

MANUAL

## IO-Link Master

ICE2-8IOL1-G65L-V1D

Fieldbus Module with  
EtherNet/IP, Modbus/TCP and  
IO-Link



Class B Addendum

EtherNet/IP®

IO-Link

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# 1. Overview

This is an addendum to the *IO-Link Master EtherNet/IP (EIP) and Modbus/TCP User Guide*, which did not include the ICE2-8IOL1-G65L-V1D (70118644) and contains information specific to this model.

**Note:** Refer to <https://www.pepperl-fuchs.com> to download the User Guide.

## 1.1. Class B Specific Topics

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The following topics for the ICE2-8IOL1-G65L-V1D are different than that other models.

- *Hardware Installation* on Page 6
- *Connecting Devices* on Page 11
- *Using the Diagnostics Page for Class B* on Page 14
- *Troubleshooting* on Page 15

## 2. Hardware Installation

### 2.1. ICE2-8IOL1-G65L-V1D Hardware Installation

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

- *Setting the Rotary Switch*
- *Connecting to the Network* on Page 8
- *Connecting the Power* on Page 8
- *Mounting the ICE2-8IOL1-G65L-V1D* on Page 10

**Note:** Refer to *Connecting Devices* on Page 11 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 IO-Link Master to set the lower 3-digits (8 bits) of the static IP address.

**Note:** Optionally, you can leave the rotary switch set to the default and use the web interface or PortVision DX 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 startup, but the current position is always shown on the **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 IO-Link Masters so that they do not have duplicate addresses to make setting the IP addresses using software easier. After using PortVision DX or the web page to change the IP address, reset the rotary switches back to 000.
- An emergency method to return the IO-Link Master back to factory defaults, so that software can be used to program the appropriate IP address, and then return the switches back to 000.

**Note:** If you set the network address using the rotary switches, the Rotary Switch setting overrides the network settings in the web interface when the IO-Link Master is initially powered on or after cycling the power.

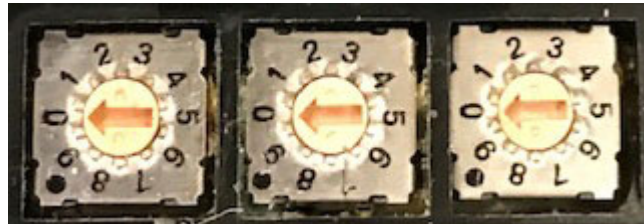
Switch Setting	Node Address
000 (Default setting)	Use the network configuration stored in the flash. The default network configuration values are: <ul style="list-style-type: none"> <li>• IP address = 192.168.1.250</li> <li>• Subnet mask = 255.255.255.0</li> <li>• IP gateway = 0.0.0.0</li> </ul> After completing the hardware installation, see the <i>IO-Link Master EtherNet/IP (EIP) and Modbus/TCP User Guide</i> to set the network address using the web interface or PortVision DX.
001, 255-887	Reserved.

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Switch Setting	Node Address (Continued)
002	Setting the rotary switches to 002 configures the IO-Link Master to use DHCP addressing.
003-254	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. <b>Note:</b> <i>If software is used to change the IP address to another value before setting the rotary switches, the IO-Link Master uses that IP address value. For example, if the IO-Link Master is set to 10.0.0.250 and the first rotary switch is set to 3, the IP address would still be 10.0.0.250.</i>
888	Reset to factory defaults. If the IO-Link Master 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 IO-Link Master is rebooted or power cycled.
889-998	Reserved.
999	Use the default IP address. If the IO-Link Master 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 IO-Link Master is rebooted or power cycled.

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

1. Gently pop open the window using a small flathead screwdriver.
2. 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.
3. Turn each dial to the appropriate position using a small flathead screwdriver.



*The default setting is 000 as shown above.*

*The arrow points to the switch location. 0 is located at the 9:00 position. Turn the dial to the appropriate setting.*

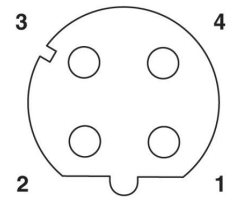
4. Close the window and make sure that it snaps shut tightly.

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

### 2.1.2. Connecting to the Network

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

Pin	Signal
1	Tx+
2	Rx+
3	Tx-
4	Rx-



You can use this procedure to connect the IO-Link Master to the network.

