Honeywell

ControlEdge PLC

Release 174.1

EtherNet/IP User's Guide

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DISCLAIMER

CONTENTS

CHAPTER

1 ABOUT THIS GUIDE

This document provides an overview of the use of EtherNet/IP™ communication with ControlEdge™ 900 Controller and offers practical guidance to perform a successful integration of EtherNet/IP with ControlEdge™ 900 Controller.

Revision history

Revision	Date	Description
A	December 2022	Initial release of this document

Intended audience

This documentation is intended for the following audience: Users who plan, install, configure, operate, or maintain ControlEdge™ 900 controllers running the eCLR (IEC 61131-3) execution environment.

Prerequisite skills

Knowledge of SCADA systems and experience of working in a Microsoft Windows environment are required.

Introduction to ControlEdge Technology

Item	Description
ControlEdge PLC	ControlEdge 900 controllers running the eCLR (IEC 61131-3) execution environment with PLC software options configured with ControlEdge Builder.
ControlEdge RTU	ControlEdge 2020 controllers running the eCLR (IEC 61131-3) execution environment with RTU software options configured with ControlEdge Builder.
ControlEdge UOC	ControlEdge 900 controllers running the Honeywell control execution environment (CEE) configured with Experion Control Builder.

Special terms

The following table describes some commonly used industry-wide and Honeywell-specific terminology:

Terminology	Description
Adapter	A communication device which connects to the EtherNet/IP network to serve data from a set of devices or modules underneath it. Adapter typically supports I/O connectivity from Scanners via implicit EtherNet/IP connections.
Assembly	A set of data passed between a Originator and a Target after an implicit I/O connection has been established on an EtherNet/IP network.
CIP	Common Industrial Protocol
EDS	Electronic Data Sheet. A text file which specifies all the properties of an EtherNet/IP device necessary for a Scanner module to communicate with it. EDS files may be used in the first step of creating an I/O module or device type for interfacing to an EtherNet/IP device.
IP	Internet Protocol
Originator	Originator is the controller that initiates any data exchange with EtherNet/IP devices on the EtherNet/IP network.
RPI	Requested Packet Interval. The repetitive interval by which assemblies are periodically transported over EtherNet/IP I/O connections between Producer and Consumer.
Scanner	A device which connects to the EtherNet/IP network to act as a client of other EtherNet/IP connected devices. ControlEdge 900 Controller acts as EtherNet/IP Scanner. It connects to and exchanges data with Adapters of Modular I/O stations, directly connected devices and Rockwell AB ControLogix controllers.
Target	Target is the EtherNet/IP device that address any data requests generated by the controller.
TCP	Transport Control Protocol
UDP	User Datagram Protocol
ODVA	Open DeviceNet Vendors Association

Related documents

The following list identifies publications that may contain information relevant to the information in this document.

- ControlEdge Builder Software Installation User's Guide
- ControlEdge Builder Software Change Notice
- ControlEdge PLC and ControlEdge RTU Getting started
- ControlEdge Builder User's Guide
- ControlEdge 900 Platform Hardware Planning and Installation Guide
- ControlEdge Builder Function and Function Block Configuration Reference Guide
- ControlEdge Builder Protocol Configuration Reference Guide
- ControlEdge PLC and ControlEdge RTU Network and Security Planning Guide
- ControlEdge RTU and PLC DNP3 Outstation Device Profile
- ControlEdge RTU and PLC DNP3 Master Device Profile
- Firmware Manager User Guide

CHAPTER

2 OVERVIEW

EtherNet/IP™ (Ethernet industrial protocol) is an application layer protocol for industrial automation applications. It uses all the transport and control protocols used in traditional Ethernet including the Transport Control Protocol (TCP), the User Datagram Protocol (UDP), the Internet Protocol (IP) and the media access and signaling technologies found in off-the-shelf Ethernet interfaces and devices. It allows the user to address a broad spectrum of process control needs using a single technology.

EtherNet/IP is currently managed by the Open DeviceNet Vendors Association (ODVA). EtherNet/IP is the name given to the Common Industrial Protocol (CIP™), as implemented over standard Ethernet (IEEE 802.3 and the TCP/IP UDP protocol suite). CIP encompasses a comprehensive suite of messages and services for a variety of manufacturing automation applications, including control, safety, synchronization, motion, configuration and information.

ControlEdge PLC supports comprehensive integration between ControlEdge 900 Ccontrollers and compatible devices installed on an EtherNet/IP network. An EtherNet/IP enabled ControlEdge 900 Controller can communicate with EtherNet/IP compliant devices connected on EtherNet/IP networks. Data accessed from EtherNet/IP devices (reads and writes) can be used for control and indication.

ControlEdge Builder provides options to create new device types for the supported EtherNet/IP compatible devices. To enable easy integration between ControlEdge 900 Controller and third-party controllers, ControlEdge Builder also provides a set of function blocks for the communication between controllers.

CHAPTER

3 PLANNING AND DESIGNING ETHERNET/IP

The following sections provide more information to help you plan and design an EtherNet/IP interface for the integration between ControlEdge 900 Controller and the EtherNet/IP compatible devices:

- EtherNet/IP implementation architecture and topology
- Network usage guidelines and recommendations

Tested EtherNet/IP devices

The following table lists the tested EtherNet/IP compliant devices:

Device category	Device name	Vendor	Revision
Adapter + I/O module	Turck BL20-E-GW-EN, adapter	Turck	2.7
	BL20-E-4IOL	Turck	2.7
	BL20-2RFID-S	Turck	2.7
	BL20-S4T-SBBS	Turck	2.7
	BL20-PF-24VDC-D	Turck	2.7
	BL20-P3T-SBB	Turck	2.7
	BL20-BR-24VDC-D	Turck	2.7
	BL20-4DO-24VDC-0.5A-P	Turck	2.7
	BL20-S4T-SBCS	Turck	2.7
	BL20-4DI-24VDC-P	Turck	2.7
	BL20-2AIH-I	Turck	2.7
	BL20-2AOH-I	Turck	2.7
	BL20-4DI-NAMUR	Turck	2.7
	BL20-2DO-R-CO	Turck	2.7
	BL20-E-2CNT-2PWM	Turck	2.7
	1756 EN2T	Rockwell Automation	N/A

Device category	Device name	Vendor	Revision
	1756 EN2TR	Rockwell Automation	N/A
	1756-IB32/B	Rockwell Automation	N/A
	1756-OB32/B	Rockwell Automation	N/A
	1756-IF16	Rockwell Automation	N/A
	1756 IF6I	Rockwell Automation	N/A
	1756 IF8I	Rockwell Automation	N/A
	1756-OF4	Rockwell Automation	N/A
	1794 AENTR	Rockwell Automation	N/A
	1794-IB16/A	Rockwell Automation	N/A
	1794-OB16/A	Rockwell Automation	N/A
	1794-IE8/B	Rockwell Automation	N/A
	1794-OE4/B	Rockwell Automation	N/A
	1794-OW8/A	Rockwell Automation	N/A
	1756-IF8H	Rockwell Automation	N/A
	1756-OF8H	Rockwell Automation	N/A
Drive	Rockwell PowerFlex 525	Rockwell Automation	N/A
	Rockwell PowerFlex 753	Rockwell Automation	N/A

Device category	Device name	Vendor	Revision
	YASKAWA V1000	YASKAWA	N/A
	Sinamics G120	Siemens	N/A
Remote I/O	FEN20-16DXP	Turck	2.7
	FEN20-4DI-4DXP	Turck	2.7
	1732E-OF4	Rockwell Automation	1.006
	Rockwell ArmorBlock 1732E-16CFGM12P5QCR	Rockwell Automation	1.14
	Turck BLCEN-4M12MT-4AI4AO-VI	Turck	2.5
	TBEN-L5-16DIP	Turck	2.7
	Turck TBEN-L5-16DOP	Turck	2.7
	Turck PBEN-L4-8DIDO	Turck	2.7

ATTENTION: You can also add and configure other EtherNet/IP compliant devices and modules which are not covered in the list above, however these must be qualified and validated by the project team internally. Only after successful communication and functionality testing, these new devices should be offered to customer. If you have any difficulties in communicating a new EtherNet/IP device or module, please get in touch with Honeywell Product Development for support.

EtherNet/IP implementation architecture and topologies

EtherNet/IP can be used to communicate between ControlEdge 900 controller and the EtherNet/IP compatible third-party devices, such as I/Os, drives, and relays.

Supported EtherNet/IP topologies

The EtherNet/IP-I/O devices, drives, and relays can be set up in one of the following network topologies:

- Device Level Ring (DLR) topology - The nodes of the network are connected in a circular mode, forming a ring.
- Linear bus topology - Nodes are connected in a linear array, with a single cable hop from one device to the next.
- Star topology - The nodes of the network are connected to a central hub.

The topology can also be a hybrid setup with a combination of star, linear bus, and ring topologies.

A Device-level ring topology is recommended because it provides a network that is single-fault tolerant.

In an EtherNet/IP implementation setup, the ring network includes the following components:

- EtherNet/IP compatible I/O devices, drives, and relays
- Ring supervisor
- ETAP modules for single port devices
- Stratix 5700 or Stratix 8000 switches

The Ring supervisor is an important component on the ring network because it is used as the connection media between the EtherNet/IP-compatible devices and the stratix switch. Only one node (ETAP or stratix switch) in the Device Level Ring topology can be configured as an active ring supervisor.

The stratix 5700/8000 switch is capable of playing Ring Supervisor role and can be a node on the ring.

The 1783-ETAP modules are also used to connect single-port devices on the ring and linear bus network.

> **NOTE:** Moxa or any other unmanaged switches (copper/fiber) are not recommended for ring network (HSR/DLR).

Device Level Ring (DLR)

You can set up a Device Level Ring topology with or without ETAP.

> **NOTE:** It is recommended to set up Device Level Ring topology without ETAP.

> **NOTE:** ETAP is optional for the Device Level Ring topology. If it is used, it can be configured using Rockwell RSLogix software. Refer to the vendor's document for more information.

> **NOTE:** Stratix switches which support the Device Level Ring topology should be configured. Refer to the vendor's document for how to configure the switch.

You must follow the rules below for Device Level Ring topology:

- If the Device Level Ring topology is without ETAP, configure CPM downlink network topology as “DLR Topology” (and Rotary switch on EPM is setting as 5).

  For more information about how to configure the network topology, Binding EtherNet/IP Client to an Ethernet port

  For more information about the rotary switch, see "Assembling I/O racks" in the ControlEdge 900 Controller Hardware Planning and Installation Guide.
- If the Device Level Ring topology is with ETAP, configure CPM downlink network topology as “Star Topology” (and Rotary switch on EPM is setting as 4).
- Do not connect non-DLR devices directly to the network. Non-DLR devices must be connected to the network through 1783-ETAP.

