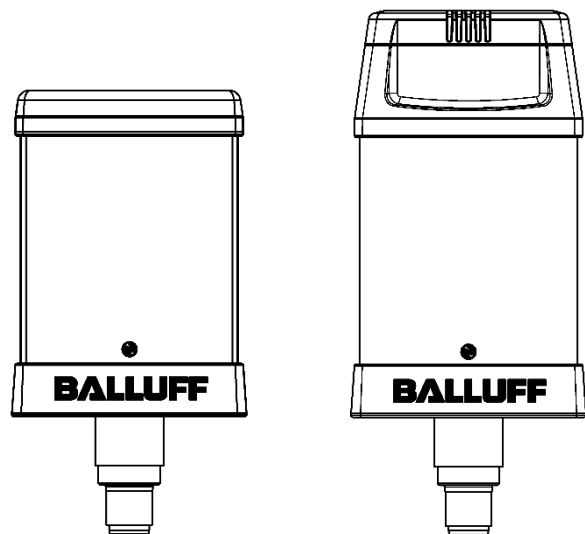


BNI IOL-800-000-Z036
BNI IOL-800-000-Z037



Smart Light
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),
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.
-
- 1.3 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 |
| DPP | Direct Parameter Page |
| EMC | Electromagnetic Compatibility |
| FE | Function Earth |
| IOL | IO-Link |
| ISDU | Indexed Service Data Unit |
- 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 Safety

2.1 Intended use

This guide describes the Balluff BNI IOL-800-000-Z03x for the application as status light 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 trained specialists. Qualified personnel are persons who are familiar with the installation and operation of the product, and who fulfill 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.

2.4 Resistance to aggressive substances



Attention!

The BNI modules generally have a good chemical and oil resistance. When used in aggressive media (eg chemicals, oils, lubricants and coolants each in high concentration (ie, 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 Getting Started

3.1 Overview BNI IOL-800-000-Z036

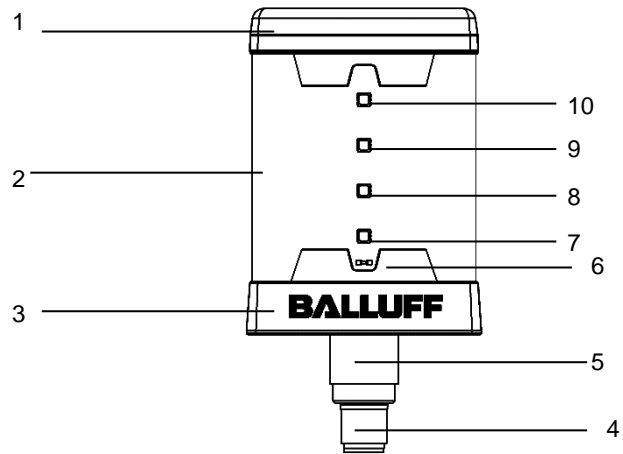


Fig. 3-1: BNI IOL-800-000-Z036

- | | | | |
|---|-------------------------|----|------|
| 1 | Cap | 7 | LED4 |
| 2 | Segment 1 | 8 | LED3 |
| 3 | Socket | 9 | LED2 |
| 4 | M12 connector | 10 | LED1 |
| 5 | M18 thread for mounting | | |
| 6 | Status LED | | |

