

# Sensors

## Reliable data recording with sensors

Hydrotechnik produces a large range of high-quality sensors that are tuned perfectly to the measuring instruments. We offer a large variety of products in the fields of pressure, temperature and volume flow rate – the most suitable sensor is available for nearly every application. Due to our own development and production, we also have the competence, which is confirmed by our own DKD calibration laboratory. We are flexible enough to produce economically-rational customized sensor solutions.

### ISDS – automatic sensor data transmission

All Hydrotechnik sensors are equipped with the „Intelligent Sensor Detection System“ (ISDS), where all sensor parameters, including the calibration data, are stored in the sensor. After switching-on, the measuring instrument automatically takes over all information from the connected sensor, and the time-consuming and error-prone process of entering parameters and linearisation tables is no longer necessary.

This is reliable plug-and-play: connect – switch on – measure.

## Pressure sensors

### PR 15

Measuring sensor for mobile and stationary use, recommended for the Hydrotechnik measuring instruments of series Multi-System.



- Measuring principle: piezo-resistive (silicium chip embedded in silicone oil and welded in high-grade steel casing)
- Accuracy:  $\pm 0,2$  % of final value
- Readiness for operation:  $< 1$  s
- Noise performance:  $< \pm 0,02$  % of final value
- Response time:  $< 1$  ms
- Long-term stability:  $\pm 0,1$  % of final value per year
- Over-pressure: 1,5 times nominal pressure
- Burst pressure: 3 times nominal pressure
- Signal output: 0 to 20 mA
- Staggered measuring ranges:  
-1 to 600 bar (-0,1 to 60 MPa)
- Working temperature range:  $-40$  °C to  $+120$  °C
- Medium temperature:  $-40$  °C to  $+130$  °C
- Housing material: Stainless steel

## Pressure sensors

### HT-PD

Industrial sensor for the mobile and stationary use.



- Measuring principle: piezo-resistive (polykristalline silicon strain gauge on a stainless steel diaphragm)
- Accuracy:  $\pm 0,25$  % of final value
- Readiness for operation:  $> 10$  s
- Noise performance:  $< \pm 0,2$  % of final value
- Response time: 1 ms
- Long-term stability:  $\pm 0,1$  % of final value per year
- Over-pressure: 1,5 times nominal pressure
- Burst pressure: 3 times nominal pressure
- Signal output: 0 to 20 mA
- Staggered measuring ranges:
  - 1 to 600 bar (-0,1 to 60 MPa)
- Working temperature range:  $-40$  °C to  $+100$  °C
- Medium temperature:  $-40$  °C to  $+130$  °C
- Gehäusewerkstoff: rostfreier Edelstahl

## Pressure and temperature sensors

### Dual sensor

Industrial sensor for mobile and stationary use. Recording of pressure and temperature at one measuring point.



- Accuracy pressure:  $\pm 0,5$  % of final value
- Over-pressure: 1,5 times nominal pressure
- Burst pressure: 3 times nominal pressure
- Signal output: 4 to 20 mA (for both channels)
- Measuring range: 0 to 60 bar or 0 to 600 bar (0 to 6 MPa or 0 to 60 MPa)
- Working temperature range:  $-40$  °C to  $+100$  °C
- Medium temperature:  $-40$  °C to  $+130$  °C
- Temperature sensor: Pt 100 (Platinum measurement resistor acc. to DIN 43760, class B)
- Temperature measuring range:  $-50$  °C to  $+200$  °C
- Accuracy temperature:  $\pm 1$  % of final value

# Temperature sensors

## Screwed sensor

Industrial sensor for mobile and stationary use that can be coupled under pressure.



- Temperature sensor: Pt 100 (Platinum-measurement resistor acc. to DIN 43760, class B)
- Temp. measurement range: -50 °C to +200 °C
- Accuracy:  $\pm 1$  % of final value
- Pressure load: max. 630 bar (63 MPa)
- Signal output: 4 to 20 mA
- Working temperature range: -20 °C to +80 °C (with reference to electronics)

## Surface sensor

Measurement sensor for mobile use. The sensor head allows the reliable and fast measurement of a surface temperature.



