

# CONTOIL®

VZF3 / VZFA3, DN 15 - 50

## Table of Contents

|          |                                                                                  |           |
|----------|----------------------------------------------------------------------------------|-----------|
| <b>1</b> | <b>Safety.....</b>                                                               | <b>3</b>  |
| 1.1      | Intended use.....                                                                | 3         |
| 1.2      | Safety information and symbols.....                                              | 3         |
| 1.3      | Safety rules and precautions.....                                                | 4         |
| <b>2</b> | <b>Scope of delivery and accessories.....</b>                                    | <b>4</b>  |
| <b>3</b> | <b>Product description .....</b>                                                 | <b>4</b>  |
| 3.1      | Application .....                                                                | 4         |
| 3.2      | Device components .....                                                          | 5         |
| <b>4</b> | <b>Installation .....</b>                                                        | <b>6</b>  |
| 4.1      | Mechanical Installation.....                                                     | 6         |
| 4.2      | Preparing for installation .....                                                 | 7         |
| 4.3      | Installing the measuring system in the pipe .....                                | 12        |
| 4.4      | Electrical Installation.....                                                     | 14        |
| <b>5</b> | <b>Commissioning.....</b>                                                        | <b>16</b> |
| 5.1      | Display .....                                                                    | 16        |
| 5.2      | Adjustment of settings .....                                                     | 16        |
| 5.3      | Compensation to Standard Volume and Mass Flow Calculation .....                  | 17        |
| 5.4      | Counter values for CE-MID .....                                                  | 17        |
| 5.5      | Engineering notes .....                                                          | 18        |
| 5.6      | Factory settings .....                                                           | 18        |
| 5.7      | Menu and setting navigation.....                                                 | 19        |
| 5.8      | General overview of Menu structure.....                                          | 20        |
| 5.9      | Counters and instant values .....                                                | 21        |
| 5.10     | Information, operating hours and billing .....                                   | 22        |
| 5.11     | Loggers, unlock and logbook .....                                                | 23        |
| 5.12     | Output settings: Pulse; frequency and status .....                               | 24        |
| 5.13     | Output settings: Analog and Modbus communication .....                           | 26        |
| 5.14     | Units.....                                                                       | 27        |
| 5.15     | Configuration .....                                                              | 28        |
| 5.16     | System settings and System information.....                                      | 29        |
| 5.17     | Startup and commissioning of mechanical part of the flow measuring system: ..... | 30        |
| <b>6</b> | <b>Maintenance and Repair .....</b>                                              | <b>31</b> |
| 6.1      | Calibration .....                                                                | 31        |
| 6.2      | Service maintenance.....                                                         | 31        |
| 6.3      | Spare parts .....                                                                | 33        |
| <b>7</b> | <b>Troubleshooting and error messages.....</b>                                   | <b>34</b> |
| 7.1      | Troubleshooting.....                                                             | 34        |
| 7.2      | Alarm messages .....                                                             | 35        |
| 7.3      | Error messages .....                                                             | 36        |
| <b>8</b> | <b>Decommissioning, dismantling and disposal .....</b>                           | <b>37</b> |

|           |                                             |           |
|-----------|---------------------------------------------|-----------|
| 8.1       | Decommissioning.....                        | 37        |
| 8.2       | Dismantling.....                            | 37        |
| 8.3       | Disposal.....                               | 37        |
| 8.4       | Returning devices / decontamination .....   | 38        |
| <b>9</b>  | <b>Technical Data.....</b>                  | <b>39</b> |
| 9.1       | Model code.....                             | 39        |
| 9.2       | Hydraulic characteristics .....             | 40        |
| 9.3       | Electronic characteristics.....             | 41        |
| 9.4       | Output and communication types.....         | 42        |
| <b>10</b> | <b>Appendix .....</b>                       | <b>46</b> |
| 10.1      | Dimensional drawings .....                  | 46        |
| 10.2      | Modbus address list .....                   | 47        |
| 10.3      | Default Settings list.....                  | 50        |
| <b>11</b> | <b>Certificates.....</b>                    | <b>53</b> |
| 11.1      | EU Type examination certificate MI005 ..... | 53        |

### About this Operating Manual

The manufacturer reserves the right to make changes to technical data without prior notice. The latest information and versions of this operating manual can be obtained from your local dealer or found on our website: <https://www.aquametro.com>

For smart devices, scan the QR code on the following page.



#### WARNING

The manufacturer assumes no liability if the instructions and procedures described in this manual are not followed!



#### NOTICE

This installation manual is intended for qualified personnel and therefore does not include basic working steps. Before operating the equipment or system, this installation and operating manual must be completely read and understood. Please retain this manual for future reference!



#### NOTE

This manual is valid for CONTOIL® VZF3

Hardware-Version: 01.03

Firmware Version: 01.00.00

Manual: 4355e\_contoil\_vzf3\_2608.docm

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# 1 Safety

## 1.1 Intended use

The device CONTOIL® VZF3 is designed and intended exclusively for the measurement of flow and consumption of diesel, heavy oil, and lubrication oil.

Any improper or non-intended use may compromise operational reliability. The manufacturer accepts no liability for personal injury or material damage resulting from such use.

## 1.2 Safety information and symbols

The device is designed to meet the latest safety requirements. It has been tested and delivered in a condition that ensures safe operation. Improper or non-intended use of the device may, however, pose a risk. Therefore, pay particular attention to the safety instructions in this manual. These instructions are identified by the following symbols:



### **WARNING**

**WARNING** indicates a hazardous situation which, if not avoided, could result in death or serious injury.



### **CAUTION**

**CAUTION** indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



### **NOTICE**

**NOTICE** indicates a hazardous situation which, if not avoided, could result in property damage.



### **NOTE**

**NOTE** indicates helpful tips and recommendations, as well as information for efficient and trouble-free operation.



See technical brochure or  
mounting and operating manual  
Download via QR code or click, on our website



get PDF

### 1.3 Safety rules and precautions

The manufacturer accepts no liability if the following safety rules and precautions are disregarded:

- » Any modifications to the device carried out without the prior written consent of the manufacturer shall result in the immediate termination of product liability and warranty.
- » Installation, operation, maintenance, and decommissioning of this device must be carried out only by trained and qualified specialists authorized by the manufacturer, operator, or owner of the facility. Such specialists must have read and understood this entire installation and operating manual and must comply with all instructions contained herein.
- » Check the supply voltage and the information on the type plate before installing the device.
- » Check all connections, settings, and technical specifications of any peripheral devices.
- » Do not open the housing or any parts of the housing containing electrical or electronic components before the electrical power supply has been switched off.
- » Do not touch any electronic components (ESD-sensitive components).
- » Never exceed the specified classifications for mechanical and electrical loads (e.g. pressure, temperature, ingress protection (IP), voltage).
- » Before carrying out any work on mechanical components of the system, release the pressure in the piping system and reduce the temperature of the medium to a level that is safe for humans.
- » None of the information contained in this manual or in any other documents shall relieve planners, engineers, installers, or operators of their responsibility to carry out a careful and comprehensive assessment of the respective system configuration with regard to functional capability and operational safety.
- » Local labor, safety, and accident-prevention laws and regulations must be observed.

## 2 Scope of delivery and accessories

The scope of delivery is specified in the delivery note. Please check all delivered components and parts immediately upon receipt of the goods. Any transport damage must be reported immediately upon receipt.

- » CONTOIL® VZF3 flow measuring system
- » Quick instructions - full Mounting and Operating instructions as download (this document)

## 3 Product description

This manual describes a high-quality flow measuring system designed for reliable operation in demanding environments.

### 3.1 Application

The CONTOIL® VZF3 is designed for fuel flow and consumption measurement in industrial and marine applications. It can be used either as a single unit for direct measurement or as part of a differential measurement system.

### 3.2 Device components

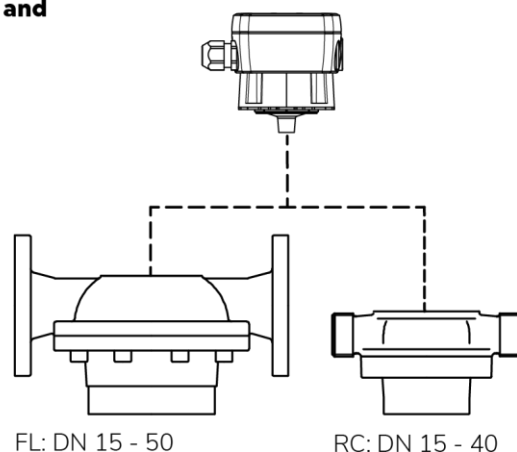
CONTOIL® VZF3 consists of a long-proven hydraulic unit, a coupling with an integrated temperature sensor, and a state-of-the-art electronic display unit with advanced sensor technology.

The hydraulic unit determines the nominal size of the flow meter.

All flow meters are calibrated before leaving the factory. However, for optimal accuracy in differential measurement applications, it is recommended to use CONTOIL® VZFA3 flow meters that are factory-paired or provided with special linearized calibration.

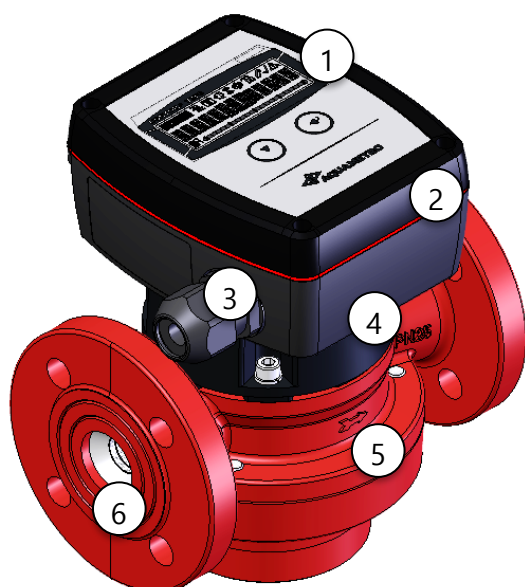
#### Display unit with coupling and temperature sensor

#### Hydraulic



For details, see the dimensional drawings in section 10.1 on page 46.

### CONTOIL® flow measuring system VZF3



1. Display with operating elements
2. Electronic housing
3. Cable entry (switchable left /right)
4. Coupling with temperature sensor
5. Hydraulic part with flow direction
6. Pipe connection flange or thread

## 4 Installation

### CAUTION



Material damage caused by neglected ambient/environment conditions.

Danger of malfunction or damage!

Assuring accessibility for installation, operation, and maintenance.

Mount to rigid object to avoid excessive vibrations.

### CAUTION



The surfaces of the device and the medium may be hot.

Risk of burns!

Carry out work only on cooled systems.

Work may only be performed by authorized specialists in accordance with the applicable regulations.

Use appropriate protective equipment.

### WARNING



The pipe and the device may be under pressure.

Risk of severe injury!

Carry out work only on non-pressurized systems.

When working on the device watch out for leaking medium.

Work may only be performed by authorized specialists in accordance with the applicable regulations.

Use appropriate protective equipment, particularly safety goggles.

### 4.1 Mechanical Installation

Identify the flow measuring system and ensure that it is suitable for the intended process conditions. Easy access for reading the flow measuring system and for controlling ancillary equipment must be ensured.

#### 4.1.1 Correct layout of flow measuring system and accessories

If the flow measuring system is used with media viscosities higher than 5 mPa·s, or if it is installed on the suction side of a pump, the resulting pressure loss and the achievable flow rate must be determined using the pressure loss curves provided in the CONTOIL® Technical Information. In addition, any pressure loss caused by installed filters must be taken into consideration.

Select the flow meter and ancillary equipment according to the following operating conditions:

- » Flow meters must be selected based on the maximum flow rate, not on the pipe diameter.  
If necessary, adapt the pipeline accordingly.
- » Flow rate: maximum expected application flow rate (= maximum continuous flow rate of the flow meter,  $Q_{cont}$ ).
- » Material compatibility with the medium.
- » Operating pressure and operating temperature.
- » Ambient temperature.

**NOTE**

Magnetic fields

Keep away from magnetic disturbances.

**NOTE**

Inclusions of air, foam or gas

Check piping layout.

Avoid installation in the highest point of the piping system.

Ensure that the measuring system is always filled with liquid.

Installation of bypass recommended.

Make sure that no hazardous fumes can accumulate in the piping or in the flow measuring system during commissioning, decommissioning, or dismantling.

During operation, the flow measuring system must always be completely filled with liquid.

Check the flow measuring system periodically for tightness of all connections and for proper functioning.

Before carrying out any work on the installation, observe the following safety measures:

- » Release the pressure in the installation if hazardous liquids are used.
- » Wear suitable protective clothing and safety goggles.
- » Place a collecting tray underneath the installation.

## 4.2 Preparing for installation

Check the flow measuring system and all installation materials before installation.

Compare the data on the flow measuring system name plate with the expected maximum operating conditions of the installation. These values must not exceed the specifications of the flow measuring system:

- » Maximum flow rate ( $Q_{\max}$ , l/h) – recommended maximum continuous flow rate ( $Q_{\text{cont}}$ )
- » Maximum operating pressure ( $P_N$ , bar)
- » Maximum operating temperature ( $^{\circ}\text{C}$ )
- » Suitable connections and seals (gaskets)
- » Fasteners for mounting the flow measuring system
- » Material compatibility and temperature resistance of the flow measuring system with respect to the measured liquid

### Required Tools



Torx T15



Flat screwdriver 3.5 mm



Allen keys 3 – 14 mm



Wrench 10 – 30 mm

**NOTE**

Select the flow measuring system and ancillary equipment according to the operating conditions listed below:



Flow rate: maximum expected application flow rate = maximum continuous flow rate of the flow measuring system ( $Q_{cont}$ ).  $Q_{cont}$  must not be exceeded.

Material compatibility with the medium.

Operating pressure and operating temperature.

Ambient temperature.

The flow measuring system must be selected based on the maximum application flow rate and not on the pipe diameter. If necessary, adapt the pipework accordingly.

Install non-return valves downstream of the flow measuring system if reverse flow may occur.

**NOTICE**

Pulsations / contamination



Risk of damage or malfunction of the flow measuring system.

Avoid flow pulsations.

Install a suitable pulsation reducer if required.

Prevent contamination by dirt particles or welding spatter.

Install a sufficiently fine filter upstream of the flow measuring system.

**CAUTION**

Risk of injury!



Unauthorized start-up during mounting.

Ensure that unauthorized start-up is not possible during mounting.

Comply with all applicable work safety regulations when carrying out any work on the system.

**NOTE**

Modifying an existing system



Take the flow measuring system out of operation before flushing the system to remove debris.

Refer to the flushing instructions on page 11.

**NOTE**

The piping layout must ensure that the flow meter is always completely filled with liquid and that no inclusions of air, foam, or gas can occur.

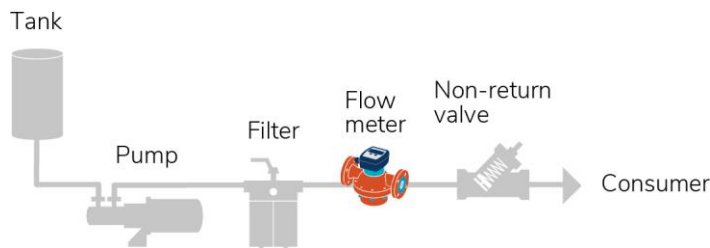
Aquametro recommends installing bypass valves.



The flow meter must register the quantities of all consumers.

#### 4.2.1 Non-Return-Valves

To prevent backflow and draining, non-return valves must be installed downstream of the flow meter. Backflow and draining can lead to incorrect measurements and may damage the flow meter.



Pressure shocks during operation of the flow meter must be avoided.

#### 4.2.2 Dirt filter, Safety filter

Install suitable filters upstream of the flow meter to protect it from damage caused by impurities in the oil.

