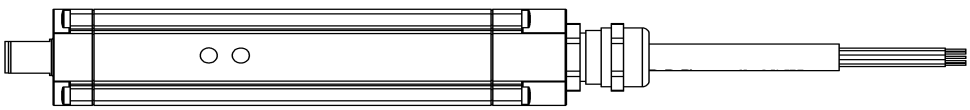
BALLUFF

# BNI IOL-771-000-A027
# BNI IOL-772-000-A027

## IO-Link Version 1.1
## Universel IO-Link Interface
## With undervoltage / broken coil detection

## User´s Guide



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# 1 Notes to 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

The chapters in this guide build on one another.
Section 2: Basic safety information.
……..

## 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 “hex” (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 most be observed.



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

## 1.5. Abbreviations

| | |
|---|---|
| BNI | Balluff Network Interface |
| DPP | Direct Parameter Page |
| EMC | Electromagnetic compatibility |
| FE | Function ground |
| 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. 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 of safety and accident prevention regulations are complied with.

### 2.2. 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.

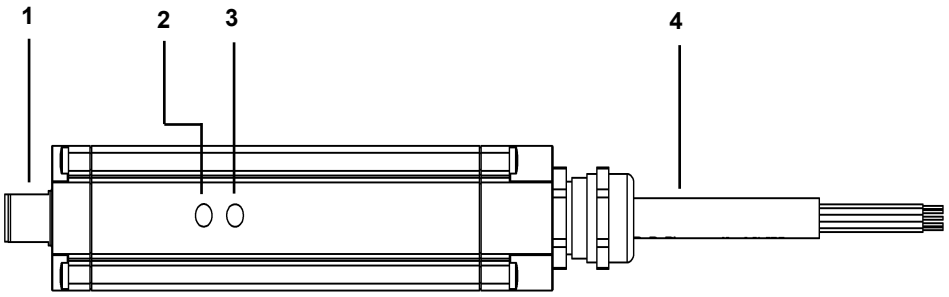
**Hazardous voltage**

**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



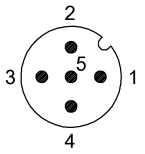

| | | | |
|---|---|---|---|
| 1 | Connector IO-Link | 3 | Status LED „COM“ |
| 2 | Status LED „UA“ | 4 | cable 0.5mtr |

### 3.2. Electrical connection

The universal 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-771_772-000-A027 |
|---|---|
| 1 | US |
| 2 | UA |
| 3 | GND US, GND UA |
| 4 | C/Q |
| 5 | - |

| | |
|---|---|
| US | Power Supply Module, +24V |
| UA | Power Supply Actuators, +24V |
| GND US | Ground reference to Power Supply Module |
| GND UA | Ground reference to Power Supply Actuators |
| C/Q | C/Q, IO-Link communication line |

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

## 3 Getting started

**PIN assignment**

| | PIN | BNI IOL-771-000-A027 | | BNI IOL-772-000-A027 |
|---|---|---|---|---|
| | | Color of wire | Marking paint | Color 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 limmited to 200mA, this limit also apllies for US OUT. If you use Balluff IO-Link Master the maximum value 1,0 A is possible.

### 3.3. Current sense / Broken coil detection

The valve plug can monitor the current of each coil in high state separately. It will be discern between the current of the coil and the lower current of the valve state LED. This discrimination allows detecting a broken wire in the coil.

If the current of a coil in high state is below 25mA ±20% a broken wire will detect. See capture 4.3 and capture 4.5 for signalizing the broken coil error.
This function is only functional at a temperature of over 10° C.

## 4 IO-Link Interface

### 4.1. Communication parameters

| | BNI IOL-771-000-A027 |
|---|---|
| Transmission rate | COM 2 (38,4 k Baud) |
| Minimum cycle time | 4 ms |

| | BNI IOL-772-000-A027 |
|---|---|
| Transmission rate | COM 2 (38,4 k Baud) |
| Minimum cycle time | 3 ms |

### 4.2. Process data

Following process data are exchanged between the IO-Link master and the device.

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 |

**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 gray/brown | PIN 11 white/grey | PIN 10 grey/rose | PIN 9 red/blue |

For "772" only byte 0

## 4 IO-Link Interface

### 4.3. Parameter data / On request data

| | DPP | SPDU | | 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 | 0x30 | 0x40 |
| | | 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-A027 | BNI IOL-772-000-A027 |
| | | 13hex | 0 | Product ID | read only | BNI005Z | BNI005Y |
| | | 14hex | 0 | Product text | read only | Uni IOL 16 I/O with current sense | Uni IOL 8 I/O with current sense |
| | | 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<br>16,8 | Inversion | read/write | 0x0000 | 0x00 |
| | | 41hex | 0<br>16,8 | Port Direction | read/write | 0x0000 | 0x00 |
| | | 42hex | 0<br>16,8 | Fault State | read/write | 0x0000 | 0x00 |
| | | 44hex | 1,3,5 | Supply Status | read only | | |
| | | 45hex | 0<br>16,8 | Actuator short circuit | read only | | |
| | | 46hex | 0<br>16,8 | Actuator warning | read only | | |
| | | 48hex | 0<br>16,8 | Open coil Error | read only | | |
| | | 51hex | 0,1 | Event Configuration | read/write | 0x00 | 0x00 |
| | | 54hex | 0 | Serial number | read/write | 16*0x00 | 16*0x00 |

**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

**Inverting port (x):**
0 - normal
1 - Inverted

**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

**Port direction (x):**
0 - Input
1 - Output

## 4 IO-Link Interface

**Fault State**
**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 |

| 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**

Supply status gives you information about the current power supply.

