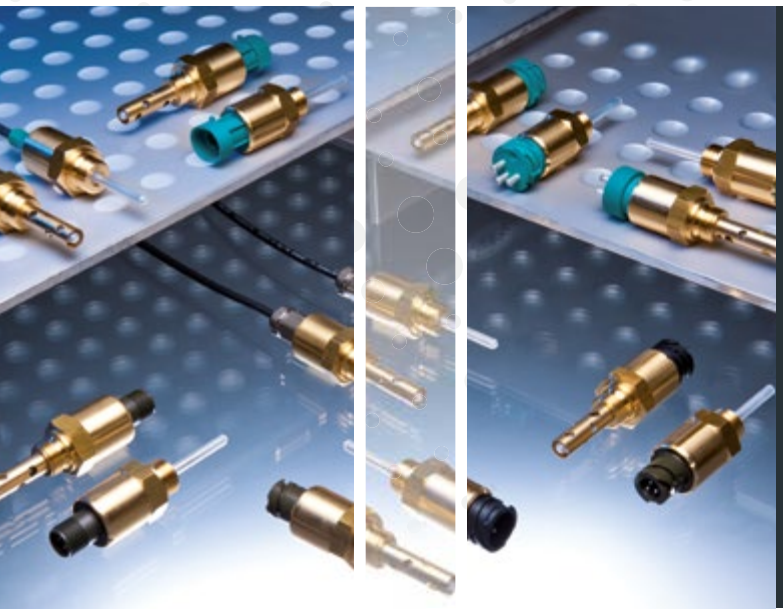
BEDIA®
MOTORENTECHNIK



LEVEL MONITORING SENSORS

According to railway standard DIN EN 50155
Fire behaviour according to DIN EN 45545-2

- TYPE **CLS 20 12/24 V DC**
- TYPE **CLS 25 5/12 V DC**

THOUGHT-OUT SOLUTIONS AT THE HIGHEST LEVEL

AEO

TÜV SÜD ISO 9001
Certified Quality Management System
www.tuv-sud.com/ms-cert

TÜV SÜD ISO 14001
Certified Environmental Management System
www.tuv-sud.com/ms-cert

CONTENT

BEDIA

The company

Measuring with system and passion

As a high performance and innovative company BEDIA develops, produces and distributes well thought out solutions for level and temperature monitoring.
We have been concentrating our skills in the domain of measuring filling levels and temperatures under extreme operating conditions. We are able to offer customized solutions to the specific requirements of our clients for small to large series. In doing so we are combining tried and tested technologies with innovative product ideas. Our expertise and flexibility are well demonstrated in the developement of customer specific solutions.

One thing that all our products have in common is the nonexistence of moving or adjustable parts; our parts are not subject to mechanical interference and exhibit exceptional operational reliability.

Since 1986 BEDIA Motorentechnik is a valued partner of numerous manufacturers of agricultural and construction machinery, compressors, engines, power train control systems and utility vehicles.
The high quality requirements of our world wide operating customers are our motivation for the constant improvement of our products and processes. The stable customer relationships of many years standing express the high quality of our products and the satisfaction of our customers.

We hope you will get a comprehensive overview of our products from this catalog. Please feel free to contact us, we will be happy to assist you with our advice and experience.

Company history at a glance

2018 currently about 140 employees

2016 30th company anniversary

2012 Foundation of BEDIA Sensors USA in Austin, Texas

2009 Relocation of BEDIA Motorentechnik and BEDIA Kabel to the new corporate building in Altdorf in the industrial park near the A6.

2008 Takeover of the production for sensors from the business entit E-T-A in Altdorf

2006 Spin-off of the new BEDIA Kabel business unit from BEDIA Motorentechnik GmbH & Co. KG into BEDIA Kabel GmbH & Co. KG.

2005 Reorganization of BEDIA Motorentechnik GmbH into BEDIA Motorentechnik GmbH & Co. KG, preparation and the transfer of business administration to Holger Schultheis.

2000 Sale of the water treatment business unit to Aqua-Concept GmbH.

1994 Transfer of the Sensor Systems and Water Treatment business unit from BEDIA Maschinenfabrik to BEDIA Motorentechnik.

1986 Foundation of BEDIA Motorentechnik in Leinburg. Core focus business with vehicle wiring cables and delivery of sensor parts for the Bedia Maschinenfabrik in Bonn.

Our products at a glance

- capacitive level sensors for a versatile range of applications:
  - CLS 20/25 for railway applications tested according to DIN EN 50155
  - CLS 40/45 for off- and onroad applications with E1-type approval of the KBA
  - CLS 50/55 for maritime applications with approvals of the classification societies
- intelligent, analog tank sensors for fuels and oils
- intelligent, analog hot wire sensors for monitoring oil sump fill levels
- temperature sensors
- mechanical temperature switches
- electronic temperature switches
- electronic temperature sensors
- DC/DC converters

We are certified in accordance with ISO 9001:2015 and ISO 14001:2015.

GENERAL DESCRIPTION

Areas of application and advantages

BEDIA level monitoring sensors are used to monitor the filling levels of liquids. The sensors detect when a filling level is exceeded or falls below a limit.

Water-based liquids like coolants, AdBlue®, fresh water, waste water and oil-based liquids like motor oils, hydraulic oils, fuels and brake fluids can be monitored. Due to their rugged design, high IP protection classes and a working temperature range from -40°C to 125°C (-40°F to +257°F) the BEDIA monitoring sensors are primarily used in the following areas:

- **RAILWAY**
- **ENGINES**
- **HYDRAULIC POWER-TRAIN CONTROL SYSTEMS**

Wherever pressure switches or temperature sensors are today used as level monitoring elements, this sensor offers the advantage of indicating a critical condition far earlier:

Temperature sensors frequently react too late, because the medium to be monitored is no longer present. The rise in temperature is not passed on to the pick-up sensor. Pressure switches do not indicate low oil until there is a total shortage of oil and thus too late to protect the engine. The level sensor already indicates a critical filling level.

Sensor for water-based liquids

Sensor for oil-based liquids

BEDIA Level Monitoring Sensors differ from float-type switches in their compact design and their resistance to vibration:

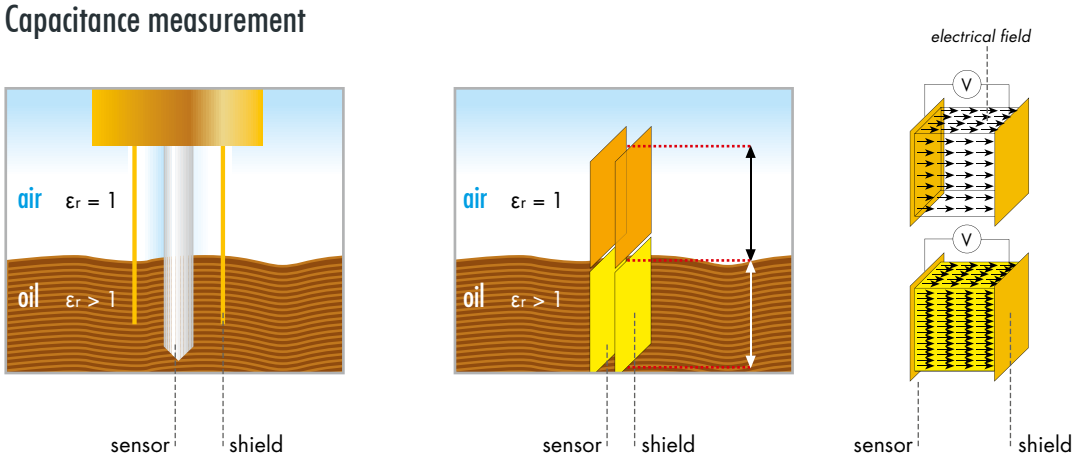
Since they contain no mechanical moving parts, their function will not be influenced by dirt particles or other influences. No electrical current is sent through the medium via an electrode with BEDIA sensors, an electrolysis of the medium is not possible.

