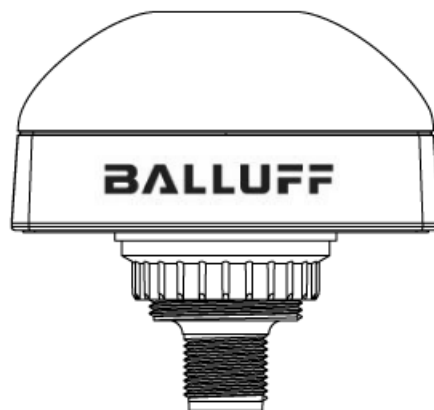


BALLUFF

BNI IOL-803-102-R036
BNI IOL-803-103-R036



SmartLight Indicator
User's Guide



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1 Notes to the user

- 1.1 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.
.....
- 1.2 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),
Binary numbers are shown with the additional indicator _{bin} (e.g. 10_{bin})
Hexadecimal numbers are shown with the additional indicator _{hex} (e.g. AF_{hex}).
- Cross-references** Cross-references indicate where additional information on the topic can be found.
-
- 1.3 Symbols**
-  **Attention!**
This symbol indicates a security notice which must be observed.
-
-  **Note**
This symbol indicates general notes.
-
- 1.4 Abbreviations**
- | | |
|------|-------------------------------|
| BNI | Balluff Networking Interface |
| C/Q | Data communication |
| DPP | Direct Parameter Page |
| EMC | Electromagnetic Compatibility |
| GND | Ground |
| HMI | Human Machine Interface |
| IOL | IO-Link |
| ISDU | Indexed Service Data Unit |
| US | Supply voltage |
- 1.5 Deviating views** Product views and illustrations in this guide may differ from the actual product. They are intended only as illustrative material.

2.1 Intended use

This guide describes the Balluff BNI IOL-803-10x-R036 for the application as status light with optional sensor module. 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 Installation and startup



Attention!

Installation and startup are to be performed only by qualified personnel. 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.

2.3 General safety instructions

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.

Attention!

The BNI IOL-803-103-R036 contains a laser emitter and corresponding drive circuitry.

The laser output is designed to remain within Class 1 laser safety limits under all reasonably foreseeable conditions including single faults in compliance with IEC 60825-1:2007.



Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No.50, dated June 24, 2007

2.4 Resistance to aggressive substances

Attention!

The BNI modules generally have a good chemical and oil resistance. When used in aggressive media (e.g. chemicals, oils, lubricants and coolants each in high concentration (i.e. low water content)) must be checked prior application-related material compatibility. In the event of failure or damage to the BNI modules due to such aggressive media are no claims for defects.



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.



3.1 Overview BNI IOL-803-102-R036

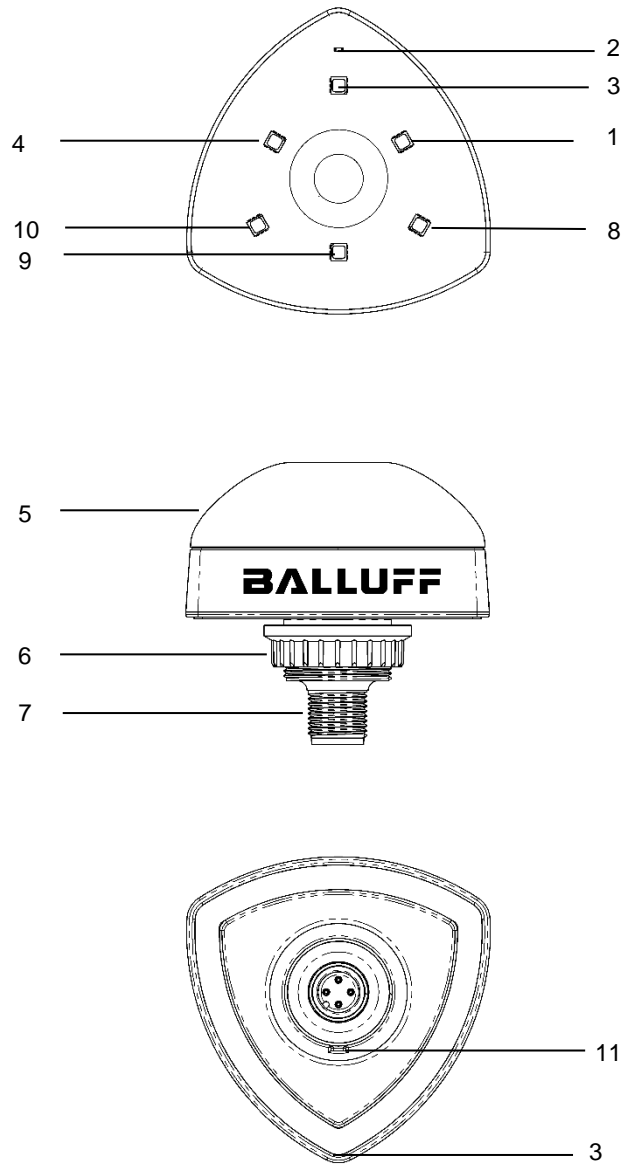


Fig. 3-1: BNI IOL-803-102-R036

- | | |
|---------------------------|-----------------|
| 1 Segment 2 | 8 Segment 3 |
| 2 Status LED | 9 Segment 4 |
| 3 Segment 1 | 10 Segment 5 |
| 4 Segment 6 | 11 Mounting Key |
| 5 Lens | |
| 6 M22 Thread for Mounting | |
| 7 M12 Connector | |