##### Maximum mesh width for filters

| Size  | Flow meter type |          |
|-------|-----------------|----------|
|       | VZx             | VZxA     |
| DN 15 | 0.250 mm        | 0.100 mm |
| DN 20 | 0.400 mm        | 0.100 mm |
| DN 25 | 0.400 mm        | 0.250 mm |
| DN 40 | 0.600 mm        | 0.250 mm |
| DN 50 | 0.600 mm        | 0.250 mm |

##### NOTICE



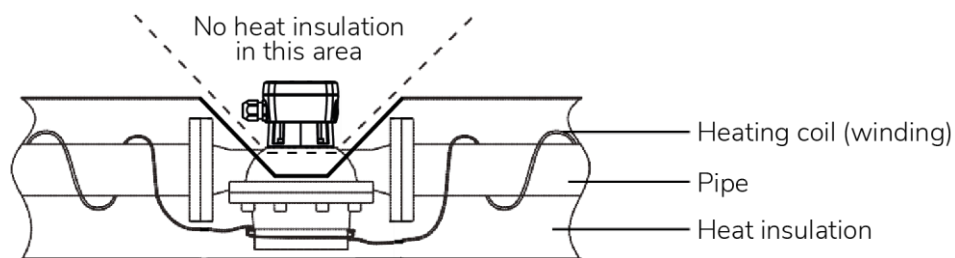
The filter mounted in the flow meter inlet is only a safety filter and cannot act as a dirt filter.

Risk of malfunction or damage.

If the medium contains dirt, always have a dirt filter installed upstream of the flow meter.

#### 4.2.3 Heat insulation

The display unit must not be insulated. Insulation may cause the permitted temperature range to be exceeded.



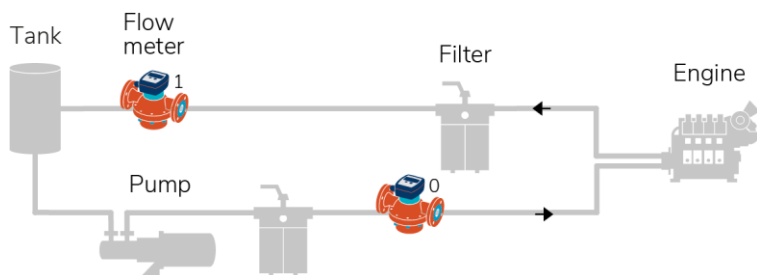
The permitted temperature ranges for the flow meter must be observed!

#### 4.2.4 Special requirements - differential measurements

For differential measurements, one flow meter is installed in the supply line and one in the return line. The difference between the measured flow rates determines the consumption.

If ordered with the "differential measurement" option, CONTOIL® VZFA3 flow meters are factory-calibrated according to the specified supply and return flow volumes. The flow meters are labeled "SUPPLY" (0) and "RETURN" (1).

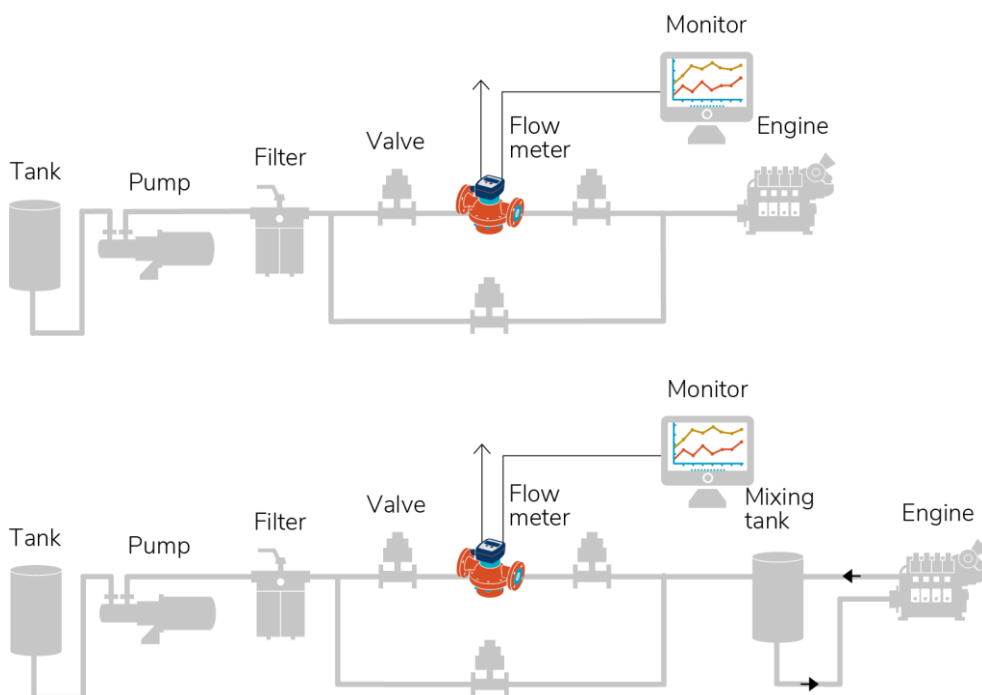
Ensure that each flow meter is installed in the correct pipeline: the SUPPLY flow meter must be installed in the supply line, and the RETURN flow meter must be installed in the return line.



#### 4.2.5 Special requirements - ships

On ships, it is important to ensure that the engine can continue to operate at full power even in the event of heavy filter contamination or flow meter failure.

A pressure switch can be used to activate the bypass and signal the need for maintenance. The engine will continue to operate, but consumption measurements will not be recorded while the bypass is active.

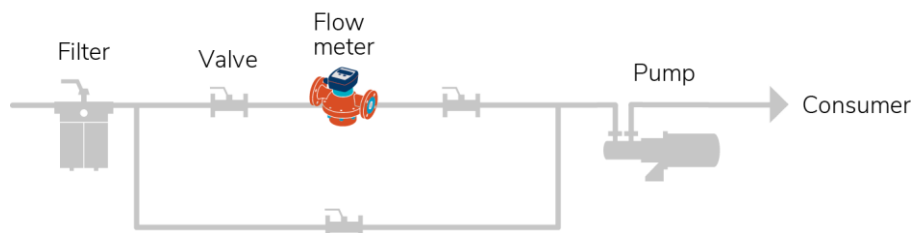


#### NOTICE

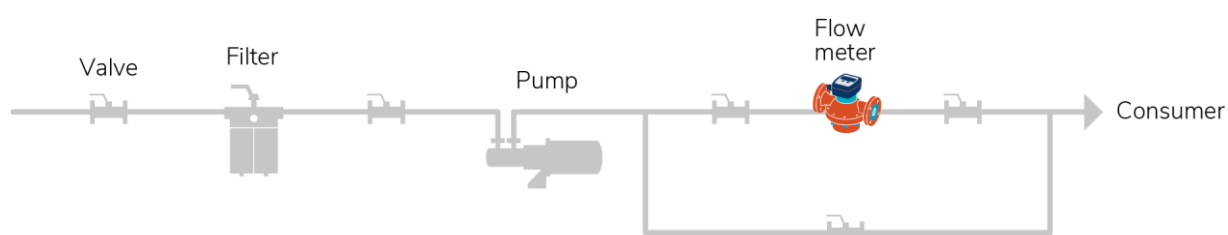
Ship classification societies require the installation of bypass pipes. The relevant regulations must be followed.

#### 4.2.6 Installation of the flow meter on the suction side of a pump

If the flow meter is installed on the suction side of a pump, precautions must be taken to prevent air intake or foam formation.

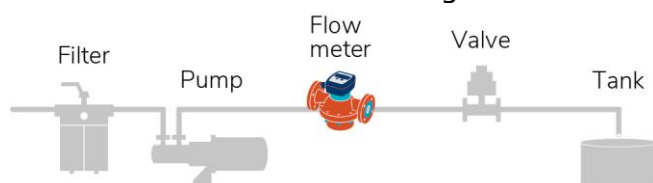


#### 4.2.7 Installation of the flow meter on the pressure side of a pump



#### 4.2.8 Special requirements - filling and dosing units

For filling and dosing, the valve must be fitted between flow meter and discharge. The shorter the pipe section between valve and discharge, the higher the accuracy. Avoid water hammer if fast closing valve is installed.



#### 4.2.9 Flushing of pipes

If the pipes are to be flushed at a later stage, stop valves shall be provided on both sides of the flow measuring system.

##### NOTICE

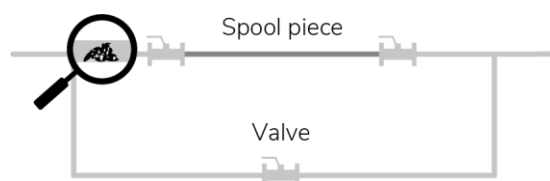


Damage or malfunction of flow measuring system.

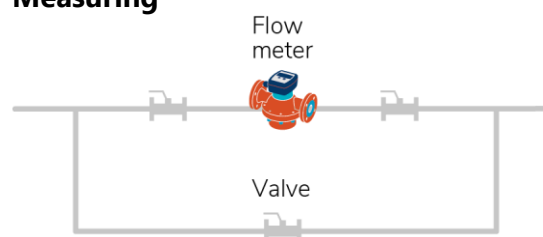
Accumulation of debris.

Replace the flow measuring system with a spool piece.  
Ensure of no dirt accumulation in front of the valve.

##### Flushing



##### Measuring



#### 4.2.10 Trial operation

Start trial operation without the flow measuring system installed. Open the stop valves slowly during this process.

- » Carry out a pressure test prior to installing the flow measuring system.
- » Check all bolts and connections for leaks and tightness.
- » Flush the pipework until it is clean (flow measuring system must be out of the pipeline).
- » Release the pressure and stop the system.

This trial operation ensures that all pipework is tight, clean, and free of foreign matter that could damage the flow measuring system.

#### 4.3 Installing the measuring system in the pipe

- » Remove the protective plugs or caps from the flow meter (inlet and outlet).
- » Insert the flow measuring system into the pipeline in the prescribed position, ensuring that the arrow on the housing aligns with the direction of flow.
- » Install mating flanges parallel to the pipe and without introducing any tension.

Provided that the arrow on the housing is aligned with the flow direction, the flow measuring system can be installed in any orientation without special modifications.

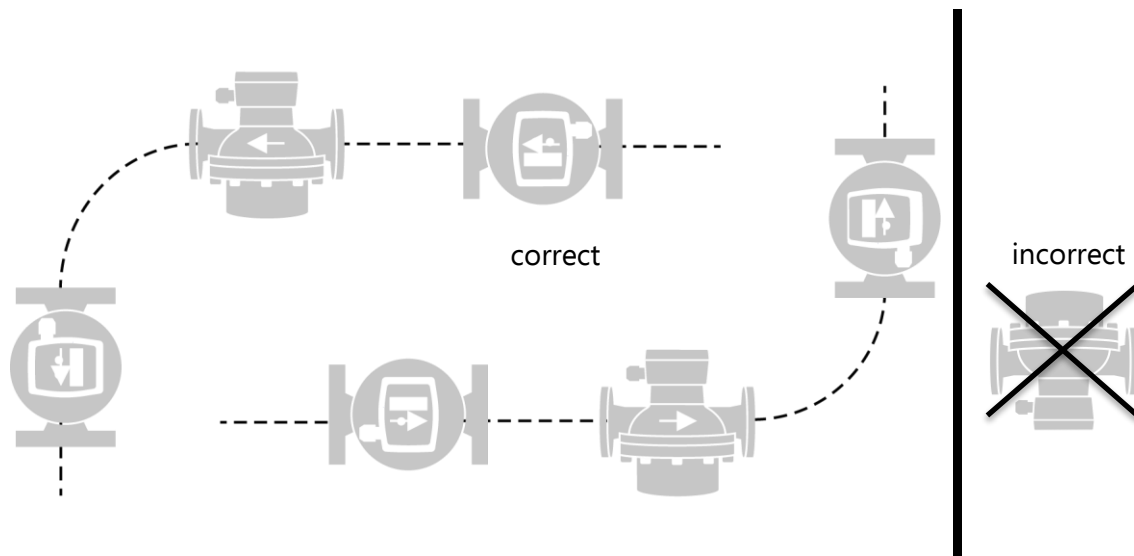
Flow conditioners are not required.



#### NOTE

Exception

Do not install it upside down.



#### NOTE

The electronic display unit can be rotated in 90 degrees steps (90° CCW and 90°/180° CW), to the installed position. See Electrical Installation, page 14.

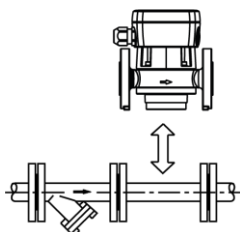
**NOTICE**

Mechanical connection of flow meter into the pipe systems.

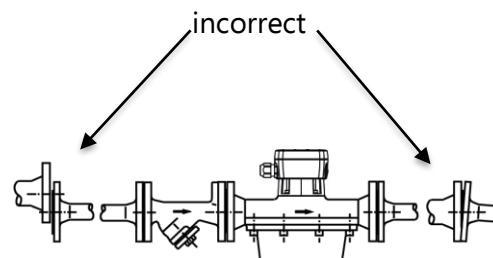
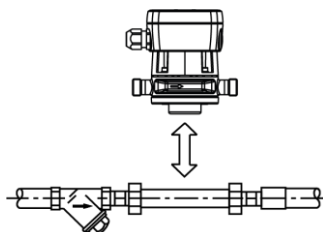
Risk of leakage!

Always use appropriate sealing material as per connection type.

Meter with  
flanged ends



Meter with  
threaded ends



For pipes made of copper or thin-walled steel pipes, the flow meter requires additional fastening.  
Use appropriate fasteners.

**WARNING**

Risk of severe injury!

Risk of substantial property damage!



Leakage or rupture due to connections being made using force.

Never attempt to overcome misalignments (lateral, angular, longitudinal, torsional) using force.

Make sure the piping are flexible enough, if not: use compensators.

Consider the effects of thermal contraction and expansion.

**NOTICE**

Risk of leakage

Fuel sprays!

Always use appropriate sealing materials as per connection type.

## 4.4 Electrical Installation

### WARNING

Risk of malfunction or damage



Injuries due to electrical power or systems!

Ensure that the system is safe to work.

Follow local safety guidelines.

Review of technical data, chapter 9.

### NOTE



The electronic display unit can be rotated in 90° steps (90° ccw and 90°/180° cw), to the installed position.

Loosen the screws until the unit can be rotated.

The housing does NOT need to be removed (lifted off).



90° CCW



90° CW



180° CW

### 4.4.1 Cable connection

#### NOTE

Power supply



Wire size for terminal 1-6 is: 0.75...1.5 mm<sup>2</sup> / 20...16 AWG.

Supply voltage: VDC 12 - 24; check polarity

Connection to an uninterruptable power supply is recommended.

» Use an uninterruptable power supply for CE-MID applications.

#### NOTE

Cable and cable entries



Up to two cable entries may be used if required.

Use a suitable cable gland.

Recommended max. cable length for power and communication: ≤500 m.

For cable lengths exceeding this value, use a larger conductor cross-section.

#### Cable gland

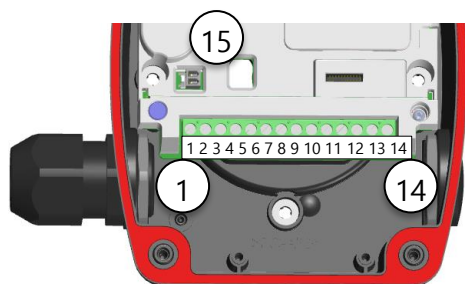
» Strain relief: Type A according to EN 62444

» Thread: M25x1.5

» Clamping range: 10 - 17 mm

» Key width: 29 mm

#### 4.4.2 Cabel terminals



- |                   |                        |
|-------------------|------------------------|
| 1. Supply -       | 9. Analog output +     |
| 2. Supply +       | 10. Analog output -    |
| 3. RS485 a        | 11. Plug-in module CH1 |
| 4. RS485 b        | 12. Plug-in module CH1 |
| 5. Relay output 1 | 13. Plug-in module CH2 |
| 6. Relay output 1 | 14. Plug-in module CH2 |
| 7. Relay output 2 |                        |
| 8. Relay output 2 | 15. Temperature sensor |

» No shield connection available

#### NOTICE



Electrical connection of the Pt1000 temperature sensor.

Risk of malfunction or damage!

Route the cable through the designated opening and ensure that the cable is not pinched when mounting the electronic display unit onto the coupling.



