CLPA

Cutting-edge Technology

Open Industrial Network

Global Partners

CC-Link Partner Association Overview

CC-Link **IE T SN**
Open the Future of Connected Industries

CC-Link IE TSN
Open the Future of Connected Industries

CC-Link Partner Association (CLPA), a Global Leader in Promoting Truly Open Industrial Networks Essential for Smart Factories

Message

Information and communication technology has fundamentally changed our daily lives and industrial activities. Various activities, which used to be performed by human-to-human communication or document sharing, are now performed by digitalized methods and in an automated/autonomous manner. The production process now integrates many different lifecycle tasks. These include direct physical production activities, business processes, supply chains, after sales service and take back/ recycling. Key to this integration is information and communication technologies. By flexibly combining complementary activity in related enterprises, new industrial sectors are emerging. With key words such as "Smart manufacturing" or "Cyber-physical production systems", many projects from new industrial revolutions are being promoted in industrially advanced countries. Developing countries are also rapidly catching up on such trends.

One of the important factors for the drastic changes in production is the spread of information and communication infrastructure. This consists of industrial information networks connected to enterprise information networks. Hence the integration and utilization of comprehensive data about production assets is made possible. These assets may include equipment, materials, parts, products, manufacturing technology and environment. Such industrial information networks of production assets become indispensable infrastructure for advanced manufacturing.

To realize such an industrial information network in practical and meaningful scale and cost, it must be an open and standardized network which can be shared and utilized across the boundary of individual enterprises. Versatile functional requirements with respect to communication speed, data volume, network control methods and network complexity, etc. are also desirable. Finally, continuing development works should be performed to seek higher functionalities.

CLPA has addressed these requirements for an open and standardized industrial network. This was begun with CC-Link open fieldbus. Ethernet-based CC-Link IE followed, and high-performance CC-Link IE TSN was recently introduced. CLPA will continue to respond to the ever expanding demands for advanced industrial networks. In this way, CC-Link Family of open networks will contribute to the development of future advanced manufacturing systems.

Supreme Advisor
Fumihiko Kimura

Faculty of Science and Engineering,
Department of Mechanical Engineering
Professor emeritus of Tokyo University,
Doctor of Engineering

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CC-Link Partner Association has developed CC-Link IE TSN, the world's first open industrial network utilizes Time-Sensitive Networking (TSN) technology, which is an extension of standard Ethernet, to accelerate the construction of smart factories utilizing IoT.
In response to increasingly diverse market demands in the manufacturing field, we will provide a variety of development methods and develop a truly open industrial network on a global scale.

CC-Link Partner Association Overview

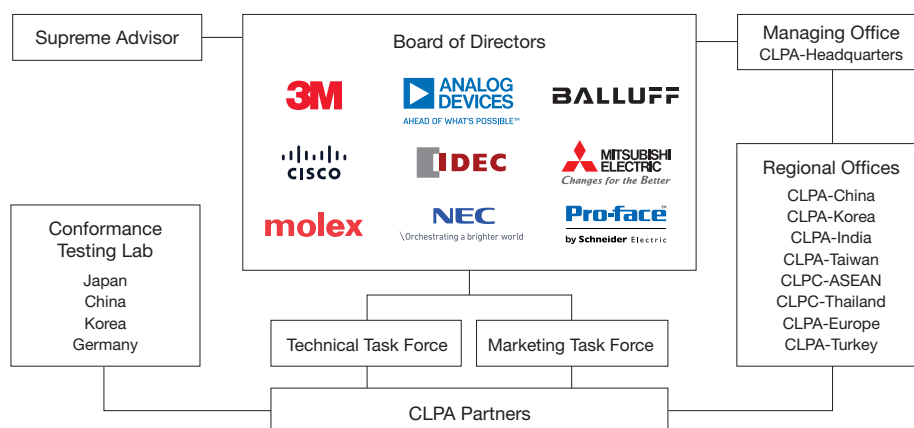For more information, please check CLPA Global Website.

CLPA, the organization promoting open networks as well as your business partner. Support vendors and users in the global promotional activities of CC-Link Family*.

CC-Link Partner Association (CLPA) was established in November 2000 with the slogan "CC-Link, the open field network, will become world's de facto standard". Ever since, the Board of Directors, Marketing Task Force and Technical Task Force have joined forces to help vendors to develop compatible products and users to build open FA systems.

* A general term for network technologies promoted by CLPA, such as CC-Link, CC-Link IE, and CC-Link IE TSN.

■ Organization Chart for CC-Link Partner Association

Supreme Advisor	Board of Directors	Managing Office CLPA-Headquarters

Board of Directors:
3M, ANALOG DEVICES AHEAD OF WHAT'S POSSIBLE™, BALLUFF, CISCO, IDEC, MITSUBISHI ELECTRIC Changes for the Better, molex, NEC \Orchestrating a brighter world, Pro-face by Schneider Electric

Conformance Testing Lab
Japan
China
Korea
Germany

Regional Offices
CLPA-China
CLPA-Korea
CLPA-India
CLPA-Taiwan
CLPC-ASEAN
CLPC-Thailand
CLPA-Europe
CLPA-Turkey

Technical Task Force	Marketing Task Force

CLPA Partners

The industrial open network first from Japan continues to keep the interest of the world.

CLPA regularly participates in exhibitions and holds seminars all over the world for various industries. These are a key part of our strategy to promote the industry leading features of CC-Link Family. CLPA will continue to propose future visions as represented by CC-Link IE TSN.
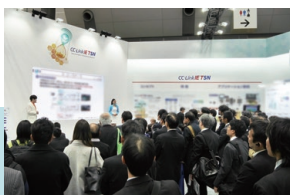
Exhibitions

Seminars

Website and News

Growth of CLPA - Global Network

These figures are self-explanatory about the development and growth on the global level.
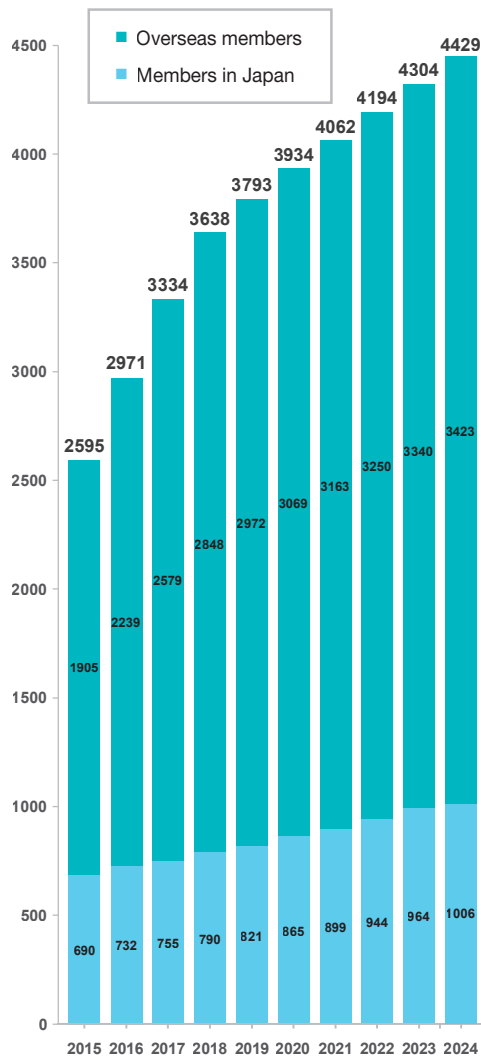
Many Member Firms Come Crossing the Borders to Join CC-Link Partner Association.

Though starting with only 134 member firms when established, currently CLPA has over 4,429 corporate members worldwide in financial year 2024 (as of the end of March 2025). The overseas firms account for as much as 80 % of the memberships, providing solid evidence that the world has recognized that CC-Link Family have become true global standards.

A Line of Diversified CC-Link Family Compatible Products, as Many as the Number of User Voices.

With the increasing number of vendor firms joining CC-Link Partner Association, the accumulated number of CC-Link Family compatible products is now over 3,245 models. Partner companies also receive the benefit of their products being promoted in various CC-Link Partner Association activities free of charge, including CC-Link Family Certified Product Search.
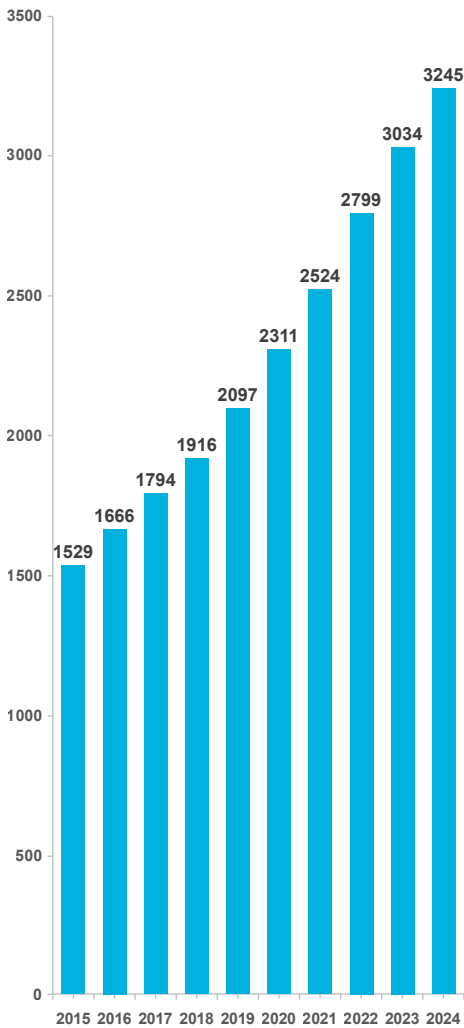
■ Number of CLPA Partners

Overseas members
Members in Japan

Year	Total	Overseas	Japan
2015	2595	1905	690
2016	2971	2239	732
2017	3334	2579	755
2018	3638	2848	790
2019	3793	2972	821
2020	3934	3069	865
2021	4062	3163	899
2022	4194	3250	944
2023	4304	3340	964
2024	4429	3423	1006

■ Number of CC-Link Family Compatible Products

Year	Products
2015	1529
2016	1666
2017	1794
2018	1916
2019	2097
2020	2311
2021	2524
2022	2799
2023	3034
2024	3245

Global Operations in 9 Regions Worldwide

CLPA has 9 regional offices located in Japan, China, Korea, India, Taiwan, ASEAN, Thailand, Europe and Turkey. These offices promote CC-Link Family network technology, facilitate the adoption of CLPA networks by device vendors, machine builders and end users, and provide a wide range of services to CLPA members.

