

User's Manual

Brad™ HarshIO 300 ePN IP67 Digital I/O Modules for PROFINET IO

from Molex

Version 2.1
June 19, 2015



Revision History

Date	Author	Changes	Revision
February 11, 2013	E. GORY	First release	1.0
April 02, 2013	E. GORY	Second release	1.1
May 16, 2013	E. GORY	Add Step7 commissioning chapter	1.2
July 01, 2013	E. GORY	Typo corrections	1.3
September 24, 2013	E. GORY	Add torque for M12 connectors	1.4
February 27,2014	S.Savary	Alarm management – additional information	1.5
April 22,2014	M. Bliss	Add other variants, added note for power on order (page 6)	1.6
May 15,2014	M. Bliss	Add more information for M12 modules	1.7
May 21, 2014	M. Bliss	Implement feedback from review	1.8
May 23, 2014	M. Bliss	Implement remaining feedback	1.9
June 20, 2014	E. GORY	Typo corrections	2.0
June 19, 2015	S.Savary	Add web link for Easy replacement procedure Add grounding info for M12 configurable version Typo corrections	2.1

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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.
 - Power cords should be attached to the module before turning the 24V power on. If it isn't done in this order then there is a possibility that the module will not power up due to the added surge protection.

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 ePN (PROFINET IO) 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 and automated assembly.

All BradControl™ HarshIO modules, with Micro-Change® (M12) ports, accept both standard threaded cordsets and the 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: <http://www.molex.com/link/ultralock.html> .



BradControl™ HarshIO 300 includes advanced diagnostic features. Each module embeds visible LEDs to provide 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.

BradControl™ HarshIO 300 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
- M8 or M12 I/O connectors
- 8x digital channels
- Support PROFINET real-time (RT) conformance Class-B
- I/O update rate from 1ms with a PROFINET controller
- Integrated 2-port unmanaged Ethernet switch (with cross-over capability) for daisy chain topology
- Module and Network LEDs (green/red) provides status of module and network
- Auxiliary power status LED (green) to indicate power present or low voltage
- Each digital I/O channel has a diagnostic LED (green) to indicate I/O status and (red) to indicate a fault status
- Easy commissioning and replacement with 3x rotary switches
- Digital input and output short circuit protection
- Fixed or user configurable (of input and output channels) according to module version

BradControl™ HarshIO 300 digital modules are available in various combinations:

M8 I/O port versions

- 8x Inputs
- 4x Inputs + 4x Outputs
- 8x Outputs
- 8x User Configurable Inputs/Outputs

SAP No	Material No	Description
112095-5064	TBDEP-880P-D84-G	IP67 module for PROFINET IO, 8x digital Inputs PNP, M8 I/O connector, Isolated grounding
112095-5065	TBDEP-844P-D84-G	IP67 module for PROFINET IO, 4x PNP Inputs + 4x Outputs PNP, M8 I/O connector, Isolated grounding
112095-5066	TBDEP-808P-D84-G	IP67 module for PROFINET IO, 8x Outputs PNP, M8 I/O connector, Isolated grounding
112095-5067	TBDEP-8YYP-D84	IP67 module for PROFINET IO, 8x User Configurable Inputs/Outputs PNP, M8 I/O connector

M12 I/O port versions

- 8x Inputs
- 4x Inputs + 4x Outputs
- 8x Outputs
- 8x User Configurable Inputs/Outputs

SAP No	Material No	Description
112095-5076	TBDEP-480P-D8U-G	IP67 module for PROFINET IO, 8x digital Inputs PNP, M12 I/O connector, Isolated grounding
112095-5077	TBDEP-444P-D8U-G	IP67 module for PROFINET IO, 4x PNP Inputs + 4x Outputs PNP, M12 I/O connector, Isolated grounding
112095-5078	TBDEP-408P-D8U-G	IP67 module for PROFINET IO, 8x Outputs PNP, M12 I/O connector, Isolated grounding
112095-5079	TBDEP-4YYP-D8U	IP67 module for PROFINET IO, 8x User Configurable Inputs/Outputs PNP, M12 I/O connector

Whatever the combination, the digital Inputs are always PNP (current sink) and Outputs are always PNP (current source).

3. System description

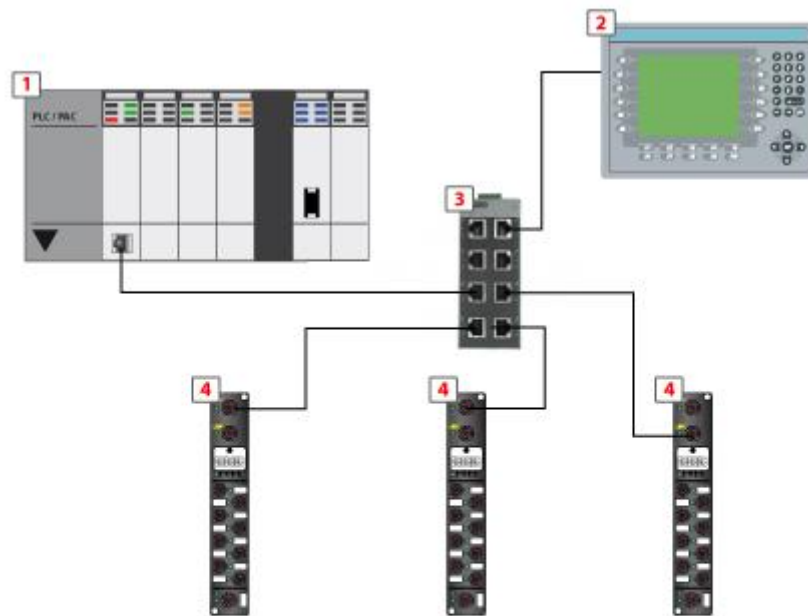
Overview

HarshIO 300 ePN modules can be used with protocol compliant controllers as part of the control system architecture. The built-in unmanaged 2-port Ethernet switch allows flexibility in the network topology to meet 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 equipment. This topology allows maintenance on one module – for example, by removing the network cable, or by cycling power to the module – without affecting the other modules.



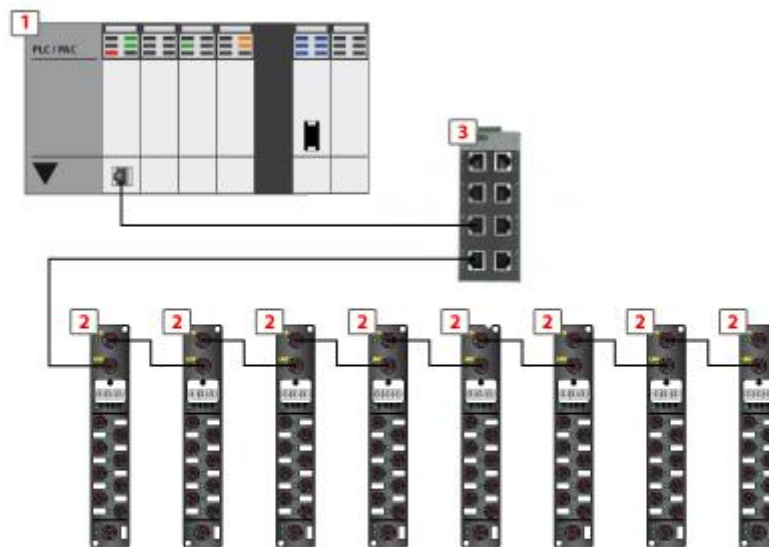
- 1 PLC / PAC
- 2 HMI device
- 3 Ethernet switch
- 4 HarshIO 300 modules

Daisy-chain topology

A daisy-chain topology can be created using the module's embedded switch ports to connect a series of HarshIO ePN modules.

NOTE: When considering the daisy chain topology

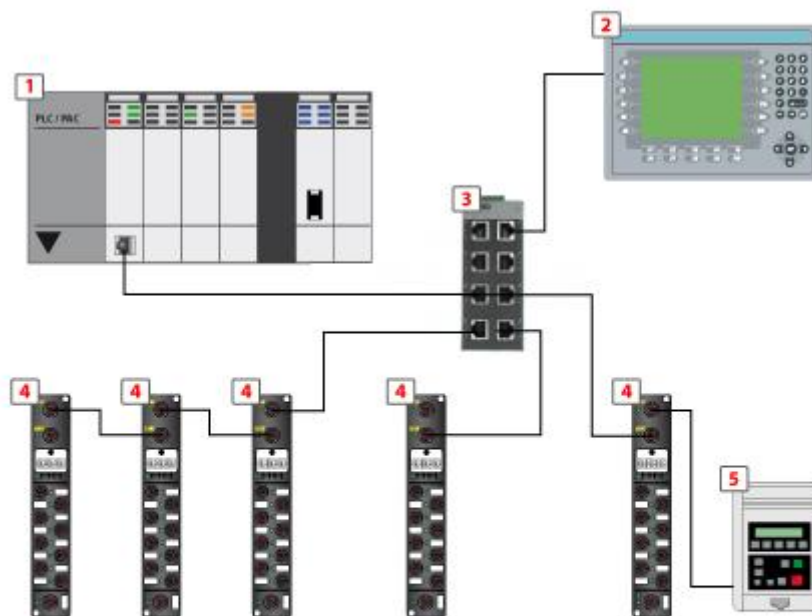
- If a module, somewhere in the middle of the chain, has the network cable disconnected or power to the module is removed then communications to any module located down the chain will be lost.
- The embedded dual port Ethernet switch located in each module eliminates the need for additional Ethernet switches.



- 1 PLC / PAC
- 2 HarshIO 300 modules
- 3 Ethernet switch

Combination of star and daisy-chain topologies

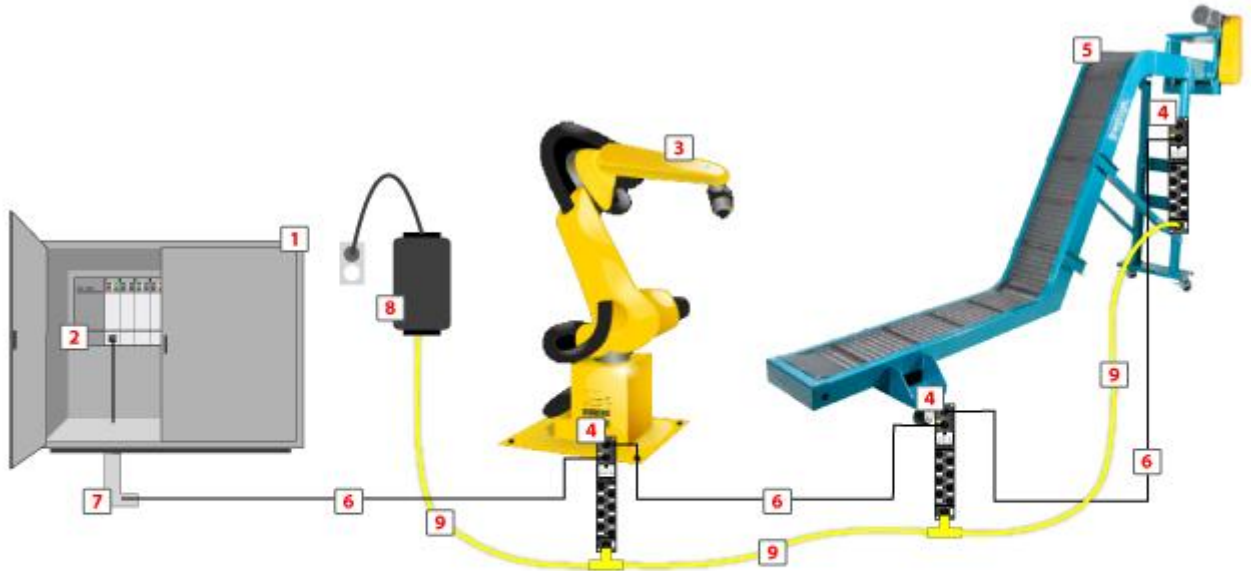
Combining star and daisy-chain topologies allows you to connect HarshIO ePN modules with mixed HarshIO modules or additional network devices.



- 1 PLC / PAC
- 2 HMI device
- 3 Ethernet switch
- 4 HarshIO 300 modules
- 5 Drive

Typical application

This diagram shows you an example of a typical application using an in-cabinet PLC controlling HarshIO ePN modules that are mounted throughout this industrial system.