#### NOTE

Tighten bolts of electronic display housing with 2 Nm of torque to the coupling.

#### 4.4.3 Interfaces

The device provides multiple configurable output functions:

##### Relay outputs (potential-free)

Two relay outputs are available and can be configured as follows:

Pulse output for connection to external totalizers or monitoring systems.

Frequency output for flow rate indication.

Limit switch with programmable high and low flow rate thresholds (NO / NC).

Status output for signaling errors, alarms, or supply voltage status (NO / NC).

##### Analog output

One electrically isolated, passive 4–20 mA current output.

##### Serial communication

One electrically isolated RS-485 serial interface (Modbus RTU).

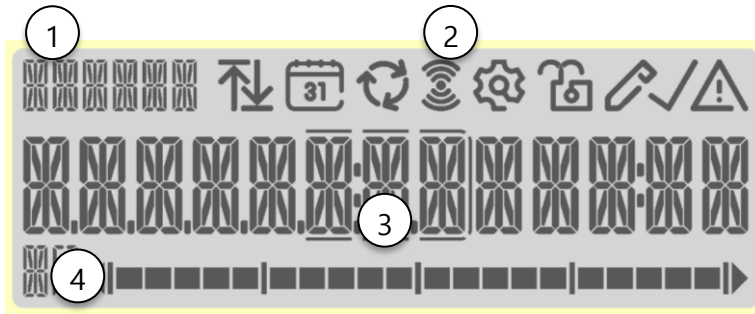
##### Expansion

One spare plug-in board slot.

For details on interface types see technical data, section 9.4 on page 42.

## 5 Commissioning

### 5.1 Display



1. Menu identification info (level 2 and 3)
2. Status indication symbols
3. Main display with units
4. Bar graph and identifier

#### Symbols of status display

|  |                           |                                                    |
|--|---------------------------|----------------------------------------------------|
|  | Arrow up / down           | Limit switch, min/max<br>Event in / event out      |
|  | Calendar icon             | Visible at log data display and with option CE-MID |
|  | Rotating arrows           | Indicates flow                                     |
|  | Radio signal              | Communication active                               |
|  | Settings                  | Indicates in settings mode                         |
|  | Editing locked / unlocked | Indicates lock status                              |
|  | Pencil                    | Indicates field editing mode                       |
|  | Checkmark                 | Confirmation of editing                            |
|  | Caution                   | Alarm or Error indication                          |
|  | Flow bar                  | Indicates % of signal incl min/max value           |

In the event of an alarm or error, the display flashes red.  
The flashing pattern identifies the active condition.

Alarm pattern:

Error pattern:

### 5.2 Adjustment of settings

#### NOTE



Modification of settings

Changing operating settings may lead to incorrect or invalid measurement results.  
Always consult and follow this manual when adjusting operating parameters.

### 5.3 Compensation to Standard Volume and Mass Flow Calculation

Temperature compensation for standard volume and mass flow calculation can be enabled or disabled via the configuration menu. When compensation is enabled, additional display and output parameters become available.

When compensation is active, the measured liquid volume is corrected for thermal expansion using the actual measured temperature and normalized to the reference temperature of 15 °C (base condition). The standardized volume at 15 °C is used as the basis for mass and mass flow calculation. Compensation calculations are performed in accordance with DIN 51757.

**Menu:** CONFIG > COMP > DOUBLE OIL or SINGLE OIL see section 5.15 on page 28.

#### Effect on Outputs:

When compensation is enabled, additional calculated process variables, including standardized volume and mass, become available.

#### The following output functions are available:

##### Pulse output

Provides pulses proportional to either measured volume, standardized volume, or mass for external totalizers.

##### Frequency output

Output frequency is proportional to the selected flow variable, such as measured volume flow, standardized volume flow, or mass flow.

##### Analog current output

Output current is proportional to the selected process variable, such as measured volume flow, standardized volume flow, mass flow, or measured liquid temperature.



#### NOTE

Visibility of Counters and Settings

Counters, parameters, and settings related to temperature compensation and mass calculation are only visible and active when compensation is enabled.

### 5.4 Counter values for CE-MID



#### NOTICE

For measurements subject to CE-MID (2014/32/EU)

Only the volume counter values shall be used.

All other displayed or transmitted values are not CE-MID compliant.

## 5.5 Engineering notes

Parameterizing ancillary devices.

Some ancillary devices require the configuration of pulse values or frequency parameters (refer to the relevant operating instructions).

The maximum permissible frequency is calculated using the following formula:

$$\frac{\text{max. flow rate in liters/hour}}{\text{pulse value in liters} \times 3600} = \text{frequency in Hz} \leq 200\text{Hz}$$

Examples:

$$\frac{140 \text{ l/h}}{0.01 \text{ l/p} \times 3600} = 3.88 \text{ Hz} \quad \frac{400 \text{ l/h}}{0.05 \text{ l/p} \times 3600} = 2.22 \text{ Hz}$$

### NOTICE

GND to PE fault



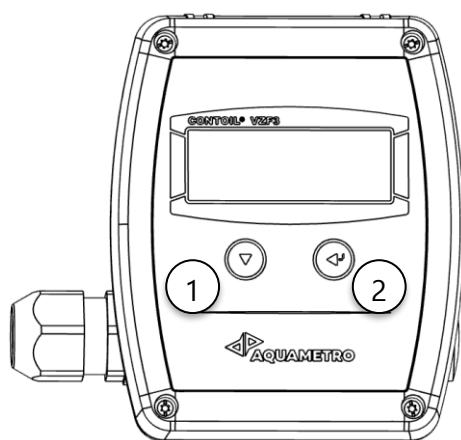
May lead to malfunction or damage!

The device is not protected against GND to PE fault connections.  
Incorrect grounding may lead to malfunction or damage.

## 5.6 Factory settings

| Type       |             |                | VZF3 DN15 | VZF3 DN20-50 |
|------------|-------------|----------------|-----------|--------------|
| Output1&2: | Function    | FCT            | IMPULSE   | IMPULSE      |
|            | Signal      | SIGNAL         | VOLUME    | VOLUME       |
|            | Pulse value | UPP      ltr/p | 0.1       | 1            |
|            | Pulse width | MS      ms     | 20        | 20           |
| Analog     | Function    | Fct            | 4-20mA    | 4-20mA       |
| RS485:     | Modbus RTU  | Address        | 1         |              |
|            |             | Baud rate      | 38400     |              |
|            |             | Parity         | EVEN      |              |
|            |             | Stop bit       | 1         |              |

## 5.7 Menu and setting navigation



1. Scroll button

2. Enter button

| Menu level 1                                                                      | Menu level 2                                                                          | Menu level 3 |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--------------|
| COUNTER                                                                           | ◀ -                                                                                   | ◀ -          |
|  | Volume                                                                                |              |
|  | Enter to next Menu level.                                                             |              |
|  | Scroll to next Menu item.                                                             |              |
|                                                                                   | At the end of the menu items, the display returns to the previous (upper) menu level. |              |
|                                                                                   | Menu items are dynamic and may vary depending on the device configuration.            |              |

Use Scroll button to navigate through the menu and change field values.

Use Enter button to enter submenus and to edit or confirm field entries.

» **Backwards scroll:** Press and hold the Enter button, then use the Scroll button to navigate backwards.

» **Return to “home” screen** (totalizer volume): Press and hold the Scroll button, then press the Enter button once.

All menus and parameters can be viewed without entering a user code. To modify parameters, the device must first be unlocked using the user code.

### Unlock procedure:

1. Scroll to the menu item “UNLOCK” and press Enter to select.
  2. Press Enter again to edit; the pencil icon ( ) will appear, and the first digit will start flashing. This indicates the device is ready for user code entry (default: 00001111).
  3. Enter each digit using the Scroll button and confirm each with the Enter button. Continue until all code digits are entered. At the end of the procedure, a confirmation icon ( ) will be displayed. The flow measuring system is now unlocked and in edit mode.
- » If no button is pressed within 15 minutes, the device returns to the home screen and relocks. Any incomplete entries that were not confirmed with the Enter button are rejected.

### Reset of sub totalizers [TRIP-COUNTER]

To reset all trip counters, the device must be unlocked.

Navigate to “TRIP COUNTER”, scroll to “CANCEL” press Enter, scroll to select “RESET”, and press Enter. All trip counters will be reset.

Changing the decimal point is performed as the last character in the entry sequence. It is indicated by a flashing underline, the same as all other characters.

### Factory calibration:

To guarantee accurate measurement, the electronic module of the flow measuring system is calibrated at the factory. The nominal size and the exact correction factor for the measuring chamber volume are entered during calibration. These parameters are generally not editable after factory calibration.

These parameters usually cannot be changed again.

At the end of the menu items, the display returns to the previous (upper) menu level.

Menu items are dynamic and may vary depending on the device configuration.

## 5.8 General overview of Menu structure

| Menu level 1        | Menu level 2         | Menu level 3 | Description                                 | el |
|---------------------|----------------------|--------------|---------------------------------------------|----|
| <b>COUNTER</b>      |                      |              | Counter values (totalizers)                 |    |
| <b>TRIP-COUNTER</b> |                      |              | Trip counter (subtotals)                    |    |
| <b>INSTANT</b>      |                      |              | Instantaneous values                        |    |
| <b>INFO</b>         |                      |              | Only visible if an alarm or error is active |    |
| <b>OP-HOURS</b>     |                      |              | Operating hour information                  |    |
| <b>BILLING</b>      | <b>option -xx-xC</b> |              | Only visible with option CE-MID005          |    |
| <b>LOGGER</b>       |                      |              | Logger values                               |    |
| <b>UNLOCK</b>       |                      |              | Code to unlock and edit values              |    |
| <b>LOG-BOOK</b>     |                      |              | Only visible with user code                 |    |
| <b>P-OUT</b>        |                      |              | Digital pulse outputs (counting signal)     |    |
| <b>F-OUT</b>        |                      |              | Digital frequency outputs (flow signal)     |    |
| <b>S-OUT</b>        |                      |              | Status outputs (limits & alarms)            |    |
| <b>I-OUT</b>        |                      |              | Analog outputs                              |    |
| <b>MODBUS</b>       |                      |              | Serial bus communication                    |    |
| <b>Option Card</b>  |                      |              | Plug-in card                                |    |
| <b>UNITS</b>        |                      |              | Units                                       |    |
| <b>CONFIG</b>       |                      |              | System configuration                        |    |
| <b>SYSTEM</b>       |                      |              | System settings                             |    |
| <b>SYSTEM-INFO</b>  |                      |              | System information                          |    |
| <b>DISPLAYTEST</b>  |                      |              | Displays all characters on the display      |    |

Some menu items are only visible depending on preset conditions (e.g. compensation enabled or disabled).

These menu items are only available if option CE-MID005 has been ordered.

| Access / edit level           | el |
|-------------------------------|----|
| None                          | 0  |
| User                          | 1  |
| User (without option "C" MID) | 2  |
| Supervisor / manager          | 3  |
| Service technician            | 4  |
| Production                    | 5  |
| No edit, read only            |    |

## 5.9 Counters and instant values

| Menu level 1        | Menu level 2 | Menu level 3 | Description                                       | el |
|---------------------|--------------|--------------|---------------------------------------------------|----|
| <b>COUNTER</b>      |              |              | Counter values (totalizers)                       |    |
|                     | VOLUME       |              | Measured volume at operating conditions           | 4  |
|                     | VOL          |              | Volume (fuel) converted to 15 °C                  | 4  |
|                     | H VOL        |              | Volume (heavy fuel) converted to 15 °C            | 4  |
|                     | MASS         |              | Mass (fuel) calculated                            | 4  |
|                     | H MASS       |              | Mass (heavy fuel) calculated                      | 4  |
|                     | CO2          |              | CO <sub>2</sub> emissions (fuel) calculated       | 4  |
|                     | H CO2        |              | CO <sub>2</sub> emissions (heavy fuel) calculated | 4  |
| <b>TRIP-COUNTER</b> |              |              | Trip counter (subtotals)                          |    |
|                     | RESET        |              | Reset trip counter                                | 1  |
|                     | VOLUME       |              | Measured volume at operating conditions           |    |
|                     | VOL          |              | Volume (fuel) converted to 15 °C                  |    |
|                     | H VOL        |              | Volume (heavy fuel) converted to 15 °C            |    |
|                     | MASS         |              | Mass (fuel) calculated                            |    |
|                     | H MASS       |              | Mass (heavy fuel) calculated                      |    |
|                     | CO2          |              | CO <sub>2</sub> emissions (fuel) calculated       |    |
|                     | H CO2        |              | CO <sub>2</sub> emissions (heavy fuel) calculated |    |
| <b>INSTANT</b>      |              |              | Instantaneous values                              |    |
|                     | Q VOL        |              | Volume flowrate at operating conditions           |    |
|                     | Q STD        |              | Volume flowrate at reference conditions (15 °C)   |    |
|                     | Q MASS       |              | Mass flowrate calculated                          |    |
|                     | TEMP         |              | Fuel temperature                                  |    |
|                     | DENS         |              | Density calculated                                |    |

## 5.10 Information, operating hours and billing

| Menu level 1    | Menu level 2         | Menu level 3 | Description                                                     | el |
|-----------------|----------------------|--------------|-----------------------------------------------------------------|----|
| <b>INFO</b>     |                      |              | Only visible if an alarm or error is active                     |    |
|                 | A-TEMP               |              | Temperature alarm $T > T\text{-MAX}$                            |    |
|                 | A-FLOW               |              | Flow alarm, exceeds limits or reverse flow                      |    |
|                 | A-OUTPUT 1           |              | Output 1 out of range, adjust settings                          |    |
|                 | A-OUTPUT 2           |              | Output 2 out of range, adjust settings                          |    |
|                 | A-MANIP              |              | Tampering detected (external)                                   |    |
|                 | A-SIM-P              |              | Simulation active (P-Out), switch simulation off                |    |
|                 | A-SIM-SYSTEM         |              | Simulation active (System), switch simulation off               |    |
|                 | A-SIM-F              |              | Simulation active (F-Out), switch simulation off                |    |
|                 | A-SIM-I              |              | Simulation active (I-Out), switch simulation off                |    |
|                 | A-I-OUT              |              | Analog output out of range, adjust settings                     |    |
|                 | E-SYSTEM             |              | System fault, reset System (call for service)                   |    |
|                 | E-LOG-BOOK           |              | Log-Book fault, reset System (call for service)                 |    |
|                 | E-POWER              |              | Power supply fault, ensure power is available                   |    |
|                 | E-TEMP               |              | Temperature fault (hardware)                                    |    |
|                 | E-EEPROM             |              | EEPROM fault, reset System (call for service)                   |    |
|                 | E-FLOW               |              | Flow measurement fault (hardware)                               |    |
|                 | E-OPTION             |              | Optional module fault                                           |    |
|                 | E-SENSOR             |              | Sensor fault, reset System (call for service)                   |    |
|                 | E-HW-RTC             |              | RTC / EEPROM HW fault (call for service)                        |    |
| <b>OP-HOURS</b> |                      |              | Operating hour information                                      |    |
|                 | TIME 0               |              | Total operating hours                                           | 5  |
|                 | TIME 1               |              | Hours in rated operating range ( $Q_{\min} - Q_{\text{cont}}$ ) | 5  |
|                 | TIME 2               |              | Hours in upper operating range ( $Q_{\text{cont}} - Q_{\max}$ ) | 5  |
|                 | TIME 3               |              | Hours above maximum flowrate ( $Q_{\max}$ )                     | 5  |
|                 | TIME A               |              | Hours in alarm condition                                        | 4  |
|                 | TIME E               |              | Hours in error / fault condition                                | 4  |
|                 | Q MAX                |              | Maximum flowrate recorded (>20 s)                               | 4  |
|                 | T MAX                |              | Maximum temperature recorded                                    | 4  |
| <b>BILLING</b>  | <b>option -xx-xC</b> |              | <b>Only visible with option CE-MID005</b>                       |    |
|                 | NR                   |              | Billing period selection nr.                                    | 0  |
|                 | SETDAT               |              | Set date (dd.mm.yy)                                             | 1  |
|                 | EXEDAT               |              | Execution date (dd.mm.yy)                                       |    |
|                 | VOLUME               |              | Measured volume at operating conditions                         |    |
|                 | VOL                  |              | Volume (fuel) converted to 15 °C                                |    |
|                 | H VOL                |              | Volume (heavy fuel) converted to 15 °C                          |    |
|                 | MASS                 |              | Mass (fuel) calculated                                          |    |
|                 | H MASS               |              | Mass (heavy fuel) calculated                                    |    |
|                 | CO2                  |              | CO <sub>2</sub> emissions (fuel) calculated                     |    |
|                 | H CO2                |              | CO <sub>2</sub> emissions (heavy fuel) calculated               |    |
|                 | TIME A               |              | Hours in alarm condition (h)                                    |    |
|                 | TIME E               |              | Hours in error / fault condition (h)                            |    |

