

User's Manual

HarshIO 600 eIP IP67 Digital I/O Modules for EtherNet/IP

Isolated Grounding and QuickConnect Versions

BradControl™ from Molex

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Revision History

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February 06, 2012	E. GORY	- Various typo corrections - Hyperlink to Molex Support and Download page	1.1
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1. General Safety Instructions

General information

The current documentation is intended for persons technically qualified to install, use and service the products described herein. It contains the necessary information for proper use of the products. However, for advanced use of our products, please contact your nearest dealer for additional information.

The content of this documentation is not binding and cannot extend or limit warranties.

Personnel qualifications

Only qualified persons are authorized to install, use and service the products. Use by unqualified persons or failure to follow the safety instructions of this document, the manuals and/or those affixed to the devices, can result in irremediable harm or damage to persons and equipment. The following personnel are deemed to be **qualified persons** for:

- *Equipment operation:* Personnel who operates the machines and/or processes connected to the Brad™ products. Brad™ HarshIO must be used by persons who have received training and have been informed of the major risks involved in working in an industrial environment.
- *Preventive and corrective maintenance:* Persons who modify Brad™ products hardware and software configuration and install the product updates supplied by the manufacturer. These persons must:
 - be trained in Brad™ products and operation and
 - have the experience and technical knowledge required to be aware of the risks (electrical hazards in particular) involved in their job and the ways of reducing these risks for themselves, third parties and the equipment being used.

Preventive messages

Preventive messages are designed to identify the particular risks likely to affect personnel and/or hardware. Different message types, both in the documentation and on the products, indicate different degrees of risk:

Danger messages indicate immediate hazards that could result in death or serious injury if not averted.

Warning messages indicate situations that could result in death, serious injury or material damage.

Caution messages indicate potentially dangerous situations that could cause bodily harm or material damage.

Usage compliance

The products described in the current documentation **comply with currently applicable European Directives** (EC labeling). However, they can only operate correctly with the applications for which they were

intended as described in the documentation, and with approved products.

As a general rule, if all the handling, transportation, and storage recommendations and installation, operation and maintenance instructions are followed, the products will operate correctly without risk for personnel or hardware.

Device installation and set-up

It is important to follow the rules below when installing and setting up the Brad™ HarshIO. If system installation includes products more than thirty meters away from each other, the basic cabling rules must be closely followed.

- Strict compliance with the safety instructions provided in this documentation or on the equipment to be installed and implemented, is absolutely essential.
- Make sure that the installation is carried out in compliance with regulations of the user country,
- Install the equipment in a suitable environment. As a closed equipment, the Brad™ HarshIO may be installed in two ways:
 - In a casing (cabinet, chest) or,
 - Directly without any additional protection, if the associated systems (power supply, cables, sensors, etc.) already carry a protection index equivalent to IP67 or higher.

Always connect the Brad™ HarshIO to the protective earth (PE) in compliance with existing standards (for example: use the green/yellow wires in accordance with the NFC 15 100 standard).

- LV (Low Voltage) circuits must have a protective earth connection to ensure dangerous voltage detection.
- Before powering up the device, check that the nominal voltage is the same as the mains voltage.
- Only use FELV (Functional Extra Low Voltage) power supplies which comply with existing standards.
- Check that the power voltages are within the tolerance ranges defined in the technical specifications for the devices.
- Always ensure that power restoration (immediate, hot or cold) will not create a hazard for personnel or equipment.
- Ensure that emergency stop devices remain effective in any equipment operation mode, even when abnormal (for example, in the event of a cut wire). Resetting these devices should not result in uncontrolled or undefined restarts.
- Position the signal cables so that the automation functions will not be disrupted by any capacitive, inductive or electromagnetic influences, etc.
- Install the automation devices and their controlling devices so that they are protected against any adverse incident.
- Adequate safety precautions must be applied to inputs and outputs to prevent the lack of signals from causing undefined states in the automation devices.

Device operation

Because Brad™ HarshIO devices are components of a control system, the safety of the entire automated system, including that of the installation and the application, cannot be dealt with in this document. For further information, see IEC 1131-4, describing risk reduction measures for PLC users.

See the documentation of the specific products involved for more information on operation safety.

Electrical, mechanical and thermal specifications

Detailed information about the electrical, mechanical and thermal specifications of the device is available in the associated technical documentation (installation manuals, service instructions).

Preventive and corrective maintenance

Servicing

- When replacing parts or components, only use factory approved parts.
- In all cases, before servicing a Brad™ HarshIO, disconnect the power supply from the device (unplug the power cord or open the power cut-out device).
- Before servicing an onsite mechanical Brad™ HarshIO, disconnect its power supply and mechanically lock the moving parts.
- On positive logic outputs or negative logic inputs, take all the necessary precautions to prevent any disconnected wires from coming into contact with the mechanical ground (risk of unwanted commands).

Product end-of-life

Contact your local dealer for information on how to dispose of used products in compliance with current regulations.

2. General Description

Introduction

BradControl™ HarshIO eIP (EtherNet/IP) modules provide a reliable solution for connecting industrial controllers to I/O devices in harsh duty environments. Contained in an IP67 rated housing, BradControl I/O modules can be machine mounted and are able to withstand areas where liquids, dust or vibration may be present. This makes them ideally suited for many applications including material handling equipment and automated assembly machinery.

All BradControl™ HarshIO modules with Micro-Change® (M12) ports accept both threaded cordsets and Molex Ultra-Lock™ system.

Ultra-Lock™ connection System! The fastest, easiest and most secure connection ever designed. Ultra-Lock™ technology is designed for higher performance and reliability. Discover how the push-to-lock technology of the Ultra-Lock connection system can eliminate your downtime, increase your productivity and lower your costs. More information visit: www.molex.com .



BradControl™ HarshIO 600 includes advanced diagnostic features. Each module embeds visible LEDs to provide for maintenance personnel the ability to easily determine I/O, module and network status. These statuses are also available through the process data image or via extended slave diagnostics telegram.

BradControl™ HarshIO 600 main features include:

- Module is housed in an IP67 rated enclosure that when properly installed—according to IEC 60529—provides protection against the ingress of dust, water
- 16x digital channels with up to 1ms I/O cycle time
- Integrated 2-port unmanaged Ethernet switch with cross-over capability
- Isolated grounding to able to use 2 separate power supplies to power the module logic/input ground and the module output ground for safety application
- Digital input and output short circuit protection
- Quick Connect feature to power up and run the HarshIO module in less than 500ms for robotic application where I/O are control on a tool changer

BradControl™ HarshIO 600 is available in various combinations:

- 16x Inputs
- 16x Outputs
- 8x Inputs + 8x Outputs

Whatever the combination, the digital inputs and outputs are always PNP.

Part Number Table

SAP No	Material No	Description
112095-5040	TCDEI-8D0P-DYU-G	IP67 module for EtherNet/IP, Classic format, Digital 8 Ports, 16 PNP Inputs, Isolated grounding and QuickConnect
112095-5041	TCDEI-888P-DYU-G	IP67 module for EtherNet/IP, Classic format, Digital 8 Ports, 8 PNP Inputs + 8 Outputs, Isolated grounding and QuickConnect
112095-5042	TCDEI-80DP-DYU-G	IP67 module for EtherNet/IP, Classic format, Digital 8 Ports, 16 Outputs, Isolated grounding and QuickConnect

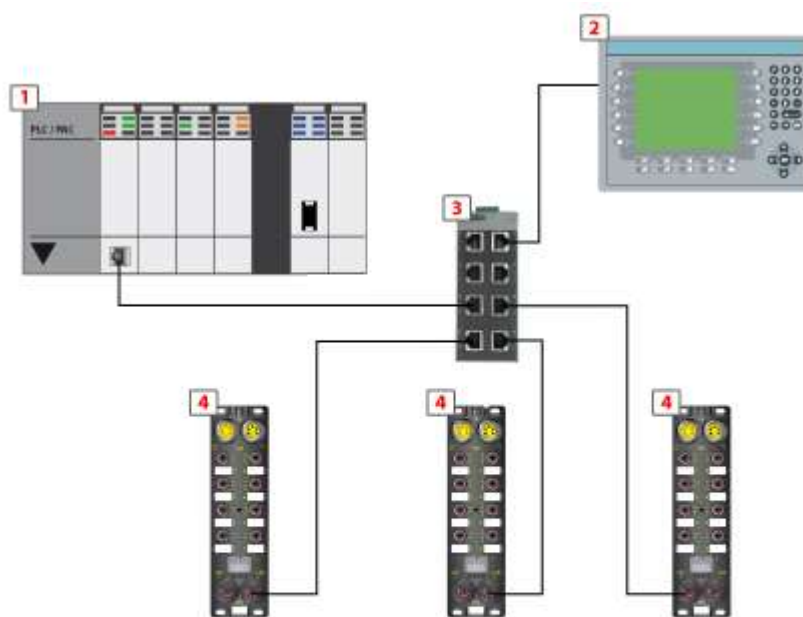
Overview

HarshIO eIP modules can be used with a protocol compliant scanner as part of control system architecture. The modules' built-in unmanaged 2-port Ethernet switch allows you to use the network topology that meets your application needs. These topologies include the following:

- star
- daisy-chain
- combination of star and daisy-chain

Star topology

Star topology allows you to connect mixed I/O modules or additional equipments. Performing maintenance on one module – for example, by removing the network cable, or by cycling power to the module – does not affect other modules.



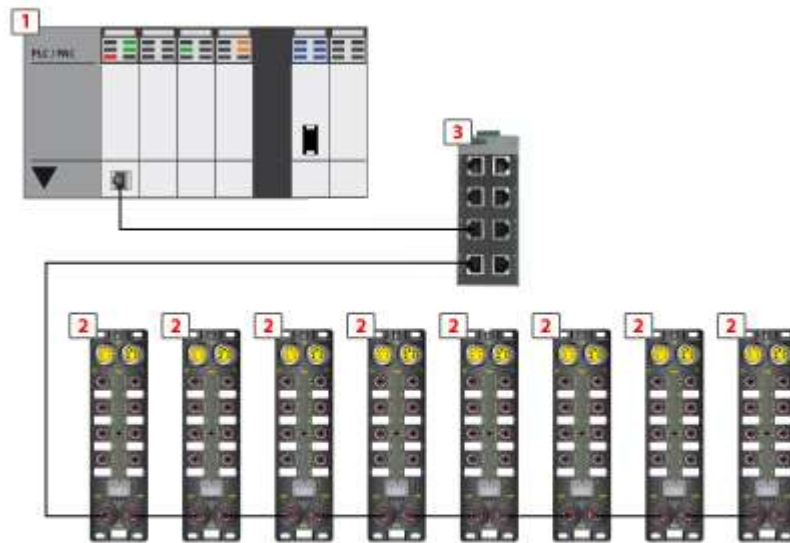
- 1 EtherNet/IP PLC
- 2 HMI device
- 3 Ethernet switch
- 4 HarshIO eIP modules

Daisy-chain topology

You can create a daisy-chain topology by using the module's embedded switch ports to connect a series of up to 8 HarshIO eIP modules.

NOTE: When considering the daisy chain topology, note that:

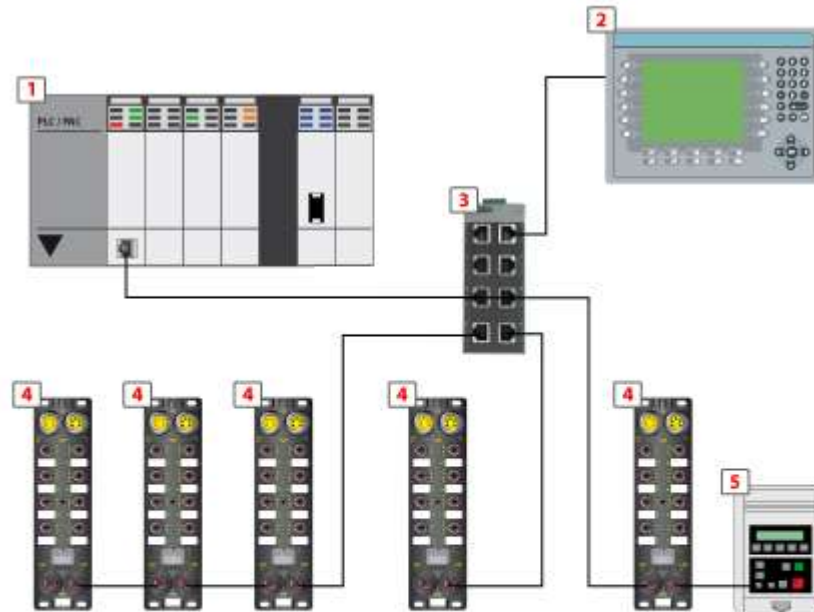
- Performing maintenance on any module not physically located at the end of the daisy chain – for example, by removing the network cable, or by cycling power to the module – affects any modules located down the chain from the maintained module.
- The embedded dual port Ethernet switch located in each module eliminates the need for additional Ethernet switches.



- 1 EtherNet/IP PLC
- 2 HarshIO eIP modules
- 3 Ethernet switch

Combination of star and daisy-chain topology

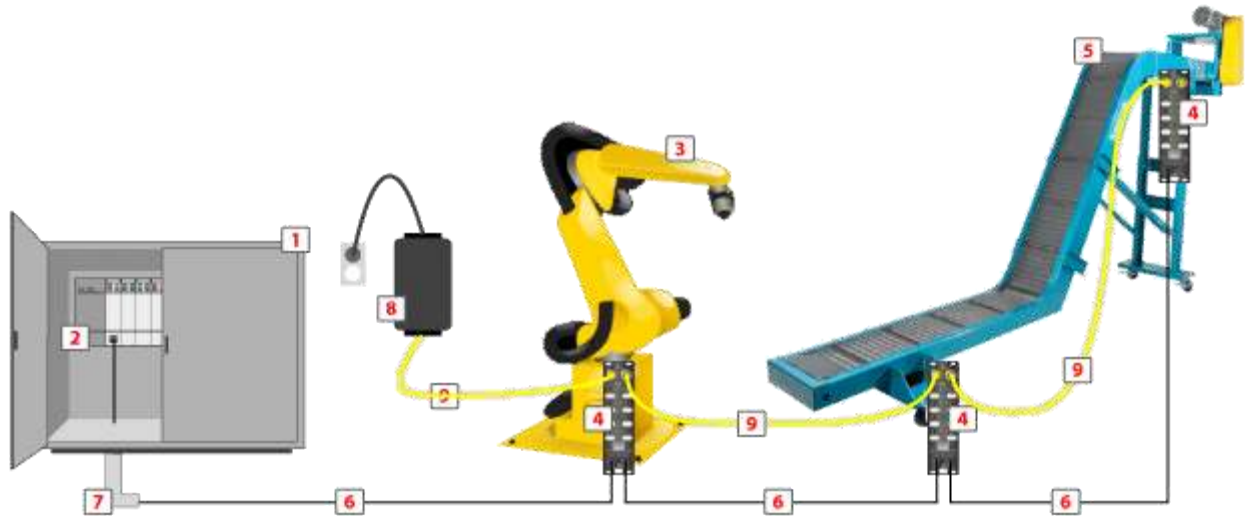
Combining star and daisy-chain topology allows you to connect HarshIO eIP modules with mixed HarshIO modules or additional equipments.



