BALLUFF

BFP-3SC

BFP 3SC2-22V000-R05-UD8-000S04
BFP 3SC2-22V000-R10-UD8-000S04
BFP 3SC2-22V000-R32-UD8-000S04
BFP 3SC2-22V000-R34-UD8-000S04
BFP 3SC2-22V000-R38-UD8-000S04
BFP 3SC2-22V000-R40-UD8-000S04
BFP 3SC2-22V000-R42-UD8-000S04
BFP 3SC2-22V000-R46-UD8-000S04
BFP 3SC2-22V000-R48-UD8-000S04
BFP 3SC2-22V000-R53-UD8-000S04
BFP 3SC2-22V000-R56-UD8-000S04
BFP 3SC2-22V000-R58-UD8-000S04
BFP 3SC2-02X000-R05-UD8-000S04
BFP 3SC2-02X000-R10-UD8-000S04
BFP 3SC2-02X000-R40-UD8-000S04
BFP 3SC2-02X000-R46-UD8-000S04
BFP 3SC2-02X000-R53-UD8-000S04
BFP 3SC2-05X000-R05-UD8-000S04-502
BFP 3SC2-05X000-R40-UD8-000S04-501



english

Contents

1 About this guide **1**
1.1 Validity . . . 1
1.2 Disclaimer . . . 1
1.3 Explanation of the warnings . . . 1
1.4 Symbols and conventions . . . 2
1.5 Technical terms and abbreviations used . . . 2

2 Safety notes **4**
2.1 Intended use . . . 4
2.2 Reasonably foreseeable misuse . . . 4
2.3 General safety notes . . . 4

3 Scope of delivery, transport and storage **6**
3.1 Scope of delivery . . . 6
3.2 Unpacking . . . 6
3.3 Transport . . . 6
3.4 Storage conditions . . . 6

4 Product Information **7**
4.1 Product description . . . 7
4.2 Technical data . . . 10
4.3 Accessories . . . 14

5 Interfaces and communication **15**
5.1 LED Meaning . . . 15
5.2 Faults . . . 15

6 IO-Link interface reference **17**
6.1 Primary device functions . . . 17
6.2 System functions . . . 23

7 Installation and connection **25**
7.1 Preparing for installation . . . 25
7.2 Installation . . . 25
7.3 Electrical connection . . . 26
7.4 Shielding and cable routing . . . 27

8 Commissioning **28**
8.1 Post-commissioning measures . . . 28

9 Operation and maintenance **29**
9.1 Startup . . . 29
9.2 Operation . . . 29
9.3 Operating notes . . . 31
9.4 Cleaning . . . 32
9.5 Maintenance . . . 32

10 Decomissioning **33**
10.1 Dismounting . . . 33
10.2 Return . . . 33
10.3 Disposal . . . 34

1 About this guide

1.1 Validity

This guide provides all the information required for the safe use of the BFP 3SC. It applies to the following models:

BFP 3SC…

This guide was created in English. Other language versions are translations of this guide.

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1.2 Disclaimer

The following description is provided free of charge and is a general application example. The description should support the programming and planning of PLC applications and illustrate possible solutions. The user has no claim to warranty, error correction or updates. In particular, any claims for compensation that could result from the use of this description are excluded. This liability limitation excludes

- (a) damages due to loss of life, personal injury or harm to health,
- (b) liability in accordance with the Product Liability Act and -
- (c) cases of intent.

Prior to implementation in systems and machines, please check whether the description provided here is intended for your application. The use of this free description shall be deemed to imply acceptance of the warranty and liability limitation!

1.3 Explanation of the warnings

Always observe the warnings in this guide and the measures described to avoid hazards.
The warnings used here contain various signal words and are structured as follows:

SIGNAL WORD

Type and source of the hazard
Consequences if not complied with
► Measures to avoid hazards

The individual signal words mean:

NOTICE

Identifies a danger that could **damage or destroy the product**.

⚠ CAUTION

The general warning symbol together with the signal word CAUTION indicates a hazard which can lead to **slight or moderate injuries**.

WARNING

The general warning symbol together with the signal word WARNING indicates a hazard which can lead to **death or serious injuries**.

DANGER

The general warning symbol in conjunction with the signal word DANGER identifies a hazard which, if not avoided, will certainly result in **death or serious injury**.

1.4 Symbols and conventions

- Individual instructions are indicated by a preceding triangle. :::

Action sequences are numbered consecutively:

1. Instruction 1
2. Instruction 2

Numbers unless otherwise indicated are decimals (e.g. 23). Hexadecimal numbers are represented with a preceding 0x (e.g. 0x12AB).

Buttons or selectable menu entries are described in italic and small caps, e.g.Save.

Menu commands are joined with a greater-than sign, e.g. “Settings>Options” stands for the menu command Options from the Settings menu.

Note

Note, tip
This symbol indicates general notes.

1.5 Technical terms and abbreviations used

ADT
Fieldbus Autodetection

BET
Balluff Engineering Tool

DID
Device ID

EIP
EtherNet/IP

I/O
Input/Output

IOL
IO-Link

ISDU
IO-Link-Parameter (Index Service Data Unit)

MBT
Modbus

Modbus TCP
Modbus Transmission Control Protocol

PLC
Programmable Logic Controller

PNT
Profinet

SIO
Standard IO-Mode

VID
Vendor ID

2 Safety notes

2.1 Intended use

The model BFP-3SC pressure sensor is used for the switching of circuits as a function of the measured pressure via a PNP or NPN output signal. In addition, the pressure value can be output to appropriate read-out units as a standardised digital signal (IO-Link 1.1). The switching conditions can optionally be programmed using IO-Link 1.1 (switch and reset points, switching functions, time response, …).

The model BFP-3SC has been developed for the pressure measurement of non-hazardous fluids, liquids and gases (classification in accordance with Directive 2014/68/EU Article 13, Regulation (EC) No. 1272/2008, or GHS[1]) which are mainly used for cooling, lubrication, cleaning or power transmission in industrial machines.

Proper function according to the specifications in the technical data is only assured when the product is used solely as described in the user's guide and the respective documents as well as in compliance with the technical specifications and requirements and only with suitable original Balluff accessories.

Otherwise, there is deemed to be unintended use. Unintended use is not permitted and will result in the loss of warranty and liability claims against the manufacturer.