## 5.11 Loggers, unlock and logbook

| Menu level 1    | Menu level 2  | Menu level 3     | Description                                       | el                             |
|-----------------|---------------|------------------|---------------------------------------------------|--------------------------------|
| <b>LOGGER</b>   | Logger values |                  |                                                   |                                |
|                 | LOGGER        |                  | Logger selection                                  | 0                              |
|                 | MONTH         |                  | Log data of every end of the month                | 0                              |
|                 | DAY           |                  | Log data of every end of the day                  | 0                              |
|                 | NOON2NOON     |                  | Log data of every noon                            | 0                              |
|                 | HOUR          |                  | Log data of every end of the hour                 | 0                              |
|                 | MINUTE        |                  | Log data of every end of the minute               | 0                              |
|                 |               | NR               | Select Log nr.                                    | 0                              |
|                 |               | DATE             | Date of log entry (dd.mm.yy)                      |                                |
|                 |               | TIME             | Time of log entry (hh:mm)                         |                                |
|                 |               | VOLUME           | Measured volume at operating conditions           |                                |
|                 |               | VOL              | Volume (fuel) converted to 15 °C                  |                                |
|                 |               | H VOL            | Volume (heavy fuel) converted to 15 °C            |                                |
|                 |               | MASS             | Mass (fuel) calculated                            |                                |
|                 |               | H MASS           | Mass (heavy fuel) calculated                      |                                |
|                 |               | CO2              | CO <sub>2</sub> emissions (fuel) calculated       |                                |
|                 |               | H CO2            | CO <sub>2</sub> emissions (heavy fuel) calculated |                                |
|                 |               | TIME A           | Hours in alarm condition (h)                      |                                |
|                 |               | TIME E           | Hours in error / fault condition (h)              |                                |
|                 |               | Q VOL $\bar{t}$  | Maximum volume flowrate (period)                  |                                |
|                 |               | Q MASS $\bar{t}$ | Maximum mass flowrate (period)                    |                                |
|                 |               | T MAX $\bar{t}$  | Maximum temperature (period)                      |                                |
| <b>UNLOCK</b>   |               |                  |                                                   | Code to unlock and edit values |
|                 | CODE          |                  | Code to unlock the device for editing             | 0                              |
| <b>LOG-BOOK</b> |               |                  |                                                   | Only visible with user code    |
|                 | NR            |                  | Log entry selection nr. from now to 100           | 1                              |
|                 | EVENT         |                  | Event information                                 |                                |
|                 | TIME          |                  | Time and Date of log entry (dd.mm.yyyy hh:mm)     |                                |
|                 | STATUS        |                  | Status information                                |                                |

## 5.12 Output settings: Pulse; frequency and status

Two relays are available. Each relay can be assigned to one output function. Select the output number (channel) to configure it. Only one output function can be active for each channel.

| Menu level 1 | Menu level 2                            | Menu level 3  | Description                                                     | el |
|--------------|-----------------------------------------|---------------|-----------------------------------------------------------------|----|
| <b>P-OUT</b> | Digital pulse outputs (counting signal) |               |                                                                 |    |
|              | NR                                      |               | Output channel selection                                        | 0  |
|              | FCT                                     |               | Select function                                                 | 1  |
|              | OFF                                     |               | Pulse output disabled (OFF)                                     | 1  |
|              | <b>IMPULSE</b>                          |               | Pulse output signal                                             | 1  |
|              |                                         | SIGNAL        | Output signal selection                                         | 1  |
|              |                                         | <b>VOLUME</b> | Measured volume at operating conditions                         |    |
|              |                                         | STD VOLUME    | Volume (fuel) converted to 15 °C                                |    |
|              |                                         | H STD VOLUME  | Volume (heavy fuel) converted to 15 °C                          |    |
|              |                                         | MASS          | Mass (fuel) calculated                                          |    |
|              |                                         | H MASS        | Mass (heavy fuel) calculated                                    |    |
|              |                                         | CO2           | CO <sub>2</sub> emissions (fuel) calculated                     |    |
|              |                                         | H CO2         | CO <sub>2</sub> emissions (heavy fuel) calculated               |    |
|              |                                         | UPP           | Pulse value (quantity per pulse) ( <b>1 / 0.1</b> , 0.001-1000) | 1  |
|              |                                         | MS            | Pulse duration ( <b>20 ms</b> , 2-500)                          | 1  |
|              |                                         | SIMVAL        | Output simulation value                                         | 1  |
|              |                                         | SIMACT        | Simulation enable / disable (ON / OFF)                          | 1  |
| <b>F-OUT</b> | Digital frequency outputs (flow signal) |               |                                                                 |    |
|              | NR                                      |               | Output channel selection                                        | 0  |
|              | FCT                                     |               | Select function                                                 | 1  |
|              | <b>OFF</b>                              |               | Frequency output disabled (OFF)                                 | 1  |
|              | 0-200Hz                                 |               | Frequency output signal enabled                                 | 1  |
|              |                                         | SIGNAL        | Output signal value selection                                   | 1  |
|              |                                         | VOLUME FLOW   | Volume flowrate at operating conditions                         |    |
|              |                                         | STD VOL FLOW  | Volume flowrate at reference conditions (15 °C)                 |    |
|              |                                         | MASS FLOW     | Mass flowrate calculated                                        |    |
|              |                                         | TEMPERATURE   | Fuel temperature                                                |    |
|              |                                         | DENSITY       | Density calculated                                              |    |
|              |                                         | LO VAL        | Lower range value (0; 0-Qmax)                                   | 1  |
|              |                                         | HI VAL        | Upper range value (Qmax; 0-Qmax)                                | 1  |
|              |                                         | LO Hz         | Lower frequency value (0 Hz; 0-200)                             | 1  |
|              |                                         | HI Hz         | Upper frequency value (200 Hz; 0-200)                           | 1  |
|              |                                         | SIMVAL        | Output simulation value                                         | 1  |
|              |                                         | SIMACT        | Simulation enable / disable (ON / OFF)                          | 1  |
|              |                                         | ERROR         | Fail-safe behavior (cont / high / low)                          | 1  |
|              |                                         | CONT Hz       | Continuous signal                                               | 1  |
|              |                                         | HIGH Hz       | High frequency signal (200Hz)                                   | 1  |
|              |                                         | LOW Hz        | Low frequency signal (0Hz)                                      | 1  |
|              |                                         | STATUS        | Actual output frequency                                         | 1  |

| Menu level 1 | Menu level 2 | Menu level 3                 | Description                                       | el |
|--------------|--------------|------------------------------|---------------------------------------------------|----|
| <b>S-OUT</b> |              |                              | Status outputs (limits & alarms)                  |    |
|              | NR           |                              | Output channel selection                          | 0  |
|              | FCT          |                              | Select function                                   | 1  |
|              | <b>OFF</b>   |                              | Status output disabled (OFF)                      | 1  |
|              |              | STATE                        | Active logic function (NO/NC)                     | 1  |
|              |              | STATUS                       | Status of function, active/inactive on/off        | 1  |
|              | LIMIT 1      |                              | 1 point limit switch                              | 1  |
|              |              | SIGNAL                       | Limit signal selection                            | 1  |
|              |              | VOLUME FLOW                  | Volume flowrate at operating conditions           |    |
|              |              | STD VOL FLOW                 | Volume flowrate at reference conditions (15 °C)   |    |
|              |              | MASS FLOW                    | Mass flowrate calculated                          |    |
|              |              | TEMPERATURE                  | Fuel temperature                                  |    |
|              |              | DENSITY                      | Density calculated                                |    |
|              |              | LIMIT1 $\downarrow \uparrow$ | Limit value; (Qcont, 0 to full range of size)     | 1  |
|              |              | HYST (+/-%)                  | Hysteresis of value (5 %, 0.0-99.9)               | 1  |
|              |              | STATE                        | Logic function (NO/NC)                            | 1  |
|              |              | STATUS                       | Status of function, active/inactive on/off        | 1  |
|              | LIMIT 2      |                              | 2 point limit switch (min/max)                    | 1  |
|              |              | SIGNAL                       | Limit signal selection                            | 1  |
|              |              | VOLUME FLOW                  | Volume flowrate at operating conditions           |    |
|              |              | STD VOL FLOW                 | Volume flowrate at reference conditions (15 °C)   |    |
|              |              | MASS FLOW                    | Mass flowrate, calculated                         |    |
|              |              | TEMPERATURE                  | Fuel temperature                                  |    |
|              |              | DENSITY                      | Density calculated                                |    |
|              |              | LIMIT1 $\downarrow$          | Limit value min. (Qmin, 0 to full range of size)  | 1  |
|              |              | LIMIT2 $\uparrow$            | Limit value max. (Qcont, 0 to full range of size) | 1  |
|              |              | HYST (+/-%)                  | Hysteresis of value min. / max. (5 %, 0.0-99.9)   | 1  |
|              |              | STATE                        | Logic function (NO/NC)                            | 1  |
|              |              | STATUS                       | Status of function, active/inactive on/off        | 1  |
|              | STATUS       |                              | Action on alarm or fault/error                    | 1  |
|              |              | STATE                        | Logic function (NO/NC)                            | 1  |
|              |              | STATUS                       | Status of function, active/inactive on/off        | 1  |

### 5.13 Output settings: Analog and Modbus communication

| Menu level 1  | Menu level 2   | Menu level 3       | Description                                     | el |
|---------------|----------------|--------------------|-------------------------------------------------|----|
| <b>I-OUT</b>  | Analog outputs |                    |                                                 |    |
|               | FCT            |                    | Select function                                 | 1  |
|               | OFF            |                    | Current output disabled (OFF)                   | 1  |
|               | <b>4-20 mA</b> |                    | Current output signal                           |    |
|               |                | SIGNAL             | Output signal selection                         | 1  |
|               |                | <b>VOLUME FLOW</b> | 2 point limit switch (min/max)                  |    |
|               |                | STD VOL FLOW       | Limit signal selection                          |    |
|               |                | MASS FLOW          | Volume flowrate at operating conditions         |    |
|               |                | TEMPERATURE        | Volume flowrate at reference conditions (15 °C) |    |
|               |                | DENSITY            | Mass flowrate calculated                        |    |
|               |                | MIN mA             | Lower range value (0; 0-Qmax)                   | 1  |
|               |                | MAX mA             | Upper range value (Qmax; 0-Qmax)                | 1  |
|               |                | ERROR              | Fail-safe behavior (cont / high / low)          | 1  |
|               |                | <b>CONT mA</b>     | Continuous signal                               |    |
|               |                | HIGH mA            | High current signal (21.8 mA)                   |    |
|               |                | LOW mA             | Low current signal (3.8 mA)                     |    |
|               |                | SIMVAL             | Output simulation value                         | 1  |
|               |                | SIMACT             | Simulation enable / disable (OFF / ON)          | 1  |
|               |                | STATUS             | Actual output current                           | 1  |
| <b>MODBUS</b> |                |                    | Serial bus communication                        |    |
|               | ADR            |                    | Device address ( <b>1</b> , 1-247)              | 1  |
|               | BAUD           |                    | Baud rate                                       | 1  |
|               | 9600           |                    |                                                 |    |
|               | 19200          |                    |                                                 |    |
|               | <b>38400</b>   |                    |                                                 |    |
|               | PARITY         |                    | Parity                                          | 1  |
|               | ODD            |                    | Odd                                             |    |
|               | NONE           |                    | None                                            |    |
|               | <b>EVEN</b>    |                    | Even                                            |    |
|               |                |                    |                                                 |    |

## 5.14 Units

| Menu level 1 | Menu level 2  | Menu level 3 | Description                 | el |
|--------------|---------------|--------------|-----------------------------|----|
| UNITS        |               |              | Units                       |    |
|              | <b>VOLUME</b> |              | Unit of volume              | 2  |
|              |               | <b>L</b>     | Liter                       |    |
|              |               | m3           | Cubic meter                 |    |
|              |               | GAL          | US gallon                   |    |
|              | V DEC         |              | Decimals of volume value    | 2  |
|              |               | 0.001        |                             |    |
|              |               | 0.01         |                             |    |
|              |               | 0.1          |                             |    |
|              | <b>MASS</b>   | <b>1</b>     |                             |    |
|              |               |              | Unit of mass                | 2  |
|              |               | <b>Kg</b>    | Kilogram                    |    |
|              |               | T            | Tonne (metric ton)          |    |
|              | M DEC         | LBS          | Pound (US Pounds)           |    |
|              |               |              | Decimals of mass value      | 2  |
|              |               | 0.001        |                             |    |
|              |               | 0.01         |                             |    |
|              |               | 0.1          |                             |    |
|              |               | <b>1</b>     |                             |    |
|              | <b>V FLOW</b> |              | Unit of volume flowrate     | 1  |
|              |               | L/s          | Liter per second            |    |
|              |               | L/m          | Liter per minute            |    |
|              |               | <b>L/h</b>   | Liter per hour              |    |
|              |               | m3/h         | Cubic meter per hour        |    |
|              |               | GA/h         | Gallon per hour             |    |
|              | M FLOW        |              | Unit of mass flowrate       | 1  |
|              |               | <b>Kg/h</b>  | Kilogram per hour           |    |
|              |               | t/h          | Tonne (metric ton) per hour |    |
|              |               | LB/h         | Pound per hour              |    |
|              |               | <b>Kg/m3</b> | Unit of density             | 1  |
|              | DENS          |              | Unit of temperature         | 1  |
|              |               | <b>°C</b>    | Degrees Celsius             |    |
|              |               | °F           | Degree Fahrenheit           |    |
|              | VPULSE        |              | Pulse unit of volume        | 1  |
|              |               | mL           | Milliliter                  |    |
|              |               | <b>L</b>     | Liter                       |    |
|              |               | m3           | Cubic meter                 |    |
|              | MPULSE        | GAL          | US gallon                   |    |
|              |               |              | Pulse unit of mass          | 1  |
|              |               | Kg           | Kilogram                    |    |
|              |               | t            | Tonne (metric ton)          |    |
|              |               | LBS          | Pound                       |    |

## 5.15 Configuration

| Menu level 1 | Menu level 2 | Menu level 3  | Description                                           | el |
|--------------|--------------|---------------|-------------------------------------------------------|----|
| CONFIG       |              |               | System configuration                                  |    |
|              | COMP         |               | Enables Volume conv. to reference cond. (15 °C)       | 2  |
|              | OFF          |               | Compensation disabled (OFF)                           | 2  |
|              | DOUBLE OIL   |               | Double fuel compensation (e.g. Diesel / HFO)          | 2  |
|              |              | DFO-HFO       | Medium/Fuel selection for compensation                | 1  |
|              |              | T REF         | Temperature reference (15 °C)                         |    |
|              |              | T THR         | Temperature threshold (60 °C, 20-90)                  | 2  |
|              |              | DENS          | Fuel density (830 kg/m <sup>3</sup> , 800-1200)       | 2  |
|              |              | H DENS        | Heavy fuel density (998 kg/m <sup>3</sup> , 800-1200) | 2  |
|              |              | FCI           | Fuel carbon index (3.206, 0-4)                        | 2  |
|              |              | H FCI         | Heavy fuel carbon index (3.1144, 0-4)                 | 2  |
|              | SINGLE OIL   |               | Single fuel compensation (e.g. Diesel or Lube)        | 2  |
|              |              | FLUID         | Medium/Fuel 1 selection for compensation              | 1  |
|              |              | DISTILLATE FO | Distillate fuel oil                                   |    |
|              |              | HEAVY FO      | Heavy fuel oil                                        |    |
|              |              | LUBE OIL      | Lube oil                                              |    |
|              |              | T REF         | Temperature reference (15 °C)                         |    |
|              |              | DENS          | Fuel density (830 kg/m <sup>3</sup> , 800-1200)       | 2  |
|              |              | FCI           | Fuel carbon index (3.206, 0-4)                        | 2  |
|              |              | LFC           | Low flow cut off (Qstart/2 of DN, Qstart/2-Qmin)      | 2  |
|              |              | DQ            | Damping of flow values (10 %, 0-99)                   | 1  |
|              |              | DT            | Damping of temperature values (10 %, 0-99)            | 1  |