- | | |
|-----------------------|--------------------------------|
| 1 Cabinet | 6 Ethernet cable |
| 2 PLC / PAC | 7 RJ45 to M12 Ethernet adapter |
| 3 Robot | 8 24V power supply |
| 4 HarshIO 300 modules | 9 Power supply cable |
| 5 Conveyor | |

4. Module characteristics

Characteristics for M8 versions

Type	8x Inputs	4x Inputs + 4x Outputs
Product Reference	TBDEP-880P-D84-G	TBDEP-844P-D84-G
PROFINET Identification	Vendor ID: 0x0127 Device ID: 0x1008 DAP identifier: 0x40110008	Vendor ID: 0x0127 Device ID: 0x1008 DAP identifier: 0x40110404
Power		
Power connector	M12 Ultra-Lock, 5-pin, male, A-Coded, stainless steel	
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)	Not Applicable	24 VDC, -15/+20% (protected against power crossing)
Operating current (UL)	Not Applicable	10 mA (without load)
Inputs		
Channels	8x channels, 2 or 3-wire	4x channels, 2 or 3-wire
Connector	M8, 3-pin, female, stainless steel	
Input type	PNP, Sinking	
On-state current	1-8mA maximum	
Max off state current	300µA	
Input voltage	UB	
Sensor power supply (max)	250 mA at 25°C	
Input channel voltage ("1")	10V ... 25V	
Input channel voltage ("0")	-0.2V ... 5V	
Input short circuit protection (per port)	600mA	
Switching frequency	min of 100Hz	
Input filter	0.5 ← → 3 ms (default 1 ms)	
Outputs		
Channels	Not Applicable	4x channels, 2-wire
Output voltage	Not Applicable	UL - 1 VDC
Connector	Not Applicable	M8, 3-pin, female, stainless steel
Output type	Not Applicable	PNP, Sourcing
Output current	Not Applicable	0.5A per channel, max. 4A total
Maximum output current	Not Applicable	4.0 A at 25°C ; total for all outputs combined
Short circuit current (typical)	Not Applicable	up to 6.5 A
Switching frequency	Not Applicable	200 Hz

Type	8x Outputs	8x User Configurable Inputs/Outputs
Product Reference	TBDEP-808P-D84-G	TBDEP-8YYP-D84
PROFINET Identification	Vendor ID: 0x0127 Device ID: 0x1008 DAP identifier: 0x40110800	Vendor ID: 0x0127 Device ID: 0x1008 DAP identifier: 0x40110808
Power		
Power connector	M12 Ultra-Lock, 5-pin, male, A-Coded, stainless steel	
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	Not Applicable	Up to 8x channels, 2 or 3-wire
Connector	Not Applicable	M8, 3-pin, female, stainless steel
Input type	Not Applicable	PNP, Sinking
On-state current	Not Applicable	1-8mA maximum
Max off state current	Not Applicable	300µA
Input voltage	Not Applicable	UB
Sensor power supply (max)	Not Applicable	250 mA at 25°C
Input channel voltage ("1")	Not Applicable	10V ... 25V
Input channel voltage ("0")	Not Applicable	-0.2V ... 5V
Input short circuit protection (per port)	Not Applicable	600mA
Switching frequency	Not Applicable	min of 100Hz
Input filter	Not Applicable	0.5 ← → 3 ms (default 1 ms)
Outputs		
Channels	8x channels, 2-wire	Up to 8x channels, 2-wire
Output voltage	UL - 1 VDC	
Connector	M8, 3-pin, female, stainless steel	
Output type	PNP, Sourcing	
Output current	0.5A per channel, max. 4A total	
Maximum output current	4.0 A at 25°C ; total for all outputs combined	
Short circuit current (typical)	up to 6.5 A	
Switching frequency	200 Hz	

Characteristics for M12 versions

Type	8x Inputs	4x Inputs + 4x Outputs
Product Reference	TBDEP-480P-D8UG	TBDEP-444P-D8U-G
PROFINET Identification	Vendor ID: 0x0127 Device ID: 0x1008 DAP identifier: 0x50110008	Vendor ID: 0x0127 Device ID: 0x1008 DAP identifier: 0x50110404
Power		
Power connector	M12 Ultra-Lock, 5-pin, male, A-Coded, stainless steel	
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)	Not Applicable	24 VDC, -15/+20% (protected against power crossing)
Operating current (UL)	Not Applicable	10 mA (without load)
Inputs		
Channels	8x channels, 2 or 3-wire	4x channels, 2 or 3-wire
Connector	M12, 5-pin, female, stainless steel	
Input type	PNP, Sinking	
On-state current	1-8mA maximum	
Max off state current	300µA	
Input voltage	UB	
Sensor power supply (max)	250 mA at 25°C	
Input channel voltage ("1")	10V ... 25V	
Input channel voltage ("0")	-0.2V ... 5V	
Input short circuit protection (per port)	600mA	
Switching frequency	min of 100Hz	
Input filter	0.5 ← → 3 ms (default 1 ms)	
Outputs		
Channels	Not Applicable	4x channels, 2-wire
Output voltage	Not Applicable	UL - 1 VDC
Connector	Not Applicable	M8, 3-pin, female, stainless steel
Output type	Not Applicable	PNP, Sourcing
Output current	Not Applicable	0.5A per channel, max. 4A total
Maximum output current	Not Applicable	4.0 A at 25°C ; total for all outputs combined
Short circuit current (typical)	Not Applicable	up to 6.5 A
Switching frequency	Not Applicable	200 Hz

Type	8x Outputs	8x User Configurable Inputs/Outputs
Product Reference	TBDEP-408P-D8U-G	TBDEP-4YYP-D8U
PROFINET Identification	Vendor ID: 0x0127 Device ID: 0x1008 DAP identifier: 0x50110800	Vendor ID: 0x0127 Device ID: 0x1008 DAP identifier: 0x50110808
Power		
Power connector	M12 Ultra-Lock, 5-pin, male, A-Coded, stainless steel	
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	Not Applicable	Up to 8x channels, 2 or 3-wire
Connector	Not Applicable	M12, 5-pin, female, stainless steel
Input type	Not Applicable	PNP, Sinking
On-state current	Not Applicable	1-8mA maximum
Max off state current	Not Applicable	300µA
Input voltage	Not Applicable	UB
Sensor power supply (max)	Not Applicable	250 mA at 25°C
Input channel voltage ("1")	Not Applicable	10V ... 25V
Input channel voltage ("0")	Not Applicable	-0.2V ... 5V
Input short circuit protection (per port)	Not Applicable	600mA
Switching frequency	Not Applicable	min of 100Hz
Input filter	Not Applicable	0.5 ← → 3 ms (default 1 ms)
Outputs		
Channels	8x channels, 2-wire	Up to 8x channels, 2-wire
Output voltage	UL - 1 VDC	
Connector	M12, 5-pin, female, stainless steel	
Output type	PNP, Sourcing	
Output current	0.5A per channel, max. 4A total	
Maximum output current	4.0 A at 25°C ; total for all outputs combined	
Short circuit current (typical)	up to 6.5 A	
Switching frequency	200 Hz	

Fieldbus	
Ethernet connectors	2x M12 Ultra-Lock, 4-pin, female, D-Coded, stainless steel, shielded
IP assignment	DCP, DCP with auto naming (3x rotary switches)
Protocol	PROFINET IO according PI specifications v2.2
Communication Class	Real Time Conformance Class-B (RT CC-B)
Data access	<ul style="list-style-type: none"> • Cyclic data exchange <ul style="list-style-type: none"> ○ Input and output process data ○ I/O diagnostics • Acyclic data exchange <ul style="list-style-type: none"> ○ Alarms ○ Reading module configuration settings ○ Reading module diagnostic data ○ Instructions and Maintenance services (I&M)
Cyclic connection	1x IO-Controller connection
Acyclic connection	Max up to 4 simultaneous requests
Integrated Switch	<ul style="list-style-type: none"> • 2x ports integrated switch • Speed: 100Mbps • Auto negotiation • Auto crossing • Auto polarity • 1x status led per port • Storm Protection against network loop (Broadcast, Multicast and Unicast packets)
Daisy Chain (Ethernet)	Up to 8 HarshIO
Module performance	Manage up to 3000 packet/sec
Refresh Period	from 1 ms up to 512 ms (default 16 ms)
LLDP	Yes (Sender / Receiver)
GSD file	Yes
Easy Device Replacement	Yes (based on LLDP)
SNMP	Server according v1/v2

Module factory settings:

PROFINET name molex-harsh300-ip67
Rotary switch Position 700
IP address: 0.0.0.0
Subnet mask: 0.0.0.0
Gateway: 0.0.0.0
ETH1 port: Auto negotiation / Auto MDIX
ETH2 port: Auto negotiation / Auto MDIX
LLDP: Enabled
Easy Replacement: Enabled

Module identification: Each HarshIO has a unique Ethernet MAC address printed on the back of the module. This address is unique and has a fixed length of 6 bytes (48 bits) built with the manufacturer's ID, the product family and the module's serial number.

Manufacturer ID	Family	Serial Number
00.A0.91	72	XX.XX

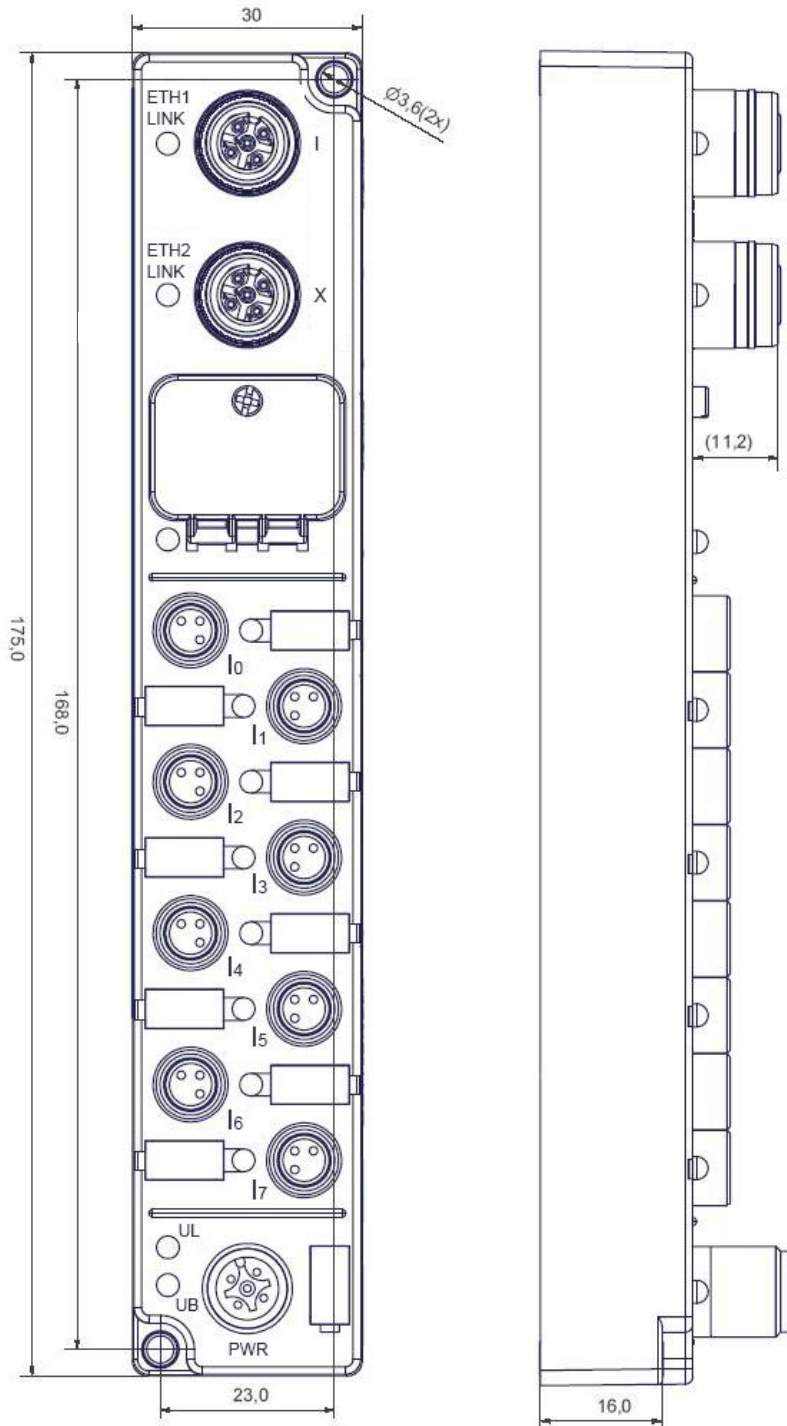
Mechanical	
Housing dimensions	30 x 175 x 20 mm (1.18"x6.89"x0.78")
Housing material	PBT VALOX 420 SEO Black 7701
Flammability Standard	UL 94 V-0
Corner mounting hole	2 mounting holes, 3,6 x16 mm
Operating temperature	-20°C ... +70°C
Storage temperature	-25°C ... +85°C
Vibration resistance	7G (15,7Hz to 500Hz), 3 axis
Shock resistance	10g, 11ms, 3 axis
Electro-magnetic compatibility	EN 61000-6-2 / EN 61000-6-4
Relative humidity	10 % to 95 %, non-condensing
Protection Class	IP67
Approval	CE (according IEC 61131-2), UL / cUL
Environmental	RoHS and REACH
MTBF	100 000 hours / 11 years at 70°C

Note: M12 cordsets connected to the module shall be screw with a torque of 2.0 Nm to ensure a correct sealing to achieve IP67 rating.

Note: M8 cordsets connected to the module shall be screw with a torque of 1.5 Nm to ensure a correct sealing to achieve IP67 rating.

