BALLUFF

BES M30EP-PFC12F-S04G-D12
BES Q40ZU-PFC15B-S04G-D12
BES Q40ZU-PFC20F-S04G-D12
Inductive Safety Sensors

User's Manual

english

www.balluff.com

Original user's guide

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1 About This User's Guide

This user's guide contains all the information you need for operating the following inductive safety sensors:

– BES0577
– BES057A
– BES057C

For questions that go beyond the scope of this user's guide, our Technical Customer Service is available for any function-related information.

1. Read this user's guide completely and follow the instructions contained in it.
2. In particular, follow the safety and warning instructions.
3. Retain this user's guide and ensure that it is always available directly at the location of the use.
4. Make this user's guide available to third parties as necessary.

Note
In the interest of continual product improvements the technical data for this product and the contents of this user's guide are subject to change without notice. The latest status of this user's guide is available on Balluff website **www.balluff.com.**

1.1 Typographical Conventions

Actions

Individual action instructions are indicated by a preceding triangle:

- ▶ Action instruction
  ⇒ Result of action
- ▶ Action instruction 2

Action sequences are numbered in order:

1. Step 1
2. Step 2
3. Step 3

Symbols

Note
The symbol and the word Note indicate information which is helpful or important for use of the product.

1.2 Abbreviations

CCF Common Cause Failure
Failure as a consequence of as common cause

DC Diagnostic Coverage
Diagnostic Coverage

$MTTF_D$ Mean Time To Dangerous Failure
Mean Time To Dangerous Failure

PFH (PFH_D) Probability of (dangerous) Failure per Hour
Probability of (dangerous) Failure per Hour

PL Performance Level
PL according to EN ISO 13849-1

SIL Safety Integrity Level
Safety Integrity Level SIL 1-4 according to IEC 61508. The higher the SIL, the less the probability for failure of a safety function.

SILCl Safety Integrity Level claim limit
Safety Integrity Level Suitability (according to IEC 62061)

T_M Mission time
Life expectancy (=max. time of use)

1.3 Warnings

Warning notes are especially safety-relevant and are used for accident avoidance. This information must be read thoroughly and followed exactly. The warning notes are constructed as follows:

SIGNAL WORD
Type and source of the hazard **Consequences of non-observance** ► Measures for hazard avoidance

The signal words used have the following meaning:

NOTICE
The warning word NOTICE indicates a risk which can result in **damage to or destruction of the product.**

⚠ CAUTION
The general warning symbol combined with the signal word CAUTION indicates a risk which can result in **slight or moderate injuries.**

⚠ WARNING
The general warning symbol combined with the signal word WARNING indicates a risk which can result in **serious injury or death.**

⚠ DANGER
The general warning symbol combined with the signal word DANGER indicates a risk which can result **directly in serious injury or death.**

2 About This Product

2.1 Product description

The inductive safety sensor type BES057A, BES057C, and BES0577 detects metal without contact.

2.2 Scope of delivery

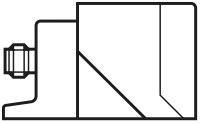
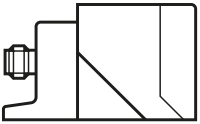
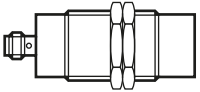
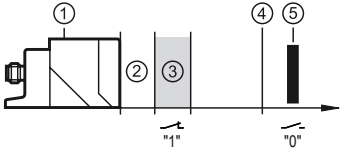
Type	Scope of delivery	Order Code
BES Q40ZU-PFC15B-S04G-D12: 	– 1 Safety sensor with pre-attached mounting bracket – 1 Allen wrench for fixing the safety sensor on the mounting bracket – 1 Original user's guide	BES057A
BES Q40ZU-PFC20F-S04G-D12: 	– 1 Safety sensor with pre-attached mounting bracket – 1 Allen wrench for fixing the safety sensor on the mounting bracket – 1 Original user's guide	BES057C
BES M30EP-PFC12F-S04G-D12: 	– 1 Safety sensor – 2 Mounting nuts M30 – 1 Original user's guide	BES0577

Figure 1 Scope of delivery by type

Note
Should one of the components listed be missing or damaged, please contact one of the Balluff subsidiaries.