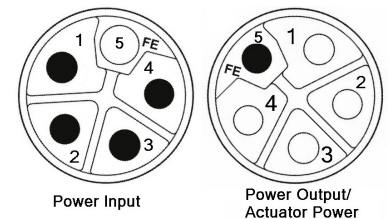
1. Securely connect one end of a shielded twisted-pair (Cat 5 or higher) M12 Ethernet cable to either Ethernet port.
2. Connect the other end of the cable to the network.
3. Optionally, use the other Ethernet port to daisy-chain to another Ethernet device.
4. If you did not connect both Ethernet ports,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

**Note:** Ethernet ports must have an approved cable or protective cover attached to the connector to guarantee IP67 integrity.

### 2.1.3. Connecting the Power

The ICE2-8IOL1-G65L-V1D provides M12 (5-poles) L-coded input and output power connectors. Use a 24VDC power supply capable of the total output current required.

**Note:** Power connectors must have an approved cable or protective cover attached to the port guarantee to IP67 compliance. If you require cables or protective covers, see the Pepperl+Fuchs web site.



Pin	Power Input (Male)	Power Output or Actuator Power (Female)	Description
1	U <sub>S</sub> +	U <sub>S</sub> + or +V	IO-Link Master's system electronics and IO-Link devices
2	U <sub>A</sub> -	U <sub>A</sub> - or 0V	Actuator supply
3	U <sub>S</sub> -	U <sub>S</sub> - or 0V	IO-Link Master's system electronics and IO-Link devices
4	U <sub>A</sub> +	U <sub>A</sub> + or +V	Actuator supply
5	FE		

**Note:** The IO-Link Master requires a UL listed power supply with an output rating of 24 VDC.



Power Supply	Values
Power Supply In - Maximum $V_S$ and $V_A$	16A (Maximum)
IO-Link Connector <b>Port 1B (Class B)</b> C/Q (Pin 4) configured as digital output L+/L- Sensor Supply (Pins 1 and 3)	Max 500mA via L+ (Pin 1) Max 3.5A via 2L+ (Pin 2) Max 200mA via C/Q (Pin 4)
IO-Link Connector <b>Ports 2B through 4B (Class B)</b> C/Q (Pin 4) configured as digital output L+/L- Sensor Supply (Pins 1 and 3)	Max 500mA via L+ (Pin 1) Max 2.3A via 2L+ (Pin 2) Max 200mA via C/Q (Pin 4)
IO-Link Connectors <b>Ports 5A through 8A (Class A)</b> C/Q (Pin 4) configured as digital output L+/L- Sensor Supply (Pins 1 and 3)	Max 500mA via L+ (Pin 1) Max 200mA via C/Q (Pin 4) Max 200mA via DO (Pin 2) <b>Note:</b> See Connecting Devices on Page 11 for information about how to divide up the power output between ports.
IO-Link Master Power	120mA @ 24VDC ( $V_S$ )
Power Supply Out $V_S$ $V_A$	16A † (Maximum) 16A †† (Maximum) <b>Note:</b> DO current for the Class A DO pins, if used. So $V_A$ would be the same as for $V_S$ with this one exception.
<p>† <math>V_S</math> output available is determined by subtracting the following from the available input current.</p> <ul style="list-style-type: none"> <li>- IO-Link Master module electronics current.</li> <li>- Total L+/L- current for all IO-Link ports.</li> <li>- Total C/Q current for all IO-Link ports.</li> </ul> <p>†† <math>V_A</math> output available is the same as the available <math>V_A</math> input current.</p>	

You can use the following procedure to connect the IO-Link Master to a power supply.

**Note:** Power should be disconnected from the power supply before connecting it to the IO-Link Master. Otherwise, your screwdriver blade can inadvertently short your power supply terminal connections to the grounded enclosure.

1. Securely attach the power cable between the male power connector (**PWR In**) and the power supply.
2. 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. Contact your Customer Sales Representative if you need to order connector caps for the ICE2-8IOL1-G65L-V1D.
3. 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.
  - a. The **US** LED lights.

**Note:** If the power supply applies power to Pin 2, the **UA** LED also lights green.

  - b. The **ETH1/ETH2** LED lights on the connected port.
  - c. The **MOD** and **NET** LEDs are lit.
  - d. The IO-Link LEDs flash (if no IO-Link device attached) or are lit if an IO-Link device is attached.

**Note:** It takes approximately 25 seconds after power up for the IO-Link Master to be ready for

operation.