- Temperature sensor: Pt 100 (Platinum-measurement resistor acc. to DIN 43760, class B)
- Temp. measuring range: -50 °C to +200 °C
- Accuracy:  $\pm 1$  % of final value
- Signal output: 4 to 20 mA
- Sensor length: 150 mm
- Connection cable: spiral cable approx. 1,2 m (extended)

## Immersion sensor

Measurement sensor for mobile use that allows the reliable and fast measuring of a medium temperature.





- Temperature sensor: Pt 100 (Platinum-measurement resistor acc. to DIN 43760, class B)
- Temp. measuring range: -50 °C to +200 °C
- Accuracy:  $\pm 1$  % of final value
- Signal output: 4 to 20 mA
- Sensor length: 150 mm
- Connection cable: spiral cable approx. 1,2 m (extended)

# Flow rate sensors

Hydrotechnik offers flow rate sensors based on two different principles:

- **Gear flow meters, using the principle of positive displacement**
- **Turbines using the flow principle**

The 2 systems have advantages and disadvantages within different applications. The following table contains criteria to find the right decision:

<b>Turbine</b> 		<b>Gear flow meters</b> 
<ul style="list-style-type: none"> <li>▪ Good reproduceability</li> <li>▪ Linearised error limits with reference to the measuring range: <math>\pm 0,5\%</math> to <math>\pm 1,0\%</math> of the current value</li> <li>▪ Low flow resistance, broad range of applicable media</li> <li>▪ Low response time (10 to 40 ms)</li> <li>▪ Low weight, small fitting size, free mounting orientation</li> <li>▪ Medium temperature: max. <math>+120\text{ }^{\circ}\text{C}</math></li> <li>▪ Working pressures: dependent on measuring range 35,0 to 40,0 MPa (350 bar to 400 bar)</li> </ul>	<p><b>Advantages for the use</b></p>	<ul style="list-style-type: none"> <li>▪ Very accurate measurements possible</li> <li>▪ Error limits with reference to the measuring range: <math>\pm 0,4\%</math> to <math>\pm 0,5\%</math> of current value</li> <li>▪ Viscosity-independent to a large degree, maximal up to 5000 mm<sup>2</sup>/s (cSt)</li> <li>▪ Wide measuring range with one type (up to a relation of 1:1000)</li> <li>▪ Medium temperature: <math>-20\text{ }^{\circ}\text{C}</math> to <math>+120\text{ }^{\circ}\text{C}</math> (ambient temperature max. <math>+80\text{ }^{\circ}\text{C}</math>)</li> <li>▪ Working pressures: dependent on measuring range 40,0 to 63,0 MPa (400 bar to 630 bar)</li> <li>▪ Mounting orientation and connectors free of choice</li> <li>▪ Volume counting for dispensing (quantity measurement)</li> </ul>
<ul style="list-style-type: none"> <li>▪ Very viscosity-dependent, 1-10 l/min to 60 cSt.</li> <li>▪ High viscosities not possible max. 270 mm<sup>2</sup>/s (cSt) (Attention high shear forces)</li> </ul>	<p><b>Consider this!</b></p>	<ul style="list-style-type: none"> <li>▪ Large delta-p (up to 9 bar, dependent on viscosity)</li> <li>▪ Sensitive to pollution</li> <li>▪ High weight</li> <li>▪ For thin media only partly suitable, do not use below 4 mm<sup>2</sup>/s (cSt)</li> </ul>

# Flow rate sensors

## Turbine



## Gear flow meter



### Preselection

### Measuring range

1,0 to 10  
2,0 to 75  
9,0 to 300  
16,0 to 600  
l/min

0,005 to 1  
0,05 to 5  
0,2 to 30  
0,7 to 70  
3,0 to 300  
l/min

### Viscosity

Max. 60 cSt (1,0 to 10 / Typ RE 4)  
Max. 270 cSt (2,0 to 75 / Typ RE 4)  
Max. 270 cSt (9,0 to 300 / Typ RE 4)  
Max. 270 cSt (15,0 to 300 / Typ RE 4)  
Max. 270 cSt (7,5 to 100 / Typ RE 6)  
Max. 270 cSt (16,0 to 600 / Typ RE 6)  
Max. 270 cSt (25,0 to 600 / Typ RE 6)

10 to 500 mm<sup>2</sup> s<sup>-1</sup> (cSt)

### Medium

Mineral oils, HFA- and HFC-liquids, Skydrol, water a.s.o.

