Product index

Product index

Druck

Druck
Pressure

Sensors TIVAL®

Sketches + Notes

Pressure switch FF 4

0,11 up to 250 bar, ample wiring room, easy to adjust,
high repeatability of set switchpoints, easily read scale

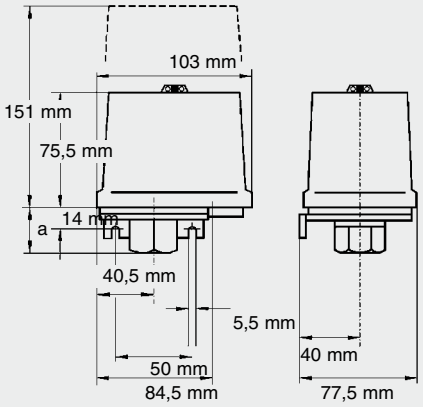
Applications

Air compressors, water pumps, booster pumps, firefighting equipment, or oil supply equipment.

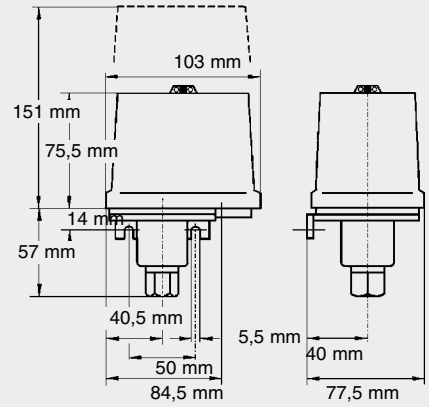
TIVAL pressure switches of the FF 4 series are suitable for a wide range of applications.

For example they can be utilized for:

- Monitoring and controlling the pressure of liquid or gaseous media in pipelines, tanks, vats, pressure vessels and apparatus.
- Applications in process control, cooling, pneumatics and hydraulics.
- Pressure monitoring of cooling circuits and lubrication systems on various types of machinery.
- Automatic switching of pump and compressor motors for supplying water to dwellings, booster pumps, firefighting equipment and on compressed air systems.



FF 4-2, FF 4-4, FF 4-8,
FF 4-16, FF 4-32



FF 4-12, FF 4-30, FF 4-60,
FF 4-120, FF 4-250

Description

The pressure of the monitored medium operates against a flat diaphragm, bellows or plunger (depending on pressure range). A system of levers and springs work on a snapaction cascade switch of high vibration resistance, ensuring flutterfree switching. With no pressure on the diaphragm contact 1-2 is closed. This can be used as an „ON“ signal for a pump or compressor motor. If pressure exceeds the upper switchingpoint, contact 1-2 opens and contact 1-4 closes. The connected motor will be switched off. Contact 1-4 is often used to indicate the „off“ condition.
Contact 1-2 will close again, when the pressure on the diaphragm has dropped below the set lower switchpoint. Upper and lower switch points can be adjusted independently of each other using a screwdriver. The two switch points are indicated on the scale inside the unit.

Change-over contact with manual reset min.:
If the pressure drops below the set value, contact 1-4 opens and contact 1-2 closes and locks. When the pressure has risen above the set value, the contact can be unlocked with the manual reset button.

Change-over contact with manual reset max.:
If the pressure rises above the set value, contact 1-2 opens and contact 1-4 closes and locks. When the pressure has dropped below the set value, the contact can be unlocked with the manual reset button.

Pressure connection, pressure sensing element, switch mechanism and electrical terminals are fitted on a die-cast aluminum-alloy base. The scale and switch are protected against environmental effects by an impact-resistant, transparent polycarbonate cover, (CTI 200-225) and can be lead-sealed.
Included in standard units: Rubber grommet with orifice for cable entry, pressure connector „Y“, made out of plastic for demineralised water applications.

Options upon request:

- Gold flashed contacts
- Cable gland M 20 for protection IP 65
- Viton diaphragm for aggressive media
- Manual reset
- **GL - approved version**
- **UL/CSA - approved version**
- **ATEX - approved version**
- **VdS - approved version**

Pressure switch FF 4

0,11 up to 250 bar, ample wiring room, easy to adjust,
high repeatability of set switchpoints, easily read scale

Types

Pressure switch with perbunan diaphragm for mineral oils, water and air. Additional type **G = gold flashed contacts**
Pressure connector: H (G 3/8“ Female thread, DIN 1725/2), ALSi 12. VDE 0660, IEC 337-1, IEC 553-1

Order reference	Upper switch pt. adjustable (bar)	Lower switch pt. adjustable (bar)	Smallest diff.* (bar)	Max. operating pressure (bar)	Max. test pressure (bar)	Standard setting (bar)	Part No.
FF 4-2 DAH	0,11 ... 2	0,04 ... 1,89	0,07 0,11	20	40	0,5 / 1,5	1010061
FF 4-2 DAH G	0,11 ... 2	0,04 ... 1,89	0,07 0,11	20	40	0,5 / 1,5	1010109
FF 4-4 DAH	0,22 ... 4	0,07 ... 3,75	0,15 0,25	24	40	1 / 3	1010062
FF 4-4 DAH G	0,22 ... 4	0,07 ... 3,75	0,15 0,25	24	40	1 / 3	1010012
FF 4-8 DAH	0,5 ... 8	0,2 ... 7,5	0,3 0,5	30	40	2 / 6	1010078
FF 4-8 DAH G	0,5 ... 8	0,2 ... 7,5	0,3 0,5	30	40	2 / 6	1010096
FF 4-16 DAH	1 ... 16	0,4 ... 15	0,6 1	36	48	4 / 12	1010081
FF 4-16 DAH G	1 ... 16	0,4 ... 15	0,6 1	36	48	4 / 12	1010102
FF 4-32 DAH	2 ... 32	0,8 ... 30	1,2 2	52	64	10 / 20	1010076
FF 4-32 DAH G	2 ... 32	0,8 ... 30	1,2 2	52	64	10 / 20	1010003

* at lower ... higher end of range

Types

Pressure switch with perbunan diaphragm and plastic pressure connector suitable i.e. for demineralised water.
Pressure connector: Y (G 3/8“ Female thread, DIN 1725/2), polyamid. VDE 0660, IEC 337-1, IEC 553-1

Control pressure switch FF 4-... DAY

Order reference	Upper switch pt. adjustable (bar)	Lower switch pt. adjustable (bar)	Smallest diff.* (bar)	Max. operating pressure (bar)	Max. test pressure (bar)	Standard setting (bar)	Part No.
FF 4-2 DAY	0,11 ... 2	0,04 ... 1,89	0,07 0,11	6	12	0,5 / 1,5	1010077
FF 4-4 DAY	0,22 ... 4	0,07 ... 3,75	0,15 0,25	8	12	1 / 3	1010063
FF 4-8 DAY	0,5 ... 8	0,2 ... 7,5	0,3 0,5	12	16	2 / 6	1010084
FF 4-10 DAY	0,7 ... 10	0,3 ... 9,2	0,4 0,8	12	16	4 / 5	1010073
FF 4-16 DAY	1 ... 16	0,4 ... 15	0,6 1	20	24	4 / 12	1010082

* at lower ... higher end of range

Pressure switch FF 4

0,11 up to 250 bar, ample wiring room, easy to adjust,
high repeatability of set switchpoints, easily read scale

Types

Pressure switch with stainless steel bellows Declaration of Conformity in acc. with PED, media temperature up to +200° C, de-ionised water

Pressure connector: G (G 1/4“ Female thread DIN 1725/2), stainless steel. VDE 0660, IEC 337-1, IEC 553-1

Control pressure switch FF 4-... AAG / PAH

Order reference	Upper switch pt. adjustable (bar)	Lower switch pt. adjustable (bar)	Smallest diff.* (bar)	Max. operating pressure (bar)	Max. test pressure (bar)	Standard setting (bar)	Part No.
FF 4-12 AAG	1 ... 12	0,5 ... 11,2	0,5 0,8	12	16	6 / 7	1010074
FF 4-30 AAG	4 ... 30	1 ... 26,4	1,8 3,6	30	42	16 / 20	1010066

* at lower ... higher end of range

Types

High pressure switch with plastic plunger.

Throttle is fitted as standard on these units. This must be removed for use with viscous media.

Pressure connector: H (G 3/8“ Female thread, DIN 1725/2), stainless steel. VDE 0660, IEC 337-1, IEC 553-1

Order reference	Upper switch pt. adjustable (bar)	Lower switch pt. adjustable (bar)	Smallest diff.* (bar)	Max. operating pressure (bar)	Max. test pressure (bar)	Standard setting (bar)	Part No.
FF 4-60 PAH	8 ... 60	4 ... 52	4 8	100	120	20 / 40	1010064
FF 4-120 PAH	16 ... 120	8 ... 104	8 16	200	240	20 / 80	1010079
FF 4-250 PAH	30 ... 250	14 ... 226	12 24	400	500	100 / 200	1010072

* at lower ... higher end of range

Pressure switch FF 4

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Types

Pressure switch with manual reset DDH = reset min., DRH = reset max.
Pressure connector: H (G 3/8“ Female thread, DIN 1725/2), ALSi 12. VDE 0660, IEC 337-1, IEC 553-1

Control pressure switch FF 4-... with manual reset

Order reference	Upper switch pt. adjustable (bar)	Lower switch pt. adjustable (bar)	Smallest diff. (bar)	Max. operating pressure (bar)	Max. test pressure (bar)	Standard setting (bar)	Part No.
FF 4-2 DRH	0,11 ... 2		0,2	20	40	0,5 / 1,5	1010106
FF 4-2 DDH		0,04 ... 1,89	0,1	20	40	0,5 / 1,5	1010107
FF 4-4 DRH	0,22 ... 4		0,5	24	40	1 / 3	1010016
FF 4-4 DDH		0,07 ... 3,75	0,2	24	40	1 / 3	1010100
FF 4-8 DRH	0,5 ... 8		1,0	30	40	2 / 6	1010069
FF 4-8 DDH		0,2 ... 7,5	0,4	30	40	2 / 6	1010094
FF 4-16 DRH	1 ... 16		2,0	36	48	4 / 12	1010110
FF 4-16 DDH		0,4 ... 15	0,8	36	48	4 / 12	1010101
FF 4-32 DRH	2 ... 32		4,0	52	64	10 / 20	1010057
FF 4-32 DDH		0,8 ... 30	1,6	52	64	10 / 20	1010087

Pressure switch FF 4

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Types

Pressure switch with UL / CSA-approval IP 65 for mineral oils, water and air.
Pressure connector: F (1/4”18 NPTF), silumin. Cable gland 1/2“ 14 NPTF is fitted as standard on these units.
VDE 0170/0171/0660, IEC 337-1, IEC 553-1

Control pressure switch FF 444-... with UL / CSA-approval

Order reference	Upper switch pt. adjustable (psi)	Lower switch pt. adjustable (psi)	Smallest diff.* (psi)	Max. operating pressure (psi)	Max. test pressure (psi)	Standard setting (psi)	Part No.
FF444-V2 DAF	3 ... 58	1 ... 54	2 4	348	580	14 / 44	1010309
FF444-V4 DAF	15 ... 232	6 ... 217	9 14	522	696	58 / 174	1010311
FF444-V6 PAF	116 ... 870	58 ... 754	58 116	1450	1740	290 / 580	1010299
FF444-V7 PAF	232 ... 1740	116 ... 1508	116 232	2900	3840	290 / 1160	1010300

* at lower ... higher end of range

Technical data						
Rated operating current at	**12 V**	**24 V**	**60 V**	**110 V**	**230 V**	**400 V**
AC 1					16 A	10 A
AC 15					6 A	4 A
DC 13	6 A	1 A	0,5 A	0,2 A	0,1 A	
Permissible motor power 1 ~ 230 V Rated operating current AC 3	0,55 kW 10 A					
Resistance to vibration 10 to 1000 Hz	4 g					
Protection acc. to DIN 40 050 / IEC 529 with rubber grommet	IP54					
Protection acc. to DIN 40 050 / IEC 529 with cable glands PG 13.5 / M20	IP65					
Ambient temperature range	-20 … +70° C					
Perm. media temperature (… DAH, PAH, DAF) (...DAY) (...AAG)	+70° C +50° C +200° C					
Repeatability	< 2 % FS					
Electrical lifespan	AC 15 – at least 1 * 10^6					
Max. switching frequency	30 * min^{-1}					

Pressure switch FF 4

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Media compatibility guide

Medium name	Chemical Formula	Stainless steel	Perbunan	Viton	Plastic
Acetone	CH_3COCH_3	X			
Acetylene	HC = CH	X	X	X	X
Air	-	X	X	X	X
Benzene	Sulphur-free	X		X	
Butane	C_4H_{10}	X	X	X	X
Butyl acetate	$CH_3COOC_4H_9$	X			
Butyl alcohol	CH_3-CH_2-CH_2-CH_2-OH	X			
Carbon dioxide	CO_2	X	X	X	X
Carbonic acid	H_2CO_3	X	X	X	X
Chlorine	Cl_2			X	
Crude oil	-	X	X	X	X
Diesel oil	See fuels	X	X	X	X
Ethyl acetate	$CH_3OOOC_2H_5$	X			
Fuels	Diesel oil,	X	X	X	X
	Leaded petrol	X	X	X	X
	Benzene	X		X	
Glycerine	CH_2OH-CHOH-CH_2OH	X	X	X	X
Glycol	CH_2OH-CH_2OH	X	X	X	X
Heating fuel oil	See also oils	X	X	X	X
Hydrogen	H_2	X	X		X
Inert gases	-	X			
Methanol	CH_3OH	X			
Methyl chloride	CH_3Cl	X			
Natural gas	-	X	X	X	X
Nitrogen	N2	X	X	X	X
Oils	Mineral	X	X	X	X
Oils	Vagetable	X	X	X	
Oxygen	O_2	X		X	
Ozone	-	X		X	
Perchlorethylene	CCl_2=CCL_2	X		X	
Petrol	All types	X		X	
Phenolic acid	$C_6H_5(OH)$	X			
Sulphar dioxide	SO_2	X		d	
Toluene (Metyl benzene)	$C_6H_5CH_3$	X		X	
Trichlorethene	CHCl=CCl_2	X		X	
Water	Steam / vapor	X	X	X	
Water	Destilled, de-aerated	X	X	X	X
Water	Sea water	X	X		
Xylene	$C_6H_4(CH_3)_2$	X		X	

X = recommended, d = dry

Accessories

Order reference	Description	Weight (g)	Part No.
	Throttles		
Throttle FF4-2 ... 32	Throttle for series FF4-2 up to 32	3	1011002
Throttle FF4-60 ... 250	Throttle for series FF4-12/30/60/120/250 (stainless steel)	3	1011003
	Glands		
H 124-114	Steel gauge fitting, G 3/8" - G 1/2"	180	1071004
Gland M 20	Glands FF4	-	1011004
Nut M 20	Nut FF4	-	1011007
	Cover		
Cover FF4	Cover FF4	-	1011001

Pressure switch FF 4

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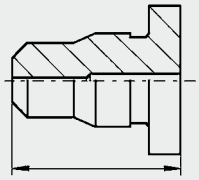
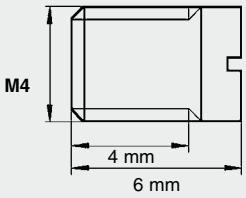
Dimensions



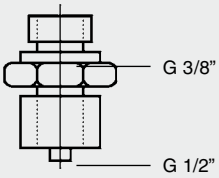
Throttle for FF 4-2 up to 32

weight: ~ 3 g
Order No.: 1011002



Throttle screw for FF 4-12/30/60/120/250

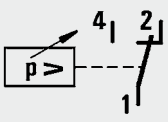
weight: ~ 3 g (stainless steel)
Order No.: 1011003



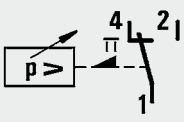
Gauge fitting

Steel, G 3/8” - G 1/2”, Type: H 124-114
weight: ~ 18 g
Order No.: 1071004

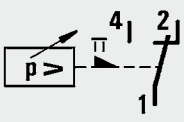
Circuit diagrams



Change-over contact



Change-over contact
with manual reset min.



Change-over contact
with manual reset max.

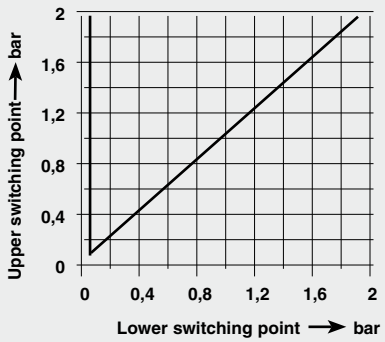
Pressure switch FF 4

0,11 up to 250 bar, ample wiring room, easy to adjust,
high repeatability of set switchpoints, easily read scale

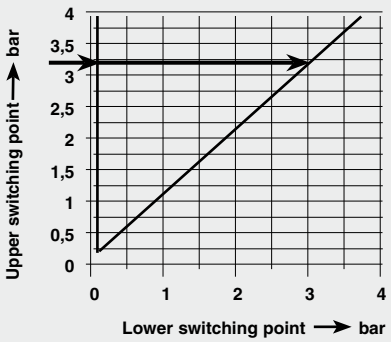
Pressure diagrams

Charts show the smallest adjustable differential.
Example per figure FF 4-4: If upper setting is at 3.25 bar, lower setting can be adjusted between 0.07 and 3.0 bar (see arrows in the drawing).

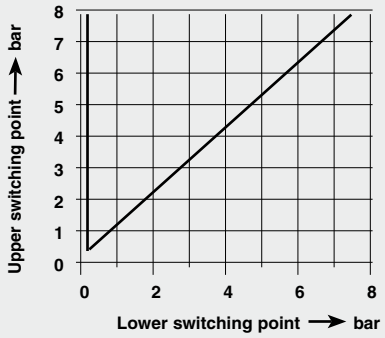
FF 4-2



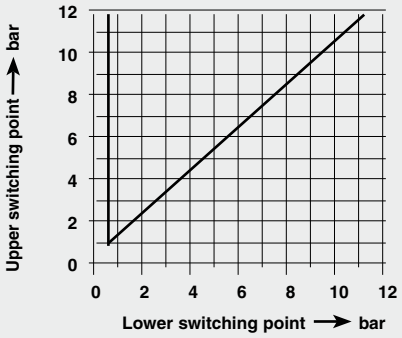
FF 4-4



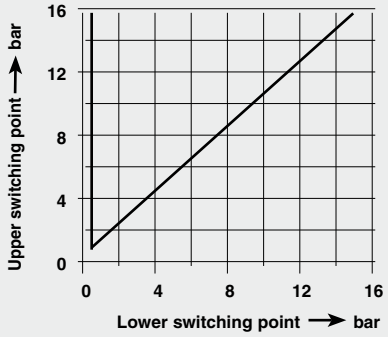
FF 4-8



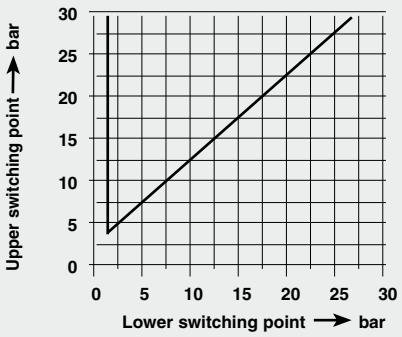
FF 4-12



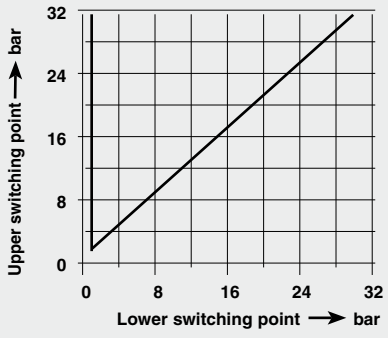
FF 4-16



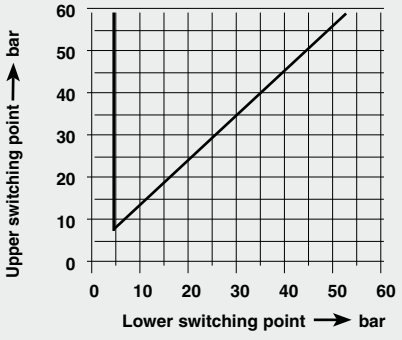
FF 4-30



FF 4-32



FF 4-60



Pressure switch FF 4

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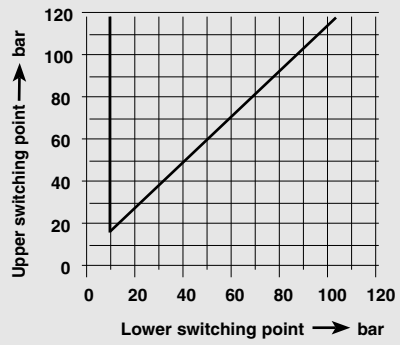
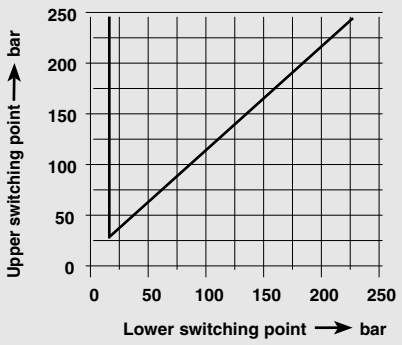
Pressure diagrams

FF 4-120



FF 4-250



Sensors TIVAL®

Sketches + Notes

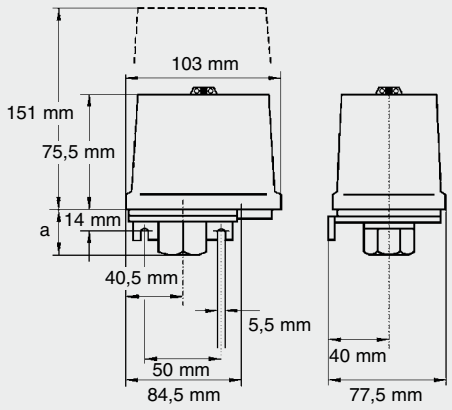
Pressure switch FF 4

Approval acc. to ATEX

Description

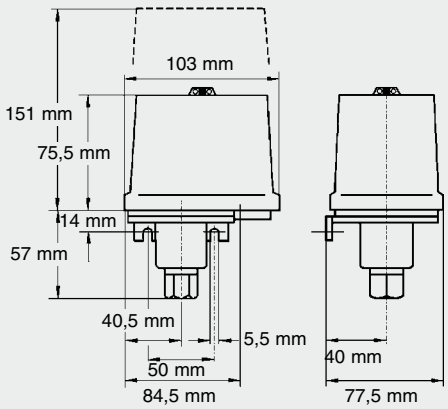
- Pressure switches 2 ... 32 bar with perbunan diaphragm.
- Pressure switches 60 ... 250 bar with plastic plunger and throttle.
- Throttle must be removed when using viscous media.

Control pressure switch FF 4-4 AB DAH



FF 4-2, FF 4-4, FF 4-8, FF 4-16, FF 4-32

Control pressure switch FF 4-4 AC DAH



FF 4-12, FF 4-30, FF 4-60, FF 4-120, FF 4-250

Types

Protection class: IM2 Ex ia IMb, Pressure connector: H (G 3/8" Female thread)

Order reference	Upper switch pt. adjustable (bar)	Lower switch pt. adjustable (bar)	Smallest diff.* (bar)	Max. operating pressure (bar)	Max. test pressure (bar)	Standard setting (bar)	Part No.
FF 4-2 AB DAH	0,11 ... 2	0,04 ... 1,89	0,07 0,11	20	40	0,5 / 1,5	1030133
FF 4-4 AB DAH	0,22 ... 4	0,07 ... 3,75	0,15 0,25	24	40	1 / 3	1030134
FF 4-8 AB DAH	0,5 ... 8	0,2 ... 7,5	0,3 0,5	30	40	2 / 6	1030135
FF 4-16 AB DAH	1 ... 16	0,4 ... 15	0,6 1	36	48	4 / 12	1030136
FF 4-60 AB PAH	8 ... 60	4 ... 52	4 8	100	120	20 / 40	1030138
FF 4-120 AB PAH	16 ... 120	8 ... 104	8 16	200	240	20 / 80	1030139
FF 4-250 AB PAH	30 ... 250	14 ... 226	12 24	400	500	100 /200	1030140

* at lower ... higher end of range

Pressure switch FF 4

Approval acc. to ATEX

Types

Protection class: II 2G Ex ia IIC T6 Gb, Pressure connector: H (G 3/8“ Female thread)

Order reference	Upper switch pt. adjustable (bar)	Lower switch pt. adjustable (bar)	Smallest diff.* (bar)	Max. operating pressure (bar)	Max. test pressure (bar)	Standard setting (bar)	Part No.
FF 4-2 AC DAH	0,11 ... 2	0,04 ... 1,89	0,07 0,11	20	40	0,5 / 1,5	1030141
FF 4-4 AC DAH	0,22 ... 4	0,07 ... 3,75	0,15 0,25	24	40	1 / 3	1030142
FF 4-8 AC DAH	0,5 ... 8	0,2 ... 7,5	0,3 0,5	30	40	2 / 6	1030144
FF 4-16 AC DAH	1 ... 16	0,4 ... 15	0,6 1	36	48	4 / 12	1030145
FF 4-32 AC DAH	2 ... 32	0,8 ... 30	1,1 2	52	64	10 / 20	1030146
FF 4-60 AC PAH	8 ... 60	4 ... 52	4 8	100	120	20 / 40	1030147
FF 4-120 AC PAH	16 ... 120	8 ... 104	8 16	200	240	20 / 80	1030149
FF 4-250 AC PAH	30 ... 250	14 ... 226	12 24	400	500	100 /200	1030150

* at lower ... higher end of range

Types

Protection class: II 2G Ex ia IIC T6 Gb, Pressure connector with stainless steel corrugated bellows,
Pressure connector: G (G 1/4“ Female thread)

Order reference	Upper switch pt. adjustable (bar)	Lower switch pt. adjustable (bar)	Smallest diff.* (bar)	Max. operating pressure (bar)	Max. test pressure (bar)	Standard setting (bar)	Part No.
FF4-12 AC AAG	1 ... 12	0,5 ... 11,2	0,5 0,8	12	16	6 / 7	1030131
FF4-30 AC AAG	4 ... 30	1 ... 26,4	1,8 3,6	30	42	16 / 20	1030132

* at lower ... higher end of range

Technical data	
Resistance to vibration 10 up to 1000 Hz	4 g
Protection acc. to DIN 40 050/IEC 529 with rubber grommet	IP 54
Protection acc. to DIN 40 050/IEC 529 with cable glands PG 13.5/M20	IP 65
Ambient temperature range	-30 ... +60° C
Perm. medium temperature (...DAH, PAH)	+70° C
(...AAG)	+200° C
Repeatability	< 2 % FS

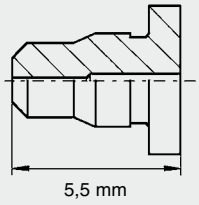
Accessories

Order reference	Description	Weight (g)	Part No.
	Throttles		
Throttle FF4-2 ... 32	Throttle for series FF4-2 up to 32	3	1090401002
Throttle FF4-60 ... 250	Throttle for series FF4-12/30/60/120/250 (stainless steel)	3	1090401003
	Glands		
H 124-114	Steel gauge fitting, G 3/4” - G 1/2”	180	1090501004

Pressure switch FF 4

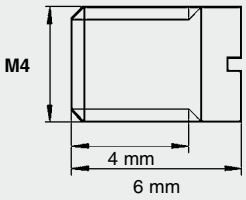
Approval acc. to ATEX

Dimensions



Throttle for FF 4-2 up to 32

weight: ~ 3 g
Order No.: 1011002



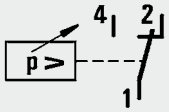
Throttle screw for FF 4-12/30/60/120/250

weight: ~ 3 g(stainless steel)
Order No.: 1011003

Switch amplifier TS-500 Ex
see page 169

Zener barrier MTL 7787+
see page 175

Circuit diagram



Change-over contact

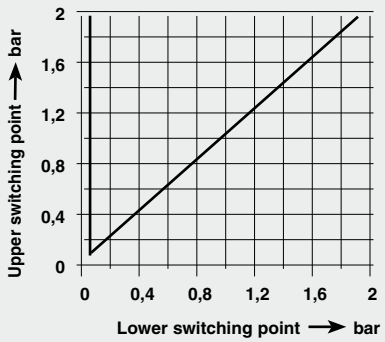
Pressure switch FF 4

Approval acc. to ATEX

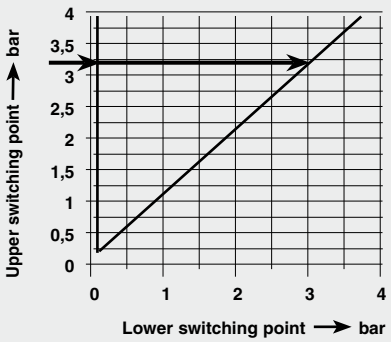
Pressure diagrams

Charts show the smallest adjustable differential.
Example per figure FF 4-4: If upper setting is at 3.25 bar, lower setting can be adjusted between 0.07 and 3.0 bar (see arrows in the drawing).

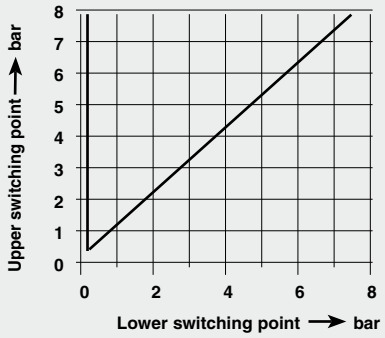
FF 4-2



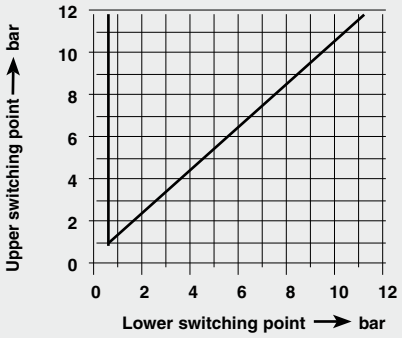
FF 4-4



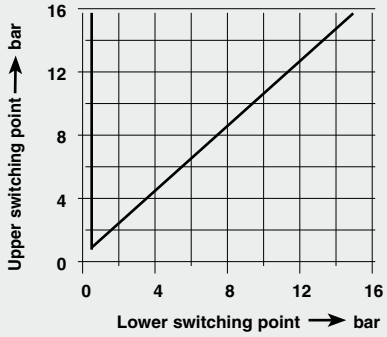
FF 4-8



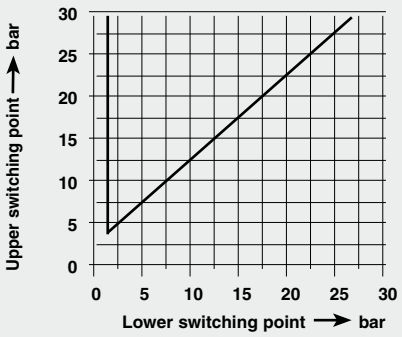
FF 4-12



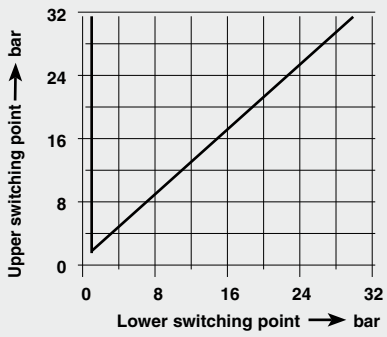
FF 4-16



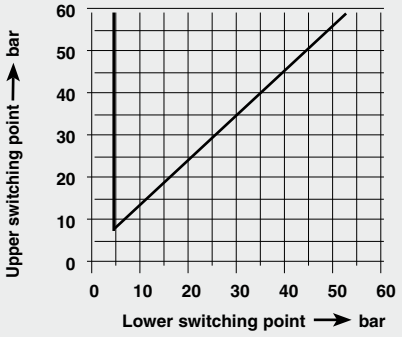
FF 4-30



FF 4-32



FF 4-60

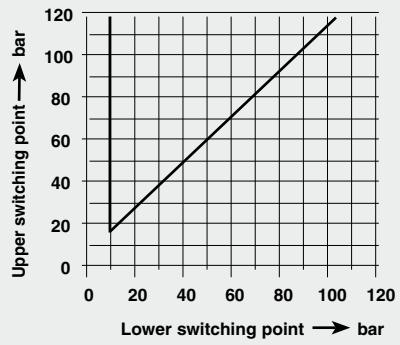


Pressure switch FF 4

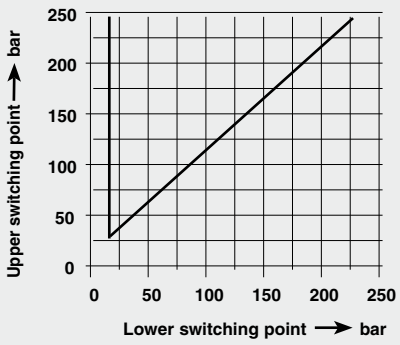
Approval acc. to ATEX

Pressure diagrams

FF 4-120



FF 4-250



Media compatibility guide

Medium name	Chemical Formula	Stainless steel	Perbunan	Viton	Plastic
Acetone	CH_3COCH_3	X			
Acetylene	HC = CH	X	X	X	X
Air	-	X	X	X	X
Benzene	Sulphur-free	X		X	
Butane	C_4H_{10}	X	X	X	X
Butyl acetate	$CH_3COOC_4H_9$	X			
Butyl alcohol	CH_3-CH_2-CH_2-CH_2-OH	X			
Carbon dioxide	CO_2	X	X	X	X
Carbonic acid	H_2CO_3	X	X	X	X
Chlorine	Cl_2			X	
Crude oil	-	X	X	X	X
Diesel oil	See fuels	X	X	X	X
Ethyl acetate	$CH_3OOOC_2H_5$	X			
Fuels	Diesel oil,	X	X	X	X
	Leaded petrol	X	X	X	X
	Benzene	X		X	
Glycerine	CH_2OH-CHOH-CH_2OH	X	X	X	X
Glycol	CH_2OH-CH_2OH	X	X	X	X
Heating fuel oil	See also oils	X	X	X	X
Hydrogen	H_2	X	X		X
Inert gases	-	X			
Methanol	CH_3OH	X			
Methyl chloride	CH_3Cl	X			
Natural gas	-	X	X	X	X
Nitrogen	N2	X	X	X	X
Oils	Mineral	X	X	X	X
Oils	Vagetable	X	X	X	
Oxygen	O_2	X		X	
Ozone	-	X		X	
Perchlorethylene	CCl_2=CCL_2	X		X	
Petrol	All types	X		X	
Phenolic acid	$C_6H_5(OH)$	X			
Sulphar dioxide	SO_2	X		d	
Toluene (Metyl benzene)	$C_6H_5CH_3$	X		X	
Trichlorethene	CHCl=CCl_2	X		X	
Water	Steam / vapor	X	X	X	
Water	Destilled, de-aerated	X	X	X	X
Water	Sea water	X	X		
Xylene	$C_6H_4(CH_3)_2$	X		X	

X = recommended, d = dry

Sensors

TIVAL®

Sketches + Notes

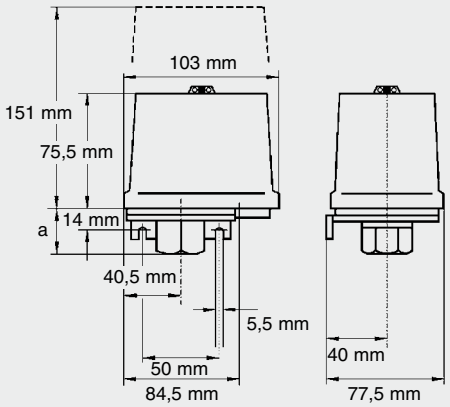
Pressure switch FF 4 GL

Approved for shipbuilding applications by Germanischer Lloyd
Certificate No.: 26 490 - 05 HH

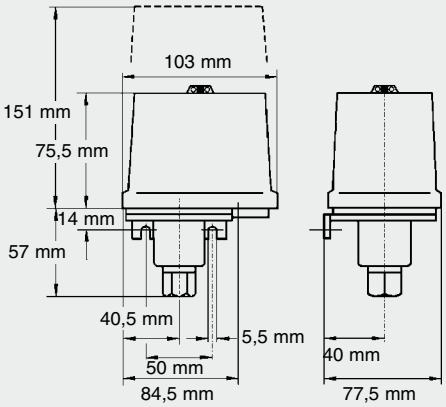
Description

- Pressure switch 2 ... 32 bar range equipped with perbunan diaphragm.
- Pressure switch 60 ... 250 bar range equipped with a plastic plunger and a throttle is fitted as standard.
- All GL-certified pressure switches are equipped with a marine-type cable gland and additional grounding clamp as standard.

FF 4-... GL-approval



FF 4-2, FF 4-4, FF 4-8, FF 4-16, FF 4-32



FF 4-12, FF 4-30, FF 4-60, FF 4-120, FF 4-250

Types

Pressure switch with perbunan diaphragm for mineral oils, water and air.
Pressure connector: H (G 3/8“ Female thread, DIN 1725/2), silumin. VDE 0660, IEC 337-1, IEC 553-1

Order reference	Upper switch pt. adjustable (bar)	Lower switch pt. adjustable (bar)	Smallest diff.* (bar)	Max. operating pressure (bar)	Max. test pressure (bar)	Standard setting (bar)	Part No.
FF 4-2 GL DAH	0,11 ... 2	0,04 ... 1,89	0,07 0,11	20	40	0,5 / 1,5	1010122
FF 4-4 GL DAH	0,22 ... 4	0,07 ... 3,75	0,15 0,25	24	40	1 / 3	1010020
FF 4-8 GL DAH	0,5 ... 8	0,2 ... 7,5	0,3 0,5	30	40	2 / 6	1010031
FF 4-16 GL DAH	1 ... 16	0,4 ... 15	0,6 1	36	48	4 / 12	1010117
FF 4-32 GL DAH	2 ... 32	0,8 ... 30	1,2 2	52	64	10 / 20	1010026

* at lower ... higher end of range

Types

High pressure switch with plastic plunger.
Throttle is fitted as standard on these units. This must be removed for use with viscous media.
Pressure connector: H (G 3/8“ Female thread, DIN 1725/2), stainless steel. VDE 0660, IEC 337-1, IEC 553-1

Order reference	Upper switch pt. adjustable (bar)	Lower switch pt. adjustable (bar)	Smallest diff.* (bar)	Max. operating pressure (bar)	Max. test pressure (bar)	Standard setting (bar)	Part No.
FF 4-60 GL PAH	8 ... 60	4 ... 52	4 8	100	120	20 / 40	1010088
FF 4-120 GL PAH	16 ... 120	8 ... 104	8 16	200	240	20 / 80	
FF 4-250 GL PAH	30 ... 250	14 ... 226	12 24	400	500	100 /200	

* at lower ... higher end of range

Pressure switch FF 4 GL

Approved for shipbuilding applications by Germanischer Lloyd
Certificate No.: 26 490 - 05 HH

Technical data	
Rated operating current at 230 V AC 1	16 A
Rated operating current at 230 V AC 15	6 A
Rated operating current at 230 V DC 13	0,1 A
Permissible motor power 1 ~ 230 V	0,55 kW
Resistance to vibration 10 up to 1000 Hz	4 g
Protection acc. to DIN 40 050/IEC 529 with rubber grommet	IP 54
Protection acc. to DIN 40 050/IEC 529 with cable glands PG 13.5/M20	IP 65
Ambient temperature range	-20 ... +70° C
Perm. medium temperature (...DAH, PAH)	+70° C
Repeatability	< 2 % FS

Media compatibility guide

Medium name	Chemical Formula	Stainless steel	Perbunan	Viton	Plastic
Acetone	CH_3COCH_3	X			
Acetylene	HC = CH	X	X	X	X
Air	-	X	X	X	X
Benzene	Sulphur-free	X		X	
Butane	C_4H_{10}	X	X	X	X
Butyl acetate	$CH_3COOC_4H_9$	X			
Butyl alcohol	CH_3-CH_2-CH_2-CH_2-OH	X			
Carbon dioxide	CO_2	X	X	X	X
Carbonic acid	H_2CO_3	X	X	X	X
Chlorine	Cl_2			X	
Crude oil	-	X	X	X	X
Diesel oil	See fuels	X	X	X	X
Ethyl acetate	$CH_3OOOC_2H_5$	X			
Fuels	Diesel oil,	X	X	X	X
	Leaded petrol	X	X	X	X
	Benzene	X		X	
Glycerine	CH_2OH-CHOH-CH_2OH	X	X	X	X
Glycol	CH_2OH-CH_2OH	X	X	X	X
Heating fuel oil	See also oils	X	X	X	X
Hydrogen	H_2	X	X		X
Inert gases	-	X			
Methanol	CH_3OH	X			
Methyl chloride	CH_3Cl	X			
Natural gas	-	X	X	X	X
Nitrogen	N2	X	X	X	X
Oils	Mineral	X	X	X	X
Oils	Vagetable	X	X	X	
Oxygen	O_2	X		X	
Ozone	-	X		X	
Perchlorethylene	CCl_2=CCL_2	X		X	
Petrol	All types	X		X	
Phenolic acid	$C_6H_5(OH)$	X			
Sulphar dioxide	SO_2	X		d	
Toluene (Metyl benzene)	$C_6H_5CH_3$	X		X	
Trichlorethene	CHCl=CCl_2	X		X	
Water	Steam / vapor	X	X	X	
Water	Destilled, de-aerated	X	X	X	X
Water	Sea water	X	X		
Xylene	$C_6H_4(CH_3)_2$	X		X	

X = recommended, d = dry

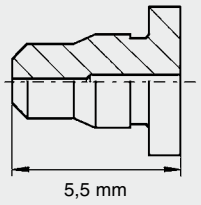
Pressure switch FF 4 GL

Approved for shipbuilding applications by Germanischer Lloyd
Certificate No.: 26490-05HH

Accessories

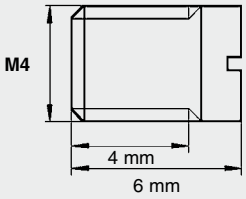
Order reference	Description	Weight (g)	Part No.
	Throttles		
Throttle FF4-2 ... 32	Throttle for series FF4-2 up to 32	3	1011002
Throttle FF4-60 ... 250	Throttle for series FF4-12/30/60/120/250 (stainless steel)	3	1011003
	Glands		
H 124-114	Steel gauge fitting, G 3/4" - G 1/2"	180	1071004

Dimensions



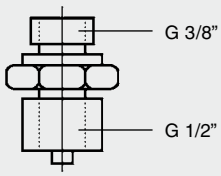
Throttle for FF 4-2 up to 32

weight: ~ 3 g
Order No.: 1011002



Throttle screw for FF 4-12/30/60/120/250

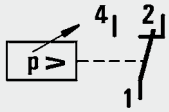
weight: ~ 3 g (stainless steel)
Order No.: 1011003



Gauge fitting

Steel, G 3/8" - G 1/2", Type: H 124-114
weight: ~ 18 g
Order No.: 1071004

Circuit diagram



Change-over contact

Pressure switch FF 4 GL

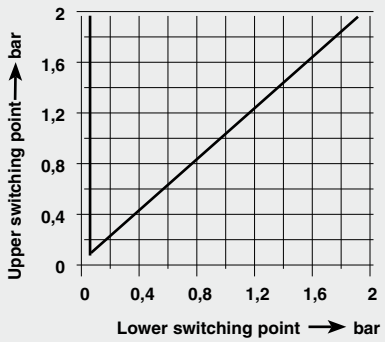
Approved for shipbuilding applications by Germanischer Lloyd
Certificate No.: 26490-05HH

Sensors TIVAL®

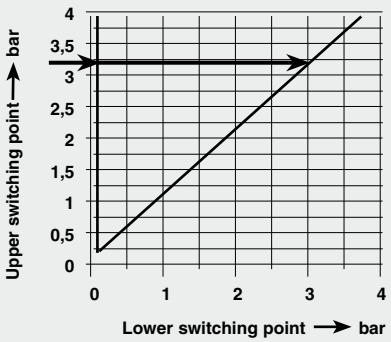
Pressure diagrams

Charts show the smallest adjustable differential.
Example per figure FF 4-4: If upper setting is at 3.25 bar, lower setting can be adjusted between 0.07 and 3.0 bar (see arrows in the drawing).

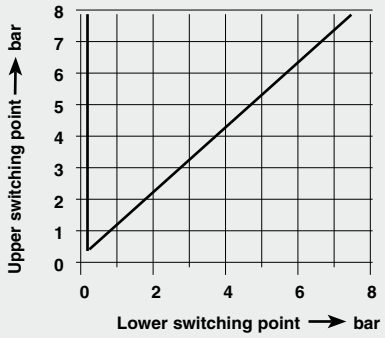
FF 4-2



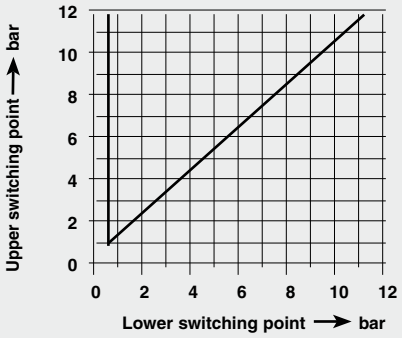
FF 4-4



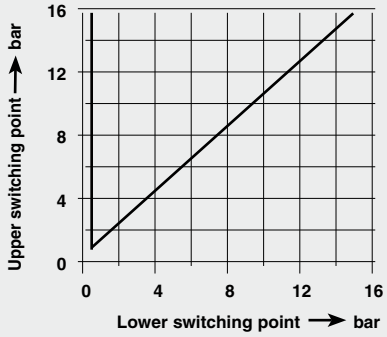
FF 4-8



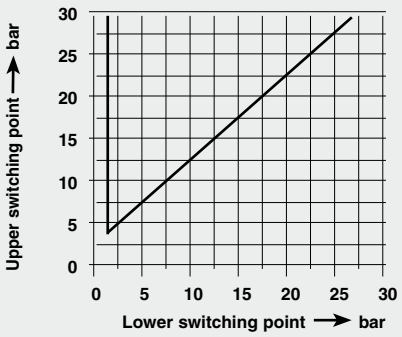
FF 4-12



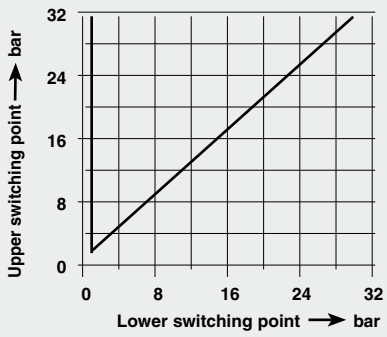
FF 4-16



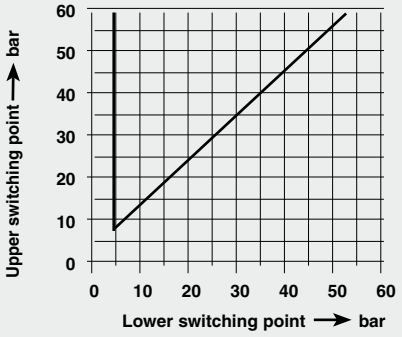
FF 4-30



FF 4-32



FF 4-60

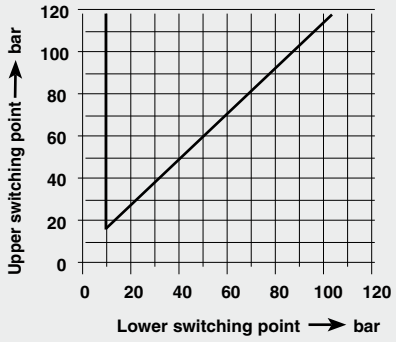


Pressure switch FF 4 GL

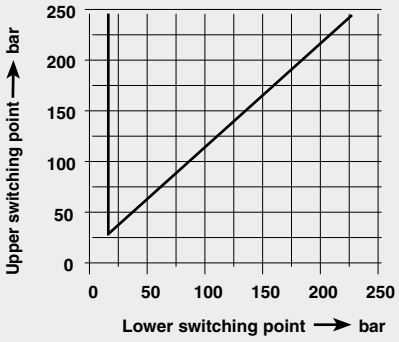
Approved for shipbuilding applications by Germanischer Lloyd
Certificate No.: 26490-05HH

Pressure diagrams

FF 4-120



FF 4-250



Sensors

TIVAL®

Sketches + Notes

Pressure switch FF 4 VdS

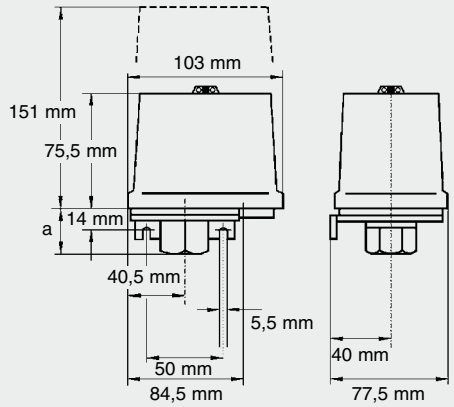
For firefighting equipment
VdS-approval

Control pressure switch FF 4-... VdS

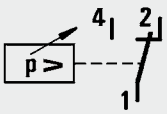
Description

- FF 4-... VdS are approved for use in fixed watersprinkler installations by the German Association of Insurers.
- 4-2 VdS is a typical alarm pressure switch. The setting range is limited to 1 bar. Differential lever and spring are omitted to assure a minimum resetting differential.
- FF 4-10 VdS and FF 4-16 VdS pressure switches limit the differential to 1.5 bar maximum.

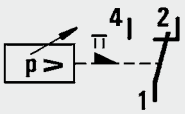
Dimensions



Circuit diagrams



Change-over contact



Change-over contact
with manual reset max.

Types

Pressure switch for fire fighting equipment, VdS-approved. Special demands for quality and functional reliability are placed on pressure switches intended for pressure monitoring on fireprotection equipment.
Pressure connector: I (G 1/2“ Female thread, DIN 1725/2), ALSi 12.