- 1 EtherNet/IP PLC
- 2 HMI device
- 3 Ethernet switch
- 4 HarshIO eIP modules
- 5 Drive

Typical application

This diagram shows you an example of a typical application using in-cabinet PLC controlling HarshIO eIP modules mount on various industrial systems.



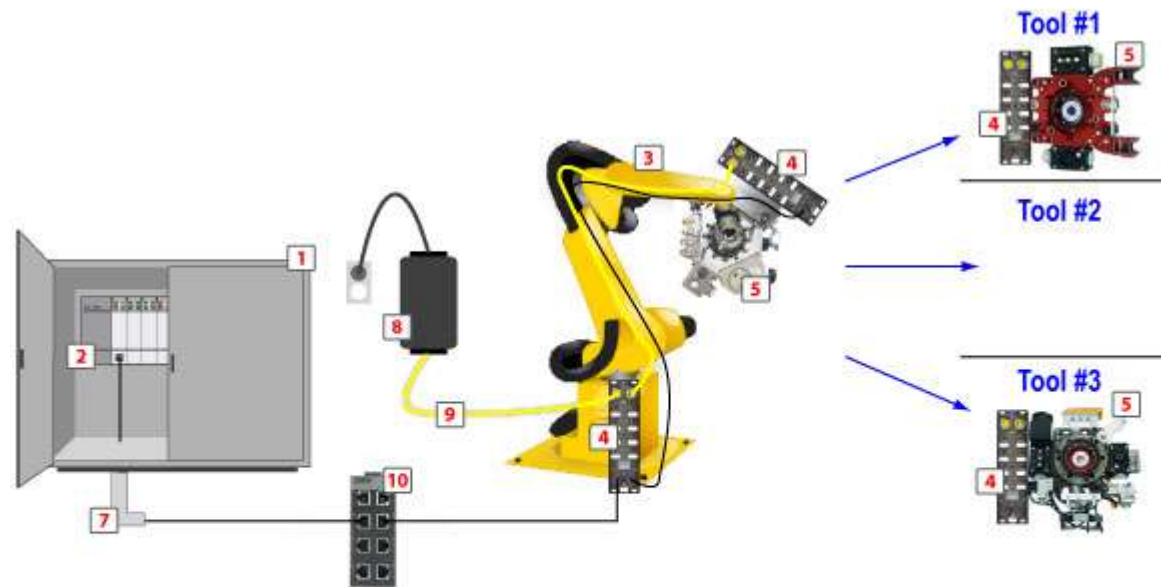
- | | |
|-----------------------|--------------------------------|
| 1 Cabinet | 6 Ethernet cable |
| 2 EtherNet/IP PLC | 7 RJ45 to M12 Ethernet adapter |
| 3 Robot | 8 24V power supply |
| 4 HarshIO eIP modules | 9 Power supply cable |
| 5 Conveyor | |

Quick Connect applications

The HarshIO eIP modules are designed to support the new **Quick Connect** feature according to the ODVA specifications which allow to power up, connect an EtherNet/IP scanner and start I/O cyclic data exchange **in less than 500 msec**.

The Quick Connect feature is typically used in robotic application where some I/O devices are mounted on a tool changer. The robot can disconnect and reconnect on the fly a new tool without stopping the manufacturing process.

The diagram shows you an example of a robotic application using Quick Connect feature.

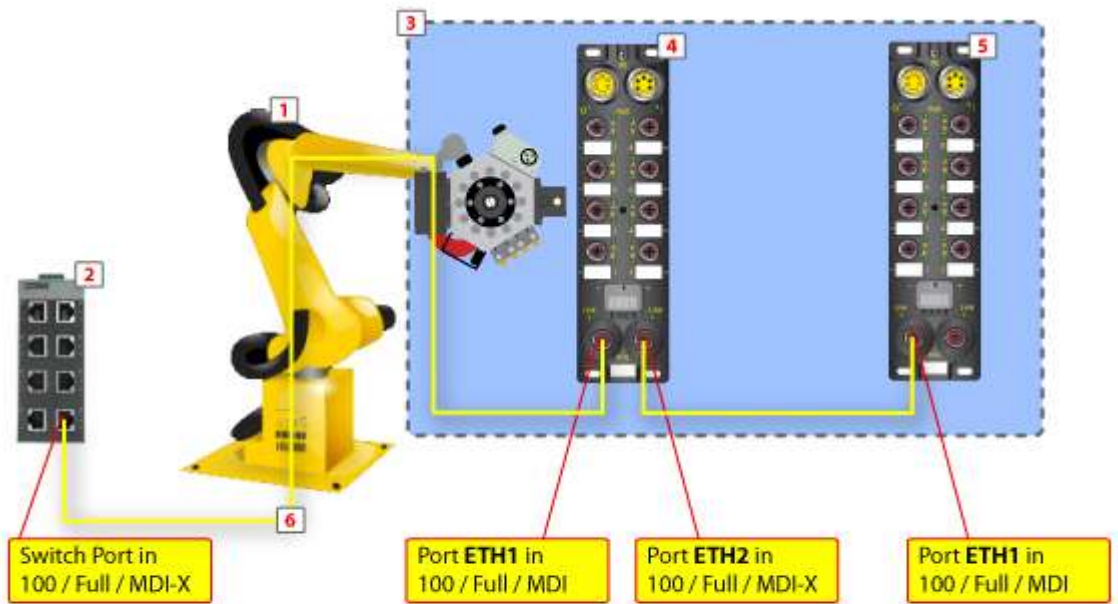


- | | |
|-----------------------|--------------------------------|
| 1 Cabinet | 6 Ethernet cable |
| 2 EtherNet/IP PLC | 7 RJ45 to M12 Ethernet adapter |
| 3 Robot | 8 24V power supply |
| 4 HarshIO eIP modules | 9 Power supply cable |
| 5 Tool Changer | 10 Ethernet Switch |

Quick Connect Architecture

When Quick Connect feature is used, the following recommendations should apply:

- A Quick Connect device Ethernet switch ports must be configured with fixed speed to 100Mbps and full duplex enabled (auto negotiation is prohibited).
- The Ethernet cable mounted on the robot must be connected to the ETH1 port (MDI port) of the HarshIO eIP module. Quick Connect devices shall not use Auto-MDIX (detection of the required cable connection type). This detection may take more time than the allowed Quick Connect system connection time (see diagram below).
- The maximum number of Quick Connect HarshIO eIP modules connected using daisy-chain topology on the robot tool changer is recommended to be less or equal to 8. This limit can be reduced depending of the Quick Connect performance supported by the EtherNet/IP controller.



- | | |
|-------------------|-------------------------|
| 1 Robot | 4 HarshIO eIP module #1 |
| 2 Ethernet Switch | 5 HarshIO eIP module #2 |
| 3 Tool Changer | 6 Ethernet cable |

Enabling Quick Connect mode

The HarshIO eIP modules can be configured for Quick Connect mode according the 2 methods:

1. Set Byte 9, Bit 0 of the configuration assembly (see chapter [I/O Data Mapping](#)).
 - a value of “0” automatically
 - o disables Quick Connect
 - o sets ETH1 and ETH2 Ethernet ports to auto-negotiation
 - o If the module fails the auto-negotiation after a reset or a restart, the ETH1 port goes to 100 Full Duplex Auto-MDIX and ETH2 goes to 100 Full Duplex Auto-MDIX
 - a value of “1” automatically
 - o enables Quick Connect
 - o sets ETH1 port to 100 Full Duplex MDI
 - o sets ETH2 port to 100 Full Duplex MDIX
2. Set Attribute 12 of CIP TCP/IP object (0xF5) using Explicit Messaging

Note: After each change of Quick Connect mode (means enable ↔ disable), the HarshIO module stores the new requested mode in its non-volatile memory. The module behaves in this mode until the next modification.

Note: The modification of a Quick Connect mode is applied after the next power supply cycling of the module or by sending a Reset command (CIP object 0x01, Instance 1 Service 5).

4. Module Characteristics

Hardware characteristics

Type	TCDEI-8D0P-DYU-G	TCDEI-888P-DYU-G	TCDEI-80DP-DYU-G
Description	16x Inputs	8x Inputs + 8x Outputs	16x Outputs
ODVA Product Code	0x320 (0008000C03200601.eds)	0x323 (0008000C03230601.eds)	0x329 (0008000C03290601.eds)
Power			
Power IN connector	Mini Change (7/8"), 4-pin, male, stainless steel, Maximum 8 A		
Power OUT connector	Mini Change (7/8"), 4-pin, female, stainless steel, Maximum 8 A		
Module & Input power (UB)	24 VDC, -15/+20% (protected against power crossing). Warning, a voltage over 30 VDC will destroy the module		
Operating current (UB)	68 mA		
Output power (UL)	24 VDC, -15/+20% (protected against power crossing)		
Operating current (UL)	10 mA (without load)		
Inputs			
Channels	16x channels, 2 or 3-wire	8x channels, 2 or 3-wire	
Connector	M12 Ultra-Lock, 5-pin, female, A-Coded, stainless steel		
Input type	PNP, Sinking		
Input voltage	UB		
Sensor power supply	140 mA at 25°C		
Input channel voltage ("1")	10V ... 30V		
Input channel voltage ("0")	-0.2V ... 5V		
Input short circuit protection (per port)	600mA		
Input filter	1 ... 5 ms (5 ms by default)		
Outputs			
Channels		8x channels, 2-wire	16x channels, 2-wire
Output voltage		UL -1 VDC	
Connector		M12 Ultra-Lock, 5-pin, female, A-Coded, stainless steel	
Output type		PNP, Sourcing	
Output current		2 A per channel	
Maximum output current		8.0 A at 25°C	
Short circuit current (typical)		up to 6.5 A	
Switching frequency		200 Hz	
Fieldbus			
Ethernet connectors	M12, 5-pin, female, D-Coded, stainless steel, shielded		
IP setting	DHCP based on MAC (infinite lease), Static IP		
Protocol	EtherNet/IP Adapter according specification Vol 1-3.9 (CIP) and Vol 2 – 1.10 (EtherNet/IP)		
Data access	Implicit messages for I/O data transfer		
Implicit (I/O) connection	<ul style="list-style-type: none"> • 1x Exclusive Owner (EO) connection • Up to 7 Listen Only (LO) connections 		
Explicit (EM) connection	<ul style="list-style-type: none"> • Up to 8 		
Supported CIP Objects	<ul style="list-style-type: none"> • 0x01 – Identity object • 0x02 – Message Router object • 0x04 – Assembly object <ul style="list-style-type: none"> ◦ 103: T→O (Input process data) 		

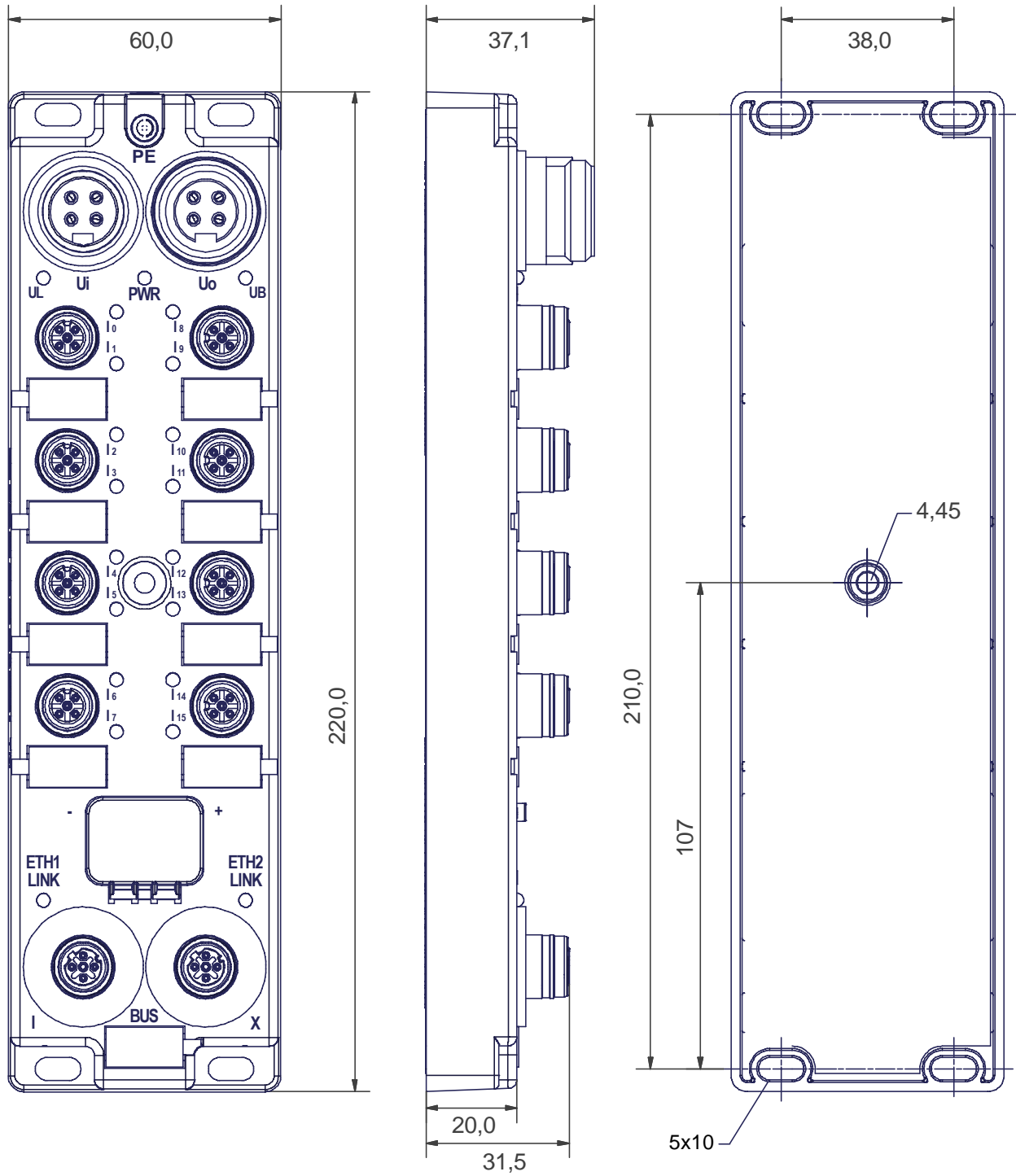
	<ul style="list-style-type: none"> ○ 104: O→T (Output process data) ○ 106: Configuration ○ 199: O→T Heartbeat (Listen Only) ● 0x06 – Connection Manager object ● 0xF5 – TCP/IP Interface object (including Attribute 12 for Quick Connect activation) ● 0xF6 – Ethernet Link object
Integrated Switch	<ul style="list-style-type: none"> ● 2x ports integrated switch ● Speed: 10/100Mbps ● Auto negotiation ● Auto crossing ● Auto polarity ● 1x status Led / port ● Storm Protection against network loop (Broadcast, Multicast and Unicast packets)
Daisy Chain (Ethernet)	Up to 8 HarshIO
Ethernet Packet	Manage up to 9000 packet/sec (TBC)
Request Packet Interval (RPI)	from 1 ms up to 65535 ms (default 30 ms)
IP Address Conflict Detection	Yes (ACD supported)
Quick Connect	Yes (Class A)
ODVA conformance	Yes (pending)
Characteristics	
Housing dimension	600 x 220 x 20 mm (2.36"x8.66"x.780")
Housing material	PBT VALOX 420 SEO Black 7701
Flammability Standard	UL 94 V-0
Corner mounting hole	4 mounting holes, 5 x10 mm
Central mounting hole	1 mounting hole, Ø4.45 mm
Operating temperature	-25°c ... +70°c
Storage temperature	-40°c ... +90°c
Vibration resistance	7g (15,7Hz to 500Hz), 3 axis
Shock resistance	10g, 11ms, 3 axis
Electro-magnetic compatibility	EN 61000-6-2 / EN 61000-6-4
Protection Class	IP67
Approval	CE (according IEC 61131-2), UL / cUL
Environmental	RoHS and REACH
MTBF	100 000 hours / 11 years at 70°C

