Volume flow rate sensors

Kalibrierdienst
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DIN EN ISO 9001
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Test with confidence

HYDROTECHNIK
Limburg

Messen mit System

English

Hydrotechnik gear flow meters type GFM

Gear flow meters are used for the precise measuring of the volume flow rate as well as for the accurate volume counting

Measuring of the volume flow rate

For the measuring of the volume flow rate, pulses are evaluated as a volume per time in any flow unit whatever, e.g. l/min.

Counting of the volume (quantity)

For the counting of the volume, individual pulses per gear tooth volume are added up in the instrument and are shown in freely selectable volume units.

Advantages at a glance

- high accuracy and repeatability
- operational pressure up to 630 bar
- fitting in any position and measuring in both flow directions possible
- large measuring range up to 1:200
- application for a large viscosity range
- test points for pressure and temperature
- suitable for hydraulic- and other oils on mineral oil basis, diesel oil, fats, glue, resins, waxes, pastes, polyurethane etc.
- option: detection of flow direction and pulse doubling

Short description of measuring principle

A ball bearing pair of gear wheels is moved by the streaming fluid. The fluid is transported in the cavities between each gear tooth and the housing. This measuring system works accordingly to the positive displacement principle.

Due to this, the measuring accuracy is largely independent of the fluid viscosity. The rotation of the gear wheels is detected by a non-contacting magnetoresistor sensor. Each tooth cuts through a small magnetic field and produces a square wave electrical output.
The connected HYDROTECHNIK measuring instruments display the volume flow rate in any flow unit whatever (e.g. l/min.).

As an option it is possible to realize a doubling of the pulses, when installing an additional magnetoresistor sensor into the gear flow meter.

In doing so, a better resolution is achieved and modifications of the direction are detected exactly.

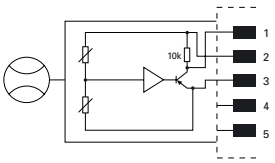
Technical data

Material: **(Standard type)**	Top of housing X12CrNiS 188 (1.4305) Middle piece and bottom piece GGG60 (0.7060), sealings Viton Gear wheels 16 Mn Cr 5 (1.7131) or special material
Viscosity range:	4 to 50 000 mm^2/s (cST)
Standard viscosity range:	10 to 500 mm^2/s (cST), calibration value and geometric tooth volume are stamped onto the label of the gear flow meter
Allowed temp. operat. material:	-20 °C to +120 °C (-4 ... 248 °F) ambient temperature max. 80 °C (176 °F)
Hydraulic connection:	see table
Measuring ranges:	see table
Allowed operational pressure:	see table
Non-linearities:	see table
Reproducibility:	<0,1 % of the measuring value
Measuring signal output:	Magnetoresistor sensor with integrated amplifier, voltage supply +8 V to +30 V (direct voltage), plug 5-poles, Amphenol-Tuchel

Technique in detail

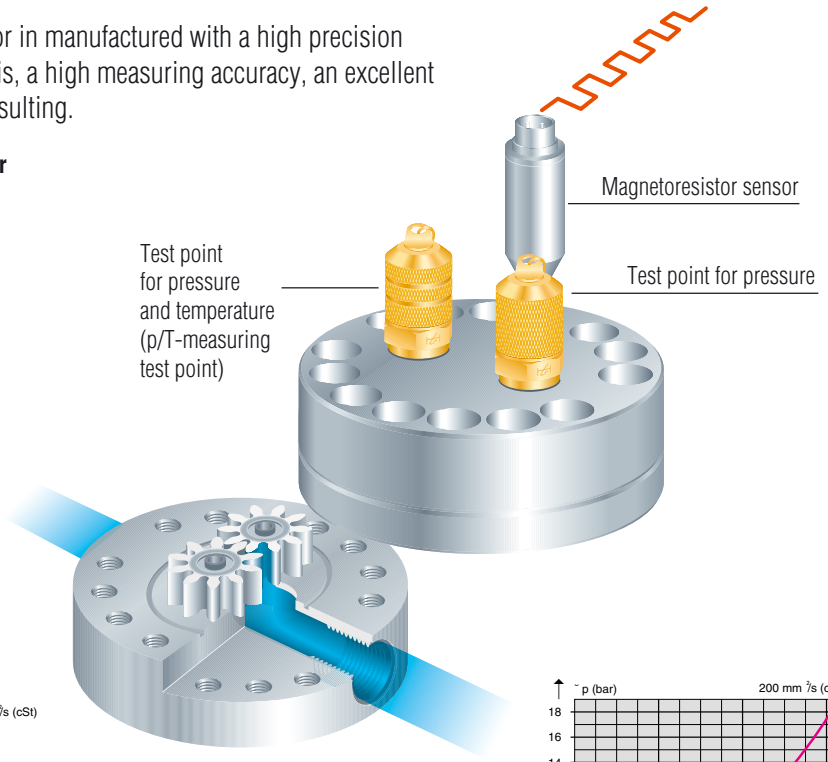
The measuring system of the sensor in manufactured with a high precision and very small tolerances. From this, a high measuring accuracy, an excellent reliability and a long lifetime are resulting.