2.2 Reasonably foreseeable misuse

The product is not intended for the following applications and areas and may not be used there:

- in safety-oriented applications in which personal safety or the safety of machinery and equipment depends on the device function
- in explosive atmospheres
- in areas with food contact
- for processing personal data in accordance with the GDPR
- for processing financial transactions

2.3 General safety notes

⚠ WARNING

Physical injuries and damage to property and the environment through exceeding the performance limits
Exceeding the performance limits can destroy the instrument and lead to danger in the end-use application.
 Only use the instrument in applications that lie within its technical performance limits.
 Any permanent operation in the overload range is not permitted. Above the highest permissible operating pressure, up to the overload limit, the pressure sensor is operating outside its specifica-tion. The overload range is intended to prevent damage to the pressure sensor, as part of a pressure vessel system, during the pressure containment test.
 The overload limit must never be exceeded, even when failures occur in the end-use application. Loads above the overload limit can cause irreversible damage, which can lead, for example, to permanent measuring errors.
 The manufacturer or operator of the machine or plant in which the product is used must ensure the compatibility of the materials of the wetted parts with the medium used.
 The pressure switch should not be used with abrasive or unstable fluids, in particular not with hydrogen.

The (dis-)mounting, installation, parameterisation and maintenance of the model BFP-3SC in industrial environments absolutely requires suitably skilled personnel in accordance with its section below.

1 Globally Harmonized System of Classification, Labelling and Packaging of Chemicals

Info

- Pressure surges below the nominal pressure and shorter than 1 ms can cause measuring errors.
- For applications where pressure spikes can occur, the use of a restrictor is recommended. The restrictor narrows the pressure port to 0.6 mm and thus increases the resistance against pressure spikes.
- With media that could block the pressure port (e.g. through particles), it is recommended to use a wider pressure port of 6 or 12 mm.
- It must be ensured that no atomic hydrogen can form in the pressure port of the pressure sensor.

Activities such as **installation**, **connection** and **startup** may only be carried out by qualified personnel.

Qualified personnel are persons whose technical training, cyber security training, knowledge and experience as well as knowledge of the relevant regulations allows them to assess the work assigned to them, recognize possible hazards and take appropriate safety measures.

The **operator** is responsible for ensuring compliance with local safety regulations, maintaining a safe and cyber-secure operating environment, and taking appropriate measures to ensure that a defect in the product will not result in hazards to persons or equipment. This includes assessing cybersecurity risks and implementing the necessary cybersecurity measures for the operation of the machine.

The product must not be opened, modified or changed. If defects and unresolvable faults occur in the product, take it out of service and secure against unauthorized use.

Inadequate isolation of the product may result in damage and malfunction of the product or in the application due to unauthorized access or modification of data and settings or product availability.

⚠ WARNING

Before mounting and commissioning the instrument, ensure you read the operating instructions.

Use of accessories and spare parts

It is recommended to use original accessories and original spare parts from Balluff. Using accessories and spare parts from third parties can lead to damage to the instrument or accidents, due to quality defects or other reasons.

Balluff assumes no liability for damage or accidents caused by a malfunction or unsuitability of accessories and spare parts which do not originate from Balluff (e.g. non-compliance with the IP ingress protection of connectors).

No warranty claims can be made which arise due to a malfunction or unsuitability of any accessory or spare part from a third party.

3 Scope of delivery, transport and storage

3.1 Scope of delivery

- Pressure sensor
- Basic information
- 3-point measuring protocol

Cross-check scope of delivery with delivery note.

3.2 Unpacking

To ensure that the delivered product is an original product of Balluff GmbH, check the following points when unpacking: The information on the nameplate of the device must match the information on the delivery note. In case of any doubts of the integrity or authenticity of the product, please contact Balluff sevice.

3.3 Transport

Note

With improper transport, damage to property can occur.
- When unloading packed goods upon delivery as well as during internal transport, proceed carefully and observe the symbols on the packaging.
- With internal transport, observe the instructions in chapter storage-conditions

Check the pressure sensor for any damage that may have been caused by transport. Obvious damage must be reported immediately.

3.4 Storage conditions

Do not remove packaging until just before mounting. Keep the packaging as it will provide optimum protection during transport (e.g. change in installation site, sending for repair).

Permissible conditions at the place of storage:

- Storage temperature: -40 … +70 °C [-40 … +158 °F]
- Humidity: 45 … 75 % relative humidity (non-condensing)

4 Product Information

This section provides information about the product features and specifications.

4.1 Product description

4.1.1 Function

A pressure sensor is used to measure the pressure of liquids or gases in machines and industrial systems. The applied pressure is converted into an electrical signal, which is then processed electronically and provided as a measurement value. Depending on the device version, the measured pressure value is transmitted via the corresponding interface as either an analog or a digital output signal.



1 Electrical connection
2 Status LED
3 Spanner flats
4 Process connection

Fig. 1: Operating and display elements

Electrical connection: The electrical connection is made via a plug connection (see *Type code*).

Housing: Robust housing containing the sensor electronics and pressure sensing components.

Process connection: The sensor is mounted to the application via a standardized process connection. Various process connection types are available depending on the application requirements (see *Type code*).

4.1.2 Construction

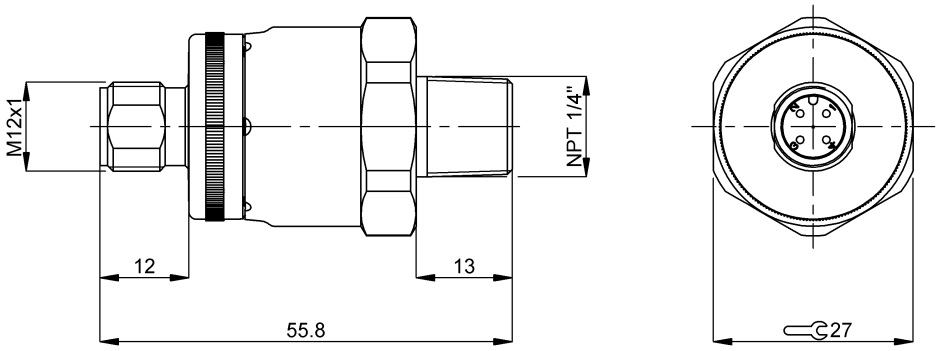

Fig. 2: BFP 3SC2-02X000-… with Male Thread NPT 1/4”

