BNI EIP-502-105-Z015
BNI EIP-508-105-Z015

EtherNet/IP™ IP67 modules

User's Guide

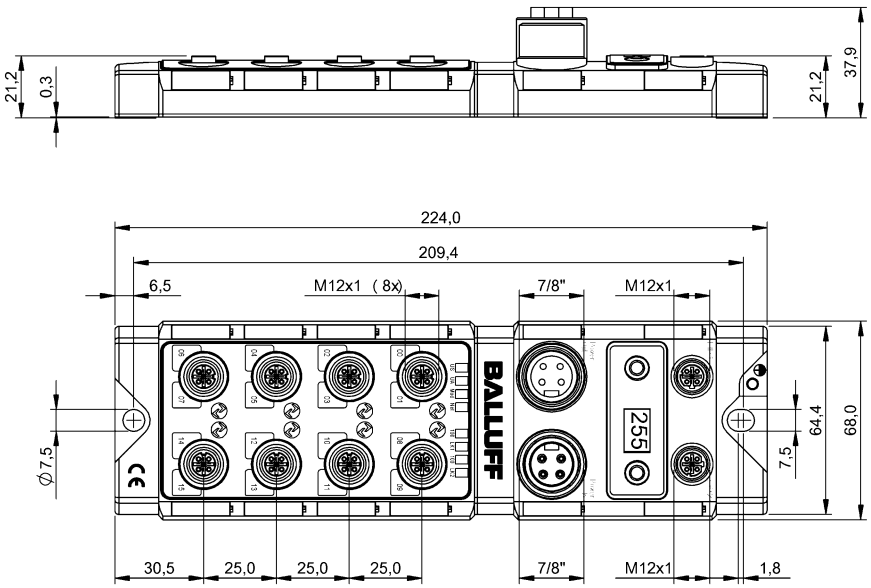


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1 Notes

1.1. Structure of the guide

This guide is arranged so that one chapter builds upon the other.
Chapter 2: Basic safety instructions
Chapter 3: Main steps for installing the device
……

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

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 most be observed.

1.4. Abbreviations

BNI	Balluff Network Interface
I	Standard input port
EIP	EtherNet/IP™
EMC	Electromagnetic compatibility
FE	Function ground
O	Standard output port

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 EIP-… is a decentralized IO-Link, input and output module for connecting to the EtherNet/IP™ 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.
Intended 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

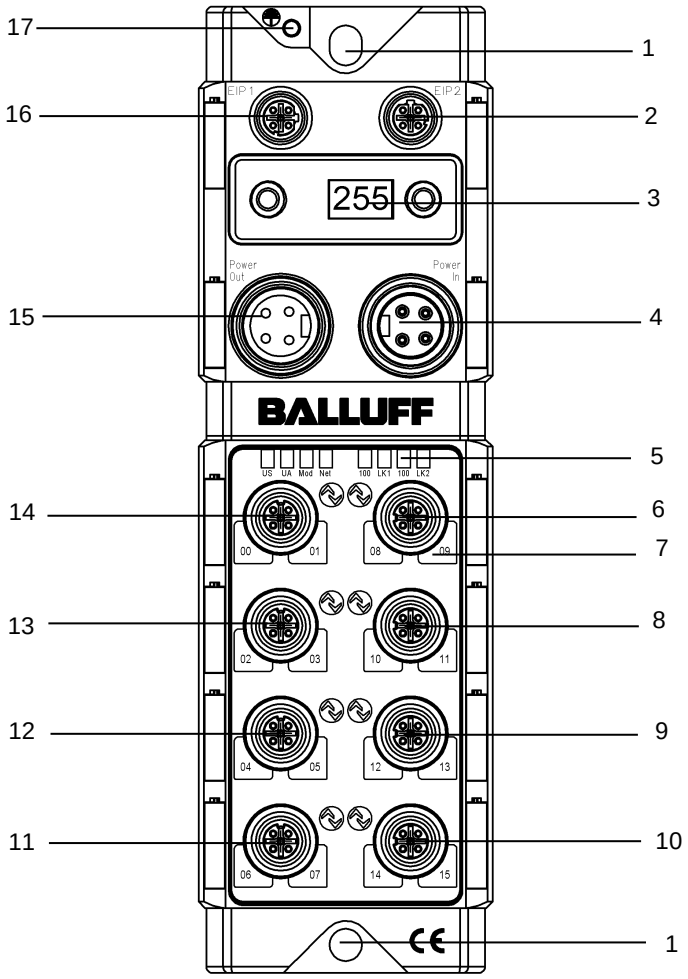


Figure – Overview: BNI EIP-508-105-Z015

1	Mounting hole
2	EtherNet/IP™ port 2
3	Display
4	Power supply, input
5	Status LED: communication / module
6	Port 08 / 09 (IO-Link, standard I/O)
7	Pin/port LED: signal status
8	Port 10 / 11 (IO-Link, standard I/O)
9	Port 12 / 13 (IO-Link, standard I/O)
10	Port 14 / 15 (IO-Link, standard I/O)
11	Port 06 / 07 (IO-Link, standard I/O)
12	Port 04 / 05 (IO-Link, standard I/O)
13	Port 02 / 03 (IO-Link, standard I/O)
14	Port 00 / 01 (IO-Link, standard I/O)
15	Power supply, output
16	EtherNet/IP™ port 1
17	Ground connection

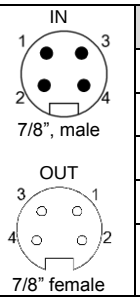
3 First Steps

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

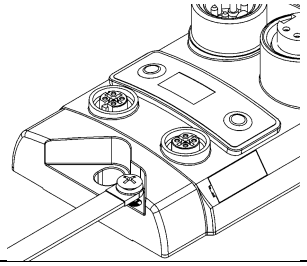
Power Supply



Pin	Function	Description
1	+24 V	Actuator supply
2	+24 V	Module / sensor supply
3	0 V	GND module / sensor and actuator supply
4		

Note
Where possible, use a separate power source to supply the sensor/bus and actuator with power.
Total current < 9 A The total current of all modules must not exceed 9 A even in the case of series connection of the actuator supply.

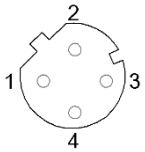
Grounding



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

Ethernet IP Interface

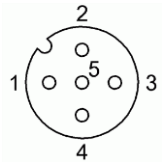
M12, D-coded, female



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

I/O Port

M12, A-coded, female



Pin	Function
1	+24 V, 200 mA
2	Input/output 2A
3	GND
4	Input/output 2A
5	FE

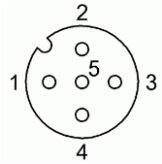
Note
For the digital sensor inputs, refer to guideline on inputs EN 61131-2, Type 2.

Note
The total current of the module must not exceed 9 A.

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

IO-Link Port

M12, A-coded, female



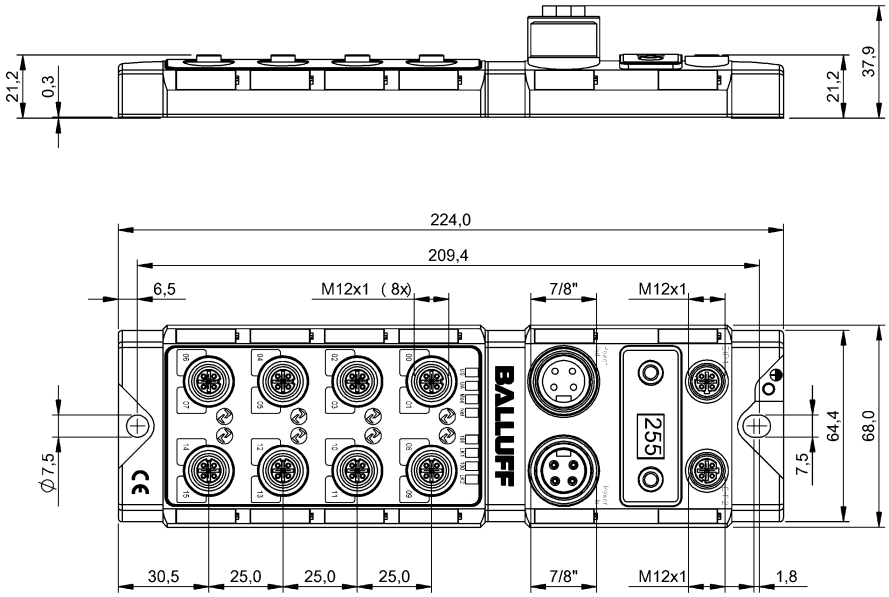
Pin	Function
1	+24 V, 1.6 A
2	Input/output 2A
3	GND
4	IO-Link/input/output 2A
5	n.a.

Port

	Port	
	00/01, 02/03, 08/09, 10/11	04/05, 06/07, 12/13, 14/15
BNI EIP-502-105-Z015	IN / OUT	IN / OUT / IO-Link
BNI EIP-508-105-Z015	IN / OUT / IO-Link	

4 Technical Data

4.1. Dimensions



4.2. Mechanical Data

Housing material	Die case zinc, matt nickel plated
Enclosure rating per IEC 60529	IP 67 (only when plugged-in and threaded-in)
Supply voltage	7/8" 4-pin, connector / female
Input ports / output ports	M12, A-coded (8x female)
Dimensions (W x H x D in mm)	68 x 224 x 37.9
Type of mounting	Screw mounting with 2 mounting holes
Ground strap installation	M4
Weight	Approx. 670 gr.

4.3. Operating Conditions

Operating temperature T_a Storage temperature	-5 °C ... 70 °C -25 °C ... 70 °C
EMC - Immunity - Emission	EMC Directive 2004/108/EEC - EN 61000-6-2 - EN 61000-6-4
Shock/vibration	EN 60068-2-6, EN 60068-2-27 EN 60068-2-29, EN 60068-2-64

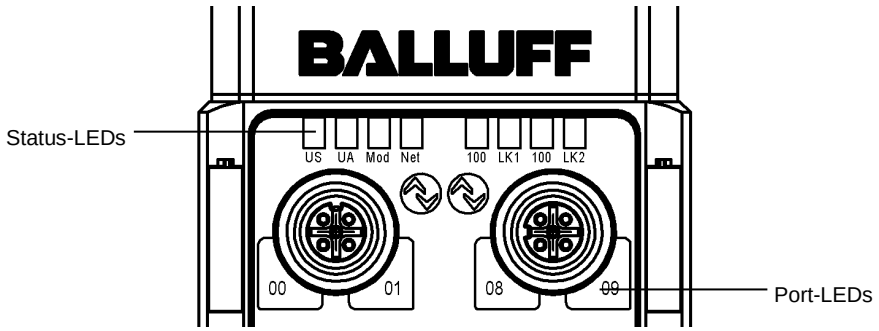
4.4. Electrical Data

Supply voltage	18...30.2 V DC, in accordance with EN 61131-2
Ripple	< 1%
Input current at 24 V	130 mA

4.5. Ethernet

Ethernet IP port	2 x 10Base/100Base Tx
Connection for Ethernet IP 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	10/100 Mbps
Max. cable length	100 m
Flow control	Half-duplex/full-duplex (IEEE 802.33x pause)

4.6. Function Indicators



Module Status

LED	Display	Description
UA	Green	Output power OK
	Red, flashing	Low output power (< 18V)
	Red	No output power (< 11V)
US	Green	Input power OK
	Red, flashing	Low input power (< 18V)
Mod	Green, flashing	Incorrect or no configuration of the module
	Green	Module is working
	Red, flashing	Fixed bus clock is not possible
	Red-green, flashing	Initial sequence
Network	Off	Module has no IP address
	Green, flashing	Module has IP, but no connection established
	Green	Connection established
	Red, flashing	Connection timeout
	Red-green, flashing	Initial sequence
100	Off	Bus clock: 10 Mbps
	Yellow	Bus clock: 100 Mbps
LNK	Green	Data transfer

4 Technical Data

Port

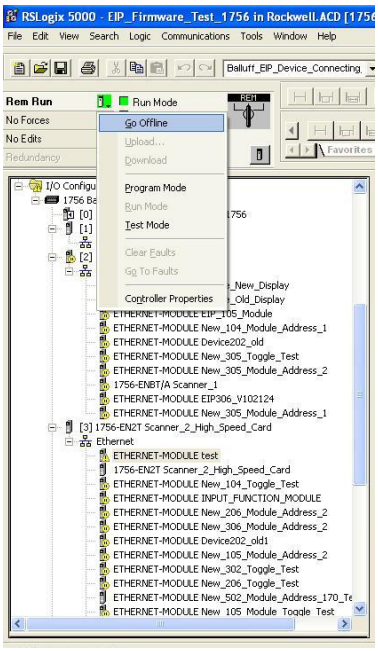
Each port has two bicolored LEDs for displaying the I/O statuses.