Figure 3-1: Device Level Ring topology without ETAP

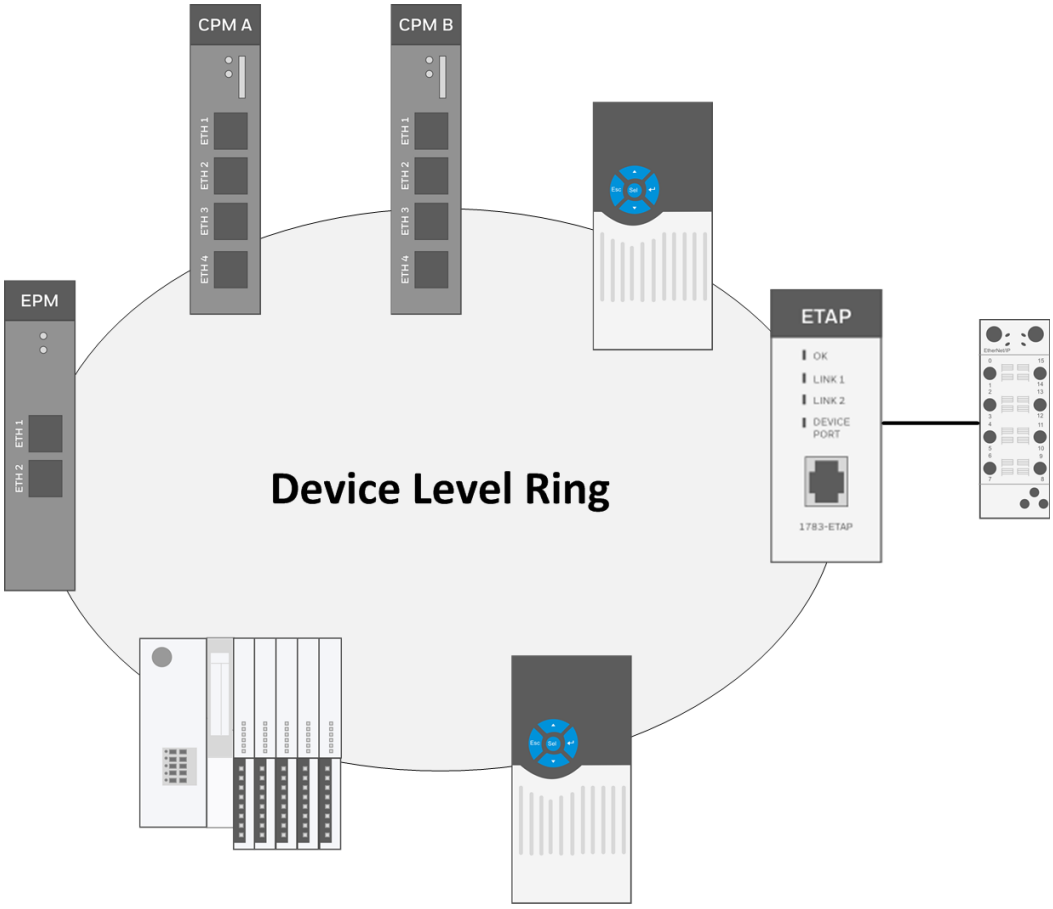
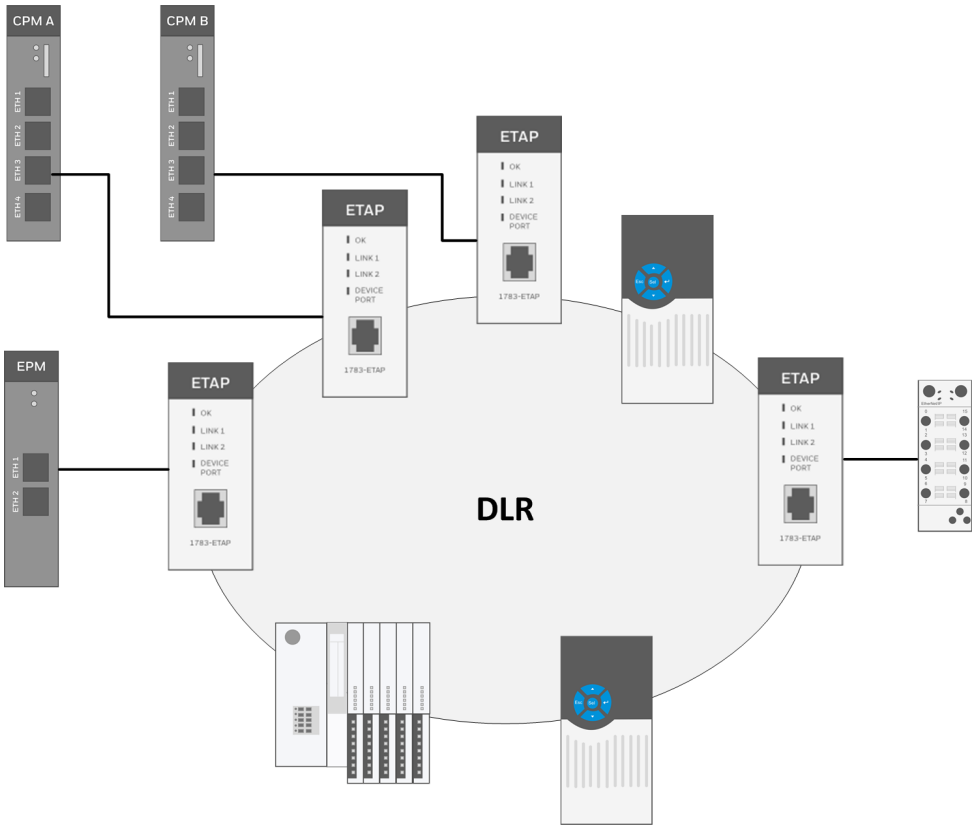


Figure 3-2: Device Level Ring topology with ETAP



STAR with Stratix switch or MOXA switch

You must follow the rule below for Star topology:

- Only use ETH3 to connect to Stratix or MOXA switch with EtherNet/IP devices.
- Tested switches include MOXA, Stratix 5700 and Stratix 8000.
- Inter-connection with more switches for port expanding is allowed.
- Single EPM or EtherNet/IP device failed won't impact other devices operation.
- Maximum two network devices are allowed to be connected between CPM and EPM including switch and Fiber optical convertor.

Figure 3-3: Star with Moxa switch

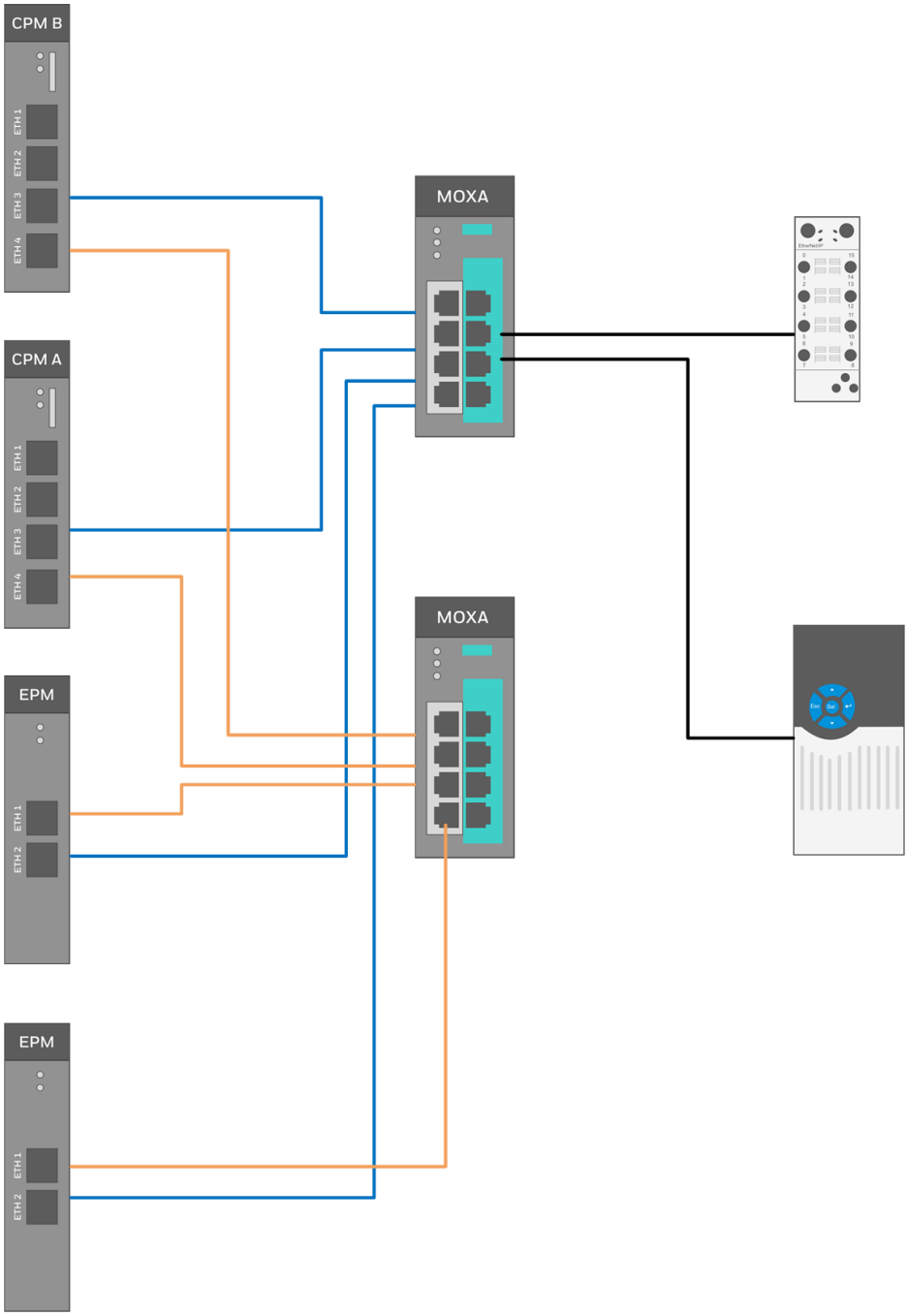
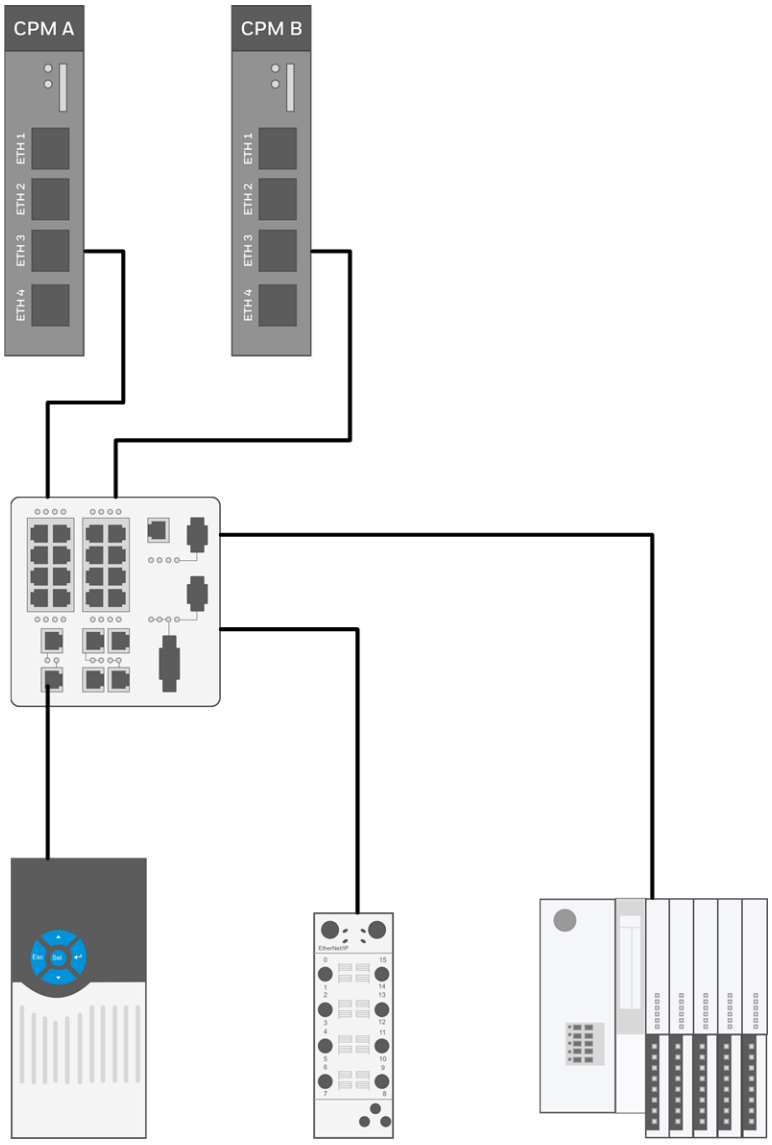


