M910 / M910E *Electromagnetic flowmeter*

User's manual

1 Basic information

1.1 Basic features

The inductive flow meter M910 is designed to measure, indicate and record the instantaneous and total flow of the conductive media flowing through the sensor. The flow meter M910 records both forward and reverse flows. As there are no moving parts in the flow profile the M910 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 M910 is for use in the Chemical Industry, Paper Industry, Water and Wastewater Treatment Industry and most other process industries.

Features. The inductive flowmeter M910 is a highly accurate and stable device. The construction of the M910 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 M910 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. Status and RS485 outputs are not available in M910E.

Power supply. Available versions are: 115V/230V AC and 12, 24 or 48V DC.

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:

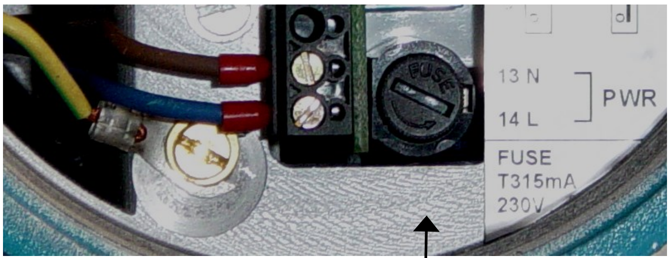
- Flanged sensor
- Electronic Transmitter (can be integral or remote)
- Spare fuse
- Operating manual.
- Calibration certificate
- Special wrench for opening the housing covers
- Magnetic pointer
- Software FlowAssistant
- RS232 cable

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 230/115V 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.



Fuse holder

- Screw on the back cover.
- Reconnect the power supply.

Note:

- *T315mA fuse is used for 115/230 V version*
- *1A fuse is used for 24 and 48 V DC versions*
- *2A fuse is used for 12 V DC*

2.3 Power supply

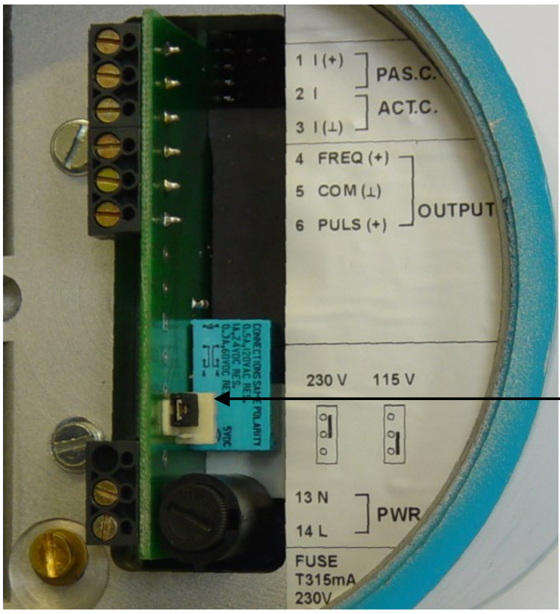
From a power supply point of view the flowmeter is delivered in four basic versions:

- **115/230V** AC (+10%, -15%), 50/60Hz, automatic switching for M910 (manual switching for M910E)
- **12V** DC (+20%, -10%)
- **24V** DC (+20%, -10%)
- **48V** DC (+20%, -10%)

2.4 Power supply voltage selection (M910E, 115/230V version only)

M910E is equipped with a power supply voltage selector, which enables the use of both 115VAC and 230VAC supply voltage. The selector is located on the PC board (see below). It is accessible after removing the cover as follows:

- Disconnect the power supply from the flowmeter.
- Unscrew the back cover using the special wrench (standard part of delivery).
- The power supply voltage selector is located behind the back cover. Move the jumper to the required position.
- Screw on the back cover.
- Reconnect the power supply.



Power supply voltage selector

Note: M910 is equipped with automatic power supply selector.

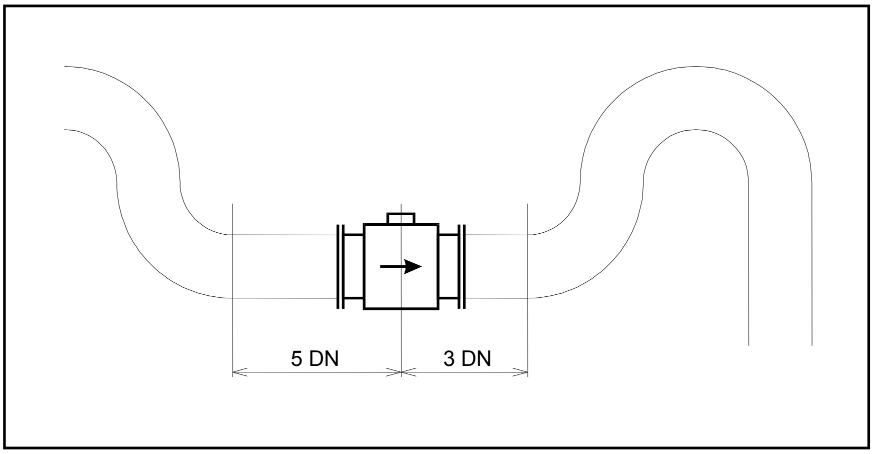
3 Installation

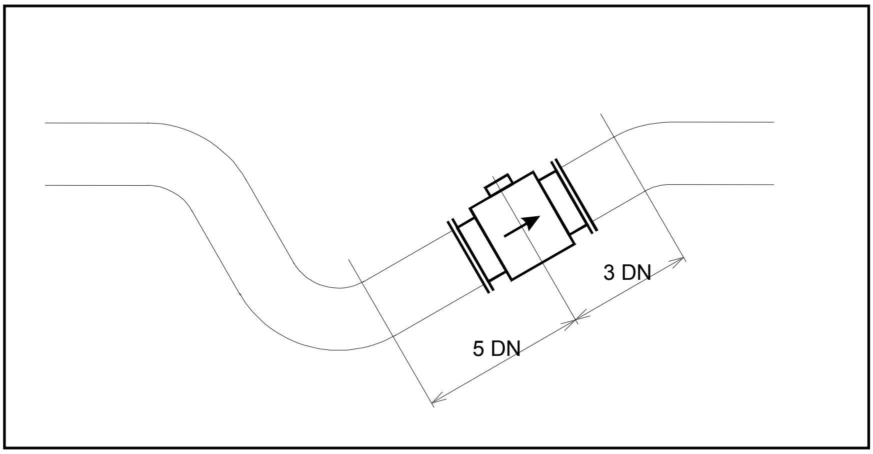
3.1 Sensor location

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

Horizontal (standard) mounting

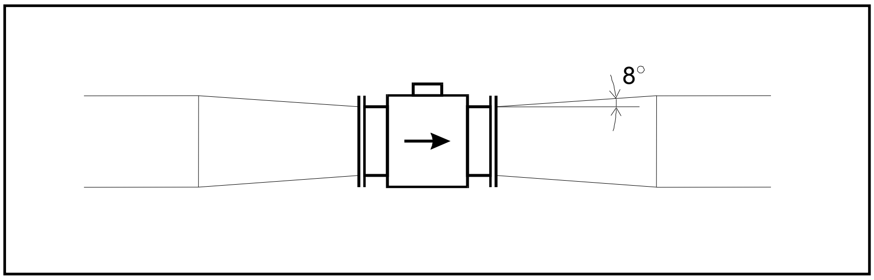
The sensor tube must always remain full. The best way to achieve this is to locate the sensor in a low section of pipe, see the following picture. It is recommended to install the sensor in a section of straight pipe with at least 5 times the pipe diameter before sensor and 3 times after sensor.





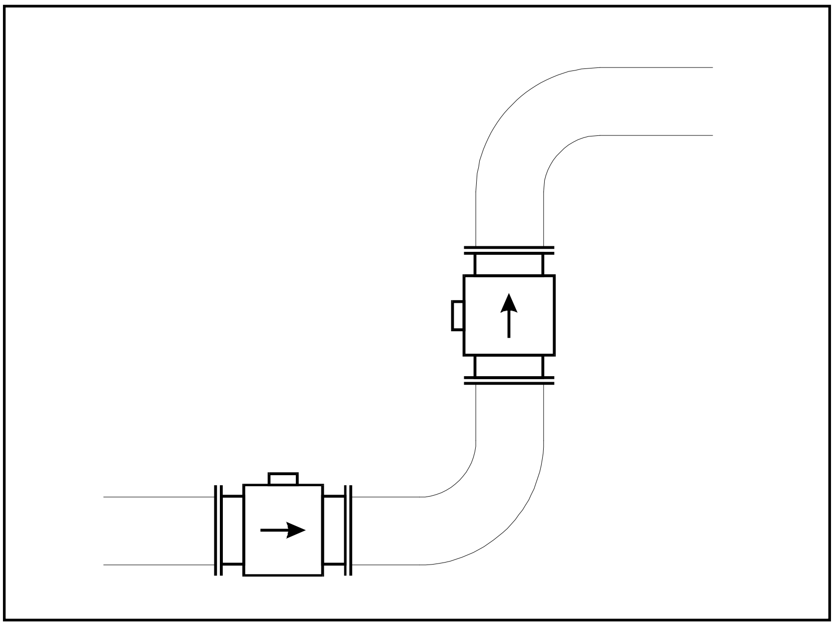
Pipe reducers

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°.



