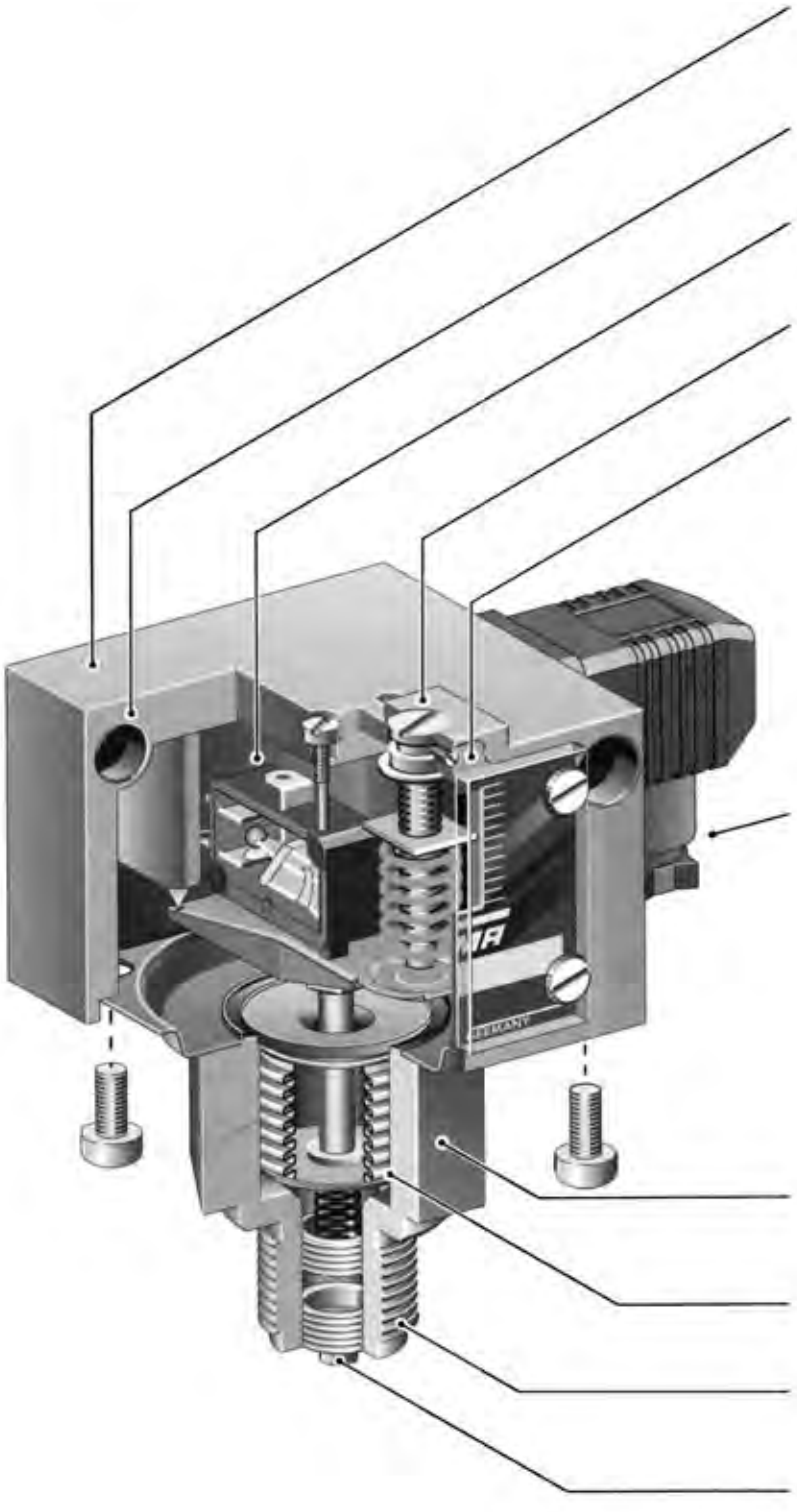
Typ	Medium*	Pressure ranges	European Directive	Testing basis	Comments	Page
HCD	Air and fuel gases	0.2 mbar to 150 mbar	EN/2009/142/EG	DIN EN1854	Differential pressure monitor	71
DPS	Air and non-aggressive gases	20 Pa to 2500 Pa	EN/2009/142/EG	DIN EN1854	Differential pressure monitor	72
DCM DNM	Non-aggressive liquids and gases	1 bar to 63 bar	RL 2006/95/EG	DIN EN60730	Mechanical pressure switches	40
Ex-DCM Ex-DNM	Non-aggressive liquids and gases	1 bar to 63 bar	ATEX 94/9/EG	DIN EN60730, DIN EN60079	Mechanical Ex-Pressure switches	65
DNS VNS	Aggressive liquids and gases	-1 bar to 16 bar	RL 2006/95/EG	DIN EN60730	Vacuum switches with 1.4571 stainless steel sensors	41–42
Ex-DNS Ex-VNS	Aggressive liquids and gases	-1bar to 16 bar	ATEX 94/9/EG	DIN EN60730, DIN EN60079...	Ex-Pressure-/ Ex-Vacuum switches with 1.4571 stainless steel sensors	66
DDCM	Liquids and gases	4 mbar to 16 bar	RL 2006/95/EG	DIN EN60730	Differential pressure monitor	43
Ex-DDCM	Liquids and gases	4 mbar to 16 bar	ATEX 94/9/EG	DIN EN60730, DIN EN60079	Ex-Differential pressure monitor	67
VCM VNM	Liquids and gases	-1...0.5 bar	RL 2006/95/EG	DIN EN60730	Vacuum switches	44
Ex-VCM Ex-VNM	Liquids and gases	-1 bar to 0.5 bar	ATEX 94/9/EG	DIN EN60730, DIN EN60079	Ex-Vacuum switches	68
DWAM DWAMV SDBAM	Steam and hot water	0.1 bar to 32 bar	DGR 97/23/EG	VdTÜV Memo Pressure 100, DIN EN12952-11, DIN EN12953-9	Pressure monitors and pressure limiters	53
DBS	Liquids and gases	0.1 bar to 40 bar	DGR 97/23/EG ATEX 94/9/EG	VdTÜV Memo Pressure 100, DIN EN 1854, EN 13611 DIN EN12952-11, DIN EN12953-9	Self-monitoring pressure sensors to be combined with isolating amplifiers	54–56
FD	Liquid gases	3 bar to 16 bar	DGR 97/23/EG ATEX 94/9/EG	VdTÜV Memo Pressure 100, DIN EN 764-7	Self-monitoring pressure sensors to be combined with isolating amplifiers	57
DGM	Fuel gases	15 mbar to 1.6 bar	EU/2009/142/EG	DIN EN1854, DIN EN13611	Pressure monitors Suitable for fuel gases	58
Ex-DGM	Fuel gases	15 mbar to 1.6 bar	ATEX 94/9/EG EU/2009/142/EG	DIN EN1854, DIN EN13611, DIN EN60079	Ex-Pressure monitors especially suitable for fuel gases	70
DWR	Steam, hot water, fuel gases and liquid fuels	0.1 bar to 40 bar	DGR 97/23/EG	VdTÜV Memo Pressure 100, DIN EN1854, DIN EN12952-11, DIN EN12953-9	Pressure switches "of special construction" tested with 2 million cycles.	59–60
Ex-DWR	Steam, hot water, fuel gases and liquid fuels	0.1 bar to 40 bar	ATEX 94/9/EG DGR 97/23/EG	VdTÜV Memo Pressure 100, DIN EN1854, DIN EN12952-11, DIN EN12953-9, DIN EN60079	Ex-Pressure switches "of special construction" tested with 2 million cycles	69

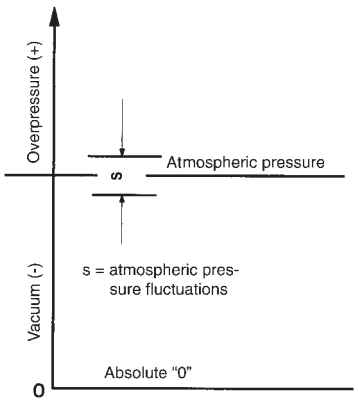
* Materials in contact with medium are listed in the datasheets. The test on media resistance is gererally up to the planner or technical decision maker.

Mechanical pressure switches

Technical features / Advantages



Definitions



Pressure data

Overpressure Pressure **over** the relevant atmospheric pressure. The reference point is atmospheric pressure.

Vacuum Pressure **under** the relevant atmospheric pressure. The reference point is atmospheric pressure.

Absolute pressure Overpressure relative to absolute vacuum.

Differential pressure Difference in pressure between 2 pressure measuring points.

Relative pressure Overpressure or vacuum relative to atmospheric pressure.

Pressure data in all FEMA documents refers to relative pressure.

That is to say, it concerns pressure differentials relative to atmospheric pressure.
Overpressures have a positive sign, vacuums a negative sign.

Permissible working pressure (maximum permissible pressure)
The maximum working pressure is defined as the upper limit at which the operation, switching reliability and water tightness are in no way impaired (for values see Product summary).

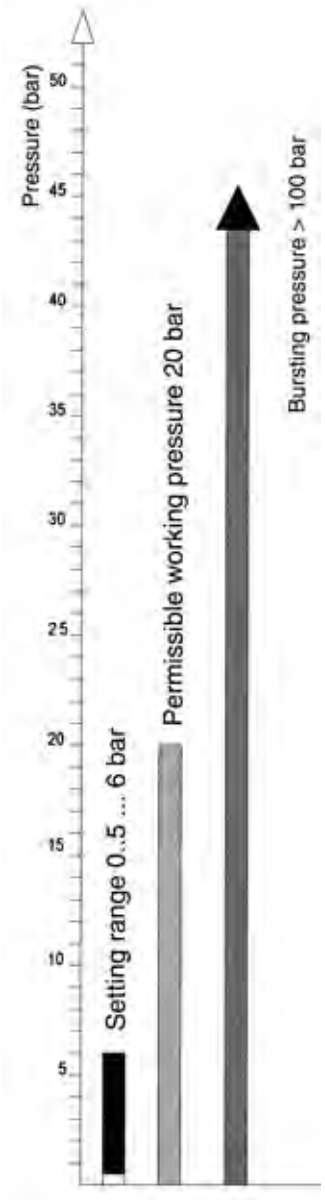
Bursting pressure (test pressure)
Type-tested products undergo a pressure test certified by TÜV affirming that the bursting pressure reaches at least the values mentioned in the Product summary. During the pressure tests the measuring bellows are permanently deformed, but the pressurized parts do not leak or burst. The bursting pressure is usually a multiple of the permissible working pressure.

Setting range
Pressure range in which the cutoff pressure can be set with the setting spindle.

Pressure units

Unit	bar	mbar	Pa	kPa	MPa	(psi) lb/m²
1 bar	1	1000	10^5	100	0.1	14.5
1 mbar	0.001	1	100	0.1	10^{-4}	0.0145
1 Pa	10^{-5}	0.01	1	0.001	10^{-6}	$1.45 \cdot 10^{-4}$
1 kPa	0,01	10	1000	1	0.001	0,145
1 MPa	10	10^4	10^6	1000	1	145

In FEMA documents pressures are stated in **bar** or **mbar**.

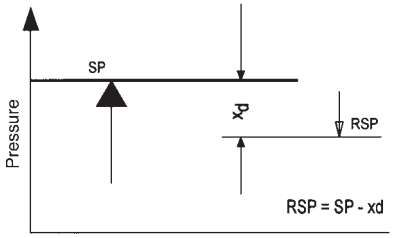


Pressure data for a pressure switchbased on the example of DWR625:
Setting range: 0.5-6 bar
Perm. working pressure: 20 bar
Bursting pressure: >100 bar

Important:
All pressure data refers to overpressures or vacuums relative to atmospheric pressure.
Overpressures have a positive sign, vacuums a negative sign.

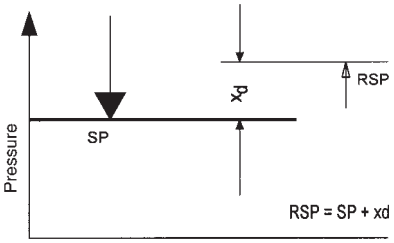
Definitions

Maximum pressure monitoring
RSP = SP – xd



SP = switching point RSP = reset point
xd = switching differential (hysteresis)

Minimum pressure monitoring
RSP = SP + xd



SP = switching point RSP = reset point
xd = switching differential (hysteresis)

Switching differential

The switching differential (hysteresis) is the difference in pressure between the **switching point (SP)** and the **reset point (RSP)** of a pressure switch. Switching differential tolerances occur due to tolerances in the microswitches, springs and pressure bellows. Therefore the data in the product summaries always refers to average values. In the case of limiter functions the switching differential has no significance, as one is only interested in the switching point at which cutoff occurs, not the reset point. For a **controller function**, i. e. in the case of pressure switches used to switch a burner, pump etc. **on and off**, a pressure switch with an **adjustable switching differential** should be chosen. The switching frequency of the burner or pump can be varied by changing the switching differential.

Adjustable switching differential/ calibration
In the case of pressure switches with adjustable switching differential, the hysteresis can be set within the specified limits. The switching point (SP) **and** reset point (RSP) are precisely definable. When setting the pressure switch, the switching differential situation and the type of factory calibration must be taken into account. Some pressure switches (e.g. minimum pressure monitors of the DCM series) are calibrated under "falling" pressure, i.e. switching under falling pressure takes place at the scale value with the switching differential being above it. The device switches back at scale value + switching differential. If the pressure switch is calibrated under rising pressure, switching takes place at the scale value and the device switches back at scale value - switching differential (see direction of action). The calibration method is indicated in the data sheets.

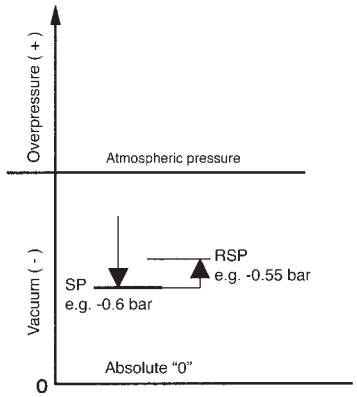
Direction of action

In principle, any pressure switch can be used for both maximum pressure and minimum pressure monitoring. This excludes pressure limiters, whose direction of action (maximum or minimum) is predefined. The only thing to remember is that the scale reading may deviate by the amount of the switching differential. See example at bottom left: The scale value is 2.8 bar.

Maximum pressure monitoring
With rising pressure, switching takes place once the preset switching pressure is reached (SP). The reset point (RSP) is lower by the amount of the switching differential.

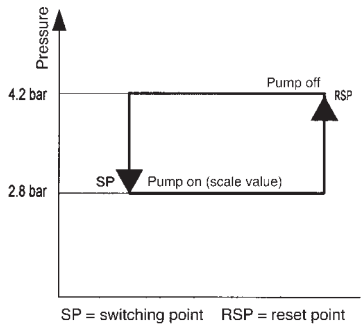
Minimum pressure monitoring
With falling pressure, switching takes place once the preset switching pressure is reached (SP). The reset point (RSP) is higher by the amount of the switching differential.

Direction of action in vacuum range
It is particularly important to define the direction of action in the vacuum range.
Rising does not mean a rising vacuum, but rising pressure (as viewed from absolute "0"). "Falling" pressure means a rising vacuum.
For example: Vacuum switch set to -0.6 bar falling means: Switching (SP) takes place under falling pressure (rising vacuum) at -0.6 bar. The reset point is higher by the amount of the switching differential (e.g. at -0.55 bar).



Setting a pressure switch

To define the switching point of a pressure switch exactly, it is necessary to determine the direction of action in addition to the pressure. "Rising" means that switching takes place at the set value when the pressure rises.
The reset point is then lower by the amount of the switching differential. "Falling" means exactly the opposite.



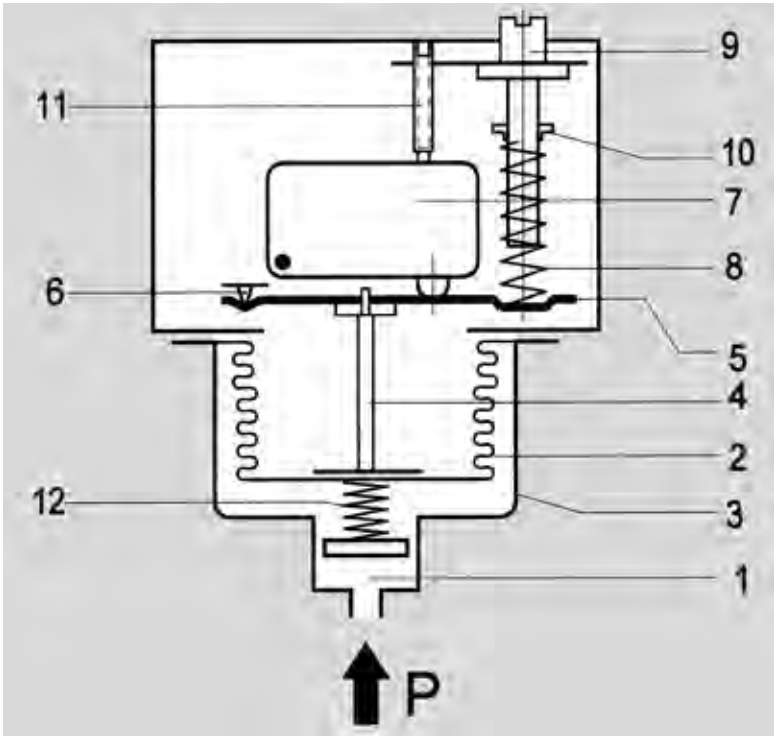
SP = switching point RSP = reset point

Please note when specifying the setting of a pressure switch:
In addition to the switching point it is also necessary to specify the direction of action (falling or rising).

Example for selection of a pressure switch:
A pump is to be turned on at 2.8 bar and off again at 4.2 bar.
Chosen type: DCMV6 according to data sheet DCM. Setting: Scale pointer to 2.8 bar (lower switching point). Switching differential to 1.4 bar (set according to pressure gauge).
Cutoff point: 2.8 bar +1.4 bar = 4.2 bar.

Operating mode
The pressure prevailing in the sensor housing (**1**) acts on the measuring bellows (**2**). Changes in pressure lead to movements of the measuring bellows (**2**) which are transmitted via a thrust pin (**4**) to the connecting bridge (**5**). The connecting bridge is frictionlessly mounted on hardened points (**6**). When the pressure rises the connecting bridge (**5**) moves upwards and operates the microswitch (**7**). A counter-force is provided by the spring (**8**), whose pre-tension can be modified by the adjusting screw (**9**) (switching point adjustment). Turning the setting spindle (**9**) moves the running nut (**10**) and modifies the pre-tension of the spring (**8**). The screw (**11**) is used to calibrate the microswitch in the factory. The counter pressure spring (**12**) ensures stable switching behaviour, even at low setting values.

1 = Pressure connection
2 = Measuring bellows
3 = Sensor housing
4 = Thrust pin
5 = Connecting bridge
6 = Pivot points
7 = Microswitch or other switching elements
8 = Setting spring
9 = Setting spindle (switching point adjustment)
10 = Running nut (switching point indicator)
11 = Microswitch calibration screw (factory calibration)
12 = Counter pressure spring



Pressure sensors
Apart from a few exceptions in the low-pressure range, all pressure sensors have measuring bellows, some made of copper alloy, but the majority of high-quality stainless steel. Measured on the basis of permitted values, the measuring bellows are exposed to a minimal load and perform only a small lifting movement. This results in a long service life with little switching point drift and high operating reliability. Furthermore, the stroke of the bellows is limited by an internal stop so that the forces resulting from the overpressure cannot be transmitted to the switching device. The parts of the sensor in contact with the medium are welded together without filler metals. The sensors contain no seals. Copper bellows, which are used only for low pressure ranges, are soldered to the sensor housing. The sensor housing and all parts of the sensor in contact with the medium can also be made entirely from stainless steel 1.4571 (DNS series). Precise material data can be found in the individual data sheets.

Pressure connection
The pressure connection on all pressure switches is executed in accordance with DIN 16288 (pressure gauge connection G 1/2A). If desired, the connection can also be made with a G 1/4 internal thread in accordance with ISO 228 Part 1.
Maximum screw-in depth on the G 1/4 internal thread = 9 mm.

Centring pin
In the case of connection to the G 1/2 external thread with seal in the thread (i.e. without the usual stationary seal on the pressure gauge connection), the accompanying centring pin is not needed. Differential pressure switches have 2 pressure connections (max. and min.), each of which are to be connected to a G 1/4 internal thread.

Principal technical data

Valid for all pressure switches of the DCM, DNM, DWAM, DWAMV, SDBAM, VCM, VNM, DNM, DWR, DGM, DNS and DDCM series that have a microswitch. The technical data of type-tested units may differ slightly (please refer to particular type sheet).

