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A BELDEN BRAND

Manual

LioN-P PROFINET Digital-I/O

0980 ESL 300-xxx ... 0980 ESL 303-xxx
0980 ESL 390-xxx ... 0980 ESL 393-xxx
0980 ESL 390-121-DCU1 and 0980 ESL 393-121-DCU1

Contents

1 About this Manual

1.1 General Information

Please read the assembly and operating instructions in this manual carefully before starting up the LioN-P modules with the PROFINET IO interface. Keep the manual where it is accessible to all users.

The texts, figures, diagrams and examples used in this manual are used exclusively to explain how to operate and apply the LioN-P modules with PROFINET IO interface.

Please contact us if you have any more detailed questions on installing and starting up the devices. We will be happy to help you.

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1.2 Explanation of Symbols

1.2.1 Handling Danger Information

Danger information is denoted as follows:

Danger: Means that death, serious physical injury, or substantial damage to property will occur if the required safety measures are not taken.

Warning: Means that death, serious physical injury, or substantial damage to property can occur if the required safety measures are not taken.

Caution: Means that minor physical injury or damage to property can occur if the required safety measures are not taken.

1.2.2 Use of General Information

General information is denoted as follows:

Attention: Contains important information on the product, on how to manage the product, or on the respective section of the documentation to which your special attention is being drawn.

1.3 Version Information

Index	Created	Changed	Changed
Version number	Version 1.0	Version 1.1	Version 1.2
Date	May 2013	December 2015	February 2016

Index	Changed	Changed	Changed
Version number	Version 2.0	Version 2.1	Version 2.2
Date	May 2017	July 2018	August 2019

Index	Changed	Changed	Changed
Version number	Version 2.3		
Date	March 2021		

Table 1: Overview of revisions to manual

2 Safety Instructions

2.1 Intended Use

The devices described in this manual are decentralized input/output assemblies on a PROFINET I/O network.

We adhere to all safety standards when developing, producing, testing, and documenting our products. When you adhere to the handling specifications and safety instructions described for the configuration, assembly, and correct operation, there should not normally be any risks for people or equipment.

The modules fulfill the requirements of the EMC guideline (2014/30/EU) and the low voltage guideline (2014/35/EU).

The modules are designed to be used in the industrial sector. The industrial environment is distinguished by the fact that the consumer is not connected directly to the public low voltage network. Additional measures are required for use in residential areas or in business and commercial sectors.

Attention: This equipment may cause radio interference in residential areas. In this case the operator may be requested to carry out appropriate measures.

The proper and safe operation of this product depends on proper transportation, proper storage, assembly, and installation, and careful operation.

A completely assembled device housing is required for the proper operation of the modules. Only connect devices to the modules that fulfill the requirements of EN 61558-2-4 and EN 61558-2-6.

During the configuration, installation, start-up, maintenance, and testing of the devices, adhere to the safety and accident-prevention guidelines for the specific application.

Only install cables and accessories that fulfill the requirements and regulations for safety, electromagnetic compatibility, and, where applicable, telecommunication end devices, as well as the specification information.

Information on which cables and accessories are permitted for the installation can be obtained from Lumberg Automation™ or is contained in this manual.

2.2 Qualified Personnel

The configuration, installation, start-up, maintenance, and testing of the devices may only be performed by a qualified electrician who is familiar with the safety standards of the automation technology.

The personnel requirements are based on the requirement profiles described by ZVEI, VDMA, or equivalent organizations.

Only electricians who are familiar with the content of this manual are authorized to install and maintain the devices described. These are persons who

- based on their technical training, knowledge, and experience, and their knowledge of the pertinent standards, can evaluate the work to be carried out and identify any potential risks or
- based on working for several years in a related sector, have the same level of knowledge as they would have from the relevant technical training.

Only Belden Deutschland GmbH - Lumberg Automation™ - is permitted to make changes to the hardware or software of the products that go beyond the scope of this manual.

Warning: Making unqualified changes to the hardware or software, as well as any non-adherence to the warning information contained in this manual, can result in serious personal injury or damage to equipment.

3 System Description

The LioN-P (Lumberg I/O-Network Power) module series includes standalone field bus devices for decentralized use in tough industrial environments. The devices feature easy handling of I/O data in a higher-level bus system. They are especially suitable for use in machines and installations with a moderate I/O concentration over separate assemblies.

The LioN-P I/O module series has a very rugged metal housing made of die-cast zinc. The module electronics are fully protected from environmental influences by the fully sealed housing. The modules have protection classes IP65, IP67 (IP69 for modules with M12-L). The permissible temperature range for the modules is -25 ° C to +70 °C. The module series is therefore ideally suited for direct field service in a tough industrial environment.

Despite the sturdy construction, the module series has compact dimensions and a low weight.

The integrated 2-port Ethernet switch of the modules allows a bus or star topology to be set up for the PROFINET I/O network. The implemented Media Redundancy Protocol (MRP) enables the design of a highly available network infrastructure.

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

The LioN-P module series consists of four types of modules with different I/O functionality. Modules with 16 digital inputs (16 DI), 16 digital outputs (16 DO), 8 digital inputs / 8 digital outputs (8DI/8DO) or 16 universal inputs/outputs (16DI/DO) are available. The output current is 2 A per channel. The output power circuits are electrically isolated (with exception of 16DI/DO) from the rest of the network and the sensor electronics.

Warning: If modules with electric isolation and modules without electric isolation are used within the same system, the electric isolation of all connected modules is cancelled.

The modules with output functionality feature a failsafe function. During the configuration of these modules, the behavior of each output channel can be adjusted in case of interruption or loss of communication.

Two DCU1 (Distributed Control Unit) variants are also available with integrated programmable logic. Details on the DCU programming are available in the µDCU Manual.

To connect the network, power packs and I/O devices the module series features the widely-used M12 connector A-coding for I/O signals, D-coding for the network and L-coding for the power supply. The connectors are also color-coded to prevent the connections from being mixed up.

In accordance with the PROFINET specification, the modules get their network parameters from a DCP server. Rotary encoding switches are not required.

For the functions of the rotary encoding switches with multiprotocol, refer to the LioN-P Multiprotocol Manual.

Flex-bit technology is the opposite of the fixed specification for bit assignment. Flexible bitmapping means that the bit assignment has no fixed port assignment. Users have the option of setting the bit assignment of the 16DIO I/O module to their usual bit assignment. Flex-bit technology is a great advantage when implementing new devices in different existing systems. This means that an existing application with I/O devices could have a different bit mapping assignment, such as with a µDCU. In the past, manufacturers had to buy products with the same bitmap mapping to operate the established system with new products. With the flex-bit technology, BELDEN offers the option to customize the Lion-P 16DIO products with different bitmap assignments.

Force Mode is another advantage that makes it possible to put machines into operation faster. Force Mode enables simulation of test applications without connecting sensors and actuators. The users are therefore able to test an application in advance without full physical application. This function is a great advantage when putting into operation and checking new production plants or lines. Outputs can be switched without a PLC, and input switching states can be simulated.

3.1 Product Overview

3.1.1 Module Variants

Item number LioN-P 16DI	Description	I/O ports	Design
0980 ESL 301-111 (single protocol) SAP number: 934 881-001	Decentralized I/O module with 16 digital inputs, 2.0 A, peripheral equipment connection through 8 M12 slots.	8 x M12	Sturdy/metal
0980 ESL 301-121 (single protocol) SAP number: 934 878-001			
0980 ESL 391-111 (multiprotocol) SAP number: 934 882-001			
0980 ESL 391-121 (multiprotocol) SAP number: 934 879-001			

Item number	Description	I/O ports	Design
LioN-P 16DO			
0980 ESL 302-111 (single protocol) SAP number: 934 881-002	Decentralized I/O module with 16 digital outputs, 2.0 A, peripheral equipment connection through 8 M12 slots.	8 x M12	Sturdy/metal
0980 ESL 302-121 (single protocol) SAP number: 934 878-002			
0980 ESL 392-111 (multiprotocol) SAP number: 934 882-002			
0980 ESL 392-121 (multiprotocol) SAP number: 934 879-002			

Item number	Description	I/O ports	Design
LioN-P 8DI/8DO			
0980 ESL 303-111 (single protocol) SAP number: 934 881-003	Decentralized I/O module with 8 digital inputs and 8 digital outputs, 2.0 A, peripheral equipment connection through 8 M12 slots.	8 x M12	Sturdy/metal
0980 ESL 303-121 (single protocol) SAP number: 934 878-003			
0980 ESL 393-111 (multiprotocol) SAP number: 934 882-003			
0980 ESL 393-121 (multiprotocol) SAP number: 934 879-003			

Item number	Description	I/O ports	Design
LioN-P 16DIO			
0980 ESL 300-111 (single protocol) SAP number: 934 881-007	Decentralized I/O module with 16 digital inputs or 16 digital outputs, 2.0 A, peripheral equipment connection through 8 M12 slots.	8 x M12	Sturdy/metal
0980 ESL 300-121 (single protocol) SAP number: 934 878-007			
0980 ESL 390-111 (multiprotocol) SAP number: 934 882-007			
0980 ESL 390-121 (multiprotocol) SAP number: 934 879-007			

Item number	Description	I/O ports	Design
LioN-P 8DI/8DO-DCU			
0980 ESL 393-121-DCU (MP) SAP number: 934 879-005	Decentralized I/O module with 8 digital inputs and 8 digital outputs, 2.0 A, peripheral equipment connection through 8 M12 slots.	8 x M12	Sturdy/metal

Item number	Description	I/O ports	Design
LioN-P 16DIO-DCU			
0980 ESL 300-121-DCU (MP) SAP number: 934 879-009	Decentralized I/O module with 16 digital inputs and 16 digital outputs, 2.0 A, peripheral equipment connection through 8 M12 slots.	8 x M12	Sturdy/metal

4 Assembly and Wiring

4.1 General Information

Mount the module for LioN-P on a flat surface using 2 screws (M4x25/30). The torque required here is 1 Nm. For all fastening methods use washers as per DIN 125. The mounting holes require a spacing of 190.3 to 191.8 mm for the LioN-P modules with a 7/8" connector/socket and a spacing of 196.8 to 198.3 mm for the LioN-P modules with M12-Power L-coded.

Attention: The modules have a ground connection with an M4 thread for the conduction of interference currents and the EMC immunity. This is labeled with the symbol for the ground and the designation "XE".

Attention: Use a low-impedance connection to connect the module to the reference ground. When using a grounded mounting surface, you can make the connection directly via the fixing screws.

Attention: If the mounting surface is not grounded, use a ground strap or a suitable PE line. Use an M4 screw to connect the ground strap or the PE line to the ground point and if possible fit a washer and a toothed washer below the fixing screw.

Attention:

For UL application:

Be sure to use a UL-certified cable with a suitable evaluation to connect the devices (CYJV or PVVA). To program the control, please refer to the OEM information, and only use suitable accessories.

Attention:

For UL application:

Only approved for inner area. Please note the maximum elevation of 2000 meters. Approved up to a maximum soiling level of 2.

Warning: Terminals, housings of field-wired terminal boxes or individual components can exceed temperatures of 60 °C.

Warning:

For UL application:

Use temperature-resistant cables with following properties: For modules 0980 ESL3x1-121 heat resistance up to at least 85 °C.

For modules 0980 ESL3x0-121, 0980 ESL3x2-121 and 0980 ESL3x3-121 heat resistance up to at least 96 °C.

