



Operating Manual

IO-Link Master
EtherNet/IP and Modbus/TCP

EN

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1 About this document

1.1 Purpose

This document provides installation, configuration, and embedded web interface information for the Baumer IO-Link Master (BIOLM). In addition, it includes detailed information about EtherNet/IP and Modbus/TCP.

The web interface provides a platform so that you can easily configure, review diagnostic pages, and access advanced features, such as the ability to:

- Upload the latest BIOLM images or applications
- Set up user accounts with different user levels and passwords
- Load IODD files and configure IO-Link device parameters
- Implement manual or automatic data storage (upload or download)
- Implement device and/or data validation

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1.2 Installation and configuration overview

The BIOLM installation includes the following procedures:

Instruction:

- a) Connect the power and Ethernet cable ([Hardware Installation ▶ 10](#)).
- b) Configure the IP address using the embedded web interface.
BIOLM L-EIP ([BIOLM L-EIP Hardware Installation ▶ 10](#)): If desired you can use the rotary switch to set the IP address.
- c) Configure BIOLM device features such as passwords or miscellaneous settings.
- d) If necessary, upload the latest images to support the latest features (Updating Images and Applications).
- e) Connect the IO-Link and digital I/O devices ([Connecting Devices ▶ 21](#)).
- f) Use the web interface to configure the Modbus/TCP and OPC UA settings following:
 1. BIOLM ports for your environment using the web interface ([IO-Link Port Configuration ▶ 33](#)).
 - IO-Link settings, such as the **Port Mode**, which by default is set to IO-Link but depending on the device, you may need to set it to Digital In or Digital Out.
 - EtherNet/IP settings
 - Modbus/TCP settings
 - OPC UA settings (on select models)
 2. If necessary, configure the dedicated digital I/O ports on the BIOLM (Dedicated Digital I/O Port Configuration (BIOLM)).
 3. If desired, upload the appropriate IODD files for your IO-Link devices ([Loading and Managing IODD Files ▶ 54](#)) to simplify IO-Link device configuration.
 4. If desired, implement BIOLM features or options ([Utilizing BIOLM Features ▶ 61](#)), such as:
 - Data storage, automatic or manual – upload or download
 - Device validation
 - Data validation
 - BIOLM configuration files (save and load)
- g) Use the **Diagnostic** pages to monitor or troubleshoot your devices.
- h) Connect to a PLC and configure the PLC or HMI/SCADA (depending on your protocol).
 1. **EtherNet/IP** configuration is discussed in detail in the following chapters:
 - [EtherNet/IP Interface ▶ 82](#) provides a functionality summary, data type definitions, terms and definition, and data transfer methods.
 - [Functionality Descriptions ▶ 87](#) (for EtherNet/IP and Modbus/TCP) details process data block descriptions, event handling, and ISDU handling.
 - [EtherNet/IP CIP Object Definitions ▶ 111](#) discusses the vendor specific CIP definitions.
 - If applicable, use [ControlLogix Family – Example PLC Programs ▶ 137](#) to get your PLCs operating quicker.
 - If applicable, use [SLC/PLC-5/MicroLogix Interface ▶ 152](#) to get your PLCs operating quicker.
 - [EDS Files ▶ 159](#), which provides procedures on how to add EDS files to RSLinx for normal BIOLM to PLC communications.
 2. **Modbus/TCP**: connect PLCs or HMI/ SCADA devices, which is discussed in detail in these two supporting sections:
 - [Functionality Descriptions ▶ 87](#) details process data block descriptions, event handling,

and ISDU handling.

- [Modbus/TCP Interface ▶ 161](#) discusses Modbus Function codes, address definition and multiple port process data (PDI/PDO).

2 Hardware Installation

Use the appropriate hardware installation for your BIOLM model:

- [BIOLM L-EIP Hardware Installation \[▶ 10\]](#)
- [BIOLM DR-EIP Hardware Installation \[▶ 16\]](#)

Refer to [Connecting Devices \[▶ 21\]](#) for information about connecting IO-Link or digital devices to the ports after you program the network information using the next chapter.

2.1 BIOLM L-EIP Hardware Installation

Use the following subsections to install the hardware and verify operation:

- [Setting the rotary switch \[▶ 10\]](#)
- [Connecting to the network \[▶ 12\]](#)
- [Connecting the power \[▶ 13\]](#)
- [Mounting \[▶ 15\]](#)

Refer to [BIOLM L-EIP IO-Link Ports \[▶ 22\]](#) for information about connecting IO-Link or digital devices to the ports after you program the network information using the next chapter.

2.1.1 Setting the rotary switch

You can use the rotary switches under the configuration window on the BIOLM to set the lower 3-digits (8 bits) of the static IP address.



INFO

Optionally, you can leave the rotary switch set to the default and use the web interface to set the network address.

If the rotary switches are set to a non-default position, the upper 9-digits (24 bits) of the IP address are then taken from the static network address. The switches only take effect during start-up, but the current position is always shown on **Help | SUPPORT** page.

Using the rotary switches to set the IP address may be useful in the following situations:

- A permanent method to assign IP addresses while setting machines for a special application where a PC or laptop is not available.
- A temporary method to assign IP addresses to several BIOLMs so that they do not have duplicate addresses to make setting the IP addresses using software easier. After using the web page to change the IP address, reset the rotary switches back to 000.
- An emergency method to return the BIOLM back to factory defaults, so that software can be used to program the appropriate IP address, and then return the switches back to 000.

NOTICE

If you set the network address using the rotary switches, the Rotary Switch setting overrides the network settings in the web interface when the BIOLM is initially powered on or after cycling the power.

Switch Setting	Node Address
000 (Default setting)	Use the network configuration stored in the flash. The default network configuration values are:

Switch Setting	Node Address
	<ul style="list-style-type: none"> IP address: 192.168.0.250 Subnet mask: 255.255.255.0 IP gateway: 0.0.0.0 <p>After completing the hardware installation, you can set the network address using the web interface (Configuring the Network Information ▸ 19).</p>
001 - 254	<p>This is the last three digits in the IP address. This uses the first three numbers from the configured static address, which defaults to 192.168.1.xxx.</p> <p>If software is used to change the IP address to another range before setting the rotary switches, the BIOLM uses that IP address range. For example, if the BIOLM is set to 10.0.0.250 and the first rotary switch is set to 2, the IP address would be 10.0.0.200.</p>
255 - 887	Reserved.
888	Reset to factory defaults. If the BIOLM is set to 888 and the IP address is changed using other methods, the IP address is returned to the default IP address if the BIOLM is rebooted or power cycled.
889 - 997	Use the network configuration values stored in the flash (reserved).
998	Setting the rotary switches to 998 configures the BIOLM to use DHCP addressing.
999	Use the default IP address. If the BIOLM is set to 999 and the IP address is changed using other methods, the IP address is returned to the default IP address if the BIOLM is rebooted or power cycled.

Use the following steps if you want to change the default rotary switch settings:

Instruction:

- Gently pop open the window using a small flathead screwdriver.
- Gently swing open the switch window from the top to the bottom, allowing it to pivot on the hinge on the bottom of the window.
- Turn each dial to the appropriate position using a small flathead screwdriver.
 - ✓ The default setting is 000 as shown below.
 - ✓ The arrow points to the switch location. 0 is located at the 9:00 position. Turn the dial clockwise to the appropriate setting.



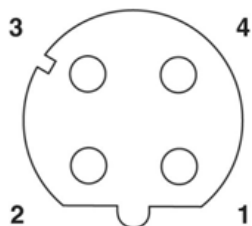
- Close the window and make sure that it snaps shut tightly.

NOTICE

Failure to close the configuration window properly may compromise IP67 integrity.

2.1.2 Connecting to the network

The BIOLM provides two Fast Ethernet (10 / 100BASE-TX) M12, 4-pin female D-coded connectors.



1	TX+	2	RX+
3	TX-	4	RX-

Use the following steps to connect the BIOLM to the network:

Condition:

- ⇒ Ethernet ports must have an approved cable or protective cover attached to the connector to guarantee IP67 integrity.

Instruction:

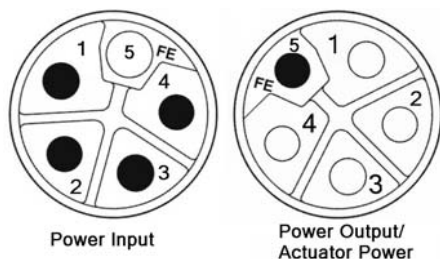
- Securely connect one end of a shielded twisted-pair (Cat 5 or higher) M12 Ethernet cable to either Ethernet port.
- Connect the other end of the cable to the network.
- Optionally, use the other Ethernet port to daisy-chain to another Ethernet device.
- If you did not connect both Ethernet ports, make sure that the unused port is covered with a connector cap to keep dust and liquids from getting in the connector.

2.1.3 Connecting the power

NOTICE

Power connectors must have an approved cable attached to the port guarantee to IP67 compliance.

The BIOLM L-EIP provides M12 (5-poles) L-coded input and output power connectors. Use a 24 VDC power supply capable of the total output current required.



Pin	Power Input (Male)	Power Output or Actuator Power (Female)	Description
1	US+	US+ or +V	IO-Link Master's system electronics and IO-Link devices
2	UA-	UA- or 0 V	Actuator supply
3	US-	US- or 0 V	IO-Link Master's system electronics and IO-Link devices
4	UA+	UA+ or +V	Actuator supply
5	FE		

Power supply	Values
Power Supply In – Maximum V_S and V_A	16 A (Maximum)
IO-Link Connector Port 1	
C/Q (Pin 4)	200 mA (Maximum)
L+/L- Sensor Supply (Pins 1 and 3)	1.6 A (Maximum)
IO-Link Connector Port 3	
C/Q (Pin 4)	200 mA (Maximum)
L+/L- Sensor Supply (Pins 1 and 3)	1 A (Maximum)
IO-Link Connector Port 2 and 4 - 8	
C/Q (Pin 4)	200 mA (Maximum)
L+/L- Sensor Supply (Pins 1 and 3)	500 mA (Maximum)/up to 1A Output Budget
BIOLM Power	100 mA at 24 VDC (V_S)
Power Supply Out	
V_S	16 A (Maximum)
V_A	16 A (Maximum)

- V_S output available is determined by subtracting the following from the available input current:
 - IO-Link Master module electronics current.
 - Total L+/L- current for all IO-Link ports.

Power supply	Values
	<ul style="list-style-type: none"> ▪ Total C/Q current for all IO-Link ports. ▪ V_A output available is the same as the available V_A input current.

NOTICE

Power should be disconnected from the power supply before connecting it to the BIOLM. Otherwise, your screwdriver blade can inadvertently short your power supply terminal connections to the grounded enclosure.

To connect the BIOLM to a power supply use the following procedure:

Instruction:

- Securely attach the power cable between the male power connector (**PWR In**) and the power supply.
- Either attach a power cable between the female power connector and another device to which you want to provide power or securely attach a connector cap to prevent dust or liquids from getting into the connector.
- Apply the power and verify that the following LEDs are lit indicating that you are ready to attach your IO-Link or digital I/O devices.
 - The **US** LED lights.
 - The **ETH** LED lights on the connected port.
 - The **MOD** and **NET** LEDs are lit.
 - The IO-Link LEDs flash (if no IO-Link device attached) or are lit if an IO-Link device is attached.

It takes approximately 25 seconds after power up for the IO-Link Master to be ready for operation.

 - The **MOD** LED is solid green, the IO-Link Master is ready for operation.

If the LEDs indicate that you are ready to go to the next installation step:

- Program the IP address using the web interface. For configuring the network information see [Configuring the Network Information](#) [► 19].
- If using the rotary switches to set the IP address, then you are ready to attach devices (see [Connecting Devices](#) [► 21]).

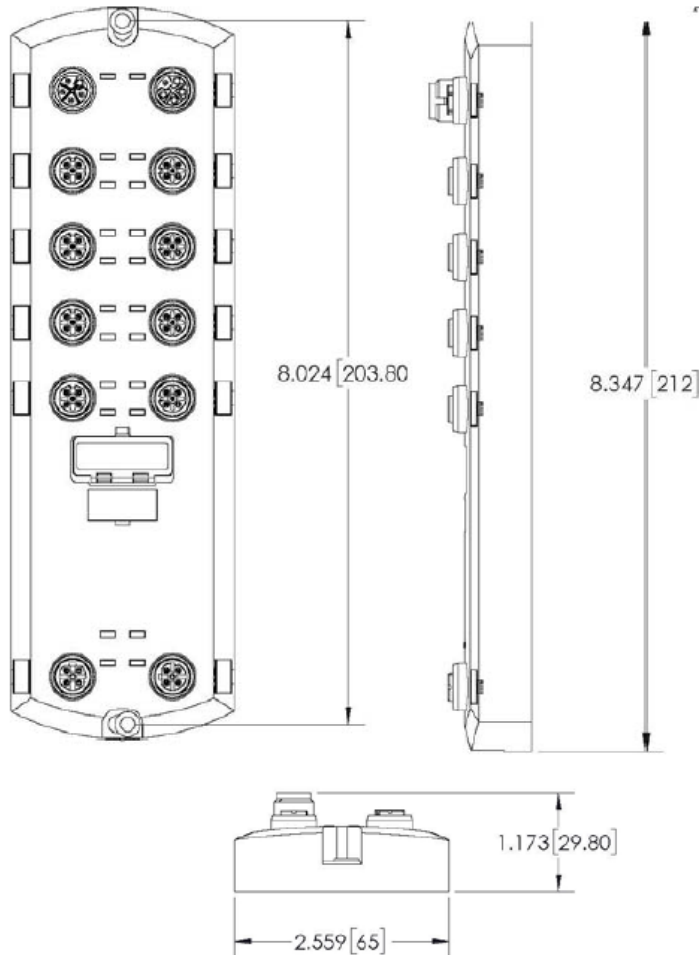
If the LEDs do not meet the above conditions go to [BIOLM L-EIP LEDs](#) [► 168].

2.1.4 Mounting

You can mount the BIOLM on a mounting panel or a machine. Use the following procedure to mount the BIOLM:

Instruction:

- Verify that the mounting surface is level (flat) to prevent mechanical stress to the BIOLM.
- Attach the BIOLM to the surface with two 6mm screws and washers, torque down to 8 Nm.



2.2 BIOLM DR-EIP Hardware Installation

NOTICE

The BIOLM DR-EIP must be installed in a suitable fire, electrical, mechanical enclosure.

Use the following information to install the hardware for the BIOLM DR-EIP:

- [Connecting to the network \[▶ 16\]](#)
- [Connecting the power \[▶ 17\]](#)
- [Mounting \[▶ 18\]](#)

Depending on your preference you can connect the BIOLM DR-EIP using several methods:

- First mount the BIOLM DR-EIP and connect the power with it attached to the DIN rail.
- Remove the connector with a small flat screwdriver, connect the power, and insert the connector into the receptacle.

Refer to [BIOLM DR-EIP IO-Link Ports \[▶ 30\]](#) for information about connecting IO-Link or digital devices to the ports after you program the network information using the next chapter.

2.2.1 Connecting to the network

The BIOLM provides two Fast Ethernet (10/100BASE-TX) standard RJ45 connectors.

1	TX+	2	TX-
3	RX+	6	RX-

Use the following steps to connect the BIOLM to the network:

Instruction:

- a) Securely connect one end of the RJ45 Ethernet cable to either Ethernet port.
- b) Connect the other end to the network.
- c) Optionally, use the other Ethernet port to daisy-chain to another Ethernet device.

2.2.2 Connecting the power

The BIOLM DR-EIP provides redundant power input with a single pluggable connector on the top of the IO-Link Master. The power plug is keyed for your safety so that it cannot be inserted into an IO-Link port using the headers and plugs keyed as supplied.



Signal	Pins	Description
V-	1 and 2	24 VDC Power Supply Return
V+	3	Primary +24 VDC Supply
V+	4	Secondary +24 VDC Supply

Power supply	Values
Power Supply In (V+)	3.7 A (Maximum) <ul style="list-style-type: none"> The sum of the following must not exceed V+ maximum input current: <ul style="list-style-type: none"> IO-Link Mode module power. Actual C/Q current for each IO-Link port. Actual U_s current for each IO-Link port
IO-Link Connectors Ports 1 - 8	
C/Q	200 mA (Maximum)
L+	200 mA (Maximum)
IO-Link Master Power	155 mA at 24 VDC (V_s)

NOTICE

Power should be disconnected from the power supply before connecting it to the BIOLM. Otherwise, your screwdriver blade can inadvertently short your connections to the grounded enclosure.

To connect the BIOLM to a UL Listed power supply and UL Listed power cord use the following procedure:

Instruction:

- Optionally, use a small screw driver to remove the power connector from the receptacle.
- Depress the orange tab until it is flush with the connector to insert positive and negative solid or ferrule wires (12 - 24 AWG) into the V+ and V- contacts.
- If necessary, re-insert the connector into the power receptacle.
- Apply the power and verify that the following LEDs are lit indicating that you are ready to program the IP address and then attach your IO-Link devices.
 - The **E1/E2** LED lights on the connected port.

2. The **MOD** and **NET** LEDs are lit.
3. The IO-Link LEDs flash (if no IO-Link device attached) or are lit if an IO-Link device is attached.
4. The **MOD** LED is solid green, the IO-Link Master is ready for operation.

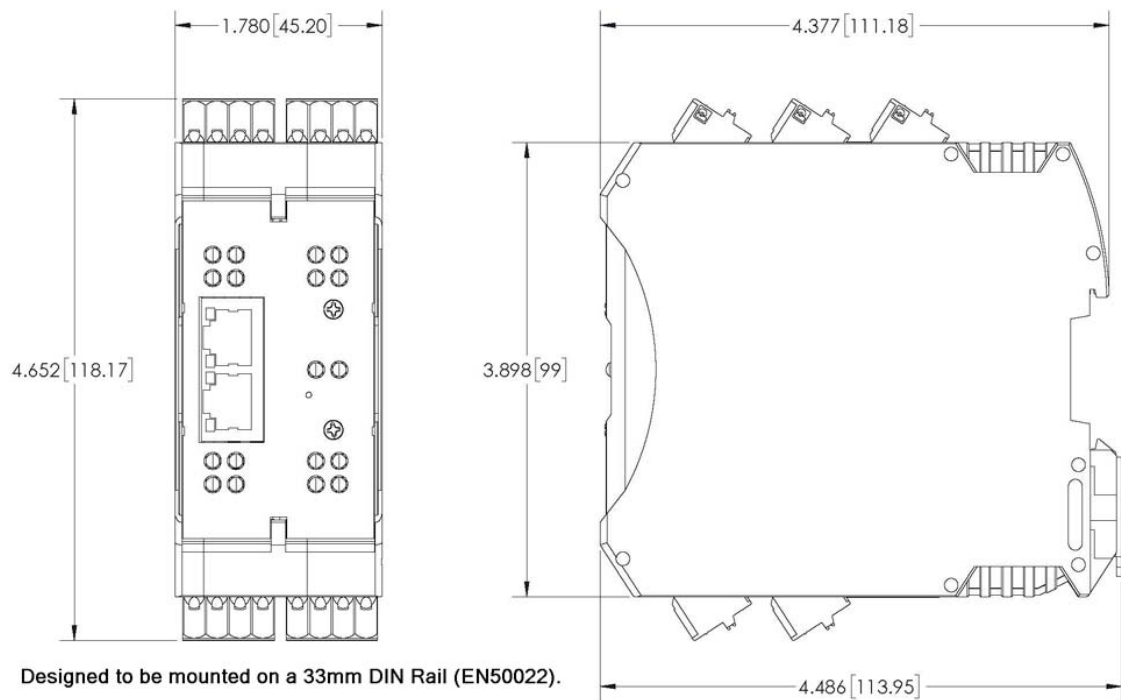
If the LEDs indicate that you are ready to go to the next installation step. Refer to [Configuring the Network Information](#) [▶ 19] to configure the network information.

If the LEDs do not meet the above conditions, you can refer to [BIOLM DR-EIP LEDs](#) [▶ 170] in the [Troubleshooting and Technical Support](#) [▶ 167] for more information.

2.2.3 Mounting

You may want to mount the BIOLM after programming the IP address and connecting the IO-Link and digital input/output devices.

1. Slide the metal latch down, hook the top of the BIOLM DR-EIP to the DIN rail and release the latch.
2. Verify that is tightly mounted.



INFO

You may want to connect the IO-Link devices before attaching the BIOLM DR-EIP to the DIN rail. Use [Connecting Devices](#) [▶ 21] if you require IO-Link cabling information.

3 Configuring the Network Information

The following topics are discussed in this chapter:

- [Network Configuration Overview \[► 19\]](#)
- [Using the Web Interface to Program the Network \[► 20\]](#)

3.1 Network Configuration Overview

If you used the rotary switch (applicable models) to set the IP address ([Hardware Installation \[► 10\]](#)), may want to configure the upper 9 digits (24 bits) of the IP address using the embedded web interface.

NOTICE

If you set the network address using the rotary switches, the Rotary Switch setting overrides the network settings in the web interface when the BIOLM is initially powered on or after cycling the power.

You can use one of the following method to configure the IP address:

- Web interface ([Using the Web Interface to Program the Network \[► 20\]](#)):
 - The BIOLM default IP address is: 192.168.0.250 and the Subnet Mask is: 255.255.255.0.

You may want to use the **Advanced | Network** page, if you need to configure the following:

- Host name
- DNS servers
- Syslog Server IP/Host name
- Syslog Port
- SSH Server Enable

3.2 Using the Web Interface to Program the Network

This subsection discusses using the web interface to configure the IP address. The default IP address is 192.168.0.250 and the Subnet Mask is: 255.255.255.0.



INFO

The rotary switch settings (applicable models) override the lower 3 digits (8 bits) of static IP address configured on the **Configuration | Network** page. The default rotary switch setting uses the settings configured in the flash. Optionally, you can use the web interface to configure the upper 9 digits (24 bits) and the rotary switch to configure the lower 3 digits (8 bits) of the static IP address. You can also refer to [Hardware Installation \[10\]](#) for additional information.

You may need to change your host system IP address so that it can communicate with the BIOLM default IP address: 192.168.0.250. The BIOLM is shipped from the factory with the Admin account enabled without a password. You can configure the Admin, Operator, and User passwords.

Instruction:

- a) Open your browser and enter the IP address of the BIOLM to open the BIOLM web interface.
- b) Click **Configuration | NETWORK**.
- c) Click the **EDIT** button.
- d) Click the **CONTINUE** button.
- e) Optionally, enter a host name to identify this BIOLM.
- f) Select the IP type, **Static** or **DHCP**.
 - If using a static IP address, enter the static IP address, subnet mask and IP gateway address.
 - If using DNS:
 - Enter the DNS primary server IP address.
 - Optionally, enter the DNS secondary server IP address.
- g) If desired, enter the NTP server IP or host name.
- h) If you want the BIOLM to send syslog messages to a syslog server:
 - Enter the syslog server's IP address (or host name if using DNS).
 - Enter the syslog server's port number (default is 514).
- i) If you want to enable the SSH server, click **Enable**.
- j) Click **SAVE** to save the changes.
- k) If the BIOLM does not redirect you to the new page, open a session using the new IP address.
 - The BIOLM does not need to be rebooted.

You should verify that you have the latest software installed on the BIOLM and if necessary, update the software. Refer to Updating Images and Applications for information about locating the latest files and uploading the software.

After verifying that you have the latest software, you are ready to configure the BIOLM port characteristics.

4 Connecting Devices

This chapter discusses connecting devices to the BIOLM. Use the appropriate discussion for your BIOLM model:

- [Overview \[▶ 21\]](#)
- [BIOLM L-EIP IO-Link Ports \[▶ 22\]](#)
- [BIOLM IO-Link and DIO Ports \[▶ 24\]](#)
- [BIOLM DR-EIP IO-Link Ports \[▶ 30\]](#)

4.1 Overview

The C/Q pin for the IO-Link ports in SIO mode for all models:

- *DI*: Sinking input
The *DI* pin on the IO-Link ports for all models is a sinking input.
- *DO*: PNP/NPN (push/pull) output



INFO

BIOLM Only – with two dedicated DIO ports:

- a) The extra *DI* is the same as the *DI* on the IO-Link ports – sinking input.
- b) The extra *DIO* is as follows:
DI: Sinking input
DO: PNP output

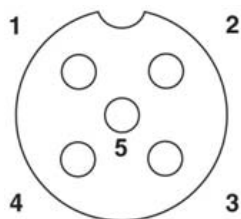
The following table provides definitions of the terminology used above:

Term	Definition
PNP output	Is an output that can source current. That is; the (+) side of the device is connected to the output and the (-) side of the device is connected to (-) of the supply. The device is powered when the output LED is on.
NPN output	Is an output that sinks current. That is: the (-) of the device is connected to the output and the (+) side of the device is connected to (+) side of the supply. The device is powered when the output LED is off.
Sinking input	Sinks current into the IO-Link Master so a positive voltage will cause the input to turn on.
NOTICE! Using NPN with inputs is not correct as NPN described an output situation – however some vendors describe their inputs as accepting a certain type of sensor output – so in this case a sinking input will accept a PNP output sensor.	

4.2 BIOLM L-EIP IO-Link Ports

The BIOLM L-EIP provides eight IO-Link ports with M12, 5-pin female/A coded connectors. Each port has robust over-current protection and short circuit protection on its L+/L- power output and C/Q IO-Link signal. The pin-out for each IO-Link port is per the IO-Link standard and is provided in the following table:

This table provides signal information for the IO-Link connectors.



Pin	Signal	Description
1	L+	IO-Link device power supply (+24 V)
2	DI	Digital input
3	L-	IO-Link device power supply (0 V)
4	C/Q	Communication signal, which supports SDCI (IO-Link) or SIO (standard input / output) digital I/O
5	FE	Functional Earth (electronics wiring)

The standard SDCI (IO-Link) transmission rates are supported:

- COM1 at 4.8 Kbps
- COM2 at 38.4 Kbps
- COM3 at 230.4 Kbps

There are active over-current limiter electronics for each port in the BIOLM L-EIP that detects the overload/short-circuit condition within a few milliseconds and shuts off the output power to protect the port and the devices connected to it. The port's power output self-recovers and restores to normal immediately after the overload or short-circuit condition is removed.

The over-current limiter circuit for L+/L- pins is separate circuits than the over-current limiter circuit for the C/Q output pin. When a port is affected by overload/short-circuit condition, it does not affect the operation of the other ports. All other ports will continue to operate normally without any glitch or interruption. The current output capacity, cutoff current, and power sharing/budgeting for L+/L- and C/Q signal for the ports on the BIOLM L-EIP are as follows.

Port	L+/L-			C/Q		
	Output Current Capacity (max.)	Overload Cutoff Current	Short-Circuit Protection	Output Current Capacity (max.)	Overload Cutoff Current	Short-Circuit Protection
Port 1: Independent over-current limiter circuits/IC for L+/L- and C/Q pins	1.6 A	1.65 A	Yes	200 mA	400 mA	Yes
Port 3: Independent over-current limiter circuits/IC for L+/L- and C/Q pins	1 A	1.05 A	Yes	200 mA	400 mA	Yes
Ports 2 and 4 (Pair) Ports 5 and 7 (Pair) Ports 6 and 8 (Pair)	500 mA / port pair (1 A output power budget per port pair)	1.05 A / port pair	Yes	200 mA ¹ / port	400 mA ¹ / port	Yes

There's one independent over-current limiter that protects L+/L- pins on each pair of ports, for example: Port 2 and 4.

This allows you to do power budgeting on pair of ports that allows flexibility in the application. The combined overload cutoff current on a pair of ports is 1.05 A for the L+/L- pins.

As long as the cutoff current of 1.05 A is not exceeded, the current output could be budgeted between a pair of ports such as, Port 2 and 4 any way you want.

For example, Port 2 output can be at 900 mA and Port 4 output can be at 100 mA. Or, Port 2 could be left open and Port 4 output can be at 1 A.

- ¹ Each port's C/Q pin has its own independent over-current limiter circuit and are not combined. The current output of C/Q pin for each port is also independently controlled and cannot be budgeted with other ports.

Use the following procedure to attach IO-Link or digital input/output devices to the ports:

Instruction:

- a) Securely attach the IO-link cable between the IO-Link or digital input/output device and the IO-Link port.

NOTICE! Make sure that you tighten the cables properly to maintain IP67 integrity.

- b) If necessary, securely attach a connector cap to prevent dust or liquids from getting into any unused ports. Connector caps were shipped with the BIOLM.

NOTICE! IO-Link ports must have an approved cable or protective cover attached to the port to guarantee IP67 compliance.

- c) If necessary, configure IO-Link port parameters using the **Configuration | IO-Link Settings** page to configure the port mode.

Result:

- ✓ If an IO-Link device is attached to the port, the IO-Link LED should now be lit green and the device is receiving power.
- ✓ If a digital input or output device is attached to the IO-Link port, after the port is configured for digital input or output on the **IO-Link Settings** page, the IO-Link LED does not light but when an event occurs:
Digital input causes the DI LED to flash.
Digital output causes the IO-Link LED to flash.

You can refer to the help system or [IO-Link Port Configuration](#) [► 33] for configuration information.

4.3 BIOLM IO-Link and DIO Ports

The following provides information about the IO-Link ports:



Label	Signal	Description	Value
1	L+	Power Supply Output (+)	200 mA @ 24 V (Maximum)
2	L-	Power Supply Output (-)	
3	DI	Digital Input	Not applicable.
4	C/Q	Communication signal, which supports SDCI (IO-Link) or SIO (standard input/output) digital I/O	200 mA @ 24 V (Maximum)



INFO

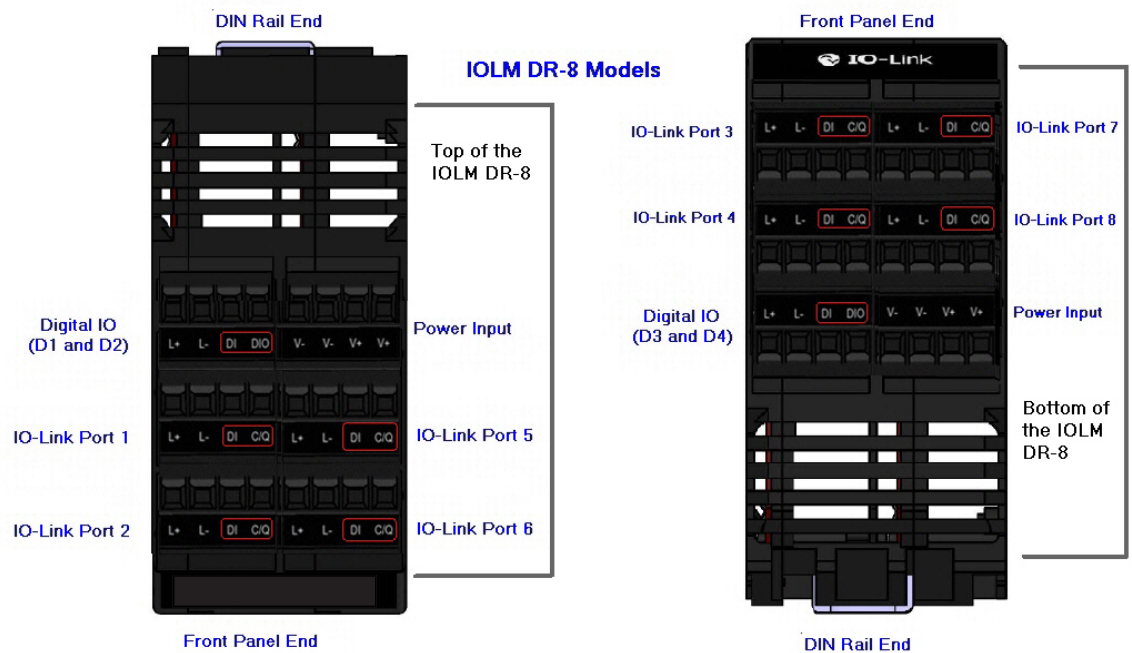
Depending on your model, the terminal blocks may be labeled numerically or with the signal abbreviations.

The standard SDCI (IO-Link) transmission rates are supported:

- COM1 at 4.8 Kbps
- COM2 at 38.4 Kbps
- COM3 at 230.4 Kbps

Use the appropriate procedure to connect devices to the IO-Link ports:

- [Tips when Connecting Devices to the BIOLM](#) [► 25]
- [Connecting IO-Link Devices](#) [► 26]
- [Connecting Digital Input Devices to IO-Link Ports](#) [► 26]
- [Connecting DIO Devices to IO-Link Ports](#) [► 27]



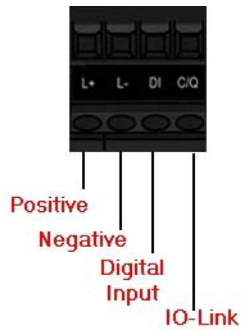
4.3.1 Tips when Connecting Devices to the BIOLM

The following tips may be useful when connecting devices to the BIOLM because it may be difficult to manipulate the wire-clamp screws on the adjacent ports.

- If you are going to connect devices to Digital I/O ports (*D1* through *D4*), connect the digital devices before connecting devices to IO-Link ports.
- Connect a device to IO-Link Port 1 before IO-Link Port 2
- Connect a device to IO-Link Port 4 before IO-Link Port 3
- Connect a device to IO-Link Port 5 before IO-Link Port 6
- Connect a device to IO-Link Port 8 before IO-Link Port 7

4.3.2 Connecting IO-Link Devices

Use the following procedure to connect IO-Link devices to the IO-Link ports:

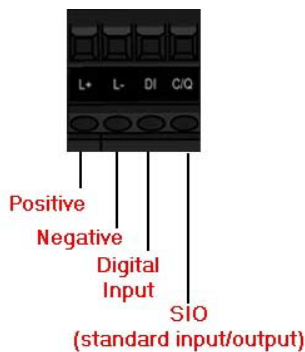


Instruction:

- Insert the IO-Link device negative wire into the *L-* contact and tighten the wire-clamp screws to prevent the wire from coming loose.
- Insert the IO-Link device positive wire into the *L+* contact and tighten the wire-clamp screws to prevent the wire from coming loose.
- If applicable, insert the DI wire into the *DI* contact and tighten the wire-clamp screws to prevent the wire from coming loose.
- Insert the IO-Link wire into the *C/Q* contact and tighten the wire-clamp screws to prevent the wire from coming loose.
- If necessary, configure IO-Link parameters for each port. Refer to [Preparing for Port Configuration](#) [33] or the help system for detailed port configuration information.

4.3.3 Connecting Digital Input Devices to IO-Link Ports

You can use an IO-Link port as a digital in port if you wish to do so:



Instruction:

- Insert the IO-Link device negative wire into the *L-* contact and tighten the wire-clamp screws to prevent the wire from coming loose.
- Insert the IO-Link device positive wire into the *L+* contact and tighten the wire-clamp screws to prevent the wire from coming loose.
- If applicable, insert the DI wire into the *DI* contact and tighten the wire-clamp screws to prevent the wire from coming loose.
- Refer to the help system for detailed port configuration information.

4.3.4 Connecting DIO Devices to IO-Link Ports

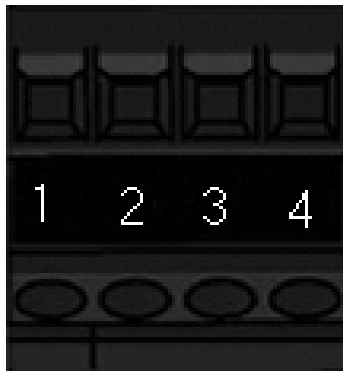
You can use an IO-Link port to connect and operate a digital input or output device:

Instruction:

- Insert the IO-Link device negative wire into the *L*- contact and tighten the wire-clamp screws to prevent the wire from coming loose.
- Insert the IO-Link device positive wire into the *L*+ contact and tighten the wire-clamp screws to prevent the wire from coming loose.
- If applicable, insert the DI or DO wire into the *C/Q* contact and tighten the wire-clamp screws to prevent the wire from coming loose.
- Refer to the help system for detailed port configuration information.

4.3.5 Connecting Devices to the Digital IO Ports

The BIOLM provides two digital input (DI) ports and two digital IO ports.



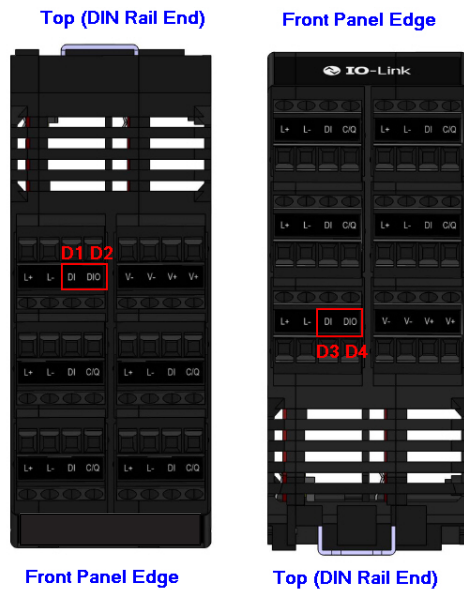
Label	Signal	Description	Value
1	L+	Power Supply Output (+)	200 mA @ 24 V (Maximum)
2	L-	Power Supply Output (-)	
3	DI	Digital Input	
4	DIO	Digital I/O	200 mA @ 24 V (Maximum)



INFO

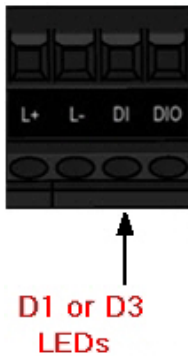
Depending on your model, the terminal blocks maybe labeled numerically or with the signal abbreviations.

You can connect a digital input device to DI and/or DIO. DIO supports digital out.



4.3.5.1 Connecting to DI

Use this procedure to connect a digital input device using the *DI* terminal on a DIO port:



Instruction:

- Insert the IO-Link device negative wire into the *L-* contact and tighten the wire-clamp screws to prevent the wire from coming loose.
- Insert the IO-Link device positive wire into the *L+* contact and tighten the wire-clamp screws to prevent the wire from coming loose.
- Insert the DI wire into the *DI* contact and tighten the wire-clamp screws to prevent the wire from coming loose.
- Go to the **Configuration | Digital I/O Settings** page to configure the port. If necessary, refer to the help system or [IO-Link Configuration Page](#) [35].