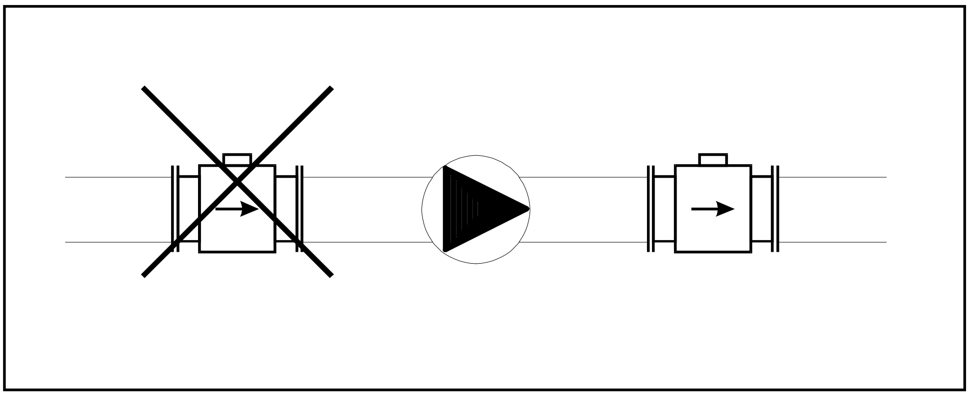
Vertical mounting

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.



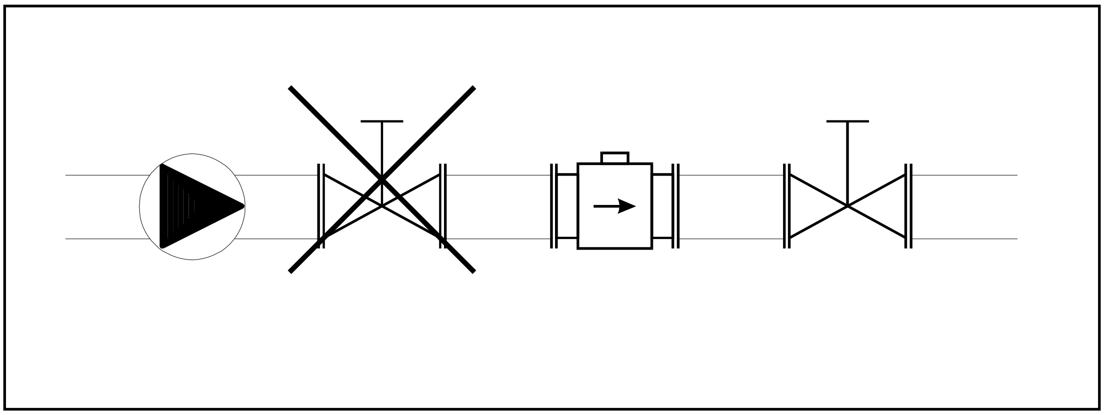
Pumps

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



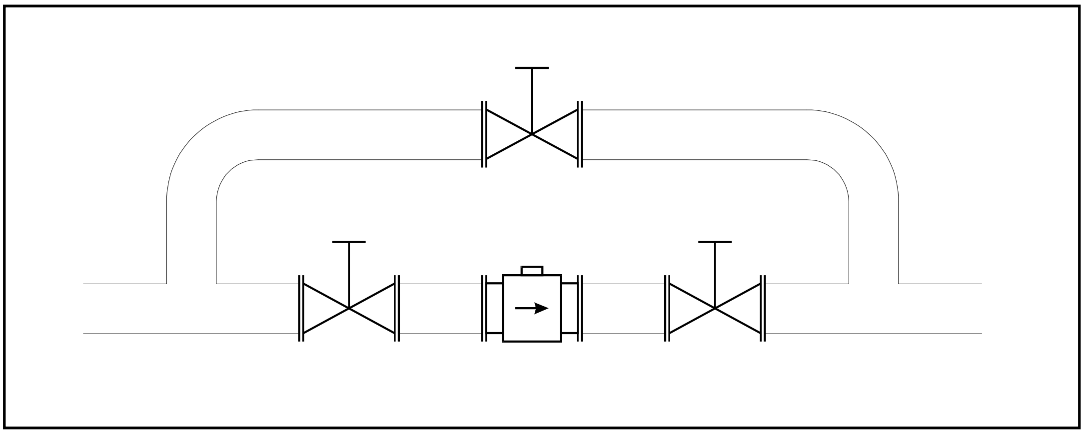
Valves

Suitable location of a shutoff valve is downstream of a sensor.



Removal during maintenance

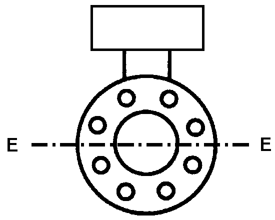
If the application requires removal of the sensor for periodic maintenance, it is recommended to install a bypass section as the following drawing.



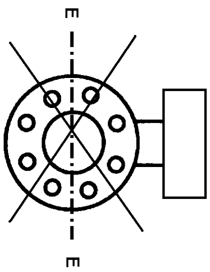
Position of electrodes

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

YES



NO



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.

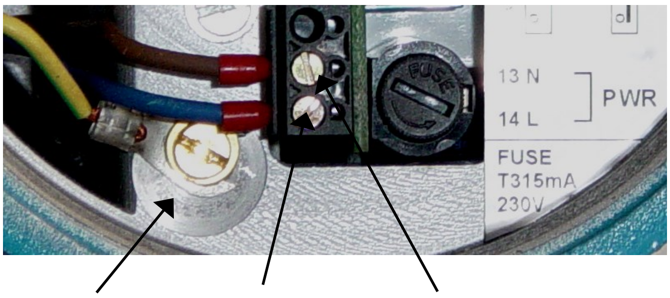
If you use a cable and plug it is recommended that the cable has a cross-section of 3 x 1.5mm^2 and with a minimum length of 1 m.

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

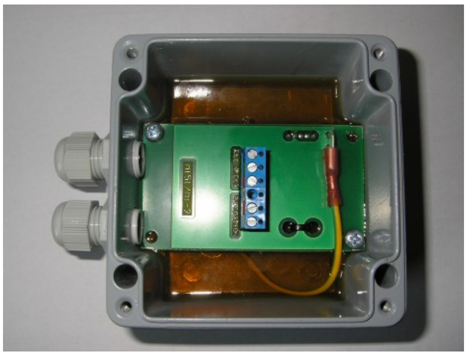
Note:

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.

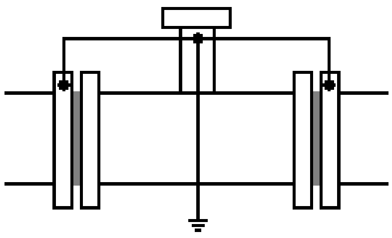
3.3 Sensor grounding

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.

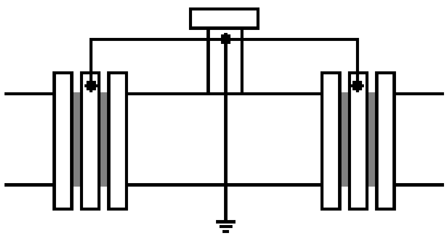
If the pipeline is made of an electrically nonconductive material, or if the pipe is lined with a similar material, special grounding rings must be installed between flanges.

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

Sensor grounding without grounding rings



Sensor grounding with grounding rings

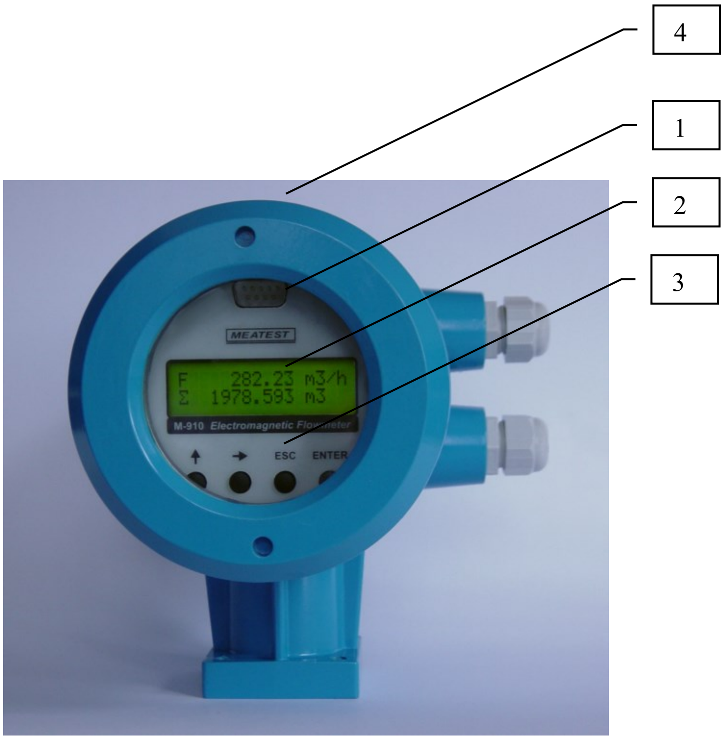


3.4 Turning the display panel

The flowmeter M910 (M910E) 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

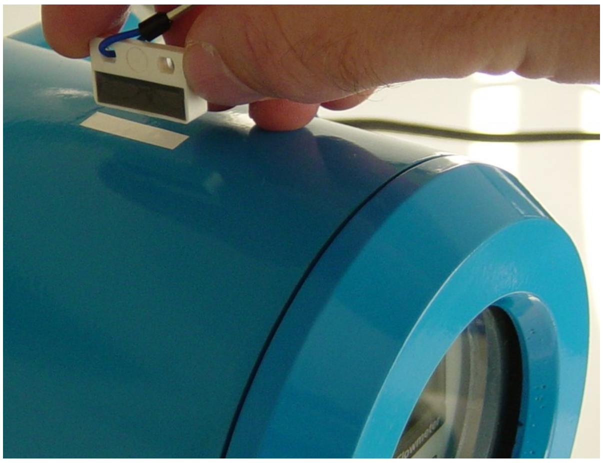
Two-row alphanumerical display is used for displaying all information. The instantaneous flowrate is displayed in upper row. Total volume is displayed in the lower row.

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

3 Keyboard (M910 only)

4 keys enable you to change flowmeter configuration and provide flowmeter calibration. These are “UP”, “DOWN”, “ESC” and “ENTER” keys.

