

OPERATING INSTRUCTIONS AND SAFETY NOTES

NUMERlxx³ oval gear meter

2–100 l/min Pulse meter IPG for Diesel and Urea



FMT Swiss AG

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Operating instructions translation

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We reserve the right to make design and product modifications, which serve to improve the product.

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1. Introduction

1.1. Preface

Please carefully read these operating instructions and observe in particular all safety notes!

Our staff will be pleased to provide support if you have any questions about the product.

Yours sincerely, FMT Swiss AG

1.2. Obligations of the personnel

Before they start to work, all persons who are entrusted with work with the oval gear meter, are obliged:

- to follow all applicable regulations on occupational safety and accident prevention.
- to read and to comply with all safety instructions and warning notes contained in these operating instructions.

Please observe the following instructions in the interest of all concerned:

- Refrain from any unsafe working methods!
- Adhere to all hazard and warning notes contained in this manual!
- In addition to this documentation, keep to all generally accepted safety rules, legal provisions as well as all other binding rules regarding occupational safety, accident prevention and environmental protection!
- Wear appropriate protective clothing in accordance with the work to be done!
- Perform only work for which you have been sufficiently trained and instructed!
- Only genuine spare parts as well as original tools and auxiliaries of the manufacturer are allowed to be used in order to ensure the functional safety and maintain the warranty coverage.

1.3. Symbols in this manual

1.3.1. Structure of the warning notes

The warning notes have the following structure:



SIGNAL WORD

Type and source of the hazard

- Consequences of non-compliance with the notes
- Measures to avoid that risk

Depending on the danger level, different signal words are used




Signal word	Danger level	Consequences of non-compliance
DANGER	Imminent threat of danger	Death or serious bodily injury
WARNING	Possible threat of danger	Death or serious bodily injury
CAUTION	Possibly dangerous situation	Minor bodily injury
ATTENTION	Possibly dangerous situation	Damage to material property



NOTE

Indicates further information or tips which facilitate work

1.3.2. Hazard symbols

Symbol	Meaning
	General hazard symbol. The warning note marked in this way contains supplementary information on the type of hazard.
	This symbol warns of dangerous electrical voltages.
	This symbol warns of a hazardous explosive atmosphere.

1.3.3. General symbols

Symbol	Meaning
■	A small black square indicates the work you have to perform.
–	The dash denotes lists.
⇒	The arrow identifies cross-references. If cross-references to other chapters are required within the text, the expression is shortened for reasons of clarity. Example: ⇒ Chapter 2 Safety notes This means: please refer to chapter 2 for the safety notes.

2. Safety notes

Various dangers may occur if the oval gear meter is improperly handled during installation, commissioning and daily operation.



WARNING

Risk of injury and damage to material property because of improper handling!

- Hold the manual at the disposal of the operating staff at the usage site of the unit.
- Country-specific safety measures and accident prevention regulations must be observed.

2.1. Authorized personnel

Only qualified and authorized persons are allowed to operate and to work on the oval gear meter.

Persons are qualified if they are, due to their training, experience, instruction and knowledge of the relevant standards, able to assess assigned tasks and to identify potentially hazardous situations.

These persons must have been authorized by the person responsible for the safety of the unit and must be able to identify and to avoid potential dangers.

All persons charged with installation, operation, maintenance and repair work, must have read and understood this operation manual.

A copy of this operating manual must be stored permanently and ready at hand at the place of usage of the unit.

2.2. Intended conditions of use

The oval gear meter/pulse meter has been designed and built for the precise measurement and logging of volumes of various fluids with different viscosities such as diesel fuel, heating oil and AdBlue®.

2.3. Reasonably foreseeable misuse

Any departure from the usage stipulations (other media, use of force) or user modifications (changes, use of non-original parts) can be dangerous and are considered as non-intended usage.

The user is liable for any damage resulting from non-intended use.

The use in the food industry is forbidden.



DANGER

Risk of injury and material damage from explosive vapours

- Never pump explosive or oily fluids such as gasoline or other fluids with similar flashpoints.
- The oval gear meter must not be used in potentially explosive environments.

2.4. Risks when handling the oval gear meter and diesel fuel, heating oil and AdBlue®

An improper handling of Diesel fuel and heating oil can cause risk to human health or to the environment.

Provide adequate ventilation and avoid splashing in the working area.

Do not allow spills to enter drains or ground water. Local and country regulations relating to domestic water supply must be obeyed.

Diesel fuels and heating oil are combustible fluids. This must be taken into consideration for their storage.



DANGER

Use of diesel fuel

- Vapours and mist may form explosive mixtures with air.
- May be fatal if it is swallowed and enters the airways.
- Do not smoke, do not use open fire and do not weld when handling fuel.

Use of heating oil

- Heating oil may cause lung damage if swallowed.



WARNING

Risk of slips and falls because of leaks.

- In case of an excessive leakage, the oval gear meter must be immediately stopped and the source of the leakage must be repaired.



CAUTION

- Avoid skin and eye contact.
- In case of contact with the eyes, rinse the eyes with plenty of drinking water and consult a physician.
- Use appropriate equipment such as protective gloves and goggles.



NOTE

- Observe the safety data sheet for diesel fuel and heating oil.
- Observe the safety data sheet for AdBlue®.

The AdBlue® concentrate is not inflammable, not explosive and not oxidizing.
AdBlue® is corrosive to non-ferrous metals.

3. Design and functional description

The oval gear meter/pulse meter is a fluid meter with electronic counter and digital display.

The fluid flowing through the oval gear sets one oval gear in rotation, whereby a Hall sensor sends pulses to the electronic counter. By means of a calculation factor, these pulses are converted into the actual flow volume which appears on the display.

The multiplication factor has been pre-set at the factory using an average that has turned out to be useful in normal operation. However, it can be easily adapted to specific requirements by the user.

The total volume measured is stored and can be called up by pressing the TOTAL button.

The user needs only two membrane key switches for operation: RESET and TOTAL (total volume).

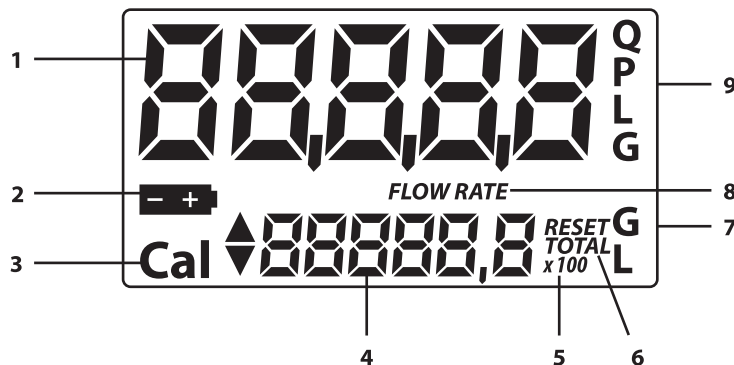
The meter housing is made of aluminium (stainless steel for AdBlue® version).



The electronic components and LCD display sit at the top of the oval gear meter, well insulated against the wet measuring chamber. There is a cover to protect them against the working environment.

3.1. LCD display

The meter's LCD display is equipped with two numeric registers and different types of display modes showing information to the user only when it is actually needed with the operation / function going on at the moment.



Key:

1. Register of partial volume (5 digits with floating decimal: 0.000+99999) showing the amount of liquid that has been delivered since the RESET button was last pressed
2. Battery charge
3. Display of the calibration mode
4. Register of total volume (6 digits with floating decimal 0.0-999999x10/x100) showing two different kinds of total volumes.
 - 4.1 Non-resettable total volume (TOTAL)
 - 4.2 Resettable total volume (RESET TOTAL)
5. Total volume multiplication factor (x10/x100)
6. Type of total volume display (TOTAL/RESET TOTAL)
7. Units for total volume; L=litres; GAL=gallons
8. Flow rate display
9. Display of measuring unit for partial volumes: QTS=quarters; PTS=pints; L=litres; GAL=gallons;

The display can be adapted to the direction of flow in 90° steps. To do so (refer to fig. 15-1; item 19), loosen the four screws. Now you can mount the display unit turned by 90°.



