

CONTOIL®

VZD2 / VZDA2, DN 4 - 8

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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 or can be found on our website: <https://www.aquametro-oil-marine.com>

For smart devices scan 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® VZD2

Hardware-Version: 00.13

Firmware Version: 01.02.xx

Manual: 4235e_contoil_vzd2_2508.docx

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1 Safety

1.1 Intended Use

The device CONTOIL® VZD2 is designed and solely intended for the flow and consumption measurement of Diesel oil and Lubrication oil.

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
Download via QR code or click, on our website



get PDF

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 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 parts of the housing containing electric or electronic components before the electric power is turned off.
- » Do not touch any electronic components (ESD sensitivity).
- » Never exceed the specified classifications for mechanical and electrical load (e.g. pressure, temperature, ingress protection (IP), voltage 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 labor and safety laws and regulations must be adhered to.

2 Scope of delivery and accessories

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

- » 1 CONTOIL® VZD2 flow measuring system
- » 2 Quick instructions - full Operating instructions as download (this document)
- » 3 mounting kit VSR-set 1/8" - M14x1,5 (only for size DN4)

3 Product description

Thank you for purchasing this high-quality flow measuring system.

3.1 Application

The CONTOIL® VZD2 is designed for fuel and consumption measurement applications within the automotive, industrial, residential, and marine area. It can be used as a single (direct measurement) unit.

3.2 Device components

CONTOIL® VZD2 contains of a longtime proven hydraulic and electronic part with state-of-the-art sensor technology.



- 1. Display
- 2. Operating elements
 -  Scroll button
 -  Enter button
- 3. Pressure compensating element
- 4. Connection cable
- 5. Measuring chamber

3.3 Power supply

Use the preconfigured cable and connect to a power source of 12 - 24vdc. The connection to an uninterruptable power supply is recommended.

3.4 Interfaces

The CONTOIL® VZD2 has an isolated RS485 serial connection with either Modbus RTU or M-Bus and a solid state relay for pulse output.

Cable details are described in section 5.2 on page 10

For details on communication types see technical data, section 10.4 on page 29

4 Mounting

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
- » Use provided mounting holes



1. Use provided mounting holes

5 Installation

5.1 Mechanical Installation

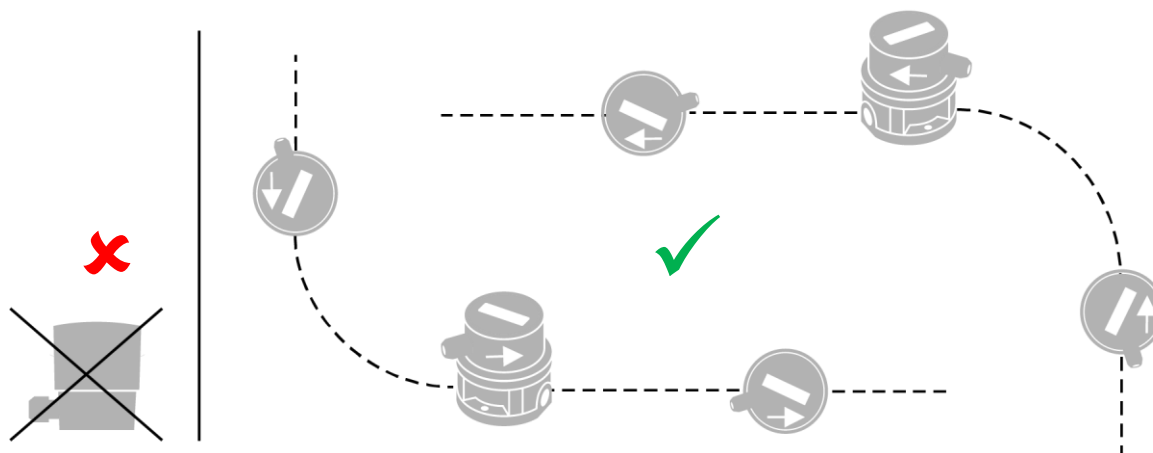
Identify the flow measuring system and ensure that the flow measuring system is suitable for the intended process and conditions. Easy access for reading the flow measuring system and controlling the ancillary equipment is important. Provided that the arrow on the housing is in the direction of flow, the flow measuring system can be installed in any position without any special modifications.

NOTE



Exception

- » Do not install upside down



NOTE



Magnetic fields

- » Keep away from magnetic disturbances

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.

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 by-pass recommended

Make sure that no hazardous fumes can build up in the piping and in the flow measuring system during commissioning, decommissioning and dismantling. The flow measuring system must at all times during operation be completely filled with liquid. Check the flow measuring system 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 measuring system and installation material.

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

- Maximum flow rate ($Q_{\max}$ l/h) (preferred max. Q_{cont})
- Maximum operating pressure (PN bar)
- Maximum temperature ($^{\circ}\text{C}$)
- Appropriate connections and seals (gaskets)
- Fasteners for the flow measuring system
- Material and temperature resistance of measuring system to measured liquid

Correct layout of flow measuring system and accessories

If the flow measuring system is used for viscosities higher than 5 mPa.s, 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.

NOTE

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



- » Flow rate (maximum expected application flow rate = maximum continuous flow rate of flow measuring system (Qcont). Qcont shall not be exceeded
- » Material compatibility with medium
- » Operating pressure and temperature
- » Ambient temperature
- » The flow measuring system must be selected according to the max. application flow rate and not according to the pipe diameter. If necessary, adapt the pipe-work.
- » Use Non-Return-Valves after the flow measuring system if return flow can occur.

NOTICE

Pulsations / dirt



Damage or malfunction of flow measuring system

- » Avoid flow pulsations
- » Install pulsation reducer
- » Avoid dirt particles/welding pearls
- » Install sufficient fine filter

CAUTION

Risk of injury!



Unauthorized start-up while mounting.

