BALLUFF

BNI IOL-104-S02-Z012

IO-Link 1.1 Sensor Hub
with extension port
User´s Guide

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1 User Instructions

1.1. About this Manual

This manual describes the Balluff IO-Link I/O module, also called a sensor/actuator hub. The IO-Link protocol is used to link to the higher-level master module.
In terms of function, this compact, cost-effective module is similar to a passive splitter box; it records digital sensor signals and transmits them over the IO-Link interface. It passes control signals coming over IO-Link to the connected actuators.

1.2. Structure of the Manual

The manual is organized so that the sections build on one another.
Chapter 2: Basic safety information.
……..

1.3. Typographical Conventions

The following typographical conventions are used in this manual.

Enumerations

Enumerations are shown as a list with an en-dash.

- 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.
- ↳ Action result.
- ➢ Action instruction 2.

Syntax

Numbers:
Decimal numbers are shown without additional indicators (e.g. 123), hexadecimal numbers are shown with the additional indicator $_{hex}$ (e.g. 3F$_{hex}$).

Cross references

Cross references indicate where additional information on the topic can be found.

1.4. Symbols

Attention!
This symbol indicates a safety instruction that must be followed without exception.

Note
This symbol indicates general notes.

1.5. Abbreviations

BNI	Balluff Network Interface
DPP	Direct Parameter Page
I/O port	Digital input/output port
IOL	IO-Link
ISDU	Indexed Service Data Unit (former SPDU)
EMC	Electromagnetic compatibility
FE	Function ground
LSB	Least Significant Bit
MSB	Most Significant Bit
SC	Short circuit
UA	Actuator supply
US	Sensor supply

1.6. Differing views

Product views and images in this manual may differ from the product described. They are intended to serve only as illustrations.

2 Safety

2.1. Intended Use

The BNI IOL-… acts as a decentralized input sensor module, which is connected to a higher-level IO-Link master module through an IO-Link interface.

2.2. Installation and Startup

Attention!
Installation and startup must only be carried out by trained technical personnel. Qualified personnel are people who are familiar with installation and operation of the product and have the necessary qualifications for these tasks. Any damage resulting from unauthorized tampering or improper use voids the manufacturer's guarantee and warranty. The operator must ensure that appropriate safety and accident prevention regulations are observed.

2.3. General Safety Instructions

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 is dependent upon proper functioning of the device.
Authorized personnel
Installation and startup must only be carried out by trained technical personnel.
Intended use
Warranty and liability claims against the manufacturer are rendered void by:

- Unauthorized tampering
- Improper use
- Use, installation or handling contrary to the instructions provided in this user's guide

Obligations of the operating company
The device is a piece of equipment in accordance with EMC Class A. This device can produce RF noise. The operator must take appropriate precautionary measures. The device may only be used with an approved power supply. Only use approved cables.
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 generally have a good chemical and oil resistance. When used in aggressive media (eg chemicals, oils, lubricants and coolants each in high concentration (ie, low water content)) must be checked prior application-related material compatibility. In the event of failure or damage to the BNI modules due to such aggressive media are no claims for defects.

Hazardous voltage

Attention!
Before maintenance, disconnect the device from the power supply.

Note
In the interests of product improvement, Balluff GmbH reserves the right to change the technical data of the product and the content of this manual at any time without notice.

3 First Steps

3.1. Connection overview

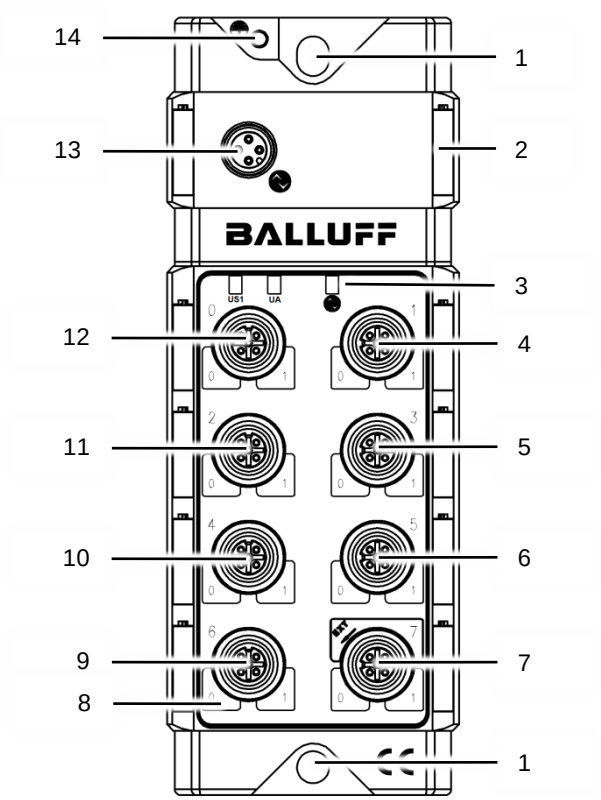


Figure 3.1: Connection overview

1 Mounting hole
2 Label
3 Communication state
4 Port 1
5 Port 3
6 Port 5
7 Port 7 / Extension Port
8 Pin/Port LED : Signal status
9 Port 6
10 Port 4
11 Port 2
12 Port 0
13 IO-Link interface
14 FE connection

3 First Steps

3.2. Mechanical Connection

The BNI IOL modules are fastened with using 2 M6 screws and 2 spacers .