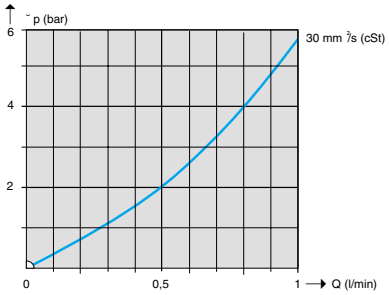
Connections magnetoresistor sensor



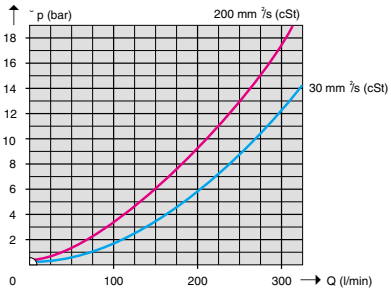
1: + Signal
2: - Signal / -U_b / GND
3: + U_b / +8 to +30 VDC
4: free/NC
5: free/NC

Signal amplitude (square wave) = power supply minus app. 1 Volt



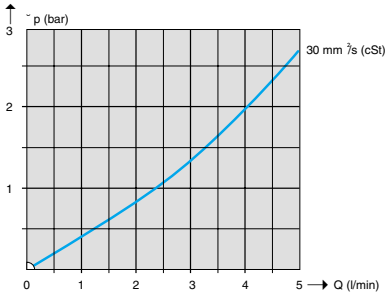


Picture 1 Q=0,005 to 1 l/min

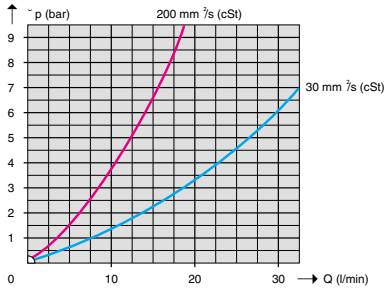


Picture 5 Q=3 to 300 l/min

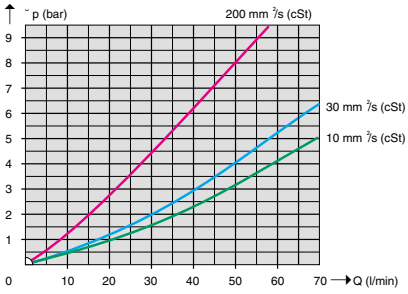
Typical pressure drop curves



Picture 2 Q=0,05 to 5 l/min



Picture 3 Q=0,2 to 30 l/min



Picture 4 Q=0,7 to 70 l/min

Measuring range in l/min	Non-linearities at standard viscosity 10 to 500 mm²/s	Vgz geometric tooth volume app. cm³	Pulses per app. dm³	Hydraulic connection ISO-228	Tube	Type	Housing Ø in mm	Height in mm	Weight in kg	*thread boring (depth)
0,005 to 1	0,005 to 0,025 l/min ±1 % from meas. value 0,025 to 1 l/min ±0,5 % from meas. value	0,022	46000	G 1/4	S8 (S6)	For screw-in pipe connection with BSP. thread acc. to DIN 3852	84	app. 118	1,6	M6 (9 mm)
0,05 to 5	±0,5 % from meas. value	0,19	5250	G 1/4	S8			app. 125	2,7	M8 (12 mm)
0,2 to 30	±0,5 % from meas. value	0,61	1640	G 3/8	S12		106	app. 133	3,6	M8 (15 mm)
0,7 to 70	±0,5 % from meas. value	2,22	450	G 3/4	S20		136	app. 153	8,5	M12 (18 mm)
3,0 to 300	±0,5 % from meas. value	10,0	100	SAE-flange connection 1 1/4			210	app. 190	32	M16 (24 mm)

Other measuring ranges on request

*Planned mechanical fastenings: thread borings on bottom side

Order data

The standard Gear Flow Meter is delivered with the following features:

- Work's calibration for mineral oil at 10 to 500 mm²/s (cSt): if no other viscosity is indicated.
- Equipped with one MINIMESS-screw test point, one p/T-test point of series 1620 and one standard magnetoresistor sensor (part-number: 3107-00-17.00).

Additions to the standard type can be seen below, in the order key for special types.