Default IP setting:

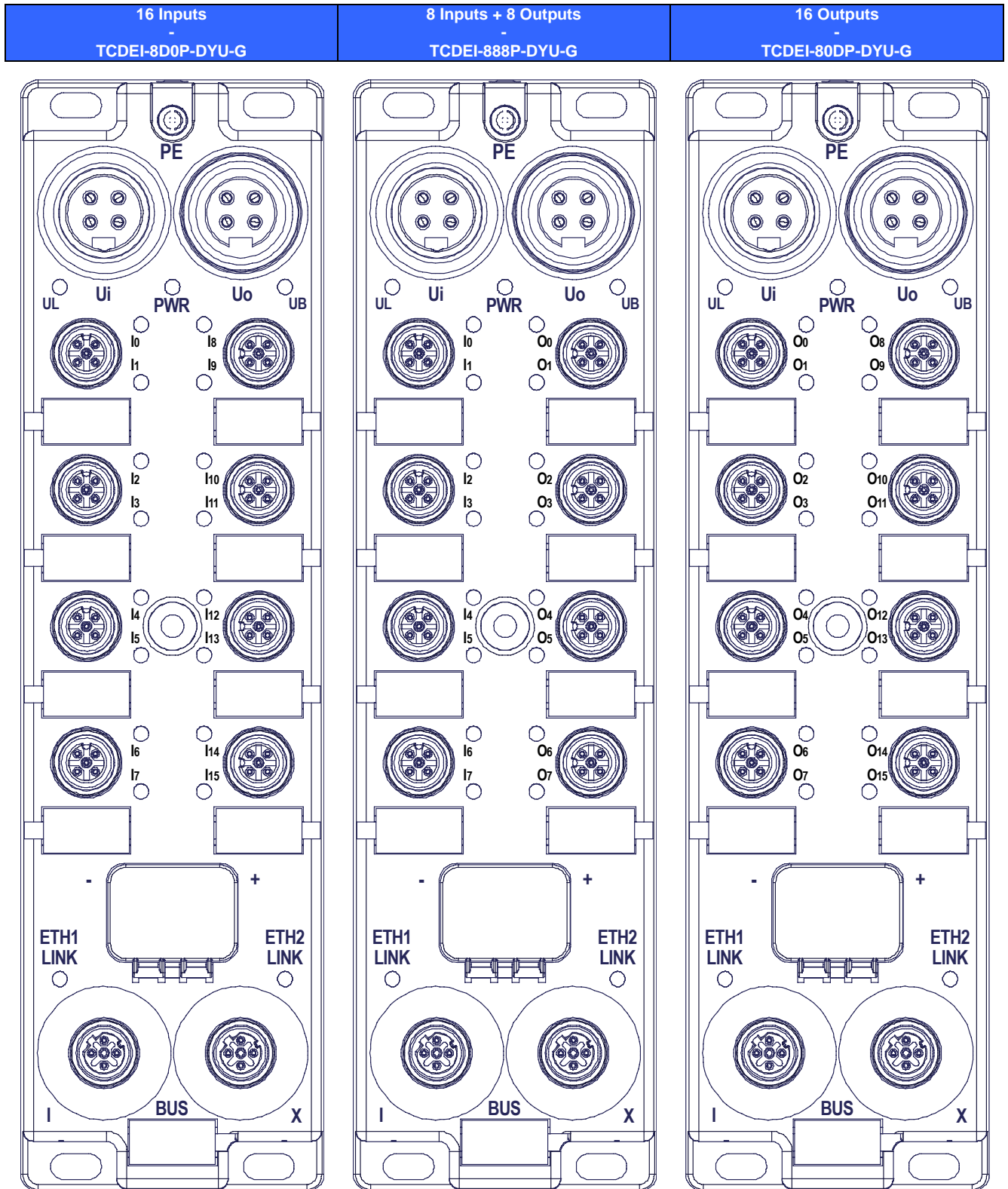
IP address: 136.129.1.1
 Subnet mask: 255.255.0.0
 Gateway: 0.0.0.0
 ETH1 port: Auto negotiation
 ETH2 port: Auto negotiation
 Quick Connect: Disabled
 ACD: Enabled

Mechanical characteristics

Size and dimensions (in mm)



Physical I/O mapping

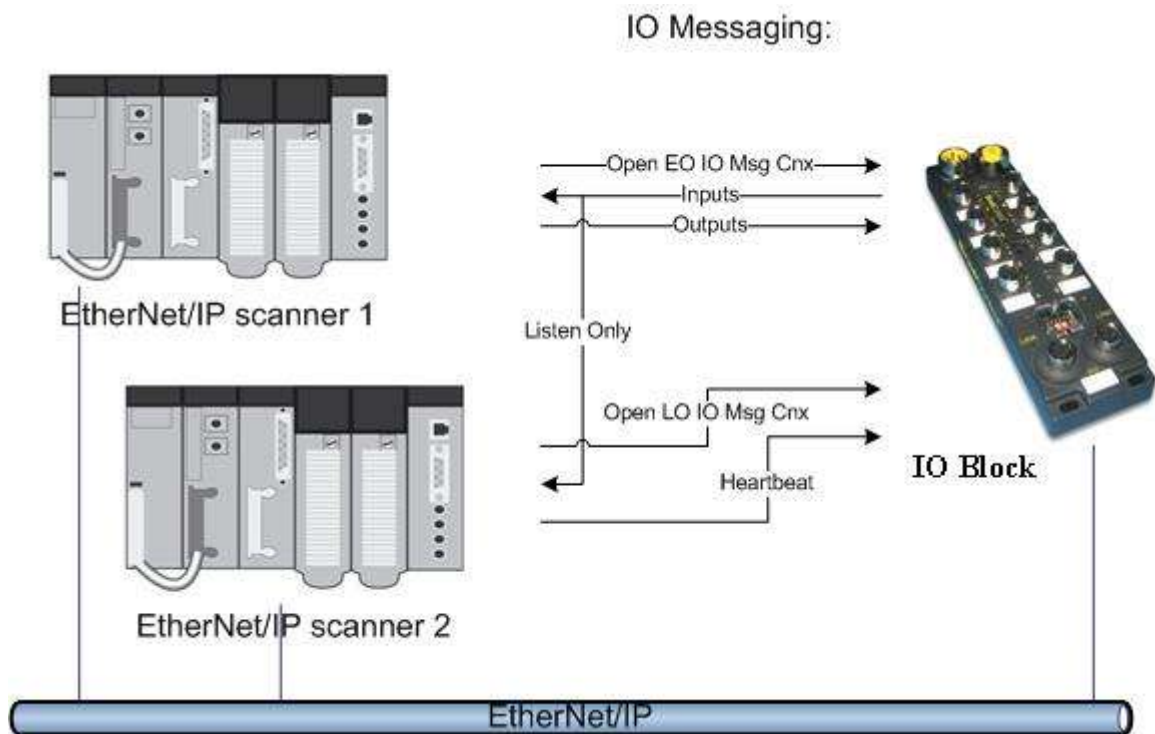


I/O messaging

The firmware embedded in the **HarshIO 600 eIP** supports up to a maximum of 8 I/O connections. Fewer connections allow faster data I/O update rates (RPI value).

I/O Connections:

- Module supports 2 Transport Class 1 I/O connections (Cyclic and Change-Of-State triggers):
 - o 1x Exclusive Owner
 - Unicast and Multicast (T→O) connection
 - Unicast (O→T) connection
 - o 7x Listen Only
 - Multicast (T→O) connection



I/O data mapping

The I/O process data are available through the EtherNet/IP assemblies:

- **Assembly #103** for Input process data
- **Assembly #104** for Output process data
- **Assembly #106** for Configuration data

16 Inputs module version (TCDEI-8D0P-DYU-G)

	Byte Offset	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input Data (Assembly #103), Size: 8 bytes																	
Data	00	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Input Data	02	I ₁₅	I ₁₄	I ₁₃	I ₁₂	I ₁₁	I ₁₀	I ₉	I ₈	I ₇	I ₆	I ₅	I ₄	I ₃	I ₂	I ₁	I ₀
Port Status	04	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Port Status	06	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	PS P ₇	PS P ₆	PS P ₅	PS P ₄	PS P ₃	PS P ₂	PS P ₁	PS P ₀
Output data (Assembly #104), Size: 2 bytes																	
Output Data	00	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Configuration (Assembly #106), Size: 16 bytes																	
Data	00	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Data	02	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Data	04	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Data	06	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Data	08	n/u	n/u	n/u	n/u	n/u	n/u	n/u	QC	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Data	10	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Data	12	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Data	14	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u

n/u: Not used

I_x: Input channel x

PS: Port Status (short circuit detected on a port driving Input channels)

QC: Quick Connect, 1 = Enable; 0 = Disable

16 Outputs module version (TCDEI-80DP-DYU-G)

	Byte Offset	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input Data (Assembly #103), Size: 8 bytes																	
Data	00	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Input Data	02	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Port Status	04	CS O ₇	CS O ₆	CS O ₅	CS O ₄	CS O ₃	CS O ₂	CS O ₁	CS O ₀	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Port Status	06	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	CS O ₁₅	CS O ₁₄	CS O ₁₃	CS O ₁₂	CS O ₁₁	CS O ₁₀	CS O ₉	CS O ₈
Output data (Assembly #104), Size: 4 bytes																	
	00	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Output Data	02	O ₁₅	O ₁₄	O ₁₃	O ₁₂	O ₁₁	O ₁₀	O ₉	O ₈	O ₇	O ₆	O ₅	O ₄	O ₃	O ₂	O ₁	O ₀
Configuration (Assembly #106), Size: 16 bytes																	
Data	00	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Data	02	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Data	04	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Data	06	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Data	08	n/u	n/u	n/u	n/u	n/u	n/u	n/u	QC	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Data	10	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Data	12	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Data	14	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u

n/u: Not used

CS: Channel status (short circuit on Output channel or impossible to drive the Output)

If output power supply (UL) is down, output channel status (CS) is set for the corresponding activated output channels. The module display shows the message: "IO: ERR".

Example: if the output "O₃" is active and UL goes down, the "CS O₃" status bit is set to 1.

O_x: Output channel x

QC: Quick Connect, 1 = Enable; 0 = Disable

8 Inputs + 8 Outputs module version (TCDEI-888P-DYU-G)

	Byte Offset	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input Data (Assembly #103), Size: 8 bytes																	
Data	00	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Input Data	02	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	I7	I6	I5	I4	I3	I2	I1	I0
Port Status	04	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Port Status	06	CS O7	CS O6	CS O5	CS O4	CS O3	CS O2	CS O1	CS O0	n/u	n/u	n/u	n/u	PS P3	PS P2	PS P1	PS P0
Output data (Assembly #104), Size: 4 bytes																	
	00	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Output Data	02	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	O7	O6	O5	O4	O3	O2	O1	O0
Configuration (Assembly #106), Size: 16 bytes																	
Data	00	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Data	02	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Data	04	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Data	06	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Data	08	n/u	n/u	n/u	n/u	n/u	n/u	n/u	QC	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Data	10	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Data	12	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Data	14	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u

n/u: Not used

Ix: Input channel x

Ox: Output channel x

PS: Input Port Status (short circuit on Input channel)

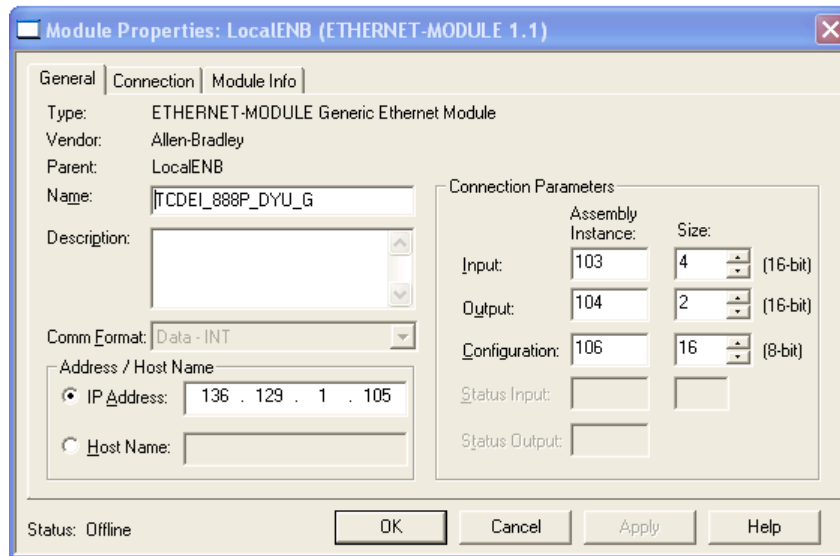
CS: Channel status (short circuit on Output channel or impossible to drive the Output)

If output power supply (UL) is down, output channel status (CS) is set for the corresponding activated output channels. The module display shows the message: "IO: ERR".

Example: if the output "O3" is active and UL goes down, the "CS O3" status bit is set to 1.

QC: Quick Connect, 1 = Enable; 0 = Disable

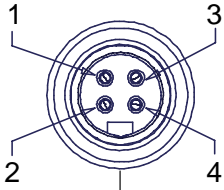
Note: If your controller configuration software doesn't support the management of EDS files, you may have to configure manually the assembly number to access the process data.