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

NOTE

Altering an existing system

- » Take the flow measuring system out of operation in order to flush the system clean of debris.
- » Flushing information on page 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

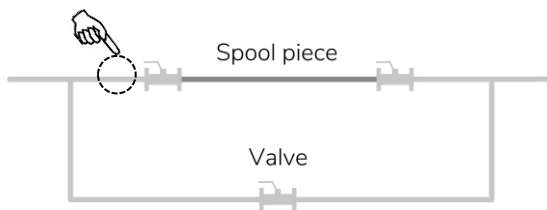


Damage or malfunction of flow measuring system

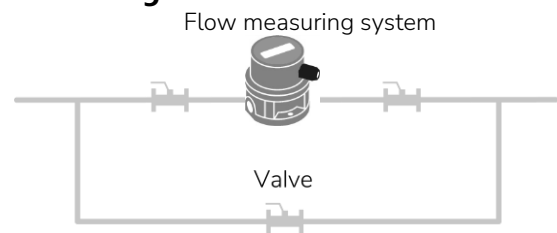
Accumulation of debris

- » replace the flow measuring system with a spool piece
- » ensure of no dirt accumulation in front of the valve

Flushing



Measuring



Trial operation

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

- Carry out a pressure test prior to measuring system installation
- Check for leaks and tightness of all bolts
- Flush the pipework until clean (flow measuring system out of pipeline)
- Release the pressure and stop the system again

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

Installing the measuring system in the pipe

Remove the protection plugs or caps from the flow measuring system (inlet and outlet).

Insert the flow measuring system into the pipeline in the prescribed position and flow direction.

The arrow on the flow measuring system should correspond with the direction of flow. Install mating flanges parallel and without tension in the pipe.

NOTICE



Risk of leakage

Fuel sprays

- » Always use appropriate sealing materials as per connection type.

5.2 Electrical Installation

NOTICE

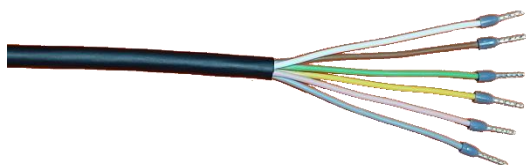
Risk of malfunction or damage



Injuries due to electrical power or systems

- » Ensure that the system is safe to work
- » Follow local safety guidelines
- » Review of technical data, chapter 8.1

5.2.1 Cabel configuration



- | | | |
|----|--------|--------------|
| 1. | White | supply + |
| 2. | Brown | supply - |
| 3. | Green | relay output |
| 4. | Yellow | relay output |
| 5. | Pink | RS485 A |
| 6. | Grey | RS485 B |

NOTE



Power supply

- » Supply voltage: VDC 12 – 24; check polarity
- » Use uninterruptable power supply for CE-MID applications.

6 Commissioning

NOTE



Modification of settings

- » Modification of operation settings may result in faulty or wrong measuring results.
- » Always consult and read this manual when adjusting operation settings.

Multiple output functions are available.

One potential-free relay output:

- Pulses; for external totalizer or monitoring systems.
- Frequency signal; for flow rate displays
- 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).

One isolated RS485 serial connection:

- Modbus RTU or M-Bus

Startup and commissioning of mechanical part of flow measuring system:

Open valves slowly, fill pipework gradually. Vent the installation well.

NOTICE



Damage or malfunction of flow measuring system

Pressure surges, inclusion of air

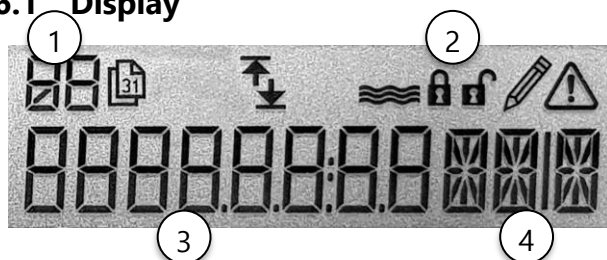
- » avoid pressure surges, open valves slowly
- » air causes measuring errors, ensure that no air is in the system during operation

Check the tightness of the connections and watch for leakages.

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

Should the established flow rate be greater than the specification of the flow measuring system (Q_{cont}), either a flow control valve (throttle) must be inserted behind the flow sensor or a larger size flow measuring system must be used.

6.1 Display



1. Menu Identification info (level 2 and 3)
2. Status indication symbols
3. Main display
4. Units

Symbols of status display



Calendar icon

Visible at log data display



Arrow up / down

Limit switch min/max
Event in / event out



Flow bars

Indicates flow recognized



Editing locked / unlocked

Indicates lock status



Pencil

Indicates editing mode



Caution and red flashing

Indicates alarm



Caution and red on

Indicates error

6.2 Operation of flow measuring system



1. Scroll button 
2. Enter button 

Use Scroll button  to scroll the menu and to change field values.

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

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

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

The menu can be viewed without any code.

If parameters need to be changed the device must be unlocked () with the user code.

Scroll to the menu item "unLoc" press enter to select and enter to edit, the pencil () is displayed and the first left digit will start flashing, which means, the unit is ready for the entry of the first digit of the **user code 00001111**. Press the Enter button to accept the value (in our case 0) and to move to the second digit. Continue this way to enter all code numbers.

At the end of the procedure a  will be displayed. The flow measuring system is now unlocked and in edit mode. Parameters can be changed.

If no button is pressed within 15 minutes, the device returns to the "home" display and returns to locked mode. Any entries that have not been completed by pressing the Enter button are rejected.

In order to guarantee accurate measurement, the electronic module of the flow measuring system requires adjustment. During factory calibration, the data for nominal size and the exact correction factor value of the measuring chamber volume are entered for this purpose.

These parameters cannot usually be changed again.

Reset of sub totalizers [trIP-Cnt]

To reset all sub totalizers, go to "trIP-Cnt", scroll to "rE" and press enter.

All sub totalizers are reset.

Compensation to Norm-Volume and Mass flow calculation: (Config/CM)

Compensation to norm-volume and Mass flow can be turned on, display and output parameters are added accordingly.

This means that the volumetric expansion of the medium is calculated using actual temperature and normalized to the actual volume at 15°C (volume at base condition) this value is also used to calculate mass / mass flow. Compensation calculation is according to DIN51757.

NOTE

Visibility of counters and modification of settings

- » Counters and settings related to compensation and mass calculation, are only visible or functional if compensation under menu "ConFIG/CM" is turned on to either "SGL OIL" or "dbL OIL" compensation

NOTE

Counter values for CE-MID (2014/32/EU)

- » Only the volume counter values are valid for CE-MID compliant measurements.

