





The CC-Link Partner Association (CLPA) is a global leader in developing a truly open industrial network that accelerates the construction of smart factories.

The CC-Link Family is the first field network in Japan and Asia.

It has acquired international standards such as ISO and IEC, and has grown as a global standard network in various fields of the manufacturing industry.

Now, the CC-Link Partner Association has developed "CC-Link IE TSN", the world's first open industrial network using TSN (Time-Sensitive Networking), which is an extension of standard Ethernet, to accelerate the construction of smart factories utilizing IoT. We globally offer a wide variety of development methods and truly open industrial networks in response to growing market demands for the use of a wide range of sensors at manufacturing sites, for high-performance drive devices, and for the implementation of protocols for various types of devices, applications, etc.





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Partner

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anufacture

Development Too Manufacturer

Development flow for CC-Link Family compatible products.

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

Development Support

As part of various support activities, in addition to CLPA-sponsored seminars, there are seminars hosted by our Board Members (such as Mitsubishi Electric Corporation). These are intended to provide useful information for all users of the CC-Link family, from novices

Consider Development

Select the station type,

development methods

development method, etc.

It is possible to use various

(dedicated communication

corresponding development

tool partner manufacturer.

LSI, embedded module.

software stack, etc.)

provided by the

certification class.

Provision of Technical Specifications

CLPA provides CC-Link Family Specifications for development methodologies free of charge. For details, please refer to "Development Method Guide"

How to Become a Member

products, you must first become

member of the CC-Link Partner

a regular, executive or board

Association website below to

In order to develop and sell

CC-Link Family compatible

CLPA offers member firms the "CC-Link Conformance Test" specifications for free, applicable to developed products.

Development/Evaluation

We provide detailed designs of

Download the conformance test

specifications, system profile

(CSP+) specifications, CSP+

support tools from the CLPA

creation guidelines, and CSP+

hardware and software for

products to be developed.

Provision of Conformance

Test Specifications

Testing Laboratory

CLPA conducts conformance tests. The member firms use the conformance test facilities to test CC-Link Family compatible products in various ways. The noise

test, hardware test, software test and combined test among others enable verification of correct performance.

Testing Laboratory

https://www.cc-link.org/en/support/testlab/index.html



Promotion 1

"CLPA Partner Product Search Tool" is available, fully covering all the CC-Link Family compatible products that the member manufacturers have developed and put on the market. CLPA provides users with diversified solutions.

CLPA Partner Product Search Tool

https://www.cc-link.org/en/downloads/ index.html#section-A



Promotion 2

By registering

CLPA website.

compatible product

information, products

can be published on the

Mass Production

Planning · Evaluation

Make a prototype based on

the design and perform

various evaluations.



Do Conformance Tests

Perform conformance tests for each model based on the "Conformance Test Specification". To facilitate the conformance testing process, the CC-Link Partner Association has test centers available in Japan and

※A certificate will be issued after a conformance test is passed.

See P.14 to P.17

Sales

Products that have passed the conformance test can be sold as compatible products. In order to promote products on the CLPA website, the product information must be added by the partner manufacturer.

https://www.cc-link.org/en/ downloads/index.html



See P.12 to P.13

website.

https://www.cc-link.org/en/clpa/

Association

Visit the CC-Link Partner

apply for membership.

members/index.html

See P.28

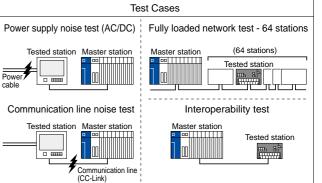
What is a Conformance Test?

- •A conformance test is to be conducted on each model to ensure reliable communication between CC-Link Family compatible products.
- •Your products need to be tested to ensure that your products meet the CC-Link Family communication specifications and can be connected to CC-Link networks.

•We offer test tools for CC-Link IE Field Basic, SLMP and open tools for CC-Link IE TSN.

By conducting the

· easily design system configurations where products of different manufacturers and models are connected.



* The conformance test is to ensure that the product meets the common specification of CC-Link Family. The conformance test is not intended to ensure the performance and quality of the product itself

Inquiries/Consulting

See P.6 to P.11, P.20 to P.25

In addition to consultation on product development, seminars sponsored by development tool partner manufacturers are also Please contact the

manufacturer.

Support for technical Please contact the manufacturers.

manufacturer.

Development Tool Sales

Please contact the

Technical Support

questions in the process of

ensure the communication reliability of your product with the CC-Link Family, and

Steps when Considering Development

Select the station type

Select the certification class

Select the development method

Select the development

Decide which station type to support.

Master station

Local station

Remote station

See P.8

Decide which certification class to support.

Class A

Class B

Class B devices has higher function than Class A devices.

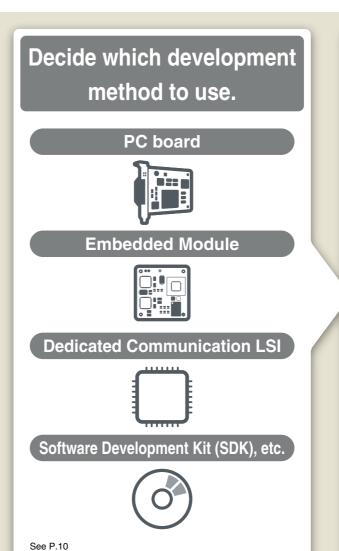
Class A

• Can be developed by changing the software of existing (Non-TSN) products.

■Class B

- · Guarantees synchronization accuracy of 1µs or less
- Requires either designated LSI or general purpose Ethernet LSI that supports fast communication cycles.

See P.9





* Some of the items to be considered during development are different for recommended wiring components, such as switches, cables, and connectors.

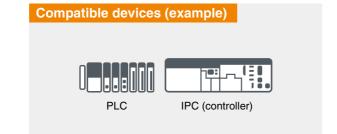




Select the station type

Master station

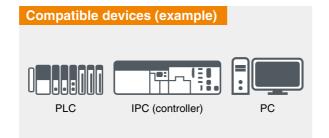
A station that manages a network. A station that contains control information (parameters) and controls slave stations* and other master stations through cyclic transmission and transient transmission.