- Example of HarshIO 8in/8Out assembly configuration in Rockwell Automation RSLogix 5000 -

Pin assignment

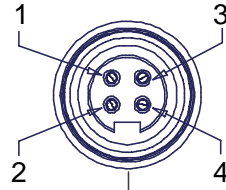
Power IN
4-pole, 7/8 (Mini-Change), Male



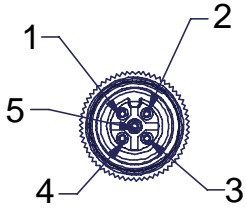
Wiring Information

- 1 - 24 VDC (Outputs Power)
- 2 - 24 VDC (Module & Inputs Power)
- 3 - 0 V (Ground Module & Inputs Power)
- 4 - 0 V (Outputs Power)

Power OUT
4-pole, 7/8 (Mini-Change), Female



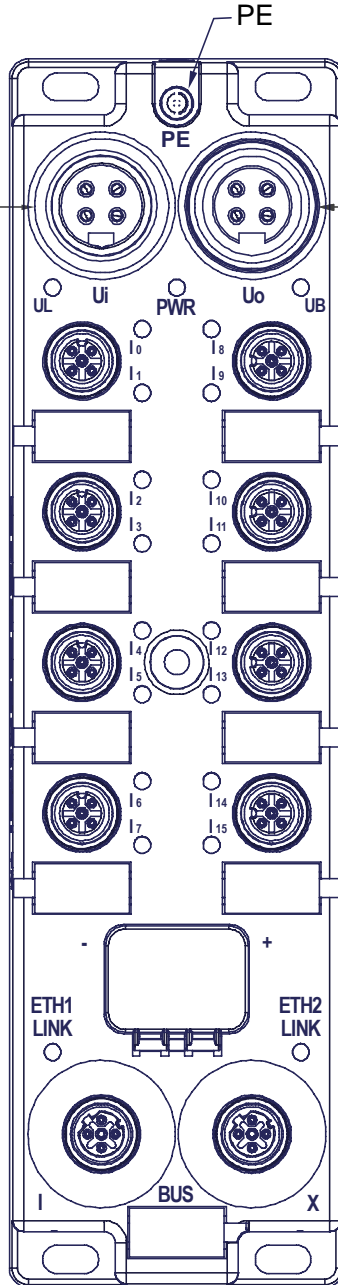
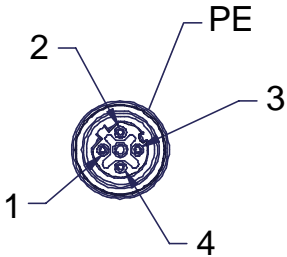
I/O Ports
5-pole, M12 (Micro-Change), Female, A-Code



Wiring Information

- 1 - +24 VDC
- 2 - B Input / Output
- 3 - 0 V (Ground)
- 4 - A Input / Output
- 5 - PE (Protected Earth)

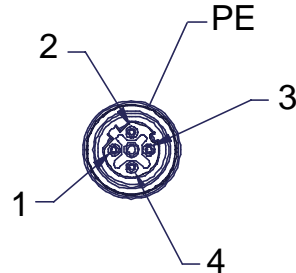
Ethernet Port 1 (ETH1)
4-pole, M12 (Micro-Change), Female, D-Code



Wiring Information

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

Ethernet Port 2 (ETH2)
4-pole, M12 (Micro-Change), Female, D-Code



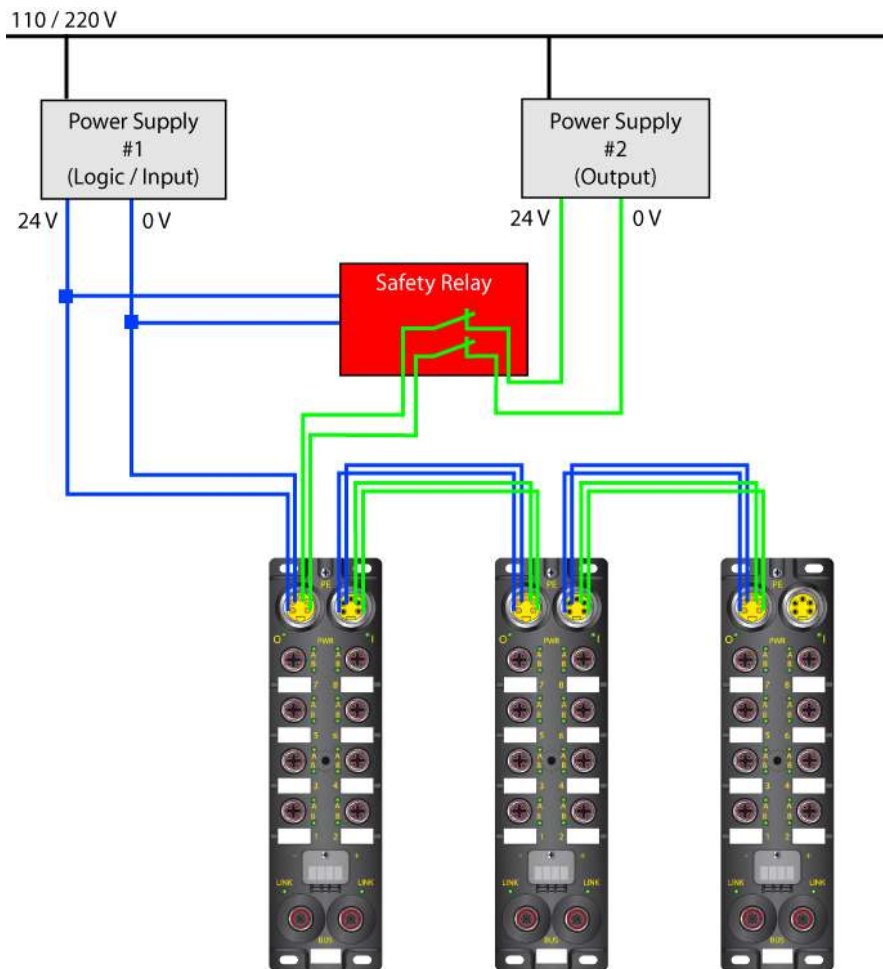
Separate grounding wiring for application using safety relays

The HarshIO Ethernet power connector includes a separate grounding isolation between the input/logic ground (Pin 3) and the output ground (Pin 4). This feature allows powering the module with 2 distinct power supplies that is commonly used in safety application.

Typically in automation application, a system designer is using safety relays (like Rockwell Automation Guard I/O EtherNet/IP Safety Modules [1791ES-IB8XOBV4, 1791ES-IB16], Siemens PM-E F pp DC24V [6ES7 138-4CF42-0AB0], Siemens PM-E F pm DC24V [6ES7 138-4CF03-0AB0]) that regularly perform the pulse test to be able to detect a short-circuit, ground fault or an earth fault. If an error is detected the safety function is triggered and unwanted and dangerous plant conditions are therefore avoided.

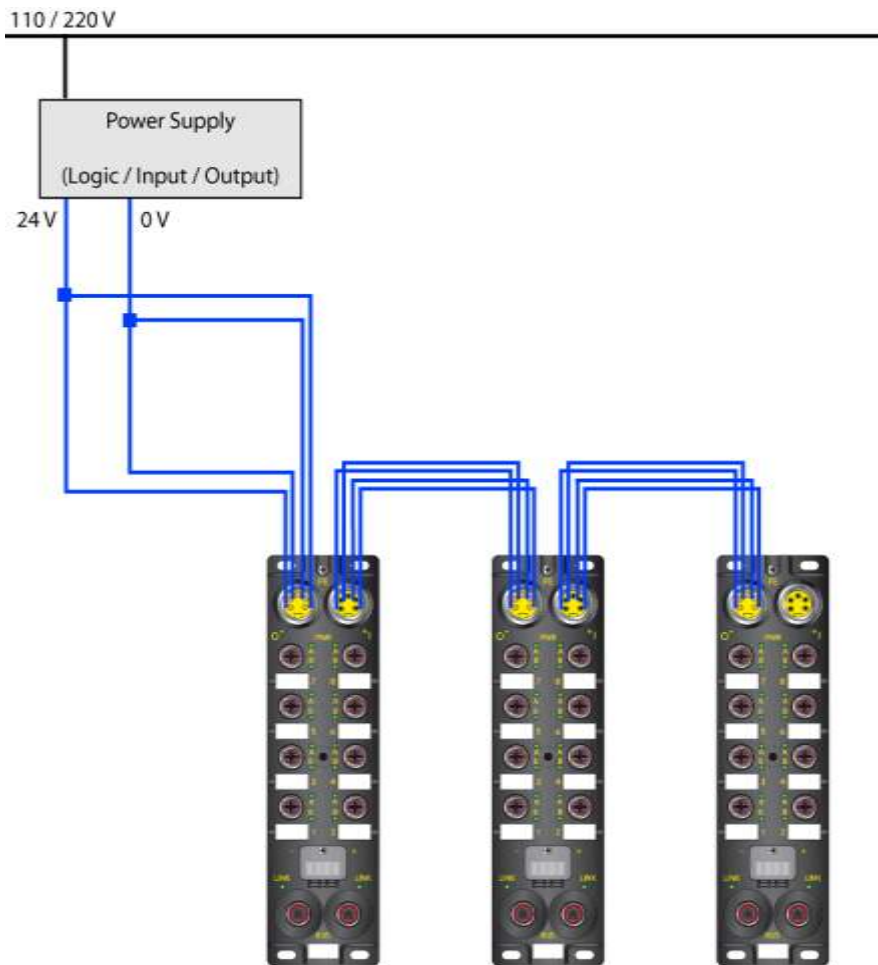
However if the separate grounding for safety is not required by the system designer, the HarshIO modules can operate using a single power supply where the grounds of both logic/input and output are identical. See the diagram “Architecture with single power supply” below for more details.

Architecture using two distinct power supplies with safety relay



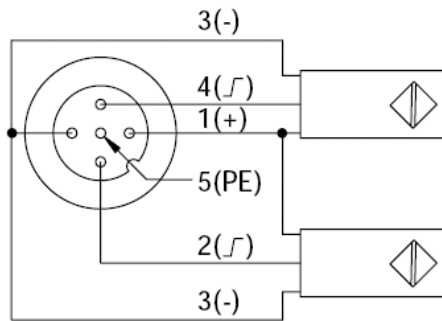
Architecture with single power supply

Note, the connection of the common ground (Logic/Input + Output) is made outside the HarshIO module.



Port wiring type

2 Input channels per port – Twin wired

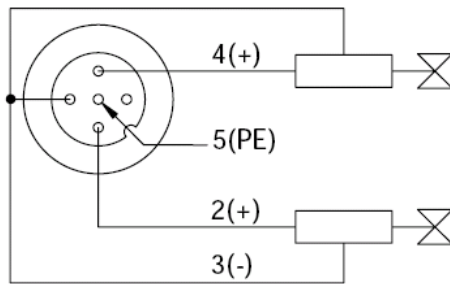


Note:

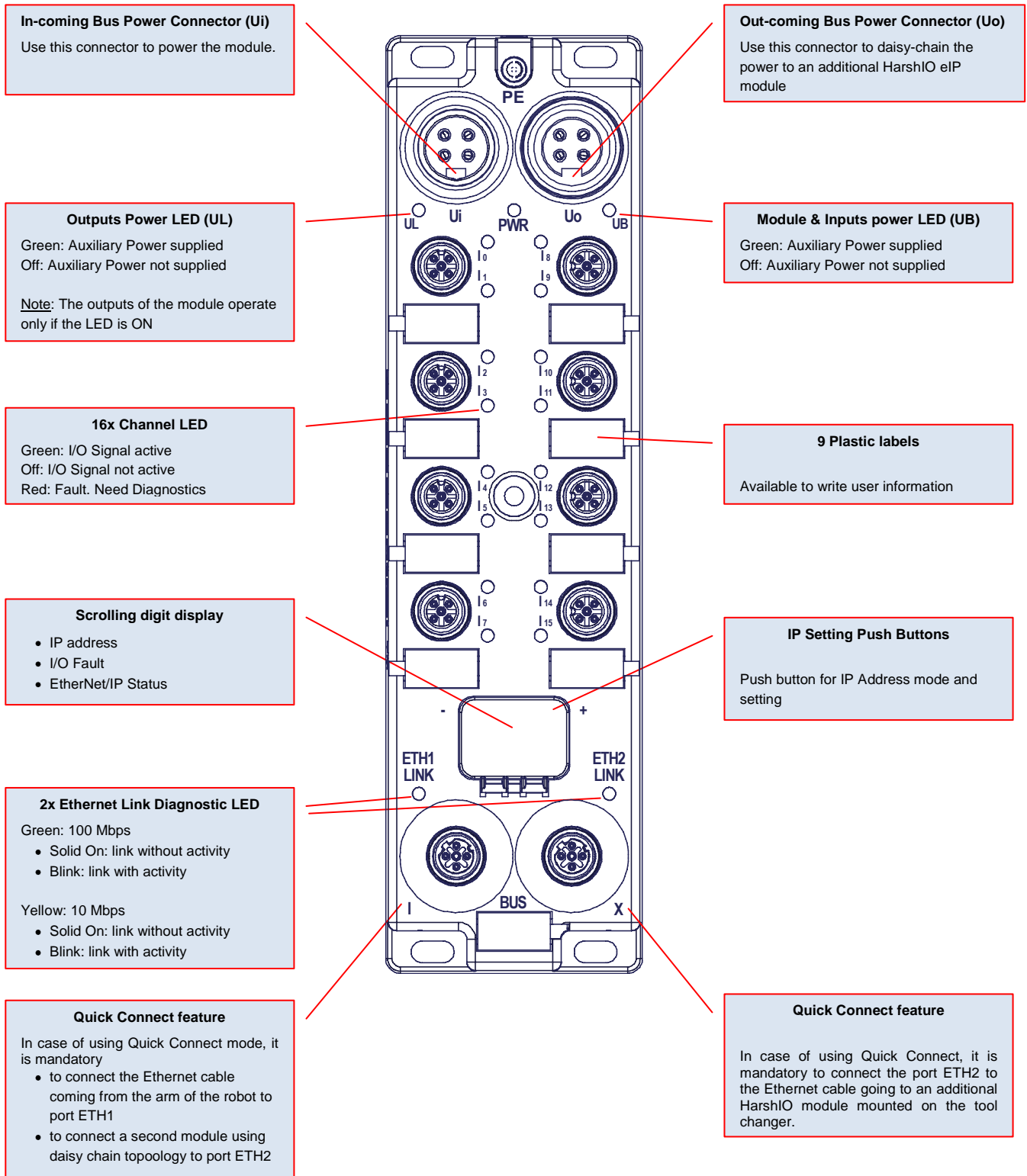
PNP wiring with a 2 wires input sensor

Connect pin 1 (24 V) and pin 4 or 2 (signal in)

2 Output channels per port – Twin wired



LED assignment



Network IP address setting

The HarshIO 600 eIP is configured out of the box with the default static IP address setting:

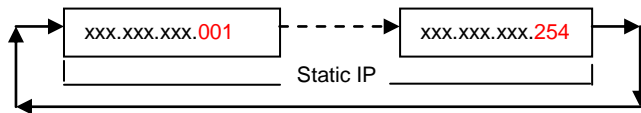
IP address: 136.129.1.1
Subnet mask: 255.255.0.0
Gateway: 0.0.0.0

To change the default IP address, the operator has the possibility to use one of the following methods:

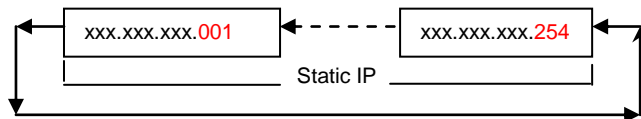
- Use of the display

Use the push-buttons and the scrolling display; This method only allows an operator to change the last byte of the IP address (136.129.1.**x**). To change the network IP address, push on the right or left button of the clear window of the HarshIO module.

