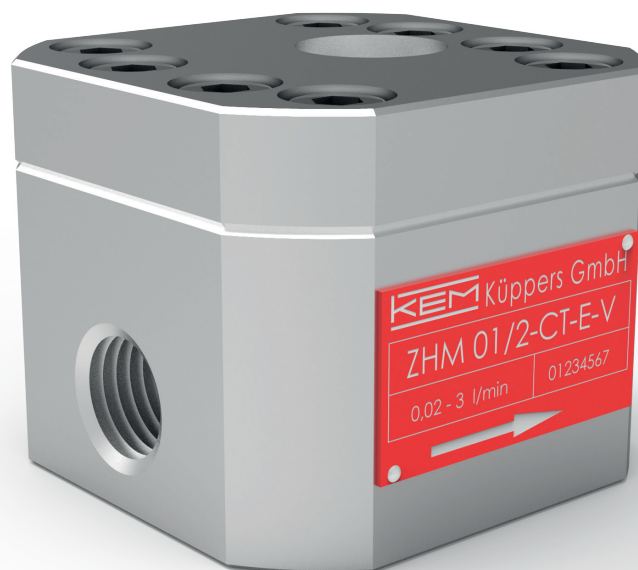


# Technical Datasheet



## ZHM CT Series

Gear Flow Meters in Cartridge Design  
for paint applications, optimized flushing and  
weight design

## Overview

With more than 50 years of experience in the flow measurement field and numerous innovative and customer-specific product developments, we are a qualified and competent contact for flow measuring technology and calibration. KEM offers a broad selection of measuring principles for this purpose. We develop, produce, and deliver high quality Gear Flow Meters, Turbine Flow Meters, Helical Flow Meters and Micro Flow Meters as well as Coriolis Mass Flow Meters worldwide. Specific accessories complement the product range.

This document provides information, technical details and typical applications concerning the ZHM CT Gear Flow Meter Series.

Series	Application	Process Medium	Attributes
ZHM ST	Flow measurement	Polyol + isocyanat, glue, epoxy resins Abrasive, less lubricating Medium/high viscosity	Stainless steel body Tungsten carbide sleeve bearing Bigger tolerances
ZHM KL	Filling processes	Lubricants, oils, grease Lubricating Medium/high viscosity	Stainless steel body Stainless steel ball bearing Bigger tolerances
ZHM MK	Dosing & consumption	Diesel, Skydrol, AdBlue, odorant (Less) lubricating Low viscosity	Stainless steel body Stainless steel ball bearing Small tolerances
ZHA KL	Test bed monitoring (Hydraulics)	Hydraulic fluid, ATF Lubricating Medium viscosity	Aluminum body Stainless steel ball bearing Bigger tolerances
ZHM CT	Dosage control (Paint shops)	Paints, waxes, amine Less lubricating Medium viscosity	Stainless steel body Tungsten carbide sleeve bearing Ball bearing (optional)
ZHM HP	Flow measurement (High Pressure)	Lubricants, coolant, inhibitors Abrasive, less lubricating Medium/high viscosity	Stainless steel body Stainless steel ball bearing Tungsten carbide sleeve bearing (optional)
ZHM CI	Dosage control (Oil & Gas)	Inhibitors, glycol, hydraulic control fluids Abrasive, less lubricating Low/medium viscosity	Stainless steel body Stainless steel ball bearing Tungsten carbide sleeve bearing (optional)

Please contact KEM Sales for additional information on our Flow Meters or for advisory purposes related to your individual application needs. For KEM Sales contact details see the document's last page.



## Description

The ZHM CT gear flow meter series (cartridge design) are flow meters which are mainly used in water- and solvent-based paints, as well as fillers and base coats. Also suitable for cavity waxes and for abrasive and filled media in the automotive sector. Short response times, accurate dosage, and flow rate measurements support applications in coating lines and preservation and other coating systems.

