M920
Electromagnetic flowmeter

User's manual

1   Basic information

1.1   Basic features

The inductive flow meter M920 is designed to measure, indicate and record the instantaneous and total flow of the conductive media flowing through the sensor. The flow meter M920 records both forward and reverse flows. As there are no moving parts in the flow profile the M920 can be used to measure extremely dirty liquids containing solids. The only limitation is that the flowmeter can be used solely with conductive liquids.

Range of applications. The inductive flow meter M920 is for use in the Chemical Industry, Paper Industry, Water and Wastewater Treatment Industry and most other process industries.

Features. The inductive flowmeter M920 is a highly accurate and stable device. The construction of the M920 flowmeter uses components with long-term, time and temperature stability. Configuration data is backed up and can be recovered after a power failure. The back-up structure enables data recovery even if a partial loss of data occurs as a result of (e.g. high level electrostatic discharge or a noisy power supply). Internal CPU provides all functions usually built in electronic flow meters, incl. low flow rate correction, frequency response setting, bandwidth of sensitivity setting at low flow rates, etc.

Outputs. Flowmeter M920 is equipped with 6 standard isolated outputs: 4 to 20mA either active or passive, frequency output, impulse output, status (relays) output, RS485 and RS232 output. User can configure these outputs.

Inputs. Flowmeter M920 has one programmable digital input (PLC).

Power supply. Basic version is for AC power supply 85 to 264 V (frequency 50 or 60 Hz). 12, 24 and 48 DC power supply is available as an option.

1.2   Warranty

Within the manufacturers general supply conditions, all material and manufacturing faults are covered by warranty. Upon warranty claim, Meatest will test the item and decide whether to repair it or replace with a new one. Place of the warranty obligation is Czech Republic. Further claims on compensation, especially for loss of production or resultant of damages, are strictly excluded.

Any defects caused by improper use are absolutely not included in the warranty. Excluded from warranty are also expendable items (as i.e. accumulators, batteries, pushbuttons after attained life time, ribbons, etc.)

In case of a warranty claim the user is asked to give detailed description of the defect and also of the application for which you use the product. This information is important in order to avoid time and cost extensive tests and for the eventual achievement of warranty claims from our suppliers and sub-suppliers. For the item or instrument, returned after the expired warranty time, repair or replacement on warranty can only be accepted, if manufacturer has been informed in time that a warranty case has occurred.

Warranty period for all types of electromagnetic flowmeter is 24 months.

The flowmeter should only be used according to the instructions described in this operating manual.

2   Preparing for start up

2.1   Inspecting contents of the package

Basic package includes the following items:

- Flanged sensor

- Electronic Transmitter (can be integral or remote)

- Spare fuse

- Operating manual.

- Calibration certificate

- Special wrench for opening the housing covers

- Magnetic pointer

- Software FlowAssistant

- RS232 cable

The flowmeter is delivered ready for use after connecting to the power supply. Please check that it has been correctly installed according to chapter "Installation".
Only a power supply with the appropriate voltage and frequency should be used. The flowmeter can be supplied with either 85 ... 164 VAC 50/60Hz, or 24V (12V, 48V) DC power supply, see ordering information in chapter "Power supply".

2.2   Fuse replacement

A mains fuse is located behind the back cover. The fuse must only be exchanged by a competent person. Procedure is as follows:

- Disconnect the power supply from the flowmeter.

- Unscrew the back cover using the special wrench (standard part of delivery).

- The fuse holder is located behind the back cover. Remove the fuse. Replace it with new fuse with the same rating.

- Screw on the back cover.
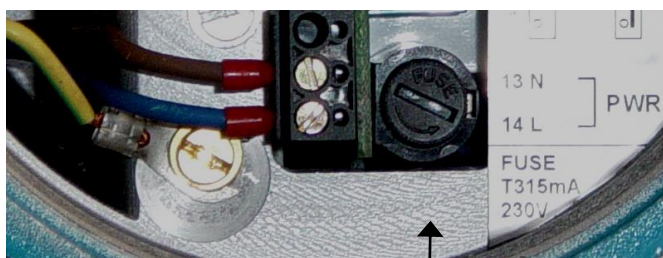
Fuse holder

- Reconnect the power supply.

Note:

- *T315mA fuse is used for 85 to 264 VAC version*

- *1A fuse is used for 24 and 48 V DC versions*

- *2A fuse is used for 12 V DC*

2.3   Power supply

From a power supply point of view the flowmeter is delivered in four basic versions:

- **85 to 264V AC**, 50/60Hz – version **M920-Vxx0x**

- **12V** DC (+20%, -10%) – version **M920-Vxx1x**

- **24V** DC (+20%, -10%) – version **M920-Vxx2x**

- **48V** DC (+20%, -10%) – version **M920-Vxx3x**

3   Installation

3.1   Sensor location

Observe the following instructions to avoid measurement errors due to air bubbles or partially filled pipe:

Horizontal (standard) mounting

The sensor tube must always remain full. The best way to achieve this is to locate the sensor in a low section of pipe, see the following picture. It is recommended to install the sensor in a section of straight pipe with at least 5 times the pipe diameter before sensor and 3 times after sensor.
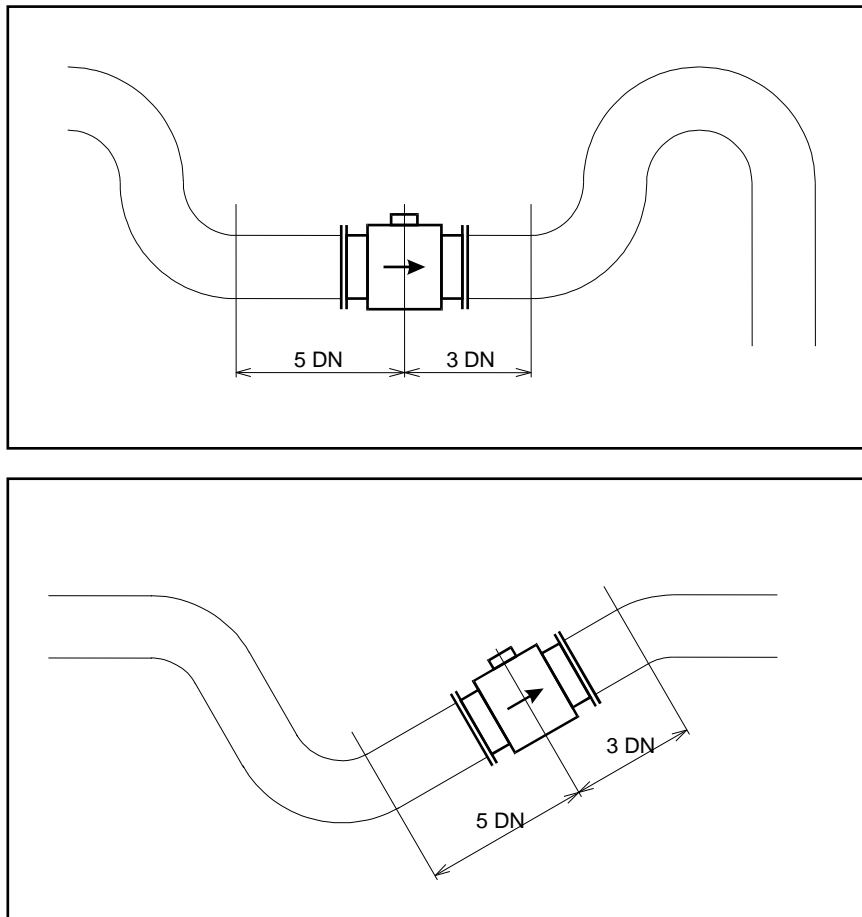
Pipe reducers

If the pipe diameter is not the same as the diameter of sensor, then pipe reducers can be used. So as not to lose accuracy of the measurement, the slope of reducers should not exceed 8°.
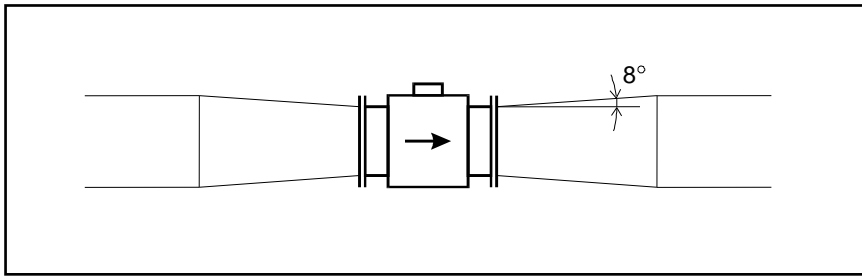
Vertical mounting

When the sensor is mounted on a vertical section of pipe, the flow direction must be upwards. In the case of a downward flow direction, air bubbles could collect in the sensor resulting in unstable and inaccurate measurement.
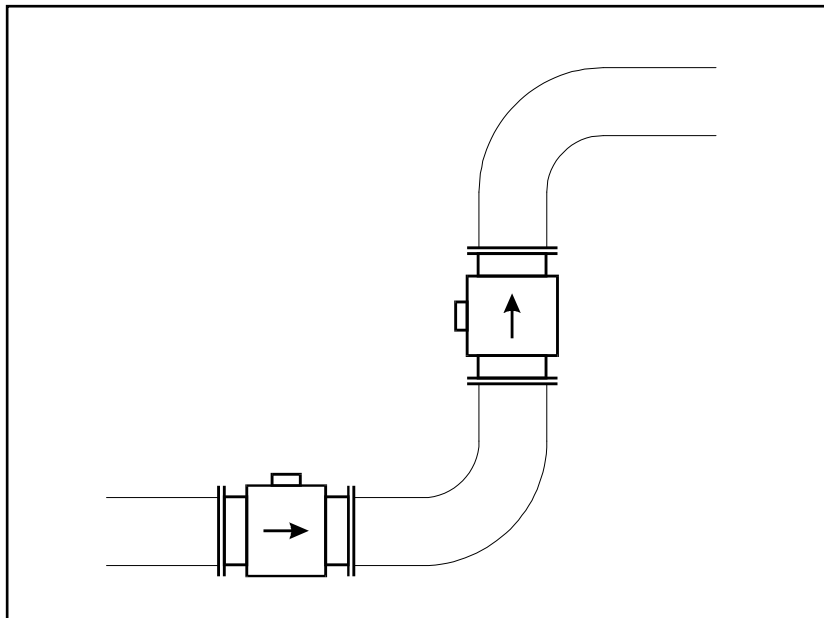
Pumps

Never install the sensor on the suction side of a pump or on a section of pipe where a vacuum is possible.
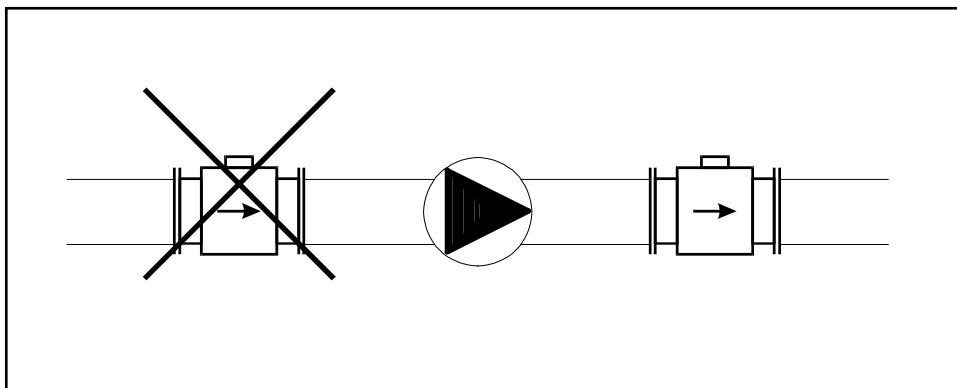
Valves

Suitable location of a shutoff valve is downstream of a sensor.
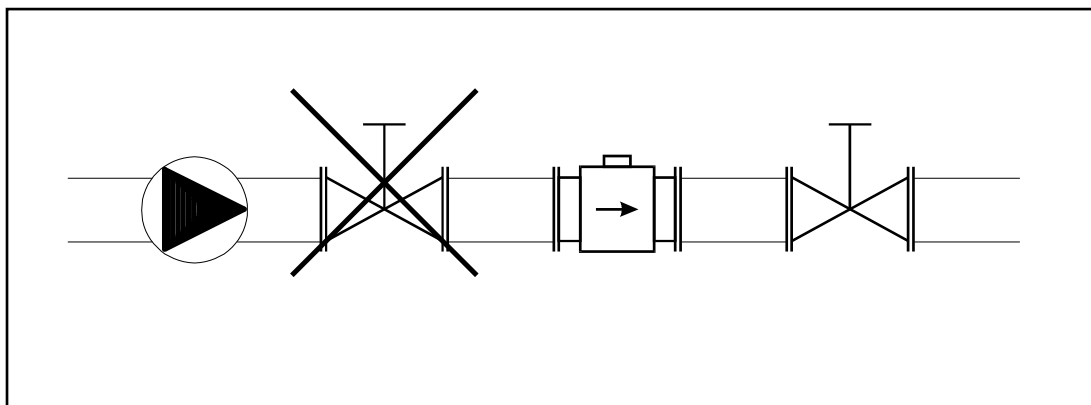
Removal during maintenance

If the application requires removal of the sensor for periodic maintenance, it is recommended to install a bypass section as the following drawing.
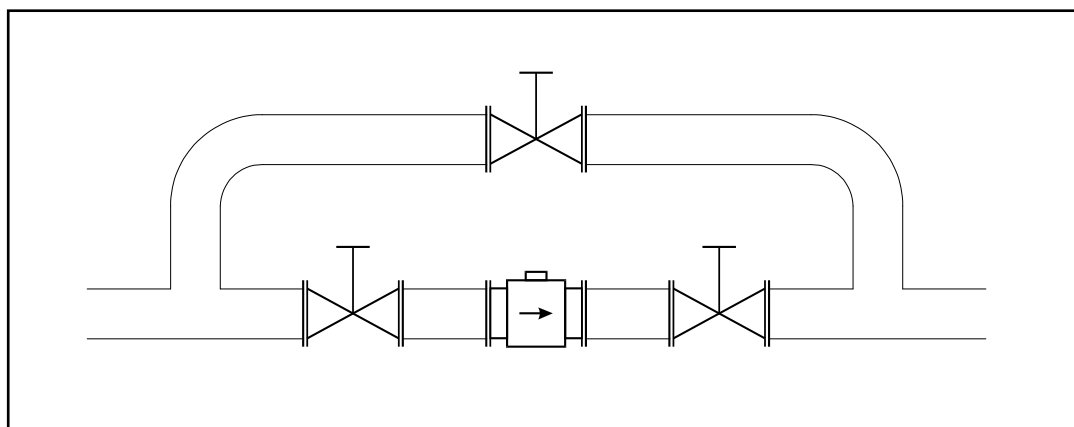
Position of electrodes

The axis of measuring electrodes must be approximately horizontal (see picture).

Vibration

To avoid mechanical damage protect both electronic unit and sensor against mechanical vibrations. When strong vibrations are possible, both the input and output pipe must be mechanically fixed or the remote version with a separate electronic unit should be used.

Overheating

To avoid overheating, the electronic unit should be protected against direct sunlight especially in areas with a warm climate with ambient temperatures over 30 °C. If necessary a sunshade has to be mounted over the electronic unit or a remote version with a separate electronic unit should be used.

3.2   Electrical connection

Only a competent person may connect the flowmeter to the mains power supply.

The flowmeter can be connected to the power supply with either a fixed power cable or with a flying lead cable and plug. Cable entries on the electronic unit can be used for flexible electrical cables. Cables with a diameter between 8 and 10 mm must be used to keep protection IP67. It is not recommended to use rigid metal or plastic conduits.

If you use a cable and plug it is recommended that the cable has a cross-section of 3 x 1.5mm^2 and with a minimum length of 1 m.

In the case of a fixed connection an independent power switch or circuit breaker should be located close to the flowmeter. Cable cross-section as above.

3.2.1   Power supply

To connect the compact version to the power supply the following procedure should be used.

- Unscrew the back cover using the special wrench (standard part of delivery).

- Connect the ground wire (yellow-green colour) to the central grounding point inside the case. The end of ground wire must be hooked (app. 3 mm) and fixed to the ground screw.

- Connect Line and Neutral power cables to the power line terminal clamps with labels 14 (L-wire, brown terminal colour) and 13 (N-wire, blue terminal colour).

- Screw the back cover on again.

- Switch on the power supply.
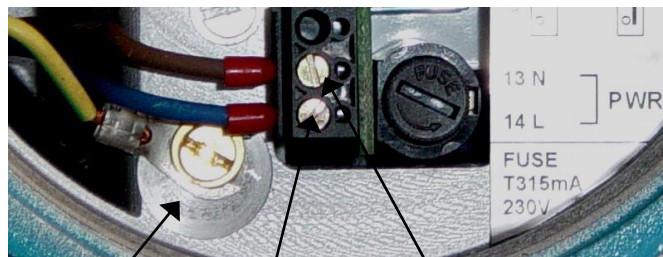
GND central grounding point   L wire   N wire

Note:

Be careful to avoid following problems during electrical installation:

- *Do not cross or loop cables inside electronic unit.*

- *Use separate cable entries for power supply and signal wires.*

3.2.2   Electric connection between converter and sensor – Remote version

For remote version converter and flanged sensor are connected with two (2-wire unshielded and 3-wire shielded) cables. Standard length of cables is 6 meter. It is recommended to mount the transmitter not too far from the flanged sensor. Use cables as short as possible.

