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CAMBIA AUTOMATION LIMITED



Allen Bradley 1794-IB16

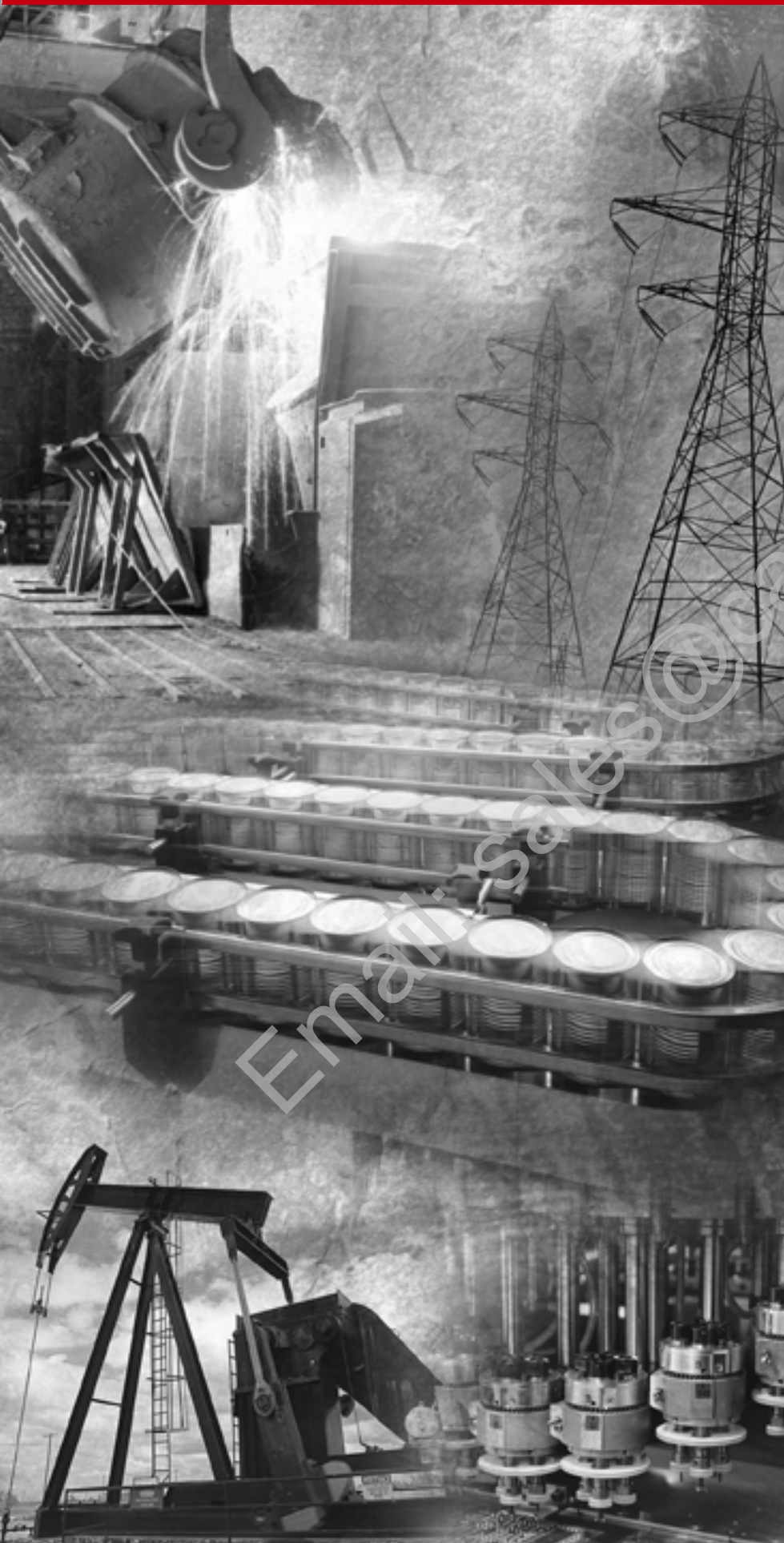
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Cambia Group

2018/10/18

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*Allen-Bradley*

## **FLEX I/O EtherNet/IP Adapter Module**

**1794-AENT**

**User Manual**

**Rockwell  
Automation**

## **Important User Information**

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI-1.1, Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

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Throughout this manual we use these notes to make you aware of safety considerations:

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**WARNING**

Identifies information about practices or circumstances that have the potential to create an explosion hazard.

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**ATTENTION**

Identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss.

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Warning and Attention statements help you to:

- identify a hazard
  - avoid a hazard
  - recognize the consequences
- 

**IMPORTANT**

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

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This product is tested to meet the Council Directive 89/336/EC Electromagnetic Compatibility (EMC) by applying the following standards:

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This product is intended for use in an industrial environment.

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## About This User Manual

### What this Preface Contains

This preface describes how to use this manual. The following table lists where to find specific information within this chapter.

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Common Techniques Used in This Manual	P-1
How To Use This Manual	P-2
About the Example Applications	P-2
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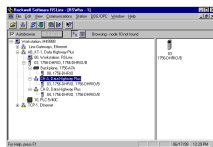
### Who Should Use This Manual

This manual is intended for control engineers and technicians who are installing, configuring, and maintaining an EtherNet/IP control system that communicates with FLEX I/O through a 1794-AENT adapter. We assume you have a good understanding of Ethernet and the TCP/IP protocol.

### Common Techniques Used in This Manual

The following conventions are used throughout this manual:

- Numbered lists provide sequential steps.
- Bulleted lists provide information, not procedural steps.
- Information in **bold** text identifies menu windows, screen options, screen names, or areas of the screen, such as dialog boxes, status bars, radio buttons, and parameters.



The screen captures shown in this manual are pictures of the software's actual screens.

**TIP**

This symbol identifies helpful tips.





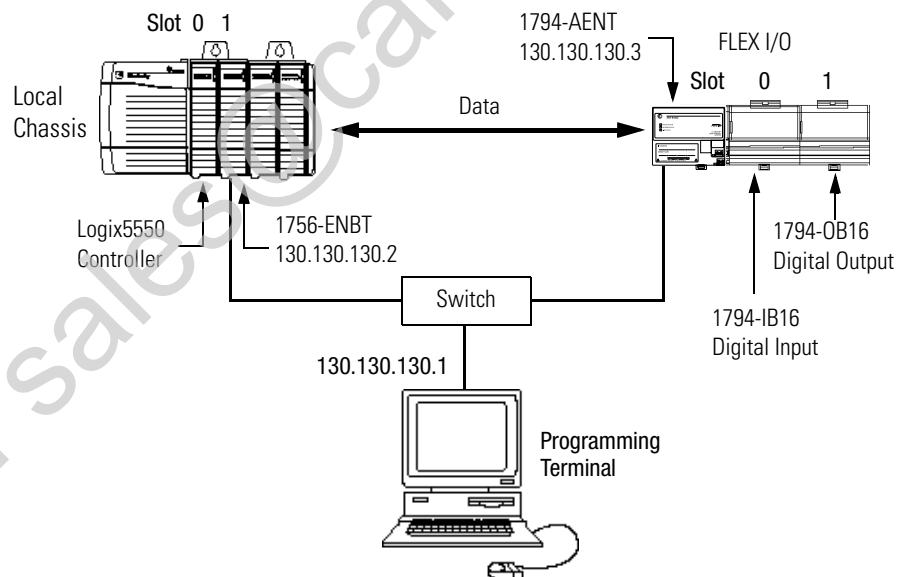
## How To Use This Manual

This manual contains an overview of the 1794-AENT adapter. It describes how to install and configure the adapter, and provides examples showing how to use the adapter to communicate with FLEX I/O over an EtherNet/IP network.

## About the Example Applications

This manual presents two example applications that demonstrate the procedures for configuring and communicating with FLEX I/O using the 1794-AENT adapter: The example applications are intended as building blocks to help you get your own system up and running. We recommend that you set up and run the example applications and use them as guides.

Here is the type of system you'll be setting up:



## System Components

We used the following components for the example applications. You will need the same or similar components to set up your own control system using FLEX I/O on EtherNet/IP.

Quantity	Product Name	Catalog Number
	<b>Hardware</b>	
1	FLEX I/O EtherNet/IP Adapter	1794-AENT
1	FLEX I/O Digital Input Module	1794-IB16
1	FLEX I/O Digital Output Module	1794-OB16
1	FLEX I/O Analog Input Module	1794-IF41
1	FLEX I/O Analog Output Module	1794-OF41
1	FLEX I/O Power Supply	1794-PS1
1	DIN Rail	199-DR1 or equivalent
1	ControlLogix chassis	1756-A4, (or -A7, -A13, -A13, -A17)
1	ControlLogix power supply	1756-PA72, (or -PB72)
1	Logix5550 controller	1756-L1
1	ControlLogix EtherNet/IP Bridge Module	1756-ENBT
1	Personal computer that supports RSLogix 5000 software	Any appropriate model running Windows NT 4.0, Service Pack 5 or higher
1	Ethernet switch	Refer to manufacturer's specifications
	Associated media and connectors as needed	
	<b>Software</b>	
1	RSLinx communications software, V2.3 or higher	9355-WAB, -WABOEM, -WABC
1	RSLogix 5000 programming software, V8.1 or higher	9324-RLD300ENE

## Where to Find More Information

Refer to the following Rockwell publications as needed for additional help when setting up and using your EtherNet/IP network.

For information about	See this publication	Publication number
Using EtherNet/IP for industrial control	EtherNet/IP Performance and Application Guide	ENET-AP001
EtherNet/IP media	EtherNet/IP Media Planning and Installation Guide	ENET-IN001
1794-AENT Adapter	FLEX I/O EtherNet/IP Adapter Installation Instructions	1794-IN082
FLEX I/O input and output modules	FLEX I/O and FLEX Integra Technical Data Manual	1794-2.1
ControlLogix chassis	ControlLogix Chassis Installation instructions	1756-5.80 (Series B)
ControlLogix power supplies	ControlLogix Power Supplies Installation Instructions	1756-5.67 (PA72/PB72) 1756-5.78 (PA75/PB75)
Logix5550 programmable controllers	Logix5550 Controller User Manual	1756-6.5.12
ControlLogix EtherNet/IP Bridge Module	ControlLogix EtherNet/IP Bridge Module Installation Instructions	1756-IN082
	ControlLogix EtherNet/IP Bridge Module User Manual	1756-UM050
RSLogix 5000 programming software	Getting Results with RSLogix5000	9399-RLD300GR
RSLinx communications software	RSLinx Lite User's Guide	9399-WAB32LUG

**TIP**

Many of the above publications are available online from The Automation Bookstore:

<http://www.theautomationbookstore.com>.

**TIP**

Rockwell Software products contain extensive tutorials and online help. We recommend that you use the tutorials and help screens to learn about these products.

For more information about Rockwell Software products, visit the Rockwell Software internet site:

<http://www.software.rockwell.com>.

## Terminology

<b>This term</b>	<b>Means</b>
bandwidth	The transmission capacity of the network, expressed in bits per second. Traditional Ethernet has a 10Mbit bandwidth. Fast Ethernet is 100Mbit.
BootP	<p>BootP (Bootstrap Protocol) is a low-level protocol that provides configurations to other nodes on a TCP/IP network. BootP configuration files let you automatically assign IP addresses to an Ethernet module (you can also obtain subnet masks and gateway addresses from BootP).</p> <p>The 1794-AENT factory default is BootP enabled. Upon powerup, the module sends a message containing its hardware address to the BootP server on the network. The server is a computer with BootP server software installed. The server compares that hardware address to those in its lookup table in the configuration file and sends a message back to the module with the appropriate IP address.</p>
bridge	A node between two similar communication subnets where protocol translation is minimal.
CIP	Control and Information Protocol, the EtherNet/IP application layer. CIP uses the "producer/consumer" networking model. In this model one producer broadcasts (multicasts) the data once to all the consumers. All consumers see the data simultaneously, and may choose whether to consume (receive) the data or not. Delivery time is consistent, no matter how many consumers there are.
consumer	A destination device in the CIP networking model. See CIP.
CSMA/CD	Carrier Sense Multiple Access/Collision Detection. The access method used in Ethernet. When a device wants to gain access to the network, it checks to see if the network is quiet (senses the carrier). If it is not, it waits a random amount of time before retrying. If the network is quiet and two devices access the line at exactly the same time, their signals collide. When the collision is detected, they both back off and each waits a random amount of time before retrying.
determinism	The ability to predict when information will be delivered. Important in time critical applications.
DHCP	The Dynamic Host Configuration Protocol (DHCP) is an Internet protocol, similar to BootP, for automating the configuration of computers that use TCP/IP. DHCP can be used to automatically assign IP addresses, to deliver IP stack configuration parameters such as the subnet mask and default router, and to provide other configuration information such as the addresses for printer, time and news servers.
DNS	The Domain Name System (DNS) is a hierarchical, distributed method of organizing the name space of the Internet. The DNS administratively groups hosts into a hierarchy of authority that allows addressing and other information to be widely distributed and maintained. A big advantage to the DNS is that using it eliminates dependence on a centrally-maintained file that maps host names to addresses.
Ethernet	A physical layer standard using Carrier Sense Multiple Access with Collision Detection (CSMA/CD) methods.

<b>This term</b>	<b>Means</b>
Ethernet network	A local area network designed for the high-speed exchange of information between computers and related devices.
EtherNet/IP	Ethernet Industrial Protocol. EtherNet/IP applies a common application layer (CIP) over Ethernet by encapsulating messages in TCP/UDP/IP.
explicit messaging	Non-time critical messaging used for device configuration and data collection, such as downloading programs or peer-to-peer messaging between two PLCs.
fast Ethernet	Ethernet operating at 100Mbps/second.
full duplex	A mode of communication that allows a device to send and receive information at the same time, effectively doubling the bandwidth.
fully qualified domain name	A Fully Qualified Domain Name (FQDN) is a domain name that includes all higher level domains relevant to the entity named. If you think of the DNS as a tree-structure with each node having its own label, a Fully Qualified Domain Name for a specific node would be its label followed by the labels of all the other nodes between it and the root of the tree. For example, for a host, a FQDN would include the string that identifies the particular host, plus all domains of which the host is a part up to and including the top-level domain (the root domain is always null). For example, PARIS.NISC.SRI.COM is a Fully Qualified Domain Name for the host at 192.33.33.109.
gateway	A module or set of modules that allows communications between nodes on dissimilar networks.
host name	<p>The Host Name is the unique name for a computer within its domain. It's always the first element of a full name, and, with its domain and top-level domain suffix, creates the unique name of that computer on the Internet. For example, let's say the foobar website is www.foobar.com. The Host Name is "www", which is not unique on the web, but is unique within the foobar domain.</p> <p>The Host Name can also refer to the Fully Qualified Domain Name, or in this example, www.foobar.com. Both naming methods seem to be used interchangeably in various documents. For the purposes of this document, the Host Name will refer to the FQDN, or as in this example, www.foobar.com.</p>
hub	A central connecting device that joins devices together in a star configuration. Hubs are generally not suitable for use in I/O control systems, since they are time critical applications that cannot tolerate lost packets.
implicit messaging	Real time messaging of I/O data.
IP	Internet Protocol that provides the routing mechanism for messages. All messages contain not only the address of the destination station, but the address of a destination network, which allows messages to be sent to multiple networks within an organization or around the world.

<b>This term</b>	<b>Means</b>
IP address	32-bit identification number for each node on an Internet Protocol network. These addresses are represented as four sets of 8-bit numbers (numbers from 0 to 255), with periods between them. Each node on the network must have a unique IP address.
latency	The time between initiating a request for data and the beginning of the actual data transfer.
module address	A six-bit number used to uniquely identify any module on the local and extended ControlLogix backplane.
multicast	In the CIP producer/consumer model one producer multicasts (broadcasts) the data once to all the consumers.
producer	The source of information in the CIP networking model. See CIP.
rack	A physical and logical collection of application modules sharing a common power supply and backplane for module to module communication.
star configuration	A network configuration in which the devices are connected to a central hub or switch.
subnet mask	An extension of the IP address that allows a site to use a single net ID for multiple networks.
switch	A network device that cross connects devices or network segments. A switch provides each sender/receiver the full network bandwidth (2x in full duplex mode), reduces collisions, and increases determinism.
TCP	Transport Control Protocol. More reliable but slower transport protocol than UDP. Used for explicit (not time critical) messaging in EtherNet/IP.
TCP/IP	Transmission Control Protocol/Internet Protocol (TCP/IP). A transport-layer protocol (TCP) and a network-layer protocol (IP) commonly used for communication within networks and across internetworks.
transaction	An exchange of request and data and response and data.
UDP	User Datagram Protocol. Transport protocol that provides a very simple, but fast capability to send datagrams between two devices. Used for I/O (implicit) messaging in EtherNet/IP.

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## About the 1794-AENT Adapter

### What This Chapter Contains

This chapter provides an overview of the 1794-AENT FLEX I/O EtherNet/IP adapter, its primary features, and how to use it. You will need to understand the concepts discussed in this chapter to configure your adapter and use it in an EtherNet/IP control system. The following table lists where to find specific information in this chapter.

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Adapter Features	1-1
Hardware/Software Compatibility	1-2
What the Adapter Does	1-2
Use of the Control and Information Protocol (CIP)	1-2
Understanding the Producer/Consumer Model	1-3
Specifying the Requested Packet Interval (RPI)	1-3
Support of Rack Optimized and Direct Connections	1-4
Mixing Rack Optimized and Direct Connections	1-5

### Adapter Features

The 1794-AENT adapter's features include:

- use of EtherNet/IP messages encapsulated within standard TCP/UDP/IP protocol
- common application layer with ControlNet and DeviceNet
- interfacing via Category 5 rated twisted pair cable
- half/full duplex 10 Mbit or 100 Mbit operation
- DIN rail mounting
- communication to and from other FLEX I/O modules on the same DIN rail
- communication supported by RSLinx software
- IP address assigned via standard BootP tools
- I/O configuration via RSLogix 5000 software
- no network scheduling required
- no routing tables required

## Hardware/Software Compatibility

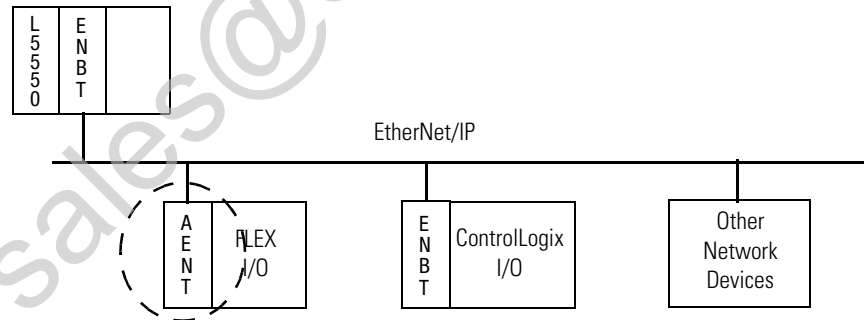
The 1794-AENT adapter and the applications described in this manual are compatible with the following firmware versions and software releases. Contact Rockwell Automation if you need software or firmware upgrades to use this equipment.