6.3 General overview of Menu structure

Menu level 1	Menu level 2	Menu level 3	description	el
CountEr			Counter values (totalizers)	
trIP-Cnt			Trip counter (subtotals)	
InStAnt			Instant values	
InFo			only visible if an alarm or error is active	
OP_hourS			Operating hour information	
bILLInG	option -xx-xC		only visible with option MID005	
LoGGEr			Log values	
unLoc			Code, to unlock and edit values	
LoG			only visible with user code	
P-Out			Digital pulse outputs (counting signal)	
F-Out			Digital frequency outputs (flow signal)	
S-Out			Status outputs (limits & alarms)	
Int-BUS			Internal bus communication in single mode	
UnItS			Units	
ConFIG			System configuration	
SYS-SEt			System settings	
SYSINFO			System Information	
DisplayTest			displays all characters on the display	

Some menu items only visible based on preset conditions (e.g., compensation on/off)

Only visible if option CE-MID005 is set / 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	

6.4 Counters and instant values

Menu level 1	Menu level 2	Menu level 3	description	el
CountEr	Counter values (totalizers)			
	V		measured raw volume	4
	dV		distillate fuel volume corrected	4
	hV		heavy fuel volume corrected	4
	dM		distillate fuel mass calculated	4
	hM		heavy fuel mass calculated	4
	dC		Co2 distillate fuel	4
	hC		Co2 heavy fuel	4
trIP-Cnt	Trip counter (subtotals)			
	rE		reset trip counter	1
	V		raw volume	
	dV		distillate fuel volume corrected	
	hV		heavy fuel volume corrected	
	dM		distillate fuel mass calculated	
	hM		heavy fuel mass calculated	
	dC		Co2 distillate fuel	
	hC		Co2 heavy fuel	
InStAnt	Instant values			
	Qv		raw volume flow	
	Qc		standardized volume flow (norm volume)	
	Qm		calculated mass flow	
	dE		calculated density	
	t		fuel temperature	

6.5 Information, Operating hours and Billing

Menu level 1	Menu level 2	Menu level 3	description	el
InFo			only visible if an alarm or error is active	
	A-tEMP		temperature alarm	
	A-Flow		flow alarm	
	A-SIM-P		alarm when P-Out simulation is on	
	A-SIM-F		alarm when F-Out simulation is on	
	A-o1 LI		output settings need to be adjusted, out of limits	
	A-Man		alarm when device is being manipulated (external)	
	A-SIM-S		alarm when system simulation is on	
	E-SYS		system error (call for service)	
	E-LOG		Log backup is faulty (call for service)	
	E-tEMP		temperature error, Hardware faulty (call for service)	
	E-Flow		flow error, Hardware faulty (call for service)	
	E-EEP		EEPROM error (call for service)	
OP_hourS			Operating hour information	
	H0		operating hours	5
	H1		hours in preferred range (Qmin – Qcont)	5
	H2		hour in upper flow range (Qcont – Qmax)	5
	H3		hours above max. flow (Qmax)	5
	HA		time in alarm mode (h)	4
	HE		time in error mode (h)	4
bILLInG	option -xx-xC		only visible with option CE-MID005	
	Nr		select billing cicle nr	0
	Sd		set date (dd.mm.yy)	1
	Ed		execute date (dd.mm.yy)	
	V		measured raw volume	
	dV		distillate fuel volume corrected	
	hV		heavy fuel volume corrected	
	dM		distillate fuel mass calculated	
	hM		heavy fuel mass calculated	
	dC		Co2 distillate fuel	
	hC		Co2 heavy fuel	
	HA		time in alarm mode (h)	
	HE		time in error mode (h)	

6.6 Loggers, unlock and Logbook

Menu level 1	Menu level 2	Menu level 3	description	el
LoGGER	Log values			
	LG		select log	0
	Month		log data of every end of the month	0
	dAY		log data of every end of the day	0
	noon2n		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 numbers back from now (1, 1-60)	0
		dA	date of log entry (dd.mm.yy)	
		ti	time of log entry (hh:mm)	
		V	measured raw volume	
		dV	distillate fuel volume corrected	
		hV	heavy fuel volume corrected	
		dM	distillate fuel mass calculated	
		hM	heavy fuel mass calculated	
		dC	distillate fuel Co2	
		hC	heavy fuel Co2	
		HA	time in alarm mode (h)	
		HE	time in error mode (h)	
		qv $\bar{t}$	max volume flow	
		qm $\bar{t}$	max mass flow	
		t $\bar{t}$	max temperature	
unLoc			Code, to unlock and edit values	
	Lo		user or manager code	0
LoG			only visible with user code	
	Nr		select numbers back from now (1, 1-100)	1
	dA		date of log entry (dd.mm.yy)	
	ti		time of log entry (hh:mm)	
	A-tEMP		temperature alarm	
	A-Flow		flow alarm	
	A-SIM-P		alarm when p-out simulation is on	
	A-SIM-F		alarm when f-out simulation is on	
	A-o1 LI		output settings need to be adjusted, out of limits	
	A-Man		alarm when device is being manipulated (external)	
	A-SIM-S		alarm when system simulation is on	
	E-SYS		system error (call for service)	
	E-LOG		Log backup is faulty (call for service)	
	E-tEMP		temperature error, Hardware faulty (call for service)	
	E-Flow		flow error, Hardware faulty (call for service)	
	E-EEP		EEPROM error (call for service)	
	I-PWr UP		last power up	

6.7 Output settings

Menu level 1	Menu level 2	Menu level 3	description	el
P-Out	Digital pulse outputs (counting signal)			
	Fc		select function	1
	IMPULS		digital output pulses	1
		SG	select output signal	1
		VoLuME	raw volume	1
		VoL dVC	volume compensated distillate fuel	1
		VoL hVC	volume compensated heavy fuel	1
		MASS dVC	mass calculated distillate fuel	1
		MASS hVC	mass calculated heavy fuel	1
		CO2 dVC	CO2 volume compensated distillate fuel	1
		CO2 hVC	CO2 volume compensated heavy fuel	1
		UP	pulse value (0.01 , 0.001-1000)	1
		MS	pulse width (20 , 2-500)	1
		SI	simulation of output	1
		#.###	value to be simulated	1
		oFF	simulation off / on	1
	oFF		outputs off	1
		Ac	active logic function (NO/NC)	1
		St	status of function on/off	1
F-Out	Digital frequency outputs (flow signal)			
	Fc		select function	1
	oFF		outputs off	1
		0-200Hz	frequency output signal	1
		SG	select output signal	1
		FLOW	frequency of flow Q	1
		FLOW C	frequency of compensated flow Qvc	1
		MASSFLO	frequency of mass flow Qm	1
		tEMP	frequency of temperature tMP	1
		dEnSitY	frequency of density dEn	1
		SL	signal value low (0 ; 0-Qmax)	1
		SH	signal value hi (Qmax ; 0-Qmax)	1
		FL	frequency low (0Hz ; 0-200Hz)	1
		FH	frequency hi (200Hz ; 0-200Hz)	1
		SI	simulation of output	1
		#.###	value to be simulated	1
		oFF	simulation off / on	1
		Er	action on error	1
		cont	continuous signal on error	1
		HI	hi frequency signal on error (200Hz)	1
		Lo	lo frequency signal on error (0Hz)	1
		St	actual output frequency	1

