BNI PNT-538-105-Z063

IP67 Module

User's Guide

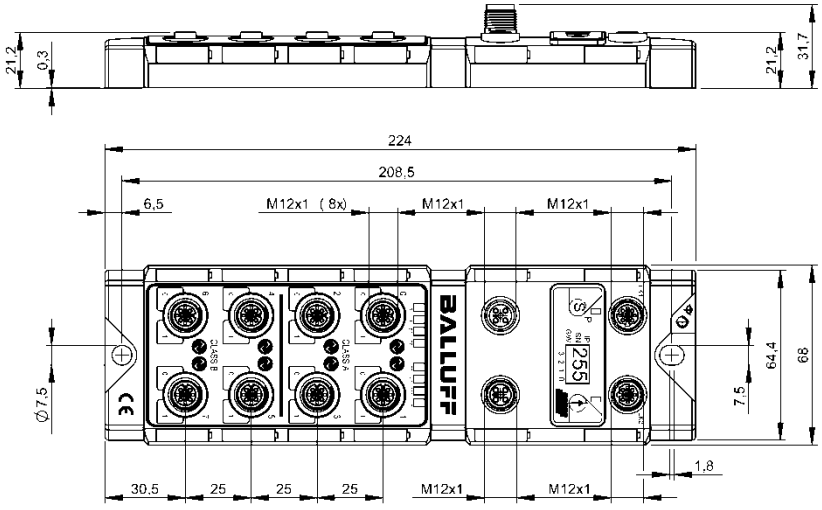


Table of Contents

1 General

1.1. Structure of the guide

This guide is arranged so that one chapter builds upon the other.
Chapter 1: General
Chapter 2: Basic safety instructions
……

1.2. Typographical Conventions

The following typographical conventions are used in this manual.

Enumerations

Enumeration is shown in the form of bulleted lists.

- Entry 1
- Entry 2

Actions

Action instructions are indicated by a preceding triangle. The result of an action is indicated by an arrow.

➢ Action instruction 1
↳ Result of action
➢ Action instruction 2

Actions can also be indicated as numbers in parentheses.

(1) Step 1
(2) Step 2
(3)

Syntax

Numbers:
Decimal numbers are shown without additional information (e.g. 123),
Hexadecimal numbers are shown with the additional indicator hex (e.g., 00_{hex}) or the prefix "0x" (e.g., 0x00).

Cross-references

Cross-references indicate where additional information on the topic is located.

1.3. Symbols

Note
This symbol indicates general notes.

Attention!
This symbol indicates a security notice which must be observed.

1.4. Abbreviations

BNI	Balluff Network Interface
I	Standard input port
PNT	ProfiNet™
EMC	Electromagnetic Compatibility
FE	Function earth
O	Standard output port
US	Sensor supply undervoltage
UA	Actuator supply undervoltage

1.5. Deviating views

Product views and illustrations in this manual may differ from the actual product. They are intended only as illustrative material.

2 Safety

2.1. Intended use

The BNI PNT-… is a decentral IO-Link, input module for connecting to a ProfiNet™ network.

2.2. Installation and Startup

Attention!
Installation and startup are to be performed by trained technical personnel only. Skilled specialists are people who are familiar with the work such as installation and the operation of the product and have the necessary qualifications for these tasks. Any damage resulting from unauthorized tampering or improper use shall void warranty and liability claims against the manufacturer. The operator is responsible for ensuring that the valid safety and accident prevention regulations are observed in specific individual cases.

2.3. General Safety Notes

Commissioning and inspection
Before commissioning, carefully read the User's Guide.
The system must not be used in applications in which the safety of persons depends on the function of the device.
Intended use
Warranty and liability claims against the manufacturer shall be rendered void by damage from:

- Unauthorized tampering
- Improper use
- Use, installation or handling contrary to the instructions provided in this User's Guide.

Obligations of the owner/operator
The device is a piece of equipment in accordance with EMC Class A. This device can produce RF noise. The owner/operator must take appropriate precautionary measures against this for its use. The device may be used only with a power supply approved for this. Only approved cables may be connected.
Malfunctions
In the event of defects and device malfunctions that cannot be rectified, the device must be taken out of operation and protected against unauthorized use.
Approved use is ensured only when the housing is fully installed.

2.4. Resistance to Aggressive Substances

Attention!
The BNI modules always have good chemical and oil resistance. When used in aggressive media (such as chemicals, oils, lubricants and coolants, each in a high concentration (i.e. too little water content)), the material must first be checked for resistance in the particular application. No defect claims may be asserted in the event of a failure or damage to the BNI modules caused by such aggressive media.

Dangerous Voltage

Attention!
Before working on the device, switch off its power supply.

Note
In the interest of continuous improvement of the product, Balluff GmbH reserves the right to change the technical data of the product and the content of these instructions at any time without notice.

3 First Steps

3.1. Module overview

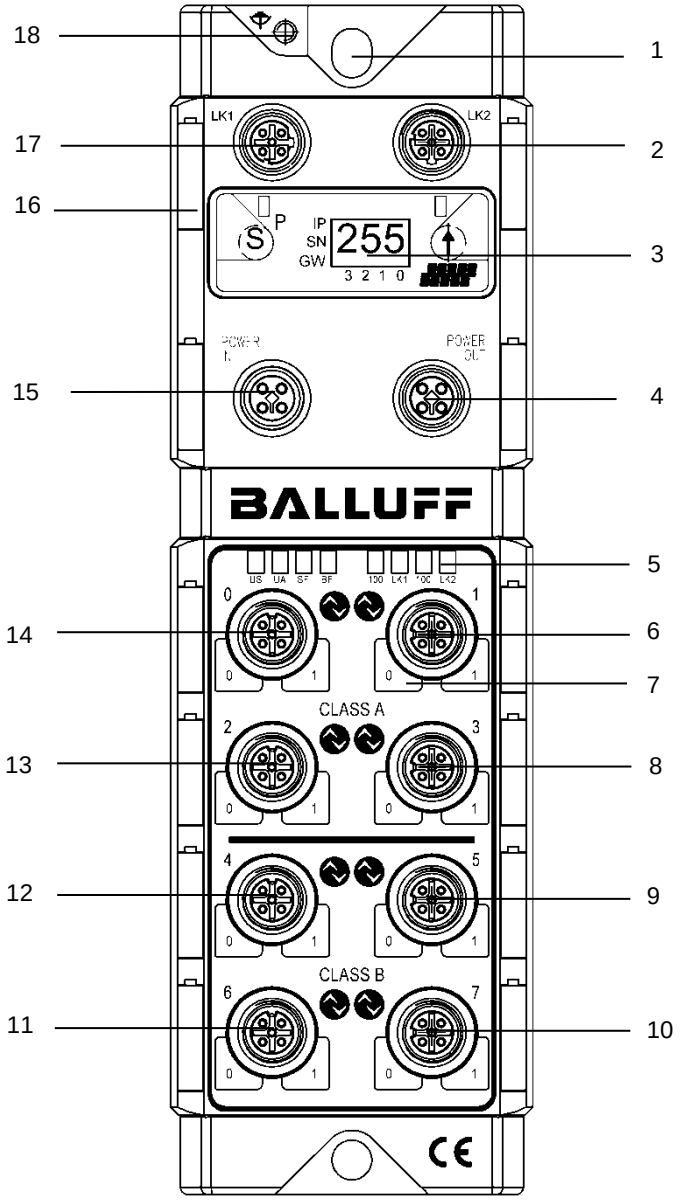


Figure 1 – Overview BNI PNT-538-105-Z063

1	Mounting hole	11	Port 6
2	PROFINET ™ Port 2	12	Port 4
3	Display	13	Port 2
4	Power supply, output	14	Port 0
5	Status LED	15	Power supply, input
6	Port 1	16	Information sign
7	Pin/port LED: signal status	17	PROFINET ™ Port 1
8	Port 3	18	Function earth
9	Port 5		
10	Port 7		

3 First Steps

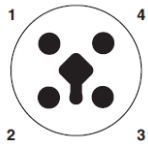
3.2. Mechanical Connection

The module is secured by means of two M6 screws and two washers.
Insulation support is available separately.

3.3. Electrical Connection

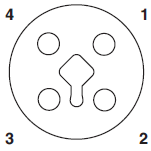
Power supply

Voltage supply IN, M12 T-coded, 4 Pin, male connector



Pin	Function	Description
1	Module / sensor supply	+24 V
2	Separate voltage supply (-)	N24
3	GND module / sensor supply	0 V
4	Separate voltage supply (+)	P24

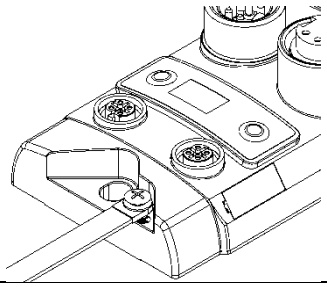
Voltage supply OUT, M12 T-coded, 4 Pin, female connector



Pin	Function	Description
1	Module / sensor supply	+24 V
2	Separate voltage supply (-)	N24
3	GND module / sensor supply	0 V
4	Separate voltage supply (+)	P24

Note
Where possible, use separate power supplies for sensor/bus and actuator.
Total current < 12 A The total current of all modules must not exceed 12 A even in the case of series connection of the actuator supply.

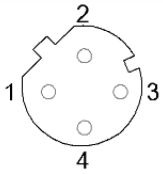
Grounding



Note
The functional ground connection between housing and machine must have a low impedance and be as short as possible.

PROFINET interface

M12, D-coded, female



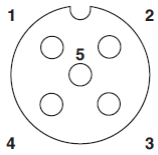
Pin	Function	
1	Tx+	Transmit Data +
2	Rx+	Receive Data +
3	Tx-	Transmit Data -
4	Rx-	Receive Data -

Note
Unused I/O ports must be provided with cover caps to comply with degree of protection IP67.

3 First Steps

IO-Link Port

M12, A-coded, female



Pin	Function	
	Class A	Class B
1	+24 V, 1.6 A	+24 V, 1.6 A
2	Input/ Output 2A	P24
3	GND	GND
4	Input / Output / IO-Link	Input / IO-Link
5	n.a.	N24

Note
For the digital sensor inputs, refer to guideline on inputs EN61131-2, Type 3.

Note
All outputs are powered via the sensor power supply.

Note
Unused ports must be provided with cover caps in order to ensure enclosure rating IP67.

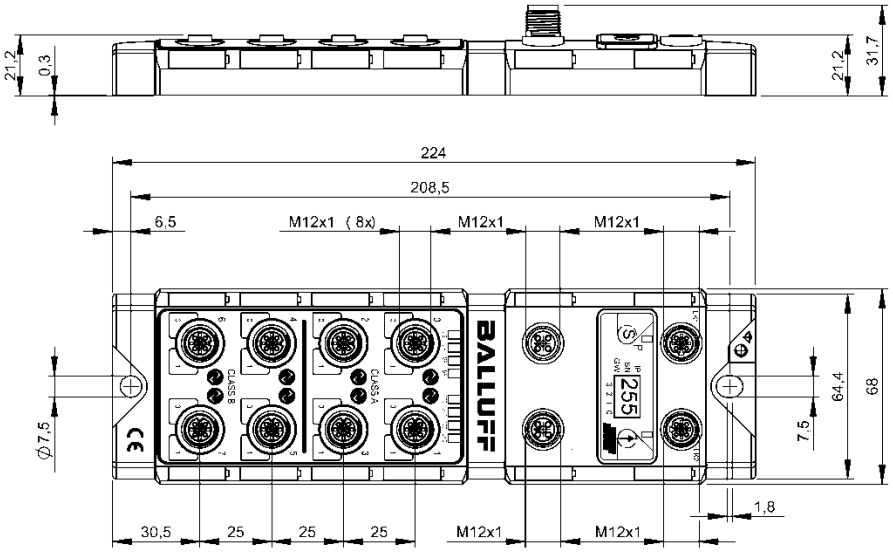
Attention!
If the power supply UA is disabled, the Class A outputs (port 0 to port 3) are also switched off.