Product	Firmware Version/ Software Release
1794-AENT Adapter	1.xx or higher
Logix 5550 Controller	8.1 or higher
RSLogix 5000 software	8.1 or higher
RSLinx software	2.3 or higher

## What the Adapter Does

The 1794-AENT adapter performs two primary tasks:

1. Control of real time I/O data (also known as “implicit messaging”).  
The 1794-AENT adapter serves as a bridge between I/O modules and the network.



2. Support of messaging data for configuration and programming information (also known as “explicit messaging.”).

## Use of the Control and Information Protocol (CIP)

The 1794-AENT adapter uses the Control and Information Protocol (CIP). CIP is the application layer protocol specified for EtherNet/IP, the Ethernet Industrial Protocol, as well as for ControlNet and DeviceNet. It is a message-based protocol that implements a relative path to send a message from the “producing” device in a system to the “consuming” devices.

The producing device contains the path information that steers the message along the proper route to reach its consumers. Since the producing device holds this information, other devices along the path simply *pass* this information; they do not need to *store* it.

This has two significant benefits:

1. You do not need to configure routing tables in the bridging modules, which greatly simplifies maintenance and module replacement.
2. You maintain full control over the route taken by each message, which enables you to select alternative paths for the same end device.

## Understanding the Producer/Consumer Model

The CIP “producer/consumer” networking model replaces the old source/destination (“master/slave”) 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 input modules are not polled by a controller. Instead, they produce (“multicast”) their data either upon a change of state (COS) or periodically. The frequency of update depends upon the options 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 EtherNet/IP network. This data exchange conforms to the producer/consumer model.

## Specifying the Requested Packet Interval (RPI)

The RPI is the update rate specified for a particular piece of data on the network. The RPI can be specified for the adapter and include all of the I/O modules communicating through it (using a rack optimized connection) or specified for a particular module (using direct connection). When you add a module or an adapter to the I/O configuration of a controller, you must enter the RPI as a parameter. “This value specifies how often to produce the data for that device. For example, if you specify an RPI of 50ms, it means that every 50ms the device should send its data to the controller or the controller should send its data to the device.

RPIs are only used for devices that produce data. For example, a ControlLogix EtherNet/IP bridge module in the same chassis as the controller does not require an RPI because it is not a data-producing member of the system; it is used only as a bridge to remote racks.

## Support of Rack Optimized and Direct Connections

The 1794-AENT adapter supports both direct and rack optimized connections. A direct connection is a “real-time” data transfer link between the controller and the device that the configuration data references. Direct connection messaging occurs at a cyclic rate specified by the RPI during configuration. A rack optimized connection is a grouping of data from more than one I/O module into a single block of data sent over a single connection at the same data rate.

Rack optimized connections reduce the total number of connections needed to transfer data when using many I/O modules in a system. The following example illustrates the benefit of rack optimized connections.

Assume you have set up a system that contains 8 discrete I/O modules interfaced to a 1794-AENT adapter. If you use direct connections to transfer data to each of these I/O modules, you need 8 connections to transfer all of the data, one to each of the 8 I/O modules. If you use a rack-optimized connection to transfer the data, you only need a single connection – the connection to the 1794-AENT adapter.

---

### IMPORTANT

Although rack optimized connections offer an efficient way to use resources, there are a few limitations on their use:

- You can only use rack optimized connections to send data to and from discrete I/O modules. Analog I/O requires direct connections.
- Rack optimized connections can contain I/O data and status information only. Additional module information, such as diagnostics, is not available through a rack-optimized connection.
- All data is sent at the same time at the RPI rate of the 1794-AENT adapter.

---

See the *EtherNet/IP Performance and Application Guide*, publication number ENET-AP001, for more information on connections.

## Mixing Rack Optimized and Direct Connections

You can mix communication formats for different I/O modules communicating through the same adapter. I/O modules set up to use rack optimization will communicate at the rate of the RPI (requested packet interval) configured for the 1794-AENT adapter. I/O modules configured for direct communication will communicate at their own set RPIs and ignore the 1794-AENT adapter's RPI.

### What's Next?

The following chapter describes how to physically install the 1794-AENT adapter and connect it to the EtherNet/IP network.

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## Installing the 1794-AENT Adapter

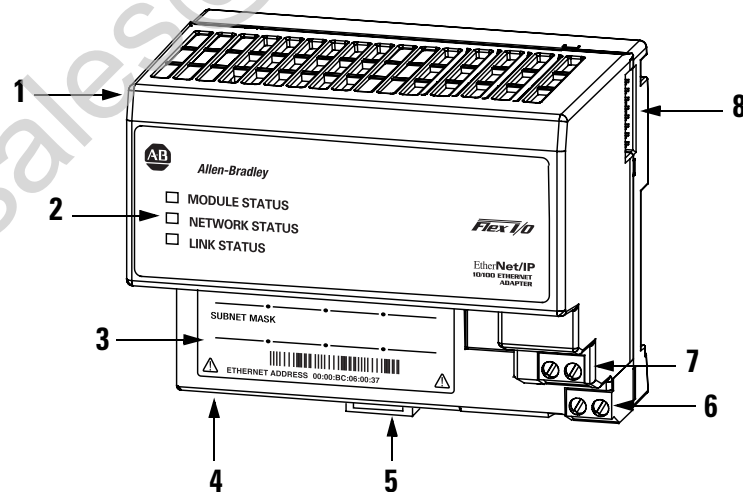
### What This Chapter Contains

This chapter describes how to physically install the 1794-AENT adapter on the DIN rail and connect it to the EtherNet/IP network. The following table lists where to find specific information.

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Identifying Module Components	2-1
Mounting the Adapter on a DIN Rail Before Installing Modules	2-2
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Mounting Dimensions	2-6

### Identifying Module Components

Use the following illustration to identify the external features of the FLEX I/O EtherNet/IP adapter.



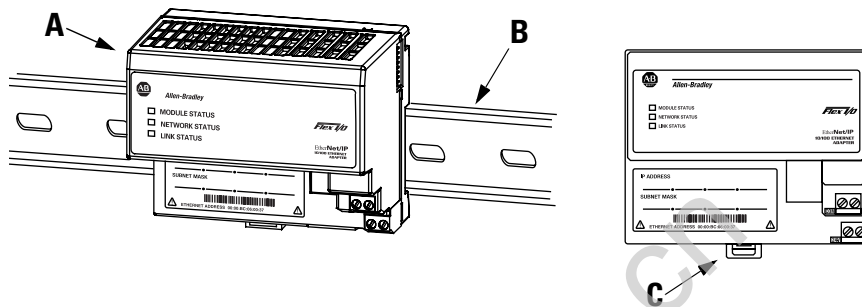
**Component Identification**

1	EtherNet/IP Adapter Module
2	Indicators
3	MAC ID Label
4	Network cable RJ-45 connector (underside)
5	Module locking tab location
6	+24V dc connections
7	24V common connections
8	Flexbus connector



## Mounting the Adapter on a DIN Rail Before Installing Modules

Use the following procedure to mount the adapter on a new system before any I/O modules have been installed.

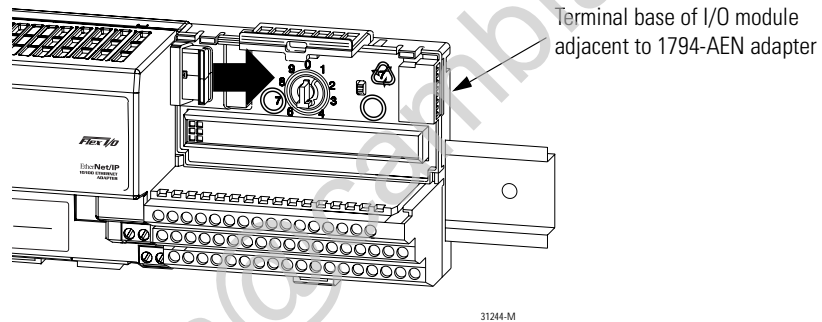


1. Position the EtherNet/IP adapter module (A) on a 35 x 7.5mm DIN rail (B) (A-B pt. no. 199-DR1; 46277-3; EN 50022) with the bottom rotated outward at a slight angle.
2. Hook the lip on the top rear of the adapter (A) onto the top of the DIN rail (B), and rotate the bottom of the adapter module onto the rail.
3. Press the adapter module down onto the DIN rail until flush. Locking tab (C) will snap into position and lock the adapter module to the DIN rail.
4. If the adapter module does not lock in place, use a screwdriver or similar device to pull the locking tab down while pressing the adapter module flush onto the DIN rail. Then release the locking tab to secure the adapter module in place. If necessary, push up on the locking tab.
5. Connect the adapter wiring as shown under "Wiring" later in this document.

## Mounting (or Replacing) the Adapter on an Existing System

Use the following procedure to mount or replace the adapter on an existing system.

1. If present, disconnect the RJ-45 connector from the bottom of the old adapter.
2. Disconnect any wiring jumpered to the adjacent terminal base.
3. Using a screwdriver or similar tool, open the locking tab on the back of the adjacent I/O module and remove the I/O module from its terminal base.
4. Push the flexbus connector toward the right side of the terminal base to unplug the backplane connection.

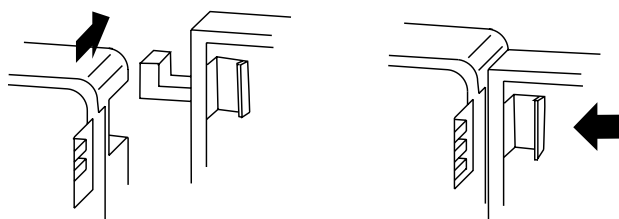


### ATTENTION



Make certain that the flexbus connector is completely clear of the adapter. The slide must be completely to the right and the raised spot on the slide visible.

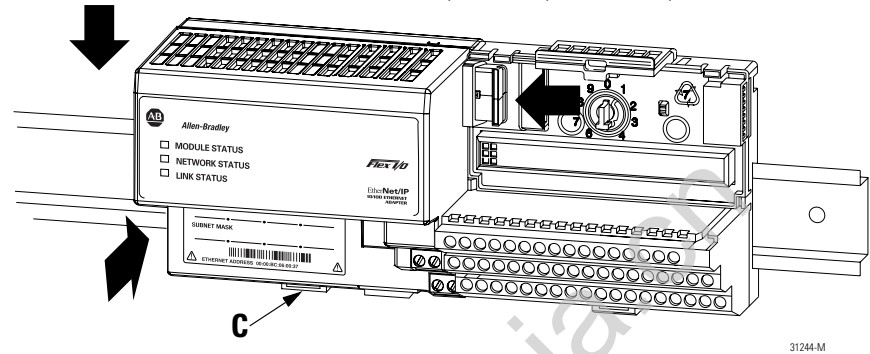
5. Release the locking tab on the back of the old adapter module and remove the old adapter from its terminal base.
6. Before installing the new adapter, note the notch on the right rear of the adapter. This notch accepts the hook on the terminal base of the I/O module mounted next to the adapter. The notch is open at the bottom. The hook and adjacent connection point keep the terminal base and adapter tight together, reducing the possibility of a break in communication over the backplane.



7. Complete the adapter mounting as shown below.

Push down and in at the same time to lock the adapter on the DIN rail.

When the adapter is locked onto the DIN rail, gently push the flexbus connector into the adapter to complete the backplane.



8. If the adapter module does not lock into place, use a screwdriver or similar device to pull locking tab **C** down while pressing the adapter module flush onto the DIN rail. Then release the locking tab to lock the adapter module in place. If necessary, push up on the locking tab to lock.

9. Reinstall the I/O module onto its terminal base unit.

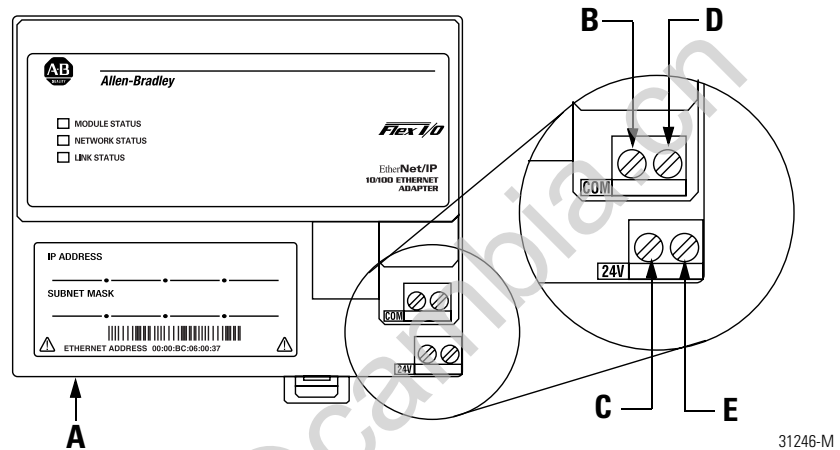
Email: sales@cambridge

## Wiring

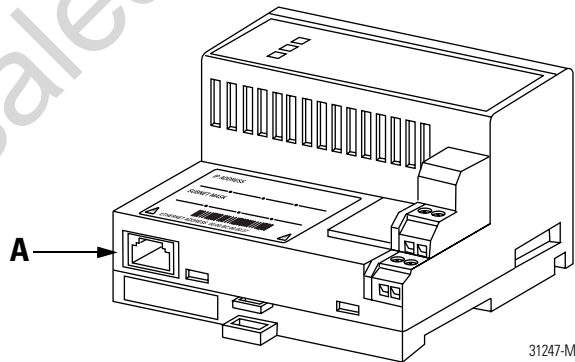
### WARNING



If you connect or disconnect the Ethernet cable with power applied to the adapter or any device on the network, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.



1. Connect the Ethernet network cable to the RJ-45 connector (A) on the underside of the adapter.



### IMPORTANT

We recommend connecting the module to the network via a 100MB full duplex switch, which will reduce collisions and lost packets and increase network bandwidth. For detailed EtherNet/IP connection information, see the following publications:

- *EtherNet/IP Performance and Application Guide*, publication ENET-AP001
- *EtherNet/IP Media Planning and Installation Guide*, publication number ENET-IN001

2. Connect 24V common to the left side of the upper connector, terminal **B**.

**IMPORTANT**

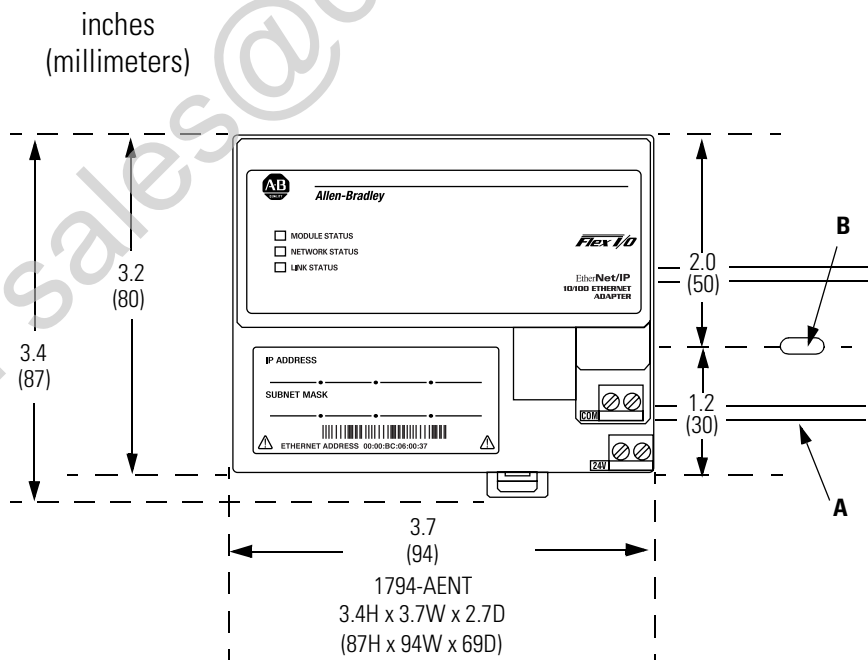
When connecting wiring, torque terminal screws B, C, D and E to 5-7 inch-pounds.

3. Connect +24V dc input power to the left side of the lower connector, terminal **C**.
4. Use connectors **D** and **E** to pass 24V common (D) and 24V dc power (E) to the next module in the series).

**IMPORTANT**

The 1794-AENT requires a minimum load of approximately 100mA (e.g., two FLEX I/O modules) on the Flex rail.

## Mounting Dimensions



**A** = DIN rail

**B** = Secure DIN rail approximately every 200mm

## What's Next?

The following chapter describes how to configure the adapter to communicate on your EtherNet/IP network by providing an IP address, Gateway address, and Subnet mask.

