

# CONTOIL®

## VZF II / VZFA II, DN 15 – 50

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# 1 Safety

## 1.1 Intended Use

The device CONTOIL<sup>®</sup> fuel oil meter is designed and solely intended for for the flow measurement of Diesel oil to Heavy Fuel Oil according to ISO 8217-2010.

Improper or non-intended use of the device may compromise operational reliability of the device. The manufacturer accepts no liability for any resulting personal injury or material damage.

## 1.2 Notes on safety rules and symbols

The devices are designed to meet the latest safety requirements. They were tested and delivered in a condition that ensures safe operation. Improper or non-intended use of the devices can, however, be dangerous. Therefore, pay particular attention to the safety instructions within this manual, which are always shown 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  
QR code link to our download website



### 1.3 Safety rules and precautions

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

- » Any modifications of the device implemented without the prior written consent of the manufacturer will result in the immediate termination of product liability and warranty.
- » Installation, operation, maintenance and decommissioning of this device must be carried out by trained, qualified specialists, authorized by the manufacturer, operator or owner of the facility. The specialist must have read and understood this entire installation and operating manual and must follow the instructions contained herein.
- » Check the mains voltage and the information on the type plate before installing the device.
- » Check all connections, settings and technical specifications of any peripheral devices.
- » Open housing or parts of housing containing electric or electronic components only when the electric power is turned off.
- » Do not touch any electronic components (ESD sensitivity).
- » Never exceed the specified classifications for mechanical load (e. g. pressure, temperature, ingress protection (IP) etc.).
- » Release the pressure in the pipe system and reduce the temperature of the medium to a safe level for humans when carrying out any work involving the system's mechanical components.
- » None of the information contained in this manual or in any other documents shall release planners, engineers, installers and operators from their own careful and comprehensive assessment of the respective system configuration in terms of functional capability and operational safety.
- » The local labour and safety laws and regulations must be adhered to.

### 1.4 About the 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 requested from your local dealer.



#### **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!

## 2 Product description

Thank you for purchasing this high-quality Product.

### 2.1 Flow meter configuration

The CONTOIL® flow meters consist of a hydraulic part, a coupling with temperature sensor included and an electronic display unit.

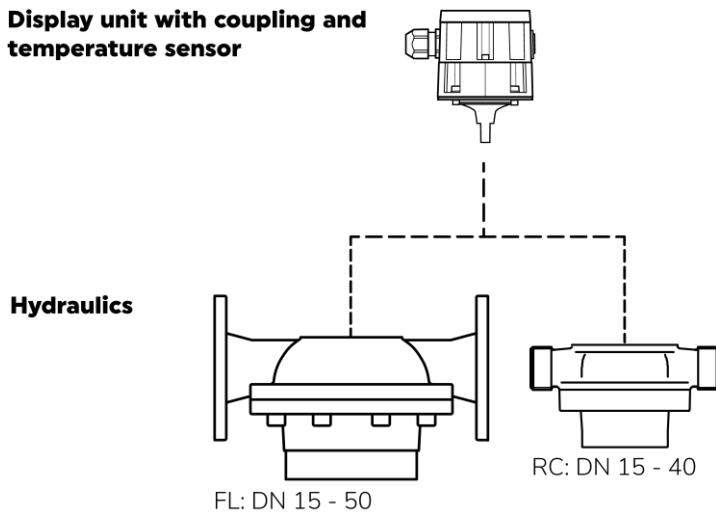
The hydraulic part determines the nominal size of the flow meter.

The flow meters are calibrated before they leave the factory. Nevertheless, for optimal results of differential measurement, flow meters of VZFA II with either a pairing or a special linearized calibration should be used.

#### Electronic display unit VZF II / VZFA II

Local electronic display unit with 2 pulse output and 1 passive analog current loop.

#### Display unit with coupling and temperature sensor



For details, see the dimensional drawings on page 43.

### **3 Scope of delivery an accessories**

The scope of delivery is described on the delivery note. Please check all components and parts delivered promptly after receipt of goods. Transport damages shall be reported immediately on receipt of the goods.

- » 1 Flow meter with electronic display unit
- » 1 Mounting and operating instruction

## 4 Mounting

### 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.

### Flow meter installation

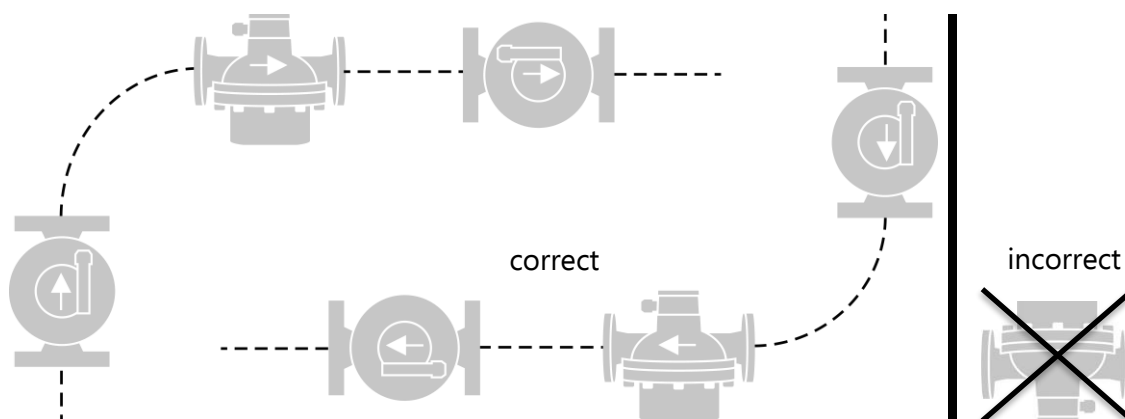
Easy access for reading the flow meter and controlling the ancillary equipment is important.

**Provided that the arrow on the housing is in the direction of flow**, the flow meter can be installed in any position without any special modifications.

The electronic display unit is rotateable in 90° steps to the installed position.

**Exception:** upside down installation.

Flow conditioners are unnecessary.

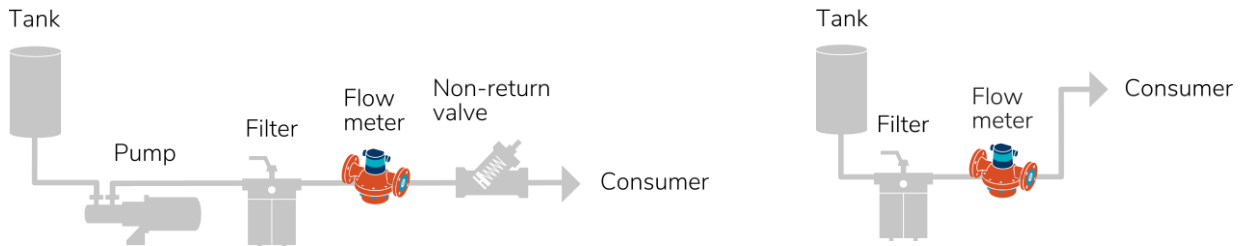




### NOTE

The layout of piping must ensure that the flow meter is filled with liquid at all times and that no inclusions of air, foam or gas may occur.

Aquametro Oil & Marine recommends to install bypass valves.



The quantities from all consumers must be registered by the flow meter.

### Correct layout of flow meter and accessories

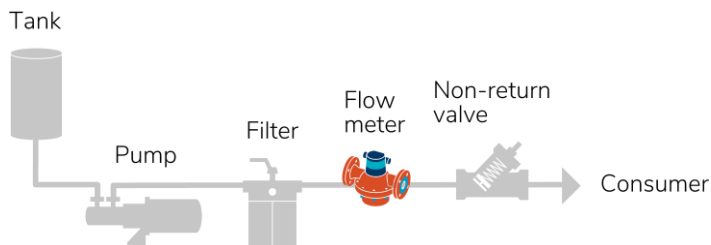
If the flow meter is used for viscosities higher than 5 mPas, or if it is mounted on the suction side of a pump, the pressure loss and the flow rate that can still be attained should be determined with the help of the pressure loss curves provided in CONTOIL® Technical Information. In addition, the pressure loss due to installed filters must be taken into consideration.

Select the flow meter and ancillaries according to the working conditions listed below:

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

### Non-Return-Valves

In order to avoid backflow and draining, Non-Return-Valves must be mounted after the flow meter. Backflow and draining can cause faulty measurements and may damage the flow meter.



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

## Dirt filter, Safety filter

Filters should be fitted to prevent any damage to the flow meter from impurities in the oil.

### Maximum mesh width for filters

Nominal size	Flow meter type	
	VZO	VZOA
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 can not act as a dirt filter.

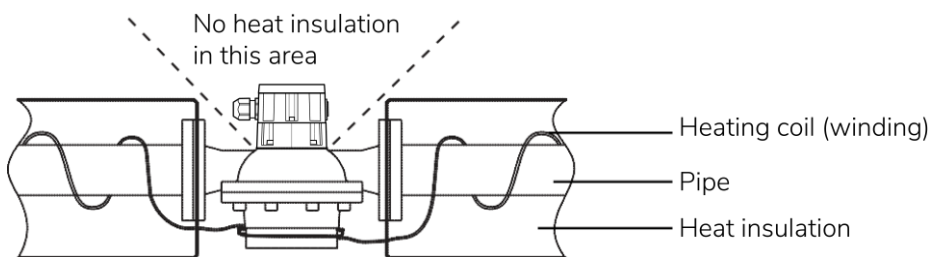


#### Risk of malfunction or damage.

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

## Heat insulation

The display unit shall not be insulated. This could cause its permitted temperature range to be exceeded.



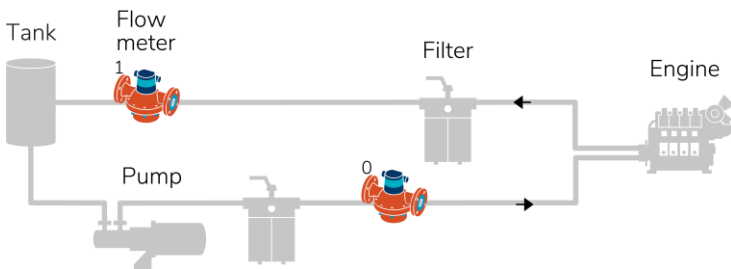
The permitted temperature ranges for the flow meter must be observed!