Five-terminal connector is located in separated box. The same box is used for the converter and also for the sensor. Colours of wires are following:

3-wire shielded cable (shielding is connected to the green wire):

Blue (Brown) :   Electrode 1 (EL1)
Green :   Ground
Red (White):   Electrode 2 (EL2)

2-wire cable:

Brown :   Excitation 1 (EXCITATION)
White :   Excitation 2 (EXCITATION)

Use the following procedure to connect sensor cable to the transmitter or sensor:

- Switch off power supply.
- Dismount top cover of connection box. Four screws must be removed.
- Connect 5 wires to the connector.
- As the basic protection of connection box is IP65 it is important (in case you need better protection) to fill the box (with connected wires) with reenterable insulating and sealing compound. One piece of compound is standard part of delivery. Using this technology will be protection of transmitter IP67 and protection of sensor IP68.
- Mount the cover back.
- Switch on power supply.

3.3   Sensor grounding

Proper grounding is critical for correct flow meter operation. The sensor is equipped with screw connection for a grounding wire. This screw has to be connected to both pipeline flanges. Use Copper wire to connect between the flange and the grounding screw on the sensor.

If the pipeline is made of an electrically nonconductive material, or if the pipe is lined with a similar material, special grounding rings must be installed between flanges.

Note: Do not switch the flow meter on if it's not properly grounded!

Sensor grounding without grounding rings   Sensor grounding with grounding rings
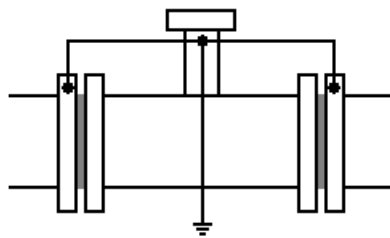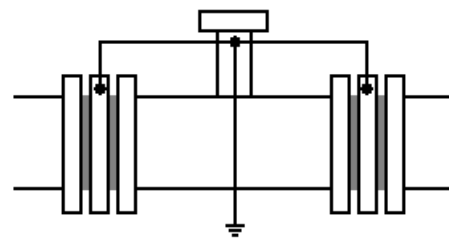
3.4   Turning the display panel

The flowmeter M920 display can rotated ± 90°. Procedure is as follows:

- Disconnect the power supply from the flowmeter.
- Unscrew the front cover using the special wrench (standard part of delivery).
- Unscrew two hex bolts from the front panel and then remove it.
- Unscrew two coupling nuts
- Turn the display. Make sure you don't damage the cable leading to it.
- Reassemble in reverse order.
- Reconnect the power supply.

4   Electronic unit description

4.1   *Front panel (display)*

1   *RS232 connector*

RS232 port for connection with PC. Serial port is galvanically isolated from other electronic circuits.

2   *Display*

Two-row alphanumerical display is used for displaying all information. The instantaneous flowrate is displayed in upper row. Total volume is displayed in the lower row.

The decimal point position and type of units can be changed in the flowmeter "Setup Menu" (see chapter "Flowmeter configuration").

3   *Keyboard*

4 keys enable you to change flowmeter configuration and provide flowmeter calibration. These are "UP", "RIGHT", "ESC" and "ENTer" keys.

4   Magnetic sensor
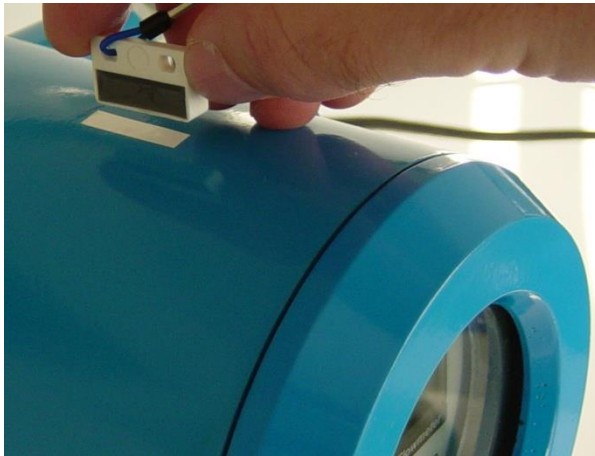
All the important information can be read without opening the flowmeter. Activate sensor on top of the flow meter using a magnet to simulate "UP" key press. Activating the sensor for more than 3 seconds is equal to pushing "RIGHT" key.

4.2   Rear panel (inputs/outputs)

Under the back cover of the electronic unit are terminals for input/output signals and supply terminals. Fuse holder is located near the power supply terminals. The top cable gland is for input/output signal cables, bottom cable gland for power supply cable.
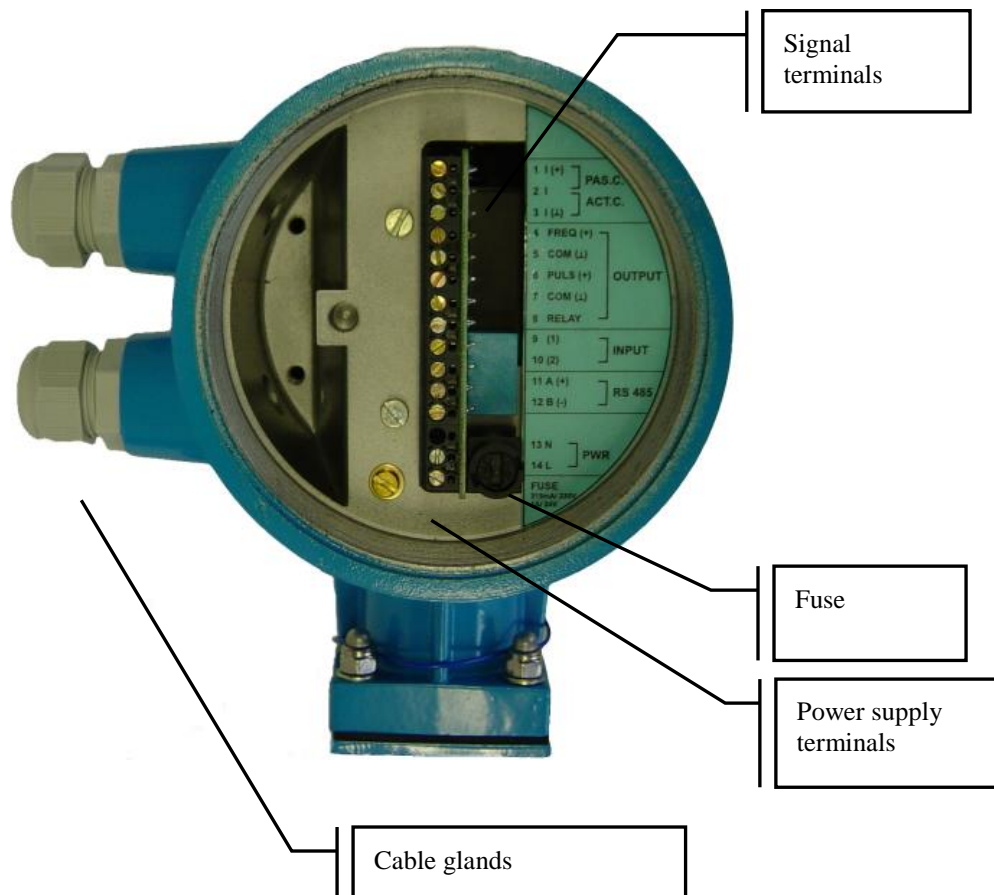
4.3   Signal terminals

Current loop

Frequency output

Impulse output

Status output

PLC input

RS485 interface

Power supply
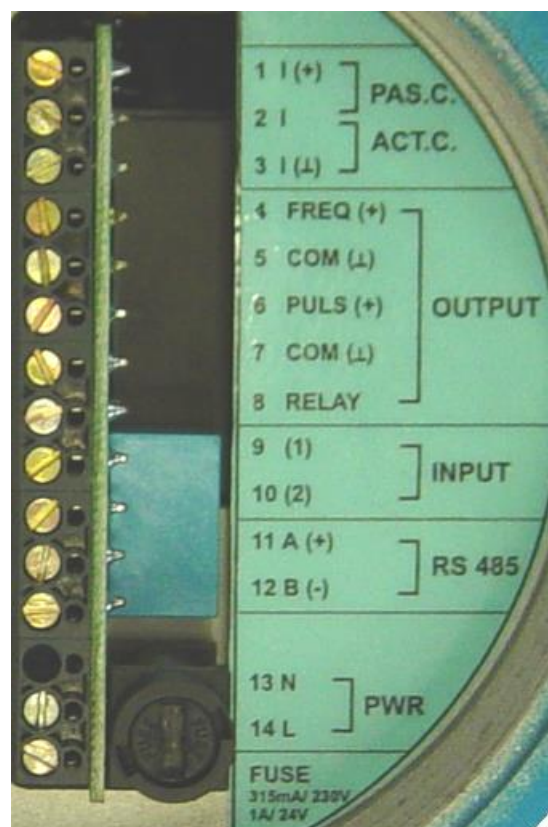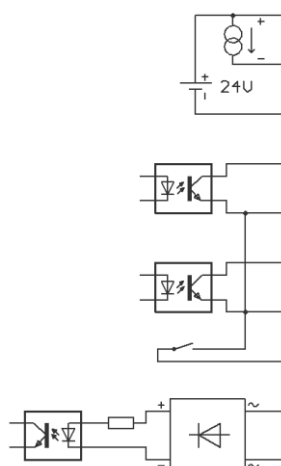
4.3.1   Current loop output

The 4 to 20 mA current loop can be set as a passive type between outputs 1, 2 (1 positive, 2 negative) or as an active type between outputs 2, 3 (2 positive, 3 negative). In both cases the outputs are galvanically isolated from all other electronic circuits of the flowmeter. Voltage drop on passive current loop is 4 V. Active current loop can work to a maximum of 800 Ω.

Example of current output connection:
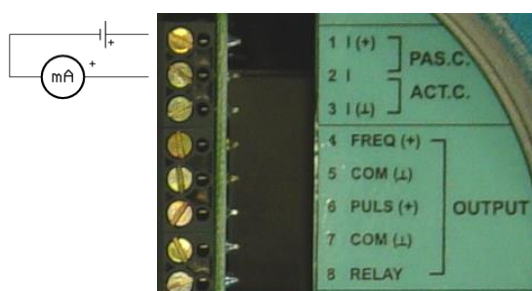
Passive current output connection   **Active** current output connection
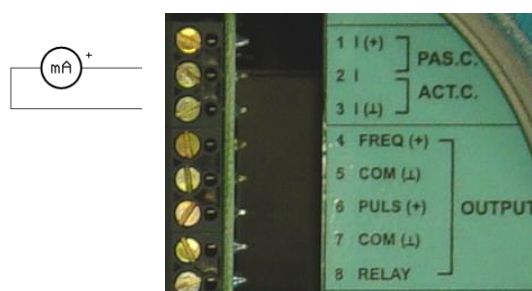
For more information about current output see chapter "*Input and outputs configuration*".

4.3.2   Frequency output

The frequency output is a galvanically isolated transistor NPN switch. Voltage drop on the switch is 1 V in the made status. Maximum switched voltage is 50 V. Maximum switched current should not exceed 100 mA. Positive output is on terminal 4, negative output is on terminals 5 and 7 (internally connected). Frequency range of the output is from 10 Hz to 12 kHz.

Example of the frequency output connection:
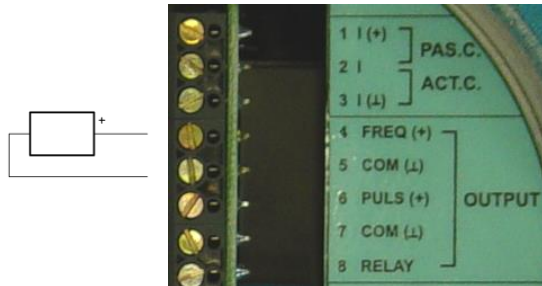
Passive frequency output connection   **Active** frequency output connection
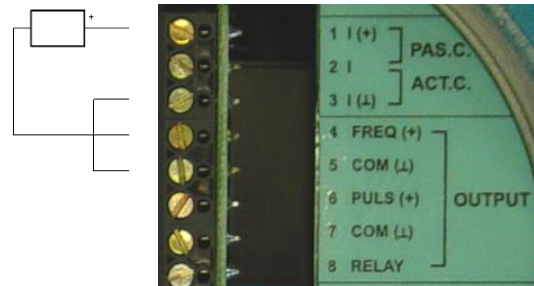
For more information about frequency output see chapter "*Input and outputs configuration*".

Note 1: Frequency, impulse and status outputs are galvanically connected to each other and galvanically isolated from other electronic circuits.

Note 2: Active frequency output uses the power supply of the current output. Total current take-off from this power supply (terminal nr. 1) must be less than 40 mA. Active frequency output is galvanically connected to current output.

4.3.3   Impulse output

The impulse output is formed by a galvanically isolated transistor NPN switch. Voltage drop on the switch is 1 V in the made mode. Maximum switched voltage is 50 V. Maximum switched current should not exceed 100 mA. Positive output is on terminal 6, negative output is on terminals 5 and 7 (internally connected). Width of the impulse can be set. Maximum frequency of impulse output is limited by impulse width. Maximum frequency is 200 Hz for the shortest impulse 2.5 ms.

Example of impulse output connection:
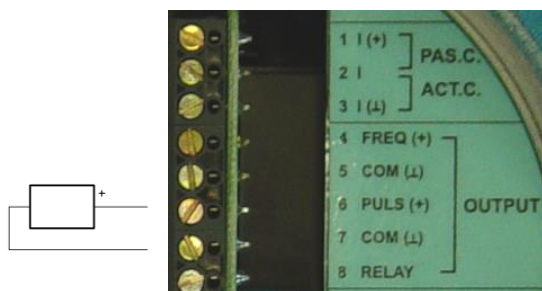
Passive impulse output connection   **Active** impulse output connection
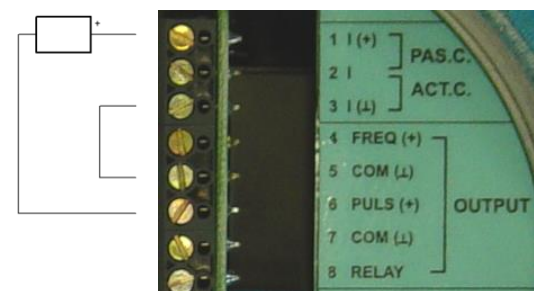
For more information about impulse output see chapter "*Input and outputs configuration*".

Note 1: Frequency, impulse and status outputs are galvanically connected to each other and galvanically isolated from other electronic circuits.

Note 2: Active impulse output uses the power supply of the current output. Total current take-off from this power supply (terminal nr. 1) must be less than 40 mA. Active impulse output is galvanically connected to current output.

4.3.4 Status output

Status output is formed by relays. Maximum switched voltage is 100 V. Maximum switched current should not exceed 500 mA. First output is on terminal 8, second output is on terminal 5 and 7 (internally connected).

Example of status output connection:

| **Passive** status output connection | **Active** status output connection |
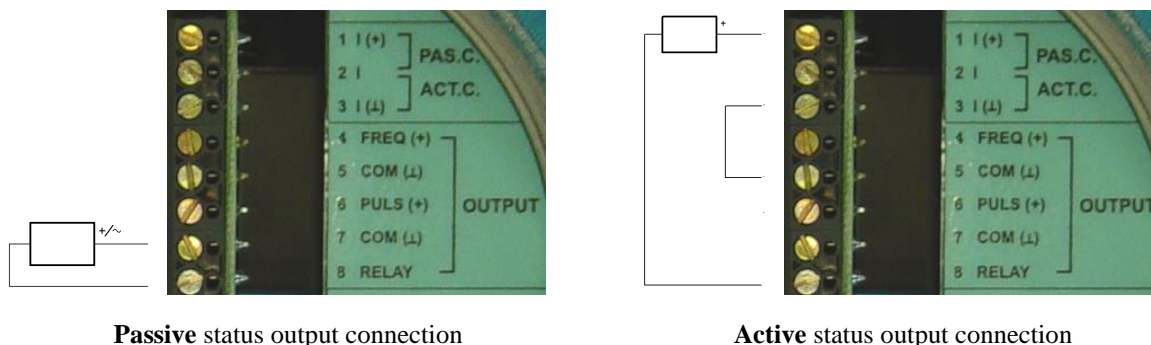
For more information about status output see chapter "*Input and outputs configuration*".

Note 1: Frequency, impulse and status outputs are galvanically connected to each other and galvanically isolated from other electronic circuits.

Note 2: Active status output uses the power supply of the current output. Total current take-off from this power supply (terminal nr. 1) must be less than 40 mA. Active status output is galvanically connected to the current output.

4.3.5 PLC digital input

The digital input is activated with a DC voltage between 5 and 30 V (positive or negative). The digital input is between terminals 9 and 10.

For more information about digital input see chapter "*Input and outputs configuration*".

Note: PLC digital input is galvanically isolated from other electronic circuits.

4.3.6 Serial port RS485

The serial port RS485 is designed for online communication between flowmeter and computer. It is suitable for real time flowmeter monitoring. In contrast to the RS232 serial port, which is suitable for one-shot configuration or calibration of the flowmeter. The RS485 can be connected to up to 16 flowmeters together and the total connection length of all wires can be up to 800 meters. Positive output (A) is on terminal 11, negative output (B) on terminal 12.

Example of three flowmeters and one computer interconnection:

All flowmeters and computer are connected parallel using twisted pair cable. At each end of the communications line should be 470 Ω terminations.
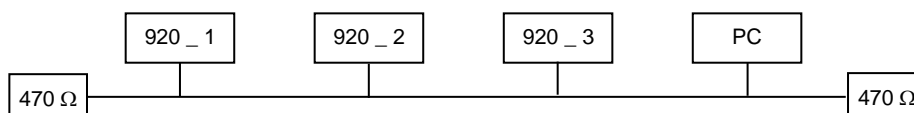
Interconnection of three flowmeters and computer using RS485 bus

Flowmeters are marked with numbers. These numbers are equal to flowmeters' RS485 address.