## Configuring the 1794-AENT Adapter for Your EtherNet/IP Network

### What This Chapter Contains

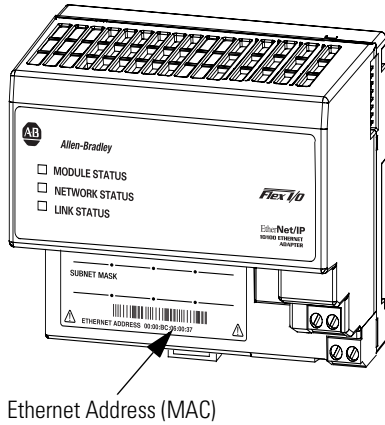
Before you can use your 1794-AENT adapter in an EtherNet/IP network you must configure it with an IP address, and optional Gateway address and Subnet mask. This chapter describes these configuration requirements and the procedures for providing them. There are several way you can do this:

1. Using the Rockwell BootP utility that ships with RSLogix 5000 software. You can also use this utility to reconfigure a device whose IP address is unknown or must be changed.
2. Using a third party BootP server.
3. Having your network administrator configure the adapter via the network server.

The following table lists where to find specific information within this chapter.

<b>For information about</b>	<b>See page</b>
Configuration Requirements	3-2
IP Address	3-2
Gateway Address	3-3
Subnet Mask	3-4
Using the Rockwell BootP Utility	3-6
Using Force IP Renew To Reconfigure a Device	3-8
Saving the Relation List	3-10
Using a Third Party BootP Server	3-11
Using DHCP Software to Configure Your Adapter	3-13

## Configuration Requirements



Before you can use your 1794-AENT adapter, you must configure its IP address, and optionally, its subnet mask and gateway address. You can use the Rockwell BootP utility to perform the configuration. You can also use generic BootP software or, within some limitations, a DHCP server.

### IMPORTANT

When using the BootP protocol, you must enter the Ethernet hardware address of your adapter. Rockwell assigns each 1794-AENT adapter a unique 48-bit hardware address at the factory. The address is printed on a label on the front of your 1794-AENT adapter as shown in the figure at left. It consists of six hexadecimal digits separated by colons. This address is fixed by the hardware and cannot be changed.

If you change or replace the 1794-AENT adapter, you must enter the new Ethernet hardware address of the adapter when you configure the new adapter.

## IP Address

The IP address identifies each node on the IP network (or system of connected networks). Each TCP/IP node on a network (including the 1794-AENT adapter) must have a unique IP address.

The IP address is 32 bits long and has a Net ID part and a Host ID part. Networks are classified A, B, C, (or other). The class of the network determines how an IP address is formatted.

	0	8	9	31
Class A	0	Net ID		Host ID
	0		16	17
Class B	1 0	Net ID		Host ID
	0		24	25
Class C	1 1 0	Net ID		Host ID

You can distinguish the class of the IP address from the first integer in its dotted-decimal IP address as follows:

Range of first integer	Class	Range of first integer	Class
0 -127	A	192 - 223	C
128 -191	B	224 - 255	other

Each node on the same physical network must have an IP address of the same class and must have the same Net ID. Each node on the same network must have a different Host ID thus giving it a unique IP address.

IP addresses are written as four decimal integers (0-255) separated by periods where each integer gives the value of one byte of the IP address.

**EXAMPLE**

For example, the 32-bit IP address:

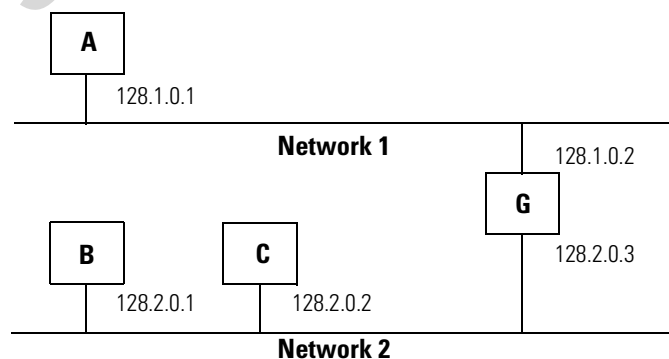
10000000 00000001 00000000 00000001 is written as 128.1.0.1.

**TIP**

Contact your network administrator or the Network Information Center for a unique fixed IP address to assign to your module.

**Gateway Address**

The Gateway Address is the default address of a network. It provides a single domain name and point of entry to the site. Gateways connect individual physical networks into a system of networks. When a node needs to communicate with a node on another network, a gateway transfers the data between the two networks. The following figure shows gateway G connecting Network 1 with Network 2.



When host B with IP address 128.2.0.1 communicates with host C, it knows from C's IP address that C is on the same network. In an Ethernet environment, B can then resolve C's IP address into a hardware address (MAC address) and communicate with C directly.



When host B communicates with host A, it knows from A's IP address that A is on another network (the net IDs are different). In order to send data to A, B must have the IP address of the gateway connecting the two networks. In this example, the gateway's IP address on Network 2 is 128.2.0.3.

The gateway has two IP addresses (128.1.0.2 and 128.2.0.3). The first must be used by hosts on Network 1 and the second must be used by hosts on Network 2. To be usable, a host's gateway must be addressed using a net ID matching its own.

### Subnet Mask

The Subnet Mask is used for splitting IP networks into a series of subgroups, or subnets. The mask is a binary pattern that is matched up with the IP address to turn part of the Host ID address field into a field for subnets.

#### EXAMPLE

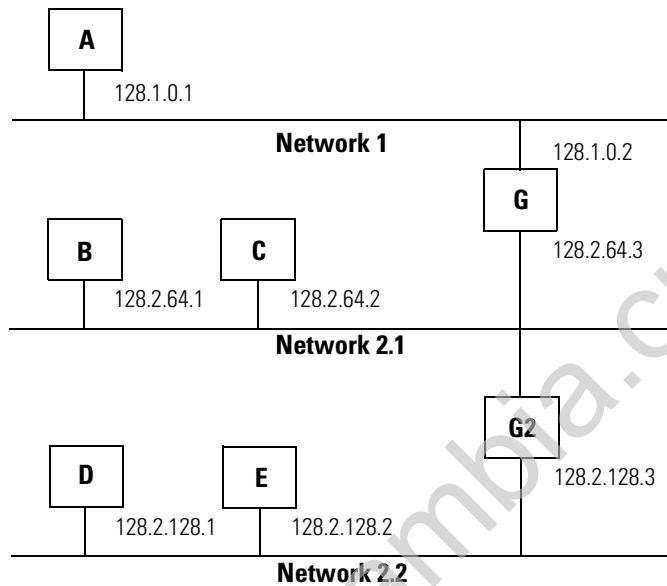
Take Network 2 (a Class B network) in the previous example and add another physical network. Selecting the following subnet mask would add two additional Net ID bits allowing for four physical networks:

11111111 11111111 **11**000000 00000000 = 255.255.192.0

These two bits of the Host ID  
used to extend the Net ID

Two bits of the Class B host ID have been used to extend the Net ID. Each unique combination of bits in the part of the Host ID where subnet mask bits are 1 specifies a different physical network.

The new configuration is:



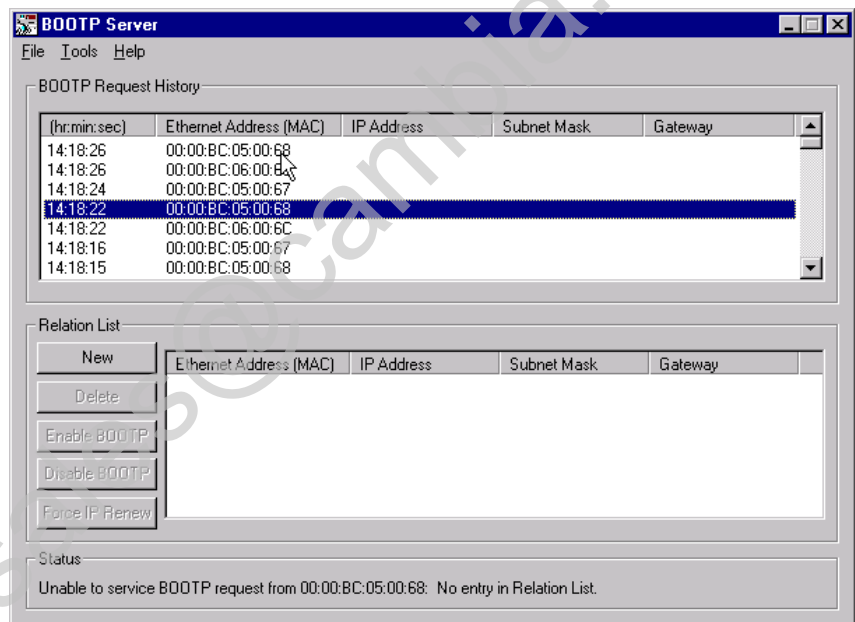
A second network with Hosts D and E has been added. Gateway G2 connects Network 2.1 with Network 2.2. Hosts D and E will use Gateway G2 to communicate with hosts not on Network 2.2. Hosts B and C will use Gateway G to communicate with hosts not on Network 2.1. When B is communicating with D, G (the configured Gateway for B) will route the data from B to D through G2.

## Using the Rockwell BootP Utility

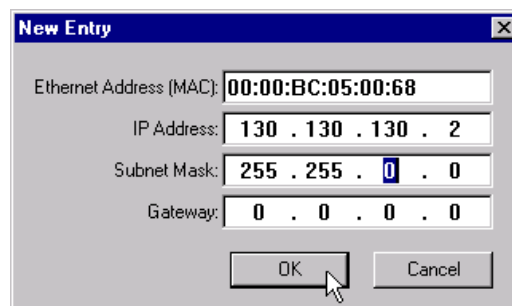
The Rockwell BootP utility is a stand alone program that incorporates the functionality of standard BootP software with a user friendly graphical interface. It is located in the **Utils** directory on the **RSLogix 5000** installation CD. The 1794-AENT adapter must have BootP enabled (factory default) to use the utility.

To configure your adapter using the BootP utility, perform the following steps:

1. Run the BootP software. In the **BOOTP Request History** panel you will see the hardware addresses of devices issuing BootP requests.

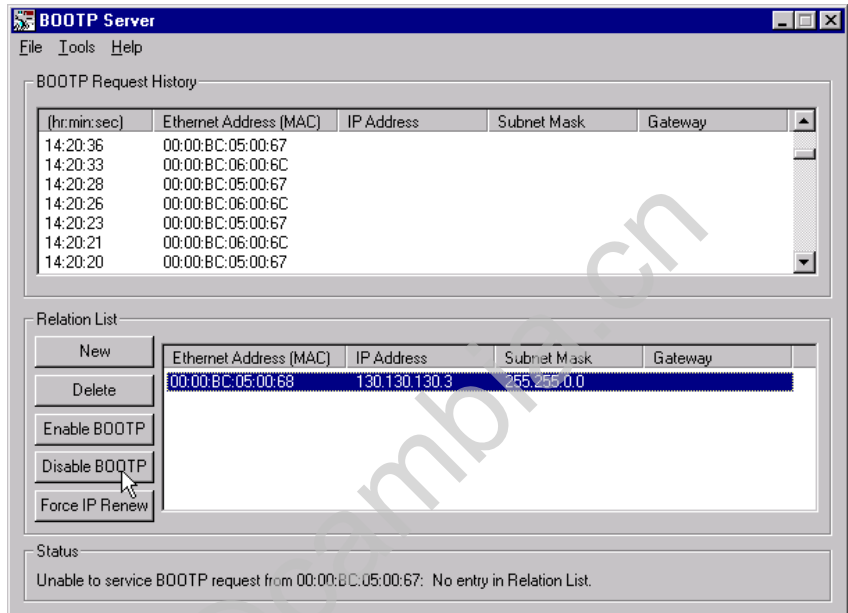


2. Double-click on the hardware address of the device you want to configure. You will see the **New Entry** pop-up window with the device's Ethernet Address (MAC).



3. Enter the **IP Address**, **Subnet Mask**, and **Gateway** you want to assign to the device, and click on **OK**.

The device will be added to the **Relation List**, displaying the Ethernet Address (MAC) and corresponding IP Address, Subnet Mask, and Gateway (if applicable).



- If you want to permanently assign this configuration to the device, highlight the device and click on the **Disable BOOTP** button. When power is recycled to the device, it will use the configuration you assigned and not issue a BootP request.

**Note:** To enable BootP for a device that has had BootP disabled, highlight the device and click on the **Enable BOOTP** button.

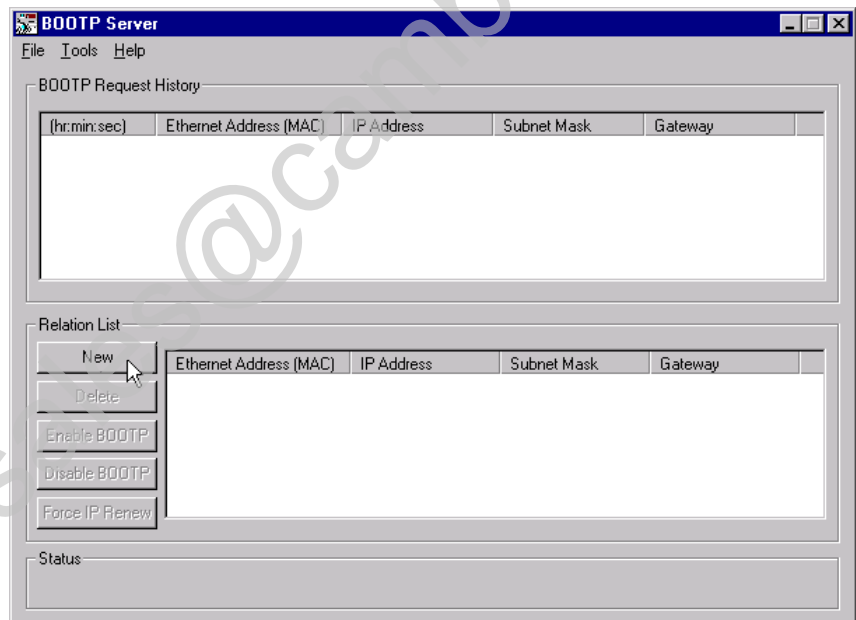
## Using Force IP Renew To Reconfigure a Device

The **Force IP Renew** feature can be used to reconfigure a device that has Bootp disabled. This can be useful:

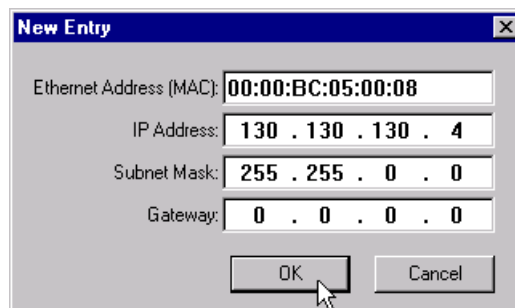
- if you do not know the IP address of a configured device (e.g., the address is not written on the label or the label is missing), or
- if you know the IP address but want to change the configuration.

To use this feature perform the following steps:

1. Connect the device to your network and run the Bootp utility.

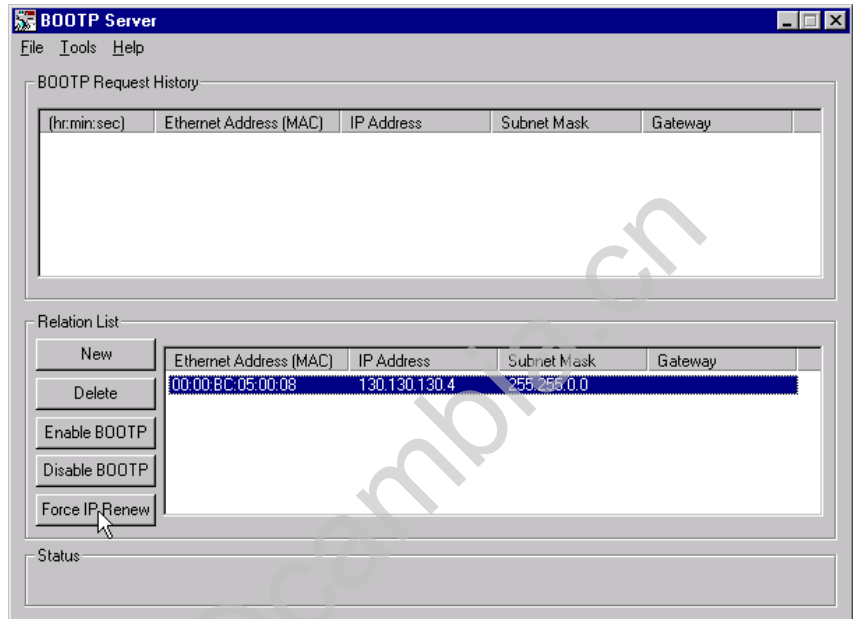


2. Click on the **New** button. The **New Entry** pop-up window will open.



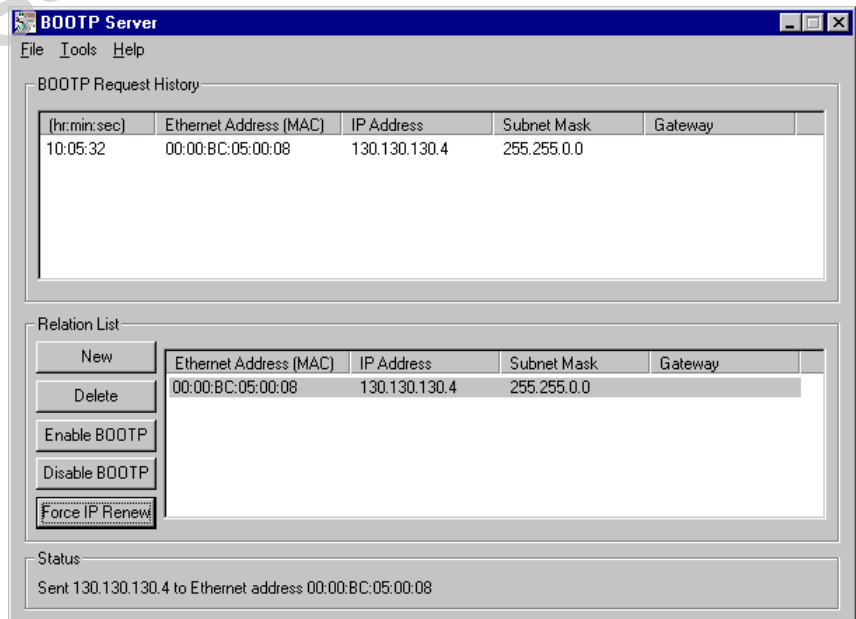
3. Enter the fixed **Ethernet Address (MAC)** of your device.

