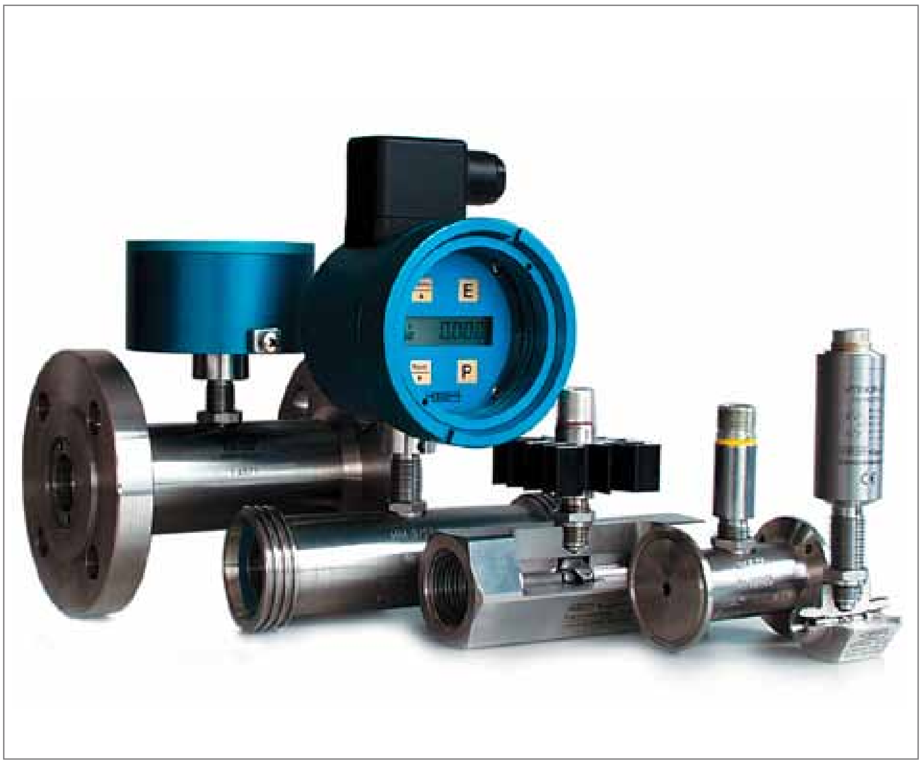
Küppers Elektromechanik GmbH

Certified according to DIN EN ISO 9001

Technical Datasheet



HM Series

Turbine Flow Meters

Index

Index

Description

Turbine flow meters (hereinafter referred to as turbines) are used for the precise measurement of instantaneous flow rates and flow quantities of low-viscosity fluids.

Every different type varies by the direction ot the inflow and by the method of recording the measurements. .

Application:

- Tap and demineralised water
- Fuels
- Liquefied gases
- Light fuel oil
- Solvents
- Pharmaceutical fluids

Principle

Turbine flow meters are mediate volume transmitters similar to a Woltmann's Sail Wheel. The volume passing through the tube is measured by the mean velocity of the streaming fluid. Flow rectifiers ensure a laminar flow in the axial direction of the wheel.

A light-weight turbine wheel carried concentrically in the tube body is rotated by the fluid. The revolutions per minute (RPM) of the turbine wheel is directly proportional to the mean flow velocity within the tube diameter and corresponds to the volume flow over a wide range.

Features:

- High Resolution
- Fast Response Time
- Temperature Range from –273 up to +350°C
- High Pressure Resistance
- Low Pressure Drop
- Resistant to contamination with solids

The following equation applies (excluding mechanical and hydraulic loss):

Equation 1

$Q = c \cdot 2\pi \cdot r \cdot A \cdot n \cdot \cot\alpha$

Q = Flow rate
c = Correction factor
r = Mean radius of blades in dm
A = Effective area in dm^2
n = RPM
α = Angel between blade and wheel axle with r = r mean

An inductive pickup or a carrier-frequency pickup is screwed into the turbine flow meter. The pickup will detect the RPM of the turbine wheel through the non-magnetic turbinebody without magnetic drag and without coming into contact with the measuring medium. The turbine wheel is made from stainless steel and has sufficient magnetic conductibility.

