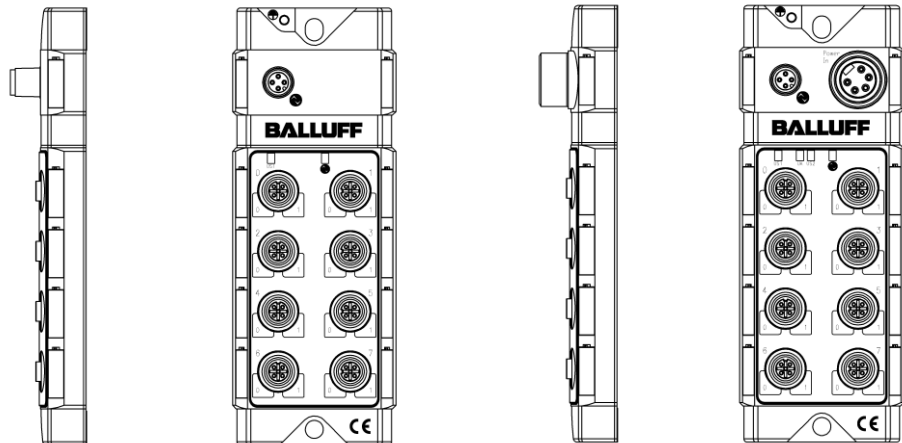


BALLUFF

sensors worldwide

BNI IOL-104-S01-Z012-C01 **BNI IOL-104-S01-Z012-C02** **BNI IOL-302-S01-Z013-C01**

User's Guide



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1 Notes for the user

1.1 About this guide This guide describes the Balluff Network Interface BNI IOL.... for the application as peripheral in-/ output module to establish connection of binary standard sensors or actuators. Hereby it is about an IO-Link device which communicates by means of IO-Link protocol with the superordinate IO-Link master assembly.

1.2 Structure of the guide The guide is organized so that the sections build on one another.
Section 2: Basic safety information.
Section 3: The main steps for installing the device.
Section 4: IO-Link, parameter and process data for the device.
Section 5: Technical data for the device.

1.3 Typographical conventions The following typographical conventions are used in this guide.

1.3.1 Enumerations Enumerations are shown in list form with bullet points:
- Entry 1,
- Entry 2.

1.3.2 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.

1.3.3 Syntax **Numbers:**
- Decimal numbers are shown without additional indicators (e.g. 123),
- Hexadecimal numbers are shown with the additional indicator _{hex} (e.g. 00_{hex}).

1.3.4 Cross references Cross references indicate where additional information on the topic can be found (see section 5 „Technical Data”).

1.4 Symbols



Note, Tipp

This symbol indicates general notes.



Note!

This symbol indicates a security notice which must be observed.

1.5 Abbreviations

BNI	Balluff Network Interface
I/O-port	Standard In-/ Output port
DPP	Direct parameter page
IOL	IO-Link
EMC	Electromagnetic Compatibility
FE	Function earth
SPDU	Service Protocol Data Unit

2 Safety

2.1 Installation and startup



Note

Installation and startup are to be performed only by trained specialists. Qualified personnel are persons who are familiar with the installation and operation of the product, and who fulfills the qualifications required for this activity. Any damage resulting from unauthorized manipulation or improper use voids the manufacturer's guarantee and warranty. The Operator is responsible for ensuring that applicable safety and accident prevention regulations are complied with.

2.2 General safety notes

Commissioning and inspection

Before commissioning, carefully read the operating manual.

The system must not be used in applications in which the safety of persons is dependent on the function of the device.

Authorized Personnel

Installation and commissioning may only be performed by trained specialist 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 operating manual

Obligations of the Operating Company

The device is a piece of equipment from EMC Class A. Such equipment may generate RF noise. The operator must take appropriate precautionary measures. The device may only be used with an approved power supply. Only approved cables may be used.

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.

Hazardous voltage



Note

Disconnect all power before servicing equipment.



Note

In the interest of product improvement, the Balluff GmbH reserves the right to change the specifications of the product and the contents of this manual at any time without notice.

