BALLUFF

sensors worldwide

BNI IOL-302-000-Z013
BNI IOL-302-S01-Z013
User's Guide
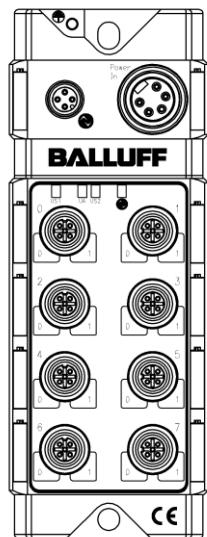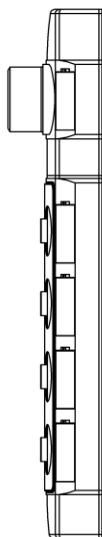
1 Notes for the user

1.1 About this guide

This guide describes the Balluff Network Interface BNI IOL-302-xxx-Z013 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.
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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.

1.4 Symbols

i   **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 input / output port
DPP	Direct Parameter Page
IOL	IO-Link
EMC	Electromagnetic Compatibility
FE	Function earth
SPDU	Service Protocol Data Unit

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 anufacturer's guarantee and warranty. The Operator is responsible for ensuring that applicable of 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.

2.3 Resistance to Aggressive Substances

Note
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.

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
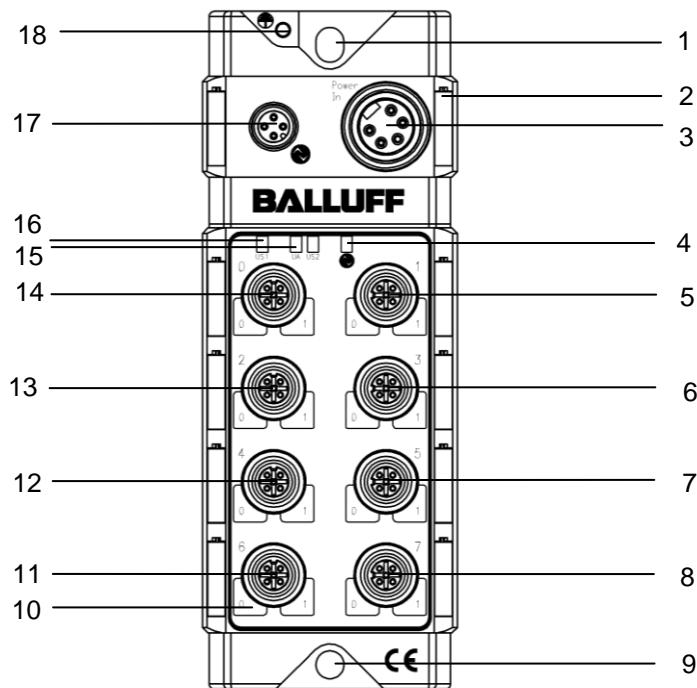
Figure 3-1: Connection overview BNI IOL-302-xxx-Z013

1	Mounting hole	10	Pin/Port LED: Signal status
2	Label	11	Standard I/O port 6
3	Supply voltage connection	12	Standard I/O port 4
4	Status LED: communication / module	13	Standard I/O port 2
5	Standard I/O port 1	14	Standard I/O port 0
6	Standard I/O port 3	15	Status LED: sensors/ actuators supply
7	Standard I/O port 5	16	Status LED: module supply
8	Standard I/O port 7	17	IO-Link interface
9	Mounting hole	18	Ground connection

3.2	Mechanical connection	The BNI IOL-302-xxx-Z013 modules are attached by using 2 M6 screws and 2 spacers.

3.3	Electrical connection	The BNI IOL-302-xxx-Z013 modules require two separate supply voltage connection. The supply voltage of the module is provided through the IO-Link interface by the host IO-Link Master. The power for the sensors and actuators is provided by the 7/8" connector.

3.3.1 IO-Link interface

IO-Link (M12, A coded, male)
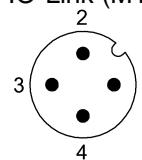
Pin	Function
1	Power supply controller, +24V, max 1,1A
2	not connected
3	GND, reference potential
4	C/Q, IO-Link data transmission channel

Connecting the hub

➢   Connection protection ground to FE terminal, if present.
➢   Connect sensor/actuator supply.
➢   Connect the incoming IO-Link line to the hub.

