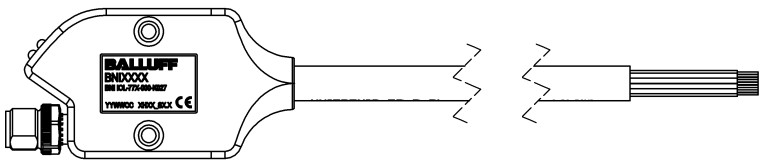
BALLUFF

BNI IOL-771-000-K027
BNI IOL-772-000-K027
BNI IOL-771-002-K027-003
BNI IOL-772-002-K027-003

IO-Link Version 1.1

User´s Guide



Inhalt

1 Notes for the user

1.1. About this guide

This guide describes the Balluff Network Interface BNI IOL-… to control various devices of different manufacturers. Connection to the host interface IO-Link master is made through The IO-Link protocol.

1.2. Structure of the guide

The chapters in this guide build on one another.
Section 2: Safety
……..

1.3. Typographical conventions

The following typographical conventions are used in this guide.

Enumerations

Enumerations are shown in list form with bullet points:

- 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 (e. g. 00_{hex}).

Cross references

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

1.4. Symbols

Attention!
This symbol indicates a security notice which must be observed.

Note
This symbol indicates general notes.

1.5. Abbreviations

BNI	Balluff Network Interface
DPP	Direct Parameter Page
EMC	Electromagnetic compatibility
FE	Function earth
IOL	IO-Link
LSB	Least Significant Bit
MSB	Most Significant Bit
SPDU	Service Protocol Data Unit (see IO-Link Specification)

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-…serves as a decentralized output module that communicates with a IO-Link Master. This allows to control various devices.

2.2. Installation and startup

Attention!
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 of safety and accident prevention regulations are complied with.

2.3. General safety instructions

Commissioning and inspection
The operating company shall be responsible for observance of locally applicable safety instructions.
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.

2.4. Resistance to Aggressive Substances

Attention!
The BNI modules always have good chemical and oil resistance. When used in aggressive media (such as chemicals, oils, lubricants and coolants, each in a high concentration (i.e. too little water content)), the material must first be checked for resistance in the particular application. No defect claims may be asserted in the event of a failure or damage to the BNI modules caused by such aggressive media.

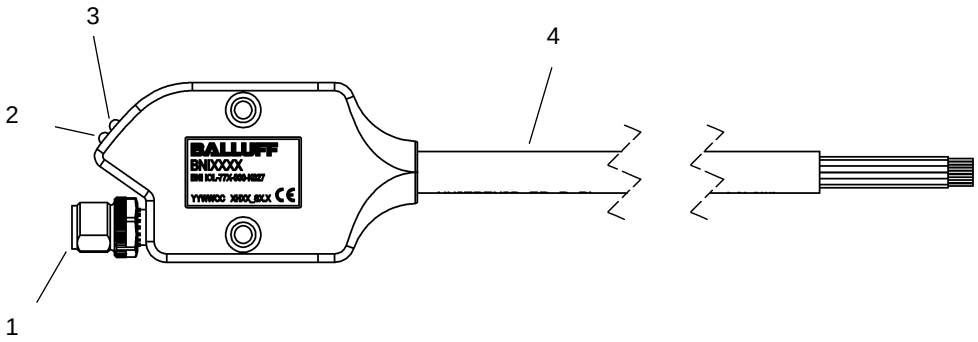
Hazardous voltage

Attention!
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



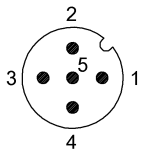
1	Connector IO-Link	4	Cable 0,5mtr
2	Status LED „COM“		
3	Status LED „UA“		

3.2. Electrical connection

The Interface has no separate power supply connection. The supply of the power comes from the IO-Link master unit at pin 1 and pin 2 of the M12 male connector.

IO-Link connection

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



Pin	BNI IOL-77x-00x-K027
1	Power Supply Module (US), +24V
2	Power Supply Actuators (UA), +24V
3	GND UA / US
4	C/Q, IO-Link communication line
5	-

Note
The IO-Link cable must not be longer than 20 meters.

