Technical Manual
LioN-R PROFINET
0980 ESL 801-PNET 16DI-M12-R
0980 ESL 802-PNET 16DO-M12-R
0980 ESL 803-PNET 8DI/8DO-M12-R

Table of contents

1. About this manual

Please, read the assembly and operating instructions of this manual carefully, before you put the LioN-R I/O-modules with PROFINET interface into operation. The manual should be kept at a place that is accessible to all users.

The texts, illustrations, diagrams and examples being used in this manual are solely intended to explain the operation and application of the LioN-R I/O-modules with PROFINET interface.

To obtain further information on the installation and putting into operation of the devices, please do not hesitate to contact us. We will be glad to be at your disposal at any time.

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Belden Deutschland GmbH -Lumberg Automation™- reserves the right of any technical changes or changes to this manual without prior notice.

1.1. Explanation of the symbolism

1.1.1. Use of notes

References to important information are marked particularly. They are displayed as follows.

1.1.2. Use of hazard warnings

Hazard warnings are marked as follows:

DANGER:
Failure to observe appropriate precautions may cause danger to the life and health of the user.

ATTENTION:
The non-observance of appropriate precautions may cause damage to other equipment or material assets.

1.2. Safety guidelines

1.2.1. Intended use

The devices described in this manual are intended to be used as decentralized input / output modules in a PROFINET IO network.

Our products are designed, manufactured, tested and documented with respect to common safety standards. With attention to the handling specifications for planning, development and mounting as well as the safety instructions our products do not cause any danger to persons and property under normal conditions.

The modules comply to the rules of the
- EMC Directive (89/336/EEC, 93/68/EEC and 93/44/EEC)
- Low Voltage Directive (73/23/EEC)

They are designed to be used in the industrial sector. The industrial environment is characterized by the fact that electrical consumers are not connected directly to the public low voltage network. For the application in residential areas, business areas and commercial areas additional measures are to be taken.

	Caution!
i	**This equipment can cause interferences in the residential area. In this case the operator can be asked to accomplish appropriate measures.**

The proper and safe function of the product requires an appropriate transport, storage, installation and mounting as well as a careful operation.

The intended operation of the device is only guaranteed with a completely installed housing. All devices connected to this equipment must fulfil the requirements of the EN 61558-2-4 and EN 61558-2-6.

Projecting, installation, commissioning, maintenance and test of the devices may be carried out only by an approved qualified electrical specialist who is familiar with the security standards of the automation technology.

During projecting, installation, commissioning, maintenance and test of the devices the safety regulations and accident prevention instructions in the specific application case have to be considered.

Only cables and accessories shall be installed that correspond to the requirements and regulations for safety, electromagnetic compatibility and, if necessary, telecommunication terminals as well as the specification data.
More information about the cables and accessories that are admitted for installation may be obtained from Belden Deutschland GmbH – Lumberg Automation™- or are described in this technical manual.

1.3. Qualified personnel

The requirements for the personnel depend on the requirement profile described by the ZVEI and VDMA or comparable organizations.

Only electrical specialists, who know the content of this manual, may install and maintain the described products.
These are persons who
- can assess the works to be performed and recognize possible dangers based on their technical education, knowledge and experience as well as their knowledge of the relevant standards.
- have the same level of knowledge as after a technical education due to an activity in a comparable area for several years.

Modifications to the hard- and software of our products, as far as they are not described in this technical manual, may be carried out only by Belden Deutschland GmbH -Lumberg Automation™.

ATTENTION!
Unqualified modifications to the hardware or software or the non-observance of the warning instructions given in this technical manual can entail heavy personal damages or damages to property.

1.4. Version information about this manual

Index	Created	Changed	Changed	Changed	Changed	Changed
Version number	Version 1.0					
Date	May 2013					
Name/Department	Knipp/PM					

2. System description

LioN (Lumberg I/O network)-R is a stand-alone fieldbus device for the decentralized operation in rough industrial environment for the simple handling of the I/O data in a superordinate bus system. It is particularly suitable for application places with moderate I/O concentration on distributed assemblies.

The LioN-R I/O-module series has a very robust metal housing made of die-cast zinc. The module electronics is protected against environmental influences by the fully encapsulated housings. As the protection degree the modules offer IP67. The permissible temperature range of modules is -10 °C to + 60 °C. The module series is therefore very well suited for the direct field use in harsh industrial environments.

However, in spite of the robust construction the module series offers compact dimensions and a low weight.

The integrated 2-port Ethernet switch of the modules allows a line or a star topology for the PROFINET IO network.

The LioN-R module series consists of three types of modules with different I/O-functionality. Modules with 16 digital inputs (16 DI), 16 digital outputs (16 DO) and 8 digital inputs/8 digital outputs (8DI/8DO) are available. The output current is 1.6 Amps per channel. The output circuits are galvanically isolated from the remaining network and sensor electronics.

The modules with output functionality provide a fail-safe function. During the configuration of these modules, the behavior of each output channel can be adjusted in case of an interruption or loss of communication.

For the connection of the network and the I/O-devices the module series provides the widely-used M12-connector with A-coding for the I/O-signals and D-coding for the network. In addition, the connectors are colour-coded to avoid confusion between the terminals.

According to the PROFINET specification the modules receive their network parameters by a DCP server. Rotary switches are not required.

3. Product overview

3.1. Module variants

| Part number	Description	I/O connection	Design
LioN-R 16 DI			
0980 ESL 801-PNET 16DI-M12-R SAP-number: 934 692-001	Decentralized I/O module with 16 digital inputs. Connection of the peripherals by 8 M12 sockets.	8 M12 sockets	R (Rugged) / Metal
LioN-R 16 DO			
0980 ESL 802-PNET 16DO-M12-R SAP-number: 934 692-002	Decentralized I/O module with 16 digital outputs, 1.6 A. Connection of the peripherals by 8 M12 sockets.	8 M12 sockets	R (Rugged) / Metal
LioN-R 8DI/8DO			
0980 ESL 803-PNET 8DI/8DO-M12-R SAP-number:934 692-003	Decentralized I/O module with 8 digital inputs and 8 digital outputs, 1.6 A. Connection of the peripherals by 8 M12 sockets.	8 M12 sockets	R (Rugged) / Metal

3.2. Accessories

Part number	Description
PROFINET	
0985 342 100/... M	Connecting cable for PROFINET, assembled on both sides with M12 connector, straight, 4-pole, D-coded
0985 342 102/... M	Connecting cable for PROFINET, assembled on one side with M12 connector, straight, 4-pole, D-coded
0985 342 104/... M	Connecting cable for PROFINET, assembled on both sides with M12 connector, straight, 4-pole, D-coded and RJ45 connector, straight
Power supply	
0905 204 301/... M	Connecting cable for power supply, assembled on one side with 7/8" female connector, straight, 5-pole
0905 204 302/... M	Connecting cable for power supply, assembled on both sides with 7/8" connectors male/female, straight, 5-pole.
0905 204 303/... M	Connecting cable for power supply, assembled on one side with 7/8" male connector, straight, 5-pole
0905 204 308/... M	Connecting cable for power supply, assembled on one side with 7/8" female connector, angled, 5-pole
0905 204 309/... M	Connecting cable for power supply, assembled on both sides with 7/8" connectors male/female, angled, 5-pole
0905 204 310/... M	Connecting cable for power supply, assembled on one side with 7/8" male connector, angled, 5-pole
Field attachable connectors	
0986 EMC 102	Field attachable M12-connector for PROFINET cable, straight, 4-pole, D-coded, with spring type terminals
RSC 50/11	Field attachable 7/8"-connector for power supply, male, straight, 5-pole, for cable diameter 8.0 -10.0 mm
RKC 50/11	Field attachable 7/8"-connector for power supply, female, straight, 5-pole, for cable diameter 8.0 -10.0 mm

Part number	Description
Other accessories	
M12 protective cap	ZVK
Designation labels	ZBR 9/40