	Display	Status	Description
I/O port	Off	I/O status	The status of the input or output pins is 0
	Yellow	I/O status	The status of the input or output pins is 1
	Red, flashing	Short-circuit	Short-circuit between pin 1 and 3
	Red	Short-circuit	Short-circuit at dedicated pin
IO-Link port	Green	IO-Link	IO-Link communication active
	Green, flashing	IO-Link	No IO-Link communication
	Green, rapidly flashing	IO-Link	IO-Link pre-operate during data storage
	Red	Short-circuit	Short-circuit at pin 4
	Red, flashing quickly	IO-Link	Validation failed / Data storage failed / Wrong device for data storage

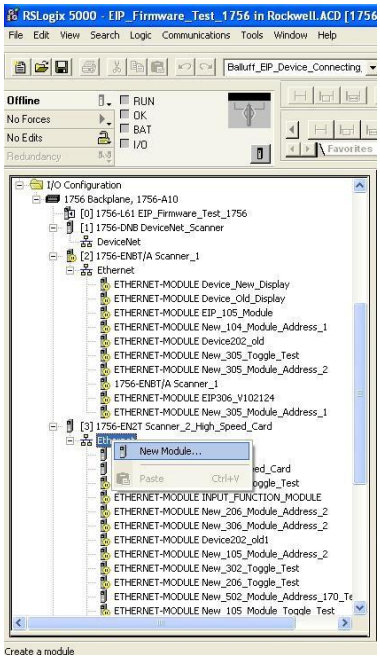
5.1. Integration in Rockwell RS Logix 5000

Here you see an example of how the module can be integrated into a Rockwell RS Logix 5000:

First go offline

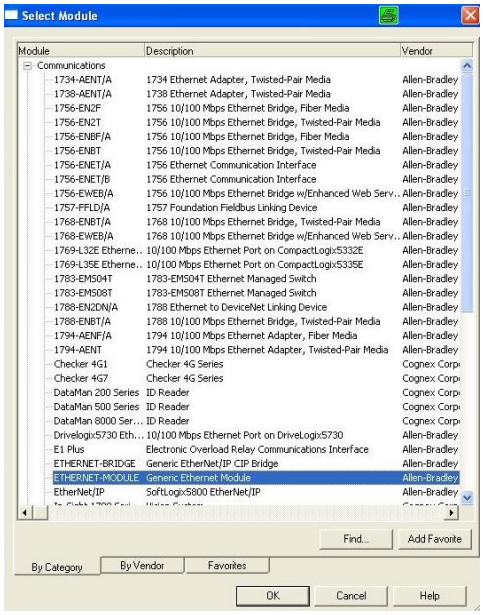


Right-click Ethernet (on the correct scanner card)
Select a new module

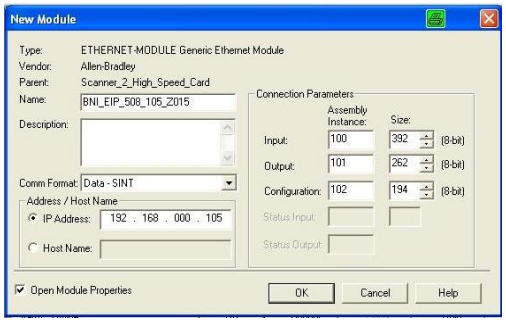


5 Integration

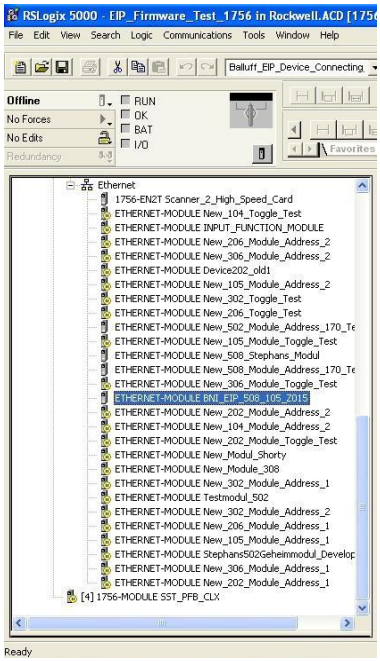
Then select the general Ethernet module as the ETHERNET module in the communication path



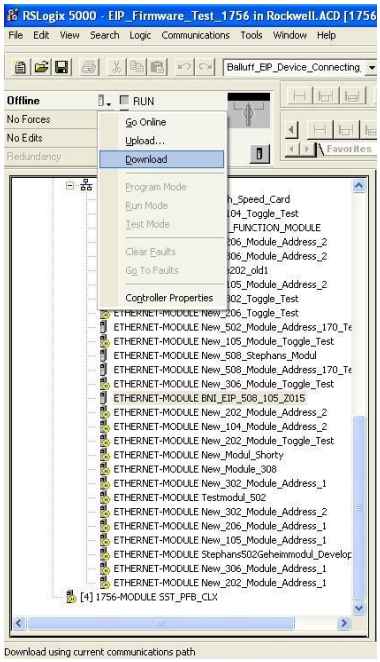
Now enter a user-defined tag name to select the general format Data-SINT, to enter the IP address of the module and to enter the correct connection parameters.



The new module and corresponding controller tags are generated automatically.



Then download the configuration

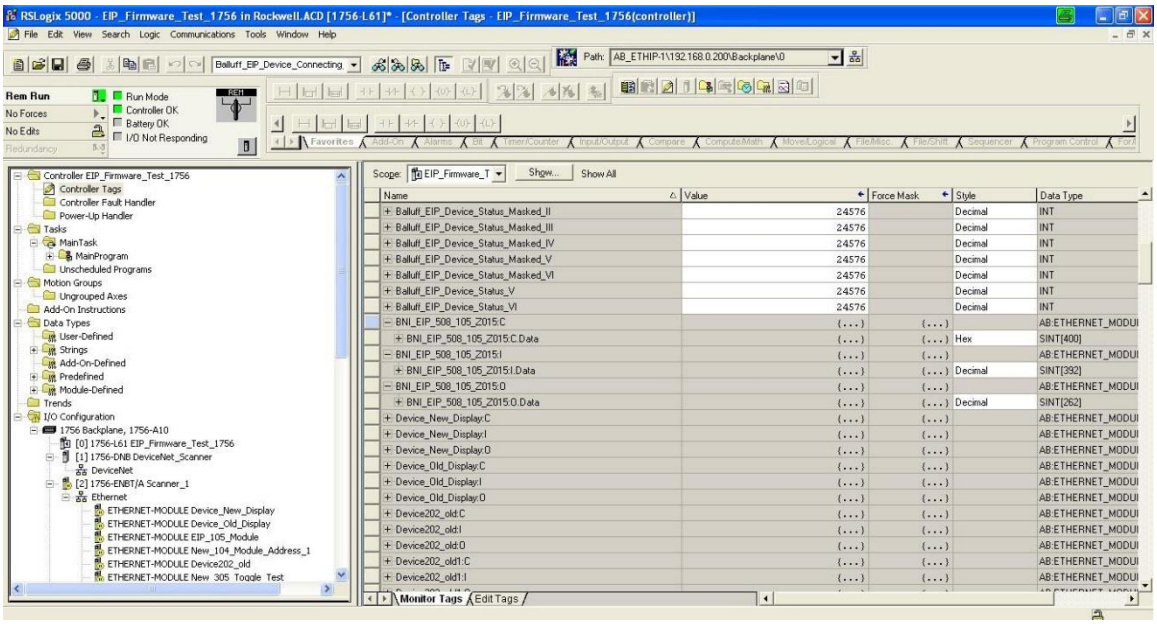


5 Integration

When the download is done, you can observe and control the tags using the Controller Tags option. Make sure you select the correct tag name, which you configured beforehand.

The input, output and configuration data for this is described on the following pages.

You can use these tags for the programming, too.



5.2. Address Specifications

These settings are factory-set.

IP-Adresse: 192.168.1.1
Subnetmaske: 255.255.255.0
Gatewayadresse: 192.168.1.1

5.3. Data Configuration

Please enter the following values in the control system. They describe the data sizes of the input, output and configuration data.

	Instanc ID	Data length				
		502	508	507	527	508-C06
Input	100	200	392	196	196	128
Output	101	134	262	130	128	86
CONFIG	102	98	194	98	98	0

5.4. Configuration Data

The following tables show an allocation of the configuration data sequence. The standard values specified below describe a configuration with the IO-Link function at Pin 4 and standard I/O functions at Pin 2 and 4 of each port. The input and output functions of the configured standard I/O ports are set via the process data.

BNI EIP-502-105-XXXX, BNI EIP-507-005-Z040, BNI EIP-527-005-Z040

Byte	Slot	Module part	Description
0…1	1	Module	General configuration for the entire module
2…25	2	IO-Link port 0	Configuration of IO-Link port 0
26…49	3	IO-Link port 1	Configuration of IO-Link port 1
50…73	4	IO-Link port 2	Configuration of IO-Link port 2
74…97	5	IO-Link port 3	Configuration of IO-Link port 3

BNI EIP-508-105-XXXX

Byte	Slot	Module part	Description
0…1	1	Module	General configuration for the entire module
2…25	2	IO-Link port 0	Configuration of IO-Link port 0
26…49	3	IO-Link port 1	Configuration of IO-Link port 1
50…73	4	IO-Link port 2	Configuration of IO-Link port 2
74…97	5	IO-Link port 3	Configuration of IO-Link port 3
98…121	6	IO-Link port 4	Configuration of IO-Link port 4
122…145	7	IO-Link port 5	Configuration of IO-Link port 5
146…169	8	IO-Link port 6	Configuration of IO-Link port 6
170…193	9	IO-Link port 7	Configuration of IO-Link port 7

Note
The BNI EIP-508-XXX-XXXX-C06 has no configuration data. These are fixed and can not be changed.

5 Integration

Module Configuration BNI EIP-502-105-XXX

Byte	Bit 7	6	5	4	3	2	1	0	Description
0	P3		P2		-		-		Port function 0x00: Standard I/O 0x01: IO-Link
1	P7		P6		-		-		

Module Configuration BNI EIP-508-105-XXX

Byte	Bit 7	6	5	4	3	2	1	0	Description
0	P3		P2		P1		P0		Port function 0x00: Standard I/O 0x01: IO-Link
1	P7		P6		P5		P4		

Module Configuration BNI EIP-507-005-Z040, BNI EIP-527-005-Z040

Byte	Bit 7	6	5	4	3	2	1	0	Description
0	P3		P2		P1		P0		Port function 0x00: Standard I/O 0x01: IO-Link
1	Reserved								

Module Configuration BNI EIP-508-XXX-XXXX-C06

The IO-Link ports are always activated.