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

**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 | 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

**Actuator warning 46hex**

Displays the current state of the actuator warning, when input signal on the configured output port.
The structure is the same as the actuator short circuit.

**Broken coil error 48hex**

Broken coil error shows the current open coil error state. The structure is the same as actuator short circuit.

**Event Configuration 51hex**

Turns the event for the broken coil error on or off.
0 - off
1 - on

| Byte | 0 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Bit | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Sub Index | | | | | | | | 1 |
| Description | | | | | | | | Broken coil error |

**Serial number 54hex**

The serial number has the default value 16*0x00hex. 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 IO-Link Interface

### 4.4. Errors

| 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 |

### 4.5. Events

| IO-Link Revision 1.0 | |
|---|---|
| **Event Code** | **Describtion** |
| 0x5112 | Low sensor voltage (US) |
| 0x5114 | Low actuator voltage (UA) |
| 0x5151 | Short circuit output stages |
| 0x9000 | Broken coil error |
| **IO-Link Revision 1.1** | |
| **Event Code** | **Describtion** |
| 0x5111 | Low sensor voltage (US) |
| 0x5112 | Low actuator voltage (UA) |
| 0x7710 | Short circuit output stages |
| 0x7700 | Broken coil error |

## 5 IO-Link 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**

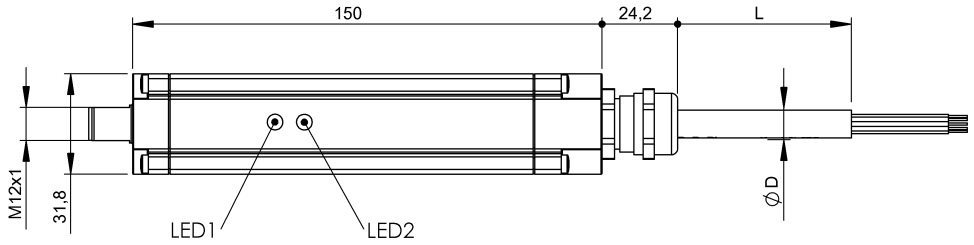
This feature allows writing parameters in one block. It´s necessary of one parameter depends on the other.

**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 | Aluminum housing |
| IO-Link port | M12, A-coded, male |
| Enclosure rating per 60529 | IP 67 (only when mounted and threated-in.) |
| Dimensions (B x H x T in mm) | 190 x 31,8 x 31,8 without cable |
| Cable length | 0,5 m |
| Weight | ca. 300 g |

### 6.3. Electrical data

| | |
|---|---|
| Operating voltage | 18...30.2 V DC, per EN 61131-2 |
| Ripple | < 1% |
| Current draw without load | 60 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

### 6.6. Indicators / LEDs

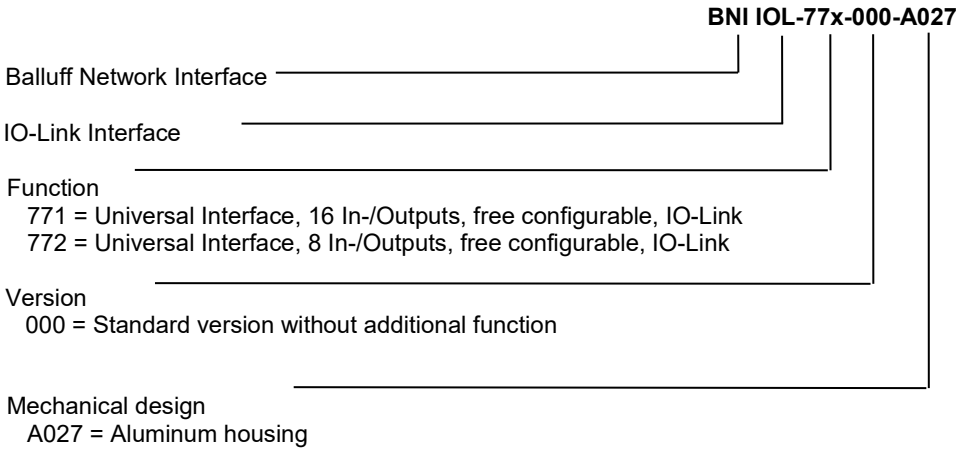
See "Dimensions"

| **LED 1 – Status of Actuator Power Supply** | |
|---|---|
| Green | Actuator power supply ok |
| Green, pulsed | Short circuit on output |
| Off | Actuator power supply <18V |

| **LED 2 – Communication Status** | |
|---|---|
| Green, static on | No communication |
| Green, negative pulsed | Communication OK |
| Green, flashing | Sensor power supply <18V |

# 7 Appendix

## 7.1. Type designation code




## 7.2. Order information

| Type | Order code |
|---|---|
| BNI IOL-771-000-A027 | BNI005Z |
| BNI IOL-772-000-A027 | BNI005Y |

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Nr. 910698-726 E •03.127308 •Edition J18 • Replaces Edition 1405 • Subject to modification

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