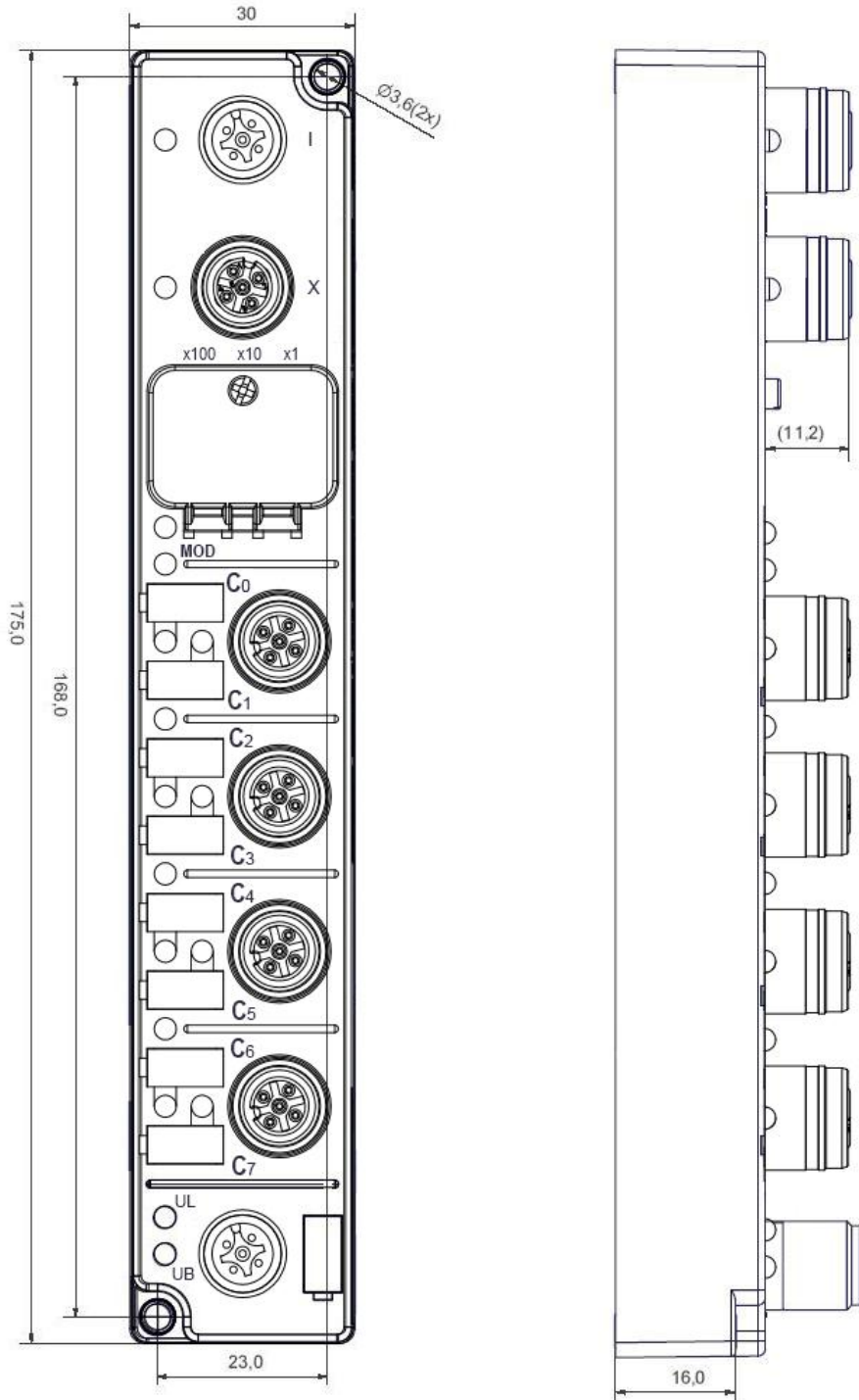
M8 Mechanical Characteristics

Size and dimensions (in mm)

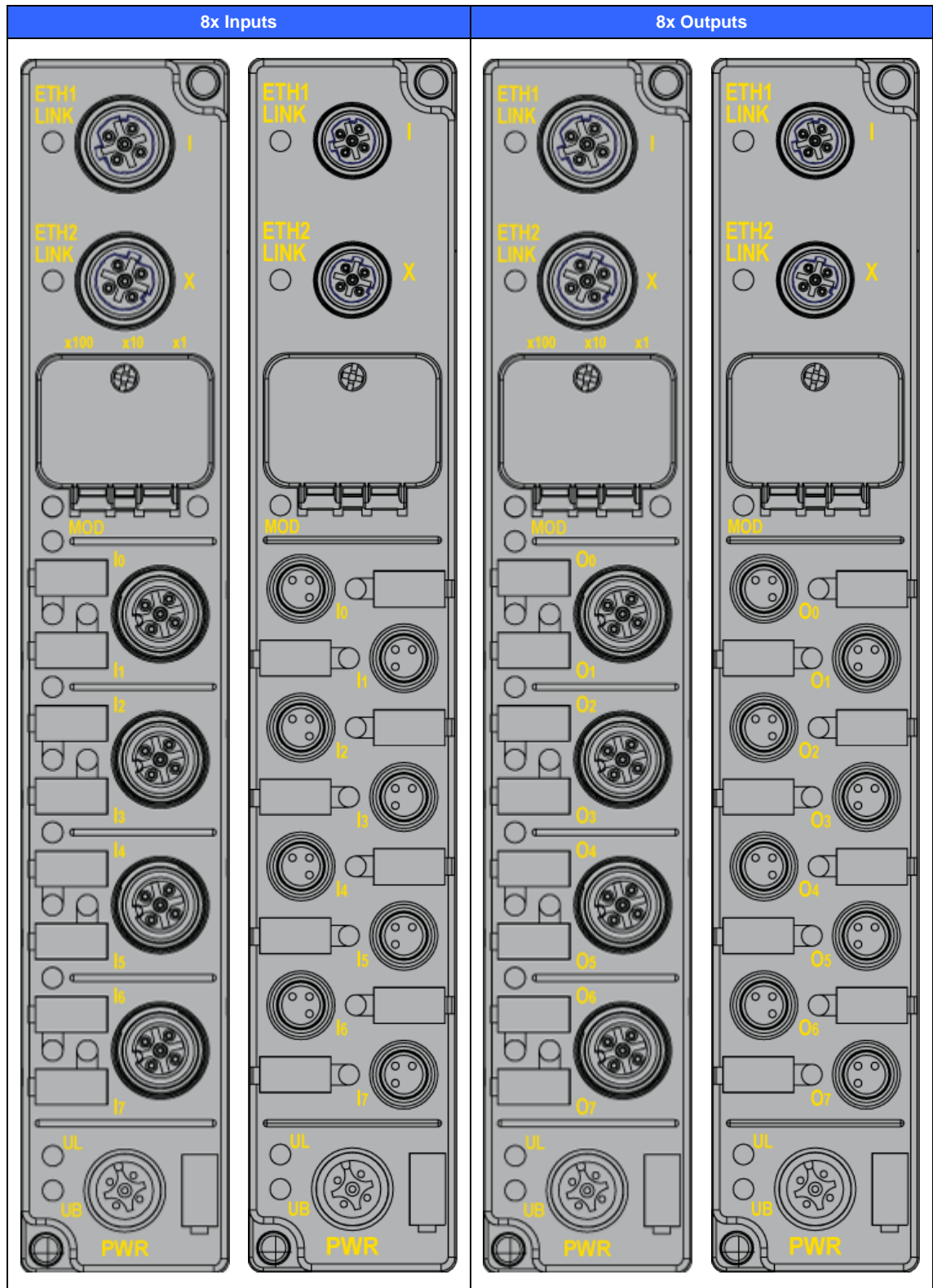


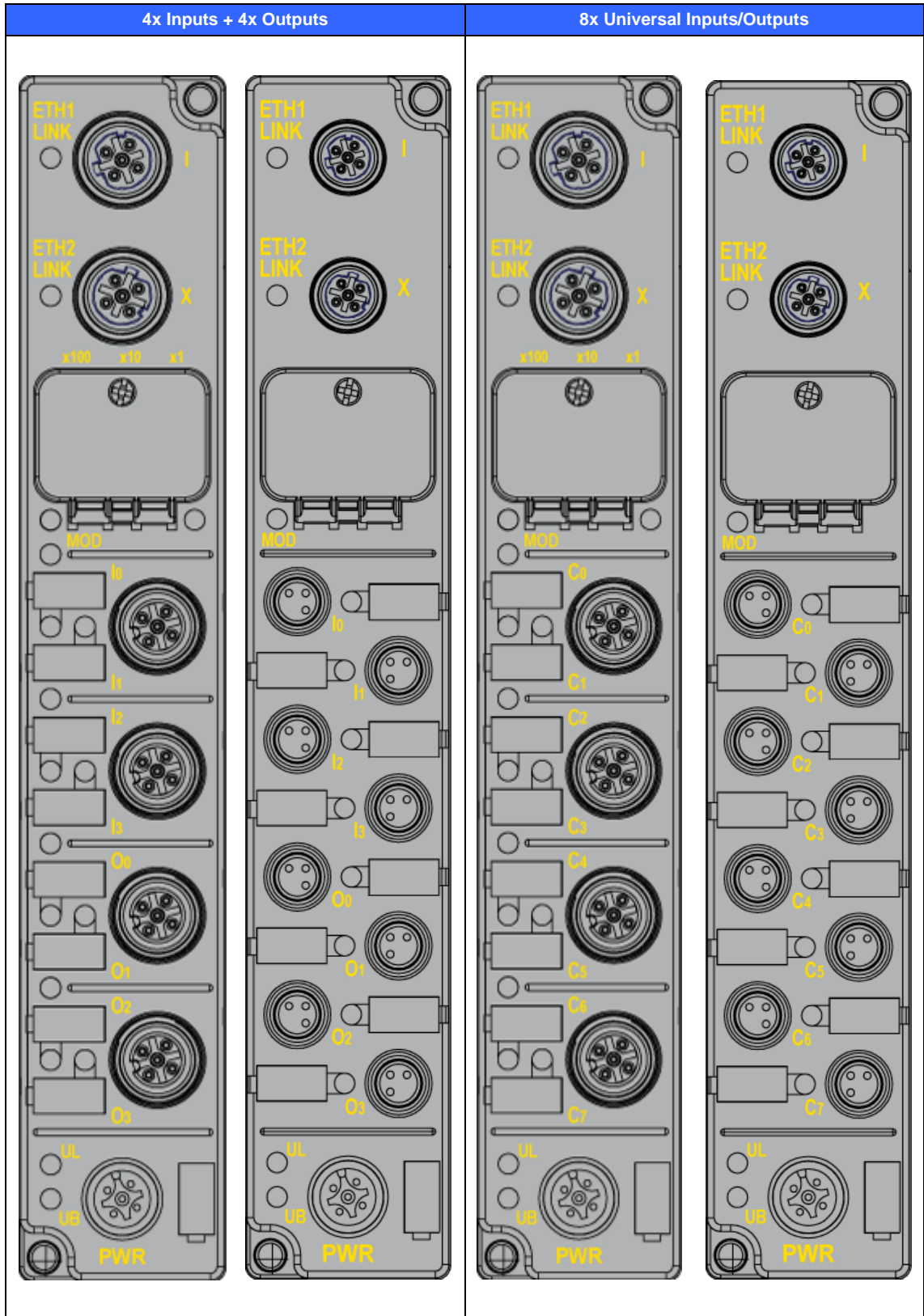
M12 Mechanical Characteristics

Size and dimensions (in mm)



Physical I/O mapping





Process I/O mapping

8 Inputs module version

	Byte Offset	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Inputs 3 bytes									
Input Data	0x00	I7	I6	I5	I4	I3	I2	I1	I0
Input Channel Status	0x01	CS I7	CS I6	CS I5	CS I4	CS I3	CS I2	CS I1	CS I0
Output Channel Status	0x02	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Outputs 1 byte									
Output Data	0x00	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u

4 Inputs + 4 Outputs module version

	Byte Offset	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Inputs 3 bytes									
Input Data	0x00	n/u	n/u	n/u	n/u	I3	I2	I1	I0
Input Channel Status	0x01	n/u	n/u	n/u	n/u	CS I3	CS I2	CS I1	CS I0
Output Channel Status	0x02	CS O3	CS O2	CS O1	CS O0	n/u	n/u	n/u	n/u
Outputs 1 byte									
Output Data	0x00	O3	O2	O1	O0	n/u	n/u	n/u	n/u

Outputs module version

	Byte Offset	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Inputs 3 bytes									
Input Data	0x00	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Input Channel Status	0x01	n/u	n/u	n/u	n/u	n/u	n/u	n/u	n/u
Output Channel Status	0x02	CS 07	CS 06	CS 05	CS 04	CS 03	CS 02	CS 01	CS 00
Outputs 1 byte									
Output Data	0x00	07	06	05	04	03	02	01	00

8 User Configurable I/O module version

	Byte Offset	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Inputs 3 bytes									
Input Data	0x00	I7	I6	I5	I4	I3	I2	I1	I0
Input Channel Status	0x01	CS I7	CS I6	CS I5	CS I4	CS I3	CS I2	CS I1	CS I0
Output Channel Status	0x02	CS 07	CS 06	CS 05	CS 04	CS 03	CS 02	CS 01	CS 00
Outputs 1 byte									
Output Data	0x00	07	06	05	04	03	02	01	00

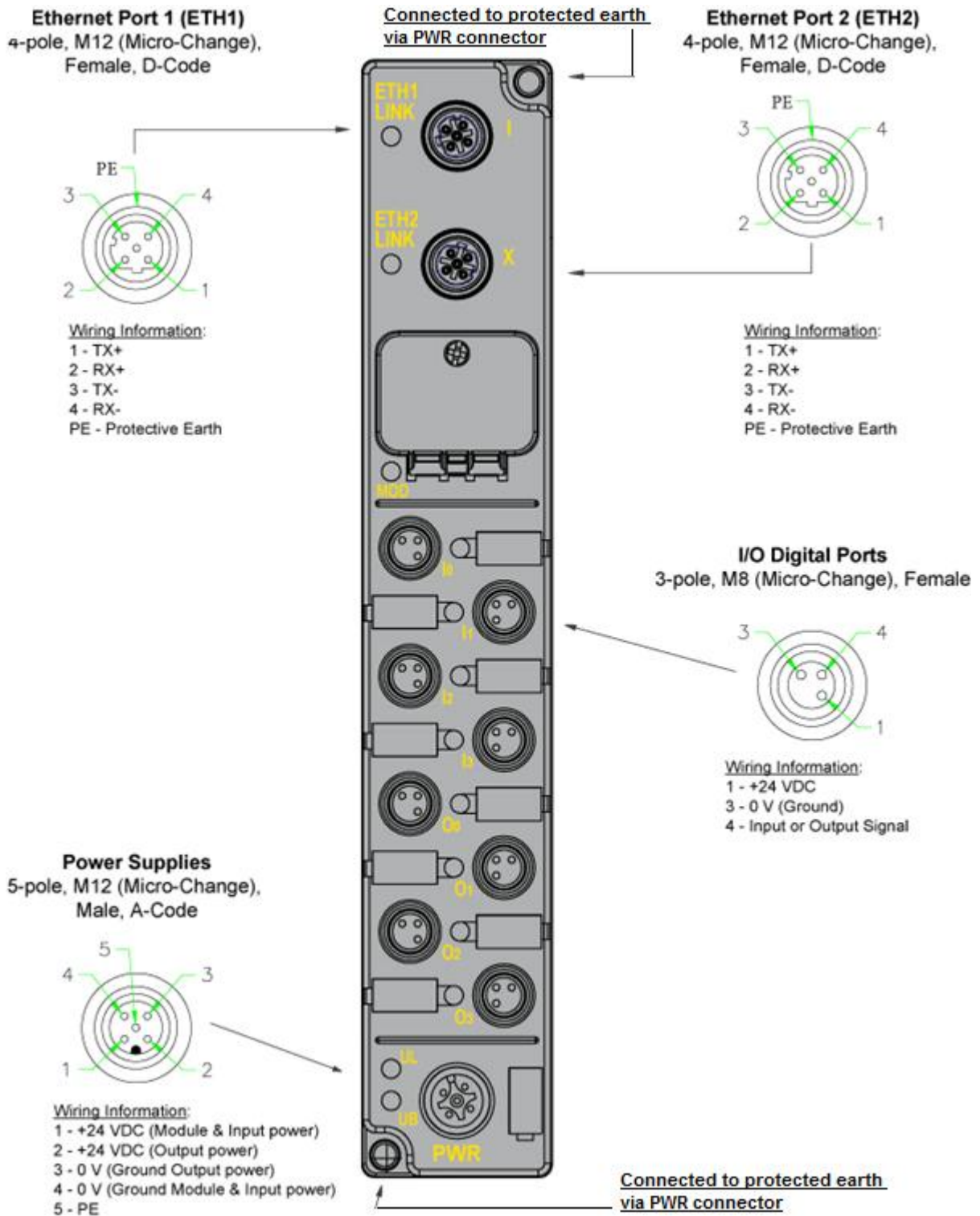
n/u: not used

CS (Channel Status): shows the current condition of digital channels

- 0: no error
- 1: detected short circuit or power supply on the corresponding channel