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4.   Mounting

4.1.   Outer dimensions

4.1.1.   0980 ESL 801
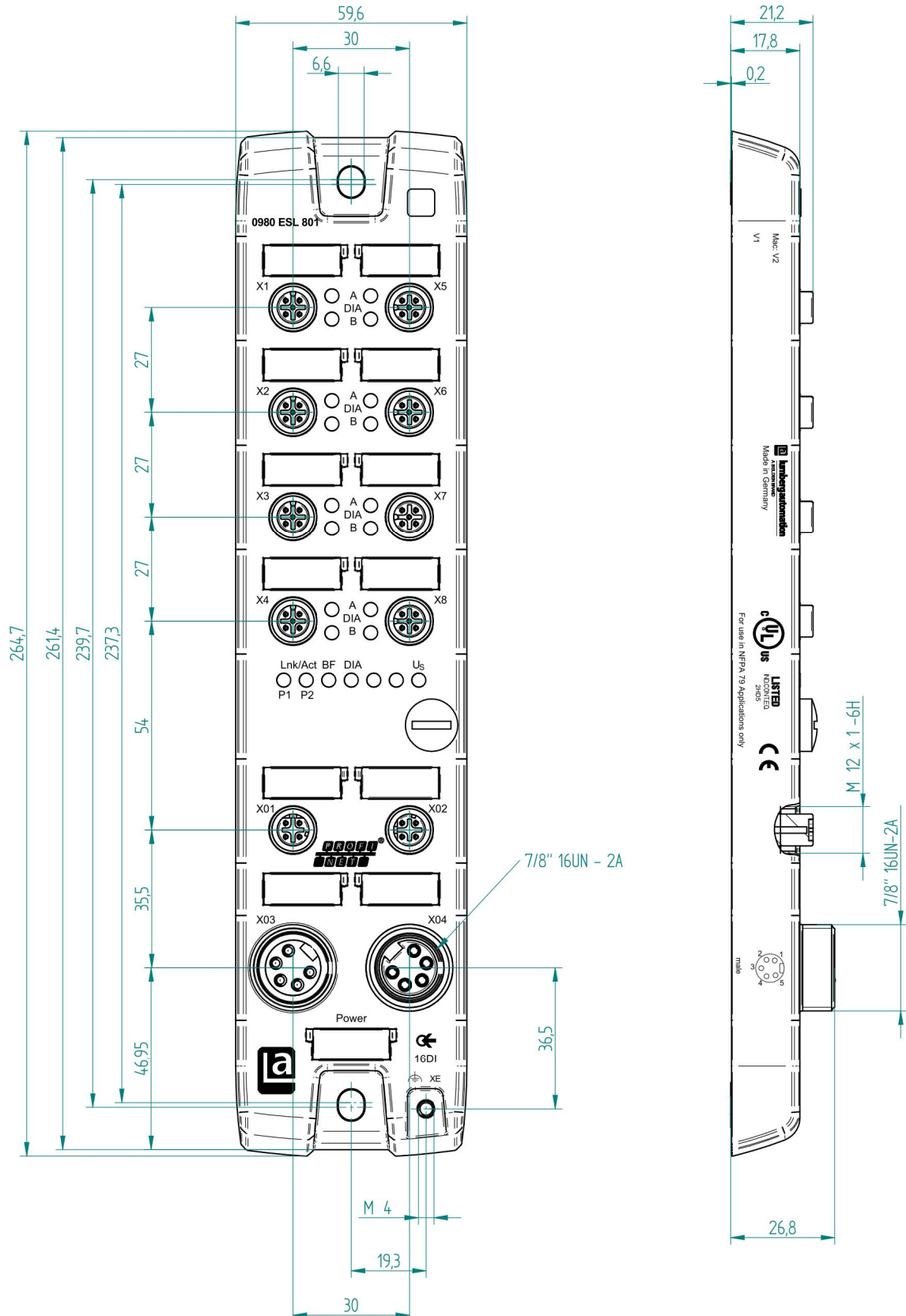
4.1.2.   0980 ESL 802
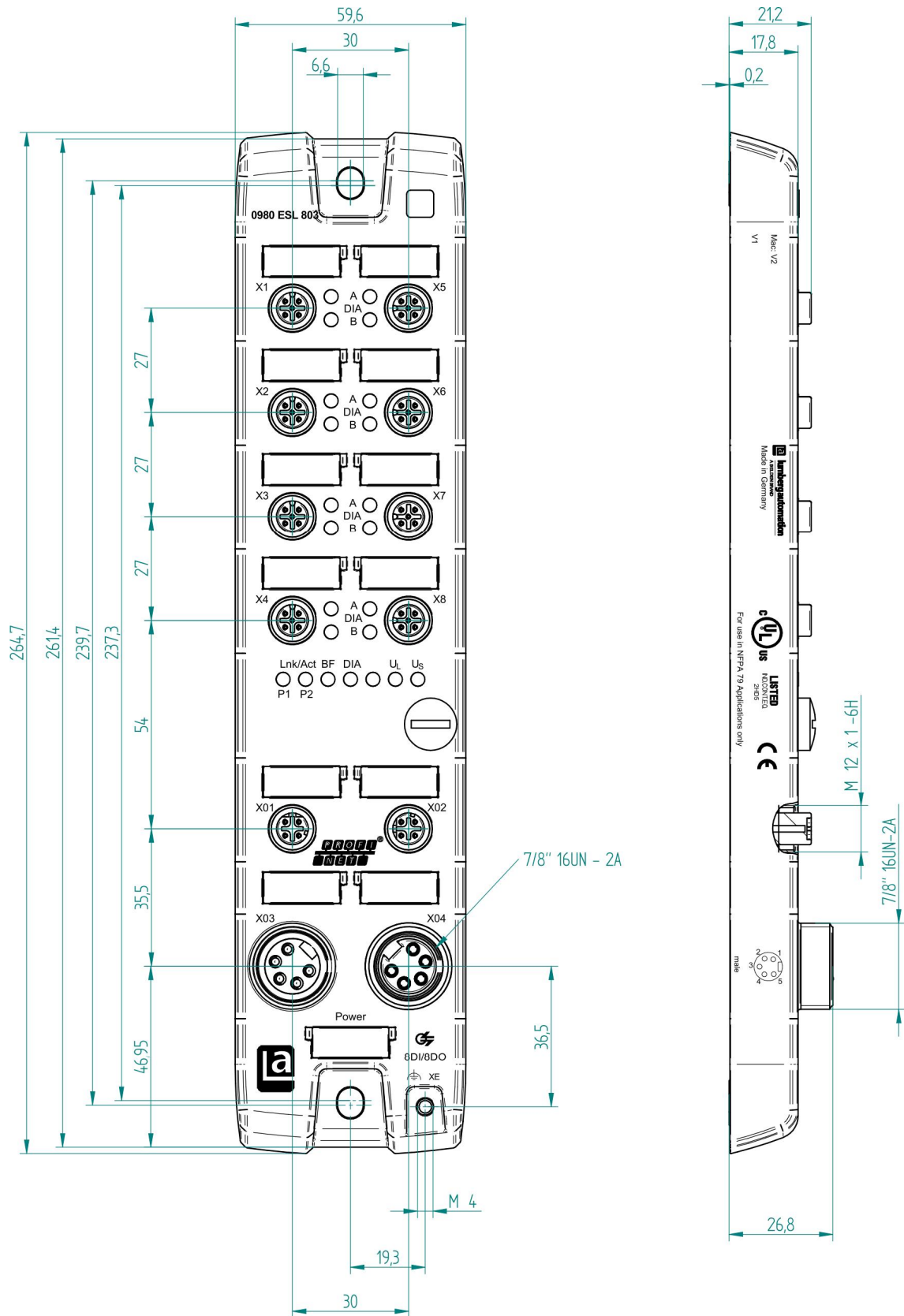
4.1.3.   0980 ESL 803
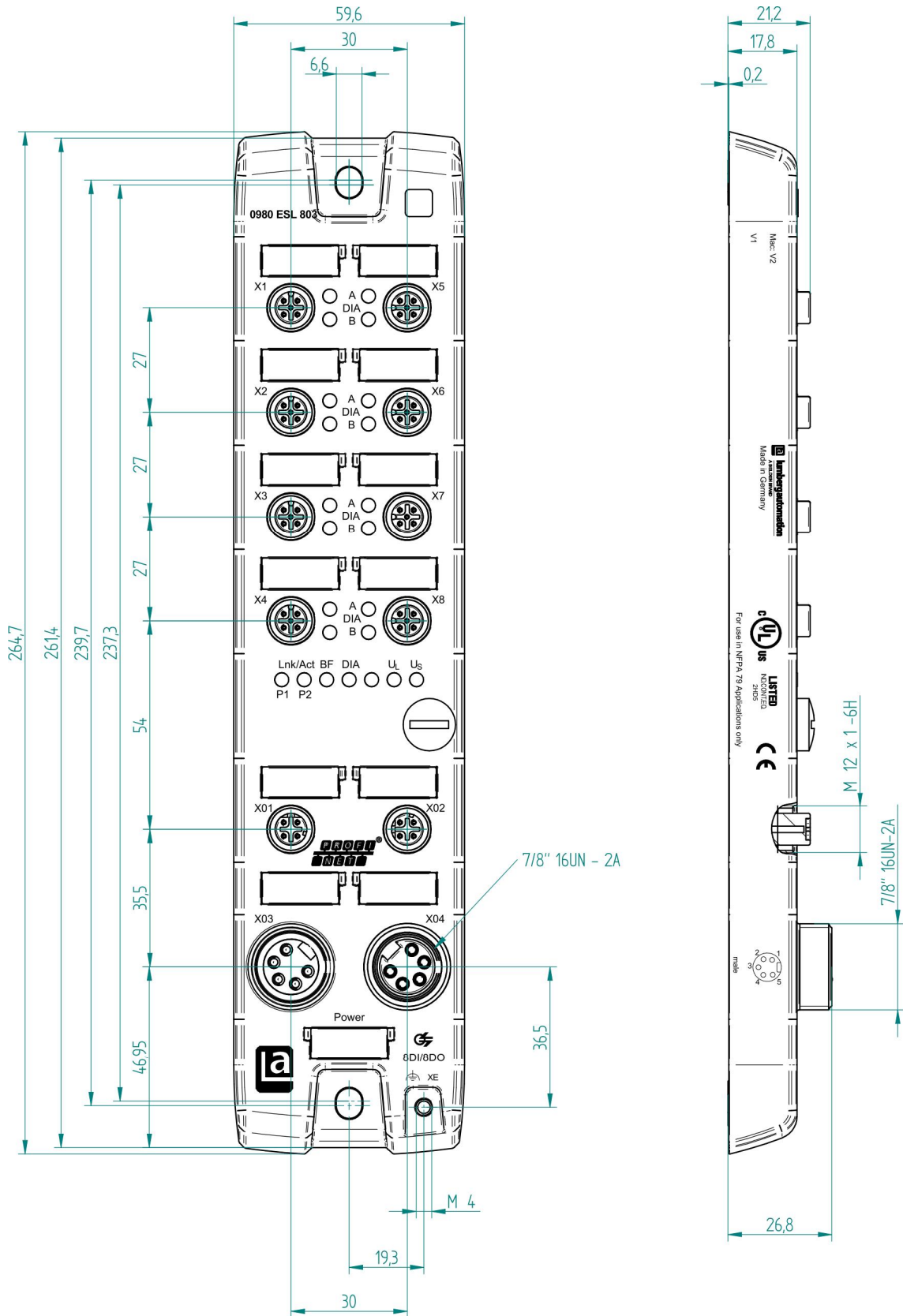
4.2. Notes for the field installation

