EtherCAT
Motion Control Solution

Vol. EC_5.25.05_EN

EMP-9000-Impeccable EtherCAT Motion Controllers

The EMP-9000 features a compact 3U rackmount metal chassis and runs on Windows 10 IoT, making it versatile for various sectors. Unlike larger IPCs, it supports both Windows and PLC program development. Equipped with multiple industrial Ethernet ports, the EMP-9000 enables the integration of control and data applications, as well as performing various motion control functions, optimizing EtherCAT performance for a wide range of applications.

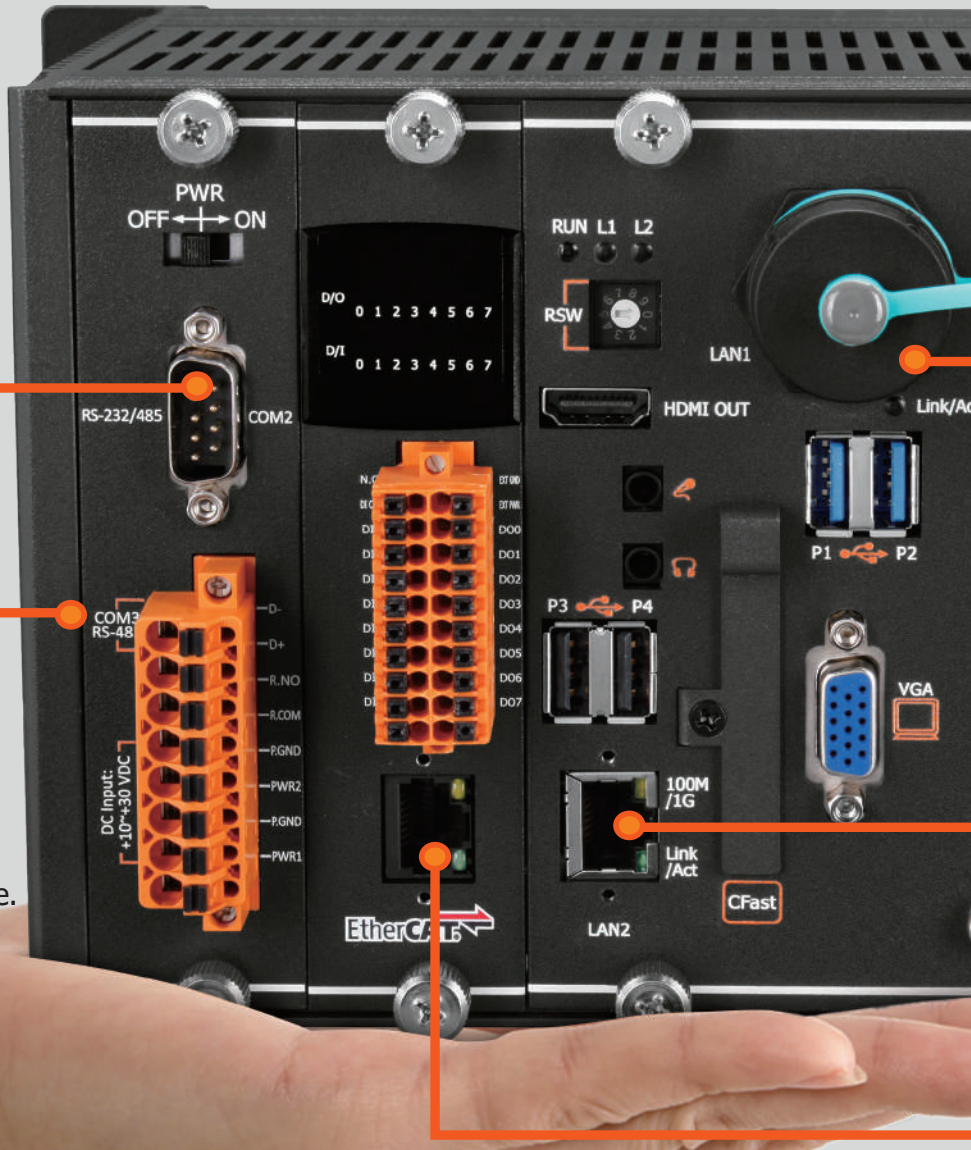
Communication

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

Case

- WxLxH(mm):239x164x133
- 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

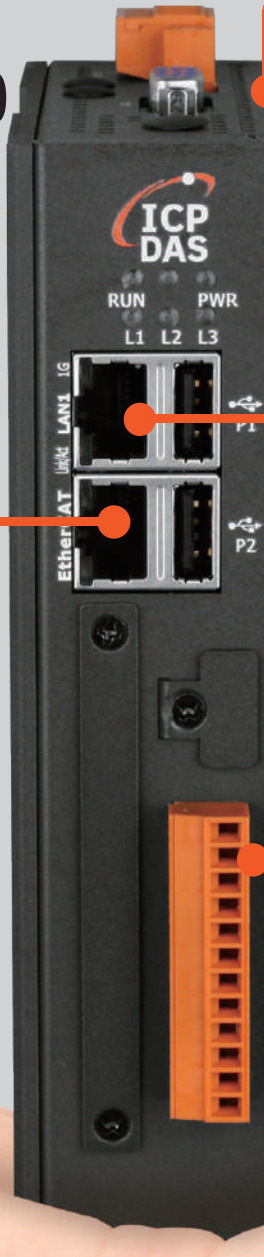
- Servos
- Inverters
- Robotics
- Vision systems
- Distributed I/O
- Sensors

- Robust RJ-45 EtherCAT Port Motion Control
- 16/32 Motion Control Axis
- Maximum Number of SubDevices: 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 with. It features a 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 constraints a deciding factors. 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 SubDevices

Machine Network

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

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 M2M

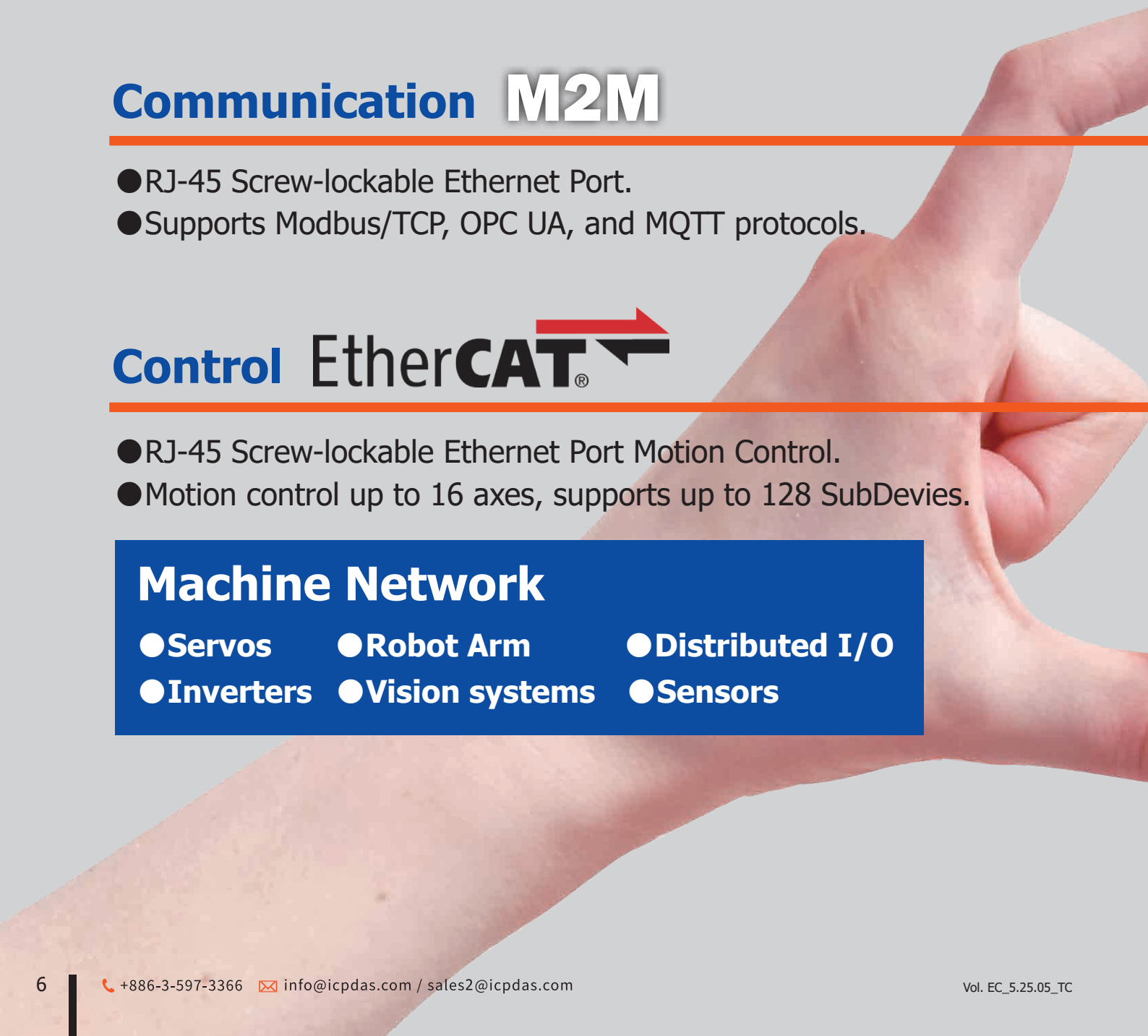
- Supports Modbus TCP
- Supports Modbus RTU/ASCII
- Supports OPC UA
- Supports MQTT

Case

- W x L x H (mm): 42 x 164 x 129
- Metal casing is effective against noise
- Compact size, can be mounted on DIN-Rail

EMP-4648 Ultra-compact EtherCAT Motion Controller

EMP-4648 is equipped with a high-performance quad-core Cortex-A53 processor, which delivers speed that traditional PLCs cannot match, supporting EtherCAT slim expansion modules from the EC4 Series. This combination offers compact size, cost-effective flexibility, and excellent performance. Suitable for semiconductor and automation applications. With the ICP DAS EtherCAT control engine and Win-GRAF Soft PLC, you can optimize the performance of EtherCAT to meet different application requirements.



Communication M2M

- RJ-45 Screw-lockable Ethernet Port.
- Supports Modbus/TCP, OPC UA, and MQTT protocols.

Control EtherCAT®

- RJ-45 Screw-lockable Ethernet Port Motion Control.
- Motion control up to 16 axes, supports up to 128 SubDevies.

Machine Network

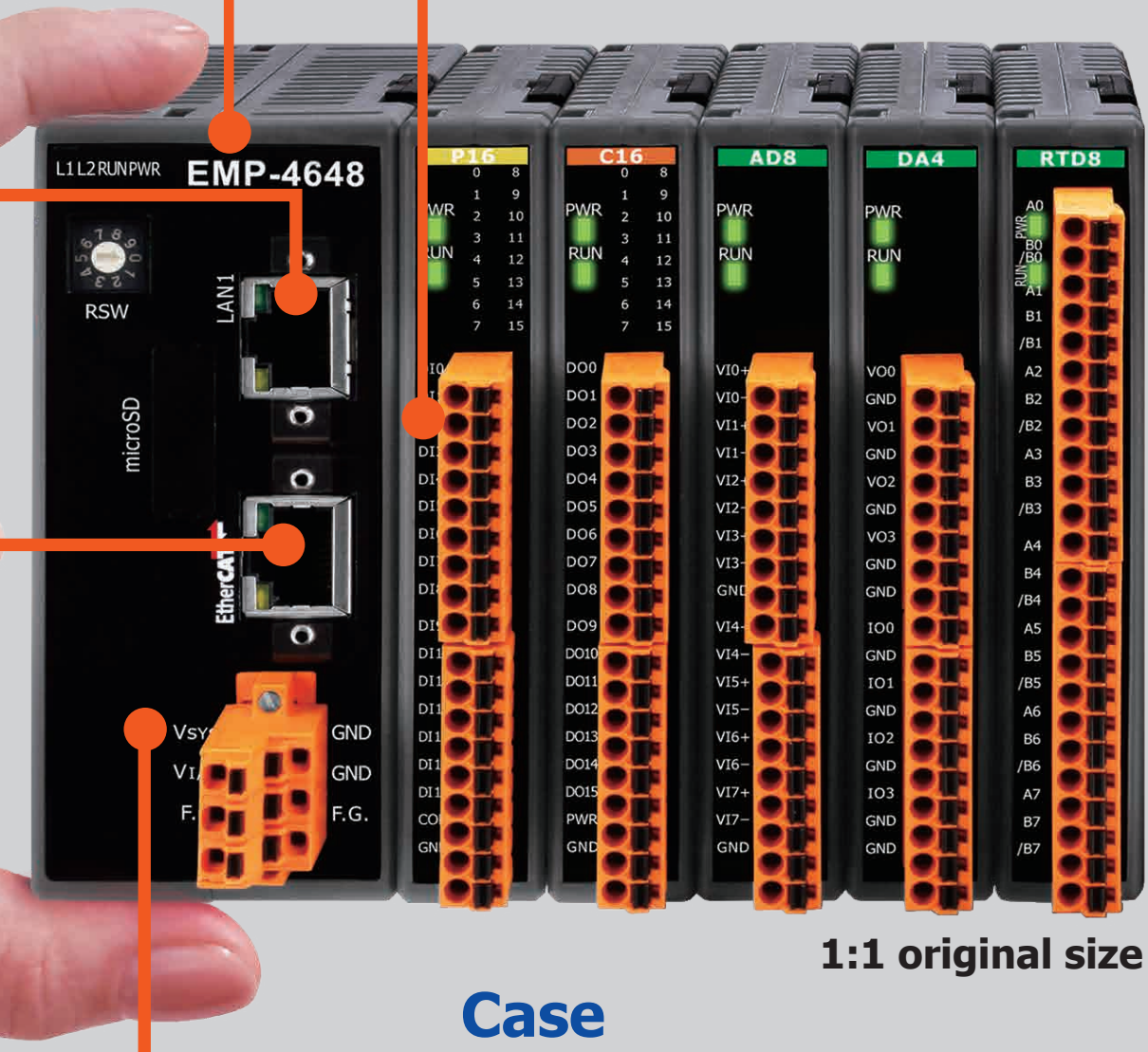
- **Servos**
- **Robot Arm**
- **Distributed I/O**
- **Inverters**
- **Vision systems**
- **Sensors**

Hardware Design

- High-performance quad-core Cortex-A53 processor
- Built-in microSD Card slots
- Built-in memory of up to 2GB
- Built-in FLASH memory of up to 8GB (eMMC)

Local Expansion

EtherCAT Slim Expansion Modules EC4 Series



1:1 original size

Case

W x L x H (mm): 43 x 108 x 73

Ultra-compact size, can be mounted on DIN-Rail

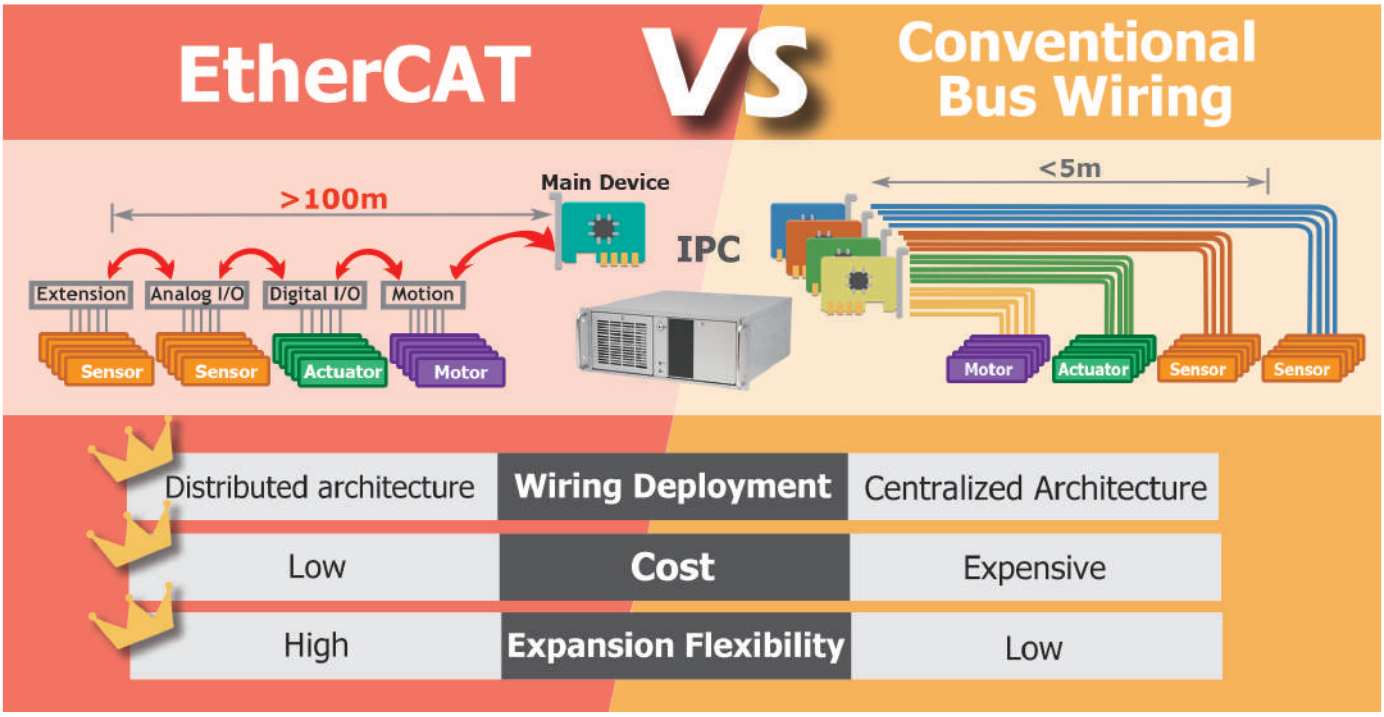
Table of Contents

CH1 Technology

1-1 Why Choose EtherCAT ?

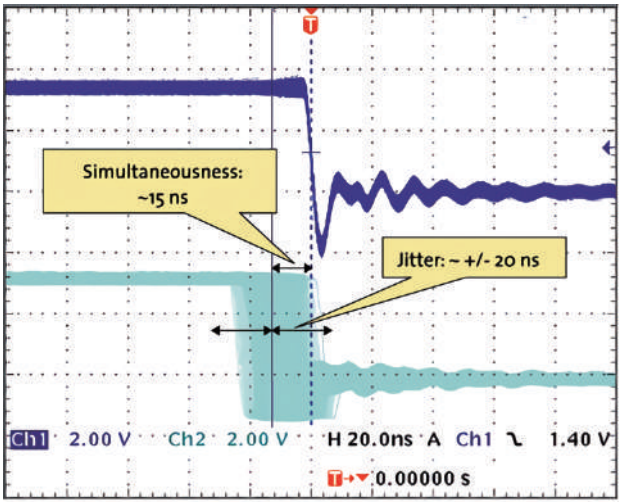
As time progresses, the system architecture of automation equipment has gradually changed from conventional centralized control (that is, using plug-in cards for expansion) to distributed control. EtherCAT communication technology features the advantages of "openness, high synchronization, good real-time performance, low hardware cost, and easy deployment", and has become an important part of the IEC international standard, and has been adopted by manufacturers of major automation systems and equipment.

EtherCAT v.s. Conventional Bus Wiring



EtherCAT Distributed Clock Synchronization

The distributed clock (DC) in EtherCAT devices synchronizes all devices to the same system time, enabling synchronous execution with less than 1μs jitter. The DC function in SubDevices can also control interrupts or trigger digital I/O, which is crucial for 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 an Ethernet-based industrial communication bus that has become a mainstream solution in industrial automation due to its high-speed performance, precision, and cost-effectiveness.

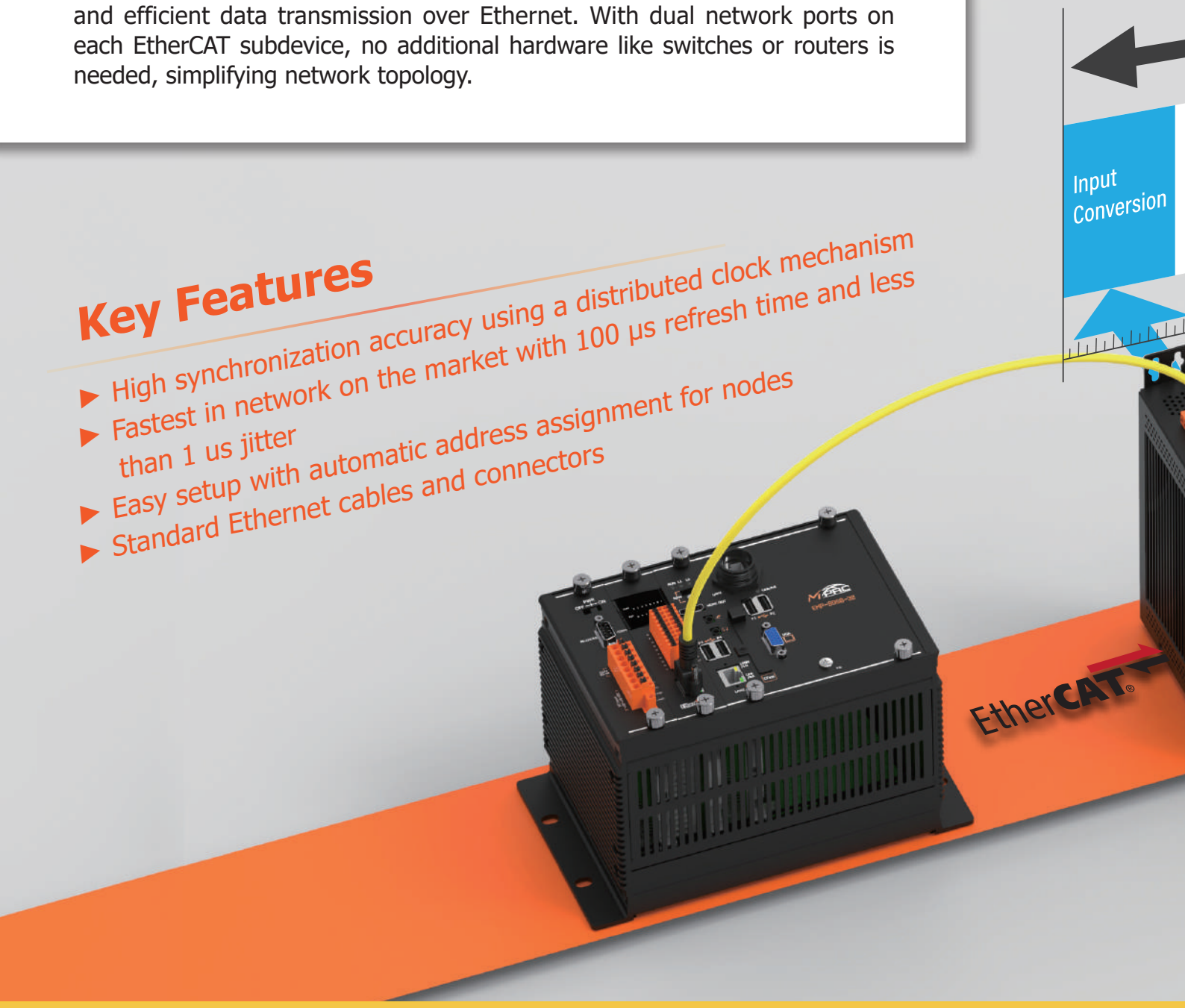
ICP DAS's EtherCAT solutions support all main device functions, enabling millisecond updates for multiple subdevices, including motion control for up to 64 axes. They offer comprehensive control of single-axis and multi-group motions, and the optional IEC 61131 Soft PLC function simplifies the integration of various EtherCAT subdevices.

1-2 EtherCAT Features

EtherCAT is the fastest industrial network for machine automation, connecting to I/O, motors, encoders, sensors, and more. It enables high-speed, reliable, and efficient data transmission over Ethernet. With dual network ports on each EtherCAT subdevice, no additional hardware like switches or routers is needed, simplifying 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

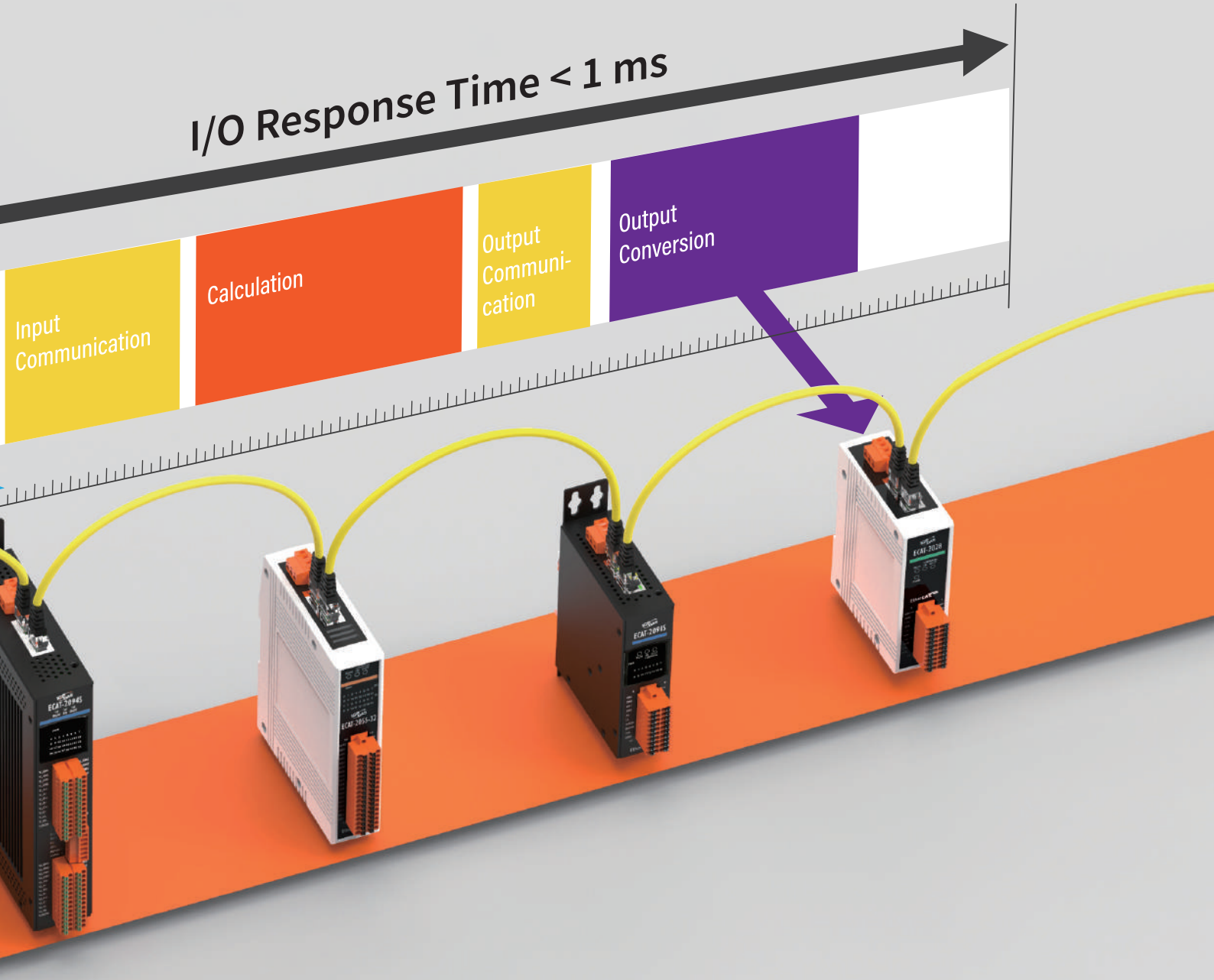
The optimized EtherCAT data is included in the IEEE 802.3 Ethernet frame. The frame travels through the media at 100 Mbps in full-duplex mode.

Flexible Topologies

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

Distributed Clocks

The EtherCAT node SubDevice measures the time difference between incoming and returning frame - timestamp-. With these timestamps the MainDevice can determine the propagation delay offset to the individual subdevice 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 subdevices extract and/or insert data on the fly. This method assures the highest possible throughput.

1-3 ICP DAS EtherCAT Solution Guide

ICP DAS provides a comprehensive range of EtherCAT products, including Main Device cards, motion controllers, and various SubDevice like I/Os, junctions, converters, gateways, and motion control modules. Optimizing real-time performance with these components reduces system load, enhances control efficiency and accuracy, and boosts production quality.

Real-time & Reliability

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

Compatibility

- Supports 3rd Main Device and SubDevice
- 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

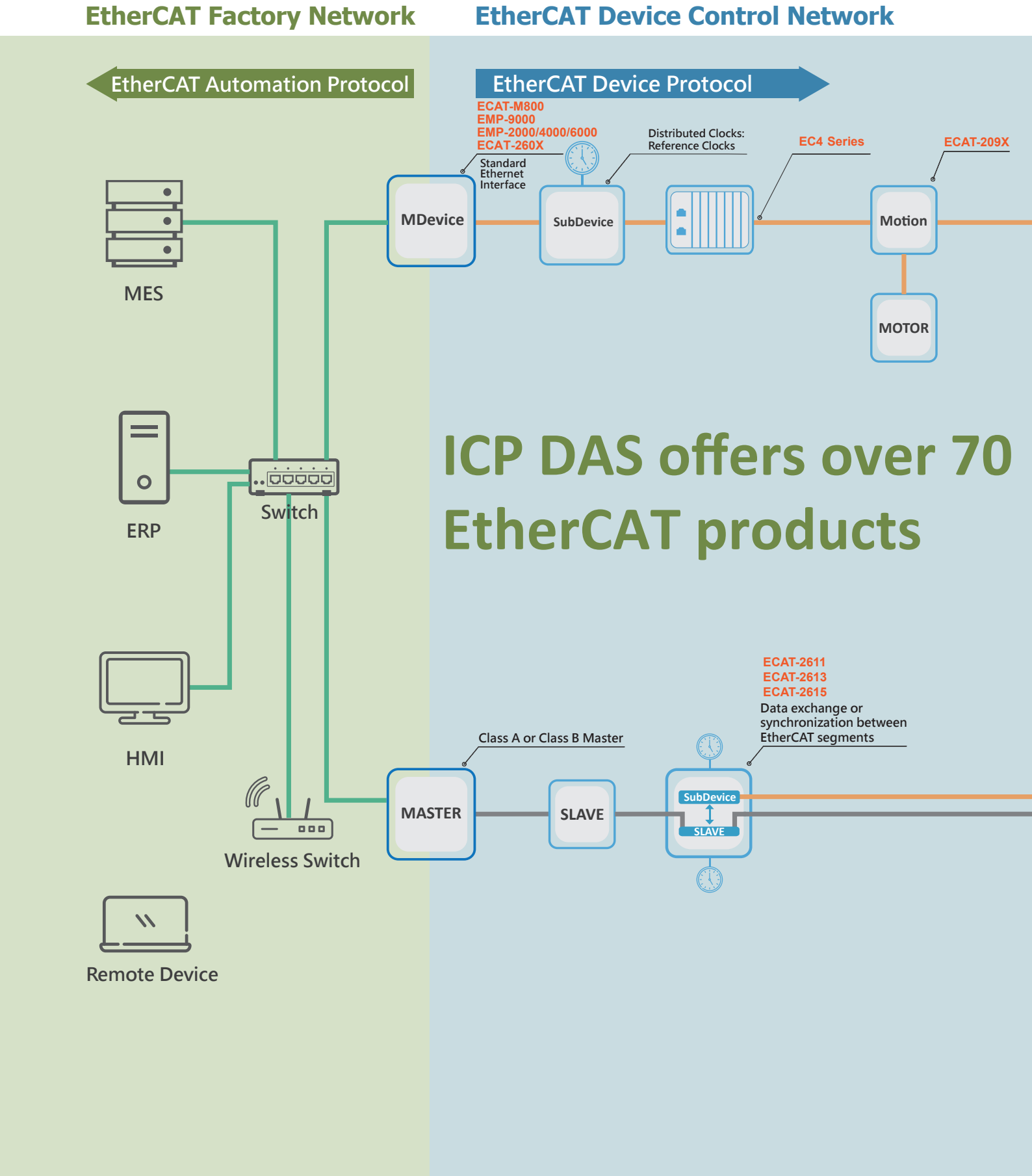
Ease of development

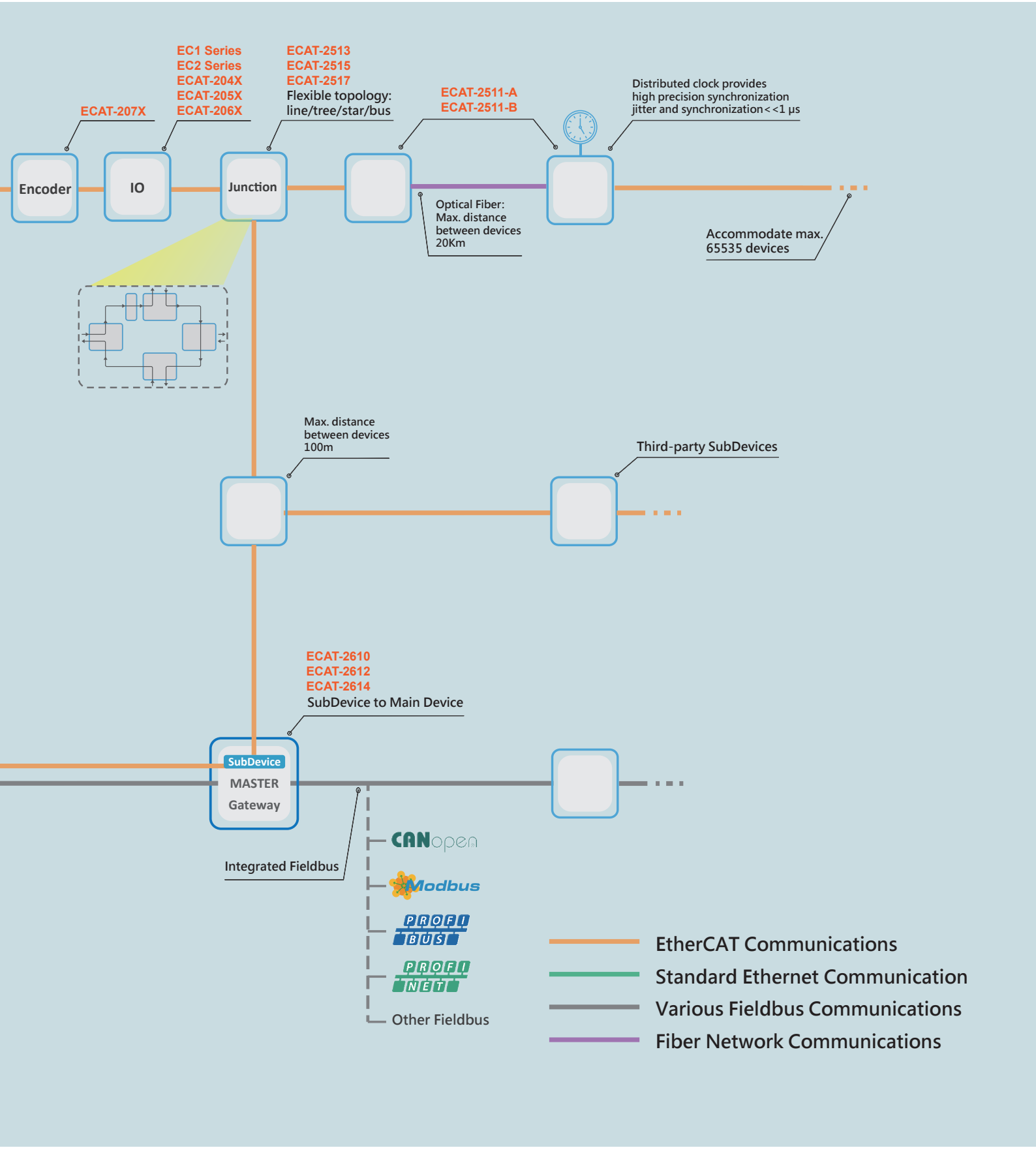
All ICP DAS MainDevice products come with an easy-to-use C language library compatible with most programming tools, allowing users to quickly reduce development time by simply calling the relevant API functions.

