Operation Manual

eYc FCM06 Coriolis Mass Flow Meter

Contents

1. General specifications

1.1 Power supply

Electrical power of the flowmeters, depending on its voltage modification is provided by an external DC 24V power supply or AC 220 V with frequency (50 ± 1) Hz.

Power supply parameters

Nominal voltage	Voltage range	Maximum power consumption
DC 24 V	18…36 V	15 VA
AC 220 V	85…265 V	15 VA

1.2 Output signals

The flowmeter has the following output signals:

- pulse output;
- current output;
- digital output (RS-485 interface).
- Hart communication

To display the values of the mass flow, volume flow and other measured parameters the flowmeter's transmitter has built-in display.

1.3 Pulse output

Pulse output signal is a periodical pulse signal.

The pulse output can be configured to denote mass flow rate, volumetric flow rate or density of the medium. Pulse output is active.

The total number of pulses generated on the pulse output corresponds to the mass or volume of the fluid passing through the flowmeter since the measurement start.

Maximum frequency (fmax) of the pulse output signal calculated as

$$f_{max} = Q_{max} / (3.6*m), \text{ Hz} \quad (1.5)$$

where Q_{max} – upper limit of the full mass flow range, kg/h;

m – pulse weight, g/pulse.

Pulse output signal frequency range is 0…10000 Hz. Maximum frequency can be increased up to 12000 Hz.

The amplitude of the pulse output signal is 13 V.

Default pulse weight

Size in inch(mm)	3/8(10)	1/2(15)	1(25)	1 1/2(40)	2(50)	3(80)	4(100)	6(150)	8(200)
Pulse weight, g/pulse	0.05	0.1	0.4	2	4	8	10	20	40

1.4 Current output

The value of the current in the current output circuit ranges from 4 to 20 mA and is proportional to the measured flow rate(density, Water-cut% , Brix. For option)

The current value of 4 mA corresponds to zero flow rate. The current value of 20 mA corresponds to the upper limit of the full flow range of the flowmeter (Qmax).The current output can be configured to report mass flow rate, volumetric flow, water cut % or density of the medium.

Current output is active.

Current output signal	
Current value	4…20 mA
Load resistance	250…600 Ohm

2. Operation and maintenance

2.1 Safety precautions

Installation, operation, maintenance of flowmeters should be performed by persons studied this manual and safety instructions for working with electrical devices.

All operations on calibration and usage of flowmeters must comply with the requirements for protection against static electricity.

Installation of flowmeter in the pipeline and its removal from the pipeline should be performed without pressure in the pipeline and with the power supply switched off.

Electrical connection should also be performed only when the power supply is switched off.

During the installation, commissioning and maintenance shall be prohibited:

• replacement of electronic components when the flowmeter is powered on;

• connecting the flowmeter to the power supply with output voltage other than specified in this manual;

• using electrical devices and tools without protective grounding and also in case of their malfunctions.

During installation the hazardous factors are:

• power supply voltage of 220V AC or higher (in case of the external power supply located in close vicinity of the installation place);

• excess pressure in the pipeline;

• high temperature of the medium.

CAUTION!
Installation and operation of the flowmeter in conditions of pressure or temperature exceeding their maximum allowable values is prohibited. Do not use the flowmeter with the cover opened, and also without the chassis grounding.

3. Installation on pipeline

3.1 Installation location

Determining a Location.

When selecting the installation place you should follow these rules:

- There should be no strong vibration, high temperatures or strong magnetic fields at the installation place. Therefore, do not install the flowmeter close to transformers, power units and other mechanisms that create vibration and electromagnetic interference.
- The flowmeter should not be installed in the strained section of the pipeline and should not be used as a pillar for the pipeline.
- It is recommended to provide moisture protection for the flowmeter.
- Flowmeter should be installed in easily accessible places. Free space around the flowmeter should be provided for easy installation and maintenance.
- Display of the flowmeter should be installed at a place which is convenient for the operator to read displayed data.
- The installation place of the flowmeter should be selected to ensure a minimum temperature of the transmitter's surface. In direct sunlight the surface temperature may rise by up to 30 degrees compared to the ambient temperature, so if installation in the shade is not possible, it is recommended to use a sunshade.

Basic requirements for the installation place

CAUTION!
If there is a strong vibration or pipeline strained at the installation place, it is necessary to provide external support for the pipeline before and after the flowmeter. The support base must be firm.In this case installation of the flowmeter in such places, including mobile units is permitted.

3.2 Orientation

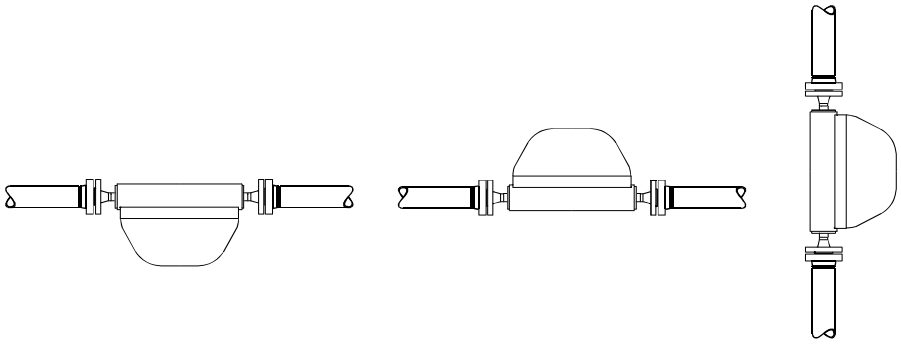
Flowmeter can be installed in horizontal, vertical or inclined sections of the pipeline. It is optimal to install the flowmeter in the horizontal section.

The flowmeter should be installed so that its measuring tubes are always filled with fluid and the arrow on the sensor body coincided with the flow direction. In these conditions, the flowmeter will operate properly in any orientation.