4.3.5.2 Connecting to DIO



Instruction:

- a) Insert the IO-Link device negative wire into the *L-* contact and tighten the wire-clamp screws to prevent the wire from coming loose.
- b) Insert the IO-Link device positive wire into the *L+* contact and tighten the wire-clamp screws to prevent the wire from coming loose.
- c) Insert the DI wire into the *DI* contact and tighten the wire-clamp screws to prevent the wire from coming loose.
- d) Go to the **Configuration | Digital I/O Settings** page to configure the port. If necessary, refer to the help system or Dedicated Digital I/O Port Configuration (BIOLM).

4.4 BIOLM DR-EIP IO-Link Ports

The following provides information about the IO-Link ports:



Label	Signal	Description	Value
1	L+	Power Supply Output (+)	200 mA @ 24 V (Maximum)
2	L-	Power Supply Output (-)	
3	DI	Digital Input	Not applicable
4	C/Q	Communication signal, which supports SDCI (IO-Link) or SIO (standard input/output) digital I/O	200 mA @ 24 V (Maximum)

The standard SDCI (IO-Link) transmission rates are supported:

- COM1 at 4.8 Kbps
- COM2 at 38.4 Kbps
- COM3 at 230.4 Kbps

The BIOLM DR-EIP provides removable, pluggable terminals to connect your IO-Link devices.

NOTICE

Connectors are keyed headers

The connectors on the BIOLM DR-EIP IO-Link ports are keyed headers that prevent inserting the power plug in an IO-Link port.

Use the following procedure to attach IO-Link or digital input/output devices to the ports:

Instruction:

- a) Optionally, use a small screw driver to remove the IO-Link plug from the receptacle.

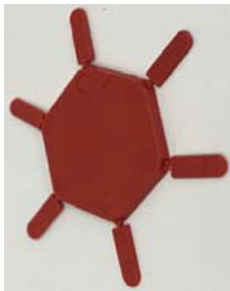
By default, the IO-Link ports are keyed headers on Pins 2 and 3 of the receptacle.

CAUTION! Do not remove the red coding sections from the headers on the IO-Link receptacle or the fully keyed power connector could be inserted in an IO-Link receptacle.



- b) Optionally, key the port plug using the following information:

1. Locate the top of the Coding Profile Star, which is the side that has the mold markings.
2. Slide the Coding Profile tab (mold marking facing out) into one of the end slots.
3. Slightly twist the star so that it snaps off the star.
4. Then repeat for the slot on the opposite end.



- c) Depress the orange tab until it is flush with the connector to insert the IO-Link device negative wire into the *L-* contact.
- d) Depress the orange tab until it is flush with the connector to insert the IO-Link device positive wire into the *L+* contact.
- e) If applicable, depress the orange tab until it is flush with the connector to insert the DI wire into the *DI* contact.
- f) Depress the orange tab until it is flush with the connector to insert the IO-Link wire into the *C/Q* contact.

- ✓ If an IO-Link device is attached to the port, the IO-Link LED should now be lit green and the device is receiving power.
- ✓ If a digital input or output device is attached to the IO-Link port, after the port is configured for digital input or output on the **IO-Link Settings** page, the IO-Link LED does not light but when an event occurs:
 - Digital input causes the DI LED to flash.
 - Digital output causes the IO-Link LED to flash.

g) If necessary, configure IO-Link parameters for each port.

You can refer to the help system or [IO-Link Port Configuration ▶ 33](#) for configuration information.

5 IO-Link Port Configuration

This chapter discusses port configuration, which includes these topics:

- [Preparing for Port Configuration](#) [► 33]
- [IO-Link Configuration Page](#) [► 35]
- [Ethernet/IP Settings Configuration Page](#) [► 40]
- [Modbus/TCP Settings Configuration Page](#) [► 48]
- [OPC UA Settings Configuration Page](#) [► 53]

See Dedicated Digital I/O Port Configuration (BIOLM) for information about configuring dedicated digital I/O ports (BIOLM).

Depending on your environment, the IO-Link Master you may not need to change many of the default options.

5.1 Preparing for Port Configuration

Before beginning port configuration, you may want to verify that the connected device is functioning:

Instruction:

- a) If necessary, log into the IO-Link Master.
- b) Click **Diagnostics** | **IO-Link Diagnostics**.
- c) Review the **Port Status** and **IO-Link State** (see also the tables at the end of the sections).
- d) Review the **Device IO-Link Version**.
 - ✓ If the field is blank, it is not a valid IO-Link device, which could mean that it is a digital device and the port has not been configured for digital input or digital output.
 - ✓ The field displays the Device IO-Link version.
- e) Optionally, review the following to see if you need to change the **Configured Minimum Cycle Time**:
 - ✓ **Actual Cycle Time**
 - ✓ **Device Minimum Cycle Time**
 - ✓ **Configured Minimum Cycle Time**

The **Configured Minimum Cycle Time** is the minimum cycle time that the IO-Link Master allows the port to operate at. The **Actual Cycle Time** is negotiated between the IO-Link Master and the device and will be at least as long as the greater of the **Configured Minimum Cycle Time** and the **Device Minimum Cycle Time**.
- f) Verify that the **Auxiliary Input Bit Status** field displays **On**, if the device is connected to DI (Pin 2 with M12 connectors).

For additional information about the **IO-Link Diagnostics** page, see the help system or [IO-Link Port Diagnostics](#) [► 71].

Port Status

Operational, PDI Valid	An IO-Link device is operating on the port that has received valid PDI data.
Operational	An IO-Link device is operating on the port that has not received valid PDI data.
Inactive	One of the following conditions exists: <ul style="list-style-type: none"> ■ A valid IO-Link device is not connected to the port. ■ A digital input or output device is connected to the port but the configured Port Mode is not correct.

IOLink Status

Operate	Port is functioning correctly in IO-Link mode but has not received valid PDI data. This may also display during a data storage upload or download.
Init	The port is attempting initialization.
Reset	One of the following conditions exists: <ul style="list-style-type: none"> ■ The Port Mode configuration is set to Reset. ■ The Port Mode configuration is set to DigitalIn or DigitalOut.
DS: Wrong Sensor	Hardware failure (IO-Link LED also flashes red) because there is Data Storage on this port, which does not reflect the attached device.
DV: Wrong Sensor	Hardware failure (IO-Link LED also flashes red) because Device Validation is configured for this port and the wrong device is attached.
DS: Wrong Size	Hardware failure (IO-Link LED also flashes red) because the size of the configuration on the device does not match the size of the configuration stored on the port.
Comm Lost	Temporary state after a device is disconnected and before the port is re-initialized.
Pre-operate	Temporary status displayed when the device: <ul style="list-style-type: none"> ■ Is starting up after connection or power-up. ■ Uploading or downloading automatic data storage.

**INFO**

If a digital input or output device is connected to an IO-Link port, there is no valid data until the port is set to the correct **Port Mode**.

5.2 IO-Link Configuration Page

You can use the **Configuration | IO-Link Settings** page to configure IO-Link port settings. When the IO-Link device is attached to a port, it begins operating without requiring any configuration. The BIOLM and attached IO-Link device automatically negotiate the **Minimum Cycle Time**. If required by an application, you can set a specific **Minimum Cycle Time**.

This subsection discusses:

- [Editing IO-Link Port Settings](#) [▶ 35]
- [IO-Link Settings Parameters](#) [▶ 36]



INFO

Data Storage, Device Validation, and Data Validation are discussed in [Utilizing BIOLM Features](#) [▶ 61].

5.2.1 Editing IO-Link Port Settings

You can use this procedure to configure IO-Link settings for each IO-Link port.

If an IO-Link device is attached to the port, no configuration is required for operation. If a digital input or output device is attached, it is necessary to change the **Port Mode**.

Instruction:

- If necessary, open the IO-Link Master web interface with your web browser using the IP address.
- Click **Configuration | IO-Link Settings**.
- Click the **EDIT** button for the port or ports that you want to configure.
You can click each EDIT button and open all ports to quickly configure port parameters.
- Make appropriate selections for the device that you connected to that port.
 - ✓ Make sure you select the **DigitalIn** option for a digital input device and the **DigitalOut** option for a digital output device for the **Port Mode**.
 - ✓ The BIOLM negotiates the **Minimum Cycle Time** so it is not necessary to set a cycle time unless you need a specific cycle time.
 - ✓ You can use the help system if you require definitions or values for the options or refer to [IO-Link Settings Parameters](#) [▶ 36].

NOTICE! Do not enable Automatic Download and then attempt device configuration as Automatic Download changes the settings back to what is stored on the BIOLM.

- Click the **SAVE** button for each port.
- Return to the **IO-Link Diagnostics** page to verify that your changes have taken affect.



INFO

Port 6 now indicates that it is functioning as a valid digital input device and the friendly port names are displaying.

5.2.2 IO-Link Settings Parameters

The **Configuration | IO-Link Settings** page supports the following options:

IO-LINK Settings Page

Port Name	User defined port or device description: <ul style="list-style-type: none"> Standard ASCII characters Max length = 80 characters
Port Mode Default: IO-Link	Selected IO-Link port mode. Valid settings are: <ul style="list-style-type: none"> Reset: Select to disable a port or to reset/restart an IO-Link port. IO-Link: Select to connect and operate an IO-Link device on the port. Digital In: Select if a DI device is attached to the port. Digital Out: Select if a DO device is attached to the port.
Invert SIO Default: False	If enabled and the Port Mode is Digital In or Digital Out , this option inverts the SIO value. <ul style="list-style-type: none"> False: Disabled – Do not invert SIO True: Enabled – Invert SIO <p>This option does not affect the Auxiliary Input.</p>
Invert Auxiliary Input	If this option is enabled, the Auxiliary bit is inverted.
Default Digital Output Default: Off	If the Port Mode is Digital Out , defines the default digital output value that is used at startup and when there is no active PDO controller. <ul style="list-style-type: none"> Off: Low voltage – 0 On: High voltage – 24 V
Minimum Cycle Time Default: 4	The minimum, or fastest, cycle time at which the IO-Link device may operate. The valid range is 4 - 538 ms. <p>You can leave the Minimum Cycle Time set to the default value and the IO-Link Master negotiates with the IO-Link device for its minimum cycle time. The IO-Link Diagnostics page displays the Actual Cycle Time, which is the negotiated cycle time.</p>
Auxiliary Input Settling Time (0 - 10000)	The auxiliary input settling time that remains constant before that input is considered/accepted.
Auxiliary Input Hold Time (0 - 10000)	This is how long the IO-Link Master keeps the input at its present value. For example, if the IO-Link Master detects the input to go to high, and the hold time is X milliseconds, then the IO-Link Master reports the input as high for X milliseconds, even though the input itself may have ceased. If X is zero, then you get the behavior currently in the field.
SIO Input Settling Time (0 - 10000)	The SIO input settling time that remains constant before that input is considered/accepted.
SIO Input Hold Time (0 - 10000)	This is how long the IO-Link Master keeps the input at its present value. For example, if the IO-Link Master detects the input to go to high, and the hold time is X milliseconds, then the IO-Link Master

IO-LINK Settings Page

reports the input as high for X milliseconds, even though the input itself may have ceased. If X is zero, then you get the behavior currently in the field.

Data Storage Config**Storage Contents**

Indicates that the data storage for the port is empty or displays the Vendor ID and Product ID of the data stored on that port.

Automatic Data Storage Upload Enable

Default: Off

When this option is initially set to On, the BIOLM saves the data storage parameters (if the data storage is empty) from the IO-Link device to the BIOLM.

Automatic upload occurs when the **Automatic Upload Enable** option is set to **On** and one of these conditions exists:

- There is no upload data stored on the gateway and the IO-Link device is connected to the port.
- The IO-Link device has the **DS_upload** bit on (generally because you have changed the configuration via Teach buttons or web page).

When a port contains data storage for an IO-Link device and if you attach a device whose Vendor and Device ID do not match, the IO-Link LED on the BIOLM flashes red to indicate a wrong device is attached. In addition, the IO-Link Diagnostics page displays **DS: Wrong Sensor** in the **IOLink State** field.

Not all device parameters are sent to data storage, this is determined by the IO-Link device manufacturer.

Automatic Data Storage Download Enable

Default: Off

The data storage parameters on the BIOLM are downloaded to the connected IO-Link device if:

- The Automatic Download option is enabled.
- The data stored on the BIOLM port contains the same Vendor ID and Product ID as the IO-Link device connected to the port.
- Data storage parameters are also downloaded to the IO-Link device if configuration changes are made on the device causing the **DS_upload** bit to turn on and automatic upload is not enabled.
- The IO-Link device requests an upload and the **Automatic Upload Enable** option is set to **Off**.

If you change configuration parameters on the IO-Link device and want the parameters to remain loaded on the IO-Link device, you must disable the **Automatic Download** option because otherwise the BIOLM will reload the data storage on the port down to the IO-Link device.

Data Storage Manual Ops

The **Manual Data Storage Ops** option provides the following functionality, if data storage is supported by the IO-Link device:

- **CLEAR:** This clears any stored data for an IO-Link device on this port.
- **UPLOAD:** This uploads and stores the IO-Link device configuration on the BIOLM.

IO-LINK Settings Page

- **DOWNLOAD:** This downloads the stored IO-Link device configuration from the BIOLM to the IO-Link device attached to this port if the Vendor ID and Device ID match.

Validation Config**Device Validation Mode**

Default: None

Device Validation Mode provides these options:

- **None:** This disables **Device Validation Mode**.
- **Compatible:** Permits a compatible IO-Link device (same Vendor ID and Device ID) to function on the corresponding port.
- **Identical:** Only permits an IO-Link device to function on the corresponding port as defined in the following fields:
 - **Vendor ID**
 - **Device ID**
 - **Serial Number**

NOTICE! Connecting an IO-Link device that is different than the configured with Data Validation enabled will generate a DV: wrong sensor error.

Vendor ID

(0 - 65535)

This is required if you select a **Device Validation Mode** other than **None**.

The **Vendor ID** can be manually entered in this field or click the **GET ATTACHED** button and the IO-Link Master populates the **Vendor ID** in this field.

Device ID

(0 - 16777215)

This is required if you select a **Device Validation Mode** other than **None**.

The **Device ID** can be manually entered in this field or click the **GET ATTACHED** button and the IO-Link Master populates the **Device ID** in this field.

Serial Num

This is required if you select **Identical** for the **Device Validation Mode**.

The **Serial Number** can be manually entered in this field or click the **GET ATTACHED** button and the IO-Link Master populates the serial number in this field.

Data Validation Mode

Default: None

There are three **Data Validation Modes**:

- **None:** No data validation is performed on the port.
- **Loose:** The slave device's PDI/PDO lengths must be less than or equal to the user-configured values.
- **Strict:** The slave device's PDI/PDO lengths must be the same as the user-configured values.

PDI Length

(0 - 32)

This is input length of the PDI data field.

This is required if you select a **Data Validation Mode** other than **None**.

The **PDI Length** can be manually entered in this field or click the **GET ATTACHED** button and the IO-Link Master populates the PDI length in this field.

IO-LINK Settings Page**PDO Length**

(0 - 32)

This is input length of the PDO data field.

This is required if you select a **Data Validation Mode** other than **None**.

The **PDO Length** can be manually entered in this field or click the **GET ATTACHED** button and the IO-Link Master populates the PDO length in this field

GET ATTACHED

(Button)

After opening a port for editing, you can click the **GET ATTACHED** button to automatically populate the following fields with data from the IO-Link device:

- **Vendor ID**
- **Device ID**
- **Serial Num**
- **PDI Length**
- **PDO Length**

5.3 Ethernet/IP Settings Configuration Page

Use the **EtherNet/IP Settings** page to configure EtherNet/IP options.

You may want to refer to the following sections for additional information:

- [EtherNet/IP Interface \[82\]](#) provides a functionality summary, data type definitions, terms and conditions, and data transfer methods.
- [Functionality Descriptions \[87\]](#) discusses process data block descriptions, event handling, and ISDU handling.
- [EtherNet/IP CIP Object Definitions \[111\]](#), which explains vendor specific CIP object definitions.
- [ControlLogix Family – Example PLC Programs \[137\]](#), which provides is intended to provide basic working functionality.
- [SLC/PLC-5/MicroLogix Interface \[152\]](#) lists requirements and discusses PLC-5 and SLC messages, and PDI and PDO access via PCCC messages.
- [EDS Files \[159\]](#) provides installation instructions to add the EDS files to RSLinx.

This subsection includes the following topics:

- [Editing EtherNet/IP Settings \[40\]](#)
- [EtherNet/IP Settings Parameters \[41\]](#)



INFO

The IO-Link Master may work out of the box for *ControlLogix* PLCs.

5.3.1 Editing EtherNet/IP Settings

You can use this procedure to configure EtherNet/IP characteristics for each port:

Instruction:

- a) If necessary, open the IO-Link Master web interface with your web browser using the IP address.
- b) Click **Configuration | EtherNet/IP**.
- c) Click the **EDIT** button for each port that you want to configure.
You can click each **EDIT** button and open all ports to quickly configure port parameters.
- d) Make appropriate selections for the device that is connected to the port.
 - ✓ You can use the help system if you require definitions or values for the options or refer to [EtherNet/IP Settings Parameters \[41\]](#) in the next subsection.
- e) Scroll to the top of the page and click the **SAVE** button.

Result:

- ✓ Make sure that the port now displays the **EDIT** button.

5.3.2 EtherNet/IP Settings Parameters

The **Configuration | EtherNet/IP Settings** page supports the following options.

EtherNet/IP Settings Page

ISDU Data Settings

ISDU Response Timeout Default = 20 seconds	<p>The time that the IO-Link Master's EtherNet/IP interface waits for a response to an ISDU request.</p> <p>The timeout needs to set long enough to allow all commands within the ISDU request to be processed.</p> <p>Valid range: 1 - 10,000 seconds</p>
--	--

Process Data Settings

PDI Data Block Size (To PLC) Default: 36-bytes	<p>The configurable PDI data block length. Supported optional lengths are:</p> <ul style="list-style-type: none"> ■ 4-bytes (header only) ■ 8-bytes (4 bytes data) ■ 10-bytes (6 bytes data) ■ 16-bytes (12 bytes data) ■ 20-bytes (16 bytes data) ■ 24-bytes (20 bytes data) ■ 36-bytes (32 bytes data)
PDI Data Block Format (To PLC) Default: Word-16	<p>Data format of PDI data block to be transferred to the PLC(s) in Class 1 and/or Write-to-Tag/File PDI Transfer Modes. Supported formats are:</p> <ul style="list-style-type: none"> ■ Byte-8 (8-bit or SINT) ■ Word-16 (16-bit or INT) ■ Dword-32 (32-bit or DINT) <p>The Data Block Format is independent of the PDI Data Byte-Swap Method.</p> <p>This setting is not used for the SLC, PLC-5 and <i>MicroLogix</i> PLCs which are always Word-16.</p>
PDI Data Byte-Swap Method Default: Work (16-bit) byte swap	<p>If enabled, the IO-Link Master swaps the data bytes in word (2 byte) format or dword (4 byte) format.</p> <p>Supported values are:</p> <ul style="list-style-type: none"> ■ No byte-swap – data passed through as received ■ Word (16-bit) byte-swap – data is byte-swapped in word format ■ Dword (32-bit) byte-swap – data is byte-swapped in dword format ■ Reverse byte order – data passed through after being reversed <p>NOTICE! The byte swapping must be set correctly in order to convert from IO-Link (big-endian byte order), to EtherNet/IP (little-endian byte order).</p>

EtherNet/IP Settings Page***Include Digital I/O in PDI Data Block***

Default: False
(BIOLM, Only)

If enabled, the IO-Link Master includes the current digital I/O pins D1 to D4 status in the PDI data block header.

- **False** – Do not include the digital I/O pins status
- **True** (enable check box) – Include the digital I/O pins status in PDI data block header

Does not affect the Auxiliary Input.

PDO Data Block Size (From PLC)

Default: 32-bytes

The configurable PDO data block length. Supported optional lengths are:

Event code not included:

- **4-bytes** = all data
- **8-bytes** = all data
- **10-bytes** = all data
- **16-bytes** = all data
- **20-bytes** = all data
- **24-bytes** = all data
- **32-bytes** = all data
- **34-bytes** = 32 bytes data, 2 pad bytes
- **36-bytes** = 32 bytes data, 4 pad bytes

Event code included – PDO Data Format = Byte8:

- **4-bytes** = 2 byte event code, 2 data bytes
- **8-bytes** = 2 byte event code, 6 data bytes
- **10-bytes** = 2 byte event code, 8 data bytes
- **16-bytes** = 2 byte event code, 14 data bytes
- **20-bytes** = 2 byte event code, 18 data bytes
- **24-bytes** = 2 byte event code, 22 data bytes
- **32-bytes** = 2 byte event code, 30 data bytes
- **34-bytes** = 2 byte event code, 32 data bytes
- **36-bytes** = 2 byte event code, 32 data bytes, 2 byte pad

Event code included – PDO Data Format = word (16-bit):

- **4-bytes** = event code word, data word
- **8-bytes** = event code word, 3 data words
- **10-bytes** = event code word, 4 data words
- **16-bytes** = event code word, 7 data words
- **20-bytes** = event code word, 9 data words
- **24-bytes** = event code word, 11 data words
- **32-bytes** = event code word, 15 data words
- **34-bytes** = event code word, 16 data words
- **36-bytes** = event code word, 16 data words, pad word

Event code included – PDO Data Format = dword (32-bit):

- **4-bytes** = event code dword
- **8-bytes** = event code dword, data dword

EtherNet/IP Settings Page

	<ul style="list-style-type: none"> ■ 10-bytes = event code dword, data dwords ■ 16-bytes = event code dword, 3 data dwords ■ 20-bytes = dword event code, 4 data dwords ■ 24-bytes = dword event code, 5 data dwords ■ 32-bytes = dword event code, 7 data dwords ■ 34-bytes = dword event code, 7 data dwords, 2 data bytes ■ 36-bytes = dword event code, 8 data dwords
PDO Data Block Format (From PLC) Default: Word-16	<p>Data format of PDO data block received from the PLC(s) in Class 1 or Read from TagOrFile PDO Transfer Modes. Formats include:</p> <ul style="list-style-type: none"> ■ Byte-8 (8-bit) ■ Word-16 (16-bit) ■ Dword-32 (32-bit) <p>The Data Block Format is independent of the PDO Data Byte-Swap Method.</p> <p>This setting is not used for the SLC, PLC-5 and MicroLogix PLCs which are always Word-16.</p>
PDO Data Byte-Swap Method Default: Word (16-bit) byte-swap	<p>If enabled, the IO-Link Master swaps the data bytes in word (2 byte) format or dword (4 byte) format. Supported values are:</p> <ul style="list-style-type: none"> ■ No byte-swap – data passed through as received ■ Word (16-bit) byte-swap – data is byte-swapped in word format ■ Dword (32-bit) byte-swap – data is byte-swapped in dword format ■ Reverse byte order – data passed through after being reversed <p>NOTICE! The byte swapping must be set correctly in order to convert from EtherNet/IP (little-endian byte order), to IO-Link (big-endian byte order).</p>
Clear Event Code in PDO Block Default: False	<p>If enabled, the IO-Link Master expects the first 2 bytes, word, or dword of the PDO block to be used for event code handling. Supported values are:</p> <ul style="list-style-type: none"> ■ True (enable check box) = expect event code ■ False = no event code, expect only PDO data
Clear Event Code After Hold Time Default: True	<p>If enabled, the IO-Link Master clears any event code reported in the PDI data block after the Event Active Hold Time. Supported values are:</p> <ul style="list-style-type: none"> ■ True (enable check box) = clear event code after hold time ■ False = do not clear event code after hold time

EtherNet/IP Settings Page**Active Event Hold Time**

Default: 1000 ms

If **Clear Event Code After Hold Time** is enabled, the time period an event code is reported in the PDI block before it is cleared.

Valid range: 1 - 65535

Valid Units are:

- **ms** (milliseconds)
- **sec** (seconds)
- **min** (minutes)
- **hours**
- **days**

Event Hold Time Units

Default: ms

Valid Units are:

- **ms** (milliseconds)
- **sec** (seconds)
- **min** (minutes)
- **hours**
- **days**

Clear Event Hold Time

Default: 500 ms

Once an event code has been cleared, the time an event code stays cleared in the PDI block before another event code can be reported.

Valid range: 1 - 65535

Valid Units are:

- **ms** (milliseconds)
- **sec** (seconds)
- **min** (minutes)
- **hours**
- **days**

Event Clear Time Units

Default: ms

Once an event code has been cleared, the time an event code stays cleared in the PDI block before another event code can be reported.

Valid Units are:

- **ms** (milliseconds)
- **sec** (seconds)
- **min** (minutes)
- **hours**
- **days**

Include Digital Output(s) in PDO Data Block

Default: False

If enabled, the IO-Link Master expects the digital output settings to be included in the PDO data block.

- **False** – The digital pin setting(s) are not included in the PDO data block.
- **True** (enable check box) – The digital pin setting(s) are included in the PDO data block.

EtherNet/IP Settings Page**Transfer Mode Settings**

PDI Receive Mode(s) to PLC Determines which PDI Receive (To PLC) Modes are enabled.
Supported modes are:

Default: Polling, Class1

- **Polling**
- **Class1**
- **Write-to-TagOrFile**

PDO Transmit Mode from PLC Supported modes are:

Default: Class 1

- **Off**
- **PLC-Writes**
- **Class1**
- **Read-from-TagOrFile**

Read/Write Tag/File Settings

PLC IP Address (xxx.xxx.xxx.xxx) The PLC IP Address is required if either **Write-to-TagOrFile** or **Read-from-TagOrFile** mode are enabled.

Default: 0.0.0.0

Format: xxx.xxx.xxx.xxx

PLC Controller Slot Number The PLC Controller Slot Number is required if either **Write-to-TagOrFile** or **Read-from-TagOrFile** mode are enabled.

Default: 0

Valid range: 0 - 64

PLC Type Indicates the type of PLC that the tag(s) or file(s) are written to and/or read from. Supported PLC Types are:

Default: ControlLogix

- **ControlLogix**
- **SLC**
- **PLC-5**
- **MicroLogix**

Write PDI to Tag/File Settings

PDI Tag/File Name The tag or file name to place the PDI data block:

Default: blank

- ControlLogix family:
 - Tags must be same type as **PDI Data Format** (SINT, INT or DINT).
 - Tags must be an array.
 - Tags must be at least as long as the **PDI Data Block Length**.
- SLC/PLC-5/MicroLogix:
 - Files must be of INTEGER (16-bit) type.
 - Files must be named with standard file name conventions (i.e: N10:0, N21:30, etc)
 - The file must be at least as long as the **PDI Data Block Length**.

Append PDO to PDI Data If selected, the IO-Link Master appends any PDO data to the end of the PDI data.

Default: False

- **False** = Do not append PDO data
- **True** (enable check box) = Append PDO data

EtherNet/IP Settings Page**Maximum PLC Update Rate**

Default: 40 ms

The maximum rate at which the IO-Link Master updates the PDI tag or file.

This parameter is used to ensure that the PLC receives all state changes.

Setting the update rate to 10 ms effectively disables this feature.

The valid range is 10 to 65535 ms.

Heartbeat Update Enable

Default: False

If selected, the IO-Link Master updates the PDI data block at the **Heartbeat Update Rate**.

- **False** = Heartbeat update disabled
- **True** (enable check box) = Heartbeat update enabled

Heartbeat Update Rate

Default: 1000 ms

If **Heartbeat Update Enable** is selected, the rate at which the IO-Link Master updates the PDI data block in the **Write-to-Tag/File** mode.

The valid range is 50 to 65535 ms.

Read PDO from Tag/File Settings**PDO Tag/File Name**

Default: blank

The tag or file name that the IO-Link Master reads the PDO data block from.

- ControlLogix family:
 - Tags must be same type as **PDO Data Format** (SINT, INT or DINT).
 - Tags must be an array.
 - Tags must be at least as long as the **PDO Data Block Length**.
- SLC/PLC-5/MicroLogix:
 - Files must be of INTEGER (16-bit) type.
 - Files must be named with standard file name conventions (i.e: N10:0, N21:30, etc)

The file must be at least as long as the **PDO Data Block Length**.

PLC Poll Rate

Default: 1000 ms

The frequency which the IO-Link Master reads the PDO data block in the Read-from-Tag/File mode.

Valid range: 50 - 65535 ms

TTL (Time To Live) Network Value (1 - 255)

Default: 1

The TTL value indicates how many network “hops” can be made for Multicast packets.

It is used to prevent Multicast packets from being forwarded beyond its own subnet(s).

Each network router decreases the hop count when forwarding the Multicast packet.

Once the hop count reaches zero, the Multicast packet is no longer forwarded.

EtherNet/IP Settings Page**Multicast IP Address Allocation Control**

Default: Automatic

This setting indicates how the starting Multicast address is determined.

- **Automatic** – The IO-Link Master determines the starting Multicast IP address based on an EtherNet/IP specification algorithm.
- **User-Defined** – The user sets the starting Multicast address.

User-Defined Number of Multicast IP Addresses (1 - 32)

Default: 32

When the Multicast IP Address Allocation Control is set to User-Defined, the maximum number of Multicast addresses that the IO-Link Master may use.

User-Defined Multicast Start IP Address (239.192.1.0 - 239.255.255.255)

Default: 239.192.1.0

When the multicast IP Address Allocation Control is set to User-Defined, the Multicast starting IP address for the IO-Link Master. Make sure you avoid redundant Multicast IP addresses on a network.

Session Encapsulation Timeout (0 = disable; 1 - 3600 sec) (0 - 3600)

Default = 120

Defines the inactivity period before an established session between a controller, such as a PLC, and the BIOLM will time out. If such a timeout occurs, the current session is closed and a new session must be established before communications can resume between the controller and the BIOLM.

5.4 Modbus/TCP Settings Configuration Page

You can use the **Configuration | Modbus/TCP Settings** page to configure Modbus/TCP with the IO-Link Master.

Additional Modbus information is available in the following chapters:

- [Functionality Descriptions](#) [► 87]
- [Modbus/TCP Interface](#) [► 161]

This subsection includes these topics:

- [Editing Modbus/TCP Settings](#) [► 48]
- [Modbus/TCP Settings Parameters](#) [► 49]



INFO

Modbus is disabled by default. To use Modbus, click the **EDIT** button and select **Enable**.

5.4.1 Editing Modbus/TCP Settings

Instruction:

- a) If necessary, open the IO-Link Master web interface with your web browser using the IP address.
- b) Click **Configuration | Modbus/TCP**.
- c) Click the **EDIT** button for the port that you want to configure.
You can click each **EDIT** button and open all ports to quickly configure port parameters.
- d) Make appropriate selections for the IO-Link device that you will connect to that port. You can use the help system if you require definitions or values for the options or [Modbus/TCP Settings Parameters](#) [► 49].
- e) Scroll to the top of the page and click the **SAVE** button.

Result:

- ✓ Make sure that the port now displays the **EDIT** button.
- ✓ If it displays the **SAVE** and **CANCEL** buttons, that means that one of the parameters contains an incorrect value. If necessary, scroll down the page, make the needed corrections, and click **SAVE**.

5.4.2 Modbus/TCP Settings Parameters

The following table provides detailed information about the **Modbus/TCP Settings** page.

Modbus/TCP Settings Page

ISDU Response Timeout Default = 20 seconds	The time that the IO-Link Master's Modbus/TCP interface waits for a response to an ISDU request. The timeout needs to set long enough to allow all commands within the ISDU request to be processed. Valid range: 1 - 10,000 seconds
--	---

Process Data Settings

PDI Data Block Size Default: 36-bytes	The configurable PDI data block length. Optional lengths are: <ul style="list-style-type: none"> ■ 4-bytes (header only) ■ 8-bytes (4 bytes data) ■ 16-bytes (12 bytes data) ■ 24-bytes (20 bytes data) ■ 36-bytes (32 bytes data)
PDI Byte-Swap Method Default: No byte-swap	If enabled, the IO-Link Master swaps the data bytes in word (2 byte) format or dword (4 byte) format. Options include: <ul style="list-style-type: none"> ■ No byte-swap – data passed through as received ■ Word (16-bit) byte-swap – data is byte-swapped in word format ■ Dword (32-bit) byte-swap – data is byte-swapped in dword format ■ Reverse registers – data passed through after being reversed <p>Because both IO-Link and Modbus/TCP use big-endian byte ordering, byte swapping typically is not required for word and dword data.</p> <p>Byte swapping is most commonly required when receiving byte (8-bit) data and it is desired to place the first data byte in the least significant byte position of the holding register. For these cases, word (16 bit) byte-swap is typically used.</p>
Include Digital I/O in PDI Data Block Default: False	If enabled, the IO-Link Master includes the current digital I/O pins D1 to D4 status in the PDI data block header. <ul style="list-style-type: none"> ■ False – Do not include the digital I/O pins status ■ True (enable check box) – Include the digital I/O pins status in PDI data block header <p>Does not affect the Auxiliary Input.</p>
PDO Data Block Size (From PLC) Default: 32-bytes	The configurable PDO data block length. Optional lengths are: Event code not included: <ul style="list-style-type: none"> ■ 4-bytes = 2 data words ■ 8-bytes = 4 data words ■ 16-bytes = 8 data words ■ 24-bytes = 12 data words ■ 32-bytes = 16 data words

Modbus/TCP Settings Page

- **34-bytes** = 16 data words, 1 pad word

Event code included:

- **4-bytes** = event code word, 1 data word
- **8-bytes** = event code word, 3 data words
- **16-bytes** = event code word, 7 data words
- **24-bytes** = event code word, 11 data words
- **32-bytes** = event code word, 15 data words
- **34-bytes** = event code word, 16 data words

PDO Byte-Swap Method

Default: No byte-swap

If enabled, the IO-Link Master swaps the data bytes in word (2 byte) format or dword (4 byte) format. Options include:

- **No byte-swap** – data passed through as received
- **Word (16-bit) byte-swap** – data is byte-swapped in word format
- **Dword (32-bit) byte-swap** – data is byte-swapped in dword format
- **Reverse registers** – data passed through after being reversed

Because both IO-Link and Modbus/TCP use big-endian byte ordering, byte swapping typically is not required for word and dword data.

Byte swapping is most commonly required when sending byte (8-bit) data to the IO-Link device and it is desired to send the least significant byte of the holding register first. For these cases, word (16 bit) byte-swap is typically used.

Append PDO to PDI Data

Default: False

If selected, the IO-Link Master appends any PDO data to the end of the PDI data.

- **False** = Do not append PDO data
- **True** (enable check box) = Append PDO data

Clear Event Code in PDO Block

Default: False

If enabled, the IO-Link Master expects the first word of the PDO block to be used for event code handling.

Values are:

- **True** (enable check box) = expect event code
- **False** = no event code, expect only PDO data

Clear Event Code After Hold Time

Default: True

If enabled, the IO-Link Master clears any event code reported in the PDI data block after the **Event Active Hold Time**.

Values are:

- **True** (enable check box) = clear event code after hold time
- **False** = do not clear event code after hold time

Modbus/TCP Settings Page

Active Event Hold Time Default: 1000 ms	If Clear Event Code After Hold Time is enabled, the time period an event code is reported in the PDI block before it is cleared. Valid range: 1 - 65535 Valid Units are: <ul style="list-style-type: none"> ■ ms (milliseconds) ■ sec (seconds) ■ min (minutes) ■ hours ■ days
Event Hold Time Units	Valid Units are: <ul style="list-style-type: none"> ■ ms (milliseconds) ■ sec (seconds) ■ min (minutes) ■ hours ■ days
Clear Event Hold Time Default: 500 ms	Once an event code has been cleared, the time an event code stays cleared in the PDI block before another event code can be reported. Valid range: 1 - 65535 Valid Units are: <ul style="list-style-type: none"> ■ ms (milliseconds) ■ sec (seconds) ■ min (minutes) ■ hours ■ days
Event Clear Time Units	Valid Units are: <ul style="list-style-type: none"> ■ ms (milliseconds) ■ sec (seconds) ■ min (minutes) ■ hours ■ days
Include Digital Output(s) in PDO Data Block Default: False	If enabled, the IO-Link Master expects the digital output settings to be included in the PDO data block. <ul style="list-style-type: none"> ■ False – The digital pin setting(s) are not included in the PDO data block ■ True (enable check box) – The digital pin setting(s) are included in the PDO data block
Transfer Mode Settings	
Slave Mode Device ID Default: 1	The Modbus Device ID used to access this IO-Link port. Range: 1 - 247
PDI Receive Mode(s) Default: Slave	Determines which PDI Receive (To PLC) Modes are enabled. The selectable mode is Slave .

Modbus/TCP Settings Page

NOTICE! Not selecting slave mode disables Modbus/TCP access to the PDI data block.

PDO Transmit Mode

Default: Slave

Selectable modes are:

- ***Disabled***
- ***Slave***

5.5 OPC UA Settings Configuration Page

Use the **Configure** | **OPC UA Settings** page to configure OPC UA with the BIOLM.

This subsection includes these topics:

- [Edit OPC UA Settings \[▶ 53\]](#)
- [OPC UA Settings Parameters \[▶ 53\]](#)



INFO

OPC UA is disabled by default.

5.5.1 Edit OPC UA Settings

You can use this procedure to edit OPC UA settings:

Instruction:

- a) If necessary, open the IO-Link Master web interface with your web browser using the IP address.
- b) Click **Configuration** | **OPC UA**.
- c) Click the **EDIT** button.
- d) Make the appropriate selections for your environment. You can use the help system if you require definitions or values for the options or [OPC UA Settings Parameters \[▶ 53\]](#).
- e) Click the **SAVE** button.

5.5.2 OPC UA Settings Parameters

The following table provides information about the **OPC UA Setting** page:

Option	OPC UA Configuration Descriptions
OPC UA Port CONFIG	
Allow OPC UA clients to write PDO data Default = disable	Determines whether OPC UA clients are allowed to write PDO data to the IO-Link devices.
OPC UA CONFIGURATION	
OPC UA Server Enable Default = disable	This option controls whether or not the OPC UA server runs on the IO-Link Master.
Work-around for faulty OPC UA clients that require unique browsenames Default = disable	Enables an alternative set of browsenames where each node's browsename is unique. Normally only browsepaths are required to be unique.
Allow OPC UA clients to write ISDU data Default = disable	Determines whether OPC UA clients are allowed to write ISDU data to the IO-Link devices.

6 Loading and Managing IODD Files

There are several **Attached Devices** pages that support IO-Link Device Description (IODD) file management.

- [IO-Link Device Description Files Page \[▶ 54\]](#) – load IODD files from the IO-Link device manufacturer onto the BIOLM.
- [IO-Link Device Configuration Summary Page \[▶ 57\]](#) – verify the correct files were loaded for each IO-Link device or use the page to retrieve information about the baud rate, SIO mode, and device number.
- The **Port** pages are discussed in [Configuring IO-Link Devices \[▶ 58\]](#).