Japan	• CLPA-Headquarters CT	
Asia-Pacific	• CLPA-China CT	• CLPA-Taiwan
	• CLPA-Korea CT	• CLPC-ASEAN
	• CLPA-India	• CLPC-Thailand
EMEA	• CLPA-Europe CT	
	• CLPA-Turkey	

CT : Conformance Testing Lab

For more information on Regional Offices, please check CLPA Global Website.

International Standardization

High-level technology and ease-of-use

CC-Link Family has been certified to conform to international standards, IEC Standards and SEMI Standards for the semiconductor and FPD industries, in addition to the National Standards of China and Korea. An established de facto standard in Japan, now it is now also recognized as a global standard. It meets the conventional requirements for open networks, communication compatibility and a diverse lineup of compatible products. In addition, it can drastically improve the production efficiency of manufacturing systems and applications. Its high technological level and ease of use are internationally appreciated.

International Standard: ISO	ISO15745-5: CC-Link published in February 2007
International Standard: IEC	IEC61158, IEC61784-1: CC-Link published in December 2007 IEC61158: CC-Link IE Controller Network, CC-Link IE Field Network published in August 2014 IEC61158: CC-Link IE TSN in March 2023 IEC61784-2-8 : CC-Link IE Controller Network, CC-Link IE Field Network, CC-Link IE TSN in March 2023 IEC61784-3-8: CC-Link Safety published in June 2010 IEC61784-3-8: CC-Link IE Safety published in July 2016 IEC61800-7: CC-Link IE Field Network published in November 2015
SEMI Standard	SEMI E54.12: CC-Link published in July 2001 SEMI E54.23: CC-Link IE Field Network published in May 2013 SEMI E54.23: CC-Link IE TSN published in May 2020
The National Standards of the People's Republic of China: GB	GB/T 20299.4-2006 Chinese BA (Building Automation) standard: CC-Link published in December 2006 GB/T 19760.1/2/3/4-2008: CC-Link published in June 2009 GB/Z 29496.1/2/3-2013 : CC-Link Safety in December 2013 GB/T 33537.1/2/3-2017: CC-Link IE published in September 2017 GB/T 37085.308-2025: CC-Link IE Safety published in January 2026
The National Standards of the Republic of China (Taiwan): CNS	CNS 15252X6068: CC-Link published in May 2009
Korean Industrial Standards: KS	KSB ISO 15745-5: CC-Link published in March 2008 KSC IEC 61158/61784: CC-Link published in December 2011 KSC IEC 61784-5-8: CC-Link, CC-Link IE Controller Network, CC-Link IE Field Network published in December 2014 KSC IEC 61784-3-8: CC-Link IE Safety published in July 2018

For more information on International Standardization, please check CLPA Global Website.

Process Flow for Developing CC-Link IE TSN Compatible Products

CC-Link Partner Association will support you from development to sales of CC-Link IE TSN compatible products.

Flow from development to sales of partner manufacturers

1 Consider development

Select the station type, certification class, development method, etc. It is possible to use various development methods provided by the corresponding development tool partner manufacturer.

2 Admission

In order to develop and sell CC-Link Family compatible products, you must first become a regular member or higher of CC-Link Partner Association.

3 Development/ Evaluation

Perform detailed design of the hardware and software based on the products to be developed and the network configuration.

Full support from CLPA!

Development support

For those who are developing CC-Link Family products for the first time, we can introduce you to development tool partners and provide individual technical support on development methods. CLPA also offers seminars for developers.

Provision of technical specifications and conformance test specifications

Provided free of charge by CLPA
• Specifications for the development of CC-Link Family compatible products
• "Conformance Test Specification" for conformance testing of developed products

Support at development tool partner manufacturers

■ Consulting
In addition to consultation on product development, seminars sponsored by development tool partner manufacturers are also held. Please contact the manufacturer.

■ Development tool sales/ Technical support
Support for technical questions in the process of development. Please contact the manufacturer.

4 Perform conformance tests

The test at the manufacturer and the test at CLPA are taken for each model based on the "Conformance Test Specifications". To facilitate the conformance testing process, CC-Link Partner Association has conformance testing labs available in Japan and overseas.
* A certificate will be issued after a conformance test is passed.

5 Sales

Products that have passed the conformance test can be sold as compatible products. If you wish to promote your product on CLPA Global Website, please register your product information on CLPA Members Site.

Conformance test application

Registering	Requested	CLPA Accepted	Testing in progress	Certified	Completed

You can apply for the conformance test and check your progress from CLPA Members Site.

Conformance testing lab

CLPA members can use the Conformance Testing Lab facilities to perform the various tests required for CC-Link Family compatible products.
Communication performance can be verified by noise test, hardware test, software test, and combined test.

Promotion

By registering compatible product information, products can be published on CLPA Global Website.

CC-Link Family Network Features

CLPA has released "CC-Link", the first open field network from Japan and Asia, "CC-Link IE", the industry's first industrial open network based on 1Gbps Ethernet, and "CC-Link IE TSN", the world's first industrial open network to combine gigabit bandwidth with Time-Sensitive Networking (TSN) technology. Over the 20 years since the establishment of CLPA, CC-Link Family has evolved into network technologies that can seamlessly connect and integrate networks from sensors to controllers and IT systems, and are essential to the realization of smart factories.
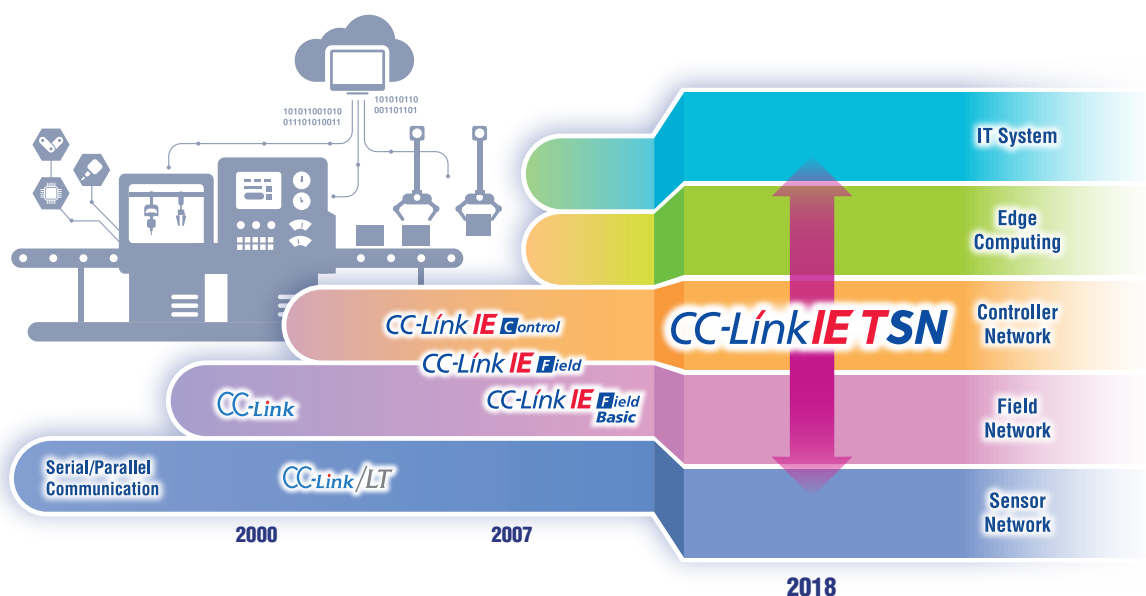
Ethernet Based Network

CC-Link IE TSN

The first in the world to adopt TSN technology for industrial open network.

▶ Details: P.10

CC-Link IE Field

High-speed, seamless networking at the field level.

▶ Details: P.21

CC-Link IE Control

A wide factory backbone network utilizing gigabit Ethernet technology.

▶ Details: P.20

CC-Link IE Field Basic

Enables software implementation and easier development. Suitable field network for small-scale systems.
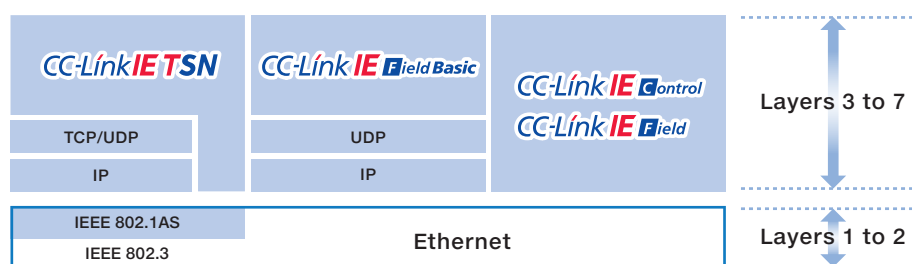
▶ Details: P.22

Serial Based Network

CC-Link

Open field network that has become a global standard from Japan and Asia.

▶ Details: P.22

CC-Link IE

CC-Link IE is an open industrial network that utilizes standard Ethernet technology to connect distributed control, I/O control, synchronous motion control, and safety control all on the same network. Its features achieve a mixture of high-speed, large-volume control communication (real-time communication) combined with information communication (non real-time communication). The two can coexist thanks to the 1 Gbps bandwidth. Since it is simple to build not only the system to control and monitor a production site but also the system to collect and analyze information on the production site, CC-Link IE will bring benefits to a wide rage of industries.

| CC-Link IE TSN	CC-Link IE Field Basic	CC-Link IE Control CC-Link IE Field	Layers 3 to 7
TCP/UDP	UDP		
IP	IP		
IEEE 802.1AS IEEE 802.3	Ethernet		Layers 1 to 2

Deterministic Control

The 1 Gbps communication bandwidth is divided into control communication and information communication such as traceability and diagnostic data. Control communication is deterministic and achieves a stable communication cycle even with large volumes of information communication.