3 Getting Started

3.2 Overview BNI
IOL-800-000-Z037

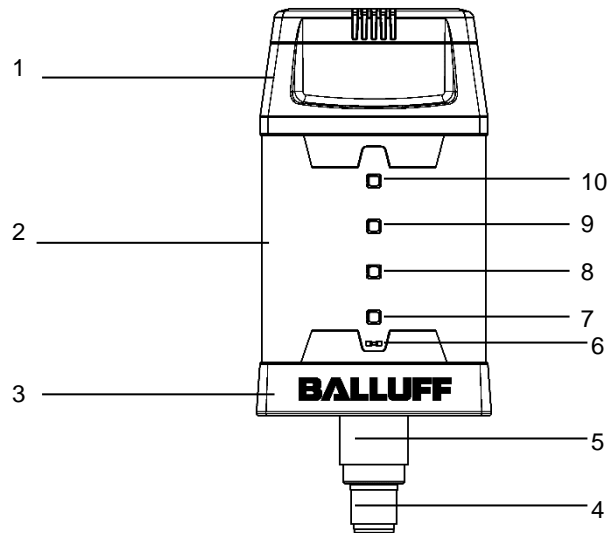


Fig. 3-2: BNI IOL-800-000-Z037

- | | | | |
|---|-------------------------|----|------|
| 1 | Cap with buzzer | 7 | LED4 |
| 2 | Segment 1 | 8 | LED3 |
| 3 | Socket | 9 | LED2 |
| 4 | M12 connector | 10 | LED1 |
| 5 | M18 thread for mounting | | |
| 6 | Status LED | | |

3 Getting Started

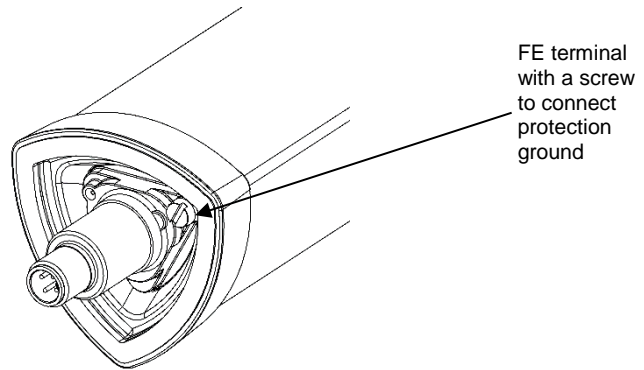
3.3 Mechanical connection

The BNI IOL-800-000-Z03x modules are attached by using an M18 nut.

3.4 Electrical connection

The BNI IOL-800-000-Z03x modules require no separate supply voltage connection. Power is provided through the IO-Link interface by the host IO-Link Master.

3.5 Function ground



Note

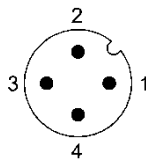


The FE connection from the housing to the machine must be low-impedance and as short as possible.

There is no need to use an additional FE connection if a low impedance connection to FE can be assured through the M18 SmartLight connector thread.

3.6 IO-Link connection

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



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

Smart Light connection

- Connection protection ground to FE terminal, if present.
- Connect the incoming IO-Link line to the Smart Light.



Note

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

Module versions

Version	Description
BNI IOL-800-000-Z036	1 segment configurable signal light with runlight mode and flexible mode.
BNI IOL-800-000-Z037	1 segment configurable signal light with runlight mode, flexible mode and buzzer.

3 Getting Started

3.7 Short description of the functionality The functionality of the Balluff status light module can be controlled through process data and ISDU registers. It has three main mode of functionality:

- Segment mode
- Runlight mode
- Flexible mode*

With the help of the three modes various warning and indication signals can be indicated. The buzzer function is available in all modes. The synchronisation* is available in segment and runlight mode and if the Smartlight contains buzzer it is also available in flexible mode.

3.8 Segment mode To use the module as a standard status light, the Mode ISDU register must be set to segment mode. In the segment mode the module can be used as a standard status light, with one segment. The module has 4 LEDs. The color of the segment can be selected from a color table, which has six pre-defined colors and one user defined color. In the segment mode, the segment can be set to blink too. It has a control bit in process data, which determines the blinking of the segment. The blinking has two modus. Either normal blinking or flash mode can be selected. In normal blinking the LEDs are switched on and off periodically with a 50% duty cycle. In the flash mode, the LEDs are switched on and off quickly three times. The flash is repeated in every second. The type of the blinking can be set in ISDU register. The frequency of the normal blinking can be changed through an ISDU register.

