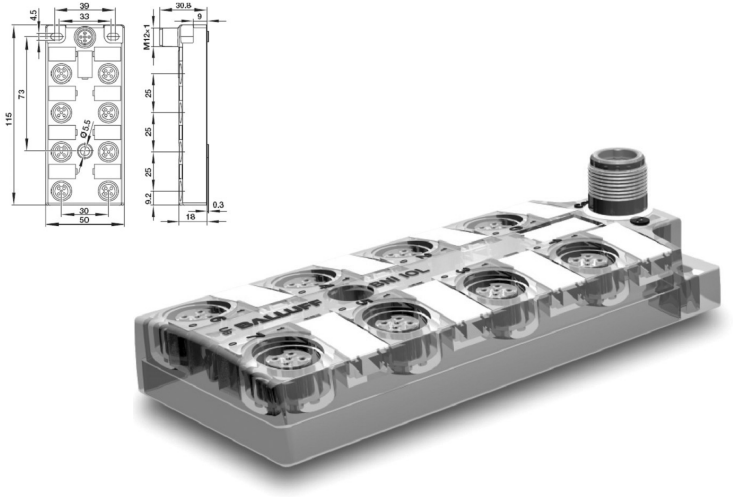
Balluff GmbH
Schurwaldstrasse 9
73765 Neuhausen a.d.F.
Germany
Tel. +49 7158 173-0
Fax +49 7158 5010
balluff@balluff.de

Nr. 871292 E • Issue 1006 • Subject to modification

BALLUFF
sensors worldwide

BNI IOL-530-000-K006



User's Guide

Appendix

Product ordering code

BNI IOL-530-000-K006

Balluff Network Interface

IO-Link interface

Functions
530 = 8 digitale inputs + 8 digitale DSC inputs

Versions
000 = Standard version

Mechanical design
K006 = Plastic housing, M12, 8-Port
Bus connection and power supply: 1xM12x1 external thread
E-Ports: 8xM12x1 internal thread

Order information

Product ordering code	Order code
BNI IOL-530-000-K006	BNI002Z

5 Technical data

5.5 LED indicator port status

LED 4, Input Pin4 (DSC enable)

Indicator	Function
Yellow	Sensor normal, Input = 1
Out	Sensor normal, Input = 0
Yellow, flashing	Sensor warning (Only in full DSC mode)
Red, flashing	Sensor error
Red	Sensor short circuit

LED 4, Eingang Pin4 (DSC disable)

Indicator	Function
Yellow	Sensor normal, Input = 1
Out	Sensor normal, Input = 0
Red	Sensor short circuit

LED 3, Eingang Pin2

Indicator	Function
Yellow	Sensor normal, Input = 1
Out	Sensor normal, Input = 0
Red	Sensor short circuit

1 Notes for the user

1.1 About this guide

This guide describes the Balluff Network Interface BNI IOL-530-000-K006 for the application as peripheral input module to establish connection of binary standard sensors. 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 port	Standard input port
DPP	Direct parameter page
IOL	IO-Link
EMC	Electromagnetic Compatibility
FE	Function earth
SPDU	Service Protocol Data Unit

2 Safety

2.1 Intended use

This guide describes the Balluff Network Interface BNI IOL-530-000-K006 for the application as peripheral input module to establish connection of binary standard sensors.
Hereby it is about an IO-Link device which communicates by means of IO-Link protocol with the superordinate IO-Link master assembly.

2.2 General safety notes

Installation and start up
Installation and start up are to be performed only by trained specialists. Any damage resulting from unauthorized manipulation or improper use voids the manufacturer's guarantee and warranty.
The device complies with EMC Class A. Such equipment may generate RF noise.
The operator must take precautionary measures accordingly.
The device must be powered only using an approved power supply (see section 5 "Technical data"). Only approved cable may be used.

Operating and testing
The operator is responsible for observing local prevailing safety regulations.
When defects and non-clearable faults occur in the device, take it out of service and secure against unauthorized use.
Approved use in ensured only when the housing is fully installed.

2.3 Meaning of the warnings

Note!
The pictogram used with the word "Caution" warns against a possible hazardous situation affecting the health of persons or resulting in equipment damage. Ignoring these warnings can result in injury or equipment damage.