Compatible with a wide variety of third-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

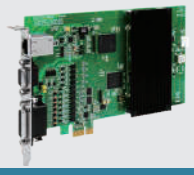


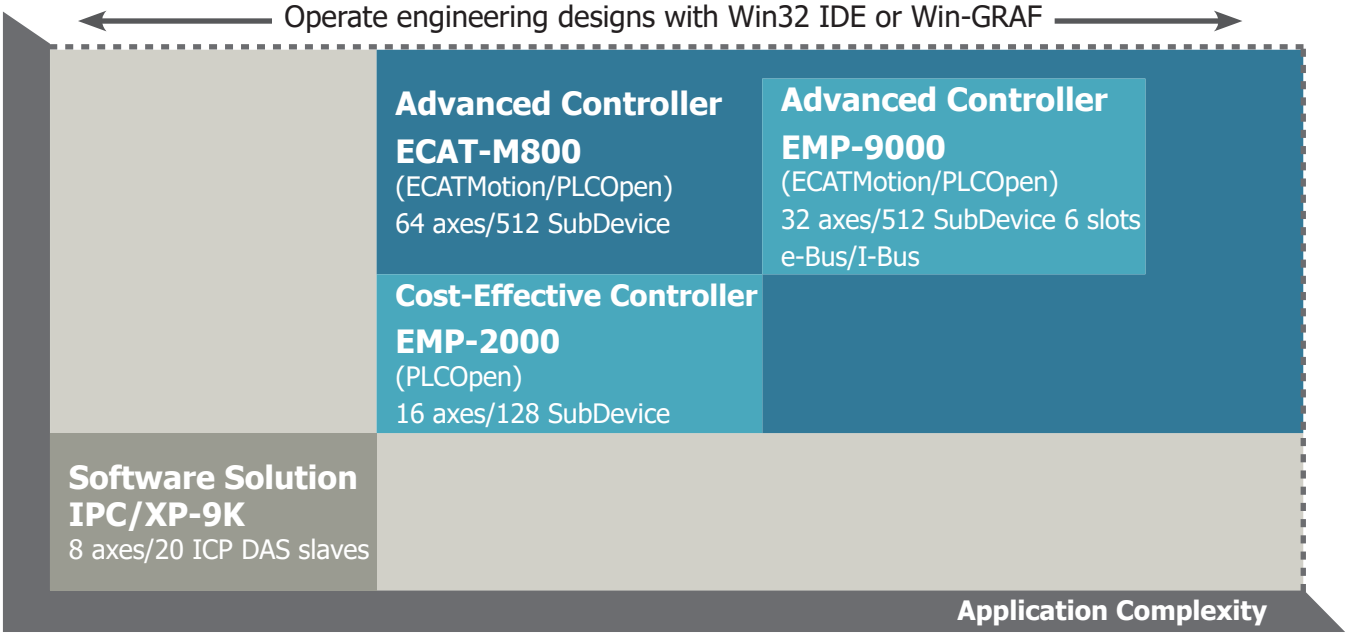

EC1 Series
EC2 Series
ECAT-204X
ECAT-205X
ECAT-206X
ECAT-207X
ECAT-2513
ECAT-2515
ECAT-2517
Flexible topology:
line/tree/star/bus
ECAT-2511-A
ECAT-2511-B
Distributed clock provides
high precision synchronization
jitter and synchronization < <1 µs
Encoder
IO
Junction
Optical Fiber:
Max. distance
between devices
20Km
Accommodate max.
65535 devices
Max. distance
between devices
100m
Third-party SubDevices
ECAT-2610
ECAT-2612
ECAT-2614
SubDevice to Main Device
SubDevice
MASTER
Gateway
Integrated Fieldbus
CANopen
Modbus
PROFIBUS
PROFINET
Other Fieldbus
EtherCAT Communications
Standard Ethernet Communication
Various Fieldbus Communications
Fiber Network Communications

CH2
Main Device

2-1 EtherCAT Motion Control Main Device Overview

ICP DAS provides high-performance Motion Control, Combining Independent Hardware and Real-Time Algorithm Technology. Supports point-to-point, interpolation, semiconductor management, and robot control applications. Our controllers are compatible with third-party EtherCAT MainDevice and slaves, ensuring high precision, high speed, and synchronized control. Enhances application performance and shortens development cycles. We also provide custom motion control and expert support to lead in EtherCAT solutions.

	PC-Based Solution	Motion Controller Solution	Smart Solution	Software Solution
Product Image				
Product	ECAT-M800 Series	EMP-2000/4000/6000/9000 Series	EMP-2601	ECATDAQ
Type	EtherCAT PCIe MainDevice Card	PACs/Soft PLC EtherCAT Motion Controller	Industrial IOT Accelerator	Software MainDevice
Features	Supports up to 64 axes, integrated API function, and a built-in compare trigger.	Provide IEC 61131-3 for integrating Win-GRAF Soft PLC with EtherCAT solutions.	Built-in Web interface and rule engine for easy setup without programming.	Uses standard network interface, no dedicated hardware required for basic motion and I/O control.
Benefits	I/O control and high-precision motion.	To facilitate the integration of various IoT applications, an open platform and a standard interface are provided.	Flexible and reliable data transmission, supports third-party EtherCAT devices, improves system openness and efficiency.	Cost-effective, highly flexible, easy to expand.
Advantages	Easy integration, reduces development time, and overall system complexity.	Compact size, improved equipment intelligence & stability, and maintenance efficiency.	Integrates EtherCAT motion control with cloud systems, enhancing automation and flexibility.	Easy to install, deploy remotely, and suitable for testing.



ICP DAS offers a variety of controllers to meet diverse automation needs. The new generation of EtherCAT motion controllers—available in Cost-Effective, Advanced, and Premium models—stands out in the market for its scalability, stability, and high performance.

EtherCAT Motion Control MainDevice Selection Guide

Product Image								
Series		**ECAT-M800**	**EMP-9000**	**EMP-2848M**	**EMP-4648**	**EMP-6648**	**ECAT-2601**	**ECATDAQ**
Type		Pcle Comm. card	PACs / Soft PLCs Controllers	Soft PLC Controller	Ultra-compact Soft PLC Controller	Compact Soft PLC Controller	Gateway	Software
EtherCAT Comm. Unit		Quad Core Cortex A53, 1.6GHz (EMP-9000 built-in CPU INTEL 3/5 8th Gen)			Quad Core Cortex A53, 1.4GHz		x86, 200MHz	-
EtherCAT Interface		RJ-45						PC's built-in network card
Expansion Interface	**EtherCAT I/O**	-			Support EC4 Series	Support EC6 Series	-	
	PAC I/O	-	Support 2/6 slot e-9K, I-9K, I-87K and other expansion modules Module	-				
Cycle Time (Max.)		0.5ms					0.125ms	20ms
No. of Axes		8/16/32/64	16/32	16			Depends on the amount of data	8 (Support third party CiA402 motor)
Slave Stations		512	512	128			Depends on the amount of data	20 (Only support ICP DAS slave station)
Motion Control		• Support CiA-402 Driver • PLCopen • Multi-axis Linear/Circular Interpolation/Continuous Interpolation/Helical Interpolation • Reset Position/Speed in Motion • T/S Curve		• Support CiA-402 Driver • PLCopen • Real-Time • Single-axis Motion Control • T/S Curve			Depends on the host	• Single-axis Motion Control • Support CiA-402 Driver • Reset Position/ Speed in Motion
Sync Mode		Free Run/SM/DC						Free Run
Platform		Win/Linux	Win10	Standalone			Win/Linux	Win
Programming Languages		Provide a cross-language common DLL library		-			Provide a cross-language common DLL library	Provide a cross-language common DLL library
SoftPLC		IEC 61131-3 Standard (IL/LD/FBD/ST/SFC)					-	-
Real-time		Linux (Preempt-RT)					MiniOS7+	-
Dimensions (W × L × D)		135 x 192 x 21.5	239x164x133 300x164x133 422x164x133	42 x 164 x 129	43 x 108 x 73	25 x 120 x 90	31 x 157x119	-

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

- 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

ICP DAS Slave Axes / Station Usage List

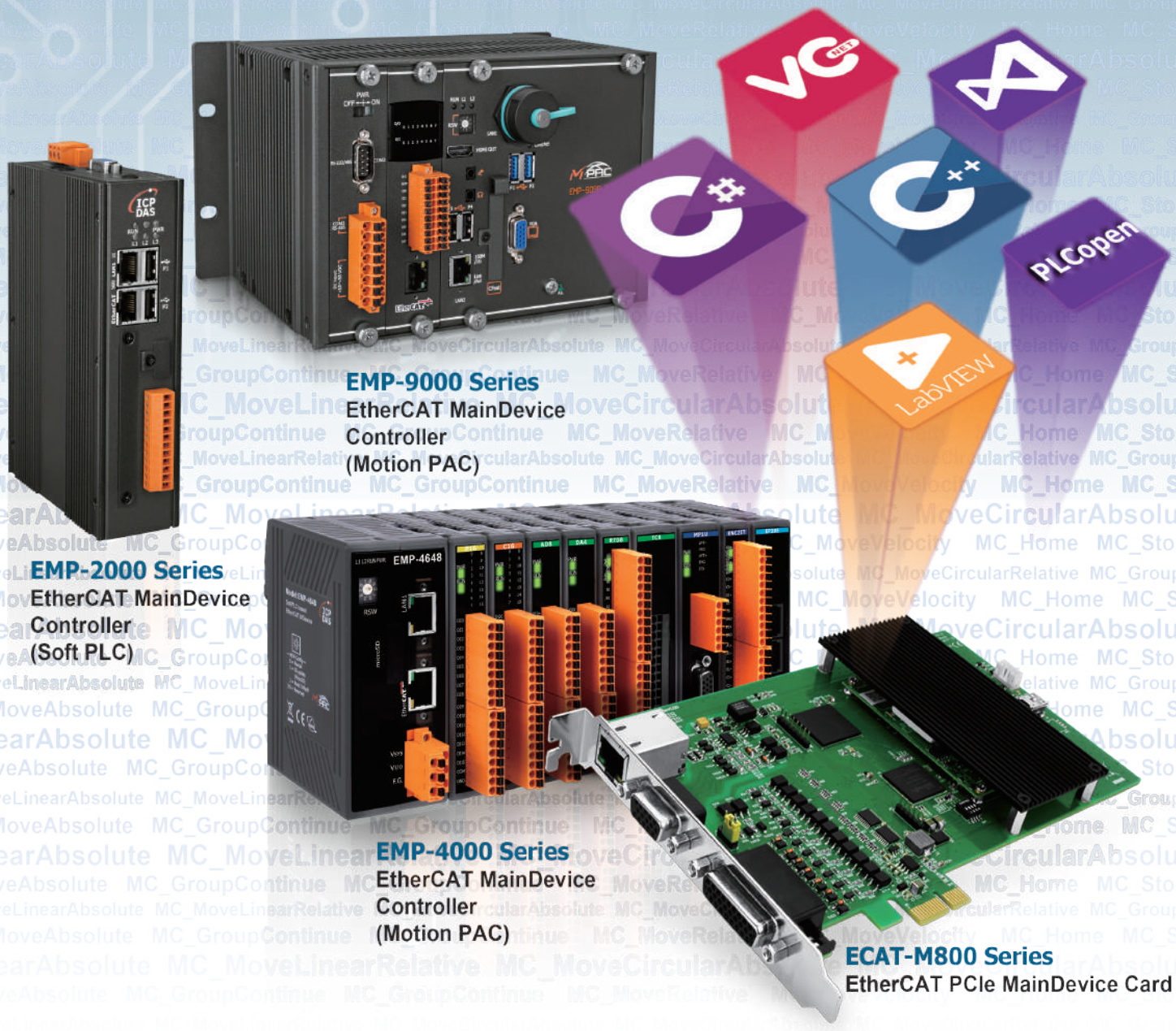
Module	Axes	Station
ECAT-2094 Series	4	1
ECAT-2091 Series	1	1
ECAT-2513	0	2
ECAT-2515	0	4
ECAT-2517	0	5
ICP DAS I/O Modules	0	1

Common Motion Control Commands List

Module	EMP-9000	ECAT-M800	ECAT-4000	ECAT-2000	ECAT-6000	ECATDAQ
Single Axis Motion Control	V	V	V	V	V	V
T Curve	V	V	V	V	V	-
S Curve	V	V	-	-	-	-
Linear Interpolation	V	V	-	-	-	-
Circular Interpolation	V	V	-	-	-	-
3D Circular/Helical	V	V	-	-	-	-
Continuous Compare	V	V	-	-	-	-
Electronic Gearing	V	V	V	V	V	-
Electronic cams	V	V	-	-	-	-
Position/Speed Reset	V	V	V	V	V	V
Compare Trigger	V	V	V ※Requires an encoder module			-
Position Limit	V	V	V ※Requires a motor that supports the position limit function.			-
PP Mode	V	V	-	-	-	V

2-2 EtherCAT Development Environment

ICP DAS provides standard Windows API and Win-GRAF Workbench to support the development of automatic control applications in a variety of programming languages. All ICP DAS EtherCAT MainDevice and slave devices, including third-party slave devices, can be configured and tested by using the 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 adjustment on PLC development platforms that share a variable database. The Win-GRAF environment enables developers to directly access all system elements, eliminating the traditional data synchronization bottleneck commonly encountered in programming environments.



EMP-9000 Series
EtherCAT MainDevice Controller (Motion PAC)

EMP-2000 Series
EtherCAT MainDevice Controller (Soft PLC)

EMP-4000 Series
EtherCAT MainDevice Controller (Motion PAC)

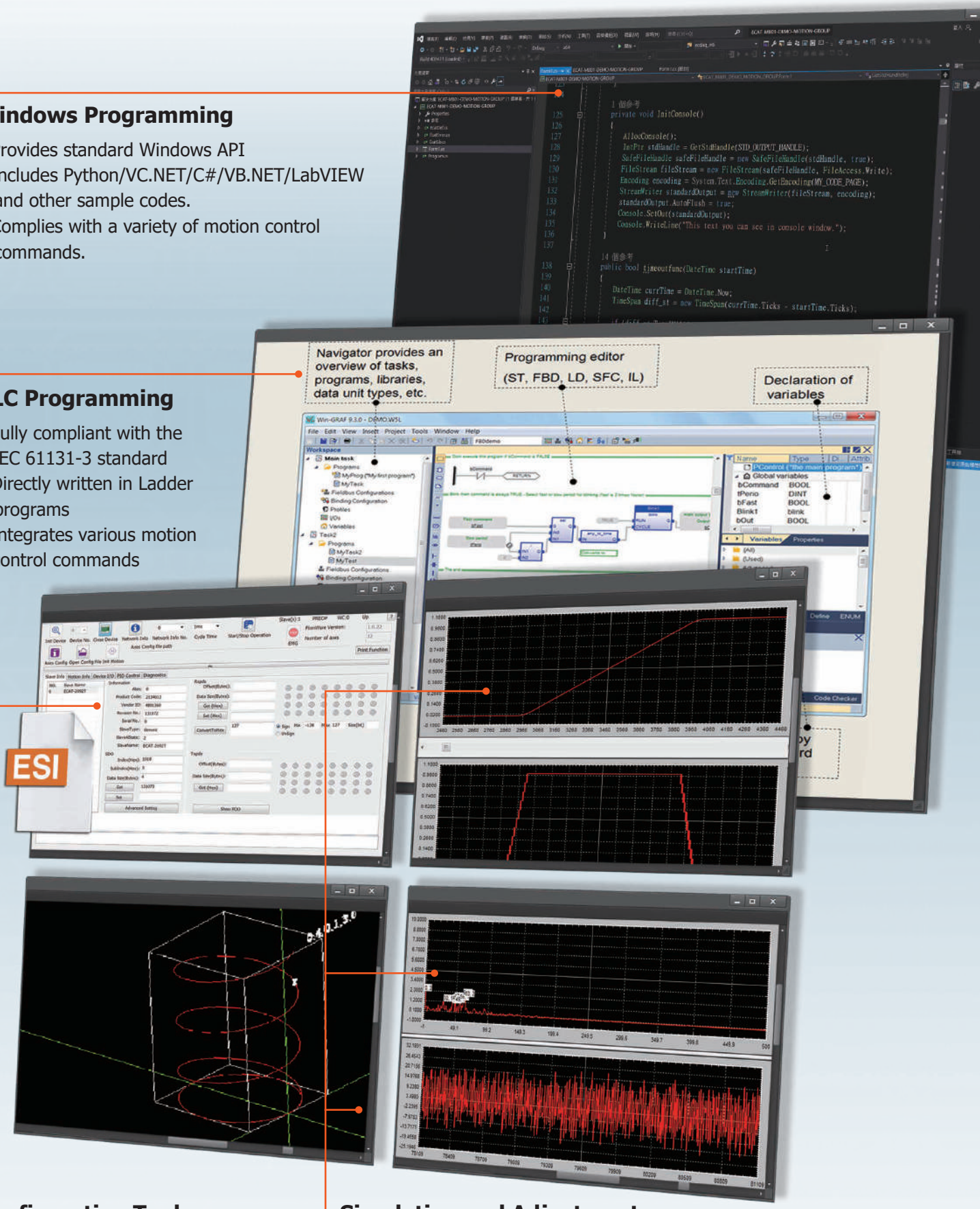
ECAT-M800 Series
EtherCAT PCIe MainDevice Card

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 SubDevice topologies
- Configures EtherCAT SubDevice settings
- Configures EtherCAT Servo settings

Simulation and Adjustment

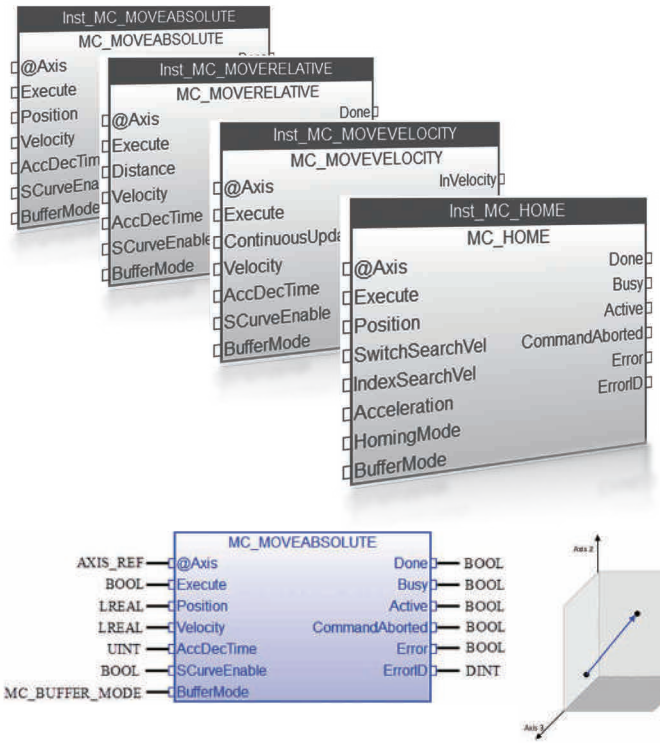
- Simulate an analog signal on a waveform diagram
- Simulate a digital signal on the LED object
- Simulate and adjust the motion path and diagram for motion control commands

Win-GRAF PLCopen Library

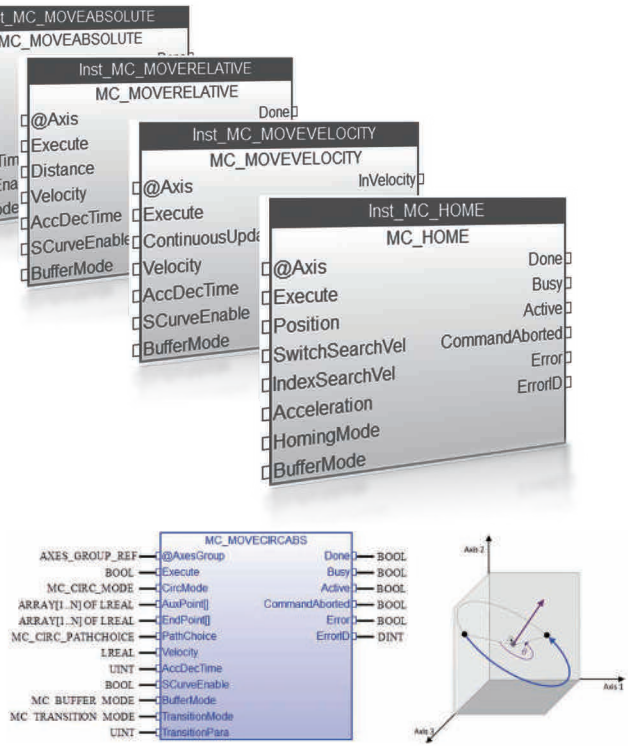
- Supports up to 32 axes
- The built-in real-time operating system's high-performance motion engine ensures consistent performance

Supports EtherCAT servos and stepper motors with CiA402 drive configuration

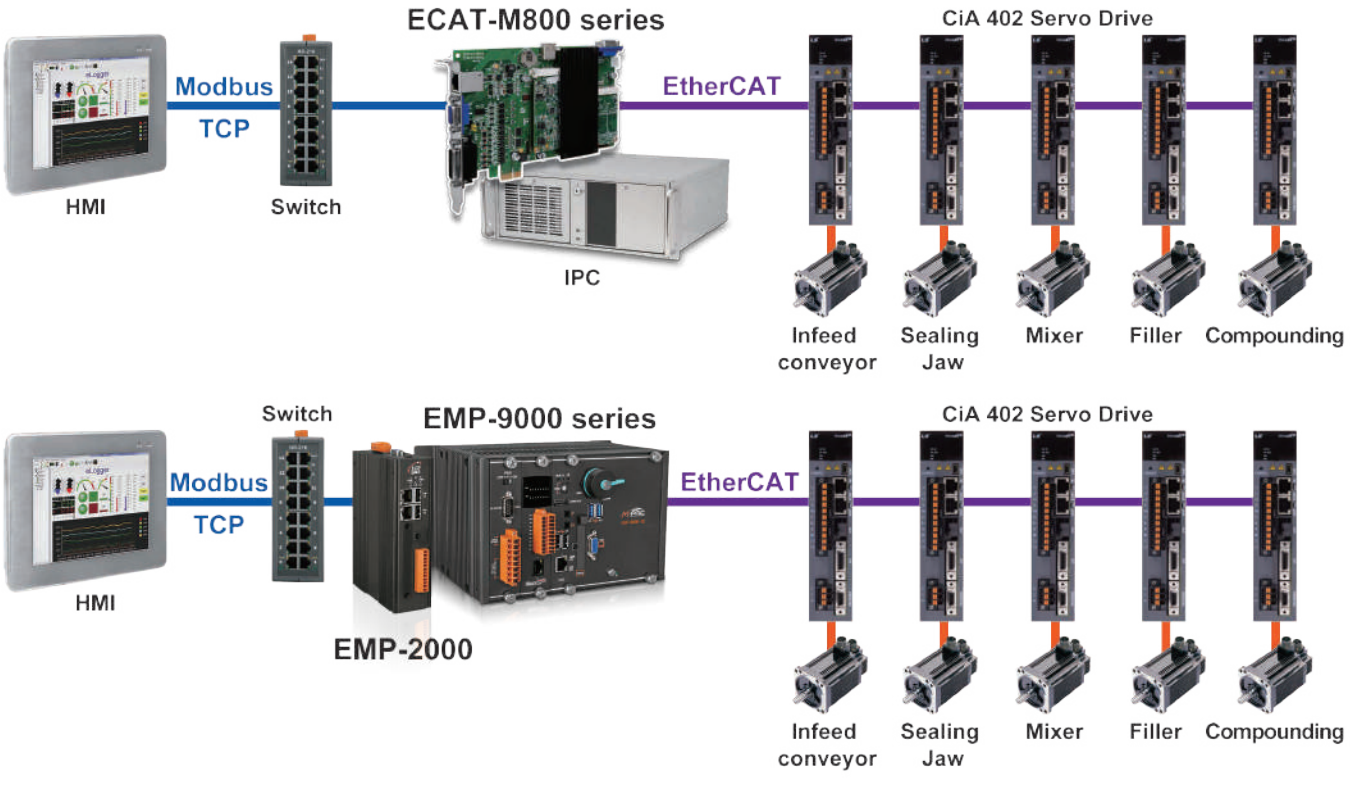
- Supports Cyclic Synchronous Position (CSP) and Cyclic Synchronous Velocity (CSV) modes The synchronization cycle time can be customized
- Once the axis is added to the configuration,the axis position is automatically mapped to PDO



▲The Straight Path



▲The Arc Path



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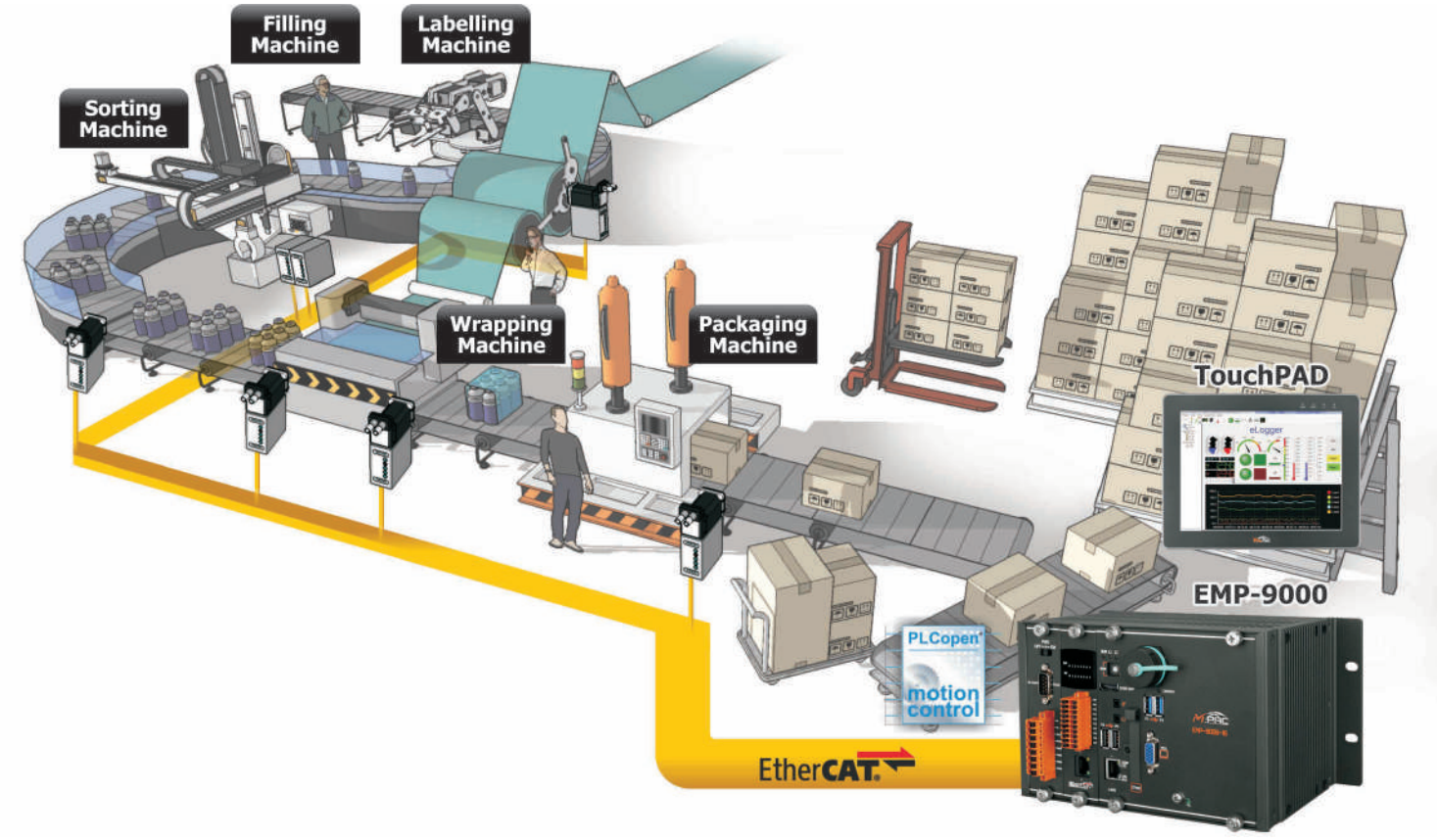
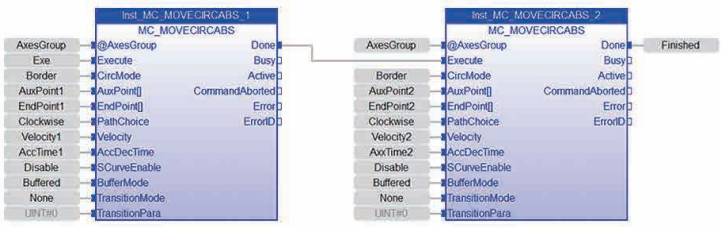


Applications of Motion Control



★ 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

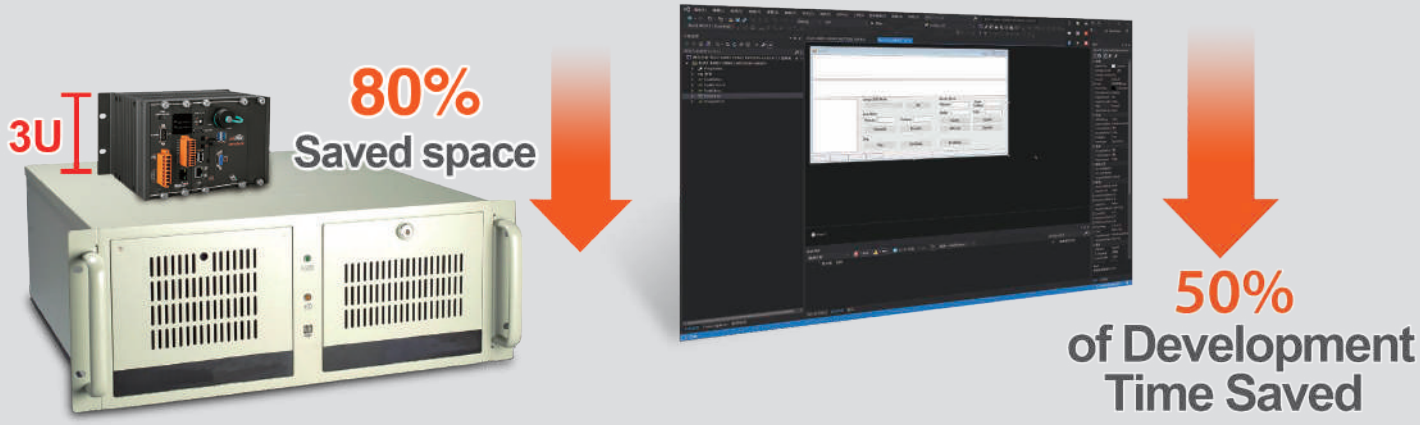
★ Robot Control

- 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 32 servo axes and 512 slave nodes simultaneously. The motion functions include 32-axis individual motion, 3D linear interpolation, 3D circular interpolation, multi-axis synchronous movement, follow-up movement, and electronic cams.

ICP DAS EMP-9_



3U Rack-mount Case

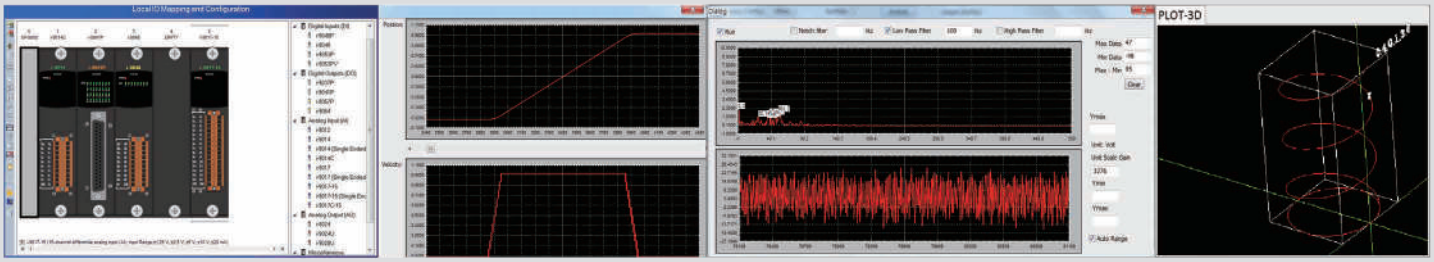
- Can be installed on a 3U cabinet
- Expandable e-9K/I-9K/97K I/O modules
- x86 architecture CPU
- Efficient anti-interference metal outer case

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

Get Started Quickly without Prior EtherCAT Knowledge

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



Dedicated CPU for EtherCAT motion control

Supports EtherCAT communication retention technology, which maintains EtherCAT communication stability when the OS system or program crashes, so that process recipes will not be interrupted.