3 Getting started

PIN assignment

	PIN	BNI IOL-771-000-K027 BNI IOL-771-002-K027-003		BNI IOL-772-000-K027 BNI IOL-772-002-K027-003
		Colour of wire	Marking paint	Colour of wire
Ground		Black	-	Black
Byte 0, Bit 0	1	Purple	-	Purple
Byte 0, Bit 1	2	White	-	White
Byte 0, Bit 2	3	Brown	-	Brown
Byte 0, Bit 3	4	Green	-	Green
Byte 0, Bit 4	5	Yellow	-	Yellow
Byte 0, Bit 5	6	Grey	-	Grey
Byte 0, Bit 6	7	Rose	-	Rose
Byte 0, Bit 7	8	Blue	-	Blue
US OUT (24 Volt)		Red	-	Red
Byte 1, Bit 0	9	Red	Blue	-
Byte 1, Bit 1	10	Grey	Rose	-
Byte 1, Bit 2	11	White	Grey	-
Byte 1, Bit 3	12	Grey	Brown	-
Byte 1, Bit 4	13	White	Green	-
Byte 1, Bit 5	14	Brown	Green	-
Byte 1, Bit 6	15	Yellow	Brown	-
Byte 1, Bit 7	16	White	Yellow	-

In- / Outputs

- The output pins are overcurrent protected.
- Wire length of the I/O < 3m
- Note: According to the IO-Link specification the current at pin 1 is limited to 200mA, this limit also applies for US OUT. If you use Balluff IO-Link Master the maximum value 1,0 A is possible.

4 IO-Link Interface

4.1. Communication parameters

	BNI IOL-771-000-K027 BNI IOL-771-002-K027-003
Transmission rate	COM 2 (38,4 k Baud)
Minimum cycle time	4 ms

	BNI IOL-772-000-K027 BNI IOL-772-002-K027-003
Transmission rate	COM 2 (38,4 k Baud)
Minimum cycle time	3,2 ms

4.2. Process data

The BNI IOL-…has 2 bytes of input and 2 bytes of output data. The direction of the data transmission for output data is IO-Link Master to IO-Link device, the direction of the data transmission for input data is IO-Link device to IO-Link Master.

Output data

Byte	**0**								**1**							
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Description	PIN 8 blue	PIN 7 rose	PIN 6 grey	PIN 5 yellow	PIN 4 green	PIN 3 brown	PIN 2 white	PIN 1 purple	PIN 16 white/yellow	PIN 15 yellow/brown	PIN 14 brown/green	PIN 13 white/green	PIN 12 grey/brown	PIN 11 white/grey	PIN 10 grey/rose	PIN 9 red/blue

For "772" only Byte 0

Input data

Byte	**0**								**1**							
Bit	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Description	PIN 8 blue	PIN 7 rose	PIN 6 grey	PIN 5 yellow	PIN 4 green	PIN 3 brown	PIN 2 white	PIN 1 purple	PIN 16 white/yellow	PIN 15 yellow/brown	PIN 14 brown/green	PIN 13 white/green	PIN 12 grey/brown	PIN 11 white/grey	PIN 10 grey/rose	PIN 9 red/blue

For "772" only Byte 0

4.3. Parameter data / On-request data

	DPP	ISDU		Object name	Access right	Default value	
	Index	Index	Sub-Index			BNI IOL-771-..	BNI IOL-772-..
Identification Data	07hex			Vendor ID	read only	0x03	0x03
	08hex				read only	0x78	0x78
	09hex			Device ID	read only	0x05	0x05
	0Ahex				read only	0x04	0x04
	0Bhex				read only	0x50	0x60
		10hex	0	Vendor name	read only	BALLUFF	
		11hex	0	Vendor text	read only	www.balluff.com	
		12hex	0	Product name	read only	BNI IOL-771-000-K027 / BNI IOL-771-002-K027-003	BNI IOL-772-000-K027 / BNI IOL-772-002-K027-003
		13hex	0	Product ID	read only	BNI005M / BNI00CA	BNI005N / BNI00CC
		14hex	0	Product text	read only	Uni IOL	Uni IOL
		15hex	0	Serial number	read only	16*0x00	16*0x00
		16hex	0	Hardware Revision	read only		
		17hex	0	Firmware Revision	read only		
		18hex	0	Application Tag	read/write		
Parameter Data		40hex	0-8 0-16	Inversion	read/write	0x0000	0x00
		41hex	0-8 0-16	Port Direction	read/write	0x0000	0x00
		42hex	0-8 0-16	Fault State	read/write	0x0000	0x0000
		44hex	1,3,5	Supply Status	read only		
		45hex	0-8 0-16	Actuator Short Circuit	read only		
		46hex	0-16	Actuator warning	read only		
		54hex	0	Serial number	read/write	16*0x00	16*0x00

4 IO-Link Interface

Inversion
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	PIN 8 blue	PIN 7 rose	PIN 6 grey	PIN 5 yellow	PIN 4 green	PIN 3 brown	PIN 2 white	PIN 1 purple	PIN 16 white/yellow	PIN 15 yellow/brown	PIN 14 brown/green	PIN 13 white/green	PIN 12 grey/brown	PIN 11 white/grey	PIN 10 grey/rose	PIN 9 red/blue

