BALLUFF

BNI IOL-104-S02-R012-008
IO-Link 1.1 sensor hub
with extension port
User´s Guide

1   Contents

1   User Instructions

1.1. Structure of the Manual	The manual is organized so that the sections build on one another. Chapter 2: Basic safety information. ……..
1.2. 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. 00hex).
Cross-references	Cross-references indicate where additional information on the topic can be found.

1.3. Symbols

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

ℹ **Note, tip**
This symbol indicates general notes.

1.4.   Abbreviations

BNI	Balluff Network Interface
DPP	Direct Parameter Page
I/O port	Digital input/output port
IOL	IO-Link
ISDU	Indexed Service Data Unit
EMC	Electromagnetic compatibility
FE	Function ground
LSB	Least Significant Bit
MSB	Most Significant Bit

1.5. Divergent views   Product views and images can differ from the specified product in this manual. They serve only as an illustration.

2.1. Intended Use

The BNI IOL-… acts as a decentralized input/output 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
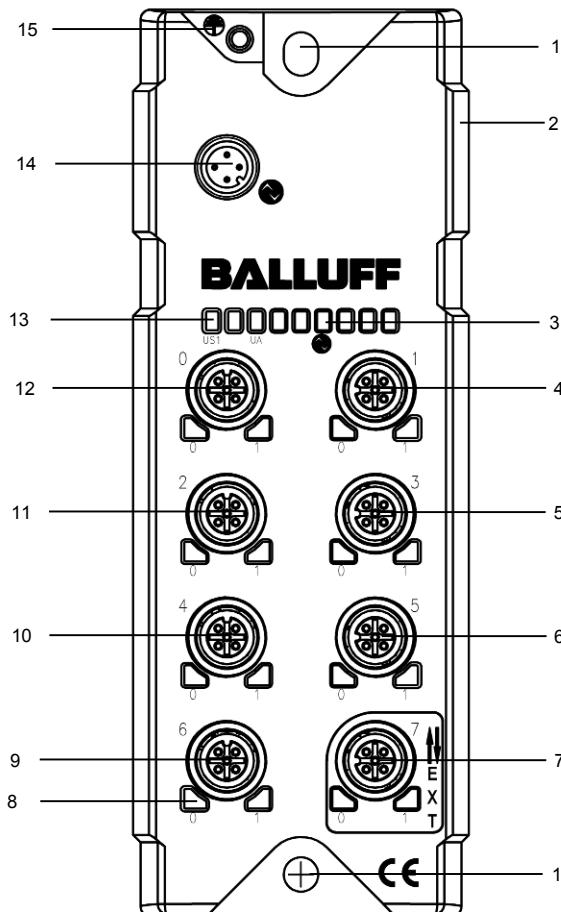
Figure 3-1: Connection overview BNI IOL-104-S02-R012-008

1 Mounting hole	9 Port 6
2 Label	10 Port 4
3 Status LED: communication	11 Port 2
4 Port 1	12 Port 0
5 Port 3	13 Status LED: supply module
6 Port 5	14 IO-Link interface
7 Port 7, extension port	15 Ground connection
8 Pin/Port LED: signal status	

| 3.2. | Mechanical Connection | The BNI IOL modules are fastened with 3 M4 screws (position 1, Fig. 3-1/3-2). |

| 3.3. | Electrical Connection | The BNI IOL-104-xxx-R012-008 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 ground   The modules are equipped with a ground connection.
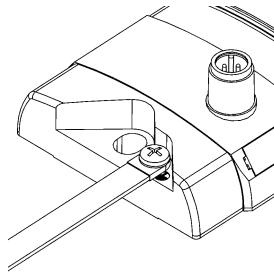
Figure 3-3: BNI ground connection IOL-104...

➢ 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).

IO-Link (M12, A-coded, male)
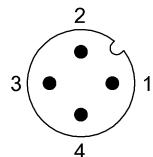
Pin	Requirement
1	Supply voltage for controller US +24 V
2	Supply voltage for actuators UA, +24 V
3	GND, reference potential
4	C/Q, IO-Link data transmission channel

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.