3.3. Electrical Connection

The BNI IOL-104-S02-Z012 modules do not require a separate supply voltage connection. Supply voltage is provided via the IO-Link interface and the higher-level IO-Link master module.

Function earth

The modules are equipped with a ground (FE) connection.

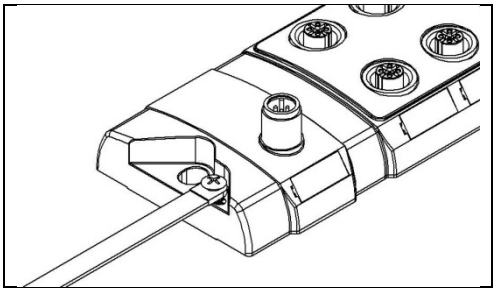


Figure 3.2: FE connection

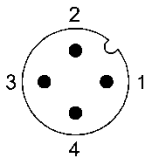
- Connect the sensor hub module to the ground connection.

Note
The FE connection from the housing to the machine must have low-impedance and be kept as short as possible.

IO-Link connection

The IO-Link connection is established via an M12 connector (A-coded, male).
This connector is used for powering the module. In some devices, this connector is also used for powering sensors and/or actuators which is connected to the module.

IO-Link (M12, A-coded, male)



Pin	Requirement
1	Supply voltage for module (US1), +24 V, max. 4 A
2*	Supply voltage for actuators (UA), +24 V, max. 4 A
3	GND, reference potential
4	C/Q, IO-Link data transmission channel

* Required when Extension Port activated

Attention!
Overcurrent. Defective or absent fusing of the supply voltage for the sensor and actuator will result in their damage or destruction.
Use a fuse or an intelligent power supply (current monitoring designed for maximum 4 A) which turns off power when overcurrent is present.

3 First Steps

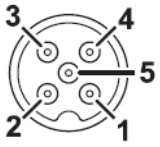
Connecting the sensor hub

- Connect ground conductor to the FE terminal, if available.
- Connect the incoming IO-Link cable to the sensor hub.

Note
A standardized sensor cable is used to connect to the higher-level IO-Link master module. Maximum length of 20 m.

Digital sensors

Digital Input port (M12, A-coded, female)



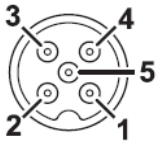
Pin	Requirement
1	+24V, 200mA
2	PNP Input 2
3	0V, GND
4	PNP Input 1
5	FE

Note
For the digital inputs, the input guideline specified in EN 61131-2, Type 3 applies.

Note
Unused input port sockets must be fitted with blind caps to ensure the IP67 protection rating.

Extension port

Port-7 (M12, A-coded, female) when Extension Port function activated



Pin	Requirement
1	+24V, 2A (Sensor/Module supply)
2*	+24V, 2A (Actuator supply)
3	0V, GND
4	Communication
5	FE

* Powered from Pin2 of IO-Link connection

Note
A standardized sensor cable is used to connect to the device to be extended. Maximum length of 20 m.

3 First Steps

3.4. Device functions

Device	Functionality
BNI IOL-104-S02-Z012	16 Digital Inputs with single channel monitoring, IO-Link V1.1 with extension port

3.5. Extension Port

These modules provide using the Port 7 in various ways. By default, it is used as a digital input port, where both pin 2 and pin 4 can be used as a digital input.
Additionally this port can be used as an Extension Port by making a corresponding entry in the ISDU parameter with an index of 55hex. This makes it possible to operate one of the following modules connected to the Port 7.

- Device alone
- Same device
- 22/24 Valve Plug Terminal

4 Configuration Overview

4.1. Introduction

This document provide information about the device. The device can be configured in 5 different modes. By this, you have 5 hardware setups. Before the detailed technical data, here is an overview and a summary about the main features and properties.

4.2. Process Data In

Configuration of Extension Port		Process Data Input Bytes							
		0	1	2	3	4	5	6	7
0	BNI IOL-104-S02-Z012	Input State		Diagnostic Info		-		-	
1	BNI IOL-104-S02-Z012 + same device	Input State		Diagnostic Info		Input State (Ext. Port)		Diag. Info (Ext. Port)	
2 3 4	BNI IOL-104-S02-Z012 + valve terminal	Input State		Diagnostic Info		-		-	

4.3. Process Data Out

Configuration of Extension Port		Process Data Output Bytes			
		0	1	2	3
0	BNI IOL-104-S02-Z012	-	-	-	-
1	BNI IOL-104-S02-Z012 + same device	-	-	-	-
2 3 4	BNI IOL-104-S02-Z012 + valve terminal	Valve State Coil A		Valve State Coil B	

4 Configuration Overview

4.4. Configuration of the Extension Port

Following devices can be connected to the Extension Port

Configuration	Use Case
Device alone (Extension Port not active)	
Device with same Device	
Device with BNI IOL-751-V08-K007	
Device with BNI IOL-751-V10-K007	
Device with BNI IOL-751-V13-K007	

The device which is connected to the Extension Port is called as “Second Device” in this manual.

Note
The "Factory reset" command does not affect the configuration of the extension port in any way.