3.2 Overview BNI IOL-803-103-R036

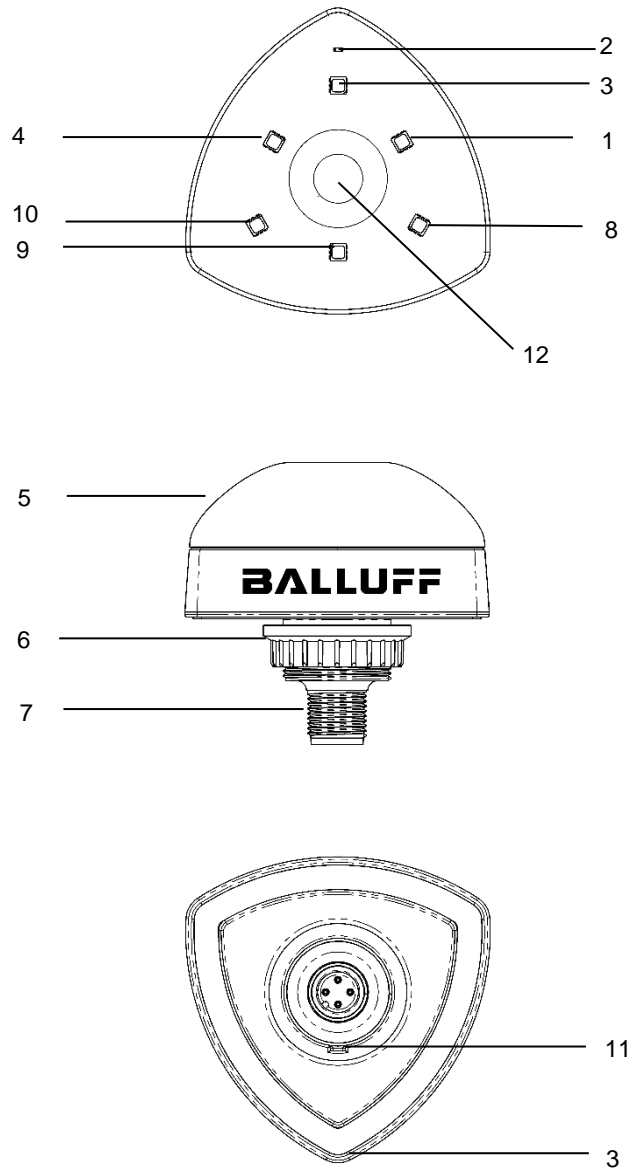


Fig. 3-2: BNI IOL-803-103-R036

- | | |
|---------------------------|-----------------|
| 1 Segment 2 | 8 Segment 3 |
| 2 Status LED | 9 Segment 4 |
| 3 Segment 1 | 10 Segment 5 |
| 4 Segment 6 | 11 Mounting Key |
| 5 Lens | 12 Sensor |
| 6 M22 Thread for Mounting | |
| 7 M12 Connector | |

3 Getting Started

3.3 Mechanical connection

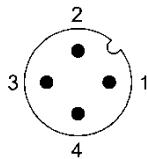
The BNI IOL-803-10x-R036 modules are attached by using an M22 x 1 nut.

3.4 Electrical connection

The BNI IOL-803-10x-R036 modules require no separate supply voltage connection. Power is provided through the IO-Link interface by the host IO-Link Master.

3.5 IO-Link connection

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



Pin	Function
1	Power supply controller, +24V
2	Communication (Extension Mode)
3	GND, reference potential
4	C/Q, IO-Link Data transmission channel

SmartLight Indicator connection

Connect the incoming IO-Link line to the SmartLight Indicator.



Note

A standard 4 wire sensor cable is used for connecting to the host IO-Link master.



Note

When Extension Mode (ISDU 55_{hex}) is enabled it is recommended to use Y splitter cable BCC M413-M415-M415-U209x-xxx/xxx

Module versions

Version	Description
BNI IOL-803-102-R036	6 segment indicator configurable as segments, level, runlight, and color wheel mode.
BNI IOL-803-103-R036	6 segment indicator configurable as segments, level, runlight, and color wheel mode with a proximity sensor.

3.6 Short description of the functionality

The functionality of the Balluff SmartLight Indicator utilizes process data and ISDU registers to create an HMI capable of communicating status, warnings, and errors. Operating modes can be generalized as:

- Segment mode
- Level mode
- Runlight mode
- Color Wheel
- Power-on mode

With the use of sensing technology, the BNI IOL-803-103-R036 enables the device to communicate feedback from a user.

The synchronization is available in segment mode and runlight mode.

3.7 Segment mode

The module is used as a simple status indicator when segment mode is selected. Each segments color, flashing, and the number of segments can be controlled through process data.

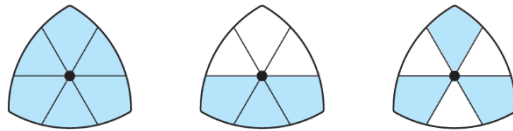


Fig. 3-3: Process Output Data as shown:
 04_{hex} 00_{hex} 00_{hex} 01_{hex} 01_{hex} 00_{hex} 01_{hex} 00_{hex} (left)
 74_{hex} 00_{hex} 00_{hex} 01_{hex} 02_{hex} 00_{hex} 01_{hex} 00_{hex} (center)
 74_{hex} 74_{hex} 74_{hex} 01_{hex} 06_{hex} 00_{hex} 01_{hex} 00_{hex} (right)

3.8 Level mode

Level mode can be used to realize an analog output by means of a rotary indicator. The foreground and background colors, direction, and the fading of the transitioning segment can be selected through process data. Level mode can display finer resolution through multiple rotations.

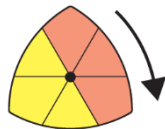


Fig. 3-4: Process Output Data as shown:
 23_{hex} 00_{hex} 00_{hex} 02_{hex} 00_{hex} 00_{hex} 45_{hex} 00_{hex}

3.9 Runlight mode

Runlight mode can be used to indicate operation rate, timing, rotation direction, or loading. The running and background colors, number of segments, direction, and *Loading Mode* can be selected through process data.



Fig. 3-5: Process Output Data as shown:
 17_{hex} 00_{hex} 00_{hex} 04_{hex} 03_{hex} 02_{hex} 03_{hex} 00_{hex}

3.10 Color Wheel

Color wheel mode is used to demonstrate the gamut capable by the module. It can be used for demonstration or to indicate any abnormal behavior. The rotational speed and direction can be selected through process data.



Fig. 3-6: Process Output Data as shown:
 00_{hex} 00_{hex} 00_{hex} 08_{hex} 00_{hex} 00_{hex} 01_{hex} 00_{hex}

3 Getting Started

- 3.11 Sensor** The BNI IOL-803-103-R036 includes a proximity optical sensor placed in the center. This can be used to detect the presence of objects up to approx. 100 mm from the sensor face. The sensitivity depends on the material that reflects the light. Certain characteristics (range, gain, and sensitivity) can be adjusted using the devices parameters.
- 3.12 Extension Port** The BNI IOL-803-10x-R036 module gives you the ability to use Pin 2 as an Extension PortExtension Port by making a specific values in ISDU 55_{hex}. This enables the user to control an additional module using BCC M413-M415-M415-U209x-xxx/xxx (See **Section 4.10 Parameter Description - 55_{hex}** for more detail.)
- 3.13 Synchronization** In synchronisation mode you can synchronise functions (blinking, flashing) of several Balluff Proxlights. The function is available in runlight- and segment mode. The synchronisation is controlled by 2 bits in the process data: (Sync Start and Sync Impluse). When a rising edge is detected on the Sync start bit, the Proxlight resets its internal state. This assures that the synchronised Proxlights start to work in the same state. The Sync start rising edge has to be generated once after a reset. When a rising edge is detected on the Sync impulse bit, the Proxlight resets its internal timer. It has to be generated cyclically in order to keep the Proxlight synchronised. The time period of the Sync impluse can be configured by the user.
It's recommended to set the values between 1 sec. and 15 sec., depending on the frequency of the synchronised parameters (blinking, flashing)

4.1 IO-Link Data

BNI IOL-803-10x-R036	
Data transmission rate	COM2 (38,4 kBaud)
Minimal cycle time	8.4 ms 19.2 ms ¹
Process data length	2 Byte input, 8 Byte output 4 Byte input, 16 Byte output ¹
IO-Link Revision	1.1
Frame type	2.V
Process data cycle time*	8.4 ms

* by min. cycle time

¹ When Extension Mode (ISDU 55_{hex}) is enabled

4.2 Process data / Input data

The BNI IOL-803-10x-R036 has two bytes of input process data. The BNI IOL-803-103-R036 contains the sensor output as the first byte of input process data. In the BNI IOL-803-102-R036 this byte is reserved. The input process data contains the error value for configuration errors. There are different errors, which can be present at the same time, but only the error code with the highest priority will be sent in the input process data.

