

MANUAL

ICDM-RX/EN

EtherNet/IP Quick Start



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Table of Contents

1. Overview	5
1.1. Installation Overview	5
1.2. Locating the Latest Software and Documentation	5
1.3. Data Type Definitions	6
2. Configuring Read-Only Serial Devices	7
2.1. Read-Only Serial Device Prerequisites.....	7
2.2. Read-Only Serial Device Web Page Configuration.....	7
3. Configuring Read-Only Ethernet TCP/IP Devices.....	13
3.1. Read-Only Ethernet TCP/IP Device Prerequisites	13
3.2. Read-Only Ethernet TCP/IP Device Web Page Configuration	13
4. Configuring Read/Write Devices	21
4.1. Prerequisites	21
4.2. Read-Only Ethernet TCP/IP Device Web Page Configuration	21
4.3. Configuring ControlLogix family PLCs for Class 1.....	22
4.4. Configuring ControlLogix family PLCs for Write-to-Tag	24
4.5. Configuring SLC/PLC-5/MicroLogix PLCs.....	26
5. Filtering/Data Extraction Configuration.....	29
5.1. PLC Filtering/Data Extraction	29
5.1.1. RFID (EPCglobal Formats).....	30
5.1.2. Barcode (UPC/EAN Formats).....	30
5.2. Application Filtering/Data Extraction.....	31
5.2.1. RFID (EPCglobal Formats).....	31
5.2.2. Barcode (UPC/EAN Formats).....	32
6. Application Socket Configuration	33
7. Troubleshooting and Technical Support.....	35
7.1. Troubleshooting Checklist	35
7.2. General Troubleshooting	36
7.3. Daisy-Chaining ICDM-RX/EN Units With Dual Ethernet Ports	36
7.4. Technical Support.....	37



1. Overview

This *Quick Start* is intended to help you quickly set-up serial or Ethernet devices. with the ICDM-RX/EN and EtherNet/IP, for example:

- Read-only devices such as barcode scanners and some RFID readers
- Read/write devices such as printers and some weigh scales

1.1. Installation Overview

Use the following steps to install the ICDM-RX/EN.

You can download the documents referenced from: <https://pepperl-fuchs.com>.

1. Connect the ICDM-RX/EN to the network using the *ICDM-RX/EN Hardware Installation and Configuration Guide*.
2. If necessary, download and install PortVision DX from <https://pepperl-fuchs.com>.
3. Configure the ICDM-RX/EN network settings using PortVision DX using the *ICDM-RX/EN Hardware Installation and Configuration Guide*.
4. If necessary, upload the latest EtherNet/IP firmware into the ICDM-RX/EN using PortVision DX.
5. Configure the serial or Ethernet TCP/IP socket port characteristics using the ICDM-RX/EN web pages, which is discussed in the *ICDM-RX/EN EtherNet/IP User Guide*.

If you have *Read-only or read/write* devices, you can use the appropriate procedures for your device, which are located in this *Quick Start*:

- Read-only devices (barcode scanners and some RFID readers), go to *Configuring Read-Only Serial Devices* on Page 7 or *Configuring Read-Only Ethernet TCP/IP Devices* on Page 13.
- Read/write devices (printers and some weigh scales), first perform the appropriate procedure for a read-only device and then go to *Configuring Read/Write Devices* on Page 21.

Optionally, the *ICDM-RX/EN EtherNet/IP User Guide* provides detailed information about each web page discussed in this *Quick Start*.

You may want to reference the Programming Interface chapter in the *ICDM-RX/EN EIP | UP EtherNet/IP User Guide*.

6. Optionally, reference the example plc programs in the *ICDM-RX/EN EtherNet/IP User Guide*.
7. Connect any serial device or devices using the *ICDM-RX/EN Hardware Installation and Configuration Guide*.
8. Verify any Ethernet TCP/IP devices are connected to the same subnet as the ICDM-RX/EN.

1.2. Locating the Latest Software and Documentation

Go to <https://pepperl-fuchs.com> for the latest software and documentation.



1.3. Data Type Definitions

The following data type definitions apply in this *Interface Configuration Guide*.

Data Type	Definition
USINT	Unsigned short integer (8-bit)
UINT	Unsigned integer (16-bit)
UDINT	Unsigned double integer (32-bit)
BYTE	Bit string (8-bit)



2. Configuring Read-Only Serial Devices

2.1. Read-Only Serial Device Prerequisites

Before you can configure the serial ports for read-only serial devices, make sure that you have done the following:

- Installed the hardware
- Installed PortVision DX
- Configured the ICDM-RX/EN IP address using PortVision DX
- If necessary, uploaded the latest EtherNet/IP firmware using PortVision DX

If you need to perform any of these procedures or locate the latest files, refer to: <https://pepperl-fuchs.com>.

2.2. Read-Only Serial Device Web Page Configuration

Use the following procedure to configure read-only serial ports.

1. Access the *ICDM-RX/EN* web page by entering the ICDM-RX/EN IP address in your web browser or by highlighting the ICDM-RX/EN in PortVision DX and clicking **Webpage**.
2. Click the **Serial** menu, which displays the **Serial Port Overview** tab.
3. Click the appropriate **Port N** tab to open the *Serial | Port Configuration* page for that port.

Note: If you need detailed information about any options, refer to the [ICDM-RX/EN EIP | UP EtherNet/IP User Guide](#).

4. Configure the *Serial Configuration* for the device that you plan on attaching to this port.

5. Set up the *Serial Packet Identification*.

- a. Set **STX (Start of transmission) Rx Detect** in decimal format.

Serial Packet Identification

STX (Start of Transmission) Rx Detect:

one byte Byte 1: Byte 2:

ETX (End of Transmission) Rx Detect:

one byte Byte 1: Byte 2:

Discard Rx Packets With Errors:

PLC Specific Settings

STX (Start of Transmission) Tx Append:

none Byte 1: Byte 2:

ETX (End of Transmission) Tx Append:

none Byte 1: Byte 2:

Strip Rx STX/ETX:

Application Specific Settings

STX (Start of Transmission) Tx Append:

none Byte 1: Byte 2:

ETX (End of Transmission) Tx Append:

none Byte 1: Byte 2:

Strip Rx STX/ETX:

- b. Set **ETX (End of transmission) Rx Detect** in decimal format.

- c. Set the PLC specific **Strip Rx STX/ETX Chars** setting if you do not wish to receive the STX/ETX bytes in the received data packet.

Note: Refer to your serial device's User Manual for the Start and End of Transmission byte(s) value(s). You may also be able to use the *Diagnostics | Serial Logs* page to determine these settings.

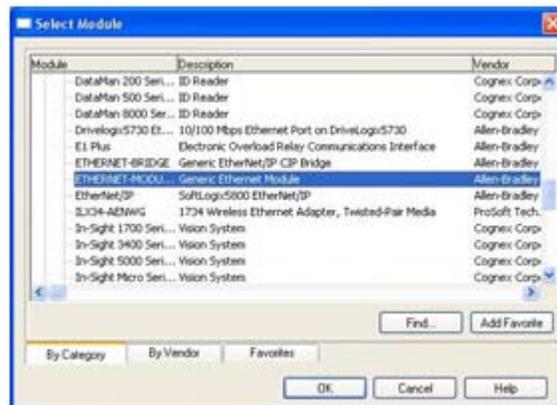
6. Click the **Save** button.

7. Configure the EtherNet/IP settings. Use the following steps if you want to configure the *Class 1 Interface receive method* (full CIP PLCs, including the ComtrolLogix family) or skip to Step 8.
 - a. Click the **Class1 Overview** menu option and the *Class 1 Overview* page displays.
 - b. If only Serial port connectivity is required, click the **Display Serial Only Defaults** button.
 - c. After the page has reloaded, click the **Set to Serial Only Defaults** button.

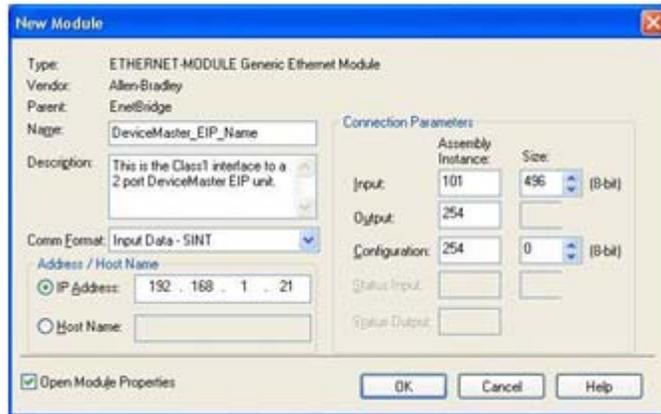
Note: *If the Display Serial Only Defaults button is not displayed, the active configuration is already set to the serial port only defaults.*

The Active Configuration is now set to Serial Only Defaults.
8. Click **Serial | Port** for the appropriate port and then click the **EtherNet/IP Settings** menu option to set up the *Ethernet/IP Settings*.
 - a. Set **Oversized Rx Packet Handling** to **Truncate** or **Drop**, depending on your environment.
 - b. If necessary, change the **Maximum Rx Data Packet Size** in bytes.

