



# EtherNet/IP Network Devices



***Allen-Bradley***

by ROCKWELL AUTOMATION

User Manual

Original Instructions

## Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.



**WARNING:** Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.

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**ATTENTION:** Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.

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**IMPORTANT** Identifies information that is critical for successful application and understanding of the product.

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Labels may also be on or inside the equipment to provide specific precautions.



**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.

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**BURN HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.

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**ARC FLASH HAZARD:** Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

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## About This Publication

This manual describes how to use EtherNet/IP™ network devices in control systems.

Make sure that you are familiar with the following:

- Use of an EtherNet/IP network
- Use of various software applications from Rockwell Automation

## Inclusive Terminology

Rockwell Automation recognizes that some of the terms that are currently used in our industry and in this publication are not in alignment with the movement toward inclusive language in technology.

We are proactively collaborating with industry peers to find alternatives to such terms and making changes to our products and content. Please excuse the use of such terms in our content while we implement these changes.

## Summary of Changes

This publication contains the following new or updated information. This list includes substantive updates only and is not intended to reflect all changes.

Topic	Page
EtherNet/IP Protocol	7
EtherNet/IP Network Specifications	22
Configuration Software Descriptions	25
Configure the Ethernet Communication Driver in FactoryTalk Linx Software	26
Set the IP Address with the EtherNet/IP Address Commissioning Tool	33
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## Additional Resources

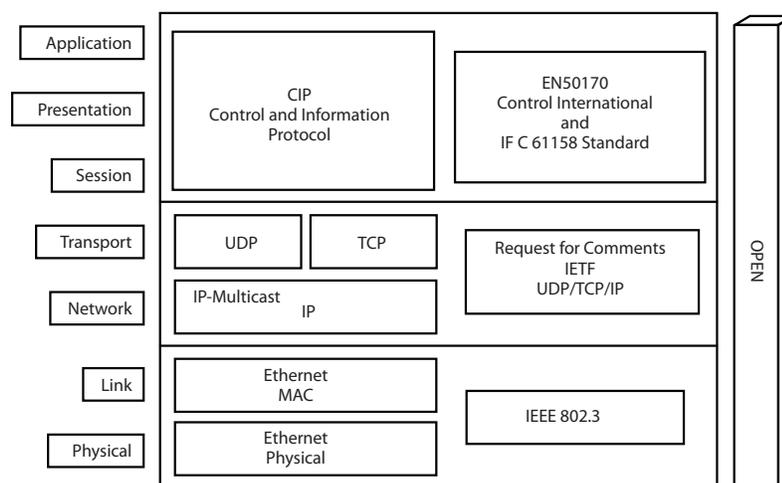
These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
EtherNet/IP Media Planning and Installation Manual	Describes how to use the required media components and how to plan for, install, verify, troubleshoot, and certify your EtherNet/IP network. This manual is available from ODVA at: <a href="http://www.odva.org">http://www.odva.org</a> .
EtherNet/IP QuickConnect Application Technique, publication <a href="#">ENET-AT001</a>	Describes EtherNet/IP QuickConnect technology and how to quickly power up and join an EtherNet/IP network.
EtherNet/IP Socket Interface Application Technique, publication <a href="#">ENET-AT002</a>	Describes the socket interface that you can use to program MSG instructions to communicate between a Logix 5000™ controller and Ethernet devices. In this case, the interface is used because the Ethernet devices that do not support the EtherNet/IP application protocol. Such devices include barcode scanners, RFID readers, or other standard Ethernet devices.
Troubleshoot EtherNet/IP Networks, publication <a href="#">ENET-AT003</a>	Describes troubleshooting techniques for Integrated Architecture® products on EtherNet/IP networks.
EtherNet/IP Parallel Redundancy Protocol Application Technique, publication <a href="#">ENET-AT006</a>	Describes how you can configure a Parallel Redundancy Protocol (PRP) network with the 1756-EN2TP EtherNet/IP communication module and a Stratix® 5400 or 5410 switch.
EtherNet/IP Device Level Ring, publication <a href="#">ENET-AT007</a>	Describes DLR network operation, topologies, configuration considerations, and diagnostic methods
System Security Design Guidelines Reference Manual, <a href="#">SECURE-RM001</a>	Provides guidance on how to conduct security assessments, implement Rockwell Automation products in a secure system, harden the control system, manage user access, and dispose of equipment.
Ethernet Reference Manual, <a href="#">ENET-RM002</a>	Describes basic Ethernet concepts, infrastructure components, and infrastructure features.
Industrial Components Preventive Maintenance, Enclosures, and Contact Ratings Specifications, publication <a href="#">IC-TD002</a>	Provides a quick reference tool for Allen-Bradley® industrial automation controls and assemblies.
Safety Guidelines for the Application, Installation, and Maintenance of Solid-state Control, publication <a href="#">SGI-1.1</a>	Designed to harmonize with NEMA Standards Publication No. ICS 1.1-1987 and provides general guidelines for the application, installation, and maintenance of solid-state control in the form of individual devices or packaged assemblies incorporating solid-state components.
Industrial Automation Wiring and Grounding Guidelines, publication <a href="#">1770-4.1</a>	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, <a href="http://rok.auto/certifications">rok.auto/certifications</a> .	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at [rok.auto/literature](http://rok.auto/literature).

## EtherNet/IP Protocol

EtherNet/IP™ protocol is a multi-discipline, control, and information platform for industrial environments and time-critical applications. EtherNet/IP uses standard Ethernet and TCP/IP technologies and an open, application-layer protocol called the Common Industrial Protocol (CIP).



The EtherNet/IP protocol follows these standards:

- IEEE 802.3—Standard Ethernet, Precision Time Protocol (IEEE-1588)
- IETF—Internet Engineering Task Force, standard Internet Protocol (IP)
- IEC—International Electrotechnical Commission
- CIP - Common Industrial Protocol (CIP)

## Common Industrial Protocol (CIP)

CIP™ is a messaging protocol for devices in industrial automation control systems. CIP is the application layer for the EtherNet/IP network. This protocol implements a relative path to send a message from the producing modules in a system to the consuming modules.

CIP uses the Producer/Consumer networking model instead of a source/destination (Primary/Secondary) model. The Producer/Consumer model reduces network traffic and increases speed of transmission.

In traditional I/O systems, controllers poll input modules to obtain their input status. In the CIP system, digital input modules are not polled by a controller. Instead, they produce their data either upon a change of state (COS) or at a requested packet interval (RPI). The frequency of update depends upon the options that are chosen during configuration and where on the network the input module resides. The input module, therefore, is a producer of input data and the controller is a consumer of the data.

The controller can also produce data for other controllers to consume. The produced and consumed data is accessible by multiple controllers over the Logix backplane and over the EtherNet/IP network. This data exchange conforms to the Producer/Consumer model.

## Connections

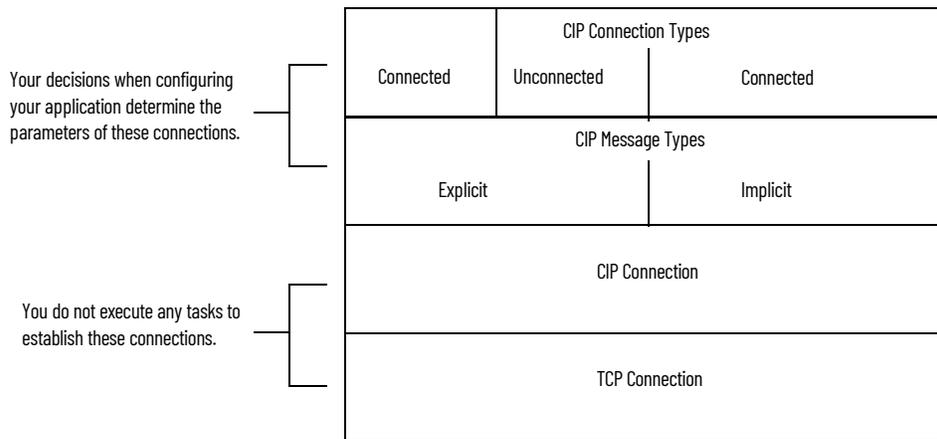
EtherNet/IP communication modules must connect to Ethernet nodes to communicate on the EtherNet/IP network.

A connection is a point-to-point communication mechanism that is used to transfer data between a transmitter and a receiver. Connections can be logical or physical.

Two connection types--TCP connections and CIP connections--are layered over each other each time data is transferred. The TCP connection is the first connection established. It is used for all EtherNet/IP communication and is required for all CIP connection use. One TCP connection supports multiple CIP connections and remains open.

Established over TCP connections, EtherNet/IP CIP connections transfer data from an application running on one end-node (transmitter) to an application running on another end-node (receiver). CIP connections are configured to use explicit or implicit message types. The message types support connected and unconnected connection types. Typically, connected CIP messages are used to transfer data. Unconnected CIP messages are used, but they are only temporary.

The following graphic shows how connections are layered on each other when data is transferred over the EtherNet/IP network.



Remember these points when configuring your EtherNet/IP network application:

- All connections are used each time data is transferred on the EtherNet/IP network.
- You specify CIP connection message types and CIP connection types when configuring your application.

For example, when a Logix 5000™ controller sends an MSG instruction to another Logix 5000 controller, the transmitter sends the instruction to the receiver over a connection. That connection includes the following:

- A TCP connection is established.
- A CIP connection is layered on the TCP connection.
- An explicit or implicit CIP connection message is delivered via the CIP connection or via unconnected messaging.
- If an explicit message type is used, it can be connected or unconnected. If an implicit message type is used, it is connected.
- Each EtherNet/IP communication module has TCP and CIP connection limits that you must account for when configuring your application.

These example applications describe how connections are used.

---

**EXAMPLE** I/O Connections

A Logix 5000 controller has five CIP I/O connections to modules in a remote chassis and all of these connections are through the same local 1756-EN2T module and the same remote 1756-EN2T module.

The following connections exist:

- One TCP connection
  - Five CIP connections
- 

**EXAMPLE** RSLinx® OPC Test Client

The following connections exist:

- One TCP connection
  - Four CIP connections (four is the default)
-

## Terminology

The terms in this table help you understand connections.

**Table 1 - EtherNet/IP Connection Terminology**

Term	Definition
Producer and consumer	<p>Producer/Consumer refers to implicit connections. With implicit connections, messages are sent cyclically (every RPI).</p> <p><b>EXAMPLE:</b> Assume that a ControlLogix® controller is controlling one rack of FLEX™ I/O with a rack connection. Both the ENBT module that is local to the controller and the FLEX AENT module are consumers and producers of data. The AENT consumes outputs and produces inputs.</p>
Client and server	<p>Client/server refers to explicit connections. A client creates a connection and initiates messages. A server provides a service or data. Clients can send messages continuously or intermittently.</p> <p><b>EXAMPLE:</b> A ControlLogix controller can use an MSG instruction to communicate to another controller.</p>
Transports	<p>Each connection has transports. A transport is a uni-directional entity with its own numeric identifier. An implicit connection has 2 transports. An explicit connection has 1 transport. Transports are important because they help you calculate the number of packets per second for each Ethernet interface.</p> <p><b>EXAMPLE: I/O</b></p> <p>For an I/O connection to a rack of distributed I/O, a connection is configured in the Logix Designer application by adding the communication adapter and I/O modules in the I/O list. When the connection is created, output packets flow from the controller to the I/O rack. In addition, input packets flow from the I/O to the controller. Each direction of flow is a transport. In this example, two transports exist. One transport is from the controller to the adapter. The second transport is from the adapter to the controller.</p> <p><b>EXAMPLE: Produced Tag</b></p> <p>For a multicast produced tag connection with two consumers, there is a connection to each consumer. Data from the producer is produced to the wire on one transport. Each of the consumers returns a heartbeat. A total of three transports exist in this example. One transport is from the tag producing controller to the 'wire' media. The second transport is from one consumer to the tag producer. The third transport is from the second consumer.</p>
UCMM	<p>In the web servers, you can see references to Unconnected Message Manager (UCMM). This type of messaging is momentary and therefore can be ignored unless you are troubleshooting. Examples of where UCMM messages are used are:</p> <ul style="list-style-type: none"> <li>• Update of module firmware</li> <li>• Some functions in RSLinx® software</li> <li>• CIP Generic MSG instruction</li> <li>• Opening any CIP connection (forward_open command)</li> </ul>

## TCP Connections

TCP connections are used for all EtherNet/IP communication and are established before one device on the network transmits data to one or more devices on the network. EtherNet/IP communication modules use one TCP connection for each IP address to which the module is connected.

TCP connections are automatically established before CIP connections because you can establish CIP connections only over a TCP connection. One TCP connection supports multiple CIP connections.

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**IMPORTANT** EtherNet/IP communication modules also have web servers that use TCP connections for non-CIP traffic, such as HTTP. However, TCP connections that are used for non-CIP traffic do not count against the limits that are mentioned in the preceding text.

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## CIP Connections

CIP connections are automatically established over a TCP connection and transfer data from one device on the EtherNet/IP network to another. The following are examples of CIP connections:

- Logix 5000 controller message transfer to another Logix 5000 controller
- I/O or produced tag
- Program upload, download, or going online
- Data acquisition from FactoryTalk® Linx and RSLinx® Classic
- PanelView™ polling of a Logix 5000 controller

There are different CIP connections.

**Table 2 - CIP Connections**

CIP Connection	Description
Bridged	A bridged connection is a connection that passes through the EtherNet/IP communication module. The endpoint of the connection is a module other than the EtherNet/IP communication module. <b>EXAMPLE:</b> An explicit connection from a controller through a 1756-EN2T module to another controller.
End-node	An end-node connection is a connection whose endpoint is the EtherNet/IP communication module itself. <b>EXAMPLE:</b> An explicit connection from RSLinx software to the EtherNet/IP communication module to set the module's IP address.
Rack-optimized	A rack-optimized connection is an implicit message connection to a rack or Assembly Object in the EtherNet/IP communication module. Data from selected I/O modules is collected and produced on one connection (the rack-optimized connection) rather than on a separate direct connection for each module. This CIP connection is available with only digital I/O modules.
Direct	An implicit message connection from a controller to a specific I/O module (as opposed to a rack-optimized connection). This CIP connection is available with analog and digital I/O modules.