Program FlowAssistant is designed for flowmeter control using RS485 or RS232 serial bus

Note 1: Communication through the serial port RS485 is a half duplex type. The flowmeter is a listener and sends data only after a query from a computer. Each flowmeter has its own RS485 address. The range of addresses is 0 to 255. Factory setting of RS485 address is 0. Communication speed is selectable between 4800 and 19200 Bd. For cables over 100m or a noisy power supply voltage (especially peaks generated, usually by motors, etc.), select communication speed below 9600 Bd.

Note 2: Serial port RS485 is galvanically isolated from all the other electronic circuits.

4.4 Serial port RS232

The connector is located on the front panel and is accessible after removing the electronic unit cover. RS232 enables you to connect the flowmeter to a PC. RS232 interface is intended for flowmeter configuration and calibration. It's not suitable for online communication during operation, because the flowmeter must be open and IP67 protection is void. For such communication use RS485 interface.

Communication rate is selectable 1200...19200 Bd. Other parameters are fix:

Data bits	8
Stop bit	1
Parity	none

Cable between Flowmeter and PC (configuration 1:1)

PC	D-Sub 1	D-Sub 2	Flowmeter
Receiver	2	2	Transmitter
Transmitter	3	3	Receiver
Ground	5	5	Ground

Use the <u>original</u> RS232 cable (1 : 1, standard part of delivery) to connect the flow meter to a PC and follow this procedure:

- Unscrew the front cover using the special wrench (standard part of delivery).

- Plug the one end of the RS cable onto the serial connector in the flowmeter.

- Connect the opposite end to the serial port in the PC.

- Use the application software (FlowAssistant) to enter new calibration data or to change settings of the flowmeter.

- Disconnect RS232 cable and screw the cover back on.

Note: Serial port RS232 is galvanically isolated from all the other electronic circuits.

5   Operation

5.1   *Main menu*

Main menu is the first menu that appears on power up and can be always reached by pushing the ESC key repeatedly. This menu can be operated with a magnetic pointer even with the housing sealed. Short use of the magnet (less than 3 seconds) is equal to pushing "UP" key. Longer use of the magnet (more than 3 seconds) is equal to pushing "RIGHT" key.
The following information can be displayed in the *Main Menu*.

5.1.1   *Current Flowrate / Total Volume*

```
F  153.2111 m3/h
Σ 63501.254 m3
```

Basic display (after power on). Current flowrate is displayed on the first line. Total volume is displayed on the second line. Flow in forward direction is added to this volume and flow in reverse direction is subtracted. Measuring parameters (units, resolution, moving average etc.) are selectable in *Setup menu*. After pushing "UP" key "Positive Volume" is displayed.

5.1.2   *Positive Volume*

```
Positive volume
Σ+  600.241 m3
```

Total volumetric flow in a forward direction. After pushing "UP" key "Negative Volume" is displayed.

5.1.3   *Negative Volume*

```
Negative volume
Σ-   52.124 m3
```

Total volumetric flow in the reverse direction. After pushing "UP" key "Auxiliary Volume" is displayed.

5.1.4   *Auxiliary Volume*

```
Auxiliary volume
ΣA  14.5352 m3
```

Second Total Volume counter. Value is cleared after longer use of magnet (if magnet is allowed). It is usually used for measuring volumetric flow during a set period such as day, month etc.. After pushing "UP" key "Auxiliary Time Volume" is displayed.

5.1.5   *Auxiliary Time Volume (programmable time period)*

Third Total Volume counter. It is cleared automatically after programmed time period (day, week, month or year). There are three different values displayed periodically:

```
Volume - Day   1
ΣT   134.56 m3
```

1) Total volume measured in both directions during the programmed period

```
Volume - Day   2
00:00 14/01/2009
```

2) Start of measured period

```
Volume - Day   3
00:00 15/01/2009
```

3) End of measured period

In pictures is displayed volume measured 14.1.2009. The flowmeter displays the result from the last closed cycle (on Thursday is displayed volume measured on Wednesday). After pushing "UP" key "Minimum Flowrate" is displayed.

5.1.6   *Minimum Flowrate / Minimum Flowrate Time*

Minimum flowrate value indicated since last reset (long use of magnet or Setup menu). There are two different values displayed periodically:

```
Min. flowrate  1
   0.1254 m3/h
```

1)   Minimum flowrate value since last reset

```
Min. flowrate  2
12:10 21.03.2008
```

2)   Date and time of minimum value

After pushing "UP" key "Maximum Flowrate" is displayed.

5.1.7   *Maximum Flowrate / Maximum Flowrate Time*

Maximum flowrate value indicated since last reset (long use of magnet or Setup menu). There are two different values displayed periodically:

```
Max. flowrate  1
  900.541 m3/h
```

1)   Maximum flowrate value since last reset

```
Max. flowrate  2
12:10 20.03.2008
```

2)   Date and time of maximum value

After pushing "UP" key "Datalogger" is displayed.

5.1.8   *Datalogger*

```
Datalogger
```

```
15:50 09/01/2009
   12.256 m3/h
```

Individual samples can be displayed by pushing "RIGHT" key. In this submenu samples are read sequentially using "UP" key. "Sequential reading" submenu is left by pushing "RIGHT" key. By pushing "UP" key "Current Flowrate / Total Volume" is displayed. Datalogger capacity is more than 10000 samples (typical 15000 samples).

5.2   *Menu SETUP - Basic rules*

In this menu the flowmeter parameters (measuring, output, communication etc.) can be changed. Access the *Setup menu* by pushing the "ENTER" key when in *Main* menu. Meaning of keys is:

„UP"   - parameter selection
„ENTer"   - confirmation of selected parameter
„ESC"   - return one level back

Parameter's value is displayed in square brackets – [10] mA. In this mode it's not possible to change displayed value, parameter has to be switched into edit mode. Edit mode is entered after pressing „ENTer" key. The parameter in edit mode is displayed between marks „<" and „>" - < 10> mA.

5.3   Setup menu

In this menu the flowmeter parameters (measuring, output, communication etc.) can be changed. Access to the *Setup menu* is enabled after pushing the "ENTer" key from the *Main menu* and after entering the Password.

```
 SETUP MENU
⬍INPUT/OUTPUT
```

```
Enter Password
   [00000]
```

```
    BASIC
   <<🔒>>
```

Correct password must be entered before entering *Setup menu*. Without correct password the access to the *Setup menu* is refused. Default factory set password is "00000". Displayed password [00000] should be switched to the edit mode <00000> pressing "ENTer" key. Now you can enter the password using "UP" and "RIGHT" keys and confirm using "ENTer" key. Return to the *Main menu* is possible after pushing the "ESC" key.

After entering correct password the flowmeter displays actual access level for app. 3s. There are three levels of access (according to the password):

1) BASIC – default value is 00000. This level allows changing user settings of the flowmeter.

2) CALIBRATION – default value is 10000. This level allows changing user settings and cal. data.

3) SERVICE – only for service engineers.

5.3.1   Input and outputs configuration (INPUT/OUTPUT)

For the flowmeter outputs and input configuration. "UP" key selects next item ("FLOWMETER"), "ENTER" key displays following submenu:

5.3.1.1   Current loop (CURRENT OUT)

Current loop 4 to 20 mA can be set as passive type between outputs 1, 2 (1 positive, 2 negative) or as active type between outputs 2, 3 (2 positive, 3 negative). In both cases outputs are galvanically separated from all other electronic circuits of the flowmeter. Voltage drop on the passive current loop is 4 V. Active current loop can work to a maximum of 800Ω.

5.3.1.1.1   Current loop mode (CURRENT MODE)

Current loop output can be programmed in one of the following modes:

a)	**Off**	current output is adjusted to 4mA (error message 01 - "Current output" is switched off)
b)	**Positive Flow**	current 4+16*Flowrate / QI [mA] is generated for a positive flowrate direction. For a negative flowrate direction 4mA is generated.
c)	**Negative Flow**	current 4-16*Flowrate / QI [mA] is generated for a positive flowrate direction. For a positive flowrate direction 4 mA is generated.
d)	**Absolute Flow**	current 4+16*abs(Flowrate) / QI [mA] is generated for both flowrate directions.
e)	**Bipolar Flow**	current 12+8*Flowrate / QI [mA] is generated for both flowrate directions.
f)	**Fixed**	current output is adjusted to fixed value (4.000 … 20.000 mA)

5.3.1.1.2   Fixed current value (FIXED CURRENT)

Item allows setting current amplitude in the current mode f) (Fixed). The range is between 4 and 20 mA. Fixed current mode is suitable for testing purposes.

5.3.1.1.3   Flowrate for current 20 mA (FLOW FOR 20mA)

Item allows setting the QI constant. QI represents a flowrate for a current of 20 mA and can be set independently to the nominal diameter of the sensor. The range of QI value is proportional to the flowrate range of range of the flowmeter (DN diameter).

5.3.1.1.4   *Current loop test (LOOP TEST)*

Item allows enable/disable the current loop test. The flowmeter will detect a fault (Error 08 – Current open) if the test is enabled and current loop is not connected.

5.3.1.2   **Frequency output (FREQUENCY OUT)**

Frequency output is a galvanically isolated transistor NPN switch. Voltage drop on the switch is 1 V in the made status. Maximum switched voltage is 50 V. Maximum switched current should not exceed 100 mA. Positive output is on terminal 4, negative output is on terminals 5 and 7 (internally connected). Frequency range of the output is from 10 Hz to 12 kHz.

5.3.1.2.1   *Frequency mode (FREQUENCY MODE)*

The frequency output can be programmed in one of following modes:

a)	**Off**	output is not active (HI state).
b)	**Positive Flow**	frequency 1000*Flowrate/QF [Hz] is generated for positive flowrate direction.
c)	**Negative Flow**	frequency -1000*Flowrate/QF [Hz] is generated for negative flowrate direction.
d)	**Absolute Flow**	frequency 1000*abs(Flowrate)/QF [Hz] is generated for both flowrate directions.
e)	**On Positive**	output is HI in case of negative flow and LO in case of positive flow.
f)	**On Negative**	output is HI in case of positive flow and LO in case of negative flow.
g)	**On In**	output is LO, when flowrate is higher than PF1 and lower than PF2, otherwise it is HI.
h)	**On Out**	output is HI, when flowrate is higher than PF1 and lower than PF2, otherwise it is LO.
i)	**Dose On**	output is LO, when programmed dose is being measured and HI when the dose is out.
j)	**Dose Off**	output is HI, when programmed dose is being measured and LO when the dose is out.
k)	**On<F2**	output is LO, when flowrate is lower than PF2, otherwise it is HI.
l)	**On>F2**	output is LO, when flowrate is higher than PF2, otherwise it is HI.
m)	**Fixed**	frequency output is adjusted to fixed value (10 … 12000 Hz)

If setting the flow limit is chosen, hysteresis H can be set too. Hysteresis is a tolerance field on one side of flow limits PF1 and PF2. The output status changes (indicates crossing over the pre-set limit), when the immediate flowrate crosses over the value PF2 (or goes below limit PF1). The output status comes back to the default status, when the immediate flowrate decreases under the value PF2-H (or increases over limit PF1+H) again.

Mode g) with non-zero hysteresis:

Mode h) with non-zero hysteresis:

Mode k) with non-zero hysteresis:

Mode l) with non-zero hysteresis:
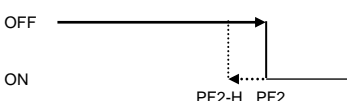
QF value represents flowrate for frequency 1000 Hz and can be set independently to the nominal diameter of the sensor. Values PF1, PF2 and H are described in the chapter "LIMITS".

5.3.1.2.2 *Fixed frequency value (FIXED FREQUENCY)*

Item allows setting frequency in the frequency mode m) (Fixed). The range is between 10 and 12000 Hz. Fixed frequency mode is suitable for testing purposes.

5.3.1.2.3 *Flowrate for frequency 1000Hz (FLOW FOR 1kHz)*

Item allows setting the QF constant. QF represents the flowrate for the frequency 1000Hz and can be set independently to the nominal diameter of the sensor. The range of QF value is proportional to the flowrate range of range of the flowmeter (DN diameter).

5.3.1.3 *Pulse output (PULSE OUT)*

Pulse output is formed by a galvanically isolated transistor NPN switch. Voltage drop on the switch is 1 V in LO mode. Maximum switched voltage is 50 V. Maximum switched current should not exceed 100 mA. Positive output is on terminal 6, negative output is on terminal 5 and 7 (internally connected). Width of the impulse can be set. Maximum frequency of impulse output is limited by the impulse width. For the shortest impulse 2.5 ms is maximal frequency 200 Hz.

5.3.1.3.1 *Pulse mode (PULSE MODE)*

Pulse output can be programmed in one of the following modes:

a)	**Off**	output is not active (HI state).
b)	**Positive Flow**	1 impulse is generated every time when volume QP has flown in positive direction.
c)	**Negative Flow**	1 impulse is generated every time when volume QP has flown in negative direction.
d)	**Absolute Flow**	1 impulse is generated every time when volume QP has flown in any direction.
e)	**On Positive**	output is HI in case of negative flow and LO in case of positive flow.
f)	**On Negative**	output is HI in case of positive flow and LO in case of negative flow.
g)	**On In**	output is LO, when flowrate is higher than PF1 and lower than PF2, otherwise it is HI.
h)	**On Out**	output is HI, when flowrate is higher than PF1 and lower than PF2, otherwise it is LO.
i)	**Dose On**	output is LO, when programmed dose is being measured and HI when the dose is out.
j)	**Dose Off**	output is HI, when programmed dose is being measured and LO when the dose is out.
k)	**On>F1**	output is LO, when flowrate is higher than PF1, otherwise it is HI.
l)	**On<F1**	output is LO, when flowrate is lower than PF1, otherwise it is HI.

If setting of flow limit is chosen, hysteresis H can be set too. Hysteresis is a tolerance field on one side of flow limits PF1 and PF2. The output status changes (indicates crossing over pre-set limit), when the immediate flowrate crosses over the value PF2 (or goes below limit PF1). The output status comes back to the default status, when the immediate flowrate decreases under the value PF2-H (or increases over limit PF1+H) again.

Mode g) with non-zero hysteresis:

Mode h) with non-zero hysteresis:

Mode k) with non-zero hysteresis:
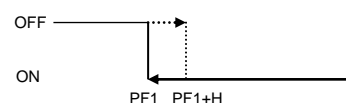
Mode l) with non-zero hysteresis:
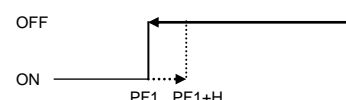
QP value represents volume for 1 impulse and can be set independently to the nominal diameter of sensor. Values PF1, PF2 and H are described in the chapter "LIMITS".

5.3.1.3.2   Pulse width (PULSE WIDTH)

Item allows setting pulse width in [ms]. Available are widths from line 2.5, 5, 10, 25, 50, 100, 250 and 500 ms.

5.3.1.3.3   Volume for one impulse (VOLUME FOR 1IMP)

Item allows setting the QP constant. QP represents the volume for one impulse.

5.3.1.4   Status output (STATE OUT)

Status output is formed by relays. Maximum switched voltage is 100 V. Maximum switched current should not exceed 500 mA. First output is on terminal 8, second output is on terminals 5 and 7 (internally connected).

5.3.1.4.1   Status mode (STATE MODE)

Status output can be programmed in one of the following modes:

a)	**Off**	output is not active (HI state).
b)	**On Positive**	output is HI in case of negative flow and LO in case of positive flow.
c)	**On Negative**	output is HI in case of positive flow and LO in case of negative flow.
d)	**On In**	output is LO, when flowrate is higher than PF1 and lower than PF2, otherwise it is HI.
e)	**On Out**	output is HI, when flowrate is higher than PF1 and lower than PF2, otherwise it is LO.
f)	**Dose On**	output is LO, when programmed dose is being measured and HI when the dose is out.
g)	**Dose Off**	output is HI, when programmed dose is being measured and LO when the dose is out.
h)	**On>F1**	output is LO, when flowrate is higher than PF1, otherwise it is HI.
i)	**On<F1**	output is LO, when flowrate is lower than PF1, otherwise it is HI.
j)	**Error On**	output is LO, when an error is indicated
k)	**Error Off**	output is HI, when an error is indicated

If setting of flow limit is chosen, hysteresis H can be set too. Hysteresis is a tolerance field on one side of flow limits PF1 and PF2. The output status changes (indicates crossing over pre-set limit), when the immediate flowrate crosses over the value PF2 (or goes below limit PF1). The output status comes back to the default status, when the immediate flowrate decreases under the value PF2-H (or increases over limit PF1+H) again.
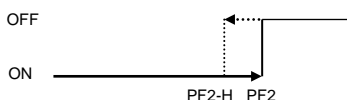
Mode d) with non-zero hysteresis:
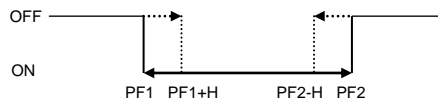
Mode e) with non-zero hysteresis:

Mode h) with non-zero hysteresis:
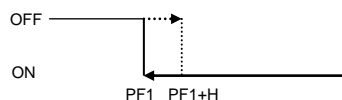
Mode i) with non-zero hysteresis:
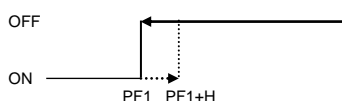
5.3.1.4.2   *Setting the mask for Status Output error message (ERROR MASK)*

The Mask allows selecting which errors will be reported via the Status Output. Mask value is calculated as sum of bit values all enabled errors. Bit value of available errors is in the table:

Bit	Bit value	Error
D0	1	SPI Busy
D1	2	ADC Init
D2	4	ADC Long measure
D3	8	ADC Overload
D4	16	Excitation short
D5	32	Period measure
D6	64	RS232 frame
D7	128	Current open
D8	256	DSP timeout
D9	512	Empty pipe
D10	1024	Excitation open
D11	2048	Frequency over
D12	4096	Current over
D13	8192	Pulse over
D14	16384	Datalogger full
D15	32768	Flowrate over
D16	65536	Temperature out

Note:

Error Mask should be set to value 131071 to report all error messages. This is sum of all error's bit values. Error Mask 65536 means that only the "Temperature out" error will be reported via the Status Output. The Status Output should be set to the mode j) "Error on" or mode k) "Error off".