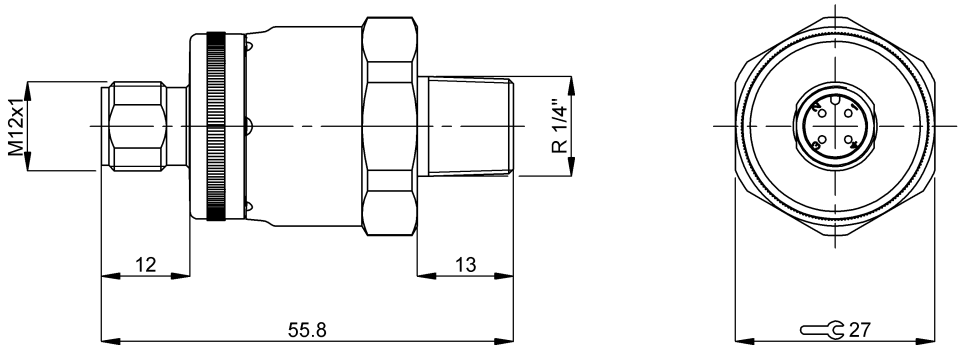

Fig. 3: BFP 3SC2-05X000-… with Male thread R1/4”

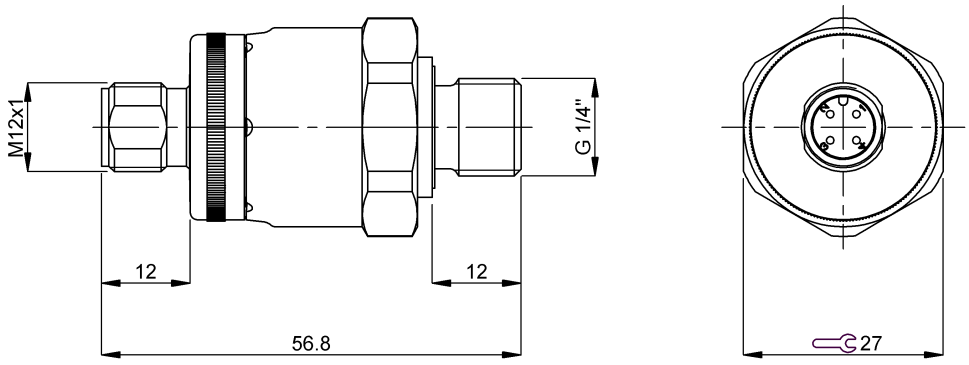

Fig. 4: BFP 3SC2-22V000-… with Male Thread G 1/4”

4.1.3 Labeling

If the serial number becomes illegible (e.g. due to mechanical damage or overpainting), traceability will no longer be possible.



1 Order code
2 Type code
3 Serial number
4 QR-Code
5 Operating voltage and Measuring range
6 Approvals

Fig. 5: Part label (excerpt, example)

4.1.4 Type code

Example	BFP	3SC2	-	22V000	-	R05	-	UD8	-	000S04
Definition	BFP	3S***ab***	-	***ccd***000	-	***eee***	-	***fgh***	-	000S04

Table 1: Type code variant details

Code	Parameter	Meaning
BFP 3S	Sensor type	Balluff Fluid Sensor Pressure
a	Design	C = Transmitter with pressure compensation vent and LED
b	Pressure resistance	2 = Dual range
cc	Process connection	• 02 = Male thread 1/4" NPT • 05 = Male thread R1/4" according to ISO 7 • 22 = Male thread G1/4" A according to DIN EN ISO 1179-2
d	Process connection sealing material	• V = FKM (Viton) • X = No sealing ring
R**ee**	Measurement range	• R05 = -1…2 bar • R10 = -1…10 bar • R32 = 0…1 bar • R34 = 0…2 bar • R38 = 0…5 bar • R40 = 0…10 bar • R42 = 0…20 bar • R46 = 0…50 bar • R48 = 0…100 bar • R53 = 0…250 bar • R56 = 0…400 bar • R58 = 0…600 bar
f	Interface	U = IO-Link
g	Interface version and output	D = IO-Link V1.1, COM2, with one PNP switching output
h	Operating voltage	8 = 10…32 VDC
000S04	Electrical connection	M12 connector, 4-pin
iii	Special version	xxx = customer specific variant

4.2 Technical data

Depending on the selected instrument version (e.g. seals), the specification may deviate from the specifications listed here. The specifications in the order documentation are definitive.

4.2.1 Measuring range

Table 2: Measuring range

Measuring range	see product label / see *Type code*
Overload safety	2 times
Vacuum-tight	Yes

4.2.2 LED status display

Table 3: LED status display

Visibillity	360°
Status displays	see chapter *LED Meaning*

4.2.3 Output signal

Table 4: Output signal

Output signal	PNP switching output
IO-Link	
Revision	1.1
Transmission rate	38.4 kBaud (COM2)
Min. cycle time	2.3 ms
Master port class	A
Zero point setting	max. 3 % of span (via IO-Link)
Damping of switching outputs	0 ms … 65 s (adjustable via IO-Link)
Switch-on time	1 s
Switching thresholds	Switch point 1 is individually adjustable via IO-Link.
Switching functions	Normally open, normally closed, window, hysteresis (adjustable via IO-Link)
Switching voltage	Supply voltage - 1 V
Switching current	max. 250 mA
Response time of switching output	≤ 5 ms
Service life	100 million switching cycles

4.2.4 Accuracy specifications

Table 5: Accuracy specifications

Accuracy, switching output	≤ ±1 % of span
Long-term drift, switching output	≤ ±0.1 % ≤ ±0.2 % for measuring ranges ≤ 0.4 bar [10 psi] and for increased overload safety
With switching currents greater than 50 mA	≤ ±0.075 % per 50 mA additional applied switching current
Temperature error in rated temperature range	≤ ±1.5 % of span ≤ ±2.5 % of span for increased overload safety
Temperature coefficients in rated temperature range	
Mean TC zero point	≤ ±0.16 % of span/10 K
Mean TC span	≤ ±0.16 % of span/10 K

4.2.5 Reference conditions (per IEC 61298-1)

Table 6: Reference conditions (per IEC 61298-1)