Flowmeter does not require collateral straight pipeline sections before and after the flowmeter, nor installation of additional equipment to level the flow profile

(flow conditioning plates, etc.). But if two or more flowmeter is installed in the same section of the pipeline, the distance between them should be at least 2 m.

Recommendations for installation



Tubes down Horizontal Pipeline

Tubes up Horizontal Pipeline

Flag mount Vertical Pipeline

Flow direction arrow

The sensor has a flow direction arrow (on the sensor) to help you configure the transmitter for flow direction. If possible, install the sensor so that the flow direction arrow matches actual process flow.

Vertical pipeline

If the sensor is installed in a vertical pipeline, liquids and slurries should flow upward through the sensor. Gases may flow upward or downward.

	Recommendations
1	It is recommended to install the flowmeter tubes downward to improve their filling with fluid and to prevent accumulation of gas in them.
2	For vertical or inclined pipeline orientation it is recommended to install the flowmeter in a pipeline section with the upward flow direction to improve filling of the pipe with fluid.

In the event of bending pipe it is recommended to install the flowmeter in the lower section of the pipeline.

Do not install the flowmeter on a horizontal pipe before the drainage section with free flow,

because in this case filling the flowmeter's tubes wit fluid is not guaranteed.

3.3 Installation

Prior to installation, it is necessary:

• Thoroughly clean the pipeline of cinder, sands, and other solid particles;

• Inspect the flanges and the measuring tubes of the flowmeter and remove solid mechanical and other particles from them;

• Remove the preservative grease from the flowmeter, by passing through it kerosene, gasoline or diesel fuel.

To install the flowmeter in the pipeline do the following steps

• Arrange the flowmeter so that the arrow on the sensor's body corresponds to the process direction of flow;

• Slide the bolts through the holes of one of the pipeline flanges and flowmeter's flange, put washers and nuts. Nuts should not be finally tightened yet;

• Put the gasket between the pipeline flange and flowmeter's flange and align it. It is recommended to avoid protrusion of the gasket into the pipeline opening;

• Install the gasket between the other pair of flanges; slide the bolts through the holes of the flanges, put washers and nuts. Nuts should not be finally tightened yet; When installing the flowmeter bending and torsional load on the joints, and also mated flanges misalignment should be minimized.

4. Wiring

4.1 Basic operations

Electrical connections should be performed in the following sequence

• Remove the back cover of the transmitter;

• Lead signal cables and power cable through the cable entries

• Loose the terminal block screws;

• Connect wires according to the wiring diagram shown in Appendix ;

• Tighten the terminal block screws;

• Tighten the clamp of the cable entry;

• If necessary, install the blind plug instead of the unused cable entry;

• Connect the ground cable to the ground terminal;

• Tighten the cover of the transmitter.

Maximum length of the power cable is 300 m with minimum wire section 0.8 mm^2 (AWG18). Connecting to the current and pulse outputs should be performed with a twisted pair wire with the maximum length of 150 m and minimal wire section 0.5 mm^2 (AWG20).
Sensor and transmitter of the flowmeter of separate type are connected through a special 9-core shielded cable with maximum length of 300 m.

4.2 Wiring recommendations

During electrical connection of the flowmeter you should follow these recommendations:

• Wire cores must be cleaned and fixed on terminals to prevent a short circuit between each other and the body of the flowmeter (ground);

• It is recommended to use separate power supplies or a multichannel power supply with isolated channels to power the flowmeter and each of its outputs;

• If it is necessary to calculate the load resistor value, the total load impedance should be calculated as the sum of the cable resistance, external load resistance, resistance of safety barriers, load resistance of the secondary equipment;

• To minimize interference when transmitting of analog output signal 4…20 mA and digital signal it is recommended to use a shielded twisted pair cable. Grounding

of the cable should be provided only on one side of the cable (near the power supply);

• It is not recommended to lay the signal cables in the same conduit with power

wires, and also near sources of strong electromagnetic fields. If necessary, grounding of signal wiring can be done at any point in the signal circuit. For example, it is possible to ground the negative terminal of the power supply. The electronics housing is grounded to the sensor housing.

4.3 Grounding

Transient processes induced by lightning, welding, big power-consuming equipment or switches may lead to distortion of the flowmeter’ s measuring or damage it. For protection from transient processes one should provide a connection of the ground terminals located on the transmitter body, with the ground through a wire, designed for operation under high currents. For grounding, it is recommended to use copper wire of at least 2.5 mm^2 (AWG13) section. Ground wires should be as short as possible and have a resistance of less than 1 Ohm. Transmitter can be grounded through the pipeline, if the pipeline provides the ground.

5. Operation and maintenance

5.1 Basic recommendations

To ensure reliable operation of the flowmeter and maintain accuracy it is necessary to satisfy the following requirements:

• To prevent damage to the measuring tubes of the flowmeter because of hydroblow, opening / closing valves on the inlet pipe should be done gradually;

• Operation at flow rates close to the upper limit of the full flow should last no more than 2 hours per day;

5.2 Power-Up

Right after power-up the flowmeter performs a self-test, and if it succeeds, the flowmeter begins to measure flow, to generate output signals and display the measured values.

5.3 Display operating

Controlling of the flowmeter's display is performed via three buttons of optical type, below the display. Thus, display operating doesn't require opening the front cover of the transmitter, which is important in explosive environment, in conditions of high humidity or precipitations, and other conditions with a high probability of contamination of the internal structural elements of transmitter or ingress of moisture, liquids, foreign objects, etc.

To "push" the optical button one should briefly put a finger or other opaque object close to the display glass in the area of the button. At that time the OLED next to the display lights for a moment.

Flowmeter can display the measured parameters shown in Table To change the display page (next page of parameters), press the ↓ button. Display sequence corresponds to Table.

Displayed parameters sequence

Displayed parameter	*Display format*
	Flow XXX.XXX Mass XXX.XXX
Volume flow rate Volume total	Flow XXX.XXX Volm XXX.XXX
Density Temperature	Den XXX.XXX Temp XX.X
Brix Volume	Brix x.xxx °Bx Volm XXX.XXX

If the displayed value becomes more than 999.999, the units are automatically switched to bigger ones to be able to display that value.