- Right button behavior (clockwise) :



- Left button behavior (counterclockwise) :



Note: When IP address is selected, it will be stored in non-volatile memory after 5 seconds of inactivity on the push-button. The IP address will be taken in account after a module reset or a power cycle. During this phase, a message “**NEED RESET**” is showed on the display of the module.

Note: If an I/O connection is active with a scanner, it will not be possible to change the IP settings using the push buttons.

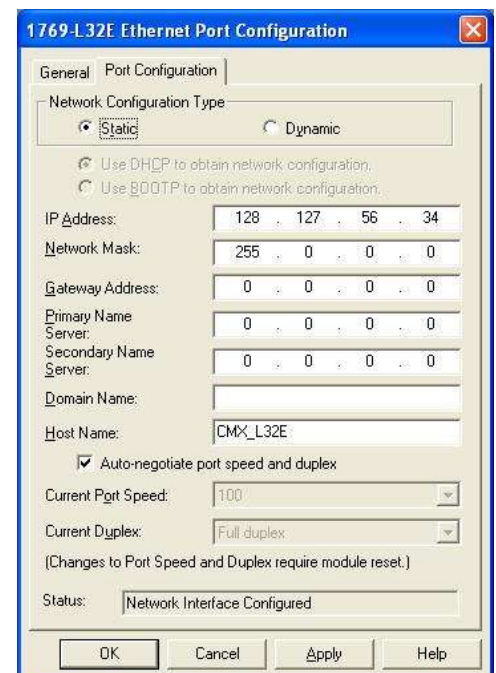
Note: When DHCP mode is selected, the push buttons are disabled.

- Use a configuration tool supporting EtherNet/IP Explicit Messages

To change the IP settings of the module, you have to use a software tool like Rockwell RSLinx[®] that manages *Explicit Messaging* requests to access module CIP objects to set parameters like:

- Static or dynamic IP addressing
- IP address
- Network mask
- Etc.

Note: If an I/O connection is active with a scanner, it will not be possible to change the IP settings.



Display information

The 4-digit LED display shows the Ethernet configuration and the global state of the module.

Information present into the display:

- Module information
 - **NEED RESET:** Means that the module requires a reset via software (using CIP Identity object) or a power cycle

- Ethernet IP addressing mode
 - **STORED_IP: xxx.xxx.xxx.xxx:** Stored IP Address

 - **DHCP: xxx.xxx.xxx.xxx:** DHCP mode (assignment based on MAC address)

- I/O status
 - **IO:ERR:** I/O error detection (short circuit on output or input power supply)

- Ethernet information
 - **STARTING...:** Waiting IP address from DHCP server.
Note: The HarshIO module send a DHCP request with an infinite lease (The IP address assignes never expired). According the configuration of the DHCP server, it can accept or modify the lease to a different period.

 - **IPCONFLICT:** The module has detected an IP address conflict

 - **WAIT LINK:** No link has been detected on the both Ethernet ports. If the IP address is configured as static then the IP address will be displayed

- EtherNet/IP Information
 - **EIP:NO_CNX:** No connection is established with a scanner

 - **EIP:OPERATE:** Connection in progress: An I/O connection was opened, but I/O data are not yet exchanged with the scanner

 - **EIPRUN:** The module exchange data with a scanner.

 - **EIP:IDLE:** The connection is established, but I/O are not exchanged

 - **EIP:TIMEOUT:** The connection has been lost with a scanner

 - **EIP:CLOSE:** The close connection has been received from a scanner

 - **RST:** The module has received a "reset" command on the Identity Object and will reboot shortly

Hardware address (MAC Address)

Each **HarshIO 600 eIP** has a unique Ethernet MAC address figured on the attached label on the back of the module. This address has a fixed length of 6 bytes (48 bits) including the manufacturer's ID and the serial number of the HarshIO module.

The MAC address will be defined as the following:

Manufacturer ID	Family	Serial Number
00.A0.91	3	X.XX.XX

EDS files

The EDS files can be downloaded from the Molex website:

<http://www.molex.com/molex/mysst/DownloadCenter.action>

Configure the **HarshIO 600 eIP** via the EDS file. In this EDS file, the HarshIO 600 eIP is implemented as standard device in your system.

EDS file list for HarshIO 600 eIP devices:

Name	EDS File	Product Code
TCDEI-8D0P-DYU-G	0008000C03200601.eds	0x320
TCDEI-888P-DYU-G	0008000C03230601.eds	0x323
TCDEI-80DP-DYU-G	0008000C03290601.eds	0x329

5. Specific Behavior

I/O behavior

When the **HarshIO 600 eIP** is running (Scanner connection in progress) if the module detects a connection lost with the Scanner, the module sets automatically the output process data to 0.

The detection of the connection lost with the Scanner is calculated based on the time-out (multiplier x RPI) defined in the I/O connection (Forward_Open request) sent by the scanner.

IDLE behavior

An EtherNet/IP scanner can produce the output process data in IDLE mode (typically when it is in programming mode). In this case the controller maintains its I/O connections open but informs the devices the output process data must not be processed.

When the **HarshIO 600 eIP** received output data in IDLE mode,

- the scrolling display shows **EIP:IDLE**
- the module sets all its outputs to 0
- the module produces its inputs to the scanner

Duplicate IP address

The **HarshIO 600 eIP** performs a duplicate IP address checking according to ACD method (IPv4 Address Conflict Detection) defined by ODVA and RFC 5227.

The goal of this feature is to ensure that the IP address is not used by another device on the network. This mechanism is done during boot up of the module, during module operation (if a new device inserted to the network is trying to use the same IP) or after software reset (CIP object 0x01, Instance 1 Service 5).

If the module detects another device with the same IP address, it will:

- Defend its IP address
- If conflict is confirmed
 - o The module will release its IP address
 - o The display will show the message : **IP CONFLICT**

6. EtherNet/IP Object Classes

The following services are accessible through the use of EtherNet/IP Explicit Messaging.

Identity (0x01)

This object allows reading the identity of the module.

Class Attributes

Id	Description	Get	Set	Limits
01h	Revision	●	○	1
02h	Max Instance	●	○	1
03h	Number of instances	●	○	1

● Supported ○ Not supported

Class Services

Id	Service	Param. Options
01h	Get_Attributes_All	
0Eh	Get_Attribute_Single	

Instance Attributes

Id	Description	Get	Set	Limits
01h	Vendor Id	●	○	8
02h	Device Type	●	○	12
03h	Product Code	●	○	Depends on the product
04h	Revision	●	○	Depends on the revision
05h	Status	●	○	
06h	Serial Number	●	○	
07h	Product Name	●	○	Depends on the product

● Supported ○ Not supported

Instance Services

Id	Service	Param. Options
01h	Get_Attributes_All	
05h	Reset	
0Eh	Get_Attribute_Single	

Message Router (0x02)

Class Attributes

Id	Description	Get	Set	Limits
1	Revision	<input type="radio"/>	<input type="radio"/>	
4	Optional Attribute List	<input type="radio"/>	<input type="radio"/>	
5	Optional Service List	<input type="radio"/>	<input type="radio"/>	
6	Max ID of class attributes	<input type="radio"/>	<input type="radio"/>	
7	Max ID of instance attributes	<input type="radio"/>	<input type="radio"/>	

● Supported Not Supported

Class Services

Service		Param. Options
Get_Attributes_All	<input type="radio"/>	
Get_Attribute_Single	<input type="radio"/>	

● Supported Not Supported

Instance Attributes

Id	Description	Get	Set	Limits
1	Object List	<input type="radio"/>	<input type="radio"/>	
2	Maximum connections supported	<input type="radio"/>	<input type="radio"/>	
3	Number of active connections	<input type="radio"/>	<input type="radio"/>	
4	Active connections list	<input type="radio"/>	<input type="radio"/>	

● Supported Not Supported

Instance Services

Service		Param. Options
Get_Attributes_All	<input type="radio"/>	
Get_Attribute_Single	<input type="radio"/>	

● Supported Not Supported

Assembly (0x04)

This object allows to access I/O process data.

Class Attributes

Id	Description	Get	Set	Limits
01h	Revision	●	○	2
02h	Max Instance	●	○	199
03h	Number of instances	●	○	4

● Supported ○ Not supported

Class Services

Service	Param. Options
Get_Attribute_Single	●

● Supported ○ Not Supported

Instance Attributes

Id	Description	Get	Set	Limits
03h	Data	●	●	Set command is not allowed if an exclusive owner connection is open

● Supported ○ Not supported

Instance Services

Id	Service	Param. Options
0Eh	Get_Attribute_Single	
10h	Set_Attribute_Single	

Connection Manager (0x06)

Class Attributes

Id	Description	Get	Set	Limits
01h	Revision	●	○	1
02h	Max Instance	●	○	1
03h	Number of instances	●	○	1

● Supported ○ Not supported

Class Services

Id	Service	Param. Options
01h	Get_Attributes_All	
0Eh	Get_Attribute_Single	

Instance Attributes

Id	Description	Get	Set	Limits
01h	Open Requests	●	○	
02h	Open Format Rejects	●	○	
03h	Open Resource Rejects	●	○	
04h	Open Other Rejects	●	○	
05h	Close Requests	●	○	
06h	Close Format Requests	●	○	
07h	Close Other Requests	●	○	
08h	Connection Timeouts	●	○	

● Supported ○ Not supported

Instance Services

Id	Service	Param. Options
01h	Get_Attributes_All	
0Eh	Get_Attribute_Single	
4Eh	Forward_Close	
54h	Forward_Open	
5Bh	Large_Forward_Open	Class 3 only

TCP/IP Interface (0xF5)

Class Attributes

Id	Description	Get	Set	Limits
01h	Revision	●	○	2
02h	Max Instance	●	○	1
03h	Number of instances	●	○	1

● Supported ○ Not supported

Class Services

Id	Service	Param. Options
01h	Get_Attributes_All	
0Eh	Get_Attribute_Single	

Instance Attributes

Id	Description	Get	Set	Limits
1	Status	●	○	
2	Configuration Capability	●	○	
3	Configuration Control	●	●	
4	Physical Link	●	○	
5	Interface Configuration	●	●	
6	Host Name	●	●	
7	Safety Network Number	○	○	
8	TTL Value	○	○	
9	Mcast Config	○	○	
10	Select ACD	●	●	
11	LastConflictDetected	●	●	
12	EtherNet/IP Quick_Connect	●	●	

● Supported ○ Not supported

Instance Services

Id	Service	Param. Options
01h	Get_Attributes_All	
0Eh	Get_Attribute_Single	
10h	Set_Attribute_Single	

Ethernet Link (0xF6)

Class Attributes

Id	Description	Get	Set	Limits
01h	Revision	●	○	3
02h	Max Instance	●	○	3
03h	Number of Instance	●	○	3

● Supported ○ Not supported

Class Services

Id	Service	Param. Options
0Eh	Get_Attributes_All	
0Eh	Get_Attribute_Single	

Instance Attributes

Id	Description	Get	Set	Limits
01h	Interface Speed	●	○	
02h	Interface Flags	●	○	
03h	Physical Address	●	○	
04h	Interface Counters	●	○	
05h	Media Counters	●	○	
06h	Interface Control	●	●	
07h	Interface Type	○	○	
08h	Interface State	○	○	
09h	Admin State	○	●	
10h	Interface Label	●	○	

● Supported ○ Not supported

Instance Services

Id	Service	Param. Options
01h	Get_Attributes_All	
0Eh	Get_Attribute_Single	
10h	Set_Attribute_Single	
4Ch	Get_and_Clear	

7. Getting Started

Packaging content

Each product packaging includes:

- 1x HarshIO 600 eIP module
- 9x plastic labels (for digital channel labeling)
- 8x M12 male closure caps (for sealing unused port)

Accessories

Required devices, accessories and cordsets:

Reference	Description	Quantity	Manufacturer
Devices			
	Programmable controller processor with EtherNet/IP scanner port	1	
TCDEI-8D0P-DYU-G TCDEI-888P-DYU-G TCDEI-80DP-DYU-G	HarshIO 600 eIP	N	BradControl from Molex
Network communication			
EWWA06003Mxy0* + ER1PADAPTER	<u>From Scanner to HarshIO module</u> M12 Ultra-Lock™ (male D-coded) straight double-ended cordsets + M12-to-RJ45 bulkhead adapter	1	BradControl from Molex
EWWA06003Mxy0*	<u>For HarshIO module network chaining</u> M12 Ultra-Lock™ (male D-coded) straight double-ended cordsets	N-1	BradControl from Molex
Power supply			
-	24 VDC Power supply	1	-
104006A01Mxy0*	<u>From Power supply module to HarshIO module</u> Mini-Change® 4-pole female straight single-ended cordsets	1	BradControl from Molex
114030A01Mxy0*	<u>For HarshIO module power chaining</u> Mini-Change® 4-pole female straight / Mini-Change 4-pole male straight double-ended cordsets	N-1	BradControl from Molex
Inputs / Outputs			
-	Field device (actuator or sensor)	N*16 (max.)	-
	M12 Ultra-Lock™ (male A-coded) straight single-ended cordsets	N*8	BradControl from Molex

(*) xy represents the length of the cordsets in meter (M). For instance, "05" indicates a cordset of 5M. Available lengths 1M, 2M, 3M, 4M, 5M or 10M according to cordset reference ([see Cables and Cordsets](#)).

Getting Started

1. I/O wiring and connect

Wire the inputs and/or outputs according to the drawings of chapter "Port wiring type" by using M12/Ultra-Lock (A-code) connectors. Depending on the model reference, the same I/O port supports two I/O channels (2 inputs or 2 outputs) according to I/O assignment. Only one M12/Ultra-Lock (A-code) connector is needed for two I/Os. Plug I/O's on their corresponding ports.

2. Power connect

Make DC power connection from the 24 VDC power supply to the Power connector (Ui) of the HarshIO 600 eIP. If several HarshIO 600 eIP are used, chain the Power connector (Uo) of the first module with the Power connector (Ui) of the next one.

3. Communication connect

Connect the first HarshIO 600 eIP to the Scanner with the appropriate network cable. If several HarshIO 600 eIP are used, chain the network with the appropriate network cable.

4. Apply Power

Power up the power supply module and observe the status LED on each unit.