6.1 IO-Link Device Description Files Page



INFO

You will need to download the appropriate IODD files from your IO-Link device manufacturer.

Use the **IO-Link Device Description Files** page to update (upload) and delete IO-Link Device Description (IODD) files associated with this BIOLM. In addition, you can review the IODD **.xml** file by clicking the **IODD FILENAME** in the table after loading the IODD file.

The BIOLM provides 15790K of space to store IODD files. The BIOLM includes the following default IODD files, which cannot be deleted:

- *IODD-StandardDefinitions1.0.1.xml*
- *IODD-StandardUnitDefinitions1.0.1.xml*
- *IODD-StandardDefinitions1.1.xml*
- *IODD-StandardUnitDefinitions1.1.xml*

You can use the **Configuration | Save/Load** feature to backup your IODD files. You can save the configuration file from an BIOLM that has IODD files installed and then load that configuration file to another BIOLM to quickly load the IODD files.

6.1.1 Preparing IODD Files to Upload

After downloading the IODD files for the IO-Link device from the IO-Link sensor or actuator manufacturer, you may need to unzip the file and locate the appropriate **xml** file for the device.

- Some IODD zip files contain the **xml** files and supporting image files for a single product. This type of zip file can be immediately loaded onto the BIOLM.
- Some IODD zip files contain the files for multiple products. If you upload this type of IODD zip file, the BIOLM loads the first **xml** file and the associated image files, which may or may not correspond to the IO-Link device connected to the port. If you need to zip the appropriate files, the following information may be useful:
 - Unzip the package and locate the **xml** file needed for your IO-Link device.
 - Open the **xml** file and search for the **productID**, which identifies the IO-Link device.
 - Zip the **xml** file along with the supporting images. There are several ways to locate the supporting images:
 - Locate the appropriate images using the **xml** file.
 - Load only the **xml** file and the BIOLM notifies you what files are missing. Use the **UPDATE** feature to upload the missing images.
 - Zip the **xml** with all of the images and the BIOLM ignores (and not upload) any unused files and notifies which files did not upload.



INFO

Image files are not required for IO-Link device configuration.

Use the appropriate discussion for your IODD files:

- [Uploading IODD Zip Files \[► 55\]](#)
- [Uploading xml Files or Supporting Files \[► 56\]](#)

6.1.2 Uploading IODD Zip Files

You can use the following procedure to upload IODD zip files:

Instruction:

- a) Click **Attached Devices** and **IODD FILES**.
- b) Click the **UPLOAD FILE** button.
- c) Click the **CHOOSE FILE** button and browse to the file location.
- d) Highlight the **zip** file, click **Open** and then the **UPLOAD** button.
- e) If necessary, click **OK**.

Only images referenced in the xml file load to the BIOLM and the remaining files are ignored.
- f) If desired, you can view the **xml** file by clicking the **IODD FILENAME** in the table.
- g) Click the hyperlink at the top of the page if you want to view the **xml** file in your browser.
- h) Optionally, verify that the correct **xml** file was loaded using the **Summary** page ([IO-Link Device Configuration Summary Page \[► 57\]](#)).

6.1.3 Uploading xml Files or Supporting Files

You can use the following procedure to upload **xml**, or supporting image files:

Instruction:

- a) Click **Attached Devices** and **IODD FILES**.
- b) Click the **UPLOAD FILE** button.
- c) Click the **CHOOSE FILE** button and browse to the file location.
- d) Highlight the **xml** or image file and click **Open**.

NOTICE! The xml file must be loaded before the BIOLM will load the associated image files.

- e) Click the **UPLOAD** button.

✓ The BIOLM notifies you what files are missing. The missing files do not affect the operation of the IODD Port page but the product image and logo for the IO-Link device company do not display.

- f) Optionally, use the following steps to load image files:

1. Select the row in the table that contains the **xml** file by clicking the check box.
2. Click the **UPLOAD FILE** button.
3. Click the **Choose File** button and browse to the file location.
4. Highlight the file and click **Open**.
5. Click the **UPLOAD** button.
6. Optionally, verify that the correct **xml** file was loaded using the **Summary** page ([IO-Link Device Configuration Summary Page \[▶ 57\]](#)).

6.1.4 Viewing and Saving IODD Files

Use the following procedure to view the contents of an IODD file:

Instruction:

- a) If necessary, click **Attached Devices** and **IODD Files**.
- b) Click the **IODD FILENAME** in the table that you want to review. A pop up window displays the contents of the IODD file.
- c) Optionally, click the file name hyperlink at the top of the window to view the formatted file or if you want to save a copy of the file to another location.

6.1.5 Deleting IODD Files

Use the following procedure to delete an IODD file set from the BIOLM:

Instruction:

- a) If necessary, click **Attached Devices** and **IODD Files**.
- b) Check the corresponding row of the IODD file that you want to delete.
- c) Click the **DELETE SELECTED** button.
- d) Click **CONTINUE** to the **Delete files?** message.

6.2 IO-Link Device Configuration Summary Page

The **IO-Link Device Configuration Summary** page provides basic device configuration (device profile) information for ports with valid IO-Link devices attached. The **Configuration Summary** page retrieves information that resides on the IO-Link device from the manufacturer.

A file name displayed in the **IODD Name** field for a port indicates that a valid IODD file is associated with that device. If the field is empty, that indicates that a valid IODD file has not been loaded.

You can review complete IODD file information on a port by port basis by clicking the **MORE** button next to the port in question or by clicking the **PORT** menu selection in the navigational bar.

Use the following steps to access the **IO-Link Device Configuration Summary** page.

Instruction:

- a) Click **Attached Devices**.
- b) Click **SUMMARY**.
 - ✓ The **Configuration Summary** page takes several minutes to completely load as each device is queried.
- c) Click the **MORE** button or the corresponding **Port** (in the navigational bar) to configure the IO-Link device parameters for a specific device. See [Configuring IO-Link Devices \[▶ 58\]](#) for more information.

7 Configuring IO-Link Devices

This chapter discusses using the **Attached Devices** | **Port** pages to change IO-Link device parameters.



INFO

Optionally, you can use traditional methods such as: PLC interfaces or HMI/SCADAs, depending on your protocol to configure the IO-Link devices.

7.1 Port Pages Overview

You can use the **Attached Devices** | **Port** page for a port to review and easily edit the IO-Link device configuration or view Process Data.

The **Port** page provides two IO-Link device configuration methods:

- **IO-Link Device Port** table (GUI), which depends on the appropriate IODD file loaded from the IO-Link device manufacturer onto the BIOLM. To use the **IO-Link Device Port** table for configuring IO-Link devices, refer to the following subsections:
 - [Editing Parameters – IO-Link Device – Port Table](#) [► 59]
 - [Resetting IO-Link Device Parameters to Factory Defaults](#) [► 59]
- **IO-Link Device ISDU Interface – Port**, which can be used with or without IODD files loaded. Refer to the following information to use the **IO-Link Device ISDU Interface – Port** method:
 - The IO-Link Device Operator Manual from the device manufacturer is needed to use the **IO-Link Device ISDU Interface** since ISDU block index and ISDU sub-index numbers are required.
 - [Editing Parameters – IO-Link Device ISDU Interface – Port](#) [► 59]

The **IO-Link Device Port** table provides detailed information about the indexes and sub-indexes. Not all indexes have sub-indexes.

- If the IODD file follows IO-Link specifications, an asterisk next to RW means that parameter is not included in Data Storage.
- If a Sub-index has an asterisk next to it in the GUI, that means that sub-index is not sub-indexable. This may be useful information when using the IO-Link Device ISDU Interface or programming your PLC.

7.2 Editing Parameters – IO-Link Device – Port Table

Use the following procedure to edit IO-Link device parameters using the **IO-Link Device Port** table.



INFO

You may want to verify that the **Automatic Download Enable for Data Storage** option on the **Configuration | IO-Link Settings** page is NOT set to **On** as this can cause unreliable results on the corresponding port.

Instruction:

- a) If you have not done so, load the IODD file from the IO-Link device manufacturer ([Loading and Managing IODD Files \[p. 54\]](#)).
- b) Access the appropriate **Port** page by clicking **Attached Devices** and then the **Port** number that you want to configure.
- c) Click the **EDIT** button after all of the device information is populated in the table.
- d) Scroll down the table and make appropriate parameter changes for your environment.
An IODD file may not contain all IO-Link device settings depending on the IO-Link device manufacturer. If you need to change a parameter that is not displayed in the **IO-Link Device – Port** table, you can refer to the IO-Link Device Operators Manual and use the **IO-Link Device ISDU Interface** to change the settings.
You may need to scroll to the right in the table to view applicable parameter values if the parameter is not selectable in a drop list.
- e) Click the **SAVE** button after editing the parameters.

7.3 Resetting IO-Link Device Parameters to Factory Defaults

In the event you want to reset the IO-Link device to factory default, typically the IODD file provides the ability from the IO-Link device manufacturer. Use the following example to reset an IO-Link device.

Instruction:

- a) Click the **COMMAND** button and locate the **Restore Factory** button.
- b) Click the **Restore Factory** or **Load Factory Settings** button.
The name of the button is determined by the IO-Link device manufacturer.
- c) Click **OK** when the **Refresh** message appears.

7.4 Editing Parameters – IO-Link Device ISDU Interface – Port

The **IO-Link Device ISDU Interface** follows these guidelines:

- If necessary, convert hexadecimal ISDU index numbers to decimal, you must enter the decimal value for the ISDU Block Index and ISDU Sub-index numbers.
- You must enter the hexadecimal value for the IO-Link device parameters.

If the appropriate IODD files has been loaded, you can use the **IO-Link Device – Port** table to determine the index numbers and acceptable values for each parameter.

An IODD file may not contain every IO-Link device setting depending on the IO-Link device manufacturer. If you need to change a parameter that is not displayed in the **IO-Link Device – Port** table, you can refer to the IO-Link Device Operators Manual.

If an IODD file has not been loaded for an IO-Link device, you can use the IO-Link Device Operator's Manual to determine the ISDU indexes.

7.4.1 Overview

The following provides some basic information about the command usage and responses when using the ISDU Interface:

- You must enter the decimal value for the ISDU Block Index and ISDU Sub-index.
- The **GET** button retrieves the parameter value in hex from the IO-Link device. You may want to retrieve values to determine the data length.
- The **SET** button sends the value to the IO-Link device.
- After successfully changing a parameter, the IO-Link Master responds with a **command executed** notification.
- The message **other failure (write)** means that the IO-Link device defines the entry as an invalid setting.
- The message **other failure (read)** indicates that the IO-Link device cannot read the specified ISDU Block Index and Sub-index.

7.4.2 How to Use the Interface

Use the following procedure to edit parameters using the **IO-Link Device ISDU Interface – Port**.



INFO

You may want to verify that the **Automatic Download Enable for Data Storage** option on the **Configuration | IO-Link Settings** page is NOT set to **On** as this can cause unreliable results on the corresponding port.

Instruction:

- a) Click the **+** next to the **IO-Link Device ISDU Interface** to open the interface.
- b) Enter the ISDU Block Index number (decimal) that you want to edit.
- c) If applicable, enter the ISDU Sub-index (decimal).
- d) Edit the parameter (hex) and click the **SET** button.
- e) Verify that a **command executed** message returns.
- f) If the IODD file is loaded, optionally click **REFRESH** to verify your changes.

8 Utilizing BIOLM Features

This chapter discusses using the following features:

- [Setting User Accounts and Passwords \[▶ 62\]](#)
- [Data Storage \[▶ 63\]](#), which provides automatic and manual data storage to upload or download IO-Link v1.1 device parameters
- [Device Validation \[▶ 65\]](#), which supports identical or compatible device validation to dedicate a port or ports to specific IO-Link devices
- [Data Validation \[▶ 66\]](#), which supports strict or loose data validation to verify data integrity
- [BIOLM Configuration Files \[▶ 66\]](#), that supports a method to back up configuration files or load the same configuration to multiple BIOLM units
- [Configuring Miscellaneous Settings \[▶ 67\]](#), which provides the following options:
 - [Using the Menu Bar Hover Shows Submenu Option \[▶ 67\]](#)
 - [Enable PDO Write From Attached Devices Port Page \[▶ 68\]](#)
 - [IO-Link Test Event Generator \[▶ 69\]](#)
- [Clearing Settings \[▶ 70\]](#), which allows you to reset the BIOLM to factory default values

8.1 Setting User Accounts and Passwords

The BIOLM is shipped from the factory without passwords. See the following table if you want to see how permissions are granted:

Page	Admin	Operator	User
Log-in	Yes	Yes	Yes
Home	Yes	Yes	Yes
Diagnostics – All	Yes	Yes	Yes
Configuration – IO-Link Settings	Yes	Yes	View-only
Configuration – Digital I/O Settings (Applicable models)	Yes	Yes	View-only
Configuration – EtherNet/IP Settings	Yes	Yes	View-only
Configuration – Modbus/TCP	Yes	Yes	View-only
Configuration – OPC UA	Yes	Yes	View-only
Configuration – Network	Yes	View-only	No
Configuration – Misc	Yes	Yes	Yes
Configuration – Load/Save	Yes	Yes	View-only
Configuration – Clear Settings	Yes	No	No
Advanced – Software	Yes	No	No
Advanced – Accounts	Yes	No	No
Advanced – Log Files	Yes	Yes	Yes
Advanced – Licenses	Yes	Yes	Yes
Attached Devices – IO-Link Device Description Files	Yes	Yes	View-only
Attached Devices – IO-Link Device Configuration Summary	Yes	Yes	View-only
Attached Devices – IO-Link Device – Port	Yes	Yes	View-only

You can use this procedure to set up passwords for the BIOLM:

Instruction:

- Open your browser and enter the BIOLM IP address.
- Click **Advanced | ACCOUNTS**.
- Click the **ADMIN** check box.
- If applicable, enter the old password in the **Old Password** text box.
- Enter the new password in the **New Password** text box.
- Re-enter the password in the **Confirm Password** text box.
- Optionally, click the **Operator** check box, enter a new password, and re-enter the password in the **Confirm Password** text box.
- Optionally, click the User check box, enter the new password, and re-enter the password in the **Confirm Password** text box.
- Click **Apply**.
- Close the new window that displays a **Password saved** banner.
- Click the **Log out** button on the top navigation bar.
- Re-open the web interface by selecting the appropriate user type in the drop list and entering the password.

8.2 Data Storage

Data storage is typically supported by IO-Link v1.1 devices. Data storage means that you can upload parameters from an IO-Link device to the BIOLM and/or download parameters from the BIOLM to the IO-Link device. This feature can be used to:

- Quickly and easily replace a defective IO-Link device
- Configure multiple IO-Link devices with the same parameters as fast as it takes to connect and disconnect the IO-Link device

To determine whether an IO-Link (v1.1) device supports data storage, you can check one of the following:

- **IO-Link Diagnostics** page – check the **Data Storage Capable** field to see if it displays **Yes**.
- **IO-Link Configuration** page – check to see if **UPLOAD** and **DOWNLOAD** buttons display under the **Data Storage Manual Ops** group. If only a **Clear** button displays, the device on the port does not support data storage.

8.2.1 Uploading Data Storage to the BIOLM

The IO-Link device manufacturer determines which parameters are saved for data storage. Remember, the IO-Link device should be configured before enabling data storage unless you are using data storage to back up the default device configuration.

There are two methods to upload Data Storage using the **Configuration | IO-Link** page:

- **Automatic Enable Upload** – If a port is set to **On** for this option, the BIOLM saves the data storage parameters (if the data storage is empty) from the IO-Link device to the BIOLM. When this option is enabled and another IO-Link device (different Vendor ID and Device ID), the **IO-Link Diagnostics** page displays a DS: Wrong Sensor in the **IOLink State** field and the IO-Link port LED flashes red, indicating a hardware fault. Automatic upload occurs when the **Automatic Upload Enable** option is set to **On** and one of these conditions exists:
 - There is no upload data stored on the gateway and the IO-Link device is connected to the port.
 - The IO-Link device has the **DS upload** bit on; generally because you have changed the configuration through Teach buttons or the web interface.Not all device parameters are sent to data storage. The IO-Link device manufacturer determines what parameters are sent to data storage.
- **Data Storage Manual Ops: UPLOAD** – Selecting the **UPLOAD** button saves the data storage from the IO-Link device to the BIOLM. The contents of the data storage does not change unless it is uploaded again or cleared. Another IO-Link device with a different Vendor ID and Device ID can be attached to the port without causing a hardware fault.

8.2.2 Downloading Data Storage to the IO-Link Device

There are two methods to download Data Storage using the **Configuration | IO-Link Device** page:

- **Automatic Download Enable** – An automatic download occurs when the **Automatic Download Enable** option is set to **On** and one of these conditions exists:
 - The original IO-Link device is disconnected and an IO-Link device who's configuration data differs from the stored configuration data.
 - The IO-Link device requests an upload and the **Automatic Upload Enable** option is set to **Off**.
 - **NOTICE! Do not enable both Automatic Upload and Download at the same time, the results are not reliable among IO-Link device manufacturers.**
- **Data Storage Manual Ops: DOWNLOAD** – Selecting the **DOWNLOAD** button downloads the data storage from the that port to the IO-Link device.
 - If an IO-Link device with a different Vendor ID and Device ID is attached to the port and a manual download is attempted, the BIOLM issues a hardware fault.

8.2.3 Automatic Device Configuration

Use the following steps to use an BIOLM port to configure multiple IO-Link devices with the same configuration parameters.

Instruction:

- a) If necessary, configure the IO-Link device as required for the environment.
- b) Click **Configuration | IO-Link**.
- c) Click the **EDIT** button for the port for which you want to store the data on the BIOLM.
- d) Click the **UPLOAD** button.
- e) Click the **CONTINUE** button to the **Continue to upload the data storage on IO-Link Master port [number]** message.
- f) Click the **OK** button to the **Data storage upload successful on Port [number]** message.
- g) Set the **Automatic Download Enable** option to **On**.
- h) Click **SAVE**.
- i) Click **Diagnostics | IO-Link**.
- j) Replace the IO-Link device on that port with the IO-Link device for which you want configured automatically.
- k) Verify that the IO-Link device displays operational **Port Status** and the appropriate IO-Link State.
- l) Repeat the 2 previous steps for as many device as you want to configure.

8.2.4 Automatic Device Configuration Backup

The following procedure shows how to utilize data storage to automatically backup an IO-Link device configuration.

Remember, if you adjust parameters using **Teach** buttons those values may or not may be updated in the data storage, which depends on the IO-Link device manufacturer. If you are unsure, you can always use the manual **UPLOAD** feature to capture the latest settings.

Instruction:

- a) Click **Configuration | IO-Link**.
- b) Click the **EDIT** button for the port for which you want to store the data on the BIOLM.
- c) Select **On** in the drop list for **Automatic Data Storage Upload Enable**.
- d) Click **SAVE**.

Result:

- ✓ When the **Configuration | IO-Link** page is refreshed, the **Storage Contents** field displays the **Vendor ID** and **Device ID**. In addition, the **IO-Link Diagnostics** page displays **Upload-Only** in the **Automatic Data Storage Configuration** field.

8.3 Device Validation

Device validation is supported by many IO-Link devices. Device Validation Mode provides these options:

- **None** – this disables **Device Validation Mode**.
- **Compatible** – permits a compatible IO-Link device (same Vendor ID and Device ID) to function on the corresponding port.
- **Identical** – only permits an IO-Link device (same Vendor ID, Device ID, and serial number) to function on the corresponding port.

Use this procedure to configure device validation:

Instruction:

- a) Click **Configuration | IO-Link Settings**.
- b) Click the **EDIT** button.
- c) Select **Compatible** or **Identical** for the **Device Validation** mode.
Identical Device Validation requires a device serial number to operate.
- d) Click the **GET ATTACHED** button or manually complete the Vendor ID, Device, ID, and serial number.
If the device does not have a serial number, you should not select **Identical** because the BIOLM requires a serial number to identify a specific device.
- e) Click the **SAVE** button. If the wrong or incompatible device is connected to the port, the IO-Link port LED flashes red and no IO-Link activity occurs on the port until the issue is resolved.

8.4 Data Validation

You can use this procedure to configure data validation.

Instruction:

- a) Click **Configuration** | **IO-Link Settings**.
- b) Click the **EDIT** button on the port you want to configure for data validation.
- c) Select **Loose** or **Strict** to enable data validation.
 - **Loose** – the slave device's PDI/PDO lengths must be less than or equal to the user-configured values.
 - **Strict** – the slave device's PDI/PDO lengths must be the same as the user-configured values.
- d) Click the **GET ATTACHED** button or manually enter the PDI and PDO length.
- e) Click the **SAVE** button.

If data validation fails, the IO-Link port LED flashes red and the **IO-Link Diagnostics** page displays an error.

8.5 BIOLM Configuration Files

You can use the web interface to save or load BIOLM configuration files.

Use one of the following procedures to save or load configuration files:

- [Saving Configuration Files \(Web Interface\)](#) [▶ 66]
- [Loading Configuration Files \(Web Interface\)](#) [▶ 66]

8.5.1 Saving Configuration Files (Web Interface)

Use this procedure to save configuration files for the BIOLM. The configuration files includes all port settings, network settings, and encrypted passwords:

Instruction:

- a) Click **Configuration** | **Load/Save**.
- b) Click the **SAVE** button.
- c) Click the **Save as** option and browse to the location that you want to store the configuration file.

8.5.2 Loading Configuration Files (Web Interface)

Use this procedure to load a configuration file onto the BIOLM:

Instruction:

- a) Click **Configuration** | **Load/Save**.
- b) Click the **Browse** button and locate the configuration file (.dcz extension).
- c) Click the **LOAD** button.
- d) Click the **OK** button to close the **Configuration Uploaded** message that notifies you of what configuration parameters loaded.

8.6 Configuring Miscellaneous Settings

The **Miscellaneous Settings** page includes the following options:

- **Menu Bar Hover Shows Submenu:**

This option displays sub-menus for a category when you hover over the category name. For example, if you hover over **Advanced**, the **SOFTWARE**, **ACCOUNTS**, **LOG FILES**, and **LICENSES** sub-menus display. You can click any sub-menu and avoid opening the default menu for a category.

- **Enable PDO Write From Attached Devices Port Page:**

When enabled, it allows you to write PDO data to IO-Link slaves from the **Attached Devices | Port** page in the web user interface. See [Enable PDO Write From Attached Devices Port Page \[▶ 68\]](#) for more information.

NOTICE! The PDO write will not allow writes if the BIOLM has a PLC connection. This should never be enabled in a production environment.

- **LED Flash:**

You can force the IO-Link port LEDs on the BIOLM into a flashing tracker pattern that allows you to easily identify a particular unit.

- Click the **ON** button to enable the LED tracker feature on the BIOLM. The LEDs remain flashing until you disable the LED tracker feature.

Click the **OFF** button to disable the LED tracker.

8.6.1 Using the Menu Bar Hover Shows Submenu Option

Use this procedure to enable the **Menu Bar Hover Shows Submenu** option. If you enable this feature it displays the sub-menus for a category when you hover over the category name.

For example, if you hover over **Advanced**, the **SOFTWARE**, **ACCOUNTS**, **LOG FILES**, and **LICENSES** sub-menus display. You can click any sub-menu and avoid opening the default menu for a category.

Instruction:

- a) Click **Configuration | MISC**.
- b) Click the **EDIT** button.
- c) Click **Enable** next to the **Menu Bar Hover Shows Submenu** option.
- d) Click **SAVE**.

8.6.2 Enable PDO Write From Attached Devices Port Page

The purpose of this feature is for a non-production type of demonstration of the BIOLM. You can enable this feature to get familiar with IO-Link or if you are commissioning a system and want to be able to test / get familiar with devices. It allows you to interact with a PDO device that does not have a PLC connection.

You must have set and signed into the IO-Link Master using an **admin** password.

NOTICE

The PDO write will not allow writes if the BIOLM has a PLC connection. This should never be enabled in a production environment.

Use this procedure to enable PDO write from the **Attached Devices | Port** page:

Instruction:

- a) If necessary, log into the BIOLM using the Administrator account.
- b) Click **Configuration | MISC**.
- c) Click the **EDIT** button.
- d) Click **Enable** next to the **Enable PDO Write From Attached Devices Port Page** option.
- e) Click the **SAVE** button.
- f) If this will not cause an unstable environment, click the **CONTINUE** button.

8.6.3 IO-Link Test Event Generator

You can use the **IO-Link Test Event Generator** to send messages to an BIOLM port. The generated events are displayed in the **Diagnostics | IO-Link Settings** page under the **Last Events** field and the syslog. This can test a port to verify that it is functioning correctly through.

Instruction:

- a) Click **Configuration | Misc**.
- b) Expand the **IO-Link Test Event Generator**.
- c) Select the port and type of event that you want to test.
Use the table at the end of this section to determine what type of event you want to generate.
- d) Click **Diagnostics** and scroll down to **Last Events**.

IO-Link Test Event Generator Descriptions

Port	The port number to which you want to send an event.
Mode	This is the first item in the event generated: <ul style="list-style-type: none"> ▪ Single: generates Single in the event. ▪ Coming: generates Active in the event. ▪ Going: generates Cleared in the event.
Type	This is the second item in the event generated: <ul style="list-style-type: none"> ▪ Message: generates Message in the event. ▪ Warning: generates Warning in the event. ▪ Error: generates Error in the event.
Instance	This is the level in which the event is generated. This is not displayed in the generated event: <ul style="list-style-type: none"> ▪ unknown ▪ physical ▪ datalink ▪ applayer ▪ application
Source	This is the source in which the event is generated. This is the third item in the generated event: <ul style="list-style-type: none"> ▪ local: simulation generated from the BIOLM, which displays as Local in the event. ▪ remote: simulation of an IO-Link device event, which displays as Device in the generated event.
PDI	This indicates whether to send valid or invalid PDI, which is not displayed in the generated event: <ul style="list-style-type: none"> ▪ valid ▪ invalid

IO-Link Test Event Generator Descriptions

Code This is the fourth and fifth items in the generated event:

- 0x0000: generates a **s_pdu_check** event
- 0x0001: generates a **s_pdu_flow** event
- 0x0002: generates a **m_pdu_check** event
- 0x0003: generates a **s_pdu_illegal** event
- 0x0004: generates a **m_pdu_illegal** event
- 0x0005: generates a **s_pdu_buffer** event
- 0x0006: generates a **s_pdu_inkr** event
- 0x0007: generates an **s_pd_len** event
- 0x0008: generates an **s_no_pdin** event
- 0x0009: generates an **s_no_pdout** event
- 0x000a: generates an **s_channel** event
- 0x000b: generates an **m_event** event
- 0x000c: generates an **a_message** event
- 0x000d: generates an **a_warning** event
- 0x000e: generates an **a_device** event
- 0x000f: generates an **a_parameter** event
- 0x0010: generates a **devicelost** event
- 0x0011, 13 - 17: generates an unknown event
- 0x0012: generates a **s_desina** event

8.7 Clearing Settings

You can return the BIOLM to factory default values and can choose whether you want to restore these default values:

- Uploaded IODD files
- IO-Link data storage
- Hostname, network settings (DHCP/Static, static IP address, static network mask, and static IP gateway)

Use the following procedure to restore factory default values on the BIOLM:

Instruction:

- a) Click **Configuration** | **Clear Settings**.
- b) Click the **OK** button to the **Done Configuration Cleared** message.

9 Using the diagnostic pages

is chapter provides information about the following **Diagnostics** pages:

- [IO-Link Port Diagnostics](#) [▶ 71]
- [Digital I/O Diagnostics \(BIOLM\)](#) [▶ 74]
- [EtherNet/IP Diagnostics](#) [▶ 75]
- [Modbus/TCP Diagnostics](#) [▶ 79]
- [OPC UA Diagnostics Page](#) [▶ 81]

9.1 IO-Link Port Diagnostics

Use the **IO-Link Diagnostics** page to determine the status of the IO-Link configuration.

The following table provides information about the **IO-Link Diagnostics** page:

IO-Link Diagnostics	
Port Name	This is an optional friendly port name, which can be configured in the Configuration IO-Link page.
Port Mode	Displays the active device mode: <ul style="list-style-type: none"> ▪ Reset = The port is configured to disable all functionality. ▪ IO-Link = The port is configured to IO-Link mode. ▪ Digital In = The port is configured to operate as a digital input. ▪ Digital Out = The port is configured to operate as a digital output.
Port Status	Displays the port status: <ul style="list-style-type: none"> ▪ Inactive = The port is in active state. Typically, this indicates that the device is either not attached or not detected. ▪ Initializing = The port is in the process of initializing. ▪ Operational = The port is operational and, if in IO-Link mode, communications to the IO-Link device has been established. ▪ PDI Valid = The PDI data is now valid. ▪ Fault = The port has detected a fault and is unable to re-establish communications.
IO-Link State	<ul style="list-style-type: none"> ▪ Operate – Port is functioning correctly in IO-Link mode but has not received valid PDI data. This may also display during a data storage upload or download. ▪ Init – The port is attempting initialization. ▪ Reset – One of the following conditions exists: <ul style="list-style-type: none"> ▪ The Port Mode configuration is set to Reset. ▪ The Port Mode configuration is set to DigitalIn or DigitalOut. ▪ DS – Wrong Sensor – Hardware failure (IO-Link LED also flashes red) because there is Data Storage on this port, which does not reflect the attached device. ▪ DV – Wrong Sensor – Hardware failure (IO-Link LED also flashes red) because Device Validation is configured for this port and the wrong device is attached.

IO-Link Diagnostics

- **DS – Wrong Size** – Hardware failure (IO-Link LED also flashes red) because the size of the configuration on the device does not match the size of the configuration stored on the port.
- **Comm Lost** – Temporary state after a device is disconnected and before the port is re-initialized.
- **Pre-operate** – Temporary status displayed when the device:
 - Is starting up after connection or power-up.
 - Uploading or downloading automatic data storage.

Device Vendor Name	Displays the Device Vendor Name as stored in ISDU Index 16.
Device Product Name	Displays the device product name as stored in ISDU Index 18.
Device Serial Number	Displays the device serial number as stored in ISDU Index 21.
Device Hardware Version	Displays the device hardware version as stored in ISDU Index 22.
Device Firmware Version	Displays the device firmware version as stored in ISDU Index 23.
Device IO-Link Version	The supported device IO-Link version as stored in ISDU Index 0.
Actual Cycle Time	This is the actual, or current, cycle time of the IO-Link connection to the device.
Device Minimum Cycle Time	This is the minimum, or fastest, cycle time supported by the connected IO-Link device.
Configured Minimum Cycle Time	Configured in the Configuration IO-Link page, this is the minimum cycle time the IO-Link Master will allow the port to operate at. The Actual Cycle Time , which is negotiated between the IO-Link Master and the device, will be at least as long as the greater of the Configured Minimum Cycle Time and the Device Minimum Cycle Time .
Data Storage Capable	Displays whether the IO-Link device on a port supports the data storage feature. Not all IO-Link devices support the data storage feature.
Automatic Data Storage Configuration	Displays whether a port is configured to automatically upload data from the IO-Link device or download data from the BIOLM to the IO-Link device. Disabled displays if automatic upload or download are not enabled.
Auxiliary Input (AI) Bit Status	The current status of the auxiliary bit as received on DI (Pin 2 on the L-EIP) of the IO-Link port.
Device PDI Data Length	The supported Device PDI Data Length, in bytes, as stored in ISDU Index 0.
PDI Data Valid	Current status of PDI data as received from the IO-Link device.
Last Rx PDI Data (MS Byte First)	The last Rx PDI data as received from the IO-Link device.
PDO Lock Enable	If enabled on the Configuration IO-Link Settings page, an industrial protocol application (PROFINET IO, EtherNet/IP, or Modbus TCP) can lock the write access to the PDO value so that the PDO value cannot be changed by other protocols (including OPC UA or the Web interface). Such a lock is released when the PLC to IO-Link Master network link disconnects.

IO-Link Diagnostics

<i>PDO Locked</i>	Indicates whether or not one of the industrial protocol applications has locked the write access to the PDO value.
<i>Device PDO Data Length</i>	The supported Device PDO Data Length, in bytes, as stored in ISDU Index 0.
<i>PDO Data Valid</i>	Status of PDO data being received from controller(s).
<i>Last Tx PDO Data (MS Byte First)</i>	The last Tx PDO data.
<i>Time Since Initialization</i>	The time since the last port initialization.
<i>Process Data Errors</i>	The number of process data errors the port received.
<i>Process Data Retries</i>	The number of process data retries the port performed.
<i>Total Events</i>	The total number of events that were received on this port.
<i>First Events</i>	Up to the first, or oldest, three events that were received on this port.
<i>Last Events</i>	Up to the last, or most recent, three events that were received on this port.
ISDU Statistics	
<i>ISDU Read Cmd Attempts</i>	The number of read ISDU command attempts.
<i>ISDU Read Cmd Errors</i>	The number of read ISDU command errors.
<i>ISDU Write Cmd Attempts</i>	The number of write ISDU command attempts.
<i>ISDU Write Cmd Errors</i>	The number of write ISDU command errors.

9.2 Digital I/O Diagnostics (BIOLM)

The **Digital I/O Diagnostics** page may be useful when trying to troubleshoot port issues related to configuration.

The following table provides information about the **Digital I/O Diagnostics** page.

Digital I/O Diagnostics	
Mode	Displays the current configured operating mode of the digital I/O pin: <ul style="list-style-type: none">▪ Off▪ Digital-Input▪ Digital-Output (Pins D2 and D4 only)
Invert I/O	Displays the current configured Invert I/O setting: <ul style="list-style-type: none">▪ True (Invert I/O)▪ False (Do not invert I/O)
Input Setting Time (ms)	Displays the current configured input settling time.
Status	Displays the current status of the digital I/O pin: <ul style="list-style-type: none">▪ On (high voltage)▪ Off (low voltage)
Status Changes	Displays the number of times that the status of the digital I/O pin has changed.

9.3 EtherNet/IP Diagnostics

The **EtherNet/IP Diagnostics** page may be useful when trying to troubleshoot EtherNet/IP communications and port issues related to EtherNet/IP configuration.

The following table provides information about the **EtherNet/IP Diagnostics** page:

EtherNet/IP Diagnostics	
Active Session Count	The number of active Ethernet/IP sessions. A session can: <ul style="list-style-type: none"> ■ Support both Class 1 I/O and Class 3 Messages ■ Can be initiated by either the PLC or the IO-Link Master ■ Can be terminated by either the PLC or the IO-Link Master
Active Connections	The current number of active connections (both Class 1 and 3).
Total Connections Established	The total number of connections that have been established.
Connection Timeouts	The number of connections that have closed due to timing out.
Connections Closed	The number connections that have closed due to a standard processes.
Class 3 Messages/Responses Received	The number of Class 3 messages and responses received from the PLC or PLCs.
Broadcast Messages Received	The number of broadcast messages received from PLC or PLCs.
Class 3 Messages/Responses Transmitted	The number of Class 3 messages and responses sent to the PLC or PLCs.
Class 1 Output Updates (From PLC)	The number of Class 1 output data updates received from the PLC or PLCs.
Class 1 Output Data Changes (From PLC)	The number of changes in Class 1 output data received from the PLC.
Class 1 Input Data Updates (To PLC)	The number of Class 1 input data updates sent to the PLC or PLCs.
Client Object Requests	The number of Class 3 requests to the IO-Link Master vendor specific objects.
Good Responses from PLC	The number of good responses from messages sent to PLC or PLCs.
Bad Responses from PLC	Displays the number of bad responses from messages sent to the PLC or PLCs. Bad responses are typically returned for such errors as: <ul style="list-style-type: none"> ■ Incorrect tag or file names ■ Incorrect tag or file data types ■ Incorrect tag or file data sizes ■ PLC is overloaded and cannot handle the amount of Ethernet traffic ■ PLC malfunction

EtherNet/IP Diagnostics

<i>No Responses from PLC</i>	Displays the number of no responses from messages sent to the PLC or PLCs. No responses are typically returned for such errors as: <ul style="list-style-type: none"> ■ Incorrect IP address ■ Incorrect PLC configuration ■ PLC malfunction ■ PLC is overloaded and cannot handle the amount of Ethernet traffic
<i>Invalid Network Paths</i>	Displays the number of network path errors on messages sent to the PLC or PLCs. These are typically caused by incorrect IP address settings.
<i>Pending Request Limit Reached</i>	Displays the number of pending request limit errors. These errors occur when the PLC is sending a continuous stream of messages to the IO-Link Master faster than the IO-Link Master can process them.
<i>Unexpected Events</i>	Displays the number of unexpected event errors. Unexpected event errors occur when the IO-Link Master receives an unexpected message from the PLC such as an unexpected response or unknown message.
<i>Unsupported CIP Class Errors</i>	Displays the number of unsupported CIP class errors. These errors occur when a message that attempts to access an invalid class is received by the IO-Link Master.
<i>Unsupported CIP Instance Errors</i>	Displays the number of unsupported CIP instance errors. These errors occur when a message that attempts to access an invalid instance is received by the IO-Link Master.
<i>Unsupported CIP Service Errors</i>	Displays the number of unsupported CIP service errors. These errors occur when a message that attempts to access an invalid service is sent to the IO-Link Master.
<i>Unsupported CIP Attribute Errors</i>	Displays the number of unsupported CIP request attribute errors. These errors occur when a message that attempts to access an invalid attribute is sent to the IO-Link Master.
<i>Unsupported File Errors</i>	Displays the number of messages from SLC/PLC-5/MicroLogix PLCs that attempt to access an unsupported file address.
<i>System Resource Errors</i>	Displays the number of system resource errors. These errors indicate a system error on the IO-Link Master such as operating system errors or full message queues. These errors typically occur when the PLC or PLCs are sending messages to the IO-Link Master faster than the IO-Link Master can process them.
<i>First Error String</i>	Text description of the first error that occurred.
<i>Last Error String</i>	Text description of the last error that occurred.
EtherNet/IP Port Specific Diagnostics	
<i>Configuration Errors</i>	Displays the number of improper configuration errors. These errors occur when the IO-Link Master receives a message that cannot be performed due to an invalid configuration.