- Enter the **IP Address**, **Subnet Mask**, and **Gateway** you want to assign to the device, and click on **OK**. The device will appear in the **Relation List**.



- Select the device from the **Relation List** and click on the **Force IP Renew** button. Then cycle power to the device.

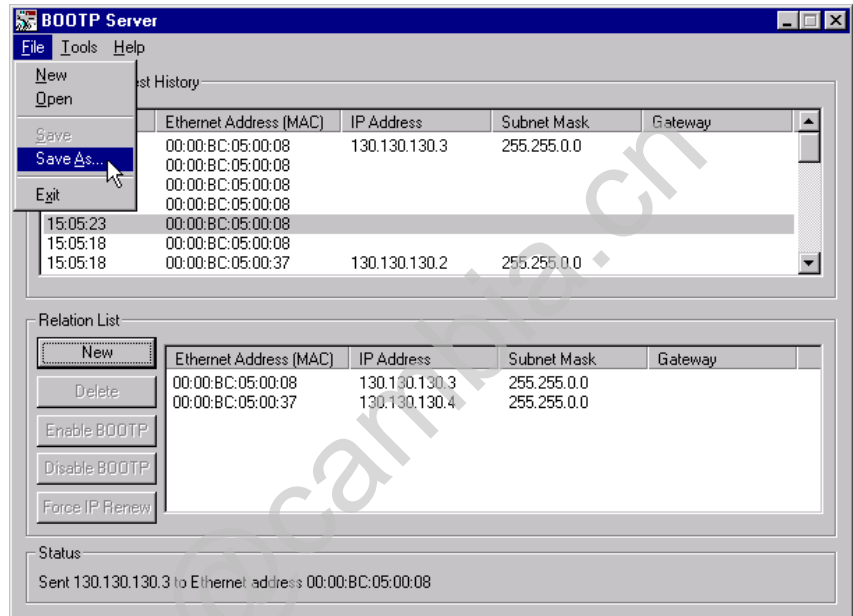
The device will perform its power-up diagnostics and issue a Bootp request. The Bootp utility will respond by assigning it the configuration you just specified.



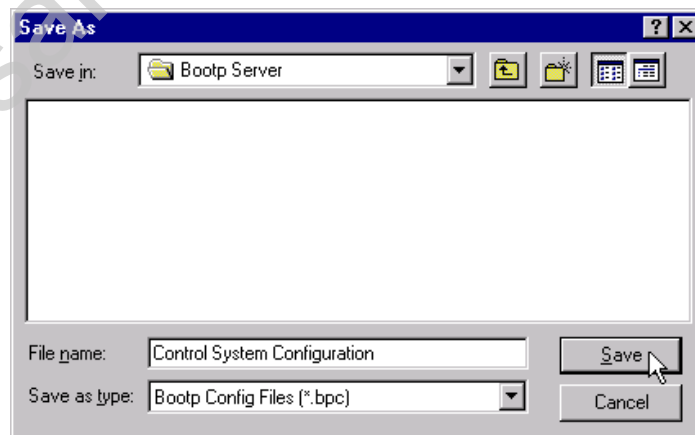
The device is now able to communicate over the network, using the new configuration.

## Saving the Relation List

You can save the **Relation List** to be used later. To save the Relation List perform the following steps:



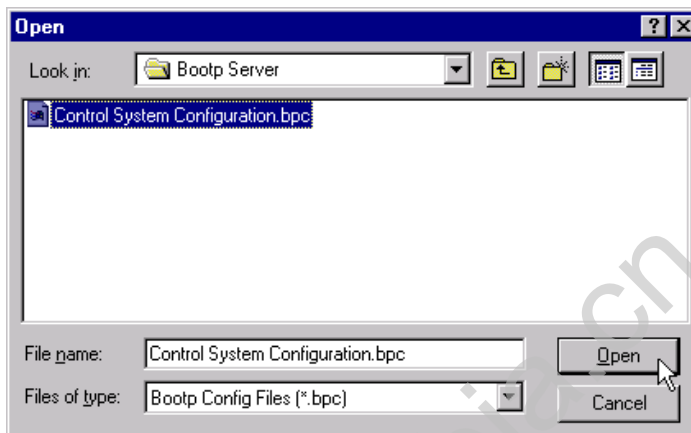
1. Select **Save As...** from the **File** menu. You will see the following window.



2. Select the folder you want to **Save in**:
3. Enter a **File name** for the Relation List (e.g., "Control System Configuration") and click on **Save**.

You can leave the **Save as type** at the default setting: "Bootp Config Files (\*.bpc)".

You can then open the file containing the Relation List at a later session.



## Using a Third Party BootP Server

### EXAMPLE

The following is an example BootP tab file that can be used with a third party BootP server:

```
# Example /etc./bootptab: database for bootp server (/etc./bootpd).
#
# Format:
#   nodename:tag=value:tag=value: . . . :tag=value
#
#   first field -- nodename (hostname) of terminal followed by colon
#   (should be full domain name)
#
# Blank lines and lines beginning with '#' are ignored.
# Make sure you include a colon and a backslash to continue a line.
# Don't put any spaces in the tag-value string.
# The ht tag MUST precede the ha tag.
#
# The options below are specified as tag=value and delimited by colons
# These are the options used by the 1794-AENT adapter:
#
#   gw -- gateway IP address
#   ha -- hardware address (link level address) (hex)
#   ht -- hardware type (either) (must precede the ha tag)
#   ip -- IP address
#   sm -- network subnet mask
#   tc -- template for common defaults (should be the first option listed)
#
#   vm -- vendor magic cookie selector (MUST be rfc1048 for
#   1794-AENT)
#
```



```
#-----  
# default values for 1794-AENT  
icp.defaults:\  
    ht=ether:\  
    vm=rfc1048:\  
    sm=255.255.254.0:\  
    gw=130.151.132.1  
#-----  
zappa0:\  
    tc=icp.defaults:\  
    ha=0000bc03404f:\  
    ip=130.151.132.121  
zappa1:\  
    tc=icp.defaults:\  
    ha=0000bc034073:\  
    ip=130.151.132.122  
zappa2:\  
    tc=icp.defaults:\  
    ha=0000bc034022:\  
    ip=130.151.132.123
```

To use a third party BootP server to configure the 1794-AENT adapter perform the following steps:

1. Access and open the BootP tab file using a text editor.
2. Enter the IP address you want to use for your adapter. If you need more information on setting IP addresses, refer to page 3-2.
3. Use the text editor to enter the Ethernet hardware address (MAC ID) of your adapter. You must enter all digits, including zeroes.
4. Enter the Gateway Address. If you need more information on assigning gateway addresses, refer to page 3-3.
5. Enter the Subnet Mask. If you need more information on selecting subnet masks, refer to page 3-4.
6. After you have entered all the configuration data, save the file in a directory where the BootP server can access it.

## Using DHCP Software to Configure Your Adapter

DHCP (Dynamic Host Configuration Protocol) software automatically assigns IP addresses to client stations logging onto a TCP/IP network. DHCP is based on BootP and maintains some backward compatibility. The main difference is that BootP was designed for manual configuration, while DHCP allows for dynamic allocation of network addresses and configurations to newly attached devices.

Be cautious about using DHCP software to configure your adapter. A BootP client, such as the 1794-AENT adapter, can boot from a DHCP server only if the DHCP server is specifically written to also handle BootP queries. This is specific to the DHCP software package you use. Check with your system administrator to see if your DHCP package supports BootP commands and manual IP allocation.

---

**ATTENTION**

The 1794-AENT adapter must be assigned a fixed network address. The IP address of this adapter must not be dynamically provided.

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

---

## What's Next?

The following chapter describes an example application in which you configure discrete I/O using a rack optimized connection.

Email: [sales@cambria.cn](mailto:sales@cambria.cn)

## Using Rack Optimized Discrete I/O

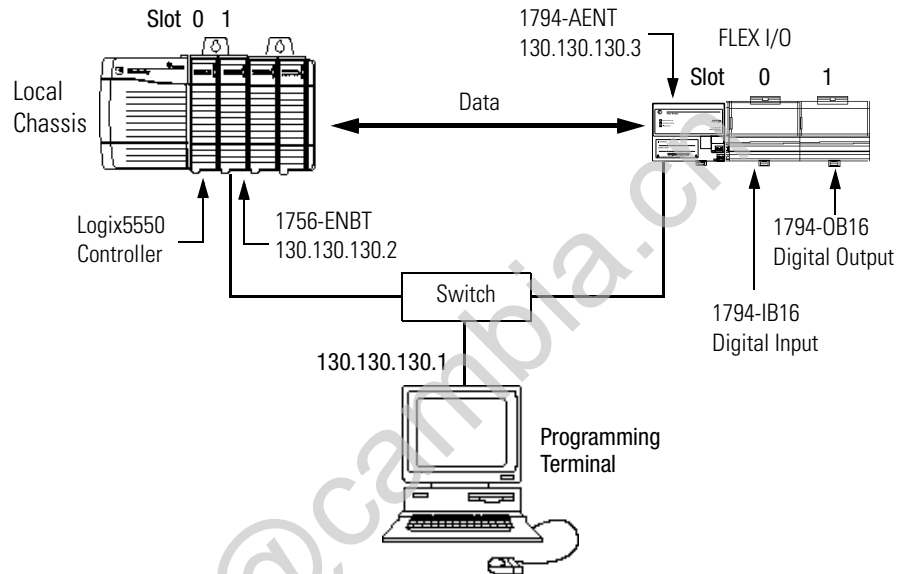
### About the Example Application

In this example a ControlLogix processor communicates with FLEX I/O via the 1794-AENT adapter using a rack optimized connection. The processor reads data from all digital input modules and sends data to all digital output modules configured in a rack connection simultaneously.

<b>What you will do</b>	<b>See page</b>
Set Up the Hardware	4-2
Create the Example Application	4-3
Configure the I/O	4-4
Add the Local EtherNet/IP Bridge to the I/O Configuration	4-4
Add the FLEX I/O Adapter to the I/O Configuration	4-6
Add the FLEX I/O Modules to the I/O Configuration	4-8
Add the Digital Input Module	4-8
Add the Digital Output Module	4-10
Edit the Controller Tags	4-12
Create the Ladder Program	4-13
Download the Program to the Controller	4-14
Test the Example Application	4-15

## Set Up the Hardware

In this example, a ControlLogix chassis contains the Logix 5550 processor in slot 0 and a 1756-ENBT bridge module in slot 1. The 1794-AENT adapter is mounted on a DIN rail with a 1794-IB16 digital input module and 1794-OB16 digital output module. You will also need a power supply (not shown) for the FLEX I/O.



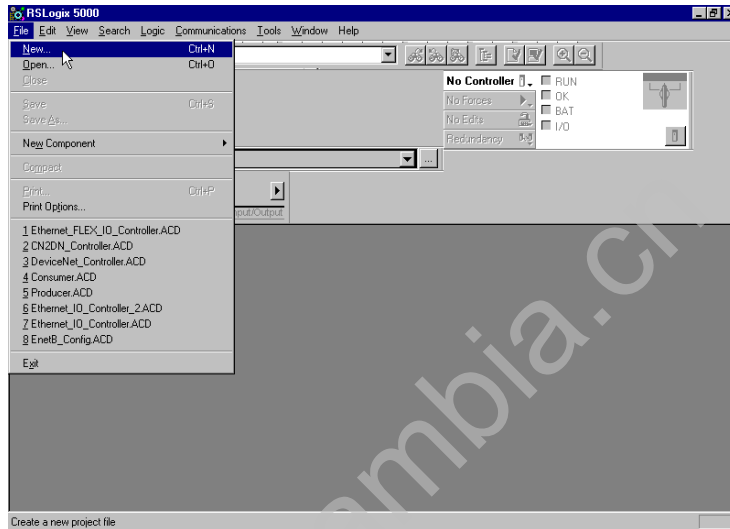
To work along with this example set up your system as shown above.

- Note that in the example application, the Logix5550 controller and 1756-ENBT module are assumed to be in the slots shown above.
- Verify the IP addresses for your programming terminal, 1756-ENBT module, and 1794-AENT adapter.
- Verify the position (slot) of the I/O modules on the DIN rail.
- Verify that all wiring and cabling is properly connected.
- Make sure your communication driver (e.g., AB\_ETH-1) is configured in RSLinx as described in Appendix C.

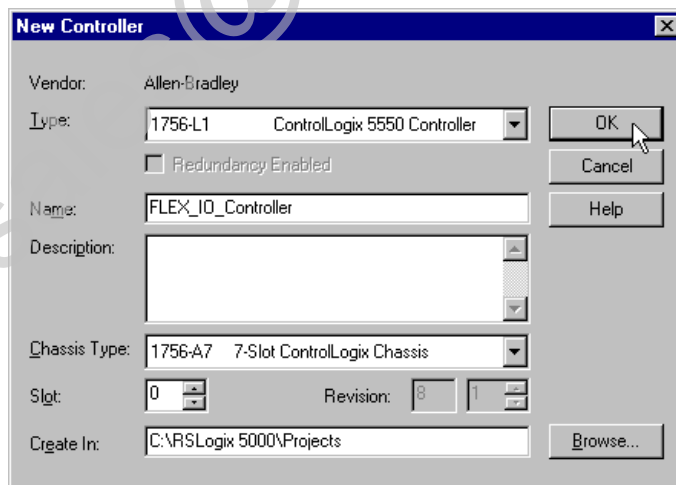
## Create the Example Application

Perform the following steps to create the example application:

1. Start **RSLogix5000**. The RSLogix 5000 Main Window will open.



2. From the **File** menu, select **New**. The **New Controller** pop-up window will open.



3. Enter an appropriate **Name** for the Controller, e.g., "FLEX\_IO\_Controller."
4. Select the correct **Chassis Type** and **Slot** number of the Logix5550 controller, and the folder where you want to save the RSLogix 5000 file (**Create In**). The **Description** is optional.
5. Click on **OK**.

## Configure the I/O

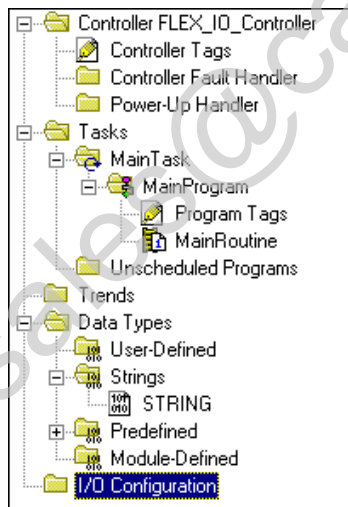
You now add the FLEX I/O modules to the controller's I/O configuration. To do this you first add the local 1756-ENBT module to the I/O configuration. Next you add the 1794-AENT adapter as a "child" of the 1756-ENBT module. Then you add the I/O modules as "children" of the 1794-AENT adapter.

### IMPORTANT

Click on the **Help** buttons on the configuration screens shown in this section if you need assistance in selecting and setting the parameters.

## Add the Local EtherNet/IP Bridge to the I/O Configuration

1. Select the **IO Configuration** folder in the project window and click the right mouse button.

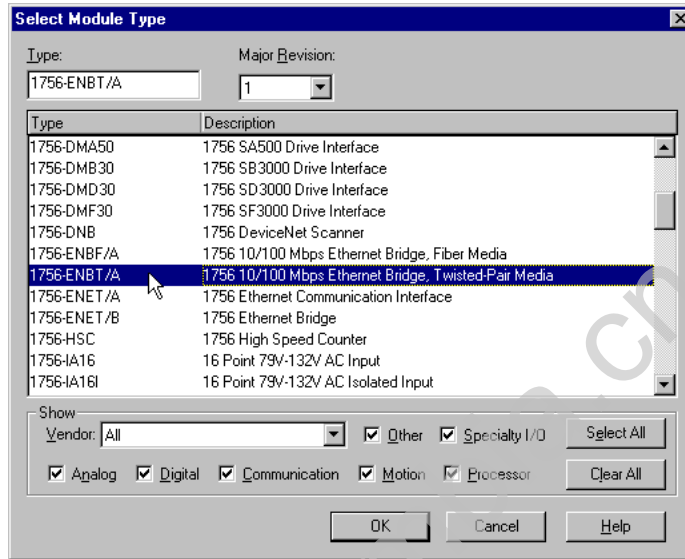


The following pop-up window will open.

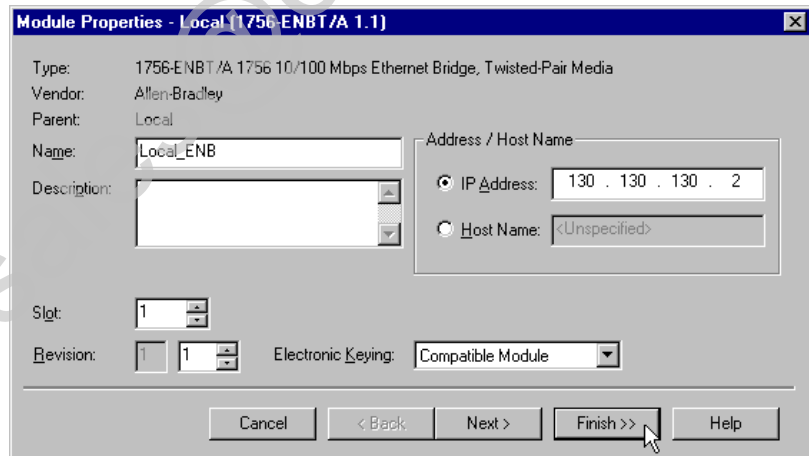


2. Click on **New Module**.

The **Select Module Type** window will open.