3 Getting started

3.1 Connection overview
BNI IOL-104....

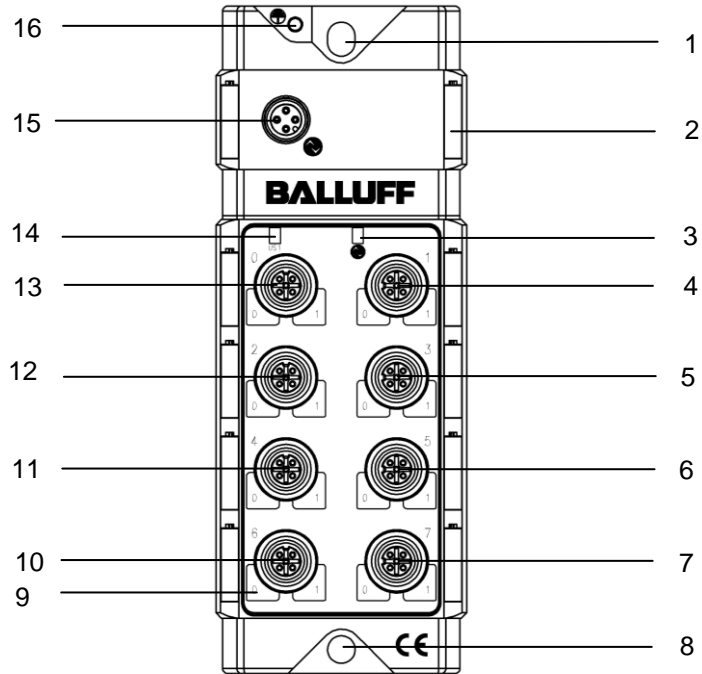


Figure 3-1: Connection overview BNI IOL-104-S01-Z012-C0x

- | | | | |
|---|------------------------------------|----|-----------------------------|
| 1 | Mounting hole | 9 | Pin/Port LED: Signal status |
| 2 | Label | 10 | Port 6 |
| 3 | Status LED: Communication / module | 11 | Port 4 |
| 4 | Port 1 | 12 | Port 2 |
| 5 | Port 3 | 13 | Port 0 |
| 6 | Port 5 | 14 | Status led: module supply |
| 7 | Port 7 | 15 | IO-Link interface |
| 8 | Mounting hole | 16 | Ground connection |

3 Getting started

3.2 Connection
Overview
BNI IOL-302.....

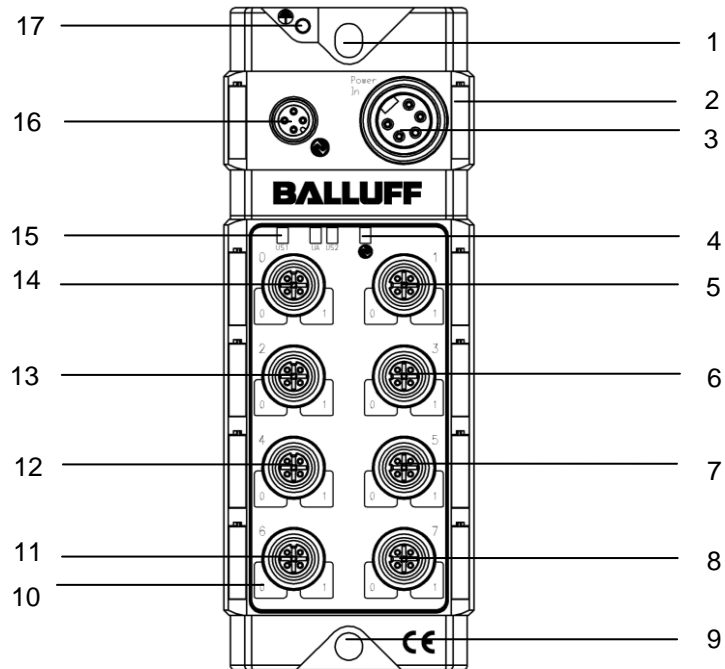


Figure 3-2: Connection overview BNI IOL-302-S01-Z013-C01

- | | |
|--------------------------------------|--------------------------------|
| 1 Mounting hole | 10 Pin/Port LED: Signal status |
| 2 Label | 11 Port 6 |
| 3 Auxiliary power connection | 12 Port 4 |
| 4 Status LED: Communication / module | 13 Port 2 |
| 5 Port 1 | 14 Port 0 |
| 6 Port 3 | 15 Status LED: Supply voltages |
| 7 Port 5 | 16 IO-Link Interface |
| 8 Port 7 | 17 Ground connection |
| 9 Mounting hole | |

3 Getting started

3.3 Mechanical connection

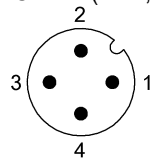
The BNI IOL ...modules are attached by using 2 M6 screws and 2 spacers.