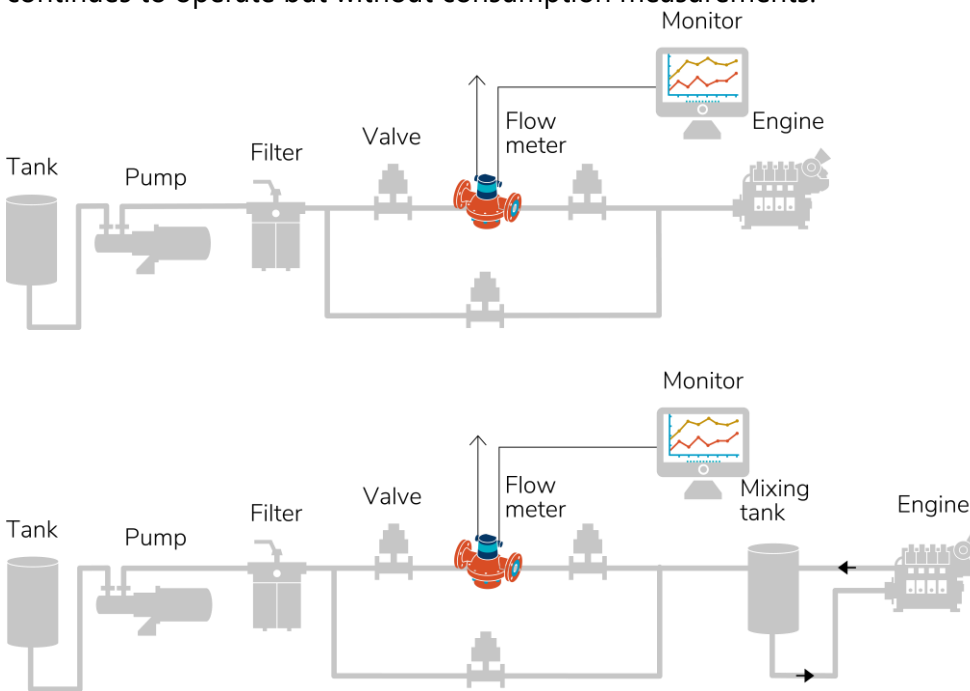
**Special requirements - differential measurements**


For differential measurements, one flow meter is installed in the supply line pipe and one in the return line pipe. The flow difference between these meters determines the consumption. If ordered with the "differential measurement" option, VZFA II flow meters are calibrated in accordance with the indicated supply and return flow volumes. The flow meters are labeled "SUPPLY" (0) and "RETURN" (1). Make sure that these flow meters are installed in the correct pipeline, i.e. the supply flow meter shall be installed in the supply line pipe and the return flow meter shall be installed in the return line pipe.



**Special requirements - ships**

On ships, attention is required to ensure that the engine can continue to operate at full power even if there is heavy filter contamination or if the flow meter is damaged. A pressure switch can be used to switch over to the bypass and to draw attention for servicing. The engine then continues to operate but without consumption measurements.

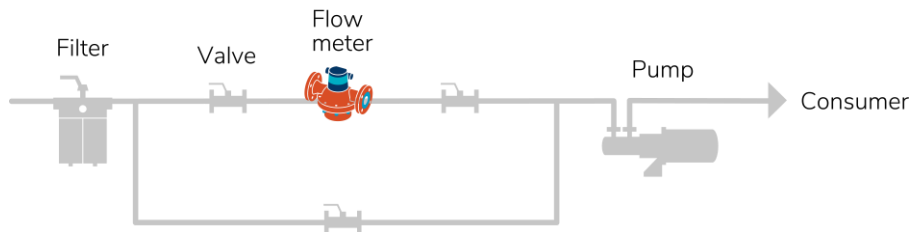




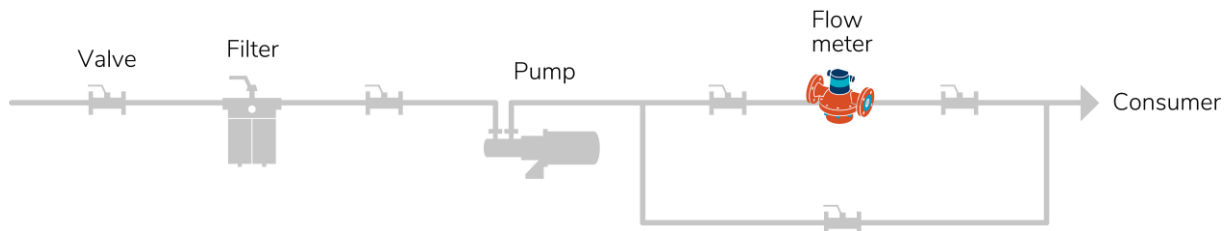
**NOTICE**  
Ship classification societies require the installation of bypass pipes. The relevant regulations must be followed.

### 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, consideration must be given to avoid air-intake or foam.

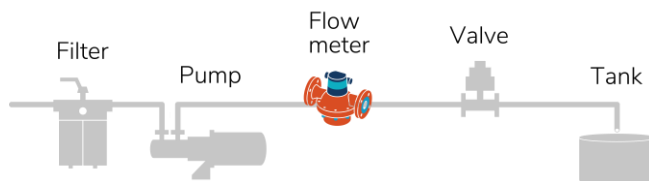


### Installation of the flow meter on the pressure side of a pump



### 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.



### Flushing of pipes

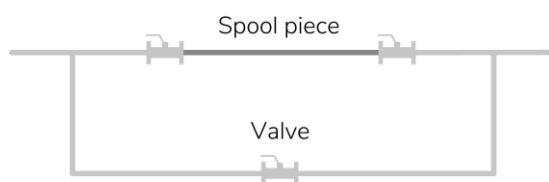
If the pipes are to be flushed at a later stage, stop valves shall be provided on both sides of the flow meter.



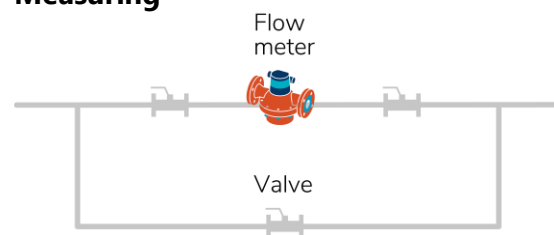
#### NOTICE

Accumulation of debris will occur in front of the stop-valve during flushing. To eliminate this, replace the flow meter with a spool piece.

### Flushing



### Measuring



## 4.1 Mechanical installation

### WARNING

Leakage or rupture due to connections being made using force.



**Risk of severe injury!**

**Risk of substantial property damage!**

- » Never attempt to overcome misalignments (lateral, angular, longitudinal, torsional) using force.
- » Make sure the pipings are flexible enough, if not: use compensators.
- » Consider the effects of thermal contraction and expansion.

### WARNING

Leakage or rupture due to misuse of the mounting material.



**Risk of severe injury!**

**Risk of substantial property damage!**

- » Regarding mechanical strength, with bolts, screws and nuts, use the prescribed dimensions.
- » Use the full number of bolts, screws and nuts.
- » Observe the prescribed thread lubrication (grease or dry!).
- » Tighten the bolts and nuts in the proper sequence to the specified torque.

If using flanged connections, the correct number of connector elements must be fitted and they must be tightened with the correct torque in accordance with the screw manufacturer's instructions. Comply with the permissible operating data as defined on the type plate. Make sure that no hazardous fumes can build up in the piping and in the flow meter during commissioning, decommissioning and dismantling. The flow meter must at all times be completely filled with liquid during operation. Check the flow meter periodically for tightness of the connections and for proper functioning. If work is to be done on the installation, before each intervention: release the pressure in the installation if hazardous liquids are used, wear protective clothing and safety goggles, place a collecting tray underneath the installation.

### Preparing for installation

Check flow meters and installation material.

Compare the data of the flow meter name plate with the expected maximum conditions of the installation. They may not exceed the flow meter specifications:

- » Continuous flow rate ( $Q_{cont}$  l/h)
- » Maximum operating pressure (PN bar)
- » Maximum temperature ( $^{\circ}C$ )
- » Appropriate connections (threaded, or flanged) and seals (gaskets)
- » Fasteners for the flow meter
- » Resistance to liquid to be metered and temperature

**CAUTION**

Unauthorized start-up while mounting

**Risk of injury!**

- » Make sure that unauthorized start-up is not possible while mounting.
- » Comply with the applicable working regulations during all work on the system.

**NOTE**

When existing systems are altered:

Take the flow meter out of operation in order to flush the system clean of debris.

Flushing information on page 11.

**Trial operation**

Start trial operation (without flow meter); open the stop valves **slowly** when doing this.

- » Carry out a pressure test in the plant.
- » Check for leaks and tightness of all bolts.
- » Flush the pipework until clean (flow meter out of pipeline).
- » Release the pressure and stop the system again.

This trial operation ensures that the pipework is tight and clean and that there are no foreign bodies in the pipe that could damage the flowmeter.

**Installing the meter in the pipe**

**Remove the protection plugs or caps** from the flow meter (inlet and outlet).

Insert the flow meter into the pipeline in the prescribed position and flow direction. The arrow on the flow meter should correspond with the direction of flow. Install mating flanges parallel and without tension in the pipe.

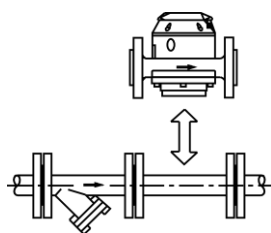
**NOTICE**

Mechanical connection of flow meter into the pipe systems.

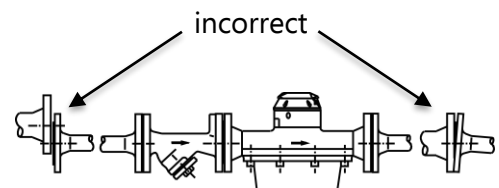
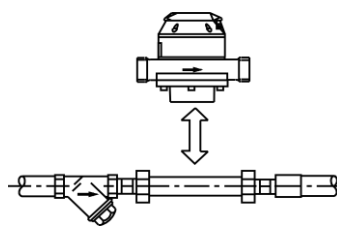
**Risk of leakage!**

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.