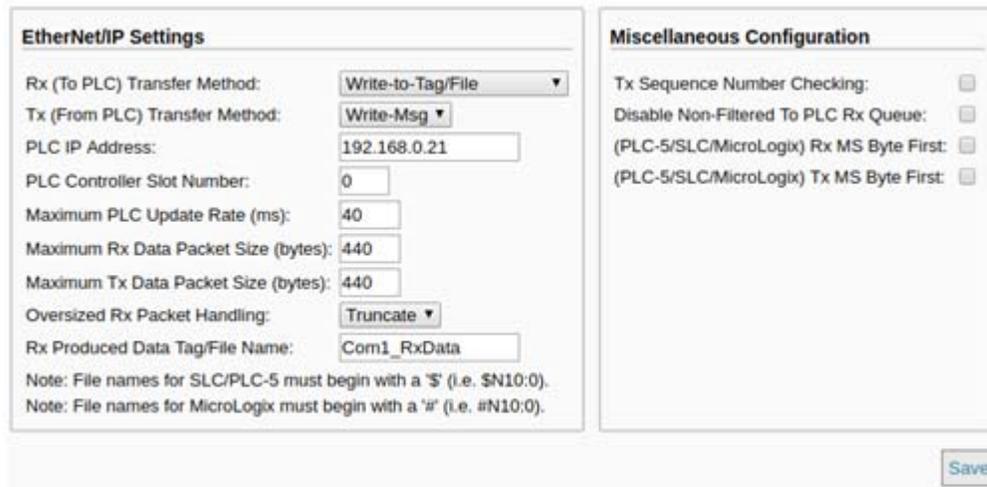
Note: *Changing this value changes the Class 1 interface.*
 - c. Click the **Save** button.
 - d. **For read-only devices only.** In the PLC program, configure the ICDM-RX/EN as a generic Ethernet device. Use the displayed connection lengths on the *Class 1 Overview* page to define the input Assembly Instance and Size.
 - In the PLC program, under the *Backplane* section, right-click the EtherNet/IP card and select **New Module...**
 - Under *Communications*, scroll down to **ETHERNET MODULE – Generic Ethernet Module**, select that line, and click the **OK** button.



- In the PLC program, configure the ICDM-RX/EN as a generic Ethernet device. Use the displayed connection lengths on the *Class 1 Overview* page to define the input Assembly Instance and Size.
- Note:** The Maximum Connection Length for port 1 contains all serial port data messages.



- To use the *Write-to-Tag/File receive method* (all Rockwell PLCs), click **Serial | Port N | EtherNet/IP Settings**,



- Set **Rx (To PLC) Transfer Method** to **Write-to-Tag/File**.
- Set the **Tx (From PLC) Transfer Method** to **Write-Msg**.
- Set **PLC IP Address** in xxx.xxx.xxx.xxx format.
- If ControlLogix, set the **PLC Controller Slot Number**.
This varies from zero to (max slot number – 1), but must always be zero for CompactLogix. For example, if the PLC has seven slots, the slot number range would be zero to six. (This field is ignored for SLC/PLC-5 PLCs.)
- If necessary, change the **Maximum PLC Update Rate (Write-To-Tag/File)** in ms.
- Set **Oversized Rx Packet Handling** to **Truncate** or **Drop**, depending on your environment.

- g. Set the **Rx (To PLC) Produced Tag Name** for the PLC type.
 - ControlLogix PLCs:** Set the **Rx (To PLC) Produced Tag Name** to the name of the tag where you want the data placed. The tag must be a public array of SINTs (bytes) large enough to hold the maximum sized data plus four bytes for the sequence number and length fields. The maximum size is 444 SINTs.
 - SLC or PLC-5 PLCs:**
 - Set the **Rx (To PLC) Produced Tag Name** to the file number where you want the data placed. This must be an integer file or files in sequence large enough for the maximum sized data plus two integers for the sequence number and length fields.
 - Set **(PLC-5/SLC) Rx MS Byte First** if you wish to receive data MS byte first (left to right in integer format).
 - h. If necessary, change the **Maximum Rx Data Packet Size** in bytes.
 - i. Click the **Save** button.
10. Set the *Filtering/Data Extraction Configuration*:
- If no filtering/data extraction is required, leave all filtering/data extraction settings to defaults.
 - If filtering/data extraction is required, go to *Filtering/Data Extraction Configuration* on Page 29.
11. Set the *Application TCP Connection Configuration*.
- If no application socket interface is required, leave all application socket interface settings at defaults and verify that the **Application Enable** option is not selected.
 - If an application socket interface is required, go to *Application Socket Configuration* on Page 33.
12. Optionally, save the settings in a configuration file using one of these two methods.
- Web page, which saves the network settings and the protocol settings. You can use configuration files to upload the settings to multiple ICDM-RX/ENs or for restoration purposes.
 - a. Click **System | Configuration File**.
 - b. Click the **Save Configuration** button.
 - c. Enter a file name for the configuration file and click **Save**.
 - PortVision DX, which saves the network settings and the protocol settings. You can use configuration files to upload the settings to multiple ICDM-RX/ENs or for restoration purposes.
 - a. Right-click the ICDM-RX/EN in the *Device List* pane (lower), and click **Configuration > Save**.
 - b. Enter a file name for the configuration file (*filename.dc*) and click **Save**.

If all is set up correctly, the ICDM-RX/EN places the data packets into the specified tag(s) or file locations. The first integer received is the sequence number. This is incremented with each new data packet. The next integer is the length, which indicates the number of bytes of data received. The rest is data.

The format of data sent to ControlLogix family PLCs:

Name	Data Type	Data Value(s)
Receive (ICDM-RX/EN to PLC message data. Structure of: Produced data sequence Data length (in bytes) Data array	UINT UINT Array of USINT	0-65535 (FFFF Hex) 0-1024 0-255

For Class 1 communications, it is recommended to limit the input connection size to 496 bytes or less. While the ICDM-RX/EN does support much larger Class 1 connections, many EtherNet/IP controllers do not. If a Class 1 connection larger than 496 bytes is required, it may be necessary to use the *Write-to-Tag Rx* method.

For large received data packets over 440 bytes in size, it is recommended to use either Class 1, up to 496 bytes, or the *Write-to-Tag Rx* method. For *Write-to-Tag*:

- Data larger than 440 SINTs require a series of tags of 444 SINT in size.
- The last tag can be smaller in size as long as the total length of all tags in the sequence is sufficient to hold the largest receive packet, plus four bytes for the sequence number and length parameters.

- Each tag must be named in sequence with the second tag having a 2 appended, the third having a 3 appended and so on. An example series of tags to hold large packets of received data would be: **Com1_RxData**, **Com1_RxData2**, **Com1_RxData3**, etc.
- All data will have been transferred to the PLC when the sequence number is updated.

The format of data sent to SLC/PLC-5 PLCs:

Name	Data Type	Data Value(s)
Receive (ICDM-RX/EN to PLC message data. Structure of: Produced data sequence Data length (in bytes) Data array	UINT UINT Array of UINT	0-65535 (FFFF Hex) 0-1024 0-65535

For large received data packets, use the *Write-to-File Rx* method:

- The data is automatically placed in sequential files.
- The files must be 256 integers in size with the exception of the last file. The last file may be shorter than 256 integers as long as the total length of all files in the sequence is sufficient to hold the largest receive packet, plus two integers for the sequence number and length parameters.
- All data is transferred to the PLC when the sequence number is updated.



3. Configuring Read-Only Ethernet TCP/IP Devices

3.1. Read-Only Ethernet TCP/IP Device Prerequisites

Before you can configure the serial ports for read-only Ethernet TCP/IP devices, make sure that you have done the following:

- Installed the hardware
- Installed PortVision DX
- Configured the ICDM-RX/EN IP address using PortVision DX
- If necessary, uploaded the latest EtherNet/IP firmware using PortVision DX

If you need to perform any of these procedures or locate the latest files, see *Installation Overview* on Page 5.