If no button is pressed within two minutes, flowmeter is automatically switched to display mass or volume flow rate (Menu items 1 or 2), depending on the state of the menu item 47 "First Menu".

The flowmeter can be configured via display menu. The structure of the menu is shown in Root menu, description of the menu items presented in Displayed parameters.

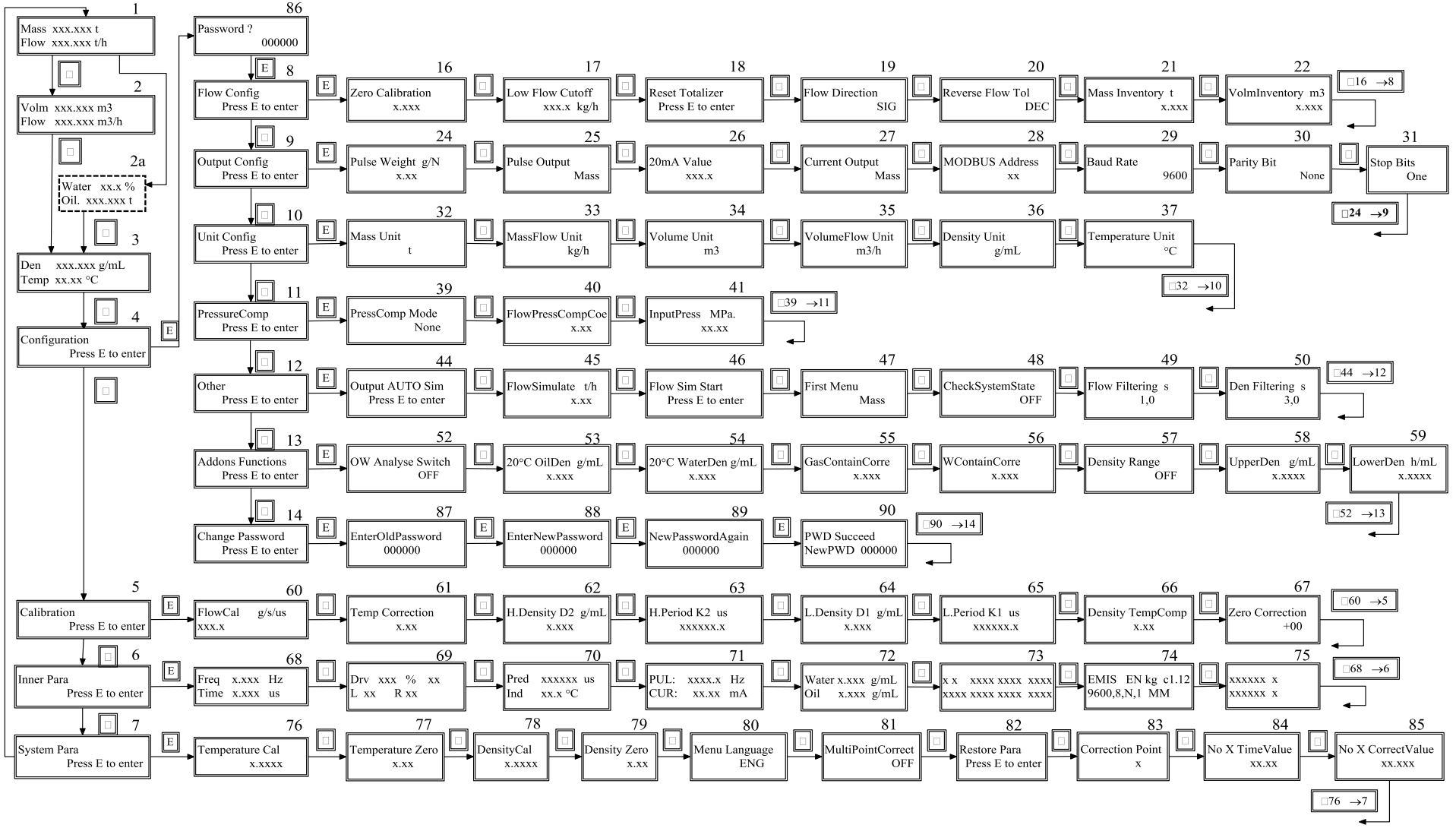
In the editable menu items press «E» button to switch to edit mode.

• If the menu item has several predefined options press «↓» or «→» to move between those options. The currently selected option is flashing. To accept selection press «E». The message «Saved? Y N» about saving changes will appear. Press «↓» or «→» to move between «Y» (yes) and «N» (no) options. Select «Y» to accept changes or «N» to cancel, then press «E» to quit edit mode.

• If the menu item has numeric value its editing is performed by changing the digits one by one and moving to the next digit on the right. The digit in currently selected position is flashing. Press «↓» to increment the digit in current position from 0 to 9. To move to the next digit press «→». Press «E» to finish editing, then select «Yes» to accept changes or «No» to cancel, then press «E» to quit edit mode.

Coriolis Mass Flow

FCM06 Root menu



Display menu structure(Refer to our latest version per P.O)