NOTE

- Take care to ensure that the cables from the battery holder kit (refer to fig. 15-1, item 5) to the board (fig. 15-1, item 3) are not pinched or excessively twisted.

Then, re-insert and tighten the screws (refer to fig. 15-1, item 19).

3.2. User controls

There are two push buttons on the meter (RESET and TOTAL), each controlling two main functions (pressed individually) and various auxiliary sub-functions (pressed simultaneously).

Main functions:

- RESET button: Resetting the partial volume register and the (resettable) total volume register RESET TOTAL.
- TOTAL button: Calling up the calibration mode. Pressed together, the two buttons call up the configuration mode where you select the unit of measurement.

3.3. Measuring chamber

The measuring chamber is located in the centre of the meter.

There is a oval gear in the measuring chamber, set in rotation by the flow of liquid. Each revolution will generate an electrical pulse that is processed by the microprocessor on the control circuit board.

The microprocessor uses a calibration factor (i.e. a 'weighting' assigned to each pulse) to convert the pulses generated by the gears' revolutions into an intelligible value representing the volume of liquid that has passed through. It is then displayed in the unit pre-set before in the corresponding registers of the LCD display for partial and total volumes, respectively.

All of our oval gear meters leave the factory with a default calibration factor = 1000 called „FACTORY K FACTOR“.

There is a possibility to calibrate the meter in order to adapt that factor to the physical properties of different liquids.

There is always a possibility to return to the manufacturer's default setting.

3.4. Battery compartment

The meter is powered by two 1.5 V standard batteries (N1).

The battery compartment is inside the body. To replace the batteries, you must remove the cover.

4. Technical data

Designation	NUMERlxx ³ Diesel 23 190	Pulse meter Oval gear meter with display Diesel 23 829	Pulse meter Oval gear meter without display Diesel 23 820
Measuring system	oval gear	oval gear	oval gear
Distance in-/out flange (mm)	95	95	95
Connection on both ends	G 1" f	G 1" f	G 1" f
Media	diesel, heating oil	diesel, heating oil	diesel, heating oil
Flow capacity l/min	2 – 100	2 – 100	2 – 100
Pre-set flow direction	horizontal	horizontal	horizontal
Permitted liquid temperature max. (°C)	40	40	40
Permitted ambient temperature (°C)	-10 / +60	-10 / +60	-10 / +60
Measuring tolerance (%)	1	1	1
Nominal pressure (bar)	3,5	3,5	3,5
Burst pressure (bar)	28	28	28
Impulses (pulses/l)		23,15	23,15
Contact form		A-closer	A-closer
Switching capacity (W)		10	10
Operating voltage (V)		3-30 V DC	3-30 V DC
Operating current (A)		0,5	0,5
Switch current (A)		0,5	0,5
Sensor resistor (mOhm)		300	300
Material housing	aluminium	aluminium	aluminium
External dimensions LxWxH (mm)	100 x 100 x 65	100 x 130 x 65	100 x 100 x 95
Weight (kg)	0,58	0,60	0,55

Tab. 4-1: Specifications oval gear meter diesel

Designation	NUMERlxx ³ AdBlue® 23 190 870	Pulse meter Oval gear meter with display AdBlue® 23 829 870	Pulse meter Oval gear meter without display AdBlue® 23 823
Measuring system	oval gear	oval gear	oval gear
Distance in-/out flange (mm)	95	95	95
Connection on both ends	G 1" f	G 1" f	G 1" f
Media	AdBlue®	AdBlue®	AdBlue®
Flow capacity l/min	2 – 100	2 – 100	2 – 100
Pre-set flow direction	horizontal	horizontal	horizontal
Permitted liquid temperature max. (°C)	35	35	35
Permitted ambient temperature (°C)	-5 / +35	-5 / +35	-5 / +35
Measuring tolerance (%)	1	1	1
Nominal pressure (bar)	3,5	3,5	3,5
Burst pressure (bar)	28	28	28
Impulses (pulses/l)		23,15	23,15
Contact form		A-closer	A-closer
Switching capacity (W)		10	10
Operating voltage (V)		3-30 V DC	3-30 V DC
Operating current (A)		0,5	0,5
Switch current (A)		0,5	0,5
Sensor resistor (mOhm)		300	300
Material housing	stainless steel	stainless steel	stainless steel
External dimensions LxWxH (mm)	100 x 100 x 65	100 x 100 x 95	100 x 100 x 65
Weight (kg)	1,35	1,36	1,30

Tab. 4-2: Specifications oval gear meter AdBlue®

5. Assembly

The oval gear meter comes pre-assembled and ready to go.

According to the version, accessories may be or must be mounted.



NOTE

- Ensure cleanliness during installation and an exact connection and accurate sealing.

6. Installation

The inlet and outlet of the oval gear meter are aligned in a straight axis and equipped with 1" threads. The meter may be installed in any given position, as a fixed unit in a pipeline and/or as a mobile unit on a spigot.

The oval gear meter does not have a pre-defined flow direction. Both ends may alternatively serve as inlet or outlet, as needed. However, it is absolutely important that the side that is used as inlet (where the pipeline arrives) is equipped with a filter with suitable performance characteristics. Solid particles getting into the measuring chamber might clog up the oval gear.

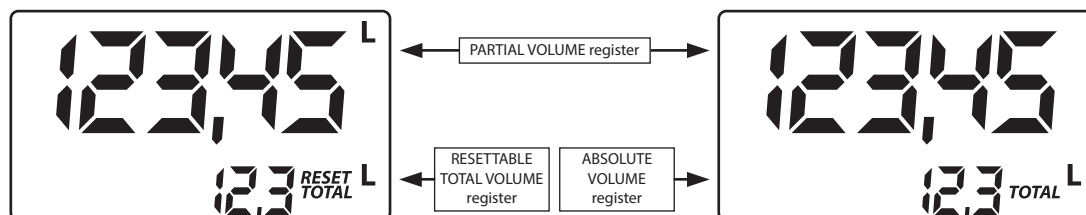
7. Routine operation

The turbine flow meter comes pre-assembled and ready to go.

Even after periods of prolonged storage, it will be ready for operation without any lengthy preparations.

The only action that may be necessary from time to time during normal operation is to reset the registers of partial and/or resettable total volumes.

To accomplish that, call up the two displays for normal operation. The first normal operation display contains the partial volume and resettable total volume (RESET TOTAL). The other display shows the partial volume and the non-resettable (absolute) TOTAL volume. The LCD automatically switches between resettable and absolute total in a given period of time. This has been set at the factory and cannot be influenced by the user.



The register of the absolute total (TOTAL) cannot be reset by the user. It will continue counting during the entire lifetime of the meter. The resettable and non-resettable registers of total volumes (RESET TOTAL and TOTAL) share the same 'window' and the same digits of the LCD display. For that reason, the two numbers cannot be viewed at the same time.

The oval gear meter has been programmed so that the one or the other total is visible at certain moments / in certain modes during operation (never both at a time):

- The absolute total volume (TOTAL) is visible in standby mode.
- The resettable total (RESET TOTAL) is visible at the following times / in the following modes:
 - For a short moment (several seconds) after resetting the (resettable) partial volume.
 - During the output of liquid.

A few seconds after output of the liquid this short time span expires and the meter switches to standby mode. The display of the bottom register shows the absolute total volume.



