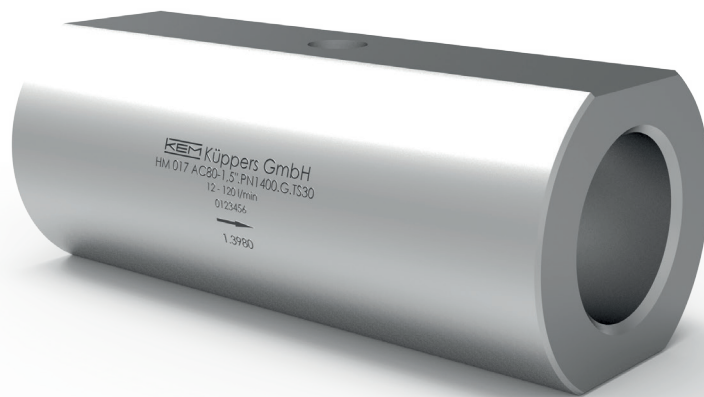


# Technical Datasheet



## HM AC Series

### Turbine Flow Meters

for High Pressure Applications up to 1,400 bar

## Description

The HM/AC turbine flow meter series (AC for Autoclave Engineers connections) is used to measure continuous and discontinuous flow rates with very high operating pressures. They are mainly used for low viscosity, lubrication and non-lubrication media. They are particularly suitable for low viscosity liquids, such as water, emulsions, additives and inhibitors.

Only high-grade steels that can withstand corrosive liquids are used in the production of turbine flow meters. Combined with the use of tungsten carbide bearings, the HM AC guarantees optimum measurement accuracy and an extremely long service life even under the toughest application conditions.

The combination of various turbine wheel dimensions and blade geometries allows a wide range of sizes that can cover a huge measuring range. This makes the HM AC ideal for a variety of applications in the field of metering as well as for monitoring and dosing.

Short response times, very dynamic performance and high measurement accuracy ensure accurate regulation and control of flow rates in the most demanding applications.

For applications in hazardous areas, we offer intrinsically safe sensors and amplifiers with Ex protection in accordance with ATEX, IECEx, CSA and other standards. Additional certifications such as EAC (TR-CU) are available.

## Principle and Design

Turbine flow meters (HM) are volume counters operating on the Woltmann impeller counter principle. They use the average flow velocity to record the flow rate through the pipe.

The flow of the medium is directed at the turbine wheel in the axial direction and so rotated. The speed of the freely turning wheel over a wide range is directly proportional to the average flow velocity. The low weight of the turbine wheel ensures very short response times as well as very dynamic behaviour in flow changes. Two flow straighteners generate quasi-laminar flow, which in turn contributes to increasing the measurement accuracy.

The speed of the turbine wheel is measured by the sensor through the housing wall. The sensor system can be selected to meet the requirements of the individual application. This can provide, for example, a signal to indicate the direction of flow.

Pulses per unit of volume are available for analysis. The calibration factor (K-factor) of the flow meter describes the exact pulse rate per unit of volume. In order to determine the individual calibration factor of a flow meter, we calibrate each of our meters in house prior to delivery. The operating viscosity specified by the customer is taken into account for calibration. A corresponding calibration certificate is included with every flow meter we supply.

The KEM turbines feature a short response time between 5 and 15 ms depending on the nominal diameter, which is advantageous for precise filling processes.

Turbine flow meters have a resolution of up to 3,000 pulses per litre. The milled and turned precision components are the reason why the HM series has neither wetted weld seams nor soldered connections. All market-related requirements for piping and material standards can thus be fully guaranteed.

## Applications

- Process monitoring
- Consumption measurement
- Dosing
- Mixing
- Water
- Emulsions
- Additives
- Inhibitors

## Features

- High measuring accuracy up to  $\pm 0.1\%$ <sup>1)</sup>
- Exceptional repeatability of  $\pm 0.05\%$
- Operating pressure up to 1,400 bar [20,305 psi]
- Short response times (from 5 ms)
- Robust tungsten carbide sleeve bearing
- High-quality materials
- No welds or solder joints
- Medium temperature:  $-40\text{ }^{\circ}\text{C}$  up to  $+150\text{ }^{\circ}\text{C}$  [ $-40\text{ }^{\circ}\text{F}$  up to  $+302\text{ }^{\circ}\text{F}$ ]