5.3.1.5   *PLC digital input (DIGITAL INPUT)*

Digital input is activated with DC voltage between 5 and 30 V (positive or negative). Digital input is between terminals 9 and 10.

5.3.1.5.1   *Digital input mode (INPUT MODE)*

Digital input can be programmed in one of the following modes:

a) **Off**   input activation does nothing.
b) **Start Dose**   input activation starts dose QD measuring. Dosing indication can be performed by one of outputs (frequency, impulse or status).
c) **Clear Aux.Vol.**   input activation clears the Auxiliary volume.
d) **Empty Pipe**   input activation invokes error Empty Pipe. Flowrate is zeroed and volume counters are stopped in this state.

QD value represents volume for dosing. QD value can be changed after selecting mode "b".

5.3.1.6   *Limits (LIMITS)*

Function enables you to set values PF1, PF2 and H. These limits define basic conditions for all digital outputs. Values are common for Frequency, Pulse and State outputs

5.3.1.6.1   *Low flowrate limit (LIMIT PF1)*

Value is flowrate expressed in selected flowrate units. Available range is according to the nominal diameter.

5.3.1.6.2   High flowrate limit (LIMIT PF2)

Value is flowrate expressed in selected flowrate units. Available range is according to the nominal diameter.

5.3.1.6.3   Hysteresis of flowrate limits (HYSTERESIS)

Value is flowrate hysteresis of limits expressed in selected flowrate units. Available range is according to the nominal diameter.

5.3.1.7   Dosing (DOSE)

The flowmeter is able to control dosing of measured liquid. For this function is required digital input (start of dosing) and one of digital outputs (end of dosing). QD value represents Dosing volume.

Example of setting:
Digital input mode: Start Dose
State output mode: Dose On
Dosing volume: 1m3
Active level on the digital input starts dosing. Flowmeter switches state output and counts the dose. As soon as measured dose is reached the flowmeter activates the State output to stop dosing. State output can control (through contractor) valve or pump.

5.3.1.7.1   Dosing Volume QD (DOSING VOLUME)

Function enables you to set volume for dosing.

5.3.1.7.2   State of dosing (ACTUAL DOSE)

Function displays the actual state and actual value of measured dose (in case that state is On).

5.3.1.7.3   Zeroing measured dose (CLEAR DOSE)

Function enables you to clear the actual dose value by pressing "ENTer" key.

5.3.2   Flowmeter configuration (FLOWMETER)

Item serves for the flowmeter configuration. After pushing "UP" key next item ("CALIBRATION ") is selected. After pushing "ENTer" key following menu is displayed:

5.3.2.1   Flowrate parameters (FLOW)

Function enables you to set flowrate unit, resolution and other flowrate parameters.

5.3.2.1.1   Flowrate units (UNIT)

Function enables you to set flowrate units.
Available units are:
l/s   litres per second
m3/h   cubic metres per hour
UG/m   US gallons per minute
IG/m   imperial gallons per minute
user   user-defined unit, factory-set is „l/h" (litres per hour), user defined unit can be changed by
         computer only

5.3.2.1.2   Flowrate resolution (RESOLUTION)

Function enables you to set flowrate resolution.
Available resolutions are:
0   without decimal digits
0.0   max. 1 decimal digit
0.00   max. 2 decimal digits
0.000   max. 3 decimal digits
0.0000   max. 4 decimal digits

5.3.2.1.3   User unit name (USER UNIT)

Function enables you to set the name of user unit. Maximum length is four letters.

5.3.2.1.4   User unit conversion constant (USER CONSTANT)

Function enables you to set the conversion constant for user unit. This constant is calculated as the ratio between flowrate in [l/s] and flowrate in [user unit].

5.3.2.1.5   Flowrate direction (DIRECTION)

Function enables you to switch between "Positive" and "Negative" flow direction (change the sign in flowrate value).

Note: Flowmeters are working in both flow directions. However standard calibration is made for positive direction only.

5.3.2.1.6   Low-flow cutoff (L.F.CUTOFF)

Function enables you to set limit for suppressing low flowrates. Available range is according to the nominal diameter.

Note: All flowrates below this value will be displayed as 0.00. This setting is valid for display and all outputs.

5.3.2.1.7   Moving average time constant (TIMECONST)

Function enables you to change the time for moving average calculating. Available range is between 0 and 20 s.

5.3.2.1.8   Nominal flowrate range (RANGE)

Function enables you to change the nominal flowrate range. This is the auxiliary constant for easy configuration of flowmeter's outputs. There is no dependency between flowmeter's accuracy and this constant.

5.3.2.1.9   Empty pipe detection (EMPTY PIPE)

Function enables you to enable/disable empty pipe internal detection. You can disable this function in case you use external empty pipe detection connected to the flowmeter's digital input.

5.3.2.1.10   Min. and Max. flowrate clear (CLEAR MIN/MAX)

Function enables you to clear Min. and Max. recorded Flowrate value by pressing "ENTer" key.

5.3.2.2   Volume parameters (VOLUME)

Function enables you to set volume unit, resolution and other volume parameters.

5.3.2.2.1   Volume units (UNIT)

Function enables you to set volume units.
Available units are:
m3   cubic metres
l   litres
UG   US gallons
IG   US gallons
user   user-defined unit, factory-set is „l" (litres), user defined unit can be changed by computer only

5.3.2.2.2   Volume resolution (RESOLUTION)

Function enables you to set volume resolution.
Available resolutions are:
0   without decimal digits
0.0   max. 1 decimal digit
0.00   max. 2 decimal digits
0.000   max. 3 decimal digits
0.0000 max. 4 decimal digits

5.3.2.2.3   User unit name (USER UNIT)

Function enables you to set the name of user unit. Maximal length is four letters.

5.3.2.2.4   User unit conversion constant (USER CONSTANT)

Function enables you to set the conversion constant for user unit. This constant is calculated as the ratio between volume in [l] and volume in [user unit]. CALIBRATION access is required.

5.3.2.2.5   Auxiliary Time Volume parameters (TIMED VOLUME)

Function enables you to set the period for Time Volume (item PERIOD) and the first day for week period (item WEEK BEGIN). This day starts counting Time Volume for new week.

5.3.2.2.6   *Resetting Volume counters (CLEAR VOLUME)*

Function enables you to clear volume counters.
TOTAL VOLUME clears total volume counter (CALIBRATION access is required).
AUX VOLUME clears auxiliary volume counter.
TIMED VOLUME clears auxiliary time volume counter. It clears displayed time volume (finished period) and also counted time volume (not displayed).

5.3.2.3   *Datalogger parameters (DATALOGGER)*

Function enables you to set the datalogger.

5.3.2.3.1   *Datalogger sampling interval (INTERVAL)*

Function enables you to set sample interval for internal datalogger. You can select one of following intervals: OFF, 5, 10, 15, 30, 45, 60, 120, 180 and 240. Values are expressed in minutes. Flowrate value written into the datalogger is calculated as average value in the selected interval.

5.3.2.3.2   *Datalogger filling (FILLING)*

Function displays datalogger filling in %. Datalogger capacity is over 10000 samples.

5.3.2.3.3   *Datalogger clear(CLEAR)*

Function enables you to clear the datalogger memory.

5.3.3   *Calibration menu (CALIBRATION)*

Item serves for the flowmeter calibration.

Setting any new value in calibration menu changes calibration data! Calibration should be performed in an appropriate equipped laboratory.

We recommended using software Flow910 for easy Calibration. It contains „calibration wizard" and can prevent flowmeter from incorrect calibration.

You can change calibration values only if the correct calibration password has been entered. Default factory set Calibration password is "10000".

Note: Flowmeter M920 enables calibration at 2, 3 or 4 points. Each calibration point contains 2 values. Nominal value of calibration point is selected by user in range between +/- Q_{MAX} (for maximum flowrates see table 1: M920 flowrates). It is expressed in flowrate units. To this nominal value is attached a calibration constant. Calibration constant doesn't have a unit. In the calibration process you change this calibration constant to reach similarity between standard flowmeter and the calibrated flowmeter. Higher calibration constant means lower displayed value.
Calibration constants must be different. In the case of two equal calibration constants, the measured values could be wrong.

5.3.3.1   *Number of Calibration Points (NUMBER OF CAL.P)*

Function enables you to enter number of calibration points in range between 2 and 4.

Note: Standard number of calibration points is 2. More calibration points are used for special applications when higher accuracy is expected (negative flowrate, low flowrates etc.).

5.3.3.2   *Calibration point 1 (CAL.POINT 1)*

Function enables you to change nominal and calibration value of Calibration point 1.

5.3.3.2.1   *Flowrate nominal value setting (FLOWRATE)*

Flowrate nominal value can be changed in the range +/- Q_{MAX} (see the table 1: M920 flowrates). This value is flowrate that is calibrated.

5.3.3.2.2   *Calibration constant (CONSTAT)*

Value presents calibration constant in above defined calibration point. Higher calibration constant means lower displayed value.

5.3.3.3   Calibration point 2 (CAL.POINT 2)

Function enables you to change nominal and calibration value of Calibration point 2. For detail description see Calibration point 1.

5.3.3.4   Calibration point 3 (CAL.POINT 3)

Function enables you to change nominal and calibration value of Calibration point 3. For detail description see Calibration point 1.

5.3.3.5   Calibration point 4 (CAL.POINT 4)

Function enables you to change nominal and calibration value of Calibration point 4. For detail description see Calibration point 1.

5.3.4   General settings (GENERAL)

Item serves for flowmeter general settings.

5.3.4.1   Interface parameters (INTERFACE)

Function enables you to change RS232 and RS485 parameters.

5.3.4.1.1   RS232 parameters (RS232)

Item RS232 BAUDRATE enables you to set the baudrate. You can select one of following baud rates: 1200, 2400, 4800, 9600 and 19200.

5.3.4.1.2   RS485 parameters (RS485)

Following items are available:
RS485 MODE   - available modes (Normal, Modbus RTU, Modbus ASCII).
RS485 BAUDRATE   - available baud rates (1200, 2400, 4800, 9600, 19200).
ADDRESS   - RS485 address (valid for Normal mode). Range is 0 to255.
MODBUS PARITY   - available are (None, Even, Odd)
MODBUS ADDRESS   - RS485 address (valid for Modbus modes). Range is 0 to 247.

5.3.4.2   Display parameters (DISPLAY)

Function enables you to change display parameters.

5.3.4.2.1   Display contrast (CONTRAST)

Item enables you to set the display contrast in range 40 to 90%.

5.3.4.2.2   Display backlight mode (BACKLIGHT)

Item enables you to set the display backlight mode. You can select one of following modes:
Off   - backlight is switched off
Auto of   - backlight is switched on after any key is pressed and after 20s is switched off
On   - backlight is switched on

5.3.4.2.3   Message display time (MESSAGE TIME)

Item enables you to set the message display time. You can select one of following items: (Short, Normal, Long).

5.3.4.2.4   Language (LANGUAGE)

Item enables you to set the language. You can select one of following items: (Cestina, English, Espanol).

5.3.4.3   Real time setting (DATE/TIME)

Function enables you to correct time of internal Real time clock and select required date format.

5.3.4.3.1   Time setting (ACTUAL TIME)

Item enables you to set the actual time. Range is 00:00:00 to 23:59:59.

5.3.4.3.2   Date setting (ACTUAL DATE)

Item enables you to set the actual date. Range is 01.01.2009 to 31.12.2099.

5.3.4.3.3   Date format setting (DATE FORMAT)

Item enables you to set required date format. You can select one of following items: („D/M/Y", „D.M.Y", „D-M-Y", „Y/M/D", „Y.M.D", „M/D/Y", „M-D-Y").

5.3.4.4   Temperature measuring (TEMPERATURES)

Function displays measured temperatures and enables to change limits for excitation coils (liquid) temperature alarm.

5.3.4.4.1   Excitation coils temperature (COIL TEMP.)

Item displays excitation coils temperature. This temperature is indicates the temperature of measured liquid.

5.3.4.4.2   Minimum allowed coil temperature (LOW LIMIT)

Item enables you to set low limit for the coil temperature. In case the actual temperature is lower the flowmeter displays error message "Temperature out". Range is -20 to +150°C.

5.3.4.4.3   Maximum allowed coil temperature (HIGH LIMIT)

Item enables you to set high limit for the coil temperature. In case the actual temperature is higher the flowmeter displays error message "Temperature out". Range is -20 to +150°C.

5.3.4.4.4   Electronic unit temperature (DISPLAY TEMP.)

Item displays temperature inside the electronic unit. This temperature should be in range -20 to +75°C.

5.3.4.5   Password setting (USER ACCESS)

Item enables you to set user passwords.

5.3.4.5.1   Basic access password (BASIC PASSWORD)

Item enables you to set five digits password for access level "BASIC".

5.3.4.5.2   Calibration access password (CAL. PASSWORD)

Item enables you to set five digits password for access level "CALIBRATION".

5.3.4.5.3   Magnetic pointer control (CLEAR BY MAGNET)

Item enables you the possibility to clear using magnetic pointer auxiliary volumes and min/max flowrates. You can select one of following items: (Disabled, Enabled). If items is enabled the password is not required for clearing.

5.3.4.6   Service information (INFO)

Function displays internal measured values. These values can be used for diagnostic.

5.3.4.6.1   Serial number (SERIAL NUMBER)

Function displays flowmeter's serial number as 'xxxxxx' (six digits).

5.3.4.6.2   Firmware and hardware version (VERSION)

Function displays internal firmware and hardware version as 'FW x.xx HWxxxx'.

5.3.4.6.3   Nominal sensor diameter DN (DIAMETER)

Function displays nominal sensor diameter in mm. This diameter you can change with access level "SERVICE".

5.3.4.6.4   Mains power supply (POWER LINE)

Function displays type of mains power supply. You can select one of following items:
- **Auto** (power supply 85 ... 264 Vac, 50/60 Hz)
- **DC 50Hz** (DC power supply, measuring period derived from 50Hz)
- **DC 60Hz** (DC power supply, measuring period derived from 60Hz)
This parameter you can change with access level "SERVICE".

5.3.4.6.5   +5V power supply (VOLTAGE +5V)

Function measures internal power supply +5V. Optimal range is 4.7 to 5.3V.

5.3.4.6.6   +15V power supply (VOLTAGE +15V)

Function measures internal power supply +15V. Optimal range is 12 to 16V.

5.3.4.6.7   -15V power supply (VOLTAGE -15V)

Function measures internal power supply -15V. Optimal range is -12 to -16V.

5.3.4.6.8 Excitation coils resistance (COIL RESISTANCE)

Function measures excitation coils resistance. Optimal range is 80 to 140Ω.

5.3.4.7 Self-test (SELFTEST)

Function enables you to check the function of flowmeters electronic. Sensor is disconnected during this test. Internal flowrate simulator is connected instead of sensor. You can check the measuring amplifier (transmitter) during this test.

5.3.4.7.1 Connection of internal simulator (INT. SIMULATOR)

Item enables you to connect / disconnect internal flowrate simulator. You can select one of following items: (On, Off). "On" means that simulator is connected and the flowmeter doesn't measure the real flowrate. "Off" means that simulator is disconnected and the flowmeter measures the real flowrate (standard setting).

5.3.4.7.2 Electronic amplifier test (GAIN)

Function measures (internal simulator should be On) swing from nominal gain of electronic amplifier. Measured value should be in range 0.98 ... 1.02.
The gain of the amplifier is adjusted to the nominal value 1.00 after pressing the ENTer key. This function is available only for access level Service.

Note: Wait app. 10s after connecting the internal flowrate simulator for measuring circuit stabilization.