- e. 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:

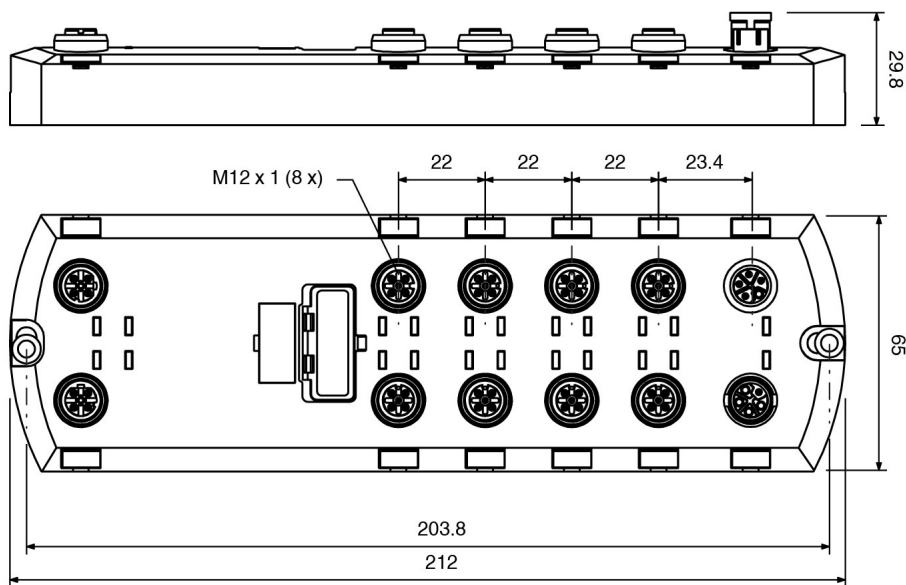
- Program the IP address using PortVision DX or the web interface. Refer to the *IO-Link Master EtherNet/IP (EIP) and Modbus/TCP User Guide*.
- If using the rotary switches to set the IP address, then you are ready to attach devices using *Connecting Devices* on Page 11.

If the LEDs do not meet the above conditions, you can refer to *ICE2-8IOL1-G65L-V1D LEDs* on Page 16 in the *Troubleshooting* chapter for more information.

### 2.1.4. Mounting the ICE2-8IOL1-G65L-V1D

Use the following procedure to mount the IO-Link Master. You can mount the IO-Link Master on a mounting panel or a machine.

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





## 3. Connecting Devices

This chapter discusses connecting devices to the IO-Link Master. Use the appropriate discussion for your IO-Link Master model.

- *Overview*
- *ICE2-8IOL1-G65L-V1D IO-Link Ports* on Page 11

### 3.1. 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

The following table provides definitions of the terminology used above.

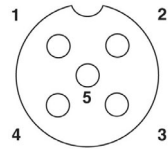
Term	Definition
PNP output	Is an output that can source current. That is; the (+) side of the device is connected to the output and the (-) side of the device is connected to (-) of the supply. The device is powered when the output LED is on.
NPN output	Is an output that sinks current. That is: the (-) 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. <b>Note:</b> <i>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.</i>

### 3.2. ICE2-8IOL1-G65L-V1D IO-Link Ports

The ICE2-8IOL1-G65L-V1D 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
<b>IO-Link</b>	1	L+	IO-Link device power supply (+24V)
	2	DIO	Digital input/output and diagnostics
	3	L-	IO-Link device power supply (0V)
	4	C/Q	Communication signal, which supports SDCI (IO-Link) or SIO (standard input/output) digital I/O
	5	NC	Not connected
<b>IO-Link Class B (Ports 1-4)</b>	1	L+	IO-Link device power supply (+24V)
	2 †	2L+ (or UA+)	IO-Link device Actuator power supply (+24V)
	3	L-	IO-Link device power supply (0V)
	4	C/Q	Communication signal, which supports SDCI (IO-Link) or SIO (standard input/output) digital I/O
	5 †	2L- (or UA-)	IO-Link device Actuator power supply (0V)



**† Caution!**

*Do not compromise galvanic isolation through incorrect wiring!*

*Sensor supply (L+/L- Pin 1/Pin 3) and actuator supply (2L+/2L- Pin 2/Pin 5) are galvanically isolated from each other.*

*If reference potentials (L- Pin 3) and (2L- Pin 5) are connected together, excessive equalization currents may flow. In this case, it is not permitted for a sensor to be connected to Class B port (Pin 2)!*

*Eliminating a galvanic isolation is not recommended.*

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

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

There are active over-current limiter electronics for each port in the ICE2-8IOL1-G65L-V1D 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 ICE2-8IOL1-G65L-V1D are as follows.