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

Easy Configuration Program

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

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 adjus program
- Stewart Platform

Exclusive

- **Efficient 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
0/2/6

CPU
5: i5-8365UE
9: E3950

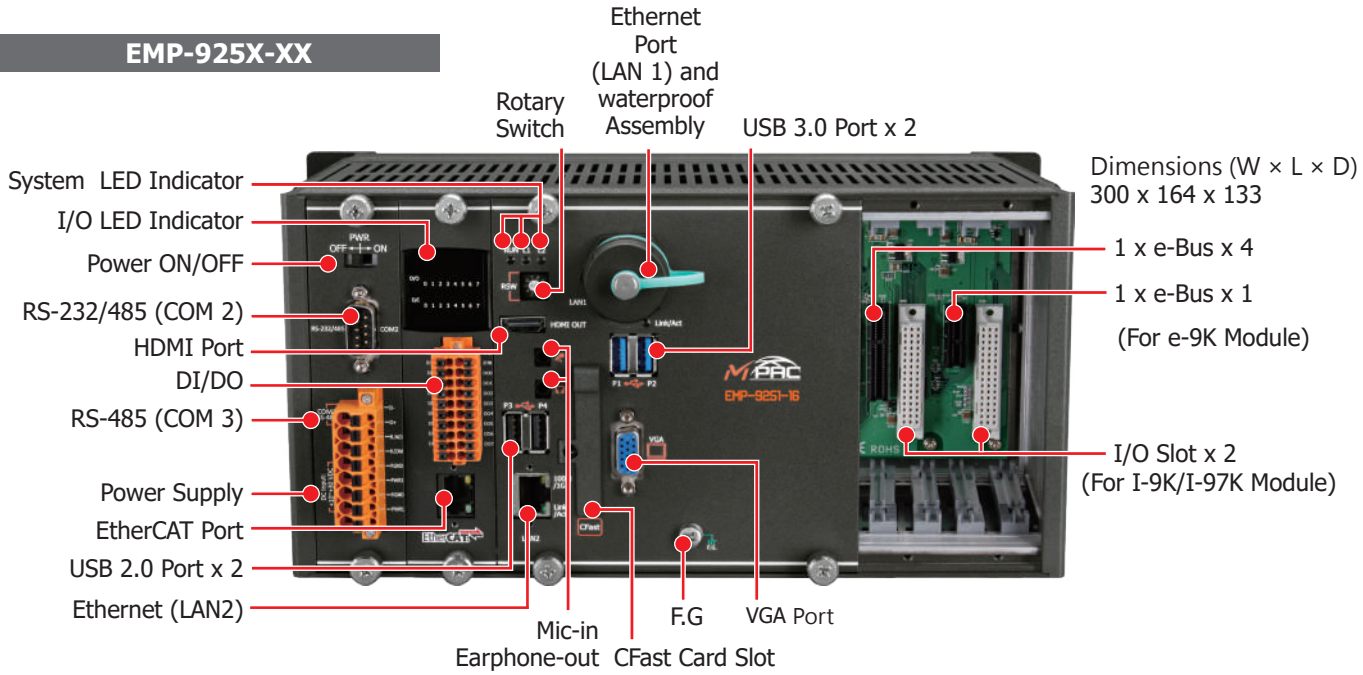
Version
1: Standard
8: Win-GRAF

Number of axes
16: 16 axes
32: 32 axes

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

Dimensions (W × L × D)
239 x 164 x 133

EMP-925X-XX



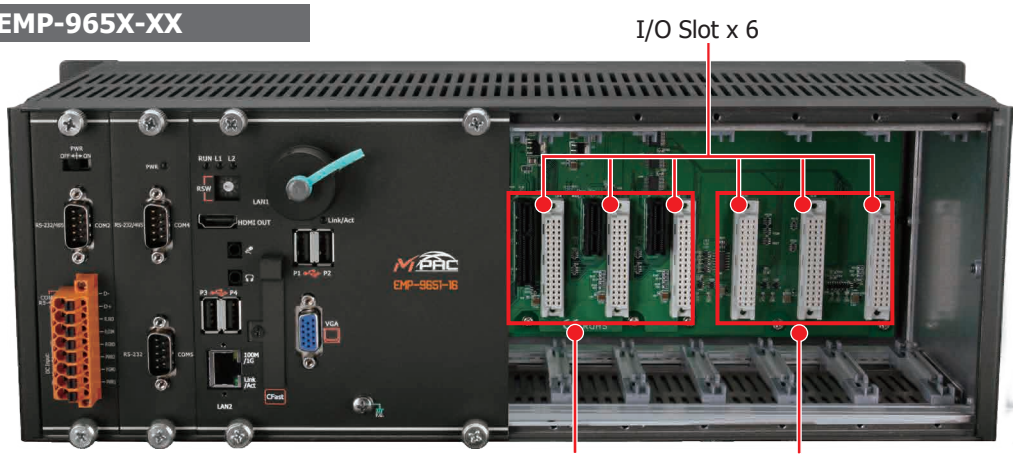
Dimensions (W × L × D)
300 x 164 x 133

1 x e-Bus x 4

1 x e-Bus x 1
(For e-9K Module)

I/O Slot x 2
(For I-9K/I-97K Module)

EMP-965X-XX



Dimensions (W × L × D)
422 x 164 x 133

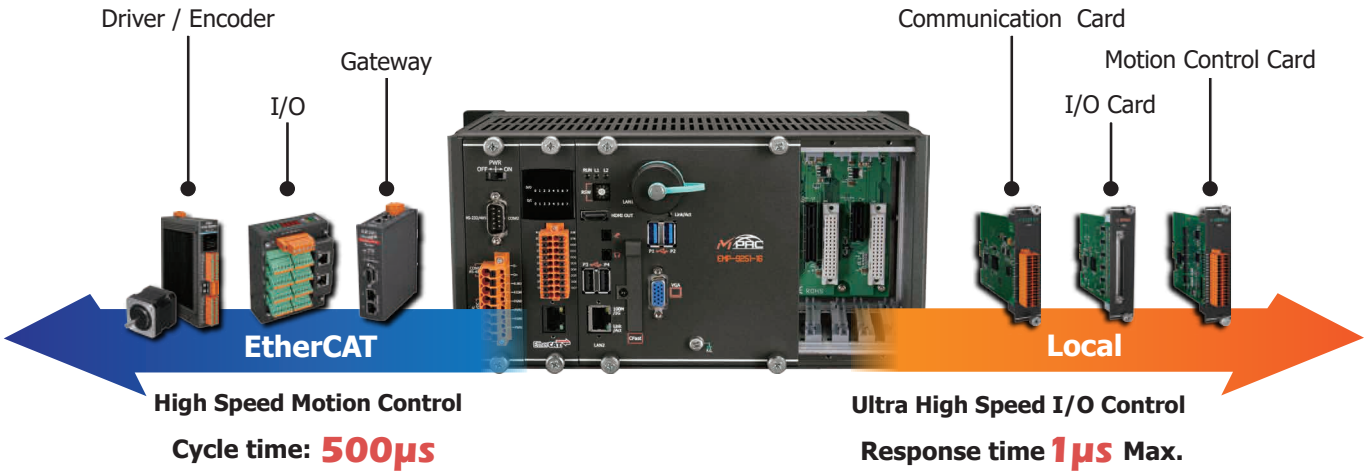
+886-3-597-3366 info@icpdas.com / sales2@icpdas.com

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 SubDevice	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)

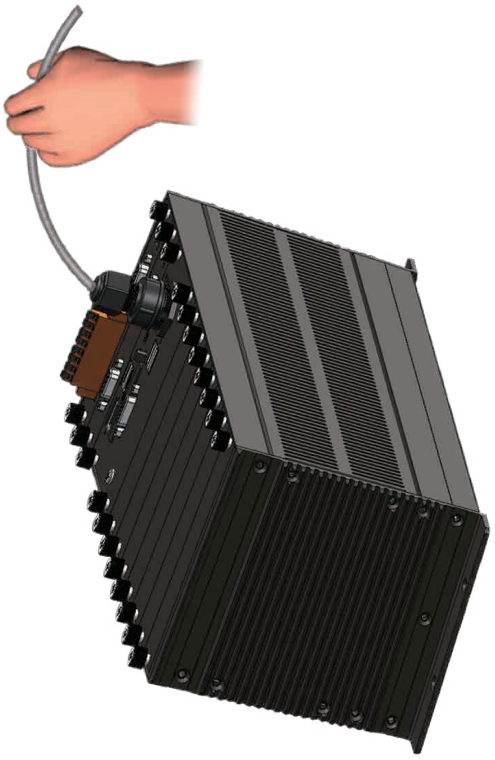
Model	CPU	RAM	e-Bus/I-Bus Expansion Slot (Shared)	Cycle Time	EtherCAT SubDevice	Motion Axes
EMP-9058-32	i5-8365UE (1.6 ~ 4.1 GHz, 4C8T)	16 GB	-	0.5/1/2/4/8 ms	512	32
EMP-9058-16						16
EMP-9258-32			2			32
EMP-9258-16						16
EMP-9658-32			6			32
EMP-9658-16						16
EMP-9098-32	E3950 (1.6 ~ 2.0 GHz,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



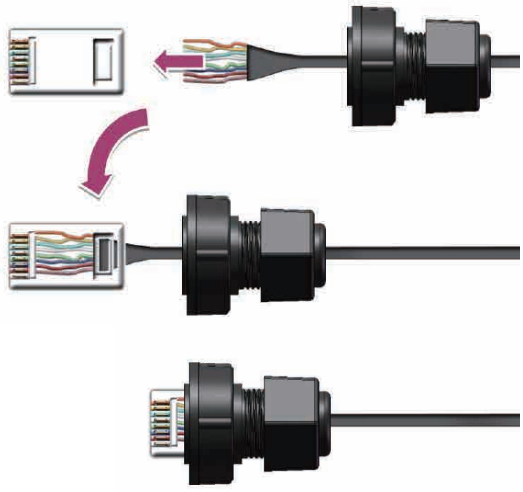
- **Secured RJ45 connector**

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

▲Regular Ethernet Cable

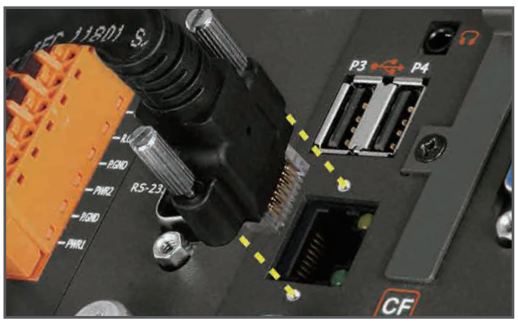
▲Secured RJ45 Connector Kit

▲Waterproof Connector Kit



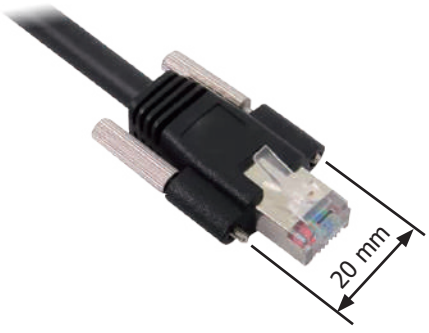
- **RJ45 Screw-lockable Connectors**

  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

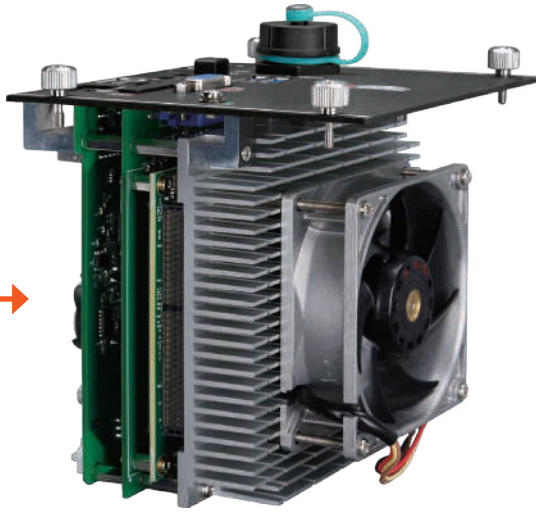


▲ Ethernet Cable with a Screw-on Lock

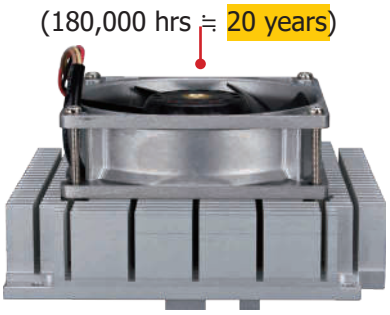
High-Efficiency Heat Dissipation CPU

● Design of CPU Heat Dissipation

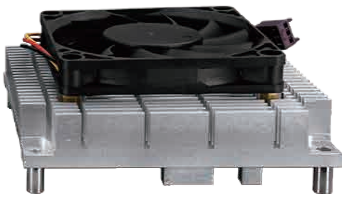
The temperature of the entire CPU can be reduced by another 10°C with larger heat sinks and fans, extending the service life of electronic components.
The fan has been specially selected for the long-life type, with a lifespan of 180,000 hours (about 20 years).



▲ CPU with Long-life Heat Dissipation



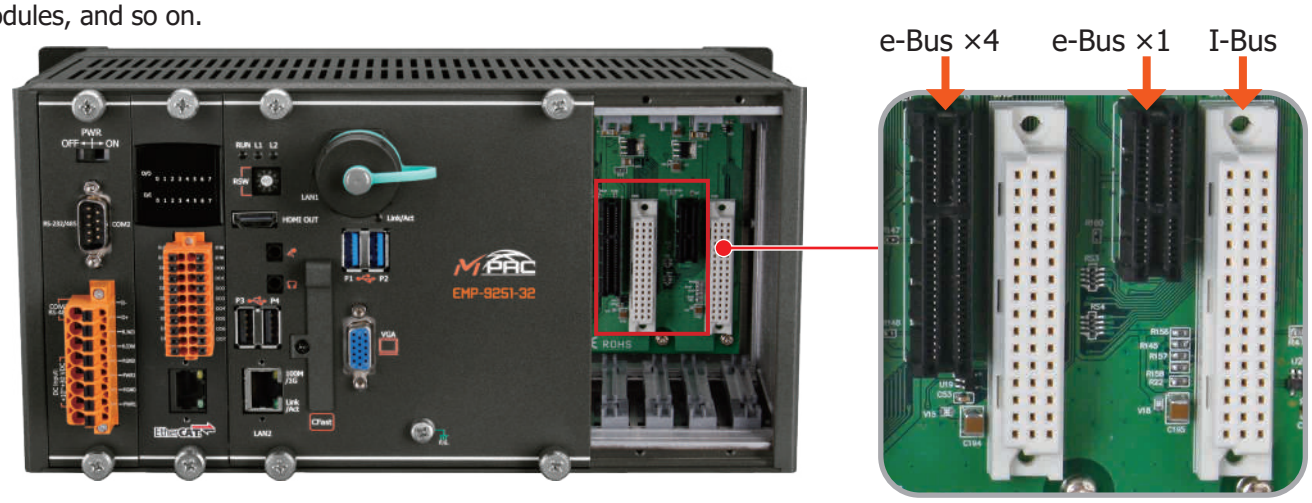
▲ Long Life Design



▲ Regular Design

Expandable I/O Slot Design

The EMP-9000 series offers a variety of I/O expansion options. Users 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, and digital input/output modules, encoder input modules, and so on.

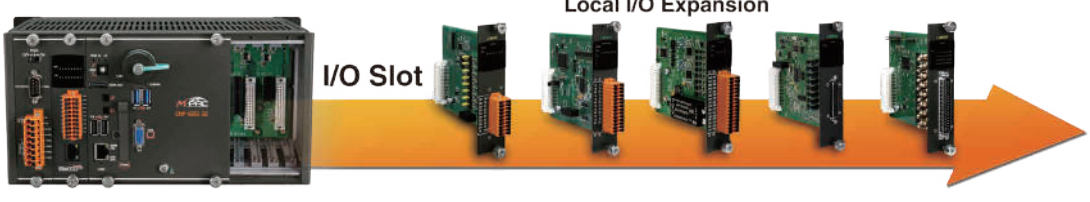


I/O Module's Communication Interface

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

- 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.
- 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

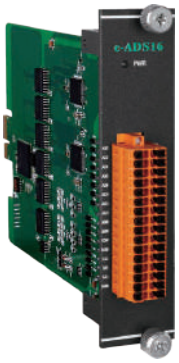
● e-9K Series , DAQ Modules (e Bus)

Model	e-Bus	Description
e-LCell4	e-Bus x1	High-speed LoadCell (24-bit, 15KHz) module , 4-channel, Terminal Block
e-A16SH	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

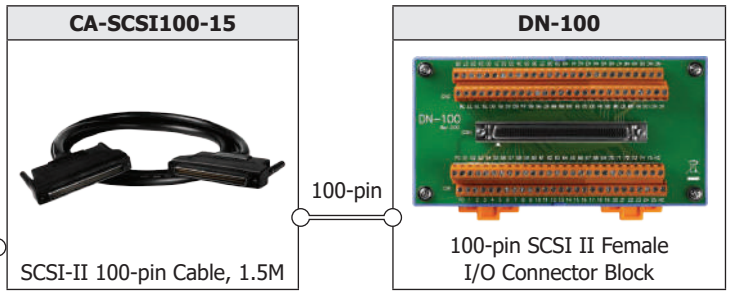
e-Bus, 200 kS/s, 16 Channels and 16 bits High-speed Analog Input Card

- 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



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
- 2 ports 10/100/1000 Mbps Ethernet
- Supports PoE power management and monitoring
- Supports PoE Camera

e-USB404

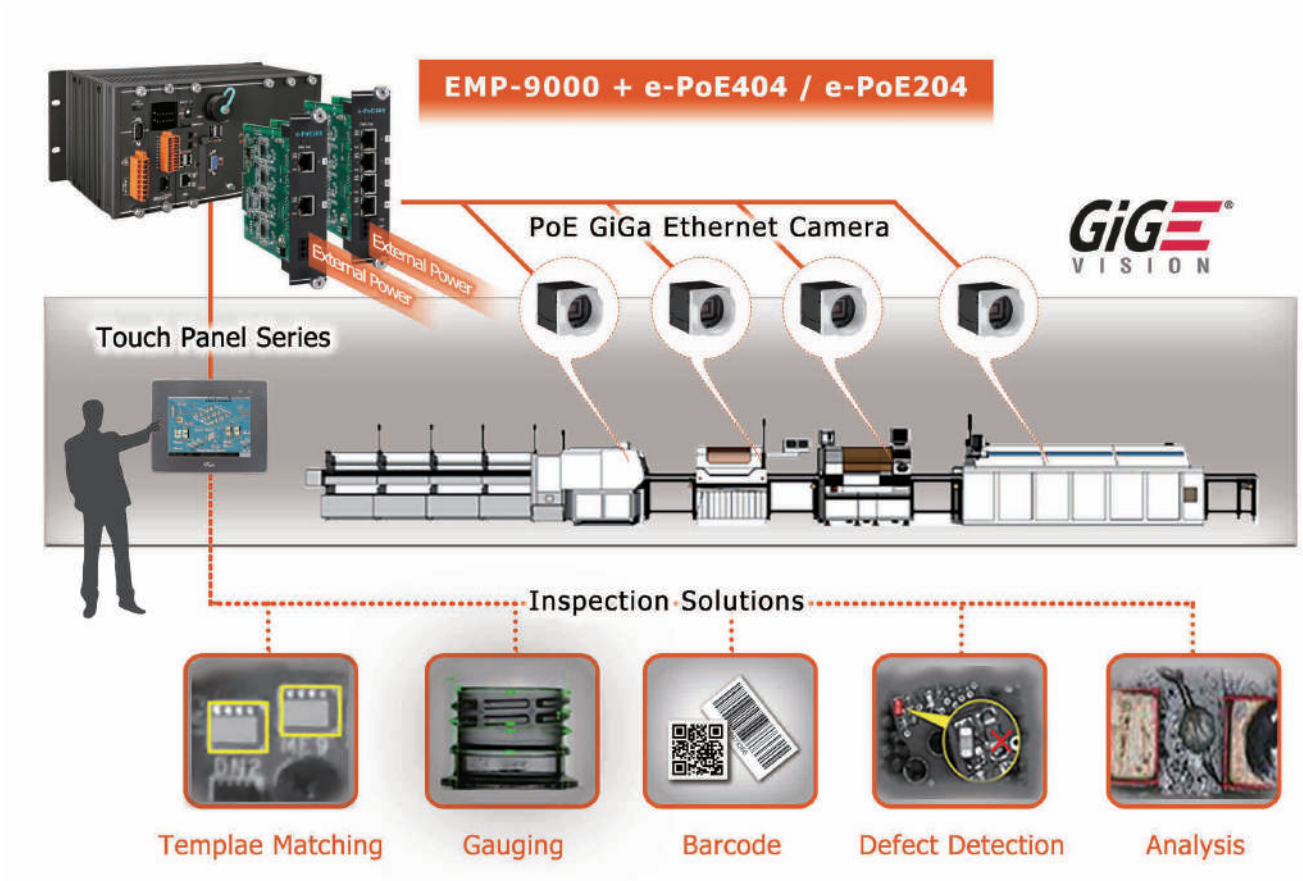
e-Bus, 4-port USB Expansion Module

- 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

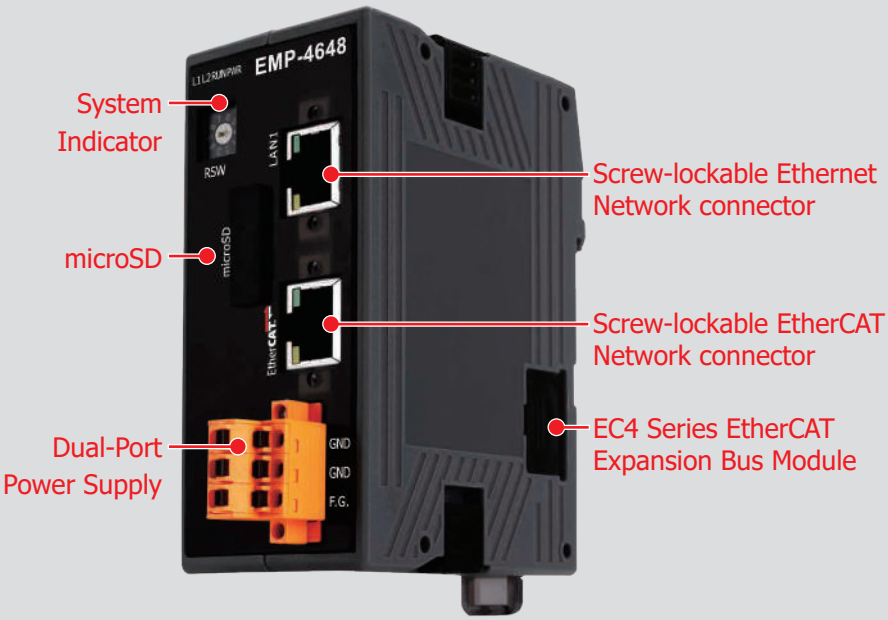
- e-Bus x4
- Supports IEEE 802.3at PoE
- 4 ports 10/100/1000 Mbps Ethernet
- Supports PoE power management and monitoring
- Supports PoE Camera



2-4 EMP-4648 EtherCAT Ultra-compact Motion Controller (Soft PLC Based)

The EMP-4648 is a high-performance, Ultra-compact EtherCAT maindevice controller that is palm-sized and suitable for embedding in a wide range of automation equipment. The built-in WinGRAF Soft PLC supports IEC 61131-3 standard programming and can accurately control up to 16 axes and 128 EtherCAT slaves for efficient real-time control. Through E-BUS expansion, it can be used with ICP DAS EC4 series slim modules to flexibly expand I/O functions. Suitable for machine automation, smart manufacturing, and production line control, providing real-time and stable industrial solutions.

ICP DAS EMP-4648



Features

Compact size

Ultra-compact design with a minimal footprint. Only 43x108x73mm

Ultra High Speed

Equipped with an ICP DAS EtherCAT real-time control engine. The cycle time is up to 500 microseconds.

Easy Configuration

Easy to configure, supports all major EtherCAT slaves.

Multiple Expansions

A wide range of expansion modules. EC4 series EtherCAT slim expansion modules are available. Combined with digital, analog, and axis control modules to satisfy various applications.

Ultra-compact, Multifunctional EtherCAT MainDevice

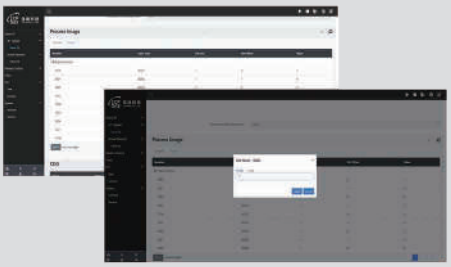
Ultra-compact design (43 x 108 x 73 mm) with EC4 slim module reduces space for cabinet installation. Built-in quad-core Cortex-A53 processor for low-power communication and motion control calculations. Supports Modbus, OPC UA, MQTT, and other communication protocols to meet the needs of Industry 4.0.

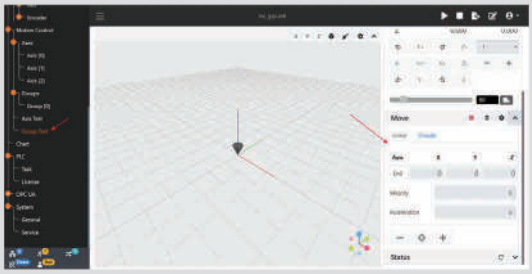
Convenient EtherCAT web management and adjustment interface

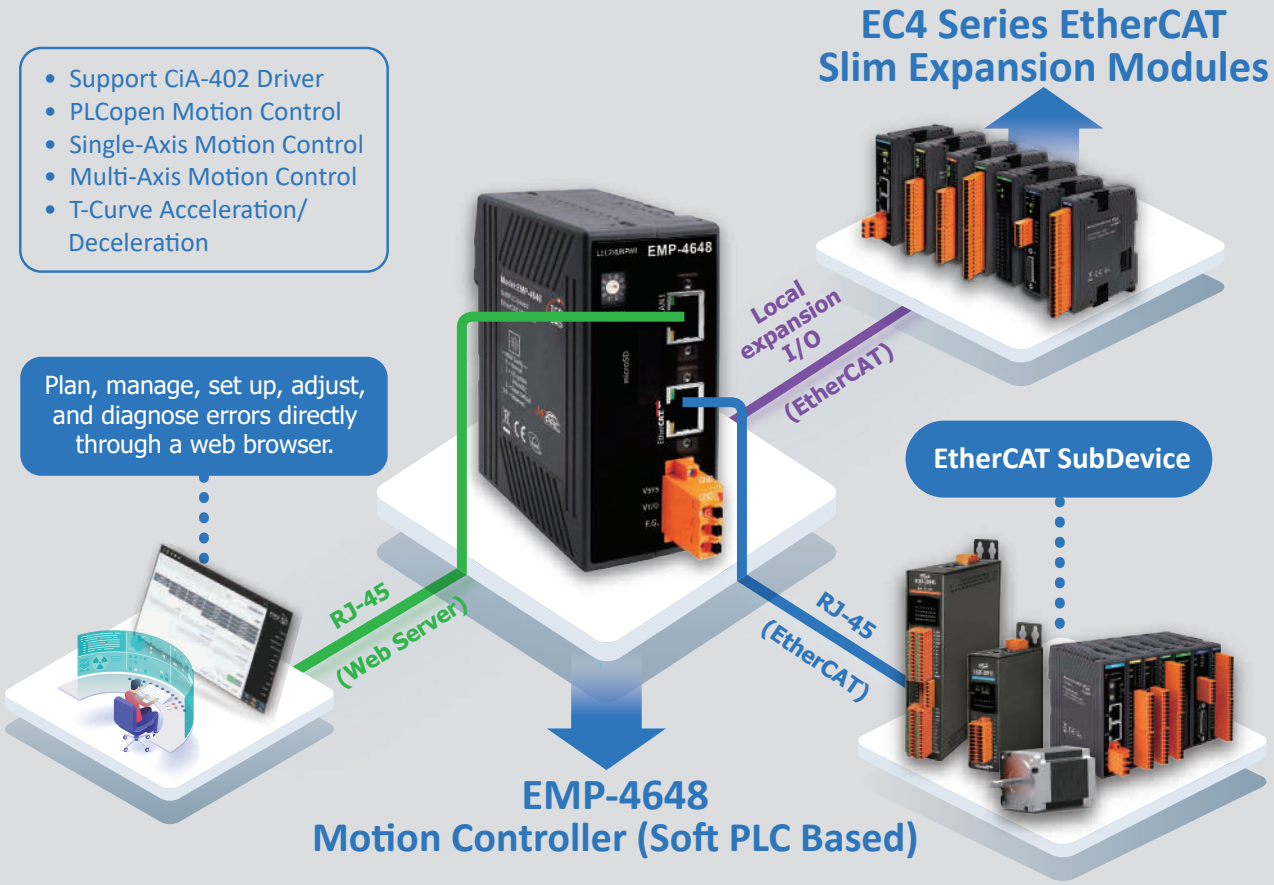
Provides an intuitive web interface, one-click EtherCAT topology creation, and support for third-party ESI file import to simplify device setup. Built-in diagnostics, motion control simulation, and slave parameter settings accelerate adjustment. The virtual slave ID memory enables fast recovery after device replacement. (See P.40–41 for details)

High Efficiency and Industrial-grade Design

The quad-core Cortex-A53 processor is equipped with an ICP DAS EtherCAT control engine, which provides a high-speed cycle time of up to 500 microseconds to ensure real-time operation. The built-in 2GB memory can fulfill the complex motion control needs. The industrial-grade design includes a RJ-45 screw lockable connector to prevent cables disconnection, and dual-port power supply to support power redundancy and enhance system reliability.







▲ The EMP-4648 offers multiple EtherCAT subdevice connection options. Users can expand via EC4 series modules or RJ-45 connectors to maximize space utilization, achieve high-density I/O configuration, maintain a compact size, and enable flexible scalability.

EtherCAT Efficiency, Real-Time, and Flexibility

Multiple EC4 series slim modules can be expanded via E-BUS or connected to a third-party slave via an EtherCAT port, supporting up to 16 axes of motion control and 128 slaves. It supports a 500-microsecond cycle time to ensure precise real-time control and provides efficient and flexible expansion capabilities to meet the needs of various chemical industry applications.

Soft PLC is Easy to Develop

Supports IEC 61131-3 standard PLC programming, equipped with Win-GRAF SoftPLC, providing FBD, LD, IL, ST, SFC, and other PLCOpen languages. In addition, the built-in single-axis motion control and group motion control can accurately synchronize the multi-axis motion. It is suitable for all kinds of automation and machine control applications.

EMP-4648M

More compact!

- **Efficient development**
- **Programmable in standard PLC language**
- **Most reliable EtherCAT motion controller**
- **EC4 series slim expansion modules, Vibration-resistant and space-saving**

2-5 EMP-6648 EtherCAT Compact Motion Controller (Soft PLC Based)

The EMP-6648 is a high-performance, compact EtherCAT maindevice controller suitable for embedding in a wide range of automation equipment. The built-in Win-GRAF Soft PLC, which supports IEC 61131-3 standard programming, can accurately control up to 16 axes of motion and 128 EtherCAT nodes.EtherCAT nodes, realizing efficient and real-time control. Through E-BUS expansion, it can be used with ICP DAS EC6 series modules to flexibly expand I/O functions. Suitable for machine automation, smart manufacturing, and production line control, providing real-time and stable industrial solutions.

Features

Smart Display

The OLED indicator displays real-time data, warning messages, and operating instructions, and can be dynamically updated for more efficient monitoring and diagnosis.

Ultra High Speed

Equipped with an ICP DAS EtherCAT real-time control engine. The cycle time is up to 500 microseconds.

Easy Configuration

Easy to configure, supports all major EtherCAT slaves.

Multiple Expansions

A wide range of expansion modules. EC4 series EtherCAT expansion modules are available. Combined with digital, analog, and axis control modules to satisfy various applications.

Compact Multifunctional EtherCAT MainDevice

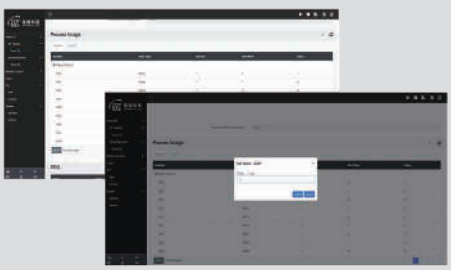
Compact design (25 x 120 x 90 mm). EC6 series modules can be used to effectively reduce the space for cabinet installation. Built-in Quad-core Cortex-A53 processor for low-power EtherCAT communication and motion control calculations. In addition, support for TCP/IP protocols such as Modbus, OPC UA, and MQTT ensures system flexibility.