Ambient temperature	15 … 25 °C [59 … 77 °F]
Atmospheric pressure	950 … 1,050 mbar [13.78 15.23 psi]
Air humidity	45 … 75 % r. h.
Supply voltage	DC 24 V
Mounting position	Process connection: lower mount

4.2.6 Materials

Table 7: Materials

Wetted parts	
Process connection	Stainless steel
Pressure transmission medium	Synthetic oil for all gauge pressure measuring ranges < 10 bar [150 psi]
Non-wetted parts	
Case	Stainless steel 316L
Circular connector M12 × 1	PBT GF30
LED status display	PC

4.2.7 Ambient conditions

Table 8: Operating conditions

Permissible temperature ranges	Higher values available. For valid values, see order documentation.
Medium	-30 … +100 °C [-22 … +212 °F]
Ambient	-30 … +85 °C [-22 … +185 °F]
Storage	-40 … +70 °C [-40 … +158 °F]
Rated temperature	-20 … +80 °C [-4 … +176 °F]
Air humidity	45 … 75 % r. h.
Vibration resistance	25 g, 10 … 2,000 Hz (IEC 60068-2-6, under resonance)
Shock resistance	100 g, 6 ms (IEC 60068-2-27, mechanical)
Service life	100 million load cycles (10 million load cycles for measuring ranges > 600 bar/7,500 psi)
Ingress protection (per IEC 60529)	IP65 and IP67
Mounting position	as required

4.2.8 Electrical data

Voltage supply

Table 9: Voltage supply

Supply voltage	DC 10 … 32 V The power supply for the pressure sensor must be made via an energy-limited electric circuit in accordance with section 9.3 of UL/EN/IEC 61010-1 or an LPS to UL/EN/IEC 60950-1 or class 2 in accordance with UL1310/UL1585 (NEC or CEC). The voltage supply must be suitable for operation above 2000 m should the pressure sensor be used at this altitude.
Current consumption	20 mA
Total current consumption	≤ 0.3 A incl. switching current (with one switching output)

4.2.9 Electrical connections

Table 10: Electrical connections

Plug connection	Circular connector M12 x 1 (4-pin), IP65 and IP67
Short-circuit resistance	SP1/SP2 vs. U-
Reverse polarity protection	U+ vs. U-
Insulation voltage	DC 500 V
Overvoltage protection	DC 36 V
Pin assignment	see product label

4.2.10 Process connections

Table 11: Process connections

Standard	Thread size
DIN EN ISO 1179-2 (formerly DIN 3852-E)	G ¼ A
ANSI/ASME B1.20.1	¼ NPT
ISO 7	R ¼

4.2.11 Default values

Table 12: Default values

Switching output	
Switching delay and reset delay	0 s
Switch point setting	Switch point (SP): 100 % Reset point (RP): 90 %
Switching function	HNO = Hysteresis, normally open
Damping	0 s

Note

The default values can deviate due to the customer-specific definition. See the order confirmation and delivery note if the default values do deviate.

4.3 Accessories

Accessories are not included in the scope of delivery and must be ordered separately.

Note

Recommended accessories can be found at www.balluff.com on the product page.

5 Interfaces and communication

This section provides information about the interfaces and communication.

5.1 LED Meaning

There is a three-coloured LED display integrated in the pressure transmitter.

5.1.1 Colour codes of status display

Table 1: LED status

Colour	Interval	Description
Green	Lit permanently	Device is ready for operation, no error.
Yellow	Blinking (continuously)	Temporary error, operation outside of the specification (e.g. under- or over-pressure, under- or overtemperature).
Red	Blinking (continuously)	“Locate me” function active or permanent error. In case of a permanent error, the device must be replaced.

5.2 Faults

⚠ CAUTION

Physical injuries and damage to property and the environment
If faults cannot be eliminated by means of the listed measures, the pressure switch must be taken out of operation immediately.

- ► Ensure that pressure or signal is no longer present and protect against accidental commissioning.
- ► Contact the manufacturer.
- ► If a return is needed, please follow the instructions given in chapter *Return*.

⚠ WARNING

Physical injuries and damage to property and the environment caused by hazardous media
Upon contact with hazardous media (e.g. oxygen) and also with refrigeration plants and compressors, there is a danger of physical injuries and damage to property and the environment.

- ► Should a failure occur, media with extremely high temperature and under high pressure or vacuum may be present at the instrument.
- ► For these media, in addition to all standard regulations, the appropriate existing codes or regulations must also be followed.
- ► Wear the requisite protective equipment.

ℹ Note

Additional information can be found at www.balluff.com on the product page.

In the event of any faults, first check whether the pressure sensor is mounted correctly, mechanically and electrically. If complaint is unjustified, the handling costs will be charged.

Table 2: Faults and measures

Fault	Possible cause	Measure
No output signal	Cable break	► Check the continuity
No output signal	No/wrong supply voltage	► Rectify the supply voltage
No/wrong output signal	Wiring error or switching of switching logic	► Observe the pin assignment ► Check the output configuration
Constant output signal upon change in pressure	Mechanical overload caused by overpressure	► Replace instrument; if it fails repeatedly, contact the manufacturer
Deviating zero point signal	Overload safety exceeded	► Observe the permissible overload safety
Signal span too small	Mechanical overload caused by overpressure	► Replace instrument; if it fails repeatedly, contact the manufacturer
Signal span too small	Supply voltage too high/low	► Rectify the supply voltage
Signal span drops	Moisture has entered	► Fit the cable correctly

6 IO-Link interface reference

This section provides information about the IO-Link interface reference.

6.1 Primary device functions

This section describes the primary device functions of the sensor.

6.1.1 Description of the IO-Link functionality

IO-Link is a point-to-point connection for the communication of the BFP-3SC with an IO-Link master.

Physical layer

The BFP-3SC supports the following features:

Table 1: IO-Link features

Property	Value
IO-Link specification	Version 1.1.5
SIO mode	Yes
Minimum cycle time	2.3 ms
Transmission rate	COM2 (38.4 kBaud)
Process data length	16 bit (Frame type 2.2)
Data storage support	Yes
Smart Sensor Profile	Yes

Process Data

The BFP-3SC has 1 digital output. Both physical switching outputs are also transmitted as process data via IO-Link.

In the 'SIO Mode' (Standard I/O Mode, without IO-Link operation) the switching output 1 will switch on pin 4 of the M12x1 connector. In the IO-Link communication mode, this pin 4 is reserved exclusively for communication.

