



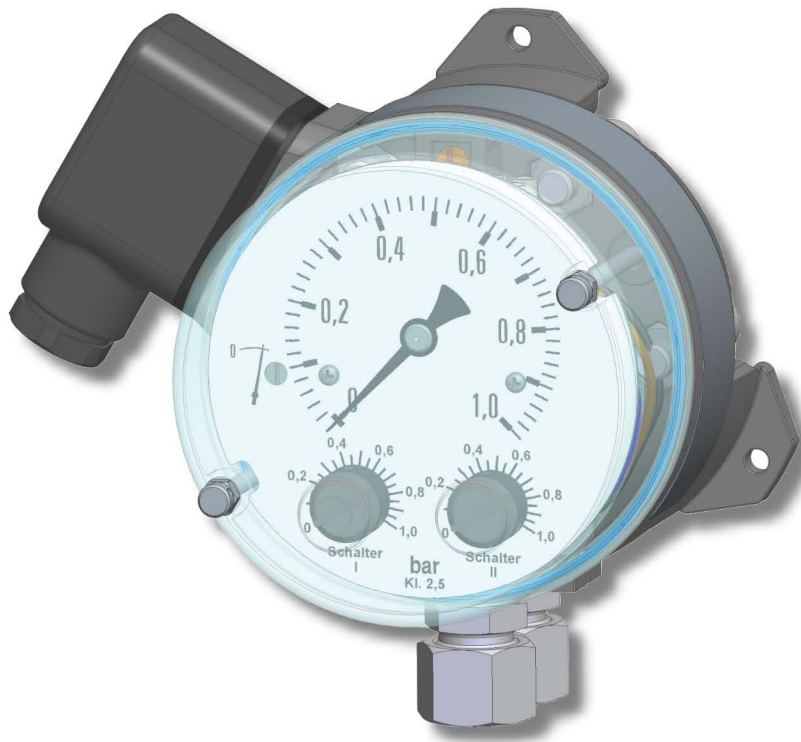
DIN EN 61508  
**SIL2**



DIN 32727



**RoHS II**  
COMPLIANT ✓



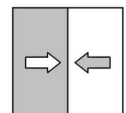
# Operating Manual

## DS21

Differential pressure measuring and switching device

Flow guard in heat transfer oil systems in compliance with DIN 32727 and hot water systems according to VdTÜV Information sheet "Flow 100"

BA\_EN\_DS21\_09/14





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# 1 Safety notes

## 1.1 General

### **WARNING**

This operating manual contains instructions fundamental to the installation, operation and maintenance of the device that must be observed unconditionally. It must be read by the assembler, operator and the specialized personnel in charge of the instrument before it is installed and put into operation.

This operating manual is an integral part of the product and therefore needs to be kept close to the instrument in a place that is accessible at all times to the responsible personnel.

The following sections, in particular instructions about the assembly, commissioning and maintenance, contain important information, non-observance of which could pose a threat to humans, animals, the environment and property.

The instrument described in these operating instructions is designed and manufactured in line with the state of the art and good engineering practice.

## 1.2 Personnel Qualification

The instrument may only be installed and commissioned by specialized personnel familiar with the installation, commissioning and operation of this product.

Specialized personnel are persons who can assess the work they have been assigned and recognize potential dangers by virtue of their specialized training, their skills and experience and their knowledge of the pertinent standards.

## 1.3 Risks due to Non-Observance of Safety Instructions

Non-observance of these safety instructions, the intended use of the device or the limit values given in the technical specifications can be hazardous or cause harm to persons, the environment or the plant itself.

The supplier of the equipment will not be liable for damage claims if this should happen.

## 1.4 Safety Instructions for the Operating Company and the Operator

The safety instructions governing correct operation of the instrument must be observed. The operating company must make them available to the installation, maintenance, inspection and operating personnel.

Dangers arising from electrical components, energy discharged by the medium, escaping medium and incorrect installation of the device must be eliminated. See the information in the applicable national and international regulations.

Please observe the information about certification and approvals in the Technical Data section.

## 1.5 Unauthorised Modification

Modifications of or other technical alterations to the instrument by the customer are not permitted. This also applies to replacement parts. Only the manufacturer is authorised to make any modifications or changes.

## 1.6 Inadmissible Modes of Operation

The operational safety of this instrument can only be guaranteed if it is used as intended. The instrument model must be suitable for the medium used in the system. The limit values given in the technical data may not be exceeded.

The manufacturer is not liable for damage resulting from improper or incorrect use.

### 1.7 Safe working practices for maintenance and installation work

The safety instructions given in this operating manual, any nationally applicable regulations on accident prevention and any of the operating company's internal work, operating and safety guidelines must be observed.

The operating company is responsible for ensuring that all required maintenance, inspection and installation work is carried out by qualified specialized personnel.

### 1.8 Pictogram explanation

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#### DANGER

##### Type and source of danger

This indicates a **direct** dangerous situation that could lead to death or **serious injury** (highest danger level).

a) Avoid danger by observing the valid safety regulations.

---

#### WARNING

##### Type and source of danger

This indicates a **potentially** dangerous situation that could lead to death or **serious injury** (medium danger level).

a) Avoid danger by observing the valid safety regulations.

---

#### CAUTION

##### Type and source of danger

This indicates a **potentially** dangerous situation that could lead to slight or serious injury, damage or **environmental pollution** (low danger level).

a) Avoid danger by observing the valid safety regulations.

---

#### NOTICE

##### Note / advice

This indicates useful information of advice for efficient and smooth operation.

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## 2 Product and functional description

### 2.1 Use as intended

The unit is exclusively designed for the purpose defined by the manufacturer in the data sheet or operating instructions.

#### Differential pressure measuring and switching device

The DS21 is a measuring and switch unit for measuring differential pressure under difficult measuring conditions such as: pressure surges, vibrations, frequent switching and high demands on the switching output. Please contact the manufacturer before using this unit with dirty or aggressive media because the unit needs to be adapted in terms of the parts that come into contact with the media.

#### Flow assurance

The units in this series are used as flow guards in heat transfer oil systems in compliance with DIN 32727 [▶ 31] and hot water systems in compliance with VdTÜV information sheet 'Flow 100'. The flow guards comprise a differential pressure transducer, e.g. a measuring orifice, the differential pressure measuring and switch unit and shut-off fittings. The respective installation instructions must be observed for this application case. All units of the series DS21 satisfy these requirements.

### NOTICE

The type tests in compliance with DIN 32 727 and VdTÜV Information sheet "Flow 100" only apply in conjunction with a differential pressure transducer, not for a differential pressure measuring and switching device alone.

