

Operating Manual



ZHM

Gearwheel Flowmeters

Operating manual version

ZHM_M_DE_170331_E004

Index

1.	GENERAL INFORMATION	4
1.1.	Intended use	4
1.2.	Safety	4
1.2.1.	General safety.....	4
1.2.2.	Safety instructions.....	5
1.2.3.	Specific hazards.....	5
1.2.4.	Notes on warranty.....	5
2.	GENERAL INFORMATION	6
2.1.	Application	6
2.2.	Layout and measuring principle	6
2.3.	Evaluation	6
3.	INSTALLATION.....	7
3.1.	Preparation	7
3.2.	Installation of the ZHM	7
3.3.	Sources of interference.....	7
3.4.	Maintenance	7
3.5.	Replacement parts and disassembly.....	8
3.6.	Assembly	8
3.6.1.	Torque values	10
4.	SENSORS AND AMPLIFIERS.....	11
5.	IMPORTANT INFORMATION	13
5.1.	Guarantee	13
5.2.	WEEE and RoHS.....	13
5.3.	List of figures.....	13

1. General information

1.1. Intended use

Gearwheel flowmeters are measuring elements for lubricating and non-lubricating liquids and for filled viscous and abrasive media.

During operation of the flow meter, it must be ensured that the values for the operating parameters specified in the documentation cannot be exceeded.

The specified maximum volume flow of each flow meter must not be exceeded by more than 20%. This must be observed in particular during rinsing and cleaning processes.

It must be ensured that the materials used in the flow meter are resistant to the media to be measured or pumped.

The device is intended exclusively for the purpose defined in the operating manual. Any other use for additional purposes or any conversion of the device without written approval from the manufacturer is deemed to constitute improper use. The manufacturer is not liable for any resulting damages. The risk is borne solely by the operating company.

NOTE

The declarations of conformity and test certificates of the approval bodies have to be observed for installation and commissioning.

1.2. Safety

1.2.1. General safety

All information in this manual regarding safety and technical data applies only when the device is operated correctly according to the manual.

The information about the protection class (IPnn) applies only if plug connections of the same or a higher protection class are connected to all jacks. Cables or covers of the corresponding diameter must be installed and firmly tightened in all cable feedthroughs.

All housing openings have to be correctly closed during operation unless otherwise specified in the manual.

Shielded cables have to be used for all load and electricity supply connections. The device has to be grounded.

The electrical supply must be with "safe extra-low voltage" (SELV).

To protect against fires, the supply requires fusing with a value that is no higher than the allowable current for the cable.

National and international installation regulations have to be observed.

Only authorized, sufficiently qualified personnel are permitted to connect and operate the device.

1.2.2. Safety instructions

NOTE

Only authorized and qualified personnel are permitted to connect, commission and operate the device. National and international installation regulations have to be observed and followed.

1.2.3. Specific hazards

WARNING!

The use of aggressive, abrasive or contaminated measuring media and cleaning agents can cause mechanical and chemical defects. Make sure that chemical compatibility with all components in contact with the media is given. For further information please contact KEM Küppers or one of our representatives.

VOLTAGE!

Shielded cables have to be used for all load and electricity supply connections. The device has to be grounded. For long cable runs, make sure that the maximum capacity and inductivity for the corresponding voltages are not exceeded.

The device has to be protected against electromagnetic interference (EMC).

1.2.4. Notes on warranty

The device is exclusively intended for the purpose defined in the operating instructions. Any other use for additional purposes or any conversion of the device without written approval from the manufacturer is deemed to constitute improper use. The manufacturer is not liable for damage resulting from this. The risk is borne solely by the operator.

NOTE

All warranty claims will be void if the ZHM is opened by unauthorized personnel and the inspection seal is damaged.

2. General information

2.1. Application

Gearwheel flowmeters are measuring elements for lubricating and non-lubricating liquids as well as filled viscous and abrasive media. Only stainless steel materials are used for this product series. This means the ZHM gearwheel flowmeters are also suitable for corrosive media. Thanks to various design sizes, the ZHM series can be used in numerous fields of application such as consumption measurement, monitoring, mixing, and dosing.

Optimum measurement accuracy and dynamic behavior are ensured through the use of hard metal bearings. Short response times and precise dosing and flow rate measurement can therefore be realized in numerous fields of application.



Figure 1 - ZHM ST flowmeter

2.2. Layout and measuring principle

Gearwheel flowmeters are displacement meters with an internal structure similar to a gear pump. There are two gearwheels in the housing that mesh with minimal play. Self-contained chambers are created between the gears. The positively driven medium being measured is “displaced” into these chambers, thereby causing the gearwheels to turn. The gearwheels rotate freely and undamped in the media flow. Their rotational speed is proportional to the flow rate and is recorded by contactless sensors through the housing wall.