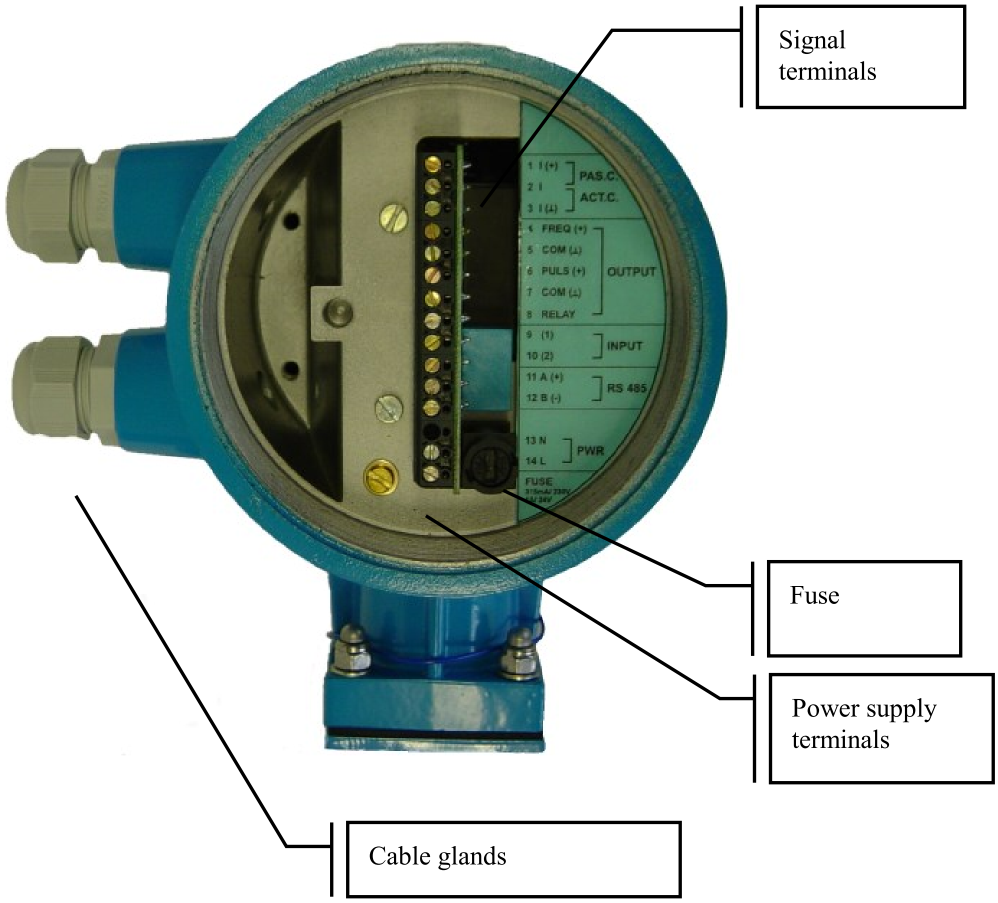
4 Magnetic sensor



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

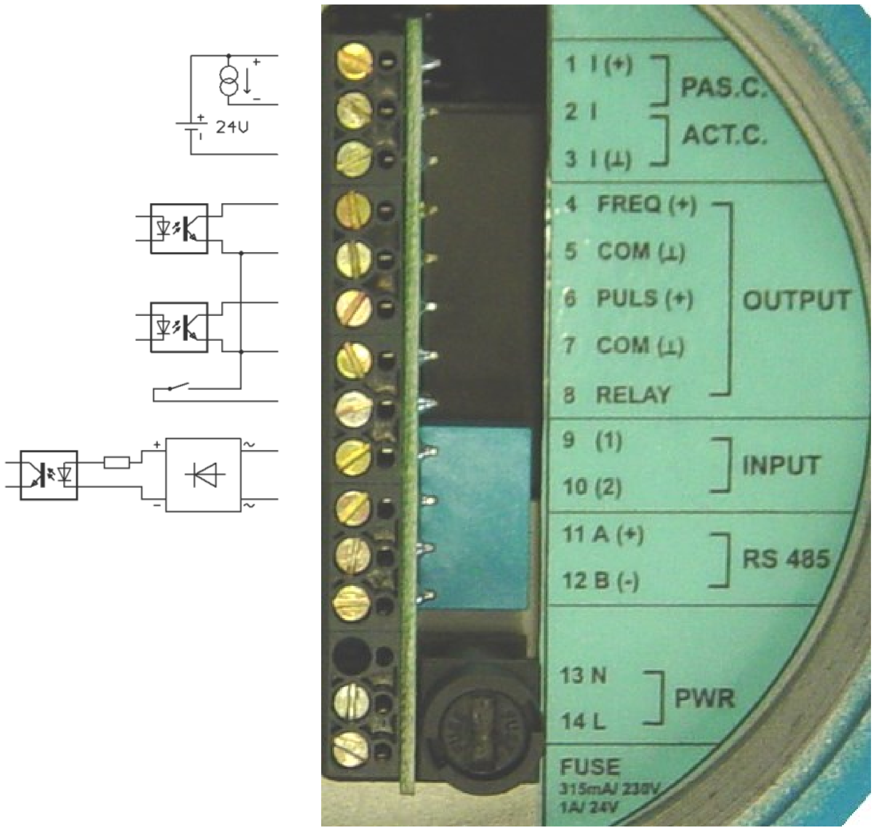
Impulse output

Status output (M910 only)

PLC input (M910 only)

RS485 interface (M910 only)

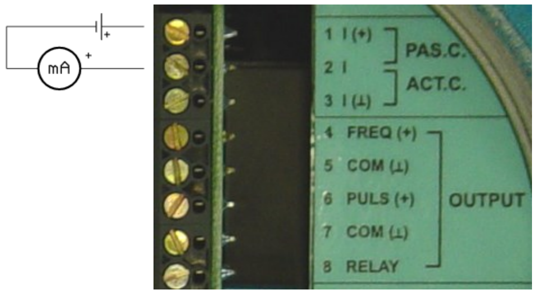
Power supply



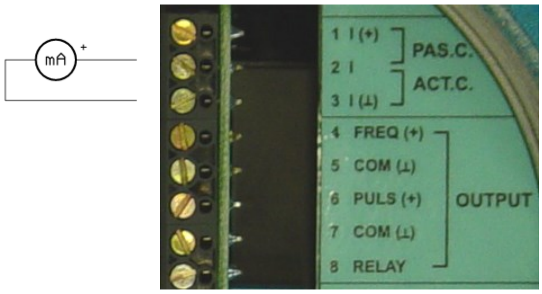
4.3.1 Current loop output

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



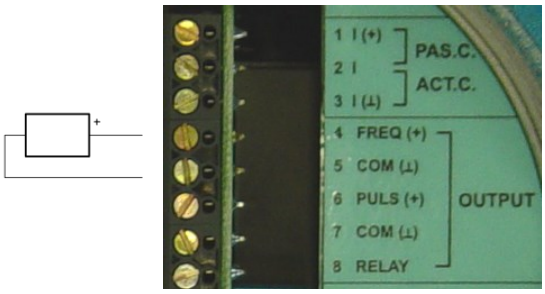
Active current output connection

For more information about current output see chapter "*Input and outputs configuration*".

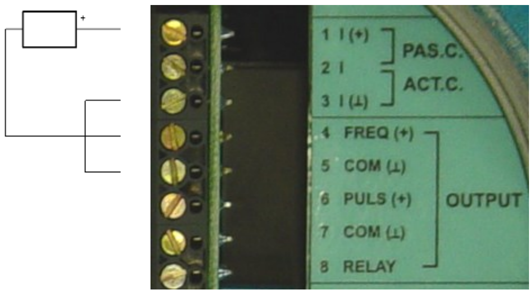
4.3.2 Frequency output

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*".

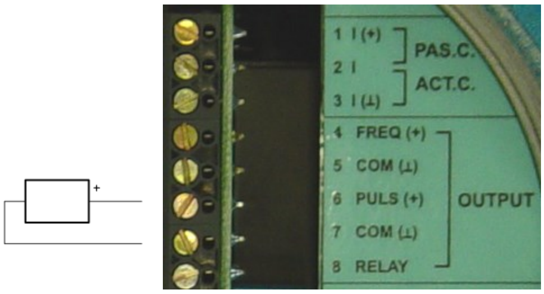
Note 1: Frequency, impulse and status outputs are galvanically connected to each other and galvanically isolated from other electronic circuits.

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.

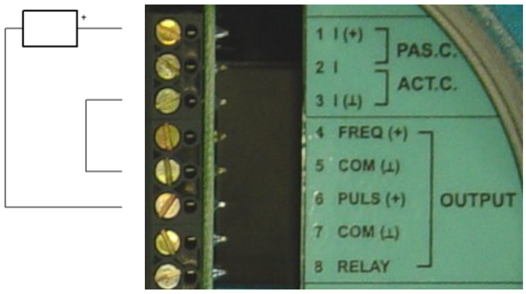
4.3.3 Impulse output

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 50 Hz for the shortest impulse 10 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*".

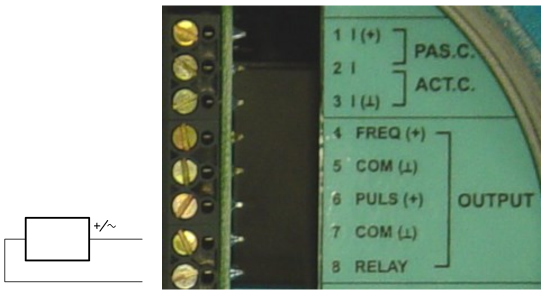
Note 1: Frequency, impulse and status outputs are galvanically connected to each other and galvanically isolated from other electronic circuits.

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.

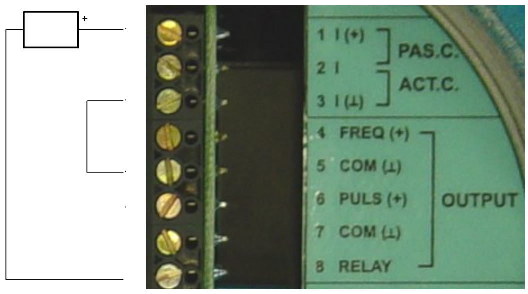
4.3.4 Status output (M910 only)

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 (M910 only)

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*".