MEASURABLE MEDIUMS

Operating principle

The function of the sensor is based on the capacitive principle. It detects the change in capacitance that occurs when an electrode surrounded by air is immersed into a liquid medium. This change in capacitance at the electrode of the sensor excites an oscillator. This signal is processed by a microcontroller-based evaluation circuit which activates or deactivates an output stage.

Capacitance measurement



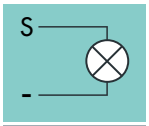
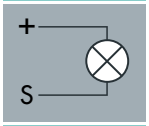
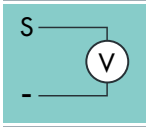
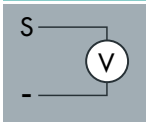
Types of media

The level monitoring sensors are designed for two different media types:

- **For electrically conductive liquid media with relative permittivity within a range of ε_r 35 ... 85 (water, coolant, water/glycol mixture)**
- **For electrically non-conductive liquid media with relative permittivity within a range of ε_r 1.8 ... 6 (engine oil, fuels, hydraulic oil)**

SWITCHING OUTPUTS

Output variants available

			Low Voltage (LV) U_B = 4,5 - 18 V Type CLS-25	High Voltage (HV) U_B = 9 - 36 V Type CLS-20
positive switching (HSS)		The output transistor switches positive potential at the output	–	✓ 1 A short circuit and overload proof
negative switching (LSS)		The output transistor switches negative potential at the output	✓ 0.5 A short circuit and overload proof	✓ 1 A short circuit and overload proof
analog output (AOV)		0.5 V* or 4.5 V* output voltage *other values on request	✓	✓
proportional analog output 30 % / 70 % (AOP)		30 %* or 70 %* respectively of the supply voltage as output voltage *other values on request	✓	–

Function control time

After the supply voltage is applied (e.g. ignition being switched on), the output is activated for the function control time, thus signalling operational readiness. If this signal does not appear, the sensor should be checked. The default function control time is 2 seconds. This self-monitoring makes it possible to check the level monitoring sensors from a central point for their operational readiness as well as for cable breaks. Especially in intricate, ramified systems, such as ships, checking conventional level switches may be very difficult.

Other function control times are available upon request.

Fault indication delay time

To avoid indication errors when the swashing surface produces short fluctuations of the liquid level, the output signal is delayed with the standard fault indication delay time of seven seconds.

Other indication delay times are available upon request.

INSTALLATION INSTRUCTION

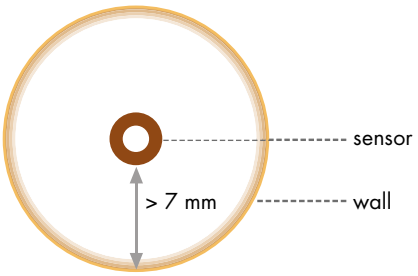
Mounting position

BEDIA level monitoring sensors may be installed in any position.

For properly function the level sensors should be mounted in a calm area of the tank, otherwise a sensor with a fault indication delay should be used.

This point is usually applicable for installation in gearboxes or for direct installation in engine oil pans during operation. In such cases, the measurement is only possible at engine shutdown.

It is mandatory to mount the sensor with a minimum distance of 7 mm to the wall.



Mounting position for water-sensors

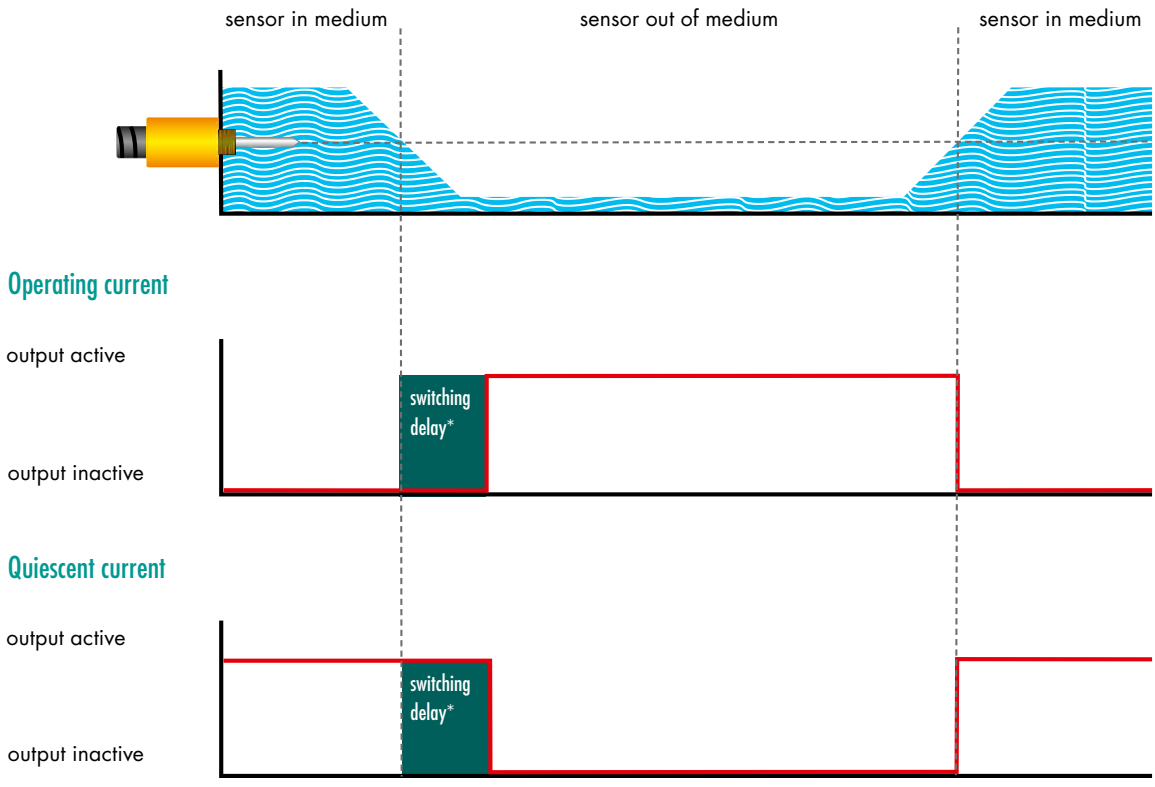
If the sensor is installed from above in a non-conductive, e.g plastic container,
erroneus messages might occur due to a missing reference potential.
In all other mounting positions, the housing will come in contact with the medium.
This ensures that a reference potential will be present.

FUNCTIONALITY OVERVIEW

Minimum-Sensors

If a minimum sensor is removed from the medium, the output is activated after the fault indication delay time. For a working current sensor, the output goes low-impedance (active) and the output signal is available. For a quiescent current sensor, the output goes high-impedance (inactive) and the output signal is no longer available.

If a minimum sensor is immersed in the medium, the output is deactivated instantaneously. For a working current sensor, the output goes high-impedance (deactivated) and the output signal is no longer available. For a quiescent current sensor, the output goes low-impedance (active) and the output signal is available.