3.4 Electrical connection

The BNI IOL-104-S01-Z012-C0x module requires no separate supply voltage connection. Power is provided through the IO-Link interface by the host IO-Link Master.
 The BNI IOL-302-S01-Z013-C01 module requires a separate power supply for the actuators and sensors. This power supply is provided through the auxiliary power connection. Supply of the communication section is made through the superordinate IO-link master assembly.

3.4.1 IO-Link interface

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



PIN	Function
1	Power supply controller, +24V, max 1.1A
2	not used
3	GND, reference potential
4	C/Q, IO-Link Data transmission channel

Connecting the hub

- Connection protection ground to FE terminal, if present.
- Connect auxiliary power supply if present.
- Connect the incoming IO-Link line to the Sensor Hub.



Note: A standard 3 wire sensor cable is used for connection to the host IO-Link master.

Function earth

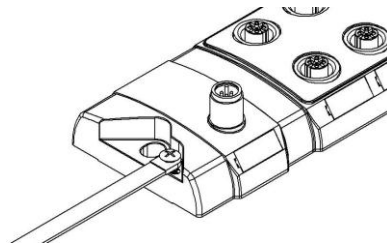


Figure 3-3: FE connection



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

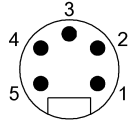
Module versions

Hub Versions	Digital port
BNI IOL-104-S01-Z012-C01	16 Inputs with single channel monitoring, 2 Identification bytes
BNI IOL-104-S01-Z012-C02	16 Inputs with single channel monitoring, 4 Identification bytes
BNI IOL-302-S01-Z013-C01	16 Inputs 16-Outputs, configurable, with single channel monitoring 2 Identification bytes

3 Getting started

3.4.2. Supply voltage connection

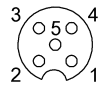
Power In (7/8", male)



Pin	Function
1	GND, Reference potential
2	GND, Reference potential
3	FE, Function earth
4	Power supply sensors, +24V
5	Power supply actuators, +24V

3.4.3 Sensor-Actuator interface

Standard I/O-port (M12, A- coded, female)



PIN	Function
1	+24V, 100mA / 300mA*
2	Input 2 /Output 2
3	GND
4	Input 1 /Output 1
5	FE

* 100mA – BNI IOL-104-S01-Z012-C0x
 300mA – BNI IOL-302-S01-Z013-C01

i Note: For the digital sensor inputs follow the input guideline per EN61131-2, type 2.

i Note: Unused I/O-port sockets must be fitted with cover caps to ensure IP67 protection rating.

4 IO-Link interface

4.1 IO-Link data

BNI IOL-104-S01-Z012-C01 / BNI IOL-104-S01-Z012-C02

	BNI IOL-104-S01-Z012-C01	BNI IOL-104-S01-Z012-C02
Data transmission rate	COM2 (38,4 kBaud)	COM2 (38,4 kBaud)
Frame type	1	1
Minimal cycle time	3 ms	3 ms
Process data cycle time	18 ms, at minimal cycle time	24 ms, at minimal cycle time
Process data length	6 Byte input	8 Byte input

BNI IOL-302-S01-Z013-C01

Data transmission rate	COM2 (38,4 kBaud)
Frame type	1
Minimal cycle time	3 ms
Process data cycle time	30 ms, at minimal cycle time
Process data length	10 Byte input

4.2 Process data / Input data

BNI IOL-104-S01-Z012-C01
BNI IOL-104-S01-Z012-C02*

Byte 0								Byte 1							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Input 7.0	Input 6.0	Input 5.0	Input 4.0	Input 3.0	Input 2.0	Input 1.0	Input 0.0	Input 7.1	Input 6.1	Input 5.1	Input 4.1	Input 3.1	Input 2.1	Input 1.1	Input 0.1
Byte 2								Byte 3							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
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	.	.	.	.	.	.	.	Under voltage UV
Byte 4								Byte 5							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Identification byte 0								Identification byte 1							
Byte 6								Byte 7							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Identification byte 2*								Identification byte 3*							