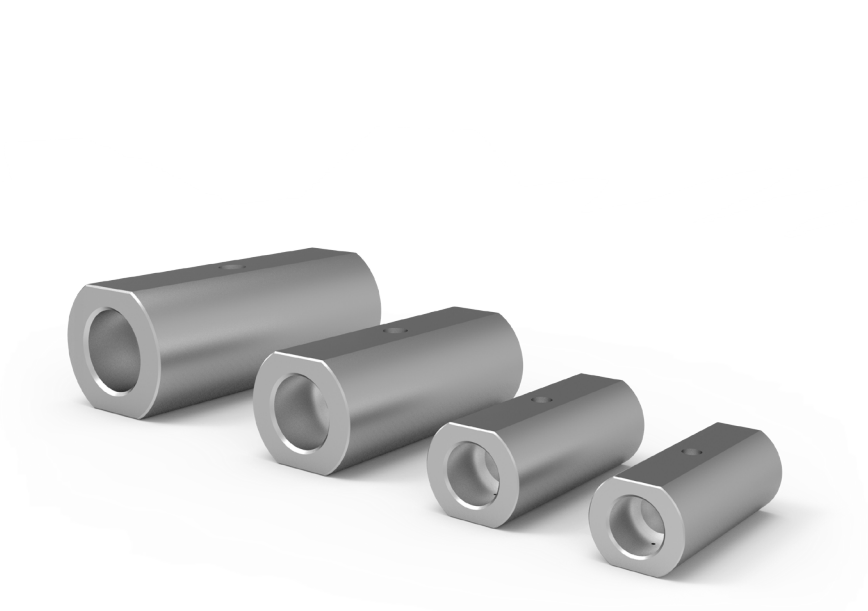
<sup>1)</sup> Under laboratory conditions; incl. linearization; viscosity  $\geq 1\text{ mm}^2/\text{s}$ .

## Technical Data – Sizes

HM Type <sup>2)</sup>	Measuring Range <sup>3)</sup> (l/min)		K-Factor <sup>4)</sup> (pulses/l)	max. Pressure (bar/psi)	max. Frequency <sup>4)</sup> (Hz)	Weight (kg)
HM 003 AC	0.3	to 1.5	32,500	1,400 [20,305]	1,100	1.9
HM 004 AC	0.5	to 4.0	25,000	1,400 [20,305]	1,700	2.0
HM 005 AC	0.8	to 6.0	17,800	1,400 [20,305]	1,740	2.2
HM 006 AC	1.2	to 10.0	12,000	1,400 [20,305]	2,100	2.2
HM 007 AC	2.0	to 20.0	5,000	1,400 [20,305]	1,667	2.3
HM 009 AC	3.3	to 33.0	5,000	1,400 [20,305]	2,750	2.4
HM 011 AC	6.0	to 60.0	3,000	1,400 [20,305]	1,350	2.4
HM 013 AC	8.5	to 85.0	920	1,035 [15,010]	1,300	5.5
HM 017 AC	12.0	to 120	380	1,035 [15,010]	840	5.5

## Technical Data – General

Measuring Accuracy	±0.1 % <sup>5)</sup>
Repeatability	±0.05 % (under the same conditions)
Linearity	±1 % of actual flow (viscosity = 1 mm <sup>2</sup> /s)
Viscosity Range	0.8 up to 30 mm <sup>2</sup> /s
Measuring Span	Standard: 1:10 Extended: on request
Materials	Housing: as per DIN 1.3980 Wheels: as per DIN 1.4462 [AISI 318 LN] Bearing: Tungsten carbide sleeve bearing
Medium Temperature	-40 °C up to +150 °C [-40°F up to +302 °F]
Dimensions	See dimensional drawing (page 4)



<sup>2)</sup> Exact type designation on request.

