



Technical Manual

Instructions for installation, operation and maintenance

149

FCM 2

Fuel consumption monitor



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1 PREFACE

1.1 GENERAL

This manual contains instructions for Installation, Operation and Maintenance (IOM) of the VAF Instruments Fuel Consumption Monitor 2 (FCM 2) (mass-)flowcomputer.

For IOM information of associated equipment supplied by VAF Instruments, refer to the separate manual supplied with those products.

This manual contains important information for the installer, the operator and for your maintenance department.



Never use the equipment outside its specifications or beyond common engineering practice nor use the equipment for other applications or make connections to other equipment than explicitly described in the order acknowledgement and/or technical manuals of VAF Instruments.



CAUTION:
TO ENSURE SAFE AND CORRECT INSTALLATION AND HANDLING, OPERATION AND MAINTAINING, READ THIS MANUAL COMPLETELY BEFORE INSTALLING THE EQUIPMENT AND STARTING OPERATIONS.



CAUTION:
DISCONNECT MAINS SUPPLY BEFORE OPENING THE FCM 2



The (micro) SD card should not be exposed to computer viruses, since this could contaminate the (micro) SD card. Contamination could disturb good working of the sensor.

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Or your local authorized VAF Instruments dealer.

Their addresses can be found on www.vaf.nl

1.2 SYMBOLS

The following symbols are used to call attention to specific types of information.



A WARNING TO USE CAUTION!
IN SOME INSTANCES, PERSONAL INJURY OR DAMAGE TO THE (MASS-)FLOWCOMPUTER MAY RESULT IF THESE INSTRUCTIONS ARE NOT FOLLOWED PROPERLY.



AN EXPLANATION OR INFORMATION OF INTEREST.

1.3 COPYRIGHT

This technical manual is copyrighted with all rights reserved.

No part of this book may be copied or reproduced by any means without permission from VAF Instruments.

While every precaution has been taken in the preparation of this manual, no responsibility for errors or omissions is assumed. Neither is any liability assumed for damages resulting from the use of the information contained herein. Specifications can be changed without notice.

2 PRODUCT DESCRIPTION

2.1 GENERAL

The VAF Instruments (mass-)flowcomputer, Fuel Consumption Monitor 2 (FCM 2) is a microprocessor based instrument for calculating fuel consumption based on standard volumetric/mass flow or differential volumetric/mass flow (depending on configuration), with temperature compensation for volume/mass correction.

2.2 DISPLAY INFORMATION

The FCM 2 has a 320x240 TFT colour display with a resistive touch screen as an user interface. The display shows all relevant data such as consumption, total, accumulated total and (mass-)flowrate in clear screens and provides the user the possibility to scroll through the different screens and settings menus.

A backup of the total, accumulated total and settings is stored in FRAM memory and will not be lost in the event of power failure.

2.3 FLOWMETER, TEMPERATURE, VISCOSITY AND DENSITY INPUT

The FCM 2 is especially designed to accommodate the use of VAF Instruments flowmeters and ViscoSense®3D systems.

Two flowmeters with a VAF Instruments PT2 type sensor or Namur signal output can be connected to the FCM 2. The FCM 2 is also equipped with two PT100 temperature inputs.

One flowmeter with double-pulse output can be connected for bi-directional counting: loading and discharging.

With the optional analog input module a ViscoSense®3D system, used for massflow determination, can be connected to the FCM 2.

2.4 MULTIPLE FUEL TYPES

A distinction can be made between "*Fuel type 1*" and "*Fuel type 2*" (e.g. HFO and MDO) fuel consumption.

The fuel type can be set manually or a temperature setpoint can be entered at which the FCM 2 automatically switches from "*Fuel type 1*" and "*Fuel type 2*", and back.

2.5 OUTPUT

The FCM 2 is fitted with a one channel digital output and optional a one/two channel analog output.

The digital output can be set as alarm or as consumption of engine one. The analog outputs are consumption of engine one and consumption of engine two.

The analog output can also be used as flow direction output in the situation of bi-directional configuration.

2.6 MODBUS RTU

The FCM 2 is fitted with Modbus communication. Information as flowrate, consumption, temperature, etc. can be read out by Modbus communication.

The register list with Modbus addresses can be found further on in this manual section 16.15. The addresses are read-only.

2.7 FCMBUS

The FCM 2 is fitted with FCMBus communication making it available to communicate between two or more different FCM 2 devices. Information as flowrate, consumption, temperature, etc. can be read out remotely from one FCM 2 on another FCM 2. The FCM 2 can also be configured as read-only.

3 TECHNICAL SPECIFICATION

3.1 GENERAL

3.1.1 Display

Display: 320x240 TFT colour display with resistive touch screen
Refresh rate: 1 time/second

3.1.2 Enclosure

Size: 160 x 130 x 71 mm
Weight: 1.2 kg approx. (unpacked)
Housing material: Die-cast aluminium
Cable glands: Maximum of 3x M16 x 1.5 mm, Ø5-10 mm
Maximum of 4x M20 x 1.5 mm, Ø10-14 mm
Depending on the FCM 2 configuration; glands or blinded.

Enclosure sealing : IP65

3.1.3 Electrical

Power supply: 100 - 240 V AC
Power consumption: maximum 10 Watt

3.1.4 Environmental

Operating ambient temperature range: 0 to 55 °C
Operating humidity range: 0 to 95 %RH (non-condensing)

3.1.5 EMC

Emissions & immunity: Meets requirements of:
EN 55016-2-1 (2009) + A1 (2011)
EN 55016-2-3 (2010) + A1 (2010) +C1(2013)
EN 61000-4-2 (2009)
EN 61000-4-3 (2006) + A1 (2008) + A2 (2010)
EN 61000-4-4 (2012)
EN 61000-4-5 (2007)
EN 61000-4-6 (2009)
EN 61000-4-11 (2004)

3.1.6 Vibration

Vibrations: Meets requirements of:
IEC 60068-2-6:2008, Environmental testing - Part 2-6
Test- Test Fc: Vibration (sinusoidal)
IEC 60945:2002, Maritime navigation and radio
communication equipment and system – General
requirements – Method of vibration testing according to
§ 8.7.2

3.1.7 Flowmeter pulse inputs

Number of pulse inputs :	2
Input type:	VAF instruments PT2 sensor or Namur
Minimum frequency pulse input:	1 Hz
Maximum frequency pulse input:	1000 Hz
Threshold voltage	3 V
Maximum pulse voltage	8,2 V

3.1.8 Flowmeter temperature inputs

Number of temperature inputs :	2
Input type:	3 wire PT100
Range:	0 °C to 200 °C
Accuracy	± 1 °C
Update time	1 time/second

3.1.9 Analog inputs

Number of analog inputs :	3
Input type:	4 – 20 mA passive ($R_i=100\Omega$) (The sensor signal must be active)
Signal source:	ViscoSense®3D (Viscosity, Temperature and Density)
Note:	In case of analog output, no analog input is possible.

3.1.10 Analog outputs

Number of analog outputs :	1 or 2 (depending on system configuration: Consumption engine one, consumption engine two or flow direction when bi-directional.)
Output type:	4 – 20 mA for consumption 8 mA and 12 mA for discharging respectively loading (Active output signal, $R_b=0...400\Omega$)
Note:	In case of analog input, no analog output is possible.

3.1.11 Digital output

Number of digital outputs :	1
Type:	Solid state relay
Maximum load:	U_{max} 350 V AC/DC, I_{max} 120 mA
Range:	Alarm warning or 1 to 9.999 pulse per unit (depending on configuration)
Maximum frequency pulse output:	250 Hz
Pulse width:	Frequencies < 2 Hz, 300 ms. Frequencies ≥ 2 Hz, ~50% duty cycle

3.1.12 Modbus RTU

Number of Modbus connections :	1
Communication protocol:	Modbus RTU
Serial interface:	RS-485 (2-wire)
BaudRate	4800 or 9600 or 19200 or 38400 or 57600 or 115200
Parity:	None or Even or Odd
DataBits:	8 or 9
StopBits:	1 or 2
Function code:	3 (Holding Registers)
Modbus slave address:	1 to 254

3.1.13 FCMbus

Number of FCMbus connections :	1
Maximum devices on the FCMbus:	10
Communication protocol:	FCMbus communication

3.1.14 Terminal sizes

Terminal connection power supply:	Removable plug-in terminal. Maximum wire 2,5 mm ²
General terminal connection:	Removable plug-in terminal. Maximum wire 1,5 mm ²



WARNING:

Inputs are not suitable for mains related measurements. Instrument is only intended for measuring signals as described in 3.1.7 – 3.1.9

4 SAFETY INSTRUCTIONS

All precautions have been taken to ensure, in so far as reasonable practical, that the equipment has been designed and constructed to be safe and without risk to health or the environment when properly used.

Provided that the recommendations contained in this manual are carefully adhered to, no circumstances are foreseen where the equipment will present a health or safety hazard.

To ensure the safety of personnel, equipment and the environment:

- Always follow the safety, installation, repair and maintenance recommendations in this manual.
- Always observe warning labels on containers and packages.
- All personnel who installs, operates, repairs or maintains the equipment should read this manual completely and make themselves acquainted with the equipment before installing, operating, repairing or maintaining the equipment.
- Make sure that all safety requirements are met before installing, operating, repairing or maintaining the equipment.
- Always use personal protective means when necessary.
- Always use the right tools for the job.
- Make sure that all equipment is isolated from the electrical power supplies before installing, repairing or maintaining the equipment.
- Never assemble or disassemble electrical equipment with power switched ON.
- Always handle printed circuit boards with CMOS components according to the correct procedures for such components, to prevent any damage due to electrostatic discharges.
- Only use cleaning solvents in a well ventilated area.
- Avoid breathing fumes.
- Keep away from open fire.
- Do not use solvents on plastic components or parts.

5 UNPACKING

- The FCM 2 is a precision instrument and should be treated with care.
- Let the equipment acclimatize inside the closed box for at least one hour at the location where the FCM 2 will be installed.
- When the FCM 2 is taken out of the box, please leave the special protection supplied with the equipment as long as possible in place to avoid any damage.
- Disposal of the packing material should be done according to local laws or regulations, or according to the rules that are applicable on the vessel or on the site.

6 INSTALLATION

6.1 SITING

The location of the FCM 2 needs to meet the following conditions:

- Field mounted
- Mounted at eye level
- Ambient temperature, range from 0 to 55 °C
- Ambient humidity, range from 0 to 95 %RH (non-condensing)
- Away from vibration and/or shock
- Away from the influence of strong electrical and/or magnetic fields

6.2 DIMENSIONS

Dimensions of the FCM 2 are as shown in Figure 1.

Dimensions / mounting holes for mechanical installation can be found in section 18.

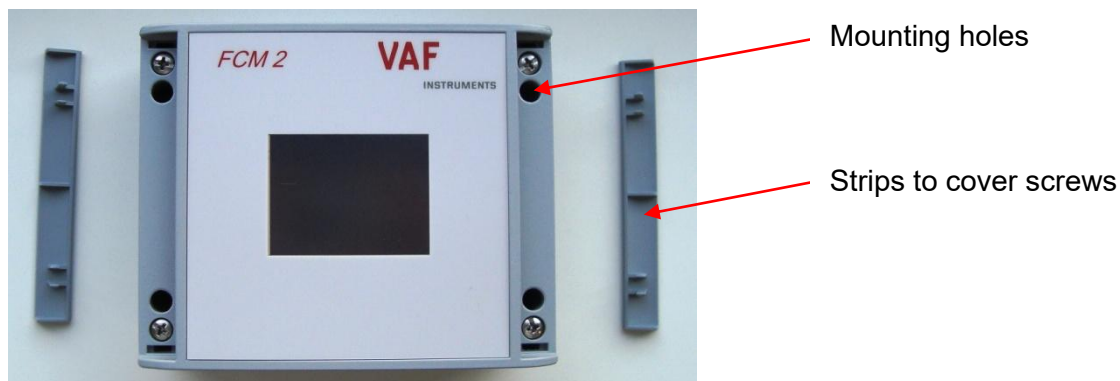
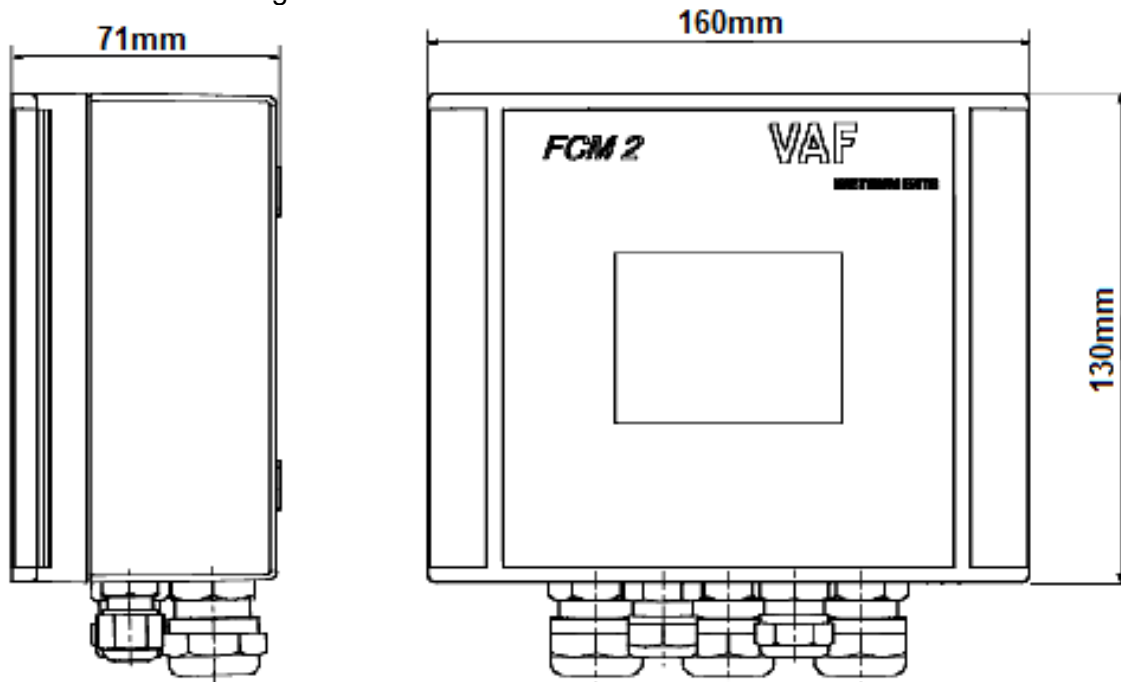


Figure 1: FCM 2 dimensions

The net weight of the FCM 2 is approximate 1.2 kg (unpacked).