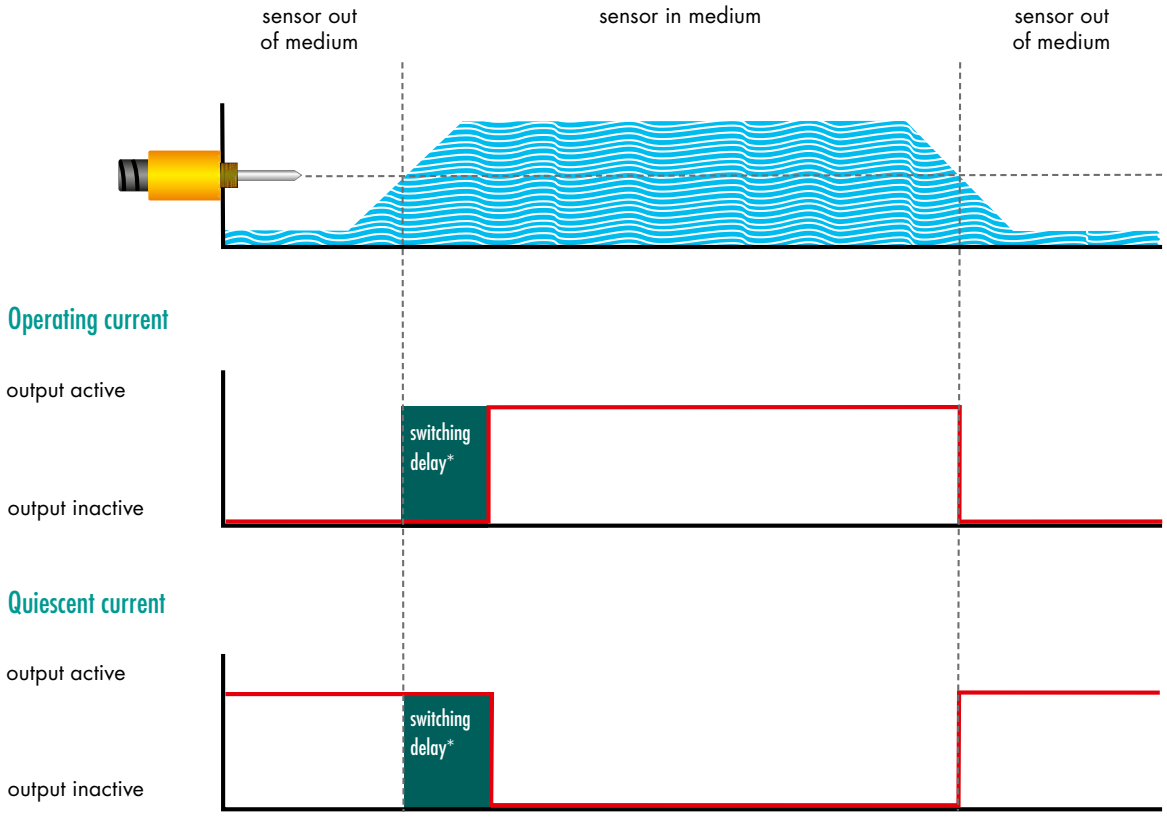
It is possible to select a fault indication delay time of 0 seconds for instantaneous switching.

FUNCTIONALITY OVERVIEW

Maximum-Sensors

If a maximum sensor is immersed in the medium, the output is activated after the fault indication delay time. For a working current sensor, the output goes low-impedance (active) and the output signal is available. For a quiescent current sensor, the output goes high-impedance (inactive) and the output signal is no longer available.

If a maximum sensor is removed from the medium, the output is deactivated instantaneously. For a working current sensor, the output goes high-impedance (deactivated) and the output signal is no longer available. For a quiescent current sensor, the output goes low-impedance (active) and the output signal is available.



It is possible to select a fault indication delay time of 0 seconds for instantaneous switching.

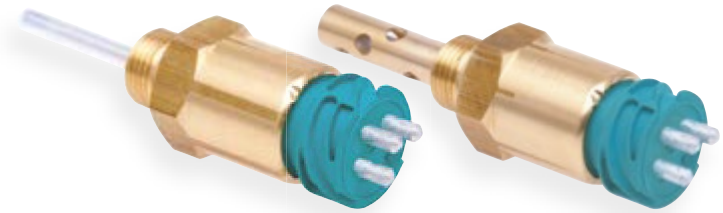
OVERVIEW OF THE CONNECTIONS

Level sensors Type CLS 20/25

Connector bayonet ISO 15170
Protection class IP 69K DIN 40050

According to railway applications DIN EN 50155
Fire behaviour according to DIN EN 45545-2
CE marking in accordance with the EU directive 2004/108/EG

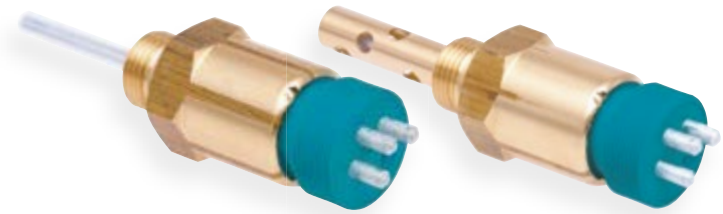
» Order numbers overview starting at page 24



Connector bayonet 16 S
Protection class IP 67 DIN 40050

According to railway applications DIN EN 50155
Fire behaviour according to DIN EN 45545-2
CE marking in accordance with the EU directive 2004/108/EG

» Order numbers overview starting at page 26



Connector fine thread M 27 x 1
Protection class IP 67 DIN 40050

According to railway applications DIN EN 50155
Fire behaviour according to DIN EN 45545-2
CE marking in accordance with the EU directive 2004/108/EG

» Order numbers overview starting at page 28

Connector Packard
Protection class IP 67 DIN 40050

According to railway applications DIN EN 50155
Fire behaviour according to DIN EN 45545-2
CE marking in accordance with the EU directive 2004/108/EG

» Order numbers overview starting at page 29

Connector DEUTSCH
Protection class IP 67 DIN 40050

According to railway applications DIN EN 50155
Fire behaviour according to DIN EN 45545-2
CE marking in accordance with the EU directive 2004/108/EG

» Order numbers overview starting at page 30

Connector bayonet 10 SL VG 95234
Protection class IP 67 DIN 40050

According to railway applications DIN EN 50155
Fire behaviour according to DIN EN 45545-2
CE marking in accordance with the EU directive 2004/108/EG

» Order numbers overview starting at page 31

OVERVIEW OF THE CONNECTIONS

Level sensors Type CLS 20/25

Connector fine thread 5/8-24 UNEF-2A VG 95342
Protection class IP 67 DIN 40050

According to railway applications DIN EN 50155
Fire behaviour according to DIN EN 45545-2
CE marking in accordance with the EU directive 2004/108/EG

» Order numbers overview starting at page 32

Connector DIN EN 175 301-803-A
Protection class IP 65 DIN 40050

According to railway applications DIN EN 50155
Fire behaviour according to DIN EN 45545-2
CE marking in accordance with the EU directive 2004/108/EG

» Order numbers overview starting at page 33

With Cable
Protection class IP 69K DIN 40050

According to railway applications DIN EN 50155
Fire behaviour according to DIN EN 45545-2
CE marking in accordance with the EU directive 2004/108/EG

» Order numbers overview starting at page 34

■ With EMC cable connection for shielded lines, protection class IP 68, up to 10 bar in accordance with DIN 40050

According to railway applications DIN EN 50155
Fire behaviour according to DIN EN 45545-2
CE marking in accordance with the EU directive 2004/108/EG