Port

	Port	
	0-3	4-7
BNI PNT-538-105-Z063	Class A	Class B

4 Technical Data

4.1. Dimensions



4.2. Mechanical Data

Housing material	Die-cast zinc, matte nickel-plated
Enclosure rating per IEC 60529	IP 67 (only in plugged-in and screwed-down state)
Supply voltage	M12-T-coded, connector male / female
Input ports / output ports	M12, A-coded (8x female)
Dimensions (W x H x D in mm)	68 x 224 x 31.7
Type of mounting	Screw mounting with 2 mounting holes
Ground strap installation	M4
Weight	Approx. 670 g

4.3. Operating conditions

Ambient temperature Storage temperature	-5°C ... 70°C -25°C ... 70°C

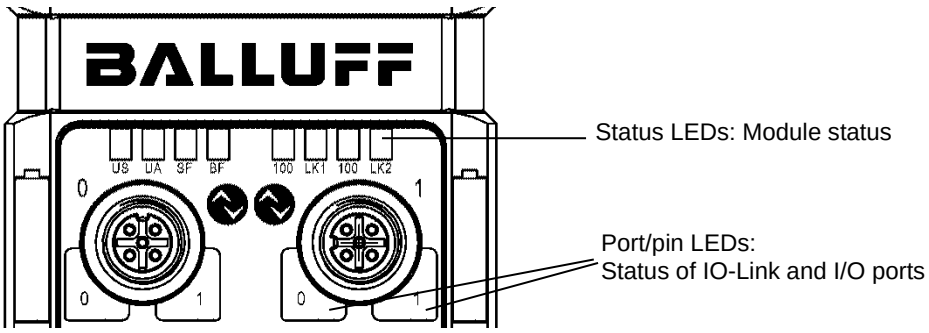
4.4. Electrical Data

Supply voltage	18...30.2 V DC, in accordance with EN 61131-2
Ripple	< 1%
No-load current consumption for 24 V	160 mA
Output current	2 A

4.5. PROFINET

PROFINET port	100Base-Tx
Connection for PROFINET port	M12, D-coded, female
Cable types in accordance with IEEE 802.3	Shielded, twisted pair min. STP CAT 5/ STP CAT 5e
Data transmission rate	100 Mbps
Max. cable length	100 m
Flow control	Full-duplex (IEEE 802.33x pause)
Profinet Conformance Class	B
Net Load Class	3

4.6. Function indicators



Module Status

LED	Indicator	Function
US	Green	Input voltage OK
	Red, flashing	Input voltage low (< 18 V)
UA	Green	Output voltage OK
	Red	Output voltage low (< 18 V)
SF	Off	No error
	Red	Watchdog timeout; channel, general or advanced diagnosis present; system error
	Red, flashing	Service DCP signal started via bus
BF	Off	No error
	Red	Low speed of physical link; or no physical link
	Red, flashing	No data exchange or no configuration
100	Off	Transmission rate: 10 Mbit/s
	Yellow	Transmission rate: 100 Mbit/s
LK	Green	Data transfer
	Red	Grounds interchanged

4 Technical Data

Port

Standard port

Status	Function
Off	Status of Input Pin is 0
Yellow	Status of Input Pin is 1
Both LEDs flashing red	Sensor power supply short circuit between Pin 1 and Pin 3
Red	Short circuit at the output on Pin 2 / 4 to Pin 3
Red	No high signal at diagnostic input

IO-Link port

Status	Function
Green	IO-Link – connection active
Green, flashing	No IO-Link – connection or wrong IO-Link device
Flashing green rapidly	IO-Link pre-operate during data storage
Flashing red rapidly	Validation failed / incorrect configuration of the IO-Link data length
Flashing red rapidly	Data storage failed / incorrect device for data storage
Red	IO-Link short circuit Pin 4 to Pin 3

5 Integration

5.1. Configuration

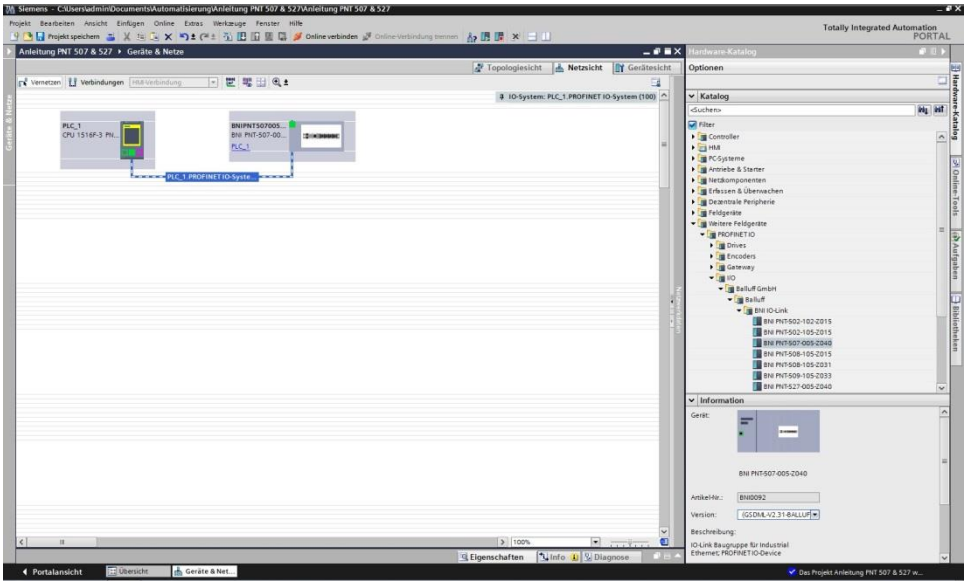
When planning Profibus devices, a device is depicted as a modular system with a header module and several data modules. The screenshots shown here have been taken from the configuration software of the Siemens HW config.

GSDML file

The device data required for project planning is saved in GSDML files (**G**eneric **S**tation **D**escription **M**arkup **L**anguage). The GSDML files are available in two languages as an Internet download (www.balluff.com). The data modules of an IO-Link block are displayed in the project planning software according to the slot.
The GSDML file makes the possible data modules available (input or output of different data ranges). For configuration of the IO-Link blocks, the corresponding data modules are assigned to a slot.

Integration of the module

The device can be found by searching in the catalog and inserted in the Profinet section by drag & drop.

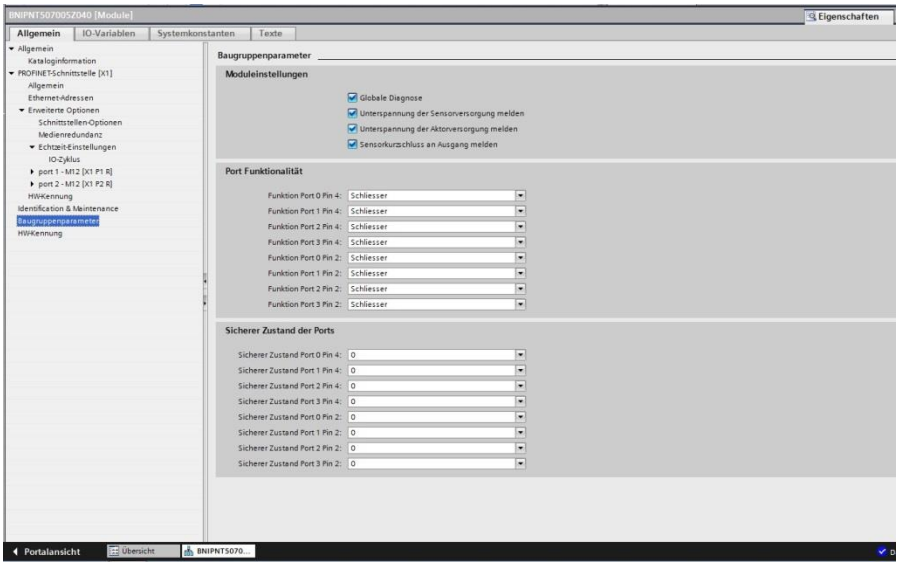


The BNIPNT538105Z063 module with submodules PN-IO, port 1-M12, port 2-M12 are used for Profinet communication.
In X1 PN-IO, functions such as prioritized run-up or the domains for the ring topology can be selected.
The port function (input, output, diagnosis input) or diagnosis messages can be defined at Slot 0.
The remaining slots (2-5) pre-assigned in the default configuration are placeholders for the IO-Link modules. Slot 2 is for the first IO-Link port / standard I/O port Slot 5 for the last.
If IO-Link communication is planned for a given port, the standard I/O module must be deleted and replaced with an IO-Link module, e.g., IOL_E_2byte.

5 Integration

Parameterizing the header module

Double-click on the header module to open its properties.
Click on the "Parameter" tab to open a menu selection for defining the port functions and diagnostic functions.



Note
IO-Link configuration:
If the connected IO-Link device makes outputs available, Pin 2 must be configured to output on the corresponding port.
Standard input and output:
For each port, the function (N.C., N.O., diagnostic input (pin 2)) can be arbitrarily selected for each port at pin 2 and pin 4.

Hardware configuration

The IO-Link / standard I/O modules must now be configured appropriately for the configuration of the header module.
If necessary, these can be taken over into the configuration table from the hardware catalog by means of drag & drop.
By default, all ports are set to Standard I/O.
If the port is to be configured as an IO-Link port, the module must be deleted and replaced with an IO-Link module.

Slots 1..8 are reserved for the IO-Link ports/standard I/O ports.

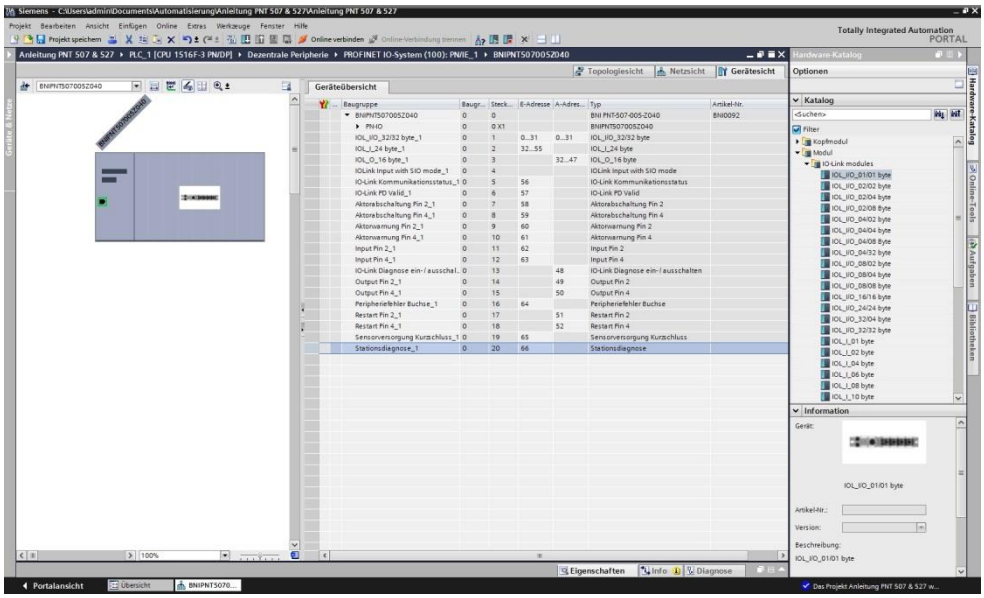
Module addressing:
Double-click on the IO-Link modules and the remaining addressable modules to change the addressing in the "Addresses" window.

Configuring the IO-Link module:
A suitable IO-Link module that corresponds to the process data length of the IO-Link device must be selected in the catalog and dragged to the appropriate slot by means of drag & drop.
The process data length required by the device in each case can be obtained from the manual of the IO-Link device.

Configuring a standard input / output:
If one of the possible port pins (pin 4) is to be configured with a standard function (input, output), the "Standard I/O" placeholder module must be used for the corresponding slot.
To address the inputs and outputs, input pin 2 / 4 and output 2 /4must be taken over from the catalog and used in the configuration according to the given modules.

For the SIO function, integrate the "IO-Link input with SIO mode" module.

