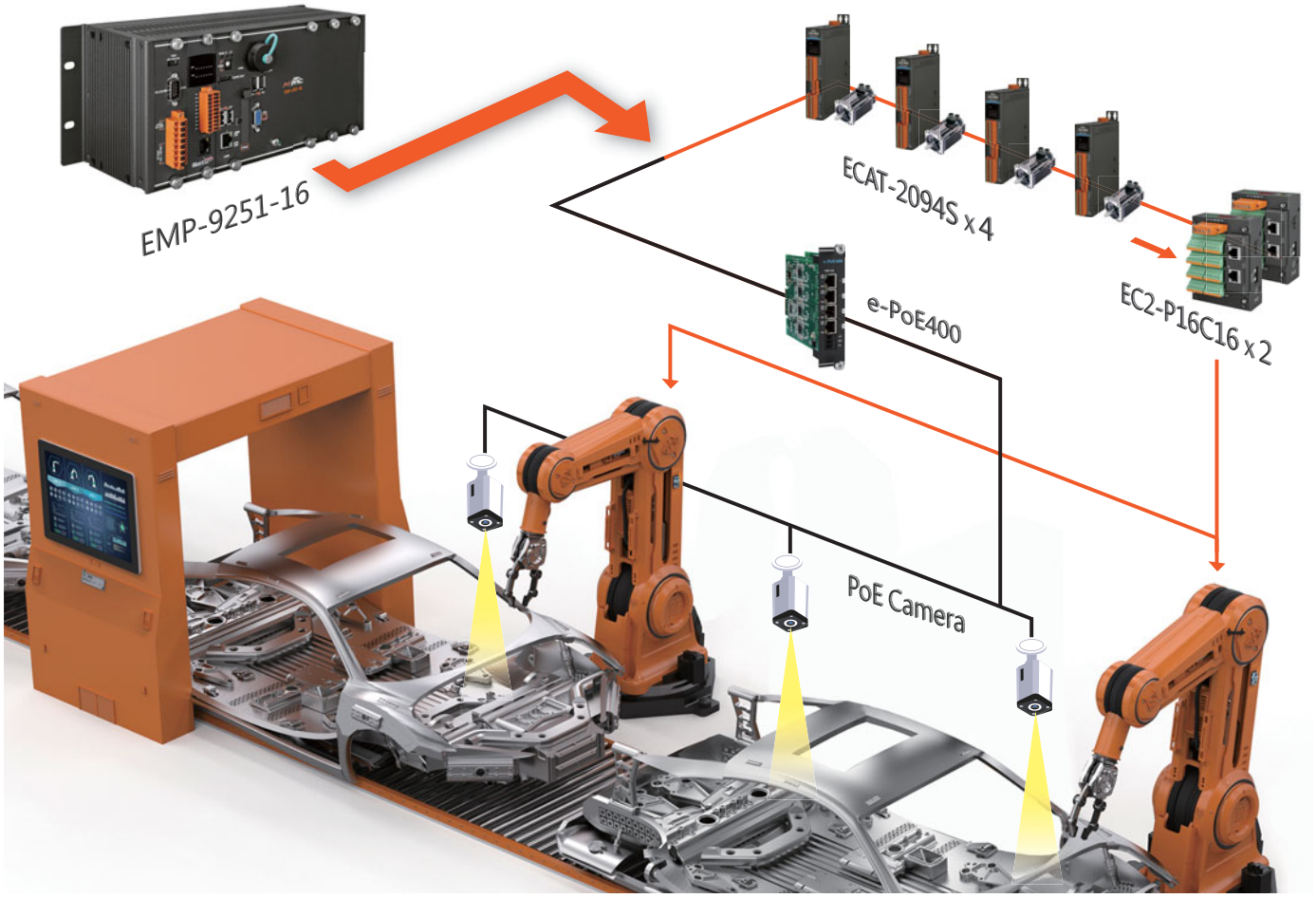


Automobile Assembly Plant (Automated Optical Inspection)

Multi-axis AOI motion is used in automotive assembly lines. By combining the advantages of multi-axis robots and machine vision, customers need an inspection solution that not only enables industrial cameras to move easily and capture objects from multiple angles, but also provides an accurate and reliable system platform to help automakers improve inspection speed and quality, thereby increasing overall productivity.

EMP-9251-16 Motion PAC from ICP DAS, as the core platform of the AOI system, can add various external devices through two e-BUS slots with various I/Os. The compact size greatly increases the space available in the cabinet. Since all inspection items have to be completed within a limited time, using the e-POE400 communication card with four independent Ethernet ports to connect 4 PoE (Power over Ethernet) industrial cameras can capture images quickly and synchronously.

