


**Operating Instructions**  
**Single/Dual Bourdon Tube Pressure Switches Type BS/BT/BX**



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**1 Intended Applications**

The pressure switches are specifically applied for monitoring and controlling of operations using maximum and minimum pressures. A micro switch triggers an electrical signal when minimum or maximum pressure are reached.

 **DANGER**

The switch may only be used in the specified fields of application (see type label).

The temperature has to be within the specified ranges, the pressure values and the electrical rating must not exceed the values specified.

Observe also the applicable national safety instructions for assembly, commissioning and operation of the switch.

The switch is not designed to be used as the only safety relevant element in pressurized systems according to DGR 2014/68/EU.

Without special provisions/actions, pressure switches must not be used for pure hydrogen applications.

**2 Safety Instructions**


The safety instructions are intended to protect the user from dangerous situations and/or material damage.

In the operating instructions the seriousness of the potential risk is designated by the following signal words:

 **DANGER**


Refers to imminent danger to men.

Nonobservance may result in fatal injuries.

 **WARNING**


Refers to a recognizable danger.

Nonobservance may result in fatal injuries, and destroy the equipment or plant parts.


 **CAUTION**

Refers to a danger.

Nonobservance may result in light injuries and material damage to the equipment and/or to the plant.

 **IMPORTANT**

Refers to important information essential to the user.

 **Disposal**

The equipment must be disposed of correctly in accordance with the local regulations for electric/electronic equipment.

The equipment must not be disposed of with the household garbage!

**3 Standards**

The standards applied during development, manufacture and configuration are listed in the CE/UKCA conformity and manufacturer's declaration.

**4 Warranty/Guaranty**

**Warranty**

Our scope of delivery and services is governed by the legal warranties and warranty periods.

**Terms of guaranty**

We guaranty for function and material of the single- / dual- pressure switch under normal operating and maintenance conditions in accordance with the statutory provisions.

**Loss of guaranty**

The agreed guaranty period will expire in case of:

- changes or modifications to the switch/housing/fitting
- incorrect use,
- incorrect installation or
- incorrect handling or operation contrary to the provisions of these operating instructions.

No liability is assumed for any damage resulting therefrom, or any consequential damage.

## 5 Installation/Commissioning

### DANGER

Only install or uninstall the switch when deenergized (electrically and hydraulically/pneumatically).  
Pressure connection and electrical connection must be carried out by trained or instructed personnel according to state-of-the-art standards.  
The switch must only be installed in systems where the maximum pressure  $P_{max}$  is not exceeded (see type label).

### WARNING

Pressure peaks and pressure shocks exceeding the maximum operating pressure are inadmissible.  
The maximum operating pressure is the upper final value of the adjustable range or, if specified, the pressure indicated as maximum operating pressure. Exceeding the max. operating pressure affects the performance and the life span of the product and may damage it.  
Install the pressure switch as far as possible free from vibration, since otherwise the switching accuracy might be impaired.

### WARNING

Check the switch regularly for functioning.  
If the switch does not work properly, stop operation immediately!

### IMPORTANT

All pressure switches are tested for proper functioning before they leave the factory. The factory proof pressures are stated on the type label.

### IMPORTANT

Comply with the torque values provided in the pipeline construction.

Tightening torques for cable glands and plugs (which are delivered):

ST1 plug GSP313, cap nut PG 11	2,5 ... 3,75 Nm
ST1 plug GSP313, M3 screw	0,5 ... 0,6 Nm
ST3 plug, cap nut PG 11	2,5 ... 3,75 Nm
ST3 plug, mounting screws 2,9x13mm	0,4 ... 0,5 Nm
ST3 plug, mounting screw plastic	0,8 Nm
M 20 x 1,5, ½" NPT cable gland grey	4 Nm
M20 x 1,5 cable gland blue	4,5 Nm
PG 11, cable gland blue	3 Nm
¾" NPT, cable gland, PA, blue 9-16mm	4 Nm
Terminal block screws	DIN EN IEC 60947-1 (VDE 0660-100)
Enclosure cover (4x M5 x 12mm), Cover adjustment screw	2 Nm

## Contact Protection

The micro switches used are normally suitable for both direct and alternating current operation. Inductive, capacitive and lamp loads may, however, considerably reduce the life expectancy of a micro switch and, under extreme circumstances, even damage the contacts.