Mineral oils, Diesel oil, fat a.s.o.

### Material

AlZnMgCu 1,5 (3.4365), anodised  
or  
X10CrNiS189 (1.4305), passivised

X10CrNiS189 (1.4305)  
GGG60 (0.7060)  
16MnCr5 (1.7131)

### p<sub>max</sub>

400 bar (40,0 MPa) (1,0 to 10)  
400 bar (40,0 MPa) (2,0 to 75)  
400 bar (40,0 MPa) (9,0 to 300)  
350 bar (35,0 MPa) (16,0 to 600)  
l/min

400 bar (40,0 MPa) (0,005 to 1)  
630 bar (63,0 MPa) (0,05 to 5)  
630 bar (63,0 MPa) (0,2 to 30)  
400 bar (40,0 MPa) (0,7 to 70)  
400 bar (40,0 MPa) (3,0 to 300)  
l/min

### Accuracy

±1,0 % o. MV (1,0 to 10)  
±0,5 % o. MV (2,0 to 75)  
±0,5 % o. MV (9,0 to 300)  
±0,5 % o. MV (16,0 to 600)  
l/min

±0,5 % o. MV (0,005 to 1)  
±0,5 % o. MV (0,05 to 5)  
±0,5 % o. MV (0,2 to 30)  
±0,4 % o. MV (0,7 to 70)  
±0,5 % o. MV (3,0 to 300)  
l/min

### Filtering

50 µm (1,0 to 10)  
50 µm (2,0 to 75)  
50 µm (9,0 to 300)  
50 µm (16,0 to 600)  
l/min

10 (0,005 to 1)  
10 µm (0,05 to 5)  
25 µm (0,2 to 30)  
25 µm (0,7 to 70)  
25 µm (3,0 to 300)  
l/min

### Consulting

Further technical support  
by Hydrotechnik

Further technical support  
by Hydrotechnik

# Flow rate sensors

## Turbine RE 4

with roller support for the use in mineral oil



### Technical data

Viscosity range:	1 to 270 mm <sup>2</sup> /s (cSt)
Medium temperature range:	max. +120 °C
Signal output:	standard frequency on request 4 to 20 mA
Material:	housing: AlZnMgCu 1,5, surface protection by anodisation
Factory calibration:	mineral oil 30 mm <sup>2</sup> /s (cSt) for other viscosity see order data page 39
Pressure drop:	max. 7,0 bar (0,7 MPa) due to measuring range at viscosity 30 mm <sup>2</sup> /s (cSt)

Turbine RE 4 linearised meas. range	Thread G	P <sub>max</sub>	Mounting length L	Error limits linearised of current value
1 to 10 l/min	ISO 228-G 1/4	400 bar (40 MPa)	120 mm	±1,0 %
2 to 75 l/min	ISO 228-G 3/4		129 mm	±0,5 %
9 to 300 l/min	ISO 228-G1	350 bar (35 MPa)	149 mm	±0,5 %
16 to 600 l/min	ISO 228-G1 1/4		173 mm	±0,5 %

## Turbine RE 6

with heavy metal slide bearing for the use in clear water and HFA/HFC-liquids.