Module and Input Power Status LED (UB)			
State	Status	Description	Recommended action
OFF	No external power source	No external power source	Apply power to the HarshIO module Check power cable
Green – Solid ON	External power present	The power is applied to the HarshIO module	None

Output Power Status LED (UL)			
State	Status	Description	Recommended action
OFF	No external power source	No external power source	Apply power to the HarshIO module Check power cable
Green – Solid ON	External power present	The power is applied to the HarshIO module	None

Network Link Status LED – ETH1 / ETH2 LINK			
State	Status	Description	Recommended action
OFF	No network link	No network link	Check the network link and set network link if not existing Check wire pinning
Green – Solid ON	100 Mbps network link present	The module is correctly connected to the network	None
Green - BLINKING	100 Mbps network active	The module is in communication with the network	None
Yellow – Solid ON	10 Mbps network link present	The module is correctly connected to the network	None
Yellow - BLINKING	10 Mbps network active	The module is communicating with the network	None

I/O Status LED			
State	Status	Description	Recommended action
OFF	Output not powered and no valid input	Output is not powered or input is not valid	None if not used Check I/O wire pinning
Green – Solid ON	Output powered and valid input	Output is powered and input is valid	None
Red – Solid ON	Fault diagnostic	<ul style="list-style-type: none"> • Short circuit occurred on I/O • Open load detection (output not set though voltage > 3V detected on this port) • Output set though output power not present • Short circuit on sensor power supply 	Check I/O wiring

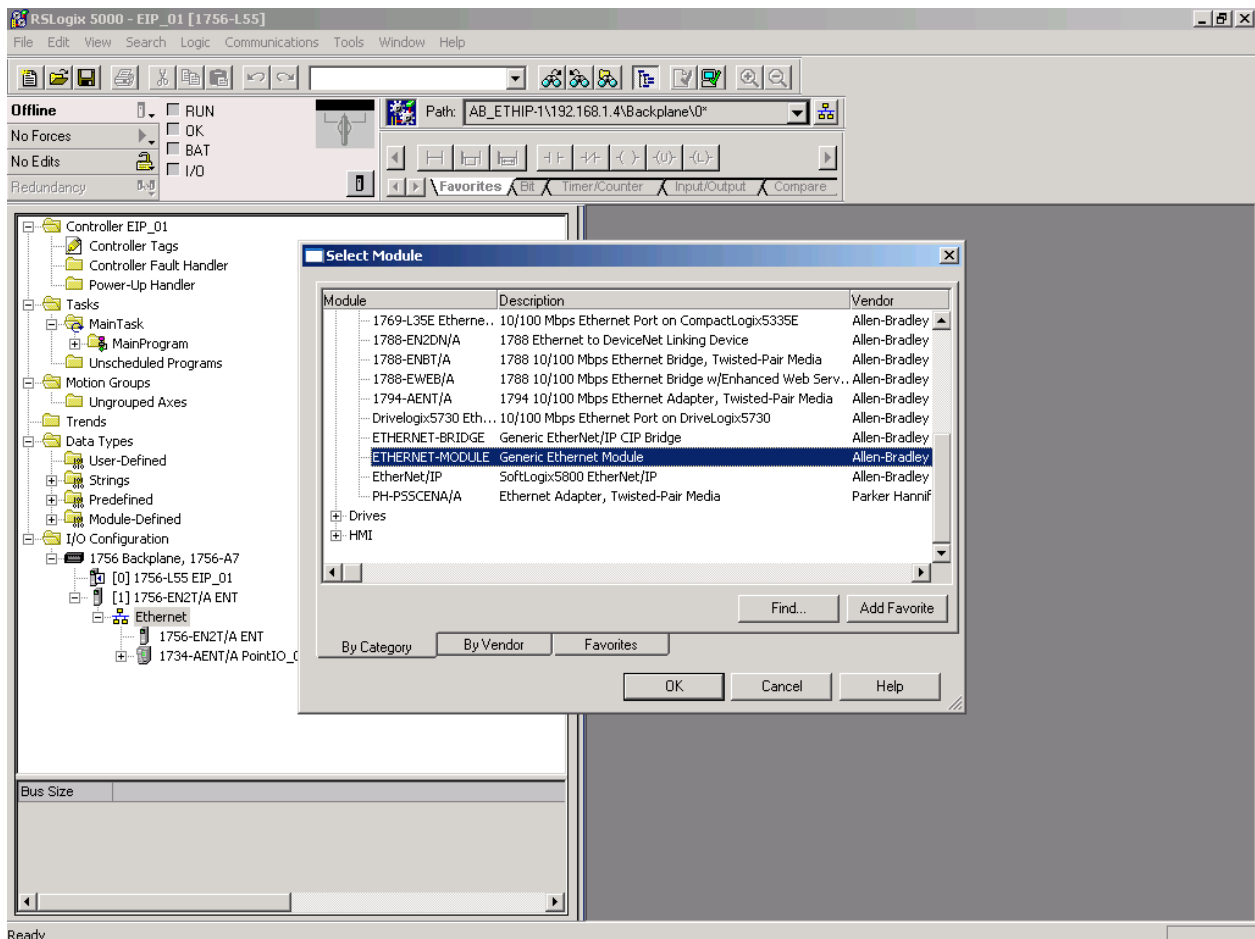
Typically, the module is correctly wired with the following status:

LINK LED:	Green or yellow	– solid ON or BLINK	→ Network OK
OUTPUT POWER:	Green	– solid ON	→ Power output OK
INPUT POWER:	Green	– solid ON	→ Power input OK
I/O LED:	Green	– solid ON	→ I/O activated

8. Configuration using RSLogix 5000

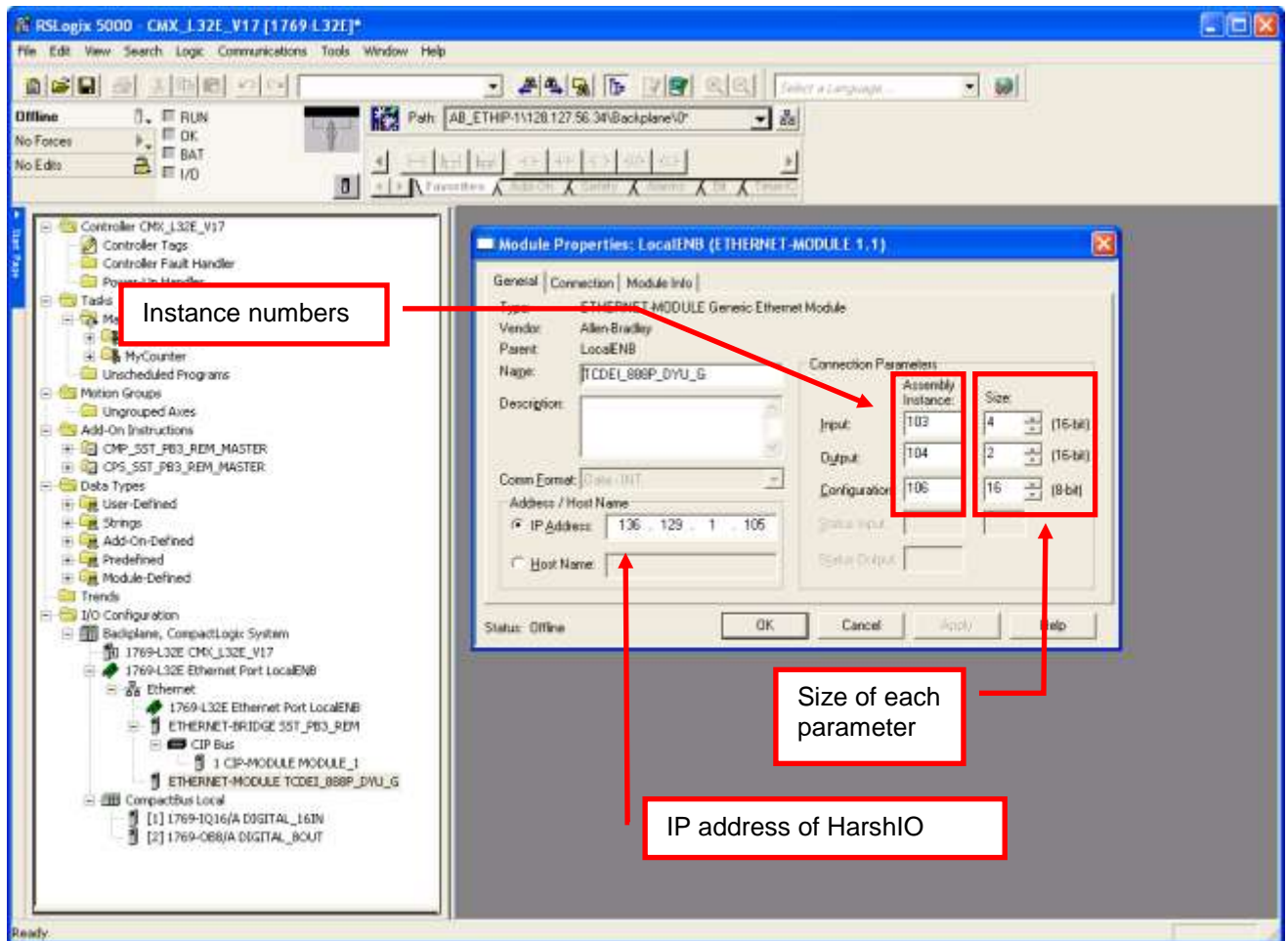
Add an EtherNet/IP HarshIO module

The first step is to add a **HarshIO 600 eIP** in the configuration of a Rockwell Scanner supporting EtherNet/IP by selecting "ETHERNET-MODULE" (Generic Ethernet Module) device as shown below.



EtherNet/IP HarshIO module configuration

In the configuration of the "ETHERNET-MODULE", set the parameters of the HarshIO 600 eIP with the following properties:



Connection Parameters:

Input:

Assembly: **103**

Size (in 16-bit word): **4**

See chapter [I/O Data Mapping](#) for input data mapping details.

Output:

Assembly: **104**

Size (in 16-bit word): **1 or 2**

See chapter [I/O Data Mapping](#) for output data mapping details.

Configuration:

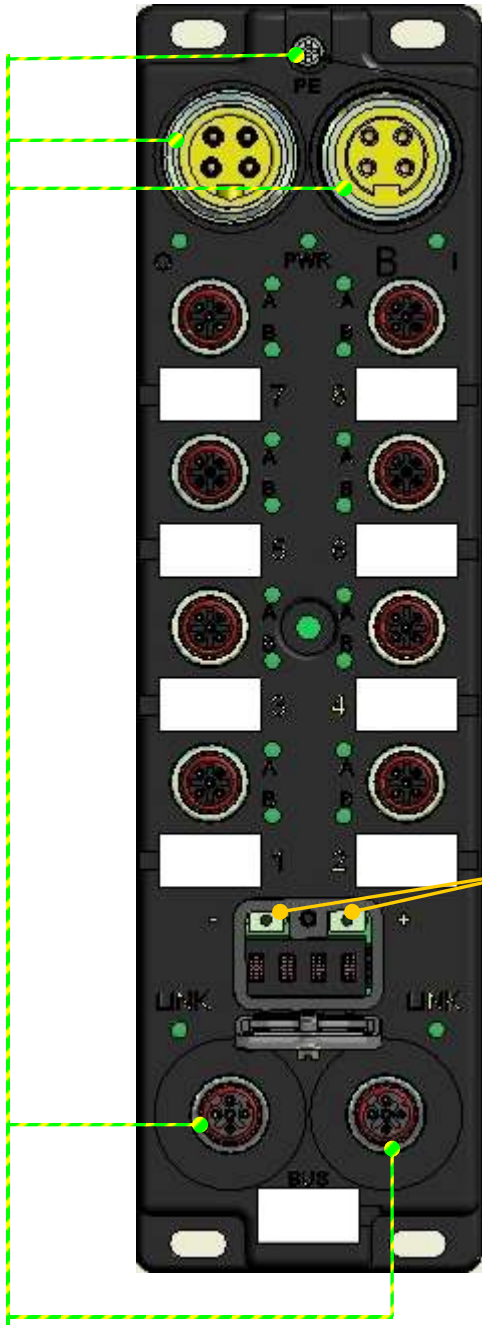
Assembly: **106**

Size (in 8-bit byte): **16**

See chapter [I/O Data Mapping](#) for configuration data mapping details.

9. Earth Connection

At least one of the earth connections shown on the schematics must be ground connected to ensure the good operation of the module.



Use a plastic stick to press button or wear anti-static equipment.

Figure 9_1

If the earth connection is done by one of the Ethernet cable, in order to avoid noise loop it is important to not connect other earth connection of the module to the ground (See Figure 9_2).

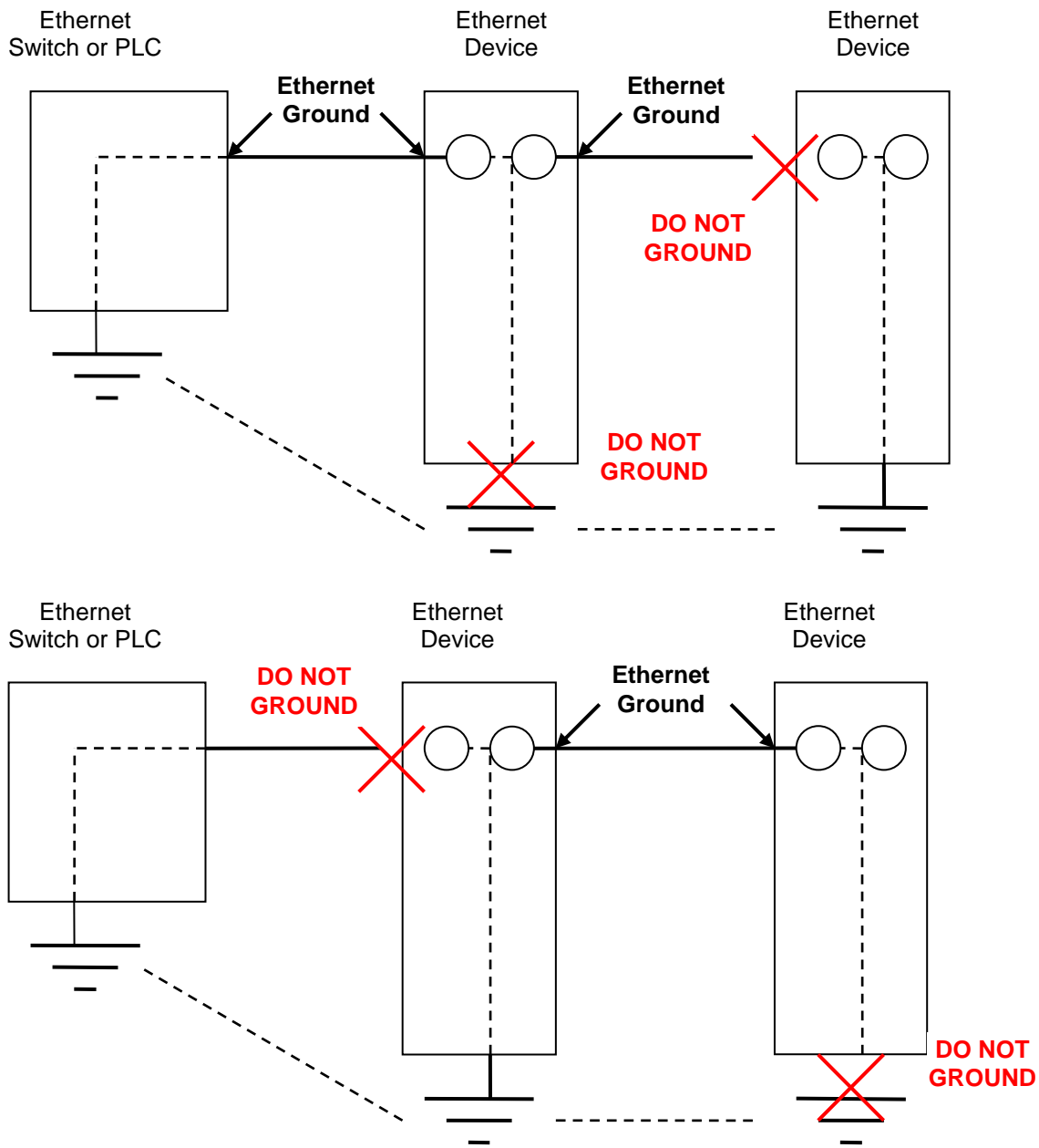


Figure 9_2

10. Cables and Cordsets

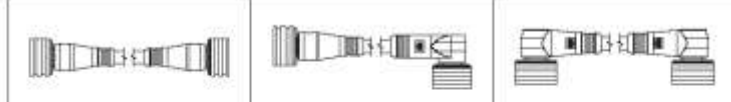
BradConnectivity™ is part of Molex as well as BradControl™ and is specialized in the manufacturing of connectors, cordsets and distribution boxes for sensors, actuators and bus network applications.