Depending on the application spark suppression and current limiting is recommended (see succeeding figures).

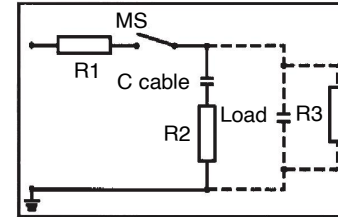


Fig. 1: Protection in case of capacitive loads  
R1: Protection against starting current rushes  
R2, R3: Protection against high discharge currents

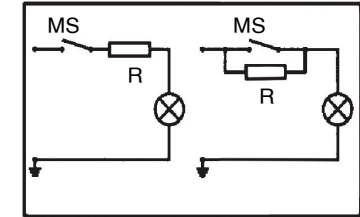


Fig. 2: Lamp load provided with resistance in parallel or series connection to switch of condensators

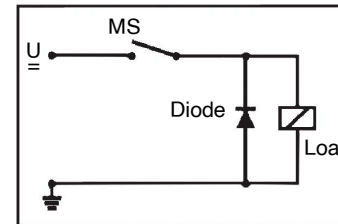


Fig. 3: Protection in case of continuous current and inductive load by recovery diode

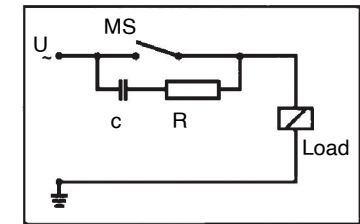


Fig. 4: Protection in case of alternating current and inductive load by RC-link


## Set point adjustment

### IMPORTANT

Factory-Provided: pressure (temperature) switch point setting  
We confirm for pressure (temperature) switches that have been factory set the setting will be detailed on the label name plate.  
Warranty is not applicable for any changes that may occur due to transportation or installation.  
For critical applications we recommend the setting is checked and re-set if necessary after installation and wiring of the pressure (temperature) switch.

In pressure switches, a displacement of the pressure sensing element occurs with a change in pressure. Following the displacement of the pressure sensing element operates a microswitch. Upon delivery of the product, the set points are likely to be found in the middle of the adjustable range. On request, fix set points may be adjusted by our factory. In this event, the point will be indicated on the type plate or any separate plate, i = increasing, d = decreasing.


The set point is adjusted by turning the adjustment screw.

 **IMPORTANT**

To reach the adjustment screw for pressure switches with housing, remove the cover.

Allow pressure switch to reach the desired switch pressure.

Turn adjustment screw clockwise or counterclockwise to actuate the micro switch.


 **IMPORTANT**

+ ↺ -

Counterclockwise rotation: set point increasing

+ ↻ -

Clockwise rotation: set point decreasing

 **IMPORTANT**


Please consult the wiring diagram for the contact status at atmospheric pressure (see Fig. 5).

**Precise adjustment of set point to actuate on increasing pressure**

- Lower system pressure to 0 bar.
- Increase pressure slowly and check if micro switch is actuated at desired switch pressure.
- If necessary, readjust by turning the adjustment screw
- Repeat preceding steps until microswitch operates at desired switch pressure.