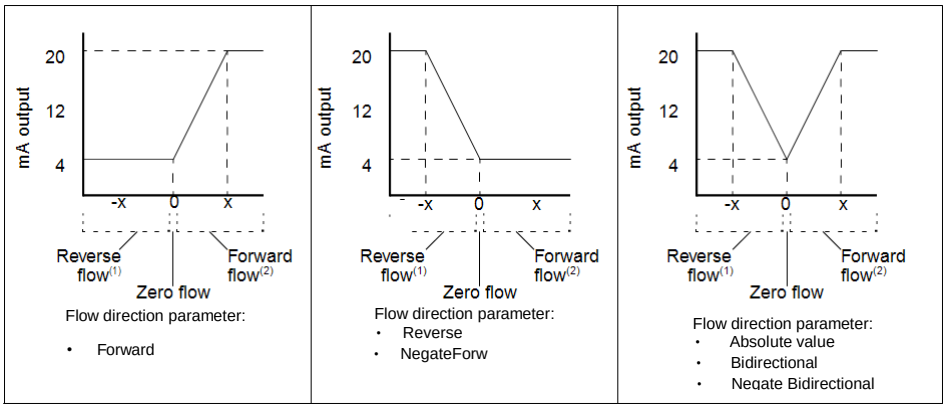
Menu item	Indication format		Button actions	Description
Measured parameters display				
0	GPE Ver.2.23 and later. 2012.03		→1	Version and data of electronics. Press"→" at first screen and it's showed on flowmeter's power-up.
1	Flow Mass	XXX.X XXX.XXXX	↓2, →0	Total mass and mass flow rate. Mass flow units: Kg lb Ton(Metric ton,default setting) Mass flow rate units: t/d t/h(default setting) Kg/h Kg/m lb/h lb/m
2	Flow Volm	XXX.X XXX.XXXX	↓3, →1	API tables (Special function , need to be marked on order) supported by the petroleum measurement application The API tables listed here are supported by the petroleum measurement application. API MPMS Chapter 11 provides Temperature and Pressure Volume Correction Factors for Generalized Crude Oils, Refined Products, and Lubricating Oils for 3 different sets of base conditions: 60 °F and 0 psig 15 °C and 0 kPa 20 °C and 0 kPa » 60°F is used as the base temperature within the United States and by producing countries that deal with the United States » The 15 °C temperature is popular in Latin America and Europe. » The 20 °C temperature is popular in Asia. » Middle-East counties such as Saudi Arabia or the U.A.E. may use 60 °F when trading with U.S. companies and then use 15 or 20°C when trading elsewhere. » Literally any country or user may decide that they need to use any one of the 3 base temperatures for any reason at any time. Total volume and instant volumetric flow rate. Volumetric flow units: GL(US Gallon) BBL m^3 Total volume units: m^3/d BL/d(BBL/day) GL/h (US gallon/hr) m^3/h GL/m(US Gallon/min)

				m³/m(cubic meter/min) This menu item is not displayed when Menu item 52 "OW Analyze Switch" if set to On.
2a	Oil Water	XXX.XXX XXX %	↓4, →1	Mass or volume flow rate of net oil and water cut %. This menu item is displayed only if Menu item 52 "OW Analyze Switch" if set to On. API MPMS provides Temperature and Pressure Volume Correction Factors for Generalized Crude Oils, Refined Products, and Lubricating Oils for 3 different sets of base conditions: 60 °F and 0 psig 15 °C and 0 kPa 20 °C and 0 kPa » 60°F is used as the base temperature within the United States and by producing countries that deal with the United States » The 15 °C temperature is popular in Latin America and Europe. » The 20 °C temperature is popular in Asia. » Middle-East counties such as Saudi Arabia or the U.A.E. may use 60 °F when trading with U.S. companies and then use 15 or 20°C when trading elsewhere. » Literally any country or user may decide that they need to use any one of the 3 base temperatures for any reason at any time.
3	Den Temp	X.XXX XX.XX	↓4, →1	Density and temperature of the measured medium. Denisty flow units: g/mL kg/L b/gl(lbs/ US gallon) kg/m (Kg/m3) g/cc Tempetaure unit: °C °F
4	Brix measurement			Brix x.xxx °Bx (Speical order only) Volm XXX.XXX m3
5	**Configuration** Press «E» to enter		↓5, →1, E86	Press «E» button to enter the submenus for configuring the flowmeter.
Submenus of the "Configuration" menu				
86	Password?	000000	E8	The following submenus can be accessed only after entering the 6-digit password. If the entered password is invalid a message "Wrong password" will be displayed. To return to the Menu item 4 "Configuration" press «→». To enter the password again press «↓».
8	**Flow Config** Press «E» to enter		↓9, →4, E16	Allows user to specify low flow cutoff, flow direction and the way of its counting.
16	Zero Calibration	X.XXX us	↓17, →6	Zero point adjustment. The value displayed is the time delay between the signals coils, taken as zero point. Press «E» to start zeroing procedure described in paragraph 2.5.4.
17	Low Flow Cutoff	X.XXX kg/h	↓18,	If the current mass flow rate is less than specified

			→6, E − edit	Low Flow Cutoff value then the flow rate is assumed as zero and totalizers will pause. Cutoff default values Cutoff type: Mass flow Recommended setting: 1.0% of the sensor's rated maximum flow rate
18	Reset Totalizer Press «E» to enter		↓19, →6, E − reset	Press «E» to reset mass and volume totalizers (resettable totalizer).
19	Flow Direction	Fwd Rvr Bid Abs NFwd NBid	↓20, →6, E − edit	Option of flow direction, Forward «Rwd» or Reverse «Rvr» or Bidirectional«Bid» or Absolute Value «Abs» or Negate Forward«NFwd» or Negate Birirectional «Nbid» If «Rwd» is chosen then only direct flow will be accumulated (direction corresponding to the arrow on the sensor body). Please see following chapter configuring the flow direction parameter for more detailes

Configuring the flow direction parameter

The flow direction parameter controls how the transmitter reports flow rate and how flow is added to or subtracted from the totalizers, under conditions of forward flow, reverse flow, or zero flow.
• Forward (positive) flow moves in the direction of the arrow on the sensor.
• Reverse (negative) flow moves in the direction opposite of the arrow on the sensor.
Options for flow direction include:
• Forward(Rwd)
• Reverse(Rvr)
• Bidirectional(Bid)
• Absolute Value(Abs)
• Negate Forward(NFwd)
• Negate Bidirectional(Nbid)
For the effect of flow direction on mA outputs: See Figure f the 4 mA value of the mA output is set to 0. mA output configuration:
• 20 mA value = x
• 4 mA value = 0
(1) Process fluid flowing in opposite direction from flow direction arrow on sensor.
(2) Process fluid flowing in same direction as flow direction arrow on sensor.