With carrier-frequency pickups each passing of a rotor blade will influence the electric field of the pickup. The frequency of the amplitude modulation of the carrier corresponds to the RMP of the turbine wheel.

With inductive pickups each passing of a rotor blade will influence the magnetic field of the pickup. The change in magnetic flux induces a voltage in the pickup. The frequency of the sinusoidal alteration corresponds to the RPM of the turbinewheel.

After amplifying and transforming the pickup signal a squarewave pulse signal is available. The number of pulses per time unit is in proportion with the instantaneous flow rate.

Principle (continued)

Equation 2

$$\frac{n}{Q} = K\left(\frac{n}{\nu}\right)$$

n = RPM
Q = Instantaneous flow in l/min
K = Pulses per volume unit
v = Kinematic viscosity

The ideal K-factor, which is to be derived from equation 1, really is a function of geometrical dimensions, flow velocity and kinematic viscosity. The turbine design provides a sufficiently constant K-factor over a certain velocity range. Considering calculating factors, equation 3 can be derived from equation 2:

Equation 3

$$Q = \frac{f \cdot 60}{K} \text{ l/min}$$

Q = Instantaneous flow
f = Frequency in Hz
K = K-factor in pulses/ltr.

Advantages of KEM Turbines

Fast response time and high resolution
The turbine wheel's low moment of inertia allows a fast acceleration from standstill up to full number of revolutions within 5 to 50 msec. For that reason rapidly rising flow rates and pulsating flows may be detected. The resolution can amount to as much as 109,000 pulses per litre.

Wide temperature range from –273 up to +350°C
Standard turbine flow meters: –20 up to +120°C.
Special models for cryogenic liquids: –273°C
Special models with high-temperature pickups: up to +350°C

High Pressure Resistance and Low Pressure Drop
KEM turbines are available for pressures up to 630 bars and up to 4,000 bar using high-pressure adapters or BASF high-pressure flanges. A major advantage over other flow meters can be found in the low pressure drop figures. These depend on viscosity and turbine size and have to be observed at very low working pressures only.

Resistant to contamination with solids
Turbine wheel and bearings are designed in a way that solids are flushed through the turbine with the medium. Furthermore the twist of flow in this area has a self-cleaning effect preventing solids from blocking the turbine.

Technical Data

Type	Measuring Range ltr./min			K-Factor*, pulses/ltr.		Frequency*, in Hz		Output Signal, mVss		
HM 9 EP	0.03	up to	0.8	139,000		1,970		0.5	up to	5
HM 3/1,5	0.3	up to	1.5	32,000	32,500	1,000	1,000	0.5	up to	5
HM 3/4	0.5	up to	4	24,000	19,000	1,250	1,250	0.5	up to	5
HM 5/6	0.8	up to	6	17,800	17,800	1,740	1,780	1.0	up to	10
HM 5/10	1.2	up to	10	11,000	11,000	1,750	1,750	1.0	up to	10
HM 7	2.0	up to	20	5,200	5,200	1,800	1,800	1.5	up to	15
HM 9	3.3	up to	33	1,900	4,200	1,080	2,200	1.7	up to	17
HM 11	6.0	up to	60	1,300	2,730	1,350	2,700	2.0	up to	20
HM 13	8.5	up to	85	900	1,900	1,300	2,600	2.5	up to	25
HM 17	12	up to	120	380	840	800	1,650	2.7	up to	27
HM 19	15	up to	150	310	650	925	1,600	2.9	up to	30
HM 22	20	up to	200	217	450	800	1,600	3.1	up to	31
HM 24	25	up to	250	170	362	800	2,000	3.8	up to	40
HM 28	30	up to	360	155	320	960	2,000	4.0	up to	42
HM 30	35	up to	400	130	270	860	1,850	4.1	up to	45
HM 36	40	up to	500	60	135	600	1,200	4.3	up to	48
HM 40	50	up to	750	105	110	1,320	1,400	4.5	up to	52
HM 50	70	up to	1,200	65		1.400		6.0	up to	64
HM 65	100	up to	2,000	25		850		10	up to	80
HM 80	160	up to	3,200	11		615		15	up to	100
HM 100	250	up to	5,000	7		560		20	up to	120
				pulses/m³						
HM 125	300	up to	6,600	4,500		495		30	up to	125
HM 150	350	up to	10,000	3,400		420		35	up to	140
HM 200	430	up to	13,400	412		134		40	up to	150
HM 250	830	up to	25,000	266		150		45	up to	160
HM 300	1,600	up to	48,000	135		110		50	up to	180

* The wheel's axial pitch is halved for viscosities from 8 mm^2/s onwards, therefore pulse rates will double for dia 9 up to 36.
All K-factors and output signals are average values. Exact specifications can be taken from individual calibration records.