5.4 Nominal values (standard factory setting)

INPUT/OUTPUT

CURRENT OUT

```
CURRENT MODE      Positive Flow
FIXED CURRENT     10 mA
FLOW FOR 20mA     flowrate Qn (nominal flowrate)
LOOP TEST         Off
```

FREQUENCY OUT

```
FREQUENCY MODE    Positive Flow
FIXED FREQUENCY   1000 Hz
FLOW FOR 1kHz     flowrate Qn (nominal flowrate)
```

PULSE OUT

```
PULSE MODE        Positive Flow
PULSE WIDTH       100 ms
VOLUME FOR 1IMP   1 m3
```

STATE OUT

```
STATE MODE        Off
ERROR MASK        131071
```

DIGITAL INPUT

```
INPUT MODE        Off
```

LIMITS

```
LIMIT PF1         flowrate - Qn (nominal flowrate)
LIMIT PF2         flowrate Qn (nominal flowrate)
HYSTERESIS        flowrate Qn/10
```

DOSE

```
DOSING VOLUME     1 m3
```

FLOWMETER

FLOW

```
UNIT            m3/h
RESOLUTION      0.0000 for Q100% < 3.0000
                0.000 for 3.000 ≤ Q100% < 30.000
                0.00 for 30.00 ≤ Q100% < 300.00
                0.0 for 30.0 ≤ Q100% < 3000.0
                0 for Q100% > 3000
USER UNIT       l/h
USER CONSTANT   3600
DIRECTION       Positive
```
L.F.CUTOFF   *flowrate $Q_{1\%}/2$*
```
TIME CONSTANT   10s
```
RANGE   *flowrate Qn (nominal flowrate)*
```
EMPTY PIPE      On
```

VOLUME

```
UNIT            m3
RESOLUTION      0.000
USER UNIT       l
USER CONSTANT   1.0
TIMED VOLUME
  PERIOD        Day
  WEEK BEGIN    Monday
```

DATALOGGER

```
INTERVAL        Off
```

CALIBRATION

NUMBER OF CAL.P   2

CAL. POINT 1

```
FLOWRATE        5 ... 10 % of required Qn
CONSTANT        is assigned according to the calibration
```
FLOWRATE   *5 ... 10 % of required Qn*
CONSTANT   *is assigned according to the calibration*

CAL. POINT 2

FLOWRATE   *40 ... 70 % of required Qn*
CONSTANT   *is assigned according to the calibration*

CAL. POINT 3

Not used

CAL. POINT 4

Not used

GENERAL

INTERFACE

```
RS232
  RS232 BAUDRATE  9600
RS485
```

```
   RS485 MODE        Normal
   RS485 BAUDRATE    9600
   ADDRESS           0
   MODBUS PARITY     Even
   MODBUS ADDRESS    10
```

DISPLAY

```
CONTRAST           60 %
BACKLIGHT          Auto off
MESSAGE TIME       Normal
LANGUAGE           English
```

DATE/TIME

```
ACTUAL TIME        actual time (GMT + 1)
ACTUAL DATE        actual date (GMT + 1)
DATE FORMAT        D/M/Y
```

TEMPERATURES

```
COIL TEMP.         measured value [°C]
LOW LIMIT          -20°C
HIGH LIMIT         150°C
DISPLAY TEMP.      measured value [°C]
```

USER ACCESS

```
BASIC PASSWORD     00000
CAL. PASSWORD      10000
CLEAR BY MAGNET    Enabled
```

INFO

```
SERIAL NUMBER      xxxxxx
VERSION            SW x.xx HWxxxx
DIAMETER           according to the sensor DN
POWER LINE         according to the electronic version
VOLTAGE +5V        measured value [V]
VOLTAGE +15V       measured value [V]
VOLTAGE -15V       measured value [V]
COIL RESISTANCE    measured value [Ω]
```

SELFTEST

```
INT. SIMULATOR     Off
GAIN               measured value
```

6   System control

The flowmeter includes serial lines RS232 and RS485. RS232 connector is located on the front panel. RS485 connectors are behind the back cover. For the remote control to work properly, bus parameters must be set in the setup menu (item GENERAL / INTERFACE).

6.1   RS485 bus properties

RS485 interface can work in three modes:

   a) Normal – communication protocol ADAM compatible with flowmeter M910.

   b) Modbus RTU – communication protocol Modbus, binary communication.

   c) Modbus ASCII – communication protocol Modbus, ASCII communication.

To transfer the data using RS485 bus, 8N1 data format is used, i.e. each data word includes 8 bits, no parity and one stop bit. The communication speed can be set using the system menu. Available values: 1200, 2400, 4800, 9600 and 19200 Bd. Each flowmeter has its own RS485 address. Range of these addresses is from 0 to 255 (0 to 247 in Modbus mode).

6.2   RS232 bus properties

To transfer the data using RS232 bus, 8N1 data format is used, i.e. each data word includes 8 bits, no parity and one stop bit. Communication speed can be set using the system menu. Available values: 1200, 2400, 4800, 9600 and 19200 Bd. Address is not used in RS232 mode.

6.3   Command syntax

Communication between flowmeter and computer consists of a flow of periodically alternating commands type command-response or query-response. Command is always a text followed by parameter and ended by control sign <cr>. Response is always ended with control sign <cr>.

There are three types of responses:

   1) Parameters value – response to a query

   2) Ok – response to a command

   3) ErrX – in case that command has wrong format. Where X is error code from the table below:

Error code	Meaning
1	Unknown command
2	Parameter out of range
3	Value cannot be set
4	Value cannot be read
5	Unknown parameter
6	Parameter too low
7	Parameter to high
8	Number as parameter is required
9	Access denied – use appropriate password
10	Wrong value of calibration point
11	Password locked – six unsuccessful attempts to enter password. Setup menu is blocked for 20 minutes.

Commands described in this chapter can be issued through both buses (RS485 and RS232). The only difference is, that before all commands for RS485 bus is identification in form "#00". Where '#' is the

command prefix and "00" is flowmeters address 0 in hexadecimal form. For flowmeter with address 1 it's identification is "#01". Flowmeter answers are prefix in form ">00" for flowmeter 0, ">01" for flowmeter 1 etc.

Modbus protocol is explained in independent chapter.

Syntax description

<DNPD> = Decimal Numeric Program Data, this format is used to express decimal number with or without the exponent.

<CPD> = Character Program Data. Usually, it represents a group of alternative character parameters. e.g. {0 | 1 | 2 | 3}.

? = A flag indicating a request for the value of the parameter specified by the command. No other parameter than the question mark can be used.

(?) = A flag indicating a request for the parameter specified by the command. This command permits a value to be set as well as requested.

<cr> = carriage return. ASCII code 13. This code executes the command or query.

6.4   Command list

6.4.1   Main menu

Flowrate reading

RFL?

Response contains actual "Flowrate" value in selected units.

Example:
If query „RFL?<cr>" is sent, flowmeter returns response in format „100.000<cr>". Resolution is designed by Setup menu.

Volume reading

RVO?

Response contains actual "Volume" counter value in selected units.

Example:
If query „RVO?<cr>" is sent, flowmeter returns response in format „100.000<cr>". Resolution is designed by Setup menu.

Positive volume reading

RVP?

Response contains actual Positive volume counter value.

Example:
If query „RVP?<cr>" is sent, flowmeter returns response in format „100.000<cr>". Resolution is designed by Setup menu.

Negative volume reading

RVN?

Response contains actual Negative volume counter value.

Example:
If query „RVN?<cr>" is sent, flowmeter returns response in format „-100.000<cr>". Resolution is designed by Setup menu.

Auxiliary volume reading

RVA?

Response contains actual Auxiliary volume counter value.

Example:
If query „RVA?<cr>" is sent, flowmeter returns response in format „100.000<cr>". Resolution is designed by Setup menu.

Maximum flowrate value reading

RMX?

Response contains maximum Flowrate value.

Example:
If query „RMX?<cr>" is sent, flowmeter returns response in format „100.000<cr>" (maximum flowrate value indicated since last reset – command CLRMM).

Date and time of maximum flowrate reading

RXD?

Response contains time & date of maximum flowrate.

Example:
If query „RXD?<cr>" is sent, flowmeter returns response in format „10:06 15/01/2009<cr>" (time & date of maximum flowrate value indicated since last reset – command CLRMM).

Minimum flowrate value reading

RMN?

Response contains minimum Flowrate value.

Example:
If query „RMN?<cr>" is sent, flowmeter returns response in format „0.000 " (minimum flowrate value indicated since last reset – command CLRMM).

Date and time of minimum flowrate reading

RND?

Response contains time & date of minimum flowrate.

Example:
If query „RND?<cr>" is sent, flowmeter returns response in format „11:36 16/01/2009<cr>" (time & date of minimum flowrate value indicated since last reset – command CLRMM).

Finished timed volume reading

RTV?

Response contains volume of the last finished counting period.

Example:
If query „RTV?<cr>" is sent, flowmeter returns response in format „100.000<cr>". Resolution is designed by Setup menu.

Actual timed volume reading

RTA?

Response contains volume of the actual counting period.

Example:
If query „RTV?<cr>" is sent, flowmeter returns response in format „100.000<cr>". Resolution is designed by Setup menu.

Time & date of the begin last finished counting period (timed volume)

RTB?

Response contains starting time & date of the last finished counting period.

Example:
If query „RTB?<cr>" is sent, flowmeter returns response in format „00:00 16/01/2009<cr>".

Time & date of the end last finished counting period (timed volume)

RTE?

Response contains ending time & date of the last finished counting period.

Example:
If query „RTE?<cr>" is sent, flowmeter returns response in format „00:00 17/01/2009<cr>".

Actual dosing volume reading

RDO?

Response contains actual dosing volume value.

Example:
If query „RDO?<cr>" is sent, flowmeter returns response in format „100.000<cr>". Resolution is designed by Setup menu.

Dosing state reading

RDA?

Response contains dosing state.

Response is:

- 0   - dosing is not in progress (inactive)
- 1   - dosing is in progress (active)

Example:
If query „RDA?<cr>" is sent, flowmeter returns response in format „0<cr>" in case dosing is not in progress.

Errors reading

IER?

Response contains list of all errors from the power on or from the last reading (query IER?).

The Mask allows selecting which errors will be reported via the State Output. Errors are expressed as sum of bit values of errors. Bit value of possible errors is in the table:

Bit	Bit value	Error
D0	1	SPI Busy
D1	2	ADC Init
D2	4	ADC Long measure
D3	8	ADC Overload
D4	16	Excitation short
D5	32	Period measure
D6	64	RS232 frame
D7	128	Current open
D8	256	DSP timeout
D9	512	Empty pipe
D10	1024	Excitation open
D11	2048	Frequency over
D12	4096	Current over
D13	8192	Pulse over
D14	16384	Datalogger full
D15	32768	Flowrate over
D16	65536	Temperature out

Example:
Response „0<cr>" indicates that there was no error. Response "65536<cr>" indicates that temperature of current excitation coils was (is) out of programmed limits. Value "1536<cr>" (1024+512) indicates that excitation circuit is open and there is no liquid in the pipe (empty pipe).

Flowmeter's state reading

RES?

Response contains flowmeter's state.

Response is:

- 0   - flowmeter measures without correct
- 1   - flowmeter indicates error (in the last 3 seconds before the query was sent)

Example:
If query „RES?<cr>" is sent, flowmeter returns response in format „0<cr>"

6.4.2   Input/output

6.4.2.1   Current output

Current output mode setting

SCM(?)<CPD> { 0 | 1 | 2 | 3 | 4 | 5 }

Following modes can be set:

- 0   Off
- 1   Positive Flow
- 2   Negative Flow
- 3   Absolute Flow
- 4   Bipolar Flow
- 5   Fixed

M920 confirms execution with string „Ok<cr>".

Example:
Command „SCM1<cr>" sets mode "Positive flowrate" for current output. If query „SCM?<cr>" is sent, flowmeter returns response in format „1<cr>".

Current output constant QI setting

SCO(?)<DNPD>

Command sets constant QI, which represents flowrate value for current 20 mA.

<DNPD>

It represents required flowrate in actual units. M920 confirms execution with string „Ok<cr>". In case of query M920 returns set value in actual units.

Example:
Command „SCO10.5<cr>" sets value QI to 10.5 in actual units. After query „SCO?<cr>" flowmeter returns string „10.500000<cr>".

Fixed current setting

SFC(?)<DNPD>

Command sets fixed current in range between 4 mA and 20 mA. Current output must be set to "Fixed" mode.

<DNPD>

It represents current for "Current output" in mA. M920 confirms execution with string „Ok<cr>". In case of query M920 returns set value in mA.

Example:
Command „SFC10<cr>" sets current output to 10 mA (it must be set to "Fixed current" mode). After query „SFC?<cr>" flowmeter returns string „10.000000<cr>".

Current loop test

FCE(?)<CPD> { 0 | 1 }

Internal current loop test can be switched:

- 0   Off
- 1   On

M920 confirms current loop test state with string „Ok<cr>".

Example:
Command „FCE0<cr>" switches current loop test "Off". If query „FCE?<cr>" is sent, flowmeter returns response in format „0<cr>".

Current loop state reading

RCE?

Response contains state of current loop.

Response is:

- 0 - current loop is closed
- 1 - current loop is disconnected

Example:
If query „RCE?<cr>" is sent, flowmeter returns response in format „0<cr>" for closed current loop.

6.4.2.2 Frequency output

Frequency output mode setting

SFM(?)<CPD> { 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 }

Following modes can be set:

- 0   Off
- 1   Positive Flow
- 2   Negative Flow
- 3   Absolute Flow
- 4   On Positive
- 5   On Negative
- 6   On In
- 7   On Out
- 8   Dose On
- 9   Dose Off
- 10   On<F2
- 11   On>F2
- 12   Fixed

M920 confirms execution with string „Ok<cr>".

Example:
Command „SFM1<cr>" sets mode "Positive flowrate" for frequency output. If query „SFM?<cr>" is sent, flowmeter returns response in format „1<cr>".

Frequency output constant QF setting

SFO(?)<DNPD>

Command sets constant QF, which represents flowrate value for frequency 1000 Hz.

<DNPD>

It represents required flowrate in actual units. M920 confirms execution with string „Ok<cr>". In case of query M920 returns set value in actual units.

Example:
Command „SFO10.5<cr>" sets value QF to 10.5. After query „SFO?<cr>" flowmeter returns string „10.500000<cr>".

Fixed frequency setting

SFF(?)<DNPD>

Command sets fixed for frequency in range between 10 Hz and 12 kHz. Frequency output must be set to "Fixed" mode.

<DNPD>

It represents frequency for "Frequency output" in Hz. M920 confirms execution with string „Ok<cr>". In case of query M920 returns set value in Hz.

Example:
Command „SFF1000<cr>" sets frequency output to 1000 Hz (it must be set to "Fixed frequency" mode). After query „SFF?<cr>" flowmeter returns string „1000.000000<cr>".

6.4.2.3   Pulse output

Impulse output mode setting

SPM(?)<CPD> { 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 }

Following modes can be set:

- 0   Off
- 1   Positive Flow
- 2   Negative Flow
- 3   Absolute Flow
- 4   On Positive
- 5   On Negative
- 6   On In
- 7   On Out
- 8   Dose On
- 9   Dose Off
- 10   On>F1
- 11   On<F1

M920 confirms execution with string „Ok<cr>".

Example RS232:
Command „SPM1<cr>" sets mode "Positive flowrate" for impulse output. If query „SPM?<cr>" is sent, flowmeter returns response in format „1<cr>".

Impulse output constant QP setting

SPO(?)<DNPD>

Command sets constant QP, which represents volume for 1 impulse.

<DNPD>

It represents volume for 1 impulse in actual units. M920 confirms execution with string „Ok<cr>". In case of query M920 returns set value in actual units.

Example:
Command „SPO1.0<cr>" sets value QP to 1.0. After query „SPO?<cr>" flowmeter returns string „1.000000<cr>".

Impulse width setting

SPT(?)<CPD> { 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 }

Following widths can be set:

- 0   2.5 ms
- 1   5 ms
- 2   10 ms
- 3   25 ms
- 4   50 ms
- 5   100 ms
- 6   250 ms
- 7   500 ms

M920 confirms execution with string „Ok<cr>".

Example RS232:
Command „SPT5<cr>" sets 100 ms pulse width. If query „SPT?<cr>" is sent, flowmeter returns response in format „5<cr>".

6.4.2.4   State output

State output mode setting

SSM(?)<CPD> { 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 }

Following modes can be set:

- 0   Off
- 1   On Positive
- 2   On Negative
- 3   On In
- 4   On Out
- 5   Dose On
- 6   Dose Off
- 7   On>F1
- 8   On<F1
- 9   Error On
- 10   Error Off

M920 confirms execution with string „Ok<cr>".

Example:
Command „SSM1<cr>" sets mode "On for positive flowrate" for state output. If query „SSM?<cr>" is sent, flowmeter returns response in format „1<cr>".

Setting the mask for State Output error message (ERROR MASK)

SEM(?)<DNPD>

Command sets the mask that enables error message.

<DNPD>

It represents error mask.
The Mask allows selecting which errors will be reported via the State Output. Mask value is calculated as sum of bit values all enabled errors. Bit value of available errors is in the table:

Bit	Bit value	Error
D0	1	SPI Busy
D1	2	ADC Init
D2	4	ADC Long measure
D3	8	ADC Overload
D4	16	Excitation short
D5	32	Period measure
D6	64	RS232 frame
D7	128	Current open
D8	256	DSP timeout
D9	512	Empty pipe
D10	1024	Excitation open
D11	2048	Frequency over
D12	4096	Current over
D13	8192	Pulse over
D14	16384	Datalogger full
D15	32768	Flowrate over
D16	65536	Temperature out

Note:
Error Mask should be set to value 131071 to report all error messages. This is sum of all error's bit value. Error Mask 65536 means that only the "Temperature out" error will be reported via the State Output. If query „SEM?<cr>" is sent, flowmeter returns response in format „65536<cr>". The State Output should be set to the mode "Error On" or mode "Error Off" (see command SSM).

6.4.2.5   Digital input PLC

Digital input mode setting

SIM(?)<CPD> { 0 | 1 | 2 | 3 }

Following modes can be set:

- 0 Off
- 1 Dose
- 2 Clr. Vol
- 3 Empty Pipe

M920 confirms execution with string „Ok<cr>".

Example:
Command „SIM1<cr>" sets mode "Dose" for digital input. If query „SIM?<cr>" is sent, flowmeter returns response in format „1<cr>".

6.4.2.6   Limits setting

Low limit value

SF1(?)<DNPD>

Command sets low limit value PF1.

<DNPD>

It represents flowrate for low limit value PF1 in actual unit. M920 confirms execution with string „Ok<cr>". In case of query M920 returns set value in actual unit.

Example:
Command „SF1-10.5<cr>" sets low limit value to –10.5. After query „SF1?<cr>" flowmeter returns string „-10.500000<cr>".

High limit value

SF2(?)<DNPD>

Command sets low limit value PF2.

<DNPD>

It represents flowrate for high limit value PF2 in actual unit. M920 confirms execution with string „Ok<cr>". In case of query M920 returns set value in actual unit.

Example:
Command „SF210.5<cr>" sets low limit value to 10.5. After query „SF2?<cr>" flowmeter returns string „10.500000<cr>".

Hysteresis

SHY(?)<DNPD>

Command sets hysteresis H.

<DNPD>

It represents flowrate for hysteresis H in actual unit. M920 confirms execution with string „Ok<cr>". In case of query M920 returns set value in actual unit.

Example:
Command „SHY1.05<cr>" sets hysteresis to 1.05. After query „SHY?<cr>" flowmeter returns string „1.050000<cr>".