- Always observe the described measures for preventing this danger.

5 Technical data

5.5 LED indicators

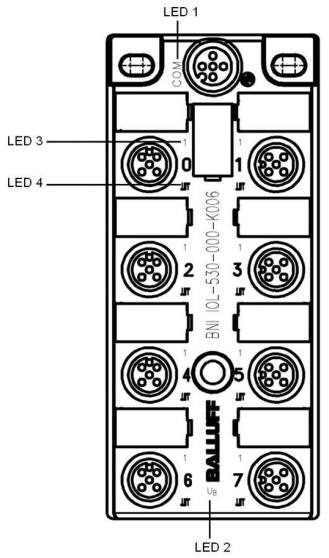


Figure 5.2: LED indicators

LED 1, IO-Link communication

LED indicator module status

Indicator	Function
Green	No communication
Green, negative pulsed	Communication ok
Red flashing	Communication overload
Out	Module is without voltage

LED 2, IO-Link Kommunikation

Indicator	Function
Green	Supply voltage ok
Green, flashing	Supply voltage < 18V
Green, flashing slowly	Overload, total current > 1A
Out	Module is without voltage

5 Technical data

5.1 Dimensions

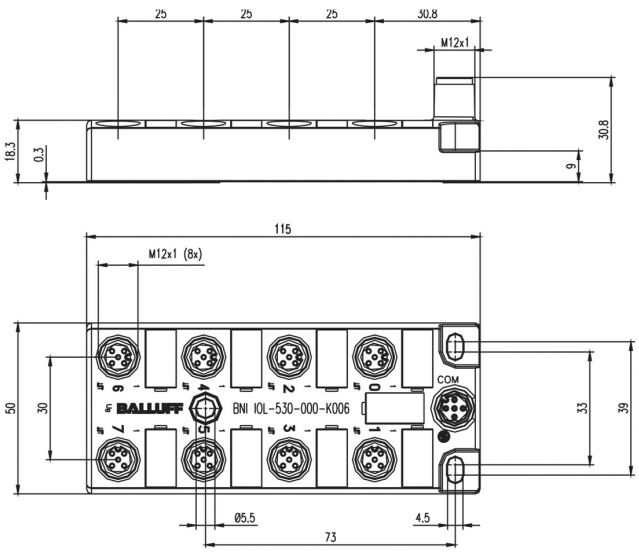


Figure 5.1: Dimensions

5.2 Mechanical data

Huosing material	Plastic transparent
IO-Link port	M12, A coded, male
E-Ports	M12, A coded (female, 8 poles)
Enlosure rating per IEC 60529	IP 67 (only when plugged in and threaded in)
Dimensions (B x H x T in mm)	115 x 50 x 30,8 mm
Weight	90 g

5.3 Electrical data

Operating voltage	18...30.2 V DC, per EN 61131-2
Ripple	< 1%
Current draw without load	<= 80 mA

5.4 Operating conditions

Operating temperature	-5 °C ... 55 °C
Storage temperature	-25 C ... 70 °C
EMC EN 61000-4-2/3/4/5/6	Severity level 4A/3A/4B/2A/3A
Shock	EN 60068-2-6, EN 60068-2-27 EN 60068-2-29, EN 60068-2-64

3 Getting started

3.1 Connection overview

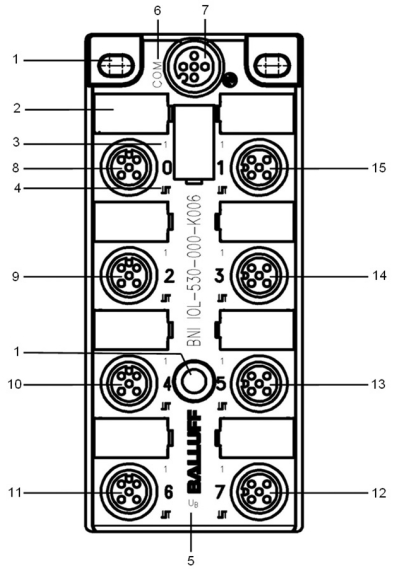


Figure 3-1 BNI IOL-503-000-K006

1	Mounting hole	8	Input-Port 0
2	Label	9	Input-Port 2
3	Port LED: standard input Pin 2	10	Input-Port 4
4	Port LED: DSC input Pin 4	11	Input-Port 6
	Port LED: Single channel monitoring	12	Input-Port 7
5	Status LED: Supply voltage	13	Input-Port 5
6	Status LED: Communication / Module	14	Input-Port 3
7	IO-Link Interface	15	Input-Port 1

3 Getting started

3.2 Mechanical connection

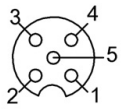
The BNI IOL-530-000-K006 modules are attached by using 3 M4 screws.