6.3 ELECTRICAL INSTALLATION



WARNING:

- The FCM 2 is not fitted with a power switch, therefore a disconnecting device such as a switch or circuit breaker conforming to local safety standards must be fitted to the final installation.
The switch must be mounted in close proximity to the FCM 2 within easy reach of the operator and must be marked clearly as the disconnection device for the FCM 2.
- Make sure that all equipment is isolated from the electrical power supplies before installing, repairing or maintaining the equipment.
- All connections to secondary circuits must have basic insulation.
- The digital output cable must be fused externally or galvanically isolated to protect the output circuits.
- After installation, there must be no access to live parts e.g. terminals.
- If the FCM 2 is used in a manner not specified by VAF Instruments, the protection provided by the equipment may be impaired.
- When connecting power supply wiring, make sure that PE wire is longer than power wires, in order to assure connection under any circumstance.



NOTE:

- Always route signal cables and power cables separately, preferably in earthed (grounded) metal conduits.
- It is required that screened cable is used for signal inputs and digital output connections.
- All screens are to be properly connected under the cable glands *on FCM 2 side only*, as shown in Figure 2.
- Connecting the screen on both sides of the cable will result in a ground loop.

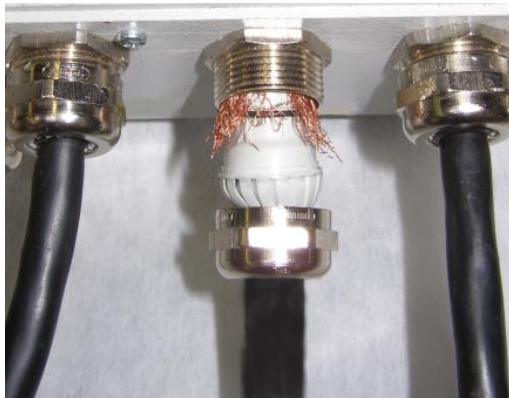


Figure 2: Cable shielding in cable gland

6.4 CONNECTION DIAGRAM

The FCM 2 must be connected to the power supply and flowmeter(s). Optional the digital output, analog input/output, Modbus and FCMbus can be connected as shown in

Figure 3 and

Figure 4.

The terminal connections and switch settings are shown in Figure 5 and Table 1.

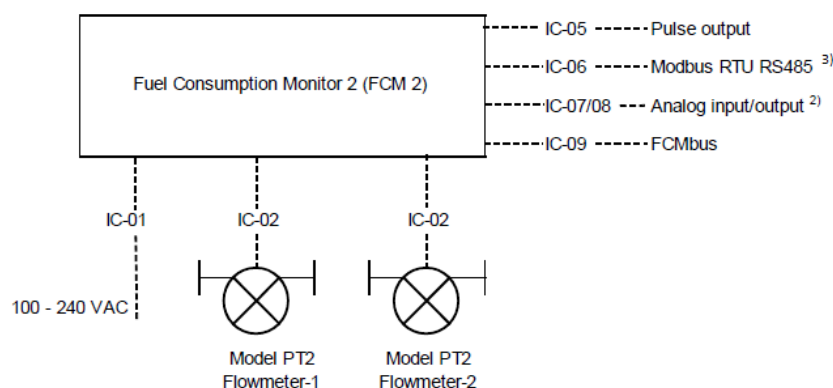


Figure 3: Schematic external connections FCM 2 with PT2 flowmeters

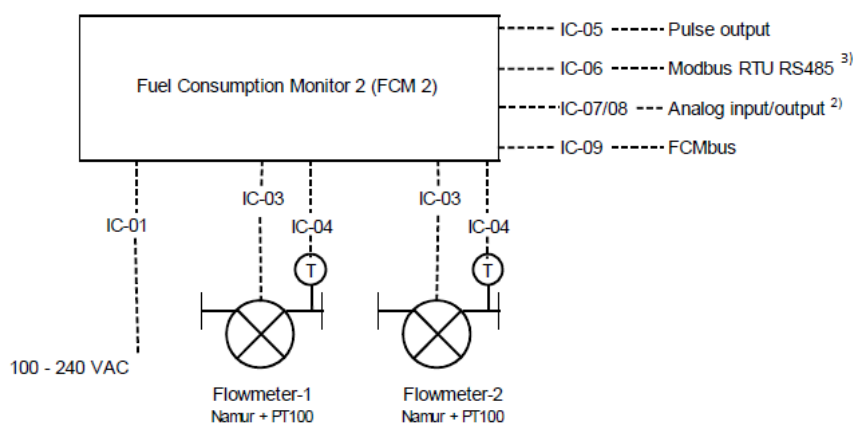


Figure 4: Schematics external connections FCM 2 with flowmeters with Namur sensor and external PT100

Cable specifications:

IC-01	Power supply cable (100 – 240 VAC)	3 x 1.5 mm ²
IC-02	PT2 flowmeter cable for pulse and PT100 (3m integrated)	2 x 3 x 0.50 mm ² or 4 x 2 x 0.50 mm ² , twisted pair, individually screened, braid shielded ¹⁾
IC-03	Namur sensor input cable	1 x 2 x 0.50 mm ² , twisted pair, braid shielded ¹⁾
IC-04	PT100 input cable	1 x 2 x 0.50 mm ² , twisted pair, braid shielded ¹⁾
IC-05	Digital pulse out cable	1 x 2 x 0.50 mm ² , twisted pair, braid shielded
IC-06	Modbus connection cable	1 x 2 x 0.50 mm ² , twisted pair, braid shielded ³⁾
IC-07	Analog input connection cable	3 x 2 x 0.50 mm ² , twisted pair, individually screened, braid shielded. ²⁾
IC-08	Analog output connection cable	2 x 2 x 0.50 mm ² , twisted pair, individually screened, braid shielded. ²⁾
IC-09	FCMbus connection cable	1 x 2 x 0.50 mm ² , twisted pair, braid shielded

¹⁾ Pulse and PT100 signals should not be joined within the same pair together.

²⁾ Optional: Analog output or analog input.

³⁾ Optional: Modbus RTU RS485.

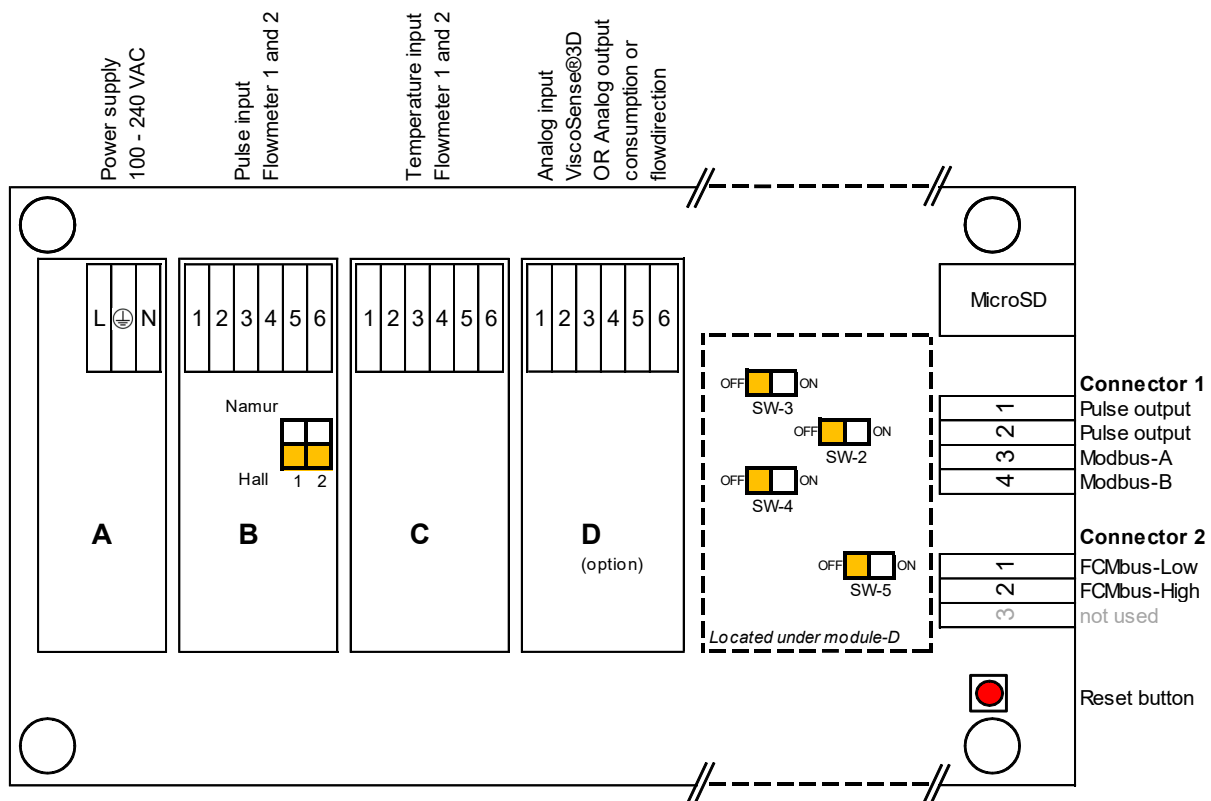


Figure 5: Terminal connections for FCM 2



NOTE: **Pulse switches** 1 and 2 on the counter module-B must be set to “Hall” or to “Namur” according the connected flowmeter input signal.



NOTE: **Modbus switches** SW2(termination resistor), SW3(bias resistor) and SW4(bias resistor) settings:

- When the FCM 2 is in the middle within the Modbus network, all three switches must be set “OFF”.
- When the FCM 2 is the last module in the Modbus network, switch SW2 must be set “ON” and switches SW3 and SW4 must be set “OFF”.
- When the FCM 2 is the first module in the Modbus network, all three switches must be set “ON”.



NOTE: **FCMbus switch** SW5(termination resistor) setting:

- When the FCM 2 is in the middle within the FCMbus network, switch SW5 must be set “OFF”.
- When the FCM 2 is the first or last module in the FCMbus network, switch SW5 must be set “ON”.

	Connector	Description	Cable type	Remarks			
Power supply 100-240 VAC	L	L	IC-01				
		PE					
	N	N					
Flowmeter 1 VAF-PT2 HALL-sensor	B-1	Pulse +	IC-02	1	Red	← PT2 wire number and wire colour	
	B-2	Pulse signal		3	Yellow		
	B-3	Pulse GND		2	Black		
	C-1	PT100 (1)		6	Brown		
	C-2	PT100 (2)		5	Blue		
	C-3	PT100 sense		4	White		
	Flowmeter 2 VAF-PT2 HALL-sensor	B-4		Pulse +	IC-02		1
B-5		Pulse signal	3	Yellow			
B-6		Pulse GND	2	Black			
C-4		PT100 (1)	6	Brown			
C-5		PT100 (2)	5	Blue			
C-6		PT100 sense	4	White			
Flowmeter 1 NAMUR-sensor		B-1	Namur +	IC-03			
	B-2	Namur -					
	B-3	not used					
	C-1	PT100 (1)	IC-04				
	C-2	PT100 (2)					
	C-3	PT100 sense					
Flowmeter 2 NAMUR-sensor	B-4	Namur +	IC-03				
	B-5	Namur -					
	B-6	not used					
	C-4	PT100 (1)	IC-04				
	C-5	PT100 (2)					
	C-6	PT100 sense					
Analog input ViscoSense®3D (option)	D-1	GND	IC-07	Viscosity		4 – 20mA (passive, Ri=100Ω)	
	D-2	+		Temperature			
	D-3	GND		Density			
	D-4	+					
	D-5	GND					
	D-6	+					
Analog output Consumption or flow direction (option)	D-1	GND	IC-08	Consumption engine 1* or flow direction		4 – 20mA consumption or 8mA discharge and 12mA loading (Active, Rb=0....400Ω)	
	D-2	+					
	D-3	GND		Consumption engine 2*			
	D-4	+					
	D-5	not used	*flowrate only, please use Modbus or pulse output for totalizing				
	D-6	not used					
Pulse output	Conn. 1-1	Pulse output	IC-05	Consumption engine 1 or alarm		Solid state relay	
	Conn. 1-2	Pulse output					
Modbus	Conn. 1-3	Modbus-A	IC-06	Details section 7.4.9		RS485 2-wire	
	Conn. 1-4	Modbus-B					
FCMbus	Conn. 2-1	FCMbus-low	IC-09	Details section 7.4.10		No galvanic isolation	
	Conn. 2-2	FCMbus-high					
	Conn. 2-3	not used					

Table 1: Terminal connections for FCM 2 with PT2-flowmeters or NAMUR-flowmeters with external PT100

7 OPERATING INSTRUCTIONS

7.1 MENU LAYOUT

The FCM 2 has a menu layout as shown below in Figure 6.

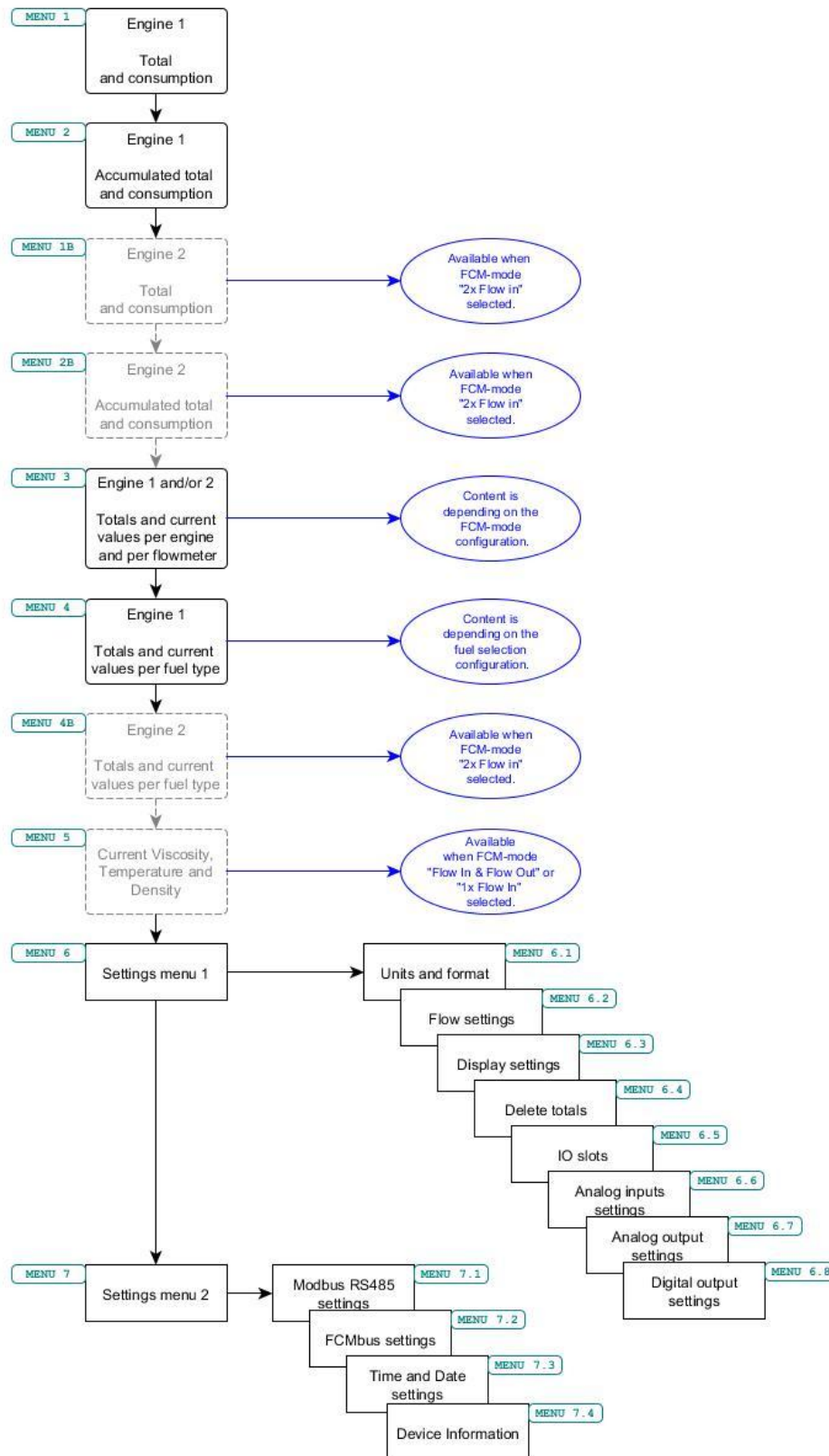


Figure 6: Menu layout

7.2 BASIC OPERATION

After the power is switched on, the FCM 2 will initialise and display Figure 7 or Figure 8.