3. Select the **1756-ENBT** EtherNet/IP Bridge and click on **OK**. The **Module Properties** window will open.



4. Enter or select the following parameters: **Name**, **IP Address**, **Slot**, and **Electronic Keying**. We used the following values:

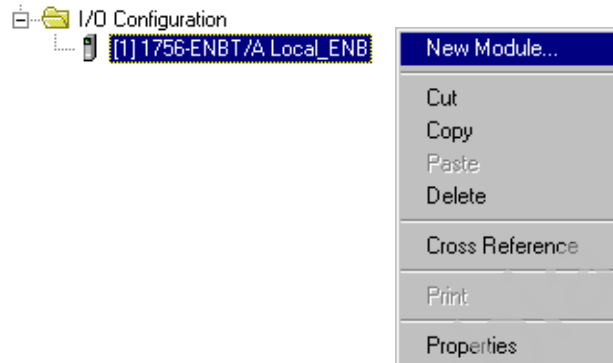
<b>Name</b>	Local_ENB
<b>IP Address</b>	130.130.130.2
<b>Slot</b>	1
<b>Electronic Keying</b>	Compatible Module

5. Click on **Finish** to accept the configuration.

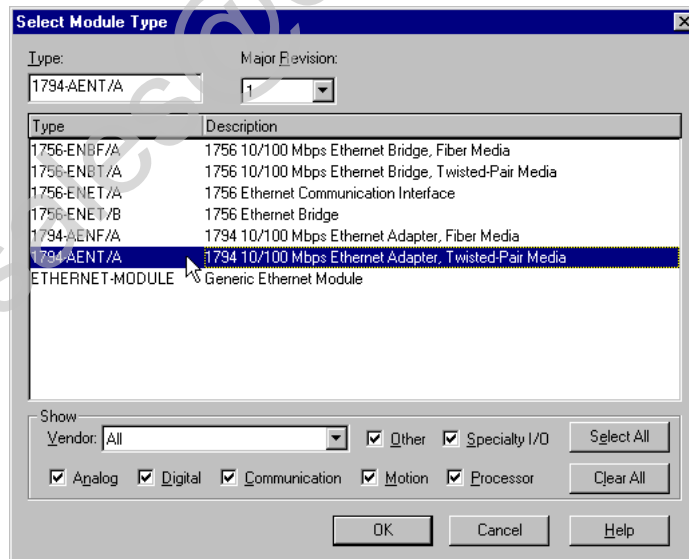


## Add the FLEX I/O Adapter to the I/O Configuration

Next, you must add the 1794-AENT adapter as a “child” of the local 1756-ENBT module.



1. In the Project window, right click on the local 1756-ENBT module under the I/O Configuration folder and select **New Module** from the pop-up window. The **Select Module Type** window will open.



2. Select the **1794-AENT/A** Ethernet adapter from the list and click on **OK**.

The **Module Properties** window will open.

3. Enter or select the following parameters (the values we used are listed in the table):

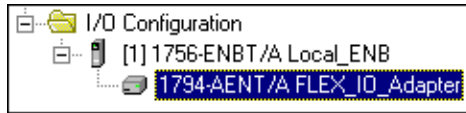
<b>Name</b>	FLEX_IO_Adapter
<b>IP Address</b>	130.130.130.3
<b>Comm Format</b>	Rack Optimization
<b>Chassis Size</b>	8 (default)
<b>Electronic Keying</b>	Compatible Module

4. Click on **Next**. The following page will open:

5. Verify that the **Requested Packet Interval** (RPI) is appropriate for your system (10ms for this example). This will be used for the rack optimized connection to the I/O modules.

6. Click on the **Finish** button to accept the configuration.

The 1794-AENT adapter will appear indented under the local 1794-ENBT in the I/O Configuration folder.



### Add the FLEX I/O Modules to the I/O Configuration

You must now add the FLEX I/O modules to the I/O Configuration List under the 1794-AENT adapter.

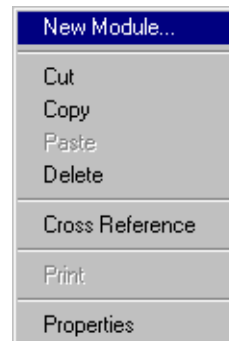
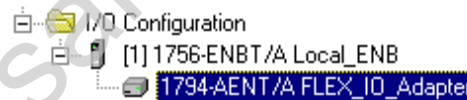
In this example, you will add a 17946-IB16 digital input module and a 1756-OB16 digital output module with standard configurations. Use these steps as a guide when you are configuring different I/O modules for your system.

**TIP**

This example application uses the I/O modules' default configurations. For more information see publications 1794-IN071 and 1794-IN072.

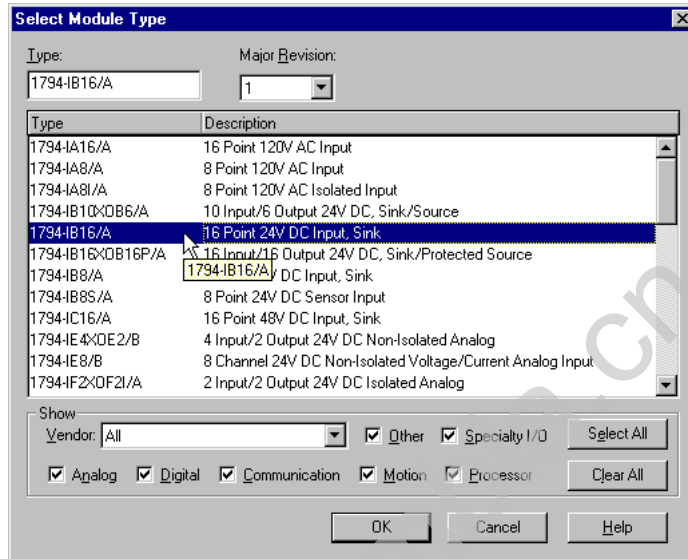


#### Add the Digital Input Module

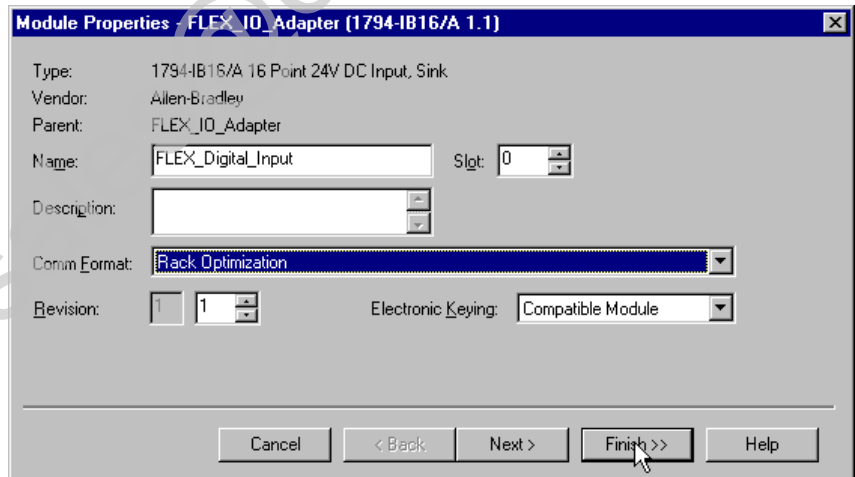


1. Right click on the remote **1794-AENT** adapter under the I/O Configuration folder and select **New Module**.

2. The **Select Module Type** window will open.



3. Select the **1794-IB16/A** digital input module from the list and click on **OK**. The **Module Properties** window will open.

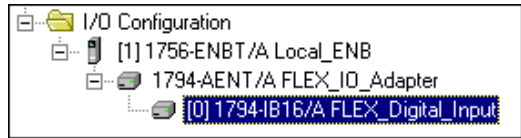


4. Enter or select the following parameters (the values we used are listed in the table):

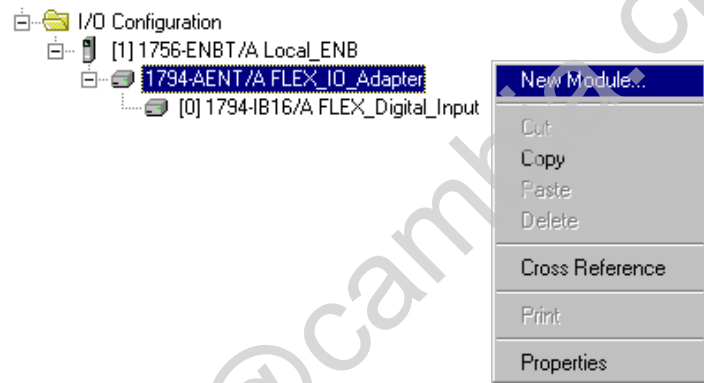
<b>Name</b>	FLEX_Digital_Input
<b>Slot</b>	0
<b>Comm Format</b>	Rack Optimization
<b>Electronic Keying</b>	Compatible Module

5. Click on the **Finish** button to save the configuration.

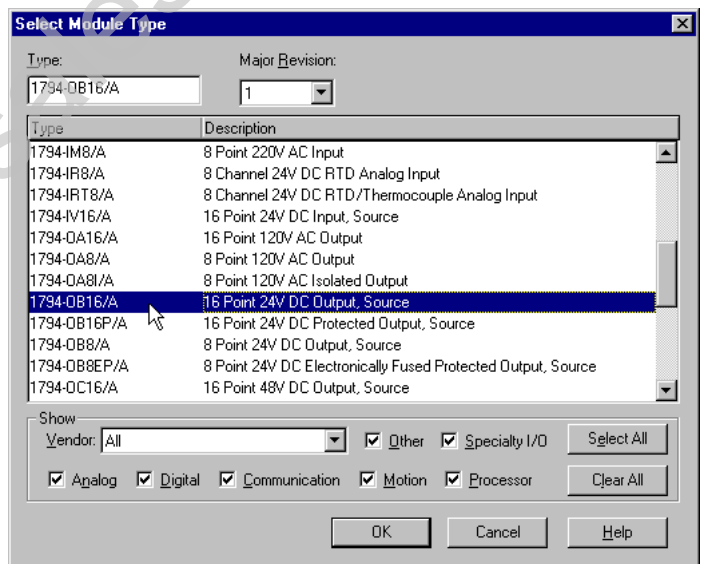
The digital input module will appear in the I/O configuration indented under the 1794-AENT adapter.



*Add the Digital Output Module*

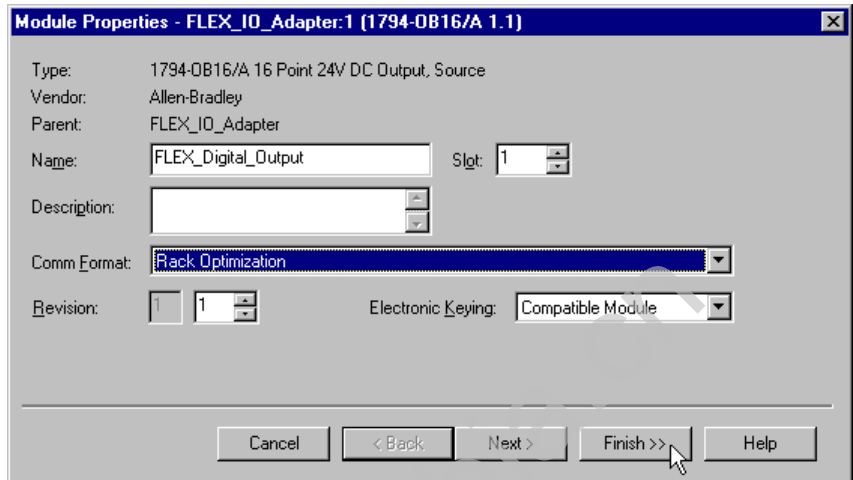


- Right click on the **1794-AENT** adapter and again select **New Module**. The **Select Module Type** window will open.



- Select the **1756-OB16/A** digital output module from the list.

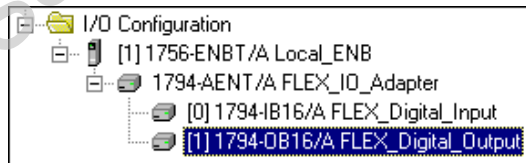
The **Module Properties** window will open.



8. Enter or select the following parameters (the values we used are listed in the table):

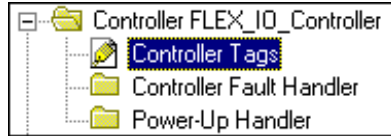
<b>Name</b>	FLEX_Digital_Output
<b>Slot</b>	1
<b>Comm Format</b>	Rack Optimization
<b>Electronic Keying</b>	Compatible Module

9. Click on the **Finish** button to accept the configuration. The I/O Configuration in the Project window should look similar to the one shown below.

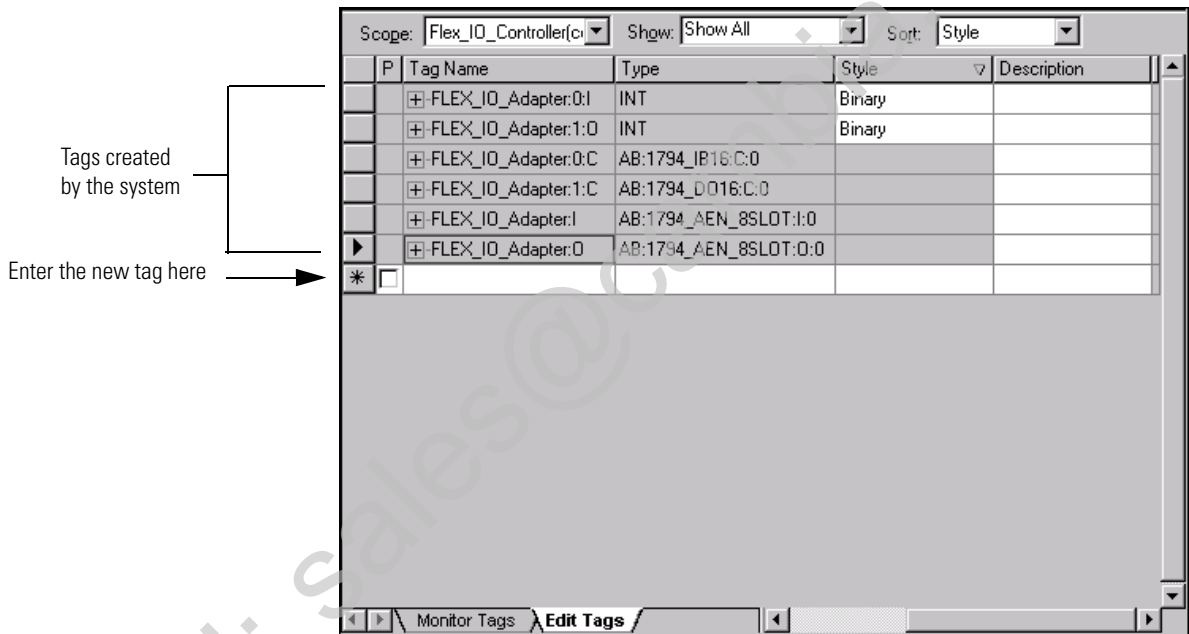


## Edit the Controller Tags

When you add modules to the I/O configuration the system creates tags for those modules to use in the application program. For the example application you need to add one more Controller Tag.

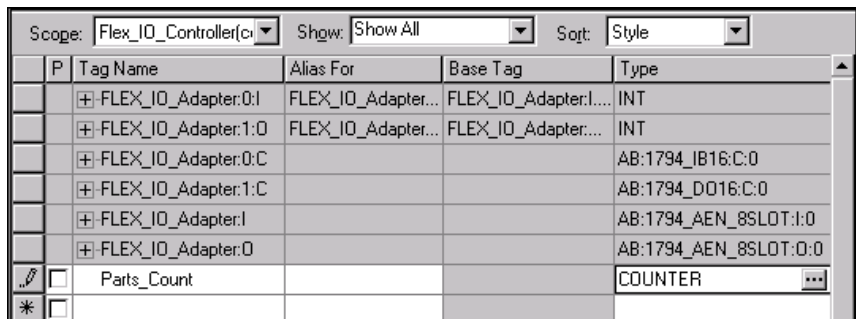


1. Double-click on the **Controller Tags** folder in the project window. The **Controller Tags** window will open. You will see the tags created for the 1794-AENT and digital I/O modules.



2. Make sure the **Edit Tags** tab at the bottom of the Controller Tags window is selected and create the following tag:

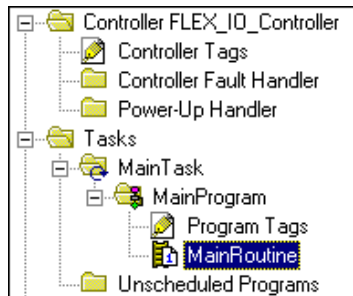
Tag	Type
Parts_Count	Counter



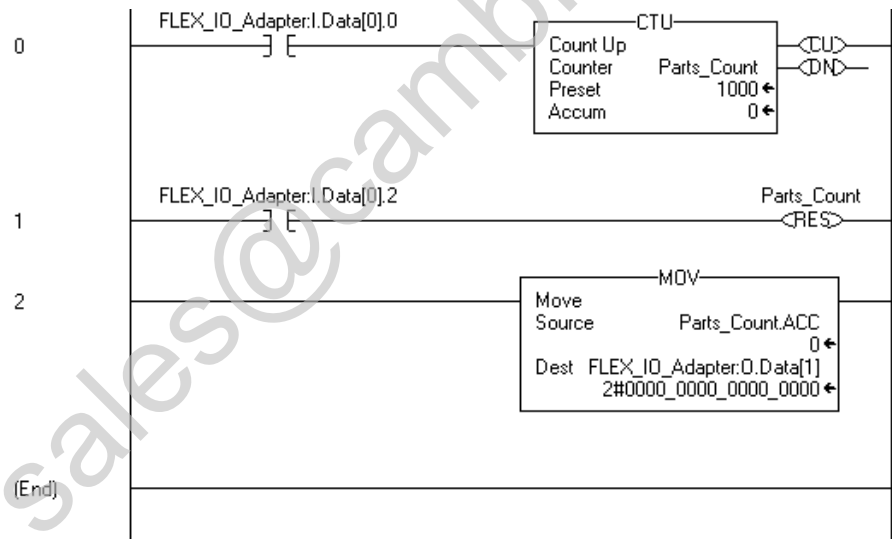
3. Close the **Controller Tags** window.

## Create the Ladder Program

Next create the example ladder program to test the IO.



1. Double-click on **Main Routine** under the **Main Program** folder, and enter the following ladder program, using the tags previously created.



2. **Save** the program.