The successful type test of the series DS21 was confirmed by means of the following test symbols:

- for flow guards in compliance with DIN 32 727 :  
DIN CERTCO registration number 1B012/07
- according to VdTÜV Information sheet "Flow 100" :  
Part code TÜV . SW/SB . 07 – 020

### 2.2 Equipment versions

The DS21 can be supplied with the following different pressure chambers:

- Aluminium
- Stainless steel 1.4305

The aluminium pressure chambers can also be supplied with a HART COAT® coating. The following shows the various unit versions. On the left-hand side are casings with hoods (IP 55) and on the right-hand side casings with bayonet rings (IP 65).

### NOTICE

#### Installation of front panel

Please note that the switch points of devices with bayonet rings need to be set before mounting the front control panel. When installed, the unit can no longer be opened.

Please see the order code [▶ 25] for the process connection options.

### 2.2.1 Pressure chamber in aluminium

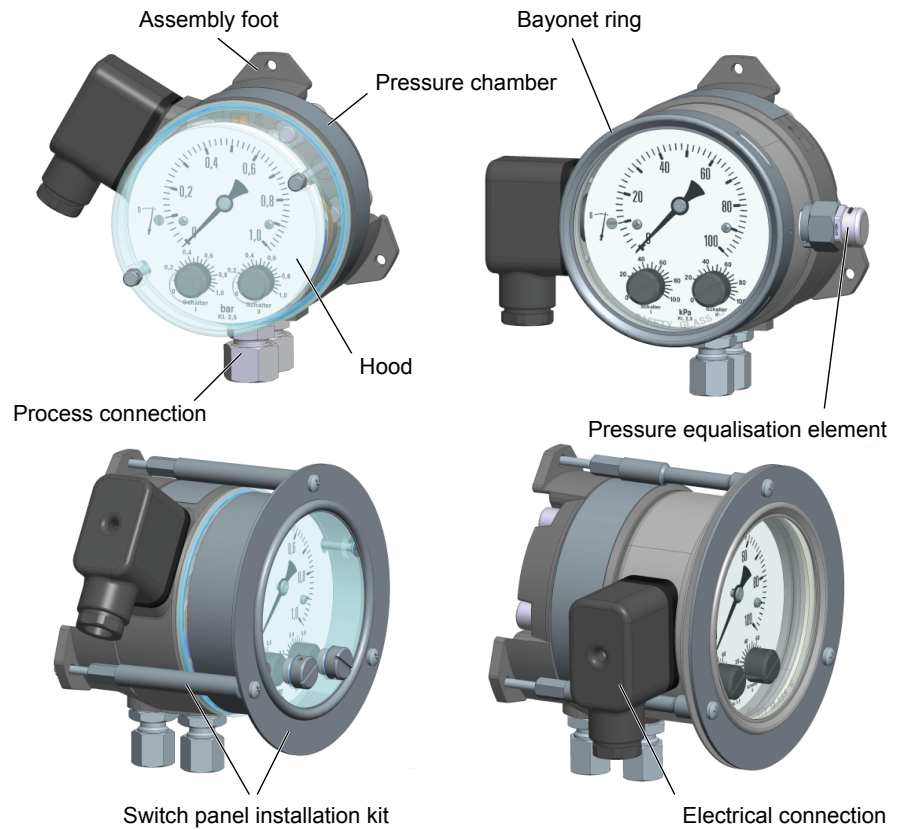


Illustration 1: DS21\_Pressure chamber in aluminium [Standard]

### 2.2.2 Pressure chamber in stainless steel

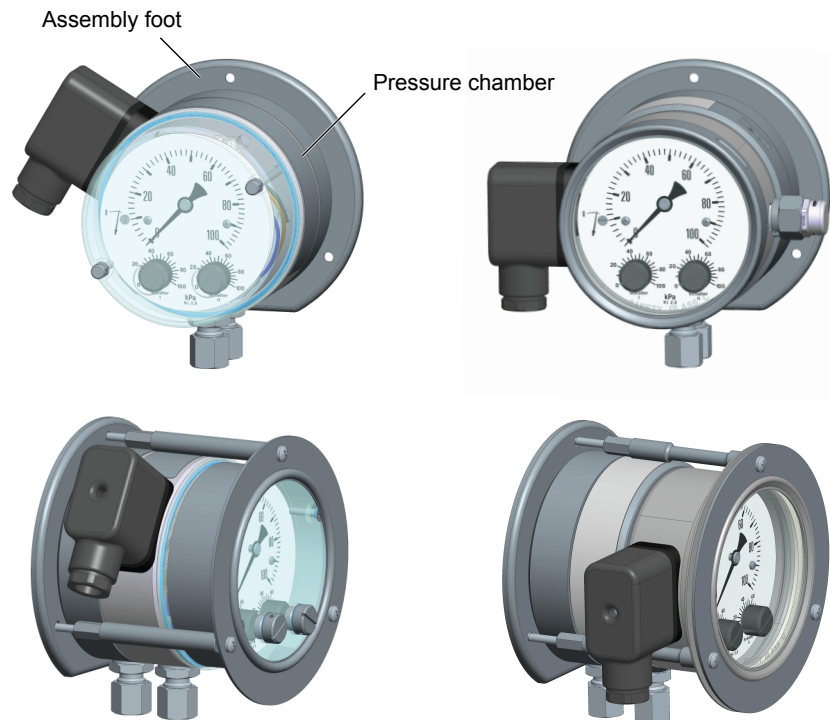


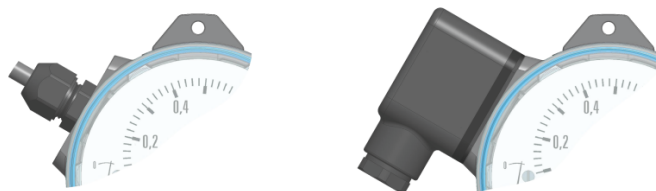
Illustration 2: DS21\_Pressure chamber in stainless steel [Standard]



### 2.2.3 Electro connection variants

All pressure chamber types are available optionally with a permanently wired number cable, a cable connection socket or a cable connector. The cable connector has the same dimensions as the cable socket.

GL models are an exception. These are only supplied with a cable socket including a 3 m long connection cable. The associated wiring diagrams are shown on the type plate and in the section 'Installation and assembly'.



Numbered cables

Cable connection socket

Illustration 3: DS21\_EL-connection variants [Standard]

### 2.3 Function diagram

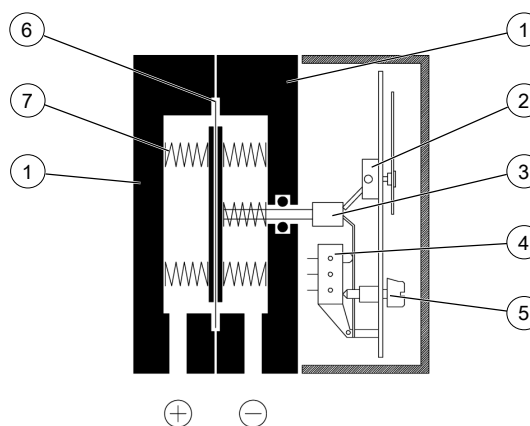


Illustration 4: DS21 Function diagram [Standard]

1	Pressure chamber	2	Motion train
3	Tappet	4	Micro-switch
5	Switch point setting	6	Measuring diaphragm
7	Measuring springs		

### 2.4 Design and mode of operation

The basis for this measurement and switch unit is a sturdy non-sensitive diaphragm measuring unit that is suitable for measuring differential pressure, and over and under-pressure. The unit uses the same measuring principle for all three measuring applications.