The modules are to be mounted on a flat surface, each with two screws.

Type of mounting	Screw	Tightening torque
Flat	M6x25/30	1,0 Nm
A flat washer according to DIN 125 has to be used.		

Important note:
For the derivation of interference currents and/or for the EMC stability the module provides a grounding connection with a M4 thread, marked with the earth sign and XE.

It is necessary to connect this grounding connection by a low impedance connection to the reference earth. In case of a grounded mounting surface the connection can be set up directly through the mounting screws.

With a not grounded mounting surface a ground strap or a suitable PE-cable has to be used. This ground strap or PE-cable should be connected by a M4 screw to the grounding point underlayed by a flat and toothed washer.

5. Wiring

5.1. Pin assignments

All connector pin arrangements that are shown in this chapter show the view from the front to the mating area of the plug connectors.

5.1.1. PROFINET ports, M12 (MICRO) female connectors, 4-pole, D-coded

Colour code of the connections: green

Connector	Pin	Signal	Function
PROFINET Ports X01, X02	1	TD+	Transmit Data +
	2	RD+	Receive Data -
	3	TD-	Transmit Data +
	4	RD-	Receive Data -

ATTENTION, risk of destruction!
Do not connect power supply lines (24 V DC) to the data lines.

5.1.2. Power supply connectors, 7/8 inch (MINI), 5-pole, male/female connectors

Colour code of the connections: grey
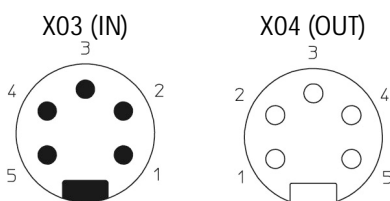
Pin	Function	Signal	
		0980 ESL 801	0980 ESL 802 0980 ESL 803
Power supply X03 / X04	1	Actuators	see note	GND (0V)
	2	System / Sensors	GND (0V)	GND (0V)
	3		Earth	Earth
	4	System / Sensors	+24 V	+24 V
	5	Actuators	see note	+24 V

Important note!
For the input module 0980 ESL 801 both contacts 1 and 5 are not required for the power supply of the actuators. Nevertheless, these two contacts on the male and female connector side are bridged to allow a 5-pole forwarding of the power supply to a subsequent module.

The power supply units that are used for the system/sensor and actuator power shall match PELV (Protective Extra Low Voltage) or SELV (Safety Extra Low Voltage). Power supplies in accordance with EN 61558-2-6 (power transformer) or EN 60950-1 (switching power supplies) meet these requirements.

5.1.3. Connections for sensors / actuators, M12 female connectors, 5-pole

Colour coding of the connections: black
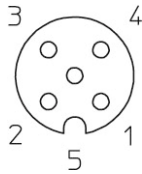
Connector	Pin	Function		
		0980 ESL 801	0910 ESL 802	0980 ESL 803
Sensor/ actuator	1	+24 V DC	n.c.	+24 V DC (ports X1..X4) n.c. (ports X5..X8)
	2	IN B	OUT B	IN B (ports X1..X4) OUT B (ports X5..X8)
	3	0 V DC	0 V DC	0 V DC
	4	IN A	OUT A	IN A (ports X1..X4) OUT A (ports X5..X8)
	5	Earth/GND	Earth/GND	Earth/GND

6. Configuration and commissioning

The configuration and commissioning of the LioN-R PROFINET IO modules described on the following pages was accomplished with the help of the *STEP 7* software from the *Siemens AG*. In case of using a control system from another controller supplier please attend to the associated documentation.

6.1. GSDML-file

For the configuration of the LioN-R modules in the control system a GSD-file in the XML format is required. The file can be downloaded from our homepage

http://www.beldensolutions.com/en/Service/Downloadcenter/Software_Lumberg/index.phtml

On request the GSDML file would be sent also by the support team.

The name of the file is as follows:

GSDML-V2.3-LumbergAutomation-0980ESL80x-yyyymmdd.xml,

in which „yyyymmdd" expresses the release date of the file.

In *STEP 7* you create a new project and open the hardware manager *HW-Config*. By the menu command *Options – Install GSD File...* and the following dialog the GSD file is installed. Afterwards the LioN-R I/O modules with PROFINET interface are available in the hardware catalogue.

6.2. MAC addresses

The modules get three MAC addresses assigned on delivery. These are unique and cannot be changed by the user.

6.3. SNMP

The modules support the Ethernet network protocol SNMP (Simple Network Management Protocol). The information of the network management is presented according to the MIB-II (Management Information Base) which is defined in the RFC 1213.