3.9 Runlight mode To use the module as a runlight display, the Mode ISDU register must be set to runlight mode. In the runlight mode, the complete module displays a running light effect. In this case all of the LEDs are working as one runlight effect. The runlight mode is controlled by ISDU registers.

Three registers set the functionality of the runlight. The color of the running LEDs, the background color and the speed of the running segment can be set in the ISDU registers. One segment has a size of 4 LEDs.

3.10 Flexible mode In the flexi mode each LED-ring can be configured individually. With BNI IOL-800... you can realize up to 4 different segments. To use the flexi mode, the ISDU register must be set to flexi mode. There is an ISDU register for each LED ring, which has 5 subindices, 3 for the color channels, one for brightness ON and one for brightness OFF. In the process data there is one bit for every LED-ring, which sets the LED state (ON or OFF)

3.11 Synchronisation In synchronisation mode you can synchronise functions (blinking, flashing, buzzer) of several Balluff SmartLights. 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 SmartLight resets its internal state. This assures that the synchronised SmartLights 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 SmartLight resets its internal timer. It has to be generated cyclically in order to keep the SmartLights 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, buzzer).

*Available from software version 3.0

4 IO-Link Interface

4.1 IO-Link Data

BNI IOL-800-000-Z03x		
Data transmission rate	COM2 (38,4 kBaud)	
Minimal cycle time	5 ms	
Process data length	1 Byte output	
IO-Link Revision	1.1	1.0
Frame type	2.V	1
Process data cycle time*	5 ms	5 ms

* by min. cycle time

4.2 Process data / Output data

The BNI IOL-800-000-Z036 and BNI IOL-800-000-Z037 Smart Light modules have 1 byte output process data. The output process data has different meaning depending on the selected mode (segment mode, runlight mode or flexible mode).

BNI IOL-800-000-Z03x, Segment Mode

Byte	0							
Bit	7	6	5	4	3	2	1	0
Description	Buzzer state	Sync impulse	Sync start	.	Segment 1 blink	Segment 1 color		

Bit definitions in segment mode

Bit 0-2, Segment color

000 = Off
 001 = Green
 010 = Red
 011 = Yellow
 100 = Blue
 101 = Orange
 110 = User defined
 111 = White

Bit 5/6, Sync start/Sync impulse (available from software version 3.0)

These bits are rising edge sensitive

Bit 3, Segment blink

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

Bit 7, Buzzer state

(Only in case of BNI IOL-800-000-Z037)

0 – buzzer is off
 1 – buzzer is on

4 IO-Link Interface

BNI IOL-800-000-Z03x, Runlight Mode

Byte	0							
Bit	7	6	5	4	3	2	1	0
Description	Buzzer state	Sync impulse	Sync start	Run direction

Bit definitions in runlight mode

Bit 7, Buzzer state
(Only in case of BNI IOL-800-000-Z037)

- 0 – buzzer is off
- 1 – buzzer is on

Bit 4, Run direction
(available from software version 4.0)

- 0 – bottom-up
- 1 – top-down

Bit 5/6, Sync start/Sync impulse
(available from software version 3.0)

These bits are rising edge sensitive

BNI IOL-800-000-Z03x, Flexible Mode

Byte	0							
Bit	7	6	5	4	3	2	1	0
Description	Buzzer state	Sync impulse	Sync start	.	LED4	LED3	LED2	LED1

Bit definitions in flexible mode

Bit 0-4, LEDx state

- 0 – LED is off
- 1 – LED is on

Bit 7, Buzzer state
(Only in case of BNI IOL-800-000-Z037)

- 0 – buzzer is off
- 1 – buzzer is on

Bit 5/6, Sync start/Sync impulse
(available from software version 3.0)