In the idle position, the spring forces are equalised on both sides of the measuring diaphragm. The pressure that is to be measured or the differential pressure creates a one-sided force on the measuring diaphragm that moves the diaphragm system against the measuring range springs until the spring forces are equalised. In the case of overload, the measuring diaphragm is supported by metallic contact surfaces.

A central tappet transfers the movement of the diaphragm system onto the display mechanism and, at the same time, onto the actuation elements of the micro-switches. The switch points are set via the setting screws and referenc value scale.

## 3 Installation and assembly

### 3.1 General

The instrument may only be installed and commissioned by specialized personnel familiar with the installation, commissioning and operation of this product.

Specialized personnel are persons who can assess the work they have been assigned and recognize potential dangers by virtue of their specialized training, their skills and experience and their knowledge of the pertinent standards.

### 3.2 Assembly

The standard unit is designed for wall mounting. In the case of units with an aluminium pressure chamber, there are three mounting feet. Units with stainless steel pressure chambers are mounted using the rear attachment plate that also acts as a mounting foot.

A control panel installation set can be ordered for each unit that allowed installation on the front of the unit.

The unit is set for vertical installation ex-works. Only this installation position is allowed. To ensure safety during installation and maintenance, we recommend installing a suitable shut-off valve on the system.

### 3.3 Process connection

- By authorized and qualified specialized personnel only.
- The pipes need to be depressurized when the instrument is being connected.
- Appropriate steps must be taken to protect the device from pressure surges.
- Check that the device is suitable for the medium being measured.
- Maximum pressures must be observed (cf. Tech. data)

The differential pressure connections are marked with (+) and (-) symbols on the device. The differential pressure connection lines must be mounted according to these symbols.

- (+) Higher pressure
- (-) Lower pressure

The differential pressure lines must be installed at an inclination so that when fluids are measured no air pockets are created or when measuring gases, no water pockets are created. If the required inclination is not reached, water or air filters must be installed at suitable places.

The differential pressure lines must be kept as short as possible and installed without any tight bends to avoid delays.

In the case of fluid measuring media, the differential pressure lines must be vented because different fluid columns in the lines will distort the measurements.

If water is used as a measuring medium, the unit must be protected against frost.

#### 3.3.1 Installation regulations for flow guards in heat transfer units in compliance with DIN 4754

In the case of differential pressure transducers in compliance with DIN 1952/VDI 2041, the measurement must be set up in compliance with VDE/VDI 3512, sheet 1.

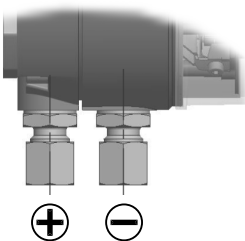


Illustration 5: Differential pressure connection

Shut-off valves in differential pressure lines may only be activated with tools. Threaded screw connections in these lines must be designed so that they remain tight without any sealing agent, or the connection must be welded or hard-soldered.

The clear diameter and length of differential pressure lines must be dimensioned so that when the line is cold (approx. 20 °C), the response time of the unit is no longer than 5 sec.

Differential pressure lines must be made of metal. Their clear width may not undercut 4 mm and the stretched length must be at least 500 mm. If arranged with block valves, the differential pressure line between the valve block and differential pressure transducer must be at least 500 mm.

Locking and unlocking conditions must be ensured during installation via the following electrical lines.

### 3.3.2 Installation regulations for flow limiters in steam boilers and hot water systems

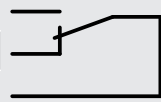
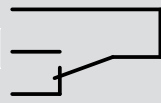
Differential pressure transducers in compliance with DIN 1952/VDI 3212, sheet 1, Itaba or Annubar probes must be used as measuring elements. If a differential pressure transducers in compliance with DIN 1952/VDI 2041 is used, the measurement must be set up in compliance with VDE/VDI 3212, sheet 1

It must be possible to block the differential pressure lines with a 5x valve block in front of the differential pressure unit and must be designed to allow blow-out. Shut-off valves in differential pressure lines may only be activated with tools. Threaded screw connections in these lines must be designed so that they remain tight without any sealing agent, or the connection must be welded or hard-soldered.

The differential pressure lines must be made of metal and have a clear width of at least 8 mm. The stretched length of the differential pressure lines must be at least 500 mm.

### 3.4 Electrical connections

- By authorized and qualified specialized personnel only.
- When connecting the unit, the national and international electro-technical regulations must be observed.
- Disconnect the system from the mains, before electrically connecting the device.
- Install the consumer-adapted fuses.

No	Contact	Switch	
1	Make contact	NO	
2	Break contact	NC	
3	Joint	COM	
4	Joint	COM	
5	Make contact	NO	
6	Break contact	NC	
⊕	Ground connection		