^{*} Slave stations : A general term other than master stations such as local stations and remote stations

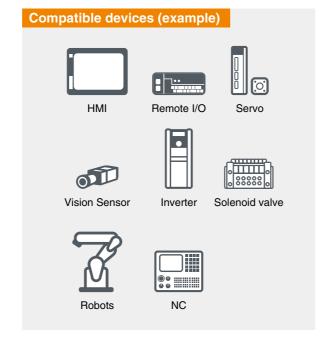
Local station

A station capable of n:n cyclic transmission with the master station and other local stations, 1:n cyclic transmission with other stations, and transient transmission with other stations. It has a server function and client function for transient transmission.



Remote station

A station capable of 1:n cyclic transmission, and transient transmission with other stations. It has a server function and client function for transient transmission.







Select the certification class

- The CC-Link IE TSN network has different certification classes depending on the functions and performance of the device (node) and switch.
- Certification classes include A and B, with B being the higher function.

Device

• It is generally recommended to develop certification class B products that have a wide variety of applications. Develop certification class A products only when modifying the software of existing (non-TSN compatible)

Certification Classes for Devices

• :	Required	—: Optional

No. Function		Conditions	Certification Class		
NO.	Function	Conditions	Α	В	
1	Reception/Relay	Full rate reception/relay (*1, *2)	_	•	
		IEEE1588 compliant	•	•	
2	Standards	IEEE802.1AS compliant	_	•	
		IEEE802.1Qbv compliant	_	•	
3	Time Synchronization Accuracy	1μs or less	_	(*4)	
4 Communication Mode		Unicast	•	•	
		Broadcast/Multicast	(*3)	•	
5	Transient Transmission	NRSV-Transient	•	•	

Switches

Certification Classes for Switches

: Required	—: Optional
------------------------------	-------------

No	No. Standards		Certification	
NO.			Α	В
		1000BASE-T(IEEE802.3ab) compliant	● (*)	● (*)
1	Link up/Relay	100BASE-TX(IEEE802.3u) compliant		(")
	Link up/nelay	Auto MDI/MDI-X	•	•
		Auto Negotiation	•	•
2	Standards	IEEE1588 compliant	_	•
2	Statiuatus	IEEE802.1AS compliant	_	•
3	Time Synchronization Accuracy	1µs or less	_	•
4	Time Aware Queuing	IEEE802.1Qbv compliant	_	•

^{*} Supports either 1000BASE or 100BASE or both

² Communication speed does not matter as long as it is 100 Mbps or more

3 Implementation is required for local stations

4 In the case of a system that guarantees time synchronization accuracy of 1 μs, it consists of only products of certification class B. In this case, products of certification class A (including switches) shall not be placed between products of certification class B.

Step Step Step 4

Select the development method

Extensive early lineup of supported products

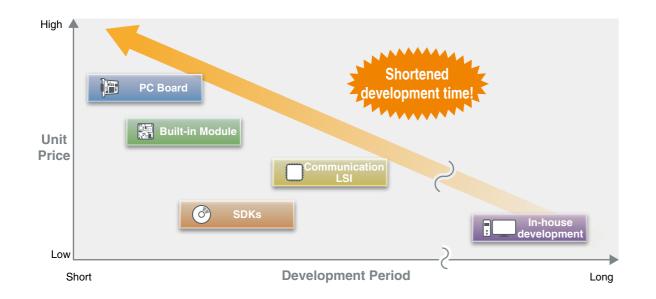
Various types of product development are supported, from high-performance devices implemented on dedicated ASIC/FPGA to low-cost devices implemented on general-purpose Ethernet chips using software protocol stacks.

Development using methods provided by various companies

Application	①High Performance, High Function	②For IPC Systems	③Use of Existing	Ethernet Products
Configuration	Hardware Master 1Gbps (/100Mbps) Hardware Slave	Software Master 1Gbps /100Mbps Hardware Slave	Hardware Master (1Gbps/) 100Mbps Software Slave	Software Master (1Gbps/) 100Mbps Software Slave
Communication Accuracy	High			Low

: Achieved with communication LSI / PC board / Built-in module

: Achieved with SDK





Select the development location

Develop in-house

Various development methods can be used to internally develop communication interfaces.



Use a contracted development manufacturer

As one of the methods of clearing the technical and personnel issues in internal development, it is possible to commission a manufacturer to develop communication interface hardware and software.

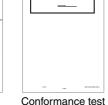
Carren Associated A

Development/Evaluation

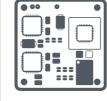
■ Supports from the CC-Link Partner Association during the development and evaluation period

- CC-Link IE TSN specifications are provided free of charge by the CC-Link Partner Association to CLPA partners.
- The CC-Link Partner Association provides conformance test specifications free of charge for the conformance testing of developed products.
- The CC-Link Partner Association introduces tools and evaluation boards manufactured by the partners.





specifications



CC-Link IE TSN Specifications

Evaluation Board

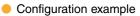
■ List of Public Tools

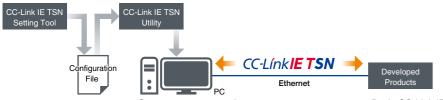
The following tools are available on the CC-Link Partner Association website.

No.	Tool	Application	Additional Information
0	CC-Link IE TSN Configuration Tool	Simple Configuration/Diagnostics	Can be downloaded by Registered members.
9	CC-Link IE TSN Utility	Pseudo Master Station, Pseudo Slave Station	Can be downloaded by Registered members.
•	Profile Creation Support Tool	CSP+ File Creation	Can downloaded by anyone.

■ Overview of Public Tools

The CC-Link IE TSN communication of developed products can be checked using a computer.





Operates as a pseudo master station or pseudo slave.

Basic CC-Link IE TSN communication can be confirmed during the product development of our partners.

Overview of CSP+



CSP+

CSP+ is an abbreviation for Control & Communication System Profile Plus. It is a profile that describes information (network parameter information, memory map, etc.) required for the startup, operation and maintenance of CC-Link Family compatible devices.