6.4.2.7   Dosing

Dosing constant QD

SIO(?)<DNPD>

Command sets constant QD, which represents volume for dosing.

<DNPD>

It represents volume for dosing in actual units. M920 confirms execution with string „Ok<cr>". In case of query M920 returns set value in actual units.

Example:
Command „SIO1.0<cr>" sets value QD to 1.0. After query „SIO?<cr>" flowmeter returns string „1.000000<cr>".

Dosing volume Reset

CLRDO

Command clears volume for dosing.

M920 confirms execution with string „Ok<cr>".

Example:
Command „ CLRDO <cr>" clears dosing volume counter

Dosing volume Reset with restart

CLRDR

Command clears volume for dosing and starts new batch.

M920 confirms execution with string „Ok<cr>".

Example:
Command „ CLRDR <cr>" clears dosing volume counter and starts new batch.

6.4.3   Flowmeter

6.4.3.1   Flowrate parameters

Flowrate unit

FFS(?)<CPD> { 0 | 1 | 2 | 3 | 4 }

Following units can be set:

- 0   l/s
- 1   m3/h
- 2   UG/m
- 3   IG/m
- 4   "user"

M920 confirms execution with string „Ok<cr>".

Example:
Command „FFS0<cr>" sets flowrate unit "l/s". If query „FFS?<cr>" is sent, flowmeter returns response in format „0<cr>".

Flowrate resolution

FFR(?)<CPD> { 0 | 1 | 2 | 3 | 4 }

Following resolution can be set:

- 0   0
- 1   0.0
- 2   0.00
- 3   0.000
- 4   0.0000

M920 confirms execution with string „Ok<cr>".

Example:
Command „FFR3<cr>" sets flowrate resolution "0.000". If query „FFR?<cr>" is sent, flowmeter returns response in format „3<cr>".

Flowrate user unit

FFU(?)<CPD>

Command sets text for flowrate user unit.

<CPD>

It represents user units expressed as 5 ASCII characters. M920 confirms execution with string „Ok<cr>". In case of query M920 returns set user unit.

Example:
Command „FFU l/m <cr>" sets flowrate user unit " l/m ". After query „FFU?<cr>" flowmeter returns string „ l/m <cr>".

Conversion constant for flowrate user unit

FFC(?)<DNPD>

Command sets conversion constant for flowrate user unit with respect to [l/s].

<DNPD>

It represents a constant, which is calculated as a ratio between flowrate in user unit and flowrate in basic unit ([l/s]). For example constant for [m3/h] is 3.6. M920 confirms execution with string „Ok<cr>". In case of query M920 returns set constant.

Example:
Command „FFC3.6<cr>" sets constant "3.6 ". After query „FFC?<cr>" flowmeter returns „3.600000<cr>".

Flowrate direction

FFD(?)<CPD> { 0 | 1 }

Following directions can be set:

- 0 Positive
- 1 Negative

M920 confirms direction with string „Ok<cr>".

Example:
Command „FFD0<cr>" sets "Positive direction". If query „FFD?<cr>" is sent, flowmeter returns response in format „0<cr>".

Low flow cutoff

FLF(?)<DNPD>

Command sets flowrate limit for suppression low flowrates.

<DNPD>

It represents flowrate expressed in actual unit. All flowrates below this limit are displayed as 0. M920 confirms execution with string „Ok<cr>". In case of query M920 returns set low flow cut-off.

Example:
Command „FLF0.2<cr>" sets low flow cut-off "0.2". After query „FLF?<cr>" flowmeter returns „0.200000<cr>".

Time constant

FTC(?)<DNPD>

Command sets time for moving average calculation.

<DNPD>

It represents time expressed in seconds. Any value in range between 1 second and 20 seconds can be set. M920 confirms execution with string „Ok<cr>". In case of query M920 returns time constant.

Example:
Command „FTC6<cr>" sets time constant "6" seconds. After query „FLF?<cr>" flowmeter returns „6<cr>".

Min. / Max. flowrates Reset

CLRMM

Command resets "Min. Flowrate" and "Min. Flowrate" values.

M920 confirms execution with string „Ok<cr>".

Example:
Command „CLRMM<cr>" resets both min/max values.

Nominal flowrate reading

RQN?

Response contains actual flowmeters Nominal flowrate (Q_N).

Example:
If query „RQN?<cr>" is sent, flowmeter returns response in format „80.000<cr>" for nominal flowrate 80 (m3/h…).

Empty pipe detection

FEP(?)<CPD> { 0 | 1 }

Empty pipe detection can be enabled (1) or disabled (0).

- 0 Disable
- 1 Enable

M920 confirms command with string „Ok<cr>".

Example:
Command „FEP0<cr>" disables empty pipe detection. You can disable this function in case you use external empty pipe detection connected to the flowmeter's digital input. If query „FEP?<cr>" is sent, flowmeter returns response in format „0<cr>".

6.4.3.2   Volume parameters

Volume unit

FVS(?)<CPD> { 0 | 1 | 2 | 3 | 4 }

Following units can be set:

- 0   m3
- 1   l
- 2   UG
- 3   IG
- 4   "user"

M920 confirms execution with string „Ok<cr>".

Example:
Command „FVS0<cr>" sets volume unit "m3". If query „FVS?<cr>" is sent, flowmeter returns response in format „0<cr>".

Volume resolution

FVR(?)<CPD> { 0 | 1 | 2 | 3 | 4 }

Following resolution can be set:

- 0   0
- 1   0.0
- 2   0.00
- 3   0.000
- 4   0.0000

M920 confirms execution with string „Ok<cr>".

Example:
Command „FVR3<cr>" sets volume resolution "0.000". If query „FVR?<cr>" is sent, flowmeter returns response in format „3<cr>".

Volume user unit

FVU(?)<CPD>

Command sets text for volume user unit.

<CPD>

It represents user units expressed as 5 ASCII characters. M920 confirms execution with string „Ok<cr>". In case of query M920 returns set user unit.

Example:
Command „FVU dm3 <cr>" sets volume user unit " dm3 ". After query „FVU?<cr>" flowmeter returns string „ dm3 <cr>".

Conversion constant for volume user unit

FVC(?)<DNPD>

Command sets conversion constant for volume user unit with respect to [l].

<DNPD>

It represents a constant, which is calculated as a ratio between volume in user unit and volume in basic unit ([l]). For example constant for [m3] is 0.001. M920 confirms execution with string „Ok<cr>". In case of query M920 returns set constant.

Example:
Command „FVC0.001<cr>" sets constant "0.001 ". After query „FVC?<cr>" flowmeter returns „0.001000>".

Timed volume counting period

FTI(?)<CPD> { 0 | 1 | 2 | 3 }

Following periods can be set:

- 0 Day
- 1 Week
- 2 Month
- 3 Year

M920 confirms execution with string „Ok<cr>".

Example:
Command „FTI1<cr>" sets counting period 1 week.. After query „FTI?<cr>" flowmeter returns „1<cr>".

Week begin

FTW(?)<CPD> { 0 | 1 | 2 | 3 | 4 | 5 | 6 }

Following days can be set:

- 0 Monday
- 1 Tuesday
- 2 Wednesday
- 3 Thursday
- 4 Friday
- 5 Saturday
- 6 Sunday

M920 confirms execution with string „Ok<cr>".

Example:
Command „FTW0<cr>" sets Monday as begin of counting period. After query „FTW?<cr>" flowmeter returns „0<cr>".

Total volume counter Reset

CLRVO

Command resets "Total volume counter" including the positive and negative volume counter.

M920 confirms execution with string „Ok<cr>".

Example:
Command „CLRVO<cr>" resets the *Total, positive and negative volume counters*.

Auxiliary volume counter Reset

CLRAV

Command resets "Auxiliary volume counter".

M920 confirms execution with string „Ok<cr>".

Example:
Command „CLRAV<cr>" resets the *Auxiliary volume counter*.

Timed volume counter Reset

CLRTV

Command resets "Timed volume counter".

M920 confirms execution with string „Ok<cr>".

Example:
Command „CLRTV<cr>" resets the *Timed volume counter*.

6.4.3.3   *Datalogger parameters*

Datalogger step

DST(?)<CPD> { 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 }

Datalogger can be set:

- 0   Datalogger is Off
- 1   Datalogger sampling rate is 5 minutes.
- 2   Datalogger sampling rate is 10 minutes.
- 3   Datalogger sampling rate is 15 minutes.
- 4   Datalogger sampling rate is 30 minutes.
- 5   Datalogger sampling rate is 45 minutes.
- 6   Datalogger sampling rate is 60 minutes.
- 7   Datalogger sampling rate is 120 minutes.
- 8   Datalogger sampling rate is 180 minutes.
- 9   Datalogger sampling rate is 240 minutes.

M920 confirms datalogger step with string „Ok<cr>".

Example RS232:
Command „DST0<cr>" switches datalogger "Off". If query „DST?<cr>" is sent, flowmeter returns response in format „0<cr>".

Datalogger number of samples

DNR?

Response contains number of flowrate samples stored in datalogger.

Example:
If query „DNR?<cr>" is sent, flowmeter returns response in format „252<cr>" for 252 samples in datalogger.

Datalogger filling (percentage)

DPC?

Response contains datalogger filling in percent.

Example:
If query „DPC?<cr>" is sent, flowmeter returns response in format „14<cr>" for 14% datalogger full.

Datalogger filling (bytes)

DBT?

Response contains datalogger filling in bytes.

Example:
If query „DBT?<cr>" is sent, flowmeter returns response in format „1850<cr>" for 1850 bytes used.

Datalogger reading (text format)

DRT?

Response contains all values stored in internal datalogger.

Example:
If query „DRT?<cr>" is sent, flowmeter returns response in format:

```
14:28 13.10.2003     5.820 l/s
14:33 13.10.2003     4.765 l/s
14:38 13.10.2003     4.712 l/s
14:43 13.10.2003     4.792 l/s
14:48 13.10.2003     4.760 l/s
No Record
```

Datalogger reading (hex format)

DRD?

Response contains all values stored in internal datalogger.

Example:
If query „DRD?<cr>" is sent, flowmeter returns response in intel hex format:

Datalogger clear

DCLR

Command clears all data stored in internal datalogger.

M920 confirms execution with string „Ok<cr>".

Example:
Command „DCLR<cr>" clears all data in datalogger.

6.4.4   Calibration

Number of calibration points

CPN(?) <CPD> { 2 | 3 | 4 }

MAG920 confirms completion with string „Ok<cr>".

Example:
Command „CPN2<cr>" sets mode 2 calibration points. If query „CPN?<cr>" is sent, flowmeter returns response in format „2<cr>".

Nominal value of calibration point 1

CX1(?)<DNPD>

Command sets constant CX1, which represents the nominal value of calibration point 1.

<DNPD>

It represents nominal value in selected units. M920 confirms completion with string „Ok<cr>". In case of a query the M920 returns the set value in the selected unit.
Example:

Command „CX110.5<cr>" sets value CX1 to 10.5. After query „CX1?<cr>" flowmeter returns string „10.500000<cr>".

Nominal value of calibration points 2, 3 and 4

CX2, CX3, CX4

For explanation see command CX1.

Calibration constant for calibration point 1

CY1(?)<DNPD>

Command sets constant CY1, which represents the calibration constant for calibration point 1.

<DNPD>

It represents the calibration constant. M920 confirms completion with string „Ok<cr>". In case of a query the M920 returns the set value.
Example:

Command „CY110.5<cr>" sets value CY1 to 10.5. After query „CY1?<cr>" flowmeter returns string „10.500000<cr>".

Calibration constants for calibration points 2, 3 and 4

CY2, CY3, CY4

For explanation see command CY1.

6.4.5 General

6.4.5.1 Display parameters

Contrast setting

FDC(?)<DNPD>

Command sets display contrast in range 40 to 90%.

<DNPD>
Presents the contrast. M920 confirms completion with string „Ok<cr>". In case of a query the M920 returns the contrast value.

Example:
Command „FDC65<cr>" sets the contrast to 65%. If query „FDC?<cr>" is sent, flowmeter returns response in format „65<cr>".

Backlight mode setting

FDB(?)<CPD> { 0 | 1 | 2 }

You can select one of following modes:
* 0   Off - backlight is switched off
* 1   Auto of - backlight is switched on after any key is pressed and after 20s is switched off
* 2   On - backlight is switched on

M920 confirms completion with string „Ok<cr>".

Example:
Command „FDB1<cr>" sets the backlight mode "Auto of". If query „FDB?<cr>" is sent, flowmeter returns response in format „1<cr>".

Message time setting

FDM(?)<CPD> { 0 | 1 | 2 }

You can select one of following items:

* 0   Short
* 1   Normal
* 2   Long

M920 confirms completion with string „Ok<cr>".

Example:
Command „FDM2<cr>" sets the message time to "Long". If query „FDM?<cr>" is sent, flowmeter returns response in format „2<cr>".

Language setting

FLG(?)<CPD> { 0 | 1 }

You can select one of following items:

* 0   English
* 1   Cestina
* 2   Espanol

M920 confirms completion with string „Ok<cr>".

Example:
Command „FLG0<cr>" selects language "English". If query „FLG?<cr>" is sent, flowmeter returns response in format „0<cr>".

6.4.5.2 Real time clock setting

Time setting

FTM(?)<CPD> HH:MM:SS

Command sets new time for internal Real Time Clock.

<CPD>

It represents new time in format HH:MM:SS. Any value in range between 00:00:00 and 23:59:59 can be set. M920 confirms execution with string „Ok<cr>". In case of query M920 returns real time.

Example:
Command „FTM14:25:00<cr>" sets new time (2:25:00 pm). After query „FTM?<cr>" flowmeter returns „14:25:00<cr>".

Date setting

FDT(?)<CPD> DD.MM.YYYY

Command sets new date for internal Real Time Clock.

<CPD>

It represents new date in format DD.MM.YYYY. Any value in range between 01.01.2000 and 31.12.2099 can be set. M920 confirms execution with string „Ok<cr>". In case of query M920 returns real date.

Example:
Command „FDT05.03.2002<cr>" sets new date (March 5, 2002). After query „FDT?<cr>" flowmeter returns „05.03.2002<cr>".

Date format setting

FDF(?)<CPD> { 0 | 1 | 2 | 3 | 4 | 5 | 6 }

You can select one of following items:

- 0   MM/DD/YY
- 1   MM-DD-YY
- 2   DD/MM/YYYY
- 3   DD.MM.YYYY
- 4   DD-MM-YYYY
- 5   YYYY/MM/DD
- 6   YYYY.MM.DD

M920 confirms completion with string „Ok<cr>".

Example:
Command „FDF0<cr>" sets the date format "D/M/Y". If query „FDF?<cr>" is sent, flowmeter returns response in format „0<cr>".

6.4.5.3   Temperature measuring

Excitation coils temperature

ICT?

Response contains excitation coils (measured liquid) temperature.

Example:
Response contains measured temperature in format „35.2<cr>" (for 35.2 °C).

Minimum allowed coil temperature setting

FTL(?)<DNPD>

Command sets low temperature limit in range -20 to +150°C.

<DNPD>
Presents low temperature limit. M920 confirms completion with string „Ok<cr>". In case of a query the M920 returns the temperature value.

Example:
Command „FTL-20<cr>" sets the low temperature limit to -20°C. If query „FTL?<cr>" is sent, flowmeter returns response in format „-20<cr>".

Maximum allowed coil temperature setting

FTH(?)<DNPD>

Command sets high temperature limit in range -20 to +150°C.

<DNPD>
Presents high temperature limit. M920 confirms completion with string „Ok<cr>". In case of a query the M920 returns the temperature value.

Example:
Command „FTH80<cr>" sets the low temperature limit to 80°C. If query „FTH?<cr>" is sent, flowmeter returns response in format „80<cr>".

Electronic unit temperature (display)

IT?

Response contains temperature inside the electronic unit. This temperature should be in range -20 to +75°C.

Example:
Response contains measured temperature in format „35.2<cr>" (for 35.2 °C).

6.4.5.4   Password setting

Password

PSW<DNPD>

Command enters password, that enables access to flowmeter's settings. Password can be change with new command PSW.

Example:
Command „PSW12345<cr>" enters password 12345.

Actual access level

PAL(?)<CPD> { 0 | 1 | 2 | 3 }

Command can set the access level to 0. Query returns the actual access level.

Available levels:

- 0   Without access
- 1   Basic access level
- 2   Calibration access level
- 3   Service access level

Example:
If query „PAL? <cr>" is sent flowmeter returns response in format "2<cr>", for "Calibration access level".
Command „PAL0<cr>" sets the flowmeter to access level 0 (without access).

Magnetic pointer control (clear by magnet)

FME(?)<CPD> { 0 | 1 }

Command enables the possibility to clear certain value using magnetic pointer.

You can select one of following items:

- 0   Disabled
- 1   Enabled

M920 confirms completion with string „Ok<cr>".

Example:
Command „FME1<cr>" enables "clear by magnet". If query „FME?<cr>" is sent, flowmeter returns response in format „1<cr>".

Basic access password setting

FPB(?)<DNPD>

Command changes the password valid for access level "Basic".

<DNPD>
Presents new password in range 0 to 99999. M920 confirms completion with string „Ok<cr>".

Example:
Command „FPB520<cr>" sets basic password "520". If query „FPB?<cr>" is sent, flowmeter returns response in format „520<cr>".

Calibration access password setting

FPC(?)<DNPD>

Command changes the password valid for access level "Calibration".

<DNPD>
Presents new password in range 0 to 99999. M920 confirms completion with string „Ok<cr>".

Example:
Command „FPC520<cr>" sets calibration password "520". If query „FPC?<cr>" is sent, flowmeter returns response in format „520<cr>".

6.4.5.5   Service information

Device identification

IDN?

Response contains flowmeter's model type number.

Example:
If query „IDN?<cr>" is sent, flowmeter returns response in format „M920-Vxxxx<cr>".