» Order numbers overview starting at page 35

Special versions

■

Level monitoring sensor with sensing pin 80 mm long

ACCESSORIES

For level monitoring sensors

4-pin bayonet ISO 15170
connector for corrugated tubing NW10 straight

» Order numbers overview on page 25

4-pin bayonet ISO 15170
for corrugated tubing NW10 90° angle

» Order numbers overview on page 25

4-pin bayonet ISO 15170
connector for cable straight

» Order numbers overview on page 25

4-pin bayonet ISO 15170
for cable 90° angle

» Order numbers overview on page 25

Ready-made cable with 4-pin bayonet
ISO 15170 connector straight

» Order numbers overview on page 25

Ready-made cable with 4-pin bayonet
ISO 15170 90° angle

» Order numbers overview on page 25

3-pin bayonet 16 S connector
for cable straight

» Order numbers overview on page 27

3-pin bayonet 16 S connector
for corrugated tubing NW10 90° angle

» Order numbers overview on page 27

3-pin bayonet 16 S connector
for corrugated tubing NW10 straight

» Order numbers overview on page 27

3-pin bayonet 16 S
for cable 90° angle

» Order numbers overview on page 27

Ready-made cable with 3-pin bayonet connector 16 S
straight

» Order numbers overview on page 27

or with 3-pin connector M 27 x 1 straight

» Order numbers overview on page 28

Ready-made cable with 3-pin bayonet connector 16 S
90° angle

» Order numbers overview on page 27

or with 3-pin connector M 27 x 1 90° angle

» Order numbers overview on page 28

ACCESSORIES

For level monitoring sensors

3-pin connector M 27 x 1
for corrugated tubing NW10 straight

» Order numbers overview on page 28

3-pin connector M 27 x 1
for corrugated tubing NW10 90° angle

» Order numbers overview on page 28

3-pin connector M 27 x 1
for cable straight

» Order numbers overview on page 28

3-pin connector M 27 x 1
for cable 90° angle

» Order numbers overview on page 28

4-pin Packard connector

» Order numbers overview on page 29

3-pin plug with centralized screw
M 3 x 35 DIN EN 175 301-803-A

» Order numbers overview on page 33

Plug-in connector bayonet 10 SL with mounting flange VG 95234 straight

» Order numbers overview on page 31

or connector fine thread 5/8-24 UNEF-2A
VG 95342 straight

» Order numbers overview on page 32

Plug-in connector bayonet 10 SL with mounting flange VG 95234 90° angle

» Order numbers overview on page 31

or connector fine thread 5/8-24 UNEF-2A
VG 95342 90° angle

» Order numbers overview on page 32

Ready-made cable with 3-pin bayonet connector 10 SL VG 95234 straight

» Order numbers overview on page 31

Ready-made cable with 3-pin bayonet connector 10 SL VG 95234 90° angle

» Order numbers overview on page 31

Screw-in adapter

» Order numbers overview from page 24-35

Braze-on adapter

» Order numbers overview from page 24-35

ACCESSORIES

for level monitoring sensors in the oil sump

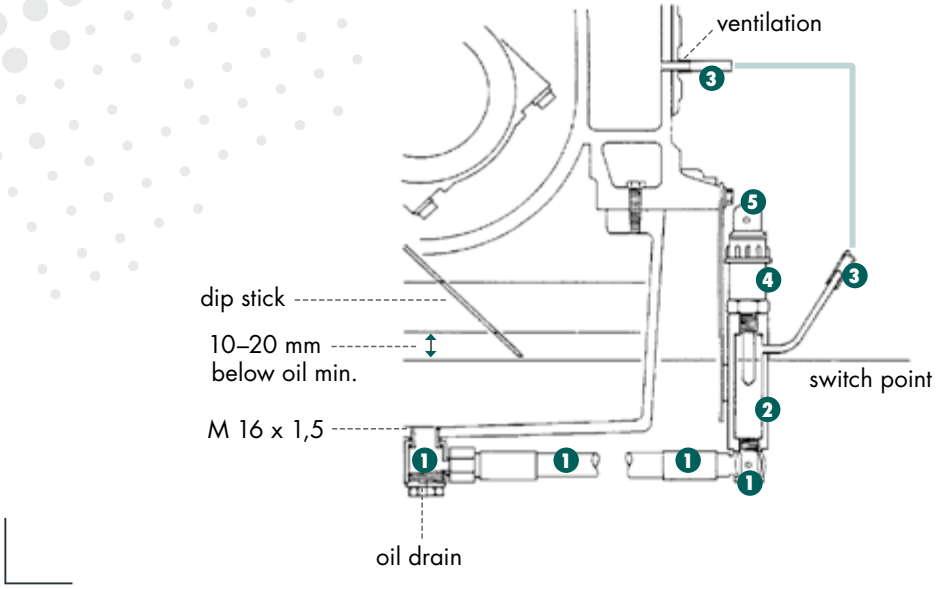
Proposal for level monitoring in the oil sump

Which are the benefits of a level monitoring system in the oil sump over conventional pressure and temperature sensors?

Temperature sensors react very slowly. When engine oil is lost, e. g. by tubing breakage, the engine temperature is no longer conducted to the sensor.

The lower limit value of oil pressure switches or sensors is set low (low oil pressure, with the motor running at no load). At rated motor speed and with too little oil in the oil circuit an oil-air mixture may be formed and no alarm signal is given. The engine is no longer sufficiently cooled and lubricated.

In the two events described above, the alarm signal is available either too late or even not at all so that the engine will be damaged. The level monitoring sensor gives the alarm before a serious oil deficiency occurs. The oil deficiency is indicated as soon as the oil level has fallen 10 to 20 mm below the minimum marking on the dipstick.



Special accessoires for level sensors type CLS 20 and type CLS 25				
Order No.	**Description**	**Length**		**Picture-Nr. (see illustration)**
421 660	Tubing complete with 350 mm pipe coupling	350 mm		1
421 661	Tubing complete with 450 mm pipe coupling	450 mm		1
421 659	Tubing complete with 550 mm pipe coupling	550 mm		1
454 134	Sensor support			2
421 662	PA pipe, available in meters			3
	Level monitoring sensor	OIL MIN 9–36 V		4
	Level monitoring sensor	OIL MAX 9–36 V		4
420 703	Connector ISO 15170	straight		5
420 702	Connector ISO 15170	90° angle		5
420 707	Connector ISO 15170	with cable 1000 mm straight		5
420 706	Connector ISO 15170	with cable 1000 mm 90° angle		5

Installation instructions

1. Drain the engine oil.
2. Fasten adjustable corner swivelling screw-fitting to the engine with hose line and sensor bracket.
   The sensor holder has to be adjustable by the slots to determine the minimum point.
3. Install the ventilation to the crankcase (such as inspection hole cover)
4. Install and connect the sensor.
5. Check for correct electrical function. The minimum sensor must indicate now.
6. Refill the oil up to the minimum marking on the dip stick.
7. Move the sensor and support slowly down until the signal is no longer available.
   The switch point of the sensor is now exactly at the minimum oil level of the motor.
8. Move the sensor down by another 10 to 20 mm and fix it. The signal „oil level too low“ will now be put out when the level is approx. 10 to 20 mm below the minimum marking on the dipstick.

TECHNICAL DATA

For level monitoring sensors CLS 20

Medium	Water / Oil
Function	Minimum - Maximum
Operating voltage	12 V (-25% / +50%) 24 V (-30% / +50%) (9 - 36 V DC)
Current consumption	< 8 mA
Output low-side switch / high-side switch	≤ 1 A over the hole temperature range. Short-circuit and overload protected over the ambient temperature range. For inductive loads freewheeling diode e.g. 1N4007, has to be mounted at load.
Output analog switching	output load >10 kOhm
Mounting thread	see order number overview
Function control time	see order number overview
Fault indication delay time	see order number overview
Connection	see order number overview
Housing material	CuZn38Pb2 EN12164; CW608N
	housing capacitive connected to ground
Sheath of sensing device	Tefzel ® ETFE
Sensor protection	IP 65 - 69K nach DIN 40050 (depending on connector type)
Switch point hysteresis	typic < 3 mm
Medium temperature	-40°C to +125°C (-40°F to +257°F) water +150°C (oil)
Ambient temperature	-40°C to +125°C (-40°F to +257°F)
Storage temperature	-50°C to +125°C (-58°F to +257°F)
Mounting possition	any
Reverse polarity protection	inbuilt, between positive and negative terminal

Caution!