4.2 Outer Dimensions

4.2.1 Module 0980 ESL 3xx-111

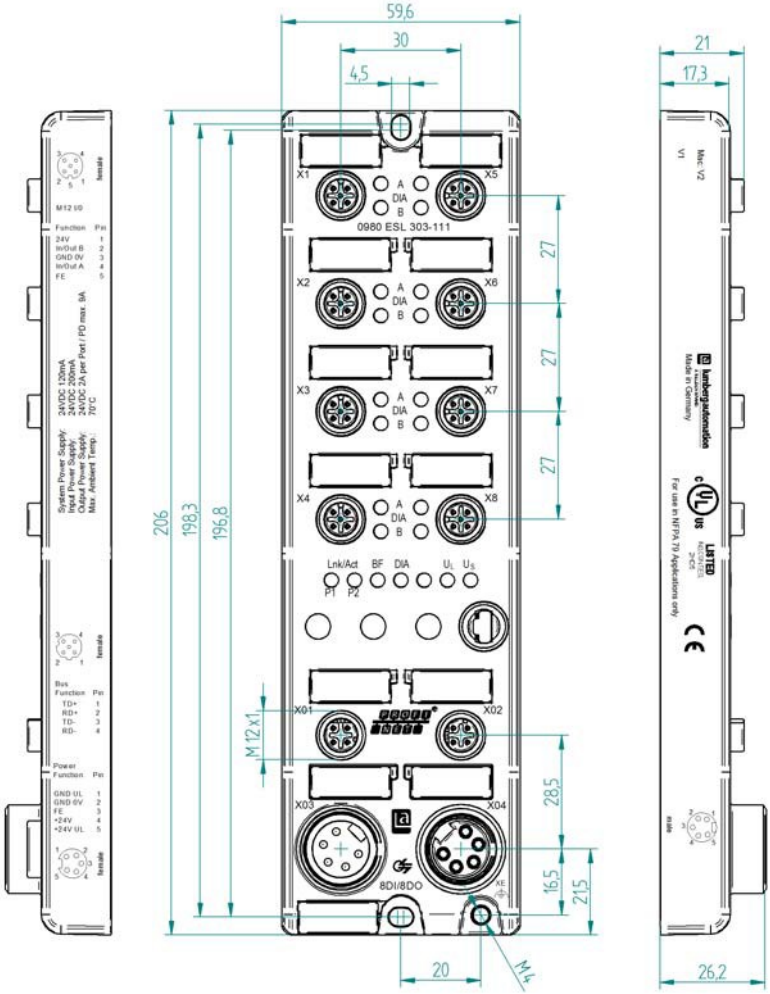


Figure 1: Example figure for 0980 ESL 303-111

4.2.2 Module 0980 ESL 3xx-121

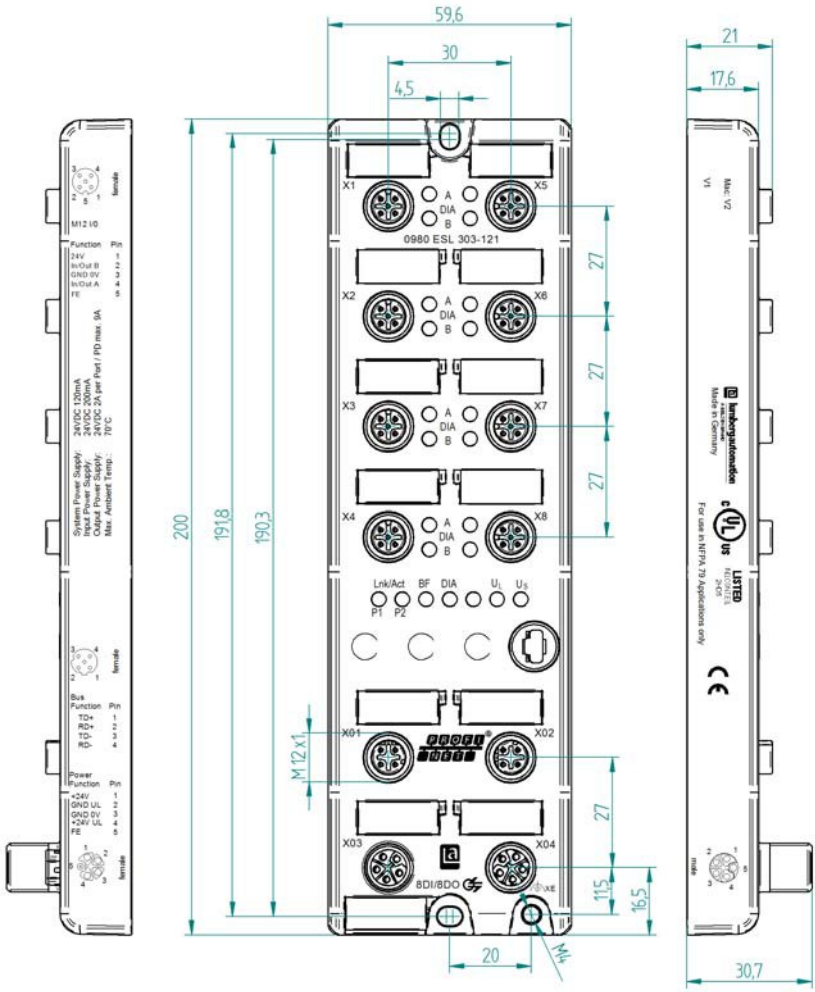


Figure 2: Example figure for 0980 ESL 303-121

4.3 Port Assignments

All the contact arrangements shown in this chapter show the frontal view of the connection area for the connectors.

4.3.1 PROFINET Ports, M12 Socket, 4-Pin, D-Coded

- Color coding: green

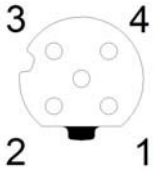


Figure 3: Schematic drawing, ports X01, X02

Port	Pin	Signal	Function
PROFINET	1	TD+	Transmit data plus
Ports X01, X02	2	RD+	Receive data plus
	3	TD-	Transmit data minus
	4	RD-	Receive data minus

Table 2: Assignment of ports X01, X02

Caution: Risk of destruction! Never connect the power supply to the data cables.

4.3.2 Power Supply with 7/8", 5-pin

- Color coding: gray

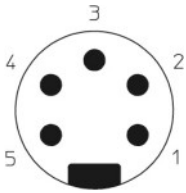


Figure 4: Schematic drawing, port X03 (IN)

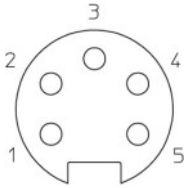


Figure 5: Schematic drawing, port X04 (OUT)

Port	Pin	Signal	Function
Power supply	1	GND_U_L	Actuator
X03, X04	2	GND_U_S	System/sensors
	3	FE	Functional earth
	4	U_S(+24 V)	System/sensors
	5	U_L(+24 V)	Actuator

Table 3: Assignment of ports X03, X04

Attention: For the input module 0980 ESL 301-xxx, the two contacts 1 and 5 are not required for the power supply to the actuators. However, these two contacts are connected to each other on the connector and socket side to enable 5-pin transmission of the power supply to a downstream module.

Attention: Only use power supply units for the system/sensor and actuator supply that correspond to PELV (Protective Extra

Low Voltage) or SELV (Safety Extra Low Voltage). Power supplies according to EN 61558-2-6 (transformers) or EN 60950-1 (switching power supply units) fulfill these requirements.

Attention: For modules with a 7/8" housing, use the "SELV and Limited Energy" power source.

4.3.3 Power Supply with M12 Power L-Coded

- Color coding: gray

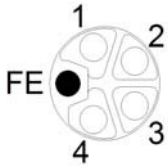


Figure 6: Schematic diagram of the M12 L-coding (connector), port X03 (IN)

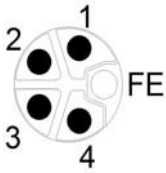


Figure 7: Schematic diagram of the M12 L-coding (socket), port X04 (OUT)

Power supply	Pin	Signal	Function
	1	U_S(+24 V)	System/sensors
	2	GND_U_L	Actuator
	3	GND_V_S	System/sensors
	4	U_L(+24 V)	Actuator
	5	FE	Function earth

Table 4: Assignment of X03, X04

Attention: Only use power supply units for the system/sensor and actuator supply that correspond to PELV (Protective Extra Low Voltage) or SELV (Safety Extra Low Voltage). Power supplies according to EN 61558-2-6 (transformers) or EN 60950-1 (switching power supply units) fulfill these requirements.

4.3.4 Ports for Sensors/Actuators

- Design: M12 socket, 5-pin
- Color coding: black

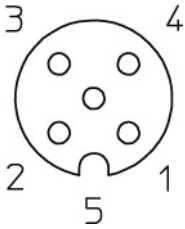


Figure 8: Schematic drawing, ports X1 to X8

Port	Pin	16DI	16DO	8DI/8DO
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	Shielding/PE	Shielding/PE	Shielding/PE

Table 5: Assignment of ports X1 to X8

Port	Pin	16DI/DO
Sensor/actuator	1	+24 V DC
	2	IN/OUT B
	3	0 V DC
	4	IN/OUT A
	5	Shielding/PE

5 Configuration and Startup

The configuration and startup of LioN-P PROFINET modules described on the following pages was carried out with the aid of the TIA Portal software of Siemens AG. If you are using a control system from another control system provider, please consult the associated documentation.

5.1 GSDML File

For configuration of the LioN-P PROFINET modules in the controller, a GSDML file in XML format is required. All device variants are grouped in a single GSDML file. The file can be downloaded from the product pages on our online catalog: catalog.belden.com

On request, the GSDML file is also sent by the support team.

The file for the LioN-P PROFINET modules is named:

- GSDML-V2.3x-LumbergAutomation-LioN-P-yyyymmdd.xml

"yyyymmdd" stands for the date on which the file was issued.

In the TIA Portal create a new project, add a CPU and in the main menu

Extras > **Manage device description files (GSD)**

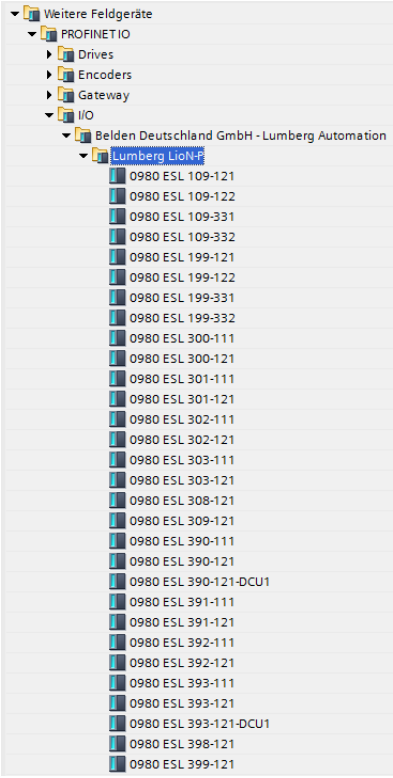
open the GSD administration manager. Enter a source path, mark the GSDML files to be installed and confirm the installation. The LioN-P PROFINET modules are then shown in the hardware catalog.

5.2 Configuration of LioN-P PROFINET Modules in TIA Portal

After installation of the GSDML files for the LioN-R PROFINET modules, they are available at

Further field devices > **PROFINET IO** > **I/O** > **Belden Deutschland GmbH – Lumberg Automation** > **Lumberg LioN-P**

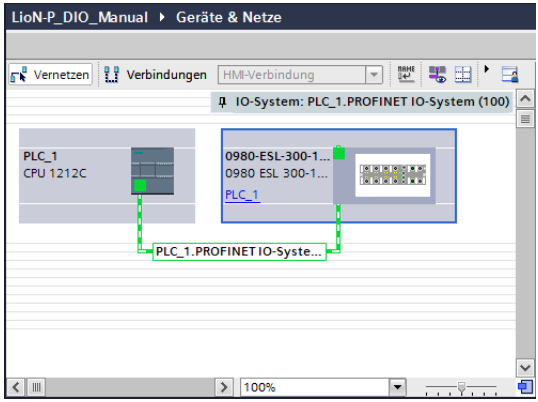
in the hardware catalog.



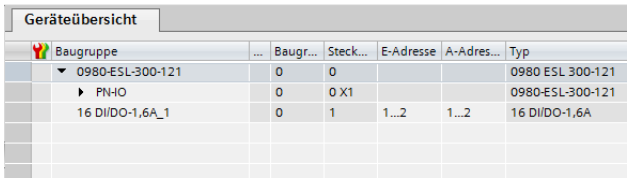
You can also add your project to it for use by double clicking on a module in the network view. In the newly projected module click on

Not assigned

and choose the corresponding PROFINET interface.



A suitable module for the I/O function is automatically inserted into slot 1 of the subrack.



The input and output addresses specified in the device summary can be changed.

LioN-P 16DIO modules (0980-ESL-300-111, 0980-ESL-300-121, 0980-ESL-390-111, 0980-ESL-390-121, 0980-ESL-390-121-DCU1) have an extended I/O function scope. Different profiles (e.g. 16 DI/DO) or modules may be used in slot 1 of the subrack.

The advantage of this is that all older inventories of digital I/O modules can be replaced in each instance by a LioN-P 16DIO module. The selection of a suitable profile and the use of IO mapping in the module parameters can be replaced without changing the I/O addresses in the PLC program of these devices.

To change a profile it is necessary to delete the module in slot 1 and to insert another one in its place. This is done by adding a LioN-P PROFINET module through the hardware catalog.