Signal port (x):
x.0: Pin 4,
x.1: Pin 2

4 IO-Link interface

BNI IOL-302-S01-Z013-C01

Byte 0								Byte 1							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Input 7.0	Input 6.0	Input 5.0	Input 4.0	Input 3.0	Input 2.0	Input 1.0	Input 0.0	Input 7.1	Input 6.1	Input 5.1	Input 4.1	Input 3.1	Input 2.1	Input 1.1	Input 0.1
Byte 2								Byte 3							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
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	.	.	.	.	.	.	.	Under voltage UV
Byte 4								Byte 5							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Short circuit Port 7.0	Short circuit Port 6.0	Short circuit Port 5.0	Short circuit Port 4.0	Short circuit Port 3.0	Short circuit Port 2.0	Short circuit Port 1.0	Short circuit Port 0.0	Short circuit Port 7.1	Short circuit Port 6.1	Short circuit Port 5.1	Short circuit Port 4.1	Short circuit Port 3.1	Short circuit Port 2.1	Short circuit Port 1.1	Short circuit Port 0.1
Byte 6								Byte 7							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Warning Port 7.0	Warning Port 6.0	Warning Port 5.0	Warning Port 4.0	Warning Port 3.0	Warning Port 2.0	Warning Port 1.0	Warning Port 0.0	Warning Port 7.1	Warning Port 6.1	Warning Port 5.1	Warning Port 4.1	Warning Port 3.1	Warning Port 2.1	Warning Port 1.1	Warning Port 0.1
Byte 8								Byte 9							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Identification-byte 0								Identification-byte 1							

Signal port (x):
x.0: Pin 4,
X.1: Pin 2

Short circuit on Port x between Pin 1 and Pin 3
Short circuit port x = 1
where x=0...7

Actuator short circuit on port x
Short circuit port x.0 = Pin 4
Short circuit port x.1 = Pin 2

Actuator warning at signal port on port x
Warning port x.0 = Pin 4
Warning port x.1 = Pin 2

Note:



Actuator short circuit: overload or short circuit of the output signal against 0V.
Actuator warning signal: short circuit of the output signal against +24V

4.3 Process data / Output data

BNI IOL-104-S01-Z012-C01
BNI IOL-104-S01-Z012-C02

No output data

BNI IOL-302-S01-Z013-C01

Byte 0								Byte 1							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Output 7.0	Output 6.0	Output 5.0	Output 4.0	Output 3.0	Output 2.0	Output 1.0	Output 0.0	Output 7.1	Output 6.1	Output 5.1	Output 4.1	Output 3.1	Output 2.1	Output 1.1	Output 0.1

Signal port (x):
x.0: Pin 4,
X.1: Pin 2

4 IO-Link interface

4.4 Parameter data / Request data

	DPP		SPDU		Object name	Length	Range	Default value
	Index	Index	Sub-Index	Sub-Index				
Identification data	0x07				Vendor ID	2 Byte	read only	0x0378
	0x08							
	0x09				Device ID	3 Byte		0x050709 0x050711 0x05070D
	0x0A							
	0x0B							
		0x10	0	Vendor name	7 Byte	BALLUFF		
		0x11	0	Vendor text	15 Byte	www.balluff.com		
		0x12	0	Product name	20 Byte	BNI IOL-104-S01-Z012-C01 BNI IOL-104-S01-Z012-C02 BNI IOL-302-S01-Z013-C01		
		0x13	0	Product ID	7 Byte	BN 003T BNI005P BN 0048		
		0x14	0	Product text	22 Byte	Sensor hub metal 16 inputs + ID Sensor/Actor hub metal		
	0x16	0	Hardware Revision	1 Byte				
	0x17	0	Firmware Revision	23 Byte				
Parameter data		0x40	0 1-16	Inversion	2 Byte	0-FFFF	0x0000	
		0x41	0 1-16	Port Direction*	2 Byte	0-FFFF	0x0000	
		0x42	0 1-16	Secure state Pin4*	2 Byte	0-FFFF	0x0000	
		0x43	0 1-16	Secure state Pin2*	2 Byte	0-FFFF	0x0000	
		0x44	0 1-16	Sp. monitoring	2 Byte	0-FFFF	-	
		0x45	0 1-16	Actuator short circuit*	2Byte	0-FFFF	-	
		0x46	0 1-16	Actuator warning*	2 Byte	0-FFFF	-	
		0x60	0 1-16	Identification	2 Byte	0-FFFF	-	
	0x60	0 1-32**	Identification	4 Byte**	0-FFFF FFFF**			