Figure 3-4: Star with Stratix 5700



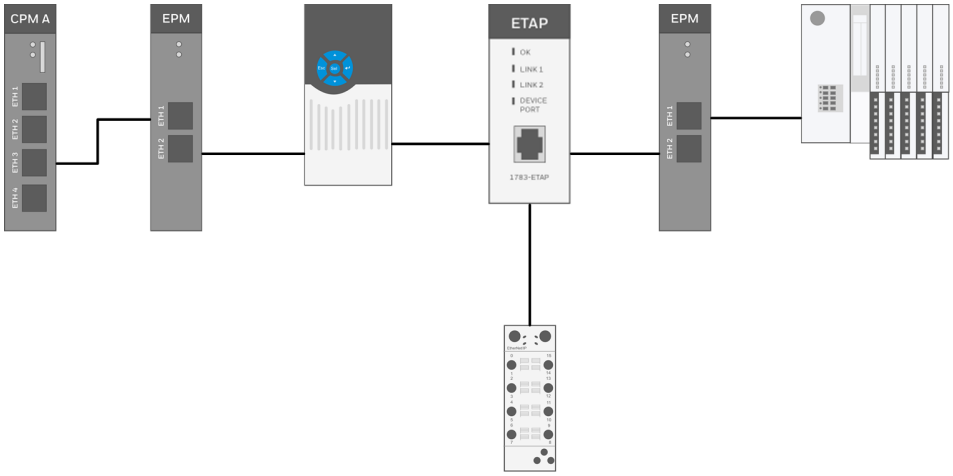
Linear (Broken Ring) on Non-redundant CPM

- This topology applies to small projects and simple connection.
- It supports single port EtherNet/IP devices by ETAP and dual port devices.
- If EPM is connected in the topology directly, CPM downlink network topology must be configured as "Start Topology" (and Rotary switch on EPM is setting as 5).

  For more information about how to configure the network topology, see "Configuring ETH3 and ETH4 for ControlEdge 900 Controller" in the ControlEdge Builder User's Guide.

  For more information about the rotary switch, see "Assembling I/O racks" in the ControlEdge 900 Controller Hardware Planning and Installation Guide.
- If EPM is connected in the topology through ETAP, CPM downlink network topology must be configured as "Start Topology" (and Rotary switch on EPM is set as 4).

Figure 3-5: Non-redundant CPM as Client through Linear



Common network for multiple CPM

- All EtherNet/IP devices connected with different CPMs can be connected under the same network.
- Each device (EPM or EtherNet/IP device) only can be owned by a unique host (CPM). Not support to be owned by multiple controllers (except redundant controller).
- You must avoid IP conflict on each device.
- Common network topologies support both Device Level Ring and STAR.

Figure 3-6: Downlink as Client through MOXA dual STAR

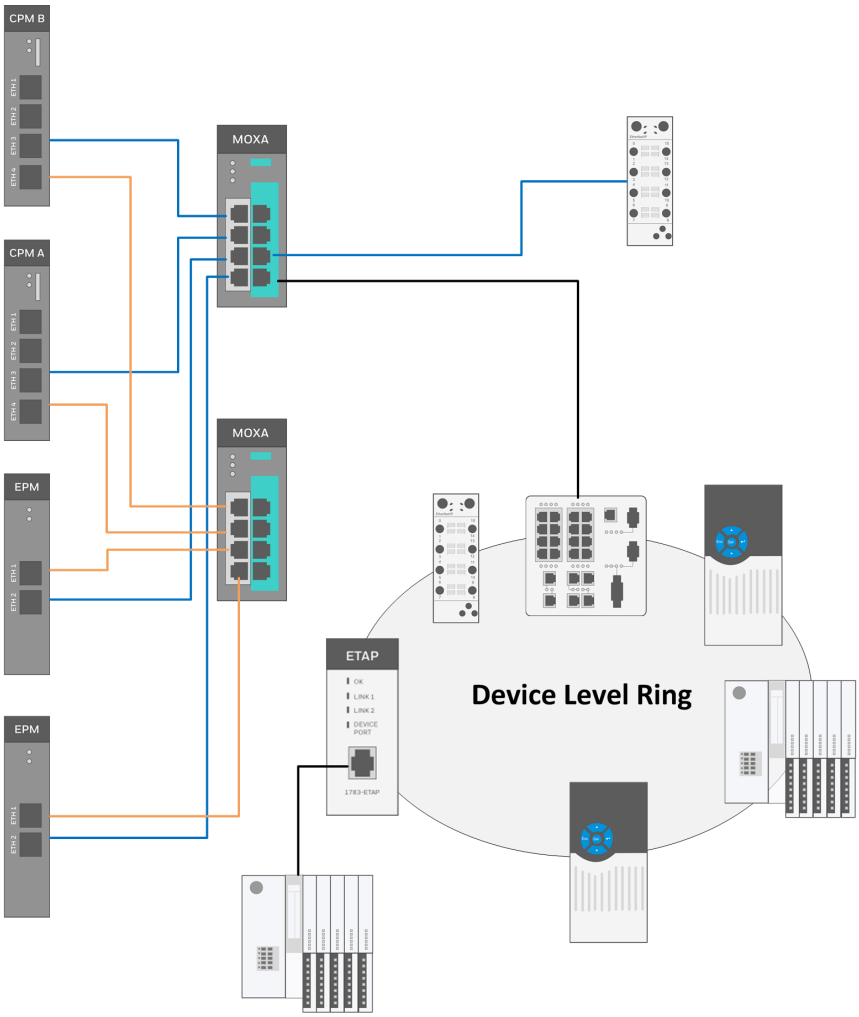
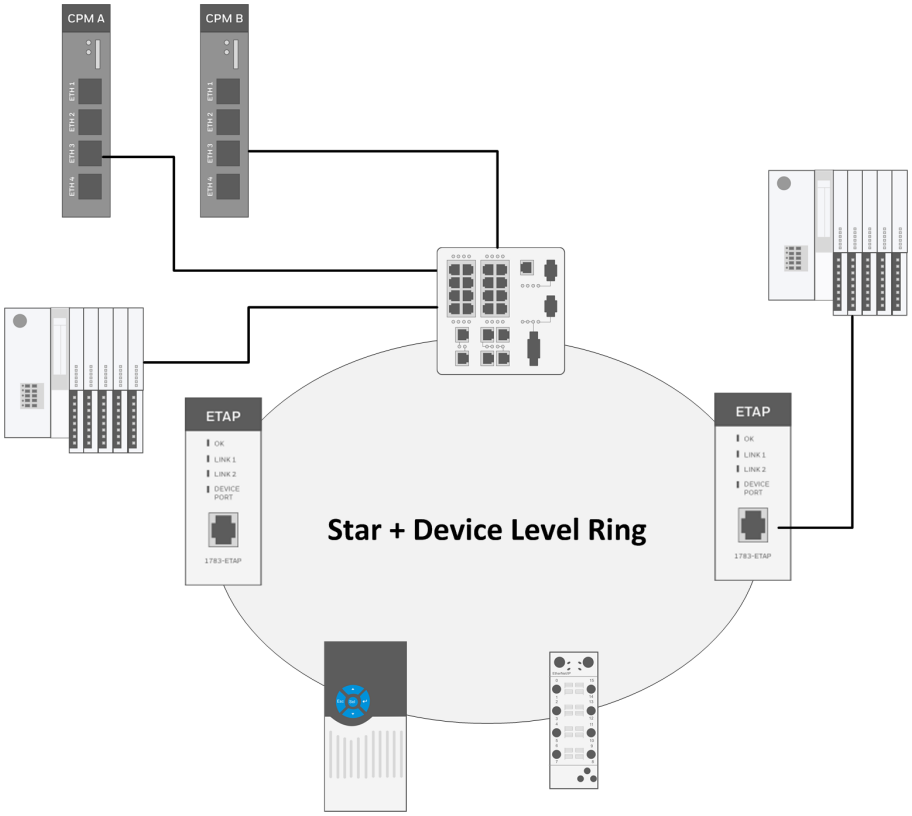


Figure 3-7: Downlink as Client through STRATIX for Device Level Ring



Network usage guidelines and recommendations

Consider the guidelines and recommendations in the following table.