Order reference	Upper switch pt. adjustable (bar)	Lower switch pt. adjustable (bar)	Smallest diff.* (bar)	Max. operating pressure (bar)	Max. test pressure (bar)	Standard setting (bar)	Part No.
FF 4-2 VdS DAI	0,35 ... 1	0,25 ... 0,9	0,1 fixed	20	40	0,6 / 0,7	1020068
FF 4-2 VdS DRI**	0,5 ... 1		0,2 fixed	20	40	... / 0,7	1020070
FF 4-10 VdS DAI	0,7 ... 10	0 ... 8,5	0,5 1,5	32	40	4 / 5	1020080
FF 4-16 VdS DAI	1 ... 16	0,5 ... 15	0,8 1,5	36	48	11 / 12	1020067

** FF 4-2 VdS DRI with manual reset max.

* at lower ... higher end of range

Technical data	
Rated operating current at 230 V AC 1	16 A
Rated operating current at 230 V AC 15	6 A
Rated operating current at 230 V DC 13	0,1 A
Permissible motor power 1 ~ 230 V	0,55 kW
Resistance to vibration 10 up to 1000 Hz	4 g
Protection acc. to DIN 40 050/IEC 529 with rubber grommet	IP 54
Protection acc. to DIN 40 050/IEC 529 with cable glands PG 13.5/M20	IP 65
Ambient temperature range	-20 ... +70° C
Perm. medium temperature	+70° C
Repeatability	< 2 % FS

Sensors

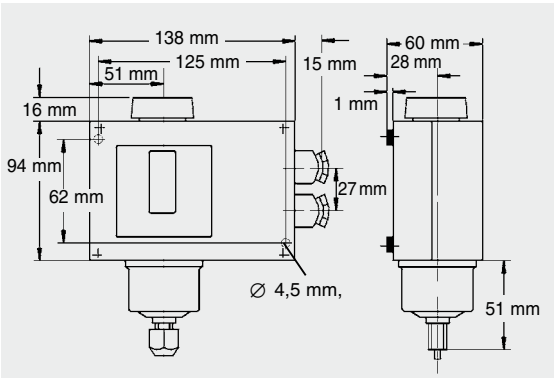
TIVAL®

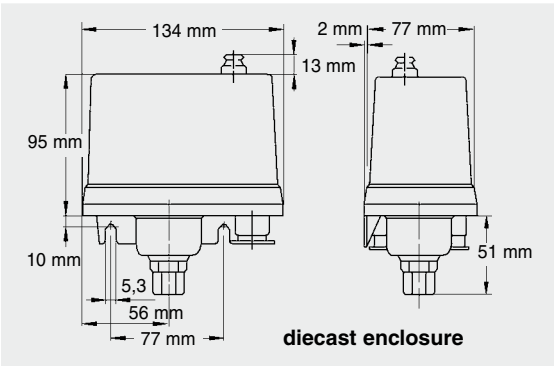
Sketches + Notes

Pressure switch FF 142

2 Change-over contacts, simple installation, easy pressure setting, scale in bar and psi, high repeatability, die cast enclosure

Control pressure switch FF 142-... DAH





diecast enclosure

Applications

The FF 142 Series is a pressure switch which has been standardized in a wide variety of industrial, commercial and seagoing applications to monitor or control the pressure of liquid or gaseous media.

- Pipelines
- Pressure vessels
- Process technology
- Refrigeration and heating plants
- Pump motors for water supply to dwellings
- Containers
- Apparatus
- Pneumatics and hydraulics
- Lubrication systems

Description

Turning the setting knob Pmax changes both the upper and the lower switch points. By turning the differential spindle Dp only, the lower switch point is adjusted, while the upper setting remains unchanged.

Construction

The standard FF 142 series are fitted in insulation enclosures, made of ABS. Large clear scales ease exact adjustment of upper switch point and switching differential. They are marked both in bar and in psi units. Scales are connected to the frame of the device and remain in place, when the cover is removed. Ample wiring room simplifies wiring.

Types

with Perbunan diaphragm, standard enclosure. Pressure connector: G 3/8" female polyamid. Suitable for oil, water, air etc.

Order reference	Upper switch pt. adjustable (bar)	Pressure diff. adjustable (bar)	Lower switch pt. adjustable (bar)	max. pressure (bar)	Standard setting (bar)	Part No.
FF 142-6 DAH	0,2 ... 1,5	0,12 ... 0,5	0,1	5	1 / 0,8	1050004
FF 142-8 DAH	1 ... 8	0,4 ... 2,4	0,1	10,5	5 / 4	1050003
FF 142-9 DAH	2 ... 21	0,8 ... 6	0,1	25	12 / 10	1050002

Types

Pressure switch with stainless steel bellows, silumin enclosure. Pressure connector: R 1/4" male, stainless-steel.

Order reference	Upper switch pt. adjustable (bar)	Pressure diff. adjustable (bar)	Lower switch pt. adjustable (bar)	max. pressure (bar)	Standard setting (bar)	Part No.
FF 142-3 AAC	-0,4 ... 8	0,6 ... 3	- 1	25	4 / 2	1050001
FF 142-5 AAC	2 ... 22	2 ... 9	0,1	30	16 / 12	1050005
FF 142-10 AAC	5 ... 40	2 ... 10	0,1	50	25 / 21	1050009

Pressure switch FF 142

2 Change-over contacts, simple installation, easy pressure setting, scale in bar and psi, high repeatability, die cast enclosure

Types

Pressure switch with perbunan diaphragm, silumin enclosure

Suitable for oil, water, air etc.

Order reference	Upper switch pt. adjustable	Pressure diff. adjustable	Lower switch pt. adjustable	max. pressure (bar)	Standard setting (bar)	Part No.
FFg 142-6 DAH	0,2 ... 1,5	0,12 ... 0,5	0,1	5	1 / 0,8	1050025
FFg 142-8 DAH	1 ... 8	0,4 ... 2,4	0,1	10,5	5 / 4	1050026
FFg 142-9 DAH	2 ... 21	0,8 ... 6	0,1	25	12 / 10	1050027

Types

Pressure switch with stainless steel bellows, silumin enclosure

Order reference	Upper switch pt. adjustable	Pressure diff. adjustable	Lower switch pt. adjustable	max. pressure (bar)	Standard setting (bar)	Part No.
FFg 142-3 AAC	-0,4 ... 8	0,6 ... 3	- 1	25	4 / 2	1050028
FFg 142-5 AAC	2 ... 22	2 ... 9	0,1	30	16 / 12	1050029
FFg 142-10 AAC	5 ... 40	2 ... 10	0,1	50	25 / 21	1050030

Technical data	
Rated operating current at 230 V FF (g) 142... AC 1	16 A
Rated operating current at 230 V FF (g) 142... AC 15	6 A
Rated operating current at 230 V FF (g) 142... DC 13	0,1 A
Rated operating current at 400 V FF (g) 142... AC 1	10 A
Rated operating current at 400 V FF (g) 142... AC 15	4 A

Enclosure	standard	silumin
Protection class acc. to DIN 40050/IEC 529	IP 55	IP 65
Resistance of vibration 10 up to 1000 Hz	4 g	4 g
Ambient temperature range	-50° ... +70° C	-50° ... +70° C
Ambient temperature range with Perbunan diaphragm	-30° ... +70° C	-30° ... +70° C
Contacts	2 Change-over contacts (SPDT)	2 Change-over contacts (SPDT)
Weight	~800 g	~1200 g

Pressure switch FF 142

2 Change-over contacts, simple installation, easy pressure setting, scale in bar and psi, high repeatability, die cast enclosure

Media compatibility guide

Medium name	Chemical Formula	Stainless steel	Perbunan
Acetone	CH_3COCH_3	X	
Acetylene	HC = CH	X	X
Air	-	X	X
Benzene	Sulphur-free	X	
Butane	C_4H_{10}	X	X
Butyl acetate	$CH_3COOC_4H_9$	X	
Butyl alcohol	CH_3-CH_2-CH_2-CH_2-OH	X	
Carbon dioxide	CO_2	X	X
Carbonic acid	H_2CO_3	X	X
Chlorine	Cl_2		
Crude oil	-	X	X
Diesel oil	See fuels	X	X
Ethyl acetate	$CH_3OOOC_2H_5$	X	
Fuels	Diesel oil,	X	X
	Leaded petrol	X	X
	Benzene	X	
Glycerine	CH_2OH-CHOH-CH_2OH	X	X
Glycol	CH_2OH-CH_2OH	X	X
Heating fuel oil	See also oils	X	X
Hydrogen	H_2	X	X
Inert gases	-	X	
Methanol	CH_3OH	X	
Methyl chloride	CH_3Cl	X	
Natural gas	-	X	X
Nitrogen	N2	X	X
Oils	Mineral	X	X
Oils	Vagetable	X	X
Oxygen	O_2	X	
Ozone	-	X	
Perchlorethylene	CCl_2=CCL_2	X	
Petrol	All types	X	
Phenolic acid	$C_6H_5(OH)$	X	
Sulphar dioxide	SO_2	X	
Toluene (Metyl benzene)	$C_6H_5CH_3$	X	
Trichlorethene	CHCl=CCl_2	X	
Water	Steam / vapor	X	X
Water	Destilled, de-aerated	X	X
Water	Sea water	X	X
Xylene	$C_6H_4(CH_3)_2$	X	

X = recommended

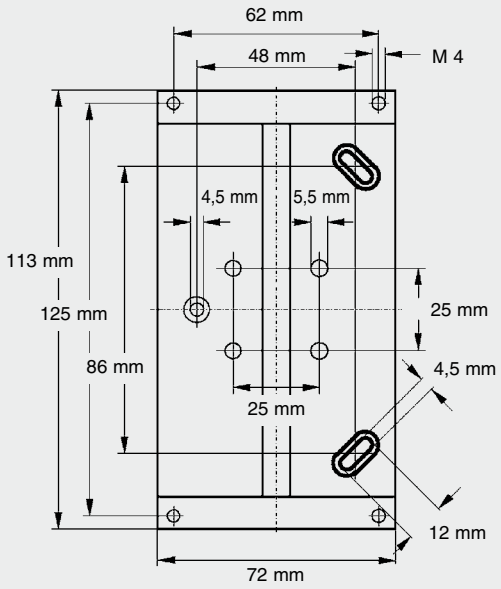
Accessories

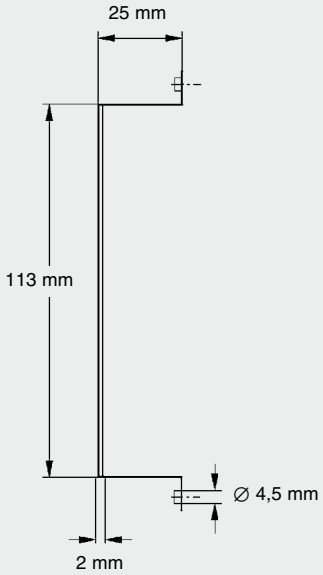
Order reference	Description	Weight (g)	Part No.
	Glands		
H 124-114	Steel gauge fitting, G 3/8" - G 1/2"	180	1051004
H 124g-127	Console	115	1051006

Pressure switch FF 142

2 Change-over contacts, simple installation, easy pressure setting, scale in bar and psi, high repeatability, die cast enclosure

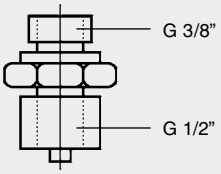
Dimensions





Console

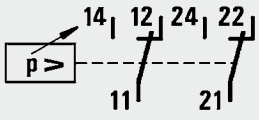
Type: H 124-g127
Weight: ~ 115 g
Order No.: 1051006



Gauge fitting

Steel, G 3/8" - G 1/2", Type: H 124-114
Weight: ~ 18 g
Order No.: 1071004

Circuit diagram



2 Change-over contacts

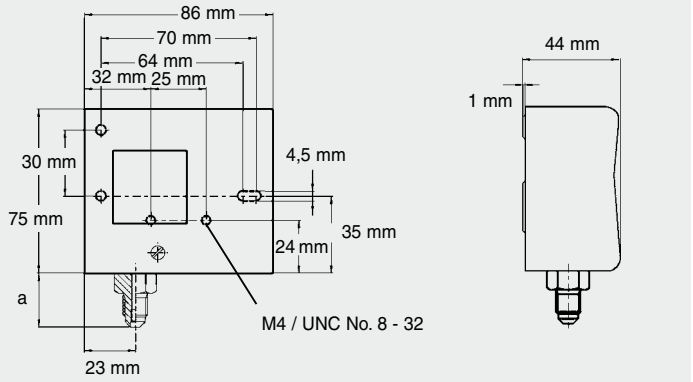
Pressure switch PS 1

Compact size pressure switch for high and low pressure, such as vacuum applications

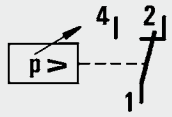
Control pressure switch PS 1-...

Description

- Adjustable pressure range, narrow adjustable differentials,
- pressure and differential range pointer in bar and psi, lockable by lead
- seal, test lever for maintenance work, sturdy terminals.



Circuit diagram



Change-over contact

Types Standard

Order reference (bar)	Upper switch pt. adjustable (bar)	Pressure diff. adjustable (bar)	Lowest setpoint (bar)	Factory setting (bar)	Leakage test pressure	Pressure connection	Part No.
PS1-A1R	- 0,75 ... 3	0,25 ... 2	- 0,9	0,5 / 1	13	G 1/4" extern	1040007
PS1-A2R	- 0,8 ... 1,5	0,2 ... 1	- 1,0	0,5 / 1	13	G 1/4" extern	1040002
PS1-A3R	- 0,5 ... 7	0,5 ... 5	- 0,9	3,5 / 4,5	13	G 1/4" extern	1040008
PS1-A4R	1 ... 20	1 ... 10	0,3	8 / 10	23	G 1/4" extern	1040004
PS1-A5R	6 ... 31	2 ... 15	3,0	16 / 20	36	G 1/4" extern	1040009
PS1-A6R	4 ... 12	0,5 ... 7	0,1	6 / 7	16	G 1/4" extern	1040011

Technical data	
General	
Type of contact: PS1	1x Change-over contact (SPDT)
Contact material: Standard Special option	$CuAg^3$ gold fl.contacts
AC 1	24 A / 230 V AC
AC 15	10 A / 230 V AC
DC 13	0,1 A / 230 V AC 3 A / 24 V AC 6 A / 12 V AC
Motor rating (FLA)	24 A / 230 V AC
Locked rotor (LRA) / startup (AC3)	144 A / 230 V AC
Approvals	
Low voltage directive (CE-Label) 73/23/EWG 93/68/EWG; EN 60947-1, EN 60947-5-1	standardmodels
UL / CSA	standardmodels
Environmental conditions	
Ambient temperature storage, transportation and operation	-50° ... + 70° C
Temperature at pipe tap	-50° ... + 70° C
Dust and water protection EN 60529 / IEC 529	IP44 Switch mounted flush against wal
Vibration resistance	4 g@10 ... 1000 Hz
Materials and compatibility	
Housing material: Cover frame	polycarbonate (PC) steel
Materials with medium contact: Pressure connection (A/R) / bellows	brass / bronze

Pressure switch PS 1

Compact size pressure switch for high and low pressure, such as vacuum applications

Media compatibility guide

Medium name	Chemical Formula	Bronze
Acetone	CH_3COCH_3	X
Acetylene	HC = CH	
Air	-	X
Benzene	Sulphur-free	X
Butane	C_4H_{10}	X
Butyl acetate	$CH_3COOC_4H_9$	X
Butyl alcohol	CH_3-CH_2-CH_2-CH_2-OH	X
Carbon dioxide	CO_2	X
Carbonic acid	H_2CO_3	X
Chlorine	Cl_2	
Crude oil	-	X
Diesel oil	See fuels	X
Ethyl acetate	$CH_3OOOC_2H_5$	X
Fuels	Diesel oil,	X
	Leaded petrol	X
	Benzene	X
Glycerine	CH_2OH-CHOH-CH_2OH	X
Glycol	CH_2OH-CH_2OH	X
Heating fuel oil	See also oils	X
Hydrogen	H_2	X
Inert gases	-	X
Methanol	CH_3OH	X
Methyl chloride	CH_3Cl	X
Natural gas	-	X
Nitrogen	N2	X
Oils	Mineral	X
Oils	Vagetable	X
Oxygen	O_2	X
Ozone	-	
Perchlorethylene	CCl_2=CCL_2	d
Petrol	All types	X
Phenolic acid	$C_6H_5(OH)$	
Sulphar dioxide	SO_2	
Toluene (Metyl benzene)	$C_6H_5CH_3$	X
Trichlorethene	CHCl=CCl_2	d
Water	Steam / vapor	X
Water	Destilled, de-aerated	X
Water	Sea water	
Xylene	$C_6H_4(CH_3)_2$	X

X = recommended, d = dry

Pressure switch PS 3

Miniature pressure switch, fixed pressure setting, high repeatability, custommade styles

Control pressure switch PS 3-...

Description

PS 3 are equipped with a SPDT snap action contact, switching from 1-2 to 1-4 on rising pressure and from 1-4 to 1-2 on falling pressure (see diagram). The PS 3 is factory preset according to customers specification and it is not adjustable.

Several models are available:

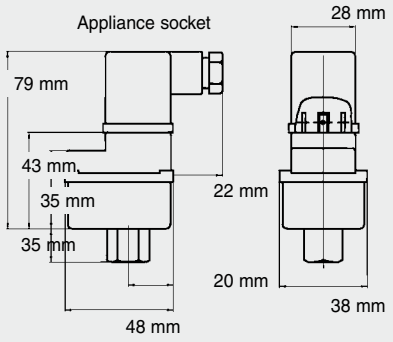
- Low pressure switch, with automatic or manual reset
- High pressure switch, with automatic or manual reset

The PS 3 is mainly designed for OEM use and manufactured in minimum batches of 100 pieces.

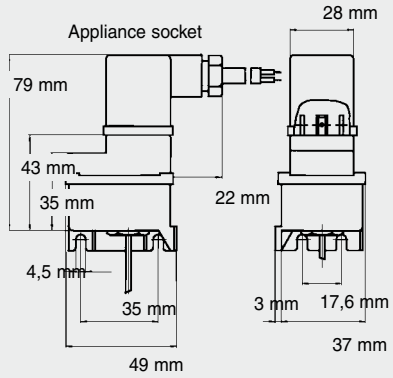
Options

- With high temperature diaphragm and snubber for direct mounting on the head of compressor
- Factory wiring
- Available with microswitch for narrow pressure differentials
- Gold flashed contacts for use with electronic circuits
- Other pressure connectors

Dimensions



free standing



Panel mounting

Typescode

PS 3 - □□□ - XX/XX

Function	
Automatic reset	A
With manual reset	R

Pressure range / Type of contact	
Standard, max. 6 bar	1
Standard, max. 16 bar	3
Standard, max. 30 bar	4
Standard, max. 30 bar	5
Standard, max. 43 bar	6
Standard, gold flashed, max. 6 bar	A
Standard, gold flashed, max. 16 bar	C
Standard, gold flashed, max. 30 bar	D
Standard, gold flashed, max. 30 bar	E
Standard, gold flashed, max. 43 bar	F
Micro switch, max. 6 bar	J
Micro switch, max. 16 bar	L
Micro switch, max. 30 bar	M
Micro switch, max. 30 bar	N
Micro switch, max. 43 bar	O
Micro switch, gold flashed contacts, max. 6 bar	S
Micro switch, gold flashed contacts, max. 16 bar	U
Micro switch, gold flashed contacts, max. 30 bar	V
Micro switch, gold flashed contacts, max. 30 bar	W
Micro switch, gold flashed contacts, max. 43 bar	X

Pressure connectors	
G 1/4“ male brass	R
G 1/4“ female brass	G

Pressure switch PS 3

Miniature pressure switch, fixed pressure setting, high repeatability, custommade styles

Pressure range

Range code	Type of contact	Range (bar)	Max. operating pressure PS (bar)	Proof pressure (bar)	Reset difference (bar)	Differential (bar)
1	Standard (change-over)	- 0.6 - 6	27	30	approx. 1,3	see diagrams
3		0.1 - 16	27	30	approx. 1,5	
4 and 5		6 - 30	31	36	approx. 4,0	
6		10 - 43	43	48	approx. 5,0	
1	Micro switch (change-over)	-0,6 - 6	27	30		approx. 0,1-0,3
3		0.1 - 16	27	30		approx. 0,3-0,45
5		6 - 30	31	36		
6		10 - 43	43	48		approx. 0,4-0,6

Tolerances (bar)

Range code	1	3	4	5	6
Setting	± 0,1	± 0,25	± 0,5	± 0,5	± 0,5
Repeatability	± 0,06	± 0,15	± 0,3	± 0,3	± 0,3

Electrical rating

Type of contact	Standard (change-over)	Standard gold flashed	MIcro switch (change-over)	Micro switch gold flashed
Inductive load (AC15)	3 A / 230 V AC	0,1 A / 230 V AC	1,5 A / 230 V AC	0,1 A / 230 V AC
Inductive load (DC)	0,1 A / 230 V DC	0,1 A / 230 V DC	0,1 A / 230 V DC	0,1 A / 230 V DC
Motor rating amps	6 A / 230 V AC		2,5 A / 230 V AC	
Locked rotor amps	36 A / 230 V AC		15 A / 230 V AC	

Technical data	
Resistance of vibration at 10 ... 1000 Hz	4 g
Medium compatibility depending on material of diaphragm	see table
Storage and transportation temperature	-30 ... +70° C
Weight	~ 90 g
Approvals	UL, CSA
Protection (IEC 529 / DIN 40050)	
without cover	IP 00
with appliance socket acc. to DIN 43650	IP 65
Standard Diaphragm (Single diaphragm)	
Max. media temperature	+70° C
Material	bronze
DIN / TÜV approval	optional
UL Function code	A, R
Pressure range	1, 3, 4, 5, 6

Pressure switch PS 3

Miniature pressure switch, fixed pressure setting, high repeatability, custommade styles

Media compatibility guide

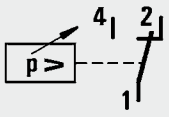
Medium name	Chemical Formula	Bronze
Acetone	CH_3COCH_3	X
Acetylene	HC = CH	
Air	-	X
Benzene	Sulphure-free	X
Butane	C_4H_{10}	X
Butyl acetate	$CH_3COOC_4H_9$	X
Butyl alcohol	CH_3-CH_2-CH_2-CH_2-OH	X
Carbon dioxide	CO_2	X
Carbonic acid	H_2CO_3	X
Chlorine	Cl_2	
Crude oil	-	X
Diesel oil	See fuels	X
Ethyl acetate	$CH_3OOOC_2H_5$	X
Fuels	Diesel oil,	X
	Leaded petrol	X
	Benzene	X
Glycerine	CH_2OH-CHOH-CH_2OH	X
Glycol	CH_2OH-CH_2OH	X
Heating fuel oil	See also oils	X
Hydrogen	H_2	X
Inert gases	-	X
Methanol	CH_3OH	X
Methyl chloride	CH_3Cl	X
Natural gas	-	X
Nitrogen	N2	X
Oils	Mineral	X
Oils	Vagetable	X
Oxygen	O_2	X
Ozone	-	
Perchlorethylene	CCl_2=CCL_2	d
Petrol	All types	X
Phenolic acid	$C_6H_5(OH)$	
Sulphar dioxide	SO_2	
Toluene (Metyl benzene)	$C_6H_5CH_3$	X
Trichlorethene	CHCl=CCl_2	d
Water	Steam / vapor	X
Water	Destilled, de-aerated	X
Water	Sea water	
Xylene	$C_6H_4(CH_3)_2$	X

X = recommended, d = dry

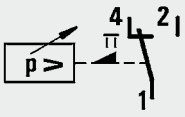
Accessories

Order reference	Description	Weight (g)	Part No.
Seal	Appliance socket PG 9 acc. to DIN 43 650	-	1070002
	Seal for plug socket	-	1070003
	Terminal cover, cable entry from top / side	-	

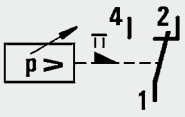
Circuit diagrams



Change-over contact



Change-over contact
with manual reset min.



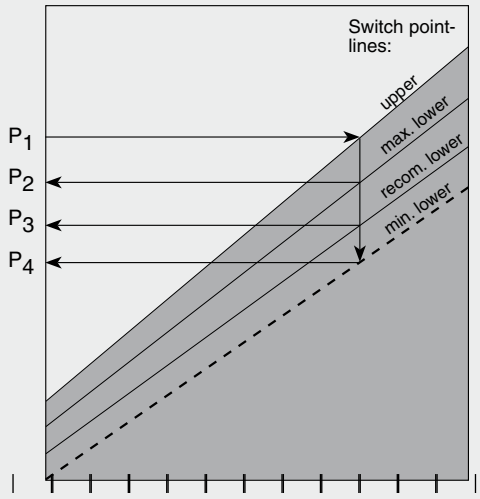
Change-over contact
with manual reset max.

Pressure switch PS 3

Miniature pressure switch, fixed pressure setting, high repeatability, custommade styles

Pressure diagrams

Example

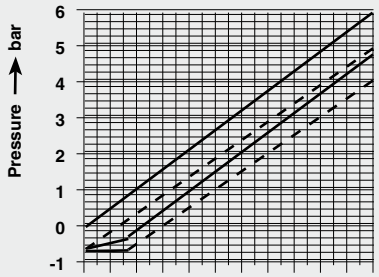


Selection
The possibilities of factory switch point settings are shown on charts below. Use the recommended lower switch point in the working window for optimum results.

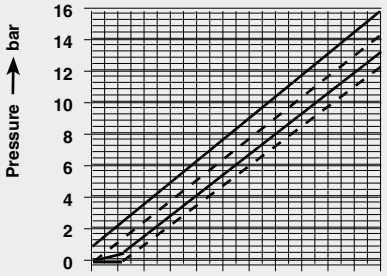
Example
Step 1:
Select your desired upper switch point P1.
Draw a horizontal line to cross the upper switch point line.
Step 2:
Draw a vertical line from above mentioned intersection point.
Step 3:
Select your desired switch point between P2 and P4.

Notes:
1. Select P1/P3 as switch points for optimum results
2. Specify always upper and lower switch points for pressure switch with automatic reset function.
3. Specify only cutout switch point for pressure switch with manual reset function.

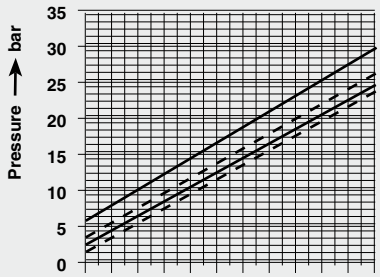
Range 1



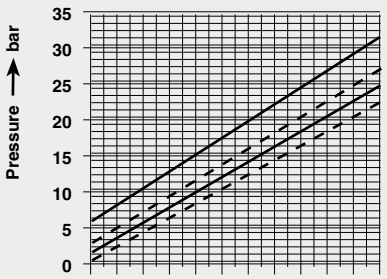
Range 3



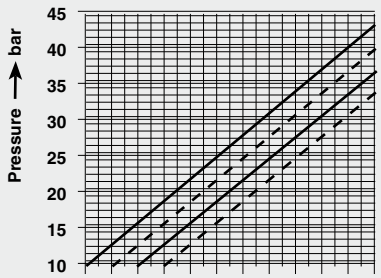
Range 4



Range 5



Range 6



Pressure switch PM / PT

2- and 3-pole pressure switch
1 ... 12 bar perbunan-diaphragm equipped

Pressure switch PM / PT

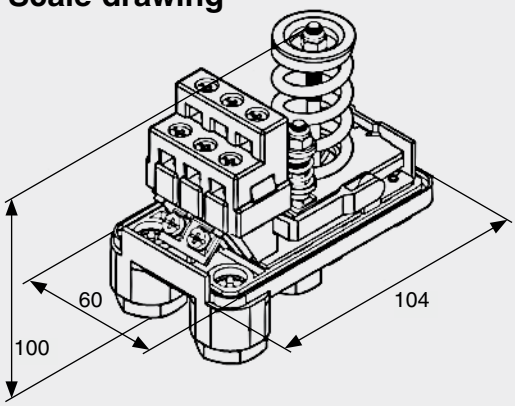
(ON / OFF switch equipped)

Description

TIVAL-Pressure switches of the type series PM and PT are designed for a broad field of application in industrial and commercial use. Main application is for pumps, compressors and pressure tanks. Equipped with double or triple openers in their contact blocks these pressure switches are suitable for direct switching action of AC and rotary-current electrical motors.

Dimensions

Scale drawing



Type

Series PM (2 opening contacts)
Series PMA (ON / OFF switch and unloader valve equipped)
Pressure port: 1/4" female
Perbunan-diaphragm equipped

Order reference	adjustment range min. bar		max. bar	adjustable differential bar			standard setting bar	Part no.
PM/5	1	...	5	0,6	...	2,5	1,4 / 2,8	1080001
PMA/5	1	...	5	0,6	...	2,5	1,4 / 2,8	1080004
PM/12	3	...	12	1,5	...	4	5 / 7	1080006
PMA/12	3	...	12	1,5	...	4	5 / 7	1080007

Type

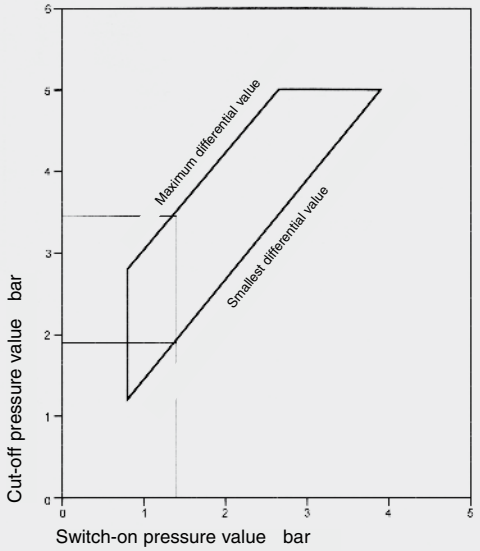
Series PT (3 opening contacts)
Series PTA (ON / OFF switch and unloader valve equipped)
Pressure port: 1/4" female
Perbunan-diaphragm equipped

Order reference	adjustment range min. bar		max. bar	adjustable differential bar			standard setting bar	Part no.
PT/5	1	...	5	0,6	...	2,5	1,4 / 2,8	1080002
PT/12	3	...	12	1,5	...	4	6 / 8	1080008
PTA/12	3	...	12	1,5	...	4	6 / 8	1080009

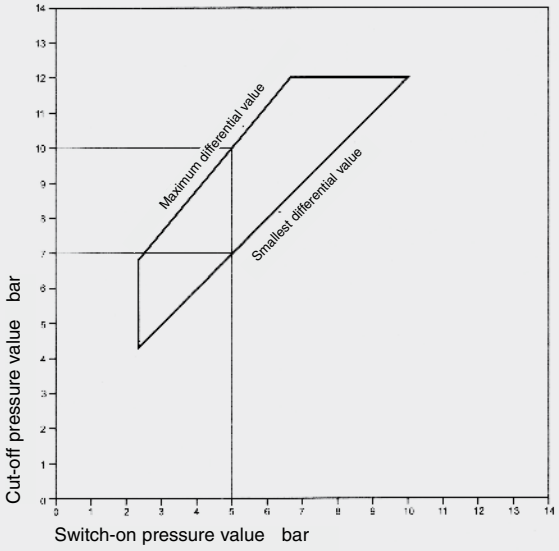
Pressure switch PT / PM

2- and 3-pole pressure switch
1...12 bar perbunan-diapragm equipped

Adjustable pressure range: PM / PMA / PT / PTA 5



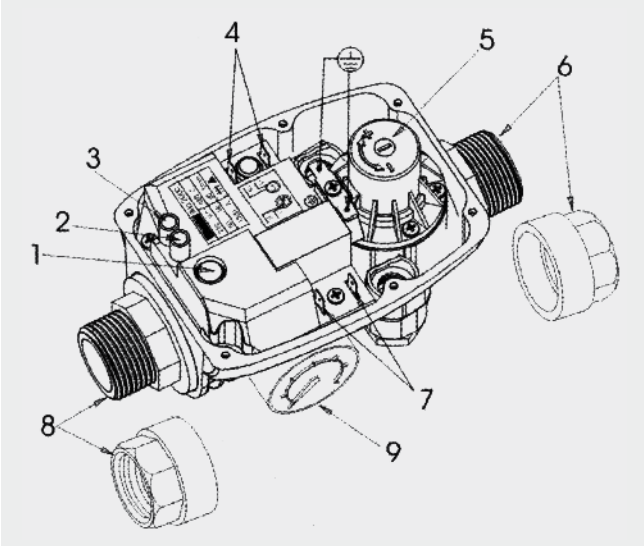
Adjustable pressure range: PM / PMA / PT / PTA 12



Technical data	Type: PTM / PMA	Type: PT / PTA
Rated isolation voltage	500 V	500 V
Conventional thermic current Ith	16 A	16 A
Braking capacity AC 3	250 V, 1~, 50 / 60 Hz: 2,5 kW	400 V, 50 / 60 Hz: 4 kW
Contact assembly	2 opening contacts	3 opening contacts
Protection class	IP 44	IP 44
Permitted media temperature	+ 55° C	+ 55° C
Cable gland	2 mounted (Ø 11 mm)	2 mounted (Ø 11 mm)
Weight	~ 400 g	~ 400 g

Electronic pump control EPS-MT

Integrated protection against dry running and bolt-on manometer
Option: connection cable



1. Reset button
2. LED „dry running“
3. LED „operation“
4. electrical connectors for pump motor
5. Cut-in pressure adjusting knob
6. Discharge connection 1“ male
7. Electrical connectors for power supply
8. Inflow connection 1“ male
9. Manometer

Application

- Booster stations
- Domestic waterworks
- Garden pumps
- Sprinkle irrigation units
- Water system applications

Mode of operation

The electronic pump control EPS-MT combines the function of both pressure switch and flow-control (dry running protection) in one unit. The EPS-MT controls and protects AC-powered pumps convincingly.
The application range is limited to pumps with a max. pressure of up to 10 bar, for higher operating pressures a pressure-reducing regulator has to be installed on the intake side.The readiness for operation is indicated by a green LED. Failures are displayed by a red LED.
Directly after connection to the electrical power supply the pump will start automatically and the EPS-MT will imediately take over the control function. If the piping system is under pressure, but no flow is detected, the EPS-MT will cut off the pump after a short time delay.If the system pressure decreases below the preadjusted start-up pressure (factory setting 1,5 bar) the pump will restart. In case of no pressure and flow is detected after the pump restart, the EPS-MT will identify this status within short time as „dry running“ and switch off the pump.
At frequent intervals of 60 minutes the pump control automatically checks for sufficient amount of water in the system. If enough water is detected, the EPS-MT will reset to normal operating modus. After four repeating attempts without sufficient water in the system the pump control finally performs the troublecode „dry-running“ and must then be resetted manually. The system pressure is displayed by the integrated bolt-on manometer.

Technical data	Type: EPS-MT
Power supply	110 - 230 V AC 50 / 60 Hz
Rated operational current	max. 12 A
Start-up pressure	1… 3,5 bar (adjustable)
Max. operating pressure	10 bar
Protection class	IP 65
Display range of manometer	0 …12 bar

Types

Order reference	Part No.
EPS-MT	1080014
EPS-MT-KSK	1080015 with 1,5 m cable with molded plug and 0,3 m cable with molded coupling

Sensors

TIVAL®

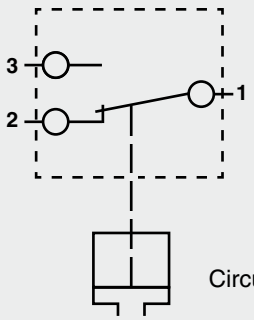
Sketches + Notes

Pressure switch FF 501

10 ... 1000 mbar

Description

Model range FF 501 pressure switches are change-over contact equipped.
The subtle pressure range grading allows a precise switchpoint adjustment within mbar range.



Circuit diagram

- Subtle pressure range grading, accurate adjustment
- High-rated maximum operating cycles
- Factory pre-calibrated types available

Types

Pressure switch with diaphragm for mbar range usage, pressure connection G 1/4“ male

Order reference	Adjustment range	Over-pressure safety	Sealing type
FF 501-50	10 ... 50 mbar	1 bar	NBR- or silicone diaphragm
FF 501-100	10 ... 100 mbar	1 bar	NBR- or silicone diaphragm
FF 501-200	20 ... 200 mbar	2 bar	NBR- or silicone diaphragm
FF 501-500	50 ... 500 mbar	2 bar	NBR- or silicone diaphragm
FF 501-1000	100 ... 1000 mbar	5 bar	NBR- or silicone diaphragm

Technical data	Type: FF 501
Reproducibility	~ 3 ... 5 %
Switch-back difference	~ 5 ... 10 %
Circuit element	change-over contact
Max. operating cycles	200 / min.
Max. voltage	250 V
Max. current	5 Amp. (FF 501-50: 2 A)
Protection class	IP 55
Operating temperature	-20° ... +80° C
Weight	~ 185 g
Connection thread	G 1/8", G 1/4"

Please state medium and desired mounting position when ordering. Special types (i.e. gold-plated switch contacts) upon request.

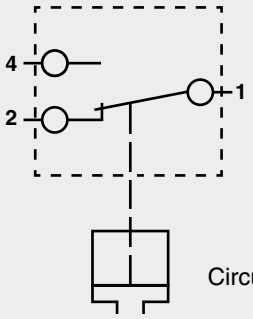
Pressure switch FF 603

Flush mounted diaphragm, 1 ... 100 bar

shown with connector plug

Description

Model range FF 603 pressure switches are change-over contact equipped.This type series is purpose-built for high-viscious media pressure monitoring and flush-mount diaphragm equipped. Depending on application, lower or upper switchpoint is tuned, switch-back difference arises from typical switch hysteresis (~ 20%).



Circuit diagram

- Purpose-built for high-viscous media
- High-rated over-pressure safety
- High-rated maximum operating cycles
- Factory pre-calibrated types available

Types

Pressure switch with flush mounted diaphragm, pressure connection G 1/4“ male

Order reference	Adjustment range	Over-pressure safety	Sealing type
FF 603-10	1 ... 10 bar	100 bar	Diaphragm 60 FKM 590
FF 603-20	2 ... 20 bar	300 bar	Diaphragm 60 FKM 590
FF 603-50	5 ... 50 bar	300 bar	Diaphragm 60 FKM 590
FF 603-100 M	10 ... 100 bar	300 bar	Diaphragm 60 FKM 590
connector plug type 600, please order separately			

Technical data	Type: FF 603
Reproducibility	~ 2 ... 5 %
Switch-back difference	~ 20%, smaller values upon request
Circuit element	change-over contact
Max. operating cycles	200 / min.
Max. voltage	250 V
Max. current	6 A
Protection class	IP 65
Operating temperature	-20° ... +80° C
Weight	~ 120 g
Connection thread	G 3/4"

Special types (i.e. gold-plated switch contacts) upon request.

Pressure switch FF 701

Vacuum switch -0,05 ... -1 bar, high-rated over-pressure safety

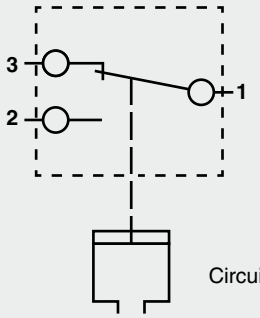
FF 701

FF 702 (upon request)

Description

Model range FF 701 vacuum switches are change-over contact equipped. Switchpoint can be set in range of -0,05 ... -1,0 bar. Switch-back difference value of 0,02 ... 0,05 bar (approx.)

- High-rated over-pressure safety
- High-rated maximum operating cycles
- Factory pre-calibrated types available



Circuit diagram

Types

Vacuum switch, pressure connection G 1/4“ male

Technical data	Type: FF 701
Adjustment range	-0,05 ... -1 bar
Over-pressure safety	10 bar
Medium resistance	air, oil, petrol
Reproducibility	~ 5 %
Switch-back difference	~ 0,02 ... 0,05 bar
Max. operating cycles.	200 / min.
Electric connection	connector plug Pg 9 DIN 43650
Max. voltage	250 V
Max. current	5 A
Protection class	IP 55
Operating temperature	-20° ... +100° C
Material grade	cylinder: aluminium, connector: brass
Weight	~ 290 g

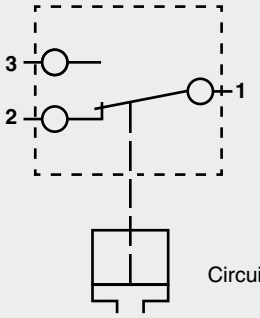
Special types (i.e. gold-plated switch contacts) upon request.

Pressure switch FF 902

0,2 ... 400 bar, high-rated over-pressure safety

Description

Model range FF 701 pressure switches are change-over contact equipped. Depending on application, lower or upper switchpoint is tuned, switch-back difference arises from typical switch hysteresis (20 ... 30 % approx.).



Circuit diagram

- High-rated over-pressure safety
- Special suitability for hydraulic and pneumatic application
- Plate-mounting types upon request
- High-rated maximum operating cycles
- Factory pre-calibrated types available

Types

Diaphragm- or piston-type pressure switch, pressure connection G 1/4“ female

Order reference	adjustment range	over-pressure safety	sealing
FF 902-2	0,2 ... 2 bar	100 bar	Perbunan-diaphragm
FF 902-10	1 ... 10 bar	100 bar	Perbunan-diaphragm
FF 902-20	2 ... 20 bar	200 bar	Viton- diaphragm
FF 902-50	5 ... 50 bar	200 bar	Viton- diaphragm
FF 902-100 M	10 ... 100 bar	200 bar	Viton- diaphragm
FF 902-100	10 ... 100 bar	600 bar	Piston-type
FF 902-200	20 ... 200 bar	600 bar	Piston-type
FF 902-400	40 ... 400 bar	600 bar	Piston-type

Technical data	Type: FF 902	
Reproducibility	~ 2 ... 5 %	
Switch-back difference	~ 20 ... 30 %	smaller values upon request
Circuit element	change-over contact	
Max. operating cycles	200 / min.	
Max. voltage	250 V	
Max. current	2 A	optional: 10 A
Protection class	IP 55	
Operating temperature	-20° ... +100° C	
Weight	~ 380 g	

Special types (i.e. gold-plated switch contacts) upon request.

Druck

Pressure

Sensors

TIVAL®

Sketches + Notes

Pressure transmitter series TST

Pressure Range -1 ... +1 bar, 0 ... 600 mbar, 0 ... 4000 bar
Output Signals 4 ... 20 mA, 0 ... 10 V

Construction

- Stainles steel diaphragm, vacuum-proof
- Piezo-resistive, pressure range resistor (Poly-Si on SiO_2)
- Silicium measuring cell
- Ceramic measuring cell
- Stainless steel casing

Application

- Hydraulics
- Air conditioning and heating
- Process control
- Water technology
- Pneumatics
- Brakesystems

Properties

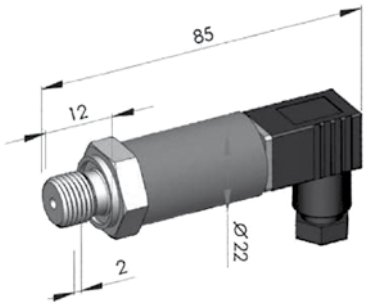
- High pressure peak consistency
- Shock- and vibration-proof
- High long-term stability
- Protection class IP 65 acc. to DIN EN 60529
- High load changing consistency
- Ambient temperature -40° C ... +105° C
- Class ± 0,5 % F.S.

On request

- Various pressure ports
- Various output signals
- Various electrical connections
- Miniature construction types
- Electronic pressure switches without display
- Higher accuracies
- Special construction designs

Pressure transmitter TST 10.0.../20...

Measuring range -1 … 1000 bar
Output signal 4 … 20 mA (2- or 3-wire) or 0 … 10 V (3-wire)



Applications

- General industrial applications
- Mechanical engineering
- Hydraulics and pneumatics
- Plant engineering and automation technology

Description

- Measuring ranges -1 … 0 bar up to 0 … 1000 bar
- Media temperature -40° C … +125° C
- No internal transfer medium
  ("dry" measuring cell, completely welded)
- Protection class up to IP67
  (IP69K upon request)
- Compact and robust stainless steel housing
- High reliability

Standard pressure ranges											
Measuring range	**P(bar)**	**1,0**	**1,6**	**2,0**	**2,5**	**4,0**	**6,0**	**10,0**	**16,0**	**20**	**25**
Overload pressure	P(bar)	6	6	6	10	10	20	20	40	40	100
Bursting Pressure	P(bar)	9	9	9	15	15	30	30	60	60	150
Measuring range	**P(bar)**	**40**	**60**	**100**	**160**	**200**	**250**	**400**	**600**	**1000**	
Overload pressure	P(bar)	100	200	200	400	400	750	750	840	1200	
Bursting Pressure	P(bar)	150	300	300	600	600	1000	1000	1050	1500	

Individual pressure ranges on request (e. g. -1 … +2,5 bar)

Technical data	Type: TST 10.../20...	
Electrical parameters		
	TST 10...	**TST 20...**
Output signal*	4 ... 20 mA (2- or 3-wire)	0 … 10 V DC (3-wire)
Operating voltage U_B	9 … 32 V DC	12 … 32 V DC
Permitted max. load R_A	$R_A \leq (U_B - 9\ V) / 20\ mA$	
Recommended max. load resistor R_L		$R_L > 5\ k\Omega$
Response time* (10 … 90%)	<1ms	<1ms
Electric strength	350 VDC	350 VDC
Accuracy specifications		
BFSL	≤± 0,15 % of range	
Total error at RT	**≤± 0,50 % of range** - including nonlinearity, hysteresis, zero point and full scale error (according to IEC 61298-2). Optional total error ≤± 0,25 % of range available	
Stability per year	≤± 0,10 % of range	

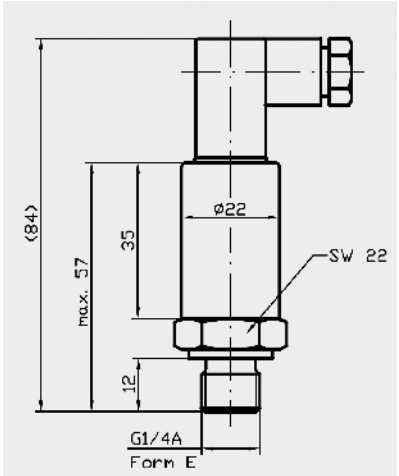
* Other output signals (e. g. 0 … 5 V DC; 0,5 … 4,5 V DC ratiometric) and other response times upon request.

Pressure transmitter TST 10.0.../20...

Measuring range -1 … 1000 bar
Output signal 4 … 20 mA (2- or 3-wire) or 0 … 10 V (3-wire)

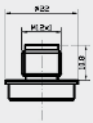
Technical data	Type: TST 10... / 20...
Temperature ranges	
Media temperature	-40 ... +125° C
Ambient temperature	-40 ... +105° C
Storage temperature	-40 ... +105° C
Compensated temperature range	-20 ... +85° C
Temperature coefficient zero point	≤± 0,15 / 10K % (% of range)
Temperature coefficient range	≤± 0,15 / 10K % (% of range)
Total Error	at -40° C - 2,00 % of range
	at +105° C - 2,00 % of range
Mechanical parameters	
Sensor element	stainless steel on media side
Material of parts with contact to measuring medium	CrNiCuNb 17-4 PH / 1.4542
Housing	stainless steel
Process connection	G 1/4 E, G 1/4 B, G 1/2 B, others on request
Gasket ring	FKM-Viton
Electrical connection	connector M12x1, MVS / A, MVS / C, others on request
Weight	80 … 120 g according to layout
Shock resistance	1000 g according to IEC 68-2-32
Vibration resistance	20 g according to IEC 68-2-6 and IEC 68-2-36
CE conformity	EMC directive 2004 / 108 / EC
IP protection class	corresponding to the used and connected mating connector

Dimensional drawing

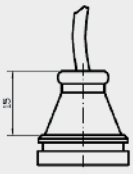


Connector variants

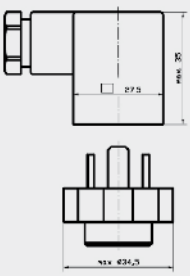
Connector M12x1(S763)



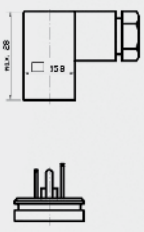
Cable outlet



MVS/A DIN EN 175301-803



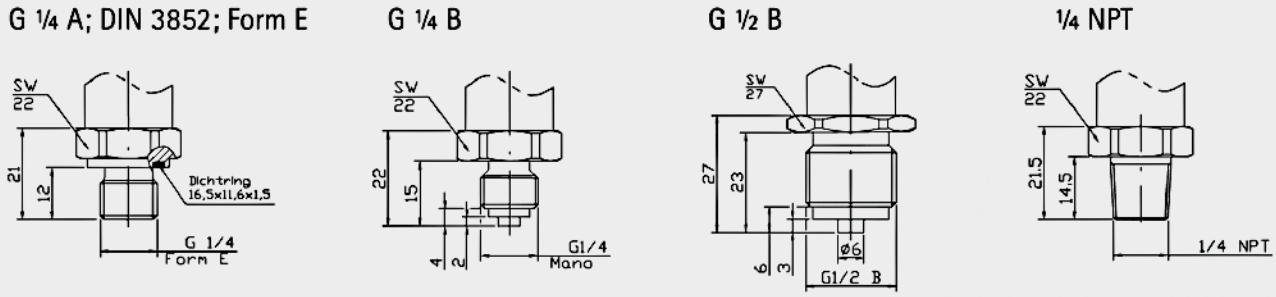
MVS/C DIN EN 175301-803



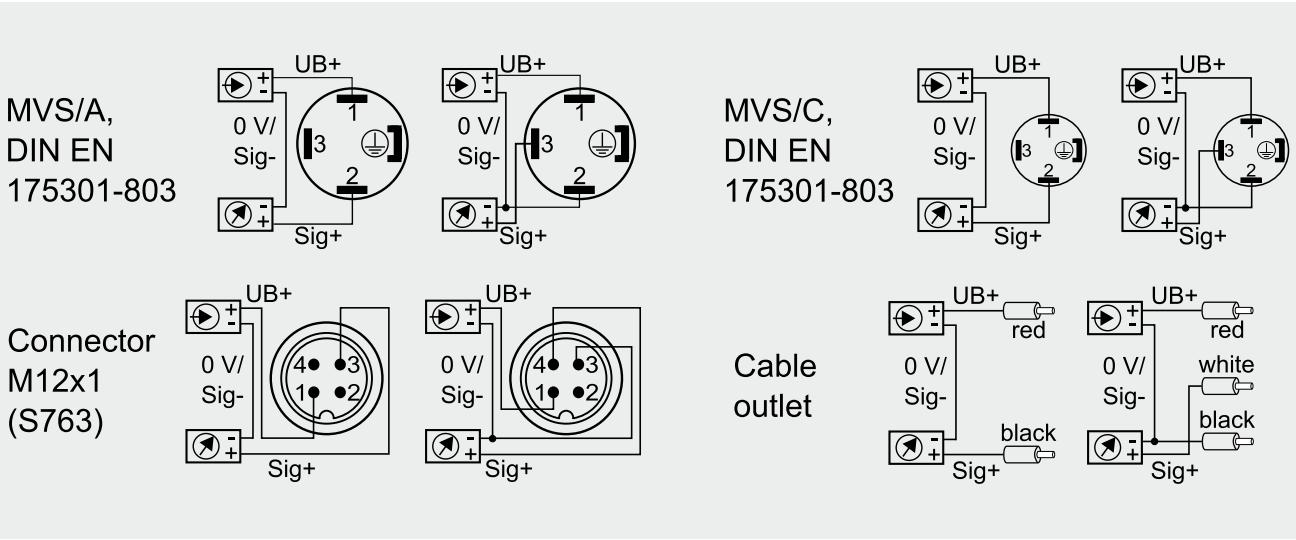
Pressure transmitter TST 10.0.../20...