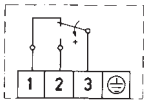
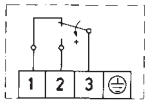
Standard version

Plug connection

…200

Terminal connection

…300

	Plug connection	Terminal connection
Switch housing	Diecast aluminium GDAlSi 12	Diecast aluminium GDAlSi 12
Pressure connection	G 1/2" external thread (pressure gauge connection) and G 1/4" internal thread. 1/4" internal thread for DDCM differential pressure switches	G 1/2" external thread (pressure gauge connection) and G 1/4" internal thread. 1/4" internal thread for DDCM differential pressure switches
Switching function and connection scheme (applies only to version with microswitch)	Floating changeover contact. With rising pressure single pole switching from 3–1 to 3–2. 	Floating changeover contact. With rising pressure single pole switching from 3–1 to 3–2 
Switching capacity (for microswitches with a silver contact)	8 A at 250 VAC 5 A at 250 VAC inductive 8 A at 24 VDC 0.3 A at 250 VDC min. 10 mA, 12 VDC	3 A at 250 VAC 2 A at 250 VAC inductive 3 A at 24 VDC 0.1 A at 250 VDC min. 2 mA, 24 VDC
Mounting position	Preferably vertical (see technical data sheet)	Vertical
Protection class (in vertical position)	IP 54	IP 65
Electrical connection	Plug connection	Terminal connection
Cabel entry	Pg 11	M 16 x 1.5
Ambient temperature	–25 to +70 °C (exceptions: DWAM, DWAMV, SDBAM series –20 to +70 °C DGM and FD series: –25 to +60 °C DCM4016, 4025, 1000, VCM4156: –15 to +60 °C)	–25 to +70 °C (exceptions: DWAM, DWAMV, SDBAM series –20 to +70 °C DGM and FD series: –25 to +60 °C DCM4016, 4025, 1000, VCM4156: –15 to +60 °C)
Switching point	Adjustable using the setting spindle (for 300 device: after removing switch housing cover)	Adjustable using the setting spindle once the switch housing cover is removed
Hysteresis	Adjustable or not adjustable (see Product Summary)	Adjustable or not adjustable (see Product Summary)
Medium temperature	Max. 70 °C, briefly 85 °C	Max. 70 °C, briefly 85 °C
Relative humidity	15 to 95 % (non-condensing)	15 to 95 % (non-condensing)

Vacuum	Higher medium temperatures are possible provided the above limits for the switching device are ensured by suitable measures (e.g. siphon). All pressure switches can operate under vacuum. This will not damage the device (exception DCM1000).
Repetition accuracy of switching points	< 1 % of the working range (for pressure ranges > 1 bar).
Vibration resistance	No significant deviations up to 4 g.
Mechanical durability (pressure sensor)	With sinusoidal pressure application and room temperature, 10 x 10^6 switching cycles. The expected life depends to a very large extent on the type of pressure application, therefore this figure can serve only as a rough estimate. With pulsating pressure or pressure impacts in hydraulic systems, pressure surge reduction is recommended.
Electronical durability (microswitch)	100.000 switching cycles at nominal current 8 A, 250 VAC. A reduced contact load increases the number of possible switching cycles.
Isolation values	Overvoltage category III, contamination class 3, reference surge voltage 4000 V. Conformity to DIN VDE 0110 is confirmed.
Oil and grease-free	The parts of all pressure switches in contact with the medium are oil and grease-free (except the HCD…and DPS…series). The sensors are hermetically sealed and contain no seals (also see ZF1979, special packing).

Principal technical data

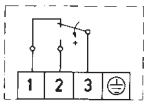
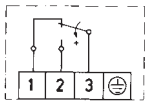
Valid for all pressure of the DCM, VCM, DNM, DWR, DGM, DNS and DDCM series that have a microswitch.
The technical data of type-tested units may differ slightly (please refer to particular type sheet).

Ex-i-version

…500

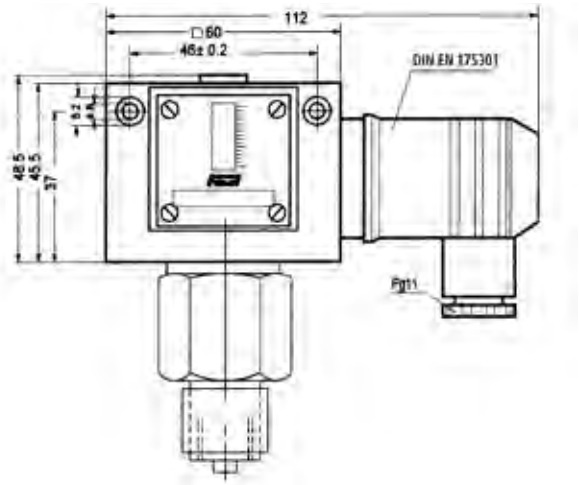
Ⓔx version (Ex-d)

…700

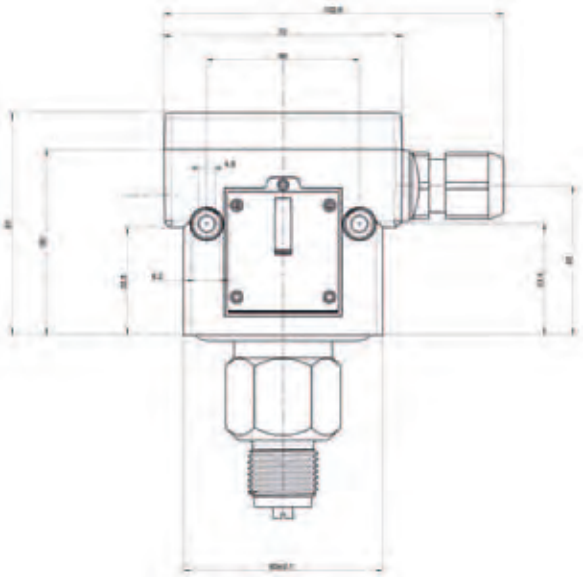
Switch housing	Diecast aluminium GDAlSi 12	Diecast aluminium GDAlSi 12
Pressure connection	G 1/2" external thread (pressure gauge connection) and G 1/4" internal thread. 1/4" internal thread for DDCM differential pressure switches	G 1/2" external thread (pressure gauge connection) and G 1/4" internal thread. 1/4" internal thread for DDCM differential pressure switches
Switching function and connection scheme (applies only to version with microswitch)	Floating changeover contact. With rising pressure single pole switching from 3–1 to 3–2 	Floating changeover contact. With rising pressure single pole switching from 3–1 to 3–2 
Switching capacity	max.: 100mA, 24VDC min.: 2mA, 5VDC	3 A at 250 VAC 2 A at 250 VAC inductive 3 A at 24 VDC 0.1 A at 250 VDC min. 2 mA, 24 VDC
Mounting position	Vertical	Vertical
Protection class (in vertical position)	IP 65	IP 65
Explosion protection Code	Ⓔx II 1/2G Ex ia IIC T6 Ga/Gb Ⓔx II 1/2D Ex ia IIIC T80 °C	Ⓔx II 2G Ex d e IIC T6 Gb Ⓔx II 1/2D Ex ta/tb IIIC T80 °C Da/Db
EC Type Examination Certificate Number	IBExU12ATEX1040	IBExU12ATEX1040
Electrical connection	Terminal connection	Terminal connection
Cabel entry	M 16 x 1.5	M 16 x 1.5
Ambient temperature	–25 to +60 °C (exceptions: DWAM, DWAMV, SDBAM series –20 to +60 °C DGM and FD series: –25 to +60 °C DCM4016, 4025, 1000, VCM4156: –15 to +60 °C)	–20 to +60 °C
Medium temperature	Max. 60 °C	Max. 60 °C
Relative humidity	15 to 95 % (non-condensing)	15 to 95 % (non-condensing)
Switching point	After removing switch housing cover	After removing switch housing cover
Hysteresis	Not adjustable	Not adjustable
Vacuum	Higher medium temperatures are possible provided the above limits for the switching device are ensured by suitable measures (e.g. siphon). All pressure switches can operate under vacuum. This will not damage the device.	
Repetition accuracy of switching points	< 1 % of the working range (for pressure ranges > 1 bar).	
Vibration resistance	No significant deviations up to 4 g.	
Mechanical durability (pressure sensor)	With sinusoidal pressure application and room temperature, 10 x 10^6 switching cycles. The expected life depends to a very large extent on the type of pressure application, therefore this figure can serve only as a rough estimate. With pulsating pressure or pressure impacts in hydraulic systems, pressure surge reduction is recommended.	
Electronical durability (microswitch)	100.000 switching cycles at nominal current 8 A, 250 VAC. A reduced contact load increases the number of possible switching cycles.	
Isolation values	Overvoltage category III, contamination class 3, reference surge voltage 4000 V. Conformity to DIN VDE 0110 is confirmed.	
Oil and grease-free	The parts of all pressure switches in contact with the medium are oil and grease-free (except the HCD…and DPS…series). The sensors are hermetically sealed and contain no seals (also see ZF1979, special packing).	

Dimensioned drawings of switch housings (mm)

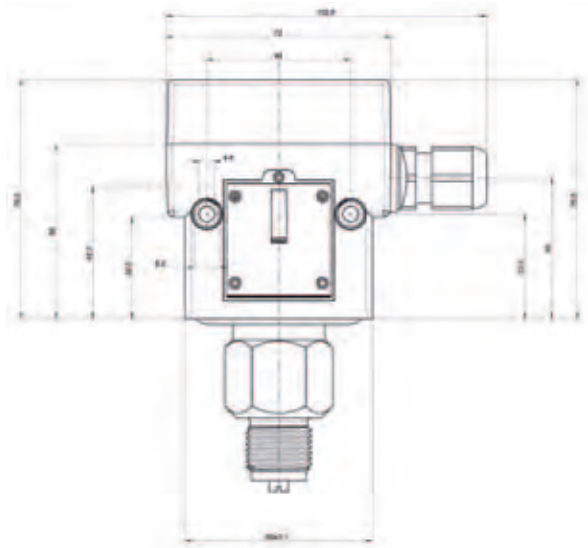
1 **Housing 200 (plug connection)**



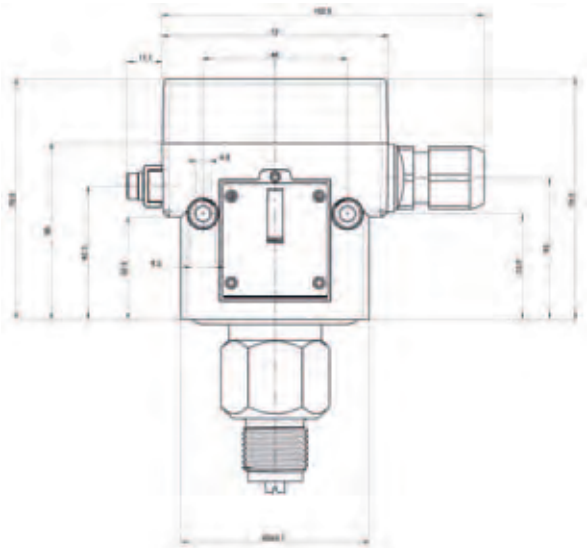
2 **Housing 300 (terminal connection)**



3 **Housing 500 (terminal connection Ex-i)**

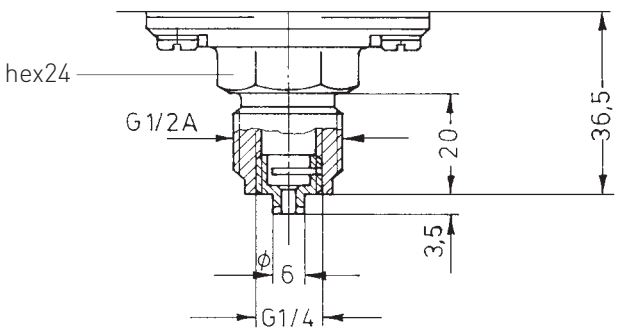


4 **Housing 700 (terminal connection Ex-d)**



Dimensioned drawings of pressure sensors (mm)

10



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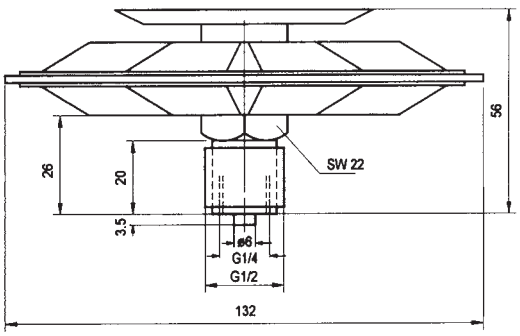
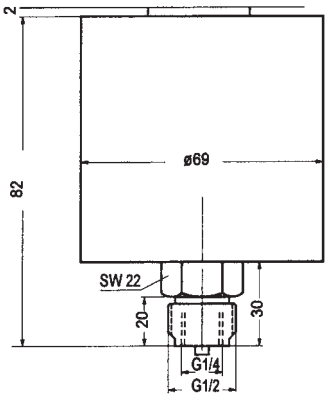
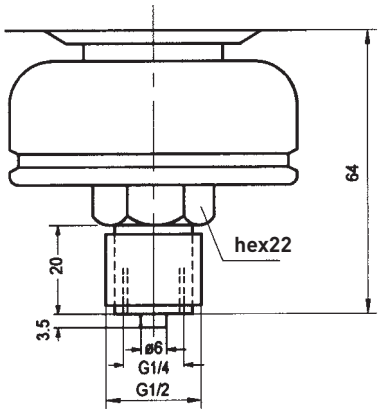


Dimensioned drawings of pressure sensors (mm)

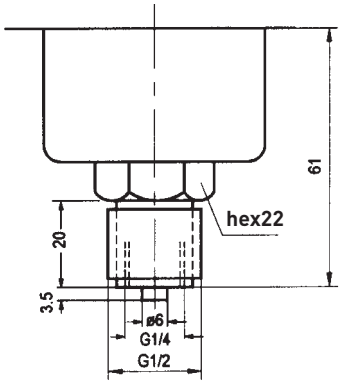
12



13



14



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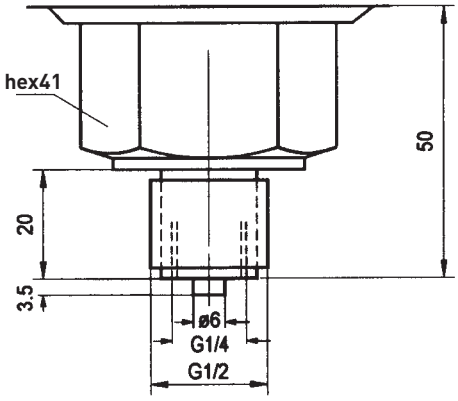
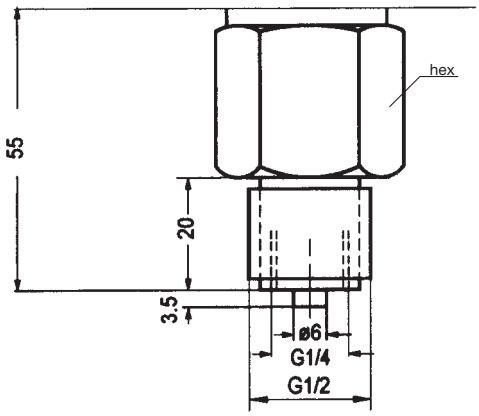
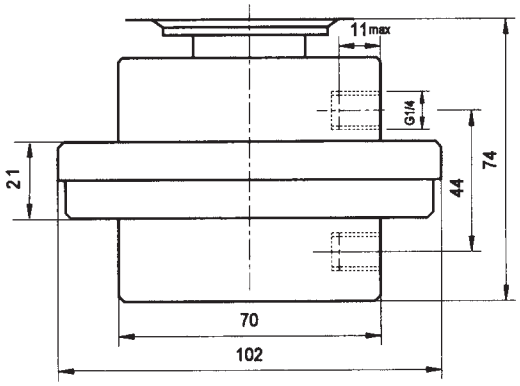


16 – 19

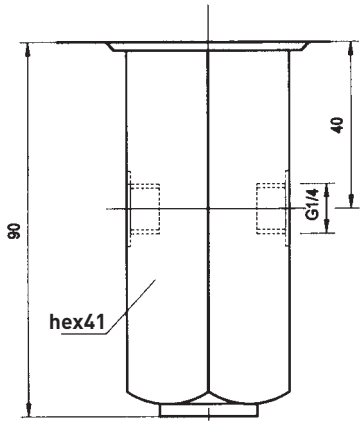


Dimensioned drawing	hex
16	22
17	24
18	30
19	32

20



21

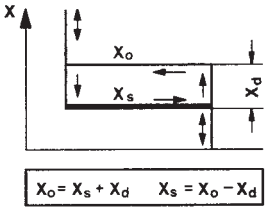


Setting instructions

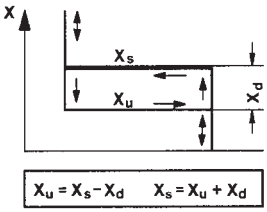
Factory calibration of pressure switches

In view of tolerances in the characteristics of sensors and springs, and due to friction in the switching kinematics, slight discrepancies between the setting value and the switching point are unavoidable. The pressure switches are therefore calibrated in the factory in such a way that the setpoint adjustment and the actual switching pressure correspond as closely as possible in the middle of the range. Possible deviations are equally distributed on both sides.
The device is calibrated either for falling pressure (calibration at lower switching point) or for rising pressure (calibration at higher switching point), depending on the principal application of the type series in question.
Where the pressure switch is used at other than the basic calibration, the actual switching point moves relative to the set switching point by the value of the average switching differential. As FEMA pressure switches have very small switching differentials, the customer can ignore this where the switching pressure is set only roughly. If a very precise switching point is needed, this must be calibrated and checked in accordance with normal practice using a pressure gauge.

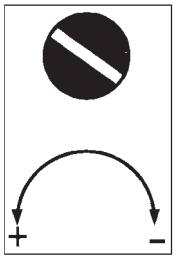
1. Calibration at lower switching point
Setpoint x_s corresponds to the lower switching point, the upper switching point x_o is higher by the amount of the switching differential x_d.



2. Calibration at upper switching point
Setpoint x_s corresponds to the upper switching point, the lower switching point x_u is lower by the amount of the switching differential x_d.



The chosen calibration type is indicated in the technical data for the relevant type series.



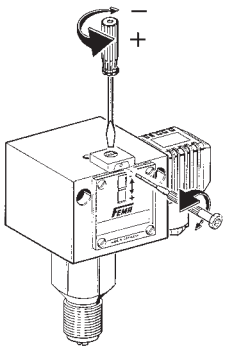
Clockwise: lower switching pressure

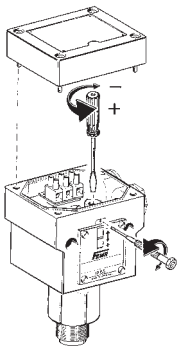
Anticlockwise: higher switching pressure

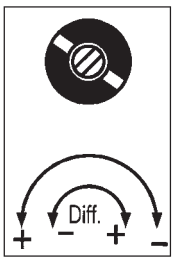
Direction of action of setting spindle

Setting switching pressures

Prior to adjustment, the securing pin above the scale must be loosened by not more than 2 turns and retightened after setting. The switching pressure is set via the spindle. The set switching pressure is shown by the scale.
To set the switching points accurately it is necessary to use a pressure gauge.







Clockwise: greater difference
Anticlockwise: smaller difference

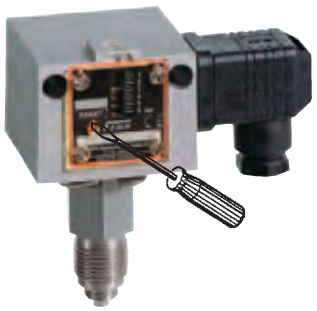
With pressure switches from the DWAMV and DWR...-203 series, the direction of action of the differential screw is reversed.

Changing the switching differential (only for switching device with suffix "V", ZF203)

By means of setscrew within the spindle. The lower switching point is not changed by the differential adjustment; only the upper switching point is shifted by the differential. One turn of the differential screw changes the switching differential by about 1/4 of the total differential range. The switching differential is the hysteresis, i.e. the difference in pressure between the switching point and the reset point.

Lead sealing of setting spindle (for plug connection housing 200 only)

The setting spindle for setting the desired value and switching differential can be covered and sealed with sealing parts available as accessories (type designation: P2) consisting of a seal plate and capstan screw. The sealing parts may be fitted subsequently. The painted calibration screws are likewise covered.

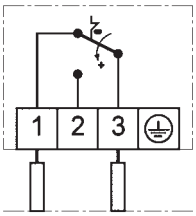


Pressure switch with switching state locking (reclosing lockout)

In the case of limiter functions, the switching state must be retained and locked, and it may be unlocked and the system restarted only after the cause of the safety shutdown has been eliminated. There are two ways of doing this:

1. Mechanical locking inside the pressure switch
Instead of a microswitch with automatic reset, limiters contain a "bi-stable" microswitch. If the pressure reaches the value set on the scale, the microswitch trips over and remains in this position. The lock can be released by pressing the unlocking button (identified by a red dot on the scale side of the switching device). The lock can operate with rising or falling pressure, depending on the version. **The device can only be unlocked when the pressure has been reduced (or increased) by the amount of the predefined switching differential.** When selecting a pressure limiter, it is necessary to distinguish between maximum and minimum pressure monitoring. Ex-d versions cannot be equipped with internal locking.

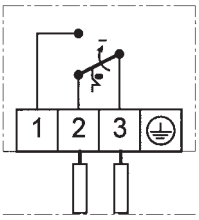
Maximum pressure limitation



Switching and interlocking with rising pressure. Additional function ZF205.

Connection of control current circuit to terminals 1 and 3.

Minimum pressure limitation

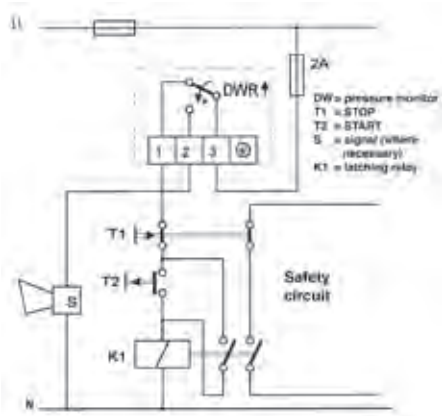


Switching and interlocking with falling pressure. Additional function ZF206.