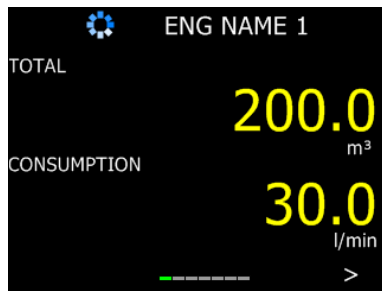


Figure 7: Menu 1



Figure 8: FCM-mode read-only

Since the FCM 2 has no buttons or keys, the touchscreen is the interface between the FCM 2 and the operator. The touchscreen also displays all relevant information.

The touchscreen is of the resistive type. To activate a key on the screen, a small amount of pressure has to be applied to the keys by pressing it.



CAUTION:

IN ORDER NOT TO DAMAGE THE TOUCH SCREEN IT IS RECOMMENDED ONLY TO PRESS THE TOUCH SCREEN WITH YOUR FINGERS OR STYLUS AND NOT BY ANY SHARP OR POINTY OBJECT.

By pressing the < or > key in the *lower left or right* corner of the screen, it is possible to navigate to the next or previous menu.

On the bottom of the screen menu is indicated by the grey/green bar  which menu is currently showing.

Depending on the configuration made in the settings Menu 6, more or less menus will be displayed. See also the menu layout in Figure 6.

By pressing the < or > key in the *top left or right* corner of the screen, it is possible to navigate to the next or previous FCM 2 remotely connected through FCMbus. For further details see section 7.4. Remote connections are indicated by a 2nd grey/green bar  at the bottom of the screen.

In the settings menu (section 7.6) the configuration of the FCM 2 can be changed by sliding and typing on the touch screen. Please see the following three (3) examples.

Example 1

Sliding through the menu's.

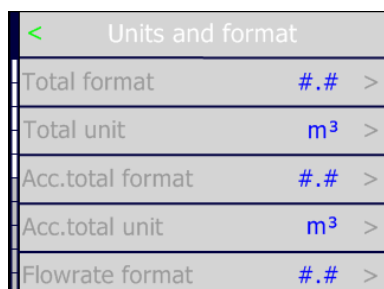


Figure 9: Menu 6.1 upper part

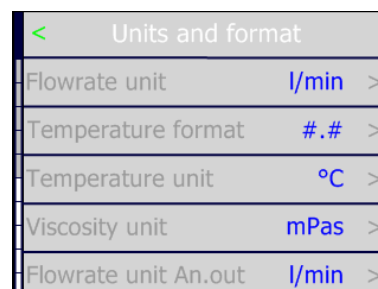


Figure 10: Menu 6.1 lower part

When entered Menu 6.1 (Figure 9) there will be 5 options visible. These 5 options are indicated by the 5 white rectangles at the left side of the screen.

The 5 light grey rectangles indicate that 5 other options are also available lower down the screen. To make these options available, slide with the fingertip from the down part of the screen upwards to enter the lower 5 options (Figure 10).

To change a specific setting, select the option by pressing the associated > button on the right side of the screen.

Example 2

Select a required setting by sliding.

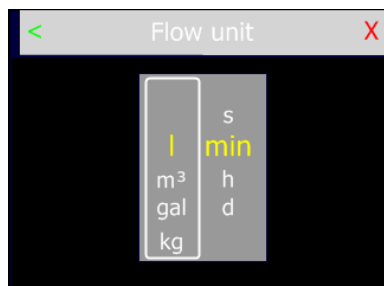


Figure 11: Menu 6.1.6 [l/min]

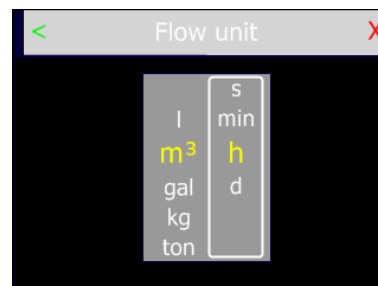


Figure 12: Menu 6.1.6 [m³/h]

Figure 11 shows the screen after the Flowrate Unit Menu 6.1.6 option is selected.

The required settings can be selected by sliding with the fingertip over the screen.

Sliding up-down selects the unit.

Sliding left-right select the column.

Press the green < button at the upper left corner of the screen to **save** the setting and to return to the previous screen.

Press the red X at the upper right corner of the screen to **cancel** the selection and to return to the previous screen.

Example 3

Value can be changed by entering the required value with the keypad or numpad by pressing the screen.

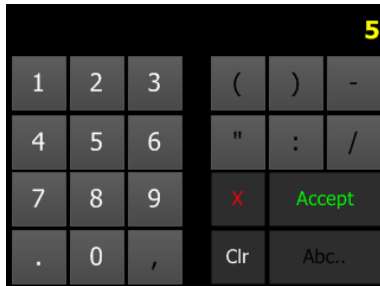


Figure 13: Numpad

or



Figure 14: Keypad

- Press X-key for cancelling the action and go back to the previous screen.
- Press Clr-key for erasing the current value in top right screen.
- Press back-key or del-key for erasing forward or backward.
- Press <<, <-, ->, >> for moving the cursor.
- Press Accept-key to accept the new value and go back to the previous screen.

7.3 MENU'S AND INDICATIONS

This section will show the different menu's which will be displayed depending on the selected FCM-mode and the Fuel selection.

In the Flow settings Menu 6.2, the *FCM-mode* can be selected by one of the following options:

- *Flow In & Flow Out* → For further details see section 7.3.1
- *1x Flow in* → For further details see section 7.3.2
- *2x Flow in* → For further details see section 7.3.3
- *Bi-directional Flow* → For further details see section 7.3.4
- *Read Only* → For further details see section 7.4

In the Flow settings Menu 6.2, the *Fuel* can be selected by one of the following options:

- Fuel 1
- Fuel 2
- Fuel 1 & Fuel 2

More settings are shown in section 7.6.

7.3.1 FCM-mode: Flow In & Flow Out

One flowmeter inlet and one flowmeter outlet and one engine.

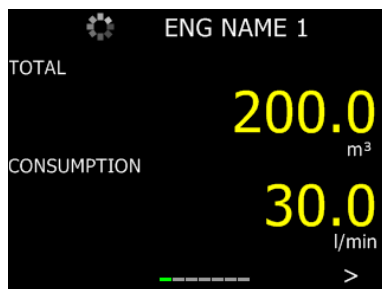


Figure 15: Menu 1

On the screen of Menu 1 (Figure 15), the Total consumption of the engine (both fuel types together) and the current Consumption rate is displayed.

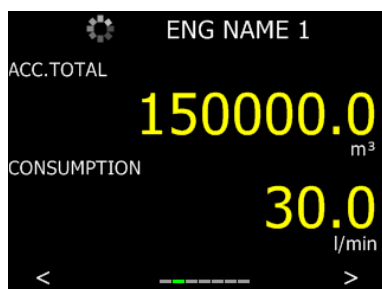


Figure 16: Menu 2

On the screen of Menu 2 (Figure 16), the Accumulated total consumption of the engine (both fuel types together) and the current Consumption rate is displayed.

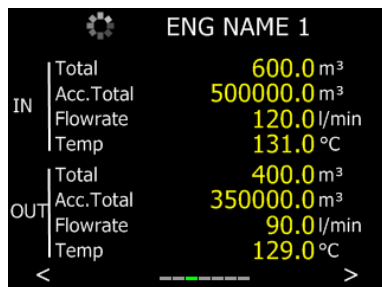


Figure 17: Menu 3

On the screen of Menu 3 (Figure 17) the current values for both the Inlet- and Outlet flowmeter are shown:

- Total volume/mass (both fuel types together) that has passed through the inlet- and outlet flowmeter
- Accumulated total volume/mass (both fuel types together) that has passed through the inlet- and outlet flowmeter
- Current flowrate through the inlet- and outlet flowmeter
- Current temperature of the fuel through the inlet- and outlet flowmeter

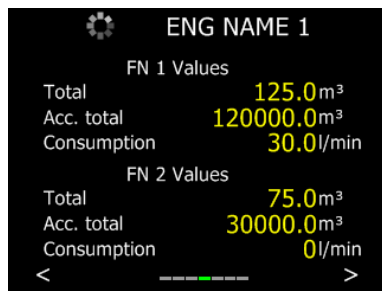


Figure 18: Menu 4

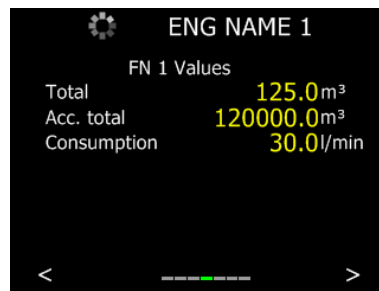


Figure 19: Menu 4

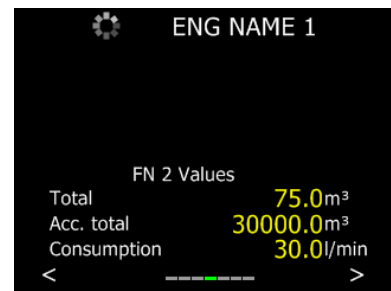


Figure 20: Menu 4

On the screen of Menu 4 (Figure 18, 19, 20) the *total- and current consumption per fuel type* (FN 1 and FN 2) is shown:

- Total consumption per fuel type
- Accumulated total consumption per fuel type
- Current consumption per fuel type



Only one of the screens Menu 4 (Figure 18, 19, 20) will be available.

This is depending on the setting made in the Flow settings Menu 6.2. Both fuel types or only one type can be selected.

More details are shown in section 7.6.2

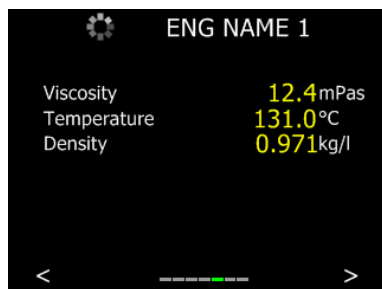


Figure 21: Menu 5

On the screen of Menu 5 (Figure 21) the Viscosity, Temperature and Density of the current fuel type are visible.



This screen is only available when the Analog-input is selected in the I/O-slots Menu 6.5, section 7.6.5. Accordingly the Analog-input needs to receive input signals from the ViscoSense®3D. By using the density the mass-flow can be determined.

7.3.2 FCM-mode: 1x Flow In

To be used with one flowmeter and one engine

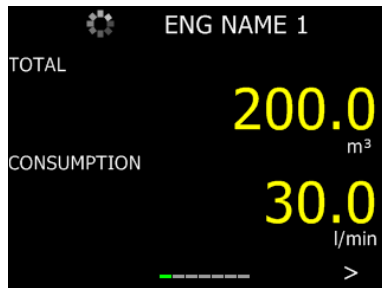


Figure 22: Menu 1

On the screen of Menu 1 (Figure 22), the Total consumption of the engine (both fuel types together) and the current Consumption rate is displayed.

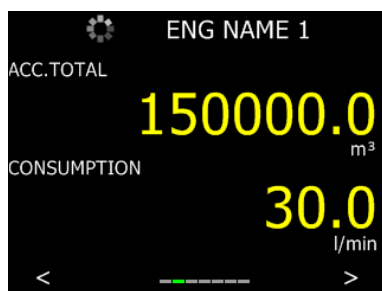


Figure 23: Menu 2

On the screen of Menu 2 (Figure 23), the Accumulated total consumption of the engine (both fuel types together) and the current Consumption rate is displayed.

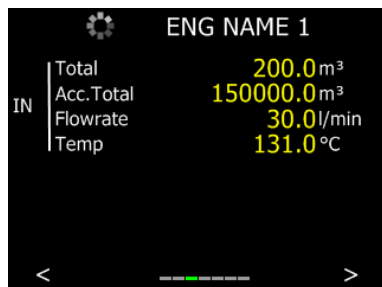


Figure 24: Menu 3

On the screen of Menu 3 (Figure 24) the current values for the inlet flowmeter are shown:

- Total volume/mass (both fuel types together) that has passed through the inlet flowmeter
- Accumulated total volume/mass (both fuel types together) that has passed through the inlet flowmeter
- Current flowrate through the inlet flowmeter
- Current temperature of the fuel through the inlet flowmeter

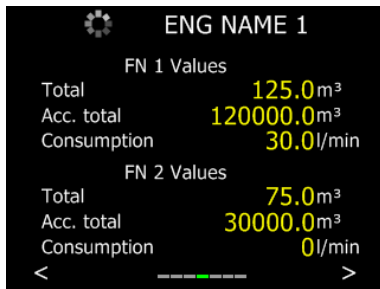


Figure 25: Menu 4

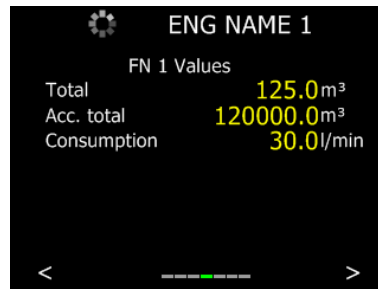


Figure 26: Menu 4

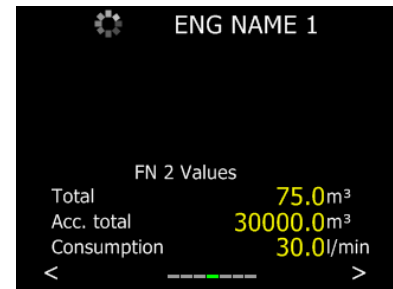


Figure 27: Menu 4

On the screen of Menu 4 (Figure 25, 26, 27) the *total- and current consumption per fuel type* (FN 1 and FN 2) is shown:

- Total consumption per fuel type
- Accumulated total consumption per fuel type
- Current consumption per fuel type



Only one of the screens Menu 4 (Figure 25, 26, 27) will be available.