Measuring range -1 … 1000 bar
Output signal 4 … 20 mA (2- or 3-wire) or 0 … 10 V (3-wire)

Process connectors



PIN assignment



Assembled cable and connection accessories

Type	Length	Specification	Part No.: straight	angled
M12x1 (S763) 4- pin	-	connector M12x1 for self-connection	1070039	1070038
	-	connector M12x1 self-connection, shielded	1070030	1070031
	2 m	cable: PUR	1070044	-
	5 m	cable: PUR, halogen-free	1070023	1070025
	5 m	cable: PUR, shielded, halogen-free	1070032	1070033
MVS / C, 3-pin +PE	3 m	cable: PUR, connector MVS / C	-	1070021

Special types upon request.

Pressure transmitter TST 16.0 GL

Approved for shipbuilding applications by Germanischer Lloyd
Certificate No. 61 220 – 13 HH

Applications

- Marine and offshore
- Mechanical engineering
- Hydraulics and pneumatics

Description

- Approved by Germanischer Lloyd
  GL directive Chapter 2, Edition 2012
- Output signal 4 … 20 mA (2-wire)
- Measuring ranges 0 … 2000 bar
- Media temperature -40 … +125° C
- No internal transfer medium
  (“dry” measuring cell, completely welded)
- Protection class up to IP67
  (IP69K upon request)
- Compact and robust stainless steel housing
- High reliability

Available pressure ranges

The table of Standard pressure ranges of the Pressure transmitter TST 10…/ 20…series applies to measuring ranges up to a maximum pressure of 1.000 bar. (see page 50 to 52)

The table of Standard pressure ranges of the Pressure transmitter TST-SMH series applies to measuring ranges of 1.600 or 2.000 bar maximum pressure. (see page 55 to 57)

Connector variants, Process connectors, PIN assignment Assembled cable and connection accessories

The data and illustrations of the Pressure transmitter TST 10…/ 20…series apply to measuring ranges up to a maximum pressure of 1.000 bar. (see pages 50 to 52)

The data and illustrations of the Pressure transmitter TST-SMH series apply to measuring ranges up to a maximum pressure of 1.600 or 2.000 bar. (see page 55 to 57)

Technical data	Type: TST 16.0 GL
Electrical parameters	
Output signal	4 … 20 mA (2-wire)
Operating voltage U_B	12 … 32 V DC
Permitted max. load R_A	$R_A \leq (U_B - 9\ V) / 20\ m_A$
Response time (10 … 90%)	= 1 ms
Electric strength	350 V DC
Accuracy specifications	
BFSL (Best Fit Straight Line)	≤± 0,15 % of range
Total error at RT	≤**± 0,50 % FS** – including nonlinearity, hysteresis, zero point and full scale error (according to IEC 61298-2).
Stability per year	≤± 0,10 % of range

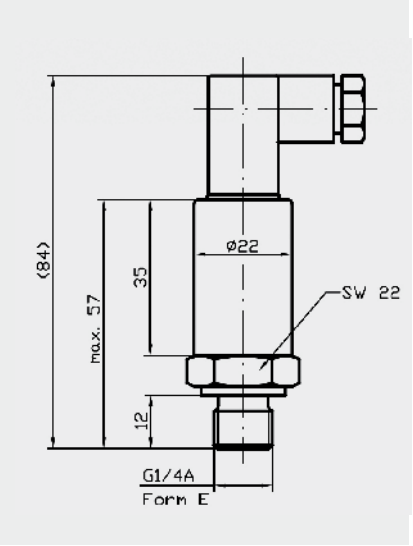
Pressure transmitter TST 16.0 GL

Approved for shipbuilding applications by Germanischer Lloyd
Certificate No. 61 220 – 13 HH

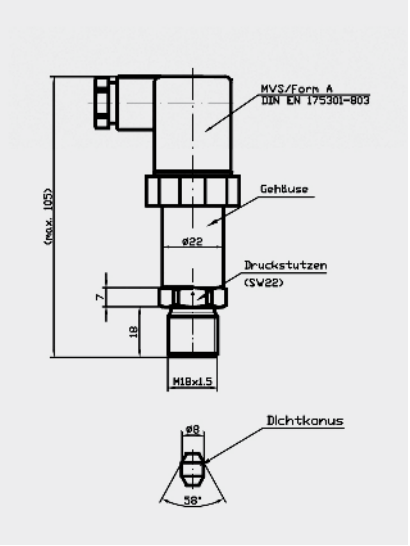
Technical data	Type: TST 16.0 GL
Temperature ranges	
Media temperature	-40 ... +125° C
Ambient temperature	-40 ... +105° C
Storage temperature	-40 ... +105° C
Compensated temperature range	-20 ... +85° C
Temperature coefficient zero point	≤± 0,15 / 10K % (% of range)
Temperature coefficient range	≤± 0,15 / 10K % (% of range)
Total Error	at -40° C - 2,00 % of range
	at +105° C - 2,00 % of range
Mechanical parameters	
Sensor element	stainless steel on media side
Material of parts with contact to measuring medium	stainless steel 1.4301 / 1.4542
Housing	stainless steel 1.4301
Process connection	G 1/4 E, G 1/4 B, G 1/2 B, NPT (up to 1.000 bar pressure) M18x1,5, M16x1,5 (1.600 / 2.000 bar pressure)
Gasket ring	FKM-Viton
Electrical connection	round connector S 763-4 (M12x1), MVS / A
Weight	80 … 150 g according to layout
Shock resistance	1000 g according to IEC 68-2-32
Vibration resistance	20 g according to IEC 68-2-6 and IEC 68-2-36
IP protection class	corresponding to the used and connected mating connector
CE conformity	
Conducted disturbances acc.to CISPR 16	< 20 dB µV
Radiated disturbances acc. to CISPR 16	< 38 dB µV / m
Immunity approved acc. to.	EN 61000-4-2 + A1 + A2, EN 61000-4-3 + A1, EN 61000-4-4, EN 61000-4-6, German Lloyd VI-Part 7 Ch. 2:2012

Dimensional drawing

up to 1.000 bar pressure



1.600 / 2.000 bar pressure



High pressure transmitter TST-SMH

Measuring range 0 … 4000 bar
Pressure connection with double seal cone

Applications

- Hydraulics
- Mechanical engineering
- Hydropower technology
- Test stand engineering
- Diesel engine technology

Description

- Measuring ranges > 0 … 1000 bar up to 0 … 4000 bar
- Ambient Temperature -40 … +125° C
- Suitable for aggressive liquid or gaseous media
- Compact and robust stainless steel housing
- High reliability

Standard pressure ranges					
Measuring range	**P(bar)**	**1600**	**2000**	**2500**	**4000**
Overload pressure	P(bar)	2400	2400	3600	4800
Bursting Pressure	P(bar)	3000	3000	4500	6000

Technical data	Type: TST-SMH	
Electrical parameters		
Output signal*	4 ... 20 mA (2- or 3-wire)	0 ... 10 V DC (3-wire)
Operating voltage U_B	9 … 32 V DC	12 … 32 V DC
Permitted max. load R_A	$R_A \leq (U_B - 9\ V)/20\ mA$	
Recommended max. load resistor R_L		$R_L > 5\ k\Omega$
Response time* (10 … 90%)	< 1 ms	< 1 ms
Electric strength	350 V DC	350 V DC
Accuracy specifications	**pressure ranges ≤ 2000 bar**	**pressure ranges > 2000 to 4000 bar**
BFSL (Best Fit Straight Line)	≤± 0,15 % of range	≤± 0,25 % of range
Total error at RT	**≤± 0,50 % of range**	**≤± 1,00 % of range**
	including nonlinearity, hysteresis, zero point and full scale error (according to IEC 61298-2).	
	Optional ≤± 0,25 % of range or	≤± 0,50 % of range available
Stability per year	≤± 0,10 % of range	≤± 0,20 % of range

* Other output signals (e. g. 0 … 5 V_{DC}; 0,5 … 4,5 V_{DC} ratiometric) and other response times upon request.

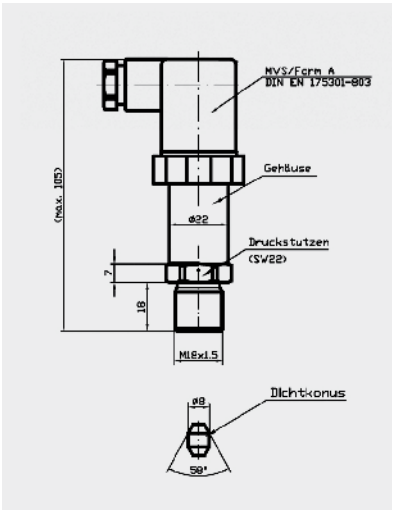
High pressure transmitter TST-SMH

Measuring range 0 … 4000 bar
Pressure connection with double seal cone

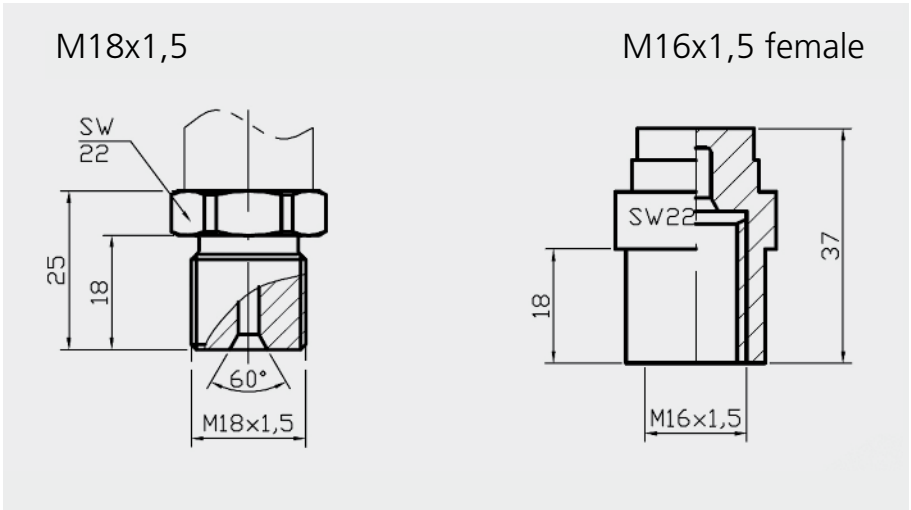
Technical data	Type: TST-SMH
Temperature ranges	
Media temperature	-40 ... +125° C
Ambient temperature	-40 ... +105° C
Storage temperature	-40 ... +105° C
Compensated temperature range	-20 ... +85° C
Temperature coefficient zero point	≤± 0,15 / 10K % (% of range)
Temperature coefficient range	≤± 0,15 / 10K % (% of range)
Total Error	at -40° C - 2,00 % of range
	at +105° C - 2,00 % of range
Mechanical parameters	
Sensor element	stainless steel on media side
Material of parts with contact to measuring medium	stainless steel (316L)
Housing	stainless steel
Process connection	M18x1,5, M16x1,5 others on request
Gasket ring	double seal cone
Electrical connection	connector M12x1, MVS / A, MVS / C, others on request
Weight	120 … 150 g according to layout
Shock resistance	1000 g according to IEC 68-2-32
Vibration resistance	20 g according to IEC 68-2-6 and IEC 68-2-36
CE conformity	EMC directive 2004 / 108 / EC
IP protection class	corresponding to the used and connected mating connector

* Pressure connection is sealed by double seal cone. The screw connection must be tightened to the specified torque.

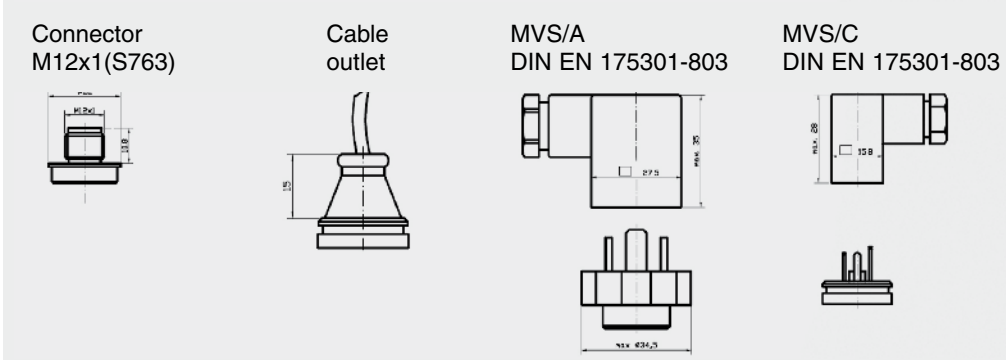
Dimensional drawing



Process connectors



Connector variants

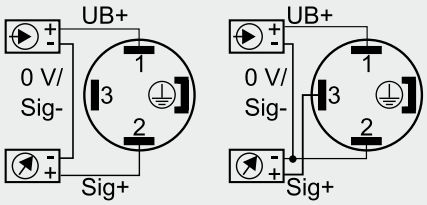


High pressure transmitter TST-SMH

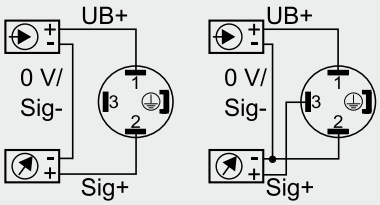
Measuring range 0 … 4000 bar
Pressure connection with double seal cone

PIN assignment

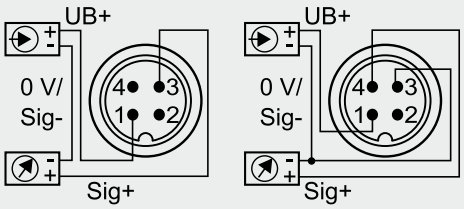
MVS/A, DIN EN 175301-803



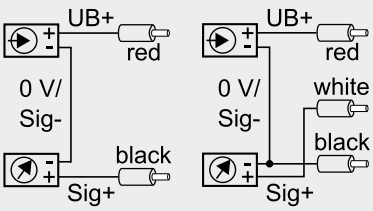
MVS/C, DIN EN 175301-803



Connector M12x1 (S763)



Cable outlet



Assembled cable and connection accessories

Type	Length	Specification	Part No.: straight	angled
M12x1 (S763) 4- pin	-	connector M12x1 for self-connection	1070039	1070038
	-	connector M12x1 self-connection, shielded	1070030	1070031
	2 m	cable: PUR	1070044	-
	5 m	cable: PUR, halogen-free	1070023	1070025
	5 m	cable: PUR, shielded, halogen-free	1070032	1070033
MVS / C, 3-pin +PE	3 m	cable: PUR, connector MVS / C	-	1070021

Special types upon request.

Pressure transmitter TST-SMX 2

Intrinsically safe pressure transmitter with ATEX certification
Protection class zone 1: II 2G Ex ia IIC T4 and zone 0: II 1G Ex ia IIB T4

Applications

- Chemical industry
- Oil and gas industry
- Food industry
- Plant engineering and automation technology

Description

- Measuring ranges 10 … 600 mbar up to 0 … 1000 bar
- Ex approval for zone 0: II 1G Ex ia IIB T4 or II 1G Ex ia IIC T4
- Ex approval for zone 1: II 2G Ex ia IIC T4
- Output signal 4 … 20 mA
- Compact and robust stainless steel housing
- High reliability

Standard pressure ranges													
Measuring range*	**P(mbar)**	**10**	**16**	**20**	**25**	**40**	**60**	**100**	**160**	**200**	**250**	**400**	**600**
Overload pressure	P(mbar)	50	80	100	125	200	300	500	800	1000	1250	1200	1800
Bursting Pressure	P(mbar)	150	2400	300	375	600	900	1500	2400	3000	3750	2000	3000
Measuring range**	**P(bar)**	**1,0**	**1,6**	**2,0**	**2,5**	**4,0**	**6,0**	**10,0**	**16**	**20**	**25**		
Overload pressure	P(bar)	6	6	6	10	10	20	20	40	40	100		
Bursting Pressure	P(bar)	9	9	9	15	15	30	30	60	60	150		
Measuring range**	**P(bar)**	**40**	**60**	**100**	**160**	**200**	**250**	**400**	**600**	**1000**			
Overload pressure	P(bar)	100	200	200	400	400	750	750	840	1200			
Bursting Pressure	P(bar)	150	300	300	600	600	1000	1000	1050	1500			

*silicium type, **stainless steel diaphragm type

Technical data	Type: TST-SMX 2	
Electrical parameters		
Output signal*	4 ... 20 mA (2-wire)	
Operating voltage U_B	20 … 27 V DC	
Permitted max. load R_A	$R_A \leq (U_B - 16\ V)/20\ mA$, at least 100 Ohm	
Response time* (10 … 90%)	< 1 ms	
Electric strength	350 V DC	
Accuracy specifications	**pressure range 1 to 1000 bar**	**pressure range 10 to 600 mbar**
BFSL	≤± 0,25 % of range	≤± 0,50 % of range
(Best Fit Straight Line)	≤± 0,20 % of range	≤± 0,40 % of range
Total error at RT	**≤± 0,50 % of range**	**≤± 1,00 % of range**
	including nonlinearity, hysteresis, zero point and full scale error (according to IEC 61298-2). Optional ≤± 0,25 % of range or ≤± 0,50 % of range available	
(Best Fit Straight Line)	≤± 0,20 % of range	≤± 0,40 % of range

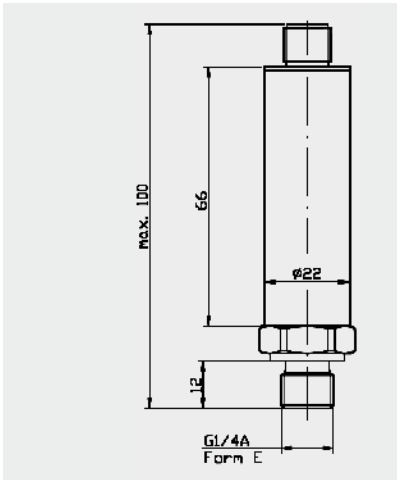
* Other response times on request.

Pressure transmitter TST-SMX 2

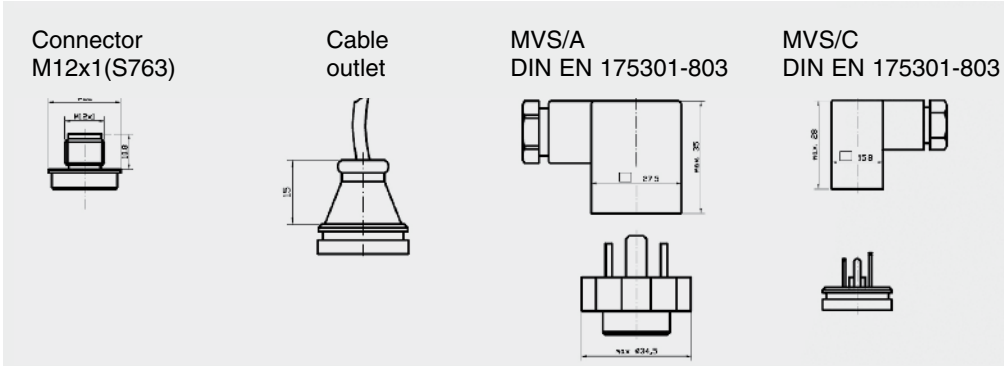
Intrinsically safe pressure transmitter with ATEX certification
Protection class zone 1: II 2G Ex ia IIC T4 and zone 0: II 1G Ex ia IIB T4

Technical data	Type: TST-SMX 2	
Temperature ranges	**Zone 0**	**Zone 1**
Media temperature	-20 ... +60° C	-40 ... +100° C
Ambient temperature	-20 ... +60° C	-40 ... +85° C
Storage temperature	-40 ... +120° C	-40 ... +125° C
Compensated temperature range	-20 ... +60° C	-20 ... +85° C
Temperature coefficient zero point	≤± 0,15 / 10K % (% of range)	≤± 0,15 / 10K % (% of range)
Temperature coefficient range	≤± 0,15 / 10K % (% of range)	≤± 0,15 / 10K % (% of range)
Total error	bei -20° C - 1,00 % (% of range)	bei -40° C - 1,00 % (% of range)
	bei +60° C - 1,00 % (% of range)	bei -85° C - 1,00 % (% of range)
ATEX certification	**Zone 0**	**Zone 1**
Ignition protection category	II 1G Ex ia IIB T4	II 2G Ex ia IIC T4
Ignition protection category	II 1G Ex ia IIC T4 (only with connector M12x1)	
Applicable norms and directives	EN 60079-0, EN 60079-11, EN 60079-26, EN 60079-14 (both zones)	
Maximum connection values	27 V, 125 mA, 85 W	27 V, 125 mA, 85 W
Temperature class	T4 (ambiance -20 … +60° C)	T4 (ambiance -40 … +85° C)
Mechanical parameters		
Material of parts with contact to measuring medium	silicium for pressure range from 10 to 600 mbar stainless steel (CrNiCuNb 17-4 PH / 1.4542) for pressure range from 1 to 1000 bar	
Housing	X5CrNi18-10	
Process connection	G 1/4 E, G 1/4 B, G 1/4 B, 1/4 NPT, others on request	
Electrical connection	connector M12x1, MVS / A, MVS / C, others on request	
Weight	~ 150 g according to layout	
Shock resistance	1000 g according to IEC 68-2-32	
Vibration resistance	20 g according to IEC 68-2-6 and IEC 68-2-36	
CE conformity	EMC directive 2004 / 108 / EC	
IP protection class	corresponding to the used and connected mating connector	

Dimensional drawing



Connector variants

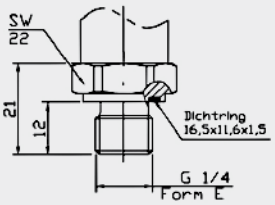


Pressure transmitter TST-SMX 2

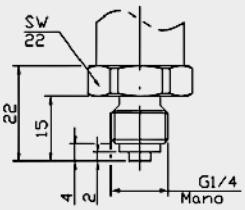
Intrinsically safe pressure transmitter with ATEX certification
Protection class zone 1: II 2G Ex ia IIC T4 and zone 0: II 1G Ex ia IIB T4

Process connectors

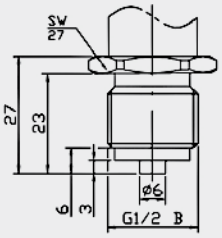
G ¼ A; DIN 3852; Form E



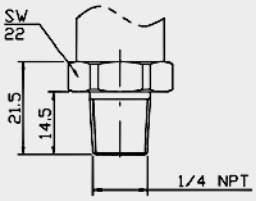
G ¼ B



G ½ B

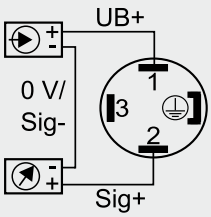


¼ NPT

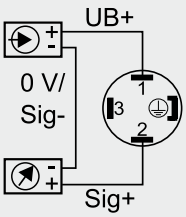


PIN assignment

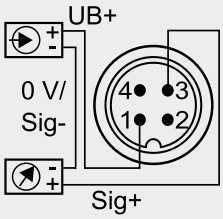
MVS/A, DIN EN 175301-803



MVS/C, DIN EN 175301-803



Connector M12x1 (S763)



Assembled cable and connection accessories

Type	Length	Specification	Part No.: straight	angled
M12x1 (S763) 4- pin	-	connector M12x1 for self-connection	1070039	1070038
	-	connector M12x1 self-connection, shielded	1070030	1070031
	2 m	cable: PUR	1070044	-
	5 m	cable: PUR, halogen-free	1070023	1070025
	5 m	cable: PUR, shielded, halogen-free	1070032	1070033
MVS / C, 3-pin +PE	3 m	cable: PUR, connector MVS / C	-	1070021

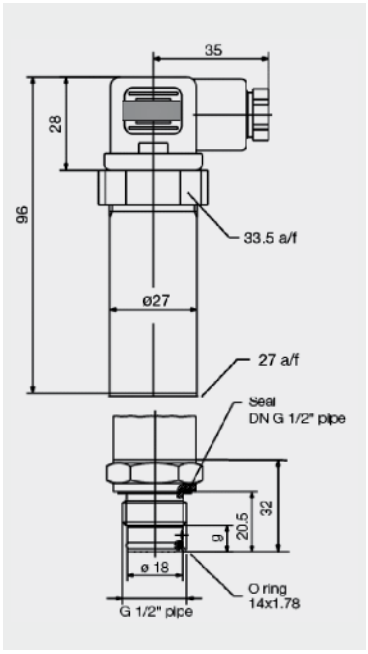
Special types upon request.

Pressure transmitter TST-SPT-F 10.../ 20...

Measuring range 0 … 40 bar
Front-flush diaphragm

Description

Pressure transmitters of the TST-SPT-F series are special qualified for use with viscous or polluted media, which are clogging a standard pressure connection easily. Using the TST-SPT-F provides a troublefree pressure monitoring of problematic media. G 1/2" male pressure connection is standard scope of supply. G1" or special designs like Tri-Clamp or milk pipe connection are optionally available.



Standard pressure ranges (bar)										
0,16	0,3	0,6	1	1,6	2,5	4	6	16	25	40

Technical data	Type: TST-SPT-F
Overload range	1,5 x pressure range
Bursting pressure	2,0 x pressure range
Pressure type	overpressure, absolute pressure
Materials of media-wetted parts:	
Type SPT-F	CrNi steel, O-ring: NBR
Housing	CrNi steel
Internal transmission fluid	synthetic oil / FDA filling (upon request)
Weight	~ 200 g
Operating voltage U_B	12 ... 32 V DC at 4 ...20 mA or 14 ... 32 V DC at 0 ... 10 V DC
Output signal with max. permitted load	4 ... 20 mA, 2-wire $R_A \leq (U_B\text{-}12\ V) / 20\ mA$ 0 ... 5 V DC, 3-wire $R_A > 5\ k\Omega$ 0 ... 10 V DC, 3-wire $R_A > 10\ k\Omega$ others upon request
Measurement uncertainty, % FS	< 0,25 % FS (incl. zero point error and final value deviation, hysteresis, nonlinearity, and reproducibility)
Nonlinearity	≤ 0,2 % FS (BFSL) according to IEC 61298-2
Reproducibility	≤ 0,1 % FS
Reproducibility stability	≤ 0,2 % FS per year under reference conditions
Permitted temperature ranges	
Process / media Temperature	-20 ... +80° C
Ambient temperature	-20 ... +80° C
Storage temperature	-20 ... +80° C
Compensated temperature range	-20 ... +80° C
Temperature coefficient zero point	≤ ± 0,20 / 10K % of range
Temperature coefficient range	≤ ± 0,20 / 10K % of range
Pressure equipment directive	97 / 23 / EG
EMC directive	89/336/EWG disturbance transmission (class B) interference immunity acc. to EN61326
Shock resistance	1000 g according to IEC 68-2-32
Vibration resistance	20 g according to IEC 68-2-6 and IEC 68-2-36
Overvoltage	36 V DC
Short-circuit strength	Out+ / U_B-
Polarity reversal	U_B+ / U_B-

Sensors

TIVAL®

Sketches + Notes

Pressure transmitter TST-SMF

Measuring range 0 … 200 bar
Front-flush diaphragm

Applications

- General industrial applications
- Plant engineering and automation technology
- Food industry
- Sanitary technology
- Chemical industry

Description

- Front-flush diaphragm
- Suitable for gauge, absolute and differential pressure measurements
- Measuring ranges 0 … 0,6 bar up to 0 … 200 bar
- Media temperature -30 … +100° C
- Accuracy class 0,5 %
- Protection class up to IP67 (IP69K upon request)
- Compact and robust stainless steel housing

Standard pressure ranges										
Measuring range, gauge pressure	**P(bar)**	**0,6**	**1,0**	**1,6**	**2,0**	**2,5**	**4,0**	**6,0**	**10,0**	**20,0**
Overload pressure	P(bar)	3,0	3,0	4,0	4,0	7,0	7,0	15,0	15,0	30,0
Measuring range, absolute pressure	**P_{abs}(bar)**	**1,0**	**2,0**	**2,5**	**6,0**	**10,0**	**20,0**	**40,0**		
Overload pressure	P_{abs}(bar)	3	4	7	15	15	30	100		
Measuring range, absolute pressure	**P_{abs}(bar)**	**60**	**100**	**160**	**200**					
Overload pressure	P_{abs}(bar)	200	200	300	300					

Technical data	Type: TST-SMF	
Electrical parameters		
Output signal*	4 … 20 mA (2- or 3-wire)	0 ... 10 V DC (3-wire)
Operating voltage U_B	9 … 32 V DC	12 … 32 V DC
Permitted max. load R_A	$R_A \leq (U_B - 9\ V) / 20\ mA$	
Recommended max. load resistor R_L		$R_L > 5\ k\Omega$
Response time* (10 … 90%)	< 1 ms	< 1 ms
Electric strength	350 V DC	350 V DC
Accuracy specifications		
BFSL (Best Fit Straight Line)	≤ ± 0,15 % of range	
Total error at RT	≤ **± 0,50 % of range** – including nonlinearity, hysteresis, zero point and full scale error (according to IEC 61298-2). Optional total error ≤ ± 0,25 % of range available	
Stabilität/Jahr	≤ ± 0,10 % of range	

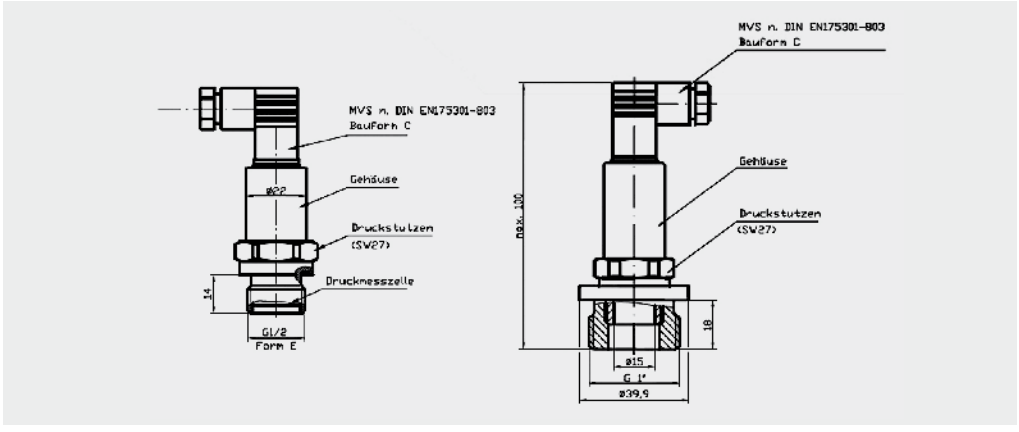
* Other output signals (e. g. 0 … 5 V DC; 0,5 … 4,5 V DC ratiometric) and other response times upon request.

Pressure transmitter TST-SMF

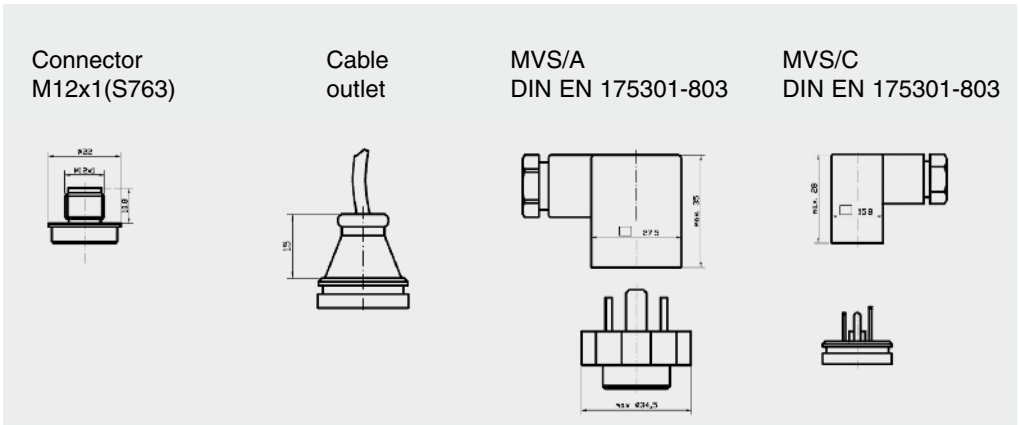
Measuring range 0 … 200 bar
Front-flush diaphragm

Technical data	Type: TST-SMF
Temperature ranges	
Media temperature	-30 ... +100° C
Ambient temperature	-30 ... +100° C
Storage temperature	-40 ... +100° C
Compensated temperature range	-20 ... +85° C
Temperature coefficient zero point	≤ ± 0,15 / 10K (% of range)
Temperature coefficient range	≤ ± 0,15 / 10K (% of range)
Total error	at -30° C - 2,00 (% of range)
	at +100° C - 2,00 (% of range)
Mechanical parameters	
Sensor element	stainless steel on media side
Material of parts with contact to measuring medium	stainless steel (316L)
Housing	stainless steel
Process connection	G 1/4 E, G 1/4 B, G 1/2 B, 1/4 NPT others on request
Gasket ring	FKM-Viton
Electrical connection	connector M12x1, MVS / A, MVS / C, others on request
Weight	80 … 120 g according to layout
Shock resistance	1000 g according to IEC 68-2-32
Vibration resistance	20 g according to IEC 68-2-6 and IEC 68-2-36
CE conformity	EMC directive 2004 / 108 / EC
IP protection class	corresponding to the used and connected mating connector

Dimensional drawing



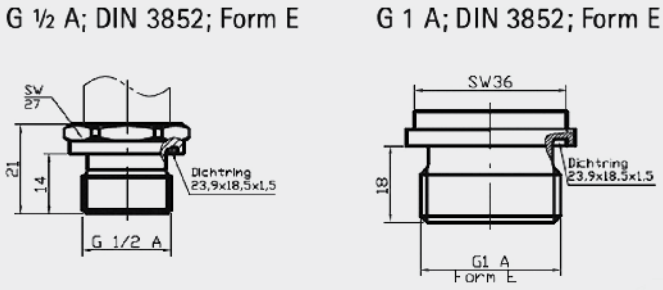
Connector variants



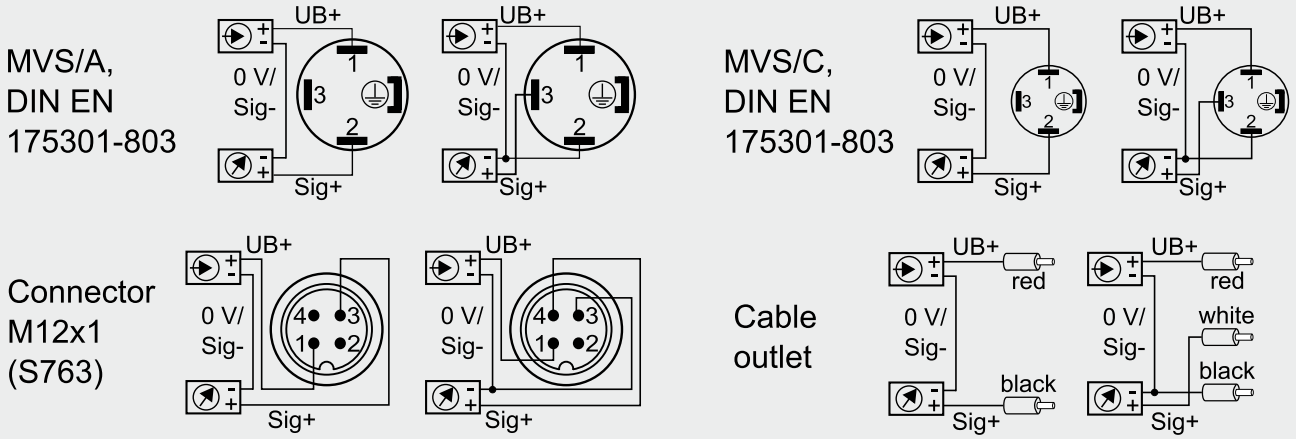
Pressure transmitter TST-SMF

Measuring range 0 … 200 bar
Front-flush diaphragm

Process connectors



PIN assignment



Assembled cable and connection accessories

Type	Length	Specification	Part No.: straight	angled
M12x1 (S763) 4- pin	-	connector M12x1 for self-connection	1070039	1070038
	-	connector M12x1 self-connection, shielded	1070030	1070031
	2 m	cable: PUR	1070044	-
	5 m	cable: PUR, halogen-free	1070023	1070025
	5 m	cable: PUR, shielded, halogen-free	1070032	1070033
MVS / C, 3-pin +PE	3 m	cable: PUR, connector MVS / C	-	1070021

Special types upon request.

Pressure transmitter TST-SKL

Measuring range 0 … 1000 bar
Media temperature -40 … +180° C

Applications

- General industrial applications
- Automotive engineering
- Hydraulics and pneumatics
- Plant engineering and automation technology

Description

- Designed for applications with higher temperature requirements and environments with strong thermal loads
- Stainless steel cooling section
- No internal transfer medium ("dry" measuring cell, completely welded)
- Measuring ranges 0 … 1 bar up to 0 … 1000 bar
- Media temperature -40 … +180° C
- Compact and robust stainless steel housing

Standard pressure ranges											
Measuring range	**P(bar)**	**1,0**	**1,6**	**2,0**	**2,5**	**4,0**	**6,0**	**10,0**	**16**	**20**	**25**
Overload pressure	P(bar)	6	6	6	6	10	20	20	40	40	100
Bursting Pressure	P(bar)	9	9	9	9	15	30	30	60	60	150
Measuring range	**P(bar)**	**40**	**60**	**100**	**160**	**200**	**250**	**400**	**600**	**1000**	
Overload pressure	P(bar)	100	200	200	400	400	500	750	840	1200	
Bursting Pressure	P(bar)	150	300	300	600	600	1000	1000	1050	1500	

Technical data	Type: TST-SMH	
Electrical parameters		
Output signal*	4 ... 20 mA (2- or 3-wire)	0 ... 10 V DC (3-wire)
Operating voltage U_B	9 … 32 V DC	12 … 32 V DC
Permitted max. load R_A	$R_A \leq (U_B - 9\ V) / 20\ mA$	
Recommended max. load resistor R_L		$R_L > 5\ k\Omega$
Response time* (10 … 90%)	< 1 ms	< 1 ms
Electric strength	350 V DC	350 V DC
Accuracy specifications		
BFSL (Best Fit Straight Line)	≤± 0,15 % of range	
Total error at RT	**≤± 0,50 % of range** - including nonlinearity, hysteresis, zero point and full scale error (according to IEC 61298-2). Optional total error ≤± 0,25 % of range available	
Stability per year	≤± 0,10 % of range	

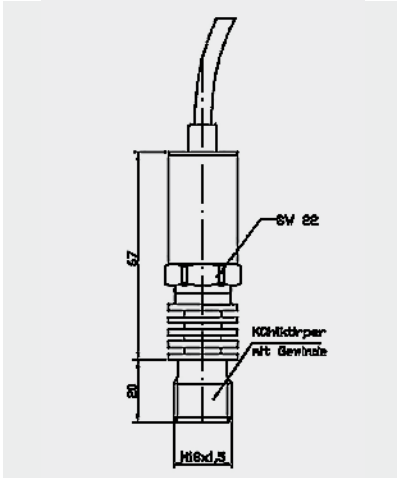
* Other output signals (e. g. 0 … 5 V DC; 0,5 … 4,5 V DC ratiometric) and other response times upon request.

Pressure transmitter TST-SKL

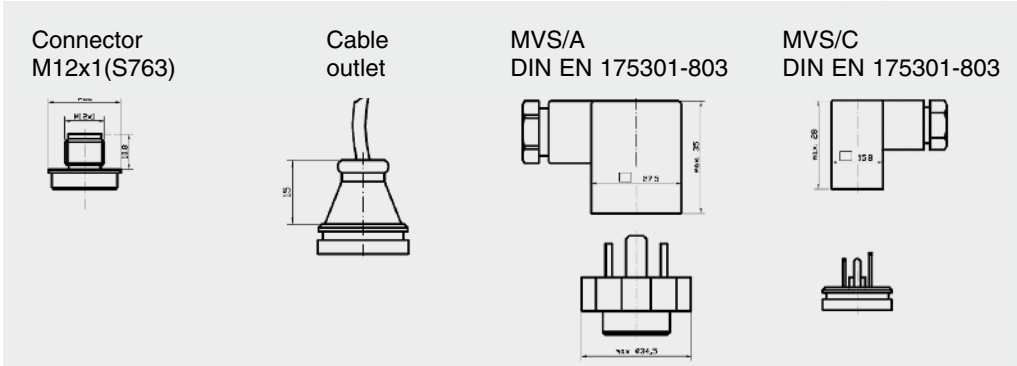
Measuring range 0 … 1000 bar
Media temperature -40 … +180° C

Technical data	Type: TST-SKL
Temperature ranges	
Media temperature, permanent	-40 ... +160° C
Media temperature, up to max. 15 min	-40 ... +180° C
Ambient temperature	-40 ... +105° C
Storage temperature	-40 ... +105° C
Compensated temperature range	-20 ... +85° C
Temperature coefficient zero point	≤± 0,15 / 10K % (% of range)
Temperature coefficient range	≤± 0,15 / 10K % (% of range)
Total error	at -40° C - 2,00 % of range
	at +105° C - 2,00 % of range
Mechanical parameters	
Sensor element	stainless steel on media side
Material of parts with contact to measuring medium	stainless steel (316L)
Housing	stainless steel
Process connection	G 1/4 E, G 1/4 B, G 1/2 B, others on request
Electrical connection	Connector M12x1, MVS / A, MVS / C, others on request
Weight	~ 250 g according to layout
Shock resistance	1000 g according to IEC 68-2-32
Vibration resistance	20 g according to IEC 68-2-6 and IEC 68-2-36
CE conformity	EMC directive 2004 / 108 / EC
IP protection class	corresponding to the used and connected mating connector

Dimensional drawing



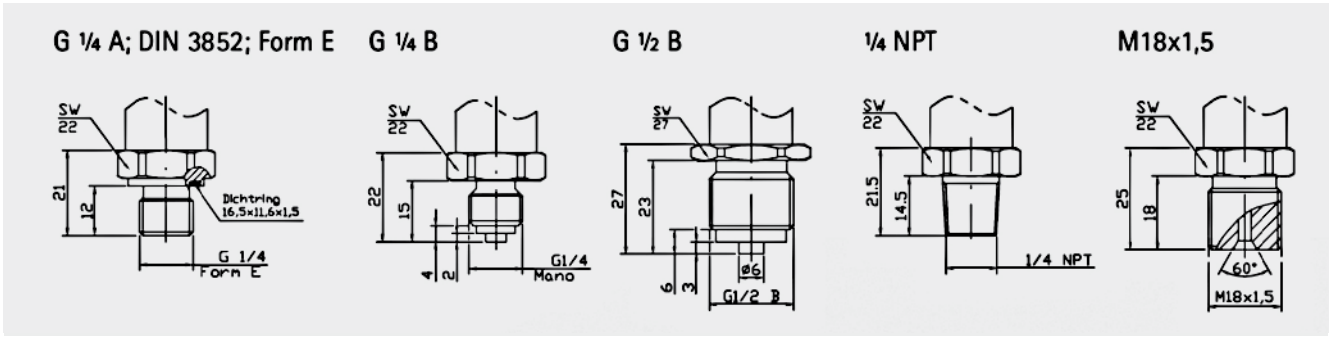
Connector variants



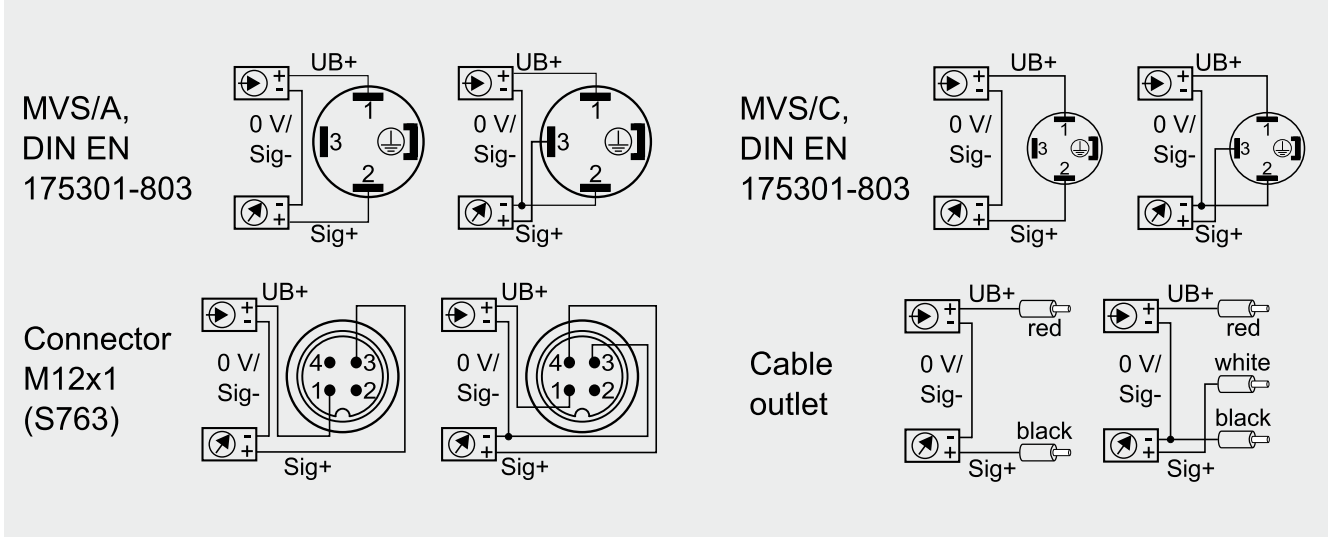
Pressure transmitter TST-SKL

Measuring range 0 … 1000 bar
Media temperature -40 … +180° C

Process connectors



PIN assignment



Assembled cable and connection accessories

Type	Length	Specification	Part No.: straight	angled
M12x1 (S763) 4- pin	-	connector M12x1 for self-connection	1070039	1070038
	-	connector M12x1 self-connection, shielded	1070030	1070031
	2 m	cable: PUR	1070044	-
	5 m	cable: PUR, halogen-free	1070023	1070025
	5 m	cable: PUR, shielded, halogen-free	1070032	1070033
MVS / C, 3-pin +PE	3 m	cable: PUR, connector MVS / C	-	1070021

Special types upon request.

Pressure transmitter TST-SMO

Measuring range 0 … 4000 bar
Version for mobile hydraulics providing high vibration- and EMC-resistance

Applications

- Automotive engineering
- Diesel- and natural gas engines
- Brake systems
- Plant engineering and automation technology

Description

- Measuring ranges 0 … 4 bar up to 0 … 4000 bar
- Media temperature -40 … +125° C
- Protection class up to IP67 (IP69K upon request)
- Shock resistance > 1000 g
- Vibration resistance > 30 g
- compact and robust stainless steel housing
- High reliability
- Load-dump module equippedl

Standard pressure ranges											
Measuring range	**P(bar)**	**4**	**6**	**10**	**16**	**20**	**25**	**40**	**60**	**100**	**160**
Overload pressure	P(bar)	20	20	20	40	40	100	100	200	200	400
Bursting Pressure	P(bar)	30	30	30	60	60	150	150	300	300	600
Measuring range	**P(bar)**	**200**	**250**	**400**	**600**	**1000**	**1600**	**2000**	**2500**	**4000**	
Overload pressure	P(bar)	400	750	750	840	1200	2400	2400	4500	4500	
Bursting Pressure	P(bar)	600	1000	1000	1050	1500	3000	3000	5000	5000	

Technical data	Type: TST-SMO	
Electrical parameters		
Output signal*	4 … 20 mA (2- or 3-wire)	0 … 10 V DC (3-wire))
Operating voltage U_B	9 … 32 V DC	12 … 32 V DC
Permitted max. load R_A	$R_A \leq (U_B - 9\ V) / 20\ mA$	
Recommended max. load resistor R_L		$R_L > 5\ k\Omega$
Response time* (10 … 90%)	< 1 ms	< 1 ms
Electric strength	350 V DC	350 V DC
Accuracy specifications		
BFSL (Best Fit Straight Line)	≤± 0,15 % of range	
Total error at RT	≤± **0,50 % of range** - including nonlinearity, hysteresis, zero point and full scale error (according to IEC 61298-2). Optional total error ≤± 0,25 % of range available	
Stability per year	≤± 0,10 % of range	

* Other output signals (e. g. 0 … 5 V DC; 0,5 … 4,5 V DC ratiometric) and other response times upon request.