CIP connections are further defined by these connection parameters:

- [CIP Connection Message Types](#)
- [CIP Transport Types](#)

### CIP Connection Message Types

CIP connections use one of the following CIP connection message types:

- Implicit
- Explicit

**Implicit connections** are time critical in nature. These connections include I/O and produced/consumed tags. Implicit refers to the data type and the meaning of the data.

**Explicit connections** are non-time critical and are request/reply in nature. Executing an MSG instruction or executing a program upload are examples of explicit connections. Explicit refers to basic information (such as data type, or meaning) that is included in every message.

## CIP Transport Types

CIP transport types determine how CIP connections transfer data on the network. The CIP transport types determine whether a connection is established between devices.

There are two CIP transport types:

- Connected—Available with both implicit and explicit messages.
- Unconnected—Available with only explicit messages.

[Table 3](#) describes how CIP connections are used with implicit and explicit messages.

**Table 3 - CIP Transport Types with Implicit and Explicit Messages**

CIP Transport Type	As Used with Implicit Messages	As Used with Explicit Messages
Connected	<p>The following events occur:</p> <ol style="list-style-type: none"> <li>1. A connection is established between devices.</li> <li>2. Data is transferred between devices.</li> <li>3. The connection remains open for future data transmission.</li> </ol> <p>The following are examples of connected implicit messaging:</p> <ul style="list-style-type: none"> <li>• I/O data transfer</li> <li>• Produced/consumed tags between Logix 5000 controllers</li> </ul> <p>Keep in mind the following points for connected implicit messaging:</p> <ul style="list-style-type: none"> <li>• Execution time is more efficient because the CIP connection between devices does not need to be reopened for each data transfer.</li> <li>• EtherNet/IP communication modules support limited numbers of CIP connections. Because this connection is always open, there is one less CIP connection available for other data transfer through the module.</li> </ul>	<p>The following events occur:</p> <ol style="list-style-type: none"> <li>1. A connection is established between devices.</li> <li>2. Data is transferred between devices.</li> <li>3. The connection between the devices can be closed.</li> </ol> <p>If data must be transferred again between these same two devices, the connection must be reopened.</p> <p>The following are examples of connected explicit messaging:</p> <ul style="list-style-type: none"> <li>• MSG instruction</li> <li>• RSLinx® Classic software setting the IP address for an EtherNet/IP communication module</li> </ul> <p>Keep in mind the following points for connected explicit messaging:</p> <ul style="list-style-type: none"> <li>• Execution time is less efficient because the CIP connection between devices must be reopened for each data transfer.</li> <li>• EtherNet/IP communication modules support limited numbers of CIP connections. Because this CIP connection is closed immediately after use, the CIP connection is immediately available for other data transfer through the module.</li> </ul> <p>NOTE: If you select a cached connection, the connection is not closed at the end of the transaction.</p>
Unconnected	—	<p>In unconnected explicit messaging, no connection is established between devices.</p> <p>Data is sent in a packet that includes destination identifier information in the data structure but does not have a dedicated CIP connection.</p>

## Packet Rate Capacity

The packet size impacts the implicit packet rate capacity of the ControlLogix EtherNet/IP communication modules.

Smaller connections are processed faster than larger connections. Larger connections can affect the increased packet rate capacity that is obtained with firmware revision 3 or later. These types of applications use larger connections.<sup>(1)</sup>

- Applications with rack-optimized connections
- Applications with Integrated Motion on the EtherNet/IP network
- Applications with large produce/consume tag arrays

Modules with firmware revision 3 or later always have greater packet rate capacity than modules with firmware revision 2 or earlier in the same application. Larger connections impact only how much greater the packet rate capacity is with firmware revision 3 or later.

Some EtherNet/IP communication modules offer webpages that show module and application information such as capacity being used, in packets per second. To view your module's information, type the module's IP address into your web browser. See [Appendix A](#) for more information.

## Messaging

The EtherNet/IP network supports both time-critical (implicit) and non time-critical (explicit) message transfer services of CIP. Exchange of time-critical messages is based on the Producer/Consumer model where a transmitting device produces data on the network and many receiving devices can consume this data simultaneously.

### Implicit Messages

Implicit messages are time critical in nature. These messages include I/O and produced/consumed tags. Implicit refers to information (source address, data type, and destination address) that is implied in the message, but not contained in the message. Examples of implicit applications include the following:

- Real-time I/O data
- Functional safety data
- Motion control data

Implicit messages use the User Datagram Protocol (UDP) and can be unicast or multicast.

- The data source/destination is an application object (Assembly Object).
- There is no protocol in the message data—it is all I/O data.
- Data transfer is more efficient because the meaning of the data is known ahead of time.
- Transfer is initiated on a time basis (cyclic trigger) or requested packet interval (RPI).
- There is a connection timing mechanism to alert the application if the other side has stopped communicating.

(1) Excludes the 1756-EN4TR.

- Messaging is always connected.

An implicit message times out in *controller\_multiplier* x RPI. The multiplier is selected by the controller firmware so that the timeout is greater than or equal to 100 ms. The minimum multiplier is 4.

These are examples:

- RPI = 2 ms; controller multiplier = 64. The timeout is 128 ms.
- RPI = 10 ms; controller multiplier = 16. The timeout is 160 ms.

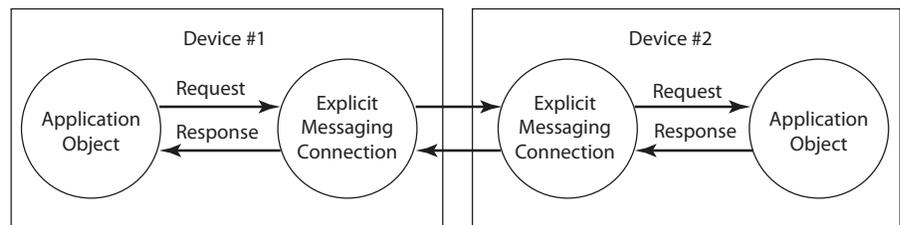
## Explicit Messages

Explicit messages are non-time critical and are request/reply in nature. Executing an MSG instruction or executing a program upload are examples of explicit connections. Explicit refers to basic information (such as source address, data type, or destination address) that is included in every message. Each request is typically directed at another data item. Examples of explicit applications include the following:

- HMI
- RSLinx connections
- Message (MSG) instructions
- Program upload/download

Explicit messages use TCP. Explicit messages are used for point-to-point, client-server transactions.

- The server side is bound to the Message Router object and has access to all internal resources.
- The client side is bound to a client application object and must generate requests to the server.
- Explicit messages use an explicit messaging protocol in the data portion of the message packet.
- Explicit messages can be connected or unconnected.



An explicit message times out in 30 seconds by default. This setting is user-changeable in the Message (MSG) instruction structure.

## Ethernet Features in Network Devices

EtherNet/IP™ networks offer a comprehensive suite of messages and services for many automation applications. This open network standard uses standard Ethernet communication products to support real-time I/O messaging, information exchange, and general messaging. All EtherNet/IP network devices include the following features:

- Support for messaging, produced/consumed tags, and distributed I/O
- DNS addressing
- Internet Group Management Protocol (IGMP) snooping (enabled by default) and querier (disabled by default)
- Port configuration and diagnostics
- Email server

EtherNet/IP supports CIP Safety™, CIP Motion™, and CIP Security™ at the application layer.

## EtherNet/IP Device-Specific Features

EtherNet/IP network devices can provide the following functionality. See the user manual for your device for details.

- Supports various communication rates depending on your device
- Linear network
- Device Level Ring protocol
- Parallel Redundancy Protocol
- Duplicate IP address detection
- Socket interface
- Email client

## Device Level Ring (DLR)

Device Level Ring (DLR) is an EtherNet/IP protocol defined by the Open DeviceNet® Vendors' Association (ODVA). DLR provides a means to detect, manage, and recover from single faults in a ring-based network.

A DLR network includes the following types of ring nodes.

Node	Description
Ring supervisor	<p>A ring supervisor provides these functions:</p> <ul style="list-style-type: none"> <li>• Manages traffic on the DLR network</li> <li>• Collects diagnostic information for the network</li> </ul> <p>A DLR network requires at least one node to be configured as ring supervisor. By default, the supervisor function is disabled on supervisor-capable devices.</p>
Ring participants	<p>Ring participants provide these functions:</p> <ul style="list-style-type: none"> <li>• Process data that is transmitted over the network.</li> <li>• Pass on the data to the next node on the network.</li> <li>• Report fault locations to the active ring supervisor.</li> </ul> <p>When a fault occurs on the DLR network, ring participants reconfigure themselves and relearn the network topology.</p>
Redundant gateways (optional)	<p>Redundant gateways are multiple switches that connect to a single DLR network and also connect together through the rest of the network.</p> <p>Redundant gateways provide DLR network resiliency to the rest of the network.</p>

Depending on their firmware capabilities, both devices and switches can operate as supervisors or ring nodes on a DLR network. Only switches can operate as redundant gateways.

For more information about DLR, see the EtherNet/IP Device Level Ring Application Technique, publication [ENET-AT007](#).

## Parallel Redundancy Protocol (PRP)

Parallel Redundancy Protocol (PRP) is defined in international standard IEC 62439-3 and provides high-availability in Ethernet networks. PRP technology creates seamless redundancy by sending duplicate frames to two independent network infrastructures, which are known as LAN A and LAN B.

A PRP network includes the following components.

Component	Description
LAN A and LAN B	Redundant, active Ethernet networks that operate in parallel.
Double attached node (DAN)	An end device with PRP technology that connects to both LAN A and LAN B.
Single attached node (SAN)	An end device without PRP technology that connects to either LAN A or LAN B. A SAN does not have PRP redundancy.
Redundancy box (RedBox)	A switch with PRP technology that connects devices without PRP technology to both LAN A and LAN B.
Virtual double attached node (VDAN)	An end device without PRP technology that connects to both LAN A and LAN B through a RedBox. A VDAN has PRP redundancy and appears to other nodes in the network as a DAN.
Infrastructure switch	A switch that connects to either LAN A or LAN B and is not configured as a RedBox.

For more information about PRP, see the EtherNet/IP Parallel Redundancy Protocol Application Technique, publication [ENET-AT006](#).

## Duplicate IP Address Detection

Duplicate IP address detection verifies that an IP address does not match any other device IP address on the network when you perform either of these tasks:

- Connect the device to a EtherNet/IP network.
- Change the IP address on the device.

If the IP address matches that of another device on the network, the EtherNet/IP port on the device transitions to conflict mode. In conflict mode, these conditions exist:

- OK status indicator blinks red.
- Network (NET) status indicator is steady red.
- If the device has a text display, the following message scrolls across the 4-character display:

```
<IP_address_of_this_device> Duplicate IP -
<MAC_address_of_duplicate_node_detected>
```

For example: 10.88.60.196 Duplicate IP - 00:00:BC:02:34:B4

## Duplicate IP Address Resolution

This table describes how to resolve duplicate IP addresses.

Duplicate IP Address Detection Conditions	Resulting Behavior
<ul style="list-style-type: none"> <li>• Both devices support duplicate IP address detection</li> <li>• Second device is added to the network after the first device is operating on the network</li> </ul>	<ol style="list-style-type: none"> <li>1. The device that began operation first uses the IP address and continues to operate without interruption.</li> <li>2. The device that begins operation second detects the duplication and enters Conflict mode.</li> </ol>
<ul style="list-style-type: none"> <li>• Both devices support duplicate IP address detection</li> <li>• Both devices were powered up at approximately the same time</li> </ul>	<p>Both EtherNet/IP devices enter Conflict mode. To resolve this conflict, follow these steps:</p> <ol style="list-style-type: none"> <li>a. Assign a new IP address to one of the devices.</li> <li>b. Cycle power to the other device or disconnect and reconnect all Ethernet cables from the other device.</li> </ol>
One device supports duplicate IP address detection and a second device does not	<ol style="list-style-type: none"> <li>1. Regardless of which device obtained the IP address first, the device that does not support IP address detection uses the IP address and continues to operate without interruption.</li> <li>2. The device that supports duplicate IP address detection detects the duplication and enters Conflict mode.</li> </ol>

## DNS Addressing

To qualify the device address further, use DNS addressing to specify a host name for a device. When you specify a host name for the device, you also specify a domain name and DNS servers. DNS addressing makes it possible to create similar network structures and IP address sequences under different domains.

DNS addressing is necessary only if you refer to the device by host name, such as in path descriptions in MSG instructions.

To use DNS addressing, follow these steps.

1. Assign a host name to the device.

A network administrator can assign a host name. Valid host names must be IEC-1131-3 compliant.

2. Configure the device IP address:

In the DNS server, the host name must match the IP address of the device.

---

**IMPORTANT** Make sure the DNS enable bit is set.

- If you use Logix Designer application, version 28 or later, to configure your device, the enable bit is set and DNS addressing is successful.
- If you use RSLinx® Classic software, version 2.41.00 or later, to configure your device, the enable bit is cleared and DNS addressing fails.

3. In the Logix Designer application, add the device to the I/O.

---

**IMPORTANT** If a child device resides in the same domain as its parent device, type the host name. If the domain name of the child device differs from its parent device, type the host name and the domain name (host.domain)

---

**IMPORTANT** You can also use DNS addressing in a device profile in the I/O configuration tree or in a message path. If the domain name of the destination device differs from the source device, use a fully qualified DNS name (hostname.domainname). For example, to send a message from AEN2TR1.location1.companyA to AEN2TR1.location2.company, the host names match, but the domains differ. Without the entry of a fully qualified DNS name, the device adds the default domain name to the specified host name.

---

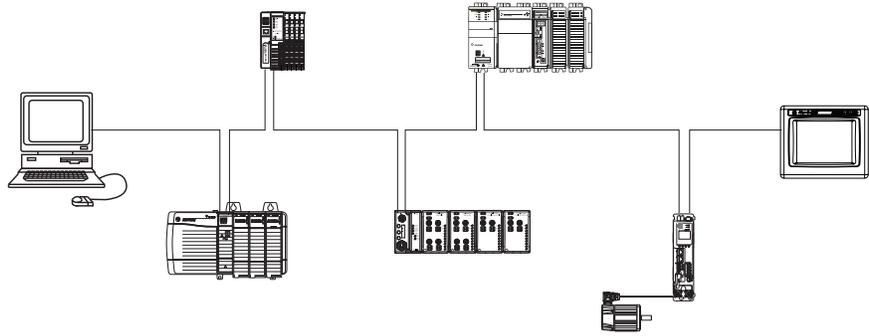
## Socket Interface

Some EtherNet/IP devices support the use of a CIP Generic MSG instruction to request socket services. For more information, see EtherNet/IP Socket Interface Application Technique, [ENET-AT002](#).