The following module profiles (e.g. 16DI/DO) are available for configuration of a LioN-P 16DIO module:

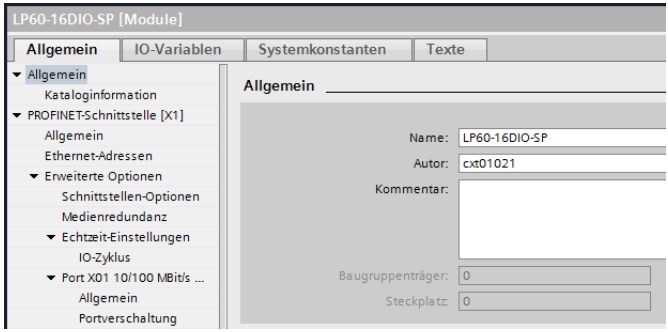
5.2.1 Assigning a Unique Device Name

PROFINET IO devices in the PROFINET network are activated through a unique device name. This can be freely assigned by the user, but may only be used once on the network.

In the device summary of the LioN-P module, select slot 0 and in

General

issue a suitable module name.



In

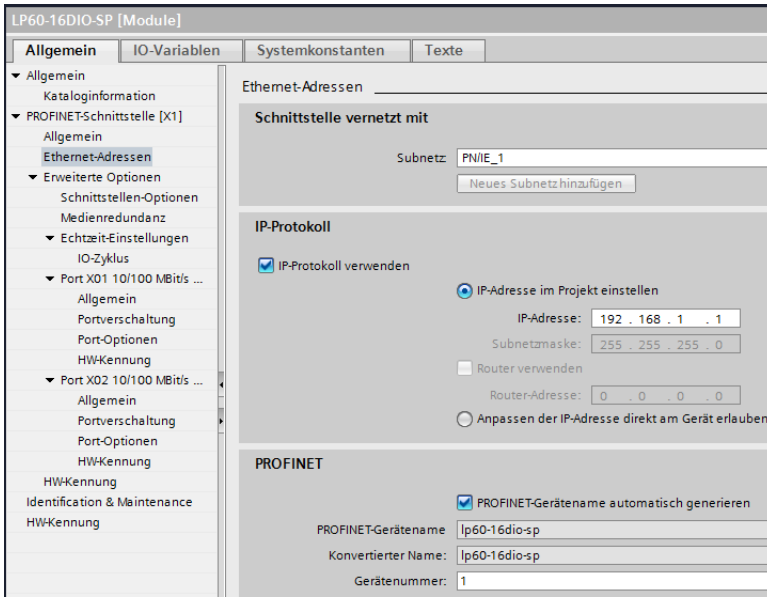
PROFINET interface [X1] > **Ethernet addresses**

check the automatically issued IP address and check if the controller and the module are located in the same Ethernet subsystem. If necessary, change the settings.

If the selection

Automatically generate PROFINET device name

is activated, then the previously projected module name is used as a PROFINET device name. For reasons of clarity, it is not advisable to use a different name.



5.2.2 Assigning Device Name to a LioN-P Module

To enable a participant to be assigned an IP address in a PROFINET network, each LioN-P module has to be issued with a device name. A participant search enables the detected PROFINET devices to be displayed.

The LioN-P modules are assigned MAC addresses when they are shipped. These are unique and cannot be changed by the user. The first MAC address is depicted on the housing of the LioN-P module. This can be used to locate every device in the list of reachable participants and to assign a device name in each instance.

Connect the LioN-P module to the PROFINET network.

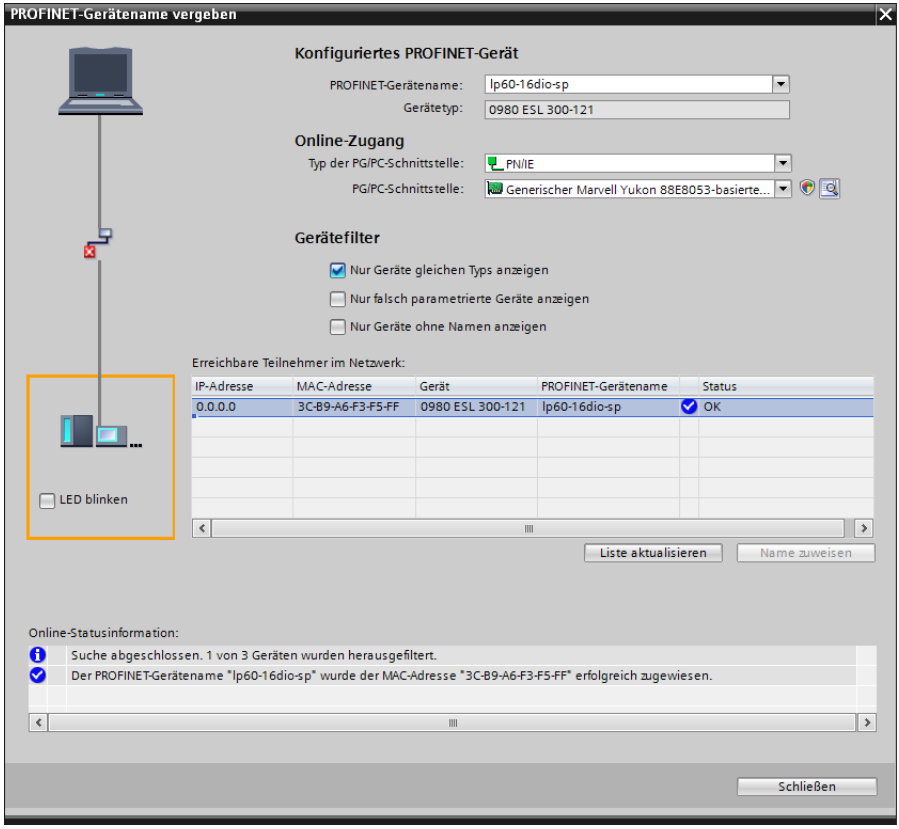
In the device summary for the LioN-P module, select slot 0 and in the main menu

Online > **Assign device name**

open the **Issue PROFINET device name** dialog.

If the LioN-P module does not appear in the list of reachable participants in the network, you can change the device filter and then update the list. If the device still fails to appear, check your firewall settings.

Select a detected LioN-P module and assign it to the selected PROFINET device name. If the device name was successfully assigned, this is indicated by the status.



5.2.3 Device Replacement without Removable Media/PD

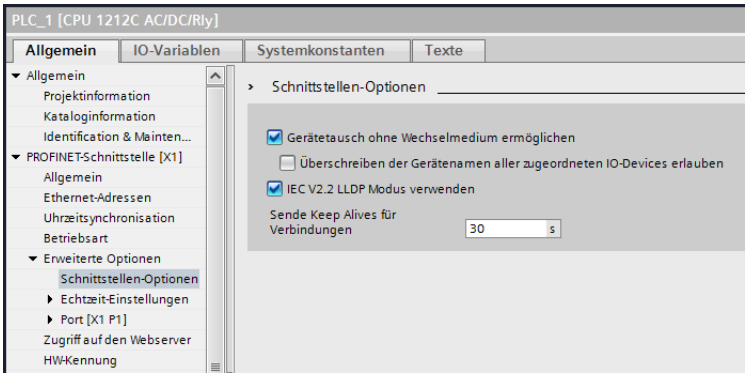
PROFINET I/O devices that support the function of device replacement without removable media or a programming unit can be replaced by the same devices in an existing PROFINET network.

In this case, the I/O controller takes care of assignment of the device name. It uses the projected topology here and proximity relationships determined by the IO Devices.

The LioN-P modules support the function of the device replacement without removable media/programming unit. CPU slot 1 with

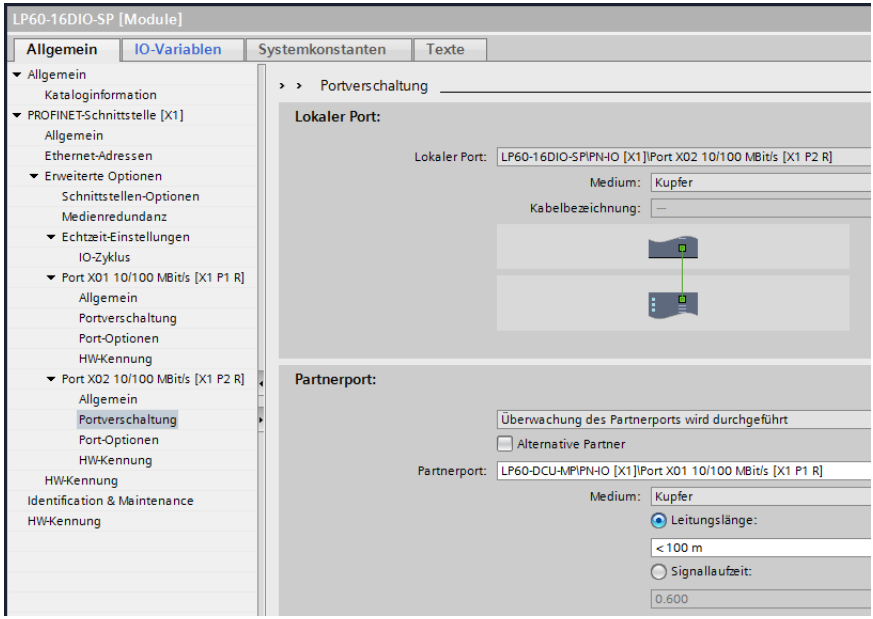
PROFINET interface [X1] > Extended options > Interface options > Device replacement without removable media

can be used to activate it.



A network topology is configured by connecting the PROFINET ports of the individual devices. These can be accessed using slot 0 of the PROFINET devices used. By displaying all the unused ports you can also define a suitable partner port in each instance.

PROFINET interface [X1] > Extended options > Port X0n 10/100 Mbit/s [X1 Pn R] > Port connection



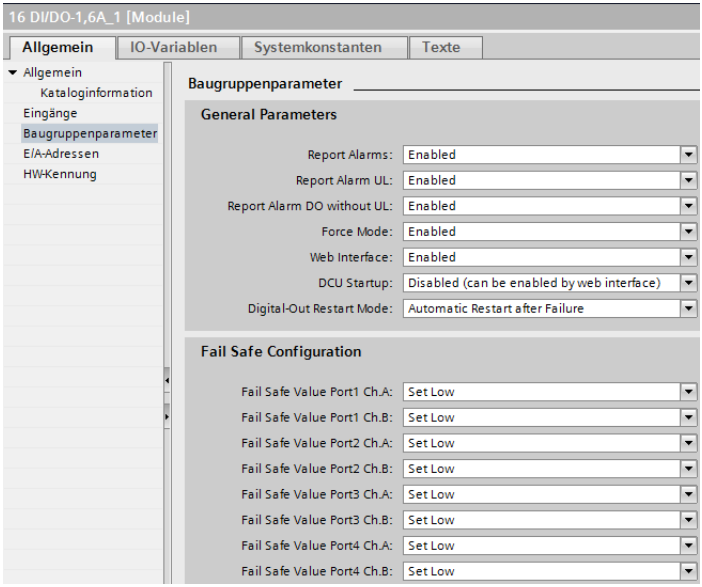
5.2.4 Parameter Settings for LioN-P Modules

You can access the parameter settings through the device summary of the LioN-P module. With slot 0 (for LioN-P 16DI, 16DO and 8DI/8DO) and slot 1 (for LioN-P 16DIO) and the

General > module parameters

tab, you can display the configuration parameters for the module.

The parameter settings display is dependent on the module variant used as well as the version of the device description file. Each module has its own individual parameter record.


16 DI/DO-1,6A_1 [Module]
Allgemein
IO-Variablen
Systemkonstanten
Texte
Allgemein
Katalogiinformation
Eingänge
Baugruppenparameter
E/A-Adressen
HW-Kennung
Baugruppenparameter
General Parameters
Report Alarms: Enabled
Report Alarm UL: Enabled
Report Alarm DO without UL: Enabled
Force Mode: Enabled
Web Interface: Enabled
DCU Startup: Disabled (can be enabled by web interface)
Digital-Out Restart Mode: Automatic Restart after Failure
Fail Safe Configuration
Fail Safe Value Port1 Ch.A: Set Low
Fail Safe Value Port1 Ch.B: Set Low
Fail Safe Value Port2 Ch.A: Set Low
Fail Safe Value Port2 Ch.B: Set Low
Fail Safe Value Port3 Ch.A: Set Low
Fail Safe Value Port3 Ch.B: Set Low
Fail Safe Value Port4 Ch.A: Set Low
Fail Safe Value Port4 Ch.B: Set Low

5.2.4.1 General Parameters

Report Alarms:
Activate/deactivate Global PROFINET alarm messages.