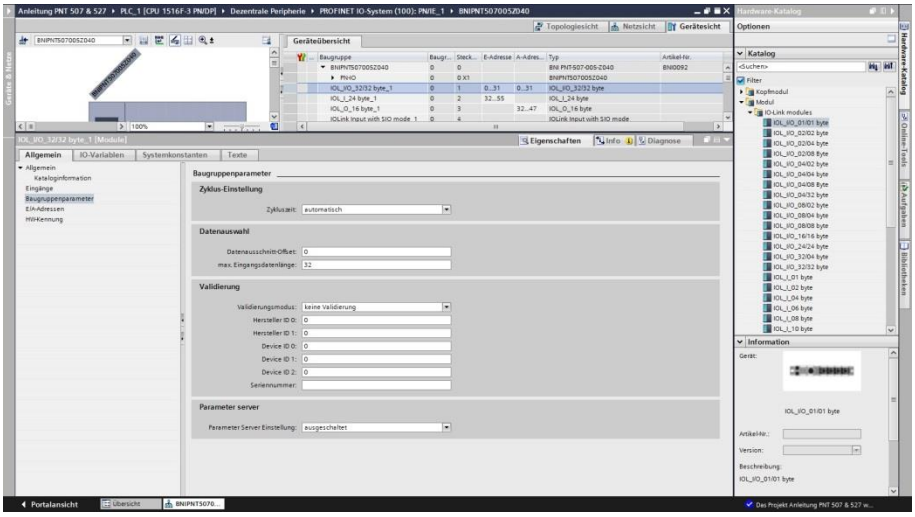
With the remaining modules, the various functions are mapped into the process data areas.



5 Integration

IO-Link configuration

The IO-Link parameters of the respective port can be changed in the IO-Link module properties.



IO-Link functions

Explanation of the possible settings in the properties of the IO-Link port.

Cycle Settings

Use this parameter to reduce the IO-Link communication speed by increasing the IO-Link cycle time.
The cycle time can be adjusted via the scroll down menu.

Data selection

The start byte of the process data can be defined with the data section offset. For the max. input data length, the actual process data length of the IO-Link device is entered. These settings are only for the input data.
The visible data window for the input data can now be adjusted via an IO-Link module with appropriate process data length.

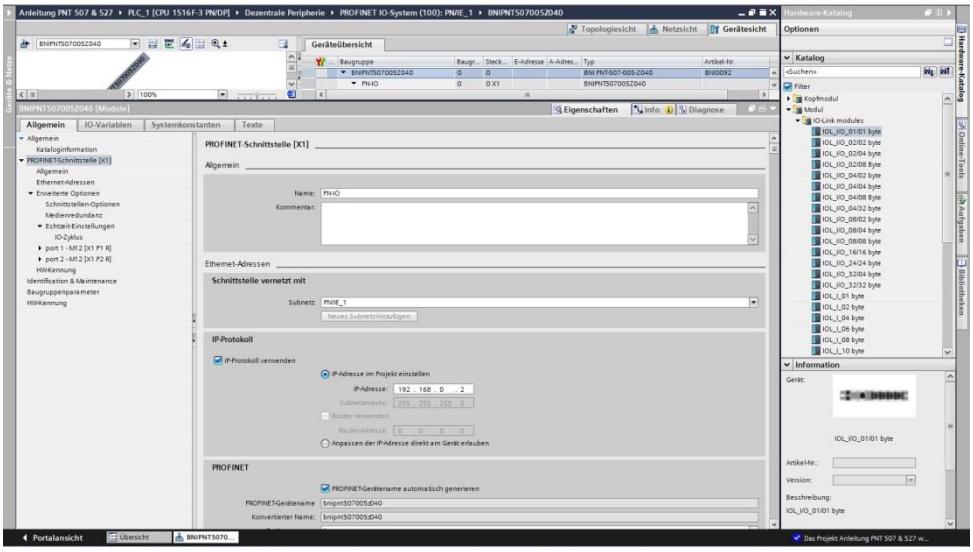
Validation

No validation: validation deactivated, every device is accepted
Compatibility: manufacturer ID and device ID are compared to the module data.
The IO-Link communication is only started if there is a match. Manufacturer ID and device ID are entered in decimal format.
Identity: manufacturer ID and device ID and serial number are compared to the module data. The IO-Link communication is only started if there is a match.
Manufacturer ID and device ID are entered in decimal format, the serial number is entered in ASCII code.

Device name, Profinet address

Double-click on the module in the Profinet line to view the communication parameters of the module.

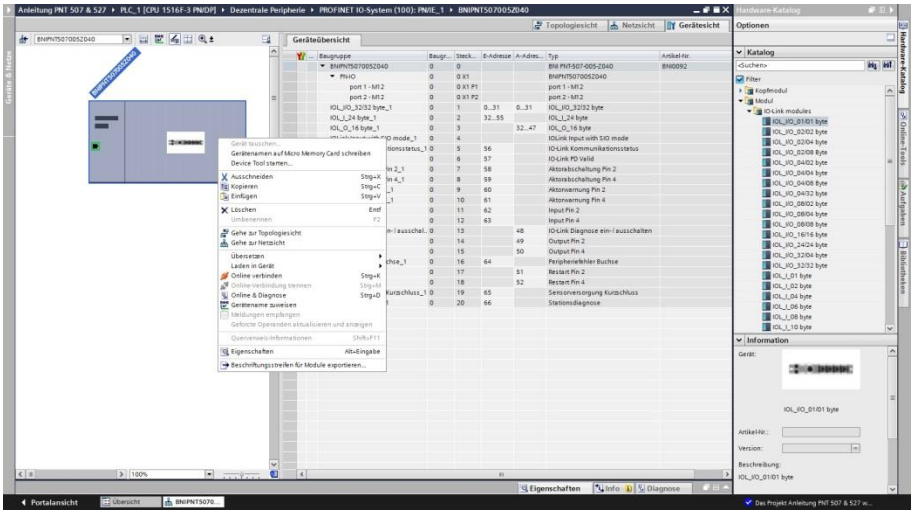
The device name and the Profinet address (IP) are configured here.



5 Integration

Establishing device relationship

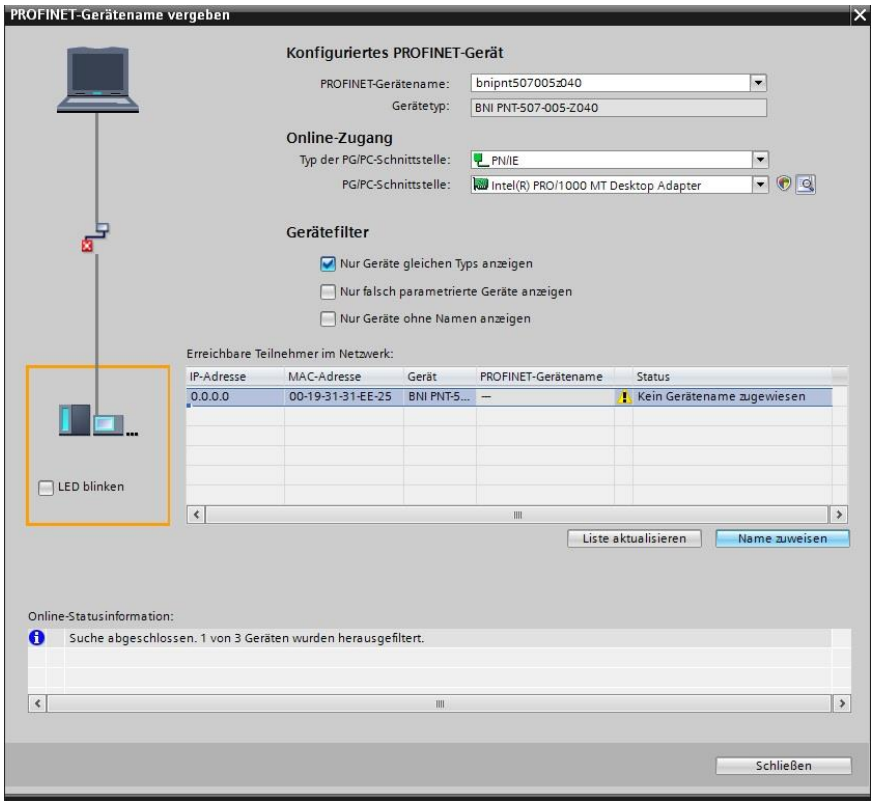
"Device view" → right click on module → "Assign device name".



Assigning device name

Select the desired name and use "Assign name" to assign the marked device that you found.
The device name must be the same as that previously configured under device properties (see previous page).

Identification takes place via the MAC address (on the rear of the device) or via the Blink Test.



Concluding the configuration

Download the configuration into HW config.

At this point, the bus error on the module should disappear.
There could still be an active system error, particularly if an IO-Link is used.

Possible causes:

- Line break (no IO-Link device connected)
- IO-Link device fault (e.g., external voltage supply not connected)
- Validation failed

If the module still reports a bus error, there could be a problem in one of the following areas:

- Device relationship not established.
  Scan the network and check whether the device is signaling under the correct device name and correct IP address.
  Adapt the Ethernet address or device name if necessary, assign the device name to the device once again and download the configuration.

5 Integration

5.2. Functions in module properties

Description of the functions in module properties

Module settings

Global diagnostics:
This function can be used to permit / suppress all diagnostics messages of the module. (optical diagnostics signals and diagnostics in configured diagnostics modules are not affected)

Sensor supply undervoltage:
This function can be used to permit / suppress the diagnostics message Sensor supply undervoltage. (optical diagnostics and diagnostics in configured diagnostics modules are not affected)

Actuator supply undervoltage:
This function can be used to permit / suppress the diagnostics message Actuator supply undervoltage. (optical diagnostics signals and diagnostics in configured diagnostics modules are not affected)

Sensor short circuit at output:
This function is used to permit/suppress the sensor short circuit diagnostics message at the module output. (Optical diagnosis and diagnosis in configured diagnosis modules is not affected). Function only applies to channels/pins that are configured as outputs. Channels/pins configured as inputs are not affected.

Port functions

The function for every individual port pin can be defined here:
Make contact = input as normally open contact
Break contact = input as normally closed contact
Output = output function
IO-Link input with SIO mode = SIO mode; An IO-Link device can be parameterized via IO-Link and then set to a SIO mode in which the IO-Link port pin functions as a simple switch input Pin function depending on configuration.

Safe state

This function is a supplement to an output configuration of the respective port pin. For each port pin, a safe status can be predefined which is assumed in the event of a failure in bus communication.

5.3. Bit mapping and function

Bit mapping and function of the configurable modules

Inputs pin 4
Inputs pin 2
Outputs pin 4
Outputs pin 2

Signal from configured inputs or outputs are depicted in the modules inputs pin 4 / inputs pin 2 and outputs pin 4, outputs pin 2.

The "inputs pin 2" module also depicts the diagnostic inputs of the diagnostic input function. Depending on configuration.

IO–Link modules

The IO-Link modules always have the same structure:

IOL_I/O_x/xBytes
- Number of process data items used (should be equal to or greater than the process data length of the IO-Link device)
- I = Input data
- O = Output data
- I/O = Both input and output data

Actuator shutdown Pin 4 / Pin 2

Depicts a short circuit between a set output to ground at the respective port pin.

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

Actuator warning Pin 4 / Pin 2

Feedback if a voltage is being supplied at an output that is not set.

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

Restart Pin 4 / Pin 2

If this function is configured, after an actuator short-circuit there is no automatic restart, but rather the port must be activated by inserting the corresponding bit.

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

5 Integration

Switching IO-Link diagnostics on / off

If this function is configured, the IO-Link diagnostics is deactivated for all ports and can be reactivated for the desired ports.

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

IO-Link communication

Bit status for each IO-Link port; feedback indicating whether communication is established.

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

Peripheral error, socket

Feedback indicating the port at which an error occurred.

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

Sensor supply Short circuit

Feedback indicating the port at which there is a sensor supply short circuit.

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

Station diagnostics

Feedback indicating which fault occurred.

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
IO-Link short circuit	Actuator Warning	Actuator Short circuit	Sensor voltage Short circuit	External error	No UA	US actuator	US sensor

IO-Link PD Valid

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

Parameter server

Switched off:
data management functions disabled, saved data are retained.

Delete:
data management functions disabled, saved data are deleted.

Restore:
Only a parameter data download to the IO-Link device is performed.
As soon as the saved parameter data in the port parameter differ from the connected IO-Link device, a download is performed.
Sole exception: The parameter server is empty. A one-off upload is then performed.

Save/restore:
A parameter data up- and download to the IO-Link device is performed.
As soon as the saved parameter data in the port parameter differ from the connected IO-Link device and there are no upload requirements from the IO-Link device, a download is performed.
As soon as a device requests an upload (upload flag set) or if no data are saved in the master port (e.g. after data deletion or before the first data upload) the master launches an upload of the parameter data from the device.