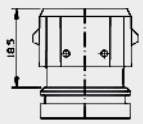
Pressure transmitter TST-SMO

Measuring range 0 … 4000 bar
Version for mobile hydraulics providing high vibration- and EMC-resistance

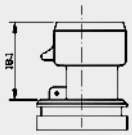
Technical data	Type: TST-SMO
Temperature ranges	
Media temperature	-40 ... +125° C
Ambient temperature	-40 ... +125° C
Storage temperature	-40 ... +125° C
Compensated temperature range	-20 ... +85° C
Temperature coefficient zero point	≤± 0,15 / 10K (% of range)
Temperature coefficient range	≤± 0,15 / 10K (% of range)
Total error	at -40° C - 2,00 % of range
	at +105° C - 2,00 % of range
Mechanical parameters	at -40° C - 2,00 % of range
Sensor element	stainless steel on media side
Material of parts with contact to measuring medium	CrNiCuNb 17-4 PH / 1.4542
Housing	stainless steel
Process connection	G 1/4 E, 1/4 NPT, M14x1,5, M12x1,5 others on request
Electrical connection	connector M12x1, Superseal, Packard, others on request
Weight	80 …120 g according to layout
Shock resistance	> 1000 g according to IEC 68-2-32
Vibration resistance	> 30 g according to IEC 68-2-6 and IEC 68-2-36
CE conformity	EMC Directive 89 / 336 / EEC
IP protection class	corresponding to the used and connected mating connector
Optional	with throttle

Connector variants

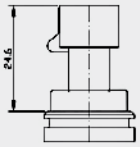
Junior-Timer-Connector



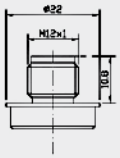
Packard-Connector



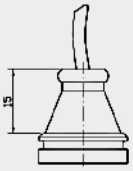
Superseal-Connector



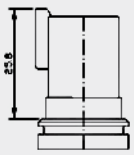
Connector M12x1(S763)



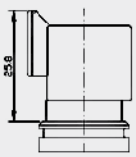
Cable outlet



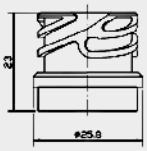
Deutsch Connector 3 pole



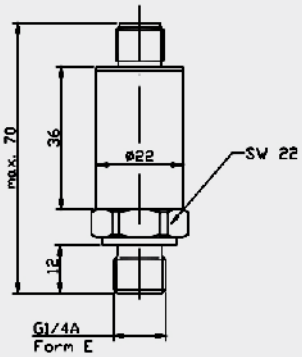
Deutsch Connector 3 pole



Roundplug DIN 72585

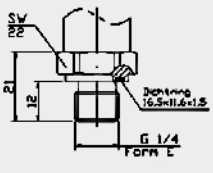


Dimensional drawing

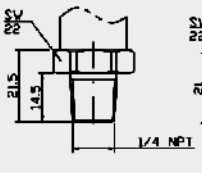


Process connectors

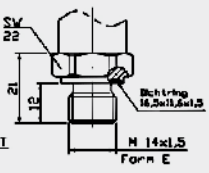
G ¼ A; DIN 3852; Form E



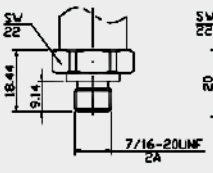
¼ NPT



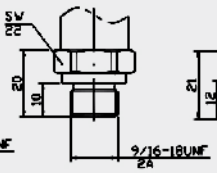
M 14x1,5; DIN 3852; Form E



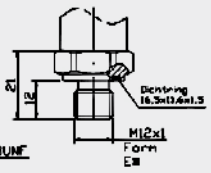
7/16-20UNF-2A SAE 514



9/16-18UNF-2A



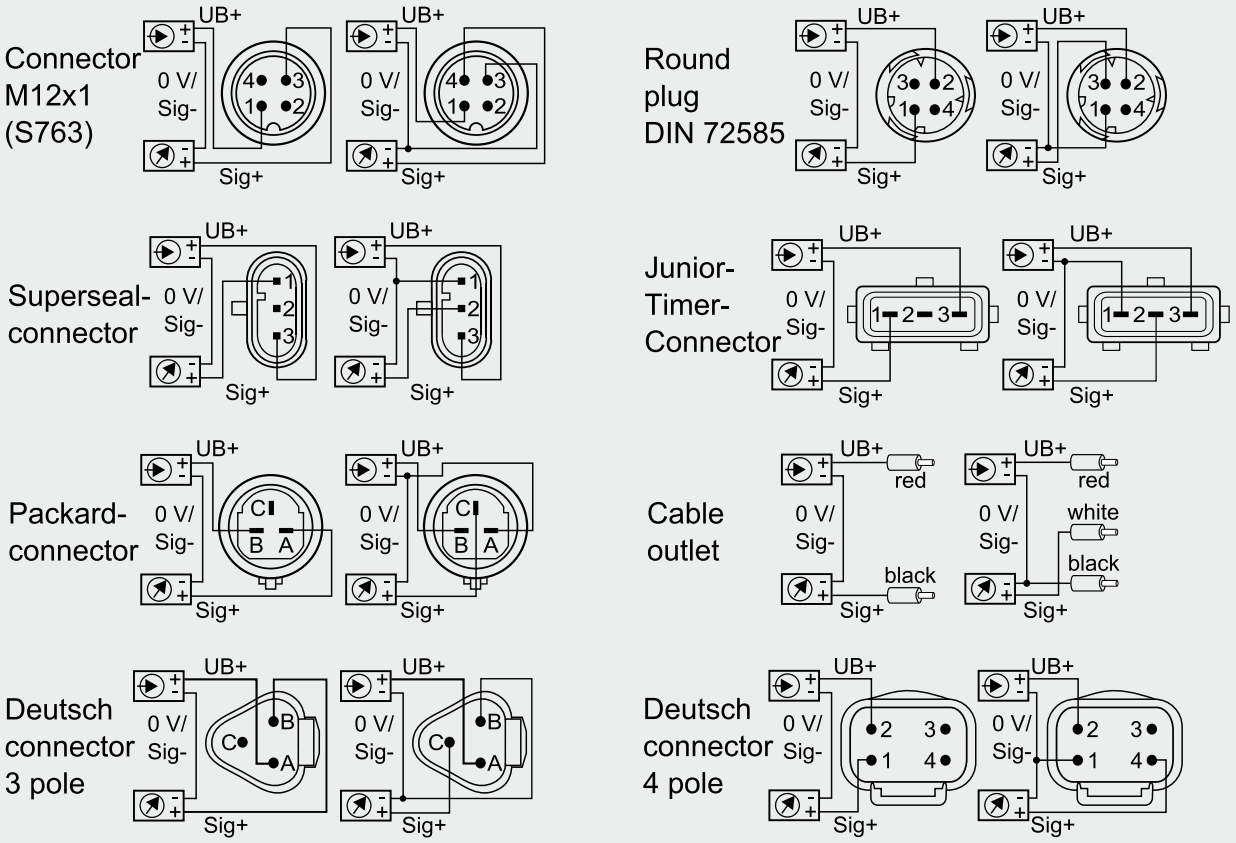
M12x1,5



Pressure transmitter TST-SMO

Measuring range 0 … 4000 bar
Version for mobile hydraulics providing high vibration- and EMC-resistance

PIN assignment



Assembled cable and connection accessories

Type	Length	Specification	Part No.: straight	angled
M12x1 (S763) 4- pin	-	connector M12x1 for self-connection	1070039	1070038
	-	connector M12x1 self-connection, shielded	1070030	1070031
	2 m	cable: PUR	1070044	-
	5 m	cable: PUR, halogen-free	1070023	1070025
	5 m	cable: PUR, shielded, halogen-free	1070032	1070033
MVS / C, 3-pin +PE	3 m	cable: PUR, connector MVS / C	-	1070021

Special types upon request.

Pressure and temperature transmitter TST-TPSI

Pressure measuring range 0 … 1000 bar
Temperature measuring range -50 … +150° C

Applications

- Hydraulics and pneumatics
- Climate and refrigeration technology
- Plant engineering and automation technology

Description

- Parallel and independent pressure and temperature measuring
- Temperature measuring by internal temperature probe
- Pressure measuring range 0 … 1 bar up to 0 … 1000 bar
- Temperature measuring range -50 … +150° C
- No internal transfer medium
- Protection class IP67
- Compact and robust stainless steel housing
- High reliability

Standard pressure ranges											
Measuring range	**P(bar)**	**1,0**	**1,6**	**2,0**	**2,5**	**4,0**	**6,0**	**10,0**	**16,0**	**20**	**25**
Overload pressure	P(bar)	6	6	6	10	10	20	20	40	40	100
Bursting Pressure	P(bar)	9	9	9	15	15	30	30	60	60	150
Measuring range	**P(bar)**	**40**	**60**	**100**	**160**	**200**	**250**	**400**	**600**	**1000**	
Overload pressure	P(bar)	100	200	200	400	400	750	750	840	1200	
Bursting Pressure	P(bar)	150	300	300	600	600	1000	1000	1050	1500	

Technical data	Type: TST-TPSI	
Electrical parameters	**Pressure signal**	
Output signal* Operating voltage U_B Recommended max. load resistor R_L	0,5 … 4,5 V DC ratiometric 5 V DC ± 10 % R_L > 4,7 kΩ	0 … 10 V DC (3-wire) 12 … 32 V DC R_L > 5 kΩ
Response time* (10 … 90%)	< 1 ms	
	Temperature signal	
Output signal*	0,25 … 4,75 V DC (if pressure signal is ratiometric, temperature signal will also be ratiometric)	
Response time* (10 … 90%)	120 s	
Electric strength	350 V DC	
Accuracy specifications	**Pressure / temperature**	
BFSL (Best Fit Straight Line) **Total error at RT**	≤ ± 0,15 % of range ≤ **± 0,50 % of range** - including nonlinearity, hysteresis, zero point and full scale error (according to IEC 61298-2). Optional total error ≤± 0,25 % of range available	
Stability per year	≤ ± 0,10 % of range	

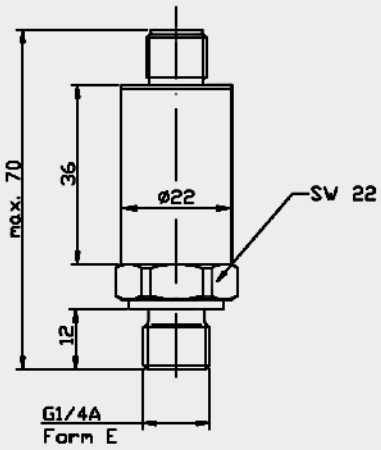
* Other output signals and other response times upon request.

Pressure and temperature transmitter TST-TPSI

Pressure measuring range 0 … 1000 bar
Temperature measuring range -50 … +150° C

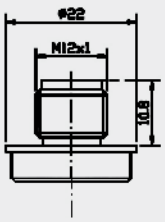
Technical data	Type: TST-TPSI
Temperature ranges	
Media temperature, permanent	-40 ... +125° C
Media temperature, up to max. 15 min	-50 ... +150° C
Ambient temperature	-40 ... +105° C
Storage temperature	-40 ... +125° C
Compensated temperature range	-20 ... +85° C
Temperature coefficient zero point	≤ ± 0,15 / 10K (% of range)
Temperature coefficient range	≤ ± 0,15 / 10K (% of range)
Total error	at -40° C - 2,00 % of range
	at +105° C - 2,00 % of range
Mechanical parameters	
Sensor element	stainless steel on media side
Material of parts with contact to measuring medium	stainless steel (316L)
Housing	stainless steel
Process connection	G 1/4 E, G 1/4 B, 1/4 NPT, others on request
Electrical connection	connector M12x1, M16x0,75, others on request
Weight	80 …120 g according to layout
Shock resistance	1000 g according to IEC 68-2-32
Vibration resistance	20 g according to IEC 68-2-6 and IEC 68-2-36
CE conformity	EMC directive 2004 / 108 / EC
IP protection class	corresponding to the used and connected mating connector

Dimensional drawing

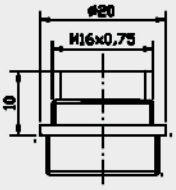


Connector variants

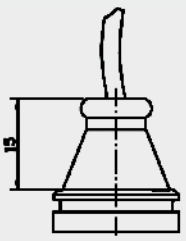
Connector
M12x1(S763)



Connector
M16x0,75 (S723)



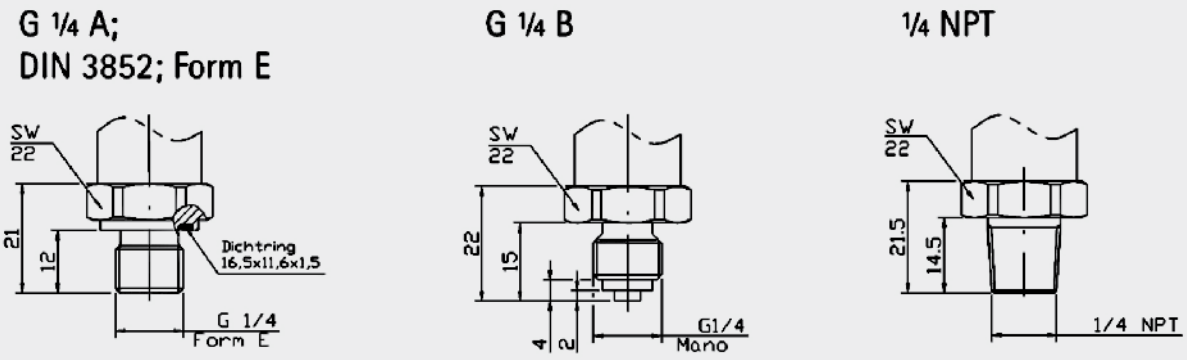
Cable
outlet



Pressure and temperature transmitter TST-TPSI

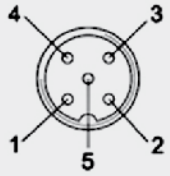
Pressure measuring range 0 … 1000 bar
Temperature measuring range -50 … +150° C

Process connectors



PIN assignment

nc = not connected
P = Pressure
T = Temperature

Connector M12x1 5-pin	Cable outlet	Connector M16x0,75 5-pin	Connector M16x0,75 8-pin
			
Voltage 1: UB+ 2: nc 3: UB- 4: P out 5: T out	Voltage rt: UB+ sw: UB- ws: P out gn: T out ws/bl: nc	Voltage 1: P out 2: T out 3: UB+ 4: UB- 5: nc	Voltage 1: UB- 2: nc 3: nc 4: P out 5: T out 6: UB+ 7: nc 8: nc

Pressure and temperature transmitter TST-TPSE

Pressure measuring range 0 … 600 bar
Temperature measuring range -50 … +200° C

Applications

- Hydraulics and pneumatics
- Climate and refrigeration technology
- Plant engineering and automation technology

Description

- Parallel and independent pressure and temperature measuring
- Temperature measuring by external temperature probe
- Pressure measuring range 0 … 4 bar up to 0 … 600 bar
- Temperature measuring range -50 … +125° C (short-term up to +200° C)
- No internal transfer medium
- Protection class IP67
- Compact and robust stainless steel housing
- High reliability

Standard pressure ranges									
Measuring range	**P(bar)**	**4**	**6**	**10**	**40**	**60**	**100**	**400**	**600**
Overload pressure	P(bar)	20	20	20	200	200	200	840	840
Bursting Pressure	P(bar)	30	30	30	300	300	300	1050	1050

Technical data	Type: TST-TPSE	
Electrical parameters	**Pressure signal**	
Output signal* Operating voltage U_B Permitted max. load R_A Recommended max. load resistor R_L	4 … 20 mA (2- or 3-wire) 9 … 32 V DC $R_A > (U_B - 9\ V) / 20\ mA$	0 … 10 V DC (3-wire) 12 … 32 V DC $R_L > 5\ k\Omega$
Response time* (10 … 90%)	< 1 ms	
	Temperature signal	
Output signal* Operating Voltage U_B	4 … 20 mA (2-wire) 9 … 32 V DC	
Response time* (10 … 90%)	10 - 20 s	
Electric strength	350 V DC	
Accuracy specifications	**Pressure / Temperature**	
BFSL (Best Fit Straight Line) **Total error at RT**	≤± 0,15 % of range **≤± 0,50 % of range** – including nonlinearity, hysteresis, zero point and full scale error (according to IEC 61298-2). Optional total error ≤± 0,25 % of range available	
Stability per year	≤± 0,10 % of range	

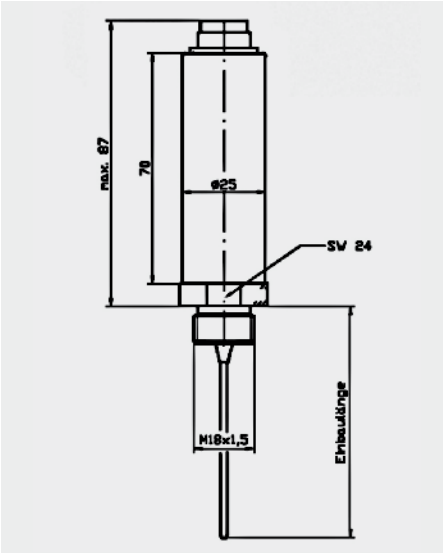
* Other output signals and other response times upon request.

Pressure and temperature transmitter TST-TPSE

Pressure measuring range 0 … 600 bar
Temperature measuring range -50 … +200° C

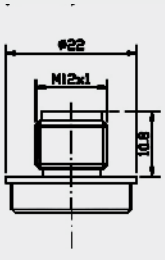
Technical data	Type: TST-TPSE
Temperature ranges	
Media temperature, permanent	-40 ... +125° C
Media temperature, up to max. 15 min	-50 ... +200° C
Ambient temperature	-40 ... +105° C
Storage temperature	-40 ... +125° C
Compensated temperature range	-20 ... +85° C
Temperature coefficient zero point	≤± 0,15 / 10K (% of range)
Temperature coefficient range	≤± 0,15 / 10K (% of range)
Total error	at -40° C - 2,00 % of range
	at +105° C - 2,00 % of range
Mechanical parameters	
Sensor element	stainless steel on media side
Material of parts with contact to measuring medium	stainless steel (316L)
Housing	stainless steel
Process connection	G 1/2 E, G 1/4 A, M18x1,5, others on request
Electrical connection	connector M12x1, M16x0,75, others on request
Weight	~ 120 g according to layout
Shock resistance	1000 g according to IEC 68-2-32
Vibration resistance	20 g according to IEC 68-2-6 and IEC 68-2-36
CE conformity	EMC directive 2004/108/EC
IP protection class	corresponding to the used and connected mating connector

Dimensional drawing

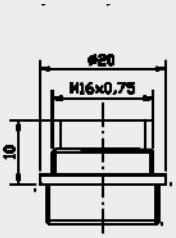


Connector variants

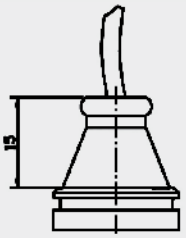
Connector M12x1(S763)



Connector M16x0,75 (S723



Cable outlet

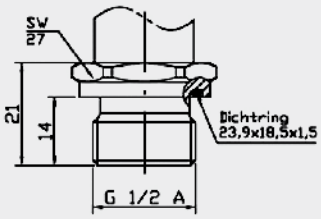


Pressure and temperature transmitter TST-TPSE

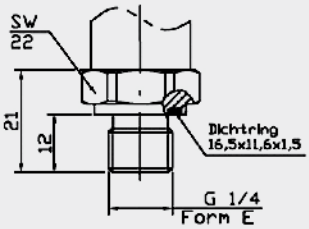
Pressure measuring range 0 … 600 bar
Temperature measuring range -50 … +200° C

Process connectors

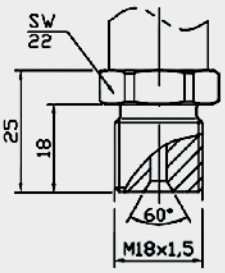
G ½ A;
DIN 3852; Form E



G ¼ A;
DIN 3852; Form E

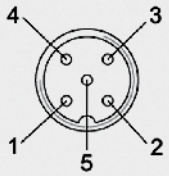


M18x1,5



PIN assignment

nc = not connected
P = Pressure
T = Temperature

Connector M12x1 5-pin	Cable outlet	Connector M16x0,75 5-pin	Connector M16x0,75 8-pin
			
current output · P/ T 1: P+ 2: T+ 3: P - 4: nc 5: T-	current output · P/ T rt : P+ sw: P- gn: T+ ws: T- ws/bl: nc	current output · P/ T 1: P- 2: T+ 3: P+ 4: nc 5: T-	current output P/ T 1: P- 2: T+ 3: nc 4: nc 5: T- 6: P+ 7: nc 8: nc
current output - P voltage output - T 1: UB+ 2: T+ 3: UB- 4: P out 5: T-	current output - P voltage output - T rt : UB+ sw: UB- ws: P out gn: T+ ws/bl: T-	current output - P voltage output - T 1: P out 2: T+ 3: UB+ 4: UB- 5: T-	current output - P voltage output - T 1: UB- 2: T+ 3: nc 4: P out 5: T- 6: UB+ 7: nc 8: nc

Pressure transmitter TST-SMC

Measuring range 0 … 1000 bar
Integrated CANopen interface (CANopen 2.0 A – optional B)

Applications

- General industrial applications
- Automotive engineering
- Hydraulics and pneumatics
- Plant engineering and automation technology
- Environmental and climate technology

Description

- Integrated CANopen interface according to standard 2.0 A (optional B) with data rate up to 1 Mbit / s
- No internal transfer medium (“dry” measuring cell, completely welded)
- Measuring ranges 0 … 1 bar up to 0 … 1000 bar
- Media temperature -40 … +125° C
- Protection class up to IP67
- Compact and robust stainless steel housing
- High reliability

Standard pressure ranges											
Measuring range	**P(bar)**	**1,0**	**1,6**	**2,0**	**2,5**	**4,0**	**6,0**	**10,0**	**16**	**20**	**25**
Overload pressure	P(bar)	6	6	6	6	10	20	20	40	40	100
Bursting Pressure	P(bar)	9	9	9	9	15	30	30	60	60	150
Measuring range	**P(bar)**	**40**	**60**	**100**	**1600**	**200**	**250**	**400**	**600**	**1000**	
Overload pressure	P(bar)	100	200	200	400	400	500	750	840	1200	
Bursting Pressure	P(bar)	150	300	300	600	600	1000	1000	1050	1500	

Technical data	Type: TST-SMC
Electrical parameters	
Output signal*	CAN-interface according to DIN ISO 11898 CAN2.0A (optional CAN2.0B)
CAN Protocol	CANopen
Operating voltage U_B	10 … 32 V DC
current consumption	< 30 mA
Response time* (10 … 90%)	< 1ms
Electric strength	350 V DC
Accuracy specifications	
BFSL (Best Fit Straight Line)	≤± 0,15 % of range
Total error at RT	**≤± 0,50 % of range**– including nonlinearity, hysteresis, zero point and full scale error (according to IEC 61298-2). Optional total error ≤± 0,25 % of range available
Stability per year	≤± 0,10 % of range

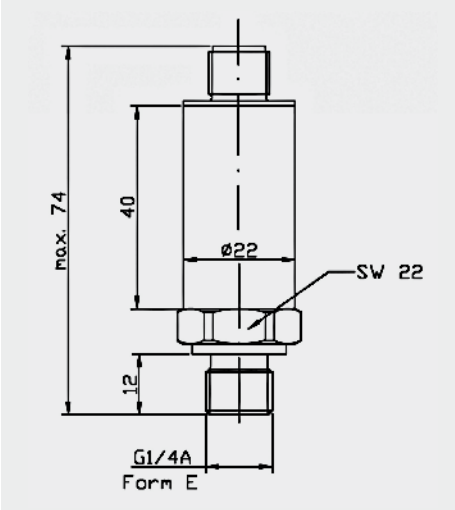
* Other response times on request.

Pressure transmitter TST-SMC

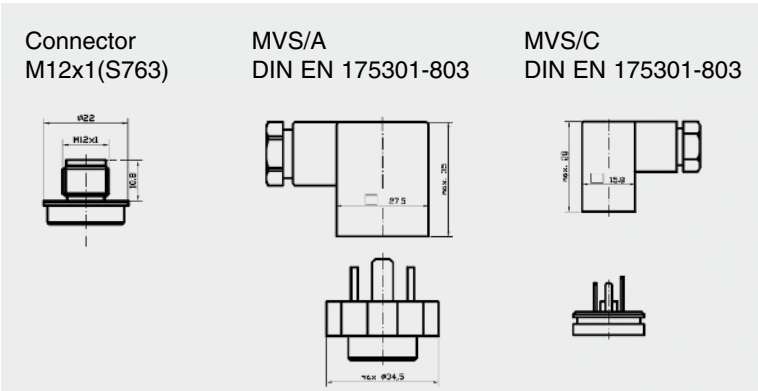
Measuring range 0 … 1000 bar
Integrated CANopen interface (CANopen 2.0 A – optional B)

Technical data	Type: TST-SMC
Temperature ranges	
Media temperature	-40 ... +125° C
Ambient temperature	-40 ... +105° C
Storage temperature	-40 ... +105° C
Compensated temperature range	-20 ... +85° C
Temperature coefficient zero point	≤± 0,15 / 10K (% of range)
Temperature coefficient range	≤± 0,15 / 10K (% of range)
Total Error	at -40° C - 2,00 (% of range)
	at +105° C - 2,00 (% of range)
Mechanical parameters	
Sensor element	stainless steel on media side
Material of parts with contact to measuring medium	CrNiCuNb 17-4 PH / 1.4542
Housing	stainless steel
Process connection	G 1/4 E, G 1/4 B, G 1/2 B, 1/4 NPT, others upon request
Electrical connection	connector M12x1, others upon request
Weight	80-120 g according to layout
Shock resistance	1000 g according to IEC 68-2-32
Vibration resistance	30 g according to IEC 68-2-6 and IEC 68-2-36
CE conformity	EMC Directive 2004/108/EC
IP protection class	corresponding to the used and connected mating connector
Optional	with throttle

Dimensional drawing



Connector variants

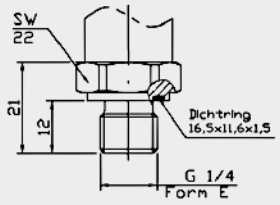


Pressure transmitter TST-SMC

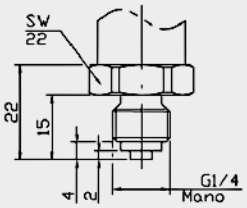
Measuring range 0 … 1000 bar
Integrated CANopen interface (CANopen 2.0 A – optional B)

Process connectors

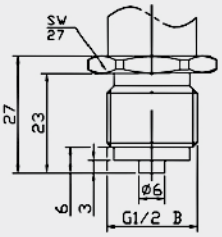
G ¼ A; DIN 3852; Form E



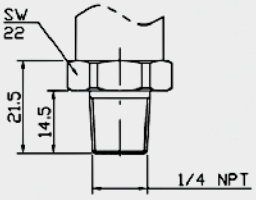
G ¼ B



G ½ B

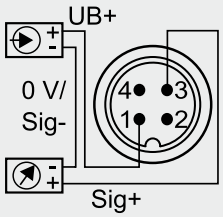


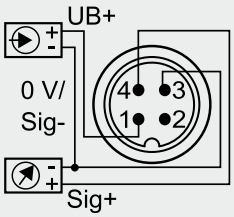
¼ NPT



PIN assignment

Connector
M12x1
(S763)





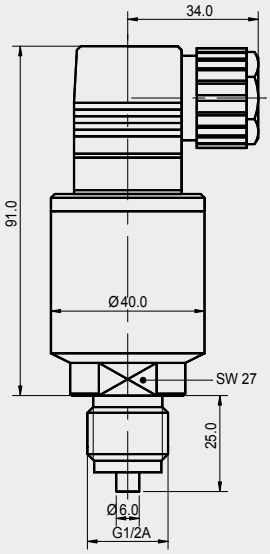
Assembled cable and connection accessories

Type	Length	Specification	Part No.: straight	angled
M12x1 (S763) 4- pin	-	connector M12x1 for self-connection	1070039	1070038
	-	connector M12x1 self-connection, shielded	1070030	1070031
	2 m	cable: PUR	1070044	-
	5 m	cable: PUR, halogen-free	1070023	1070025
	5 m	cable: PUR, shielded, halogen-free	1070032	1070033
MVS / C, 3-pin +PE	3 m	cable: PUR, connector MVS / C	-	1070021

Special types upon request.

Pressure transmitter TST-K121 10.0/20.0

Measuring range 0 … 250 bar
Ceramic sensor cell, accuracy 0,2 %

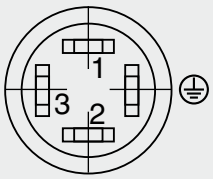


Pin assignment:

4 ... 20 mA (2-wire)
PIN1 Signal +
PIN2 Signal -

0 ... 10 V (3-wire)
PIN1 in +
PIN2 in -
PIN3 out +

Plug connector
DIN EN 175301-803 BFA



Type designation: Example
TST-K121 10.0, 16 bar, G1/4"A, SW27, MVS/A (Output 4-20 mA, 2-wire)
TST-K121 20.0, 16 bar, G1/4"A, SW27, MVS/A (Output 0-10 V, 3-wire)

Description

- "dry" measuring cell
- Measuring range from 40 mbar to 250 bar
- Accuracy < 0,2 %*
- High overload resistance
- Output signal: 4 ... 20 mA (2-wire)
- Output signal: 0 ... 10 V DC (3-wire)
- Other Process connectors on request
- Other Electrical connectors on request
- Absolute pressure measuring available

Measuring range	Overload (bar)	
0 ... 40	mbar*	-0,3/4
0 ... 50	mbar*	-0,3/4
0 ... 60	mbar*	-0,3/4
0 ... 100	mbar	-0,3/4
0 ... 160	mbar	-0,6/5
0 ... 200	mbar	-1/6
0 ... 250	mbar	-1/6
0 ... 0,4	bar	-1/6
0 ... 0,5	bar	-1/6
0 ... 0,6	bar	-1/10
0 ... 1,0	bar	-1/10
0 ... 1,6	bar	-1/18
0 ... 2,0	bar	-1/18
0 ... 2,5	bar	-1/18
0 ... 4,0	bar	-1/25
0 ... 5,0	bar	-1/40
0 ... 6,0	bar	-1/40
0 ... 10	bar	-1/40
0 ... 16	bar	-1/40
0 ... 20	bar	-1/40
0 ... 25	bar	-1/40
0 ... 40	bar	-1/60
0 ... 50	bar	-1/100
0 ... 60	bar	-1/100
0 ... 100	bar*	-1/250
0 ... 160	bar*	-1/400
0 ... 250	bar*	-1/600
-100 ... 0	mbar	-0,3/4
-100 ... 100	mbar	-1/6
-200 ... 0	mbar	-1/6
-200 ... 200	mbar	-1/6
-1 ... 1	bar	-1/10
-1 ... 3	bar	-1/25
-1 ... 5	bar	-1/40
-1 ... 9	bar	-1/40
-1 ... 15	bar	-1/40
0,8 ... 1,2	bar	-1/10

*measuring error 0,5 %

Technical data	Type: TST-K121 10.0 / 20.0
Output signal	4 … 20 mA (2-wire) or 0 ... 10 V (3-wire)
Accuracy	< 0,2 % F.S.
Response time	200 ms (others available upon request)
Operating voltage U_B	9 ... 32 V DC, max. 30 mA
Ambient temperature	-25 ...+ 80° C
Media temperature	-40 ... +100° C (+125° C < 0,5 h)
Temperature coefficient zero point	≤± 0,15 / 10K (% of range)
Temperature coefficient range	≤± 0,10 / 10K (% of range)
Stability per year	< 0,15 / K (% of range)
Housing	stainless steel 1.4404
Sensor element	ceramic AL_2O_3
Electrical connection	connector DIN EN 175301-803 BFA

Plug-in display TST-LCD

For 4 ... 20 mA pressure transmitters, with angled connector acc. to DIN EN 175301-803/A

Description

- 10 mm LCD display
- Display range -1999 … 9999 digit
- Programmable display range and decimal point
- Input 4 … 20 mA
- Programmable 3-stage input damping
- Direct mounting on pressure transmitters
- Protection class IP 65
- 4-pin angled plug electrical connection DIN EN 175301-803/A

The plug-in display TST-LCD provides an on-site measured pressure value display with simultaneous 4 ... 20 mA signal transmission at minimally installing effort. Display range and decimal point can be easily adjusted with push-buttons after front cover removal. A trouble free upgrade of operating pressure transmitters is provided.

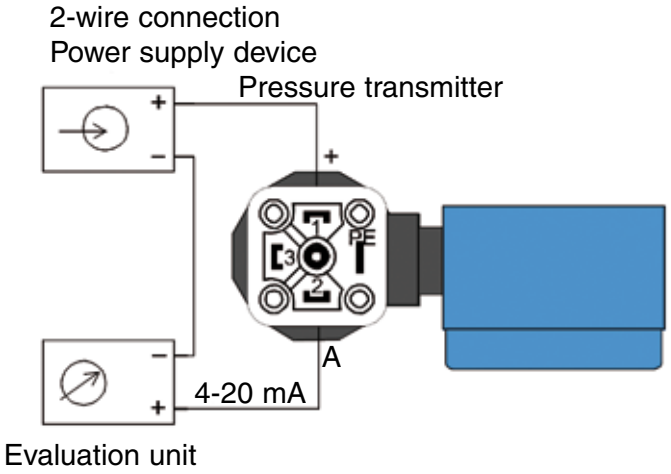
Ordering example: TST-LCD

Technical data	Type: TST-LCD
Auxiliary power	
Operating voltage U_B	Unnecessary, supply from current loop
Working temperature	0 … +50° C (extended temp. range available upon request)
Permitted rel. humidity	< 90 %, non-condensating
CE-conformity	EN50081-1 and EN50082-2
Input	
Input signal	4 ... 20 mA
Max. overload	40 mA
Voltage drop	3 V DC
Accuracy	± 0,2 %, ± 1 digit
Temperature coefficient	0,10 / 10K %
Display	LCD-Display 10 mm
Display range	-1999 ... 9999 digit
Display interval	5 / s
Adjustable input damping	3 stage
Housing	ABS material, polycarbonate front window
Dimensions	50 x 50 x 35 mm (w x h x d)
Weight	~ 80 g
Electrical connection	4-pin angled plug acc. to DIN EN 175301-803/A
Protection class	IP 65, housing and plug

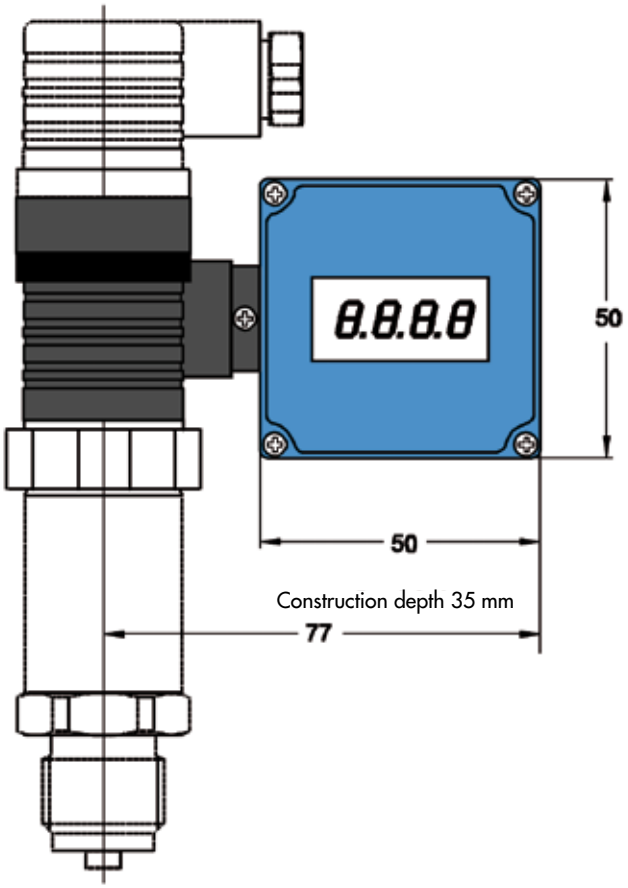
Plug-in display TST-LCD

For 4 ... 20 mA pressure transmitters, with angled connector acc. to DIN EN 175301-803/A

Connection diagram



Dimensional drawing



Note:
The display must not be used without pressure transmitter. The angled plug fastening screw supplied with the unit may be subject to trimming to fit the operating pressure transmitter.

Electronic pressure switch TST-PSD 30

Pressure ranges up to 600 bar, accuracy 1 %

Application

- Engineering products
- Machine tools
- Hydraulics and pneumatics
- Pumps and compressors

Description

- Easily readable and rugged 14-segment LED display, 180° electronically rotatable
- User-friendly 3-button control
- Simple menu navigation (acc. to VDMA standards)
- Flexible initial operation provided by independent rotatability of M12x1 connector (320°) and display (330°)
- Two switching outputs and one analog output possible

The TST-PSD 30 is easily adaptable to the installation situation on initial operation. Based on a double housing construction rotatability of more than 300° the display can be adjusted independently from the electrical connection. The display always allows alignment to the operators view angle and the M12 connector can be positioned to the desired cable routing. The display is 180° electronically rotatable for overhead mounting situations.

The electrical connector housing and thread are made of stainless steel. Overtighting or plug blow-off is almost impossible. Installed metal thin film or piezo-sensors are welded in hermetic sealed and come without any additional internal gaskets.

Standard pressure ranges	Type: TST-PSD 30								
Measuring range	bar	1	1,6	2,5	4	6	10	16	25
Overload limits	bar	2	3,2	5	8	12	20	32	50
Burst pressure	bar	5	10	10	17	34	34	100	100
Measuring range	bar	40	60	100	160	250	400	600	
Overload limits	bar	80	120	200	320	500	800	1200	
Burst pressure	bar	400	550	800	1000	1200	1700	2400	

Assembled cable and connection accessories (see page 176)




Electronic pressure switch TST-PSD 30

Pressure ranges up to 600 bar, accuracy 1%

Technical data	Type: TST-PSD 30
Lifespan	10 mio. load changes
Material Wetted parts Pressure connection Pressure sensor Housing Lower part Plastic head Keypad Display window Internal transmission fluid	 316 L 316 L (from 0 ... 10 bar rel 13-8 PH) 316 L highly resistant glass-fiber reinforced plastic (PBT) TPE-E PC synthetic oil (only for meas. Ranges <0 … 10 bar and < 0 … 25 bar abs.pressure)
Operating voltage U_B	15 ... 35 V DC
Output signal and permitted max. load R_A	4 ... 20 mA, (3-wire) $R_A \leq 0{,}5$ kΩ 0 … 10 V (3-wire) $R_A > 10$ kΩ
zero offset alignment	max. 3% of range
Settling time (analog signal)	3 ms
Current consumption	max. 100 mA
Total current consumption	max. 600 mA (max. 500 at IO-link) incl. switching current
Switching output Type Number of outputs Output function Switching voltage Switching current Settling time Accuracy	adjustable individually by external keypad transistor switching output PNP or NPN 1 or 2 NO / NC; window- and hysteresis function freely adjustable Supply voltage U_B – 1 V SP1: 250 mA SP2: 250 mA ≤ 10 ms ≤ 0,5 % of range (setting accuracy)
Isolating voltage	500 V DC
Display Principle Accuracy Update time	 14-segment LED, red 4-digit, figures height 9 mm, 180° electronically rotatable ≤ 1,0 % of range ± 1 digit ms 100, 200, 500, 1000 (adjustable))
Accuracy	
Non-linearity	≤ ± 0,5 % of range (BFSL) corresp. to IEC 61298-2
Long-term drift	≤ 0,2 % of range corresp. to IEC 61298-2
Permitted temp. ranges Media temperature Environment temperature Storage temperature	 -20 ... +85° C -20 ... +80° C -20 ... +80° C
Nominal temp. range	0 ... +80° C
Temperature error in nominal temp. range	typical ≤ 1,0 % of range max. ≤ 2,5 % of range
Temperature coefficient (TC) in nominal temp. range Middle TC of zero point Middle TC of range	 ≤ 0,2 / 10 K (% of range) ≤ 0,2 / 10 K (% of range)
Reference conditions	relative humidity: 45 ... 75 % acc. to IEC 61298-1
Approvals	cULus
RoHS-conformity	yes
CE-conformity Pressure equipment directive EMV-guideline	
Shock resistance	50 g according to IEC 60068-2-27 (mechanical shock)
Vibration resistance	30 g according to IEC 60068-2-6 (resonant vibration)
Electrical protection classes Overvoltage protection Short-circuit strength Polarity protection	 40 V DC S+ / SP1 / SP2 against U- U+ against U
Weight	~ 200 g

Electronic pressure switch TST-PSD 30

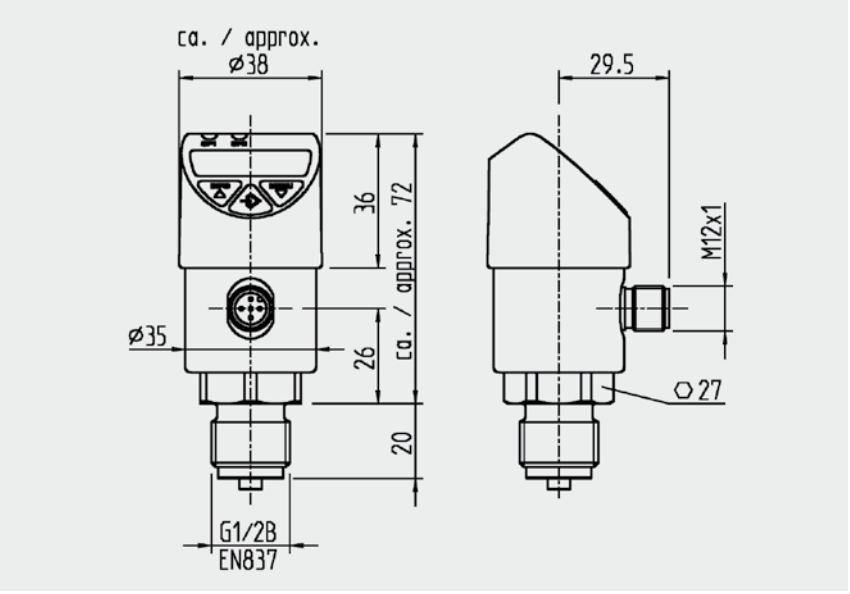
Pressure ranges up to 600 bar, accuracy 1%

Dimensional drawing

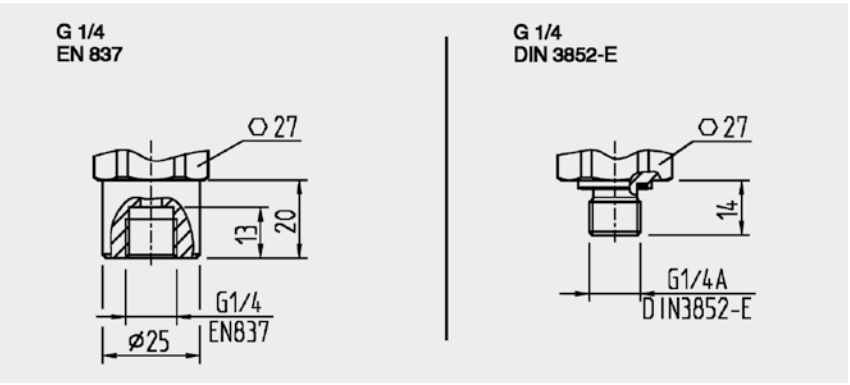
Electrical connection
Circular connector M 12x1

Mating plugs are not within the scope of supply

Pressure connection
G 1/2"
EN 837



Connector variants



Electrical connections

Circular connector M12x1, 4-wire

2 switching outputs or
1 switching output +
1 analog output

U+ = 1	U- = 3	SP1 = 4 / C = 4	SP2 = 2 / S+ = 2

Protection class acc.to IEC 60 529
IP 65 and IP 67

Circular connector M12x1, 5-wire

2 switching outputs + 1 analog output

U+ = 1	U- = 3	SP1 = 4 / C = 4	SP2 = 2	S+ = 5

IP 65 and IP 67

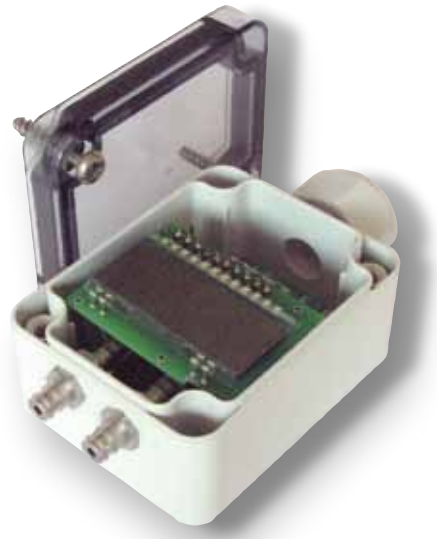
Stated protection classes are valid only with mated line connectors with according protection class.

Legend:

U+	supply pin positive
U-	supply pin negative
SP1	switching output no. 1
SP2	switching output no. 2
S+	analog output
C	IO-link communication

Differential pressure transmitter TST-DD 10.0... / 20.0...

Output signal 4 … 20 mA or 0 … 10 V DC
For air and non-agressive gases



Description

- Measurement of differential pressure values
- Pneumatic and process technology application
- Switchable measuring ranges
- Bar- or pascal-style display
- Equating to zero possible
- Available with or without display

Type designation

TST-DD 10.0... (4 ... 20 mA / 2-wire)
TST-DD 20.0... (0 ... 10 V DC / 3-wire)

Further specifications

- With switching function
- With multi-function output
  (4 … 20 mA or 0 … 10 V and transistor)

Measuring ranges

(switchable by internal bridges)

Rated differential pressure (mbar)	Factor 0,5	Factor 2	max. over-pressure (mbar)
2	1	4	20
5	2,5	10	100
25	12,5	50	250
100	50	200	500

Other measuring ranges upon request (vacuum available)

Technical data	Type: TST-DD 10.0…	Type: TST-DD 20.0…
Output signal	4 … 20 mA (2-wire)	0 … 10 V DC (3-wire)
Operating voltage U_B	12 … 30 V DC	14 … 30 V DC / 24 V AC
Linearity error	+/- 1,0 % FS	+/- 1,0 % FS
Total error	+/- 2,5 % FS	+/- 2,5 % FS
Electric connection	screw terminal inside	screw terminal inside
Process connection	hose connector 3,5 mm / 5,5 mm	hose connector 3,5 mm / 5,5 mm
Media temperature	0 ... +50° C	0 ... +50° C
Ambient temperature	0 ... +50° C	0 ... +50° C
Protection class	IP 65	IP 65
Dimensions (height x width x depth)	36 x 65 x 51 mm	36 x 65 x 51 mm

Differential pressure transmitter TST-DDM 10.0... / 20.0...

Output signal 4 … 20 mA or 0 … 10 V DC
For air and non-agressive gases

Description

- Pressure range stages from 0,4 … 1000 bar
- Overpressure safety 1,2 x nominal value
- Optionally differential pressure from 1:2 to 1:15 of nominal pressure value (please state when ordering)
- Output signal scalable to double or half differential pressure range
- Process technology and water supply application
- Available with or without display
- Stainless steel fluid-wetted parts
- Equating to zero possible

Type designation

TST-DDM 10.0... (4 … 20 mA / 3-wire)
TST-DDM 20.0... (0 … 10 V DC / 3-wire)

Technical data	Type: TST-DDM 10.0…	Type: TST-DDM 20.0…
Output signal	4 … 20 mA (3-wire)	0 … 10 V DC (3-wire)
Operating voltage U_B	14 … 30 V DC	14 … 30 V DC
Measuring range	0,4 … 1000 bar selectable	0,4 … 1000 bar selectable
Differential pressure	Factor 1:2 to 1:15 of nominal pressure value	Factor 1:2 to 1:15 of nominal pressure value
Total error, typical	± 0,4 % FS	± 0,4 % FS
Process connection	hose connector 3,5 mm / 5,5 mm	hose connector 3,5 mm / 5,5 mm
Media temperature	-20 ... +80° C	-20 ... +80° C
Cable gland	M 16	M 16
Protection class	IP 66	IP 66
Dimensions (height x width x depth)	45 x 100 x 65 mm	45 x 100 x 65 mm

Digital contact gauge TST-PM 63

Dry ceramic sensor
Measuring range 250 mbar … 250 bar

Description

- 3-digit LED display
- 14 mm digits
- 1 adressable transistor output
- Dry ceramic sensor
- Measuring range 250 mbar … 250 bar
- 4 (0) ... 20 mA analog output, 3-wire
- 0 ... 10 V analog output, 3-wire
- Contact output DC PNP, max. 50 mA
- Range of temperatures -25 ... +80° C
- Media temperature -25 ... +100° C
- 63 mm stainless steel case

The digital contact gauge TST-PM 63 measures and monitors pressure ranges from 250 mbar to 250 bar and displays the measured value. The threshold values can be set via the control buttons.