2.3. Evaluation

The C-factor (calibration factor) is individually determined for each ZHM, defining the exact pulse rate per liter. This C-factor is recorded in the calibration certificate supplied with every ZHM.

The calibration certificate contains information you can use to configure the evaluation electronics for the ZHM, for example:

- Max. measuring error in reference to the instantaneous value
- Max./min. frequency with corresponding flow rate values
- C-factors at various measuring points
- Average C-factor for the entire measuring range of the ZHM

The following equation applies:

Q = Flow rate in l/min
 f = Output frequency in Hz
 K = C-factor of the ZHM in pulses/liter

$$Q = \frac{f \times 60}{K}$$

3. Installation

3.1. Preparation

The mechanical and electrical installation may only be carried out by authorized and qualified personnel. Flush the pipework before installing the ZHM. Solids must not be allowed to enter the ZHM since they can block the gearwheels. This applies in particular for the small design sizes of the ZHM 01 – ZHM 02. Please use the following filters as a preventive measure:

ZHM	01–03: 120 microns
	04–05: 200 microns
	06–07: 300 microns

3.2. Installation of the ZHM

The ZHM can be installed horizontally or vertically in the flow direction (calibration direction).

The intake and discharge sides are marked with the arrow on the type plate. In case of two flow directions, the installation position does not play a role since the ZHM is calibrated for both directions in this case.

Our standard ZHMs have imperial bores or bores for Ermeto threaded connections. Therefore additional seals are not required. If seals are necessary due to different connections, do not use fibrous seals such as hemp or PTFE bands under any circumstances.

3.3. Sources of interference

Magnetic fields or similar sources of interferences near the ZHM can interfere with the sensors.

The cables to connect the sensors and amplifiers/evaluation electronics have to be shielded, preferably with braided shielding.

Vibrations in the pipework can have a microphone effect on the sensors, especially on inductive sensors. You can counteract this by installing flexible hose sections before and after the ZHM and preventing a metallic contact between the sensor tip and the end of the sensor bore in the ZHM (the latter does not apply to type TD*, HD*, and FOP 60 type sensors, since they are plugged and mounted with screws):

- Screw in the sensor hand tight without excessive force
- Loosen the sensor by ¼ turn and tighten the counter nut

Air pockets in the pipework distort the measurement results – gearwheel flowmeters are pure volume meters. For applications in explosion-prone areas, the ZHM must be completely filled with the medium being measured during operation.

3.4. Maintenance

- In principle, gearwheel flowmeters in standard design are maintenance-free in accordance with the above instructions. Regular recalibration is recommended to prevent damage and wear to the flow meter. This should be carried out annually or after 8000 operating hours.
- If the flow is not permanent or when the ZHM will not be used for an extended period of time, flush the ZHM with a suitable solvent. Flushing is especially important when measuring media that harden so that particles adhere to the gearwheels.

3.5. Replacement parts and disassembly

Before removing the ZHM, ensure that the pipework is depressurized, emptied, and flushed. The ZHM must be completely cleaned before returning it to KEM. This applies in particular with media that pose a health hazard.

All components of the ZHM are available as replacement parts. Parts are replaced by KEM since recalibration is required after replacement.

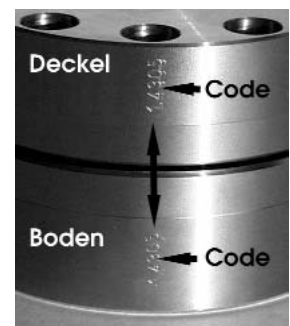
For cleaning, you can disassemble the ZHM as described in the following (the numbers in brackets refer to the figures on page 9). Disassembly may only be performed outside explosion-prone areas. Mark the components so they can be reinstalled in their original positions during later assembly. O-rings and flat seals have to be replaced with new KEM seals prior to assembly.

- Remove the sensor (1) from the ZHM. With some sensor types, you have to unscrew the recessed mounting screws in the sensor cover. Then you can simply pull these sensors out.
- Loosen the Allen screws (2) and unscrew them except for two threads. Two screws across from each other have to remain in the ZHM, all others can be removed.
- Hold the ZHM on the housing cover (3) and carefully tap the remaining screws through alternately with a plastic hammer so that the cover and bottom (4) separate from each other in parallel. Do not attempt to force the housing elements apart with a screwdriver or similar, since this can damage the axles and bearings. Do not remove the dowel pins (6).
- After you have separated the housing elements, remove the gearwheels and axles (5). Also remove the O-ring to clean the groove (not necessary on ZHM versions with flat seals). You may use a solvent for cleaning. Once again, note that new KEM seals must be used for assembly.