Linearity: each ±0.5% at 1 mm^2/a

Materials

Stainless steel as per DIN (AISI)

Component	Standard material	Special material
Housing	1.4305 (1.4571 with flange versions)	1.4571 (316 Ti) or 1.4404 (316 L)
Internal parts	1.4305 (303)	1.4571 (316 Ti) or 1.4404 (316 L)
Wheel	1.4122 (303)	1.4460 (329)
Bearing	Tungsten carbide	Tungsten carbide or teflon

Turbine Flow Meters for special applications

Different designs are available in accordance with the application. Individual datasheets are available.

Fluid food:	HM...RV with dairy connections as per DIN 11851
Pharmaceutical fluids:	HM...FT with »Tri-Clamp« connections
High pressure rates:	HM...FHD with BASF flanges up to 4,000 bar HM...AC mit Autoclave-threads
Small flow rates:	HM 9 EP with sapphire bearings
Alternative connections:	HM...E with Ermeto threads HM...F with flanges as per DIN or ANSI HM...R with female inch-type threads
Lightweight design :	HM...U Aluminium

Accuracy

Linearity corresponding to actual flow

It defines the max. percentual difference between a specific K-factor and the average K-factor. Linearity usually amounts to ±0.15% up to ±1% within the linear measuring range of the turbine flow meter. The linearity range of hydrodynamic flow meters as turbine flow meters depends on the Reynold’s number of the measuring medium and the nominal diameter of the turbine flow meter. As viscosity increases linearity deteriorates and the linear measuring range will be smaller at low flow velocities. The influence of viscosity decreases with increasing nominal diameters.

Repeatability

It gives the percentual difference between two measuring results at identical flow rates. It usually amounts to 0.05 up to 0.1%. Only with small turbine flow meters below 9 mm diameter will repeatability increase to 0.2 %.

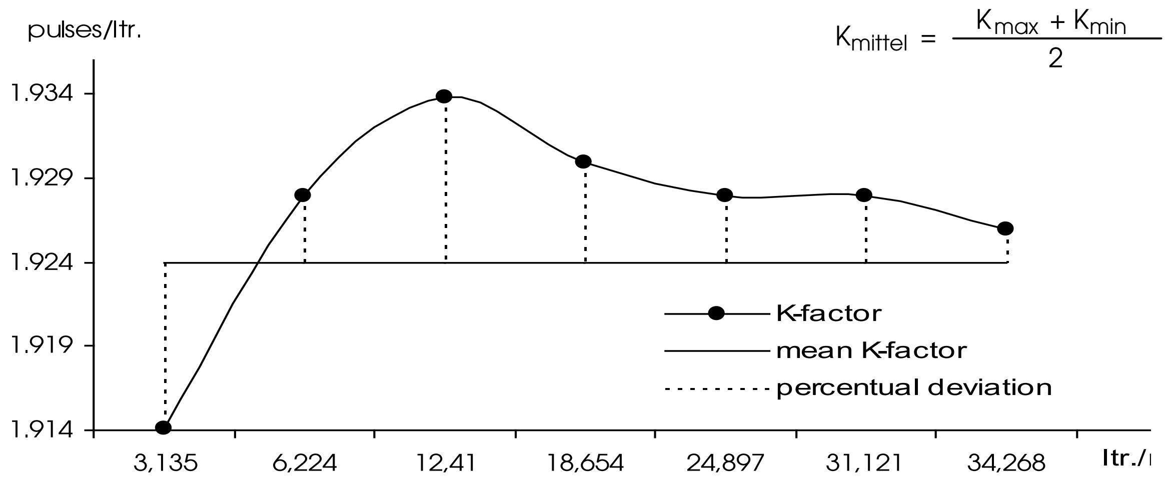
Calibration

All turbines are calibrated before they leave our factory, and individual calibration records are supplied with the meters. Calibrations are performed on our volumetric calibration rigs or, on special request, in our DKD calibration laboratory. It is possible to calibrate at different viscosities. Therefore viscosity variations in an application may be compensated by using the prevailing viscosity. Comparative measurements with our DKD lab ensure that calibration results have a valid relationship to nationally recognized standards.