Byte	0/2 ¹							
Bit	7	6	5	4	3	2	1	0
Description	Sensor Input ²

Sensor Input

0 – Not Active
1 – Active

¹ When Extension Mode (ISDU 55_{hex}) is enabled

² Available in BNI IOL-803-103-R036

Byte	1/3 ¹							
Bit	7	6	5	4	3	2	1	0
Description	Error Code		

Error Code

- 0 – No error
- 1 – Wrong mode selected
- 2 – Wrong number of segments selected
- 3 – Wrong frequency selected
- 4 – Wrong speed selected
- 5 – Wrong trailing edge

An error code (values from 0 to 5) with lower value has higher priority than error code with higher value.

¹ When Extension Mode (ISDU 55_{hex}) is enabled

² Available in BNI IOL-803-103-R036

4.3 Process data / Output data

The BNI IOL-803-10x-R036 has 8 bytes output process data. The output process data has different meaning depending on the selected mode (segment mode, level mode, runlight or color wheel mode). Byte 3 has a special meaning in the output process data, it is common for all modes. The mode of the SmartLight Indicator can be selected with the help of this byte.

Segment Mode

Byte	0/8 ¹							
Bit	7	6	5	4	3	2	1	0
Description	Segment 2 blink	Segment 2 color			Segment 1 blink	Segment 1 color		

Byte	1/9 ¹							
Bit	7	6	5	4	3	2	1	0
Description	Segment 4 blink	Segment 4 color			Segment 3 blink	Segment 3 color		

Byte	2/10 ¹							
Bit	7	6	5	4	3	2	1	0
Description	Segment 6 blink	Segment 6 color			Segment 5 blink	Segment 5 color		

Bit 0-2/4-6, Segment color

000_{bin} – Off
 001_{bin} – Green
 010_{bin} – Red
 011_{bin} – Yellow
 100_{bin} – Blue
 101_{bin} – Orange
 110_{bin} – User defined
 111_{bin} – White

Bit 3/7, Segment blink

0 – Segment does not blink
 1 – Segment blinks according to the blink mode settings

Byte	3/11 ¹							
Bit	7	6	5	4	3	2	1	0
Description	Operating Mode			

Operating Mode

0001_{bin} – Segment Mode

Byte	4/12 ¹							
Bit	7	6	5	4	3	2	1	0
Description	Sync start-	Sync impulse-	.	.	.	Number of Segments (1 - 6)		

Number of Segments

- 001_{bin} – 1 Segment
- 010_{bin} – 2 Segments
- 011_{bin} – 3 Segments
- 110_{bin} – 6 Segments

Sync start/Sync impulse

These bits are rising edge sensitive

Byte	5/13 ¹							
Bit	7	6	5	4	3	2	1	0
Description	.	.	Blink mode Segment 6	Blink mode Segment 5	Blink mode Segment 4	Blink mode Segment 3	Blink mode Segment 2	Blink mode Segment 1

Blink mode Segment x

- 0 – The segment is blinking with a 50% duty cycle
- 1 – The segment is flashing.

Byte	6/14 ¹							
Bit	7	6	5	4	3	2	1	0
Description	Blink Frequency		

Blink Frequency

- 001_{bin} – 0.5 Hz
- 010_{bin} – 1 Hz
- 011_{bin} – 2 Hz
- 100_{bin} – 5 Hz
- 101_{bin} – 10 Hz

Level Mode

Byte	0/8 ¹							
Bit	7	6	5	4	3	2	1	0
Description	.	Level color 2			.	Level color 1		

Byte	1/9 ¹							
Bit	7	6	5	4	3	2	1	0
Description	Level color 3		

Bit 0-2/4-6, Level color 1, 2, and 3

- 000_{bin} – Off
- 001_{bin} – Green
- 010_{bin} – Red
- 011_{bin} – Yellow
- 100_{bin} – Blue
- 101_{bin} – Orange
- 110_{bin} – User defined
- 111_{bin} – White

Byte	2/10 ¹							
Bit	7	6	5	4	3	2	1	0
Description

Byte	3/11 ¹							
Bit	7	6	5	4	3	2	1	0
Description	Operating Mode			

Operating Mode

0010_{bin} – Level Mode

Byte	4/12 ¹							
Bit	7	6	5	4	3	2	1	0
Description	.	.	.	Level Fade	.	.	.	Level type

Level Type

- 0 – Clockwise
- 1 – Counter-Clockwise

Level Fade

- 0 – Fade Not Active
- 1 – Fade Active

Byte	5/13 ¹							
Bit	7	6	5	4	3	2	1	0
Description	Level value (16 bit) – Low byte							

Byte	6/14 ¹							
Bit	7	6	5	4	3	2	1	0
Description	Level value (16 bit) – High byte							

Level value
16 bit value for level indicator

Runlight Mode

Byte	0/8 ¹							
Bit	7	6	5	4	3	2	1	0
Description	.	Running color			.	Background color		

Bit 0-2 / 4-6, Background color / Running color

- 000_{bin} – Off
- 001_{bin} – Green
- 010_{bin} – Red
- 011_{bin} – Yellow
- 100_{bin} – Blue
- 101_{bin} – Orange
- 110_{bin} – User defined
- 111_{bin} – White

Byte	1/9 ¹							
Bit	7	6	5	4	3	2	1	0
Description

Byte	2/10 ¹							
Bit	7	6	5	4	3	2	1	0
Description

Byte	3/11 ¹							
Bit	7	6	5	4	3	2	1	0
Description	Operating Mode			

Operating Mode

0100_{bin} – Runlight Mode

Byte	4/12 ¹							
Bit	7	6	5	4	3	2	1	0
Description	Sync start-	Sync impulse-	.	Loading Mode	Run Direction	Number of Running Segments		

Number of Running Segments

- 001_{bin} – 1 Segment
- 010_{bin} – 2 Segments
- 011_{bin} – 3 Segments
- 100_{bin} – 4 Segments
- 101_{bin} – 5 Segments
- 110_{bin} – 6 Segments

Run direction:

- 0 – Clockwise
- 1 – Counter Clockwise

Loading Mode:

- 0 – Running Mode
- 1 – Loading Mode

Sync start/Sync impulse:

These bits are rising edge sensitive

Byte	5/13 ¹							
Bit	7	6	5	4	3	2	1	0
Description	Trailing Edge	

Byte	6/14 ¹							
Bit	7	6	5	4	3	2	1	0
Description	Running Speed		

Running Speed

- 001_{bin} – 0.5 Hz
- 010_{bin} – 1 Hz
- 011_{bin} – 2 Hz
- 100_{bin} – 5 Hz
- 101_{bin} – 10 Hz

Trailing Edge

- 000_{bin} – Disabled
- 001_{bin} – 1 Edge Fade
- 010_{bin} – 2 Edges Fade

Color Wheel

Byte	0/8 ¹							
Bit	7	6	5	4	3	2	1	0
Description

Byte	1/9 ¹							
Bit	7	6	5	4	3	2	1	0
Description

Byte	2/10 ¹							
Bit	7	6	5	4	3	2	1	0
Description

Byte	3/11 ¹							
Bit	7	6	5	4	3	2	1	0
Description	Operating Mode			

Operating Mode

1000_{bin} – Color Wheel Mode

Byte	4/12 ¹							
Bit	7	6	5	4	3	2	1	0
Description	Run Direction	.	.	.

Run direction:

- 0 – Clockwise
- 1 – Counter Clockwise

Byte	5/13 ¹							
Bit	7	6	5	4	3	2	1	0
Description

Byte	6/14 ¹							
Bit	7	6	5	4	3	2	1	0
Description	Running Speed		

Running Speed

001_{bin} – 0.5 Hz

010_{bin} – 1 Hz

011_{bin} – 2 Hz

100_{bin} – 5 Hz

101_{bin} – 10 Hz

¹ When Extension Mode (ISDU 55_{hex}) is enabled

4.4 Parameter data
BNI IOL-803-
102-R036

	DPP	ISDU		Object name	Length	Access right	Default Value
	Index	Index	Sub-index				
Identification Data	07 _{hex} 07			Vendor ID	2 Bytes	Read only	0378 _{hex}
	08 _{hex} 08						
	09 _{hex} 09			Device ID	3 Bytes		050A20 _{hex}
	0A _{hex} 10						
	0B _{hex} 11						
		10 _{hex} 16	0	Vendor name	7 Bytes		BALLUFF
		11 _{hex} 17	0	Vendor text	15 Bytes		www.balluff.com
		12 _{hex} 18	0	Product name	20 Bytes		BNI IOL-803-102-R036
		13 _{hex} 19	0	Product ID	7 Bytes		BNI00CZ
		14 _{hex} 20	0	Product text	20 Bytes		SmartLight Indicator
		15 _{hex} 21	0	Serial Number	16 Bytes		
		16 _{hex} 22	0	Hardware Revision	1 Bytes		-
	17 _{hex} 23	0	Firmware Revision	48 Bytes	-		
	18 _{hex} 24	0	Application tag*	32 Bytes	Read / Write		

* 32 Byte string adjustable by the user

	ISDU		Object name	Length	Range	Default Value
	Index	Sub-index				
Parameter Data	40 _{hex} 64	0	Mode Register	1 Byte	0...2	0
	44 _{hex} 68	0	Power-On Display 0 Register	8 Bytes	8x00...8xFF	010000010 1000100 _{hex}
	45 _{hex} 69	0	Power-On Display 1 Register	8 Bytes	8x00...8xFF	0A0000010 1000100 _{hex}
	50 _{hex} 80	0	Supply Monitoring**	1 Byte	-	-
	51 _{hex} 81	0	Brightness	3 Bytes	0...7F7F7F _{hex}	7F7F7F _{hex}
		1-3				
	52 _{hex} 82	0	Device Temperature**	5 Bytes	-	-
		1-5				
	54 _{hex} 84	0	Serial Number Set	16 Bytes	16x00...16xFF _{hex}	16x00
	55 _{hex} 85	0	Extension Mode Enable	1 Byte	0...2	0
	57 _{hex} 87	0	Operating Hours Counter**	4 Bytes	-	-
	58 _{hex} 88	0	Boot Cycle Counter**	4 Bytes	-	-
	FB _{hex} 251	0	Safe State	1 Byte	0...1	1
	FC _{hex} 252	0	User color	3 Bytes	0...FFFFFF _{hex}	008080 _{hex}
1-3						

** Read Only

4.5 Parameter data
 BNI IOL-803-
 102-R036 with
 BNI IOL-803-
 102-R036

	DPP	ISDU		Object name	Length	Access right	Default Value
	Index	Index	Sub-index				
Identification Data	07 _{hex}			Vendor ID	2 Bytes	Read only	0378 _{hex}
	08 _{hex}						
	09 _{hex}			Device ID	3 Bytes		050A21 _{hex}
	0A _{hex}						
	0B _{hex}						
	10 _{hex}	16	0	Vendor name	7 Bytes		BALLUFF
	11 _{hex}	17	0	Vendor text	15 Bytes		www.balluff.com
	12 _{hex}	18	0	Product name	46 Bytes		BNI IOL-803-102-R036 with BNI IOL-803-102-R036
	13 _{hex}	19	0	Product ID	20 Bytes		BNI00CZ with BNI00CZ
	14 _{hex}	20	0	Product text	44 Bytes		SmartLight Indicator, extension mode enabled
	15 _{hex}	21	0	Serial Number	16 Bytes		
	16 _{hex}	22	0	Hardware Revision	1 Bytes		-
17 _{hex}	23	0	Firmware Revision	48 Bytes	-		
18 _{hex}	24	0	Application tag*	32 Bytes	Read / Write		

* 32 Byte string adjustable by the user

	ISDU		Object name	Length	Range	Default Value
	Index	Sub-index				
Parameter Data	40 _{hex} 64	0 1-2	Mode Register	2 Bytes	0...0202 _{hex}	0
	44 _{hex} 68	0 1-2	Power-On Display 0 Register	16 Bytes	16x00...16xFF	2x(0100 00010100 0100) _{hex}
	45 _{hex} 69	0 1-2	Power-On Display 1 Register	16 Bytes	16x00...16xFF	2x(0A00 00010100 0100) _{hex}
	50 _{hex} 80	0 1-2	Supply Monitoring**	2 Bytes	-	-
	51 _{hex} 81	0 1-6	Brightness	6 Bytes	0...7F7F7F7F7F7F _{hex}	7F7F7F 7F7F7F _{hex}
	52 _{hex} 82	0 1-10	Device Temperature**	10 Bytes	-	-
	54 _{hex} 84	0	Serial Number Set	32 Bytes	32x00...32xFF _{hex}	32x00
	55 _{hex} 85	0	Extension Mode Enable	1 Byte	0...2	0
	57 _{hex} 87	0	Operating Hours Counter**	8 Bytes	-	-
	58 _{hex} 88	0	Boot Cycle Counter**	8 Bytes	-	-
	FB _{hex} 251	0 1-2	Safe State	2 Bytes	0...0101 _{hex}	0101 _{hex}
	FC _{hex} 252	0 1-6	User color	6 Bytes	0...FFFFFFFFFFFF _{hex}	008080 008080 _{hex}