3.6. Assembly

- After cleaning to remove all residues, first insert the gearwheels, axles, and seals into the lower section. The wheels have to turn very easily to ensure proper functioning.
- Set on the cover parallel to the lower section. The cover and lower section have engraved material designations (codes) on the side that have to be above each other. Make sure that the two dowel pins (6) are pressed into the corresponding bores.
- Tighten the Allen screws to the torque values as described on page 6.
- After assembly, the ZHM has to be tested for leak tightness and pressure resistance according to Directive 97/23/EC.



Now install the sensor:

Type VTE*/P, IF*, VTM, IWA, HE*

Screw in the sensor hand tight without excessive force

Loosen the sensor by ¼ turn

Tighten counter nut

Type TD*, HD*, and FOP 60

Insert the sensor into the bore

Tighten mounting screws in the sensor cover

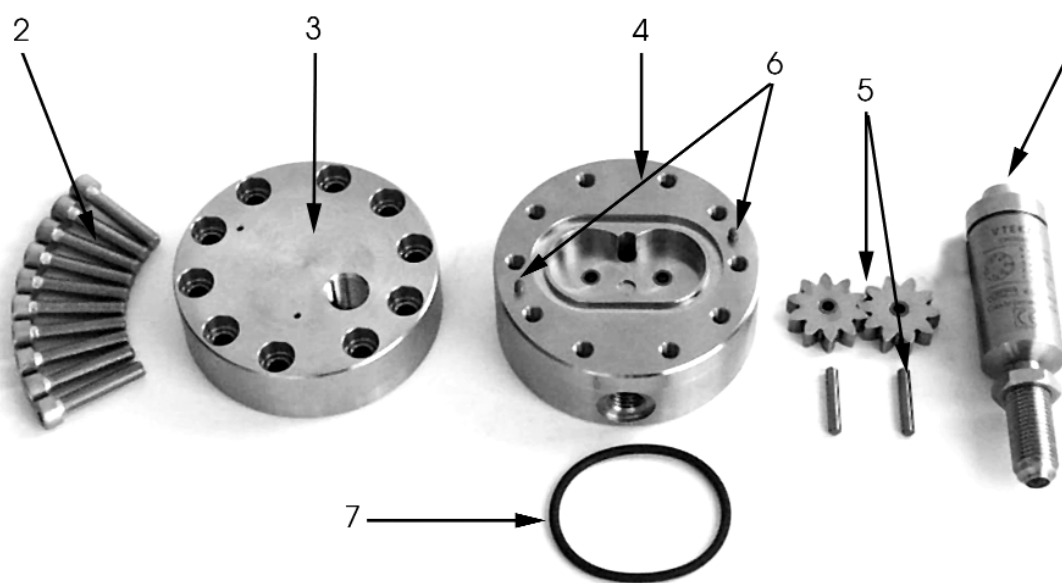


Figure 2 – ZHM in the standard version

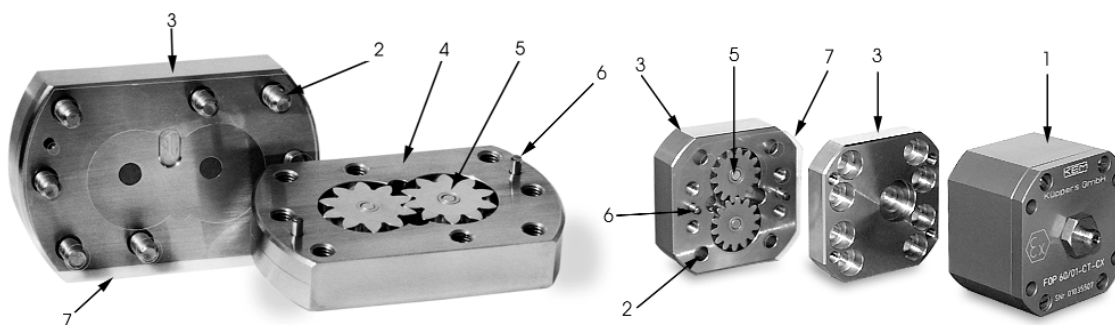


Figure 3 – ZHM in the lightweight and cartridge versions

3.6.1. Torque values

The following torque values apply for tightening DIN 13 standard threads. A thread friction value of $\mu_{ges} = 0.14$ was assumed for establishing these values (new screw without finishing treatment, not lubricated).