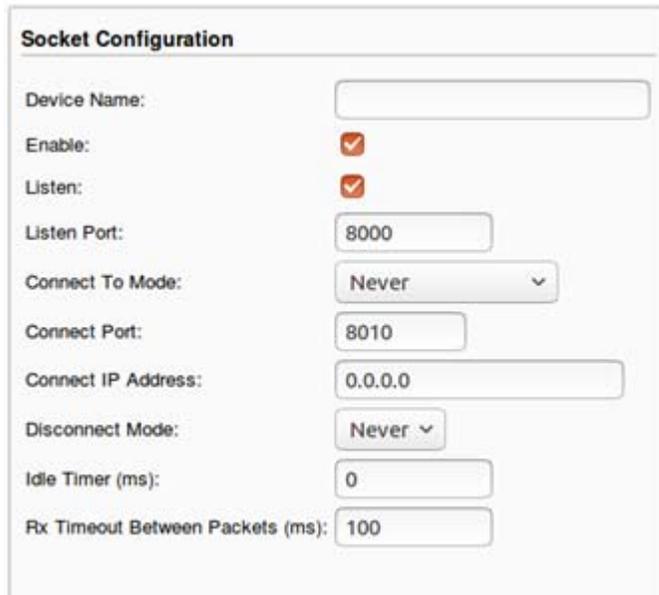
3.2. Read-Only Ethernet TCP/IP Device Web Page Configuration

Use the following procedure to configure read-only socket devices.

1. Access the web page by entering the ICDM-RX/EN IP address in your web browser or by highlighting the ICDM-RX/EN in PortVision DX and clicking **Webpage**.
2. Click the **Ethernet** menu, which opens the *Ethernet Device Overview* page. The complete page is not displayed in this image.
3. Click the appropriate **Device N** tab to open *Device Interface Configuration* page for that port.
4. Under *Socket Configuration* area, select **Enable** and configure the port for your environment.
 - If your Ethernet TCP/IP device requires another device to connect to it, configure the socket port on the ICDM-RX/EN to **Connect** mode.
 - Do not enable the **Listen** option.
 - Set **Connect To Mode** to **Connect-Always**.
 - Set the **Connect Port** to the socket port number of your Ethernet device.
 - Set the **Connect IP Address** to the IP address of your Ethernet device.
 - Set **Disconnect Mode** to **Never**.
 - Set the **Rx timeout Between Packets**. For normal settings, typical values are 10 to 100ms.

Field	Value
Device Name	
Enable	<input checked="" type="checkbox"/>
Listen	<input type="checkbox"/>
Listen Port	8000
Connect To Mode	Connect-Always
Connect Port	9000
Connect IP Address	192.168.0.25
Disconnect Mode	Never
Idle Timer (ms)	0
Rx Timeout Between Packets (ms)	100

- If your Ethernet TCP/IP device is configured to connect to another device, configure the socket port on the ICDM-RX/EN to **Listen** mode.
 - Select **Listen**.
 - Use the default **Listen Port** on the ICDM-RX/EN of $\&xxx$ or designate your own.
 - Set **Connect To Mode** to **Never**.
 - Set **Disconnect Mode** to **Never**.
 - Configure your Ethernet device to connect to the ICDM-RX/EN at the **ICDM-RX/EN IP address** and **Listen Port**.
 - Set the **Rx Timeout Between Packets**. For normal settings, typical values are 10 to 100ms.



Socket Configuration

Device Name:

Enable:

Listen:

Listen Port:

Connect To Mode:

Connect Port:

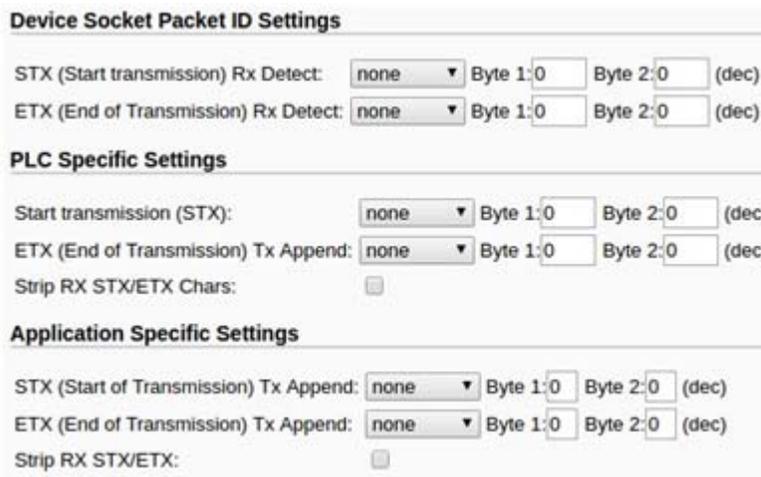
Connect IP Address:

Disconnect Mode:

Idle Timer (ms):

Rx Timeout Between Packets (ms):

5. Set up the **Device Socket Packet ID Settings**.



Device Socket Packet ID Settings

STX (Start transmission) Rx Detect: Byte 1: Byte 2: (dec)

ETX (End of Transmission) Rx Detect: Byte 1: Byte 2: (dec)

PLC Specific Settings

Start transmission (STX): Byte 1: Byte 2: (dec)

ETX (End of Transmission) Tx Append: Byte 1: Byte 2: (dec)

Strip RX STX/ETX Chars:

Application Specific Settings

STX (Start of Transmission) Tx Append: Byte 1: Byte 2: (dec)

ETX (End of Transmission) Tx Append: Byte 1: Byte 2: (dec)

Strip RX STX/ETX:

- Set the **STX (Start of transmission) Rx Detect** in decimal format.
- Set the **ETX (End of transmission) Rx Detect** in decimal format.
- Enable the **Strip Rx STX/ETX** option if you do not want the STX and ETX bytes returned to the PLC or application.

Note: Refer to your device's User Manual for the Start and End of Transmission byte(s) settings. You may also be able to use the **Diagnostics | Ethernet Device Logs** page to determine these settings.

6. Under *Ethernet/IP Settings*:

- To use the *Class1 Interface receive method* (Full CIP PLCs, including ControlLogix family), click the **Class 1 Overview** option:
 - a. If only Ethernet device connectivity is required, click the **Display Ethernet Only Defaults** button.
 - b. After page has reloaded, click **Set to Ethernet Only Defaults** button.

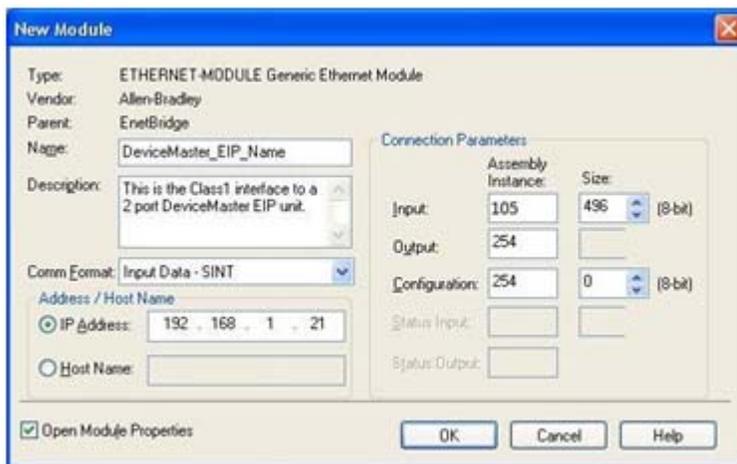
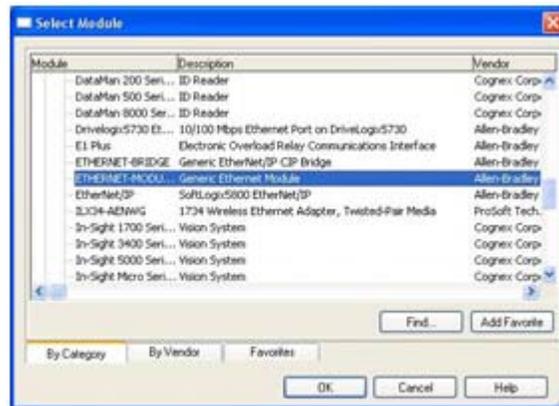
Note: *If the Display Ethernet Only Defaults button is not displayed, the active configuration is already set to the Ethernet device only defaults.*

The active configuration is set to the Ethernet device default.

- c. Click **Serial | Port x | EtherNet/IP Settings**.
- d. **Set Oversized Rx Packet Handling to Truncate or Drop**, depending on your environment.
- e. If necessary, change the **Maximum Rx Data Packet Size** in bytes.
- f. Doing so will change the Class 1 interface.
- g. Click the **Save** button.

The screenshot shows two side-by-side configuration panels. The left panel, titled "EtherNet/IP Settings", contains the following fields: "Rx (To PLC) Transfer Method:" with a dropdown menu set to "Class1"; "Tx (From PLC) Transfer Method:" with a dropdown menu set to "Class1"; "PLC IP Address:" with a text input field containing "0.0.0.0"; "PLC Controller Slot Number:" with a text input field containing "0"; "Maximum PLC Update Rate (ms):" with a text input field containing "40"; "Maximum Rx Data Packet Size (bytes):" with a text input field containing "120"; "Maximum Tx Data Packet Size (bytes):" with a text input field containing "116"; "Oversized Rx Packet Handling:" with a dropdown menu set to "Truncate"; and "Rx Produced Data Tag/File Name:" with an empty text input field. Below these fields are two notes: "Note: File names for SLC/PLC-5 must begin with a '\$' (i.e. \$N10:0)." and "Note: File names for MicroLogix must begin with a '#' (i.e. #N10:0).". The right panel, titled "Miscellaneous Configuration", contains four checkboxes: "Tx Sequence Number Checking:" (unchecked), "Disable Non-Filtered To PLC Rx Queue:" (unchecked), "(PLC-5/SLC/MicroLogix) Rx MS Byte First:" (unchecked), and "(PLC-5/SLC/MicroLogix) Tx MS Byte First:" (unchecked).