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

Function earth
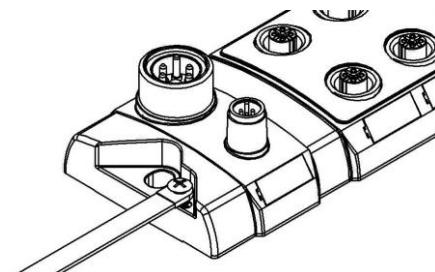
Figure 3-2: FE connection

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-302-000-Z013	16 In-/ Outputs, configurable
BNI IOL-302-S01-Z013	16 In-/ Outputs, configurable, with single channel monitoring

3.3.2. Supply voltage connection

Power In (7/8", male)
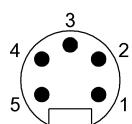
Pin	Function
1	GND, Reference potential
2	GND, Reference potential
3	FE, function earth
4	Power supply sensors, +24V
5	Power supply actuators, +24V

**3.3.3 Sensor-Actuator
        interface**

Standard I/O port (M12, A coded, female)
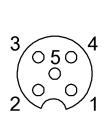
Pin	Function
1	+24V, 300mA
2	Input 2 / Output 2
3	GND
4	Input 1 / Output 1
5	FE

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

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i   **Note!**
       Outputs: Maximum 2A per output.
       Total current of actuator supply is maximum 9A.

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

4.1 IO-Link data   **BNI IOL-302-000-Z013**

Data transmission rate	COM2 (38,4 kBaud)
Frame type	1
Minimal cycle time	3 ms
Process data cycle time	12 ms, 3 ms, at minimal cycle time
Process data length	2 Bytes input, 2 Bytes output

BNI IOL-302-S01-Z013

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	8 Bytes input, 2 Bytes output

**4.2 Process data /
Input data**

BNI IOL-302-000-Z013

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

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

BNI IOL-302-S01-Z013

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

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

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 UA	Untder voltage US2	Under voltage US1

Short circuit on
port x between
Pin 1 and Pin 3
Short circuit Port x = 1

where x=0...7

4   IO-Link interface

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=Pin4 Short circuit port x.1=Pin2

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

i **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-302-xxx-Z013

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

4.4 Parameter data / Request data

	DPP	SPDU		Object name	Length	Range	Default value
	Index	Index	Sub-Index				
Identification data	0x07			Vendor ID	2 Byte	read only	0x0378
	0x08						
	0x09			Device ID	3 Byte		0x050703 0x050708
	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-302-000-Z013 BNI IOL-302-S01-Z013
		0x13	0	Product ID	7 Byte		BNI 0035 BNI 003A
		0x14	0	Product text	22 Byte		Sensor/Actor hub metal
		0x16	0	Hardware Revision	1 Byte		1
		0x17	0	Firmware Revision	23 Byte		1.1
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	Fault state Pin4	2 Byte	0-FFFF	0x0000
		0x43	0 1-16	Fault state Pin2	2 Byte	0-FFFF	0x0000
		0x44	0 1-16	Power 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	-

BNI IOL-302-xxx-Z013

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

Fault state Pin 4

Byte 0								Byte 1							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Fault state 3.0		Fault state 2.0		Fault state 1.0		Fault state 0.0		Fault state 7.0		Fault state 6.0		Fault state 5.0		Fault state 4.0	

Fault state port (x)
00 – 0
01 – 1
10 – Latest state
11 – Not defined

Fault state Pin 2

Byte 0								Byte 1							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Fault state 3.1		Fault state 2.1		Fault state 1.1		Fault state 0.1		Fault state 7.1		Fault state 6.1		Fault state 5.1		Fault state 4.1	

Fault state port (x)
00 – 0
01 – 1
10 – Latest state
11 – Not defined

BNI IOL-302-S01-Z013

Power 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 0								Byte 1							
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=Pin4
Short circuit Port x.1=Pin2

Actuator warning

	Byte 0								Byte 1							
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 t 0.1

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.