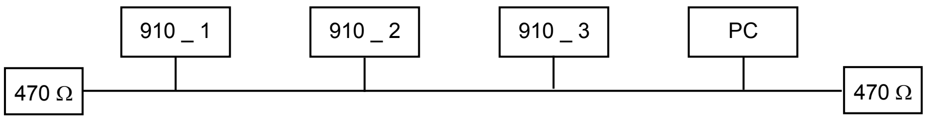
Note: PLC digital input is galvanically isolated from other electronic circuits.

4.3.6 Serial port RS485 (M910 only)

The serial port RS485 in M910 is designed for online communication between flowmeter and computer. It is suitable for real time flow meter 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 an 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 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.

RS-232 parameters are fixed:

Baud rate	1200 Bd
Data bits	8
Stop bit	1
Parity	none

Note: Control computer must keep signal RTS in static level between –3 to –12 V and signal DTR in static level +3 to +12V

Cable between Flowmeter and PC (configuration 1:1)

PC	D-Sub 1	D-Sub 2	Flowmeter
Receiver	2	2	Transmitter
Transmitter	3	3	Receiver
DTR (+3 … +12V) static level	4	4	Power supply RS232 +
Ground	5	5	Ground
RTS (-3 … -12V) static level	7	7	Power supply RS232 -

Use the original 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.*

Note: M910E can be operated by a magnetic pointer only. To use M910's keyboard, unscrew the front cover of the electronic unit using special wrench (standard part of delivery).

5.1.1 Current Flowrate / Total Volume

```
F      120.03 m3/h
Σ   8703.012 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+ 8903.012 m3
```

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

5.1.3 Negative Volume

```
Negative Volume
Σ-   220.310 m3
```

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

5.1.4 Auxiliary Volume

```
Auxiliary Volume
ΣA 5943.942 m3
```

Second Total Volume counter. Can be cleared by pushing "RIGHT" key. It is usually used for measuring volumetric flow during a set period such as day, month etc. After pushing "UP" key "Maximum Flowrate" is displayed.

5.1.5 Maximum Flowrate / Maximum Flowrate Time (M910 only)

```
Hi    620.42 m3/h
07:13 04.03.2003
```

Maximum flowrate value indicated since last reset (pushing "RIGHT" key). Date and time of maximum flowrate is displayed in second row. After pushing "UP" key "Minimum Flowrate" is displayed.

5.1.6 Maximum Flowrate (M910E only)

```
Hi    620.42 m3/h
Maximum Flowrate
```

Maximum flowrate value indicated since last reset (longer use of the magnet).

5.1.7 Minimum Flowrate / Minimum Flowrate Time (M910 only)

```
Lo     26.20 m3/h
20:42 06.03.2003
```

Minimum flowrate value indicated since last reset (pushing “RIGHT” key). Date and time of minimum flowrate is displayed in second row. After pushing “UP” key “Datalogger” is displayed.

5.1.8 Minimum Flowrate (M910E only)

```
Lo     26.20 m3/h
Minimum Flowrate
```

Minimum flowrate value indicated since last reset (longer use of the magnet).

5.1.9 Datalogger (M910 only)

```
Datalogger     5%
Samples:     723
```

```
20:42 06.03.2003
F      120.03 m3/h
```

Number of samples stored in datalogger and percentage used. 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 or “UP” key when all values have been displayed. By pushing “UP” key “Current Flowrate / Total Volume” is displayed. Datalogger capacity is more than 10000 samples (typical 15000 samples).

5.2 Setup menu

Note: The only way to access the “Setup menu” and its submenus in M910E is by using a computer and FlowAssistant software.

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*.

```
Setup Menu
1 INPUT/OUTPUT
```

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”. Return to the *Main menu* is possible after pushing the “ESC” key.

```
Enter Password
     [00000]
```

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.

Setup menu items are changed by pushing “UP” key and selected by pushing “ENTER” key.

5.2.1 Input and outputs configuration (1 INPUT/OUTPUT)

For the flowmeter outputs and input configuration. “UP” key selects next item (“2 FLOWMETER“), “ENTER” key displays following submenu:

5.2.1.1 Current loop output (1.1 CURRENT)

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 800 Ω.

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)	**Pos.Flow**	current 4+16*Flowrate / QI [mA] is generated for a positive flowrate direction. For a negative flowrate direction 4mA is generated.
c)	**Neg.Flow**	current 4-16*Flowrate / QI [mA] is generated for a negative flowrate direction. For a positive flowrate direction 4 mA is generated.
d)	**Abs.Flow**	current 4+16*abs(Flowrate) / QI [mA] is generated for both flowrate directions.
e)	**Bip.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)

QI value represents a flowrate for a current of 20 mA and can be set independently to the nominal diameter of the sensor. QI value can be changed in *"Setup mode"* after selecting modes "b", "c", "d" or "e". Fixed current value can be changed in *"Setup mode"* after selecting mode "f". Following values are pre-set:

Current loop standard factory setting:
Mode „Positive flowrate".
QI flowrate corresponds to maximum required nominal flowrate Q_N

5.2.1.2 Frequency output (1.2 OUTPUT F)

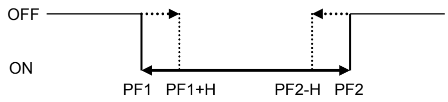
Frequency output is a galvanically isolated transistor NPN switch. Voltage drop on the switch is 1 V in the made status. Maximum switched voltage is 50 V. Maximum switched current should not exceed 100 mA. Positive output is on terminal 4, negative output is on terminals 5 and 7 (internally connected).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

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

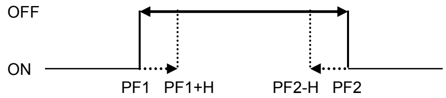
a)	**Off**	output is not active (HI state).
b)	**Pos.Flow**	frequency 1000*Flowrate/QF [Hz] is generated for positive flowrate direction.
c)	**Neg.Flow**	frequency -1000*Flowrate/QF [Hz] is generated for negative flowrate direction.
d)	**Abs.Flow**	frequency 1000*abs(Flowrate)/QF [Hz] is generated for both flowrate directions.
e)	**On Pos.**	output is HI in case of negative flow and LO in case of positive flow.
f)	**On Neg.**	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.

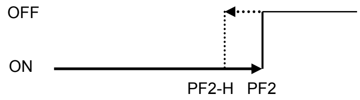
Mode g) with non-zero hysteresis:



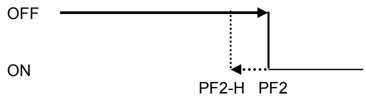
Mode h) with non-zero hysteresis:



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. QF value can be changed after selecting modes “b”, “c” or “d”. Fixed frequency value can be changed after selecting mode “m”. Following values are pre-set:

Frequency output standard factory setting:

Mode „Positive flowrate“.
QF flowrate corresponds to the required nominal flowrate Q_N
PF1 limit corresponds to the required nominal flowrate $-Q_N$
PF2 limit corresponds to the required nominal flowrate Q_N
H hysteresis corresponds to the required nominal flowrate $Q_N/10$

Parameters PF1, PF2 and H are common for frequency, impulse and status mode.

5.2.1.3 Impulse output (1.3 OUTPUT P)

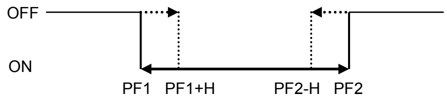
Impulse output is formed by a galvanically isolated transistor NPN switch. Voltage drop on the switch is 1 V in LO mode. Maximum switched voltage is 50 V. Maximum switched current should not exceed 100 mA. Positive output is on terminal 6, negative output is on terminal 5 and 7 (internally connected). Width of the impulse can be set. Maximum frequency of impulse output is limited by the impulse width. For the shortest impulse 10 ms is maximal frequency 50 Hz.

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

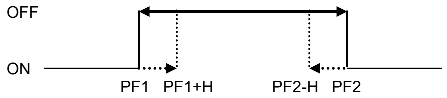
a) **Off** output is not active (HI state).
b) **Pos.Flow** 1 impulse is generated every time when volume QP has flown in positive direction.
c) **Neg.Flow** 1 impulse is generated every time when volume QP has flown in negative direction.
d) **Abs.Flow** 1 impulse is generated every time when volume QP has flown in any direction.
e) **On Pos** output is HI in case of negative flow and LO in case of positive flow.
f) **On Neg** 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.
n) **Dose On** output is LO, when programmed dose is being measured and HI when the dose is out.
i) **Dose Off** output is HI, when programmed dose is being measured and LO when the dose is out.
j) **On>F1** output is LO, when flowrate is higher than PF1, otherwise it is HI.
k) **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.

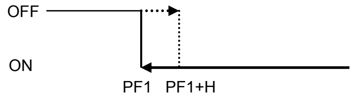
Mode g) with non-zero hysteresis:



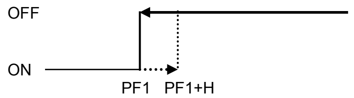
Mode h) with non-zero hysteresis:



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. QP value can be changed after selecting modes “b”, “c” or “d”. Following values are pre-set:

Impulse output standard factory setting:

Mode „Positive flowrate“.
QP 1 m^3
PF1 limit corresponds to the required nominal flowrate $-Q_N$
PF2 limit corresponds to the required nominal flowrate Q_N
H hysteresis corresponds to the required nominal flowrate $Q_N/10$

Parameters PF1, PF2 and H are common for frequency, impulse and status mode.

5.2.1.4 Pulse width (1.4 PULSE WIDTH)

Function enables to change the pulse width of “Impulse Output” in milliseconds. Press “ENTER” key to enter this menu and use “UP” and “RIGHT” keys to select any value between 10 millisecond and 2500 milliseconds. Confirm the new value by pressing the “ENTER” key or discards changes using “ESC” key.