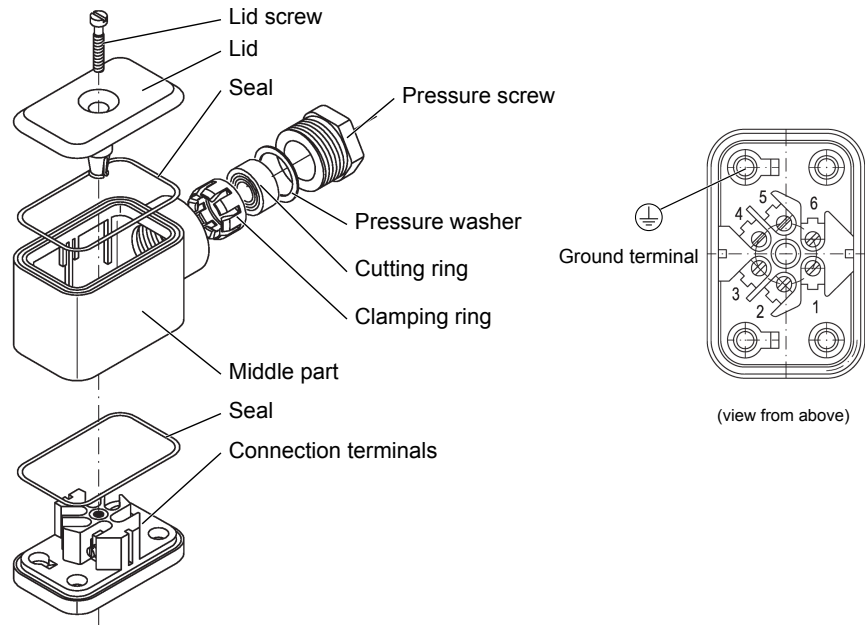


Illustration 6: Cable socket

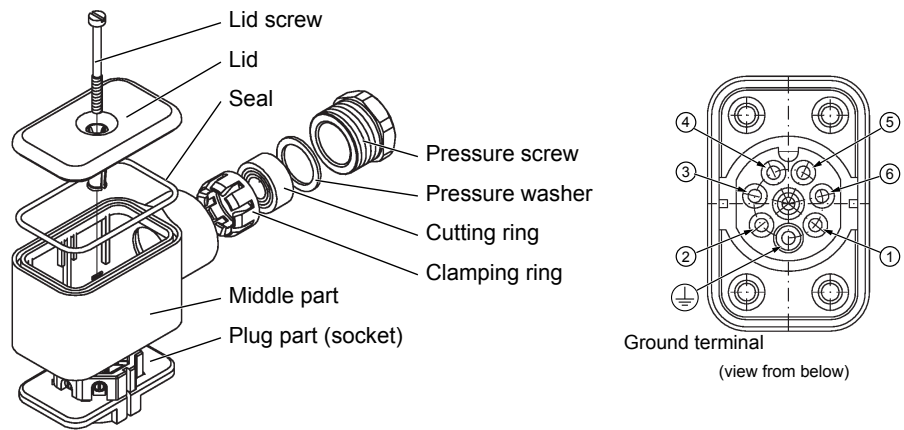


Illustration 7: Cable plug

For models with numbered cables, the cable numbers correspond with the presented terminal numbers.

**GL version**

In models with one switch, a cable **(0.6/1KV 4Gx1.5)** with the following color code is connected:

Ter- minal	Wire ID
1	grey
2	brown
3	black
⊕	green/yellow

In models with two switches, a cable **(0.6/1KV 7Gx1.5)** with numbers for identifying the wires must be connected. The numbers of the cable correspond to the terminal numbers of the cable socket.

## 4 Commissioning

### 4.1 General

The instrument may only be installed and commissioned by specialized personnel familiar with the installation, commissioning and operation of this product.

Specialized personnel are persons who can assess the work they have been assigned and recognize potential dangers by virtue of their specialized training, their skills and experience and their knowledge of the pertinent standards.

A prerequisite for commissioning is correct installation of all electrical supply lines and the differential pressure lines. All connections are arranged so that there are no mechanical forces acting on the device.

### **CAUTION**

#### Leak test

The differential pressure lines need to be checked for leaks before commissioning.

### 4.2 Display and control elements

The illustration shows an example because the measurement scale and therefore also the reference value scale depend on the respective measuring range. The position and form of the control elements are at least similar to the illustration.

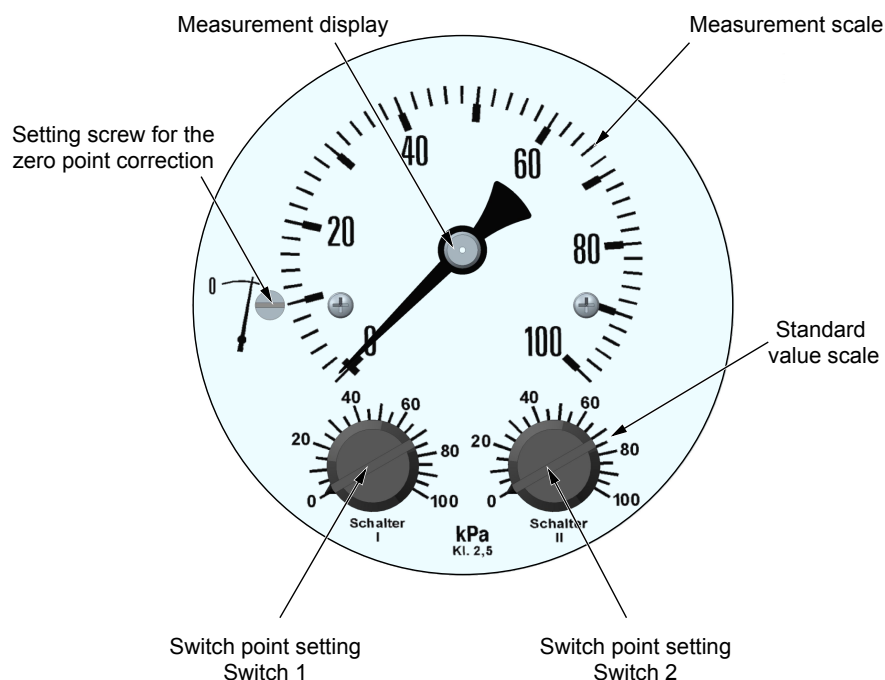


Illustration 8: Control elements [DS21]

### 4.3 Lead seal

It is possible to secure the unit against removal and adjustment of the switch points by means of a lead seal. This seal may not be removed. The device can be sealed on site or ex-works. In the latter case, the device is supplied with a pre-setting. After this, it is no longer possible to adjust the switch point setting or correct the zero-point.

#### 4.4 Zero point correction

1. Load the pressure chamber with the existing static system pressure.
2. Open the unit either by removing the hood or the bayonet ring and the front disk. Use a wrench to mount or remove the bayonet ring to prevent damage to the casing.
3. Set the measurement display with the setting screw for correcting the zero-point to the zero-point of the measurement scale.
4. Close the unit.

#### 4.5 Switch point setting

1. Open the unit either by removing the hood or the bayonet ring and the front disk. Use a wrench to mount or remove the bayonet ring to prevent damage to the casing.
2. Use a screwdriver to set the required switch points in compliance with the markings on the standard value scale.
3. Close the unit.

### NOTICE

#### Setting accuracy

The achievable setting accuracy with the standard value scale is  $\pm 5\%$ .

A higher level of precision can only be achieved using suitable units such as test manometers, ohmmeters etc. Optionally, these devices can be pre-installed ex-works.

#### 4.6 Function test

Open the unit either by removing the hood or the bayonet ring and the front disk.

If the unit has two switch points, the stated test steps must be carried out for both switches.

After the test, the switch points need to be reset (see above).

### NOTICE

#### Lead seal

It is possible to secure the bayonet ring or the hood against removal by means of a lead seal. This seal may not be removed. A function test can only be carried out in this case by changing the operating pressure (see below).

##### 4.6.1 Checking the switch points in a depressurized state

No measurement is shown and the measurement display point to zero.

Turn the switch point setting button toward the zero-point until the micro-switch is activated.