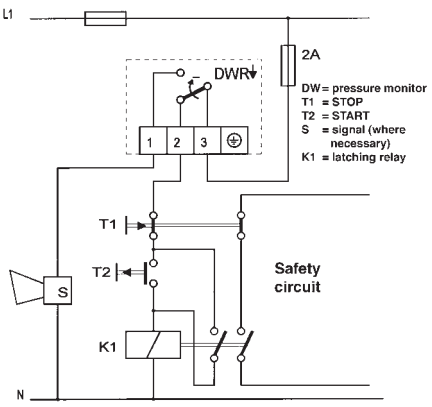
Connection of control current circuit to terminals 2 and 3.

2. External electrical interlock in the control cabinet (suggested circuits)
A pressure monitor (microswitch with automatic reset) can also be used as a limiter if an electrical interlock is added. For pressure limitation in steam and hot water boilers, an external interlock is only permitted if it has been ascertained that the pressure monitor is "of special construction".

Maximum pressure limitation with external interlock



Minimum pressure limitation with external interlock



Where the above lock circuit is used, the requirements of DIN 57 116/VDE 0116 are met if the electrical equipment (such as contactors or relays) of the external interlock circuit satisfy VDE 0660 or VDE 0435.

Explanation of type designations – type codes

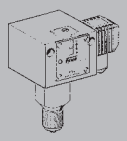
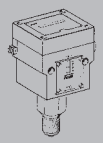
The type designations of FEMA pressure switches consist of a combination of letters followed by a number denoting the setting range. Additional functions and version variants are indicated by an extra code which is separated from the basic type by a hyphen. Ex versions (explosion protection Ex-d) are identified by the prefix "Ex" in front of the type designation.

Basic version (based on the example of DCM series) **DCMXXX**	**With additional function** **DCMXXX-YYY**	**Ex version** **Ex-DCMXXX**

DCM →	Series code (e. g. DCM)
XXX →	Codes for pressure range
YYY →	Code for additional function
Ex →	Code for Ex-version

Switch housing version	
DCMXXX	Basic version with plug connection housing
DCMXXX-2...	Basic version with plug connection housing
DCMXXX-3...	Terminal connection housing (300)
Ex-DCMXXX	Ex-d switching device (700)
DCMXXX-5...	Ex-ia version (500)

Which additional function fits with which pressure switch?

	Plug connection, 200 series  Additional function ZF			Terminal connection, 300/500 series  Additional function ZF				
	203	213	217	301 351	307	513	574 576	575 577
DCM/VCM	•[1]	•	•[1]	•	•[1]	•		
VNM/DNS/VNS	•	•	•	•	•	•		
DWAM		•		•		•	•	•
DDCM		•		•		•		
DWR	•	•		•		•	•	•
DGM		•		•		•	•	•

• available

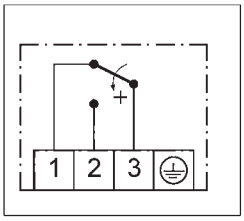
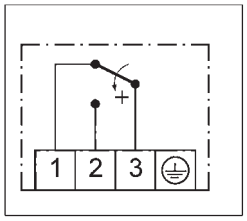
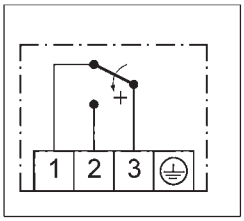
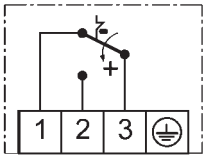
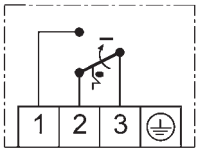
[1] except DCM4016, DCM4025, VCM4156 and DCM1000

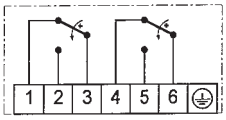
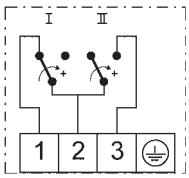
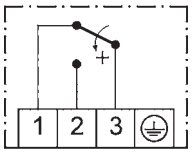
Combination of several additional functions not possible!

Ex versions (Ex-d) can only be supplied in basic form.
Additional functions are not possible.

Pressure switches and pressure monitors

Additional functions / Connection schemes

	Plug connection, 200 series (IP 54)	Terminal connection, 300 series (IP 65)	Connection scheme	
Standard version (plug connection) Micro switch, single pole switching, switching differential not adjustable				
Terminal connection housing (300)		**ZF301**		
Unit with adjustable switching differential	**ZF203**			
Maximum pressure limiter with reclosing lockout **Interlocking with rising pressure** see DWR series	**ZF205**			
Minimum pressure limiter with reclosing lockout **Interlocking with falling pressure** see DWR series	**ZF206**			

	Plug connection 200 series (IP 54)	Terminal connection 300 series (IP 65)	Connection scheme	
Two micro switches, switching in parallel or in succession. Fixed switching differential, only possible with terminal connection housing. **State the switching differential** (not possible with all pressure switches). (See page 34+35).		**ZF307**		
Two micro switches, 1 plug switching in succession, no adjustable switching differential. **State the switching scheme *** (not possible with all pressure switches). (See page 34–37).	**ZF217 ***		 Connection scheme selection, see page 36	
Gold-plated silver contact, single pole switching (not available with adjustable switching differential). **Switching capacity:** max. 24 VDC, 100 mA, min. 5 VDC, 2 mA	**ZF213**			
Switch Housing with surface protection (chemical version)		**ZF351**		

The prices shown are additional prices compared to the basic device of the 200 series (plug connection).
* Connection schemes for switching schemes, see page 36.
Please state interval when ordering!
Example for ordering: DCM10-217A-S.
Additional text: switching scheme A4

Example for ordering:
DCM 6 – 205
- 205: Code of additional function (e.g. maximum limiter)
- 6: Code for pressure range
- DCM: Sensor system

How to order:
Pressure switch
DCM6-205
or DCM6 with ZF205

Pressure switches and pressure monitors

Additional functions for Ex-i-equipment

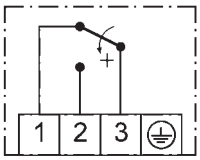
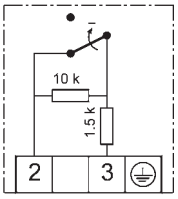
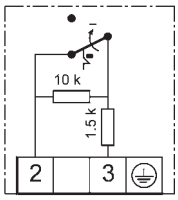
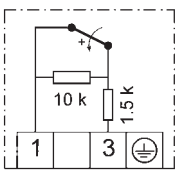
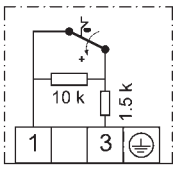
DWAM6-576

· Housing (500) with terminal connection (IP 65), "blue" cable entry and terminals.
· Also available with resistor combination for line break and short-circuit monitoring (with isolating amplifier).

! Important:
All pressure switches with the ZF5… additional functions listed here can only be operated in combination with a suitable isolating amplifier.

i Additional information:
Our pressure switches and thermostats are considered to be "simple electrical equipment" within the meaning of standard EN60079-11: 2007. Testing is not mandatory for this type of equipment.

i ATEX-Certificate: please see page 10–13

Additional functions for Ex-ia-equipment **Ⓔx II 1/2G Ex ia IIC T6 Ga/Gb** **Ⓔx II 1/2D Ex ia IIIC T80 °C**		**Connection scheme**
Gold-plated contact single pole switching, fixed hysteresis, not adjustable **Switching capacity:** max. 24 VDC, 100 mA, min. 5 VDC, 2 mA **For the power supply circuit:** U_i 24 V DC I_i 100 mA C_i 1 nF L_i 100 µH	**ZF513**	
Versions with resistor combination for line break and short-circuit monitoring in control current circuit, see DBS series, pages 54–56: **For the power supply circuit:** U_i 14 V DC R_i 1500 Ohm C_i 1 nF L_i 100 µH		
Normally closed contact with resistor combination, for **minimum pressure monitoring,** gold-plated contact, plastic-coated housing (chemical version).	**ZF574**	
Normally closed contact **with reclosing lockout** and resistor combination, for **minimum pressure monitoring,** plastic-coated housing (chemical version).	**ZF575**	
Normally closed contact with resistor combination, for **maximum pressure monitoring,** gold-plated contact, plastic-coated housing (chemical version).	**ZF576**	
Normally closed contact **with reclosing lockout** and resistor combination, for **maximum pressure monitoring,** plastic-coated housing (chemical version).	**ZF577**	

see DBS series pages 54–56

Service functions

Devices with service functions will be produced according to the customer's specifications.
The system requires that these product combinations are identified in such a way as to prevent any possibility of confusion. These combinations are characterised by a product code with the suffix "-S" on the packaging label as well as separate labels with barcodes for each service function.

Service functions	Plug connection 200 series	Terminal connection 300 series	Ex-i/ Ex-d
Adjustment according to customer's instruction:			
one switching point	**ZF1970***	**ZF1970***	**ZF1970***
two switching points or defined switching differential	**ZF1972***	**ZF1972***	**–**
Adjustment and lead sealing according to customer's instruction:			
one switching point	**ZF1971***	**–** **–**	
two switching points or defined switching differential	**ZF1973***	**–** **–**	
Labelling of units according to customer's instruction with sticker	**ZF1978**	**ZF1978**	**ZF1978**
Special packing for oil and grease-free storage Test reports according to EN 10 204	**ZF1979**	**ZF1979**	**ZF1979**
Certificate 2.2 based on non-specific specimen test	**WZ2.2**	**WZ2.2**	**WZ2.2**
Inspection test certificate 3.1 based on specific test	**AZ3.1B1**	**AZ3.1B1**	**AZ3.1B1**
Inspection test certificate for FV separating diaphragms	**AZ3.1-V**	**AZ3.1-V**	**AZ3.1-V**

*** Switching point adjustment:** Please specify **switching point and direction of action** (rising or falling pressure).

Service functions are available for the following type series (including Ex versions):
Pressure switches: DCM, DNM, DNS, VNS, VCM, VNM, DDCM, DWR, DWAM, DWAMV, SDBAM, DGM, FD

Ordering devices with service functions

Example:
Ordering 1 DCM6, set at 4 bar rising, identified with code PSH008 as requested by the customer and acceptance test certificate 3.1.
The order confirmation contains:

1 DCM6-S ("S" is need for factory = following lines belong to this item)
1 ZF1970: set to 4 bar rising
1 ZF1978: PSH008
1 AZ3.1B1

Included items: Labels with barcodes on the packaging:
DCM6-S
ZF1970: set to 4 bar rising
ZF1978: PSH008
AZ3.1B1

Pack contents: 1 DCM6 (without "S" suffix) marked
1 ZF1970: set to 4 bar rising
1 ZF1978: PSH008
1 AZ3.1 will be sent by extra post
1 Installation and operating instructions

S2 type series

Pressure switches with 2 microswitches - technical data

FEMA pressure switches of the **DCM** (except DCM1000, DCM4016 and DCM4025), **VCM** (except VCM4156), **VNM, DNS, VNS** series can be equipped with 2 microswitches.

This is not possible with any other type series or with Ex versions.

Technical data

Standard equipment
The standard equipment of every two-stage pressure switch includes a switching device with 2 microswitches, both single-pole switching. Switch I monitors the low pressure, switch II the higher pressure. The setting ranges indicated in the data sheets for the basic types apply to the two-stage pressure switches as well. It should be noted that the switching differentials of the individual microswitches may not be exactly the same due to component tolerances.

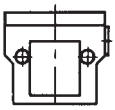
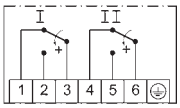
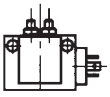
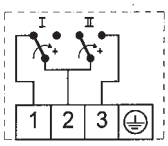
Switching difference
The switching interval of the two microswitches is the difference (in bar or mbar) between the switching points of the two micro switches.

Example for ZF307:
When the pressure rises (e.g. 2.8 bar), a two-stage pressure switch turns on a warning light, and if the pressure continues to rise (e.g. 3.2 bar) the system shuts down. The switching interval is 3.2-2.8 = 0.4 bar. The following applies to all versions:
The switching interval remains constant over the whole setting range of the pressure switch. If the switching pressure setting is changed with the setting spindle, the switching interval does not change - the switching points are moved in parallel.

Switching differential
The switching differential, i.e. the hysteresis of the individual micro switches, corresponds to the values of the relevant basic version referred to in the Product summary. In the case of two-stage pressure switches, **the switching differential of the individual micro switches is not adjustable.**

Versions
Two-stage pressure switches are available in three different versions, each identified by a ZF number. The versions differ in terms of their connection schemes and electrical connection types (terminal or plug connection).

The applicable data sheet for the basic types contains the technical data for the two-stage pressure switches. This includes all limits of use, such as temperature, maximum pressure, mounting position, protection class, electrical data etc. The principal dimensions are the same as for single-stage pressure switches with comparable pressure ranges and design features.

Additional function	Switching difference between the two micro switches	Electrical connection	Connection diagram	Ordering information required
ZF307 	**Factory setting** according to customer's instruction Switching difference fixed	**Terminal connection** (All terminals of both microswitches are accessible (6 terminals)	2 x single-pole switching 	1. Basic type with ZF 307 2. Switching points I and II, with direction of action in each case (rising or falling pressure) Example: DCM16-307 Switching point I: 10 bar falling Switching point II: 12 bar falling or switching interval only.
ZF217 	**Adjustable** via adjustment knobs I and II in accordance with "Switching difference" table	**Plug connection** in accordance with DIN EN175301 (3-prong + earth conductor) Function-appropriate internal wiring in accordance with "Switching functions" table	Example selection in accordance with "Switching schemes" table, page 36. 	1. Basic type with ZF217 2. **Switching scheme** For example: DCM16-217/B 4 Since all values are adjustable within the specified limits, no further data is required.

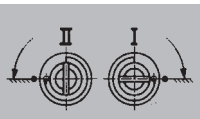
Note on ordering additional function ZF217

Switching scheme	Switching device	Ordering position	Additional text
A1	A	DCM6-217A-S	Switching scheme A1
A2	C	DCM6-217C-S	Switching scheme A2
A3	C	DCM6-217C-S	Switching scheme A3
A4	A	DCM6-217A-S	Switching scheme A4
B1	B	DCM6-217B-S	Switching scheme B1
B2	D	DCM6-217D-S	Switching scheme B2
B3	D	DCM6-217D-S	Switching scheme B3
B4	B	DCM6-217B-S	Switching scheme B4
C1	B	DCM6-217B-S	Switching scheme C1
C2	D	DCM6-217D-S	Switching scheme C2
C3	D	DCM6-217D-S	Switching scheme C3
C4	B	DCM6-217B-S	Switching scheme C4
D1	A	DCM6-217A-S	Switching scheme D1
D2	C	DCM6-217C-S	Switching scheme D2
D3	C	DCM6-217C-S	Switching scheme D3
D4	A	DCM6-217A-S	Switching scheme D4

S2 type series (selection)

ZF217 pressure switches with two microswitches and switching difference

Switching difference of two-stage pressure switches (ZF217, ZF307)

Type series S2 ZF217 ZF307		 Higher pressure Lower pressure					
	min. switching difference	max. switching difference (mean values)					
Type	Factory default	Switching scheme A1/A3/B2/B4 C1/C3/D2/D4 + ZF307		Switching scheme A2/A4/C2/C4		Switching scheme B1/B3/D1/D3	
DCM06	40	mbar	165	mbar	190	mbar	140	mbar
DCM025	20	mbar	140	mbar	160	mbar	120	mbar
DCM1	40	mbar	240	mbar	280	mbar	200	mbar
DCM3	0.1	bar	0.65	bar	0.75	bar	0.55	bar
DCM6	0.15	bar	0.95	bar	1.2	bar	0.8	bar
DCM10	0.25	bar	1.6	bar	1.85	bar	1.35	bar
DCM16	0.3	bar	2.0	bar	2.3	bar	1.7	bar
DCM25	0.6	bar	4.0	bar	4.6	bar	3.4	bar
DCM40	0.9	bar	6.0	bar	6.9	bar	5.1	bar
DCM63	1.3	bar	8.5	bar	9.8	bar	7.2	bar
DNM025	35	mbar	215	mbar	240	mbar	180	mbar
VCM095	40	mbar	300	mbar	340	mbar	260	mbar
VCM101	40	mbar	260	mbar	300	mbar	220	mbar
VCM301	20	mbar	100	mbar	120	mbar	80	mbar
VNM111	50	mbar	310	mbar	360	mbar	260	mbar

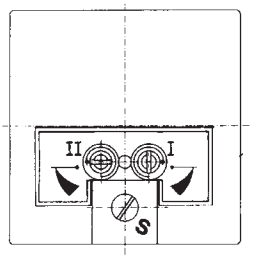
Switching devices with adjustable switching difference

Additional function ZF217

On switching devices with additional function ZF217, the switching differene is continuously adjustable via two adjustment knobs I and II accessible from outside. The maximum possible switching difference is stated in the "Switching difference" table.
Turning adjustment knob I clockwise produces a lower switching point for microswitch I
Turning adjustment knob II anticlockwise produces a higher switching point for microswitch II
Adjustment knobs I and II have an internal stop to prevent the micro switches from being adjusted beyond the effective range.

Adding together the adjustments on knobs I and II results in the switching difference between the two micro switches. Changes made with the setting spindle do not affect the switching difference. The switching difference remains constant over the whole setting range of the spindle. The two switching points are moved up or down in parallel.

Recommended adjustment method for switching devices with ZF217

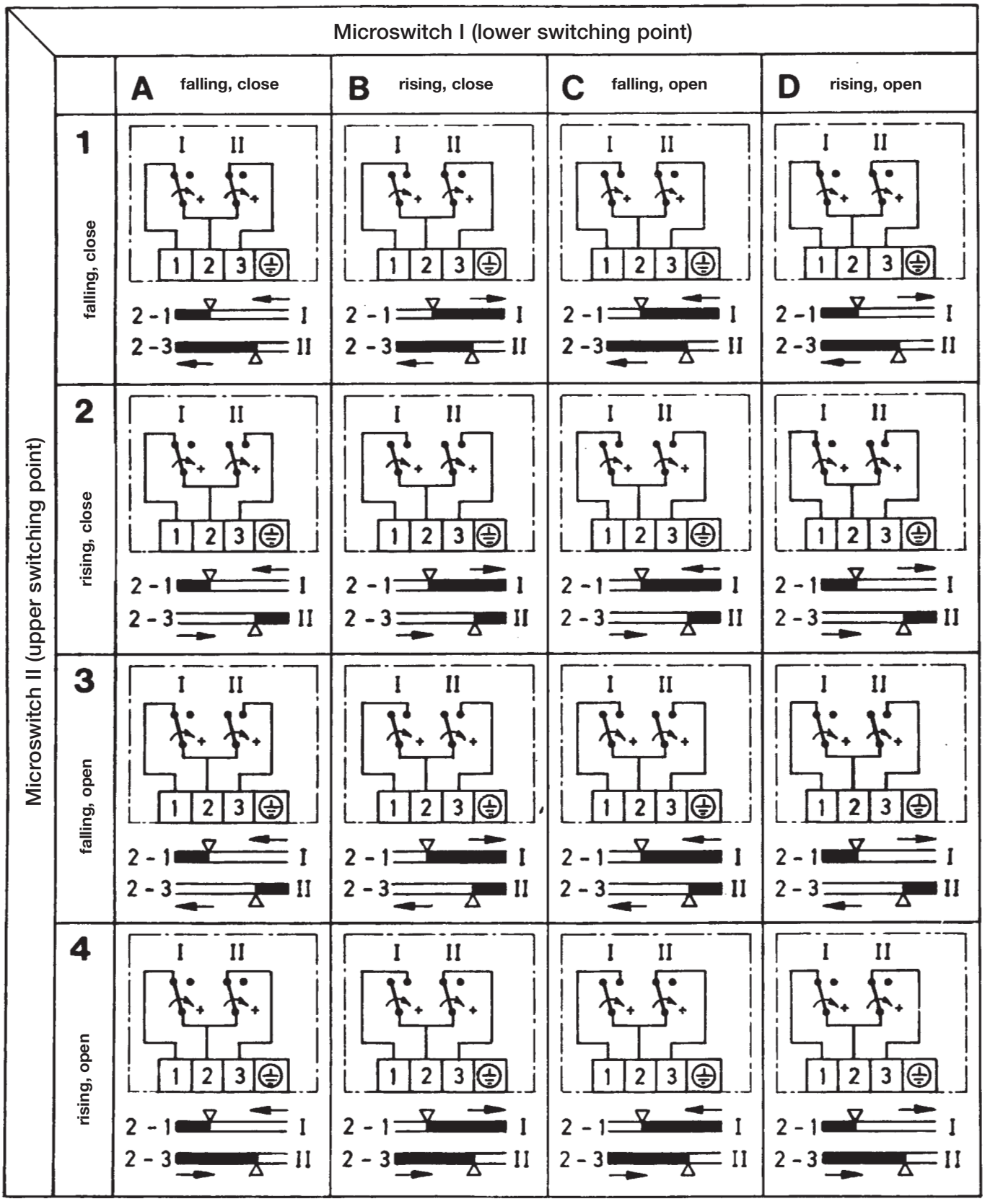


1. Set adjustment knobs I and II to their basic positions.
   Turn adjustment knob I anticlockwise as far as possible.
   Turn adjustment knob II clockwise as far as possible.
2. Adjust the setting spindle **S** by the scale to a value midway between the desired upper and lower switching points.
3. With pressure applied, set the lower switching point with adjustment knob I.
4. In the same way as in step 3, set the upper switching point with adjustment knob II.
5. If the desired upper and lower switching points cannot be reached, turn the setting spindle **S** in the appropriate direction and repeat steps 3 and 4.