- **For read-only devices only:** In the PLC program, configure the ICDM-RX/EN as a generic Ethernet device. Use the displayed connection lengths on the *Class 1 Overview* page to define the input Assembly Instance and Size.
 - In the PLC program, under the backplane section, right-click the EtherNet/IP card and select **New Module...**
 - Under **Communications**, scroll down and select **ETHERNET MODULE – Generic Ethernet Module**, and click the **OK** button.
 - In the PLC program, configure the ICDM-RX/EN as a generic Ethernet device. Use the displayed connection lengths on the *Class 1 Overview* page to define the input Assembly Instance and Size.



- To use the *Write-to-Tag/File* receive method (All Rockwell PLCs), click **Serial | Port x | EtherNet/IP**.

- Set **Rx (To PLC) Ethernet Transfer Method** to **Write-to-Tag/File**.
- Set **Tx (From PLC) Transfer Method** to **Write-Msg**.
- Set the **PLC IP Address** in xxx.xxx.xxx.xxx format.
- For ControlLogix, set the **PLC Controller Slot Number**. This varies from zero to (max slot number – 1), but must always be zero for CompactLogix. For example, if the PLC has seven slots, the slot number range would be zero to six.
(This field is ignored for SLC/PLC-5 PLCs.)
- If necessary, change the **Maximum PLC Update Rate (Write-To-Tag/File)** in ms.
- If necessary, change the **Maximum Rx Data Packet Size** in bytes (The Maximum Tx Data Packet Size).
- Set **Oversized Rx Packet Handling** to **Truncate** or **Drop**, depending on your environment.
- Set the **Rx (To PLC) Produced Tag Name** for the appropriate environment.

ControlLogix family PLCs: Set this field to the name of the tag where you want the data placed. The tag must be a public array of SINTs (bytes) large enough to hold the maximum sized data plus four bytes for the sequence number and length fields. The maximum size is 444 SINTs.

SLC or PLC-5/MicroLogix PLCs:

- Set the **Rx (To PLC) Produced Tag Name** to the File number where you want the data placed. This must be an Integer file or files in sequence large enough for the maximum sized data plus two integers for the sequence number and length fields.
- Set **(PLC-5/SLC) Rx MS Byte First** if you wish to receive data MS byte first (left to right in integer format).
- For transmit only: set **(PLC-5/SLC) Tx MS Byte First** if you wish to transmit data MS byte first (left to right in integer format).

- Click the **Save** button.

7. Set the *Filtering/Data Extraction Configuration*:

- If no filtering/data extraction is required, leave all filtering/data extraction settings to defaults.
- If filtering/data extraction is required, go to *Filtering/Data Extraction Configuration* on Page 29.

8. *Set the Application TCP Connection Configuration:*

- If no application socket interface is required, leave all application socket interface settings at defaults and verify that the **Enable** option is not selected.
- If an application socket interface is required, go to *Application Socket Configuration* on Page 33.

9. Optionally, save the settings in a configuration file using one of these two methods.

- Web page, which saves the network settings and the protocol settings. You can use configuration files to upload the settings to multiple ICDM-RX/ENs or for restoration purposes.
 - a. Click **System | Configuration File**.
 - b. Click the **Save Configuration** button.
 - c. Enter a file name for the configuration file and click **Save**.
- PortVision DX, which saves the network settings and the protocol settings. You can use configuration files to upload the settings to multiple ICDM-RX/ENs or for restoration purposes.
 - a. Right-click the ICDM-RX/EN in the *Device List* pane (lower), and click **Configuration > Save**.
 - b. Enter a file name for the configuration file (*filename.dc*) and click **Save**.

If all is set up correctly, the ICDM-RX/EN will place the data packets into the specified tag(s) or file locations. The first integer received is the sequence number. This is incremented with each new data packet. The next integer is the length, which indicates the number of bytes of data received. The rest is data.

The format of data sent to ControlLogix family PLCs:

Name	Data Type	Data Value(s)
Receive (ICDM-RX/EN to PLC) message data. Structure of: Produced data sequence Data length (in bytes) Data array	UINT UINT Array of USINT	0-65535 (FFFF Hex) 0-2048 0-255

For Class 1 communications, it is recommended to limit the input connection size to 496 bytes or less. While the ICDM-RX/EN does support larger Class 1 connections, many EtherNet/IP controllers do not. If a Class 1 connection larger than 496 bytes is required, it may be necessary to use the Write-to-Tag Rx method.

For large received data packets over 440 bytes in size, it is recommended to use either Class 1, up to 496 bytes, or the Write-to-Tag Rx method. For Write-to-Tag:

- Data larger than 440 SINTs require a series of tags of 444 SINT in size.
- The last tag can be smaller in size as long as the total length of all tags in the sequence is sufficient to hold the largest receive packet, plus four bytes for the sequence number and length parameters.
- Each tag must be named in sequence with the second tag having a 2 appended, the third having a 3 appended and so on.
- An example series of tags to hold large packets of received data would be: **Com1_RxData**, **Com1_RxData2**, **Com1_RxData3**, etc.
- All data will have been transferred to the PLC when the sequence number is updated.

The format of data sent to SLC/PLC-5 PLCs:

Name	Data Type	Data Value(s)
Receive (ICDM-RX/EN to PLC) message data. Structure of: Produced data sequence Data length (in bytes) Data array	UINT UINT Array of UINT	0-65535 (FFFF Hex) 0-2048 0-65535



For large received data packets, use the *Write-to File-Rx* method:

- The data will automatically be placed in sequential files.
- The files must be 256 integers in size with the exception of the last file. The last file may be shorter than 256 integers as long as the total length of all files in the sequence is sufficient to hold the largest receive packet, plus two integers for the sequence number and length parameters.
- All data will have been transferred to the PLC when the sequence number is updated.



4. Configuring Read/Write Devices

4.1. Prerequisites

Before you can configure the serial ports for read-only Ethernet TCP/IP devices, make sure that you have done the following:

- Installed the hardware
- Installed PortVision DX and configured the ICDM-RX/EN IP address using PortVision DX
- Uploaded the EtherNet/IP firmware (V7.02 or higher) using PortVision DX

If you need to perform any of these procedures or locate the latest files, see *Installation Overview* on Page 5.

4.2. Read-Only Ethernet TCP/IP Device Web Page Configuration

Follow the procedures in *Configuring Read-Only Serial Devices* on Page 7 or *Configuring Read-Only Ethernet TCP/IP Devices* on Page 13 and use the following procedure to complete the procedure for read/write devices.

1. Access the ICDM-RX/EN web page by entering the ICDM-RX/EN IP address in your web browser or by highlighting the ICDM-RX/EN in PortVision DX and clicking **Webpage**.
Note: *If the browser does not display the web page correctly, clear the browser history and refresh the ICDM-RX/EN web page.*
2. Open the web page for the serial or socket port and make the appropriate selections for your environment.
 - **Serial Ports** - Click **Serial | Port x**.
Set up the transmit serial packet identification.
 - If desired, set the **STX (Start of transmission) Tx Append** in decimal format for the PLC and/or the application. This will append the STX byte(s) to your transmitted message. Refer to your *serial device's User Manual* for this setting.
 - If desired, set the **ETX (End of transmission) Tx Append** in decimal format for the PLC and/or the application. This will append the ETX byte(s) to your transmitted message. Refer to your *serial device's User Manual* for this setting.
 - Click the **Save** button after making any changes.
PLC-5/SLC PLCs/MicroLogic: set (PLC-5/SLC) **Tx MS Byte First** if you wish to transmit data MS byte first (left to right in integer format).
 - **Socket Ports** - Click **Ethernet | Device x**.
PLC-5/SLC PLCs: Set (PLC-5/SLC) **Tx MS Byte First** if you wish to transmit data MS byte first (left to right in integer format).
 - If desired, set the **STX (Start of transmission) Tx Append** in decimal format for the PLC and/or the application. This will append the STX byte(s) to your transmitted message. Refer to your *serial device's User Manual* for this setting.
 - If desired, set the **ETX (End of transmission) Tx Append** in decimal format for the PLC and/or the application. This will append the ETX byte(s) to your transmitted message. Refer to your *serial device's User Manual* for this setting.
 - Click the **Save** button after making any changes.
PLC-5/SLC PLCs/MicroLogic: Set (PLC-5/SLC) **Tx MS Byte First** if you wish to transmit data MS byte first (left to right in integer format).