3.3 Electrical connection

The BNI IOL-530-000-K006 modules require no separate supply voltage connection. Power is provided through the IO-Link interface by the host IO-Link Master.

3.3.1 IO-Link interface

IO-Link (M12, A coded, male)



Pin	Requirement
1	Supply voltage, +24V, max 1.0A
2	-
3	GND, Reference potential
4	C/Q, IO-Link Data transmission channel
5	-

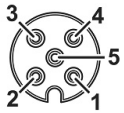
Connecting the Sensor-Hub

➢ 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.

3.3.2. Sensor interface

Standard input port (M12, A coded, female)



Pin	Requirement
1	+24V, max 100mA
2	Input
3	0 V, GND
4	DSC Input
5	-

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

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

4 IO-Link interface

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	U2 = Supply + 24V
0xC0	0x30	0x03	0x5000	0x0100	0x0010	0x0002
0xF3			0x5112			
Disappears	Error	AL	Device Hardware	Supply	Supply low voltage	U2 = Supply + 24V
0x80	0x30	0x03	0x5000	0x0100	0x0010	0x0002
0xB3			0x5112			
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			

4 IO-Link interface

Note:

Inversion

Index	0x40 (Inversion)															
Subindex	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Byte	low byte								high byte							
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Allocation (Bit)	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

Input x.0: Input signal of the corresponding port (pin 4)
Input x.1: Input signal of the corresponding port (pin 2)

DSC Filter-Width

Index	0x44 (DSC Filter width)							
Subindex	8	7	6	5	4	3	2	1
Allocation (Bit)	Input 7.0	Input 6.0	Input 5.0	Input 4.0	Input 3.0	Input 2.0	Input 1.0	Input 0.0

Diagnosis x.0: DSC signal of the corresponding port

- A DSC diagnosis is only transferred if the detection time of DSC status is longer than the DSC filter time.

  DSC Filter time = DSC Filter width x 10ms

  The DSC Filter width can be set for each channel between 0 and 255.
  The minimal DSC Filter time is about 15ms, a DSC Filter width from 0 or 1 is replaced internal by 15ms.

DSC Enable, DSC mode, DSC Reset mode

Index	0x44 (DSC Filter width)							
Subindex	8	7	6	5	4	3	2	1
Allocation (Bit)	Input 7.0	Input 6.0	Input 5.0	Input 4.0	Input 3.0	Input 2.0	Input 1.0	Input 0.0

Diagnose x.0: DSC signal of the corresponding port

- In mode „manual DSC reset", a DSC message through reading of the suitable Bit in "DSC Reset mode" Byte can be reset. Through reading of overall "DSC Reset mode" Byte all DSC messages are reset.

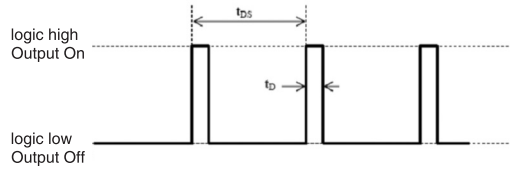
3 Getting started

3.4 Diagnosis

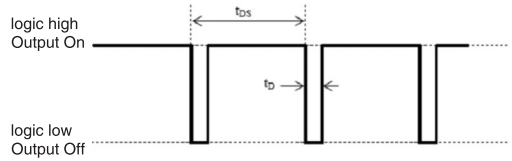
Dynamic sensor diagnosis

For each sensor-input-channel the impulses modulated by the sensor (pin 4) are evaluated separately.
The period of modulated impulses in the normal status of the sensor is between 2,8ms and 3,8ms. If there is a warning of the sensor, the period amounts from 5,9ms to 6,9ms. Sensor warnings can only be detected in full DSC mode. The pulse-width of the modulated impulses is independent from the sensor status and ranges from 100µs to 300µs.