Module variants

Sensor hub variants	Digital port
BNI IOL-104-S02-R012-008	16 inputs

Digital sensors

Digital input/output port (M12, A-coded, female)
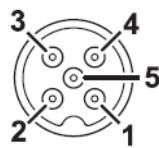
Pin	Requirement
1	+24 V
2	Input 2/output 2
3	0 V, GND
4	Input 1/output 1
5	FE

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

Digital input/output port (M12, A-coded, female)
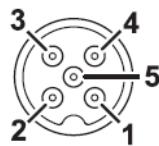
Pin	Requirement
1	+24 V
2	Extension port for actuator power supply
3	0 V, GND
4	Communication
5	FE

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

Extension port   The BNI IOL-104-S02-R012-008 module gives you the ability to use the No. 7 slot in various ways. By default, it is used as a digital Input slot, where both pin 2 and pin 4 can be used as a digital input.
This slot can be used as an extension port by making a corresponding entry in the parameter with an index of 55hex. This makes it possible to operate one of the following modules using the No. 7 slot.
BNI IOL-104-S02-R012-008
BNI IOL-751-V13-K007-008

Extension port configuration

Configuration	Index 55hex value
BNI IOL-104-S02-R012-008	0
BNI IOL-104-S02-R012-008 with BNI IOL-104-S02-R012-008	1
BNI IOL-104-S02-R012-008 with BNI IOL-751-V13-K007-008	4

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

4   Configuration: "Extension Off"

4.1. IO-Link Data

BNI IOL-104-S02-R012-008 Extension off	
Transfer rate	COM2 (38.4 kbaud)
Minimum cycle time	4.5 ms
Process data length	4 byte input

4.2. Process Data/Input Data

Byte	0								1							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Description	Input Port 3 Pin 2	Input Port 3 Pin 4	Input Port 2 Pin 2	Input Port 2 Pin 4	Input Port 1 Pin 2	Input Port 1 Pin 4	Input Port 0 Pin 2	Input Port 0 Pin 4	Input Port 7 Pin 2	Input Port 7 Pin 4	Input Port 6 Pin 2	Input Port 6 Pin 4	Input Port 5 Pin 2	Input Port 5 Pin 4	Input Port 4 Pin 2	Input Port 4 Pin 4

Byte	2								3							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Description	Short-circuit Port 7	Short-circuit Port 6	Short-circuit Port 5	Short-circuit Port 4	Short-circuit Port 3	Short-circuit Port 2	Short-circuit Port 1	Short-circuit Port 0	-	-	-	-	-	-	-	Undervoltage US1

4.3. Parameter Data/ Demand Data

	DPP	ISDU		Parameter	Data width	Access rights	Default value
	Index	Index	Sub-index				
Identification data	07hex 07			Vendor ID	2 bytes	Read only	0378hex
	08hex 08						
	09hex 09			Device ID	3 bytes		0x05 0D E0
	0Ahex 10						
	0Bhex 11						
		10hex 16	0	Vendor name	8 bytes		BALLUFF
		11hex 17	0	Vendor text	16 bytes		www.balluff.com
		12hex 18	0	Product name	20/24 bytes		BNI IOL-104-S02-R012-008
		13hex 19	0	Product ID	7 bytes		BNI00CH
		14hex 20	0	Product text	16 bytes		Sensor Hub M12
		15hex 21	0	Serial number	16 bytes		0hex
		16hex 22	0	Hardware revision			
		17hex 23	0	Firmware revision			
		18hex 24	0	Application-specific tag	32 bytes	Read/Write	0hex

	DPP	ISDU		Parameter	Data width	Access rights	Default Value
	Index	Index	Sub-index				
Parameter data		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	16x00hex
		55hex 85	0	Extension port	1 byte	Read/write	0hex