Menu level 1	Menu level 2	Menu level 3	description	el
S-Out	Status outputs (Limits & alarms)			
	Fc		select function	1
		LIMIT 1	1 point limit switch	1
	LIMIT 1	SG	select signal the limit applies	1
		FLOW	limit on flow Q	1
		FLOW C	limit on compensated flow Qvc	1
		MASSFLO	limit on mass flow Qm	1
		tEMP	limit on temperature tMP	1
		dEnSitY	limit on density dEn	1
		L1 , +	limit value; (Qcont , 0 to full range of size)	1
		HY (+/-%)	hysteresis of value (5 , 0.0-99.9 %)	1
		Ac	active logic function (NO/NC)	1
		St	status of function on/off	1
	LIMIT 2		2 point limit switch (min/max)	1
		SG	select signal the limit applies	1
		FLOW	limit on flow Q	1
		FLOW C	limit on compensated flow Qvc	1
		MASSFLO	limit on mass flow Qm	1
		tEMP	limit on temperature tMP	1
		dEnSitY	limit on density dEn	1
		L1 ,	limit value min. (Qmin , 0 to full range of size)	1
		L2 +	limit value max. (Qcont , 0 to full range of size)	1
		HY (+/-%)	hysteresis of value min. / max. (5 , 0.0-99.9 %)	1
		Ac	active logic function (NO/NC)	1
		St	status of function on/off	1
	StAtE		action on alarm or error status	1
		Ac	active logic function (NO /NC)	1
		St	status of function on/off	1
	oFF		outputs off	1
		Ac	active logic function (NO /NC)	1
		St	status of function on/off	1

6.8 Internal bus communication

Menu level 1	Menu level 2	Menu level 3	description	el
Int-BUS	Internal bus communication in single mode			
	ModbuS	Fc	select function	1
			Modbus RS485	1
		Ad	Address (1 , 1-247)	1
		BA	Baud rate	1
		300		1
		2400		1
		9600		1
		19200		1
		38400		1
		PA	Parity	1
		odd		1
		NONE		1
		EVEN		1
	M-BUS		M-Bus RS485	1
		Ad	Address (0 , 0-250)	1
		SE	Secondary address	1
		BA	Baude rate	1
		300		1
		2400		1
		9600		1
		Ac	Access counter	1
		AP	Application Reset	1
		CANCEL		1
		rESEt		1

6.9 Units

Menu level 1	Menu level 2	Menu level 3	description	el
UnItS	Units			
	V		units for volume	2
		L	liter	2
		GAL	us gallon	2
		m3	cubic meter	2
	Vd		decimals for volume value	2
		0.001		2
		0.01		2
		0.1		2
		1		2
	M		units for mass	2
		Kg	kilogram	2
		T	ton	2
		lbs	pound	2
	Md		decimals for mass value	2
		0.001		2
		0.01		2
		0.1		2
		1		2
	Qv		units for volume flow	1
		L/s	liter per second	1
		L/m	liter per minute	1
		L/h	liter per hour	1
		m3/h	cubic meter per hour	1
		GA/h	gallon per hour	1
	Qm		units for mass flow	1
		Kg/h	kilogram per hour	1
		t/h	ton per hour	1
		LB/h	pound per hour	1
	dE	Kg/m3	unit for density	1
			units for temperature	1
		°C	degrees Celsius	1
	t	°F	degree Fahrenheit	1
			units for volume pulse	1
	VP	mL	milli liter	1
		L	liter	1
		m3	cubic meter	1
		GAL	us gallons	1
	MP		units for mass pulse	1
		Kg	kilogram	1
		t	ton	1
		lbs	pound	1

6.10 Configuration and System settings

Menu level 1	Menu level 2	Menu level 3	description	el
ConFIG			System configuration	
	CM		fuel compensation	2
	oFF		compensation off	2
	dbL OIL		double fuel compensation (e.g. Diesel / HFO)	2
		FL	medium/fluid selection for compensation	1
		dFO	distillate fuel oil (e.g. Diesel)	1
		HFO	heavy fuel oil (e.g. HFO)	1
		tr	temperature reference (15°C)	
		tt	temperature threshold (60°C , 20-90)	2
		dd	distillate fuel density (830kg/m3 , 800-1200)	2
		hd	heavy fuel density (998kg/m3 , 800-1200)	2
		dC	distillate fuel carbon index Co2 (3.206 , 2-4)	2
		hC	heavy fuel carbon index Co2 (3.1144 , 2-4)	2
	SGL OIL		single fuel compensation (e.g. Diesel or Lube)	2
		FL	medium/fluid selection for compensation	1
		dFO	distillate fuel oil	1
		HFO	heavy fuel oil	1
		LubE	lube oil	1
		tr	temperature reference (15°C)	
		dd	distillate fuel density (830kg/m3 , 800-1200)	2
		dC	distillate fuel carbon index Co2 (3.206 , 2-4)	2
	LF		low flow cut off (Qstart of DN , 0-Qmin)	2
	dQ		damping of instant flow values (10 , 0-99)	1
	dt		damping of temperature values (10 , 0-99)	1
SYS-SEt			System settings	
	dA		system date (dd.mm.yy)	1
	ti		system time (hh:mm)	1
	dY		weekday	
	dS		daylight saving time: oFF / Add 1h	1
	Mo		select mode	
		SINGLE	single flow measuring system mode	
	Co	00001111	edit user code, reset with manager code only (el3)	1
	rE		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 to initializing date	4
	SI		simulation of complete system	4
	SI	#.###	value to be simulated	4
		oFF	simulation off / on	4