2.3 Funktion

BES057A:

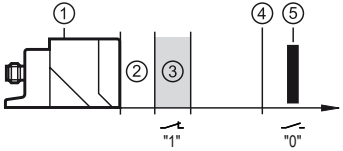


① Safety sensor
② Close zone
③ Release zone
④ Assured turn-off distance s_{ar}
⑤ Damping element

Yellow signal LED: Switching state

Green power LED: Operating voltage

BES057C:

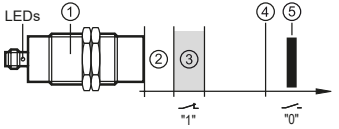


① Safety sensor
② Close zone
③ Release zone
④ Assured turn-off distance s_{ar}
⑤ Damping element

Yellow signal LED: Switching state

Green power LED: Operating voltage

BES0577:



① Safety sensor
② Close zone
③ Release zone
④ Assured turn-off distance s_{ar}
⑤ Damping element

Yellow signal LED: Switching state

Green power LED: Operating voltage

Figure 2 Function overview

2.4 Release zone

The outputs (OSSDs) are only released when damping occurs in the release zone. Outside this release zone the outputs remain off.

NOTICE

Improper damping elements

The use of incorrect damping elements can result in changes or deviations in the release zone.

- ► Use only standardized targets which correspond to the standardized target in shape and size.

Please refer to the following table for the assured turn-off distance s_{ar} for the various sensors:

Order code	Turn-off distance
BES057A	> 30 mm
BES057C	> 45 mm
BES0577	> 30 mm

Release zone for selected materials[1]:

Material	Release zone		
	BES057A	BES057C	BES0577
FE360 (=ST37K)	10…15 mm	4…20 mm	6…12 mm
Stainless steel 1.4301 (V2A)	7.5…13.2 mm	2…17.6 mm	3.8…8.8 mm
AlMg3G22	2…5.8 mm	0…9.6 mm	0.7…4.8 mm
Al 99 %	1.4…5 mm	0…8.6 mm	–
CuZn37	2.3…6.2 mm	0…10 mm	1…5.2 mm
Cu	0.8…4.3 mm	0…7 mm	0…3.7 mm

1) Typical values for damping with a reference target
(per EN 60947-5-2 at an ambient temperature of 20 °C):
– BES057A: 45 x 45 x 1 mm and non-flush mounting
– BES057C: 60 x 60 x 1 mm and non-flush mounting
– BES0577: 45 x 45 x 1 mm and non-flush mounting

Note
Depending on the composition of the damping element the close zone may be absent.

2.5 Relevant standards

The following directives and standards were applied:

- **2006/42/EG**
  European Machine Directive
- **2014/30/EU**
  EMC Directive
- **EN ISO 13849-1:2015**
  Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design
- **IEC 60947-5-2:2007 + A1:2012**
  Low-voltage switching devices: Control devices and switching elements – Proximity switches
- **IEC 61508:2010**
  Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems
- **EN: 62061/: 2013**
  Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems
- **UL 508**
- **IEC 60947-5-3:2013**

3 General Safety Notes

3.1 Approved Use

Safety function SF: The safe condition (final stage turned off, logical "0") is achieved when there is undamping greater than or equal to the safe turn-off condition s_{ar} (see Section Technical Data on page 36). Also observe the instructions for installing the sensor (see Section Installation on page 17).

Note
The device is suitable for applications up to 5 Hz.

The safety sensor meets Performance Level d per EN ISO 13849-1 as well as the requirements for SIL 3 per IEC 61508 and meets SILcl 3 per IEC 62061.

The device corresponds to the classification:

– I2C40SP2 per IEC 60947-5-2 **for non-flush** mounting (BES057A and BES057C).
– I2A30SP2 per IEC 60947-5-2 **for non-flush** mounting (only BES0577).

The inductive safety sensor has been certified by TÜV NORD. 1-channel operation is included in the certification.

Note
The EU Declaration of Conformity as well as the certificates for EN/IEC 61508 and EN/ISO 13849-1 from TÜV NORD can be found at **www.balluff.com**.

3.2 Non-approved 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 User's Guide.
- The sensor is not permitted to be used as a mechanical stop.
- Measures must be taken against the foreseeable defeating of the interlocking device (see DIN EN ISO 14119).

3.3 Personnel Requirements

Installation and startup are to be performed only by skilled professionals. The specifications contained in this user's guide as well as the prevailing standards and directives must be followed. Skilled professionals are persons who are familiar with the work such as installation and the operation of the product and have the necessary qualifications for these tasks.

3.4 Obligations of the Operating Company

Follow the instructions in the User's Guide.