##### 4.6.2 Checking the switch points when the system is operational

A measurement is shown. If despite operational pressure, no measurement is shown, you can generate a differential pressure by blocking the differential pressure line on one side.

Turn the switch point setting button toward the measurement until the micro-switch is activated.

##### 4.6.3 Checking the switch points by changing the operational pressure

If the unit is sealed or the switch point setting cannot be changed for any other reason, you can carry out a function test by changing the operational pressure. Set the differential pressure so that the micro-switch(es) are activated.

## 5 Maintenance

### 5.1 Wartung (maintenance)

The unit is maintenance-free apart from regular cleaning of the surface of the casing.

#### WARNING

##### Dust deposits

The casing of the unit must be cleaned regularly with a damp cloth to prevent heat accumulation, as this can lead to the surface overstepping the maximum allowed temperature (T70 °C). The cleaning frequency depends on the amount of dust in the location.

To ensure reliable operation and a long service life, we recommend carrying out the following test on a regular basis:

- Check the reading.
- Checking the switch function in connection with the downstream components.
- Checking the differential pressure lines for leaks.
- Checking the electrical connections (terminal connection of the cable).

The precise test cycles and operating and ambient conditions need to be adjusted. If several components of the unit interact, all operating instructions of the other units also need to be observed.

### 5.2 Transport

The measuring device must be protected against impacts. It should be transported in the original packaging or a suitable transport container.

### 5.3 Service

All defective or faulty devices should be sent directly to our repair department. Please coordinate all shipments with our sales department.

#### WARNING

##### Process media residues

Process media residues in and on dismantled devices can be a hazard to people, animals and the environment. Take adequate preventive measures. If required, the devices must be cleaned thoroughly.

Return the device in the original packaging or a suitable transport container.

### 5.4 Accessories

##### Recommended shut-off fitting

- DZ23 Three-spindle equalisation and shut-off valve  
Art.No. DZ2300H ###  
For casing material and pressure connection, see data sheet
- DZ23 Four-spindle equalisation and shut-off valve with venting valve  
Art.No. DZ2400H ###  
For casing material and pressure connection, see data sheet

## 5.5 Disposal

 **WARNING**

Incorrect disposal may pose a risk to the environment.

Please help to protect the environment by always disposing of the work pieces and packaging materials in compliance with the valid national waste and recycling guidelines or reuse them.



## 6 Technical data

Please also observe the order code here.

### 6.1 Input variables

**Measuring variable**

Differential, over and under-pressure for gaseous and fluid media.

**Measurement range**

Measurement range	Allowed static operating pressure
0 ... 250 mbar	6 bar
0 ... 400 mbar	6 bar
0 ... 0.6 bar	10 bar
0 ... 1 bar	16 bar
0...1.6 bar	16 bar
0...2.5 bar	16 bar
0 ... 4 bar	16 bar
0 ... 6 bar	16 bar

**Rated pressure of the measuring system**

25 bar

**Max. pressure load**

Over-pressure-proof on one side up to rated pressure of the measuring system, (+) and (-) sides, under-pressure-proof

### 6.2 Output parameters

**Switching outputs**

1 or 2 micro-switches with 1-pin changeover contact.

**Switch point setting**

After opening the casing using the setting screw and reference value scale. Smallest settable value approx. 5% of the end value of the measuring range.

**Reproducibility**

The reproducibility of the switch-point setting corresponds to the measuring precision.

**Switch hysteresis**

approx. 2.5% of the upper range value

**Load data/contact**

		AC	DC
Max. switching voltage	$U_{\max}$	250V	30V
Max. switching current	$I_{\max}$	5A	0.4A
max. switching output	$P_{\max}$	250 VA	10 W

### 6.3 Measured Value Display

**Anzeige**

Indicator with measurement scale

**Measurement accuracy**

$\pm 2.5\%$  of the upper range value

### 6.4 Electrical connection

- Cable socket  
screw terminal up to 1.5 mm<sup>2</sup> with wire protection  
Contact material Ms gold-flashed  
Cable screw connection M20 x 1.5
- Cable connector  
screw terminal up to 1.5 mm<sup>2</sup> with wire protection  
Contact material Ms nickel-plated  
Cable screw connection M20 x 1.5
- Number cable  
4 x 0.75 mm<sup>2</sup> YSLY-JZ  
strand end with clip, wire ID 1,2,3, gn/ge

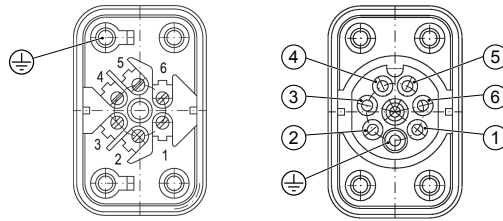


Illustration 9: Cable socket / cable plug

No	Contact	Switch
1	Make contact	NO
2	Break contact	NC
3	Joint	COM
4	Joint	COM
5	Make contact	NO
6	Break contact	NC
⊥	Ground connection	

**GL version**

In models with one switch, a cable (**0.6/1KV 4Gx1.5**) with the following color code is connected:

Ter- minal	Wire ID
1	grey
2	brown
3	black
⊥	green/yellow

In models with two switches, a cable (**0.6/1KV 7Gx1.5**) with numbers for identifying the wires must be connected. The numbers of the cable correspond to the terminal numbers of the cable socket.

**6.5 Application conditions**

**Ambient conditions**

Allowed ambient temperatures	-10 °C ... +70 °C
Allowed temperature of the medium in the device	-10 °C ... +70 °C
Enclosure protection class (depending on model)	IP 55 or IP 65 in compliance with DIN EN 60529

**EC Declaration of conformity**

Low-Voltage Directive	2006/95/EC
Pressurised Vessel Directive	97/23/EC
RoHS Directive	2011/65/EU

<b>Certificates</b>	Type testing (Module B)	No. 07 202 1081 Z 9142/13/H
	Quality assurance system (Module D)	No. 07 202 1042 Z 0626/2H
	EAC Declaration	No TC RU д-DE.AB71.B.09656
	Manufacturer's declaration DIN CERTCO	DIN 32727:1981-02 TÜV NORD SSW 7002/07
	VdTÜV	Data sheet flow 100 TÜV SW/SB 07-020
	DNV GL	No. 93 823 – 88 HH
	SIL 2	No. 44 799 13759902

## 6.6 Construction design

<b>Process connection</b>	Inner thread G $\frac{1}{4}$ Cutting ring screw connection in steel for 6, 8, 10, 12 mm pipe Cutting ring screw connection in stainless steel 1.4571 for 6, 8, 10, 12 mm pipe
<b>Measuring system</b>	Pressure spring measuring diaphragm system
<b>Weight</b>	Pressure chamber in aluminium: approx. 1.2 kg Pressure chamber in CrNi steel: approx. 3.5 kg