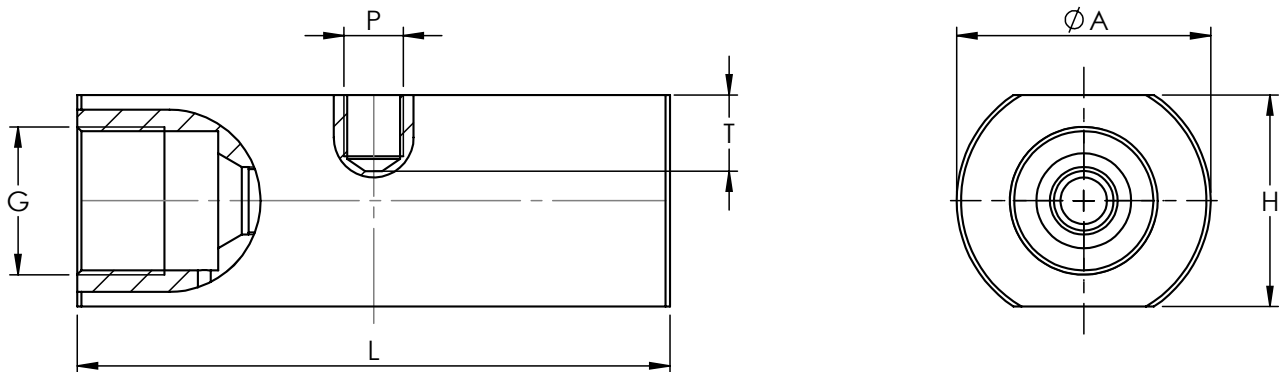
<sup>3)</sup> Extended measuring ranges on request.

<sup>4)</sup> Average values for single sensors at viscosity of 1 mm<sup>2</sup>/s; higher viscosities may differ.

<sup>5)</sup> Under laboratory conditions; incl. linearization; viscosity ≥1 mm<sup>2</sup>/s.

# Turbine Flow Meters – HM AC Series

## Dimensional Drawing



HM Type	Ø A	G <sup>6)</sup>	H	L	P <sup>7)</sup>	T <sup>7)</sup>	Autoclave
HM 003 AC	60 mm [2.36 in]	1-3/16" -16 UNF	50 mm [1.97 in]	90 mm [3.54 in]	M14x1.5	21 mm [0.83 in]	SF562CX20 (for 3/16" tube)
HM 004 AC	60 mm [2.36 in]	1-3/16" -16 UNF	50 mm [1.97 in]	90 mm [3.54 in]	M14x1.5	21 mm [0.83 in]	SF562CX20 (for 3/16" tube)
HM 005 AC	60 mm [2.36 in]	3/4" NPS	50 mm [1.97 in]	105 mm [4.13 in]	M14x1.5	21 mm [0.83 in]	SF750CX20 (for 3/4" tube)
HM 006 AC	60 mm [2.36 in]	3/4" NPS	50 mm [1.97 in]	105 mm [4.13 in]	M14x1.5	21 mm [0.83 in]	SF750CX20 (for 3/4" tube)
HM 007 AC	60 mm [2.36 in]	1-3/8" -12 UNF	50 mm [1.97 in]	135 mm [5.31 in]	M14x1.5	20 mm [0.79 in]	SF1000CX20 (for 1" tube)
HM 009 AC	60 mm [2.36 in]	1-3/8" -12 UNF	50 mm [1.97 in]	135 mm [5.31 in]	M14x1.5	20 mm [0.79 in]	SF1000CX20 (for 1" tube)
HM 011 AC	60 mm [2.36 in]	1-3/8" -12 UNF	50 mm [1.97 in]	140 mm [5.51 in]	M14x1.5	18 mm [0.71 in]	SF1000CX20 (for 1" tube)
HM 013 AC	80 mm [3.15 in]	1-7/8" -12 UNF	70 mm [2.76 in]	175 mm [6.89 in]	M14x1.5	27 mm [1.06 in]	SF1500CX (for 1 1/2" tube)
HM 017 AC	80 mm [3.15 in]	1-7/8" -12 UNF	70 mm [2.76 in]	178 mm [7.01 in]	M14x1.5	25 mm [0.98 in]	SF1500CX (for 1 1/2" tube)

<sup>6)</sup> See the corresponding Autoclave connection size.

<sup>7)</sup> Only applies for single pickup holes of type „E“.

Attention: the total installation height is the result of the height (H) and the height of the electronics (dimensions in separate datasheet).

## Calibration

In-house calibration is performed on volumetric calibration rigs or in our accredited calibration laboratory, depending on the needs of the client.