By using the PoE function, the communication card can supply power to the camera mounted on the robot without a power cord. The multi-axis robot system can use 4 ECAT-2094S to achieve 16-axis motion control through EtherCAT communication, and use 2 EC2-P16C16 to provide 64-channel digital I/O to control peripheral devices such as sensors, solenoid valves, switches, and indicators so that users can instantly and comprehensively grasp the on-site situation.



Universal Visual Motion Controller EMP-9000

EMP-9258 is a compact and high-performance motion controller that uses a powerful INTEL Core i5 processor and provides high-speed interfaces such as USB3.0, PoE and EtherCAT. EMP-9258 has complete functions, small size, and high motion control precision, which is convenient for manufacturers to match various high-speed camera modules to create more efficient, lighter, and cost-effective AI vision applications. It is also an ideal mechanical automation for electronic equipment manufacturing solution.

Applications

- Electronic Manufacturing
- Machinery Industry
- Process Control
- AGV
- Robotics
- Factory Automation

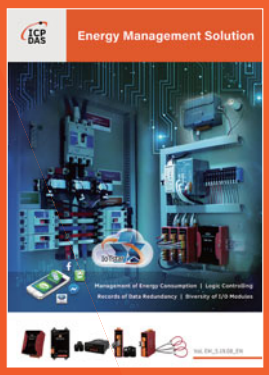
Model	Compatible e-Bus Card	EtherCAT Port	USB 3.0 Port	PoE Port
EMP-9251-16 **EMP-9251-32** **EMP-9258-16** **EMP-9258-32**	-	1	0	0
	e-USB404	1	4	0
	e-POE404	1	0	4

6-axis Motion Simulator

Replace bulky IPCs with the compact EMP-9000 controller

The Motion Simulator is designed to satisfy the logistics and transportation, oil and gas industries, OEMs, skill development organizations, research institutes, and defense industries. The motion simulator provides a safe environment to train novice drivers in basic driving skills.

The original motion simulator platform was built by a bulky IPC from another brand and an EtherCAT master card. To reduce the weight and size of the platform, the users select the ICP DAS EMP-9051-16 motion controller with servo motors and the ECAT-2016N single-channel load cell module. This setup effectively provides force feedback to the steering wheel, letting the driver simulate a real driving scenario.



Energy Management Solution

- InduSoft SCADA Software
- Smart Power Meter Concentrator
- Smart Power Meter
- True RMS Input Module
- TouchPAD Devices - VPD Series

IIoT Product

- IoTstar : cloud management software
- UA-5200 : communication server
- WISE series : IIoT host
- iCAM series : IP camera
- MQ-7200M series : MQTT I/O module
- Sensors : temperature, humidity, CO2, PM2.5,...

ZigBee Wireless Product Solutions

- ZigBee Wireless Network
- Applications
- ZigBee Converters
- ZigBee Repeater
- ZigBee Bridge
- ZigBee I/O Group Module
- ZigBee I/O Module
- ZigBee Modbus Data Concentrator
- Accessories

UA Series / BRK Series: IIoT Cloud Solution

- IIoT Cloud Solution Products
- IIoT Communication Server: UA-2000 /5000/7000 SeriesSupport Logic Control IFTTT
- MQTT Communication Server: BRK-2000 Series
- OPC UA I/O Module: U-7000 Series

WISE - Intelligent IIoT Edge Controller & I/O Module

- WISE IIoT Edge Controller & I/O Module
- Cloud Management
- Applications
- Product Specification
- Solution Integration

Smart Building, Smart Home Automation

- Video Intercom & Access Control
- Touch HMI - TouchPAD Series
- Smart Lighting Control
- Energy Saving - PM/PMC Series
- Environmental - DL/CL Series
- Motion Detector - PIR Series
- Wi-Fi Wireless - WF Series
- Infrared Wireless - IR Series
- ZigBee Wireless - ZT Series
- IIoT Server & Concentrator
- LED Display - iKAN Series

Industrial Panel PC Industrial Panel Controlle

- iPPC - Industrial Panel PC
- ViewPAC - Industrial Panel Controller
- AEV - SCADA/HMI Panel Controller
- Industrial I/O Modules
- SmartView - Multifunctional HMI

PC-based I/O Boards

- PCI Express Bus Data Acquisition Boards
- PCI Bus Data Acquisition Boards
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