## Linear Network

A linear network is a collection of devices that are daisy chained together. The EtherNet/IP embedded switch technology lets you implement this topology at the device level. No additional switches are required.

Figure 1 - Example Linear Network



The following are advantages of a linear network.

- Simple installation
- Reduced wiring and installation costs
- No special software configuration required
- Improved CIP Sync application performance on linear networks

The primary disadvantage of a linear network is that any break of the cable disconnects all devices downstream from the break from the rest of the network.

## Device Level Ring

Device Level Ring (DLR) is an EtherNet/IP protocol that is defined by ODVA. DLR provides a means to detect, manage, and recover from single faults in a ring-based network.

A DLR network includes the following types of ring nodes.

Node	Description
Ring supervisor	<p>A ring supervisor provides these functions:</p> <ul style="list-style-type: none"> <li>• Manages traffic on the DLR network</li> <li>• Collects diagnostic information for the network</li> </ul> <p>A DLR network requires at least one node to be configured as ring supervisor.</p> <p><b>IMPORTANT:</b> By default, the supervisor function is disabled on supervisor-capable devices, so they are ready to participate on a linear or star network or as a ring node on a DLR network. In a DLR network, you must configure at least one of the supervisor-capable devices as the ring supervisor before physically connecting the ring. If you do not, the DLR network does not work.</p>
Ring participants	<p>Ring participants provide these functions:</p> <ul style="list-style-type: none"> <li>• Process data that is transmitted over the network.</li> <li>• Pass on the data to the next node on the network.</li> <li>• Report fault locations to the active ring supervisor.</li> </ul> <p>When a fault occurs on the DLR network, ring participants reconfigure themselves and relearn the network topology.</p>
Redundant gateways (optional)	<p>Redundant gateways are multiple switches that are connected to one DLR network and also connected together through the rest of the network.</p> <p>Redundant gateways provide DLR network resiliency to the rest of the network.</p>

Depending on their firmware capabilities, both devices and switches can operate as supervisors or ring nodes on a DLR network. Only switches can operate as redundant gateways.

For more information about DLR, see the EtherNet/IP Device Level Ring Application Technique, publication [ENET-AT007](#).

## EtherNet/IP Network Specifications

Table 4 - EtherNet/IP Network Specifications

Cat. No.	Connections		CIP Unconnected Messages (Backplane + Ethernet)	Ethernet Node Count, Max	Packet Rate Capacity (packets/second) <sup>(1)</sup>		SNMP Support (password required)
	TCP	CIP			I/O	HMI and MSG	
1734-AENT, 1734-AENR	32	20	32	—	5000	900	No
1738-AENT, 1738-AENR	32	20	32	—	5000	900	No
1756-EN2F, 1756-EN2T, 1756-EN2TXT, 1756-EN2TR, 1756-EN2TRXT	128	256 <sup>(2)</sup>	128 + 128	—	<b>IMPORTANT:</b> Packet rates for ControlLogix EtherNet/IP communication modules depend on series and firmware revision.	2000	Yes
1756-EN3TR	128	256 <sup>(2)</sup>	128 + 128	—		2000	Yes
1756-EN4TR, 1756-EN4TRXT	512	1000 I/O 528 <sup>(2)</sup>	256+256	—	<ul style="list-style-type: none"> <li>• 50,000 without CIP Security</li> <li>• 25,000 with integrity</li> <li>• 15,000 with integrity and confidentiality</li> </ul>	<ul style="list-style-type: none"> <li>• 3700 without CIP Security</li> <li>• 2700 with integrity</li> <li>• 1700 with integrity and confidentiality</li> </ul>	Yes
1783-ETAP, 1783-ETAP1F, 1783-ETAP2F	64	—	—	—	—	900	No
1794-AENT	64	64	—	—	9500	—	Yes
5069-AENR	32	16 (messaging)	16	—	100,000	500	Yes
5069-AEN2TR		256 (messaging)	32	—	100,000	2000	Yes
5094-AENR, 5094-AENRXT, 5094-AEN2TR, 5094-AEN2TRXT	32	16 (messaging)	16	—	100,000	500	Yes

(1) Total packet rate capacity = I/O Produced Tag, max + HMI/MSG, max. Packet rates vary depending on packet size. For more detailed specifications, see the EDS file for a specific catalog number.

(2) There are 1000 CIP I/O connections and 528 CIP messaging connections.

Reserve 10% of the bandwidth (packets/second) of the network device for temporary Explicit Messaging.

For other devices with EtherNet/IP connectivity, see the specifications in the technical data for the device.

## Time Synchronization

In certain situations, the I/O modules can synchronize with the adapter before the adapter synchronizes with the system Grandmaster clock. This synchronization occurrence leads to a time difference between the I/O and the Grandmaster clock until the adapter synchronizes with the Grandmaster clock.

In your logic, verify that the adapter is synchronized with the Grandmaster clock before you initiate time stamp requests or scheduled outputs from your I/O modules. A system with intermediate devices, such as network bridges and switches, can require that you insert a delay until the time stabilizes in the system.

For information on how to verify that the adapter is synchronized to a Grandmaster clock, see CIP Sync Diagnostics in the Integrated Architecture® and CIP Sync Configuration Application Technique, publication [IA-AT003](#). This publication also includes information on Time Sync Object Attributes.

## Simple Network Management Protocol (SNMP)

SNMP enables an Ethernet switch to be remotely managed through other network management software. SNMP defines the method of communication among the devices and also denotes a manager for the monitoring and supervision of the devices. Confidential information can be encrypted to help prevent the contents from being exposed on the network. For more information, see the [SNMP Password and MIB Configuration](#) Knowledgebase article.

**Notes:**

## Configure a Workstation to Operate on an EtherNet/IP Network

Before you can connect to the device via an Ethernet cable, you must install an EtherNet/IP™ driver on your workstation.

A communication driver is required to complete these tasks:

- Upload and download controller projects over an EtherNet/IP network.
- Collect controller data for electronic operator interfaces, for example, PanelView™ Plus terminals, and visualization software, for example, FactoryTalk® View software
- Update device firmware
- Set or change the IP address.
- Configure the device

When you are configuring your software, consider the details in [Table 5](#).

**Table 5 - Configuration Software Descriptions**

Configuration Software	Description
FactoryTalk® Linx™	FactoryTalk® Linx™ is a FactoryTalk Live Data server and communications service designed to deliver control system information from Allen-Bradley® control products to the Rockwell Automation FactoryTalk® software portfolio and Studio 5000® design software. FactoryTalk Linx is specifically optimized to work with Logix 5000™ Programmable Automation Controllers (PAC) and the PlantPAx® process controller. Prior to version 6.00 FactoryTalk Linx was called RSLinx® Enterprise. Because of this, some portions of the software installation and documentation still contain references to the previous RSLinx Enterprise name.
RSLinx Classic®	RSLinx Classic links Allen-Bradley networks and devices to Microsoft Windows applications. RSLinx Classic also incorporates advanced data optimization techniques and contains a set of diagnostics. RSLinx Classic is an OPC DA (Data Access) Compliant Server and a DDE server.

## Configure the Ethernet Communication Driver in FactoryTalk Linx Software

FactoryTalk Linx software supports the following communication drivers:

Driver	Description
Ethernet	Provides an option to broadcast device discover or option to specific device list / range Supports runtime communications Supports communications over longer distances when compared to the USB driver.
USB Driver	Three drivers are automatically created using configurations from earlier versions of Linx software. The USB is populated when a USB cable is connected to a device capable of supporting CIP Lets you: <ul style="list-style-type: none"> <li>• Connect to an unconfigured device and configure an Ethernet port.</li> <li>• Update the device firmware</li> </ul> Not intended for runtime connections; it is a temporary-use only connection with a limited cabling distance.

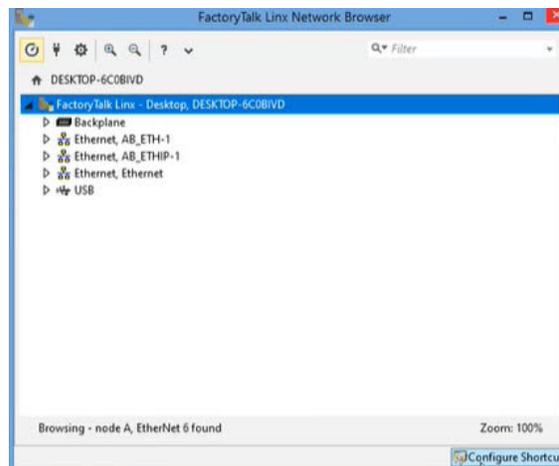
Before you add an Ethernet driver, confirm that these conditions exist:

- The workstation is properly connected to the EtherNet/IP network.
- The workstation IP address and other network parameters are configured correctly.



CIP™ Security is available through FactoryTalk® Linx, version 6.11 or later.

Open FactoryTalk Linx network browser either from within your programming application or from Start > Rockwell Software > FactoryTalk Linx network browser.



FactoryTalk Linx creates two Ethernet drivers by default.

**Table 6 - Ethernet Drivers**

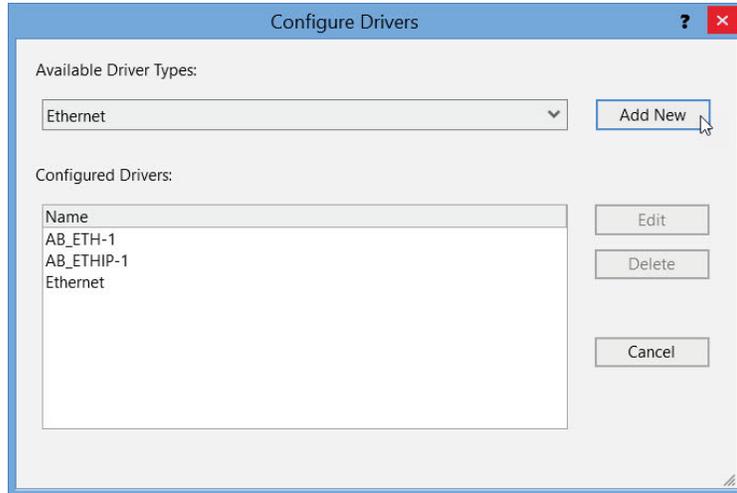
Driver	Description
Ethernet, AB_ETH-1	Enables the FactoryTalk Linx Network Browser to target a device that is configured to block remote broadcast messages. The list can contain a maximum of 255 IP addresses specified individually or as a range. If you are using an IP address range, each IP address in the range can be assigned to a device. Unattached IP addresses can delay broadcast messages and can create additional network messages.
Ethernet, AB_ETHIP-1	<ul style="list-style-type: none"> <li>• Broadcast - enables the FactoryTalk Linx Network Browser to send a UDP broadcast message to all devices on a local or remote subnet.</li> <li>• Local - enables the FactoryTalk Linx Network Browser to send a UDP broadcast message to all devices on the same subnet that is connected to the computer.</li> <li>• Remote - enables the FactoryTalk Linx Network Browser to target the UDP broadcast to another subnet on the network determined the IP address and subnet mask you provide.</li> <li>• In some cases, the default Ethernet Switch configuration blocks a remote UDP broadcast message from being propagated to a subnet, and no devices are detected. If this occurs, use the Device List/Range discovery method.</li> </ul> <p>When a local or remote UDP broadcast discovery message is transmitted, each device responds with their individual identity information. Avoid using this driver configuration if you have a subnet with a high number of devices or if the network is heavily loaded. When adding new drivers, the FactoryTalk Linx Network Browser defaults to Local Broadcast Configuration.</p>

With FactoryTalk Linx, you can:

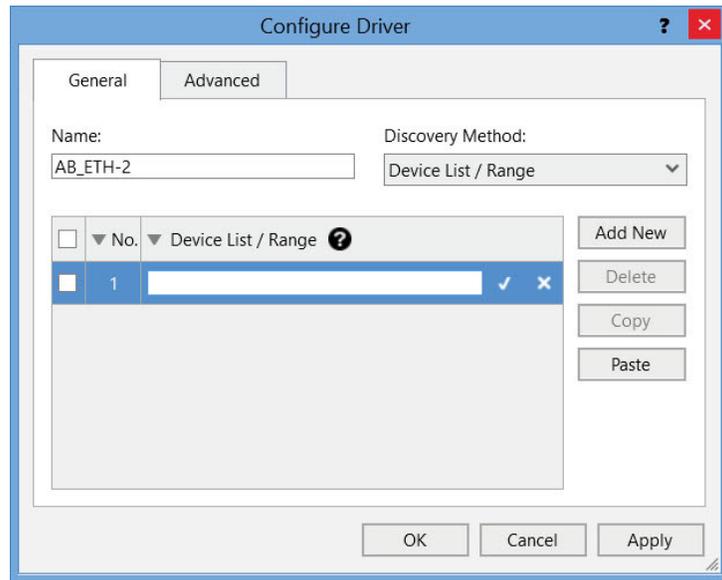
- Specify a single IP address or a range of IP addresses for the AB-Ethernet driver.
- Create a new driver.

## Specify a Single IP Address or a Range of IP Addresses

1. Select the Ethernet, AB\_Eth1 driver and select Driver Configuration.



2. The following image appears when you click Add New.



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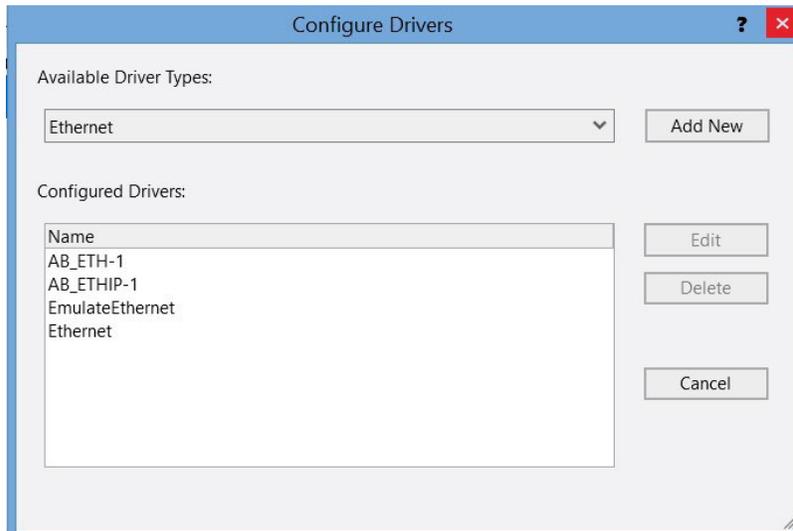
**IMPORTANT** IP Addresses in a range that do not exist on the network result in extra network traffic.