### 6.6.1 Materials

<b>Pressure chamber</b>	Aluminium Gk-ALSi10Mg, painted black Aluminium Gk-ALSi10MG with HART-COAT® Surface protection CrNi steel 1.4305
<b>Measuring diaphragm</b>	Fabric-reinforced VITON®
<b>Gaskets</b>	VITON®
<b>Inner parts in contact with the medium</b>	CrNi-steel 1.4310, 1.4305
<b>Hood</b>	Polycarbonate (PC) Makrolon®
<b>Bayonet ring</b>	CrNi-Steel 1.4305
<b>Front pane</b>	Safety laminated glass

### 6.6.2 Assembly

Wall mounting  
Mounting the control panel

### 6.7 Dimensional drawings

(All dimensions in mm unless otherwise stated)

#### 6.7.1 Pressure chamber in aluminium

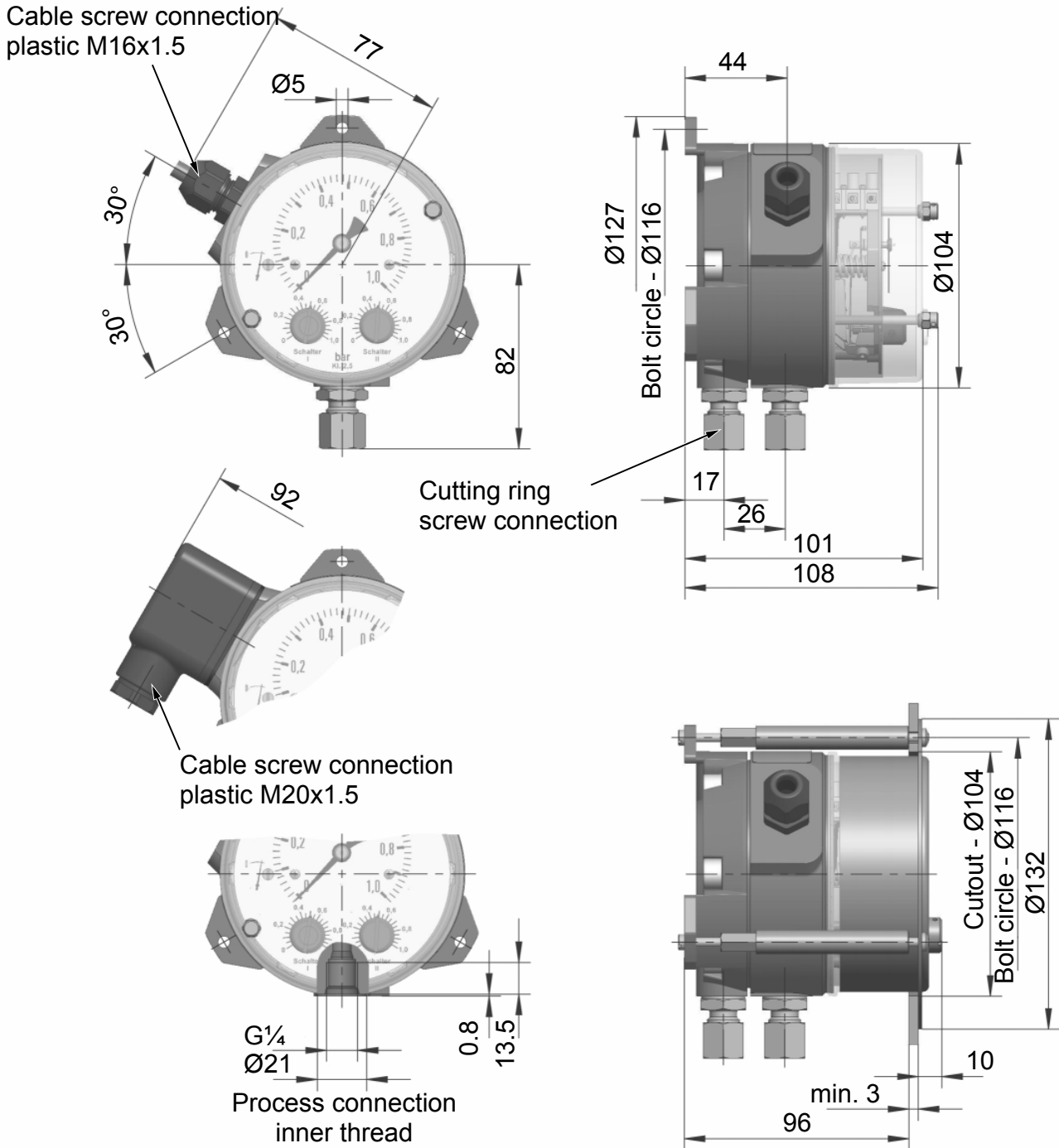


Illustration 10: Pressure chamber in aluminium (IP55)