As CSP+ has integrated profile specifications, all CC-Link Family protocols can be described in the same format.

By using CSP+, CC-Link Family users can easily set parameters for each model with the same engineering tool.

Advantages of CSP+ Development

1Integrated engineering tool environment

Development vendors of CC-Link Family compatible products do not need to create separate engineering tools as long as CSP+ files for the developed products are created. Furthermore, the profile notation according to applications such as diagnostics and energy management makes it possible to display dedicated screens with layouts specialized for each application in the engineering tool.

2Reduced support operations

Since the network parameter information and memory map are described in the CSP+ file, CC-Link Family users can set network parameters and create comments without needing a manual. Also, since device parameters can be set and monitored without a program, user support operations for development vendors will be reduced.

BXML format adopted

As CSP+ compatible files are in XML format, a general-purpose XML processing library can be used. Therefore, development vendors can reduce the time required for profile development.

CSP+ conformance testing

With the addition of CSP+ test items, conformance tests will be operated as follows.

1 Partners developing new CC-Link Family compatible products

As of April 2013, it is necessary to take the CSP+ test in addition to the conventional device tests based on the new conformance test specifications.

2 Partners who already have certified products

Development of CSP+ is optional for products that have already been certified. In addition, conformance testing will be conducted free of charge for CSP+.

Flow of CSP+ operations

- (1) Using the CSP+ creation support tool (can be downloaded from the CC-Link Partner Association website), development vendors create profiles for the CC-Link Family compatible devices.
- (2) After the above file is created, a conformance test is conducted at the CC-Link Partner Association, and the certified file will be posted on the CC-Link Partner Association website.
- (3) CC-Link Family users can download the CSP+ files describing the profiles of the CC-Link Protocol Family connected devices created by development vendors of CC-Link Family compatible products from the website of CC-Link Partner Association or the development vendor.
- (4) The CC-Link Family user will use an engineering tool that can use CSP+, import the CSP+ file of the device downloaded in (3), and implement engineering for the device.



Refer to the following URL. https://www.cc-link.org/en/cclink/cspplus/index.html

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Conformance Testing

■ Conformance Testing

Conformance tests are tests of the communication operation defined by the CC-Link Partner Association for CC-Link IE TSN compatible products to confirm that they meet the CC-Link IE TSN communication specifications and can be connected to the CC-Link IE TSN network.

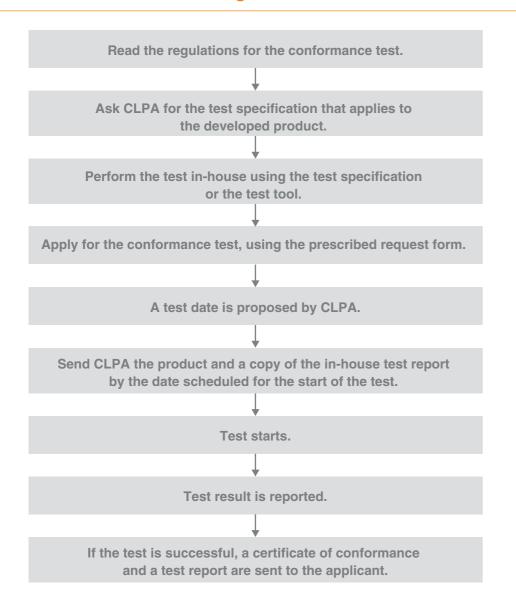
■ Conformance testing means...

- The reliability of the CC-Link IE TSN communication unit can be guaranteed.
- Smooth system construction is possible with mutual connection among different manufacturers and models.



- The conformance test is intended to assure that the product meets CC-Link IE TSN communication specifications, and not intended for device-specific functions.
- Passing the conformance test does not mean that the performance or quality of the product itself are guaranteed.
- * Refer to the recommended wiring component specifications for switches, cables, connectors, etc.

■ Workflow for Conformance Testing



CC-Link IE TSN conformance tests include required tests and optional tests.

The test items differ for each certification class.

Test Items

1 Required Tests

The product must pass all of the required tests in order to be certified.

2Optional Tests

We recommend that you perform these tests when the corresponding functions are implemented.

1Required Tests

Required items and implementation categories (e.g. remote sta	tion)	Certification Class Field ●: Implemented ▲: Conditionally implemented —: O	ptional
---	-------	--	---------

			tion Class	Category	
Classification	Test Items	А	В	Partner Manufacturers	CC-Link Association
	Noise test	'	'		
	●Confirming the CE conformity declaration	_	•		
	Simulator noise (common mode) test	_]	
	Cable (wire bundle) noise test	_	1		
Hardware test	Selectrical fast transient / burst test (EFT/B) (power supply application)	_	A		
	Selectrical fast transient / burst test (EFT/B) (cable application)	_		•	_
	Conductive immunity test	_			
	Functional Test	_	•		
	Used Parts Check Test	_	•		
	Time Synchronization				
	● IEEE 1588	•	•		
	② IEEE 802.1AS	_	•		
Software test	Cyclic Transmission	•	•		
Software test	Transient Transmission	•	•	•	_
	Topology (line-star)	A	•		
	Diagnostics	•	•		
	Error Processing	•	•		
Checking the profile description (CSP+)	Description Contents Check	•	•	•	_
Aging test	Aging Test	•	•	_	•

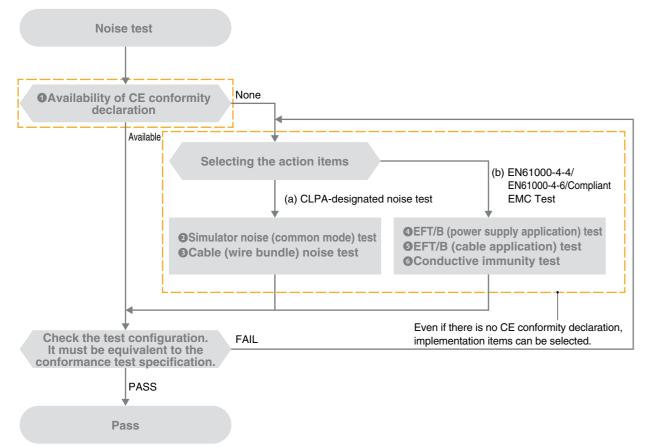
Test items for both 1G/100 Mbps compatible devices