Guideline/Recommendation	Explanation
Do not configure a supervisor (ETAP or stratix switch) on a linear network.	If your linear network includes non-DLR nodes and has a supervisor-enabled node on the network, it will impact communication to non-DLR devices connected to the linear network.
Connect switches to a DLR network via 1783-ETAP.	If switches are connected to the DLR network without a 1783-ETAP, the network will experience unpredictable behavior.
Run all nodes on the DLR network at 100 Mbps and in Full-duplex mode.	These configuration values provide the best performance for your network.

Guideline/Recommendation	Explanation
	Additionally, we recommend the following: • Use auto-negotiate for all nodes on the DLR network. • Do not use auto-negotiate on one node and then force speed on the next node linked to it.
Do not physically close a DLR network without a supervisor configured on the network.	A DLR network without a supervisor node results in a network storm. If you do close the DLR network without a supervisor configured, break the ring and configure at least one supervisor before physically reconnecting the network.

CHAPTER

4 CONFIGURATION

The following table lists workflows for different scenarios.

Task	Go to
Configure EtherNet/IP Client	Configure EtherNet/IP devices with EDS file: 1. See Binding EtherNet/IP Client to an Ethernet port for more information. 2. See Registering device types for more information. 3. See Configuring EtherNet/IP devices using EDS files for more information.
	If you do not have the EDS file, you can configure generic EtherNet/IP devices: 1. See Binding EtherNet/IP Client to an Ethernet port for more information. 2. See Configuring generic EtherNet/IP devices for more information.
Configure EtherNet/IP Server	1. See Binding EtherNet/IP Server to an Ethernet port for more information. 2. See Selecting EtherNet/IP for variables for more information.
Configure communication with C300/UOC	When ControlEdge 900 controller communicates with C300/UOC, it acts as an EtherNet/IP Server. Only User-defined data type **STRUCT** is supported for communicating with C300/UOC. 1. See Binding EtherNet/IP Server to an Ethernet port for more information. 2. Declare a STRUCT data type. See Configuring communication with C300/UOC for more information. 3. Configure the target variable data type as

Task	Go to
	the STRUCT data type. 4. See Selecting EtherNet/IP for variables for more information.
Configure communication with ControlLogix controllers	If ControlEdge 900 controller acts as an EtherNet/IP client: ControlEdge Builder provides function blocks to enable the communication, see "EtherNetIP" in the *ControlEdge Builder Function and Function Block Configuration Reference*.
	If ControlEdge 900 controller acts as an EtherNet/IP server, user-defined data types are not supported. See Configuring communication with ControlLogix controllers for more information. 1. See Binding EtherNet/IP Server to an Ethernet port for more information. 2. See Selecting EtherNet/IP for variables for more information.

Configuring EtherNet/IP Client

The ControlEdge 900 controller supports communication with EtherNet/IP compliant third-party devices, such as I/O modules, drives, and relays. To facilitate the integration of PLC with the EtherNet/IP compliant devices, you must add and configure equivalent devices by using ControlEdge Builder. Each configured device represents an equivalent physical EtherNet/IP compliant-device, which is installed on the EtherNet/IP network.

To enable communication between I/O modules and the EtherNet/IP network, an adapter is needed. The adapter provides the Assembly connection feature, which helps you in consolidating connections from a group of I/O modules.

You can create EtherNet/IP device, drive, and I/O module types by using Electronic Data Sheets (EDS) files. Or if you do not have the EDS file, you can create a generic EtherNet/IP device.

Binding EtherNet/IP Client to an Ethernet port

This section introduces how to bind EtherNet/IP Client protocol to ETH3.

ETH4 has the same configuration as ETH3, so only ETH3 should be configured manually.

Star or *DLR* topology is required if you bind EtherNet/IP Client.

To bind EtherNet/IP Client

1. From Home Page, click **Configure Ethernet Ports** and select **ETH3**.
2. Under **Network Setting**, configure the IP address and the subnet mask.
   - The default IP address is 172.168.0.101.
   - The range of the IP address is from 101 to 254.
   - The IP address cannot be in the same network subnet as ETH1 and ETH2.
   - The IP address must be in the same network subnet as the EtherNet/IP device.
   - The IP address cannot be conflict with the IP address of EtherNet/IP device.
   - The IP address cannot be conflict with the EPM IP address.
3. Under **Protocol Binding**, select **EtherNet/IP Client**.
4. Under **I/O Network Topology**, Select **DLR Topology** or **Star Topology**.

   This configuration should match the position of 100X switch on the EPM hardware. 4 is for Star network topology and 5 is for DLR network topology. For more information about the switch, see “Assembling I/O racks” in the *ControlEdge 900 Controller Hardware Planning and Installation Guide*.

   If you select DLR Topology, you should configure the following 4 options.

   - **Role**: Specify the role for CPM as **Supervisor** or **Member**. The default value is **Supervisor**. A supervisor yields to another supervisor with a higher precedence, such that the highest precedence is always the Active Supervisor.

- **Supervisor Precedence**: Set the precedence of a ring supervisor in the network with multiple ring supervisors. Numerically higher value indicates higher precedence. Node with highest Supervisor Precedence value becomes Active Supervisor. The configuration value ranges from 1 to 255. The default value is 250.
- **Beacon Interval (usec)**: Set Beacon interval (in micro seconds) that supervisor transmits. The configuration value ranges from 400 to 10000. The default value is 400.
- **Beacon Timeout (usec)**: Set the amount of time (in micro seconds) all nodes in ring network shall wait before timing out reception of Beacon frames and taking the appropriate action. Beacon timeout must be set to 2-3X Beacon Interval. The configuration value ranges from 800 to 50000. The default value is 1960.

> **NOTE:** You must reboot the controller if you change the I/O network topology from **Star Topology** to **DLR Topology** and vice versa.

5. Click **Save** to complete the Ethernet port configuration.
6. Click **Back** to return to the Home Page.

Registering device types

> **NOTE:** For Rockwell 1756&1794 series I/O modules, you do not need to import EDS files to generate device types. They are registered in ControlEdge Builder by default.

You can use EDS files to generate EtherNet/IP device types or I/O module types for communication with EtherNet/IP devices or I/O modules. See To generate a device type by importing an EDS file for more information in this section.

You can download EDS files from the third party vendor and register them into the Device Type list. The registered information will be stored under the location: C:\ProgramData\Honeywell\ControlEdge Builder\EDSFiles. The registered information cannot be saved along with project backups. You must back up them manually.

If you want to modify EDS files, you can access EZ EDS tool from ODVA official website: https://www.odva.org/software/EZ-EDS-Download. For how to modify EDS file, check the online help embedded in the EZ EDS tool.

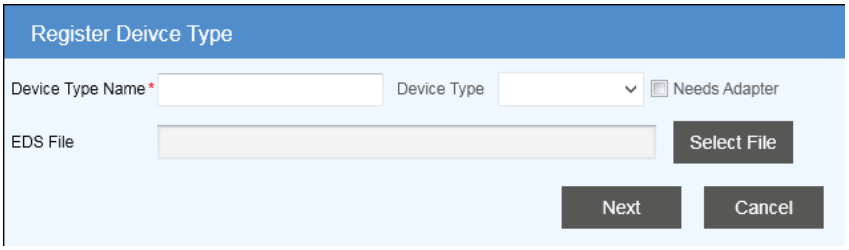
You can also create a device type without an EDS file. See To create a device type without an EDS file for more information in this section.

Prerequisites

- If you want to create the EtherNet/IP device types, or I/O module types by using the EDS, ensure that you have the appropriate EDS file.
- Ensure that you have all the required device-related specifications, which are available with the device, before you create the device, or I/O module type.

To register device types

1. From the Home Page, click **Configure EtherNet/IP Devices** > **Register Device Types**, and click **Register Device Type**. The following dialog appears:



2. Enter a **Device Type Name**. The device type name cannot begin with numbers and cannot contain any spaces and special characters.
3. Select **Device Type** according to the type of the physical EtherNet/IP device.

   If a device supports both Input and Output channels, then select Output here. For example, a device has analog input and analog output, then select **Analog Output**.

   If a device supports neither Input nor Output channels, then select **Generic Device** here.
4. When you register a device type for an I/O module, indicate whether the I/O module requires an associated adapter or not. If the I/O module requires an adapter, select the **Needs Adapter** box.

> **NOTE:** In a scenario where multiple I/O modules share a single communication adapter to communicate with an EtherNet/IP protocol, the **Needs Adapter** must be selected. When you select **Needs Adapter**, the device type is only available on the **I/O Configuration** tab when you create or customize a generic EtherNet/IP Adapter.

> **NOTE:** You cannot change this setting after compiling the project. You must remove the device type from both ControlEdge Configuration Workspace and IEC Programming Workspace, and re-add a device type.

5. You can import an EDS file to generate a device type or create one without EDS files:

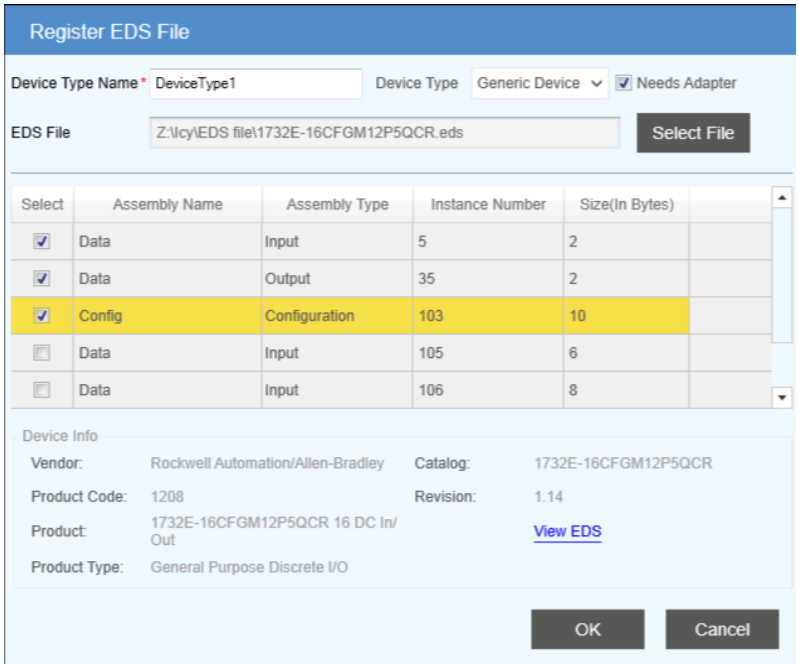
   - **To generate a device type by importing an EDS file**

     a. Click **Select File**, browse to the location stored the target EDS file, select the EDS file and click **Open**.

     b. You can view the basic information of the EDS file at the bottom panel. You can also click **View EDS** to open the EDS file to view more details.