- Improper use may result in malfunction of the device. Equipment damage and/or personal injury during operation may then result. Therefore observe all instructions for installation and handling of the device as described in this document. Observe the safety instructions for operation of the overall system.
- Non-observance of instructions and standards, especially for manipulation and/or changes to the device will result in loss of liability and warranty.
- If the sensor is damaged the safety function can no longer be guaranteed.
- Errors caused by damage cannot be detected by the sensor.

- The device may be installed, connected and put into service only by a person trained in safety technology and electronics.
- The relevant technical standards must be considered as part of the respective application.
- Observe the requirements of EN 60204 when installing.
- If the device malfunctions, contact the manufacturer. Opening of and tampering with the device are not permitted.
- Disconnect the device from power before working on it. If appropriate also turn off independently powered relay circuits.
- Perform a complete function test after installation, maintenance or repair.
- Use the device only in specified ambient conditions (see Section Technical Data on page 36). Contact the manufacturer for any special ambient conditions.
- Use only within the specified application description.
- Safety requirements for the application
- The safety requirements for the respective application must agree with the requirements laid out here.

Observe the following conditions::

- Take measures which prevent metallic objects from unknowingly contacting the active surface.
- For interlocking devices together with guards observe DIN EN ISO 14119.
- Maintain specified application conditions (see Section Technical Data on page 36).
- Use of the sensor in the vicinity of chemical and biological media as well as ionizing radiation is not permitted.
- Maintain the rest current principle for all safety circuits connected externally to the system.
- For faults within the safety sensor which result in a change to the condition defined as safe: Take measures which maintain the safe condition for continued operation of the host controller.
- Replace damaged devices.

Functional impairments

In the event of defects and device malfunctions that cannot be rectified, the device must be immediately taken out of operation and protected against unauthorized use.

Intended use is ensured only when the housing is fully installed.

4 Installation

4.1 Mounting and installation conditions for BES057A and BES057C

Orient sensor face

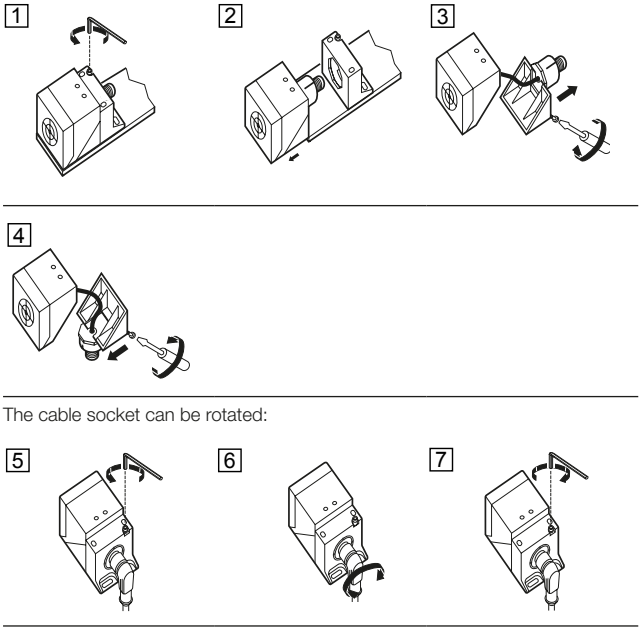


Figure 3 Material of sensing surface

Installation conditions for BES057A:

The device cannot be installed flush in steel per IEC 60947-5-2, Type I2C40SP2.

In addition the device may be installed flush on steel on one side.

In copper, aluminum and brass the device can be flush mounted per IEC 60947-5-2, Type I1C40SP2.

- ► Secure the device against coming loose.
- ► Tighten screws to 1 Nm.
- ► Limit use of slot holes to initial setting.
- ► Note installation conditions per figures 1 to 5:

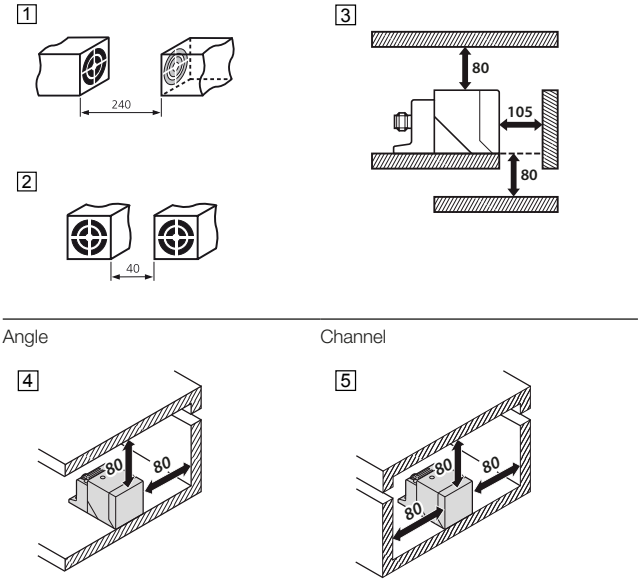


Figure 4 Minimum distances from metal surfaces for BES057A

Installation conditions for BES057C:

The device cannot be installed flush in steel per IEC 60947-5-2, Type I2C40SP2.

Flush mounting of the safety sensor is not permitted since an increase of the switching distance up to release of the outputs (OSSDs) may occur.

- Secure the device against coming loose.
- Tighten screws to 1 Nm.
- Limit use of slot holes to initial setting.
- Note installation conditions per figures 1 to 5:

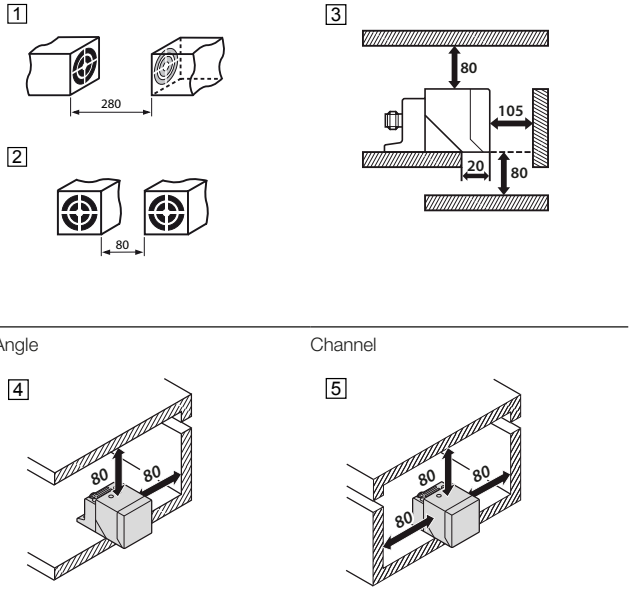


Figure 5 Minimum distances from metal surfaces for BES057C

4.2 Mounting and installation conditions: BES0577

The device cannot be installed flush in steel per IEC 60947-5-2, Type I2C40SP2.

- ► Secure device against loosening (tightening torque ≤ 50 Nm).
- ► Note installation conditions per figures 1 to 3:

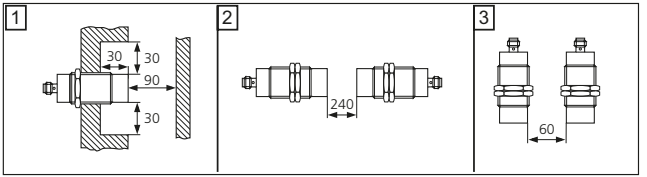


Figure 6 Minimum distances from metal surfaces for BES0577

⚠ WARNING

Failure of the safety function

The safety function of the sensor cannot be assured when using outside of the defined ambient conditions.

- ► Use only in accordance with the defined ambient conditions (see Section Technical Data on page 36).
- ► Use of the sensor in the vicinity of chemical and biological media as well as ionizing radiation is not permitted.

NOTICE

Unintended metallic objects

If unintended metallic objects besides the intended damping element contact the sensing face or land in the release zone, this can result in destruction of the device and loss of the safety functionality.

- ► Provide appropriate measures to ensure that only intended metallic objects for damping come near the sensing face.

4.3 Measures against simple circumvention

The safety sensor responds to metallic objects, e.g. the frame of a safety door. Other metallic objects which are not supposed to result in release of the sensor must not cause an unintended release of the safety sensor.

In addition, the sensor has the following switching behavior for making simple circumvention of its safety function more difficult:

1. Slow approach of a metallic object into the release zone causes the outputs to switch without delay but the Signal LED does not come on until approx. 3 sec. later (see Section 7.1 Operating mode on page 29). This means in general the object is in the close zone before the Signal LED comes on. The technical requirements with respect to restarting the system must be observed.
2. If the object remains in the close zone for more than approx. 2 sec., the outputs are completely locked and not released when there is damping in the close zone. If the object remains in the close zone longer than 5 sec., the adjustment mode is activated (see Section 6.1 Calibration aid on page 24).