Only high-grade steels that even withstand corrosive liquids are used in the production of gear flow meters. Combined with the use of tungsten carbide bearings, the ZHM CT guarantees optimum measurement accuracy and a long service life under even the toughest application conditions.

The cartridge construction reduces the weight by another 75% compared to the standard version. The space-saving design with reduced weight permits installation in fully automated coating lines as well as mounting on robot arms in the process without limiting the dynamic behavior. Thanks to the innovative, dead space optimized design, color changes and flushing cycles can be realized in less time.

Fiber optics pulse amplifiers that enable interference-free signal transmission in areas of powerful electrical fields make applications possible in electrostatic coating lines (ESTA lines). 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

Gear flow meters (ZHM) are positive displacement meters. Two precise gears rotate freely inside the measuring chamber.

Sealed cavities are created between the gears and the housing. The measured media causes the rotation of the gears. The flowing medium is distributed evenly in the measuring chamber and causes the rotation of the gears. The gear wheels rotate freely and undamped in the media flow. Their rotational frequency is proportional to the flow rate and is measured by non-intrusive sensors (pickups) through the housing wall.

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.

Thanks to a high output frequency, excellent resolution and short response times, our gear flow meters are outstanding for measuring pulsing flows, for consumption measurement and for dosing of liquids.

## Applications

- Water- and solventbased paints
- Primers, fillers
- Cavity und preservative waxes
- Abrasive and filled media
- Metallic- and Softfeel paints
- Painting facilities
- ESTA- and robot applications
- 2-component and 3-component mixing plants
- Dosing systems and consumption measurement

## Features

- High measuring accuracy up to  $\pm 0.1 \%$ <sup>1)</sup>
- Exceptional repeatability of  $\pm 0.05 \%$
- Measuring range up to 1:400
- Short response times
- Pressure-resistant up to 200 bar [2,900 psi]
- Medium temperature up to 180 °C [356 °F]
- Robust construction and long lifetime
- Applicable for electrostatic/ESTA applications

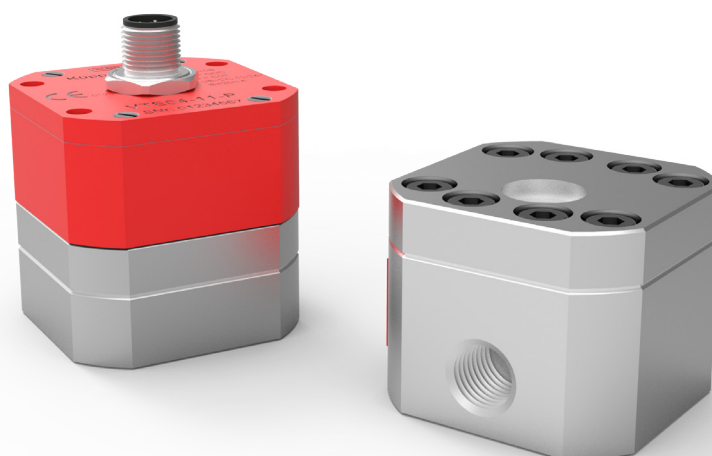
<sup>1)</sup> Under laboratory conditions; incl. linearization; viscosity  $\geq 30 \text{ mm}^2/\text{s}$ .

## Technical Data – Sizes

ZHM Type <sup>2)</sup>	Measuring Range (l/min)			K-Factor <sup>3)</sup> (pulses/l)	max. Pressure (bar/psi)	Frequency <sup>3)</sup> (Hz)			Weight (kg)
ZHM 01/1	0.005	to	2.0	26,500	200 [2,900]	2.2	to	880	0.4
ZHM 01/2	0.02	to	3.0	14,000	200 [2,900]	4.6	to	700	0.5