Note: Pulse width can be set with 10 ms resolution (values 10, 20, 30,…).

Pulse width standard factory setting:

Pulse width 100 milliseconds

5.2.1.5 Status output (1.5 OUTPUT S) (M910 only)

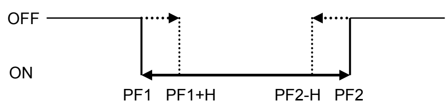
Status output is formed by relays. Maximum switched voltage is 100 V. Maximum switched current should not exceed 500 mA. First output is on terminal 8, second output is on terminals 5 and 7 (internally connected).

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

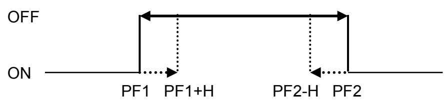
a)	**Off**	output is not active (HI state).
b)	**On Pos.**	output is HI in case of negative flow and LO in case of positive flow.
c)	**On Neg.**	output is HI in case of positive flow and LO in case of negative flow.
d)	**On In**	output is LO, when flowrate is higher than PF1 and lower than PF2, otherwise 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.

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.

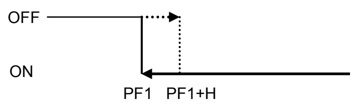
Mode d) with non-zero hysteresis:



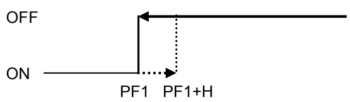
Mode e) with non-zero hysteresis:



Mode h) with non-zero hysteresis:



Mode i) with non-zero hysteresis:



Status output standard factory setting:

Mode „Off“.
PF1 limit corresponds to the required nominal flowrate $-Q_N$
PF2 limit corresponds to the required nominal flowrate Q_N
H hysteresis corresponds to the required nominal flowrate $Q_N/10$

Parameters PF1, PF2 and H are common for frequency, impulse and status mode.

5.2.1.6 PLC digital input (1.6 INPUT) (M910 only)

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

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

a) **Off** input activation does nothing.

b) **Dose** input activation starts dose QD measuring. Dosing indication can be performed by one of outputs (frequency, impulse or status).

c) **Clr.Vol** input activation clears the Auxiliary volume.

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

Digital input standard factory setting:
QD volume 1 m^3
Mode „Off“.

5.2.1.7 Low flowrate limit (1.7 LIMIT PF1)

Function enables you to set low flowrate limit for some functions of digital outputs after pressing “ENTER” key. See “Frequency output”, “Impulse output” and “Status output”. With the “UP” and “RIGHT” keys any value between +/- Q_{MAX} flowrate can be set. Limit PF1 is displayed in the same format as the flowrate. Confirm the new value by pressing the “ENTER” key or discards changes using “ESC” key. Following values are pre-set:

Low flowrate limit standard factory setting:
PF1 limit corresponds to the required nominal flowrate $-Q_N$

5.2.1.8 High flowrate limit (1.8 LIMIT PF2)

Function enables you to set high flowrate limit for some functions of digital outputs by pressing key “ENTER”. See “Frequency output”, “Impulse output” and “Status output”. With the “UP” and “RIGHT” keys any value between +/- Q_{MAX} flowrate can be set. Limit PF2 is displayed in the same format as the flowrate. Confirm the new value by pressing the “ENTER” key or discards changes using “ESC” key. Following values are pre-set:

High flowrate limit standard factory setting:
PF2 limit corresponds to the required nominal flowrate Q_N

5.2.1.9 Hysteresis of flowrate limits (1.9 HYSTERESIS)

Function enables you to set hysteresis of limit values for some functions of digital outputs by pressing key “ENTER”. See “Frequency output”, “Impulse output” and “Status output”. With the “UP” and “RIGHT” keys any value between +/- Q_{MAX} flowrate can be set. Hysteresis is displayed in the same format as the flowrate. Confirm the new value by pressing the “ENTER” key or discards changes using “ESC” key. Following values are pre-set:

Hysteresis standard factory setting:
H limit corresponds to the required nominal flowrate $Q_N/10$

5.2.1.10 RS485 baud rate (1.A RS485 B.R.) (M910 only)

Function enables you to set parameter baud rate of RS485 interface by pressing “ENTER” key. With the “UP” key any value from the row 4800, 9600 or 19200 Bd can be set. Confirm the new value by pressing the “ENTER” key or discards changes using “ESC” key. Following values are pre-set:

Baud rate standard factory setting:
Baud Rate 9600 Bd.

5.2.1.11 RS485 address (1.B RS485 ADDR.) (M910 only)

Function enables to set parameter address of RS485 interface by pressing "ENTER" key. With the "UP" and "RIGHT" keys any value between 0 and 255 can be set. Confirm the new value by pressing the "ENTER" key or discards changes using "ESC" key. Following values are pre-set:

Baud rate standard factory setting:
ADDR 00.

Note: RS485 address is important in case of connecting more flowmeters to common RS485 bus. Each flowmeter has its own RS485 address. The connected computer can control communication between these flowmeters using theirs addresses. Communication will be excluded in case of two equal addresses.

5.2.2 Flowmeter configuration (2 FLOWMETER)

For flowmeter parameters configuration. After pushing "UP" key next item ("3 GENERAL") is selected. After pushing "ENTER" key following submenu is displayed:

5.2.2.1 Flowrate units (2.1 FLOW UNIT)

Function enables you to set flowrate units after pressing the "ENTER" key. With the "UP" key any item from the list "l/s", "m3/h", "G/m" and "user" can be set. Confirm the new value by pressing the "ENTER" key or discards changes using "ESC" key.
Available units:

l/s	litres per second
m3/h	cubic metres per hour
G/m	US gallons per minute
user	user-defined unit, factory-set is „l/h"(litres per hour), user defined unit can be changed by computer only

Flowrate units standard factory setting:
Flowrate units m3/h
User l/h

5.2.2.2 Flowrate resolution (2.2 FLOW RESOL.)

Function enables you to set flowrate resolution after pressing the "ENTER" key. With the "UP" key any item from the list "0", "0.0", "0.00", "0.000" and "0.0000" can be set. To change the current valid resolution to the selected resolution press the "ENTER" key. "ESC" key discards changes.
Available resolution:

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

Note: selected resolution is the maximal resolution. It is reduced for high values. For example 4 decimal digits resolution is valid up to -99.9999 or 99.9999 displayed value. For higher values, the resolution reduced (999.999).

Flowrate resolution standard factory setting:
Resolution 0.0000 for $Q_{100\%} < 3.0000$
0.000 for $3.000 \le Q_{100\%} < 30.000$
0.00 for $30.00 \le Q_{100\%} < 300.00$
0.0 for $300.0 \le Q_{100\%} < 3000.0$
0 for $Q_{100\%} \ge 3000.0$

5.2.2.3 Volume units (2.3 VOLUME UNIT)

Function enables to set volume units after pressing the “ENTER” key. With the “UP” key any item from the list “m3”, “l”, “US.G” and “user” can be set. To change the current valid unit to the selected unit press the “ENTER” key. “ESC” key discards changes.

Available units:

m3 cubic metres

l litres

US.G US gallons

user user-defined unit, factory-set is „l“(litres), user defined unit can be changed by computer only

Volume units standard factory setting:

Volume units m3

User l

5.2.2.4 Volume resolution (2.4 VOL. RESOL.)

Function enables to set volume resolution after pressing the “ENTER” key. With the “UP” key any item from the list “0”, “0.0”, “0.00”, “0.000” and, “0.0000” can be set. To change the current valid resolution to the selected resolution press the “ENTER” key. “ESC” key discards changes.

Available resolution:

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

Note: selected resolution is the maximum resolution. It is reduced for high values. For example 4 decimal digits resolution is valid up to -999.9999 or 9999.9999 displayed value. For higher values the resolution is reduced (99999.999).

Following values are pre-set:

Volume resolution standard factory setting:

Resolution 0.000

5.2.2.5 Flowrate direction (2.5 FLOW DIREC.)

Function enables you to switch between “Positive” and “Negative” flow direction (change the sign in flowrate value) after pressing the “ENTER” key. With the “UP” key any item from the list “Positive” and, “Negative” can be set. To change the current valid direction to the selected direction press the “ENTER” key. “ESC” key discards changes.

Note: flowmeters are working in both flow directions, however they are calibrated for positive direction only.

Following values are pre-set:

Flowrate direction standard factory setting:

Flow direc. Positive

5.2.2.6 Low-flow cut-off (2.6 L.F.CUTOFF)

Function enables you to set limit for suppressing low flowrates after pressing “ENTER” key. With the “UP” key and “RIGHT” any value between +/- Q_{MAX} flowrate can be set. Limit is displayed in the same format as the flowrate. Confirm the new value by pressing the “ENTER” key or discards changes using “ESC” key.

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

Following values are pre-set:

Low-flow cut-off standard factory setting:

L.F.Cutoff corresponds to the flowrate $Q_{1\%}/2$ (see table 2 M910 Flowrates)

5.2.2.7 Moving average time constant (2.7 TIMECONST)

Function enables you to change the time for moving average calculating after pressing “ENTER” key. With “UP” and “RIGHT” key any value between 1 second and 20 seconds can be set. Confirm the new value by pressing the “ENTER” key or discards changes using “ESC” key.

Following values are pre-set:

Time constant standard factory setting:
Timeconst 10 seconds

5.2.2.8 Time setting (2.8 TIME SET.) (M910 only)

Function enables you to correct time of internal Real time clock after pressing “ENTER” key. With “UP” and “RIGHT” key any time between 00:00:00 and 23:59:59 can be set. Confirm the new value by pressing the “ENTER” key or discards changes using “ESC” key.