During calibration the volume of a tank determined as accurate as ± 0.01 % is filled with a constant flow passing through the turbine flow meter. The output pulses of the turbine flow meter are added electronically and calculated for a volume unit to receive the K-factor in pulses per litre. Strictly speaking this K-factor applies only for a certain flow velocity or flow volume respectively. For the application of turbine flow meters, however, it is necessary to know the linear measuring range, i. e. the range with a constant K-factor. This range is determined by successively repeating the filling process at constant frequency intervals and different flow velocities. These individual measurements will result in the calibration curve from which the average K-factor can be drawn. The average K-factor applies for the entire measuring range.

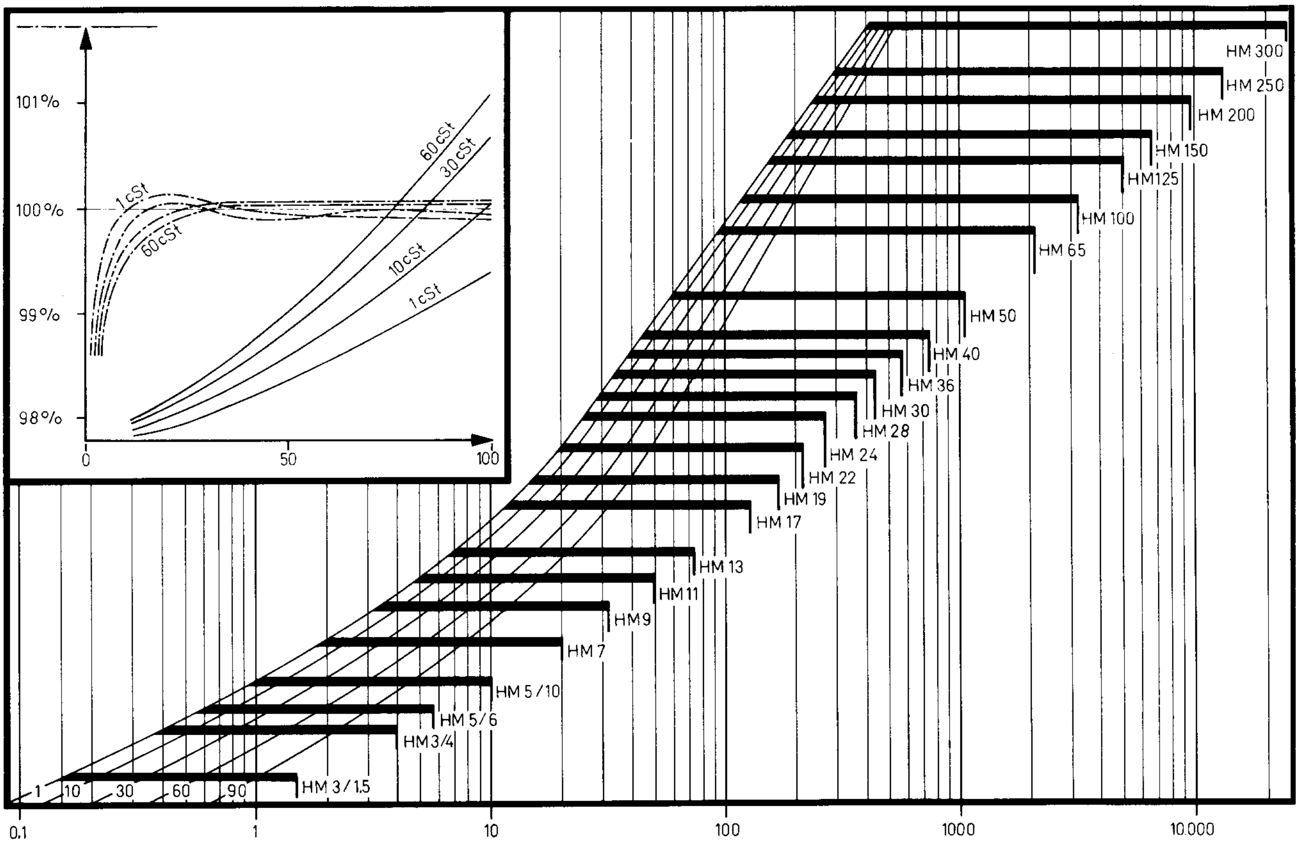
Example

Turbine HM 9 E (3 up to 30 ltr./min)