With low-side switching sensors do not connect **minus potential** to the signal terminal and plus potential to the minus terminal. With high-side switching sensors do not connect **plus potential** to the signal terminal and minus potential to the plus terminal.

Customs tariff number	90261029
Environmental simulations	
Simulated long life testing at increased random vibration levels	DIN EN 61373-clause 9
Shock testing conditions	DIN EN 61373-clause 10
Performance test with broad-band random	DIN EN 61373-clause 8
Storage at cold	DIN EN 60068-2-1
Dry heat	DIN EN 60068-2-2
Damp heat, cyclic	DIN EN 60068-2-30
Salt mist	DIN EN 60068-2-11
Fire behaviour	DIN EN 45545-2
Pressure resistance	2,5 MPa (25 bar) (362,6 psi) at 25 °C (75°F) / 1 h
EMC	
Conducted continuous dissturbance at mains ports	EN 50121-3-2 class A+20
Conducted continuous dissturbance at signal and data ports	EN 50121-3-2 class A+20
Radiated disturbance, electrical field	EN 50121-3-2 class A
Immunity radiated electromagnetic fields	IEC 61000-4-3 20V/m
Conducted immunity, injected currents	EN 61000-4-6 10V
EFT/Burst	EN 61000-4-4 2kV
Electrostatic discharge test	EN 61000-4-2 6kV/8kV
Surge immunity test	EN 61000-4-5 1kV/2kV
Immunity to voltage dips, interruptions and fluctuations	EN 50155
Insulation test	DIN EN 50155 clause 12.2.9.1
Voltage withstand test	DIN EN 50155 clause 12.2.9.2

TECHNICAL DATA

For level monitoring sensors CLS 25

Medium	Water / Oil
Function	Minimum / Maximum
Operating voltage	5 V stabilized (-10% / +50%) 12 V (-30% / +50%) (4,5 - 18 V DC)
Current consumption	< 8 mA
Output low-side switch / high-side switch	≤ 0,5 A over the hole temperature range. Short-circuit and overload protected over the ambient temperature range. For inductive loads freewheeling diode e.g. 1N4007, has to be mounted at the load.
Output analog switching	output load >10 kOhm
Mounting thread	see order number overview
Function control time	see order number overview
Fault indication delay time	see order number overview
Connection	see order number overview
Housing material	CuZn38Pb2 EN12164; CW608N
	housing capacitive connected to ground
Sheath of sensing device	Tefzel ® ETFE
Sensor protection	IP 65 - 69K nach DIN 40050 (depending on connector type)
Switch point hysteresis	typic < 3 mm
Medium temperature	-40°C to +125°C (-40°F to +257°F) water +150°C (oil)
Ambient temperature	-40°C to +125°C (-40°F to +257°F)
Storage temperature	-50°C to +125°C (-58°F to +257°F)
Mounting possition	any
Reverse polarity protection	inbuilt, between positive and negative terminal

Caution!

With low-side switching sensors do not connect **minus potential** to the signal terminal and plus potential to the minus terminal.

Customs tariff number	90261029
Environmental simulations	
Simulated long life testing at increased random vibration levels	DIN EN 61373-clause 9
Shock testing conditions	DIN EN 61373-clause 10
Performance test with broad-band random	DIN EN 61373-clause 8
Storage at cold	DIN EN 60068-2-1
Dry heat	DIN EN 60068-2-2
Damp heat, cyclic	DIN EN 60068-2-30
Salt mist	DIN EN 60068-2-11
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Conducted continuous dissturbance at signal and data ports	EN 50121-3-2 class A+20
Radiated disturbance, electrical field	EN 50121-3-2 class A
Immunity radiated electromagnetic fields	IEC 61000-4-3 20V/m
Conducted immunity, injected currents	EN 61000-4-6 10V
EFT/Burst	EN 61000-4-4 2kV
Electrostatic discharge test	EN 61000-4-2 6kV/8kV
Surge immunity test	EN 61000-4-5 1kV/2kV
Immunity to voltage dips, interruptions and fluctuations	EN 50155
Insulation test	DIN EN 50155 clause 12.2.9.1
Voltage withstand test	DIN EN 50155 clause 12.2.9.2

ORDER NUMBER OVERVIEW

Connector bayonet ISO 15170

Thread	Operating voltage	Function	Function control time sec	Fault indication delay time sec	Order number for **low-side switch**				Order number for **high-side switch**			
					Water-based liquids		Oil-based liquids		Water-based liquids		Oil-based liquids	
					Operating current	Quiescent current	Operating current	Quiescent current	Operating current	Quiescent current	Operating current	Quiescent current
M 14 x 1,5	9-36 V DC	MAX	0	7	-	-	-	-	350 535	350 536	-	-
M 14 x 1,5	9-36 V DC	MIN	0	7	-	350 741	-	-	-	350 549	-	350 550
M 14 x 1,5	9-36 V DC	MIN	2	7	-	-	350 731	-	350736	-	-	-
M 18 x 1,5	9-36 V DC	MIN	0	0	350 565	-	350 514	-	350 633	-	350 518	-
M 18 x 1,5	9-36 V DC	MAX	0	0	350 515	-	350 599	-	350 634	-	350 669	-
M 18 x 1,5	4,5-18 V DC	MAX	0	0	-	-	350 519	-	-	-	-	-
M 18 x 1,5	9-36 V DC	MAX	0	7	-	-	-	-	-	-	350 730	-
M 18 x 1,5	9-36 V DC	MIN	2	7	350 566	-	350 600	-	350 635	-	350 670	-
M 18 x 1,5	9-36 V DC	MAX	2	7	-	350 585	-	350 618	-	350 654	-	350 687
G 1/4"	9-36 V DC	MAX	0	0	-	-	-	-	350 551	-	-	-
G 3/8"	9-36 V DC	MIN	0	0	350 567	350 586	350 601	350 619	350 636	350 655	350 671	350 688
G 3/8"	9-36 V DC	MIN	0	7	-	350 552	-	-	-	-	-	-
G 3/8"	9-36 V DC	MIN	2	7	-	350 587	-	350 553	-	350 656	-	350 689
G 3/8"	9-36 V DC	MAX	2	7	350 568	-	350 602	-	350 637	-	350 672	-
R 1/2"	9-36 V DC	MIN	0	7	-	322 202	-	-	-	-	-	-
3/8" NPTF	9-36 V DC	MIN	0	0	-	-	-	350 735	-	-	-	-
1/4" NPTF	9-36 V DC	MIN	0	7	-	-	-	-	-	350 753	-	-

ACCESSORIES

Connector	
Order-Nr.	Description
420 700	4-pin bayonet ISO 15170 connector for corrugated tubing NW10 straight
420 701	4-pin bayonet ISO 15170 for corrugated tubing NW10 90° angle
420 703	4-pin bayonet ISO 15170 connector for cable straight
420 702	4-pin bayonet ISO 15170 for cable 90° angle