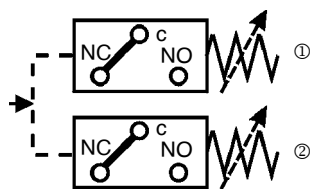
**Precise adjustment of set point to actuate on decreasing pressure**

- Increase pressure up to a point clearly above the desired switch pressure (at least, switch pressure plus max. hysteresis; not above max. operating pressure).
- Lower pressure slowly and check if micro switch is actuated at desired switch pressure.
- If necessary, readjust by turning the adjustment screw
- Repeat preceding steps until microswitch operates at desired switch pressure.
- Following the adjustment of all set points, each set point must be checked and, if necessary, be readjusted.

 **IMPORTANT**

The adjustment of several set points occurs for each set point as specified above.

**Wiring Code for all Types** (Contact status at atm. pressure)



Power circuit ①	Power circuit ②
C = purple	C = brown
NC = blue	NC = orange
NO = red	NO = black

at vacuum NC/NO vice versa

Fig. 5: Wiring Code

**Use in Hazardous Locations**

There are two housing designs for use in hazardous locations.

The BX version with an explosion-proof enclosure for **Ex d** applications.


The Bourdon tube pressure switches with T and X housing are approved for use in intrinsically safe circuits as **Ex ia**. The intrinsically safe units marked as **Ex i** must be operated with a certified switch amplifier (see Fig. 6).

The B1S/B2S pressure switch has none of the aforementioned ATEX/IECEx approvals.

BX pressure switches with explosion-proof enclosures are designed and certified to be used according to UL, CSA, Nema 4, 7, 9 or ATEX/IECEx regulations.

The wiring between switch and **Ex i** isolation amplifier must meet the local safety requirements.

The customer must provide for a highly conductive connection between switch and grounding.

 **WARNING**

With option Ex i: The models having light-alloy (aluminium) enclosures or enclosure parts must be protected against all impact or friction which can ignite the explosive atmosphere.

**Unprotected area**

**Ex ia area**



Zener barrier type  
Switch amplifier NAMUR

Fig. 6: Operation of pressure switches in intrinsically safe areas

## 6 Maintenance/Cleaning

### Maintenance

The pressure switch is maintenance free. Checking the set points lies within the discretion of the user. The usual preventive maintenance work in accordance with the PED and ATEX/IECEX guidelines must always be carried out.

Please note that small setpoint drifts may occur during the initial use of the switch (run-in period). To minimize the setpoint drift we can perform a run-in (ageing) process in our works on request. Larger or continuing setpoint drifts during the normal use of the switch may indicate that the measuring system is not used correctly within the specified limits, exceeding the design criteria or is worn-out. This might lead to metal fatigue of the measuring system and it therefore should be replaced before an ultimate rupture of the metal diaphragm might take place. Please consult your supplier or Barksdale directly for guidelines.

## 7 Technical Data

See data sheet

Dimensions in mm (inch)