ICE2-8IOL1-G65L-V1D		Port X1 (Class B): Output Current	Ports X2-X4 (Class B): Output Current	Ports X5-X8 (Class A): Output Current.
2L+/2L- (24VU <sub>A</sub> / GND U <sub>A</sub> )	Output Current Capacity (max.)	3.5A†	2.3A†	N/A
	Overload Cutoff Protection	Yes	Yes	N/A
	Short-Circuit Protection	Yes	Yes	N/A
L+/L- (24V U <sub>S</sub> / GND U <sub>S</sub> )	Output Current Capacity (max.)	500mA†	500mA†	500mA†
	Overload Cutoff Protection	Yes	Yes	Yes
	Short-Circuit Protection	Yes	Yes	Yes
C/Q (IO-Link mode, Digital Output mode)	Output Current Capacity (max.)	200mA*	200mA*	200mA*
	Overload Cutoff Protection	Yes	Yes	Yes
	Short-Circuit Protection	Yes	Yes	Yes
† Each port's 2L+ and L+ pins have their own independent over-current limiter circuit. The current output for each port is also independently controlled and cannot be budgeted with other ports. * Each port's C/Q pin has its own independent over-current limiter circuit. The current output of C/Q pin for each port is also independently controlled.				

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

- Securely attach the IO-link cable between the IO-Link or digital input/output device and the IO-Link port.  
**Note:** Make sure that you tighten the cables properly to maintain IP67 integrity.
- If necessary, securely attach a connector cap to prevent dust or liquids from getting into any unused ports.  
**Note:** IO-Link ports must have an approved cable or protective cover attached to the port to guarantee IP67 compliance.
- If necessary, configure IO-Link port parameters using the **Configuration | IO-Link Settings** page to configure the port mode.
  - 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.

## 4. Using the Diagnostics Page for Class B

Refer to the *IO-Link Master EtherNet/IP (EIP) and Modbus/TCP User Guide* for all Diagnostic pages that are not Class B specific.

### 4.1. Power Diagnostics Page (ICE2-8IOL1-G65L-V1D Only)

The *Power Diagnostics* page displays status of power related information for the ICE2-8IOL1-G65L-V1D.

ICE2-8IOL1-G65L-V1D Power Diagnostics	
<b>POWER GENERAL STATUS</b>	
UA Power Supply Status	Displays the $U_A$ power status, which is required to meet Class B power standards.
Input Power FETs Temperature	Displays the current temperature of input power FETs.
RPP FET Temperature	Displays the current temperature of RPP FET.
FPGA/Processor Temperature	Displays the current temperature of FPGA and processor.
Class B Quad High Side Temperature	Displays the current temperature of Class B quad high side drivers.
Class A Quad High Side Temperature	Displays the current temperature of Class A quad high side drivers.
<b>POWER PORT STATUS</b>	
Port Class	IO-Link port Class A or Class B.
2L+ Status	Displays the current status of 2L+ power supply. Class B ports only.
2L+ Faults	Displays the total number of faults on 2L+ power supply. Class B ports only.
Auxiliary Output Status	Displays the current auxiliary digital output status. Class A ports only.
Auxiliary Output Faults	Displays the total number of faults on auxiliary digital output. Class A ports only.
L+ Status	Displays the current status of L+ power supply.
L+ Overcurrent	Displays if L+ power supply load current exceeds the current-limit threshold.
L+ Undervoltage	Displays if L+ power supply falls below 18V.
CQ Driver Fault	Displays if a fault is detected on the CQ driver.
Thermal Shutdown	Displays if the die temperature reaches 150 °C and the die enters thermal shutdown.
Die Temperature Warning	Displays if the die temperature reaches 135 °C warning threshold.
VCC Undervoltage	Displays if the Vcc voltage falls below 9V.
VCC Supply Voltage Warning	Displays if the Vcc voltage falls below 18V.

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## 5. Troubleshooting

### 5.1. Troubleshooting

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

- Check to make sure LEDs are not reporting an issue using *ICE2-8IOL1-G65L-V1D LEDs* on Page 16.
- 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 ICE2-8IOL1-G65L-V1D are set to a non-default position, the rotary switches may 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 IO-Link Master. Use the **Advanced | Software** page to reboot the IO-Link Master.
- 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
  - EtherNet/IP Diagnostics
  - Modbus/TCP Diagnostics
  - OPC UA Diagnostics
  - MQTT Diagnostics
  - ICE2-8IOL1-G65L-V1D only: Power Diagnostics
- If you have a spare IO-Link Master, try replacing the IO-Link Master.