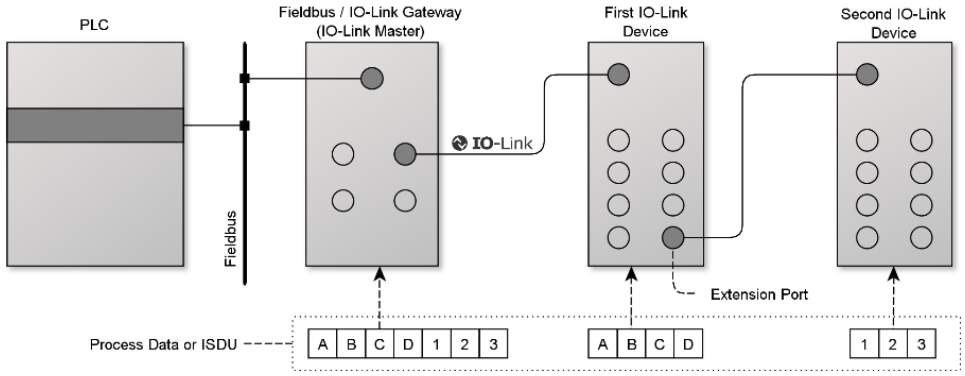
Note
The process data length depends on the configuration.

The configuration of the extension port can be performed via the parameter 0x55.
If the data storage or the validation is used, it must be configured on the validation (compatible). Depending on the system, the device ID has to be entered (table parameter data) or the device ID is read out from the IODD.

4 Configuration Overview

4.5. Data handling with the Extension Port

When the Extension Port is activated, the content and length of the Process Data (or ISDU) is calculated as the union of the process data (or ISDU) provided by the two parties.
PD result = PD of first device + PD of second device
ISDU result = ISDU of first device + ISDU of second device
The '+' operation means concatenation.



5 Configuration: BNI IOL-104-S02-Z012, extension port off

5.1. Extension Port Configuration

Factory default configuration is Extension Port off.

Configuration	ISDU Index 55hex value
Device alone (Extension Port not active)	**0**
Device with same device	1
Device with BNI IOL-751-V08-K007	2
Device with BNI IOL-751-V10-K007	3
Device with BNI IOL-751-V13-K007	4

5.2. IO-Link Data

BNI IOL-104-S02-Z012	
Transfer rate	COM2 (38.4 kBaud)
Minimum cycle time	4.4 ms
Process data length	4 bytes input

5 Configuration: BNI IOL-104-S02-Z012, extension port off

5.3. Process Data/ Input Data

The first two bytes are the input state. Last two bytes are the diagnostic info.

Byte	0								1							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Input state of…	Port 7 Pin 4	Port 6 Pin 4	Port 5 Pin 4	Port 4 Pin 4	Port 3 Pin 4	Port 2 Pin 4	Port 1 Pin 4	Port 0 Pin 4	Port 7 Pin 2	Port 6 Pin 2	Port 5 Pin 2	Port 4 Pin 2	Port 3 Pin 2	Port 2 Pin 2	Port 1 Pin 2	Port 0 Pin 2

Byte	2								3							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Voltage monitoring	SC Port 7 Pin 1	SC Port 6 Pin 1	SC Port 5 Pin 1	SC Port 4 Pin 1	SC Port 3 Pin 1	SC Port 2 Pin 1	SC Port 1 Pin 1	SC Port 0 Pin 1	-	-	-	-	-	-	-	Undervoltage US1

5.4. Process Data/ Output Data

Not available, no process data output

5 Configuration: BNI IOL-104-S02-Z012, extension port off

5.5. Parameter Data/ Identification Data and Device Parameter

	DPP	ISDU		Parameter	Data width	Access rights	Default value
	Index	Index	Sub-index				
Identification data	07hex			Vendor ID	2 bytes	Read only	0378hex
	08hex						
	09hex			Device ID	3 bytes		05 0E 50hex
	0Ahex						
	0Bhex						
		10hex 16	0	Vendor name	7 bytes		BALLUFF
		11hex 17	0	Vendor text	15 bytes		www.balluff.com
		12hex 18	0	Product name			BNI IOL-104-S02-Z012
		13hex 19	0	Product ID	7 bytes		BNI00CR
		14hex 20	0	Product text			Sensor Hub M12
		15hex 21	0	Serial number	16 bytes		various
		16hex 22	0	Hardware Revision			
		17hex 23	0	Firmware Revision			
		18hex 24	0	Application Specific Tag	32 bytes	Read / Write	0hex
D.Par.		0Chex 12	0	Access Locks Data Storage Lock	2 bytes	Read / Write	0hex

5.6. Parameter Data/ Device Configuration

	ISDU		Parameter	Data width	Access rights	Default Value
	Index	Subindex				
Configuration	40hex 64	0 1-16	Inversion of the inputs	2 bytes	Read / Write	0hex
	44hex 68	0 1-16	Voltage monitoring	2 bytes	Read	-
	54hex 84	0	Serial number	16 bytes	Read / Write	various
	55hex 85	0	Extension port	1 byte	Read / Write	0hex

5 Configuration: BNI IOL-104-S02-Z012, extension port off

Inversion of the inputs 40hex

Byte	0								1							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Sub-index	8	7	6	5	4	3	2	1	16	15	14	13	12	11	10	9
Inversion of…	Port 7 Pin 4	Port 6 Pin 4	Port 5 Pin 4	Port 4 Pin 4	Port 3 Pin 4	Port 2 Pin 4	Port 1 Pin 4	Port 0 Pin 4	Port 7 Pin 2	Port 6 Pin 2	Port 5 Pin 2	Port 4 Pin 2	Port 3 Pin 2	Port 2 Pin 2	Port 1 Pin 2	Port 0 Pin 2