* Only in case of BNI IOL-302-S01-Z013-C01

** Only in case of BNI IOL-302-S01-Z013-C02

Inversion

Byte 0								Byte 1							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Inversion 7.0	Inversion 6.0	Inversion 5.0	Inversion 4.0	Inversion 3.0	Inversion 2.0	Inversion 1.0	Inversion 0.0	Inversion 7.1	Inversion 6.1	Inversion 5.1	Inversion 4.1	Inversion 3.1	Inversion 2.1	Inversion 1.1	Inversion 0.1

Inversion port (x):
x.0: Pin 4,
x.1: Pin 2

Inversion
0: normal
1: inverted

4 IO-Link interface

Port direction

Byte 0								Byte 1							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Direction 7.0	Direction 6.0	Direction 5.0	Direction 4.0	Direction 3.0	Direction 2.0	Direction 1.0	Direction 0.0	Direction 7.1	Direction 6.1	Direction 5.1	Direction 4.1	Direction 3.1	Direction 2.1	Direction 1.1	Direction 0.1

Direction port (x):
x.0: Pin 4,
x.1: Pin 2

Direction
0: Input
1: Output

Secure status Pin 4

Byte 0								Byte 1							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Secure st. 3.0		Secure st. 2.0		Secure st. 1.0		Secure st. 0.0		Secure st. 7.0		Secure st. 6.0		Secure st. 5.0		Secure st. 4.0	

Secure status port (x)
00 – 0
01 – 1
10 – Last status
11 – Not defined

Secure status Pin 2

Byte 0								Byte 1							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Secure st. 3.1		Secure st. 2.1		Secure st. 1.1		Secure st. 0.1		Secure st. 7.1		Secure st. 6.1		Secure st. 5.1		Secure st. 4.1	

Secure status port (x)
00 – 0
01 – 1
10 – Last status
11 – Not defined

Sp. monitoring

Byte 0								Byte 1							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
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	-	-	-	-	-	Under voltage UA	Under voltage US2	Under voltage US1

Short circuit on
Port x between
Pin 1 und Pin 3
Short circuit Port x = 1

where x=0...7

Actuator short circuit

Byte 4								Byte 5							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Short circuit port 7.0	Short circuit port 6.0	Short circuit port 5.0	Short circuit port 4.0	Short circuit port 3.0	Short circuit port 2.0	Short circuit port 1.0	Short circuit port 0.0	Short circuit port 7.1	Short circuit port 6.1	Short circuit port 5.1	Short circuit port 4.1	Short circuit port 3.1	Short circuit port 2.1	Short circuit port 1.1	Short circuit port 0.1

Actuator short circuit at signal
port on port x
Short circuit port x.0 = Pin 4
Short circuit port x.1 = Pin 2

4 IO-Link interface

Actuator warning

Byte 6								Byte 7							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Warning port 7.0	Warning port 6.0	Warning port 5.0	Warning port 4.0	Warning port 3.0	Warning port 2.0	Warning port 1.0	Warning port 0.0	Warning port 7.1	Warning port 6.1	Warning port 5.1	Warning port 4.1	Warning port 3.1	Warning port 2.1	Warning port 1.1	Warning port 0.1

Actuator warning at signal port on port x
 Warning port x.0 = Pin 4
 Warning port x.1 = Pin 2

Identification

Byte 0								Byte 1							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Identification byte 0								Identification byte 1							
Byte 2								Byte 3							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Identification byte 2**								Identification byte 3**							

**Only in case of BNI IOL-104-S01-Z012-C02

4.5 Error

Error Code	Additional Code
Device application error 0x80	Index not available 0x11
Device application error 0x80	Subindex not available 0x12
Device application error 0x80	Value out of range 0x30