6.4. Configuration of the LioN-R PROFINET IO modules in *STEP 7*
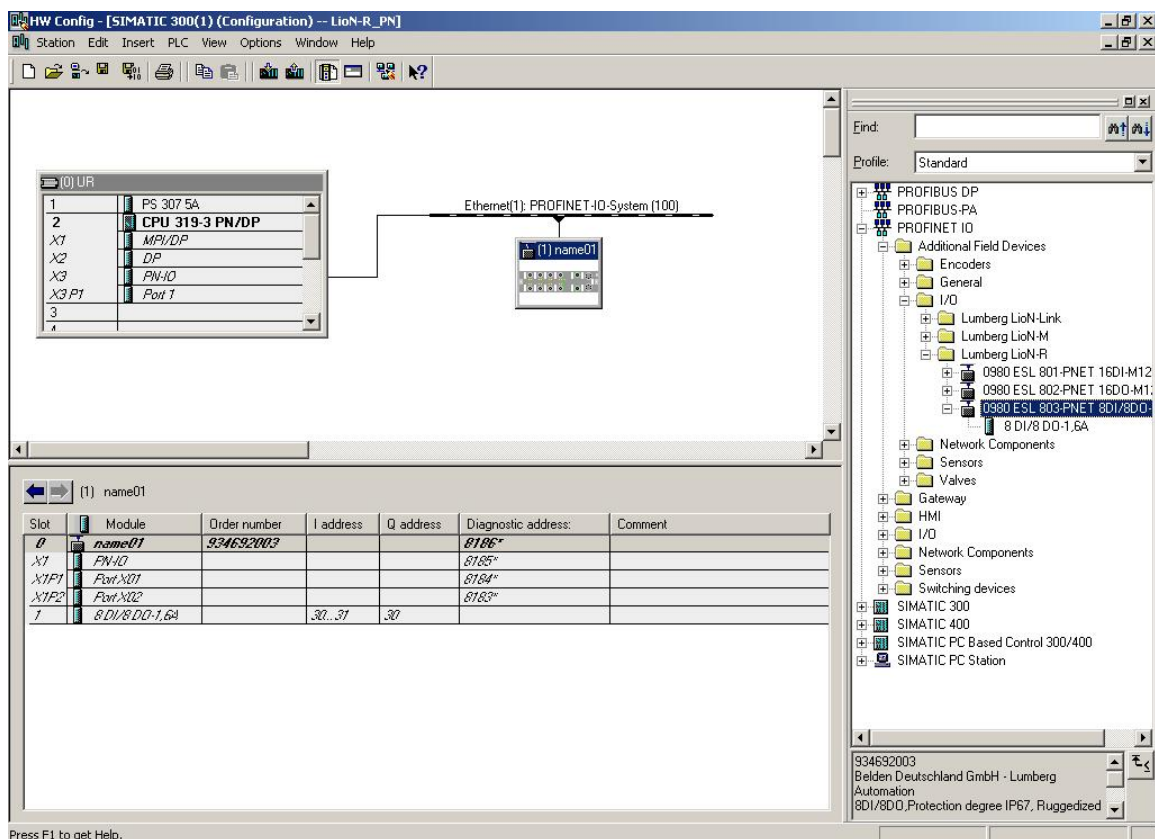
After the installation of the GSDML file for the LioN-R PROFINET IO modules these are available in the hardware catalogue under *PROFINET IO – Additional Field Devices - I/O - Lumberg LioN-R.*

First configure the control system in the usual way. Assign an IP-address and a subnet mask for the PROFINET port of the control unit.

Afterwards click on the part description of the modules *0980 ESL 801-PNET 16DI-M12-R, 0980 ESL 802-PNET 16DO-M12-R* or *0980 ESL 803-PNET 8DI/8DO-M12-R* in the hardware catalogue and move the desired module to the PROFINET line of the control unit.

The suitable element for the I/O-functionality is inserted automatically into the slot 1 of the module rack.

The input and output addresses adjusted by the hardware manager can be changed.

6.4.1. Assignment of a unique device name in *STEP 7*

PROFINET IO devices are addressed in PROFINET by a unique device name. The name can be assigned freely by the user but may only appear once in the network.

Select the module in *HW Config* and open the menu item *Edit – Object Properties*. In the opening dialog box you can change the device name.

Check whether the displayed IP-address is correct and control unit and module are located in the same Ethernet subsystem.

Confirm the settings with OK.
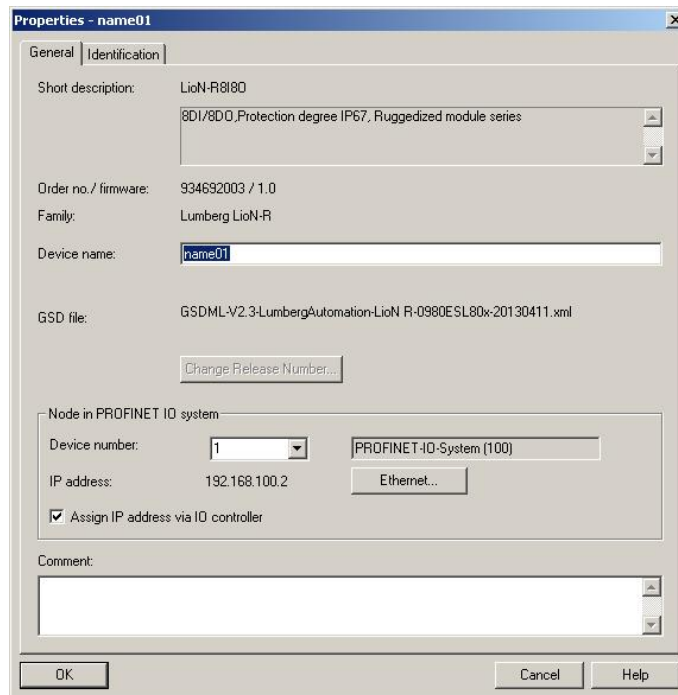
6.4.2. Assignment of the device name to a LioN-R module

For the assignment of a device name to a module an online PROFINET connection between the programming device and the module is necessary.

Select the LioN-M module and open the dialog *PLC – Ethernet – Assign Device Name...*
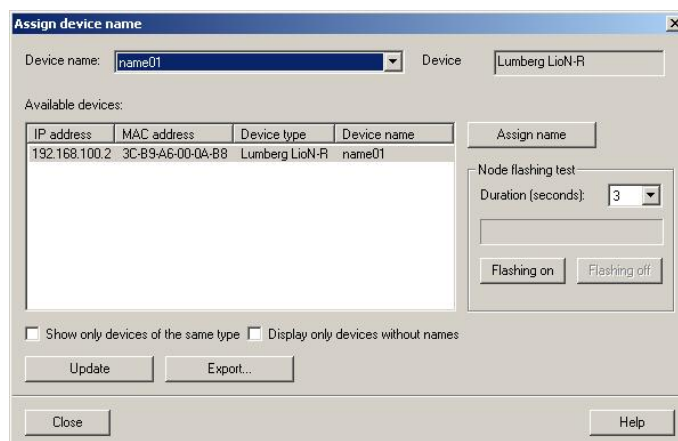
6.4.3. Device replacement without removable media/PG

PROFINET IO devices which support this feature can be exchanged on an existing PROFINET network by an identical device without having to use a removable media or programming unit. In this case the IO controller takes over the assignment of the device name. For the assignment of the device name the IO controller uses the projected topology and the neighbourhood relations ascertained by the IO-devices.

The LioN-M PROFINET modules support the feature of the device replacement without removable media/PG.

The topology of the network must be projected for the use of the function.

During the configuration of the IO-Controller in *HW Config* the function has to be selected. A double click on the PROFINET IO port of the controller opens the properties dialogue. Activate the function "*Support device replacement without exchangeable medium*".
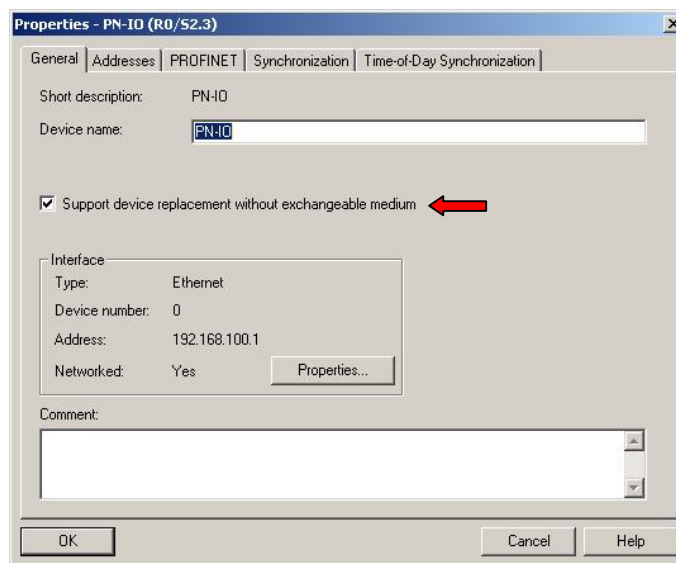
The interconnections of the PROFINET ports of the individual devices have to be configured also. A double click on a port of a device in *HW Config* opens its properties dialogue. In the register *Topology* the interconnections with the partner ports of other devices in the network are defined.

> **Notice!**
> The replacement device must be in the delivery state (factory settings) for the exchange without removable media/PG. If necessary the factory settings have to be restored.

6.4.4. The parameter settings of the LioN-R modules

The parameter settings can be reached via the menu item *Object Properties… – Parameter*. For this purpose select the LioN-R module in *HW Config*. In the configuration table click with the right mouse button on the row *Slot 0* and the PROFINET name of the module.