Inversion of port (x):
0 – Normal
1 – Inverted

Voltage monitoring 44hex

Byte	0								1							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Sub-index	8	7	6	5	4	3	2	1								9
Voltage monitoring	SC Port 7 Pin 1	SC Port 6 Pin 1	SC Port 5 Pin 1	SC Port 4 Pin 1	SC Port 3 Pin 1	SC Port 2 Pin 1	SC Port 1 Pin 1	SC Port 0 Pin 1	-	-	-	-	-	-	-	Undervoltage US1

Setting the serial number 54hex

The serial number has a factory default value, 16 ASCII characters, example: 0E-G550389-1D-26. However the device's serial number cannot be modified, for compatibility reasons this parameter allows to give a custom specific serial number.

Note
The "Factory reset" command sets serial number back to the factory default value.

Configuration of the extension port 55hex

Configuration	ISDU Index 55hex value
Device alone (Extension Port not active)	0
Device with same Device	1
Device with BNI IOL-751-V08-K007	2
Device with BNI IOL-751-V10-K007	3
Device with BNI IOL-751-V13-K007	4

Note
The "Factory reset" command does not affect the configuration of the extension port in any way.

6 Configuration: BNI IOL-104-S02-Z012 extended with BNI IOL-104-S02-Z012

6.1. Extension Port Configuration

Configuration	ISDU Index 55hex value
Device alone (Extension Port not active)	0
Device with same device	**1**
Device with BNI IOL-751-V08-K007	2
Device with BNI IOL-751-V10-K007	3
Device with BNI IOL-751-V13-K007	4

6.2. IO-Link Data

BNI IOL-104-S02-Z012 with same device	
Transfer rate	COM2 (38.4 kBaud)
Minimum cycle time	5.6 ms
Process data length	8 bytes input

6 Configuration: BNI IOL-104-S02-Z012 extended with BNI IOL-104-S02-Z012

6.3. Process Data/ Input Data

Byte	0								1							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Input state of…	Extension Port Connection State	Input Port 6 Pin 4	Input Port 5 Pin 4	Input Port 4 Pin 4	Input Port 3 Pin 4	Input Port 2 Pin 4	Input Port 1 Pin 4	Input Port 0 Pin 4	Extension Port Validation State	Input Port 6 Pin 2	Input Port 5 Pin 2	Input Port 4 Pin 2	Input Port 3 Pin 2	Input Port 2 Pin 2	Input Port 1 Pin 2	Input Port 0 Pin 2

Byte	2								3							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Voltage monitoring	SC Port 7 Pin 1	SC Port 6 Pin 1	SC Port 5 Pin 1	SC Port 4 Pin 1	SC Port 3 Pin 1	SC Port 2 Pin 1	SC Port 1 Pin 1	SC Port 0 Pin 1	-	-	-	-	-	-	-	Undervoltage US1

Byte	4								5							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Input state of…	Same device on Extension port															
	Port 7 Pin 4	Port 6 Pin 4	Port 5 Pin 4	Port 4 Pin 4	Port 3 Pin 4	Port 2 Pin 4	Port 1 Pin 4	Port 0 Pin 4	Port 7 Pin 2	Port 6 Pin 2	Port 5 Pin 2	Port 4 Pin 2	Port 3 Pin 2	Port 2 Pin 2	Port 1 Pin 2	Port 0 Pin 2

Byte	6								7							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Voltage monitoring	Same device on Extension port															
	SC Port 7 Pin 1	SC Port 6 Pin 1	SC Port 5 Pin 1	SC Port 4 Pin 1	SC Port 3 Pin 1	SC Port 2 Pin 1	SC Port 1 Pin 1	SC Port 0 Pin 1	-	-	-	-	-	-	-	Undervoltage US1

6.4. Process Data/ Output Data

Not available, no process data output.

6 Configuration: BNI IOL-104-S02-Z012 extended with BNI IOL-104-S02-Z012

6.5. Parameter Data/ Identification Data and Device Parameter

	DPP	ISDU		Parameter	Data width	Access rights	Default value
	Index	Index	Sub-index				
Identification data	07hex			Vendor ID	2 bytes	Read only	0378hex
	08hex						
	09hex			Device ID	3 bytes		05 0E 51hex
	0Ahex						
	0Bhex						
		10hex 16	0	Vendor name	7 bytes		BALLUFF
		11hex 17	0	Vendor text	15 bytes		www.balluff.com
		12hex 18	0	Product name			BNI IOL-104-S02-Z012 with BNI IOL-104-S02-Z012
		13hex 19	0	Product ID			BNI00CR with BNI00CR
		14hex 20	0	Product text			Sensor Hub M12 extended with Sensor Hub M12
		15hex 21	0	Serial number	16 bytes		various
		16hex 22	0	Hardware Revision			
		17hex 23	0	Firmware Revision			
		18hex 24	0	Application Specific Tag	32 bytes	Read / Write	0hex
D.Par.		0Chex 12	0	Access Locks Data Storage Lock	2 bytes	Read / Write	0hex