IO-Link Port Configuration

Byte	Bit								Description
	7	6	5	4	3	2	1	0	
2	Basic		Time						Cycle time
3	Validation type								Validation type *0 No validation* *1 compatible (VID + DID)* *2 Identical (VID + DID + SerNum)*
4	Vendor ID 1								Vendor ID
5	Vendor ID 2								
6	Device ID 1								Device ID
7	Device ID 2								
8	Device ID 3								
9	Serial number 1								Serial number
…	…								
24	Serial number 16								
25	Parameter server								Parameter server 0x8X Enable 0x0X Disable 0x40 Delete 0xX1 Enable upload 0xX2 Disable download
…	The data of the other IO-Link ports is structured identically and described in the following.								

5 Integration

Cycle Settings

This parameter can be used to influence the IO-Link communication speed. Calculated using the multiplier and the time base, the IO-Link cycle time can be increased.
The time base is described in Table B3. The multiplier is entered in decimal form from 0…63.

Bit								Description
7	6	5	4	3	2	1	0	
Time base		Multiplier						Bit 0 to 5: Multiplier These bits contain a 6-bit multiplier for the calculation of MasterCycleTime or MinCycle Time. Permissible values for the multiplier are 0 to 63. Bit 6 to 7: Time Base These bits specify the time base for the calculation of MasterCycleTime or MinCycleTime.

Possible values of MasterCycleTime and MiniCycleTime

Time base encoding	Time base value	Calculation	Cycle time
00	0.1 ms	Multiplier x time base	0.4 ms to 6.3 ms
01	0.4 ms	6.4 ms + multiplier x time base	6.4 ms to 31.6 ms
10	1.6 ms	32.0 ms + multiplier x time base	32.0 ms to 132.8 ms
11	Reserved	Reserved	Reserved
NOTE: The value 0.4 results from the minimum possible transmission time according to A.3.7.			

Validation Settings

No validation: validation deactivated, every device will be accepted.
Compatibility: manufacturer ID and device ID are compared to the IO-Link device data.
Identity: manufacturer ID and device ID and serial number are compared to the IO-Link device data. The IO-Link communication is only started if there is a match.

Parameter Server

Enable: data management functions enabled, parameter data and identification data of the IO-Link device are stored permanently.
Disable: data management functions disabled, stored parameter data and identification data of the IO-Link device remain stored.
Deleted: data management functions disabled, stored parameter data and identification data of the IO-Link device are deleted.
Enable upload:
If only the upload is enabled, the master always starts an upload of the parameter data. In this case, the upload is independent of the upload flag of the IO-Link device. If no data is stored in the Master Port, an upload likewise takes place. (e.g. after deleting the data or before the first data upload)
Enable download:
If only the download is enabled, the master always starts a download of the parameter data. In this case, the download is likewise independent of the upload flag of the IO-Link device. If no data is stored in the Master Port, however, an upload takes place first. (e.g. after deleting the data or before the first data upload)
Enable upload and download:
If the upload and download are enabled, different parameter sets are distinguished depending on the upload flag of the IO-Link device.
If no parameter data is stored in the IO-Link master port, an initial upload takes place. (e.g. after deleting the data or before the first data upload)
If the upload flag is set on the IO-Link device, an upload of the parameter data always takes place.
If no upload flag is set and parameter data has already been stored, a download of the parameter data always takes place.



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.
If an IO-Link device of a different type is to be used, the contents of the parameter server must be deleted.
The data storage is supported only by IO-Link devices with IO-Link Revision 1.1.

Upload Flag on the IO-Link Device

The upload flag is needed to overwrite already saved data in the parameter server with new parameter data of the same IO-Link device.

To enable the upload flag of an IO-Link device,
the data value 0x05 must be entered in the index 0x02, subindex 0.
(For information about configuration via IO-Link, refer to the "Web Server" chapter under "Device Properties" or the "Configuration via Explicit Messages" chapter under "IO-Link Device Parameterization")

6 Configuration via Explicit Messages

QuickConnect

The QuickConnect function makes it faster to boot up and integrate the BNI EIP-50x-105-X015 modules.

Enabling QuickConnect automatically takes over all necessary port properties on the module:

- Static IP address
- Ports at 100 Mbps full-duplex
- Auto-negotiation disabled
- Auto MDI-X disabled
- Prepared for linear topology

You can configure QuickConnect via the following class instance attribute of the explicit messages:

Class	Instance	Attribute	Value
245 (0xF5)	1 (0x01)	12 (0x0C)	0: disabled (default) 1: enabled

Note
For QuickConnect to be enabled, ACD (Address Conflict Detection) must also be enabled. This is switched on by default.

The ACD can be reviewed and changed using the following class instance attributes of the explicit messages:

Class	Instance	Attribute	Value
245 (0xF5)	1 (0x01)	10 (0x0A)	0: disabled 1: enabled(default)

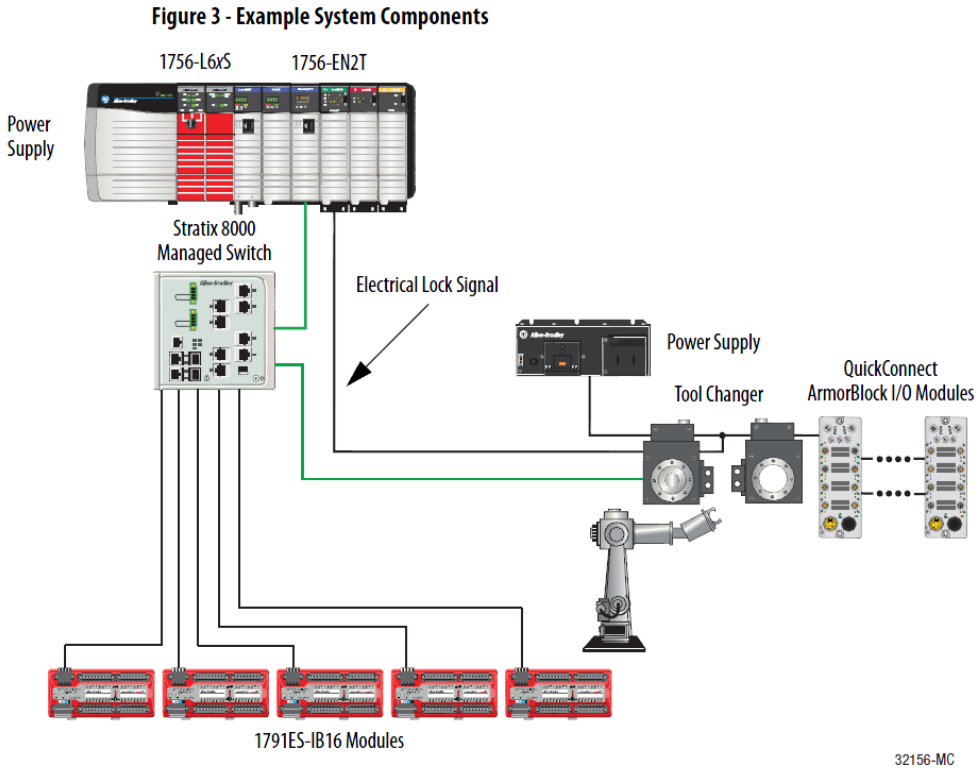
Rockwell Automation Products that are Compatible with QuickConnect

Component	Supported Rockwell Automation Products
Controller	ControlLogix® controllers: • 1756-L6*x* • 1756-L7*x* GuardLogix controllers: • 1756-L6*x*S • 1756-L7*x*S All controllers require firmware revision 20.001 or later.
EtherNet/IP managed switch on the controller side	Stratix 6000 switches: • 1783-EMS04T • 1783-EMS08T Stratix 8000 switches: • 1783-MS06T or 1783-MS10T • 1783-RMS06T or 1783-RMS10T • 1783-MX08T or 1783-MX08F
EtherNet/IP communication modules	ControlLogix communication modules: • 1756-EN2T with firmware revision 4.003 • 1756-ENBT with firmware revision 6.002
Application logic that uses generic CIP Messages to inhibit and uninhibit I/O modules	Studio 5000 Logix Designer application, version 21.00.00 or later or RSLogix 5000 software, version 20.01.02

Source:
Allen-Bradley Ethernet/IP QuickConnect Application Technique
Page 13

6 Configuration via Explicit Messages

Example with Rockwell Components



Source:
Allen-Bradley Ethernet/IP QuickConnect Application Technique, Page 12

Please also note the following:

- Direct connection between PLC and QuickConnect slave with crossover cable
- Slave-to-slave connection using patch cable
- For setting up the topology, only the linear topology with a maximum of 20 modules on the tool side is permitted.
- If needed, only one managed switch may be used between the PLC and Ethernet/IP slave.
- To trigger the QuickConnect sequence, an electrical lock signal is required that reads in the supply voltage of the QuickConnect slaves via the controller.

PLC Program

Add Application Logic

Add ladder logic to inhibit and uninhibit QuickConnect I/O modules:

- Run this logic in a periodic task with a recommended 10 ms update rate.
- The logic examples shown configure two ArmorBlock I/O modules. Modify the code as needed to configure as many as 20 ArmorBlock I/O modules.

IMPORTANT A connection time of 500 ms with 20 QuickConnect modules is supported with only a ControlLogix 1756-L7*x* controller and 1756-EN2T communication module. For average connection times per number of modules, see Average Timing with Rockwell Automation Products on page 50.

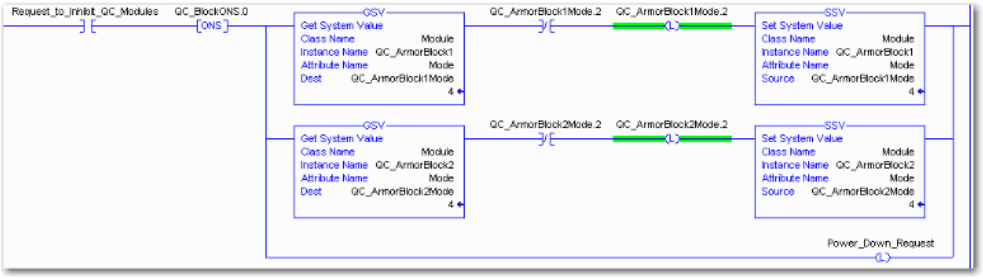
Inhibit and Power Down

Add this logic to inhibit and power down the QuickConnect modules.

1. Rung 0: Inhibit the modules.

   Before making a tool change, you must uninhibit the QuickConnect ArmorBlock I/O modules mounted to the tool before powering down. Use a GSV (Mode) instruction to monitor the present state of the modules and one SSV (Mode) instruction per module to inhibit the modules.

   The input condition to start the inhibit process must come from an external input. For example, as the robot is traveling back to change out the tool, this input condition must be enabled. By the time the tool is being changed, the modules are inhibited and can proceed to powering down the tool and modules.