Certifica	tion Class Field	: Implemented -	—: Optional

Classification	Test Items	1G/100 Mbps compatible devices	
		1Gbps	100Mbps
	Noise test		
	Confirming the CE conformity declaration	•	_
	2Simulator noise (common mode) test	•	_
	Cable (wire bundle) noise test	•	_
Hardware test	Electrical fast transient / burst test (EFT/B) (power supply application)	•	_
	Selectrical fast transient / burst test (EFT/B) (cable application)	•	_
	Conductive immunity test	•	_
	Functional Test	•	•
	Used Parts Check Test	•	•
Software test		•	_
Checking the profile descrip	otion (CSP+)	•	_
Aging test		•	•
		'	

PA

■ Flow of executing the noise test



(a) CLPA-designated noise test

Test Items	Test Configuration	Test Conditions
Simulator noise (common mode) test	Refer to the conformance test specifications.	Noise Voltage
3Cable (wire bundle) noise test	Refer to the conformance test specifications.	Noise Voltage : ±1,000 V Application Time : 10 minutes

(b) EN61000-4-4/EN61000-4-6 compliant EMC test

Test Items	Test Configuration	Test Conditions *
◆Electrical fast transient / burst test (EFT/B) (power supply application)	Comply with EN61000-4-4.	Noise Voltage : ±2,000 VAC : ±2,000 VDC
		Application Time : 1 minutes
5 Electrical fast transient / burst test	Comply with EN61000-4-4.	Noise Voltage : ±1,000 V
(EFT/B) (cable application)	Comply with EN6 1000-4-4.	Application Time : 1 minutes
		Sweep Frequency : 0.15 to 80 MHz
6 Conductive immunity test	Comply with EN61000-4-6.	Electric Field Strength: 10 Vrms
Conductive inimumity test	Comply with Live 1000-4-6.	Modulation : 80%AM
		Frequency Step : 1%

^{*} EN61000-6-2 is an immunity standard for industrial environments of the EMC shared standards.

Requests from CLPA

- Documents that show the test configuration need to be submitted in order to confirm that the configuration is correct.
- As all of the above test items have different noise waveforms, we recommend that you check all the test items.

2Optional Tests

Classification	Test Items	Remarks
Hardware test	1000BASE-T compliance test	
Software test	Cyclic transmission (checking the transmitting station (local station) status register) Topology (ring connection, mesh connection, mixed) Control (cyclic start/stop / reserved station) Error processing (station number setting mismatch / network number setting mismatch / station type mismatch)	the CC-Link Partner Association.

Requests from CLPA

- These are optional tests, but they are test items related to the communication and functions of the product.
 The corresponding test items should be implemented when developing a product with applicable functions.
- Although we as an association do not confirm the results through testing, the test results should be submitted.

■ Differences in conformance testing between CC-Link IE TSN and CC-Link IE Field

Classification		Changes	CC-Link IE TSN	CC-Link IE Field
0	Defined by cer	tification class A,B	Test is conducted for each certification class A, B. See P6 for definition of certification class	No certification class
0	Change in noise test method		(a) CLPA-designated noise test using a simulator (impluse) noise tester. (b) EN61000-4-4/EN61000-4-6 compliant EMC Test	CLPA-desinated noise test using a simulator (impulse) noise tester only.
		1000BASE-T Compliance Test	Optional Test	Manufacturer Mandatory Test Items
	Changes	Topology Ring Connection	Optional Test	Manufacturer/CLPA Mandatory Test Items
6		Reserved Station	Optional Test	Manufacturer/CLPA Mandatory Test Items
Ð	to test item requirements	Station Number Setting Mismatch	Optional Test	Manufacturer/CLPA Mandatory Test Items
		Network Number Setting Mismatch	Optional Test	Manufacturer/CLPA Mandatory Test Items
		Station Type Mismatch	Optional Test	Manufacturer/CLPA Mandatory Test Items

■ CC-Link IE TSN Conformance Test Implementation Division

There are two conformance test types for CC-Link IE TSN; a "Manufacturer Test" and a "Conformance test conducted by the CC-Link Partner Association". You can use the test lab recommended by CLPA when the partner manufacturer conducts the test for the test item whose test category is "Manufacturer Test". (The use of the test lab is chargeable.) If conduct conformance test by CLPA in advance at the same test lab will waive the conformance testing and reduce the testing costs. Please see below for details.

Test				CC-Link Association		
Implementation Division	Partner Manufacturers	Test Lab	Conformance Test	Confirmation of Partner Manufacturer Test Results	Cost (Regular Member)	
0	All tests implemented		Implemented	Implemented	100,000 yen	
0	Some tests implemented	Partial testing implemented (including conformance testing)		Implemented	50,000 von	
6		All tests implemented (including conformance testing)		Implemented	50,000 yen	

■ CC-Link IE TSN Development Tool Partner

Choose a development method to suit your goals.

Development Method Company		Certification Classes A or B	Dedicated Communication LSI	⊘ SDK	Publication page
	Master/Local station	В	•		P.20
MITSI IRISHI	Master station	В		•	1.20
MITSUBISHI ELECTRIC	Remote station	В	•		P.21
		Α		•	
POPT PROFESSIONAL INDUSTRIAL COMMUNICATION	Master station	A/B		Coming soon	P.22
OMMUNICATION	Remote station	Α		Coming soon	P.23
RENESAS	Remote station	В	•		P.24
SILA 200	Remote station	A/B		Coming soon	P.25

Embedded module or PC board are under consideration by partners. For details, contact the CC-Link Partner Association.

The partners that are considering development are as follows.















Memo		





Mitsubishi Electric Corporation

2-7-3, Marunouchi Chiyoda-ku, Tokyo 100-8310, Japan <Mitsubishi Electric FA Website> https://www.mitsubishielectric.co.jp/fa/ *Or contact your local CLPA office (P.27)



When products are made compatible with CC-Link IE TSN... This not only ensures the system flexibility unique to multi-vendor products, but also provides an opportunity for the competitive strength of the product to reach the global level.