With a Frametype 2.2, the 16-bit process data from the pressure switch is transmitted cyclically. Bit 0 is the state of switching output 1, where 1 respectively DC 24 V correspond to the "closed" logic state of the respective output.

The remaining 14 Bit contain the analog value measured by the pressure switch. According to the measuring range of the sensor and the unit configured, the 14 Bit process data of the measured value, is dynamically adjusted. Multiplying the process data with the gradient (Index #67) allows for a pressure reading in the selected unit.

Table 2: Process data bit allocation

Bit	Process value	Value range
0	OU1	0 = inactive; 1 = active
2–15	ProcessData	-8192 … 8191

Example: Measuring range of the sensor = 0 … 10 psi ProcessData range = 0…1,000 with Gradient = 0.01 In this example: ProcessData 500 = 5.0 psi

Changing the unit, will result in new ProcessData range and Gradient.

Service data (ISDU – Indexed Service Data Unit)

Service data is always acyclic and exchanged on the request of the IO-Link Master. With the help of the service data, the following parameter values or instrument status can be read:

Index	Name	Format	Length	Access	Default Value	Value/Range
16 (0x10)	Vendor Name	StringT	max. 64 octets	R	Balluff GmbH	
17 (0x11)	Vendor Text	StringT	max. 64 octets	R	www.balluff.com	
18 (0x12)	Product Name	StringT	max. 64 octets	R	BFP 3SC	
19 (0x13)	Product ID[1]	StringT	max. 64 octets	R		
20 (0x14)	Product Text[2]	StringT	max. 64 octets	R		
21 (0x15)	Serial Number[3]	StringT	max. 16 octets	R		
22 (0x16)	Hardware Revision	StringT	max. 64 octets	R		
23 (0x17)	Firmware Revision	StringT	max. 64 octets	R		
24 (0x18)	Application Specific Tag[4]	StringT	max. 32 octets	R/W		
25 (0x19)	Function Tag	StringT	max. 32 octets	R/W		
26 (0x1A)	Location Tag	StringT	max. 32 octets	R/W		
32 (0x20)	Error Count[5]	UIntegerT	2 octets	R		
36 (0x24)	Device status	UIntegerT	1 octet	R		0 = Device is OK 1 = Maintenance required 2 = Out of specification 3 = Functional check 4 = Failure
37 (0x25)	Detailed Device Status[6]	ArrayT of OctetStringT3	24 octets	R	00 00 00 h	

Output signal settings

1 Similar to DeviceID
2 Additional product information.
3 Corresponds to serial number on the product label (S#...).
4 Customer-specific measuring point name, Allowed Characters: “A...Z”; “0...9”; “-“;
5 Counts errors since power-on or reset.
6 Error storage

Table 3: Parameter (ISDU) index table

Index (dec / hex)	Name	Format	Length	Access	Default value	Value / Range	Remarks
64 (0x40)	Order Number	StringT	max. 16 octets	R			Corresponds to article number on the product label (P#...).
66 (0x42)	Unit Process Data	UIntegerT	1 octet	R/W	Order-related	0 = bar; 1 = mbar; 2 = MPa; 3 = kPa; 4 = PSI; 5 = kg/cm²; 6 = %	Selection of unit for ProcessData and all related parameters (switch point settings, analogue output scaling, etc.)
67 (0x43)	Gradient	Float32T	4 octets	R	Order-related		Factor for calculation: ProcessData × Gradient = actual pressure in set unit (e.g. ProcessData 0...1000 with gradient 0.01 for 0...10 psi)
68 (0x44)	Start of Measuring Range	IntegerT	2 octets	R	Order-related		Start of measuring range in set ProcessData unit
69 (0x45)	End of Measuring Range	IntegerT	2 octets	R	Order-related		End of measuring range in set ProcessData unit
70 (0x46)	OU1	UIntegerT	1 octet	R/W	HNO	0 = HNO; 1 = HNC; 2 = FNO; 3 = FNC	Switching function – switching output 1
71 (0x47)	DS1	UIntegerT	2 octets	R/W	0	0...65000	Switch delay time switching output 1 [ms]
72 (0x48)	DR1	UIntegerT	2 octets	R/W	0	0...65000	Reset delay time switching output 1 [ms]
73 (0x49)	Damping OU1	UIntegerT	2 octets	R/W	0	0...65000	Damping for switching signal 1 (99%). 0 = no damping active

Output signal settings based on selected unit

Index 66 (0x42) “Unit ProcessData” defines which configurable parameters are shown in the IO-Link tool and which parameter is prioritized.

(e.g. Index 66 is set to “bar” -> Index 142-145 is shown and can be configured, any configuration in e.g. Index 202-205 in “psi” will be ignored.)

Table 4: Switching point parameters (ISDU) index table

Index (dec / hex)	Name	Format	Length	Access	Default value	Value / Range	Remarks
142 (0x8E)	SP1 / FH1_bar	IntegerT	2 octets	R/W	End of measuring range (Start of meas. range + 0.25 %)	End of measuring range (Start of meas. range + 0.25 %) … end of measuring range	Switching point (or window high) value. The value must always be higher than the reset point (or window low). Minimum gap = 0.25% of pressure range. If Gap < minimum hysteresis, the associated reset point is adjusted automatically.
143 (0x8F)	RP1 / FL1_bar	IntegerT	2 octets	R/W	End of measuring range - 10% of range	Start of meas. range … (end of meas. range - 0.25 %)	Reset point (or window low) value. The value must always be lower than the switch point (or window high). Minimum gap = 0.25% of pressure range. If Gap < minimum hysteresis, the associated switching point is adjusted automatically.
144 (0x90)	SP2 / FH2_bar	IntegerT	2 octets	R/W	End of measuring range (Start of meas. range + 0.25 %)	End of measuring range (Start of meas. range + 0.25 %) … end of measuring range	See SP1 / FH1; only available for devices with 2 switching outputs.
145 (0x91)	RP2 / FL2_bar	IntegerT	2 octets	R/W	End of measuring range - 10% of range	Start of meas. range … (end of meas. range - 0.25 %)	See RP1 / FL1; only available for devices with 2 switching outputs.
157–160 (0x9D–0xA0)	Index 142 … 145 in Unit “mbar”	IntegerT	2 octets	R/W	See 142 … 145	See 142 … 145	Index 142 … 145 expressed in unit “mbar”
172–175 (0xAC–0xAF)	Index 142 … 145 in Unit “MPa”	IntegerT	2 octets	R/W	See 142 … 145	See 142 … 145	Index 142 … 145 expressed in unit “MPa”
187–190 (0xBB–0xBE)	Index 142 … 145 in Unit “kPa”	IntegerT	2 octets	R/W	See 142 … 145	See 142 … 145	Index 142 … 145 expressed in unit “kPa”