3. Optionally, save the settings in a configuration file using one of these two methods.
 - Web page, which saves the network settings and the protocol settings. You can use configuration files to upload the settings to multiple ICDM-RX/ENs or for restoration purposes.
 - a. Click **System | Configuration File**.
 - b. Click the **Save Configuration** button.
 - c. Enter a file name for the configuration file and click **Save**.
 - PortVision DX, which saves the network settings and the protocol settings. You can use configuration files to upload the settings to multiple ICDM-RX/ENs or for restoration purposes.
 - a. Right-click the ICDM-RX/EN in the *Device List* pane (lower), and click **Configuration > Save**.
 - b. Enter a file name for the configuration file (*filename.dc*) and click **Save**.
4. Go to the appropriate discussion to complete configuration for your environment:
 - *Configuring ControlLogix family PLCs for Write-to-Tag* on Page 24
 - *Configuring SLC/PLC-5/MicroLogix PLCs* on Page 26

4.3. Configuring ControlLogix family PLCs for Class 1

Use the following procedure to configure ControlLogix PLCs for Class 1.

1. Click **Ethernet | Device x** and then the **EtherNet/IP Settings** tab.
 - a. **Set Tx (From PLC) Transfer Mode to Class1.**
 - b. If necessary, change the **Maximum Tx Data Packet Size**.

Note: *Doing so will change the Class 1 interface.*

The screenshot shows two configuration panels. The left panel, titled "EtherNet/IP Settings", contains the following fields:

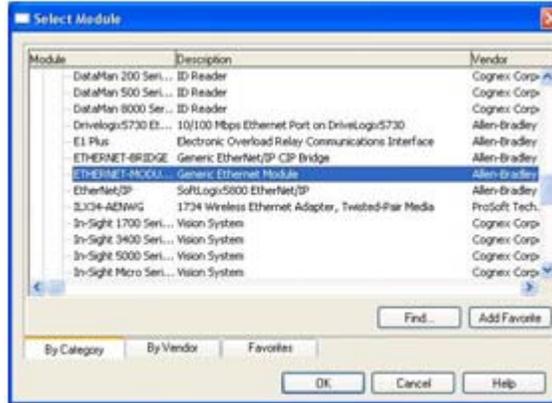
- Rx (To PLC) Transfer Method: Class1 (dropdown)
- Tx (From PLC) Transfer Method: Class1 (dropdown)
- PLC IP Address: 0.0.0.0 (text input)
- PLC Controller Slot Number: 0 (text input)
- Maximum PLC Update Rate (ms): 40 (text input)
- Maximum Rx Data Packet Size (bytes): 120 (text input)
- Maximum TX Data Packet Size (bytes): 116 (text input)
- Oversized Rx Packet Handling: Truncate (dropdown)
- Rx Produced Data Tag/File Name: (text input)

 Below these fields are two notes: "Note: File names for SLC/PLC-5 must begin with a '\$' (i.e. \$N10:0)." and "Note: File names for MicroLogix must begin with a '#' (i.e. #N10:0).". The right panel, titled "Miscellaneous Configuration", contains three checkboxes, all of which are unchecked:

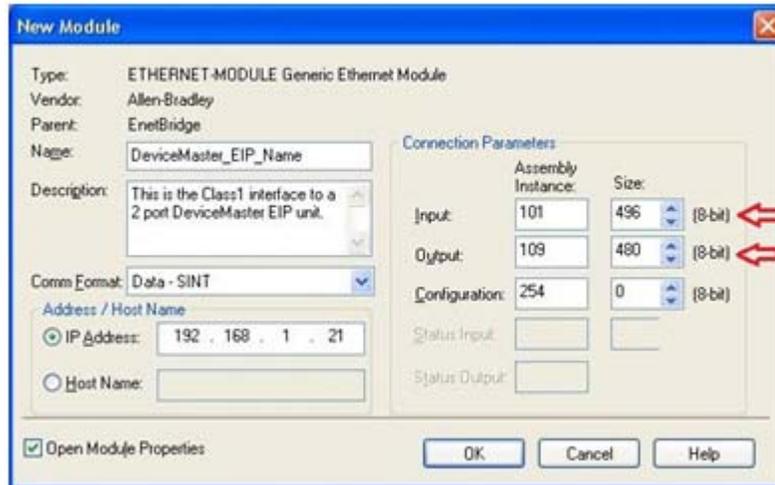
- Tx Sequence Number Checking:
- Disable Non-Filtered To PLC Rx Queue:
- (PLC-5/SLC/MicroLogix) Rx MS Byte First:
- (PLC-5/SLC/MicroLogix) Tx MS Byte First:

 A "Save" button is located at the bottom right of the interface.

2. In the PLC program, configure the ICDM-RX/EN as a generic Ethernet device. Use the displayed connection lengths on the Class 1 Overview page to define the input *Assembly Instance* and *Size*.



- a. Under the *backplane* section, right-click on the EtherNet/IP card and select **New Module...**
- b. Under **Communications**, scroll down and select **ETHERNET MODULE – Generic Ethernet Module** and click the **OK** button.
- c. In the PLC program, configure the ICDM-RX/EN as a generic Ethernet device. Use the displayed connection lengths in the *Class 1 Overview* page to define the input *Assembly Instance* and *Size*.



Note: The Maximum Connection Length for Port 1 contains all serial port data messages.

3. The transmit sequence number must be incremented before a transmit operation will be performed on a serial port or to an Ethernet device.



4.4. Configuring ControlLogix family PLCs for Write-to-Tag

1. Import the example PLC program **loopbackExampleTagWrite.L5K** into RSLogix5000.

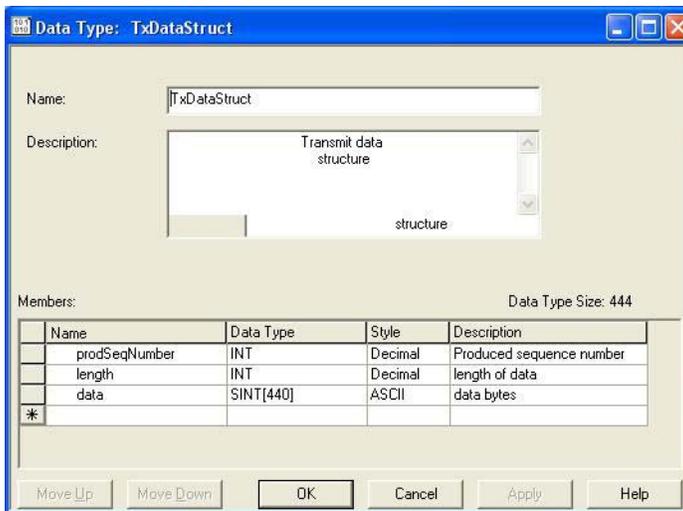
2. Copy the *User-Defined* data type **TxDATASTRUCT** into your PLC program. The data format is as follows:

INT – Produced Sequence Number.

INT – Length of data filed in bytes.

SINT[440] – Data field (max size is 440, but that size may not be necessary for your application).

3. Create a **Controller** or **Program** tag with the **TxDATASTRUCT** data type. Call it **Com1_TxDATASTR** for a serial port and **Skt1_TxDATASTR** for a socket port.



4. Open the **TX data tag**.

[-] Com1_TxDATASTR	{...}	{...}	TxDATASTRUCT	Transmit data stru...
[-] Com1_TxDATASTR.prodSeqNumber	0		Decimal	Transmit data stru...
[-] Com1_TxDATASTR.length	256		Decimal	Transmit data stru...
[-] Com1_TxDATASTR.data	{...}	{...}	ASCII	Transmit data stru...

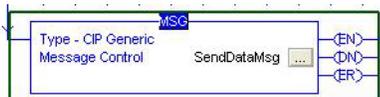
a. Set the **TX tag** field length to the number of bytes you wish to transmit out the serial or socket port.

b. Input the data to transmit into the data array.

c. You can optionally increment the transmit sequence number **prodSeqNumber** with each message you transmit, but it is not required.

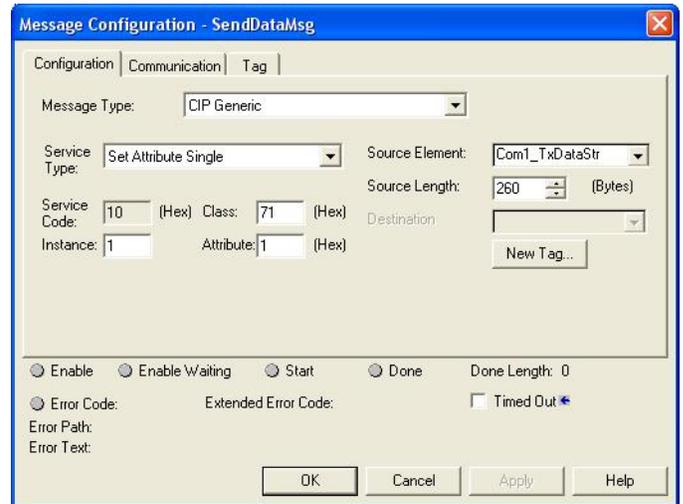
5. Create a message instruction for transmitting the data or copy **SendDataMsg** from **loopbackExampleTagWrite.L5K**.