In order to speedily and reliably develop CC-Link IE TSN compatible products, Mitsubishi Electric provides support in all aspects, including providing development tools.

Developable Stations / Certification Classes

Development Method	StationType	Certification Class	Product Name	
Communication LSI	Master/ Local station	Class B devices	Designated communication LSI for development of CC-Link IE TSN Master/Local Station (CP610)	NEW
Software Development Kit	Master station	Class B devices	CC-Link IE TSN Master Station Software Developmen	nt Kit

Development Method

Designated communication LSI for Master/Local station CP610

This is a communication LSI that allows to develop devices that perform cyclic transmission or transient transmission without being aware of the protocol. The CP610 is controlled by software.



CC-Link IE TSN Master Station Software Development Kit SW1DTD-GNSDK1M (the source code bundled version) SW1DTD-GNSDK2M (the Library veersion)

A method for developing a master station using a software protocol stack.

CC-Link IE TSN compatible devices can be developed without changing the hardware of devices compatible with general-purpose Ethernet.



Features and benefits of development methods

Block diagram

Designated communication LSI for Master/Local stations CP610

- 1 You can develop a CC-Link IE TSN Master Station/Local Station without having to implement the protocol.
- 2 Available sample code can be customized according to the customer's hardware specifications and applications.
- Freely selectable MPU and OS.
- 4 Can use the CC-Link IE TSN configuration tool included in the source code development kit to set parameters and diagnose the CC-Link IE TSN Master Station/Local Station.



Source code development kit: A software package for developing a CC-Link IE TSN Master Station / Local Station. The source code kit can be downloaded from the There is also a device kit which is a set of CP610 and a Flash ROM with the source code.

CC-Link IE TSN Master Station Software Development Kit SW1DTD-GNSDK1M/SW1DTD-GNSDK2M

- A software protocol that runs on a PC. Regardless of high-performance PC or inexpensive PC, various systems can be constructed.
- OANopen® compliant API. Customers who develop CANopen® compatible products can easily develop CC-Link IE TSN compatible devices.
- 3 The source code bundled version can be customized by the customer. It can be expanded and ported to different development environments. In addition, the library version can build a system at a low cost

List of communication specification

	Item		Contents	
Maximum cyclic data size per 1 network Input data Output data		Input data	Total 36KB	
		Output data	Total SUND	
	Maximum cyclic data	Input data	Total 36KB	
	size per 1 station	Output data	Total SUND	
Communication speed		ı	1Gbps, 100Mbps	Pan
	Maximum number of connected nodes		129 stations* (Total of Master station + remote station) * Does not include general-purpose TCP / IP communication function	
Connected cable			Double shielded - straight of Category 5e or higher	
Distance between stations (max.)		ions (max.)	Compliant with 100m (ANSI / TIA / EIA- 568-B (Category 5e or higher))	
Transmission line type			Line type, Star type, Line+star type	
Communication bandwidth guarantee method		uarantee method	Time sharing	
	Time synchronization p	protocol	IEEE802.1AS and IEEE 1588	

Software configuration

	INtime® Real-time Application(rta)					
	User program					
_	SDK for master station					
	File Loader Application Programming Interface					
ameter file	\$					
(.BIN)	CC-Link IE TSN protocol stack					
	Control communication					
	Other function TCPLDP/IP communication Nework Introduce Communication Cptilic Communication Communication Communication Communication Communication Communication Communication Communication Communication					
	20ter Andbra TOP LEPAR OFFICE LEPAR Helmork Names energies Cyclic					
	Mon) ation the story of the sto					
	Communication bandwidth guarantee (IEEE 802.1Qbv, IEEE 802.1AS, IEEE 1588)					
	Ethernet (Network interface card)					

Developable Stations / Certification Classes

Development Method	Station Type	Certification Class	Product name
Communication LSI with	Domoto otation	Class B dayioos	Communication LSI with Built-in GbE-PHY for
Built-in GbE-PHY	Remote station	Class B devices.	development of CC-Link IE TSN Remote Station (CP620)
Coffusoro Dovolonment Kit	ant Kit Dameta etation	Olaca A davisasa	CC-Link IE TSN Remote Station for Software
Software Development Kit	Remote station	Class A devices.	Development Kit

Development Method

Communication LSI with Built-in GbE-PHY for development of CC-Link IE TSN Remote Station (CP620)

LSI that integrates an ASIC for CC-Link IE TSN communication, MPU and GbE-PHY. It allows devices that perform cyclic transmission and transient transmission to be developed without having to implement the protocol.

■ CC-Link IE TSN Remote Station for Software Development Kit SW1DNC-GNSDK1S-M/ SW1DNC-GNSDK2S-M (TCP/IP stack bundled version)

A method for developing remote stations using a software protocol stack.

It enables the development of CC-Link IE TSN compatible devices without changing the hardware of devices compatible with general-purpose Ethernet.

Features and benefits of development methods

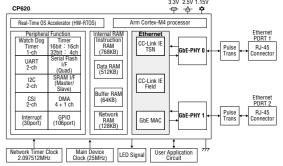
Communication LSI CP620 with Built-in GbE-PHY for Remote Stations

- 1 GbE-PHY is integrated, making it easy to create pattern designs for communication circuits. In addition, there are only few parts and circuits around the CPU and GbE-PHY, allowing the developed substrate to be compact.
- 2 Sample codes are available that can be customized according to the hardware specifications and applications.
- 3 As it is equipped with a H/W-RTOS, CPU load and power consumption of the developed device can be reduced.

■ CC-Link IE TSN Remote Station for Software **Development Kit** SW1DNC-GNSDK1S-M

- 1 Requires few resources for the operation of the software protocol stack, allowing it to be operated even with a microcomputer for lowcost devices.
- 2 Everything is provided as source code, and API and wrapper layers are included, making it easy to port to the customer's development
- 6) By using the log function, errors and processing status in the protocol stack can be traced during debugging.