This is depending on the setting made in the Flow settings Menu 6.2. Both fuel types or only one type can be selected.

More details are shown in section 7.6.2

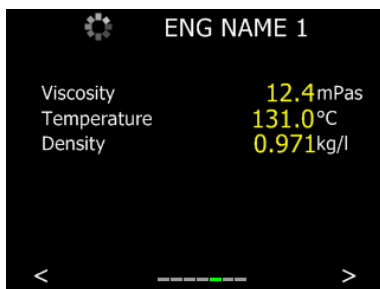


Figure 28: Menu 5

On the screen of Menu 5 (Figure 28) the *Viscosity, Temperature and Density* of the current fuel type are visible.



This screen is only available when the Analog-input is selected in the I/O-slots Menu 6.5, section 7.6.5. Accordingly the Analog-input needs to receive input signals from the ViscoSense®3D. By using the density the mass-flow can be determined.

7.3.3 FCM-mode: 2x Flow In

To be used with two flowmeters and two engines

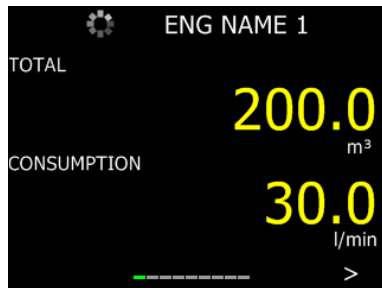


Figure 29: Menu 1

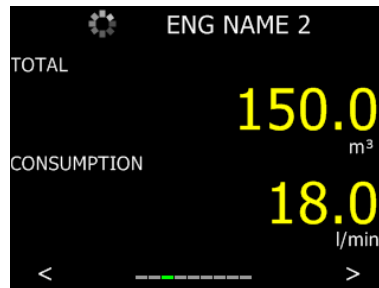


Figure 30: Menu 1B

On the screens of Menu 1 (B) (Figure 29, 30), the Total consumption of the engines (both fuel types together) and the current Consumption rate is displayed.

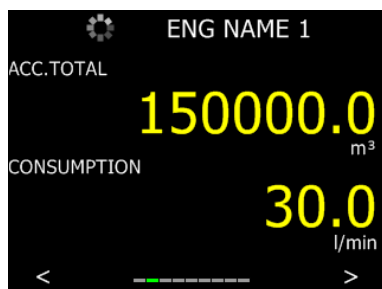


Figure 31: Menu 2



Figure 32: Menu 2B

On the screens of Menu 2 (B) (Figure 31, 32), the Accumulated total consumption of the engines (both fuel types together) and the current Consumption rate is displayed.

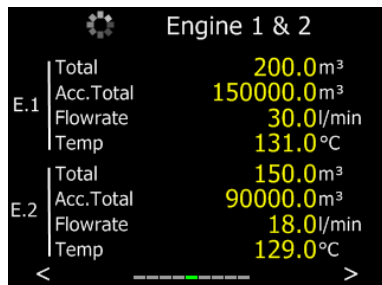


Figure 33: Menu 3

On the screen of Menu 3 (Figure 33) the current values for both engine-1 and engine-2 are shown:

- Total volume/mass (both fuel types together) that has passed through the inlet flowmeter
- Accumulated total volume/mass (both fuel types together) that has passed through the inlet flowmeter
- Current flowrate through the inlet flowmeter
- Current temperature of the fuel through the inlet flowmeter

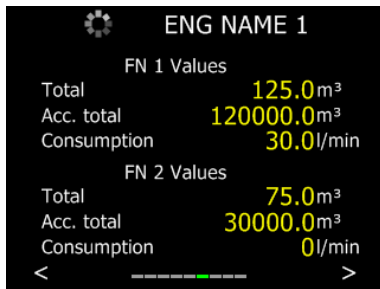


Figure 34: Menu 4

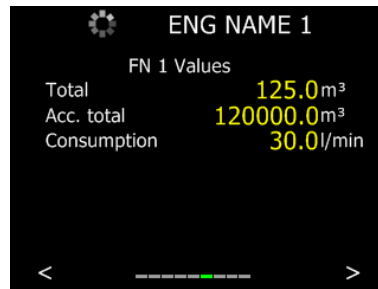


Figure 35: Menu 4

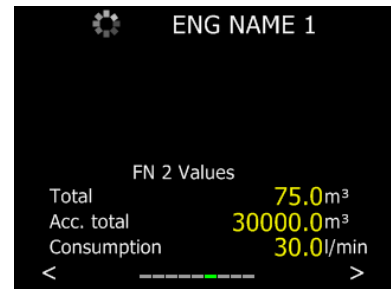


Figure 36: Menu 4

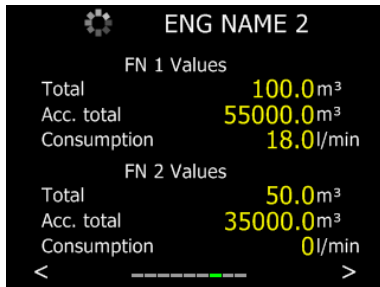


Figure 37: Menu 4B

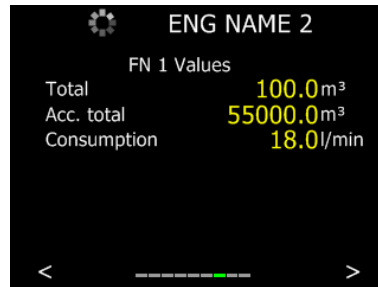


Figure 38: Menu 4B

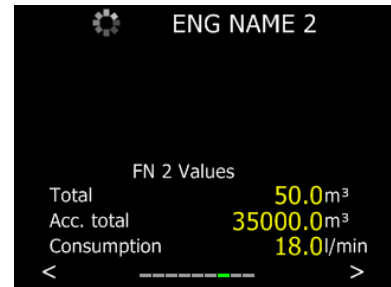


Figure 39: Menu 4B

On the screen of Menu 4 (B) (Figure 34 to 39) the *total- and current consumption per engine (Engine 1 and Engine 2) and per fuel type (FN 1 and FN 2)* are shown:

- Total consumption per fuel type
- Accumulated total consumption per fuel type
- Current consumption per fuel type



Only one of the screens Menu 4 (Figure 34, 35, 36) and only one of the screens of Menu 4B (Figure 37, 38, 39) will be available.

This is depending on the setting made in the Flow settings Menu 6.2. Both fuel types or only one type can be selected.

More details are shown in section 7.6.2



The Menu 5 screen with the Viscosity, Temperature and Density is not available when the FCM-mode: 2x Flow in is selected.

7.3.4 FCM-mode: Bi-directional Flow

To be used with one flowmeter with double pulse, used for loading and discharging.

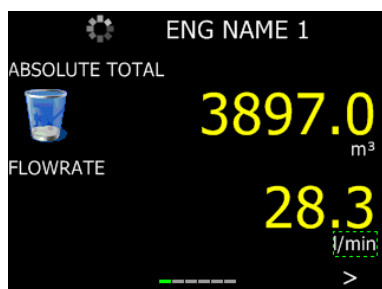


Figure 40: Menu 1

On the screen of Menu 1 (Figure 40), the Absolute total (*loaded fuel minus discharged fuel*) and the current Flowrate of the flowmeter is displayed.

By pressing the trashbin icon the Absolute total (menu 1), Total Load (menu 2) and Total Discharge (menu 3) will be cleared to zero.

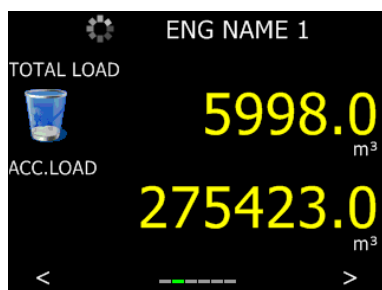


Figure 41: Menu 2

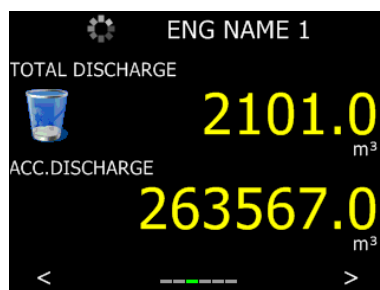


Figure 42: Menu 3

On the screens of Menu 2 and 3 (Figure 41, 42), the Total and Accumulated Load/Discharge of the flowmeter is displayed.

By pressing the trashbin icon the Total Load (menu 2) or Total Discharge (menu 3) will be cleared to zero.



Deleting the Total Load (menu 2) or Total Discharge (menu 3) will not effect the Absolute total (menu 1) number.

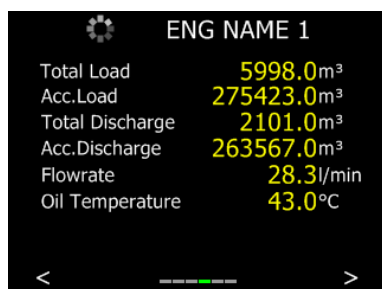


Figure 43: Menu 4

On the screen of Menu 4 (Figure 43), an overview is shown of the Total and Accumulated Load/Discharge of the flowmeter is displayed.



For selecting Bi-directional flow refer to FCM-mode (section 7.6.2) and I/O-slot (section 7.6.5). For analog flow direction signal, please refer to section 7.6.7.

7.4 FCMBUS OPERATION

The FCM 2 is fitted with FCMBus communication making it available to communicate between two or more different FCM 2 devices. Information as flowrate, consumption, temperature, etc. can be read out remotely from one FCM 2 on another FCM 2. FCMBus communication is read-only.



The physical FCMBus-connection is explained in section 6.4 and the FCMBus-settings are explained in section 7.6.10.

When the FCMBus connection has been established an extra bar will appear on top of the existing grey/green menu-bar.  The number of indicators is depending on the settings and amount of FCM 2 devices connected with the FCMBus communication.

Figure 44 shows two (2) bars at the bottom of the screen.

- The top-indicators show four (4) FCM 2 devices are connected remotely within de FCMBus.
- The lower-indicators show which menu is showing of the selected FCM 2 device.

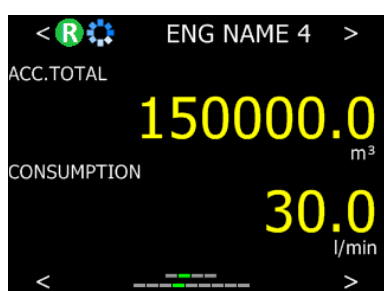


Figure 44: Remote screen

By pressing the < or > key at the top left or right corner of the screen, it is possible to navigate remotely to the next or previous FCM 2 device.

By pressing the < or > key in the lower left or right corner of the screen, it is possible to navigate to the next or previous menu.

Example

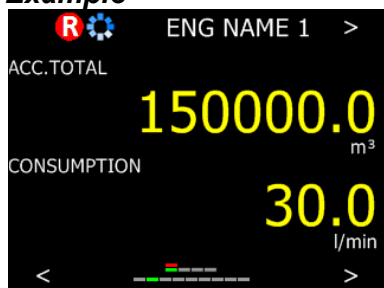


Figure 45: Remote 3 reads remote 1

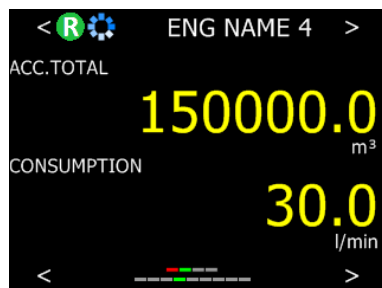


Figure 46: Remote 3 reads remote 2

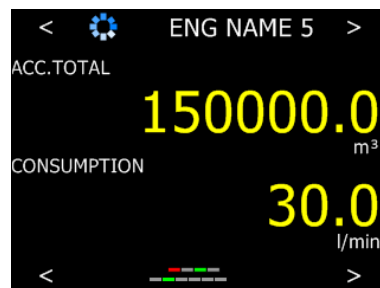


Figure 47: Remote 3 reads remote 3

In this example a few screens are shown of a FCMBus system.

- Four (4) FCM 2 devices are connected remotely
- When **red** or **green** "R" is shown the readout is remotely
- The **green** "R" is shown in a normal situation
- The **red** "R" is shown when there is an active alarm on the selected remote device
- In case of an alarm the indicator at the bottom-bar is flashing red.

A FCM 2 device within the FCMbus communication system can also be set as a read-only device. A read-only device has no flowmeters connected. FCM-mode needs to be set as Read Only in the Flow settings Menu 6.2.1.

Example

The FCM 2 is set to read-only mode when the FCM 2 is located in the ECR and no flowmeter is connected to this FCM 2. The FCM 2 located in the ECR can read data through the FCMbus connection from other FCM 2 devices located elsewhere and having flowmeters connected.

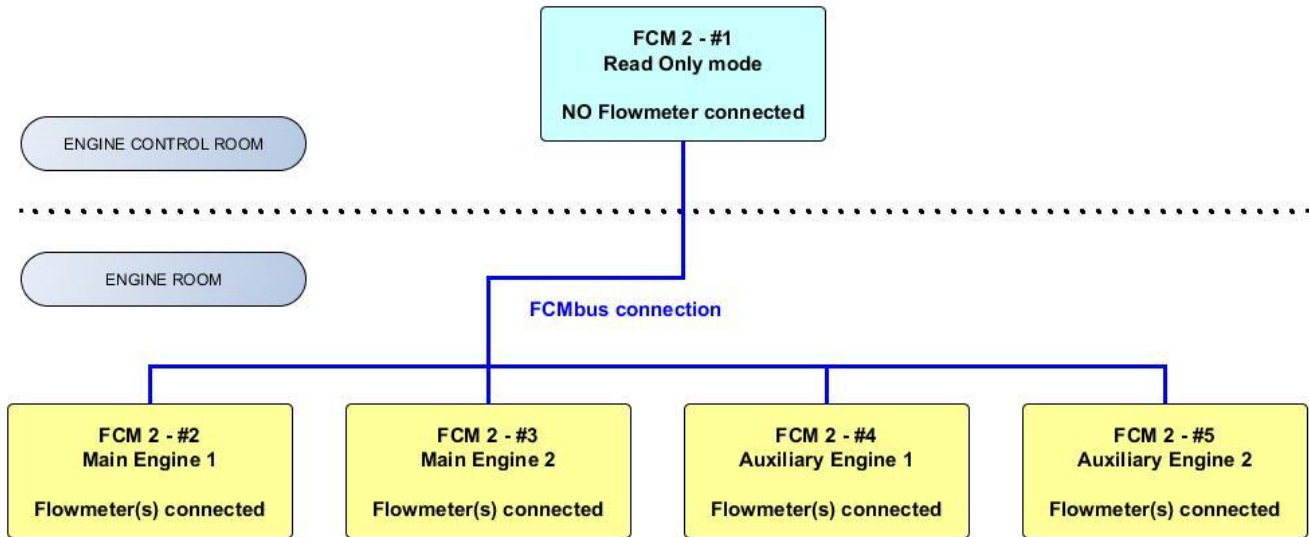


Figure 48: Example of FCM 2 Read Only setup

7.5 ALARMS AND WARNINGS

During operation the FCM 2 monitors several functions.