4   Configuration: "Extension 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
Description	Inversion of Port 7 Pin 4	Inversion of Port 6 Pin 4	Inversion of Port 5 Pin 4	Inversion of Port 4 Pin 4	Inversion of Port 3 Pin 4	Inversion of Port 2 Pin 4	Inversion of Port 1 Pin 4	Inversion of Port 0 Pin 4	Inversion of Port 7 Pin 2	Inversion of Port 6 Pin 2	Inversion of Port 5 Pin 2	Inversion of Port 4 Pin 2	Inversion of Port 3 Pin 2	Inversion of Port 2 Pin 2	Inversion of Port 1 Pin 2	Inversion of 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	16							9
Description	Short-circuit Port 7 Pin 1	Short-circuit Port 6 Pin 1	Short-circuit Port 5 Pin 1	Short-circuit Port 4 Pin 1	Short-circuit Port 3 Pin 1	Short-circuit Port 2 Pin 1	Short-circuit Port 1 Pin 1	Short-circuit Port 0 Pin 1	-	-	-	-	-	-	-	Undervoltage US

Setting the serial number 54hex

The serial number has a default value of 16x00hex.
In order to use the "Identity" master validation mode, a serial number can be set using this parameter.
This prevents a device from connecting to the wrong master port.

Configuration of the extension port 55hex

Configuration	Index 55hex value
BNI IOL-104-S02-R012-008	0
BNI IOL-104-S02-R012-008 with BNI IOL-104-S02-R012-008	1
BNI IOL-104-S02-R012-008 with BNI IOL-751-V13-K007-008	4

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

5.1. IO-Link Data

BNI IOL-104-S02-R012-008 extended with BNI IOL-104-S02-R012-008	
Transfer rate	COM2 (38.4 kbaud)
Minimum cycle time	6.8 ms
Process data length	8 byte input

5.2. Process Data/Input Data

Byte	0								1							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Description	Input Port 3 Pin 2	Input Port 3 Pin 4	Input Port 2 Pin 2	Input Port 2 Pin 4	Input Port 1 Pin 2	Input Port 1 Pin 4	Input Port 0 Pin 2	Input Port 0 Pin 4	-	-	Input Port 6 Pin 2	Input Port 6 Pin 4	Input Port 5 Pin 2	Input Port 5 Pin 4	Input Port 4 Pin 2	Input Port 4 Pin 4

Byte	2								3							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Description	Short-circuit Port 7	Short-circuit Port 6	Short-circuit Port 5	Short-circuit Port 4	Short-circuit Port 3	Short-circuit Port 2	Short-circuit Port 1	Short-circuit Port 0	-	-	-	-	-	-	-	Undervoltage US1

5   Configuration: Extended with BNI IOL-104-S02-R012-008

Byte	4								5							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
	Extension port															
Description	Input Port 3 Pin 2	Input Port 3 Pin 4	Input Port 2 Pin 2	Input Port 2 Pin 4	Input Port 1 Pin 2	Input Port 1 Pin 4	Input Port 0 Pin 2	Input Port 0 Pin 4	Input Port 7 Pin 2	Input Port 7 Pin 4	Input Port 6 Pin 2	Input Port 6 Pin 4	Input Port 5 Pin 2	Input Port 5 Pin 4	Input Port 4 Pin 2	Input Port 4 Pin 4

Byte	6								7							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
	Extension port															
Description	Short-circuit Port 7	Short-circuit Port 6	Short-circuit Port 5	Short-circuit Port 4	Short-circuit Port 3	Short-circuit Port 2	Short-circuit Port 1	Short-circuit Port 0	-	-	-	-	-	-	-	Undervoltage US1

5.3. Parameter Data/ Demand Data

	DPP	ISDU		Parameter	Data width	Access rights	Default value
	Index	Index	Sub-index				
Identification data	07hex 07			Vendor ID	2 bytes	Read only	0378hex
	08hex 08						
	09hex 09			Device ID	3 bytes		0x05 0D E1
	0Ahex 10						
	0Bhex 11						
		10hex 16	0	Vendor name	8 bytes		BALLUFF
		11hex 17	0	Vendor text	16 bytes		www.balluff.com
		12hex 18	0	Product name	20/24 bytes		BNI IOL-104-S02-R012-008 with BNI IOL-104-S02-R012-008
		13hex 19	0	Product ID	7 bytes		BNI00CH with BNI00CH
		14hex 20	0	Product text	16 bytes		Sensor hub M12 extended with Sensor hub M12
		15hex 21	0	Serial number	16 bytes		0hex
		16hex 22	0	Hardware revision			
		17hex 23	0	Firmware revision			
		18hex 24	0	Application-specific tag	32 bytes	Read/Write	0hex