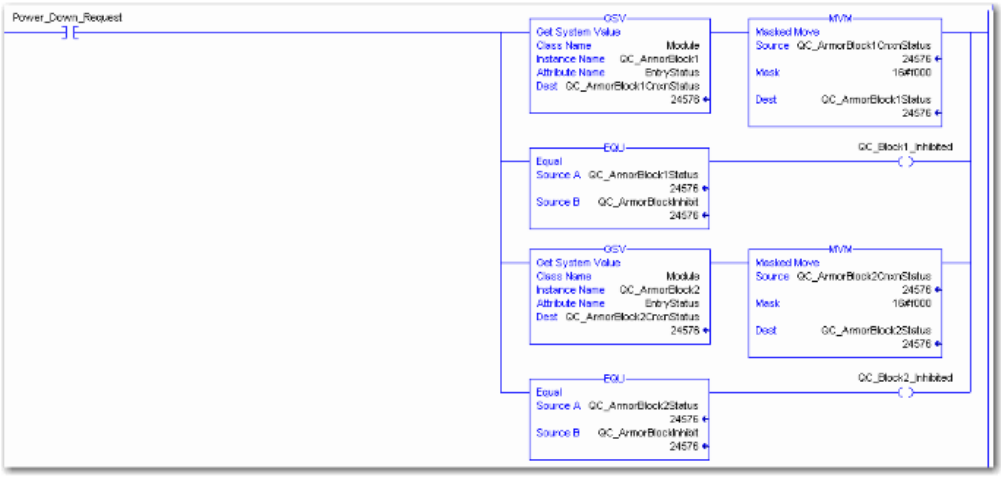


Source:
Allen-Bradley Ethernet/IP QuickConnect Application Technique, Page 29

6 Configuration via Explicit Messages

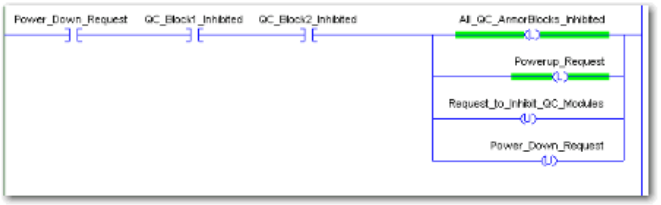
2. Rung 1: Verify the modules are inhibited.

   After the modules have been inhibited, verify that the modules have indeed been inhibited. Use one GSV (Entry Status) instruction per module. When the Entry Status value equals a decimal value of 24576, the module can be disconnected from the robotic arm and powered down.



3. Rung 2: Power down the modules.

   This rung verifies that all the modules have been inhibited and powered down. The tool and modules can be physically disconnected from the robotic arm.



Source:
Allen-Bradley Ethernet/IP QuickConnect Application Technique, Page 30

Uninhibit and Power Up

Add this logic to uninhibit and power up the QuickConnect I/O modules.

1. Rung 3: Power up the modules.

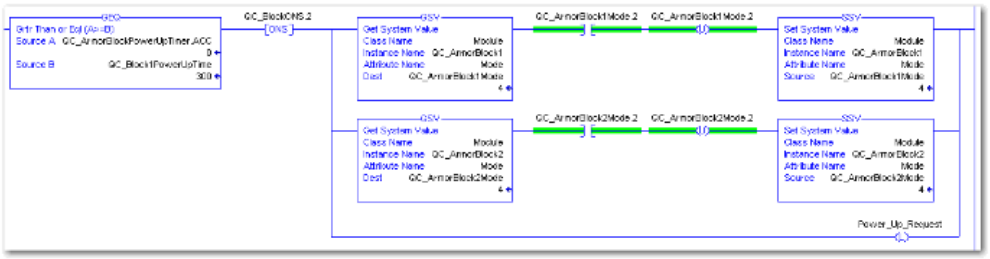
   Once the tool and module is connected, an external input module sends an electrical lock input signal. On receipt of the signal, start a timer to keep track of how long the tool and modules have been connected.

   Every QuickConnect ArmorBlock I/O module has a delay time embedded in its electronic data sheet (EDS) file. This delay time is the amount of time the module takes to power up. The module takes about 300 ms to fully power up before establishing a connection to the controller.



2. Rung 4: Uninhibit the modules.

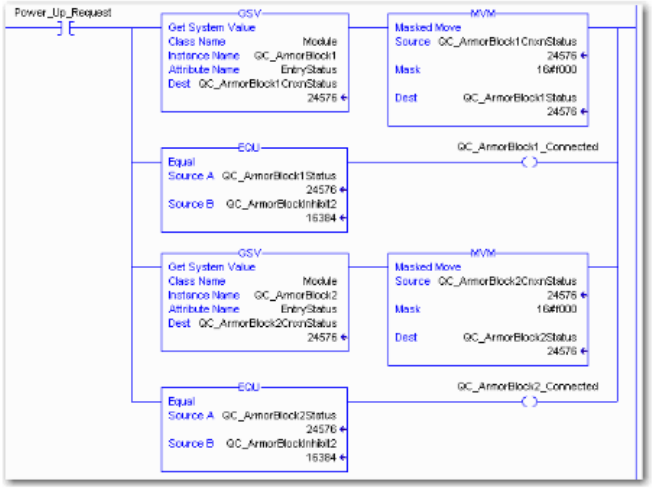
   When the Timer. Acc is greater then or equal to the module delay time (300 ms), use an SSV (Mode) instruction to uninhibit the module. Use a GSV (Mode) instruction to verify the mode of the module at powerup.



Source:
Allen-Bradley Ethernet/IP QuickConnect Application Technique, Page 31

3. (Optional) Rung 5: Verify the modules are uninhibited.

   After the modules have been uninhibited, verify that the modules have indeed been uninhibited. Use one GSV (Entry Status) instruction per module. When the Entry Status value equals a decimal value of 16384, the module has been uninhibited.



Source:
Allen-Bradley Ethernet/IP QuickConnect Application Technique, Page 32

Fault State

A safe state that the port is to take on in the case of a loss of bus communication can be predefined for each output on the port pins.

The fault state settings can be configured using the following class instance attributes of the explicit messages.

Enable/Disable Fault State

Class	Instance	Attribute	Value
9 (0x09)	1 - m	6	0: Fault state disabled 1: Fault state enabled

Fault State Action

Class	Instance	Attribute	Value
9 (0x09)	1 - m	5	0: Output on 1: Hold last state

m: Number of outputs

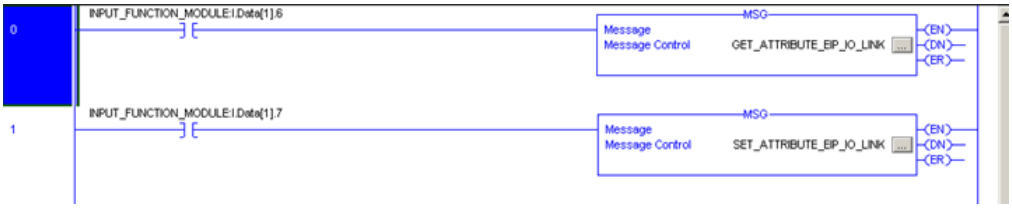
Note
The fault state settings are stored only temporarily in the module. They are deleted after a power reset.
To ensure a long-term fault state configuration, the configuration has to be programmed via the PLC so that the settings are transferred to the module again when the system is restarted.

IO-Link Device Para-meterization

There are two options for configuring an IO-Link device connected to the IO-Link port.

- Configuration via the web server
  refer to the "Web Server" chapter under "Device Properties"
- Configuration via explicit messages

The following example describes how Rockwell RSLogix 5000 devices can be used to configure an IO-Link device via explicit messages.
For this purpose, the "MSG" components in the PLC program are used.



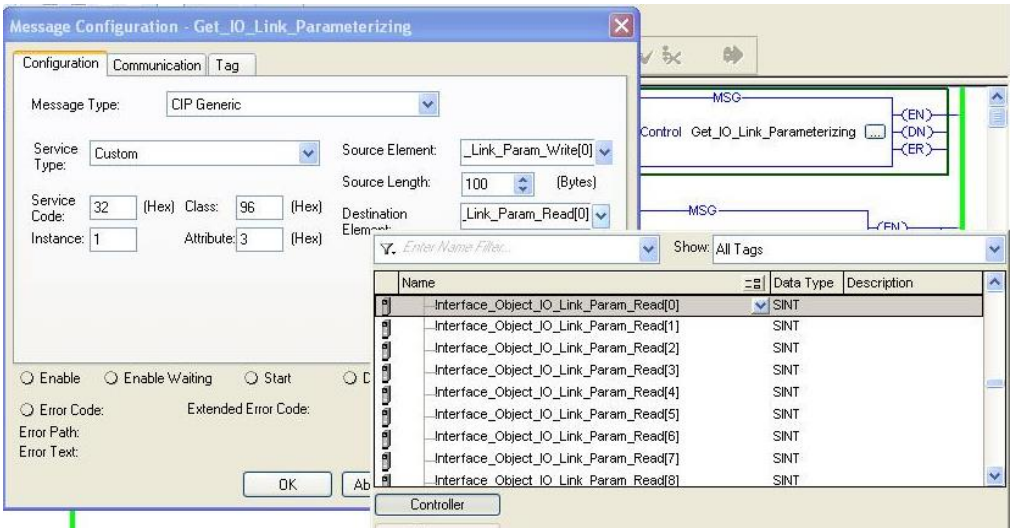
Read IO-Link Parameter

Service Code	Class	Instance	Attribute
0x32	0x96	1 - n	0x03 (Read Parameter)

n: Number of ports

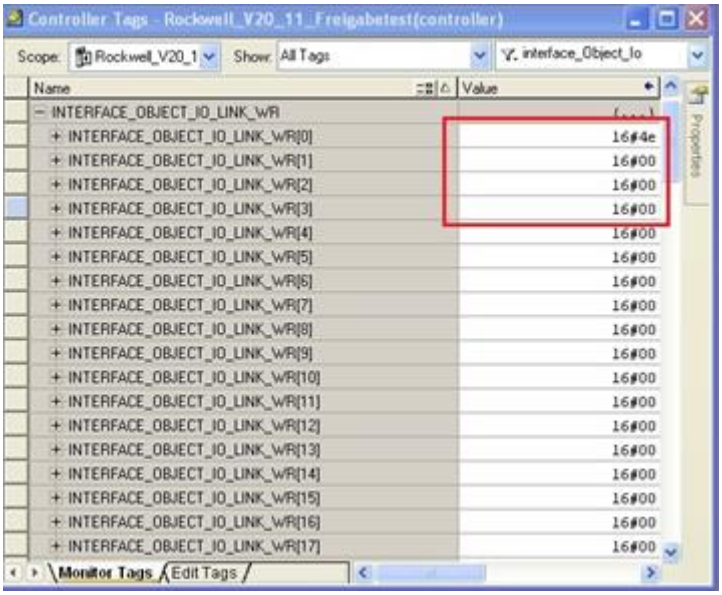
Source Length must correspond to at least the read parameters, but a larger value can also be entered. (In this example, 100 bytes)

As the Source Element (Write) and as the Destination Element (Read),
create one SINT[100] array each and select the first line[0].



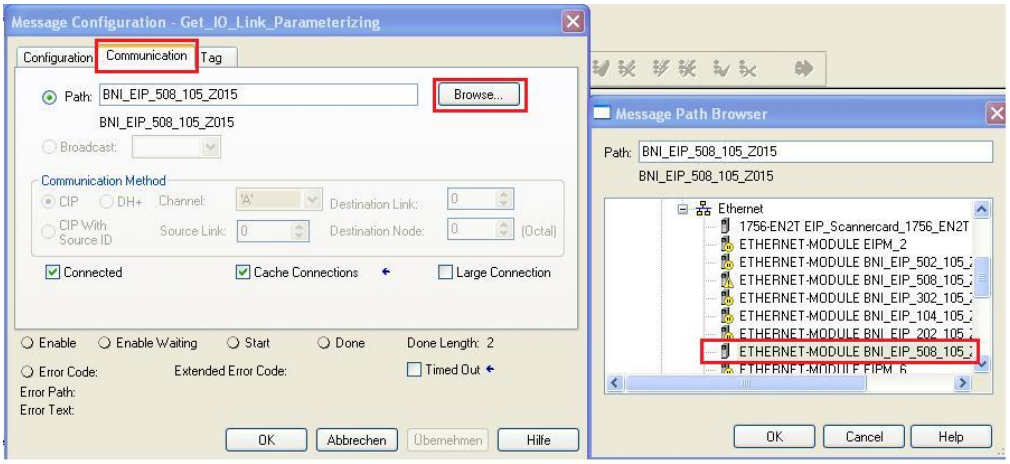
6 Configuration via Explicit Messages

In the Source Element Array (Write), enter which index is to be read.
In this example, this is index 0x4E.