Block diagram



Recommended development environment



ol		Name	Manufacturer
	1	IAR Embedded Workbench for Arm	IAR Systems K.K.
	2	μC3/Compact	eForce Co.,Ltd.
	3	NUCLEO-F429ZI	STMicroelectronics

port industrial

automation GmbH

PROFESSIONAL INDUSTRIAL COMMUNICATION

PORT's CC-Link IE TSN Stack products can be obtained in different versions. Whether master or remote station (software stack) - large quantities or small quantities - PORT offers the right solution for every user of CC-Link IE TSN technology.

Developable Stations / Certification Classes

Regensburger Strasse 7b / 06132 Halle-Saale (TEL/FAX) +49-345-77755-0 (-20)

URL https://www.port.de/

E-mail service@port.de

Development Method	Station Type	Certification Class	Product name	
Software	Master Station	Class A or Class B*	CC Link IF TON Moster CDV	7 000n
Development Kit	Masier Station	*Class B available if Hardware supports TSN	CC-Link IE TSN Master SDK	Soon

Development Method

- ■The application decides what you need PORT offers the right CC-Link IE TSN Master solution for your need - Semiconductor independently.
- SDK uses GOAL, port's Industry 4.0 platform.
- Platform is easily portable to customer's hardware and operating system.
- Master Station sample platform is the NXP LS1028ARDB.
- Port's Design Tool allows easy creation of application data objects (Link Devices or CANopen objects), Stack configurations and Device Description files.

Features and benefits of development methods

- Allows implementation of Management Master station and Control Master station.
- Management Master Station: Controls other slaves and manages the network (only one station per network).
- Control Master Station: controls other slaves and masters (one or multiple CM stations per network).
- Supports time synchronization via IEEE 802.1AS and IEEE 1588v2 (both E2E and P2P delay mechanisms are
- Supports both hardware and software implementation of TDMA-scheduling (IEEE 802.1Qbv). (Software implementation is less deterministic but allows support of standard MAC controllers)
- Supports control communication (cyclic communication) with Slave stations and other Master stations.
- Supports Transient Transmissions (acyclic communication) with other stations.
- Reserved transient Transmission: acyclic communication within timeslot for cyclic communication.
- Non-reserved Transient Transmission: acyclic communication within timeslot for standard Ethernet
- Supports SLMP (Seamless Message Protocol) for acyclic data transfer.
- Support of multiple cycle times. The Master can perform control communication with multiple slaves with different cycle times. All cycle times must be a multiple of the smallest cycle time.
- Cyclic Start/Stop: stop and restart cyclic transmission with other stations.
- Certification Class B is possible.

Application GOAL Target API Operating System Hardware Industrial Communication Framework - Middleware GOAL

Developable Stations / Certification Classes

Development Method	Station Type	Certification Class	Product name	
Software	Remote Station	Class A	CC-Link IE TSN Remote SDK	na soon
Development Kit	riemote Station	Olass A	CO-LITIK IL 1311 Helliole 3DK	ig 30011

Development Method

- ■The application decides what you need PORT offers the right CC-Link IE TSN Remote solution for your need - Semiconductor independently.
- SDK uses GOAL, port's Industry 4.0 platform.
- Platform is easily portable to customer's hardware and operating system.
- Remote Station sample platform is the STMicroelectronics NUCLEO-F429ZI.
- Port's Design Tool allows easy creation of Application data objects (Link Devices or CANopen objects), Stack configurations and Device Description files.

Features and benefits of development methods

- Allows implementation of Remote Slave Station.
- Supports time synchronization via IEEE 802.1AS and IEEE 1588v2 (both E2E and P2P delay mechanisms are
- Supports both hardware and software implementation of TDMA-scheduling (IEEE 802.1Qbv). (software implementation is less deterministic but allows support of standard MAC controllers)
- Supports control communication (cyclic communication) with Master stations.
- Supports Transient Transmissions (acyclic communication) with other stations.
- Reserved transient Transmission; acvclic communication within timeslot for cyclic communication.
- Non-reserved Transient Transmission: acyclic communication within timeslot for standard Ethernet traffic.
- Supports SLMP (Seamless Message Protocol) for acyclic data transfer.

*Please refer to the diagram on the left.

Renesas Electronics Corporation

TOYOSU FORESIA, 3-2-24 Toyosu, Koto-ku, Tokyo 135-0061, Japan For inquiries regarding products, samples, or purchases, please contact your local sales representative or

URL https://www.renesas.com/jp/ja/support/contact.html
*Or contact your local CLPA office (P.27)



"R-IN32M4-CL3" is a communication LSI for CC-Link IE TSN Class B remote station. CC-Link IE TSN is realized on a single chip by installing 2 port Gigabit Ether PHY, CPU, and large-capacity memory. In addition, OS and software necessary for development are included to realize smooth product development.

Developable Stations / Certification Classes

Development Method	Station Type	Certification Class	Product name
Communication LSI with built- in GbE-PHY	Remote station	Class B	R-IN32M4-CL3

Development Method

Provides all hardware, software and development environment necessary for CC-Link IE TSN communication. Evaluation can be started immediately according to the procedures in the startup manual.