     > **NOTE:** The EDS file is read-only and not allowed to be modified here.

     c. Select the boxes for the following Assembly types according to devices types:



- Input

  An assembly transfers data from an EtherNet/IP device as Producer device to a controller as Consumer.

- Output

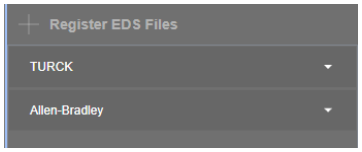
  An assembly transfers data from a controller as Producer device to an EtherNet/IP device as Consumer.

- Configuration

  An assembly which transports configuration data from the EtherNet/IP device originating the connection to the EtherNet/IP device or I/O module which is the target of the connection.

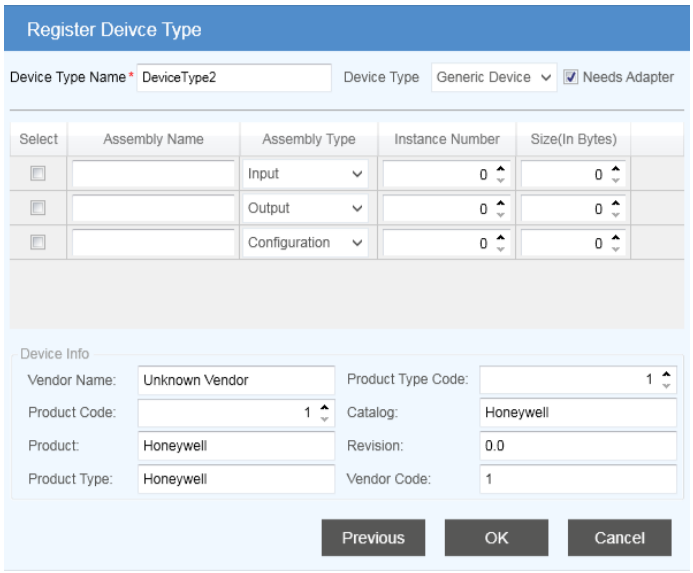
> **NOTE:** There might be more than one Input, Output and Configuration assembly types. However, ensure that you select one instance of Input, one instance of Output, and one instance of Configuration assembly type per your requirement.

d. Click **OK** to register the device type to ControlEdge Builder. Device types are created and grouped by different vendors automatically based on the "vendor" information in the EDS file.



- **To create a device type without an EDS file**

  a. Click **Next**, and the following dialog appears:



  b. Select the boxes for the following Assembly types according to devices types:

  - Input

    An assembly transfers data from an EtherNet/IP device as Producer device to a controller as Consumer.

  - Output

    An assembly transfers data from a controller as Producer device to an EtherNet/IP device as Consumer.

  - Configuration

    An assembly which transfers configuration data from the EtherNet/IP device originating the connection to the EtherNet/IP device or IO module which is the target of the connection.

> **NOTE:** You must select at least one instance of Input/Output/Configuration assembly per your requirement.

c. Enter **Assembly Name**, **Instance Number** and **Size (In Bytes)** for the selected Assembly.

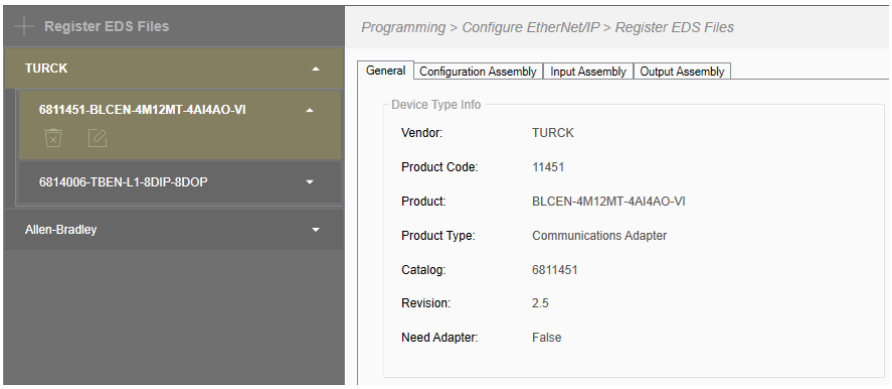
> **ATTENTION: Instance Number** must be greater than 0.

> **ATTENTION:** At least one **Size (In Bytes)** must be greater than 0.

d. Select **Vendor Name** from the drop-down list and other information is displayed automatically.

e. Click **OK** to register the device type to ControlEdge Builder.

6. Click the vendor name to expand the group, and select the target device type, you can view **General**, **Configuration Assembly**, **Input Assembly** and **Output Assembly** information.

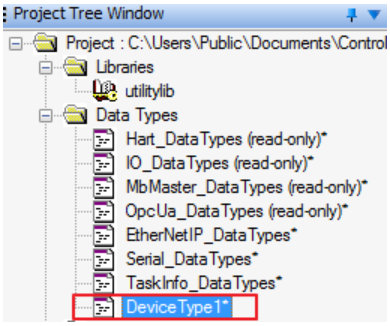


7. You can click the **Delete** icon to remove the device type.

8. You can click the **Edit Device Type** icon to modify the device type. See Editing device types for more information.

9. Click **Save** to complete the configuration.

   After saving, the new device type will be populated in the **Data Type** library with an input and output channel in **IEC Programming Workspace**. You can use the created device type from the library to configure new devices.

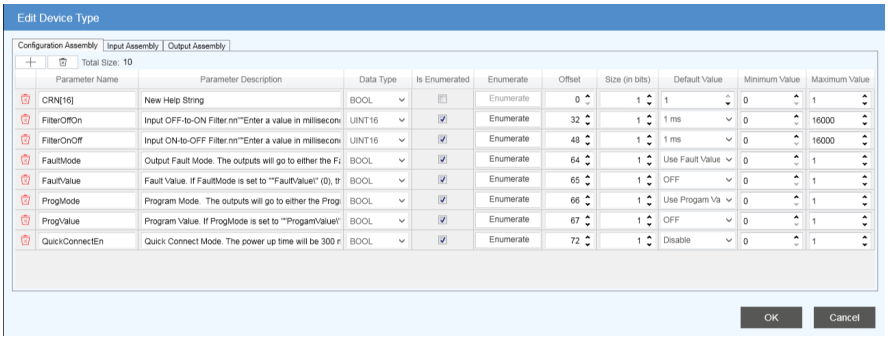


Editing device types

This feature enables you to edit device types using ControlEdge Builder.

To edit a device type

1. From the Home Page, click **Configure EtherNet/IP Devices** > **Register Device Types**.
2. Select the device type you want to modify and click the **Edit Device Type** icon. The **Edit Device Type** dialog appears.



3. In the **Configuration Assembly**, **Input Assembly** and **Output Assembly** tab, you can configure the following parameters per your requirements. For more information, see the vendor's document.

Parameter	Description
Enable Run/Idle Header	It is only applicable for **Input Assembly** and **Output Assembly**.
Parameter Name	Parameter name
Parameter Description	Parameter description
Data Type	Data type of the parameter. The following

Parameter	Description
	options are available: • BOOL • INT8 • BYTE • UINT8 • UINT16 • INT16 • UINT32 • INT32 • UINT64 • INT64 • FLOAT32 • REAL • LREAL • FLOAT64
Is Enumerated	Select to enable **Enumerate**
Enumerate	It is configurable if **Is Enumerated** is selected. Click **Enumerate** to configure values: 1. Enter **Value** and **String**, and click **Insert**. 2. Click **OK**.
Offset	The initial bit for the parameter
Size (in bits)	Parameter size
Default Value	Select the configuration of **Enumerate** If **Enumerate** is not configured, enter the value per your requirement.
Minimum Value	Minimum value of the parameter

Parameter	Description
	It depends on the data type.
Maximum Value	Maximum value of the parameter It depends on the data type.

4. (Optional) You can click + to add a new parameter.

> **NOTE:** Size (Bits) of existing parameters cannot exceed the Total Size (Bytes).

5. (Optional) You can click to delete all parameters.
6. (Optional) You can click to delete a parameter.
7. Click **OK** to complete the configuration.

Configuring EtherNet/IP devices using EDS files

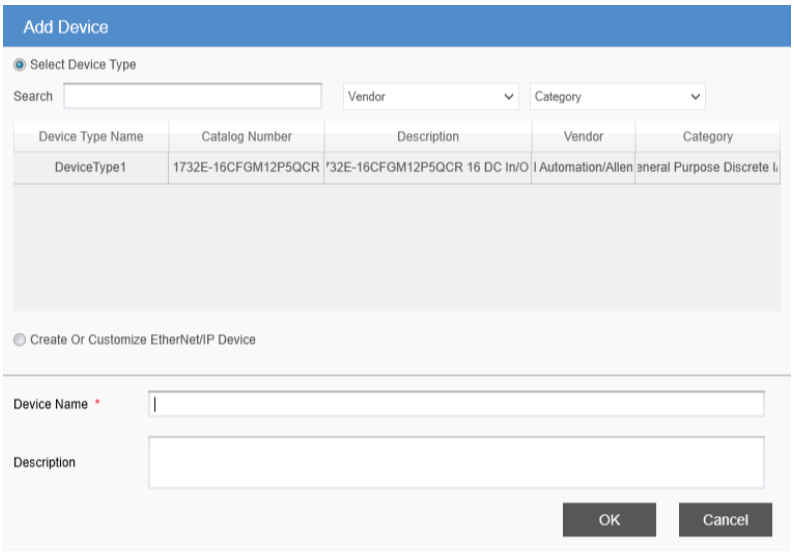
Prerequisites

- Ensure you have registered the device type by using the EDS file of the EtherNet/IP device into ControlEdge Builder. See Registering device types for more information.
- The following information in the EDS file are critical for device type creation. Ensure that these details are available before using the EDS file.
  - Device and Vendor information
  - Parameter information
  - Assembly information
  - Connection information
- Bind EtherNet/IP Client to an Ethernet port. See Binding EtherNet/IP Client to an Ethernet port for more information.

To configure a device using an EDS file, without an adapter

1. From the Home Page, click **Configure EtherNet/IP Devices** > **Configure Devices**, and click **Add Device**.
2. Click **Select Device Type**, and all available device types are displayed.