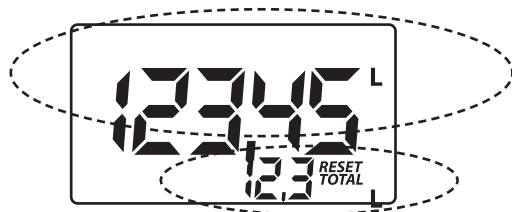
NOTE

For the display of total volumes, there are 6 digits available, plus two icons x10/x100. The increments are activated in the following sequence:

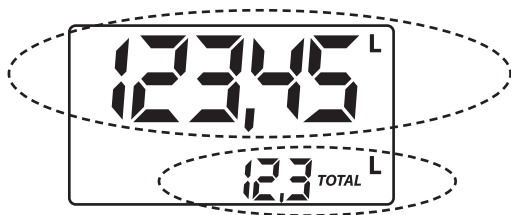
0,0 ---> 99999,9 ---> 999999 ---> 100000 x10 ---> 999999 x10 ---> 100000 x100 ---> 999999 x100

7.1. Output of liquid during standard operation (Normal Mode)

During standard output of liquid, the meter will count and at the same time display the volume having gone through the device so far, and the resettable total (RESET TOTAL).



Accidental pressing of the RESET or TOTAL button does not have any effect in this state.



A few seconds after fluid discharge, the display of the lower register will change from resettable total to absolute total: The word RESET above the word TOTAL will disappear, and the value of the resettable total will be replaced by the absolute total.

We call this state (or mode) „standby“. It will persist as long as the user does not carry out any more actions on the meter.

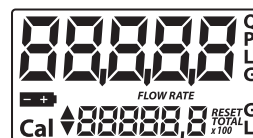
7.1.1 Resetting partial volumes

For resetting the partial volume register: Press the RESET button while the meter is in standby, i.e. when you see the word TOTAL in the display.

When you press RESET, the display will first switch on all the segments, one after the other, and then switch them all off again.

When the reset is complete, the display will first show the partial volume having been reset and then RESET TOTAL.

After a couple of seconds, RESET TOTAL will be replaced by the NON-resettable total amount TOTAL.



7.1.2. Resetting the resettable total volume (RESET TOTAL)

You can reset the resettable total only if you have reset the register of the partial volumes before. To reset the resettable total: press RESET for several seconds. The display will show the words RESET TOTAL (see fig.):

You must carry out the following steps (in this order):

1. Wait until the display is back to default standby mode (i.e. showing only TOTAL).
2. Press RESET shortly.
3. The meter will now start resetting the partial volume register.
4. While the display shows RESET TOTAL, briefly press RESET.



5. The display will show all the segments again. Only then follows the phase where all segments are switched off. Finally, there will be a display showing the total that has been reset (RESET TOTAL).



7.2. Output of liquid with display of current flow rate (Flow Rate Mode)

It is possible to output a liquid and have the following displays available at the same time:

- Partial volumes having been output
- Current flow rate (Flow Rate) in [unit of partial volume per min.], as shown below.

This is how you get into this mode:

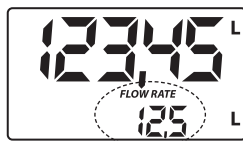
- Wait until the meter is in default standby mode (i.e. the display shows only the total volume).
- Press TOTAL shortly.
- Start output operation.

The display of the current flow rate will be updated every 0.7 secs. For that reason the display may 'flutter' somewhat with low flow rates. However, the higher the flow rate, the more stable the display will be.



NOTE

The current flow rate will be shown in the unit set for the partial volume register. That means if partial and total volume have been set to different units (as shown in the example below) you must bear in mind that the flow rate shown is in the unit set for partial volumes. In the example shown, the flow rate is in L./min.



The word L next to the flow rate refers to the register of the (resettable and NON-resettable) total volumes which will be displayed again as soon as you leave the current flow rate' display mode.

In order to go back to the default standby mode, press the TOTAL button again.

Accidental pressing of the RESET or TOTAL button does not have any effect in this state.

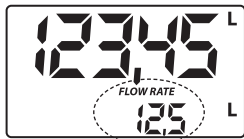


NOTE

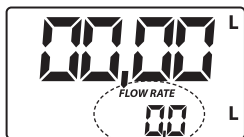
RESET TOTAL and absolute total (TOTAL) are not shown in this mode. However, the values nevertheless go up. You can check after fluid discharge. Wait for the default standby mode and press TOTAL shortly.

7.2.1. Resetting partial volumes

In order to reset the partial volume register, you must first complete the output of liquid. Wait until the display shows a flow rate of 0.0 (see fig.) and then press RESET shortly.



The effect is different from what you would have if you press Reset in default standby mode. There is no phase where all the segments are first switched on and then off again. Instead, the register will display the reset partial volume immediately.



8. Calibration

8.1. Definition

Calibration factor or „K FACTOR“:

This is the multiplication factor the system ascribes to the electronic pulses it receives in order to convert them into a plain unit of measurement.

- **FACTORY K FACTOR:** Calibration (default) factor pre-set at the factory.
Factory K Factor = 1000.

This calibration factor ensures maximum precision under the following operating conditions:

Fluid	Diesel	AdBlue®
Temperature	20 °C	20 °C
Flow rate	2-60 l/min	5-30 l/min

You can always return to the original Factory K Factor even after you have changed the value. The procedure is simple.

- **USER K FACTOR:** This is the calibration factor the user has set to adapt the meter to specific requirements (i.e. the user has carried out a calibration procedure).

8.2. Why calibrate?

The oval gear meter comes to you with a calibration factor pre-set at the factory that will guarantee the most precise measurements under most operating conditions.

If calibration is necessary, it should be conducted under the operating conditions in which the meter is used, such as in the following extreme conditions:

- liquids having a viscosity close to the admissible limits (e.g. antifreeze with low viscosity, high-viscosity oils for gearboxes)
- extreme flow rates (i.e. close to upper or lower limits)

8.3. Calibration mode

The oval gear meter has a fast and precise electronic calibration mode where you simply change the calibration factor (K FACTOR).

There are two calibration procedures you may choose from:

- Calibration during simulated operation (requiring actual output of liquid to be carried out).
- Direct calibration (simply changing the calibration factor).

By briefly pressing the TOTAL button > FLOW RATE screen, and subsequently pressing the RESET and TOTAL buttons for a longer time, the calibration process can be called up for the following reasons:

- To display the valid calibration factor
- To reset the calibration factor pre-set at the factory (FACTORY K FACTOR) after calibration by the user
- To change the calibration factor using one of the two available calibration procedures

During calibration, the registers on the LCD display - that normally show partial and total volumes of liquid output - will take on new meanings.

During calibration, the meter cannot carry out normal output operation.

During calibration, the count of the absolute total volume of liquid having been output (non-resettable total) will not increase.



NOTE

The oval gear meter is equipped with a non-volatile memory so that saved calibration data and the total output amount will be stored for prolonged periods of time – even without power supply. That means you don't have to re-calibrate after you have exchanged the batteries.

8.3.1. Displaying the valid calibration factor – resetting the factory calibration factor (if necessary)

By briefly pressing the TOTAL button > FLOW RATE screen, and subsequently pressing the RESET and TOTAL buttons for a longer time, the calibration factor currently being used appears on the display.

Two situations are possible:

- a) User never changed the calibration factor and/or user restored the factory calibration factor after changing it: the display will show the following: The word FACT (short for FACTORY) indicates that the valid calibration factor is the factor pre-set at the factory.



- b) If calibrations have been made by the user, the calibration value currently used is indicated (in our example 0,998).

The word USER indicates that the calibration factor currently used was entered by the user.



The flow chart below shows the schematics of the display modes the LCD display may go through.

In this mode, the user may press RESET and thus change from the USER to the FACTORY FACTOR.