### Technical data

Viscosity range:	1 to 270 mm <sup>2</sup> s <sup>-1</sup> (cSt)
Medium temperature range:	max. +120 °C
Signal output:	frequency
Material:	housing: X10CrNiS189 surface protection by passivation
Factory calibration:	mineral oil 30 mm <sup>2</sup> /s (cSt) for other viscosity see order data page 39
Pressure drop:	max. 1,6 bar (0,16 MPa) due to measuring range at viscosity 30 mm <sup>2</sup> /s (cSt)

Turbine RE 6 Measuring range	Thread G	P <sub>max</sub>	Mounting length L	Error limits
7,5 to 100 l/min	ISO 228-G 3/4	400 bar (40 MPa)	142 mm	±2,5 %
15 to 300 l/min	ISO 228-G 1 1/4		181 mm	±2,0 %
25 to 600 l/min	ISO 228-G 1 1/2	350 bar (35 MPa)	185 mm	±2,5 %

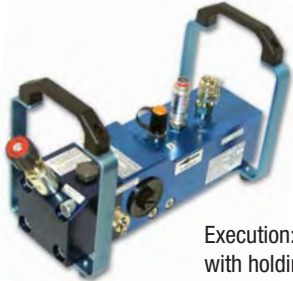


Further executions. e.g. CAN, are mentioned in the sensor catalogue. Available in September 2007.

# Flow rate sensors

## Loading valve

For pump tests like e.g. the recording of pump curves dependent to pressure, we recommend our loading valve with integrated measuring turbine as a useful test equipments.



Execution:  
with holding frame



### Technical data

Measuring range:	12 to 600 l/min
Error limit:	±0,5 % of measured value at 30 mm <sup>2</sup> /s (cSt)
Viscosity range:	3 to 200 mm <sup>2</sup> /s (cSt)
Working pressure:	max. 420 bar
Working temperature:	-20 °C to +80 °C (short time up to 100 °C)
Connector:	ISO 228-G1 1/4 (inflow or outflow)
Dimensions:	295 x 146 x ca. 208 mm (L x W x H)
Application:	preferably for hydraulic and other oils based on mineral oil

## Gear flow meter GFM



### Technical data

Viscosity range:	standard 10 to 500 mm <sup>2</sup> /s (cSt)
Possible viscosity range:	4 to 5000 mm <sup>2</sup> /s (cSt)
Medium temperature range:	-20 °C to +120 °C
Ambient temperature:	max. +80 °C
Signal output:	frequency
Material:	casing lid X10CrNiS189 (1.4305) middle part and bottom assembly GGG60 (0.7060), seals FKM (Viton) gear wheels 16MnCr5 (1.7131)

Measuring range	p <sub>max</sub>	Thread G	Error limits standard - (linearised) of current value
0,005 to 1 l/min	400 bar (40 MPa)	ISO 228-G 1/4, S8(S6)	to 0,025 l/min ±1,0 % from 0,025 l/min ±0,5 %
0,05 to 5 l/min	630 bar (63 MPa)	ISO 228-G 1/4, S8	±0,5 %
0,2 to 30 l/min	160 bar*) (16 MPa)	ISO 228-G 3/8, S12	±0,5 %
	630 bar (63 MPa)		±0,5 %
0,7 to 70 l/min	400 bar (40 MPa)	ISO 228-G 3/4, S20	±0,4 %
3,0 to 300 l/min		SAE-flange 1 1/4	±0,5 %

\*) Material: housing AlCuMgPb F37.

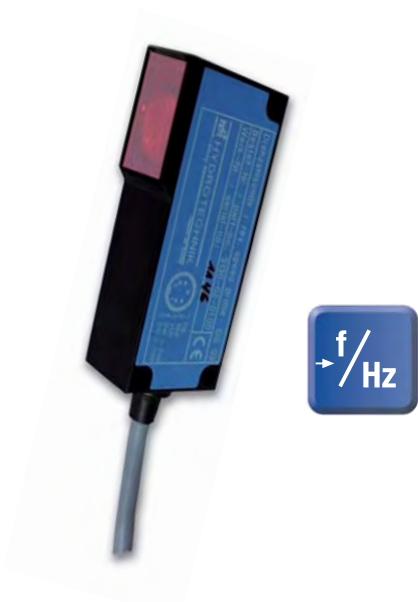


Further executions are mentioned in the sensor catalogue.  
Available in September 2007.