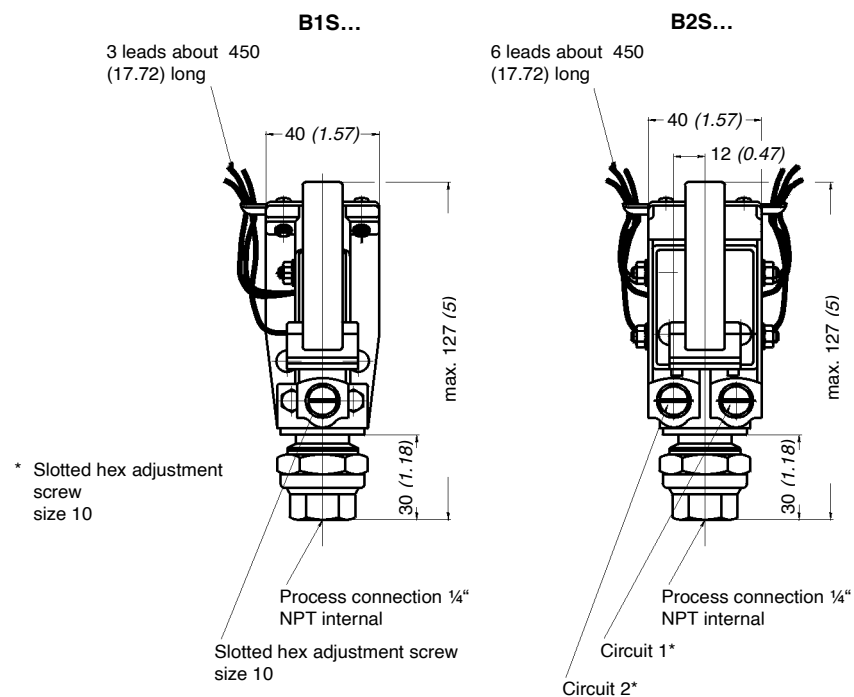


Fig. 7: Bourdon tube pressure switch type B1S.../B2S...

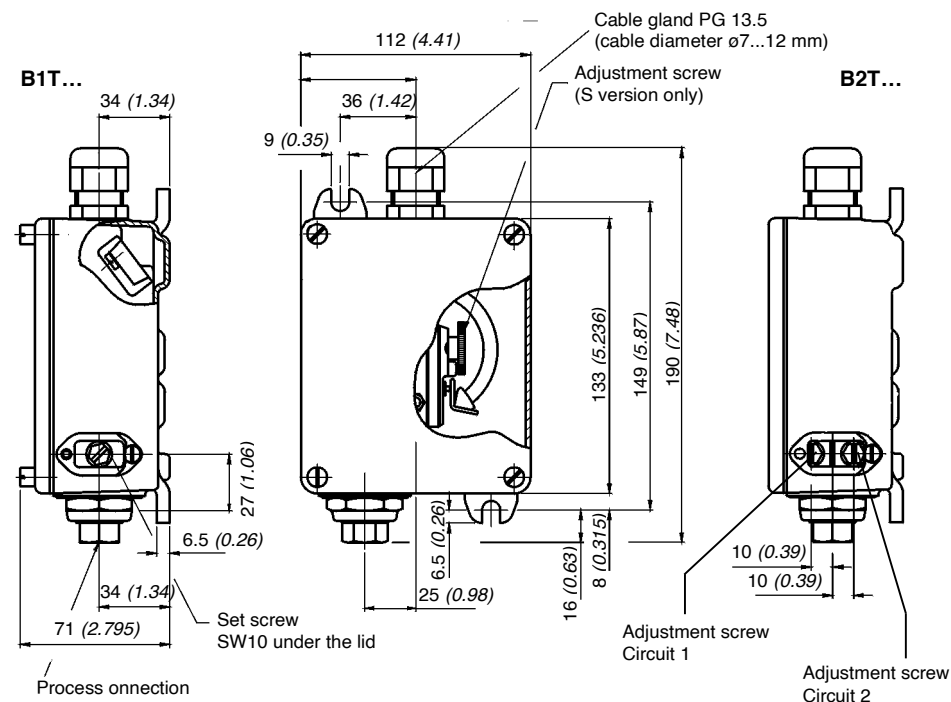


Fig. 8: Bourdon tube pressure switch type B1T.../B2T...

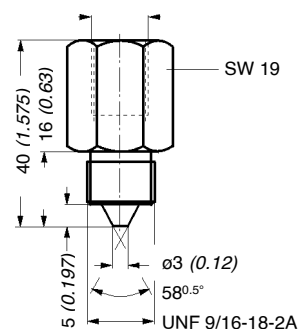


Fig. 9: Adapter, adjustable ranges\*) see section Adjustable Ranges Pressure Switch Type B1S.../B2S... and Type B1T.../B2T... and Adjustable Ranges Pressure Switch Type B1X.../B2X...