Note
After the upload of the parameter data, the vendor ID and device ID of the connected IO-Link device are also still saved until the data records are deleted. When the connected IO-Link device is started, a validation takes place. Thus, only an IO-Link device of the same type can be used for the data management.

6 Configuration of IO-Link devices

General

IO-Link devices can be configured via the web server, function modules and the IO-Link device tool.

When using the device tool and web server, the write and read accesses are adopted by the software.

Function module

The "IOL_Call" function module creates a telegram, which is sent to the master via DPV1 functions. The following settings are required in this case:

Diagnosis address	The diagnosis address of Slot 1 is used
CAP access	255

The sample project with the IO_Call function module from Siemens AG can be downloaded on the Balluff homepage.

The telegram structure is described in the following table:

Area	Size in bytes	Value	Definition
Call header	1	08h	08h for "CALL", fixed
	1	0 1…63 64…255	IOL master Port number Reserved
	2	65098	FI_Index, IO-Link header is following
IO-Link header	1	0…255	Task 2 = write 3 = read
	2	0…32767 65535	IO-Link index Port function
	1	0…255	IO-Link subindex
Data range	232		Range of the data to be written or read

Read

To read out data, the master must be given a reading task for the corresponding slot/index/subindex.

The telegram must be adapted accordingly for this purpose (slot, index), and 0x03 for reading must be entered under "Task".
The telegram can then be sent by write instruction to the corresponding module.

The module reads the data from the IO-Link device.
The data can be retrieved by reading with the same telegram.

Write

To write data, the master must be given a writing task for the corresponding slot/index/subindex.

The telegram must be adapted accordingly for this purpose (slot, index), and 0x02 for writing must be entered under "Task".
The telegram can then be sent by write instruction to the corresponding module.

7 Monitoring & Diagnosis

7.1. General

The field bus module offers several diagnosis interfaces, which are described below:

- Device diagnosis via the web interface
- Network diagnosis via SNMP
- Field bus-specific diagnosis via the PLC

The web interface and field bus-specific diagnosis interfaces are respectively described in a separate chapter.

Access to the device monitoring and diagnosis interfaces is performed via the IP-based management interface over the Ethernet network. As an alternative to the procedure described in the "Integration" chapter, the necessary setting of the IP access can be performed by means of other dedicated configuration tools using the PROFINET DCP protocol. The following parameters must be set for this purpose:

- IP address (IP)
- Subnet mask (SN)
- Gateway address (GW)
- Device name

The configuration settings can be reset to the default settings (delivery condition) via the web interface.

Configuration settings are only possible when the module has no active connection to a control unit.

7.2. SNMP MIBs

Device network interface monitoring and diagnosis can be performed over the network with the help of the SNMPv1 protocol. Access to the latter is easy via a so-called SNMP browser or common network management applications.

The following MIBs are supported:

- MIB-2 (RFC 1213)
- LLDP-MIB (IEEE 802.1AB)

Field bus module information is supplied in the MIB-2 module-related information:

MIB Variable	Description
sysDescr	A textual description of the entity. This value should include the full name and version identification of the system's hardware type, software operating-system, and networking software.
sysObjectID	{1.3.6.1.4.1.44233.1.2.1} For Balluff products with Product enterprise Number (PEN) = 44233, the product list is defined in **BALLUFF-PRODUCTS-MIB**
sysUpTime	The time (in hundredths of a second) since the network management portion of the system was last re-initialized.
sysContact	The textual identification of the contact person for this managed node, together with information on how to contact this person. (“BALLUFF”)
sysName	An administratively-assigned name for this managed node. By convention, this is the node's fully-qualified domain name. (“BNI PNT ….”)
sysLocation	The physical location of this node (e.g. “73765 Neuhausen a.d.F, Germany”)

7 Monitoring & Diagnosis

The MIB-2 port-related information diagnosis data on the network connections, including the IO-Link ports, is displayed:

MIB Variable	Ethernet port	IO-Link Port
ifIndex	A unique value, contiguously starting from 1.	
ifDescr	A textual string containing information about the interface, i.e. "Ethernet X"	”IO-Link X" / “IO-IN X” / ”IO-OUT X”
ifType	IANAifType = 6 (ethernetCsmaCd) when Ethernet	IANAifType = 280 (sdci) when IO-Link-Port = 0 (other) when I/O-Port
ifMTU	length of Ethernet MTU	length of IO-Link process data (typically max. 32 Byte) or 1, when IO-port
ifSpeed	actual Ethernet speed	IO-Link speed (no device = 0 bit/s, Com1 Mode = 4800 bit/s, Com2 Mode 38400 bit/s, Com3 Mode = 230400 bit/s)
ifPhysAddress	MAC address assigned to this port	This object may contain an octet string of zero length, since IO-Link is a serial P2P protocol with no specific addressing.
ifAdminStatus	Up(1), Down(2), depending	Up(1), Down(2), depending if IO-Link capability is configured.
ifOperStatus	Up(1), Down(2), depending if an IO-Link device is connected and operable.	
ifLastChange	The value of sysUpTime at the time the interface entered its current operational state. If the current state was entered prior to the last re-initialization of the local network management subsystem, then this object contains a zero value.	n/a
ifInOctets	The total number of octets received on the interface, including framing characters.	
ifInErrors	n/a	Number of received frames that were rejected as invalid by the IO-Link-Master (Abort).
ifOutOctets	The total number of octets transmitted out of the interface, including framing characters.	
ifOutErrors	n/a	Number of retries by the IO-Link-Master, indicating unsuccessful packet transmissions.

8 Display

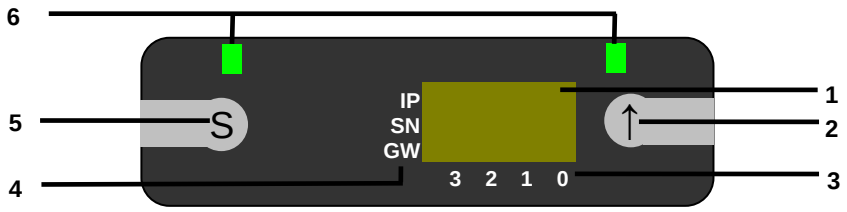
8.1. General

The display of the BNI IOF-538-105--Z063 consists of two LEDs, two keys and a LCD display. Background illumination is built-in to ensure readability even under weak ambient light. Background illumination is also activated as soon as the menu is started.
The station name can be displayed. In delivery condition "no name" is displayed. This means that the module has not yet been assigned a name.
The IP settings are represented by the following points and reflect the current module configuration.

- IP address (IP)
- Subnet mask (SN)
- Gateway address (GW)

Every address consists of four octets.
In addition, the display shows information about the device name, hardware and software version and MAC ID.
The address settings can also be reset to the default settings via the display.

8.2. Control and Display

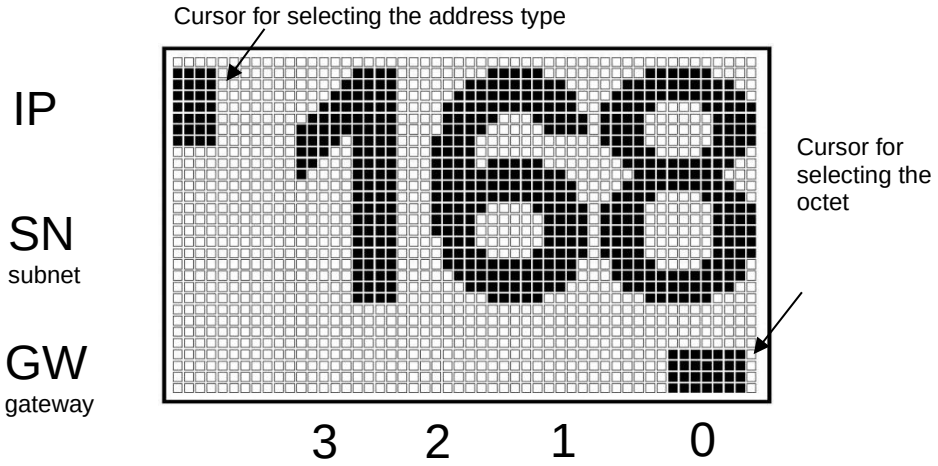


1 Display
2 Arrow key
3 Octet cursor
4 Address type cursor
5 Set button
6 LEDs

Arrow key: This key is used to scroll through the menu entries and is a short-time pushbutton. The display shows the standard screen after 10 seconds of inactivity.
Octet cursor: The octet cursor default position is Position 0, equivalent to the lowest-value octet.
Address type cursor: The address type cursor default setting is the IP position.
Set key: This key is used to launch edit mode and save or confirm a configuration.
LEDs: The two LEDs can be controlled via the module process data.
The "Display LEDs" module must be selected for this purpose.

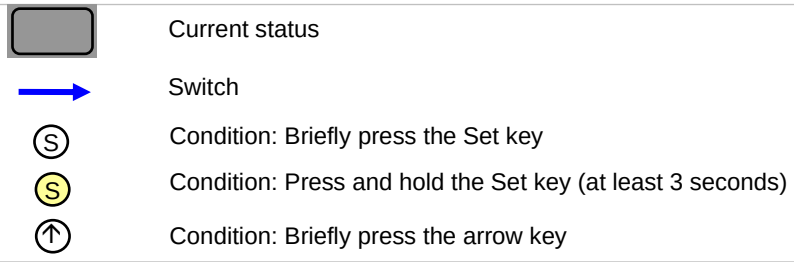
8 Display

8.3. Display Information

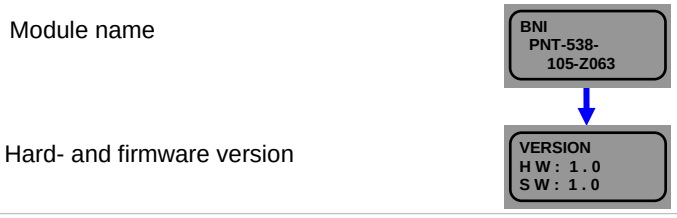


8.4. Design and Symbols

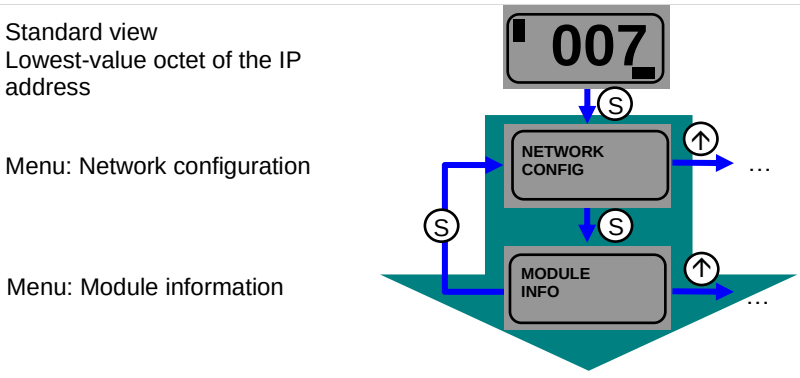
In the following flow charts, some symbols are used to describe the display functions:



8.5. Startup

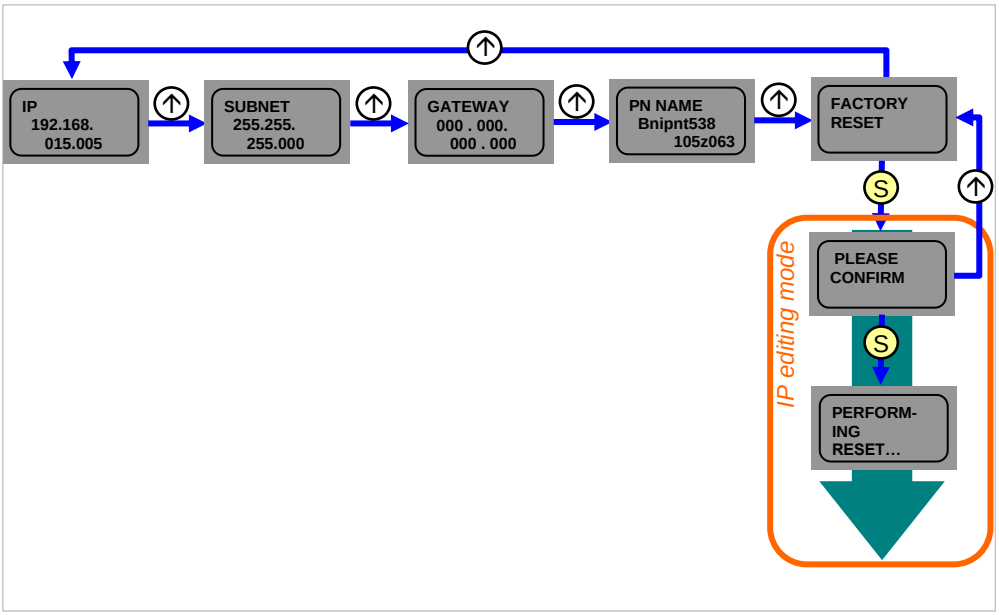


8.6. Main Menu



- Press the Set key briefly to scroll through the main menu.
- Press the arrow key to open the menu.