** Read Only

4.6 Parameter data
 BNI IOL-803-
 102-R036 with
 BNI IOL-803-
 103-R036

	DPP	ISDU		Object name	Length	Access right	Default Value
	Index	Index	Sub-index				
Identification Data	07 _{hex}			Vendor ID	2 Bytes	Read only	0378 _{hex}
	08 _{hex}						
	09 _{hex}			Device ID	3 Bytes		050A22 _{hex}
	0A _{hex}						
	0B _{hex}						
	10 _{hex}	16	0	Vendor name	7 Bytes		BALLUFF
	11 _{hex}	17	0	Vendor text	15 Bytes		www.balluff.com
	12 _{hex}	18	0	Product name	46 Bytes		BNI IOL-803-102-R036 with BNI IOL-803-103-R036
	13 _{hex}	19	0	Product ID	20 Bytes		BNI00CZ with BNI00E0
	14 _{hex}	20	0	Product text	44 Bytes		SmartLight Indicator, extension mode enabled
	15 _{hex}	21	0	Serial Number	16 Bytes		
	16 _{hex}	22	0	Hardware Revision	1 Bytes		-
	17 _{hex}	23	0	Firmware Revision	48 Bytes		-
18 _{hex}	24	0	Application tag*	32 Bytes	Read / Write		

* 32 Byte string adjustable by the user

	ISDU		Object name	Length	Range	Default Value
	Index	Sub-index				
Parameter Data	40 _{hex} 64	0 1-2	Mode Register	2 Bytes	0...0202 _{hex}	0
	41 _{hex} 65	0	Sensor Teach	1 Byte	20 _{hex} ...64 _{hex}	64 _{hex}
	42 _{hex} 66	0	Excess Gain**	1 Byte	-	-
	43 _{hex} 67	0	Sensor Filter	1 Byte	0...6	2
	44 _{hex} 68	0 1-2	Power-On Display 0 Register	16 Bytes	16x00...16xFF	2x(0100 00010100 0100) _{hex}
	45 _{hex} 69	0 1-2	Power-On Display 1 Register	16 Bytes	16x00...16xFF	2x(0A00 00010100 0100) _{hex}
	50 _{hex} 80	0 1-2	Supply Monitoring**	2 Bytes	-	-
	51 _{hex} 81	0 1-6	Brightness	6 Bytes	0...7F7F7F7F7F7F _{hex}	7F7F7F 7F7F7F _{hex}
	52 _{hex} 82	0 1-10	Device Temperature**	10 Bytes	-	-
	54 _{hex} 84	0	Serial Number Set	32 Bytes	32x00...32xFF _{hex}	32x00
	55 _{hex} 85	0	Extension Mode Enable	1 Byte	0...2	0
	57 _{hex} 87	0	Operating Hours Counter**	8 Bytes	-	-
	58 _{hex} 88	0	Boot Cycle Counter**	8 Bytes	-	-
	FB _{hex} 251	0 1-2	Safe State	2 Bytes	0...0101 _{hex}	0101 _{hex}
	FC _{hex} 252	0 1-6	User color	6 Bytes	0...FFFFFFFFFFFF _{hex}	008080 008080 _{hex}

** Read Only

4.7 Parameter data
BNI IOL-803-
103-R036

	DPP	ISDU		Object name	Length	Access right	Default Value
	Index	Index	Sub-index				
Identification Data	07 _{hex} 07			Vendor ID	2 Bytes	Read only	0378 _{hex}
	08 _{hex} 08						
	09 _{hex} 09			Device ID	3 Bytes		050A30 _{hex}
	0A _{hex} 10						
	0B _{hex} 11						
		10 _{hex} 16	0	Vendor name	7 Bytes		BALLUFF
		11 _{hex} 17	0	Vendor text	15 Bytes		www.balluff.com
		12 _{hex} 18	0	Product name	20 Bytes		BNI IOL-803-103-R036
		13 _{hex} 19	0	Product ID	7 Bytes		BNI00E0
		14 _{hex} 20	0	Product text	32 Bytes		SmartLight Indicator with Sensor
		15 _{hex} 21	0	Serial Number	16 Bytes		
		16 _{hex} 22	0	Hardware Revision	1 Bytes		-
	17 _{hex} 23	0	Firmware Revision	48 Bytes	-		
	18 _{hex} 24	0	Application tag*	32 Bytes	Read / Write		

* 32 Byte string adjustable by the user

	ISDU		Object name	Length	Range	Default Value
	Index	Sub-index				
Parameter Data	40 _{hex} 64	0	Mode Register	1 Byte	0...2	0
	41 _{hex} 65	0	Sensor Teach	1 Byte	20 _{hex} ... 64 _{hex}	64 _{hex}
	42 _{hex} 66	0	Excess Gain**	1 Byte	-	-
	43 _{hex} 67	0	Sensor Filter	1 Byte	0...6	2
	44 _{hex} 68	0	Power-On Display 0 Register	8 Bytes	8x00...8xFF	010000010 1000100 _{hex}
	45 _{hex} 69	0	Power-On Display 1 Register	8 Bytes	8x00...8xFF	0A0000010 1000100 _{hex}
	50 _{hex} 80	0	Supply Monitoring**	1 Byte	-	-
	51 _{hex} 81	0	Brightness	3 Bytes	0...7F7F7F _{hex}	7F7F7F _{hex}
		1-3				
	52 _{hex} 82	0	Device Temperature**	5 Bytes	-	-
		1-5				
	54 _{hex} 84	0	Serial Number Set	16 Bytes	16x00...16xFF _{hex}	16x00
	55 _{hex} 85	0	Extension Mode Enable	1 Byte	0...2	0
	57 _{hex} 87	0	Operating Hours Counter**	4 Bytes	-	-
	58 _{hex} 88	0	Boot Cycle Counter**	4 Bytes	-	-
	FB _{hex} 251	0	Safe State	1 Byte	0...1	1
	FC _{hex} 252	0	User color	3 Bytes	0...FFFFFF _{hex}	008080 _{hex}
1-3						