---

## Add a New Driver

1. Select the Backplane or an existing driver.

Select the plug icon  and select Add New.



2. Enter the information for the new driver.

The new driver follows the same list and broadcast options as the AB\_ETH1 driver.

## Configure the Ethernet Communication Driver in RSLinx Classic Software

RSLinx Classic software supports the following communication drivers:

Driver	Description
EtherNet/IP	Supports runtime communications Supports communications over longer distances when compared to the USB driver
Ethernet	Lets you manually configure the IP addresses for devices.
USB Driver	Lets you: <ul style="list-style-type: none"> <li>Connect to an unconfigured device and configure an Ethernet port.</li> <li>Update the device firmware</li> </ul> Not intended for runtime connections; it is a temporary-use only connection with a limited cabling distance.

Before you add an Ethernet driver, confirm that these conditions exist:

- The workstation is properly connected to the EtherNet/IP network.
- The workstation IP address and other network parameters are configured correctly.

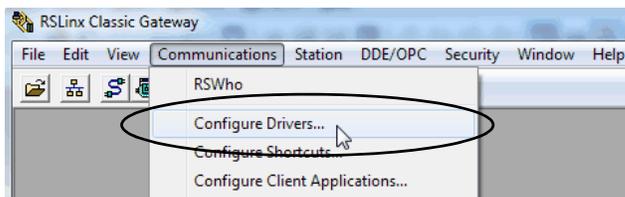


If you need to use CIP™ Security, it is only available through FactoryTalk® Linx, version 6.11 or later.

Open RSLinx Classic software either from within your programming application or from Start > Rockwell Software > RSLinx Classic.

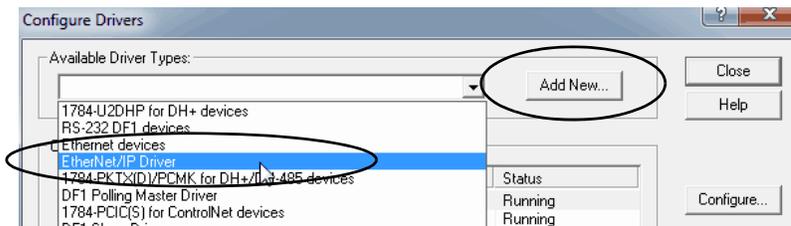
To configure the EtherNet/IP driver, follow these steps.

1. From the Communications menu, choose Configure Drivers.



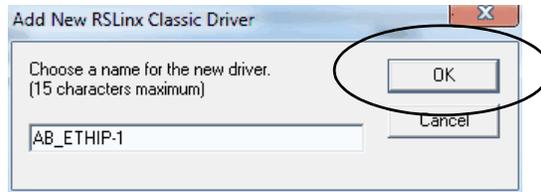
The Configure Drivers dialog box appears.

2. From the Available Driver Types pull-down menu, choose EtherNet/IP Driver.
3. Click Add New.



The Add New RSLinx® Driver dialog box appears.

- Type a name for the new driver and click OK.



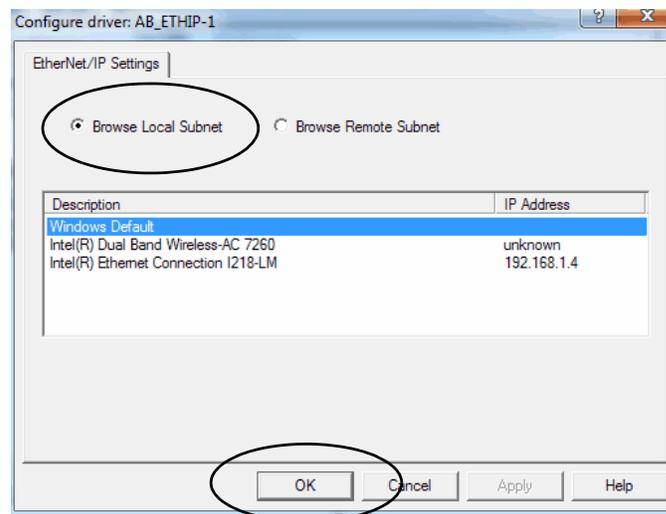
The Configure driver dialog box appears.

- Click Browse Local Subnet.



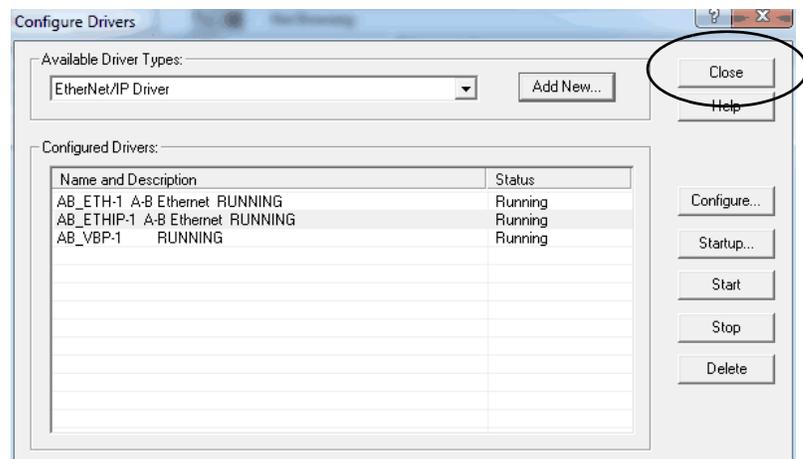
To view devices on another subnet or VLAN from the workstation running RSLinx Classic software, click Browse Remote Subnet.

- Select the desired driver, and click OK.



The new driver is available on the Configure Drivers dialog box.

- Click Close.



**Notes:**

## Set an IP Address

There are multiple ways to set an IP address. Check the user documentation for your device for the preferred method.

- EtherNet/IP™ Address Commissioning Tool
- FactoryTalk® Linx Network Browser software
- Studio 5000 Logix Designer® Application
- BOOTP/DHCP tool
- RSLinx® Classic software
- Hardware switches

### Set the IP Address with the EtherNet/IP Address Commissioning Tool

You can use the EtherNet/IP Address Commissioning Tool to:

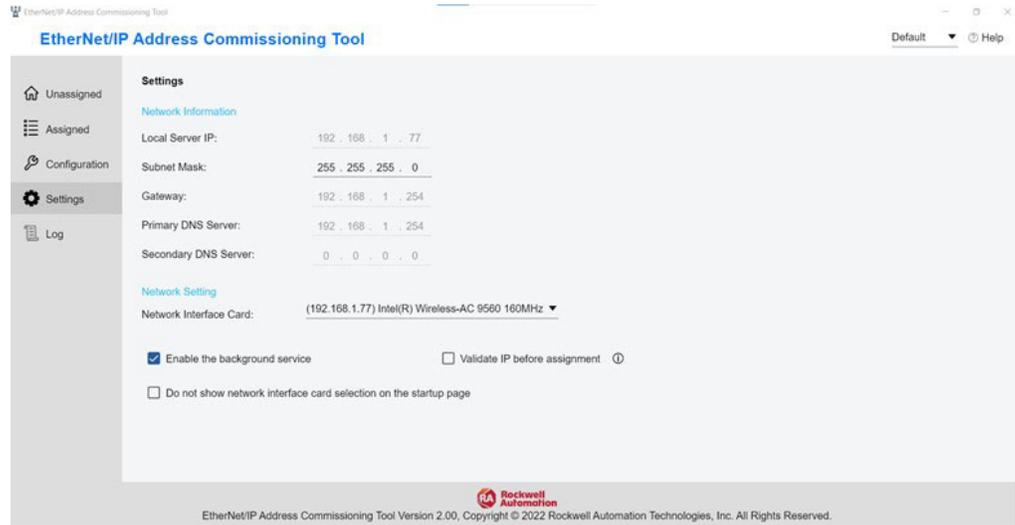
- Assign the IP address, subnets, and other parameters to BOOTP and DHCP enabled devices.
- For EtherNet/IP or CIP™ connected devices, change the device operation between dynamic mode where the device initiates BOOTP/DHCP request to static mode where BOOTP/DHCP requests are disabled and communications settings within the device are used.
- Set and modify the IP addresses of EtherNet/IP devices with known MAC addresses, but unknown IP addresses.

The BOOTP/DHCP IP address assignment process begins when a device without an IP address powers up. The device initiates a BOOTP/DHCP request that contains the device's Media Access Control (MAC) address onto the network as a broadcast message. If the network switches are configured to support broadcast and BOOTP/DHCP messages (many managed switches disable this capability), a BOOTP/DHCP server receives the request, determines the appropriate IP address for the device and responds with an IP address assignment.

If the device does not receive a response in an appropriate amount of time, it waits a random amount of time and retries the request. After each failed attempt, the retries become less frequent. A device configured to use BOOTP/DHCP typically resets or loses its IP address assignment when powered down, unless its settings are modified to change it out of dynamic BOOTP/DHCP mode to static mode.

## Set Up the Tool

1. Open the EtherNet/IP Address Commissioning Tool and select the network interface card for your workstation.
2. Open Settings to define how the tool operates.



If a multiple network interfaces card (NICs) exists, the EtherNet/IP Address Commissioning Tool can only interact with one of them.

## Assign IP Addresses Manually



There are many computer and network configuration scenarios that can affect this process. If an error is reported, review the troubleshooting section in tool online help.

The Unassigned tab lists the devices that have not been assigned an IP address. Use the Unassigned tab to configure the IP address or set up rules for automatic IP assignment.

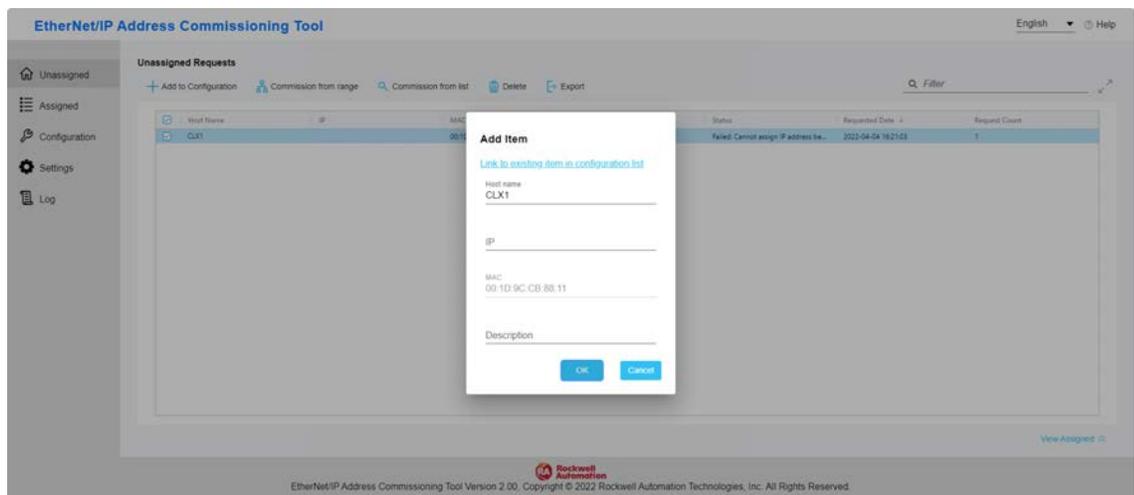
When a BOOTP/DHCP is requested and the MAC address is not found in the configuration list, the device appears in the Unassigned list.

1. Select Add to Configuration to manually enter the information for a device into the configuration list.

The IP address is offered the next time that the device makes a BOOTP/DHCP request. This function is similar to how the BOOTP/DHCP tool operates.

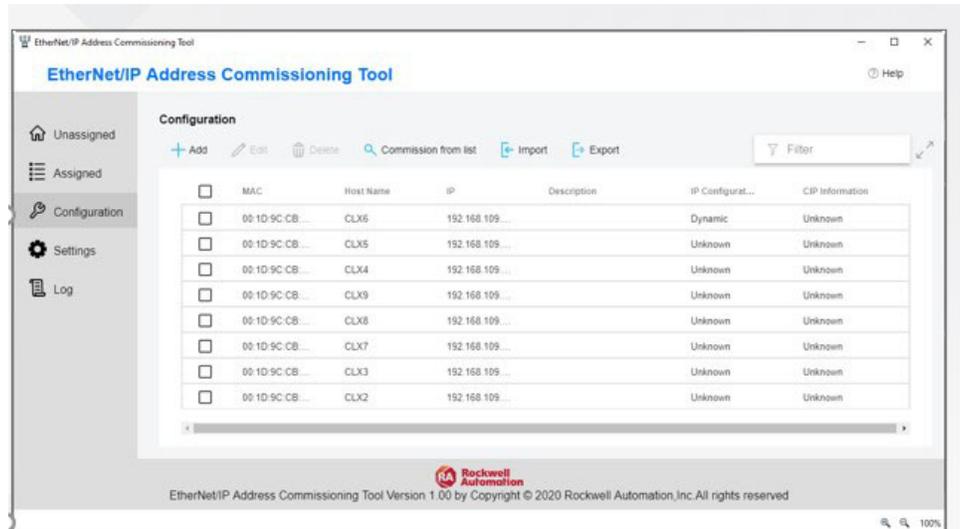


To choose an existing IP address, move to [step 4](#).