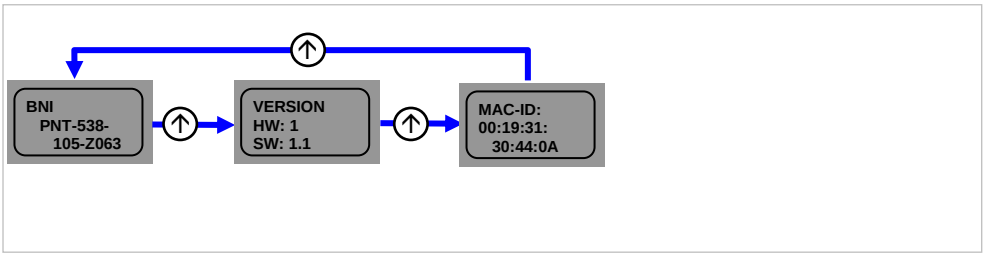
8.7. Factory Reset



- Press the arrow key briefly to access the "Network Config" menu.
- Hold down the S-key at the "Factory Reset" entry to reset the module.
- The arrow key need only be pressed briefly to reject the reset.
- Press the S-key again briefly to confirm the reset.
  The module reboots automatically after the reset.

Note
A factory reset can only be performed after a voltage reset with a connected network cable.

8.8. Module information



- Press the arrow key briefly to scroll through the "Module information" menu.
- The product name, module updates and Mac-ID are displayed as information.

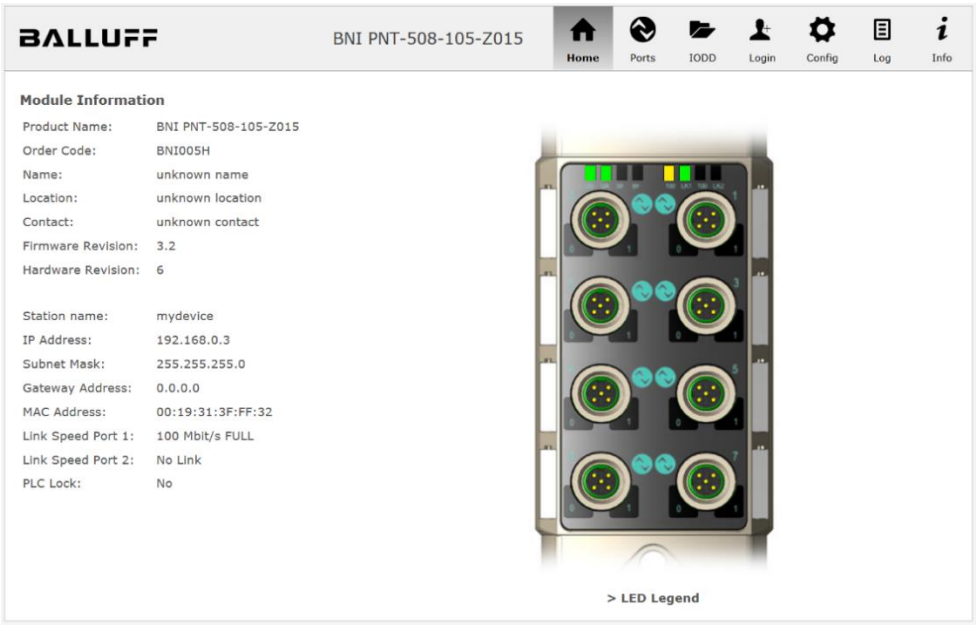
9 Web Server

9.1. General information

The BNI fieldbus module contains an integrated web server for retrieving detailed device information and for configuring the device.

To use the web interface you must first ensure that the module has been correctly integrated into your network. In addition the IP subnet of the BNI module must be accessible from the PC on which the browser is running. For the supported web browsers, please refer to the corresponding data sheet.

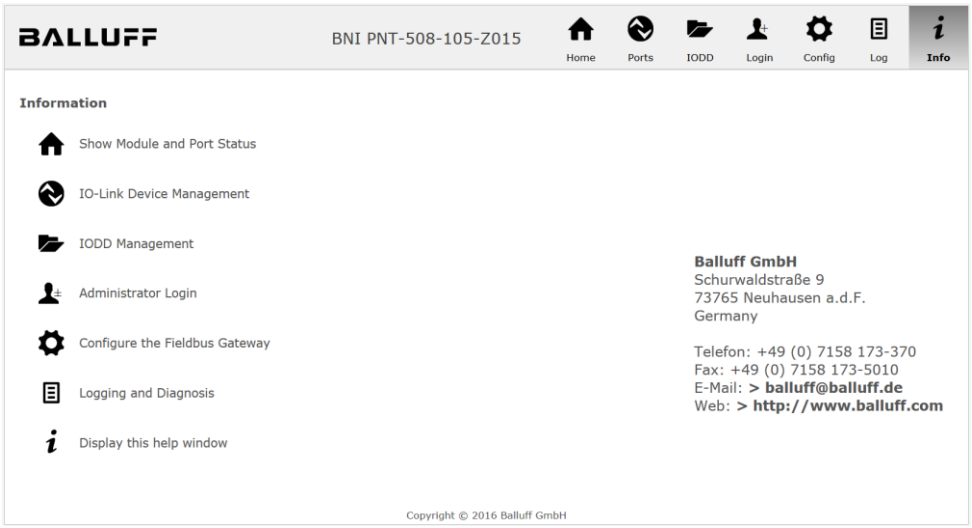
For open a connection with the web server, enter the IP address of the module in the address line of the browser. The homepage then appears with the essential device information.



9.2. Navigation / Info

The navigation bar is located in the upper area of the window, which allows you to switch between the various dialogs of the web interface. To do this click on the corresponding icon.

When the "Info" tab is selected the following overview appears:



The "BALLUFF" logo at upper right links to the international Balluff homepage.

9 Web Server

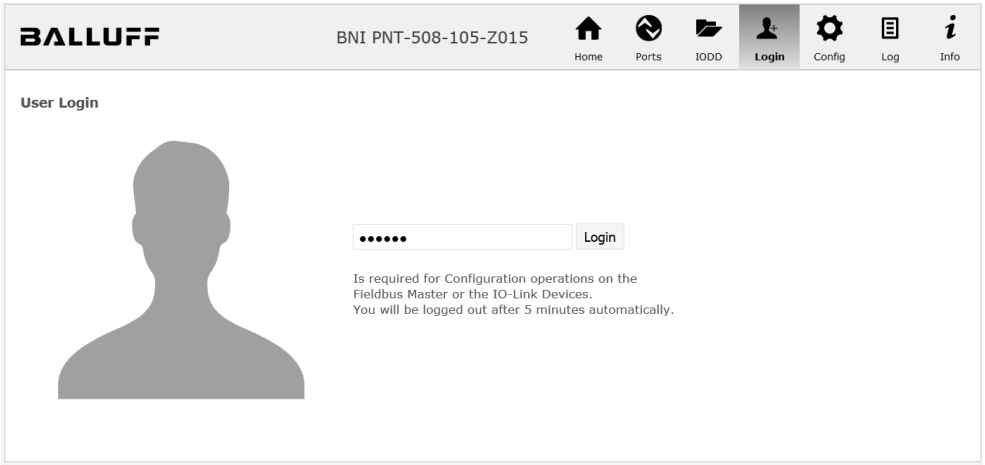
9.3. Login/Logout

To make configuration settings on the fieldbus module using the web interface, you must first log in. Functionalities which cannot be used without logging in are indicated by the grayed out buttons.

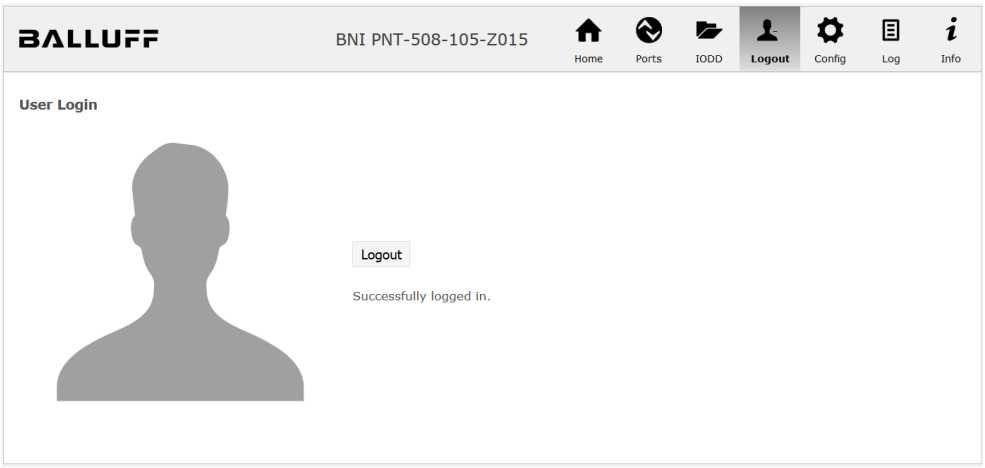
The default password is:

BNI PNT-XXX-XXX-XXXX	"BNIPNT“
BNI EIP-XXX-XXX-XXXX	"BNIEIP“
BNI ECT-XXX-XXX-XXXX	"BNIECT“

The password cannot be changed!



After successfully logging in the dialogs are shown as follows:



Use the "Logout" button to log out again. After 5 minutes of no interaction with the Webserver the user is automatically logged out.

Note
For security reasons the fieldbus module shows only one login at a time with configuration access. Reading (without logging in) is however possible from multiple PCs at the same time on the fieldbus module.

9.4. "Home" dialog

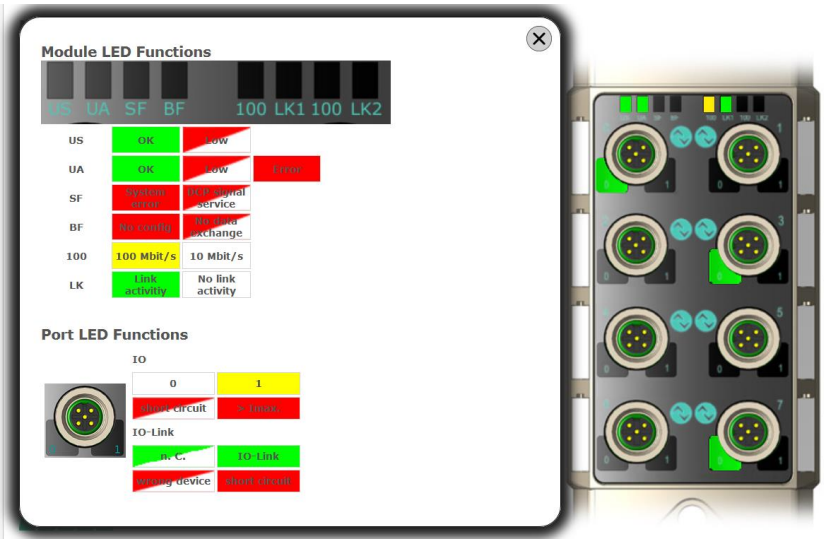
Under "Home" you are given the essential information about the fieldbus itself and its network activity. You are also shown whether the configuration block was enabled by the controller (PLC).

Information is also shown about the current process data and the status of the module via the corresponding LEDs. After selecting "LED Legend" a Help dialog appears which explains the meaning of the LEDs.

If an IO-Link device is connected to one of the configured IO-Link terminals, some of the device data will be displayed in addition to the module data in the form of a link. After selecting one of these links the corresponding device dialog is opened.