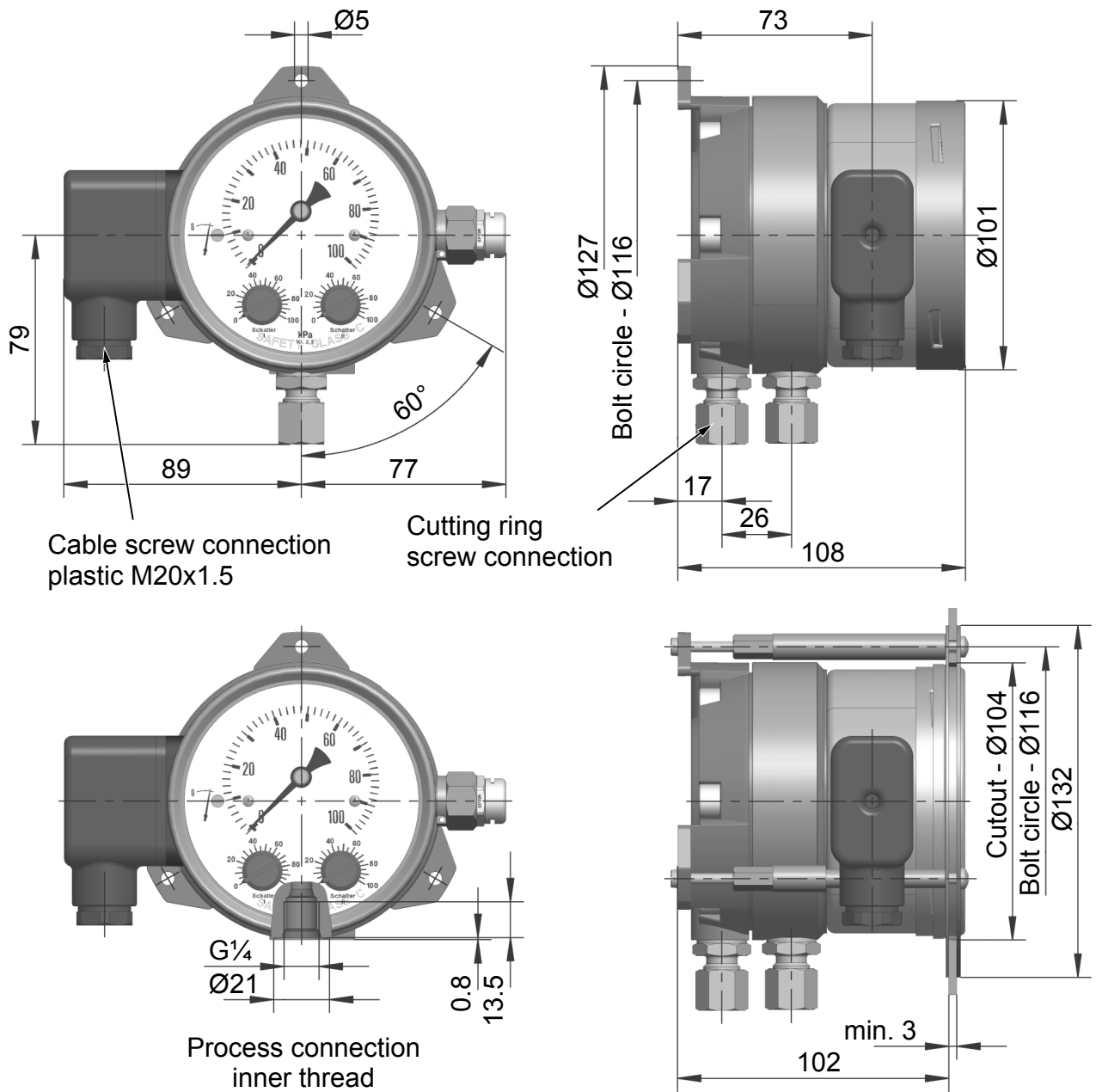


Illustration 11: Pressure chamber in aluminium (IP65)

### 6.7.2 Pressure chamber in stainless steel

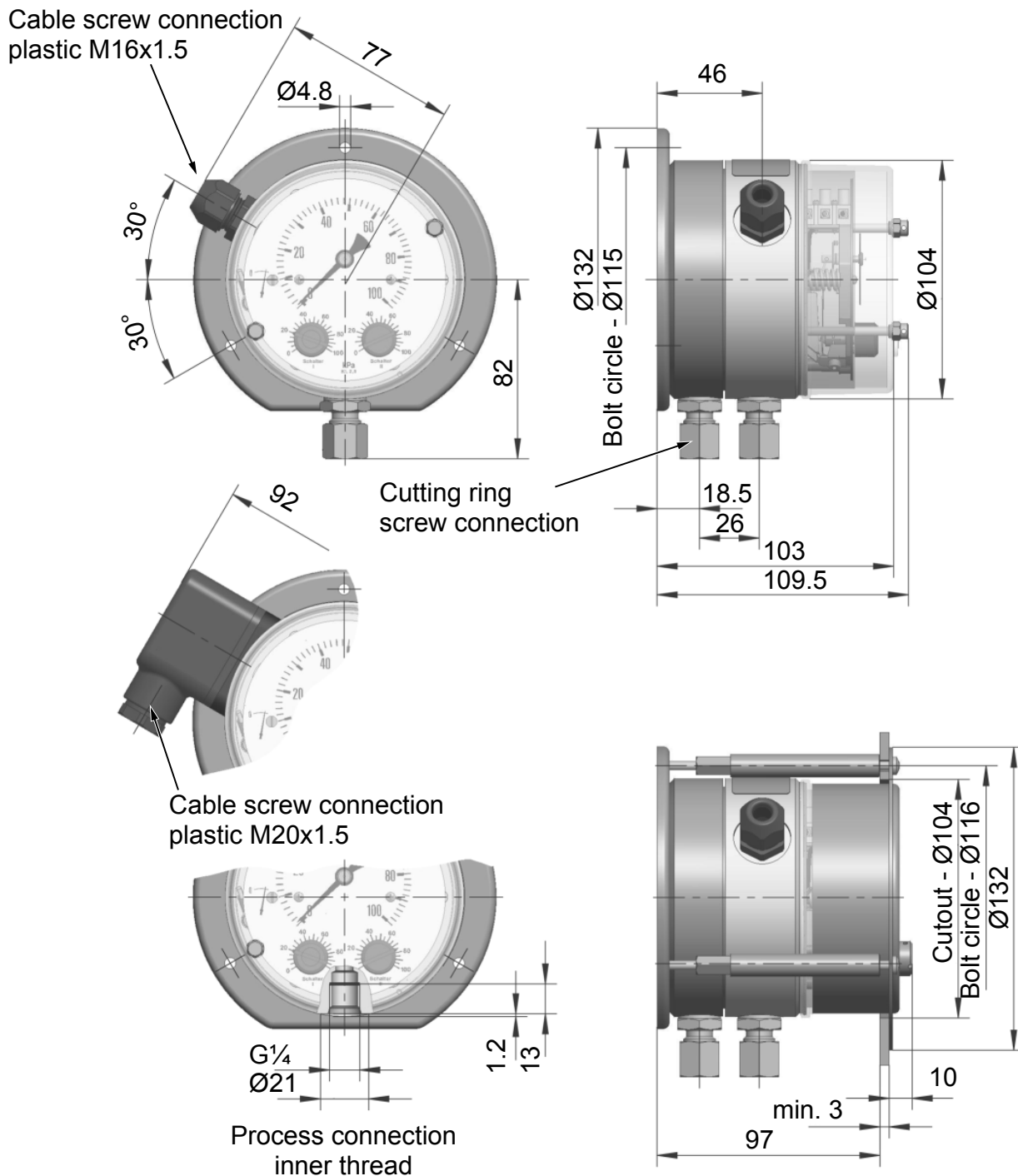


Illustration 12: Pressure chamber in VA (IP55)