The calibrations are performed with different hydrocarbons. This ensures the optimum simulation of changing operating conditions in density and viscosity even when temperatures change. This way the primary viscosity for the use of the flow meter can be specifically taken into account when viscosity fluctuations occur in a customised application.

The calibration result is the specified calibration factor (K-factor) in pulses per litre. This K-factor accordingly applies only at a certain flow velocity or a certain flow rate. The calibration factor varies only very slightly at different volume flow rates. The individual measuring points provide the calibration curve of the flow meter from which the average K-factor is determined. The average calibration factor applies to the entire measuring range.

The linearity specification (percent deviation) refers to the average K-factor. To further increase the measurement accuracy in onsite use, the specific K-factors can be used to calculate the flow rate. For this, KEM also supplies optional special electronics.

For special requirements on the traceability of the results, it is possible to perform an accredited calibration on customer request. The KEM accredited calibration lab uses a high-precision load cell system. With an accuracy of 0.05 % for the mass and 0.1 % for the volume of flowing liquids, we occupy a leading position worldwide. The laboratory is accredited with engineers, processes and measuring equipment according to the international standard DIN EN ISO/IEC 17025:2018.

The KEM accredited calibration certificate not only verifies the accuracy of a flow meter, but also guarantees its traceability to national standards ensuring all requirements according to international quality standards are met.

## Calculation of volume flow

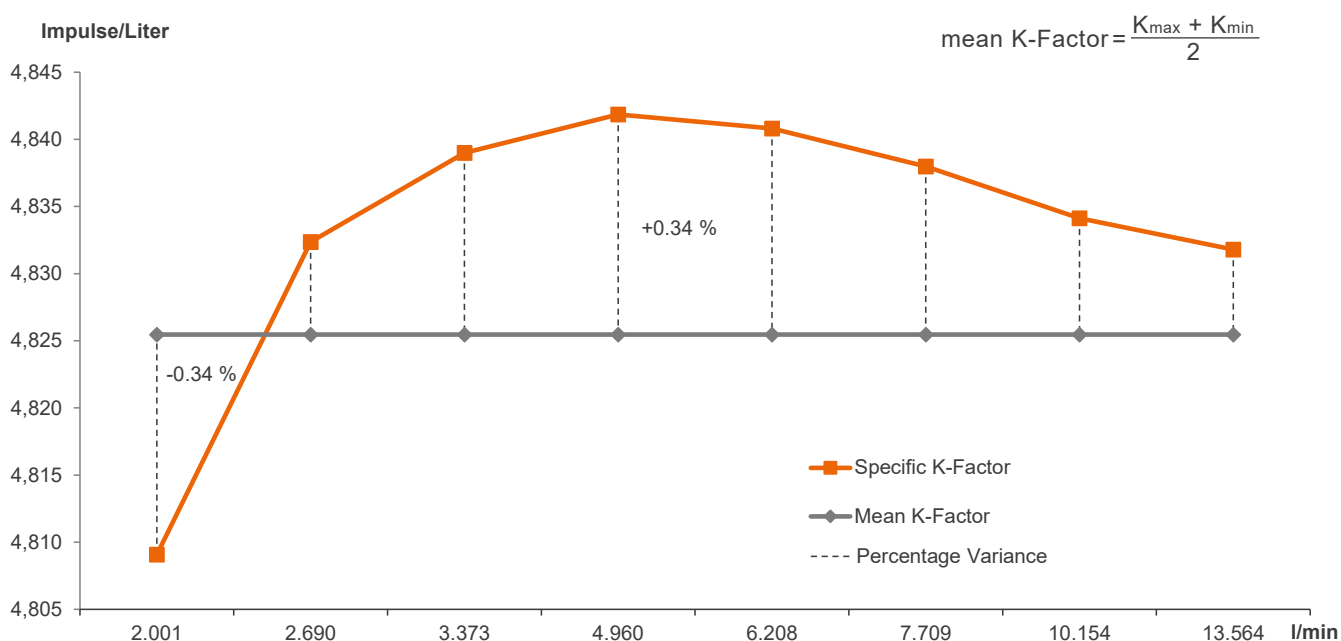
The flow is directly dependent on the measured frequency and the associated calibration factor:

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

- Q = Volume Flow
- f = Measuring frequency
- K = Specific K-Factor

## Calibration protocol

Example: HM 007 AC





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