Cable with connector				
Order-Nr.	Description	Length	Connection	
420 705	Ready-made cable with 4-pin bayonet ISO 15170 straight connector	300 mm	1*	
420 707	Ready-made cable with 4-pin bayonet ISO 15170 straight connector	1000 mm	1*	
420 709	Ready-made cable with 4-pin bayonet ISO 15170 straight connector	2000 mm	1*	
420 717	Ready-made cable with 4-pin bayonet ISO 15170 straight connector	3000 mm	1*	
420 714	Ready-made cable with 4-pin bayonet ISO 15170 straight connector	5000 mm	1*	
420 719	Ready-made cable with 4-pin bayonet ISO 15170 straight connector	6000 mm	1*	
420 755	Ready-made cable with 4-pin bayonet ISO 15170 straight connector	7000 mm	1*	
421 730	Ready-made cable with 4-pin bayonet ISO 15170 straight connector	10000 mm	1*	
420 706	Ready-made cable with 4-pin bayonet ISO 15170 90° angle	1000 mm	1*	
420 764	Ready-made cable with 4-pin bayonet ISO 15170 90° angle	2000 mm	1*	
420 708	Ready-made cable with 4-pin bayonet ISO 15170 90° angle	3000 mm	1*	
420 756	Ready-made cable with 4-pin bayonet ISO 15170 90° angle	4000 mm	1*	
420 718	Ready-made cable with 4-pin bayonet ISO 15170 90° angle	5000 mm	1*	
420 716	Ready-made cable with 4-pin bayonet ISO 15170 90° angle	6000 mm	1*	
420 715	Ready-made cable with 4-pin bayonet ISO 15170 90° angle	10000 mm	1*	
420 795	Ready-made cable with 4-pin bayonet ISO 15170 90° angle	12000 mm	1*	
423 158	Ready-made cable with 4-pin bayonet ISO 15170 90° angle	15000 mm	1*	

1* Cable with flying leads

Screw-in adapter			
Order-Nr.	Thread outside	Thread inside	
421 696	M 16 x 1,5	M 14 x 1,5	
421 640	M 22 x 1,5	M 14 x 1,5	
421 884	M 22 x 1,5	1/4" NPTF	
421 695	G 1/2"	M 14 x 1,5	
421 694	R 1/2"	M 14 x 1,5	
421 639	R 1"	M 18 x 1,5	

Braze-on adapter		
Order-Nr.	Thread inside	
421 644	M 14 x 1,5	
421 648	M 18 x 1,5	

ORDER NUMBER OVERVIEW

Connector bayonet 16 S

Thread	Operating voltage	Function	Function control time sec	Fault indication delay time sec	Order number for **low-side switch**				Order number for **high-side switch**			
					Water-based liquids		Oil-based liquids		Water-based liquids		Oil-based liquids	
					Operating current	Quiescent current	Operating current	Quiescent current	Operating current	Quiescent current	Operating current	Quiescent current
M 14 x 1,5	9-36 V DC	MIN	2	7	-	-	350 529	-	-	-	-	-
M 14 x 1,5	9-36 V DC	MIN	0	7	-	-	-	350 530	-	-	-	-
M 18 x 1,5	9-36 V DC	MIN	0	0	350 570	350 589	350 603	-	350 639	-	350 507	-
M 18 x 1,5	9-36 V DC	MAX	0	0	-	-	350 604	-	350 508	-	350 674	-
M 18 x 1,5	9-36 V DC	MIN	0	7	-	-	-	350 537	350 746	350 747	-	350 527
M 18 x 1,5	9-36 V DC	MAX	0	7	-	-	-	-	-	-	-	350 528
M 18 x 1,5	9-36 V DC	MIN	2	7	350 571	-	350 563	-	350 640	-	350 675	-
M 18 x 1,5	9-36 V DC	MAX	2	7	-	350 590	-	350 622	-	350 658	-	350 692
1/4" NPTF	9-36 V DC	MIN	0	7	-	350 558	-	-	-	-	-	-

ACCESSORIES

Connector	
Order-Nr.	Description
421 673	3-pin bayonet 16 S connector for cable straight
421 773	3-pin bayonet connector 16 S for corrugated tubing NW10 90° angle
421 772	3-pin bayonet 16 S connector for corrugated tubing NW10 straight
421 672	3-pin bayonet 16 S for cable 90° angle

Cable with connector			
Order-Nr.	Description	Length	Connection
421 670	Ready-made cable with 3-pin bayonet connector 16 S straight	300 mm	2*
421 891	Ready-made cable with 3-pin bayonet connector 16 S straight	800 mm	2*
421 018	Ready-made cable with 3-pin bayonet connector 16 S straight	1015 mm	2*
421 586	Ready-made cable with 3-pin bayonet connector 16 S straight	1300 mm	2*
421 668	Ready-made cable with 3-pin bayonet connector 16 S straight	3000 mm	2*
421 775	Ready-made cable with 3-pin bayonet connector 16 S straight	5000 mm	2*
421 774	Ready-made cable with 3-pin bayonet connector 16 S straight	15000 mm	2*
421 671	Ready-made cable with 3-pin bayonet connector 16 S 90° angle	300 mm	2*
421 585	Ready-made cable with 3-pin bayonet connector 16 S 90° angle	1300 mm	2*
421 669	Ready-made cable with 3-pin bayonet connector 16 S 90° angle	5000 mm	1*
420 809	Ready-made cable with 3-pin bayonet connector 16 S 90° angle	10000 mm	1*

1* Cable with flying leads 2* Cable with 3 pole blade terminals 6.3 in housing

Screw-in adapter		
Order-Nr.	Thread outside	Thread inside
421 696	M 16 x 1,5	M 14 x 1,5
421 640	M 22 x 1,5	M 14 x 1,5
421 884	M 22 x 1,5	1/4" NPTF
421 695	G 1/2"	M 14 x 1,5
421 694	R 1/2"	M 14 x 1,5
421 639	R 1"	M 18 x 1,5

Braze-on adapter	
Order-Nr.	Thread inside
421 644	M 14 x 1,5
421 648	M 18 x 1,5
421 641	1/4" NPTF

ORDER NUMBER OVERVIEW

Connector fine thread M 27 x 1

Thread	Operating voltage	Function	Function control time sec	Fault indication delay time sec	Order number for **low-side switch**				Order number for **high-side switch**			
					Water-based liquids		Oil-based liquids		Water-based liquids		Oil-based liquids	
					Operating current	Quiescent current	Operating current	Quiescent current	Operating current	Quiescent current	Operating current	Quiescent current
M 14 x 1,5	9-36 V DC	MIN	2	7	350 539	-	-	-	-	-	-	-
M 18 x 1,5	9-36 V DC	MIN	0	0	350 573	350 592	350 606	350 624	350 642	350 660	350 677	350 694
M 18 x 1,5	9-36 V DC	MIN	2	7	350 574	-	350 607	-	350 643	-	350 678	-
M 18 x 1,5	9-36 V DC	MAX	2	7	-	-	-	350 625	-	350 661	-	350 695

ACCESSORIES

Connector	
Order-Nr.	Description
421 642	3-pin connector M 27 x 1 for corrugated tubing NW10 straight
421 643	3-pin connector M 27 x 1 for corrugated tubing NW10 90° angle
421 742	3-pin connector M 27 x 1 for cable straight
421 743	3-pin connector M 27 x 1 for cable 90° angle

Cable with connector			
Order-Nr.	Description	Length	Connection
421 988	Ready-made cable with 3-pin connector M 27 x 1 straight	300 mm	2*
421 038	Ready-made cable with 3-pin connector M 27 x 1 90° angle	300 mm	2*
421 588	Ready-made cable with 3-pin connector M 27 x 1 straight	10000 mm	1*

1* Cable with flying leads 2* Cable with 3 pole blade terminals 6.3 in housing

Screw-in adapter		
Order-Nr.	Thread outside	Thread inside
421 696	M 16 x 1,5	M 14 x 1,5
421 640	M 22 x 1,5	M 14 x 1,5
421 884	M 22 x 1,5	1/4" NPTF
421 695	G 1/2"	M 14 x 1,5
421 694	R 1/2"	M 14 x 1,5
421 639	R 1"	M 18 x 1,5

Braze-on adapter	
Order-Nr.	Thread inside
421 644	M 14 x 1,5
421 648	M 18 x 1,5
421 641	1/4" NPTF