** Read Only

4.8 Parameter data
 BNI IOL-803-
 103-R036 with
 BNI IOL-803-
 103-R036

	DPP	ISDU		Object name	Length	Access right	Default Value
	Index	Index	Sub-index				
Identification Data	07 _{hex}			Vendor ID	2 Bytes	Read only	0378 _{hex}
	08 _{hex}						
	09 _{hex}			Device ID	3 Bytes		050A31 _{hex}
	0A _{hex}						
	0B _{hex}						
	10 _{hex}	16	0	Vendor name	7 Bytes		BALLUFF
	11 _{hex}	17	0	Vendor text	15 Bytes		www.balluff.com
	12 _{hex}	18	0	Product name	46 Bytes		BNI IOL-803-103-R036 with BNI IOL-803-103-R036
	13 _{hex}	19	0	Product ID	20 Bytes		BNI00E0 with BNI00E0
	14 _{hex}	20	0	Product text	56 Bytes		SmartLight Indicator with Sensor, extension mode enabled
	15 _{hex}	21	0	Serial Number	16 Bytes		
	16 _{hex}	22	0	Hardware Revision	1 Bytes		-
17 _{hex}	23	0	Firmware Revision	48 Bytes	-		
18 _{hex}	24	0	Application tag*	32 Bytes	Read / Write		

* 32 Byte string adjustable by the user

	ISDU		Object name	Length	Range	Default Value
	Index	Sub-index				
Parameter Data	40 _{hex} 64	0 1-2	Demo Mode Active	2 Bytes	0...0101 _{hex}	0
	41 _{hex} 65	0 1-2	Sensor Teach	2 Bytes	2020 _{hex} ...6464 _{hex}	6464 _{hex}
	42 _{hex} 66	0 1-2	Excess Gain**	2 Bytes	-	-
	43 _{hex} 67	0 1-2	Sensor Filter	2 Bytes	0...0606 _{hex}	0202 _{hex}
	44 _{hex} 68	0 1-2	Power-On Display 0 Register	16 Bytes	16x00...16xFF	2x(0100 00010100 0100) _{hex}
	45 _{hex} 69	0 1-2	Power-On Display 1 Register	16 Bytes	16x00...16xFF	2x(0A00 00010100 0100) _{hex}
	50 _{hex} 80	0 1-2	Supply Monitoring**	2 Bytes	-	-
	51 _{hex} 81	0 1-6	Brightness	6 Bytes	0...7F7F7F7F7F7F _{hex}	7F7F7F 7F7F7F _{hex}
	52 _{hex} 82	0 1-10	Device Temperature**	10 Bytes	-	-
	54 _{hex} 84	0	Serial Number Set	32 Bytes	32x00...32xFF _{hex}	32x00
	55 _{hex} 85	0	Extension Mode Enable	1 Byte	0...2	0
	57 _{hex} 87	0	Operating Hours Counter**	8 Bytes	-	-
	58 _{hex} 88	0	Boot Cycle Counter**	8 Bytes	-	-
	FB _{hex} 251	0 1-2	Safe State	2 Bytes	0...0101 _{hex}	0101 _{hex}
	FC _{hex} 252	0 1-6	User color	6 Bytes	0...FFFFFFFF _{hex}	008080 008080 _{hex}

** Read Only

4.9 Parameter data
 BNI IOL-803-
 103-R036 with
 BNI IOL-803-
 102-R036

	DPP	ISDU		Object name	Length	Access right	Default Value
	Index	Index	Sub-index				
Identification Data	07 _{hex}			Vendor ID	2 Bytes	Read only	0378 _{hex}
	08 _{hex}						
	09 _{hex}			Device ID	3 Bytes		050A32 _{hex}
	0A _{hex}						
	0B _{hex}						
	10 _{hex}	16	0	Vendor name	7 Bytes		BALLUFF
	11 _{hex}	17	0	Vendor text	15 Bytes		www.balluff.com
	12 _{hex}	18	0	Product name	46 Bytes		BNI IOL-803-103-R036 with BNI IOL-803-102-R036
	13 _{hex}	19	0	Product ID	20 Bytes		BNI00E0 with BNI00CZ
	14 _{hex}	20	0	Product text	56 Bytes		SmartLight Indicator with Sensor, extension mode enabled
	15 _{hex}	21	0	Serial Number	16 Bytes		
	16 _{hex}	22	0	Hardware Revision	1 Bytes		-
	17 _{hex}	23	0	Firmware Revision	48 Bytes		-
18 _{hex}	24	0	Application tag*	32 Bytes	Read / Write		

* 32 Byte string adjustable by the user

	ISDU		Object name	Length	Range	Default Value
	Index	Sub-index				
Parameter Data	40 _{hex} 64	0 1-2	Demo Mode Active	2 Bytes	0...0101 _{hex}	0
	41 _{hex} 65	0	Sensor Teach	1 Byte	20 _{hex} ... 64 _{hex}	64 _{hex}
	42 _{hex} 66	0	Excess Gain**	1 Byte	-	-
	43 _{hex} 67	0	Sensor Filter	1 Byte	0...6	2
	44 _{hex} 68	0 1-2	Power-On Display 0 Register	16 Bytes	16x00...16xFF	2x(0100 00010100 0100) _{hex}
	45 _{hex} 69	0 1-2	Power-On Display 1 Register	16 Bytes	16x00...16xFF	2x(0A00 00010100 0100) _{hex}
	50 _{hex} 80	0 1-2	Supply Monitoring**	2 Bytes	-	-
	51 _{hex} 81	0 1-6	Brightness	6 Bytes	0...7F7F7F7F7F7F _{hex}	7F7F7F 7F7F7F _{hex}
	52 _{hex} 82	0 1-10	Device Temperature**	10 Bytes	-	-
	54 _{hex} 84	0	Serial Number Set	32 Bytes	32x00...32xFF _{hex}	32x00
	55 _{hex} 85	0	Extension Mode Enable	1 Byte	0...2	0
	57 _{hex} 87	0	Operating Hours Counter**	8 Bytes	-	-
	58 _{hex} 88	0	Boot Cycle Counter**	8 Bytes	-	-
	FB _{hex} 251	0 1-2	Safe State	2 Bytes	0...0101 _{hex}	0101 _{hex}
	FC _{hex} 252	0 1-6	User color	6 Bytes	0...FFFFFFFF _{hex}	008080 008080 _{hex}

** Read Only

4.10 Parameter Description

40_{hex} Mode Register

The demo mode and the power-on mode functions can be activated with this register.

- 0 – Normal mode
- 1 – Demo mode
- 2 – Power-on mode

Demo mode:

When demo mode is active, upon power on the device will display a demonstration of the different operating modes until an IO Link connection is validated. The visualization will cycle based on a preset timer for the BNI IOL-803-102-R036 and with the sensor trigger for the BNI IOL-803-103-R036. This takes priority over Safe State (FB_{hex})

Information belonging the functionality of the Demo mode:
The extension port doesn't support this functionality.

Power-on mode:

In Power-on mode the device will operate as a dual-state indicator without the need for an IO-Link connection. States of the power-on mode:

Conditions	State
No power	Off
Powered and Pin2 is low	Display 0 (ISDU 44 _{hex} - default green)
Powered and Pin2 is high	Display 1 (ISDU 45 _{hex} - default blinking red)

When power-on mode is active, the BNI IOL-803-103-R036 will function with Standard IO (SIO) on Pin 4. The device will output the discrete state of the sensor. A low output corresponds to the sensor being Inactive whereas a high output would be Active

Information belonging the functionality of the Power-on mode:
The extension port doesn't support this functionality.