Nominal diameter reading

RDN?

Response contains actual flowmeter's Nominal diameter (DN).

Example:
If query „RDN?<cr>" is sent, flowmeter returns response in format „50<cr>" for nominal diameter 50mm.

Power supply type

PPW(?)<CPD> { 0 | 1 | 2 }

Command sets the power supply type (frequency of excitation current):

- **0 - Auto** (power supply 85 to 264Vac, 50/60 Hz)
- **1 - DC 50Hz** (DC power supply, frequency 50 Hz)
- **2 - DC 60Hz** (DC power supply, frequency 60 Hz)

M920 confirms completion with string „Ok<cr>".

Example:
Command „PPW0<cr>" sets frequency selection to Auto (AC power supply). If query „PPW?<cr>" is sent, flowmeter returns response in format „0<cr>".

+5V power supply

IU1?

Response contains measured value of +5V internal power supply. Accuracy is not guaranteed (value is informative).

Example:
If query „IU1?<cr>" is sent, flowmeter returns response in format „4.994<cr>" for voltage 4.994 V.

+15V power supply

IU2?

Response contains measured value of +15V internal power supply. Accuracy is not guaranteed (value is informative).

Example:
If query „IU2?<cr>" is sent, flowmeter returns response in format „14.94<cr>" for voltage 14.94 V.

-15V power supply

IU3?

Response contains measured value of -15V internal power supply. Accuracy is not guaranteed (value is informative).

Example:
If query „IU3?<cr>" is sent, flowmeter returns response in format „-14.84<cr>" for voltage -14.84 V.

Excitation coils resistance

ICO?

Response contains measured value of excitation coil resistance. Accuracy is not guaranteed (value is informative).

Example:
If query „ICO?<cr>" is sent, flowmeter returns response in format „104.7<cr>" for resistance 104.7 Ω.

6.4.5.6   Self-test

Internal flowrate simulator

FIS(?)<CPD> { 0 | 1 }

Command enables (disables) internal flowrate simulator.

You can select one of following items:

- 0   Off
- 1   On

M920 confirms completion with string „Ok<cr>".

Example:
Command „FIS1<cr>" enables internal simulator. If query „FIS?<cr>" is sent, flowmeter returns response in format „1<cr>".

7   Error messages

When any error occurs, the flowmeter will display an error message. Errors can arise because of:

- Incorrect control, i.e. faulty connection to the flowmeter, grounding, etc.,

- Flowmeter failure

```
ERROR 10
Empty pipe
```

In case of any error, the error message is displayed on the display for approx. 1 to 5 seconds. The same error message can be read by computer using RS232 or RS485 (command IER?).

After switching on, an internal test of the hardware is performed. If there were any error during the power on test, the flowmeter would display the appropriate error message.

Types of errors and methods of troubleshooting (if available) are in following table:

Nr	Error	Meaning	Troubleshooting
01	SPI Busy	Internal communication error.	Internal error. Turn the flowmeter off and after 5 s turn on. If the error will appear again, contact manufacturer.
02	ADC Init	Internal communication error.	Internal error. Turn the flowmeter off and after 5 s turn on. If the error will appear again, contact manufacturer.
03	ADC Long measure	Internal communication error.	Internal error. Turn the flowmeter off and after 5 s turn on. If the error will appear again, contact manufacturer.
04	ADC Overload	Parasitic signal on electrodes.	Parasitic signal in measured liquid (frequency converter, poor grounding) or dirty electrodes (check electrodes). This error can be displayed also for empty pipe in case that empty pipe indication is disabled.
05	Excitation short	Short circuit on the excitation terminals. (Resistance of excitation coils is lower than 50 Ohms)	Resistance of excitation coils is too low (short circuit). Check sensor connection.
06	Period measure	Unstable frequency of power supply voltage.	Measuring is not synchronized with the power supply voltage and can be out of specification. Turn the flowmeter off and after 5 s turn on.
07	RS232 frame	Valid stop bit not received.	Wrong communication format. Check the communication baud rate.
08	Current open	Current loop is disconnected.	Connect the current output or switch the current output OFF (if it is not used). This message can be disabled in "Setup menu".
09	DSP timeout	Internal communication error.	Internal error. Turn the flowmeter off and after 5 s turn on. If the error will appear again, contact manufacturer.
10	Empty pipe	No liquid in pipe	Fill the pipe with liquid. In case there is liquid in the pipe, clean electrodes and check connection cables between sensor and electronic.
11	Excitation open	Resistance of excitation coils is higher than 250 Ohm.	Resistance of excitation coils is too high (open circuit). Check sensor connection.
12	Frequency over	Incorrect setting of frequency output.	Generated frequency is over 12kHz. Correct the frequency output setting.
13	Current over	Incorrect setting of current output.	Generated current is over 20mA. Correct the current output setting.
14	Pulse over	Incorrect setting of pulse output.	Generated frequency of pulses is higher than selected pulse width. Correct the pulse output setting.
15	Datalogger full	Memory of datalogger is full.	Read the datalogger using the FlowAssistant software.
16	Flowrate over	Measured flowrate doesn't correspond with nominal diameter.	Check the nominal diameter setting.
17	Temperature out	Temperature of excitation coils is out of limits.	Temperature of excitation coils (measured liquid) is out of limits. In case of need change the limits.

Except of errors mentioned above the flowmeter reports also errors caused by incorrect communication with the computer. These errors are described in the chapter „Remote control".

8   Maintenance

The inductive flowmeter is an electronic device with circuits protected with built-in electronic fuses. These protect the instrument against damage caused by the user.

8.1   Advice for correct operation

The following principles should be consider during installation:

- *If there is a noisy power supply voltage (especially peaks generated, usually by motors, etc.), use an external power supply filter between the flowmeter and power supply.*

- *Protect the flowmeter and the internal lining of the sensor pipe from mechanical damage, especially during installation or cleaning.*

- *Protect the flowmeter from direct sunlight. Fit a sunshade if necessary.*

- *Do not expose the flowmeter to intense vibration.*

8.2   Periodical maintenance

The flowmeter does not require any special maintenance. Dependent on the media being measured it is recommended that approx. once a year, remove the sensor from the pipe and clean the liner. Method of cleaning consists of removing mechanical dirt and any non-conductive coating (like oil film) from the liner. A very dirty liner could cause inaccuracy of the measurement. Check mechanical state of the liner.

8.3   What to do in case of failure

If an **obvious failure** occurs during the operation (e.g. the display is not lit), the flowmeter must be switched off immediately. First, check the fuse located under the electronic board cover.

- Turn off the power to the flowmeter.

- Remove the cover from the transmitter

- The fuse holder is located behind the power supply terminals. Remove the fuse. Replace it with a new fuse of   the same rating if necessary

- Replace the cover.

- Connect power supply again.

If an obvious fault is evident, e.g. a measurement range or an operating mode is not functional, the user cannot correct the fault.

Hidden faults can cause different symptoms. Usually, they cause instability of some parameters. Hidden defects can be caused by unacceptable distortion, degraded insulation etc. In this case contact Distributor.

The flowmeter can have "hidden defects", when correct operation rules are not applied. In this case, the fault can be caused by wrong installation. Most frequent cases of false "hidden defects":

- mains voltage out of tolerance limits or unstable

- poor grounding of the measuring circuit (bad connection of the ground terminal)

large electrostatic or electromagnetic field.

9 Application information

9.1 Weight and dimensions

Flowmeter weight and dimensions depend mostly on the version (remote or compact) and diameter of the pipe.

9.1.1 Electronic unit – compact version

The pictures below show dimensions of the electronic unit for the compact version. Dimensions are in millimetres.
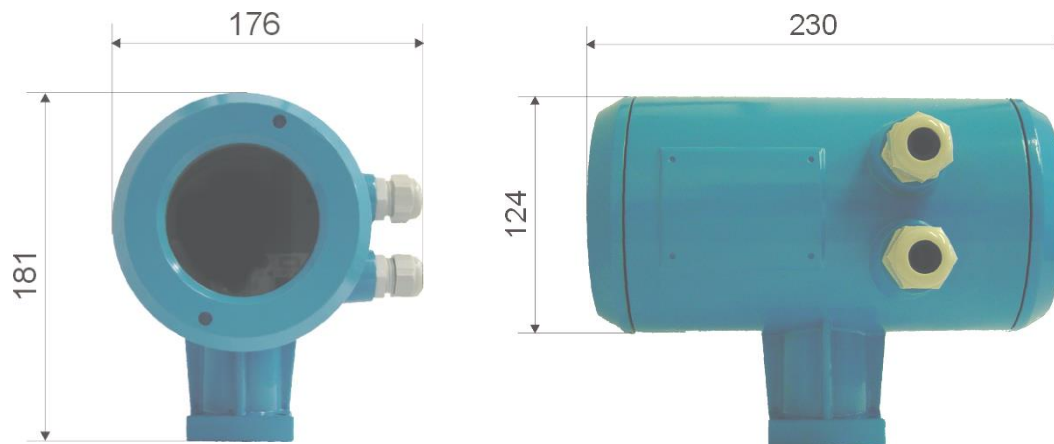
Weight: 3.8 kg

9.1.2 Electronic unit – remote version
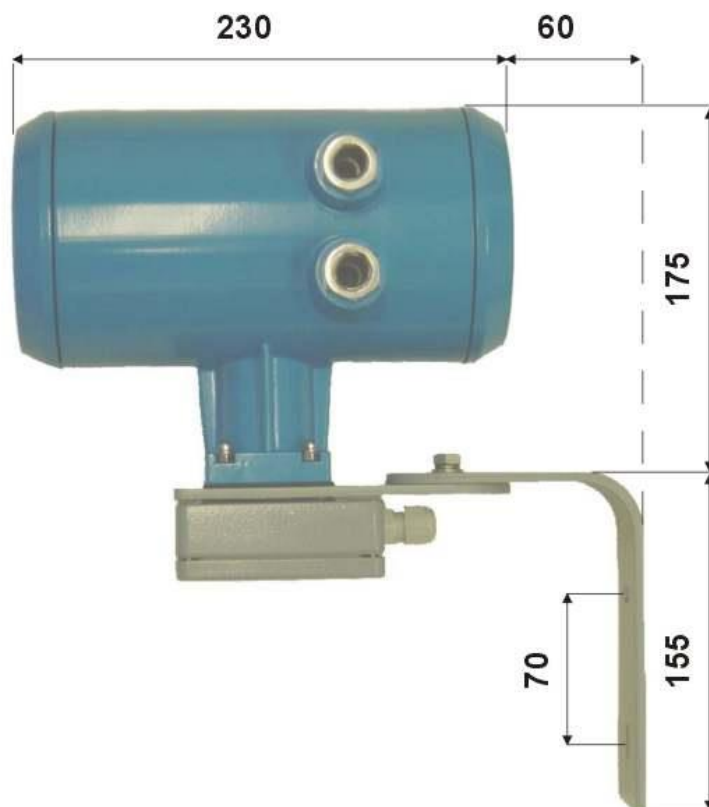
The picture shows dimensions of the electronic unit for the remote version. Dimensions are in millimetres.

Weight: 5.1 kg

9.1.3   Sensor

In the table below are the dimensions of the sensor for compact version. In case of remote version add 120 millimetres to dimension "A" for cable gland and cable. Flanges in DIN version meet standard EN1092. Flanges in ANSI version meet requirements of ANSI B 16.5 standard.
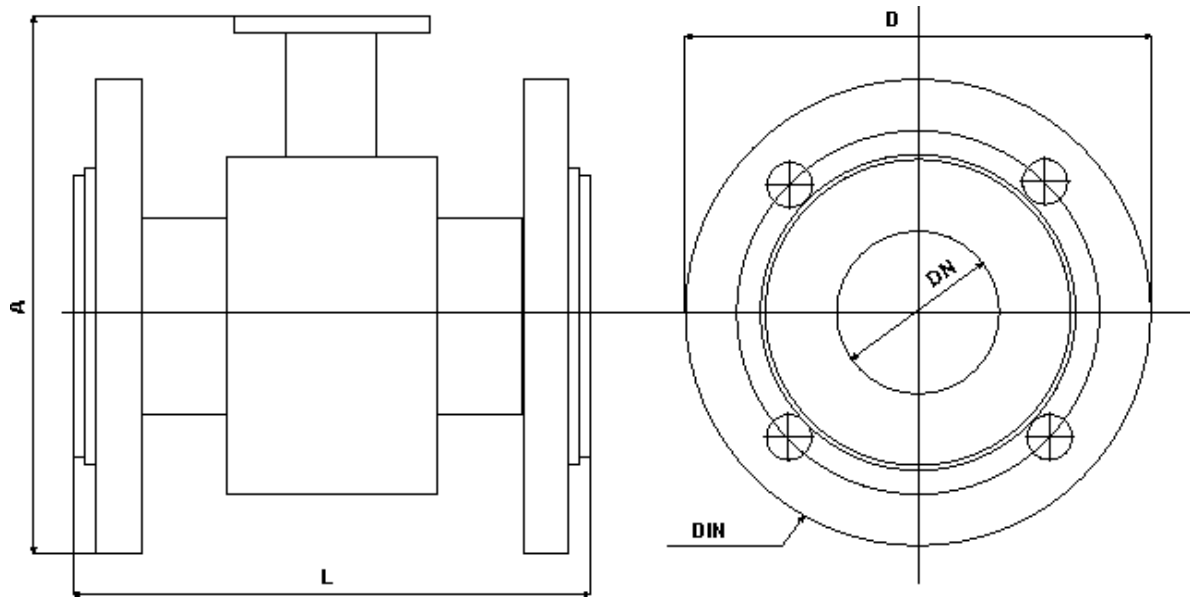
DN (mm)	PN (bar)	D (mm)	A (mm)	L (mm)	Weight (kg)
15	16	95	145	200	3
20	16	105	150	200	3,5
25	16	115	155	200	4
32	16	140	165	200	5
40	16	150	175	200	5
50	16	165	185	200	7
65	16	185	200	200	8,5
80	16	200	215	200	10
100	16	220	235	250	13
125	16	250	265	250	17
150	16	285	295	300	22
200	16	340	355	350	31
250	10	395	435	450	44
300	10	445	485	500	57
350	10	505	535	550	72
400	10	565	580	600	95
500	10	670	695	600	120
600	10	780	800	600	160
700	10	895	900	700	230
800	10	1015	1010	800	330

Table 1: M920 dimensions and weights – DIN flanges

9.2   Used materials

Electromagnetic flowmeter is made from materials, which meet international standards and conventions.

Liner:	Hard rubber Teflon - PTFE	as standard
Electrodes	CrNi stainless steel 1.4571 Hastelloy C-4 Tantalum	as standard
Sensor tube	Stainless steel 1.4201,	dimensions according to DIN 17457
Flange	Carbon steel 1.0402 or higher,	dimensions according to DIN2501 (=EN1092=BS 4504), ANSI B16.5, JIS B2220, Sanitary DIN11851, flangeless wafer style

9.3   *Flowrate versus diameter*

The choice of flowrate for an electromagnetic flowmeter depends on the diameter of the sensor. The higher pipe diameter, the higher flowrate can be measured. A determining parameter for flowrate is maximum velocity of the liquid. Maximum velocity is the speed, where the flow of liquid inside pipe is still laminar. In M920 it is limited to 10m/s (with 125% overload). Speed over 10 m/s is usually too high for industrial applications. Such diameter of pipe is usually selected, where expected flowrate is between $Q_{5\%}$ and $Q_{50\%}$.

In the table below applicable flowrates for various diameters is displayed in units l/s and m^3/hr.

DN	Flowrates [l/s]						Flowrates [m3/h]					
	$Q_{0.3\%}$	$Q_{5\%}$	Q_N	$Q_{50\%}$	$Q_{100\%}$	Q_{MAX}	$Q_{0.3\%}$	$Q_{5\%}$	Q_N	$Q_{50\%}$	$Q_{100\%}$	Q_{MAX}
15	0,005	0,09	0,50	0,88	1,77	2,21	0,06	0,32	2,00	3,18	6,36	7,95
20	0,009	0,16	0,90	1,57	3,14	3,93	0,11	0,57	3,20	5,65	11,31	14,14
25	0,015	0,25	1,40	2,45	4,91	6,14	0,18	0,88	5,00	8,84	17,67	22,09
32	0,024	0,40	2,20	4,02	8,04	10,05	0,3	1,5	8,00	14,5	29,0	36,2
40	0,04	0,6	4,0	6,3	12,6	15,7	0,5	2,3	13,0	22,6	45,2	56,6
50	0,06	1,0	6,0	9,8	19,6	24,5	0,7	3,5	20,0	35,3	70,7	88,4
65	0,10	1,7	9,0	16,6	33,2	41,5	1,2	6,0	35,0	59,7	119,5	149,3
80	0,15	2,5	14,0	25,1	50,3	62,8	1,8	9,0	50,0	90,5	181,0	226,2
100	0,24	3,9	20,0	39,3	78,5	98,2	3	14	80	141	283	353
125	0,4	6	30,0	61	123	153	4	22	150	221	442	552
150	0,5	9	50,0	88	177	221	6	32	200	318	636	795
200	0,9	16	100	157	314	393	11	57	300	565	1131	1414
250	1,5	25	150	245	491	614	18	88	500	884	1767	2209
300	2,1	35	200	353	707	884	25	127	800	1272	2545	3181
350	2,9	48	300	481	962	1203	35	173	1000	1732	3464	4330
400	3,8	63	400	628	1257	1571	45	226	1300	2262	4524	5655
500	5,9	98	600	982	1963	2454	71	353	2000	3534	7069	8836
600	8,5	141	800	1414	2827	3534	102	509	3000	5089	10179	12723
700	12	192	1000	1924	3848	4811	139	693	4000	6927	13854	17318
800	15	251	1200	2513	5027	6283	181	905	5000	9048	18096	22620

$Q_{0.3\%}$ - minimum applicable flowrate (minimum flowrate with guaranteed accuracy)
$Q_{5\%}$ - recommended minimum flowrate (minimum flowrate with best accuracy)
Q_N - recommended nominal flowrate (expected working flowrate)
$Q_{50\%}$ - recommended maximum flowrate (maximum flowrate for industrial use)
$Q_{100\%}$ - maximum applicable flowrate (maximum flowrate with guaranteed accuracy)
Q_{MAX} - maximum applicable overload ($Q_{125\%}$) (flowmeter is still measuring)

Table 2: M920 flowrates

A sensor diameter should be chosen to keep real flowrate between $Q_{5\%}$ and $Q_{50\%}$, because in this range the flowmeter has the best accuracy.