DETERMINISTIC

1 Gbps bandwidth

- Control communication (real-time communication) bandwidth
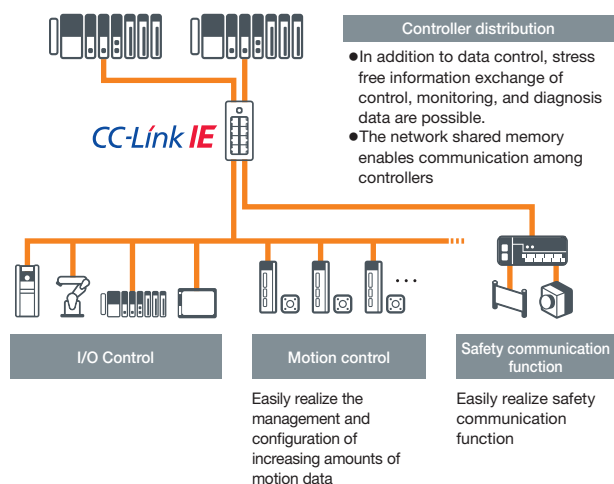- Information communication (non real-time communication) bandwidth
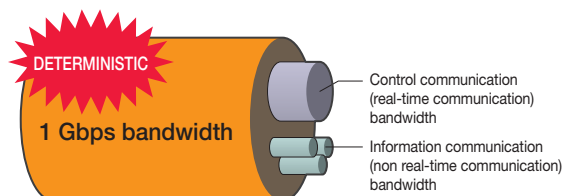
Ethernet Cable and Connector

Since the physical and data link layers of CC-Link IE use standard Ethernet technology, conventional cables, switches and hubs can be used. The availability of materials and selection of equipment for the network installation and maintenance are enhanced.

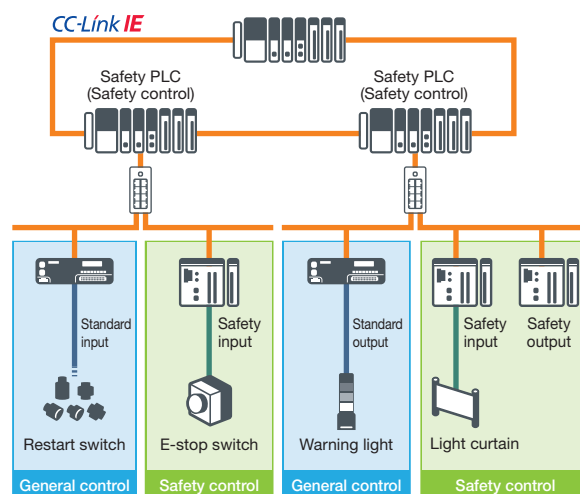| Ethernet cable	RJ-45 Connector	Ethernet switch
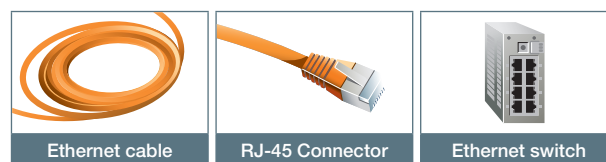
Seamless Networking

- The communication can be done simultaneously with standard Ethernet TCP/IP communication (HTTP, FTP, etc.).
- General distributed control, synchronous motion control, and safety control are integrated into one network.

CC-Link IE

Controller distribution
- In addition to data control, stress free information exchange of control, monitoring, and diagnosis data are possible.
- The network shared memory enables communication among controllers

I/O Control

Motion control
Easily realize the management and configuration of increasing amounts of motion data

Safety communication function
Easily realize safety communication function

Integrating Safety Communication on One Network

Safety control can be mixed with general control and motion control, and the high speed of the network enables the design of safety systems with high response performance.

CC-Link IE

Safety PLC (Safety control)

Safety PLC (Safety control)

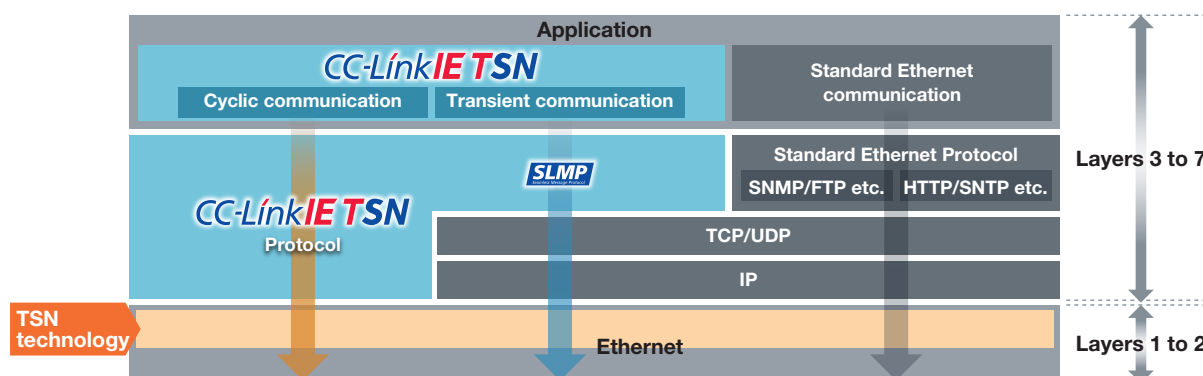| Standard input	Safety input	Standard output	Safety input	Safety output
Restart switch	E-stop switch	Warning light	Light curtain	
General control	Safety control	General control	Safety control	

CC-Link IE TSN

TSN (Time-Sensitive Networking) technology

TSN is the IEEE-defined standard technology that enables deterministic messaging on standard Ethernet. The technology ensures deterministic communications by utilizing the time synchronization method (IEEE 802.1AS) and time-sharing method (IEEE 802.1Qbv). With the addition of these standards to Ethernet technology, real-time control communication and non-real time information communication can be mixed, which is not possible with conventional Ethernet communications.

TSN Technology and Protocol Layers

CC-Link IE TSN is based on the TSN technology, which is located in Layer 2 of the OSI reference model, and consists of CC-Link IE TSN protocol and Ethernet standard protocols in Layers 3 - 7.

Application

CC-Link IE TSN
Cyclic communication | Transient communication

Standard Ethernet communication

CC-Link IE TSN Protocol

SLMP

Standard Ethernet Protocol
SNMP/FTP etc. | HTTP/SNTP etc.

Layers 3 to 7

TCP/UDP

IP

TSN technology
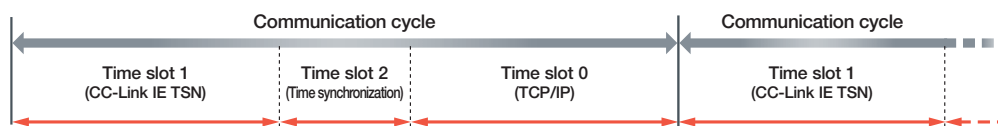
Ethernet

Layers 1 to 2

IEEE 802.1AS for Highly Precise Time Synchronization

Each station connected to the network shares the timestamp information with the grand master, achieving highly accurate time synchronization accuracy within ±1 μs.

CC-Link IE TSN

Manager station (Grand Master) | Remote station 1 | Remote station 2 | Remote station 3
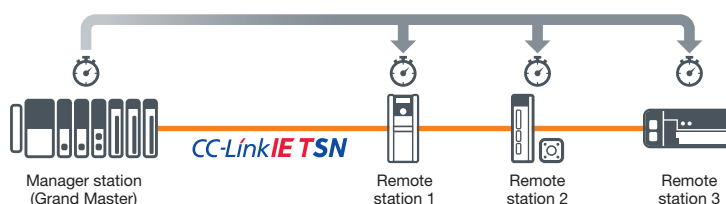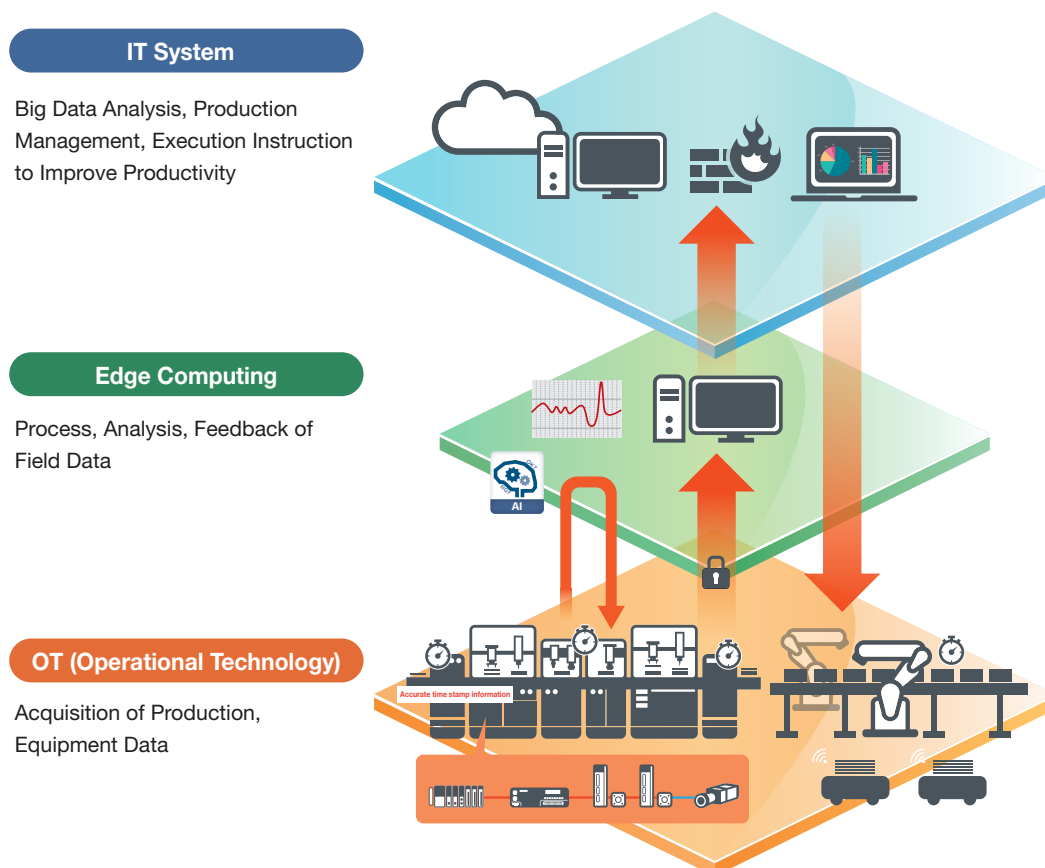
IEEE 802.1Qbv for Scheduled Traffic

Communication cycles are divided into time slots as the time sharing method, and each station schedules the transmission of frames according to its priority based on a synchronized time.