For "772" only Byte 0

Inversion Port (x)
0 - Normal
1 - Inversion

Port Direction
41hex

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	PIN 8 blue	PIN 7 rose	PIN 6 grey	PIN 5 yellow	PIN 4 green	PIN 3 brown	PIN 2 white	PIN 1 purple	PIN 16 white/yellow	PIN 15 yellow/brown	PIN 14 brown/green	PIN 13 white/green	PIN 12 grey/brown	PIN 11 white/grey	PIN 10 grey/rose	PIN 9 red/blue

For "772" only Byte 0

Direction Port (x)
0 - Input
1 - Output

Fault State Output 42hex

With “Fault State” – parameter you are able to program the outputs for fail situation. If there is no IO-Link communication or the Process data outputs valid flag is not set by the IO-Link master the outputs will be set to the programmed values. Each pin can be programmed to following states:

Value		Output State
bin	dec	
00	0	Output is 0V
01	1	Output is 24V
10	2	Output holds current state
11	3	Error

The bytes are structured as follows. The table describes byte, bit and subindex structure:

Byte	0				1				2				3			
Bit	7|6	5|4	3|2	1|0	7|6	5|4	3|2	1|0	7|6	5|4	3|2	1|0	7|6	5|4	3|2	1|0
Sub Index	4	3	2	1	8	7	6	5	12	11	10	9	16	15	14	13
Description	PIN 4 green	PIN 3 brown	PIN 2 white	PIN 1 purple	PIN 8 blue	PIN 7 rose	PIN 6 grey	PIN 5 yellow	PIN 12 grey/brown	PIN 11 white/grey	PIN 10 grey/rose	PIN 9 red/blue	PIN 16 white/yellow	PIN 15 yellow/brown	PIN 14 brown/green	PIN 13 white/green

For "772" only Byte 0 and 1

Supply Status 44hex

Information about the current power supply status.

Byte	0							
Bit	7	6	5	4	3	2	1	0
Sub Index				5		3		1
Description				US Out status		UA status		US status

4 IO-Link Interface

Actuator short circuit 45hex

The bytes are structured as follows.

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	4	3	2	1	0	16	15	14	13	12	11	10	9
Description	PIN 8 blue	PIN 7 rose	PIN 6 grey	PIN 5 yellow	PIN 4 green	PIN 3 brown	PIN 2 white	PIN 1 purple	PIN 16 white/yellow	PIN 15 yellow/brown	PIN 14 brown/green	PIN 13 white/green	PIN 12 grey/brown	PIN 11 white/grey	PIN 10 grey/rose	PIN 9 red/blue

For "772" only Byte 0

Actuator warning 46hex

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	4	3	2	1	0	16	15	14	13	12	11	10	9
Description	PIN 8 blue	PIN 7 rose	PIN 6 grey	PIN 5 yellow	PIN 4 green	PIN 3 brown	PIN 2 white	PIN 1 purple	PIN 16 white/yellow	PIN 15 yellow/brown	PIN 14 brown/green	PIN 13 white/green	PIN 12 grey/brown	PIN 11 white/grey	PIN 10 grey/rose	PIN 9 red/blue

For "772" only Byte 0

Serial number 54hex

The serial number has the default value 16*0x00. To use the master validation mode "Identity", with this Parameter are set a serial number. This prevents that a Device will be connected to a wrong master.

4.4. Events

IO-Link Revision 1.0	
Event Code	**Description**
0x5112	Low sensor voltage (US)
0x5114	Low actor voltage (UA)
0x5151	Short circuit output stages
IO-Link Revision 1.1	
Event Code	**Description**
0x5111	Low sensor voltage (US)
0x5112	Low actor voltage (UA)
0x7710	Short circuit output stages

4.5. Error Code

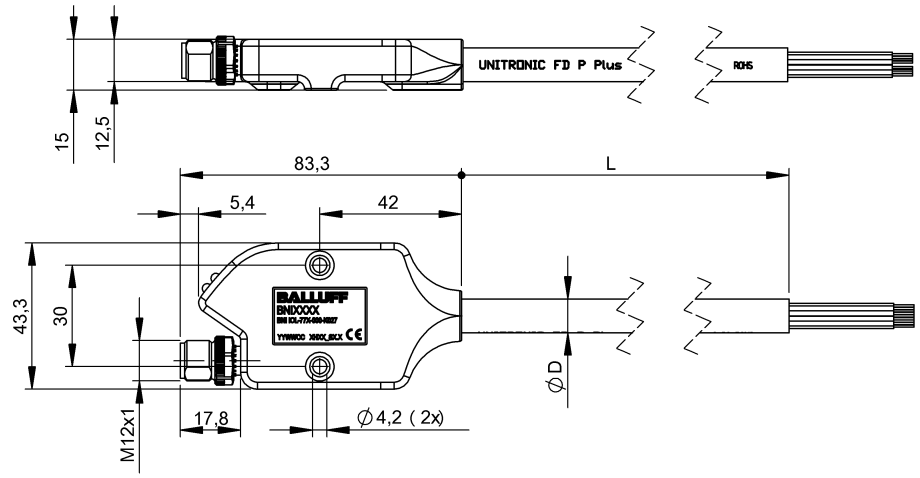
Error Code	Description
0x8011	Index not available
0x8012	Subindex not available
0x8023	Access Denied
0x8030	Parameter Value out of Range
0x8031	Parameter Value above limit
0x8032	Parameter Value below limit
0x8033	Parameter length overrun
0x8034	Parameter length underrun
0x8035	Function not available