The following figure shows the parameter settings of the module 0980 ESL 803-PNET 8DI/8DO-M12-R.
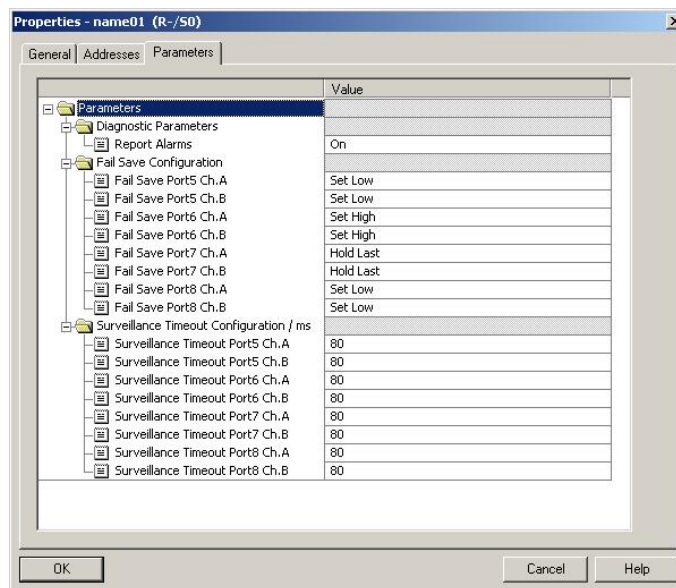
6.4.4.1. The parameter *Report Alarms*

This parameter setting enables or disables the alarm messages of the device diagnostics over PROFINET.

The setting is available for all three different types of modules (16DI, 16DO, 8DI/8DO).

6.4.4.2. The parameter *Fail Safe*

This parameter is provided by the module types with digital outputs (16DO, 8DI/DO).

The firmware of the modules provides a fail-safe function for the outputs. During the configuration of the modules the status of the outputs after an interruption or loss of communication in the PROFINET IO network can be defined.

The following options can be selected:

        Set low   - the output channel is disabled
        Set high   - the output channel is activated
        Hold last   - the last output state is held

6.4.4.3. The parameter *Surveillance Timeout*

This parameter is provided by the module types with digital outputs (16DO, 8DI/DO).

The firmware of these modules allows the configuration of a delay time until the monitoring of the output currents is activated. This delay time is called the surveillance timeout and can be adjusted for every single output channel. The delay time is started whenever the status of the output channel changes, i.e. when it is activated (after a rising edge) or deactivated (after a falling edge). After this time, the monitoring of the output is enabled and error conditions are reported by diagnostics. The surveillance timeout can be adjusted from 0 to 255 ms. The default value for this parameter is 80 ms. In the static state of an output channel, this means if the output channel is permanent on or off, the surveillance timeout is fixed set to 100 ms.
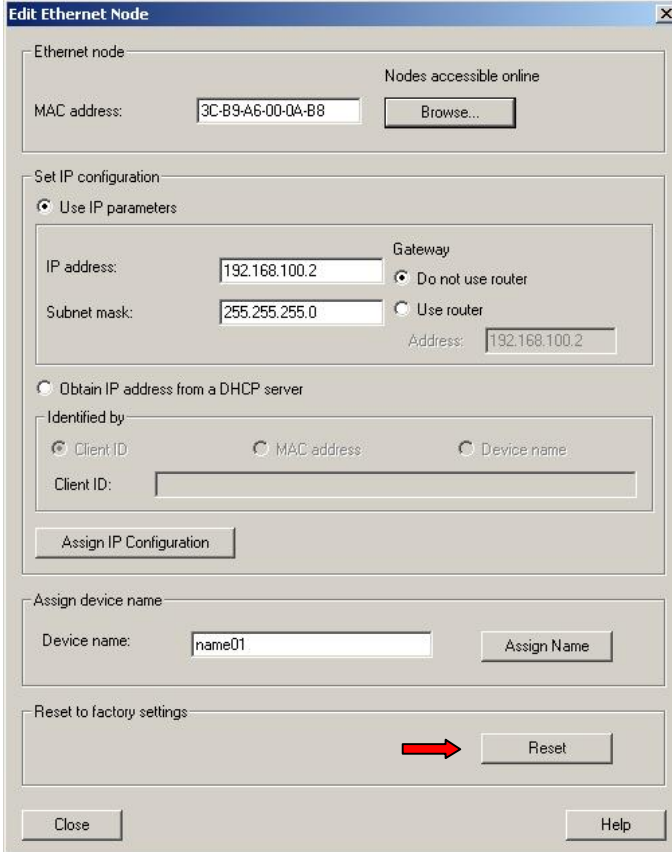
6.4.5. Prioritized startup

The prioritized startup is not supported by the LioN-R modules. Hence, the selection box *Prioritized startup* in the dialogue window *Properties – PN-IO (X1)* should not be selected.
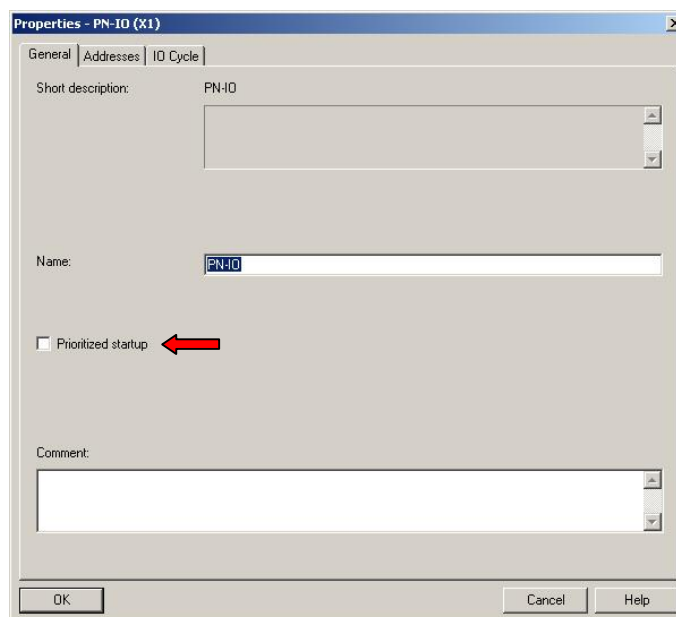
6.4.6. Resetting the LioN-R modules to factory settings

Resetting the LioN-R modules to the factory settings is carried out in *STEP 7* via the menu item *PLC – Ethernet – Edit Ethernet Node*. After searching the online accessible participants and selecting the desired LioN-R module, the reset is performed by a click on the button *Reset*.

7. Allocation of the process data

This chapter describes the allocation of the process data from the control unit to the I/O-channels of the modules.

7.1. Module 0980 ESL 801-PNET 16DI-M12-R

7.1.1. Input data

The module provides two bytes of status information of the digital inputs. The bit allocation is as follows:

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n	4B	4A	3B	3A	2B	2A	1B	1A
Byte n+1	8B	8A	7B	7A	6B	6A	5B	5A

At this applies:
1A...8A: Actual input status of the I/O-channel A (contact pin 4) of the M12 sockets 1 to 8.
1B...8B: Actual input status of the I/O-channel B (contact pin 2) of the M12 sockets 1 to 8.

7.2. Module 0980 ESL 802-PNET 16DO-M12-R

7.2.1. Input data

This module provides two bytes of input data that monitor the actual status of the output channels.

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n	4B	4A	3B	3A	2B	2A	1B	1A
Byte n+1	8B	8A	7B	7A	6B	6A	5B	5A

At this applies:
1A...8A: Actual output status of the output channel A (contact pin 4) of the M12 sockets 1 to 8.
1B...8B: Actual output status of the output channel B (contact pin 2) of the M12 sockets 1 to 8.

7.2.2. Output data

Only the LioN-R module 0980 ESL 700 with universal I/O functionality requires two bytes of status information for the control of the digital outputs.

Output	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n	4B	4A	3B	3A	2B	2A	1B	1A
Byte n+1	8B	8A	7B	7A	6B	6A	5B	5A

At this applies:
1A...8A: Target output status of the I/O-channel A (contact pin 4) of the M12 sockets 1 to 8.
1B...8B: Target output status of the I/O-channel B (contact pin 2) of the M12 sockets 1 to 8.

7.3. Module 0980 ESL 803-PNET 8DI/8DO-M12-R

7.3.1. Input data

This module provides two bytes of input data that monitor the actual status of the input and output channels.

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n	4B	4A	3B	3A	2B	2A	1B	1A
Byte n+1	8B	8A	7B	7A	6B	6A	5B	5A

At this applies:
1A...4A: Actual input status of the input channel A (contact pin 4) of the M12 sockets 1 to 4.
1B...4B: Actual input status of the input channel B (contact pin 2) of the M12 sockets 1 to 4
5A...5A: Actual output status of the output channel A (contact pin 4) of the M12 sockets 5 to 8.
5B...5B: Actual output status of the output channel B (contact pin 2) of the M12 sockets 5 to 8.