4.5 Error

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

4.6 Events

Class / Qualifier			Code (high + low)			
Mode	**Type**	**Instance**				
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			

5.1 Dimensions
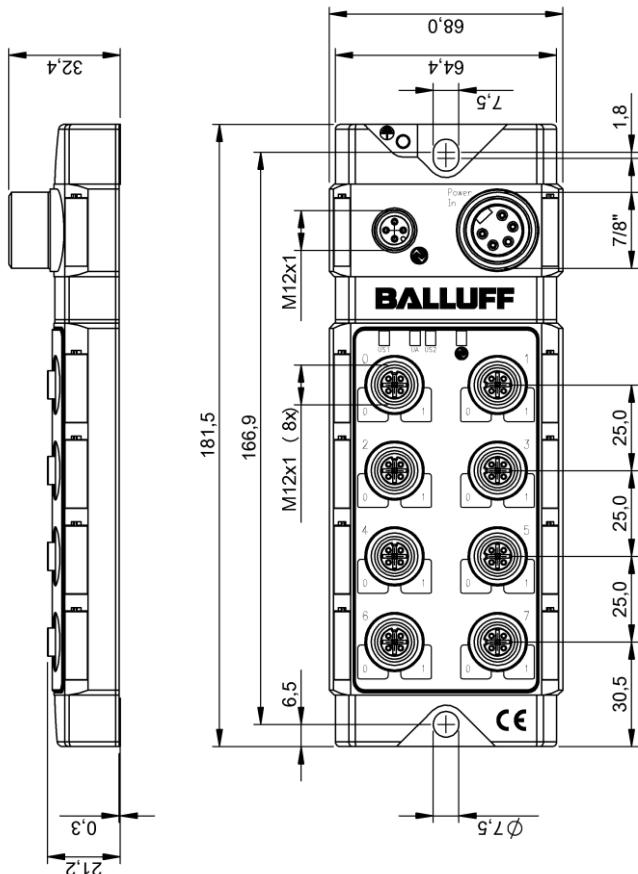
Figure 5-1: Dimensions BNI IOL-302-xxx-Z013

5.2 Mechanical data

Housing material	Die-cast zinc housing
IO-Link port	M12, A coded, male
Supply voltage connection	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)
Dimensions (B x H x T in mm)	68 x 181,5 x 32,4
Weight	ca. 500 gr.

5.3 Electrical data

Supply voltage	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

5.5 LED indicators

Port/Pin LED:
Status input / output
ports
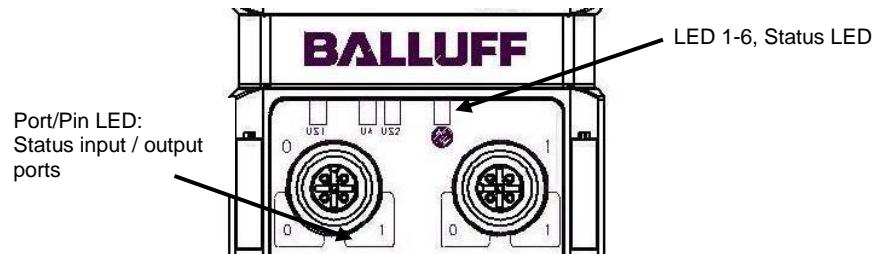
LED 1-6, Status LED

Figure 5-2: Indication LEDs

Status LEDs

BNI IOL-302-xxx-Z013

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: KS, Short circuit Output port: Imax, Over-current

Product ordering code   **BNI IOL-302-xxx-Z013**

      Balluff Network Interface ───────────────────────────

      IO-Link Interface ────────────

      Functions
      302 = 16 dig. Inputs/ Outputs

      Versions ──────────
      000 = Standard version
      S01 = Single channel monitoring

      Mechanical design ────────────
      Z013 = Die-cast zinc housing, matte nickel plated
               Bus connection and power supply: 1xM12 male, external thread
               Power supply: 1x7/8" male, external thread
               I/O-Ports: 8xM12, female, 5-poles, internal thread

Order information

Product ordering code	Order code
BNI IOL-302-000-Z013	BNI0035
BNI IOL-302-S01-Z013	BNI003A

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

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