Standard type GFM

Measuring range	p_{max}	Hydraulic connection	Part-number
0,005 to 1 l/min (0,0013 ... 0,25 US gal/min)	400 bar (5800 psi)	ISO 228-G 1/4, S8(S6)	**3143-01-35.00**
0,05 to 5 l/min (0,013 ... 1,3 US gal/min)	630 bar (9000 psi)	ISO 228-G 1/4, S8	**3143-02-35.00**
0,2 to 30 l/min (0,05 ... 8 US gal/min)	160 bar*) (2300 psi)*)	ISO 228-G 3/8, S12	**3843-03-35.00**
	630 bar (9000 psi)		**3143-03-35.00**
0,7 to 70 l/min (0,18 ... 18,5 US gal/min)	400 bar (5800 psi)	ISO 228-G 3/4, S20	**3143-04-35.00**
3,0 to 300 l/min (0,79 ... 79,25 US gal/min)		SAE-flange 1 1/4	**3143-05-35.00**

*) Housing material: ALCuMgPb F37

Order key for special types

Special calibration on request (add requested viscosity to the complete part-number)	**.99**
Design with two magnetoresistor sensors (detection of direction): **46** EX-type with Zener-barriers: **78** Design with f/DC-converter (output signal corresponds to the volume flow rate measuring range 4 to 20 mA) **85**	
GFM without test points	**00**
GFM equipped with MINIMESS-test point and p/T-test point for further screw series: MINIMESS 1615 **26** MINIMESS 1215 **14**	

Gear flow meter type GFM made from stainless steel 1.4571 (p_{max} 250 bar / 3600 psi) Measuring range 0,005 to 1 l/min (0,0013 ... 0,25 US gal/min) Measuring range 0,05 to 5 l/min (0,013 ... 1,3 US gal/min) Measuring range 0,2 to 30 l/min (0,05 ... 8 US gal/min) (on request) (equipped with MINIMESS-test point and p/T-test point, series 1620)	**3774-01-35.00** **3774-02-35.00**
Accessories Measuring cable MK 01 (standard length 2,5 m for all gear flow meters type GFM) Magnetoresistor sensor (single ones are available for replacement)	**8824-91-02.50** **3107-00-17.00**

Technical details are subject to change without notice.

HYDROTECHNIK evaluation instruments which can be connected:

- Hand held measuring instruments: Series 5000, 4010/4020, and 2040/2045
- Panel mounted instruments: Typ "SEG 1000 and Compare" for volume flow rate
- Measuring data acquisiton systems: Group 8000, HY-MoCom 6000

HYDROTECHNIK-RE-series flow measuring turbines

Flow measuring turbines are used in many fields to acquire instantaneous flow rates from dynamic fluid systems.

- RE 3 with external metric thread connections
  for solder-free screw-in pipe connection according to DIN 2353
- RE 4 with internal BSP threaded connections
  according to DIN ISO 228

Advantages at a glance

- Ideally suited for use with mineral oil and HFA-/HFC-liquids, skydrol, water etc.
- Integrated test points for acquiring pressure and temperature measurements
- Small physical dimensions, high pressure capability
- Installation in any position, reverse flow operation
- Low operational noise, high level of reproducibility
- Improved accuracy through linearization feature with the corresponding evaluative instrumentation from within our product range
- Measuring range expandable through linearization feature

The measuring principle in brief

The flow measuring turbine is a flow rate meter.
The turbine blade wheel is axially driven by the flow stream, rotating in proportion to the mean flow velocity.
A non-contacting inductive pick-up generates a pulse each time its' electro magnetic field is interrupted
by the rotating blades of the turbine. These pulses are then directly conver-ted into a flow measurement by the associated electronic instrumentation, in for example l/min.

An advantage of the RE flow meas-uring turbine are the integrated test points which enable additional measurements of pressure and temperature.

Common technical data for RE 3 and RE 4

Materials:	Housing AlZnMgCu 1,5, surface protection by anodic oxidation. With HFA- and HFC-liquids the surface protection is achieved by a special anodic oxidation process.
Viscosity range:	1 to 270 mm^2/s (cSt), > 60 mm^2/s = restriction of measuring range (for RE 4-10, max. viscosity 60 mm^2/s)
Allowed temperature of operating material:	Max. +120 °C (248 °F)
Signal connection:	Inductive transducer with amplifier, signal output square wave

Error limits referring to the calibration viscosity for the following types:

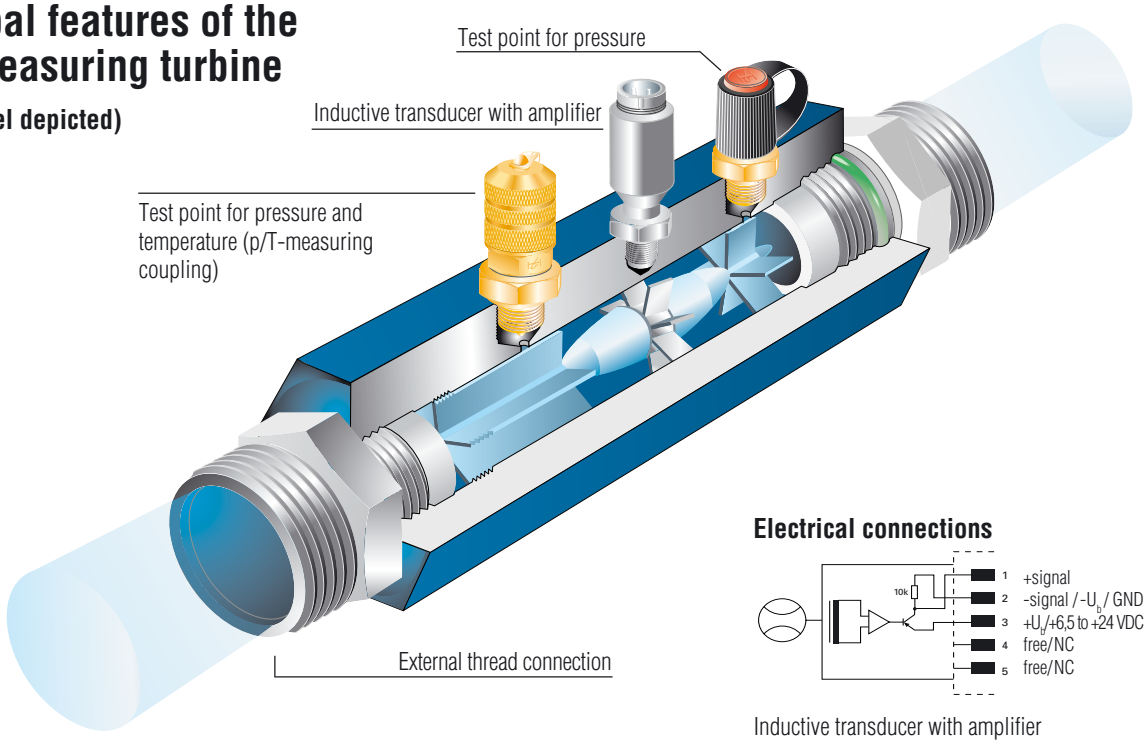
RE 4 - 10	1,0 to 10 l/min	±2,5% of the actual value
RE 3 - 75 / RE 4 - 75	7,5 to 75 l/min	
RE 3 - 300 / RE 4 - 300	15 to 300 l/min	
RE 3 - 600 / RE 4 - 600	25 to 600 l/min	±2,0% of the actual value

Higher accuracies and downward expansion of the lower flow measuring range can be achieved by linearization with different HYDROTECHNIK-evaluation instruments:

RE 4 - 10	1 to 10 l/min	±1,0% of the actual value
RE 3 - 75 / RE 4 - 75	2 to 75 l/min	±0,5% of the actual value
RE 3 - 300 / RE 4 - 300	9 to 300 l/min	
RE 3 - 600 / RE 4 - 600	16 to 500 l/min	

Principal features of the flow measuring turbine

(RE 3 model depicted)



Electrical connections

Inductive transducer with amplifier
Signal amplitude (square wave) = power supply minus app. 2 Volt

Typical pressure drop curves at 30 mm² /s (cSt)

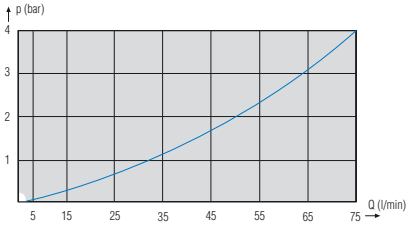


Fig. 1 RE 3-75/RE 4-75

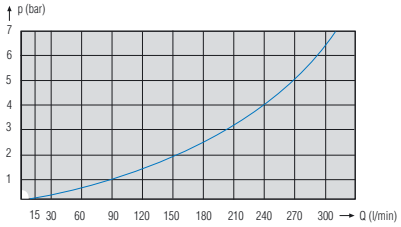


Fig. 2 RE 3-300/RE 4-300

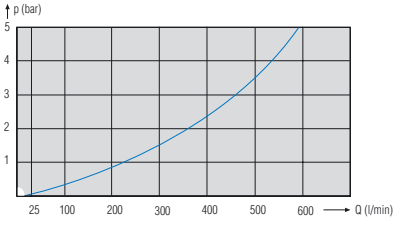


Fig. 3 RE 3-600/RE 4-600

Additional features

Analog signals in 0 to 20 / 4 to 20 mA for PC, PLC or other instrumentation

For convenient adaptation to different evaluative instruments, measuring turbines with calibrated frequency/current-converters are available, which give standard constant current output signals proportionate to the flow measuring range.

Volume flow rate measurement under load operation

At pump inspections like records of pump curves in dependency of pressure, we recommend our loading valve with integrated measuring turbines as a useful testing device.