When any of these functions do not meet certain conditions an alarm warning is given in the form of a **red warning sign** in the right upper corner of the screen as shown in Figure 49.

If an alarm has occurred, but is not longer active, a **green warning sign** is shown on the screen as shown in Figure 50.

The alarm conditions monitored by the FCM 2 are shown in Table 2.



Figure 49: Menu 2 with Active alarm warning



Figure 50: Menu 2 with Alarm warning

By pressing the red (or green) alarm icon the Alarm overview menu is displayed.

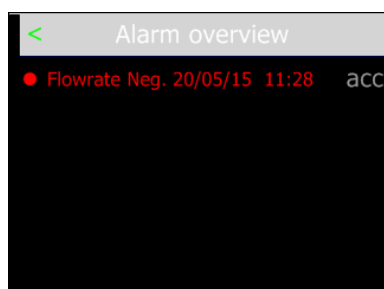


Figure 51: Alarm overview

In the Alarm overview menu all warnings are shown.

- When an alarm is **active** the alarm warning is shown in **red**.
- When an alarm has occurred but is **not longer active** the alarm warning is shown in **green**.

The acc button can be pressed to acknowledge the alarm.

- When an **alarm is still active**, the flashing will stop. The warning will disappear automatically when not-active anymore.
- When an **alarm is not-active anymore**, the warning will disappear.

On the menu screens a flow-icon is shown.

The **blue clockwise** rotating icon is shown during normal operation.

The **red anti-clockwise** rotating icon is shown in case of a negative consumption.



Figure 52: flow-icons

Alarm indication	Alarm condition
Negative consumption	Flowrate of flowmeter 2 > cutoff value + flowrate flowmeter 1 <i>A negative consumption can only be measured when FCM-mode "Flow In & Flow out" is selected. Menu 6.2.1</i>
Sensor fail	When the PT100 input is: 0Ω or open-loop or >200°C
Communication fail	No communication between internal module(s) and backplane
Flowmeter fail	Flowrate of flowmeter 1 = 0 and Flowrate of flowmeter 2 > 5x cutoff value <i>A flowmeter fail can only be measured when FCM-mode "Flow In & Flow out" is selected. Menu 6.2.1</i>
Analog-in fail	Overrange (O.R.) when analog-in >20mA Underrange (U.R.) when analog-in <4mA Twist wire (T.W.) when polarity is twisted Not connected (N.C.) when the analog-in is not connected
Analog-out fail	Loop error (L.E.) when nothing connected to the analog-out or when Rb >400Ω

Table 2: Alarm conditions

7.6 SETTINGS MENU

Before the FCM 2 can be used, it has to be properly configured.

Although most parameters are already set at the VAF Instruments factory, some parameters still have to be set to the appropriate values in accordance to the specific system or to accommodate the user preferences.

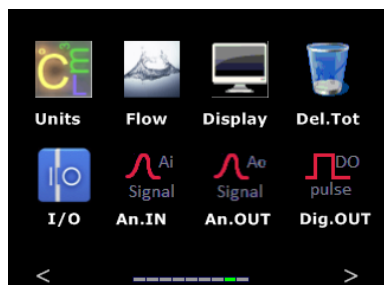


Figure 53: *Menu 6*

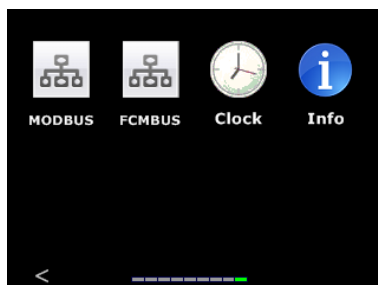


Figure 54: *Menu 7*

The different sub menu's can be entered by pressing the associated icon. How to change the settings is described in section 7.2

7.6.1 Units and format (menu 6.1)



In the Units and format Menu 6.1 the units and format on the display (Menu 1 to 5) can be set. The settings that can be made are shown in Table 3.

< Units and format		
Total format	#.#	>
Total unit	m ³	>
Acc.total format	#.#	>
Acc.total unit	m ³	>
Flowrate format	#.#	>

Figure 55: Menu 6.1 upper part



< Units and format		
Flowrate unit	l/min	>
Temperature format	#.#	>
Temperature unit	°C	>
Viscosity unit	mPas	>
Flowrate unit An.out	l/min	>

Figure 56: Menu 6.1 lower part

Menu	Description	Remark
6.1.1	Total format	The number of decimals for the <i>total consumption</i> can be selected. The options are: # - #.# - #.## - #.###
6.1.2	Total unit	The unit of the <i>total consumption</i> can be selected. The options are: l - m ³ - gal - kg - ton - lb
6.1.3	Acc. total format	The number of decimals for the <i>accumulated total consumption</i> can be selected. The options are: # - #.# - #.## - #.###
6.1.4	Acc. total unit	The unit of the <i>accumulated total consumption</i> can be selected. The options are: l - m ³ - gal - kg - ton - lb
6.1.5	Flowrate format	The number of decimals for the <i>actual flowrate</i> can be selected. The options are: # - #.# - #.## - #.###
6.1.6	Flowrate unit	The units of the <i>actual flowrate</i> can be selected. The volume/mass options are: l - m ³ - gal - kg - ton - lb The timeframe units are: s - min - h - d
6.1.7	Temperature format	The number of decimals for the <i>actual temperature</i> can be selected. The options are: # - #.#
6.1.8	Temperature unit	The units of the <i>actual temperature</i> can be selected. The options are: °C - °F - K
6.1.9	Viscosity unit	The units of the <i>actual viscosity</i> can be selected. The options are: mPas - cSt
6.1.10	Flowrate unit An.out	The units of the <i>actual flowrate analog output</i> can be selected. The volume/mass options are: l - m ³ - gal - kg - ton - lb The timeframe units are: s - min - h - d

Table 3: Settings menu 6.1 Units and formats

7.6.2 Flow settings (menu 6.2)



In the Flow settings Menu 6.2 the FCM-mode, Fuel-type and other specific settings are made for calculating the correct consumption. The settings that can be made are shown in Table 4.

< Flow computer	
FCM Mode	1x Flow In >
K-factor inlet	12 P/L>
K-factor outlet	10 P/L>
Normal temp. FN1	15 °C>
Ther.exp.x10e-6 FN1	1250 /°C>

Figure 57: Menu 6.2 top

< Flow computer	
Dense Fuel FN1	0 Kg/l>
Normal temp. FN 2	15 °C>
Ther.exp.x10e-6 FN2	750 /°C>
Dense Fuel FN2	0 Kg/l>
Fuel Select	Fuel 1 & Fuel 2 >

Figure 58: Menu 6.2 medium

< Flow computer	
Fuel Select	Fuel 1 & Fuel 2 >
Switching temp.	70 °C>
Cutoff Value	0 l/m>
Temp. smoothing filter	5 sec>
Flow smoothing filter	5 sec>

Figure 59: Menu 6.2 bottom

Menu	Description	Remark
6.2.1	FCM-mode	Flow In & Out: To be used with one flowmeter inlet and one flowmeter outlet and one engine 1x Flow In: To be used with one flowmeter and one engine 2x Flow In: To be used with two flowmeters and two engines Bi-directional To be used with one flowmeter for loading and discharging Read Only: To be used when read only in FCMBus system and no flowmeters connected to the device.
6.2.2	K-factor inlet/Eng.1/loading	The K-factor is the number of pulses generated by the flowmeter per litre and can be found on the textplate of the flowmeter. The following range can be selected: 0.001 – 9999.999
6.2.3	K-factor outlet/Eng.2/discharging	The K-factor is the number of pulses generated by the flowmeter per litre and can be found on the textplate of the flowmeter. The following range can be selected: 0.001 – 9999.999
6.2.4	Normal temp. FN 1	The thermal expansion reference temperature in °C for fuel type 1. For most fluids the reference temperature is 15 °C. The following range can be selected: 0.0 – 999.9
6.2.5	Ther.exp. x10e-6 FN 1	The thermal expansion coefficient α for fuel type 1. The value to be entered has to be multiplied with 10^{-6} . Example: $\alpha = 830 \times 10^{-6} / ^\circ\text{C} \rightarrow$ Enter: 830. <i>When set to a value of 0, the volume correction is disabled.</i>
6.2.6	Dense Fuel FN 1	The density ρ for fuel type 1. The following range can be selected: 0.00001 – 9.99999 <i>In case a ViscoSense®3D is connected the measured density value will automatically be used for determining massflow.</i>
6.2.7	Normal temp. FN 2	The thermal expansion reference temperature in °C for fuel type 2. For most fluids the reference temperature is 15 °C. The following range can be selected: 0.0 – 999.9
6.2.8	Ther.exp. x10e-6 FN 2	The thermal expansion coefficient α for fuel type 2. The value to be entered has to be multiplied with 10^{-6} . Example: $\alpha = 830 \times 10^{-6} / ^\circ\text{C} \rightarrow$ Enter: 830. <i>When set to a value of 0, the volume correction is disabled.</i>
6.2.9	Dense Fuel FN 2	The density ρ for fuel type 2. The following range can be selected: 0.00001 – 9.99999 <i>In case a ViscoSense®3D is connected the measured density value will automatically be used for determining massflow.</i>

6.2.10	Fuel Select	Fuel 1: The currently measured flow is added to the totals of fuel type 1. Fuel 2: The currently measured flow is added to the totals of fuel type 2 Fuel 1 & Fuel 2: The currently measured flow is added <i>automatically</i> to the totals of either fuel type 1 <i>or</i> fuel type 2, depending on inlet fuel temperature. This temperature can be set in menu 6.2.11 Switching temp.
6.2.11	Switching temp.	The switching temperature defines if the currently measured flow is added to the totals of fuel type 1 or fuel type 2. Fuel type 1: When the actual temperature of the inlet flowmeter > than the switching temperature. Fuel type 2: When the actual temperature of the inlet flowmeter ≤ than the switching temperature. The following range can be selected: 0.0 – 999.9 <i>The switching temperature is only applicable when Fuel 1 & Fuel 2 is selected (Menu 6.2.10).</i>
6.2.12	Cutoff Value (Eng.1/Eng.2)	If the current <i>consumption</i> is ≤ than the cutoff value, no consumption is added to the totals. The following range can be selected: 0.01 – 999.9 <i>The cutoff value is set per engine.</i> <i>One cutoff value: FCM-mode: Flow In & Out or 1xFlow In</i> <i>Two cutoff values: FCM-mode: 2x Flow In</i> <i>Rule of thumb is cut off value = 0.5% of maximum flowrate.</i> <i>The cut off value has to be less than the minimum consumption.</i>
6.2.13	Temp. smoothing filter	Look back period for the moving average of the temperature shown. This will filter out spikes and display a more natural course of the temperature. The following range can be selected: 0 – 10
6.2.14	Flow smooting filter	Look back period for the moving average of the flowrate shown. This will filter out spikes and display a more natural course of the temperature. The following range can be selected: 0 – 10

Table 4: Settings menu 6.2 Flow settings

7.6.3 Display settings (menu 6.3)



In the Display settings Menu 6.3 the display settings and device/engine/fuel names can be set. The settings that can be made are shown in Table 4.

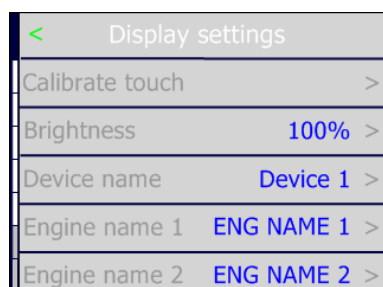


Figure 60: Menu 6.3 top

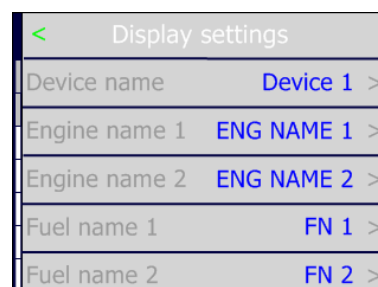


Figure 61: Menu 6.3 bottom

Menu	Description	Remark
6.3.1	Calibrate touch	With this procedure the accuracy of the location where the screen is touched can be improved. It is required to follow the instructions on the screen and consecutive touch the screen on the prompted locations. <i>If the procedure is not followed properly a error warning is given. After an error warning the settings of the touch screen are restored to default and it is strongly advised to recalibrated the touchscreen.</i>
6.3.2	Brightness	To set the brightness level of the screen. The following range can be selected: 5 – 100
6.3.3	Device name	To set the name of the FCM 2 device
6.3.4	Engine name 1	To set the name of engine 1.
6.3.5	Engine name 2	To set the name of engine 2.
6.3.6	Fuel name 1	To set the name of fuel 1.
6.3.7	Fuel name 2	To set the name of fuel 2.

Table 5: Settings menu 6.3 Display settings

7.6.4 Delete totals (menu 6.4)



When the Delete Totals menu 6.4 is entered, the following totals can be reset:

- Total consumption of *engine one and two* regardless the fuel type
- Total volume that has passed through *flowmeter one and two*
- Total consumption of *fuel type one and two*

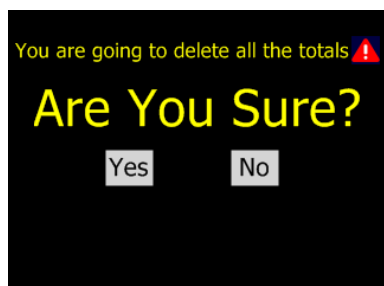


Figure 62: Menu 6.4



It is not possible to undo a reset of the total values.



Deleting the accumulated totals is not possible.