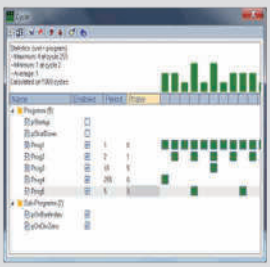
Convenient EtherCAT web management and adjustment interface

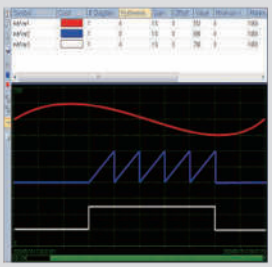
Provides an intuitive web interface, one-click EtherCAT topology creation, and support for third-party ESI file import to simplify device setup. Built-in diagnostics, motion control simulation, and slave parameter settings accelerate adjustment. The virtual slave ID memory enables fast recovery after device replacement. (See P.40–41 for details)

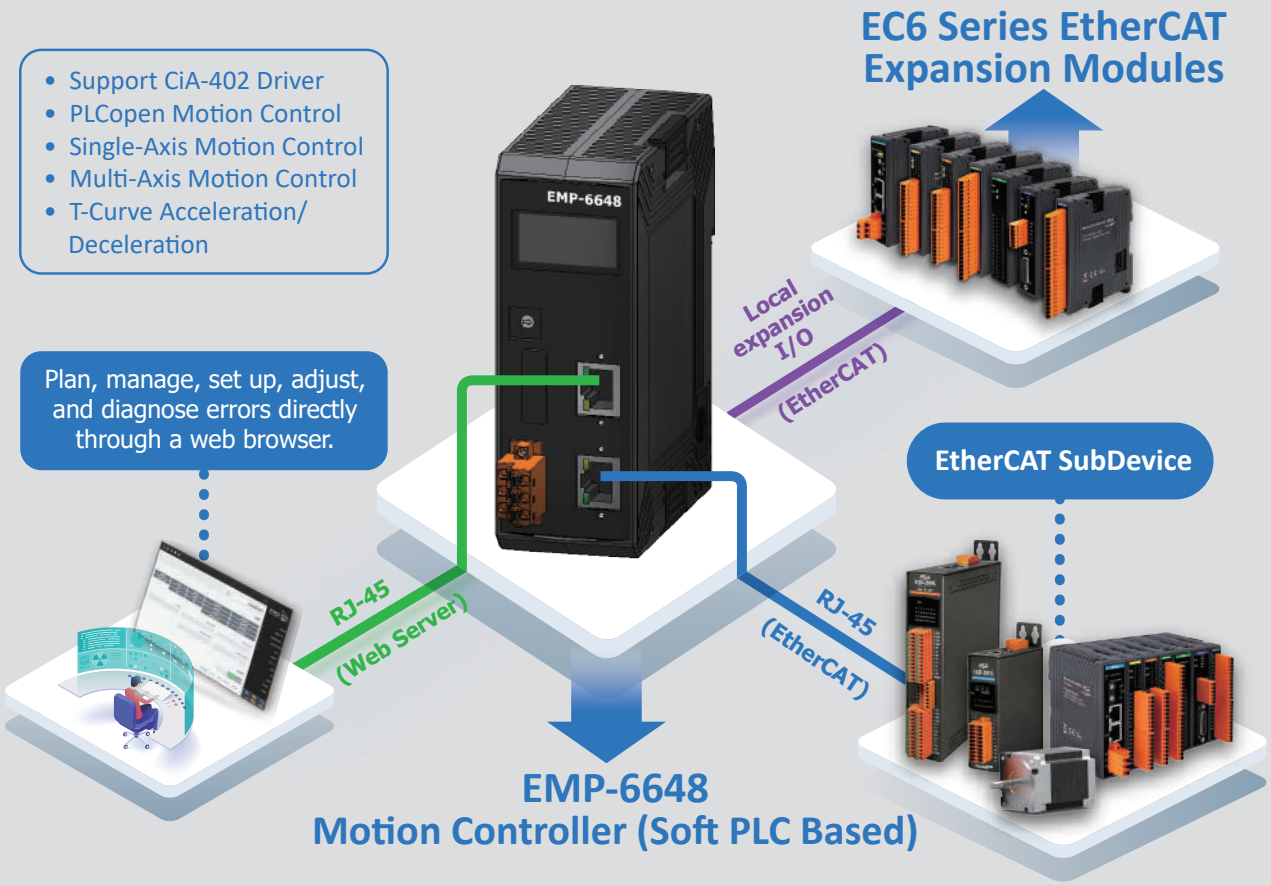
High Efficiency and industrial-grade design

The quad-core Cortex-A53 processor is equipped with an ICP DAS EtherCAT control engine, which provides a high-speed cycle time of up to 500 microseconds to ensure real-time operation. The built-in 2GB memory can fulfill the complex motion control needs. The industrial-grade design includes a RJ-45 screw lockable connector to prevent cables disconnection, and dual-port power supply to support power redundancy and enhance system reliability.









▲ The EMP-6648 offers multiple EtherCAT subdevice connection options. Users can expand via EC6 series modules or RJ-45 connectors to maximize space utilization, achieve high-density I/O configuration, maintain a compact size, and enable flexible scalability.

EtherCAT Efficiency, Real-Time, and Flexibility

Multiple EC4 series slim modules can be expanded via E-BUS or connected to a third-party slave via an EtherCAT port, supporting up to 16 axes of motion control and 128 slaves. It supports a 500-microsecond cycle time to ensure precise real-time control and provides efficient and flexible expansion capabilities to meet the needs of various chemical industry applications.

Soft PLC is Easy to Develop

Supports IEC 61131-3 standard PLC programming, equipped with Win-GRAF SoftPLC, providing FBD, LD, IL, ST, SFC, and other PLCOpen languages. In addition, the built-in single-axis motion control and group motion control can accurately synchronize the multi-axis motion. It is suitable for all kinds of automation and machine control applications.

- **Efficient development**
- **Programmable in standard PLC language**
- **Most reliable EtherCAT motion controller**
- **EC6 series slim expansion modules, Vibration-resistant and space-saving**

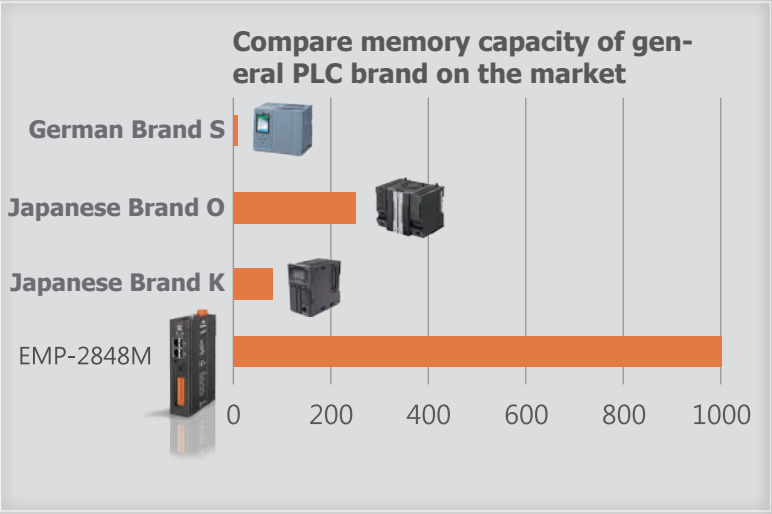
2-6 EMP-2848M EtherCAT Motion Controller (Soft PLC Based)

The ICP DAS compact EtherCAT motion controller, housed in a durable metal casing, fits in a 3U cabinet and is ideal for harsh environments with strong anti-noise capability. Network topology and module settings are managed via a built-in web page.

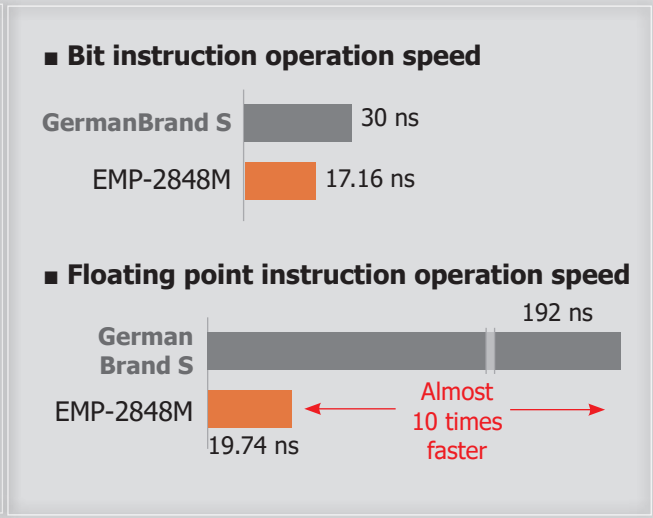
The EMP-2000 integrates control, data processing, and network connectivity into one platform, supporting IEC 61131-3 PLC programming with Win-GRAF. It can control up to 16 servo axes and 128 SubDevices simultaneously, meeting diverse automation needs.

ICP DAS EMP-2848

Large memory capacity for easy-to-use



EMP-2848M is really fast!



Supports Multiple Networks

- Supports EtherCAT Main Device
- Supports Modbus TCP (Main Device/SubDevice)
- Supports Modbus RTU/ASCII (Main Device/SubDevice)
- Supports OPC UA (Available soon)

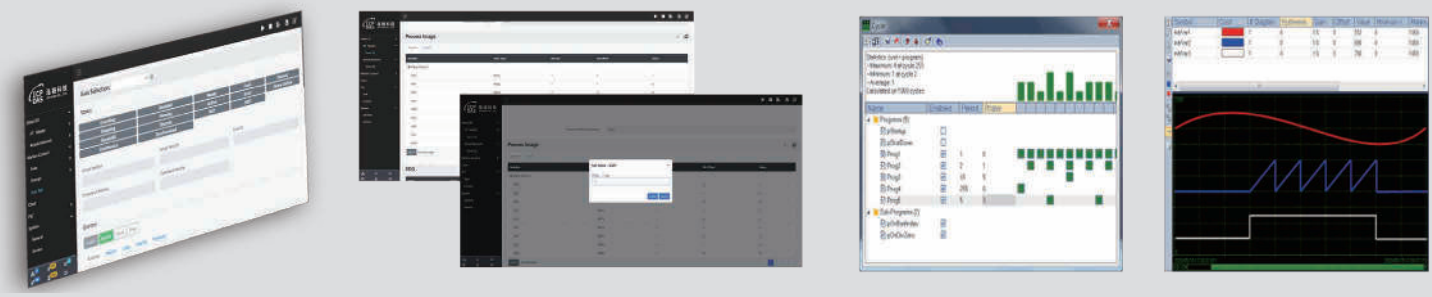
High Efficiency and High Protection

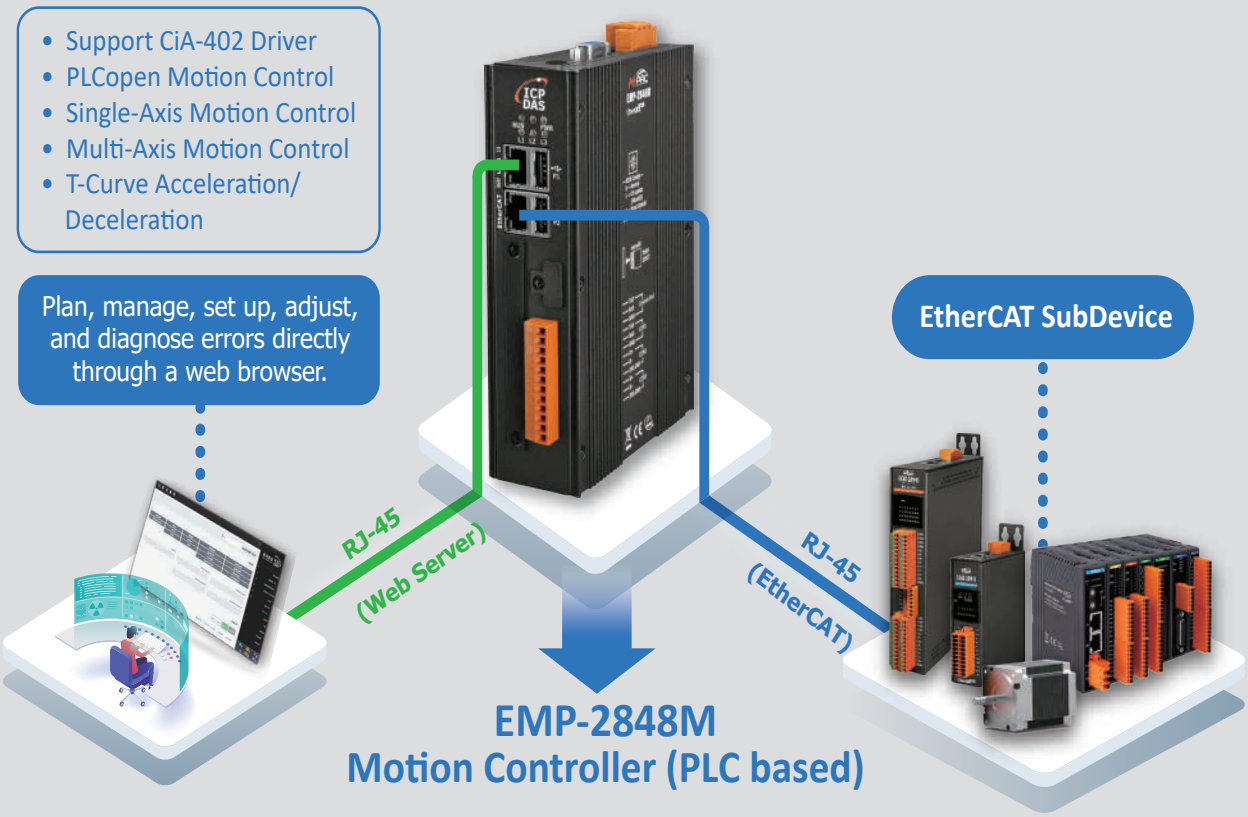
- Cortex-A53 1.6GHz quad-core processor
- Control cycle up to 500 µs
- EtherCAT engine independently developed by ICP DAS
- Single axis motion control
- Metal casing is effective against noise
- Built-in 1G large capacity memory

Built-in Integrated Web Page

- Get EtherCAT network topology with one click
- Compatible with ESI files from third-party SubDevice
- Easy troubleshooting
- Adjustment Motion Controller
- Configure SubDevice module parameters
- Supports virtual SubDevice ID memory function

(See P.40–41 for details)





▲ The EMP-2000 series has a metal casing that offers anti-interference protection while being compact in both system and space. It simplifies development and configuration, considering all aspects like size, safety, stability, and convenience.

EMP-2848M

Thinner than a dictionary!

Easy to Develop

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

Supports 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

- **Efficient development**
- **Programmable in standard PLC language**
- **Most reliable EtherCAT motion controller**
- **Compact and durable, saving space and wiring**

Convenient web management interface

EMP-2848M EMP-4648 EMP-6648

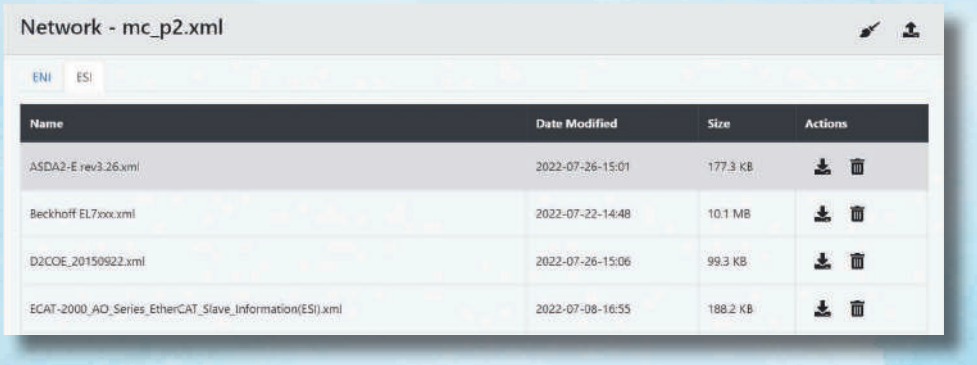
Open the web page through the browser, you can plan the topology settings, adjust the slave modules, and you can also diagnose the error in real time.

Simultaneous control of up to 16 axes

Synchronously control 16 axes in real time using the EtherCAT protocol, with a control cycle as fast as 0.5ms.

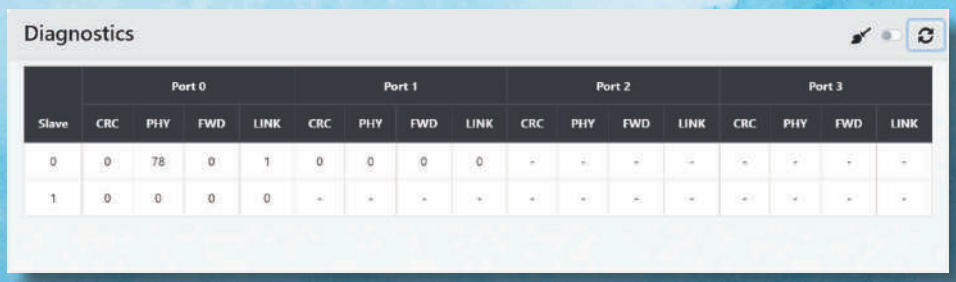
Compatible with all ICP DAS slave stations and third-party slaves

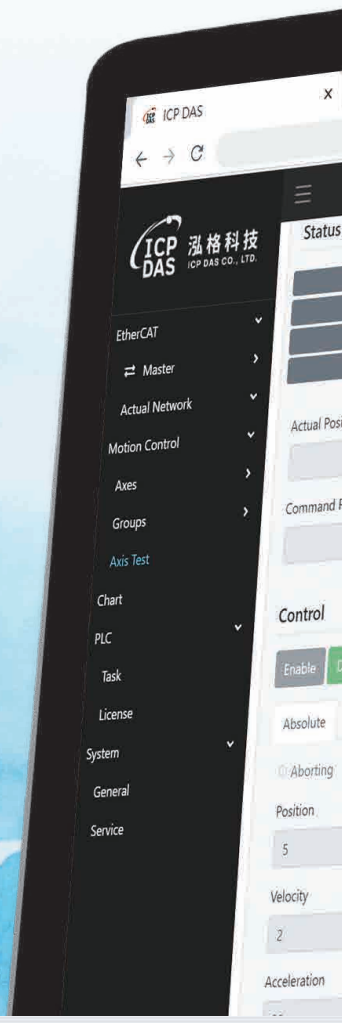
EMP-2848M, EMP-4648, and EMP-6648 support ESI file configuration, ESI file,can be imported through the web interface to be compatible with all slaves.

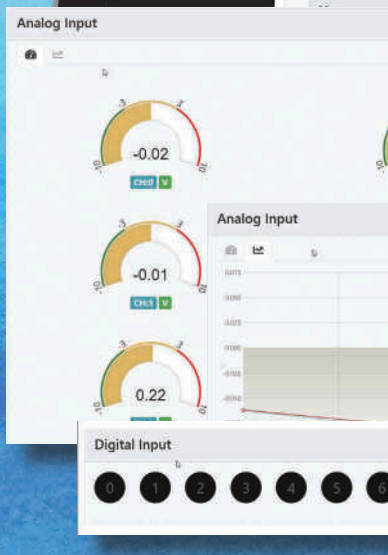


Network Connection Diagnosis Interface

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

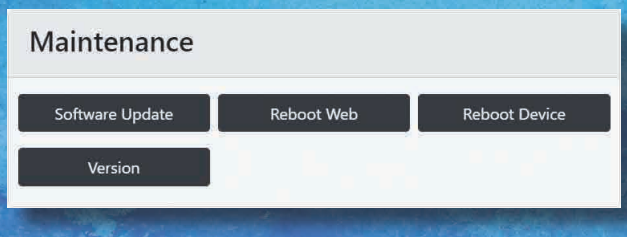






Update firmware function

Users can update the firmware at the local side through the Maintenance pages of the EMP-2848M, EMP-4648, and EMP-6648 web interface for function update and problem solving.



Task1 EtherCAT
Task2 Modbus RTU
Task3 Modbus TCP
Task4 OPC UA

Multitask function

Users can assign different communication protocols to separate task blocks for simultaneous execution, greatly simplifying communication terminals and program development.

CiA402 PDO Automatic assignment function

t provides an automatic PDO assignment function for CiA402 subdevices, automatically configuring the PDO settings based on different motion control functions.

Visual Module Data Interface

Users can easily control or obtain DAQ module data.

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.

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

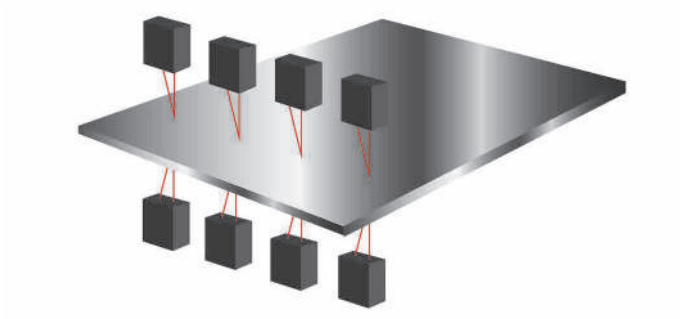
High real-time behavior and deterministic

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.

2-7 ECATDAQ Lightweight EtherCAT Main Device Library

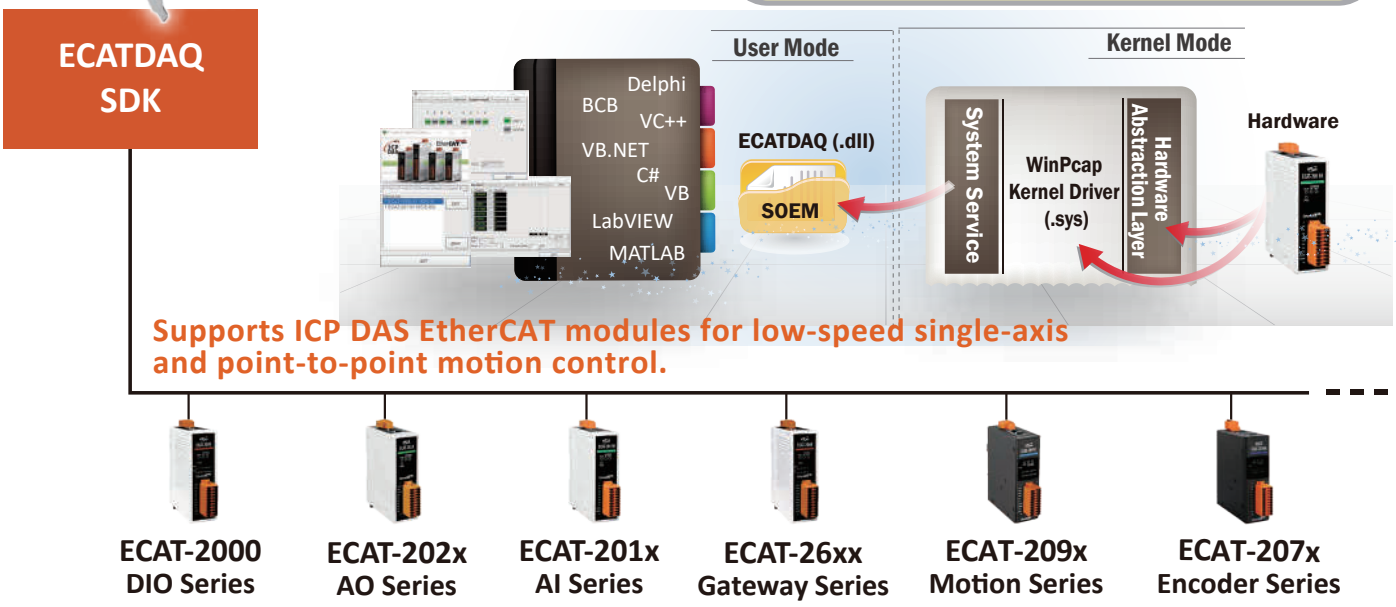
Cost-Effective EtherCAT Software MainDevice – Installation-Free EtherCAT MainDevice Cards

ECATDAQ is a DLL library for developing EtherCAT Main device control programs on XP-9K-IoT (Win10-based) programmable automation controllers or PCs. It simplifies programming for EtherCAT Main Device, enabling quick development of applications to connect and control ICP DAS subdevices.

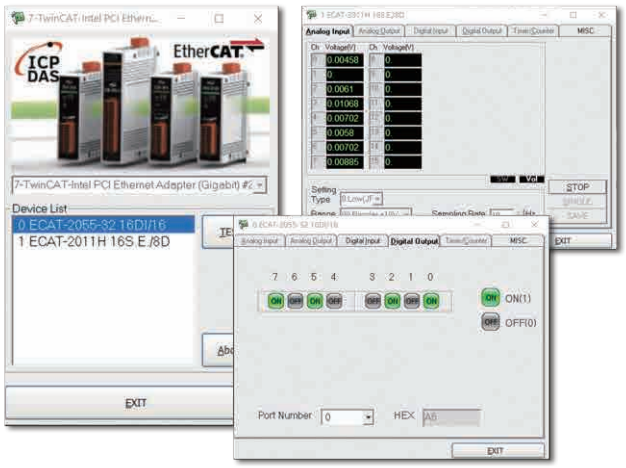
◀ Standard Ethernet Adapter

- Standard Ethernet Adapter (Installation-Free EtherCAT MainDevice Cards)
- Supports Windows 7 / 10 / 11
- ESI files are not required
- Provides DLL Library, VC/VB6/C# Example Programs
- Supports ICP DAS slaves (third-party slaves are not supported).
- Control cycle 20ms (Free-Run mode)
- Supports 8-axis (single-axis linear interpolation, PP mode), Slave Stations: 20
- Supports third-party CiA402 drivers

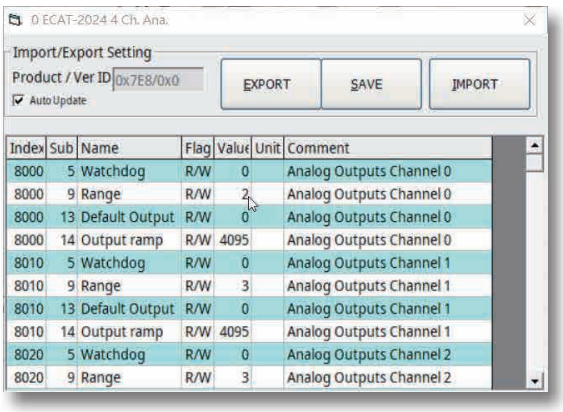
FREE



▲ AXP/XP-9000 or PCs can develop the ICP DAS slave applications through the ECATDAQ library.



▲ iECAT Utility ICP DAS EtherCAT Module Verification and Adjustment Tool

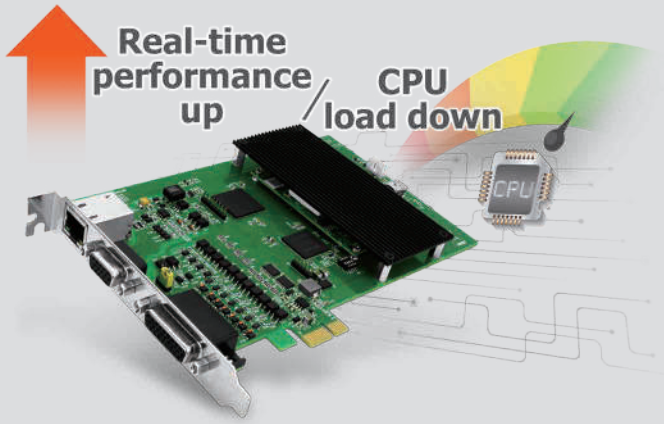


▲ Export/Import Module Settings

2-8 ECAT-M800 EtherCAT Main Device Card (PC Based)

ICP DAS offers EtherCAT network motion control cards compatible with both Windows and Linux, enabling convenient real-time motion control on any platform. These cards can synchronously control up to 64 servo axes and 512 SubDevices, providing a range of common motion control functions to accelerate software development.

ECAT-M80



Model	Axes	Slaves	Motion Control
ECAT-M808-8AX	8	512	full-featured
ECAT-M808-16AX	16	512	
ECAT-M808-32AX	32	512	
ECAT-M808-64AX	64	512	

	ECAT-M800 Series	Third-party software-based MainDevice
Real-Time	High, Microsecond Synchronization (WIN)	Normal, Affected by OS
CPU Usage	Low (WIN)	High
Stability	High Stability (WIN)	Affected by OS Easily

Single Axis Motion Control

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

High Performance

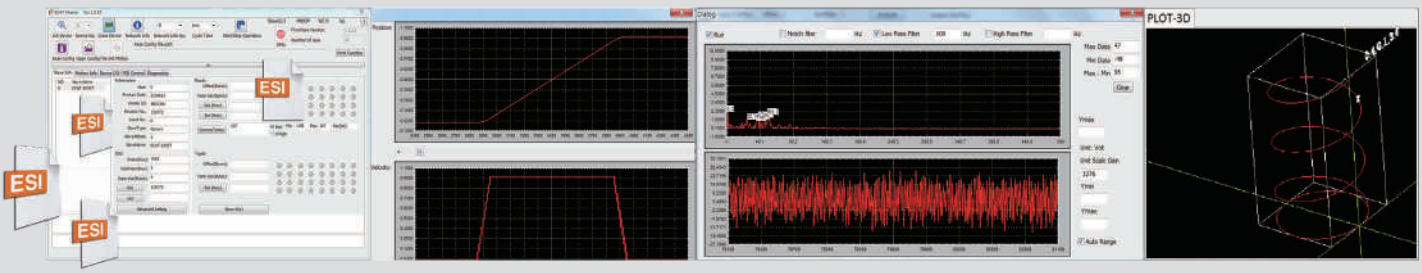
- Cycle times of up to 500 µs
- Supports Windows 10 and Linux operating systems
- Supports 32 and 64-bit operating systems
- Independently developed EtherCAT engine by ICP DAS

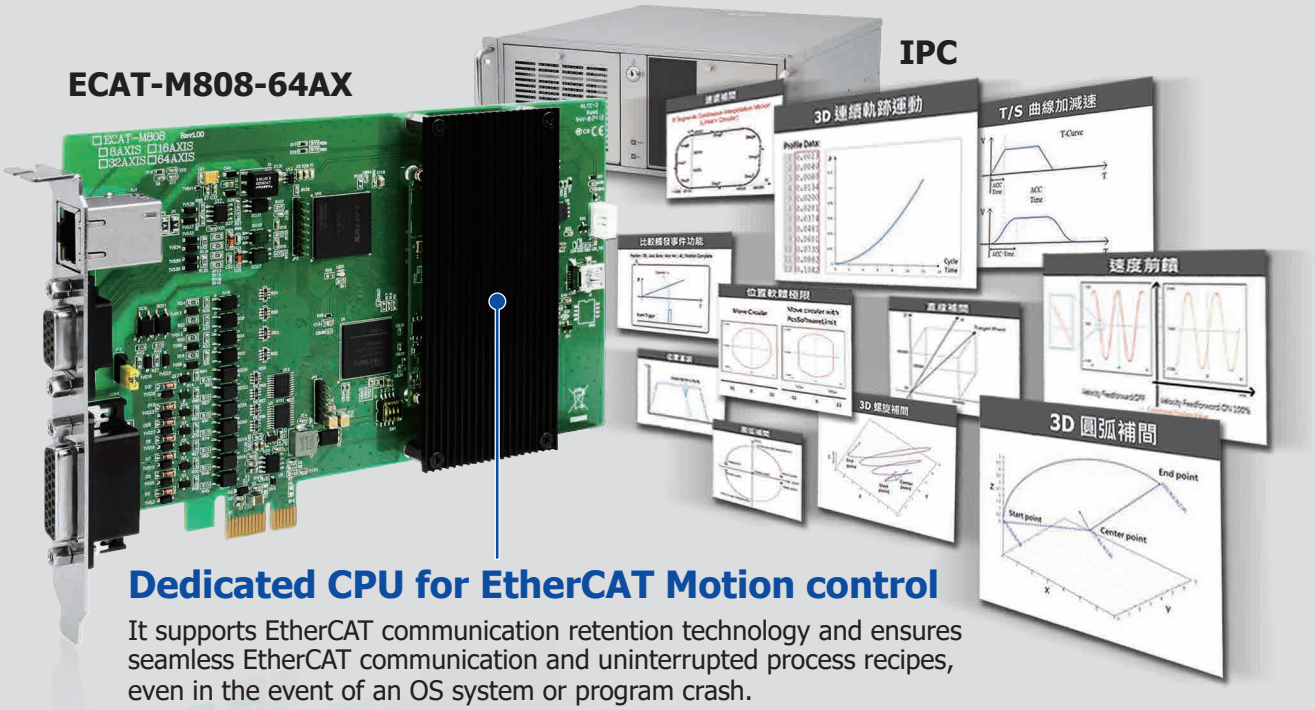
Local I/O Interface

- 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





Dedicated CPU for EtherCAT Motion control

It supports EtherCAT communication retention technology and ensures seamless EtherCAT communication and uninterrupted process recipes, even in the event of an OS system or program crash.

▲ECAT-M800 Series handles motion control, allowing the PC system to focus on other tasks.

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 SubDevices
- Compatibility with third-party SubDevices
- An easy-to-use troubleshooting function
- Supports the SubDevice 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

- **Efficient development**
- **It can be programmed in a variety of languages**
- **Allow ECAT-M800 assist the system to perform real-time operations such as motion control, measurement, etc.**

CH3
Motion

3-1 EtherCAT Stepper Motor Controllers/Drivers

ICP DAS stepping motor controllers are designed for two-phase bipolar motors using open-loop control. They support up to four-axis synchronized control, the CiA402 protocol, and programmable current control up to 8A. They also offer a range of protective, stabilized, and precise control functions.

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

Accurate and Stable Stepping Motor Control

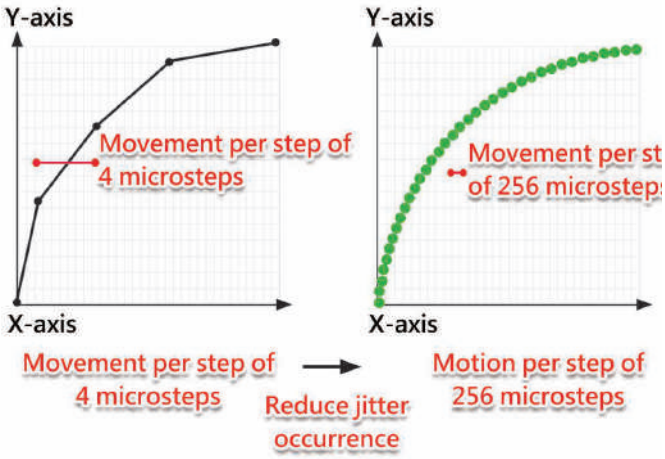
- Supports two-phase bipolar stepping motor
- Supports CiA402 protocol
- Open loop processing
- Programmable current control, up to 8 A
- Programmable step resolution
- Up to 256 microsteps per full step

Built-In Multiple I/O Interfaces

- Differential 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

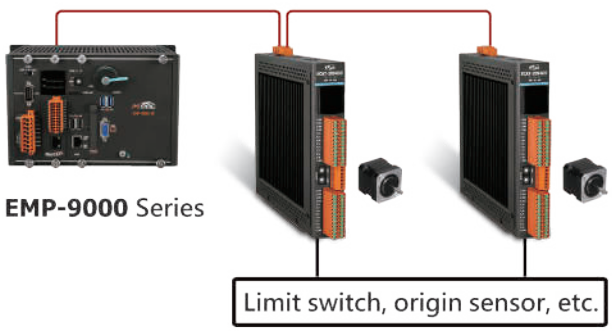
- Built-in driver over temperature and short circuit protection mechanism
- I/O terminal isolation protection
- Automatic rectification prevents the motor from overheating
- Provides fault indicator lights for I/O and motor status.

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 uses a single network cable to connect the controller and stepper driver, reducing wiring compared to pulse control. Its compact design can fit a four-axis stepper driver in a space the size of a book.