For Example
Configuration:
• Flow direction = Forward
• mA output: 4 mA = 0kg/hr; 20 mA = 2000kg/hr (See the first graph)
As a result:
• Under conditions of reverse flow or zero flow, the mA output level is 4 mA.
• Under conditions of forward flow, up to a flow rate of 2000kg/hr, the mA output level varies between 4 mA and 20 mA in proportion to (the absolute value of) the flow rate.
• Under conditions of forward flow, if (the absolute value of) the flow rate equals or exceeds 2000kg/hr, the mA output will still at 20mA

Effect of flow direction on frequency output, totalizers, and digital communications(see table 2.7.1)
Forward flow(1)

Flow direction value	Frequency output	Flow totals	Flow values via digital comm.
Forward	Increase	Increase	Positive
Reverse	0 Hz	No change	Positive
Bidirectional	Increase	Increase	Positive
Absolute value	Increase	Increase	Positive(3)
Negate Forward	Zero(3)	No change	Negative
Negate Bidirectional	Increase	Decrease	Negative

Zero flow

Flow direction value	Frequency output	Flow totals	Flow values via digital comm.
All	0 Hz	No change	0

Reverse flow(4)

Flow direction value	Frequency output	Flow totals	Flow values via digital comm.
Forward	0 Hz	No change	Negative
Reverse	Increase	Increase	Negative
Bidirectional	Increase	Decrease	Negative
Absolute value	Increase	Increase	Positive(3)
Negate Forward	Increase	Increase	Positive
Negate Bidirectional	Increase	Increase	Positive

(1) Process fluid flowing in same direction as flow direction arrow on sensor.
(2) Refer to the digital communications status bits for an indication of whether flow is positive or negative.
(3) Process fluid flowing in opposite direction from flow direction arrow on sensor

20	MassInventory	X.XXX	↓21, →6	Accumulated total mass. This value is also displayed in Menu item 1 “Flow Mass”.
21	VolmInventory	XXXX.XX	↓16, →6	Accumulated total volume. This value is also displayed in Menu item 2 “Flow Volm”.
9	**Output Config** Press «E» to enter		↓10, →4, E24	Configuration of the outputs of the flowmeter.
24	Pulse Weight	XXX. XX g/N	↓25, →9, E − edit	Input mass flow rate, volume flow rate or density corresponding to one pulse on the pulse output. Frequency output scale methods: Units per pulse A pulse represents a user-specified number of flow For example Pulse output: Mass Pulse Weight: 50.0 g/N, which means a pulse represents 50g.
25	Pulse Output	Mass Volm Dens	↓26, →9, E − edit	The pulse output can be configured to denote mass flow rate (“Mass”), volumetric flow rate (“Volm”) or density (“Dens”) of the medium.
26	20mA Value	XXX.X	↓27, →9, E − edit	Input mass flow rate, volume flow rate or density corresponding to 20mA on the current output.
27	Current Output	Mass Volm Dens Water cut% Brix.	↓28, →9, E − edit	The current output can be configured to denote mass flow rate (“Mass”), volumetric flow rate (“Volm”) , density (“Dens”) of the medium and water cut %. And Brix °
28	MODBUS Address	XXX	↓29, →9, E − edit	Address of the flowmeter in Modbus network.
29	Baud Rate	9600 4800 2400 1200	↓30, →9, E − edit	Data transfer baud rate in Modbus network.
30	Parity Bit	No Even Odd	↓31, →9, E − edit	Parity control in data transfer protocol. Select «NO» for no parity; «Even» for 1 even parity bit; «Odd» for 1 odd parity bit.

31	Stop Bits	One Two	↓24, →9, E – edit	Select one or two stop bits in data transfer protocol in Modbus network.
10	**Unit Config** Press «E» to enter		↓11, →4, E32	Select units for parameters displayed in the menu items 1, 2, 3.
32	Mass Unit	Kg, lb, Ton(metric)	↓33, →10, E – edit	Select units for mass totalizer.
33	MassFlow Unit	t/d t/h(default setting) Kg/h Kg/m lb/h lb/m	↓34, →10, E – edit	Select units for mass flow rate.
34	Volume Unit	GL(US Gallon) BBL m^3	↓35, →10, E – edit	Select units for volume totalizer.
35	VolumeFlow Unit	m^3/d BL/d(BBL/day) GL/h (US gallon/hr) m^3/h GL/m (US Gallon/min) m^3/m (cubic meter/min)	↓36, →10, E – edit	Select units for volumetric flow rate.
36	Density Unit	g/mL kg/L lbs/gal kg/m3 g/cc	↓37, →10, E – edit	Select units for density.
37	Temperature Unit	°C °F	↓32, →10, E – edit	Select units for temperature.
38	Brix° unit	Bx °	39, →10, E – edit	Select units for Brix°.
11	**PressureComp** Press «E» to enter		↓12, →4, E39	Switching On/Off and changing parameters of pressure compensation for flow.
39	PressComp Mode	None Manu Auto	↓40, →11, E – edit	Pressure compensation modes: Select «None» to disable pressure compensation; select «Manu» for manual compensation, when the actual pressure value is entered manually in the Menu item 41; select «Auto» for automatic pressure compensation, when actual pressure is measured by an external pressure sensor, connected to the flowmeter's corresponding terminals. It's for special order requirement for standard specification, no Pressure Compenstaion mode.
40	FlowPress CompCoe	X. XX	↓41, →11, E – edit	Coefficient of pressure compensation for flow as percentage of calibration coefficient correction for pressure deviation of 1MPa. Default value is 0.01 %/MPa.
41	InputPress MPa	XX. XX	↓39, →11, E – edit	Actual pressure value for manual compensation mode.
12	**Other** Press «E» to enter		↓13, →4, E44	Miscellaneous functions such as flow simulation, etc.
44	Output AUTO Sim Press «E» to enter		↓45, →12, E – edit	Press «E» to start automatic flow simulation procedure. The sequence of frequency and current test signals appears on the flowmeter's outputs. Signal on the current output changes from 4 to 20 mA in steps of 0.5mA; frequency on the pulse output changes from 0 to 12000 Hz in steps of 375 Hz. Values change every 5 seconds.
45	FlowSimulate t/h	X. XX	↓46, →12, E – edit	Input mass flow rate used in flow simulation. Signals on pulse and current outputs will correspond to that flow rate.
46	Flow Sim Start		↓47,	Flow simulation mode starts by pressing «E».