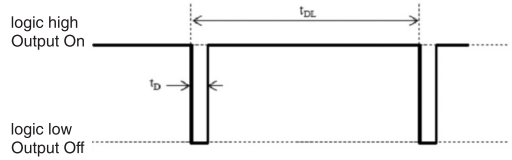
Sensor status normal, undamped



Sensor status normal, damped



Sensor status warning, damped



Parameter	Minimum	Maximum	Unit
t_D	0,1	0,3	ms
t_{DS}	2,8	3,8	ms
t_{DL}	5,9	6,9	ms

4 IO-Link interface

4.1 IO-Link data

Data transmission rate	COM2 (38,4 kBaud)
Frame type	1
Minimal cycle time	2.5 ms
Process data cycle time	10 ms, at minimal cycle time
Process data lenght	4 Byte

4.2 Process data / Output data

No output data provided.

4.3 Process data / Input data

Byte 0								Byte 1							
7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6
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

Input x.0: Input signal of the corresponding port (pin 4)
Input x.1: Input signal of the corresponding port (pin 2)

Byte 2								Byte 3							
7	6	7	6	7	6	7	6	7	6	7	6	7	6	7	6
Diagnosis 3.0		Diagnosis 2.0		Diagnosis 1.0		Diagnosis 0.0		Diagnosis 7.0		Diagnosis 6.0		Diagnosis 5.0		Diagnosis 4.0	

Diagnosis x.0: DSC signal of the corresponding port

Note: Diagnosis message

Diagnosis x.0		Description		
high Bit	low Bit	full DSC mode	classic DSC mode	DSC disable
0	0	Normal	Normal	No short circuit
0	1	Warning	-	-
1	0	Error	Error	-
1	1	Short circuit	Short circuit	Short circuit

- Diagnosis warnings are sensor specific.
- Diagnosis warnings are not evaluated in classic DSC mode.

4 IO-Link interface

4.4 Parameter data / Request data

	DPP	SPDU		Object name	Length	Range	Default value
	Index	Index	Sub-Index				
Identification data	0x07	0x03		Vendor ID	2 Byte	read only	0x0378
	0x08	0x78					
	0x09	0x05		Device ID	3 Byte		0x050301
	0x0A	0x03					
	0x0B	0x01					
		0x10	0	Vendor name	8 Byte		BALLUFF
		0x11	0	Vendor text	16 Byte		www.balluff.com
		0x12	0	Product name	21 Byte		BNI IOL-530-000-K006
		0x13	0	Product ID	7 Byte		BNI002Z
		0x14	0	Product text	23 Byte		IO-link Sensor-Hub
		0x16	0	Hardware revision	3 Byte		01
		0x17	0	Firmware revision	3 Byte		01
Parameter data		0x40	0 1-16	Inversion	2 Byte	0x0000 - 0xFFFF	0x0000
		0x41	0 1-8	DSC Enable	1 Byte	0x00 - 0xFF	0xFF
		0x42	0 1-8	DSC Mode	1 Byte	0x00 - 0xFF	0x00
		0x43	0 1-8	DSC Reset Mode	1 Byte	0x00 - 0xFF	0xFF
		0x44	0 1-8	DSC filter widht	8 Byte	0x00 - 0xFF	0x00

The following features are for each port configurable:

Parameter	Function
Inversion (0x40)	Setting normally closed or normally open (1: open; 0: closed) Factory setting: normally closed (no inversion)
DSC Enable (0x41)	DSC monitoring active (1: enabled; 0: disabled) Factory setting: DSC monitoring active (enabled)
DSC Mode (0x42)	Selection between „full DSC" und „classic DSC" (1: classic DCS; 0: full DSC) Factory setting: full DSC
DSC Reset Mode (0x43)	Selection between „automatic reset" und „manual reset" (1: manual DSC reset; 0: automatic DSC reset) Factory setting: automatic DSC reset
DSC Filter width (0x44)	Configuration of DSC Filter-time DSC Filter-time = DSC Filter-width x 10ms (minimal Filter-time 15ms) (Range of values for filter-width: 0...255) Factory setting: 0 (0 = 15ms)