Report Alarm U_L:
Activate/deactivate PROFINET alarm message for missing actuator supply voltage (U_L). If the global PROFINET alarm messages are deactivated, this alarm is not registered.

Report Alarm DO without U_L:
Activate/deactivate PROFINET alarm message for missing actuator supply voltage (U_L) and actuation of an actuator. If the global PROFINET alarm messages are deactivated, this alarm is not registered.

Force Mode:
Permit/inhibit use of Force Mode on web server.

Web interface:
Permit/inhibit use of web server.

DCU Startup (for DCU modules only):
Deactivate/block DCU function or start DCU program. Further details are available in the µDCU Manual.

Digital Out Restart Mode:
Automatic restart following short circuit of digital output or reset of channel diagnosis when resetting digital output

5.2.4.2 Fail Safe Configuration

These parameters are provided to all module types with digital outputs. If a breakdown/loss of PROFINET communication occurs or another major fault, the outputs can be switched using parameterization into a reliable condition.

The following options are available

- Set Low – Deactivation of output channel (digital value = 0)
- Set High – Activation of output channel (digital value = 1)
- Hold Last – Holds last output status (digital value corresponds to last status)

5.2.4.3 Surveillance Timeout Configuration (ms)

These parameters are provided to all module types with digital outputs. The configuration can be used to set a delay time (Surveillance Timeout) that defines the monitoring procedure for the individual digital output currents for each channel.

The delay time starts after a change to the output channel status. If an output is activated (rising edge) or deactivated (falling edge) the output monitoring does not start until the delay time expires. Any fault conditions that arise after this delay are registered by the diagnosis.

The adjustable value range for the delay time is 0 to 255 ms. The default value is 80 ms. When the output channel is in the static state, (channel permanently switched on or off) the value is 100 ms.

5.2.4.4 IO Mapping Configuration (for 16DI/DO Modules Only)

Configuration of the IO mapping makes it possible to change the data structure of the I/O data. By default each I/O channel is mapped in sequence in the process data. Existing PLC programs however, may under certain circumstances, use another channel assignment.

These parameters enable all I/O channels to be freely assigned a bit in the I/O data. It should be noted that duplicate assignments are not possible here. If faulty parameterization of the IO mapping when transferring the configuration is detected,the LioN-P module registers a fault.

5.2.5 Fast Start-Up (FSU) / Prioritized Start-Up

The LioN-P modules with Fast Start-Up (FSU) support an optimized system start-up. This guarantees a faster restart after the power supply is restored.

Fast Start-Up can be activated for the LioN-P modules with **PROFINET interface [X1]** > **Extended options** > **Interface options** over **Prioritized start-up**.

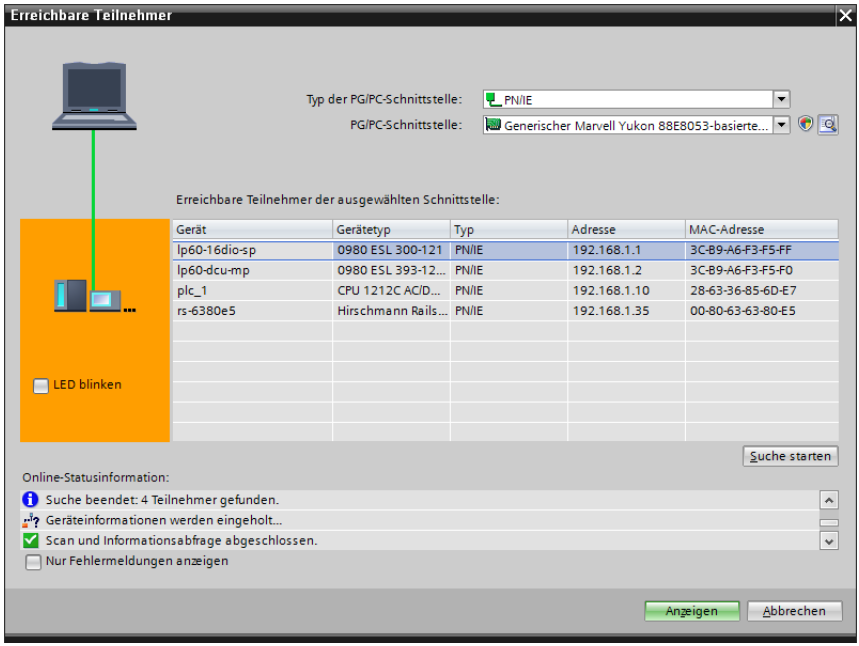
5.2.6 Resetting LioN-P Modules to Factory Settings

To reset the LioN-P module to the factory settings you have to search in the TIA Portal for PROFINET participants that can be reached.

In the main menu select

Online > **Reachable participants...**

and start the search using your available PG/PC interface. Choose the LioN-P module to be reset and confirm the prompt.



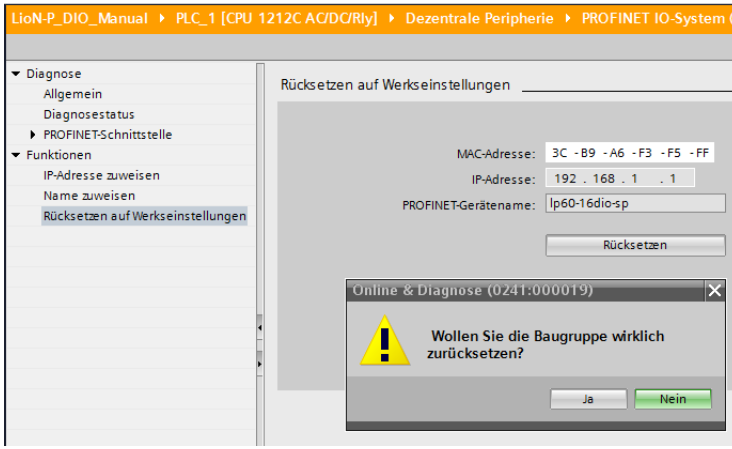
Use the project navigation to select

Online accesses > **...** > **...** > **Online & Diagnosis**

of LioN-P module. In the window that opens you can use

Functions > **Reset to factory settings**

to reset the LioN-P module again to its original condition



5.2.7 Media Redundancy Protocol (MRP)

Redundant PROFINET communication can be implemented with the LioN-P modules via a ring topology without the use of additional switches. A MRP redundancy manager terminates the ring, detects individual failures, and transmits the data packets on the redundant path in case of error.

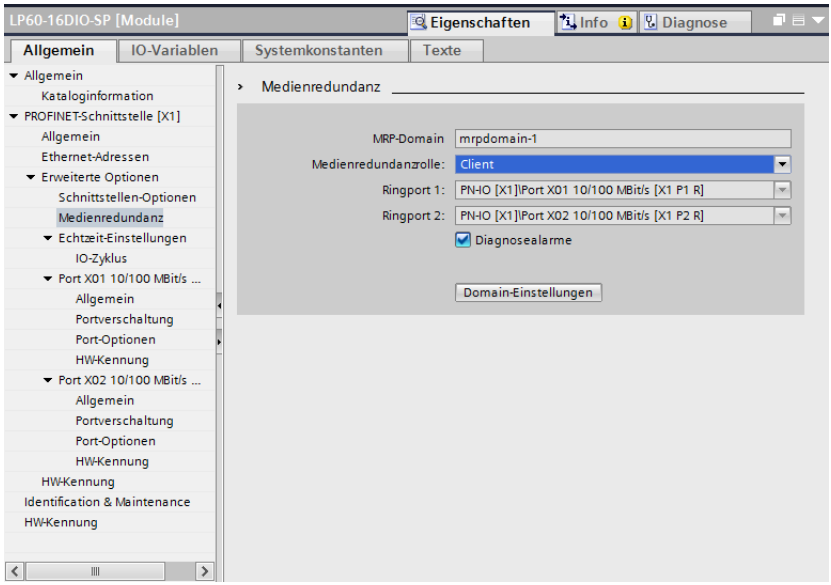
The following conditions must be met to use MRP:

- All devices must support MRP.
- MRP must be enabled on all devices.
- Connections to the devices are only possible via the ring ports. A mesh topology is not permissible.
- A max. of 50 devices are permissible in the ring.
- All devices share the same redundancy domain.
- One device must be configured as the redundancy manager.
- All other devices must be configured as redundancy clients.
- Prioritized boot (FSU) is permissible.
- The response monitoring time for all the devices must be greater than the reconfiguration time (typically 200 ms, min. 90 ms for LioN-P modules).
- It is advisable to use automatic network settings on all devices.

When using MRP ring configuration it is advisable to use the PLC as a redundancy manager and all the other devices as clients. To detect an individual failure, the diagnostics alarms should be activated.

Media redundancy can be configured using a LioN-P module through slot 0 of the device summary.

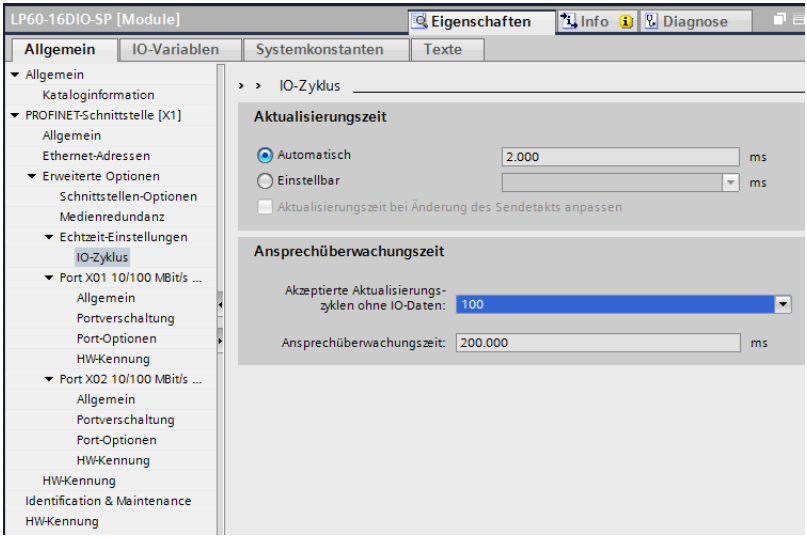
PROFINET interface [X1] > Extended options > Media redundancy



The response monitoring time for LioN-P modules can use

PROFINET interface [X1] > Extended options > Real time settings > IO cycle

for configuration.


LP60-16DIO-SP [Module]
Eigenschaften
Info
Diagnose
Allgemein
IO-Variablen
Systemkonstanten
Texte
Allgemein
Kataloginformation
PROFINET-Schnittstelle [X1]
Allgemein
Ethernet-Adressen
Erweiterte Optionen
Schnittstellen-Optionen
Medienredundanz
Echtzeit-Einstellungen
IO-Zyklus
Port X01 10/100 MBit/s ...
Allgemein
Portverschaltung
Port-Optionen
HW-Kennung
Port X02 10/100 MBit/s ...
Allgemein
Portverschaltung
Port-Optionen
HW-Kennung
HW-Kennung
Identification & Maintenance
HW-Kennung
IO-Zyklus
Aktualisierungszeit
Automatisch
2.000
ms
Einstellbar
ms
Aktualisierungszeit bei Änderung des Sendetakts anpassen
Ansprechüberwachungszeit
Akzeptierte Aktualisierungs-zyklen ohne IO-Daten:
100
Ansprechüberwachungszeit:
200.000
ms

6 Assignment of Process Data

This chapter describes the assignment of controller process data to the I/O channels in slot 1 and the 16DI/DO DCU extension in slot 2 and 3 of the LioN-P modules.

6.1 16DI Modules

- 0980 ESL 301-xxx
- 0980 ESL 391-xxx

6.1.1 Input Data

This module provides two bytes of input data that reflect the current status of the input 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

Table 6: Slot 1

The following applies here:

- 1A...8A: Actual status of input channel A (contact pin 4) of the M12 socket connections 1 to 8.
- 1B...8B: Actual status of input channel B (contact pin 2) of the M12 socket connections 1 to 8.