You can enter keywords to search device types, and also can filter them by selecting from the various filters for the **Vendor** and **Category** fields.



3. Select the target device type, and enter the **Device Name** and **Description**. The device name cannot begin with numbers and cannot contain any spaces and special characters.
4. Click **OK** to add the device.
5. In the **General** tab, configure the following parameters.

Parameter	Description
IP Address	The IP address of the EtherNet/IP device which is provided by the vendor.
Electronic Keying	It is used to control if accept the connection when the identity information of EDS file does not match the EtherNet/IP device. • Disable Keying: Allow the connection with EtherNet/IP device even the identity information of EDS file and the EtherNet/IP device do not match. • Exact Match: The identity

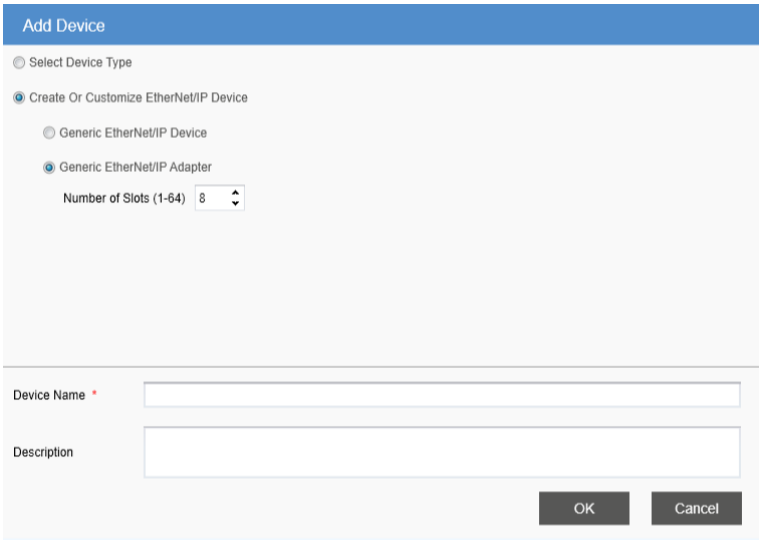
Parameter	Description
	information of EDS file must match the EtherNet/IP device, and then the connection will be allowed.
Connection Timeout Multiplier	Configure it according to Vendor's document. The following options are available: ***4**, ***8**, ***16**, ***32**, ***64**, ***128**, ***256**, ***512** and **Computed**.
Originator to Target RPI (ms)	Requested Packet Interval (RPI) specifies the rate at which data is updated during a connection. Set the rate for initiating the date exchange with the EtherNet/IP device.
Connection Type	The following options are available: • Null • Multicast • Point2Point It is recommended to use the default value.
Priority	The following options are available: • Low • High • Scheduled • Urgent It is recommended to use the default value.
Target to Originator RPI (ms)	Set the rate for reading data from the EtherNet/IP device.
Connection Type	The following options are available: • Null

Parameter	Description
	• Multicast • Point2Point **ATTENTION:** For output modules, select Multicast. **ATTENTION:** For other types of modules, use the default value.
Priority	The following options are available: • Low • High • Scheduled • Urgent It is recommended to use the default value.

6. Click **Configuration** tab to configure parameters which are defined by the corresponding EDS file. Configure them according to vendor's documents.
7. In the **Configuration** tab, you can also do the following options if required:
   - Click **Change Device Type** to re-select a device type.
   - Click **Clear Device Type** to remove the device type.
8. You can click to edit the device name and description. You can also click to remove the device if required.
9. Click **Save** to complete the configuration.

To configure a device using an EDS file, associated with an adapter

1. From the Home Page, click **Configure EtherNet/IP Devices** > **Configure Devices**, and click **Add Device**.
2. Select **Create or Customize EtherNet/IP Device**, and select **Generic EtherNet/IP Adapter**.



3. Enter the **Number of Slots** ranging from 1 to 64.

> **ATTENTION:** An attempt to communicate with the I/O module fails if the number of slots entered does not match the physical configuration. Therefore, ensure that the number of slots matches the number of the physically installed I/O modules and the adapter (number of slots = number of I/O modules + one for the adapter). For example, if the number of I/O modules is 7, the number of slots should be 8.

4. Enter the **Device Name** and **Description**. The device name cannot begin with numbers and cannot contain any spaces and special characters.
5. Click **OK** to add the device.
6. In the **General** tab, configure the following parameters.

Parameter	Description
IP Address	The IP address of the EtherNet/IP device.
Apply RPI settings on all associated I/O modules	Select the checkbox to apply the specified RPI to all I/O modules associated to the adapter. If you do not select this

Parameter	Description
	option, you should configure the RPI for every I/O modules separately in the **I/O Configuration** tab.
Originator to Target RPI (ms)	RPI specifies the rate at which data is updated during a connection. Set the rate for initiating the date exchange with the EtherNet/IP device. It is applicable for all the I/O modules associated to the adapter if the **Apply RPI settings on all associated I/O modules** option is selected.
Target to Originator RPI (ms)	Set the rate for reading data from the EtherNet/IP device. It is applicable for all the I/O modules associated to the adapter if the **Apply RPI settings on all associated I/O modules** option is selected.

7. In the **I/O Configuration** tab, perform the following steps to configure parameters.

   a. You can click + or − to add or remove I/O modules.

   b. Select the **Enable** box for an I/O module, configure the following parameters.

      If you do not select the **Enable** box, you cannot download configurations to the controller.

Parameter	Description
I/O Module Name	Define a name for the I/O module. It cannot begin with numbers and cannot contain any

Parameter	Description
	spaces and special characters.
Connection Timeout Multiplier	Configure it according to Vendor's document. The following options are available: ***4**, ***8**, ***16**, ***32**, ***64**, ***128**, ***256**, ***512** and **Computed**. **ATTENTION:** For Rockwell 1756&1794 series I/O modules, the value of multiplying this parameter by RPI cannot exceed 1600. For example, if RPI is set as 50, Connection Timeout Multiplier cannot be set larger than 32.
Originator to Target RPI (ms)	Set the rate for initiating the date exchange with the EtherNet/IP device. It is un-configurable if the **Apply RPI settings on all associated I/O modules** option is selected in the **General** tab.
Connection Type	The following options are available: • Null • Multicast • Point2Point It is recommended to use the default value.
Priority	The following options are available: • Low • High • Scheduled • Urgent It is recommended to use the default value.
Target to Originator RPI (ms)	Set the rate for reading data from the EtherNet/IP device.

Parameter	Description
	It is un-configurable if the **Apply RPI settings on all associated I/O modules** option is selected in the **General** tab.
Connection Type	The following options are available: • Null • Multicast • Point2Point **ATTENTION:** For output modules, select Multicast. **ATTENTION:** For other types of modules, use the default value.
Priority	The following options are available: • Low • High • Scheduled • Urgent It is recommended to use the default value.

c. Click **Select Device Type** to choose a device type. The **Select Device Type** dialog appears.

   The available device types are displayed. You can enter keywords to search device types, and also can filter them by selecting from the various filters for the **Vendor** and **Category** fields.

d. Select the target device type, and click **Next** to configure more parameters which are defined in the corresponding EDS file. Configure them according to vendor's documents.

   For some Input and Output parameters of Rockwell 1756&1794 series I/O modules, see Input and Output parameter of Rockwell 1756 and 1794 series I/O modules for more information.

e. Click **OK** to add the device type.

f. You can select **Edit Device Type** to re-configure the device type. The **Edit Configuration Assembly** dialog appears.

- Click **Change Device Type** to re-select a device type.
- Click **Clear Device Type** to remove the device type.

g. If you complete all the configurations, the **Status** will change from to  .

8. From the left panel, you can click  to edit the device name and description. You can also click  to remove the device if required.
9. Click **Save** to complete the configuration.

Configuring generic EtherNet/IP devices

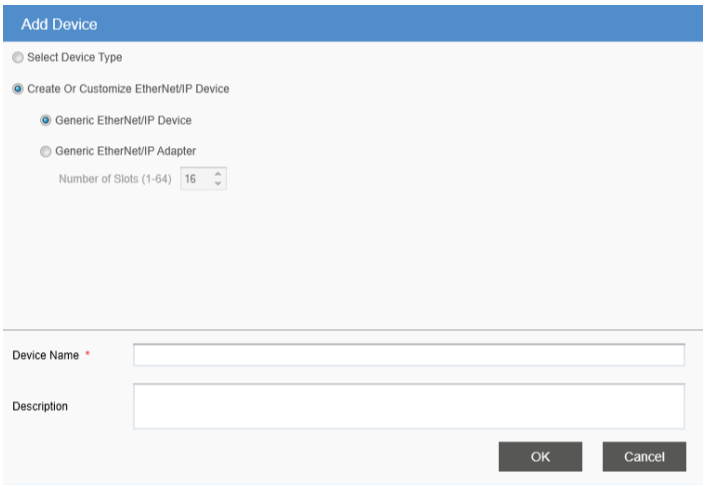
If you do not have the EDS file, you can create and configure a generic EtherNet/IP device.

Prerequisites

- Ensure that the following details are available before creating and configuring the device:
  - Device and Vendor information
  - Parameter information
  - Assembly information
  - Connection information
- Bind EtherNet/IP Client to an Ethernet port. See Binding EtherNet/IP Client to an Ethernet port for more information.

To configure a generic EtherNet/IP device

1. From the Home Page, click **Configure EtherNet/IP Devices** > **Configure Devices**, and click **Add Device**.
2. Select **Create or Customize EtherNet/IP Device**, and select **Generic EtherNet/IP Device**.



3. Enter the **Device Name** and **Description**. The device name cannot begin with numbers and cannot contain any spaces and special characters.
4. Click **OK** to add the device.
5. In the **General** tab, configure the following parameters.

Parameter	Description
IP Address	The IP address of the EtherNet/IP device
Connection Timeout Multiplier	Configure it according to Vendor's document. The following options are available: ***4**, ***8**, ***16**, ***32**, ***64**, ***128**, ***256**, ***512** and **Computed**.
Originator to Target RPI (ms)	Set the rate for initiating the date exchange with the EtherNet/IP device.
Connection Type	The following options are available: • Null • Multicast • Point2Point

Parameter	Description
	It is recommended to use the default value.
Priority	The following options are available: • Low • High • Scheduled • Urgent It is recommended to use the default value.
Target to Originator RPI (ms)	Set the rate for reading data from the EtherNet/IP device.
Connection Type	The following options are available: • Null • Multicast • Point2Point **ATTENTION:** For output modules, select Multicast. **ATTENTION:** For other types of modules, use the default value.
Priority	The following options are available: • Low • High • Scheduled

Parameter	Description
	• Urgent It is recommended to use the default value.