	Press «E» to enter		→12, E – edit	Simulated flow rate is specified in the Menu item 45. Simulation stops after pressing «↓» или «→».	
47	First Menu	Hold Mass Volm	↓48, →12, E – edit	Select the menu item, which will be displayed if no button is pressed within 2 minutes. Select “Mass” to move to Menu item 1, “Volm” to move to Menu item 2. If “Hold” option is selected moving to other menu items will not occur.	
48	CheckSystem State	OFF ON	↓49, →12, E – edit	Enable/disable system check function.	
49	Flow Filtering s	X.XXX	↓50, →12, E – edit	Flow rate averaging time from 0.5 to 10 s in steps of 0.5 s.	
50	Den Filtering s	X.X	↓44, →12, E – edit	Density averaging time from 0.5 to 30 s in steps of 0.5 s.	
13	**Addons Function** Press «E» to enter		↓14, →4, E52	Entering parameters for measurement of two-component media.	
52	OW Analyse Switch	OFF ON	↓53, →13, E – edit	Enable/disable oil-water analyze function.	
53	20ºC OilDen or API 15C oilDen or 60 °F OilDen	X.XXX g/mL	↓54, →13, E – edit	Density of pure oil under standard conditions.	
54	20ºC WaterDen or API 15CWaterDen Or 60 °F WaterDen	X.XXX g/mL	↓55, →13, E – edit	Density of pure water under standard conditions.	
55	GasContainCorre	X.XXX	↓56, →13, E – edit	Flow compensation by percentage of gas in the oil-water. It works only if oil-water analyze function is enabled in the Menu item 52.	
56	WContainCorre	X.XXX	↓57, →13, E – edit	Flow compensation by percentage of pure water in the oil-water (not realized in current versions of flowmeters).	
57	Density Range	OFF ON	↓58, →13, E – edit	Enable/disable density range check. When enabled and If density of the medium is out of range specified in menu items 58 and 59 then the volumetric flow will not be calculated.	
58	UpperDen	X.XXXX	↓59, →13, E – edit	The upper limit of density range (see Menu item 57).	
59	LowerDen	X.XXXX	↓52, →13, E – edit	The lower limit of density range (see Menu item 57).	
14	**Change Password** Press «E» to enter		↓8, →4, E87	Password changing is used for protection against unauthorized access to the settings of the flowmeter.	
87	EnterOld PassWord	000000	↓→ edit, E88	Input current password	If the entered password is invalid a message “Wrong password” will be displayed. To return to the Menu item 14 “Change Password” press «→». To enter the password again press «↓».
88	EnterNew PassWord	000000	↓→ edit, E89	Input new password	
89	NewPassWord Again	000000	↓→ edit, E90	Confirm new password	
90	PWD Succeed	NewPWD 000000	↓14, →14, E14	New password is displayed	
5	**Calibration** Press «E» to enter		↓6, →1, E60	Setting of calibration parameters provided for measuring flow, density, temperature.	
60	FlowCal	X.XXX g/s/us	↓61, →5, E – edit	Calibration coefficient **K**.	
61	Temp Correction	X.XX%	↓62, →5, E – edit	Temperature correction coefficient for flow rate as percentage of calibration coefficient correction for temperature deviation of 100°C.	
62	H.Density D2	X.XXX g/mL	↓63, →5,	High density value corresponding to the medium of high density (water). Used for calibration for density	