6.2 16DO Modules

- 0980 ESL 302-xxx
- 0980 ESL 392-xxx

6.2.1 Input Data

This module provides two bytes of input data that reflect the current 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

Table 7: Slot 1

The following applies here:

- 1A...8A: Actual status of output channel A (contact pin 4) of the M12 socket connections 1 to 8.
- 1B...8B: Actual status of output channel B (contact pin 2) of the M12 socket connections 1 to 8.

6.2.2 Output Data

This module provides two bytes of status information for 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

Table 8: Slot 1

The following applies here:

- 1A...8A: Target status of output channel A (contact pin 4) of the M12 socket connections 1 to 8.
- 1B...8B: Target status of output channel B (contact pin 2) of the M12 socket connections 1 to 8.

6.3 8DI/8DO Modules

- 0980 ESL 303-xxx
- 0980 ESL 393-xxx
- 0980 ESL 393-xxx-DCU1

6.3.1 Input Data

This module provides two bytes of input data that reflects the current 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

Table 9: Slot 1

The following applies here:

- 1A...4A: Actual status of input channel A (contact pin 4) of the M12 socket connections 1 to 4.
- 1B...4B: Actual status of input channel B (contact pin 2) of the M12 socket connections 1 to 4.
- 5A...8A: Actual status of output channel A (contact pin 4) of the M12 socket connections 5 to 8.
- 5B...8B: Actual status of output channel B (contact pin 2) of the M12 socket connections 5 to 8.

6.3.2 Output Data

This module provides one byte of status information for 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

Table 10: Slot 1

The following applies here:

- 5A...8A: Target status of output channel A (contact pin 4) of the M12 socket connections 5 to 8.
- 5B...8B: Target status of output channel B (contact pin 2) of the M12 socket connections 5 to 8.

6.4 16DI/DO Modules

- 0980 ESL 300-xxx
- 0980 ESL 390-xxx
- 0980 ESL 390-xxx-DCU1

The data structure for the process data in slot 1 is dependent on the IO mapping used. LioN-P DCU modules have an extended process data area in slot 2 and 3. This is therefore listed here as an option. Further details on using the extended process data area are available in the µDCU Manual.

The following figures refer to the default settings for each of the profiles.

6.4.1 Input Data Profile 16DI/DO (Default Profile)

This module provides two bytes of input data that reflect the current 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

Table 11: Slot 1

The following applies here:

- 1A...8A: Actual status of input/output channel A (contact pin 4) of the M12 socket connections 1 to 8.
- 1B...8B: Actual status of input/output channel B (contact pin 2) of the M12 socket connections 1 to 8.

6.4.2 Output Data Profile 16DI/DO (Default Profile)

This module provides two bytes of status information for 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

Table 12: Slot 1

The following applies here:

- 1A...8A: Target status of output channel A (contact pin 4) of the M12 socket connections 1 to 8.
- 1B...8B: Target status of output channel B (contact pin 2) of the M12 socket connections 1 to 8.

6.4.3 Input Data Profile 8DI/DO

This module provides one byte of input data that reflects the current 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	8A	7A	6A	5A	4A	3A	2A	1A

Table 13: Slot 1

The following applies here:

- 1A...8A: Actual status of input/output channel A (contact pin 4) of the M12 socket connections 1 to 8.

6.4.4 Output Data Profile 8DI/DO

This module provides one byte of status information for control of the digital outputs.

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

Table 14: Slot 1

The following applies here:

- 1A...8A: Target status of output channel A (contact pin 4) of the M12 socket connections 1 to 8.

6.4.5 Input Data Profile 16DI

This module provides two bytes of input data that reflect the current status of the input 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

Table 15: Slot 1

The following applies here:

- 1A...8A: Actual status of input channel A (contact pin 4) of the M12 socket connections 1 to 8.
- 1B...8B: Actual status of input channel B (contact pin 2) of the M12 socket connections 1 to 8.

6.4.6 Input Data Profile 8DI

This module provides 1 byte of input data that reflects the current status of the input channels.

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

Table 16: Slot 1

The following applies here:

- 1A...8A: Actual status of input channel A (contact pin 4) of the M12 socket connections 1 to 8.

6.4.7 Output Data Profile 16DO

This module provides two bytes of status information for 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

Table 17: Slot 1

The following applies here:

- 1A...8A: Target status of output channel A (contact pin 4) of the M12 socket connections 1 to 8.
- 1B...8B: Target status of output channel B (contact pin 2) of the M12 socket connections 1 to 8.

6.4.8 Output Data Profile 8DO

This module provides one byte of status information for control of the digital outputs.

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

Table 18: Slot 1

The following applies here:

- 1A...8A: Target status of output channel A (contact pin 4) of the M12 socket connections 1 to 8.

6.4.9 Input Data Profile 8DI/8DO

This module provides one byte of input data that reflects the current status of the input 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

Table 19: Slot 1

The following applies here:

- 1A...4A: Actual status of input channel A (contact pin 4) of the M12 socket connections 1 to 4.
- 1B...4B: Actual status of input channel B (contact pin 2) of the M12 socket connections 1 to 4.

6.4.10 Output Data Profile 8DI/8DO

This module provides one byte of status information for 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

Table 20: Slot 1

The following applies here:

- 5A...8A: Target status of output channel A (contact pin 4) of the M12 socket connections 5 to 8.
- 5B...8B: Target status of output channel B (contact pin 2) of the M12 socket connections 5 to 8.

6.4.11 Input Data DCU Extension

The DCU extension provides 16 bit input data in slot 2 and 8 INT input data in slot 3.

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n Byte n + 1	16 bit I/O DCU extension							

Table 21: Slot 2 (only LioN-P DCU modules)

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n Byte n + 1	INT I/O DCU extension							

Input	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte n + 14 Byte n + 15	INT I/O DCU extension							

Table 22: Slot 3 (only LioN-P DCU modules)

The following applies here:

- 16 bit I/O DCU extension: Bit states as DCU output data
- INT I/O DCU extension: 8 word data types as DCU output data (e.g. for transferring counter states)

6.4.12 Output Data DCU Extension

The DCU extension provides 16 bit output data in slot 2 and 8 INT output data in slot 3.

Output	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Byte n Byte n + 1	16 bit I/O DCU extension

Table 23: Slot 2 (only LioN-P DCU modules)

Output	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Byte n Byte n + 1	INT I/O DCU extension
.	
.	
Byte n + 14 Byte n + 15	INT I/O DCU extension

Table 24: Slot 3 (only LioN-P DCU modules)

The following applies here:

- 16 bit I/O DCU extension: Bit states as DCU input data
- INT I/O DCU extension: 8 word data types as DCU input data (e.g. for transferring program parameters)

7 Diagnostic Properties of the Modules

The modules provide advanced diagnosis behavior, in particular for the output channels to determine errors in the transmission. The firmware of the modules differentiates between five distinct types of error.

7.1 Channel Error

A channel error is determined by comparing the target value set by a controller and the actual value of the output channel.

Target value	Actual value	Comment
Active	Active	OK, no diagnosis
Off	Off	OK, no diagnosis
Active	Off	Short circuit, channel indicator is red. Channel error bit in the diagnosis is set. Channel is locked after error is removed.
Off	Active	Voltage fed back in, red and yellow/white channel indicators are activated. Channel error bit in the diagnosis is set.

Table 25: Interpretation of channel errors

Attention: If both output channels of an M12 slot are activated when a channel error occurs, the controller locks both channels, even if only one channel is affected by the error. If only one channel is activated, the controller only locks this one. Locked channels are deactivated and remain in the Off state if you do not reset them using the controller.

When an output channel is activated (rising edge of the channel state) or deactivated (falling edge), the channel errors are filtered for the period that you set using the "Surveillance Timeout" parameter during the configuration

of the module. The value of this parameter can range from 0 to 255 ms; the factory setting is 80 ms.

The filter is used to avoid premature error messages when a capacitive load is activated or an inductive load is deactivated, and during other voltage peaks when a status changes.

When a channel is in the static state – that is, when it is permanently activated or deactivated – the controller uses a fixed specified duration of 100 ms for filtering the error message.

7.2 Voltage Errors at M12 Slots (Sensor Short Circuit)

On each M12 input connector of the modules, contact 1 provides a 24 V potential for power supply. This potential is obtained from the system/sensor voltage U_S and monitored.

In the case of a sensor short-circuit, a voltage error is reported. Both channel indicators of the M12 input socket light up red, and the relevant error bit for the sensor short-circuit is set in the diagnosis bytes.

The error message is filtered by the "Surveillance Timeout" parameter. The same parameters as for the channel errors are also used for the voltage errors.

7.3 Overload of Output Drivers

The output drivers of the modules with output functions (variants 16DO, 8DI/8DO and 16DI/DO) report an error when they detect an overload. This error is reported by setting the relevant channel error bits in the diagnosis bytes.

Target value	Actual value	Comment
Active	Active	OK, no diagnosis
Off	Off	OK, no diagnosis
Active	Off	Short circuit, channel indicator is red. Channel error bit in the diagnosis is set. Channel is locked after error is removed.
Off	Active	Voltage fed back in, red and yellow/white channel indicators are activated. Channel error bit in the diagnosis is set.

Table 26: Interpretation of channel errors

Attention: If both output channels of an M12 slot are activated when a channel error occurs, the controller locks both channels, even if only one channel is affected by the error. If only one channel is activated, the controller only locks this one. Locked channels are deactivated and remain in the Off state if you do not reset them using the controller.

If there is an overload, the status indicator of the active output channel lights up red. If both output channels of an M12 slot are active during an overload, both status indicators light up red.

A channel error alarm is sent to the PROFINET I/O controller.

The overload error is filtered by the "Surveillance Timeout" parameter. The identical "Surveillance-Timeout" parameter setting applies for the channel, voltage and overload errors, which are explained in the 7.1 and 7.2 chapters.

7.4 Error in Actuator Power Supply

The voltage value at the connections for the power supply of the actuators is monitored globally and at the module level.

If the actuator power supply U_L goes outside the voltage range of 18 to 30 V, an error is reported. The U_L indicator lights up red, and the actuator undervoltage bit is set in the module information byte.

Attention: Every output channel that is active at the same time as the error occurs in supply voltage U_L is locked. This means that for correct operation, the output channel must be reset by the controller when the status of the supply voltage U_L has normalized again. We recommend deactivating all output channels with the controller as soon as the undervoltage is detected. Otherwise, because it is locked, every active output channel will report a diagnosis when the voltage value has normalized again.

The error message is filtered by means of a fixed filter period of 300 ms.

7.5 Error in System/Sensor Power Supply

The voltage value for the system/sensor power supply is also monitored globally. If the value goes outside the voltage range of 18 to 30 V, an error message is created.

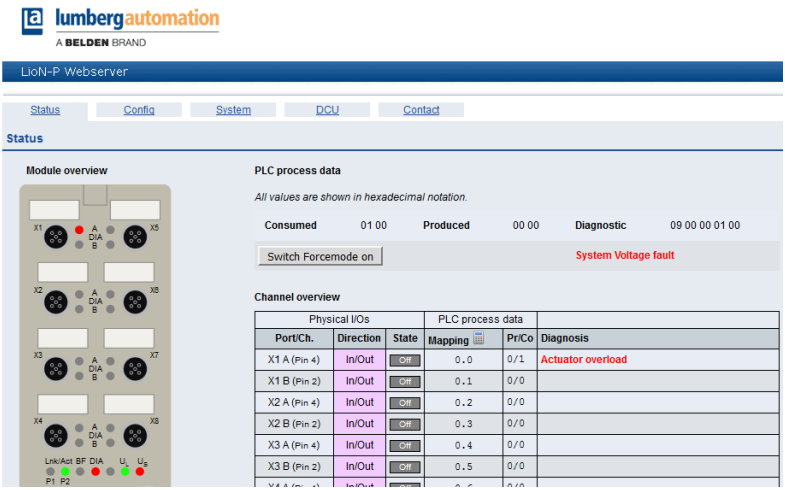
The U_S indicator lights up red and the sensor undervoltage bit is set in the module information byte.

The error message has no effect on the outputs and is not filtered, but is reported immediately.

Caution: It must always be ensured that the supply voltage measured at the most remote participant does not drop below 18 V DC from the perspective of the system power supply.

7.6 Diagnostic Display in Integrated Web Server

The LioN-P modules display the channel and module status as well as the fault diagnosis on the status page of the integrated web server in clear text and also in hexadecimal notation. For information on opening the status page, please refer to the chapters of this manual that follow.