6. Add the transmit message to your PLC program. It may help to reference rung 3 of **loopbackExampleTagWrite.L5K**.

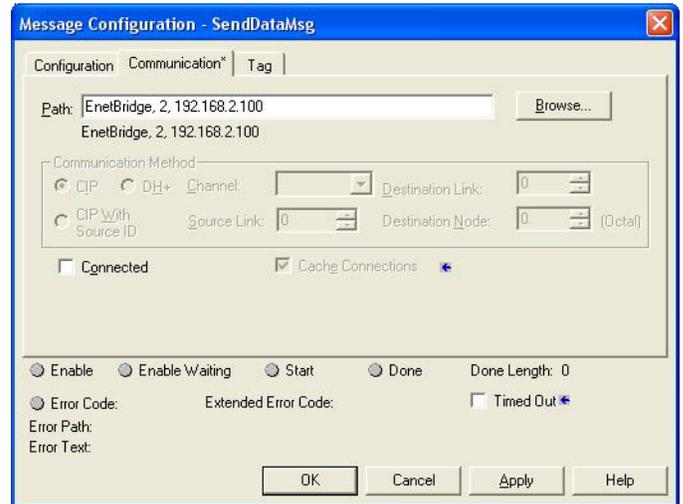


7. Open the transmit message.

8. On the *Configuration Controller* pane:
 - a. Set **Message Type** to **CIP Generic**.
 - b. Set **Service Type** to **Set Attribute Single**.
 - c. Set **Class** to:
 - Serial ports: Set to **71 Hex**.
 - Socket ports: Set to **74 Hex**.
 - d. Set **Instance** to the serial or socket number.
 - e. Set **Attribute** to **1**.
 - f. Set **Source Element** to **Com1_TxDataStr** (or **Skt1_TxDataStr**).
 - g. Set **Source Length** to at least the length **TxDataStr.length** (or **Skt1_TxDataStr.length**) plus 4.



9. On the *Communication* pane:
 - a. Set **Path** to: **<Ethernet IP Card Name>,2,<IP Address>**.
 If MicroLogix PLC, the path may need to be in one of the following formats:
 - **<Ethernet IP Card Name>,0,<IP Address>**
 - **<Ethernet IP Card Name><IP Address>**
 - b. Leave **Connected** unchecked.
 - c. Click **OK**.
10. Add controlling logic to your PLC program to control when to transmit the message. You may wish to use **loopbackExampleTagWrite.L5K** as a reference.



4.5. Configuring SLC/PLC-5/MicroLogix PLCs

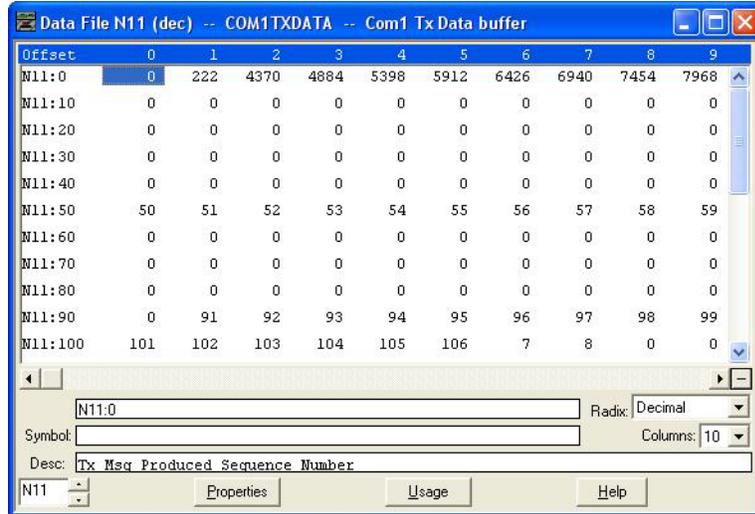
1. Create a **Data File** to send the transmit data. It will have the form of:

- Integer - Produced Sequence Number
- Integer - Length of data field in bytes.
- Integer[] - Data field array large enough to hold all data to transmit (two bytes or characters per integer).

2. Open the **TX Data** file.

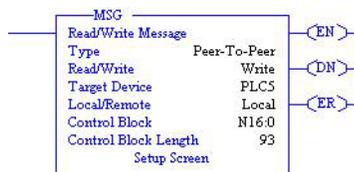
3. Set the second integer to the length of data to transmit in bytes.

4. Input the data to transmit starting at the third integer. It can be entered from left to right in each integer, MS Byte First, or from right to left which is LS Byte First.



For operating in the MS Byte First mode, you must set the **(PLC-5/SLC) Rx MS Byte First** and **(PLC-5/SLC) Tx MS Byte First** settings on the corresponding serial or socket port on the ICDM-RX/EN embedded web page.

5. Optionally, increment the transmit sequence number in the first **TX Data File** integer with each message you transmit.
6. Create a transmit message of either **PLC5** or **SLC (500CPU) Write**. For MicroLogix, use **SLC (500CPU) Write**.
7. Set up a control message block of the appropriate length.
8. Add the message to your ladder logic.



9. Open the *Setup* screen and in the *General* pane, under *This Controller*:

- a. Set **Data Table Address** to that of the **TX Data File** in your PLC program. (i.e. N11:0)
- b. Set **Size in Elements** to be at least large enough to contain the entire **TX Data message**. That will include the sequence number, length, and data integers. The ICDM-RX/EN will only send the number of bytes specified in the second message integer and will ignore any extra data.
- c. Set **Channel** to that of your Ethernet channel.

10. In the *General* pane, under *Target Device*:

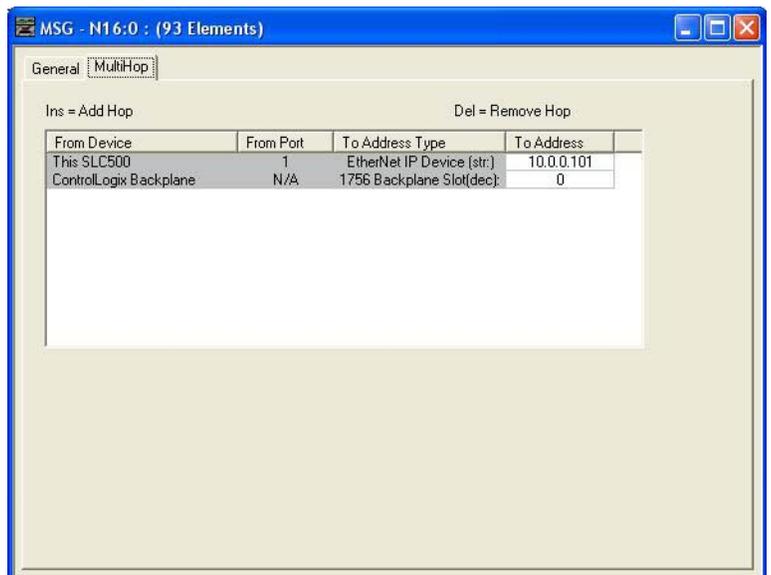
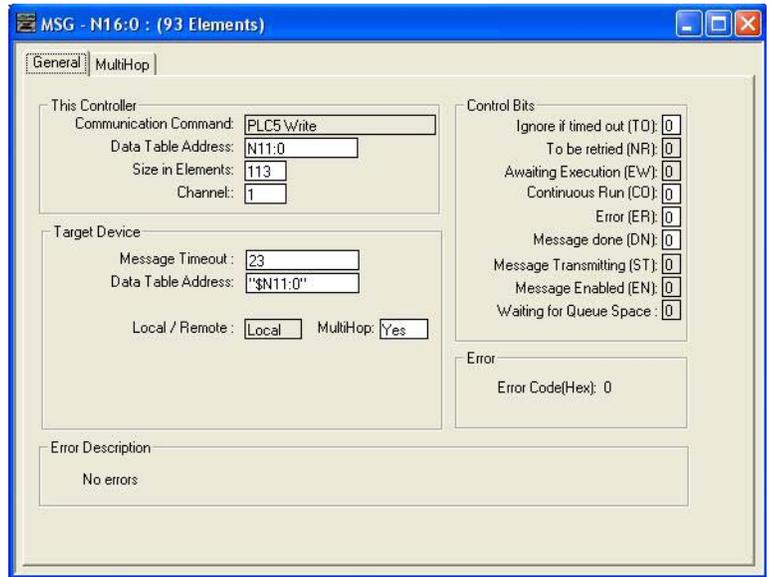
- a. Leave **Message Timeout** to the default value.
- b. Set **Data Table Address** to that of the corresponding transmit address of the serial or socket port on the ICDM-RX/EN.
 - Serial Port 1 = N11:0
 - Serial Port 2 = N21:0
 - Serial Port 3 = N31:0
 - Serial Port 4 = N41:0
 - Socket Port 1 = N51:0
 - Socket Port 2 = N61:0
 - Socket Port 3 = N71:0
 - Socket Port 4 = N81:0

11. In the *MultiHop* pane:

- a. First line: set the IP address to that of the ICDM-RX/EN.
- b. Second line: set the ControlLogix Backplane to 0 (zero).