These bits are rising edge sensitive

4.3 Parameter data/
Request data

	DPP	ISDU		Object name	Length	Access right	Default Value		
	Index	Index	Sub-index						
Identification Data	07hex			Vendor ID	2 Byte	Read only	0378hex		
	08hex			Device ID	3 Byte		050A05 hex 050A06hex		
	09hex						BALLUFF		
	0Ahex			10hex	0		Vendor name	7 Byte	www.balluff.com
	0Bhex			11hex	0		Vendor text	15 Byte	BNI IOL-800-000-Z036 BNI IOL-800-000-Z037
		12hex	0	Product name	20 Byte		BNI007T BNI0087		
		13hex	0	Product ID	7 Byte		Smart Light 1 segment Smart Light 1 segment with buzzer		
		14hex	0	Product text	21 Byte 33 Byte				
		15hex	0	Serial Number	16 Byte				
		16hex	0	Hardware Revision	1 Byte				
		17hex	0	Firmware Revision	48 Byte				
		18hex	0	Application tag*	32 Byte	Read / Write			

* 32 Byte string adjustable by the user

4 IO-Link Interface

	ISDU		Object name	Length	Range	Default Value
	Index	Sub-index				
Parameter Data	40hex	0	Mode	1 Byte	0 or 2	0
	4Dhex	0	Runlight mode background color	1 Byte	0...7	0
	4Ehex	0	Runlight mode running color	1 Byte	0...7	1
	50hex	0 1-2	Supply monitoring*	1 Byte	-	-
	51hex	0 1-3	Brightness	3 Byte	0hex...7F7F7Fhex	7F7F7Fhex
	52hex	0	Blinking frequency / Runlight speed	1 Byte	1...5	2
	53hex	0	Blinking mode	1 Byte	0...1	0
	54hex	0	Serial Number Set****	16 Byte		16x00hex
	57hex	0 1-3	Operating Hours Counter*****	12 Byte	-	-
	58hex	0	Boot Cycle Counter*****	4 Byte	-	-
	59hex	0 1-5	Device Temperature*****	5 Byte	-	-
	A1hex	0 1-5	LED01 settings***	5 Byte	0hex...FFFFFFFFhex	FF0000FF01hex
	A2hex	0 1-5	LED02 settings***	5 Byte	0hex...FFFFFFFFhex	FF0000FF01hex
	A3hex	0 1-5	LED03 settings***	5 Byte	0hex...FFFFFFFFhex	FF0000FF01hex
	A4hex	0 1-5	LED04 settings***	5 Byte	0hex...FFFFFFFFhex	FF0000FF01hex
	FBhex	0	Safe State****	1 Byte	0...1	0
	FChex	0 1-3	User color	3 Byte	0hex...FFFFFFhex	008080hex
FEhex	0	Buzzer****	2 Byte	0hex...03FFhex	007Fhex	

*Read only

**Only in case of BNI IOL-800-000-Z037

***Available from software version 3.0

****Available from software version 4.0

*****Read only, available from software version 4.0

Mode
40hex

The operating mode of the Smart Light can be selected in the Mode ISDU register.

- 0 = Segment mode
- 2 = Runlight mode

Runlight mode, background color
4Dhex

Byte	0							
Bit	7	6	5	4	3	2	1	0
Description	Background color		

The background of the runlight effect can be set in this register.

Bit 0-2, Background color

- 000 = Off
- 001 = Green
- 010 = Red
- 011 = Yellow
- 100 = Blue
- 101 = Orange
- 110 = User defined
- 111 = White

Runlight mode, running color
4Ehex

Byte	0							
Bit	7	6	5	4	3	2	1	0
Description	Running color		

The color of the running segment in runlight mode can be set in this register.