7.3.2. Output data

Only the LioN-R module 0980 ESL 700 with universal I/O functionality requires two bytes of status information for the control of the digital outputs.

Output	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n	8B	8A	7B	7A	6B	6A	5B	5A

At this applies:
5A...8A: Target output status of the I/O-channel A (contact pin 4) of the M12 sockets 5 to 8.
5B...8B: Target output status of the I/O-channel B (contact pin 2) of the M12 sockets 5 to 8.

8. Diagnostic properties of the modules

The modules offer an extended diagnostics behaviour especially for the output channels that is explained in this chapter.

There are five different types of faults that need to be distinguished.

8.1. Channel error

Channel errors result from a comparison between the target value of an output channel set by a control unit or PLC and its actual value.

Target value	Actual value	Remark
Active	Active	OK, no diagnostics
Off	Off	OK, no diagnostics
Active	Off	Short circuit Channel indicator is solid red. Channel error alarm is sent. Channel is locked after fault disappeared.
Off	Active	Power feed back on channel Channel indicators red and yellow/white are on. Channel error alarm is sent. Channel is not locked after fault disappeared.

IMPORTANT!
If both output channels of an M12 socket are activated when a channel error occurs, both channels will be locked even if only one channel is affected. If only one channel is activated, only this channel is locked after a channel error.
Locked channels are disabled and remain in the off state, unless they are reset by the controller and enabled again.

When the channel is activated (rising edge of channel status) or deactivated (falling edge) the channel error is filtered for a time period that can be adjusted by the parameter *Surveillance Timeout* during the configuration of the module in the control unit/PLC. The *Surveillance Timeout* can be set from 0 to 255 ms. The default setting is 80 ms.

The filter is used to avoid premature error reports in case of switching on a capacitive load or switching off an inductive load and other voltage peaks during a status change.

In the static state of the channel, i.e., while it is permanently switched on or off, a fixed time of 100 ms for filtering the error report is used.

8.2. Voltage error on M12 sockets / sensor short circuit

On every M12 input socket of the modules, the pin 1 provides a 24 Volts power supply signal. This power supply signal corresponds to the system/sensor power U_S. The status of this power supply signal is monitored.

In case of a sensor short circuit a voltage error is reported. Both channel indicators of the M12 socket light up red and an alarm message is sent for both channels.

The voltage error report is also filtered by the parameter *Surveillance Timeout*. The same parameter settings as for the channel error are also used for the voltage error.

8.3. Overload error of the output drivers

The output drivers of the modules 0980 ESL 802 – 16DO and 0980 ESL 803 – 8DI/8DO report an error if they detect an overload condition.

The overload detection is always related to both output channels on a M12-port on a module, not to a single output channel.

IMPORTANT!
If both output channels of an M12 socket are activated when an overload occurs, both channels are locked. If only one channel is active during an overload, only this one will be locked. Locked channels must be reset by the controller before they can be used again.

The status indicator of the active output channel on the M12-port turns on red during the overload. If both output channels are active during the overload both channel indicators will turn on red.

The channel error alarm is sent to the PROFINET IO controller.

The overload error is filtered by the parameter *Surveillance Timeout*. The same setting of the parameter *Surveillance Timeout* applies to the channel, voltage and overload errors that are explained in the chapters 8.1 and 8.2.

8.4. Error on actuator power supply U_L

The voltage level on the actuator power supply is also monitored globally and module related at the power supply connectors.

In case of the fact that U_L exceeds the voltage level of 18 V to 30 V an error is reported.

The indicator U_L turns on red.

A low voltage alarm is sent to the PROFINET IO-controller.

IMPORTANT!
Every output channel, which is active at the same time when the global error on the power supply U_L is detected, is locked. This means, the output channel has to be reset for correct operation by the control unit/PLC if the status of power supply U_L is normal again.

We recommend to deactivate all output channels by the PLC as soon as the UL fault is detected. Otherwise, every active output channel will generate an alarm due to its locking if UL returns.

This error is filtered by a fixed filter time of 300 ms.

8.5. Error on system/sensor power supply U_S

The voltage level of the system/sensor power supply U_S is also monitored globally. If it exceeds the voltage range of 18 to 30 V an error is reported.

The indicator U_S turns on red and a low voltage alarm is sent.

This error has no impact on any outputs and is not filtered. The error is reported immediately.

8.6. Diagnostic display in the integrated web server

The LioN-R modules display the fault diagnostics on the status page of the integrated web server. For opening the status page please refer to the following chapter of this manual.

In the data section of the status page up to 5 bytes of diagnostic data are displayed depending on the module. The diagnostic bytes in order from left to right are structured like follows.

a) Module 0980 ESL 801-PNET 16DI-M12-R

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 1	0	0	0	0	0	SC	0	LV-U$_S$
Byte 2	X8	X7	X6	X5	X4	X3	X2	X1

Legend:

LV-U$_S$:	Low voltage sensor power U$_S$
SC:	Sensor short circuit (module related)
X1...X8:	M12-socket with diagnostics

b) Module 0980 ESL 802-PNET 16DO-M12-R

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 1	0	0	0	0	AC	0	LV-U$_L$	LV-U$_S$
Byte 2	0	0	0	0	0	0	0	0
Byte 3	0	0	0	0	0	0	0	0
Byte 4	X4-B	X4-A	X3-B	X3-A	X2-B	X2-A	X1-B	X1-A
Byte 5	X8-B	X8-A	X7-B	X7-A	X6-B	X6-A	X5-B	X5-A

Legend:

LV-U$_S$:	Low voltage sensor power U$_S$
LV-U$_L$:	Low voltage actuator power U$_L$
AC:	Actuator short circuit
X1-A...X8-A:	M12-socket, channel A
X1-B...X8-B:	M12-socket, channel B

c) Modul 0980 ESL 803-PNET 8DI/8DO-M12-R

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 1	0	0	0	0	AC	SC	LV-U$_L$	LV-U$_S$
Byte 2	0	0	0	0	X4	X3	X2	X1
Byte 3	0	0	0	0	0	0	0	0
Byte 4	X8-B	X8-A	X7-B	X7-A	X6-B	X6-A	X5-B	X5-A

Legend:

LV-U$_S$:	Low voltage sensor power U$_S$
LV-U$_L$:	Low voltage actuator power U$_L$
SC:	Sensor short circuit
AC:	Actuator short circuit
X1...X4:	M12 socket
X5-A...X8-A:	M12-socket, channel A
X5-B...X8-B:	M12-socket, channel B

8.7. Alarm messages and error messages of the LioN-R modules on PROFINET

> **Note:**
> The transmission of the alarm and error messages on PROFINET is only performed if the parameter for the diagnostics is enabled during the configuration of the modules in the control unit.

If the LioN-R modules detect an error condition, they trigger an alarm message. The modules support diagnostic alarms. Diagnostic alarms are triggered by peripheral faults, as for example overload, short circuit, low voltage.

An alarm is triggered by a coming event (e. g. sensor short circuit), as well as by a going event.

The evaluation of the alarms is carried out in dependence of the used PROFINET IO controller.

8.7.1. Evaluation of alarms in *STEP 7*

In *STEP 7* the processing of the application program is interrupted by triggering a diagnostic alarm. A diagnostic organization block (fault OB) is called. The following organization blocks are used:

Cause of the alarm	OB call
Peripheral fault (short circuit, overload, broken wire, low voltage)	OB 82
Complete failure of a module	OB 86

Based on the called OBs and their start information the first information about the cause of the fault and type of the fault is already delivered. More detailed information about the fault event can be obtained in the fault OB by calling the system function block SFB 54 RALRM (Read additional alarm information). The SFB 54 therefore has to be called in every fault OB.

If the called fault OB is not available in the CPU, the CPU changes to the operation mode STOP.

It is also possible to call a diagnostic data record by its data record number with the help of the system function block SFB 52 "RDREC" in OB 1.

8.7.2. Structure of the diagnostic data records

For the presentation of the diagnostic data records, the block version 0x0101 and format identifier (USI, User Structure Identifier) 0x8000 are used.