12. Add controlling logic to your PLC program to control when to transmit the message. You may wish to use one of the write-to-file example programs as a reference:

- PLC-5:
lpbkExamplePlc5MsgFileRS5
- SLC:
lpbkExampleSlcMsgFileRS500





5. Filtering/Data Extraction Configuration

Select your filtering mode(s):

- Use *String* filtering if:
 - Received data can be no greater than 128 bytes in length.
 - Received data is not in EPCglobal or barcode UPC/EAN formats or you do not want the ICDM-RX/EN to extract the RFID tag or barcode parameters.
 - You want to filter and eliminate duplicate received messages.
- Use *RFID* filtering if:
 - You have an Alien or Intermec RFID reader or another reader that can provide RFID tag data in ASCII hex format similar to either an Alien or Intermec reader.
 - Your data is in EPCglobal format and you want the ICDM-RX/EN to extract the RFID tag data parameters and filter based on those parameters.
- Use *Barcode* filtering if your barcode data is in UPC-A, UPC-E, EAN-13, JAN, EAN-14, or EAN-8 formats and you want the ICDM-RX/EN to extract the barcode data parameters and filter based on those parameters.

Filtering/Data Extraction Configuration

To PLC Filter Mode:

To PLC Filter Options (RFID Only):

 Antenna Filter Value Serial Number

To PLC Filter Options (RFID/Barcode):

 Company Product/Location Encoding/Numbering

To Application Filter Mode:

To Application Filter Options (RFID Only):

 Antenna Filter Value Serial Number

To Application Filter Options (RFID/Barcode):

 Company Product/Location Encoding/Numbering

RFID Antenna Grouping:

RFID Reader Interface Type:

Barcode UPC/EAN Standard 12-14 Digit Format:

Barcode UPC/EAN Eight Digit Format:

Filter Age Time (Time filtered after last read):

 (min) (sec) (msec)

Discard Unrecognized Data (RFID/Barcode):

5.1. PLC Filtering/Data Extraction

Under the *Filtering/Data Extraction Configuration* section corresponding to the desired serial or socket port:

1. Set **To PLC Filter Mode** to the desired mode.
2. **For String (128 char max)**: set the **Filter Age Time** to how long after the last read you want an entry to be filtered.
3. Go to the appropriate discussion for your environment.
 - *RFID (EPCglobal Formats)* on Page 30
 - *Barcode (UPC/EAN Formats)* on Page 30



5.1.1. RFID (EPCglobal Formats)

1. Set any or all of the **To PLC Filter Options (RFID Only)** filtering options.
2. Set any or all of the **To PLC Filter Options (RFID/Barcode)** filtering options.
Note: You must select at least one filtering option for filtering/data extraction to function.
3. If **Antenna Grouping** is desired, set **RFID Antenna Grouping** option to reflect your antenna configuration.
4. Set the **RFID Reader Interface Type** to that of your RFID Reader configuration.
If your RFID Reader is not listed, refer to the *ICDM-RX/EN Filtering and Data Extraction Reference Guide* for the supported RFID reader interfaces. If your RFID reader format matches one of the listed formats, then set the **RFID Reader Interface Type** to that format.
5. Set the **Filter Age Time** to how long after the last read you want an entry to be filtered.
6. If you want the ICDM-RX/EN to discard any non-RFID tag messages, set the **Discard Unrecognized Data** to either **To-PLC** or **To-PLC/Application**.

Refer to the *ICDM-RX/EN Filtering and Data Extraction Reference Guide* for more information.

To PLC RFID Data Format: When the PLC interface is operating in RFID filtering mode, all data sent to the PLC will be in the following format:

Field	Data Type	Description
Produced data sequence number	UINT Values = 0-65535 (FFFF Hex)	Sequence number that is incremented with each new message.
Length of RFID message	UINT Values = 20-148	Length in bytes of following data.
Company Code	UDINT[2]	Company Code extracted from tag data. Depending on encoding scheme, this field may include Company Prefixes, Company Prefix Indexes, or Government Managed Identifier.
Product/Location Code	UDINT[2]	Product Code extracted from tag data Depending on encoding scheme, this field may include the Item Reference, Location Reference, Asset Reference, Object Class, or be set to zero.
Serial Number	UDINT[2]	Serial Number extracted from tag data. Depending on the encoding scheme, this field may include the Serial Number or Individual Asset Reference.
Encoding Scheme	UINT	Encoding Scheme from tag data.
Filtering Value	UINT	Filtering value from tag data.
Antenna Number	UINT	Antenna number on RFID reader/scanner.
Tag Data Length	UINT	Length of RFID tag string in bytes
Tag Data	BYTE[128]	Tag data string (variable length field). May also include non-tag messages, which can optionally be sent to the PLC and/or application

5.1.2. Barcode (UPC/EAN Formats)

1. Set any or all of the **To PLC filter options (RFID/Barcode)** filtering options.
Note: You must select at least one for the filtering/data extraction to function.
2. If you are using *standard* twelve to fourteen digit UPC/EAN barcodes, set the **Barcode UPC/EAN 12-14 Digit Format** to match that of your barcodes.

The **Company-5/Product-5** is the most popular format.

3. If you are using *eight* digit UPC/EAN barcodes, set the **Barcode UPC/EAN 8 Digit Format** to match that of your barcodes.
4. If you want the ICDM-RX/EN to discard any non-RFID tag messages, set the **Discard Unrecognized Data** to either **To-PLC** or **To-PLC/Application**.

Refer to the *ICDM-RX/EN Filtering and Data Extraction Reference Guide*.

for more information:

To PLC Barcode Data Format: When the PLC interface is operating in barcode filtering mode, all data sent to the PLC will be in the following format:

Field	Size	Description
Produced data sequence number	UINT Values = 0-65535 (FFFF Hex)	Sequence number that is incremented with each new message.
Length	UINT Values = 12-140	Length in bytes of following data.
Company Code	UDINT	Company Code.
Product Code	UDINT	Product Code.
Numbering Code	UINT	Numbering code (from first byte(s) of barcode data).
Barcode Data Length	UINT	Length of barcode string in bytes.
Barcode Data	BYTE[128]	Barcode data string (variable length field).

Note: The Company Code will be set to zero for all EAN-8 codes.

5.2. Application Filtering/Data Extraction

Access the *Filtering/Data Extraction Configuration* section corresponding to the desired serial or socket port:

1. Set **To Application Filter Mode** to the desired mode.
2. For **String (128 char max)**: set the **Filter Age Time** to how long after the last read you want an entry to be filtered.
3. Use the appropriate procedure for your environment:
 - *RFID (EPCglobal Formats)* on Page 31
 - *Barcode (UPC/EAN Formats)* on Page 32

5.2.1. RFID (EPCglobal Formats)

1. Set any or all of the **To Application Filter Options (RFID Only)** filtering options.
2. Set any or all of the **To Application Filter Options (RFID/Barcode)** filtering options.

Note: You must select at least one filtering option for filtering/data extraction to function.
3. If **Antenna Grouping** is desired, set **RFID Antenna Grouping** option to reflect your antenna configuration.
4. Set the **RFID Reader Interface Type** to that of your RFID reader configuration.

If your RFID reader is not listed, refer to the *ICDM-RX/EN Filtering and Data Extraction Reference Guide* for the supported RFID reader interfaces. If your RFID reader format matches one the listed formats, the set the **RFID Reader Interface Type** to that format.
5. Set the **Filter Age Time** to how long after the last read you want an entry to be filtered.
6. If you want the ICDM-RX/EN to discard any non-RFID tag messages, set the **Discard Unrecognized Data** to either **To-Application** or **To-PLC/Application**.

6/7/19

Refer to the *ICDM-RX/EN Filtering and Data Extraction Reference Guide* for more information.