9 Web Server

PNT:



EIP:

9.5. "Ports" dialog

The "Ports" dialog displays information and process data for the connected IO-Link devices. Select the desired IO-Link Port in the image of the fieldbus module on the right side to see the device data.

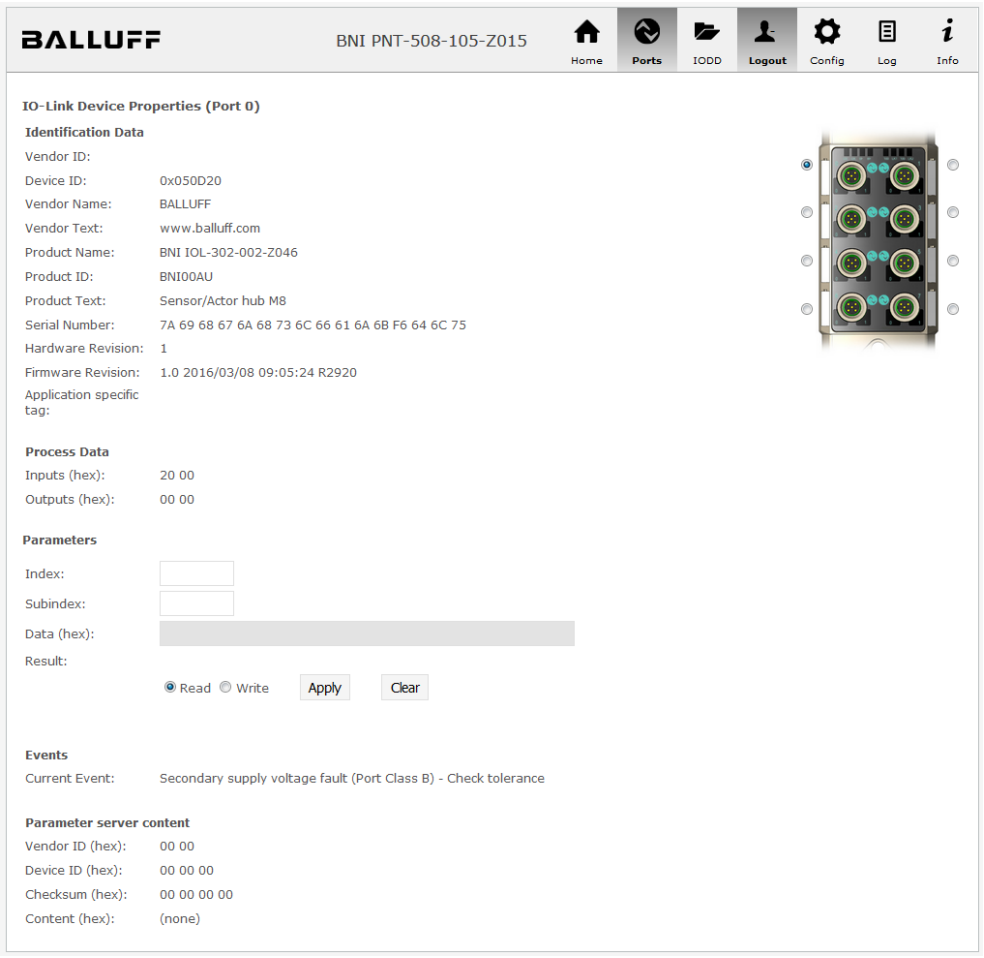
Note
The IO-Link device data are only displayed if the port is also configured as an IO-Link port!

No appropriate IODD uploaded

It is possible to read and write the configuration parameters of the IO-Link device via the "Parameters" option. The parameter indexes and subindexes of the IO-Link device are described in the corresponding separate user's guide (and follow the IO-Link conventions).

Under "Events" you can see whether a diagnostic event from the IO-Link device exists.

Under "Parameter Server Content" you can view the content of the parameter server if parameter data is stored on the parameter server.



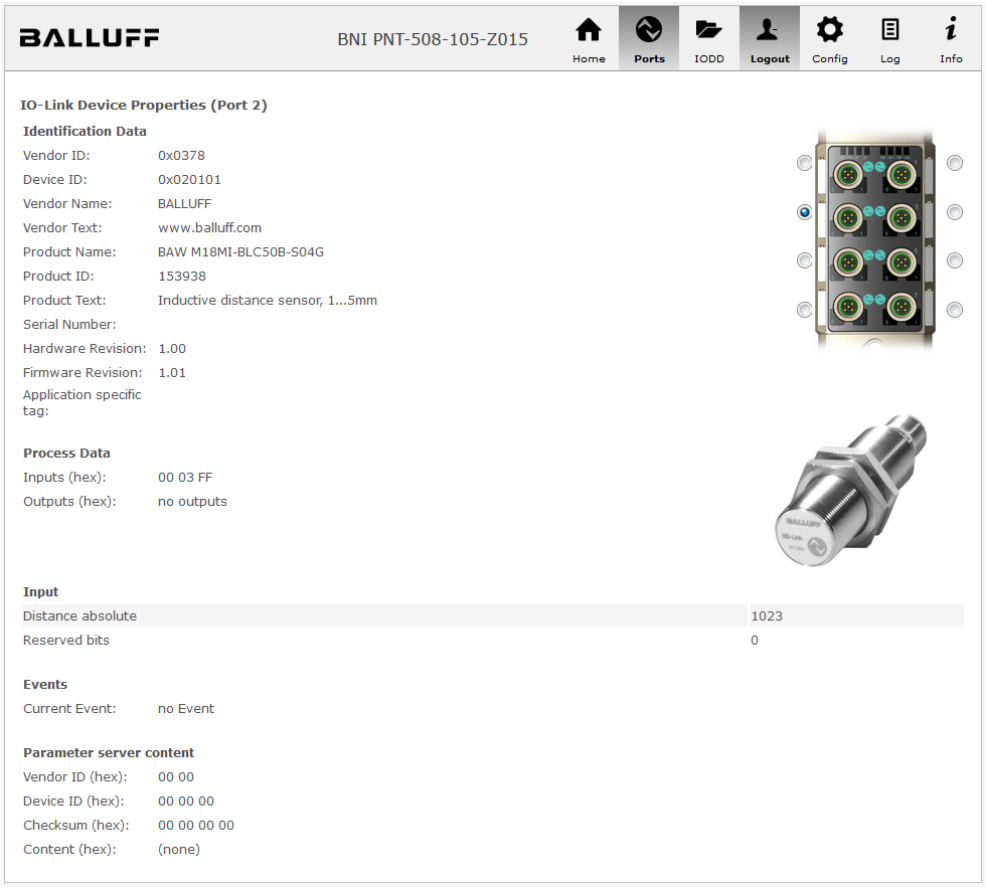
"Ports" dialog with direct parameter access

9 Web Server

Appropriate IODD uploaded

If an IODD appropriate to the IO-Link device connected to the currently selected port has been uploaded (see "Dialog "IODD"), the normal dialog for "Process Data" and "Parameters" is not displayed, but rather an expanded dialog.
Information from the IODD of the device is used so that the data can be better understood.

Thus in the following screenshot not only are the input data of the distance sensor displayed as a hex number, but also interpreted and labeled under "Input".
Since the sensor has no parameters, none are displayed.

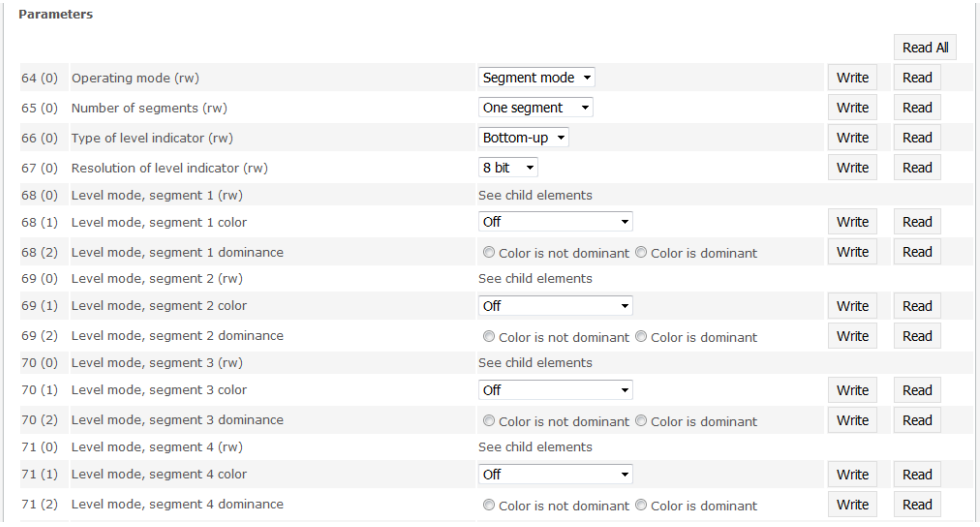


Dialog "Ports“: IODD interpretation and device image

If the IODD of the IO-Link device on the currently selected port has parameters, these are shown in table format (see following screenshot). In this example the parameters for the Balluff Smart Light are shown.
The Smart Light is a signal light which can be used in three different modes. These modes can be set using an IO-Link parameter. The parameter values and associated texts are stored in the IODD.
This means "Operation Mode" can be read out and displayed ("Read" and "Read All" buttons) or written to the device ("Write" button).

If subindexes have no buttons they cannot be individually processed but rather only the entire index at once.

Note
Each changed value must be individually written by clicking on the "Write" button!



"Ports" dialog: Parameter list of an IO-Link device with uploaded IODD

9 Web Server

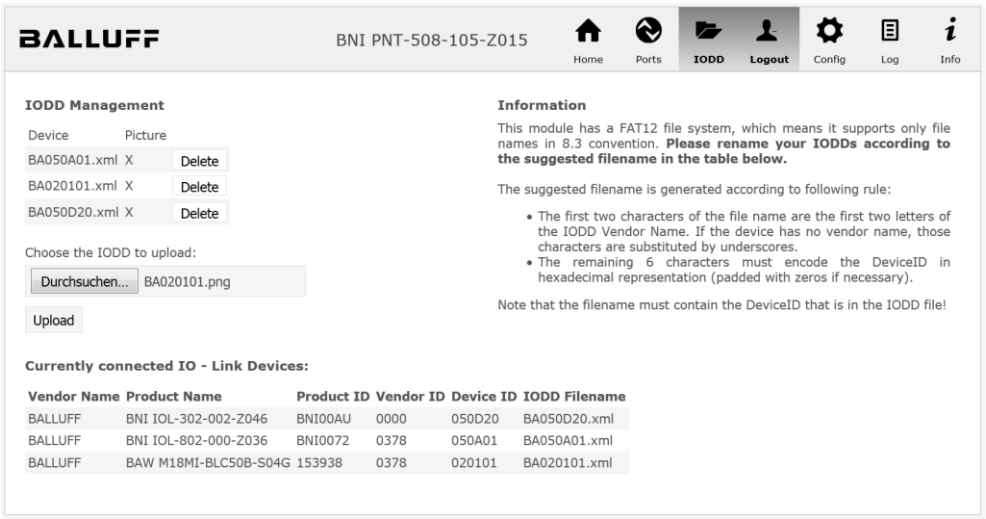
9.6. "IODD" Dialog

Using this dialog you can transfer IODDs (device description files for IO-Link devices) and the associated device images to the fieldbus module, so that a detailed representation of the connected IO-Link devices in the "Ports" dialog is possible.

When IO-Link devices are connected and IO-Link ports are activated, the dialog shows a table with information about the IO-Link devices.

The fieldbus module file system supports only device names in "8+3" format, i.e. with a restricted name length. Since IODD files are generally published with a long file name, these must be renamed and given a shorter naming scheme on the PC before uploading to the fieldbus module.
For this a help setting is provided in the dialog, with the associated required IODD file name for the currently connected IO-Link devices shown in the bottom section of the list (column IODD Filename).

Image files without IODD can also be uploaded; the images are still displayed in the "Ports" dialog.