## 4.2 Electrical Installation

### NOTICE

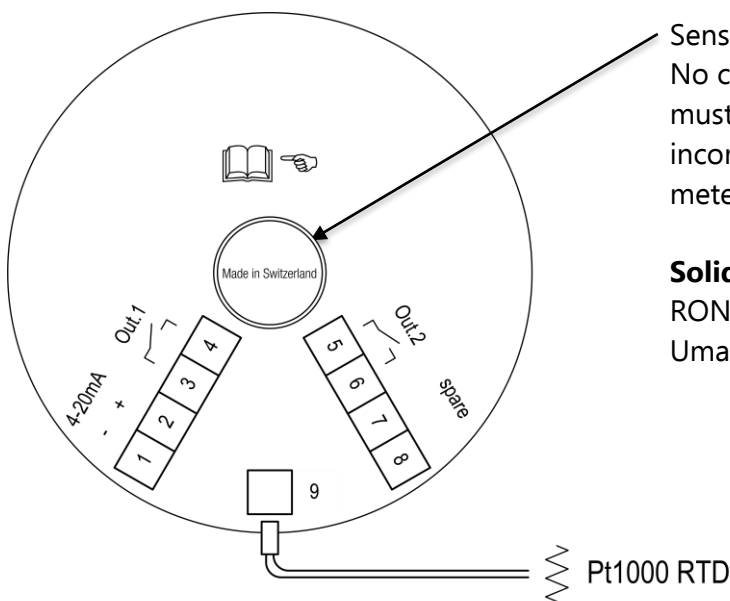


Electrical connection to the supply voltage and/or connections to other systems.

**Risk of malfunction or damage!**

Review of technical data, chapter 9, on page 36.

### Electrical connection - Display unit options VZF II, VZFA II



**Sensor area! (Sensor dome)**  
No cables, wires or other installation material must be present in this area. This can lead to incorrect measurements and damage to the meter.

### Solid state relay

RON ≤ 100 Ohm, RefOFF ≥ 10M Ohm  
Umax ≤ 48 VAC/VDC, Imax ≤ 50 mA



### NOTE

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

### Cable connection

- 1 / 2 Power supply / output current loop (passive)
- 3 / 4 Output 1 (passive)
- 5 / 6 Output 2 (passive)
- 7 / 8 Reserve
- 9 Temperature sensor Pt1000

**Cable gland**

- » Strain relief: Version A according to EN 62444
- » Thread: M25x1.5
- » Clamping range: 10 - 17 mm
- » Key width: 29 mm

**Mounting of electronic display unit****NOTE**

The display can be rotated +/-270° in 90° steps during installation to improve readability.

**NOTICE**

Electrical connection to Pt1000 temperature sensor.

**Risk of malfunction or damage!**

- » Ensure not to pinch cable while mounting electronic display unit onto coupling.
- » Guide cable around sensor dome
- » Electronic display unit shall not be rotated more than 270° in same direction

**NOTE**

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

**Factory setting of outputs**

- Output 1: Out.1 - Volume pulses: 50 ms, 1 l/pulse  
(exception: DN15 is set to 0.1 l/pulse)
- Output 2: Out.2 - Volume pulse: 50 ms, 1 l/pulse  
(exception: DN15 is set to 0.1 l/pulse)
- Analog: disabled

**4.3 Engineering notes**

Parameterizing ancillary devices

Some ancillary units require programming of pulse values or frequency (see the relevant operating instructions). Pulse values of the VZO(A) flow meters can be taken of the type plate. The maximum frequency is calculated with the following formula:

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

## 5 Handling and operation



### NOTE

Modification of operation settings may result in faulty or wrong measuring results.

Multiple output functions are available, any of these functions can be used simultaneously. 2 potential-free digital outputs (Out.1 + Out.2), each freely programmable. The passive current loop is also used to power the flow meter at the same time.

### Default settings:

- » Volume pulses; for external totalizer or monitoring systems.
- » Flow / Frequency; output 0...200Hz corresponding to flow rate.
- » Limiting switch; Switching function with programmable high and low flow rate (NO / NC).
- » Status switch; control functions for Errors, Alarms and Supply Voltage (NO / NC).
- » Analog current loop 4...20mA corresponding to actual flow rate or actual temperature of the medium

### Compensation to Norm-Volume:

Compensation to norm-volume can be turned on, this means that the volumetric expansion of the medium is calculated using actual temperature to its normalized volume (15°C).

The following outputs will change from volume only to compensated norm-volume.

Therefore, output values will have the following functions:

- » Volume pulses; for external totalizer or monitoring systems (50 % Duty cycle).
- » Flow / Frequency; output 0...200 Hz corresponding to flow rate.
- » Analog current loop 4...20 mA corresponding to actual flow rate or actual temperature of the medium.

### Mass flow calculation:

Calculation to mass flow can be turned on, this means that the normalized volume of the medium based on base density (15°C) and actual temperature is calculated to mass / mass flow.

Therefore, the following outputs are added and can be set accordingly:

- » Mass pulses; for external totalizer or monitoring systems.
- » Mass Flow / Frequency; output 0...200 Hz corresponding to mass flow rate.
- » Analog current loop 4...20 mA corresponding to actual mass flow rate.



## 5.1 Commissioning

Startup and commissioning of mechanical part of flow meter, without programming any electronic counter (VZF II and VZFA II). Open valves slowly, fill pipework gradually. Vent the installation well.

Startup and commissioning of mechanical part of flow meter (VZO, VZOA). Open valves slowly, fill pipework gradually. Vent the installation well.

Water hammer must be avoided in order not to damage the flow meter. Inclusions of air cause measuring errors in all types of flow meter and can damage them during operation.

Check the tightness of the connections watch for leakages. Check if the flow rate of the installation correspond to the specification of the flow meter.

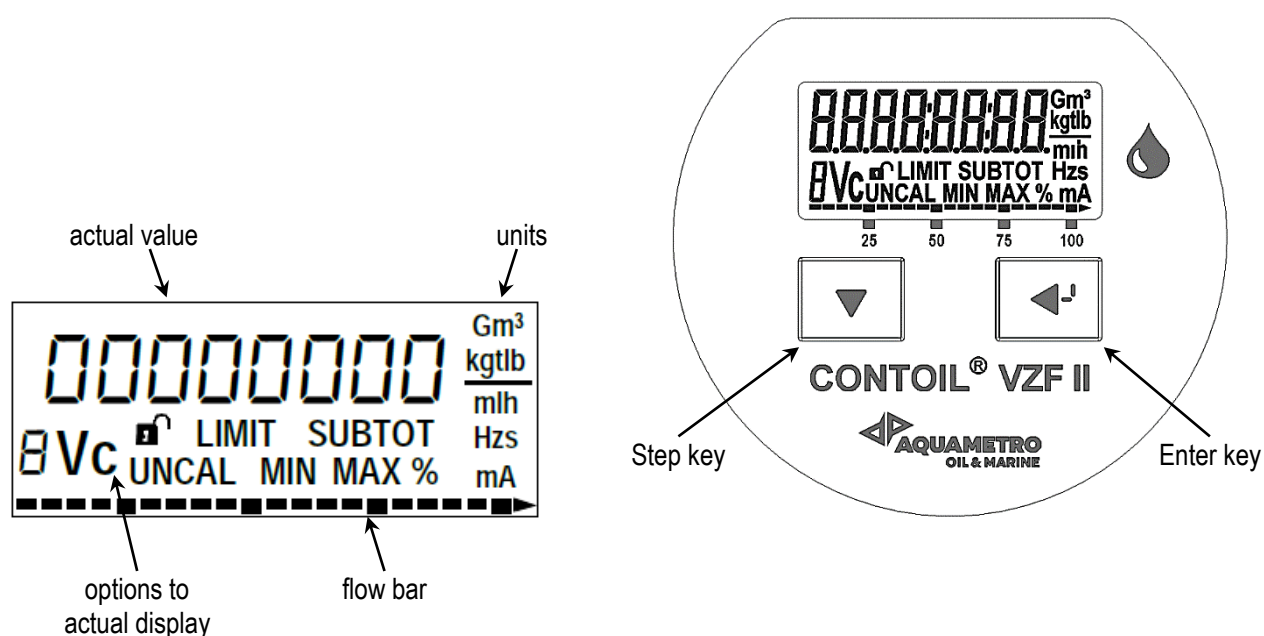
Function check with electronic display: read the instantaneous flow value.

Should the established flow rate be greater than the specification of the flow meter (Qcont), either a flow control valve (throttle) must be inserted behind the flow sensor or a larger size flow meter must be used.


## 5.2 Display and operation

The display shows 8-digits with a decimal point or text messages using letters. Units of measurement and additional items of information are shown with symbols.

The references to these are shown in square brackets, e.g. [o1VoLum].



Use Step key  to scroll the menu and to change field values.


Use Enter key  to enter submenus and to edit / confirm field entries.

The display data and parameters are split into two menu groups:




- » Main Menu: displays measured data, accesses other menus, tests display segments and displays error or alarm messages (if present).
- » Setup Menu: displays parameter settings for the display, output signals, additional information about the flow meter and operating status.

When entering the access code, adjustment of parameters are possible.

### 5.3 Parameterizing


In order to adjust the parameters, scroll to the [SEtUP] item from the Main Menu and press the Enter key .

No code is required to view parameters.

To adjust any parameter in the Seutp menu, the device must be unlocked (  ) with the user code. Press both keys (  +  ) simultaneously for 4 seconds until **[CodE0000] is displayed**.

Press Enter again and the first right digit will start flashing, which means, the unit is ready for the entry of the first digit of the **user code 1111**.

Enter the first digit by using the Step key. Press the Enter key to accept the value (in our case 1) and to move to the second right digit. Continue this way to enter all code digits.

At the end of the procedure a  will be displayed. The flow meter is now in the edit mode and parameters can be changed.

If no key is pressed within 1 minute, the device returns to the "home" display but the edit mode is still active (15 minute timeout). Any entries that have not been completed by pressing the Enter key are rejected.

#### Parameterizing the flow meter data

In order to guarantee accurate measurement, the electronic module of the flow meter requires adjustment. During factory calibration, the data for nominal size and the exact measuring chamber volume are entered for this purpose. These parameters cannot usually be changed again.

If the display shows **[UNCAL]** the flow meter is not calibrated.

If the electronic counter has to be replaced, please mention the serial number of the defective counter in your communication. Spare parts are set to the appropriate hardware size.

#### Reset of subtotalizers

To reset all subtotalizers, go to subtotalizer volume (\*), press and hold both buttons for 4s until the counter are reset.