Bit 0-2, Running color

- 000 = Off
- 001 = Green
- 010 = Red
- 011 = Yellow
- 100 = Blue
- 101 = Orange
- 110 = User defined
- 111 = White

4 IO-Link Interface

Supply monitoring
50_{hex}

Bit	7	6	5	4	3	2	1	0
Sub Index							2	1
Description	LED Voltage failure	Under voltage Us

Under voltage Us

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

LED Voltage failure

0: LED Voltage is Ok
1: LED Voltage failure

Brightness
51_{hex}

This register sets the brightness for each channel (red, green and blue). Values from 0x00 to 0x7F 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	1	2
Sub Index	1	2	3
Description	Brightness value for red channel	Brightness value for green channel	Brightness value for blue channel

Blinking frequency / Runlight speed
52hex

The frequency of the blinking in segment mode and the speed of the running segment in runlight mode can be set in this register. Values between 1 and 5 are accepted. One means the slowest and five means the fastest blinking or running speed.



Note
The blinking frequency is only valid for 50% duty cycle blinking. The frequency of the flashing cannot be changed.

Blinking mode
53hex

Byte	1							
Bit	7	6	5	4	3	2	1	0
Description	Segment 1 flashing

The segment 1 flashing bit sets the mode of the blinking.

- 0 - blinking with 50% duty cycle
- 1 - flashing



Note
Through this register only the mode of the blinking can be set (either 50% duty cycle or flash). The blinking of the desired segment must be activated in process data to enable blinking.

Setting the serial number
54hex

The serial number has a default value of 16x 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
Is is recommended to set a unique serial number for each device, and use the "Identity" master validation mode.

4 IO-Link Interface

Operating Hours Counter
57_{hex}

The register contains the operating hours of the device.
 Operating Hours (Subindex 1): operating hours during lifetime, not resettable.
 Operating Hours Maintenance (Subindex 2): operating hours, resettable with system command 0xA5.
 Operating Hours Power Up (Subindex 3): operating hours since last power up.

Byte	3	2	1	0	3	2	1	0	3	2	1	0
Subindex	1				2				3			
Description	Operating Hours				Operating Hours Maintenance				Operating Hours Power Up			

Boot Cycle Counter
58_{hex}

Boot Cycle Counter counts the number of start-ups.

Byte	3	2	1	0
Sub-index	0			
Description	Boot Cycle Counter			

Device Temperature
59_{hex}

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:
 1E_{hex} = 30_{dec} = 30 °C
 FD_{hex} = -3_{dec} = -3 °C

Byte	0	1	2	3	4
Subindex	1	2	3	4	5
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)

Flexible mode, LEDx settings
A1hex...A4hex

This register contains the settings for the flexible LEDs. Values from 0x00 to 0xFF are accepted for each setting. This register can be accessed through the subindices 0, 1, 2, 3, 4 or 5. Reading/writing the subindex 0 the whole 5 byte data can be accessed. Subindex 1, 2 and 3 contains the red, green and blue color component, subindex 4 is the ON brightness and subindex 5 is the OFF brightness.

Note



These registers are available from software version 3.0. The Brightness ISDU register (51hex) determines the maximum brightness of each channel. It is recommended to set the Brightness ISDU register's value to 7F7F7Fhex in case of using flexible mode.

Byte	0	1	2	3	4
Sub Index	1	2	3	4	5
Description	LED color, red channel	LED color, green channel	LED color, blue channel	On brightness	Off brightness

Safe State
FBhex

The safe state function can be activated with this register.

- 0 = Not Active
- 1 = Active

Safe state not active: when there is no IO-Link communication all LEDs are switched off.
Safe state active: when there is no IO-Link communication the upper LED ring blinks red, with 5 Hz frequency.

User color
FChex

This register sets the value of the user defined color. Values for 0x00 to 0xFF 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	1	2
Sub Index	1	2	3
Description	User defined color, red channel	User defined color, green channel	User defined color, blue channel

4 IO-Link Interface

Buzzer FE_{hex}

This register is available only for BNI IOL-800-000-Z037. The type and volume of the buzzer sound can be set in this register.