6.11 System information

Menu level 1	Menu level 2	Menu level 3	description	el
SYSINFO			System Information	
	SN	#####	Serial number	5
	SY		System name and size	5
	tA	#####	Customer tag name	1
	Vc		Volume of measuring chamber	
	CF	0.0000	correction factor (%)	4
	QI		min flow volume	
	QS		max flow volume	
	tI		min fluid temperature	
	tS		max fluid temperature	
	FI	dd.mm.yy	Manufacturing date (Factory Initializing date)	5
	CI	dd.mm.yy	Customer initializing date (special case only)	1
	FW	00.00.00	Firmware version	
	HW	00.00.00	Hardware version	
	CS	ABCDE	Checksum	
	CE	YYYY	Year of metrological conformity assessment	5
		NB-1259	Notified Body	
DisplayTest			displays all characters on the display	

6.12 Factory settings

Type			VZD/P2 4	VZD/P2 8	VZD/P2 8E
Output1:	Function	Fc	Impulse		
	Signal	SG	Volume		
	Pulse value	UP ltr/p	0.01		
	Pulse width	MS ms	20		
RS485:	Modbus RTU:	Baud rate	9600		
		Parity	EVEN		
		Address	1		

Engineering notes

Parameterizing ancillary devices.

Some ancillary devices require programming of pulse values.

The maximum frequency is calculated with the following formula:

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

Examples:

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

7 Maintenance and Repair

7.1 Calibration

All our flow measuring systems are calibrated in the factory.

An accuracy check and recalibration is offered at Aquametro Oil & Marine AG, 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 measuring system is installed in.

7.2 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 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

7.3 Spare parts

No spares available at this time

8 Troubleshooting and error messages

8.1 Troubleshooting

Fault symptoms	Possible causes	Procedures
No reading / blank display	No power supply	Check wiring, polarity
	Electronic counter defective	Replace complete device
- Totalizer not running - No flow rate indicated - Indicated quantity or flow rate too small	Flow rate outside allowed range (below $Q_{\min}$ or above $Q_{\max}$ of measuring system)	- Check flow rate (reverse flow) totalizer "0" - If too high, reduce flow or install larger measuring system - If too low, increase flow or install smaller measuring system - Reduce LFC to 0.1
	Moving parts heavily worn out due to continuous overload	install new larger measuring system
	Dirt trap / filter heavily soiled	Clean dirt trap, replace filter
	Safety filter in measuring system intake clogged	- Replace safety filter - Install dirt trap / filter with correct mesh size
	Moving parts jammed	clean measuring chamber, replace defective parts / measuring system
Totalizer(s) run backwards	Measuring system mounted in wrong direction	Install measuring system with arrow pointing in flow direction
Indicated quantity or flow rate too high	- Measuring system positioned wrongly (e.g. at highest point) - Gas or air inclusion in fluid	- Check and rectify operating conditions and measuring system position - De-aerate pipes carefully
pressure drop at measuring system too high	Dirt trap or filter heavily soiled	Clean dirt trap, replace filter
	Flow measuring system's safety filter heavily soiled	Clean safety filter of flow measuring system
- No signal - No communication - No pulse output signal	No flow	Check flow using indication
	Wrong parameterization	Set correct parameters for outputs/communication
	Polarity of communication connection	Connect with correct polarity
	Transducer defective	Replace transducer/no repair

8.2 Alarm messages

A-tEMP Temperature alarm

Cause: Temperature outside the defined temperature range: The fluid and density values are not recalculated

Action: Adjust temperature to be in normal range defined in technical specification

A-Flow flow alarm

Cause: Flow range exceeded: $Q < 0$ (return flow) or $Q > Q_{\max}$

Action: Check flow direction or reduce flow to max continuous flow as specified

A-SIM-P Alarm when pulse output simulation is on

Cause: Pulse output simulation is active

Action: Turn pulse output simulation off

A-SIM-F Alarm when frequency output simulation is on

Cause: Frequency output simulation is active

Action: Turn frequency output simulation off

A-o1 LI Output settings out of limits

Cause: Overflow of the pulse output buffer, false settings

Action: Adjust output settings

A_MAn Alarm when device is being manipulated

Cause: Magnetic manipulation detected (from outside)

Action: Remove magnetic disturbances surrounding the flow measuring system

A-SIM-S Alarm when system simulation is on

Cause: System simulation is active

Action: Turn system simulation off

8.3 Error messages

E-SYS System error

Cause: Hardware error of the EEPROM: the initialization of the EEPROM is faulty

Action: Restart device or electronic module must be replaced, please contact the supplier

E-LOG Log backup is faulty

Cause: The log backup of the counter readings is faulty

Action: Restart device or electronic module must be replaced, please contact the supplier

E-tEMP 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

E-Flow 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

E-EEP EEprom error

Cause: Error of the EEPROM handling: loading or saving of data into EEPROM faulty

Action: please contact the supplier

9 Decommissioning, Dismantling and Disposal

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

9.1 Decommissioning

Disconnect all sources of energy.

Remove the device from the system.

Pay particular attention to the disposal instructions in section 9.3.

9.2 Dismantling

Not required.

9.3 Disposal



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

Electronic parts, 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.

10 Technical Data

10.1 Model code

CONTOIL®	VZx	S	2	- 8E	S
					Calibration S standard C EU Type certificate MI005 L linearized with higher accuracy Nominal Size 4 4mm / 1/8" 8 8mm / 1/4" 8E 8mm / 1/4" (extended flow) Version 1 previous (not marked, discontinued) 2 new Class S standard (not marked) A higher accuracy Type VZD with display

10.2 Hardware characteristics

Hydraulics					
Type			VZD2 4	VZD2 8	VZD2 8E
Nominal diameter	DN	mm	4	8	8
		inch	1/8	1/4	1/4
Hydraulic connection		mm	14x1.5 ¹⁾	M14x1.5	M14x1.5
		inch	1/8	-	-
Installation length		mm	54 / 110 ¹⁾	70	70
Nominal pressure		bar	25	25	25
Maximum medium temperature	Tmax	°C	-30 to +80		
Maximum flow rate ²⁾	Qmax	l/ h	80 ²⁾	200 ²⁾	600 ²⁾
Continuous flow rate	Qcont	l/ h	50	140	400
Minimal flow rate	Qmin	l/ h	1	4	10
Starting flow rate	Qstart	l/ h	0.4	1.6	2
Minimum measured quantity	MMQ	L	0.9	0.9	0.9
Measuring chamber volume		cm ³	5	12.44	12.44
Max. permissible error of actual value		%	< ±1 ³⁾	< ±1 ⁴⁾	< ±1
Repeatability		%	< ±0.2	< ±0.2	< ±0.2
Safety filter mesh size		mm	0.125	0.15	0.15
Fuel	diesel and low viscosity fuels				

1) Length including adapter set VSR, part no.: 80630

2) Do not use for measuring system sizing.