	DPP	ISDU		Parameter	Data width	Access rights	Default Value
	Index	Index	Sub-index				
Parameter data		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	16x00hex
		55hex 85	0	Extension port	1 byte	Read/write	1hex

5   Configuration: Extended with BNI IOL-104-S02-R012-008

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
Description	-	Inversion of Port 6 Pin 4	Inversion of Port 5 Pin 4	Inversion of Port 4 Pin 4	Inversion of Port 3 Pin 4	Inversion of Port 2 Pin 4	Inversion of Port 1 Pin 4	Inversion of Port 0 Pin 4	-	Inversion of Port 6 Pin 2	Inversion of Port 5 Pin 2	Inversion of Port 4 Pin 2	Inversion of Port 3 Pin 2	Inversion of Port 2 Pin 2	Inversion of Port 1 Pin 2	Inversion of 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
	Extension port															
Description	Inversion of Port 7 Pin 4	Inversion of Port 6 Pin 4	Inversion of Port 5 Pin 4	Inversion of Port 4 Pin 4	Inversion of Port 3 Pin 4	Inversion of Port 2 Pin 4	Inversion of Port 1 Pin 4	Inversion of Port 0 Pin 4	Inversion of Port 7 Pin 2	Inversion of Port 6 Pin 2	Inversion of Port 5 Pin 2	Inversion of Port 4 Pin 2	Inversion of Port 3 Pin 2	Inversion of Port 2 Pin 2	Inversion of Port 1 Pin 2	Inversion of 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
Description	Short-circuit Port 7 Pin 1	Short-circuit Port 6 Pin 1	Short-circuit Port 5 Pin 1	Short-circuit Port 4 Pin 1	Short-circuit Port 3 Pin 1	Short-circuit Port 2 Pin 1	Short-circuit Port 1 Pin 1	Short-circuit Port 0 Pin 1	'	'	'	'	'	'	'	Undervoltage US

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
	Extension port															
Description	Short-circuit Port 7 Pin 1	Short-circuit Port 6 Pin 1	Short-circuit Port 5 Pin 1	Short-circuit Port 4 Pin 1	Short-circuit Port 3 Pin 1	Short-circuit Port 2 Pin 1	Short-circuit Port 1 Pin 1	Short-circuit Port 0 Pin 1	'	'	'	'	'	'	'	Undervoltage US

Setting the serial number 54hex

The serial number has a default value of 16x00hex.
In order to use the "Identity" master validation mode, a serial number can be set using this parameter.
This prevents a device from connecting to the wrong master port.

Configuration of the Extension port 55hex

Configuration	Index 55hex value
BNI IOL-104-S02-R012-008	0
BNI IOL-104-S02-R012-008 with BNI IOL-104-S02-R012-008	1
BNI IOL-104-S02-R012-008 with BNI IOL-751-V13-K007-008	4

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

6   Configuration extended with Valve Terminal Connector with 22/24 Valves

6.1. IO-Link Data

BNI IOL-104-S02-R012-008 extended with valve terminal connector with 22/24 valves	
Transfer rate	COM2 (38.4 kbaud)
Minimum cycle time	5.5 ms
Process data length	4 byte input, 4 byte output

6.2. Process Data/ Input Data

Process data length of 4 bytes:

Byte	0								1							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Description	Input Port 3 Pin 2	Input Port 3 Pin 4	Input Port 2 Pin 2	Input Port 2 Pin 4	Input Port 1 Pin 2	Input Port 1 Pin 4	Input Port 0 Pin 2	Input Port 0 Pin 4	-	-	Input Port 6 Pin 2	Input Port 6 Pin 4	Input Port 5 Pin 2	Input Port 5 Pin 4	Input Port 4 Pin 2	Input Port 4 Pin 4