In order to confirm your choice, shortly press TOTAL while the display shows either USER or FACT.

After re-start, the meter will use the new calibration factor you just confirmed.

Key

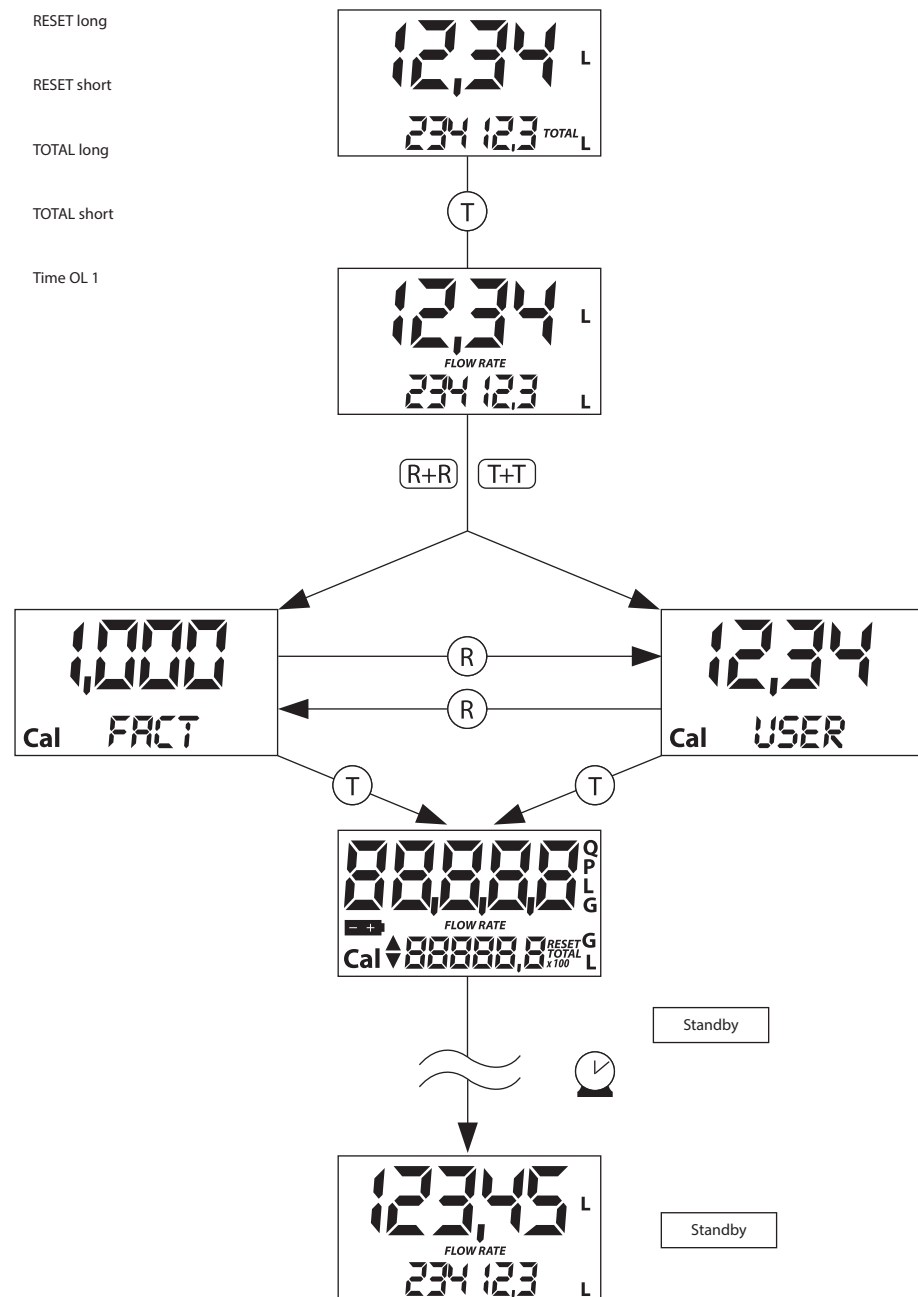
R+R RESET long

R RESET short

T+T TOTAL long

T TOTAL short

 Time OL 1



NOTE

When you confirm restoration of the Factory K Factor, the old user factor will be deleted from memory.

8.3.2. Calibration during simulated operation

This procedure is basically a simulated output of liquid into a calibration vessel under actual operating conditions (flow rate, viscosity etc.). The procedure must be carried out with utmost care.


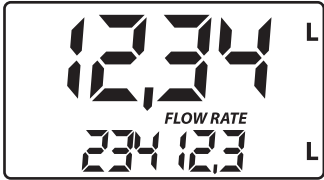
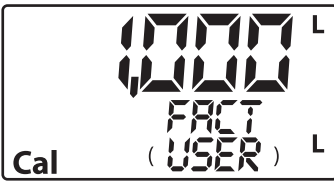



NOTE

Absolutely bear in mind the following points in order to guarantee proper calibration:

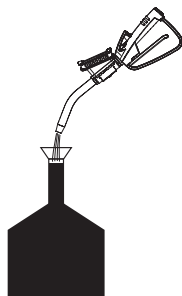
- Have your equipment properly vented before calibration.
- Use a calibrated vessel holding at least 5 litres with a precise full mark.
- For calibration, tap a certain amount of test liquid with a constant flow rate, exactly as you would do in normal operation. Continue until the vessel is full.
- Do not decrease the flow rate when you approach the full mark. Instead, turn the spigot on and off and fill the vessel in small batches, but make sure the flow rate remains unchanged.
- When you are finished be sure to wait a few minutes and let air bubbles escape that may still be in the calibration vessel. Otherwise there is a danger you get a wrong value because the level in the vessel may still go down.
- Be sure to carry out the following procedure correctly.

8.3.3. Meter calibration during simulated operation

Operation		Display configuration
1	NONE Meter is in default standby mode, not counting.	
2	SHORT PRESS OF THE TOTAL BUTTON The meter changes to the FLOW RATE screen.	
3	LONG PRESS OF THE RESET AND TOTAL BUTTONS Meter switches to calibration mode, displaying TOTAL. Display no longer shows total volume, but instead the valid calibration factor. FACT and USER indicate whether valid calibration factor is FACTORY K FACTOR or USER K FACTOR.	
4	PRESS RESET SEVERAL SECS Meter shows TOTAL display and the resettable total register displays zeroes. Meter is now ready for simulated operation calibration.	

4 FILL LIQUID INTO CAL VESSEL

Start simulated operation, but do not press any buttons yet.



Simulated operation may be interrupted and continued as necessary. Continue filling the vessel until full mark is reached. It is not necessary to top out at any specific value.

Set value

Actual value



5 PRESS RESET SHORTLY

This is how the meter 'knows' that discharge for calibration is complete. Make sure cal vessel has really been filled up to full mark before you do this.

For calibration you must correct the count indicated by the partial volume register (ex.: 9,800), entering the actual value, i.e. the volume of the cal vessel. An arrow at the bottom left of the display (pointing up or down) indicates the direction in which USER K FACTOR is changed. Increase or decrease when actions 6 or 7 are carried out.



6 PRESS RESET SHORTLY

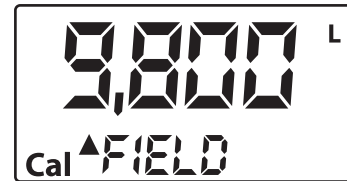
Direction of arrow flips. This may be repeated as often as necessary.



7 PRESS TOTAL SHORTLY / SEVERAL SECS

Value indicated will change as indicated by arrow:

- One increment per each time TOTAL is pressed.
- Continuous if the TOTAL button is held down, the first 5 increments slow, then fast.
- If you overshoot, go back to point 6 and repeat (6).