4.6 Events

Class / Qualifier			Code (high + low)			
Mode	Type	Instance	Device Hardware	Supply	Supply low voltage	
Appears	Error	AL	Device Hardware	Supply	Supply low voltage	US1
0xC0	0x30	0x03	0x5000	0x0100	0x0010	0x0002
0xF3			0x5112			
Disappears	Error	AL	Device Hardware	Supply	Supply low voltage	US1
0x80	0x30	0x03	0x5000	0x0100	0x0010	0x0002
0xB3			0x5112			
Appears	Error	AL	Device Hardware	Supply	Supply low voltage	UA
0xC0	0x30	0x03	0x5000	0x0100	0x0010	0x0004
0xF3			0x5114			
Disappears	Error	AL	Device Hardware	Supply	Supply low voltage	UA
0x80	0x30	0x03	0x5000	0x0100	0x0010	0x0004
0xB3			0x5114			
Appears	Error	AL	Device Hardware	Supply	Supply low voltage	US2
0xC0	0x30	0x03	0x5000	0x0100	0x0010	0x0005
0xF3			0x5115			
Disappears	Error	AL	Device Hardware	Supply	Supply low voltage	US2
0x80	0x30	0x03	0x5000	0x0100	0x0010	0x0005
0xB3			0x5115			
Appears	Error	AL	Device Hardware	Supply	Supply periphery	
0xC0	0x30	0x03	0x5000	0x0100	0x0060	
0xF3			0x5160			
Disappears	Error	AL	Device Hardware	Supply	Supply periphery	
0x80	0x30	0x03	0x5000	0x0100	0x0060	
0xB3			0x5160			
Appears	Error	AL	Device Hardware	Power	Output Stages	
0xC0	0x30	0x03	0x5000	0x0400	0x0010	
0xF3			0x5410			
Disappears	Error	AL	Device Hardware	Power	Output Stages	
0x80	0x30	0x03	0x5000	0x0400	0x0010	
0xB3			0x5410			

5 Technical data

5.1 Dimensions

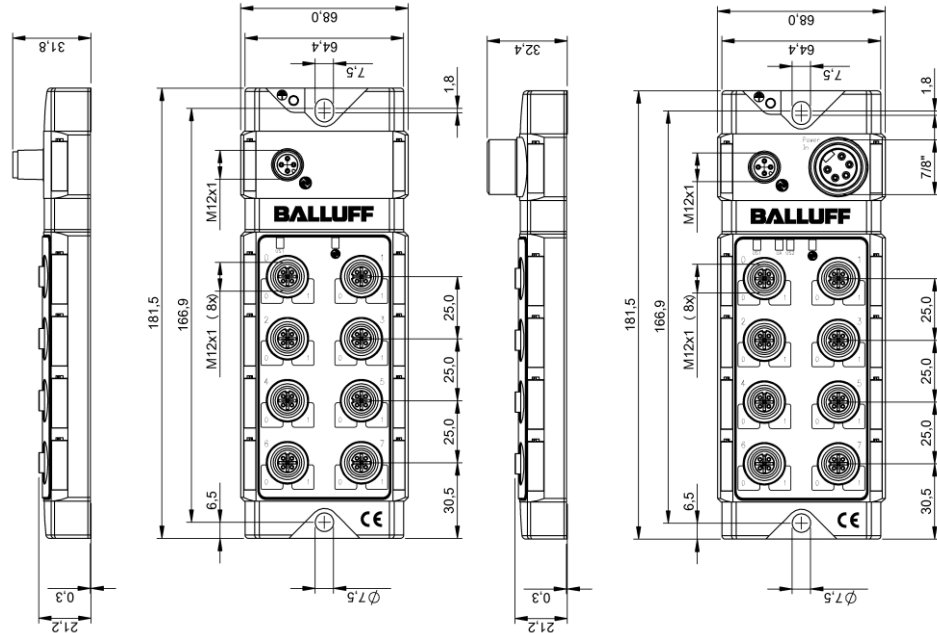


Figure 5-1: Dimensions BNI IOL-...-Z012 & BNI IOL-...-Z013

5.2 Mechanical data

Housing material	Die-cast zinc housing
IO-Link port	M12, A coded, male
Power supply	7/8" male, 5-poles
I/O-ports	M12, female, 5-poles
Enclosure rating per IEC 60529	IP 67 (only when plugged in and threaded in)
Dimension (W x H x D in mm)	68 x 181,5 x 31,8 (32,4)
Weight	ca. 500 gr.