3) 1- 2 l/h ±2.5 %

4) 4- 5 l/h ±2 %

10.3 Electronic characteristics

Electronic			
Environment			
Maximum environment temperature	Tmax	°C	-20 to +60
Maximum storage temperature	Tmax	°C	-25 to +80
Maximum storage humidity, none condensing	Hmax	%h	95
Protection class	IEC60529		IP66
Safety, vibration and shock	IEC68		
Classification	OIML R 117:2019		H2 / 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			EEPROM
Relay output			
Switching element			solid state relay
Resistance ON		Ω	≤40
Resistance OFF		MΩ	≥10
Max. supply voltage		VDC	≤48
Max. switching current		mA	≤50
Pulse width		ms	2 - 500 (dynamic)
Pulse frequency		Hz	0 - 200
Serial interface			
Isolation			galvanically
Typical output capacitance:		pF	100
Type			RS485 2-wire
Protocol			Modbus
			M-Bus
Max. speed Modbus		kBaud	38.4
Max. speed M-Bus		kBaud	9.6

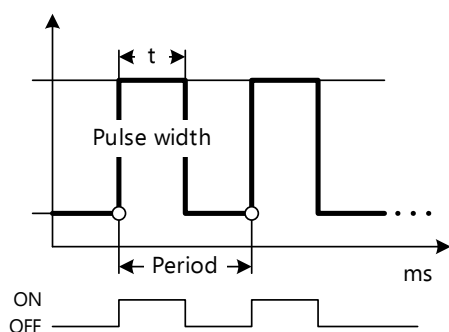
10.4 Output and communication types

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.

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

Digital pulse output (counting signal) for counting / totalizing the flow volume, compensated volume, mass or CO₂.



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

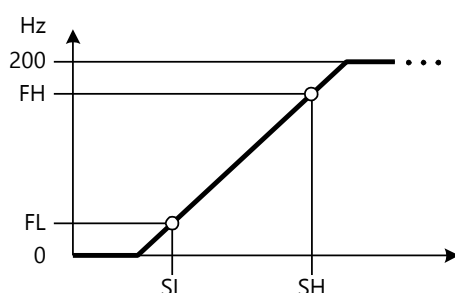
(factory setting: 0.01 ltr/p)

Pulse width (t): 2 - 500 ms

(factory setting: 20 ms)

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

Digital frequency outputs (flow signal) for continuous flow signal of flow, compensated flow, mass flow, temperature or density.



Frequency range and proportionality of the signal across the desired flow rate measurement range SL – SH.

Signal behavior:

The signal will start carrying a frequency as soon as the flow rises past Q_{start} or >1 Hz at factory setting conditions.

Accuracy of frequency output is +/-1% of 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 – 200Hz

(factory setting: 0 Hz)

Frequency Hi [FH]: 0 – 200Hz

(factory setting: 200 Hz)

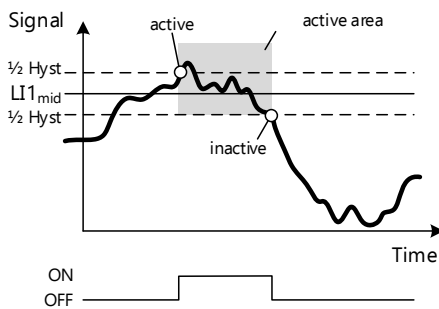
Error [Er]: cont; Hi; Lo

(factory setting: cont)

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

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

1 Point

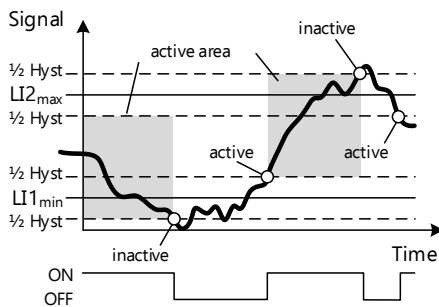


The function Limit allows you to set an alert whenever predefined values (e.g. flow rate) are exceeded.

Limit defines upper ($LI2_{max}$) and lower ($LI1_{min}$) values of thresholds which, when exceeded, activate a switch (alert). In order to prevent oscillating between active and inactive states when the values fluctuate around a threshold, a 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 value passes below or above these bands, the switch will be deactivated. The hysteresis bands are calculated as a percentage of the threshold values (LI).

2 Point



Signal behavior:

1 Point (Balanced)

Setpoints ($LI1$) and reset points ($\frac{1}{2} \text{ Hyst}$) are the setpoint values expanded up and down by half the hysteresis value.

2 Point (Balanced)

Setpoints ($LI1/LI2$) and reset points ($\frac{1}{2} \text{ Hyst}$) are the setpoint values expanded upwards or downwards by half the hysteresis value.

	Work State	
	NC	NO
inactive		
active		

Parameters that can be set:

Lower value [$LI1_{min}$]: ≥ 0
 Upper value [$LI2_{max}$]: $\leq Q_{max}$
 Hysteresis [**HYST**]: 0...99.9 %

(factory setting: Q_{min})

(factory setting: Q_{max})

(factory setting: 5 %)

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 open, closes when triggered (active).

Limit switch [NC]: Contact closed, opens when triggered (active).

10.4.4 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**)

Serial communication outputs

10.4.5 Modbus RTU

For a list of main communication parameters see Appendix 11.2, page 33.