The clear zone can be unblocked as follows:

– Undamp (> 30 mm) for a time of more than 2 sec

Type	Undamp
BES057A	> 30 mm
BES057C	> 45 mm
BES0577	> 30 mm

– Voltage interruption (see Section 6.3 Disabling the calibration aid on page 26).

5 Electrical Connection

NOTICE

Exceeding maximum voltage

In case of a single fault, if the supply voltage of 60 V exceeds the maximum supply voltage of 120 V DC for more than 0.2 sec. can result in destruction of the device and loss of the safety functionality.

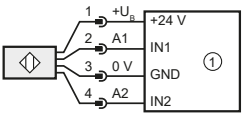
- ► Ensure separation of the supply voltage and transformer.
- ► Use a safety industrial power supply with overvoltage protection where in case of a fault 42 V AC or 60 V DC is not exceeded.

Connecting the safety sensor:

1. Disconnect the equipment from power.
2. If appropriate also turn off independently powered relay circuits.
3. Connect the supply voltage: +U_B to terminal 1 and 0 V to terminal 3 of the plug.

Note
The nominal voltage is 24 V DC. This voltage may fluctuate according to EN 61131-2 between 19.2 V and 30 V incl. 5 % ripple.

5.1 Operation as 4-conductor



① Safety-relevant logic unit

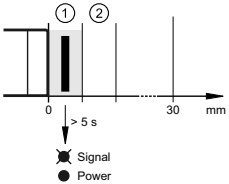
Figure 7 Electrical connection when operating as a 4-conductor

6 Startup

6.1 Calibration aid

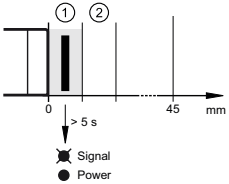
For simple and safe installation the sensor has an optical setup aid for visualizing the release zone.

BES057A:



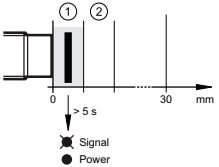
The setup aid is activated by bringing the metallic object in front of the safety sensor (close zone).
After approx. 5 sec. the yellow Signal LED starts to flash: The setup aid is activated.
While this mode is active the output stage remains in the safe condition "0").

BES057C:



The setup aid is activated by bringing the metallic object in front of the safety sensor (close zone).
After approx. 5 sec. the yellow Signal LED starts to flash: The setup aid is activated.
While this mode is active the output stage remains in the safe condition "0").

BES0577:



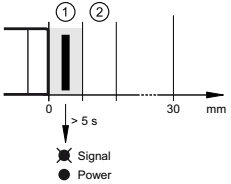
The setup aid is activated by bringing the metallic object in front of the safety sensor (close zone).
After approx. 5 sec. the yellow Signal LED starts to flash: The setup aid is activated.
While this mode is active the output stage remains in the safe condition "0").

① Close zone
② Release zone

Figure 8 Activating the setup aid

6.2 Determining the Release zone

When the setup aid is activated, moving the damping element (or the sensor if the target is fixed) allows the release zone to be determined.



As soon as the target arrives in the release zone the yellow LED turns off.

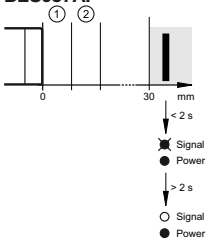
If the target is located in one of the directions outside the release zone, the LED begins to flash again.

① Close zone
② Release zone

Figure 9 Determining the Release zone

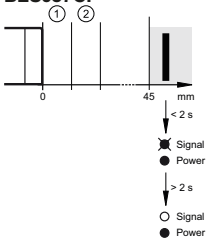
6.3 Disabling the calibration aid

BES057A:



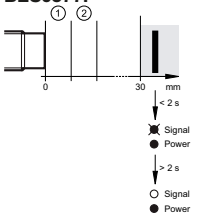
If the sensor is undamped (> 30 mm) for more than 2 sec., the setup aid is turned off and the yellow Signal LED goes out.
This can also be accomplished by interrupting the supply voltage.

BES057C:



If the sensor is undamped (> 45 mm) for more than 2 sec., the setup aid is turned off and the yellow Signal LED goes out.
This can also be accomplished by interrupting the supply voltage.

BES0577:



If the sensor is undamped (> 30 mm) for more than 2 sec., the setup aid is turned off and the yellow Signal LED goes out.
This can also be accomplished by interrupting the supply voltage.