6.6. Parameter Data/ Device Configuration

	ISDU		Parameter	Data width	Access rights	Default Value
	Index	Subindex				
Configuration	40hex 64	0 1-32	Inversion of the inputs	4 bytes	Read / Write	0hex
	44hex 68	0 1-32	Voltage monitoring	4 bytes	Read	–
	54hex 84	0	Serial number	16 bytes	Read / Write	various
	55hex 85	0	Extension port	1 byte	Read / Write	0hex

6 Configuration: BNI IOL-104-S02-Z012 extended with BNI IOL-104-S02-Z012

Inversion of the inputs
40hex

Byte	0								1							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Sub-index	8	7	6	5	4	3	2	1	16	15	14	13	12	11	10	9
Inversion of…	-	Port 6 Pin 4	Port 5 Pin 4	Port 4 Pin 4	Port 3 Pin 4	Port 2 Pin 4	Port 1 Pin 4	Port 0 Pin 4	-	Port 6 Pin 2	Port 5 Pin 2	Port 4 Pin 2	Port 3 Pin 2	Port 2 Pin 2	Port 1 Pin 2	Port 0 Pin 2

Byte	2								3							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Sub-index	24	23	22	21	20	19	18	17	32	31	30	29	28	27	26	25
	Same device on Extension port															
Inversion of…	Port 7 Pin 4	Port 6 Pin 4	Port 5 Pin 4	Port 4 Pin 4	Port 3 Pin 4	Port 2 Pin 4	Port 1 Pin 4	Port 0 Pin 4	Port 7 Pin 2	Port 6 Pin 2	Port 5 Pin 2	Port 4 Pin 2	Port 3 Pin 2	Port 2 Pin 2	Port 1 Pin 2	Port 0 Pin 2

Inversion of port (x):
0 – Normal
1 – Inverted

6 Configuration: BNI IOL-104-S02-Z012 extended with BNI IOL-104-S02-Z012

Voltage monitoring 44hex

Byte	0								1							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Sub-index	8	7	6	5	4	3	2	1								9
Voltage monitoring	SC Port 7 Pin 1	SC Port 6 Pin 1	SC Port 5 Pin 1	SC Port 4 Pin 1	SC Port 3 Pin 1	SC Port 2 Pin 1	SC Port 1 Pin 1	SC Port 0 Pin 1	-	-	-	-	-	-	-	Undervoltage US1

Byte	2								3							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Sub-index	24	23	22	21	20	19	18	17								25
	Same device on Extension Port															
Voltage monitoring	SC Port 7 Pin 1	SC Port 6 Pin 1	SC Port 5 Pin 1	SC Port 4 Pin 1	SC Port 3 Pin 1	SC Port 2 Pin 1	SC Port 1 Pin 1	SC Port 0 Pin 1	-	-	-	-	-	-	-	Undervoltage US1

Setting the serial number 54hex

The serial number has a factory default value, 16 ASCII characters, example: 0E-G550389-1D-26. However the device's serial number cannot be modified, for compatibility reasons this parameter allows to give a custom specific serial number.

Configuration of the extension port 55hex

Configuration	ISDU Index 55hex value
Device alone (Extension Port not active)	0
Device with same Device	1
Device with BNI IOL-751-V08-K007	2
Device with BNI IOL-751-V10-K007	3
Device with BNI IOL-751-V13-K007	4

7 Configuration: BNI IOL-104-S02-Z012 extended with 22/24 Valve Terminal

7.1. Extension Port Configuration

Any of the three different Valve Terminal variants can be connected to the device via the Extension Port:

Configuration	ISDU Index 55hex value
Device alone (Extension Port not active)	0
Device with same device	1
Device with **BNI IOL-751-V08-K007**	**2**
Device with **BNI IOL-751-V10-K007**	**3**
Device with **BNI IOL-751-V13-K007**	**4**

However BNI IOL-104-S02-Z012 is a digital input module, which does not require UA Voltage, this configuration with Valve Terminal requires the UA Voltage to drive the Valve Terminal's output.

Note
UA Voltage required.

7.2. IO-Link Data

BNI IOL-104-S02-Z012 with 22/24 Valve Terminal	
Transfer rate	COM2 (38.4 kBaud)
Minimum cycle time	5.6 ms
Process data length	4 bytes input, 4 bytes output

7 Configuration: BNI IOL-104-S02-Z012 extended with 22/24 Valve Terminal

7.3. Process Data/ Input Data

Byte	0								1							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Input state of…	Extension Port Connection State	Input Port 6 Pin 4	Input Port 5 Pin 4	Input Port 4 Pin 4	Input Port 3 Pin 4	Input Port 2 Pin 4	Input Port 1 Pin 4	Input Port 0 Pin 4	Extension Port Validation State	Input Port 6 Pin 2	Input Port 5 Pin 2	Input Port 4 Pin 2	Input Port 3 Pin 2	Input Port 2 Pin 2	Input Port 1 Pin 2	Input Port 0 Pin 2

Byte	2								3							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Voltage monitoring	SC Port 7 Pin 1	SC Port 6 Pin 1	SC Port 5 Pin 1	SC Port 4 Pin 1	SC Port 3 Pin 1	SC Port 2 Pin 1	SC Port 1 Pin 1	SC Port 0 Pin 1	-	-	-	-	Outputs off (UA too low)	Undervoltage UA	-	Undervoltage US1