Destination Array (Read) shows the read-out value.
In case of a configuration error, the error code is likewise displayed there.

In the "Communication" window, you have to select the Ethernet module on which the configuration is to take place.



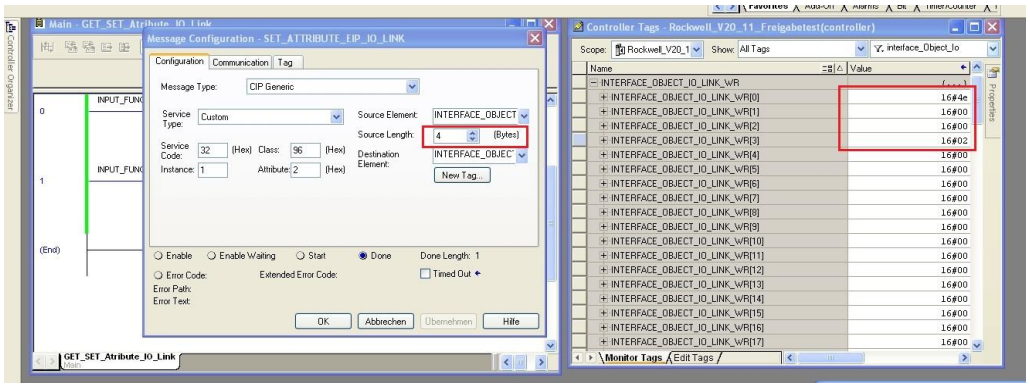
Write IO-Link Parameter

Service Code	Class	Instance	Attribute
0x32	0x96	1 - n	0x02 (Write Parameter)

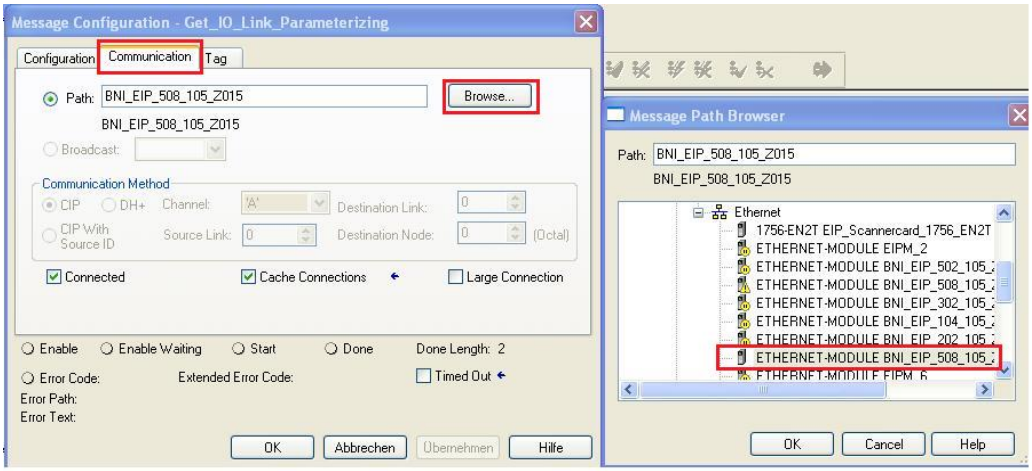
n: Number of ports

Source Element and Destination Element are to be selected so they are identical to the previous example, "Read IO-Link parameter".
The Source Length must be exactly the same length as the parameter data to be written.

In this example, index 0x4E, subindex 0,
value 0x02 is written in Source Element Array (Write).
In case of a configuration error, an error code appears in Destination Element Array (Read).



In the "Communication" window, you likewise have to select the Ethernet module on which the configuration is to take place.



Note
The explicit messages functions are implemented in accordance with the Volume 1: Common Industrial Protocol Specification and Volume 2: Ethernet/IP Adaption of CIP.

7 Process Data

7.1. Process Data Inputs

The input data size is 200 bytes. Take a look at the tables below for the allocation of the process data inputs.

BNI EIP-502-105-Z015

Byte	Module part	Description
0…7	Standard I/O ports	Process data inputs at the standard inputs
8…55	IO-Link port 1	Process data inputs at IO-Link port 1
56…103	IO-Link port 2	Process data inputs at IO-Link port 2
104…151	IO-Link port 3	Process data inputs at IO-Link port 3
152…199	IO-Link port 4	Process data inputs at IO-Link port 4

BNI EIP-508-105-Z015

Byte	Module part	Description
0…7	Standard I/O ports	Process data inputs at the standard inputs
8…55	IO-Link Port 0	Process data inputs at IO-Link port 0
56…103	IO-Link port 1	Process data inputs at IO-Link port 1
104…151	IO-Link port 2	Process data inputs at IO-Link port 2
152…199	IO-Link port 3	Process data inputs at IO-Link port 3
200…247	IO-Link port 4	Process data inputs at IO-Link port 4
248…295	IO-Link port 5	Process data inputs at IO-Link port 5
296…343	IO-Link port 6	Process data inputs at IO-Link port 6
344…391	IO-Link port 7	Process data inputs at IO-Link port 7

Standard Input Data

BNI EIP-502-105-Z015 and BNI EIP-508-105-Z015

Byte	Bit								Description
	7	6	5	4	3	2	1	0	
0	I32	I34	I22	I24	I12	I14	I02	I04	Input data I04 → Input at port 0, pin 4 The result is 0 only if the port is configured as an IO-Link port.
1	I72	I74	I62	I64	I52	I54	I42	I44	
2	S3		S2		S1		S0		Short-circuit status Short-circuit between pin 1 and 3 at the registered port
3	S7		S6		S5		S4		
4	O32	O34	O22	O24	O12	O14	O02	O04	Overload status O04 → Overload at port 0, pin 4 Only if the port is configured as an output.
5	O72	O74	O62	O64	O52	O54	O42	O44	
6	0	0	0	0	0	NA	PS	PA	Status of the power supply NV: No actuator power supply PS: Power supply for sensor PA: Power supply for actuator
7	0	0	0	0	0	0	0	0	Reserved

IO-Link Input Data BNI EIP-502-105-Z015 and BNI EIP-508-105-Z015

Byte	Bit								Description	
	7	6	5	4	3	2	1	0		
8 … 39									IO-Link port 0 input data	
40	0	0	0	0	0	0	DC	IOL	IO-Link status IOL: Port in IO-Link mode DC: Device connected 0: Reserved	
41	SC	0	0	0	0	PDI	DF	VF	IO-Link error VF: Validation failed SC: IO-Link short-circuit DF: Data storage validation failed PDI: Process data invalid	
42	Vendor ID 1								Vendor ID	
43	Vendor ID 2									
44	Device ID 1								Device ID	
45	Device ID 2									
46	Device ID 3									
47	Mode		Type		0				Event 1	Mode: 0: Reserved 1: Event single shot 2: Event disappears 3: Event appears Type: 0: Reserved 1: Notification 2: Warning 3: Error
48	Event code high									
49	Event code low									
50	Mode		Type		0				Event 2	
51	Event code high									
52	Event code low									
53	Mode		Type		0				Event 3	
54	Event code high									
55	Event code low									
…	The data of the other IO-Link ports are structured identically and described in the following.									

7 Process Data

7.2. Process Data Outputs

The output data size is 134 bytes. Take a look at the tables below for the allocation of the process data outputs.

BNI EIP-502-105-Z015

Byte	Module part	Description
0…5	Standard I/O ports	Process data outputs at the standard inputs
6…37	IO-Link port 1	Process data outputs at IO-Link port 1
38…69	IO-Link port 2	Process data outputs at IO-Link port 2
70…101	IO-Link port 3	Process data outputs at IO-Link port 3
102…133	IO-Link port 4	Process data outputs at IO-Link port 4

BNI EIP-508-105-Z015

Byte	Module part	Description
0…5	Standard I/O ports	Process data outputs at the standard inputs
6…37	IO-Link Port 0	Process data output at IO-Link port 0
38…69	IO-Link port 1	Process data output at IO-Link port 1
70…101	IO-Link port 2	Process data output at IO-Link port 2
102…133	IO-Link port 3	Process data output at IO-Link port 3
134…165	IO-Link port 4	Process data output at IO-Link port 4
166…197	IO-Link port 5	Process data output at IO-Link port 5
198…229	IO-Link port 6	Process data output at IO-Link port 6
230…261	IO-Link port 7	Process data output at IO-Link port 7

Standard Output Data

Byte	Bit								Description
	7	6	5	4	3	2	1	0	
0	O32	O34	O22	O24	O12	O14	O02	O04	Output data O04 → Output at port 0, pin 4 To use this function at an IO-Link port, the port has to be configured as an output.
1	O72	O74	O62	O64	O52	O54	O42	O44	
2	R32	R34	R22	R24	R12	R14	R02	R04	Restart Restart of the output after a short-circuit is detected
3	R72	R74	R62	R64	R52	R54	R42	R44	
4	0	0	0	0	0	0	0	0	Reserved
5	0	0	0	0	0	DL	GO	RO	Display control system DL: Display disabled / PLC lock GO: Green display LED illuminates RO: Red display LED illuminates

IO-Link Output Data

Byte	Bit								Description
	7	6	5	4	3	2	1	0	
6…37									IO-Link port 0 output data
…	The data of the other IO-Link ports are structured identically and described in the following.								

8 Display

8.1. General

With the implemented display, the address is output directly to the devices BNI EIP…
The following address types are possible:

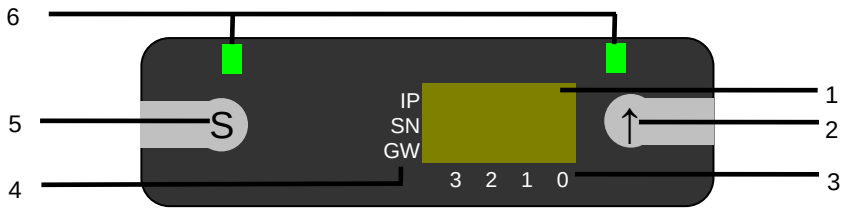
- IP address
- Subnet mask
- Gateway address

Each address is composed of 4 octets.
The display also shows information about the hardware and firmware update.
The display has a locking function that can be enabled from the control panel. If the lock is set, no more editing can be done (see bit layout, Chapter 6.2 Standard output data).