# Rotational speed sensors

## Rotational speed probe DS 03

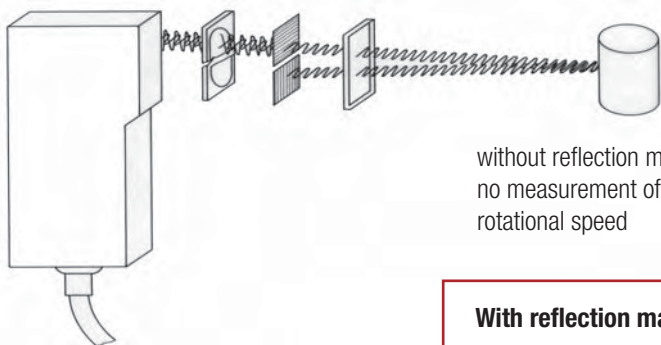
Proven industrial sensor for fixed stationary use allowing a reliable rotational speed measurement over distances of up to four meters.



- Light source: high-performance LED with visible, intermittent red light
- Range: min. 50 mm to max. 4000 mm (depends on size of reflection mark)
- Signal cycle frequency: max. 500 Hz
- Signal output: frequency (dependent on power supply); optional analogue signal 4 to 20 mA
- Working temperature range: -10 °C to +60 °C

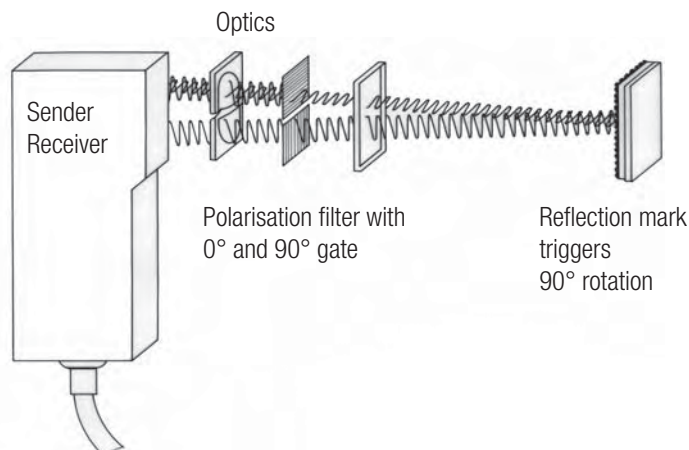
## Function principle

### without reflection mark



without reflection mark  
no measurement of  
rotational speed

### With reflection mark





## Rotational speed sensors

### Inductive sensor

Special industrial sensor for the measurement of the rotational speed of sprocket wheels.



- Measurement principle: inductive, with integrated amplification circuit
- Signal output: rectangle impulse (depending on power supply)
- Signal cycle frequency: max. 5 kHz
- Power supply: 6,5 V to 30 VDC
- Working temperature range: -20 °C to +85 °C
- Fixing thread: M 10 x 1,5
- Housing: aluminium, anodised 20 µm, RAL 5015

## Further sensors

You can connect further sensors to Hydrotechnik measuring instruments:

- Distance and position sensors
- Torque transducers
- Rotation angle sensors
- Power sensors
- Further sensors on request



Further information is contained in the Hydrotechnik sensor catalogue that is available in September 2007.

# Order data sensors

## Pressure sensors PR 15



Measuring range	Output signal	Order number
-1 to 6 bar (-0,1 to 0,6 MPa)	0 to 20 mA	3403-32-S-71.33A
0 to 60 bar (0 to 6 MPa)		3403-21-S-71.33A
0 to 200 bar (0 to 20 MPa)		3403-10-S-71.33A
0 to 400 bar (0 to 40 MPa)		3403-15-S-71.33A
0 to 600 bar (0 to 60 MPa)		3403-18-S-71.33A

Other output signals on request.