			E – edit	measuring.
63	H.Period K2	XXXXXX.X us	↓64, →5, E – edit	Measuring tubes oscillation frequency for the medium of high density (water). Used for calibration for density measuring.
64	L.Density D1	X.XXX g/mL	↓65, →5, E – edit	Low density value corresponding to the medium of low density (air). Used for calibration for density measuring.
65	L.Period K1	XXXXXX.X us	↓66, →5, E – edit	Measuring tubes oscillation frequency for the medium of low density (air). Used for calibration for density measuring.
66	Density TempComp	X.XX %	↓67, →5, E – edit	Temperature correction coefficient for density as percentage of measured density correction for temperature deviation of 100°C.
67	Zero Correction	+00	↓60, →5, E – edit	Correction of the zero flow point in the range of -19 to +19.
6	**Inner Para** Press «E» to enter		↓7, →1, E68	Inner parameters of the flowmeter used for diagnostic purposes.
68	Freq Time	XX.XX Hz XX.XX us	↓69, →6	Measuring tubes oscillation frequency. Current time delay between left and right signal coils
69	Drv L XX mV	XXX %, YY R XX mV	↓70, →6	Drive coil load as percentage (XXX) and its standard deviation within 8 seconds as percentage (YY). Voltage on the left (L) and right (R) signal coils.
70	Pred Ind	XXXXX.XX us XX.X °C	↓71, →6	Measuring tubes oscillation period. Internal temperature of the flowmeter.
71	PUL: CUR:	XXXX.X Hz XX.XX mA	↓72, →6	Frequency of the signal on the pulse output. Current value on the current output.
72	Water Oil	X.XXX g/mL X.XXX g/mL	↓73, →6	Density of water in oil-water under working conditions. Density of oil in oil-water under working conditions.
73	X X XXXX XXXX XXXX	XXXX XXXX XXXX XXXX	↓74, →6	Internal parameters for pressure compensation mode.
74	GPE EN kg 9600, 8, N, 1	cX.XX tY.YY	↓75, →6	Menu language (EN), version of the display menu (X.XX), Modbus data format, register map version (Y.YY)
75	XXXXXX 1 XXXXXX 0		↓68, →6	Display low volume flow cutoff (L/h), totalizer mode (0 – disabled, 1 – enabled), low density cutoff (g/mL), bytes order for float point values (default value is 0).
7	**System Para** Press «E» to enter		↓1, →1, E76	System parameters of the flowmeter. **Intended to use for the representatives of the manufacturer only.**
76	Temperature Cal	X.XXXX	↓77, →7, E – edit	Correction coefficient of the temperature Tk for simulation mode (in the range of 0.9 – 1.1). T= Tk ×Tdev +T0. (Tdev is temperature deviation).
77	Temperature Zero	X.XX	↓78, →7, E – edit	Zero temperature T0 for simulation mode (in the range of -20C° to +20C°).
78	DensityCal	X.XXXX	↓79, →7, E – edit	Correction coefficient of the density ρk for simulation mode (in the range of 0.9 – 1.1). ρ= ρk× ρdev + ρ0. (ρdev is density deviation).
79	DensityZero	X.XX	↓80, →7, E – edit	Zero density ρ0 for simulation mode (in the range of -0.1 g/cm^3 to +0.1 g/cm^3).
80	Menu Language	RUS ENG	↓81, →7, E – edit	Select display menu language. Switching from English language to Russia
81	MultipointCorrect	OFF ON	↓82, →7, E – edit	Enable/disable multipoint correction function used for correction of the calibration coefficient in several points of flow rate (time delay).
82	Restore Para Press «E» to enter		↓83, →7, E – edit	Restore of all coefficients and settings of the flowmeter, except for calibration parameters in the menu items 60-67, to factory defaults.
83	Correction Point	X	↓84, →7, E – edit	Number of correction coefficient (0 – 7), which values are specified in the menu items 84 and 85.
84	No X TimeValue	YY.YYY	↓85, →7, E – edit	The value of time delay between left and right signal coils (YY.YYY μs) for the correction coefficient number X.
85	No XCorrectValue	XX.XXX	↓76, →7, E – edit	Correction coefficient (in the range of 0.9 to 1.1) applied to the calibration coefficient **K** for time delay point specified in the menu item 84.

5.4 Zero point adjustment

After installation and electrical connection, a zero point adjustment (zero calibration) procedure should be performed. This procedure sets the base point corresponding to zero flow. Without actual flow there is a certain time delay between signal coils anyway, that delay assumed as zero point. To perform this procedure, follow these steps:

- Apply power to the flowmeter and let it warm up for at least 30 minutes;
- Let the measuring medium flow through the flowmeter, as long as the thermal balance is established;
- Close the valve located after the flowmeter;
- Make sure that the flowmeter's tubes are completely filled with fluid;
- Close the valve located before the flowmeter
- Make sure that the fluid in the flowmeter is completely still

CAUTION!

Place pipe supports as close to the process connection as possible

- Make sure pipe supports are securely clamped or attached to the process line
- If multiple meters are installed in series or in parallel, piping to each meter must have separate supports. CMF should not share the same pipe supports
- Do not install a CMF in the highest part of the system. The lowest part of the system is preferred.

• Staying in the root menu press ↓ button several times
to move to the Menu item "Configure". Press E button and enter the password (default password is 000000). To enter the password press ↓ to plus the currently selected digit, to move to the next digit press → button. After successful password entering a message "Zero calibration" will appear. Press E to start zero calibration procedure. A message "Zeroing?" will appear. Press E to confirm that. Zero calibration procedure lasts for 30 seconds, the remaining time is displayed.

CAUTION!

Zero calibration should also be performed if the flowmeter indicates some flow when there is no actual flow at the moment.

5.5 Maintenance

The flowmeter put into operation does not require special maintenance other than periodic inspection to verify the following:

• Compliance with the working conditions;

• Whether the voltage and the other parameters of the power supply conform to the requirements of parameter “Power supply”;

• Visibility of the information on the nameplates and other labels;

• Cleanness of the exterior surfaces of the flowmeter;

• Tightness of connections of the flowmeter to the pipeline;

• No damage to the flowmeters parts is visible.

Examination period for the flowmeter depends on operation conditions and defined by the maintenance organization in agreement with the operating organization.

In case of the flowmeter’s failure it is necessary to follow the instructions of the paragraph

CAUTION!
Working in inappropriate operating conditions may lead to failure of the flowmeter or increase of the measuring error.

5.6 Troubleshooting

Possible faults, their probable reasons and repairing ways are presented

Troubleshooting

Fault	*Probable reason*	*Repairing way*
1 When the flowmeter is powered there is no indication on display nor any signal on the flowmeter’s outputs	Wrong connection of the power wires to the flowmeter.	Check the power cable connection according to the wiring diagram
	Power wires break.	Check the power wires and replace them if needed.
	Power supply voltage does not meet the requirements of this manual.	Check the power supply voltage and set its value in accordance with the requirements of this manual.
2 When the flowmeter is powered the measured parameters are displayed correctly but there are no signals on the flowmeter’s outputs	Wrong connection of the output wires to the flowmeter or secondary devices.	Check the output wires connection according to the wiring diagrams Check the computer’s port used to connect the flowmeter to the computer through digital interface. Make sure that the same port number is set in the “Gpe-Integrator” settings.

3 When there is a certain actual flow the flowmeter shows zero flow rate on the outputs	The actual flow rate is less than the lower limit of the measuring range for this size of the flowmeter. The actual flow rate is less than the low flow cutoff value set in the menu.	Fully open the valves to set the flow rate within the measuring flow range. Decrease the low flow cutoff value to be less than the actual flow rate.

Fault	*Probable reason*	*Repairing way*
4 When there is no actual flow the flowmeter indicates a certain flow	Deviation of the zero point because of temperature and pressure deviation from temperature and pressure values on previous zero calibration.	Perform zero calibration in “Zero point adjustment”.
5 In the menu it is not possible to enter the “Calibration” and “System Para” sections	At least one of the switches of the protection switch block is set to the ON position.	Set all the switches to OFF positions for the time needed to perform changes in those sections.