8.2. Address Specifications

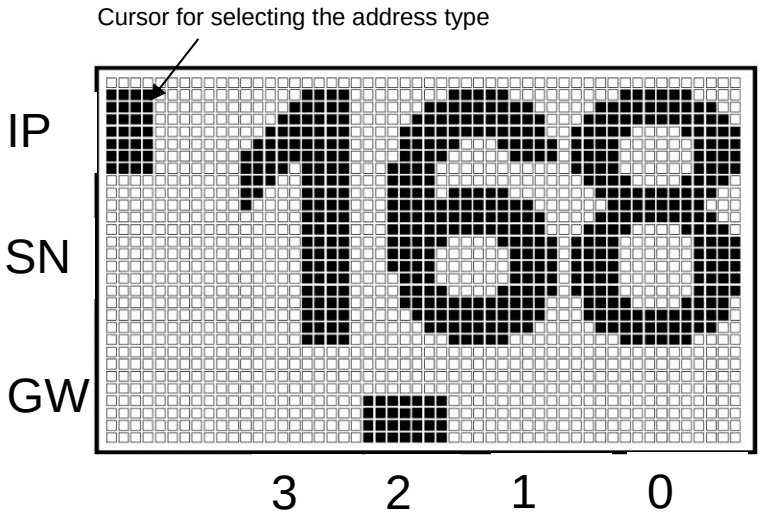
IP address:	192.168.1.1
Subnet mask:	255.255.255.0
Gateway address:	192.168.1.1

8.3. Control and Display



1 Display
2 Arrow key
3 Octet cursor
4 Address type cursor
5 "Set" key
6 LED

8.4. Display Information



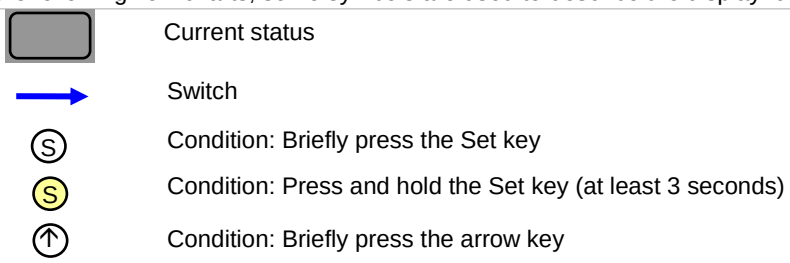
IP: IP address
SN: Subnet address
GW: Gateway address

3: First octet
2: Second octet
1: Third octet
0: Fourth octet

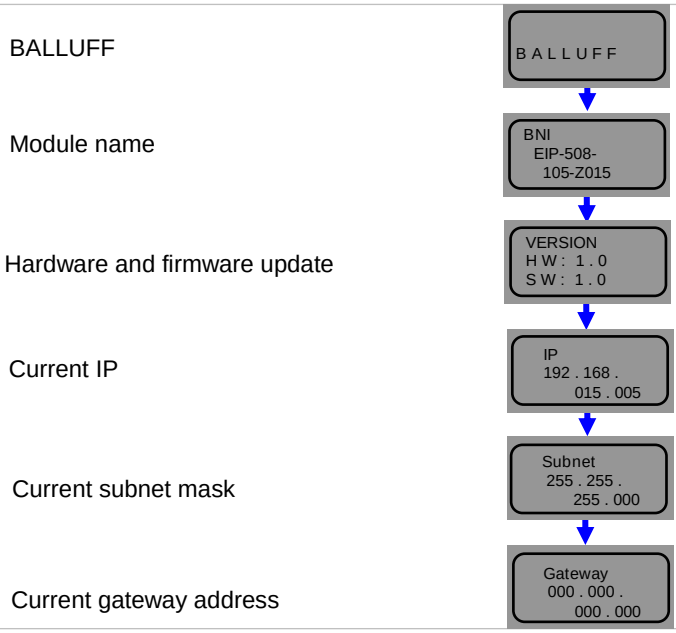
8 Display

8.5. Design and Symbols

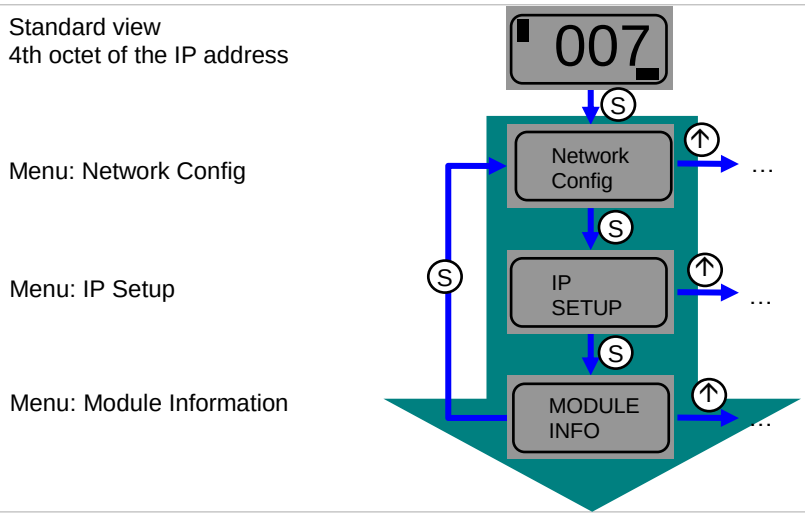
In the following flow charts, some symbols are used to describe the display functionality:



8.6. Startup

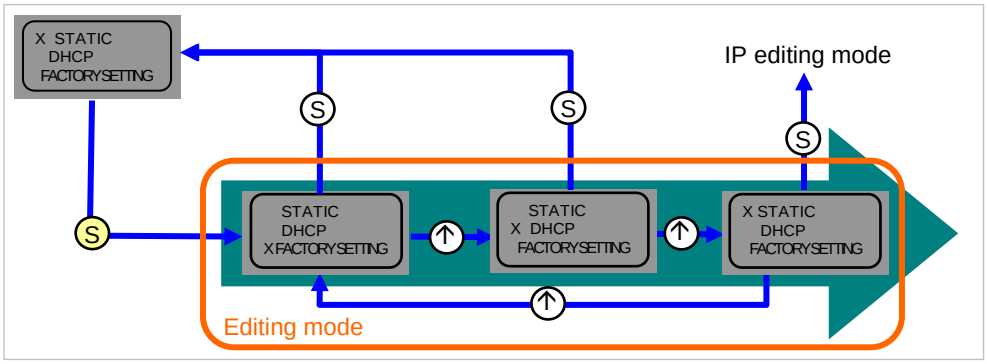


8.7. Main Menu



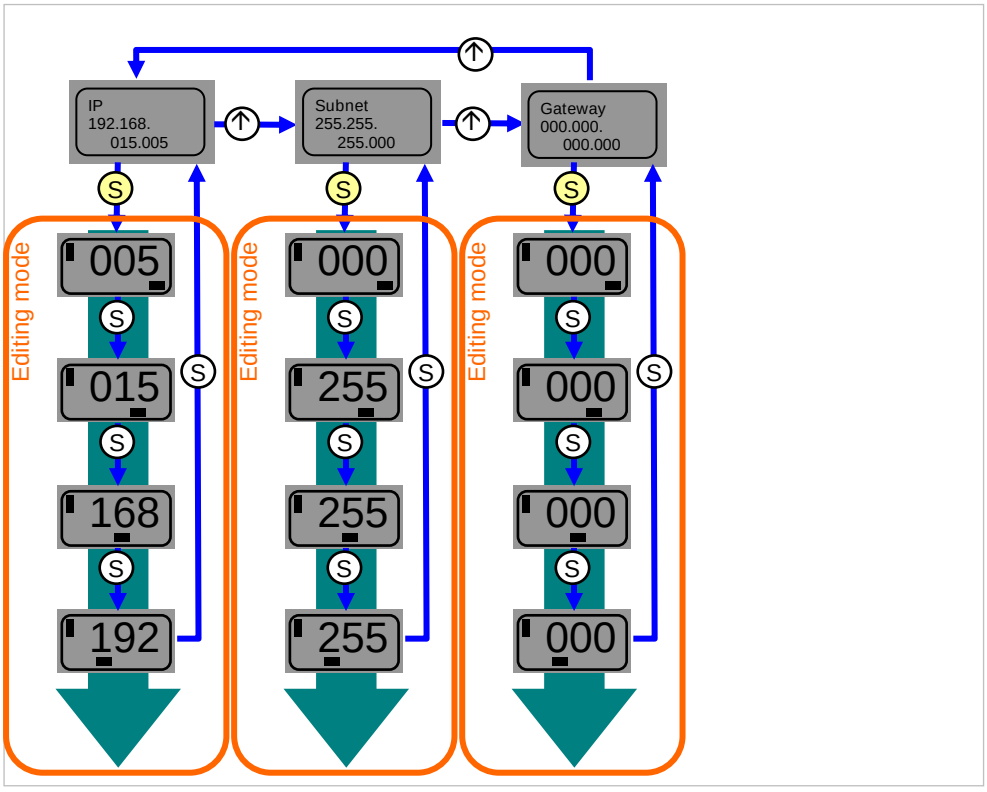
- Press the Set key briefly to scroll through the main menu.
- Press the arrow key to open the menu.

8.8. IP Setup



- Press and hold the Set key to call up the editing mode.
- The preferred value is configured by briefly pressing the arrow key.

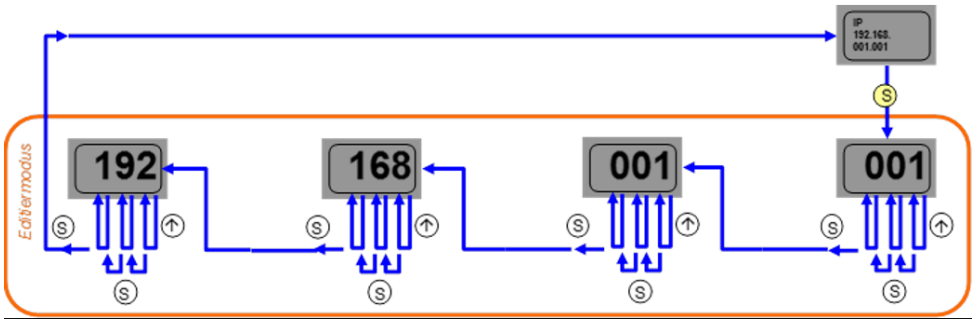
8.9. Network Config



- Press and hold the Set key to call up the editing mode.
- The preferred value is configured by briefly pressing the arrow key.
- Press and hold the arrow key to call up the fast program mode.
- Briefly pressing the Set key saves the entered value and scrolls to the next octet. The 4th octet represents the beginning of the editing process.
- The completely entered address is saved by briefly pressing the Set key when editing the first octet. The entered value appears right afterwards in the IP overview display.
- Manual changes to IP, subnet or gateway lead to an automatic change of the IP setup to "static".

8 Display

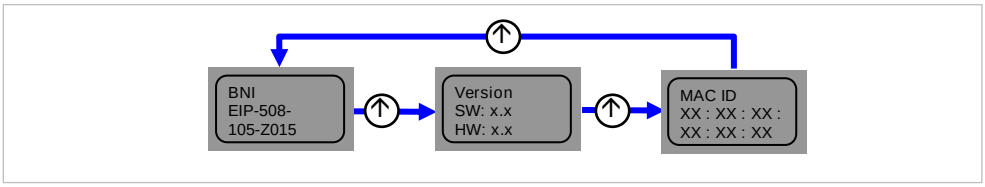
8.10. Edit mode



- In the Network Configuration menu, select IP / Subnet or Gateway Address.
- Press the set button long to switch to edit mode.
- Press the arrow key briefly to change the number.
- Press the Set button briefly to move to the next position.
- After the last digit, press the set button briefly to move to the next octet of the address or to accept the new number after the last octet.

Note
The module has to be restarted to work with the new configuration.

8.11. Module Information



- Briefly pressing the arrow key allows scrolling through the "Module information" menu.
- The product name, module updates and Mac-ID are displayed as information.