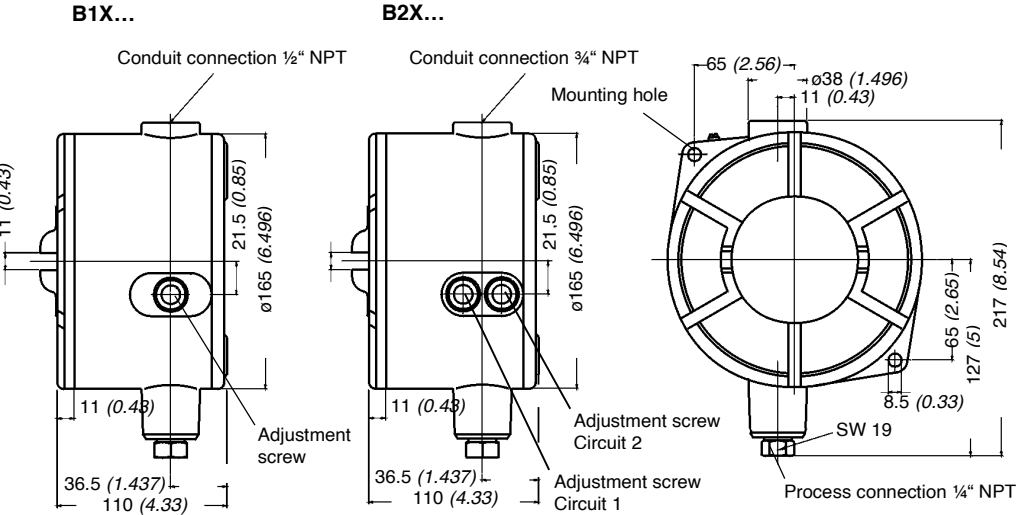


Fig. 10: Bourdon tube pressure switch type B1X .../B2X ...

Adjustable Ranges Pressure Switch Type B1S.../B2S... and Type B1T.../B2T...


Pressure range code	Adjustable range [bar]		Max. operating pressure [bar]		Proof press. [bar] (short term)		Max. hysteresis of switch types (end of range)	
	Increasing pressure	Decreasing pressure	B.T	B.S	B.T	B.S	H, GH [bar]	M, GM [bar]
Overpressure								
12SS	4.8 ...82	3.4 ...81	100	90	124	103	0,96	1,86
32SS	13.7 ...220	11.0 ...217	250	250	330	276	2,68	5,44
48SS	22.4 ...330	16.5 ...325	400	370	497	414	2,75	5,90
65SS*	30.3 ...448	22.5 ...440	550	500	672	560	3,58	7,92
120SS*	79.3 ...827	41.4 ...790	900	850	1241	1035	16,90	37,90
180SS*	79.3 ...950	41.4 ...950	999	999	1655	1380	16,90	37,90

Adjustable Ranges Pressure Switch Type B1X.../B2X...

Pressure range code	Adjustable range [bar]		Max. operating pressure [bar]	Proof pressure [bar]	Max. hysteresis of switch types (end of range)	
	Increasing pressure	Decreasing pressure			H, GH [bar] (short term)	M, GM [bar]
Overpressure						
12SS	5.3 ...83	3.4 ...81	100	125	0,96	1,86
20SS	13.7 ...137	11.0 ...134	250	330	2,68	5,44
32SS	22.4 ...220	16.5 ...215	400	500	2,75	5,90
72SS*	79.3 ...496	41.4 ...459	600	950	16,90	37,90

Electrical Ratings


Micro switch	Special Characteristics	Volt AC 50/60 Hz	Ind. Load A	Res. Load A	Volt DC	Ind. Load A	Res. Load A	Notes
H	Microswitch with silver contacts	125 250 480	10 10 3	10 10 3	6 to 24	0.50	0.5	Small hysteresis; high AC / low DC loads
M	Microswitch with silver contacts	125 250 480	10 10 3	10 10 3	12 24 250	5.00 1.00 0.25	15.0 2.0 0.4	Medium hysteresis; high AC and DC loads
GH	Microswitch with gold plated contacts for low voltage and low current	125	1	1	24	1,00	1,00	low change-back values
GM		30	0.1	0.1	30	0,10	0,10	Medium hysteresis

 **IMPORTANT**

We recommend to use a prefuse of the maximum current rating from the table above according to the load switched.