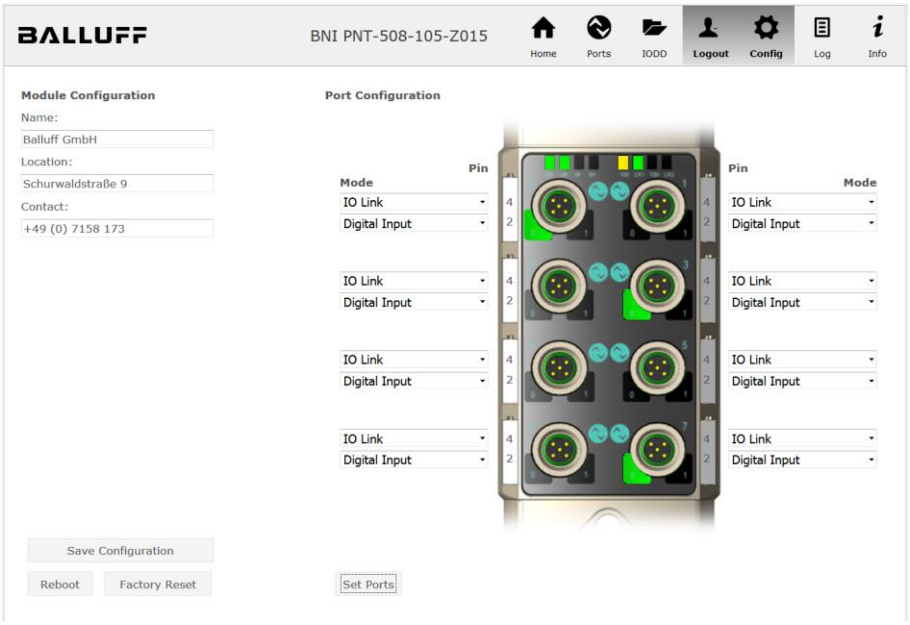
Use the "Delete" button to delete IODDs and device images from the field bus module as required.

Note
Before selecting the IODD it must be renamed on the PC to the file name which is shown in the table in the "IODD Filename" column!

9.7. "Config" dialog

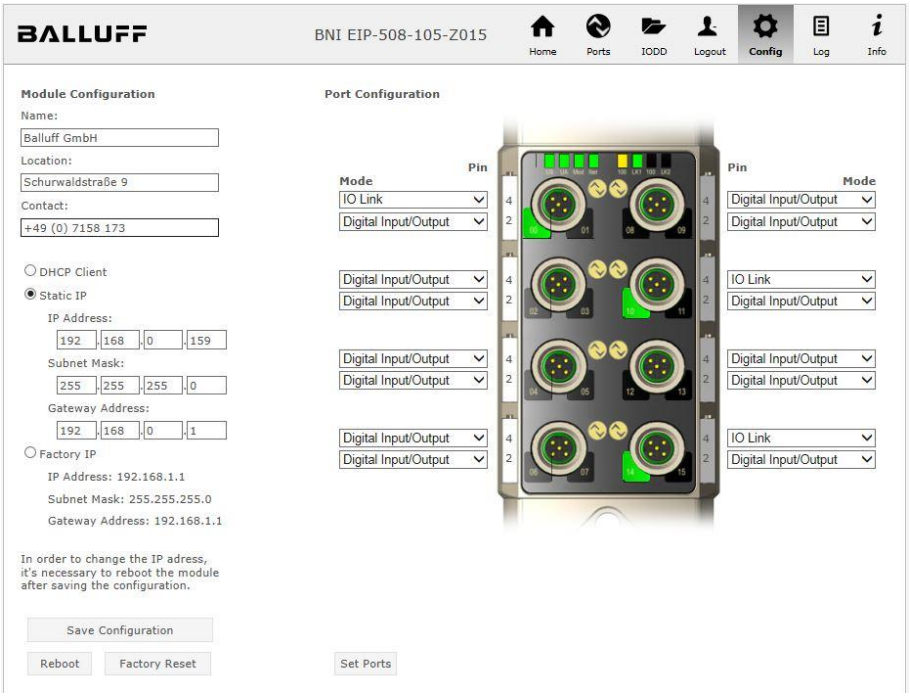
The configuration page enables configuration of the module. You can change both the module information texts and the port configuration.
The "Set Ports" action is not permanently stored in the device and is lost after the next reboot or reset.

PNT / ECT:



9 Web Server

EIP:



The parameter set “Module Configuration” on the left side is used by clicking "Save Configuration" and permanently stored in the device.
The "Reboot" button reboots the device as if the power to the module had been turned off and on again.
Clicking on "Factory Reset" deletes the configuration and log files saved in the device and then performs a reboot, so that the device is restored to the default factory configuration as on delivery.

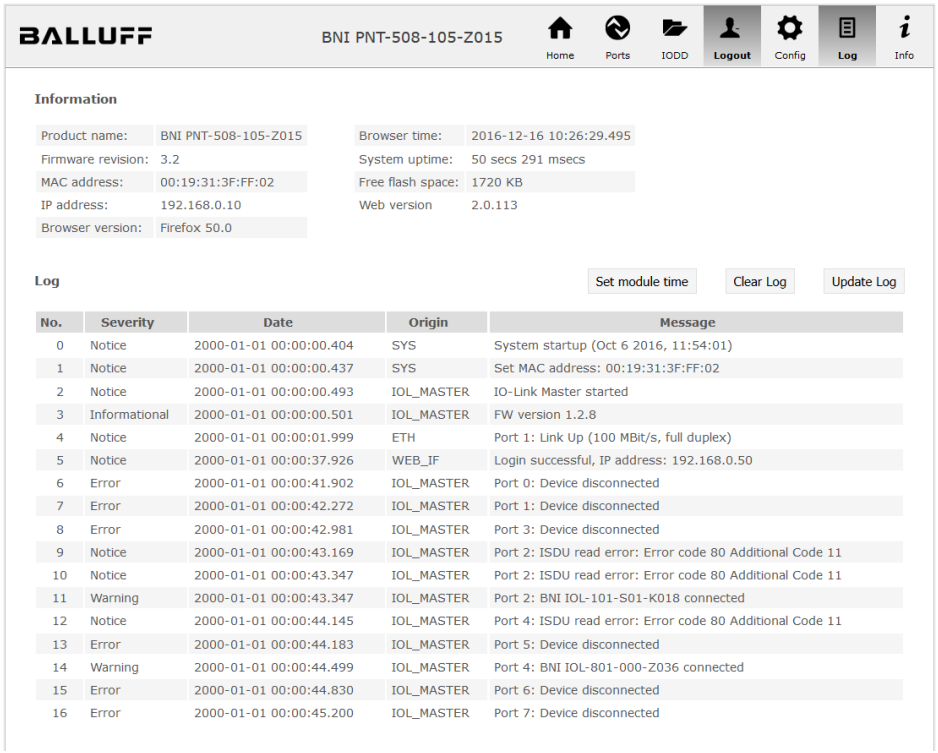
9.8. "Log" dialog

This dialog provides general service information about the device as well as a logging function.

The upper table (see screenshot below) contains important information for all service inquiries.

Note
If you have a detailed question about a specific situation, send us a screenshot of this Web site or print the site as a PDF.

Logging shows events which have occurred in chronological order. This provides a tool for detailed troubleshooting in equipment.



No.	Severity	Date	Origin	Message
0	Notice	2000-01-01 00:00:00.404	SYS	System startup (Oct 6 2016, 11:54:01)
1	Notice	2000-01-01 00:00:00.437	SYS	Set MAC address: 00:19:31:3F:FF:02
2	Notice	2000-01-01 00:00:00.493	IOL_MASTER	IO-Link Master started
3	Informational	2000-01-01 00:00:00.501	IOL_MASTER	FW version 1.2.8
4	Notice	2000-01-01 00:00:01.999	ETH	Port 1: Link Up (100 MBit/s, full duplex)
5	Notice	2000-01-01 00:00:37.926	WEB_IF	Login successful, IP address: 192.168.0.50
6	Error	2000-01-01 00:00:41.902	IOL_MASTER	Port 0: Device disconnected
7	Error	2000-01-01 00:00:42.272	IOL_MASTER	Port 1: Device disconnected
8	Error	2000-01-01 00:00:42.981	IOL_MASTER	Port 3: Device disconnected
9	Notice	2000-01-01 00:00:43.169	IOL_MASTER	Port 2: ISDU read error: Error code 80 Additional Code 11
10	Notice	2000-01-01 00:00:43.347	IOL_MASTER	Port 2: ISDU read error: Error code 80 Additional Code 11
11	Warning	2000-01-01 00:00:43.347	IOL_MASTER	Port 2: BNI IOL-101-S01-K018 connected
12	Notice	2000-01-01 00:00:44.145	IOL_MASTER	Port 4: ISDU read error: Error code 80 Additional Code 11
13	Error	2000-01-01 00:00:44.183	IOL_MASTER	Port 5: Device disconnected
14	Warning	2000-01-01 00:00:44.499	IOL_MASTER	Port 4: BNI IOL-801-000-Z036 connected
15	Error	2000-01-01 00:00:44.830	IOL_MASTER	Port 6: Device disconnected
16	Error	2000-01-01 00:00:45.200	IOL_MASTER	Port 7: Device disconnected

9 Web Server

Events are classified using the "**Severity**“ column:

Internal Error (Emergency, Alert, Critical)
→ The fieldbus module has detected a fault in itself (hardware or software) which should not occur during normal operation. If this happens, the module must be serviced or replaced.

External Error (Error, Warning)
→ The fieldbus module has detected what may be a non-permissible event which is affecting the module from the outside. The system may require troubleshooting.

Event (Informational, Notice)
The fieldbus module has detected an important normal operating event and reports it. These may include for example configuration actions over the web interface and other configuration interfaces which are also recorded.

Clicking on "Set Module Time” sends the current browser time to the fieldbus module but does not permanently store it. After a reset, reboot or loss of power the time begins to run again from the year 2000.

Clicking on "Update Log” refreshes the display, and "Clear Log” deletes all entries. The log entries are stored in a ring buffer.

10 Diagnostics

10.1. Diagnostics message

The diagnostics message that is generated by the module in the event of an error is usually read out by the PLC and processed. It is also possible to read out the diagnosis from the module by means of function modules and evaluate it.

The diagnostics message is 34 bytes long and divided into 3 blocks:
Block Header, Alarm Specifier, Channel Properties

Byte	Value	Meaning	Block
0	00	Block Type	BlockHeader
1	02		
2	00	Block Length	
3	1E		
4	01	Block Version High	
5	00	Block Version Low	
6	00	Alarmtype	
7	01		
8	00	API	
9	00		
10	00		
11	00		
12	00	Slotnumber	
13	01		
14	00	Subslotnumber	
15	01		
16	00	Module Ident	
17	00		
18	00		
19	17		
20	00	Submodule Ident	
21	00		
22	00		
23	01		
24	A8	AlarmSpecifier	AlarmSpecifier
25	36		
26	80	User Structure Ident	
27	00		
28	00	Channelnumber	
29	08		
30	08	ChannelProperties	ChannelProperties
31	00		
32	00	ChannelErrorType	
33	1A		

10 Diagnostics

10.2. Block Header

The first part of the diagnosis is the so-called Block Header, which is 24 bytes long.

Block Type

The first 2 bytes of the Block Header are described by the Block Type to define the data type.

Possible values	Meaning
0x0002	Alarm Notification Low

Block Length

2 bytes of data that define the length of the following diagnostics message.
(for the complete diagnostics message, the 2 bytes from the Block Type and the 2 bytes from the Block Length must be added).

Block Version High

1 byte, preset to 0x01

Block Version Low

1 byte, preset to 0x00

Alarm Type

2 bytes; the information on the type of alarm is provided here

Possible values	Meaning
0x0001	Diagnostics

API

4 bytes, default is 0.