① Close zone
② Release zone

Figure 10 Deactivating the setup aid

6.4 Switching state of the outputs

Safe condition

The safe condition is a turned-off condition (unpowered condition: Logic "0") of at least one of the outputs A1 or A2 (OSSDs).

If one of the outputs A1 or A2 is turned off, the downstream safety logic unit must bring the entire system into the condition defined as safe.

Switched condition

If the damping element is in the release zone and there is no sensor error, both outputs A1 and A2 (OSSDs) are released (Logic "1").

Output specifications

The output specifications are based on the specifications for the input per EN 61131-2 Type 1 or Type 2:

Logic "1"	≥ 15 V	2...15 mA
	≥ 11 V	15...30 mA
Logic "0"	≤ 5 V	Residual current 0.2 mA[1)]

1) Pull-down current typ. 30 mA

Cross-connection / short circuit

– Crossing both the outputs (A1 and A2) is detected by the sensor and results in turning off the outputs (OSSDs) at the next safety request. The outputs A1 and A2 remain turned off until the fault is eliminated and a voltage reset has been performed.

– A short-circuit between one of the outputs (A1 or A2) and the supply voltage causes the other output (A1 or A2) to turn off when there is a safety request.

7 Operation

7.1 Operating mode

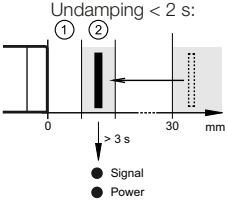
The duration of the previous undamping determines whether the yellow Signal LED comes on immediately or with a time delay when a damping object enters the release zone. In any case the outputs turn on with no time delay.

When undamping, the outputs turn off and the yellow Signal LED comes on with no time delay.

When damping in the close zone the outputs immediately turn off, whereas the yellow Signal LED only goes off after a delay of approx. 2 sec. When the Signal LED goes out the outputs are kept in the off state at the same time. This makes it no longer possible to turn them back on in the release zone. A release takes place either by undamping (> sar) for more than 2 sec. or by a voltage interruption (see Section 4.3 Measures against simple circumvention on page 21).

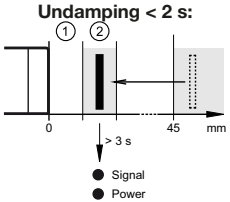
Delayed switching of the Signal LED

BES057A:



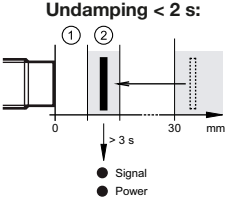
If the damping element was removed from the sensor for more than approx. 2 sec. (> 30 mm), the yellow Signal LED comes on when damping in the release zone with a delay of approx. 3 sec.
This is also the case if the damping element is located in the release zone when power is turned on.

BES057C:



If the damping element was removed from the sensor for more than approx. 2 sec. (> 45 mm), the yellow Signal LED comes on when damping in the release zone with a delay of approx. 3 sec.
This is also the case if the damping element is located in the release zone when power is turned on.

BES0577:



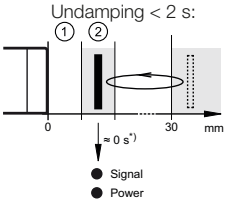
If the damping element was removed from the sensor for more than approx. 2 sec. (> 30 mm), the yellow Signal LED comes on when damping in the release zone with a delay of approx. 3 sec.
This is also the case if the damping element is located in the release zone when power is turned on.

① Close zone
② Release zone

Figure 11 Delayed switching

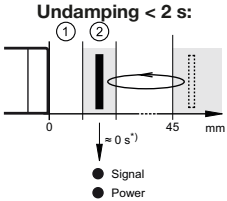
Non-delayed switching of the Signal LED

BES057A:



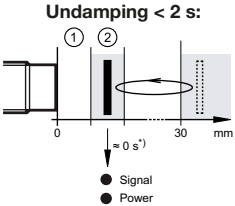
If the damping element was removed from the sensor for less than 2 sec. (> 30 mm), the yellow Signal LED comes on with no delay when damping in the release zone.

BES057C:



If the damping element was removed from the sensor for less than 2 sec. (> 45 mm), the yellow Signal LED comes on with no delay when damping in the release zone.