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Table 4 – continued from previous page

Index (dec / hex)	Name	Format	Length	Access	Default value	Value / Range	Remarks
202–205 (0xCA–0xCD)	Index 142 … 145 in Unit “PSI”	IntegerT	2 octets	R/W	See 142 … 145	See 142 … 145	Index 142 … 145 expressed in unit “PSI”
217 to 220(0xD9 to 0xDC)	Index 142 … 145 in Unit “kg_cm²”	IntegerT	2 octets	R/W	See 142 … 145	See 142 … 145	Index 142 … 145 in Unit “kg_cm²”
232 to 235 (0xE8 to 0xEB)	Index 142 … 145 in Unit “%”	IntegerT	2 octets	R/W	See 142 … 145	See 142 … 145	Index 142 … 145 in Unit “%”

Indication

Table 5: Locate parameter (ISDU)

Index (dec / hex)	Name	Format	Length	Access	Default value	Value / Range	Remarks
106 (0x6A)	Locate me	Boolean	1 octet	R/W	Off	0 = Off; 1 = On	Helps to locate the device on a machine; flashes the LED indicator in red. “Locate Me” has highest priority (e.g. warnings have lower priority).

Diagnosis

Table 6: Diagnosis parameters (ISDU)

Index (dec / hex)	Name	Format	Length	Access	Value / Range	Remarks
110 (0x6E)	Temperature Unit Default value: °C	UIntegerT	1 octet	R/W	0 = °C; 1 = °F	Unit of the internal temperature measurement.
111 (0x6F)	Actual Temperature	Float32T	4 octets	R		Internal temperature measurement of the electronic components.
112 (0x70)	Temperature Low	Float32T	4 octets	R		Minimum temperature since first installation / since “reset low temperature”.
113 (0x71)	Temperature High	Float32T	4 octets	R		Maximum temperature since first installation / since “reset high temperature”.

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Table 6 – continued from previous page

Index (dec / hex)	Name	Format	Length	Access	Value / Range	Remarks
114 (0x72)	Temperature Low since Power Up	Float32T	4 octets	R		Minimum temperature since last power-up.
115 (0x73)	Temperature High since Power Up	Float32T	4 octets	R		Maximum temperature since last power-up.
120 (0x78)	Pressure Overload Counter	UIntegerT	4 octets	R		Duration in pressure overload range [s].
121 (0x79)	Operating Hours Total	UIntegerT	4 octets	R		Total operating hours since first installation [h].
122 (0x7A)	Operating Hours since Power Up	UIntegerT	4 octets	R		Displays the total operating hours since power-up [h].
123 (0x7B)	Sensor Status	UIntegerT	1 octet	R	Bit0=Sensor defect; Bit1=Overpressure; Bit2=Underpressure; Bit3=Overtemperature; Bit4=Undertemperature; 0 = no error/warning; 1 = error/warning	Status of sensor self-diagnosis.
124 (0x7C)	Low Pressure	IntegerT	2 octets	R		Minimum pressure value in ProcessData unit since first installation / since “Reset Low Pressure”.
125 (0x7D)	High Pressure	IntegerT	2 octets	R		Maximum pressure value in ProcessData unit since first installation / since “Reset High Pressure”.
126 (0x7E)	Low Pressure since Power Up	IntegerT	2 octets	R		Minimum pressure value in ProcessData unit since last power-up.
127 (0x7F)	High Pressure since Power Up	IntegerT	2 octets	R		Maximum pressure value in ProcessData unit since last power-up.

System commands

Table 7: System commands (ISDU)

Index (dec / hex)	Name	Format	Lengt	Access	Default value	Value / Range	Remarks
2 (0x02)	Device Reset	UIntegerT	1 octet	W		128 (0x80)	Restarts the device without changing parameters.
2 (0x02)	Application Reset	UIntegerT	1 octet	W		129 (0x81)	Technology-specific parameters are reset to their default values; identification parameters are retained; data is uploaded, if enabled.
2 (0x02)	Restore Factory Settings	UIntegerT	1 octet	W		130 (0x82)	Restores the device to factory settings.
2 (0x02)	Back-to-box	UIntegerT	1 octet	W		131 (0x83)	Restore factory settings and disable communication until the system restarts.
2 (0x02)	Reset High Pressure	UIntegerT	1 octet	W		160 (0xA0)	Resets the high pressure counter.
2 (0x02)	Reset Low Pressure	UIntegerT	1 octet	W		161 (0xA1)	Resets the low pressure counter.
2 (0x02)	Reset Pressure Overload Counter	UIntegerT	1 octet	W		162 (0xA2)	Clears the overload counter to zero.
2 (0x02)	Reset High Temperature	UIntegerT	1 octet	W		163 (0xA3)	Resets the high temperature counter.
2 (0x02)	Reset Low Temperature	UIntegerT	1 octet	W		164 (0xA4)	Resets the low temperature counter.
2 (0x02)	Adjust Zero Point	UIntegerT	1 octet	W		165 (0xA5)	Performs an “Autozero”.

6.2 System functions

This section describes the system functions of the sensor.

6.2.1 Device Access Locks

Description

With *Device Access Locks*, the device can be locked for certain types of configuration access to prevent changes to the parameters.

This functionality is defined in the IO-Link standard and is implemented according to Version 1.1.

