

# Ethernet/IP

Ethernet/IP is a member of a family of networks that implement the Common Industrial Protocol (CIP). CIP encompasses a comprehensive suite of messages and services that facilitate a variety of manufacturing automation applications, including control, motion, and data access. Ethernet/IP employs standard Ethernet and TCP/IP technologies, allowing commonly available components, protocol stacks, and diagnostic tools to be used.

## Common Industrial Protocol (CIP)

CIP is an object oriented protocol, where every node is represented by a collection of objects, defined by class. The use of objects permits the standardization of attributes and access methods. Although the details of CIP are beyond the scope of this document, it is important to understand a few concepts that are often confusing.

## Connections

A CIP connection is different from a TCP connection. A TCP connection establishes a relationship between devices (IP Address) and identifies services the device offers (port). A CIP connection defines a specific application to application relationship within the CIP protocol (identified by a Connection ID). When Ethernet/IP vendors such as Rockwell Automation use the term “connections”, it refers to CIP connections. A single TCP connection can be used to transport messages for multiple CIP connections.

## CIP Message Types

**I/O Messages**, also called **Implicit Messages**, include no context information and thus contain a minimum of overhead. The association between the devices is established when the CIP I/O connection is established, and the I/O data is transmitted at a specified packet rate. Typically, this type of communication is used for real-time data exchange, where speed and low latency are important. The transmission is very efficient but less flexible than Explicit Messages.

Ethernet/IP uses TCP to establish the CIP I/O connection and UDP for transmission of the I/O data. I/O messages use the Producer/Consumer model described below.

**Explicit Messages** are based on the request/reply (or Client/Server) model. Explicit messages include a description of their meaning (expressed explicitly), so the transmission is less efficient, but very flexible. An Explicit Message is used for general purpose non-real-time communications such as configuration, data access, and diagnostic status monitoring. Explicit messages may be connected (a CIP connection exists) or unconnected (no CIP connection is used). Ethernet/IP always uses TCP to transport Explicit Messages.

## Producer/Consumer Model

I/O (Implicit) Messages use the Producer/Consumer model to transmit CIP I/O data over UDP. Unlike the traditional polling model, the Producer/Consumer model allows each node to independently produce (transmit) data and consume (receive and accept) data. For example, an I/O Adapter that provides input to a controller can be independently configured to produce data on a specified interval. The type of production, the definition of the data that will be produced, and other parameters such as the **Requested Packet Interval (RPI)** are negotiated when the CIP connection is established.

The RPI has a variety of uses. For timer based production, the RPI defines the production interval. For change of state, the RPI is used to specify the maximum time between each production. If the state of a variable does not change within the RPI, the data associated with the variable will still be produced when the RPI expires. The RPI also allows consumers to detect when a producer is no longer producing data by establishing a timeout value based on the RPI.

**Note: CTI products use the timer-based production model for producing I/O data messages.**

## Ethernet/IP Protocols

Three different Ethernet/IP fieldbus implementations are available:

## Ethernet/IP Scanner

The **Ethernet/IP Scanner** is used to communicate with process control devices such as drives and I/O blocks via Ethernet/IP I/O connections. The Scanner acts as an I/O master, producing Output data and consuming Input data sent by the Ethernet I/P adapter. This method is often used for transferring data with I/O devices such as motor controllers, flow meters, and temperature sensors. The Ethernet/IP Scanner functions without additional program logic. For more information, see [Ethernet/IP Scanner](#).

## Ethernet/IP Adapter/Server

The **Ethernet/IP Adapter** (or Server) allows the CTI product to exchange data with devices acting as an Ethernet/IP Scanner (via I/O messages) or CIP Explicit Message Client. In most cases, an Allen-Bradley™ RSLogix™ controller functions as the I/O Scanner and/or CIP Explicit Message Client.

When configured as an Ethernet/IP I/O Adapter, the CTI product functions as an I/O device and exchanges data with the Allen-Bradley™ RSLogix™ controller via periodic Implicit I/O Messages.

When configured as an Explicit Message Adapter, the Allen-Bradley™ Logix controller acts as Client to initiate Explicit Messages via PLC program logic MSG instructions to exchange data with the module application. This method is used when "on demand" data transfer is required (instead of continuous data updates) or when expanding/replacing existing system that utilize Ethernet/IP interface to the CTI 2572-A Ethernet Adapter. For more information see [Ethernet/IP Adapter](#).

## Ethernet/IP Tag Client

The **Ethernet/IP Tag Client** is used to directly access Controller (global) Tags in Allen-Bradley™ RSLogix™ controllers. Its operation is similar to the Explicit Message interface described above. However, the Tag Client differs in that it initiates periodic or event-triggered requests to access Controller Tag data by tag name. This operation can be implemented without additional program logic.

For more information see [Ethernet/IP Tag Client](#).

## Ethernet/IP Tag Server

The Ethernet/IP Tag Server allows HMI/SCADA systems and operator panels that can access tag data in Allen-Bradley RSLogix™ controllers to access data in CTI IEC 61131 based controllers. For more information see [Ethernet/IP Tag Server](#).