BES0577:



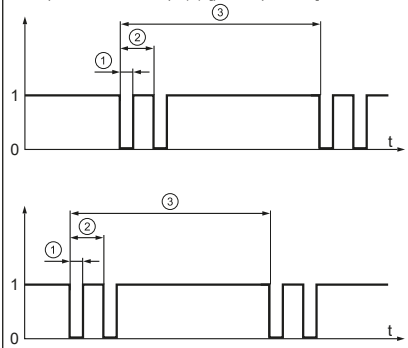
If the damping element was removed from the sensor for less than 2 sec. (> 30 mm), the yellow Signal LED comes on with no delay when damping in the release zone.

① Close zone
② Release zone
*) except for initial startup

Figure 12 Non-delayed switching

7.2 Response times

Type	Response time
Response time to a safety request (removing from the release zone)	≤ 50 ms
Response time when approaching the close zone (non-safety relevant done)	≤ 100 ms
Response time when approaching the release zone (release time)	typ. 100 ms ≤ 200 ms
Risk time / error response time for safety-relevant errors	≤ 100 ms
Permissible dwell time in close area	approx. 2 s
Delay time for activating the setup aid (see Section 6.1 Calibration aid on page 24).	approx. 5 s
Dwell time in undamped state (≥ 30 mm) for return to operating mode (see Section 6.3 Disabling the calibration aid on page 26).	approx. 2 s
Simultaneity of switching on and off of the outputs in case of a safety request	≤ 50 ms
Test pulse duration t_{i_max} on A1A2	max. 1 ms

Type	Response time
Test pulse interval Tp (2) [pulse packet]  Response times ① Test pulse duration ② Test pulse interval Tp (pulse packet) ③ Test pulse interval T	min. 2 ms max. 5 ms
Test pulse interval T (pulse packet repetition)	min. 30 ms max. 50 ms

7.3 LED display

Sensor type BES057A, BES057C:

LED	Operating status	Outputs	A1 (OSSD)	A2 (OSSD)
○ Signal ○ Power	No supply voltage	Both outputs turned off	0	0
○ Signal ✱ Power	Undervoltage		0	0
○ Signal ✱ Power	Overvoltage	Both outputs turned off	0	0
○ Signal ● Power	Damping element outside the release zone (operating mode) or within the release zone (adjusting mode)	Both outputs turned off	0	0
● Signal ● Power	Damping element within the release zone (operating mode)	Both outputs released	1	1
✱ Signal ● Power	Damping element outside the release zone (adjusting mode)	Both outputs turned off	0	0
✱ Signal ○ Power	Internal or external error (see Section 9.1 Troubleshooting on page 40)		0 0 1	0 1 0

● LED on ○ LED off ✱ LED flashing (2 Hz) ✱ LED flashing rapidly (5 Hz)

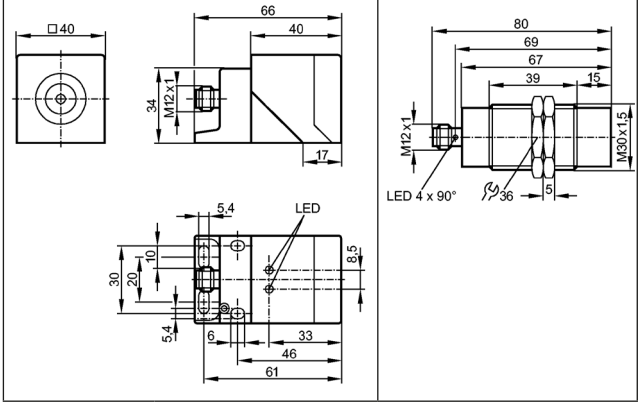
Sensor type BES0577:

LED	Operating status	Outputs	A1 (OSSD)	A2 (OSSD)
○ Signal ○ Power	No supply voltage	Both outputs turned off	0	0
○ Signal ✱ Power	Undervoltage		0	0
○ Signal ✱ Power	Overvoltage	Both outputs turned off	0	0
	Sensor error (see Section 9.1 Troubleshooting on page 40)	One output or both outputs turned off	0 1 0	1 0 0
○ Signal ● Power	– Operating mode: Damping element at assured turn-off distance from sensor (> 30 mm) – Adjusting mode: Damping element within the release zone	Both outputs turned off	0	0
✱ Signal ● Power	Adjusting mode: Damping element within the close zone or very near the release zone	Both outputs turned off	0	0
● Signal ● Power	Operating mode: Damping element within the release zone (operating mode)	Both outputs released	1	1

● LED on ○ LED off ✱ LED flashing (2 Hz) ✱ LED flashing rapidly (5 Hz)