We recommend gold plated contacts for all intrinsically safe and other applications with low voltage/power.

#### Approval data for Ex i switches (B1T, B2T and B1X, B2X)

Approval:	 II 1 G Ex ia IIC T6 Ga II 1 D Ex ia IIIC T <sub>200</sub> 100°C Da
Certificate no.:	TÜV 22 ATEX 322922 X, IECEx TUN 22.0011X
Permissible ambient temperature:	-40 °C ≤ T <sub>a</sub> ≤ +75 °C
Electrical data for intrinsically safe application:	U <sub>i</sub> = 28 V I <sub>i</sub> = 50 mA P <sub>i</sub> = 0,84 W C <sub>i</sub> , L <sub>i</sub> , negligibly small
Standards applied:	EN IEC 60079-0:2018/AC:2020-02, EN 60079-11:2012, IEC 60079-0:2017, IEC 60079-11:2011

#### Approval data for Ex i switches B1T with connector ST1, and B2T with connectors ST1, ST3

Approval:	 II 1 G Ex ia IIB T6 Ga II 1 D Ex ia IIIC T <sub>200</sub> 100°C Da
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#### CAUTION

##### Special conditions for use:


1. The size of the nameplate exceeds the permissible area and can therefore be electrostatically charged:  
For IIC Ga uses the pressure switches have to be installed and used in such a way, that electrostatic charging from operation, maintenance and cleaning is excluded.  
For the use in explosive dust atmospheres process-related electrostatic charges, e.g. due to passing media have to be excluded.
2. All metallic parts of the devices have to be included in the local potential equalization.
3. The intrinsically safe circuit of the device is connected to the earth potential, therefore potential equalization has to exist in the entire area of the installation of the intrinsically safe circuit.
4. The housings of the devices consist of more than 10% aluminum, therefore in EPL Ga applications the installation has to be carried out in such a way, that ignition hazard due to impact or friction can be excluded.




#### CAUTION

No inadmissible heating can be expected that affect the maximum surface temperature. The maximum surface temperature lies only a small amount above the permissible ambient temperature during operation.

#### Approval data for Ex d switches (BX)

Approval:	 II 2 G Ex db IIC T6 Gb II 2 D Ex tb IIIC T80°C Db IP66
Permissible ambient temperature:	-40 °C ≤ T <sub>a</sub> ≤ +75 °C

#### Approval data for Ex d switches (BX-option "LT")

Approval:	 II 2 G Ex db IIC T5 Gb II 2 D Ex tb IIIC T95°C Db IP66
Certificate no.:	ISSeP08ATEX024X/3
Permissible ambient temperature:	-60 °C ≤ T <sub>a</sub> ≤ +85 °C
Standards applied:	EN 60079-0:2012+A11:2013 EN 60079-1 : 2014 EN 60079-31 : 2014

#### Operating life time

Normal expected service life (expressed in the number of cycles over the full adjustment range) is appr. 1 million for the pressure switch. This may be extended to 2.5 million cycles max. if only a part of the adjustment range is used (about 20%).  
Switch sensor life may also be effected negatively by:

- Media not compatible with the wetted materials.
- Too high switch cycling speed or more than 20 cycles per minute.
- System cycling pressure exceeding the top of the adjustable range.

The proof pressure must never be exceeded to avoid permanent sensor damage. Matching the working range of the switch to the application is also a key for optimal switch performance. For greatest accuracy the set point should fall in the upper 70% of the adjustable range. For most favourable life the set point should be in the lower 30% of the adjustable range. Therefore, the most favourable combination of accuracy and life factor lies between 30% and 70% of the adjustable range.



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