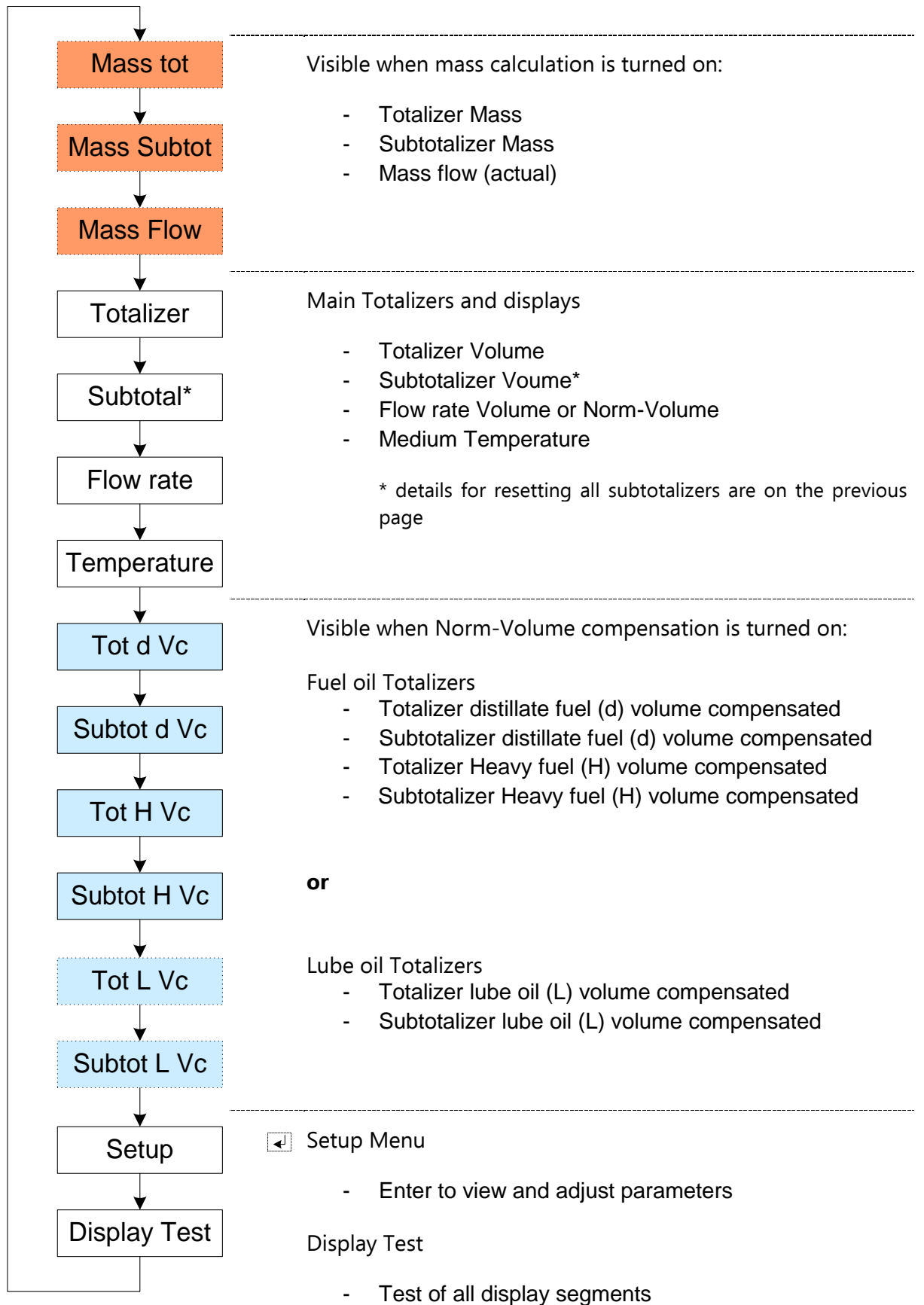
### 5.4 Main Menu

The **Main Menu** displays most important measured data and accesses the setup menu.

The standard "Home" display of the Main Menu is the volume total [TOT], when Mass compensation is turned on the "Home" display is mass total [TOT].

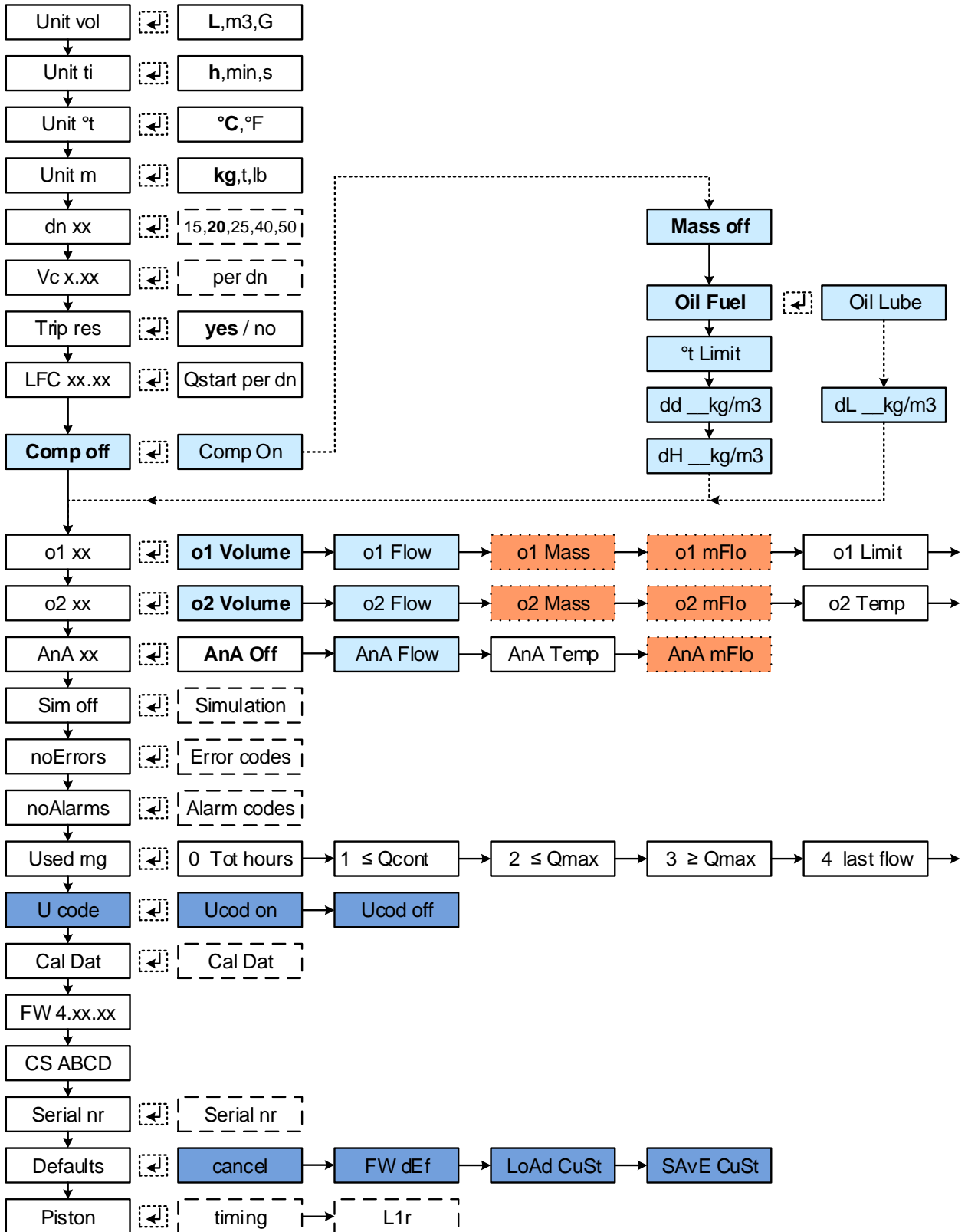
Quick return to "home": quickly press both key simultaneously.

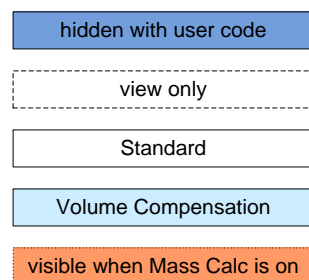
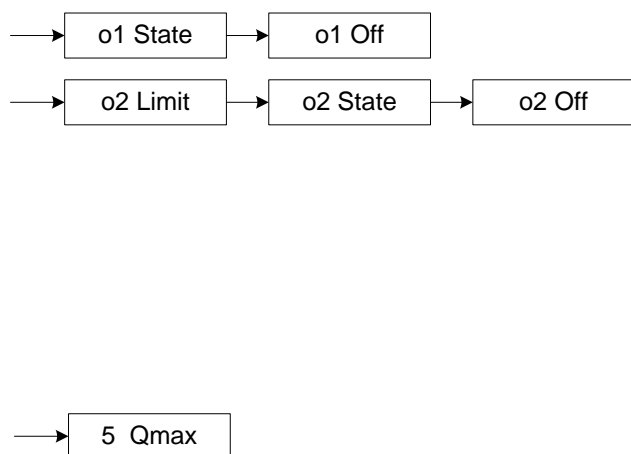
Use the Step key to scroll through all the menu items, as follows:



### 5.5 Setup menu structure

Setup Menu: shows settings for parameters, units and output signals.