EtherNet/IP Diagnostics

Invalid Data Errors	Displays the number of invalid message data errors. These errors occur when the IO-Link Master receives a message that cannot be performed due to invalid data.
Active PDO Controller(s)	Lists the controller interface(s) type, (Class 1 or Class 3), and IP address that are controlling the PDO data.
PDO Writes to Offline or Read-Only Ports	<p>Displays the number of PDO write messages that were dropped due to any of the following:</p> <ul style="list-style-type: none"> ■ The port is configured in IO-Link mode: <ul style="list-style-type: none"> ▪ There is no device connected to the port. ▪ The IO-Link device is off-line. ▪ The IO-Link device does not support PDO data. ■ The PDO Transmit Mode (To PLC) is disabled. ■ The port is configured in Digital Input mode.
Undeliverable PDI Updates (To PLC)	<p>Displays the number of PDI update messages that could not be delivered to the PLC in the Write-to-Tag/File method. Undeliverable updates may result when:</p> <ul style="list-style-type: none"> ■ The IO-Link Master cannot complete an Ethernet connection to the PLC. ■ The PDI data is changing faster than the Maximum PLC Update Rate.
ISDU Request Msgs From PLC(s)	Displays the number of ISDU request messages received from the PLC(s) or other controllers. These request messages may contain one or multiple ISDU commands.
ISDU Invalid Requests	Displays the number of ISDU requests received over EtherNet/IP with one or more invalid commands.
ISDU Requests When Port Offline	<p>Displays the number of ISDU requests received over EtherNet/IP when the IO-Link port was offline. This can occur when:</p> <ul style="list-style-type: none"> ■ The IO-Link port is initializing, such as after start-up. ■ There is no IO-Link device attached to the port. ■ The IO-Link device is not responding. ■ Communication to the IO-Link device has been lost.
Valid ISDU Responses From Port	Displays the number of valid ISDU response messages returned from the IO-Link port interface and available to the PLC(s). The response messages contain results to the ISDU command(s) received in the request message.
ISDU Response Timeouts	Displays the number of ISDU requests that did not receive a response within the configured ISDU Response Timeout .
Unexpected ISDU Responses	Displays the number of unexpected ISDU responses. Unexpected responses may occur when an ISDU response is received after the ISDU request has timed out. This typically requires setting the ISDU Response Timeout to a longer value.
ISDU Read Commands	Displays the number of ISDU read commands received over EtherNet/IP.

EtherNet/IP Diagnostics

<i>Maximum ISDU Request Msg Response Time</i>	Displays the maximum time period required to process all commands within an ISDU request message. The response is not available until all ISDU command(s) contained in the request have been processed.
<i>Average ISDU Request Msg Response Time</i>	Displays the average time period required to process the ISDU request message(s). The response is not available until all ISDU command(s) contained in the request have been processed.
<i>Minimum ISDU Request Msg Response Time</i>	Displays the minimum time period required to process all commands within an ISDU request message. The response is not available until all ISDU command(s) contained in the request have been processed.
<i>ISDU Write Commands</i>	Displays the number of ISDU write commands received over EtherNet/IP.
<i>ISDU NOP Commands</i>	Displays the number of ISDU NOP (no operation) commands received over EtherNet/IP.

9.4 Modbus/TCP Diagnostics

The **Modbus/TCP Diagnostics** page may be useful when trying to troubleshoot Modbus/TCP communications or port issues related to Modbus/TCP configuration.

The following table provides information about the **Modbus/TCP Diagnostics** page:

Modbus/TCP Diagnostics	
Active Connections	Displays the current number of active Modbus/TCP connections.
Messages Received from Masters	Displays the number of Modbus messages received from Modbus/TCP Masters.
Responses Sent to Masters	Displays the number of Modbus responses sent to Modbus/TCP Masters.
Broadcasts Received	Displays the number of broadcast Modbus/TCP messages received.
Invalid Message Length Errors	Displays the number of Modbus messages received with incorrect length fields.
Invalid Message Data Errors	Displays the number of invalid message data errors. These errors occur when the IO-Link Master receives a message that cannot be performed due to invalid data.
Invalid Message Address Errors	Displays the number of invalid message address errors. These errors occur when the IO-Link Master receives a message that cannot be performed due to an invalid address.
Unknown Device ID Errors	Displays the number of unknown device ID errors. These errors occur when the IO-Link Master receives a message that is addressed to a device ID other than the configured Slave Mode Device ID .
Invalid Protocol Type Errors	Displays the number of invalid message protocol type errors. These errors occur when the IO-Link Master receives a Modbus/TCP message that specifies a non-Modbus protocol.
Unsupported Function Code Errors	Displays the number of invalid Modbus function code errors. These errors occur when the IO-Link Master receives a message that cannot be performed due to an unsupported Modbus function code.
Configuration Errors	Displays the number of improper configuration errors. These errors occur when the IO-Link Master receives a message that cannot be performed due to an invalid configuration.
No Available Connection Errors	Displays the number of Modbus/TCP connection attempts that were rejected due to no available connections. This occurs when the number of Modbus/TCP connections has reached the limit.
System Resource Errors	Displays the number of system resource errors. These errors indicate a system error on the IO-Link such as operating system errors or full message queues. These errors typically occur when the PLC(s) are sending messages to the IO-Link Master faster than the IO-Link Master can process them.
First Error String	Text description of the first error that occurred.
Last Error String	Text description of the last error that occurred.
Modbus/TCP Port Specific Diagnostics	

Modbus/TCP Diagnostics	
Active PDO Controller(s)	Lists IP addresses that are controlling the PDO data.
PDO Writes to Offline or Read-Only Ports	<p>Displays the number of PDO write messages that were dropped due to any of the following:</p> <ul style="list-style-type: none"> ■ The port is configured in IO-Link mode: <ul style="list-style-type: none"> ▪ There is no device connected to the port. ▪ The IO-Link device is off-line. ▪ The IO-Link device does not support PDO data. ■ The PDO Transmit Mode (To PLC) is disabled. ■ The port is configured in Digital Input mode.
ISDU Request Msgs From PLC(s)	Displays the number of ISDU request messages received from the PLC(s) or other controllers. These request messages may contain one or multiple ISDU commands.
ISDU Invalid Requests	Displays the number of ISDU requests received over Modbus/TCP with one or more invalid commands.
ISDU Requests When Port Offline	<p>Displays the number of ISDU requests received over Modbus/TCP when the IO-Link port was offline. This can occur when:</p> <ul style="list-style-type: none"> ■ The IO-Link port is initializing, such as after start-up. ■ There is no IO-Link device attached to the port. ■ The IO-Link device is not responding. ■ Communication to the IO-Link device has been lost.
Valid ISDU Responses From Port	Displays the number of valid ISDU response messages returned from the IO-Link port interface and available to the PLC(s). The response messages contain results to the ISDU command(s) received in the request message.
ISDU Response Timeouts	Displays the number of ISDU requests that did not receive a response within the configured ISDU Response Timeout .
Unexpected ISDU Responses	Displays the number of unexpected ISDU responses. Unexpected responses may occur when an ISDU response is received after the ISDU request has timed out. This typically requires setting the ISDU Response Timeout to a longer value.
Maximum ISDU Request Msg Response Time	Displays the maximum time period required to process all commands within an ISDU request message. The response is not available until all ISDU command(s) contained in the request have been processed.
Average ISDU Request Msg Response Time	Displays the average time period required to process the ISDU request message(s). The response is not available until all ISDU command(s) contained in the request have been processed.
Minimum ISDU Request Msg Response Time	Displays the minimum time period required to process all commands within an ISDU request message. The response is not available until all ISDU command(s) contained in the request have been processed.
ISDU Read Commands	Displays the number of ISDU read commands received over Modbus/TCP.
ISDU Write Commands	Displays the number of ISDU write commands received over Modbus/TCP.

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ISDU NOP Commands Displays the number of ISDU NOP (no operation) commands received over Modbus/TCP.

9.5 OPC UA Diagnostics Page

The ***OPC UA Diagnostics*** page displays status for OPC UA:

- Whether the OPC UA feature is enabled or disabled
- Number of TCP connections

10 EtherNet/IP Interface

10.1 Introduction

This section is intended to describe the EtherNet/IP interface provided by the BIOLM.

These interfaces provide the ability to retrieve port and device status information, input and output process data and access to IO-Link device ISDU (SPDU) data blocks.



INFO

Indexed Service Data Unit (ISDU) is sometimes referred to as Service Protocol Data Unit (SPDU). See [ISDU Handling](#) [98] for more information.

10.1.1 Functionality Summary

The EtherNet/IP interface consists of:

- Input Process Data blocks that include:
 - Port communication status
 - PDI valid status
 - Auxiliary Input status of IO-Link connector (Pin 2 on the L-EIP)
 - The active event code (zero if no active event)
 - The input process data received from the port. This may be:
 - IO-Link mode: IO-Link device input process data
 - I/O Input mode: Input bit status
 - I/O Output mode: Output bit status (configurable option)
- Output Process Data blocks that include:
 - The active event code to clear ((configurable option)
 - The output process data to be sent to the port. This may be:
 - IO-Link mode: IO-Link device output process data
 - I/O Output mode: Output bit status
- ISDU (ISDU) interface:
 - Provides single and nested batch read/write capabilities
 - Requires use of MSG instructions
 - Provides both blocking and non-blocking message capabilities
 - Blocking message responses are not returned until all the ISDU command(s) have completed.
 - Non-blocking messages return immediately. The PLC must then request the ISDU command(s) response status until a valid response is returned.
- Web based configuration and diagnostic pages:
 - IO-Link interface configuration and diagnostics
 - EtherNet/IP interface configuration and diagnostics
- EtherNet/IP interface support for ControlLogix, SLC, MicroLogix, and PLC-5 PLC families.
- Modbus/TCP slave interface.
- Example PLC programs to aid the PLC programmer.

10.1.2 Data Type Definitions

The following data type definitions apply:

Data Type Definitions	
BOOL	Boolean; TRUE if = 1; False if = 0
USINT	Unsigned Short Integer (8 bit)
CHAR	Character (8 bit)
SINT	Short Integer (8 bit)
UINT	Unsigned Integer (16 bit)
INT	Signed Integer (16 bit)
UDINT	Unsigned Double Integer (32 bit)
DINT	Signed Double Integer (32 bit)
STRING	Character String (1 byte per character)
BYTE	Bit String (8 bit)
WORD	Bit String (16 bits)
DWORD	Bit String (32 bits)

10.1.3 Terms and Definitions

Class 1	<p>Otherwise called implicit messaging, is a method of communication between EtherNet/IP controllers and devices that:</p> <ul style="list-style-type: none"> ■ Uses Ethernet UDP messages. ■ Is cyclic in nature. Input and/or output data is exchanged between the controllers and devices at regular time intervals.
Class 3	<p>Otherwise called explicit messaging, is a method of communication between EtherNet/IP controllers and devices that:</p> <ul style="list-style-type: none"> ■ Uses Ethernet TCP/IP messages. ■ By itself is not cyclic in nature. The controller and devices must send individual messages to each other.
EtherNet/IP	An Ethernet based industrial communication protocol utilized to communicate between controllers, often times PLCs, and devices.
Ethernet TCP/IP	Standard Ethernet communications protocol utilizing socket communication interfaces that guarantees delivery to the intended device.
Ethernet UDP/IP	Standard Ethernet communications protocol utilizing socket communication interfaces that does not guarantee delivery . The data may or may get to the intended device.
BIOLM	IO-Link gateway that provides communication between IO-Link devices and Ethernet protocols such as EtherNet/IP and Modbus/TCP.
Multicast	<p>Multicast addressing involves Ethernet devices sending messages to each other using a multicast address. Multicast addressing:</p> <ul style="list-style-type: none"> ■ Uses a specified IP address range designated for multicast communication. ■ Allows either one or multiple devices to receive the same messages.
Point-to-Point	Point-to-Point, otherwise called unicast , addressing involves Ethernet devices sending messages directly to each other using their own IP addresses. Messages are sent to only one device.
PDI data (Process Data Input)	Process data received from an IO-Link device or I/O interface that can be provided to external controllers such as PLCs, HMIs, SCADA, and OPC UA Servers.
PDO data (Process Data Output)	Process data received from external controllers such as PLCs, HMIs, SCADA, and OPC Servers and sent to an IO-Link device or I/O interface. IO-Link devices may or may not support PDO data.
ISDU	Indexed Service Data Unit. Otherwise called ISDU, refers to the Service Data units on IO-Link devices that are used for information, status and configuration settings.
Class 1	<p>Otherwise called implicit messaging, is a method of communication between EtherNet/IP controllers and devices that:</p> <ul style="list-style-type: none"> ■ Uses Ethernet UDP messages. ■ Is cyclic in nature. Input and/or output data is exchanged between the controllers and devices at regular time intervals.

10.2 Data Transfer Methods

The BIOLM provides a selection of process data transfer methods and a number of options to customize the process data handling.

- [Receive Process Data Methods \[► 85\]](#)
- [Transmit Process Data Methods \[► 86\]](#)

10.2.1 Receive Process Data Methods

The BIOLM supports the following receive process data methods:

10.2.1.1 Polling-PLC Requests Data

Also called Slave-Mode for some industrial protocols, the polling method requires the controller to request data from the BIOLM via messages. The BIOLM does not respond until it receives a request for data.

10.2.1.2 Write-to-Tag/File-BIOLM Writes Data Directly Into PLC Memory

Also called Master-Mode for some industrial protocols, the Write-to-Tag/File method requires the BIOLM to send messages that write data directly into a tag or file on the PLC. The BIOLM sends changed data to the PLC immediately and, optionally, can be configured to also send “heartbeat” update messages at a regular time interval.

10.2.1.3 Class 1 Connection (Input Only)-PLC and BIOLM Utilize an I/O Connection

Also called I/O Mode for some industrial protocols, the Class 1 connection method requires the BIOLM and PLC to connect to each via an I/O connection. For EtherNet/IP, a connection over UDP must first be created. Once the connection is established, the BIOLM continually sends input data to the PLC at a PLC configurable rate.

10.2.2 Transmit Process Data Methods

The BIOLM supports the following transmit process data methods:

10.2.2.1 PLC-Writes

Also called Slave-Mode for some industrial protocols, the PLC-Writes method requires the PLC to send data to the BIOLM via write messages.

10.2.2.2 Read-from-Tag/File-BIOLM Reads Data from PLC Memory

Also called Master-Mode for some industrial protocols, the Read-from-Tag/File method requires the BIOLM to read data from a tag or file on the PLC. In this method, the BIOLM requests data from the PLC at configurable time intervals.

10.2.2.3 Class 1 Connection (Input and Output)-PLC and BIOLM Utilize an I/O Connection

Also called I/O Mode for some industrial protocols, the Class 1 connection method requires the BIOLM and PLC to connect to each via an I/O connection. For EtherNet/IP, a connection over UDP must first be created. Once the connection is established, the PLC and BIOLM continually exchange data at a configurable rate.

11 Functionality Descriptions

This chapter discusses the following for Modbus/TCP:

- [Process Data Block Descriptions \[87\]](#)
- [Event Handling \[93\]](#)
- [ISDU Handling \[98\]](#)

11.1 Process Data Block Descriptions

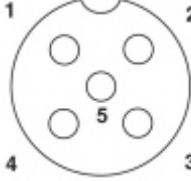

This subsection discusses the following:

- [Input Process Data Block Description \[87\]](#)
- [Output Process Data Block Description \[89\]](#)

11.1.1 Input Process Data Block Description

The Input Process Data Block format is dependent on the configured PDI Data Format. The following tables describe the Input Process Data Block in the possible formats.

Parameter Name	Data Type	Description
Port Status	BYTE	<p>The status of the IO-Link device.</p> <p>Bit 0 (0x01): 0 = IO-Link port communication initialization process is inactive. 1 = IO-Link port communication initialization process is active.</p> <p>Bit 1 (0x02): 0 = IO-Link port communication is not operational. 1 = IO-Link port communication is operational.</p> <p>Bit 2 (0x04): 0 = IO-Link input process data is not valid. 1 = IO-Link input process data is valid.</p> <p>Bit 3 (0x08): 0= No fault detected. 1= Fault detected.</p> <ul style="list-style-type: none"> ▪ A minor communication fault is indicated by the Operational status bit being set to 1. A minor communication fault results from: <ul style="list-style-type: none"> ▪ A temporary loss of communication to the IO-Link device. ▪ A recoverable BIOLM software or hardware fault. ▪ A major communication fault is indicated by the Operational bit being set to 0: <ul style="list-style-type: none"> ▪ An unrecoverable loss of communication to the IO-Link device. ▪ An unrecoverable BIOLM software or hardware fault. <p>Bits 4 - 7: Reserved (0)</p>

Parameter Name	Data Type	Description
Auxiliary I/O	BYTE	<p>The auxiliary bit on the IO-Link port is:</p> <ul style="list-style-type: none"> Pin 2 on the BIOLM L-EIP  <ul style="list-style-type: none"> DI (labeled as 3 on the device) on the BIOLM DR-EIP  <p>Bit 0 (0x01): The status of the auxiliary bit. 0 = off 1 = on</p> <p>Bits 1 - 3: Reserved (0) If Include Digital I/O in PDI Data Block is disabled: Bits 4 - 7: Reserved (0)</p>
Event Code	INT	16-bit event code received from the IO-Link device.
PDI Data Default Length = 32 bytes	Array of up to 32 BYTES	The PDI data as received from the IO-Link device. May contain from 0 to 32 bytes of PDI data. The definition of the PDI data is device dependent. Length is configurable using the web page interface.

11.1.1.1 Input Process Data Block-8 Bit Data Format

The following table provides detailed information about the Input Process Data Block-8 Bit data format.

Byte	Bit 7 / Bit 0
0	Port Status
1	Auxiliary I/O
2	Event Code LSB
3	Event Code MSB
4	PDI Data Byte 0
5	PDI Data Byte 1
..	..
..	..
N+3	PDI Data Byte (N-1)

11.1.1.2 Input Process Data Block-16 Bit Data Format

The following table provides detailed information about the Input Process Data Block-16 data format.

Word	Bit 15 / Bit 8	Bit 7 / Bit 0
0	Port Status	Auxiliary I/O
1	Event Code	
2	PDI Data Word 0	
3	PDI Data Word 1	
..	..	
..	..	
N+1	PDI Data Word (N-1)	

11.1.1.3 Input Process Data Block-32 Bit Data Format

The following table provides detailed information about the Input Process Data Block-32 Bit data format.

Long Word	Bit 31 / Bit 24	Bit 23 / Bit 16	Bit 15 / Bit 0
0	Port Status	Auxiliary I/O	Event Code
2	PDI Data Long Word 0		
3	PDI Data Long Word 1		
..	..		
N	PDI Data Long Word (N-1)		

11.1.2 Output Process Data Block Description

The contents of the Output Process Data Block are configurable.

Parameter Name	Data	Description
Clear Event Code in PDO Block (Configurable option) Default: Not included	INT	If included, allows clearing of 16-bit event code received in the PDI data block via the PDU data block.
Include Digital Output(s) in PDO Data Block Default: Not included	INT	If included, allows setting the Digital Output Pins D2 and D4.
PDO Data Default Length = 32 bytes	Array of up to 32 BYTES	The PDO data written to the IO-Link device. May contain from 0 to 32 bytes of PDO data. The definition and length of the PDO data is device dependent. Length is configurable via web page interface.

11.1.2.1 Output Process Data Block-8 Bit (SINT) Data Format

Without either the **Clear Event Code in PDO Block** or **Include Digital Output(s) in PDO Data Block** options selected:

Byte	Bit 7 / Bit 0
0	PDO Data Byte 0
1	PDO Data Byte 1
..	..
..	..
N-1	PDO Data Byte (N-1)

With the **Clear Event Code in PDO Block** option selected and without the **Include Digital Output(s) in PDO Data Block** option selected:

Byte	Bit 7 / Bit 0
0	Event Code LSB
1	Event Code MSB
2	PDO Data Byte 0
3	PDO Data Byte 1
..	..
..	..
N-1	PDO Data Byte (N-1)

With both the **Clear Event Code in PDO Block** and **Include Digital Output(s) in PDO Data Block** options selected:

Byte	Bit 7 / Bit 0
0	Event code LSB
1	Event code MSB
2	Digital Output Settings: Bit 1 (0x02) – DI setting Bit 3 (0x08) – C/Q setting
3	0 (Unused)
4	PDO Data Byte 0
5	PDO Data Byte 1
..	..
..	..
N+3	PDO Data Byte (N-1)

11.1.2.2 Output Process Data Block-16 Bit (INT) Data Format

Without either the **Clear Event Code in PDO Block** or **Include Digital Output(s) in PDO Data Block** options selected:

Word	Bit 15 / Bit 0
0	PDO Data Word 0
1	PDO Data Word 1
..	..
..	..
N-1	PDO Data Word (N-1)

With the **Clear Event Code in PDO Block** option selected and without the **Include Digital Output(s) in PDO Data Block** option selected:

Word	Bit 15 / Bit 0
0	Event Code
1	PDO Data Word 0
2	PDO Data Word 1
..	..
..	..
N	PDO Data Word (N-1)

With both the **Clear Event Code in PDO Block** and **Include Digital Output(s) in PCO Data Block** options selected:

Word	Bit 15 / Bit 0
0	Event Code
1	Digital Output Settings: Bit 1 (0x02) – DI setting Bit 3 (0x08) – C/Q setting
2	PDO Data Word 0
3	PDO Data Word 1
..	..
..	..
N+1	PDO Data Word (N-1)

11.1.2.3 Output Process Data Block-32 Bit (DINT) Data Format

Without either the **Clear Event Code in PDO Block** or **Include Digital Output(s) in PDO Data Block** options selected:

Long Word	Bit 31 / Bit 0
0	PDO Data Long Word 0
1	PDO Data Long Word 1
..	..
..	..
N-1	PDO Data Long Word (N-1)

With the **Clear Event Code in PDO Block** option selected and without the **Include Digital Output(s) in PDO Data Block** option selected:

Long Word	Bit 31 / Bit 16	Bit 15 / Bit 0
0	0	Event Code
1	PDO Data Long Word 0	
2	PDO Data Long Word 1	
..	..	
..	..	
N-1	PDO Data Long Word (N-1)	

With both the **Clear Event Code in PDO Block** and **Include Digital Output(s) in PDO Data Block** options selected:

Long Word	Bit 31 / Bit 16	Bit 15 / Bit 0
0	Digital Output Settings: Bit 17 (0x2000) – DI setting Bit 19 (0x8000) – C/Q setting	Event Code
1	PDO Data Long Word 0	
2	PDO Data Long Word 1	
..	..	
..	..	
N-1	PDO Data Long Word (N-1)	

11.2 Event Handling

The BIOLM event handling is designed to provide real-time updates of event codes received directly from the IO-Link device. The IO-Link event code:

- Is included in the second 16-bit word of the Input Process Data (PDI) block.
 - An active event is indicated by a non-zero value.
 - Inactive or no event is indicated by a zero value.
- Two methods are provided to clear an event:
 - Enable the **Clear Event After Hold Time** option.

The BIOLM keeps, or holds, the active event code in the PDI block until the configured **Active Event Hold Time** has passed.

The BIOLM then clears the event code in the PDI block and waits until the **Clear Event Hold Time** has passed before including another event code in the PDI block.
 - Enable the **Clear Event In PDO Block** option.

The BIOLM monitors the PDO block received from the PLC.

The BIOLM expects the first entry of the PDO block to indicate an event code to be cleared.

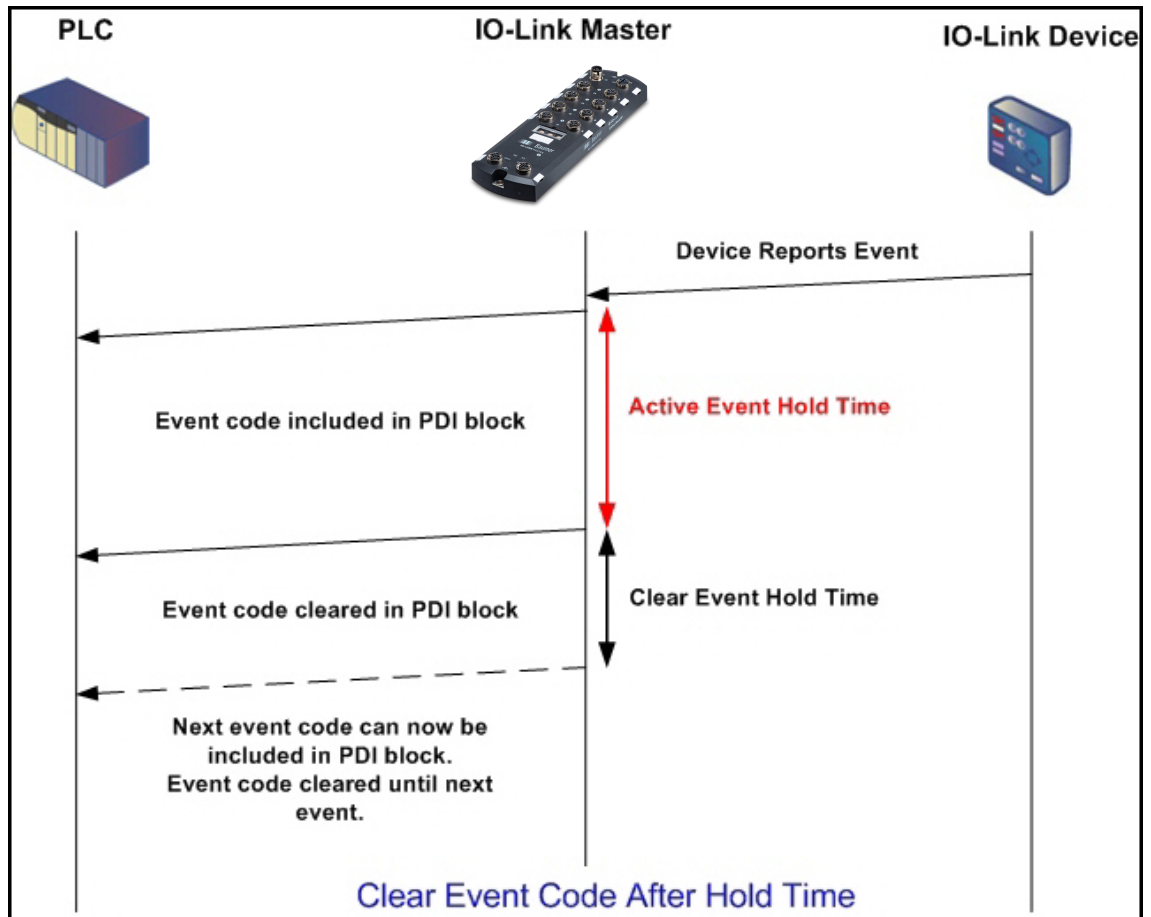
If there is an active event code in the PDI block and the PDO block both contain the same event code, the event code is cleared in the PDI block.

The BIOLM then clears event code in the PDI block and waits until the **Clear Event Hold Time** has passed before including another event code in the PDI block.
- The two methods can be used separately or together to control clearing of events.

The next subsections illustrate the event clearing process for the various event configurations.

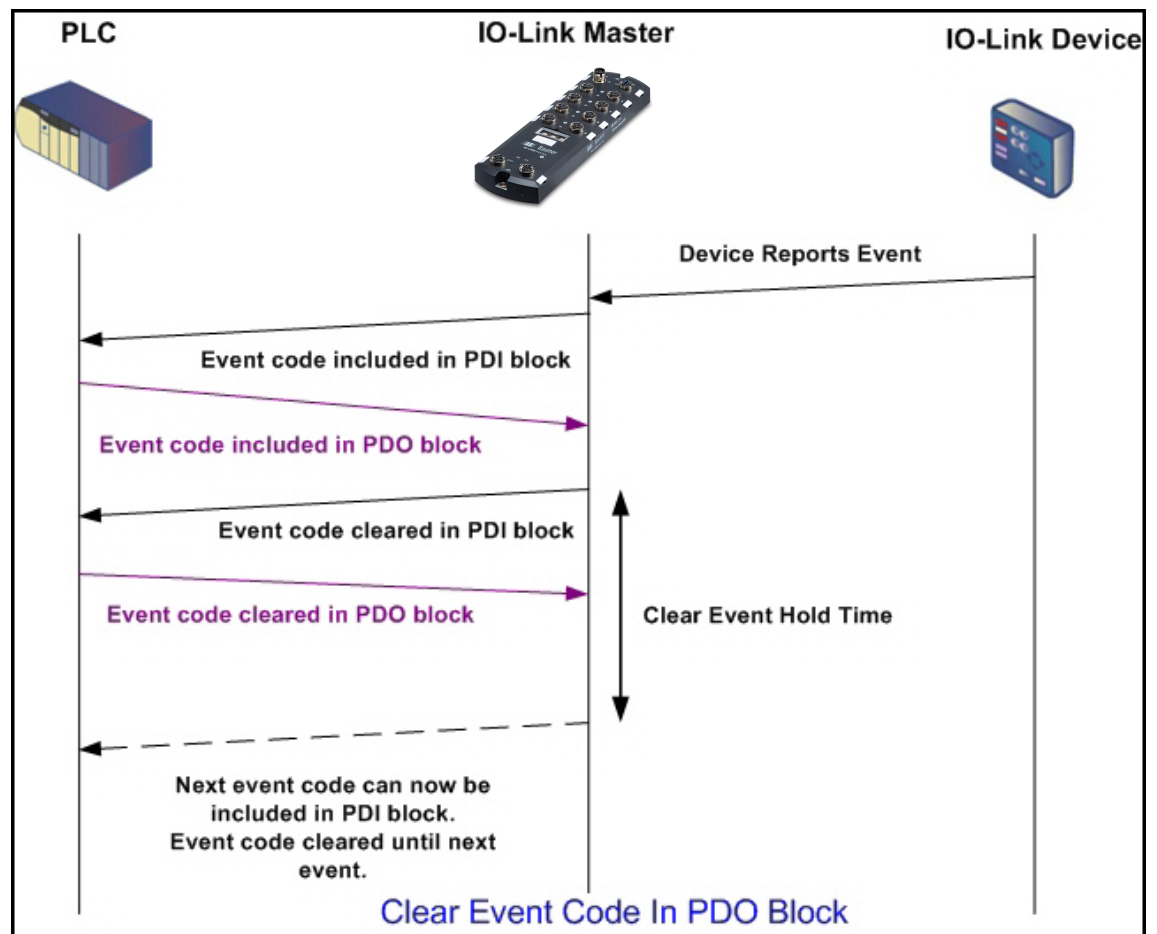
11.2.1 Clear Event After Hold Time Process

This illustrates clearing the event after the hold time process.



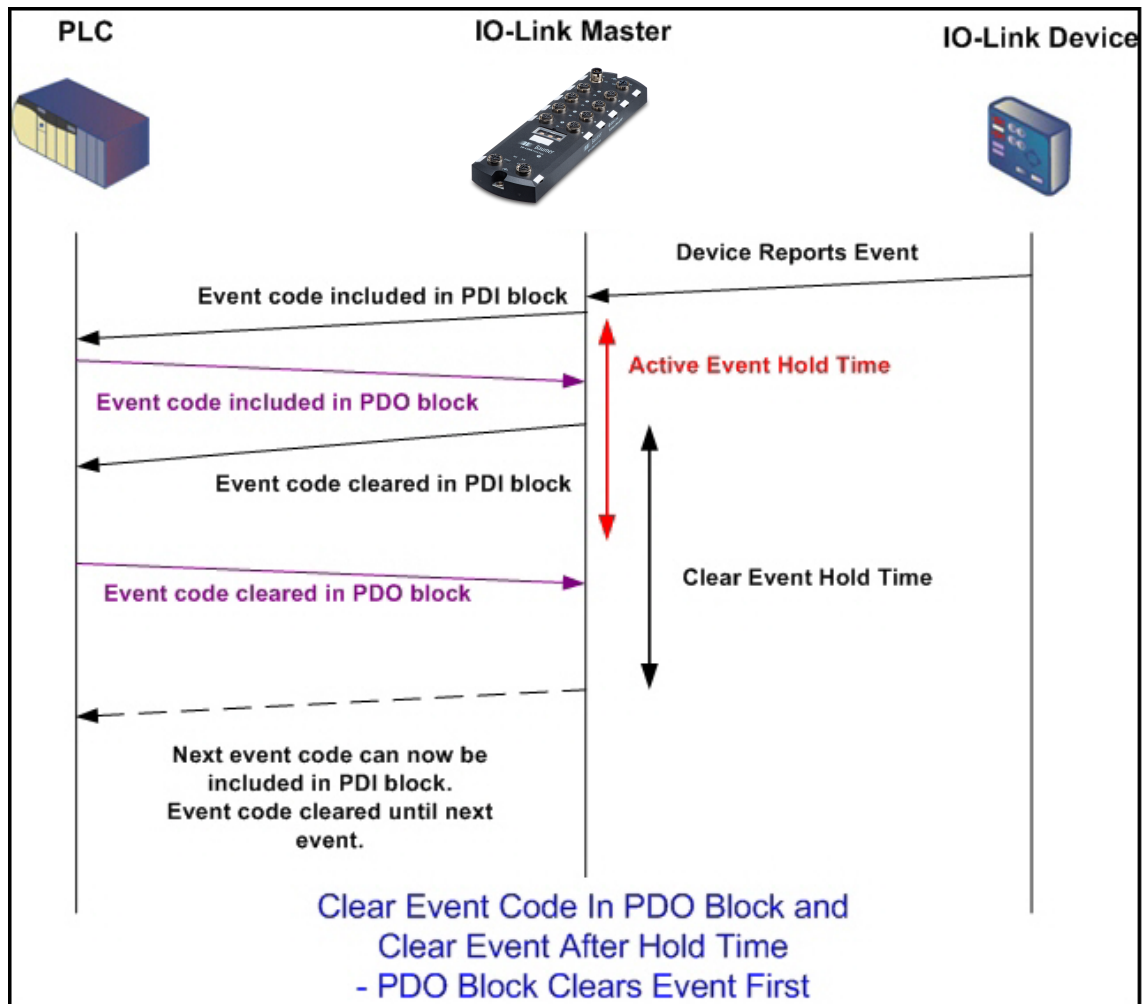
11.2.2 Clear Event in PDO Block Process

This illustrates clearing the event in the PDO block process.



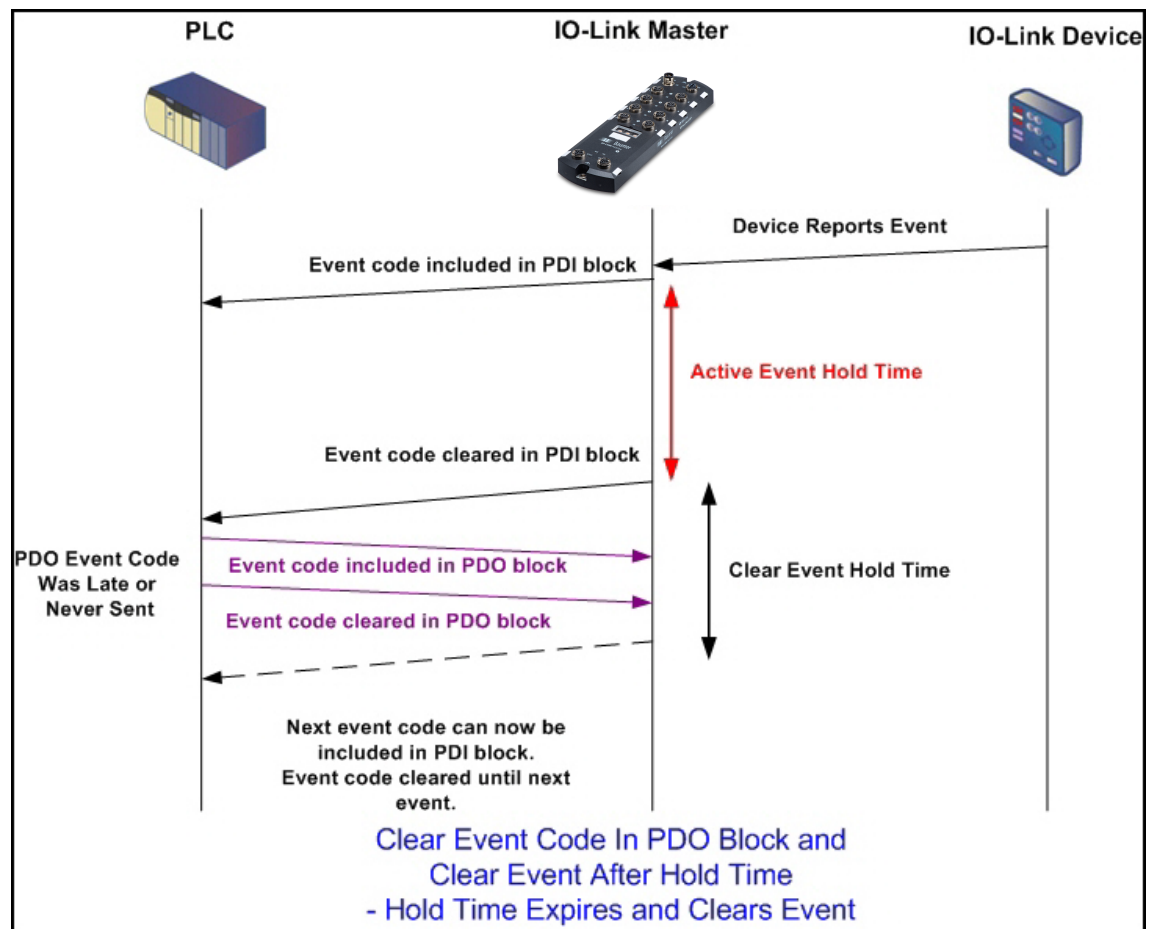
11.2.3 Clear Event Code in PDO Block and Clear Event After Hold Time Process-PDO Block First

This illustrates clearing the event code in the PDO block and clearing the event after the hold time process with the PDO block first.



11.2.4 Clear Event Code in PDO Block and Clear Event After Hold Time Process-Hold Time Expires

This illustrates clearing the event code in the PDO block and clearing the event after the hold time process with the hold time expired.



11.3 ISDU Handling

The BIOLM provides a very flexible ISDU interface that is used by all supported industrial protocols. The ISDU interface contains the following:

- An ISDU request may contain one or multiple individual ISDU read and/or write commands.
- Individual ISDU command based byte swapping capabilities.
- Variable sized command structures to allow access to wide range of ISDU block sizes.
- A single ISDU request may contain as many ISDU read and/or write commands as allowed by the industrial protocol payload. For example, if an industrial protocol provides up to 500 byte read/write payloads, then an ISDU request may contain multiple commands of various lengths that can total up to 500 bytes in length.
- For the ControlLogix family of EtherNet/IP PLCs, both blocking and non-blocking ISDU request methods are provided.
 - The BIOLM implements blocking ISDU requests by not responding to an ISDU request message until all commands have been processed.
 - The BIOLM implements non-blocking ISDU requests by:
Responding to an ISDU request message immediately after receiving and verifying the ISDU request.
Requiring the PLC to monitor the ISDU request status with read messages. The BIOLM will not return a completed status until all of the ISDU commands have been processed.