8 PRESS RESET SEVERAL SECS

This is how the meter, 'knows' that calibration is now complete.

Before you press the button, be absolutely sure the display shows the correct value (volume of vessel).

Set value

Actual value



The meter will now calculate the new USER K FACTOR: This may take a couple of secs. depending on the complexity of the correction. The arrow will disappear during this phase, but the word TOTAL will remain unchanged.

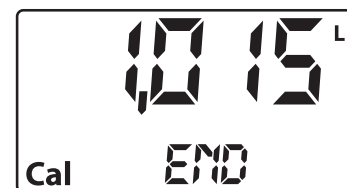
If you carry out this action right after point 5 the new USER K FACTOR will be equal to the FACTORY K FACTOR. It will be ignored, therefore.



9 NO OPERATION

After completion of the calculation the new USER K FACTOR will be displayed a few seconds. Next, the meter will re-start. Finally, the meter will be back in default standby mode.

PLEASE NOTE: From now on, the new value set will be used as the new valid K Factor and will remain even after replacement of batteries!



10 NO OPERATION

The meter stores the new K Factor for operation and is now ready for operation using the newly set USER K FACTOR.



8.3.4. Changing the K FACTOR directly

This procedure is helpful for the correction of a mean error that may occur as a result of many output operations. In the event you observe a mean percentage error during normal meter operation you may carry out a correction by changing the valid User K Factor by that percentage. In order to calculate the correction of the USER K FACTOR, proceed as follows:

$$\text{New calibration factor} = \text{old calibration factor} \times \frac{100 - E\%}{100}$$

Example:

Observed mean percentage error E %	-0,9 %
Current K Factor	1.000
New USER K FACTOR	$1.000 \times \{[100 - (-0,9)] \div 100\} =$ $1.000 \times [(100 + 0,9) \div 100] =$ 1.009

If the meter displays less than the actual amount of liquid output (negative error), the new K Factor must be greater than the old one (see example). The opposite is true if the value indicated is greater than the actual amount (positive error).

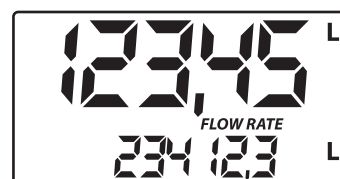
Operation

- 1 NO
Meter is in default standby mode, not counting.

Display configuration



- 2 SHORT PRESS OF THE TOTAL BUTTON
The meter changes to the FLOW RATE screen.



- 3 LONG PRESS OF THE RESET AND TOTAL BUTTONS
The meter changes to the calibration mode, the word TOTAL is displayed, and the calibration factor used is displayed instead of the total volume. The messages FACT and USER indicate which one of the two factors (manufacturer or user) is currently being used.



- 4 PRESS RESET SEVERAL SECS
Meter shows TOTAL display and the resettable total register displays zeroes.
Meter is now ready for simulated operation calibration.



- 5 PRESS RESET SEVERAL SECS
Changing valid K Factor directly: The word DIRECT is displayed, together with the calibration factor currently in use. An arrow at the bottom left of the display (pointing up or down) indicates the direction in which the displayed value is changed. Increase or decrease when actions 5 or 6 are carried out.



6 PRESS RESET SHORTLY

Direction of arrow flips. This may be repeated as often as necessary in order to set the correct direction.



7 PRESS RESET SHORTLY / SEVERAL SECS

Value indicated will change as indicated by arrow:

- One increment per each time TOTAL is pressed.
- Continuously if TOTAL is held down. Display will 'roll' more quickly if button is held permanently.

If you overshoot, go back to point 5 and repeat.



8 PRESS RESET SEVERAL SECS

This is how the meter 'knows' that calibration is now complete.

Before you press this button, be absolutely sure the value indicated is the value you wanted to set.



9 NO OPERATION

After the following calculation the new USER K FACTOR will be displayed a few secs. Next, the meter will re-start. Finally, the meter will be back in default standby mode.

PLEASE NOTE: From now on, the new value set will be used as the new valid K Factor and will remain even after replacement of batteries.



10 NO OPERATION

The meter stores the new K Factor for operation and is now ready for operation using the newly set USER K FACTOR.



9. Configuration of the meter

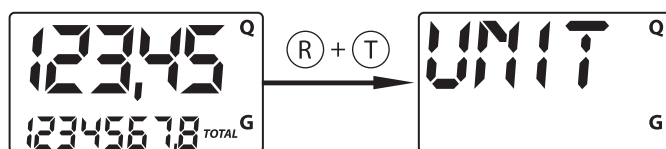
The oval gear meter has a menu to assist users in the selection of the main unit of measure: quarters (QTS), pints (PTS), litres (L), gallons (GAL).

Combining partial-volume and total-volume units is possible as shown in the following table:

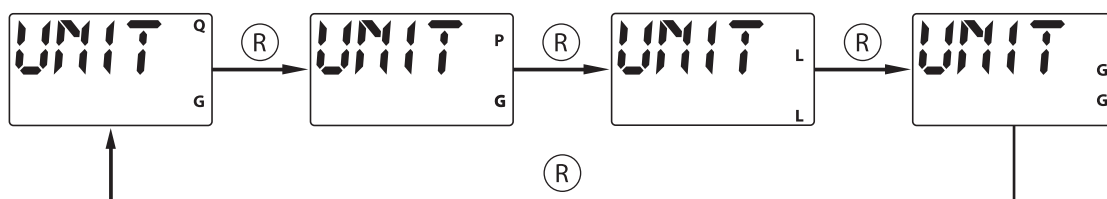
Combination no.	Unit Register of partial amounts	Unit Register of total amounts
1	litres (L)	litres (L)
2	gallons (GAL)	gallons (GAL)
3	quarters (QTS)	gallons (GAL)
4	pints (PTS)	gallons (GAL)

This is how you select any of the combinations proposed:

Wait until the meter is in default standby mode. Simultaneously press TOTAL and RESET until the display shows the word „UNIT“ displaying the valid unit being used at present (in our example: litres/litres).



Every time you (shortly) press RESET, one of the other combinations of units will be displayed one after the other (see figs.):



Press TOTAL for several seconds to store the new combination. The meter will re- start and is then ready for operation using the newly selected combination of units.



NOTE

The registers of the resettable and absolute total amounts are automatically set to the new measuring units.

When the measuring unit is modified, a new calibration is NOT required.

10. Maintenance

This oval gear meter has been designed for minimum maintenance requirements. What remains to be done from time to time:

- Exchange the batteries when discharged.
- Clean the measuring chamber. This may be necessary from time to time depending on the specific liquid(s) being measured and/or when foreign matter gets into the chamber (inlet filter not sufficient).

10.1. Exchanging batteries

The meter is supplied complete with two 1.5 V alkaline batteries (1N).

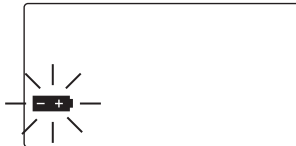
The meter has a two-step low battery indicator:

- 1) As soon as the batteries dip below the first charge level the battery icon in the display will light up.

The meter will continue to operate correctly, but the user is informed that the batteries should be exchanged as soon as possible.



- 2) If the batteries are not exchanged, the battery will sooner or later reach the second alarm level. Normal operation is no longer possible. At this state, the battery icon will flash, being the only thing that is still visible in the display.



NOTE

- Do not throw batteries in the dustbin. Be sure to know and respect local regulations concerning proper disposal.

Proceed as follows (items correspond to spare parts list):

- Press RESET in order to update total volume.
- Unscrew the battery cover (82 353).
- Remove the old batteries.
- Insert new batteries. Observe + and - icons on batteries and cap.
- Replace battery cap properly and screw down tightly.
- The meter will go on automatically and revert to default standby mode. Routine operation may now be continued.