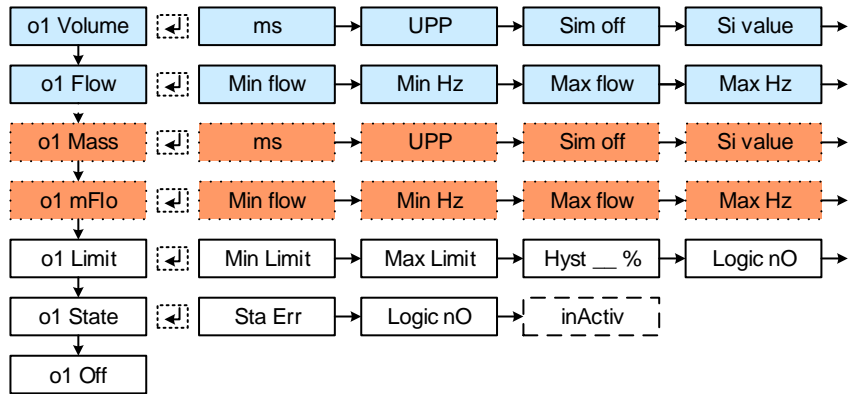




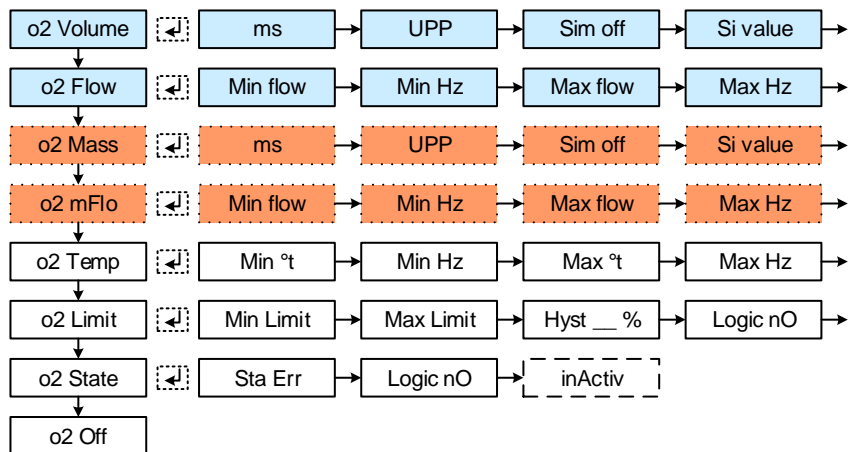
## 5.6 Output assignment settings

Use Step key to scroll through output 1 / 2 options (volume, flow / frequency, mass, mass flow, limit, state and off). Technical output specifications can be found on page 38.

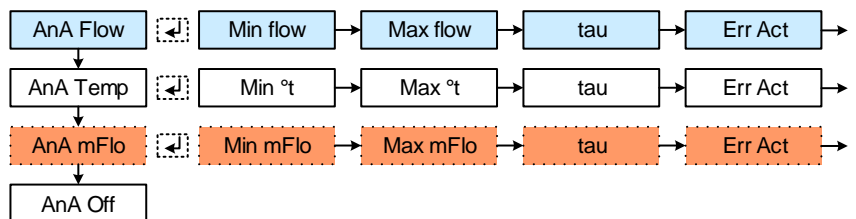
### Output 1 settings

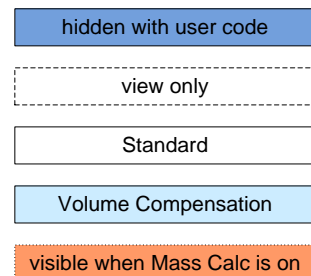
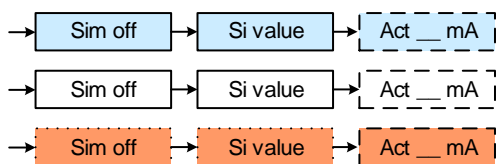
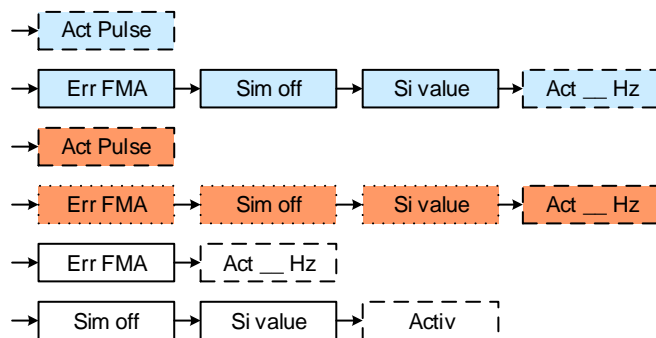
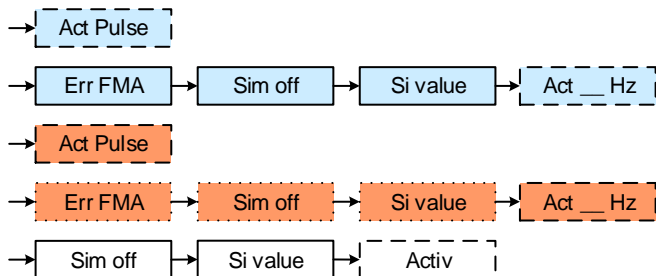


### Output 2 settings



### Analog current loop settings 4...20mA





## 5.7 Description of menu items

As they appear in the menu structure

Possible parameter units are described on page 44

### Main Menu

Mass Tot	totalizer of mass flow in selected units
Mass Subtot	subtotalizer of mass flow
Mass Flow	mass flow
Totalizer	main totalizer of volume flow
Subtot	subtotalizer of volume flow
Flow rate	flow rate (volume compensated when Comp on is set, Vc is displayed)
Temperature	displays oil temperature in selected unit
Tot d Vc	main totalizer of compensated volume flow for distillate fuel
Subtot d Vc	subtotalizer of compensated volume flow for distillate fuel
Tot H Vc	main totalizer of compensated volume flow for heavy fuel
Subtot H Vc	subtotalizer of compensated volume flow for heavy fuel
Tot L Vc	main totalizer of compensated volume flow for Lube oil
Subtot L Vc	subtotalizer of compensated volume flow for Lube oil
<b>Setup</b>	displays all setup parameters (edit with user, service code)
Display test	Test of all display segments

### Setup Menu

Unit vol	select units for volume display
Unit ti	select units for time display
Unit °t	select units for temperature display
Unit m	select units for mass display
Dn*	select nominal size of the hydraulics → pre set during calibration
Vc*	displays the volume of the measuring chamber → set after calibration
Trip res	select if trips (all subtotals) can be reset (yes, no)
LFC	select Low Flow Cut off (no counting below this value, displays zero [0])
Comp OFF	compensation is turned off (volume and mass)
Comp On	compensation is turned on (if mass is off, it will only compensate to Norm-Volume)
Mass OFF	Mass calculation is turned off
Mass On	Mass calculation is turned on (outputs are in mass)
Oil Fuel	select usage type Fuel oil
°t Limit	enter the thermal threshold for distillate and heavy fuel oil
dd 880kg/m <sup>3</sup>	enter the density of currently used distillate fuel
dH 990 kg/m <sup>3</sup>	enter the density of currently used heavy fuel
Oil Lube	select usage type Lube oil if counter is used to measure Lube oil
dL 900kg/m <sup>3</sup>	enter the density of current Lube oil
o1 / o2 / AnA	Outputs, see details on next page
noErrors	no error messages
Errors	error messages displayed (see <b>Troubleshooting</b> for error message details)
noAlarms	no alarm messages
Alarms	alarm messages displayed (see <b>Troubleshooting</b> for alarm message details)



Used rng	Range where the counter been used in hours (h)
0	Total hours of operation (h)
1	hours of operation in preferred range (Qmin – Qcont)
2	hour of operation in upper flow range (Qcont – Qmax)
3	hours of operation above Qmax (h)
4	duration since last recorded flow (h)
5	maximum registered flow rate since start of operation
U Code*	select to enable / disable access with user code
FW 4.xx.xx	Firmware version
CS yyyy	Check Sum value (hexadecimal 4 digits)
Serial nr*	Serial number
Defaults*	select to save / load customer settings and reset to firmware defaults
Save Cust*	select to save customer settings
Load Cust*	select to load saved customer settings
FW def*	select to reset the device to firmware defaults
Piston	additional piston rotation timing information for service technicians

\*edit access for service technicians only

**Outputs** see Technical output specifications on page 38 for more details  
oX = o1 or o2

oX Volume	select when volume pulses are required (digital pulse)
oX Flow	select when flow is required (frequency)
oX Mass	select when mass pulses are required (digital pulse)
oX mFlo	select when mass flow is required (frequency)
oX Limit	select when a limit switch function is required
oX State	select when the status of the device is required
oX OFF	select to turn this output off
o2 Temp	select when temperature with an frequency output is required
AnA Flow	select when an analog current flow is required
AnA Temp	select when an analog current temperature is required
AnA mFlo	select when an analog current mass flow is required
AnA OFF	select to turn the analog off
Sim OFF	Simulation off, turn on to simulate individual outputs
Si 0.0000	enter a simulation value when simulation is on

## Output settings

ms	pulse width limit in milliseconds
UPP	Units per pulse (the value of 1 pulse)
Act xx	the actual value on output
Min flow	lower flow rate value for frequency output (Qmin for o1/o2)
Min Hz	lower frequency value of frequency output (fmin for o1/o2)
Max flow	upper flow rate value of frequency output (Qmax for o1/o2)
Max Hz	upper frequency value of frequency output (fmax for o1/o2)
Err FmA	behavior during error of output (set to fMAX as defined in settings ( o1/o2 )
Err Act	behavior during error of output (actual value; error suppression)
Err Low	behavior during error of output (output signal is at low limit 3.5mA)
Err High	behavior during error of output (output signal is at high limit 21.5mA)
Min Limit	lower flow rate limiting value
Max Limit	upper flow rate limiting value
Hyst x%	hysteresis in percent of limiting value
Logic NO	logic function NO (normally open)
Logic NC	logic function NC (normally closed)
Activ	status of logic output is active
inActiv	status of logic output is inactive
Min °t	lower temperature value for frequency output (Tmin for o1/o2)
Min Hz	lower frequency value of frequency output (fmin for o1/o2)
Max °t	upper temperature value of frequency output (Tmax for o1/o2)
Max Hz	Upper frequency value of frequency output (fmax for o1/o2)
Min mA	lower value for the analog current signal of 4mA (valid for flow, temp & mass flow)
Max mA	upper value of the analog current signal of 20mA (valid for flow, temp & mass flow)

## 6 Maintenance and Repair

### 6.1 Calibration

All our flow meters are calibrated in the factory.

All our flow meters are calibrated in the factory. An accuracy check and recalibration is offered at Aquametro Oil & Marine, this is usually dependent on customer, operator or regulation requirements. This interval depends largely on the operating conditions, process liquid and the application the flow meter is installed in.

### 6.2 Service maintenance

#### 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 specialists in accordance with the applicable regulations.
- » Use appropriate protective equipment, particularly safety goggles.

#### NOTICE

Use of unsuitable cleaning agents and procedures.



#### Risk of malfunction or damage!

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 Oil & Marine 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 Oil & Marine 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

## 6.3 Maintenance



### NOTICE

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

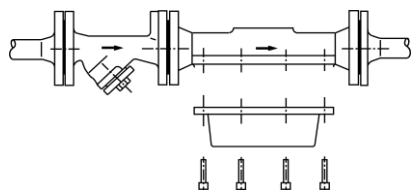
Check connections periodically for tightness and if necessary retighten. For control and cleaning, the measuring chamber and the ring piston of the flow meters CONTOIL® DN 15 - 50 can be removed without dismantling the flow meter from the pipe.