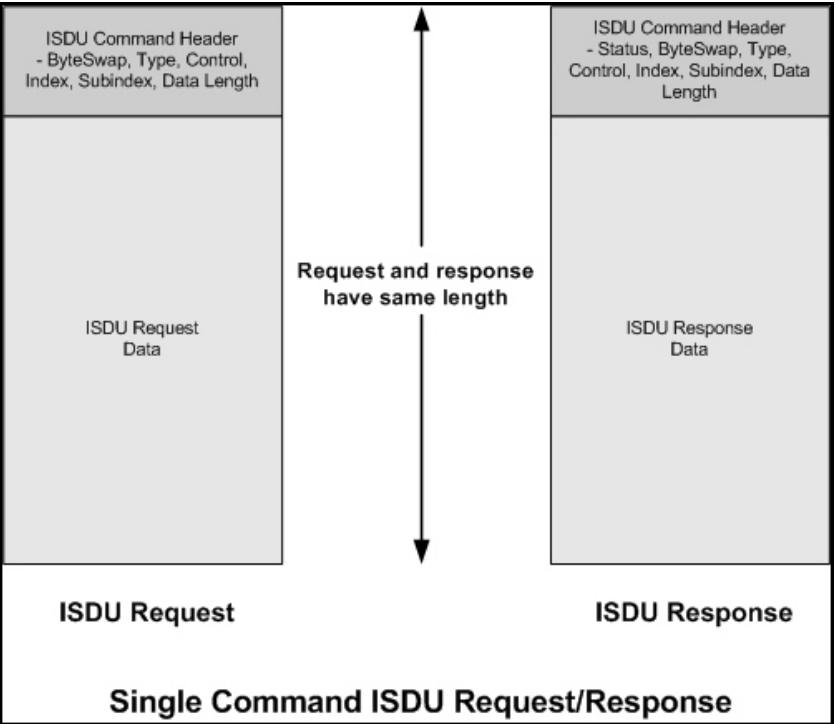
11.3.1 ISDU Request/Response Structure

ISDU requests may contain a single command or multiple, nested commands. This subsection discusses the following:

- [Single ISDU Command Request \[99\]](#)
- [Multiple ISDU Command Structure \[100\]](#)

11.3.1.1 Single ISDU Command Request

This illustrates a single ISDU command request.

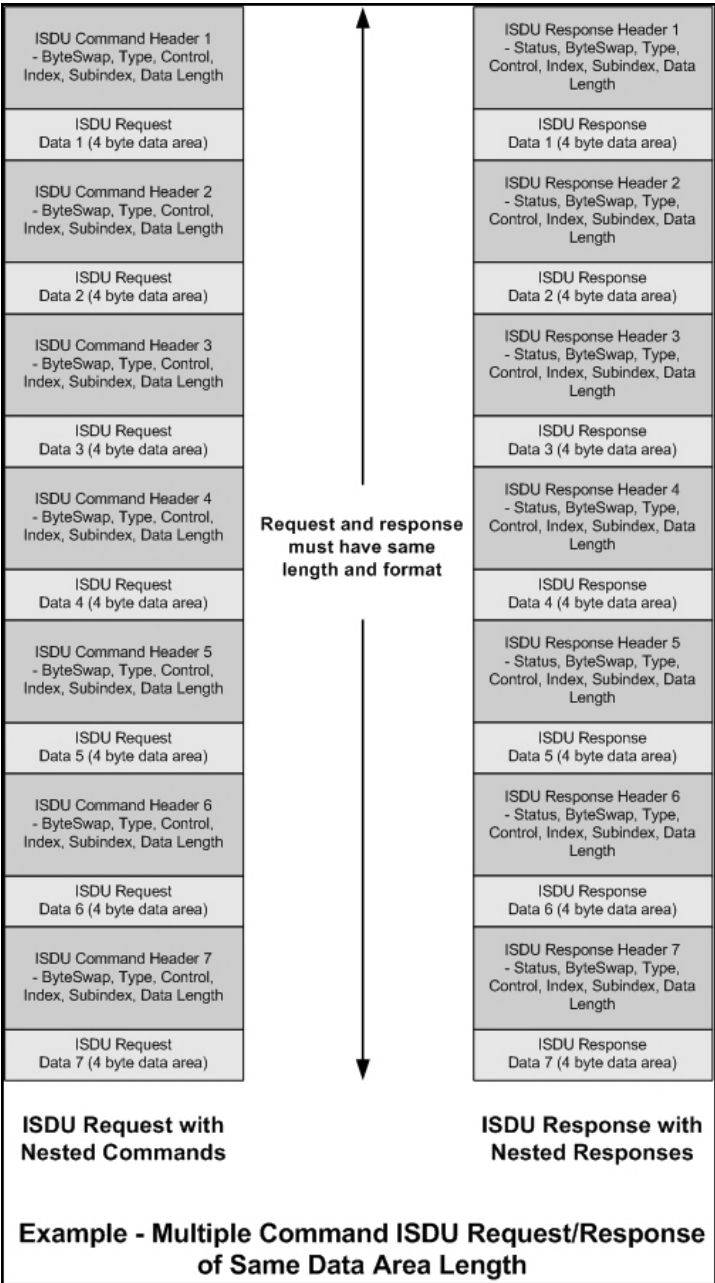


11.3.1.2 Multiple ISDU Command Structure

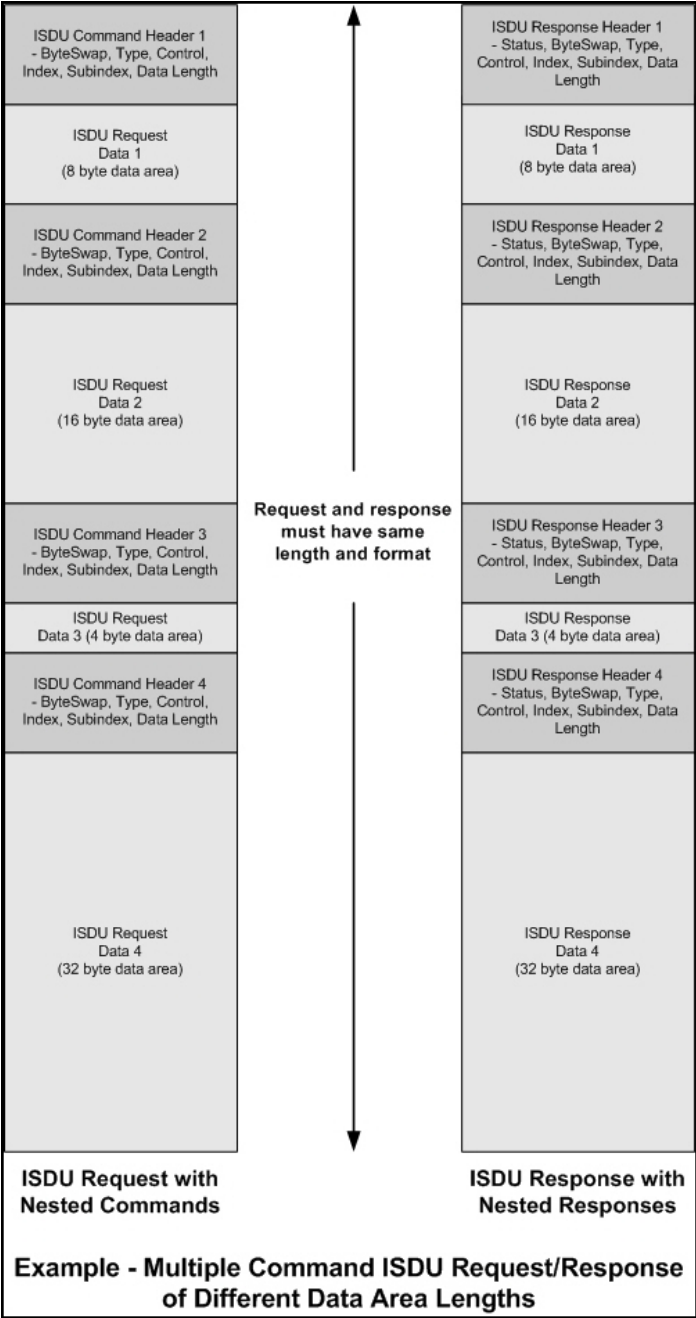
ISDU requests with multiple commands may consist of commands of the same data size or commands with different data sizes. The following are two examples of multiple ISDU commands.

- ISDU commands of same data size
- ISDU commands of different data sizes

Multiple Command ISDU Request/Response of Same Data Area Length



Multiple Command ISDU Request/Response of Different Data Lengths



11.3.2 ISDU Request Message Format-From PLC to BIOLM

Write and read ISDU commands have the same message data format. Each ISDU request message is comprised of one or more commands. The command(s) can consist of either a series of nested commands or a single read command.



INFO

A list of nested ISDU commands is terminated with either a control field of 0, (single/last operation), or the end of the message data.

11.3.2.1 Standard ISDU Request Command Format

This table displays a standard ISDU request command format with ControlLogix PLCs.

Name	Data Type	Parameter Descriptions
Byte Swapping	USINT	Bits 0 - 3: 0 = No byte swapping. 1 = 16-bit (INT) byte swapping of ISDU data. 2 = 32-bit (DINT) byte swapping of ISDU data. Bits 4 - 7: Set to zero. Unused.
RdWrControl-Type	USINT	Provides the control and type of ISDU command. Bits 0 - 3, Type Field: 0 = NOP (No operation) 1 = Read operation 2 = Write operation 3 = Read/Write "OR" 4 = Read/Write "AND" Bits 4 - 7, Control Field: 0 = Single/Last Operation (length can vary from 1 to 232) 1 = Nested batch command – fixed 4 byte data area 2 = Nested batch command – fixed 8 byte data area 3 = Nested batch command – fixed 16 byte data area 4 = Nested batch command – fixed 32 byte data area 5 = Nested batch command – fixed 64 byte data area 6 = Nested batch command – fixed 128 byte data area 7 = Nested batch command – fixed 232 byte data area
Index	UINT	The parameter address of the data object in the IO-Link device.
Subindex	UINT	The data element address of a structured parameter of the data object in the IO-Link device.
Datalength	UINT	Length of data to read or write. For nested batch commands, the data length can vary from 1 to the fixed data area size.
Data	Array of USINTs, UINTs, or UD-INTs.	Size of array is determined by the Control field in RdWr-ControlType. Data is valid only for write commands.

11.3.2.2 Integer (16-Bit Word) ISDU Request Command Format

This table shows an integer (16 bit word) ISDU request command format with a SLC, MicroLogix, PLC-5, or Modbus/TCP.

Name	Data Type	Parameter Descriptions
Byte Swapping / RdWrControl-Type	UINT	<p>Provides the control, type and byte swapping of ISDU command.</p> <p>Bits 0 - 3, Type Field: 0 = NOP (No operation) 1 = Read operation 2 = Write operation 3 = Read/Write "OR" 4 = Read/Write "AND"</p> <p>Bits 4 - 7, Control Field: 0 = Single/Last Operation (length can vary from 1 to 232) 1 = Nested batch command – fixed 4 byte data area 2 = Nested batch command – fixed 8 byte data area 3 = Nested batch command – fixed 16 byte data area 4 = Nested batch command – fixed 32 byte data area 5 = Nested batch command – fixed 64 byte data area 6 = Nested batch command – fixed 128 byte data area 7 = Nested batch command – fixed 232 byte data area</p> <p>Bits 8 - 11: 0 = No byte swapping. 1 = 16-bit (INT) byte swapping of ISDU data. 2 = 32-bit (DINT) byte swapping of ISDU data.</p> <p>Bits 12 - 15: Set to zero. Unused.</p>
Index	UINT	The parameter address of the data object in the IO-Link device.
Subindex	UINT	The data element address of a structured parameter of the data object in the IO-Link device.
Datalength	UINT	<p>Length of data to read or write.</p> <p>For nested batch commands, the data length can vary from 1 to the fixed data area size.</p>
Data	Array of USINTs, UINTs, or UDINTs.	<p>Size of array is determined by the Control field in RdWrControlType.</p> <p>Data is valid only for write commands.</p>

11.3.3 ISDU Response Message Format

The ISDU responses have the same data format as requests with the only exception being the returned command status. Each ISDU response message is comprised of one or more responses to the single and/or nested command(s) received in the request.

11.3.3.1 Standard ISDU Response Command Format

The following table show the standard ISDU response command format with ControlLogix PLCs.

Name	Data Type	Parameter Descriptions
Status	USINT	<p>Indicates the byte alignment and status of the command response.</p> <p>Byte swapping, Bits 0 - 3: 0 = No byte swapping. 1 = 16-bit (INT) byte swapping of TX/RX ISDU data. 2 = 32-bit (DINT) byte swapping of TX/RX ISDU data.</p> <p>Status, Bits 4 - 7: 0 = NOP (No operation) 1 = In process (Only valid for non-blocking requests) 2 = Success 3 = Failure: IO-Link device rejected the request. 4 = Timed out: IO-Link device did not respond</p>
RdWrControl-Type	USINT	<p>Provides the control and type of ISDU request.</p> <p>Bits 0 - 3, Type Field: 0 = NOP (No operation) 1 = Read operation 2 = Write operation 3 = Read/Write "OR" 4 = Read/Write "AND"</p> <p>Bits 4 - 7, Control Field: 0 = Single/Last Operation (length can vary from 1 to 232) 1 = Nested batch command – fixed 4 byte data area 2 = Nested batch command – fixed 8 byte data area 3 = Nested batch command – fixed 16 byte data area 4 = Nested batch command – fixed 32 byte data area 5 = Nested batch command – fixed 64 byte data area 6 = Nested batch command – fixed 128 byte data area 7 = Nested batch command – fixed 232 byte data area</p>
Index	UINT	The parameter address of the data object in the IO-Link device.
Subindex	UINT	The data element address of a structured parameter of the data object in the IO-Link device.
Datalength	UINT	<p>Length of data that was read or written.</p> <p>For nested batch commands, the data length can vary from 1 to fixed data area size.</p>

Name	Data Type	Parameter Descriptions
Data	Array of USINTs, UINTs, or UD-INTs.	<p>Data required for read commands. Optionally can return the data of a write command.</p> <p>The size of the array is determined by the Control field in the RdWrControlType.</p> <p>Data field not required for single NOP commands.</p>

11.3.3.2 Integer (16-Bit Word) ISDU Response Command Format

The following table shows an integer (16-bit word) ISDU response command format with SLC, MicroLogix, PLC-5, or Modbus/TCP.

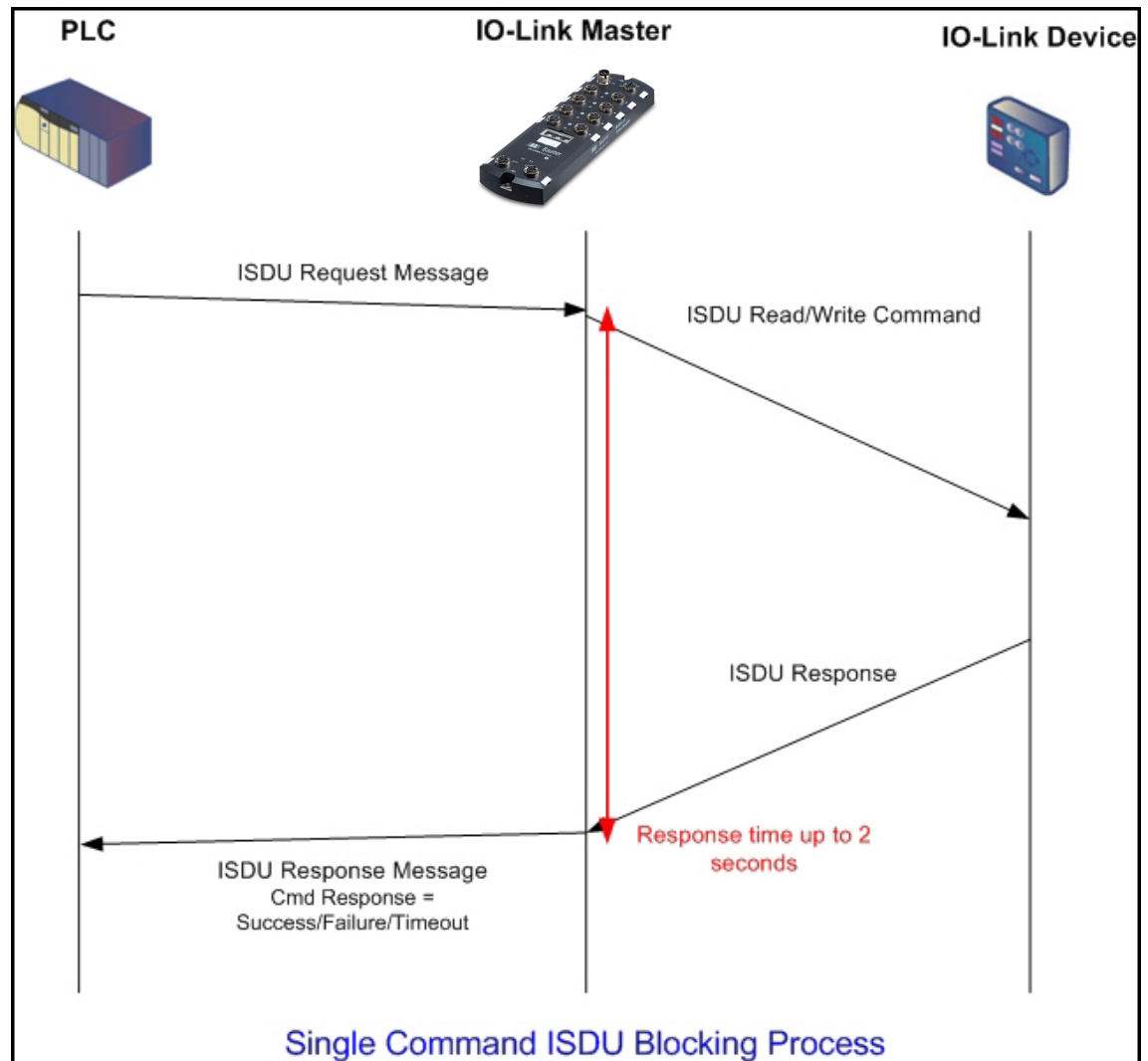
Name	Data Type	Parameter Descriptions
Status, Byte-Swapping, RdWrControlType	UINT	<p>Indicates the control, type, byte swapping and status of the ISDU command.</p> <p>Bits 0 - 3, Type Field: 0 = NOP (No operation) 1 = Read operation 2 = Write operation 3 = Read/Write "OR" 4 = Read/Write "AND"</p> <p>Bits 4 - 7, Control Field: 0 = Single/Last Operation (length can vary from 1 to 232) 1 = Nested batch command – fixed 4 byte data area 2 = Nested batch command – fixed 8 byte data area 3 = Nested batch command – fixed 16 byte data area 4 = Nested batch command – fixed 32 byte data area 5 = Nested batch command – fixed 64 byte data area 6 = Nested batch command – fixed 128 byte data area 7 = Nested batch command – fixed 232 byte data area</p> <p>Byte swapping, Bits 8 - 11: 0 = No byte swapping. 1 = 16-bit (INT) byte swapping of TX/RX ISDU data. 2 = 32-bit (DINT) byte swapping of TX/RX ISDU data.</p> <p>Status, Bits 12 - 15: 0 = NOP (No operation) 1 = In process (Only valid for non-blocking requests) 2 = Success 3 = Failure: IO-Link device rejected the request. 4 = Timed out: IO-Link device did not respond</p>
Index	UINT	The parameter address of the data object in the IO-Link device.
Subindex	UINT	The data element address of a structured parameter of the data object in the IO-Link device.
Datalength	UINT	<p>Length of data that was read or written.</p> <p>For nested batch commands, the data length can vary from 1 to fixed data area size.</p>
Data	Array of USINTs, UINTs, or UDINTs	<p>Data returned for read commands. Contains the data of a write command.</p> <p>The size of the array is determined by the Control field in RdWrControlType.</p> <p>Data field not required for single NOP commands.</p>

11.3.4 ISDU Blocking and Non-Blocking Methods

The BIOLM supports both blocking and non-blocking ISDU requests. The following diagrams demonstrate how each mode works.

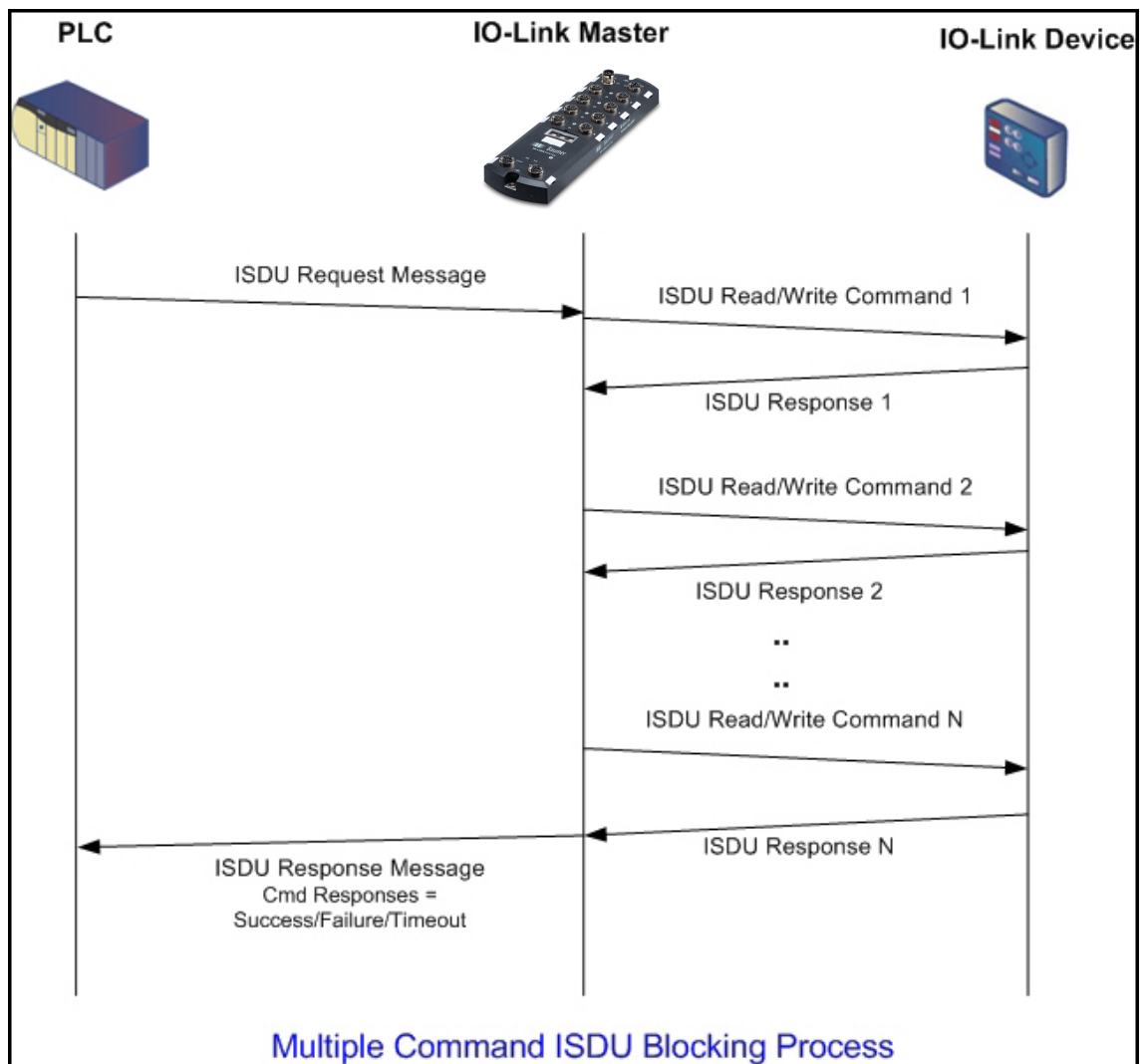
11.3.4.1 Single Command Blocking

The following illustrates the single command blocking method.



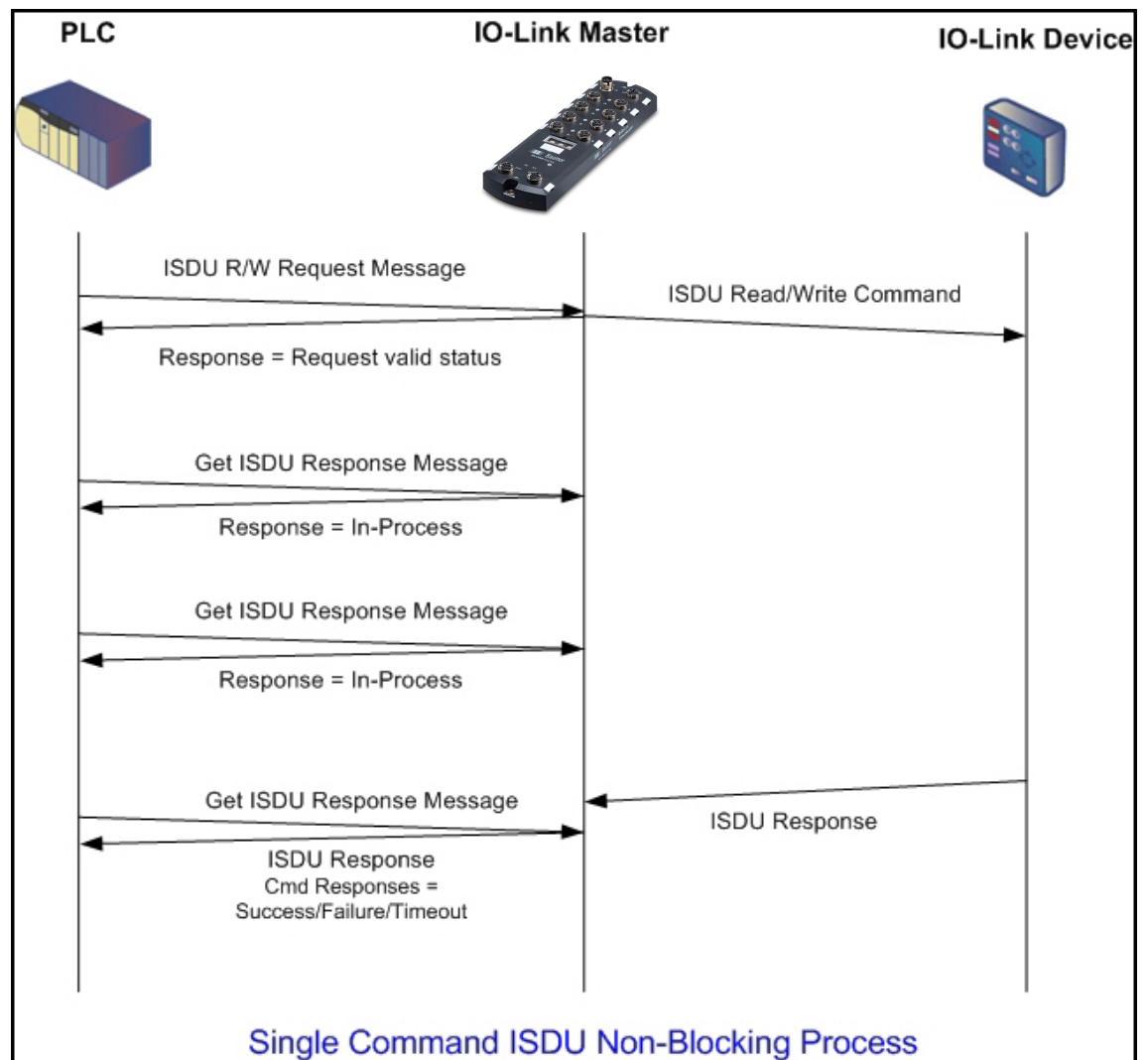
11.3.4.2 Multiple Command Blocking

This illustrates the multiple command blocking method.



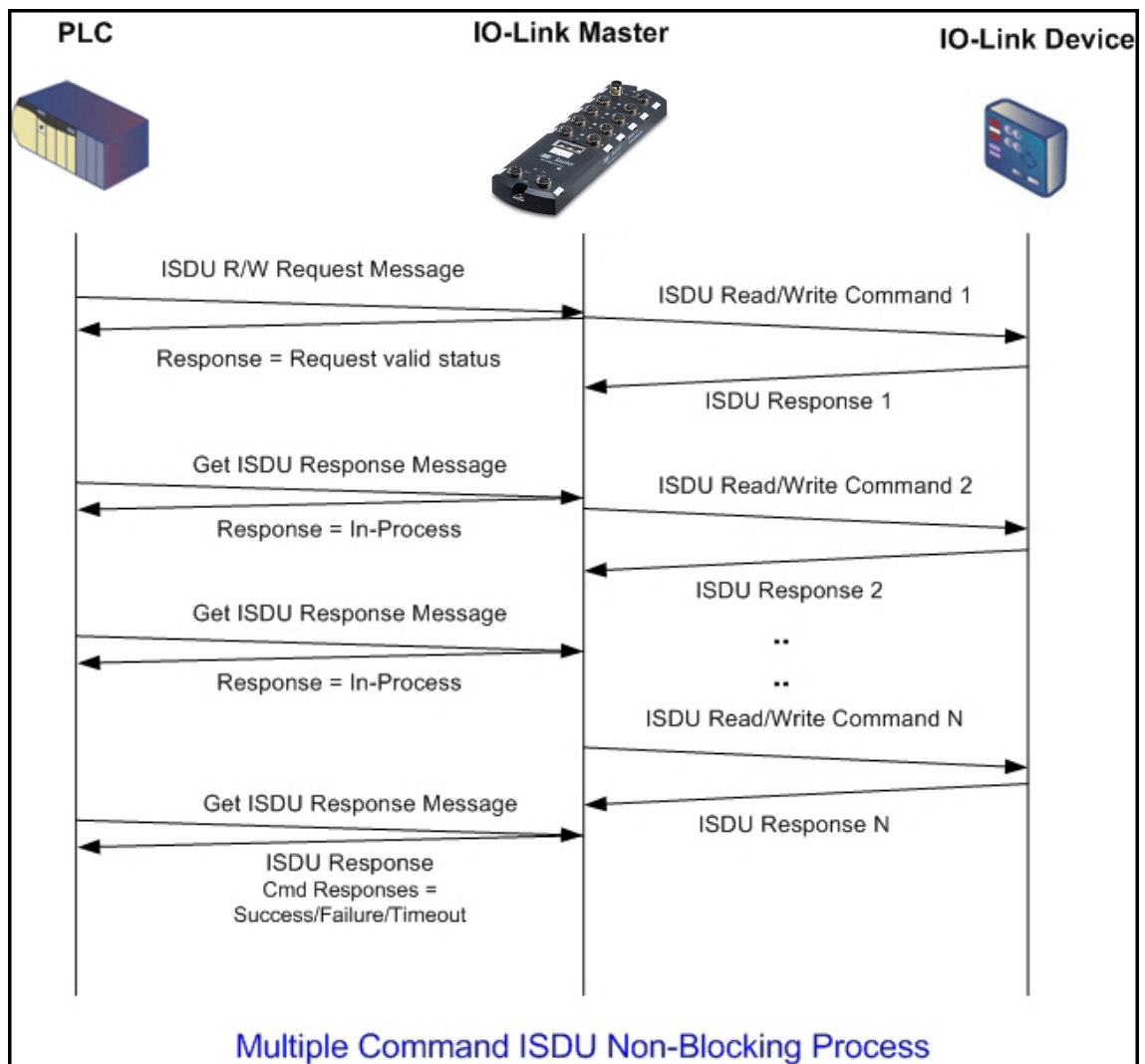
11.3.4.3 Single Command Non-Blocking

This illustrates the single command non-blocking method.



11.3.4.4 Multiple Command Non-Blocking

This illustrates the multiple command non-blocking method.



12 EtherNet/IP CIP Object Definitions

The following are the vendor specific CIP Object definitions as supported in the BIOLM:

- [IO-Link Port Information Object Definition \(71 hex\) \[▶ 111\]](#)
- [PDI \(Process Data Input\) Transfer Object Definition \(72 hex\) \[▶ 116\]](#)
- [PDO \(Process Data Output\) Transfer Object Definition \(73 hex\) \[▶ 117\]](#)
- [ISDU Read/Write Object Definition \(74 hex\) \[▶ 118\]](#)

The following are standard CIP Object Definitions that are supported in the BIOLM:

- [Identity Object \(01 hex, 1 instance\) \[▶ 120\]](#)
- [Message Router Object \(02 hex\) \[▶ 122\]](#)
- [Connection Manager Object \(06 hex\) \[▶ 123\]](#)
- [Port Object \(F4 hex-1 instance\) \[▶ 124\]](#)
- [TCP Object \(F5 hex-1 instance\) \[▶ 126\]](#)
- [Ethernet Link Object \(F6 hex-1 instance\) \[▶ 129\]](#)
- [PCCC Object \(67 hex-1 instance\) \[▶ 130\]](#)

12.1 IO-Link Port Information Object Definition (71 hex)

The IO-Link Device Information object defines the attributes by which the PLC can request standard device information stored in the IO-Link device's ISDU blocks.

12.1.1 Class Attributes

The following table shows the class attributes for IO-Link port information object definition (71 hex).

Attribute ID	Name	Data Type	Data Value(s)	Access Rule
1	Revision	UINT	1	Get
2	Max Instance	UINT	8	Get
3	Num Instances	UINT	8 ¹	Get

¹ Instance number determines the IO-Link port.

12.1.2 Instance Attributes

The following table shows the instance attributes for IO-Link port information object definition (71 hex).

Attribute ID	Name	Data Type	Data Value(s)	Access Rule
1	Vendor Name	Array of 64 SINTs	0-255	Get
2	Vendor Text	Array of 64 SINTs	0-255	Get
3	Product Name	Array of 64 SINTs	0-255	Get
4	Product Id	Array of 64 SINTs	0-255	Get
5	Product Text	Array of 64 SINTs	0-255	Get
6	Serial Number	Array of 16 SINTs	0-255	Get
7	Hardware Revision	Array of 64 SINTs	0-255	Get
8	Firmware Revision	Array of 64 SINTs	0-255	Get
9	Device PDI Length	INT	0-32	Get
10	Device PDO Length	INT	0-32	Get
11	PDI Block Length	INT	4-36	Get
12	PDO Block Length	INT	0-36	Get
13	Input Assembly PDI Offset	INT	0-108 (8-bit format) 0-54(16-bit format) 0-27 (32-bit format)	Get
14	Input Assembly PDO Offset	INT	16-246 (8-bit format) 8-123(16-bit format) 4-62 (32-bit format)	Get
15	Output Assembly PDO Offset	INT	0-102 (8-bit format) 0-51 (16-bit format) 0-26 (32-bit format)	Get
16	Control Flags	INT	Bit settings	Get

12.1.3 Common Services

The following table shows the common services for IO-Link port information object definition (71 hex).

Service Code	Implemented in Class	Implemented in Instance	Service Name
01 hex	Yes	Yes	Get_Attributes_All
0E hex	Yes	Yes	Get_Attribute_Single

12.1.4 Instance Attribute Definitions

These attributes provide access to the standard ISDU information blocks on the IO-Link devices. These ISDUs are read at IO-Link device initialization time and then provided once the IO-Link device is operational.

12.1.4.1 Attribute 1-Vendor Name

Data	Attribute 1 – Vendor Name Description
64 ASCII characters	Requested from ISDU block index 16, contains the Vendor Name description of the IO-Link device.

12.1.4.2 Attribute 2-Vendor Text

Data	Attribute 2 – Vendor Text Description
64 ASCII characters	Requested from ISDU block index 17, contains the Vendor Text description of the IO-Link device.

12.1.4.3 Attribute 3-Product Name

Data	Attribute 3 – Product Name Description
64 ASCII characters	Requested from ISDU block index 18, contains the Product Name description of the IO-Link device.

12.1.4.4 Attribute 4-Product ID

Data	Attribute 4 – Product ID Description
64 ASCII characters	Requested from ISDU block index 19, contains the Product ID description of the IO-Link device.

12.1.4.5 Attribute 5-Product Text

Data	Attribute 5 – Product Text Description
64 ASCII characters	Requested from ISDU block index 20, contains the Product Text description of the IO-Link device.

12.1.4.6 Attribute 6-Serial Number

Data	Attribute 6 – Serial Number Description
16 ASCII characters	Requested from ISDU block index 21, contains the Vendor Specific Serial Number of the IO-Link device.

12.1.4.7 Attribute 7-Hardware Revision

Data	Attribute 7 – Hardware Revision Description
64 ASCII characters	Requested from ISDU block index 22, contains the Hardware Revision of the IO-Link device.

12.1.4.8 Attribute 8-Firmware Revision

Data	Attribute 8 – Firmware Revision Description
64 ASCII characters	Requested from ISDU block index 23, contains the Firmware Revision of the IO-Link device.

12.1.4.9 Attribute 9-Device PDI Length

Data	Attribute 9 – Device PDI Length Description
INT (0-32)	Requested from ISDU block index 0, sub-index 5. Contains the number of PDI data bytes provided by the IO-Link device.

12.1.4.10 Attribute 10-Device PDO Length

Data	Attribute 10 – Device PDO Length Description
INT	Requested from ISDU block index 0, sub-index 6. Contains the number of PDO data bytes required by the IO-Link device.

12.1.4.11 Attribute 11-PDI Data Block Length

Data	Attribute 11 – PDI Data Block Length Description
INT	The configured PDI block length in units based on the configurable PDI data format (8-bit, 16-bit, 32-bit). This contains the PDI block header, (port status, auxiliary bit, event code) status and the PDI data.

12.1.4.12 Attribute 12-PDO Data Block Length

Data	Attribute 12 – PDO Data Block Length Description
INT	The configured PDO data block length in units based on the configurable PDO data format (8-bit, 16-bit, 32-bit). Depending on the configuration, this may include both the returned event code and the PDO data.

12.1.4.13 Attribute 13-Input Assembly PDI Offset

Data	Attribute 13 – Input Assembly PDI Offset Description
INT	Based from the start of the first Input Assembly instance, the PDI data block's offset for the corresponding port's PDI data block. This index is based on the configurable PDI data format (8-bit, 16-bit, 32-bit). To use this offset effectively, it is recommended to set BIOLM PDI and PDO data as well as the Class 1 I/O connection all to the same data format.