S2 type series

Two-stage pressure switches, switching schemes for ZF217

Function-appropriate internal configuration of microswitches I and II, switching scheme selection table. The switch position shown corresponds to the pressureless state. On the horizontal axis is the switching function of microswitch I (A–D); on the vertical axis is the switching function of microswitch II (1–4). At the intersection is the switching scheme which satisfies both conditions (e.g. A 2).



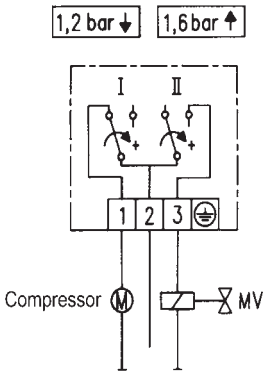
Information required when ordering:
As well as the basic type (e.g. DCM10) and the switching scheme (e.g. A 2), for factory setting it is also necessary to indicate the switching points and direction of action:
Example: DCM 10-217C-S, switching scheme: A2, Switch I: 6.5 bar falling, Switch II: 7.5 bar rising.

S2 type series

Examples of use for two-stage pressure switches

Pressure monitoring and controlling can be greatly simplified by using pressure monitors with two built-in microswitches which can be made to operate one after the other under rising or falling pressure. For example, minimum and maximum pressure monitoring can be achieved with only **one** pressure switch, doing away with the need for a second pressure switch (including the cost of installation). Step switching, e.g. pressure-dependent control of a two-stage pump, is of course also possible using this special series.

For pressure-dependent control of automatic expansion valves and pressure holding devices



Example 1:

Requirement

Pressure holding devices and automatic expansion valves usually have a gas cushion whose pressure must be kept constant within a certain range. If the pressure is too low, a compressor is switched on. If the pressure is too high, a solenoid valve must be opened to vent the gas. Between these two levels is a neutral zone, in which the compressor and the solenoid valve are at rest.

Solution

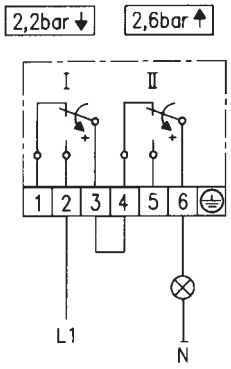
All pressure switches of types DCM, DNS, each with additional function ZF217 and switching scheme A 2, are suitable. All pressure ranges listed in the technical documents are possible. Example for ordering: see page 24

Switching function / connection scheme

Switch I: With falling pressure, contact 1–2 closes (compressor on)
With rising pressure, contact 1–2 opens (compressor off)

Switch II: With rising pressure, contact 2–3 closes (valve open)
With falling pressure, contact 2–3 opens (valve closed).
In between there is a neutral zone in which the compressor is not switched on and the solenoid coil is not energized (off position).

Minimum and maximum pressure monitoring in a nitrogen line



Example 2:

Requirement

In a process engineering system, the pressure in a nitrogen line has to be monitored. A green signal lamp indicates that the pressure in the line is between 2.2 and 2.6 bar. If the pressure goes below 2.2 bar or above 2.6 bar, the indicator lamp goes out and the system shuts down.

Solution

The first contact of a DCM3–307 pressure switch with 2 microswitches opens under falling pressure at 2.2 bar; the second microswitch opens under rising pressure at 2.6 bar. If the pressure is >2.2 bar or <2.6 bar, the circuit is closed via both microswitches and the signal lamp is lit.

Liquids and gases

DCM025

DCM/DNM

Mechanical pressure switches

This universal pressure switch can be used in general mechanical engineering and the printing machine industry, as well as in pneumatics and hydraulics.

→ p.40
→ p.65

Liquids and gases

DNS6-351

DNS/VNS

Pressure and vacuum switches with stainless steel sensors (1.4571)

Pressure switches of the DNS series are suitable for monitoring and controlling pressures in chemical plants, process engineering and any situation where the pressure of aggressive liquids and gases must be monitored. All components of the sensor system are made of high-quality stainless steel (1.4571) and welded using the latest methods without filler metals. The pressure sensor is gasket-free plasma-welded.

→ p.41–42
→ p.66

Liquids and gases

DDCM252

DDCM

Differential pressure switches

FEMA differential pressure monitors are suitable for monitoring and controlling differential pressures, flow monitoring and automatic supervision of filter systems. A double chamber system with stainless steel bellows or Perbunan diaphragm detects the difference between the two applied pressures. The desired switching pressure is continuously adjustable within the ranges mentioned in the product summary. All differential pressure monitors can also be used in the vacuum range. The switching differential is not adjustable.

→ p.43
→ p.67

Liquids and gases

VCM301

VCM/VNM

Negative pressure switches (vacuum switches)

FEMA negative pressure switches detect the pressure difference relative to atmospheric pressure. All data relating to the switching pressure ranges and thus also the scale divisions on the switching devices are to be understood as the difference in pressure between the relevant atmospheric pressure and the set switching pressure. The "zero" reference point on the scale of the unit corresponds to the relevant atmospheric pressure.

→ p.44
→ p.68

10 selection criteria

CHECKLIST

1	**Medium**	Steam, hot water, fuel gases, air, flue gases, liquid gas, liquid fuels, other media
1a	**Sensor material**	Stainless steel, non-ferrous metals, plastics (e.g. Perbunan). Are all sensor materials resistant to the medium? Oil and grease-free for oxygen?
2	**Type approval**	Is type approval (TÜV, DVGW, ATEX, etc.) required for the intended application?
3	**Function**	Monitors, limiters. Safety-engineered pressure limiters.
4	**Direction of action**	Is the maximum pressure or minimum pressure to be monitored? Does the pressure switch have a controller function (e.g. turns pump on and off)?
5	**Setting range**	The desired setting range can be found in the Product Summaries.
6	**Switching differential** for controllers/monitors only	The adjustable switching differential is only important in the case of pressure switches with a controller function. For limiter functions the switching differential (hysteresis) has no significance
7	**Maximum working pressure**	The maximum working pressure listed in the tables must be equal to or greater than the maximum system pressure
8	**Environmental conditions**	Medium temperature / ambient temperature / protection class / humidity / Ex-zone / Outdoor installation – protective measures
9	**Type of construction/ size Pressure connection**	Size, installation position, installation method, pressure connection with seal
10	**Electrical data Switching capacity**	Switching element / changeover contact / normally closed contact / normally open contact / switching capacity / interlocking / gold contacts / contactless signal transmission

This list of criteria does not claim to be complete.
However, all items must be checked.
The stated sequence is expedient but not mandatory.

DCM25

DCM/DNM

Pressure switches and pressure monitors for overpressure

This universal pressure switch can be used in general mechanical engineering and the printing machine industry, as well as in pneumatics and hydraulics.

SIL 2 according IEC 61508-2

Technical data

Pressure connection
External thread G 1/2 (pressure gauge connection) according to DIN 16 288 and internal thread G 1/4 according to ISO 228 Part 1.

Switching device
Robust housing (200) made of seawater-resistant diecast aluminium GD Al Si 12.

Protection class
IP 54, in vertical position.

Pressure sensor materials

DNM025…DCM63	Metal bellows: 1.4571 Sensor housing: 1.4104
DCM025 – DCM 1	Metal bellows: Cu Sensor housing: Cu + Ms
DCM4016/ DCM4025	Diaphragm: Perbunan Sensor housing: 1.4301
DCM1000	Diaphragm: Perbunan Sensor housing: Brass

Mounting position
Vertically upright and horizontal. DCM4016 and 4025 vertically upright.

Ambient temp. at switching device
–25…+70 °C, except: DCM4016, 4025, 1000: –15…+60 °C

Max. medium temperature
The maximum medium temperature at the pressure sensor must not exceed the permitted ambient temperature at the switching device. Temperatures may reach 85°C for short periods). Higher medium temperatures are possible provided the above limit values for the switching device are ensured by suitable measures (e.g. siphon).

Mounting
Directly on the pressure line (pressure gaugeconnection) or on a flat surface with two 4 mm Ø screws.

Switching pressure
Adjustable from outside with screwdriver.

Switching differential
Not adjustable with DCM and types. Adjustable from outside with DCMV types. For values see Product Summary.

Contact arrangement
Single-pole changeover switch.

Switching capacity	250 VAC (ohm)	250 VAC (ind)	250 VDC (ohm)	24 VDC (ohm)
Normal	8 A	5 A	0.3 A	8 A

Type	Setting range	Switching differential (mean values)	Max. permissible pressure	Materials in-contact with medium	Dimen-sioned drawing
Switching differential not adjustable					**page 25 + 26**
DCM4016	1…16 mbar	2 mbar	1 bar	Perbunan	1 + 11
DCM4025	4…25 mbar	2 mbar	1 bar	+ 1.4301	
DCM1000	10…100 mbar	12 mbar	10 bar	Perbunan + MS	1 + 10
DCM025	0.04…0.25 bar	0.03 bar	6 bar	Cu + Ms	
DCM06	0.1…0,6 bar	0.04 bar	6 bar	Cu + Ms	1 + 14
DCM1	0.2…1,6 bar	0.04 bar	6 bar	Cu + Ms	
DNM025	0.04…0.25 bar	0.03 bar	6 bar		1 + 15
DCM506	15…60 mbar	10 mbar	12 bar		1 + 12
DCM3	0.2…2.5 bar	0.1 bar	16 bar	Sensor	1 + 18
DCM6	0.5…6 bar	0.15 bar	16 bar	housing	
DCM625	0.5…6 bar	0.25 bar	25 bar	1.4104	1 + 17
DCM10	1…10 bar	0,3 bar	25 bar	+	
DCM16	3…16 bar	0.5 bar	25 bar	Pressure	
DCM25	4…25 bar	1.0 bar	60 bar	bellow	1 + 16
DCM40	8…40 bar	1.3 bar	60 bar	1.4571	
DCM63	16…63 bar	2.0 bar	130 bar		
Switching differential adjustable					
DCMV025	0.04…0.25 bar	0.03…0.4 bar	6 bar		
DCMV06	0.1…0.6 bar	0.04…0.5 bar	6 bar	Cu + Ms	1 + 14
DCMV1	0.2…1.6 bar	0.07…0.55 bar	6 bar		
DCMV3	0.2…2.5 bar	0.15…1.5 bar	16 bar	Sensor	1 + 18
DCMV6	0.5…6 bar	0.25…2.0 bar	16 bar	housing	
DCMV625	0.5…6 bar	0.25…2.0 bar	25 bar	1.4104	1 + 17
DCMV10	1…10 bar	0.5…2.8 bar	25 bar	+	
DCMV16	3…16 bar	0.7…3.5 bar	25 bar	Pressure	
DCMV25	4…25 bar	1.3…6.0 bar	60 bar	bellow	
DCMV40	8…40 bar	2.6…6.6 bar	60 bar	1.4571	1 + 16
DCMV63	16…63 bar	3.0…10 bar	130 bar		

For smaller pressure ranges see also VCM, DGM, HCD and DPS sheets.
For additional functions refer page 30–32.

Calibration

The **DCM** series is calibrated for falling pressure. This means that the adjustable switching pressure on the scale corresponds to the switching point at falling pressure. The reset point is higher by the amount of the switching differential. (See also page 27, 1. Calibration at lower switching point).

Ex-DCM/DNM
see page 65

DNS3-201

DNS/VNS

Pressure switches and vacuum switches with stainless steel sensors (1.4571)

Pressure switches of the DNS series are suitable for monitoring and controlling pressures in chemical plants, process engineering and any situation where the pressure of aggressive liquids and gases must be monitored.

All components of the sensor system are made of high-quality stainless steel (1.4571) and welded using the latest methods without filler metals. The pressure sensor is gasket-free plasma-welded.

SIL 2 according IEC 61508-2

SIL2 FUNCTIONAL SAFETY

Technical data

Pressure connection
External thread G 1/2 (pressure gauge connection) according to DIN 16 288 and internal thread G 1/4 according to ISO 228 Part 1.

Switching device
Robust housing (200) made of seawater-resistant diecast aluminium GD Al Si 12.

Protection class
IP 54, in vertical position.

Pressure sensor materials
Pressure bellows and all parts in contact with medium. X 6 Cr Ni Mo Ti 17122 Material no. 1.4571

Mounting position
Vertically upright and horizontal.

Max. ambient temperature at switching device
–25…+70 °C.

Max. medium temperature
The maximum medium temperature at the pressure sensor must not exceed the permitted ambient temperature at the switching device. Temperatures may reach 85°C for short periods.
Higher medium temperatures are possible provided the above limit values for the switching device are ensured by suitable measures (e.g. siphon).

Mounting
Directly on the pressure line (pressure gaugeconnection) or on a flat surface with two 4 mm Ø screws.

Switching pressure
Adjustable from outside with screwdriver.

Switching differential
For values see Product Summary.

Contact arrangement
Single-pole changeover switch.

Switching capacity	250 VAC (ohm)	(ind)	250 VDC (ohm)	24 VDC (ohm)
Normal	8 A	5 A	0.3 A	8 A

Plastic coating
The diecast aluminium housing in GD Al Si is chromated and stove-enamelled with resistant plastic. Corrosion tests with 3% saline solution and 30 temperature changes from +10 to +80°C showed no surface changes after 20 days.

Product Summary

Type	Setting range	Switching differential (mean values)	Max. permissible pressure	Dimen-sioned drawing
Switching differential not adjustable				page 25 + 26
VNS301-201	-250…+100 mbar	45 mbar	3 bar	
VNS111-201	-1*…+0.1 bar	50 mbar	6 bar	
DNS025-201	0.04…0.25 bar	30 mbar	6 bar	1 + 15
DNS06-201	0.1…0.6 bar	40 mbar	6 bar	
DNS1-201	0.2…1.6 bar	60 mbar	6 bar	
DNS3-201	0.2…2.5 bar	0.1 bar	16 bar	
DNS6-201	0.5…6 bar	0.15 bar	16 bar	1 + 18
DNS10-201	1…10 bar	0.3 bar	16 bar	
DNS16-201	3…16 bar	0.5 bar	25 bar	1 + 16
Switching differential adjustable				
VNS301–203	–250…+100 mbar	70 –300 mbar	3 bar	
VNS111–203	–1*…+0.1 bar	90 –550 mbar	6 bar	
DNS025–203	0.04…0.25 bar	60 –300 mbar	6 bar	1 + 15
DNS06–203	0.1…0.6 bar	80 –400 mbar	6 bar	
DNS1–203	0.2…1.6 bar	100 –600 mbar	6 bar	
DNS3–203	0.2…2.5 bar	0.15– 1.5 bar	16 bar	1 + 18
DNS6–203	0.5…6 bar	0.25– 2.0 bar	16 bar	
DNS10–203	1…10 bar	0.45– 2.5 bar	16 bar	1 + 16
DNS16–203	3…16 bar	0.8– 3.5 bar	25 bar	

* At very high vacuums, close to the theoretical maximum of –1 bar, the switch may not be usable in view of the special conditions of vacuum engineering. However, the pressure switch itself will not be damaged at maximum vacuum.

Calibration

The **DNS** and **VNS** series are calibrated for falling pressure. This means that the adjustable switching pressure on the scale corresponds to the switching point at falling pressure. The reset point is higher by the amount of the switching differential. (See also page 27, 1. Calibration at lower switching point).

-DNS/VNS
see page 66

CE

Protection Class:
IP 54

DNS6-351

DNS/VNS

Pressure and vacuum switches with stainless steel sensors (1.4571)

Chemical version (switching housing with surface protection)
Pressure switches of the DNS series are suitable for monitoring and controlling pressures in chemical plants, process engineering and any situation where the pressure of aggressive liquids and gases must be monitored. All components of the sensor system are made from high-quality stainless steel (1.4571) and welded using the latest methods without filler metals. The pressure sensor is gasket free plasma welded.

SIL 2 according IEC 61508-2

Technical data

Pressure connection External thread G 1/2" (pressure gauge connection) according to DIN 16 288 and internal thread G 1/4" according to ISO 228 Part 1

Switching device Robust housing (300) made of seawater-resistant diecast aluminium GD Al Si 12

Protection class IP 65, in vertical position

Pressure sensor materials Pressure bellows and all parts in contact with medium X 6 Cr Ni Mo Ti 17122 Material no. 1.4571

Mounting position Vertically upright and horizontal

Max. ambient temperature at switching device –25 to +70 °C

Max. medium temperature The maximum medium temperature at the pressure sensor must not exceed the permitted ambient temperature at the switching device. Temperatures may reach 85 °C for short periods. Higher medium temperatures are possible provided the upper limit at the switching device is ensured by suitable measures (e.g. siphon).

Plastic coating The diecast aluminium housing in GD Al Si is chromated and stove-enamelled with resistant plastic. Corrosion tests with 3% saline solution and 30 temperature changes from +10 to +80°C showed no surface changes after 20 days

Contact arrangement Single-pole changeover switch

Switching capacity	250 VAC (ohm)	250 VAC (ind)	250 VDC (ohm)	24 VDC (ohm)
Normal	8 A	5 A	0.3 A	8 A

Type	Setting range	Switching differential (mean value)	Max. permissible pressure	Dimensioned drawing
Hysteresis not adjustable				page 25+26
VNS301-351	-250…+100 mbar	45 mbar	3 bar	2 + 15
VNS111-351	-1*…+0,1 bar	50 mbar	6 bar	
DNS025-351	0,04…0,25 bar	30 mbar	6 bar	
DNS06-351	0,1…0,6 bar	40 mbar	6 bar	
DNS1-351	0,2…1,6 bar	60 mbar	6 bar	
DNS3-351	0,2…2,5 bar	0,1 bar	16 bar	2 + 18
DNS6-351	0,5…6 bar	0,15 bar	16 bar	
DNS10-351	1…10 bar	0,3 bar	16 bar	2 + 16
DNS16-351	3…16 bar	0,5 bar	25 bar	

* At very high vacuums, close to the theoretical maximum of –1 bar, the switch may not be usable in view of the special conditions of vacuum engineering. However, the pressure switch itself will not be damaged at maximum vacuum.

Calibration

The **DNS** and **VNS** series are calibrated for falling pressure. This means that the adjustable switching pressure on the scale corresponds to the switching point at falling pressure. The reset point is higher by the amount of the switching differential. (See also page 27, 1. Calibration at lower switching point).

DNS/VNS
see page 66

DDCM252

DDCM

Differential pressure switches

FEMA differential pressure monitors are suitable for monitoring and controlling differential pressures, flow monitoring and automatic control of filter systems. A double chamber system with stainless steel bellows or Perbunan diaphragm detects the difference between the two applied pressures.

The desired switching pressure is continuously adjustable within the ranges mentioned in the product summary.
All differential pressure monitors can also be used in the vacuum range.
The switching differential is not adjustable.

SIL 2 according IEC 61508-2

Technical data

Pressure connection
Internal thread G 1/4

Switching device
Robust housing (200) made of seawater-resistant diecast aluminium GD Al Si 12.

Protection class
IP 54, in vertical position.

Pressure sensor materials
DDCM014–16:
Pressure bellows of 1.4571
Sensor housing of 1.4305.
DDCM252–6002:
Perbunan diaphragm.
Aluminium sensor housing.

Mounting position
vertically upright.

Ambient temperature at switching device
–25…+70 °C

Max. medium temperature
The maximum medium temperature at the pressure sensor must not exceed the permitted ambient temperature at the switching device. Temperatures may reach 85°C for short periods). Higher medium temperatures are possible provided the above limit values for the switching device are ensured by suitable measures (e.g. siphon).

Mounting
Directly on the pressure line or on a flat surface with two 4 mm Ø screws.
Note the connection of pressurized lines:
P (+) = high pressure
S (–) = low pressure

Switching pressure
Adjustable from outside with screwdriver.

Switching differential
Not adjustable. For values see Product Summary.

Switching capacity	250 VAC (ohm)	(ind)	250 VDC (ohm)	24 VDC (ohm)
Normal	8 A	5 A	0.3 A	8 A

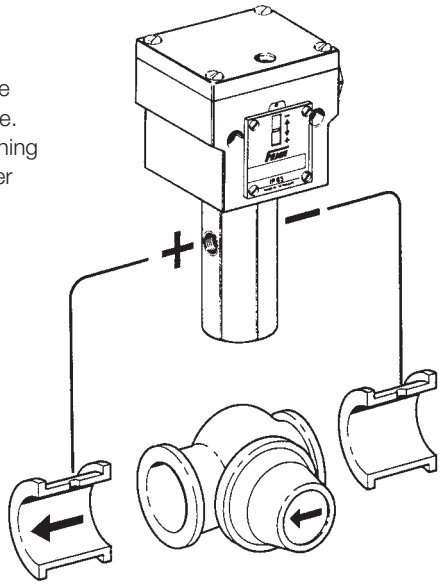
Type	Setting range (differenttial pressure	Switching differential (mean values)	Max.** permissible pressure	Materials in contact with medium	Dimen-sioned drawing
Switching differential not adjustable					**page 25 + 26**
DDCM252*	4…25 mbar	2 mbar	0,5 bar		
DDCM662*	10…60 mbar	15 mbar	1,5 bar	Aluminium	1 + 20
DDCM1602*	20…160 mbar	20 mbar	3 bar	+ Perbunan	
DDCM6002*	100…600 mbar	35 mbar	3 bar		
DDCM014	–0.1…0.4 bar	0.15 bar	15 bar		
DDCM1	0.2…1.6 bar	0.13 bar	15 bar	Stainless steel	
DDCM4*	1…4 bar	0.20 bar	25 bar	1.4305 +	
DDCM6	0.5…6 bar	0.20 bar	15 bar	1.4571	1 + 21
DDCM16	3…16 bar	0.60 bar	25 bar		

* without graduation (only ± scale) set according to pressure gauge
** also loadable on one side
For more differential pressure monitors, see the HCD and DPS series, page 71 and 72.