7.6.5 IO slots (menu 6.5)



In the IO Slots menu 6.5 it is possible to set the type of IO modules which are installed in the FCM 2. Normally this is done at the VAF Instruments factory and does not need changing. The settings that can be made are shown in Table 6.

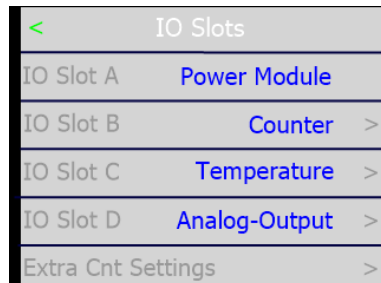


Figure 63: Menu 6.5

Menu	Description	Remark
6.5.1	IO slot A	Shows the IO module (Power module) installed in slot A. <i>This option cannot be changed.</i>
6.5.2	IO slot B	Determines the type of IO module installed in slot B. The following modules can be selected: <i>Empty slot – Counter – Bi-Direct.Cnt – Temperature – Analog-input – Analog-Output</i>
6.5.3	IO slot C	Determines the type of IO module installed in slot C. The following modules can be selected: <i>Empty slot – Counter – Bi-Direct.Cnt – Temperature – Analog-input – Analog-Output</i>
6.5.4	IO slot D	Determines the type of IO module installed in slot D. The following modules can be selected: <i>Empty slot – Counter – Bi-Direct.Cnt – Temperature – Analog-input – Analog-Output</i>
6.5.5	Extra Cnt. Settings	Extra counter settings menu: <i>Pulses Needed – Timeout – Debounce Time → See table below !</i>

Table 6: Settings menu 6.5 IO Slots

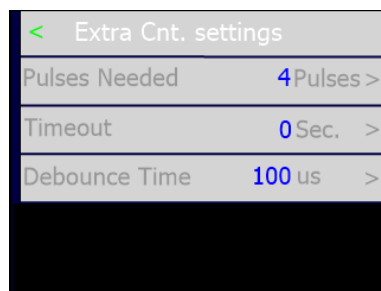


Figure 64: Menu 6.5.5

Menu	Description	Remark
6.5.5.1	Pulses Needed	The <i>Needed Pulses</i> can be set. The following range can be selected: <i>1 – 9</i>
6.5.5.2	Timeout	The <i>Timeout</i> can be set. The following range can be selected: <i>1 – 99 [s]</i>
6.5.5.3	Debounce Time	The <i>Debounce Time</i> can be set. The following range can be selected: <i>50 – 9999 [µs]</i>

Table 7: Settings menu 6.5.5 Extra Cnt. settings

7.6.6 Analog input settings (menu 6.6)



In the Analog input settings Menu 6.6 the actual input is visible and the minimum (4mA) and the maximum (20mA) values can be set. The settings that can be made are shown in Table 8.

< Analog Inputs	
Analog input 1	Disabled >
Actual Analog in 1 0.000 mA	
4mA Analog in 1	0 mPas >
20mA Analog in 1	50 mPas >
Analog input 2	Disabled >

Figure 65: Menu 6.6 top

< Analog Inputs	
Analog input 2	Disabled >
Actual Analog in 2 0.000 mA	
4mA Analog in 2	0 °C >
20mA Analog in 2	200 °C >
Analog input 3	Disabled >

Figure 66: Menu 6.6 medium

< Analog Inputs	
Analog input 3	Disabled >
Actual Analog in 3 0.000 mA	
4mA Analog in 3	0.8 kg/l >
20mA Analog in 3	1.2 kg/l >
Dense Temp Sel	Flow 1 >

Figure 67: Menu 6.6 bottom

Menu	Description	Remark
6.6.1	Analog input 1	The analog input 1 channel can be set to Disabled or Enabled
6.6.2	Actual Analog input 1	The actual value on input 1 is visible in mA. No settings can be changed.
6.6.3	4mA Analog in 1	The viscosity at 4mA can be set. The following range can be selected: 0,000 – 9999,99
6.6.4	20mA Analog in 1	The viscosity at 20mA can be set. The following range can be selected: 0,000 – 9999,99
6.6.5	Analog input 2	The analog input 2 channel can be set to Disabled or Enabled
6.6.6	Actual Analog input 2	The actual value on input 2 is visible in mA. No settings can be changed.
6.6.7	4mA Analog in 2	The temperature at 4mA can be set. The following range can be selected: 0,000 – 999,999
6.6.8	20mA Analog in 2	The temperature at 20mA can be set. The following range can be selected: 0,000 – 999,999
6.6.9	Analog input 3	The analog input 3 channel can be set to Disabled or Enabled
6.6.10	Actual Analog input 3	The actual value on input 3 is visible in mA. No settings can be changed.
6.6.11	4mA Analog in 3	The density at 4mA can be set. The following range can be selected: 0,000 – 9,999
6.6.12	20mA Analog in 3	The density at 20mA can be set. The following range can be selected: 0,000 – 9,999
6.6.13	Dense Temp Selection	Flow 1 or Flow 2 can be set as temperature input if Analog 2 is disabled.

Table 8: Settings menu 6.6 Analog input settings

7.6.7 Analog output settings (menu 6.7)



In the Analog ouput settings Menu 6.7 the actual ouput is visible and the minimum (4mA) and the maximum (20mA) values can be set. Like all other values, the consumption is temperature compensated. The settings that can be made are shown in Table 9.

Please note that analog outputs are meant to display consumptionrates and should not be used for totalizing. For the latter Modbus or pulse output can be used.



Analog Out 2 is only available in FCM-mode 2x Flow In which can be set in menu 6.2.1.



In Bi-directional mode the Analog Out 1 can be used for sending the flow direction. At discharge the analog output will be 8mA and when loading the analog output will be 12mA.

< Analog Outputs	
Analog Out 1	4 mA
4mA =	0 l/min >
20mA =	100 l/min >
Alalog Out 2	20.5 mA
4mA =	0 l/min >
20mA =	0 l/min >

Figure 68: Menu 6.7

Menu	Description	Remark
6.7.1	Analog Out 1	The actual value of output 1 is visible in mA. No settings can be changed.
6.7.2	4mA =	The consumption rate of engine 1 at 4mA can be set. The following range can be selected: 0 – 9999
6.7.3	20mA =	The consumption rate of engine 1 at 20mA can be set. The following range can be selected: 0 – 9999
6.7.4	Analog Out 2	The actual value of output 2 is visible in mA. No settings can be changed.
6.7.5	4mA =	The consumption rate of engine 2 at 4mA can be set. The following range can be selected: 0 – 9999
6.7.6	20mA =	The consumption rate of engine 2 at 20mA can be set. The following range can be selected: 0 – 9999

Table 9: Settings menu 6.7 Analog output settings

7.6.8 Digital output settings (menu 6.8)



The digital output generates *X-number of pulses per unit for the consumption of engine 1*. Like all other values, the consumption is temperature compensated.

The output can also be set as an alarm output.

When the Digital output settings menu 6.8 is entered, several options for the pulse output can be set. The settings that can be made are shown in Table 10.

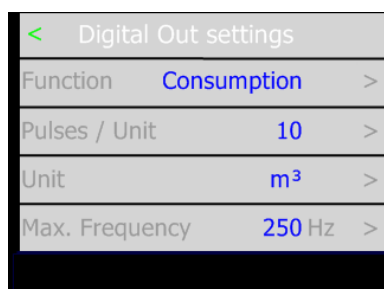


Figure 69: Menu 6.8

Menu	Description	Remark
6.8.1	Function	The output can forward the consumption of engine 1 or can be an alarm output. The following function can be selected: Consumption – Alarm (N.O.) – Alarm (N.C.)
6.8.2	Pulses / Unit	The number of pulses that will be generated per unit. The unit is set in menu 6.8.3. The following range can be selected: 1 – 99999
6.8.3	Unit	The unit per which the output pulses are generated. The output pulses are set in menu 6.8.2. The following units can be selected: l - m³ - gal – kg – ton - lb
6.8.4	Max. Frequency	The maximum output frequency in Hz is set. The following range can be selected: 1 - 99999 When the maximum frequency goes out of range e.g. when the flowrate increases, an internal buffer will be used to "store the missed pulses". As soon as the flowrate reduces again, the buffer will be "emptied". It is advised to set the maximum frequency within the range of the receiver to decrease the chance of missing pulses.

Table 10: Settings menu 6.8 Digital output settings

7.6.9 Modbus RTU settings (menu 7.1)



With the Modbus connection a list of register addresses can be read. The complete list of Modbus addresses can be found in section 16.15.

When the Modbus settings menu 7.1 is entered, several options for the Modbus communication can be set. The settings that can be made are shown in Table 11.

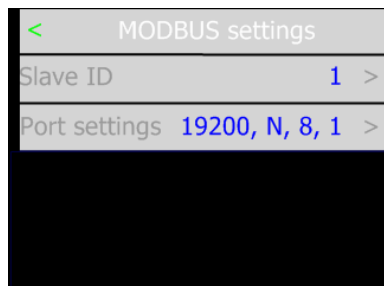


Figure 70: Menu 7.1

Menu	Description	Remark
7.1.1	Slave ID	The ID number of the FCM 2 is set. The following range can be selected: 1 - 254
7.1.2	Port settings	The port settings of the modbus communication are set. The following ranges can be selected: BaudRate: 115200 – 57600 – 38400 – 19200 – 9600 – 4800 Parity, DataBits: N,8 – E,8 – O,8 – N,9 StopBits: 1 – 2

Table 11: Settings menu 7.1 Modbus settings



NOTE: Modbus switches (section 6.4) SW2(termination resistor), SW3(bias resistor) and SW4(bias resistor) settings:

- When the FCM 2 is in the middle within the Modbus network, all three switches must be set “OFF”.
- When the FCM 2 is the last module in the Modbus network, switch SW2 must be set “ON” and switches SW3 and SW4 must be set “OFF”.
- When the FCM 2 is the first module in the Modbus network, all three switches must be set “ON”.

7.6.10 FCMBus settings (menu 7.2)



The FCM 2 is fitted with FCMBus communication making it available to communicate between two or more different FCM 2 devices. Information as flowrate, consumption, temperature, etc. can be read out remotely from one FCM 2 on another FCM 2. Operation is described in section 7.4.

When the FCMBus settings menu 7.2 is entered, several options for the FCMBus communication can be set. The settings that can be made are shown in Table 12.

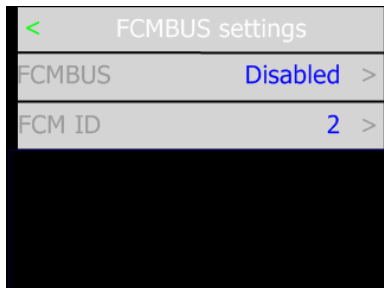


Figure 71: Menu 7.2

Menu	Description	Remark
7.2.1	FCMBUS	This option switches the FCMBus communication function <i>on</i> or <i>off</i> . The following can be selected: Disabled or Enabled
7.2.2	FCM ID	The ID number of the FCM 2 for the FCMBus communication is set. The following range can be selected: 1 – 2046 <i>Please note that the every device within the FCMBus system needs to have an unique ID number.</i>

Table 12: Settings menu 7.2 FCMBus settings



NOTE: **FCMBus switch (section 6.4) SW5**(termination resistor) setting:

- When the FCM 2 is in the middle within the FCMBus network, switch SW5 must be set “OFF”.
- When the FCM 2 is the first or last module in the FCMBus network, switch SW5 must be set “ON”.

7.6.11 Time settings (menu 7.3)



The Time settings menu 7.3 shows the current time and date. The time and date are used as a timestamp in the Alarm overview.

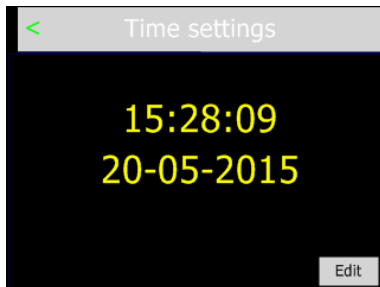


Figure 72: Menu 7.3

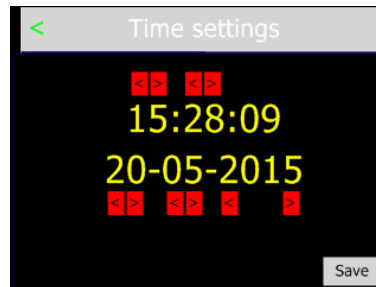


Figure 73: Menu 7.3.1

To change the time or date, press the `Edit` button and press the associated red `<` or `>` button to increase or decrease the value.

When the date and time are set correctly, press the `Save` button.

7.6.12 Device Information (menu 7.4)



The Device Information menu 7.4 shows the current software version.



Figure 74: Menu 7.4

8 MAINTENANCE

Under normal conditions the FCM 2 requires no maintenance.

Conditions what are considered “Normal” are;

- A clean operating environment
- The FCM 2 is installed in accordance with the installation instructions given.
- Operation of the FCM 2 is in accordance with this manual and other related publications
- Uninterrupted power supply at normal specified values.



WHEN CLEANING OF THE FCM 2 HOUSING IS REQUIRED, USE A SOFT CLOTH.
DO NOT USE SOLVENTS OR AGGRESSIVE FLUID ON PLASTIC COMPONENTS OR PARTS.
PREVENT ANY MOISTURE PENETRATING THE FCM 2.

9 REPAIR



SAFETY PRECAUTIONS:

MAKE SURE THAT ALL SAFETY REQUIREMENTS AS DESCRIBED IN SECTION 4 ARE MET BEFORE ANY WORK IS COMMENCED.

9.1 CUSTOMER REPAIR RESTRICTION

In case of malfunction, repair work by the user should be restricted to the externally accessible leads, connections and components to which the user is expressly permitted to deal with himself (e.g. bridge circuits, fuses etc.).

All further work, especially on internal components will terminate warranty and can cause considerable damage to the circuitry.

9.2 REPLACEMENT

To replace the FCM2, the following steps should be taken:

- Write down all parameter settings as described in sections 7.6.1 through 7.6.12.
- Switch off the 100-240 VAC electrical power supply.
- Make sure that all connections to the FCM 2 are labelled correctly so that re-installation can be done without any errors.
- Disconnect all the connections in a reverse order as described in section 6.
- Reinstall a replacement the FCM 2 as described in section 6.
- Set all the previous written down parameter settings as described in sections 7.6.1 through 7.6.12

10 TAKE OUT OF SERVICE



SAFETY PRECAUTIONS:

MAKE SURE THAT ALL SAFETY REQUIREMENTS AS DESCRIBED IN SECTION 4 ARE MET BEFORE ANY WORK IS COMMENCED.

The FCM 2 can be taken out of service by switching off the 100-240 VAC electrical supply and disconnecting all wires.