## Technical Data – General

Measuring Accuracy	Up to $\pm 0.1$ % <sup>4)</sup>
Repeatability	$\pm 0.05$ % (under the same conditions)
Linearity	$\pm 0.5$ % of actual flow (viscosity $\geq 30$ mm <sup>2</sup> /s)
Materials	Housing: as per DIN 1.4305 [AISI 303] Wheels: as per DIN 1.4122 Bearing: Tungsten carbide sleeve bearing, stainless steel ball bearing Seals: PTFE (others on request)
Medium Temperature	-40 °C up to +180 °C [-40 °F up to +356 °F] (others on request)
Dimensions	See dimensional drawing (page 5 to 6)

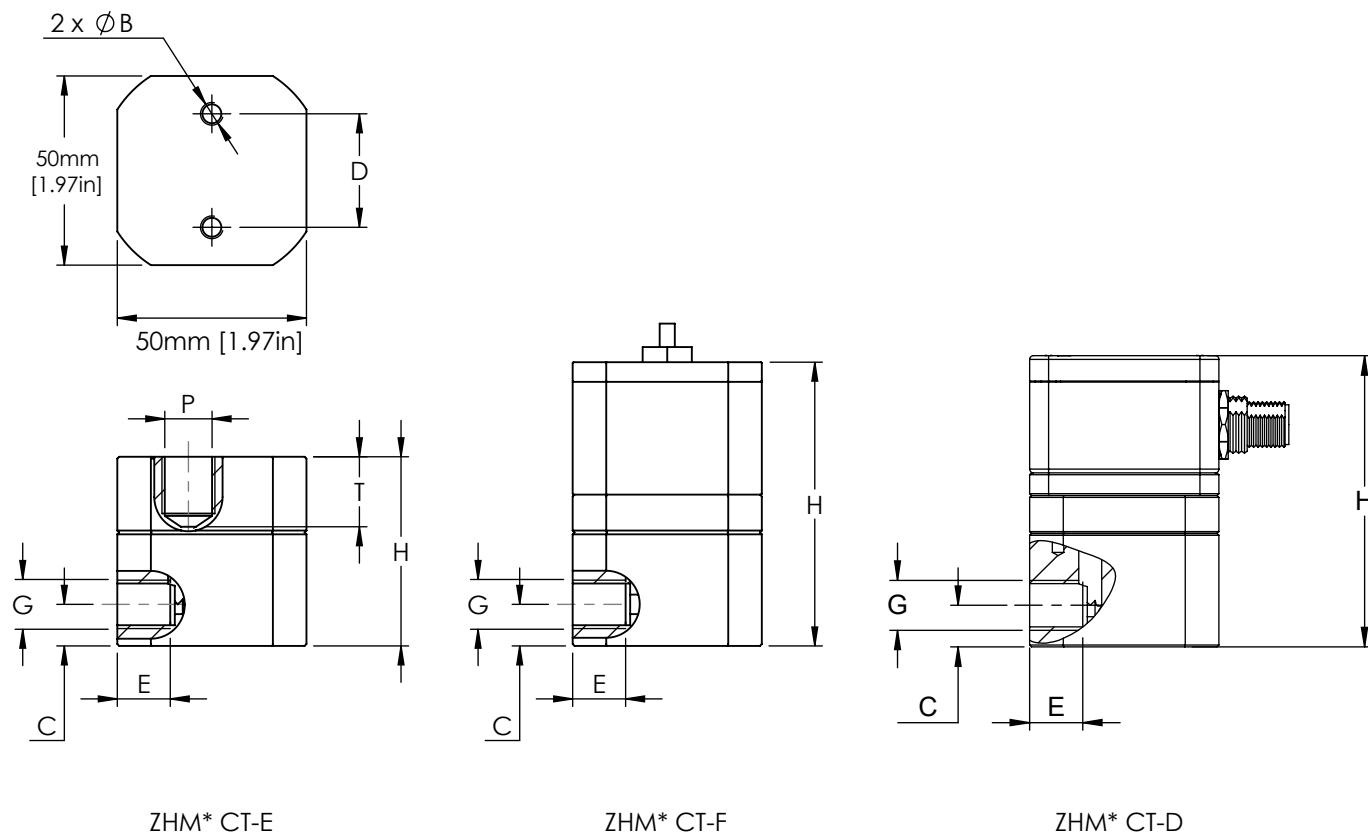


<sup>2)</sup> Exact type designation see ordering code (page 7).