Messbereiche bei verschiedenen Viskositäten

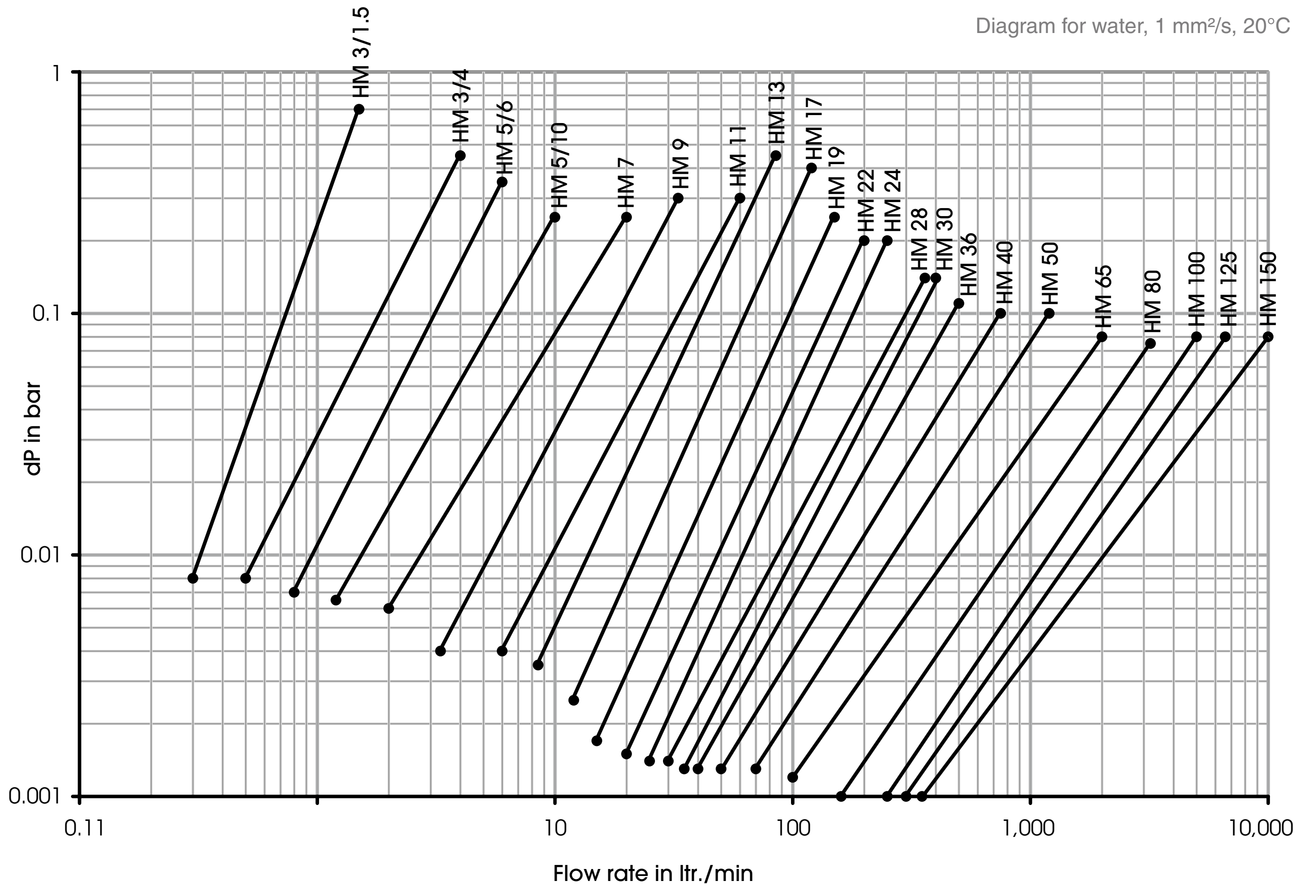
K-Factor / Pressure Drop



Viscosity

Flow rate in ltr./min

Pressure Drop



Küppers Elektromechanik GmbH

Contact worldwide

KEM-Headquarter
Liebigstraße 2
D-85757 Karlsfeld
T. +49 8131 5 93 91 - 0
F: +49 8131 9 26 04
info@kem-kueppers.com

KEM-Office West
Im Langen Hahn 44
D-58515 Lüdenscheid
T. +49 2351 9 78 80
F: +49 2351 9 78 83 1
kem-west@kem-kueppers.com

KEM-Office South
Dahlienweg 35
D-73765 Neuhausen
T. +49 7158 98 56 82
F: +49 7158 98 56 83
kem-sued@kem-kueppers.com

Denmark
E. Eberhardt ApS
Bygstubben 6
DK-2950 Vedbæk
T. +45/45/89 33 66
info@eeberhardt.dk

Norway
Flow Teknikk as
Olav Brunborgsv. 27, Postboks 244
N-1377 Billingstad
T. +47/66/77 54 00
mail@flow.no

Singapore
Polyquip Engineering Pte Ltd
Blk 20 Woodlands Link #08-12
Woodlands East Industrial Est.
SGP- 738733 Singapur
T. +65/6753/79 97
sales@polyquip.com.sg

China
KEM China
Mr. Xiao Tianxiang
Rm.2429, JinYuan Office Building, No. 36,
CN- BeiYuan Road, Beijing 100012
T. +86/10/52 00 37 38
Shaw@kem-kueppers.com

Poland
Newtech Engineering
ul. Sowinskiego 3
PL-4-100 Gliwice
T. +48/32/237 61 98
newtech@newtech.com.pl

Slovakia
Bibus SK, s.r.o.
Priemyselná 4
SK-949-01 Nitra
T. +421/377/41 25 25
gyenes@bibus.sk