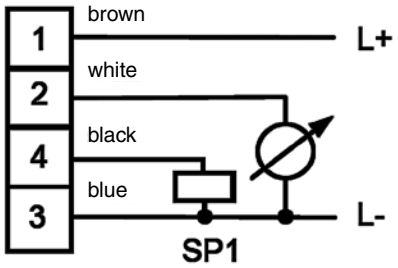
Technical data	Type: TST-PM 63
Measuring range	0 ... 250 mbar to 0 ... 250 bar
Analog output	4(0) ... 20 mA, 0 ... 10 V
Contact output	DC PNP, max. 200 mA
Accurancy	≤± 0,5% FS
Response time	200 ms
Operating voltage U_B	10 ... 30 V DC, 20 mA Output 16 ... 30 V DC, 10 V DC Output
Range of temperatures	-25 ... +80° C
Process temperature	-25 ... +100° C
Temperature coefficient zero point Temperature coefficient range	≤± 0,03 % FS / K ≤± 0,02 % FS / K
Stability per year	≤± 0,5 % FS p. a.
Bayonet lock case	Stainless steel, 1.4301 (304) IP 67
Process connection	G1/4B, 1.4404 (316L)
Sensor element	ceramic AL_2O_3, gasket ring FKM-Viton (others on request)
Electrical connection	connector M8 x 1, 4-pin

Digital contact gauge TST-PM 63

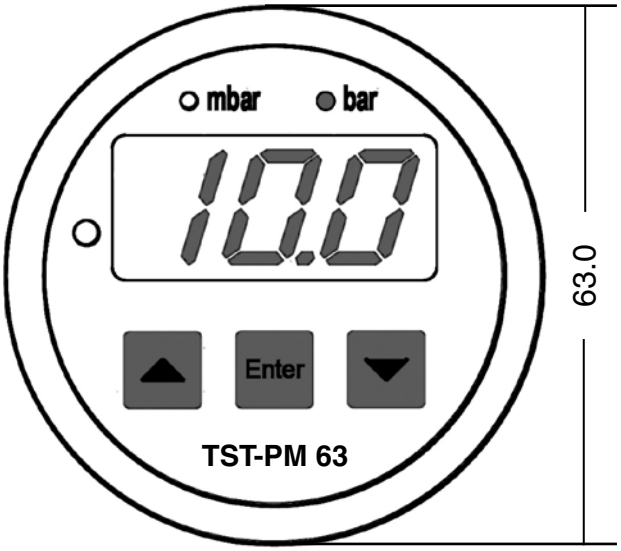
Dry ceramic sensor
Measuring range 250 mbar … 250 bar

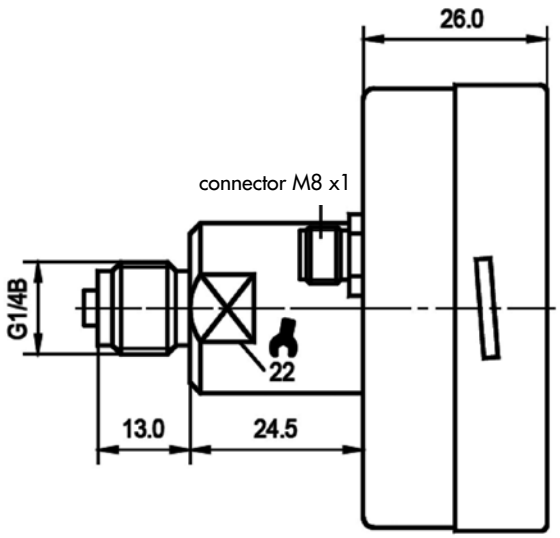
Electrical connections

Connector M8 x 1 4-pin



Dimensional drawing





Ranges

Measuring range	Overload (bar)
0...250 mbar (*)	-0,15/1
0...400 mbar	-0,15/1
0...500 mbar	-0,2/2
0...600 mbar	-0,2/2
0... 1 bar	-0,4/4
0... 1,6 bar	-0,4/4
0... 2 bar	-0,4/4
0... 2,5 bar	-0,8/10
0... 4 bar	-0,8/10
0... 5 bar	-0,8/10
0... 6 bar	-1/20
0...10 bar	-1/40
0...16 bar	-1/40
0...20 bar	-1/40
0...25 bar	-1/100
0...40 bar	-1/100
0...50 bar	-1/100
0...60 bar	-1/200
0...100 bar	-1/200
0...160 bar	-1/400
0...200 bar	-1/400
0...250 bar	-1/600
-1...0 bar	-1/4
-1...0,6 bar	-1/4
-1...1 bar	-1/4
-1...1,5 bar	-1/4
-1...3 bar	-1/10
-1...5 bar	-1/10
-1...9 bar	-1/40
-1...15 bar	-1/40
-1...19 bar	-1/40

(*) Accurancy 1% Absolutpressure on Request

Digital contact gauge TST-PM 82

Dry ceramic sensor
Measering ranges from 25 mbar ... 250 bar

Characteristics

- 3-digit LED display
- 2 adressable transistor outputs
- Dry ceramic Sensor
- Ranges from 25 mbar ... 250 bar
- 4 (0) … 20 mA analog output, 3-wire
- 0 … 10 V analog output, 3-wire
- Contact output DC PNP, max. 50 mA
- Range of temperature -25 … +80° C
- Process temperature -25 … +100° C
- 80 mm stainless steel case
- Available with all standard process connections

Function

The digital contact gauge TST-PM 82 measures and monitors pressure ranges from 25 mbar to 250 bar and displays the measured value. One or two threshold values can be set via the control buttons. LEDs show the switching status of the transistor outputs.

Technical data	Type: TST-PM 82
Measuring range	0 ... 25 mbar to 0 ... 250 bar
Analog output	4(0) ... 20 mA, 0 ... 10 V
Contact output	DC PNP, max. 200 mA
Accuracy	≤± 0,5% FS
Response time	200 ms
Operating voltage U_B	10 ... 30 V DC, 20 mA output 16 ... 30 V DC, 10 V output
Range of temperature	-25 ... +80° C
Process temperature	-25 ... +100° C
Temperature coefficient zero point Temperature coefficient range	≤ ± 0,03 % FS / K ≤ ± 0,02 % FS / K
Stability per year	≤ ± 0,5 % FS
Bayonet lock case	Stainless steel, 1.4301 (304) IP 67
Process connection	1.4404 (316L)
Sensor element	Ceramic AL_2O_3, gasket ring FKM-Viton (others on request)
Electrical connection	Connector, M12x1 (IP 67)

Assembled cable and connection accessories (see page 176)

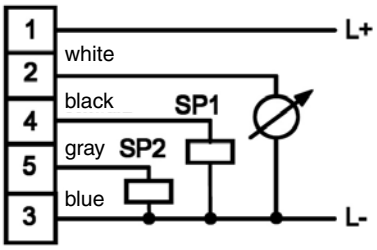



Digital contact gauge TST-PM 82

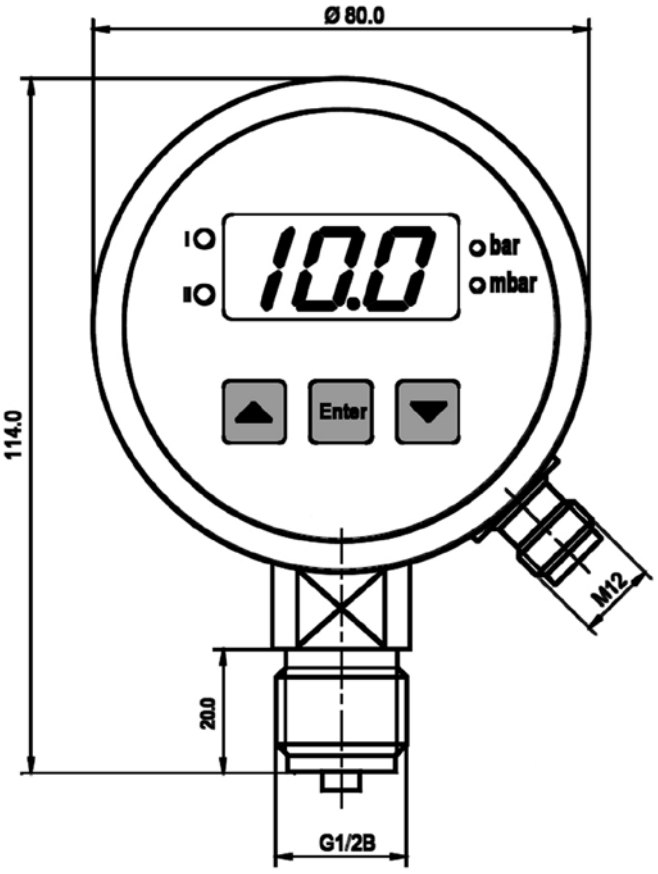
Dry ceramic sensor
Measuring ranges from 25 mbar ... 250 bar

Electrical connections

Connector M12x1, 5-pin



Dimensional drawing



TST-PM 82 G 1/2B DIN 16288

Ranges

Measuring range	Overload (bar)
-20 ... 20 mbar	-0,3/4
0 ... 25 mbar	-0,3/4
0 ... 40 mbar	-0,3/4
0 ... 50 mbar	-0,3/4
0 ... 60 mbar	-0,3/4
-100 ... 100 mbar	-1/2
0 ... 100 mbar	-1/2
0 ... 160 mbar	-1/2
0 ... 200 mbar	-1/2
0 ... 250 mbar	-1/2
0 ... 400 mbar	-1/2
0 ... 500 mbar	-0,2/2
0 ... 600 mbar	-0,2/2
0 ... 1 bar	-1/4
0 ... 1,6 bar	-1/4
0 ... 2 bar	-1/4
0 ... 2,5 bar	-1/10
0 ... 4 bar	-1/10
0 ... 5 bar	-1/10
0 ... 6 bar	-1/20
0 ... 10 bar	-1/40
0 ... 10 bar	-1/105 (1) (2)
0 ... 16 bar	-1/40
0 ... 20 bar	-1/40
0 ... 25 bar	-1/100
0 ... 40 bar	-1/100
0 .. .50 bar	-1/100
0 ... 60 bar	-1/200
0 ... 100 bar	-1/200
0 ... 160 bar	-1/400
0 ... 250 bar	-1/600
-1 ... 1 bar	-1/4
-1 ... 1,5 bar	-1/4
-1 ... 3 bar	-1/10
-1 ... 5 bar	-1/10
-1 ... 9 bar	-1/40

(1) only process connection G1/2 B; (2) burst pressure 175 bar

Niveau

Level

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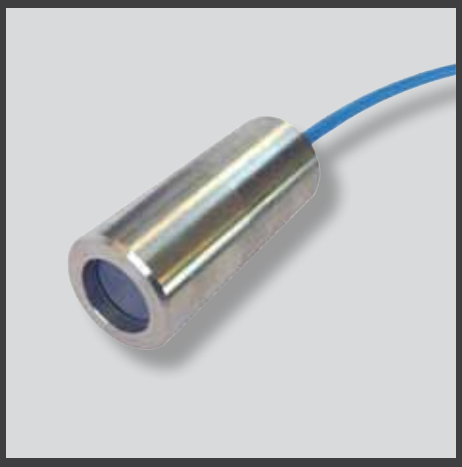


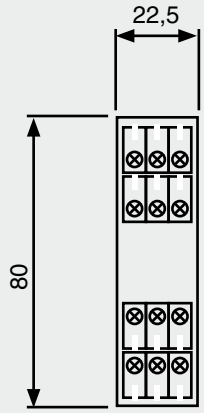
Sensors

TIVAL®

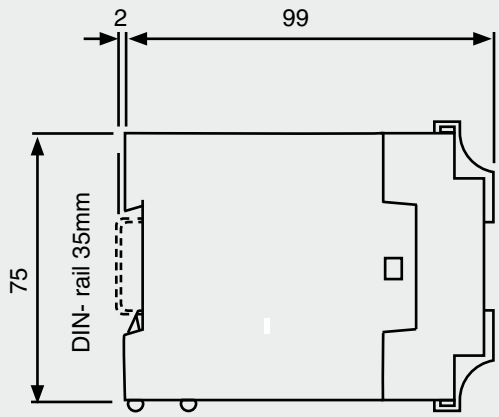
Sketches + Notes

Level controller TS-NW2

Liqiud level monitoring of electroconductive liquids,
for connection of immersion electrodes



12-terminal housing



Application

- Level monitoring of electroconductive liquids
- Filling and draining of tanks and reservoirs
- Monitoring of wells
- Dry-running protection

Description

- Mounting width 22,5 mm
- Two change-over contacts
- Connection ports for up to three immersion electrodes
- Resistance range 100 kW / 2 MW

The TS-NW2 devices are level relays used for monitoring the levels of conductive liquids. The exciting voltage must be applied to terminals A1 and A2 during operation of the devices. Single-terminal electrodes are used for recording measured values. The test circuit of the electronic control is electrically isolated from the power supply, the transformer used is manufactured according to VDE 0551. Electrode current 10 mA, electrode voltage 18 V AC. The delay on energization and the drop-out time are both 0,6 s.

1-point control

The reference electrode or conductive vessel wall is connected to terminal B1. The maximum electrode is connected to terminal B2. If the maximum electrode is not moistened by the liquid, then the output relay is attracted instanteneously. If the maximum electrode is moistened by the liquid, then the output relay returns to its normal position. For this function, terminals B1-X2 must be bridged in the case of TS-NW2. Without the jumper the relay function is reversed.

2-point control

The devices are connected as for the 1-point control with the addition of an electrode (minimum electrode) connected to terminal B3. If the maximum electrode B2 is not moistened by the liquid, then the output relay is attracted instantaneously. If the maximum electrode is moistened by the liquid, then the output relay returns to its normal position. If the minimum electrode is no longer moistened by the liquid, then the output relay attracts again. For this function, terminals B1-X2 must be bridged in the case of TS-NW2. Without the jumper the relay function is reversed.

Accessories

Immersion Electrode EL-V

Types

Order reference	Part No.
TS-NW2 (230 V – 100 kΩ)	1090 001
Other operating voltages and other resistance ranges upon request.	

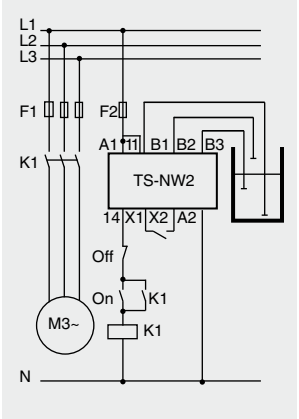
Level controller TS-NW2

Liqiud level monitoring of electroconductive liquids,
for connection of immersion electrode

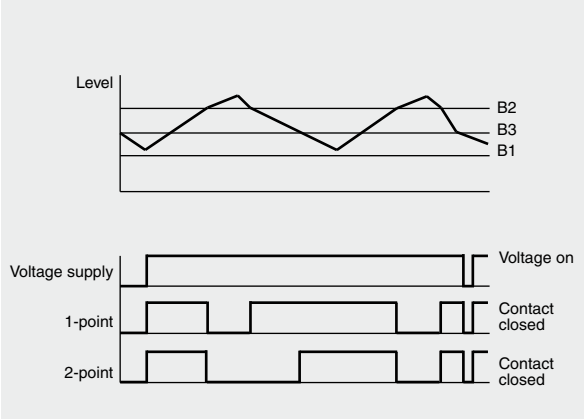
Technical data	Type: TS-NW2
Repeat accuracy	± 0,2 %
Setting accuracy at end of scale	± 4 %
Power consumption	2,5 to 3 VA
Voltage tolerance range	0,85 to 1,1 U_B
Duty cycle	100 % continuous
Max. continuous current	5 A AC, 2 change-over contacts, 1 A DC
Operating voltage U_B	24 V AC, 42-48 V AC, 110-127 V AC, 230 V AC
Relay operation	reversal of switching function
Resistance ranges	1 KΩ ... 100 KΩ, 10 kΩ ... 2 MΩ
Max. switching voltage	250 V AC, 50 ... 60 Hz, 250 V DC
Max. switching rate	6000 operations / h
Mechanical life	3 x 10^7 operations
Contact material	silver cadmium oxide or equivalent material
Ambient temperature	- 25 ... + 70° C
Climatic resistance	to DIN 40040, class F
Shock / wVibration resistance	5 g in all 3 planes, approx. 32 Hz
Test voltage	2500 V, 50 Hz
Standards	to DIN VDE 0435
Leakage paths / Air gaps	DIN VDV 0110-1, DIN EN 50178, dregree of pollution 2, category of overvoltage III
Operating position	no restriction
Weight	~ 120 g for 22,5 mm housing
Class of protection	IP 20, Finger-touch and back-of-handtouch protection to VDE 0106/100 as well as VBG4.
Conductor connection	2 x 1,5 mm^2 massive wire 2 x 1,0 mm^2 strand with hull DIN 46228
Mounting dimensions	to DIN EN 50022
Terminal markings	to DIN EN 40050
Visual swtiching state (green) and voltage supply (red)	
When mounting TS-NW2 side by side (in non-air-conditioned cabinets under frequently continuing overvoltage from mains power supply during longer periods) please install with ≥ 5 mm gap.	

We reserve the right to make changes to the technical specification.

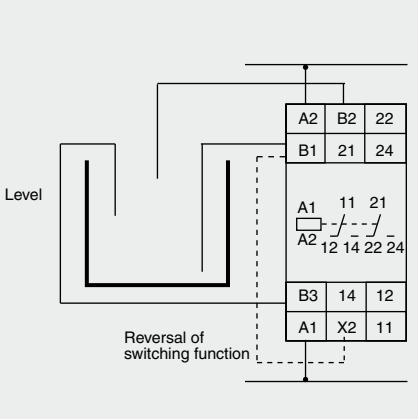
Basic wiring diagram



Function diagram

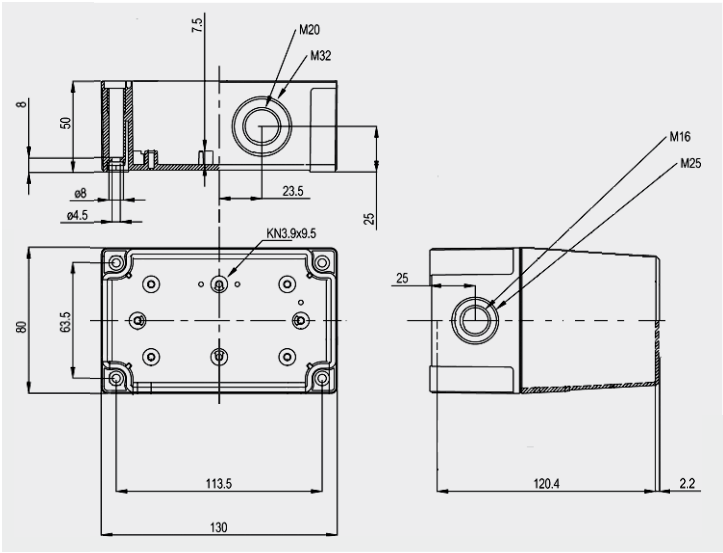


Wiring diagram



Level controller in enclosure TS-003 W

Pre-assembled Liqiud level monitoring of electroconductive liquids,
for connection of immersion electrode



Application

- Level monitoring of electroconductive liquids
- Filling and draining of tanks and reservoirs
- Monitoring of wells
- Dry-running protection

Description

- Level controller TS-NW 2 pre-assembled in enclosure, protection class IP 66
- Enclosure material: polycarbonate (PC)
- Built-in PE-terminal
- One pair of cable glands M16 and M20 included

The TS-003 W devices consist of level controller TS-NW 2 which is pre-assembled in an enclosure with protection class IP 66. TS-003 W devices are used for level monitoring of conductive liquids. The exciting voltage must be applied to terminals A1 and A2 during operation of the devices. Single-terminal electrodes are used for recording measured values. The test circuit of the electronic control is electrically isolated from the power supply, the transformer used is manufactured according to VDE 0551. Electrode current 10 mA, electrode voltage 18 V AC. The delay on energization and the drop-out time are both 0,6 s.

1-point control

The reference electrode or conductive vessel wall is connected to terminal B1. The maximum electrode is connected to terminal B2. If the maximum electrode is not moistened by the liquid, then the output relay is attracted instantaneously. If the maximum electrode is moistened by the liquid, then the output relay returns to its normal position. For this function, terminals B1-X2 must be bridged in the case of TS-NW2. Without the jumper the relay function is reversed.

2-point control

The devices are connected as for the 1-point control with the addition of an electrode (minimum electrode) connected to terminal B3. If the maximum electrode B2 is not moistened by the liquid, then the output relay is attracted instantaneously. If the maximum electrode is moistened by the liquid, then the output relay returns to its normal position. If the minimum electrode is no longer moistened by the liquid, then the output relay attracts again. For this function, terminals B1-X2 must be bridged in the case of TS-NW2. Without the jumper the relay function is reversed.

Accessories

Immersion Electrode EL-V

Type

Order reference	Part No.
TS-NW2 (230 V – 100 kΩ)	1090 006
Other operating voltages and other resistance ranges upon request.	

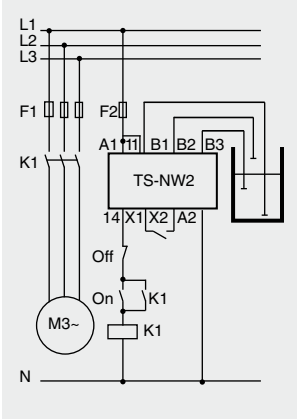
Level controller in enclosure TS-003 W

Pre-assembled Liqiud level monitoring of electroconductive liquids,
for connection of immersion electrode

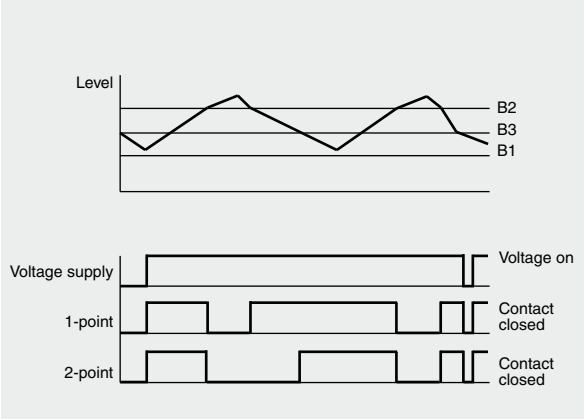
Technical data	Type: TS-003 W
Repeat accuracy	± 0,2 %
Setting accuracy at end of scale	± 4 %
Power consumption	2,5 to 3 VA
Voltage tolerance range	0,85 to 1,1 U_B
Duty cycle	100 % continuous
Max. continuous current	5 A AC, 2 change-over contacts, 1 A DC
Operating voltage U_B	24 V AC, 42-48 V AC, 110-127 V AC, 230 V AC
Relay operation	reversal of switching function
Resistance ranges	1 KΩ ... 100 KΩ, 10 kΩ ... 2 MΩ
Max. switching voltage	250 V AC, 50 ... 60 Hz, 250 V DC
Max. switching rate	6000 operations / h
Mechanical life	3 x 10^7 operations
Contact material	silver cadmium oxide or equivalent material
Ambient temperature	- 25 ... +70° C
Climatic resistance	to DIN 40040, class F
Shock/Vibration resistance	5 g in all 3 planes, approx. 32 Hz
Test voltage	2500 V, 50 Hz
Standards	to DIN VDE 0435
Leakage paths / Air gaps	DIN VDV 0110-1, DIN EN 50178, dregree of pollution 2, category of overvoltage III
Operating position	no restriction
Weight	~ 120 g for 22,5 mm housing
Class of protection	IP 20, Finger-touch and back-of-handtouch protection to VDE 0106/100 as well as VBG4.
Conductor connection	2 x 1,5 mm^2 massive wire 2 x 1,0 mm^2 strand with hull DIN 46228
Mounting dimensions	to DIN EN 50022
Terminal markings	to DIN EN 40050
Visual swtiching state (green) and voltage supply (red)	
When mounting TS-NW2 side by side (in non-air-conditioned cabinets under frequently continuing overvoltage from mains power supply during longer periods) please install with ≥ 5 mm gap.	

We reserve the right to make changes to the technical specification.

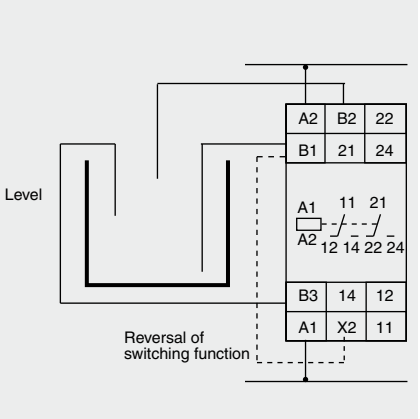
Basic wiring diagram



Function diagram



Wiring diagram



Immersion electrode EL-V

For connection to level controller

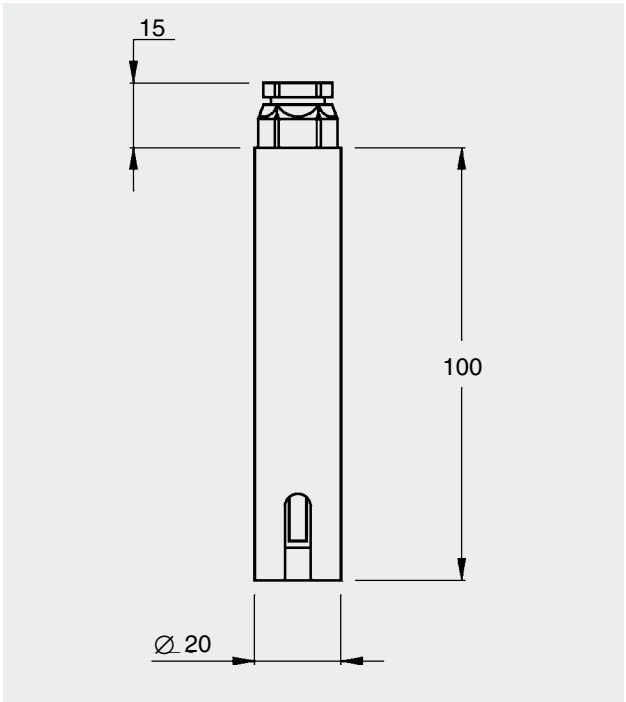
Application

- Conductive liquids
- Water supply
- Well application
- Pumping stations
- Dry run protection

Description

- Single pole immersion electrode
- Stainless steel core
- Polypropylene protective cover
- Overall length 115 mm
- Overall diameter 20 mm

Scale drawing



Type

Order reference	Part no.
Electrode EL-V	1090002

Technical data	Type: Electrode EL-V
Dimensions:	∅ 20 mm, Length 115 mm
Electrode core:	Stainless steel 1.4305
Protective cover:	Polypropylene
Max. media temperature:	+70° C
Recommended cable:	H 07 RN-F, 1,5 mm^2

Sensors

TIVAL®

Sketches + Notes

Float switch OPT

Description

- Automatic liquid level control
- Hollow body, ball and microswitch equipped
- Optionally filling or emptying or both functions combined available
- Polypropylene (PP) housing
- Adaptor plug type available
- Maintenance-free operation

Types	Function	cable lenghts, standard
OPT 1	emptying	1,5, 3, 5, 10 , 15, 20 m (other lenghts upon request)
OPT 2	filling	1,5, 3, 5, 10 , 15, 20 m (other lenghts upon request)
OPT 3	emptying +filling	1,5, 3, 5, 10 , 15, 20 m (other lenghts upon request)

Type designation example: OPT 1 – 5 m

Technical data	Type		
	OPT 1	OPT 2	OPT 3
Switching capacity	10(6) A, 250 V	10(6) V, 250 V	6(6) A, 250 V
Cable type	H07 RN-F 3G1 Ozoflex plus	H07 RN-F 3G1 Ozoflex plus	A05RN-F 4G0,75
Operating temperature	max. +80° C	max. +80° C	max. +75° C
Switching angle	± 45°	± 45°	± 45°
Housing volume	290 ccm	290 ccm	290 ccm
Dimensions	81 x 42 x 166 mm	81 x 42 x 166 mm	81 x 42 x 166 mm
Colour	yellow	yellow	yellow
Housing material	non-toxic PP	non-toxic PP	non-toxic PP
Protection class	IP 68	IP 68	IP 68

Chemical resistance housing material		
no impairment	**low impairment**	**high impairment**
acetic acid	orthophosphoric acid 85 %	hydrochloric acid 38 %
water	ethyl alcohol	sulfuric acid 98 %
seawater	methyl alcohol	nitric acid 50 %
soap solution 5 %	phenol	petrol, benzene
	glycose	chloroform
	ammonium nitrate	sodium hypochlorite
	zinc sulfate	sodium hydroxide
		mineral oil
		trichloroethylene, xylene
		petroleum jelly, vaseline

Float switch OPT

Accessories

Sensors TIVAL

Weights

Cable-mount weight 220 g
Art.code 1091 005

Cable-mount weight 420 g
Art.code 1091 006

Anchoring clamps

Galvanized steel, zinc-plated
for cable diameters 5,5 ... 10,5 mm
Art.code 1091 002

Stainless steel
for cable diameters 6,5 ... 17,5 mm
Art.code 1091003

Float switch TS-MPS

Reed-contact equipped
Ready assembled or construction kit (without float pipe) - only in combination with level control TS-NIA

Float switch TS-MPS

Application

Reed-module equipped float switches are perfectly appropriate for monitoring and controlling of in-tank liquid levels.

They are used as display for messages like empty status signal / full status signal, for controlling of pumps or valves as well as for alarm status signals.

The variety of applications demands individual configuration. Following this need, the float switch TS-MPS is optional available as a construction kit for self-installation.

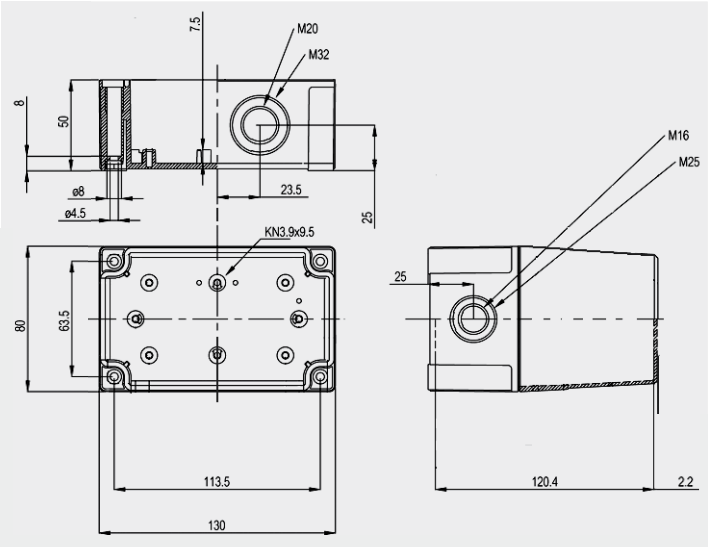
Description

- Liquid level probe/sensor, reed-contact equipped
- Float pipe available in a choice of materials, PVC, PP, PVDF or stainless steel
- Up to 5 reed-modules per application
- Float lever, permanent magnet equipped
- Male screw-in thread 11/2“ and 2“
- Spacious connection chamber
- Protection class IP 65

TIVAL Sensors magnetic float switches are equipped with special designed reed-modules mounted inside the float pipe.The cable length between the individual reed-modules defines the pitch between the desired liquid levels. Reed-module actuation is provided by a permanent magnet, which is part of the float lever. The lever moves along the float pipe and is the system`s only mobile part.

The *TIVAL* Sensors Level Control TS-NIA is required for liquid level interpretation

Dimensional drawing



Components

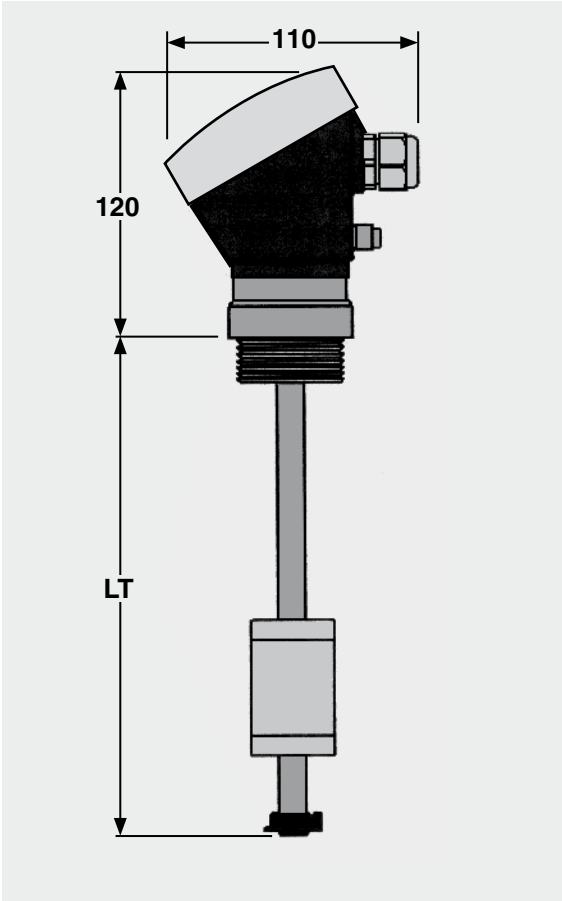
Connector head:	including cable clamps, float lever and sealing plug.
Reed-module:	MPS 05
Float lever (cylindric):	material PP ø 38 x 60 mm
	material PVDF ø 55 x 70 mm
	material stainless steel ø 52 x 52 mm

Float switch TS-MPS

Reed-contact equipped
Ready assembled or construction kit (without float pipe) - only in combination with TS-NIA

Technical data	Type: TST-MPS			
Material float pipe	PVC	PP	PVDF	Stainless steel
Material connector head	PBT	PBT	PBT	PBT
Medium temperature, max	+60° C	+60° C	+60° C	+60° C
Medium density, max (g / cm³)	0,5	0,5	0,9	0,7
Tank pressure, max (bar)	2	2	3	30
Protection class	IP 65	IP 65	IP 65	IP 65
Float pipe diameter (mm)	ø16 x 1,2	ø16 x 1,8	ø20 x 1,8	ø15 x 1
Float pipe length (mm)	min. 100 max. 2500	min. 100 max. 2500	min. 100 max. 2500	min. 100 max. 2500
Process connection*	1 1/2"	1 1/2"	1 1/2"	2"
Cable, connection between reed-modules	1 mm² (rigid)	1 mm² (rigid)	1 mm² (rigid)	1 mm² (rigid)

* Process connection in different sizes, materials and flange connection upon request.



Level control TS-NIA

Construction kit

For flexible and individual adaption to variable tank dimensions and liquid levels the float switch TS-MPS is optional available as a construction kit for self-installation. This version is supplied without a float pipe.

Please refer to the following chart for combining the components for your individual application.

Construction kit

Type	Part No.
Connector head NR 11/2“ (PVC)	1090105
Reed-module MPS 05	1090106
Level control TS-NIA (230 V)	1090100

Level control TS-NIA

For liquids, must be used with float switch (i.e. TS-MPS)

Level control TS-NIA

Float switch TS-MPS

Description

- Monitoring and control of 1 to 5 liquid levels
- 3 operating modes: filling, emptying and level monitoring
- Number of reed-modules adjustable to scale
- 5 LEDs for liquid levels display
- Adjustable time delay for compensation of wave motion

The level control TS-NIA must be used with a float switch (i.e. TS-MPS). Number of reed-modules in the float switch has to be equal to the number of liquid levels to be monitored. Float switch and level control are forming a functional unit. If the number of reed-modules set to the control unit marked „MODULES“ differs from the number of the actual installed reed-modules in the float switch, the 5 LEDs (N1 to N5) will conjointly flash after supply voltage is connected. No function will be delivered. After setting the right number of modules to the control unit the proper function will be provided immediately.

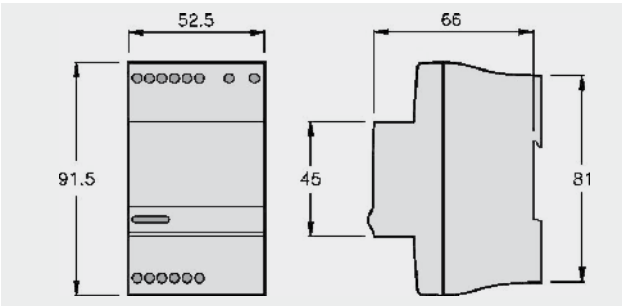
The level control TS-NIA can be comfortably set to one of the three different working modes -filling, emptying and level monitoring- by using a front-mounted turn-knob.

The depictable performance of the level control depends on the selected working mode as well as on the number of reed-modules installed in the float switch.

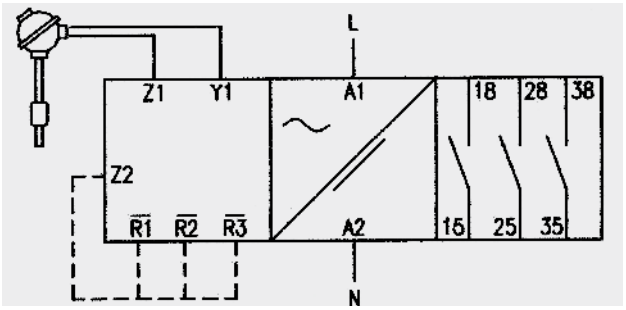
Level monitoring feature, displayed by yellow LEDs, is available independently from the working mode set to the level control.

Important notice: Prior to initial use, the floater must be moved one time fully up and down the float pipe to assure safe level readout!

Dimensional drawing



Scale drawing TS-NIA



Terminal assignment

Function	No. of modules	Filling	Emptying	Monitoring
Minimum	1		X	
Maximum	1	X		
Maximum, minimum	2	X	X	
Max., min., min. - Alarm	3		X	
Max., min. max. - Alarm	3	X		
Max., min., min. and max. - Alarm	4	X	X	
Level control	1 - 5			X

Level control TS-NIA

For liquids, must be used with float switch (i.e. TS-MPS)

Time delay function

The adjustable time delay function –potentiometer „TIME“- provides the comfort of avoiding any unintentional switching action caused by in-tank wave motion. The time delay is connected to to the particular alarmrelays during function setting to „Filling“ and „Emptying“. If the function setting „LEVEL MONITORING“ is choosen, the adjusted time delay comes across all relais.

The yellow LED assigned to the particular reed-module will flash as long as the adjusted time delay value has expired.

Inverted relay function

For better application adaption the the TS-NIA provides the option of inverting the function of each of the relais. This option is activated by bridging the output Z2 with the outputs R1, R2 and/or R3.

Sensor cable specification

A shielded cable must be used.

Total cable resistance has to be less or equal 1.0 Ohm.

The cable lenght to be detected is defined as the cable length between the float switch TS-MPS an the level control TS-NIA.

Relay outputs

Each relay output is assigned to a single function in addiction to the respectively choosen operating mode and the number of reed-modules installed.

Function filling	
1 reed-module	relay 1 = pump control
2 reed-modules	relay 2 = pump control
3 reed-modules	relay 2 = pump control; relay 3 = max. alarm
4 reed-modules	relay 1 = min. alarm; relay 2 = pump control; relay 3 = max. alarm
5 reed-modules	relay 1 = min. alarm; relay 2 = pump control; relay 3 = max. alarm

For use of more than 4 modules, Z2 must be bridged to R1

Function emptying	
1 reed-module	relay 1 = pump control
2 reed-modules	relay 2 = pump control
3 reed-modules	relay 1 = min. alarm; relay 2 = pump control
4 reed-modules	relay 1 = min. alarm; relay 2 = pump control; relay 3 = max. alarm
5 reed-modules	relay 1 = min. alarm; relay 2 = pump control; relay 3 = max. alarm

For use of more than 4 modules, Z2 must be bridged to R1

Function level monitoring	
1 reed-module	relay 2 = middle liquid level
2 reed-modules	relay 1 = min. liquid level; relay 2 = middle liquid level
3 reed-modules	relay 1 = min. liquid level; relay 2 = middle liquid level.; relay 3 = max. liquid level
4 - 5 reed-modules	relay a.m.; display liquid level by built-in LEDs

Technical data	Type: TS-NIA
Operation voltage	220 / 230 V AC; others on request
Relay (NO)	AC 1 / AC 15: 6 / 3 A (250 V, 50 / 60 Hz)
Electrical life span	30×10^6
Protection class	IP 20
Storage temperature	-50 ... +85° C
Environment temperature	-20 ... +30° C
LED display:	green LED: unit engaged red LED (3): relay closed yellow LED (5): liquid level
Operating voltage in sensor:	5 V DC, max. 24 V DC
Operating current in sensor:	1 mA

Designed and manufactured acc. to 89/366/EEC, 92/31 EEC and 73/23 EEC

Float switches LS 303-51 and 803-51

Liquid level control in tanks (horizontal installation)

Description

- For use in potable and waste water
- Sidewall mounting in tanks
- Inside or outside mounting
- Reed contact switch
- NC or NO contacts acc. to mounting position (180°)
- M16 x 2 mounting thread
- Silicone or NBR gaskets
- UL / CSA approval

Technical data	Type: LS 303-51 (Silicon) Type: LS 303-51 N (NBR)	Type: LS 803-51 (Silicon) Type: LS 803-51 N (NBR)
Housing material	polyamide 6.6 (blue)	PP, glass-fiber reinforced (black)
Contacts	one reed contact 1S	one reed contact 1S
Max. Voltage	250 V AC	250 V AC
Max. switching current/power	1A / 15 W	1A / 15 W
Media temperature	max. +110° C	max. +80° C
Max. pressure	4 bar	4 bar
Cable	0,5 m PVC single conductor	0,5 m PVC single conductor
Gasket type	silicone or NBR (nitrile)	silicone or NBR (nitrile)
Media density	> 0,85	> 0,65

Electronic level switch TS-LSD 30

Rotatable, easily readable and rugged 14-segment LED display
Range up to 669 mm

Application

- Machine tools
- Hydraulics and pneumatics
- Cooling and lubrication systems
- Mechanical engineering

Description

- Easily readable and rugged 14-segment LED display; 180° electronically rotatable
- User-friendly 3-button control
- Simple menu navigation (acc. to VDMA standards)
- Flexible initial operation provided by independent rotatability of M12x1 connector (320°) and display (330°)
- Two switching outputs and one analog output possible
- Ranges: 189, 309, 349, 459, 669 mm

The TS-LSD 30 is easily adaptable to the installation situation on initial operation. Based on a double housing construction rotatability of more than 300° the display can be adjusted independently from the electrical connection. The display always allows alignment to the operators view angle and the M12 connector can be positioned to the desired cable routing. The display is 180° electronically rotatable for overhead mounting situations.

The electrical connector housing and thread are made of stainless steel. Overtighting or plug blowoff is almost impossible.

Technical data	Type: TS-LSD 30
Sensor	resistance measuring chain with reed switches and float
Resolution	< 6 mm
Response time	< 700 ms
Range	189, 309, 349, 459, 669 mm
Specific gravity range of the medium	0,7 g / cm³
Maximum working pressure	3 bar
Analog output	4 ... 20 mA, 0 ... 10 V DC
Contact output	DC PNP, max. 200 mA
Update time	200 ms
Media temperature	-20 ... +80° C
Ambient temperature	-20 ... +80° C
Process connection	G 3/4 A DIN 3852-E or 3/4 NPT
Electrical connection	connector M12x1 IP 67

Electronic level switch TS-LSD 30

Rotatable, easily readable and rugged 14-segment LED display
Range up to 669 mm

Technical data	Type:TS-LSD 30
Material Wetted parts Pressure Connection Guide tube Float Housing Case Display head Keypad Display window	 CrNi-Steel 316Ti CrNi-Steel 316Ti NBR (see „Media compatibility") CrNi-Steel 304 PC + ABS-Blend TPE-E PC
Operating voltage U_B	15 ... 35 V DC
Output signal and permitted max. load R_A	4 ... 20 mA, 3-wire $R_A \leq 0{,}5$ kΩ 0 … 10 V DC, 3-wire $R_A > 10$ kΩ
Offset adjustment (display)	max. +1500 mm
Scaling (display and analogue signal) Zero point Final value	 max. +25 % of span max. -25 % of span
Measuring element Resolution Response time	 < 6 mm < 700 ms
Switching and indication accuracy	1 % of span (display ±1 digit) at room temperature
Current consumption	max. 100 mA
Total current consumption	max. 600 mA incl. switching current
Switching output Type Numbers of outputs Output function Switching voltage Switching current Settling time Accuracy	adjustable individually by external keypad transistor switching output PNP 1 or 2 NO / NC; window- and hysteresis function freely adjustable Operating voltage U_B minus 1 V DC SP1: 250 mA SP2: 250 mA ≤ 200 ms 2,5 mm steps
Isolating voltage	500 DC V
Display Principle Accurancy	 14-segment LED, red 4-digit, figures height 9 mm, 180° electronically rotatable ≤ 1,0 % of range ± 1 Digit
Permitted temp. ranges Media Environment Storage permitted humidity	 -20 ... +80° C -20 ... +80° C -20 ... +80° C 45 … 75 % relativ
Nominal temp. range	0 ... +80° C
Reference conditions	relative humidity: 45 ... 75 % acc. to IEC 61298-1
RoHS-conformity	yes
CE- conformity EMV-guideline	 2004/108/EG, EN 61326-2-3 emission (group 1, class B) interference immunity (industrial use)
Weight	~ 300 g
Electrical protection class Overvoltage protection Short-circuit strengh Polarity protection	 40 V DC S+ / SP1 / SP2 against U- U+ against U-

Assembled cable and connection accessories (see page 176)




Electronic level switch TS-LSD 30

Rotatable, easily readable and rugged 14-segment LED display
Range up to 669 mm

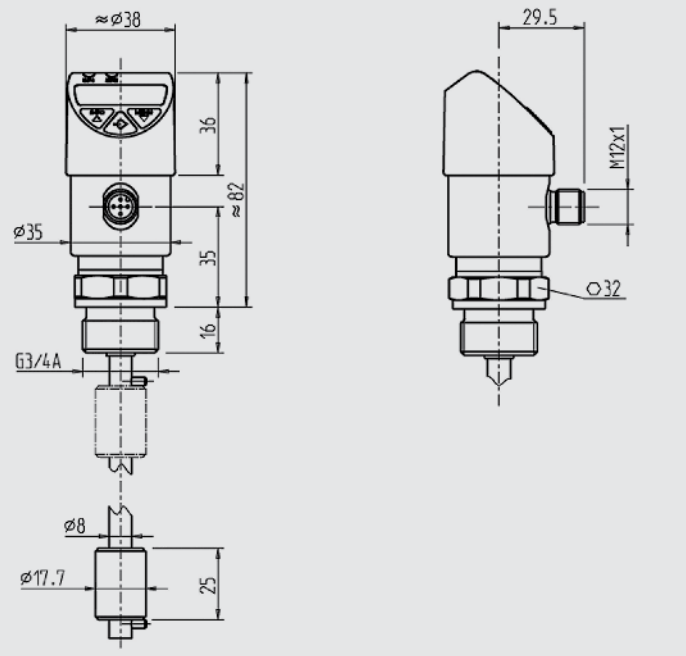
Media compatibility

Test following ISO 7620, section 6, table 1

Medium		Standard
Mineral oil	HLP	per DIN 51524
Aqueous solution	HFC	per VDMA 24317
Organic ester	HFD-U	per VDMA 24317
Triglyzeride (rape oil)	HETG	per VDMA 24568
Synthetc ester	HEES	per VDMA 24568
Poyglycols	HEPG	per VDMA 24568

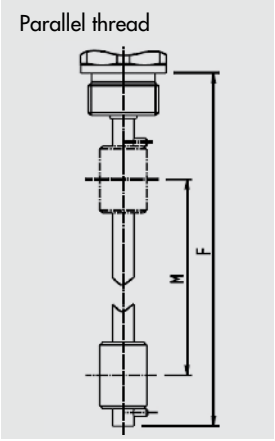
Dimensional drawing

Level switch



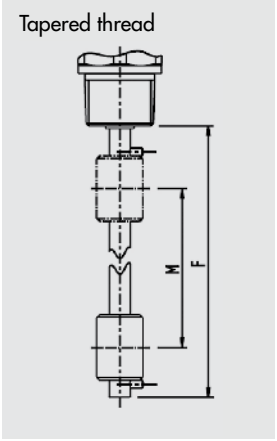
Insertion length

Parallel thread



F	M
250	189
370	309
410	349
520	459
730	669

Tapered thread



F	M
250	189
370	309
410	349
520	459
730	669

Connection diagram

Circular connector M12x1, 4 pin

Assignment

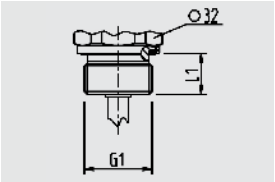
U_+	U-	S_+	SP1	SP2
1	3	2	4	2

Circular connector M12x1, 5 pin

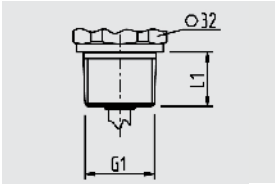
Assignment

U_+	U-	S_+	SP1	SP2
1	3	5	4	2

Process connections



G1	L1
G 3/4 A DIN 3852-E	16



G1	L1
3/4 NPT	20

Legend:	
U_+	positive operating voltage
U-	negative operating voltage
SP1	switching output 1
SP2	switching output 2
S_+	analog output

Level probe TST-HD 133

Hydrostatic pressure transmitter for liquid levels,
also available in Ex design, 40 mm diameter

Description

- Stainless steel housing 1.4404, IP 68
- Plastic housing, available in PP or PVDF
- Measuring range from 40 mbar … 60 bar
- Measurement error < 0,2 %
- High overload stability
- Ex II 1G EEx ia IIC T4/T6
- Cable according to Bg VV-1.12.96 –recommendation, appropriate for foodstuff and drinking water
- AL_2O_3 ceramic sensor
- Optional 0 … 10 V DC output signal

The level probe HD 133 has been designed as a hydrostatic pressure transmitter for liquid level measurements. Variable process connections and electrical hookups are available.

The housing is designed in stainless steel as a standard. Polypropylene (PP) or PVDF housings and designs with integrated overload protection (HD 135) are available.

The standard process connection is equipped with a FPM (Viton) gasket.