5.3 Electrical data

Operating conditions	18...30.2 V DC, per EN 61131-2
Ripple	< 1%
Current draw without load	<= 90 mA

5.4 Operating conditions

Operating temperature	-5 °C ... 70 °C
Storage temperature	-25 C ... 70 °C
EMC EN 61000-4-2/3/4/5/6	Severity level 2B/3A/4B/2B/3A
Shock / vibration	EN 60068-2-6, EN 60068-2-27 EN 60068-2-29, EN 60068-2-64

5 Technical data

5.5 LED indicators

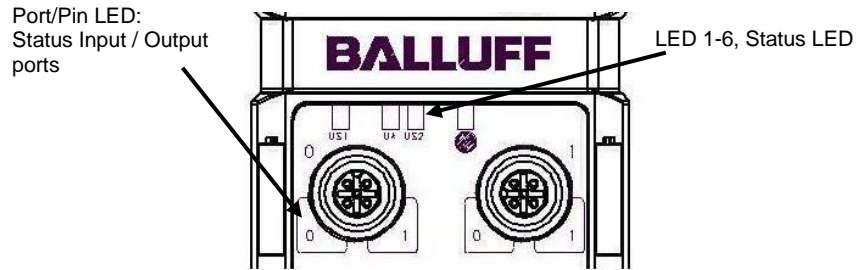


Figure 5-2: LED Indicators

Status LEDs

BNI IOL-104-S01-Z012-C01 / BNI IOL-104-S01-Z012-C02

LED	Indicator	Function
LED 1	Green / Red	Supply Sensors & Module ok / under voltage
LED 6	Green / Green flashing	Communication error / communication ok

BNI IOL-302-S01-Z013-C01

LED	Indicator	Function
LED 1	Green / Red	Supply Module OK/ Under voltage
LED 3	Green / Red	Supply actuators Ok/ under voltage
LED 5	Green / Red	Supply Sensors Ok / under voltage
LED 6	Green / Green flashing	Communication error / communication ok

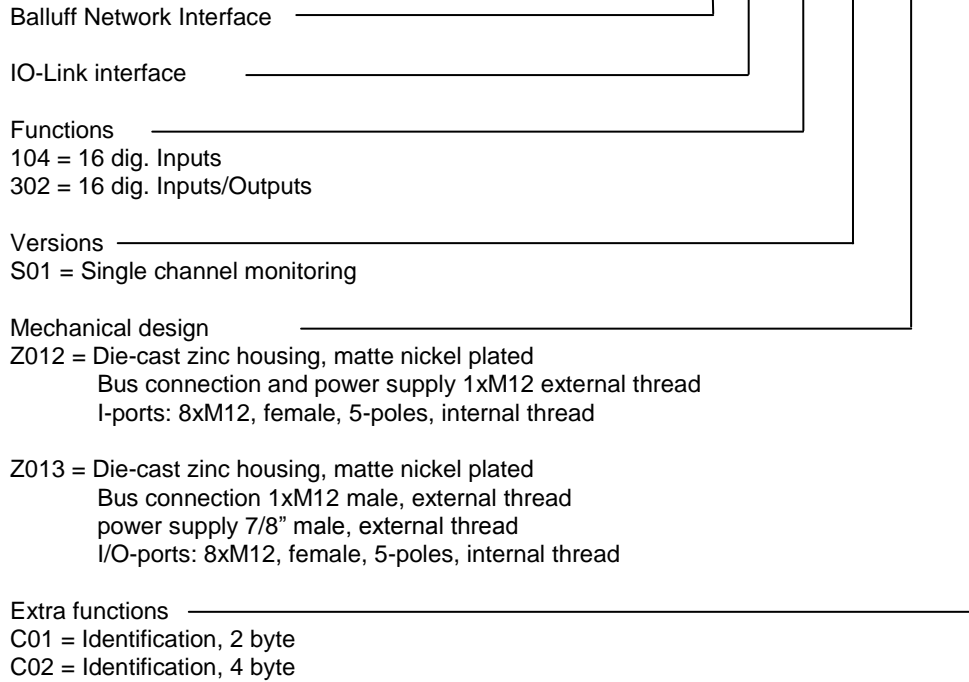
LED I/O-ports Standard

Indicator	Function LED Pin 2 / Pin 4
Out	Input signal / Output signal = 0
Yellow, static	Input signal / Output signal = 1
Red	Input port: Short circuit Output port: I _{max}

Appendix

Product ordering code

BNI IOL-104-S01-Z01x-C0x



Order information

Product ordering code	Order code
BNI IOL-104-S01-Z012-C01	BNI003T
BNI IOL-104-S01-Z012-C02	BNI005P
BNI IOL-302-S01-Z013-C01	BNI0048

Scope of delivery

- BNI IOL-.....consists of the following components:
- IO-Module
 - 4 filler plugs M12
 - Ground connection-band
 - Screw M4x6
 - 20 Labels
 - User's Guide

Notes

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