Finland
Wexon Oy
Juhanilantie 4
FI-01740 Vantaa
T. +358/9/29 04 40
wexon@wexon.com

Portugal
Contimetra Departmento Indûstria
R. Braamcamp 88–40 Dt0
P-1269–020 Lisboa
T. +351/213/86 05 00
contimetra@contimetra.com

Spain
Ortrat S.L.
Calle La Sofora 13 + 15
ES-28020 Madrid
T. +349/1/57 91 60 6
ortrat@ortrat.es

United Kingdom & Eire
KEM Küppers UK
2 Highfield Drive
Ickenham Uxbridge
UB10 8AL England
T. +44/1895/23 35 52
hans.rader@kueppers.co.uk

Russia
Michael Dueck
Industrievertretungen und Vertrieb
St.-Vither-Str. 12
D-50171 Kerpen
T. +49/2237/67 91 88
info@m-dueck.de

Taiwan
Yuden Electric Co.,Ltd
Taiwan Headquarter
5F, No.121 , Li De ST, JHONGHE TAIPEI
COUNTY 235, Taiwan ROC
T. +886/2/82 21 29 58
sales@yuden.com.tw

Hong Kong Area
Asia Technology and Instrument Ltd.
Unit 5, 9/F., Free Trade Centre
49 Tsun Yip Street, Kwun Tong
HK-Kowloon
T. +85/227/16 55 56
ati@ati.com.hk

Sweden
Pentronic AB
SE-590 93 Gunnebobruk
T. +46/490/25 85 00
info@pentronic.se

United States of America
AW-LAKE Company
Electronics for Instrumentation
8809 Industrial Dr.
Franksville, WI 53126, USA
T. +1/262/88 49 80 0
sales@aw-lake.com

Italy
Ingg. Vigo e Cova SAS
Piazzale Segrino 6/a
I-20159 Milano
T. +39/02/668 82 02
vigo.cova@vigocova.com

www.kem-kueppers.com
info@kem-kueppers.com