Communication cycle | Communication cycle

Time slot 1 (CC-Link IE TSN) | Time slot 2 (Time synchronization) | Time slot 0 (TCP/IP) | Time slot 1 (CC-Link IE TSN)

Features

CC-Link IE TSN is a network technology that responds to market demand for the current CC-Link IE and accelerates the realization of smart factories utilizing the Industrial IoT (IIoT). It is the first to combine Gigabit Ethernet bandwidth with Time-Sensitive Networking (TSN) technology, enabling the integration of OT and IT to further enhance performance and functionality while increasing openness. Furthermore, software implementation is supported in addition to hardware implementation, enabling the development of CC-Link IE TSN compatible products in a more ideal and efficient manner.

IT System

Big Data Analysis, Production Management, Execution Instruction to Improve Productivity

Edge Computing

Process, Analysis, Feedback of Field Data

OT (Operational Technology)

Acquisition of Production, Equipment Data

Accurate time stamp information

1. Accurate Time Stamp Information and Advanced Analysis

- Collection of field data with accurate time stamp information
- Improvement of analysis accuracy by application using AI

2. Network Integration

- Coexistence of multi-protocol on a single trunk
- Realize OT layer real time control and IT layer seamless communication at the same time
- Construct general communication, motion communication and safety communication on a single network

3. Realization of Advanced Motion Control

- Fast and high accuracy synchronization control
- Optimize device performance by combining different communication cycles

4. Utilization of Wireless Network and 5G

- Layout-free production line construction
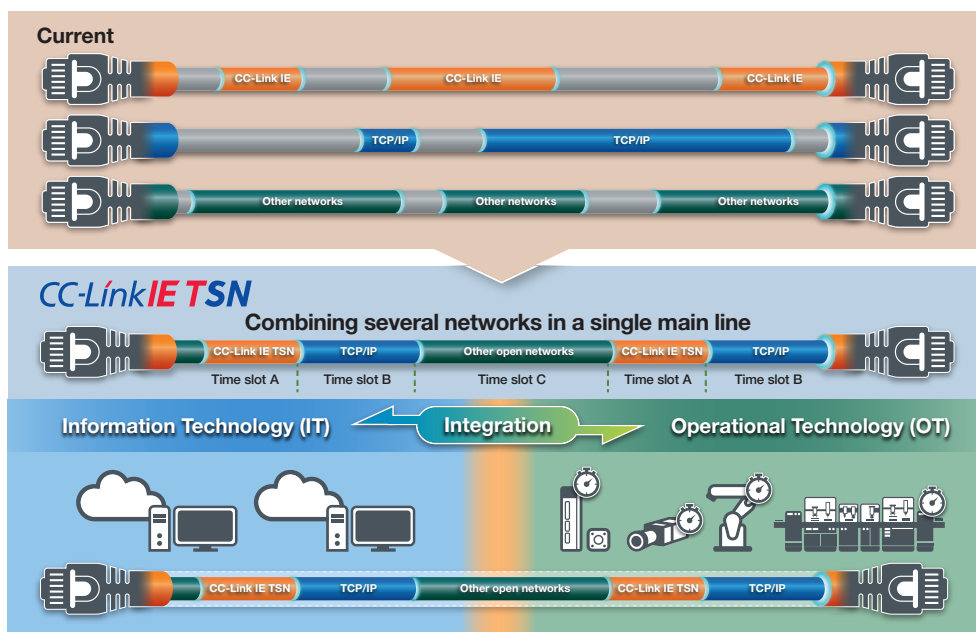- Wiring-free system construction

5. Compatibility of IT-OT Integration and Security

- Build a stable security environment
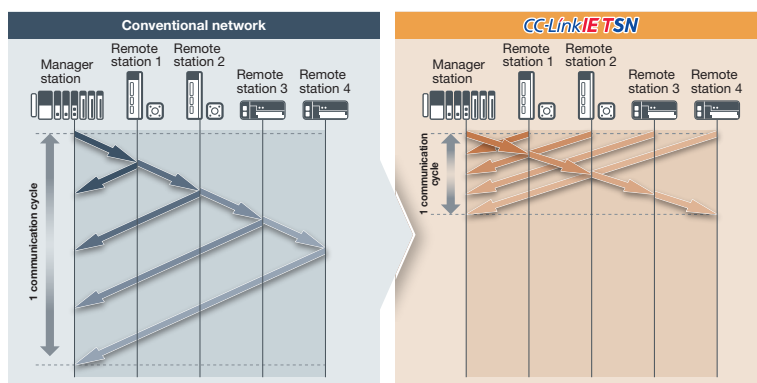- Expansion of devices and services compatible with security

Integration of IT and OT

By enabling control communication that ensures real-time performance while integrating communication of other open networks and IT system information on the same network, it achieves the freedom of system configuration and significantly reduce wiring costs.

Current

CC-Link IE | CC-Link IE | CC-Link IE
TCP/IP | TCP/IP
Other networks | Other networks | Other networks

CC-Link IE TSN

Combining several networks in a single main line

| CC-Link IE TSN | TCP/IP | Other open networks | CC-Link IE TSN | TCP/IP |
| Time slot A | Time slot B | Time slot C | Time slot A | Time slot B |

Information Technology (IT) ← **Integration** → **Operational Technology (OT)**

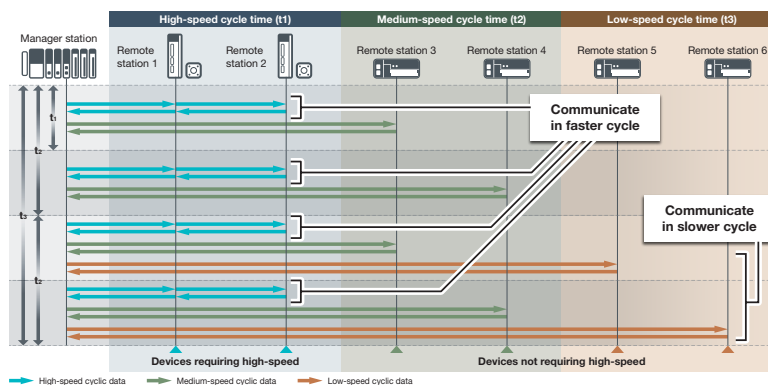| CC-Link IE TSN | TCP/IP | Other open networks | CC-Link IE TSN | TCP/IP |

Advanced Motion Control

CC-Link IE TSN uses common time synchronized across the network. The input and output communication frames are simultaneously transmitted in both directions in a fixed time. Combining this method with TSN shortens the network cyclic data update time.

Conventional network

Manager station | Remote station 1 | Remote station 2 | Remote station 3 | Remote station 4

1 communication cycle

CC-Link IE TSN

Manager station | Remote station 1 | Remote station 2 | Remote station 3 | Remote station 4

1 communication cycle

CC-Link IE TSN allows for multiple communication cycles to be used within the same network. This makes it possible to maintain the device performance that require a high-performance communication cycle, such as servo amplifiers and connect devices that do not require a high-speed communication cycle, such as remote I/O, to match the characteristics of each device. It can optimize the communication cycle, maximize the drive control performance, and shorten the tact time.

High-speed cycle time (t1) | **Medium-speed cycle time (t2)** | **Low-speed cycle time (t3)**

Manager station | Remote station 1 | Remote station 2 | Remote station 3 | Remote station 4 | Remote station 5 | Remote station 6

Communicate in faster cycle

Communicate in slower cycle

Devices requiring high-speed | Devices not requiring high-speed

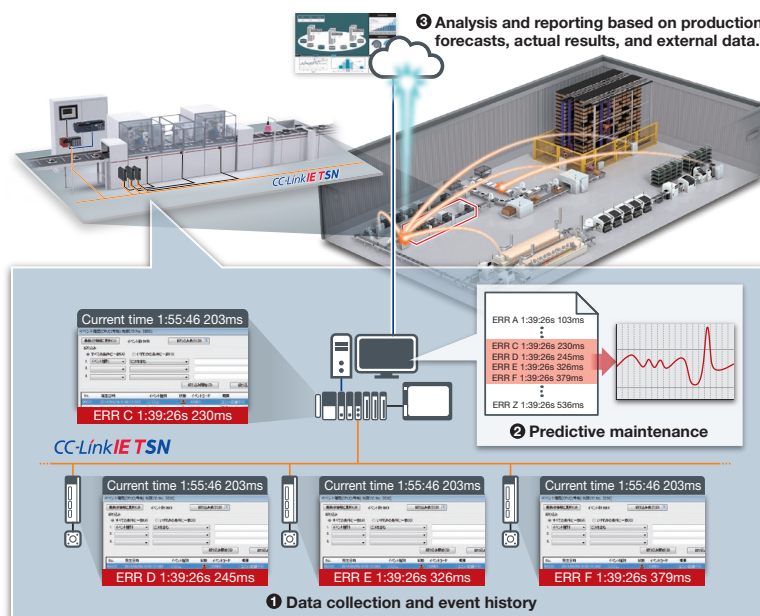→ High-speed cyclic data → Medium-speed cyclic data → Low-speed cyclic data

Reduction of Man-Hours for Start-Up, Operation, and Maintenance

CC-Link IE TSN also supports SNMP. With a general-purpose SNMP monitoring tool, both CC-Link IE TSN devices and IP communication devices such as switching hubs and routers can be analyzed together.