11 REMOVAL AND STORAGE OF EQUIPMENT



SAFETY PRECAUTIONS:

MAKE SURE THAT ALL SAFETY REQUIREMENTS AS DESCRIBED IN SECTION 4 ARE MET BEFORE ANY WORK IS COMMENCED.

To remove and store the controller, the following steps have to be taken:

- Switch off the 100 - 240 VAC electrical power supply.
- Make sure that all connections to the FCM 2 are labelled correctly so that re-installation can be done without any errors.
- Disconnect all the connections in a reverse order as described in section 6.
- Store the FCM 2 in a cool and dry location, in such way that the FCM 2 cannot be damaged.

12 MALFUNCTION AND SEND FOR REPAIR

In case of a malfunction, follow the guidelines as described in Section 9.

If the FCM 2 cannot be repaired on site, it should be sent back for repair.

To take the FCM 2 out of service, follow the instructions as described in Section 10.

The shipment must be accompanied by a fault report as shown in Table 13, giving full information about the reason for return, all other relevant information and further instructions.

Sender	
Company Name :	Contact Person :
Street :	Department :
Postal Code :	Telephone :
City :	Fax :
Country :	E-mail :
Shipping address for return of goods to user if different from above mentioned)	
Reason for return	
☐ Repair	
☐ Warranty Claim	
☐ Other: _____	
Type of FCM 2(see the nameplate on the instrument)	
Code / Type: _____	
Serial Number: _____	
Description of Complaint / Work to be performed	
Installation date:	_____
Failure date:	_____
Name & Title:	_____
Date & Signature	_____

Table 13: Example of a fault report to accompany a return shipment to the VAF Instruments factory or service agent. The fault report should be filled out in the English language

12.1 CONDITIONS FOR RETURN OF GOODS

Return shipments of goods to VAF Instruments or local service agent must meet the following conditions:

- The shipment must be accompanied by a fault report as shown in Table 13: *Example of a fault report to accompany a return shipment to the VAF Instruments factory or service agent. The fault report should be filled out in the English language*, giving full information about the reason for return, all other relevant information and further instructions.
- The shipping container must be strong enough to protect the FCM 2 during transport and should be packed with soft material to protect against shocks.
- Goods must be sent C.I.F. destination.

In the event a FCM 2 has to be sent back for repair, send it directly to:



VAF Instruments B.V.
Vierlinghstraat 24
3316 EL Dordrecht
P.O. Box 40
3300 AA Dordrecht
The Netherlands

Tel.: +31 (0)78 6183100
Website: www.vaf.nl
E-mail: service@vaf.nl

13 ENVIRONMENT

- The FCM 2 has no negative influence on the environment during normal operation.

14 DISPOSAL

The FCM 2 consists of metal, plastics and electronic parts. It should be disposed according to local laws or regulations.

If in doubt or not able to dispose of the equipment it can be returned to VAF Instruments.

VAF Instruments will dispose of the equipment in a correct way.

Materials declaration in accordance with the latest IMO regulations can be supplied upon request.

Main materials:

- Body Aluminium
- PCBs Electronic parts
Lithium Manganese Dioxide battery

15 CYBER SECURITY DISCLAIMER

This product is designed to be connected to and to communicate information and data via a network interface. It is operator's sole responsibility to provide and continuously ensure a secure connection between the product and your network or any other network (as the case may be).

Operator shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information.

VAF Instruments and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

16 TROUBLE SHOOTING AND FAULT FINDING

16.1 DISPLAY REMAINS BLANK

Possible cause

(perform the checks in sequential order)

1. Power supply failure
2. Loose wiring
3. The FCM 2 is malfunctioning.

Solution

- Check if the power supply is ON
- Check wire connections on module A of the FCM 2.
See section 6.4
- Return the FCM 2 to VAF Instruments for repair

16.2 NO FLOWRATE

Possible cause

(perform the checks in sequential order)

1. Valves are closed
2. Bypass valve is open
3. Loose wiring
4. Wrong type of flowmeter input
5. Wrong IO module selected

Solution

- Open the valves to and from the flowmeter
- Close the bypass valve
- Check wire connections on module B of the FCM 2.
See section 6.4
- Check wire connections on module B of the FCM 2,
in accordance to section 6.4.
- Check position of switch 1 and switch 2 on module
B of the FCM 2, in accordance to section 6.4.
- Set IO slot B to `Counter` in menu 6.5.2

16.3 WRONG VOLUME FLOWRATE

Possible cause

(perform the checks in sequential order)

1. Valves are (partly) closed
2. Bypass valve is (partly) open
3. K-factor setting is not correct
4. Thermal expansion coefficient is not correct

Solution

- Open valves to and from the flowmeter
- Close the bypass valve
- Check the k-factor on the flowmeter and set the
correct k-factor in menu 6.2.2 and/or menu 6.2.3
- Check the thermal expansion coefficient for the fuel
and set the correct coefficient in menu 6.2.5 and/or
6.2.8

16.4 WRONG MASS FLOWRATE

Possible cause

(perform the checks in sequential order)

1. Valves are (partly) closed
2. Bypass valve is (partly) open
3. K-factor setting is not correct
4. Thermal expansion coefficient is not correct
5. The density coefficient is not correct
6. The density measurement is not correct

Solution

- Open valves to and from the flowmeter
- Close the bypass valve
- Check the k-factor on the flowmeter and set the correct k-factor in menu 6.2.2 and/or menu 6.2.3
- Check the thermal expansion coefficient for the fuel and set the correct coefficient in menu 6.2.5 and/or 6.2.8
- Check the density coefficient for the fuel and set the correct coefficient in menu 6.2.6 and/or 6.2.9
- Check section 16.10 Analog input fail

16.5 WRONG TEMPERATURE INDICATION

Possible cause

(perform the checks in sequential order)

1. Loose wiring
2. Wrong type of temperature sensor
3. Wrong IO module selected

Solution

- Check wire connections on module C of the FCM 2.
See section 6.4
- Disconnect wiring from module C
- For PT2 flowmeter:
Measure resistance between wires 4-5 and 4-6.
Resistance should be between 100 Ω and 160 Ω
- For separate PT100
Measure resistance between the red and white wires.
Resistance should be between 100 Ω and 160 Ω
- Set IO slot C to `Temperature` in menu 6.5.3

16.6 NEGATIVE CONSUMPTION

Possible cause

(perform the checks in sequential order)

1. The FCM-mode is not set correctly
2. The inlet and outlet flowmeters are reversed.
3. Setting for cut off value is not correct
4. K-factor setting is not correct

Solution

Check if the correct FCM-mode is selected.
A negative consumption can only be measured when FCM-mode "Flow In & Flow out" is selected in menu 6.2.1

Check wire connections on modules C and B of the FCM 2. See section 6.4

Rule of thumb is cut off value = 0.5% of maximum flowrate.
The cut off value has to be less than the minimum consumption.
Setting the correct cut off value in menu 6.2.12

Check the k-factor on the flowmeter and set the correct k-factor in menu 6.2.2 and/or menu 6.2.3

16.7 TEMPERATURE SENSOR FAIL

Possible cause

(perform the checks in sequential order)

1. Loose wiring
2. PT100 broken

Solution

Check wire connections on module C of the FCM 2.
See section 6.4

Disconnect wiring from module C

For PT2 flowmeter:
Measure resistance between wires 4-5 and 4-6
Resistance should be between 100 Ω and 160 Ω
If not replace PT2 sensor

For separate PT100
Measure resistance between the red and white wires
Resistance should be between 100 Ω and 160 Ω
If not replace PT100

3. Wrong IO module selected

Set IO slot C to `Temperature` in menu 6.5.3

16.8 COMMUNICATION FAIL

Possible cause

(perform the checks in sequential order)

1. The FCM 2 is malfunctioning.

Solution

Return FCM 2 to VAF Instruments for repair

16.9 FLOWMETER FAIL

Possible cause

Solution

(perform the checks in sequential order)

1. The FCM-mode is not set correctly

Check if the correct FCM-mode is selected.
A flowmeter fail can only be measured when FCM-mode "Flow In & Flow out" is selected in menu 6.2.1

2. Bypass valve is open

Close the bypass valves for flowmeter 1 and flowmeter 2.

3. Loose wiring

Check wire connections on module B of the FCM 2.
See section 6.4

4. Wrong type of flowmeter input

Check wire connections on module B of the FCM 2, in accordance to section 6.4.

Check position of switch 1 and switch 2 on module B of the FCM 2, in accordance to section 6.4

5. Wrong IO module selected

Set IO slot B to `Counter` in menu 6.5.2

6. Setting for cut off value is not correct

Rule of thumb is cut off value = 0.5% of maximum flowrate.
The cut off value has to be less than the minimum consumption.
Setting the correct cut off value in menu 6.2.12

7. K-factor setting is not correct

Check the k-factor on the flowmeter and set the correct k-factor in menu 6.2.2 and/or menu 6.2.3

16.10 ANALOG-IN FAIL

Possible cause

(perform the checks in sequential order)

1. Loose wiring

Check wire connections on module D of the FCM 2.
See section 6.4
Check wire connections on the ViscoSense®3D interface box.

2. Wrong IO module selected

Set IO slot D to `Analog-Input` in menu 6.5.4

3. No 4-20mA signal is available

Check the incoming analog signal in menu 6.6.1 and 6.6.4 and 6.6.7
Check if the ViscoSense®3D interface box is powered on.
Check ViscoSense®3D manual for the making the correct settings.

4. Wrong analog-input settings

Check if the correct settings have been set in menu 6.6.2, 6.6.3, 6.6.5, 6.6.6, 6.6.8 and 6.6.9

16.11 ANALOG-OUT FAIL

Possible cause

(perform the checks in sequential order)

Solution

1. Loose wiring	Check wire connections on module D of the FCM 2. See section 6.4
2. Wrong IO module selected	Set IO slot D to <i>Analog-Output</i> in menu 6.5.4
3. The $R_b > 400\Omega$	Make sure that the connected device has a $R_b < 400\Omega$
4. No 4-20mA signal is available	Check the outgoing analog signal in menu 6.7.1 and 6.7.4
4. Wrong analog-output settings	Check if the correct settings have been set in menu 6.7.2, 6.7.3, 6.7.5 and 6.7.6

16.12 DIGITAL-OUT FAIL

Possible cause

(perform the checks in sequential order)

1. Loose wiring
2. No signal output
2. Wrong digital-output settings

Solution

- Check wire connections of connector 1 (1-2) of the FCM 2. See section 6.4
- Check if there is consumption of engine 1 or if there is an active alarm.
Depending on the setting in menu 6.8.1
- Check if the correct settings have been set in menu 6.8.1, 6.8.2, 6.8.3 and 6.8.4

16.13 MODBUS FAIL

Possible cause

(perform the checks in sequential order)

1. Loose wiring
2. Wrong data settings

Solution

- Check wire connections of connector 1 (3-4) of the FCM 2. See section 6.4
- Check if the correct settings have been set in menu 7.1.1 and 7.1.2

16.14 FCMBUS FAIL

Possible cause

(perform the checks in sequential order)

1. Loose wiring
2. Wrong data settings

Solution

- Check wire connections of connector 2 (1-2) of the FCM 2. See section 6.4
- Check if the correct settings have been set in menu 7.2.1 and 7.2.2

16.15 MODBUS LIST

Address	Name	Registers	Bytes	Unit (kg)	Unit (litre)	Unit (lb)	Unit (lb)	Data Type	Description
Read only									
0	Consump1Rate	2	4	kg/hour	litre/hour	lb/hour	US gal/hour	32-Bit Floating Point	Fuel consumption rate of Engine 1
2	Engine 1 HFO Consump. Rate	2	4	kg/hour	litre/hour	lb/hour	US gal/hour	32-Bit Floating Point	HFO consumption rate of Engine 1
4	Engine 1 MDO Consump. Rate	2	4	kg/hour	litre/hour	lb/hour	US gal/hour	32-Bit Floating Point	MDO consumption rate of Engine 1
6	Eng1 Total Mass	2	4	kg	m3	lb	US gal	32-Bit Floating Point	Total fuel mass of Engine 1
8	Eng1 Accum Mass	2	4	kg	m3	lb	US gal	32-Bit Floating Point	Accumulated fuel mass of Engine 1
10	Engine 1 HFO Total	2	4	kg	m3	lb	US gal	32-Bit Floating Point	Total HFO fuel mass of Engine 1
12	Engine 1 HFO Accum	2	4	kg	m3	lb	US gal	32-Bit Floating Point	Total MDO fuel mass of Engine 1
14	Engine 1 MDO Total	2	4	kg	m3	lb	US gal	32-Bit Floating Point	Accumulated total HFO fuel mass of Engine 1
16	Engine 1 MDO Accum	2	4	kg	m3	lb	US gal	32-Bit Floating Point	Accumulated total MDO fuel mass of Engine 1
18	Eng1 Total input (Load)	2	4	kg	m3	lb	US gal	32-Bit Floating Point	
20	Eng1 Accum input (Load)	2	4	kg	m3	lb	US gal	32-Bit Floating Point	
22	Eng1 Total output (Discharge)	2	4	kg	m3	lb	US gal	32-Bit Floating Point	
24	Eng1 Accum output (Discharge)	2	4	kg	m3	lb	US gal	32-Bit Floating Point	
100	Flow1Rate	2	4	kg/hour	litre/hour	lb/hour	US gal/hour	32-Bit Floating Point	Flowrate of flowmeter 1, without temperature correction
102	Flow2Rate	2	4	kg/hour	litre/hour	lb/hour	US gal/hour	32-Bit Floating Point	Flowrate of flowmeter 2, without temperature correction
104	Flow1Temp	2	4	°C	°C	°F	°F	32-Bit Floating Point	Temperature of flowmeter 1
106	Flow2Temp	2	4	°C	°C	°F	°F	32-Bit Floating Point	Temperature of flowmeter 2
108	AnalogInput1	2	4	uA	uA	uA	uA	32-Bit Floating Point	Actual value of analog input 1
110	AnalogInput2	2	4	uA	uA	uA	uA	32-Bit Floating Point	Actual value of analog input 2
112	AnalogInput3	2	4	uA	uA	uA	uA	32-Bit Floating Point	Actual value of analog input 3
1000	Consump2Rate	2	4	kg/hour	litre/hour	lb/hour	US gal/hour	32-Bit Floating Point	Fuel consumption rate of Engine 2
1002	Engine 2 HFO Consump. Rate	2	4	kg/hour	litre/hour	lb/hour	US gal/hour	32-Bit Floating Point	HFO consumption rate of Engine 2
1004	Engine 2 MDO Consump. Rate	2	4	kg/hour	litre/hour	lb/hour	US gal/hour	32-Bit Floating Point	MDO consumption rate of Engine 2
1006	Eng2 Total Mass	2	4	kg	m3	lb	US gal	32-Bit Floating Point	Total fuel mass of Engine 2
1008	Eng2 Accum Mass	2	4	kg	m3	lb	US gal	32-Bit Floating Point	Accumulated fuel mass of Engine 2
1010	Engine 2 HFO Total	2	4	kg	m3	lb	US gal	32-Bit Floating Point	Total HFO fuel mass of Engine 2
1012	Engine 2 HFO Accum	2	4	kg	m3	lb	US gal	32-Bit Floating Point	Total MDO fuel mass of Engine 2
1014	Engine 2 MDO Total	2	4	kg	m3	lb	US gal	32-Bit Floating Point	Accumulated total HFO fuel mass of Engine 2
1016	Engine 2 MDO Accum	2	4	kg	m3	lb	US gal	32-Bit Floating Point	Accumulated total MDO fuel mass of Engine 2

Table 14: MODBUS list – Unit dependable registers



The responded value of the requested Modbus address is equal with the unit set in Units and format Menu 6.1 section 7.6.1 of this manual.