41_{hex} Sensor Teach

Enables the user to define the switching distance of the photoelectric sensor. Values between 20_{hex} and 64_{hex} (32-100) are valid. The hysteresis will remain constant.

42_{hex} Excess Gain

The average of the signal return rate of the sensor. The value is recorded after a measurement at the threshold defined by parameter 41_{hex}. The average is normalized and can be employed as an indicator of the signal to noise ratio for the application and environment of the device.

43_{hex} Sensor Filter

A time averaging filter which can be used to debounce the output of the sensor signal. For applications where the signal to noise ratio is low, a slower filter can be achieved with a higher number of samples. This will improve the validity of the output. For an ideal application, the filter can be faster with a lower filter order for a more responsive feel. Values between 0 and 6 are valid. The value references the number of samples taken to verify the output state.

**44_{hex}
Power-On Mode
0 Display
Register**

The register works like an outgoing process data with *all the functionality of the Segment mode (except Synchronization)*. If the power-on mode is enabled, and Pin2 is **low**, the device will lit as lit set with this register.

For the setting details please check chapter: Process data / Output data / Segment Mode

**45_{hex}
Power-On Mode
1 Display
Register**

The register works like an outgoing process data with *all the functionality of the Segment mode (except Synchronization)*. If the power-on mode is enabled, and Pin2 is **high**, the device will lit as it set with this register.

For the setting details please check chapter: Process data / Output data / Segment Mode

**50_{hex}
Supply
Monitoring**

Bit	7	6	5	4	3	2	1	0
Description	Under voltage Us

Under voltage Us

- 0 – Us voltage is Ok
- 1 – Low voltage on IO-Link pin 1

**51_{hex}
Brightness**

This register sets the brightness for each channel (red, green and blue). Values from 00 to 7F_{hex} (0-127) are accepted for each channel. This register can be accessed through the subindices 0, 1, 2 or 3. Reading/writing the subindex 0 the whole 3 byte brightness data can be accessed. Subindex 1, 2 and 3 contains the brightness data for red, green and blue channels.

Byte	0/3 ¹	1/4 ¹	2/5 ¹
Subindex	1/4 ¹	2/5 ¹	3/6 ¹
Description	Brightness value for red channel	Brightness value for green channel	Brightness value for blue channel

Note



If the color of a segment has been set to white, the RGB brightness values has effect on the brightness with 1/3 (R), 1/2 (G), 1/6(B) weighting.

**52hex
Device
Temperature**

The device measures its temperature and stores the minimum and maximum temperature values during life-time and since last start-up.

The temperature value is stored as a signed 8 bit integer (from -128 °C to 127 °C), with 1 °C resolution.

For example:

1Ehex = 30 = 30 °C

FDhex = -3 = -3 °C

Byte	0/5 ¹	1/6 ¹	2/7 ¹	3/8 ¹	4/9 ¹
Subindex	1/6 ¹	2/7 ¹	3/8 ¹	4/9 ¹	5/9 ¹
Description	Actual Temperature Value (°C)	Max. Temperature Value Since Last Start (°C)	Min. Temperature Value Since Last Start (°C)	Max. Temperature Value Since First Start (°C)	Min. Temperature Value Since First Start (°C)

**54hex
Setting the
serial number**

The serial number has a default value of 16 x 00_{hex}.

In order to use the "Identity" master validation mode, a serial number can be set using this parameter.

This prevents a device from connecting to the wrong master port.

**Note**

It is recommended to set a unique serial number for each device and use the "Identity" master validation mode.

**55hex
Extension
Mode**

The extension mode function can be activated with this register.

Configuration	Index 55 _{hex} Value
BNI IOL-803-102-R036	0
BNI IOL-803-102-R036 with BNI IOL-803-102-R036	1
BNI IOL-803-102-R036 with BNI IOL-803-103-R036 ²	2
BNI IOL-803-103-R036 ²	0
BNI IOL-803-103-R036 ² with BNI IOL-803-103-R036 ²	1
BNI IOL-803-103-R036 ² with BNI IOL-803-102-R036	2

When parameter is active, it is recommended to use Y splitter cable BCC M413-M415-M415-U209x-xxx/xxx

**Note**

The "Factory Reset" command does not affect the configuration of the Extension Port in any way.

**57_{hex}
Operating
Hours Counter**

Operating Hours Counter counts the number of operating hours of the device for its lifetime.

Byte	3/7 ¹	2/6 ¹	1/5 ¹	0/4 ¹
Description	Operating Hours			

**58_{hex}
Boot Cycle
Counter**

Boot Cycle Counter counts the number of start-ups of the device for its lifetime.

Byte	3/7 ¹	2/6 ¹	1/5 ¹	0/4 ¹
Description	Boot Cycle Counter			

**FB_{hex}
Safe State**

The safe state function can be activated with this register.

- 0 – Not Active
- 1 – Active

Safe state not active: IO-Link status indicator operates as described in 5.5.

Safe state active: when there is no IO-Link communication segment 1 blinks red, with 5 Hz frequency, IO-Link status indicator is disabled.

**FC_{hex}
User color**

This register sets the value of the user defined color. Values for 0x00 to 0xFF (0-255) are accepted for each channel. This register can be accessed through the subindices 0, 1, 2 or 3. Reading/writing the subindex 0 the whole 3 byte user color data can be accessed. Subindex 1, 2 and 3 contains the red, green and blue channel data for the user color.

Byte	0/3 ¹	1/4 ¹	2/5 ¹
Subindex	1/4 ¹	2/5 ¹	3/6 ¹
Description	User defined color, red channel	User defined color, green channel	User defined color, blue channel

¹ When Extension Mode (ISDU 55_{hex}) is enabled

² Available in BNI IOL-803-103-R036

4 IO-Link Interface

4.11 Errors

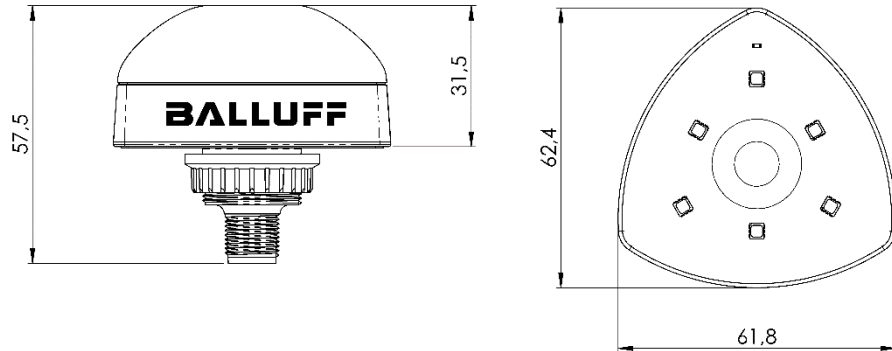
Error Code	Description
8011 _{hex}	Index not available
8012 _{hex}	Subindex not available
8023 _{hex}	Access Denied
8030 _{hex}	Parameter Value out of Range
8033 _{hex}	Parameter length overrun
8034 _{hex}	Parameter length underrun
8DF0 _{hex}	Retry at the extension port
8DF1 _{hex}	Device lost at the extension port
8DF2 _{hex}	Wrong device at the extension port