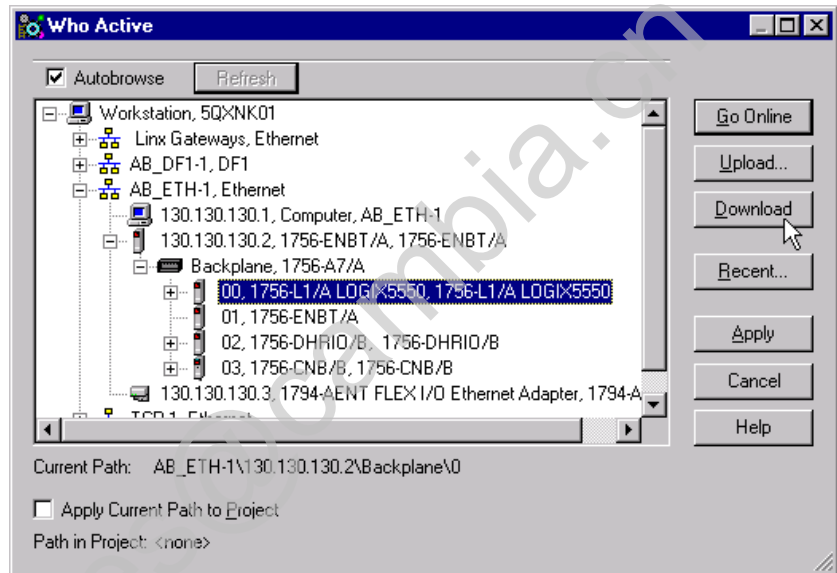


## Download the Program to the Controller

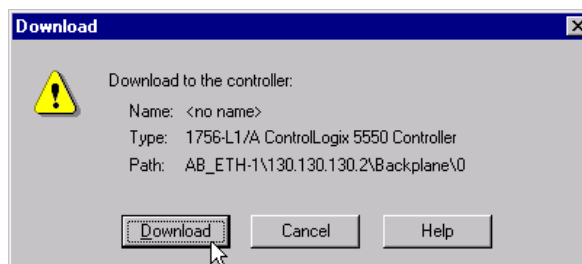
To download the program to the controller do the following:

1. Click on the **Communications** menu and select **Who Active**.

The **Who Active** window will open (Your window will show the drivers and devices you have installed).



2. Select your Ethernet driver (e.g., AB\_ETH-1) and expand the tree through the backplane of the local ControlLogix chassis.
3. Highlight the Logix 5550 controller and click on the **Download** button. You will see a message similar to the following:

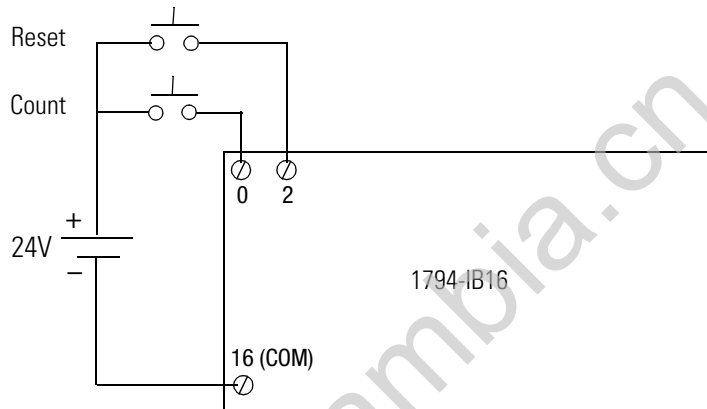


4. Click on the **Download** button. The program will be downloaded to the controller.
5. **Minimize** RSLogix5000.

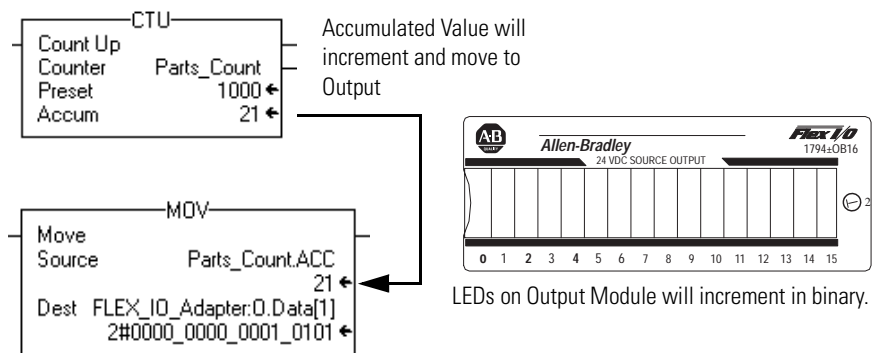
## Test the Example Application

You will test the example application by using a momentary switch to simulate a parts sensor.

1. Remove power from the FLEX I/O and wire inputs 0 and 2 of the the 1794-IB16 FLEX I/O input module as shown in the following figure:



2. Restore power to the FLEX I/O.
3. Restore the **RSLogix5000** software and place the controller in **Run** mode.
4. Repeatedly press and release the momentary switch at Input 0 (Count) on the 1794-IB16 input module. Each time you press the switch you should see the Parts\_Count accumulated value increment on the screen and the LEDs of the 1794-OB16 output module increment in binary.



5. Press and release the momentary switch at Input 2 (Reset) on the 1794-IB16 input module. You should see the accumulated value of the Parts\_Count reset to zero and all of the LEDs on the 1794-OB16 output module turn off.

**TIP**



Refer to the FLEX I/O Digital I/O Modules Installation Instructions, publications 1794-IN071 and 1794-IN072, for assistance in wiring and debugging the I/O modules.

This completes the Rack Optimized Discrete I/O example.

## What's Next?

The following chapter describes an example application in which you add an analog output adapter to the I/O configuration using a direct connection.

Email: [sales@cambria.cn](mailto:sales@cambria.cn)

## Using Analog I/O with Direct Connection

### About the Example Application

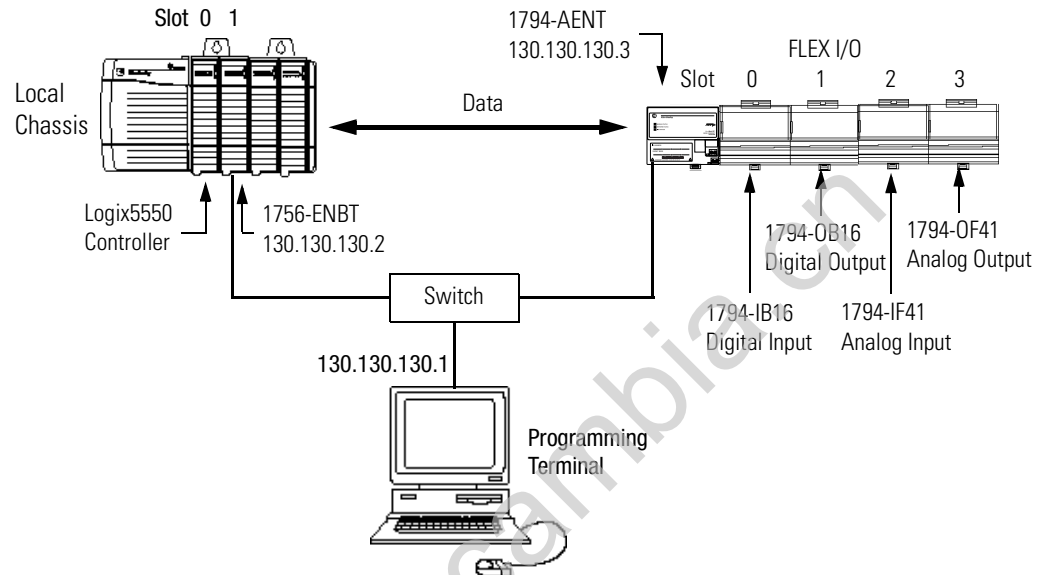
In this example you add analog input and output modules to the FLEX I/O configured with two digital I/O modules in the previous chapter. Analog modules default to direct connection, so you will open a direct connection to each analog module while still using a single rack optimized connection for the two digital I/O modules.

To test the system, the example of the previous chapter is modified to send a signal to one of the analog output channels and read the signal back in through one of the analog input channels.

<b>What you will do</b>	<b>See page</b>
Set Up the Hardware	5-2
Create the Example Application	5-3
Add the Analog Modules to the I/O Configuration	5-4
Add the Analog Input Module to the I/O Configuration	5-4
Add the Analog Output Module to the I/O Configuration	5-7
Edit the Controller Tags	5-11
Modify the Ladder Program	5-12
Download the Program	5-13
Test the Example Application	5-14

## Set Up the Hardware

Change the system hardware setup of the previous chapter to that shown below, adding the FLEX analog input and output modules to the DIN rail with the 1794-AENT adapter and digital I/O modules.

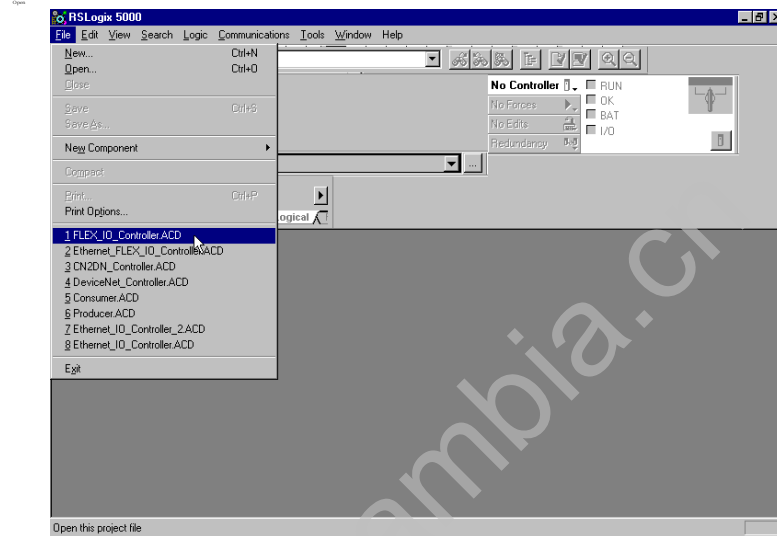


- Note that in the example application, the Logix5550 controller and 1756-ENBT module are in the slots shown above in the ControlLogix chassis.
- Verify that the IP addresses for the 1756-ENBT module, 1794-AENT adapter, and programming terminal are correct.
- Verify the position (slot) of the I/O modules on the DIN rail.
- Verify that all wiring and cabling is properly connected.
- Make sure you have your communication driver (e.g., AB\_ETH-1) is configured in RSLinx as described in Appendix C.

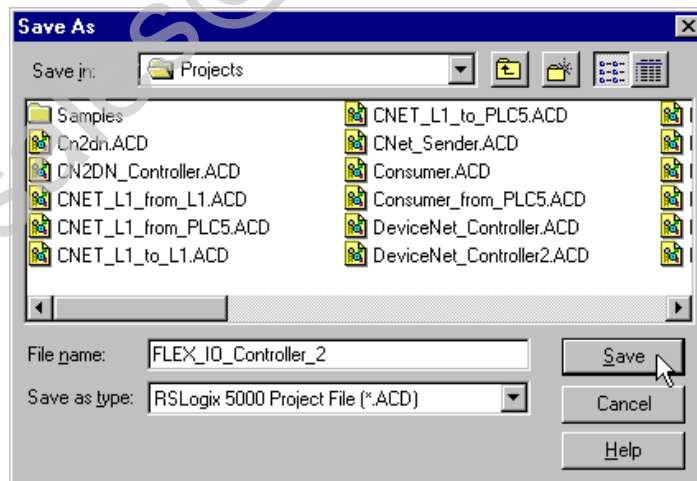
## Create the Example Application

Perform the following steps to create the example application:

1. Start **RSLogix5000**. The RSLogix 5000 Main Window will open.



2. **Open** the project file from the previous chapter (i.e., “FLEX\_IO\_Controller”).



3. **Save** the file using a different name (e.g., “FLEX\_IO\_Controller\_2”).

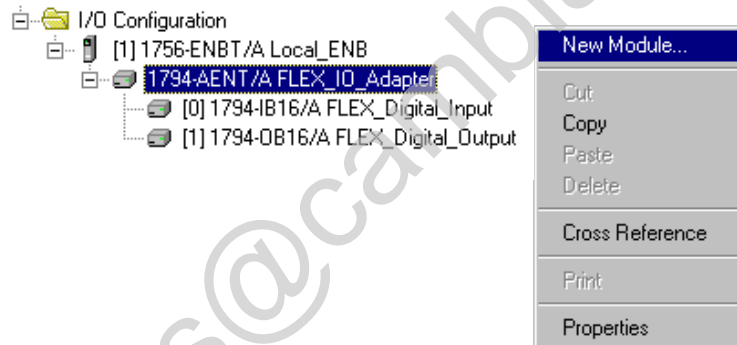
## Add the Analog Modules to the I/O Configuration

You must now add the analog I/O modules to the I/O Configuration. In this example, you add a 1794-IF41 analog input module and a 1794-OF41 analog output module. Use these steps as a guide when you are configuring different I/O modules for your system.

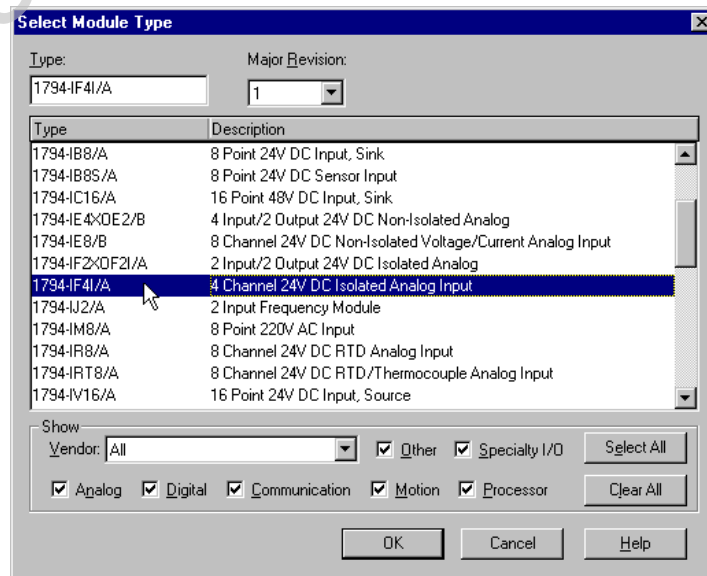
### IMPORTANT

Click on the **Help** buttons on the configuration screens shown in this section if you need assistance in selecting and setting the parameters.

## Add the Analog Input Module to the I/O Configuration

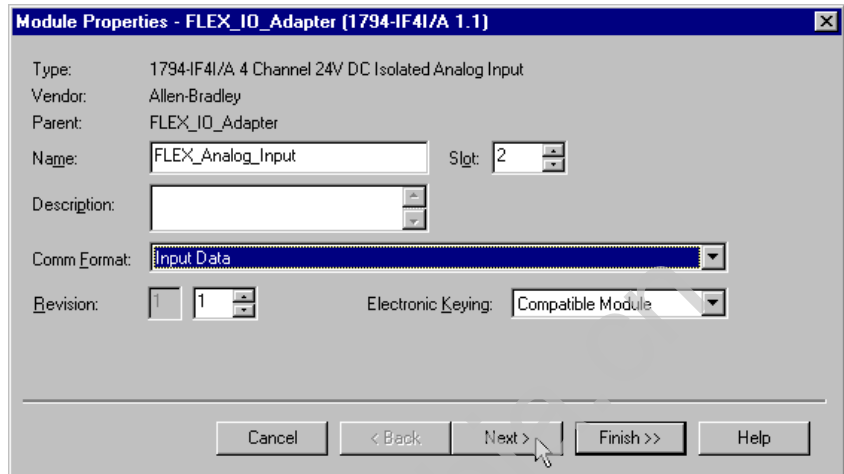


1. Right click on the **1794-AENT** adapter under the I/O Configuration folder and select **New Module** from the pop-up window. The **Select Module Type** window will open.



2. Select the **1794-IF41/A** analog input module from the list and click on **OK**.

The **Module Properties** window will open.

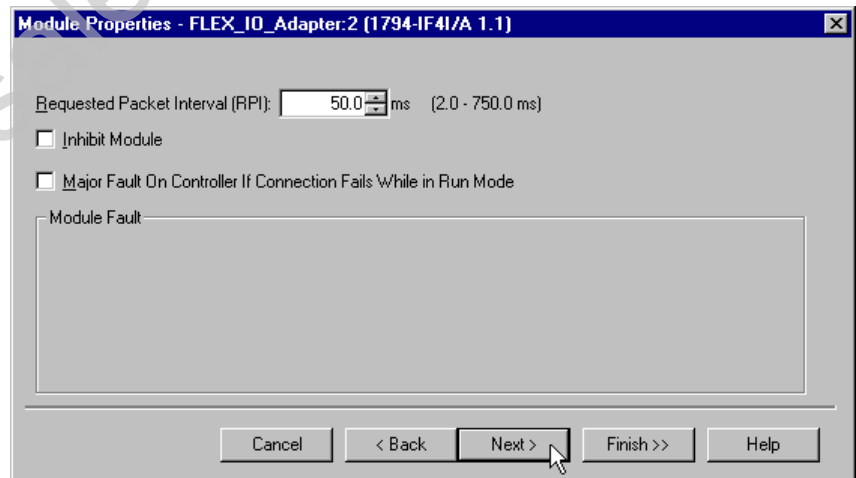


3. Enter the following parameters:

<b>Name</b>	FLEX_Analog_Input
<b>Slot</b>	2
<b>Comm Format</b>	Input Data <sup>(1)</sup>
<b>Electronic Keying</b>	Compatible Module

<sup>(1)</sup> All analog Comm Formats use direct connection. The default here is Input Data.

4. Click on the **Next** button. The following page will open:



5. This window allows you to adjust the **Requested Packet Interval (RPI)** to meet your system's requirements. For this example you can leave it at the default 50 ms rate shown above. This RPI will be used for the direct connection to this analog module. The two rack connected digital I/O modules will continue to communicate at the RPI of the rack connection.



- Click on **Next**. This page is used during online monitoring but not during initial configuration.