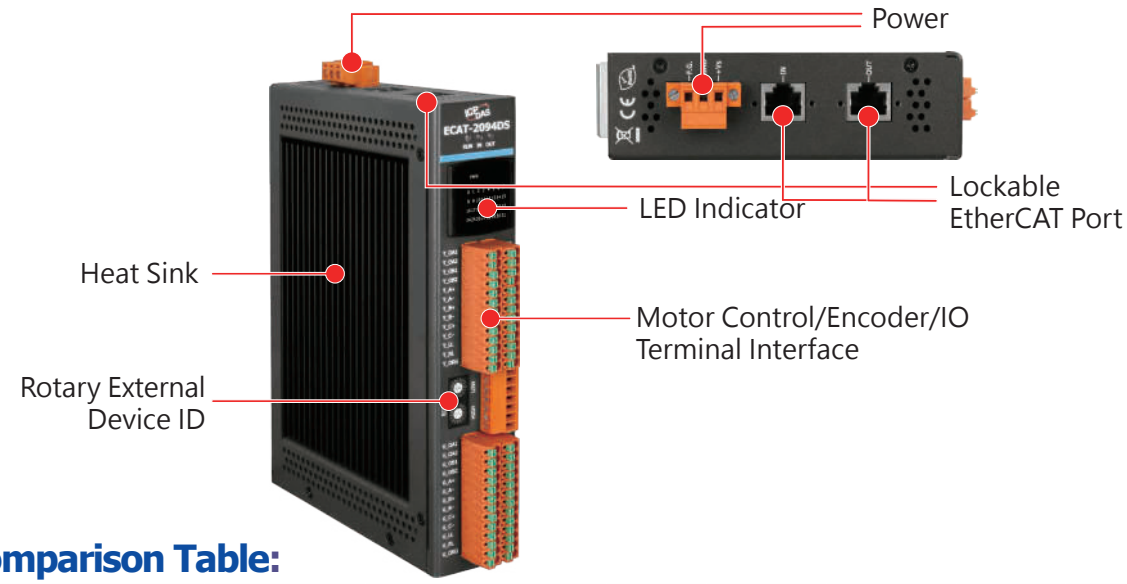


ECAT-209 Y XXX - XX

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

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

N/A: Below 4A
8A: 8.0A



Comparison Table:

Model	EtherCAT		Motor output				Encoder input		Digital I/O
	Cycle Time	Supports 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
- Supports 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
- Supports CiA402 protocol

Pulse Output Driver P Series

ECAT-2094P

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

Brushless Motor Driver BL Series

ECAT-2092BL

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

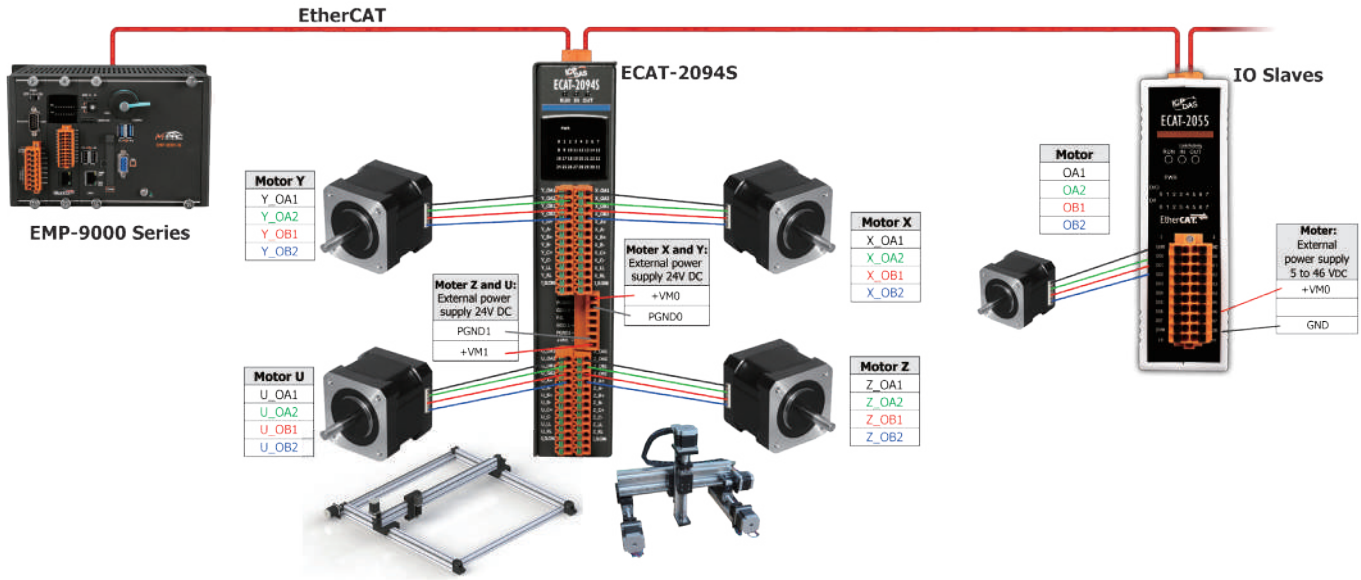
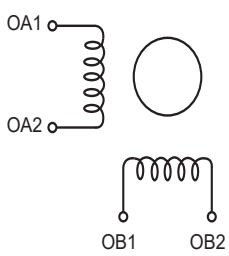
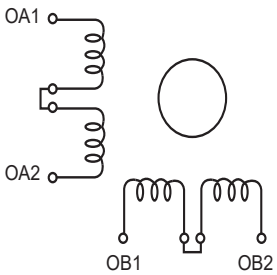
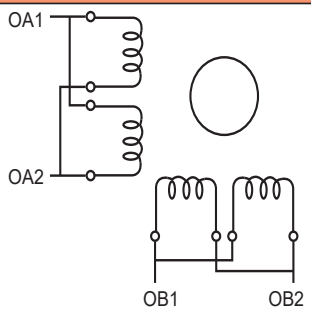


Diagram of ECAT-2094S and ECAT-2091S in EtherCAT Network

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 a device's original signals into EtherCAT communication signals, enabling the control system to leverage EtherCAT's nanosecond-precision synchronization and flexible topology. This results in precise, reliable control at a lower cost, providing faster and more accurate measurements in frequency, displacement, and angle.

ECAT-207 E Y - X

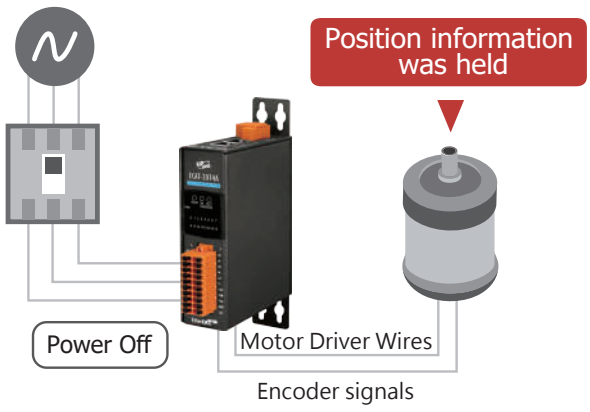
- **E** — Channels:
  - 2:2 channel
  - 3:3 channel
  - 4:4 channel
- **Y** — Encoder Type
  - I: Incremental
  - A: Absolute
- **X** — Function
  - T: Compare Trigger

Comparison Table

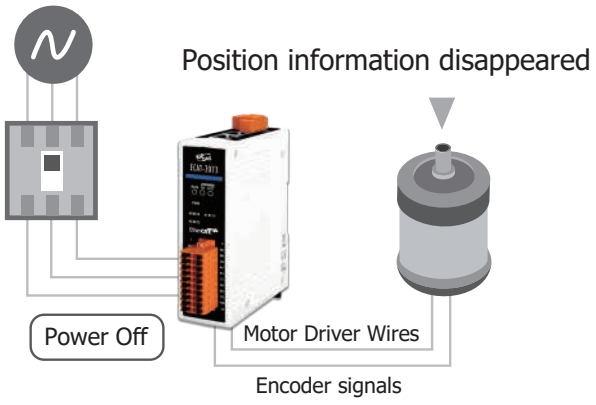
Model	EtherCAT		Encoder Input					External Latch Input	Compare Trigger Output
	Cycle Time	DC Mode	Type	Channels	Resolution/ Serial Input	Frequeency (MHz)	Counting Mode	Channels	Channels
ECAT-2072IT	0.5 ms	v	Incremental	2	32-bit	4 MHz	AB Phase CW/CCW Pulse/Dir	2	2
ECAT-2073I	0.5 ms		Incremental	3				3	-
ECAT-2072A	0.1 ms		Absolute	2	40-bit	10 MHZ	BiSS-C SSI	-	-
ECAT-2074A	0.2 ms		Absolute	4					

Absolute VS Incremental Encoder

Incremental encoders adjust the pulse count based on motion direction to provide relative position and direction, while absolute encoders offer non-repetitive position or angle data, retaining the exact position even after power cycling. Please choose the appropriate encoder type and pair it with the correct module.



Absolute Encoder System



Incremental Encoder System

EtherCAT Absolute Encoder Counters

ECAT-2072A
ECAT-2074A

- 2/4 channel absolute encoder
- Support SSI and BiSS-C modes
- Anti-interference design

Encoder Input	
Encoder Input Number	2/4 encoder counters (D+,D-,Cl+,Cl-) differential
Sample Type	Synchronization
Counter Resolution	40 bit
Encoder Mode	SSI, BiSS-c
Maximum transmission pulse frequency	10 MHz

The ECAT-2074A connects to SSI or BiSS-C absolute encoders, supporting both single-turn and multi-turn types. It supplies 5V power via terminal connections and offers flexible parameterization for different encoder types.

EtherCAT Incremental Encoder Counters

ECAT-2073I

- 3 channel encoder
- Supports 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

The ECAT-2073I is a three-channel high-speed encoder interface module designed for reading pulses from incremental encoders, mainly for position feedback. The position latch function can be triggered by the phase C signal, but there is no dedicated DI for this purpose.

ECAT-2072IT

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

The ECAT-2072IT is a two-channel high-speed encoder module with a dedicated DI trigger for recording positions and a DO output for comparison functions. It can control external devices, like cameras or pulse lasers, by setting the trigger output pulse width before operation.

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

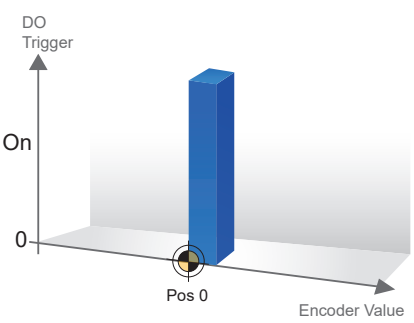
Compare trigger Functions

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 specific parts. It is also used in other fields, such as laser micromachining for photomask repair or semiconductor repair trigger control.

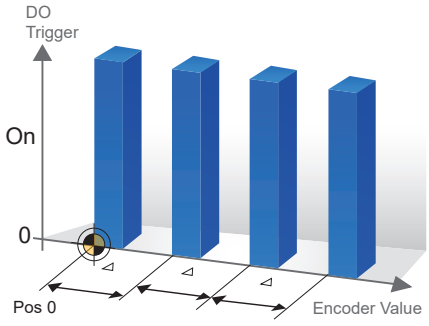
Three Different Types of Position Compare Trigger Functions

The position 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.

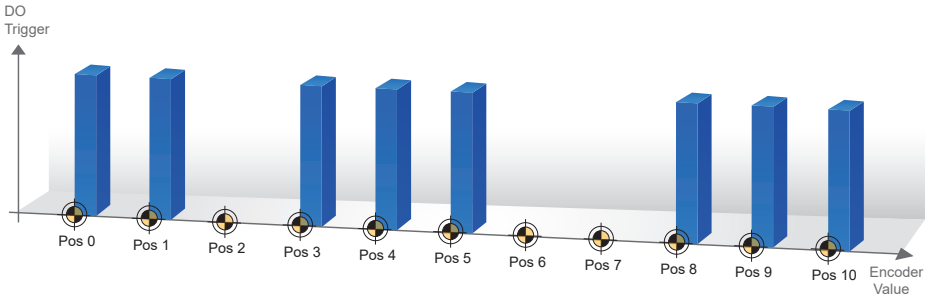
The image on the left depicts a simple position comparison application with a comparison function that can be enabled/disabled via software or hardware.



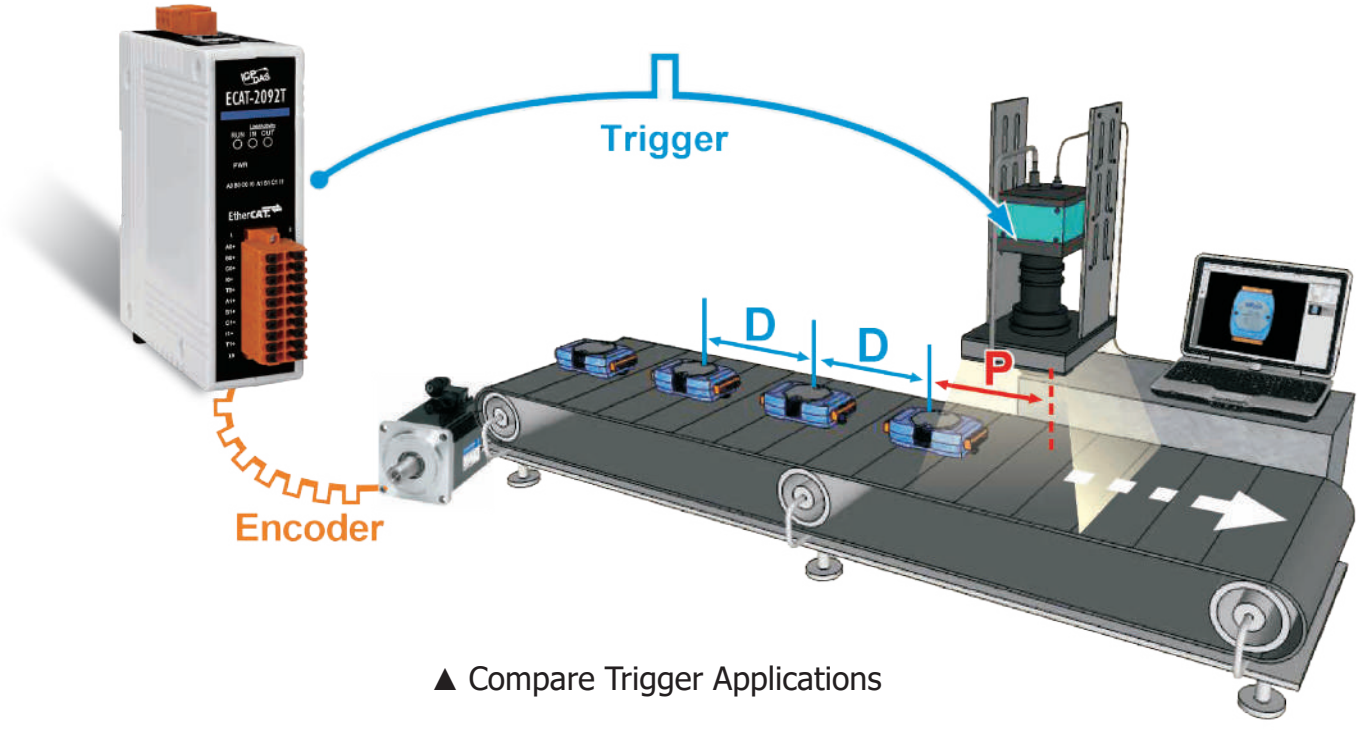
▲ Single Point Position Comparison



▲ Automatic Incremental Comparison



▲ Position Array Comparison



▲ Compare Trigger Applications

CH4
I/O

4-1 EtherCAT I/O Overview

ICP DAS offers a complete range of fieldbus modules, from general bus terminals to high anti-noise protection modules, covering all common I/O signals and fieldbus systems. ICP DAS also provide an integrated product line to optimize EtherCAT systems.

EtherCAT

ECAT-2000 Series

EC1 Series

EC2 Series

EC4 Series

Distributed Module

- Independent module design
- Compact
- Can be installed in the chassis
- Metal casing provides high anti-noise ability
- Cycle Time up to 100 µs

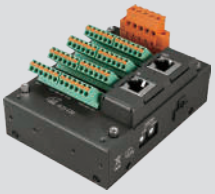
Slim Module

- Slim Modular Design
- Copact
- Nearly 10 different Slim Modules
- Provide Over-Under Voltage Protection Function
- Cycle Time up to 100 µs

Customized modules

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

Comparison table for ICP DAS SubDevice stations:

Module				
Series	**ECAT-2000 Series**	**EC1 Series**	**EC2 Series**	**EC4 Series**
Type	Distributed	Plug-in	Distributed	Distributed
Casing	Plastic	Metal(Anti-interference)		Plastic
Interface	RJ45 x 2	ICP DAS plug-in terminal	RJ45 x 2	RJ45 x 2 (coupler)
Performance	1 ms (Typical)	100 µs (Typical)		
I/O points	DIO: max. 32 AI: max. 16 AO: max. 8	DIO: max. 32 AI: max. 16 AO: max. 8		DIO: max. 16*12 AI: max. 8*12 AO: max. 4*12
FOE online update	-	V		
Explicit Device ID	-	V		
Connector	Detachable	-	Detachable	
Lockable RJ45	-	user-designed	V	-
Dimensions (WxLxH)	33 x 127 x 108 mm 31 x 157 x 126 mm	20 x 98 x 84 mm	83 x 112 x 65 mm	17.5 x 100 x 73 mm 25 x 100 x 73 mm

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

- **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 SubDevice

ICP DAS offers a variety of I/O SubDevice 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

- **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-grade 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

The RJ45 connector has screw holes with a 20 mm spacing on both sides, allowing the use of screw-locking network cables to minimize the risk of disconnection due to vibration.

Easy and fast firmware update

EC series modules support FOE online firmware updates, allowing you to quickly resolve issues with a single click.

Explicit Device ID

Explicit Device ID allows module identification via a unique ID number set by an external rotary switch. This feature helps in connecting and disconnecting products and prevents incorrect cable installation during EtherCAT wiring.

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

- **I/O Channels of Various Types**
  Over dozens of EtherCAT I/O modules with 4, 8, 16 and 32 channels are available.

EtherCAT®

Supports ICP DAS and third-party Main Device

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

Retain output values after state machine changes

If the module is disconnected or switched to another state machine for any reason, the output value will be retained.

Power-On Value

Users can customize the initial DO and AO values upon power-up to match the device's operating characteristics, ensuring normal operation and enhanced safety.

Programmable Digital Filter

Programmable digital filters eliminate jitter from switches or relays and prevent false readings in noisy industrial environments.

Isolated Protection

Each channel offers isolation protection, preventing damage to the module's core if the wrong wire is connected or high voltage is applied, significantly reducing maintenance costs.

Automatic Memory of Settings

The module automatically retains user settings, ensuring they aren't lost during power cycles, saving time and reconfiguration costs.

4-3 EtherCAT Plug-in Modules EC1 Series

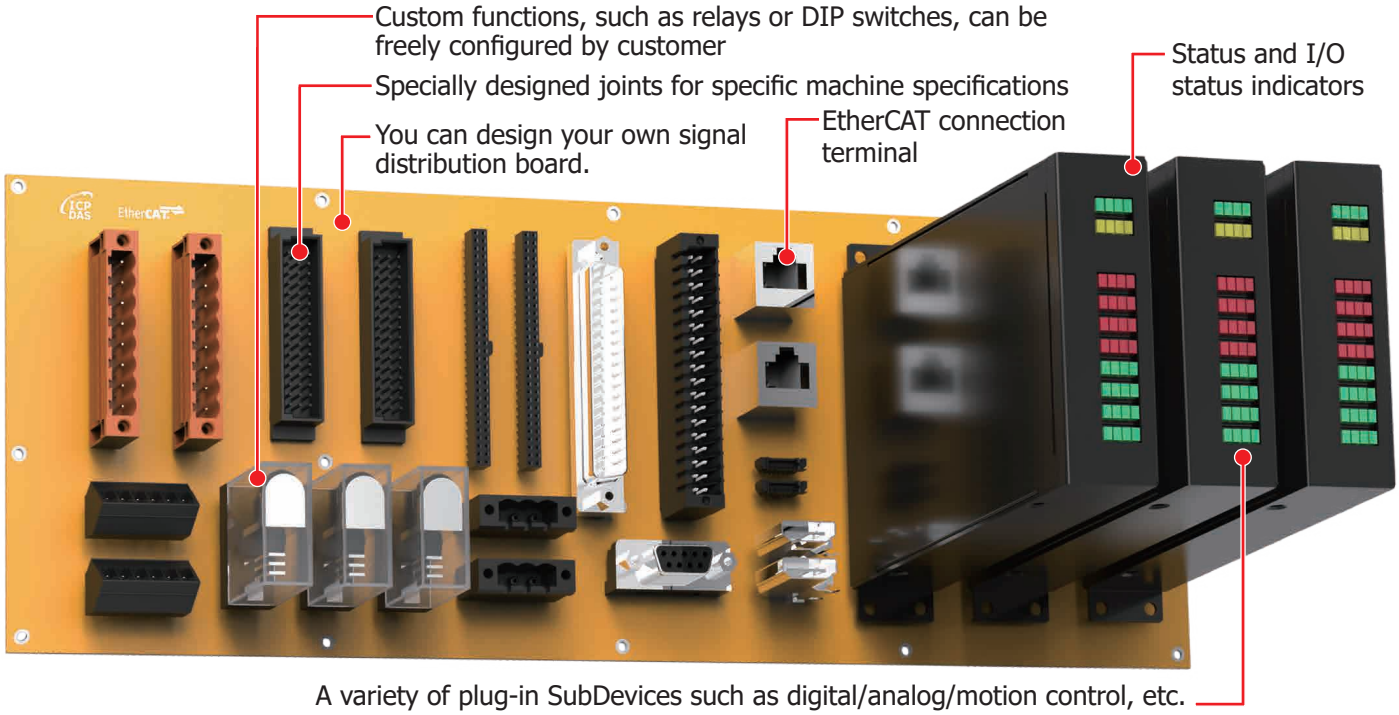
New I/O solution using PCB Bus Terminals

Reduce equipment costs | **Save the cabinet space** | **Reduce installation Time** | **Enhance troubleshooting efficiency**

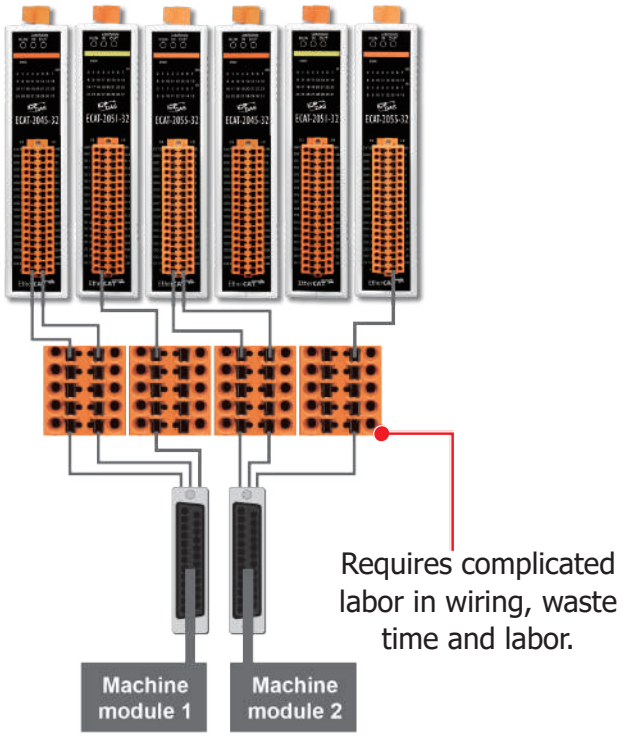
The EC1 series EtherCAT plug-in modules simplify the process of large-scale production. The modules process electronic signals and can be directly plugged into the circuit board. The circuit board distributes signals and power supply to individual plug connectors to connect the controller to other machine 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 implement the plug-and-play concept.

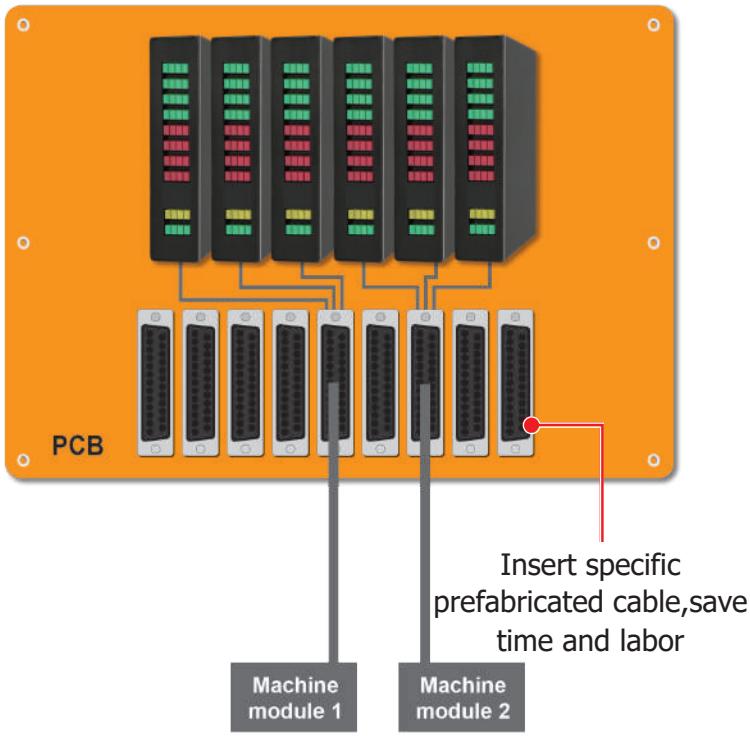
EC1 series modules are installed on user-designed signal distribution boards.



Comparison of Different Wiring Method



▲conventional EtherCAT SubDevice



▲Plug-in EtherCAT SubDevice

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 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

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.

Advantages

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

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
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)	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		

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				
ECAT-2028C	8		±10 V, ±5 V, 0 ~ 10 V, 0 ~ 5 V, 20mA		

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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 enabel)
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			

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.

Advantages

Decrease the cost and space of devices, massively reduce the 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)

Model	Analog Input Channel	Analog Output Channel	Digital Input Channel
	Channels		
EC1-AD8DA4	8	4	12

EC2 Series I/O Modules

Features

Distributed structure for easy expansion. Based on the ECAT-2000 series, the Full-metal casing design improves efficiency and reduces size.

Advantages

10 times more efficient than the ECAT-2000, with improved anti-noise capability. Provides setting functions such as power on value and DO disconnect retention to meet user's needs.

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-AD8DA4	8	4	12

4-5 EC4 Series slim expansion module overview

The compact and slim EC4 series EtherCAT modular I/O system provides high-density plug-in connections for customized solutions. Application-oriented features reduce equipment costs, support customized system solutions, and save space.

With its modern design, user-friendly installation concept, plug-in connections, and clear signal distribution, the system simplifies and extends its functions, enabling it to meet the requirements of the machine-building industry.

ICP DAS EC4_

EC4 Series Couplers:

Model	Description
EC4-EP21	EtherCAT Coupler with ID switch
EC4-EP20E	EtherCAT 2-Port Junction

EC4 Series Axes Control Modules:

Model	Description
EC4-MP1U	1-axis Pulse Output Module
EC4-MS1	1-axis Stepper Motor Controller
EC4-ENC2IT	2-axis Incremental Encoder Counter Module with Compare Trigger
EC4-ENC2A	2-axis Absolute Encoder

EC4 Series I/O Modules:

Model	Description
EC4-P16	16-ch Digital Input
EC4-C16	16-ch Digital Output (SINK/NPN)
EC4-A16	16-ch Digital Output (SOURCE/PNP)
EC4-R8	8-ch Relay Output
EC4-P4R4	4-ch Digital Input, 4-ch Relay Output
EC4-DA4	12-bit, 4-ch Analog Output
EC4-DA4H	16-bit, 4-ch Analog Output
EC4-AD8	16-bit, 1KHz, 8-ch Analog Input
EC4-AD8H	16-bit, 10KHz, 8-ch Analog Input
EC4-AD8R	16-bit, 1KHz, 8-ch Analog Input, Isolation Protection
EC4-TC8	8-ch Thermocouple Measurement
EC4-RTD8	8-ch RTD Input
EC4-LC1	1-ch Strain Gauge

High-efficiency Distributed Module

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

High protection and durable design

The EC4 series Slim Module provides over- and under-voltage and current protection to ensure system safety by automatically disconnecting the system. It can withstand operating temperatures from -25°C to +75°C and be used in extreme environments.

Customized Module

- Special I/O channel numbers can be customized
- Special functions can be customized
- Consult for Slim Module Planning


EC4-EP21

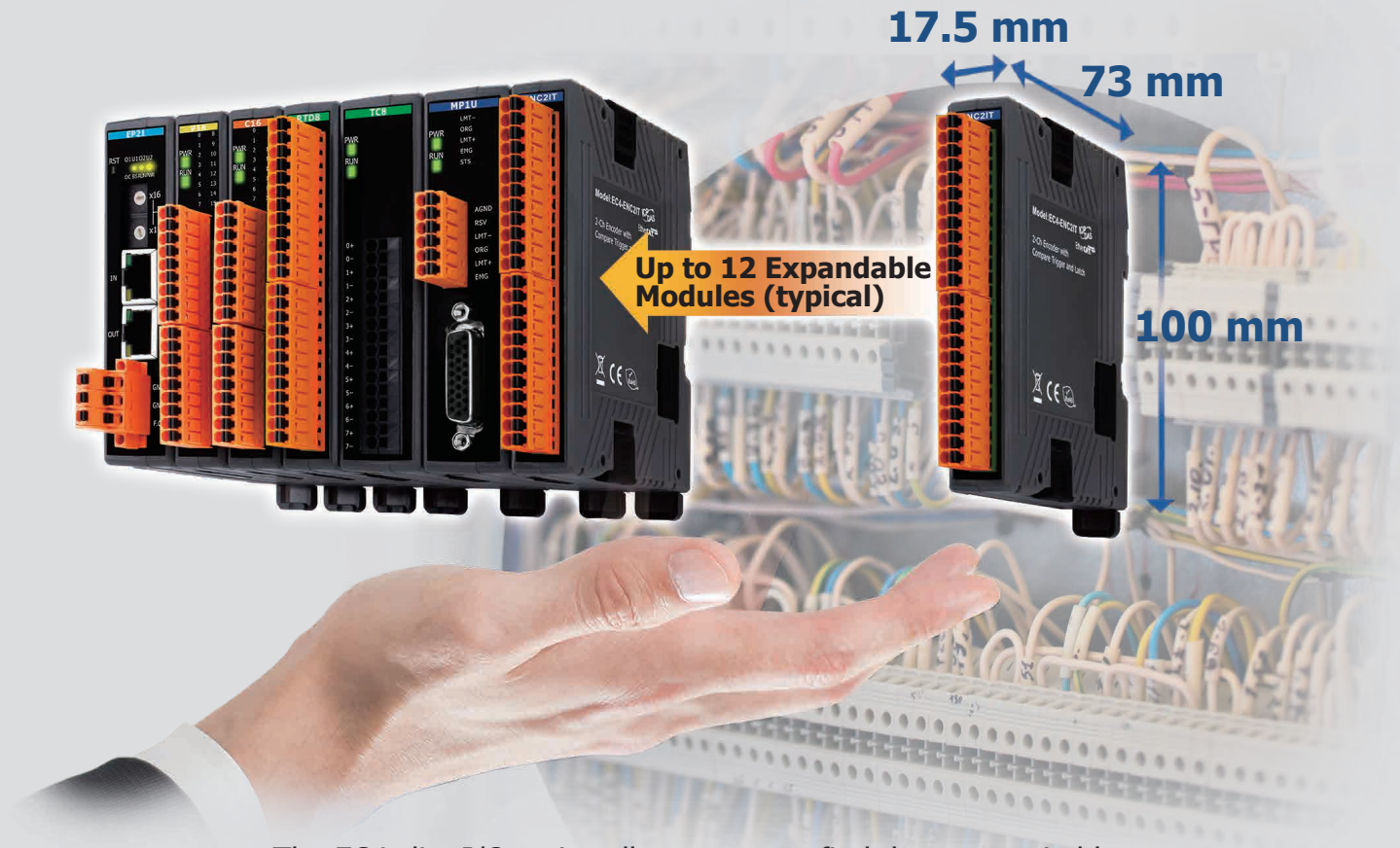

EC4-P16


EC4-C16


EC4-DA4 EC4-AD8


EC4-ENC2IT

Ultra-compact size
Save space and wiring



▲ The EC4 slim I/O series allows users to find the most suitable option for their application combinations.

High real-time, flexible, and multiple advanced functions

With nearly 10 different bus terminal modules, you can mix and match any of these modules to meet the needs of any application. Each module features an independent chip for high-precision synchronization and supports advanced functions like firmware updates, automatic memory and power-on value settings, enhancing system flexibility and reliability.


EC4-MP1U


EC4-RTD8


EC4-TC8


EC4-LC1

- **Comprehensive slim module 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 applications in a limited space

Examples of suitable applications

Digital I/O

- 16-ch Digital Input Module
- 16-ch Digital Output Module
- 8-ch Relay Output Module
- Ultra High Speed Module

▲ **PAC/PLC** (EMP-905X)

EtherCAT®

- EtherCAT
- ID Switch for 256

Communication Coupler

Analog I/O

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

Strain

- 1-ch Strain Gauge Module
- Ultra High Speed Conversion Time 1ms

Temperature Measurement

- 8-ch Thermocouple Measurement Module
- 8-ch RTD Input Module
- Conversion Time 10 ms, 25 ms or 50 ms

Motion Control

- 1-axis Encoder Input Module
- 1-axis Stepper Driver Module
- 1-axis Pulse Output Module
- Supports Incremental or Absolute Encoder Input

4-6 EC4 Series Selection

EC4 Series Slim Modules

Features

Users can create the most suitable application in a limited space through a dedicated slim module.

Advantages

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.