Possible values	Meaning
0x00000000	Default value

Slot

2 bytes of data that describe which slot of the module reports an error

BNI PNT-538-105-Z063

Possible values	Meaning
0x0001	Slot 1 - 8 (IO-Link Ports 0 - 7)
0x0002	Slot 1 - 8 (IO-Link Ports 0 - 7)
0x0003	Slot 1 - 8 (IO-Link Ports 0 - 7)
0x0004	Slot 1 - 8 (IO-Link Ports 0 - 7)
0x0005	Slot 1 - 8 (IO-Link Ports 0 - 7)
0x0006	Slot 1 - 8 (IO-Link Ports 0 - 7)
0x0007	Slot 1 - 8 (IO-Link Ports 0 - 7)
0x0008	Slot 1 - 8 (IO-Link Ports 0 - 7)
0x0009	Slot 1 - 8 (IO-Link Ports 0 - 7)
0x0010	Slot 9-24 (Standard IO Modules)
0x0011	Slot 9-24 (Standard IO Modules)
0x0012	Slot 9-24 (Standard IO Modules)
0x0013	Slot 9-24 (Standard IO Modules)
0x0014	Slot 9-24 (Standard IO Modules)
0x0015	Slot 9-24 (Standard IO Modules)
0x0016	Slot 9-24 (Standard IO Modules)
0x0017	Slot 9-24 (Standard IO Modules)
0x0018	Slot 9-24 (Standard IO Modules)

Subslot

2 bytes of data that describe which subslot of the slot reports an error

Possible values	Meaning
0x0001	Subslot 1

Module ID

4 bytes of data that describe which module is inserted in the respective slot.
(The module ID is saved in the GSDML)

Possible values	Meaning
0x00000025	IOL IN 1 OUT 0
0x00000026	IOL IN 2 OUT 0
0x0000003A	IOL IN 4 OUT 0
0x0000003B	IOL IN 6 OUT 0
0x00000027	IOL IN 8 OUT 0
0x00000035	IOL IN 10 OUT 0
0x00000037	IOL IN 16 OUT 0
0x0000003C	IOL IN 24 OUT 0
0x00000028	IOL IN 32 OUT 0
0x00000029	IOL IN 0 OUT 1
0x0000002A	IOL IN 0 OUT 2
0x0000003D	IOL IN 0 OUT 4
0x0000003E	IOL IN 0 OUT 6
0x0000002B	IOL IN 0 OUT 8
0x00000036	IOL IN 0 OUT 10
0x00000038	IOL IN 0 OUT 16
0x0000003F	IOL IN 0 OUT 24
0x0000002C	IOL IN 0 OUT 32
0x0000002D	IOL IN 1 OUT 1
0x0000002E	IOL IN 2 OUT 2
0x00000040	IOL IN 2 OUT 4
0x00000041	IOL IN 4 OUT 2
0x00000042	IOL IN 4 OUT 4
0x0000002F	IOL IN 2 OUT 8
0x00000043	IOL IN 4 OUT 8
0x00000030	IOL IN 8 OUT 2
0x00000044	IOL IN 8 OUT 4
0x00000045	IOL IN 8 OUT 8
0x00000031	IOL IN 4 OUT 32
0x00000032	IOL IN 32 OUT 4
0x00000039	IOL IN 16 OUT 16
0x00000046	IOL IN 24 OUT 24
0x00000033	IOL IN 32 OUT 32
0x00000059	Output Pin 4
0x0000005A	Output Pin 2
0x0000005B	Input Pin 4
0x0000005C	Input Pin 2

Submodule ID

4 bytes of data that describe which submodule is used with the respective module.
(The submodule ID is saved in the GSDML)

Possible values	Meaning
0x00000001	BNI PNT-538-105-Z063 (header module)

10 Diagnostics

10.3. AlarmSpecifier

2 bytes, subdivided as follows:

Sequence Number

Bit 0-10, this counter is incremented with every new diagnostic message.

Channel Diagnostic

Bit 11

Possible values	Meaning
0x00	No diagnosis related to channel is pending
0x01	Diagnosis related to channel is pending

Manufacturer Specific Diagnosis

Bit 12

Possible values	Meaning
0x00	No diagnosis related to manufacturer is pending
0x01	Diagnosis related to channel is pending

Submodule Diagnostic State

Bit 13

Possible values	Meaning
0x00	No further diagnosis of submodule present
0x01	At least one further diagnosis of the submodule present

Bit 14 reserved

ARDiagnosis State

Bit 15

Possible values	Meaning
0x00	No further diagnosis of module is present
0x01	At least one further diagnosis of the module is present

User Structure Ident

2 bytes, describes the type of diagnosis

Possible values	Meaning
0x8000	Channel-related diagnosis

10.4. Channel Number

Configuration as standard I/O

Error Type	Channel Number
Undervoltage US	8000
Undervoltage UA	8000
No UA	8000
Sensor Short circuit Pin 1 - 3	0…..n
Actor Short circuit Pin 2 - 3	0…..n
Actor Short circuit Pin 4 - 3	0…..n

n = no. of IOL ports

Configuration as IO-Link

Error Type	Channel Number
Line break	0
Short circuit IOL Pin 4 - 3	0
Sensor short circuit Pin 1 - 3	0
IOL Device wrong configuration	0

Diagnosis of IO-Link devices

Error Type	Channel Number
Short circuit	1
Undervoltage	1
Upper threshold exceeded	1
Lower threshold undershot	1

10 Diagnostics

10.5. Channel Properties

2 bytes, subdivided as follows:

Type

Possible values	Meaning
0x00	Used if the channel number is 0x8000 or none of the types defined below is relevant.
0x01	1 Bit
0x02	2 Bit
0x03	4 bit
0x04	8 bit
0x05	16 Bit
0x06	32 bit
0x07	64 bit
0x08 – 0xFF	Reserved

Bit 0-7

Accumulative

Bit 8 not used, always 0.

Maintenance

Possible values		Meaning
Bit 9	Bit 10	
0x00	0x00	Diagnostics

Bit 9-10

Specifier

Possible values	Meaning
0x00	Not used
0x01	Diagnosis appeared
0x02	Diagnosis left
0x03	Diagnosis left, but another is still active

Bit 11-12

Direction

Possible values	Meaning
0x00	Manufacturer-specific
0x01	Channel used as input
0x02	Channel used as output
0x03	Channel used as input and output

Bit 13-15

10.6.Channel Error Type

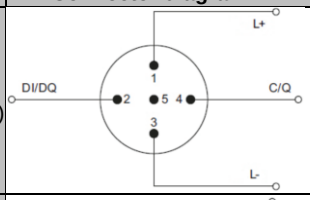
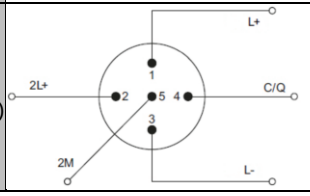
Error code in hex	Description
0x0000	Unknown error
0x0001	Short circuit
0x0002	Undervoltage
0x0003	Overvoltage
0x0004	Overload
0x0005	Temperature limit exceeded
0x0006	Cable break
0x0007w	Upper threshold exceeded
0x0008	Lower threshold undershot
0x0009	Error
0x001A	External error
0x001B	Sensor has incorrect configuration (IO-Link device)
0x0101	Actuator warning
0x0105	Actuator supply undervoltage
0x0104	No actuator power supply

11 Use in safety applications

11.1. Product description

This product is a remote IP67 IO-Link Profinet™ fieldbus module with four Class A ports and four Class B ports (per IEC 61131-9).

Description	Class A Ports	Class B Ports
BNI PNT-538-105-Z063	4	4

Port type	Connector diagramm	Pinning	Remarks
Class A (Ports 0-4)		1. +24 V/DC 2. In-/output 3. GND 4. In-/output/ IO-Link 5. n.c.	In this type the functions of Pins 2 and 5 are not specified. Pin 2 is usually connected to another digital channel.
Class B (Ports 5-7)		1. +24 V/DC 2. P24 3. GND 4. In-/output/IO-Link 5. N24	This type provides an additional supply voltage and is suitable for connecting devices which have a higher current requirement. Here pins 2 and 5 provide an additional (galvanically isolated) supply voltage.

By maintaining all the specifications in the corresponding user's guide and safety instructions Pins 2 and 5 of the Class B port on these modules can be safety switched off using a higher level safety logic (e.g. safety relay). The devices are therefore suitable for turning off actuators which are powered solely by these pins for use in safety applications.

Attention!
The Class A ports and Pines 1,3 and 4 on the Class B ports are not suitable for use in safety applications.

11.2. Safety function

The safe state of the Class B ports is no voltage on Pins 2 and 5. Turn-off must be done by the higher level safety logic (externally).
The fieldbus modules are constructed internally so that because of fault exclusions (see DIN EN ISO 13849-2) no external voltages can reach the galvanically isolated Pins 2 and 5 on the Class B port. This applies both to the IO-Link interface communication and for the external voltage supplies. The modules do not have their own safety logic or safety diagnostics.

Attention!
- Turning off actuators over the IO-Link interface is not suitable for safety functions within the safety chain.
- The actuators must be suitable for this type of safe turn-off and must if appropriate also habe galvanic isolation.

Accordingly the actuator-voltage supplies must be configured according to the principles of safe (potential-) isolation in order to prevent cross fault (per EN.IEC 60204-1, DIN EN ISO 13849-2).
Within the safety chain of the safety application both potentials (24 V and 0 V) of the actuator-voltage supplies must always be isolated using the higher level safety logic.

Attention!
The use of power supplies other than SELV/PELV can result in a hazard to the user and compromising of the functional safety.

11.3. Example of an application description

The safety function of the safe turn-off is implemented for example using the following signal chain: Safe switches/sensors (e.g. E-Stop) – safety logic (e.g. safety relay – fieldbus module with Class B ports – actuator(s). All elements must be suitable for use in the implemented safety function.

- When the safe switch/sensor (e.g. E-Stop) is actuated, Pins 2 and 5 on the Class B ports are safely isolated from the supply voltage (two-pin) by the safety logic and switched potential-free.

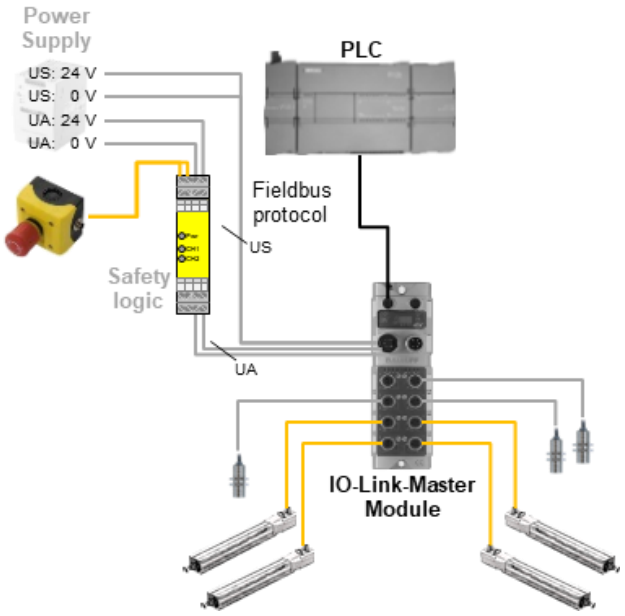


Figure 1: Schematic diagram of safety chain

The voltage supplies US / UA provide power to the Class A and Class B ports of the module galvanically isolated and independent of each other:

Description	Order code		Class A	Class B
			Port 0, 1, 2, 3	Port 4, 5, 6, 7
BNI PNT-538-105-Z063	BNI00AZ	**US** (24V/GND)	Pins 1,3 Pins 2,4*	Pins 1,3,4
		UA (P24/N24)		Pins 2,5

Table 1: Segment assignment for the voltage supplies

* When UA is turned off the Class A outputs are also deactivated via software (not safe).

11 Use in safety applications

11.4. Inspections

The inspection interval for the function test of the safety function to be documented [turning off the actuator-voltage(s)] depends on the requirements for the safety function of the higher level system, but must be performed no later than every 12 months.

Note
It is recommended that the inspection be automatically carried out by the higher level system. If this is not possible, we recommend automatically providing the user with a reminder for the inspection. If this is not possible either, performance of the inspection must be specified in the process instructions for the higher level system.

12 Appendix

12.1. Scope of Delivery

The BNI PNT comprises the following elements:

- IO-Link block
- 4x M12 dummy plugs
- Ground strap
- M4x6 screw
- 20 informational signs

12.2. Order number

BNI PNT-538-105-Z063

Balluff Network Interface

ProfiNet

Functions
538 = IP 67 IO-Link module, 4 IO-Link ports Class A, 4 IO-Link ports Class B

Versions
105 = display version, 2-port switch

Mechanical version
Z063 = Die-cast zinc
Data transmission: 2 x M12x1 internal thread
Power connection: M12 T-coded external / internal thread
Sensor connections: 8 x M12x1 internal thread

12.3. Ordering information

Product order code	Order code
BNI PNT-538-105-Z063	BNI00AZ

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