Communication LSI

- CPU Cortex-M4 large capacity memory
- CC-Link IE TSN dedicated hardware
- 2 port Gigabit Ethernet PHY

Manual

- Hardware manual
- Users manual
- Startup manual

Software

- CC-Link IE TSN remote station
- CC-Link IE Field intelligent device station
- TCP/IP stack, peripheral driver
- Project file for master station

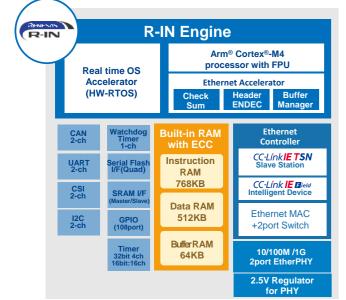
Evaluation board

Evaluation board with R-IN32M4-CL3



Features and benefits of development methods

R-IN32M4-CL3 Block diagram



Feature of R-IN32M4-CL3

- 1 Built-in hardware for CC-Link IE TSN High precision time synchronization and time sharing communication
- 2Built-in Gigabit Ethernet PHY Reduction of mounting area and development
- Equipped with R-IN engine Fast real-time response Low power consumption

Complete with OS, communication protocol and peripheral drivers to shorten development period

Package

484PBGA, 23mm□, 1.0mm pitch 356FBGA, 17mm□, 0.8mm pitch

SILA Embedded **Solutions GmbH**

Linzerstrasse 28, Sankt Pölten, 3100, Austria

URL http://www.embedded-solutions.at E-mail office@embedded-solutions.at

CC-Link IE TSN software development kit for remote station provided as portable C source code with sample applications for LINUX and STM32. A unified porting layer allows easy adaption of the stack to customer specific hardware. The SDK is self-contained and no further costs are involved for development of a CC-Link IE TSN remote station.

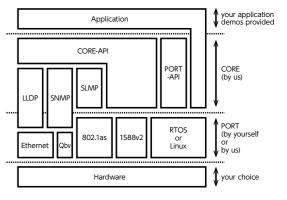
Developable Stations / Certification Classes

Development Method	Station Type	Certification Class	Product name	е
Software Development Kit	Remote Station	Class A, Class B	CC-LINK IE TSN STM32	Coming soon
Software Development Kit	Remote Station	Class A	CC-LINK IE TSN LINUX	Coming soon

Development Method

- The SDK is self-contained and evaluation can easily be performed on the STM32 NUCLEO or iMX6 evaluation boards as provided by numerous 3rd party vendors.
- Remote device application development can be started on the evaluation boards using the provided CSP+ files and examples for GX Works3. Other masters will be supported in future demos.
- If hardware and software environment is similar to the demos, they can be used for your own software development. Otherwise, the demos can serve as a starting point to adapt the port to new RTOS and/or hardware platforms.
- Embedded Experts GmbH, a SILA subsidiary, also provides porting services to existing or new customer hardware.

To further support development, the SDK includes a combined getting started and porting manual.



Features and benefits of development methods

Features:

- Delivered as C source code
- Supports iMX6 and STM32
- TSN ready
- Use hardware MAC support for IEEE 802.1AS and IEEE 1588v2 if available.
- Software 802.1Qbv implementation
- Omplete with OS, TCP/IP stack, documentation and samples to reduce development time.

	IMX6 UL/ULL	STM32	
os	Linux (Kernel > 4.6)	FreeRTOS	
IDE	GCC + CMAKE	STM32CubeIDE or GCC + CMAKE based	
TCP/IP stack	Linux	lwIP	
Devices	NXP/Freescale i.MX6 UltraLite Cortex A7	STM32F769	
TSN	IEEE 802.1AS + IEEE 1588v2	IEEE 802.1AS + IEEE 1588v2 IEEE 802.1Qbv	
Ethernet ports	1 (Star)	1 (Star)	
Speed	100Mbit/s	100Mbit/s	

■ CC-Link IE TSN Specifications

No	Item	Details		
0	Transmission Speed	1 Gbps, 100 Mbps		
9	Maximum I/O Size Per Station	Up to 4G (4,294,967,296) octets in I/O total for each station		
•	Transient Transmission	Each station has server function and client function. Transmission capacity is the same as SLMP.		
•	Communication Method	Time Sharing Method		
6	Synchronization Function	Complies with IEEE 802.1AS and IEEE 1588v2		
6	Number of Nodes Connected to One Network	64,770 units (total number of master and slave stations)		
0	Maximum Distance Between Nodes	For twisted pair cable (IEEE 802.3 compliant): 100 m For optical fiber (IEEE 802.3 compliant multi-mode fiber): 550 m For optical fiber (SI-POF): 20 m For optical fiber (SI-HPCF): 100 m		
8	Maximum Number of Branches	No upper limit		
9	Topology	Line, star, line/star mixed, ring, ring/star mixed, mesh		

■ CC-Link IE TSN Specifications



BAP-C2011ENG-001 CC-Link IE TSN Specifications



BAP-C2011ENG-002 CC-Link IF TSN Specifications (Physical Layer / Data Link Layer)



CC-Link IF TSN Specifications (Application Layer Service)



CC-Link IE TSN Specifications (Application Layer Protocol)



CC-Link IE TSN Specifications (Communication Profile)



CC-Link IE TSN Specifications (Implementation Rules)

■ CC-Link IE TSN recommended network wiring parts

CC-Link IE TSN recommended

network wiring parts

Recommended network wiring parts

CC-Link IE TSN wiring components such as cables, connectors and switches can be used as long as they comply with applicable standards such as ANSI/TIA/EIA-568-B (Category 5 or Category 5e).

However, unlike general office (OA) use, they are often used in industrial applications with devices that generate electromagnetic noise, requiring functions that are different from that for office use, such as grounding the noise induced in the cable without affecting the communication.

Therefore, the CC-Link Partner Association has conducted tests to ensure that our customers can use them safely for industrial purposes, and provides information on products that passed these tests as the recommended products.

Mutual Certification System

Ocables and connectors that can be used in CC-Link IE Field can also be used in CC-Link IE TSN, enabling mutual

The following recommended components that have passed the CC-Link IE Field network recommended wiring component test can be similarly recommended for CC-Link IE TSN. Testing is not required at this time.

- Cable
- •RJ45 plug/jack
- •RJ45 relay connector
- •M12 plug/jack

Switches that have passed the CC-Link IE Field network recommended wiring component test can be classified as recommended products that have passed certification class A in CC-Link IE TSN without further testing.

How to become a CLPA member

■ In order to develop CC-Link IE TSN compatible products...

You need to join the CC-Link Partner Association.