ISDU

Index	Name	Format	Length	Access	Default value
12 (0x0C)	Device Access Locks	RecordT	2 octets	R/W	00 00h (unlocked)

Value/Range	**Remarks**
Bit 0: Parameter (write) access	Disables change of parameters via IO-Link
Bit 1: Data Storage	Bit 1: Disables data storage mechanism
Bit 2: Local Parametrizatio	Bit 2: Disable change of parameters via buttons on the device
Bit 3: Local User Interface	Bit 3: Disable access on the menu via buttons on the device
0 = Unlocked, 1 = Locked	

7 Installation and connection

7.1 Preparing for installation

Requirements for mounting point

The mounting point must meet the following conditions:

- Protected from weather influences. Permanent exposure to UV light/sunlight can lead to a change in the colour of the plastic parts and a clouding/yellowing of the status display. Therefore, a possible limitation of the visibility of the status display cannot be excluded.
- Under corrosive environmental conditions (such as salty, humid air), reductions in the gloss level of the metal surfaces, or even corrosion on the instrument, may occur, which make readability of the product label more difficult.
- Sealing faces are clean and undamaged.
- Sufficient space for a safe electrical installation.
- The instrument is vented to the atmosphere. Therefore, no oating or other covering may be applied which might restrict the venting.

⚠ WARNING

Physical injuries and damage to property and the environment through running above or below the temperature limits
Running above or below the temperature limits can destroy the instrument and lead to danger in the end-use application.
 Permissible ambient and medium temperatures remain within the performance limits. Consider possible restrictions on the ambient temperature range caused by mating connector used. For performance limits, such as derating (maximum current consumption at a corresponding medium temperature), see chapter *Technical data*

7.2 Installation

7.2.1 Mechanical mounting

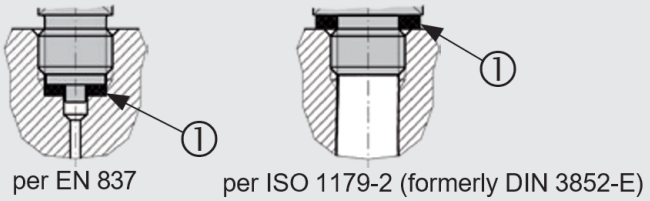
Info

The max. torque depends on the mounting point (e.g. material and shape). If you have any questions, please contact our Service Center.

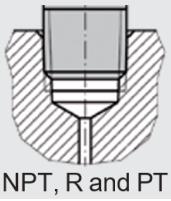
1. Seal the sealing face.
2. At the mounting point, screw the pressure sensor in hand-tight.
3. Tighten with a torque spanner using the spanner flats.

Sealing variants

Parallel threads
Seal the sealing face ① with flat gasket, lens-type sealing ring or WIKA profile sealing.



Tapered threads
Wrap threads with sealing material (e.g. PTFE tape).



1 Sealing face

Connecting the instrument

1. Assemble the mating connector or cable outlet.
2. Establish the plug connection.

7.3 Electrical connection

Pin assignment

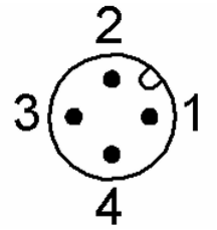


Fig. 1: M12 plug pin assignment (view on pin side)

Table 1: M12 plug pin assignment

Pin	Signal	Description
1	U+	Positive power supply
2	NC	Not connected
3	U-	Negative power supply
4	SP1/C	Switching outout 1/Communication with IO-Link

Note

For pin assignments, see also product label

For instruments with UL approval and for use in North America:

The power supply for the pressure switch must be made via an energy-limited electric circuit in accordance with section 9.4 of UL/EN/IEC 61010-1, or an LPS per UL/EN/IEC 60950-1/CSA C22.2 no. 60950-1, or class 2 in accordance with UL1310/UL1585 (NEC or CEC). The voltage supply must be suitable for operation above 2,000 m should the pressure switch be used at this altitude.

Requirements for electrical connection

- Ingress protection of the mating connector corresponds to the ingress protection of the pressure sensor.
- Cable diameter matches the cable bushing of the mating connector.
- Cable gland and seals of the mating connector are correctly seated.
- No humidity can ingress at the cable end.

7.4 Shielding and cable routing

The pressure sensor must be grounded via the process connection. When working during a running process operation, measures to prevent electrostatic discharge on the connection terminals should be taken, as a discharge could lead to temporary corruption of the measured value.

8 Commissioning

Prior to commissioning, the pressure sensor must be subjected to a visual inspection.

- Leaking fluid is indicative of damage.
- Only use the pressure sensor if it is in perfect condition with respect to safety.

8.1 Post-commissioning measures

In order to maintain a secure environment, take the following measures after commissioning:

- Create a backup of the device configuration and store it in a secure location.

9 Operation and maintenance

9.1 Startup

DANGER

Uncontrolled system movement When starting up, if the sensor is part of a closed loop system whose parameters have not yet been set, the system may perform uncontrolled movements. This could result in personal injury and equipment damage.
Please mind the following safety instructions:

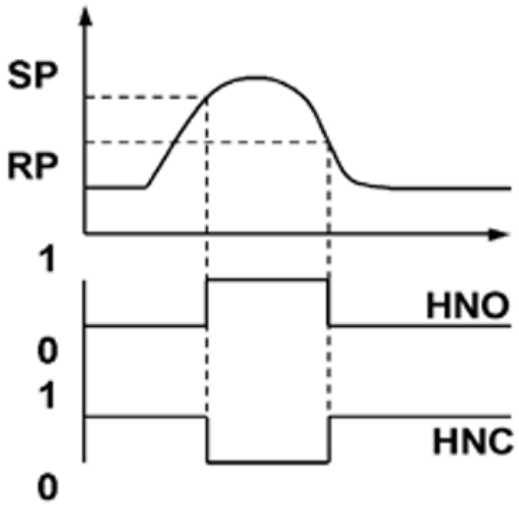
- ► Persons must keep away from the system's hazardous zones.
- ► Startup must be performed only by trained technical personnel.
- ► Observe the safety instructions of the equipment or system manufacturer.

To start up the system, proceed as follows:

1. Check connections for tightness and correct polarity.
2. Replace damaged connections.
3. Turn on the system.
4. Check measured values and adjustable parameters

9.2 Operation

Hysteresis function (configurable via IO-Link)



If the system pressure fluctuates around the set point, the hysteresis keeps the switching status of the outputs stable. With increasing system pressure, the output switches when reaching the switch point (SP).