Communication Coupler Modules

Model	EtherCAT		Explicit Device ID	Interface	ports	Dimensions (WxLxH)
	Cycle Time	Sync Mode				
EC4-EP21	100 us	Free Run SM DC	Up to 256	RJ-45	2	25 x 108 x 93
EC4-EP20E			N/A			

Digital Input/Output

Model	EtherCAT		Digital Input		Digital Output			Dimensions (WxLxH)
	Cycle Time	Sync Mode	Channels	Type	Channels	Type	Max. Load Current	
EC4-C16	100 us	Free Run SM DC	-	-	16	Open Collector (Sink)	500 mA/channel	17.5 x 108 x 73
EC4-A16			-	-		Open Collector (Source)		
EC4-P16			16	Dry (Source), Wet (Sink/ Source)	-	-	-	

Relay Output

Model	EtherCAT		Digital Input		Relay Output			Dimensions (WxLxH)
	Cycle Time	Sync Mode	Channels	Type	Channels	Type	Max. Load Current	
EC4-R8	100 us	Free Run SM DC	-	-	8	Form A	5 A@30V	17.5 x 108 x 73
EC4-P4R4			4	Dry (Source), Wet (Sink/ Source)	4			

Voltage/Current Output

Model	EtherCAT		Channels	Resolution	Input Range	Accuracy	Output Capacity	Dimensions (WxLxH)
	Cycle Time	Sync Mode						
EC4-DA4	100 us	Free Run SM DC	4	12-bit	±5 V, ±10 V, 0 ~ 5V, 0 ~ 10V, 0 ~ 10 mA, 0 ~ 20 mA	± 2 LSB	10 V @ 5mA	17.5 x 108 x 73
EC4-DA4H			4	16-bit	±5 V, ±10 V, 0 ~ 5V, 0 ~ 10V, 0 ~ 20 mA, 4~20mA	± 4 LSB		

Voltage/Current Measurement

Model	EtherCAT		Channels	Resolution	Isolation Protection	Sampling Rate	Input Range	Dimensions (WxLxH)
	Cycle Time	Sync Mode						
EC4-AD8	100 us	Free Run SM	8 Diff	16-bit	N/A	1k Hz per Channel	0 ~ 10 V, +/- 2.5 V, +/- 5 V, +/- 10 V	17.5 x 108 x 73
EC4-AD8H						10k Hz per Channel		
EC4-AD8R					V	1k Hz per Channel		

Strain Gauge Measurement

Model	EtherCAT		Channels	Resolution	Isolation Protection	Sampling Rate	Input Range	Dimensions (WxLxH)
	Cycle Time	Sync Mode						
EC4-LC1	100 us	Free Run SM	1	24-bit	N/A	1k Hz per Channel	±10 V, ±5 V, ±2.5 V, ±1.25 V, ±625 mV, ±312 mV, ±200 mV, ±100 mV, ±50 mV, ±25 mV (Software selectable)	17.5x108x73

Temperature Measurement

Model	EtherCAT		Sensor Input	Channels	Resolution	Sampling Rate	Accuracy	Dimensions (WxLxH)
	Cycle Time	Sync Mode						
EC4-TC8	500 us	Free Run SM	Thermocouple (J, K, T, E, R, S, B, N, C, L, M, and LDIN43710)	8	16-bit	100 Hz per Channel	±0.1% of FSR	25 x 108 x 73
EC4-RTD8			Pt100, Pt1000, Ni120					17.5 x 108 x 90

Motion Control/Drivers

Model	EtherCAT		CiA402	Axis	Digital Input	Digital Output	Dimensions (WxLxH)
	Cycle Time	Sync Mode					
EC4-MS1	500 us	Free Run SM DC	V	1 (Stepping)	-	-	25 x 108 x 73
EC4-MP1U				1 (Pulse)			

Counter/Encoder

Model	EtherCAT		Type	Channels	Resolution	Frequency	Counter Mode	Dimensions (WxLxH)
	Cycle Time	Sync Mode						
EC4-ENC2IT	200 us	Free Run SM DC	Incremental	2 × Encoder counter inputs 2 x Latch outputs	32-bit	4 MHz	CW/CCW , Pulse/Direc-tion, A/B Phase	17.5×108×90
EC4-ENC2A	100 us		Absolute	2(BiSS-C/SSI)	48-bit	10 MHz	-	
EC4-ENC4A	200 us			4(BiSS-C/SSI)				

CH5
Gateway/Junction Converter

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 expansion of other reliable fieldbus protocols and seamless integration with existing network equipment. It offers a solution for effectively converting the data of 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

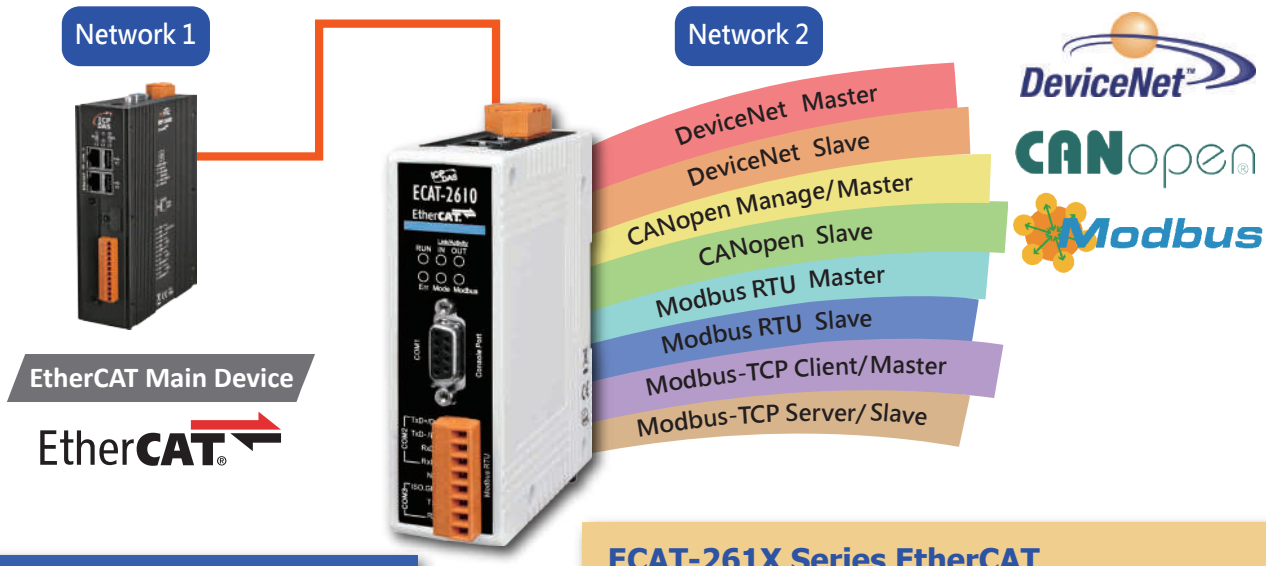
By using ICP DAS EtherCAT gateway to connect to your devices, no software or hardware modifications to the devices is required. All data/protocol conversion can be achieved and can be mapped to other networks within the gateway.

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 disconnect 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
- photovoltaic
- Transportation
- Building automation
- Industrial Automation
- Automotive Communication

ECAT-261X Series EtherCAT Gateway Modules

Connect to any EtherCAT Industrial Ethernet - Fieldbus or Industrial Networks

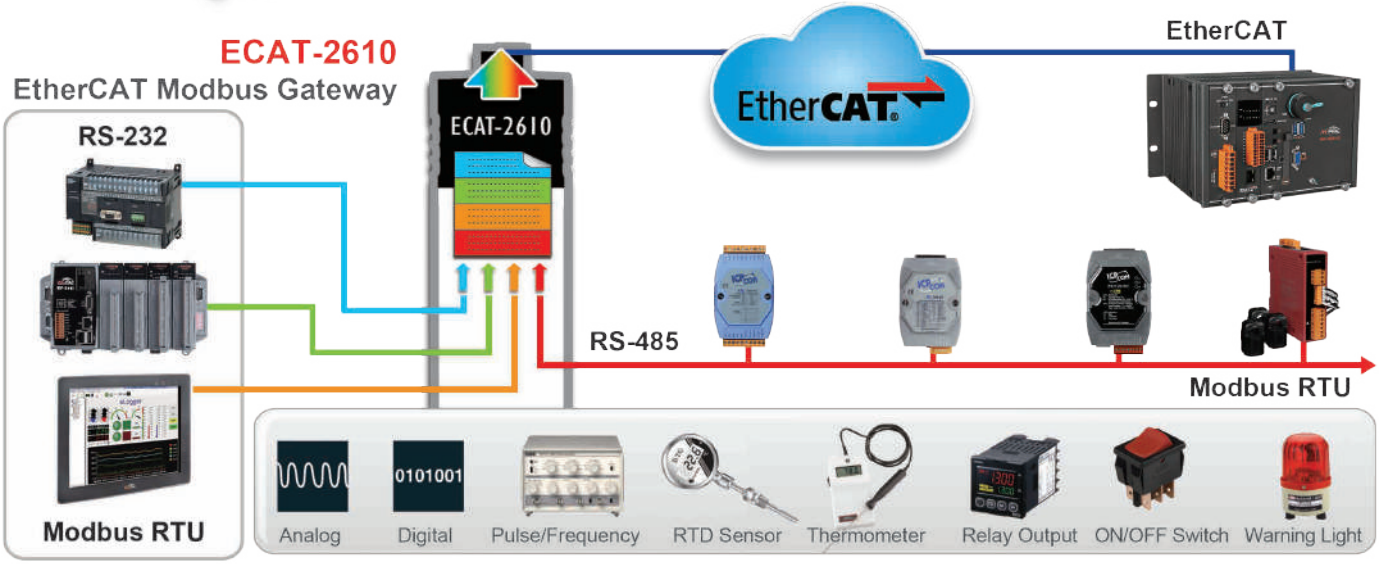
The ECAT-261X series EtherCAT gateways simplify connecting industrial networks and PLC systems, ensuring stable information flow across the factory. They enable quick I/O data transfer between similar or different networks, bypassing complex PLC calculations. The series is certified by major PLC manufacturers, including Siemens, AB, Schneider Electric, Mitsubishi, ABB, Omron, Hitachi, and Beckhoff.

5-2 Connecting Modbus RTU to EtherCAT

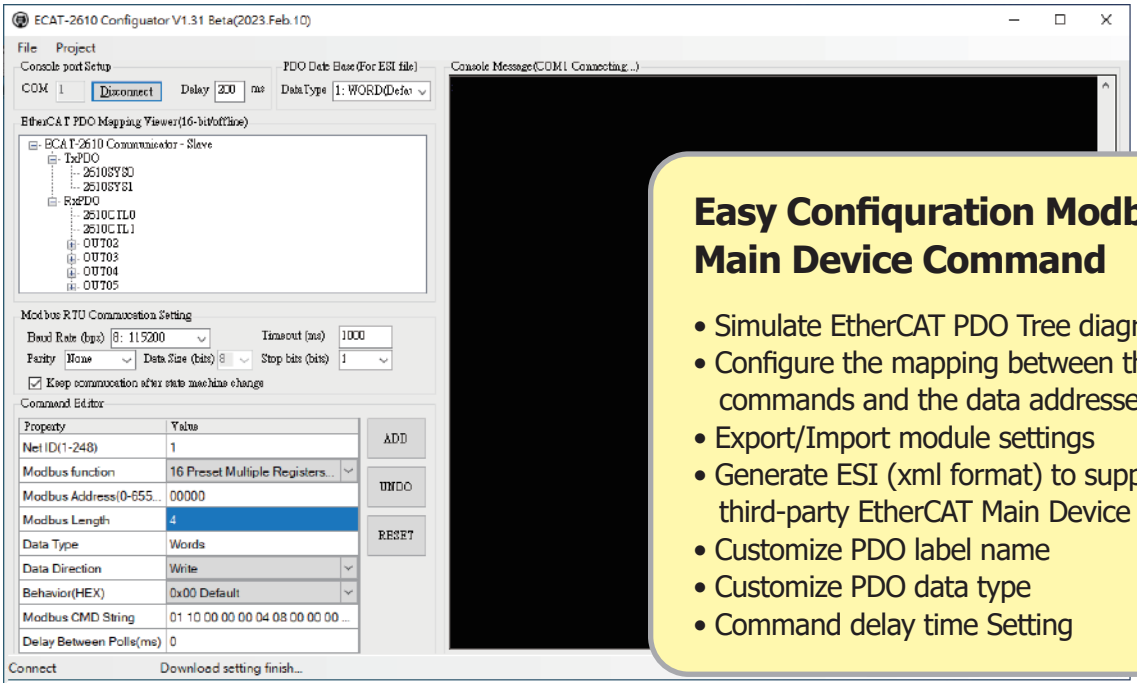
EtherCAT SubDevice - MRTU Master

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 Main Device via ECAT-2610 as long as it is a Modbus RTU device



Easy Configuration Modbus Main Device Command

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

▲ECAT-2610 provides a Modbus RTU command deployment tool that can be configured in 5 minutes.

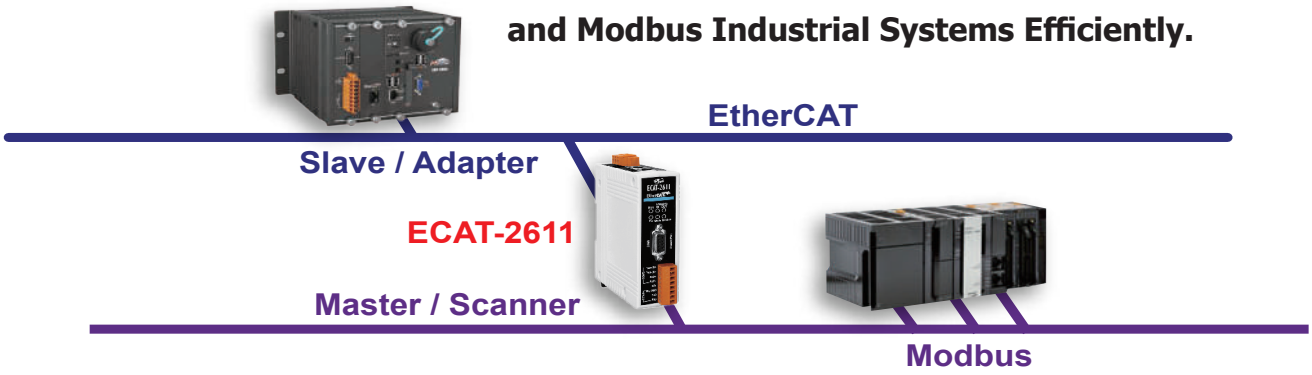
5-3 Data exchange between Modbus RTU and EtherCAT

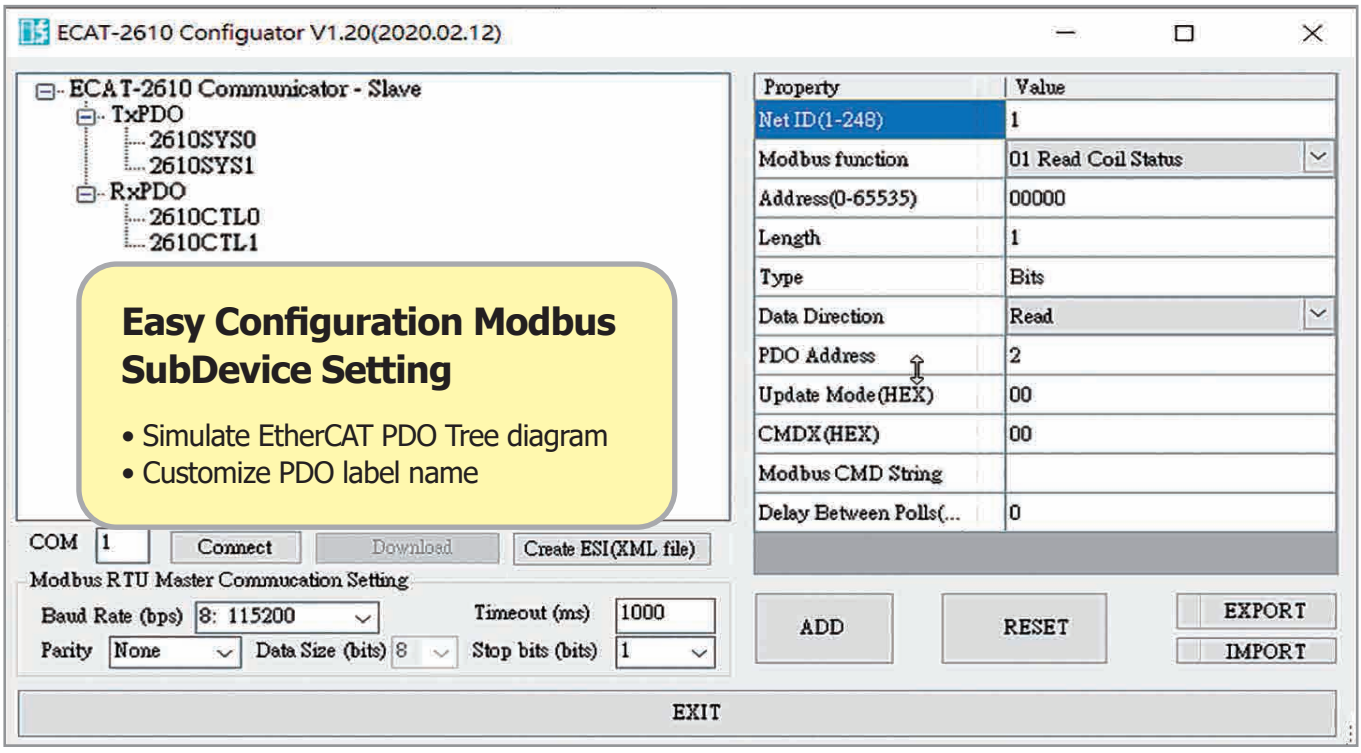
EtherCAT SubDevice - MRTU Slave

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 Main Device of EtherCAT and Modbus Industrial Systems Efficiently.





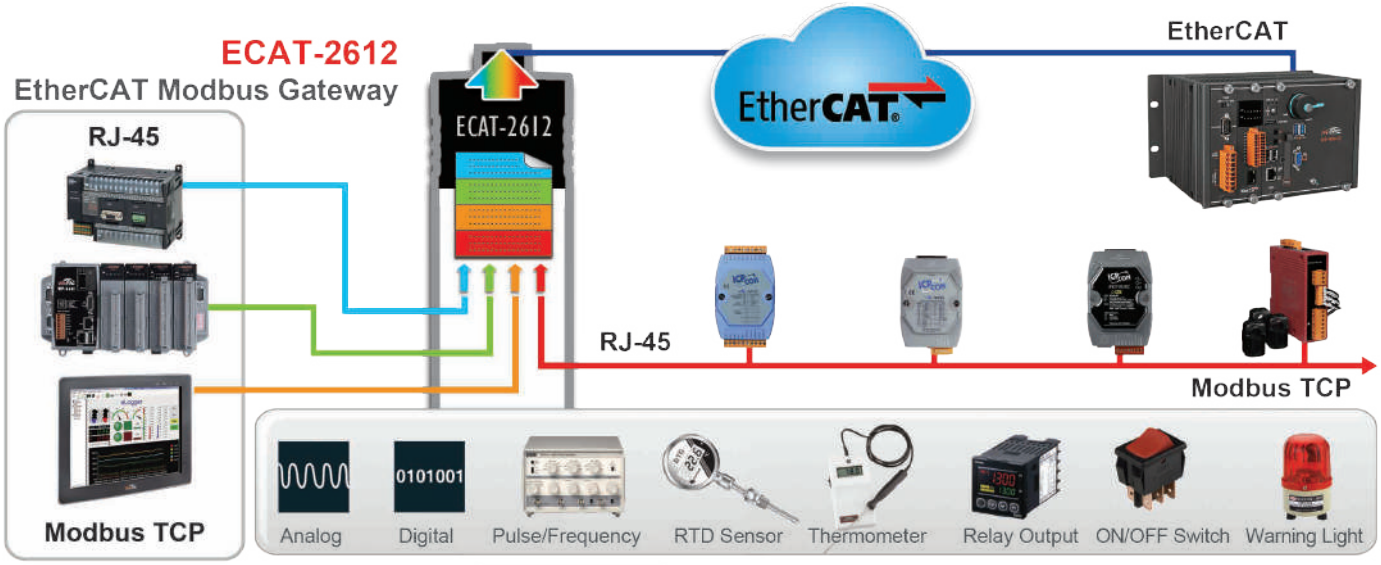
▲ ECAT-2611 provides a Modbus RTU command deployment tool that can be configured in 5 minutes.

5-4 Connecting Modbus TCP to EtherCAT

EtherCAT SubDevice - MTCP Master

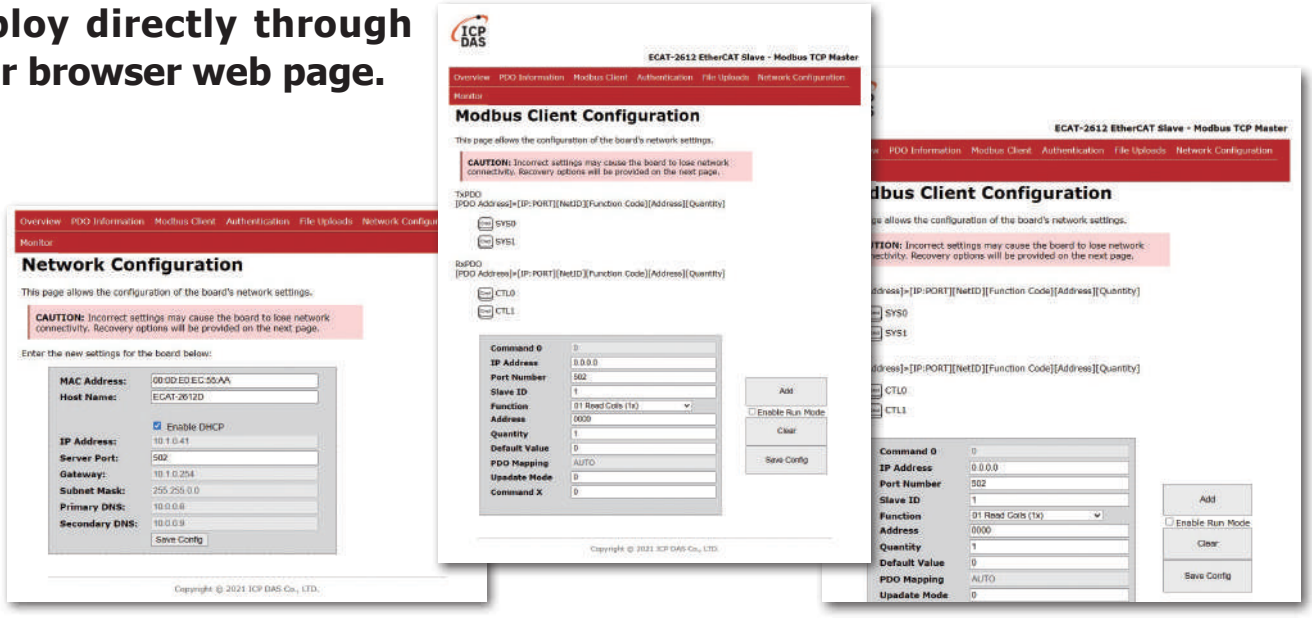
ECAT-2612 Available Soon

- Supports Modbus TCP
- Ethernet interface
- Up to 32 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 Main Device via ECAT-2612 as long as it is a Modbus TCP device

Deploy directly through your browser web page.



5-5 Data exchange between Modbus TCP and EtherCAT

EtherCAT SubDevice - MTCP Slave

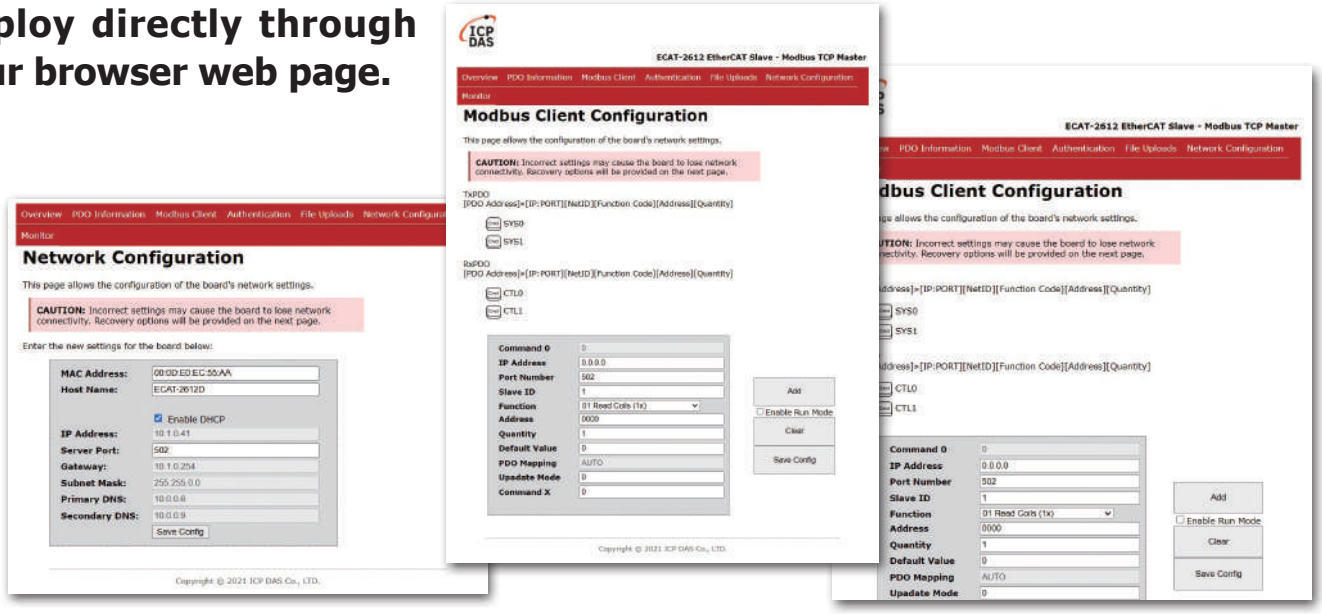
ECAT-2613

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.

Deploy directly through your browser web page.

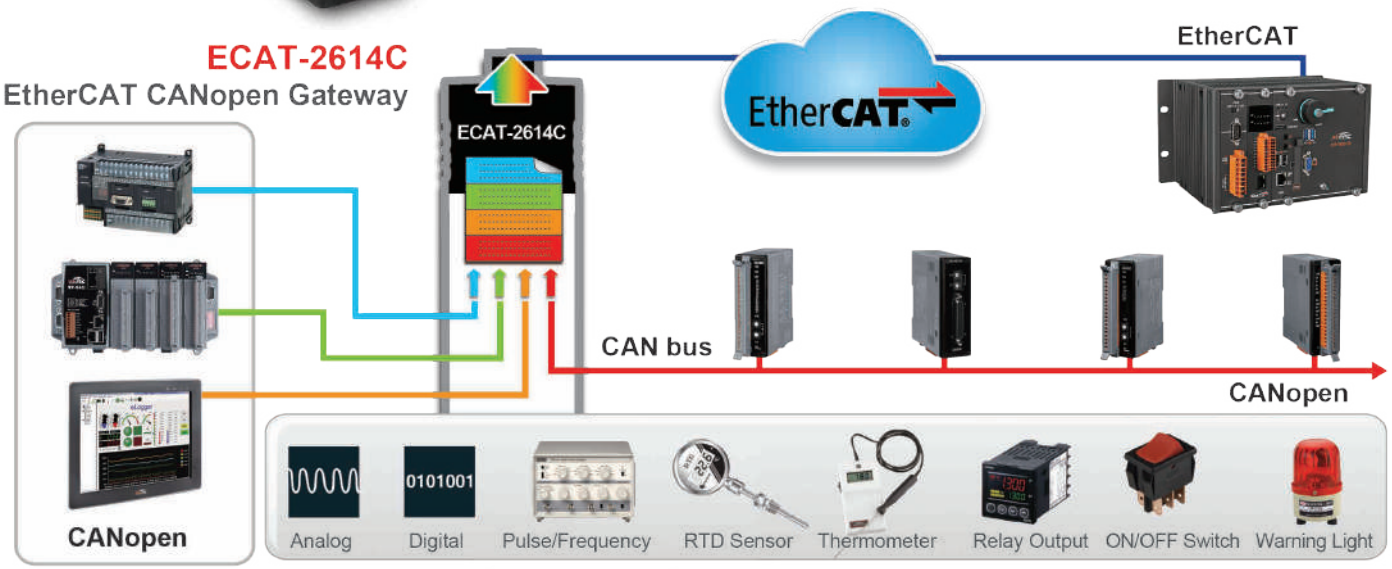


5-6 Connecting CANopen to EtherCAT

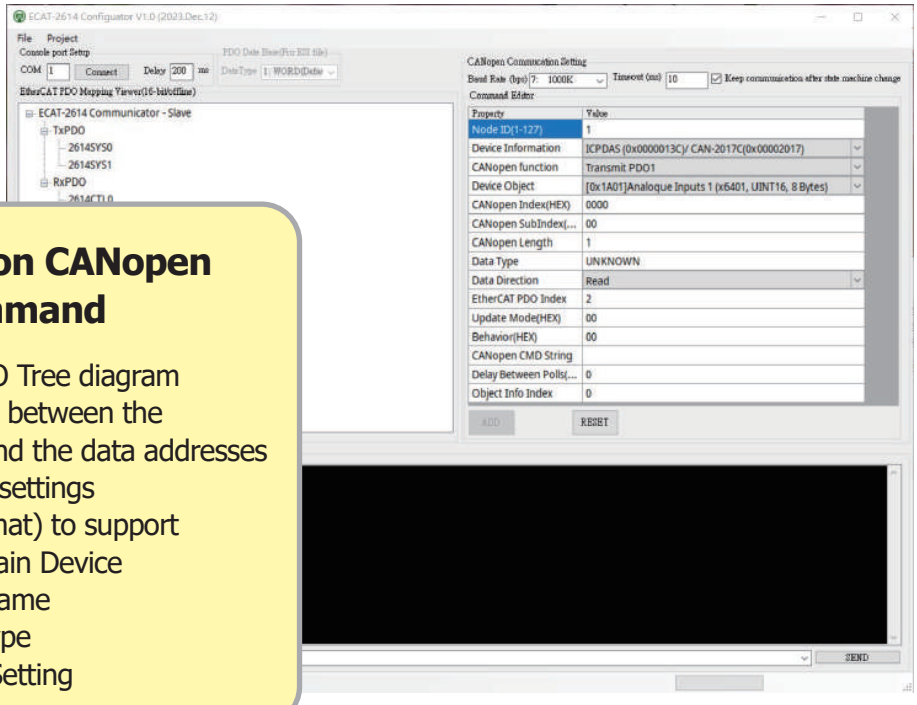
EtherCAT SubDevice - CANopen Master

ECAT-2614C Available Soon

- Supports CANopen
- CAN bus 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 Main Device via ECAT-2614C as long as it is a CANopen device



Easy Configuration CANopen Main Device Command

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

▲ ECAT-2614C provides a CANopen command deployment tool that can be configured in 5 minutes.

5-7 Data exchange between CANopen and EtherCAT

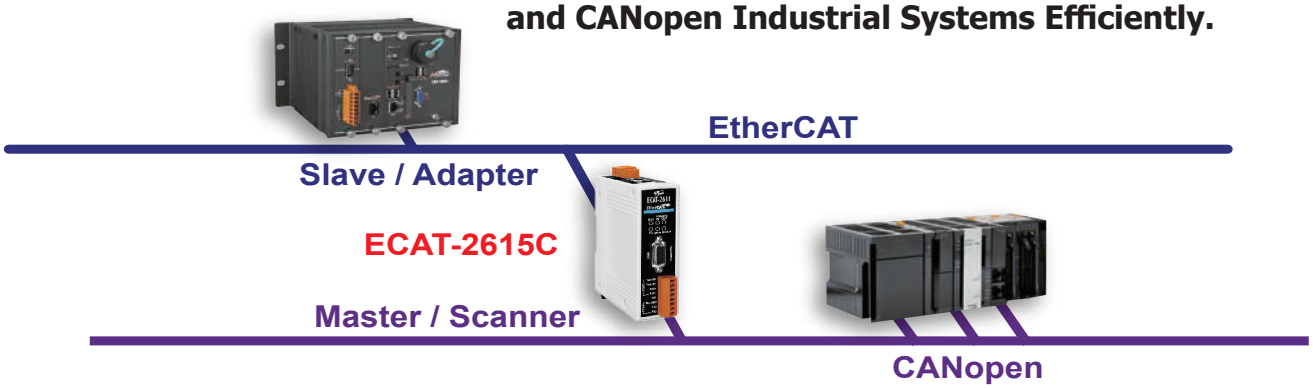
EtherCAT SubDevice - CANopen Slave

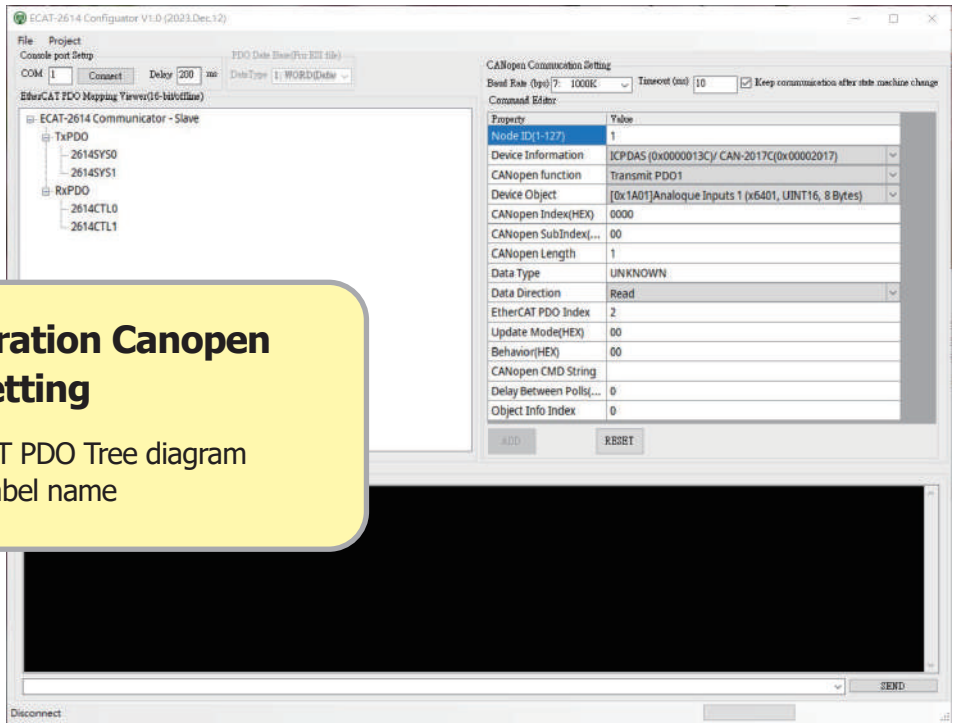
ECAT-2615C

Available Soon

- Supports CANopen
- CAN bus 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 Main Device of EtherCAT and CANopen Industrial Systems Efficiently.