Type designation: example

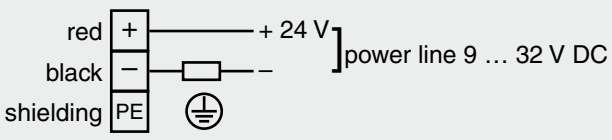
TST-HD 133, 400 mbar, 4-20 mA, 20 m PE cabel

Measuring range (bar)	Measuring range (mmWS)	Overload (bar)
0 ... 40 mbar*	0 … 400 mmWS*	-0,3/4
0 ... 50 mbar*	0 … 500 mmWS*	-0,3/4
0 ... 60 mbar*	0 … 600 mmWS*	-0,3/4
0 ... 100 mbar	0 … 1 mWS	-0,3/4
0 ... 160 mbar	0 … 1,6 mWS	-0,6/5
0 ... 200 mbar	0 … 2 mWS	-1/6
0 ... 250 mbar	0 … 2,5 mWS	-1/6
0 ... 0,4 bar	0 … 4 mWS	-1/6
0 ... 0,5 bar	0 … 5 mWS	-1/6
0 ... 0,6 bar	0 … 6 mWS	-1/10
0 ... 1,0 bar	0 … 10 mWS	-1/10
0 ... 1,6 bar	0 … 16 mWS	-1/18
0 ... 2,0 bar	0 … 20 mWS	-1/18
0 ... 2,5 bar	0 … 25 mWS	-1/18
0 ... 4,0 bar	0 … 40 mWS	-1/25
0 ... 6,0 bar	0 … 60 mWS	-1/40
0 ... 10 bar	0 … 100 mWS	-1/40
0 ... 16 bar	0 … 160 mWS	-1/40
0 ... 20 bar	0 … 200 mWS	-1/40
0 ... 25 bar	0 … 250 mWS	-1/40
0... 40 bar	0 … 400 mWS	-1/60
0 ... 60 bar	0 … 600 mWS	-1/100

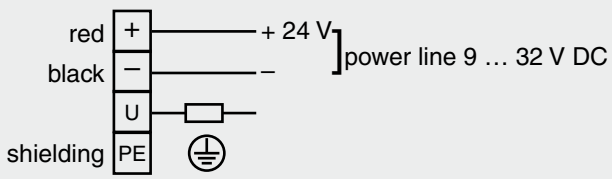
*accuracy 0,5 %

Electrical connection

4 ... 20 mA, 2-wire



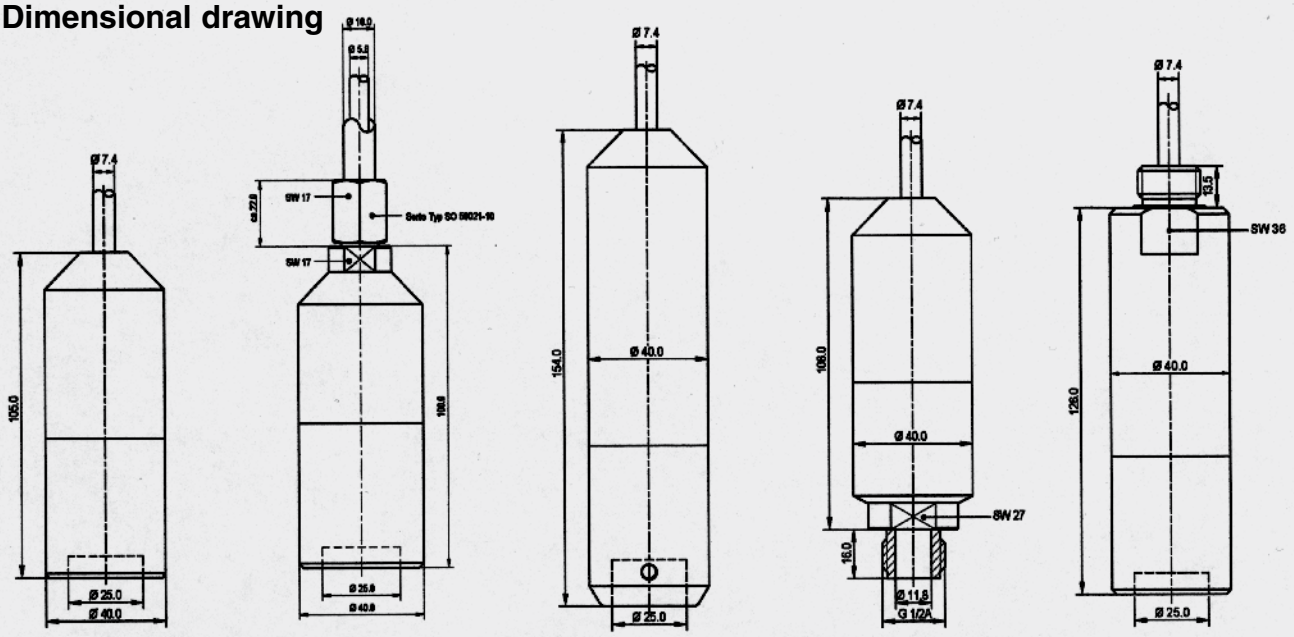
4 ... 10 V, 3-wire



Level probe TST-HD 133

Hydrostatic pressure transmitter for liquid levels,
also available in Ex design, 40 mm diameter

Dimensional drawing

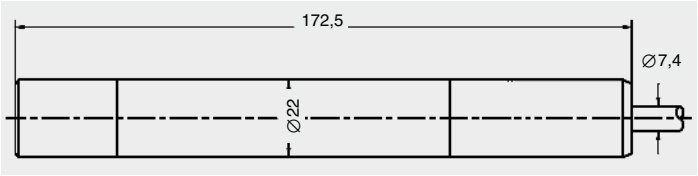


Standard S/R PP/PVDF G 6

Technical data	Type: TST-HD 133
Measuring range	0 ... 40 mbar to 0 ... 25 bar
Output signal	4 ... 20 mA, 2-wire 0 … 10 V DC, 3-wire
Accuracy	< 0,2 % of max. final value
Response time	200 ms, other values upon request
Operating voltage U_B	9 … 32 V DC, max. 30 mA (12 … 30 V for EX-types)
Media temperature	-25 ... +80° C (special version -25 ... +120° C) -25 ... +70° C for EEx ia IIC T4 -25 ... +50° C for EEx ia IIC T6
Temperature influence	< 0,015 / K % of measuring span
Housing	stainless steel, 1.4404
Protection class	IP 68
Weight, level probe	0,5 kos, approx
Weight, cable	500 g per 10 meters
Electric hookup	polyethylen-(PE) suspension cable, kevlar reinforced, wire cross-section 0,34 mm², ventilation hose and air filter equipped. FDR-, PUR-, PTFE-cable available

Level probe TST-HD 135

22 mm diameter, also available in Ex design.
With integrated overvoltage protection



Construction

- 22 mm diameter, perfect for 1” sounding pipes
- Measuring range from 100 mbar to 20 bar
- Accuracy < 0,25 %
- Ex II 1 G EEx ia IIC T4/T6
- Integrated overvoltage protection
- Cable acc. to Bg VV-1.12.96-recommendation, appropriate for foodstuff and drinking water
- Optional: integrated Pt100 sensor for temperature measurement

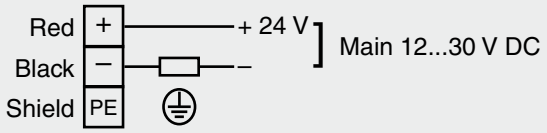
Type designation: example

TST-HD 135, 400 mbar, 4-20 mA, 2 Ltr., 10 m PE cable

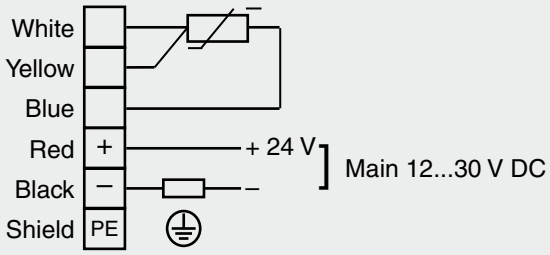
Measuring range (bar)	Measuring range (water column in m)	Overload (bar)
0 ... 100 mbar	0 … 1 mWS	-0,3/4
0 ... 160 mbar	0 … 1,6 mWS	-1/5
0 ... 200 mbar	0 … 2 mWS	-1/5
0 ... 250 mbar	0 … 2,5 mWS	-1/5
0 ... 0,4 bar	0 … 4 mWS	-1/6
0 ... 0,5 bar	0 … 5 mWS	-1/6
0 ... 0,6 bar	0 … 6 mWS	-1/10
0 ... 1,0 bar	0 … 10 mWS	-1/10
0 ... 1,6 bar	0 … 16 mWS	-1/15
0 ... 2,0 bar	0 … 20 mWS	-1/15
0 ... 2,5 bar	0 … 25 mWS	-1/15
0 ... 4,0 bar	0 … 40 mWS	-1/25
0 ... 6,0 bar	0 … 60 mWS	-1/40
0 ... 10 bar	0 … 100 mWS	-1/40
0 ... 16 bar	0 … 160 mWS	-1/40
0 ... 20 bar	0 … 200 mWS	-1/40

Electrical connection

4 ... 20 mA, 2-wire



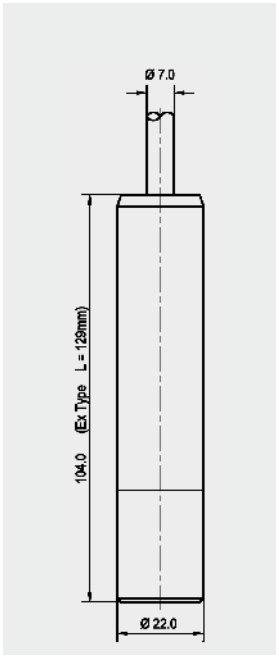
4 ... 20 mA, 2-wire and Pt 100 sensor, 3-wire

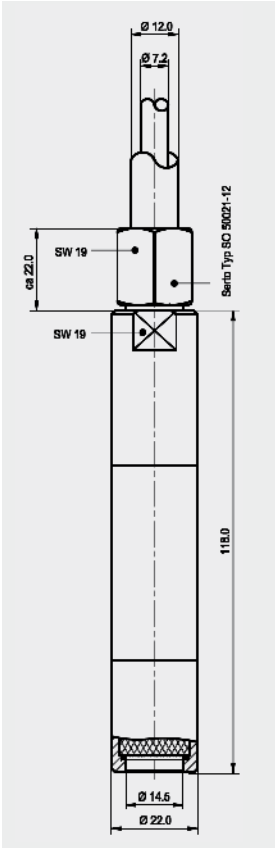


Technical data	Type: TST-HD 135
Measuring range	0 ... 100 mbar to 0 ... 20 bar
Output signal	4 … 20 mA, 2-wire
Accuracy	< 0,25 % of max. final value
Response time	200 ms (other values upon request)
Operating voltage U_B	12 ... 30 V DC, max. 30 mA
Media temperature	-25 ... +80° C -25 ... +70° C for EEx ia IIC T4 -25 ... +50° C for EEx ia IIC T6
Temperature influence	< 0,015 / K % of measuring span
Housing	stainless steel, 1.4404, standard seal FPM (Viton)
Protection class	IP 68
Weight, level probe	~ 300 g
Weight, cable	500 g per 10 meters
Electric hookup	polyethylen-(PE) suspension cable, kevlar reinforced, wire cross-section 0,34 mm², ventilation hose and air filter equipped. FDR-, PUR-, PTFE-cable available

Level probe TST-HD 135 K

22 mm diameterr, also available in Ex design
Compact size





Description

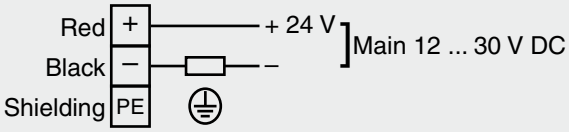
- 22 mm diameter, perfect for 1" sounding pipes
- Measuring range from 100 mbar to 20 bar
- Accuracy < 0,3 %
- Ex II 1 G EEx ia IIC T4/T6
- Cable acc. to Bg VV-1.12.96-recommendation, appropriate for foodstuff and drinking water
- Ceramic sensor AL_2O_3

Type key (example)

TST-HD 135 K, 200 mbar, 4-20 mA, 2-wire 10 m PE cable

Electrical connection

4 ... 20 mA, 2-wire



Measuring range (bar)	Measuring range (water column in m)	Overload (bar)
0 ... 100 mbar	0 ... 1 mWS	-0,3/4
0 ... 160 mbar	0 ... 1,6 mWS	-1/5
0 ... 200 mbar	0 ... 2 mWS	-1/5
0 ... 250 mbar	0 ... 2,5 mWS	-1/5
0 ... 0,4 bar	0 ... 4 mWS	-1/6
0 ... 0,5 bar	0 ... 5 mWS	-1/6
0 ... 0,6 bar	0 ... 6 mWS	-1/10
0 ... 1,0 bar	0 ... 10 mWS	-1/10
0 ... 1,6 bar	0 ... 16 mWS	-1/15
0 ... 2,0 bar	0 ... 20 mWS	-1/15
0 ... 2,5 bar	0 ... 25 mWS	-1/15
0 ... 4,0 bar	0 ... 40 mWS	-1/25
0 ... 5,0 bar		-1/40
0 ... 6,0 bar	0 ... 60 mWS	-1/40
0 ... 10 bar	0 ... 100 mWS	-1/40
0 ... 16 bar	0 ... 160 mWS	-1/40
2 ... 20 bar	0 ... 200 mWS	-1/40

Technical data	Type: TST-HD 135 K
Measuring range	0 ... 100 mbar to 0 ... 20 bar
Output signal	4 ... 20 mA, 2-wire
Accuracy	< 0,3 % of max. final value
Response time	200 ms (other values upon request)
Operating voltage U_B	9 ... 32 V DC, max. 30 mA (12...30 V for Ex-types)
Media temperature	-25 ... +80° C, -25 ... +70° C for EEx ia IIC T4, -25 ... +50° C for EEx ia IIC T6
Temperature influence	< 0,015 % / K of measuring range
Housing	stainless steel, 1.4404, standard seal FPM (Viton)
Protection class	IP 68
Weight, level probe	~ 200 g
Weight, cable	500 g per 10 meters
Electric hookup	polyethylen-(PE) suspension cable, kevlar reinforced, wire cross-section 0,34 mm², ventilation hose and air filter equipped. FDR-, PUR-, PTFE-cable available

Level probe TST-TRA 250 / 20

Hydrostatic pressure sensor for liquid level control
Special model in brass material, 22mm diameter

Applications

- For rainwater applications

Description

- Housing diameter 22 mm
- Housing length 88 mm
- Measuring range max. 250 cm
- 20 meter PE cable equipped
- Measuring accuracy < 1% full scale

Technical data	Type: TST-TRA 250/20
Output signal	4 … 20 mA, 2-wire
Operating voltage U_B	9 … 30 V DC, max. 30 mA
Media temperature	0 … +80° C
Weight, level probe	~ 850 g
Protection class	IP 68

Accessories for level probes

Anchoring clamp,galvanized steel, zinc-plated
for cable diameters 5,5 … 10,5 mm
Art.code 1091002

Anchoring clamp, stainless steel
for cable diameters 6,5 … 17,5 mm
Art.code 1091003

Accessories for level probes

Terminal enclosure with pressure balance TS-KG 80
Protection class IP 67
Art.code: 1091004

Universal isolation amplifier TV 500-Ex
Repeater transmitter ST 500 Ex
Please see page 172 for details

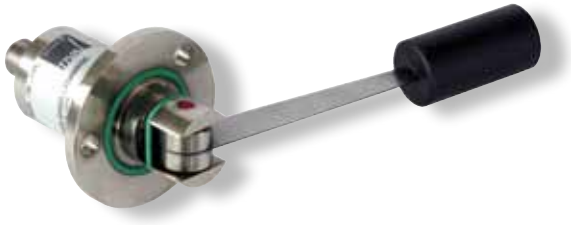
Digital display TS-WM 110
Please see page 168 for details

Digital display TS-MR 50
Please see page 166 for details

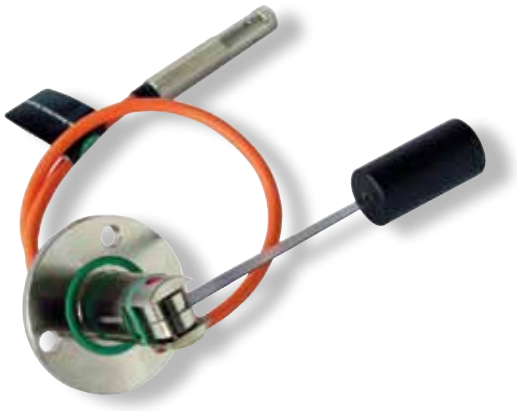
Zener diode barrier MTL 7787+
Please see page 175 for details

Joint lever transmitter TS-KNG

Fluid level measurement, i.e. for gear box assemblies



TS-KNG standard



TS-KNG high-temperature type

Joint lever captures almost 180˚ deflection or parts of angle.

Description

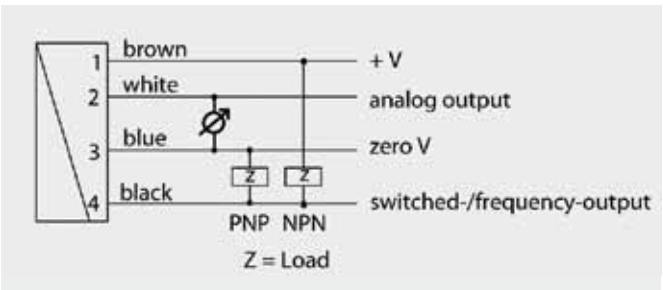
- High level measuring accuracy
- Joint lever capable of almost 180˚ measuring deflection
- Suitable for measurement in pressurized holding tanks
- Simultaneous switching and measuring
- Output linear to filling level or fill quantity
- Suitable also for viscious liquids
- Flange design allows fast installation and removal
- Vertical operation suitable
- Compact and rugged design

A swivel-mount magnet is attached to the lightweight joint lever with its floater. Fluid level differentials cause corresponding joint lever deflection. Magnet rotation is detected by an analog hall-sensor and altered to a standardized signal by microcontroller. The fluid level allocation can be set independently and is output by a 4 ... 20 mA or 0 ... 10 V or a frequency signal. Switch-point programming to recent liquid level(s) is done by usage of a small magnet bit and displayed by LED

Operation

The articulated arm encoder is supplied factory adjusted to customer specifications (please see type code). Apart from that the switchpoint can also be adjusted by using the magnet bit.
Mounting above the liquid level prevents swivel wetting which provides a long-lasting operation also with viscious liquids.
Top mounting in a holding tank cap is also an option, here special attention for free moving space for joint lever arm must be obeyed.
Software and USB adaptor for self programming are available upon request.

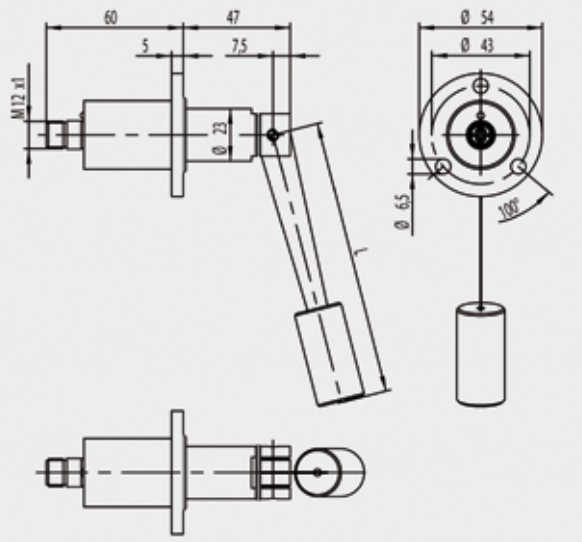
Electrical connection



Joint lever transmitter TS-KNG

Fluid level measurement, i.e. for gear box assemblies

Dimension drawing



Type key

1 Type **TS**

2 ■ **KNGI** = Current output 4 ... 20 mA
■ **KNGU** = Voltage output 0 ... 10 V

3 Flange
■ **FK** = short flange (upon request)
■ **FL** = long flange (47 mm)

4 Lever length in mm

5 Measuring range in angular degrees (max. -87° - +87°)

6 Additional features
HT = High-temperature type

	1		2		3	4		5		6
Example:	TS	-	KNGI	-	FL	150	,	-10°... +60°	,	HT

TS-KNGI-FL150, -10°+60°, HT

Technical data	Type: TS-KNG
Level range	2 x radius maximum (r = 10 cm … 50 cm, special arm lengths upon request)
Resolution	1 mm, typical
Operating pressure	PN 16 bar
Operating temperature	0 ... +70° C
Operating voltage U_B	18 ... 30 V DC
Quiescent current	< 100 mA, typical
Analog output	4 ... 20 mA or 0 ... 10 V
Electrical connection	circular plug-in connector M12 x 1
Switched output	transistor output PNP or NPN (short circuit- and polarity-reversal safe) I out = 100 mA max.
Material of parts with contact to measuring medium	joint lever: stainless steel floater: spansil magnet adaptor: brass, nickel-plated sealing: viton
Housing	brass, nickel-plated
IP protection class:	IP 67
Approval	CE

Assembled cable and connection accessories




Type	Length	Specification	Part No.: straight	angled
M12x1 (S763) 4- pin	-	connector M12x1 for self-connection	1070039	1070038
	-	connector M12x1 self-connection, shielded	1070030	1070031
	2 m	cable: PUR	1070044	-
	5 m	cable: PUR, halogen-free	1070023	1070025
	5 m	cable: PUR, shielded, halogen-free	1070032	1070033
MVS / C, 3-pin +PE	3 m	cable: PUR, connector MVS / C	-	1070021

Special types upon request.

Vibration limit switch TS-SG 51

Liquid level monitoring
Compact size

Description

- Alignment-free initial operation
- Product-independent switching point
- Very high reproducibility
- Wear- and maintenance-free
- Merest installation dimension
- Arbitrary mounting position
- Protection class IP 65
- Varying connection plugs and process connections upon request

Function

The vibrating fork is stimulated by the piezo drive on its resonance frequency. The vibrating fork resonance frequency drops on liquid level covering; this frequency change is interpreted by the internal electronics and changed into a switching signal.

Two different electronic types are available: Beside the transistor output type (PNP) a contactless switch version is on-hand.

Approvals

The device is approved as overflow protection acc. to Water Resources Act and has several approvals for shipbuilding and offshore use like i.e. GL, LRS or ABS.

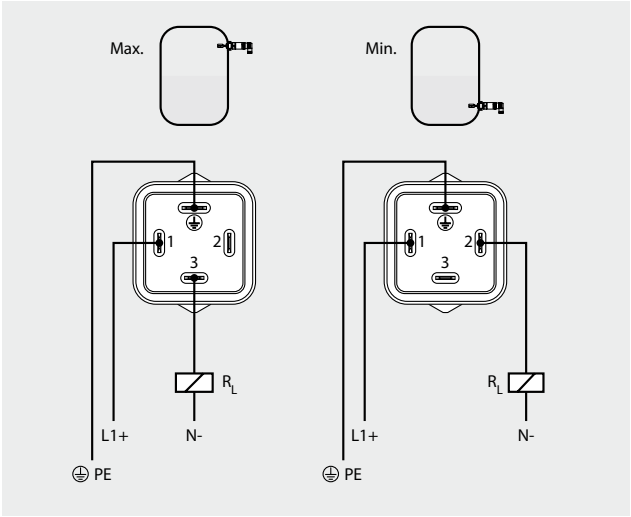
Technical data	Type: Contactless switch	Type: Transistor (PNP)
Media pressure	-1 … +64 bar	-1 … +64 bar
Media temperature standard type	-40 … +100° C	-40 … +100° C
Media temperature high-temperature type	-40 … +150° C	-40 … +150° C
Ambient temperature	-40 … +70 °C	-40 … +70 °C
Storage temperature	-40 … +80 °C	-40 … +80 °C
Material of parts with contact to measuring medium	stainless steel (316L)	stainless steel (316L)
Viscosity –dynamic	0,1 … 10000 mPa s	0,1 … 10000 mPa s
Density	0,7 … 2,5 g / cm³	0,7 … 2,5 g / cm³
Hysteresis	approx. 2 mm (0,08 in) on vertical mounting position process connection	approx. 2 mm (0,08 in) on vertical mounting position process connection
Process connection	thread G 3/4" male, Tri-Clamp G1", pipe fittings from DN 25	thread G 3/4" male, Tri-Clamp G1", pipe fittings from DN 25
Switching delay	500 ms (on / off)	500 ms (on / off)
Operating voltage U_B	20 … 253 V AC, 50 / 60 Hz, 20 … 253 V DC	10 ... 55 V DC
Current consumption	approx.. 3 mA (through load circuit)	-
Load current	min. 10 mA / max. 250 mA	< 250 mA
Reverse current	-	< 10 µA
Voltage drop	-	< 1 V
Switching voltage	-	< 55 V DC

Vibration limit switch TS-SG 51

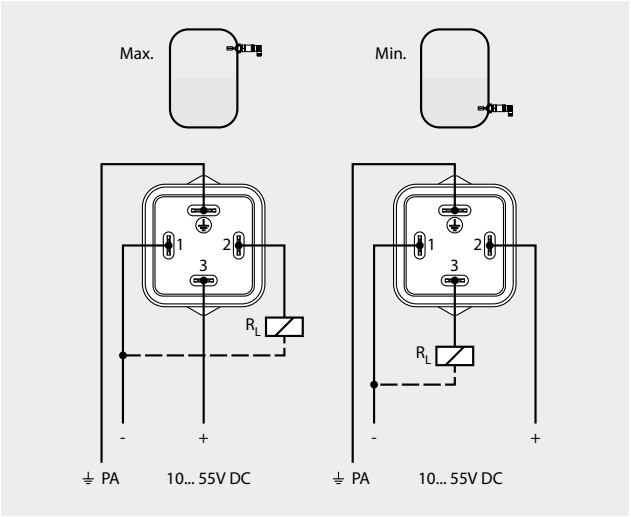
Liquid level monitoring
Compact size

Electrical connection

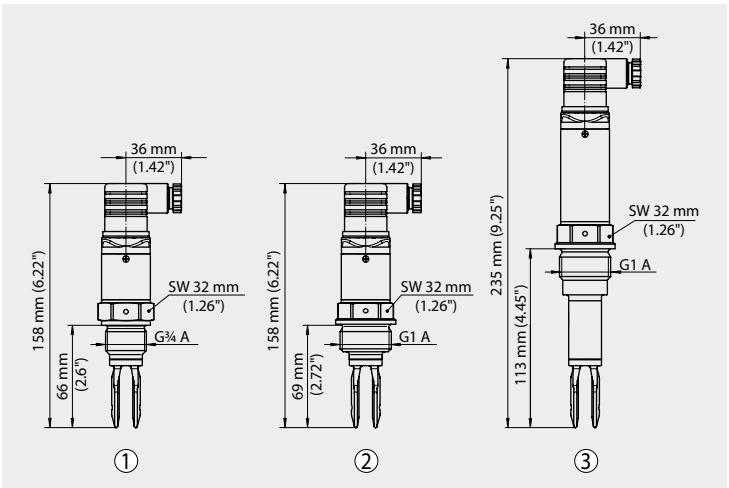
Contactless switch



Transistor (PNP)



Dimensional drawing



1 Thread type G 3/4" male up to 100° C
2 Thread type G 1" male up to 100° C
3 Thread type G 1" male up to 100° C

Type key

1 Type **TS-SG 51.XXS**

2 Process connection
- **GB** = Thread G 3/4" male, length = 66 mm others upon request

3 Electrical output
- **C** = Contactless switch 20 ... 250 V AC / DC, min. 10 mA, max. 250 mA
- **T** = Transistor output PNP 10 ... 55 V DC

4 Electrical connection
- **V** = 4-pin plug-in connector acc. to DIN EN 175301-803/A

	1	2	3		4
Example:	**TS-SG 51.XXS**	**GB**	**C**	**P**	**V**

TS-SG 51.XXSGBCPV

TDR level sensor TS-KFA 2

Guided radar liquid level monitoring
Compact size

Coaxial probe

Application

This measurement method provides a direct, precise and extremely reliable continuous fill and limit level measurement in almost every media – independent of variable process conditions (e. g. density, conductance, temperature, pressure, moisture and dust) The sensor can be used equally well in small tanks, large storage silos or small or large nozzles.

Description

- Fast response time of 0,5 s
- Combined precise fill and reliable limit level measurement in one device
- Suitable for liquids and powdery substances
- Fixtures inside the tank do not effect the measurement results
- Unique price-performance ratio

Microwave pulses are guided along a conductive probe which is immersed directly into the medium to be measured. If the pulses impact at the surface of liquid or powdery substances parts of the pulse energy are reflected back along the probe. The media level is calculated from the time difference between the pulse sent and the reflected pulse.

The sensor provides the fill level as a continuous measurement value via the analog output or converts the value into a freely positionable switching output signal. TDR is the abbreviation of the measurement method "Time Domain Reflectometry".

Technical data	Type: TS-KFA 2
Accuracy	± 3 mm or 0.03 % of range*
Repeatability	< 2 mm*
Resolution	< 1 mm* °C
Ambient temperature	-25 ... +80° C
Media temperature	single-pin probe / rope-type probecoa- -40 … +150° C xial probe with EPDM Seal -40 … +130° C coaxial probe with FKM (Viton) Seal -15 … +150° C
Process connection	thread G 3/4" male, ¾" NPT (wrench size 32 mm)
Operating voltage U_B	12 … 32 V DC (reverse polarity protected)
Outputs	analog output 4 … 20 mA (active) switching output DC PNP (active)
Material of parts with contact to measuring medium	single-pin probe 1.4404 / 316L, Peek, Ø 6 mm rope-type probe 1.4404 / 316L, Peek, Ø 4 mm coaxial probe 1.4404 / 316L, Peek, Ø 17,2 mm seals EPDM or FKM (Viton)
IP protection class	IP 68, NEMA6P (Housing)
ATEX certification	II 1/2G Ex ia/d IIC T6 Ga/Gb ; II 1/2D Ex ia/t IIIC T86°C Da/Db ; II 2G Ex ia d IIC T6 Gb ; II 2D Ex ia t IIIC T86°C Db

Measuring ranges	
Type	Messbereich
KFA2 single-pin probe	100 ... 3.000 mm
KFA2 rope-type probe	100 ... 20.000 mm
KFA2 coaxial probe	100 ... 6.000 mm

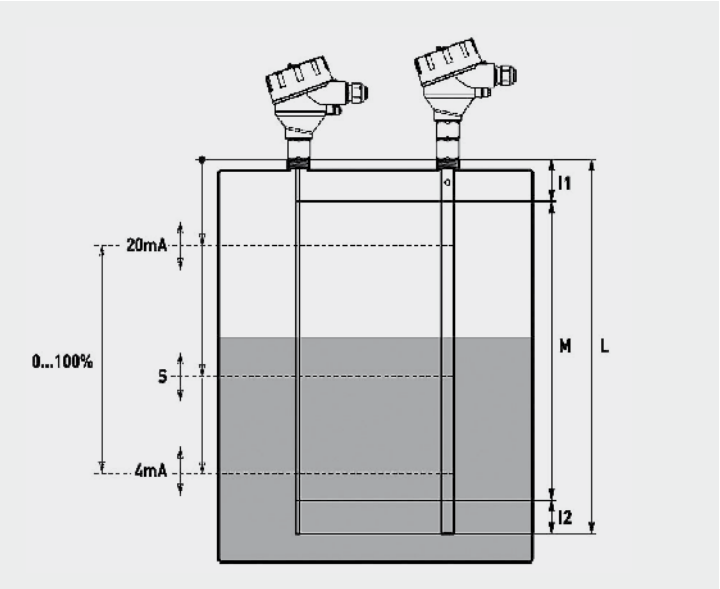
* reference conditions: dielectric constant ε_r=80, water surface, tank Ø 1 m, DN200 metal flange

TDR level sensor TS-KFA 2

Guided radar liquid level monitoring
Compact size

Probe length and measuring range

- Modular probe construction. Probe types can be adjusted to individual requirements without the need for special tools at any time
- Sensor inputs and outputs and container potential are completely galvanically isolated from the device electronics. (no electrochemical corrosion problems possible)
- Extremely reliable measurement due to 4-wire layout, innovative signal analysis and desensitizing



single-pin / rope-type probe coaxial probe

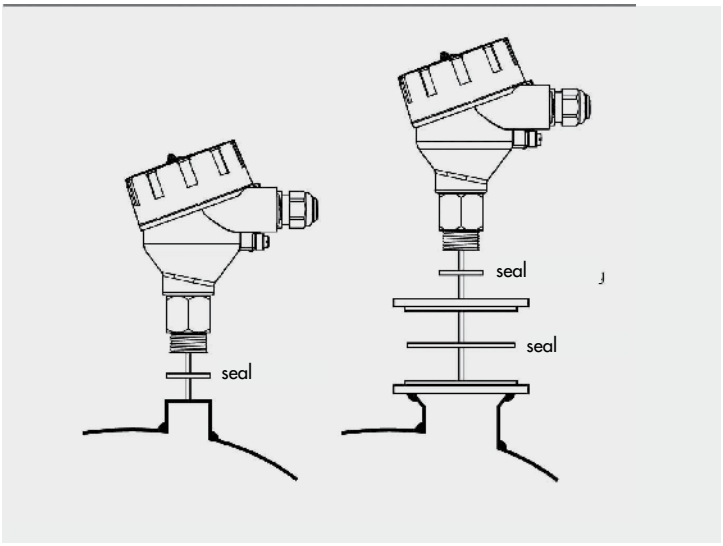
L1: inactive range	single-pin / rope-type probe	: 50 … 80 mm*
	coaxial probe	: 30 … 50 mm*
L2: inactive range	all probe types	: 10 … 50 mm*

M: measuring range
L: probe length
S: switching point

* depending on the dielectric constant ε_r of the fluid 2 … 80

Mounting

- There are almost no practical mounting restrictions for this sensor.
- Measurement is always very precise due to the guided microwave technology. Even difficult tank shapes and geometries or measuring next to disturbing influences, e. g. tank walls will not cause problems.
- Ideally the sensor can be mounted inside of bypass chambers or surge pipes..



threaded mounting flange mounting on tank stub

TDR level sensor TS-KFA 2

Guided radar liquid level monitoring
Compact size

PTFE
flange probe

High temperature
single-pin probe

High temperature
coaxial probe

Rope type

Single-pin probe

PTFE
single-pin probe

Sensors

TIVAL®

Sketches + Notes

Temperatur
Temperature

Sensors

TIVAL®

Sketches + Notes

Introduction temperature data capture

Measuring principle

The measuring principle of resistance thermometers is based upon a temperature-dependent change of resistance of the inner sensor. The inner sensor type has a significant influence on the output signal. A distinction is drawn between the following sensors:

a) Pt100 precision resistor
b) Pt1000 precision resistor
c) Ni 1000 precision resistor (acc. to DIN-standard)
d) Ni1000 precision resistor (with TK-5x10-3 K-1)
e) LM235Z semiconductor IC
f) NTC's

The specific temperature sensors perform a different rise in temperature values (TK) due to their individual characteristics. Further on, the maximum possible measuring ranges differ from sensor to sensor.

Resistance characteristics

Temp.	Pt100	Pt1000	Ni1000	Ni1000 TK5000	FeT	KTY 10-6	KTY 11-6	KTY 81-110	KTY 81-121	LM 235Z/335AZ	CuT	NTC SAT	KTY 81-210
°C	Ω	Ω	Ω	Ω	Ω	Ω	Ω	Ω	Ω	mV	Ω	kΩ	Ω
-50,00	80,31	803,10	743,00	790,88		1068,65	1035,91	515,00	510,00	2232,00	196,50	9,852	1030
-40,00	84,27	842,70	791,00	830,83		1158,95	1039,27	567,00	562,00	2332,00	207,20	9,711	1135
-30,00	88,22	882,20	842,00	871,69	1934,70	1269,25	1250,39	624,00	617,00	2432,00	217,90	9,465	1247
-20,00	92,16	921,60	893,00	913,48	2030,41	1385,15	1396,25	684,00	677,00	2532,00	228,60	9,066	1396
-10,00	96,09	960,90	946,00	956,24	2127,68	1508,65	1495,86	747,00	740,00	2632,00	239,30	8,471	1495
0,00	100,00	1000,00	1000,00	1000,00	2226,53	1639,60	1630,21	815,00	807,00	2732,00	250,00	7,661	1630
10,00	103,90	1039,00	1056,00	1044,79	2327,01	1778,10	1772,32	886,00	877,00	2832,00	260,70	7,667	1772
20,00	107,79	1077,90	1112,00	1090,65	2429,15	1924,15	1922,17	961,00	951,00	2932,00	271,40	5,573	1922
25,00	109,74	1097,40	1141,00	1113,99	2480,86	2000,00	2000,00	1000,00	990,00	2982,00	276,75	5,025	2000
30,00	111,67	1116,70	1171,00	1137,61	2533,00	2077,80	2079,77	1040,00	1029,00	3032,00	282,10	4,493	2080
40,00	115,54	1155,40	1230,00	1185,71	2638,60	2238,00	2245,17	1122,00	1111,00	3132,00	292,90	3,515	2245
50,00	119,40	1194,00	1291,00	1234,97	2745,99	2407,60	2418,21	1209,00	1196,00	3232,00	303,50	2,701	2417
60,00	123,24	1232,40	1353,00	1285,44	2855,23	2583,80	2599,06	1299,00	1286,00	3332,00	314,20	2,057	2597
70,00	127,07	1270,00	1417,00	1337,14	2966,36	2767,50	2787,65	1392,00	1378,00	3432,00	324,90	1,561	2785
80,00	130,89	1308,90	1483,00	1390,12	3079,42	2958,80	2983,99	1490,00	1475,00	3532,00	335,60	1,197	2980
90,00	134,70	1347,00	1549,00	1444,39	3194,47	3152,50	3188,08	1591,00	1575,00	3632,00	346,30	0,926	3118
100,00	138,50	1385,00	1618,00	1500,00	3311,56	3383,90	3399,91	1696,00	1679,00	3732,00	357,00	0,724	3392
110,00	142,29	1422,00	1688,00	1556,98	3430,75	3577,75	3619,50	1805,00	1786,00	3832,00	367,70	0,575	3607
120,00	146,06	1460,60	1760,00	1615,36	3552,09	3799,10	3846,83	1915,00	1896,00	3932,00	378,40	0,467	3817
130,00	149,82	1498,20	1883,00	1675,18	3675,65	4028,05	4081,91	2023,00	2003,00	4032,00	389,10	0,386	4008
140,00	153,58	1535,80	1909,00	1736,47	3801,48	4188,10	4324,74	2124,00	2103,00	4132,00	399,80	0,319	4166
150,00	157,31	1573,10	1987,00	1799,26	3929,65	4397,70	4575,31	2211,00	2189,00	4232,00	410,50	0,272	4280

Type of construction

Four different categories are available according to sensor construction:
Contact temperature sensor, cable-type temperature sensor, enclosure-type temperature sensor and screw-in temperature sensor.

Contact temperature sensor

This sensor type comes with at least one contact surface which can be applied to i.e. pipe surfaces or radiators. If the contact surface is improper positioned to the measuring surface, serious measuring errors will occur.

Introduction temperature data capture

Cable-type temperature sensor

The sensor is positioned inside a stainless steel bushing, the connection cable is lead through the bushing. Beside the standard cable insulation a huge selection of special cables allowing a wider application area is available.

Cabinet-type temperature sensor

This sensor type usually has the temperature sensor mounted inside the cabinet, however, small / short protection bushings may be attached to the plastic cabinet. Cabinet-type temperature sensors are available in on-wall and in-wall construction as well as in interior- and exterior types. The connection terminals are located inside the cabinet.

Build-in temperature sensor

Here the types differ from temperature sensors with exchangeable and with unexchangeable measuring units. The standard process connector is equipped with a G 1/2“ male thread. Other connectors are available. If the build-in temperature sensor is equipped with a supporting pipe, the application range exceeds due to the fact that ascending heat has less effect on the connection head temperature. This has to be taken care of especially when mounting transmitters / transducers.
In build-in temperature sensors the measuring unit is placed in the front end of the supporting pipe. The immersion depth must be adjusted so that the measuring error caused by heat discharge keeps within the allowed error ranges. Based on a 1/2“ connector the following guidance results:
10 x supporting pipe diameter = immersion depth.
On temperature sensors with little response time the supporting pipe should be tapered.

Maximum thermal load of components.

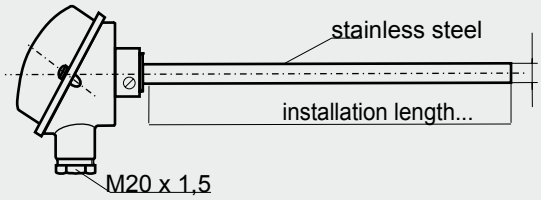
Basically all temperature sensors must be protected against improper overheating! The chart below shows the components critical limits depending on material choice, in neutral environment and under otherwise normal operating conditions:

Component	Max. critical temperature limit
Connecting head	
B-head, cast aluminium with rubber gasket	+100° C
B-head, cast aluminium with silicone gasket	+150° C
B-head, stainless steel part with teflon gasket	+200° C
Rectangular head (plastic)	+70° C
Connection cable	
PVC-normal (PVC heat-stabilized)	+70° C (+105° C)
Silicone	+180° C
PTFE	+200° C
Glass fibre insulation	+400° C
Supporting pipe	
1.4871 X 15CrNiSi25 20	+1150° C
1.4571 X 6 CrNiMoTi 17-12-2	+300° C
1.4301 X 5 CrNi 18-10	+300° C

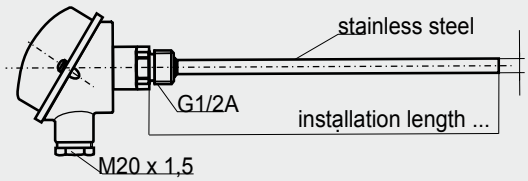
Sensor type (in forepart of supporting pipe) > please see chart for measuring principle, max. possible measuring range

Resistance thermometer EWT

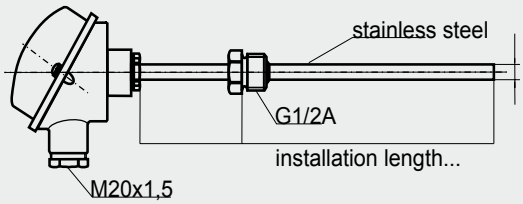
Also available as thermocouple element
With B-style connecting head (for other styles please see accessories section)



Insert-style resistance thermometer



Screw-in-style resistance thermometer



Screw-in-style resistance thermometer with neck pipe

measuring insert

Description

- Pluggable, screwable, with neck pipe
- Different connecting head styles (please see accessories section)
- Available with transducer
- Pt 100 accc. To DIN EN 60751 cl.B
- Other measuring inserts available (i.e. Pt 1000)
- 3- and 4-conductor connection provided
- Explosion-proof types available

Screw-in resistance thermometers are used as universal thermometers for measuring in liquids and gaseous media. The dense connection is an important eligibility criterion.

Air-condition / refrigeration, heating, devices and equipment manufacturing are exemplary application fields.

The B-style connecting head is, depending on type of gasket used, suitable for temperatures up to max. 150˚ C. The measuring insert is equipped with a standard Pt 100 temperature sensor. The protective pipe is available in brass or stainless steel.

Technical data	Type: EWT
Connecting head	form B, light metal acc. to DIN 43729
Cable entry point	M 20 x 1,5
Protective pipe	brass, -50˚ C ... +400˚ C stainless steel 1.4571, -50˚ C ... +800˚ C
Process connection	without or with screw in threads M18 x 1,5 in G 1/4", G 1/2", G 3/4", G 1", others upon request
Measuring insert type	Pt100 / Pt1000, others upon request
Tolerance class	class B (standard)
Electrical connection	2-, 3- and 4-conductors
Diameter	3, 6, 9, 12, 15 mm
Length (EL)	30 ... 500 mm
Compression fitting	standard or stainless steel (see accessories)

Resistance thermometer EWT

Also available as thermocouple element
With B-style connecting head (for other styles please see accessories section)

Type designation codes

1 Type **EWT** ■ connection head… (description please see accessories section)

1a **ES** = screw-in type
ST = tip-in type
HR = neck pipe, length in mm

2 Protective pipe diameter
■ 0,5 mm
■ 1 ■ 1,5 ■ 3 ■ 4 ■ 5 ■ 6 ■ 7 ■ 8 ■ 9 mm
■ 10 ■ 11 ■ 12 ■ 13 ■ 14 ■ 15 ■ 22 mm

3 Length EL = ...
■ 50 ■ 100 ■ 200 ■ 250 ■ 400 ■ 500 mm

4 Protective pipe material
■ **1** = brass ■ **3** = stainless steel

5 Sensor quantity
■ 1 x
■ 2 x
■ 3 x

6 Sensor type
■ **Pt** = Pt 100 ■ **PtM** = Pt 1000 ■ **Ni** =Ni 100 ■ **NiM** = Ni 1000 IEC751
■ **J** = Fe-CuNi ■ **K** = NiCr-Ni ■ **N** = NiCrSi-NiSi IEC584
■ **L** = Fe-CuNi DIN43710

7 Connection
■ **2**-conductor
■ **3**-conductor
■ **4**-conductor

8 Class

Resistance thermometer	Thermocouple
■ **0** = standard	■ **2** = standard
■ **1** = 1/2 DIN IEC 751	■ **1** = ~1/2 DIN IEC 584
■ **2** = 1/3 DIN IEC 751	

9 Process connection, welded
■ G 1/8 ■ G 1/4 ■ G 3/8 ■ G 1/2 ■ M 12 x 1,5
■ G 3/4 ■ G 1"
■ NPT

10 Options
■ **F** = flange C DN 25 40 DIN 2501
C DN 40 40 DIN 2501
■ **UE** = cap nut
■ **V** = tapered ■ **B** = flange ring ■ **PE** = perforated
■ **M** = measuring insert, mineral insulated, flexible tube
■ **MU-I** = transducer output 4 ... 20 mA (programmable) measuring range ...°C to ...°C
■ **MU-U** = transducer output 0…10 V(programmable) measuring range, ...°C to ...°C
■ **K** = kynar isolated
■ **P** = PVC isolated

	1	1a	2		3		4		5		6		7		8		9	10
Example:	EWTB	HR70	· 9	x	100	·	3	·	1		Pt	-	2	·	0	·	G1/2	

EWTB HR70, 9x100.3.1Pt-2.0.G1/2

Resistance thermometer EWT

Also available as thermocouple element
With B-style connecting head (for other styles please see accessories section)

Technical data for transducer

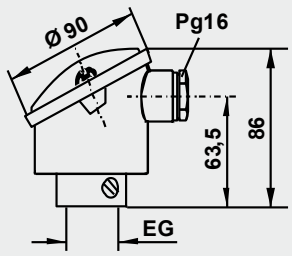
Technical data for transducer, 4 ... 20 mA, 2-conductor style	
Measuring input	Pt100 (DIN EN 60 751) 2-conductor
Smallest / largest measuring span	25 K / 1050 K
Unit	°C
Sensor current	≤ 0,5 mA
Output signal	proportional direct current 4 ... 20 mA, temperature-linear
Setting time at temperature change	≤ 10 ms
Voltage supply (Ub)	7,5 ... 30 V DC (reverse voltage protection)
Temperature range	-40 ... +85° C
EMC – emitted interference – interference resistance	EN 61 326 class B industrial standard

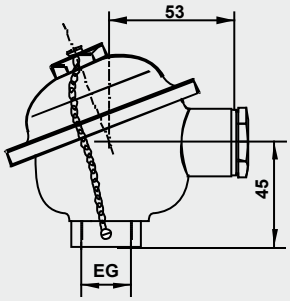
Technical data for transducer, 0 ... 10V, 3-conductor style	
Measuring input	Pt100 (DIN EN 60 751) 3-conductor
Smallest / largest measuring span	25 K / 1050 K
Unit	°C
Sensor current	≤ 0,5 mA
Output signal	0 ... 10 V, temperature-linear
Load	≤ 10 kΩ
Setting time at temperature change	≤ 10 ms
Voltage supply (Ub)	15 … 30 V DC (reverse voltage protection)
Temperature range	-40 ... +85° C
EMC – emitted interference – interference resistance	EN 61 326 class B industrial standard

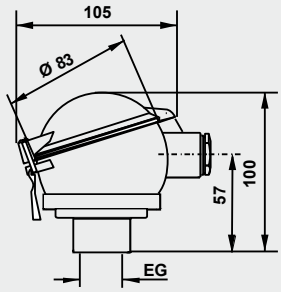
Technical data for transducer, connection head J, 4 ... 20 mA, 2-conductor style	
Measuring input	Pt100 (DIN EN 60 751) 2-conductor
Smallest / largest measuring span	25 K / 1050 K
Unit	°C
Sensor current (input)	≤ 0,5 mA
Output signal	4 ... 20 mA, temperature-linear
Apparent ohmic resistance	Rb = (U_b -7,5 V) / 22 mA
Setting time at temperature change	≤ 10 ms
Voltage supply (Ub)	7,5…30 V DC (reverse voltage protection)
Temperature range	-40 ... +85° C
EMC – emitted interference – interference resistance	EN 61 326 class B industrial standard

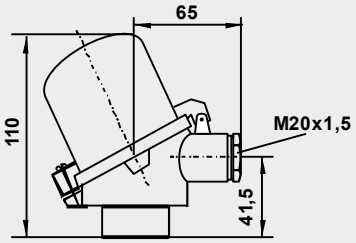
Resistance thermometer EWT

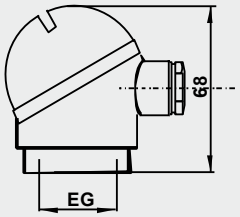
Also available as thermocouple element
With B-style connecting head (for other styles please see accessories section)

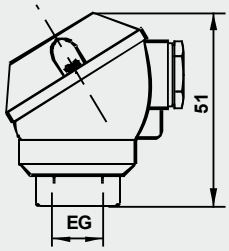












Connection heads

Connection head form A

Temperature °C	Connection head port diameter (EG)
-20 ... +100° C	22,8 mm
-20 ... +100° C	26,5 mm
-20 ... +100° C	32,5 mm

Connection head form GG

Temperature °C	Connection head port diameter (EG)
-20 ... +100° C	15,5 mm
-20 ... +100° C	M 24 x 1,5

Connection head form A/BUSH

Temperature °C	Connection head port diameter (EG)
-20 ... +100° C	M 24 x 1,5

Connection head form E

Temperature °C	Connection head port diameter (EG)
-20 ... +100° C	M 24 x 1,5
-20 ... +100° C	15,5

Connection head form CL

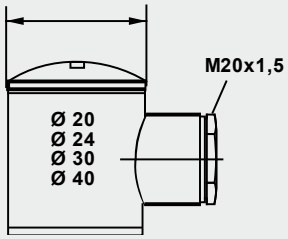
Temperature °C	Connection head port diameter (EG)
-20 ... +100° C	M 18 X 1

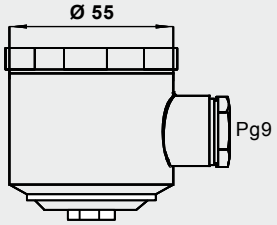
Connection head form J

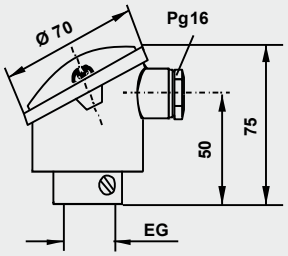
Temperature °C	Connection head port diameter (EG)
-20 ... +100° C	32,5 mm

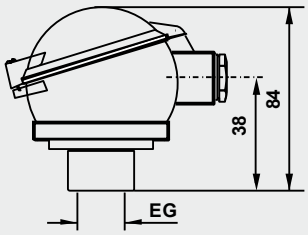
Resistance thermometer EWT

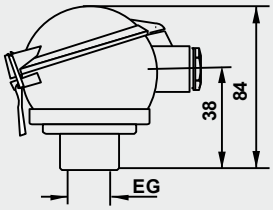
Also available as thermocouple element
With B-style connecting head (for other styles please see accessories section)

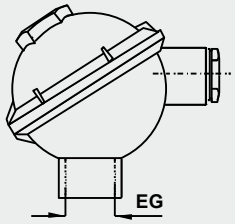












Connection heads

Connection head form BR..., stainless steel

Temperature °C	Connection head diameter
-20 ... +100° C	20 mm
-20 ... +100° C	24 mm
-20 ... +100° C	30 mm
-20 ... +100° C	40 mm

Connection head form Br 55, stainless steel

Temperature °C	Connection head diameter
-20 ... +100° C	55 mm

Connection head form BL

Temperature °C	Connection head port diameter (EG)
-20 ... +100° C	M 24 x 1,5
-20 ... +100° C	15,5

Connection head form BUS

Temperature °C	Connection head port diameter (EG)
-20 ... +100° C	M 24 x 1,5

Connection head form BUSH

Temperature °C	Connection head port diameter (EG)
-20 ... +100° C	M 24 x 1,5

Connection head form BK

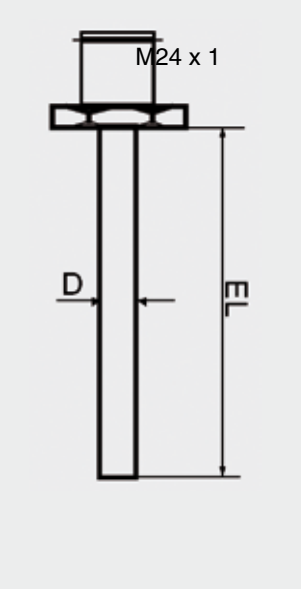
Temperature °C	Connection head port diameter (EG)
-20 ... +100° C	M 24 x 1,5

Resistance thermometer EWT

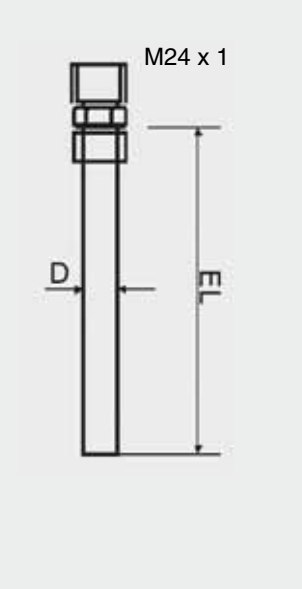
Also available as thermocouple element
With B-style connecting head (for other styles please see accessories section)

Protective fittings stainless steel 1.4571

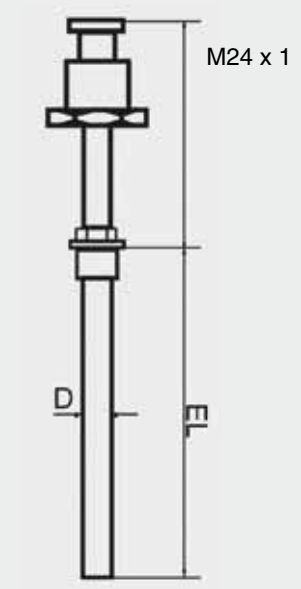
Sa EWT



Sa EWTES

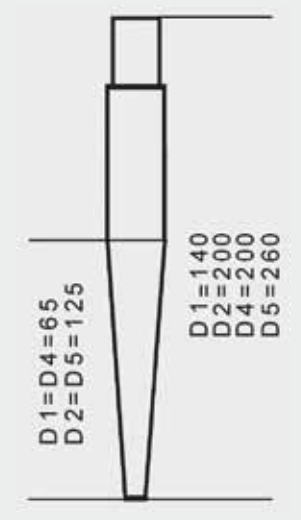


Sa EWTHR



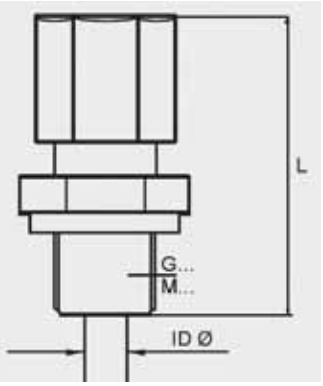
Installation length (EL)
ø 9 x 100
ø 9 x 160
ø 9 x 200
ø 9 x 250
ø 15 x 500
ø 15 x 710
ø 15 x 1000

Weld-in protective fitting



Material grade	Length	Conus	ø outer diameter
1.4571 (max. 550° C)	140 mm	65 mm	24 mm
	200 mm	125 mm	24 mm
	200 mm	65 mm	24 mm
	260 mm	125 mm	24 mm
1.7335 (max. 550° C)	140 mm	65 mm	24 mm
	200 mm	125 mm	24 mm
	200 mm	65 mm	24 mm
	260 mm	125 mm	24 mm
1.7380 (max. 550° C)	140 mm	65 mm	24 mm
	200 mm	125 mm	24 mm
	200 mm	65 mm	24 mm
	260 mm	125 mm	24 mm

Pipe fitting



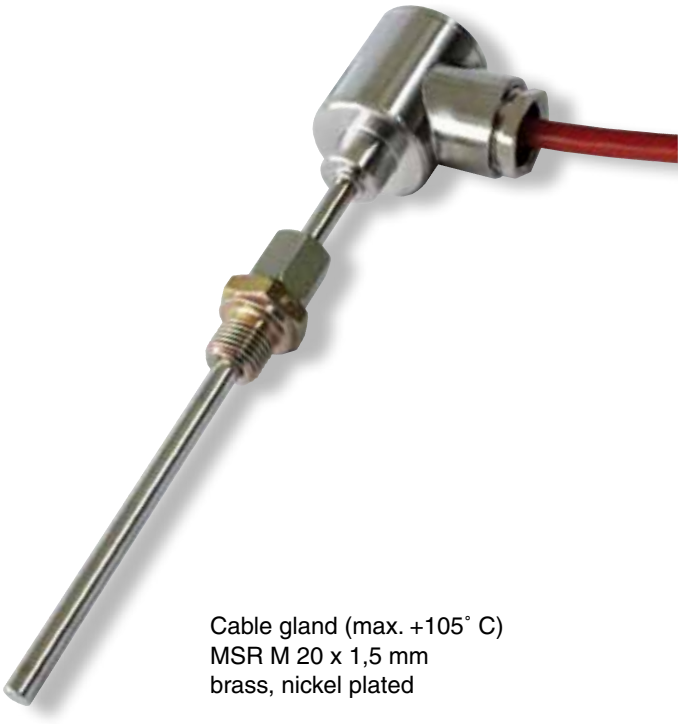
Installation length
NPT / G1/8...
NPT / G1/8...
NPT / G1/8...
NPT / G1/8...
M8 x 1...
M10 x 1...