The time synchronization protocol regulated by TSN technology is used to calibrate time differences between devices compatible with CC-Link IE TSN, keeping them synchronized with high accuracy. Time information stored in manager and remote stations is kept synchronized to the microsecond. If a network error occurs, this makes it possible to check operation logs and accurately trace events up to the error in chronological order.
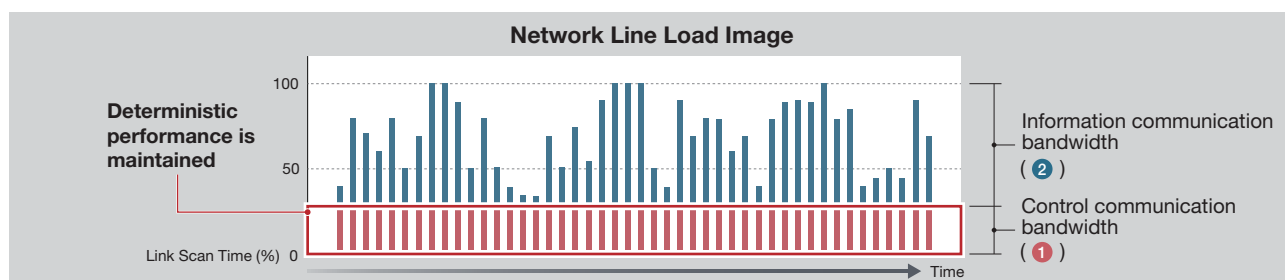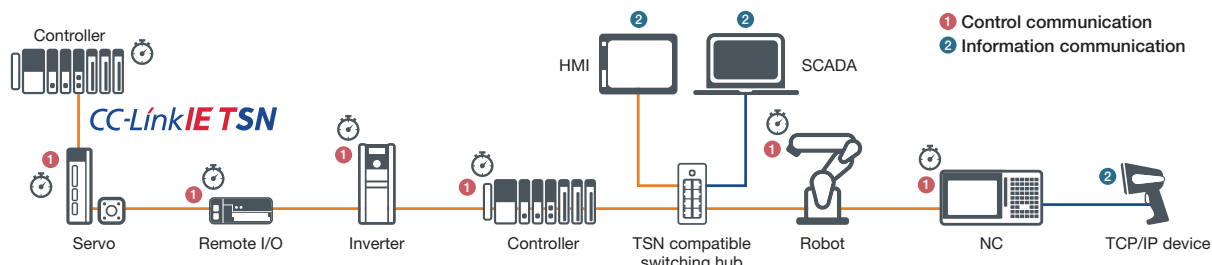
It is also possible to provide production site information and accurate time information to IT systems. This allows for AI enabled data analysis to provide further process improvement via predictive maintenance.

❸ Analysis and reporting based on production forecasts, actual results, and external data.

CC-Link IE TSN

Current time 1:55:46 203ms

ERR C 1:39:26s 230ms

CC-Link IE TSN

ERR A 1:39:26s 103ms
ERR C 1:39:26s 230ms
ERR D 1:39:26s 245ms
ERR E 1:39:26s 326ms
ERR F 1:39:26s 379ms
ERR Z 1:39:26s 536ms

❷ Predictive maintenance

Current time 1:55:46 203ms
ERR D 1:39:26s 245ms

Current time 1:55:46 203ms
ERR E 1:39:26s 326ms

Current time 1:55:46 203ms
ERR F 1:39:26s 379ms

❶ Data collection and event history

Deterministic Control even when Mixed with TCP/IP Communication

Deterministic performance of cyclic communication is maintained even when mixed with slower information data (non real-time). This enables TCP/IP communication devices to be used without affecting overall control.

Controller

CC-Link IE TSN

HMI   SCADA

❶ Control communication
❷ Information communication

Servo   Remote I/O   Inverter   Controller   TSN compatible switching hub   Robot   NC   TCP/IP device

Network Line Load Image

Deterministic performance is maintained

100

50

Link Scan Time (%)   0

Time

Information communication bandwidth (❷)

Control communication bandwidth (❶)

Plus One

CC-Link IE TSN Wireshark Plugin

CC-Link IE TSN Wireshark plugin makes it possible to simplify the display of CC-Link IE TSN protocol packet data on Wireshark. This greatly helps users to analyze data packets of protocols.

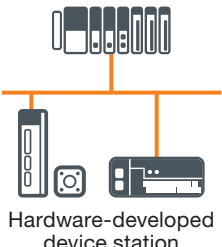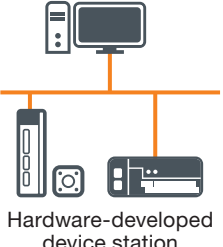Free download from CLPA Global Website.

Diverse Development Methods Enhance the Expansion of Compatible Products

CC-Link IE TSN supports implementation on both hardware and software platforms. ASIC and FPGA based hardware methods are supported. Moreover, development with software protocol stacks on a Ethernet chip is also possible for both manager and device stations. In addition to supporting 1 Gbps communication speeds, it can also handle 100 Mbps.
This flexibility permits device vendors to develop products by the most optimal methods while minimizing time to market. This leads to a wider range of products for end users.

■ Types

Development tool	🖳 PC board	🔲 Embedded Module	Dedicated Communication LSI	◎ SDK
Hardware/ Software	Hardware	Hardware	Hardware	Software
Use	Connects to PCI or PCI Express interface.	Connects user boards and embedded interface boards via a general-purpose bus (e.g., 16-bit parallel bus).	Based on the interface specifications of the released communication LSI, users can mount it on the board.	Implements the released software into devices compatible with general-purpose Ethernet communication.

■ Differences in Communication Accuracy between Product Combinations

Combination examples	Hardware-developed manager station Hardware-developed device station	Software-developed manager station Hardware-developed device station	Hardware-developed manager station Software-developed device station	Software-developed manager station Software-developed device station
Communication speed	1 Gbps	1 Gbps	100 Mbps	100 Mbps
Communication accuracy	High ◄── Low			

Plus One

Sample Code for CC-Link IE TSN Remote Station Class A

CC-Link **IE TSN**

CC-Link IE TSN-developed products

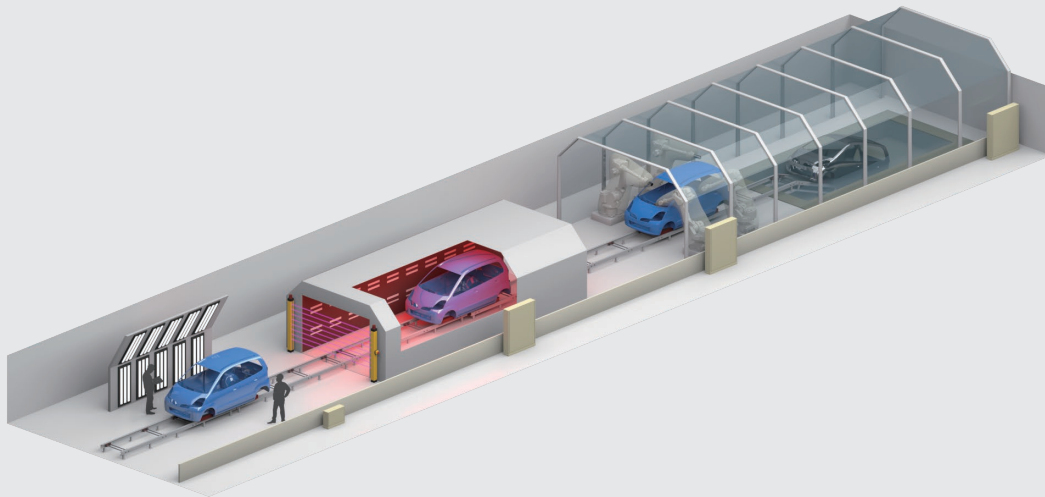Sample code for CC-Link IE TSN remote station Class A

Features

❶ Compact sample code for remote stations
❷ Software and API design enables easy application to Industrial Ethernet and CC-Link IE Field Network Basic devices
❸ Free download from the website

For more information, please check CLPA Global Website.

Memo

Use Cases

- Integrating safety communication on one network

- Flexible cabling supports line/star/ring topology

- Deterministic performance is maintained for control communication even when mixed with IP communication on the same network, allowing communication from large-volume data between controllers to data for equipment monitoring.

General-purpose PC
Server
Industrial PC
MES System
Cloud   ERP System
Firewall

CC-Link IE TSN

Controller

Coating data is processed at high speed between controllers

Ring connection

Controller   Controller

Provides robot and equipment status via IP communication

Safety remote I/O   Robot

Remote I/O

Safety Input/Output

General Input/Output

Robot   Robot   Inverter

Line/star mixed

Safety control

General control

Remote I/O

—— *CC-Link IE TSN*	—— Ethernet	- - - - General communication	- - - - Safety communication

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Semiconductor Process Equipment
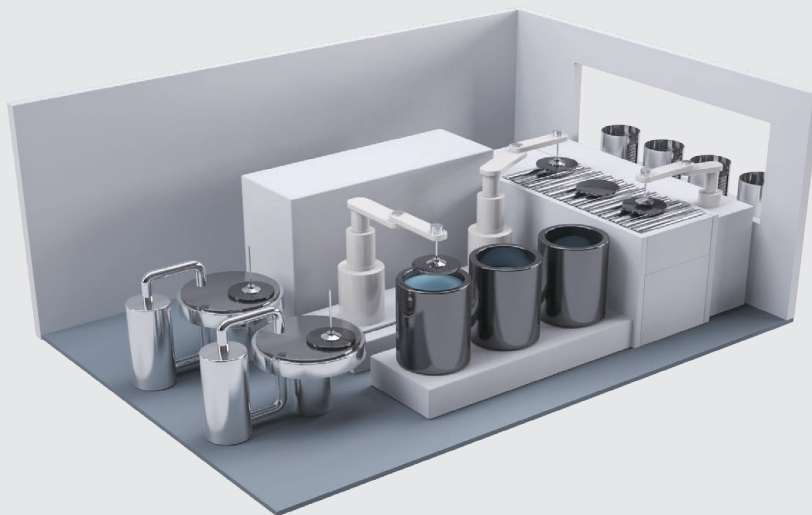
- Provides rapid communications to handle large amounts of recipe and traceability data

- Enables mixing with Ethernet communications such as SECS, HSMS, GEM, etc. without affecting the deterministic performance of control communications.

- Ethernet devices communicate directly with the host on the upper layer.