Loading valve with two handles: **31VB-72-35.00A2**

Measuring range:	12 to 600 l/min
Error limit:	±2,5 % of the actual value at 30 cst ($mm^2 s^{-1}$)
Viscosity range:	3 to 200 cst ($mm^2 s^{-1}$)
Operating pressure:	max. 420 bar
Operating temperature:	-20 °C to +80 °C (short term to 100 °C)
Connections:	ISO 228-G1 1/4 (Inlet / Outlet)
Dimensions:	305 x 146 x approx. 208 mm (LxWxH)
Media application:	Suitable for hydraulic- and other oils on mineral oil basis.

HYDROTECHNIK evaluation instruments which can be connected:

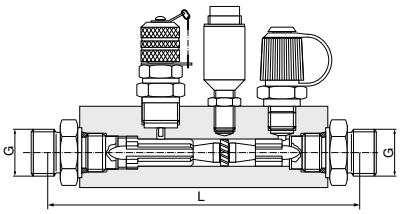
- Hand held measuring instruments:	Series 5050, 5000, 4010/4020, 3050. For the 2040/2045 please use 31GB-72-35.00A2.
- Panel mounted instruments:	Typ "SEG 1000 and Compare" for volume flow rate
- Measuring data acquisiton systems:	Group 8000, HY-MoCom 6000

Order data

The standard turbine is delivered with the following features:

- Works' calibration for mineral oil at 30 mm²/s (30 cSt), if no other viscosity is indicated.
- Equipped with one MINIMESS screw coupling, one p/T-measuring coupling of series 1620 and one inductive transducer with amplifier (part-no.: 3107-00-09.00). Additions to the standard type (see special order key below).

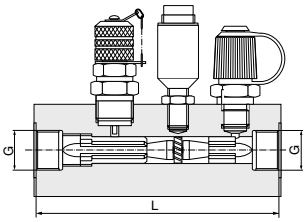
Standard type RE 3



With integrated connection group for solderless screw-in pipe connection according to DIN 2353

Measuring range	Thread	p_{max}	installation length L	Part-number
7,5 to 75 l/min (2 ... 20,0 US gal/min)	S14/M 22x1,5	400 bar (5800 psi)	154 mm	**31V7-20-35.00**
	S16/M 24x1,5		153 mm	**31V7-21-35.00**
15 to 300 l/min (4 ... 79,0 US gal/min)	S20/M 30x2		186 mm	**31V7-30-35.00**
25 to 600 l/min (6,6 ... 158,5 US gal/min)	S30/M 42x2		219 mm	**31V7-40-35.00**

Standard type RE 4



With integrated internal threads according to DIN ISO 228

1 to 10 l/min (0,26 ... 2,6 US gal/min)	ISO 228-G 1/4	400 bar (5800 psi)	120 mm	**31V7-01-35.00**
7,5 to 75 l/min (2 ... 20,0 US gal/min)	ISO 228-G 3/4		129 mm	**31V7-70-35.00**
15 to 300 l/min (4 ... 79,0 US gal/min)	ISO 228-G1		149 mm	**31V7-71-35.00**
25 to 600 l/min (6,6 ... 158,5 US gal/min)	ISO 228-G1 1/4	350 bar (5000 psi)	173 mm	**31V7-72-35.00**

Special order key

Other viscosity on request (add requested viscosity to the complete part-no.)		**.79**
Measuring medium: Measuring turbines for other media on request	HFA/HFC-liquids brake fluids Skydrol	**9** **2** **A**
Turbine equipped with:	Inductive probe IG 03 to 240 °C (464 °F) f/I-converter, 0 to 20 mA f/I-converter, 4 to 20 mA	**H** **F** **G**
Turbine equipped with MINIMESS screw coupling and p/T-measurement coupling from alternative screw series:	MINIMESS 1615 MINIMESS 1215	**-26.** **-14.**

Accessories

Measuring cable MK 01 (standard length 2,5 m for all measuring turbines of series RE)	**8824-91-02.50**
Inductive transducer (single available for replacement)	**3107-00-09.00**

Special design RE 6 for clear water

Housing material: ALZnMgCu1.5
Surface protection: hard coated

Equipped with one MINIMESS screw coupling, one p/T-measuring coupling of series 1620 and one inductive transducer with amplifier (part-no.: 3107-00-09.00). Works' calibration: 1 mm²/s (1cSt)

Measuring range	Thread	p_{max}	installation length L	Part-number
7,5 to 75 l/min (2 ... 20,0 US gal/min)	ISO 228-G 3/4	400 bar (5800 psi)	130 mm	**39V7-77-35.79**
15 to 300 l/min (4 ... 79,0 US gal/min)	ISO 228-G 1 1/4		174 mm	**39V7-78-35.79**
25 to 600 l/min (6,6 ... 158,5 US gal/min)	ISO 228-G 1 1/2	350 bar (5000 psi)	178 mm	**39V7-79-35.79**

Other fluids on request.