The data values *ChannelNumber* and *ChannelErrorType* contain the following values in dependence of the occurred error.

| Error type	Reference	ChannelNumber	ChannelErrorType
Low voltage of the sensor or actuator power	Module	0x8000	0x0002
Sensor short circuit	M12 slot	0x0001 to 0x0008 Number of the M12 slot	0x0102
Actuator short circuit	Channel A of a M12 slot	0x0001 to 0x0008 Number of the M12 slot	0x0100
Actuator short circuit	Channel B of a M12 slot	0x0001 to 0x0008 Number of the M12 slot	0x0101

With an accumulation of errors the section *Channel diagnostics* with the data values *ChannelNumber*, *ChannelProperties* and *ChannelErrorType* is repeated for every error in the diagnostic data record.
The following pictures illustrate this relationship using the online diagnostics in *STEP 7.*

To display the diagnostics in *STEP 7* select the faulty I/O-module in the hardware manager by a mouse click and open the online diagnostics with the menu item *PLC – Module Information – IO-Device Diagnostics*.
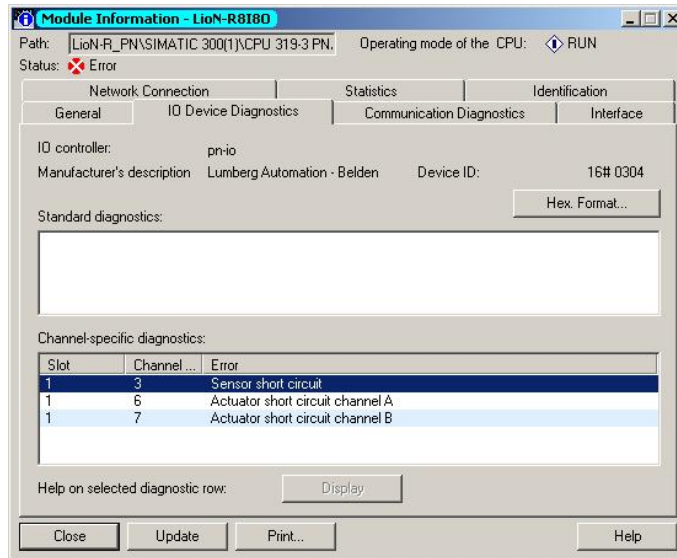
Pressing the button *Hex Format…* in the above window provides the presentation of the diagnostic data record in the hexadecimal format and its structure.
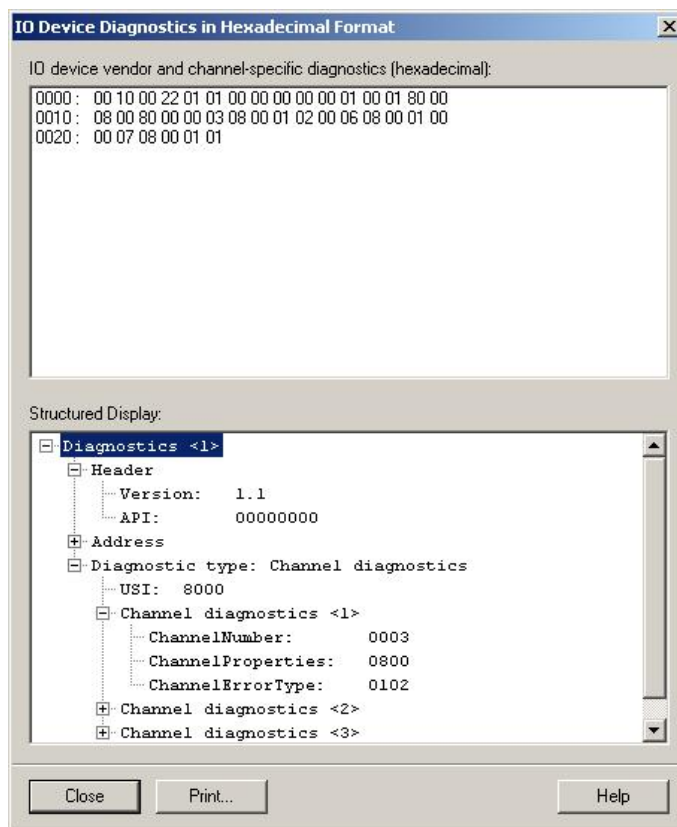
9. The embedded web server

The LioN-R modules have an embedded web server that provides functions for the configuration of the modules and the display of status and diagnostic information.

With the help of a standard web browser it is possible to get access to the provided functions over an existing TCP/IP connection.

For the use of the web server the modules need an own IP address. According to the PROFINET standard all PROFINET IO devices are delivered with IP address 0.0.0.0. Consequently, a free IP address deviating from the factory settings has to be assigned to the modules before using the web server. The assignment of the IP address can be carried out with *STEP 7*, for example, as described in chapter 6 of this manual.

As far as the IO-controller self-assigns the IP-address, this IP-address can be used to call the web server.

9.1. The home page (Home)

Enter *http://* in the address bar of your web browser, followed by the IP address, for example *http://192.168.100.2*. If the home page of the modules does not open, check your browser and firewall settings.

9.2. The configuration page (Config)

With the choice of the menu item "Config" in the menu bar of the home page a new window appears with the configuration options.
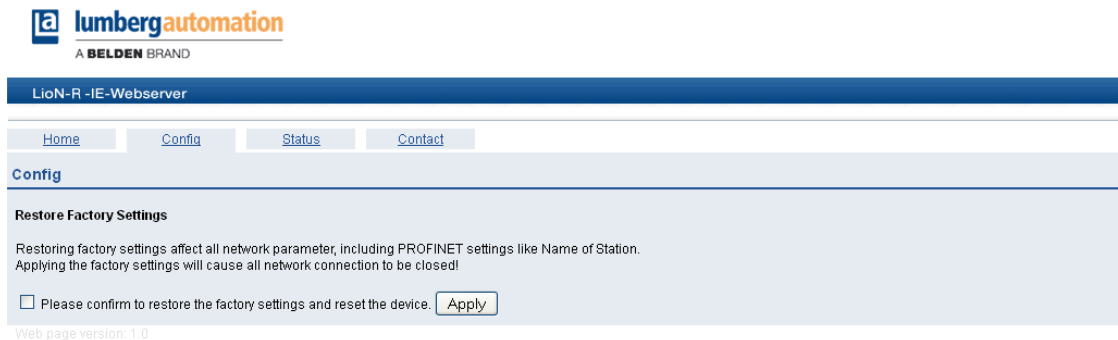
On this web page you can reset the modules to the factory settings. For this purpose, activate the check box and press the button "Apply".

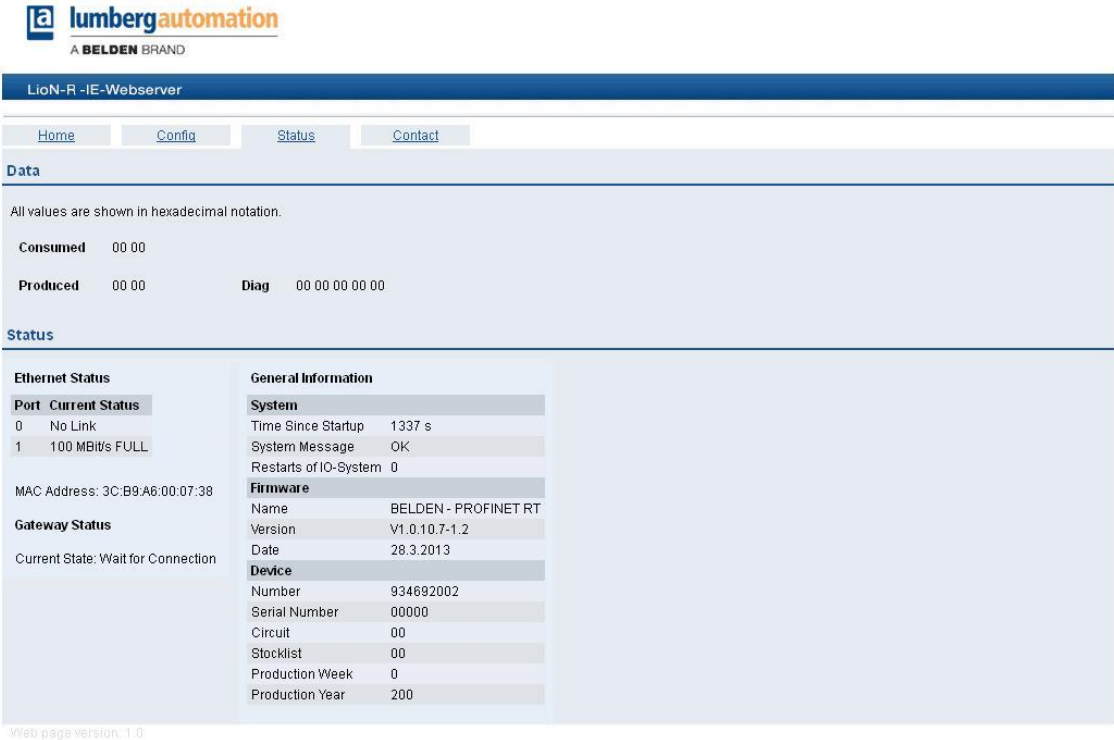|	
[i]	**NOTE!** **Please note that the PROFINET name and the IP address of the modules are changed to their default values after the factory settings are restored. Access to the web server of the modules and the data exchange in the PROFINET network do not function any longer under certain circumstances.**

9.3. The status page (Status)

This web page gives information about the actual status of the I/O channels and the diagnostics in the upper section. The I/O data are shown in the form of two bytes in hexadecimal notation. The diagnostics of the modules encloses five bytes.