7.4. Process Data/ Output Data

Byte	0								1							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
	Valve terminal on extension port															
Output state of…	-	-	-	-	* Valve 12 – Coil A	Valve 11 – Coil A	Valve 10 – Coil A	Valve 09 – Coil A	Valve 08 – Coil A	Valve 07 – Coil A	Valve 06 – Coil A	Valve 05 – Coil A	Valve 04 – Coil A	Valve 03 – Coil A	Valve 02 – Coil A	Valve 01 – Coil A

* No function for BNI IOL-751-V13-K007

Byte	2								3							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
	Valve terminal on extension port															
Output state of…	-	-	-	-	* Valve 12 – Coil B	Valve 11 – Coil B	Valve 10 – Coil B	Valve 09 – Coil B	Valve 08 – Coil B	Valve 07 – Coil B	Valve 06 – Coil B	Valve 05 – Coil B	Valve 04 – Coil B	Valve 03 – Coil B	Valve 02 – Coil B	Valve 01 – Coil B

* No function for BNI IOL-751-V13-K007

7 Configuration: BNI IOL-104-S02-Z012 extended with 22/24 Valve Terminal

7.5. Parameter Data/ Identification Data and Device Parameters

	DPP	ISDU		Parameter	Data width	Access rights	Default value
	Index	Index	Sub-index				
Identification data	07hex			Vendor ID	2 bytes	Read only	0378hex
	08hex						
	09hex			Device ID	3 bytes		05 0E 52hex 05 0E 53hex 05 0E 54hex
	0Ahex						
	0Bhex						
		10hex 16	0	Vendor name	7 bytes		BALLUFF
		11hex 17	0	Vendor text	15 bytes		www.balluff.com
		12hex 18	0	Product name			BNI IOL-104-S02-Z012 with BNI IOL-751-V08-K007 BNI IOL-104-S02-Z012 with BNI IOL-751-V10-K007 BNI IOL-104-S02-Z012 with BNI IOL-751-V13-K007
		13hex 19	0	Product ID			BNI00CR with BNI006N BNI00CR with BNI006P BNI00CR with BNI006R
		14hex 20	0	Product text			Sensor Hub M12 extended with Valve Plug CG25 24 2-3 Sensor Hub M12 extended with Valve Plug CG13 24 2-3 Sensor Hub M12 extended with Valve Plug CG13 24 2-3
		15hex 21	0	Serial number	16 bytes		various
		16hex 22	0	Hardware Revision			
		17hex 23	0	Firmware Revision			
		18hex 24	0	Application Specific Tag	32 bytes	Read / Write	0hex
D.Par.		0Chex 12	0	Access Locks Data Storage Lock	2 bytes	Read / Write	0hex

Parameter Data/Demand Data

	ISDU		Parameter	Data width	Access rights	Default Value
	Index	Subindex				
Parameter data	40hex 64	0 1-16	Inversion of the inputs	2 bytes	Read/write	0hex
	42hex 66	0 1-32	Safe state of the outputs	8 bytes	Read/write	0hex
	44hex 68	0 1-23	Voltage monitoring	3 bytes	Read	-
	45hex 69	0 1-40	Output monitoring	4 bytes	Read	-
	54hex 84	0	Serial number	16 bytes	Read/write	various
	55hex 85	0	Extension port	1 byte	Read/write	2, 3, 4hex

7 Configuration: BNI IOL-104-S02-Z012 extended with 22/24 Valve Terminal

Inversion of the inputs
40hex

Byte	0								1							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Sub-index	8	7	6	5	4	3	2	1	16	15	14	13	12	11	10	9
Inversion of…	-	Port 6 Pin 4	Port 5 Pin 4	Port 4 Pin 4	Port 3 Pin 4	Port 2 Pin 4	Port 1 Pin 4	Port 0 Pin 4	-	Port 6 Pin 2	Port 5 Pin 2	Port 4 Pin 2	Port 3 Pin 2	Port 2 Pin 2	Port 1 Pin 2	Port 0 Pin 2

Inversion of port (x):
0 – Normal
1 – Inverted

Safe state of the outputs
42hex

The safe state parameter makes it possible to configure the outputs in case of a fault. If no IO-Link communication is possible or the "valid flag" of the output process data has not been set by the master, then each output adopts the configured status.

The following statuses can be configured for each output pin.

Value		Output state
bin	dec	
00	0	Output is 0V
01	1	Output is 24V
10	2	Current status is maintained
11	3	Not defined

Byte	0								1							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Sub-index									23		21		19		17	
	Valve terminal on extension port															
Safe State of…	-		-		-		-		* Valve 12 – Coil A		Valve 11 – Coil A		Valve 10 – Coil A		Valve 09 – Coil A	

* No function for BNI IOL-751-V13-K007

Byte	2								3							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Sub-index	15		13		11		9		7		5		3		1	
	Valve terminal on extension port															
Safe State of…	Valve 08 – Coil A		Valve 07 – Coil A		Valve 06 – Coil A		Valve 05 – Coil A		Valve 04 – Coil A		Valve 03 – Coil A		Valve 02 – Coil A		Valve 01 – Coil A	

Byte	4								5							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Sub-index									24		22		20		18	
	Valve terminal on extension port															
Safe State of…	-		-		-		-		* Valve 12 – Coil B		Valve 11 – Coil B		Valve 10 – Coil B		Valve 09 – Coil B	