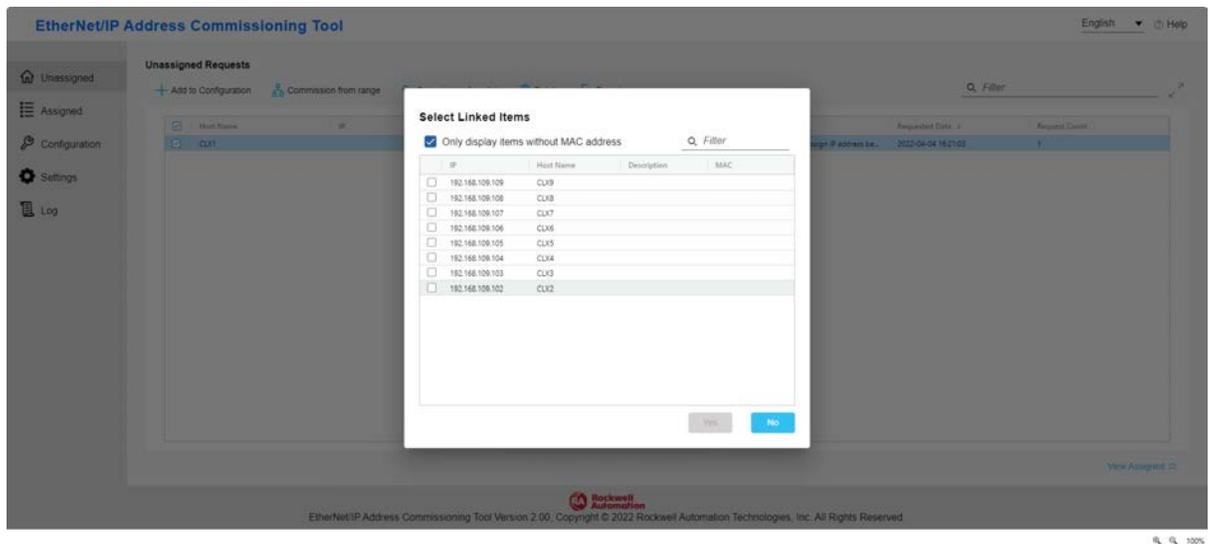
2. Wait for the device to make a subsequent BOOTP/DHCP request.

3. The device now appears on the Assigned Tab.

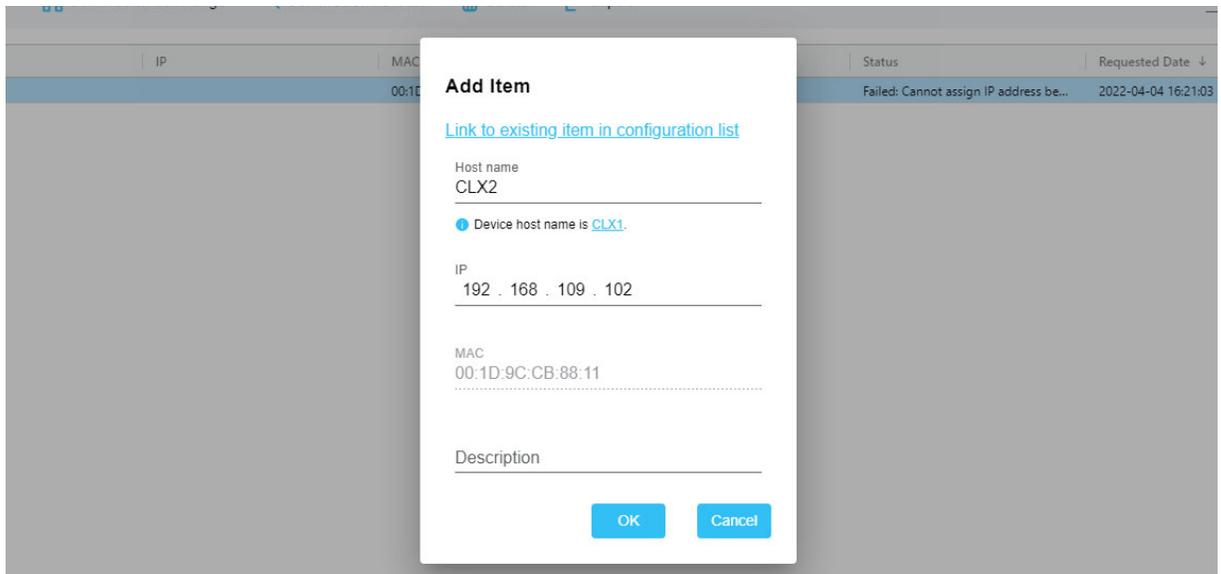


4. If you are linking to an existing item, click “Link to existing item in configuration list”.

Now you can select an item that does not have an existing MAC address. You can also remove any checks from a selected check box and replace an existing item.

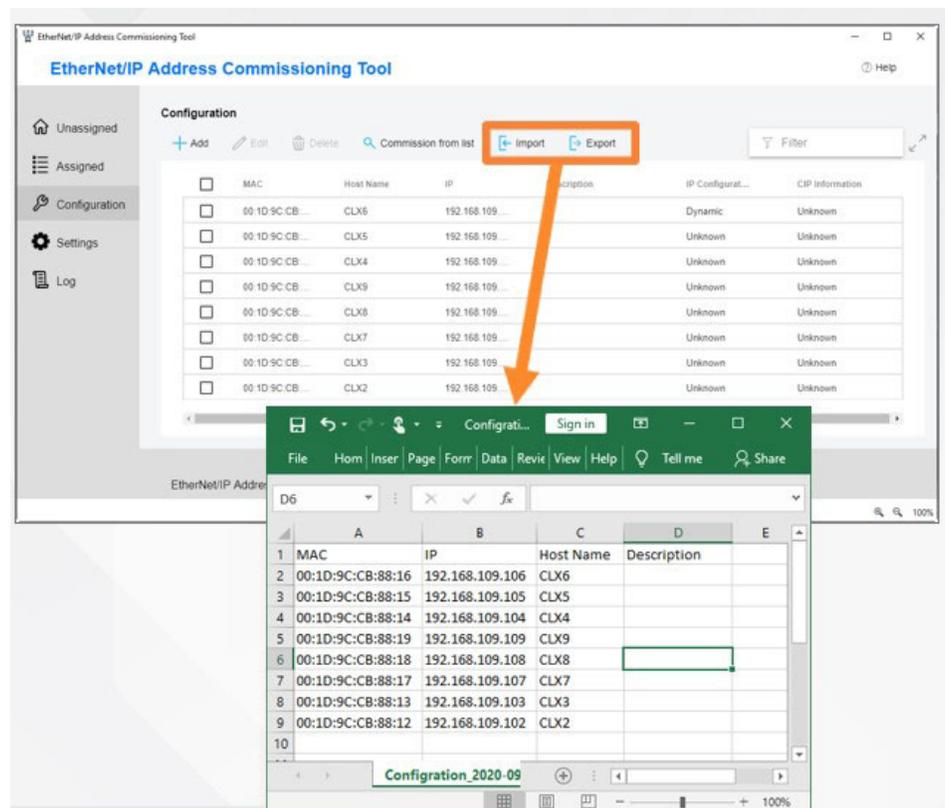


Once you click a list item, and select “Yes”, the details automatically populate the previous dialog box.



Options to make assigning IP addresses more streamlined include:

- Import a list of IP addresses in the Configuration tab and merge them with incoming requests.



- Use imported addresses with the Commission from List Feature to indicate the order to bring devices online.

Commission From List

● The next IP will be assigned to below device.

IP	Host Name	Description
192.168.109.100	temp0	

<input type="checkbox"/>	Host Name	IP	MAC	Status	Description
<input checked="" type="checkbox"/>	temp0	192.168.109.100		Wait	
<input type="checkbox"/>	temp1	192.168.109.101		Wait	
<input type="checkbox"/>	temp2	192.168.109.102		Wait	
<input type="checkbox"/>	temp3	192.168.109.103		Wait	
<input type="checkbox"/>	temp4	192.168.109.104		Wait	
<input type="checkbox"/>	temp5	192.168.109.105		Wait	
<input type="checkbox"/>	temp6	192.168.109.106		Wait	
<input type="checkbox"/>	temp7	192.168.109.107		Wait	
<input type="checkbox"/>	temp8	192.168.109.108		Wait	

- Use the Commission from Range feature option to automatically assign IP addresses to a preset range you provide.

Commission From Range

● The available IP addresses are: 192.168.109.1 to 192.168.109.255

[Configure IP auto-assign list](#)

192 . 168 . 109 . 1 - 192 . 168 . 109 . 200

Remaining IP Amount:  
**200**

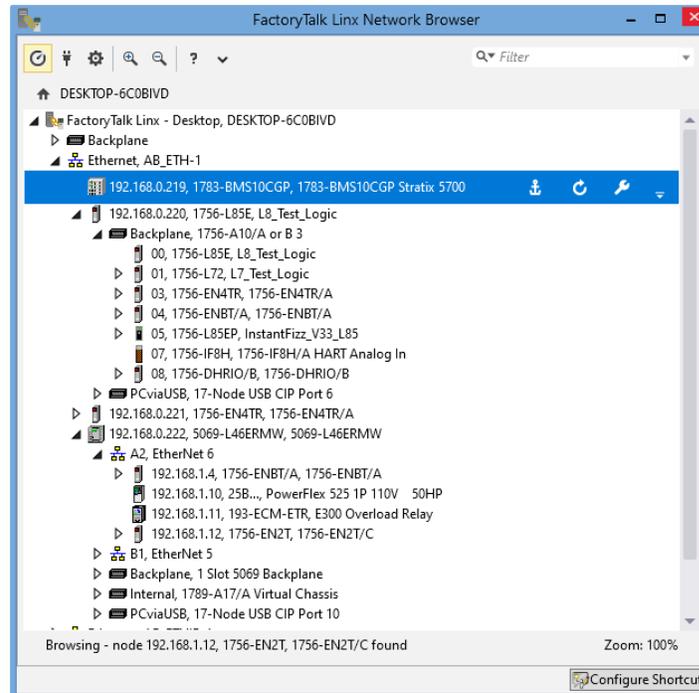
IP address for the next device  
**192.168.109.1**

Add to Configuration list

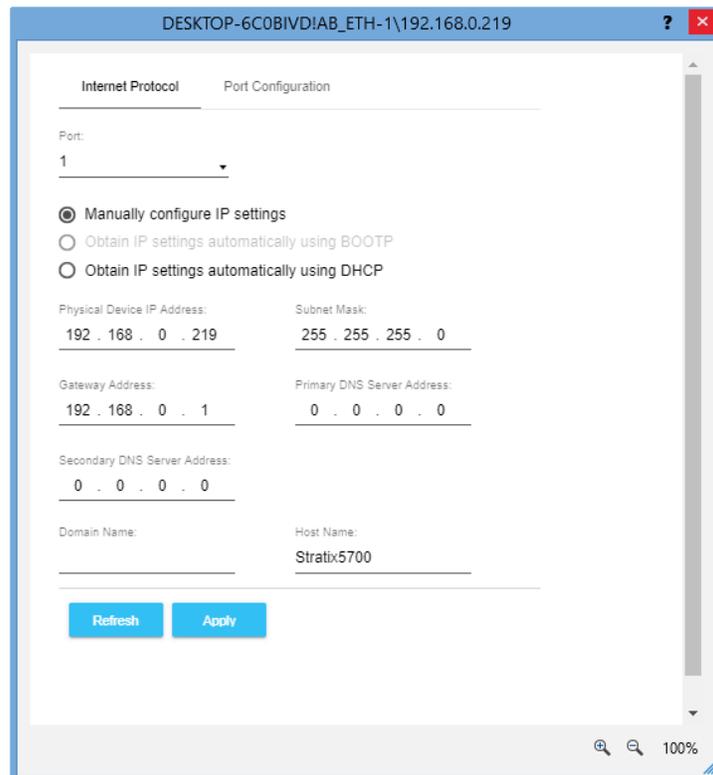
## Set the IP Address with FactoryTalk Linx Software

To use FactoryTalk Linx software to set the IP address, follow these steps.

1. Open the FactoryTalk Linx Network Browser and browse to the device.



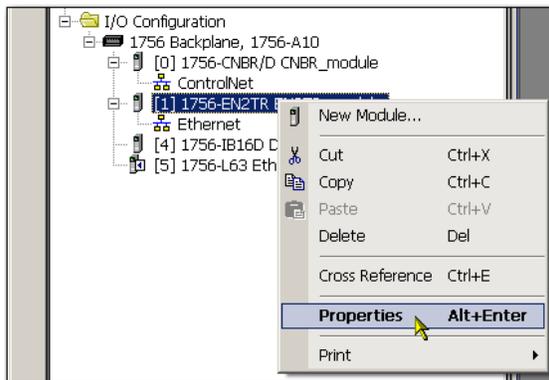
2. To set the IP address, click the wrench.



## Set the IP Address with Studio 5000 Logix Designer Application

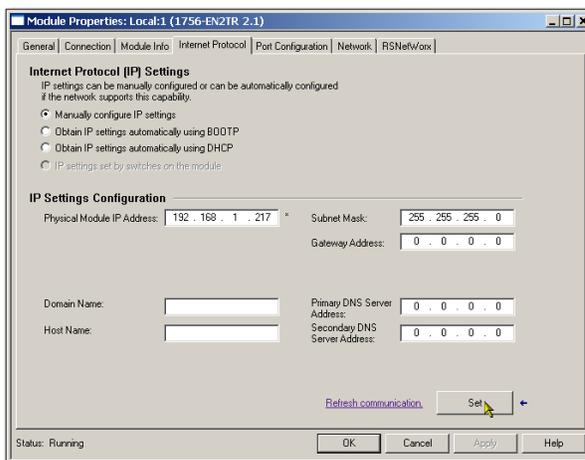
To use the Logix Designer application to set the IP address of the device, follow these steps.

1. In Logix Designer, Go Online.
2. In the Controller Organizer, right-click the device and choose Properties.



The Module Properties dialog box appears.

3. Click the Internet Protocol tab.



4. Select Manually configure IP Settings radio button, then type the IP address in the IP address field.
5. In the other fields, type the other network parameters, if needed.

---

**IMPORTANT** The fields that appear vary from one device to another.

---

6. Click Set.
7. Click OK.

## Set the IP Address with RSLinx Classic Software

You can use RSLinx Classic software to configure the device, including to change the IP address after it has been set.

If you want to use RSLinx Classic software to set the IP address for the first time (after it powers up in the out-of-box state), follow these steps.

1. Set the IP address switches on the device to anything other than 000...255)

Do not use 888: that address is reserved for a factory reset in some devices.