6. In the **Connection** tab, configure the following parameters.

Parameter	Description
Communication Format	The data type of the update data reading from EtherNet/IP devices. There are four options: **DINT**, **INT**, **REAL**, and **SINT**
Input	**Input** assembly: An assembly transfers data from an EtherNet/IP device as Producer device to a controller as Consumer.
Output	**Output** assembly: An assembly transfers data from a controller as Producer device to an EtherNet/IP device as Consumer.
Configuration	**Configuration** assembly: An assembly which transports configuration data from the EtherNet/IP device originating the connection to the EtherNet/IP device or I/O module which is the target of the connection.
Assembly Instance	The assembly instance number provided by the vendor. For more information, see the vendor's specification.
Size	The data length of the assembly provided by the vendor. For more information, see the vendor's specification.

7. You can click to edit the device name and description. You can also click to remove the device if required.
8. Click **Save** to complete the configuration.

Scaling support for generic device

Scaling support covers custom parameters as well as PV and OP parameters on generic devices.

Formulae used by the controller to perform scaling:

1. FLOATVALUE for Custom Input parameters is calculated as:

$$\text{FLOATVALUE} = \left\{ \text{SCALEFACTOR} * \left[\frac{(\text{RAWVALUE} - \text{LOWRANGE}) * 100.0}{(\text{HIGHRANGE} - \text{LOWRANGE})} \right] + \text{BIAS} \right\}$$

2. For the Output direction, use this formula to calculate RAWVALUE from the FLOATVALUE (which is typically written through the strategy):

$$\text{RAWVALUE} = \left[\left\{ (\text{FLOATVALUE} + \text{BIAS}) * \left[\frac{\text{HIGHRANGE} - \text{LOWRANGE}}{100.0} \right] * \text{SCALEFACTOR} \right\} + \text{LOWRANGE} \right]$$

The formula is the same as with Input scaling solved for 'Raw value'.

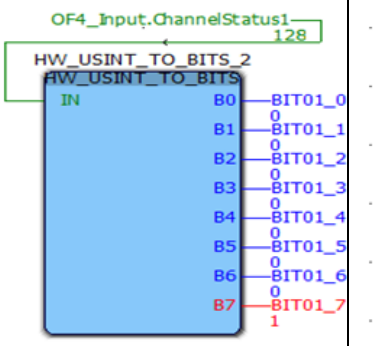
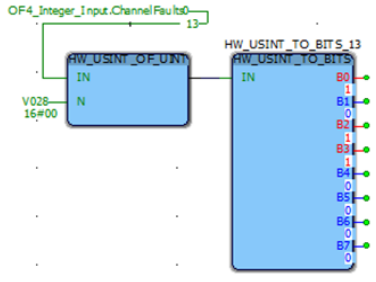
The process value that is received from field is converted to digital form by the A/D converter. LOWRANGE and HIGHRANGE values define the normal operating range of the RAW value.

RAW value in the output direction is the final output value sent to the device in the output assembly. This is the linearly scaled value (with some scale factor multiplied and bias added) of the OP (which is in percentage) within the LOWRANGE and HIGHRANGE operating range of the RAW value.

Input and Output parameter of Rockwell 1756 and 1794 series I/O modules

This topic introduces some parameter configuration for EDS files of Rockwell 1756&1794 series I/O modules.

Table 4-1: 1756-OF4 Analog Output Current/Voltage 4 Channel

Device type	Parameter	Data type	Description	Example
Float	ChannelStatus0	USINT/8	B6 is not used. • B0(bit): Ch0HLimitAlarm • B1(bit): Ch0LLimitAlarm • B2(bit): Ch0RampAlarm • B3(bit): Ch0InHold • B4(bit): Ch0CalFault • B5(bit): Ch0NotANumber • B7(bit): Ch0OpenWire	
Integer	ChannelFaults0	UINT/16/Byte0	• B0(bit): Ch0Fault • B1(bit): Ch1Fault • B2(bit): Ch2Fault • B3(bit): Ch3Fault	

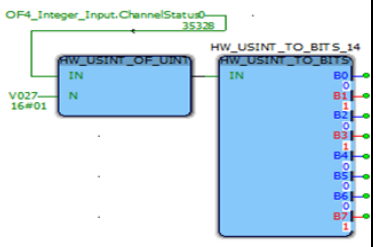
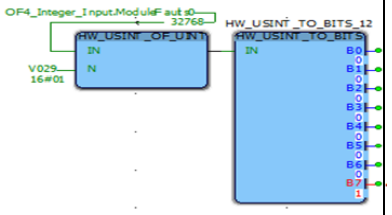
Device type	Parameter	Data type	Description	Example
	ChannelStatus0	UINT/16/Byte1	• B0(bit): Ch3InHold • B1(bit): Ch3OpenWire • B2(bit): Ch2InHold • B3(bit): Ch2OpenWire • B4(bit): Ch1InHold • B5(bit): Ch1OpenWire • B6 (bit): Ch0InHold • B7(bit): Ch0OpenWire	
	ModuleFaults0	UINT/16/Byte1	• B5(bit): CalFault • B6(bit): Calibrating • B7(bit): AnalogGroupFault	

Table 4-2: 1794-IE8/B 8 channel 24 DC Non-isolated Voltage/Current Analog Input

Parameter	Data type	Description	Example
Config_0	UINT/16	• B0(bit): Ch0FullRange • B1(bit): Ch1FullRange • B2(bit): Ch2FullRange	None

Parameter	Data type	Description	Example
		• B3(bit): Ch3FullRange • B4(bit): Ch4FullRange • B5(bit): Ch5FullRange • B6(bit): Ch6FullRange • B7(bit): Ch7FullRange • B8(bit): Ch0ConfigSelect • B9(bit): Ch1ConfigSelect • B10(bit): Ch2ConfigSelect • B11(bit): Ch3ConfigSelect • B12(bit): Ch4ConfigSelect • B13(bit): Ch5ConfigSelect • B14(bit): Ch6ConfigSelect • B15(bit): Ch7ConfigSelect	

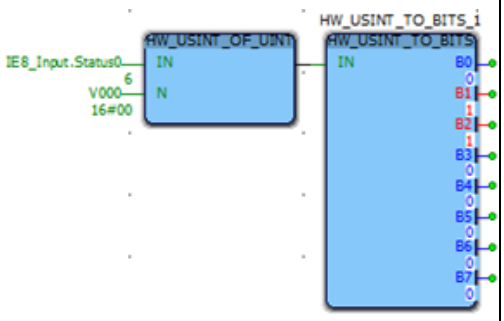
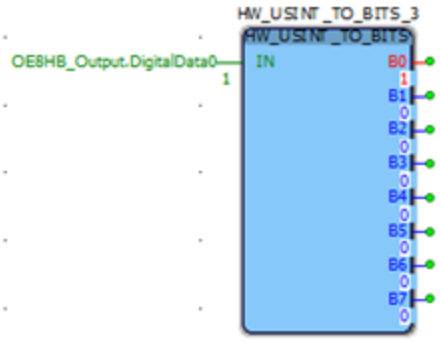
Parameter	Data type	Description	Example
Status0	UINT/16/Byte0	• B0(bit): Ch0Underrange • B1(bit): Ch1Underrange • B2(bit): Ch2Underrange • B3(bit): Ch3Underrange • B4(bit): Ch4Underrange • B5(bit): Ch5Underrange • B6(bit): Ch6Underrange • B7(bit): Ch7Underrange	

Table 4-3: 1794-OE8H/A 8 Channel Analog Output/HART

Parameter	Data type	Description	Example
DigitalData0	USINT	• B0(bit): DigitalData0 • B1(bit): DigitalData1 • B2(bit): DigitalData2 • B3(bit): DigitalData3 • B4(bit): DigitalData4 • B5(bit): DigitalData5 • B6(bit): DigitalData6	

Parameter	Data type	Description	Example
		• B7(bit): DigitalData7	

Configuring communication with third-party controllers

Configuring communication with C300/UOC

When ControlEdge 900 controller communicates with C300/UOC, it acts as an EtherNet/IP Server.

User-defined data types are not supported. C300/UOC can read & write variables of the ControlEdge 900 controller with the following data types:

- DATATYPE_BOOL (0x01)
- DATATYPE_SINT (0x02)
- DATATYPE_INT (0x03)
- DATATYPE_DINT (0x04)
- DATATYPE_USINT (0x05)
- DATATYPE_UINT (0x06)
- DATATYPE_UDINT (0x07)
- DATATYPE_REAL (0x08)

Configuring communication with ControlLogix controllers

When ControlEdge 900 controller communicates with Rockwell AB ControlLogix controllers, it can act as an EtherNet/IP Client or EtherNet/IP Server.

- If ControlEdge 900 controller acts as an EtherNet/IP Client, ControlEdge Builder provides function blocks to enable communication between 900 controller and third-party controllers. For how to configure function blocks, see "EtherNet/IP" in the *ControlEdge Builder Function and Function Block Configuration Reference*.
- If ControlEdge 900 controller acts as an EtherNet/IP Server, see Configuring EtherNet/IP Server for more information.

  User-defined data types are not supported. Rockwell AB ControlLogix can read & write variables of the ControlEdge 900 controller with the following data types:

  - DATATYPE_SINT (0x02)
  - DATATYPE_INT (0x03)
  - DATATYPE_DINT (0x04)
  - DATATYPE_USINT (0x05)
  - DATATYPE_UINT (0x06)
  - DATATYPE_UDINT (0x07)
  - DATATYPE_REAL (0x08)

Configuring EtherNet/IP Server

This section introduces how to configure ControlEdge 900 controller as an EtherNet/IP Server. EtherNet/IP Client can read, write and monitor global variable, program local variable of the EtherNet/IP Server through the Tag name configured in EtherNet/IP Client.

Global variable's tag name is *@GV. <Varname>*. If some controllers do not support special characters such as @, the tag name should be *GV.GV.<Varname>*.

Program Local variable's tag name is *<Program Instance Name>.<Varname>*.

Binding EtherNet/IP Server to an Ethernet port

This section introduces how to bind EtherNet/IP Server to ETH1 or ETH2. Only one Ethernet port can be bound at a time.

To bind EtherNet/IP Server

1. From Home Page, click **Configure Ethernet Ports** and select **ETH1** or **ETH2**.
2. Under **Network Setting**, configure the IP addresses, subnet mask and gateway.
3. Under **Protocol Binding**, select **EtherNet/IP Server**.
4. Click **Save** to complete the Ethernet port configuration.
5. Click **Back** to return to the Home Page.