Byte	2								3							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Description	Short-circuit Port 7	Short-circuit Port 6	Short-circuit Port 5	Short-circuit Port 4	Short-circuit Port 3	Short-circuit Port 2	Short-circuit Port 1	Short-circuit Port 0	-	-	-	-	Output off (UA too low)	Undervoltage UA	-	Undervoltage US1

6.3. Process Data/ Output Data

Process data length of 4 bytes

Byte	0								1							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
	Valve terminal on the Extension port															
Description	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	'	'	'	'	'	Valve 11 – Coil A	Valve 10 – Coil A	Valve 09 – Coil A

Byte	2								3							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
	Valve terminal on the Extension port															
Description	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	'	'	'	'	'	Valve 11 – Coil B	Valve 10 – Coil B	Valve 09 – Coil B

6 Configuration extended with Valve Terminal Connector with 22/24 Valves

6.4. Parameter Data / Demand Data

	DPP	ISDU		Parameter	Data width	Access rights	Default value
	Index	Index	Sub-index				
Identification data	07hex 07			Vendor ID	2 bytes	Read only	0378hex
	08hex 08						
	09hex 09			Device ID	3 bytes		0x05 0D E4
	0Ahex 10						
	0Bhex 11						
		10hex 16	0	Vendor name	8 bytes		BALLUFF
		11hex 17	0	Vendor text	16 bytes		www.balluff.com
		12hex 18	0	Product name	20/24 bytes		BNI IOL-104-S02-R012-008 with BNI IOL-751-V13-K007-008
		13hex 19	0	Product ID	7 bytes		BNI00CH with BNI00CF
		14hex 20	0	Product text	16 bytes		Sensor hub M12 extended with Valve plug CG23-24 22 2-3
		15hex 21	0	Serial number	16 bytes		0hex
		16hex 22	0	Hardware revision			
		17hex 23	0	Firmware revision			
		18hex 24	0	Application-specific tag	32 bytes		0hex

	DPP	ISDU		Parameter	Data width	Access rights	Default Value
	Index	Index	Sub-index				
Parameter data		40hex 64	0 1-16	Inversion of the inputs	2 bytes	Read/write	0hex
		42hex 66	0 1-22,24	Safe state on Pin 4	8 bytes	Read/write	0hex
		44hex 68	0 1-23	Voltage monitoring	3 bytes	Read	-
		45hex 69	0 1-40	Output monitoring	6 bytes	Read	-
		54hex 84	0	Serial number	16 bytes	Read/write	16x00hex
		55hex 85	0	Extension port	1 byte	Read/write	4hex

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
Description	-	Inversion of Port 6 Pin 4	Inversion of Port 5 Pin 4	Inversion of Port 4 Pin 4	Inversion of Port 3 Pin 4	Inversion of Port 2 Pin 4	Inversion of Port 1 Pin 4	Inversion of Port 0 Pin 4	-	Inversion of Port 6 Pin 2	Inversion of Port 5 Pin 2	Inversion of Port 4 Pin 2	Inversion of Port 3 Pin 2	Inversion of Port 2 Pin 2	Inversion of Port 1 Pin 2	Inversion of Port 0 Pin 2

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

6   Configuration extended with Valve Terminal Connector with 22/24 Valves

Safe state of 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 pin.

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 the extension port															
Description	'		'		'		'		'		Valve 11 – Coil A		Valve 10 – Coil A		Valve 09 – Coil A	

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 the extension port															
Description	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 the extension port															
Description	-	-	-	-	-	Valve 11 – Coil B		Valve 10 – Coil B		Valve 09 – Coil B	

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 the extension port															
Description	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	

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

6 Configuration extended with Valve Terminal Connector with 22/24 Valves

Voltage monitoring 44$_{hex}$

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				12	11		9
Description	Short-circuit Port 7 Pin 1	Short-circuit Port 6 Pin 1	Short-circuit Port 5 Pin 1	Short-circuit Port 4 Pin 1	Short-circuit Port 3 Pin 1	Short-circuit Port 2 Pin 1	Short-circuit Port 1 Pin 1	Short-circuit Port 0 Pin 1	-	-	-	-	Output off (UA too low)	Undervoltage UA	-	Undervoltage US

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

Monitoring the outputs 45hex

Byte	2								3							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Sub-index					39	37	35	33	31	29	27	25	23	21	19	17
	Extension port															
Description	'	'	'	'	'	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

Byte	4								5							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Sub-index					40	38	36	34	32	30	28	26	24	22	20	18
	Extension port															
Description	'	'	'	'	'	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

Setting the serial number 54hex

The serial number has a default value of 16x00hex.
In order to use the "Identity" master validation mode, a serial number can be set using this parameter.
This prevents a device from connecting to the wrong master port.