For accessories, see VKD… and MAU8…, on pages 152 and 153.

Calibration

The **DDCM** series are calibrated for falling pressure. This means that the adjustable pressure on the scale corresponds to the switching point at falling pressure. The reset point is higher by the amount of the switching differential. (See also page 23, 1. Callibration at lower switching point).



Pump monitoring application example

The differential pressure switch (e.g. DDCM1) monitors differential pressure through the pump. The system shuts down if values fall below an adjustable switching threshold. Pump monitoring does not depend on the static pressure in the system.

DDCM
see page 67

VCM301

VCM/VNM

Negative pressure switches (vacuum switches)

FEMA negative pressure switches detect the pressure difference relative to atmospheric pressure. All data relating to the switching pressure ranges and thus also the scale divisions on the switching devices are to be understood as the difference in pressure between the relevant atmospheric pressure and the set switching pressure. The "zero" reference point on the scale of the unit corresponds to the relevant atmospheric pressure.

SIL 2 according IEC 61508-2

Technical data

Pressure connection
External thread G 1/2 (pressure gauge connection) according to DIN 16 288 and internal thread G 1/4 according to ISO 228 Part 1.

Switching device
Robust housing (200) made of seawater-resistant diecast aluminium GD Al Si 12.

Protection class
IP 54, in vertical position.

Pressure sensor materials

VNM111 and VNM301:	Metal bellows: 1.4571 Sensor housing: 1.4104
VCM095, 101 and 301:	Metal bellows of CuZn Sensor housing of CuZn
VCM4156:	Perbunan diaphragm sensor housing: 1.4301

Mounting position
Vertically upright and horizontal.
VCM4156 vertically upright.

Ambient temp. at switching device
–25…+70 °C

Exeption
VCM4156 –15…+60 °C

Max. medium temperature
The maximum medium temperature at the pressure sensor must not exceed the permitted ambient temperature at the switching device. Temperatures may reach 85°C for short periods. Higher medium temperatures are possible provided the above limit values for the switching device are ensured by suitable measures (e.g. siphon).

Mounting
Directly on the pressure line (pressure gaugeconnection) or on a flat surface with two 4 mm Ø screws.

Switching pressure
Adjustable from outside with screwdriver.

Switching differential
Not adjustable with VCM types. Adjustable with VCMV type. For values see Product Summary.

Contact arrangement
Single-pole changeover switch.

Switching capacity	250 VAC (ohm)	250 VAC (ind)	250 VDC (ohm)	24 VDC (ohm)
Normal	8 A	5 A	0.3 A	8 A

Product summary

Type	Setting range (differential pressure)	Switching differential (mean values)	Max. permissible pressure	Dimen-sioned drawing
Switching differential not adjustable				**page 25 + 26**
VCM4156	–15…+6 mbar	2 mbar	1 bar	1 + 11
VCM301	–250…+100 mbar	25 mbar	1.5 bar	1 + 13
VNM301	–250…+100 mbar	45 mbar	3 bar	1 + 15
VCM101	–1*…+0.1 bar	45 mbar	3 bar	1 + 14
VCM095	–0.9…+0.5 bar	50 mbar	3 bar	1 + 14
VNM111	–1*…+0.1 bar	50 mbar	6 bar	1 + 15
Switching differential adjustable				
VCMV301	–250…+100 mbar	30 – 200 mbar	1,5 bar	1 + 13
VCMV101	–1*…+0.1 bar	80 – 350 mbar	3 bar	1 + 14
VCMV095	–0.9…+0.5 bar	90 – 400 mbar	3 bar	1 + 14
VNMV301	–250...+100 bar	70 – 450 mbar	3 bar	1 + 15
VNMV111	–1*…+0.1 bar	90 – 650 mbar	6 bar	1 + 15

* At very high vacuums, close to the theoretical maximum of –1 bar, the switch may not be usable in view of the special conditions of vacuum engineering. However, the pressure switch itself will not be damaged at maximum vacuum.

For additional functions refer to page 30–32.
For smaller pressure ranges see also HCD and DPS data sheets, page 71 and 72.

Calibration

The **VCM** and **VNM** series are calibrated for falling pressure. This means that the adjustable switching pressure on the scale corresponds to the switching point at falling pressure. The reset point is higher by the amount of the switching differential. (See also page 27, 1. Calibration at lower switching point).

VCM/VNM
see page 68

Tested to PE Directive 97/23 EC

Rated according to SIL

DWAM1

DWAM, DWAMV, SDBAM

Pressure monitors / pressure limiters

These series are particularly suitable for maximum pressure monitoring in steam and hot water systems. These pressure switch are "of special construction", with self-monitoring pressure sensor, built in accordance with Pressure Equipment Directive PED 97/23/EC. They can be used as pressure monitors or a pressure limiters for maximum pressure monitoring (systems in accordance with TRD 604 and DIN EN 12828) and are available with or without switching differential adjustment.

➔ p.53

Tested to PE Directive 97/23 EC

Rated according to SIL

DWAM6-576

DBS

Pressure monitors / pressure limiters

In many ways, safety-engineered pressure limiters offer a higher degree of safety compared with standard pressure switches and are therefore especially suitable for chemical process engineering and thermal installations in which safety is an especially critical factor in pressure monitoring. Pressure switches can also be used in Ex zones (zones 0, 1, 2 and 20, 21, 22) and, in all cases, require an isolating amplifier. The isolating amplifier is also responsible for monitoring lines for short-circuit and line break and therefore offers an additional safety advantage – even in non-Ex zones. For Ex applications, the isolating amplifier must be installed outside the Ex zone. The lines between the isolating amplifier and the pressure switch are monitored for short-circuit and line break.

➔ p.54–56

Tested to PE Directive 97/23 EC

Rated according to SIL

FD16-326

FD

Maximum pressure limiters for liquid gas installations

Pressure limiters of the FD series are constructed in accordance with the special directives for liquid gas engineering. The requirements of TRB 801 Appendix II §12 are met. All parts coming into contact with the medium are made from stainless steel 1.4104 and 1.4571. The pressure sensor was designed to be "self-monitoring" to exceed the requirements of TRB , i. e. should the measuring bellows rupture, the pressure sensor switches off towards the safe side. The pressure sensor thus complies with "of special construction" in the sense of VdTÜV Memorandum "Pressure 100". Pressure limiters are used in intrinsically safe control circuits (Ex protection Ex-i). By using an isolating amplifier, the control circuit is also monitored for line break and short-circuit.

➔ p.57

Tested to ATEX 94/9 EC

Rated according to SIL

DGM

Pressure monitors for fuel gases

DVGW tested to DIN EN1854:2006. Gas pressure monitors are suitable for all gases in accordance with DVGW Worksheet G 260 and for air.

DGM310A

→ p.58
→ p.70

Tested to PED 97/23 EC
Tested to ATEX 94/9 EC

Rated according to SIL

DWR

Pressure monitors/limiters

Especially suitable as a pressure monitor or pressure limiter for fuel gases (DVGW Worksheet G 260 to DIN EN1854) and liquid fuels (e.g. fuel oil), as well as for steam systems according to TRBS and hot water systems to DIN EN 12828. The DWR is used to monitor maximum and minimum pressures. These pressure switches are "of special construction" and have been tested with 2 million operating cycles.

DWR625

→ p.59–60
→ p.69

Pressure switches "of special construction"

Definitions and information

Pressure monitoring and pressure limiting in

- **Steam boilers**
- **District heating systems**
- **Oil pipelines**
- **Liquid gas installations etc.**
- **Hot water heating systems**
- **Gas installations**
- **Firing systems**

is extremely important with regard to safety.

Component testing

Pressure monitoring devices for safety-critical applications must work reliably and be tested according to the relevant directives in each case. **The reliability of pressure monitors and pressure limiters must be certified by a component test** which is performed by the testing agencies responsible in each case (e.g. TÜV and DVGW). The following section deals with the FEMA product range for safety-critical pressure monitoring in thermal and process engineering systems.

Special construction

The term "of special construction" originates from the **VdTÜV Memorandum "Pressure 100", issue 07.2006,** which defines the requirements for **pressure monitors and pressure limiters for steam boilers and hot water systems**. Originally used only for pressure monitoring in the area of steam and hot water, the "special construction" characteristic is increasingly used as a quality and safety argument for other applications as well. The following section describes the requirements for pressure limiters "of special construction". Recommendations for the correct selection of pressure limiters are given by reference to safety analyses.

Definitions of the VdTÜV Memorandum "Pressure 100":

Pressure monitors (DW)
Pressure monitors are devices which switch off the heating system on exceeding and / or falling below a predefined pressure limit and release the heating system again only after a change in pressure.

Pressure limiters (DB)
Pressure limiters are devices which switch off the heating system on exceeding and / or falling below a predefined pressure limit and lock it to prevent automatic restarting.

Pressure limiters "of special construction" (SDB)
Pressure limiters "of special construction" perform the same tasks as pressure limiters. In addition they must satisfy the extended safety requirements of section 3.4 (of "Pressure 100").

Safe condition

According to DIN VDE 0660, Part 209, the safe condition of the system is reached if a cut-off command is present at the output contact which means that in the safe condition, the microswitch in the pressure limiter is actuated (opened) and the control circuit is interrupted. Series connected switching devices must react in the same way. The operating mode of the safety pressure limitation thus corresponds to the **closed circuit principle**.

Additional requirements for pressure limiters "of special construction"

Section 3.4 of VdTÜV Memorandum "Pressure 100":
Pressure limiters "of special construction" **must, in the event of a breakage in the mechanical part of the measuring element, lead to cut-off and interlock of the heating**. This requirement is also fulfilled if the mechanical part of the measuring element is calculated for vibrating stress **or has withstood a test with 2 million operating cycles and the pressurized parts of the measuring element are made of corrosion-resistant materials**.
(Abbreviated except from VdTÜV Memorandum "Pressure 100").

Therefore there are two possible ways of meeting the requirements for pressure limiters "of special construction":

a) By a self-monitoring pressure sensor which is designed so that a breakage in the mechanical part of the measuring element leads to cut-off to the safe side (see Fig. 1)
b) By certification of endurance testing with 2 million operating cycles during the component test (see Fig. 2)

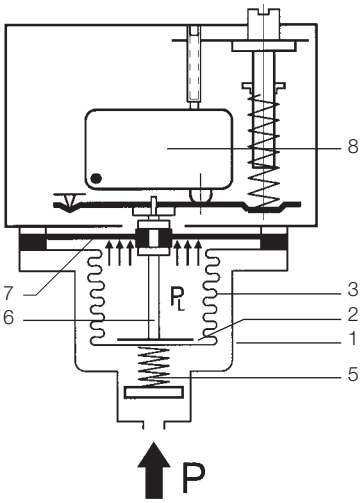


Fig. 1
Self-monitoring maximum pressure limiter with safety diaphragm DWAM…, DWAMV…, SDBAM…

a) Self-monitoring pressure sensor with safety diaphragm (for maximum pressure monitoring only)

Fig. 1 is a cross-sectional diagram of a pressure sensor which fulfils the "special construction" requirements. The measuring chamber is bordered by the housing (1), base (2) and measuring bellows (3). All parts are made of stainless steel and are welded together without filler metals. When the pressure rises the measuring bellows (3) moves upwards, supported by the back pressure spring (5). The setpoint spring installed in the switching device acts as a counterforce. A transfer bolt (6) which transfers the pressure-dependent movements of the measuring bellows (3) to the switching device located above is placed on the inside of the base. A plastic diaphragm (7), which is not in contact with the medium and in normal operation follows the movements of the measuring bellows but itself has no influence on the position of the bellows, is clamped in the upper part of the transfer bolt. On breakage of the measuring bellows (3), the medium can escape into the interior of the bellows. The medium pressure is now on the underside of the diaphragm (PL). An additional force is generated because of the far larger effective area of the diaphragm compared with the bellows, and this pushes the transfer bolt (6) upwards. This results in cut-off to the safe side. The cut-off condition thus achieved is normally interlocked electrically or mechanically, so that the system also remains cut off when the pressure drops again. The plastic diaphragm (7) is not a pressure-bearing part; it has no function in normal operation and is effective only if a leakage occurs to the measuring bellows. Safety diaphragms of the described design are permissible up to 32 bar. This should be sufficient for most applications.

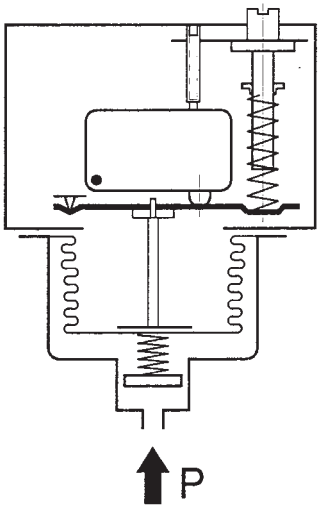


Fig. 2
Pressure limiter without safetydiaphragm (not self-monitoring for maximum pressure) DWR…

b) Pressure sensors with certification of 2 million operating cycles (DWR series)

In this design it is assumed that the pressure sensors which have withstood dynamic loading of 2 million operating cycles during component testing can be considered as reliable elements. They do not have an additional safety device in the sensor. Although the units are produced and tested with very great care, maximum pressure limiters without additional safety device can lead to dangerous conditions if errors which cannot be detected in the tests occur due to secondary effects. These may be caused by hole corrosion due to deposited metal particles on the (usually very thin-walled) bellows of the pressure sensor, material defects in the pressure bellows or a broken weld seam. Despite careful production and testing, a residual risk remains in the case of maximum pressure monitoring. It is ultimately up to the user and operator of the systems themselves to decide on the degree of safety to which pressure vessels should be monitored.

Pressure sensors without safety diaphragm are self monitoring when used in minimum pressure monitoring applications.

Safety analysis for maximum pressure monitoring

Observing the direction of action

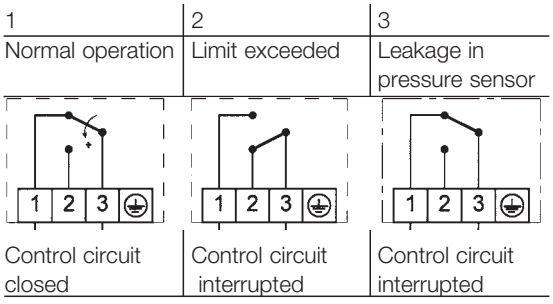
The preceding description and safety considerations relate to the monitoring of maximum pressure. The safe side here means: The energy supply is cut off (e.g. burner is turned off) to avoid a further pressure rise. Minimum pressure monitoring requires an entirely different approach. The safe side here means: Preventing the pressure from falling further (for example: hotwater systems with external pressure retention or monitoring of water level in heating systems). Based on a safety analysis, a pressure limiter without safety diaphragm is clearly the best option. In the event of leakage in the sensor, "low pressure" is signalled and the system switches over to the safe side. A pressure sensor without safety diaphragm is therefore "of special construction" within the meaning of Memorandum "Pressure 100",
if it is used as a minimum pressure limiter. On the other hand, it is clear from the above that pressure sensors with safety diaphragms, which offer considerable advantages in maximum pressure monitoring, should never be used for minimum pressure monitoring. Incorrect use can create a dangerous condition. It is therefore essential for users and planners to observe the direction of action when selecting pressure limiters.

In summary it may be said:
Pressure limiters "of special construction" with safety diaphragms (self-monitoring pressure sensors) offer the highest degree of safety in maximum pressure monitoring. Such devices must not however be used for minimum pressure monitoring. Pressure limiters "of special construction" with certification of 2 million operating cycles are self-monitoring in the case of minimum pressure monitoring, even without a safety diaphragm. In the case of maximum pressure monitoring, however, a residual risk remains.

Safety analysis for maximum pressure monitoring

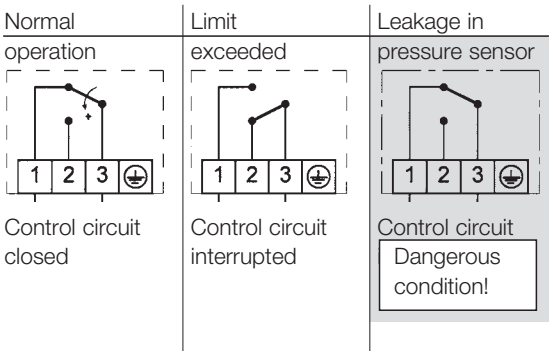
If one considers the switch positions in the possible operating conditions, the difference compared with pressure sensors "of special construction" becomes clear. The left column shows normal operation in which the switch connects terminals 3 and 1. The cut-off condition when pressure is too high is shown in column 2. The control circuit is interrupted via terminals 3 and 1.
The difference in safety terms is clear from column 3, which shows the switch position in the event of a leak in the pressure sensor. With a safety-engineered sensor the control circuit is interrupted, whereas in the case of a sensor without a safety diaphragm the control circuit remains closed, and thus a "dangerous condition" can arise.

Devices with safety diaphragm (DWAM, DWAMV, SDBAM)
In pressure limiters "of special construction" which are equipped with **safety sensors**, different operating conditions occur in the following switch positions:



Device without safety diaphragm
"Special construction" must also be proven by an **endurance test with 2 million operating cycles**. In the case of breakage/leakage (e.g. material defect, fault in weld seams, hole corrosion), the system **does not cut off to the safe side (no self-monitoring).**

In the different operating conditions the following switch positions occur **in the case of maximum pressure monitoring**: In the event of leakage in the pressure sensor, the pressure monitors/limiters according to b) are not safe. A "dangerous condition" can arise.



Further observations and summary

Minimum pressure

All **minimum pressure monitors and minimum pressure limiters are self-monitoring** within the meaning of "Pressure 100" (with or without safety diaphragm).

Pressure limiters must interlock the cut-off state
Memorandum "Pressure 100" specifies that pressure limiters must cut off and interlock against automatic restarting. For this purpose, pressure limiters are offered with integrated mechanical interlock (reclosing lockout). The direction of action is also important in the selection of the interlock. Depending on the direction of action it is necessary to determine whether the interlock should operate on rising (maximum pressure monitoring) or falling (minimum pressure monitoring) pressure.

External interlock is also possible
A pressure monitor can become a pressure limiter if an electrical interlock is connected in series. The figures on page 22 show suggested interlock circuits for maximum pressure and minimum pressure monitoring. The direction of action must be observed when deciding the circuit. For the combination of pressure monitor with external interlock to be considered as a limiter "of special construction", the pressure monitor itself must satisfy the "special construction" requirements.

Other considerations

"Special construction" — not just for steam and hot water systems
According to current standards, pressure limiters "of special construction" are mandatory for steam boilers according to TRBS and for heating systems according to DIN EN12828. It is clearly advantageous to transfer the positive experience from pressure monitoring of steam boilers to other applications. In the interest of greater safety it is desirable to incorporate the requirements for pressure limiters "of special construction" used in safety-critical monitoring applications into other standards as well. This applies particularly to applications in the field of gas, which are covered by DIN EN1854, and liquid fuels, covered by DIN EN764-7.

For even greater safety:
Positive opening contacts
In maximum pressure monitoring, safety can be further increased through additional measures. The microswitches, normally equipped with a spring contact, can be fitted with **positive opening contact (to protect against contact sticking)**.

Line break and short-circuit monitoring
The power supply to the pressure limiter is monitored for short-circuit and interruption by an external isolating amplifier. In the case of faults in the power supply, the system cuts off to the safe side. Ex-d and Ex-i versions, where applicable combined with sensors "of special construction", open up a wide range of possibilities in the field of Ex-applications for **process engineering systems and gas engineering**. See DBS-series.

Summary

It is apparent that safety can be improved significantly and numerous causes for the occurrence of dangerous conditions can be eliminated through the appropriate use of technical measures. However, it is also apparent that a residual risk remains. Careful planning and conscientious maintenance and testing of existing systems are absolutely essential for reliable pressure monitoring on pipelines and pressure vessels.

Standards – Directives – Component tests

VdTÜV Pressure 100

Steam and hot water
Pressure monitors and pressure limiters for steam and hot water in systems to DIN EN12828 and TRBS. Series DA and DWR.

DVGW DIN EN1854

Fuel gases CE
Pressure monitors and limiters for fuel gases in accordance with DVGW Worksheet G 260. Series DGM and DWR.

TÜV DIN EN764-7

Liquid fuels
Pressure monitors and pressure limiters for liquid fuels (heating oil) Series DWR.

TÜV, Pressure 100

Safety-engineered pressure limiters
For safety-critical pressure monitoring in liquid gas systems, chemical and process engineering systems.