The values of the resettable and non-resettable totals and partial volume will be the same as before.

Neither will the calibration (K) factor change in the case of power failures and/or exchange of batteries. It is not necessary to re-calibrate the meter after exchange of batteries.

10.2. Cleaning

It is not necessary to re-calibrate the meter after exchange of batteries. The inlet and outlet must be fully accessible.



ATTENTION

- Never blow compressed air into the meter, since the resulting high speed of rotation can cause damage to the oval gears!



NOTE

- Always make sure that ALL the liquid has been removed from the device before you start cleaning it.

The oval gear meter has no filter that needs to be cleaned. Therefore, it is only possible to determine at the inlet and outlet whether large particles have gotten caught in the meter. If there are any foreign objects in the meter, they can be removed with a pointed object, such as a small screwdriver, or needle nose pliers.

After removing larger objects, a suitable liquid can be used to rinse out smaller foreign particles.

Be careful not to damage the body of the device and the plastic parts.

11. Troubleshooting

Malfunction	Cause	Solution
LCD display: No display	► Loose battery contacts	► Check batteries for good contact
Accuracy of measurements is insufficient	► K FACTOR wrong ► Meter operates below admissible min. flow rate	► Check K FACTOR ⇨ see chapter 8.3. ► Increase flow rate to acceptable level
Reduced flow rate, or no flow at all	► Oval gear blocked	► Clean measuring chamber
Display flashing „Err 1“	► Data stored in electronic memory are damaged	► Sorry, irreparable
Short display of „Err 2“	► Limited error reading data (usually when exchanging batteries)	► Control circuit board automatically switches on and off to restore proper operation

12. Repair/Service

This oval gear meter has been designed and built in compliance with the highest quality standards.

If a problem should occur despite all quality measures taken, please get in touch with our service contact partners:

FMT Swiss AG

Tel +49 9462 17-246

Fax +49 9462 1063

service@fmtag.ch

13. Disposal

Dispose of the oval gear meter / pulse meter properly and without any liquid residues or have it disposed of by a specialized waste disposal company. Ensure to comply with all relevant provisions in national legislation applicable in your country.

The battery is hazardous waste and must be disposed of separately from the oval gear meter/pulse meter.

14. EC Declaration of Conformity



Manufacturer:

FMT Swiss AG

Fluid Management Technologies Swiss AG

Gewerbestraße 6

6330 Cham / Schweiz

Declares under his sole responsibility that the machine:

Model type	Oval gear meter /Pulse meter
	23 190; 23 829; 23820 Diesel
	23 190 870; 23829 870; 23 823 AdBlue®
Function	Precise measurement and registration of volumes of various media featuring different viscosities, such as diesel, heating oil and AdBlue®
Complies with all relevant provisions of the following Directive:	
EC Directives	2014/30/EU EMC Directive
Applicable standards	EN 61000-6-1:2007 EN 61000-6-3:2007/A1:2011 EN 55014-1:2006/+ A1:2009 +A2:2011 EN 55014-2:2015

Authorized representative for the compilation of the technical documentation:

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FMT Swiss AG
Cham, 10.04.2019

Dipl.-Ing. Rudolf Schlenker
(Managing Director)