Up to 5 bytes of diagnostics data can be shown in the process data area of the status page, depending on the module involved. The diagnostic bytes are structured as follows, going from the left to the right:

7.6.1 16DI Modules

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	IME	FM	0	0	0	SC	0	LV-U_S
Byte 1	X8	X7	X6	X5	X4	X3	X2	X1

Table 27: Bit assignment for the 16DI modules

7.6.2 16DO Modules

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	IME	FM	0	0	AC	0	LV-U_L	LV-U_S
Byte 1	0	0	0	0	0	0	0	0
Byte 2	0	0	0	0	0	0	0	0
Byte 3	X4-B	X4-A	X3-B	X3-A	X2-B	X2-A	X1-B	X1-A
Byte 4	X8-B	X8-A	X7-B	X7-A	X6-B	X6-A	X5-B	X5-A

Table 28: Bit assignment for the 16DO modules

7.6.3 8DI/8DO Modules

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	IME	FM	0	0	AC	0	LV-U_L	LV-U_S
Byte 1	0	0	0	0	X4	X3	X2	X1
Byte 2	0	0	0	0	0	0	0	0
Byte 3	X8-B	X8-A	X7-B	X7-A	X6-B	X6-A	X5-B	X5-A

Table 29: Bit assignment for the 8DI/8DO modules

7.6.4 16DI/DO Modules

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	IME	FM	0	0	AC	SC	LV-U_L	LV-U_S
Byte 1	X8	X7	X6	X5	X4	X3	X2	X1
Byte 2	0	0	0	0	0	0	0	0

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 3	X4-B	X4-A	X3-B	X3-A	X2-B	X2-A	X1-B	X1-A
Byte 4	X8-B	X8-A	X7-B	X7-A	X6-B	X6-A	X5-B	X5-A

Table 30: Bit assignment for the 16DI/DO modules

7.6.5 Key

- LV-U_S: Undervoltage of sensor supply U_S
- LV-U_L: Undervoltage of actuator supply U_L
- SC: Sensor short-circuit
- AC: Actuator short-circuit
- FM: Force Mode activated
- IME: Internal module error
- X1...X8: M12 slot with diagnostics
- X1-A...X8-A: M12 slot, channel A
- X1-B...X8-B: M12 slot, channel B

7.7 Alarm and Error Messages of LioN-P/-R Modules via PROFINET

Attention: Alarm and error messages are only transmitted via PROFINET when the parameter for diagnostics is activated in the configuration of the modules in the controller.

If the LioN-P modules detect an error condition, an alarm message will be triggered. The modules support diagnostic alarms. Diagnostic alarms are triggered in case of peripheral faults such as overload, short-circuit, and undervoltage.

An alarm is triggered in case of an incoming event (such as sensor short-circuit) as well as an outgoing event.

The evaluation of the alarms depends on the PROFINET I/O controller used.

7.7.1 Alarm Assessment in TIA Portal

In the TIA Portal, the user program execution is interrupted by triggering a diagnostic alarm, and a diagnostic block is activated. The following blocks are used:

Cause of the alarm	OB call
Peripheral error (short-circuit, overload, wire breakage, undervoltage of an I/O module)	OB B2
Complete failure of the system	OB B6

Initial information on the cause of the error and error type is already delivered based on the OB activated and its start information. You can receive more detailed information about the error event in the error OB by activating SFB 54 RALRM (read supplementary alarm information). For this, SFB 54 must be activated in every error OB.

If the error OB activated does not exist in the CPU, the CPU goes into the STOP operating state.

It is also possible to activate a diagnostic data record using its data record number with the system function block SFB 52 “RDREC” in OB 1.

7.7.2 Structure of Diagnostic Data Records

For the presentation of the diagnostic data records, the block version 0x0101 and the format identifier (USI, user structure identifier) 0x8000 is used.

The "ChannelNumber" and "ChannelError" data values have the following values, depending on the error that has occurred:

Error type	Reference	Channel Number	Channel Error Type
Undervoltage of sensor or actuator supply	Module	0x8000	0x0002
Sensor short-circuit	M12 slot	0x0001 to 0x0008 (Number of M12 slot)	0x0102
Actuator short-circuit	Channel A of an M12 slot	0x0001 to 0x0008 (Number of M12 slot)	0x0100
Actuator short-circuit	Channel B of an M12 slot	0x0001 to 0x0008 (Number of M12 slot)	0x0101

In case of an accumulation of errors, the Channel diagnostics section is repeated with the "ChannelNumber", "ChannelProperties", and "ChannelErrorType" data values for each error in the diagnostics data record.

To display diagnoses when in the TIA Portal online use the project navigation to select the malfunctioning LioN-P module in the decentralized periphery and click on the Maintenance symbol to open online diagnosis for slot 1.

Using

Diagnosis > **Channel diagnosis**

enables you to display pending module diagnoses.

8 Integrated Web Server

The LioN-P/-R modules are equipped with an integrated web server which makes functions available for the configuration of modules and display of status and diagnostic information.

A standard web browser can be used to access the provided functions through an existing TCP/IP connection.

To use the web server, the modules need their own IP address. In accordance with the PROFINET standard, all PROFINET I/O devices are shipped with the IP address 0.0.0.0. Consequently, the modules must be assigned a free IP address that differs from the factory setting prior to use of the web server.

If the PROFINET I/O controller assigns the IP address itself, the assigned IP address can be used to call the web server.

8.1 Start Page/Status Page (Status)

In the address line of your web browser enter http://, followed by the IP address, e.g. http://192.168.1.1. If the module start page doe snot open, check your browser and firewall settings.

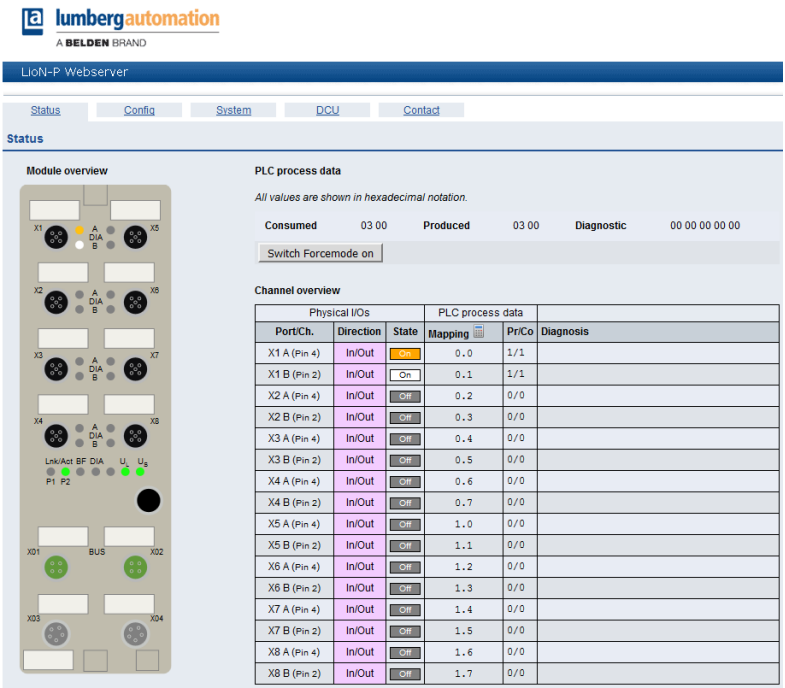
This website shows the current status of the overall module and the respective status of the individual channels. Pending diagnoses are notified as for the controller.

The "Consumed/Produced" process data including the "Diagnostic" diagnosis are shown as hexadecimal in the PLC process data as well as graphically in the Module overview and Channel overview areas. The diagnosis coding is available in the "Diagnosis display in integrated web server" chapter.

The Channel overview table is broken down into three different areas. The status of the physical input and output data for the channels as well as the process data sent to and received from the controller is displayed. Channel errors are registered in the last column.

In the LioN-P modules the channel direction, the current channel status, the IO mapping configured through the controller as well as the currently mapped process data (Pr/Co) for a channel are displayed.

Pressing the Calculator symbol enables the mapping values to be assigned as an overview to the input and output addresses from the controller. Changes to the IO mapping can only be made in 16DI/DO modules through the controller.



8.1.1 Force Mode

Force Mode can be a highly useful instrument when starting up a machine or when troubleshooting inside a machine. The data for the input and output channels can be overwritten and independently set through the web server. Therefore, each output can be manually set and each input simulated irrespective of the process data.

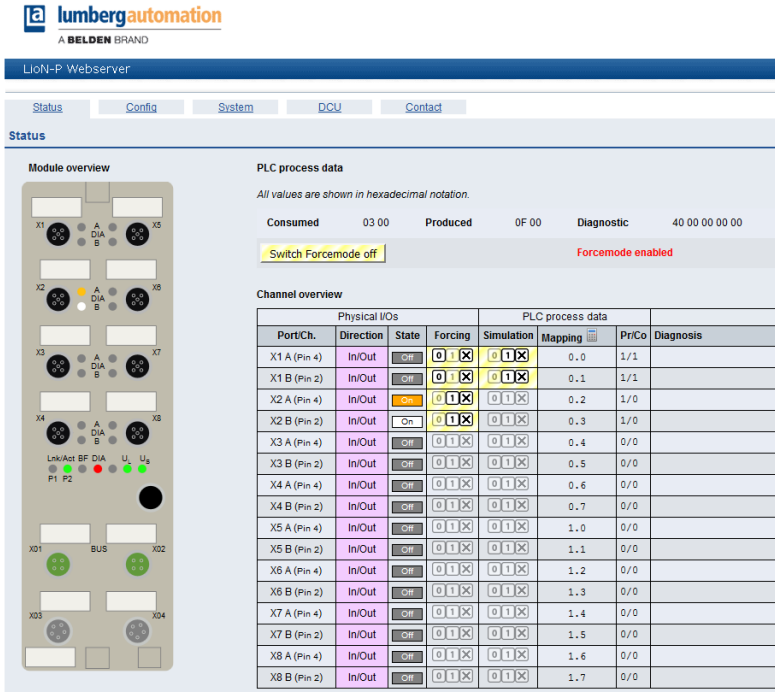
The Switch Force Mode On button activates Force Mode. This can generally be used in offline mode (without any connection to the controller) as well as in the online mode (with connection to controller). If the status page or the web server is exited, Force Mode is automatically switched off.

If Force Mode is activated in the offline mode through the web server, then a connection cannot be made to the controller.

To use Force Mode in the online mode the web interface and Force Mode have to be activated through the controller parameterization.

If Force Mode is activated in online mode through the web server, Force Mode is automatically switched off if the failsafe is actuated (connection interruption, controller to STOP, internal module error).

User authentication must be entered to use Force Mode. Users can be created and edited using the System page. The Admin user uses "private" as the default password.

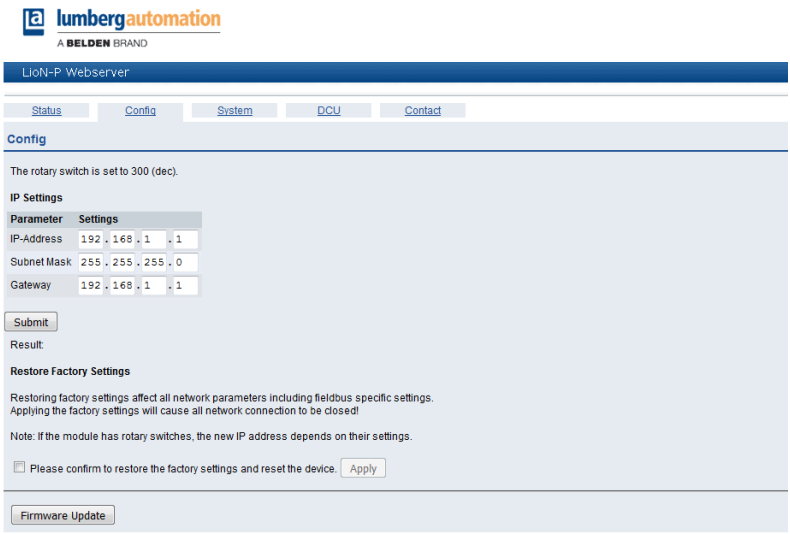


The 0 and 1 buttons in the Forcing column can be used to set the physical output data for the individual channels. The X button cancels Forcing for the corresponding channel.

In a similar manner, the Simulation column can be used to simulate the input data of the individual channels before mapping into the process data.