## 5.16 System settings and System information

| Menu level 1 | Menu level 2                           | Menu level 3    | Description                                             | el |
|--------------|----------------------------------------|-----------------|---------------------------------------------------------|----|
| SYSTEM       | System settings                        |                 |                                                         |    |
|              | DATE                                   |                 | System date (dd.mm.yy)                                  | 1  |
|              | TIME                                   |                 | System time (hh:mm)                                     | 1  |
|              | DAY                                    |                 | Weekday                                                 |    |
|              | DST                                    |                 | Daylight saving time: oFF / Add 1h                      | 1  |
|              | FLOBAR                                 |                 | Select flow bar signal                                  |    |
|              |                                        | <b>FLOW</b>     | Display flow signal in %                                |    |
|              |                                        | CURRENT         | Display current signal in %                             |    |
|              | CODE                                   | <b>00001111</b> | Edit user access code, reset with manager code only     | 1  |
|              | RESET                                  |                 | System reset                                            | 0  |
|              |                                        | CANCEL          | Cancel reset                                            | 0  |
|              |                                        | ALARM           | Reset all alarms                                        | 4  |
|              |                                        | COUNTER         | Reset all counters                                      | 4  |
|              |                                        | LOGGER          | Reset all loggers                                       | 4  |
|              |                                        | DEFAULT         | Reset to default values                                 | 4  |
|              |                                        | FI RESET        | Reset manufacturing initializing date                   | 4  |
|              | F-RES                                  |                 | System reset                                            | 5  |
|              |                                        | CANCEL          | Cancel reset                                            | 5  |
|              |                                        | FACTORY         | Reset all settings to factory default                   | 5  |
|              |                                        | RTC RESET       | Reset RTC clock                                         | 5  |
|              | SIM                                    |                 | Simulation of complete system                           | 4  |
|              | SIMVAL                                 | <b>#.###</b>    | Value to be simulated for complete system               | 4  |
|              | SIMACT                                 | <b>OFF</b>      | Simulation action off / on                              | 4  |
| SYSTEM-INFO  | System information                     |                 |                                                         |    |
|              | SNR                                    | <b>#####</b>    | Serial number                                           | 5  |
|              | TYPE                                   |                 | Device type designation and size                        | 5  |
|              | TAG                                    | <b>#####</b>    | Customer ID tag                                         | 1  |
|              | VC                                     |                 | Measuring chamber volume                                |    |
|              | CF                                     | 0.0000          | Correction factor (K-factor)                            | 4  |
|              | Q MIN                                  |                 | Minimum flowrate                                        |    |
|              | Q MAX                                  |                 | Maximum flowrate                                        |    |
|              | T MIN                                  |                 | Minimum temperature                                     |    |
|              | T MAX                                  |                 | Maximum temperature                                     |    |
|              | F INIT                                 | dd.mm.yy        | Manufacturing date (Factory/Customer Initializing date) | 5  |
|              | FW                                     | 00.00.00        | Firmware version                                        |    |
|              | HW                                     | 00.00.00        | Hardware version                                        |    |
|              | CS                                     | ABCDE           | Checksum                                                |    |
|              | CE-MID                                 | YYYY            | Metrological conformity year                            | 5  |
|              | CE-MID                                 | NB-0102         | Notified body                                           |    |
| DisplayTest  | Displays all characters on the display |                 |                                                         |    |
|              |                                        |                 | Displays empty display                                  |    |

### 5.17 Startup and commissioning of mechanical part of the flow measuring system:

Open the valves slowly and fill the pipework gradually. Vent the installation thoroughly.

#### NOTICE

Pressure surges, air inclusion



Risk of damage or malfunction of the flow measuring system!

Avoid pressure surges, open valves slowly.

Air causes measurement errors; ensure that no air is present in the system during Operation.

Check all connections for tightness and monitor the system for leaks.

Perform a functional check using the electronic display by reading the instantaneous flow value.

If the measured flow rate exceeds the specification of the flow measuring system ( $Q_{cont}$ ), either install a flow control valve (throttle) downstream of the flow sensor or use a flow measuring system with a larger nominal size.

## 6 Maintenance and Repair

### 6.1 Calibration

All flow measuring systems are factory-calibrated.

An accuracy check and recalibration service is available from Aquametro. The recalibration interval is typically defined by customer, operator, or regulatory requirements and depends largely on the operating conditions, the process liquid, and the application in which the flow measuring system is installed.

### 6.2 Service maintenance

#### WARNING

The device/system may be under pressure.

Risk of severe injury!



Carry out work only on non-pressurized systems.

When working on the device/system, watch for leaking medium.

Work may only be performed by authorized specialists in accordance with applicable regulations.

Use appropriate personal protective equipment, particularly safety goggles.

#### CAUTION

The surfaces of the device/system and the medium may be hot.

Risk of burns!



Carry out work only on cooled devices/systems.

Work may only be performed by authorized specialists in accordance with applicable regulations.

Use appropriate personal protective equipment.

#### NOTICE



Use of unsuitable cleaning agents and procedures.

Risk of malfunction or damage to the flow measuring system!

Follow the cleaning instructions on the next page.

#### NOTICE



Warranty will be void, if the flow meter is being opened during the warranty period by a non Aquametro certified person.

**Before working on the hydraulics:**

- » put the system or section out of operation
- » close the stop valves
- » release the pressure
- » put a suitable tray underneath the connection to be worked on
- » be prepared for spillage, have absorbent at hand

**Cleaning of flow meter:**

- » do not use any aggressive solvents
- » rinse hydraulic part of flow meter thoroughly

**Aquametro recommends to use the following cleaning solvents:**

- » Gasoline used for cleaning purposes
- » Cleaner's naphtha
- » Petroleum ether

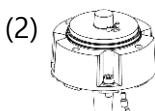
**Dirt filter** (not safety filter of flow meter):

- » Dirt filters must be cleaned periodically, initially at short intervals to keep fuel system free of dirt and debris.

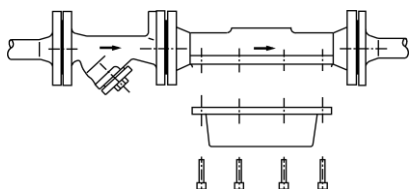
**To restart the system:**

- » slowly open the stop valves, avoiding pressure surges ("water hammer")
- » vent the pipe well
- » check tightness

Check connections periodically for tightness and if necessary, retighten.

**Torque values of screws**

| Flow meter          | Screws | Torque |
|---------------------|--------|--------|
| Electronic unit (1) | M 4    | 2 Nm   |
| Coupling (2)        | M 6    | 4.5 Nm |

**Torque of measuring chamber screws**

| Size      | Screws | Torque |
|-----------|--------|--------|
| DN 15, 20 | M 6    | 6 Nm   |
| DN 25     | M 8    | 16 Nm  |
| DN 40     | M 12   | 47 Nm  |
| DN 50     | M 16   | 100 Nm |

The cleaning and revision cycle depends largely on the conditions of operation. Under favorable conditions 5 - 10 years suffice. Check the devices for corrosion.

### Recommended revision cycle

| Size  | Totalizer volume         | Time    |
|-------|--------------------------|---------|
| DN 15 | 20'000 m <sup>3</sup>    | 7 years |
| DN 20 | 50'000 m <sup>3</sup>    | 7 years |
| DN 25 | 100'000 m <sup>3</sup>   | 7 years |
| DN 40 | 300'000 m <sup>3</sup>   | 7 years |
| DN 50 | 1'000'000 m <sup>3</sup> | 7 years |

The responsibility of the revision cycles lies with the operator.

#### NOTICE

If opening is necessary:

Risk of malfunction!



Observe positions during disassembly.

Follow assembly instructions.

Check proper function at start up.

Recalibration is recommended after service.

For more information about maintenance, see Spare part list and Maintenance instructions.

### Opening and closing

For instructions on opening and closing the flow meter please refer to separate manual.



See Spare part list and Maintenance instructions.

## 6.3 Spare parts

#### NOTICE



Use of wrong spare parts:

Risk of malfunction or damage!

Use only original spare parts, supplied by Aquametro.



Spare part list and Maintenance instructions may be requested from Aquametro.

## 7 Troubleshooting and error messages

### 7.1 Troubleshooting

| Fault symptoms                                                                                                                                             | Possible causes                                                                                                                                                    | Procedures                                                                                                                                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>No reading / blank display</li> </ul>                                                                               | <ul style="list-style-type: none"> <li>No power supply</li> </ul>                                                                                                  | <ul style="list-style-type: none"> <li>Check wiring, polarity</li> </ul>                                                                                                                                                                                              |
|                                                                                                                                                            | <ul style="list-style-type: none"> <li>Electronic counter defective</li> </ul>                                                                                     | <ul style="list-style-type: none"> <li>Replace complete device</li> </ul>                                                                                                                                                                                             |
| <ul style="list-style-type: none"> <li>Totalizer not running</li> <li>No flow rate indicated</li> <li>Indicated quantity or flow rate too small</li> </ul> | <ul style="list-style-type: none"> <li>Flow rate outside allowed range (below <math>Q_{\min}</math> or above <math>Q_{\max}</math> of measuring system)</li> </ul> | <ul style="list-style-type: none"> <li>Check flow rate (reverse flow) totalizer "0"</li> <li>If too high, reduce flow or install larger measuring system</li> <li>If too low, increase flow or install smaller measuring system</li> <li>Reduce LFC to 0.1</li> </ul> |
|                                                                                                                                                            | <ul style="list-style-type: none"> <li>Moving parts heavily worn out due to continuous overload</li> </ul>                                                         | <ul style="list-style-type: none"> <li>Install new larger measuring system</li> </ul>                                                                                                                                                                                 |
|                                                                                                                                                            | <ul style="list-style-type: none"> <li>Dirt trap / filter heavily soiled</li> </ul>                                                                                | <ul style="list-style-type: none"> <li>Clean dirt trap, replace filter</li> </ul>                                                                                                                                                                                     |
|                                                                                                                                                            | <ul style="list-style-type: none"> <li>Safety filter in measuring system intake clogged</li> </ul>                                                                 | <ul style="list-style-type: none"> <li>Replace safety filter</li> <li>Install dirt trap / filter with correct mesh size</li> </ul>                                                                                                                                    |
|                                                                                                                                                            | <ul style="list-style-type: none"> <li>Moving parts jammed</li> </ul>                                                                                              | <ul style="list-style-type: none"> <li>clean measuring chamber, replace defective parts / measuring system</li> </ul>                                                                                                                                                 |
| <ul style="list-style-type: none"> <li>Totalizer(s) run backwards</li> </ul>                                                                               | <ul style="list-style-type: none"> <li>Measuring system mounted in wrong direction</li> </ul>                                                                      | <ul style="list-style-type: none"> <li>Install measuring system with arrow pointing in flow direction</li> </ul>                                                                                                                                                      |
| <ul style="list-style-type: none"> <li>Indicated quantity or flow rate too high</li> </ul>                                                                 | <ul style="list-style-type: none"> <li>Measuring system positioned wrongly (e.g. at highest point)</li> <li>Gas or air inclusion in fluid</li> </ul>               | <ul style="list-style-type: none"> <li>Check and rectify operating conditions and measuring system position</li> <li>De-aerate pipes carefully</li> </ul>                                                                                                             |
| <ul style="list-style-type: none"> <li>pressure drop at measuring system too high</li> </ul>                                                               | <ul style="list-style-type: none"> <li>Dirt trap or filter heavily soiled</li> </ul>                                                                               | <ul style="list-style-type: none"> <li>Clean dirt trap, replace filter</li> </ul>                                                                                                                                                                                     |
|                                                                                                                                                            | <ul style="list-style-type: none"> <li>Flow measuring system's safety filter heavily soiled</li> </ul>                                                             | <ul style="list-style-type: none"> <li>Clean safety filter of flow measuring system</li> </ul>                                                                                                                                                                        |
| <ul style="list-style-type: none"> <li>No signal</li> <li>No communication</li> <li>No pulse output signal</li> </ul>                                      | <ul style="list-style-type: none"> <li>No flow</li> </ul>                                                                                                          | <ul style="list-style-type: none"> <li>Check flow using indication</li> </ul>                                                                                                                                                                                         |
|                                                                                                                                                            | <ul style="list-style-type: none"> <li>Wrong parameterization</li> </ul>                                                                                           | <ul style="list-style-type: none"> <li>Set correct parameters for outputs/communication</li> </ul>                                                                                                                                                                    |
|                                                                                                                                                            | <ul style="list-style-type: none"> <li>Polarity of communication connection</li> </ul>                                                                             | <ul style="list-style-type: none"> <li>Connect with correct polarity</li> </ul>                                                                                                                                                                                       |
|                                                                                                                                                            | <ul style="list-style-type: none"> <li>Transducer defective</li> </ul>                                                                                             | <ul style="list-style-type: none"> <li>Replace transducer/no repair</li> </ul>                                                                                                                                                                                        |

## 7.2 Alarm messages

|                     |                                                                                                                                        |
|---------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <b>A-TEMP</b>       | Temperature alarm                                                                                                                      |
| Cause:              | Temperature outside the defined temperature range.<br>The fluid and density values are not recalculated.                               |
| Action:             | Adjust temperature to be in normal range defined in technical specification.                                                           |
| <b>A-FLOW</b>       | Flow alarm                                                                                                                             |
| Cause:              | Flow range exceeded: $Q < 0$ (back flow) or $Q > Q_{\max}$ (overflow).                                                                 |
| Action:             | Check flow direction or reduce flow to max continuous flow as specified.                                                               |
| <b>A-OUTPUT 1/2</b> | Output settings out of limits                                                                                                          |
| Cause:              | The configured pulse scaling exceeds the maximum permissible output capacity, resulting in buffer overflow.                            |
| Action:             | Reduce pulse frequency, adjust scaling factors, and verify output load specifications according to device limits.                      |
| <b>A-ANALOG</b>     | Output settings out of limits                                                                                                          |
| Cause:              | Measured process value exceeds the configured analog output limits, or output scaling parameters are incorrectly set.                  |
| Action:             | Check output scaling, lower/upper range values, and process limits:<br>Adjust configuration or correct process conditions as required. |
| <b>A-SIM-P</b>      | Alarm when pulse output simulation is on                                                                                               |
| Cause:              | Pulse output simulation is active.                                                                                                     |
| Action:             | Turn pulse output simulation off.                                                                                                      |
| <b>A-SIM-F</b>      | Alarm when frequency output simulation is on                                                                                           |
| Cause:              | Frequency output simulation is active.                                                                                                 |
| Action:             | Turn frequency output simulation off.                                                                                                  |
| <b>A-SIM-I</b>      | Alarm when analog output simulation is on                                                                                              |
| Cause:              | Analog output simulation is active.                                                                                                    |
| Action:             | Turn analog output simulation off.                                                                                                     |
| <b>A_MANIP</b>      | Alarm when device is being manipulated                                                                                                 |
| Cause:              | External magnetic manipulation detected.                                                                                               |
| Action:             | Remove any magnetic sources or disturbances in the vicinity of the flow measuring system.                                              |
| <b>A-SIM-SYSTEM</b> | Alarm when system simulation is on                                                                                                     |
| Cause:              | System simulation is active.                                                                                                           |
| Action:             | Turn system simulation off.                                                                                                            |