10 Type plate

Compact version

The type plate is located on the sensor. The following information is on the plate:

	Flow direction
	Type
	DN – nominal diameter (15 … 800 mm) **PN – nominal pressure** (10 … 40 x100kPa)
	Serial number
	Production Year
	Flowrate range
	Protection
	Power supply version
	Manufacturer

MEATEST

M920-V0000

DN / PN: 100 / 16
S.n.:   310541
Zelezna 509/3   **Year: 2016**
619 00 Brno   **Q: 0..80 m³/h**
www.meatest.com

IP 67
230/115V – 50/60Hz

CE
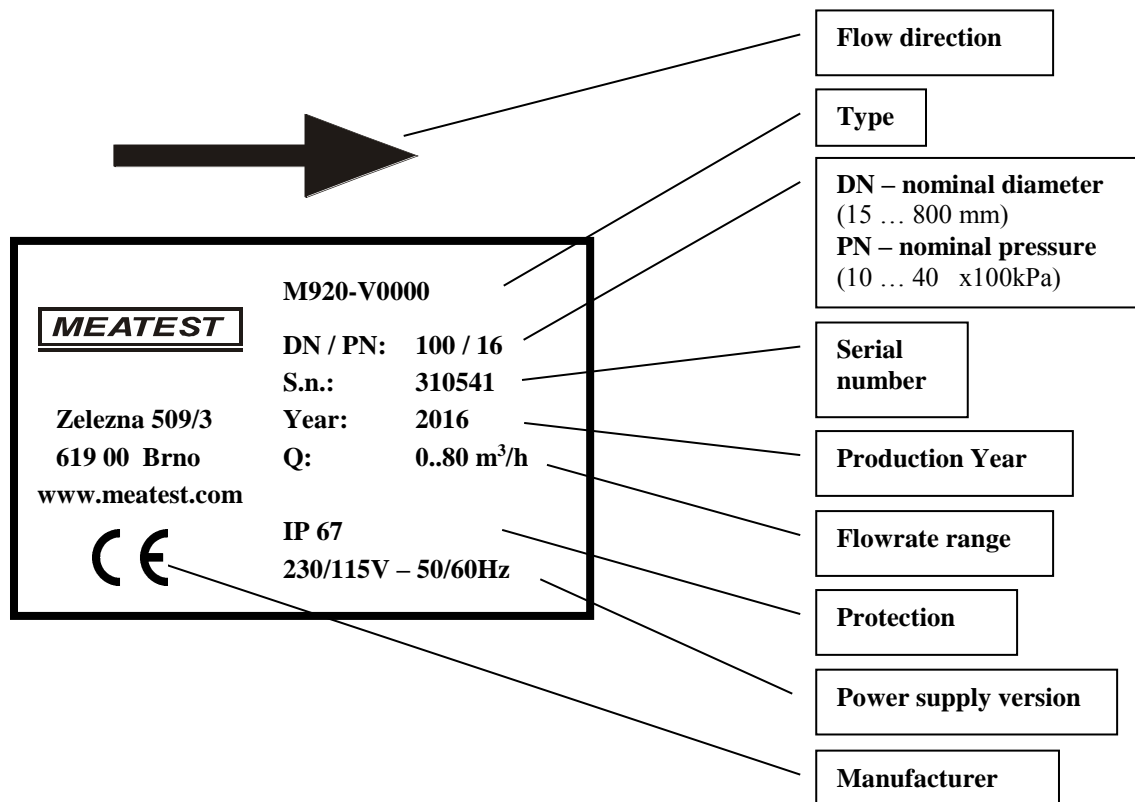
Remote version

Type plate on the **flanged sensor**:
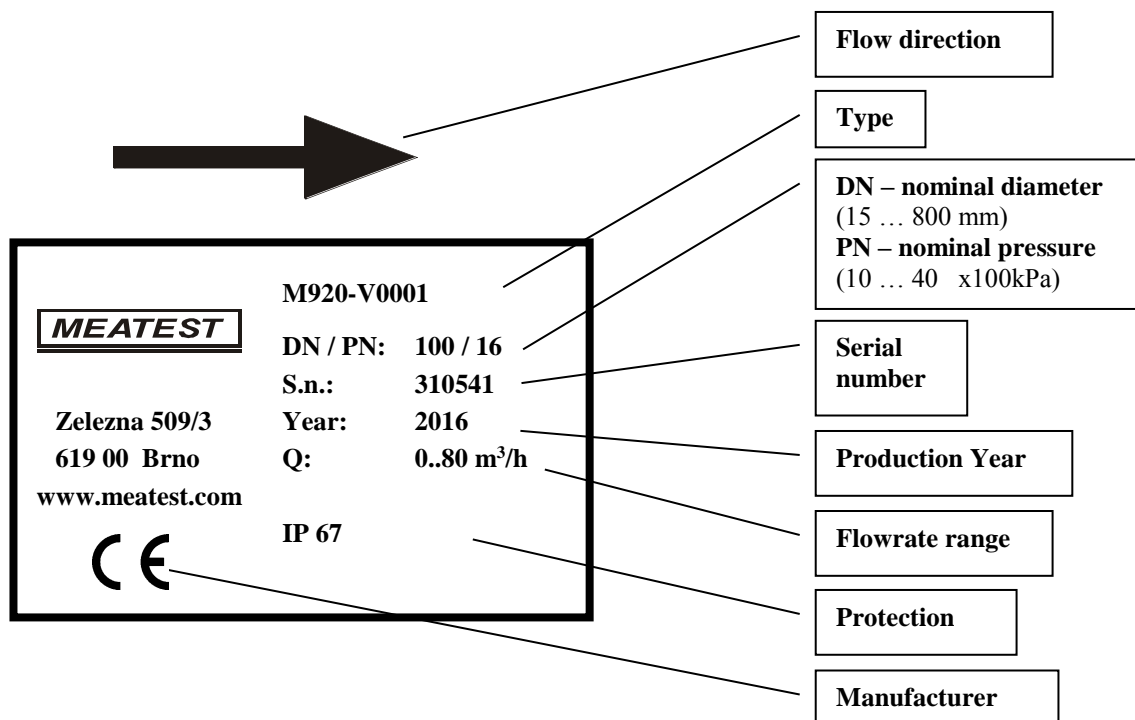
Type plate on the **converter**:

11 Technical data

Nominal size	DN15 to DN800
Nominal pressure	PN10 to PN40
Flow range	0.03 to 12 m/s (0.01 to 6000 l/s) / (0.03 to 21000 m3/h)
Accuracy	• 0.25 % (0.5 to 12 m/s) of reading value • 0.003 m/s (0.03 to 0.5 m/s)
Maximum media temperature	80°C (176°F) for rubber liner 150°C (302°F) for PTFE liner in remote version
Minimum electrical conductivity	$\geq$ 5 μS / cm
Ambient temperature	-20 to 60 °C (-4 to 140°F)
Excitation coils temperature	-20 to 150 °C (-4 to 302°F)
Power supply	• 115/230V (85 to 264 V AC), 50/60Hz, (M920-Vxx0x) • 12V DC (+20%, -10%) (M920-Vxx1x) • 24V DC (+20%, -10%) (M920-Vxx2x) • 48V DC (+20%, -10%) (M920-Vxx3x)
Power consumption	10 VA
Liner	• hard rubber • PTFE
Electrodes	• CrNi stainless steel 1.4571 • Hastelloy C-4 • Tantalum
Measuring tube	Stainless steel 1.4201, dimensions according to DIN 17457
Flange	Carbon steel 1.0402 or higher Dimensions according to DIN2501 (=EN1092=BS 4504), ANSI B16.5, JIS B2220, Sanitary DIN11851, flangeless wafer style
Protection category	• Compact version: IP67 • Remote version: sensor IP68, converter IP65- optionally IP67
Outputs	• Frequency 0 to 12 kHz with programmable flowrate and function • Pulse 0 to 200 Hz with programmable volume, function and pulse width • Relay contacts 100V/0.5A with programmable function • Current loop 4 to 20 mA with programmable flowrate and function
Input	PLC digital input with programmable function
Communication	• RS232, RS485 (Modbus)
Displayed values	• Flowrate (m3/h, l/s, US.Gal/min, Imperial.Gal/min, user) • Volume (m3, l, US.Gal, Imperial.Gal, user) • Positive, total, negative and auxiliary (clearable, daily) volume
Control	• Keyboard • Magnetic pointer • RS232 and RS485
Other features	• Test of: excitation coils, sensor, electronic unit • Diagnostic of internal temperature and power supply voltages • Internal temperature and power supply diagnostic • Real time clock • Empty pipe indication • Datalogger 10000 - 15000 records (programmable sample rate) • Registration of min. and max. flowrate including date and time
Languages	English, Spanish, Czech

12 Ordering information - options

Liner
M920-V0xxx   hard rubber
M920-V2xxx   teflon PTFE

Electrodes
M920-Vx0xx   CrNi steel
M920-Vx1xx   hastelloy C-4
M920-Vx2xx   tantalum

Power supply voltage/frequency
M920-Vxx0x   power supply 85 to 264V, 50/60 Hz
M920-Vxx1x   power supply 12V DC
M920-Vxx2x   power supply 24V DC
M920-Vxx3x   power supply 48V DC

Construction
M920-Vxxx0   compact version
M920-Vxxx1   remote version

12.1 Example of order

M920-V0000 DN50 PN16   Liner: hard rubber
                                Electrodes: CrNi steel
                                Power supply: 85 … 264 V AC
                                Construction: compact version
                                Nominal diameter: 50 mm
                                Nominal pressure: 16 bar

M920-V2120 DN15 PN25   Liner: PTFE
                                Electrodes: hastelloy C-4
                                Power supply: 24 V DC
                                Construction: compact version
                                Nominal diameter: 15 mm
                                Nominal pressure: 25 bar

13 Terminology

Special symbols and terms.

Flowrates:

$Q_{1\%}$ - minimum applicable flowrate (the least flowrate which has guaranteed measuring accuracy – depends on diameter – see table 2 M920 flowrates).

$Q_{5\%}$ - recommended minimum flowrate (least flowrate which has the best measuring accuracy – depends on diameter – see table 2 M920 flowrates).

Q_N - recommended nominal flowrate (nominal flowrate in which is flowmeter usually calibrated – depends on diameter – see table 2 M920 flowrates). You can predetermine this nominal flowrate in your order.

$Q_{50\%}$ - recommended maximum flowrate (maximum flowrate which is usually used in industrial applications – depends on diameter – see table 2 M920 flowrates).

$Q_{100\%}$ - maximum applicable flowrate (flowrate limit which has guaranteed measuring accuracy – depends on diameter – see table 2 M920 flowrates).

Q_{MAX} - maximum applicable overload ($Q_{125\%}$) (maximum flowrate which can be still measured – depends on diameter – see table 2 M920 flowrates).

Abbreviations:

QI   - current output constant. It represents flowrate for current 20 mA.

QF   - frequency output constant. It represents flowrate for frequency 1000 Hz.

QP   - impulse output constant. It represents volume for 1 impulse.

QD   - constant for dosing. It represents volume for 1 dose.

PF1   - flowrate limit constant. It represents low limit flowrate. Crossing this limit activates the appropriate digital output.

PF2   - flowrate limit constant. It represents high limit flowrate. Crossing this limit activates the appropriate digital output.

**H**   - flowrate limit constant. It represents hysteresis by evaluating limits PF1 and PF2.

Auxiliary volume counter – second Total Volume counter. Can be cleared by pushing "RIGHT" key. It is usually used for measuring volume during day, month etc.

RS232 – serial bus. It enables remote control of instruments by a computer. Only one instrument can be connected to one RS232 bus. Cable length between PC and instrument is limited to app. 10 metres.

RS485 – serial bus. It enables remote control of instruments by a computer. To the RS485 can be connected more instruments (max. 16). Total cable length is limited to app. 800 metres.

Appendix A   Measuring principle

The flowmeter is designed for electrically conductive fluids. Measurement is based on Faraday's law of induction, according to which a voltage is induced in an electrically conductive body, which passes through a magnetic field. The following expression is applicable to the voltage:
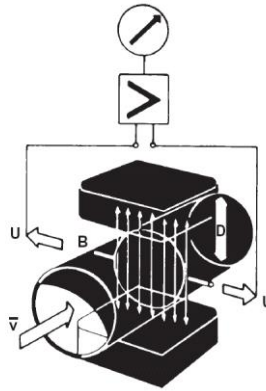
U = K x B x v x D

where:

       U = induced voltage
       K = an instrument constant
       B = magnetic field strength
       v = mean velocity
       D = pipe diameter

Thus the induced voltage is proportional to the mean flow velocity, when the field strength is constant.
Inside the electromagnetic flowmeter, the fluid passes through a magnetic field applied perpendicular to the direction of flow. An electric voltage is induced by the movement of the fluid (which must have a minimum
electrical conductivity). This is proportional to the mean flow velocity and thus to the volume of flow. The induced voltage signal is picked up by two electrodes, which are in conductive contact with the fluid and transmitted to a signal converter for a standardized output signal. This method of measurement offers the following advantages:

- No pressure loss through pipe constriction or protruding parts.
- Since the magnetic field passes through the entire flow area, the signal represents a mean value over the pipe cross-section; therefore, only relatively short straight inlet pipes x DN from the electrode axis are required upstream of the primary head.
- Only the tube liner and the electrodes are in contact with the fluid.
- Already the original signal produced is an electrical voltage, which is an exact linear function of the mean flow velocity.
- Measurement is independent of the flow profile and other properties of the fluid.

The magnetic field of the primary head is generated by a square wave current fed from the signal converter to the field coils. This field current alternates between positive and negative values. Alternate positive and negative flowrate-proportional signal voltages are generated at the same frequency by the effect of the magnetic field, which is proportional to the current. The positive and negative voltages at the primary head electrodes are subtracted from one another in the signal converter. Subtraction always takes place when the field current has reached its stationary value, so that constant interference voltages or external or fault voltages changing slowly in relation to the measuring cycle are suppressed. Power line interference voltages coupled in the primary head or in the connecting cables are similarly suppressed.

Appendix B   M920 Menu structure

M920 has three access levels for parameter's setting:
- **Basic (user access)**
- **Calibration (calibration laboratory)**
- **Service (service organization)**

Every parameter has minimal access level which allows you to change it.
Access to parameters is enabled after pushing the key "ENTER" from the *Main menu* and after entering the password. Access level is defined by used password.

Setup menu has following folders:

- INPUT/OUTPUT
- FLOWMETER
- CALIBRATION
- GENERAL

INPUT/OUTPUT	CURRENT OUT	CURRENT MODE	
		FIXED CURRENT	
		FLOW FOR 20mA	
		LOOP TEST	
	FREQUENCY OUT	FREQUENCY MODE	
		FIXED FREQUENCY	
		FLOW FOR 1kHz	
	PULSE OUT	PULSE MODE	
		PULSE WIDTH	
		VOLUME FOR 1 IMP	
	STATE OUT	STATE MODE	
		ERROR MASK	
	DIGITAL INPUT		
	LIMITS	LIMIT PF1	
		LIMIT PF2	
		HYSTERESIS	
	DOSE	DOSING VOLUME	
		ACTUAL DOSE	
		CLEAR DOSE	
FLOWMETER	FLOW	UNIT	
		RESOLUTION	
		USER UNIT	
		USER CONSTANT	
		DIRECTION	
		L.F.CUTOFF	
		TIME CONSTANT	
		RANGE	
		EMPTY PIPE	
		CLEAR MIN/MAX	
	VOLUME	UNIT	
		RESOLUTION	
		USER UNIT	
		USER CONSTANT	
		TIMED VOLUME	PERIOD
			WEEK BEGIN
		CLEAR VOLUME	
	DATALOGGER	INTERVAL	
		FILLING	
		CLEAR	

CALIBRATION	NUMBER OF CAL.P		
	CAL. POINT 1	FLOWRATE	
		CONSTANT	
	CAL. POINT 2	FLOWRATE	
		CONSTANT	
	CAL. POINT 3	FLOWRATE	
		CONSTANT	
	CAL. POINT 4	FLOWRATE	
		CONSTANT	
GENERAL	INTERFACE	RS232	RS232 BAUDRATE
		RS485	RS485 MODE
			RS485 BAUDRATE
			ADDRESS
			MODBUS PARITY
			MODBUS ADDRESS
	DISPLAY	CONTRAST	
		BACKLIGHT	
		MESSAGE TIME	
		LANGUAGE	
	DATE/TIME	ACTUAL TIME	
		ACTUAL DATE	
		DATE FORMAT	
	TEMPERATURES	COIL TEMP.	COIL TEMP.
			LOW LIMIT
			HIGH LIMIT
		DISPLAY TEMP.	
	USER ACCESS	BASIC PASSWORD	
		CAL. PASSWORD	
		CLEAR BY MAGNET	
	INFO	SERIÁL NUMBER	
		VERSION	
		DIAMETER	
		POWER LINE	
		VOLTAGE+5V	
		VOLTAGE +15V	
		VOLTAGE -15V	
		COIL RESISTANCE	
	SELFTEST	INT. SIMULATOR	
		GAIN	