12.1.4.14 Attribute 14-Input Assembly PDO Offset

Data	Attribute 14 – Input Assembly PDO Offset Description
INT	<p>Based from the start of the first Input Assembly instance, the PDO data block's offset for the corresponding port's PDO data block.</p> <p>This index is based on the configurable PDO data format (8-bit, 16-bit, 32-bit). To use this offset effectively, it is recommended to set BIOLM PDI and PDO data as well as the Class 1 I/O connection all to the same data format.</p>

12.1.4.15 Attribute 15-Output Assembly PDO Offset

Data	Attribute 15 – Output Assembly PDO Offset Description
INT	<p>Based from the start of the first Output Assembly instance, the PDO data block's offset for the corresponding port's PDO data block.</p> <p>This index is based on the configurable PDO data format (8-bit, 16-bit, 32-bit). To use this offset effectively, it is recommended to set BIOLM PDI and PDO data as well as the Class 1 I/O connection all to the same data format.</p>

12.1.4.16 Attribute 16-Control Flags

Data	Attribute 16 – Control Flags Description
INT (bit-mapped word)	<ul style="list-style-type: none"> ■ Bit 0 (01h): <ul style="list-style-type: none"> ▪ 1 = Indicates that the event code to clear is expected in the PDO block ▪ 0 = Indicates that the event code to clear is not expected in the PDO block ■ Bit 1 (02h): <ul style="list-style-type: none"> ▪ 1 = Indicates that the IO-Link device is SIO mode capable ▪ 0 = Indicates that the IO-Link device is not SIO mode capable ■ Bits 2 (04h) <ul style="list-style-type: none"> ▪ 1 = Indicates that Class 1 Rx (receive PDI block) is enabled ▪ 0 = Indicates that Class 1 Rx (receive PDI block) is disabled ■ Bit 3 (08h): <ul style="list-style-type: none"> ▪ 1 = Indicates that Class 1 Tx (transmit PDO) is enabled ▪ 0 = Indicates that Class 1 Tx (transmit PDO) is disabled ■ Bit 4 (10h): <ul style="list-style-type: none"> ▪ 1 = Indicates that the digital output settings for DI and C/Q are expected in the PDO block ▪ 0 = Indicates that the digital output settings for DI and C/Q are not expected in the PDO block ■ Bit 5 -15: Reserved

12.2 PDI (Process Data Input) Transfer Object Definition (72 hex)

The PDI Transfer object defines the attributes by which the PLC can request the PDI data block from the BIOLM.

12.2.1 Class Attributes

The following table displays Class Attributes for the PDI Transfer Object Definition (72 hex).

Attribute ID	Name	Data Type	Data Value(s)	Access Rule
1	Revision	UINT	1	Get
2	Max Instance	UINT	1	Get
3	Num Instances	UINT	1	Get

12.2.2 Instance Attributes

The following table displays Instance Attributes for the PDI Transfer Object Definition (72 hex).

Attribute ID	Name	Data Type	Length	Data Values	Access Rule
1	Port 1 PDI data block	Array of BYTES	4-36 bytes	0-255	Get
2	Port 2 PDI data block	Array of BYTES	4-36 bytes	0-255	Get
3	Port 3 PDI data block	Array of BYTES	4-36 bytes	0-255	Get
4	Port 4 PDI data block	Array of BYTES	4-36 bytes	0-255	Get
5	Port 5 PDI data block	Array of BYTES	4-36 bytes	0-255	Get
6	Port 6 PDI data block	Array of BYTES	4-36 bytes	0-255	Get
7	Port 7 PDI data block	Array of BYTES	4-36 bytes	0-255	Get
8	Port 8 PDI data block	Array of BYTES	4-36 bytes	0-255	Get

12.2.3 Common Services

The following table shows Common Services for the PDI Transfer Object Definition (72 hex).

Service Code	Implemented in Class	Implemented in Instance	Service Name
01 hex	Yes	Yes	Get_Attributes_All
0E hex	Yes	Yes	Get_Attribute_Single

12.2.4 Instance Attribute Definitions – Attribute 1 to 4-PDI Data Blocks

These attributes provide access to the PDI data blocks:

- Get Attribute Single requests return the PDI data block for a specific port.
- Get Attribute All requests return all PDI data blocks from the BIOLM.

All PDI data is returned in the configured PDI format (8-bit, 16-bit or 32-bit). Refer to [PDI \(Process Data Input\) Transfer Object Definition \(72 hex\) \[116\]](#) for a detailed explanation of the PDI data block.

12.3 PDO (Process Data Output) Transfer Object Definition (73 hex)

The PDO Transfer object defines the attributes by which the PLC can:

- Request the PDO data block from the BIOLM.
- Write PDO data block to the BIOLM.

12.3.1 Class Attributes

The following table displays the Class Attributes for the PDO Transfer Object Definition (73 hex).

Attribute ID	Name	Data Type	Data Value(s)	Access Rule
1	Revision	UINT	1	Get
2	Max Instance	UINT	1	Get
3	Num Instances	UINT	1	Get

12.3.2 Instance Attributes

The following table displays the Instance Attributes for the PDO Transfer Object Definition (73 hex).

Attribute ID	Name	Data Type	Length	Data Values	Access Rule
1	Port 1 PDO data block	Array of BYTES	0-36 bytes	0-255	Get/Set
2	Port 2 PDO data block	Array of BYTES	0-36 bytes	0-255	Get/Set
3	Port 3 PDO data block	Array of BYTES	0-36 bytes	0-255	Get/Set
4	Port 4 PDO data block	Array of BYTES	0-36 bytes	0-255	Get/Set
5	Port 5 PDO data block	Array of BYTES	0-36 bytes	0-255	Get/Set
6	Port 6 PDO data block	Array of BYTES	0-36 bytes	0-255	Get/Set
7	Port 7 PDO data block	Array of BYTES	0-36 bytes	0-255	Get/Set
8	Port 8 PDO data block	Array of BYTES	0-36 bytes	0-255	Get/Set

12.3.3 Common Services

The following table displays the Common Services for the PDO Transfer Object Definition (73 hex).

Service Code	Implemented in Class	Implemented in Instance	Service Name
01 hex	Yes	Yes	Get_Attributes_All
0E hex	Yes	Yes	Get_Attribute_Single
10 hex	No	Yes	Set_Attribute_Single
02 hex	No	Yes	Set_Attribute_All

12.3.4 Instance Attribute Definitions – Attribute 1 to 4-PDO Data Blocks

These attributes provide write access to the PDO data blocks:

- Get Attribute Single requests return the current PDO data block for a specific port.
- Get Attribute All requests return all current PDO data blocks from the BIOLM.
- Set Attribute Single allows writing the PDO data to one IO-Link port on the BIOLM.
- Set Attribute All messages allow writing of PDO data to all IO-Link ports on the BIOLM.

All PDO data is received and returned in the configured PDO format (8-bit, 16-bit or 32-bit). Refer to [PDO \(Process Data Output\) Transfer Object Definition \(73 hex\) \[▶ 117\]](#) for a detailed explanation of the PDO data block.

12.4 ISDU Read/Write Object Definition (74 hex)

The ISDU Read/Write object defines the attributes by which the PLC can:

- Send an ISDU request containing one or more read and/or write ISDU commands to an IO-Link device via the BIOLM.
- Request the ISDU response(s) from the BIOLM.
- Send both blocking and non-blocking ISDU requests.

Refer to the ISDU Handling chapter for a detailed description of the ISDU functionality.

12.4.1 Class Attributes

The following table shows the Class Attributes for the ISDU Read/Write Object Definition (74 hex).

Attribute ID	Name	Data Type	Data Value(s)	Access Rule
1	Revision	UINT	1	Get
2	Max Instance	UINT	8	Get
3	Num Instances	UINT	8 ¹	Get

¹ Instance number determines the IO-Link port.

12.4.2 Instance Attributes

The following table shows the Instance Attributes for the ISDU Read/Write Object Definition (74 hex).

Attribute ID	Name	Data Type	Data Value(s)	Access Rule
1	ISDU Response	ISDU response data block	0-255	Get
2	ISDU Read/Write Request	ISDU request data block	0-255	Set

12.4.3 Common Services

The following table shows the Common Services for the ISDU Read/Write Object Definition (74 hex):

Service Code	Implemented in Class	Implemented in Instance	Service Name
01 hex	Yes	No	Get_Attributes_All
0E hex	Yes	Yes	Get_Attribute_Single
10 hex	No	Yes	Set_Attribute_Single
02 hex	No	No	Set_Attribute_All

12.4.4 Object Specific Services

The following table shows the Object Specific Services for the ISDU Read/Write Object Definition (74 hex).

Service Code	Implemented in Class	Implemented in Instance	Service Name
4B hex	No	Yes	Blocking ISDU Request

The Blocking ISDU Request service allows one message instruction to both send an ISDU request and receive the response. Using this service causes the message to be active for several seconds.

12.4.5 Instance Attribute Definitions

The following attributes provide access to the ISDU blocks on the IO-Link devices.

12.4.5.1 Attribute 1-ISDU Read/Write Response (Non-Blocking only)

Get Attribute Single messages returns the ISDU response for a specific port through the BIOLM. The response may need to be read multiple times until a response of Success, Failure, or Timed Out has been received.

12.4.5.2 Attribute 2-ISDU Read/Write Request (Non-blocking only)

Set Attribute Single messages can send read/write type ISDU requests to the IO-Link devices via the BIOLM. The ISDU request message need be sent only once for each ISDU read/write request.

12.5 Identity Object (01 hex, 1 instance)

12.5.1 Class Attributes

This table shows the Class Attributes for the Identity Object (01 hex, 1 Instance).

Attribute ID	Name	Data Type	Data Value(s)	Access Rule
1	Revision	UINT	1	Get
2	Max Class	UINT	1	Get
3	Max Instance	UINT	1	Get
6	Maximum Number Class Attribute	UINT	7	Get
7	Maximum Number Instance Attributes	UINT	7	Get

12.5.2 Instance Attributes

This table shows the Instance Attributes for the Identity Object (01 hex, 1 Instance).

Attribute ID	Name	Data Type	Data Value(s)	Access Rule
1	Vendor ID	UINT	909 (Baumer)	Get
2	Device Type	UINT	2B hex (Generic Device)	Get
3	Product Code	UINT	As defined by Baumer	Get
4	Revision (Product or Software release)			
	Structure of:			
	Major Revision	USINT	1 to 127	Get
	Minor Revision	USINT	1 to 255	
5	Status	WORD	See Below	Get
6	Serial Number	UDINT	1-FFFFFFFF hex	Get
7	Product Name			
	Structure of:			
	Name Length	USINT	Length of string	Get
	Name String	STRING	See below	Get

12.5.3 Status Word

Refer to Page 52 of Volume 3.5 of the CIP Common Specification.

The following applies to the Identity Object status word for the BIOLM.

Status Word Bit	Setting	Description
0	0	Ownership Flag. Does not apply to the BIOLM.
1	0	Reserved.
2	0	BIOLM is operating on the default configuration.
	1	The BIOLM has a configuration other than the default configuration.
3	0	Reserved.
4-7	0101 (0x50)	Indicates that there is a major fault (either Bit 10 or Bit 11 is set).
	0100 (0x40)	Indicates the stored configuration is invalid.
	0011 (0x30)	Indicates the system is operational and there are no I/O (Class 1) connections.
	0110 (0x60)	Indicates the system is operational and there is at least one active I/O (Class 1) connection.
	0000	Indicates the system is not operational. It may be in any of the following states: <ul style="list-style-type: none"> ■ System startup. ■ Configuration in process. ■ Idle. ■ Critical (major) fault.
8	0	No recoverable minor fault. No error history entry reported within the last ten seconds.
	1	Recoverable minor fault. The BIOLM has reported an error within the last ten seconds and a major fault has not been detected.
9	1	Unrecoverable minor fault. Does not apply to the BIOLM.
10	0	No recoverable major fault.
	1	A major recoverable fault exists. This is a fault that the BIOLM may be able to recover from by a system reset. If the system does not recover automatically, a system reset message or a power cycle of the BIOLM may be required.
11	0	No major unrecoverable fault.
	1	A major unrecoverable fault has occurred in the BIOLM. If the major fault is not corrected with a system reset or a power cycle, refer to the User Guide or call Baumer support.
12-15	0	Reserved

12.5.4 Common Services

Service Code	Implemented in Class	Implemented in Instance	Service Name
01 hex	Yes	Yes	Get_Attributes_All
05 hex	No	Yes	Reset
0E hex	Yes	Yes	Get_Attribute_Single

12.6 Message Router Object (02 hex)

The Message Router Object provides a messaging connection point through which a Client may address a service to any object or instance residing in the physical device.

12.6.1 Class Attributes

This table displays the Class Attributes for the Message Router Object (02 hex).

Attribute ID	Name	Data Type	Data Value(s)	Access Rule
1	Revision	UINT	1	Get
2	Max Class	UINT	1	Get
3	Max Instance	UINT	1	Get
4	Optional Attribute List	UINT	2	Get
5	Option Service List	UINT	1	Get
6	Maximum Number Class Attribute	UINT	7	Get
7	Maximum Number Instance Attribute	UINT	2	Get

12.6.2 Instance Attributes

This table displays the Instance Attributes for the Message Router Object (02 hex).

Attribute ID	Name	Data Type	Data Value(s)	Access Rule
1	Object List Structure of: Number	UINT	Number of supported standard class codes	Get
	Classes	Array of UINT	List of supported standard class codes	Get
2	Max Connections	UINT	128	Get

12.6.3 Common Services

This table displays the Common Services for the Message Router Object (02 hex).

Service Code	Implemented in Class	Implemented in Instance	Service Name
01 hex	Yes	No	Get_Attributes_All
0E hex	Yes	Yes	Get_Attribute_Single
0A hex	No	Yes	Multiple_Service_Req

12.7 Connection Manager Object (06 hex)

This object provides services for connection and connection-less communications.

This object has no supported attributes.

12.7.1 Class Attributes Object (06 hex)

The following table displays the Class Attributes for the Connection Manager Object (06 hex).

Attribute ID	Name	Data Type	Data Value(s)	Access Rule
1	Revision	UINT	1	Get
2	Max Class	UINT	1	Get
3	Max Instance	UINT	1	Get
4	Optional Attribute List	UINT	8	Get
6	Maximum Number Class Attribute	UINT	7	Get
7	Maximum Number Instance Attribute	UINT	6	Get

12.7.2 Instance Attributes (02 hex)

This table displays the Instance Attributes for the Message Router Object (02 hex).

Attribute ID	Name	Data Type	Data Value(s)	Access Rule
1	Open Requests	UINT	0-0xffffffff	Set/Get
2	Open Format Rejects	UINT	0-0xffffffff	Set/Get
3	Open Resource Rejects	UINT	0-0xffffffff	Set/Get
4	Open Other Rejects	UINT	0-0xffffffff	Set/Get
5	Close Requests	UINT	0-0xffffffff	Set/Get
6	Close Format Requests	UINT	0-0xffffffff	Set/Get
7	Close Other Requests	UINT	0-0xffffffff	Set/Get
8	Connection Time Outs	UINT	0-0xffffffff	Set/Get

12.7.3 Common Services Object (06 hex)

Service Code	Implemented in Class	Implemented in Instance	Service Name
01 hex	Yes	Yes	Get_Attributes_All
02 hex	No	Yes	Set_Attribute_ALL
0E hex	Yes	Yes	Get_Attribute_Single
10 hex	No	Yes	Set_Attribute_Single
4E hex	N/A	N/A	Forward_Close
52 hex	N/A	N/A	Unconnected_Send
54 hex	N/A	N/A	Forward_Open
5A hex	N/A	N/A	Get_Connec- tion_Owner
5B hex	N/A	N/A	Large_Forward_Open

12.8 Port Object (F4 hex-1 instance)

The Port Object enumerates the CIP ports present on the BIOLM.

12.8.1 Class Attributes

This table illustrates the Class Attributes for the Port Object (F4 hex - 1 Instance)

Attribute ID	Name	Data Type	Data Value(s)	Access Rule
1	Revision	UINT	1	Get
2	Max Instance	UINT	1	Get
3	Num Instances	UINT	1	Get
6	Maximum Number Class Attributes	UINT	9	Get
7	Maximum Number Instance Attributes	UINT	7	Get
8	Entry Port	UINT	1	Get
9	All Ports	Array of UINT	[0] = 0 [1] = 0 [2] = 1 (Vendor Specific) [3] = 1 (Backplane) [4] = TCP_IP_PORT_TYPE (4) [5] = TCP_IP_PORT_NUMBER (2)	Get

12.8.2 Instance Attributes

This table illustrates the Instance Attributes for the Port Object (F4 hex - 1 Instance).

Attribute ID	Name	Data Type	Data Value(s)	Access Rule
1	Port Type	UINT	1	Get
2	Port Number	UINT	1	Get
3	Port Object Structure of: 16 bit word count in path Path	UINT Array of UINT	2 [0] = 6420 hex [1] = 0124 hex	Get Get
4	Port Name Structure of: String Length Port Name	USINT Array of USINT	10 "Backplane"	Get Get
7	Node Address	USINT[2]	0x10, 0x00	Get

This table illustrates the Instance Attributes for the Port Object (F4 hex - 2 Instance).

Attribute ID	Name	Data Type	Data Value(s)	Access Rule
1	Port Type	UINT	4 (TCP/IP)	Get
2	Port Number	UINT	2 (TCP/IP)	Get
3	Port Object Structure of: 16 bit word count in path Path	UINT Array of UINT	2 [0] = F520 hex [1] = 0124 hex	Get Get
4	Port Name Structure of: String Length Port Name	USINT Array of USINT	17 "Ethernet/IP Port"	Get Get
7	Node Address	USINT[2]	0x10, 0x00	Get

12.8.3 Common Services

This table illustrates the Common Services for the Port Object (F4 hex - 1 Instance).

Service Code	Implemented in Class	Implemented in Instance	Service Name
01 hex	Yes	Yes	Get_Attributes_All
0E hex	Yes	Yes	Get_Attribute_Single

12.9 TCP Object (F5 hex-1 instance)

The TCP/IP Interface Object provides the mechanism to retrieve the TCP/IP attributes for the BIOLM.

12.9.1 Class Attributes

This table shows the Class Attributes for the TCP Object (F5 hex - I Instance).

Attribute ID	Name	Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get
2	Max Instance	UINT	1	Get
3	Num Instances	UINT	1	Get
4	Optional Attribute List	UINT	4	Get
6	Maximum Number Class Attribute	UINT	7	Get
7	Maximum Number Instance Attribute	UINT	9	Get

12.9.2 Instance Attributes

This table shows the Instance Attributes for the TCP Object (F5 hex - I Instance).

Attribute ID	Name	Data Type	Data Value(s)	Access Rule
1	Status	DWORD	<ul style="list-style-type: none"> 0 = The Interface Configuration attribute has not been configured. 1 = The Interface Configuration attribute contains configuration obtained from DHCP or nonvolatile storage. 2 = The IP address member of the Interface Configuration attribute contains configuration obtained, in part, from the hardware rotary switch settings. <ul style="list-style-type: none"> Upper 3 bytes from nonvolatile storage. Least significant byte from rotary switches. 	Get
2	Configuration Capability	DWORD	34 hex (DHCP, Settable and Hardware) 04 hex = DHCP 10 hex = Settable 20 hex = Hardware configurable	Get
3	Configuration Control	DWORD	Interface control Flags: <ul style="list-style-type: none"> 0 = The device shall use statically-assigned IP configuration values. 2 = The device shall obtain its interface configuration values via DHCP. 	Set/Get
4	Physical Link Object Structure of: Path Size Path	UINT Array of USINT	2 [0] = 20 hex [1] = F6 hex [2] = 24 hex [3] = 01 hex	Get
5	Interface Configuration Structure of: IP Address Network Mask Gateway Address Name Server Name Server 2 Domain Name Length Domain Name	 UDINT UDINT UDINT UDINT UDINT UINT STRING	 <IP address> <Network mask> <Gateway Address> <Name server> <Name server2> <Length of name> <Domain name>	Set/Get
6	Host Name Structure of: Host Name Length Host Name String	 UINT STRING	 0 to 15 <Default =IP NULL (0)>	Set/Get

Attribute ID	Name	Data Type	Data Value(s)	Access Rule
8	TTL (Time-to-Live) value for IP multicast packets.	USINT	1 to 255 <Default = 1>	Set/Get
9	IP Multicast Address Configuration	Struct of: USINT - Alloc Control USINT - Reserved UINT - Num Mcast UDINT - Start Mcast Address	Alloc Control: 0 = Default Algorithm 1 = Configuration Num Mcast: 1 to 32 Start Mcast Address: 239.192.1.0 to 239.255.255.255	Set/Get

12.9.3 Common Services

This table shows the Common Services for the TCP Object (F5 hex - I Instance).

Service Code	Implemented in Class	Implemented in Instance	Service Name
01 hex	Yes	Yes	Get_Attributes_All
02 hex	No	Yes	Set_Attribute_All
0E hex	Yes	Yes	Get_Attribute_Single
10 hex	No	Yes	Set_Attribute_Single

12.10 Ethernet Link Object (F6 hex-1 instance)

The Ethernet Link Object maintains link-specific counters and status information for the Ethernet communications interface on the BIOLM.

12.10.1 Class Attributes

This table displays the Class Attributes for the Ethernet Link Object (F6 hex - 1 Instance).

Attribute ID	Name	Data Type	Data Value(s)	Access Rule
1	Revision	UINT	3	Get
2	Max Instance	UINT	1	Get
3	Num Instances	UINT	1	Get
4	Optional Attribute List	UINT	4	Get
6	Maximum Number Class Attributes	UINT	7	Get
7	Maximum Number Instance Attributes	UINT	1	Get

12.10.2 Instance Attributes

This table displays the Instance Attributes for the Ethernet Link Object (F6 hex - 1 Instance).

Attribute ID	Name	Data Type	Data Value(s)	Access Rule
1	Interface speed (Current operational speed)	UDINT	10 = 10 Mbit 100 = 100 Mbit	Get
2	Interface Flags (Current operational status)	DWORD	Bit 0 = link status (0=inactive) (1=active) Bit 1=Half/Full Duplex (0=half duplex) (2=full duplex) Bits 2-4: 00 = negotiation in progress 01 = negotiation failed 02 = negotiation failed speed OK 03 = negotiation success	Get
3	Physical Address	Array of 6 USINT	MAC Address	Get
7	Interface Type	USINT	2 = Twisted Pair	Get
8	Interface State	USINT	1 = Interface is enabled and operational	Get
9	Admin State	USINT	1 = Interface enabled	Get
10	Interface Label	USINT16 Array of USINT	Length = 1 to 64 ASCII characters <Default = IP address in "xxx.xxx.xxx.xxx" format>	Get

12.10.3 Common Services

This table displays the Common Services for the Ethernet Link Object (F6 hex - 1 Instance)

Service Code	Implemented in Class	Implemented in Instance	Service Name
01 hex	Yes	Yes	Get_Attributes_All
0E hex	Yes	Yes	Get_Attribute_Single

12.11 PCCC Object (67 hex-1 instance)

The PCCC Object provides the ability to encapsulate and then transmit and receive PCCC messages between devices on an Ethernet/IP network. This object is used to communicate to MicroLogix, SLC 5/05 and PLC-5 PLCs over EtherNet/IP.

The PCCC Object does not support the following:

- Class Attributes
- Instance Attributes

12.11.1 Instances

The PCCC Object supports Instance 1.

12.11.2 Common Services

The following table displays the Common Services for the PCCC Object.

Service Code	Implemented in Class	Implemented in Instance	Service Name
4B hex	No	Yes	Execute_PCCC

12.11.3 Message Structure Execute_PCCC: Request Message

This table displays the message structure for the Execute_PCCC Request Message for the PCCC Object.

Name	Data Type	Description
Length	USINT	Length of requester ID
Vendor	UINT	Vendor number of requester
Serial Number	UDINT	ASA Serial number of requester
CMD	USINT	Command byte
STS	USINT	0
TNSW	UINT	Transport word
FNC	USINT	Function Code
PCCC_params	Array of USINT	CMD/FMC specific parameters

12.11.4 Message Structure Execute_PCCC: Response Message

This table displays the message structure for the Execute PCCC Response Message for the PCCC Object.

Name	Data Type	Description
Length	USINT	Length of requester ID
Vendor	UINT	Vendor number of requester
Serial Number	UDINT	ASA Serial number of requester
CMD	USINT	Command byte
STS	USINT	Status Byte
TNSW	UINT	Transport word. Same value as request.
EXT_STS	USINT	Extended status. (If error)
PCCC_params	Array of USINT	CMD/FMC specific result data

12.11.5 Supported PCCC Command Types

The following table displays the Supported PCCC Command Types for the PCCC Object.

CMD	FNC	Description
0F hex	A2 hex	SLC 500 protected typed read with 3 address fields
0F hex	AA hex	SLC 500 protected typed write with 3 address fields

12.12 Assembly Object (For Class 1 Interface)

The EtherNet/IP specification requires that all Class 1 interfaces be provided through the Assembly Object interface. The Assembly Object interface is used to directly tie Vendor Specific objects to a standard interface, which the EtherNet/IP controller, or PLC, uses to communicate to the device.

For the BIOLM, the Assembly Object corresponds to the PDI and PDO Transfer objects. Each instance of the Assembly Object corresponds to one or more of the PDI and/or PDO Transfer Object attributes.

The Assembly Object is linked to the Process IO vendor specific object, which provides access to the PDI and PDO data. The Assembly object defines the interface by which a Class 1 PLC or controller can:

- Request the PDI data block from the BIOLM.
- Write the PDO data block to the BIOLM.

12.12.1 Class Attributes

This table shows the Class Attributes for the Assembly Object for a Class 1 interface.

Attribute ID	Name	Data Type	Data Value	Access Rule
1	Revision	UINT	1	Get
2	Max Instance	UINT	24	Get
3	Num Instances	UINT	24	Get

12.12.2 Instance Definitions

This table shows the Instance Definitions for the Assembly Object for a Class 1 interface for the 8-port models.

Assembly Instance Number	Description	Data Type	Data Values	Access Rule
101	PDI data blocks from Ports 1 to 8. PDO data blocks from ports 1-81	BYTE Array Valid read lengths: 1-576	0-255	Get
102	PDI data blocks from Ports 2 to 8. PDO data blocks from Ports 1-8	BYTE Array Valid read lengths: 1-540	0-255	Get
103	PDI data blocks from Ports 3 to 8. PDO data blocks from Ports 1-8	BYTE Array Valid read lengths: 1-504	0-255	Get
104	PDI data blocks from Port 4-8. PDO data blocks from Ports 1-8	BYTE Array Valid read lengths: 1-468	0-255	Get
105	PDI data blocks from Ports 5-8 PDO data blocks from Ports 1-8	BYTE Array Valid read lengths: 0-432	0-255	Get
106	PDI data blocks from Ports 6 to 8. PDO data blocks from Ports 1-8	BYTE Array Valid read lengths: 0-396	0-255	Get
107	PDI data blocks from Ports 7 to 8. PDO data blocks from Ports 1-8	BYTE Array Valid read lengths: 0-360	0-255	Get
108	PDI data blocks from Port 8. PDO data blocks from Ports 1-8	BYTE Array Valid read lengths: 0-324	0-255	Get
109	PDO data blocks from Ports 1-8	BYTE Array Valid read lengths: 0-288	0-255	Get
110	PDO data blocks from Ports 2-8	BYTE Array Valid read lengths: 0-252	0-255	Get
111	PDO data blocks from Ports 3-8	BYTE Array Valid read lengths: 0-216	0-255	Get
112	PDO data blocks from Port 4-8	BYTE Array Valid read lengths: 0-180	0-255	Get
113	PDO data blocks from Ports 5-8	BYTE Array Valid read lengths: 0-144	0-255	Get
114	PDO data blocks from Ports 6-8	BYTE Array Valid read lengths: 0-108	0-255	Get
115	PDO data blocks from Ports 7-8	BYTE Array Valid read lengths: 0-72	0-255	Get
116	PDO data blocks from Port 8	BYTE Array Valid read lengths: 0-36	0-255	Get
117	PDO data blocks to Ports 1-8	BYTE Array Valid read lengths: 0-288	0-255	Set
118	PDO data blocks to Ports 2-8	BYTE Array Valid read lengths: 0-252	0-255	Set
119	PDO data blocks to Ports 3-8	BYTE Array Valid read lengths: 0-216	0-255	Set

Assembly Instance Number	Description	Data Type	Data Values	Access Rule
120	PDO data blocks to Ports 4-8	BYTE Array Valid read lengths: 0-180	0-255	Set
121	PDO data blocks to Ports 5-8	BYTE Array Valid read lengths: 0-144	0-255	Set
122	PDO data blocks to Ports 6-8	BYTE Array Valid read lengths: 0-108	0-255	Set
123	PDO data blocks to Ports 7-8	BYTE Array Valid read lengths: 0-72	0-255	Set
124	PDO data blocks to Port 8	BYTE Array Valid read lengths: 0-36	0-255	Set

12.12.3 Instance Attributes

This table shows the Instance Attributes for the Assembly Object for a Class 1 interface.

Attribute ID	Name	Data Type	Data Value(s)	Access Rule
3	Data	Array of BYTE	0-255	Get/Set
4	Data Length	UINT	Maximum number of bytes in attribute 3	Get

12.12.4 Common Services

This table shows the Common Services for the Assembly Object for a Class 1 interface.

Service Code	Implemented in Class	Implemented in Instance	Service Name
01 hex	Yes	No	Get_Attributes_All
0E hex	Yes	Yes	Get_Attribute_Single
10 hex	No	Yes	Set_Attribute_Single
02 hex	No	No	Set_Attribute_All

12.12.5 Instance Attribute Definitions: Attribute 3-Request/Write Data

Dependent on the instance number, this is either the PDI data block and/or the PDO data block.

12.12.6 Instance Attribute Definitions: Attribute 4-Data Length

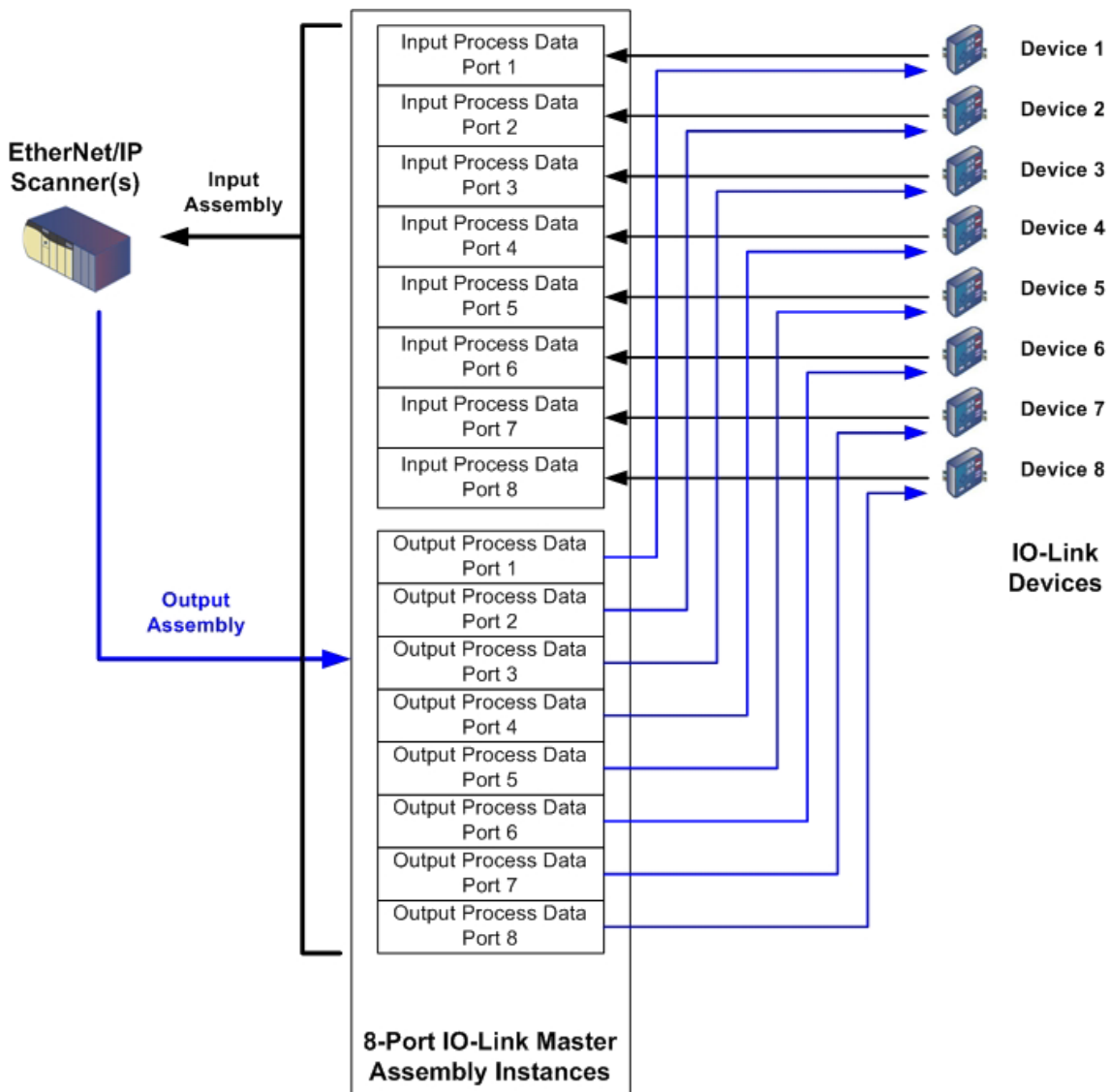
This is the maximum data length for each Assembly instance.

12.12.7 Overview of Assembly Interface

The Assembly interface is designed to:

- Provide access to all Input and Output assemblies.
- Maximize flexibility for the PLC programmer.
- Minimize required PLC and IO-Link communication bandwidth.
- Be as easy to use as possible.

The following diagram illustrates the Assembly instances for an BIOLM.



12.12.8 Grouping of Assembly Instances

In order to minimize the number of required I/O connections, the input and output assembly instances are organized as follows. The Input Assembly instances are grouped into one continuous array with no gaps between the instances. The same is also true for Output Assembly Instances.

Assembly Controller Access

	As- sembly Instance Number	Controller Port 1 Access		Controller Port 2 Access		Controller Port 3 Access		Controller Port 8 Access	
		Read (Input)	Write (Output)	Read (Input)	Write (Output)	Read (Input)	Write (Output)	Read (Input)	Write (Output)
Read (In- put) Pro- cess Data Input	101 (Port 1)	X							
	102 (Port 2)	X		X					
	103 (Port 3)	X		X		X			
	104 (Port 4)	X		X		X			
	105 (Port 5)	X		X		X			
	106 (Port 6)	X		X		X			
	107 (Port 7)	X		X		X			
	108 (Port 8)	X		X		X		X	
Read (In- put) Pro- cess Data Output	109 (Port 1)	X		X		X		X	
	110 (Port 2)	X		X		X		X	
	111 (Port 3)	X		X		X		X	
	112 (Port 4)	X		X		X		X	
	113 (Port 5)	X		X		X		X	
	114 (Port 6)	X		X		X		X	
	115 (Port 7)	X		X		X		X	
	116 (Port 8)								

	As- sembly Instance Number	Controller Port 1 Access		Controller Port 2 Access		Controller Port 3 Access		Controller Port 8 Access	
		Read (Input)	Write (Output)	Read (Input)	Write (Output)	Read (Input)	Write (Output)	Read (Input)	Write (Output)
Write (Output)	117 (Port 1)								
Process Data Out- put	118 (Port 2)		X		X				
	119 (Port 3)		X		X		X		
	120 (Port 4)		X		X		X		
	121 (Port 5)		X		X		X		
	122 (Port 6)		X		X		X		
	123 (Port 7)		X		X		X		
	124 (Port 8)		X		X		X		X

Where:

- All accessible data can be read (input) and written (output) from one I/O connection.
- Controller Read (Input) access:
 - One or more input instances may be read with one I/O connection. (i.e. If addressing the instance 101, all input instances for both PDI and PDO data, 101 to 116 (for 8-port models), may be read in one connection.)
 - The length of the Read (Input) connection can range from 1 to the total length for all input instances.
 - Multiple controllers can read access to the Input Assembly instances at one time.
- Controller Write (Output) access:
 - Only output instances may be written.
 - One or more output instances may be written to with one connection.
 - The length of the Write (Output) connection must be equal to the total length of the output instance(s).
 - Only one controller may have write access to an output instance.



INFO

In order to receive all PDI and PDO data in one Class 1 connection, it may be necessary to decrease the size of one or more PDI and/or PDO blocks via the embedded EtherNet/IP configuration web page.

13 ControlLogix Family – Example PLC Programs

The example RSLogix 5000 PLC program is intended to provide basic working functionality:

- Through a Class 1 connection, provide a PDI data block with the IO-Link port status, auxiliary bit status and the PDI data.
- Through explicit messages, provide the ability to send both read and write ISDU requests to the IO-Link devices and receive the responses.
- Through explicit messages, provide the Device Information block.

Perform the following steps to run the example PLC program on your ControlLogix family PLC.

1. [Import the PLC program into RSLogix 5000 \[▶ 137\]](#)
2. [Configure the Controller \[▶ 137\]](#)
3. [Add the EtherNet/IP Module Interface \[▶ 137\]](#)
4. [Configure the Ethernet Module \[▶ 138\]](#)
5. [Example PLC Program Operation \[▶ 140\]](#)
6. [User Defined Data Structures \[▶ 143\]](#)

13.1 Import the PLC program into RSLogix 5000

Both the standard .ACD file and library file have been provided. If your version of RSLogix 5000 will not open the .ACD file, then you will need to import the .L5K file.

13.2 Configure the Controller

The following are the controller settings used by Baumer to create the example PLC program.



INFO

You may need to change the controller settings to match those of your PLC.

Instruction:

- a) Open the RSLogix 5000 Properties page, click the **General** tab, enter the name, and click the **Change Controller** button.
- b) Select the controller type and click **OK**.
- c) Set the **System Overhead Time Slice** to 50 % and click **OK**.

13.3 Add the EtherNet/IP Module Interface

If the controller has been changed or if the Ethernet module is different, you will need to add the EtherNet/IP module to the PLC program.

You can use this procedure to add the Ethernet module for your PLC in the corresponding slot.

Instruction:

- a) Click **IO Configuration** and select **New Module**.
- b) Select the **Ethernet Module Type** and click **OK**.
- c) Right-click the **Ethernet Module** and select **Properties**.
- d) Set the **Name**, **IP Address**, **Slot**, and **Revision** for your PLC and then click **OK**.