Check with your device to verify that other addresses are not reserved by your device for other features.

2. Connect to the device via the USB port.

If the device does not have a USB port, you cannot use RSLinx Classic software to set the IP address for the first time the device powers up in the out-of-box state.



**WARNING:** Do not use the USB port in hazardous locations.



**ATTENTION:** The USB port is intended for temporary local programming purposes only and not intended for permanent connection. The USB cable is not to exceed 3.0 m (9.84 ft) and must not contain hubs.

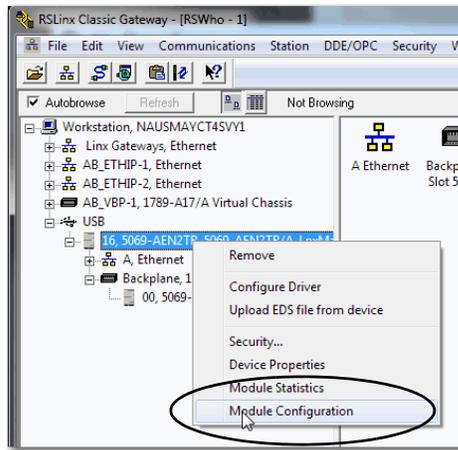
3. Start the RSLinx Classic software.

After several seconds, an RSWho dialog box appears.

4. If the RSWho dialog box does not appear, from the Communications pull-down menu, choose RSWho.

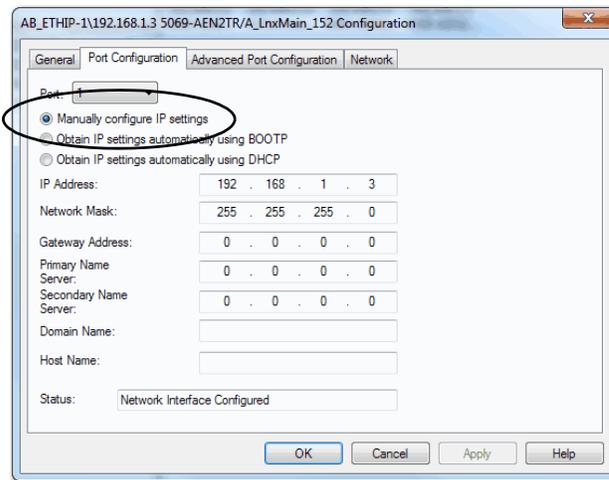


- Right-click the device and choose Module Configuration.



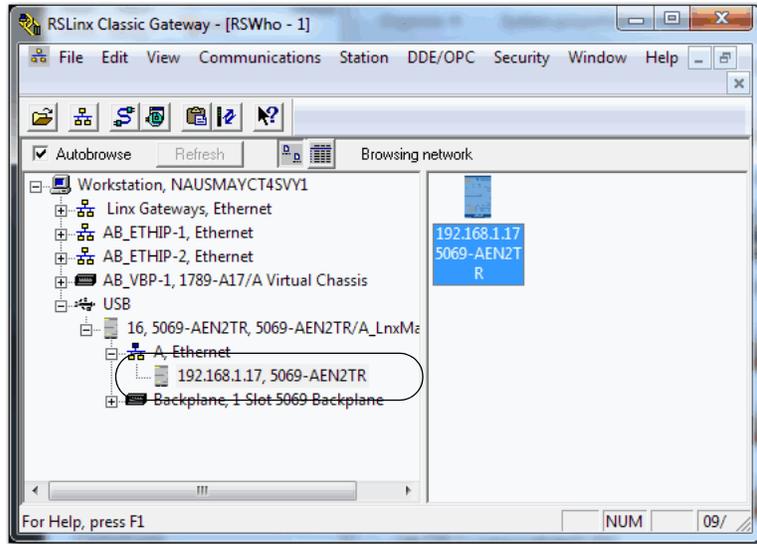
The Module Configuration dialog box appears.

- Click the Port Configuration tab.
- Click Manually configure IP settings and set the port configuration parameters.



- Click OK.
- Open the USB branch on the menu tree.

The device shows the IP address.



## Configure Port Settings with RSLinx Classic Software

You can use RSLinx Classic software to configure a subset of the parameters available on the device.

Complete the following steps.

1. Right-click the device and then click Module Configuration.
2. Click the Advanced Port Configuration tab.

---

### **IMPORTANT** Consider the following when you configure the port settings:

- When the device uses the 1 Gbps network communication rate, it supports only full-duplex mode.
- When the device uses the 10 Mbps or 100 Mbps network communication rate, it supports full-duplex and half-duplex mode.
- The speed and duplex settings for the devices on the same Ethernet network must be the same to avoid transmission errors.
- Fixed speed and full-duplex settings offer better reliability than autonegotiate settings and are recommended for some applications.
- If the device is connected to an unmanaged switch, leave Auto-negotiate checked or the device fails.
- If you force the port speed and duplex with a managed switch, the corresponding port of the managed switch must be forced to the same settings or the device fails.
- If you connect a manually configured device to an autonegotiate device (duplex mismatch), a high rate of transmission errors can occur.
- To disable a port, clear the Enable checkbox.

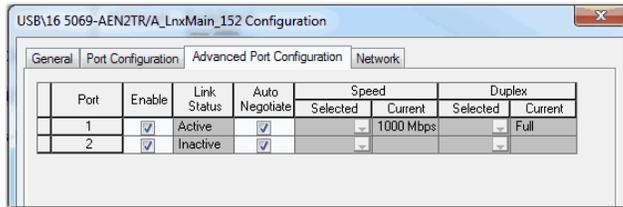
On some DLR devices you cannot disable both ports simultaneously in RSLinx Classic software. We recommend that before you disable a port, you confirm that the port is not in use.

- If you disable a port in RSLinx Classic software and the port is being used for network communication, the communication is interrupted.

In this case, if the other Ethernet port is enabled, we recommend that you moved the Ethernet cable from the disabled port and connect it to the enabled port.

After you re-enable the port that was unintentionally disabled, you can change the cable connection back to the first port

---



Task	Action
Let the device automatically set the port speed and duplex settings.	Leave the Auto-negotiate enabled.
Manually configure the port speed and duplex settings.	Follow these steps. 1. Clear the Auto-negotiate port speed and duplex checkbox. 2. From the Current Port Speed pull-down menu, choose a port speed. 3. From the Current Duplex pull-down menu, choose full-duplex.

3. On the Module Configuration dialog box, click OK.

## Set the IP Address with the BOOTP/DHCP Tool

The BOOTP/DHCP tool is a standalone server that you can use to set an IP address. The BOOTP/DHCP tool sets an IP address and other TCP parameters.

The EtherNet/IP Address Commissioning Tool provides additional functionality than the BootP/DHCP tool. See page 33.

You can use the BOOTP/DHCP tool to set the IP address when the device powers up in the out-of-box state. The out-of-box state would assume the rotary switches, if present on the device, are not set to a valid IP address, and the device is DHCP enabled.

Access the BOOTP/DHCP tool from one of these locations:

- Programs > Rockwell Software® > BOOTP-DHCP Tool > BOOTP-DHCP Tool
- Tools directory on the Studio 5000® environment installation CD

---

**IMPORTANT** Before you start the BOOTP/DHCP tool, remember the following:

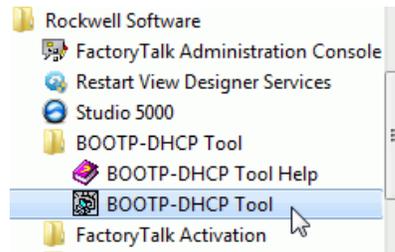
- Make sure that you have the hardware (MAC) address of the device. The hardware address is on a sticker on the side of the device and has a format similar to the following:  
00-00-BC-14-55-35
- Make sure that the workstation that you use to set the IP address has only one connection to the EtherNet/IP™ network on which the device resides.

The BOOTP/DHCP tool can fail to work if your workstation has multiple connections to the EtherNet/IP network.

---

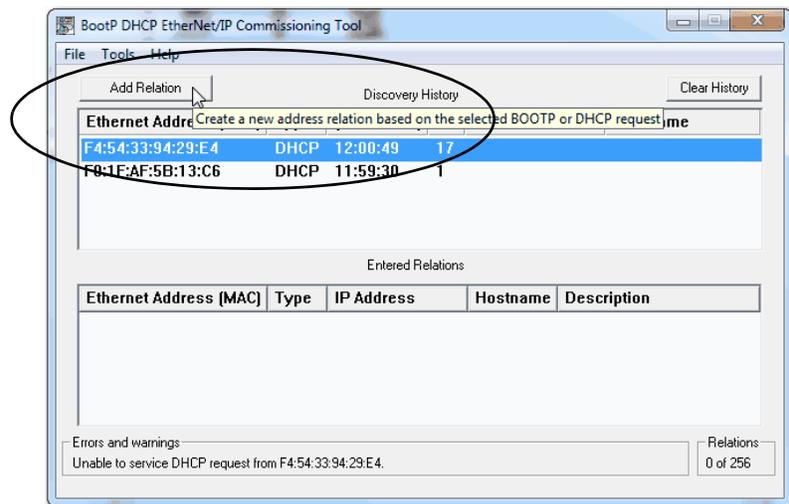
To set the IP address with BOOTP/DHCP tool, complete the following steps.

1. Confirm that the device is connected to the network.
2. Start the BOOTP-DHCP tool.



The MAC ID of the device appears in the Request History window.

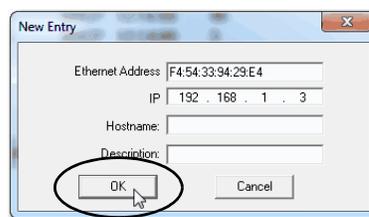
3. Select the appropriate device and click Add to Relation List.



The New Entry dialog box appears.

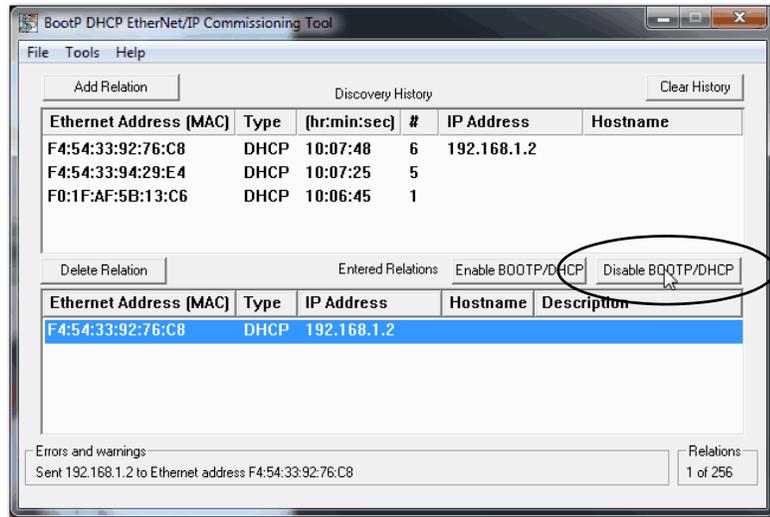
4. Type an IP address, Hostname, and Description for the device.

Hostname and Description are optional.



5. Click OK.
6. To assign this configuration on the device, wait for the device to appear in the Relation List panel and select it.

## 7. Click Disable BOOTP/DHCP.



The device now uses the assigned configuration and does not issue BOOTP or DHCP requests after power is cycled on the controller.

**IMPORTANT** Remember the following:

- If you do not click Disable BOOTP/DHCP, on future power cycles, the current IP configuration is cleared and the controller sends DHCP requests again.
- If you click Disable BOOTP/DHCP and it does not disable BOOTP/DHCP, you can use RSLinx® Classic software to disable BOOTP/DHCP. For more information on how to use RSLinx Classic software to disable BOOTP/DHCP, see page [46](#).

**Disable BOOTP/DHCP with RSLinx Classic Software**

To disable BOOTP/DHCP in RSLinx Classic software, complete the following steps.

1. Start RSLinx Classic software.

After several seconds, an RSWho dialog box appears.

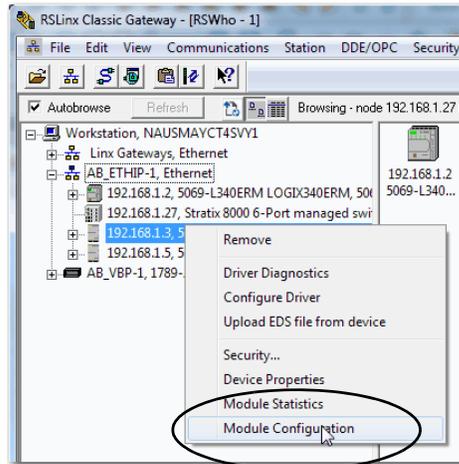
2. If no RSWho dialog box appears, from the Communications pull-down menu, choose RSWho.



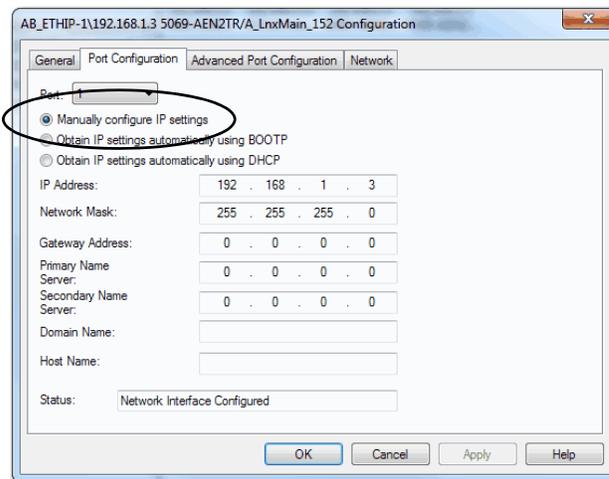
3. Navigate to the device.

You can access the device via the USB or an EtherNet/IP driver.

4. Right-click on the device and choose Module Configuration.



5. Click the Port Configuration tab.
6. Click Manually configure IP settings.



7. Click OK.

## DHCP Considerations

If the device is DHCP-enabled in the out-of-box condition, you can use a DHCP server to set the IP address.

The DHCP server automatically assigns IP addresses to client stations logging on to a TCP/IP network. DHCP is based on BOOTP and maintains some backward compatibility.