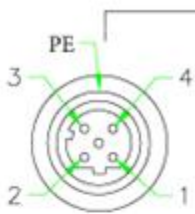
M8 Pin assignment

8 Inputs, 4 Inputs + 4 Outputs, and 8 Outputs module versions



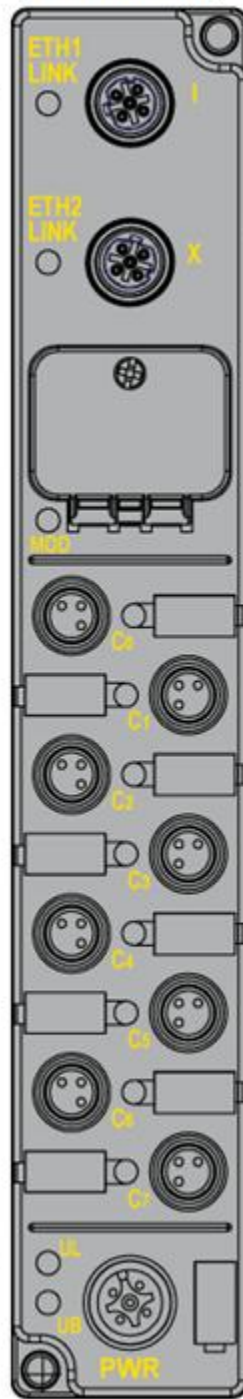
M8 User Configurable I/O module version

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

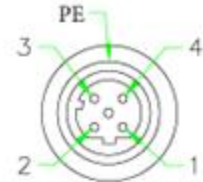


Wiring Information:
1 - TX+
2 - RX+
3 - TX-
4 - RX-
PE - Protective Earth

Connected to protected earth
via PWR connector

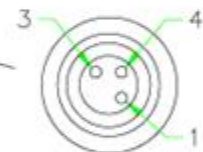


Ethernet Port 2 (ETH2)
4-pole, M12 (Micro-Change),
Female, D-Code



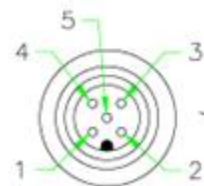
Wiring Information:
1 - TX+
2 - RX+
3 - TX-
4 - RX-
PE - Protective Earth

I/O Digital Ports
3-pole, M8 (Micro-Change), Female



Wiring Information:
1 - +24 VDC
3 - 0 V (Ground)
4 - Input or Output Signal

Power Supplies
5-pole, M12 (Micro-Change),
Male, A-Code



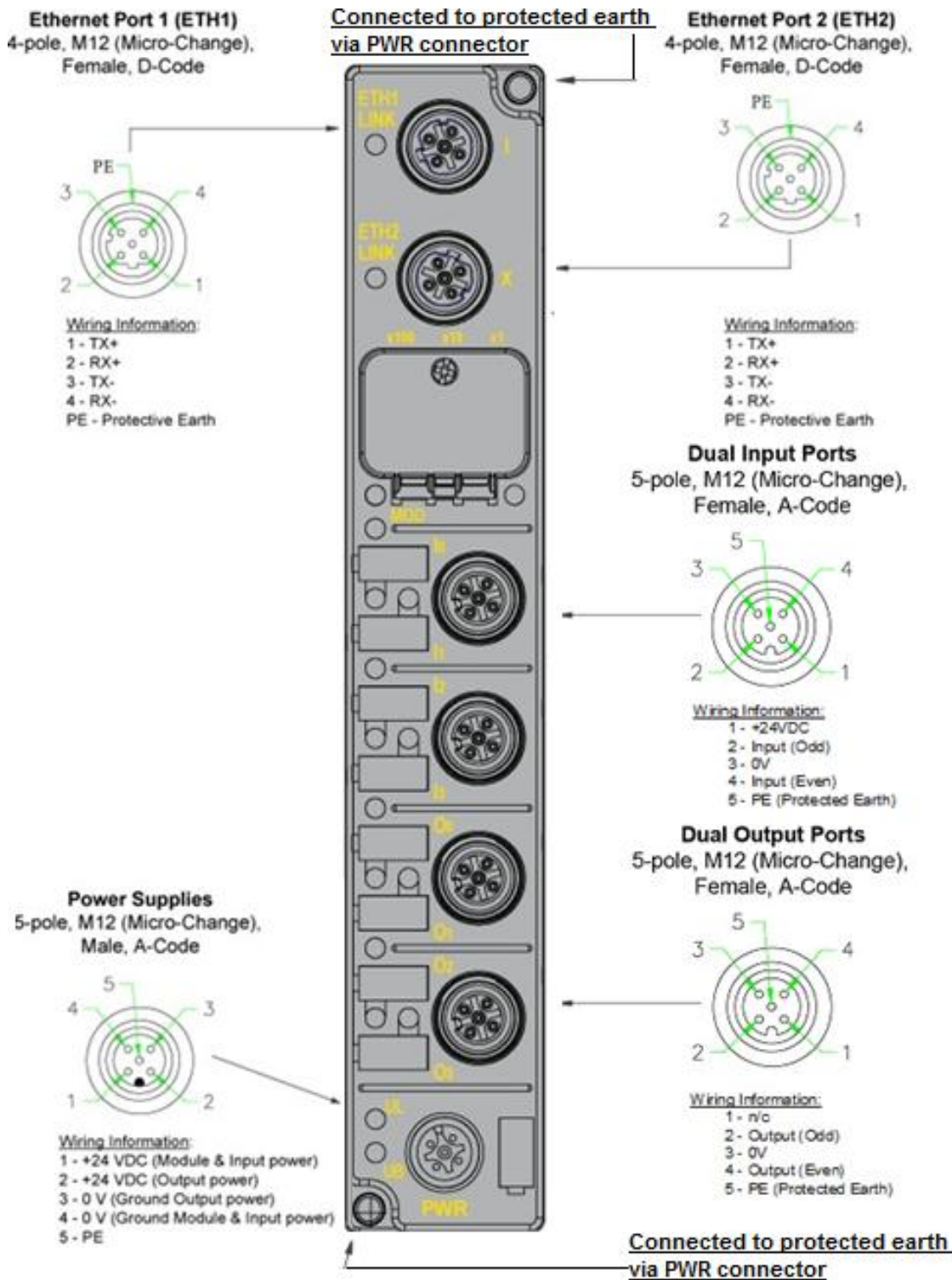
Wiring Information:
1 - +24 VDC (Module & Input power)
2 - +24 VDC (Output power)
3 - 0 V (Ground)
4 - 0 V (Ground)
5 - PE

Connected to protected earth
via PWR connector

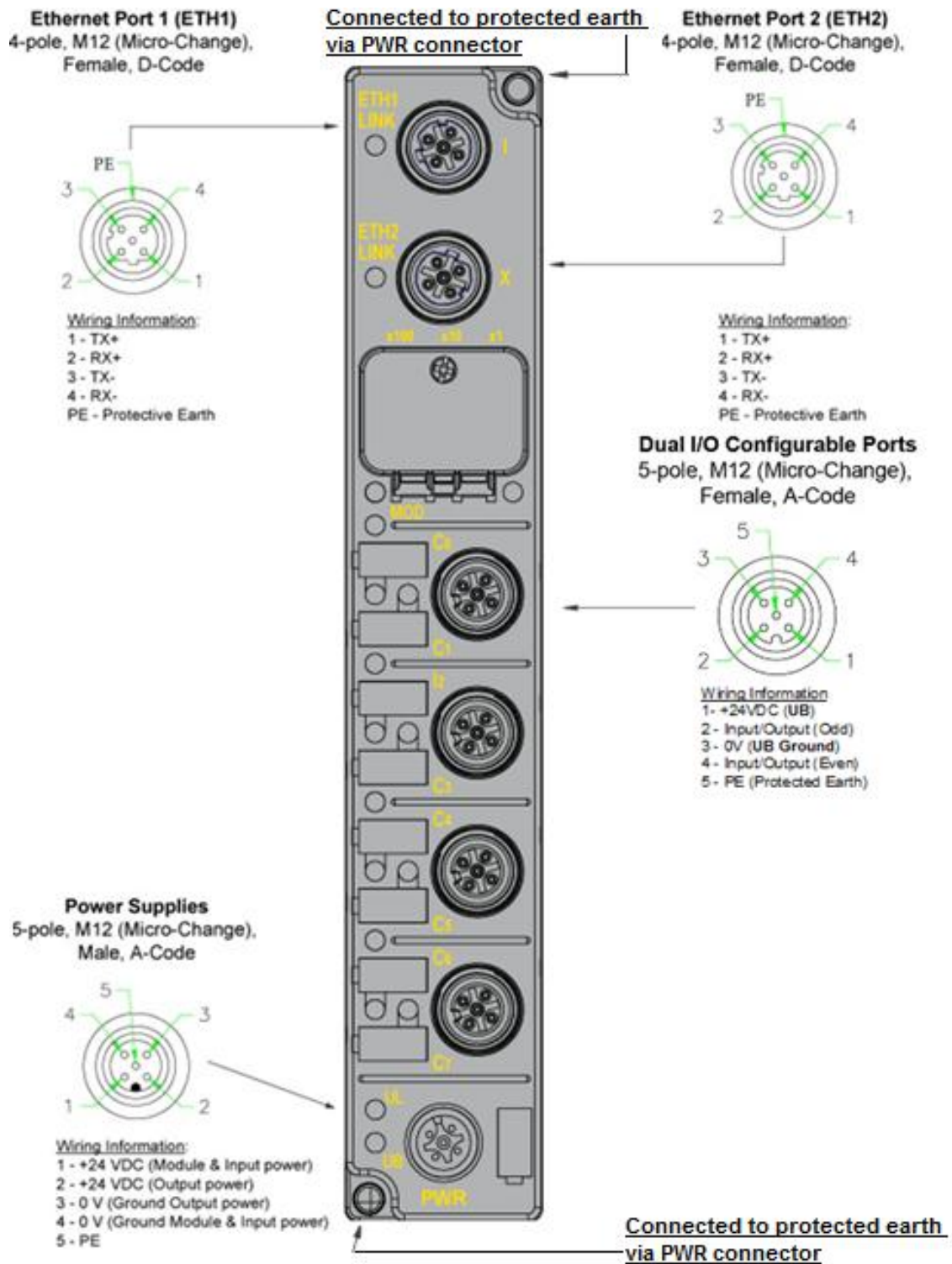
Warning: The HarshIO 300 User Configurable version has *both Logic & Input power ground and Output power ground* connected together inside the module.

M12 Pin assignment

M12 8 Inputs, 4 Inputs + 4 Outputs, and 8 Outputs module versions



M12 User Configurable I/O module version



Warning: The HarshIO 300 User Configurable version has *both Logic & Input power ground and Output power ground* connected together inside the module.