4.12 Events

IO-Link Revision 1.0	
Event Code	Description
4210 _{hex}	Device temperature high
4220 _{hex}	Device temperature low
5112 _{hex}	Low supply voltage (US)
IO-Link Revision 1.1	
Event Code	Description
4210 _{hex}	Device temperature high
4220 _{hex}	Device temperature low
5111 _{hex}	Low supply voltage (US)

5 Technical Data

5.1 Dimensions



5.2 Mechanical data

Housing Material	Polycarbonate transparent - Fortron 6165 A6
IO-Link-Port	IO-Link M12, A-coded, male
Enclosure rating	IP65 (plugged-in)
Weight	≤ 100 g
Dimensions	62.4 × 61.8 × 57.7 mm

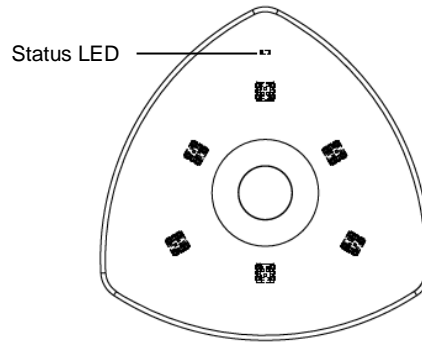
5.3 Electrical data

Operating voltage	18 ... 30,2 V DC, per EN 61131-2
Ripple	< 1 %
Current draw all segments off	≤ 25 mA @ 24V
Current draw all segments white, with sensor	≤ 100 mA @ 24V
Total number of Lights	6

5.4 Operating conditions

Ambient temperature	-5 °C ... +55 °C
Storage temperature	-15 °C ... +70 °C


5.5 LED indicator



Status LED

LED	Indicator	Function
Status LED	Green, green flashing	Supply voltage and Communication

The status LED indicates the current status of communication and power supply.

	Communication error	Communication ok
Supply module ok	LED is static on	LED is flashing 



Note

The status LED is disabled when Safe State (ISDU FB_{hex}) is active. This is the factory setting of the parameter.

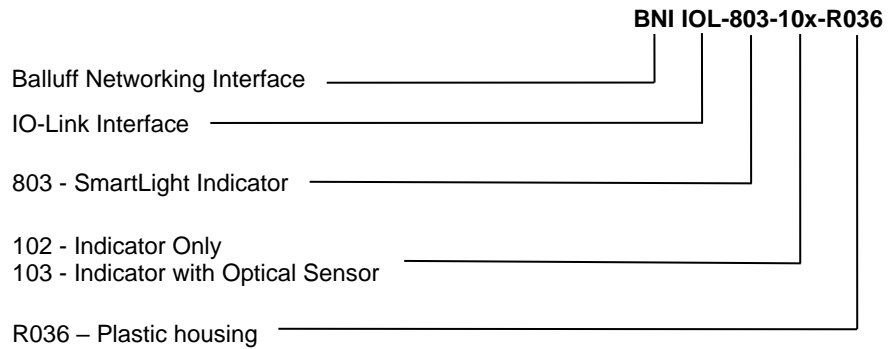


Note

To avoid color mixing the status LED is switched off during normal operation.

6 Appendix

6.1 Product ordering code



6.2 Order information

Type	Order Code
BNI IOL-803-102-R036	BNI00CZ
BNI IOL-803-103-R036	BNI00E0

Scope of delivery

BNI IOL-803-10x-R036 consists of the following components:

- SmartLight Indicator
- M22x1 Nut
- 2x Gasket
- Washer
- Installation Guide

6.3 IODD compatibility

Type	Order code	HW version	IODD version
BNI IOL-803-102-R036	BNI00CZ	01	1.x
BNI IOL-803-102-R036	BNI00CZ	02	2.x
BNI IOL-803-102-R036-012	BNI00EC	01	1.x
BNI IOL-803-103-R036	BNI00E0	01	1.x
BNI IOL-803-103-R036	BNI00E0	02	2.x
BNI IOL-803-103-R036-012	BNI00EE	01	1.x



Note

On the next two pages you can find the overview of all process data for printing.

6 Appendix

6.4 Process Data overview

Output								
Byte3		Byte2		Byte1		Byte0		
-	7	Segment 6 Blink	7	Segment 4 Blink	7	Segment 2 Blink	7	Segment Mode
-	6	Segment 6 Color	6	Segment 4 Color	6	Segment 2 Color	6	
-	5		5		5		5	
-	4		4		4		4	
Color Wheel Mode	3		Segment 5 Blink		3		Segment 3 Blink	
Runlight Mode	2	Segment 5 Color	2	Segment 3 Color	2	Segment 1 Color	2	
Level Mode	1		1		1		1	
Segment Mode	0		0		0		0	
-	7	-	7	-	7	-	7	Level Mode
-	6	-	6	-	6	Level 2 Color	6	
-	5	-	5	-	5		5	
-	4	-	4	-	4		4	
Color Wheel Mode	3	-	3	-	3		-	
Runlight Mode	2	-	2	Level 3 Color	2	Level 1 Color	2	
Level Mode	1	-	1		1		1	
Segment Mode	0	-	0		0		0	
-	7	-	7		-		7	-
-	6	-	6	-	6	Running Color	6	
-	5	-	5	-	5		5	
-	4	-	4	-	4		4	
Color Wheel Mode	3	-	3	-	3		-	3
Runlight Mode	2	-	2	-	2	Background Color	2	
Level Mode	1	-	1	-	1		1	
Segment Mode	0	-	0	-	0		0	
-	7	-	7	-	7		-	7
-	6	-	6	-	6	-	6	
-	5	-	5	-	5	-	5	
-	4	-	4	-	4	-	4	
Color Wheel Mode	3	-	3	-	3	-	3	
Runlight Mode	2	-	2	-	2	-	2	
Level Mode	1	-	1	-	1	-	1	
Segment Mode	0	-	0	-	0	-	0	
Modes: 1 – Segment Mode 2 – Level Mode 4 – Runlight Mode 8 – Color Wheel		Colors: 0 – Off 1 – green 2 – red 3 – yellow 4 – blue 5 – orange 6 – user defined 7 – white						

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