### 7.3 Error messages

|                   |                                                                                                                                                                                                |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>E-TEMP</b>     | Temperature error                                                                                                                                                                              |
| Cause:            | Temperature measurement error: Measured value outside the range.                                                                                                                               |
| Action:           | Ensure that the flow measuring system is used within the temperature specifications, ensure the temperature sensor is connected or replace flow measuring system, please contact the supplier. |
| <b>E-FLOW</b>     | Flow error                                                                                                                                                                                     |
| Cause:            | Magnetic field sensor defective: no flow can be detected.                                                                                                                                      |
| Action:           | Ensure to have flow or replace flow measuring system, please contact the supplier.                                                                                                             |
| <b>E-LOG-BOOK</b> | Log backup is faulty                                                                                                                                                                           |
| Cause:            | The log backup of the counter readings is faulty.                                                                                                                                              |
| Action:           | Reset the device. If the malfunction continues, replacement of the electronic module is required. Contact the supplier.                                                                        |
| <b>E-OPTION</b>   | Optional Plug-In module error                                                                                                                                                                  |
| Cause:            | The Plug-In module generates an error.                                                                                                                                                         |
| Action:           | Dependent on the Plug-In module, replace or contact the supplier.                                                                                                                              |
| <b>E-SYSTEM</b>   | System error                                                                                                                                                                                   |
| Cause:            | Hardware error of the EEPROM: the initialization of the EEPROM is faulty.                                                                                                                      |
| Action:           | Reset the device. If the malfunction continues, replacement of the electronic module is required. Contact the supplier.                                                                        |
| <b>E-POWER</b>    | Power supply failure                                                                                                                                                                           |
| Cause:            | The power supply is unstable or defective.                                                                                                                                                     |
| Action:           | Ensure that the device is connected to an uninterruptable power source.                                                                                                                        |
| <b>E-EEPROM</b>   | EEprom error                                                                                                                                                                                   |
| Cause:            | Error of the EEPROM handling: loading or saving of data into EEPROM faulty.                                                                                                                    |
| Action:           | Please contact the supplier.                                                                                                                                                                   |
| <b>E-SENSOR</b>   | System error                                                                                                                                                                                   |
| Cause:            | Hardware error of the EEPROM: the initialization of the EEPROM is faulty.                                                                                                                      |
| Action:           | Reset the device. If the malfunction continues, replacement of the electronic module is required. Contact the supplier.                                                                        |
| <b>E-RTC</b>      | System error                                                                                                                                                                                   |
| Cause:            | Hardware error of the EEPROM: the initialization of the EEPROM is faulty.                                                                                                                      |
| Action:           | Reset the device. If the malfunction continues, replacement of the electronic module is required. Contact the supplier.                                                                        |

## 8 Decommissioning, dismantling and disposal

### CAUTION

The surfaces of the device/system and the medium may be hot.



Risk of burns!

Carry out work only on cooled devices/systems.

Work may only be performed by authorized specialists in accordance with the applicable regulations.

Use appropriate protective equipment.

### WARNING

The device/system may be under pressure.



Risk of severe injury!

Carry out work only on non-pressurized systems.

When working on the device/system watch out for leaking medium.

Work may only be performed by authorized personnel in accordance with the applicable regulations.

Use appropriate protective equipment, particularly safety goggles.

### 8.1 Decommissioning

Disconnect all sources of energy.

Drain the system and remove the device from the installation.

Pay particular attention to the disposal instructions in section 8.3.

### 8.2 Dismantling

Not required.

### 8.3 Disposal



At the end of its life cycle, this product must be disposed of according to local regulations regarding waste management and recycling.

Electronic components, batteries, and rechargeable batteries must be collected and recycled separately in accordance with local regulations.



Any residual liquids or contaminants must be handled in compliance with local environmental and occupational health regulations.

Proper separate collection and recycling conserve natural resources and prevent environmental damage.

## 8.4 Returning devices / decontamination

Never send a device or system back unless you are absolutely certain that all traces of hazardous substances have been removed, including substances that may have penetrated crevices or diffused through plastic.

Any costs incurred for waste disposal or personal injury (e.g., burns) due to inadequate declaration or cleaning will be charged to the delivery company or operator.

When returning a device to Aquametro for repair or calibration, the following points are mandatory:

- » Always quote the type and serial number when contacting a service or repair office.
- » Always enclose a duly completed "Declaration of Decontamination" form (VD\_FO0302e).
- » Equipment may only be returned in an unpurified state in exceptional cases (e.g., for the investigation of errors) and only with prior written consent from Aquametro. In such cases, the contact person at Aquametro who granted approval must be clearly stated.



Use forms

«VD\_FO0301e\_Return Form» and

«VD\_FO0302e\_Declaration of Decontamination».

## 9 Technical Data

### 9.1 Model code

| VZF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | A | 3 | 25 | - | FL | 180/ | 25 | - | S |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|----|---|----|------|----|---|---|
| <div> <div> <b>Calibration</b><br/> <b>S</b> standard<br/> <b>C</b> EU Type certificate MI005<br/> <b>L</b> linearized with hi accuracy         </div> <div> <b>Plug-in board</b><br/>           - none         </div> <div> <b>Nominal pressure</b><br/> <b>16</b> max. 16 bar<br/> <b>25</b> max. 25 bar<br/> <b>40</b> max. 40 bar<br/> <b>5 K</b> JIS<br/> <b>10-20</b> JIS<br/> <b>150</b> ASME<br/> <b>300</b> ASME         </div> <div> <b>Temperature</b><br/> <b>90</b> max. 90<br/> <b>130</b> max. 130 °C<br/> <b>180</b> max. 180 °C         </div> <div> <b>Connection</b><br/> <b>RC</b> thread<br/> <b>FL</b> flange<br/> <b>AW</b> wafer         </div> <div> <b>Optional hydraulic modification</b><br/>           - none<br/> <b>B</b> bio-fuels<br/> <b>E</b> extended flow<br/> <b>P</b> PEEK         </div> <div> <b>Nominal Size</b><br/> <b>15</b> 15 mm / 1/2"<br/> <b>20</b> 20 mm / 3/4"<br/> <b>25</b> 25 mm / 1"<br/> <b>40</b> 40 mm / 1 1/2"<br/> <b>50</b> 50 mm / 2"         </div> <div> <b>Version</b><br/> <b>1</b> previous (not marked)<br/> <b>2</b> previous (marked II)<br/> <b>3</b> new         </div> <div> <b>Class</b><br/> <b>S</b> standard (not marked)<br/> <b>A</b> higher accuracy         </div> </div> |   |   |    |   |    |      |    |   |   |
| <b>Type</b><br><b>VZF</b> electronic display unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |   |   |    |   |    |      |    |   |   |

## 9.2 Hydraulic characteristics

| Hydraulics                              |                                      |                 | Size       |            |             |             |             |             |              |
|-----------------------------------------|--------------------------------------|-----------------|------------|------------|-------------|-------------|-------------|-------------|--------------|
| Nominal diameter                        |                                      | DN              | 15P        | 15         | 15E         | 20          | 25          | 40          | 50           |
|                                         |                                      | mm              |            |            |             |             |             |             |              |
|                                         |                                      | inch            | 1/2        | 1/2        | 1/2         | 3/4         | 1           | 1 1/2       | 2            |
| Installation length                     |                                      | mm              | 165        | 165        | 165         | 165         | 190         | 300         | 350          |
| Connection thread on meter              |                                      | inch            | 3/4        | 3/4        | 3/4         | 1           | 1 1/4       | 2           | N/A          |
| Nominal pressure threaded ends          | PN                                   | bar             | 16         |            |             |             |             |             | N/A          |
| Nominal pressure flanges                | PN                                   | bar             | 25 / 40    |            |             |             |             |             |              |
| Maximum medium temperature              | T <sub>max</sub>                     | °C              | 130, 180   |            |             |             |             |             |              |
| Maximum flow rate                       | Q <sub>max</sub> <sup>1)</sup>       | l/h             | 200        | 600        | 1500        | 1500        | 3000        | 9000        | 30000        |
| <b>Continuous flow rate</b>             | <b>Q<sub>cont</sub><sup>2)</sup></b> | <b>l/h</b>      | <b>100</b> | <b>400</b> | <b>1000</b> | <b>1000</b> | <b>2000</b> | <b>6000</b> | <b>20000</b> |
| Minimum flow rate                       | Q <sub>min</sub>                     | l/h             | 5          | 10         | 30          | 30          | 60          | 180         | 750          |
| Approx. starting flow rate              |                                      | l/h             | 2          | 4          | 12          | 12          | 30          | 90          | 300          |
| Max. permissible error of actual value  | VZF3                                 |                 | ±1.0 %     | ±1.0 %     | ±1.0 %      | ±1.0 %      | ±1.0 %      | ±1.0 %      | ±1.0 %       |
|                                         | VZFA3                                |                 | -          | ±0.5 %     | ±0.5 %      | ±0.5 %      | ±0.5 %      | ±0.5 %      | ±0.5 %       |
|                                         | VZFA3 lin                            |                 | -          | ±0.3 %     | ±0.3 %      | ±0.3 %      | ±0.3 %      | ±0.3 %      | ±0.3 %       |
| Repeatability                           |                                      |                 | -          | ±0.1 %     | ±0.1 %      | ±0.1 %      | ±0.1 %      | ±0.1 %      | ±0.1 %       |
| Measuring chamber volume                |                                      | cm <sup>3</sup> | 12         | 12         | 36          | 36          | 100         | 330         | 1200         |
| Safety filter mesh size                 |                                      | mm              | 0.400      | 0.400      | 0.400       | 0.400       | 0.400       | 0.800       | 0.800        |
| Weight with threaded ends <sup>3)</sup> |                                      | kg              | 2.2        | 2.2        | 2.5         | 2.5         | 4.2         | 17.3        | -            |
| Weight with flanges PN 25               |                                      | kg              | 3.8        | 3.8        | 4.5         | 4.5         | 7.5         | 20.3        | 41.0         |
| Weight with flanges PN 40               |                                      | kg              | 4.4        | 4.4        | 5.5         | 5.5         | 7.8         | 20.5        | 42.0         |

1) Manufacturer's specification, valid for the reference conditions as specified under reference conditions. Do not use this value for the design.

2) For burners and engines or motors, the fuel oil meter must be selected on the basis of the permanent flow rate. For higher viscosities, or if the meter is installed on the suction side, the pressure drop and any reduction in the measuring range must be taken into consideration.

3) Weight without couplings.

### 9.3 Electronic characteristics

#### Electronic VZF3

##### Environment

|                                           |                 |    |                        |
|-------------------------------------------|-----------------|----|------------------------|
| Maximum environment temperature           | Tmax            | °C | -20 to +60             |
| Maximum storage temperature               | Tmax            | °C | -25 to +85             |
| Maximum storage humidity, none condensing | Hmax            | %h | 95                     |
| Protection class                          | IEC60529        |    | IP66                   |
| Safety, vibration and shock               | IEC68           |    |                        |
| Classification                            | OIML R 117:2019 |    | H3 / M2 / E1 / E2 / E3 |

##### Power supply

|                           |   |     |              |
|---------------------------|---|-----|--------------|
| Voltage range             | U | VDC | 12 - 24      |
| Maximum power consumption | P | W   | 0.4          |
| Update interval           |   | s   | 1            |
| Data preservation         |   |     | Flash Memory |

##### Relay output

|                        |  |            |                   |
|------------------------|--|------------|-------------------|
| Switching element      |  |            | solid state relay |
| Resistance ON          |  | $\Omega$   | $\leq 40$         |
| Resistance OFF         |  | M $\Omega$ | $\geq 10$         |
| Max. supply voltage    |  | VDC        | $\leq 48$         |
| Max. switching current |  | mA         | $\leq 50$         |
| Pulse width            |  | ms         | 2 - 500 (dynamic) |
| Pulse frequency        |  | Hz         | 0 - 200           |

##### Current output

|                   |   |          |                                                                          |
|-------------------|---|----------|--------------------------------------------------------------------------|
| Analog output     | U | VDC      | 6 - 32                                                                   |
| Resolution        |   |          | 16 bit                                                                   |
| Max. error        |   | s        | <0.15% of value                                                          |
| Update interval   |   | s        | 1                                                                        |
| Maximum Load (RL) |   | $\Omega$ | 0 to 1209, depending on external supply voltage of the power supply unit |
|                   |   | U-6      |                                                                          |
|                   |   |          | 0.0215 $\Omega$<br>(e.g.: 1209 $\Omega$ @32V)                            |

##### Serial interface

|                             |  |       |                        |
|-----------------------------|--|-------|------------------------|
| Isolation                   |  |       | Galvanically (max 48V) |
| Typical output capacitance: |  | pF    | 100                    |
| Type                        |  |       | RS485 2-wire           |
| Protocol                    |  |       | Modbus RTU             |
| Max. speed Modbus           |  | kBaud | 38.4                   |
| Unit load                   |  |       | 1/8                    |
| Internal Termination        |  |       | none                   |
| Internal Bias Network       |  |       | none                   |

## Outputs VZF3

|                                             |                                           |                                                                                     |
|---------------------------------------------|-------------------------------------------|-------------------------------------------------------------------------------------|
| 3 (2 pulse / frequency, 1 analog 4 - 20 mA) |                                           | freely selectable, totally independent of each other                                |
| Pulse output                                |                                           | volume or mass pulse 0 - 200 pulse/sec. (50 % duty cycle)                           |
| Current 4 - 20 mA                           |                                           | volume flow, mass flow or temperature signal                                        |
| Frequency                                   | Qmin, Qmax                                | volume flow, mass flow or temperature minimum, maximum and hysteresis parameterized |
| Limit switch                                | QLim <sub>max</sub> , QLim <sub>min</sub> | allows you to set an alert whenever predefined flow rates are exceeded (NC / NO)    |
| Flow meter state switch                     | Alarm, Error                              | state and on/off parameterized (NC / NO)                                            |

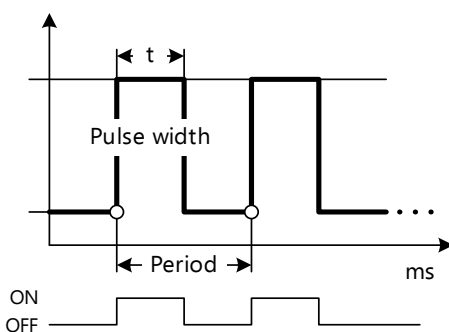
## 9.4 Output and communication types

### Digital outputs

The digital output has multiple functions, these and their characteristics are described hereafter. In order to set the parameters, the device must be unlocked with the user code.

#### 9.4.1 Function: P-Out; Pulse output (counting signal)

Digital pulse output (counting signal) for counting / totalizing the flow volume, compensated volume, mass or CO<sub>2</sub>.



#### Pulse width (t):

The pulse width limit can be set between 2...500 ms (example: 20 ms).

The actual pulse width is dynamically adjusted based on the current flow, but at least the set value.

The duty cycle is min. 50 %. The off cycle can be bigger.

#### Signal behavior:

The signal is defined as:  $t = \text{ON}$  and  $(\text{Period} - t) = \text{OFF}$ :

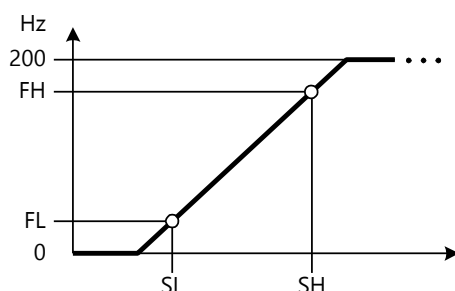
#### Parameters that can be set and Factory setting:

Pulse value (UPP): 0.001 - 1000 units per pulse  
Pulse value (UPP): 0.001 - 1000 units per pulse  
Pulse width (t): 2 - 500 ms

(factory setting DN15: 0.1 ltr/p)  
(factory setting DN20-50: 1 ltr/p)  
(factory setting: 20 ms)

### 9.4.2 Function: F-Out; Frequency output (flow signal)

The flow meter provides digital frequency outputs for continuous measurement of flow, compensated flow, mass flow, temperature, or density.



The frequency output is proportional to the measured value across the selected flow rate measurement range (SL - SH).