5 IO-Link 1.1 Functions

5.1. IO-Link Version 1.0 / 1.1	This Device is compatible to IO-Link Master version 1.0 and 1.1 version specific functions like Data Storage will be supported only in combination with an IO-Link Master accordant to the IO-Link Version of the function.
5.2. Data Storage	Each IO-Link Master of the IO-Link Version 1.1 supports data storage. This can be used to save the device parameter in the IO-Link Master. In case of a device swap, the saved device parameter will be transferred to the new device.
5.3. Block parameter	This feature allows writing parameters in one block. It´s necessary of one parameter depends on the other.
5.4. Reset factory setting	The System Command "reset factory settings", resets the device to factory settings. It can be executed by writing 0x82 to Index 2 subindex 0.

6 Technical Data

6.1. Dimensions



6.2. Mechanical data

Housing material	Plastic housing
IO-Link port	M12, A-coded, male
Enclosure rating per 60529	IP 54 (till the open cable end)
Dimensions (B x H x T in mm)	83,3x 43,3 x 15 without cable
Cable length	0,5 m
Weight	110 g incl. cable (for cable length 0.5 m)

6.3. Electrical data

Operating voltage	18...30.2 V DC, per EN 61131-2
Ripple	< 1%
Current draw without load	< 50 mA
Load current (US)	max. 1,0 A
Load current (UA)	max. 1,0 A
Load current per pin	max. 400 mA
Total load current combined UA and US	max. 1,8 A

6.4. Operating conditions

Ambient temperature	-5° C……55° C
Storage temperature	-25° C ... 70°C

6.5. Used cable

Flexible PUR Control cable
UL Style 20223
Outer diameter 10 mm

6 Technical Data

6.6. Indicators / LEDs

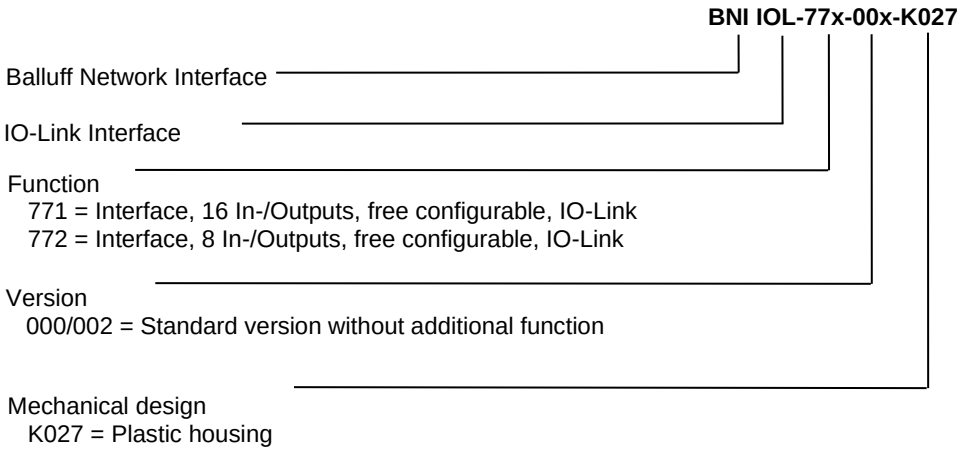
See "Dimensions"

LED – Status of Actuator Power Supply	
Green	Actuator Power Supply OK
Green, pulsed	Short Circuit on output
off	Actuator power supply <18V

LED – Communication Status	
Green, static on	No communikation
Green, negative pulsed	Communikation OK
Green flashing	Sensor Power supply <18V

7 Appendix

7.1. Type designation code



7.2. Order information

Type	Order Code	Cable length
BNI IOL-771-000-K027	BNI005M	0.5 m
BNI IOL-772-000-K027	BNI005N	0.5 m
BNI IOL-771-002-K027-003	BNI00CA	3 m
BNI IOL-772-002-K027-003	BNI00CC	3 m

Notes

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