15. Exploded view and mounting dimensions oval gear meter – digital

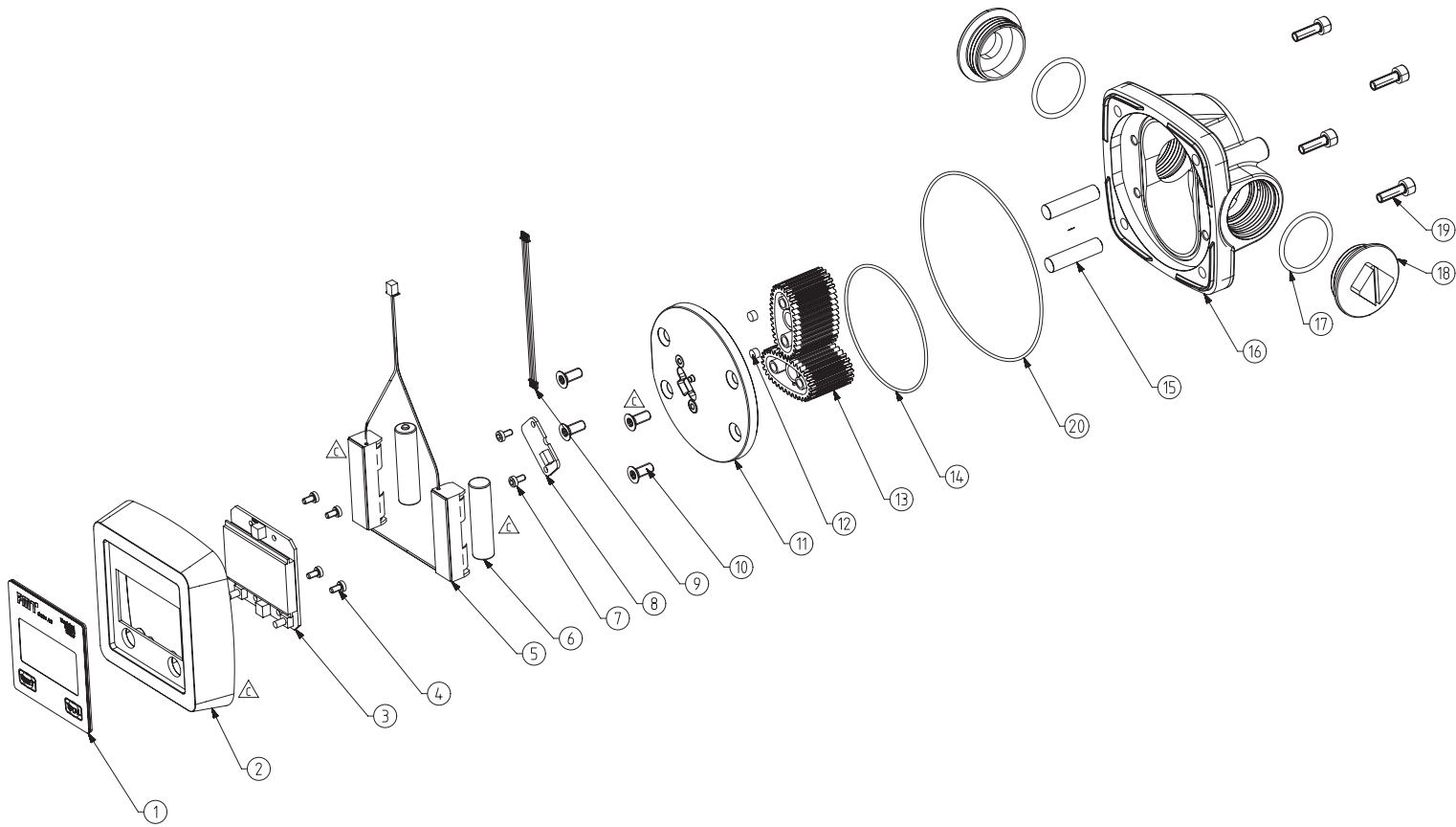


Abb. 15-1: Exploded view oval gear meter-digital

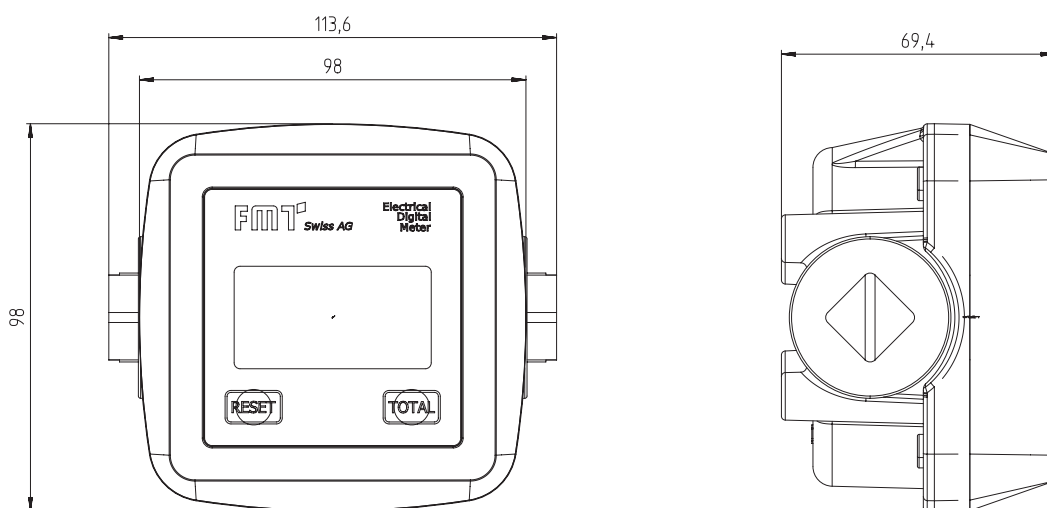


Abb. 15-2: Mounting dimensions oval gear meter-digital (in mm)

Item	Quantity	Designation
1	1	Protective display film, FMT
2	1	Housing cover-zinc
3	1	Platine
4	4	Fillister head screw M 3 x 6
5	1	Battery box
6	2	Battery AAA
7	2	Self-tapping screw M 3 x 6
8	1	Hall sensor-carrier board
9	1	Connection cable
10	4	Self-tapping screw M 5 x 12
11	1	Intermediate cover
12	2	Disc magnet 5 x 3 mm
13	2	Oval gear
14	1	O-ring NBR 70-68 x 1,5
15	2	Bearing bolt 8 x 34
16	1	Housing, lower part
17	2	O-ring NBR 70-29 x 2,5
18	2	Screw plug, black
19	4	Self-tapping screw M 5 x 20
20	1	O-ring NBR 70-105 x 1,5

Tab. 15-1: Overview of the individual parts of fig. 15-1

16. Exploded view and mounting dimensions pulse meter and oval gear meter – digital without display

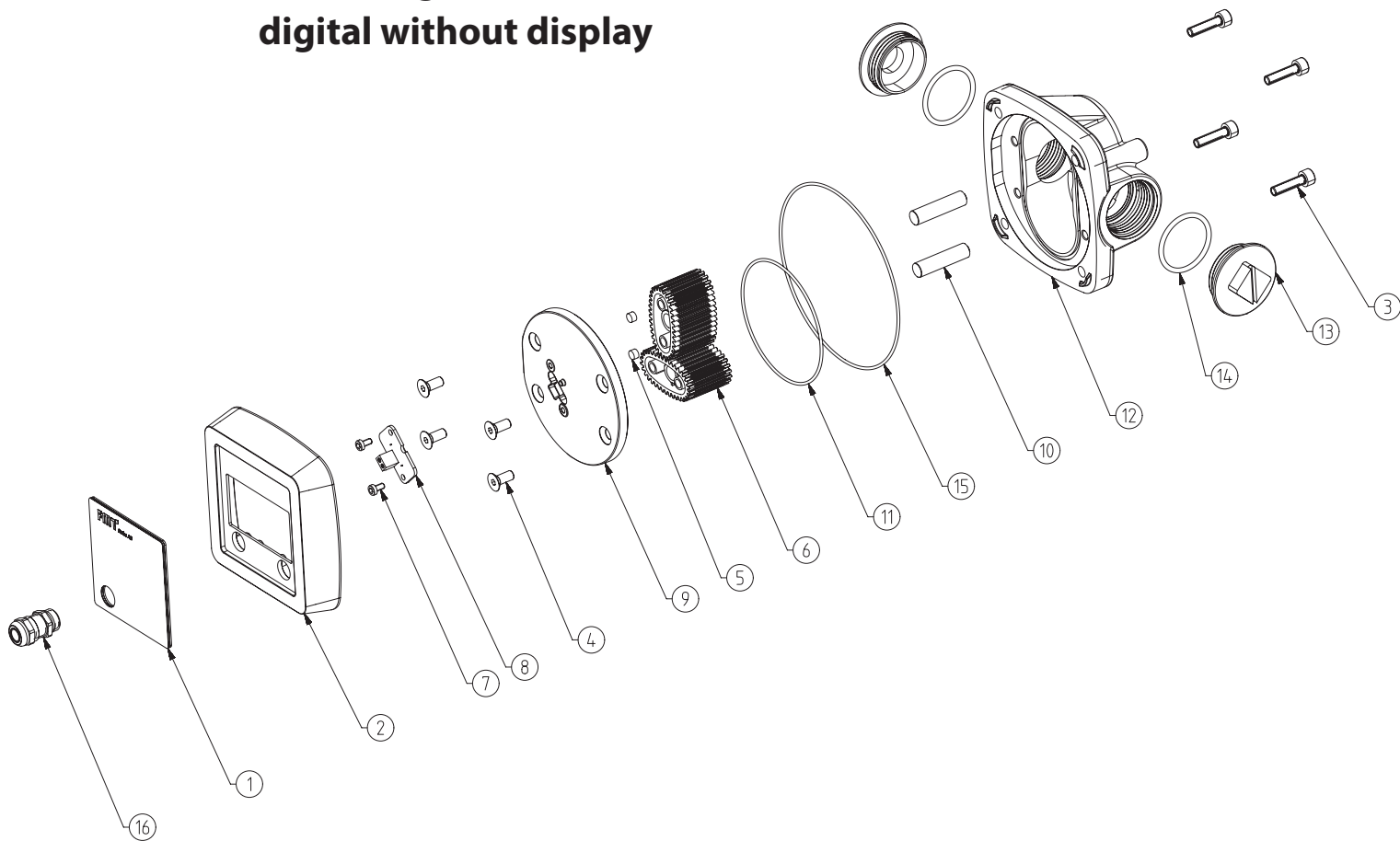


Fig. 16-1: Exploded view pulse meter and oval gear meter – digital without display

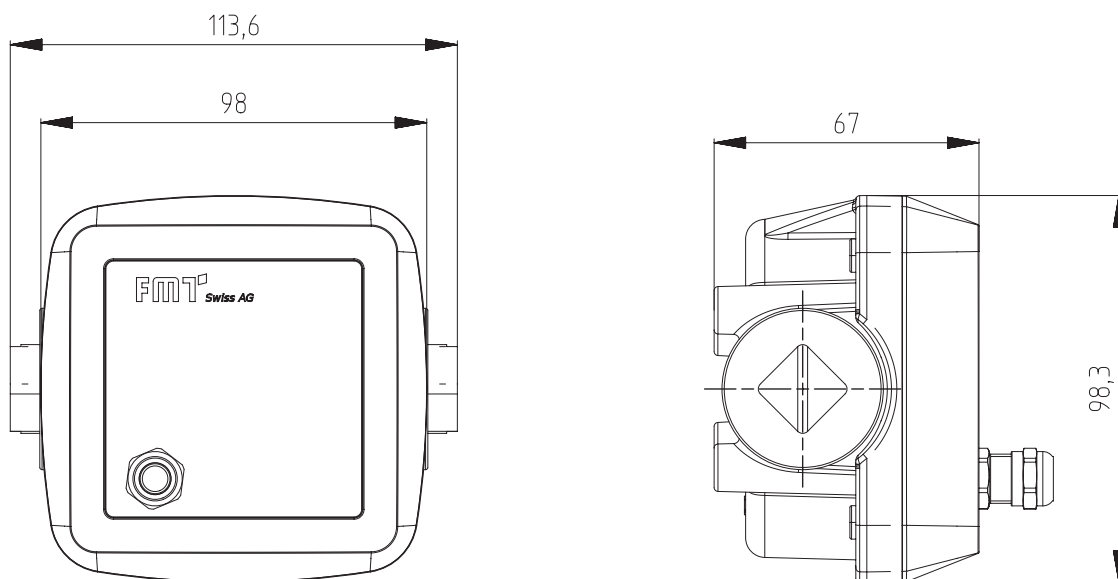


Fig. 16-2: Mounting dimensions pulse meter and oval gear meter – digital without display (in mm)