Factory settings and supported functions:

RS485: Modbus RTU:	factory	Parameter range
Addressing range	Slave ID	1 - 247
	Baud rate	300 - 38400
	Parity	ODD, NONE, EVEN
	Stop bit	1
Function code	03	Reading Holding Register Reads one or more registers of the Modbus slave (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; Address 40; Quantity 2 (4Byte/32bit)	

10.4.6 M-Bus

Interface:	M-Bus over RS485; 1 start bit, 8 data bit, 1 stop bit, EVEN		
Device identification:	VZD2 4	0x00	
	VZD2 8	0x01	
	VZD2 8E	0x02	
General:	M-Bus according to EN 1434-3 special units according to EN 13757		
Addressing:	The device supports primary and secondary addressing according to EN 13757		

For a list of main communication parameters see Appendix 11.3, page 34.

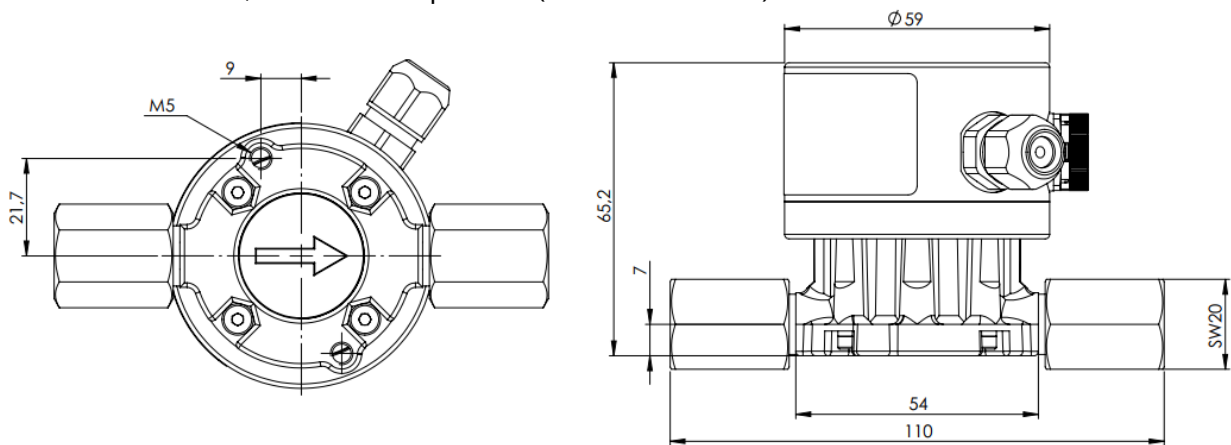
Factory setting:

RS485: M-Bus:	Baud rate	2400
	Address	0

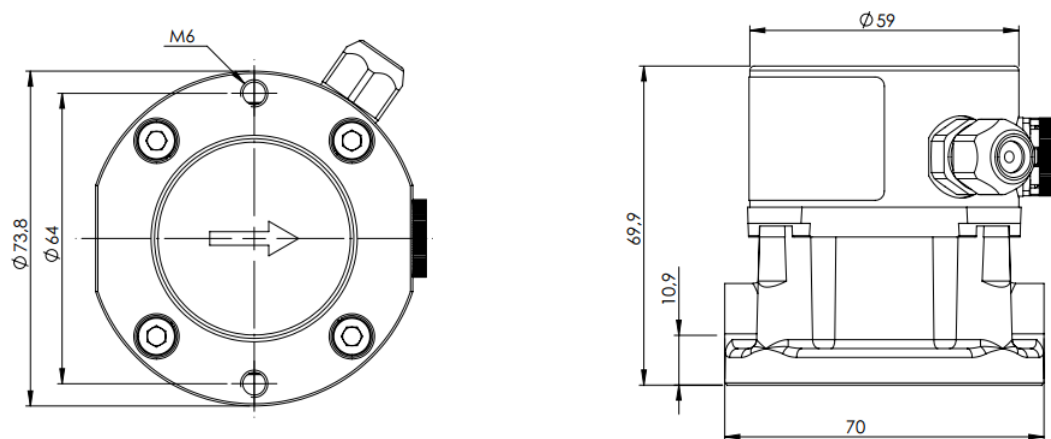
11 Appendix

11.1 Dimensional drawings

DN 4 G $\frac{1}{8}$ " thread; with VSR adapter set (G $\frac{1}{8}$ " to M14x1.5)¹⁾



DN 8 M14x1.5 thread



1) G-threads have a parallel shape in accordance with the DIN-EN-ISO 228-1 standard with flank angle 55°

11.2 Modbus addressing

Menu level 1	Menu level 2	Menu level 3	description	Address	Value	Data Type
CountEr			Counter values (totalizers)			
	V		measured raw volume	40		Float32
	dV		distillate fuel volume corrected	42		Float32
	hV		heavy fuel volume corrected	44		Float32
	dM		distillate fuel mass calculated	46		Float32
	hM		heavy fuel mass calculated	48		Float32
	dC		Co2 distillate fuel	50		Float32
	hC		Co2 heavy fuel	52		Float32
InStAnt			Instant values			
	Qv		raw volume flow	70		Float32
	Qc		standardized volume flow (norm volume)	72		Float32
	Qm		calculated mass flow	74		Float32
	dE		calculated density	76		Float32
	t		fuel temperature	78		Float32
InFo			only visible if an alarm or error is active	100	0-1	Int16
	A-tEMP		temperature alarm			Bit3
	A-Flow		flow alarm			Bit4
OP_hourS			Operating hour information			
	H0		operating hours	20		Int32
	H1		hours in preferred range (Qmin – Qcont)	22		Int32
	H2		hour in upper flow range (Qcont – Qmax)	24		Int32
	H3		hours above max. flow (Qmax)	26		Int32
	HA		time in alarm mode (h)	28		Int32
	HE		time in error mode (h)	30		Int32
SYSINFO			System Information			
	SN	#####	Serial number	1800		Int32
	SY		System name and size	1802	0-2	Int16
	tA		Device name (TAG)	1806		Int16

(Partial list of Modbus addressing)

11.3 M-Bus addressing

Standard telegram

The VZD2 has a standard telegram which can take different forms depending on the units set for the counter readings and the selected compensation.