- Click on **Next** to move to the channel configuration page.

The choices available on the channel configuration page vary according to the module being configured. The page below opens for the 1794-IF41 module.

Input Channel	Voltage/Current Range	Conversion Rate	Low Pass Time Constant
0	0 to 10 V - Binary	1200 Hz	None
1	4 to 20 mA - Signed 2's Complement	1200 Hz	None
2	4 to 20 mA - Signed 2's Complement	1200 Hz	None
3	4 to 20 mA - Signed 2's Complement	1200 Hz	None

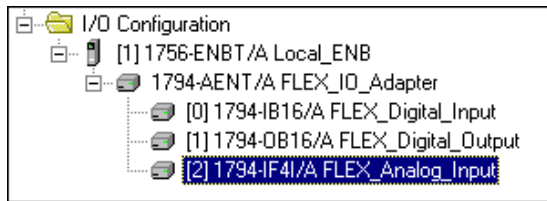
Real Time Sample: 0 ms  
 Interleave Module Interrupts

- Use the pull-down list to set the **Voltage/Current Range** for **Channel 0** to “0 to 10V - Binary”. (This range allows you to easily monitor the output with a voltmeter when you test the application.)

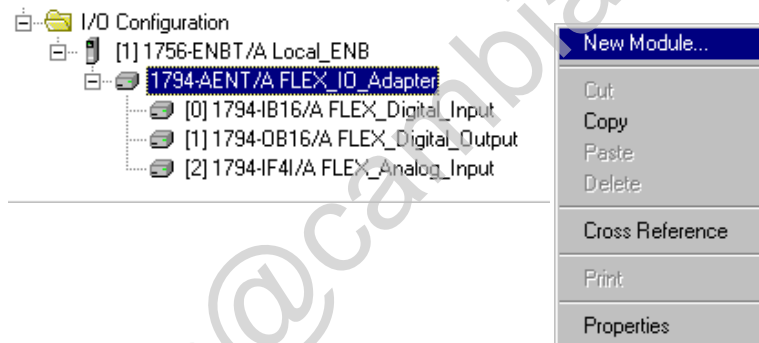
You can leave the other channels at their default values.

- Click on **Finish** to save the configuration.

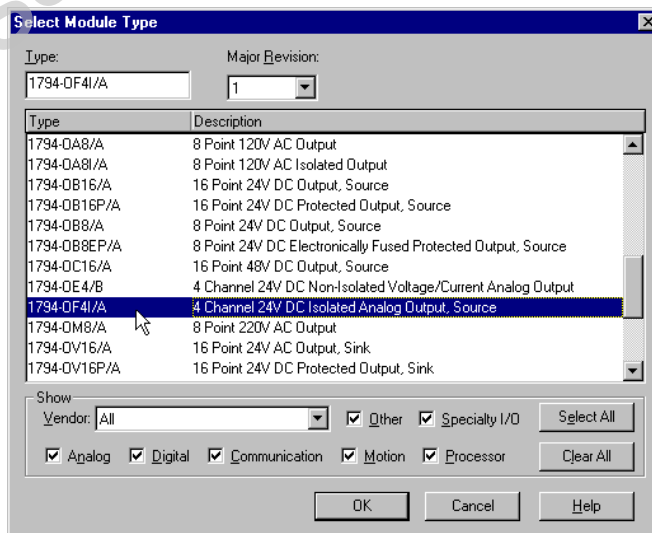
The I/O Configuration in the Project Window should now look similar to the one shown below.



## Add the Analog Output Module to the I/O Configuration

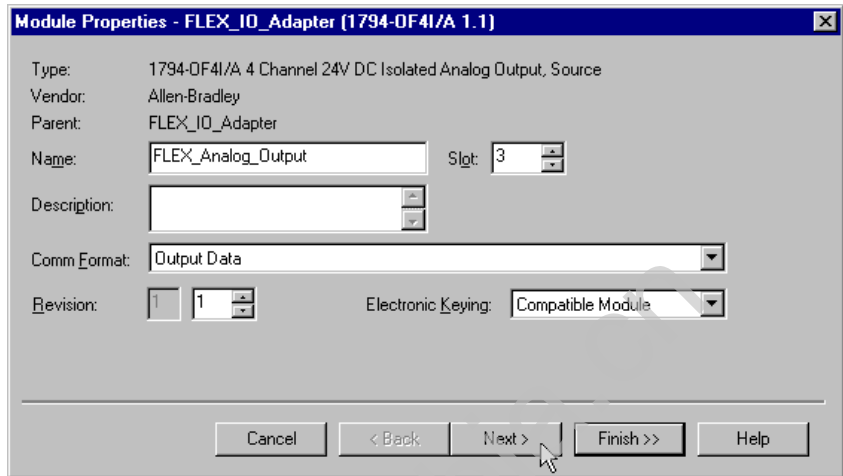


1. Right click on the **1794-AENT** adapter under the I/O Configuration folder and select **New Module** from the pop-up window. The **Select Module Type** window will open.



2. Select the **1794-OF41/A** analog output module from the list and click on **OK**.

The **Module Properties** window will open.

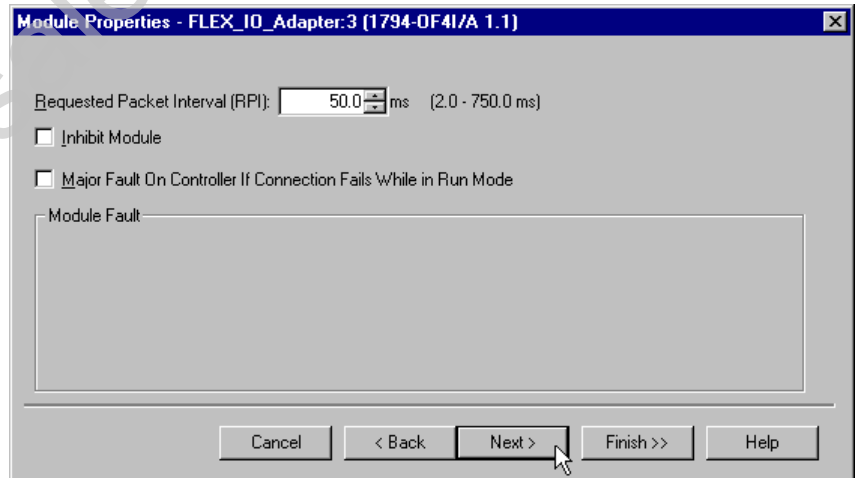


3. Enter the following parameters:

<b>Name</b>	FLEX_Analog_Output
<b>Slot</b>	3
<b>Comm Format</b>	Output Data <sup>(1)</sup>
<b>Electronic Keying</b>	Compatible Module

<sup>(1)</sup> All analog Comm Formats use direct connection. The default here is Output Data.

4. Click on the **Next** button. The following page will open:



5. This window allows you to adjust the **Requested Packet Interval (RPI)** to meet your system's requirements. For this example you can leave it at the default 50ms rate shown above. This RPI will be used for the direct connection to this analog module. The other analog module will communicate at the RPI selected for its connection. The two rack connected digital I/O modules will continue to communicate at the RPI of their rack connection.

6. Click on **Next** to open the next page. This page is used during online monitoring but not during initial configuration.

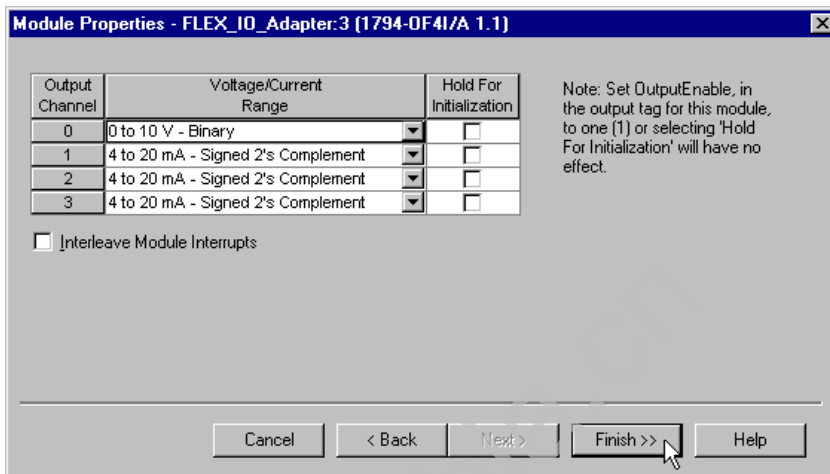
7. Click on **Next**. The page below opens for the 1794-OF41 module.

Channel	Safe State Value
0	0
1	0
2	0
3	0

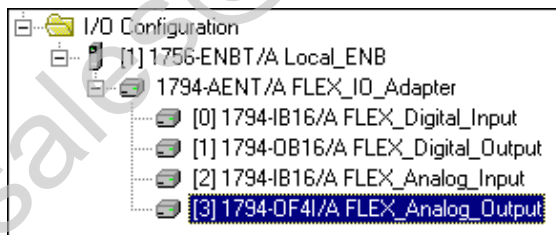
For this example you can leave these parameters at the default setting shown above. For an explanation of these parameters click on the **Help** button.

8. Click on the **Next** button.

The channel configuration page will open.



9. Use the pull-down list to set the **Voltage/Current Range** for **Channel 0** to “0 to 10V - Binary” to match the input configuration of the 1794-IF41 module. You can leave the other parameters at their default values.
10. Click on **Finish** to save the configuration. The I/O Configuration should now look similar to the one shown below.



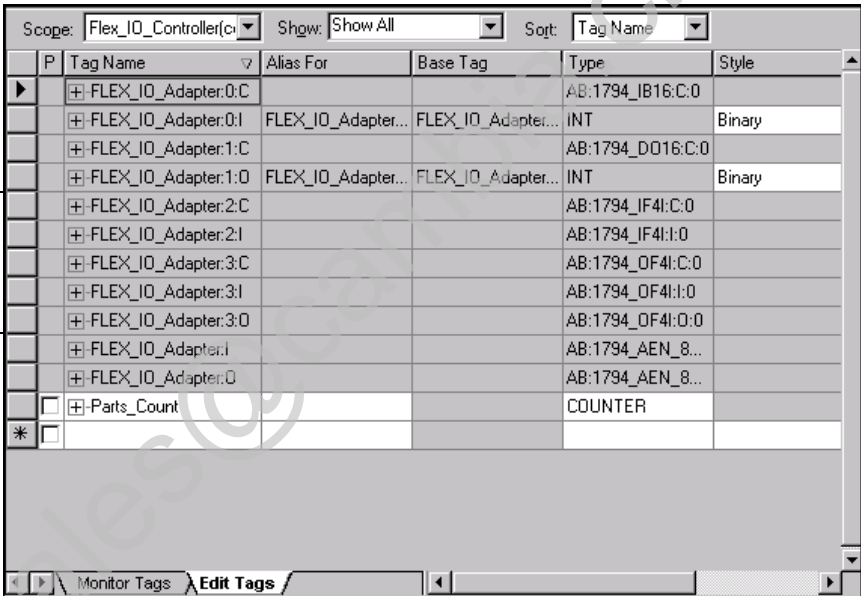
### Edit the Controller Tags

When you add modules to the I/O configuration the system creates Controller Tags for those modules. For the example program you need to add one more Controller Tag.



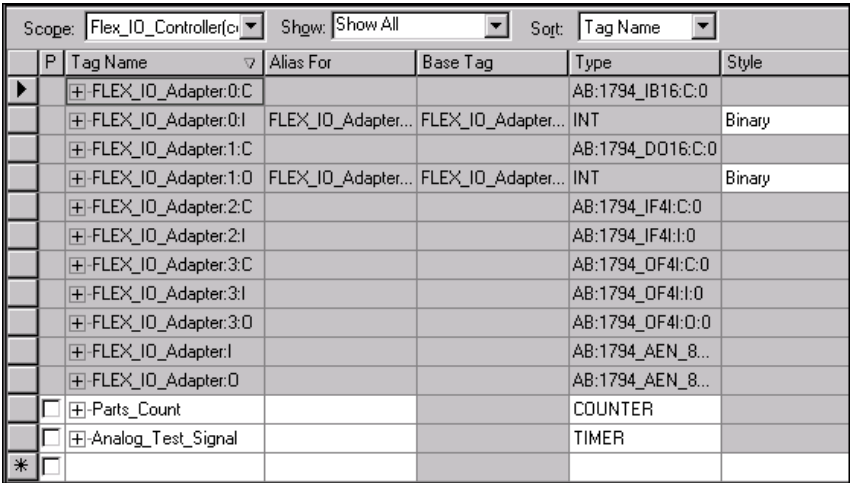
1. Double-click on the **Controller Tags** folder in the project window. Note that new tags have been added for the analog I/O modules.

New tags created by the system for the analog modules



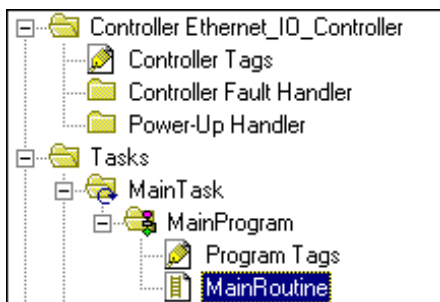
2. Make sure the **Edit Tags** tab at the bottom of the Controller Tags window is selected and create the following tag:

Tag	Type
Analog_Test_Signal	Timer

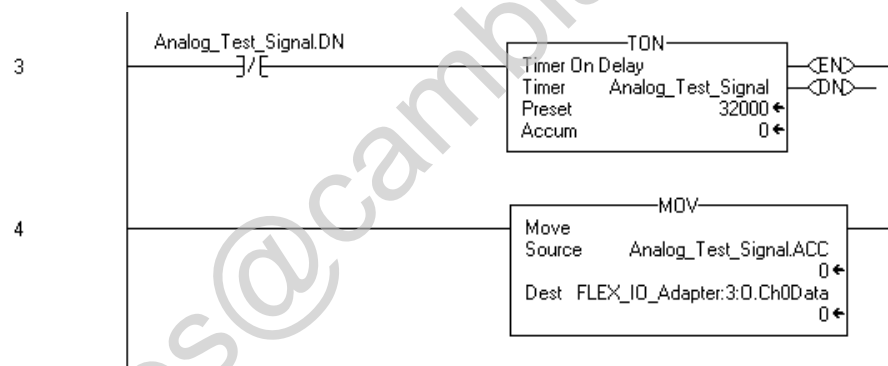


## Modify the Ladder Program

Make the following change to the ladder program to test the new configuration.



1. Double-click on **Main Routine** under the **Main Program** folder, and add rungs 3 and 4 to the ladder program.

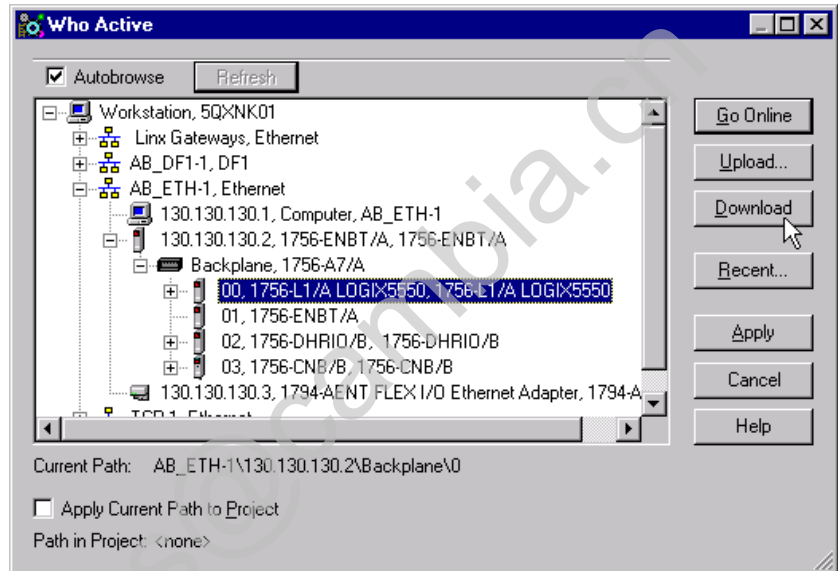


2. **Save** the program.

## Download the Program

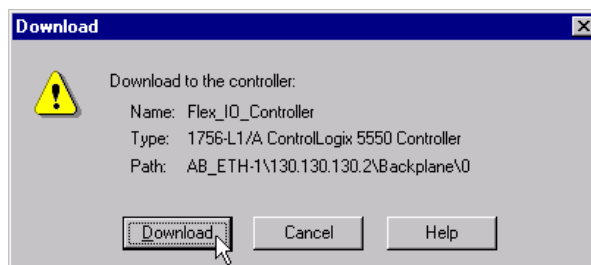
To download the program to the controller do the following:

1. Click on the **Communications** menu and select **Who Active**. The **Who Active** window will open (Your window will display the drivers and devices you have configured on your system).



2. Select your Ethernet driver (e.g., AB\_ETH-1) and expand the tree through the backplane of the local ControlLogix chassis.
3. Highlight the controller and click on the **Download** button to download the program to the Logix5550 controller.

You will see a message similar to the following:



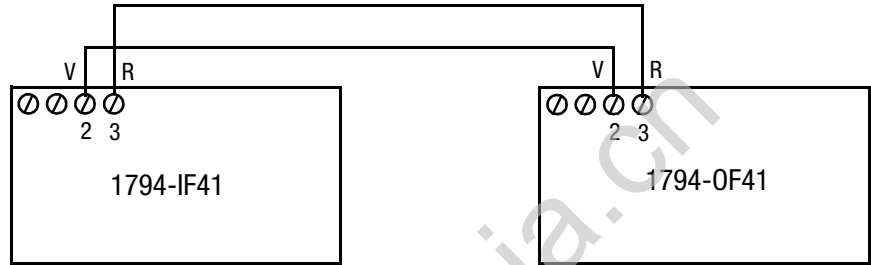
4. Click on the **Download** button. The program will be downloaded to the controller.
5. **Minimize** RSLogix5000.