Easy Configuration Canopen SubDevice Setting

- Simulate EtherCAT PDO Tree diagram
- Customize PDO label name

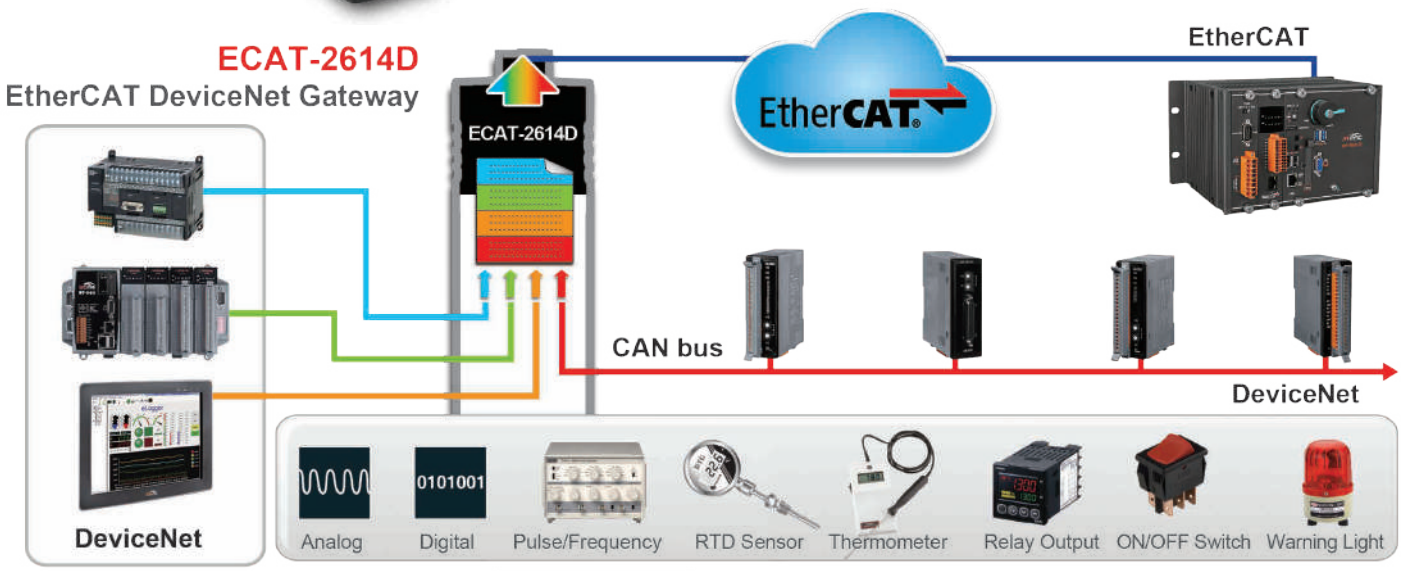
▲ ECAT-2615C provides a CANopen Slave deployment tool that can be configured in 5 minutes.

5-8 Connecting DeviceNet to EtherCAT

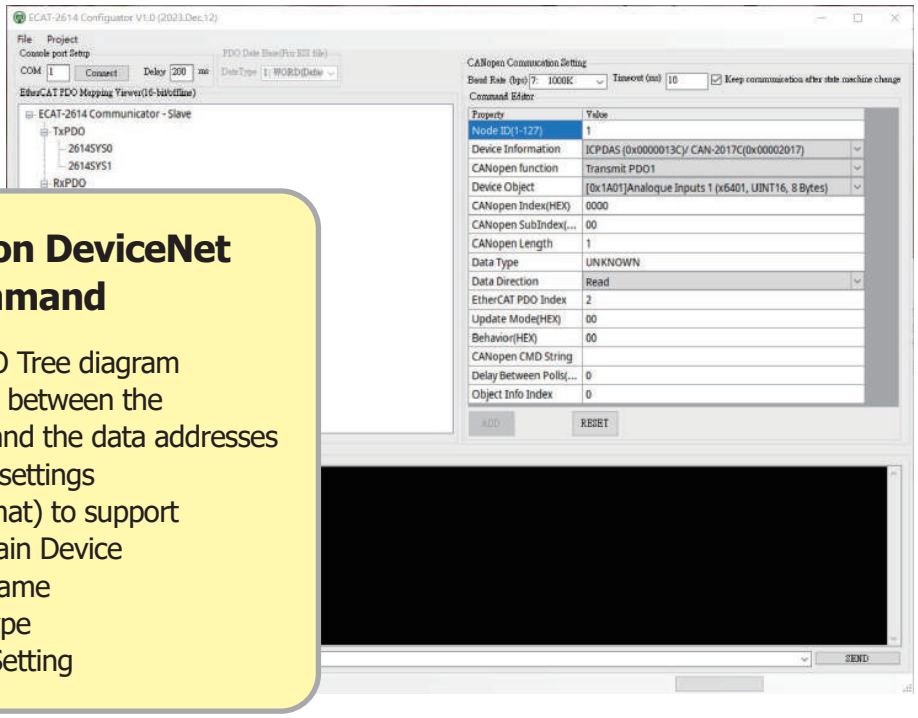
EtherCAT SubDevice - DeviceNet Master

ECAT-2614D Available Soon

- Supports DeviceNet
- CAN bus 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 Main Device via ECAT-2614D as long as it is a DeviceNet device



Easy Configuration DeviceNet Main Device Command

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

▲ ECAT-2614D provides a CANopen command deployment tool that can be configured in 5 minutes.

5-9 Data exchange between DeviceNet and EtherCAT

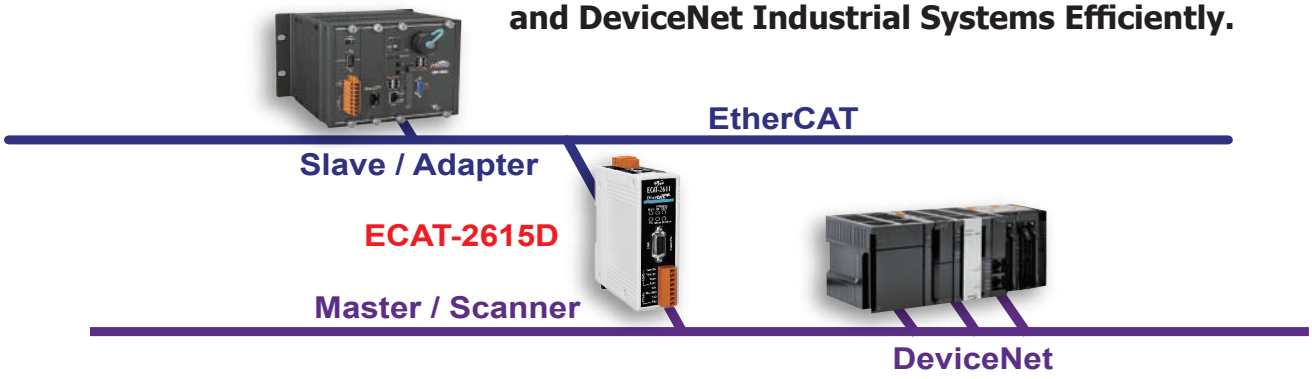
EtherCAT SubDevice - DeviceNet Slave

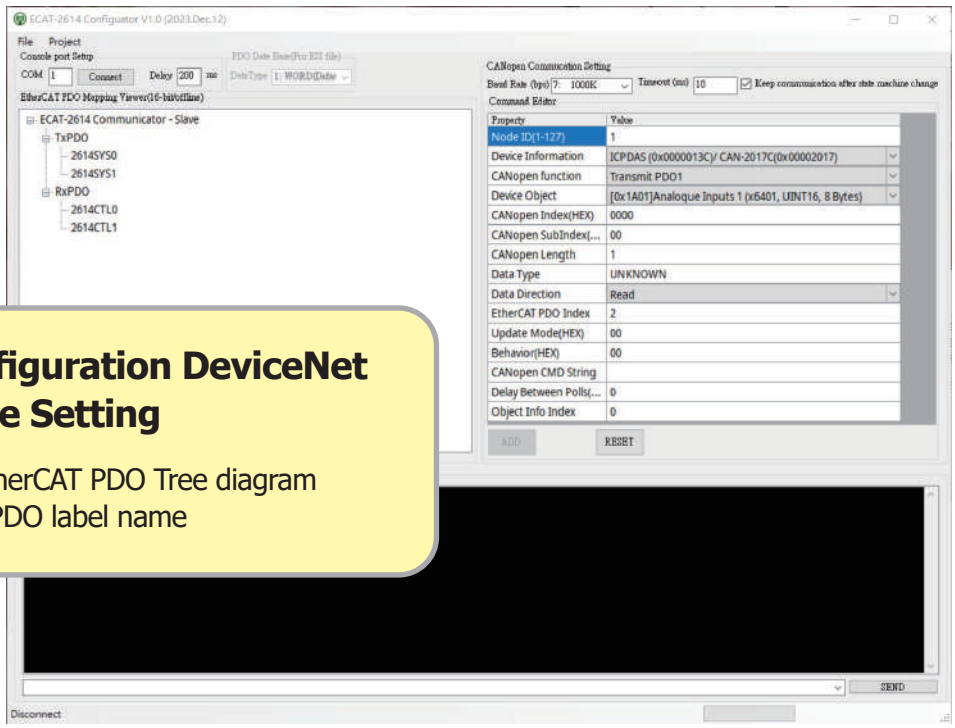
ECAT-2615D

Available Soon

- Supports DeviceNet
- CAN bus 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-2615D Connects the Main Device of EtherCAT and DeviceNet Industrial Systems Efficiently.





Easy Configuration DeviceNet SubDevice Setting

- Simulate EtherCAT PDO Tree diagram
- Customize PDO label name

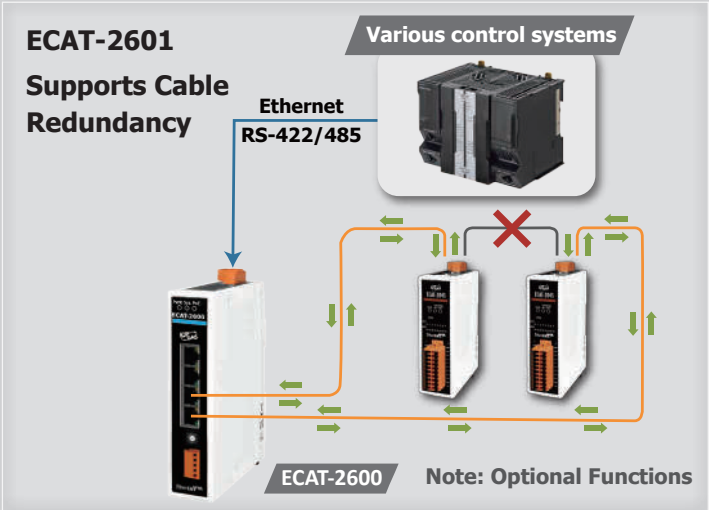
▲ ECAT-2615D provides a DeviceNet command deployment tool that can be configured in 5 minutes.

5-10 ECAT-2601 Industrial IOT Accelerator

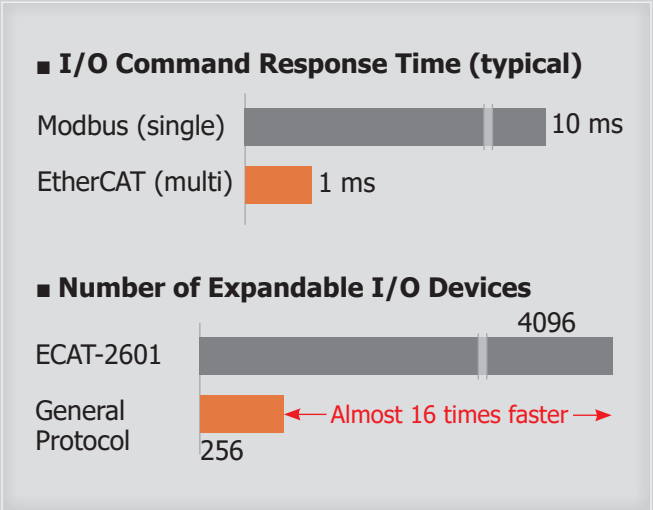
The ICP DAS ECAT-2601 series makes it easy to connect EtherCAT devices to industrial or IoT control systems, providing reliable, high-speed data transmission for applications requiring rapid data transfer. Its intuitive web interface simplifies setup, and the built-in rules engine allows users to implement IF-THEN-ELSE logic without programming, boosting automation efficiency. The ECAT-2601 series also supports mathematical operations, scheduling, and email alarms, enabling quick integration of various EtherCAT devices for enhanced system flexibility and performance.

ECAT-260

Improved Reliability



Enhanced System Capacity and Efficiency



Supports Multiple Networks

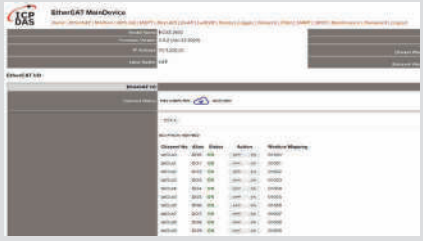
- Supports EtherCAT Main Device
- Supports Modbus RTU/UDP/TCP/TLP
- Supports OPC UA/ MQTT
- Supports CoAP/LwM2M/Rest API/ SNMP (Optional Functions)

Highest Level of Security

- Flexible user management function, you can create a user account to manage the authority of each user.
- Supports security encryption: AES-128, AES-256, SHA-256

Easy to Use

- Recognizes each EtherCAT device and map its data to the control system.
- Intuitive Web Interface
- Plug and play, no need for special cables when using Ethernet ports
- Configures SubDevice Parameters
- Supports Virtual SubDevice ID memory



Add the popular EtherCAT to your system!

▲ Your system can control EtherCAT devices simply by connecting to the ECAT-2601, lowering the threshold for development and setup, and solving the problem of system upgrades and expansions through EtherCAT.

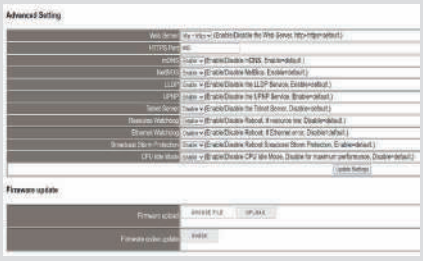
Supports Rules engine

- Can store up to 1024 commands
- Web Interface for Configuration
- I/O channel monitoring and control
- Timer operation
- Schedule operation
- Internal Register operation

Note: Optional Functions

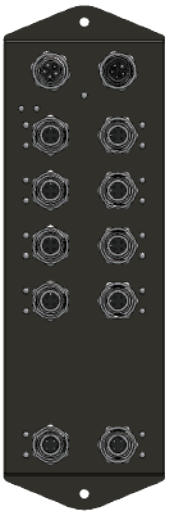
EtherCAT Main Device

- Supports Free Run Mode, SM-synchronized and DC-synchronized operation.
- Cycle time 125us (Max.)
- User-defined SDO Startup Entry
- Supports ICP DAS and third-party EtherCAT SubDevice
- Cable redundancy for greater system reliability



- **Efficient development**
- **Improve system performance easily**
- **Seamless use of EtherCAT devices**
- **Compatible with all control systems**

5-11 EtherCAT to IO-Link Master Gateway



ECAT-2718

EtherCAT to 8-Port IO-Link Main Device

Abnormal Detection

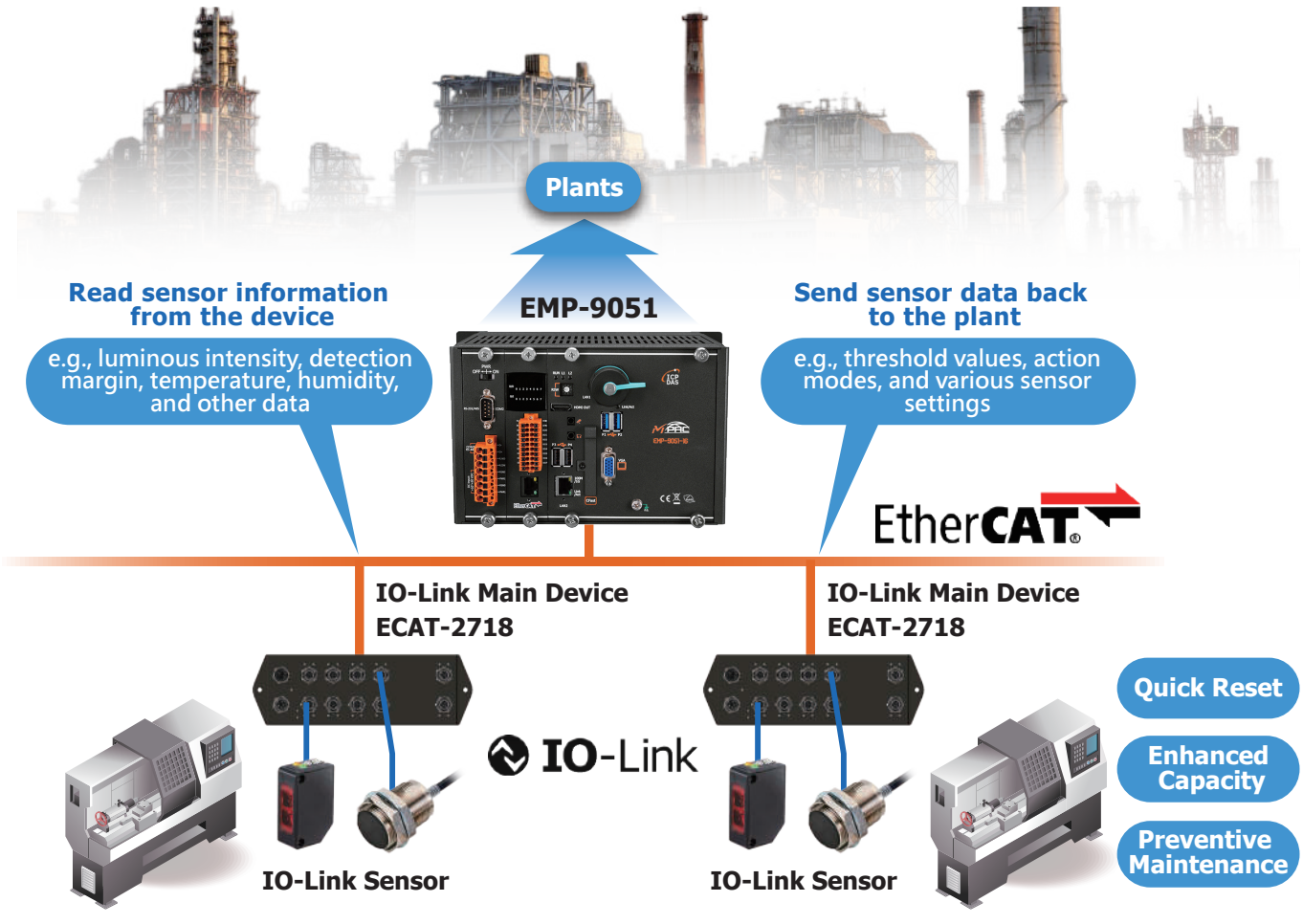
Detect wiring disconnection and abnormal conditions immediately.

Devices Monitoring

When the distance between the sensor and the detected object is too close, it will show an alarm to prevent unexpected events in advance.

Individual ID Identification

Unified ID identification enhances the efficiency of device startup and mold changeover and reduces work hours.



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5-12 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 SubDevices. The IN port is the network's input port. The OUTx port can be used to connect additional EtherCAT SubDevice.

ECAT-2513

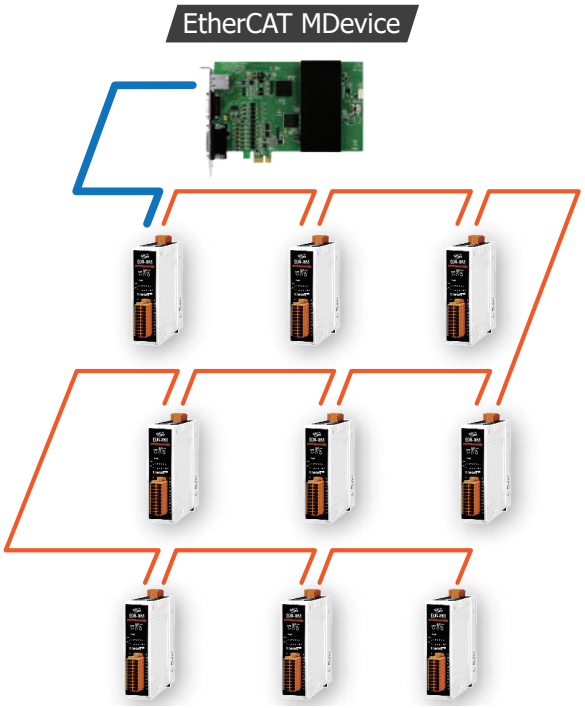
ECAT-2515

ECAT-2517

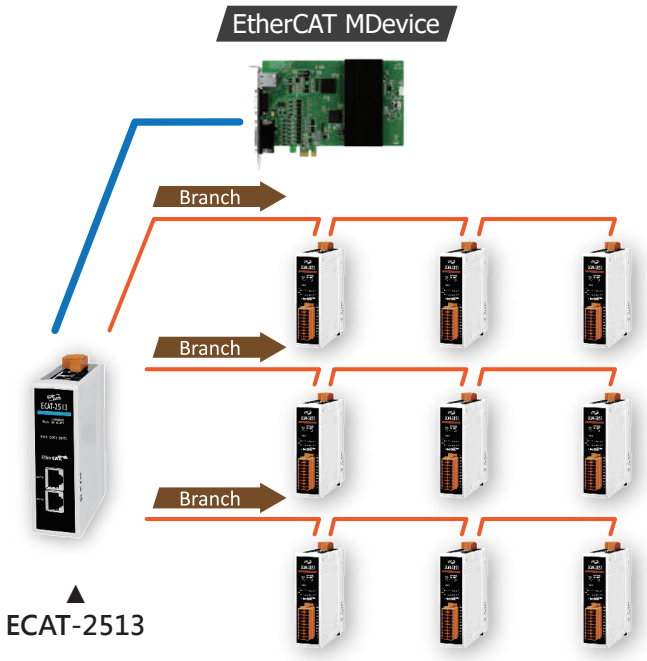
Model	Ports	No. of Nodes	Redundant cable groups(Max.)	Distance Between Stations	Reverse Polarity Protection	Input Range	Redundant Power Input	Consumption
ECAT-2513	4 x RJ-45 (1IN/3OUT)	2	1	Max. 100 m (100BASE-TX)	Yes	+10 ~ +30 VDC	Yes	0.06 A @ 24 VDC
ECAT-2515	6 x RJ-45 (1IN/5OUT)	4	2					
ECAT-2517	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

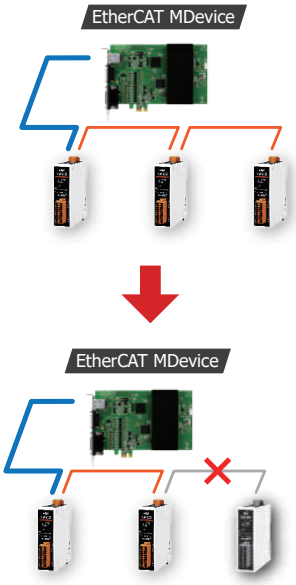


▲
ECAT-2513

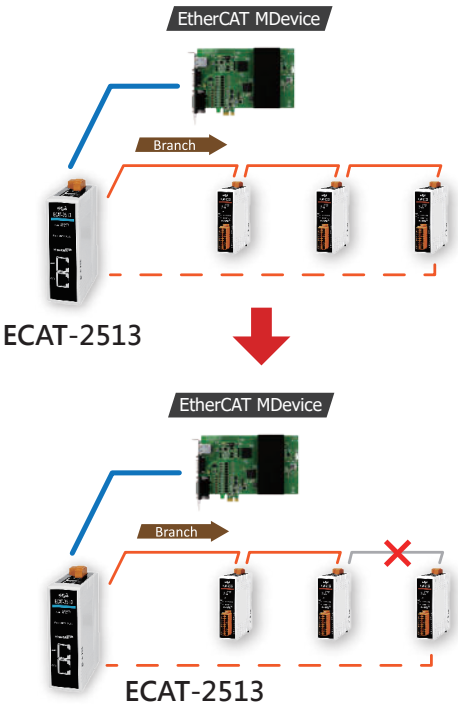
▲Convert to branching connection

Cable redundancy ensures no system shutdowns

When the EtherCAT network is disconnected, the redundancy cable still provides a continuous connection. This feature allows you to repair disconnections without stopping the machine or the production line.

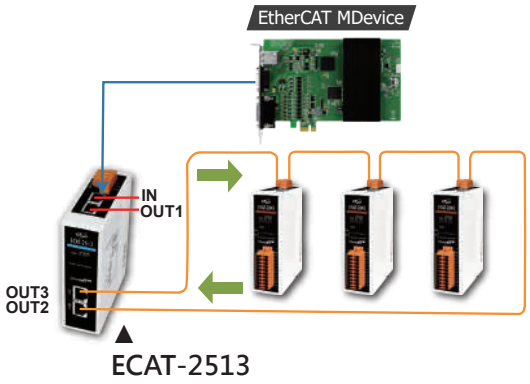


▲Without a junction, the rear module will stop working whenever the cable is disconnected.

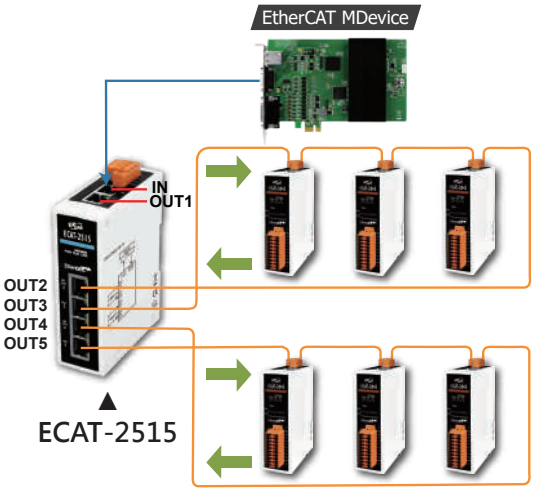


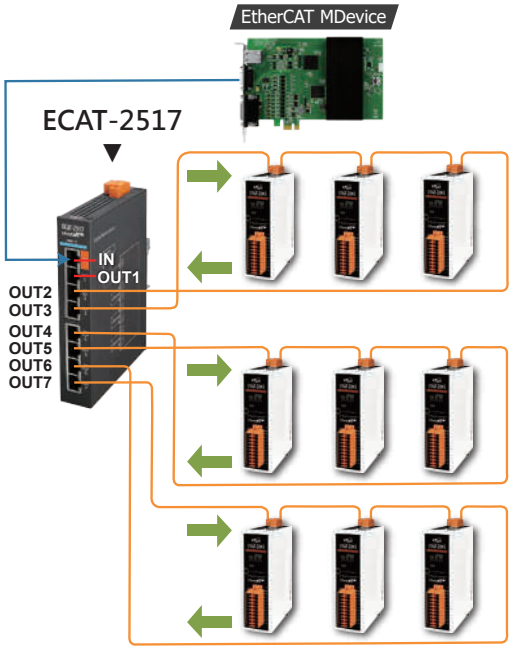
▲When there is a junction, the rear module will immediately return to normal operation via the cable redundancy function.

Provides up to three cable redundancy groups



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





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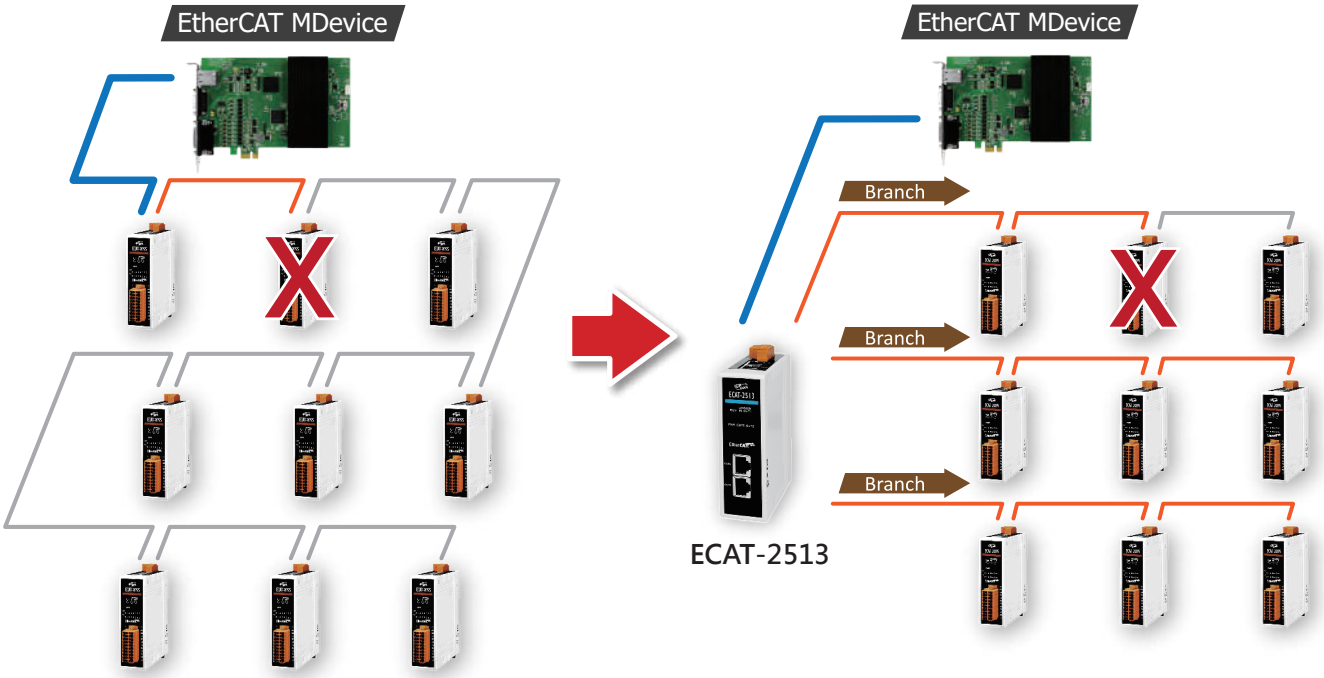
Improve the debugging efficiency and minimize losses.

In a daisy-chain topology, a single SubDevice failure can bring down the entire network. However, with EtherCAT junction, devices can be wired in separate sections. If one device fails, only its section is affected, while others remain connected to the MainDevice controller. This setup also allows for independent debugging, improving efficiency.



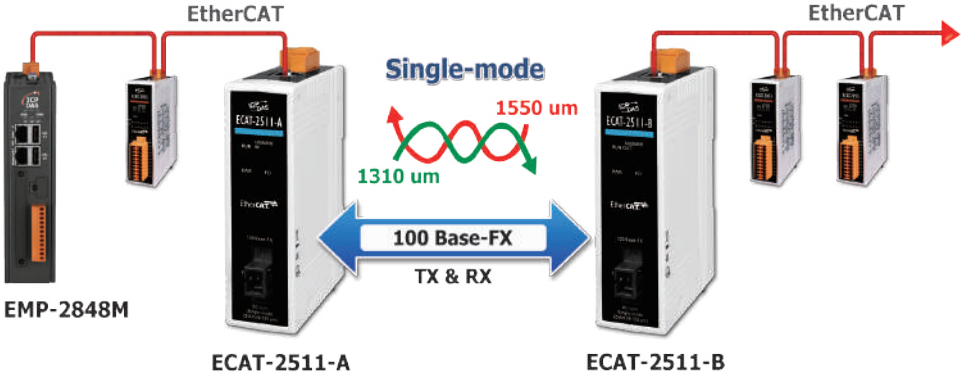
▲Daisy chaining connection

▲Convert to branching connection

5-13 EtherCAT Fiber Converter Modules

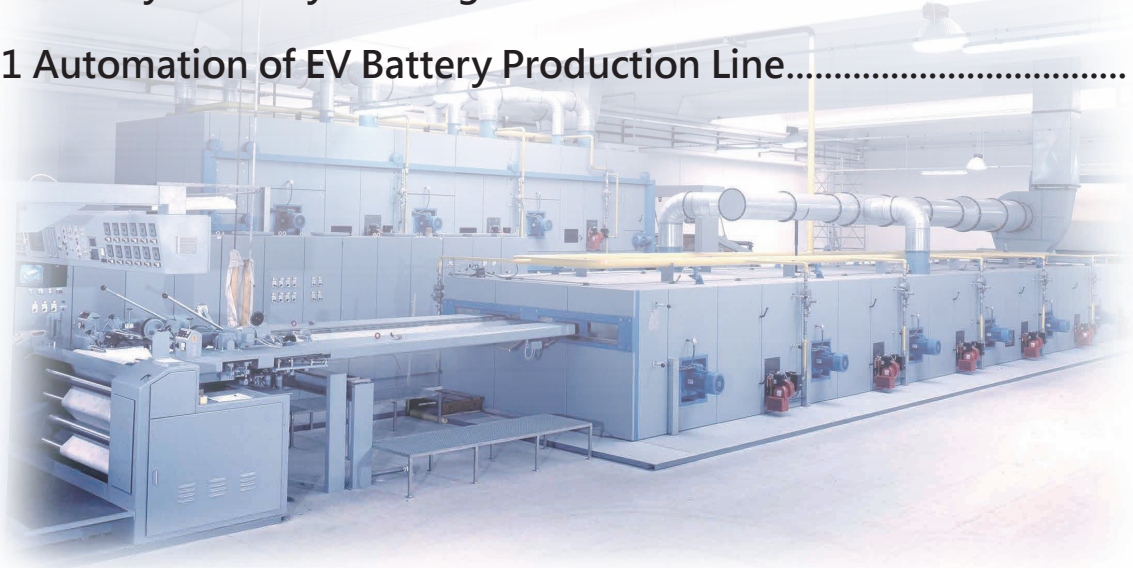
ECAT-2511-A and **ECAT-2511-B** are EtherCAT signal-mode fiber optic converters. Extend the transmission distance via fiber optic. With the advantage of fiber optic, the ECAT-2511-A and ECAT-2511-B enable secure data transmission via fiber optic transmission, and helps the EtherCAT network to prevent noise from EMS/RFI interference.