(1) 

(2) 

### 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

Flow meter	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 favourable conditions 5 - 10 years suffice. Check the devices for corrosion.

### Recommended revision cycle

Flow meter	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 instruction on opening and closing the flow meter please refer to separate manual.



See Spare part list and Maintenance instructions.

**6.4 Spare parts****NOTICE**

Use of wrong spare parts

**Risk of malfunction or damage!**

Use only original spare parts, supplied by Aquametro Oil & Marine.



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

## 7 Troubleshooting

Fault symptoms	Possible causes	Procedures <sup>1)</sup>
» No reading / blank display	» No power supply » Electronic counter defective	» Check wiring, polarity » Replace electronic counter » Mention SN during order
» Counter runs backwards	» Meter mounted in wrong direction	» Install meter with arrow pointing in flow direction
» Counter not running » No flow rate » Indicated quantity or flow rate too small	» Flow rate outside allowed range (below $Q_{min}$ or above $Q_{max}$ of meter)	» Check flow rate » If too high, reduce flow or install larger meter » If too low, increase flow or install smaller meter » Reduce LFC to 1
	» Moving parts heavily worn out due to continuous overload	» Install larger meter
	» Dirt trap / filter heavily soiled	» Clean dirt trap, replace filter
	» Safety filter in meter intake clogged	» Replace safety filter » Install dirt trap / filter with correct mesh size
	» Moving parts jammed	» Clean measuring chamber, replace defective parts
	» Alignment of inner parts	» Align cover and measuring chamber (rip to rip)
	» Separating plate broken by - Pressure hammer - Gas inclusions	» Check and rectify operating conditions and meter position » Fill pipes slowly » De-aerate pipes thoroughly » Replace defective parts
» Indicated quantity or flow rate too high	» Meter positioned wrongly (e.g. at highest point) » Gas or air inclusion in fluid	» Check and rectify operating conditions and meter position » De-aerate pipes carefully
» Pressure drop at meter too high	» Dirt trap or filter heavily soiled » Flow meter's safety filter heavily soiled	» Clean dirt trap, replace filter » Clean safety filter of flow meter
» No frequency signal » No current signal » No pulse output signal	» No flow	» Check flow using Indication
	» Wrong parameterization	» Set correct using indication
	» Transducer defective	» Replace transducer

## 7.1 Error messages VZF II / VZFA II

The electronic module performs a self-test about every 5 minutes. If an error is detected which impairs the reliability or accuracy of the measurement, **[ERROR]** message will appear every 2 seconds on the display.

Error messages are messages from the electronic module.

**[nO ErrS]** no error is active

Action: none

**[E-FLOW]** maximum permitted flow rate (Q<sub>max</sub>) exceeded The flow meter is mechanically overloaded and is no longer measuring accurately.

Action: reduce the flow rate or use higher nominal size.

**[E-Prom]** error with the Checksum of the Software saved in ROM.

Action: Please contact the supplier.

**[E-SENSOR]** signal error from flow sensor to electronic module, flow meter supplies incorrect measured values.

Action: electronic module must be replaced. Please contact the supplier.

**[E-EEP o1]** EEPROM error in output 1 parameters

Action: Go to [DEFAULTS] correct output1 memory block (under USER Code).

**[E-EEP o2]** EEPROM error in output 2 parameters

Action: Go to [DEFAULTS] correct output2 memory block (under USER Code).

**[E-EEPANA]** EEPROM error in Analog current loop parameters

Action: Go to [DEFAULTS] correct analog current loop memory block (under USER Code).

**[E-EEPLIN]** Linearisation table is corrupt, device runs in standard mode

Action: electronic module must be replaced. Please contact the supplier.

**[E-Pt1000]** temperature is out of range (-60 °C to +200 °C), broken or shorted contact

Action: check connector and cable of Pt1000.

**[E-EEPDEV]** EEPROM error in device

Action: measurement transducer must be replaced. Please contact the supplier.

**[E-EEPTOT]** EEPROM error in Totalizer. Totalizer value may be incorrect.

Action: Go to [DEFAULTS] correct Totalizer memory block (under USER Code).



***CAUTION*** Totalizer value is lost.

**[E-EEPTRP]** EEPROM error in Trip Totalizer. Trip Totalizer value may be incorrect.  
Action: Go to [DEFAULTS] correct Trip Totalizer memory block (under USER Code).

***CAUTION*** Trip Totalizer is lost.

**[E-EEP FAT]** EEPROM error in File System.

Action: electronic module must be replaced. Please contact the supplier.

## 7.2 Alarm messages VZF II / VZFA II

The electronic module performs a self-test about every 5 minutes. If an alarm condition is detected, **[ALARM]** message will appear on the display every 2 seconds.

Alarm messages are messages from the parameter settings

**[nO ALmS]** no alarm is active

Action: none.

**[A-SEnSSI]** alarm when sensor simulation is activated (Service Technician only).

Action: none. CAUTION Totalizer and Trip Totalizer accumulate the simulated value.

**[A-o1 SI]** alarm when output 1 simulation is activated.

Action: turn off when not required anymore.

**[A-o2 SI]** alarm when output 2 simulation is activated.

Action: turn off when not required anymore.

**[A-ANA SI]** alarm when Analog current loop outputsimulation is activated.

Action: turn off when not required anymore.

**[A-o1 LI]** alarm when output 1 is over its limit.

Action: adjust the settings of output1.

**[A-o2 LI]** alarm when output 2 is over its limit.

Action: adust the settings of output2.

**[A-AnA LI]** alarm when Analog current loop outputis over its limit.

Action: adust the settings of analog current loop output.

## 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 devices/systems.
- » When working on the device/system 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.

### 8.1 Decommissioning

Disconnect all sources of energy.

Remove the flow meter from system.

### 8.2 Dismantling

Not required.

### 8.3 Return of materials

Never send a device/system back if you are not absolutely certain that all traces of hazardous substances have been removed, e.g. substances which have penetrated crevices or diffused through plastic.

Costs incurred for waste disposal and injury (burns, etc.) due to inadequate declaration and/or cleaning will be charged to the delivering company or the operator.

For a device that is sent back to Aquametro Oil & Marine for repair or calibration the following point are an absolute must:

- » Always quote type and serial number when contacting an Aquametro Oil & Marine office or an Aquametro representative.
- » Always enclose a duly completed "Declaration of decontamination" form (FO0451e).
- » Only in special cases (e.g. for the reconstruction of causes of errors) and only with the prior consent of the Aquametro Oil & Marine, equipment must be returned in the unpurified state. In this case also the contact person at Aquametro Oil & Marine, which has granted the approval to return a crude device must be stated.



Use form  
«FO0451e\_ Declaration of Decontamination» and  
«FO0301e\_Return Form».

### 8.4 Disposal



At the end of its life cycle, this product should be disposed of according to local regulations regarding waste recycling or disposal.

Batteries and rechargeable batteries shall be recycled separately.



The separate collection and recycling of used products will help to conserve natural resources, and ensures that they are disposed of in a way that does not cause damage to the environment and nature.

## 9 Technical data

### 9.1 Hardware characteristics

Hydraulics			Meter DN size				
Nominal diameter		DN mm	15	20	25	40	50
		inch	1/2	3/4	1	1 1/2	2
Installation length		mm	165	165	190	300	350
Nominal pressure threaded ends	PN	bar	16	16	16	16	N/A
Nominal pressure flanges	PN	bar	25 / 40	25 / 40	25 / 40	25 / 40	25 / 40
Maximum medium temperature	T <sub>max</sub>	°C	130, 180				
Maximum flow rate	Q <sub>max</sub> <sup>1)</sup>	l/h	600	1500	3000	9000	30000
<b>Continuous flow rate</b>	<b>Q<sub>cont</sub><sup>2)</sup></b>	<b>l/h</b>	<b>400</b>	<b>1000</b>	<b>2000</b>	<b>6000</b>	<b>20000</b>
Minimum flow rate	Q <sub>min</sub>	l/h	20	40	75	225	750
Approx. starting flow rate		l/h	4	12	30	90	300
Max. permissible error of actual value <sup>1)</sup>	VZF II, VZO, DFM		±1.0 %	±1.0 %	±1.0 %	±1.0 %	±1.0 %
	VZFA II, VZOA		±0.5 %	±0.5 %	±0.5 %	±0.5 %	±0.5 %
	VZFA II linearized		±0.3 %	±0.3 %	±0.3 %	±0.3 %	±0.3 %
Repeatability			±0.1 %	±0.1 %	±0.1 %	±0.1 %	±0.1 %
Measuring chamber volume		cm <sup>3</sup>	12	36	100	330	1200
Safety filter mesh size		mm	0.400	0.400	0.400	0.800	0.800
Weight with threaded ends <sup>3)</sup>		kg	2.2	2.5	4.2	17.3	-
Weight with flanges PN 25		kg	3.8	4.5	7.5	20.3	41.0
Weight with flanges PN 40		kg	4.4	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.

Electronic display			Meter DN size				
Nominal diameter		DN mm	15	20	25	40	50
		inch	1/2	3/4	1	1 1/2	2
Max. medium temperature	T <sub>max</sub>	°C	130, 180				
Max. environment temperature		°C	-25 to +70				
Max. storage temperature		°C	-25 to +85				
Max. storage humidity	Rh <sub>max</sub>	% rh	95, non-condensing				
Protection class			IP 66 / IP 68 / IP 69				
Total volume / mass		L, m <sup>3</sup> , G <sup>1)</sup> , kg, t, lb	max. 3 decimals (dynamic)				
Resettable		L, m <sup>3</sup> , G <sup>1)</sup> , kg, t, lb	max. 3 decimals (dynamic)				
Flow rate			max. 3 decimals (dynamic)				
Smallest readable amount			0.001				
Maximum registration capacity			8 digits				
Registration time until overrun to zero at		Q <sub>cont</sub> (m <sup>3</sup> )	>100 years				
Data preservation			by non-volatile memory (EEPROM)				

- 1) 1 US gallon corresponds to 3.785 liters.