<sup>3)</sup> Average values for single sensors, dual pickups and higher resolution available.

<sup>4)</sup> Under laboratory conditions; incl. linearization; viscosity  $\geq 30$  mm<sup>2</sup>/s.

## Dimensional Drawing – ZHM 01/1 to 01/2 with lateral process connection



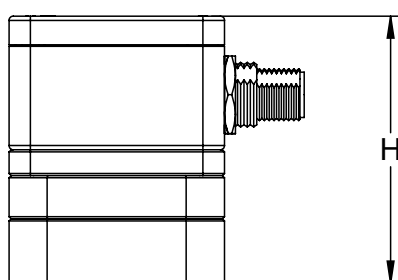
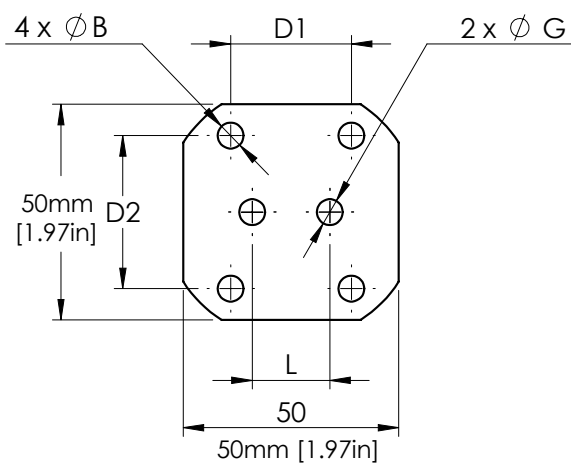
ZHM Type	Ø B	C	D	E	G <sup>5)</sup>	H	P <sup>6)</sup>	T
ZHM 01/1 **-D	M6 $\nabla$ 10	11 mm [0.43 in]	30 mm [1.18 in]	10 mm/14 mm [0.39 in/0.55 in]	G ¼"	77 mm [3.03 in]	—	—
ZHM 01/2 **-D	M6 $\nabla$ 10	11 mm [0.43 in]	30 mm [1.18 in]	10 mm [0.39 in]	G ¼"	77 mm [3.03 in]	—	—
ZHM 01/1 **-E	M6 $\nabla$ 10	11 mm [0.43 in]	30 mm [1.18 in]	10 mm [0.39 in]	G ¼"	50 mm [1.97 in]	M14x1.5	18.5 mm [0.73 in]
ZHM 01/2 **-E	M6 $\nabla$ 10	11 mm [0.43 in]	30 mm [1.18 in]	14 mm [0.55 in]	G ¼"	50 mm [1.97 in]	M14x1.5	18.5 mm [0.73 in]
ZHM 01/1 **-F	M6 $\nabla$ 10	11 mm [0.43 in]	30 mm [1.18 in]	10 mm/14 mm [0.39 in/0.55 in]	G ¼"	75 mm [2.95 in]	—	—
ZHM 01/2 **-F	M6 $\nabla$ 10	11 mm [0.43 in]	30 mm [1.18 in]	14 mm [0.55 in]	G ¼"	75 mm [2.95 in]	—	—

<sup>5)</sup> Others on request.

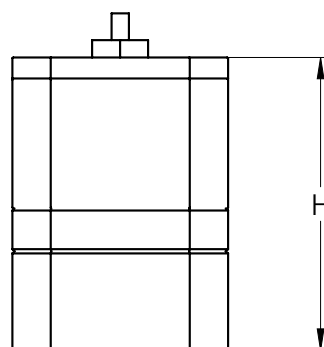
<sup>6)</sup> Only applies for single pickup holes of type „E“.