Following values are pre-set:

Time setting standard factory setting:
Time set. Central European Time

5.2.2.9 Date setting (2.9 DATE SET.) (M910 only)

Function enables you to correct date of internal Real time clock after pressing key “ENTER” key. With “UP” and “RIGHT” key any date between 01.01.2000 and 31.12.2099 can be set. Confirm the new value by pressing the “ENTER” key or discards changes using “ESC” key.

Following values are pre-set:

Date setting standard factory setting:
Date set. Actual date

5.2.2.10 Datalogger setting (2.A DATALOGGER) (M910 only)

Function enables you to set sample interval for internal datalogger after pressing “ENTER” key. With “UP” key any value from the row OFF, 5, 10, 15, 30, 45, 60, 120, 180, 240 and CLR can be select. To change the current valid value to the new value press the “ENTER” key. “ESC” key discards changes. Datalogger will be cleared after selection item CLR. This selection doesn’t change datalogger sample interval.

Following values are pre-set:

Datalogger standard factory setting:
Datalogger OFF

5.2.3 General settings (3 GENERAL)

For general settings configuration or for reading actual settings. After pushing “UP” key next item is selected. After pushing “ENTER” key following submenu is displayed:

5.2.3.1 Diameter (3.1 DIAMETER)

Flowmeters nominal diameter is displayed. After pushing “UP” key “Range” is displayed.

5.2.3.2 Nominal flowrate range Q_N (3.2 RANGE)

Nominal flowrate range Q_N is displayed in flowrate units. After pushing “UP” key “Serial number” is displayed.

5.2.3.3 Serial number (3.3 SERIAL NR.)

Flowmeters Serial number is displayed. After pushing “UP” key “Power supply” is displayed.

5.2.3.4 Power supply (3.4 POWER SUP.)

Information about power supply (voltage and frequency) is displayed. After pushing “UP” key “Self test” is displayed.

5.2.3.5 Self-test (3.5 SELFTEST)

Function enables you to switch an internal self-test (flowrate simulator) “On” or “Off” after pressing “ENTER” key. With “UP” key any item from the list “On” and, “Off” can be set. To change the current valid self-test state press the “ENTER” key. “ESC” discards changes.

Note: Self-test “Off” state is normal working state of flowmeter. After switching self-test to “On” state, internal flowrate simulator is used instead of actual flow sensor. Function can be used for signal converter testing. Number in range (0.980, 1.020) is displayed, if signal converter is OK. Number is displayed in state “On” only. After switching on you have to wait for converter stabilization (up to 20 seconds).

Following values are pre-set:

Self-test standard factory setting:
Self-test Off

5.2.3.6 Current Loop Test (3.6 C.LOOP TEST)

Function enables you to switch an internal test of the connected current loop “On” or “Off” after pressing the “ENTER” key. With the “UP” key any item from the list “On” and, “Off” can be set. To change the current valid Current Loop Test state press the “ENTER” key. “ESC” key discards changes.

Note: If Current Loop Test is in “On” state and current output flows less than 3 mA, error message “01 – Current Output” will be displayed.

Following values are pre-set:

Current Loop Test standard factory setting:
C.Loop Test Off

5.2.3.7 Basic Menu Password (3.7 PASSWORD MN.)

Function enables you to enter a new password for basic menu access after pressing the “ENTER” key. With the “UP” and “RIGHT” key any password in range between 00000 and 99999 can be set. To change the current valid password to the new password press the “ENTER” key. “ESC” key discards changes.

Following values are pre-set:

Basic Menu Password standard factory setting:
PASSWORD MN. 00000

5.2.4 Calibration menu (4 CALIBRATION)

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

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

Calibration menu is accessible as part 4 of the *Setup menu,* if the correct calibration password has been entered. After entering the *Basic menu password* only parts 1 to 3 of *Setup menu* are accessible. Without the correct password access to the *Calibration menu* is refused. Default factory set Calibration password is "10000".

Note: Flowmeter M910 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: M910 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.

5.2.4.1 Number of Calibration Points (4.1 NR.OF CALP.)

Function enables you to enter a new number of calibration points after pressing the "ENTER" key. With the "UP" and "RIGHT" keys any number in range between 2 and 4 can be set. To change the current valid number to the new number press the "ENTER" key. "ESC" key discards changes.

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.).

Number of Calibration Points standard factory setting:
NR.OF CALP. 2

5.2.4.2 Calibration point 1 (4.2 CAL.POINT 1)

Function enables you to change nominal and calibration value of Calibration point 1 after pressing the "ENTER" key. With the "UP" and "RIGHT" keys any value in the range of real flowrates can be set. To change the current valid nominal value to the new nominal value press the "ENTER" key. After entering the nominal value a new calibration constant can be set. "ESC" key discards changes. Following values are pre-set:

Calibration point 1 standard factory setting:
Nominal point 5 … 10% of required Q_N
Cal. Constant is assigned according to the calibration

5.2.4.3 Calibration point 2 (4.3 CAL.POINT 2)

Function enables you to change the nominal and calibration value of Calibration point 2 after pressing the "ENTER" key. With "UP" and "RIGHT" key any value in the range of real flowrates can be set. To change the current valid nominal value to the new nominal value press the "ENTER" key. After entering the nominal value new calibration constant can be set. "ESC" key discards changes. Following values are pre-set:

Calibration point 2 standard factory setting:
Nominal point 40 … 70% of required Q_N
Cal. Constant is assigned according to the calibration

5.2.4.4 Calibration point 3 (4.4 CAL.POINT 3)

Function is available only if 3 or 4 calibration points are selected. Function enables you to change the nominal and calibration value of Calibration point 3 after pressing the “ENTER” key. With the “UP” and “RIGHT” key any value in the range of real flowrates can be set. To change the current valid nominal value to the new nominal value press the “ENTER” key. After entering the nominal value a new calibration constant can be set. “ESC” key discards changes. Following values are pre-set:

Calibration point 3 standard factory setting:
Not used.

5.2.4.5 Calibration point 4 (4.5 CAL.POINT 4)

Function is available only if 4 calibration points are selected. Function enables you to change the nominal and calibration value of Calibration point 4 after pressing the “ENTER” key. With the “UP” and “RIGHT” keys any value in the range of real flowrates can be set. To change the current valid nominal value to the new nominal value press the “ENTER” key. After entering the nominal value a new calibration constant can be set. “ESC” key discards changes. Following values are pre-set:

Calibration point 4 standard factory setting:
Not used.

5.2.4.6 Calibration Password (4.6 PASSWORD CA.)

Function enables you to enter a new password for calibration menu access after pressing the “ENTER” key. With the “UP” and “RIGHT” keys any password in the range between 00000 and 99999 can be set. To change the current valid password to the new password press the “ENTER” key. “ESC” key discards changes. Following values are pre-set:

Calibration Password standard factory setting:
PASSWORD CA. 10000

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. Address and baud rate are important for RS485 bus. Communication parameters are fixed for RS232 bus.

6.1 RS485 bus properties (M910 only)

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: 4800, 9600 and 19200 Bd. Each flowmeter has its own RS485 address. Range of these addresses is from 0 to 255.

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 1200 Bd is fixed.

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>.

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 its identification is “#01”. Flowmeter answers are prefix in form “>00” for flowmeter 0, “>01” for flowmeter 1 etc.

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

Device identification

IDN?

Response contains flowmeters model type number.

Example RS232:
If query „IDN?<cr>" is sent, flowmeter returns response in format „M910-Vxxxx<cr>" in case of M910.

Example RS485:
If query „#00IDN?<cr>" is sent, flowmeter returns response in format „>00M910-Vxxxx<cr>".

Current output mode setting

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

Following modes can be set:

- 0 Off
- 1 Pos.Flow
- 2 Neg.Flow
- 3 Abs.Flow
- 4 Bip.Flow
- 5 Fixed

M910 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>".

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 Pos.Flow
- 2 Neg.Flow
- 3 Abs.Flow
- 4 On Pos.
- 5 On Neg.
- 6 On In
- 7 On Out
- 8 Dose On
- 9 Dose Off
- 10 On<F2
- 11 On>F2
- 12 Fixed

M910 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>".

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 Pos.Flow
- 2 Neg.Flow
- 3 Abs.Flow
- 4 On Pos.
- 5 On Neg.
- 6 On In
- 7 On Out
- 8 Dose On
- 9 Dose Off
- 10 On>F1
- 11 On<F1

M910 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>".

Status output mode setting

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

Following modes can be set:

- 0 Off
- 1 On Pos.
- 2 On Neg.
- 3 On In
- 4 On Out
- 5 Dose On
- 6 Dose Off
- 7 On>F1
- 8 On<F1

M910 confirms execution with string „Ok<cr>".

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

Digital input mode setting

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

Following modes can be set:

- 0 Off
- 1 Dose
- 2 Clr.Vol

M910 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>".

Current output constant QI

SCO(?)<DNPD>

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

<DNPD>

It represents required flowrate in actual units. M910 confirms execution with string „Ok<cr>". In case of query M910 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>".

Frequency output constant QF

SFO(?)<DNPD>

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

<DNPD>

It represents required flowrate in actual units. M910 confirms execution with string „Ok<cr>". In case of query M910 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>".

Impulse output constant QP

SPO(?)<DNPD>

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

<DNPD>

It represents volume for 1 impulse in actual units. M910 confirms execution with string „Ok<cr>". In case of query M910 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>".

Dosing constant QD

SIO(?)<DNPD>

Command sets constant QD, which represents volume for dosing.

<DNPD>

It represents volume for dosing in actual units. M910 confirms execution with string „Ok<cr>". In case of query M910 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>".

Impulse width

SPT(?)<DNPD>

Command sets impulse width in range between 10 and 2500 ms.

<DNPD>

It represents impulse width in milliseconds. Any value in range between 10 millisecond and 2500 milliseconds can be set. M910 confirms execution with string „Ok<cr>". In case of query M910 returns set value in actual units.

Example:
Command „SPT100<cr>" sets impulse width to 100 ms. After query „SPT?<cr>" flowmeter returns string „100<cr>".