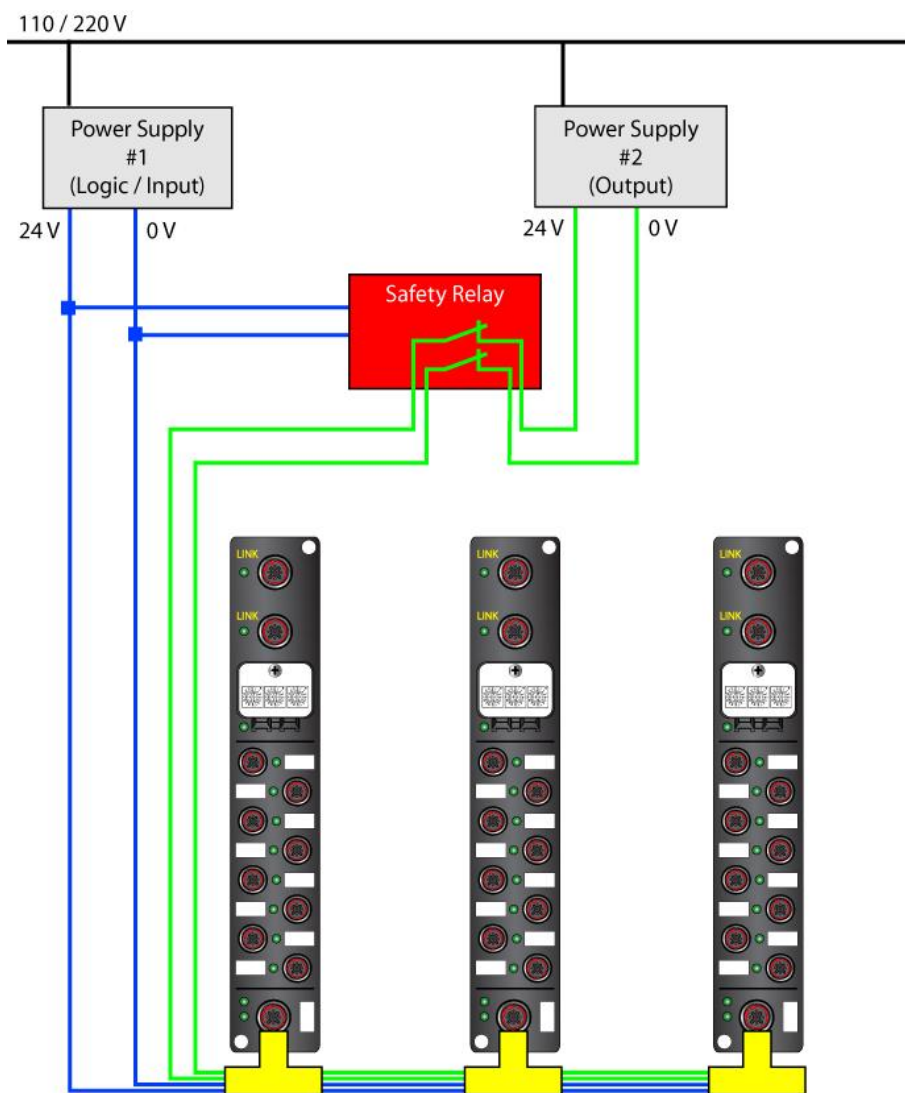
Separate grounding wiring for application using safety relays

The HarshIO 300 power connector includes a separate grounding isolation between the input/logic ground and the output ground. This feature allows powering the module with 2 distinct power supplies that is commonly used in safety application.

Note: The feature doesn't apply to HarshIO 300 User Configurable I/O version.

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.

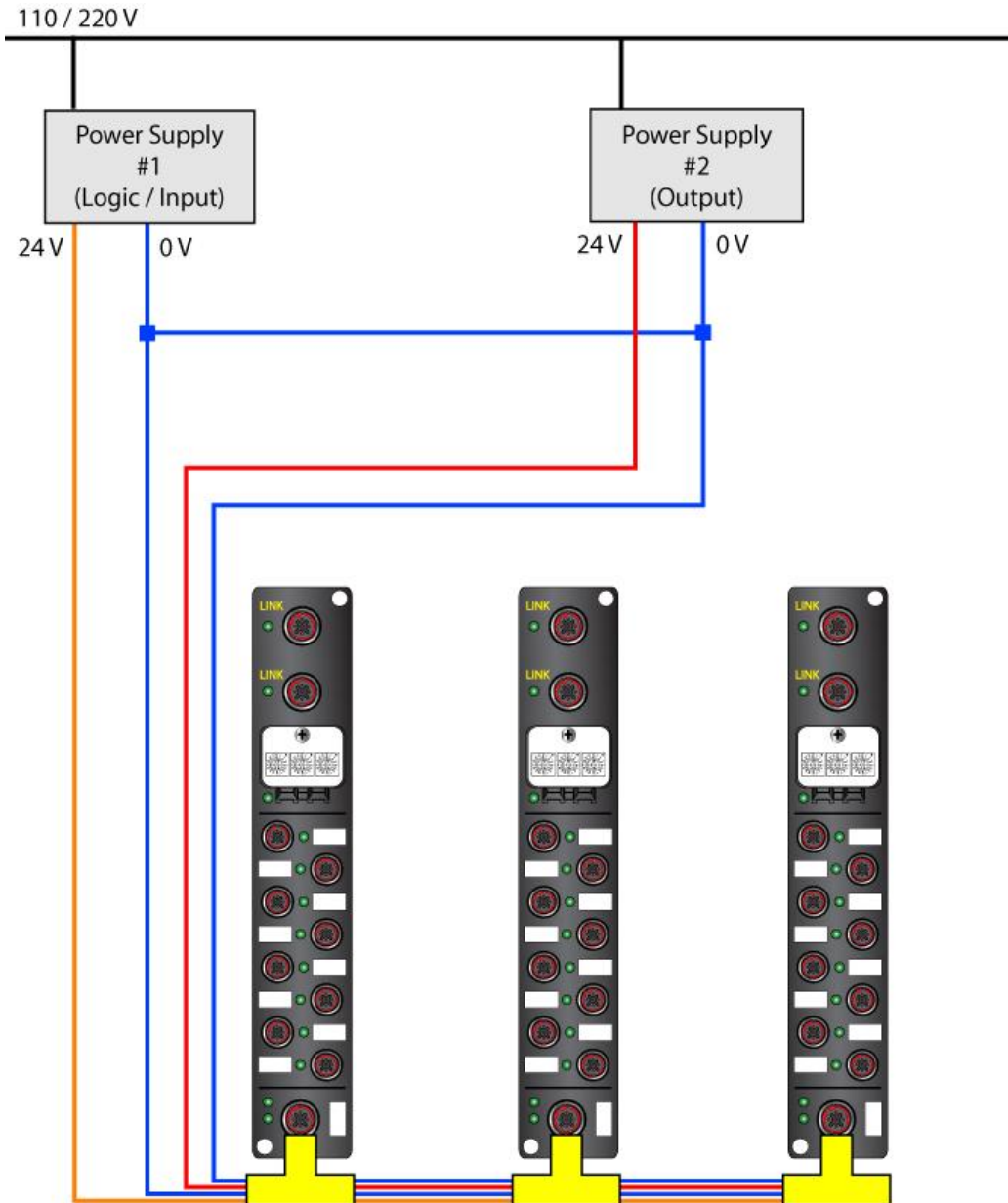
Architecture with 2 distinct grounds using safety relay



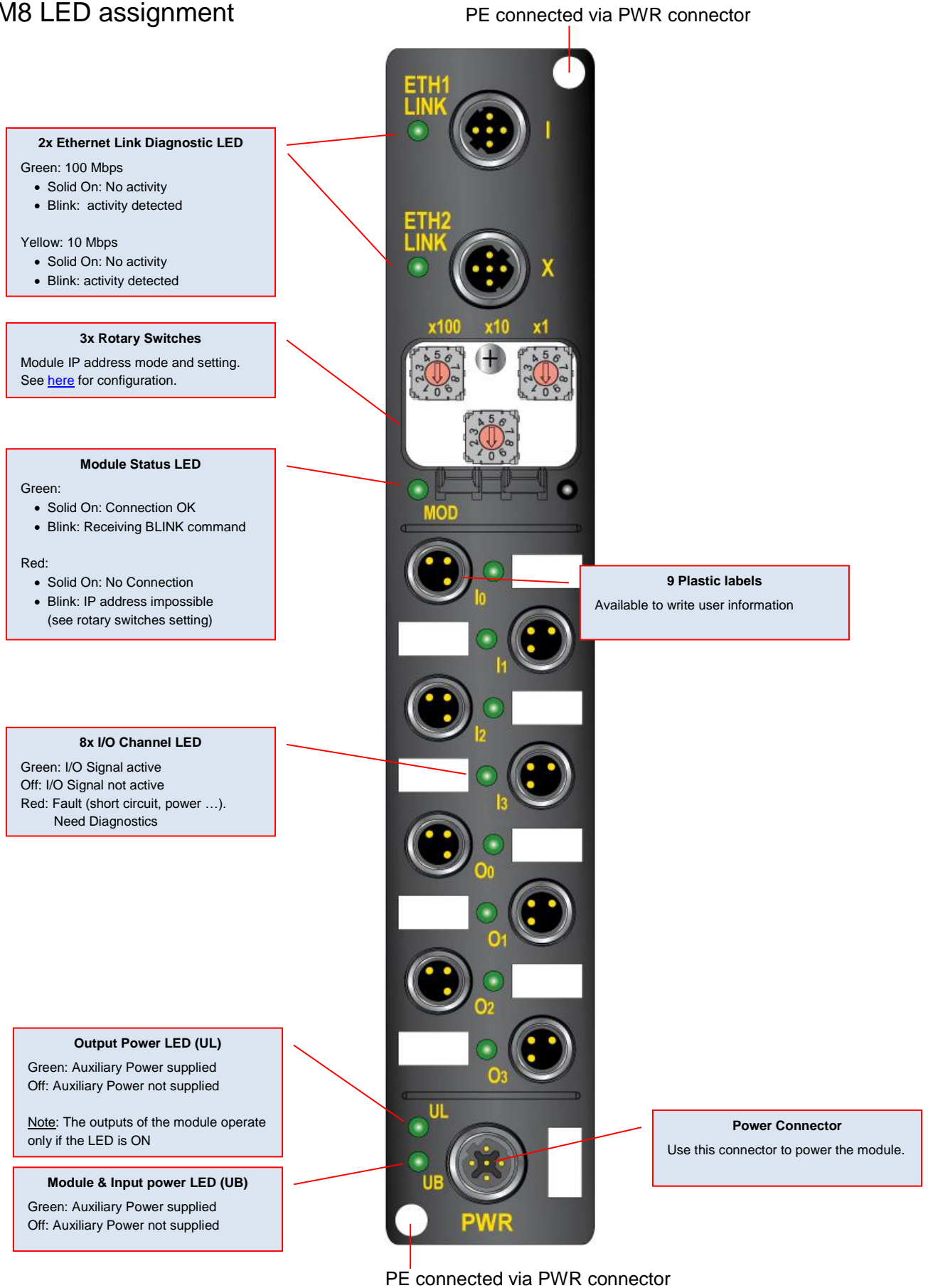
However if the separate grounding for safety is not required by the system designer, the HarshIO modules can operate using a single ground for both logic/input and output.

Architecture with a single ground

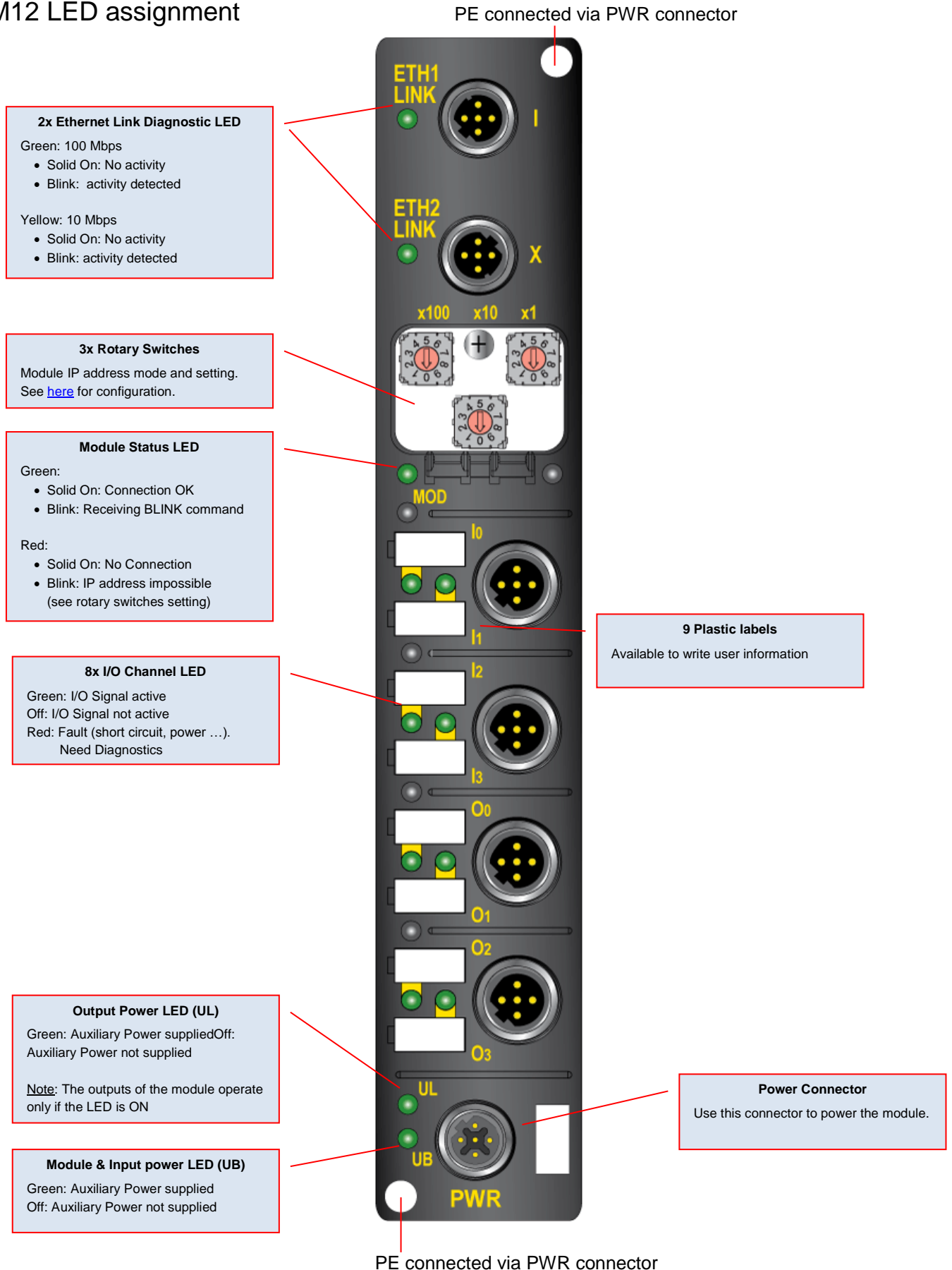
In this case, the connection of the common ground (Logic/Input + Output) is made outside the HarshIO module.