Byte	0	1
Sub Index	1	2
Description	Buzzer Type	Buzzer Volume

Buzzer Type:

- 0 = continuous sound
- 1 = 1 Hz chopped sound
- 2 = 5 Hz chopped sound
- 3 = 3 short beep, 2 sec pause

Buzzer Volume:

- Range: 0-255
- 0: minimum volume
- 255: maximum volume

4.4 Errors

Error Code	Description
0x8011	Index not available
0x8012	Subindex not available
0x8023	Access Denied
0x8030	Parameter Value out of Range
0x8033	Parameter length overrun
0x8034	Parameter length underrun

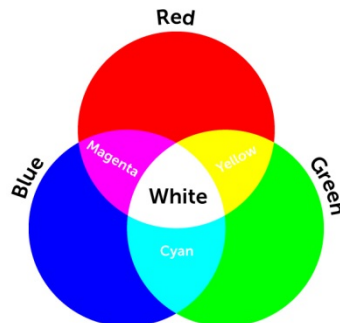
4.5 Events

IO-Link Revision 1.0	
Event Code	Description
0x5112	Low supply voltage (US)
IO-Link Revision 1.1	
Event Code	Description
0x5111	Low supply voltage (US)

4.6 RGB Color

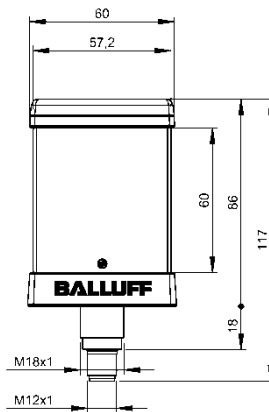
The RGB color model is an additive color model in which red, green and blue light are added together in various ways to reproduce a broad array of colors. The name of the model comes from the initials of the three additive primary colors, red, green and blue.

By changing the respective red - green - blue channels different colors can be created

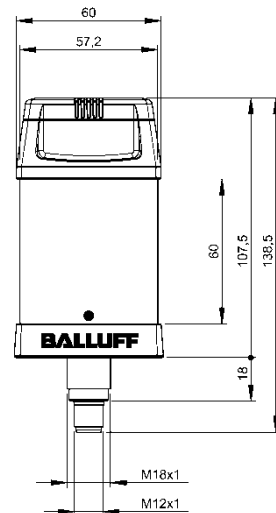


5 Technical Data

5.1 Dimensions



BNI IOL-800-000-Z036



BNI IOL-800-000-Z037

5.2 Mechanical data

Housing Material	Polycarbonate transparent - die-cast zinc housing
IO-Link-Port	M12, A-coded, male
Enclosure rating	BNI IOL-800-000-Z036 IP65 (only when plugged-in) BNI IOL-800-000-Z037 IP30 (only when plugged-in)
Weight	BNI IOL-800-000-Z036 ca. 320 g BNI IOL-800-000-Z037 ca. 390 g
Dimensions (L x W x H, excluding connector)	BNI IOL-800-000-Z036: 117 x 60 x 60 mm BNI IOL-800-000-Z037: 138,5 x 60 x 60 mm