BradConnectivity™ provides a wide range of product references among which:

Industrial Ethernet cables

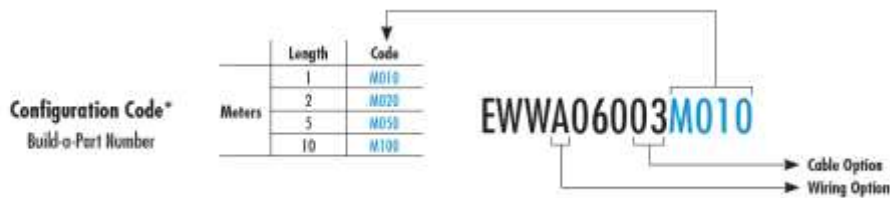
Brad® Ultra-Lock™ M12 Double-Ended Cordsets – Order Number

Male-to-Male



Face View (Male)	Max. Current per Contact	Max. Voltage	Cable Type	Cable Jacket	Wire Size AWG	Length	Male Straight-to-Male Straight		Male Straight-to-Male Right Angle		Male Right Angle-to-Male Right Angle	
							Engineering No.	Standard Order No.	Engineering No.	Standard Order No.	Engineering No.	Standard Order No.
 <p>1 - White/Orange 3 - Orange 2 - White/Green 4 - Green</p>	1.5A	30V	Unshielded	PVC	24	1.0m	EWWA06003M010	120108-006A	EWWA06203M010	120108-0074	EWWA06303M010	120108-0082
			Unshielded High Flex	TPE	24					EWWA06304M010	120108-5020	
			Shielded	PUR	22		EWWA06010M010	120108-0090	EWWA06210M010	120108-0098	EWWA06310M010	120108-0106
			Shielded	PVC	26		EWWA06015M010	120108-0042	EWWA06215M010	120108-0050	EWWA06315M010	120108-0058

Note: Sales drawings for all standard order numbers are available on molex.com

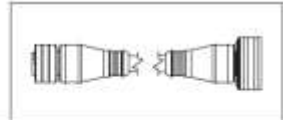


*Once an engineering number is created using the configuration code, consult Molex tech support for information regarding any part numbers.

Cable option:

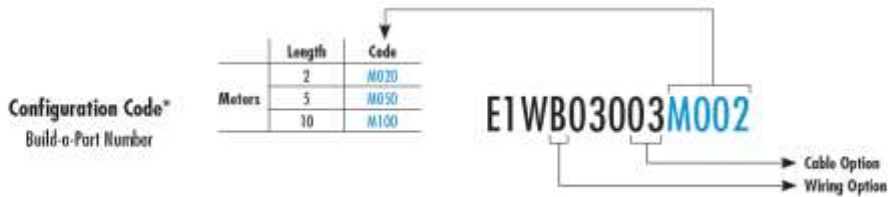
- 03 – Unshielded PVC
- 04 – Unshielded TPE
- 10 – Shielded PUR
- 15 – Shielded PVC

Female-to-Male (Straight)



Face View	Max. Current per Contact	Max. Voltage	Cable Type	Cable Jacket	Wire Size AWG	Length	M12 Micro-Change Female Straight-to-M12 Ultra-Lock Male Straight	
							Engineering No.	Standard Order No.
<p>4 Pole</p> <p>1 - Yellow (TD+) 4 - Blue (RD-) 2 - White (RD+) 5 - D-Code 3 - Orange (TD-)</p>	1.5A	30V	Unshielded	PVC	24	1.0m	E1WB03003M002	130048-0207
			Shielded	PUR	22		E1WB03010M002	130048-0208
			Shielded	PVC	26		E1WB03015M002	130048-0209

Note: Sales drawings for all standard order numbers are available on mollex.com

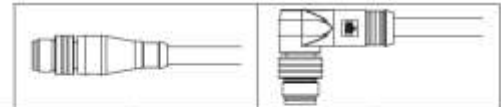


*Once an engineering number is created using the configuration code, consult Mollex tech support for information regarding any part numbers.

Cable option:

- 03 – Unshielded PVC
- 10 – Shielded PUR
- 15 – Shielded PVC

Brad® M12 Single-Ended Cordsets – Order Number



Face View	Max. Current per Contact	Max. Voltage	Cable Type	Cable Jacket	Wire Size AWG	Length	Engineering No.	Standard Order No.	Engineering No.	Standard Order No.
<p>4 Pole</p> <p>1 - Orange (TD+) 2 - Blue (RD+) 3 - Orange/White (TD-) 4 - Blue/White (TD-)</p>	1.5A	30V	Unshielded	PVC	24	1.0m (3.31')	E10A00603M010	130048-0038	E10A00703M010	130048-0062
			Shielded	PVC	22		E10A00610M010	130048-0046	E10A00710M010	130048-0070
			Shielded	PUR	24		E10A00615M010	130048-0054	E10A00715M010	130048-0078
			Shielded High-Flex	TPE	26		E10A00605M010	120108-0186		
			Shielded High-Flex				E10A00705M010	120108-0187		

Note: Sales drawings for all standard order numbers are available on mollex.com



*Once an engineering number is created using the configuration code, consult Mollex tech support for information regarding any part numbers.

Cable option:

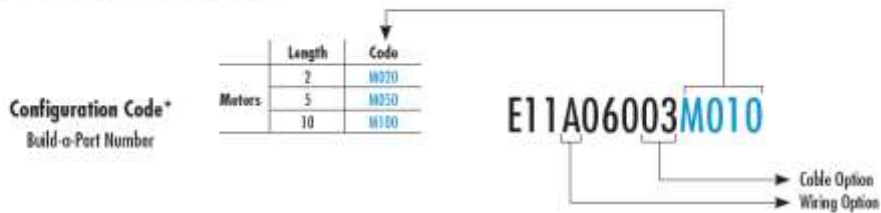
- 03 – Unshielded PVC
- 05 – Shielded TPE
- 10 – Shielded PUR
- 15 – Shielded PVC

Brad[®] M12 Double-Ended Cordsets – Order Number

Male to Male

Face View	Max. Current Per Contact	Max. Voltage	Cable Type	Cable Jacket	Wire Size AWG	Length	Male Straight-to-Male Straight		Male Straight-to-Male Right Angle		Male Right Angle-to-Male Right Angle	
							Engineering No.	Standard Order No.	Engineering No.	Standard Order No.	Engineering No.	Standard Order No.
							<p>4 Pole 1 - Yellow (D+) 4 - Blue (RD-) 2 - White (RD+) 5 - B-Code 3 - Orange (DB-)</p>	1.5A	30V	Unshielded	PVC	24
Unshielded High Flex.	TPE	24	E11A06004M010	130048-0095			E11A06304M010	120108-0147				
Shielded	PUR	22	E11A06010M010	130048-0114	E11A06210M010	130048-0145	E11A06310M010	130048-0170				
Shielded	PVC	26	E11A06015M010	130048-0122	E11A06215M010	130048-0153	E11A06315M010	130048-0179				
Shielded	TPE	26	E11A06005M010	120108-0188	E11A06205M010	120108-0189	E11A06305M010	120108-0174				

Note: Sales drawings for all standard order numbers are available on molex.com



Cable option:

- 03 – Unshielded PVC
- 04 – Unshielded TPE
- 05 – Shielded TPE
- 10 – Shielded PUR
- 15 – Shielded PVC

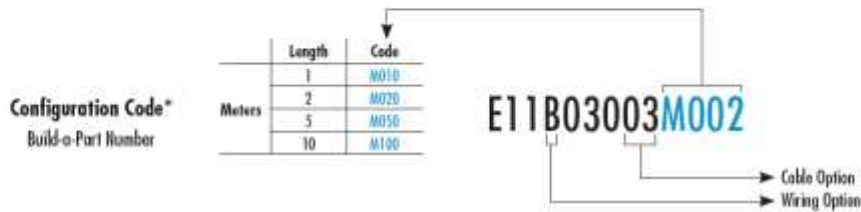
Brad® M12 Double-Ended Cordsets – Order Number

Female to Male



Face View	Max. Current Per Contact	Max. Voltage	Cable Type	Cable Jacket	Wire Size AWG	Length	Female Straight-to-Male Straight	
							Engineering No.	Standard Order No.
<p>4 Pole</p> <p>1 - Yellow (TD+) 4 - Blue (RD-) 2 - White (RD+) 5 - D-Code 3 - Orange (TD-)</p>	1.5A	30V	Unshielded	PVC	24	1.0 m	E11B03003M002	130048-0193
			Shielded	PVC	26		E11B03015M002	130048-0195

Note: Sales drawings for all standard order numbers are available on molex.com



Cable option:

- 03 – Unshielded PVC
- 15 – Shielded PVC

Brad® Micro-Change® (M12) Field Attachable Connectors – Order Number

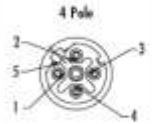


Poles (Female View)	Max. Current per Contact	Max. Voltage	Cable Diameter Range	Male Straight		Female Straight	
				Engineering No.	Standard Order No.	Engineering No.	Standard Order No.
<p>4 Pole</p> <p>1 - Yellow (TD+) 3 - Orange (TD-) 2 - White (RD+) 4 - Blue (RD-)</p>	4.0A	32V	5.50-7.20mm	E14506-52	130047-0018	E14508-52	130047-0017

Note: Sales drawings for all standard order numbers are available on molex.com

Brad® Micro-Change® (M12) Receptacles – Order Number

Female

Pole (Female View)	Max. Current per Contact	Max. Voltage	Configuration								
			Front-Panel Mount/ PG9 with 50.00mm Wire Leads		Front-Panel Mount/ M16 with 50.00mm Wire Leads		Back-Panel Mount/ M16 with 50.00mm Wire Leads				
			Wire Type PVC Leads, UL 1061								
			Wire Size (AWG) 22 AWG								
Length 0.5m						Engineering No.	Standard Order No.	Engineering No.	Standard Order No.	Engineering No.	Standard Order No.
 <p>1 - Yellow (TD+) 4 - Blue (RD-) 2 - White (RD+) 5 - D-Code 3 - Orange (TD-)</p>	1.5A	125V	ERWAAJ3000C050	120109-0034	ERWAAU3000C050	120109-5001	ERWAAU7000C050	120109-5002			

Note: Sales drawings for all standard order numbers are available on mollex.com

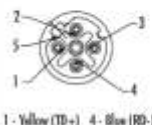
Configuration Code™
Build-a-Part Number

Length	Code
Centimeters	5 0.3
Meters	1 2

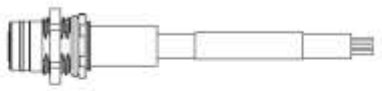
ERWAAJ3000C050

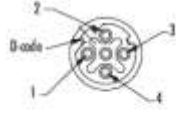
*Once an engineering number is created using the configuration code, consult Mollex tech support for information regarding any part numbers.

Female

Poles	Max. Current per Contact	Max. Voltage	Configuration							
			Front Panel Mount, PG9 Thread		Front Panel Mount, M16 Thread		Back-Panel Mount, M16 Thread			
			PCB Mount		PCB Mount		PCB Mount			
			Engineering No.	Standard Order No.	Engineering No.	Standard Order No.	Engineering No.	Standard Order No.		
 <p>1 - Yellow (TD+) 4 - Blue (RD-) 2 - White (RD+) 5 - D-Code 3 - Orange (TD-)</p>	1.5A	125V	ERWD2J30	120109-5003	ERWD2U30	120109-5004	ERWD2U70	120109-5005		

Note: Sales drawings for all standard order numbers are available on mollex.com



		Straight, Back Panel Mount		
Poles	Max. Current per Contact	Max. Voltage	Engineering No.	Standard Order No.
4 Pole  1 - Yellow (TD+) 3 - Orange (TD-) 2 - White (RD+) 4 - Blue (RD-)	1.5A	125V	ERWAAJ4002M007	130054-0012
			ERWAAJ4002M020	130054-0013

Note: Sales drawings for all standard order numbers are available on molex.com

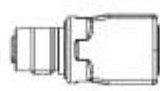

Configuration Code™
Build-a-Part Number

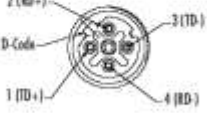
	Length	Code
Centimeters	200	C200
Meters	2	M020
	5	M050
	18	M180

ERWAAU3000C200

*Once an engineering number is created using the configuration code, consult Molex tech support for information regarding any part numbers.

Brad® Micro-Change® (M12) Bulkhead Pass-Through Adapters – Order Number

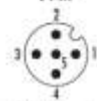



		M12-to-RJ-45 Adapter with M16 Mounting Thread			
		Female Straight		Female-Straight-to-Right Angle	
Poles		Engineering No.	Standard Order No.	Engineering No.	Standard Order No.
4 Pole  1 (TD+) 2 (RD+) 3 (TD-) 4 (RD-)		ER1PADAPTER	130054-0009	ER1PADAPTER90	130054-0010

Note: Sales drawings for all standard order numbers are available on molex.com

I/O cables

Brad[®] Ultra-Lock[™] (M12) Single-Ended Cordsets – Order Number

Poles	Max. Current per Contact	Max. Voltage	Cable Type	Cable Jacket	Wire Size	Length	Male Straight		Male Right Angle	
							Engineering No.	Standard Order No.	Engineering No.	Standard Order No.
								4.0A	250V AC/DC	UL 2464
	PUR/PVC (P03)	W05006P03M020	120079-5055	W05007P03M020	120079-5112					

Note: Sales drawings for all standard order numbers are available on molex.com



*Once an engineering number is created using the configuration code, consult Molex tech support for information regarding any part numbers.