The lower section on the status page contains details about the actual state of both Ethernet ports of the modules concerning connection, transmission rate and transmission mode.

In the area "General information" you find system-related information about the run time of the modules, firmware versions and manufacturing dates.

The status information on this page is updated only after a new call of the page or a page refresh in the web browser.

9.4. The page with contact information (Contact)

This page provides information about the company's address, telephone number and email address for the technical support.

9.5. Reading the process and diagnostic data using the embedded web server

The process and diagnostic data of both LioN-R I/O-modules can be read out with the help of the embedded web server. The web server provides the data in the standardised JSON format. The access to the data is accomplished by the web page:

http://[IP-address]/data.jsn

In advanced programming languages the process and diagnostic data is read out by HTTP-requests.
The following example uses the GET command in a HTTP-request to receive the data:

HTTP-request:
GET /data.jsn HTTP/1.1

HTTP-response:
HTTP/1.1 200 OK
Server: servX
Content-Length: 57
Content-Type: application/json

{"consumed": [36],"produced": [0,0],"diag": [12,4,0,36]}

The response has the following object structure (depending on the module):
- ProcessData
  - Produced (inputs): Array[a,b]
  - Consumed (outputs): Array[a,b]
- Diagnostics
  - Diag: Array[a,b,c,d,e]

10. Technical Data

10.1. General data

Protection degree	IP 67 (only in the screwed condition)
Ambient temperature	-10°C / +60°C
Weight	approx. 605 g
Housing material	Zinc diecasting
Vibration resistance	15 g / 5–500 Hz
Shock resistance	50 g / 11 ms
Torques: • Fastening screw M6 • M12 connectors	 1,0 Nm 0,5 Nm

10.2. Technical data of the bus system

Protocol	PROFINET IO RT is supported
GSDML-file	GSDML-V2.3-LumbergAutomation-0980ESL80x-yyyymmdd.xml
Transmission rate	100 Mbit/s, Full Duplex
Transmission method Autonegotiation	100BASE-TX supported
Vendor code (VendorID)	0016_H
Device code (DeviceID)	0304_H
Supported Ethernet protocols	• Ping • ARP • LLDP • SNMP (network diagnostics) • DCP • HTTP • TCP/IP
Switch functionality	integrated IRT is supported
PROFINET interface Connections Autocrossing	 2 M12 sockets, 4-pole, D-coded (see pin assignments) is supported

10.3. Technical data of the power supply for the electronics and sensors

Rated voltage U_S	24 V DC (SELV/PELV)
Voltage range	18–30 V DC
Current consumption electronics	typ. 100 mA
Voltage level sensors	min. (U_S – 1.5 V)
Current consumption sensors	max. 200 mA at T_{amb} = 30 °C
Reverse polarity protection	yes
Operation indicator	LED green, 18 V ≤ U_S ≤ 30 V LED red, U_S <18 V or U_S > 30 V
Connection	MINI, 7/8"-male and female connectors, 5-pole see pin assignments

10.4.   Technical data of the power supply for the actuators

Rated voltage U_L	24 V DC (SELV/PELV)
Voltage range	18–30 V DC
Potential separation	Yes
Low voltage threshold	typ. 17 V
Delay time low voltage detection	< 20 ms
Reverse polarity protection	Yes
Indicator actuator power supply U_L	LED green, 18 V ≤ U_L ≤ 30 V LED red, U_L <18 V or U_L > 30 V
Connection	MINI, 7/8"-male and female connectors, 5-pole see pin assignments

CAUTION!
The reverse polarity protection only works, if the actuator power supply is protected by an over-current fuse (10 A, mT) and switched off after a short circuit within 10 to 100 ms at the latest.

ATTENTION!
A power supply unit with current control or a wrong fuse lead to damage of the module in case of reverse polarity connection.

10.5.   Technical data of the input circuits

Input circuit	Type 3 acc. to IEC 61131-2
Rated input voltage	24 V DC
Input current at 24 V DC	typ. 5 mA
Short circuit proof	Yes
Channel type	N.O., p-switching
Number of digital channels	16 (0980 ESL 801-PNET 16DI-M12-R) 8 (0980 ESL 803-PNET 8DI/8DO-M12-R)
Status indicator	LED yellow for channel A, LED white for channel B
Diagnostic indicator	LED red per M12 socket
Connection	M12 female connector, 5-pole see pin assignments

10.6.   Technical data of the output circuits

Output circuit	Type 1,6 A acc. to IEC 61131-2
Rated output current per channel: Signal status "1" Signal status "0"	1,6 A (see info 1) max. 1.6 A max. 1 mA (acc. to specification)
Signal level of the outputs: Signal status "1" Signal status "0"	 min. (U_L - 1 V) max. 2 V
Short circuit proof	Yes
Max. current consumption per modulel	According to UL-approval: 9.0 A (12 A see info 2)
Overload proof	Yes
Number of digital channels	16 (0980 ESL 802-PNET 8DO-M12-R) 8 (0980 ESL 803-PNET 8DI/8DO-M12-R)
Channel type	N.O., p-switching
Status indicator	LED yellow for channel A, LED white for channel B
Diagnostic indicator	LED red per channel
Connection	M12 female connector, 5-pole see pin assignment

Info 1: The outputs are able to switch currents of 1.6 A with a frequency of 1 Hz with inductive loads of the utilization category DC13 (EN60947-5-1).

Info 2: Technically feasible and approved under the following conditions:
Looped through sensor/system power, maximum 2.5 A
Minimum cross section of power supply cable: 4x 1.0 mm²
Ambient temperature maximum 40 °C/ 104 °F

10.7.   LED indicators

U_S	green	System-/ sensors power supply, voltage level 18 V ≤ U_S ≤ 30 V
	red	System-/ sensors power supply, voltage level U_S <18 V or U_S > 30 V
	off	System-/ sensors power supply missing
U_L	green	Actuator power supply, voltage level 18 V ≤ U_L ≤ 30 V
	red	Actuator power supply, voltage level U_L <18 V or U_L > 30 V
	off	Actuator power supply missing
X1...X8 A/DIA	yellow	Channel status A
	red	Periphery fault (sensor or actuator overload/short circuit)
	off	Not connected, no status, no fault
X1...X8 B	white	Channel status B
	red	Periphery fault (actuator overload/short circuit)
	off	Not connected, no status, no fault
P1 Lnk / Act P2 Lnk / Act	green	Ethernet connection to another participant exists. Link detected.
	yellow flashing	Data exchange with another participant.
	off	No connection with another participant. No link, no data exchange.
BF	red	No configuration, no or slow physical connection.
	red flashing with 2 Hz	No data exchange.
	off	No error.
DIA	red	Watchdog time-out; diagnostics available, system fault
	red flashing with 2 Hz, 3 sec	DCP-signal-service is triggered over the bus.
	off	No error message available.

11. CE Declaration of Conformity

BELDEN
SENDING ALL THE RIGHT SIGNALS

Lumberg Automation™ and Hirschmann™ Products

Declaration of Conformity

We
Wir
Belden Deutschland GmbH

Adress
Adresse
Im Gewerbepark 2, 58579

declare under our sole responsibilty, that the products
erklären in alleiniger Verantwortung, dass die Produkte

Name
Bezeichnung
0980 ESL 801-PNET 16DI-M12-R
0980 ESL 802-PNET 16DO-M12-R
0980 ESL 803-PNET 8DI/8DO-M12-R

Type
Typ
I/O-Module für Profinet

angelehnt an die Direktive
corresponding to directive

EMC-Directive 2004/108/EC

fulfils the requirements of the following standards
den Anforderungen der folgenden Normen entspricht

Standards DIN EN 61000-6-4: 2007 and DIN EN 61000-6-2: 2006

Schalksmühle, den 18.03.2013

Belden Deutschland Gmbh
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Deutschland   Trade register No.: HRB 6316