M8 LED assignment



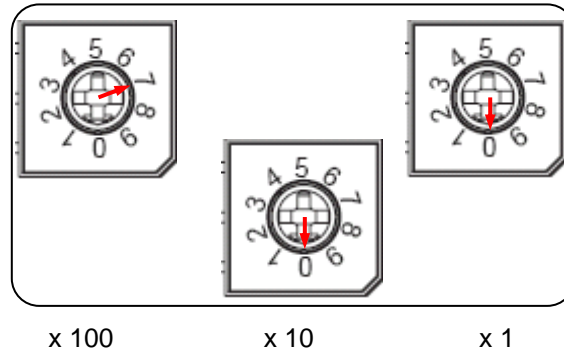
M12 LED assignment



Rotary Switches

The HarshIO 300 ePN has 3 rotary switches used to configure the different modes of PROFINET station address assignment.

Position of the rotary in the Window



Example: Above position **700**, the out-of-box position of the rotary switches.

PROFINET Station Assignment modes

Rotary Switches Position	Modes	Description				
700	DCP	Start the HarshIO module with the PROFINET device name stored in the Flash memory.				
8xx	DCP with auto naming	<p>Start the HarshIO module with a pre-configured PROFINET device name.</p> <p style="text-align: center;">ModuleName = "molex-harshio-"+XX (rotary switch value)</p> <p>This mode is very useful for a quick commissioning, maintenance, and replacement of a module. No tool will be required to replace the module. Just set the same rotary switch positions to replace it. This method is very equivalent to PROFIBUS station address.</p> <p><u>Example:</u> if the rotary switched are in 823 position. The module name is "molex-harshio-23"</p> <p><u>Note:</u> DCP A SetName command cannot change the ModuleName</p>				
900		<p>Reset the HarshIO module with the default factory setting.</p> <p>To perform the reset, power on the module with the rotary switches in position 900, wait 5 sec and power off the module. The module is now configured with the following parameters:</p> <p><u>Module factory settings:</u></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">PROFINET name</td> <td>molex-harsh300-ip67</td> </tr> <tr> <td>Rotary switch Position</td> <td>700</td> </tr> </table>	PROFINET name	molex-harsh300-ip67	Rotary switch Position	700
PROFINET name	molex-harsh300-ip67					
Rotary switch Position	700					

		IP address: 0.0.0.0 Subnet mask: 0.0.0.0 Gateway: 0.0.0.0 ETH1 port: Auto negotiation / Auto MDIX ETH2 port: Auto negotiation / Auto MDIX LLDP: Enabled Easy Replacement: Enabled
999		Reserved for technical support (firmware download)

Note: The rotary switch position is ONLY read at the boot of the module. Any modification of the position will require a power cycle (ON → OFF → ON) of the module.

Note: All other rotary switch positions are forbidden. In all of these cases, the HarshIO module will not start and the MOD led status will blink in RED.

Note: If a DCP request is received, and the rotary switches are not on DCP mode (position 700), the module will reject the request.

5. PROFINET and related functions

Module Configuration Phase

The HarshIO 300 ePN is configured by the PROFINET IO-Controller through multiple **Write.Req** by using information contained in the GSD file.

Until the connection phase is done, the frames produced by the ePN module will be marked as **STOP** (apdu status). As soon as “Parameter End Response” is sent by the HarshIO module, the frames will be produced as **RUN** (apdu status).

Module Alarms

When an I/O error occurs (ex: short-circuit), the quality of produced data will be set to **BAD**.

An alarm will be sent to the PROFINET IO-Controller. This alarm has the following characteristics:

✓ Alarmtype:	Diagnosis
✓ API:	0x00
✓ SlotNumber:	0x00
✓ SubslotNumber:	0x01
✓ channelProperties.Speifier:	0x0001 (Appears)
✓ channelErrorType:	0x0001 (short circuit)

When the default disappears, the quality of data will be set to **GOOD**. An alarm will be sent to the PROFINET IO-Controller. This alarm has the following characteristics:

✓ Alarmtype:	Diagnosis
✓ API:	0x00
✓ SlotNumber:	0x00
✓ SubslotNumber:	0x01
✓ channelProperties.Speifier:	0x0002 (Disappears)
✓ channelErrorType:	0x0001 (short circuit)

When an Output voltage issue occurs (ex: power drop or power down), the quality of produced data will be set to **BAD**.

An alarm will be sent to the PROFINET IO-Controller. This alarm has the following characteristics:

✓ Alarmtype:	Diagnosis
✓ API:	0x00
✓ SlotNumber:	0x00
✓ SubslotNumber:	0x01
✓ channelProperties.Speifier:	0x0001 (Appears)
✓ channelErrorType:	0x0002 (under voltage)

When the default disappears, the quality of data will be set to **GOOD**. An alarm will be sent to the PROFINET IO-Controller. This alarm has the following characteristics:

✓ Alarmtype:	Diagnosis
✓ API:	0x00
✓ SlotNumber:	0x00
✓ SubslotNumber:	0x01
✓ channelProperties.Speifier:	0x0002 (Disappears)
✓ channelErrorType:	0x0002 (under voltage)

Note: If you do not apply +24 output voltage on **TBDEP-8YYP-D84** or **TBDEP-4YYP-D8U** (Full input configuration only) with firmware version ≤1.32, an alarm “power drop” will be sent to the PLC. The only way to clear this alarm is to apply +24 output voltage.

Topology Discovery (LLDP)

LLDP (Link Layer Discovery Protocol) is a standard which provides a solution for the configuration issues caused by expanding LANs. LLDP specifically defines a standard method for Ethernet network devices such as switches, routers and wireless LAN access points to advertise information about themselves to other nodes on the network and store the information they discover.

The HarshIO 300 ePN manages LLDP as a Sender and Receiver;

- As a Sender; each Ethernet port of the integrated switch of the HarshIO module produces LLDP frame to its neighbor devices with the following information:
 - MAC address
 - Ethernet port identification
 - PROFINET name
 - Material number (TBDEP-xxxx)
 - Description name
- As a Receiver; each Ethernet port of the integrated switch of the HarshIO module consumes the LLDP frame of the neighbor devices.

Note: LLDP is always active on the ePN module.

Easy Device Replacement

PROFINET optimizes the device replacement and first commissioning processes.

PROFINET devices are identified via a name that is assigned in the configuration. When replacing a defective device, a new device (with the same commercial reference) can be recognized by the IO-Controller by means of topology information and have a name automatically assigned to it.

An engineering tool is therefore not required when replacing devices. This mechanism can also be used during the initial commissioning of a complete plant. Quick commissioning is thus especially possible for series machines.

The HarshIO 300 ePN supports easy device replacement service (based on LLDP receiver protocol).

To set up the easy device replacement feature, please follow the technical note [here](#).

6. Configuration using S7 Hardware Manager

This chapter presents an example of how to proceed to the commissioning of the HarshIO PROFINET modules based on the Siemens Step7 Hardware Configuration (*HW_Config*) software.

GSD File

Before proceeding to the product commissioning, the HarshIO modules require a description file (also called GSD or GSDML file) that has to be imported in the Simatic Step7 software.

The GSDML file as well as the product documentation can be downloaded from the Molex web site

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

and use option 1 – “Search by part number” to look for *TBDEP-8xxP-D84-x* parts or *TBDEP-4xxP-D8U-x* parts.

The screenshot shows the Molex website search results for the query 'Brad HarshIO 300 PROFINET IO GSDML file - Rev 2.3'. The page displays four search results:

- Found in Catalogue: Demo**
Video - EtherNet Switches and IO Blocks System Layout - V1.0 - English
 Download - [122836000 B] - 09/06/14
 Applicable Products: CCDEP-8xxP-D1U-G / CCDEP-8xxP-D1U-G02 / DRL-2xx-xxx / DRL-3xx-xxx / DRL-7xx / TBDCO-8xxx-xxx / TBDDN-4xxx-xxx / TBDDN-8xxx-xxx / TBDEP-8xxP-D84 / TBDPB-4xxx-xxx / TBDPB-8xxx-xxx / TCDDN-xxxx-xxx / TCDEI-8xxP-DYU-G01 / TCDEI-8xxP-DxU / TCDEI-8xxP-DxU-G / TCDEM-xxxx-xxx / TCDEP-8xxP-D1U-G / TCDEP-xxxx-D1U / TCDEP-8B4P-KKU / TCDEP-8xxx-xxx
 Applicable Networks: EtherNet, Profibus, PROFINET, DeviceNet, ModbusTCP
 Item Description: How-to video on EtherNet system layout. Includes how to differentiate IP67 EtherNet switches and IO Blocks
- Found in Catalogue: Software**
Brad HarshIO 300 PROFINET IO GSDML file - Rev 2.3
 Download - [12000 B] - 26/05/14
 Applicable Products: TBDEP-8xxP-D84 / TBDEP-8xxP-D84-x
 Applicable Networks: PROFINET IO protocol
 Item Description: GSDML file + Bimap for PROFINET IP67 IO block with Firmware V1.32 and upper.
- Found in Catalogue: Software, Manuals, Technical Notes**
Brad HarshIO 300 PROFINET IO firmware - Version 1.32
 Download - [1193000 B] - 20/05/14
 Applicable Products: TBDEP-8xxP-D84 / TBDEP-8xxP-D84-x
 Applicable Networks: PROFINET IO
 Item Description: Brad HarshIO 300 PROFINET IO firmware version 1.32 as well as the procedure and the firmware updater tool.
- Found in Catalogue: Manuals**
Brad HarshIO 300 PROFINET IO user's manual - Rev 2.0
 Download - [5500000 B] - 04/11/13
 Applicable Products: TBDEP-8xxP-D84 / TBDEP-8xxP-D84-x
 Applicable Networks: PROFINET IO
 Item Description: User's manual Rev 2.0 for IP67 IO block.

Fig. A: Molex download section

Add a HarshIO module

Start Simatic Manager (*Step7*), open the Hardware Configuration (*HW_Config*).

To add a PROFINET HarshIO module in the Step7 configuration, you need first to select *Options* menu \Install *GSD File* to insert the GSD file in the Step7 Catalog.

The HarshIO modules list appears in PROFINET IO directory → “Additional Field Devices” → “I/O”.

Select the relevant HarshIO reference and drag & drop the module on the virtual PROFINET network line.

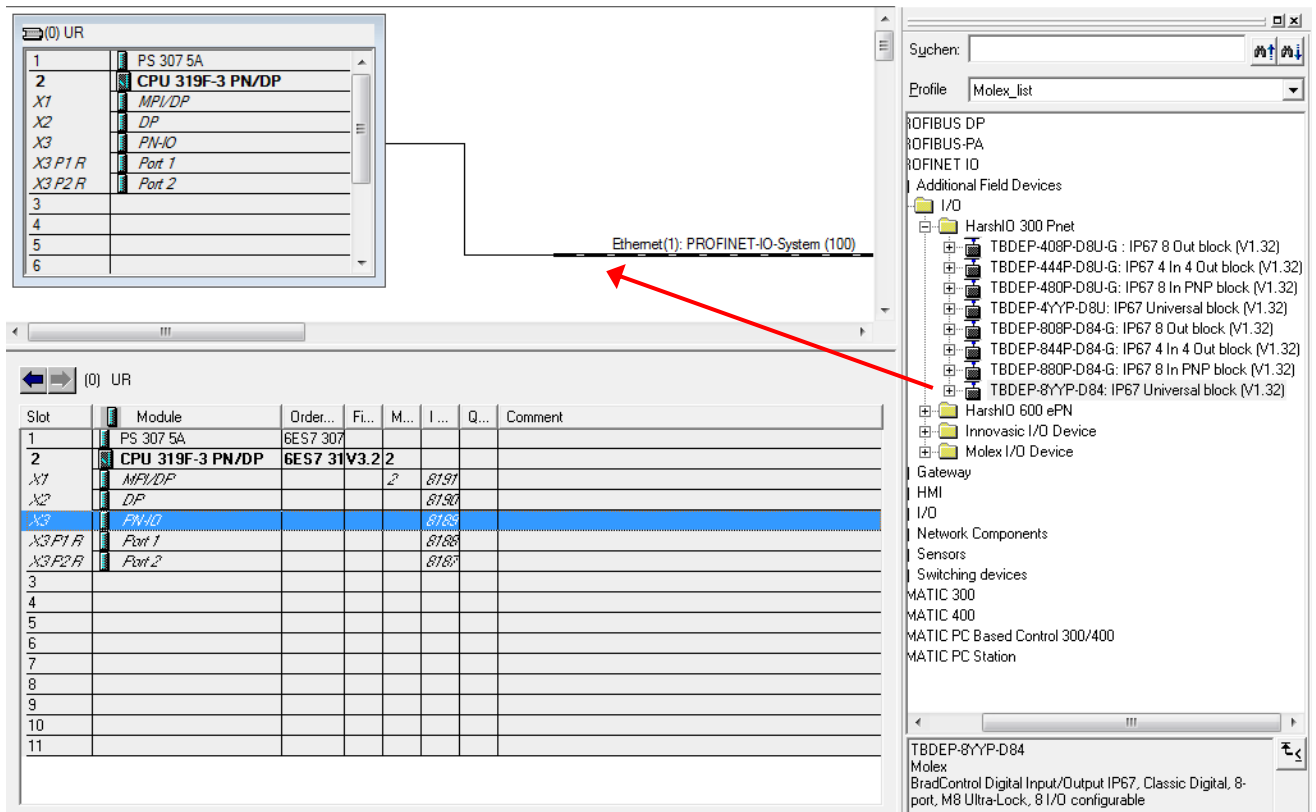


Fig. B: Step7 & HW_Config & HarshIO GSD imported

HW Config - [SIMATIC 300(1) (Configuration) -- Compact M12_test_2]