8.2 Configuration Page (Config)

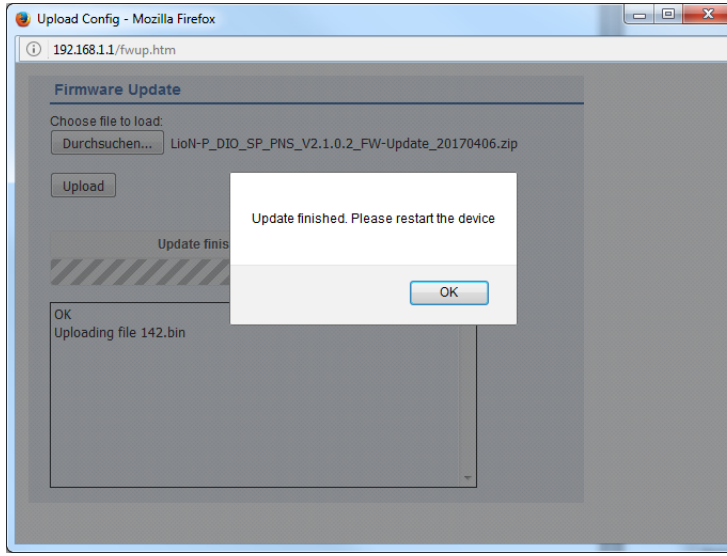
When the **Config** menu item in the Web server menu bar is selected, the Configuration page opens. Network parameters such as the IP address can be configured here and the LioN-P module reset to factory settings. Executed actions must be confirmed using the **Submit** or **Apply** button.



Attention: Please note that if you reset the modules to the factory settings, the PROFINET name and IP address are also reset to the default values. It may not be possible to access the web server of the modules and exchange data in the PROFINET network after the reset.

If the firmware of the LioN-P module is updated, this can be done using the **Firmware Update** button. Select the corresponding ZIP file and conform the procedure with the **Upload** button.

Do not interrupt the update procedure. Once the firmware update is completed you are prompted to restart the LioN-P module.



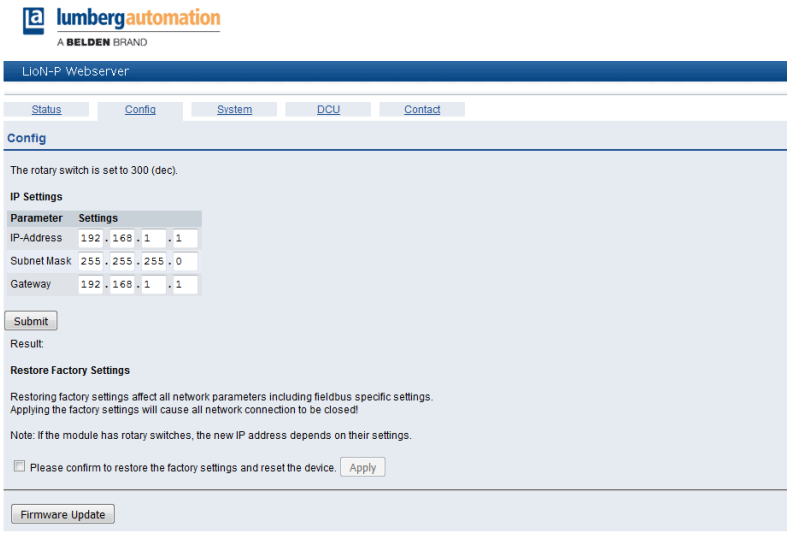
8.2.1 Firmware Update for PROFINET

8.2.1.1 Requirements

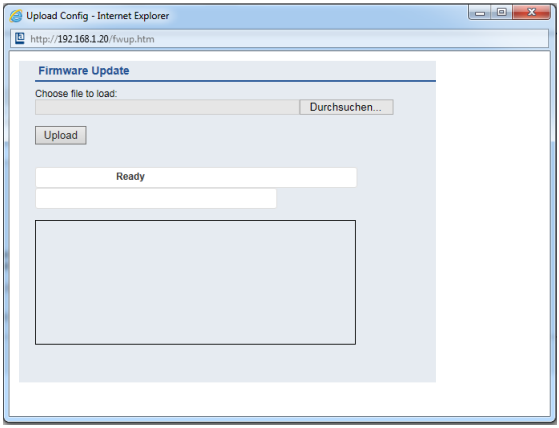
- PC with network interface
- Web browser (e.g. www.mozilla.org)

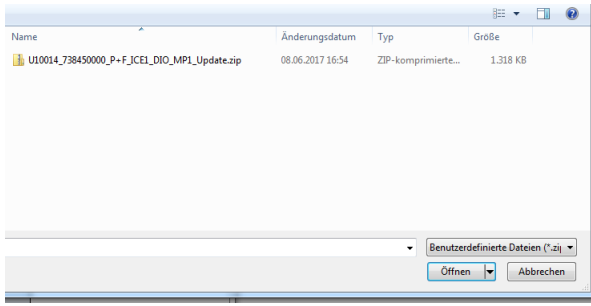
8.2.1.2 Performing Update

1. Reset into delivery status by setting the address switch to 979 and by running a power restart of the module. A period of 10 seconds should be waited (during the restart procedure the red BF/MS LED flashes on and off cyclically three times until the restart is completed / The 1st step is only necessary if the module was already operated on a PLC).
2. Set the IP address on the PC network interface (e.g. 192.168.001.050, different from the IO module).
3. Set the IP address on the IO module using a configuration tool (e.g. Hilscher Config Tool) over DCP to 192.168.001.001 and run a power restart of the module.
4. Open the WEB page http://192.168.1.1 in the browser.
5. Select Config tab on WEB page.
6. Select and click the Firmware Update button.

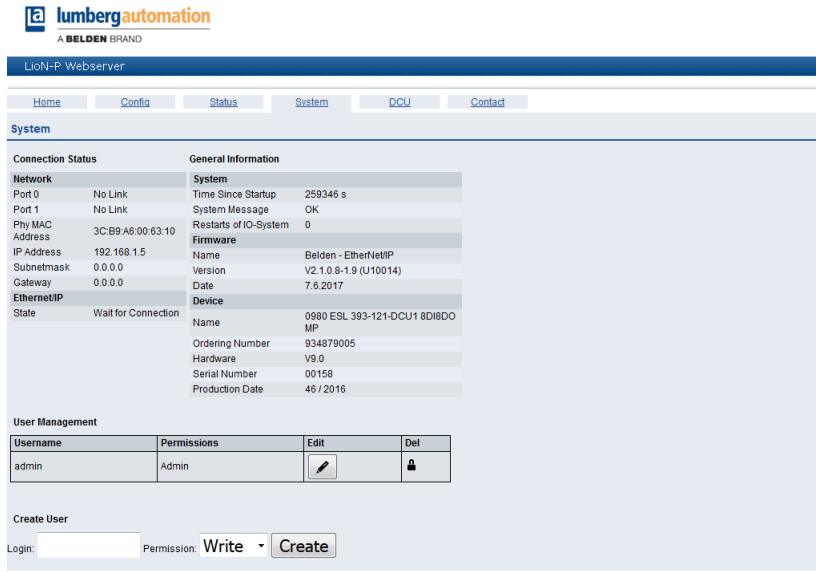


7. Select new Update ZIP file on your local drive path to start the update. Clicking Search, marking and then double-clicking the selected ZIP file before then clicking the Upload button starts the update.





8. The firmware transfer lasts roughly 30 seconds (The procedure is visualized).
9. Close display “Update finished. Please restart the device” by clicking the OK button.
10. Run power restart of module.
11. The module is written with the new firmware version.
12. To check the result call up the system WEB page http://192.168.1.1.
13. Selecting the System tab enables you to make sure that the version number and the date of the new firmware version match.



14. Reset into delivery status by setting the address switch to 979 and by running a power restart of the module. A period of 10 seconds should be waited (during the restart procedure the red BF/MS LED flashes on and off cyclically three times until the restart is completed)
15. Set the address switch to 000.
16. The firmware update is completed and the module was reset to the delivery condition.

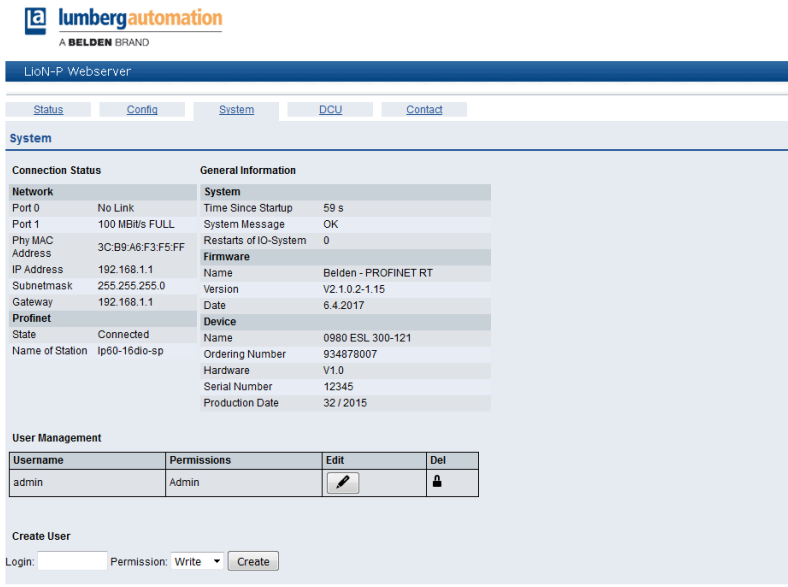
8.3 System Page

When the System menu item in the Web server menu bar is selected, the System page opens. On this page in the **Connection Status** area, the current status of both Ethernet ports is displayed with regard to the connection, transfer rate and transfer mode as well as the network parameters and the PROFINET status of the LioN-P module.

The **General Information** area contains the system-related information on the runtime, the Firmware version used and the LioN-P module's manufacturing details.

In User Management passwords of created users can be changed using the **Edit** button. The **Create User** area can be used to add users with **Write** or **Admin** permissions. Only access with **Admin** permission enables new users to be created or passwords to be changed.

The status information on this page is updated in a web browser only after reopening or refreshing of the page.

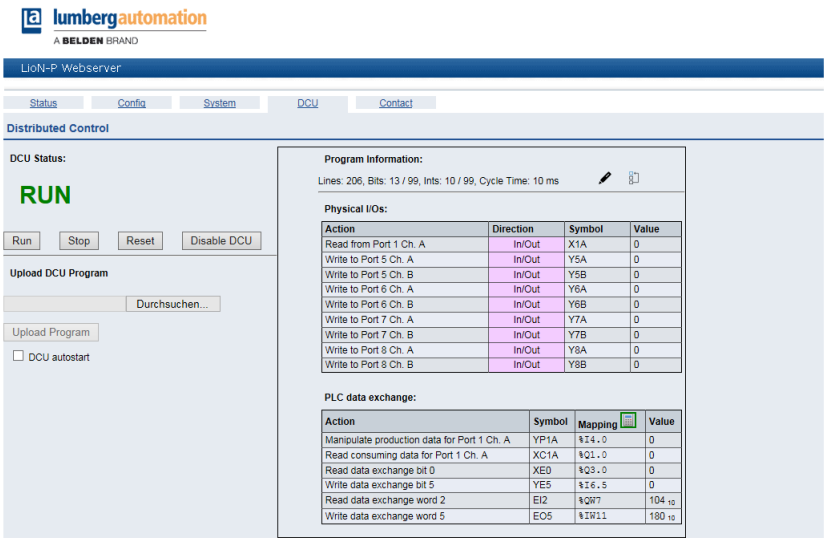


8.4 Distributed Control Page (DCU)

The **Distributed Control** function is an optional extension and it is only supported by LioN-P modules 0980 ESL 390-121-DCU1 and 0980 ESL 393-121-DCU1.

This function enables control and monitoring tasks to be executed directly on the device using a DCU program. The LioN-P module can supply status information to a higher-level PLC (online mode) or be operated independently without bus communication (offline mode).