## Outputs

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	QLimmax, QLimmin	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)

## Electronic

Power supply	VDC	6 - 30
Quiescent current zero	mA	4

### Relay output

Switching element		solid state relay (out1 & out2)
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	mA	4 - 20 passive
Resolution	Bit	16
Max. error	mA	$\pm 0.2$
Update interval	s	$< 0.1$
Maximum Load (RL)	$\Omega$	0 to 1116, depending on external supply voltage of the power supply unit

U-6

————  $\Omega$ ; (e.g.: 1116 $\Omega$ @30V)

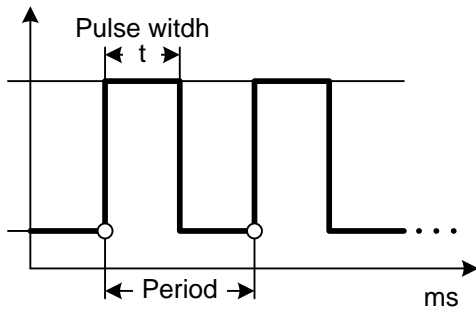
0.0215

## 9.2 Parameterizing the VZF II / VZFA II outputs

In order to set the parameters, the device must be unlocked with the user code

**Volume pulse output** for summing the flow volume (totalizer)

Setup menu: function for Output1 or Output2



### 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 50 %.

### Signal behavior:

The signal is defined as 50 % ON and 50 % OFF:

### Parameters that can be set:

Pulse width (t): 2...500 ms

(Volume or Norm-Volume pulses)

Pulse value for liters <b>[UPP]:</b>	0,0001...1000 l/pulse
Pulse value for m <sup>3</sup> <b>[UPP]:</b>	0,0001...1000 m <sup>3</sup> /pulse
Pulse value for US gallons <b>[UPP]:</b>	0,0001...1000 gallon/pulse

(Mass pulses)

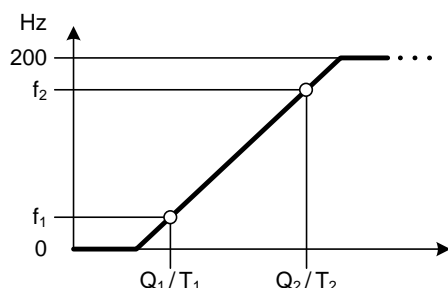
Pulse value for kilo grams <b>[UPP]:</b>	0,0001...1000 kg/pulse
Pulse value for tons <b>[UPP]:</b>	0,0001...1000 t/pulse
Pulse value for US lbs <b>[UPP]:</b>	0.0001...1000 lb/pulse

### factory setting:

**DN 20 – 50 are set to 50 ms and 1 UPP  
(DN 15 is set to 0.1 UPP)**

## Flow / Frequency output

Setup menu: function for Output1 or Output2



Frequency range and proportionality of the signal across the desired flow rate / temperature measurement range  $Q_1/T_1 - Q_2/T_2$

### Signal behavior:

If the flow falls below the set lower flow rate value, a proportional decrease to 0 Hz will occur, which is then maintained until the flow rises over the lower flow rate again.

If the flow exceeds the set upper flow rate value, a proportional increase to 200 Hz will occur, which is then maintained until the flow falls below the lower flow rate again.

On Error, select between **[Err FmA]** (frequency max; sends max. frequency) or **[Err Act]** (actual value; error ignored)

### Parameters that can be set:

(Volume or Norm-Volume flow)

Lower flow rate [MIN]:	$Q_1/T_1 \geq 0$	<i>(factory setting: <b>Qmin</b>)</i>
Lower frequency [Hz]:	$f_1 \geq 0$	<i>(factory setting: <b>20 Hz</b>)</i>
Upper flow rate [MAX]:	$Q_2/T_2 \leq Q_{max}$	<i>(factory setting: <b>Qcont</b>)</i>
Upper frequency [Hz]:	$f_2 \leq 200 \text{ Hz}$	<i>(factory setting: <b>200 Hz</b>)</i>
Error <b>[Err]</b>		<i>(factory setting: <b>Err FmA</b>)</i>

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

### Example:

Lower flow rate: 30 l (Q1) by a frequency of 20 Hz (f1)

Upper flow rate: 2000 l (Q2) by a frequency of 160 Hz (f2)

A flow range of 1970 l (2000 - 30) and a frequency range of 140 Hz (160 - 20).

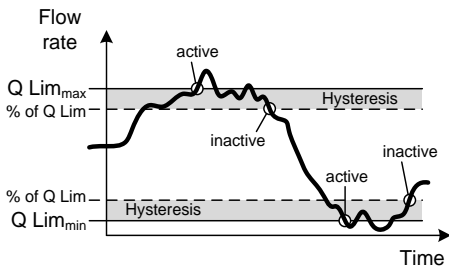
The flow range will be spread across the range of 140 Hz.

That means,  $1970 \text{ l} / 140 \text{ Hz} = 14.1 \text{ l/Hz}$ .

In other words, for a delta of 1 Hz there is an increase of 14.1 l.

## Limiting output

Setup menu: function for Output1 or Output2



	Work State	
	NC	NO
active	/—	/—
inactive	/—	/—

The function Limit allows you to set an alert whenever predefined flow rates are exceeded.

### Signal behavior:

Limit defines upper ( $Q\ Lim_{max}$ ) and lower ( $Q\ Lim_{min}$ ) flow rate thresholds which, when exceeded, activate a switch (alert). In order to prevent oscillating between active and inactive states when the flow rate fluctuates about a threshold, hysteresis bands (see adjacent diagram) can be defined in which the switch will remain active once it has been triggered to this state. When the flow rate passes below or above these bands, the switch will be deactivated. The hysteresis bands are calculated as a percentage of the threshold values ( $Q\ Lim$ ).

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

### Parameters that can be set:

Lower flow rate [**LIMIT MIN**]:

$Q\ Lim_{min} \geq 0$  **(factory setting:  $Q_{min}$ )**

Upper flow rate [**LIMIT MAX**]:

$Q\ Lim_{max} \leq Q_{max}$  **(factory setting:  $Q_{cont}$ )**

Hysteresis [**HYST**]:

0...9 % **(factory setting: 1 %)**

The switches that are activated by the above parameters can be set to NO (Normally Open) or to NC (Normally Closed). This choice is dependent on your needs.

**Limit switch [NO]:**

Contact closes when the limits are exceeded .

**Limit switch [NC]:**

Contact opens when the limits are exceeded.





### Example:

- » If the limit [**LIMIT MIN**] is set to 100l/h and [**HYST**] is set to 5%, then the hysteresis is 5 % of 100 l/h or 5 l/h. This means that as soon as the flow rate rises above 105 l/h the switch will be deactivated if it is active.
- » If the limit [**LIMIT MAX**] is 200l/h and [**HYST**] is set to 5%, then the hysteresis is 5 % of 200 l/h or 10 l/h. If the switch is active then it will be deactivated as soon as the flow falls below 190 l/h.



**State output** according to signal faults

Setup menu: function for Output1 or Output2

Work State		
	NC	NO
active		
inactive		

Whenever an error or an alarm occurs, you can send it with this selected output.

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

**Parameters that can be set:**

Available fault setting:

[Err, ALm or VCC (VCC = loss of power supply)]

**(factory setting: Err)**

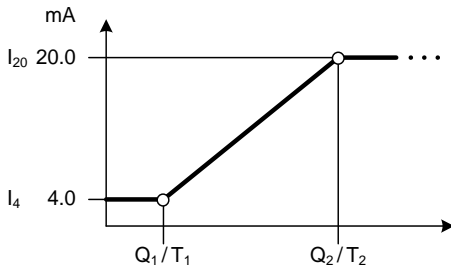
Select contact logic:

[NO] or [NC]

**(factory setting: NO)**

**Analog current loop (4...20mA)**

Setup menu: Analog current loop



- I<sub>4</sub> : current 4mA
- I<sub>20</sub> : current 20mA
- Q<sub>1</sub> : chosen min. flow rate
- T<sub>1</sub> : chosen min. temperature
- Q<sub>2</sub> : chosen max. flow rate
- T<sub>2</sub> : chosen max. temperature

The current signal is proportional to the flow rate or temperature range of Q1/T1 to Q2/T2

**Signal behavior:**

when a relevant flow meter error occurs:

- » Value falls below the set lower flow rate / temperature value Q1/T1: proportional decrease to 3.8mA which is then maintained.
- » Value exceeds the set upper flow rate / temperature value Q2/T2: proportional increase to 20.8mA which is then maintained.
- » (continuing output of actual value 3.8...20.8 mA).
- » Error signal for measurement relevant error (sensor, ROM, supply voltage, etc.)  
 For HIGH error behavior: output 21.5 mA  
 For LOW error behavior: output 3.5 mA  
 For ACT error behavior: no error signal,

**Damping of the signal [tAU]** for rapidly changing values.

Note: The higher the time constant, the more sluggish the signal. This parameter is used to avoid "jumps" of the signal.

**Parameters that can be set:**

- Lower value [MIN]: Q1/T1 ≥ 0 *(factory setting: Qmin / 0 °C)*
- Lower current [mA]: I<sub>4</sub> = 4 mA
- Upper value [MAX]: Q2/T2 ≤ Q/Tmax *(factory setting: Qcont / 100 °C)*
- Upper current [mA]: I<sub>20</sub> = 20 mA
- Error [Err] *(factory setting: Err Act)*

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

**[tAU]** Damping value (Tau)

1 (no damping) ... 9 (max. damping) *(factory setting: 4)*

**Example:**

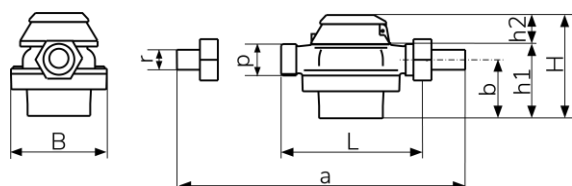
Q<sub>1</sub> is 50 l/h and Q<sub>2</sub> is 500 l/h  
 By 50 l/h a signal of 4 mA is being sent  
 By 275 l/h a signal of 12 mA is being sent  
 By 500 l/h a signal of 20 mA is being sent  
 the flow range of 450 l/h, will be distributed across the range of 16 mA (20 mA – 4 mA).