The protocol starts with the following header: 0x68 LEN LEN 0x68 0x08 PADR 0x72 ID ID ID ID MAN MAN DEV MED ACC STAT SIG SIG

The data have the following appearance and are put one after the other, see table:

Menu level 1	Menu level 2	Menu level 3	description	Address	Type	Unit
CountEr	Counter values (totalizers)					
	V		measured raw volume	0x04 0x10 VAL VAL VAL VAL	INT4	[ml]
	dV		distillate fuel volume corrected	0x84 0x40 0x10 VAL VAL VAL VAL	INT4	[ml]
	hV		heavy fuel volume corrected	0x84 0x80 0x40 0x10 VAL VAL VAL VAL	INT4	[ml]
	dM		distillate fuel mass calculated	0x04 0x1b VAL VAL VAL VAL	INT4	[g]
	hM		heavy fuel mass calculated	0x84 0x40 0x1b VAL VAL VAL VAL	INT4	[g]
	dC		Co2 distillate fuel	0x84 0x80 0x40 0x1b VAL VAL VAL VAL	INT4	[g]
	hC		Co2 heavy fuel	0x84 0xc0 0x40 0x1b VAL VAL VAL VAL	INT4	[g]
InStAnt	Instant values					
	Qv		raw volume flow	0x05 0x3b VAL VAL VAL VAL	Float4	[l/h]
	Qc		standardized volume flow (norm volume)	0x85 0x40 0x3b VAL VAL VAL VAL	Float4	[l/h]
	Qm		calculated mass flow	0x05 0x53 VAL VAL VAL VAL	Float4	[kg/h]
	dE		calculated density	0x05 0x9b 0x2c VAL VAL VAL VAL	Float4	[kg/L]
	t		fuel temperature	0x05 0x67 VAL VAL VAL VAL	Float4	[°C]
OP_hourS	Operating hour information					
	H0		operating hours	0x04 0x22 VAL VAL VAL VAL	INT4	[h]
	H1		hours in preferred range (Qmin – Qcont)	0x84 0x40 0x22 VAL VAL VAL VAL	INT4	[h]
	H2		hour in upper flow range (Qcont – Qmax)	0x84 0x80 0x40 0x22 VAL VAL VAL VAL	INT4	[h]
	H3		hours above max. flow (Qmax)	0x84 0xc0 0x40 0x22 VAL VAL VAL VAL	INT4	[h]
	HA		time in alarm mode (h)	0x34 0x22 VAL VAL VAL VAL	INT4	[h]
	HE		time in error mode (h)	0xb4 0x40 0x22 VAL VAL VAL VAL	INT4	[h]
SYS-SEt	System settings					
	dA		system date	0x04 0x6d VAL VAL VAL VAL	Typ F	(D+T)
SYSINFO	System Information					
	SN	#####	serial number	0x0c 0x78 VAL VAL VAL VAL	BCD8	
	tA	#####	customer tag name	0x0d 0xfd 0x11 LEN ASCII....	ASCII	
	FW	00.00.00	firmware version	0x0d 0xfd 0x0e 0x08 ASCII....	ASCII 8	
	HW	00.00	hardware version	0x0d 0xfd 0x0d 0x05 ASCII....	ASCII 5	

(Partial list of M-Bus addressing)

The telegram is terminated by the checksum and terminator: CS 0x16

11.4 Settings list

Menu level 1	Menu level 2	Menu level 3	description	value
P-Out	Digital pulse outputs (counting signal)			
	Fc		select function	Impulse
	IMPULS		digital output pulses	
		SG	select output signal	Volume
		UP	pulse value (0.01 , 0.001-1000)	0.01
		MS	pulse width (20 , 2-500)	20
F-Out	Digital frequency outputs (flow signal)			
	Fc		select function	0-200HZ
	0-200HZ		frequency output signal	
		SG	select output signal	Flow
		SL	signal value low (0 ; 0-Qmax)	0
		SH	signal value hi (Qmax ; 0-Qmax)	
		FL	frequency low (0Hz ; 0-200Hz)	
		FH	frequency hi (200Hz ; 0-200Hz)	
		Er	action on error	cont
S-Out	Status outputs (Limits & alarms)			
	LIMIT 1		1 point limit switch	
		SG	select signal the limit applies	
		L1 $\pm \bar{f}$	limit value; (Qcont , 0 to full range of size)	
		HY (+/-%)	hysteresis of value (5 , 0.0-99.9%)	
		Ac	acting logic function (NO/NC)	
	LIMIT 2		2 point limit switch (min/max)	
		SG	select signal the limit applies	
		L1 $\downarrow$	limit value min (Qmin , 0 to full range of size)	
		L2 $\bar{f}$	limit value max (Qcont , 0 to full range of size)	
		HY (+/-%)	hysteresis of value min / max (5 , 0.0-99.9%)	
		Ac	acting logic function (NO/NC)	
	StAtuS		acts on alarm or error status	
		Ac	acting logic function (NO/NC)	
Int-BUS	Internal bus communication in single mode			
	Fc		select function	Modbus
	ModbusS		Modbus RS485	
		Ad	Address (1 , 1-247)	1
		BA	Baude rate	9600
		PA	Parity	even
	M-BUS		M-Bus RS485	
		Ad	Address (0 , 0-250)	
		SE	Secondary address	
		BA	Baude rate	

Menu level 1	Menu level 2	Menu level 3	description	value
UnItS	Units			
	V		units for volume	L
	Vd		decimals for volume value	0.001
	M		units for mass	Kg
	Md		decimals for mass value	0.001
	Qv		units for volume flow	L/h
	Qm		units for mass flow	Kg/h
	t		units for temperature	°C
	VP		units for volume pulse	L
	MP		units for mass pulse	Kg
ConFIG	System configuration			
	CM		fuel compensation	off
		tt	temperature threshold (60°C , 20-90)	60°C
SYSINFO	System Information			
	SN	#####	Serial number	
	tA	#####	Customer tag name	
	CF	0.0000	correction factor (%)	
	FW	00.00.00	Firmware version	

12 Certificates

All certificates / approvals, can be found on our website www.aquametro-oil-marine.com

12.1 EU Type examination certificate MI005

These versions (e.g., DN4 type: VZDA2-4C) of the CONTOIL[®] oil flow measuring system bear the number of the type test certificate in accordance with Directive 2014/32/EU (MID) and the metrological CE mark.

This means that they can be used for CE-MID compliant measurements (MI005) in accordance with local laws / regulations.



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



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