Configuration of the extension port 55hex

Configuration	Index 55hex value
BNI IOL-104-S02-R012-008	0
BNI IOL-104-S02-R012-008 with BNI IOL-104-S02-R012-008	1
BNI IOL-104-S02-R012-008 with BNI IOL-751-V13-K007-008	4

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

6   Configuration extended with Valve Terminal Connector with 22/24 Valves

6.5. 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

6.6. 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
0x8DF0	Retry at the extension port
0x8DF1	Device lost at the extension port
0x8DF2	Wrong device at the extension port

7.1. 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.

7.2. 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.

7.3. 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.

7.4. Restoring the Factory Settings

The factory settings on the device can be restored by carrying out the "restore factory settings" system command.
82_{hex} must be written to Index 2 Subindex 0 for the command.

8   Technical Data

8.1. Dimensions
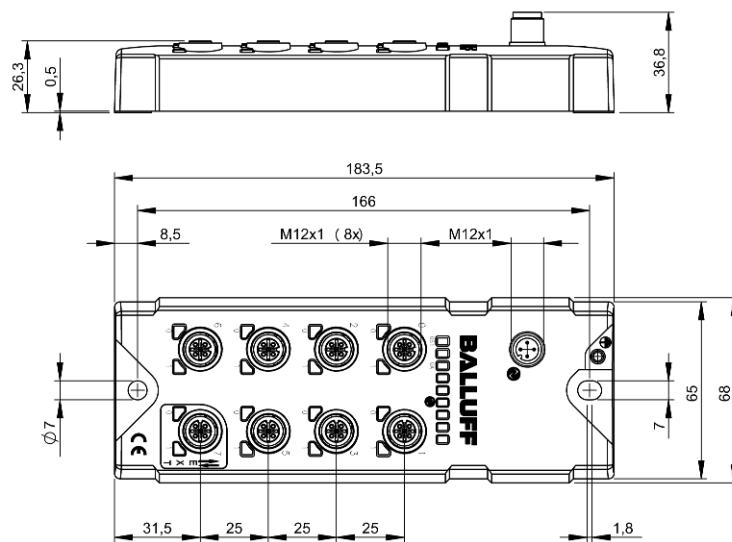
8.2. Mechanical Data

| Housing material	Plastic, resistant, Fortron 6165 A6
IO-Link Port	IO-Link port M12, A-coded, male
I/O ports	M12x1, A-coded, female (8 piece)
Weight	430 g
Dimension (L × W × H, without connector)	183,5 x 68 x 36,8 mm

8.3. Electrical Data

Supply voltage	18–30.2 V DC, corresponding to EN 61131-2
Ripple	< 1%
Current consumption without load	≤ 40 mA
Load current (PIN 1)	Max. 200 mA (temperature-dependent)
Total current US	3,5 A
Inputs	PNP, type 3

8.4. Operating conditions

Operating temperature	–5 °C … +70 °C
Storage temperature	–25 °C … +70 °C
EMC Immunity tests: Emission tests:	EN 61000-6-2:2005 AC:2005 EN 61000-6-4:2007 A1:2011
Degree of protection	IP67 (only in plugged-in and screwed state)
Vibration/shock	EN 60068 Part 2-6/27