## 5.2. ICE2-8IOL1-G65L-V1D LEDs

The ICE2-8IOL1-G65L-V1D (8-port IP67 model with an L-coded power connector and four Class B ports) provides these LEDs.

LED Activity During Power On Sequence - ICE2-8IOL1-G65L-V1D	
1.	The <b>US</b> LED lights.
2.	The <b>PWR Out UA</b> LED lights, if the Actuator Supply is valid. <b>Note:</b> <i>Actuator power (UA) is not required for the ICE2-8IOL1-G65L-V1D start-up but is required for Class B operation.</i>
3.	The <b>ETH1/ETH2</b> LED lights on the connected port.
4.	The <b>MOD</b> and <b>NET</b> LEDs are lit.
5.	The IO-Link LEDs flash (if no IO-Link device attached) or are lit if an IO-Link device is attached. The <b>MOD</b> LED is solid green, the IO-Link Master is ready for operation.

ICE2-8IOL1-G65L-V1D LEDs	
US	<p>The <b>US</b> LED provides the following information:</p> <ul style="list-style-type: none"> <li>Green solid = The IO-Link Master is powered.</li> <li>Red solid = Power input voltage below 18VDC.</li> </ul>
UA	<p>The <b>UA</b> LED provides the following information:</p> <ul style="list-style-type: none"> <li>Green solid = Pins 2/5 are powered.</li> <li>Red solid = Power input voltage below 18VDC.</li> </ul>
MOD (Module Status)	<p>The <b>MOD</b> LED provides the following information:</p> <ul style="list-style-type: none"> <li>Off = No module status</li> <li>Green and red flashing = Self-test</li> <li>Green flashing = Standby – not configured</li> <li>Green solid = Operational</li> <li>Red flashing = Minor recoverable fault - check the <b>EtherNet/IP Diagnostics</b> page to locate the issue</li> <li>Red solid = Major unrecoverable fault</li> </ul>
NET (Network)	<p>The <b>NET</b> LED provides the following information:</p> <ul style="list-style-type: none"> <li>Off = No IP address</li> <li>Green and red flashing = Self-test</li> <li>Green flashing = An IP address is configured, but no CIP connections are established, and an Exclusive Owner connection has not timed out</li> <li>Green solid = Active EtherNet/IP or Modbus connection and no EtherNet/IP connection time-outs</li> <li>Red flashing = One or more EtherNet/IP connection time-outs</li> </ul>



ICE2-8IOL1-G65L-V1D LEDs (Continued)	
1-8 IO-Link	<p>This LED provides the following information about the IO-Link port.</p> <ul style="list-style-type: none"> <li>• Off = SIO mode - signal is low or disabled</li> <li>• Yellow = SIO mode - signal is high</li> <li>• 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"> <li>- <b>Automatic Upload</b> and/or <b>Download</b> is enabled and it is not the same device.</li> <li>- <b>Device Validation Mode</b> is enabled and it is not the correct device.</li> <li>- <b>Data Validation Mode</b> is enabled but there is an error.</li> </ul> </li> <li>• Red solid = PDI of the attached IO-Link device is invalid</li> <li>• Green solid = An IO-Link device is connected and communicating</li> <li>• Green flashing = Searching for IO-Link devices</li> </ul>
Port 1-4 <b>UA</b> LED	<p>The <b>UA</b> LED indicates power supply output (<math>U_A</math>) through Pin 2.</p> <ul style="list-style-type: none"> <li>• Green solid = A Class B IO-Link device is connected and communicating.</li> <li>• Red solid = Class B fault</li> </ul>
Port 5-8 <b>DI / DO</b> LED	<p>The <b>DI / DO</b> LED indicates digital input or digital output on DIO (Pin 2).</p> <ul style="list-style-type: none"> <li>• Off = DI signal is low or disconnected</li> <li>• Yellow = DI signal is high</li> </ul>
ETH1/ETH2	<p>The <b>ETH1/ETH2</b> LEDs provide the following information:</p> <ul style="list-style-type: none"> <li>• Green solid = Link</li> <li>• Green flashing = Activity</li> </ul>

# FACTORY AUTOMATION – SENSING YOUR NEEDS



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