Hydrotechnik oval gear meters type ORM

are used for the precise measuring of the volume flow rate as well as for the accurate volume counting in the sector of the modern measuring technique: foodstuff industry, lacquer and varnish factory, car industry, chemistry, paper mill, plastic processing etc.

Measuring of the volume flow rate

For the measuring of the volume flow rate, pulses are evaluated as a volume per time in any flow unit whatever, e.g. l/min.

Counting of the volume (quantity)

In the case of a counting of the volume, a defined chamber volume will be registrated.

Measuring display

The measured value of the series ORM 10 to ORM 40 shall be indicated via mechanical display (only quantity measurement) or LCD-display. As well as that you have the possibility to evaluate the signals of the hall effect sensor externally. The series ORM 1 and ORM 2 are equipped with a hall effect sensor for external evaluation.

Advantages at a glance

- high accuracy and repeatability (also at the reverse flow operation)
- installation position with PPS-rotors is free selectable and a bidirectional flow is possible
- large measuring range up to 1:100
- application for a large viscosity range (1 – 100 000 cP)
- high compatibility of media by different rotors, sealing- and housing material
- low pressure drop, therefore low dissipation (< 1bar)
- Use: hydraulic oils, diesel oil, water, polyrethane, glue, waxes, pastes, resins, food, flow fat, color and varnish, etc.
- large and favourable customer service (the components shall be changed on mounted housing)

Technical data

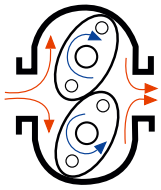
Material:	rotors in plastic PPS (Polyphenylene-Sulfide-Resins) for ORM 4 to ORM 50 housing material in plastic PPS for ORM 1, ORM 2 and ORM 7 housing and rotors in stainless steel 1.4401 (316) for all types except ORM 4 and ORM 7 housing in aluminium ALSi7Mg for ORM 4, ORM 10, ORM 40 and ORM 50 sealing material alternatively Viton (FKM), Teflon and EPDM
Standard viscosity range:	1 to 1000 cP (pressure drop < 1 bar) above 1000 cP (with special gear flow meter for high viscosity applications) calibration value and geometric chamber volume are indicated on the calibration report 80°C or rather 120°C (depends of the material and the hall effect sensor)
Measuring range:	see table
Reproduceability:	< 0,03% of the measured value
Measuring signal output:	hall effect sensor with intergrated amplifier, voltage supply: 4,5V to 24V (direct voltage), signal output: square wave (TTL – level)

Short description of the measuring principle

The measuring chamber of the sensor is an one part construction and contains no clearance volume. From this, a high measuring accuracy, an excellent reliability and a long lifetime are resulting.
The medium set in motion the two rotors (accordingly to the positive displacement principle) and the fluid is divided in defined voluminas, which are transported between the rotors and the housing. The rotors are equipped with magnets, whose magnetic field is detected by a non contacting reed switch or hall effect sensor. On this occasion the resulted magnetic impulse is electronically evaluated, while the HYDROTECHNIK-measuring instruments indicate the volume flow rate in flow units (e.g. liter).

Cut a way picture

Schematic presentation



Typ	Measuring range in l/min	Nonlinearity	Impulse per Liter	Max. particle size in mm	Fitting lenght in mm / Weight in Kg	Max. pressure / and temperature
ORM 1	above 5 cP 0,02 to 1,7 below 5cP 0,03 to 1,7	±1 % from meas. value	1000	0,0127	65 mm / 0,24 to 0,6	Housing: PPS Rotors and axles: Stainless steel: 1.4401 (316) 5 bar / 80 °C
ORM 2	above 5 cP 0,25 to 8 below 5cP 0,4 to 8	±1 % from meas. value	400	0,0127	65 mm / 0,24 to 0,6	Housing, rotors and axles: Stainless steel: 1.4401 (316) with high-temperature hall effect sensor 10 bar / 120°C
ORM 4	above 5 cP 1 to 30 below 5cP 3 to 25	±0,5 % from meas. value	112	0,28	108 mm/ 1,0 to 2,75	Housing: AL or SS. With standard PPS-rotors / 80 °C. With HT-PPS-rotors and HT-hall effect sensors 120 °C. Maximum pressure load: 55 bar.
ORM 7	above 5 cP 3 to 80 below 5cP 8 to 70	±0,5 % from meas. value	52	0,28	108 mm / 0,9 to 1,0	Housing and rotors: PPS With standard PPS-rotors / 80 °C. With HT-PPS-rotors and HT-hall effect sensors 120 °C. Maximum pressure load: 10 bar.
ORM 10	above 5 cP 6 to 120 below 5cP 10 to 100	±0,5 % from meas. value ±1 % from meas. value with mech. display	36	0,28	133 mm / 1,8 to 6,9	Housing in aluminium ALSi7Mg or stainless steel 1.4401 (316) With standard PPS-rotors / 80 °C With stainless steel rotors or high-temperature-PPS-rotors and hall effect sensors as high-temperature model / 120°C. Maximum pressure load: 55 bar.
ORM 40	above 5 cP 10 to 250 below 5cP 15 to 235	±0,5 % from meas. value ±1 % from meas. value with mech. display	14,5	0,38	150 mm / 4,5 to 9,5	
ORM 50	above 5 cP 15 to 350 below 5cP 30 to 300	±0,5 % from meas. value ±1 % from meas. value with mech. display	6,7	0,46	240 mm / 7,3 to 23	