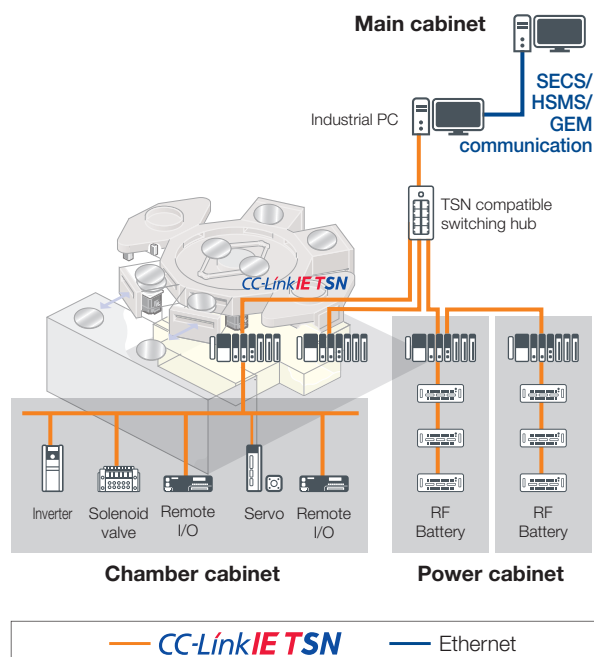- Use current design assets by implementing a software protocol stack on top of the main controller (Manager station) IPC

Upper layer host

SECS/HSMS/GEM communication

Machine A

Safety control

TSN compatible switching hub

Controller　Servo　Safety remote I/O　Robot

General control

CC-Link IE TSN

HMI　Inverter　Remote I/O　Barcode reader

Machine B

Industrial PC

CC-Link IE TSN

Servo

Ethernet devices

Vision sensor

Main cabinet

SECS/HSMS/GEM communication

Industrial PC

TSN compatible switching hub

CC-Link IE TSN

Inverter　Solenoid valve　Remote I/O　Servo　Remote I/O

RF Battery　RF Battery

Chamber cabinet　　**Power cabinet**

CC-Link IE TSN ——　—— Ethernet

Lithium Ion Battery Production Line
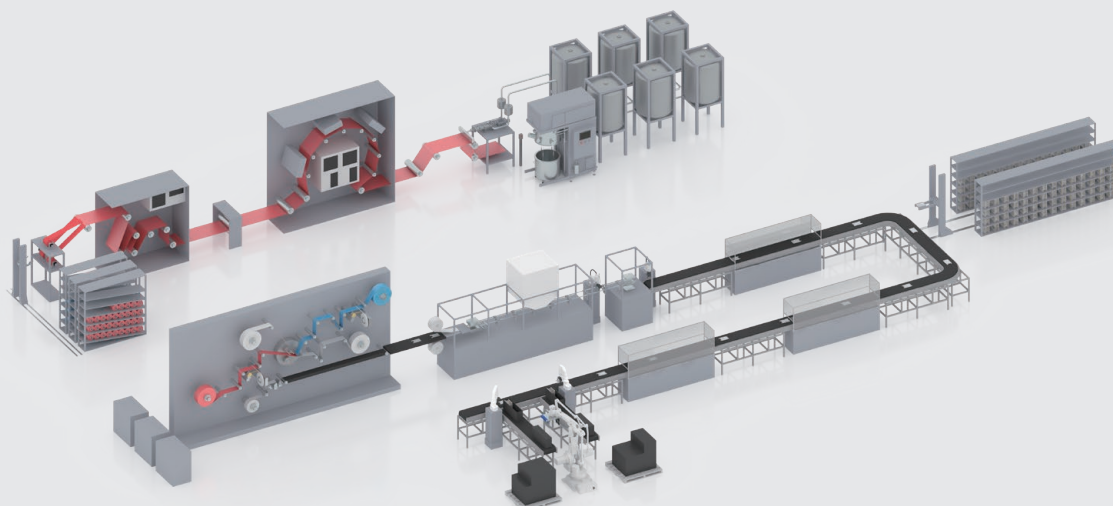
- Time sharing method enables high-accuracy multi-axis synchronized control even for large systems with 256 axes.

- Maximize productivity by using optimum communication cycles based on device performance, such as servos that require high-speed control and tension sensors and lighting power supplies that operate at lower communication speeds.

Industrial PC

CC-Link IE TSN

TSN compatible switching hub

Controller   Controller   Controller

High speed	Medium speed		High speed	Medium speed		High speed	Medium speed	Low speed
Servo	Tension sensor		Servo	Tension sensor		Servo	Vision sensor	Tension sensor	Lighting power supply

Coating machine   **Slitter**   **Electrode stacking device**

— *CC-Link IE TSN*
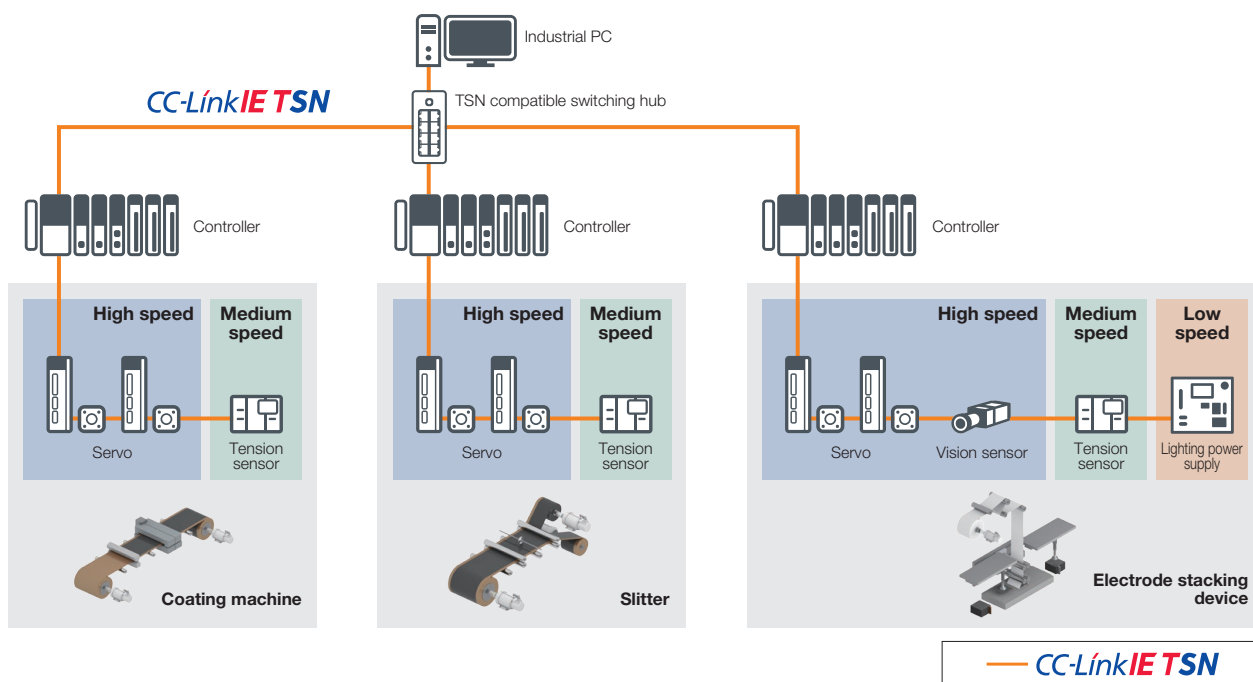
CASE 4 — Lithium Ion Battery Manufacturing Machine (Stacking Machine)

- ■ Large-volume data such as image data from vision sensors can be communicated over the same line to an industrial PC for collection and image processing without affecting motion control.

- ■ Different communication cycles can be operated while maintaining high-speed, high-accuracy motion control, not only saving wiring but also maximizing productivity.

Motion software
Image processing software

Industrial PC

TSN compatible switching hub

CC-Link IE TSN

| Inverter | Vision sensor | Linear | Servo | Servo | Vision sensor | Servo | Servo | Vision sensor | Inverter |
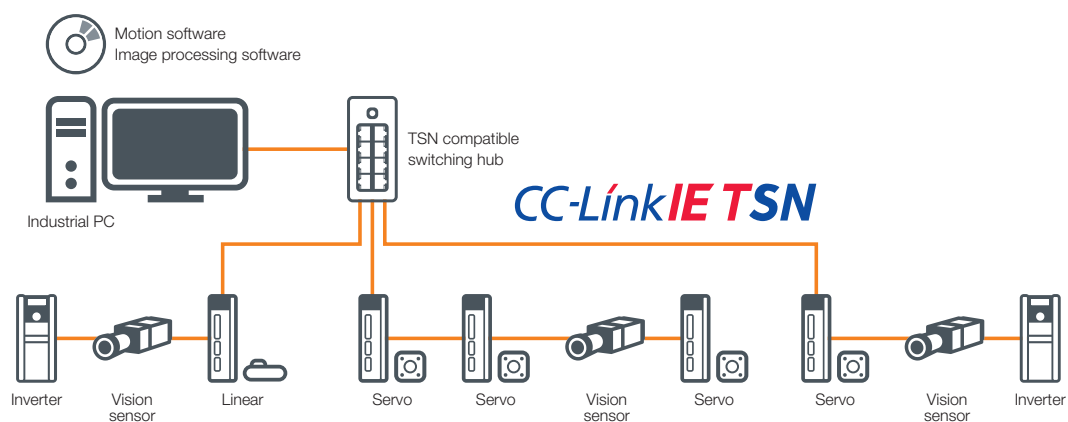
—— *CC-Link IE TSN*

CC-Línk IE Control

## Features

CC-Link IE Controller Network is designed to ensure a highly reliable network through the use of full duplex fiber optic transmission paths, delivering high-speed, high-capacity distributed control.

It's the backbone network that provides assured control of each field network.

High Speed & Reliability by Redundant Fiber Optic Loop Technology

- By adoption of redundant loop topology, each station continues communication by looping back upon detection of a broken cable or station error.

- This integrated redundancy is provided without additional equipment and without increasing network cost.