9.1. Function Indicators
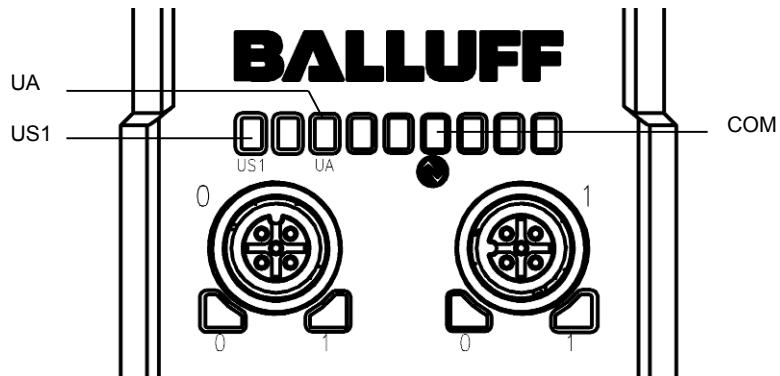
LED indicator module status

	Indicator	Function
COM	Green	No communication
	Green, negatively pulsed	Communication OK
US1 LED	Green	Sensor power supply is OK
	Red	Undervoltage < 18 V
UA LED	Green	Actuator power supply is OK
	Red	Undervoltage < 18 V

9	Function Indicators

Digital LED indicators for inputs/outputs

LED 2, input/output on Pin 4 and LED 1, input/output on Pin 2

| Indicator	Request / Signal
Yellow	Input/output signal = 1
Red	Sensor power supply short-circuit
Off	Input/output 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/outputs" can be used.

Status	Function
Green	IO-Link – connection active
Green, flashing	No IO-Link connection or faulty IO-Link device
Red flashing	Incorrect IO-Link device or incorrect configuration
Yellow	Actuator power supply active

10.1. Type Code

BNI IOL-104-S02-R012-008

Balluff Network Interface

IO-Link interface

Functions
104 = 16 inputs

Variants
S02 = with extension port

Mechanical configuration
R012 = Plastic housing, resistant, Fortron 6165 A6
Bus connection:
1x M12x1 external thread,
I/O ports: 8 x M12x1, internal thread

Variants
008 = alternative process data mapping
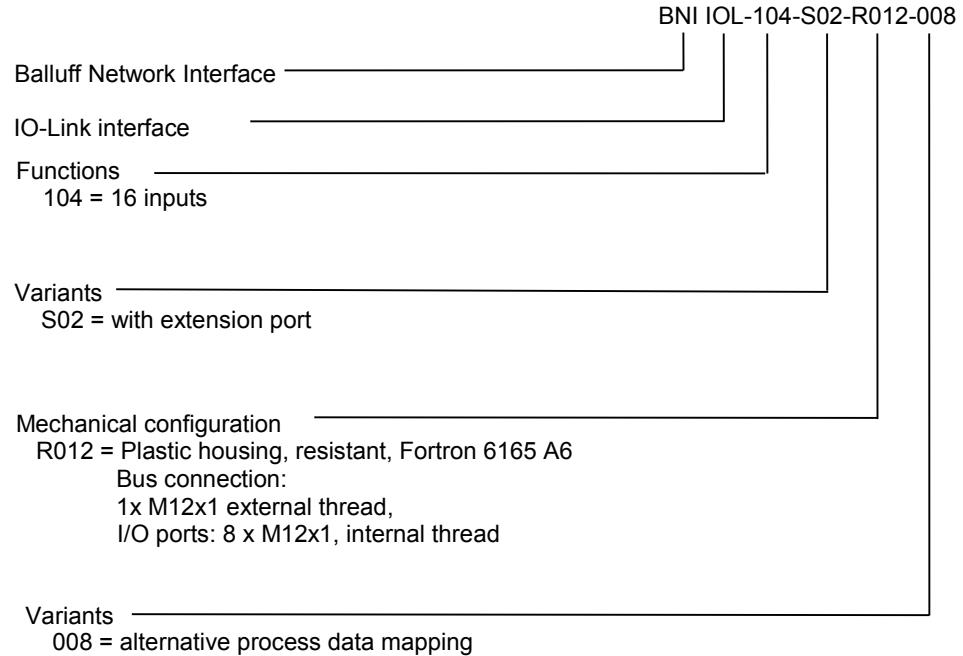
10.2. Ordering Information

Type code	Ordering code
BNI IOL-104-S02-R012-008	BNI00CH

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