## 10 Appendix

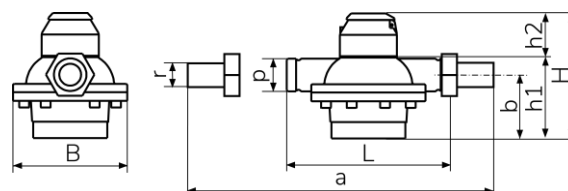
### 10.1 Dimensional drawings

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

DN 15, 20, 25: with threaded ends

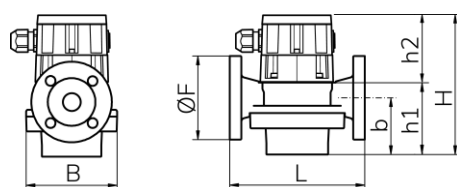


DN 40: with threaded ends

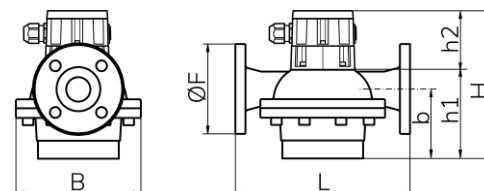


All flow meters with flanges are according to EN 1092-2, ASME B16.5 or JIS B2239.

DN 15, 20, 25: with flanged ends

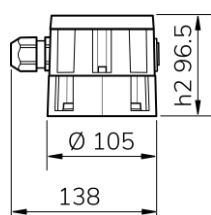


DN 40, 50: with flanged ends

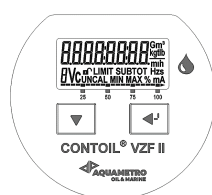


### Electronic counter

Module;  
dimensions h2



Digital display



Nominal 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 Default settings VZF II / VZFA II

<b>Total counter mass</b>	unit selected in Unit volume
<b>Trip counter mass</b>	unit selected in Unit volume
<b>Actual mass flow</b>	unit selected in Unit volume and Unit time
<b>Total counter</b>	unit selected in Unit volume
<b>Trip counter</b>	unit selected in Unit volume
<b>Actual flow</b>	unit selected in Unit volume and Unit time
<b>Temperature</b>	medium temperature in unit selected in Unit temperature
<b>Total counter dist. Fuel</b>	unit selected in Unit volume
<b>Trip counter dist. Fuel</b>	unit selected in Unit volume
<b>Total counter Heavy Fuel</b>	unit selected in Unit volume
<b>Trip counter Heavy Fuel</b>	unit selected in Unit volume
<b>Total counter Lube oil</b>	unit selected in Unit volume
<b>Trip counter Lube Oil</b>	unit selected in Unit volume
<b>Setup menu</b>	
<b>Unit volume</b>	<i>L, G, m<sup>3</sup></i>
<b>Unit time</b>	<i>s, min, h</i>
<b>Unit temperature</b>	<i>°C, °F</i>
<b>Unit mass</b>	<i>kg, t, lb</i>
<b>Nominal size*</b>	15, <b>20</b> , 25, 40, 50
<b>Measuring chamber*</b>	default: per selected size, or calibrated value
<b>Trip Reset</b>	
<b>Reset yes / no</b>	<i>yes, no</i>
<b>Low flow cut off</b>	<i>Qstart, 0...Qmin</i>
<b>Compensation</b>	<i>off, on</i>
<b>Mass Compensation</b>	<i>off, on</i>
<b>Oil Fuel</b>	<i>Oil Fuel, Oil Lube</i>
<b>°t Limit</b>	<i>60°C, 0...200°C (32...392°F)</i>
<b>dd_kg/m3</b>	<i>880kg/m<sup>3</sup>, 800...1200kg/m<sup>3</sup> (@ 15°C, Bunker report)</i>
<b>dH_kg/m3</b>	<i>990kg/m<sup>3</sup>, 800...1200kg/m<sup>3</sup> (@ 15°C, Bunker report)</i>
<b>dL_kg/m3</b>	<i>900kg/m<sup>3</sup>, 800...1200kg/m<sup>3</sup> (@ 15°C, Bunker report)</i>
<b>Output 1</b>	<i>Volume, Flow, Mass, Mass Flow, Limit, State, off</i>
<b>Volume output</b>	
<b>Pulse width</b>	<i>50ms, 2...500ms</i>
<b>Unit per pulse</b>	<i>1UPP, 0.001...1000UPP [0.1UPP DN15]</i>
<b>Simulation</b>	<i>off, on</i>
<b>Sim value</b>	0...Qmax (max. 9999.9)
<b>Actual output</b>	display flashes [Act Pulse] when active
<b>Flow output</b>	
<b>Min Flow</b>	<i>Qmin, 0...Qmax</i>
<b>Min Frequency</b>	<i>20Hz, 1...200Hz</i>
<b>Max Flow</b>	<i>Qcont, 0...Qmax</i>
<b>Max Frequency</b>	<i>200Hz, 1...200Hz</i>
<b>Error behavior</b>	<i>FMA, Act</i>
<b>Simulation</b>	<i>off, on</i>
<b>Sim Value</b>	0...Qmax (max. 9999.9)
<b>Actual output</b>	displays actual frequency on output [Act Hz] when active

<b>Mass output</b>	
Pulse width	<b>50ms</b> , 2...500ms
Unit per pulse	<b>1UPP</b> , 0.001...1000UPP [ <b>0.1UPP...DN15</b> ]
Simulation	<b>off</b> , on
Sim value	0...Qmax (max. 9999.9)
Actual output	display flashes [Act Pulse] when active
<b>Mass Flow output</b>	
Min Flow	<b>Qmin</b> , 0...Qmax
Min Frequency	<b>20Hz</b> , 1...200Hz
Max Flow	<b>Qcont</b> , 0...Qmax
Max Frequency	<b>200Hz</b> , 1...200Hz
Error behavior	<b>FMA</b> , Act
Simulation	<b>off</b> , on
Sim Value	0...Qmax (max. 9999.9)
Actual output	displays actual frequency on output [Act Hz] when active
<b>Limit output</b>	
Limit min	<b>Qmin</b> , full range of size
Limit max	<b>Qmax</b> , full range of size
Hysteresis	<b>1%</b> , 1...9% (possible rename to Threshold)??
Logic position	<b>Logic Hi</b> , Logic Lo
Simulation	<b>off</b> , on
Sim value	0...Qmax (max. 9999.9)
Actual output	displays actual state on output [Act on] / [Act off]
<b>State output</b>	
State behavior	<b>Error</b> , Alarm, UCC
Logic position	<b>Logic Hi</b> , Logic Lo
Actual output	displays actual state on output [Act on] / [Act off]
<b>Output disabled</b>	
<b>Output 2</b>	<b>Volume</b> , Flow, Mass, Mass Flow, Temperature, Limit, State, off
Same as output 1	
<b>Temperature output</b>	temperature is additional to output 1
Min Temperature	<b>20°C / 68°F</b> , 0...Tmax
Min Frequency	<b>20Hz</b> , 1...200Hz
Max Temperature	<b>100°C / 212°F</b> , 0...Tmax (Tmax = 200°C / 392°F)
Max Frequency	<b>200Hz</b> , 1...200Hz
Error behavior	<b>FMA</b> , Act
Simulation	<b>off</b> , on
Sim Value	0...Qmax (max. 9999.9)
Actual output	displays actual frequency on output [Act Hz] when active
<b>Analog Output Flow</b>	<b>disabled</b> , enabled
Min Value	<b>0</b> , 0...Qmax
Max Value	<b>Qcont</b> , 0...Qmax
tAU value	<b>4</b> , 0...9
Error behavior	<b>act</b> , High, Low
Simulation	<b>off</b> , on
Sim value	0...Qmax (max. 9999.9)
Actual output	displays actual current on output [Act mA] when active





<b>Analog Output Temperature</b>	<i>disabled</i> , enabled
Min Value	<b>20</b> , 0...Tmax
Max Value	<b>100°C / 212°F</b> , 0...Tmax (Tmax = 200°C / 392°F)
tAU value	<b>4</b> , 0...9
Error behavior	<b>act</b> , High, Low
Simulation	<b>off</b> , on
Sim value	0...Qmax (max. 9999.9)
Actual output	displays actual current on output [Act mA] when active
<b>Analog Output Mass Flow</b>	<i>disabled</i> , enabled
Min Value	<b>0</b> , 0...Qmax
Max Value	<b>Qcont</b> , 0...Qmax
tAU value	<b>4</b> , 0...9
Error behavior	<b>act</b> , High, Low
Simulation	<b>off</b> , on
Sim value	0...Qmax (max. 9999.9)
Actual output	displays actual current on output [Act mA] when active
<b>Simulation Sensor*</b>	<b>off</b> , on
Sim value	0...Qmax (max. 9999.9)
<b>Errors</b>	
Error messages.	see Technical Data
<b>Alarms</b>	
Alarm messages	see Technical Data
<b>Range</b>	
h0	total operating time t
h1	t in preferred flow range
h2	t in upper flow range
h3	t above Qmax
h4	t since last flow
5	Peak flow
<b>U Code*</b>	access with user code <b>on</b> / off
<b>Cal Date*</b>	date of calibration
Date value	dd.mm.yy, 31.12.99
<b>Verification Date*</b>	date of verification (CE devices only)
Date value	dd.mm.yy, 31.12.99
<b>Firmware</b>	4.xx.xx
<b>Checksum</b>	yyyy (hexadecimal 4 digits)
<b>Serial Number*</b>	7 digits
<b>Defaults*</b>	
Cancel	abort (back to menu)
FW def	reset of all parameters to factory settings
Save Cust	save customer settings to device
Load Cust	load customer settings from device
<b>Piston</b>	
Rev timing	advanced mechanical information
<b>Display test</b>	
<b>Alarm message</b>	shown if applicable
<b>Error message</b>	shown if applicable

Default settings are in ***bold - italic*** letters

\*edit access for service technicians only

## 11 Certificates

All the below mentioned certificates/approvals, can be found on our web site [www.aquametro-oil-marine.com](http://www.aquametro-oil-marine.com).

Class approvals		
Det Norske Veritas - German Lloyd	Norway – Germany	
Lloyds Register	United Kingdom	
RRR	Russian River Register	
RMRS	Russian Maritime Register of Shipping	
CCS	China Classification Society	

### Versions with type approval and metrological CE approval

These versions of the CONTOIL<sup>®</sup> oil flow meter bear the number of the type test certificate in accordance with Directive 2014/32/EU and the metrological CE mark.

This means that they can be used for CE-compliant measurements in accordance with local laws/regulations.



For details please request document «Versions with type approval and metrological CE approval and verification» (Art. No. 21469).



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