**ATTENTION:** You can use a DHCP server that is always configured to assign the same IP address to specific devices when they appear on the EtherNet/IP network and request an IP address.

If your system does not use a DHCP server that assigns the same IP address for specific devices, we **strongly recommend** that you assign the device a fixed IP address. Do not set the IP address dynamically. That is, do not use the Obtain IP settings automatically by using DHCP.

When a device uses Obtain IP settings automatically by using DHCP, the IP address for that device is cleared with each power cycle. If the same IP address is not automatically assigned to the device when it requests a new IP address, the device can be assigned another IP address than what was used before cycling power.

The use of a new IP address can result in such issues as a Duplicate IP address condition or configuration faults because the IP address differs from what is stored in a controller project.

Failure to observe this precaution can result in unintended machine motion or loss of process control.

## Set the IP Address with Hardware Switches

The devices ship set to 999. To change the IP address, do the following.

1. To change the number, use the rotary or thumbwheel switches on your device.
2. Use a Dynamic Host Configuration Protocol (DHCP) server, such as BootP/DHCP.
3. Retrieve the IP address from nonvolatile memory.

The device reads the rotary or thumbwheel switches first to determine if the switches are set to a valid number. Valid settings range from 001...254.

When you assign an address and set it to 001, the gateway address is set to 0.0.0.0 and the subnet mask is 255.255.255.0. When you assign an address between 002...254, the gateway address is set to 192.168.1.1 and the subnet mask is set to 255.255.255.0.

If DHCP is not enabled, the device uses the IP address, along with other TCP configurable parameters, which are stored in nonvolatile memory.

## Reset the IP Address to Factory Default Value

You can reset the IP address of the device to its factory default value with the following methods:

- If the device has rotary switches, set the switches to 888 and cycle power.
- Some devices without rotary switches support use of a MSG instruction to the reset the IP address.

## Configure the Device

After installing a device and setting the IP address, add the device to the Controller Organizer in a programming software project. This addition establishes I/O control.

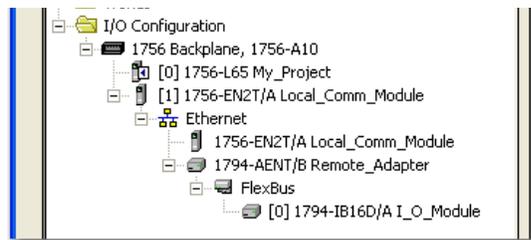
You must download that project to the host controller before operation can begin. When the controller begins operation, it establishes a connection with the device. The configuration of the device determines its behavior.

### Add the Device to the Controller Organizer

To build the I/O configuration for a typical I/O network, follow these steps.

1. Add the device.
2. Add the remote device for distributed I/O.
3. Add the I/O modules.

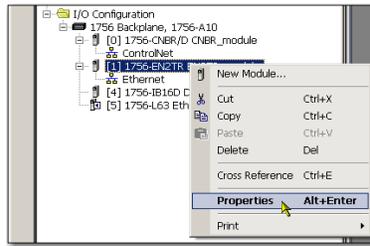
This graphic shows the I/O configuration of the consumer controller after distributed I/O modules are added.



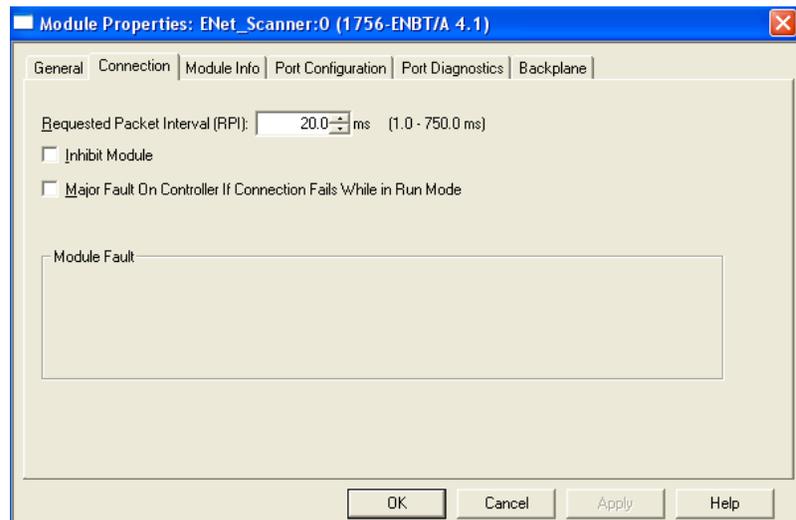
## Configure EtherNet/IP Communication

To configure the device, follow these steps.

1. Make sure that the device is installed, started, and connected to the controller.
2. In the Controller Organizer, right-click the device and choose Properties.



The Module Properties dialog box appears.



3. Make configuration selections on the individual tabs.
4. Click OK.

## Produced and Consumed Data

Logix controllers can produce (broadcast) and consume (receive) system-shared tags that are sent and received via the device. Produced and consumed tags each require connections.

Tag Type	Required Connections
Produced	The local controller (producing) must have one connection for the produced tag and the first consumer and one more connection for each additional consumer (heartbeat). The produced tag requires two connections. As you increase the number of controllers that can consume a produced tag, you also reduce the number of connections the controller has available for other operations. Example operations include communication and I/O.
Consumed	Each consumed tag requires one connection for the controller that is consuming the tag. <b>IMPORTANT:</b> When you configure a consumed tag, you must add a remote device to the programming software project for the producing controller to configure the consuming controller. The default Comm Format when adding a remote device to the project is rack-optimized. Change the Comm Format to None when adding the remote device.

All EtherNet/IP™ devices support as many as 32 produced multicast connections.

Each tag that passes through an EtherNet/IP device uses one connection. Due to this feature, the number of available connections limits the total number of tags that can be produced or consumed. If the device uses all of its connections for I/O and other devices, no connections remain for produced and consumed tags.

---

**IMPORTANT** Depending on whether it is producing or consuming a tag, a Logix 5000™ controller uses its connections differently.

---

For more information, see Logix 5000 Controllers Produced and Consumed Tags Programming Manual, publication [1756-PM011](#).

## Message Instructions

Messages transfer data to other devices, such as other controllers or operator interfaces. Each message uses one connection, regardless of how many devices are in the message path. To conserve connections, you can configure one message to read from or write to multiple devices.

For more information on programming MSG instruction, see the Logix 5000™ Controller General Instructions Reference Manual, publication [1756-RM003](#).

**Notes:**

## Send Email

This chapter describes how to send an email through an EtherNet/IP™ communication module.

For email, the EtherNet/IP communication module can be remote or local to the controller.

### EtherNet/IP Communication Module as an Email Client

The EtherNet/IP communication module is an email client that uses a mail relay server to send email.

---

**IMPORTANT** The EtherNet/IP communication module can send an email to only one recipient at a time. The module cannot mail to a distribution list.

---

**Table 7 - Ethernet Email**

Desired Action	Required Tasks
Send an email to specific personnel when a controller application generates an alarm or reaches a certain condition	Program the controller to send an MSG instruction to the EtherNet/IP communication module The MSG instruction then instructs the EtherNet/IP communication module to send the email text (contained within the MSG instruction) to the mail relay server.
Send controller or application status information regularly to a project manager	Multiple controllers can use the same EtherNet/IP communication module to initiate email.

The EtherNet/IP communication module sends only the content of an MSG instruction as an email to a mail relay server. Delivery of the email depends on the mail relay server. The EtherNet/IP communication module does not receive email.

Figure 2 - Sample System

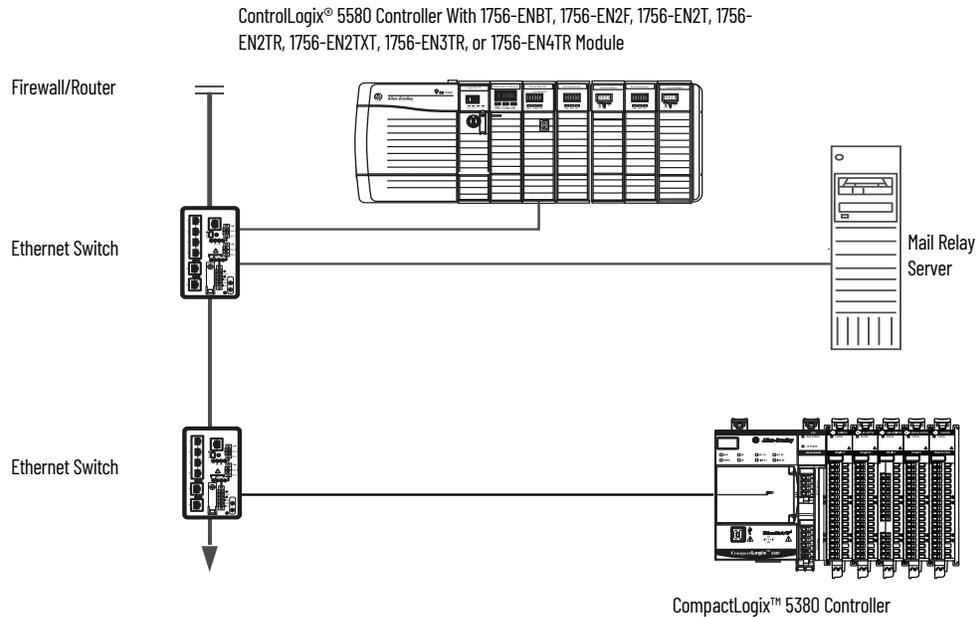


Table 8 - Sample System Capabilities

Device	Capability
ControlLogix controller	Send an MSG instruction to the 1756-ENBT module to initiate sending an email to the mail relay server.
CompactLogix controller	Use the path of the MSG instruction to identify the 1756-ENBT module as the target of the MSG instruction.
ControlLogix 5580 Controller	Send an email to the mail relay server from the email interface on the Send an Email link. This interface requires that you enter all email information.
Mail relay server	Send email to specified recipients. The mail relay server determines the delivery of any email that is sent through an EtherNet/IP communication module, whether via an MSG instruction or from its built-in interface.

## Send Email Via a Controller-initiated Message Instruction

A Logix controller can send a generic CIP™ message instruction to the EtherNet/IP communication module that instructs the module to send an email message to an SMTP mail relay server that uses the standard SMTP protocol. This process automatically communicates controller data and application conditions to appropriate personnel.

**IMPORTANT** Be careful to write the ladder logic to be sure the MSG instructions are not continuously triggered to send email messages.

Some mail relay servers require a domain name be provided during the initial handshake of the SMTP session. For these mail relay servers, specify a domain name when configuring the network settings of the EtherNet/IP communication module.

## Create String Tags

You need three controller-scoped string tags. Each tag performs one of these functions:

- Identifies the mail server
- Contains the email text
- Contains the status of the email transmission

The default STRING data type supports up to 82 characters. In most cases, this limit is sufficient to contain the address of the mail server. For example, to create tag EmailConfigstring of type STRING, follow these steps.

1. Create a String Type “EmailString” and enter 478 as the maximum number of characters.

**IMPORTANT** An email message must not exceed 474 characters in length. An additional 4-byte string-length value is added to the tag. As a result, the maximum source length is 478 characters.

String: EmailString

Name: EmailString

Description:

Maximum Characters: 478  
Enter a value between 1 and 65535.

Members:

Name	Data Type	Description
LEN	DINT	
DATA	SINT[478]	

2. Open the tag editor and create the following tags.

Tag Name	Value	Data Type
EmailConfigString	Enter the IP Address or Host Name of Server	STRING
EmailDstStr	1	EmailString
EWEB_EMAIL	Enter Email Addresses, see step ..	EmailString

Controller Tags - Email\_test(controller)

Scope: @Email\_test Show: All Tags Enter Name Filter...

Name	Alias For	Base Tag	Data Type	Description	External Access	Constant	Style
▶ EmailConfigString			STRING		Read/Write	<input type="checkbox"/>	
▶ EWEB_MAIL			EmailString		Read/Write	<input type="checkbox"/>	
▶ EmailDstStr			EmailString		Read/Write	<input type="checkbox"/>	
✎						<input type="checkbox"/>	

3. Enter email addresses in the Value column of the Controller Tags dialog box

Name	Value	Force Mask	Style	Data Type
▶ EmailConfigString	'192.168.1.10'		{...}	STRING
▶ EmailDstStr	'1'		{...}	EmailString
▶ EWEB_EMAIL	'To: person@xyz...'		{...}	EmailString

4. Type your email.

Use the string browser to type the text of the email. To include To:, From:, and Subject: fields in the email, use <CR><LF> symbols to separate each of these fields. The To: and From fields are required; the Subject: field is optional. For example:

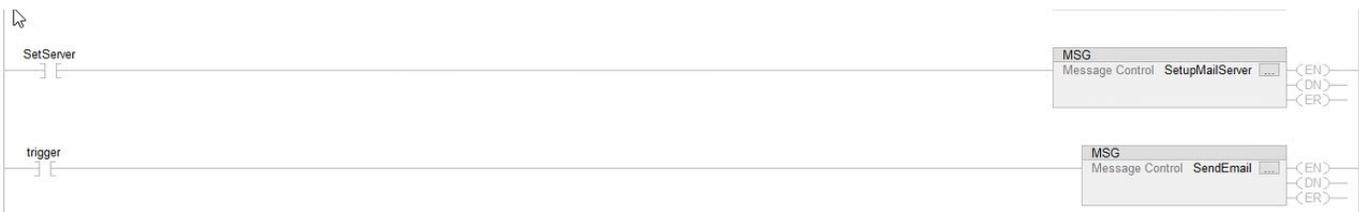
To: Email address of recipient <CR><LF>  
 From: Email address of sender <CR><LF>  
 Subject: subject of message <CR><LF>  
 body of email message

The text of the email does not have to be static. You can program a controller project to collect specific data to be sent in an email.

For more information on how to use ladder logic to manipulate string data, see the Logix 5000™ Controllers Common Procedures Programming Manual, publication [1756-PM001](#).

### Enter the Ladder Logic

Ladder logic requires two MSG instructions. One MSG instruction configures the mail server and must be executed only once. The second MSG instruction triggers the email. Execute this email MSG instruction as often as needed.



The first rung configures the mail server. The second rung sends the email text.