Station Edit Insert PLC View Options Window Help

(0) UR

1	PS 307 5A
2	CPU 319F-3 PN/DP
X1	MPI/DP
X2	DP
X3	PN-IO
X3 P1 R	Port 1
X3 P2 R	Port 2
3	
4	
5	
6	

Ethernet(1): PROFINET-IO-System

(1) molex-ha

Suchen: Molex_list

- PROFIBUS DP
- PROFIBUS-PA
- PROFINET IO
 - Additional Field Devices
 - I/O
 - HarshIO 300 Pnet
 - TBDEP-408P-D8U-G : IP67 8 Out block (V1.32)
 - TBDEP-444P-D8U-G: IP67 4 In 4 Out block (V1.32)
 - TBDEP-480P-D8U-G: IP67 8 In PNP block (V1.32)
 - TBDEP-4YYP-D8U: IP67 Universal block (V1.32)
 - TBDEP-808P-D84-G: IP67 8 Out block (V1.32)
 - TBDEP-844P-D84-G: IP67 4 In 4 Out block (V1.32)
 - TBDEP-880P-D84-G: IP67 8 In PNP block (V1.32)
 - TBDEP-8YYP-D84: IP67 Universal block (V1.32)
 - HarshIO 600 ePN
 - Innovasic I/O Device
 - Molex I/O Device
 - Gateway
 - HMI
 - I/O
 - Network Components
 - Sensors
 - Switching devices
 - SIMATIC 300
 - SIMATIC 400
 - SIMATIC PC Based Control 300/400
 - SIMATIC PC Station

TBDEP-8YYP-D84
 Molex
 BradControl Digital Input/Output IP67. Classic Digital, 8-port, M8 Ultra-Lock, 8 I/O configurable

Press F1 to get Help. Chg

Fig. C: HarshIO inserted in HW_Config

Configure a HarshIO device name and IP address

PROFINET uses name to identify the I/O devices on the network. **Each device must have a unique name on the network. The device name must be written in lowercase.**

To modify the module name, double click on the HarshIO product picture to open the module Properties dialog.

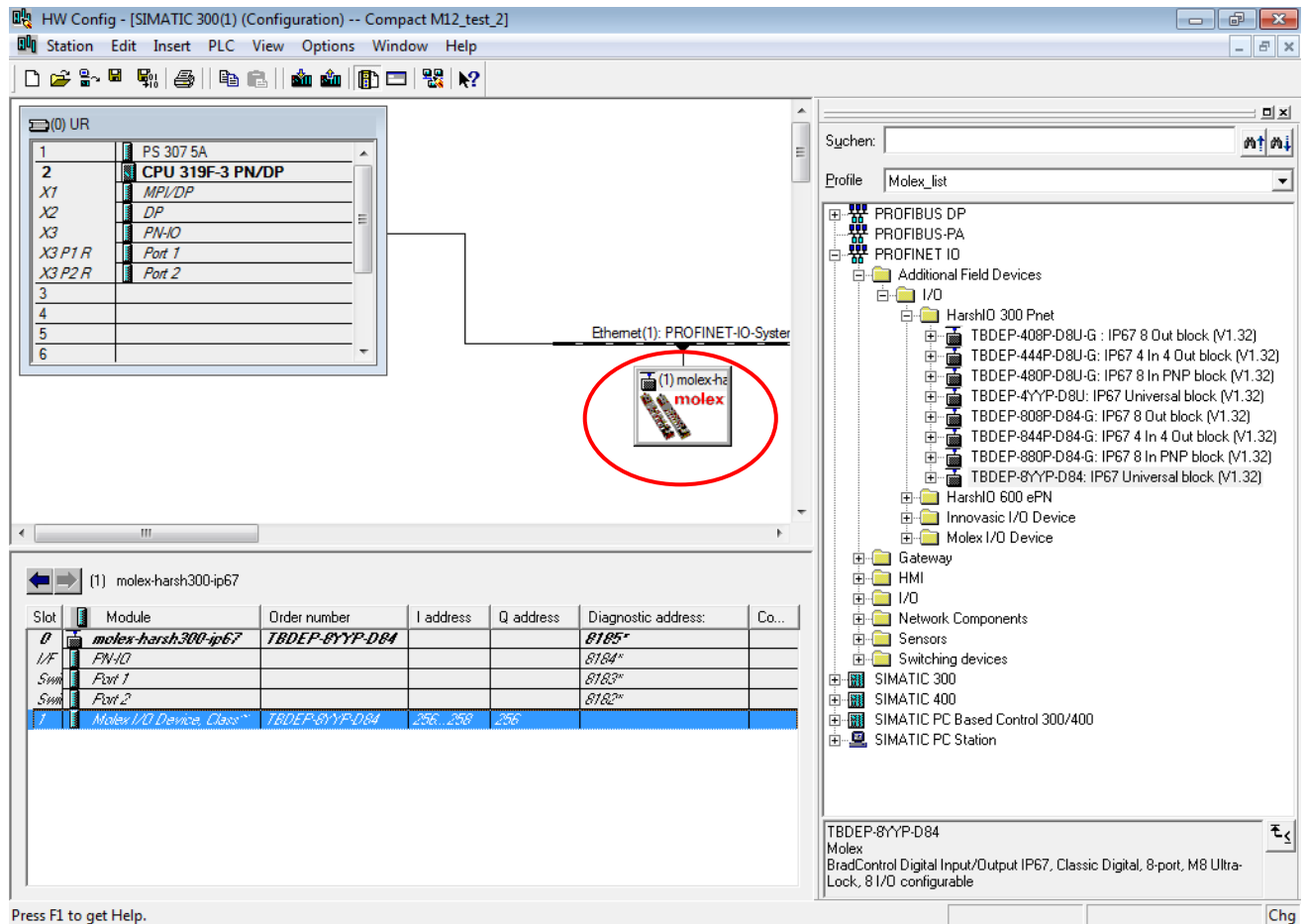


Fig. D: Selecting Properties dialog box

By default, the HarshIO name displayed is the one defined in the GSD file → molex-harsh300-ip67. You have to set the name according to the HarshIO module name connected to the PROFINET network.

Note: If you don't know module name or if you are doing the commissioning of the HarshIO module for the first time, read the section [Assigning device name](#).

For the selected HarshIO module, you also have to configure the associated IP address corresponding to the module name. **The IP address must be unique.**

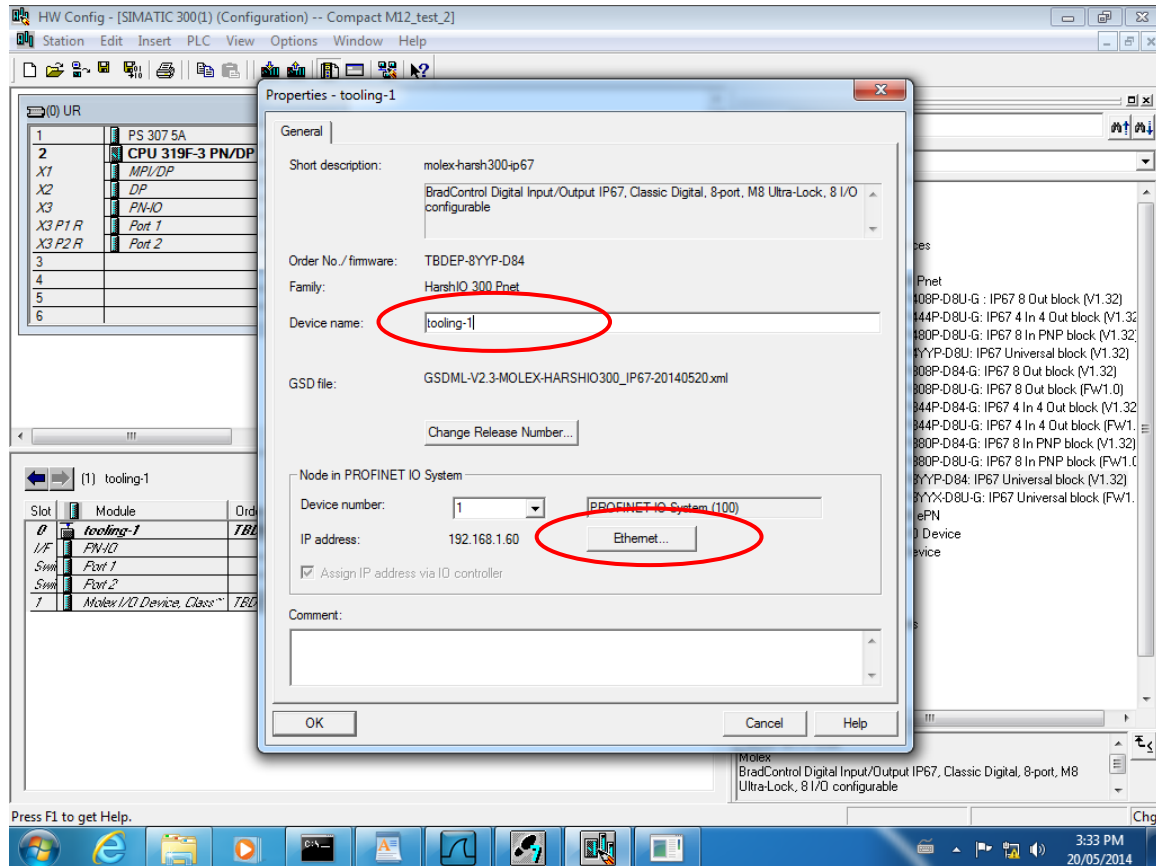


Fig. E: HarshIO name and IP configuration

Remember! At the PROFINET connection phase between the PLC and the device, the controller sets the IP address defined in this property box whatever is the IP already stored in the HarshIO device.

Warning! It is highly recommended to define the HarshIO module names and IP addresses before doing the configuration to ensure a successful commissioning.

Configure HarshIO module parameters

To open the module parameters dialog box, select the head module (slot 1), double click and select the *Parameters* tab.

- IO Configuration Group (available only with HarshIO user M8 configurable version - TBDEP-8YYP-D84 and M12 configurable version – TBDEP-4YYP-D8U)
For each of the 8 channels, you can define the digital port as
 - *Input*
 - *Output*
 - *Input/Output* also called “Universal” means that the digital channel is *automatically acting as Input or Output* depending if the controller is reading or writing into the corresponding channel
- Input filter
Define the input filter delay in a range of 0.5 to 3ms. The parameter applies on all the inputs channels.

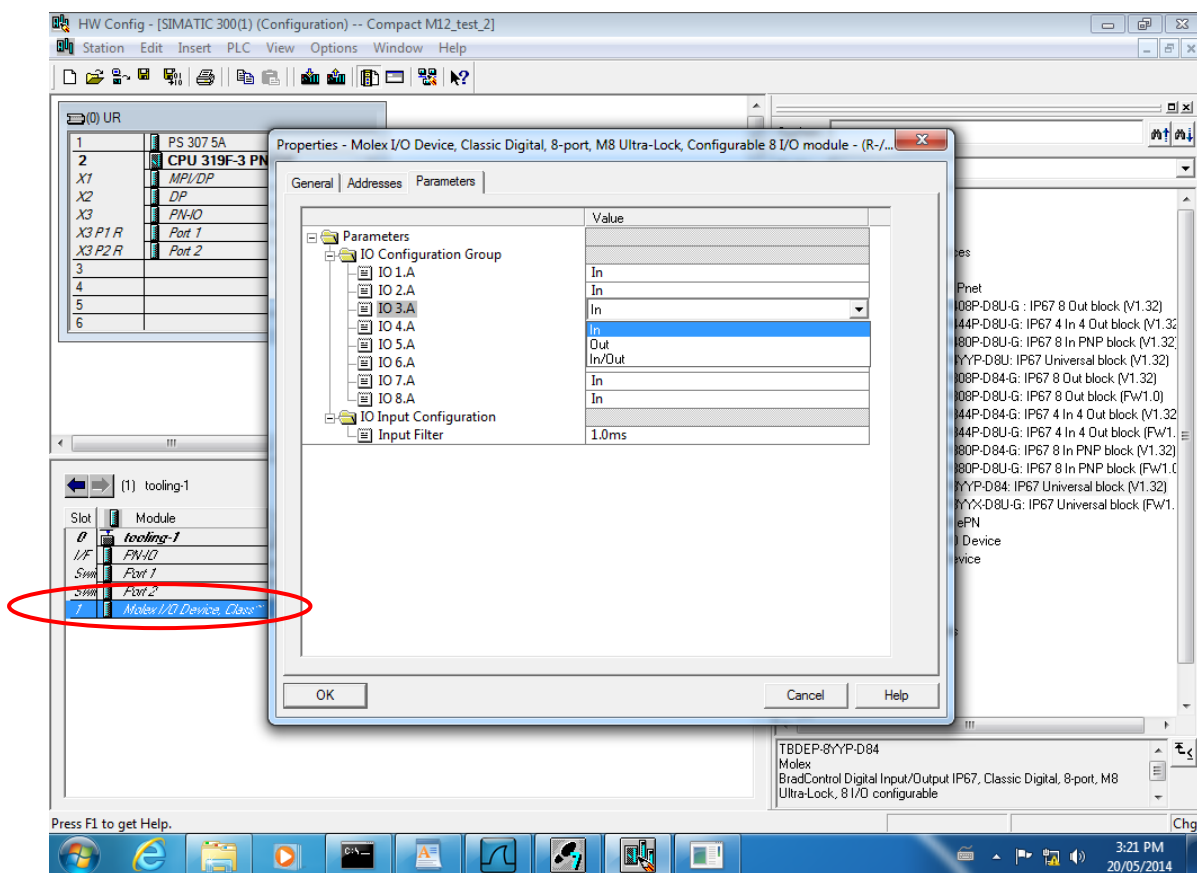


Fig. F: HarshIO module parameters

Assigning device name

Before assigning a device name, you have to identify the HarshIO module on the PROFINET network. The identification of a PROFINET device is performed using the MAC address and the device type.