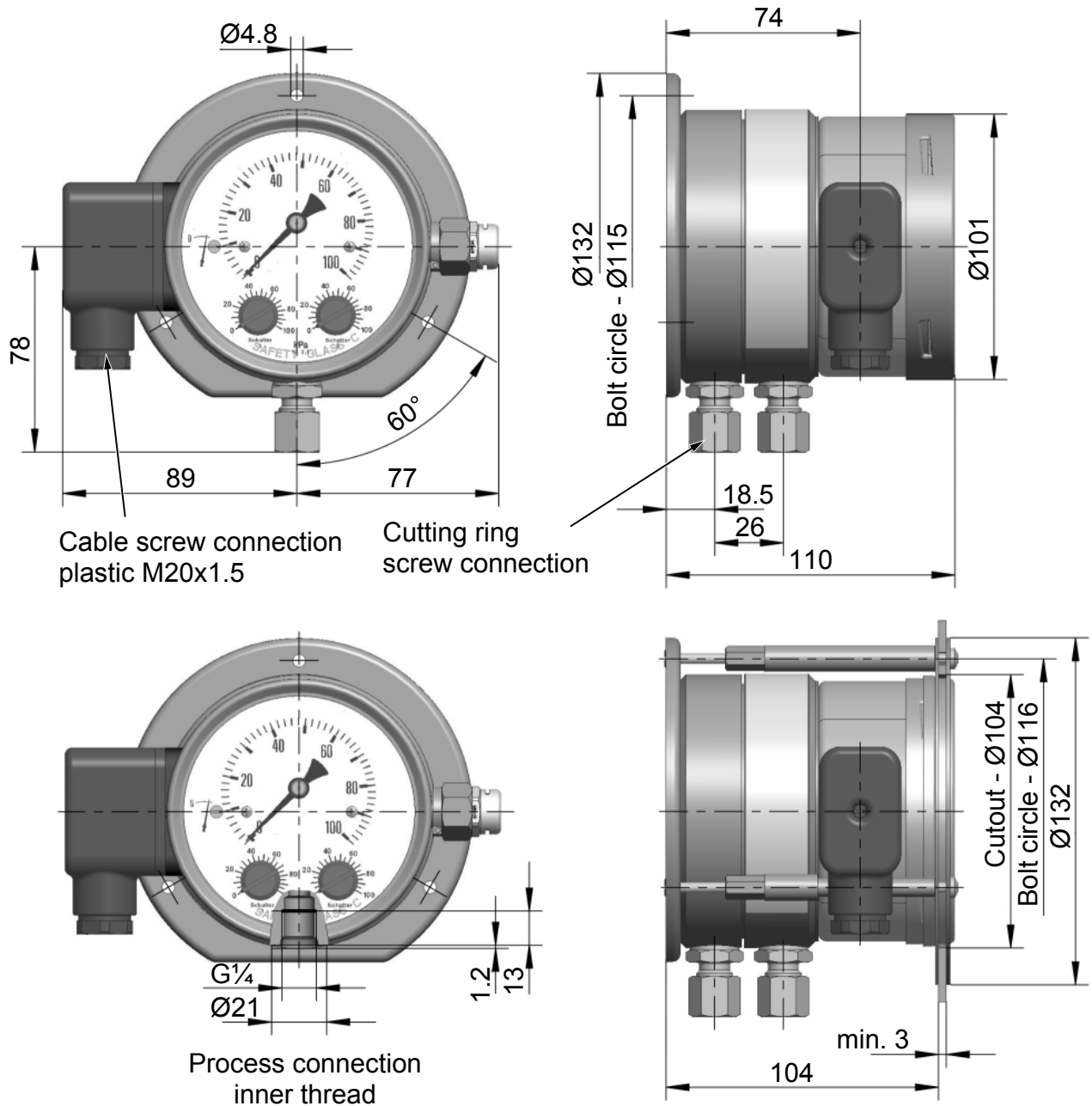


Illustration 13: Pressure chamber in VA (IP65)

### 6.7.3 Installation of front panel

The cutout required to mount the front control panel is the same for all models.

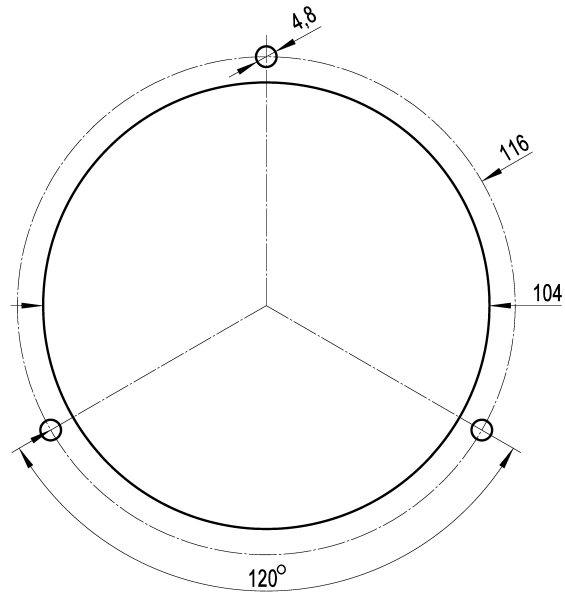
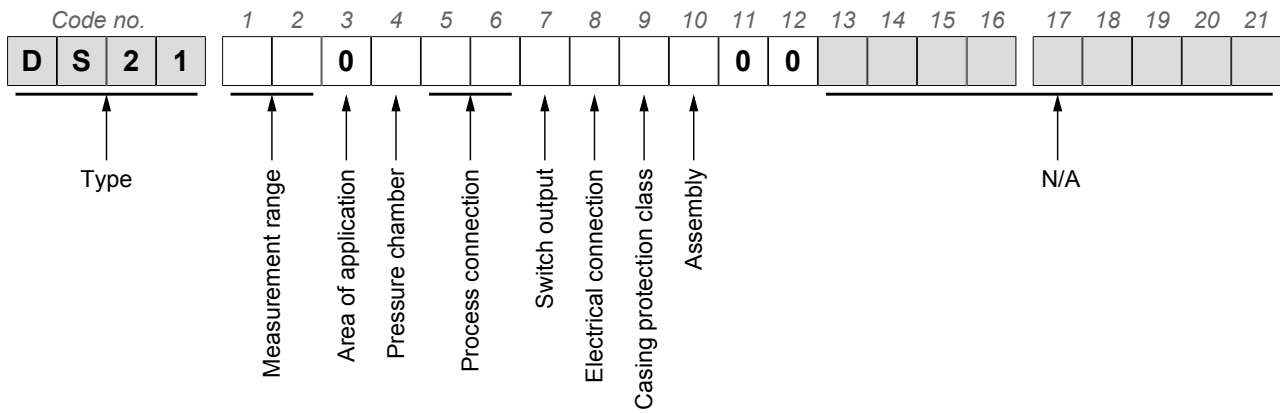


Illustration 14: Front panel cutout







**Electrical connection**

<b>[8]</b>	← <b>Code no.</b>
	Numbered cable, permanently wired
<b>1</b>	1 m long
<b>2</b>	2.5 m long
<b>5</b>	5 m long
<b>K</b>	Cable connection socket
<b>S</b>	GL version with 3 m connection cable
<b>W</b>	Cable plug

**Casing protection class**

<b>[9]</b>	← <b>Code no.</b>
<b>0</b>	IP 55
<b>P</b>	IP 65 (only with cable socket or cable connector)

**Assembly**

<b>[10]</b>	← <b>Code no.</b>
<b>D</b>	Installation of front panel
<b>W</b>	Wall mounting