PED 97/23/EC

Pressure Equipment Directive 97/23/EC
Pressure monitors and limiters to DIN EN12952-11 and DIN EN12953-9

ATEX 94/9/EC

Ex-versions
For Ex-areas Zones 1 and 2, as well as 21 and 22 all pressure switches can be supplied in pressure-proof encapsulated design.
All intrinsically safe devices are for the Ex-Zones 0, 1, 2, 20, 21 and 22.
For intrinsically safe control circuits (Ex protection class Ex-i), pressure switches with gold plated silver contact, and the blue terminals and cable entries customary in Ex-i areas can be supplied. In addition to the pressure switch, an isolating amplifier which transfers the control commands of the pressure switch from an intrinsically safe control circuit (Ex-i) to a non-intrinsically safe active circuit is required

Medium	Steam Hot water	Fuel gases DVGW Worksheet G260	Liquid fuels (fuel oil)	Pressure vessels (e.g. for liquefied gas)
Plant directives	DIN EN 12828 + TRBS			
Directives for component testing	VdTÜV Pressure 100 + DIN EN 12952-11 + DIN EN 12953-9	DIN EN 1854 + DIN EN 13611	VdTÜV Pressure 100 + DIN EN 764-7	VdTÜV Pressure 100 + DIN EN 764-7
Type series	DWAM, SDBAM DWR...	DWR... DGM...	DWR...	FD... DWAM...

Selection according to function and application

Pressure monitor

Function \ Application	**Steam and hot water** systems to TRBS and DIN EN12828	**Fuel gases** to DVGW-Worksheet G 260	**Heating oil** and other **liquid fuels**	**Other media** (check compatibility with the materials used)
Pressure monitoring Pressure regulation (e.g. burner or pump control)	DWAM… DWAMV… DWR… DWR…-203	DGM… DWR… DWR…-203	DWR… DWR…-203	DWAM… DWAMV… DWR… DWR…-203
Maximum pressure limitation with internal interlock	SDBAM… DWR…-205	DGM…-205 DWR…-205	DWR…-205	SDBAM… DWR…-205
with external interlock	DWAM… DWR…	DGM… DWR…	DWR…	DWAM… DWR…
Minimum pressure limitation with internal interlock	DWR…-206	DGM…-206 DWR…-206	DWR…-206	DWR…-206
with external interlock	DWR… DWR…	DGM… DWR…	DWR…	

Pressure limiter with internal interlock

…The code number for the pressure range must be inserted here (see datasheets). A final number of 2… (e.g. DWR…-205) means a plug connector according to DIN EN175301.

DWR series
The DWR series **covers all the applications mentioned above**.

DWAM-, DWAMV-, SDBAM-series (self-monitoring sensor)
DWAM, DWAMV and SDBAM are **only suitable for maximum pressure monitoring**. They offer **additional safety** due to the **safety diaphragm (selfmonitoring sensor)**. They are TÜV-tested for steam and hot water, but thanks to the self-monitoring sensor can also be recommended for other, **particularly safety-critical applications** (e.g. in process engineering).

Sensors of the DWR series are self-monitoring when used in minimum pressure monitoring applications.

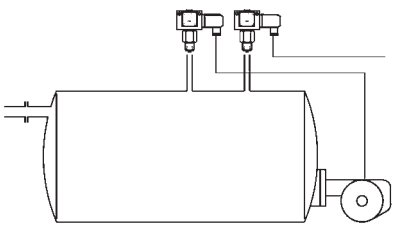
Equipment of a boiler with pressure monitor and pressure limiter

Pressure monitor for burner control: **DWAM… or DWR…** (without adjustable switching differential) or (better, because switching differential adjustable) **DWAMV… or DWR…–203**

Pressure limiter for safety monitoring: **SDBAM… or DWR…–205** (with internal interlock, unlocking button on the pressure limiter) or **DWAM… or DWR…** (with external interlock in the control cabinet) Suggested connection for the external interlock, see page 28.

Pressure monitor DWAM… or DWR…

Pressure limiter SDBAM… or DWR…-205



DWAM1

DWAM, DWAMV, SDBAM

Pressure monitors / pressure limiters

These series are particularly suitable for maximum pressure monitoring in steam and hot-water systems. The pressure switch is "of special construction", with a self-monitoring pressure sensor, built in accordance with Pressure Equipment Directive PED 97/23/EC.

It can be used as a pressure monitor or a pressure limiter for maximum pressure monitoring (systems in accordance with TRBS DIN EN12828) systems in accordance with DIN EN12952-11 and DIN EN12953-9 and is available with or without adjustment.

SIL 2 according IEC 61508-2

Technical data

Pressure connection
External thread G 1/2 (pressure gauge connection) to DIN 16 288 and internal thread G 1/4 to ISO 228 Part 1.

Switching device
Rugged housing (200) made of seawater-resistant diecast aluminium.

Materials
Pressure bellows: Material no. 1.4571
Sensor housing: Material no. 1.4104
Switch housing: GD Al Si 12 according to DIN 1725

Mounting position
Vertically upright and horizontal.

Ambient temperature at switching device
–20 to +70°C.

Medium temperature –20 to +70°C.
The maximum medium temperature at the pressure sensor must not exceed the permitted ambient temperature at the switching device. Temperatures may reach 85°C for short periods. Higher medium temperatures are possible provided the upper limit at the switching device is ensured by suitable measures (e.g. siphon).

Mounting
Directly on the pressure line (pressure gauge connection) or on a flat surface with two 4 mm Ø screws.

Calibration for maximum pressure switch
The pressure monitors and safety pressure limiting devices are calibrated so that, **under rising pressure**, switching takes place at the defined switching pressure. The reset point under falling pressure is lower by the amount of the switching differential, or, in the case of pressure limiting devices, by the fall in pressure specified in the table. The scale value corresponds to the upper switching point.

Switching differential
See Product Summary.

Contact arrangement
Single-pole changeover switch.

Switching capacity	250 VAC (ohm)	(ind)	250 VDC (ohm)	24 VDC (ohm)
Normal	8 A	5 A	0.3 A	8 A

Sealing P2
Generally available for SDBAM limiters.

Bursting pressure
For all types ≥ 100 bar.
Verified by TÜV test.

Component tested for	**Steam** Systems according to TRD 604 **Hot water** Systems according to DIN EN12828
Testing basis	VdTÜV Memorandum "Pressure 100"
Function	Pressure monitor / Pressure limiter
Directing of action	**For maximum pressure monitoring only**
Sensor	**"Of special construction"** (self-monitoring sensor with safety diaphragm)

Product Summary Maximum pressure monitoring (↑) (for other pressure ranges see DWR series)

Type	Setting range	Switching differential (mean values)	Max. permissible pressure	Dimensioned drawing
Pressure monitors without differential adjustment for max. pressure monitoring*				**page 25 + 26**
DWAM06	0.1…0.6 bar	0.04 bar	5 bar	
DWAM1	0.2…1.6 bar	0.05 bar	5 bar	1 + 15
DWAM6	1.2…6 bar	0.2 bar	10 bar	
DWAM625	1.2…6 bar	0.25 bar	20 bar	
DWAM16	3…16 bar	0.4 bar	20 bar	1 + 19
DWAM32	6…32 bar	1.2 bar	45 bar	
Pressure monitors with differential adjustment for max. pressure monitoring				
DWAMV1	0.2…1.6 bar	0.12…0.6 bar	5 bar	1 + 15
DWAMV6	1.2…6 bar	0.4…1.5 bar	10 bar	
DWAMV16	3…16 bar	0,8…2,5 bar	20 bar	1 + 19
DWAMV32	6…32 bar	2.5…6.0 bar	45 bar	
Pressure limiters for maximum pressure monitoring (with internal interlock)				
		Pressure change for unlocking		
SDBAM1	0.2…1.6 bar	0.12 bar	5 bar	
SDBAM2,5	0.4…2.5 bar	0.15 bar	5 bar	1 + 15
SDBAM6	1.2…6 bar	0.4 bar	10 bar	
SDBAM625	1.2…6 bar	0.6 bar	20 bar	
SDBAM16	3…16 bar	0.8 bar	20 bar	1 + 19
SDBAM32	6…32 bar	3.0 bar	45 bar	

* If a downstream external interlock is added, DWAM... pressure monitors can also be used as pressure limiters (see page 55).

· Sealing device P2 is included for SDBAM limiters and can also be retrofitted to pressure monitors on request. See sealing P2.
· DWAM... also available in Ex-i equipment. See DBS series.

Minimum pressure controls
– Minimum pressure monitor: DWR… page 59
– Minimum pressure limiter: DWR…-206 page 60

CE TÜV tested DIN geprüft Protection Class: IP 54

DWAM6-576

DBS

Pressure monitors / pressure limiters

In many aspects, safety-engineered pressure limiters offer a higher degree of safety compared with normal pressure switches and are therefore especially suitable for chemical process engineering and thermal installations in which safety is an especially critical factor in pressure monitoring. Pressure switches can also be used in Ex- zones (zone 0, 1, 2 and 20, 21, 22) and, in all cases, require an isolating amplifier.
The isolating amplifier is also responsible for monitoring lines for short-circuit and line break and therefore offers an additional safety advantage – even in non-Ex-zones. For Ex-applications, the isolating amplifier must be installed outside the Ex-zone. The lines between the isolating amplifier and the pressure switch are monitored for short-circuit and line break.

SIL 2 according IEC 61508-2

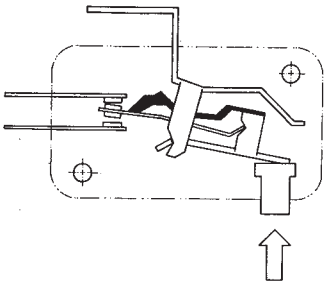
Technical data

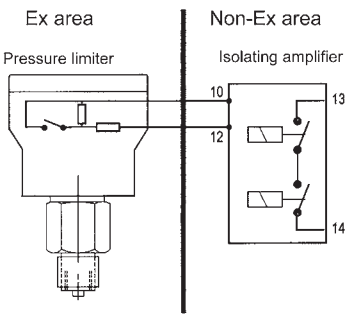
Greater safety
· in process engineering and chemical installations,
· in gas and liquid gas installations

Basic features:
– "Of special construction" according to VdTÜV Memorandum "Pressure 100"
– Line break and short-circuit monitoring-between pressure switch and isolating amplifier
– Suitable for Ex areas (zone 0, 1 & 2 or 20, 21 & 22) (explosion protection Ex-ia)
– Protection class IP 65
– Plastic-coated housing (chemical version)

Options:
– Limiter with internal interlock

Type-specific features:
– Self-monitoring sensors
– Positive opening microswitches
– Gold-plated contacts
– TÜV, DVGW component tests





Safety requirements for pressure limiters

Pressure limiters "of special construction" (DBS) must fulfil additional safety requirements, i.e. breakage or leakage in the mechanical part of the sensor must lead to shutdown to the safe side. The pressure limitermust respond as if the system pressure had already exceeded the maximum limit. The control circuit for the pressure limiter must also be considered from the point of view of safety, as short-circuits in the supply lines or other faults in the control current circuit can lead to dangerous conditions.

Switching element with positive opening operation and gold-plated contacts

The microswitch is equipped with positive opening operation. Rather than transmitting the plunger force via a spring, which is the usual method with most microswitches, this newly developed microswitch has an additional lever which transmits the movements of the pressure bellows positively to the contact lever. If the spring breaks, the contact lever is moved directly.

Line break and short-circuit monitoring in the control circuit

The resistor connected in series with the switching contact limits the current to a defined value with the switch closed. In the event of short-circuit in the area between the isolating amplifier and the series resistor, the current rises above the predetermined limit value, the relay of the isolating amplifier drops out, the output current circuit is interrupted and thus the safe condition is achieved. In the event of a line break, the current flow is interrupted, the relay drops to the safe side and interrupts the output current circuit (safety sequence). Furthermore, the isolating amplifier is designed so that, if faults occur in the electronics (conductor interruption, component defect etc.) and in the resulting situations, the safe shutdown condition is assured. These characteristics of the safety-engineered isolating amplifier, including line break and short-circuit monitoring, satisfy the requirements of DIN/VDE 0660, Part 209.

Connection diagram

For pressure monitoring in Ex areas, the isolating amplifier must be installed outside the Ex-zone. The pressure limiter has an intrinsically safe control current circuit (Ex-i). This arrangement is suitable for zones 0, 1 and 2, 20, 21 and 22.

Safety-engineered maximum pressure monitors

Technical data

Pressure connection
External thread G 1/2 (pressure gauge connection) according to DIN 16 288 and interval thread G 1/4 to ISO 228 Part 1.

Switch housing 500
Diecast aluminium GD Al Si 12. Aluminium housing coated with resistant plastic.

Mounting position
Vertically upright.

Protection class IP 65.

Ex protective category
Ex-i (only when used in conjunction with suitable isolating amplifier).

Component testing See table on page 52.

Pressure sensor materials
Housing: 1.4104
Pressure bellows: 1.4571
All parts fully welded.

Ambient temperature
DWAM: –20°C to +60°C, DWR: –25°C to +60°C. At ambient temperatures at or below 0°C, ensure that condensation cannot occur in the sensor or in the switching device.

Max. temperature of medium at sensor
+ 60°C.

Outdoor installations
Protect the device against direct atmospheric influences. Provide a protective cover.

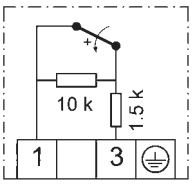
Max. working pressure
See Product Summary

Switching pressure setting
Adjustable with the setting spindle after removing the terminal box.

Mounting
With suitable weld-on connections and union nuts or with pressure gaugescrew union G 1/2.

Power supply circuit
U_i 14 V DC
R_i 1500 Ohm
C_i 1 nF
L_i 100 µH

Connection diagrams



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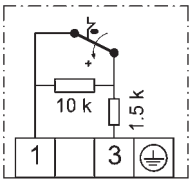

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Maximum pressure monitors

Sensor "of special construction", self-monitoring via safety diaphragm, type-tested according to VdTÜV Memorandum "Pressure 100". **SIL2 according IEC 61508-2**

Type	Setting range	Switching differential (mean values)	Max. permissible pressure	Dimen-sioned drawing
				page 25 + 26
DWAM06-576	0.1…0.6 bar	0.04 bar	5 bar	
DWAM1-576	0.2…1.6 bar	0.05 bar	5 bar	
DWAM2,5-576	0.4…2.5 bar	0.07 bar	5 bar	2 +
DWAM6-576	1.2…6 bar	0.2 bar	10 bar	15
DWAM625-576	1.2…6 bar	0.25 bar	20 bar	
DWAM16-576	3…16 bar	0.4 bar	20 bar	2 +
DWAM32-576	6…32 bar	1.2 bar	45 bar	19

Versions:
ZF 577: Maximum pressure limiter (with internal interlock)
Microswitch not positive opening, contacts: silver alloy other equimpent like DWAM…576.
Max. pressure limiter DWAM1-577 (isn´t in article master data). Please use DWAM2,5-577.

Maximum pressure monitors

Sensor "of special construction" made from stainless steel. (Component testing with 2 million operating cycles). Component tests: VdTÜV Memorandum "Pressure 100", DIN EN1854 (fuel gases), DIN EN764-7, systems in accordance to DIN EN12952-11 and DIN EN12953-9.
SIL 2 according ICE 61508-2

Type	Setting range	Switching differential (mean values)	Max. permissible pressure	Dimen-sioned drawing
				page 25 + 26
DWR06-576	0,1…0,6 bar	0,04 bar	6 bar	2 +
DWR1-576	0,2…1,6 bar	0,06 bar	6 bar	15
DWR3-576	0,2…2,5 bar	0,1 bar	16 bar	2 +
DWR6-576	0,5…6 bar	0,2 bar	16 bar	18
DWR625-576	0,5…6 bar	0,25 bar	25 bar	2 +
DWR16-576	3…16 bar	0,5 bar	25 bar	17
DWR25-576	4…25 bar	1,0 bar	63 bar	2 +
DWR40-576	10…40 bar	1,3 bar	63 bar	16

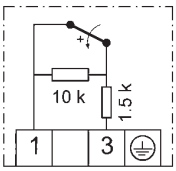
Versions:
ZF 577: Maximum pressure limiter (with internal interlock)
Microswitch not positive opening, contacts: silver alloy other equimpent like DWR… 576

Calibration
Devices of the **DWR-576** and **DWAM-576** series are calibrated for rising pressure. This means that the adjustable switching pressure on the scale corresponds to the switching point at rising pressure. The reset point is lower by the amount of the switching differential. (See also page 27, 2. Calibration at upper switching point).

Technical data

Switching element
See table opposite.

Connecting diagrams



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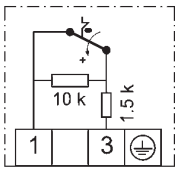

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The other technical data correspond to the devices for maximum pressure monitoring (page 51).

For the power supply circuit:
U_i 14 V DC
R_i 1500 Ohm
C_i 1 nF
L_i 100 µH

Safety-engineered minimum pressure monitors
Sensor "of special construction made from stainless steel. (self-monitoring and component testing with 2 million operating cycles). Component tests: VdTÜV Memorandum "Pressure 100", DIN EN3398 (fuel gases) DIN EN764-7, systems in accordance to DIN EN12952-11 and DIN EN12953-9
SIL2 according IEC 61508-2

Type	Setting range	Switching differential (mean values)	Max. permissible pressure	Dimensioned drawing page 25 + 26
DWR06-574	0.1…0.6 bar	0.04 bar	6 bar	2 +
DWR1-574	0.2…1.6 bar	0.06 bar	6 bar	15
DWR3-574	0.2…2.5 bar	0.1 bar	16 bar	2 +
DWR6-574	0.5…6 bar	0.2 bar	16 bar	18
DWR625-574	0.5…6 bar	0.25 bar	25 bar	2 +
DWR16-574	3…16 bar	0.5 bar	25 bar	17
DWR25-574	4…25 bar	1.0 bar	63 bar	2 +
DWR40-574	8…40 bar	1.3 bar	63 bar	16

Calibration
The **DWR-574** series is calibrated for falling pressure. This means that the adjustable switching pressure on the scale corresponds to the switching point at falling pressure. The reset point is higher by the amount of the switching differential. (See also page 27, 1. Calibration at lower switching point).

Versions:
ZF 575: Minimum pressure limiters (with internal interlock)
Switching contacts: silver alloy
other equipment like DWR… 574

Features of safety-engineered pressure monitors and pressure limiters

Devices	Component testing	Features						Options	
	1 = VdTÜV Memorandum "Pressure 100" 2 = DIN EN1854 3 = DIN EN764-7 4 = DIN EN12952-11/DIN EN12953-9	Resistor combination for line break and short-circuit monitoring	Ex-ia-version for intrinsically safe control circuits	Self-monitoring pressure sensor	Plastic-coated housing Chemical version	Positive opening microswitches	Gold-plated contacts	Limiter with internal interlock Chemical version	
Maximum pressure monitoring									
FD16-326	1 + 3	■	■	■		■	■		
FD16-327	1 + 3	■	■	■				■	
DWAM…576	1 + 4	■	■	■	■	■	■		
DWAM…577	1 + 4	■	■	■	■			■	
DWR…576	1 + 2 + 3 + 4	■	■		■	■	■		
DWR…577	1 + 2 + 3 + 4	■	■		■			■	
Minimum pressure monitoring									
DWR…574	1 + 2 + 3 + 4	■	■		■		■		
DWR…575	1 + 2 + 3 + 4	■	■		■			■	

FD16-326

FD

Maximum pressure limiters for liquid gas installations

Pressure limiters of the FD series are constructed in accordance with the special directives for liquid gas engineering. The requirements of TRB 801 Appendix II §12 are met. All parts coming into contact with the medium are made of stainless steel 1.4104 and 1.4571. The pressure sensor was designed to be "self-monitoring" to exceed the requirements of TRB , i. e. should the measuring bellows rupture, the pressure sensor switches off towards the safe side. The pressure sensor thus complies with "of special construction" in the sense of VdTÜV Memorandum "Pressure 100". Pressure limiters are used in intrinsically safe control circuits (Ex-protection Ex-i).
By using an isolating amplifier, the control circuit is also monitored for line break and short-circuit.

SIL 2 according IEC 61508-2

Technical data

Pressure connection External thread G 1/2 (pressure gauge connection) according to DIN 16 288 and internal thread G 1/4 to ISO 228 Part 1.

Switch housing 300
Diecast aluminium GD Al Si 12.

Protection class: IP 65

Mounting position: Vertically upright

Explosion protection Ex-i (only when used in conjunction with isolating amplifier).

TÜV testing station identifying mark see Product Summary.

Pressure sensor materials
Housing: 1.4104, Pressure bellows: 1.4571
All parts fully welded. Perbunan safety diaphragm (not in contact with medium).

Ambient temperature –25°C to +60°C.
At ambient temperatures below 0°C, ensure that condensation cannot occur in the sensor or in the switching device.

Max. medium temperature: +60°C.

Outdoor installations
Protect the device against direct atmospheric influences. Provide a suitable protective cover.

Max. permissible working pressure: 40 bar.

Switching pressure: 5–16 bar. Adjustable with the setting spindle after removing the terminal box.

Calibration
The **FD16-316** and **FD16-327** series are calibrated for rising pressure. This means that the adjustable switching pressure on the scale corresponds to the switching point at rising pressure. The reset point is lower by the amount of the switching differential. (See also page 23, 2. Calibration at upper switching point).

Interlock after cutout
Internal interlock on FD16–327.
Interlock defeat: after pressure reduction of approx. 2.5 bar by pressing the red button (with tool) on the scale side of the pressure switch.