- EtherCAT type: RJ45, 100 Base-TX
- Fiber optic type: SC, Sindgle-mode, 100 Base-FX
- Fiber optic cable: 8.3/125, 8.7/125, 9/125, 10/125 μm
- Maximum transmission distance up to 25km
- 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
Type	single-mode	Multi-mode
Distance	25km	Shorter
Cable Costs	Low	High

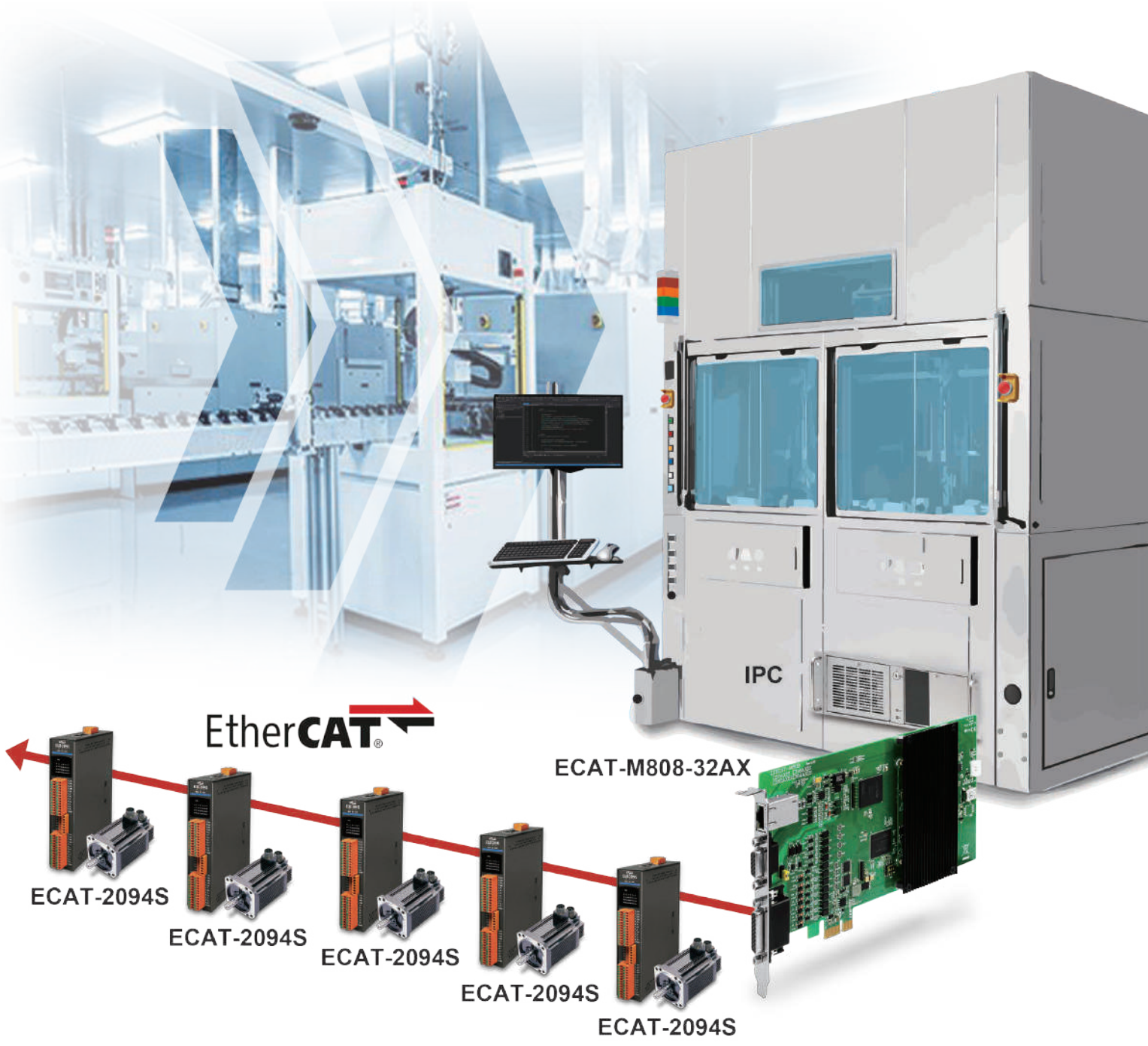
CH6
Application Story



6-1 IC Testing & Sorting Machine

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

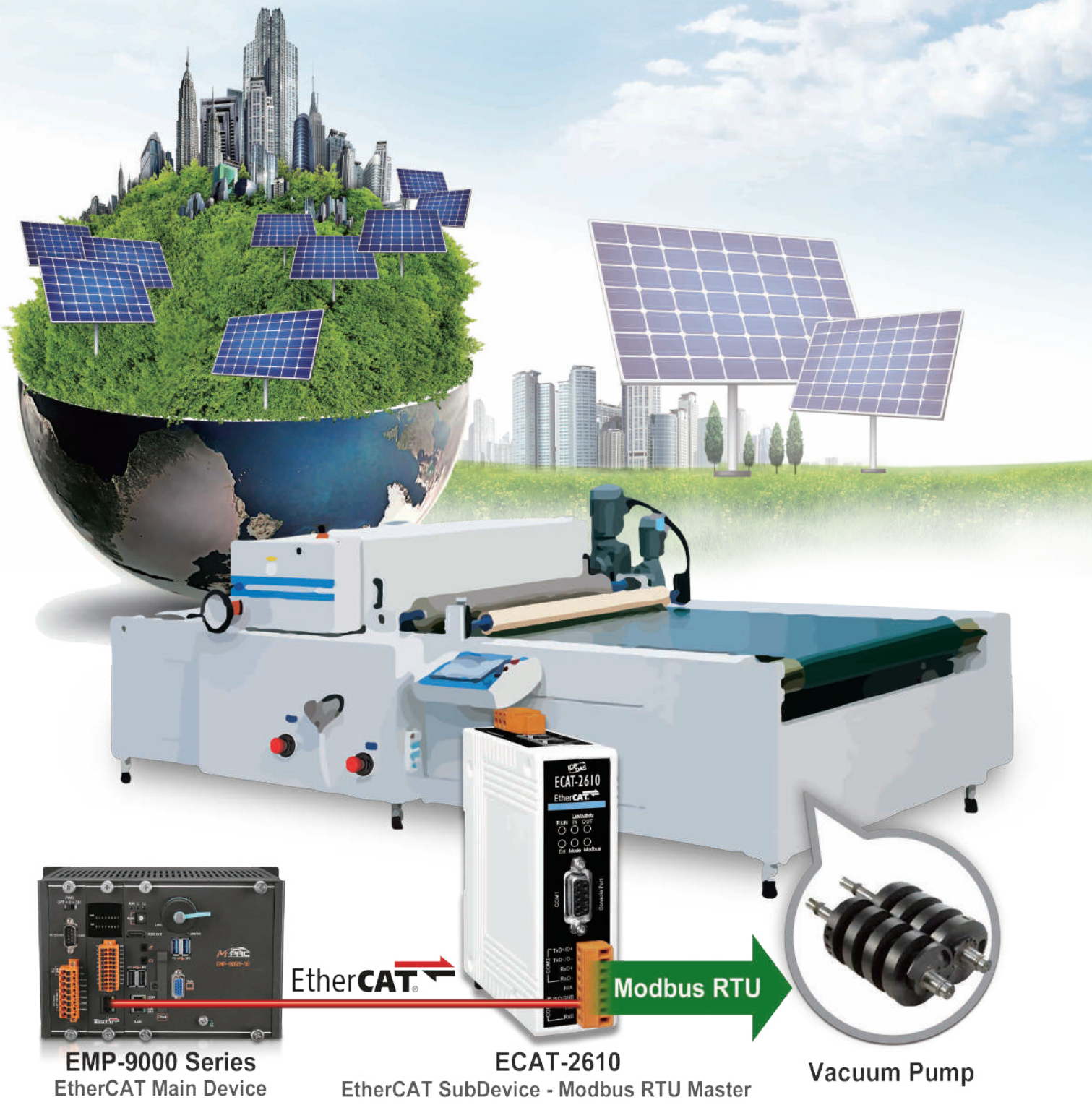
The IC Testing & Sorting Machine conducts electrical testing, visual recognition, and final performance checks on semiconductor components, classifying them as qualified or defective. ICP DAS's EtherCAT solution enhances mechanical performance, production efficiency, test stability, and yield, while saving space and reducing production costs. The ECAT-M801-32AX EtherCAT Main Device card, combined with ECAT-2094S four-axis stepper motor controllers, provides complete 20-axis motion control in limited space, significantly improving machine performance in under two weeks using ICP DAS's custom motion control API.



6-2 Vacuum Coating Machine

EtherCAT Gateway Module enables rapid industrial upgrading.

A vacuum coating machine is versatile, serving industries from decorative item manufacturing to high-tech semiconductor production. To boost efficiency, modern coating machines have adopted EtherCAT control. Monitoring the vacuum pump, crucial for coating quality, is typically done via Modbus RTU, which is difficult to replace. The ECAT-2610 module converts the pump's status data to EtherCAT, solving this challenge without the need for equipment redesign or recalibration, saving both time and effort.



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6-3 Hard Disk Manufacturing Inspection

Efficiently handle system detection with EtherCAT encoder modules

In hard disk manufacturing, the largest machines are typically those used for testing rather than cutting or assembling. Before assembling hard drives, quality control inspects each flash chip, and during assembly, various tests, including stress, high-temperature stability, and long-term reliability, are conducted. A well-known hard disk manufacturer uses the ECAT-2073I EtherCAT Three-Channel Incremental Encoder Counter for inspection planning and testing on the production line. The ECAT-2073I offers three high-speed counting channels, strong anti-noise capabilities, and multiple counting modes, enabling precise motor speed control and monitoring for potential screw failures during manufacturing.

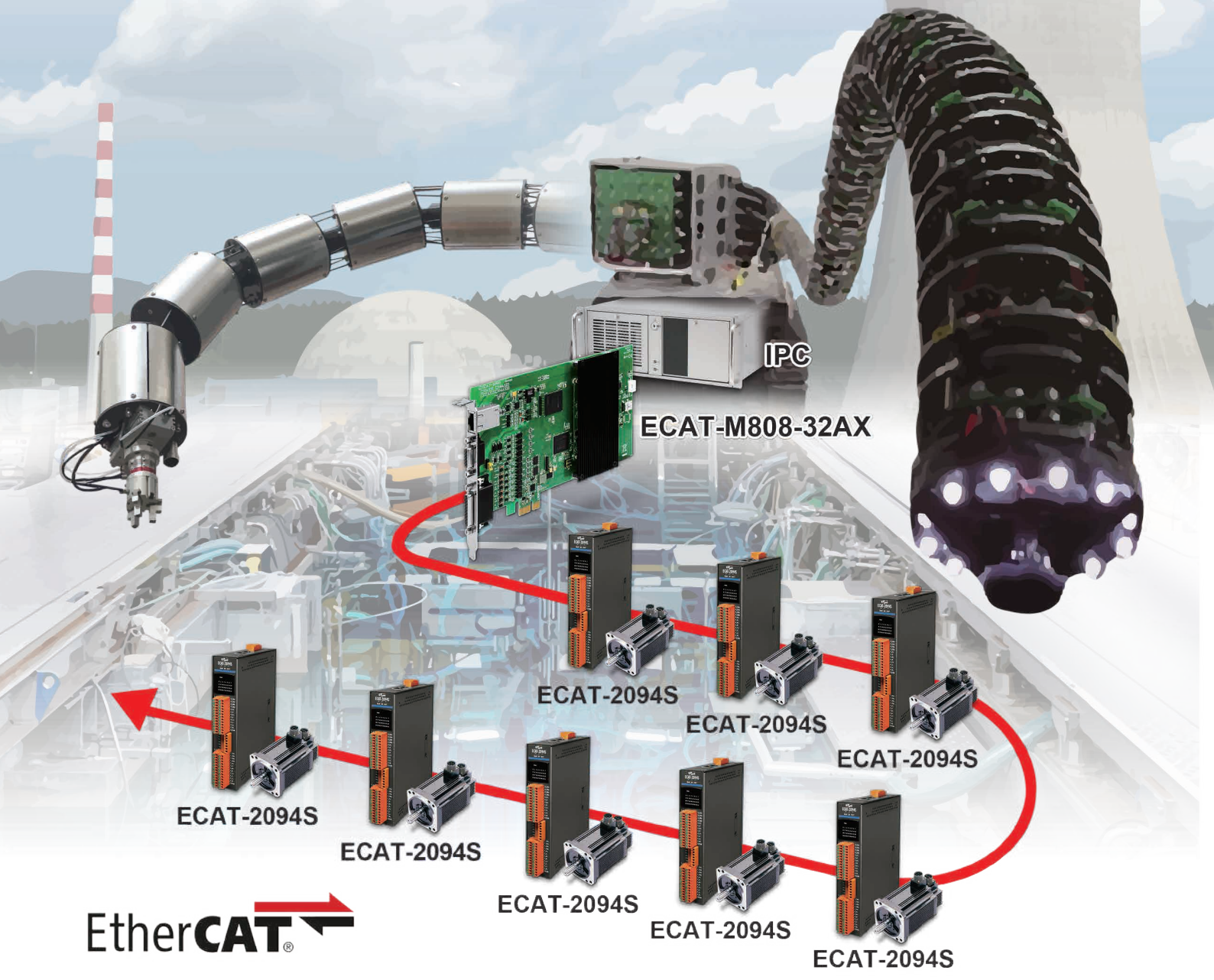
6-4 Remotely Controlled Manipulators

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

Taiwan has been moving toward a nuclear-free future, with plans to close several nuclear power plants. However, decommissioning these facilities is challenging due to the complex structure of nuclear components and the risks posed by radioactive materials.

To address this, the Institute of Nuclear Energy Research (INER) is using ICP DAS's ECAT-M808-32AX EtherCAT Main Device Card, which supports up to 32-axis motion control, along with ECAT-2094S stepper motor controllers to operate remote-controlled electrical manipulators. These manipulators assist in nuclear waste investigation and cleanup, offering high flexibility and precision.

The snake-shaped manipulators, developed by INER, are compact, flexible, and easy to operate, making them ideal for decommissioning tasks. The ICP DAS EtherCAT system ensures precise multi-axis control, enhancing the efficiency and safety of nuclear facility decommissioning.



6-5 Automatic Guided Vehicle (AGV)

Using EtherCAT gateway to freely transfer the data between two systems

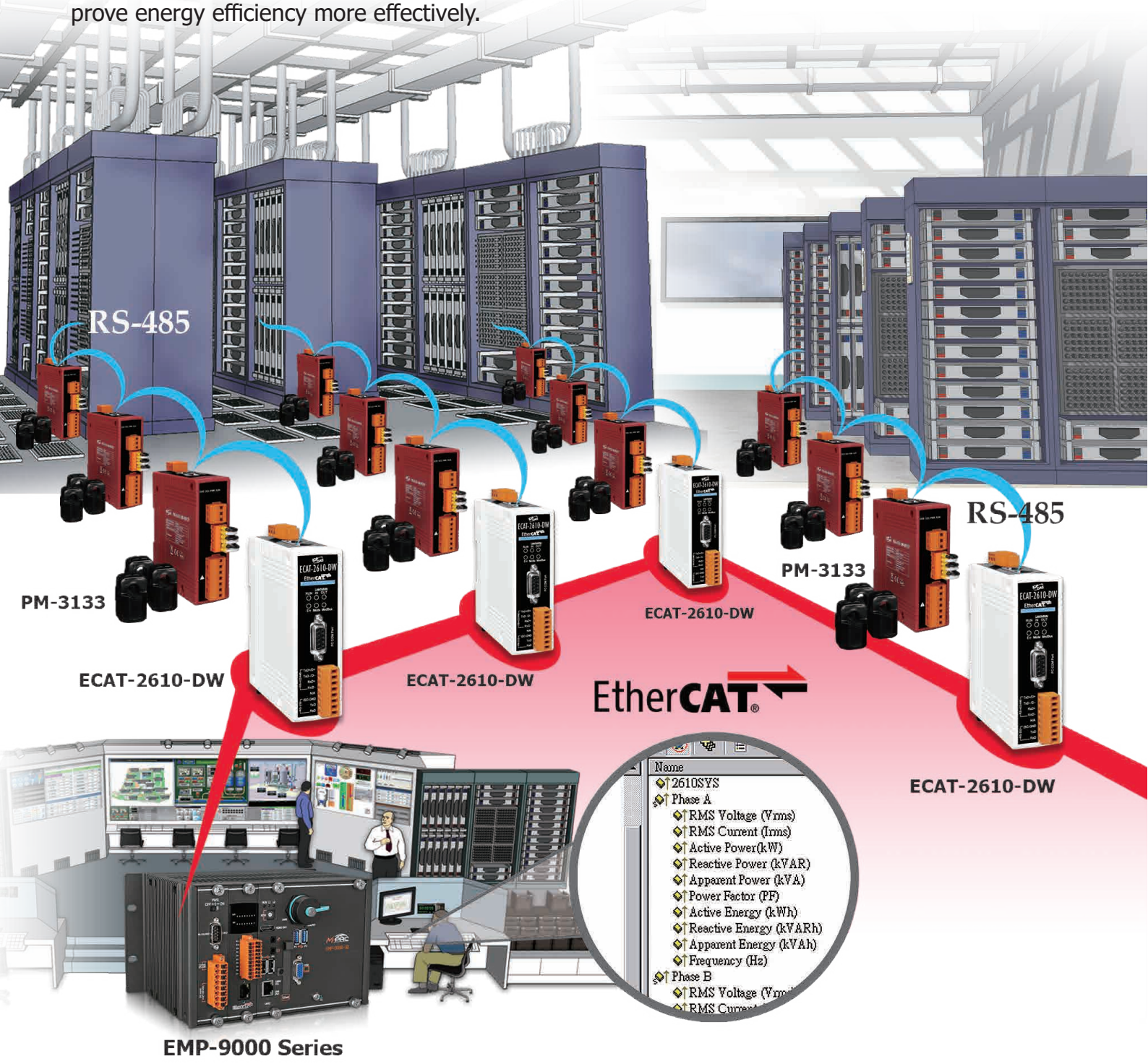
The Automatic Guided Vehicle (AGV) in this case is primarily in charge of comparing test object data and writing the result data. Firstly, the PLC reads the data of the test object via RFID, and then the AGV obtains the RFID data on the PLC via ECAT-2611 EtherCAT SubDevice to Modbus RTU Slave gateway, 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 SubDevice 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 SubDevice between the Main Device 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.

6-6 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.

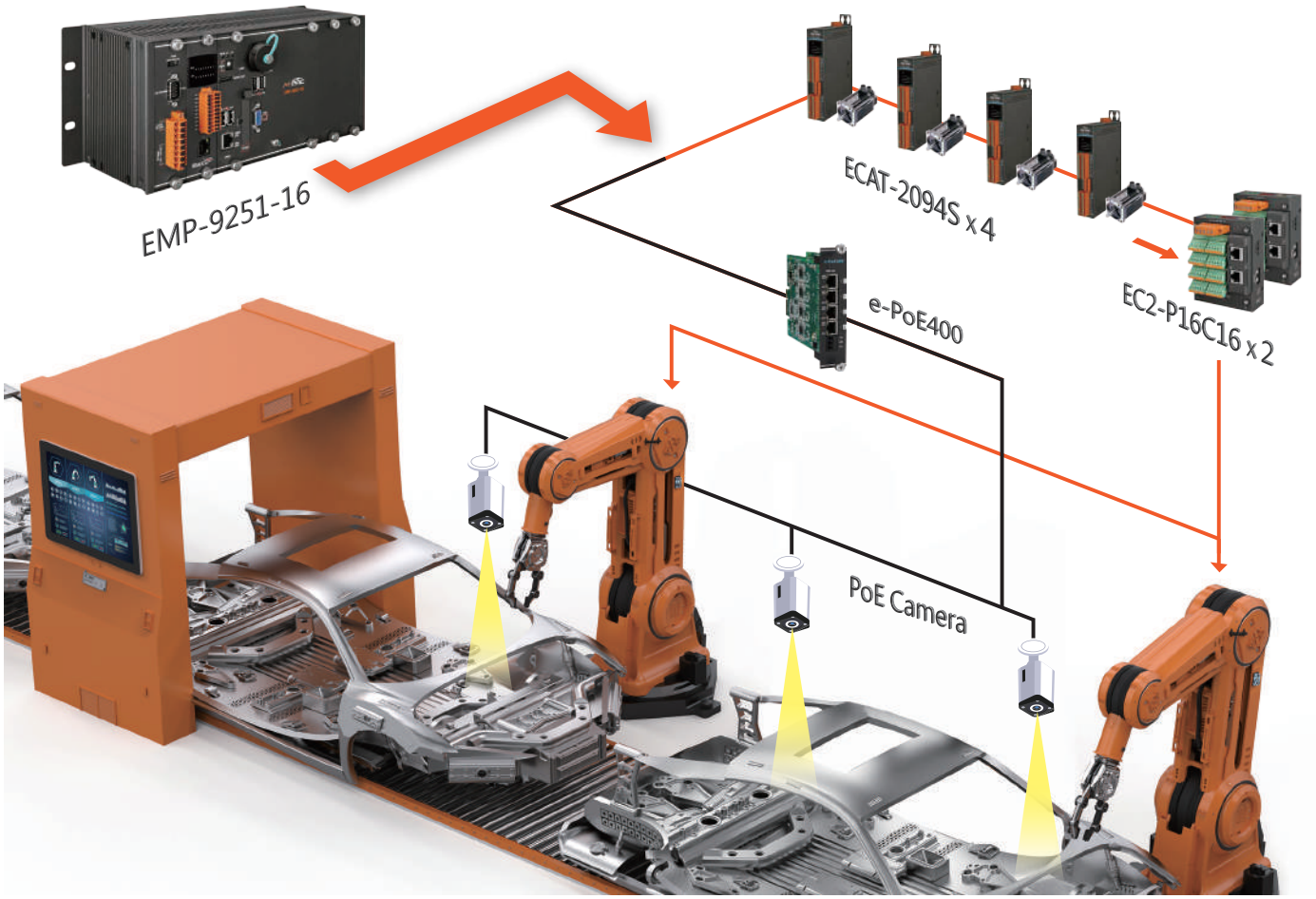


6-7 Automobile Assembly Plant (Automated Optical Inspection)

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.



6-8 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

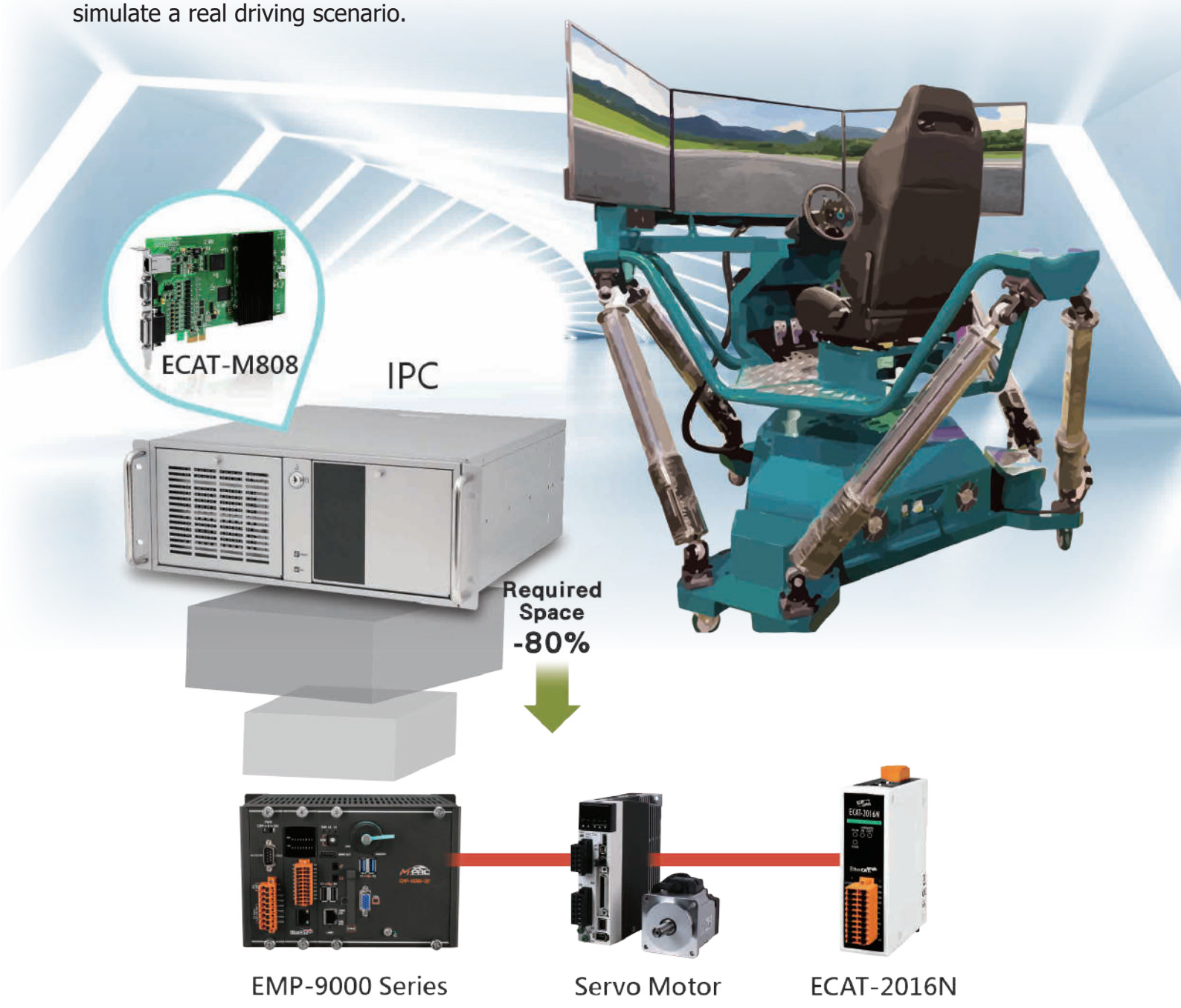
Model	Compatible e-Bus Card	EtherCAT Port	USB 3.0 Port	PoE Port
EMP-9251-16	-	1	0	0
EMP-9251-32	e-USB404	1	4	0
EMP-9258-16				
EMP-9258-32	e-POE404	1	0	4

6-9 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 Main Device 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.

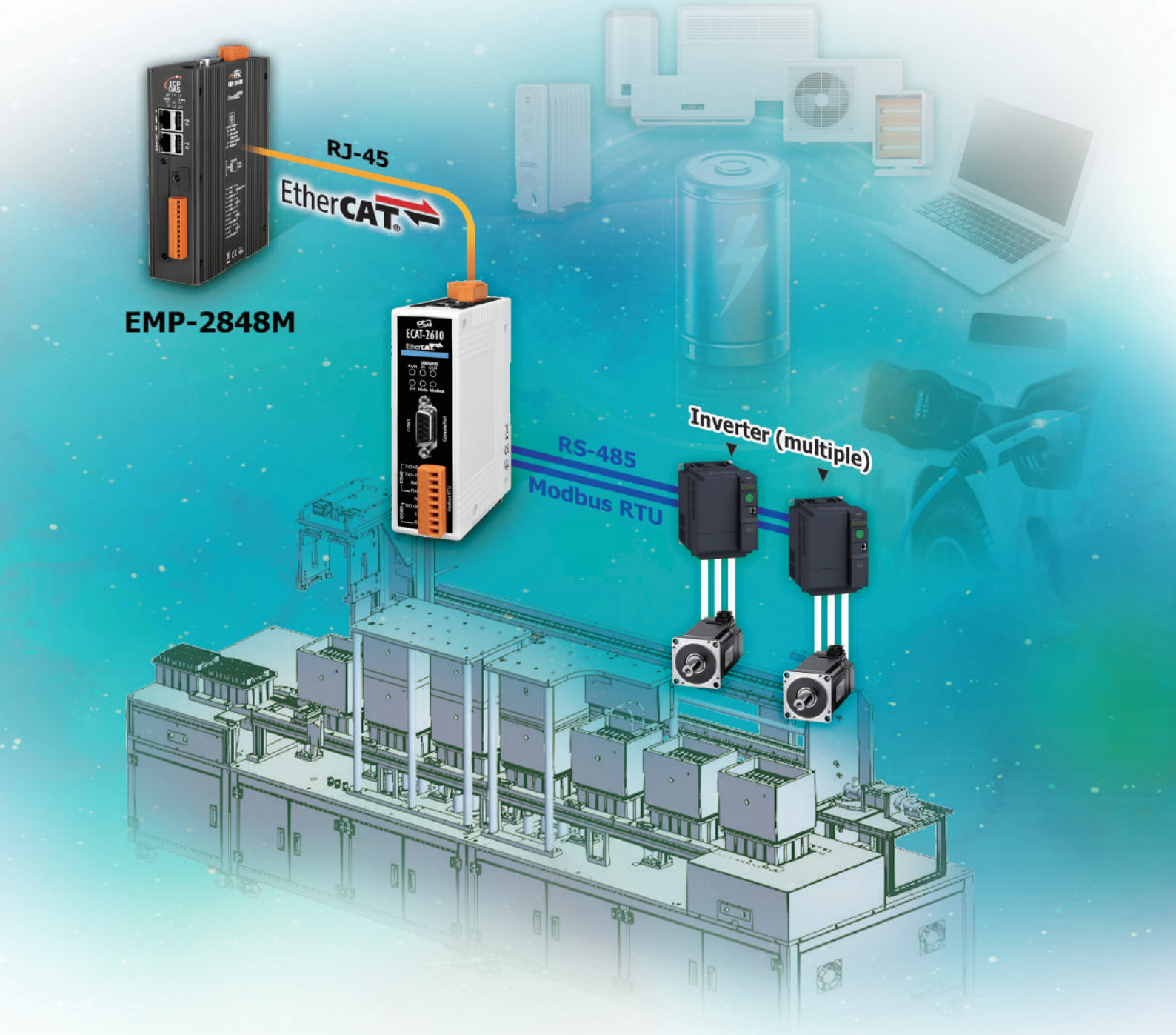


6-10 Battery Electrolyte Filling Line

Increased Production Capacity with EtherCAT Gateway

Lithium-ion batteries have become the main source of power for cell phones, laptops, home appliances, and electric vehicles. A stable and efficient battery affects the use life of the product, and battery performance depends on the quality of the electrolyte.

To make the production of lithium batteries more efficient, a battery manufacturer with one of the largest market shares in the world has switched to EtherCAT communication. However, the inverter only supports Modbus RTU communication. In this production line, the EtherCAT MainDevice EMP-2848M uses the inverter to drive the motor through the ECAT-2610 gateway, which successfully shortens the electrolyte filling time and greatly improves production efficiency.



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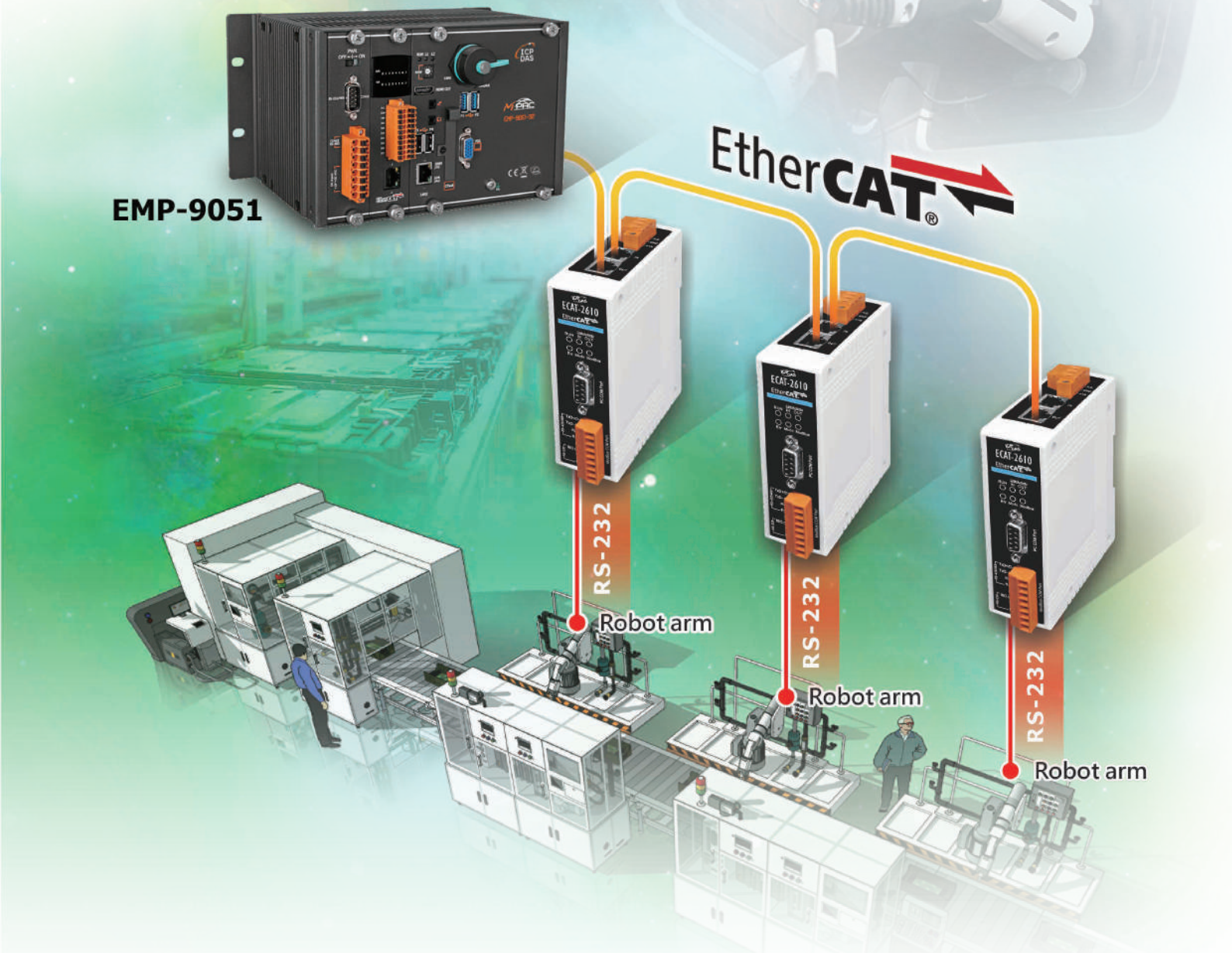
6-11 Automation of EV Battery Production Line

Increased Production Capacity and Security with multiple EtherCAT Gateways

With the increasing awareness of environmental protection, electric vehicles have shown explosive growth in recent years. Power battery technology is important in the manufacture of electric vehicles. A Chinese brand has not only the technology to manufacture vehicles but also the core patented technology of lithium-ion batteries. To maintain their competitive edge, they are constantly upgrading their plants and production processes, especially in the area of battery manufacturing. The main goal is to standardize the production of high-quality batteries to increase efficiency and reduce costs.

They plan to use EtherCAT communication to process battery cell automation. It provides reliable, efficient control to increase production capacity and operate in densely distributed infrastructures. However, one of the key components of the automation, the robot arm, only supports Modbus RTU communication. Finally, the robot arm communication problem was solved by ECAT-2610, ensuring that all robotic arms work seamlessly in coordination with other components in the production line, thus making sure that production runs smoothly and safely.



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

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