8.12. General Information

- Press and hold the arrow key to scroll quickly in editing mode.
- If no key is pressed for 10 seconds, the view reverts to the standard display (4th octet of the IP address). Changes that have not been saved will be lost.
- Differences between the new configuration and the configuration with which the module works are indicated by an unequal sign. In this case, the screen switches to the standard display after 5 seconds.
- The display flashes in editing mode. The display flickers in fast scroll mode.
- If the module receives a single ping, the word "Ping" appears on the display for a couple of seconds. Then the previous display returns. You can exit ping mode sooner by briefly pressing the Set key.
- If the module receives two or more pings, the word "Ping" appears on the display. You can exit the display only by briefly pressing the Set key. Then the display before the ping returns.
- The LED function of the display LEDs can be set in a user-specific manner by setting several bits in the process data outputs. (see bit layout, standard output data)
- The plc lock function can also be used by setting a bit in the process data outputs. (see bit layout, standard output data)

Note
You cannot select editing mode in the display if the plc lock is set in the process data inputs by a bit (see bit layout, standard output data)

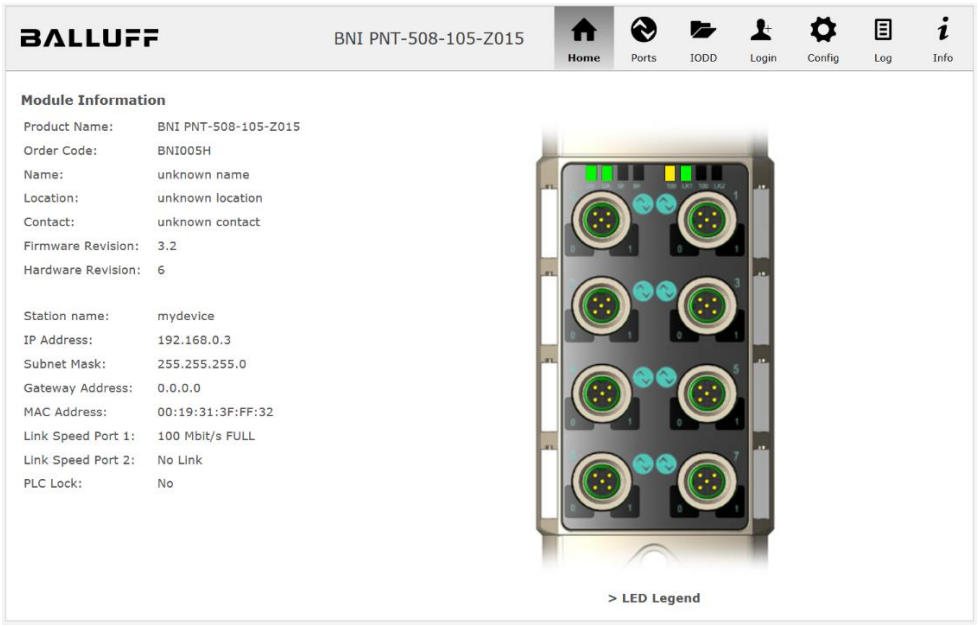
9 Web Server

9.1. General

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. Please use Internet Explorer 10 or newer as the browser; older versions may result in display problems.

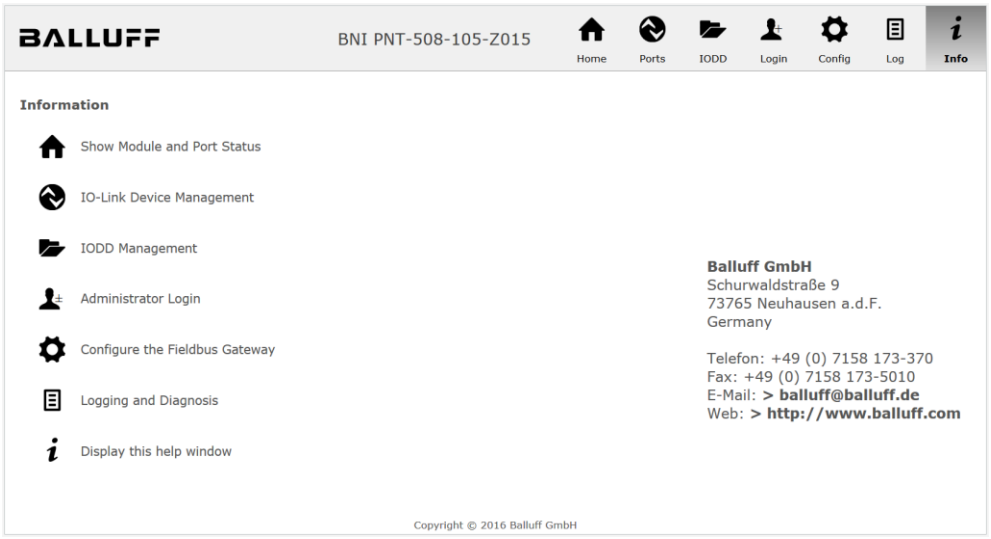
For open a connection with the web server, enter the IP address of the module in the address line of the browser. The homepage then appears with the essential device information.



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

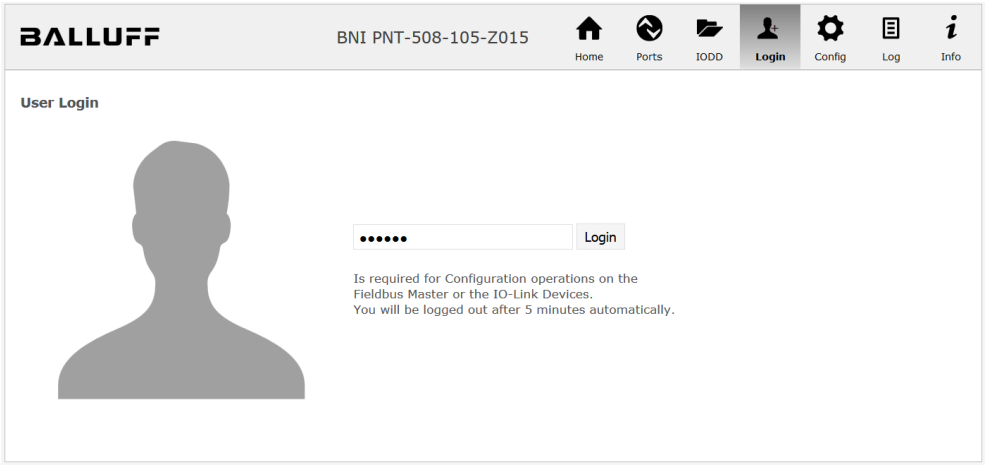
9.3. Login/Logout

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.

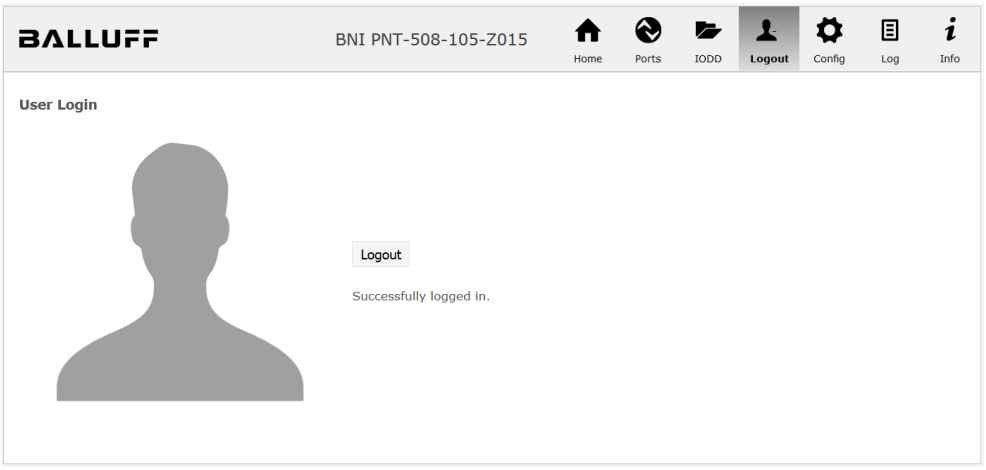
The default password is:

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.

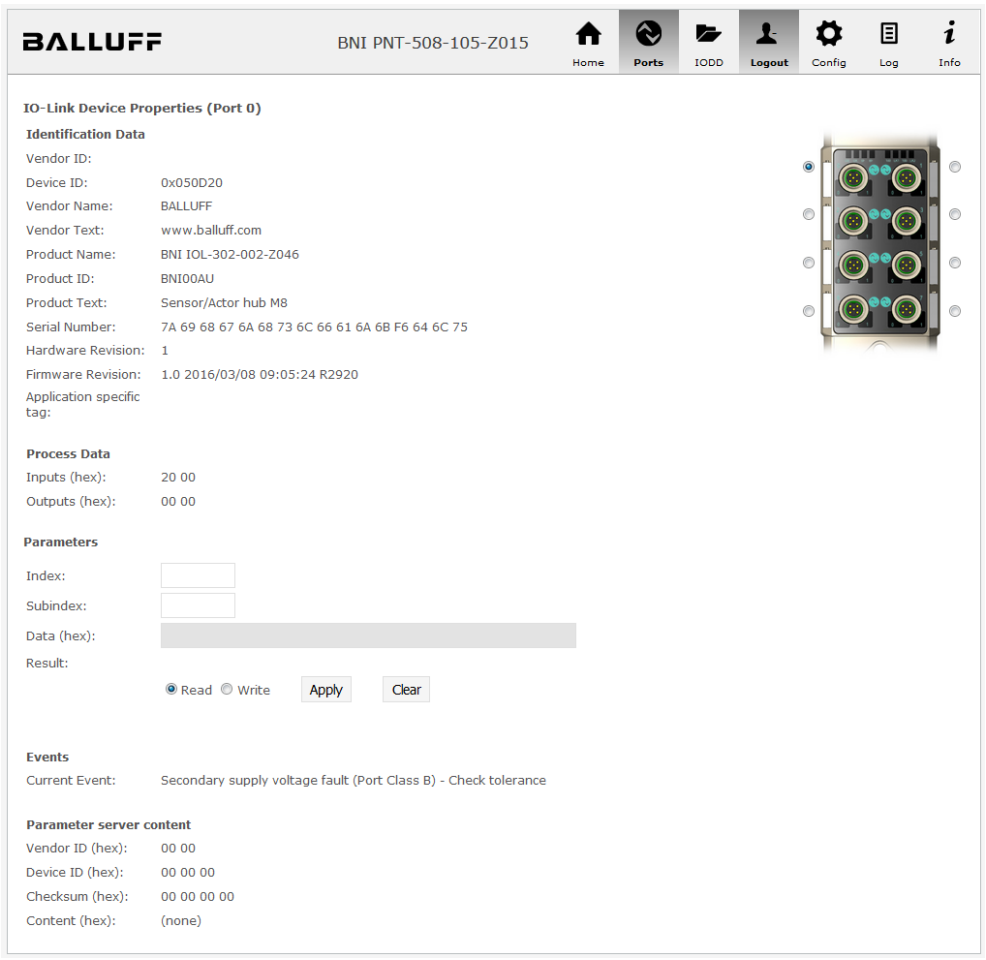
> **Note**
> The IO-Link device data are only displayed if the port is also configured as an IO-Link port!

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.



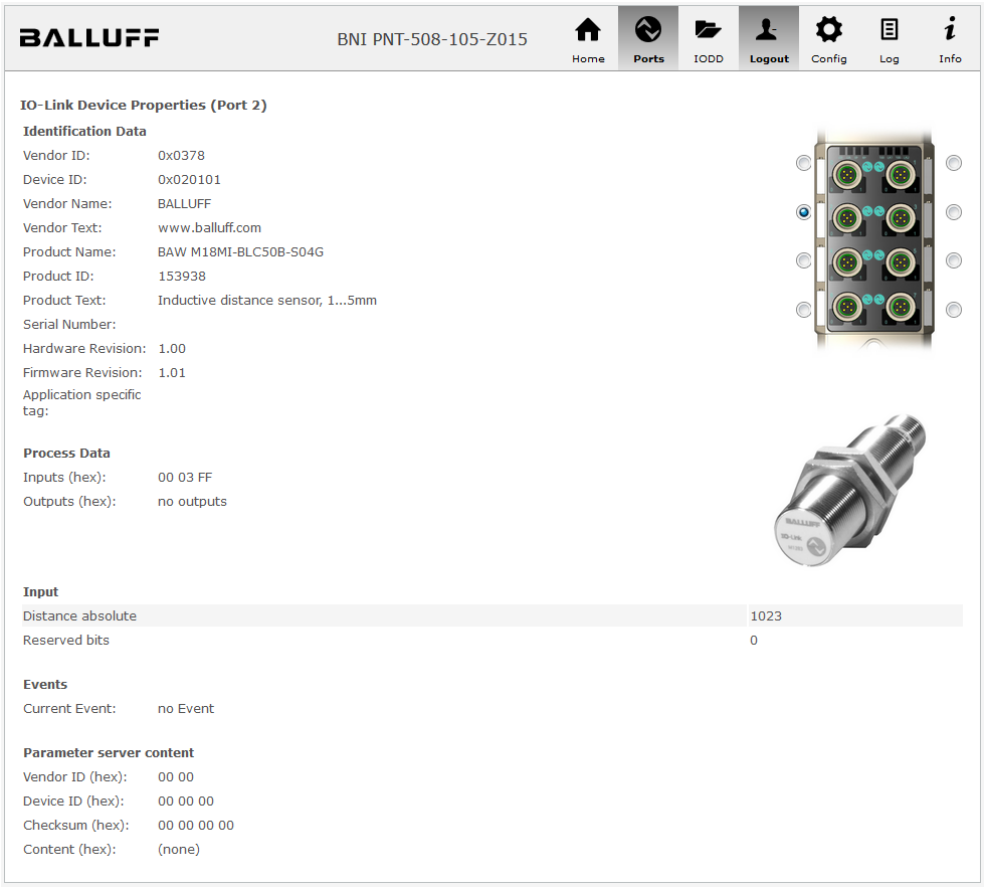
"Ports" dialog with direct parameter access

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.