* No function for BNI IOL-751-V13-K007

Byte	6								7							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Sub-index	16		14		12		10		8		6		4		2	
	Valve terminal on extension port															
Safe State of…	Valve 08 – Coil B		Valve 07 – Coil B		Valve 06 – Coil B		Valve 05 – Coil B		Valve 04 – Coil B		Valve 03 – Coil B		Valve 02 – Coil B		Valve 01 – Coil B	

7 Configuration: BNI IOL-104-S02-Z012 extended with 22/24 Valve Terminal

Voltage monitoring 44hex

Byte	0								1							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Sub-index	8	7	6	5	4	3	2	1	16	15	14	13	12	11	10	9
Voltage monitoring	SC Port 7 Pin 1	SC Port 6 Pin 1	SC Port 5 Pin 1	SC Port 4 Pin 1	SC Port 3 Pin 1	SC Port 2 Pin 1	SC Port 1 Pin 1	SC Port 0 Pin 1	-	-	-	-	Outputs off (UA too low)	Undervoltage UA	-	Undervoltage US1

Byte	2							
Bit	7	6	5	4	3	2	1	0
Sub-index		23				19		17
	Valve terminal on extension port							
Voltage monitoring	-	Overload UA	-	-	-	Undervoltage UA	-	Undervoltage US

7 Configuration: BNI IOL-104-S02-Z012 extended with 22/24 Valve Terminal

Output monitoring 45hex

Byte	0								1							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Sub-index					23	21	19	17	15	13	11	9	7	5	3	1
	Valve terminal on extension port															
Short-circuit of…	-	-	-	-	* Valve 12 – Coil A	Valve 11 – Coil A	Valve 10 – Coil A	Valve 09 – Coil A	Valve 08 – Coil A	Valve 07 – Coil A	Valve 06 – Coil A	Valve 05 – Coil A	Valve 04 – Coil A	Valve 03 – Coil A	Valve 02 – Coil A	Valve 01 – Coil A

* No function for BNI IOL-751-V13-K007

Byte	2								3							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Sub-index					24	22	20	18	16	14	12	10	8	6	4	2
	Valve terminal on extension port															
Short-circuit of…	-	-	-	-	* Valve 12 – Coil B	Valve 11 – Coil B	Valve 10 – Coil B	Valve 09 – Coil B	Valve 08 – Coil B	Valve 07 – Coil B	Valve 06 – Coil B	Valve 05 – Coil B	Valve 04 – Coil B	Valve 03 – Coil B	Valve 02 – Coil B	Valve 01 – Coil B

* No function for BNI IOL-751-V13-K007

Setting the serial number 54hex

The serial number has a factory default value, 16 ASCII characters, example: 0E-G550389-1D-26. However the device's serial number cannot be modified, for compatibility reasons this parameter allows to give a custom specific serial number.

Configuration of the extension port 55hex

Configuration	ISDU Index 55hex value
Device alone (Extension Port not active)	0
Device with same Device	1
Device with BNI IOL-751-V08-K007	2
Device with BNI IOL-751-V10-K007	3
Device with BNI IOL-751-V13-K007	4

8 Error Codes and Events

8.1. Error Codes/ Errors

Error code	Description
0x8011	Index not available
0x8012	Subindex not available
0x8023	Access denied
0x8033	Parameter length overrun
0x8034	Parameter length underrun
0x8035	Function not available
0x8036	Function temporarily unavailable

8.2. Events

IO-Link Revision 1.0	
Event code	**Description**
0x5112	Low sensor voltage (US)
0x5114	Low actuator voltage (UA)
0x5410	Output stages
0x8DF0	Retry at the extension port
0x8DF1	Device lost at the extension port
0x8DF2	Wrong device at the extension port

IO-Link Revision 1.1	
Event code	**Description**
0x5111	Low sensor voltage (US)
0x5112	Low actuator voltage (UA)
0x7710	Short circuit or Actuator Warning
0x8DF0	Retry at the extension port
0x8DF1	Device lost at the extension port
0x8DF2	Wrong device at the extension port

9 IO-Link Functions

9.1. IO-Link Version 1.0/ 1.1

This device can be operated with an IO-Link master according to IO-Link version 1.0, and version 1.1. Version-specific functions such as data storage (version 1.1) are only supported in combination with a suitable IO-Link master.

9.2. Data Storage

Each IO-Link master of IO-Link version 1.1 features data storage in which an image of the IO-Link device configuration can be stored. When a device is replaced, the stored configuration is automatically transferred to the new device. This guarantees minimal downtime. Validation must be switched on in order to use the data storage. For information about the configuration of data storage and validation, please refer to the operating manual of the respective IO-Link master.

9.3. Block Configuration

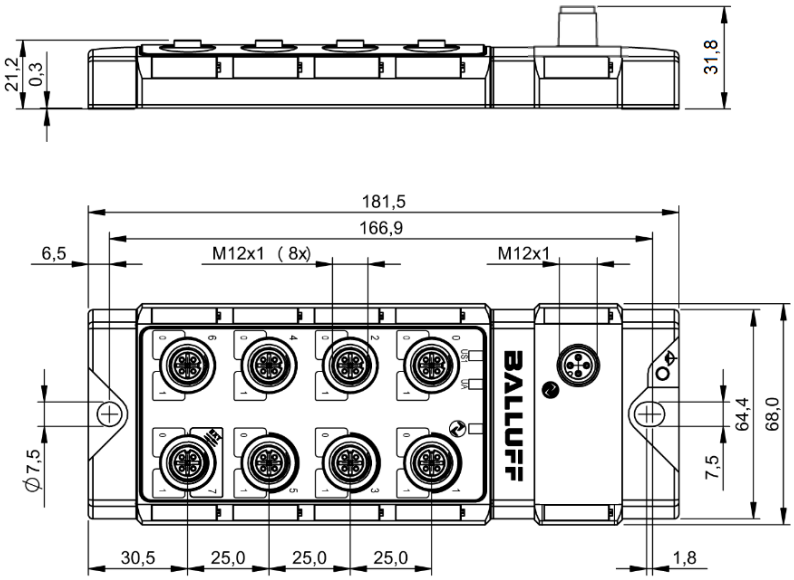
The device supports block configuration. This allows all parameters in a data block to be consistently imported from a controller or a configuration tool into the device.