Fixed current

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. M910 confirms execution with string „Ok<cr>". In case of query M910 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>".

Fixed frequency

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. M910 confirms execution with string „Ok<cr>". In case of query M910 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>".

Low limit value

SF1(?)<DNPD>

Command sets low limit value PF1.

<DNPD>

It represents flowrate for low limit value PF1 in actual unit. M910 confirms execution with string „Ok<cr>". In case of query M910 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. M910 confirms execution with string „Ok<cr>". In case of query M910 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. M910 confirms execution with string „Ok<cr>". In case of query M910 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>".

Flowrate unit

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

Following units can be set:

- 0 l/s
- 1 m3/h
- 2 G/m
- 3 "user"

M910 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>".

Volume unit

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

Following units can be set:

- 0 m3
- 1 l
- 2 US.G
- 3 “user”

M910 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>”.

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

M910 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>”.

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

M910 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>”.

Flowrate user unit

FFU(?)<CPD>

Command sets text for flowrate user unit.

<CPD>

It represents user units expressed as 5 ASCII characters. M910 confirms execution with string „Ok<cr>”. In case of query M910 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>”.

Volume user unit

FVU(?)<CPD>

Command sets text for volume user unit.

<CPD>

It represents user units expressed as 5 ASCII characters. M910 confirms execution with string „Ok<cr>”. In case of query M910 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 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. M910 confirms execution with string „Ok<cr>”. In case of query M910 returns set constant.

Example:
Command „FFC3.6<cr>” sets constant “3.6 “. After query „FFC?<cr>” flowmeter returns „3.600000<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. M910 confirms execution with string „Ok<cr>”. In case of query M910 returns set constant.

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

Flowrate direction

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

Following directions can be set:

- 0 Positive
- 1 Negative

M910 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. M910 confirms execution with string „Ok<cr>". In case of query M910 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. M910 confirms execution with string „Ok<cr>". In case of query M910 returns time constant.

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

Internal self-test (flowrate simulator)

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

Internal self-test can be switched:

- 0 Off
- 1 On

M910 confirms self-test state with string „Ok<cr>".

Example:
Command „FIS0<cr>" switches self-test "Off". If query „FIS?<cr>" is sent, flowmeter returns response in format „0<cr>".

Current loop test

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

Internal current loop test can be switched:

- 0 Off
- 1 On

M910 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>".

Time

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. M910 confirms execution with string „Ok<cr>". In case of query M910 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

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. M910 confirms execution with string „Ok<cr>". In case of query M910 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>".

Auxiliary volume counter Reset

CLRAV

Command resets "Auxiliary volume counter".

M910 confirms execution with string „Ok<cr>".

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

Min. / Max. flowrates Reset

CLRMM

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

M910 confirms execution with string „Ok<cr>".

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

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 and time & date of this flowrate.

Example:
If query „RMX?<cr>” is sent, flowmeter returns response in format „100.000, 08:06 11.04.2002<cr>“ (maximum flowrate value indicated since last reset – command CLRMM).

Minimum flowrate value reading

RMN?

Response contains minimum Flowrate value and time & date of this flowrate.

Example:
If query „RMN?<cr>” is sent, flowmeter returns response in format „0.000, 10:06 11.04.2002<cr>“ (minimum flowrate value indicated since last reset – command CLRMM).

Nominal diameter reading

RDN?

Response contains actual flowmeters Nominal diameter (DN).

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

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…).

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.

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.

M910 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

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 reading

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 clear

DCLR

Command clears all data stored in internal datalogger.

M910 confirms execution with string „Ok<cr>".

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

Internal temperature

IT?

Response contains internal temperature in flowmeters case. Accuracy of temperature value is not guarantied. It's informative value only.

Example:
If query „IT?<cr>" is sent, flowmeter returns response in format „35.2<cr>" for internal temperature 35.2 °C.

Service information

ISR?

Response contains service information (serial number, power supply voltage and power supply frequency).

Example:
If query „ISR?<cr>" is sent, flowmeter returns response in format „371561, 0, 50, 2546<cr>".

Where:
371561 is the serial number of instrument
0 is power supply voltage (0 is 230V, 1 is 24V, 2 is 115V)
50 is power supply frequency (0 is DC, 50 is 50Hz, 60 is 60Hz)
2546 is information for service only

Write to EEPROM

WEP

Command writes all new data in internal EEPROM. If you change some settings (for example Flowrate resolution) is changed, but only in internal RAM memory and after switching the flowmeter off and on, all settings will be lost. You have to use WEP command to save these settings.

Example:
Command „WEP<cr>" record all settings in internal EEPROM.