Broken
Cable Broken

Down
Station down(Error station)
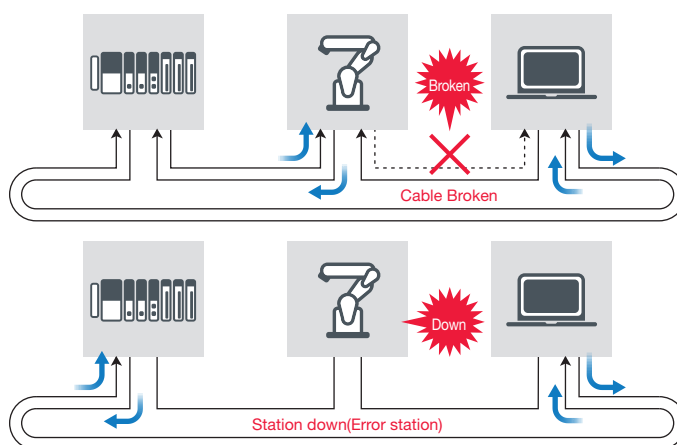
Network Shared Memory for Cyclic Communication with Ultra High Speed & Ultra Large Capacity

- To achieve stable communication independent of transmission delay, CC-Link IE Controller Network adopts a token passing protocol for data transmission control.

- Each controller passes data to the network shared memory only when it has the token, ensuring fully.

CC-Línk IE Control | CC-Línk IE Control | CC-Línk IE Control | CC-Línk IE Control

Data (PC) | Data (PLC) | Data (PLC) | Data (Robot)
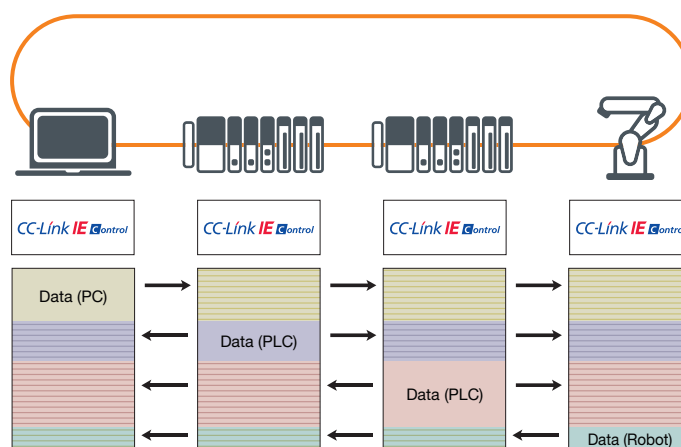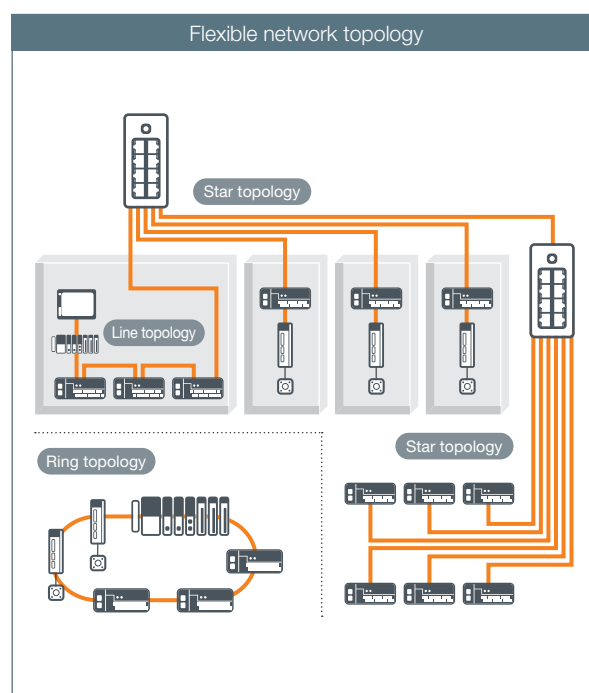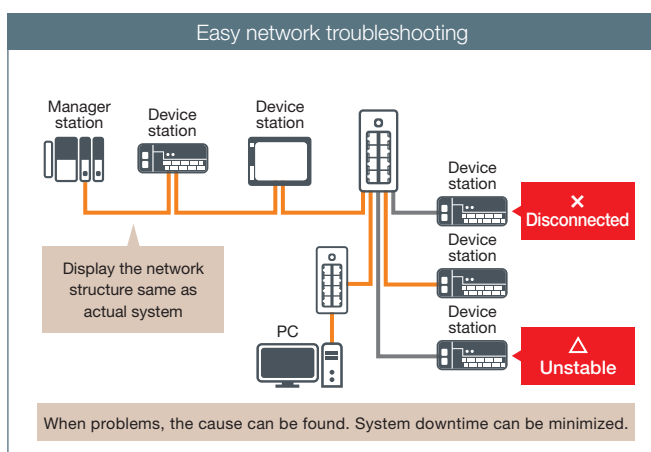
CC-Link IE Field

Features

CC-Link IE Field Network is a high-speed, high-capacity field network, which provides both synchronous deterministic and asynchronous on-demand messaging communication.
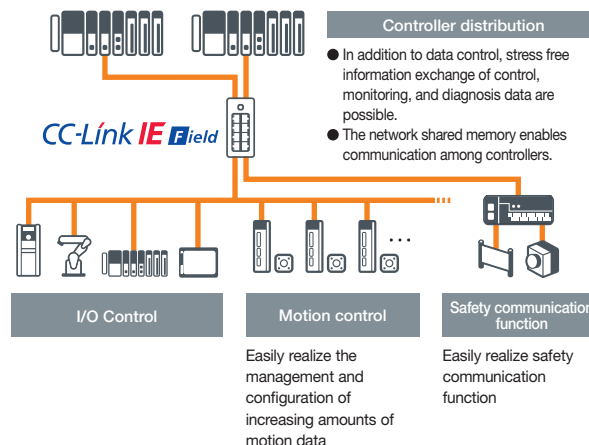I/O control, motion control and safety functions can be combined seamlessly.

Easy Networking

- Flexible network topology (ring, line and star are all possible).
- The network shared memory allows communication among controllers and field devices.
- Easy configuration and network diagnostics enable a total engineering cost reduction from system start-up to maintenance.

Easy network troubleshooting

Manager station — Device station — Device station

Display the network structure same as actual system

PC

Device station — ✕ Disconnected

Device station

Device station — △ Unstable

When problems, the cause can be found. System downtime can be minimized.

Flexible network topology

Star topology

Line topology

Ring topology

Star topology

High-Accuracy Synchronous Communication

- Highly accurate synchronization is possible by compensating for the delay in data transmission from the manager station to the device.
- Synchronous communication is possible, in synchronization with the control cycle of a servo amplifier. If I/O and sensor devices that are not to be synchronized are placed on the same network as the servo amplifiers, synchronous control is still possible.

CC-Link IE Field

Controller distribution
- In addition to data control, stress free information exchange of control, monitoring, and diagnosis data are possible.
- The network shared memory enables communication among controllers.

I/O Control

Motion control
Easily realize the management and configuration of increasing amounts of motion data

Safety communication function
Easily realize safety communication function

CC-Link IE Field Basic

Features

CC-Link IE communication using Ethernet technology which can be easily applied to small-scale equipment not requiring high-speed control and is easy to use and develop. Realizing cyclic communication with software implementation only.

Realize Cyclic Communication with Software Implementation Only

Software-based cyclic communication stack that does not require a dedicated ASIC, enabling easy network integration and reducing implementation costs for device vendors.

Combining with TCP/IP Communications

The network operates on the standard Ethernet protocol stack, which can be used together with TCP/IP communications. This feature allows CC-Link IE Field Network Basic compatible products and Ethernet compatible products to be connected on the same line, enabling a highly-flexible and low cost system.

Plus One

Sample Code for CC-Link IE Field Network Basic

Sample code is available for developing manager and remote stations for CC-Link IE Field Network Basic compatible products. Please use this sample code to realize efficient development. CLPA members can download the sample code free of charge from CLPA Global Website.
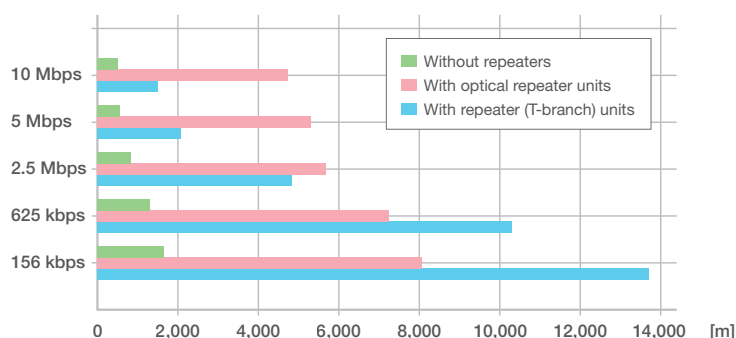
CC-Link

Features

An RS-485-based high-speed field network that can handle control and information simultaneously, enable highly reliable deterministic I/O control and realize reduced wiring whilst offering multi-vendor compatible products. This open field network is a global standard originating from Japan and Asia.

Flexible Production System

The maximum overall cable length is 100 meters when 10 Mbps is selected. This length can be extended to 1.2 km when the network speed is 156 Kbps. The use of cable repeaters and optical repeaters allows even greater distances to be covered. CC-Link supports large-scale applications and reduces the work needed for wiring and device installation.