External interlock on FD16–326.
Interlock defeat: After pressure reduction of approx. 0.5 bar. Press unlocking button in control cabinet.

Line break and short-circuit monitoring
On types FD16–326 and FD16–327 used in conjunction with isolating amplifier, the control circuit is monitored for short-circuit and line break. The resistor combination incorporated into the pressure switch ensures that a defined current flows at all times during normal operation. In the event of short-circuit or line break, the current level changes and the relay drops out to the safe side.

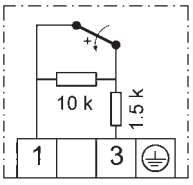
Product Summary

Type	Setting range	Switching differential	Interlock	Dimensioned drawing
				page 25 + 26
FD16–326	3...16 bar	0.5	Extern	2 + 19
FD16–327	3...16 bar	2.5	Intern	2 + 19

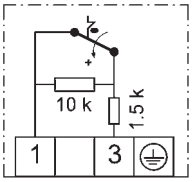
Defeat:
E = External, i.e. in control cabinet via relay with latching
I = Internal, i.e. locally at pressure limiter

For the power supply circuit
U_i 14 V DC
R_i 1500 Ohm
C_i 1 nF
L_i 100 µH

Internal circuit



FD 16-326
Single-pole changeover switch with resistor combination for line break and short-circuit monitoring.
(External interlock in control cabinet necessary).



FD 16-327
Single-pole changeover switch with mechanical switching state interlock on reaching maximum pressure and with resistor combination for line break and short-circuit monitoring.

Please note: FD pressure limiters must never be connected directly to mains voltage. They must only be used in conjunction with isolating amplifier.

DGM310A

DGM

Pressure monitors for fuel gases

DVGW tested to DIN EN1854
Gas pressure monitors are suitable for all gases in accordance with DVGW Worksheet G260 and for air.

SIL 2 according IEC 61508-2

Technical data

Pressure connection
External thread G 1/2 to DIN 16 288 and internal thread G 1/4 to ISO 228 Part 1 (permissible up to 4 bar).

Switching device
Seawater-resistant diecast aluminium GD Al Si 12.

Protection class
IP 54 for vertical installation position.

Pressure sensor materials
See Product Summary

Ambient temperature –25 to +60°C.
At ambient temperatures below 0°C, ensure that condensation cannot occur in the sensor or in the switching device.

Maximum working pressure
See Product Summary

Mounting
Either directly on the pipe or with two 4 mm ø screws on the wall surface.

Mounting position
Vertically upright and horizontal.

Setting
Continuously adjustable via the setting spindle with a screwdriver. The set switching pressure is visible in the scale window.

Sealing P2
On request (can be fitted later).

Switching differentials
Largely independent of the set switching pressure. Not adjustable. For values see Product Summary.

Switching capacity	250 VAC (ohm)	(ind)	250 VDC (ohm)	24 VDC (ohm)
Normal	8 A	5 A	0.3 A	8 A

Pressure measuring connection
Care must be taken to ensure that a pressure measuring connection is available in a suitable place on the gas appliance.

Component tested for	Fuel gases according to DVGW Worksheet G 260
Testing basis	DIN EN1854
Function	Pressure monitor
Direction of action	**For maximum and minimum pressure monitoring**

Product Summary

Type	Setting range	Switching differential (mean values)	Max. working pressure	Materials in contact with medium	Dimensioned drawing
					p. 25 + 26
DGM306A	15…60 mbar	6 mbar	0.8 bar	CU + Ms	
DGM310A	20…100 mbar	7 mbar	0.8 bar	CU + Ms	1 + 13
DGM325A	40…250 mbar	10 mbar	0.8 bar	CU + Ms	
DGM06A	100…600 mbar	25 mbar	2 bar	CU + Ms	1 + 14
DGM1A	0.2…1.6 bar	40 mbar	3 bar	CU + Ms	
DGM506	15…60 mbar	8 mbar	5 bar	1.4104	
DGM516	40…160 mbar	12 mbar	5 bar	1.4104	1 +12
DGM525	100…250 mbar	20 mbar	5 bar	1.4104	

Calibration
The **DGM** series is calibrated for rising pressure. This means that the adjustable switching pressure on the scale corresponds to the switching point at rising pressure. The reset point is lower by the amount of the switching differential. (See also page 27, 2. Calibration at upper switching point).

For other pressure ranges see type series DWR, page 59.

Ex-i version (intrinsically safe)
As above, but with additional function ZF513 (Ex-i).
Example for ordering: **DGM516-513**

Ex-DGM see page 70

DWR625

DWR

Pressure monitors

Especially suitable as a pressure monitor or pressure limiter for fuel gases (DVGW Worksheet G 260) and liquid fuels (e.g. fuel oil), as well as for steam systems according to TRD 604 and hot-water systems to DIN EN12828, systems in accordance to DIN EN12952-11 and DIN EN12953-9. The DWR is used to monitor maximum and minimum pressures. This pressure switch is "of special construction" and has been tested with 2 million operating cycles. TÜV and DVGW tests exists.

SIL 2 according IEC 61508-2

Technical data

Pressure connection
External thread G 1/2 (pressure gauge connection) to DIN 16 288 and internal thread G 1/4 to ISO 228 Part 1 (for gas applications internal thread permissible only up to 4 bar).

Switching device
Rugged housing (200) made of seawater-resistant diecast aluminium.

Materials
Pressure bellows: Material no. 1.4571
Sensor housing: Material no. 1.4104 Switch housing: GD Al Si 12 (DIN 1725)

Mounting position
Vertically upright and horizontal.

Ambient temperature at switching device
–25 to +70°C,
Medium temperature –25 to +70°C. The maximum medium temperature at the pressure sensor must not exceed the permitted ambient temperature at the switching device. Temperatures may reach 85°C for short periods. Higher medium temperatures are possible provided the above limit values for the switching device are ensured by suitable measures (e.g. siphon).

Mounting
Directly on the pressure line (pressure gauge connection) or on a flat surface with two 4 mm Ø screws.

Calibration
The DWR series is calibrated for rising pressure. This means that the adjustable switching pressure on the scale corresponds to the switching point at rising pressure. The reset point is lower by the amount of the switching differential. (See also page 27, 2. Calibration at upper switching point). In version ...-203 the switching differential is adjustable. The basic calibration is maintained.

Bursting pressure
For all types ≥ 100 bar, verified by TÜV test.

Switching differential For values see Product Summary.

Contact arrangement Single pole changeover switch.

Switching capacity	250 VAC (ohm)	(ind)	250 VDC (ohm)	24 VDC (ohm)
Normal	8 A	5 A	0.3 A	8 A

Protection class IP 54 according to DIN 40 050

Component tested for	
Steam	Systems according to TRBS
Hot water	Systems according to DIN EN12828
Fuel gases	DVGW Worksheet G 260
Pressure tank	DIN EN764-7
Function	Pressure monitor or pressure limiter (with external interlock)
Direction of action	**For maximum and minimum pressure monitoring (DWFS, SDBFS)**
Sensor	**"of special construction"** by testing with 2 million cycles.

Product Summary

Type	Setting range	Switching differential (mean values)	Maximum working pressure	Dimensioned drawing
Pressure monitors without differential adjustment				**p. 25 + 26**
DWR06	0.1…0.6 bar	0.04 bar	6 bar	1 + 15
DWR1	0.2…1.6 bar	0.06 bar		
DWR3	0.2…2.5 bar	0.1 bar	16 bar	1 + 18
DWR6	0.5…6 bar	0.2 bar		
DWR625	0.5…6 bar	0.25 bar	25 bar	1 + 17
DWR16	3…16 bar	0.5 bar		
DWR25	4…25 bar	1.0 bar	63 bar	1 + 16
DWR40	8…40 bar	1.3 bar		
Switching differential adjustable				
DWR06–203	0.1…0.6 bar	0.08…0.5 bar	6 bar	1 + 15
DWR1–203	0.2…1.6 bar	0.15…0.6 bar		
DWR3–203	0.2…2.5 bar	0.17…1.2 bar	16 bar	1 + 18
DWR6–203	0.5…6 bar	0.3…1.4 bar		
DWR625–203	0.5…6 bar	0.4…2.5 bar	25 bar	1 + 17
DWR16–203	3…16 bar	0.75…3.15 bar		
DWR25–203	4…25 bar	1.3…6.0 bar	63 bar	1 + 16
DWR40–203	8…40 bar	2.3…6.6 bar		

Ex-DWR
see page 69

DWR625-205

DWR

Pressure limiters

Especially suitable as a pressure limiter for fuel gases (DVGW Worksheet G 260) and liquid fuels (e.g. fuel oil), as well as for steam systems according to TRBS and hot-water systems to DIN EN12828, systems in accordance to DIN EN12952-11 and DIN EN12953-9.

The DWR-205/-206 is used to limit maximum and minimum pressures and has an internal interlock.

SIL 2 according IEC 61508-2

Technical data

Pressure connection
External thread G 1/2 (pressure gauge connection) to DIN 16 288 and internal thread G 1/4 to ISO 228 Part 1 (for gas applications internal thread permissible only up to 4 bar).

Switching device
Rugged housing (200) made of seawater-resistant diecast aluminium.

Materials
Pressure bellows: Material no. 1.4571
Sensor housing: Material no. 1.4104
Switch housing: GD Al Si 12 (DIN 1725)

Mounting position Vertically upright and horizontal.

Ambient temperature at switching device
–25…+70°C

Medium temperature –25…+70°C.
The medium temperature at the pressure sensor must not exceed the permitted ambient temperature at the switching device. Temperatures may reach 85°C for short periods. Higher medium temperatures are possible provided the above limit values for the switching device are ensured by suitable measures (e.g. siphon).

Mounting
Directly on the pressure line (pressure gauge connection) or on a flat surface with two 4 mm Ø screws.

Calibration
The **DWR-205** series is calibrated for rising pressure. This means that the adjustable switching pressure on the scale corresponds to the switching point at rising pressure. The reset point is lower by the amount of the switching differential. (See also page 17, 2. Calibration at upper switching point). The **DWR-206** series is calibrated for falling pressure. This means that the adjustable switching pressure on the scale corresponds to the switching point at falling pressure. The reset point is higher by the amount of the switching differential. (See also page 17, 1. Calibration at lower switching point).

Bursting pressure For all types ≥ 100 bar, verified by TÜV test.

Switching differential For values see Product Summary.

Contact arrangement Single pole changeover switch.

Switching capacity	250 VAC (ohm)	(ind)	250 VDC (ohm)	24 VDC (ohm)
Normal	8 A	5 A	0.3 A	8 A

Protection class IP 54 according to DIN 40 050

Sealing P2
On request (can be fitted later).

Component tested for	**Steam**	System according to TRBS
	Hot water	System according to DIN EN12828
	Fuel gases	DVGW Worksheet G 260
	Pressure tank	DIN EN764-7
Function	Pressure limiter (with internal interlock)	
Direction of action	**For maximum and minimum pressure monitoring (SDBFS)**	
Sensor	**"Of special construction"** by testing with 2 million cycles.	

Important: When selecting the limiter, it is necessary to decide whether the device is to be used for maximum or minimum pressure monitoring. The direction of action cannot be reversed at the pressure limiter.

Product Summary

Type	Setting range	Switching differential (mean values)	Maximum working pressure	Dimensioned drawing
Maximum pressure limiters				**page 25 + 26**
DWR06–205	0.1…0.6 bar	0.06 bar	6 bar	1 + 15
DWR1–205	0.2…1.6 bar	0.09 bar		
DWR3–205	0.2…2.5 bar	0.20 bar	16 bar	1 + 18
DWR6–205	0.5…6 bar	0.30 bar		
DWR625–205	0.5…6 bar	0.50 bar	25 bar	1 + 17
DWR16–205	3…16 bar	0.70 bar		
DWR25–205	4…25 bar	1.4 bar	63 bar	1 + 16
DWR40–205	8…40 bar	2.3 bar		
Minimum pressure limiters				
DWR06–206	0.1…0.6 bar	0.06 bar	6 bar	1 + 15
DWR1–206	0.2…1.6 bar	0.09 bar		
DWR3–206	0.2…2.5 bar	0.20 bar	16 bar	1 + 18
DWR6–206	0.5…6 bar	0.30 bar		
DWR625–206	0.5…6 bar	0.50 bar	25 bar	1 + 17
DWR16–206	3…16 bar	0.70 bar		
DWR25–206	4…25 bar	1.4 bar	63 bar	1 + 16
DWR40–206	8…40 bar	2.3 bar		

* Maximum working pressure and dimensions as for type series DWR. Pressure monitors DWR… (page 59) can also be used as maximum pressure and minimum pressure limiters with external interlock. You will find other maximum pressure limiters with safety sensor, type series SDBAM…, on page 53. Types DWAM… can also be used with external interlock as maximum pressure limiters.

FEMA by Honeywell

CE TÜV tested DIN Geprüft DVGW TÜV Protection Class: IP 54

General information about explosion protection

Basic principle

The basic principle of explosion protection is that:

a) combustible materials (gas, vapour, mist or dust) in dangerous quantities
b) air (or oxygen)
c) ignition sources

must not occur in the same place.

The permanent or temporary occurrence of explosive mixtures as per a) and b) is often unavoidable, therefore when operating electrical installations care must be taken to ensure that no ignition sources can occur.

In order to accomplish this, standards have been legislated in Europe serving as a basis for various different types of ignition protection. These standards have been recognized in all European countries. Equipment for the reliable prevention of the ignition of ambient explosive gas mixtures must be constructed according to these standards.

In addition to ISO9000ff applies to the production monitoring, the ISO/IEC 80079-34 for ex-protected areas.

These standards are based on European Directive 94/9/EC (ATEX). The goal of this regulation is the harmonization of statutory regulations EN60079 in the area of explosion protection as well as the elimination of trade barriers between Member States. This Directive provides for the harmonization of all standards relevant to the construction of equipment with ignition protection.

The most important types of ignition protection for FEMA products are as follows:

"Ex-d" pressure-proof encapsulation	**EN 60079-1**
"Ex-e" enhanced safety	**EN 60079-7**
"Ex-t" protection via housing	**EN 60079-31**
"Ex-i" intrinsically safety	**EN 60079-11**

Pressure switches
Specially designed FEMA Ex-protected pressure switches are available for use in ex-protection areas. They conform to these standards and are type-tested (Ex-d, Ex-e, Ex-t) and/or have been technically prepared for these areas (Ex-i).

"Ex-d" Pressure-Proof Encapsulation
Switch components and other electrical functional units capable of igniting explosive gas mixtures are encapsulated in a housing which will survive the explosive pressure of an internal explosion and the special design of which prevents the transference of this explosion to the ambient atmosphere.

"Ex-e" Enhanced Safety
This type of ignition protection pertains to the special design of the terminal connection housing. The connection area is grouted and thus specially separated from the microswitch. A type-tested terminal block, a type-tested cable gland, and the IP65 Protection Degree all ensure an enhanced safety of "Ex-e" in the connection housing.

"Ex-t" Protection via Housing
This type of ignition protection pertains to dust-explosion protection and is based upon the reliable protection of ignition sources against atmospheric dust. For FEMA pressure switches and thermostats for use in dust explosion-protected areas, a Protection Degree of IP65 is required. Together with devices according to "Ex-d" and "Ex-e," devices with "Ex-t" protection are approved for use in gaseous and dust-laden atmospheres.

"Ex-i" Intrinsically Safety
The equipment employed in explosion-relevant areas are components of inherently-safe electrical circuits. An electrical circuit is inherently safe if the amount of energy it contains is so small that no spark or other thermal effect can arise. This reliably prevents the ignition of explosive gas mixtures in the proximity of this equipment. In the context of this Directive, pressure switches and thermostats containing no switching components with energy-storage effects are referred to as "simple electrical equipment."

The Term "Simple Electrical Equipment"
Through the use of simple microswitches without additional capacitive or inductive components means that our "Ex-i" pressure switches and thermostats are classified as "simple electrical equipment." The testing and certification of such equipment is not required by Directive 94/9/EC. However, in explosion-relevant areas requiring "Ex-ia" explosion protection, they may be employed only together with E.C. type-tested isolating amplifiers. All of the devices which we manufacture explicitly for use in such areas are equipped with microswitches with gold contacts, an earthing terminal and are marked for easier identification with a blue cable gland.

General information about explosion protection

Zone classification

Explosion risk areas are grouped into zones according to the likelihood of a dangerous explosive atmosphere **according to EN 1127-1** occurring.
When assessing the explosion hazard, i.e. when identifying explosion risk areas, the "Guidelines for the Avoidance of Danger due to Explosive Atmospheres with Examples (ExRL)" of the German Insurance Association for the Chemical Industry must be taken into account.
If the situation concerns a special case or if doubts exist as to the definition of explosion risk areas, the matter shall be decided by the supervisory authorities (Trade Supervisory Office, where applicable with the assistance of the Insurance Association or the Technical Control Boards.
In Zones 0 (20) and 1 (21), only electrical equipment for which a type test certificate has been issued by a recognized testing agency may be used. In Zone 0 (20), however, only equipment expressly authorized for that zone may be used. Equipment approved for use in Zones 0 (20) and 1 (21) may also be used in Zone 2 (22). Under the new European Directive 94/9 EC (ATEX 100a), a distinction is made between **gas atmospheres** and **dust atmospheres**. This results in the following zone classifications:

Gas	**Zone 0**	**continuously or for long periods**	**Zone 0** (gas) is a place in which a dangerous explosive atmosphere is present continuously or for long periods. This normally includes only the interior of containers or the interior of apparatus (evaporators, reaction vessels etc.), if the conditions of Zone 0 are fulfilled. Continuous danger > 1000 hours/year.
	Zone 1	**occasionally**	**Zone 1** (gas) is a place in which a dangerous explosive atmosphere can be expected to occur occasionally in normal operation. This may include the immediate vicinity of Zone 0. Occasional danger = 10 to 1000 hours/year.
	Zone 2	**seldom and for short periods**	**Zone 2** (gas) is a place in which a dangerous explosive atmosphere can be expected to occur only rarely and then only for short periods. This may include areas surrounding Zones 0 and/or 1. Danger only under abnormal operating conditions < 10 hours/year.
Dust	**Zone 20**	**continuously or for long periods**	**Zone 20** (dust) is a place in which a dangerous explosive atmosphere in the form of a cloud of dust in air is present continuously or for long periods, and in which dust deposits of unknown or excessive thickness may be formed. Dust deposits on their own do not form a Zone 20. Continuous danger > 1000 hours/year.
	Zone 21	**occasionally**	**Zone 21** (dust) is a place in which a dangerous explosive atmosphere in the form of a cloud of dust in air may occasionally occur in normal operation, and in which deposits or layers of inflammable dust may generally be present. This may also include the immediate vicinity of Zone 20. Occasional danger = 10 to 1000 hours/year.
	Zone 22	**seldom and for short periods**	**Zone 22** (dust) is a place in which a dangerous explosive atmosphere may be expected to occur only rarely and then only for short periods. This may include areas in the vicinity of Zones 20 and 21. Danger only under abnormal operating conditions < 10 hours/year.

General information about explosion protection

Explosion group

The requirements for explosion-protected equipment depend on the gases and/or vapours present on the equipment and on the dusts lying on, adhering to and/or surrounding the equipment. This affects the gap dimensions required for pressure-proof encapsulation and, in the case of intrinsically safe circuits, the maximum permitted current and voltage values. Gases, vapours and dusts are therefore subdivided into various explosion groups.
The danger of the gases rises from explosion group IIA to IIC. The requirements for electrical equipment in these explosion groups increase accordingly. Electrical equipment approved for IIC may also be used for all other explosion groups.

Temperature class

The maximum surface temperature of an item of equipment must always be lower than the ignition temperature of the gas, vapour or dust mixture. The temperature class is therefore a measure of the maximum surface temperature of an item of equipment.

Temperature class °C	Ignition temperature °C	Maximum surface temperature °C
T1	> 450	450
T2	> 300	300
T3	> 200	200
T4	> 135	135
T5	> 100	100
T6	> 85	85

Equipment Protection Level (EPL)

In addition to the afore mentioned types of ignition protection, the new norms IEC and EN60079ff have introduced the corresponding Equipment Protection Levels (EPL).

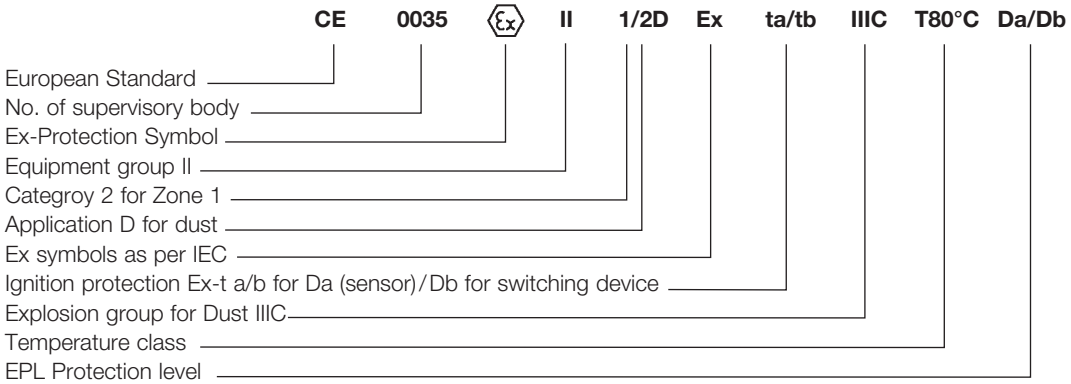
Zone (Gas-Ex)	EPL	Zone (Staub-Ex)	EPL	Protection Level
0	Ga	20	Da	highest
1	Gb	21	Db	high
2	Gc	22	Dc	standard

Example: Ex d e IIC T6 Gb:
Device is designed for Zone 1 for gas group IIC and gas equipment protection level "high level of protection".