## Test the Example Application

Use the following procedure to test the operation of the FLEX analog input and output modules:

1. Connect analog output channel 0 on the 1794-OF41/A module to analog input channel 0 on the 1794-IF41/A input module.



2. Restore **RSLogix5000** and place the controller in **Run** mode.
3. Double-click on the **Controller Tags** folder and select the **Monitor** tab.

Tag Name	Value	Force Mask	Style	Type
FLEX_IO_Adapter:0:C	{...}	{...}		AB:17
FLEX_IO_Adapter:0:I	2#0000_000...		Binary	INT
FLEX_IO_Adapter:1:C	{...}	{...}		AB:17
FLEX_IO_Adapter:1:I	2#0000_000...		Binary	INT
FLEX_IO_Adapter:2:C	{...}	{...}		AB:17
FLEX_IO_Adapter:2:I	{...}	{...}		AB:17
FLEX_IO_Adapter:2:I.Fault	2#0000_000...		Binary	DINT
FLEX_IO_Adapter:2:I.Ch0Data	25461		Decimal	INT
FLEX_IO_Adapter:2:I.Ch1Data	0		Decimal	INT
FLEX_IO_Adapter:2:I.Ch2Data	0		Decimal	INT
FLEX_IO_Adapter:2:I.Ch3Data	0		Decimal	INT

4. Monitor channel 0 of the 1794-IF41/A input module (FLEX\_IO\_Adapter:2.I.Ch0Data above). You should see the value slowly rise to approximately 32000, reset to zero, start rising again, etc., as the output of the timer is received from the 1794-OF41/A output module.

**TIP**



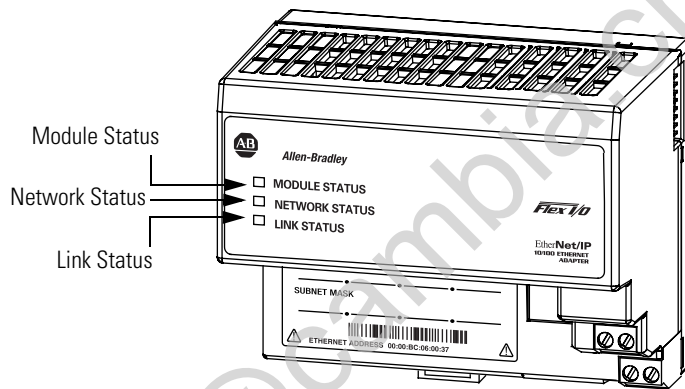
Refer to the FLEX I/O Analog I/O Module Installation Instructions, publications 1794-IN037 and 1794-IN038, for assistance in wiring and debugging the I/O modules.

This completes the Direct Connect Analog I/O example.

## LED Status Indicators

### Interpreting the Status Indicators

The faceplate of the 1794-AENT adapter is provided with LED indicators that display the Module Status, Network Status, and Link Status.



The following tables describe the states of the LED status indicators:

### Module Status

State	Status	Description
Off	No Power	Module does not have 24V DC power. Make sure power is being supplied to the module.
Flashing Green	Standby	Module not configured.
Green	Operational	Module operating correctly.
Flashing Red	Minor Fault	A recoverable fault has been detected. This could be caused by an incorrect or inconsistent configuration.
Red	Major Fault	An unrecoverable fault has been detected. Recycle power to the module. If this does not clear the fault, replace the module.
Flashing Red and Green	Self Test	Module performing power-up self test.

## Network Status

State	Status	Description
Off	Not Powered, No IP Address	Module is not powered, or does not have an IP address. <ul style="list-style-type: none"> <li>Verify there is power and the module is correctly wired to the supply.</li> <li>Make sure the module is configured</li> </ul>
Flashing Green	No Connections	Module has obtained an IP address, but has no established connections.
Green	CIP Connections	Module has an IP address and at least one established connection.
Flashing Red	Connection Timeout	One or more of the connections in which the module is the target has timed out.
Red	Duplicate IP Address	Module has detected that its IP address is already in use.
Flashing Red and Green	Self Test	Module performing power-up self test.

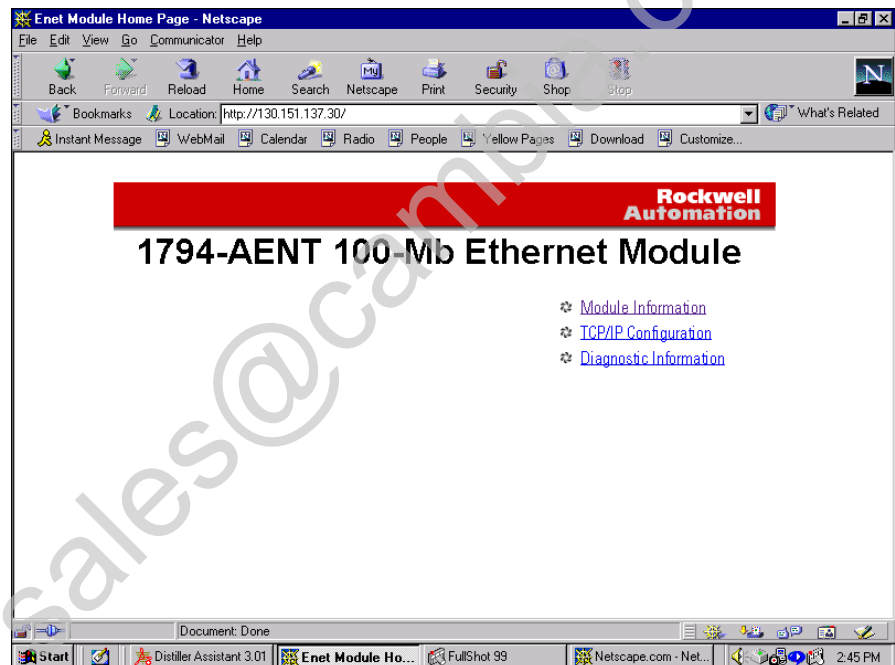
## Link Status

State	Status	Description
Off	No data transmission	Module not ready to communicate.
Green	Ready	Module is ready to communicate.
Flashing Green	Data transmission in progress	Module is communicating over the network.

## 1794-AENT Adapter Web Pages

### Web Page Diagnostics

The 1794-AENT adapter's Web pages offer extensive internal and network diagnostics. To view the Web pages, enter the adapter's IP address into Netscape or Microsoft Internet Explorer. You will see the following Web page:



The adapter's Web pages provide the following information:

- Module Information
- TCP/IP Configuration
- Diagnostic Information

Some examples of these pages are shown in the following figures.

## Module Information

Module Information	
Product Name	1794-AENT
Vendor	1
Product Type	12
Product Code	90
Module Revision	1.63
Serial Number	SN 12345678
Module Status	Specific: 0x8
Module Name	* Not Configured *
Module Description	* Not Configured *
Module Location	* Not Configured *
Firmware Identification	May 17 2001, 14:08:47
Module Uptime	06h:24m:40s

The **Module Information** page provides specific information about your AEN adapter, such as its serial number and firmware version.

## TCP/IP Configuration

TCP/IP Configuration	
IP Address	130.151.137.30
Subnet Mask	255.255.254.0
Gateway Address	130.151.136.1
Name Server	0.0.0.0
Secondary Name Server	0.0.0.0
Default Domain Name	* Not Configured *
BOOTP Enabled	No
Ethernet Address	00:00:BC:06:00:15

The **TCP/IP Configuration** page provides the EtherNet/IP configuration of your adapter, including IP Address, Gateway Address, Subnet Mask, etc.

## Diagnostic Information

### ***Diagnostic Information***

<i>Connection Manager</i>	<i>Network Statistics</i>	<i>Miscellaneous</i>
<ul style="list-style-type: none"> <li>● <a href="#">Connection Manager Statistics</a></li> </ul>	<ul style="list-style-type: none"> <li>● <a href="#">Ethernet Statistics</a></li> <li>● <a href="#">ICMP Statistics</a></li> <li>● <a href="#">IGMP Statistics</a></li> <li>● <a href="#">IP Statistics</a></li> <li>● <a href="#">UDP Statistics</a></li> <li>● <a href="#">TCP Statistics</a></li> <li>● <a href="#">Network Memory Statistics</a></li> <li>● <a href="#">Mbuf Statistics</a></li> </ul>	<ul style="list-style-type: none"> <li>● <a href="#">General Memory Statistics</a></li> <li>● <a href="#">Encapsulation Statistics</a></li> <li>● <a href="#">Enet/IP (CIP) Statistics</a></li> <li>● <a href="#">Class 1 (CIP) Connections</a></li> <li>● <a href="#">Class 3 (CIP) Connections</a></li> </ul>

The 1794-AENT adapter provides advanced diagnostic information via this page. This information may be useful to systems administrators and other experienced information technology personnel. Several examples of this information are shown in the following figures.

### *Connection Manager*

### ***Connection Manager Statistics***

Open Requests	0
Open Format Rejects	0
Open Resource Rejects	0
Open Other Rejects	0
Close Requests	0
Close Format Rejects	0
Close Other Rejects	0
Connection Timeouts	0

Refresh counters every  seconds. 0 disables refresh.

Network Statistics

**Ethernet Statistics**

motfec (unit number 0):  
 Flags: (0x8063) UP BROADCAST MULTICAST ARP RUNNING  
 Type: ETHERNET\_CSMACD  
 Internet address: 130.151.137.30  
 Broadcast address: 130.151.255.255  
 Netmask 0xffff0000 Subnetmask 0xffffe000  
 Ethernet address is 00:00:bc:06:00:15  
 Metric is 0  
 Maximum Transfer Unit size is 1500  
 14254 packets received; 117 packets sent  
 14147 multicast packets received  
 0 multicast packets sent  
 0 input errors; 0 output errors  
 0 collisions; 0 dropped

Refresh counters every  seconds. 0 disables refresh.

Miscellaneous

**Encapsulation Statistics**

Commands Received	4		
Replies Sent	4	Cumulative Encap (TCP) Connections	0
Error Replies Sent	0	Active Total Encap (TCP) Connections	0
Commands Sent	0	Active Incoming Encap (TCP) Connections	0
Replies Received	0	Active Outgoing Encap (TCP) Connections	0
Error Replies Received	0	Total Encap (TCP) Connection Limit	64
Unhandled Commands	0	Incoming Encap (TCP) Connection Limit	48
Unhandled Bad Data	0	Outgoing Encap (TCP) Connection Limit	32
Bad Session ID	0		
Bad Target ID	0		
Unsupported Revision	0		

Refresh counters every  seconds. 0 disables refresh.

*Miscellaneous (continued)*

CPU Utilization Percentage	48.00
Active Class 1 Connections	0
Active Class 3 Connections (Client)	0
Active Class 3 Connections (Server)	0
Class 1 Consumer Transport Limit	31
Class 1 Producer Transport Limit	31
Class 3 Transport Limit	32
UCMM Transaction (Client) Limit	8
UCMM Transaction (Server) Limit	8
UCMM Worst Backlog (Client)	0
UCMM Current Backlog (Client)	0
UCMM Worst Backlog (Server)	0
UCMM Current Backlog (Server)	0

Refresh counters every  seconds. 0 disables refresh.



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## Configuring the RSLinx Ethernet Communication Driver

### What This Appendix Contains

In order to communicate with your 1794-AENT adapters over your network you must configure the RSLinx Ethernet communication driver (AB\_ETH). You can configure the AB\_ETH driver with the IP addresses of all the Ethernet devices on your system. You will need this driver to download the example application programs in this manual.

The following table lists the contents of this appendix and where to find specific information:

For information about	See page
Installing the RSLinx Software	C-1
Configuring the AB_ETH Driver	C-2

### Installing the RSLinx Software

Use the following procedure to install RSLinx software on your computer.

1. Insert the CD in the CD-ROM drive.

**Note:** The CD-ROM supports Windows Autorun. Once inserted into the CD-ROM drive, if you have Autorun configured, the installation will automatically start at the first setup screen.

If Autorun is not configured for your CD-ROM drive, go to step 2.

2. From the **Start** menu, choose **Run**.

You will see the Run pop-up window.

3. Type **d:/setup** (if it doesn't appear automatically), where **d:** is your CD-ROM driver letter.

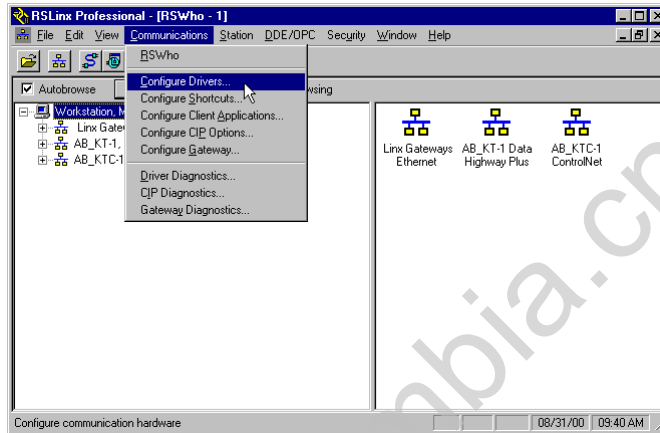
4. Click on **OK**.

You will see the progress bar, followed by the welcome screen.

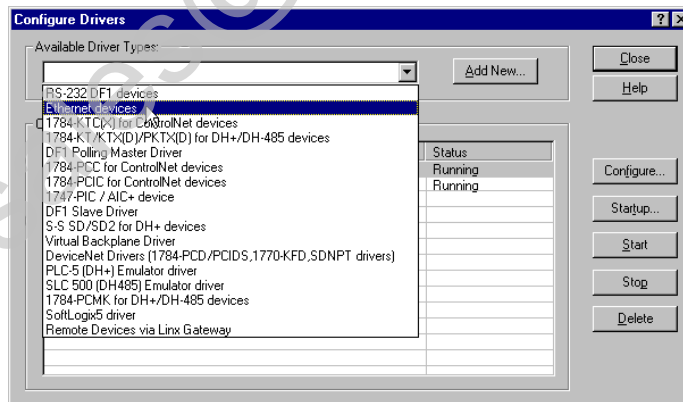
## Configuring the AB\_ETH Driver

To configure the AB-ETH Ethernet communication driver perform the following steps:

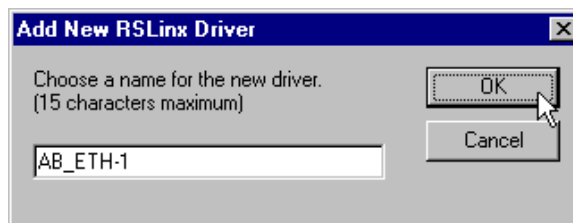
1. Start **RSLinx**.



2. From the **Communications** menu, select **Configure Drivers**.
3. Click on the arrow to the right of the **Available Driver Types** box. The **Available Driver Types** list will appear.



4. Select **Ethernet Devices** and click on **Add/New**. You will be prompted to name the driver.

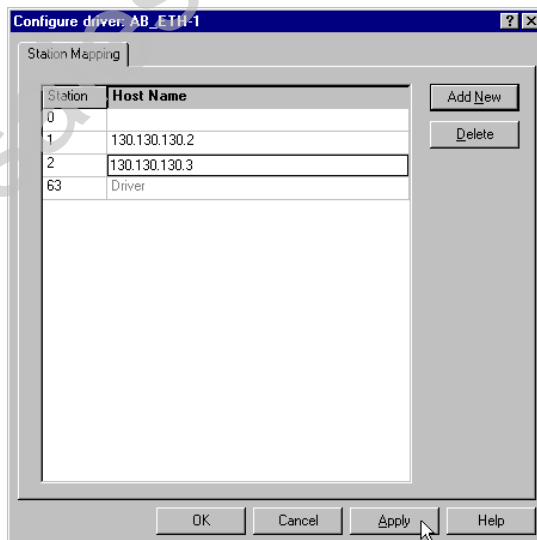


5. Select the default driver name (e.g., AB\_ETH-1) or type in your own name and click on **OK**.

The **Configure driver** window will appear with the **Station Mapping** page open.

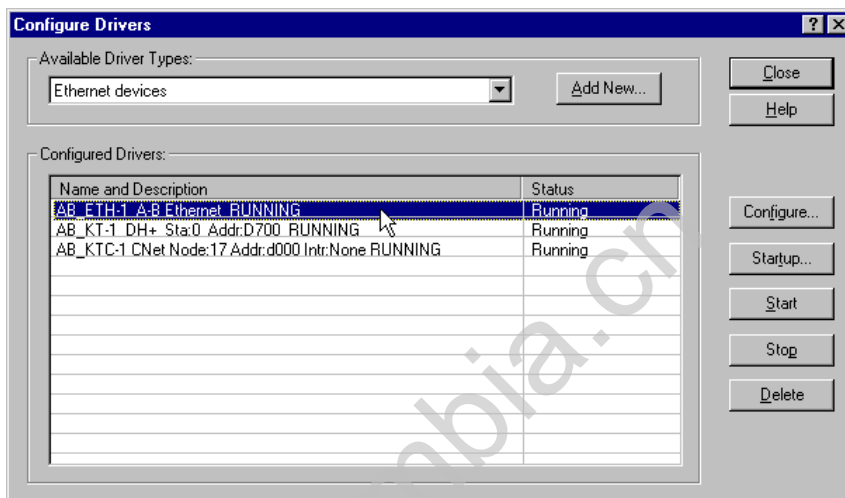


6. Click on **Add New** and enter the IP address or Host Name of your Ethernet device (e.g., 130.130.130.2, "Pump1", etc.).
7. Repeat step 6 for each additional Ethernet device you need to access.



8. When you are done entering the IP addresses, click on **Apply**. Then click on **OK** to close the **Configure driver** window.

The new driver will appear in the list of configured drivers. (Your list will display the drivers you have configured on your workstation.)



9. Close RSLinx

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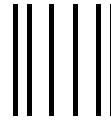
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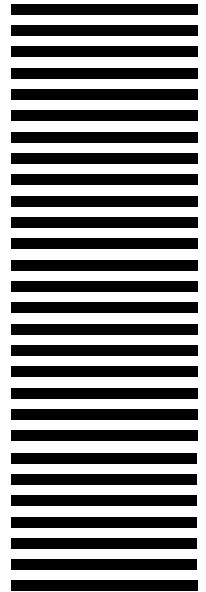
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