



New Industrial Ethernet for intelligent applications

CC-Link IE extends Gigabit Industrial Ethernet to field level devices enabling new types of intelligent integrated manufacturing systems.

A major driver in the development of CC-Link IE was to deliver a high performance automation network for tomorrow's manufacturing without many of today's shortcomings: it should be simple to implement, easy to troubleshoot and use standard Ethernet tools. The result is CC-Link IE Field.

Network hierarchy

CC-Link IE is a family of integrated Industrial Ethernet-based networks designed for high performance deterministic control. It integrates networks from controller level to field and motion networks over Ethernet for a seamless data transfer without being aware of the hierarchy or boundary of the network. This also extends to the existing non-Ethernet based CC-Link control networks.

The CC-Link IE controller network is a high reliability trunk network for large scale controller-distributed control. It operates over a 1Gbps deterministic network using full duplex optical fibre. It has a 'floating' network master to maintain stable operations, automatic cable error detection and many other features.

Sited below the controller level, the new CC-Link IE field network is also a 1Gigabit deterministic network but over Cat 5e cable. This network offers the necessary connectivity for both existing and new types of manufacturing management. Importantly, they can be used together or independently, and both will integrate the existing CC-Link and Safety networks.

Field network communication

The CC-Link IE field network has been developed to enable the easy transfer of high speed control data and large scale message communication capability across networks with determinism and minimal latency. To achieve this, control data uses cyclic communication and a distributed shared memory, while messaging data uses transient/acyclic communication.

Cyclic communication refreshes the control data among all the stations by using token passing as media access control. Through the distributed shared network memory, each controller exchanges data with all other controllers, recognises the condition of other controllers, and performs its own control actions. As control data is exchanged in real time, it supports deterministic control.

Shared memory communication

The input and output area for each slave station is assigned to the distributed shared memory to control each slave from the master station. As seen overleaf, each station sends the data in the shaded area of the distributed shared memory as cyclic data, and the cyclic data from other stations are received in the un-shaded area.

The slave stations can hold the area that is assigned to the host station such as the slave station 1 or 2, and also the area that is assigned to other slaves such as the slave station 3 when a controller is connected as a slave station.

When all areas, including areas assigned to other slave stations are held, the cyclic data of other stations can be monitored without accessing the master station, and a simplified controller network results. These transactions are made in real-time.

Transient communication

The CC-Link IE field network also provides for direct peer-to-peer transient/acyclic communication between network stations for non-deterministic messaging. This process does not affect the cyclic real-time operation of the network as CC-Link IE assigns a relatively small portion of transmission bandwidth for transient communication.



Any device connected to the network can send and receive data from this common letterbox and therefore no specific CC-Link IE protocol knowledge is required. Importantly, this function has a seamless one-to-many relationship, so creating a control program that is logically a single hierarchy network regardless of physical configuration.

Network configuration

The CC-Link IE field network accesses field devices for configuration and maintenance purposes right across the network hierarchy by remote engineering tools. Remote management means that devices can be set or monitored from anywhere in the network. CC-Link IE field network can use line, star, ring and tree topologies with up to 254 connected modules and up to 239 networks can be connected in the multi-network system.

When adding new stations, they can be connected freely either to an empty port of a hub, or to a port on an existing station. This gives flexibility without constraint and is achieved using unmanaged hubs. The physical and data link layers of the network use Ethernet so that commercial Ethernet cables, hubs and network analysers can be used.

Seamless Messaging Protocol (SLMP)

The seamless communication function of the CC-Link family is achieved over TCP/IP through an application common protocol called SLMP. Since the SLMP is a simple client/server protocol it can be easily implemented into firmware for 100Mbps Ethernet devices by third-party vendors, and then connected as shown below. The device can then access devices across the CC-Link IE field network.

About the CLPA

The CC-Link Partner Association (CLPA) is an international organisation with over 1,500 member companies worldwide. The partners' common objective is promotion and technical development of the family of CC-Link open network technologies. Over 1,100 certified products are now available from over 240 manufacturers. CC-Link is the leading industrial fieldbus in Asia and is becoming increasingly popular in Europe and the Americas. The European headquarters is in Germany, with offices throughout the continent.

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