Other connection threads on request

HT= high temperature

Order data

Standard type ORM 1, ORM 2 and ORM 7

Housing material: PPS
Rotor material: ORM 1 und ORM 2: stainless steel 1.4401 (316), ORM 7: PPS
Sealing material: Viton (FKM)
ORM 1 and ORM 2: equipped with a hall effect sensor, ORM 7: hall effect sensor and reed switch

Type	Measuring range in l/min	p_{max}	Hydraulic connection	Part-number
ORM 1	above 5 cP / 0,02 to 1,7 below 5 cP / 0,03 to 1,7	5 bar	1/4" BSP (F)	F1P S-11- 1 V.00
ORM 2	above 5 cP / 0,25 to 8 below 5 cP / 0,4 to 8			F2 P S-11- 1 V.00
ORM 7	above 5 cP / 3 to 80 below 5 cP / 8 to 70	10 bar	1" BSP (F)	F5 P P-31- 1 V.00

Order key for special types

Housing in stainless steel material 1.4401 (316), p_{max} : 10 bar, only for ORM 1 and ORM 2	S
Hydraulic connection: ORM 1 and ORM 2 in 1/4" NPT (F), ORM 7 in 1" NPT (F), Calibration in US gal.	2
Only for ORM 7 (mounted on top of the flowmeter) **Standard model:** with LCD-display and hall effect sensor, output signal TTL-level **De Luxe model:** with LCD-display, EX-version: EEx ia IIC T6 for zone 0 and zone 10 (PTB Nr. EX-93C4033X) and hall effect sensor, output signal TTL-level	6 7
Sealing materials: **EPDM** **Teflon**	E T

Standard type ORM 4, 10, 40 and 50

Housing material: Aluminium ALSi7Mg
Rotor material: PPS
Sealing material: Viton (FKM)
equipped with a hall effect sensor and reed switch

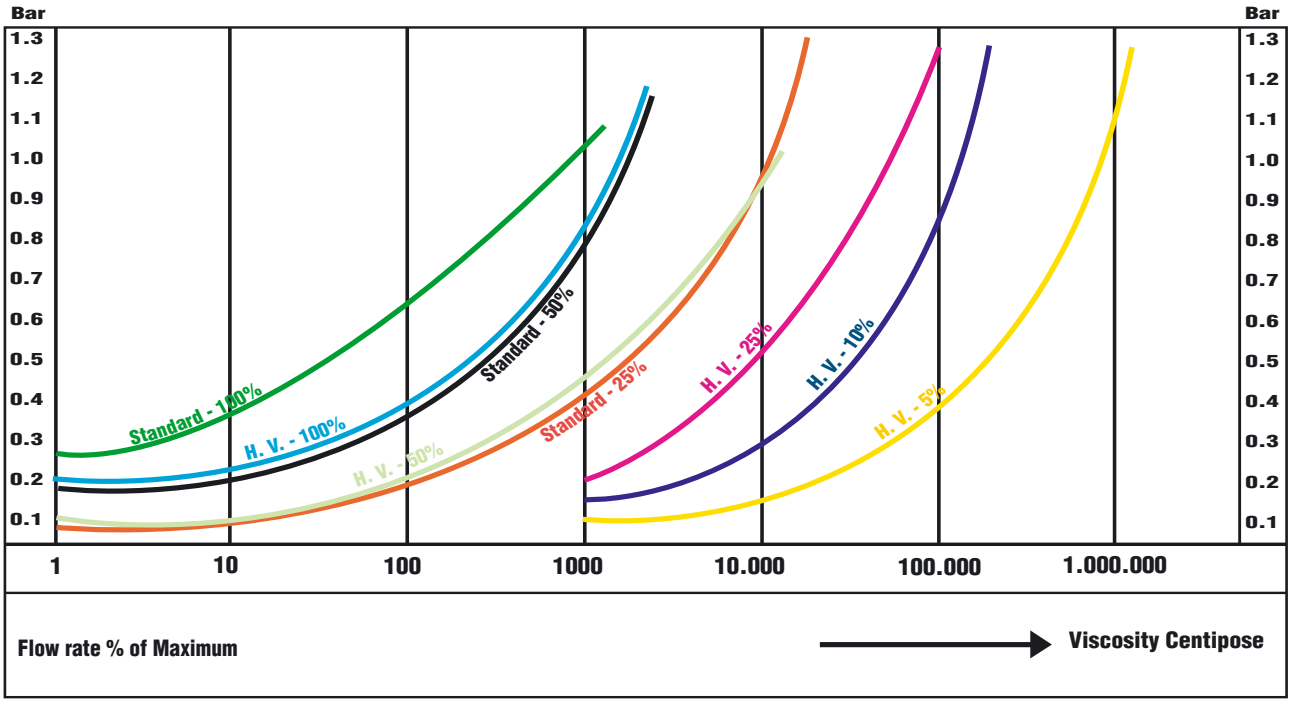
Type	Measuring range in l/min	$p_{max.}$	$p_{max.}$ for mechanical display	Hydraulic connection	Part-number
ORM 4	above 5 cP / 1 to 30 below 5 cP / 3 to 25	55 bar	34 bar	1/2" BSP (F)	F4 A P-3 1-1 V.00
ORM 10	above 5 cP / 6 to 120 below 5 cP / 10 to 100			1" BSP (F)	F6 A P-3 1-1 V.00
ORM 40	above 5 cP / 10 to 250 below 5 cP / 15 to 235	18 bar		1" 1/2 BSP (F)	F7 A P-3 1-1 V.00
ORM 50	above 5 cP / 15 to 350 below 5 cP / 30 to 300			50 mm DIN 2633 flange*	F8 A P-3 1-5 V.00