Marking of Explosion-Protected Electrical Equipment

In addition to the usual data (manufacturer, model, serial number, electrical data), the explosion-protection information is likewise to be included in the marking.
According to Directive 94/9/EC (ATEX), in compliance with the IEC recommendation and the currently valid standards, the following forms of identification are to be followed.

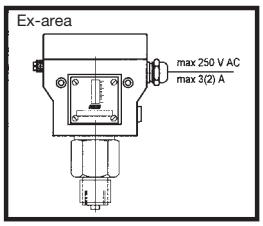
Example for FEMA Pressure Switch and Thermostats with "Ex-de" Ignition Protection

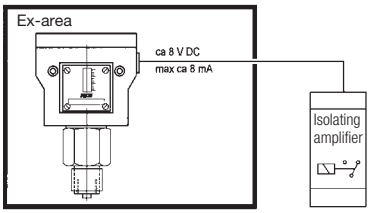


Ex devices

Pressure monitoring in explosion risk areas, Zones 1, 2 and 20, 21, 22

Specially equipped pressure switches can also be used in explosion risk areas Zone 1, 2 and 20, 21, 22. The following alternatives are possible:





1. Type of ignition protection Ex-d, Ex-e and Ex-t:
The pressure switch with protection type "Flameproof Ex-d and Increased Safety Ex-e" can be used with the switch device in hazardous areas of zone 1 and 2 for flammable gas mixtures. For use in dust atmospheres, the protection is "protected by enclosure Ex-t".
The switching device may be used in hazardous areas of zones 21 and 22 for explosive dusts. In addition, for the dust – explosion protection zone 20 on the sensor (device screwed into container walls, which may occur in the interior permanent dust atmosphere).
The permissible values for switching voltage, switching capacity and ambient temperature please refer to the detailed description of the Ex equipment, and the installation and operating instructions. In addition, please note the general rules for the use and installation of equipment in hazardous atmosphere.
Special circuits, as well as versions with adjustable switching differential or internal interlock (reclosing lock) are not possible.

2. Ignition protection Ex-i
All pressure switches with features for intrinsically safe circuits can be used with the switching device in hazardous areas Zone 1 and 2 (Gas) and zones 21 and 22 (Dust). In addition, the sensor in hazardous areas Zone 0 (Gas) and 20 (Dust) may be screwed. (Inside tank = defined as zone 0 or zone 20). A circuit is considered to be "intrinsically safe" if the amount of energy conveyed therein is not capable of generating an ignitable sparks. This pressure switch can only be operated in combination with a suitable isolating switching amplifier, which is approved for the type Ex-i. Suitable variants must be selected for this pressure switch with resistor combination for line and short circuit monitoring. Because of the low voltages and currents in intrinsically safe circuits, micro switches with gold contacts are used for pressure monitors with automatic reset. For limiter (with internal interlock) micro switches with silver contacts are used. FEMA pressure switches for use in intrinsically safe circuits are marked by blue terminals and cable entries. In addition, the pressure switch has been tested by a "notified body". The units get a serial number and the nameplate inform about the ignition protection and registration number.

Ignition protection for pressure monitoring in Zones 0 (20), 1 (21) and 2 (22)

Pressure-proof encapsulation Ex-d (EN 60079-0:2009) Enhanced safety Ex-e (EN 60079-7:2007) Protection via housing Ex-t (EN60079-31:2009)	**Intrinsically safe D ...-513 + isolating amplifier D ...574,576 + isolating amplifier**
Ignition protection type: CE 0035 Ex II 2G Ex db eb IIC T6 CE 0035 Ex II 2D Ex tb IIIC IP65 T85ºC	Ignition protection type: CE 0035 Ex II 1/2G Ex ia T6 Ga/Gb CE 0035 Ex II 1/2D Ex ia IIIC T85ºC
ATEX approval for the complete switching device	ATEX approval for the complete switching device
Pressure switches with a silver contact	Pressure switches with gold-plated contacts (monitors) Pressure switches with silver-plated contacts (monitors)
Switching capacity: max. 3 A, 250 VAC min. 2mA, 24 VDC	Rate value without resistor combination ...-513 /...-563: Ui: 24VDC Ii: 100mA Ci: 1nF Li: 100µH Rate value with resistor combination ...-574 / ...-575 / ...-576 / ...-577: Ui: 14VDC Ri: 1500 Ohm Ci: 1nF Li: 100µH
The pressure switch can be installed within the Ex-Zone.	Pressure switch will be installed in Ex-Zone The isolating amplifier must be installed outside the Ex-Zone.

Ex-DNM10

Ex-DCM / Ex-DNM

II 2G Ex d e IIC T6 Gb

II 1/2D Ex ta/tb IIIC T80 °C Da/Db

SIL 2 according IEC 61508-2

Technical data

Pressure connection
External thread G 1/2 (pressure gauge connection) according to DIN 16 288 and internal thread G 1/4 according to ISO 228 Part 1.

Switching device
Robust housing (700) made of seawater-resistant diecast aluminium GD Al Si 12.

Protection class
IP 65, in vertical position.

Pressure sensor materials

Ex-DNM	Metal bellows: 1.4571 Sensor housing: 1.4104
Ex-DCM4016/ Ex-DCM4025	Diaphragm: Perbunan Sensor housing: 1.4301

Mounting position
Vertically upright.

Ambient temp. at switching device
–20…+60 °C

Max. medium temperature
The maximum medium temperature at the pressure sensor must not exceed the permitted ambient temperature at the switching device. Higher medium temperatures are possible provided the above limit values for the switching device are ensured by suitable measures (e.g. siphon).

Mounting
Directly on the pressure line (pressure gaugeconnection) or on a flat surface with two 4 mm Ø screws.

Switching pressure
Adjustable from outside with screwdriver.

Contact arrangement
Single-pole changeover switch.

Switching capacity	250 VAC (ohm)	(ind)	250 VDC (ohm)	24 VDC (ohm)
Ex-d	3 A	2 A	0.03 A	3 A

Product Summary

Type	Setting range	Switching differential (mean values)	Max. permissible pressure	Materials in contact with medium	Dimen-sioned drawing
Switching differential not adjustable					**page 25 + 26**
Ex-DCM4016	1…16 mbar	2 mbar	1 bar	Perbunan	4 + 11
Ex-DCM4025	4…25 mbar	2 mbar	1 bar	+ 1.4301	4 + 11

For other Ex-devices, see type series VCM, DNS, DDCM, DWR, DGM.

Type	Setting range	Switching differential (mean values)	Max. permissible pressure	Dimen-sioned drawing
Ex-DNM10	1…10 bar	0.3 bar	25 bar	4 + 17
Ex-DNM63	16…63 bar	1.0 bar	130 bar	4 + 16

Calibration

The **Ex-DCM/Ex-DNM** series is calibrated for falling pressure. This means that the adjustable switching pressure on the scale corresponds to the switching point at falling pressure. The reset point is higher by the amount of the switching differential. (See also page 27, 1. Calibration at lower switching point).

Ex-DNS3

Ex-DNS/Ex-VNS

II 2G Ex d e IIC T6 Gb

II 1/2D Ex ta/tb IIIC T80 °C Da/Db

SIL 2 according IEC 61508-2

Technical data

Pressure connection
External thread G 1/2 (pressure gauge connection) according to DIN 16 288 and internal thread G 1/4 according to ISO 228 Part 1.

Switching device
Robust housing (700) made of seawater-resistant diecast aluminium GD Al Si 12.

Protection class
IP 65

Pressure sensor materials
Pressure bellows and all parts in contact with medium. X 6 Cr Ni Mo Ti 17122 Material no. 1.4571

Mounting position
Vertically upright.

Max. ambient temperature at switching device
–20…+60 °C.

Max. medium temperature
The maximum medium temperature at the pressure sensor must not exceed the permitted ambient temperature at the switching device. Higher medium temperatures are possible provided the above limit values for the switching device are ensured by suitable measures (e.g. siphon).

Mounting
Directly on the pressure line (pressure gaugeconnection) or on a flat surface with two 4 mm Ø screws.

Switching pressure
Adjustable from outside with screwdriver.

Contact arrangement
Single-pole changeover switch.

Switching capacity	250 VAC (ohm)	250 VAC (ind)	250 VDC (ohm)	24 VDC (ohm)
Ex-d	3 A	2 A	0.03 A	3 A

Plastic coating
The diecast aluminium housing in GD Al Si is chromated and stove-enamelled with resistant plastic. Corrosion tests with 3% saline solution and 30 temperature changes from +10 to +80°C showed no surface changes after 20 days.

Product Summary

Type	Setting range	Switching differential (mean values)	Max. permissible pressure	Dimensioned drawing
Switching differential not adjustable				page 25 + 26
Ex-VNS301	–250…+100 mbar	45 mbar	3 bar	
Ex-VNS111	–1*…+0.1 bar	50 mbar	6 bar	
Ex-DNS025	0.04…0.25 bar	30 mbar	6 bar	4 + 15
Ex-DNS06	0.1…0.6 bar	40 mbar	6 bar	
Ex-DNS1	0.2…1.6 bar	60 mbar	6 bar	
Ex-DNS3	0.2…2.5 bar	0.1 bar	16 bar	4 + 18
Ex-DNS6	0.5…6 bar	0.15 bar	16 bar	
Ex-DNS10	1…10 bar	0.3 bar	16 bar	4 + 16
Ex-DNS16	3…16 bar	0.5 bar	25 bar	

* At very high vacuums, close to the theoretical maximum of –1 bar, the switch may not be usable in view of the special conditions of vacuum engineering. However, the pressure switch itself will not be damaged at maximum vacuum.

Calibration

The **Ex-DNS** and **Ex-VNS** series are calibrated for falling pressure. This means that the adjustable switching pressure on the scale corresponds to the switching point at falling pressure. The reset point is higher by the amount of the switching differential. (See also page 27, 1. Calibration at lower switching point).

Ex-DDCM1 (stainless steel sensor)

Ex-DDCM

Ⓔx II 2G Ex d e IIC T6 Gb
Ⓔx II 1/2D Ex ta/tb IIIC T80 °C Da/Db

SIL 2 according IEC 61508-2

Technical data

Pressure connection
Internal thread G 1/4

Switching device
Robust housing (700) made of seawater-resistant diecast aluminium GD Al Si 12.

Protection class
IP 65

Pressure sensor materials
Ex-DDCM014–16:
Ex-Pressure bellows of 1.4571
Sensor housing of 1.4305.
DDCM252–6002:
Perbunan diaphragm.
Aluminium sensor housing.

Mounting position
vertically upright.

Ambient temperature at switching device
–20…+60 °C

Max. medium temperature
The maximum medium temperature at the pressure sensor must not exceed the permitted ambient temperature at the switching device. Higher medium temperatures are possible provided the above limit values for the switching device are ensured by suitable measures (e.g. siphon).

Mounting
Directly on the pressure line or on a flat surface with two 4 mm Ø screws.
Note the connection of pressurized lines:
P (+) = high pressure
S (–) = low pressure

Switching pressure
Adjustable from outside with screwdriver.

Switching capacity	250 VAC (ohm)	250 VAC (ind)	250 VDC (ohm)	24 VDC (ohm)
Ex-d	3 A	2 A	0.03 A	3 A

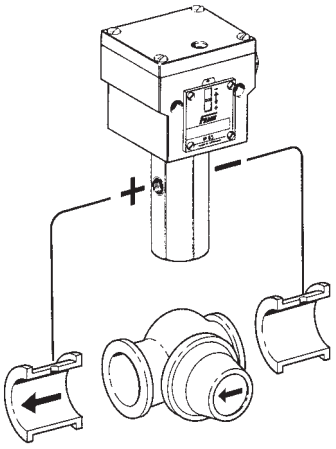
Type	Setting range (differential pressure)	Switching differential (mean values)	Max.** permissible pressure	Materials in contact with medium	Dimen-sioned drawing
Switching differential not adjustable					page 25 + 26
Ex-DDCM252*	4…25 mbar	2 mbar	0.5 bar		
Ex-DDCM662*	10…60 mbar	15 mbar	1.5 bar	Aluminium	4 + 20
Ex-DDCM1602*	20…160 mbar	20 mbar	3 bar	+ Perbunan	
Ex-DDCM6002*	100…600 mbar	35 mbar	3 bar		
Ex-DDCM014*	-0.1…0.4 bar	0.15 bar	15 bar		
Ex-DDCM1	0.2…1.6 bar	0.13 bar	15 bar	stainless steel	
Ex-DDCM4*	1…4 bar	0.2 bar	25 bar	1.4305 +	4 + 21
Ex-DDCM6	0.5…6 bar	0.2 bar	15 bar	1.4571	
Ex-DDCM16	3…16 bar	0.6 bar	25 bar		

* without graduation (only ± scale) set according to pressure gauge.
** also loadable on one side

Accessories: · Threaded joint with male adapter union G 1/4"/8 mm MAU8/Ms and MAU8/Nst page 153
· Valve combinations VKD3 and VKD5, page 152

Calibration

The **Ex-DDCM** series is calibrated for falling pressure. This means that the adjustable switching pressure on the scale corresponds to the switching point at falling pressure. The reset point is higher by the amount of the switching differential. (See also page 27, 1. Calibration at lower switching point).



Pump monitoring application example

The differential pressure switch (e.g. Ex-DDCM1) monitors differential pressure through the pump. The system shuts down if values fall below an adjustable switching threshold. Pump monitoring does not depend on the static pressure in the system.

Ex-VNM111

Ex-VCM/Ex-VNM

II 2G Ex d e IIC T6 Gb
II 1/2D Ex ta/tb IIIC T80 °C Da/Db

SIL 2 according IEC 61508-2

Technical data

Pressure connection
External thread G 1/2 (pressure gauge connection) according to DIN 16 288 and internal thread G 1/4 according to ISO 228 Part 1.

Switching device
Robust housing (700) made of seawater-resistant diecast aluminium GD Al Si 12.

Protection class
IP 65

Pressure sensor materials

Ex-VNM111 and Ex-VNM301:	Metal bellows: 1.4571 Sensor housing: 1.4104
Ex-VCM095, 101 and 301:	Metal bellows of Cu Zn Sensor housing of CuZn
Ex-VCM4156:	Perbunan diaphragm sensor housing: 1.4301

Mounting position
Vertically upright.

Ambient temp. at switching device
–20…+60 °C

Max. medium temperature
The maximum medium temperature at the pressure sensor must not exceed the permitted ambient temperature at the switching device. Higher medium temperatures are possible provided the above limit values for the switching device are ensured by suitable measures (e.g. siphon).

Mounting
Directly on the pressure line (pressure gaugeconnection) or on a flat surface with two 4 mm Ø screws.

Switching pressure
Adjustable from outside with screwdriver.

Contact arrangement
Single-pole changeover switch.

Switching capacity	250 VAC (ohm)	250 VAC (ind)	250 VDC (ohm)	24 VDC (ohm)
Ex-d	3 A	2 A	0.03 A	3 A

Product Summary

Type	Setting range	Switching differential (mean values)	Max. permissible pressure	Dimen-sioned drawing
Switching differential not adjustable				page 25 + 26
Ex-VCM4156	–15…+6 mbar	2 mbar	1 bar	4 + 11
Ex-VCM301	–250…+100 mbar	25 mbar	1.5 bar	4 + 13
Ex-VNM301	–250…+100 mbar	45 mbar	3 bar	4 + 15
Ex-VCM101	–1*…+0.1 bar	45 mbar	3 bar	4 + 14
Ex-VCM095	–0.9…+0.5 bar	50 mbar	3 bar	4 + 14
Ex-VNM111	–1*…+0.1 bar	50 mbar	6 bar	4 + 15

* At very high vacuums, close to the theoretical maximum of –1 bar, the switch may not be usable in view of the special conditions of vacuum engineering. However, the pressure switch itself will not be damaged at maximum vacuum.

Calibration

The **Ex-VCM** and **Ex-VNM** series are calibrated for falling pressure. This means that the adjustable switching pressure on the scale corresponds to the switching point at falling pressure. The reset point is higher by the amount of the switching differential. (See also page 27, 1. Calibration at lower switching point).

Ex-DWR25

Ex-DWR

II 2G Ex d e IIC T6 Gb
II 1/2D Ex ta/tb IIIC T80 °C Da/Db

SIL 2 according IEC 61508-2

Technical data

Pressure connection
External thread G 1/2 (pressure gauge connection) to DIN 16 288 and internal thread G 1/4 to ISO 228 Part 1 (for gas applications internal thread permissible only up to 4 bar).

Switching device
Rugged housing (700) made of seawater-resistant diecast aluminium.

Materials
Pressure bellows: Material no. 1.4571
Sensor housing: Material no. 1.4104 Switch housing: GD Al Si 12 (DIN 1725)

Mounting position
Vertically upright

Ambient temperature at switching device
–20 to +60°C.
Medium temperature –25 to +60°C. The maximum medium temperature at the pressure sensor must not exceed the permitted ambient temperature at the switching device. Higher medium temperatures are possible provided the above limit values for the switching device are ensured by suitable measures (e.g. siphon).

Mounting
Directly on the pressure line (pressure gauge connection) or on a flat surface with two 4 mm Ø screws.

Calibration
The DWR series is calibrated for rising pressure. This means that the adjustable switching pressure on the scale corresponds to the switching point at rising pressure. The reset point is lower by the amount of the switching differential. (See also page 27, 2. Calibration at upper switching point).

Bursting pressure
For all types ≥ 100 bar, verified by TÜV test.

Contact arrangement Single pole changeover switch.

Switching capacity	250 VAC (ohm)	(ind)	250 VDC (ohm)	24 VDC (ohm)
Ex-d	3 A	2 A	0.03 A	3 A

Protection class IP 65, only vertically upright

Ex protection
EEx de IIC T6

Component tested for	
Steam	Systems according to TRD 604
Hot water	Systems according to DIN EN12828
Fuel gases	DVGW Worksheet G 260
Pressure tank	DIN EN764-7
Function	Pressure monitor or pressure limiter (with external interlock)
Direction of action	**For maximum and minimum pressure monitoring (DWFS, SDBFS)**
Sensor	**"of special construction"** by testing with 2 million cycles.

Product Summary

Type	Setting range	Switching differential (mean values)	Maximum working pressure	Dimensioned drawing
Switching differential not adjustable				**page 25 + 26**
Ex-DWR06	0.1…0.6 bar	0.04 bar	6 bar	4 + 15
Ex-DWR1	0.2…1.6 bar	0.06 bar		
Ex-DWR3	0.2…2.5 bar	0.1 bar	16 bar	4 + 18
Ex-DWR6	0.5…6 bar	0.2 bar		
Ex-DWR625	0.5…6 bar	0.25 bar	25 bar	4 + 17
Ex-DWR16	3…16 bar	0.5 bar		
Ex-DWR25	4…25 bar	1.0 bar	63 bar	4 + 16
Ex-DWR40	8…40 bar	1.3 bar		

Ex-DGM525

Ex-DGM

II 2G Ex d e IIC T6 Gb

II 1/2D Ex ta/tb IIIC T80 °C Da/Db

SIL 2 according IEC 61508-2

Technical data

Pressure connection
External thread G 1/2 to DIN 16 288 and internal thread G 1/4 to ISO 228 Part 1 (permissible up to 4 bar).

Switching device
Seawater-resistant diecast aluminium GD Al Si 12.

Protection class
IP 65

Pressure sensor materials
See Product Summary

Ambient temperature –20 to +60°C.
At ambient temperatures below 0°C, ensure that condensation cannot occur in the sensor or in the switching device.

Maximum working pressure
See Product Summary

Mounting
Either directly on the pipe or with two 4 mm ø screws on the wall surface.

Mounting position
Vertically upright

Setting
Continuously adjustable via the setting spindle with a screwdriver. The set switching pressure is visible in the scale window.

Switching differentials
Largely independent of the set switching pressure. Not adjustable. For values see Product Summary.

Switching capacity	250 VAC (ohm)	(ind)	250 VDC (ohm)	24 VDC (ohm)
Ex-d	3 A	2 A	0.03 A	3 A

Pressure measuring connection
Care must be taken to ensure that a pressure measuring connection is available in a suitable place on the gas appliance.

Component tested for	Fuel gases according to DVGW Worksheet G 260
Testing basis	DIN EN1854
Function	Pressure monitor
Direction of action	**For maximum and minimum pressure monitoring**

Product Summary

Type	Setting range	Switching differential (mean values)	Max. working pressure	Materials in contact with medium	Dimensioned drawing
					page 25 + 26
Ex-DGM506	15…60 mbar	10 mbar	5 bar	1.4104	
Ex-DGM516	40…160 mbar	12 mbar	5 bar	1.4104	4 + 12
Ex-DGM525	100…250 mbar	20 mbar	5 bar	1.4104	

Calibration

The **Ex-DGM** series is calibrated for rising pressure. This means that the adjustable switching pressure on the scale corresponds to the switching point at rising pressure. The reset point is lower by the amount of the switching differential. (See also page 27, 2. Calibration at upper switching point).

For other pressure ranges see type series DWR, page 69