9.4. Restoring the Factory Settings

The factory settings on the device can be restored by carrying out the "restore factory settings" system command.
0x82 must be written to Index 2 Subindex 0 for the command.

10 Technical Data

10.1. Dimensions



10.2. Mechanical Data

Housing material	Die-cast zinc housing
IO-Link port	IO-Link port M12, A-coded, male
PNP I/O ports	M12x1, A-coded, female (8 piece)
Weight	approx. 530 g
Dimensions (H x W x D, without connector)	68 x 181,5 x 31,8 (mm)

10.3. Electrical Data

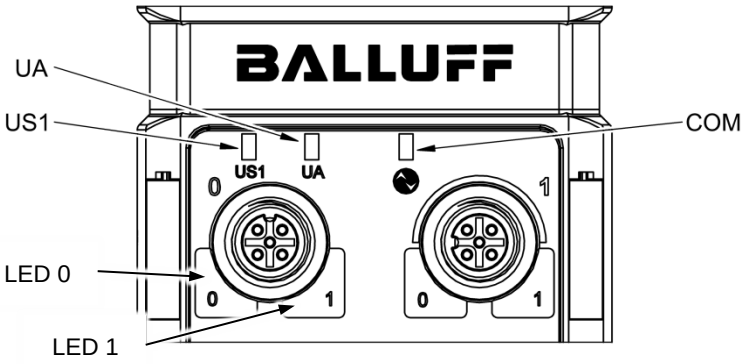
Supply voltage	18–30.2 V DC, corresponding to EN 61131-2
Supply power on M12 connector	4 A
Ripple	< 1%
Current consumption without load	≤ 50 mA
Load current (Pin 1)	max. 200 mA
Load current per Extension Port (Pin 2)	max. 2 A
Inputs	PNP, Type 3

10.4. Operating conditions

Operating temperature	-5 °C … +55 °C
Storage temperature	-25 °C … +70 °C
Degree of protection	IP67 (only in plugged-in and screwed state)

11 Function Indicators

11.1. Function Indicators



LED indicator module status

LED	Indicator	Function
COM	Green	No communication
	Green, flashing	IO-Link Communication OK
US1	Green	Module supply OK
	Red	Undervoltage < 18 V
	Off	Module without voltage
UA	Green	Actuator power supply OK
	Red	Undervoltage < 18 V

Digital LED indicators for inputs

Indicator	Description
LED 0	Input on Pin4
LED 1	Input on Pin2

Status	Function
Yellow	Input signal = 1
Red	Sensor power supply short-circuit
Off	Input signal = 0

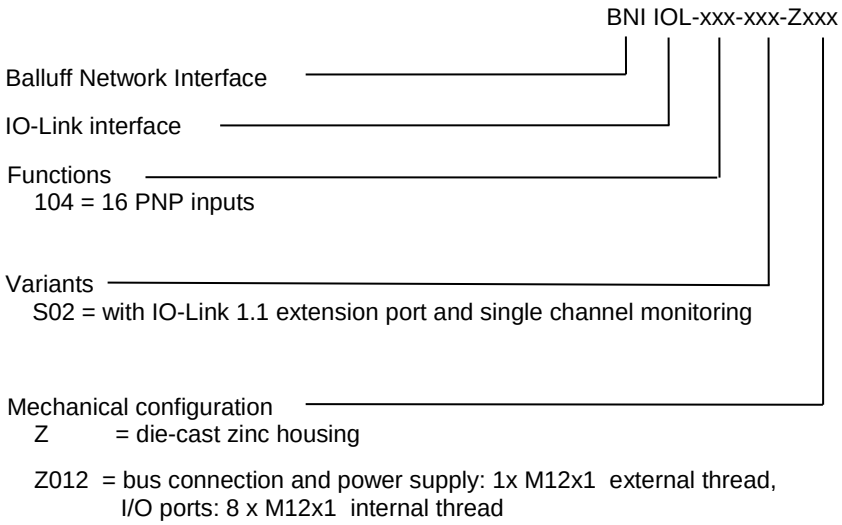
Extension port

The table is valid if the extension port is active. If the extension port is used as a standard I/O, then the description from "Digital LED indicators for inputs" can be used.

Status	Function
Green	IO-Link – connection active
Green, flashing	No IO-Link connection or faulty IO-Link device
Quick, red flashing	Incorrect IO-Link device or incorrect configuration
Red	IO-Link short-circuit on Pin 4

12 Appendix

12.1. Type Code



12.2. Ordering Information

Type code	Ordering code
BNI IOL-104-S02-Z012	BNI00CR

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