Register	Description	2000-2046	2100-2146	2200-2246	2300-2346	2400-2446	2500-2546	2600-2646	2700-2746	2800-2846	2900-2946	3000-3046	3100-3146	3200-3246	3300-3346	3400-3446	3500-3546	3600-3646	3700-3746	3800-3846	3900-3946	4000-4046	4100-4146	4200-4246	4300-4346
0	Consume1Rate	l/sec	l/min	l/hour	l/day	m3/sec	m3/min	m3/hour	m3/day	gal/sec	gal/min	gal/hour	gal/day	kg/sec	kg/min	kg/hour	kg/day	ton/sec	ton/min	ton/hour	ton/day	lb/sec	lb/min	lb/hour	lb/day
2	Engine 1 HFO Consump. Rate	l/sec	l/min	l/hour	l/day	m3/sec	m3/min	m3/hour	m3/day	gal/sec	gal/min	gal/hour	gal/day	kg/sec	kg/min	kg/hour	kg/day	ton/sec	ton/min	ton/hour	ton/day	lb/sec	lb/min	lb/hour	lb/day
4	Engine 1 MDO Consump. Rate	l/sec	l/min	l/hour	l/day	m3/sec	m3/min	m3/hour	m3/day	gal/sec	gal/min	gal/hour	gal/day	kg/sec	kg/min	kg/hour	kg/day	ton/sec	ton/min	ton/hour	ton/day	lb/sec	lb/min	lb/hour	lb/day
6	Eng1 Total Mass	l	l	l	l	m3	m3	m3	m3	gal	gal	gal	gal	kg	kg	kg	kg	ton	ton	ton	ton	lb	lb	lb	lb
8	Eng1 Accum Mass	l	l	l	l	m3	m3	m3	m3	gal	gal	gal	gal	kg	kg	kg	kg	ton	ton	ton	ton	lb	lb	lb	lb
10	Engine 1 HFO Total	l	l	l	l	m3	m3	m3	m3	gal	gal	gal	gal	kg	kg	kg	kg	ton	ton	ton	ton	lb	lb	lb	lb
12	Engine 1 HFO Accum	l	l	l	l	m3	m3	m3	m3	gal	gal	gal	gal	kg	kg	kg	kg	ton	ton	ton	ton	lb	lb	lb	lb
14	Engine 1 MDO Total	l	l	l	l	m3	m3	m3	m3	gal	gal	gal	gal	kg	kg	kg	kg	ton	ton	ton	ton	lb	lb	lb	lb
16	Engine 1 MDO Accum	l	l	l	l	m3	m3	m3	m3	gal	gal	gal	gal	kg	kg	kg	kg	ton	ton	ton	ton	lb	lb	lb	lb
18	Consume2Rate	l/sec	l/min	l/hour	l/day	m3/sec	m3/min	m3/hour	m3/day	gal/sec	gal/min	gal/hour	gal/day	kg/sec	kg/min	kg/hour	kg/day	ton/sec	ton/min	ton/hour	ton/day	lb/sec	lb/min	lb/hour	lb/day
20	Engine 2 HFO Consump. Rate	l/sec	l/min	l/hour	l/day	m3/sec	m3/min	m3/hour	m3/day	gal/sec	gal/min	gal/hour	gal/day	kg/sec	kg/min	kg/hour	kg/day	ton/sec	ton/min	ton/hour	ton/day	lb/sec	lb/min	lb/hour	lb/day
22	Engine 2 MDO Consump. Rate	l/sec	l/min	l/hour	l/day	m3/sec	m3/min	m3/hour	m3/day	gal/sec	gal/min	gal/hour	gal/day	kg/sec	kg/min	kg/hour	kg/day	ton/sec	ton/min	ton/hour	ton/day	lb/sec	lb/min	lb/hour	lb/day
24	Eng2 Total Mass	l	l	l	l	m3	m3	m3	m3	gal	gal	gal	gal	kg	kg	kg	kg	ton	ton	ton	ton	lb	lb	lb	lb
26	Eng2 Accum Mass	l	l	l	l	m3	m3	m3	m3	gal	gal	gal	gal	kg	kg	kg	kg	ton	ton	ton	ton	lb	lb	lb	lb
28	Engine 2 HFO Total	l	l	l	l	m3	m3	m3	m3	gal	gal	gal	gal	kg	kg	kg	kg	ton	ton	ton	ton	lb	lb	lb	lb
30	Engine 2 HFO Accum	l	l	l	l	m3	m3	m3	m3	gal	gal	gal	gal	kg	kg	kg	kg	ton	ton	ton	ton	lb	lb	lb	lb
32	Engine 2 MDO Total	l	l	l	l	m3	m3	m3	m3	gal	gal	gal	gal	kg	kg	kg	kg	ton	ton	ton	ton	lb	lb	lb	lb
34	Engine 2 MDO Accum	l	l	l	l	m3	m3	m3	m3	gal	gal	gal	gal	kg	kg	kg	kg	ton	ton	ton	ton	lb	lb	lb	lb
36	Flowmeter 1	l/sec	l/min	l/hour	l/day	m3/sec	m3/min	m3/hour	m3/day	gal/sec	gal/min	gal/hour	gal/day	kg/sec	kg/min	kg/hour	kg/day	ton/sec	ton/min	ton/hour	ton/day	lb/sec	lb/min	lb/hour	lb/day
38	Flowmeter 2	l/sec	l/min	l/hour	l/day	m3/sec	m3/min	m3/hour	m3/day	gal/sec	gal/min	gal/hour	gal/day	kg/sec	kg/min	kg/hour	kg/day	ton/sec	ton/min	ton/hour	ton/day	lb/sec	lb/min	lb/hour	lb/day
40	Temperature 1	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
42	Temperature 2	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C	°C
44	Temperature 1	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
46	Temperature 2	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F

Table 15: MODBUS list – Unit Independent Registers (Value of those registers are independentable of the setting on the screen)

At this time no certificates of conformity or certificates of approval are available for the FCM 2.

FCM2 VAF INSTRUMENTS

Inputs & Cable Glands

ID	DESCRIPTION	STANDARD
A	POWER IN	M20x1,5; Ø9-13 mm / (Ø10-14 mm OPTIONAL)
B & C	FLOW INPUT	M20x1,5; Ø9-13 mm / (Ø10-14 mm OPTIONAL)
D	PULSE OUTPUT	M16x1,5; Cable ø 5-9
E	MODBUS (OPTIONAL)	M16x1,5; Cable ø 5-9
F	FCM BUS (OPTIONAL)	M16x1,5; Cable ø 5-9
G	ANALOG INPUT OR ANALOG OUTPUT	M20x1,5; Ø9-13 mm

Dimensions:

- Overall Width: 142,6
- Overall Height: 130
- Mounting Flange Thickness: 15
- Mounting Flange Diameter: Ø9
- Mounting Flange Hole Diameter: Ø5,9
- Mounting Flange Hole Spacing: 30
- Mounting Flange Hole Diameter: 18
- Mounting Flange Hole Spacing: 40
- Mounting Flange Hole Diameter: 71

Power Connection:

POWER CONNECTION

Parts List:

REV	DESCRIPTION	DATE	PAR
D	REFERRED TO GLAND OPTIONS	11-05-22	AR
C	CABLE GLAND P02 AND M16 ADDED	13-7-15	WR
B	CABLE GLAND INFO	07-10-14	WR
A	CABLE GLAND INFO UPDATED (DRAWING REFERENCES ADDED)	28-04-14	WR

Dimensions:

DIMENSIONS	FCM 2
0890-1050	

DATE: 24-1-2014
CHECKED: 106
DATE: 10-1-2014
DATE: 10-1-2014
DATE: 10-1-2014

FCM	Fuel Consumption Monitor
IOM	Installation, Operation and Maintenance
ECR	Engine Control Room
IMO	International Maritime Organization

No spare parts are available for the FCM 2.

21 WARRANTY CONDITIONS

1. Without prejudice to the restrictions stated hereinafter, the contractor guarantees both the soundness of the product delivered by him and the quality of the material used and/or delivered for it, insofar as this concerns faults in the product delivered which do not become apparent during inspection or transfer test, which the principal shall demonstrate to have arisen within 12 months from delivery in accordance with sub article 1A exclusively or predominantly as a direct consequence of unsoundness of the construction used by the contractor or as a consequence of faulty finishing or the use of poor materials.

1A. The product shall be deemed to have been delivered when it is ready for inspection (if inspection at the premises of the contractor has been agreed) and otherwise when it is ready for shipment.
2. Articles 1 and 1A shall equally apply to faults which do not become apparent during inspection or transfer test which are caused exclusively or predominantly by unsound assembly/installation by the contractor. If assembly/installation is carried out by the contractor, the guarantee period intended in article 1 shall last 12 months from the day on which assembly/installation is completed by the contractor, with the understanding that in this case the guarantee period shall end not later than 18 months after delivery in accordance with the terms of sub article 1A.
3. Defects covered by the guarantee intended under articles 1, 1A and 2 shall be remedied by the contractor by repair or replacement of the faulty component either on or off the premises of the contractor, or by shipment of a replacement component, this remaining at the discretion of the contractor. Sub article 3A shall equally apply if repair or replacement takes place at the site where the product has been assembled/installed. All costs accruing above the single obligation described in the first sentence, such as are not restricted to shipment costs, travelling and accommodation costs or disassembly or assembly costs insofar as they are not covered by the agreement, shall be paid by the principal.

3A. If repair or replacement takes place at the site where the product has been assembled/installed, the principal shall ensure, at his own expense and risk, that:
 - a. the employees of the contractor shall be able to commence their work as soon as they have arrived at the erection site and continue to do so during normal working hours, and moreover, if the contractor deems it necessary, outside the normal working hours, with the proviso that the contractor informs the principal of this in good time;
 - b. suitable accommodation and/or all facilities required in accordance with government regulations, the agreement and common usage, shall be available for the employees of the contractor;
 - c. the access roads to the erection site shall be suitable for the transport required;
 - d. the allocated site shall be suitable for storage and assembly; the necessary lockable storage sites for materials, tools and other goods shall be available;
 - e. the necessary and usual auxiliary workmen, auxiliary machines, auxiliary tools, materials and working materials (including process liquids, oils and greases, cleaning and other minor materials, gas, water, electricity, steam, compressed air, heating, lighting, etc.) and the measurement and testing equipment usual for in the business operations of the principal, shall be available at the correct place and at the disposal of the contractor at the correct time and without charge;
 - f. all necessary safety and precautionary measures shall have been taken and adhered to, and all measures shall have been taken and adhered to necessary to observe the applicable government regulations in the context of assembly/installation;
 - g. the products shipped shall be available at the correct site at the commencement of and during assembly.

4. Defects not covered by the guarantee are those which occur partially or wholly as a result of:
 - a. non-observance of the operation and maintenance instructions or other than foreseeable normal usage;
 - b. normal wear and tear;
 - c. assembly/installation by third parties, including the principal;
 - d. the application of any government regulation regarding the nature or quality of the material used;
 - e. materials or goods used in consultation with the principal;
 - f. materials or goods provided by the principal to the contractor for processing;
 - g. materials, goods, working methods and constructions insofar as are applied at the express instruction of the principal, and materials or goods supplied by or on behalf of the principal;
 - h. components obtained from third parties by the contractor insofar as that party has given no guarantee to the contractor.
5. If the principal fails to fulfil any obligation properly or on time ensuing from the agreement concluded between the principal and the contractor or any agreement connected to it, the contractor shall not be bound by any of these agreements to any guarantee regardless of how it is referred to. If, without previous written approval from the contractor, the principal commences disassembly, repair or other work on the product or allows it to be commenced, then every agreement with regard to guarantee shall be void.
6. Claims regarding defects must be submitted in writing as quickly as possible and not later than 14 days after the discovery of such. All claims against the contractor regarding faults shall be void if this term is exceeded. Claims pertaining to the guarantee must be submitted within one year of the valid complaint on penalty of invalidity.
7. If the contractor replaces components/products under the terms of his guarantee obligations, the replaced components/products shall become the property of the contractor.
8. Unless otherwise agreed, a guarantee on repair or overhaul work carried out by the contractor or other services shall only be given on the correctness of the manner in which the commissioned work is carried out, this for a period of 6 months. This guarantee only covers the single obligation of the contractor to carry out the work concerned once again in the event of unsound work. In this case, sub article 3A shall apply equally.
9. No guarantee shall be given regarded the inspection conducted, advice given and similar matters.
10. Alleged failure to comply with his guarantee commitments on the part of the contractor shall not absolve the principal from his obligations ensuing from any agreement concluded with the contractor.
11. No guarantee shall be given on products which form a part of, or on work and services on, goods older than 8 years.

Revision 0514:

Table 1 and 2: Connector D1 – D6 changed in B1 – B6

Revision 0515:

Update manual from FCM 2 firmware version 1.0.9 to FCM 2 firmware version 1.3.6

Major changes: Analog-input, Analog-output, Modbus, two flowmeters in.

Revision 0715:

Update manual from FCM 2 firmware version 1.3.6 to FCM 2 firmware version 1.4.5

Major changes: Implementation of FCMbus communication; section 7.4 FCMbus operation and section 7.6.10 FCMbus settings.

Revision 1015:

Warnings added for CE compliance

Revision 0116:

Clarifications analog output

Revision 1016:

Bi-directional option added to manual

Drawing 0890-1050 updated

Firmware version 1.5.8.

Chapter 1.1 warning added

Revision 0217:

Chapter 7.6.6 updated

Firmware version 1.6.0.

Revision 0418:

Chapter 1.1 warning added

Revision 1221:

Modbus Optional

Revision 0726:

Menu IO Slots expanded with Extra Counter settings

MODBUS list – Unit dependable registers updated

MODBUS list – Unit Independent registers added

Drawing 0890-1050 updated

Cyber Security Disclaimer added



Specifications subject to change without notice
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