Cable option:

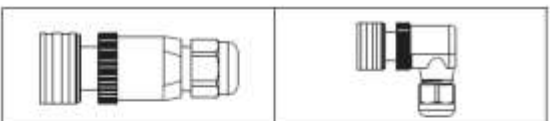
- E03 – Yellow PVC
- P03 – Black PUR/PVC, 0.34mm²
- K05 – Yellow TPE flex life (torsion and bending)
- P02 – Black PUR/PVC, 0.25mm²
- H45 – Black PUR/PVC, 26 AWG

Brad® Ultra-Lock™ (M12) Field attachable connectors – Order Number

Female Connectors				Female Straight		Female Right Angle	
				Engineering No.	Standard Order No.	Engineering No.	Standard Order No.
	4.0A	250V AC 300V DC	3.30-6.60mm (.130-.260")	WA4000-31	120085-0011	WA4001-31	120085-0015
			4.10-8.10mm (.161-.319")	WA4000-32	120085-0013		
	4.0A	30V AC 36V DC	3.30-6.60mm (.130-.260")	WA5000-31	120085-0012	WA5001-31	120085-0016
			4.10-8.10mm (.161-.319")	WA5000-32	120085-0014		

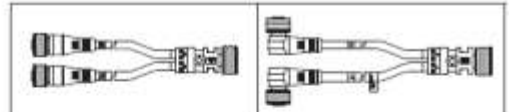


Male Connectors				Male Straight		Male Right Angle	
				Engineering No.	Standard Order No.	Engineering No.	Standard Order No.
	4.0A	250V AC 300V DC	3.30-6.60mm (.130-.260")	WA4006-31	120085-0003	WA4007-31	120085-0007
			4.10-8.10mm (.161-.319")	WA4006-32	120085-0005		
	4.0A	30V AC 36V DC	3.30-6.60mm (.130-.260")	WA5006-31	120085-0004	WA5007-31	120085-0008
			4.10-8.10mm (.161-.319")	WA5006-32	120085-0006		



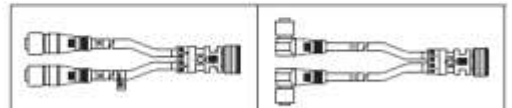
Note: Sales drawings for all standard order numbers are available on molex.com

Brad® Ultra-Lock® (M12) Splitter cordsets – Order Number



Ultra-Lock-to-Ultra-Lock Splitters

Wiring Schematic	Max. Current per Contact	Max. Voltage	Cable Type	Cable Jacket (Cable Code)	Wire Size	Length	Female Straight-to-Male Straight		Female Right Angle-to-Male Straight	
							Engineering No.	Standard Order No.	Engineering No.	Standard Order No.
	4.0A	250V AC/DC	UL 2464	PVC (E03)	0.34mm ²	0.3m	WW4A30E03M003	120080-5072	WW4A31E03M003	120080-5074
				PUR/PVC (P03)	0.34mm ²	0.3m	WW4A30P03M003	120080-5073	WW4A31P03M003	120080-5075
			PJTC-ER	TPE (K05)	0.34mm ²	0.3m	WW4A30K05M003	120080-0081	WW4A31K05M003	120080-0089



Ultra-Lock-to-Micro-Change® Splitters

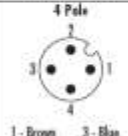
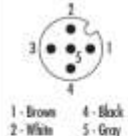
Wiring Schematic	Max. Current per Contact	Max. Voltage	Cable Type	Cable Jacket (Cable Code)	Wire Size	Length	Female Straight-to-Male Straight		Female Right Angle-to-Male Straight	
							Engineering No.	Standard Order No.	Engineering No.	Standard Order No.
	4.0A	250V AC/DC	UL 2464	PVC (E03)	0.34mm ²	0.3m	BW4A30E03M003	120080-5092	BW4A31E03M003	120080-5094
				PUR/PVC (P03)	0.34mm ²	0.3m	BW4A30P03M003	120080-5093	BW4A31P03M003	120080-5095
			PJTC-ER	TPE (K05)	0.34mm ²	0.3m	BW4A30K05M003	120080-0108	BW4A31K05M003	120080-0116

Note: Sales drawings for all standard order numbers are available on molex.com
 *Teflon is trademark of DuPont

Cable option:

- E03 – Yellow PVC
- P03 – Black PUR/PVC, 0.34mm²
- K05 – Yellow TPE flex life (torsion and bending)

Brad® Micro-Change® (M12) Single-Ended cordsets – Order Number

Poles (Male View)	Max. Current per Contact	Max. Voltage	Cable Type	Cable Jacket (Cable Code)	Wire Size	Length	Male Straight		Male Right Angle	
							Engineering No.	Standard Order No.	Engineering No.	Standard Order No.
 1 - Brown 3 - Blue 2 - White 4 - Black	4.0A	250V AC/DC	UL 2464	PVC (E03)	0.34mm ²	2.0m	804006E03M020	120006-0560	804007E03M020	120006-1975
				PUR/PVC (P03)			804006P03M020	120006-0570	804007P03M020	120006-0592
			PLC-ER	TPE (K05)			804006K05M020	120065-1129	804007K05M020	120065-1491
 1 - Brown 4 - Black 2 - White 5 - Gray 3 - Blue	4.0A	250V AC/DC	UL 2464	PVC (E03)	0.34mm ²	2.0m	805006E03M020	120006-0667	805007E03M020	120065-8096
				PUR/PVC (P03)			805006P03M020	120006-0680	805007P03M020	120006-0697

Note: Sales drawings for all standard order numbers are available on molex.com

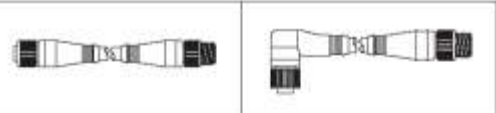


*Once an engineering number is created using the configuration code, consult Molex tech support for information regarding any part numbers.

Cable option:

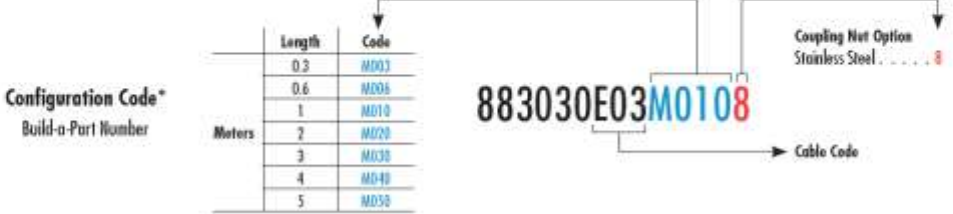
- E03 – Yellow PVC
- P03 – Black PUR/PVC
- K05 – Yellow TPE flex life (torsion and bending)

Brad® Micro-Change® (M12) Double-Ended cordsets – Order Number



Poles (Female View)	Max. Current per Contact	Max. Voltage	Cable Type	Cable Jacket (Cable Code)	Wire Size	Length	Female Straight-to-Male Straight		Female Right Angle-to-Male Straight	
							Engineering No.	Standard Order No.	Engineering No.	Standard Order No.
4 Pole 1 - Brown 3 - Blue 2 - White 4 - Black	4.0A	250V AC/DC	UL 2444	PVC (E03)	0.34mm ²	2.0m	884030E03M010	120007-0473	884031E03M010	120007-0509
				PUR/PVC (P03)			884030P03M010	120007-0488	884031P03M010	120006-0056
			PLIC-ER	TPE (K05)			884030K05M010	120066-0687	884031K05M010	120066-0376
5 Pole 1 - Brown 4 - Black 2 - White 5 - Gray 3 - Blue	4.0A	250V AC/DC	UL 2444	PVC (E03)	0.34mm ²	2.0m	885030E03M010	120007-0906	885031E03M010	120066-8189
				PUR/PVC (P03)			885030P03M010	120066-8084	885031P03M010	120066-8188

Note: Sales drawings for all standard order numbers are available on [molex.com](http://www.molex.com)







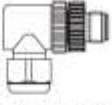


*Once an engineering number is created using the configuration code, consult Molex tech support for information regarding any part numbers.

Cable option:

- E03 – Yellow PVC
- P03 – Black PUR/PVC
- K05 – Yellow TPE flex life (torsion and bending)

Brad® Ultra-Lock™ (M12) Field attachable connectors – Order Number

							
Female Connectors				Female Straight		Female Right Angle	
Poles	Current per Contact	Max. Voltage	Cable Diameter Range	Engineering No.	Standard Order No.	Engineering No.	Standard Order No.
	4.0A	250V AC 300V DC	3.30-6.60mm (.130-.260")	8A4000-31	120071-0035	8A4001-31	120071-0037
			4.10-8.10mm (.161-.319")	8A4000-32	120071-0034		
	4.0A	30V AC 36V DC	3.30-6.60mm (.130-.260")	8A5000-31	120071-0041	8A5001-31	120071-0044
			4.10-8.10mm (.161-.319")	8A5000-32	120071-0043		

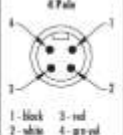
							
Male Connectors				Male Straight		Male Right Angle	
Poles	Current per Contact	Max. Voltage	Cable Diameter Range	Engineering No.	Standard Order No.	Engineering No.	Standard Order No.
	4.0A	250V AC 300V DC	3.30-6.60mm (.130-.260")	8A4006-31	120071-0038	8A4007-31	120071-0040
			4.10-8.10mm (.161-.319")	8A4006-32	120071-0039		
	4.0A	30V AC 36V DC	3.30-6.60mm (.130-.260")	8A5006-31	120071-0045	8A5007-31	120071-0049
			4.10-8.10mm (.161-.319")	8A5006-32	120071-0047		

Note: Sales drawings for all standard order numbers are available on molex.com

Power supply cables

Brad® Mini-Change® Single-Ended Cordsets – Order Number

Male

Poles (Male View)	Current	Cable Type	Cable Jacket (Cable Code)	Wire Size AWG	Length	Male Straight		Male Right Angle	
						Engineering No.	Standard Order No.	Engineering No.	Standard Order No.
 <p>1 - black 3 - red 2 - white 4 - green-yel</p>	18.8A	ST00W	PVC (A01)	16	6'	104002A01F060	130004-8995	104002B01F060	130004-1087

Note: Sales drawings for all standard order numbers are available on mollex.com

Configuration Code*
Build-o-Part Number

Length	Code
3	F030
6	F060
12	F120
20	F200

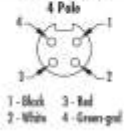
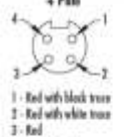
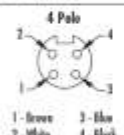
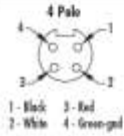
102002A01F060

Coupling Nut Option
Stainless Steel 1
Nonmetallic 2

→ Cable Code
→ Orientation Code

*Once an engineering number is created using the configuration code, consult Mollex tech support for information regarding any part numbers.

Female

Poles (Female View)	Current	Voltage	Cable Type	Cable Jacket (Cable Code)	Wire Size AWG	Cable Length	Female Straight		Female Right Angle	
							Engineering No.	Standard Order No.	Engineering No.	Standard Order No.
 <p>1 - Black 3 - Red 2 - White 4 - Green-yel</p>	10.0A	600V AC/DC	ST00W	PVC (A01)	16	6'	104000A01F060	130004-0728	104001A01F060	130004-0902
 <p>1 - Red with black trace 2 - Red with white trace 3 - Red 4 - Green-yel</p>	7.0A	300V AC/DC	UL 2641	PVC (A03)	18	6'	104000A03F060	130004-0813		
 <p>1 - Brown 3 - Blue 2 - White 4 - Black</p>	5.6A	300V AC/DC	UL 2641	PVC (A05)	18	2.0m	104000A05M028	130004-0833		
 <p>1 - Black 3 - Red 2 - White 4 - Green-yel</p>	10.0A	600V AC/DC	S00W	Rubber (011)	16	6'	104000C01F060	130004-0868		

Configuration Code*
Build-o-Part Number

Length	Code
3	F030
6	F060
12	F120
20	F200
2	M020
5	M050
10	M100

102000A01F060

Coupling Nut Option
Stainless Steel 1
Nonmetallic 2

→ Cable Code
→ Orientation Code

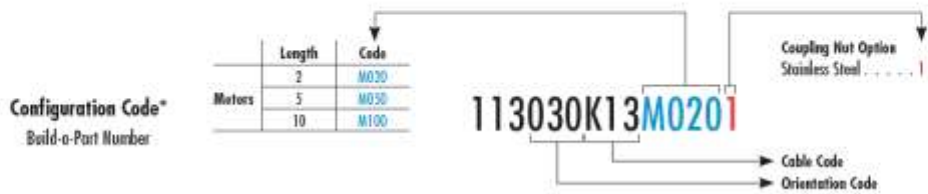
*Once an engineering number is created using the configuration code, consult Mollex tech support for information regarding any part numbers.

Brad® Mini-Change® Double-Ended Cordsets – Order Number



Poles (Female View)	Current	Cable Type	Cable Jacket (Cable Code)	Female-to-Male Straight	
				Engineering No.	Standard Order No.
4 Pole 	10.0A	ST00W	PVC (A3B)	114030K3BM020	130010-0795
		TCER	PPE (K12)	114030K12M020	130010-0865
5 Pole 	8.0A	TCER	PPE (K13)	115030K13M020	130010-0103

Note: Sales drawings for all standard order numbers are available on males.com



*Once an engineering number is created using the configuration code, consult Males tech support for information regarding any part numbers.

11. Product Support

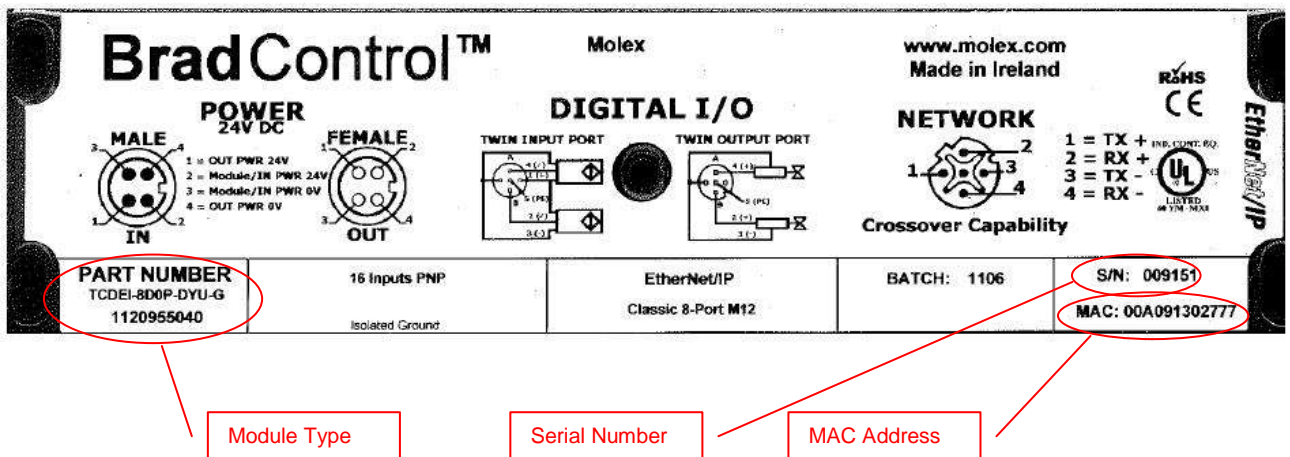
Product Information

Please ensure that you have the following information readily available before calling for technical support:

- Module type and serial number
- Details of the problem you are experiencing and circumstances that may have caused the problem

Note:

Your HarshIO 600 identification is located on the backside of the device.



Technical Support

To assist users in using the products, Molex provides technical information on its web site:

[Molex Support and Download](#)

They can find particularly:

- Downloads center
- Support Request Form
- Knowledge Base
- Worldwide technical support contacts

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