Order key for special types

Housing in stainless steel, material 1.4401 (316)	S
Rotors in stainless steel, material 1.4401 (316) - not available for ORM 4	S
Standard model: with LCD-display and hall effect sensor, output signal TTL-level **De Luxe model:** with LCD-display, EX-version: EEx ia IIC T6 for zone 0 and zone 10 (PTB Nr. EX-93C4033X) and hall effect sensor, output signal TTL-level **Mechanical display:** counting of volume (quantity)	6 7 8
Rotors for high temperature in PPS up to 120 °C **Rotors for viscosity** above 1000 cP	2 3
Hydraulic connection: **NPT (F)** for **type ORM 4** in 1/2", **type ORM 10** in 1", **Typ ORM 40** in 1 1/2", Calibration in US-gal. **ANSI 150 lb flange only for ORM 50*,** Calibration in US gal.	2 4
sealing material: **EPDM** **Teflon**	E T

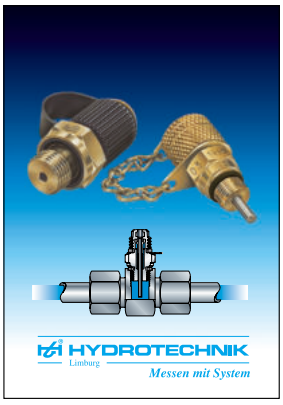
***** Counter flange on request

ORM-series and high viscosity rotor pressure drop curves



H.V. = rotors for high viscosity
cP = cst. (mm²/sec.) x density (g/cm³)

Product Line



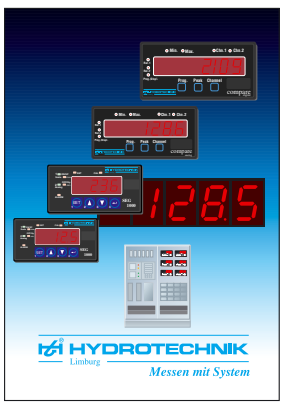
MINIMESS Test points

MINIMESS hoses with small nominal diameters DN 2 and DN 4

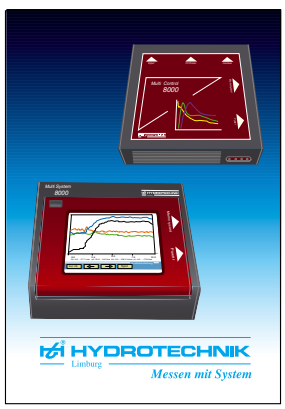
Mounting technology for tubes, cables and sensors

Sensors for pressure, temperature and RPM

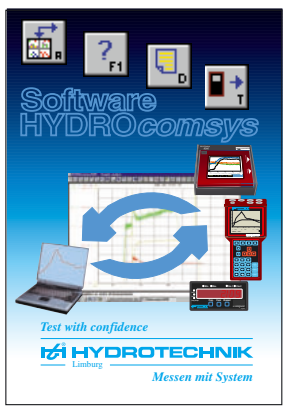
Hand held measuring instruments with different features



Panel mounted instrument for monitoring measuring, and controlling purposes



Data acquisition Series 8000 for recording, PC-evaluation, storage and grafic display of measured data



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