#### Signal behavior:

The output signal begins generating a frequency as soon as the flow exceeds  $Q_{start}$ , or approximately >1 Hz under factory default settings.

Accuracy of the frequency output is  $\pm 1\%$  of the actual value.

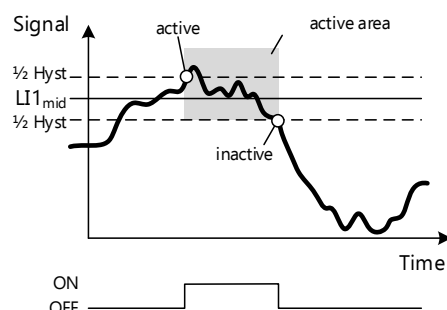
#### Parameters that can be set and factory setting:

|                     |               |                               |
|---------------------|---------------|-------------------------------|
| Signal Low [SL]:    | 0 – $Q_{max}$ | (factory setting: 0 ltr/h)    |
| Signal Hi [SH]:     | 0 – $Q_{max}$ | (factory setting: $Q_{max}$ ) |
| Frequency Low [FL]: | 0 – 200 Hz    | (factory setting: 0 Hz)       |
| Frequency Hi [FH]:  | 0 – 200 Hz    | (factory setting: 200 Hz)     |
| Error [Er]:         | cont; Hi; Lo  | (factory setting: cont)       |

### 9.4.3 Function: S-Out; Limiting output (1 or 2 point)

The limit switch function can be used for remote control or alarm systems.

#### 1 Point

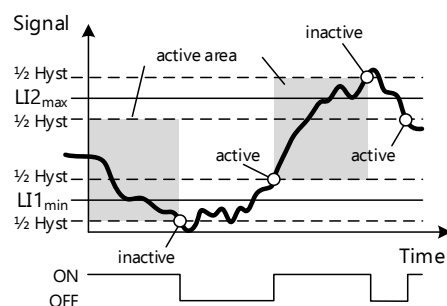


The Limit function allows you to set an alert whenever predefined values (e.g., flow rate) are exceeded.

It defines upper (Limit2) and lower (Limit1) threshold values. When these thresholds are exceeded, a switch (alert) is activated.

To prevent oscillation between active and inactive states when the measured value fluctuates around a threshold, a hysteresis band (see adjacent diagram) can be defined. Within this band, the switch remains in the active state once triggered. The switch is deactivated only when the measured value moves outside the hysteresis band. Hysteresis bands are calculated as a percentage of the threshold values (Limit).

#### 2 Point



#### Signal behavior:

##### 1-Point (Balanced)

Setpoints (Limit1) and reset points ( $\frac{1}{2}$  Hyst) are calculated by expanding the setpoint values upward and downward by half the hysteresis value.

##### 2-Point (Balanced)

Setpoints (Limit1 / Limit2) and reset points ( $\frac{1}{2}$  Hyst) are calculated by expanding the setpoints upward or downward by half the hysteresis value.

|          | Work State |    |
|----------|------------|----|
|          | NC         | NO |
| inactive |            |    |
| active   |            |    |

**Parameters that can be set:**Lower value [**Li1<sub>min</sub>**]:  $\geq 0$ **(factory setting: Q<sub>min</sub>)**Upper value [**Li2<sub>max</sub>**]:  $\leq Q_{\max}$ **(factory setting: Q<sub>max</sub>)**Hysteresis [**HYST**]: 0...99.9 %**(factory setting: 5 %)**

The switches activated by the Limit function can be configured as NO (Normally Open) or NC (Normally Closed), depending on your requirements.

**Limit switch [NO]:** Contact is open in the inactive state and closes when triggered (active).

**Limit switch [NC]:** Contact is closed in the inactive state and opens when triggered (active).

**9.4.4 Function: S-Out; Status output**

According to signal faults.

|          | Work State                                                                        |                                                                                   |
|----------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
|          | NC                                                                                | NO                                                                                |
| inactive |  |  |
| active   |  |  |

Whenever an error or an alarm occurs, the signal can be sent with this output selected.

Any fault (Error, Alarm or power loss) can be sent to a remote control or alarm system.

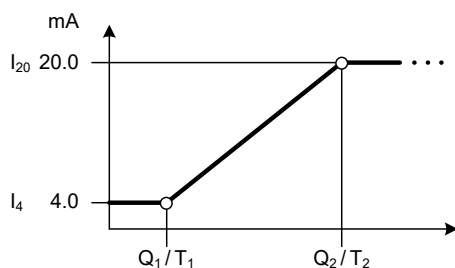
**Parameters that can be set:**

Trigger: [any status (Error, Alarm or power loss)]

Select contact logic: [NO] or [NC]

**(factory setting: NO)****Analog communication outputs****9.4.5 Function: I-Out; Passive analog current loop 4 - 20mA (flow/temp signal)**

The analog current loop signal is suitable for integration into control loop systems.



The current output is proportional to the measured flow rate or temperature over the range  $Q_1/T_1$  to  $Q_2/T_2$ .

**Signal behavior:**

- » If the measured value falls below the lower limit ( $Q_1/T_1$ ), the current decreases proportionally to 3.8 mA and remains at this value.
- » If the measured value exceeds the upper limit ( $Q_2/T_2$ ), the current increases proportionally to 20.8 mA and remains at this value.
- » Within the normal range, the output corresponds continuously to the measured value (3.8–20.8 mA).

$I_4$  : current 4mA

$I_{20}$  : current 20mA

$Q_1$  : chosen min. flow rate

$T_1$  : chosen min. temperature

$Q_2$  : chosen max. flow rate

$T_2$  : chosen max. temperature

**Error signals:**

For measurement-relevant errors (e.g., sensor failure, ROM error, supply voltage issue):

» **HIGH mA** error: output 21.5 mA

» **LOW mA** error: output 3.5 mA

» **CONT mA** error: no error signal is generated

**Parameters that can be set:**

|                            |                           |                                                                  |
|----------------------------|---------------------------|------------------------------------------------------------------|
| Lower value <b>[MIN]:</b>  | $Q_1/T_1 \geq 0$          | <i>(factory setting: 0 / 0 °C)</i>                               |
| Lower current <b>[mA]:</b> | $I_4 = 4 \text{ mA}$      |                                                                  |
| Upper value <b>[MAX]:</b>  | $Q_2/T_2 \leq Q/T_{\max}$ | <i>(factory setting: <math>Q_{\max} / 200 \text{ °C}</math>)</i> |
| Upper current <b>[mA]:</b> | $I_{20} = 20 \text{ mA}$  |                                                                  |
| Error <b>[Err]</b>         |                           | <i>(factory setting: CONT mA)</i>                                |

Notice: **Qmin**, **Qcont** and **Qmax** are dependent on the nominal size of the flow meter.

**Example:**

$Q_1$  is 50 l/h and  $Q_2$  is 500 l/h

By 50 l/h a signal of 4 mA is being sent

By 275 l/h a signal of 12 mA is being sent

By 500 l/h a signal of 20 mA is being sent

The flow range of 450 l/h, will be distributed across the range of 16 mA (20 mA - 4 mA).

**Serial communication outputs****9.4.6 Modbus RTU**

For a list of main communication parameters see Appendix 10.2, page 47.

**Factory settings and supported functions:**

| RS485: Modbus RTU: | Factory                                             | Parameter range                                                                                         |
|--------------------|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| Addressing range   | Slave ID                                            | 1 - 247                                                                                                 |
|                    | Baud rate                                           | 38400                                                                                                   |
|                    | Parity                                              | EVEN                                                                                                    |
|                    | Stop bit                                            | 1                                                                                                       |
| Function code      | 03 (4x)                                             | Reading Holding Register<br>Reads one or more registers<br>of the Modbus slave<br>(1 Register = 2 Byte) |
|                    | All other commands result in an error return        |                                                                                                         |
| Modbus-units       | The units are transferred as set in the device      |                                                                                                         |
| Example:           | ID 1; 03 (4x); Address 40; Quantity 2 (4Byte/32bit) |                                                                                                         |

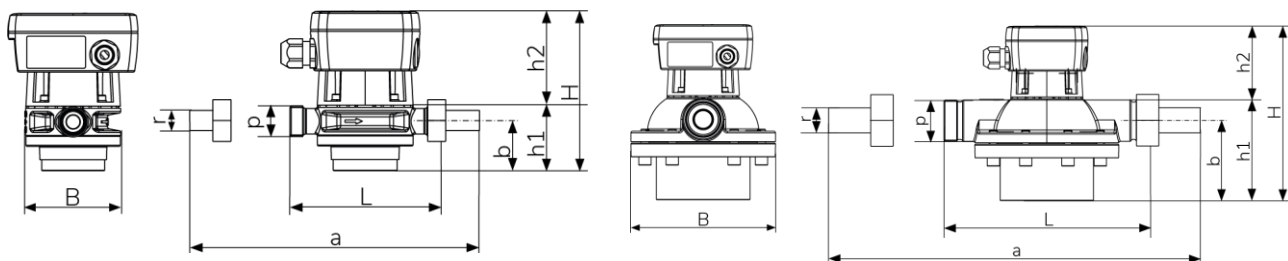
## 10 Appendix

### 10.1 Dimensional drawings

All flow meters with threaded ends are according to ISO 228-1.

DN 15, 20, 25: with threaded ends

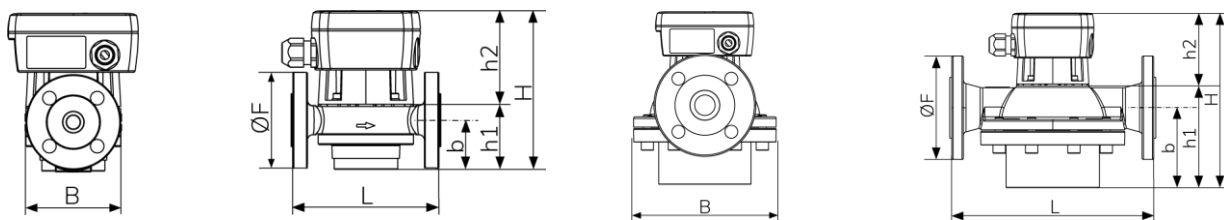
DN 40: with threaded ends



All flow meters with flanges are according to EN 1092-2, ASME B16.5 or JIS B2239.

DN 15, 20, 25: with flanged ends

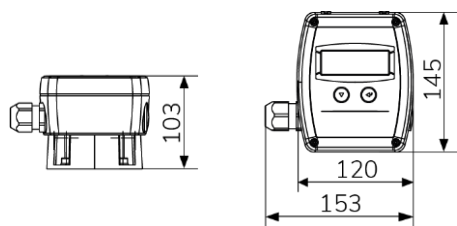
DN 40, 50: with flanged ends



#### Electronic counter

Module;  
dimensions h2

Digital display



| Size  | L   | B   | a*  | Ø F | b   | h1  | p        | r        |
|-------|-----|-----|-----|-----|-----|-----|----------|----------|
| DN 15 | 165 | 105 | 240 | 95  | 45  | 65  | G 3/4"   | G 1/2"   |
| DN 20 | 165 | 105 | 260 | 105 | 54  | 74  | G 1"     | G 3/4"   |
| DN 25 | 190 | 130 | 305 | 115 | 77  | 101 | G 1 1/4" | G 1"     |
| DN 40 | 300 | 210 | 435 | 150 | 116 | 153 | G 2"     | G 1 1/2" |
| DN 50 | 350 | 280 | —   | 165 | 166 | 209 | -        | -        |

Dimensions in mm

a\* = without gaskets (2x ~2 mm)

H = h1 + h2

## 10.2 Modbus address list

| Menu level 1   | Menu level 2 | Menu level 3 | Description                                       | el | Address (dec) | Reg / Value / Bit | Data Type  |
|----------------|--------------|--------------|---------------------------------------------------|----|---------------|-------------------|------------|
| <b>COUNTER</b> |              |              | Counter values (totalizers)                       |    | <b>40</b>     | <b>14</b>         | Float32 BE |
|                | VOLUME       |              | Measured volume at operating conditions           | 4  | 40            | 2                 | Float32 BE |
|                | VOL          |              | Volume (fuel) converted to 15 °C                  | 4  | 42            | 2                 | Float32 BE |
|                | H VOL        |              | Volume (heavy fuel) converted to 15 °C            | 4  | 44            | 2                 | Float32 BE |
|                | MASS         |              | Mass (fuel) calculated                            | 4  | 46            | 2                 | Float32 BE |
|                | H MASS       |              | Mass (heavy fuel) calculated                      | 4  | 48            | 2                 | Float32 BE |
|                | CO2          |              | CO <sub>2</sub> emissions (fuel) calculated       | 4  | 50            | 2                 | Float32 BE |
|                | H CO2        |              | CO <sub>2</sub> emissions (heavy fuel) calculated | 4  | 52            | 2                 | Float32 BE |
| <b>INSTANT</b> |              |              | Instantaneous values                              |    | <b>70</b>     | <b>10</b>         | Float32 BE |
|                | Q VOL        |              | Volume flowrate at operating conditions           |    | 70            | 2                 | Float32 BE |
|                | Q STD        |              | Volume flowrate at reference conditions (15 °C)   |    | 72            | 2                 | Float32 BE |
|                | Q MASS       |              | Mass flowrate calculated                          |    | 74            | 2                 | Float32 BE |
|                | TEMP         |              | Fuel temperature                                  |    | 78            | 2                 | Float32 BE |
|                | DENS         |              | Density calculated                                |    | 76            | 2                 | Float32 BE |
|                |              |              |                                                   |    |               |                   |            |
| <b>INFO</b>    |              |              | Only visible if an alarm or error is active       |    | <b>100</b>    |                   | Binary     |
|                | A-TEMP       |              | Temperature alarm T > TMAX                        |    |               | Bit1              |            |
|                | A-FLOW       |              | Flow alarm, exceeds limits or reverse flow        |    |               | Bit2              |            |
|                | A-OUTPUT 1   |              | Output 1 out of range, adjust settings            |    |               | Bit3              |            |
|                | A-OUTPUT 2   |              | Output 2 out of range, adjust settings            |    |               | Bit4              |            |
|                | A-MANIP      |              | Tampering detected (external)                     |    |               | Bit5              |            |
|                | A-SIM-P      |              | Simulation active (P-Out), switch simulation off  |    |               | Bit6              |            |
|                | A-SIM-SYSTEM |              | Simulation active (System), switch simulation off |    |               | Bit7              |            |
|                | A-SIM-F      |              | Simulation active (F-Out), switch simulation off  |    |               | Bit8              |            |
|                | A-SIM-I      |              | Simulation active (I-Out), switch simulation off  |    |               | Bit9              |            |
|                | A-I-OUT      |              | Analog output out of range, adjust settings       |    |               | Bit10             |            |
|                | E-SYSTEM     |              | System fault, reset System (call for service)     |    |               | Bit11             |            |
|                | E-LOG-BOOK   |              | Log-Book fault, reset System (call for service)   |    |               | Bit12             |            |
|                | E-POWER      |              | Power supply fault, ensure power is available     |    |               | Bit13             |            |
|                | E-TEMP       |              | Temperature fault (hardware)                      |    |               | Bit14             |            |
|                | E-EEPROM     |              | EEPROM fault, reset System (call for service)     |    |               | Bit15             |            |