Item	Quantity	Designation
1	1	Protective display film, FMT
2	1	Housing cover-zinc
3	4	Self-tapping screw M5 x 20
4	4	Countersunk screw M5 x 12
5	2	Disc magnet 5 x 3 mm
6	2	Oval gear
7	2	Self-tapping screw M3 x 6
8	1	Sensor carrier board
9	1	Intermediate cover
10	2	Straight pin 8 m-6 x 34 mm
11	1	O-ring NBR 70-68 x 1,5
12	1	Housing, lower part
13	2	Screw plug, black
14	2	O-ring NBR 70-29 x 2,5
15	1	O-ring NBR 70-105 x 1,5
16	1	Cable gland M12 x 1,5

Tab. 16-1: Overview of the individual parts of fig. 16-1

17. Exploded view and mounting dimensions pulse meter and oval gear meter – digital with display

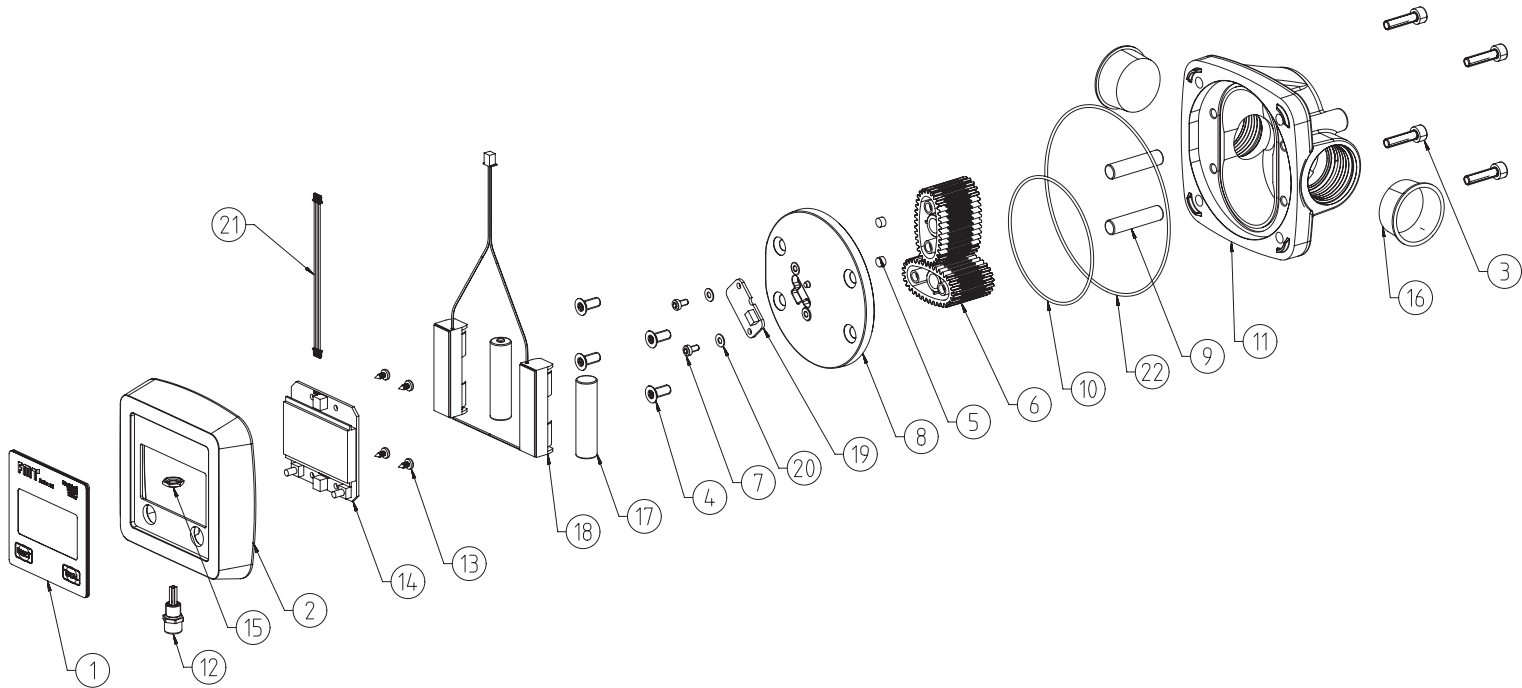


Fig. 17-1: Exploded view and mounting dimensions - digital with display

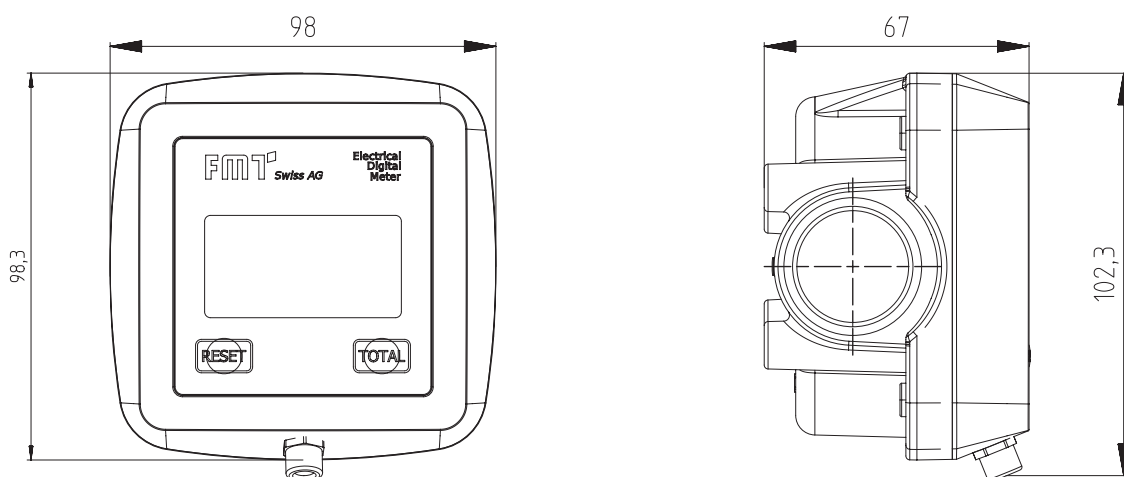


Fig. 17-2: Mounting dimensions pulse meter and oval gear meter - digital with display (in mm)

Item	Quantity	Designation
1	1	Protective display film, FMT
2	1	Housing cover-zinc
3	4	Self-tapping screw M5x20
4	4	Self-tapping screw M5x12
5	2	Disc magnet 5x3 mm
6	2	Oval gear
7	2	Self-tapping screw M3x6
8	1	Intermediate cover
9	2	Bearing bolt 8x34
10	1	O-ring NBR 70-68x1,5
11	1	Housing, lower part
12	1	Plug, M8 socket, 4-pin
13	4	Self-tapping screw 2,9x6,5
14	1	Board
15	1	Counter nut
16	2	KAPSTO taper plug
17	2	Battery AAA
18	1	Battery box
19	1	Hall sensor-carrier board
20	2	Washer D3,2mm-DIN125
21	1	Connection cable
22	1	O-ring NBR 70-105x1,5

Tab. 17-1: Overview of the individual parts of fig. 17-1

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