ZHM in the CT cartridge version

Screw	Torque value	
M5	Stainless steel	MA = 5.9 Nm

ZHM 01 through 03 in round standard version and lightweight version

Screw	Torque value	
M6	2.9 steel	MA = 18 Nm
M6	Stainless steel	MA = 10 Nm
M10	8.8 steel	MA = 49 Nm

ZHM 04/1 and 04 in round standard version

Screw	Torque value	
M10	12.9 steel	MA = 84 Nm
M10	12.9 steel	MA = 84 Nm
M10	Stainless steel	MA = 49 Nm

ZHM 05 through 06 in round standard version

Screw	Torque value	
M12	12.9 steel	MA = 145 Nm
M12	Stainless steel	MA = 85 Nm

ZHM 07 in round standard version

Screw	Torque value	
M16	12.9 steel	MA = 365 Nm
M16	Stainless steel	MA = 210 Nm




4. Sensors and amplifiers

For the safe use of sensors and amplifiers, please also read the “Safety instructions for electrical equipment”. Various sensors are available for our ZHM. The selection depends on the respective requirements for a measuring application.

VTE*/P carrier frequency amplifier Medium temperature: -20 °C to +120 °C (+150 °C) [-4 °F to 248 °F (302 °F)] Output: push pull or OC	Pin 1 U _B +7 to 29 V DC
	Pin 2 signal push
	Pin 3 0 V
	Pin 4 OC signal (collector)
	Pin 5 OC signal (emitter)
TD* dual carrier frequency amplifier and sensor Forward/reverse flow detection, high resolution Ambient temperature: -20 °C to +50 °C [-4 °F to 122 °F] Medium temperature: up to +80 °C [176 °F]	Pin 1 +U _B 8 to 30 V DC
	Pin 2 output 1 push pull or OC (fx1 or fx2)
	Pin 3 0 V/ground
	Pin 4 output 2 push pull or OC (fx1 or forward/reverse)
	Pin 5 Com, 0 V of the OC outputs
VTM on-site display and analog output Output signal: 4 - 20 mA Ambient temperature: -20 °C to +50 °C [-4 °F to 122 °F] Medium temperature: up to +120 °C (+150 °C) [(248 °F (302 °F)]	Pin 1 U _B +8 (Ex:12) up to 30 V DC
	Pin 2 frequency output three-wire
	Pin 3 0 V
	Pin 4 -I _{out}
	Pin 5 +I _{out}
	Pin 6 shield
IWA 20 local converter Output signal: 4 to 20 mA Ambient temperature: -20 °C to +50 °C [-4 °F to 122 °F] Medium temperature: up to +120 °C (+150 °C) [(248 °F (302 °F)]	Pin 1 n.c.
	Pin 2 frequency output
	Pin 3 0 V/ground
	Pin 4 -I _{out}
	Pin 5 +I _{out}
IF*HT-inductive coil Medium temperature: up to +180 °C [356 °F]	Terminals A, C signal
VIEG amplifier	Terminal 1 U _B +7 to 29 V/DC
	Terminal 2 0 V/ground
	Terminal 3 NPN/PNP output active/passive, two-wire
	Terminal 4 shield
	Terminal 5 IF*HT coil A
	Terminal 6 IF*HT coil C
FOP fiber optics amplifiers Optical output for connection to coating systems OPTV02 receiver with 10 kV and greater resistance to electromagnetic interference Ambient temperature: -20 °C to +50 °C (FOP) [-4 °F to 122 °F] Ambient temperature: -20 °C to +50 °C (OPTV) [-4 °F to 122 °F]	Terminal 1 signal output
	Terminal 2 0 V/ground
	Terminal 3 n.c.
	Terminal 4 U _B + 7 to 30

Datasheets with detailed technical data are available for every sensor/amplifier.

Explosion protection according to ATEX 100a

KEM electronics are available in an explosion protected version according to ATEX 100a  II 2 G EEx ia IIC T6/T4. We recommend our type EWS buffer amplifier for an intrinsically safe supply. With explosion protected electronics, you can use our ZHM in explosion zone 1.

5. Important information

5.1. Guarantee

KEM guarantees the materials and workmanship of its products for a period of 12 months from the installation date but no more than 18 months from delivery.

5.2. WEEE and RoHS

The devices described here are not subject to the WEEE Directive and the corresponding national laws.
Dispose of used devices properly and not in household waste.
The devices described here fully comply with the RoHS Directive.

5.3. List of figures

Figure 1 - ZHM ST flowmeter	6
Figure 2 – ZHM in the standard version	9
Figure 3 – ZHM in the lightweight and cartridge versions	9

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