Compression ring

- steel (+500° C)
- stainless steel (+600° C)
- Teflon (+260° C)
- Viton (+105° C)

Resistance thermometer BR

Available also as thermocoupler
Identification EX II 2G Ex ia IIC T6-T2



Cable gland (max. +105˚ C)
MSR M 20 x 1,5 mm
brass, nickel plated

Construction

- With neck pipe, pluggable or screwable
- Protective pipe 1.4571, 6 mm, protective hose as option
- Pt100 ac. to DIN EN 60751
- Can be fitted with 1 or 2 sensors
- 2- or 3-conductor connection possible
- Compression fitting 1/4” or 1/2” available
- Screw-in installation length 50 … 500 mm
- Certified for zone 1 and 2 usage

Description

Type BR resistance thermometers are certified for zones 1 and 2 in explosion endangered environments. They are used for temperature logging of gaseous and liquid media. Varying protective pipe lengths and pipe diameters provide versatile application variations. These units can be equipped with sensors in 2- or 3-conductor wiring and with max. number of 2 sensors.

Basically a free neck pipe length of min. 25 mm has to be considered for mounting.

Resistance Thermometer, type

Technical data	Type: BR Ex
Measuring range	-20 … +135° C with silicone cable / -20 … +100° C with oilflex cable
Sensor element Wiring mode	1 or 2 pcs. Pt 100 2- or 3-conductor wiring
Accuracy class	class B
Core values	acc. to EN 60 751
Measurement current	1 mA approx. (film resistance meas.)
Process connection	thread connection G 1/4“ or push-in type, others upon request
Accessories	clamp connection G 1/4“ A or G1/2“ A, 1.4571
Protective pipe	ø 6 mm, NL = EL +40 mm, 1.4571
Option	protective insulation with heat shrink tube (sensor tip only or full protective pipe length)
Connection head	small stainless steel connection head ø 30 mm with brass cable gland, nickel-plated
Pressure resistance	60 bar with welded-on connection
Neck pipe	25 mm of min. free neck pipe length
Connection cable	silicone, usage of oilflex cable reduces head connection temp. to. +70° C
Insulation resistance	≥ 100 MΩ at 20° C (500 V DC)
Proof voltage	> 500 VAC (50 Hz, 1 mm)
Protection class	IP 54 acc. to EN 60 529
Ex-class	EX II 2G Ex ia IIC T6-T2
EC type-examination certificate	IBExU 09 ATEX1143X Special directions in mounting instruction and EC type-examination certificate are to be obeyed

Resistance thermometer BR

Identification EX II 2G Ex ia IIC T6-T2

Type designation codes

1 Type **BR**

1a
- Ex 202 (plug-in)
- Ex 212 (screw-in)
- Ex 222 (neck tube)
- Ex 223 (clamp ring connector)

2 Protective pipe diameter
- 0,5 mm
- 6 (others on request)

3 Length EL = ...
- 50
- 100
- 200
- 250
- 400
- 500 mm

4 Protective pipe material
- 3 = stainless steel 1.4571

5 Sensor quantity
- 1 x
- 2 x

6 Sensor type
- **Pt** = Pt 100
- **PtM** = Pt 1000
- **Ni** =Ni 100
- **NiM** = Ni 1000
- **J** = Fe-CuNi
- **K** = NiCr-Ni
- **N** = NiCrSi-NiSi
- **L** = Fe-CuNi

IEC751
IEC584
DIN43710 ...=...

7 Connection
- **2**-conductor
- **3**-conductor

8 Class

Resistance thermometer
- **0** = standard
- **1** = 1/2 DIN IEC 751
- **2** = 1/3 DIN IEC 751

Thermocouple
- **2** = standard
- **1** = ~1/2 DIN IEC 584

9 Process connection, welded
- G 1/4
- G 1/2

- clamp connector, steel, relocatable
- or stainless steel
- flange, adjustable DIN EN 43 743
- aluminium flange for pipe diameter

10 Options
- **F** = flange C DN 25 40 DIN 2501
  C DN 40 40 DIN 2501
- **UE** = cap nut
- **V** = tapered
- **B** = flange ring
- **PE** = perforated
- **M** = measuring insert, mineral insulated, flexible tube
- **K** = kynar isolated
- **P** = PVC isolated

	1	1a	2	3	4	5	6	7	8	9	10
Example:	BR	EX 202	· 6	x 100	· 3	· 1	Pt	- 2	· 0	· G1/2	

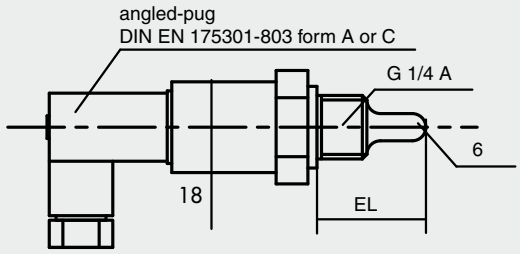
BR-EX 202, 6x100.3.1Pt-2.0.G1/2

Resistance thermometer EWTS

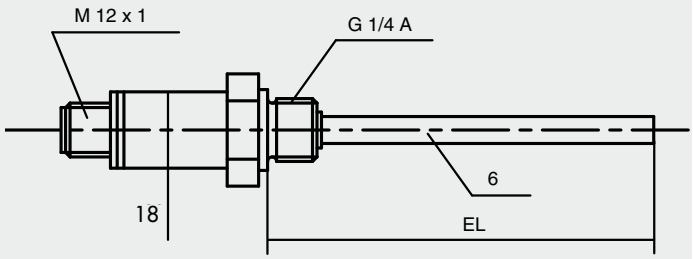
Compact resistance thermometer for plug-in connection
Ex version also available

Construction

- Compact size
- Variable connector assemblies available
- Screw-in thread G 1/4" (others on request)
- Pt100 acc. to DIN EN 60751 class B
- Various measuring inserts available (i.e. Pt 1000)
- 2-, 3- or 4-conductor wiring provided
- Special types for high pressure use available
- Temperature range from -50 … +250˚ C
- Ex II 2G Ex ia IIC T6-T2



Screw-in resistance thermometer
with angled plug



Screw-in resistance thermometer
with circular plug M 12x1

Description

Type EWTS resistance thermometers allow temperature measurement in pressurized media in compactors and in the field of plant engineering and construction. Variable plug-in connector assemblies provide adaption to each application. The units are Pt100 or Pt1000 equipped as a standard.

Technical data	Type: EWTS
Temperature range	-50° … +250° C
Process connection	G1/4", G1/2" others on request
Material	stainless steel 1.4301
Sensor type	Pt100 / Pt1000 acc. to DIN EN 60751 class B
Wiring mode	2-, 3- or 4-conductor wiring
Installation length	10 … 250 mm, 6 mm diameter
Protection class	IP 65
Pressure resistance	up to 100 bar, acc. to type

Assembled cable and connection accessories (see page176)

Resistance thermometer EWTS

Compact resistance thermometer for plug-in connection
Ex version available

Type designation codes

1 Type **EWTS or** Ex**-EWTS**

1a **B** = M12 x 1
A = plug EN 175301-803 form A
C = plug EN 175301-803 form C

2 Protective pipe diameter
■ 1 ■ 1,5 ■ 3 ■ 4 ■ 5 ■ 6 ■ 7 ■ 8 mm Ex from 6 mm

3 Length EL = ... length EL Ex = ...
■ 50 ■ 100 ■ 200 ■ 250 mm ■ 22 ■ 60 ■ 85 mm

4 Protective pipe material
■ **3** = stainless steel 1.4571

5 Sensor quantity
■ 1 x
■ 2 x

6 Sensor type
■ **Pt** = Pt 100 ■ **PtM** = Pt 1000

7 Connection
■ **2**-conductor
■ **3**-conductor
■ **4**-conductor

8 Class
Resistance thermometer
■ **0** = standard
■ **1** = 1/2 DIN IEC 751
■ **2** = 1/3 DIN IEC 751

9 Process connection, welded
■ G 1/4 ■ G 3/8 ■ G 1/2 ■ M 12 x 1,5
■ adaptor G 1/4 G 1/2A (ident no. 100.G1/4/G1/2A)
■ clamp connector, steel, relocatable
■ or stainless steel

	1	1a	2		3	4	5	6	7	8	9
Example:	EWTS	B	. 6	x	300	. 3	. 1	Pt	- 2	. 0	. G1/2

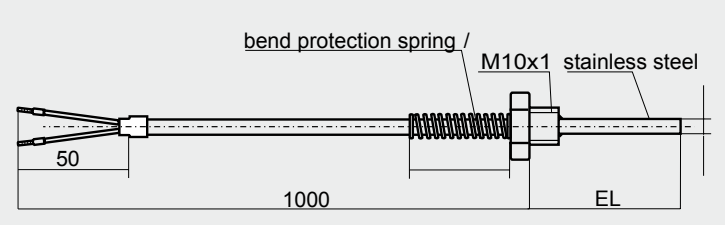
EWTSB, 6x300.3.1Pt-2.0.G1/2

Example Ex: Ex-EWTS,.....

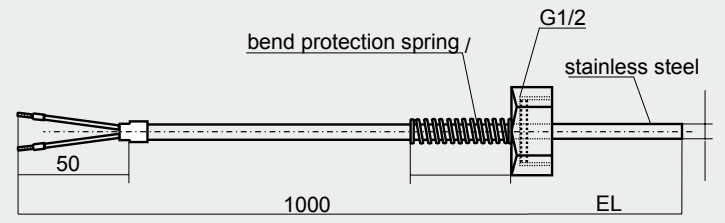
Resistance thermometer KWT...

Also available as thermocouple element

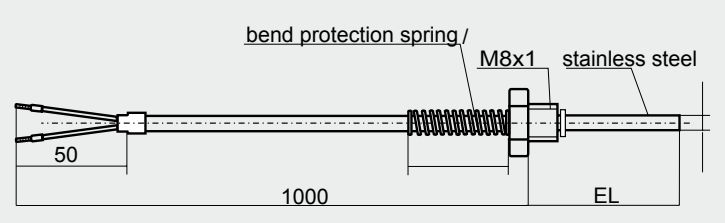
Screw-in resistance cable thermometer, with cap nut or revolvable screw connection



Screw-in resistance cable thermometer



Resistance cable thermometer with cap nut



Screw-in resistance cable thermometer, with revolvable screw connection

Description

- Bend protection spring equipped
- Pt 100 acc. to DIN EN 60751 class B
- Other measuring inserts available (e.g. Pt 1000)
- 3- and 4-conductor connection provided

Screw-in resistance cable thermometers are used as universal thermometers for measuring in liquids and gaseous media. The availability of numerous diameters, lengths and material choices provides a variable system for almost every application. Further on, various types of process connections like screw-in, plug-in or cap nut fixing are available.

Different cable types such as i.e. silicone or Teflon are available for higher temperatures. Pt100 or Pt1000 measuring inserts with 2-, 3- or 4-conductor wiring can be mounted as standard. Multiple measuring insert mounting is also an option.

Technical data	Type: KWT
Protective pipe	stainless steel 1.4571
Process connection	M10 x 1, G 1/4", G 1/2" others on request
Measuring insert type	Pt100 / Pt1000 (others upon request)
Tolerance class	class B (standard)
Connection	2-,3- and 4-conductors
Diameter	standard 6 mm, others upon request
Length (EL)	50 ... 500 mm
Measuring range	-35 ... +105° C, PVC-cable -50 ... +180° C, silicone cable other cable material on request
Protection class	IP 54

Resistance thermometer KWT...

Also available as thermocouple element
Screw-in resistance cable thermometer, with cap nut or revolvable screw connection

Type designation codes

1 Type **KWT...**+screw connector type

screw connector type
- **E** = screw-in connector
- **UE** = revolving nut connector
- **ED** = screw-in, turnable

2 Protective pipe diameter
- 0,5 mm
- 1 ■ 1,5 ■ 3 ■ 4 ■ 5 ■ 6 ■ 7 ■ 8 ■ 9 mm
- 10 ■ 11 ■ 12 ■ 13 ■ 14 ■ 15 mm

3 Length EL = ...
- 50 ■ 100 ■ 200 ■ 250 ■ 400 ■ 500 mm

4 Protective pipe material
- **1** = brass ■ **3** = stainless steel

5 Sensor quantity
- 1 x
- 2 x
- 3 x

6 Sensor type
- **Pt** = Pt 100 ■ **PtM** = Pt 1000 ■ **Ni** =Ni 100 ■ **NiM** = Ni 1000 — IEC751
- **J** = Fe-CuNi ■ **K** = NiCr-Ni ■ **N** = NiCrSi-NiSi — IEC584
- **L** = Fe-CuNi — DIN43710

7 Connection
- **2**-conductor
- **3**-conductor
- **4**-conductor

8 Class

Resistance thermometer
- **0** = standard
- **1** = 1/2 DIN IEC 751
- **2** = 1/3 DIN IEC 751

Thermocouple
- **2** = standard
- **1** = ~1/2 DIN IEC 584

9 Process connection, welded
- G 1/8 ■ G 1/4 ■ G 3/8 ■ G 1/2 ■ M 12 x 1,5 ■ M 10 x 1
- G 3/4 ■ G 1" ■ X = without screw joint
- NPT

- clamp connection, steel, relocatable
- or stainless steel

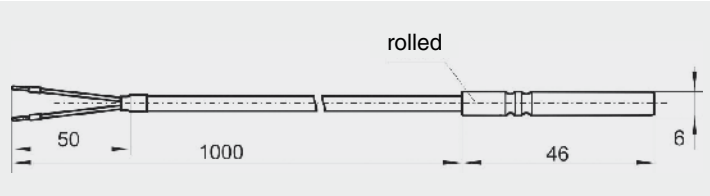
10 Connection-, balance line
- (Length in m) **PP** = PVC — MAX: +105° C
- (Length in m) **TS** = Teflon/silicone — MAX: +180° C
- (Length in m) **TT** = Teflon — MAX: +260° C
- (Length in m) **GGD** = GS/wire — MAX: +350° C

	1	2	3	4	5	6	7	8	9	10
Example:	KWT...	· 3	x 100	· 3	· 1	Pt	- 4	· 0	· M10x1	1PP

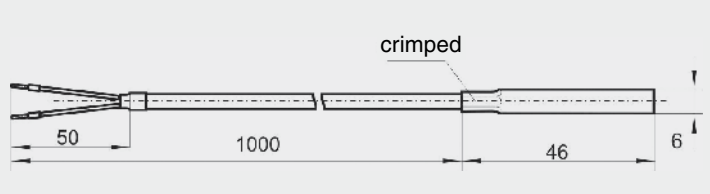
KWTE, 3x100.3.1Pt-4.0.10x1.1PP **1=1 m**

Resistance thermometer KWT…

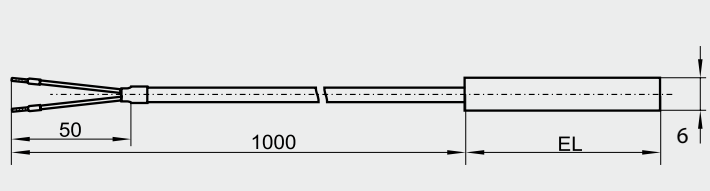
Also available as thermocouple element
Insertion resistance cable thermometer, Ex version also available



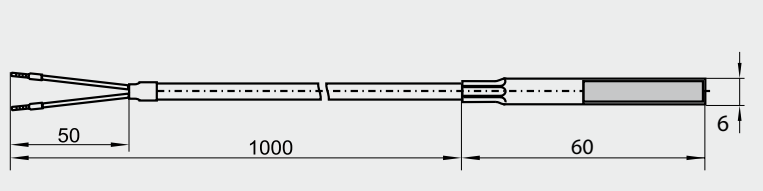
KWTSR



KWTSC



KWTBNV



KWTBNSC

Description

- Bend protection spring optionally available
- Pt 100 acc. to DIN EN 60751 class B
- Other measuring inserts available (e.g. Pt 1000)
- 3- and 4-conductor connection provided
- Ex version also available

Screw-in resistance cable thermometers are used as universal thermometers for measuring in liquids and gaseous media. The availability of numerous diameters, lenghts and material choices provides a variable system for almost every application. Further on, various types of process connections are available.

Different cable types such as i.e. silicone or Teflon are available for higher temperatures. Pt100 or Pt1000 measuring inserts with 2- 3- or 4-conductor wiring can be mounted as standard. Multiple measuring insert mounting is also an option.

Technical data	Type: KWT
Protective pipe	stainless steel 1.4571
Measuring insert type	Pt100 / Pt1000 (others upon request)
Tolerance class	class B (standard)
Connection	2-, 3- or 4-conductor wiring
Diameter	standard 6 mm, others upon request
Length (EL)	50 ... 500 mm
Measuring range	-35 ... +105° C, PVC-cable -50 ... +180° C, silicone cable other cable material on request
Protection class	IP 54

Resistance thermometer KWT…

Also available as thermocouple element
Insertion resistance cable thermometer, Ex version also available

Type designation codes

1 Type **KWT...**+ connection type
or Ex **-KWT...**+ connectionn type

connector type

- **SR** = rolled
- **SC** = crimped
- **BN** = potted

2 Protective pipe diameter (diameter smaler then 4 mm ar not available)
- 4 - 5 - 6 - 7 - 8 - 9 mm
- 10 - 11 - 12 - 13 - 14 - 15 mm

3 Length EL = ...
- 50 - 100 - 200 - 250 - 400 - 500 mm

4 Protective pipe material
- **3** = stainless steel

5 Sensor quantity
- 1 x
- 2 x

6 Sensor type

Pt = Pt 100	**PtM** = Pt 1000	**Ni** =Ni 100	**NiM** = Ni 1000	IEC751
J = Fe-CuNi	**K** = NiCr-Ni	**N** = NiCrSi-NiSi		IEC584
L = Fe-CuNi				DIN43710

7 Connection
- **2**-conductor
- **3**-conductor
- **4**-conductor

8 Class

Resistance thermometer	Thermocouple
0 = standard	**2** = standard
1 = 1/2 DIN IEC 751	**1** = ~1/2 DIN IEC 584
2 = 1/3 DIN IEC 751	

9 Connection-, balance line

(Length in m) **PP** = PVC	MAX: +105° C	M 10 x 1
(Length in m) **TS** = Teflon/silicone	MAX: +180° C	
(Length in m) **TT** = Teflon	MAX: +260° C	
(Length in m) **GGD** = GS/wire	MAX: +350° C	

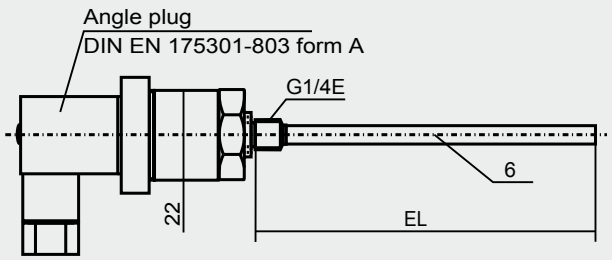
10 bend protection spring (only available with crimpt connection SC)
- **KF** = bend protection spring equipped

	1	2	3	4	5	6	7	8	9	10
Example:	KWT...	· 3	x 100	· 3	· 1	Pt	- 4	· 0	· 1PP	KF

KWT, 3x100.3.1Pt-4.0.1PP **1=1 m**
Ex-KWTSC,...

Temperature transmitter TS-TT

4 ... 20 mA or 0 ... 10 V output signal



Construction

- Stainless steel housing, 1.4301
- G 1/4“ process connection as standard
- Immersion depths selectable
- Plug connector acc. to DIN EN 175301-803 form A
- Measuring range 0 … +100° C, others on request

Description

The compact temperature transmitter is used for temperature measuring in liquids and gaseous media. Unit is used in operation areas such as pipes, containers, tanks and air-ducts.The measurement reading from the temperature dependent sensor is converted into an analog output signal of 4 … 20 mA or 0 … 10 V.

The sensor can be fitted directly to the process connection by screwing it into an appropriate female threading.There is also the option to vary the immersion depth by using a clamp connection.

Type designation: Example
TS-TT 10.0, 0-100˚C, G 1/2”A, 50 mm

Technical data	Type: TS-TT
Measuring range	0 ... +100° C or -50 ... +50° C, others on request
Material	stainless steel 1.4301
Weight	~ 200 g
Operating voltage U_B	12 ... 30 V DC at 4 ... 20 mA output 14 ... 30 V DC at 0 ... 10 V DC output
Output signal	4 ... 20 mA, 2-conductor $R_A \leq (U_B\text{-}12\ V) / 20\ mA$ 0 ... 10 V DC, 3-conductor $R_A > 10\ k\Omega$
Accuracy	< ± 0,4 % FS
Media temperature	0 ... +100° C
Ambient temperature	-20 ... +80° C
Storage temperature	-20 ... +80° C
Plug connector	acc. to DIN EN 175301-803 form A, (others on request)
Prozess pressure	10 bar

Assembled cable and connection accessories (see page176)




Electronic temperature switch TS-TSD 30

Rotatable, easily readable and rugged 14-segment LED display
Temperature range from -20 … +80° C

Application

- Machine tools
- Hydraulics and pneumatics
- Cooling and lubrication systems
- Mechanical engineering

Description

- Easily readable and rugged 14-segment LED display; 180° electronically rotatable
- User-friendly 3-button control
- Simple menu navigation (acc. to VDMA standards)
- Flexible initial operation provided by independent rotatability of M12x1 connector (320°) and display (330°)
- Two switching outputs and one analog output possible
- Optional temperature range -20 ... +120° C

The TS-TSD 30 is easily adaptable to the installation situation on initial operation. Based on a double housing construction rotatability of more than 300° is provided. The display can be adjusted independently from the electrical connection and always allows alignment to the operators view angle. The M12 connector can be positioned to the desired cable routing. The display also is 180° electronically rotatable for overhead mounting situations.

The electrical connector housing and thread are made of stainless steel. Overtighting or plug blowoff is almost impossible.

Technical data	Type: TS-TSD 30
Measuring range	-20 ... +80° C optional -20 ... +120° C
Analog output	4(0) ... 20 mA, 0 ... 10 V DC
Contact output	DC PNP, max. 200 mA
Maximum operating pressure	150 bar
Response time	200 ms
Operating voltage U_B	10 ... 30 V DC at 4 ... 20 mA output 16 ... 30 V DC, 10 V DC
Media temperature	-20 ... +80° C optional -20 ... +120° C
Ambient temperature	-20 ... +80° C
Housing material	CrNi-Stahl 304, IP 65 und 67
Process connection	G 1/4 A, 1.4404 (316L)
Sensor	Pt1000, 2-wire, DIN EN 60751 / Class A
Electrical connection	connector M12x1 IP 67

Electronic temperature switch TS-TSD 30

Rotatable, easily readable and rugged 14-segment LED display
Temperature range from -20 … +80° C

Technical data	Type: TS-TSD 30
Material	
Wetted parts	
Pressure connection	CrNi-Steel 316Ti
Probe	CrNi-Steel 316Ti
Housing	
Lower part	CrNi-Steel 304
Plastic head	PC + ABS-Blend
Keypad	TPE-E
Display window	PC
Output signal and permitted max. load R_A	4 ... 20 mA, 3-wire $R_A \leq 0{,}5$ kΩ 0 ... 10 V, 3-wire $R_A > 10$ kΩ
Temperature offset alignment	± 3 % of span
Scaling (dispaly and analogue signal)	
Zero point	max. + 25 % of span
Final value	max. - 25 % of span
Accuracy temperature sensor	± (0,15 K + 0,002 | t |) – | t | is the value of the temperature in °C without consideration of the sign
Current consumption	max. 100 mA
Total current consumption	max. 600 mA incl. switching current
Switching output	adjustable individually by external keypad
Type	transistor switching output PNP or NPN
Numbers of outputs	1 or 2
Output function	NO / NC; window- and hysteresis function freely adjustable
Switching voltage	operating voltage U_B minus 1 V DC
Switching current	SP1: 250 mA SP2: 250 mA
Settling time	≤ 10 ms
Accuracy	≤ 0,5 % of span (setting accurancy)
Isolating voltage	500 V DC
Display	
Principle	14-segment LED, red 4-digit, figures height 9 mm, 180° electronically rotatable
Accurancy	≤ ± 0,8 % of span ± 1 digit
Permitted humidity	45 … 75 % relativ
Nominal temp. range	0 ... +80° C
Reference conditions	relative humidity: 45 ... 75 % acc. to IEC 61298-1
RoHS-conformity	yes
CE-conformity	
EMV-guideline	2004/108/EG, EN 61326-2-3 emission (group 1, class B) interference immunity (industrial use)
Weight	~ 300 g
Electrical protection class	
Overvoltage protection	40 V DC
Short-circuit strengh	S+ / SP1 / SP2 against U-
Polarity protection	U+ against U-

Installation instructions

Mounting position: as required

At high medium or ambient temperatures, ensure by suitable measures that the instrument case temperature does not exceed +80° C in continuous operation (the temperature is measured at the hexagon of the process connection).

At temperatures above +80° C the thread must not be immersed into the medium.

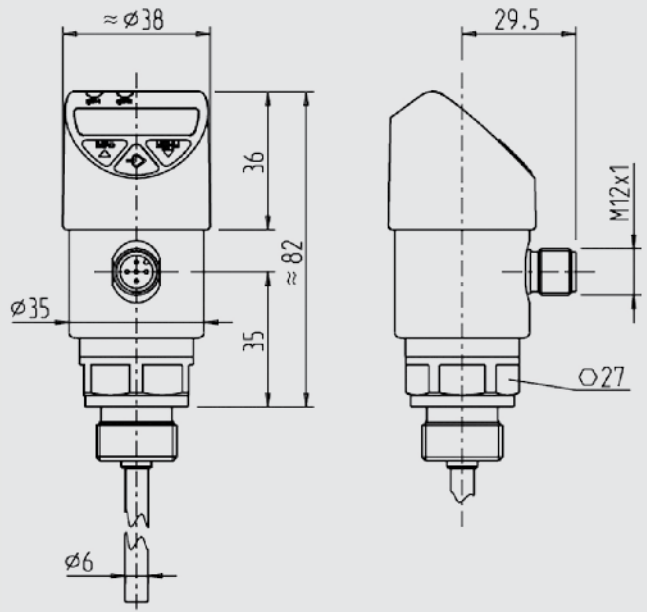
Electronic temperature switch TS-TSD 30

Rotatable, easily readable and rugged 14-segment LED display
Temperature range from -20 … +80° C

Dimensional drawing

Temperature switch

Circular connector M12x1, 4 / 5pin



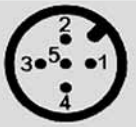
Connection diagram

Circular connector M12x1, 4 pin

Assignment

U_+	U-	S_+	SP1	SP2
1	3	2	4	2

Circular connector M12x1, 5 pin

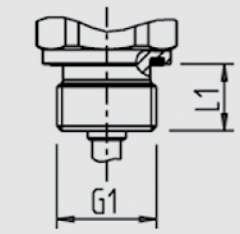


Assignment

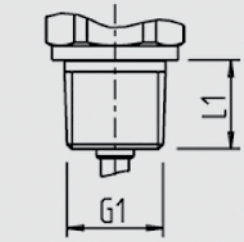
U_+	U-	S_+	SP1	SP2
1	3	5	4	2

Legend:	
U_+	Positive supply voltage
U_-	Reference potential
SP1	Switching output 1
SP2	Switching output 2
S_+	Analogue output

Process connections

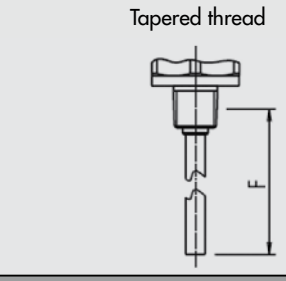


G1	L1
G1/4 A DIN 3852-E	12
G1/2 A DIN 3852-E	14



G1	L1
1/4 NPT	13
1/2 NPT	19

Insertion length



F					
25	50	100	150	250	350

Assembled cable and connection accessories

Type	Length	Specification	Part No.: straight	angled
M12x1 (S763) 4- pin	-	connector M12x1 for self-connection	1070039	1070038
	-	connector M12x1 self-connection, shielded	1070030	1070031
	2 m	cable: PUR	1070044	-
	5 m	cable: PUR, halogen-free	1070023	1070025
	5 m	cable: PUR, shielded, halogen-free	1070032	1070033
MVS / C, 3-pin +PE	3 m	cable: PUR, connector MVS / C	-	1070021

Special types upon request.

Antriebstechnik
Drive technology

Sensors

TIVAL®

Sketches + Notes

Introduction soft starter

Special: pump control

Pump control

The digital Soft Starters line of products provide an advanced microprocessor based control algorithm, enabling the sophisticated pump control feature which automatically manages the voltage prior to motor break-down torque. The motor torque is continuously monitored to eliminate peak torque from stressing the motor, pump and pipe system. These soft starters provide 3 field selectable pump control algorithms.

Overpressure during starting

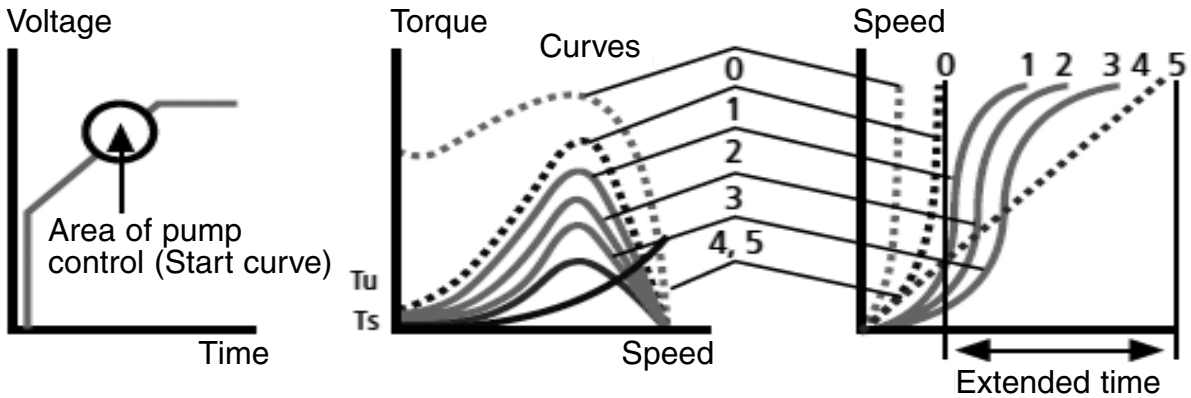
The sharp increase of torque towards the end of acceleration can cause high pressure and damage the pipe system. The pump control enables selection between three voltage ramp-up curves as well as a torque curve to reduce peak torque. Current ramp is available for special loads.

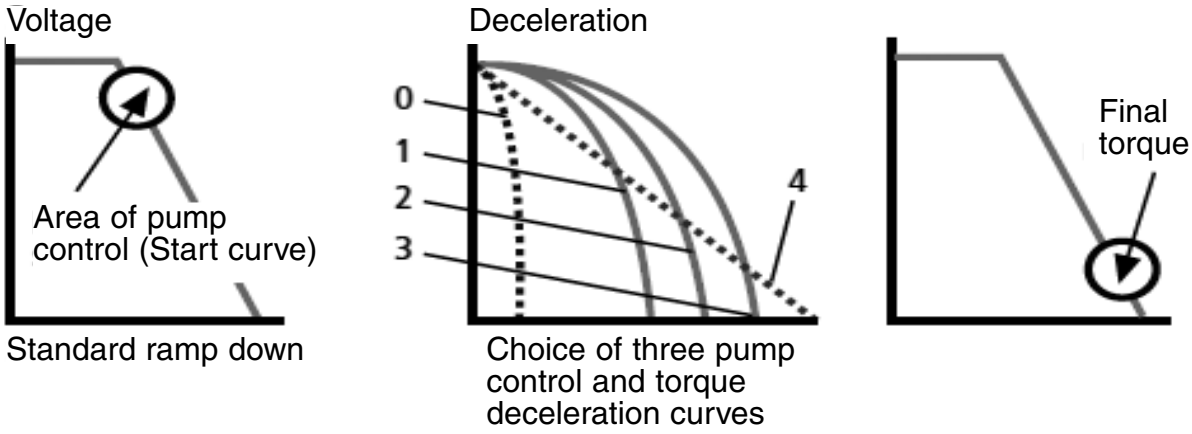
Pump- and special load control system

Two major problems are associated with starting and stopping of pumps.

Water hammer during stopping

During soft stop, when voltage is decreasing, motor torque may fall below load torque causing abrupt stalling instead of smoothly decreasing speed to zero. This creates the ”water hammer“ phenomenon, resulting in a loud noise and damage to the pipe system. The pump control algorithm enables selection between three voltage ramp-down curves or torque curve preventing stall condition and eliminating water hammer.





Digital soft starter ESA 3000-D

Digital soft starters, heavy duty industrial standard

KW at 400 V	Starter-type (A)	Dimensions (mm)			Weight (kg)
		W	H	D	
4	ESA 3000-D 8	153	310	170	4,5
7,5	ESA 3000-D 17	153	310	170	4,5
15	ESA 3000-D 31	153	310	217	6,8
22	ESA 3000-D 44	153	310	217	7,5
30	ESA 3000-D 58	153	310	217	7,5
37	ESA 3000-D 72	153	310	217	7,5
45	ESA 3000-D 85	274	385	279	15
55	ESA 3000-D 105	274	385	279	15
75	ESA 3000-D 145	274	385	279	15
90	ESA 3000-D 170	274	385	279	15
110	ESA 3000-D 210	590	500	292	31
160	ESA 3000-D 310	590	500	292	31
200	ESA 3000-D 390	590	500	292	31
250	ESA 3000-D 460	623	660	290	65
315	ESA 3000-D 580	623	660	290	65
450	ESA 3000-D 820	623	660	290	65
525	ESA 3000-D 950	623	660	290	65
630	ESA 3000-D 1100	723	1100	370	170
800	ESA 3000-D 1400	723	1100	370	170
950	ESA 3000-D 1800	723	1100	370	170
1250	ESA 3000-D 2150	750	1300	392	235
1350	ESA 3000-D 2400	900	1300	360	350
1750	ESA 3000-D 2700	900	1300	360	350
1850	ESA 3000-D 3000	900	1300	360	350
2000	ESA 3000-D 3500	900	1300	360	350

Description

- Advantages
  Superior starting and stopping characteristics
  Comprehensive motor protection package
  Easy commissioning
  Complete line 8 ... 3 500 A, 230 ... 1000 V
  Heavy duty design
  Robust construction
  Standard ambient temperature: +50° C
  Unique optional features including:
  Motor insulation tester
  RS 485 Modbus/Profi bus
  Thermistor input /analogue output
- Dispays & LEDs
  LCD – 2 lines of 16 characters each
  Selectable languages – English, German,
  French and Spanish
  8 LEDs for quick indication status
  Two display modes for basic and advanced applications
  Easy operation with default parameters
  Statistic data including: total run time,
  total number of starts, total number of trips,
  last start-current, last start time, last trip, current at trip
- Relay output
  3 programmable change-over contacts
  Operation with adjustable on- and off delay
  End of acceleration– with adjustable time delay
  Fault, programmable as fail save connection
  Motor-isolation alarm
- Starting and stopping
  Soft start and soft stop
  Current limit
  Pump control program
  Torque and Current Control for optimized
  starting and stopping process
  Dual adjustments – two starting and stopping
  characteristics
  Pulse start
  Slow speed with electronic reversing
  Linear acceleration (tacho feedback)
  Energy save for improved power factor
- Options
  RS 485 Communication
  Analogue output
  Thermistor input
  Motor insulation test
  Preparation for bypass – to maintain
  protection when bypass is closed
  Special anti-corrosive treatment – special
  coating for harsh enviroments
  Illuminated LCD
  Special tacho feedback
  Remote display
- Motor and starter protection,
  please compare to ESA 3000-DS

Digital soft starter ESA 3000-DS

Digital soft starters, integrated bypass
Ex type available

Soft starters with special Ex-certification available

KW at 400 V	Starter-type (A)	Dimensions (mm)			Weight (kg)
		W	H	D	
4	ESA 3000-DS-8	120	232	122	3,1
7,5	ESA 3000-DS 17	120	232	122	3,1
15	ESA 3000-DS 31	120	232	122	3,1
22	ESA 3000-DS 44	120	232	122	3,1
30	ESA 3000-DS 58	129	275	182	5,3
37	ESA 3000-DS 72	129	275	182	5,3
45	ESA 3000-DS 85	129	380	182	8,6
55	ESA 3000-DS 105	129	380	182	8,6
75	ESA 3000-DS 145	172	380	192	11,7
90	ESA 3000-DS 170	172	380	192	11,7
110	ESA 3000-DS 210	380	455	295	30,2
160	ESA 3000-DS 310	380	455	295	30,2
200	ESA 3000-DS 390	350	550	310	31
250	ESA 3000-DS 460	460	643	319	65
315	ESA 3000-DS 580	460	643	319	65
450	ESA 3000-DS 820	460	643	319	65
525	ESA 3000-DS 950	560	833	334	170
630	ESA 3000-DS 1100	560	833	334	170

Description

- Advantages
  Superior starting and stopping characteristics
  Comprehensive motor protection package
  User-friendly initial startup
  Fully equipped starters
  Little space requirement
  Third generation microprocessor based design
  Built-in bypass
  RS 485 communication
  Frequency autotracking: 45 ... 65 Hz
  Unique optional features including:
  Analogue output and additional Enhancements
- Dispays & LEDs
  LCD – 2 lines of 16 characters each
  Select. languages – English, German, French, Spanish
  4 LEDs – On, Run, Ramp up/down and fault
  Statistical data: start, stop and fault parameters
  Full script parameter settings
- Controls
  Opto isolated inputs
  Auxiliary relays: fault, end of acceleration or immediate (programmable)
  Local and remote reset
  RS 485 Modbus Communications for full control, display and programming
  Future enhancements: analogue I/O card with thermistor input
- Starting and stopping
  Soft start and soft stop
  Current limit
  Pump control program
  Torque and Current Control for optimized starting and stopping process
  Dual adjustments – two starting and stopping characteristics
  Pulse start
  Slow speed with electronic reversing
- Options
  RS 485 Communication
  Analogue output / Thermistor input
  Special anti-corrosive treatment – special coating for harsh enviroments
  Remote display
  Ex-approvals and certifications
- Motor and starter protection
  Too many starts
  Shear Pin (start, run, jam)
  Electronic overload with selectable curves
  Under current
  Phase loss and phase sequence
  Under, over and no voltage
  Load loss (motor not connected)
  Thyristor short; Starter over-temperature
  External fault (input programmable)
  Thyristor protection by varistors

Analog soft starter ESA 3000-A

Analog soft starters, motor protection and integrated bypass

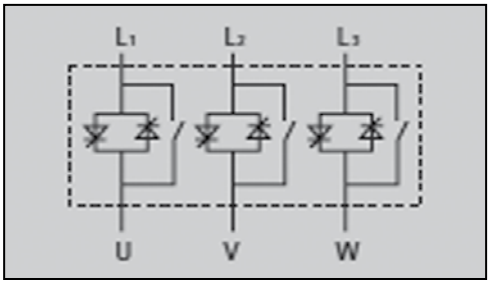
KW at 400 V	Starter-type (A)	Dimensions (mm)			Weight (kg)
		W	H	D	
4	ESA 3000-A 8	120	232	105	2,6
7,5	ESA 3000-A 17	120	232	105	2,6
15	ESA 3000-A 31	120	232	105	2,6
22	ESA 3000-A 44	120	232	105	2,6
30	ESA 3000-A 58	129	275	185	5
37	ESA 3000-A 72	129	275	185	5
45	ESA 3000-A 85	129	380	185	8,4
55	ESA 3000-A 105	129	380	185	8,4
75	ESA 3000-A 145	172	380	195	11,8
90	ESA 3000-A 170	172	380	195	11,8

KW at 400 V	Starter-type (A)	Dimensions (mm)			Weight (kg)
		W	H	D	
7,5	ESA 3000-A2P 17	90	75	105	0,6
11	ESA 3000-A2P 22	90	75	105	0,6
15	ESA 3000-A2P 31	65	190	114	1,4
22	ESA 3000-A2P 44	65	190	114	1,4
30	ESA 3000-A2P 58	120	265	121	3,5
37	ESA 3000-A2P 72	120	265	121	3,5
45	ESA 3000-A2P 85	120	265	121	3,5
55	ESA 3000-A2P 105	120	265	121	3,5
75	ESA 3000-A2P 145	129	275	182	6,5
90	ESA 3000-A2P 170	129	275	182	6,5

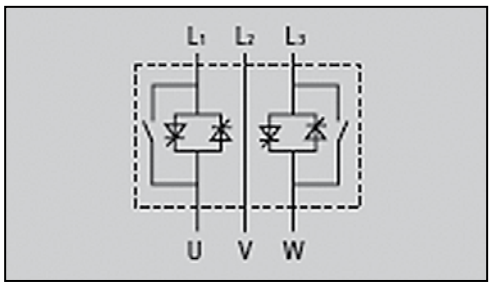
Description

- Advantages
  Soft start and soft stop
  Current limit
  Build-in motor protection
  Build-in bypass
  Start/stop by dry contact
  Compact, small foot print
  Aluminum housing
  Integrated input voltage monitoring
- Motor and starter protection
  Electronic overload
  Phase loss
  Starter over-temperature
  SCR protection by metal oxide varistors
- Displays & LEDs
  On – mains voltage connected
  Ramp up/down
  Run
  Overload
  Phase loss
  Over temperature
- Auxiliary Relays
  End of acceleration relay, N.O contact
  Fault relay, N.O contact
  Over temperature
- Application
  Pumps & compressors
  Ventilators & blowers
  Conveyor belt drives
  Starting in weak power networks
  (i.e. diesel generators)

3-phase control



2-phase control



Analog soft starter ESA 1000-B

Basic soft starters, integrated bypass

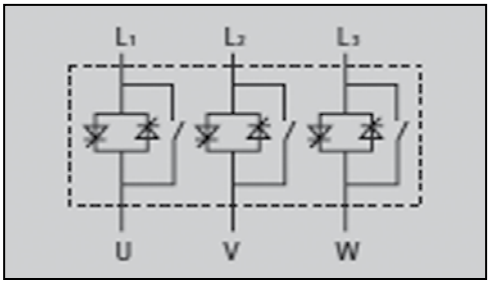
Description

- Advantages
  Soft start and soft stop
  Build-in bypass
  Start / stop by dry contact
  End of acceleration relay, N.O contact
  Compact, small foot print
  DIN rail mounting (partly option)
- Motor and starter protection
  SCR protection by metal oxide varistors
- Displays & LEDs
  On – mains voltage connected
  Ramp – voltage is ramping up/down (only ISA-B2P)
  Run – motor is running (only ISA-B2P)
- Output Relays
  End of acceleration
- Application
  Pumps
  Compressors
  Fans
  Conveyors
  Light duty motors in industrial applications
  Small conveyors (supermarkets etc.)
  Electrically driven gates
  Machine tools and appliances

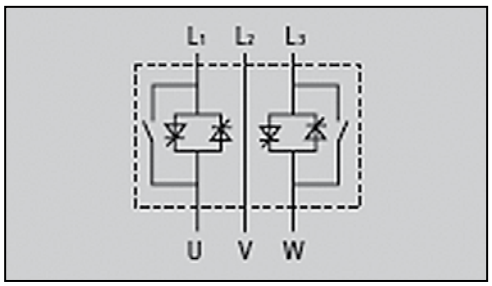
KW at 400 V	Starter-type (A)	Dimensions (mm)			Weight (kg)
		W	H	D	
4	ESA 1000-B 8	120	232	105	1,2
7,5	ESA 1000-B 17	120	232	105	1,2
15	ESA 1000-B 31	120	232	105	2,1
22	ESA 1000-B 44	120	232	105	2,1
30	ESA 1000-B 58	129	275	185	2,1

KW at 400 V	Starter-type (A)	Dimensions (mm)			Weight (kg)
		W	H	D	
4	ESA 1000-B2P 8	45	75	105	0,5
7,5	ESA 1000-B2P 17	90	75	105	0,6
11	ESA 1000-B2P 22	90	75	105	0,6
15	ESA 1000-B2P 31	65	190	114	1,3
22	ESA 1000-B2P 44	65	190	114	1,3
30	ESA 1000-B2P 58	65	190	114	1,3

3- phase control

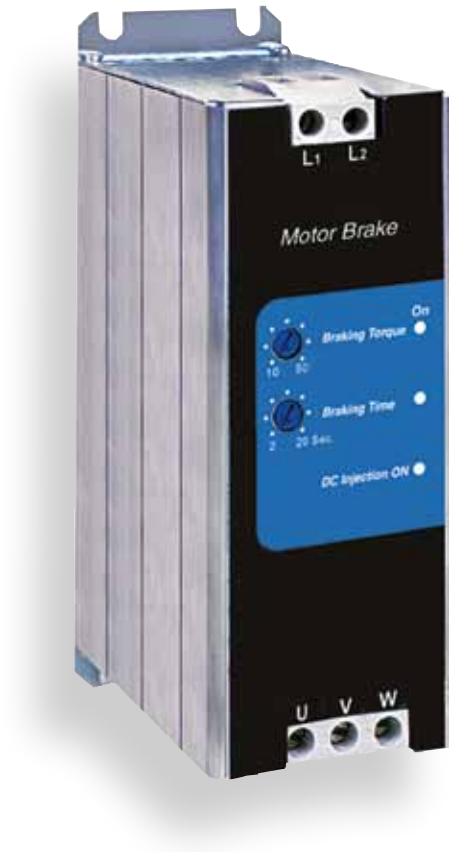


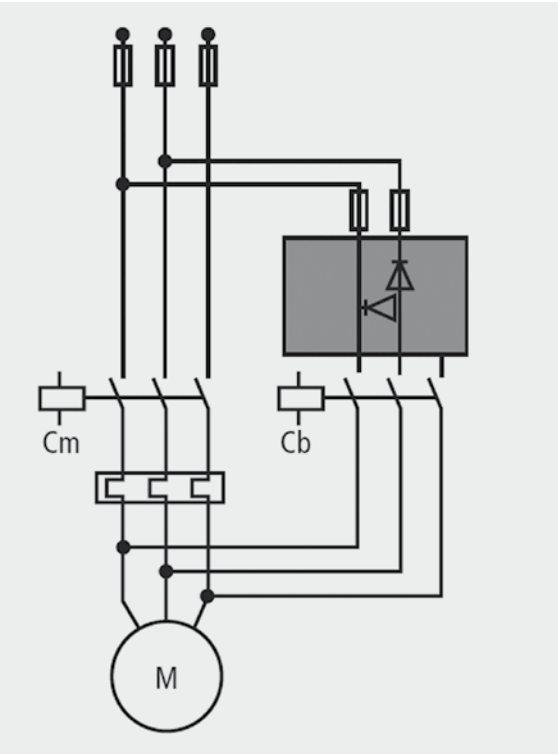
2-phase control



DC injection brake EMB 4000

For engine ranges of 5 ... 200 kW





Description

- Advantages
  The EMB electronic motor brake provides fast, smooth and frictionless stopping of a three phase induction motor by injecting controlled DC current to the motor windings after the mains contactor opened.
  Preventing mechanical wear
  Reducing stopping time of high inertia loads
  Adjustable braking time
  Auto stop – DC injection stops when motor stops
  DIN rail mounting (Standard 10 A, option 17 ... 58 A)
  Easy installation and operation

- Settings
  Braking Torque – determines the DC current level injected to the motor windings
  Two operation modes:
  1. Auto Mode:
  DC injection stops automatically when motor stops.
  2. Manual Mode:
  DC injection stops after the the pre-adjusted braking time. This mode can be used to "hold" the load at stand still.