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

## Dimensional Drawing – ZHM 01/1 to 01/2 with bottom inlet



ZHM\* CT-D



ZHM\* CT-F

Typ ZHM	Ø B	D1	D2	G <sup>7)</sup>	H	L
ZHM 01/1 **-D	5.5 mm [0.22 in]	28 mm [1.10 in]	35.5 mm [1.40 in]	Ø 6 mm [Ø 0.24 in]	62 mm [2.44 in]	18 mm [0.71 in]
ZHM 01/2 **-D	5.5 mm [0.22 in]	28 mm [1.10 in]	35.5 mm [1.40 in]	Ø 6 mm [Ø 0.24 in]	70 mm [2.75 in]	18 mm [0.71 in]
ZHM 01/1 **-E	5.5 mm [0.22 in]	28 mm [1.10 in]	35.5 mm [1.40 in]	Ø 6 mm [Ø 0.24 in]	58 mm [2.28 in]	18 mm [0.71 in]
ZHM 01/2 **-E	5.5 mm [0.22 in]	28 mm [1.10 in]	35.5 mm [1.40 in]	Ø 6 mm [Ø 0.24 in]	58 mm [2.28 in]	18 mm [0.71 in]
ZHM 01/1 **-F	5.5 mm [0.22 in]	28 mm [1.10 in]	35.5 mm [1.40 in]	Ø 6 mm [Ø 0.24 in]	60 mm [2.36 in]	18 mm [0.71 in]
ZHM 01/2 **-F	5.5 mm [0.22 in]	28 mm [1.10 in]	35.5 mm [1.40 in]	Ø 6 mm [Ø 0.24 in]	68 mm [2.68 in]	18 mm [0.71 in]

<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).

## Ordering Code

ZHM - XX - XX - X - X

### Measuring Range

0.005 - 2.0 l/min

01/1

0.02 - 3.0 l/min

01/2

### Meter Attributes

Housing	Gears	Bearing	Bolts	Thread	
1.4305 [AISI 303]	1.4122	sleeve bearing	ISO 4762	bottom in-/outlet <sup>8)</sup>	CT
1.4305 [AISI 303]	1.4122	ball bearing <sup>9)</sup>	ISO 4762	bottom in-/outlet <sup>8)</sup>	CK <sup>9)</sup>
1.4305 [AISI 303]	1.4122	sleeve bearing	ISO 4762	BSPP	71
1.4305 [AISI 303]	1.4122	ball bearing <sup>9)</sup>	ISO 4762	BSPP	47 <sup>9)</sup>

### Sensor Ports

M14x1.5

Plug-in (frequency doubling, bidirectional measurement)<sup>10)</sup>

Plug-in (ESTA fiber optic)

E  
D  
F

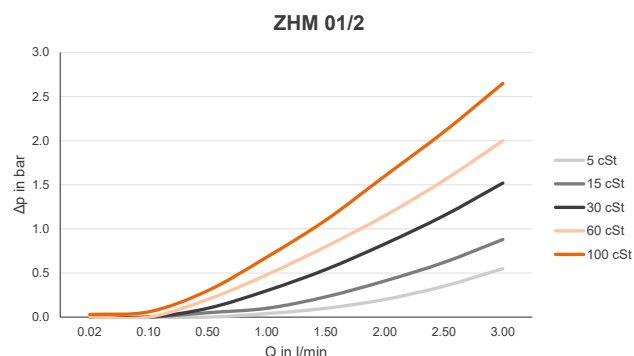
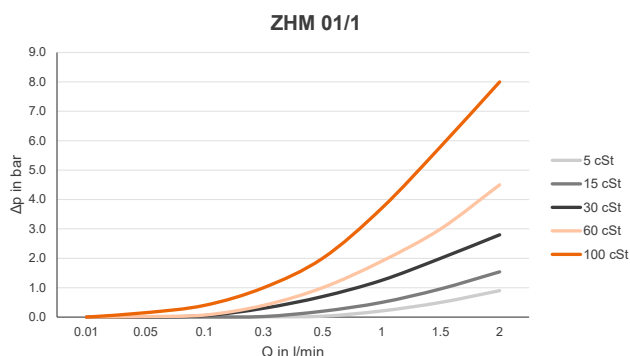
### Sealing Options