| Menu level 1    | Menu level 2  | Menu level 3 | Description                                   | el | Address (dec) | Reg / Value / Bit | Data Type                 |
|-----------------|---------------|--------------|-----------------------------------------------|----|---------------|-------------------|---------------------------|
|                 | E-FLOW        |              | Flow measurement fault (hardware)             |    |               | Bit16             |                           |
|                 | E-OPTION      |              | Optional module fault                         |    |               | Bit17             |                           |
|                 | E-SENSOR      |              | Sensor fault, reset System (call for service) |    |               | Bit18             |                           |
|                 | E-HW-RTC      |              | RTC / EEPROM HW fault (call for service)      |    |               | Bit19             |                           |
| <b>OP-HOURS</b> |               |              | Operating hour information                    |    | <b>20</b>     | <b>12</b>         | uInt32 BE                 |
|                 | TIME 0        |              | Total operating hours                         | 5  | 20            | 2                 | uInt32 BE                 |
|                 | TIME 1        |              | Hours in rated operating range (Qmin – Qcont) | 5  | 22            | 2                 | uInt32 BE                 |
|                 | TIME 2        |              | Hours in upper operating range (Qcont – Qmax) | 5  | 24            | 2                 | uInt32 BE                 |
|                 | TIME 3        |              | Hours above maximum flowrate (Qmax)           | 5  | 26            | 2                 | uInt32 BE                 |
|                 | TIME A        |              | Hours in alarm condition                      | 4  | 28            | 2                 | uInt32 BE                 |
|                 | TIME E        |              | Hours in error / fault condition              | 4  | 30            | 2                 | uInt32 BE                 |
| <b>UNLOCK</b>   |               |              | Code to unlock and edit values                |    | <b>102</b>    | <b>1</b>          | uInt16                    |
|                 | CODE          |              | Lock level information                        | 0  | 102           | 1                 | uInt16                    |
| <b>UNITS</b>    |               |              | Units                                         |    | <b>90</b>     | <b>6</b>          | uInt16                    |
|                 | <b>VOLUME</b> |              | Unit of volume                                | 2  | 90            | 0-11              | uInt16                    |
|                 |               | <b>L</b>     | Liter                                         | 2  |               | 0-3               | lowest = 3 decimals 3.333 |
|                 |               | m3           | Cubic meter                                   | 2  |               | 4-7               | (0.001, 0.01, 0.1, 1)     |
|                 |               | GAL          | US gallon                                     | 2  |               | 8-11              | highest = 0 decimals 0    |
|                 | V DEC         |              | Decimals of volume value                      | 2  |               | 0-11              | uInt16                    |
|                 |               | 0.001        |                                               | 2  |               | 0, 4, 8           |                           |
|                 |               | 0.01         |                                               | 2  |               | 1, 5, 9           |                           |
|                 |               | 0.1          |                                               | 2  |               | 2, 6, 10          |                           |
|                 |               | <b>1</b>     |                                               | 2  |               | 3, 7, 11          |                           |
|                 | MASS          |              | Unit of mass                                  | 2  | 91            | 12-23             | uInt16                    |
|                 |               | <b>Kg</b>    | Kilogram                                      | 2  |               | 12-15             | lowest = 3 decimals 3.333 |
|                 |               | T            | Tonne                                         | 2  |               | 16-19             | highest = 0 decimals 0    |
|                 |               | LBS          | Pound                                         | 2  |               | 20-23             | (0.001, 0.01, 0.1, 1)     |
|                 | M DEC         |              | Decimals of mass value                        | 2  |               | 12-23             | uInt16                    |
|                 |               | 0.001        |                                               | 2  |               | 12, 16, 20        |                           |
|                 |               | 0.01         |                                               | 2  |               | 13, 17, 21        |                           |

| Menu level 1       | Menu level 2  | Menu level 3 | Description                      | el | Address (dec) | Reg / Value / Bit | Data Type                 |
|--------------------|---------------|--------------|----------------------------------|----|---------------|-------------------|---------------------------|
|                    | <b>V FLOW</b> | 0.1          |                                  | 2  |               | 14, 18, 22        |                           |
|                    |               | <b>1</b>     |                                  | 2  |               | 15, 19, 23        |                           |
|                    |               |              | Unit of volume flowrate          | 1  | 92            | 0-4               | uInt16                    |
|                    |               | L/s          | Liter per second                 | 1  |               | 32                |                           |
|                    |               | L/m          | Liter per minute                 | 1  |               | 33                |                           |
|                    |               | <b>L/h</b>   | Liter per hour                   | 1  |               | <b>34</b>         |                           |
|                    |               | m3/h         | Cubic meter per hour             | 1  |               | 35                |                           |
|                    | M FLOW        | GA/h         | Gallon per hour                  | 1  |               | 36                |                           |
|                    |               |              | Unit of mass flowrate            | 1  | 93            | 0-2               | uInt16                    |
|                    |               | <b>Kg/h</b>  | Kilogram per hour                | 1  |               | <b>37</b>         |                           |
|                    |               | t/h          | Tonne per hour                   | 1  |               | 38                |                           |
|                    |               | LB/h         | Pound per hour                   | 1  |               | 39                |                           |
|                    | DENS          | <b>Kg/m3</b> | Unit of density                  | 1  | 94            | <b>43</b>         | uInt16                    |
|                    | TEMP          |              | Unit of temperature              | 1  | 95            | 41-42             | uInt16                    |
|                    |               | <b>°C</b>    | Degrees Celsius                  | 1  |               | <b>41</b>         |                           |
|                    |               | °F           | Degree Fahrenheit                | 1  |               | 42                |                           |
| <b>SYSTEM</b>      |               |              | System settings                  |    | <b>10</b>     | <b>5</b>          | uInt                      |
|                    | DATE          |              | System date (dd.mm.yy)           | 1  | 10            |                   | uInt48 (mm,hh,TT,MM,JJJJ) |
|                    | TIME          |              | System time (hh:mm)              | 1  | 10            |                   | uInt48 (mm,hh,TT,MM,JJJJ) |
| <b>SYSTEM-INFO</b> |               |              | System information               |    | <b>1800</b>   | <b>16</b>         |                           |
|                    | SNR           | #####        | Serial number                    | 5  | 1800          | 2                 | uInt32                    |
|                    | TYPE          |              | Device type designation and size | 5  | 1802          | 1-7               | ASCII                     |
|                    | TAG           | #####        | Customer ID tag                  | 1  | 1809          | 9-16              | ASCII                     |

### 10.3 Default Settings list

| Menu level 1  | Menu level 2                            | Menu level 3 | Description                                            | Default Value |
|---------------|-----------------------------------------|--------------|--------------------------------------------------------|---------------|
| <b>P-OUT</b>  | Digital pulse outputs (counting signal) |              |                                                        |               |
|               | NR                                      |              | Output channel selection                               | 1             |
|               | FCT                                     |              | Select function                                        | IMPULSE       |
|               | <b>IMPULSE</b>                          | 0            | Pulse output signal                                    |               |
|               |                                         | SIGNAL       | Output signal selection                                | VOLUME        |
|               |                                         | UPP          | Pulse value (quantity per pulse) (1 / 0.1, 0.001-1000) | 0.1 / 1       |
|               |                                         | MS           | Pulse duration (20, 2-500 ms)                          | 20            |
| <b>P-OUT2</b> | Digital pulse outputs (counting signal) |              |                                                        |               |
|               | NR                                      |              | Output channel selection                               | 2             |
|               | FCT                                     |              | Select function                                        | IMPULSE       |
|               | <b>IMPULSE</b>                          | 0            | Pulse output signal                                    |               |
|               |                                         | SIGNAL       | Output signal selection                                | VOLUME        |
|               |                                         | UPP          | Pulse value (quantity per pulse) (1 / 0.1, 0.001-1000) | 0.1 / 1       |
|               |                                         | MS           | Pulse duration (20, 2-500 ms)                          | 20            |
| <b>F-OUT</b>  | Digital frequency outputs (flow signal) |              |                                                        |               |
|               | NR                                      |              | Output channel selection                               | 1             |
|               | FCT                                     |              | Select function                                        | OFF           |
|               | 0-200Hz                                 | 0            | Frequency output signal enabled                        |               |
|               |                                         | SIGNAL       | Output signal value selection                          | VOLUME FLOW   |
|               |                                         | LO VAL       | Lower range value (0; 0-Qmax)                          | Qmin          |
|               |                                         | HI VAL       | Upper range value (Qmax; 0-Qmax)                       | Qmax          |
|               |                                         | LO Hz        | Lower frequency value (0 Hz; 0-200 Hz)                 | 0             |
|               |                                         | HI Hz        | Upper frequency value (200 Hz; 0-200 Hz)               | 200           |
|               |                                         | ERROR        | Fail-safe behavior (cont / high / low)                 | CONT Hz       |
| <b>F-OUT2</b> | Digital frequency outputs (flow signal) |              |                                                        |               |
|               | NR                                      |              | Output channel selection                               | 2             |
|               | FCT                                     |              | Select function                                        | OFF           |
|               | 0-200Hz                                 | 0            | Frequency output signal enabled                        |               |
|               |                                         | SIGNAL       | Output signal value selection                          | VOLUME FLOW   |
|               |                                         | LO VAL       | Lower range value (0; 0-Qmax)                          | Qmin          |
|               |                                         | HI VAL       | Upper range value (Qmax; 0-Qmax)                       | Qmax          |
|               |                                         | LO Hz        | Lower frequency value (0Hz; 0-200Hz)                   | 0             |
|               |                                         | HI Hz        | Upper frequency value (200Hz; 0-200Hz)                 | 200           |
|               |                                         | ERROR        | Fail-safe behavior (cont / high / low)                 | CONT Hz       |
| <b>S-OUT</b>  | Status outputs (limits & alarms)        |              |                                                        |               |
|               | NR                                      |              | Output channel selection                               | 1             |
|               | FCT                                     |              | Select function                                        | OFF           |
|               | LIMIT 1                                 | 0            | 1 point limit switch                                   |               |
|               |                                         | SIGNAL       | Limit signal selection                                 | VOLUME FLOW   |
|               |                                         | LIMIT1 ,+    | Limit value; (Qcont, 0 to full range of size)          | Qcont         |
|               |                                         | HYST (+/-%)  | Hysteresis of value (5, 0.0-99.9 %)                    | 5             |
|               |                                         | STATE        | Logic function (NO/NC)                                 | NO            |
|               | LIMIT 2                                 | 0            | 2 point limit switch (min/max)                         |               |
|               |                                         | SIGNAL       | Limit signal selection                                 | VOLUME FLOW   |

| Menu level 1 | Menu level 2                     | Menu level 3             | Description                                       | Default Value           |             |
|--------------|----------------------------------|--------------------------|---------------------------------------------------|-------------------------|-------------|
|              | STATUS                           | LIMIT1 ,                 | Limit value min. (Qmin, 0 to full range of size)  | Qmin                    |             |
|              |                                  | LIMIT2 +                 | Limit value max. (Qcont, 0 to full range of size) | Qcont                   |             |
|              |                                  | HYST (+/-%)              | Hysteresis of value min. / max. (5, 0.0-99.9 %)   | 5                       |             |
|              |                                  | STATE                    | Logic function (NO/NC)                            | NO                      |             |
|              | OFF                              | 0                        | Action on alarm or fault/error                    |                         |             |
|              |                                  | STATE                    | Logic function (NO/NC)                            | NO                      |             |
|              |                                  | 0                        | Status output disabled (OFF)                      |                         |             |
|              |                                  | STATE                    | Active logic function (NO/NC)                     | NO                      |             |
| S-OUT2       | Status outputs (limits & alarms) |                          |                                                   |                         |             |
| NR           |                                  | Output channel selection | 2                                                 |                         |             |
| FCT          |                                  | Select function          | OFF                                               |                         |             |
|              | LIMIT 1                          | 0                        | 1 point limit switch                              |                         |             |
|              |                                  | SIGNAL                   | Limit signal selection                            | VOLUME FLOW             |             |
|              |                                  | LIMIT1 , +               | Limit value; (Qcont, 0 to full range of size)     | Qcont                   |             |
|              |                                  | HYST (+/-%)              | Hysteresis of value (5, 0.0-99.9 %)               | 5                       |             |
|              | LIMIT 2                          | STATE                    | Logic function (NO/NC)                            | NO                      |             |
|              |                                  | 0                        | 2 point limit switch (min/max)                    |                         |             |
|              |                                  | SIGNAL                   | Limit signal selection                            | VOLUME FLOW             |             |
|              |                                  | LIMIT1 ,                 | Limit value min. (Qmin, 0 to full range of size)  | Qmin                    |             |
|              | STATUS                           | LIMIT2 +                 | Limit value max. (Qcont, 0 to full range of size) | Qcont                   |             |
|              |                                  | HYST (+/-%)              | Hysteresis of value min. / max. (5, 0.0-99.9 %)   | 5                       |             |
|              |                                  | STATE                    | Logic function (NO/NC)                            | NO                      |             |
|              |                                  | 0                        | Action on alarm or fault/error                    |                         |             |
|              | OFF                              | STATE                    | Logic function (NO/NC)                            | NO                      |             |
|              |                                  | 0                        | Status output disabled (OFF)                      |                         |             |
|              |                                  | STATE                    | Active logic function (NO/NC)                     | NO                      |             |
|              |                                  | I-OUT                    | Analog outputs                                    |                         |             |
|              |                                  | FCT                      |                                                   | Select function         | 4-20Ma      |
|              |                                  |                          | SIGNAL                                            | Output signal selection | VOLUME FLOW |
| MIN mA       |                                  |                          | Lower range value (0; 0-Qmax)                     | 0                       |             |
| MAX mA       |                                  |                          | Upper range value (Qmax; 0-Qmax)                  | Qmax                    |             |
| ERROR        |                                  |                          | Fail-safe behavior (cont / high / low)            | CONT Ma                 |             |
| MODBUS       | Serial bus communication         |                          |                                                   |                         |             |
|              | ADR                              |                          | Device address (1, 1-247)                         | 1                       |             |
|              | BAUD                             |                          | Baud rate                                         | 38400                   |             |
|              | PARITY                           |                          | Parity                                            | EVEN                    |             |
| UNITS        | Units                            |                          |                                                   |                         |             |
|              | VOLUME                           |                          | Unit of volume                                    | L                       |             |
|              | V DEC                            |                          | Decimals of volume value                          | 0.1 / 1                 |             |
|              | MASS                             |                          | Unit of mass                                      | KG                      |             |
|              | M DEC                            |                          | Decimals of mass value                            | 0.1 / 1                 |             |
|              | V FLOW                           |                          | Unit of volume flowrate                           | L/H                     |             |
|              | M FLOW                           |                          | Unit of mass flowrate                             | KG/H                    |             |
|              | DENS                             | Kg/m3                    | Unit of density                                   | KG/m³                   |             |
|              | TEMP                             |                          | Unit of temperature                               | °C                      |             |

| Menu level 1       | Menu level 2         | Menu level 3 | Description                                             | Default Value |
|--------------------|----------------------|--------------|---------------------------------------------------------|---------------|
|                    | VPULSE               |              | Pulse unit of volume                                    | L             |
|                    | MPULSE               |              | Pulse unit of mass                                      | KG            |
| CONFIG             | System configuration |              |                                                         |               |
|                    | COMP                 |              | Enables Volume conversion to reference cond. (15 °C)    | OFF           |
|                    |                      | FLUID        | Medium/Fuel 1 selection for compensation                | DISTILLATE    |
|                    |                      | T THR        | Temperature threshold (60 °C, 20-90)                    | 60°C          |
|                    |                      | DENS         | Fuel density (830 kg/m³, 800-1200)                      | 830 KG/m³     |
|                    |                      | H DENS       | Heavy fuel density (998 kg/m³, 800-1200)                | 998 KG/m³     |
|                    |                      | FCI          | Fuel carbon index (3.206, 0-4)                          | 3.206         |
|                    |                      | H FCI        | Heavy fuel carbon index (3.1144, 0-4)                   | 3.1144        |
| SYSTEM-INFO        |                      |              |                                                         |               |
| System Information |                      |              |                                                         |               |
|                    | SNR                  | #####        | Serial number                                           |               |
|                    | TYPE                 |              | Device type designation and size                        |               |
|                    | TAG                  | #####        | Customer ID tag                                         |               |
|                    | CF                   | 0.0000       | Correction factor (K-factor)                            |               |
|                    | F INIT               | dd.mm.yy     | Manufacturing date (Factory/Customer initializing date) |               |
|                    | FW                   | 00.00.00     | Firmware version                                        |               |
|                    | CE-MID               | YYYY         | Metrological conformity year                            |               |

## Notes:

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## 11 Certificates

All certificates / approvals, can be found on our website [www.aquametro.com](http://www.aquametro.com)

### Class approvals

DNV  
Det Norske Veritas

Norway



LR  
Lloyds Register

United Kingdom



CCS  
China Classification Society

China



Approvals in process

### 11.1 EU Type examination certificate MI005

Approval in process



For details, please review document VD4-319 (part no. 21469).



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