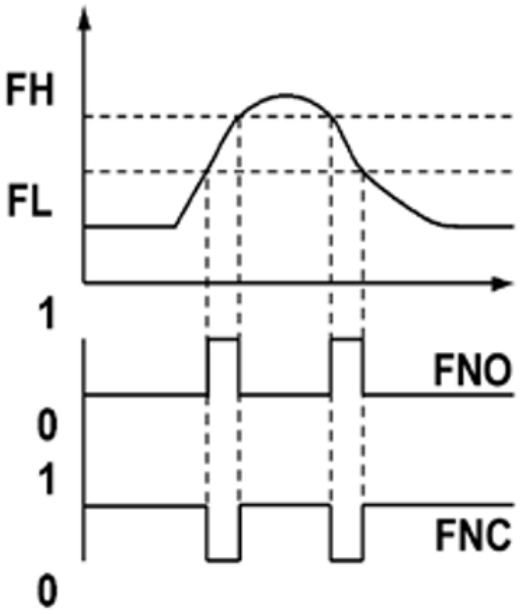
- Normally open contact (HNO): Active
- Normally closed contact (HNC): Inactive

With system pressure falling again, the output will not switch back before the reset point (RP) is reached.

- Normally open contact (HNO): Inactive

- Normally closed contact (HNC): Active

Window function (configurable via IO-Link)



The window function allows for the control of a defined range. When the system pressure is between window high (FH) and window low (FL), the output switches on.

- Normally open contact (FNO): Active
- Normally closed contact (FNC): Inactive

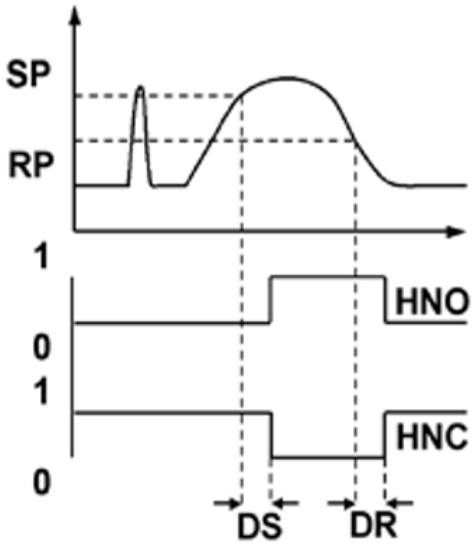
When the system pressure is outside window high (FH) and window low (FL), the output does not switch on.

- Normally open contact (FNO): Inactive
- Normally closed contact (FNC): Active

Adjustability:

- Switch point/Window High The value must be higher than the reset point or window low. The minimum difference is 0.25 % of the measuring range. With a setting less than 0.25 %, the reset point will be adjusted automatically.
- Reset point/window low The value must be lower than the switch point or window high. The minimum difference is 0.25 % of the measuring range. With a setting less than 0.25 %, the switch point will be adjusted automatically

Delay times (0 … 65 s) (configurable via IO-Link)



This makes it possible to filter out unwanted pressure peaks of a short duration or a high frequency.

The pressure must be present for at least a certain pre-set time for the output to switch on. The output does not immediately change its status when it reaches the switching event (SP), but rather only after the pre-set delay time (DS).

The output only switches back when the system pressure has fallen down to the reset point (PR) and stays at or below the reset point (RP) for at least the pre-set delay time (DR).

If the switching event is no longer present after the delay time, the switch output does not change.

Damping function (0 … 65 s) (configurable via IO-Link)

With this, the time span between a pressure change and the change of the switching state can be set.

Zero point setting

A zero point offset can be reset with the 0SET parameter via IO-Link. Only carry out zero point setting for gauge and vacuum pressure measuring ranges at the start of the measuring range.

Note

Carry out the zero point setting of absolute pressure measuring ranges at 0 bar absolute (vacuum). Since appropriate references are required for this, we recommend that this is only carried out by the manufacturer.

9.3 Operating notes

- Regularly check function of the sensor and all associated components.
- Regularly check for available firmware and security updates.
- Regularly review user accounts, access permissions and security-related settings.
- Take the sensor out of operation whenever there is a malfunction.
- Secure the system against unauthorized use.
- Check fasteners and retighten if needed.

9.4 Cleaning

⚠ CAUTION

Unsuitable cleaning agents
Cleaning with unsuitable cleaning agents may damage the instrument and the product label.
- ► Do not use any aggressive cleaning agents.
- ► Do not use any hard or pointed objects.
- ► Do not use any abrasive cloths or sponges.

Suitable cleaning agents

- Water
- Conventional dishwashing detergent

Cleaning the instrument

Wipe the instrument surface using a soft, damp cloth.

9.5 Maintenance

This pressure sensor is maintenance-free.

10 Decomissioning

Note

Exposure of sensitive data
If the device is not decommissioned properly, sensitive data may be exposed. This can lead to unauthorized access to the device and its data.
- Reset the device to factory settings to remove any remaining data and configurations.

10.1 Dismounting

1. Depressurise and de-energise the pressure sensor.
2. Disconnect the electrical connection.
3. Unscrew the pressure sensor with a spanner using the spanner flats.

WARNING

Physical injuries and damage to property and the environment caused by hazardous media
Upon contact with hazardous media (e.g. oxygen), there is a danger of physical injuries and damage to property and the environment.
- ► Should a failure occur, media with extremely high temperature and under high pressure or vacuum may be present at the instrument.
- ► Wear the requisite protective equipment.

WARNING

Risk of burns
During dismounting there is a risk of dangerously hot media escaping. The pressure sensor may have heated up severely due to hot media.
- ► Let the instrument cool down sufficiently before dismounting it.
- ► Wear the requisite protective equipment.

10.2 Return

WARNING

Physical injuries and damage to property and the environment through residual media Residual media in the dismounted instrument can result in a risk to persons, the environment and equipment.
- With hazardous substances, include the material safety data sheet for the corresponding medium.
- Clean the instrument, see chapter *Cleaning*.

Strictly observe the following when shipping the instrument:

All instruments delivered to Balluff must be free from any kind of hazardous substances (acids, bases, solutions, etc.) and must therefore be cleaned before being returned.

When returning the instrument, use the original packaging or a suitable transport packaging.

10.3 Disposal

Incorrect disposal can put the environment at risk. Dispose of instrument components and packaging materials in an environmentally compatible way and in accordance with the country-specific waste disposal regulations.



Do not dispose of with household waste. Ensure a proper disposal in accordance with national regulations.

Note

Additional information can be found at www.balluff.com on the product page.

Headquarters and Technical Service Hubs

www.balluff.com/go/contact

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