- Displays & LEDs
  On – mains voltage connected
  Braking contactor closed
  DC injection on

- Application
  Circular and band saws
  Machine tools
  Fast stopping of high inertia loads
  Emergency stop (as long as mains supply remains on)

KW at 400 V	Brake Type (A)	Dimensions (mm)			Weight (kg)
		W	H	D	
5*	EMB 4000 10	90	75	105	0,5
7,5	EMB 4000 17	65	190	114	1,3
15	EMB 4000 31	65	190	114	1,3
30	EMB 4000 58	65	190	114	1,3
55	EMB 4000 105	154	280	160	5
110	EMB 4000 210	154	280	160	5,4
160	EMB 4000 310	224	384	222	12
200	EMB 4000 390	224	384	222	12

*5,5 kW at 415 V

Durchfluss

Flow

Durchfluss Durchfluss Durchfluss Durchfluss Durchfluss

Sensors

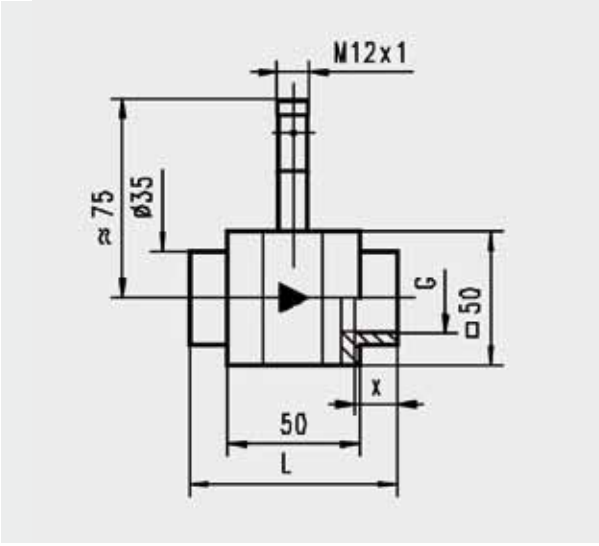
TIVAL®

Sketches + Notes

Flow rate sensor TS-FM

Flow rate 1 ... 80 Ltr. / min

Dimensional drawing



Technical data

Diameter G	PN bar	Range Ltr. / min H_2O	L mm	X mm	Weight (kg)
G 1/4	16	1 ... 15 Ltr. / min	74	12	0,6
G 3/8	16	1 ... 25 Ltr. / min	74	12	0,6
G 1/2	16	1 ... 50 Ltr. / min	78	14	0,6
G 3/4	16	1 ... 80 Ltr. / min	82	16	0,65
G 1	16	1 ... 80 Ltr. / min	82	18	0,7

Weight applies to plastic housing with metal connectors

Description

- Very fast response time
- Large overload security
- Measurement range 1:80
- Low pressure loss
- Compact dimensions
- High-temperature-type available
- Also available for small quantities measurement

A thin elastic diaphragm made of stainless steel, covering the entire flow cross-section, is deflected by the flowing fluid, and thereby pushes against an arched end stop.
A plastic-coated magnet is mounted on the diaphragm. When displaced by flow it will change its magnetic field which is detected by an analogue hall-sensor outside of the flow chamber
The Integrated evaluation electronics provides analog norm signals (4 … 20 mA, 0 … 10 V DC). The almost complete covering of the flow cross-section in the neutral position produces very high start-up sensitivity. As soon as the slightest flow exists, the diaphragm is necessarily deflected. The evaluation of the entire flow cross-section has the benefits of unproblematic pipework routing. No Run-in and run-out sections are necessary.
Due to the spring properties of the shutter and a molded stop, even strong media impacts are being withstood. The low number of parts coming into contact with media guarantees low soiling properties and reliable operation.

Full metal type
The standard type is manufactured with a plastic body with a compressive resistance of 16 bar. A full metal body (brass, nickel-plated) with a compressive resistance of 100 bar is available as an option. The use of metal fittings and connection hardware is mandatory due to the increased higher pressure strength. Measurements or switching value adjustments can be done in the range of 1… 80 Ltr. / min.

High temperature
If the full metal type is equipped with high-temperature sensors, a media temperature of up to 150˚ C can be performed and monitored. The primary sensor element is then placed in the measuring unit, while the evaluation unit is located at the end of a 0,5 m heat resistant cable.

Type designation: Example

TS-FM… -50-…-G1/2”I-RF

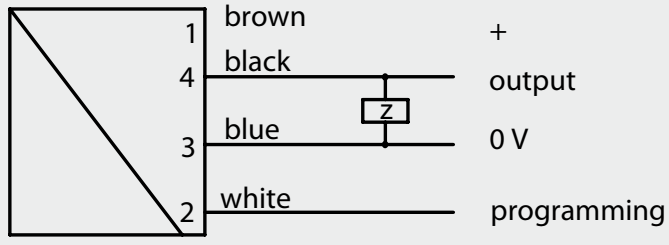
Please state:
Type of electrical output, temperature range

Flow rate sensor TS-FM

Flow rate 1 ... 80 Ltr. / min

Technical data	Type: TS-FM
Measuring range	1 … 80 Ltr. / min in water, basic ranges: please see Type nomenclature, special small amounts ranges 0,4 … 6,0 Ltr. available as option
Accuracy	basic ranges: +3 % meas.value or 0,25 Ltr. / min. Small quantity range: + 3 % meas.range 0,1 Ltr. / min (the respectively higher value is valid)
Pressure loss	max. 0,5 bar at measuring area end point
Operating pressure	plastic body type: 16 bar (70° C), Full metal type: 100 bar
Media temperature	0 ... +70° C, high-temperature option 0 … +150° C
Ambient temperature	0 ... +70° C
Storage temperature	-20 ... +80° C
Supply voltage	10 … 30 V DC, voltage output 10 V: 15 … 30 V DC
Electrical connection	circular plug-in connector M12 x 1, 4-conductor
Output data.	
Current output	4 ... 20 mA
Voltage output	0 … 10 V, output voltage max. 20 mA
Switched output	push-pull output, output current max. 200 mA minimum monitoring, maximum switch on request
Frequency output	push-pull output, output current max. 200 mA output frequency depending on measuring range, basic value 500 pulse / Ltr. (complies with 666,7 Hz at 80 Ltr. / min.) Small quantity range: 5000 pulse / Ltr. (complies with 500 Hz at 6 Ltr. / min.) other frequency ranges on request. all outputs are short-circuit proof and protected against polarity reversal.
Protection class	IP 67
CE conformity	yes
Material specs.:	
Fluid-wetted	
Plastic body	PPS
Full metal body:	brass, nickel-plated (stainless steel 1.4305 on request)
Connections	POM or brass, nickel-plated (stainless steel 1.4305 on request)
Gaskets:	Viton (others on request)
Bezel:	stainless steel 1.4031 K
Magnet fixture:	PPS
Adhesive	epoxy resin
Not fluid-wetted:	
Sensor tube	brass, nickel-plated
Adhesive	epoxy resin
Flange screws	stainless steel

Terminal assignment



The correct supply voltage value acc. to datasheet values has to be obeyed prior to installation! The use of shielded cable is highly recommended, cable length < 30 m, supply lines < 10 m.

Flow rate sensor TS-FM

Flow rate 1 ... 80 Ltr. / min

Type designation codes

1 Type **TS-FM**

2 Output signal
- **I** = 4 ... 20 mA
- **U** = 0 ... 10 V

3 Measuring range
- **15** = 1-15 Ltr. / min
- **25** = 1-25 Ltr. / min
- **50** = 1-50 Ltr. / min
- **80** = 1-80 Ltr. / min

4 Housing type
- **S** = standard (brass, plastic, brass)
- **M** = brass, brass, brass
- **ED** = stainless steel, stainless steel, stainless steel

5 Temperature range
- **ST** = standard 0 ... +70° C
- **HT** = high temperature type 0 ... +150° C

6 Process connection
- G 1/4", G 3/8", G 1/2", G 3/4", G 1"
- **I** = female thread
- **A** = male thread

7 **RF** = reverse current resistence

8 Sealing material
- **V** = FKM
- **E** = EPDM
- **N** = NBR

	1	2		3		4		5		6		7		8
Example:	**TS-FM**	**I**	-	**25**	-	**M**	-	**HT**	-	**G 1/4 I**	-	**RF**	-	**V**

TS-FMI-25-M-HT-G1/4I-RF-V

Assembled cable and connection accessories




Type	Length	Specification	Part No.: straight	angled
M12x1 (S763) 4- pin	-	connector M12x1 for self-connection	1070039	1070038
	-	connector M12x1 self-connection, shielded	1070030	1070031
	2 m	cable: PUR	1070044	-
	5 m	cable: PUR, halogen-free	1070023	1070025
	5 m	cable: PUR, shielded, halogen-free	1070032	1070033
MVS / C, 3-pin +PE	3 m	cable: PUR, connector MVS / C	-	1070021

Special types upon request.

Sensors

TIVAL®

Sketches + Notes

Flow sensor TS-FK12…

Calorimetric flow sensor

Description

- Full transmitter in 12 mm housing
- One transmitter type for different piping sizes
- Output signal proportional to media flow rate
- 4 … 20 mA; 0 … 10 V; frequency output; switch or pulse output available
- Adjustable working range
- User configuration by connection pin (teach-in)
- Simplest handling

The sensor TS-FK12 is designed for monitoring of non-viscous liquids; monitoring of gaseous media upon request. The sensor and its entire electronics are mounted into a compact size sensor housing of 12 mm diameter equipped with M12x1 round plug connector. Calorimetric signal temperature compensation and linearization are adopted by the built-in 16-bit processor. (Flowing media heat transfer measuring at the sensor tip)

The TS-FK12 electronics outputs the measuring result as:

Analog **0 / 4 … 20 mA** signal (TS-FK12-I)
Analog **0 / 2 … 10 V** signal (TS-FK12-U)
Frequency signal (TS-FK12-F)
Switch signal (TS-FK12-S)
Flow signal **pulse / x litre** (TS-FK12-C)

The range value can be adjusted by “teach-in” on pending flow upon wishing so.

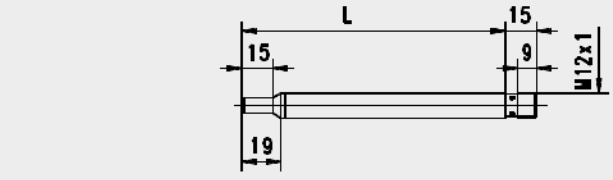
Handling

The measuring range / switching value (TS-FK12-S) can be user set by “teach-in” as described below:

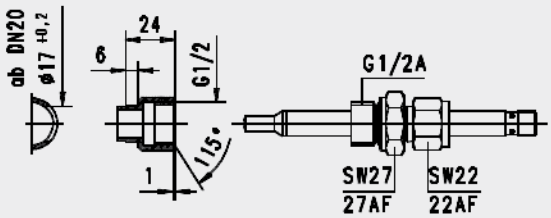
- Set the flow to the maximum flow rate.
- Apply a pulse of at least 0.5 sec. and max. 2 sec. to pin 2 (e.g. by installing a bridge to auxiliary voltage or via a pulse from the SPS control) to accept the measured final value.
- LED flashes during programming process; in normal mode this LED indicates operation voltage.
- After teach-in, pin 2 should be connected to 0 V in order to avoid unintentional programming.

Attention: The programming function must be stated when ordering; otherwise a non-programmable type will be supplied.

Dimensional drawing

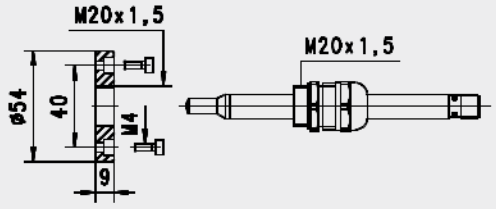


optional accessories



weld-in adaptor

stainless steel compression union



plastic weld-in adaptor

plastic compression union

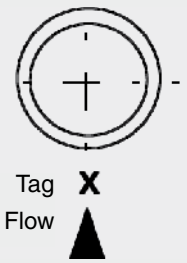
Flow sensor TS-FK12...

Calorimetric flow sensor

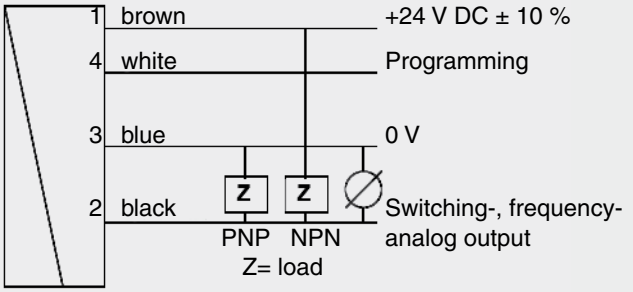
Technical data	Type: TS-FK12...
Measuring range	2 ... 150 cm / s or 3 ... 300 cm / s acc. to tag position against flow direction (see a.m.; others upon request).
Nominal diameter	DN 15 to DN 300 (others upon request)
Connection type	please refer to installation drawing
Media temperature	-20 ... +70° C
Environment temperature	0 ... +60° C
Operating pressure	40 bar on use of stainless steel union (pls. obey tightening torque) 6 bar on plastic union
Measurement deviation	dependent on mounting situation and flow conditions (typical: +5% of final value)
Repeatability	± 1 %
Temperature dependency	± 0,01 % / 1 K
Supply voltage	24 V DC ± 10 % (controlled)
Power consumption	< 1 W
Analog output	4 … 20 mA / burden max. 500 Ω or 0 … 10 V / load min. 1 kΩ
Switching output	transistor output „push-pull“ (short circuit and polarity safe) I_{out} = 100 mA max.
Frequency output	freely selectable ! Max. 0 … 2 kHz.
LED	yellow LED (on=OK / off= alarm / flashing=programming mode or malfunction
Protection class	IP67
Electrical connection	M12x1 circular plug connector, 4-pin
Material Media-wetted Non-media-wetted	 housing stainless steel 1.4571 plug connector PA 66 gold-plated contacts
Weight	50 g (excl. union)
Conformity	CE

Mounting instruction

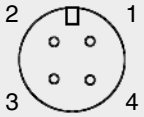
The sensors TS-FK12… are direction dependent (please obey tag on housing surface). Mounting direction has to be observed during installation process, further the conical reduction of the diameter should be positioned to 1/3 ... 1/2 of the main pipe diameter.
Blisters or deposits on the sensor must be avoided ! Best mounting position is therefore from the side of the main pipe.
In the first step the stainless steel union is tightened by hand only and then must be finally tightened in a second step one quarter-turn using a suitable wrench. After this procedure the locking ring can not be removed from the sensor anymore; the submersible depth can not be readjusted!



Connection diagram



M12x1 circular plug (pinout)



The use of shielded cables is highly recommended!

Flow sensor TS-FK12...

Calorimetric flow sensor

Type designation codes

1 Type **TS-FK12**

2 electrical output
- **I** = 4 ... 20 mA
- **U** = 0 ... 10 V
- **F** = frequency
- **C** = pulse output
- **S** = switching output

3 housing length
- 120 = 120 mm (+3)
- 170 = 170 mm (+3)
- 220 = 220 mm (+3)

4 measuring range
- 150 = 150 cm / s
- 300 = 300 cm / s

	1		2		3		4
Example:	**TS-FK12**	-	**U**	-	**120**	-	**300**

TS-FK12-U-120-300

Assembled cable and connection accessories




Type	Length	Specification	Part No.: straight	angled
M12x1 (S763) 4- pin	-	connector M12x1 for self-connection	1070039	1070038
	-	connector M12x1 self-connection, shielded	1070030	1070031
	2 m	cable: PUR	1070044	-
	5 m	cable: PUR, halogen-free	1070023	1070025
	5 m	cable: PUR, shielded, halogen-free	1070032	1070033
MVS / C, 3-pin +PE	3 m	cable: PUR, connector MVS / C	-	1070021

Special types upon request.

Sensors

TIVAL®

Sketches + Notes

Digitalanzeigen und Zubehör

Controls and accessories

Digitalanzeige Trennschaltverstärker Universaltrennverstärker Universal Speisetrenner Zenerbarriere
Digitalanzeige Trennschaltverstärker Universaltrennverstärker Universal Speisetrenner Zenerbarriere
Digitalanzeige Trennschaltverstärker Universaltrennverstärker Universal Speisetrenner Zenerbarriere
Digitalanzeige Trennschaltverstärker Universaltrennverstärker Universal Speisetrenner Zenerbarriere
Digitalanzeige Trennschaltverstärker Universaltrennverstärker Universal Speisetrenner Zenerbarriere

Digital display TS-MR 50

Standard signals 0 / 4 ... 20 mA, 0 / 2 ... 10 V DC

Features

- Input standard signals 0 / 4 ... 20 mA, 0 / 2 ... 10 V DC
- Measuring range programmable
- Basic accuracy 0,1 % ± 1 Digit
- Installed units:
  mV, V, mA, A, Ω, kΩ, µS / cm, mS / cm, °C, °F, min^{-1},
  U / min, bar, mbar, hPa, mm, cm, m, %, °, Ltr.,
  Ltr. / min, m^3, m^3 / h, ppm
  custom units programmable
- Simulator function
- Fault monitoring for break of wire
  in the measuring circuit
- Programmable fault function
  Analog output min. or max. overflow
  Alarm outputs min. or max. function
- Integrated transmitter supply 24 V DC max. 30 mA
- 4 alarm outputs (relay SPDT)
- Isolated analog output 0 / 4 ... 20 mA; 0 / 2 ... 10 V DC
- Full 3-port isolation

The digital display TS-MR 50 has inputs for industry standard signals 0 / 4 ... 20 mA and 0 / 2 ... 10 V DC. Measuring value and programmed unit are shown in the display. The integrated transmitter supply offers direct connection of loop powered sensors. Simple programming, up to 4 alarm outputs (SPDT) and optional available fully isolated free programmable analog output 0 / 4 ... 20 mA; 0 / 2 ... 10 V DC meets the demand for different applications. Peak value indication for minimum and maximum measured values are stored in the background and can be read out from the display at any time.

Ordering code

1 Type **TS-MR 50**

2 Input
- **1** = Standard signals 0 / 4 ... 20 mA; 0 / 2 ... 10 V DC
  Transmitter supply 24 V DC max. 30 mA

3 Alarm outputs
- **2R =** 2 relay outputs A1, A2 SPDT

4 Alarm outputs
- **00** = not installed
- **2R** = 2 relay outputs A3, A4 SPDT

5 Analog output
- **00** = not installed
- **AO =** Analog output 0 / 4 ... 20 mA; 0 / 2...10 V DC

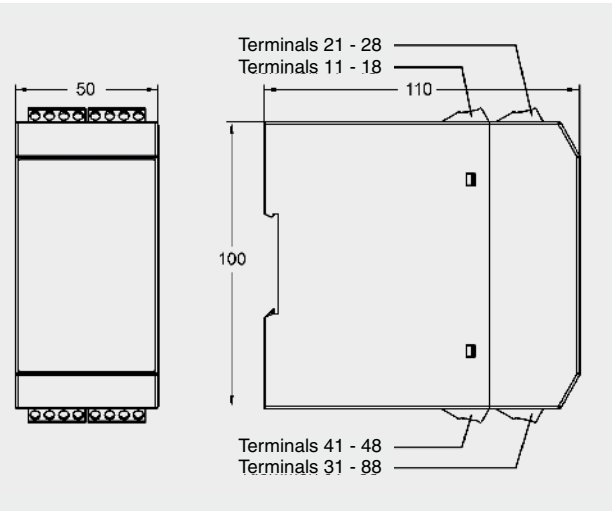
6 Supply voltage
- **0** = 230 V AC ± 10 % 50 ... 60 Hz
- **1** = 115 V AC ± 10 % 50 ... 60 Hz
- **5** = 24 V DC ± 15 %

Example:

1		2		3		4		5		6
TS-MR 50	-	1	-	2R	-	00	-	AO	-	0

TS-MR 50-1-2R-00-AO-0

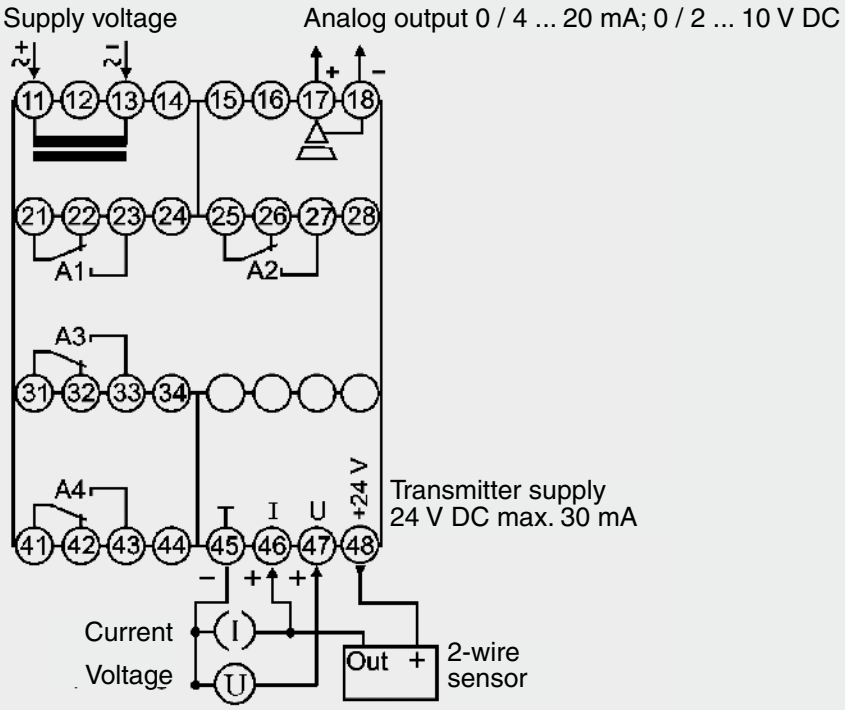
Dimensional drawing



Digital display TS-MR 50

Standard signals 0 / 4 ... 20 mA, 0 / 2 ... 10 V DC

Connection diagram



Technical data	Type: TS-MR 50
Supply voltage	230 V AC ± 10 %, 115 V AC ± 10 %, or 24 V DC ± 15 %
Power consumption	max. 5 VA
Operating temperature	-10 ... +55° C
Input	0 / 4 ... 20 mA; 0 / 2 ... 10 V DC
Fault detection	break of wire in the measuring circuit
Input resistance	current input 10 Ω, voltage input 10 kΩ
Basic accuracy	< 0,1 % ± 1 Digit
Temperature coefficient	0,01 % / K
Transmitter supply	24 V DC max. 30 mA
Output	
Alarm outputs A1-A4	relay SPDT < 250 V AC < 250 VA < 2 A cosn ≥ 0,3, < 300 V DC < 40 W < 2 A
Analog output	0 / 4 ... 20 mA burden ≥ 500 Ω; 0 / 2 ... 10 V burden > 500 Ω, galv. isolated, output changes automatically (burden impedance dependent).
Accuracy	0,2 %; TK 0,01 % / K
Fault function	for break of wire detection → Analog output 0 mA, < 3,6 mA or > 21,5 mA programmable → Alarm output(s) min. or max. function programmable
Display	graphic LCD-Display 128x64 pixels, white background illuminated
Case	polyamide (PA) 6.6, UL94V-0, DIN rail mounting TS 35
Weight	~ 450 g
Connection	screw terminals 0.14 ... 2.5 mm² (AWG 26 ... 14)
Protection	housing IP30, terminals IP20, German BGV A3

Digital display TS-WM 110

Input signals 0 / 4 … 20 mA or 0 …10 V
Two relais outputs, wall-mounting

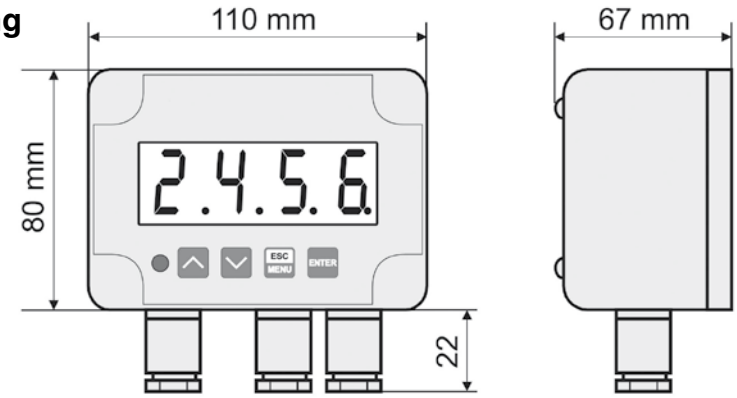
Description

- 4-digit red LED-display
- Input signals 0 / 4 … 20 mA or 0… 10 V
- 2 output relais
- Programmable measuring range
- Integrated 24 V DC sensor power supply
- Wall-mounting

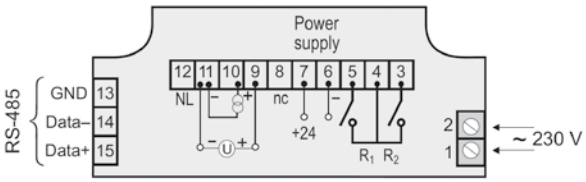
Programmable parameters

- Input signal
- Measuring range and decimal point
- Threshold and hysteresis
- Contact function
- Display light intensity
- Password protected area

Dimensional drawing



Electrical connections



Technical data	Type: TS-WM 110
Input signal	0 / 4 ... 20 mA 0 ... 10 V
Display range	-999 to 9999
Accuracy	0,25 % ± 1 Digit
Relay	2 s, 250 V AC - 1 A
Supply voltage	230 V AC ± 10 %, max. 2,5 V
Sensor supply voltage	24 V DC, max. 25 mA
Environment temperature	-20 ... +50° C
Storage temperature	-20 ...+70° C
Protection class	IP 65

Isolating switching repeater TS-500 Ex

1- and 2-channel device

Features

- Input for switching contact, proximity switch Namur type acc. to DIN EN 60947-5-6 or opto-coupler
- Input intrinsically safe acc to:
  ATEX II (1) G [Ex ia] IIC/IIB
  ATEX II (1) D [Ex iaD]
- Switchable line fault detection for broken and shorted lines
- Output relay SPDT contact or electronic (transistor passive) available
- Supply voltage 230 V AC or 24 V DC
- Power on LED, status / error LED
- 22.5 mm case for DIN rail mounting

Isolating switch-coupler TS-500 Ex can be used for monitoring and controlling digital signals out of the hazardous area. The intrinsically safe input is suitable for switching contact, proximity switch acc. Namur DIN EN 60947-5-6), or passive electronic outputs of other devices. The devices must be installed out of the Ex-area, because only the input is intrinsically safe.

Requirements

- It is necessary to keep the conditions of the ATEX EC-Type examination certificate.
- The device must be installed in dry and good monitored rooms.
- If the intrinsinc safety input is connected to the dust endangered area of zone 20 or 21, it has to be ensured that the corresponding devices in this circuit have the requirements of category 1D or 2D.
- Reparing and design modifications may only be carried out by the manufacturer.

Ordering code

1 Type **TS-500 Ex ia**
(categoric „ia“ includes „ib“)

2 Output
- **1R** = 1-channel with relay output
- **2R =** 2-channel with relay output
- **1T** = 1-channel with electronic output
- **2T** = 2-channel with electronic output

3 Supply voltage
- **0** = 230 V AC ± 10 % 50 ... 60 Hz
- **5** = 24 V DC ± 15 %

Example:

1		2		3
TS-500 Ex ia	-	1R	-	0

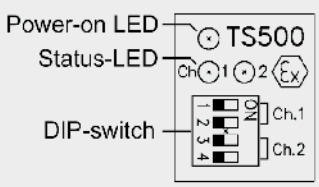
TS-500 Ex ia-1R-0

Isolating switching repeater TS-500 Ex

1- and 2-channel device

Technical data	Type: TS-500 Ex
Explosion protection	
Certification	DMT 99 ATEX E 079
Approval	II (1) G [Ex ia] IIC/IIB or II (1) D [Ex iaD]
Max. voltage (no load) U_0	10,6 V
Max. short cirduit current I_0	26,8 mA
Max. power consumption P_0 (characteristic linear)	71,0 mW
Input classification	ia / IIB ia / IIC
Max. external capacity	16,2 µF 2,3 µF
Max. external inductivity	110,0 mH 20,0 mH
Internal capacity	negligible
Internal inductivity	36 µH
Power supply	
Supply voltage	230 V AC± 10 % AC, 47 ... 63 Hz 24 V DC ± 15 % (safety voltage 253 V AC / 125 V DC)
Power consumption	< 2 W
Operating temperature	-10 ... +55° C
Rated voltage	400 V AC acc. VDE0110 group 2 between input / output / supply voltage
Test voltage	4 kV DC between input / output / supply voltage
CE conformity	ATEX-directive 94/9/EG, EN 60079-0:2006 EN 60079-11:2007 EN 61241-0:2006 EN 61241-11:2007 IEC 61000-4-2/3/4/5/6/8/11
Inputs (intrinsically safe)	
No load voltage	approx. 8 V (acc. to DIN EN 60947-5-6, Namur)
Short circuit current	approx. 8 mA (acc. to DIN EN 60947-5-6, Namur)
Switching point	inactive ≤ 1,2 mA, aktiv ≥ 2,1 mA, Hysterese ca. 0,5 mA
Broken line detection	≤ 0,1 mA
Shorted line detection	≥ 7,5 mA
Output (relay)	
Switching capacity	< 253 V AC < 100 VA < 2 A; < 100 V DC < 50 W < 2 A
Max. switching frequency	5 Hz
Max. switching delay	20 ms (2-channel: 50 ms)
Electronic output (transistor passive)	
Max. voltage	35 V DC (safety voltage 253 V AC / 125 V DC)
Max. current	50 mA (short circuit proof)
Voltage drop	≤ 3,5 V (at load 50 mA)
Max. switching frequency	2 kHz (50 % keying ratio)
Max. switching delay	300 µs
Case	standard case of polycarbonate 8020 UL94V-1 acc. to DIN EN 60715:2001-09
Weight	~ 200 g
Protection	case IP30, terminals IP20 finger safe acc. to German BGV A3
Connection	screw terminal with pressure plate, max. 2.5 mm², wire

Panel controls



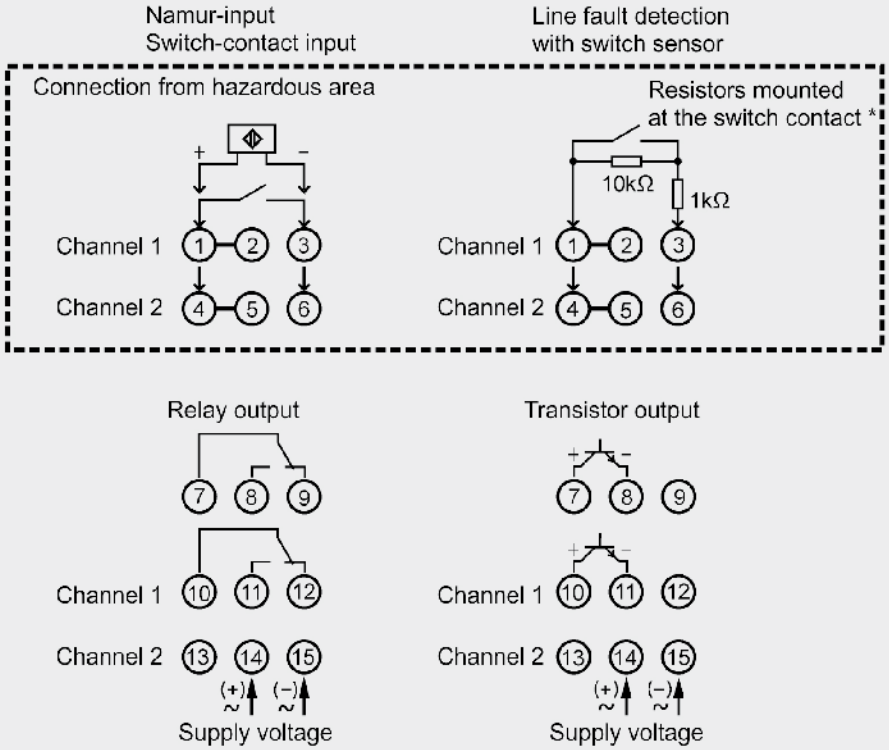
Way of effect	Channel 1	Channel 2
non inverted (N.O.)	S1 off	S3 off
inverted (N.C.)	S1 on	S3 on
Broken line/shorted line		
non active	S2 off	S4 off
active	S2 on	S4 on

Isolating switching repeater TS-500 Ex

1- and 2-channel device

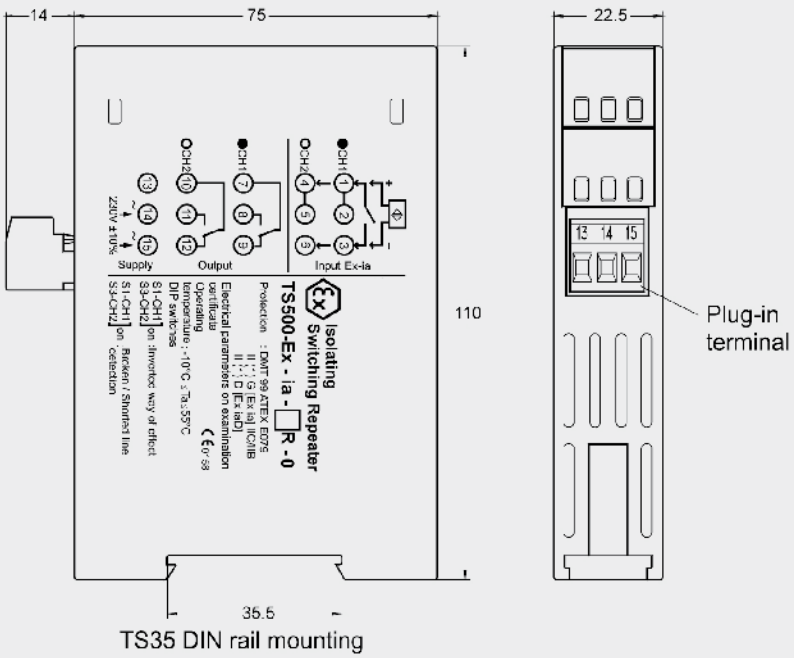
Sensors TIVAL

Connection diagram

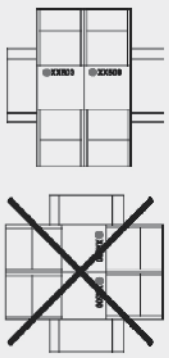


* Necessary for line fault detection in connection with switch sensors.

Dimensional drawing and controls (narrow side)



Caution!
Mounting of multiple units without distance is only permitted in horizontal orientation.



Controls and accessories

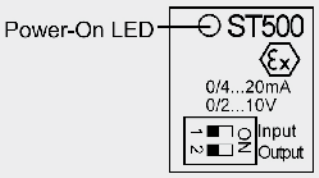
Universal isolation amplifier TV 500-Ex
Universal separator ST 500-Ex

Features

- Switch-selectable inputs
  0 / 4 ... 20 mA and 0 / 2 ... 10 V
  intrinsically safe ATEX II (1) G [Ex ia] IIC
  ATEX II (1) D [Ex iaD]
- Switch-selectable outputs
  0 / 4 ... 20 mA simultaneous 0 / 2 ... 10 V
- Supply voltage 85 ... 253 V AC or
  10 ... 30 V AC / DC
- Full 3-port isolation
- Integrated transmitter supply
  for active 2- and 3-wire sensors
  (ST500-Ex only)
- Power-on LED
- 22.5 mm case for DIN rail mounting

The isolating signal converter can be used to isolate industry standard signals 0 / 4 ... 20 mA or 0 / 2 ... 10 V DC out of the Ex area. The universal design of the in- and outputs and the wide range of supply voltage limits the devices into 2 models. The ST500Ex provides an isolated transmitter supply for direct connection of active 2- wire sensors (4 ... 20 mA) and 3-wire sensors in the Ex-area.

Front panel controls (front)



DIP-switch	0 ... 20 mA 0 ... 10 V	4 ... 20 mA 2 ... 10 V
Input	S1 OFF	S1 ON
Output	S2 OFF	S2 ON

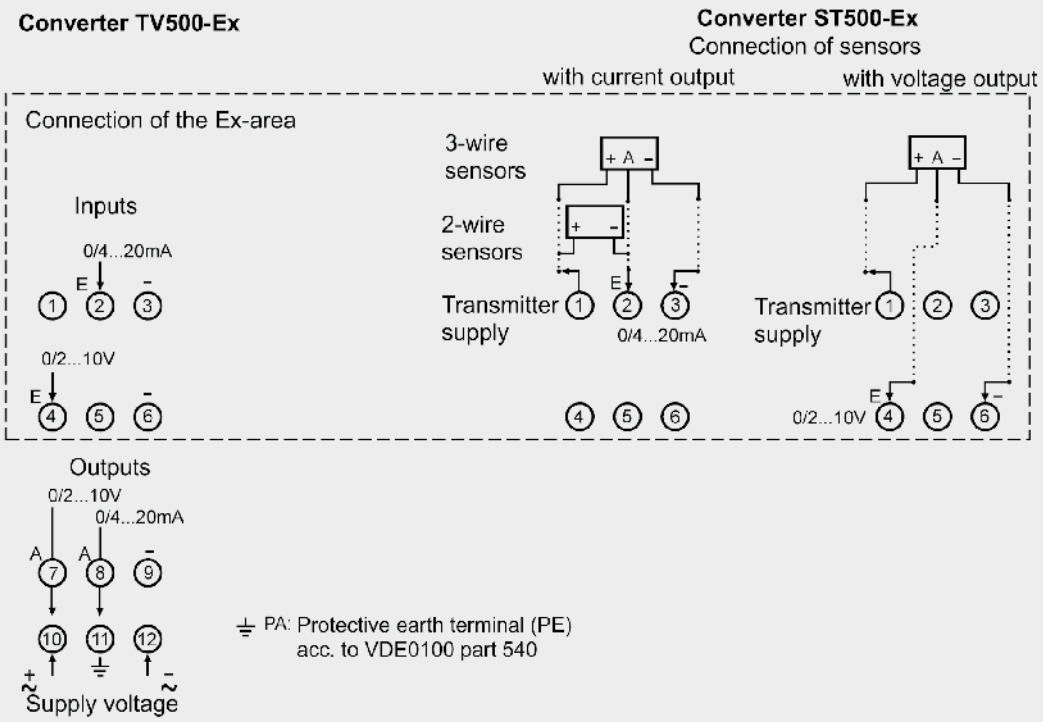
Technical data	Type: TV 500-Ex / ST 500-Ex
Power supply	
Supply voltage	85 ... 253 V AC / 110 ... 125 V DC or 10 ... 30 V AC / DC
Frequency AC	40 ... 400 Hz
Power consumption	< 3,5 VA
Operating temperature	-10 ... +55° C
Rated voltage	253 V AC or 125 V DC (Um) acc. EN 60079-0, 250 V AC acc. to EN 60664-1, degree of pollution 2 over-voltage category III between input / output / supply voltage
Test voltage	3 kV AC between input / output / supply voltage
CE-conformity	ATEX-directive 94/9/EG, European standard
(Certificate ST500ATEX.002)	EN60079-0:2006, EN60079-11:2007, EN61241-0:2006, EN61241-11:2006 EN61316-1:2004-05, EMV-directive 2004/108/EG

Universal isolation amplifier TV 500-Ex
Universal separator ST 500-Ex

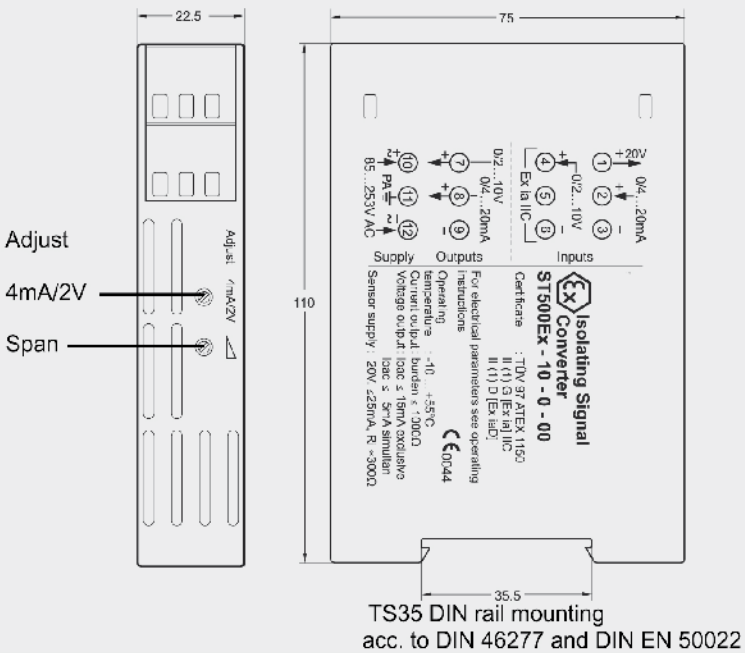
Technical data		Type: TV 500-Ex / ST 500-Ex			
Explosion protection					
Certification		TÜV 97 ATEX 1150, 2. addendum			
Protection		II (1) G [Ex ia] IIC, II (1) D [Ex iaD]			
U_0		25,2 V			
I_0		TV 500-Ex : 1 mA ST 500-Ex : 95 mA			
P_0		TV 500-Ex : < 1 mW (curve linear) ST 500-Ex : 600 mW (curve linear)			
Ignition protection class Ex ia		IIC		IIB	
L_0	TV 500-Ex	100 mH	0,5 mH	100 mH	0,5 mH
	ST 500-Ex	2 mH	0,2 mH	15 mH	1 mH
C_0	TV 500-Ex	84 nF	100 nF	460 nF	570 nF
	ST 500-Ex	47 nF	107 nF	370 nF	430 nF
The effective internal capacitances Ci and inductances Li are negligibly small. The maximum values of C0 and L0 are also allowed to be used up to the permissible limits as concentrated capacitances and as concentrated inductances (mixed circuits).					
The intrinsically safe circuits are galvanically separated from the non intrinsically safe circuits up to a peak value of the voltage of 375 V.					
Inputs					
Current input		0 / 4 ... 20 mA switch selectable, R_i = 25 Ω, overload max. 100 mA			
Voltage input		0 / 2 ... 10 V DC switch selectable, R_i ca. 40 kΩ, overload max. 100 V			
Span and start value 4 mA/2 V		adjustable approx. ± 20 %			
Transmitter supply		approx. 20 V DC, Ri approx. 300 Ω (ST 500-Ex only)			
Short circuit (Term. 1, 2)		output current < 27 mA			
Outputs					
Current output		0 / 4 ... 20 mA switch selectable, max. burden 1 kΩ			
Voltage output		0 / 2 ... 10 V DC switch selectable, max. load 15mA, short circuit protected (simultaneous to current outp. max. 5mA)			
Rated voltage		253 V AC or 125 V DC (Um) acc. to EN 60079-0 max. permissible short circuit current of the apparatus at the output 2 A			
Rise time (T_{90})		< 100 ms			
Accuracy		< 0,3 %			
Temperature coefficient		< 0,01 % / K			
Repeat accuracy		< 0,1 %			
Supply error		< 0,1 %			
Malfunction current output 4 ... 20 mA, both DIP-switches on:					
Input →		Short circuit clamp 1, 2	Short circuit clamp 2, 3	Power interruption	Overdriving (max. 100 mA)
TV 500-Ex		23 ... 27 mA < 2,5 mA	< 2,5 mA	< 2,5 mA	Threshold 23 ... 27 mA
ST 500-Ex		100 mH	< 2,5 mA	< 2,5 mA	Threshold 23 ... 27 mA
Case					
Type		DIN rail case of polycarbonate 8020 UL94-V1			
Weight		~ 200 g			
Protection		case IP30, terminals IP20 finger safe acc. German BGV A3			
Connection		screw terminals with pressure plate, max. 2,5 mm² wire			
Mounting place		mounting in dry, clean and well monitored area acc to EN60079-11:2007, part 6.1			

Universal isolation amplifier TV 500-Ex
Universal separator ST 500-Ex

Connection diagram



Dimensional drawing and controls (narrow side)



Caution!
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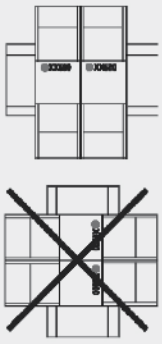

Zener diode barrier MTL 7787+

Description

All MTL7700 Series barriers are based on the same simple principle. Each channel contains two stages of pulse-tested Zener or forwardconnected diodes and an 'infallible' terminating resistor. In the event of an electrical fault in the safe area, the diodes limit the voltage that can reach the hazardous area and the resistor limits the current. A fuse protects the diodes, and the two stages of voltage limitation ensure continued safety if either stage should fail. No active outputcurrent limiting circuits are employed. All models are certified 'ia' for all zones and 'IIC' for all explosive atmospheres (except MTL7707P+ and MTL7729P+, 'ia' 'IIB').

Safety description
The safety description of a barrier, eg 10 V, 50 Ω, 200 mA, refers to the maximum voltage of the terminating Zener or forward diode while the fuse is blowing, the minimum value of the terminating resistor, and the corresponding maximum short-circuit current. It is an indication of the fault energy that can be developed in the hazardous area, and not of the working voltage or end-to-end resistance.

Polarity
Barriers may be polarised + or –, or non-polarised ('ac'). Polarised barriers accept and/or deliver safe-area voltages of the specified polarity only. Non-polarised barriers support voltages of either polarity applied at either end.

End-to-end resistance
The resistance between the two ends of a barrier channel at 20°C, ie of the resistors and the fuse. If diodes or transistors are present, their voltage drop (transistors ON) is quoted in addition.

Working voltage (Vwkg)
The greatest steady voltage, of appropriate polarity, that can be applied between the safe-area terminal of a 'basic' barrier channel and earth at 20° C for the specified leakage current, with the hazardous-area terminal open circuit.

Maximum voltage (Vmax)
The greatest steady voltage, of appropriate polarity, that can be applied continuously between the safe-area terminal of any barrier channel and earth at 20° C without blowing the fuse. For 'basic' barriers, it is specified with the hazardous-area terminal open circuit; if current is drawn in the hazardous area, the maximum voltage for these barriers is reduced. The 'ac' channels of 'basic' barriers and most channels of overvolt-protected barriers withstand voltages of the opposite polarity also – see circuit diagrams.

Fuse rating
The greatest current that can be passed continuously (for 1000 hours at 35° C) through the fuse.

Star connection
In star-connected barriers, the two channels are interlocked such that the voltage between them cannot exceed the working voltage, Vwkg: this allows for higher cable capacitance or inductance.

Maximum safe-area voltage (U_m)
The maximum permissible safe-area voltage (U_m) for MTL7700 Series barriers is 250 V AC / DC.

Technical data	Type: MLT 7787+
Ambient temperature and humidity limits	- 20 ... + 60° C continuous working - 40 ... + 80° C storage 5 … 95 % RH
Safety discription	**28 V, 300 Ohm**
Terminals	Removable terminals accommodate conductors up to 2.5 mm² (13AWG). Hazardous-area terminals are identified by blue labels. Removal force > 15 N.
Weight	~ 140 g
EMV-directive	EN 50 081-2 EN 50 082-2

Assembled cable and connection accessories




Type	Length	Specification	Part No.: straight	angled
M12x1 (S763) 4- pin	-	connector M12x1 for self-connection	1070039	1070038
	-	connector M12x1 self-connection, shielded	1070030	1070031
	2 m	cable: PUR	1070044	-
	5 m	cable: PUR, halogen-free	1070023	1070025
	5 m	cable: PUR, shielded, halogen-free	1070032	1070033
MVS / C, 3-pin +PE	3 m	cable: PUR, connector MVS / C	-	1070021

Special types upon request.