6. Transportation and storage

6.1 Transportation

While transportation of the flowmeter it is recommended to follow these recommendations:

• The flowmeter should be transported in a transport container, which should protect the flowmeter from mechanical damage;

• It is recommended to lay a waterproof paper inside the transport container;

• Transportation should be performed at ambient temperatures from -40 to +70 °C, with relative humidity up to 100% non-condensing at 35 °C;

• Protection against atmospheric precipitation must be provided;

• Flowmeters can be transported by all kinds of roofed transport, including air transport in heated hermetic compartments in accordance with the rules in force for this type of transport;

• The requirements in the package handling marks should be fulfilled;

• Method of stacking the boxes on the transport vehicle must prevent their movement;

• The boxes must not be the object to sharp blows while loading / unloading;

• Period of stay in the transportation conditions must be not more than 3 months;

• After transportation at a temperature below 0 °C container with the flowmeter should be unpacked at least 12 hours after its storage in a warm room.

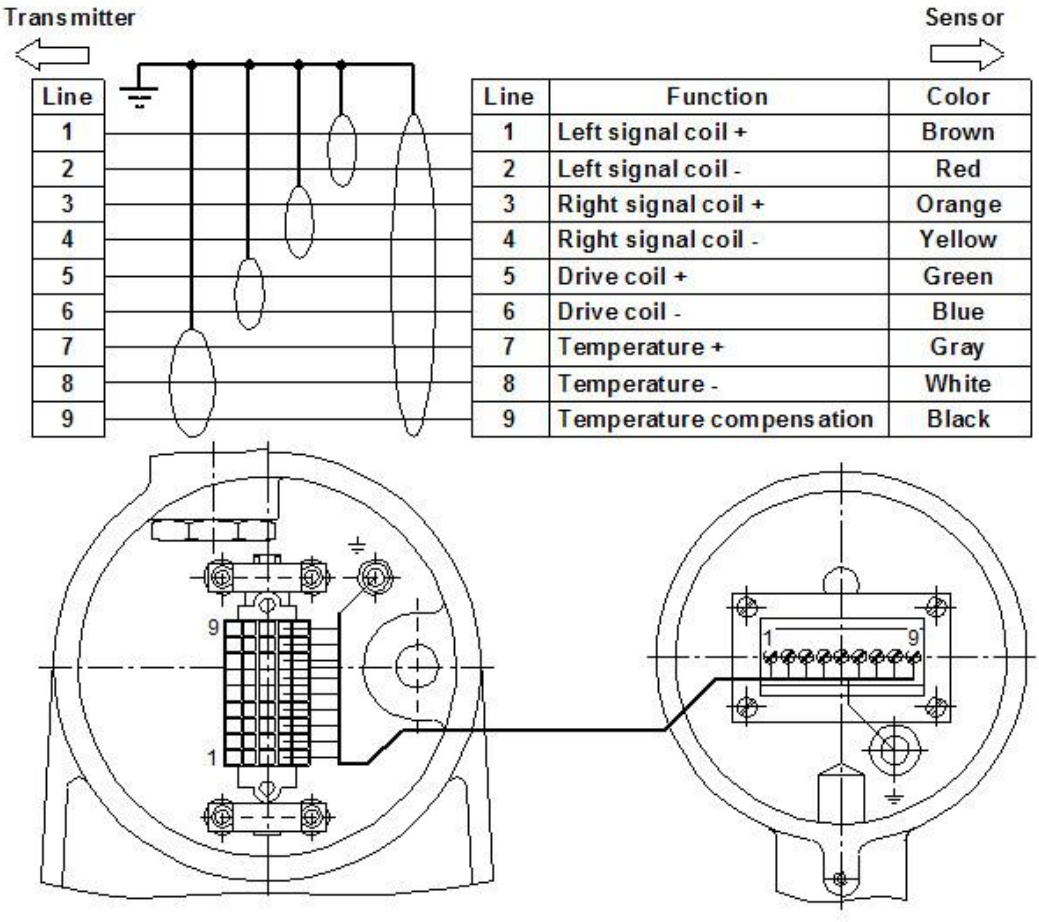
6.2 Storage

Flowmeters can be stored in unheated rooms with air temperature of -20 to +70 °C and relative humidity up to 95% (non-condensing at 25 °C).
Flowmeters can be stored in a transport boxes stacking of up to 3 boxes in height and also without package. For the long-term storage it is recommended to use the manufacturer's package.

6.3 Utilization

Flowmeters are free of harmful substances and components that are hazardous to human health and the environment during and after the life of the flowmeter and after utilization. Utilization of the flowmeter is performed separately for groups of materials: plastic parts, metal parts and fastening part

7. Wiring diagrams



Line	Function	Color
1	Left signal coil +	Brown
2	Left signal coil -	Red
3	Right signal coil +	Orange
4	Right signal coil -	Yellow
5	Drive coil +	Green
6	Drive coil -	Blue
7	Temperature +	Gray
8	Temperature -	White
9	Temperature compensation	Black

Separate type transmitter wiring box connection wiring color demonstration

Line	Function	Color
1	Left signal coil +	Brown
2	Left signal coil -	Red
3	Right signal coil +	Orange
4	Right signal coil -	Yellow
5	Drive coil +	Green
6	Drive coil -	Blue
7	Temperature +	Gray
8	Temperature -	White
9	Temperature compensation	Black

Modbus register map version 2.xx

Modbus register map version V2.17

Interface mode	RS-485, asynchronous, half-duplex
Baud rate	1200, 2400, 4800, 9600 bit/s
Data format	1 start bit, 8 data bits, No parity bit and 1 or 2 stop bits (or 1 Odd Parity or Even Parity, and 1 stop bit). Can be set in the Menu items 30, 31. Default data format is 9600-8-N-1
Maximum length of data frame	1 byte address + 253 byte data + 2byte CRC = 256 Bytes

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