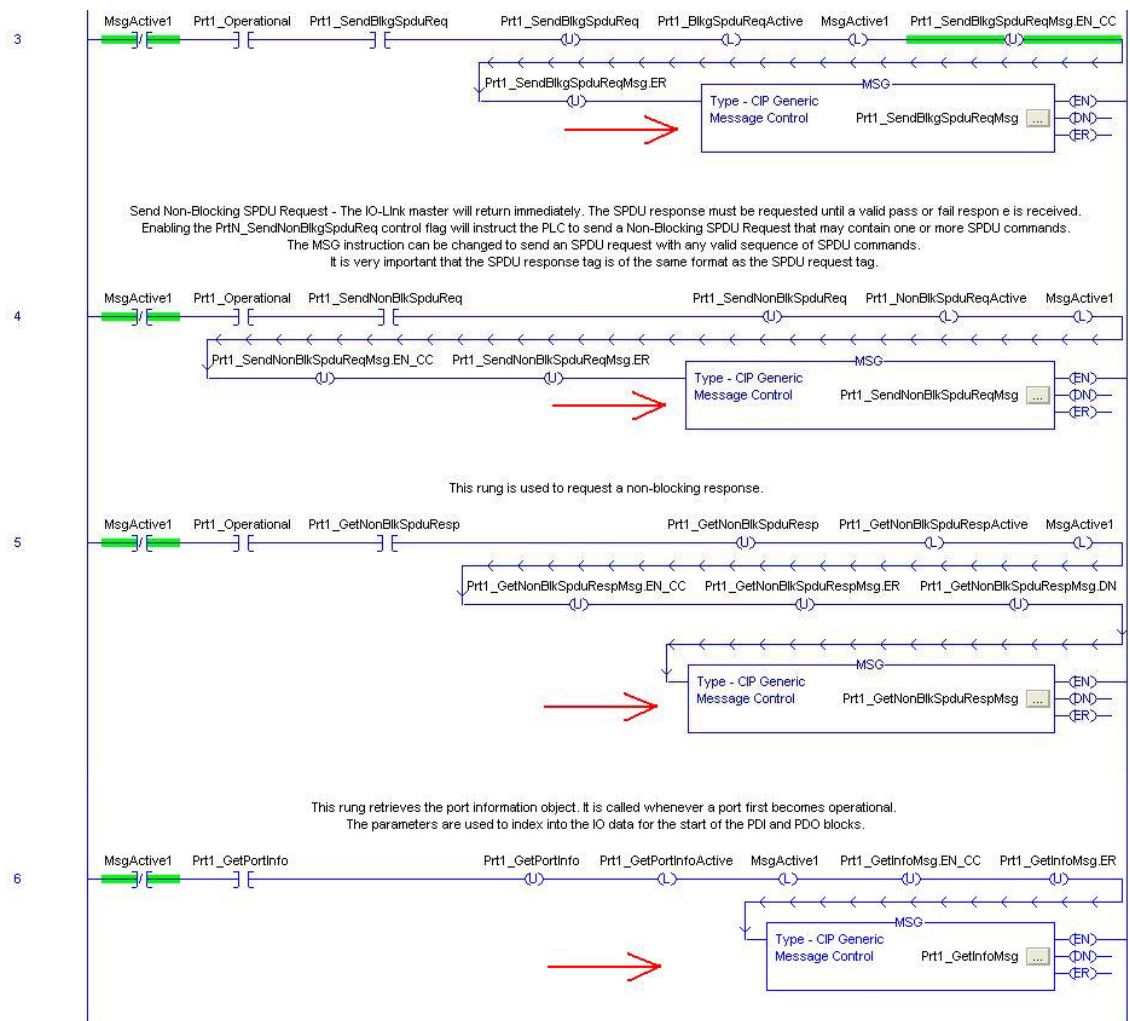
13.4 Configure the Ethernet Module

You can use these procedure as a guideline to configure the Ethernet module.

Instruction:

- a) Right-click the **Ethernet interface module** and select **New Module**.
- b) Select **ETHERNET-MODULE** Generic Ethernet Module and then click **OK**.
- c) Enter the following parameters on the **Module Properties** pane.
 1. Enter **IOLinkMstr** for the module **Name**.
 2. If desired, enter a **Description** for the module.
 3. Select **INPUT Data - INT** (16-bit) for the **Comm Format**.
 4. Enter the IP Address of the BIOLM module.
 5. Enter the **Connection Parameters**:
Enter 101 for the **Input - Assembly Instance**.
Enter 72 for the **Input-Size** (input data length in 16-bit words).
Enter 254 for the **Output - Assembly Instance**.
If not already set to zero, enter 0 for the **Output-Size** (output data length).
Set the **Configuration - Assembly Instance** to 254.
Set the **Configuration-Size** to 0. (There are no configuration parameters).
 6. Click **Next**.
Your version of RSLogix 5000 may only allow one Class 1 connection to a specific Ether-Net/IP device.
- d) Enter the **Requested Packet Interval**.
Enter the interval value that best suits your system. For the example program, it is recommended to set the interval to 10 ms.
Click **OK**.
- e) Review the **Module Information** pane.
- f) Under **Controller Tags**, observe the input tags created for the module. The example PLC program requires the **IOLinkMstr.I** (input data tag). The **IOLinkMstr.C** (configuration tag) is unused and can be ignored.

g) Under **MainProgram**, configure the **Communication Path** for all messages in all four **ProcessIoLinkPortN** subroutines.



h) Enter **IOLinkMstr** for the **Path** for all MSG instructions in all four subroutines.

i) Save the RSLogix5000 program.

j) Download to the PLC.

k) Start the PLC.

l) Click **MainRoutine** and review the RSLogix 5000 screen.

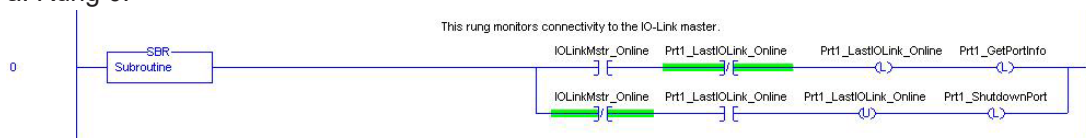
13.5 Example PLC Program Operation

The example PLC Program has been designed to operate with the default BIOLM settings. It provides only Input Process data, but can be modified to also transmit PDO data to the BIOLM. The PLC program performs the following tasks:

1. The **MainProgram** calls each of the four **ProcessIoLinkPortN** subroutines once every 100 ms. The frequency of these calls can be adjusted by changing the **CycleTimer** Preset value on rung 0.
2. Each **ProcessIoLinkPortN** subroutine is designed to handle all status and communication between the EtherNet/IP controller and one port on the BIOLM.

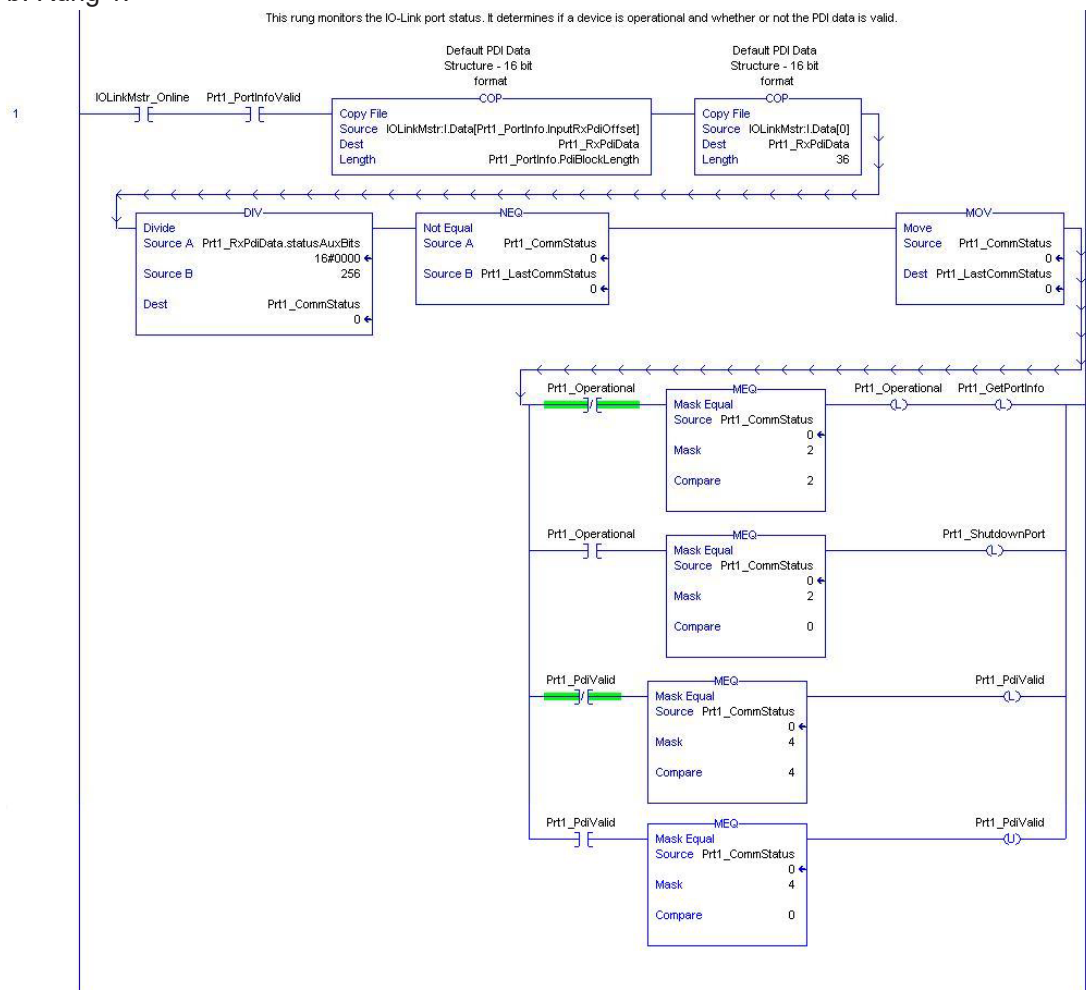


a. Rung 0:



This rung monitors the interface to the IO-Link. It sets the flags that control a port initialization or shutdown.

b. Rung 1:



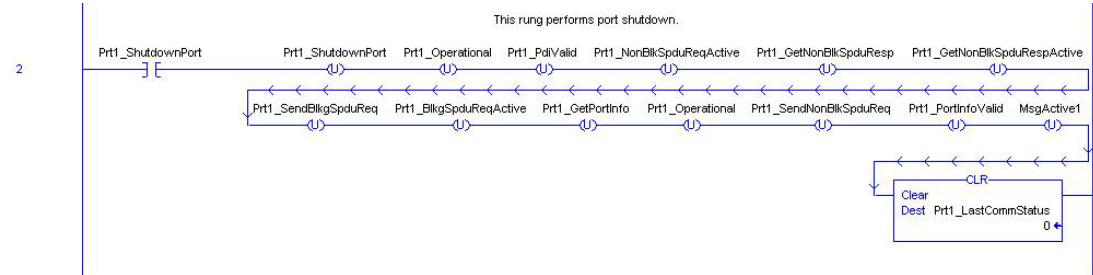
Using the parameters received in the **PortInfo** tag, automatically indexes into the input data block.

Copies the PDI data block into the **PrtN_RxPdiData** tag.

Monitors the IO-Link port status.

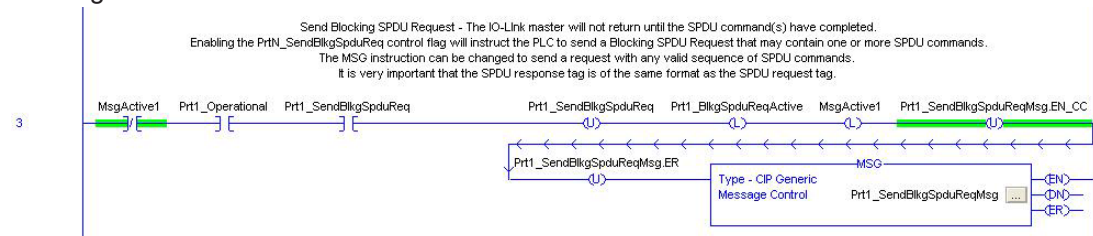
- When the device status transitions to active (2): The **PrtN_Operational** tag is enabled (latched). This enables explicit message communication to the BIOLM on Rungs 3-6.
- When the device status transitions to inactive (0) or initializing (1): The **PrtN_Shutdown** flag is enabled (latched) which causes a full shutdown of the port.

c. Rung 2:



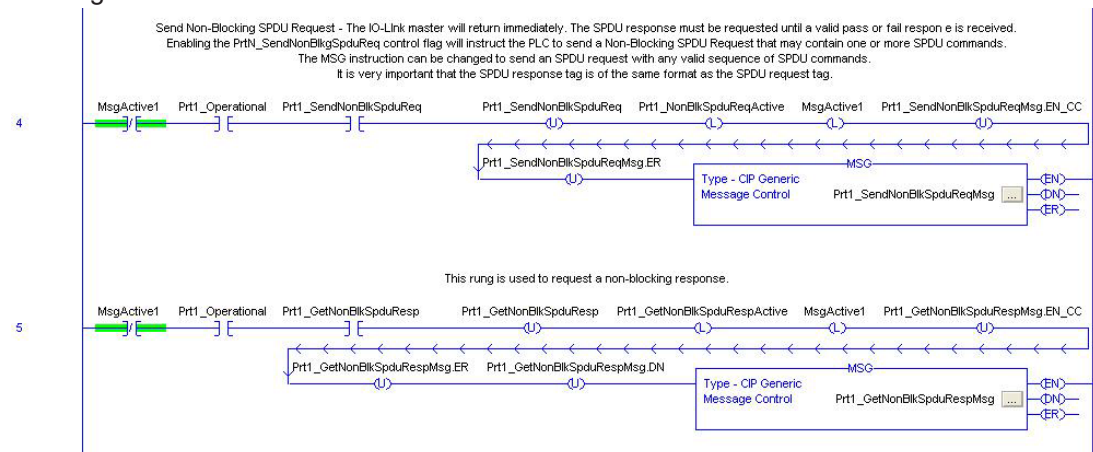
This rung clears all flags necessary to cleanly shut down a port.

d. Rung 3:



When the **PrtN_SendBlkISDUReq** tag is enabled, this rung sends an explicit message to the BIOLM. This message starts a blocking ISDU process where the BIOLM will not return a MSG response until all ISDU commands have been processed.

e. Rung 4-5:



When the **PrtN_SendNonBlkISDUReq** tag is enabled, this rung sends an explicit message to the BIOLM.

- This message starts a blocking ISDU process where the BIOLM returns a MSG response immediately after verifying the ISDU request.
- The BIOLM then processes all ISDU commands within the request.
- The IO-Link returns In-Process statuses until all ISDU commands have been processed.

When the **PrtN_GetNonBlkISDUResp** tag is enabled, this rung sends an explicit message to the BIOLM to retrieve the ISDU response.

Run 7 enables (latches) **GetNonBlkISDUResp** as soon the MSG in Rung 4 has completed successfully.

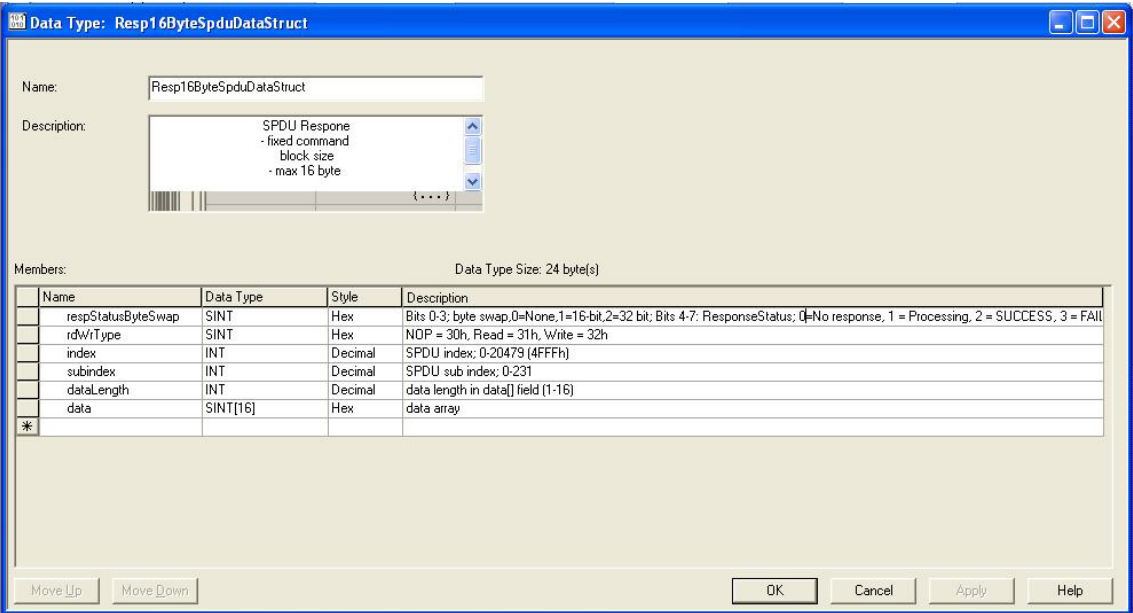
The ISDU response is retrieved until the response received indicates either a success (2) or

13.6 User Defined Data Structures

The following illustrations show a few of the User Defined Data Structure formats.

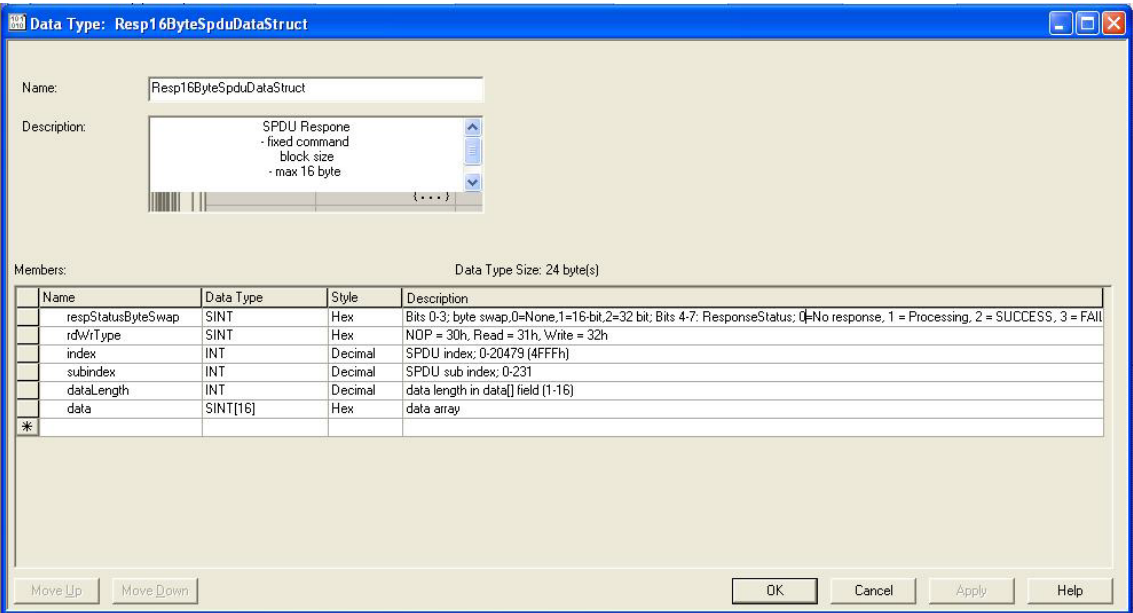
13.6.1 User Defined Structure Example 1

This displays the first example of a User Defined Data Structure.



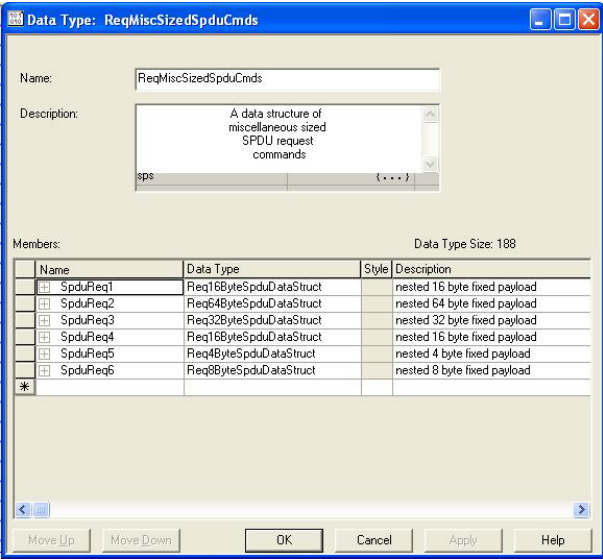
13.6.2 User Defined Structure Example 2

This the second example of the User Defined Structure.



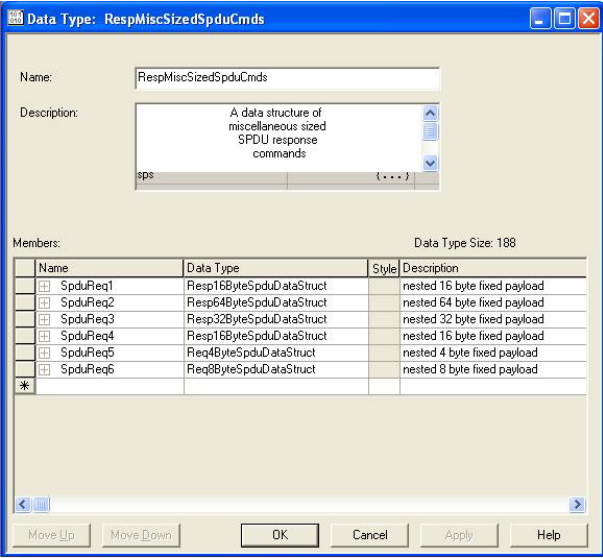
13.6.3 User Defined Structure Example 3

This is the third example of a User Defined Structure.



13.6.4 User Defined Structure Example 4

This is the fourth example of a User Defined Structure.



13.7 Example PLC Program Tag Definitions

The following tag definitions apply to the example BIOLM PLC program.

Prt1_Operational	0		Decimal	BOOL
Prt1_PdiValid	0		Decimal	BOOL
Prt1_PortInfoValid	0		Decimal	BOOL
Prt1_SendBlkgSpduReq	0		Decimal	BOOL
Prt1_SendNonBlkgSpduReq	0		Decimal	BOOL
+ Prt1_GetInfoMsg	{...}	{...}		MESSAGE
+ Prt1_GetNonBlkgSpduRespMsg	{...}	{...}		MESSAGE
+ Prt1_MiscSpduReqs	{...}	{...}		ReqMiscSizedSpd...
+ Prt1_MiscSpduResps	{...}	{...}		RespMiscSizedSp...
+ Prt1_PortInfo	{...}	{...}		IoLinkPortInfoStruct
+ Prt1_RxPdiData	{...}	{...}		RxPdiDataStruct...
+ Prt1_RxPdoData	{...}	{...}		PdoDataStructEv...
+ Prt1_SendBlkgSpduReqMsg	{...}	{...}		MESSAGE
+ Prt1_SendNonBlkgSpduReqMsg	{...}	{...}		MESSAGE
+ Prt1_SpduReqArray4Byte	{...}	{...}		Req4ByteSpduDa...
+ Prt1_SpduRespArray4Byte	{...}	{...}		Resp4ByteSpduD...
+ Prt1_SpduSingleReqData	{...}	{...}		ReqSingleSpduD...
+ Prt1_SpduSingleRespData	{...}	{...}		RespMaxSpduDat...
RepeatSpduRequests	0		Decimal	BOOL
Run	1		Decimal	BOOL

Tag Name	Value Range	Description
PrtN_Operational (init state = false)	BOOL	Controlled by the subroutine, the port operational status. The port must be operational before communication to the IO-Link port is allowed. <ul style="list-style-type: none"> 0 = false 1 = true
PrtN_PdiValid (init state = false)	BOOL	Controlled by the subroutine, the PDI (Input Process data block) valid status. <ul style="list-style-type: none"> 0 = false 1 = true
PrtN_PortInfoValid (init state = false)	BOOL	Controlled by the subroutine, the port information valid status. The port information must be retrieved before the device can become operational. <ul style="list-style-type: none"> 0 = false 1 = true
PrtN_SendBlkgISDUReq (init state = false)	BOOL	Controlled by the User or some other part of a PLC program , directs the subroutine whether to send a blocking ISDU request to the BIOLM. <ul style="list-style-type: none"> 0 = false (do not send message) 1 = true (send message)

Tag Name	Value Range	Description
PrtN_SendNonBlkISDUReq (init state = false)	BOOL	Controlled by the User or some other part of a PLC program, directs the subroutine whether to begin the non-blocking ISDU request process. If true, the subroutine sends a non-blocking ISDU request to the BIOLM. <ul style="list-style-type: none"> 0 = false (do not send message) 1 = true (send message)
PrtN_GetInfoMsg	MSG instruction parameters	Used by the subroutine, the message data used to get the port information from the BIOLM. This tag should not be modified by any other part of the PLC program or through the RSLogix 5000 user interface.
PrtN_GetNon-BlkISDURespMsg	MSG instruction parameters	Used by the subroutine, the message data used to get the non-blocking ISDU response from the BIOLM. This tag should not be modified by any other part of the PLC program or through the RSLogix 5000 user interface.
PrtN_MiscISDUReqs	User defined data structure	Group of ISDU commands used as the default ISDU request format for the example PLC program. Can be modified by the user or other part of a PLC program. Refer to PrtN_MiscISDUReqs ▸ 150 for more information.
PrtN_MiscISDUResps	User defined data structure	Group of ISDU command responses that is returned by the BIOLM after an ISDU request completion. Must be in same overall format as PrtN_MiscISDUReqs . Refer to PrtN_MiscISDUResp ▸ 151 for a complete description.
PrtN_PortInfo	User defined data structure	Contains common device information parameters automatically read by the BIOLM during initialization of the IO-Link device interface.
PrtN_RxPdiData	User defined data structure	This tag contains the latest PDI data block as received from the Class 1 interface. It is updated with every ProcessIoLinkPortN subroutine call. Refer to PrtN_RxPdiData Definition ▸ 149 for more information.
PrtN_SendBlkgISDUReqMsg	MSG instruction parameters	MSG instruction parameters used to send a blocking ISDU Request message. This tag should not be modified by any other part of the PLC program or through the RSLogix 5000 user interface.

Tag Name	Value Range	Description
PrtN_SendNonBlkISDURReqMsg	MSG instruction parameters	MSG instruction parameters used to send a non-blocking ISDU Request message. This tag should not be modified by any other part of the PLC program or through the RSLogix 5000 user interface.
PrtN_ISDURReqArray4Byte	ISDU command parameters	An alternative ISDU request format.
PrtN_ISDURRespArray4Byte	ISDU response parameters	An alternative ISDU response format. Must be used with PrtN_ISDURReqArray4Byte .
PrtN_ISDUSingleReqData	ISDU command parameters	An alternative ISDU request format.
PrtN_ISDUSingleRespData	ISDU response parameters	An alternative ISDU response format. Must be used with PrtN_ISDURReqArray4Byte .
RepeatISDURRequests	BOOL	If enabled, instructs all subroutines to repeat any ISDU requests upon completion. Intended for testing purposes. May be enabled by end user.
Run	BOOL	MainProgram only. Allows the ProcessIoLinkPortN subroutine calls if enabled (1). Prevents the ProcessIoLinkPortN subroutine calls if disabled (0).

13.7.1 PrtN_DeviceInformation Definition

The BIOLM requests this information from the IO-Link device during the IO-Link device initialization process. It is then made accessible via explicit messages. The example PLC program automatically requests this information block when the device status transitions to active.

Parameter Name	Data	Description
VendorName	64 ASCII characters	Requested from ISDU data block index 16, contains the Vendor Name description of the IO-Link device.
VendorText	64 ASCII characters	Requested from ISDU data block index 17, contains the Vendor Text description of the IO-Link device.
ProductName	64 ASCII characters	Requested from ISDU data block index 18, contains the Product Name description of the IO-Link device.
ProductId	64 ASCII characters	Requested from ISDU data block index 19, contains the Product ID description of the IO-Link device.
ProductText	64 ASCII characters	Requested from ISDU data block index 20, contains the Product Text description of the IO-Link device.
SerialNum	16 ASCII characters	Requested from ISDU data block index 21, contains the Vendor Specific Serial Number of the IO-Link device.
HardwareRev	64 ASCII characters	Requested from ISDU data block index 22, contains the Hardware Revision of the IO-Link device.
FirmwareRev	64 ASCII characters	Requested from ISDU data block index 23, contains the Firmware Revision of the IO-Link device.
DevicePdiLength	INT	Length of valid PDI data from IO-Link device or port (if not in I/O Link mode).
DevicePdoLength	INT	Length of valid PDO data that can accepted by the IO-Link device or port (if not in I/O Link mode).
PdiBlockLength	INT	The configured PDI data block length. This includes the header bytes and any PDI data.
PdoBlockLength	INT	The configured PDO data block length. This includes the header bytes and any PDO data.
InputRxPdiOffset	INT	Provides the index into the Class 1 I/O input data received from the BIOLM. The index corresponds to the configured PDI data format of the port on the BIOLM. Used to automatically index into the input data and retrieve the PDI data block.
InputRxPdoOffset	INT	Provides the index into the Class 1 I/O input data received from the BIOLM. The index corresponds to the configured PDO data format of the port on the BIOLM. Used to automatically index into the input data and retrieve the PDO data block.
OutputPdoOffset	INT	Provides the index into the Class 1 I/O output data sent to the BIOLM. The index corresponds to the configured PDO data format of the port on the BIOLM. Used to automatically index into the output data and transmit the PDO data block.
ControlFlags	Bit-mapped INT	<ul style="list-style-type: none"> ■ Bit 0 (01h):

Parameter Name	Data	Description
		<ul style="list-style-type: none"> 1 = Indicates that the event code to clear is expected in the PDO block. 0 = Indicates that the event code to clear is not expected in the PDO block. The PDO data block only contains PDO data.
		<ul style="list-style-type: none"> Bit 1 (02h): <ul style="list-style-type: none"> 1 = Indicates that the IO-Link device is SIO mode capable. 0 = Indicates that the IO-Link device is not SIO mode capable.

13.7.2

PrtN_RxPdiData Definition

The PDI data block is received from the BIOLM over a Class 1 I/O connection. The data is then copied into the PDI data block in each subroutine.

- Prt1_RxPdiData	{...}	{...}		RxPdiDataStruct_...
+ Prt1_RxPdiData.statusAuxBits	16#0000		Hex	INT
+ Prt1_RxPdiData.event	16#0000		Hex	INT
- Prt1_RxPdiData.pdiData	{...}	{...}	Hex	INT[16]
+ Prt1_RxPdiData.pdiData[0]	16#0000		Hex	INT
+ Prt1_RxPdiData.pdiData[1]	16#0000		Hex	INT
+ Prt1_RxPdiData.pdiData[2]	16#0000		Hex	INT
+ Prt1_RxPdiData.pdiData[3]	16#0000		Hex	INT
+ Prt1_RxPdiData.pdiData[4]	16#0000		Hex	INT
+ Prt1_RxPdiData.pdiData[5]	16#0000		Hex	INT
+ Prt1_RxPdiData.pdiData[6]	16#0000		Hex	INT
+ Prt1_RxPdiData.pdiData[7]	16#0000		Hex	INT
+ Prt1_RxPdiData.pdiData[8]	16#0000		Hex	INT
+ Prt1_RxPdiData.pdiData[9]	16#0000		Hex	INT
+ Prt1_RxPdiData.pdiData[10]	16#0000		Hex	INT
+ Prt1_RxPdiData.pdiData[11]	16#0000		Hex	INT
+ Prt1_RxPdiData.pdiData[12]	16#0000		Hex	INT
+ Prt1_RxPdiData.pdiData[13]	16#0000		Hex	INT
+ Prt1_RxPdiData.pdiData[14]	16#0000		Hex	INT
+ Prt1_RxPdiData.pdiData[15]	16#0000		Hex	INT

Refer to section on Input Process data format.

13.7.3 PrtN_MiscISDUReqs

This tag is used as the default ISDU request. It contains several ISDU commands that are configured to read standard ISDU blocks supported by most IO-Link devices. This User Defined Structure may be changed to include any set of ISDU commands. The only constraint is that the entire Request and response must be no larger than the maximum MSG instruction payload of 500 bytes.

Pr1_MiscSpduReqs	{...}	{...}		ReqMiscSizedSpd...
Pr1_MiscSpduReqs.SpduReq1	{...}	{...}		Req16ByteSpduD...
Pr1_MiscSpduReqs.SpduReq1.byteSwap	16#00		Hex	SINT
Pr1_MiscSpduReqs.SpduReq1.rdWrType	16#31		Hex	SINT
Pr1_MiscSpduReqs.SpduReq1.index	0		Decimal	INT
Pr1_MiscSpduReqs.SpduReq1.subindex	0		Decimal	INT
Pr1_MiscSpduReqs.SpduReq1.dataLen...	16		Decimal	INT
Pr1_MiscSpduReqs.SpduReq1.data	{...}	{...}	Hex	SINT[16]
Pr1_MiscSpduReqs.SpduReq2	{...}	{...}		Req64ByteSpduD...
Pr1_MiscSpduReqs.SpduReq2.byteSwap	16#00		Hex	SINT
Pr1_MiscSpduReqs.SpduReq2.rdWrType	16#51		Hex	SINT
Pr1_MiscSpduReqs.SpduReq2.index	16		Decimal	INT
Pr1_MiscSpduReqs.SpduReq2.subindex	0		Decimal	INT
Pr1_MiscSpduReqs.SpduReq2.dataLen...	64		Decimal	INT
Pr1_MiscSpduReqs.SpduReq2.data	{...}	{...}	Hex	SINT[64]
Pr1_MiscSpduReqs.SpduReq3	{...}	{...}		Req32ByteSpduD...
Pr1_MiscSpduReqs.SpduReq3.byteSwap	16#00		Hex	SINT
Pr1_MiscSpduReqs.SpduReq3.rdWrType	16#41		Hex	SINT
Pr1_MiscSpduReqs.SpduReq3.index	18		Decimal	INT
Pr1_MiscSpduReqs.SpduReq3.subindex	0		Decimal	INT
Pr1_MiscSpduReqs.SpduReq3.dataLen...	32		Decimal	INT
Pr1_MiscSpduReqs.SpduReq3.data	{...}	{...}	Hex	SINT[32]
Pr1_MiscSpduReqs.SpduReq4	{...}	{...}		Req16ByteSpduD...
Pr1_MiscSpduReqs.SpduReq4.byteSwap	16#00		Hex	SINT
Pr1_MiscSpduReqs.SpduReq4.rdWrType	16#31		Hex	SINT
Pr1_MiscSpduReqs.SpduReq4.index	21		Decimal	INT
Pr1_MiscSpduReqs.SpduReq4.subindex	0		Decimal	INT
Pr1_MiscSpduReqs.SpduReq4.dataLen...	16		Decimal	INT
Pr1_MiscSpduReqs.SpduReq4.data	{...}	{...}	Hex	SINT[16]
Pr1_MiscSpduReqs.SpduReq5	{...}	{...}		Req4ByteSpduD a...
Pr1_MiscSpduReqs.SpduReq5.byteSwap	16#00		Hex	SINT
Pr1_MiscSpduReqs.SpduReq5.rdWrType	16#11		Hex	SINT
Pr1_MiscSpduReqs.SpduReq5.index	22		Decimal	INT
Pr1_MiscSpduReqs.SpduReq5.subindex	0		Decimal	INT
Pr1_MiscSpduReqs.SpduReq5.dataLen...	4		Decimal	INT
Pr1_MiscSpduReqs.SpduReq5.data	{...}	{...}	Hex	SINT[4]
Pr1_MiscSpduReqs.SpduReq6	{...}	{...}		Req8ByteSpduD a...
Pr1_MiscSpduReqs.SpduReq6.byteSwap	16#00		Hex	SINT
Pr1_MiscSpduReqs.SpduReq6.rdWrType	16#21		Hex	SINT
Pr1_MiscSpduReqs.SpduReq6.index	23		Decimal	INT
Pr1_MiscSpduReqs.SpduReq6.subindex	0		Decimal	INT
Pr1_MiscSpduReqs.SpduReq6.dataLen...	8		Decimal	INT
Pr1_MiscSpduReqs.SpduReq6.data	{...}	{...}	Hex	SINT[8]

13.7.4 PrtN_MiscISDUResp

This tag contains the response to the ISDU request. It must be of the same size and structure as the request **structure**.

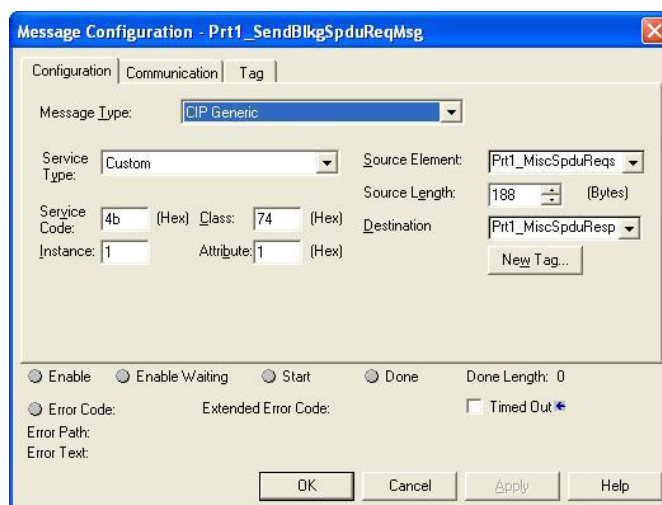
[-] Prt1_MiscSpduResps	{...}	{...}		RespMiscSizedSp...
[-] Prt1_MiscSpduResps.SpduReq1	{...}	{...}		Resp16ByteSpdu...
[+] Prt1_MiscSpduResps.SpduReq1.respSt...	16#00		Hex	SINT
[+] Prt1_MiscSpduResps.SpduReq1.rdwT...	16#00		Hex	SINT
[+] Prt1_MiscSpduResps.SpduReq1.index	0		Decimal	INT
[+] Prt1_MiscSpduResps.SpduReq1.subindex	0		Decimal	INT
[+] Prt1_MiscSpduResps.SpduReq1.dataLe...	0		Decimal	INT
[+] Prt1_MiscSpduResps.SpduReq1.data	{...}	{...}	Hex	SINT[16]
[+] Prt1_MiscSpduResps.SpduReq2	{...}	{...}		Resp64ByteSpdu...
[+] Prt1_MiscSpduResps.SpduReq3	{...}	{...}		Resp32ByteSpdu...
[+] Prt1_MiscSpduResps.SpduReq4	{...}	{...}		Resp16ByteSpdu...
[+] Prt1_MiscSpduResps.SpduReq5	{...}	{...}		Req4ByteSpduDa...
[+] Prt1_MiscSpduResps.SpduReq6	{...}	{...}		Req8ByteSpduDa...