## Pressure sensors HT-PD



Measuring range	Output signal	Order number
-1 to 6 bar (-0,1 to 0,6 MPa)	0 to 20 mA	3403-32-S-E5.33
0 to 60 bar (0 to 6 MPa)		3403-21-S-E5.33
0 to 200 bar (0 to 20 MPa)		3403-10-S-E5.33
0 to 400 bar (0 to 40 MPa)		3403-15-S-E5.33
0 to 600 bar (0 to 60 MPa)		3403-18-S-E5.33

## Pressure sensors HT-PD without ISDS



Measuring range	Output signal	Order number
-1 to 6 bar (-0,1 to 0,6 MPa)	0 to 20 mA without ISDS	3403-32-C3.33
0 to 60 bar (0 to 6 MPa)		3403-21-C3.33
0 to 200 bar (0 to 20 MPa)		3403-10-C3.33
0 to 400 bar (0 to 40 MPa)		3403-15-C3.33
0 to 600 bar (0 to 60 MPa)		3403-18-C3.33

Other output signals on request.

Recommended for panel mounted instruments series SEG 1060 and series Compare.

## Pressure sensors HT-PD only suitable for Multi-Handy 2020



Measuring range	Output signal	Order number
-1 to 6 bar (-0,1 to 0,6 MPa)	4 to 20 mA	3403-32-S-N4.37
0 to 60 bar (0 to 6 MPa)		3403-21-S-N4.37
0 to 200 bar (0 to 20 MPa)		3403-10-S-N4.37
0 to 400 bar (0 to 40 MPa)		3403-15-S-N4.37
0 to 600 bar (0 to 60 MPa)		3403-18-S-N4.37

Only available as ISDS pressure sensor.

All sensors mentioned on the pages 38 to 42 are also available without ISDS.

# Order data sensors

## Dual sensor pressure and temperature



Measuring ranges pressure and temperature	Output signal	Order number
0 to 60 bar (0 to 6 MPa) -50 °C to +200 °C	4 to 20 mA	3763-04-34.00
0 to 600 bar (0 to 60 MPa) -50 °C to +200 °C	4 to 20 mA	3763-03-34.00

Corresponding measuring cables are mentioned on page 46.

## Volume flow ratesensor Turbine RE 4



Measuring range	Thread G	p <sub>max</sub>	Order number
1 to 10 l/min	ISO 228-G 1/4	400 bar (40 MPa)	31V7-01-S-35.00
2 to 75 l/min	ISO 228-G 3/4		31V7-70-S-35.00
9 to 300 l/min	ISO 228-G 1	350 bar (35 MPa)	31V7-71-S-35.00
16 to 600 l/min	ISO 228-G 1 1/4		31V7-72-S-35.00

- Factory calibration for mineral oil at 30 mm<sup>2</sup>/s (30cSt), if no other viscosity is given. At other viscosity replace last digits of order number .00 with .79 and give the desired viscosity.
- Equipped with a MINIMESS® coupling and a p/T measuring coupling of series 1620 and an induc-

tive pick-up with amplifier and ISDS. Spare part order of the sensor see page 49.

- For desired output signal 4 to 20 mA you have to replace the first digits of the order number 31V7 with 31G7.

## Volume flow sensor Turbine RE 6



Measuring range	Thread G	p <sub>max</sub>	Order number
7,5 to 100 l/min	ISO 228-G 3/4	400 bar (40 MPa)	33V7-77-S-35.00G
15 to 300 l/min	ISO 228-G 1 1/4		33V7-78-S-35.00G
25 to 600 l/min	ISO 228-G 1 1/2	350 bar (35 MPa)	33V7-79-S-35.00G

- Factory calibration for mineral oil at 30 mm<sup>2</sup>/s (30cSt), if no other viscosity is given. At other viscosity replace last digits of order number .00 with .79 and give the desired viscosity.

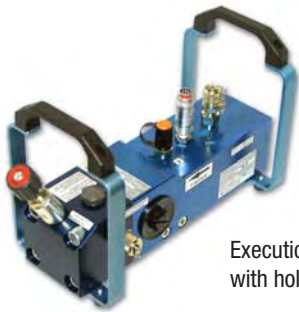
- Equipped with a MINIMESS® coupling and a p/T measuring coupling of series 1620 and an inductive pick-up with amplifier and ISDS. Spare part order of the sensor see page 49.



Further executions, e.g. CAN are mentioned in the sensor catalogue. Available in September 2007.