Remember, the HarshIO module must be physically connected to the Siemens controller to enable the identification.

Select *PLC* menu → *Ethernet* → *Edit Ethernet Node* and click on *Browse* to open the *Browse Network* dialog box. Click *Start* to start the discovery.

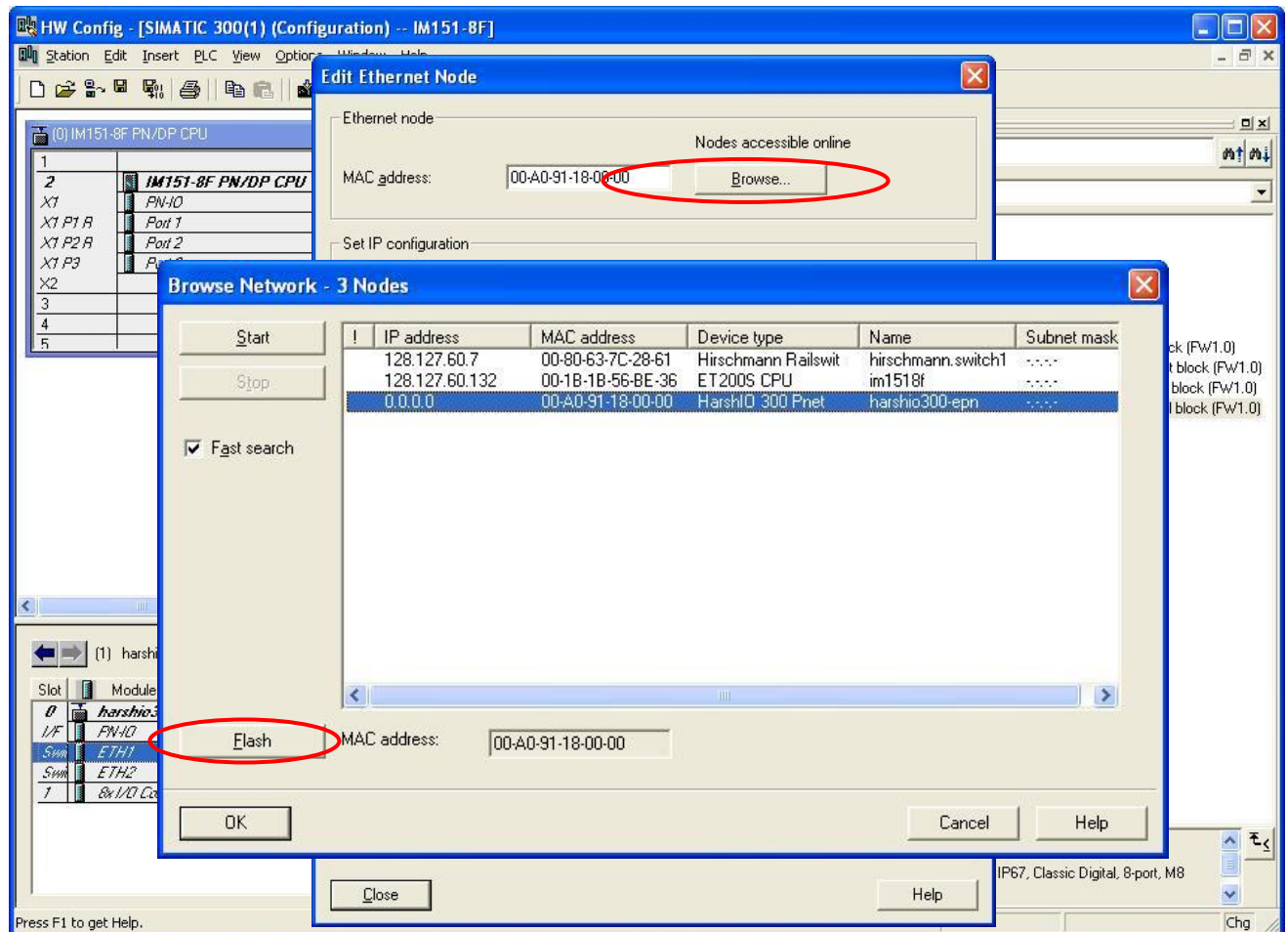


Fig. G: List of detected PROFINET devices

The identification of a HarshIO module is done using a blink test command. This test causes the Module status LED to BLINK continuously.

To perform the identification test, choose a HarshIO module in the detected device list and click *Flash* button.

Remember! HarshIO module has the following default factory settings

- MAC address: 00-A0-91-xx-xx-xx
- IP address: 0.0.0.0
- Device type: HarshIO 300 Pnet
- Name: mollex-harsh300-ip67

Now the HarshIO device is positively identified, the next step is to assign a device name.

Select OK to close the Browse Network box and go back to Edit Ethernet Node dialog box.

In the *Assign device name* area, type the HarshIO module name (here tooling-1) and select *Assign Name* button. **The device name must be written in lowercase.**

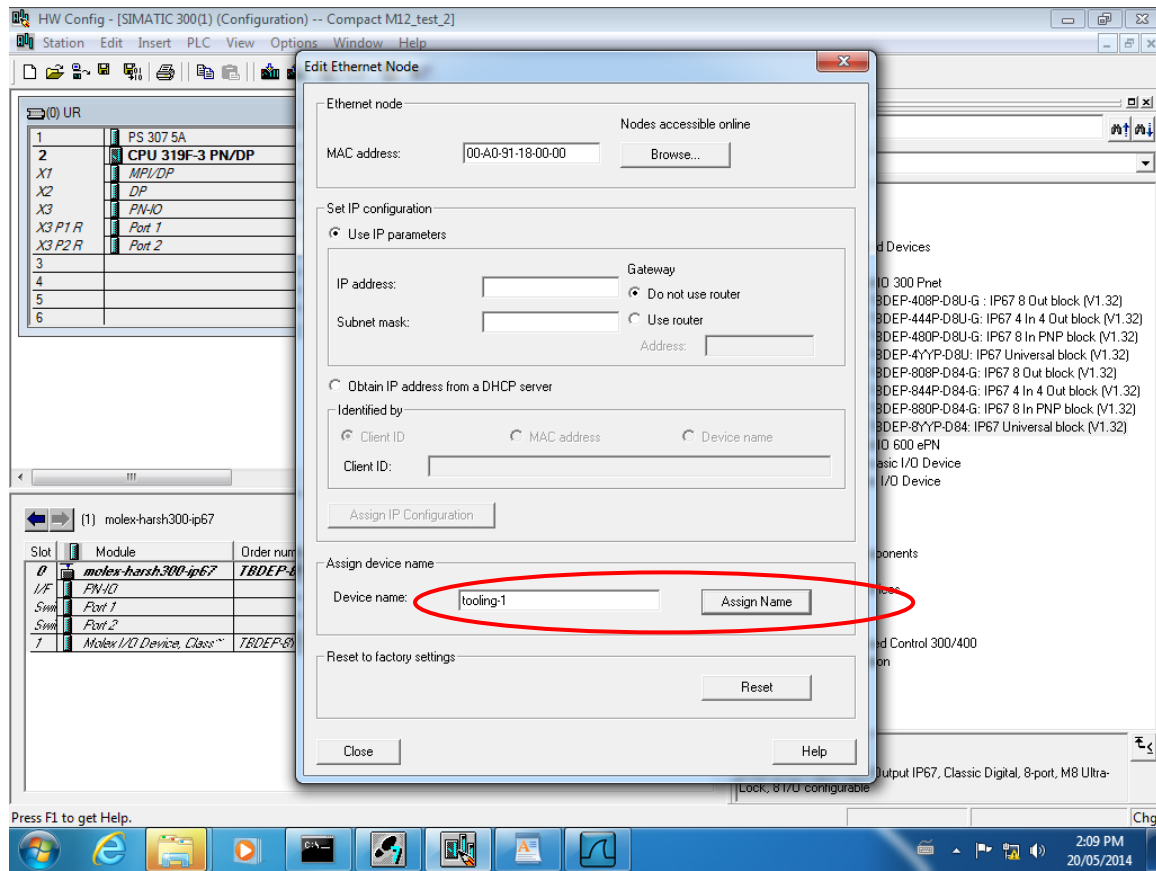


Fig. H: Assigning HarshIO module name

Warning! the HarshIO module name must match the device name defined in the module configuration; see the section [Configure a HarshIO device name and IP address](#).

7. Product support

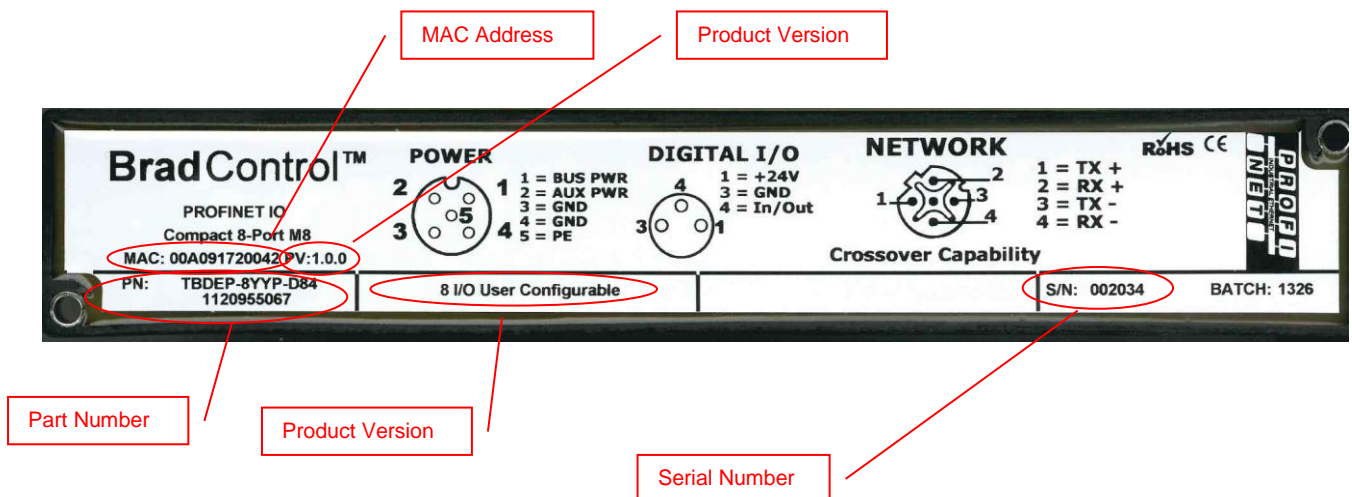
Product identification

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 300 identification is located on the backside of the device.



Technical support

Technical support is available during regular business hours by email or telephone.

To get more information, please go to our [Brad® Automation products Support Center](#) where you can find:

- **Support Request** - For technical inquiries and product support, you can initiate a support ticket and a member of our team will respond.
- **Download Center** - Download software, demo software, user manuals, quick-start guides, and technical notes. The Download Center can be searched by part number, protocol or keyword.
- **Knowledge Base** - Connects you to technical documentation, what's new!, and the latest patches.
- **Worldwide Technical Support Contacts** - Our Worldwide Technical Support covers Europe, Middle East, Africa, North America, South America, and Asia. Our Support Teams have extensive knowledge in the commissioning, diagnostics, and configuration of our automation products portfolio. They will be glad to assist you with any further questions you might have.

PROFINET IO Record

Below is the list of PROFINET Records supported by the module.

PROFINET Index	Description	Information
0x8000	<i>ExpectedIdentificationData</i>	This returns the current expected configuration for the specified connection
0x8001	<i>RealIdentificationData</i>	This returns the current expected configuration for the current Device
0xF020	<i>ARData for one API</i>	This returns the entire Connection data (AR) for a specified API
0xF820	<i>ARData</i>	This returns the entire Connection data (AR) for this device
0x8000	<i>ExpectedIdentificationData for one Subslot</i>	This returns the Expected identification (Slot, Subslot, SlotID SubslotId...) for one subslot.
0x8001	<i>RealIdentificationData for one Subslot</i>	This returns the real identification (Slot, Subslot, SlotID SubslotId...) for one subslot.
0xC000	<i>ExpectedIdentificationData for one slot</i>	This returns the Expected identification (Slot, Subslot, SlotID SubslotId...) for one slot.
0xC001	<i>RealIdentificationData for one slot</i>	This returns the real identification (Slot, Subslot, SlotID SubslotId...) for one slot.
0xE000	<i>ExpectedIdentificationData for one AR</i>	This returns the Expected identification (Slot, Subslot, SlotID SubslotId..) for one AR.
0xE001	<i>RealIdentificationData for one AR</i>	This returns the real identification (Slot, Subslot, SlotID SubslotId...) for one AR.
0xE002	<i>ModuleDiffModule for one AR</i>	This returns the module diff module (difference between Real configuration and expected identification) for one AR.
0xF000	<i>RealIdentificationData for one API</i>	This returns the real identification (Slot, Subslot, SlotID SubslotId...) for one API.
0xF840	<i>I&M0FilterData</i>	This returns the I&M0 Filter Data
0x8028	<i>RecordInputDataObjectElement for one Subslot</i>	This returns the Input data object for one Subslot
0x8029	<i>RecordOutputDataObjectElement for one Subslot</i>	This returns the Output data object for one Subslot
0xF821	<i>APIData</i>	This returns the API data for this device
0xF830	<i>LogData</i>	This returns a log of each error return by IO-Device on network. Moreover it returns also the status for each positive or negative record (read or write) in this PROFINET IO-Device. The logger is limited to 10 events.

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