Sign up for a new membership.

https://www.cc-link.org/en/clpa/members/index.html



■ CC-Link Partner Association Membership Category

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

■ CC-Link Partner Association Member Categories

(Tay	PYC	luded)	

		_	•			
		Registered member	Regular member	Executive member	Board member	
Annual fees () shows monthly fees for intermediate enrollment		_	JPY 100,000 (JPY 9,000)	JPY 200,000 (JPY 18,000)	JPY 1,000,000 (JPY 84,000)	
Initiation fee		_	_	_	JPY 1,000,000	
Acquisition of product specifi	cations		Provided for free upon I	membership registration	n	
License to use	SLMP*1		Incl	uded		
CC-Link Family technology	CC-Link Family Specifications (Other than SLMP)	_	— Included			
	CC-Link IETSN		JPY 100,000*3	JPY 50,000*3		
Conformance test fee (per device)	Master, local and intelligent device stations for CC-Link and normal stations of CC-Link IE Control Master and local stations, intelligent device stations, remote device stations of CC-Link IE Field CC-Link IE Safety IESMAP(master) IESSLP(slave) CC-Link remote device and I/O stations, cables and miscellaneous products CC-Link/LT master and slave stations, cables and miscellaneous products CC-Link IE Field Basio*2	_	JPY 300,000 JPY 200,000	JPY 200,000 JPY 100,000	Included in the annumembership fee *Contact your local CLPA office.	
Recommended product test fees (per model)	SLMP*1 connectable products Recommended network wiring parts for CC-Link IE TSN CC-Link IE Control and CC-Link IE Field		JPY 100,000	JPY 50,000	_	
Use of CC-Link Family logo				Included		
Technical support				Included		
Publishing products in home page-CLPA Partner Product Search Tool (No charge)		_		Included		
Promotion at fairs		_		Included		
Information about events Posting of company name on CLPA web site			Incl	uded		

1 SLMP: Seamless Message Protocol

1 SLIMP: Seamless Message P100001

*2 Download the test tools and conduct a self-test.

*3 If you submit the result of a test conducted on behalf of the CC-Link Partner Association at a testing organization recognized by the CC-Link Partner Association, the cost will Regular: 50,000 yen • Executive: 20,000 yen

Global support system

The CC-Link Partner Association has branches not only in Japan but also in overseas countries to provide global support



①Headquarters (Japan)

6F Ozone-front Building, 3-15-58, Ozone, Kita-ku, Nagoya 462-0825, Japan TEL:+81-52-919-1588 FAX:+81-52-916-8655 E-mail: info@cc-link.org URL : https://www.cc-link.org/

2China

Headquarters(Tongji University) : School of Electronics and Information Engineering, Jiading Campus, Tongji University, Shanghai, P.R.ChinaHead Office: 19F No.1386 Hong Qiao Road, Shanghai, P.R.China TEL:+86-21-64940523 FAX:+86-21-64940525 E-mail: support@cn.cc-link.org URL: https://www.cc-linkchina.org.cn/

3Europe

Postfach 10 12 17, 40832 Ratingen, Germany TEL: +49-2102-486-7988 FAX: +49-2102-532-9740 E-mail: partners@eu.cc-link.org

URL : https://eu.cc-link.org/en/ 4 North America

500 Corporate Woods Parkway, Vernon Hills, IL60061, USA TEL:+1-847-478-2647 FAX:+1-847-876-6611 E-mail: info@cclinkamerica.org URL: http://am.cc-link.org/en/

RM, 711, 7F GANGSEO HANGANG XI-TOWER A. 401 Yangcheon-ro, Gangseo-gu, Seoul 07528 Korea TEL: +82-2-3663-6178 FAX: +82-2-6224-0158 E-mail: clpakor@meak.co.kr URL: http://kr.cc-link.org/ko/

No.105, Wugong 3rd Rd., Wugu Dist., New Taipei City 24889, Taiwan(R.O.C.) TEL: +886-2-8990-1573 FAX: +886-2-8990-1572 E-mail: cclink01@ms63.hinet.net

URL: https://tw.cc-link.org/zh/ **DASEAN**

307 Alexandra Road #05-01/02Mitsubishi Electric Building Singapore 159943 TEL: +656-470-2480 FAX: +656-476-7439 E-mail: cclink@asia.meap.com URL : http://as.cc-link.org/en/

(3)India

Emerald House, EL-3, J Block, M.I.D.C. Bhosari, Pune - 411 026, Maharashtra, INDIA Tel: +91-20-4624 2100 FAX: +91-20-4624 2200 E-mail: Clpa India@asia.meap.com URL : https://in.cc-link.org/en/

Serifali Mahallesi Nutuk Sokak.No:5 34775Umraniyeistanbul /Turkey TEL:+90-216-526-39-90 FAX:+90-216-526-39-95 E-mail: partners@tr.cc-link.org URL: https://eu.cc-link.org/en/

Mariano Escobedo 69, Zona Industrial - Tlalnepantla. 54030, Estado de Mexico, Mexico TEL: +52-55-3067-7517 URL: http://am.cc-link.org/sp/

Thailand

CC-Link Promotion Center - Thailand 101, True Digital Park Office, 5th Floor, Sukhumvit Road, Bangchak, Phra Khanong, Bangkok 10260 Phone: +66(2) 092-8600 Ext. 5506 Fax: +66(2) 043-1231-33 URL: http://th.cc-link.org/th/

●How to become a member

Would you like to improve your FA, BA, and PA devices by making them compatible with the CC-Link Family? Are you interested in open FA devices that satisfy international standards? CLPA will support you by promoting related technologies and holding exhibitions and seminars in Japan and overseas.

How to apply for a membership: Please access from our website.FA:Factory Automation / BA:Building Automation / PA:Process Automation



https://www.cc-link.org



 $\left(\ \mathsf{Japan} \cdot \mathsf{China} \cdot \mathsf{Europe} \cdot \mathsf{Americas} \cdot \mathsf{Korea} \cdot \mathsf{Taiwan} \cdot \mathsf{ASEAN} \cdot \mathsf{India} \cdot \mathsf{Turkey} \cdot \mathsf{Mexico} \cdot \mathsf{Thailand} \ \right)$

CC-Link Partner Association

6F Ozone-front Building, 3-15-58, Ozone, Kita-ku, Nagoya

462-0825, Japan

TEL: 052-919-1588 FAX: 052-916-8655