5.3 Electrical data

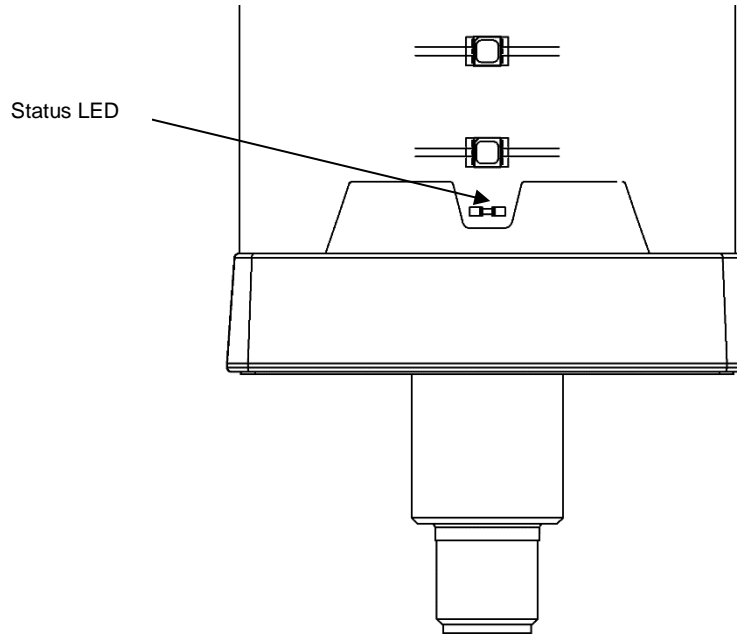
Operating voltage	18 ... 30,2 V DC, per EN 61131-2
Ripple	< 1 %
Current draw all segments off	≤ 30 mA @24V
Current draw all segments white, buzzer on	BNI IOL-800-000-Z036: ≤ 100 mA @24V BNI IOL-800-000-Z037: ≤ 110 mA @24V
Volume of the buzzer module	100dB at 1m distance
Tone frequency of the buzzer module	2800 ± 500 Hz
Total number of signal lights (all 3 pages)	3 x 4

5.4 Operating conditions

Operating temperature	-5 °C ... +50 °C
Storage temperature	-15 °C ... +50 °C

5 Technical Data



5.5 LED indicator



Status LED

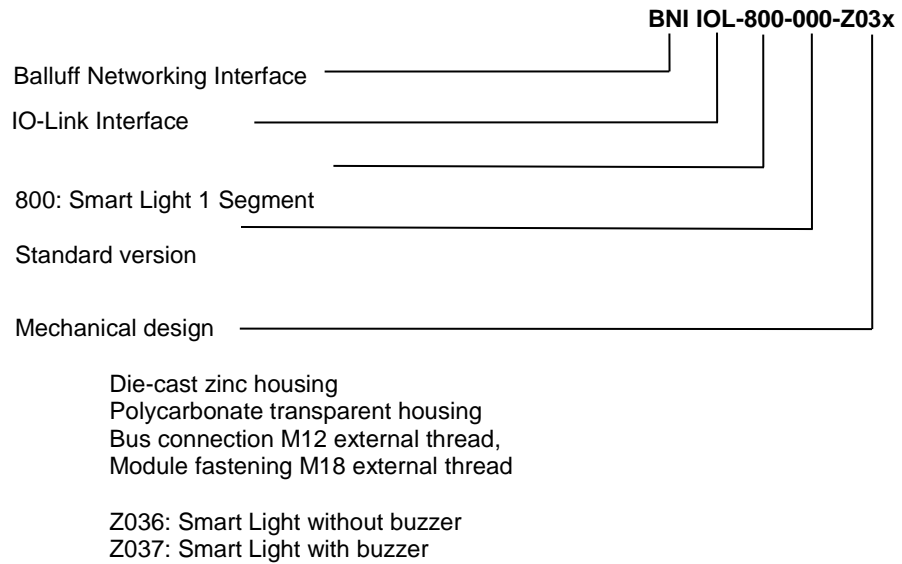
LED	Indicator	Function
Status LED	Green, green flashing	Status for supply and communication

The status LED indicates the current status of the power supply and the communication. It can be switched on, switched of and flashing.

	Communication error	Communication ok
Supply modul undervoltage	LED is static off	LED is flashing 
Supply module ok	LED is static on	LED is flashing 

6 Appendix

6.1 Product ordering code



6.2 Order information

Type	Order Code
BNI IOL-800-000-Z036	BNI007T
BNI IOL-800-000-Z037	BNI0087

Included material

BNI IOL-800-000-Z03x consists of the following components:

- signal light
- M18x1 nut
- rubber foot
- screw M4
- spring washer
- user's guide

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