13.7.5 Using Other ISDU Request/Response Command Formats

Other ISDU request/response formats may be used instead of the default request command set. The following steps demonstrate how to change the ISDU request/response formats:

Instruction:

- If one ISDU request/response is required, create a new request and response tag with any of the defined ISDU User Defined structures. The one requirement is that the request and response formats must be the same. For example, if a 16 byte nested format is use for the request, then a 16 byte nested response structure must be used.
- If multiple ISDU requests of the same nested lengths are required, created request and response arrays of the same User Defined format.
- If multiple ISDU requests of different nested lengths are required, create new User Defined Data Structures for the request and response containing user defined command structures. Then create tags using the new user Defined data structures. You may also want to modify the **ReqMiscSizedISDUCmds** and **RespMiscSizedISDUCmds** User Defined data structures.
- Modify the appropriate **MSG** instruction settings:



- Change the **Source Element** to that of the new ISDU request tag.
- Change the **Source Length** to that of the new **Source Element**. That information is often displayed on the User Defined Structure definition pane.
- Change the **Destination** to that of the new response tag.

14 SLC/PLC-5/MicroLogix Interface

The BIOLM provides support for the SLC, PLC-5 and MicroLogix PLCs. The following features are supported:

- Rx PDI data, both Polling and Write-to-File modes.
- Tx PDO data, both PLC-Writes and Read-From-File modes.
- PCCC based messages transferred by means of the PCCC CIP object, including:
 - SLC Typed Read Message
 - SLC Typed Write Message
 - PLC-5 Typed Read Message (Logical ASCII address format)
 - PLC-5 Typed Write Message (Logical ASCII address format)
- Receive, transmit and statistics data.
- Standard PLC-5/SLC file naming conventions.
- Controlled message rate to the PLC when operating in the Write-to-File receive method. This is accomplished by setting the **Maximum PLC Update Rate**.

The primary differences between the PLC-5/SLC interface and the ControlLogix interfaces are:

- Since the PLC-5 and SLC PLCs operate on a file memory system, the PLC-5/SLC interface provides Write-to-File and Read-from-File communication methods in place of Write-to-Tag and Read-from-Tag communication methods. The Write-to-File methods operate in a very similar manner to the Write-to-Tag method available for the ControlLogix family of PLCs.
- Polling is performed through the PLC-5/SLC specific messages instead of accessing the Serial Port Data Transfer object.
- When configuring the BIOLM to operate in Write-to-File or Read-from-File, enter the file name starting with an N (i.e. N10:0).



INFO

While ControlLogix PLCs support the SLC and PLC-5 messages, using those messages on ControlLogix PLCs is not recommended due to data size and performance considerations.

14.1 Requirements

Your PLC-5/SLC/MicroLogix PLC must support:

- MultiHop
- ControlLogix devices
- EtherNet/IP

The following tables list PLCs that support EtherNet/IP and the required firmware version for each PLC.



INFO

Older versions of the PLC firmware may or may not provide EtherNet/IP functionality. You must verify that an older version of the PLC firmware provides EtherNet/IP functionality before you can use it with BIOLM.

14.2 PLC-5 and SLC 5/05 PLC Requirements

The following PLCs support Ethernet/IP.

14.2.1 SLC 5/05

Models	Catalog Numbers	Required Firmware Version for Ethernet/IP
SLC 5/05	1747-L551	Series A: FRN 5 or later
	1747-L552	Series C: FRN 3 or later
	1747-L553	

Reference: SLC 500 Instruction Set, Appendix A Firmware History, Rockwell Publication 1747-RM001D-EN-P.

14.2.2 PLC-5

Models	Catalog Numbers	Required Firmware Version for Ethernet/IP
Ethernet PLC-5	1785-L20E	Base Ethernet/IP functionality: <ul style="list-style-type: none"> Series C: Revision N and later Series D: Revision E and later Series E: Revision D and later Full Ethernet/IP Compliance: <ul style="list-style-type: none"> Series C: Revision R and later Series D: Revision H and later Series E: Revision G and later
	1785-L40E	
	1785-L80E	
Enhanced PLC-5 Attached to Ethernet Module	1785-L11B	Series B: Revision N.1 or later Series C: Revision N or later Series D: Revision E or later Series E: Revision D or later
	1785-L20B	
	1785-L30B	
	1785-L40B	
	1785-L40L	
	1785-L60B	
	1785-L60L	
ControlNet PLC-5 Attached to Ethernet Module	1785-L80B	
	1785-L20C15	
	1785-L40C15	
	1785-L60C15	
Ethernet Module	1785-L80C15	All revisions
	1785-Enet	
		Series B: <ul style="list-style-type: none"> Base Ethernet/IP functionality: All Revisions Full Ethernet/IP Compliance: Revision D and later

References:

- Enhanced & Ethernet PLC-5 Series and Enhancement History, Rockwell Publication G19099
- ControlNet Processor Phase, Series, and Enhancement History, Rockwell Publication G19102
- PLC-5 Programmable Controllers System Selection Guide, Rockwell Publication 1785-SG001A-EN-P
- Ethernet Interface Module Series B, Revision D Product Release Notes, Rockwell Publication 1785-RN191E-EN-P

**INFO**

Older versions of firmware may or may not provide Ethernet/IP functionality.

14.3 PLC-5 and SLC Messages

The following PCCC messages are supported for the PLC-5 and SLC 5/05 PLCs.

Message Type	PCCC Message ID	Maximum Message Size	Maximum Serial Packet Size
SLC Typed Read	162	CLX: 242 SINTs (121 INTs) SLC: 206 SINTs (103 INTs) PLC-5: 240 SINTs (120 INTs)	CLX: 238 SINTs (119 INTs) SLC: 202 SINTs (101 INTs) PLC-5: 236 SINTs (118 INTs)
SLC Typed Write	170	CLX: 220 SINTs (110 INTs) SLC: 206 SINTs (103 INTs) PLC-5: 238 SINTs (119 INTs)	216 SINTs (108 INTs) SLC: 202 SINTs (101 INTs) PLC-5: 234 SINTs (117 INTs)
PLC-5 Typed Read	104	CLX: 234 SINTs (117 INTs) SLC: 252 SINTs (126 INTs) PLC-5: 238 SINTs (119 INTs)	230 SINTs (115 INTs) SLC: 248 SINTs (124 INTs) PLC-5: 234 SINTs (117 INTs)
PLC-5 Typed Write	103	CLX: 226 SINTs (113 INTs) SLC: 226 SINTs (113 INTs) PLC-5: 224 SINTs (112 INTs)	CLX: 222 SINTs (111 INTs) SLC: 222 SINTs (111 INTs) PLC-5: 220 SINTs (110 INTs)

The Receive Port Information is provided in one continuous file. The following file addresses are used to retrieve the various parameters.

	IO-Link Port 1	IO-Link Port 2	IO-Link Port 3	IO-Link Port 4	Access	Length
PDI Data Block	N10:0	N20:0	N30:0	N40:0	Read-Only	Configurable per port (see below for details).
Receive PDO Data Block	N11:0	N21:0	N31:0	N41:0	Read-Only	Configurable per port (see below for details).
Transmit PDO Data Block	N12:0	N22:0	N32:0	N42:0	Write-Only	Configurable per port (see below for details).
Receive ISDU Response	N13:0	N23:0	N33:0	N43:0	Read-Only	4 INTs to Max Msg Size
Transmit ISDU Request	N14:0	N24:0	N34:0	N44:0	Write-Only	4 INTs to Max Msg Size
<i>Port Information Block (Continuous Block)</i>						464 Bytes (232 INTs)
Vendor Name	N15:0	N25:0	N35:0	N45:0	Read	64 Chars (32 INTs)
Vendor Text	N15:32	N25:32	N35:32	N45:32	Read	64 Chars (32 INTs)
Product Name	N15:64	N25:64	N35:64	N45:64	Read	64 Chars (32 INTs)
Product ID	N15:96	N25:96	N35:96	N45:96	Read	64 Chars (32 INTs)
Product Text	N15:128	N25:128	N35:128	N45:128	Read	64 Chars (32 INTs)
Serial Number	N15:160	N25:160	N35:160	N45:160	Read	16 Chars (8 INTs)
Hardware Revision	N15:168	N25:168	N35:168	N45:168	Read	64 Chars (32 INTs)
Firmware Revision	N15:200	N25:200	N35:200	N45:200	Read	64 Chars (32 INTs)

This table provides information for 8-port models.

	IO-Link Port 5	IO-Link Port 6	IO-Link Port 7	IO-Link Port 8	Access	Length
PDI Data Block	N50:0	N60:0	N70:0	N80:0	Read-Only	Configurable per port (see below for details).
Receive PDO Data Block	N51:0	N61:0	N71:0	N81:0	Read-Only	Configurable per port (see below for details).
Transmit PDO Data Block	N52:0	N62:0	N72:0	N82:0	Write-Only	Configurable per port (see below for details).
Receive ISDU Response	N53:0	N63:0	N73:0	N83:0	Read-Only	4 INTs to Max Msg Size
Transmit ISDU Request	N54:0	N64:0	N74:0	N84:0	Write-Only	4 INTs to Max Msg Size
<i>Port Information Block (Continuous Block)</i>						464 Bytes (232 INTs)
Vendor Name	N55:0	N65:0	N75:0	N85:0	Read	64 Chars (32 INTs)
Vendor Text	N55:32	N65:32	N75:32	N85:32	Read	64 Chars (32 INTs)
Product Name	N55:64	N65:64	N75:64	N85:64	Read	64 Chars (32 INTs)
Product ID	N55:96	N65:96	N75:96	N85:96	Read	64 Chars (32 INTs)
Product Text	N55:128	N65:128	N75:128	N85:128	Read	64 Chars (32 INTs)
Serial Number	N55:160	N65:160	N75:160	N85:160	Read	16 Chars (8 INTs)
Hardware Revision	N55:168	N65:168	N75:168	N85:168	Read	64 Chars (32 INTs)
Firmware Revision	N55:200	N65:200	N75:200	N85:200	Read	64 Chars (32 INTs)

14.4 Process Data (PDI and PDO) Access via PCCC Messages

The process data has been grouped together in order to minimize the number of PCCC messages required to interface to the BIOLM. The PDI and PDO data for multiple ports can be received or transmitted by one message.

	File Number	Controller Port 1 Access		Controller Port 2 Access		Controller Port 3 Access		Controller Port 4 Access	
		Read (Input)	Write (Output)	Read (Input)	Write (Output)	Read (Input)	Write (Output)	Read (Input)	Write (Output)
Read (Input) Process Data Input	N10:0 (Port 1)	X							
	N20:0 (Port 2)	X		X					
	N30:0 (Port 3)	X		X		X			
	N40:0 (Port 4)	X		X		X		X	
	N50:0 (Port 5)	X		X		X		X	
	N60:0 (Port 6)	X		X		X		X	
	N70:0 (Port 7)	X		X		X		X	
	N80:0 (Port 8)	X		X		X		X	
Read (Input) Process Data Output	N11:0 (Port 1)	X							
	N21:0 (Port 2)	X		X					
	N31:0 (Port 3)	X		X		X			
	N41:0 (Port 4)	X		X		X		X	
	N51:0 (Port 5)	X		X		X		X	
	N61:0 (Port 6)	X		X		X		X	
	N71:0 (Port 7)	X		X		X		X	
	N81:0 (Port 8)	X		X		X		X	

	File Number	Controller Port 1 Access		Controller Port 2 Access		Controller Port 3 Access		Controller Port 4 Access	
		Read (Input)	Write (Output)	Read (Input)	Write (Output)	Read (Input)	Write (Output)	Read (Input)	Write (Output)
Write (Output) Process Data Output	N12:0 (Port 1)		X						
	N22:0 (Port 2)		X		X				
	N32:0 (Port 3)								
	N42:0 (Port 4)								
	N52:0 (Port 5)		X		X		X		X
	N62:0 (Port 6)		X		X		X		X
	N72:0 (Port 7)		X		X		X		X
	N82:0 (Port 8)		X		X		X		X

PCCC Read/Write Access where:

- All PDI data can be read with one PCCC read message.
- All PDO data can be read with one PCCC read message.
- All PDO data can be written with one PCCC write message.
- Controller Read access:
 - The PDI data from one or more ports may be read with one message. (That is, if addressing Port 1, N10:0, ports one to four may be read in one message.)
 - The PDO data from one or more ports may be read with one message. (That is, if addressing Port 1, N11:0, ports one to four may be read in one message.)
 - Partial PDI and PDO data reads are allowed.
 - The length of the Read message can range from 1 to the total, configured PDI or PDO length for all ports starting at the addressed port.
- Controller Write (Output) access:
 - Only PDO data may be written.
 - The PDO data for one or more ports may be written with one message.
 - Partial PDO data writes are not allowed.
 - The length of the Write message must be equal to the total of the configured PDO lengths for all ports to be written. The one exception is that the data length of the last port to be written must be equal to or greater than the device PDO length for that port.

15 EDS Files

This chapter discusses the following topics:

- [Downloading the Files \[► 159\]](#)
- [Configuring RSLinx \[► 159\]](#)
- [Adding EDS Files to Rockwell Software \[► 160\]](#)



INFO

The AOI files and documentation (bundled with the files) can be downloaded from the Baumer web site.

15.1 Overview

You do not need to add the BIOLM to Rockwell software for normal BIOLM-to-PLC communications. However, you can easily add the BIOLM and its associated Electronic Data Sheet (EDS) files to Rockwell software.

The files named *BIOLM_*.ico* are icon files and files named *BIOLM_dd_NNNN-x.xx.eds* are ODVA electronic data sheet files where:

- *dd* is the model name
- *NNNN* is the product ID number
- *x.xx* is the version number

15.2 Downloading the Files

You can download the EDS files provided for the BIOLM from the Baumer web site.

15.3 Configuring RSLinx

You can use these steps to add the BIOLM to RSLinx.

Instruction:

- a) Open RSLinx.
- b) If there is not an EtherNet/IP driver configured, use these steps:
 1. Under **Communications**, select **Configure Drivers**.
 2. Under **Available Drivers**, select **EtherNet/IP Driver**.
 3. Select **Add New**.
 4. Use the default driver name or type your own driver name and click **OK** to continue.
- c) Select the adapter of the network card used to communicate with the BIOLM and click **OK**.
- d) Select **RSWho** to verify that **RSLinx** can communicate with the BIOLM.



INFO

A yellow question mark appears by the BIOLM(s) in the **RSWho** window when the associated EDS file(s) are not installed.

15.4 Adding EDS Files to Rockwell Software

You can use this procedure to add the EDS files to Rockwell software.

Instruction:

- a) Open the **EDS Hardware Installation Tool**. (Select **Start | All Programs | Rockwell Software | RSLinx Tools**.)
- b) Click **Add**.
- c) Click **Register a directory of EDS files**.
- d) Browse to the **Baumer/EtherNet/IP** directory and click Next to continue.
- e) Verify that there is a green check beside each EDS file name and select **Next** to continue.
- f) Click **Finish** to exit.

If RSLinx does not display the device after adding BIOLM and the EDS files to RSLinx, perform the following procedure:

Instruction:

- a) Select **File | Exit and Shutdown** to exit and shutdown RSLinx.
- b) Remove the following files from your hard drive:
 - `\Program Files\Rockwell Software\RSCOMMON\Harmony.hrc`
 - `\Program Files\Rockwell Software\RSCOMMON\Harmony.rsh`
- c) Restart RSLinx. The BIOLM or BIOLMs should now appear with the associated icon or icons.

16 Modbus/TCP Interface

The BIOLM provides a slave-mode Modbus/TCP interface that provides:

- Read access to the Process Data Input (PDI) and Process Data Output (PDO) data blocks for each IO-Link port
- Write access to the PDO data block for each IO-Link port
- Write access to send ISDU requests to each IO-Link port
- Read access to ISDU responses from each IO-Link port
- Read access to the Port Information Block for each IO-Link port

The Modbus interface is disabled by default. To enable Modbus/TCP:

Instruction:

- a) Click **Configuration** | **Modbus/TCP**.
- b) Click the **EDIT** button in the **Modbus/TCP Configuration** table.
- c) Select **enable** in the **Modbus Enable** drop box.
- d) Click the **SAVE** button.

Refer to [Functionality Descriptions](#) [► 87] for detailed information about process data block descriptions, event handling, and ISDU handling:

- [Input Process Data Block-8 Bit Data Format](#) [► 88]
- [Input Process Data Block-16 Bit Data Format](#) [► 89]
- [Input Process Data Block-32 Bit Data Format](#) [► 89]
- [Output Process Data Block-8 Bit \(SINT\) Data Format](#) [► 90]
- [Output Process Data Block-16 Bit \(INT\) Data Format](#) [► 91]
- [Output Process Data Block-32 Bit \(DINT\) Data Format](#) [► 92]
- [Event Handling](#) [► 93]
- [ISDU Handling](#) [► 98]

16.1 Modbus Function Codes

This table shows the supported Modbus function codes:

Message Type	Function Code	Maximum Message Size
Read Holding Registers	3	250 Bytes (125 Words)
Write Single Register	6	2 bytes (1 Word)
Write Multiple Registers	16 (10 hex)	246 Bytes (123 Words)
Read/Write Holding Registers	23 (17 hex)	Write: 242 bytes (121 Words) Read: 246 bytes (123 Words)

16.2 Modbus Address Definitions

The address definitions for the Modbus/TCP interface are shown in the following tables:

	IO-Link Port 1	IO-Link Port 2	IO-Link Port 3	IO-Link Port 4	Access	Length
Multiple Port PDI Data Block(s)	999 (Base 0) 1000 (Base 1)	1999 (Base 0) 2000 (Base 1)	2999 (Base 0) 3000 (Base 1)	3999 (Base 0) 4000 (Base 1)	Read-Only	Configurable per port(s)
Port Specific PDI Data Block	1000 (Base 0) 1001 (Base 1)	2000 (Base 0) 2001 (Base 1)	3000 (Base 0) 3001 (Base 1)	4000 (Base 0) 4001 (Base 1)	Read-Only	Configurable per port
Multiple Port PDO Data Block(s)	1049 (Base 0) 1050 (Base 1)	2049 (Base 0) 2050 (Base 1)	3049 (Base 0) 3050 (Base 1)	4049 (Base 0) 4050 (Base 1)	Read/Write	Configurable per port(s)
Port Specific PDO Data Block	1050 (Base 0) 1051 (Base 1)	2050 (Base 0) 2051 (Base 1)	3050 (Base 0) 3051 (Base 1)	4050 (Base 0) 4051 (Base 1)	Read/Write	Configurable per port
Receive ISDU Response	1100 (Base 0) 1101 (Base 1)	2100 (Base 0) 2101 (Base 1)	3100 (Base 0) 3101 (Base 1)	4100 (Base 0) 4101 (Base 1)	Read-Only	4 to 125 Words
Transmit ISDU Request	1300 (Base 0) 1301 (Base 1)	2300 (Base 0) 2301 (Base 1)	3300 (Base 0) 3301 (Base 1)	4300 (Base 0) 4301 (Base 1)	Write-Only	4 to 123 Words
<i>Port Information Block (Continuous Block)</i>						232 Words
Vendor Name	1500 (Base 0) 1501 (Base 1)	2500 (Base 0) 2501 (Base 1)	3500 (Base 0) 3501 (Base 1)	4500 (Base 0) 4501 (Base 1)	Read-Only	64 Chars 32 Words
Vendor Text	1532 (Base 0) 1533 (Base 1)	2532 (Base 0) 2533 (Base 1)	3532 (Base 0) 3533 (Base 1)	4532 (Base 0) 4533 (Base 1)	Read-Only	64 Chars 32 Words
Product Name	1564 (Base 0) 1565 (Base 1)	2564 (Base 0) 2565 (Base 1)	3564 (Base 0) 3565 (Base 1)	4564 (Base 0) 4565 (Base 1)	Read-Only	64 Chars 32 Words
Product Id	1596 (Base 0) 1597 (Base 1)	2596 (Base 0) 2597 (Base 1)	3596 (Base 0) 3597 (Base 1)	4596 (Base 0) 4597 (Base 1)	Read-Only	64 Chars 32 Words
Product Text	1628 (Base 0) 1629 (Base 1)	2628 (Base 0) 2629 (Base 1)	3628 (Base 0) 3629 (Base 1)	4628 (Base 0) 4629 (Base 1)	Read-Only	64 Chars 32 Words
Serial Number	1660 (Base 0) 1661 (Base 1)	2660 (Base 0) 2661 (Base 1)	3660 (Base 0) 3661 (Base 1)	4660 (Base 0) 4661 (Base 1)	Read-Only	16 Chars 8 Words
Hardware Revision	1668 (Base 0) 1669 (Base 1)	2668 (Base 0) 2669 (Base 1)	3668 (Base 0) 3669 (Base 1)	4668 (Base 0) 4669 (Base 1)	Read-Only	64 Chars 32 Words
Firmware Revision	1700 (Base 0) 1701 (Base 1)	2700 (Base 0) 2701 (Base 1)	3700 (Base 0) 3701 (Base 1)	4700 (Base 0) 4701 (Base 1)	Read-Only	64 Chars 32 Words
Device PDI Length	1732 (Base 0) 1733 (Base 1)	2732 (Base 0) 2733 (Base 1)	3732 (Base 0) 3733 (Base 1)	4732 (Base 0) 4733 (Base 1)	Read-Only	1 Word
Device PDO Length	1733 (Base 0) 1734 (Base 1)	2733 (Base 0) 2734 (Base 1)	3733 (Base 0) 3734 (Base 1)	4733 (Base 0) 4734 (Base 1)	Read-Only	1 Word

	IO-Link Port 5	IO-Link Port 6	IO-Link Port 7	IO-Link Port 8	Access	Length
Multiple Port PDI Data Block(s)	4999 (Base 0) 5000 (Base 1)	5999 (Base 0) 6000 (Base 1)	6999 (Base 0) 7000 (Base 1)	7999 (Base 0) 8000 (Base 1)	Read- Only	Configurable per port(s)
Port Specific PDI Data Block	5000 (Base 0) 5001 (Base 1)	6000 (Base 0) 6001 (Base 1)	7000 (Base 0) 7001 (Base 1)	8000 (Base 0) 8001 (Base 1)	Read- Only	Configurable per port
Multiple Port PDO Data Block(s)	5049 (Base 0) 5050 (Base 1)	6049 (Base 0) 6050 (Base 1)	7049 (Base 0) 7050 (Base 1)	8049 (Base 0) 8050 (Base 1)	Read/Write	Configurable per port(s)
Port Specific PDO Data Block	5050 (Base 0) 5051 (Base 1)	6050 (Base 0) 6051 (Base 1)	7050 (Base 0) 7051 (Base 1)	8050 (Base 0) 8051 (Base 1)	Read/Write	Configurable per port
Receive ISDU Response	5100 (Base 0) 5101 (Base 1)	6100 (Base 0) 6101 (Base 1)	7100 (Base 0) 7101 (Base 1)	8100 (Base 0) 8101 (Base 1)	Read- Only	4 to 125 Words
Transmit ISDU Request	5300 (Base 0) 5301 (Base 1)	6300 (Base 0) 6301 (Base 1)	7300 (Base 0) 7301 (Base 1)	8300 (Base 0) 8301 (Base 1)	Write-Only	4 to 123 Words
<i>Port Information Block (Continuous Block)</i>						232 Words
Vendor Name	5500 (Base 0) 5501 (Base 1)	6500 (Base 0) 6501 (Base 1)	7500 (Base 0) 7501 (Base 1)	8500 (Base 0) 8501 (Base 1)	Read-Only	64 Chars 32 Words
Vendor Text	5532 (Base 0) 5533 (Base 1)	6532 (Base 0) 6533 (Base 1)	7532 (Base 0) 7533 (Base 1)	8532 (Base 0) 8533 (Base 1)	Read-Only	64 Chars 32 Words
Product Name	5564 (Base 0) 5565 (Base 1)	6564 (Base 0) 6565 (Base 1)	7564 (Base 0) 7565 (Base 1)	8564 (Base 0) 8565 (Base 1)	Read-Only	64 Chars 32 Words
Product Id	5596 (Base 0) 5597 (Base 1)	6596 (Base 0) 6597 (Base 1)	7596 (Base 0) 7597 (Base 1)	8596 (Base 0) 8597 (Base 1)	Read-Only	64 Chars 32 Words
Product Text	5628 (Base 0) 5629 (Base 1)	6628 (Base 0) 6629 (Base 1)	7628 (Base 0) 7629 (Base 1)	8628 (Base 0) 8629 (Base 1)	Read-Only	64 Chars 32 Words
Serial Number	5660 (Base 0) 5661 (Base 1)	6660 (Base 0) 6661 (Base 1)	7660 (Base 0) 7661 (Base 1)	8660 (Base 0) 8661 (Base 1)	Read-Only	16 Chars 8 Words
Hardware Revision	5668 (Base 0) 5669 (Base 1)	6668 (Base 0) 6669 (Base 1)	7668 (Base 0) 7669 (Base 1)	8668 (Base 0) 8669 (Base 1)	Read-Only	64 Chars 32 Words
Firmware Revision	5700 (Base 0) 5701 (Base 1)	6700 (Base 0) 6701 (Base 1)	7700 (Base 0) 7701 (Base 1)	8700 (Base 0) 8701 (Base 1)	Read-Only	64 Chars 32 Words
Device PDI Length	5732 (Base 0) 5733 (Base 1)	6732 (Base 0) 6733 (Base 1)	7732 (Base 0) 7733 (Base 1)	8732 (Base 0) 8733 (Base 1)	Read-Only	1 Word
Device PDO Length	5733 (Base 0) 5734 (Base 1)	6733 (Base 0) 6734 (Base 1)	7733 (Base 0) 7734 (Base 1)	8733 (Base 0) 8734 (Base 1)	Read-Only	1 Word

16.3 Multiple Port Process Data (PDI/PDO) Access via Modbus/TCP

The process data has been grouped together in order to minimize the number of Modbus messages required to interface to the IO-Link master. The PDI and PDO data for multiple ports can be received or transmitted by one message.

	Modbus Holding Register Address (Base 1)	Controller Port 1 Access		Controller Port 2 Access		Controller Port 3 Access		Controller Port 4 Access	
		Read (Input)	Write (Output)	Read (Input)	Write (Output)	Read (Input)	Write (Output)	Read (Input)	Write (Output)
Read (Input) Process Data Input	1000 (Port 1)	X							
	2000 (Port 2)	X		X					
	3000 (Port 3)	X		X		X			
	4000 (Port 4)	X		X		X		X	
Read (Input) Process Data Output	1050 (Port 1)	X							
	2050 (Port 2)	X		X					
	3050 (Port 3)	X		X		X			
	4050 (Port 4)	X		X		X		X	
Write (Output) Process Data Output	1050 (Port 1)		X						
	2050 (Port 2)		X		X				
	3050 (Port 3)		X		X		X		
	4050 (Port 4)		X		X		X		X

	Modbus Holding Register Address (Base 1)	Controller Port 5 Access		Controller Port 6 Access		Controller Port 7 Access		Controller Port 8 Access	
		Read (Input)	Write (Output)	Read (Input)	Write (Output)	Read (Input)	Write (Output)	Read (Input)	Write (Output)
Read (Input) Process Data Input	5000 (Port 5)	X							
	6000 (Port 6)	X		X					
	7000 (Port 7)	X		X		X			
	8000 (Port 8)	X		X		X		X	
Read (Input) Process Data Output	5050 (Port 5)	X							
	6050 (Port 6)	X		X					
	7050 (Port 7)	X		X		X			
	8050 (Port 8)	X		X		X		X	
Write (Output) Process Data Output	5050 (Port 5)		X						
	6050 (Port 6)		X		X				
	7050 (Port 7)		X		X		X		
	8050 (Port 8)		X		X		X		X

To receive and transmit process data for eight ports, it may be necessary to adjust the size of the PDI/PDO data blocks.

Modbus Read/Write Access where:

- All PDI data can be read with one Modbus Read Holding Registers message.
- All PDO data can be read with one Modbus Read Holding Registers read message.
- All PDO data can be written with one Modbus Write Holding Registers message.
- Controller Read access:
 - The PDI data from one or more ports may be read with one message. (i.e.: If addressing port 1, at address 1000, ports one to four may be read in one message.)
 - The PDO data from one or more ports may be read with one message. (i.e.: If addressing port 1, at address 1050, ports one to four may be read in one message.)
 - Partial PDI and PDO data reads are allowed.
 - The length of the Read message can range from 1 to the total, configured PDI or PDO length for all ports starting at the addressed port.
- Controller Write (Output) access:
 - Only PDO data may be written.
 - The PDO data for one or more ports may be written with one Write Holding Registers message.
 - Partial PDO data writes are not allowed.
 - The length of the Write message must be equal to the total of the configured PDO lengths for all ports to be written. The one exception is that the data length of the last port to be written must be equal to or greater than the device PDO length for that port.

17 Troubleshooting and Technical Support

This chapter provides the following information:

- [Troubleshooting](#) [▶ 167]
- [BIOLM LEDs](#) [▶ 168]
- [Using Log Files](#) [▶ 171]

17.1 Troubleshooting

Before contacting Technical Support, you may want to try the following:

- Check to make sure LEDs are not reporting an issue using [BIOLM LEDs](#) [▶ 168].
- Verify that the network IP address, subnet mask, and gateway are correct and appropriate for the network. Make sure that the IP address programmed into the IO-Link Master matches the unique reserved IP configured address assigned by the system administrator.
 - If using DHCP, the host system needs to provide the subnet mask. The gateway is optional and is not required for a purely local network.
 - Remember that if the rotary switches on the BIOLM L-EIP are set to a non-default position, the rotary switches override the lower 3 digits (8 bits) of the static IP address configured in the **Network** page.
 - Verify that the Ethernet hub and any other network devices between the system and the IO-Link Master are powered up and operating.
- Verify that you are using the correct types of cables on the correct connectors and that all cables are connected securely.
- Disconnect and re-connect the IO-Link device, or optionally, use the **Configuration** | **IO-Link** page to **Reset** the port, and then set the **Port Mode** back to **IOLink**.
- Reboot or power cycle the BIOLM. Use the **Advanced** | **Software** page to reboot the BIOLM.
- Verify that the **Port Mode** matches the device, for example: IO-Link, Digital In, Digital Out, or Reset (port is disabled).
- If you are receiving an error that indicates a hardware fault, check the **Configuration** | **IO-Link** page for the port experiencing the fault.
 - Check the settings for the **Automatic Upload Enable** and **Automatic Download Enable** options. If the Vendor ID or Device ID of the attached device does not match, a hardware fault is generated.
 - Make sure if the port contains data storage that the Vendor ID and Device ID match the device attached to the port. If it does not, **CLEAR** the data storage or move the device to another port.
 - Check the Device Validation and Data Validation settings. If the attached device does not meet these settings, a hardware fault is issued.
- Open the IO-Link Master web interface and review the following pages to see if you can locate a problem:
 - **IO-Link Diagnostics**
 - **Digital I/O Diagnostics (BIOLM)**
 - **EtherNet/IP Diagnostics**
 - **Modbus/TCP Diagnostics**
 - **OPC UA Diagnostics**
- If you have a spare IO-Link Master, try replacing the IO-Link Master.

17.2 BIOLM LEDs

The following tables provide LED descriptions:

- [BIOLM L-EIP LEDs \[▶ 168\]](#)
- [BIOLM DR-EIP LEDs \[▶ 170\]](#)

17.2.1 BIOLM L-EIP LEDs

The BIOLM L-EIP (8-port IP67 model with an L-coded power connector) provides these LEDs.

LED Activity During Power On Sequence – BIOLM L-EIP

1. The **US** LED lights.
2. The **ETH** LED lights on the connected port.
3. The **MOD** and **NET** LEDs are lit.
4. The IO-Link LEDs flash (if no IO-Link device attached) or are lit if an IO-Link device is attached.

The **MS** LED is solid green, the IO-Link Master is ready for operation.

BIOLM L-EIP LEDs

US	<p>The US LED provides the following information:</p> <ul style="list-style-type: none"> ■ Green solid = The IO-Link Master is powered. ■ Red solid = Power input voltage below 18 VDC.
UA	<p>The UA LED provides the following information:</p> <ul style="list-style-type: none"> ■ Green solid = The IO-Link Master is powered. ■ Red solid = Power input voltage below 18 VDC.
MOD (Module Status)	<p>The MOD LED provides the following information:</p> <ul style="list-style-type: none"> ■ Off = No module status. ■ Green and red flashing = Self-test. ■ Green flashing = Standby – not configured. ■ Green solid = Operational. ■ Red flashing: Minor recoverable fault – check the EtherNet/IP Diagnostics page to locate the issue ■ Red solid = Major unrecoverable fault.
NET (Network)	<p>The NET LED provides the following information:</p> <ul style="list-style-type: none"> ■ Off = No IP address. ■ Green and red flashing = Self-test. ■ Green flashing = An IP address is configured, but no CIP connections are established, and an Exclusive Owner connection has not timed out. ■ Green solid = Active EtherNet/IP or Modbus connection and no EtherNet/IP connection time-outs. ■ Red flashing = One or more EtherNet/IP connection time-outs. ■ Red solid = Duplicate IP address on network.
1 - 8	<p>This LED provides the following information about the IO-Link port.</p> <ul style="list-style-type: none"> ■ Off = SIO mode – signal is low or disabled.



- Yellow = SIO mode – signal is high.
- Red flashing = Hardware fault – make sure that configured IO-Link settings on the port do not conflict with the device that is attached:
 - **Automatic Upload** and/or **Download** is enabled and it is not the same device.
 - **Device Validation Mode** is enabled and it is not the correct device.
 - **Data Validation Mode** is enabled but there is an error.
- Red solid = PDI of the attached IO-Link device is invalid
- Green solid = An IO-Link device is connected and communicating.
- Green flashing = Searching for IO-Link devices.

Port 1 - 4
DI

The **DI** LED indicates digital input on DI (Pin 2).

- Off = DI signal is low or disconnected.
- Yellow = DI signal is high.

ETH1
ETH2

The **ETH** LEDs provide the following information:

- Green solid = Link
 - Green flashing = Activity
-

17.2.2 BIOLM DR-EIP LEDs

The BIOLM DR-EIP (8-port IP20 DIN rail model with pluggable, removable connectors) provides these LEDs.

LED Activity During Power On Sequence – BIOLM DR-EIP

1. The **E1/E2** LED lights on the connected port.
2. The **MOD** and **NET** LEDs are lit.
3. The IO-Link LEDs flash (if no IO-Link device attached) or are lit if an IO-Link device is attached.

The **MOD** LED is solid green, the IO-Link Master is ready for operation.

BIOLM DR-EIP LEDs

MOD (Module Status)	<p>The MOD LED provides the following information:</p> <ul style="list-style-type: none"> ■ Off = No module status. ■ Green and red flashing = Self-test. ■ Green flashing = Standby – not configured. ■ Green solid = Operational. ■ Red flashing = Minor recoverable fault – check the EtherNet/IP Diagnostics page to locate the issue. ■ Red solid = Major unrecoverable fault.
NET (Network Status)	<p>The NET LED provides the following information:</p> <ul style="list-style-type: none"> ■ Off = No IP address. ■ Green and red flashing = Self-test. ■ Green flashing = An IP address is configured, but no CIP connections are established, and an Exclusive Owner connection has not timed out. ■ Green solid = Active EtherNet/IP or Modbus connection and no EtherNet/IP connection time-outs. ■ Red flashing = One or more EtherNet/IP connection time-outs. ■ Red solid = Duplicate IP address on network.
Port 1 - 8	<p>This LED provides the following information about the IO-Link port.</p> <ul style="list-style-type: none"> ■ Off = SIO mode – signal is low or disabled. ■ Yellow = SIO mode – signal is high. ■ Red flashing = Hardware fault – make sure that configured IO-Link settings on the port do not conflict with the device that is attached: <ul style="list-style-type: none"> ▪ Automatic Upload and/or Download is enabled and it is not the same device. ▪ Device Validation Mode is enabled and it is not the correct device. ▪ Data Validation Mode is enabled but there is an error. ■ Red solid = PDI of the attached IO-Link device is invalid. ■ Green solid = An IO-Link device is connected and communicating. ■ Green flashing = Searching for IO-Link devices.
Dual Ethernet Ports	<p>The Ethernet LEDs provide the following information:</p> <ul style="list-style-type: none"> ■ Green solid = Link ■ Yellow solid = Activity

17.3 Using Log Files



INFO

Typically, log files are intended to be used by Technical Support in the event there is a problem.

The IO-Link Master provides four different log files that you can view, export, or clear:

- **Syslog** (system log) displays line-by-line activity records.
- **dmesg** displays Linux kernel messages.
- **top** displays which programs are using most of the memory and CPU.
- **ps** displays the running programs
- All log files start up automatically during the startup cycle. Each log file has a size limit of 100 KB.

You can use the following procedures to:

- [View a Log File \[▶ 171\]](#)
- [Clear a Log File \[▶ 172\]](#)
- [Export a Log File \[▶ 171\]](#)

17.3.1 View a Log File

Use this procedure to view a log file:

Instruction:

- a) Open your browser and enter the IP address of the IO-Link Master.
- b) Click **Advanced** and then **LOG FILES**.
- c) Select the log file type from the drop-list.
- d) Optionally, click the **REFRESH** button to get the latest information.
- e) Optionally, export the log file ([Export a Log File \[▶ 171\]](#)).

17.3.2 Export a Log File

Use the following procedure to export a log file:

Instruction:

- a) Open your browser and enter the IP address of the IO-Link Master.
- b) Click **Advanced** and then **LOG FILES**.
- c) Select the log file type from the drop-list.
- d) Click the **EXPORT** button.
- e) Click the **Save** button drop-list and click **Save** to save it to your user folder or **Save as** to browse to or create a new folder in which to place the log file.
- f) Depending on your browser, you may need to close the pop-up window.

17.3.3 Clear a Log File

Use this procedure to clear a log file:

Instruction:

- a) Open your browser and enter the IP address of the IO-Link Master.
- b) Click **Advanced** and then **LOG FILES**.
- c) Optionally, export the log file (Export a Log File).
- d) Select the log file type from the drop-list.
- e) Click the **CLEAR** button.

Result:

- ✓ The log file automatically starts logging the latest information.

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