8 Technical Data

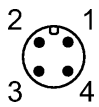
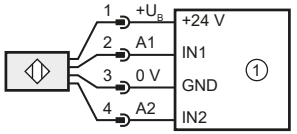
BES057A	BES057C	BES0577



	BES057A	BES057C	BES0577
Product Features			
Plug connection	M12		
Release zone	10…15 mm	4…20 mm	6…12 mm
	Flush mountable on one side	Non-flush mount	
Meets the requirements	EN ISO 13849-1:2015, Category 3 PL e IEC 61508: SIL 3 IEC 62061: SILcl 3		
Area of use			
Operating mode	Continuous operation (maintenance-free)		

	BES057A	BES057C	BES0577
Electrical data			
Electrical version	DC PNP		
Operating voltage	24 V DC (19.2…30 V DC)		
Rated isolation voltage	30 V		
Current consumption	< 30 mA		
Protection class	III		
Polarity reversal protection	Yes		
Ready delay time	5 s		
Outputs			
Output function	2 x OSSD (A1 and A2)		
Output voltage at 24 V	Compatible with EN 61131-2, inputs type 1, 2		
Voltage drop	2.5 V; (100 mA)		
Current load capacity	100 mA		
Short circuit protection	Yes		
Detection range			
Release zone	10…15 mm	4…20 mm	6…12 mm
Assured turn-off distance s_{ar}	30 mm	45 mm	30 mm
Response time to a safety request			
Response time to a safety request	≤ 50 ms		
Response time when approaching the release zone (release time)	≤ 200 ms		
Risk time (fault response time)	≤ 100 ms		

	BES057A	BES057C	BES0577
Environmental conditions			
Operating conditions	Class C per EN 60654-1 Weather-protected		
Ambient temperature	–25...70 °C	–25...60 °C	–25...70 °C
	for mission time ≤ 87,600 h 10…40 °C, for mission time ≤ 175,200 h		
Temperature change rate	0.5 K/min		
Max. permissible relative humidity	5…95 %, short-time 5…70 %, continuous		
Air pressure	80...106 kPa		
Height above sea level	≤ 2000 m		
Isolating radiation	not permitted		
Salt mist	No		
Protection Class	IP65/IP67		IP68/IP69
Approvals/Tests			
EMC	IEC 60947-5-2		
Shock resistance	IEC 60947-5-2		
Vibration resistance	IEC 60947-5-2		
Safety values			
Mission Time	≤ 175,200 h (20 years)		
Safety-related reliability PFH_D	1.0E–8 h		
Mechanical data			
Installation type	Non-flush mount		
Housing material	PPE; zinc die-cast	PPE; zinc die-cast	V4A (1.4404); PBT
Weight	0.346 kg	0.315 kg	0.255 kg

	BES057A	BES057C	BES0577
Displays/operating elements			
Display	LED yellow (Signal) LED green (Power)		
Electrical Connection			
Connection	M12 plug connection; gold plated contacts		
Pin assignments		 ① Safety-relevant logic unit	
Accessories			
Accessories (included)	1 Allen wrench 1 mounting bracket		2 mounting nuts
Remarks	Unless otherwise indicated, all data in the entire temperature range are based on a reference target per IEC 60947-5-2 (FE360 = ST37K)		
	45 x 45 x 1 mm	60 x 60 x 1 mm	45 x 45 x 1 mm
Packaging unit	1 pc.		

9 Maintenance, Care, and Disposal

No special measures for maintenance and upkeep are necessary when operated properly.

The device may be repaired only by the manufacturer.

Dispose of the device in accordance with the prevailing national regulations for environmentally safe disposal.

9.1 Troubleshooting

Problem	Possible Cause	Troubleshooting
No LED display	No supply voltage	Turn voltage on
Power LED flashes and sensor does not switch	– Undervoltage – Overvoltage	Correct voltage (see Section 8 Technical Data on page 36)
Sensor does not switch even after undamping and damping	Sensor was placed in the safe condition (logical "0"). Cause: – Short-circuit between outputs A1 and A2 – Short-circuit between output A2 and the supply voltage – Error detected within the sensor	– Eliminate short-circuit – Replace the device **Applies only to BES057A and BES057C:** – Turn power off and on again – Check wiring and connections – Check other electronics (e.g. PLC)
Applies only to BES0577: No close zone	Damping element shifts the release zone directly up to the sensor face due to its composition (material, shape, size).	If possible change the material, shape or size of the damping element (see Section 6.2 Determining the Release zone on page 25).

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