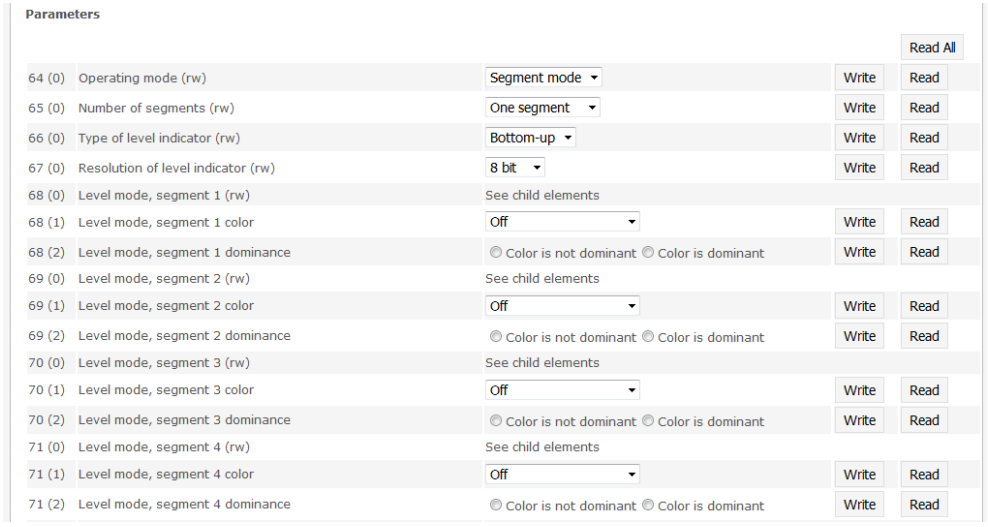


Dialog "Ports“: IODD interpretation and device image

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

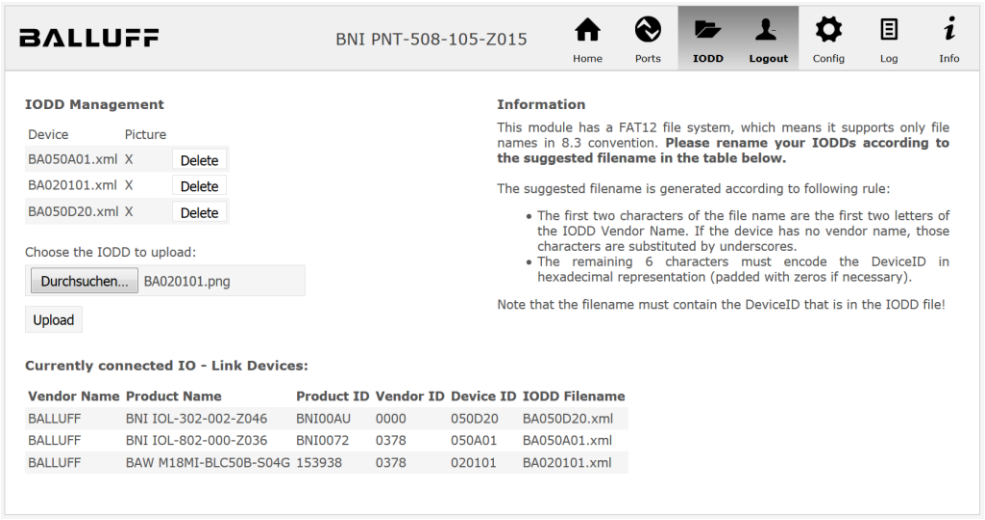
9.6. "IODD" dialog

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.



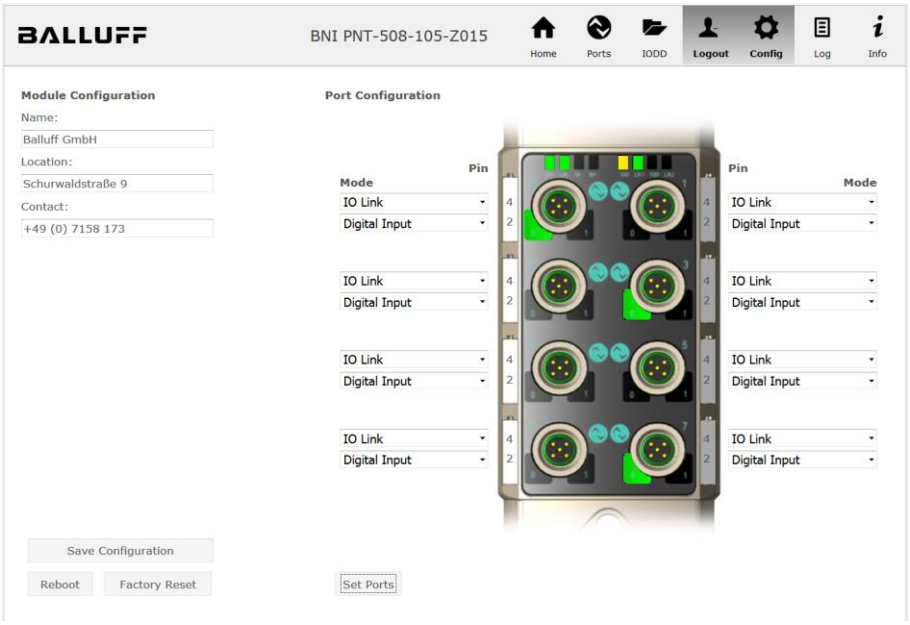
Using the "Delete" button you can delete IODDs and device images from the fieldbus when needed.

> **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

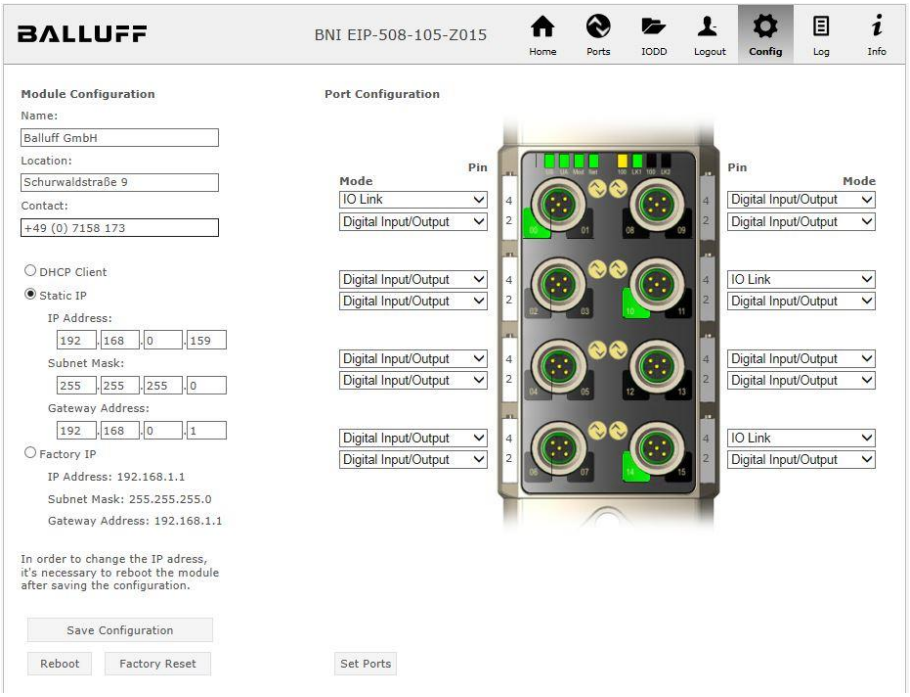
The configuration page enables configuration of the module. You can change both the module information texts and the port configuration.
The "Set Ports" action is not permanently stored in the device and is lost after the next reboot or reset.

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.

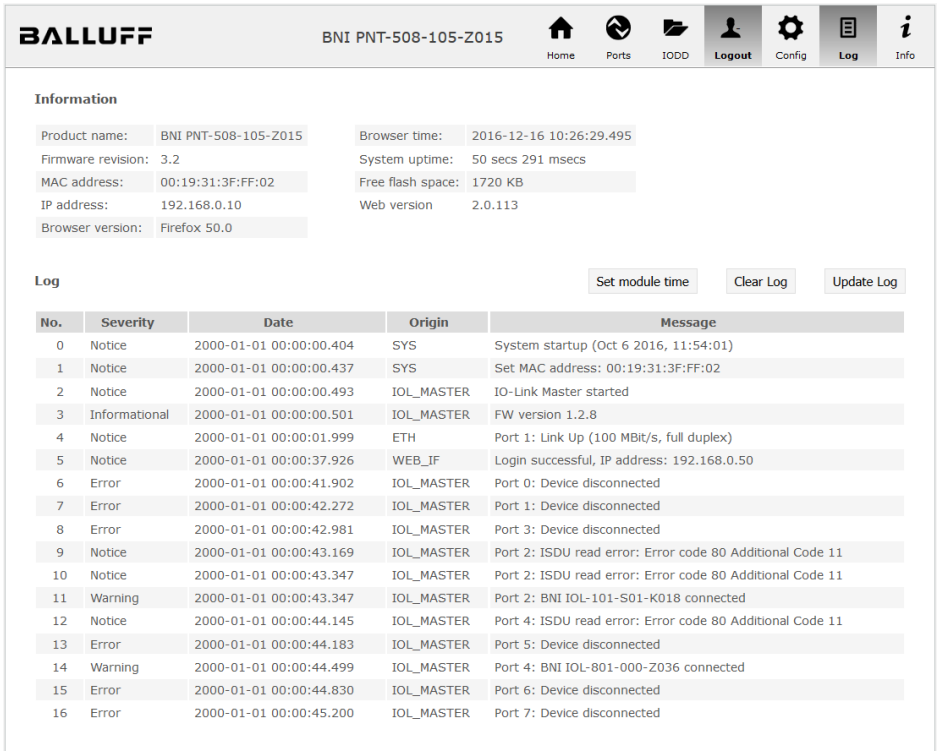
9.8. "Log" dialog

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 Website 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

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 Appendix

10.1. Scope of Delivery

The BNI EIP comprises the following elements:

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

10.2. Order Number

BNI EIP-50x-105-Z015

Balluff Network Interface

Ethernet IP

Functions
- 502 = IP 67 IO-Link master module, 4 IO-Link ports
- 508 = IP 67 IO-Link master module, 8 IO-Link ports

Versions
- 105 = display version, 2-port switch

Mechanical version
- Z015 = Die cast zinc housing
  - Data transmission: 2 x M12x1 internal thread
  - Power supply: 7/8" external thread, 7/8" internal thread
  - Sensor connections: 8 x M12x1 internal thread

10.3. Ordering Information

Product order code	Order code
BNI EIP-502-105-Z015	BNI004A
BNI EIP-508-105-Z015	BNI006A

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