CC-Link Transmission Distance

Legend:
- Without repeaters
- With optical repeater units
- With repeater (T-branch) units

Categories: 10 Mbps, 5 Mbps, 2.5 Mbps, 625 kbps, 156 kbps

X-axis: 0, 2,000, 4,000, 6,000, 8,000, 10,000, 12,000, 14,000 [m]

Memo

CC-Link Family Network Specifications

CC-Link IE TSN Specifications

Item	Specifications
Communication speed	1 Gbps, 100 Mbps (Full-duplex recommended)
Communication method	Time sharing method, Time managed polling method
Synchronization function	IEEE802.1AS
Number of nodes connected to one network	64,770 devices (total of manager/device stations) For address Class A of IP address, up to 65,535 nodes can be connected.
Maximum distance between nodes	Optical fiber (multimode fiber compliant with IEEE 802.3): 550 m Optical fiber (SI-POF): 20 m Optical fiber (SI-HPCF): 100 m Twisted pair cable (compliant with IEEE 802.3): 100 m
Maximum number of branches	No upper limit
Maximum cyclic size per station	Max. 4 G (4,294,967,296) octet in total per station
Transient transmission	With the server function and client function for each station. Transmission capacity is the same as SLMP.
Topology	Line, star, line/star mixed, ring

CC-Link IE Controller Network Specifications

Item	Specifications	
	Transmission point extended mode	Normal mode
Communication speed	1 Gbps	
No. of nodes connected to a single network	120 units (1 management node and 119 normal nodes)	
Max. number of networks	239	
Max. number of groups	32 (may be registered to multiple groups)	
Maximum distance between nodes	Optical fiber cable (IEEE802.3 compliant multimode fiber): 550 m Twisted pair cable (IEEE802.3 compliant): 100 m	
Max. number of link points per network — LB	32 K points (32768 points, 4 K octets)	
Max. number of link points per network — LW	128 K points (131072 points, 256 K octets)	
Max. number of link points per network — LX	8 K points (8192 points, 1024 octets)	
Max. number of link points per network — LY	8 K points (8192 points, 1024 octets)	
Maximum number of link points per station — LB	32 K points (32768 points, 4 K octets)	16 K points (16384 points, 2 K octets)
Maximum number of link points per station — LW	128 K points (131072 points, 256 K octets)	16 K points (16384 points, 32 K octets)
Maximum number of link points per station — LX	8 K points (8192 points, 1024 octets)	
Maximum number of link points per station — LY	8 K points (8192 points, 1024 octets)	
Transient transmission capacity	UP to 960 octets (data section)	
Topology	Optical fiber cable: Ring Twisted pair cable: Line, star, line/star mixed, ring	

CC-Link IE Field Network Specifications

Item	Specifications
Communication speed	1 Gbps
Ethernet Standards	IEEE802.3ab (1000BASE-T) compliant
Communication media	Shielded twisted pair cable (Category 5e), RJ-45 connector, M12
Communication control method	Token passing method
No. of nodes connected to a single network	254 modules (total of manager and device stations)
Maximum station-to-station distance	100 m
Cyclic communication	Control signal (bit data): max. 32768 bits (4096 bytes) 　RX (device station → manager station): 16384 bits 　RY (manager station → device station): 16384 bits Control data (word data): Max. 16384 words (32768 bytes) 　RWr (device station → manager station): 8192 words 　RWw (manager station → device station): 8192 words
Transient transmission (message communication)	Message size: Max. 2048 bytes
Topology	Line, star, line/star mixed, ring

CC-Link IE Field Network Basic Specifications

Item		Specifications
Communication speed		100 Mbps * Must support 100 Mbps (1 Gbps support is optional.)
Implementation method		Software
Cable		Ethernet category 5e or higher
Max. number of connected stations per network (open specification)		64
Cyclic communication		Supported
Max. number of link points/ network	RX, RY	512 octets each (4 K points)
	RWr, RWw	4 K octets each (2 K points)
Max. number of link points/station (More than one station can be occupied.)	RX, RY	8 octets each (64 points) (fixed)
	RWr, RWw	64 octets each (32 points) (fixed)
Link scan time (16 stations connected)		10 ms
Transient transmission		Possible (max. 2 K octets)
Mix of communication protocols, TCP and IP		Supported
Topology		Line, star

CC-Link Specifications

Item				Specifications			
				Ver. 1.10	Ver. 2.00		
Control specification	Maximum number of link points	Remote I/O (RX, RY)		2048 bits each	8192 bits each		
		Remote register (RWr)		256 words	2048 words (manager station ← device station)		
		Remote register (RWw)		256 words	2048 words (manager station → device station)		
	Extended cyclic settings			–	1X setting	2X setting	4X setting / 8X setting
	Maximum number of link points per station	1 station occupied	RX, RY	32 bits each	32 bits each	64 bits each	128 bits each
			RWr, RWw	4 words each	8 words each	16 words each	32 words each
		2 stations occupied	RX, RY	64 bits each	96 bits each	192 bits each	384 bits each
			RWr, RWw	8 words each	16 words each	32 words each	64 words each
		3 stations occupied	RX, RY	96 bits each	160 bits each	320 bits each	640 bits each
			RWr, RWw	12 words each	24 words each	48 words each	96 words each
		4 stations occupied	RX, RY	128 bits each	224 bits each	448 bits each	896 bits each
			RWr, RWw	16 words each	64 words each	64 words each	128 words each
	Maximum number of occupied stations			4			
Communication specification	Transmission rate			10 M/5 M/2.5 M/625 k/156 kbps			
	Communication method			Broadcast-polling			
	Synchronization method			Frame synchronization			
	Encoding method			NRZI			
	Type of transmission path			Bus transmission (EIA RS485-compliant)			
	Transmission format			HDLC-compliant			
	Error control method			CRC ($X^{16}+X^{12}+X^5+1$)			
	Maximum number of modules connected			64			
	Device station number			1 to 64			

Extended cyclic settings detailed values:

	1X setting	2X setting	4X setting	8X setting
1 station occupied RX, RY	32 bits each	32 bits each	64 bits each	128 bits each
1 station occupied RWr, RWw	4 words each	8 words each	16 words each	32 words each
2 stations occupied RX, RY	64 bits each	96 bits each	192 bits each	384 bits each
2 stations occupied RWr, RWw	8 words each	16 words each	32 words each	64 words each
3 stations occupied RX, RY	96 bits each	160 bits each	320 bits each	640 bits each
3 stations occupied RWr, RWw	12 words each	24 words each	48 words each	96 words each
4 stations occupied RX, RY	128 bits each	224 bits each	448 bits each	896 bits each
4 stations occupied RWr, RWw	16 words each	64 words each	64 words each	128 words each

Maximum total cable length and inter-station cable length

Manager station — Remote I/O station or remote device station — Remote I/O station or remote device station — Local station or intelligent device station — Local station or intelligent device station

Inter-station cable length

Maximum total cable length

CC-Link Ver. 1.10-compliant cable (terminal resistance used: 110 Ω)

Transmission rate	Inter-station cable length	Maximum total cable length
156 kbps	20 cm or longer	1200 m
625 kbps		900 m
2.5 Mbps		400 m
5 Mbps		160 m
10 Mbps		80 m
	20 cm or longer*	100 m*

When Ver. 1.10- and Ver. 1.00-compliant cables are used together, the maximum total cable length and inter-station cable length for the Ver. 1.00-compliant cable apply.

* When the maximum total cable length (maximum transmission distance) exceeds 80 m at a transmission speed of 10 Mbps, there are restrictions in addition to the minimum station-to-station cable length of 20 cm. For details, please refer to CC-Link Cable Wiring Manual(CC0811-06).

Connection cable

CC-Link cable Version 1.10 (Shielded, 3-core twisted pair cable)
* Mixture of different brand cables is possible only when they are all CC-Link cable Version 1.10 compatible cables.

Guide to Admission

Visit CLPA Global website to apply for membership

In order to develop CC-Link Family compatible products, it is necessary to join CC-Link Partner Association.

Our members can access the latest technical documents and specifications related to CC-Link Family free of charge and receive technical support for developing compatible products, including conformance testing.

From helping partner vendors develop compatible products to promoting our partners products globally, CLPA provides a wide range of support services.

■ CC-Link Partner Association membership category

Regular members Executive members Board members	• Development of CC-Link Family compatible products • Sales of CC-Link Family compatible products • Use of CC-Link logo • Technical support from CC-Link Partner Association • Product promotion (website, exhibition, etc.) by CC-Link Partner Association
Registered members	• Only provides access to CC-Link Family specifications

■ Rights and fees by membership category

Rights & fees	Membership categories		Registered member	Regular member	Executive member	Board member
Annual fees Amount of money in ( ) shows monthly fees for intermediate enrollment.			Not charged (free)	100,000 yen (9,000 yen)	200,000 yen (18,000 yen)	1 million yen or more (84,000 yen)
Initial fee			Not charged (free)			1 million yen
Conformance test fees (per product)	CC-Link IE TSN	- Manager/Local Station - Remote Station - Development tool	N/A	100,000 yen	50,000 yen	Not charged (included in annual fees)
		- Drive profile Compatible		100,000 yen	50,000 yen	
	CC-Link IE Controller Network	- Normal Station - Control Station - Development tool		400,000 yen	300,000 yen	
	CC-Link IE Field Network	- Manager/Local Station - Intelligent Device Station - Remote Device Station - Development tool		400,000 yen	300,000 yen	
	CC-Link IE Field Network Basic	- Manager/Remote Station - Development tool		100,000 yen	50,000 yen	
	CC-Link IE Safety Communication Function	- IESMAP - IESSLP - Development tool		300,000 yen	200,000 yen	
	CC-Link	- Remote Device Station - Remote I/O Station - Cable - Development tool		300,000 yen	200,000 yen	
		- Manager/Local Station - Intelligent Device Station - Development tool		400,000 yen	300,000 yen	
	CC-Link/LT	- Manager Station - Remote I/O Station - Cable - Development tool		300,000 yen	200,000 yen	
	SLMP	- Client - Server		100,000 yen	50,000 yen	
Recommended wiring parts test fees (per product)	CC-Link IE TSN	- Cables - Connectors - Switches, etc.	N/A	100,000 yen	50,000 yen	Not charged (included in annual fees)
	CC-Link IE Controller Network	- Cables - Media converters, etc.		150,000 yen	100,000 yen	
	CC-Link IE Field Network	- Cables - Connectors - Switches, etc.		150,000 yen	100,000 yen	
Tool test fees (per product)	CC-Link IE TSN	- Software etc.	N/A	100,000 yen	50,000 yen	Not charged (included in annual fees)
The right to obtain the CC-Link Family specifications free of charge			Yes			
The right to develop, manufacture and sell CC-Link Family products, development tools and recommended wiring products			No	Yes		
The right to use the CC-Link Family technology			No[*1]	Yes		
The right to use the CC-Link Family logo			No[*2]	Yes		
The right to publish the information about the Member's own product on the CLPA Global Website.			No	Yes		

*1 In where it is not for commercial purposes, you may use the technology.
*2 As long as it does not conflict with the rights of other partners, you may use the logo for promotional purposes only.

Memo

Get the Membership to CLPA

Would you like to improve your FA, BA, and PA devices by making them compatible with CC-Link Family? Are you interested in OT devices that satisfy international standards? The members can develop business opportunities and possibilities by receiving services such as support for developing compatible products.
Please check the details and apply for membership via our website.

FA: Factory Automation/BA: Building Automation/PA: Process Automation

CLPA Global Website
https://www.cc-link.org

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