ORDER NUMBER OVERVIEW

Connector Packard

Thread	Operating voltage	Function	Function control time sec	Fault indication delay time sec	Order number for **low-side switch**				Order number for **high-side switch**			
					Water-based liquids		Oil-based liquids		Water-based liquids		Oil-based liquids	
					Operating current	Quiescent current	Operating current	Quiescent current	Operating current	Quiescent current	Operating current	Quiescent current
M 18 x 1,5	9-36 V DC	MIN	0	0	350 583	-	350 521	-	350 651	-	350 685	-
M 18 x 1,5	9-36 V DC	MAX	0	0	350 522	-	350 616	-	350 652	-	350 686	-
M 18 x 1,5	9-36 V DC	MIN	2	7	-	350 598	-	350 632	-	350 668	-	350 702
M 18 x 1,5	9-36 V DC	MAX	2	7	350 584	-	350 617	-	350 653	-	-	-

ACCESSORIES

Connector

Order-Nr.	Description
421 763	4-pin Packard connector

Screw-in adapter

Order-Nr.	Thread outside	Thread inside
421 696	M 16 x 1,5	M 14 x 1,5
421 640	M 22 x 1,5	M 14 x 1,5
421 884	M 22 x 1,5	1/4" NPTF
421 695	G 1/2"	M 14 x 1,5
421 694	R 1/2"	M 14 x 1,5
421 639	R 1"	M 18 x 1,5

Braze-on adapter

Order-Nr.	Thread inside
421 644	M 14 x 1,5
421 648	M 18 x 1,5
421 641	1/4" NPTF

ORDER NUMBER OVERVIEW

Connector DEUTSCH

Thread	Operating voltage	Function	Function control time sec	Fault indication delay time sec	Order number for **low-side switch**				Order number for **high-side switch**			
					Water-based liquids		Oil-based liquids		Water-based liquids		Oil-based liquids	
					Operating current	Quiescent current	Operating current	Quiescent current	Operating current	Quiescent current	Operating current	Quiescent current
M 18 x 1,5	9-36 V DC	MIN	0	0	350 708	350 710	350 712	350 714	350 716	350 718	350 720	350 722
M 18 x 1,5	9-36 V DC	MIN	2	7	350 709	-	350 713	-	350 717	-	350 721	-
M 18 x 1,5	9-36 V DC	MAX	2	7	-	350 711	-	350 715	-	350 719	-	350 723

ACCESSORIES

Connector

Order-Nr.	Description
420 733	3-pin connector DT06-3S

Screw-in adapter

Order-Nr.	Thread outside	Thread inside
421 696	M 16 x 1,5	M 14 x 1,5
421 640	M 22 x 1,5	M 14 x 1,5
421 884	M 22 x 1,5	1/4" NPTF
421 695	G 1/2"	M 14 x 1,5
421 694	R 1/2"	M 14 x 1,5
421 639	R 1"	M 18 x 1,5

Braze-on adapter

Order-Nr.	Thread inside
421 644	M 14 x 1,5
421 648	M 18 x 1,5
421 641	1/4" NPTF

ORDER NUMBER OVERVIEW

Connector bayonet 10 SL VG 95234

Thread	Operating voltage	Function	Function control time sec	Fault indication delay time sec	Order number for **low-side switch**				Order number for **high-side switch**			
					Water-based liquids		Oil-based liquids		Water-based liquids		Oil-based liquids	
					Operating current	Quiescent current	Operating current	Quiescent current	Operating current	Quiescent current	Operating current	Quiescent current
M 14 x 1,5	9-36 V DC	MIN	0	0	321 527	-	-	-	-	-	-	-
M 14 x 1,5	9-36 V DC	MAX	0	0	-	-	-	-	-	-	-	350 743
M 14 x 1,5	9-36 V DC	MIN	0	7	-	-	-	-	-	-	-	350 523
M 18 x 1,5	9-36 V DC	MIN	2	0	-	350 504	-	-	-	-	-	-
M 18 x 1,5	9-36 V DC	MIN	0	7	-	-	-	-	-	321 525	-	350 524
M 18 x 1,5	9-36 V DC	MIN	0	0	350 569	321 528	350 509	350 620	350 638	350 657	350 673	350 690
M 18 x 1,5	9-36 V DC	MAX	2	0	-	350 506	-	-	-	350 503	-	-
M 18 x 1,5	9-36 V DC	MIN	2	7	350 705	-	350 548	-	350 704	350 703	350 541	-
M 18 x 1,5	9-36 V DC	MAX	2	7	-	350 588	-	350 621	-	-	-	350 691
M 18 x 1,5	9-36 V DC	MAX	0	7	350 554	-	350 559	-	350 560	-	350 706	-
M 18 x 1,5	9-36 V DC	MIN	0	20	-	-	-	350 561	-	-	-	350 707

ACCESSORIES

Connector

Order-Nr.	Description
421 652	Plug-in connector bayonet 10 SL with mounting flange VG 95234 straight
421 885	Plug-in connector bayonet 10 SL with mounting flange VG 95234 90° angle
421 770	Plug-in connector bayonet 10 SL for shielded lines VG 95234 straight
421 771	Plug-in connector bayonet 10 SL for shielded lines VG 95234 90° angle

Cable with connector

Order-Nr.	Description	Length	Connection
421 740	Ready-made cable with 3-pin bayonet connector 10 SL VG 95234 straight	2000 mm	1*
421 741	Ready-made cable with 3-pin bayonet connector 10 SL VG 95234 straight	5000 mm	1*
421 779	Ready-made cable with 3-pin bayonet connector 10 SL VG 95234 straight	10000 mm	1*
421 738	Ready-made cable with 3-pin bayonet connector 10 SL VG 95234 90° angle	2000 mm	1*
421 739	Ready-made cable with 3-pin bayonet connector 10 SL VG 95234 90° angle	5000 mm	1*
421 777	Ready-made cable with 3-pin bayonet connector 10 SL VG 95234 90° angle	10000 mm	1*

1* Cable with flying leads

Screw-in adapter

Order-Nr.	Thread outside	Thread inside
421 696	M 16 x 1,5	M 14 x 1,5
421 640	M 22 x 1,5	M 14 x 1,5
421 884	M 22 x 1,5	1/4" NPTF
421 695	G 1/2"	M 14 x 1,5
421 694	R 1/2"	M 14 x 1,5
421 639	R 1"	M 18 x 1,5

Braze-on adapter

Order-Nr.	Thread inside
421 644	M 14 x 1,5
421 648	M 18 x 1,5
421 641	1/4" NPTF

ORDER NUMBER OVERVIEW

Connector fine thread 5/8-24 UNEF-2A VG 95342

Thread	Operating voltage	Function	Function control time sec	Fault indication delay time sec	Order number for **low-side switch**				Order number for **high-side switch**			
					Water-based liquids		Oil-based liquids		Water-based liquids		Oil-based liquids	
					Operating current	Quiescent current	Operating current	Quiescent current	Operating current	Quiescent current	Operating current	Quiescent current
M 18 x 1,5	9-36 V DC	MIN	0	0	350 575	350 593	350 608	350 626	350 644	350 662	350 679	350 696
M 18 x 1,5	9-36 V DC	MIN	2	7	350 576	-	350 609	-	350 645	-	350 680	-
M 18 x 1,5	9-36 V DC	MAX	2	7	-	350 594	-	350 627	-	350 663	-	350 697
M 18 x 1,5	9-36 V DC	MIN	0	7	-	-	-	-	-	350 737	-	350 728

ACCESSORIES

Connector	
Order-Nr.	Description
421 645	Plug-in connector fine thread VG 95342 straight
421 649	Plug-in connector fine thread VG 95342 90° angle

Screw-in adapter		
Order-Nr.	Thread outside	Thread inside
421 696	M 16 x 1,5	M 14 x 1,5
421 640	M 22 x 1,5	M 14 x 1,5
421 884	M 22 x 1,5	1/4" NPTF
421 695	G 1/2"	M 14 x 1,5
421 694	R 1/2"	M 14 x 1,5
421 639	R 1"	M 18 x 1,5