## Configure the MSG Instruction That Identifies the Mail Relay Server

To configure the MSG instruction that identifies the mail relay server, follow these steps.

1. On the communications tab, enter the communication path from the controller to the email server.

Message Configuration - SetupMailServer

Configuration Communication\* Tag

Path: 1,1

Broadcast: 1,1

Communication Method

CIP DH+ Channel: A Destination Link: 0

CIP With Source ID Source Link: 0 Destination Node: 0 (Octal)

Connected Cache Connections Large Connection

Enable Enable Waiting Start Done Done Length: 0

Error Code: Extended Error Code: Timed Out

Error Path:

Error Text:

OK Cancel Apply Help

2. On the configuration tab, enter the MSG parameters for the email server.

The Source Length is the number of characters in the STRING tag that identifies the mail relay server plus 4 characters. In this example, the tag contains 13 characters.

Message Configuration - SetupMailServer

Configuration Communication Tag

Message Type: CIP Generic

Service Type: Set Attribute Single Source: EmailConfigString

Source Length: 17 (Bytes)

Service Code: 10 (Hex) Class: 32f (Hex) Destination Element:

Instance: 1 Attribute: 5 (Hex)

Done Length: 0

Error Code: Extended Error Code: Timed Out

Error Path: 1,1

Error Text:

OK Cancel Apply Help

After the MSG instruction that configures the mail relay server executes successfully, the controller stores the mail relay server information in nonvolatile memory. The controller retains this information, even through power cycles, until another MSG instruction changes the information.

## Configure the MSG Instruction That Contains the Email Text

To configure the MSG instruction that contains the email text, perform this procedure.

1. On the configuration tab, enter the MSG parameters for the email.

The Source Length is the number of characters in the STRING tag that contain the email plus 4 characters.  
In this example, the email contains 474 characters.

Message Configuration - SendEmail

Configuration Communication Tag

Message Type: CIP Generic

Service Type: Custom Source: EWEB\_MAIL

Source Length: 478 (Bytes)

Service Code: 4b (Hex) Class: 32f (Hex) Destination Element: EmailDstStr

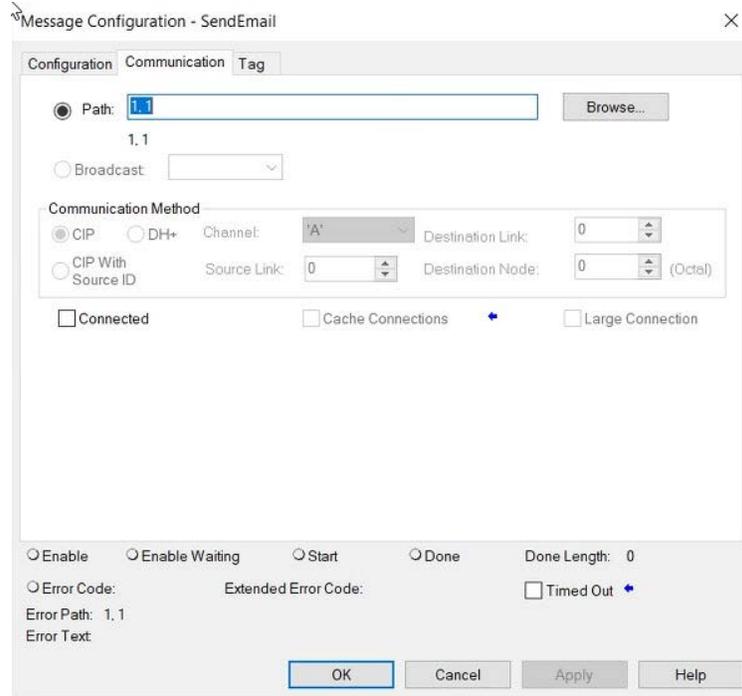
Instance: 1 Attribute: 0 (Hex)

Done Length: 0

Timed Out

OK Cancel Apply Help

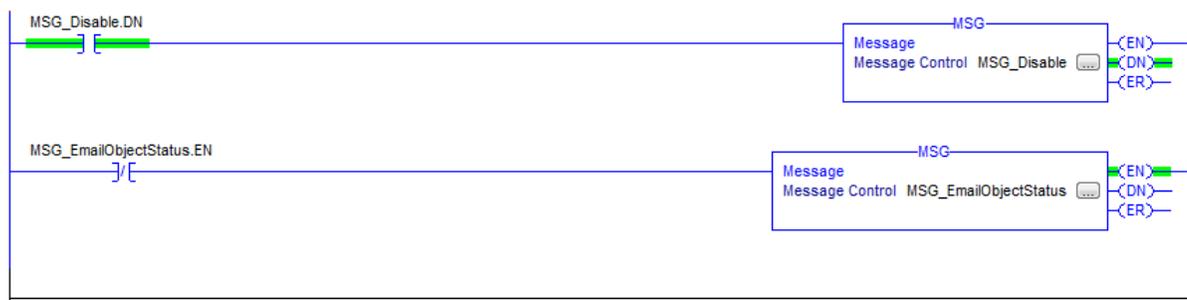
- On the Communication tab, configure the path to the EtherNet/IP device.



For more information on how to configure the path of an MSG instruction, see the Logix 5000 Controllers General Instructions Reference Manual, publication [1756-RM003](#).

## Configure the Email Object

Ladder logic requires two MSG instructions. One MSG instruction disables the mail server and must be executed only once. The second MSG instruction enables the email. Execute this email MSG instruction as often as needed.



### Disable the Email Object

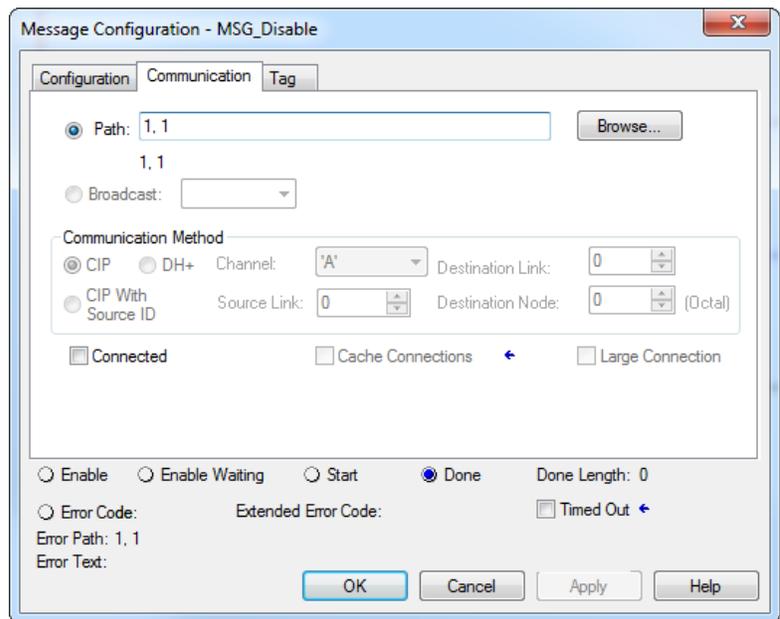
**IMPORTANT** If you disable the Email Object, it is permanently disabled and a factory reset is required to enable it again.

You can disable the Email Object by setting the class attribute ox08 to 0. After that operation, all object-specific services and all instance attributes are unavailable for writing and reading. Furthermore, the Object Enable attribute is read-only. The Email Object is permanently disabled and a factory reset is required to enable it again.

To disable the Email Object, perform this procedure.

**IMPORTANT** 1756 EtherNet/IP communication modules with firmware 10.010 or higher support this feature.

1. Create a tag DisableEmailObject of type SINT.
2. Create a MSG instruction that uses tag MSG\_Disable.
3. On the Communication tab, enter the path.



- On the Configuration tab, enter these parameters.

Message Configuration - MSG\_Disable

Configuration Communication Tag

Message Type: CIP Generic

Service Type: Set Attribute Single Source Element: DisableEmailObject

Source Length: 1 (Bytes)

Service Code: 10 (Hex) Class: 32f (Hex) Destination Element:

Instance: 0 Attribute: 8 (Hex)

Done Length: 0

Timed Out

OK Cancel Apply Help

When this MSG instruction executes, the value is returned in the second message. Since there is no destination element, you do not get a response. However, you receive the DN bit set.

### Get Email Object Status

To determine if the email object is disabled, perform this procedure.

- Create a tag EmailObjectStatus of type SINT.
- Create a MSG instruction that uses tag MSG\_EmailObjectStatus.
- On the Communication tab, enter the path.

Message Configuration - MSG\_EmailObjectStatus

Configuration Communication Tag

Path: 1.1

Broadcast:

Communication Method

CIP DH+ Channel: 'A' Destination Link: 0

CIP With Source ID Source Link: 0 Destination Node: 0 (Octal)

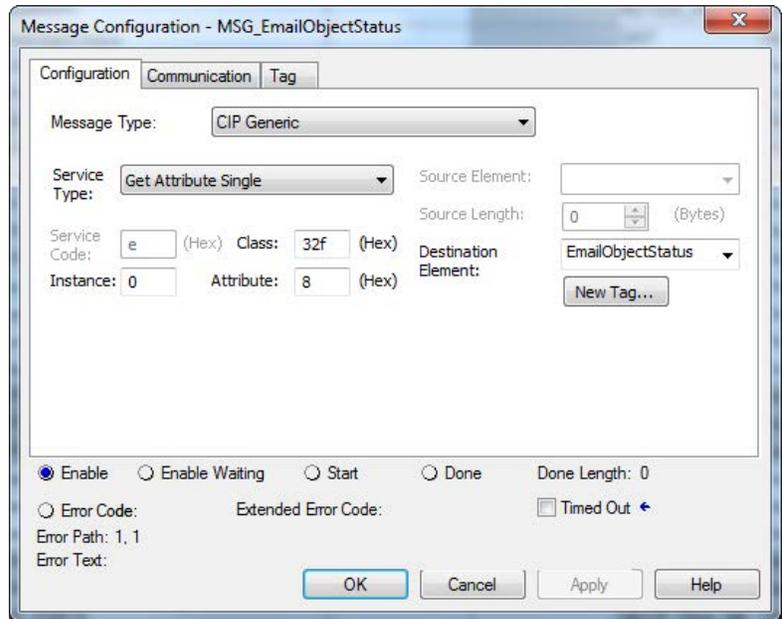
Connected Cache Connections Large Connection

Done Length: 0

Timed Out

OK Cancel Apply Help

4. On the Configuration tab, enter the following parameters.



When the MSG instruction executes:

- If the MSG\_EmailObjectStatus.DN bit is set and the value of the EnableObjectStatus is 0, then the Email Object is disabled.
- If the value of the EnableObjectStatus is 1, then the Email Object is enabled.

## Possible Email Status Codes

Examine the destination element of the email MSG to see whether the email was successfully delivered to the mail relay server. A successful delivery indicates that the mail relay server placed the email message in a queue for delivery. This notification does not mean that the intended recipient received the email message. [Table 9](#) lists the possible codes that a destination element could contain.

**Table 9 - Email Status Code Descriptions**

Error Code (Hex)	Extended-error Code (Hex)	Description
0x00	None	Delivery successful to the mail relay server.
0x02	None	Resource unavailable. The email object was unable to obtain memory resources to initiate the SMTP session.
0x08	None	Unsupported Service Request. Make sure that the Service Code is 0x4B and the Class is 0x3F.
0x11	None	Reply data too large. The Destination string must reserve space for the SMTP server reply message. The maximum reply can be 470 bytes.
0x13	None	Configuration data size too short. The Source Length is less than the Source Element string size plus the 4-byte length. The Source Length must equal the Source Element string size + 4.
0x15	None	Configuration data size too large. The Source Length is greater than the Source Element string size plus the 4-byte length. The Source Length must equal the Source Element string size + 4.
0x19	None	Data write failure. An error has occurred when attempting to write the SMTP server address (attribute 4) to nonvolatile memory.
0xFF	0x0100	Error that an email server returns; check the Destination string for reason. The email message was not queued for delivery.
	0x0101	SMTP mail server not configured. Attribute 5 was not set with an SMTP server address.
	0x0102	'To:' address not specified. Attribute 1 was not set with a 'To:' address AND there is not a 'To:' field header in the email body.
	0x0103	'From:' address not specified. Attribute 2 was not set with a 'From:' address AND there is not a 'From:' field header in the email body.
0xFF	0x0104	Unable to connect to SMTP mail server set in Attribute 5. If the mail server address is a host name, make sure that the device supports DNS, and that a Name Server is configured. If the host name is not fully qualified, for example, 'mail host' and not 'mailhost.xx.yy.com' then the domain must be configured as 'xx.yy.com'. Try 'ping <mail server address>' to make sure that the mail server is reachable from your network. Also try 'telnet <mail server address> 25', which attempts to initiate an SMTP session with the mail server via telnet over port 25. (If you connect then type 'QUIT').
	0x0105	Communication error with SMTP mail server. An error occurred after the initial connection with the SMTP mail server. See the ASCII text following the error code for more details as to the type of error.
	0x0106	SMTP mail server host name DNS query did not complete. A previous send service request with a host name as the SMTP mail server address did not yet complete. A timeout for a DNS lookup with an invalid host name can take up to 3 minutes. Long timeouts can also occur if a domain name or name server is not configured correctly.

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# Rockwell Automation Support

Use these resources to access support information.

<b>Technical Support Center</b>	Find help with how-to videos, FAQs, chat, user forums, and product notification updates.	<a href="http://rok.auto/support">rok.auto/support</a>
<b>Knowledgebase</b>	Access Knowledgebase articles.	<a href="http://rok.auto/knowledgebase">rok.auto/knowledgebase</a>
<b>Local Technical Support Phone Numbers</b>	Locate the telephone number for your country.	<a href="http://rok.auto/phonesupport">rok.auto/phonesupport</a>
<b>Literature Library</b>	Find installation instructions, manuals, brochures, and technical data publications.	<a href="http://rok.auto/literature">rok.auto/literature</a>
<b>Product Compatibility and Download Center (PCDC)</b>	Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes.	<a href="http://rok.auto/pcdc">rok.auto/pcdc</a>

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## Waste Electrical and Electronic Equipment (WEEE)



At the end of life, this equipment should be collected separately from any unsorted municipal waste.

Rockwell Automation maintains current product environmental information on its website at [rok.auto/pec](http://rok.auto/pec).

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