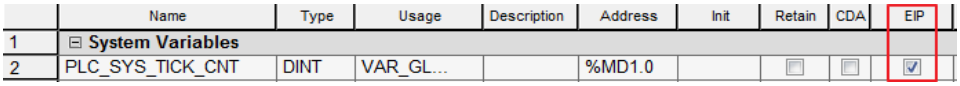
Selecting EtherNet/IP for variables

EtherNet/IP must be selected for global variables or program local variables of EtherNet/IP Server, so that EtherNet/IP Client can read, write and monitor these variables through the Tag name configured in EtherNet/IP Client.

Global variable's tag name is *@GV. <Varname>*. If some controllers do not support special characters such as @, the tag name should be *GV.GV.<Varname>*.

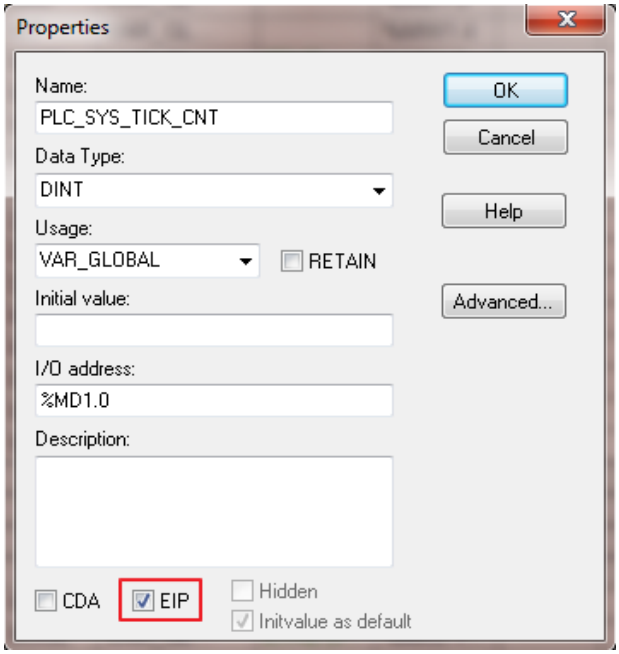
Program Local variable's tag name is *<Program Instance Name>.<Varname>*.

1. Click **IEC Programming Workspace** on the toolbar, or from Home Page, click **Program with IEC61131-3**.
2. Perform either of the following methods to select **EIP** for local variables or global variables.
   - From the variable sheets, select **EIP**.



	Name	Type	Usage	Description	Address	Init	Retain	CDA	EIP
1	⊟ **System Variables**								
2	PLC_SYS_TICK_CNT	DINT	VAR_GL...		%MD1.0		☐	☐	☑

- From the variable properties dialog, select **EIP**.



3. Compile the configuration to the controller. See "Compiling a project" in *ControlEdge Builder User's Guide*.

CHAPTER

5 ETHERNET/IP I/O BEHAVIOR DURING SWITCHOVER

On controllers switchover there will be a control freeze for 200 ms to a maximum of 2 seconds.

The control freeze time is due to controllers reforming the EtherNet/IP I/O connections from the new primary and getting the latest publication from the I/O.

> **NOTE:** This time is dependent on the number of EtherNet/IP I/O Modules configured.

During this time the IOM and channel blocks in the controllers will hold and work on with the last I/O data received before switchover.

CHAPTER

6 DIAGNOSTIC

Configuring DLR network status

You can log in as the Administrator, Engineer or Operator to connect the target controller and configure DLR network status.

1. From the Home Page, click **View Diagnostics** under **Diagnostics**. The diagnostics page appears.
2. **Auto-refresh** is selected by default, you can set a refresh rate to update diagnostics regularly. You can also click **Auto-refresh** to close it, and click **Refresh** to update diagnostics manually.
3. Click **Platform**, and select **Locate fault** or **Recover from Rapid Fault** to set the DLR network status.

Name	Description
Locate fault	When Ring Fault occurs in the **DLR Network Status**, click this button and check the IP address in **DLR Last Active Node Port 1** and **DLR Last Active Node Port 2** to identify the fault location.
Recover from Rapid Fault[1]	When Rapid Fault occurs in the **DLR Network Status**, click this button to recover the network communication if the fault is resolved.

Note1: Rapid fault may be caused by any of the following:

- Manually disconnect or reconnect network nodes 5 times in 30 seconds
- Duplex mismatch between two connected devices
- Bad Electro Magnetic Compatibility (EMC) environment
- Unstable physical connections

Viewing EtherNet/IP device diagnostics

You can log in as the Administrator, Engineer or Operator to connect the target controller and view EtherNet/IP device diagnostics.

1. From the Home Page, click **View Diagnostics** under **Diagnostics**. The diagnostics page appears.
2. Click the down arrow on the right of the **EtherNet/IP Device** tab to expand the group. The overview of the EtherNet/IP devices which are connected with the controller appears at the rightmost page.

   See the following table for the configuration parameters:

Parameter	Description
CIP Connection Used	The number of the used CIP connections.
CIP Connection Remaining	The number of the unused CIP connections.
CIP Connection Active	The number of the active CIP connections.
Device Name	EtherNet/IP device name
Device Type	EtherNet/IP device type
Status	Status of EtherNet/IP device: • OK: All the devices are running without error. • Error: Error exists for the connection.
Total Packets Sent	The number of packets sent by the client
Total Packets Received	The number of received packets from the server
Packets Received Per Second	The number of received packets from the server per second
Packets Sent Per Second	The number of packets sent by the client per second
IP Address	IP Address of the EtherNet/IP device
Connection Timeout	The number of connection timeout

Auto-refresh is selected by default. You can set a refresh rate to update diagnostics regularly. You can also click **Auto-refresh** to close it, and click **Refresh** to update diagnostics manually.

You can click **Reset Statistics** to reset statistic values to the default values.

3. Click an EtherNet/IP device name to view its diagnostics displayed at the rightmost page.

Parameter	Description
Module Connection Status	The status of EtherNet/IP device See EtherNet/IP device error codes for more information.
IP Address	The IP Address of EtherNet/IP device
Device Type	The EtherNet/IP device type
Vendor	Vendor of EtherNet/IP device
Product Code	EtherNet/IP device code
Revision	EtherNet/IP device revision
Total Packets Sent	The number of packets sent by the client
Total Packets Received	The number of received packets from the server
Packets Sent Per Second	The number of packets sent by the client per second
Packets Received Per Second	The number of received packets from the server per second
Communication Errors	The number of communication error
Communication Timeout	The number of device offline

4. For the EtherNet/IP device with an adapter, click the down arrow at the right of the device to view I/O module list. Click an I/O module to view its diagnostics.

Parameter	Description
Module Status	The status of I/O module
IP Address	The IP Address of I/O module
Device Type	The I/O module type
Vendor	Vendor of EtherNet/IP device
Product Code	EtherNet/IP device code
Revision	EtherNet/IP device revision
Total Packets Sent	The number of packets sent by the client
Total Packets Received	The number of received packets from the server
Packets Sent Per Second	The number of packets sent by the client per second
Packets Received Per Second	The number of received packets from the server per second
Communication Errors	The number of communication error
Communication Timeout	The number of device offline

EtherNet/IP device error codes

EtherNet/IP device diagnostics are also displayed in **IEC Programming Workspace**. Click **IEC Programming Workspace**, double-click **Global_ Variables**, and check the **EtherNetIP Diagnostics** group.

Error code	Status	Description
0x0000	EIP_IO_STATE_STANDBY	Device is standby.
0x1000	EIP_IO_STATE_FAULTED	Connecting failed
0x1100	EIP_IO_STATE_FAULTED_ WAITING_TO_CONNECT	Connecting failed, waiting to re-connect
0x1200	EIP_IO_STATE_FAULTED_ CONNECTING	Connecting failed, re-connecting
0x1300	EIP_IO_STATE_FAULTED_BAD_	Invalid IP address specified

Error code	Status	Description
	IP_ADDR	
0x1400	EIP_IO_STATE_FAULTED_ SERVER_ALLOC_FAILED	I/O server allocation failed
0x1500	EIP_IO_STATE_FAULTED_IO_ ALLOC_FAILED	I/O allocation failed
0x1600	EIP_IO_STATE_FAULTED_BAD_ T2O_DATAPTR	Invalid Target to Originator data size and/or pointer
0x1700	EIP_IO_STATE_FAULTED_BAD_ O2T_DATAPTR	Invalid Originator to Target data size and/or pointer
0x1800	EIP_IO_STATE_FAULTED_BAD_ T2O_RPI	Invalid Target to Originator RPI
0x1900	EIP_IO_STATE_FAULTED_BAD_ O2T_RPI	Invalid Originator to Target RPI
0x1a00	EIP_IO_STATE_FAULTED_BAD_ CONFIGPTR	Invalid configuration size and/or pointer
0x3000	EIP_IO_STATE_CONNECTING	Connecting
0x4000	EIP_IO_STATE_RUNNING	Running
0x5000	EIP_IO_STATE_SHUTTING_ DOWN	Shutting down
0x7100	EIP_IO_STATE_WAITING_TO_ CONNECT	Waiting to connect
0x7200	EIP_IO_STATE_WAITING_TO_ SHUTDOWN	Waiting to shut down
0x7300	EIP_IO_STATE_WAITING_TO_ RECONNECT	Re-connect after forward close, instead of freeing I/O
0x9000	EIP_IO_STATE_CNTRLR_ SWITCHOVER	Forward closing of I/O modules with input channels after the controller switch over

APPENDIX

A STATUS CODES

The error codes are returned with the response to a Connection Manager Service Request that resulted in an error. These error codes shall be used to help diagnose the problem with a Service Request. The error code shall be split into an 8 bit general status and one or more 16- bit words of extended status. Unless specified otherwise, only the first word of extended status shall be required. Additional words of extended status may be used to specify additional device specific information. All devices that originate messages shall be able to handle multiple words of extended status.

Table A-1: Status codes for device level

Status code	Description
0	The profinet device is deactivated.
1	The profinet device is connecting.
2	The profinet device is connected.
3	The connection has errors.

Table A-2: Status codes for slot level

Status code	Description
0	Bad by subslot The associated submodule data is not valid and should not be used for process control. The submodule detected the issue.
32	Bad by slot The associated submodule data is not valid and should not be used for process control. The module detected the issue.
64	Bad by device The associated submodule data is not valid and should not be used for process control. The IO device detected the issue.
96	Bad by controller The associated submodule data is not valid and should not be used for process

Status code	Description
	control. The IO controller detected the issue.
128	Good The associated submodule data is valid and can be used.

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