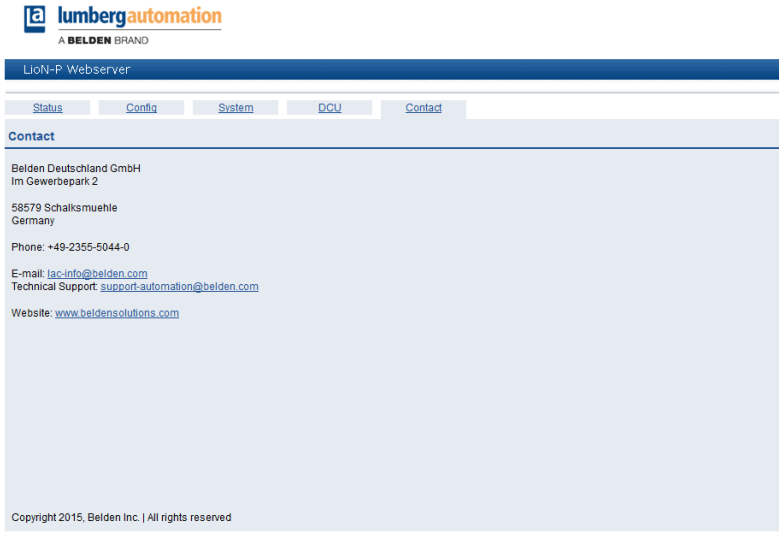
Further details are available in the µDCU Manual.



LioN-P modules without a DCU function on this website do not display any useful information.

8.5 Contact Page

When the **Contact** menu item in the Web server menu bar is selected, the Contacts page opens. This provides information on the contact data for Belden Deutschland GmbH.



8.6 Reading the process and diagnostic data

Request	Method http GET
Request URI	/info.json
Response format	JSON

Example JSON response


```
{“name”: “0980 ESL 390-121-DCU1”,“fw-version”: “V2.1.0.2-2.0”,
“hw-version”:“V1.0”, “mac”: “3C:B9:A6:00:17:00”,“bus”: 0,“failsafe”: 0,
“inputs”:[3,0],“outputs”: [0,0],“consuming”: [0,0],“producing”:
[0,0],“Diag”:[0,0,0,0],“dcu”: {“state”: 1,“autostart”: 0,“public”:
[0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0],
“consuming_bits”:[0,0],“consuming_ints”: [0,0,0,0,0,0,0,0],
“producing_bits”:[0,0],“producing_ints”:[0,0,0,0,0,0,0,0]}}
```


▼ object {11}
name : 0980 ESL 300-121-DCU1
fw-version : F10014
hw-version: : 4.1
mac : 3C:B9:A6:00:17:00
bus : 0
▶ inputs [2]
▶ outputs [2]
▶ consuming [2]
▶ producing [2]
▶ diag [4]
▼ dcu {7}
state : 0
autostart : 0
▶ public [6]
▶ consuming_bits [2]
▶ consuming_ints [8]
▶ producing_bits [2]
▶ producing_ints [8]

Fieldname	Data type	Description
sysName	String	Name of the module
fw-version	String	Firmware version
hw-version	String	Hardware version
mac	String	MAC address of the module
bus	Number	0 = Not connected to fieldbus 1 = Connected to fieldbus
failsafe	Number	0 = Normal output operation 1 = Outputs in failsafe state
inputs	Number[2]	LSB = Physical input state port X1-X4 MSB= Physical input state port X5-X8
Outputs	Number[2]	LSB = Physical output state port X1-X4 MSB= Physical output state port X5-X8
Consuming	Number[2]	Consuming data from PLC
Producing	Number[2]	Producing data to PLC
Diag	Number[4]	Contains diagnostic information of the module Byte 0: ▶ Bit 0 = System/sensor voltage supply fault (U_S) ▶ Bit 1 = Actuator voltage supply fault (U_L) ▶ Bit 2 = Sensor short circuit detected ▶ Bit 3 = Actuator overload ▶ Bit 6 = Forcemode active ▶ Bit 7 = Internal module fault (IO data invalid) Byte 1 = Sensor short circuit port 1-8 Byte 2 = Actuator short circuit port 1-4 (channel A, B) Byte 3 = Actuator short circuit port 5-8 (channel A, B)
DCU	Object	(only available on DCU modules)
DCU/state	Number	Current state of the DCU: ▶ 0 = LOCKED ▶ 1 = NO PROGRAM ▶ 2 = DISABLED ▶ 3 = STOP ▶ 4 = RUN ▶ 5 = ERROR
DCU/autostart	Number	Is 1 if the local autostart is enabled

Fieldname	Data type	Description
DCU/public	Number[32]	Contains all values of the DCU public variables _P0 - _P31
DCU/ consuming_bits	Number[2]	16 DCU exchange bits set by PLC
DCU/ producing_bit	Number[2]	16 DCU exchange bits set by DCU program
DCU/ consuming_ints	Number[8]	16 DCU exchange words (16-bit signed integer) set by PLC
DCU/ producing_ints	Number[8]	16 DCU exchange words set by DCU program

Table 31: JSON response description

9 Technical Data

9.1 General

Protection class (This only applies if the connectors are screwed together or if protective caps are used.)[1]	For all Digital LioN-P modules:	IP65, IP67
	Only for modules with M12-L power connector (not for modules with 7/8" power connector):	IP69
Ambient temperature	-25° C to +70° C (-13° F to +158° F)	
Ambient moisture	max. 98% RH (for UL applications max. 80% RH)	
Weight	480 g	
Housing material	Die-cast zinc	
Vibration resistance (oscillation)	15 g / 5-500 Hz	
Shock resistance	50 g / 11 ms	
Torques: M6/M4 fixing screws M12 connector	1.0 Nm 0.5 Nm	

Table 32: General information

1 Not under UL investigation.

9.2 Bus System

Protocol	PROFINET IO RT is supported
GSDML file	LioN-P: GSDML-V2.3x-LumbergAutomation-0980ESL39x-xxx-yyyymmdd.xml
Transfer rate	100 Mbit/s, full duplex
Transmission procedure Autonegotiation	100BASE-TX is supported
Manufacturer ID (Vendor ID)	$0016A_H$
Device ID (DeviceID)	0304_H
Supported Ethernet Protocols	Ping ARP LLDP SNMP (network diagnostics) DCP HTTP TCP/IP
Switch functionality	Integrated IRT is supported
PROFINET interface Autocrossing connections	2 M12-sockets, 4-pin, D-coded (see pin assignments) is supported

Table 33: Information on the bus system

9.3 Power Supply for the Module Electronics/ Sensors

Nominal voltage U_S	24 V DC (SELV/PELV)
Voltage range	18-30 V DC

Power consumption of module electronics	at 24 V DC:	typ. 95 mA
	at 30 V DC:	typ. 120 mA
Voltage level of the sensor power supply	Min. (U_S – 1.5 V)	
Current consumption of sensors	Max. 200 mA (at T_U = 30° C) per port	
Reverse polarity protection	Yes	
Operational indicator (U_S)	LED green:	18 V (+/- 1 V) < U_S < 30 V (+/- 1 V)
	LED red:	U_S < 18 V (+/- 1 V) or U_S > 30 V (+/- 1 V)

Table 34: Information on the power supply for the module electronics/ sensors

9.4 Power Supply for the Actuators

Nominal voltage U_L	24 V DC (SELV/PELV)	
Voltage range	18-30 V DC	
Electric isolation	Yes	
Threshold value of the undervoltage detection	Typ. 17 V	
Delay time for undervoltage detection	< 20 ms	
Reverse polarity protection	Yes	
Operational indicator (U_L)	LED green:	18 V (+/- 1 V) < U_L < 30 V (+/- 1 V)
	LED red:	U_L < 18 V (+/- 1 V) or U_L > 30 V (+/- 1 V)

Table 35: Information on the power supply for the actuators

9.5 Inputs

Input connection	Type 3 as per IEC 61131-2
Nominal input voltage	24 V DC
Input current at 24 V DC	Typically 5 mA
Short-circuit protection	Yes
Channel type	Normally open, p-switching
Number of digital channels	16 with 16DI 0 with 16DO 8 with 8DI/8DO 16 with 16DI/DO
Status indicator	Yellow LED for channel A White LED for channel B
Diagnosis indicator	LED red for each slot

Port	M12 socket, 5-pin See pin assignment

Table 36: Information on the inputs

9.6 Outputs

Each channel can switch a maximum of 2.0 A independently;

port groups X1/X2, X3/X4, X5/X6, X7/X8 (for 8DI8DO only X5/X6, X7/X8) can each be loaded on their 4 channels with max. 6.5 A total.

The entire port group X1...X8 (for 8DI8DO X5...X8) can be loaded with max. 9 A (note derating).

Output specification	Typically 2 A as per IEC 61131-2
Nominal output current per channel: Signal status “1” Signal status “0”	2 A, see Release Notes 1 Max. 2 A (note derating) Max. 1 mA (according to specification)
Signal level of the outputs: Signal status “1” Signal status “0”	 Min. (U_L – 1 V) Max. 2 V
Short-circuit protection	Yes
Max. output current per module	7/8" connectors: As per U_L approval: 9 A (12 A see Release Notes 2), M12 power connector: As per U_L approval: 9 A (16 A per feed point)
Overload protection	Yes
Number of digital channels	0 x at 16DI 16 x at 16DO 8 x at 8DI/8DO 16 x at 16DIO
Channel type	Normally open, p-switching
Status indicator	LED yellow for channel A, LED white for channel B
Diagnostic indicator	LED red for channel
Port	M12 socket, 5-pin See pin assignment

Table 37: Release notes on the outputs

Info 1:

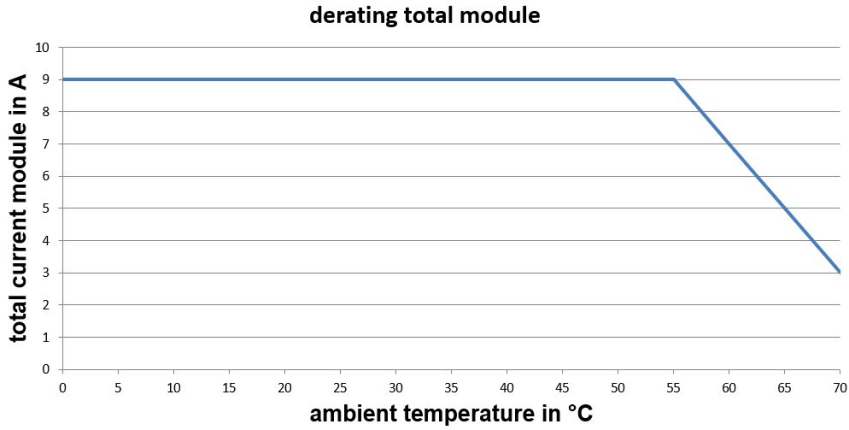
- With inductive loads of consumption category DC13 (EN60947-5-1), the outputs can provide currents of 1.6 A at a frequency of 1 Hz.

Info 2:

- Technically possible and approved under the following conditions:
  - Looped sensor/system power supply max. 2.5 A
  - Power supply cable STL 204 (5 x 1.0 mm^2)
  - Ambient temperature max. 40° C

9.6.1 Derating

Depending on the temperature, the module can be loaded with the following maximum total output current of the outputs:



For applications with ambient temperatures higher than +55° C, a power supply cable (M12-L) with 2.5 mm^2 must be used.

9.7 LEDs

U_S	Green	System/sensor power supply, voltage level 18 V (+/- 1 V) < U_S < 30 V (+/- 1 V)
	Red	System/sensor power supply, voltage level U_S < 18 V (+/- 1 V) or U_S > 30 V (+/- 1 V)
	Off	No system/sensor power supply
U_L	Green	Actuator power supply, voltage level 18 V (+/- 1 V) < U_L < 30 V (+/- 1 V)
	Red	Actuator power supply, voltage level U_L < 18 V (+/- 1 V) or U_L > 30 V (+/- 1 V)
	Off	No actuator power supply
X1…X8 A	Yellow	Channel status A "On"
DIA	Red	Periphery error (sensor or actuator overload/short-circuit)
	Off	Not connected, status "Off", no error
X1…X8 B	White	Channel status B "On"
	Red	Periphery error (actuator overload/short-circuit)
	Off	Not connected, status "Off", no error
P1 Lnk/Act	Green	Ethernet connection exists to another subscriber. Link connection created.
P2 Lnk/Act	Flashing yellow	Data exchange with another subscriber.
	Off	No connection to another subscriber. No link, no data exchange.
BF	Red	No configuration, no or slow physical connection
	Red flashing at 2 Hz	No data exchange
	Off	No error
DIA	Red	Watchdog timeout; diagnostics present; system error
	Red flashing at 2 Hz, 3 sec	DCP signal service is initiated via the bus

	Off	No error message exists
DCU/FM	Blue	DCU program stop
	Blue flashing at 1 Hz	DCU program run
	Off	DCU/FM off
	Red flashing at 1 Hz	DCU error
	Blue/red flashing	ForceMode active

Table 38: Information on the LED colors