Braze-on adapter	
Order-Nr.	Thread inside
421 644	M 14 x 1,5
421 648	M 18 x 1,5
421 641	1/4" NPTF

ORDER NUMBER OVERVIEW

Connector DIN EN 175 301-803-A

Thread	Operating voltage	Function	Function control time sec	Fault indication delay time sec	Order number for **low-side switch**				Order number for **high-side switch**			
					Water-based liquids		Oil-based liquids		Water-based liquids		Oil-based liquids	
					Operating current	Quiescent current	Operating current	Quiescent current	Operating current	Quiescent current	Operating current	Quiescent current
M 14 x 1,5	9-36 V DC	MIN	0	7	-	-	-	-	-	350 542	-	350 534
M 18 x 1,5	4,5-18 V DC	MAX	0	0	-	-	350 525	-	-	-	-	-
M 18 x 1,5	4,5-18 V DC	MIN	0	0	350 526	-	-	-	-	-	-	-
M 18 x 1,5	9-36 V DC	MIN	0	7	-	-	-	-	-	350 533	-	-
M 18 x 1,5	9-36 V DC	MIN	2	7	350 572	-	350 605	-	350 641	-	350 676	-
M 18 x 1,5	9-36 V DC	MAX	2	7	-	350 591	-	350 623	-	350 659	-	350 693

ACCESSORIES

Connector

Order-Nr.	Description
421 880	3-pin plug with centralized screw M 3 x 35 DIN EN 175 301-803-A

Cable with connector

Order-Nr.	Description	Length	Connection
421 965	Ready-made cable with 3-pin plug with centralized screw M 3 x 35 DIN EN 175 301-803-A	5000 mm	1*

1* Cable with flying leads

Screw-in adapter

Order-Nr.	Thread outside	Thread inside
421 696	M 16 x 1,5	M 14 x 1,5
421 640	M 22 x 1,5	M 14 x 1,5
421 884	M 22 x 1,5	1/4" NPTF
421 695	G 1/2"	M 14 x 1,5
421 694	R 1/2"	M 14 x 1,5
421 639	R 1"	M 18 x 1,5

Braze-on adapter

Order-Nr.	Thread inside
421 644	M 14 x 1,5
421 648	M 18 x 1,5
421 641	1/4" NPTF

ORDER NUMBER OVERVIEW

Sensors with cable

Thread	Operating voltage	Function	Function control time sec	Fault indication delay time sec	Cable length mm	Cable connection type	Order number for **low-side switch**				Order number for **high-side switch**			
							Water-based liquids		Oil-based liquids		Water-based liquids		Oil-based liquids	
							Operating current	Quiescent current	Operating current	Quiescent current	Operating current	Quiescent current	Operating current	Quiescent current
M 14 x 1,5	9-36 V DC	MIN	2	7	250	1*	318 152	-	-	-	-	-	-	-
M 14 x 1,5	9-36 V DC	MAX	0	0	1000	1*	-	-	-	-	350 531	-	-	-
M 14 x 1,5	9-36 V DC	MAX	0	0	2000	1*	-	350 739	-	-	-	-	-	-
M 14 x 1,5	9-36 V DC	MAX	0	7	2000	1*	-	-	-	-	-	350 733	-	-
M 18 x 1,5	9-36 V DC	MIN	0	0	3000	1*	350 578	-	350 611	-	350 647	-	350 516	-
M 18 x 1,5	9-36 V DC	MAX	0	0	3000	1*	350 579	-	350 612	-	350 517	-	350 682	-
M 18 x 1,5	9-36 V DC	MIN	0	7	10000	1*	-	-	-	350 564	-	-	-	-
M 18 x 1,5	9-36 V DC	MIN	2	7	1000	1*	350 580	-	350 613	-	350 648	-	350 683	-
M 18 x 1,5	9-36 V DC	MAX	2	7	1000	1*	-	350 596	-	350 629	-	350 665	-	350 699
G 3/8"	9-36 V DC	MIN	0	0	250	1*	350 581	350 538	350 614	350 630	350 649	350 666	350 684	350 700
G 3/8"	9-36 V DC	MIN	0	7	250	1*	-	322 286	-	-	-	322 344	-	-
G 3/8"	9-36 V DC	MIN	0	7	2000	1*	-	350 555	-	-	-	-	-	-
G 3/8"	9-36 V DC	MIN	0	7	3000	1*	-	350 557	-	-	-	-	-	-
G 3/8"	9-36 V DC	MAX	0	0	1000	1*	-	350 501	-	-	-	-	-	-
G 3/8"	9-36 V DC	MIN	0	0	2000	1*	-	350 532	-	-	-	-	-	-
G 3/8"	9-36 V DC	MIN	2	7	1000	1*	350 582	-	350 615	-	350 650	-	-	-
G 3/8"	9-36 V DC	MAX	2	7	1000	1*	350 766	350 597	-	350 631	-	350 667	-	350 701
G 3/4"	9-36 V DC	MIN	0	7	3000	1*	-	350 556	-	-	-	-	-	-
G 1"	9-36 V DC	MIN	2	7	250	1*	325 307	-	-	-	-	-	-	-
G 1"	9-36 V DC	MIN	0	0	3000	1*	-	-	-	-	350 520	-	-	-
R 3/4"	9-36 V DC	MIN	0	7	250	1*	-	322 342	-	-	-	-	-	-

ACCESSORIES

Screw-in adapter

Order-Nr.	Thread outside	Thread inside
421 696	M 16 x 1,5	M 14 x 1,5
421 640	M 22 x 1,5	M 14 x 1,5
421 884	M 22 x 1,5	1/4" NPTF
421 695	G 1/2"	M 14 x 1,5
421 694	R 1/2"	M 14 x 1,5
421 639	R 1"	M 18 x 1,5

Braze-on adapter

Order-Nr.	Thread inside
421 644	M 14 x 1,5
421 648	M 18 x 1,5
421 641	1/4" NPTF

1* Cable with flying leads

ORDER NUMBER OVERVIEW

Sensors with EMC cable connection

Thread	Operating voltage	Function	Function control time sec	Fault indication delay time sec	Cable length mm	Cable connection type	Order number for **low-side switch**				Order number for **high-side switch**			
							Water-based liquids		Oil-based liquids		Water-based liquids		Oil-based liquids	
							Operating current	Quiescent current	Operating current	Quiescent current	Operating current	Quiescent current	Operating current	Quiescent current
M 18 x 1,5	4,5-18 V DC	MIN	0	0	3000	1*	-	-	350 512	-	-	-	-	-
M 18 x 1,5	4,5-18 V DC	MAX	0	0	3000	1*	350 513	-	-	-	-	-	-	-
M 18 x 1,5	9-36 V DC	MAX	2	0	6000	1*	-	-	-	-	-	350 502	-	-
M 18 x 1,5	9-36 V DC	MIN	2	7	3000	1*	350 577	-	350 610	-	350 646	-	350 681	-
M 18 x 1,5	9-36 V DC	MAX	2	7	3000	1*	-	350 595	-	350 628	-	350 664	-	350 698

ACCESSORIES

Screw-in adapter

Order-Nr.	Thread outside	Thread inside
421 696	M 16 x 1,5	M 14 x 1,5
421 640	M 22 x 1,5	M 14 x 1,5
421 884	M 22 x 1,5	1/4" NPTF
421 695	G 1/2"	M 14 x 1,5
421 694	R 1/2"	M 14 x 1,5
421 639	R 1"	M 18 x 1,5

Braze-on adapter

Order-Nr.	Thread inside
421 644	M 14 x 1,5
421 648	M 18 x 1,5
421 641	1/4" NPTF

1* Cable with flying leads

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