PTFE (Teflon<sup>®</sup>)

Flat gasket PTFE (Teflon<sup>®</sup>)

T  
1

## Pressure Drop Curves



<sup>8)</sup> Bottom inlet with flat gasket PTFE, P<sub>max.</sub> 40 bar [580 psi]

<sup>9)</sup> Size ZHM 01/1 not available.

<sup>10)</sup> P<sub>max.</sub> 100 bar [1,450 psi].

## Calibration

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

The KEM 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 German Accreditation Body (DAkkS) has accredited the laboratory engineers, processes and measuring equipment in accordance with the international standard DIN EN ISO/IEC 17025:2018.

The KEM 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.

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.

## Calculation of volume flow

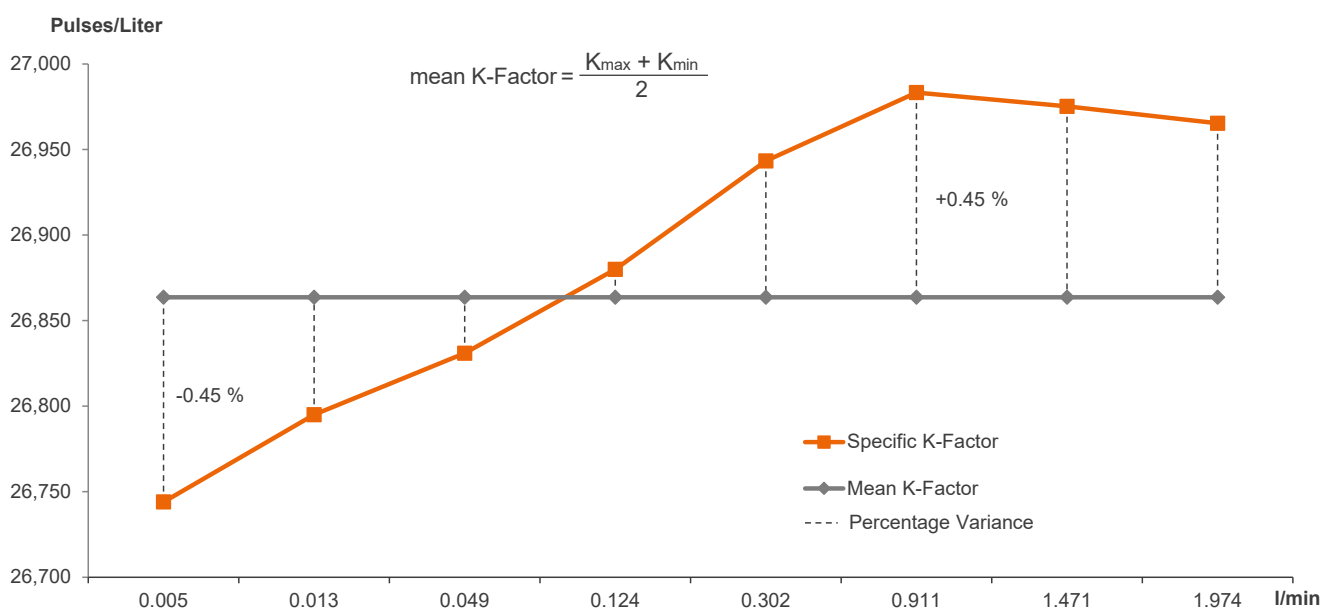
The flow is directly dependent on the measured frequency and the associated calibration factor:

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

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

## Calibration protocol

Example: ZHM 01/1 CT (0.005 to 2 l/min)







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