To Application RFID Data Format: When the application interface is operating in RFID filtering mode, all data sent to the application is in the following format:

Field	Data Type	Description
Company Code	UDINT[2]	Company Code extracted from tag data. Depending on encoding scheme, this field may include Company Prefixes, Company Prefix Indexes, or Government Managed Identifier.
Product/Location Code	UDINT[2]	Product Code extracted from tag data. Depending on encoding scheme, this field may include the Item Reference, Location Reference, Asset Reference, Object Class, or be set to zero.
Serial Number	UDINT[2]	Serial Number extracted from tag data. depending on the encoding scheme, this field may include the Serial Number or Individual Asset Reference.
Encoding Scheme	UINT	Encoding Scheme from tag data.
Filtering Value	UINT	Filtering Value from tag data.
Antenna Number	UINT	Antenna Number on RFID reader/scanner.
Tag Data Length	UINT	Length of RFID tag string in bytes.
Tag Data	BYTE[128]	Tag data string (variable length field). May also include non-tag messages, which can optionally be sent to the PLC and/or application

Note: The RFID parameters will be sent to the application in big-endian format. All parameters, with the exception of the tag data string, will have to be byte-swapped for use on a little-endian system.

5.2.2. Barcode (UPC/EAN Formats)

1. Set any or all of the **To Application Filter Options (RFID/Barcode)** filtering options.

Note: You must select at least one for the filtering/data extraction to function.)

2. If you are using *standard* twelve to fourteen digit UPC/EAN barcodes, set the **Barcode UPC/EAN 12-14 Digit Format** to match that of your barcodes.

The **Company-5/Product-5** is the most popular format.

3. If you are using *eight* digit UPC/EAN barcodes, set the **Barcode UPC/EAN 8 Digit Format** to match that of your barcodes.
4. If you want the ICDM-RX/EN to discard any non-RFID tag messages, set the **Discard Unrecognized Data** to either **To-Application** or **To-PLC/Application**.

Refer to the *ICDM-RX/EN Filtering and Data Extraction Reference Guide* for more information.

To Application Barcode Data Format: When the application interface is operating in **barcode** filtering mode, all data sent to the application is in the following format:

Field	Size	Description
Company Code	UDINT	Company Code
Product Code	UDINT	Product Code
Numbering Code	UINT	Numbering Code (from first byte(s) of barcode data)
Barcode Data Length	UINT	Length of barcode string in bytes
Barcode Data	BYTE[128]	Barcode data string (variable length field)

Note: The Company Code will be set to zero for all EAN-8 codes. The Barcode parameters will be sent to the application in big-endian format. All parameters, with the exception of the barcode data string, will have to be byte-swapped for use on a little-endian system.

6. Application Socket Configuration

Access the *Application TCP Connection Configuration* section corresponding to the desired serial or socket port:

1. Select **Enable**.
2. If your Ethernet TCP/IP application requires another device to connect to it, configure the socket port on the ICDM-RX/EN to **Connect** mode:
 - a. Make sure that the **Listen** option is not selected.
 - b. Set **Connect To Mode** to **Connect-Always**.
 - c. Set the **Connect Port** to the socket port number of your Ethernet application.
 - d. Set the **Connect IP Address** to the IP address of your Ethernet application.
 - e. Set **Disconnect Mode** to **Never**.
3. If your Ethernet TCP/IP application is configured to connect to another device, configure the socket port on the ICDM-RX/EN to **Listen** mode:
 - a. Select **Listen**.
 - b. Use the default **Listen Port** on the ICDM-RX/EN of $\delta x.x x$ or designate your own.
 - c. Set **Connect To Mode** to **Never**.
 - d. Set **Disconnect Mode** to **Never**.
 - e. Configure your Ethernet application to connect to the ICDM-RX/EN at the ICDM-RX/EN IP address and **Listen Port**.





7. Troubleshooting and Technical Support

This section contains troubleshooting information for your ICDM-RX/EN. You should review the following subsections before calling Technical Support because they will request that you perform many of the procedures or verifications before they will be able to help you diagnose a problem.

- *Troubleshooting Checklist* on Page 35
- *General Troubleshooting* on Page 36
- *Daisy-Chaining ICDM-RX/EN Units With Dual Ethernet Ports* on Page 36

If you cannot diagnose the problem, you can contact *Technical Support* on Page 37.

7.1. Troubleshooting Checklist

The following checklist may help you diagnose your problem:

- Verify that you are using the correct types of cables on the correct connectors and that all cables are connected securely.
Note: *Most customer problems reported to Pepperl+Fuchs Control Technical Support are eventually traced to cabling or network problems.*
- If the ICDM-RX/EN is a DIN rail model, verify that the chassis and signal are grounded.
- Isolate the ICDM-RX/EN from the network by connecting the device directly to a NIC in a host system.
- Verify that the Ethernet hub and any other network devices between the system and the ICDM-RX/EN are powered up and operating.
- Reset the power on the ICDM-RX/EN and watch the **PWR** or **Status** light activity.

PWR or Status LED	Description
5 sec. off, 3 flashes, 5 sec. off, 3 flashes ...	Redboot™ checksum failure.
5 sec. off, 4 flashes, 5 sec. off, 4 flashes ...	SREC load failure.
5 quick flashes	The default application is starting up.
10 sec. on, .1 sec. off, 10 sec. on .1 sec. off ...	The default application is running.

- If the device has a power switch, turn the device's power switch off and on, while watching the LED diagnostics.
- If the ICDM-RX/EN does not have a power switch, disconnect and reconnect the power cord.
- Verify that the network IP address, subnet mask, and gateway is correct and appropriate for the network. If IP addressing is being used, the system should be able to ping the ICDM-RX/EN.
- Verify that the IP address programmed into the ICDM-RX/EN matches the unique reserved IP configured address assigned by the system administrator.
- If using DHCP, the host system needs to provide the subnet mask and gateway.
- Reboot the system and the ICDM-RX/EN.
- If you have a spare ICDM-RX/EN, try replacing the device.



7.2. General Troubleshooting

This table illustrates some general troubleshooting tips.

Note: Make sure that you have reviewed the Troubleshooting Checklist on Page 35.

General Condition	Explanation/Action
PWR or Status LED flashing	Indicates that boot program has not downloaded to the unit. 1. Reboot the system. 2. Make sure that you have downloaded the most current firmware for your protocol: https://pepperl-fuchs.com Note: If the PWR or Status LED is still flashing, contact Technical Support.
PWR or Status LED not lit	Indicates that power has not been applied or there is a hardware failure. Contact Technical Support.
Cannot ping the device through Ethernet hub	Isolate the ICDM-RX/EN from the network. Connect the device directly to the NIC in the host system (see Page 35).
Cannot ping or connect to the ICDM-RX/EN	The default IP address is often not accessible due to the subnet masking from another network unless 192.168 is used in the network. In most cases, it will be necessary to program in an address that conforms to your network.
ICDM-RX/EN continuously reboots when connected to some Ethernet switches or routers	Invalid IP information may also cause the switch or router to check for a gateway address. Lack of a gateway address is a common cause.

7.3. Daisy-Chaining ICDM-RX/EN Units With Dual Ethernet Ports

The ICDM-RX/EN with dual Ethernet ports follow the IEEE specifications for standard Ethernet topologies.

The maximum number of daisy-chained ICDM-RX/EN units, and the maximum distance between units is based on the Ethernet standards and will be determined by your own environment and the conformity of your network to these standards.

Pepperl+Fuchs Control has tested with seven ICDM-RX/EN units daisy-chained together using 10 foot CAT5 cables, but this is not the theoretical limit. You may experience a performance hit on the devices at the end of the chain, so it is recommended that you overload and test for performance in your environment. The OS and the application may also limit the total number of ports that may be installed.

Following are some quick guidelines and URLs of additional information. Please note that standards and URLs do change.

- Ethernet 10BASE-T Rules
 - The maximum number of repeater hops is four.
 - You can use Category 3 or 5 twisted-pair 10BASE-T cables.
 - The maximum length of each cable is 100m (328ft).

Note: Category 3 or 5 twisted pair cables look the same as telephone cables but they are not the same. The network will not work if telephone cables are used to connect the equipment.
- Fast Ethernet 100BASE-TX rules
 - The maximum number of repeater hops is two (for a Class II hub). A Class II hub can be connected directly to one other Class II Fast Ethernet hub. A Class I hub cannot be connected directly to another Fast Ethernet hub.

- You must use Category 5 twisted-pair 100BASE-TX cables.
- The maximum length of each twisted-pair cable is 100m (328ft).
- The total length of twisted-pair cabling (across directly connected hubs) must not exceed 205m (672ft).

Note: *Category 5 twisted pair cables look the same as telephone cables but they are not the same. The network will not work if telephone cables are used to connect the equipment.*

- IEEE 802.3 specification: A network using repeaters between communicating stations (PCs) is subject to the “5-4-3” rule of repeater placement on the network:
 - Five segments connected on the network.
 - Four repeaters.
 - Three segments of the 5 segments can have stations connected. The other two segments must be inter-repeater link segments with no stations connected.

See <http://www.optronics.gr/Tutorials/ethernet.htm> for more specific information.

Additional information may be found at <http://compnetworking.about.com/cs/ethernet1/> or by searching the web.

7.4. Technical Support

It contains troubleshooting procedures that you should perform before contacting Technical Support since they will request that you perform, some or all of the procedures before they will be able to help you diagnose your problem.

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