## Order data sensors

### Loading valve



Execution:  
with holding frame

Measuring range	Thread G	p <sub>max</sub>	Order number
12 to 600 l/min	ISO 228-G 1 1/4	420 bar (42 MPa)	31VB-72-35.00S2

- Factory calibration only for mineral oil at 30 mm<sup>2</sup>/s (30 cSt).
- Equipped with a MINIMESS® coupling and a p/T measuring coupling of series 1620 and an inductive pick-up with amplifier and ISDS. Spare part order of the sensor see page 49.

### Gear flow sensor GFM



Measuring range	p <sub>max</sub>	Hydraulic connection	Order number
0,005 to 1 l/min	400 bar (40 MPa)	ISO 228-G 1/4, S8 (S6)	3143-01-S-35.00
0,05 to 5 l/min	630 bar (63 MPa)	ISO 228-G 1/4, S8	3143-02-S-35.00
0,2 to 30 l/min	160 bar*) (16 MPa)	ISO 228-G 3/8, S12	3843-03-S-35.00
	630 bar (63 MPa)		3143-03-S-35.00
0,7 to 70 l/min	400 bar (40 MPa)	ISO 228-G 3/4, S20	3143-04-S-35.00
3,0 to 300 l/min		SAE-flange 1 1/4	3143-05-S-35.00

\*) Material: casing ALCuMgPb F37.

- Factory calibration for mineral oil at 10 to 500 mm<sup>2</sup>/s (cSt), if no other viscosity is given. For other viscosity replace the last digits of the order number .00 by .99 and give the desired viscosity.
- Equipped with a MINIMESS® coupling and a p/T measuring coupling of series 1620 and an inductive pick-up with amplifier and ISDS. Spare part order of the sensor see page 49.

# Order data sensors

## Temperature sensor, Pt 100



Measuring range	Measuring error	Output signal	Order number
-50 °C to +200 °C	±1 % of final value	0 to 20 mA	3973-04-S-01.00

## Temperature surface sensor, Pt 100 - class B



Measuring range	Measuring error	Output signal	Order number
-50 °C to +200 °C	±1 % of final value	4 to 20 mA	3170-01-S-03.00
-50 °C to +400 °C			3170-01-S-07.00

## Temperatur-immersion sensor, Pt 100 - class B



Measuring range	Measuring error	Output signal	Order number
-50 °C to +200 °C	±1 % of final value	4 to 20 mA	3170-02-S-06.00
-50 °C to +400 °C			3170-02-S-08.00

## Order data sensors

### Rotational speed sensor DS 03, optical



Measuring range	Execution	Order number
Max. 30.000 rev.	with 25 reflection foils	3130-02-01.00

Spare part orders reflection foils see page 50.

**Useful accessories:** magnetic hold rotational speed sensor DS 03 see page 50.

### Rotational speed sensor for measurement at gear wheels, inductive



Output signal	Execution	Order number
$f_{\max} = 5 \text{ kHz}$	Thread M 10 x 0,75	3107-00-09.00

### Further sensors that can be connected to our measuring instruments:

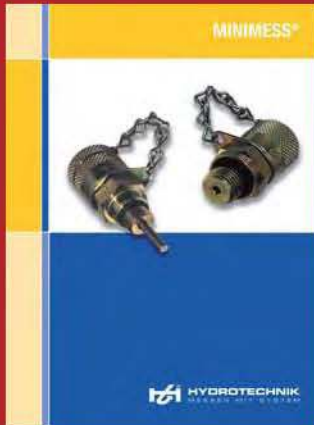
- Distance and position sensors
- Torque transducers
- Rotational angle sensors
- Power sensors
- further sensors on request



Further executions are mentioned in the sensor catalogue.  
Available in September 2007.

Further products

MINIMESS®,  
Measuring hoses a.s.o. ...



Further products

Sensors for pressure, temperature,  
rotational speed, volume flow, a.s.o. ...



Authorised distributors in India

**THI Techniaids Hydraulic  
Industries Pvt. Ltd.**

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Tel. Nos. : 040-23778803, 23778804, 23871445. Fax No.040-23876781  
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