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 45
Excitation Err.
```

In case of any error, the error message is displayed on the display for approx. 1 second.

After switching on, an internal test of the hardware is performed. If there were any error during the 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	Current output	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”.
20	Wrong password (M910 only)	Wrong password for setup / calibration / service menu was used.	Use correct password.
21	Not a number (M910 only)	Non numerical value	Write the appropriate number.
22	Value too low (M910 only)	Entry value is to low	Write the appropriate number.
23	Value too high (M910 only)	Entry value is to high	Write the appropriate number.
24	Wrong format (M910 only)	Bad date or time format	Write regular date or time format.
25	Datalogger empty (M910 only)	No records in datalogger	Datalogger is switched OFF or records have been cleared.
26	Wrong Cal. Point (M910 only)	There are 2 or more calibration constants with the same nominal value.	Correct calibration constant values or reduce number of calibration points.
31	RS232 Frame Err.	Valid stop bit missing	Communication format RS232 is wrong. Check the Baud rate (1200 Bd).
45	Excitation Err.	Excitation coils error	Excitation is not working properly. Contact service department.
46	Empty pipe	No liquid in pipe	Fill the pipe with liquid.

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.

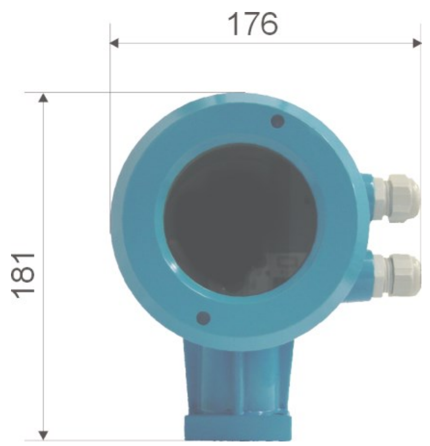
9 Application information

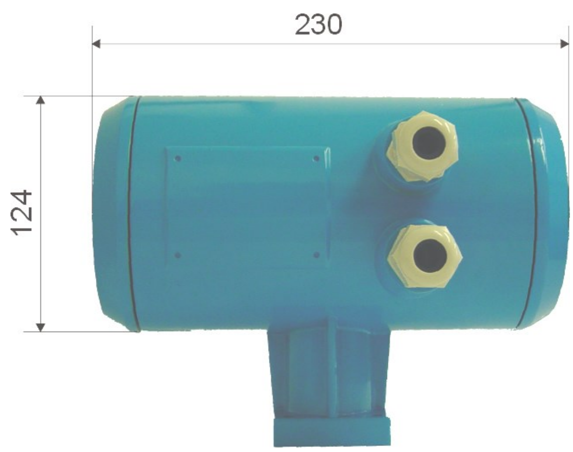
9.1 Weight and dimensions

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

9.1.1 Electronic unit – compact version

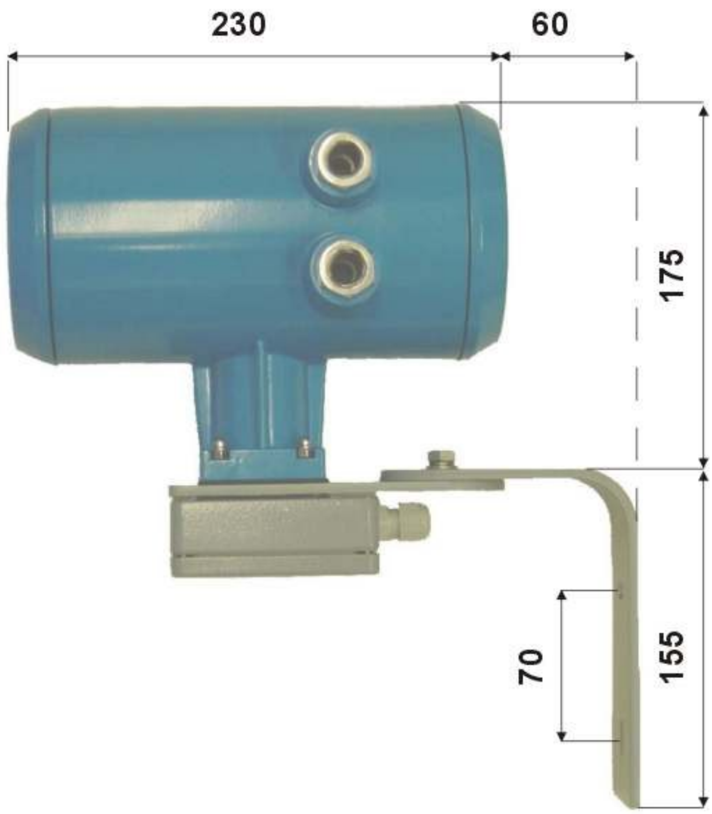
The pictures below show dimensions of the electronic unit for the compact version. Dimensions are in millimetres.





Weight: 3.8 kg

9.1.2 Electronic unit – remote version

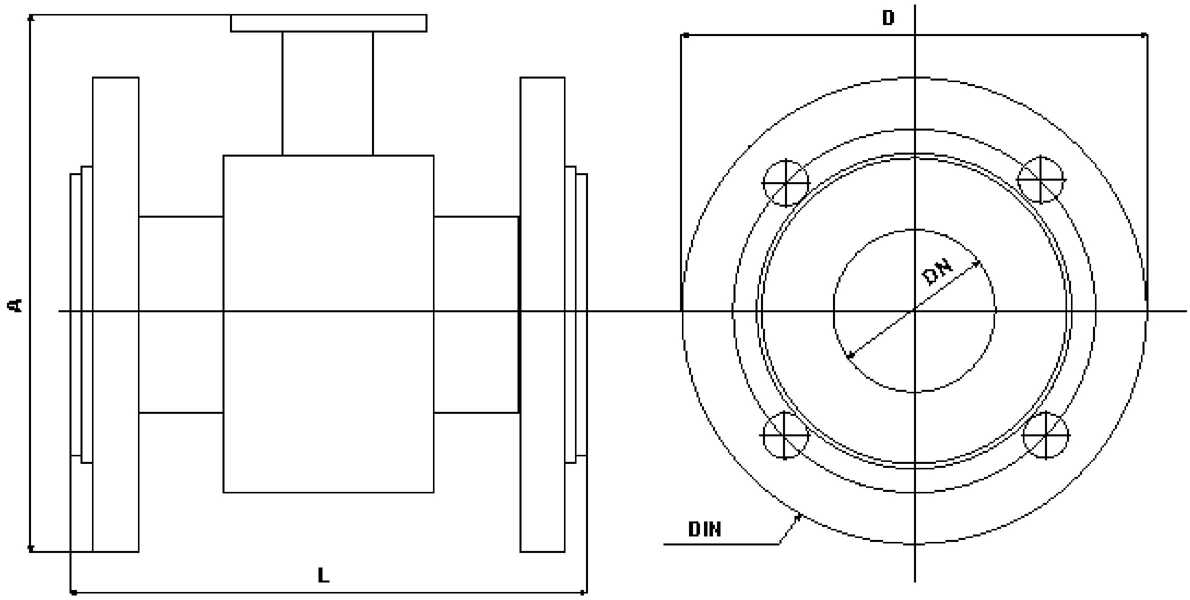


The picture shows dimensions of the electronic unit for the remote version. Dimensions are in millimetres.

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: M910 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 DIN 2501 (=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 MAG-910 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.

	Flowrates [l/s]						Flowrates [m3/h]					
DN	$Q_{1\%}$	$Q_{5\%}$	Q_N	$Q_{50\%}$	$Q_{100\%}$	Q_{MAX}	$Q_{1\%}$	$Q_{5\%}$	Q_N	$Q_{50\%}$	$Q_{100\%}$	Q_{MAX}
15	0,02	0,09	0,50	0,88	1,77	2,21	0,06	0,32	2,00	3,18	6,36	7,95
20	0,03	0,16	0,90	1,57	3,14	3,93	0,11	0,57	3,20	5,65	11,31	14,14
25	0,05	0,25	1,40	2,45	4,91	6,14	0,18	0,88	5,00	8,84	17,67	22,09
32	0,08	0,40	2,20	4,02	8,04	10,05	0,3	1,5	8,00	14,5	29,0	36,2
40	0,1	0,6	4,0	6,3	12,6	15,7	0,5	2,3	13,0	22,6	45,2	56,6
50	0,2	1,0	6,0	9,8	19,6	24,5	0,7	3,5	20,0	35,3	70,7	88,4
65	0,3	1,7	9,0	16,6	33,2	41,5	1,2	6,0	35,0	59,7	119,5	149,3
80	0,5	2,5	14,0	25,1	50,3	62,8	1,8	9,0	50,0	90,5	181,0	226,2
100	0,8	3,9	20,0	39,3	78,5	98,2	3	14	80	141	283	353
125	1	6	30,0	61	123	153	4	22	150	221	442	552
150	2	9	50,0	88	177	221	6	32	200	318	636	795
200	3	16	100	157	314	393	11	57	300	565	1131	1414
250	5	25	150	245	491	614	18	88	500	884	1767	2209
300	7	35	200	353	707	884	25	127	800	1272	2545	3181
350	10	48	300	481	962	1203	35	173	1000	1732	3464	4330
400	13	63	400	628	1257	1571	45	226	1300	2262	4524	5655
500	20	98	600	982	1963	2454	71	353	2000	3534	7069	8836
600	28	141	800	1414	2827	3534	102	509	3000	5089	10179	12723
700	38	192	1000	1924	3848	4811	139	693	4000	6927	13854	17318
800	50	251	1200	2513	5027	6283	181	905	5000	9048	18096	22620

$Q_{1\%}$ - 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)

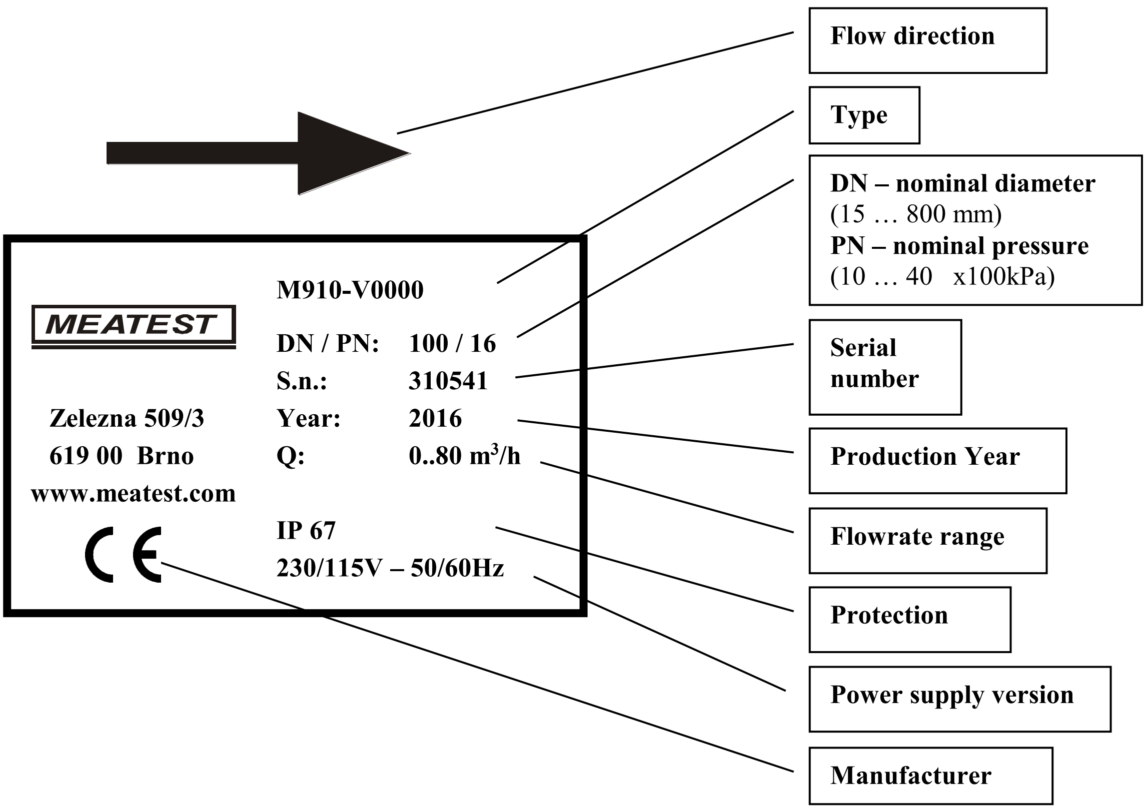
Table 2: M910 (M910E) flowrates

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

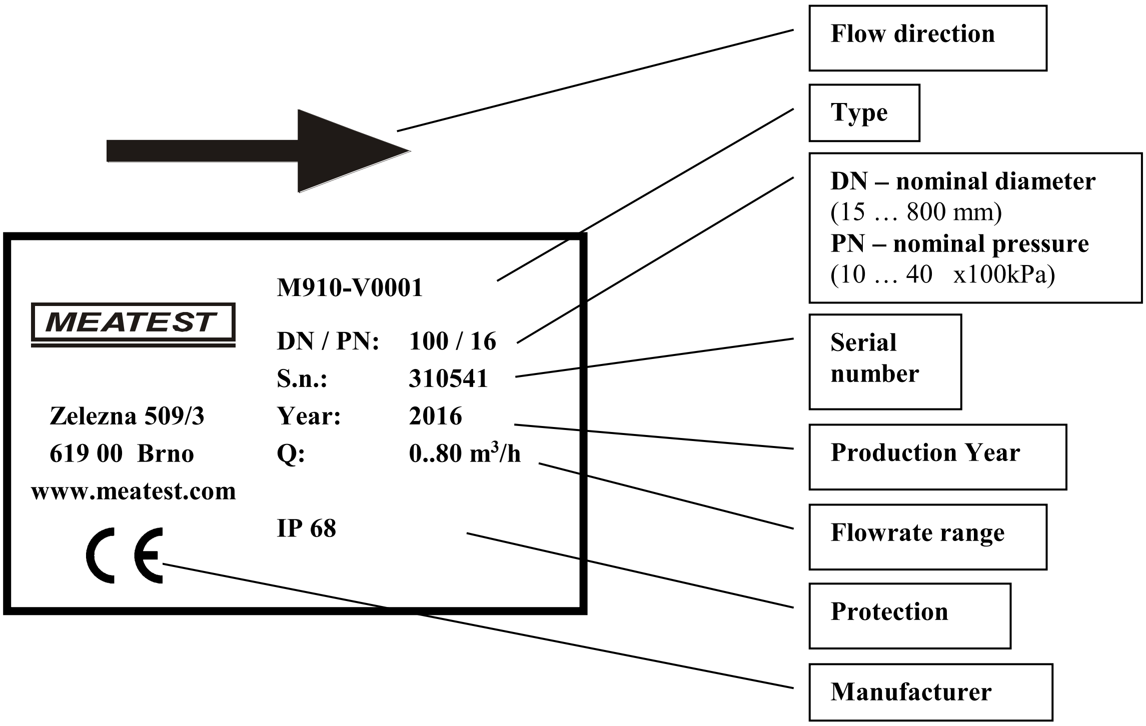
Compact version

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

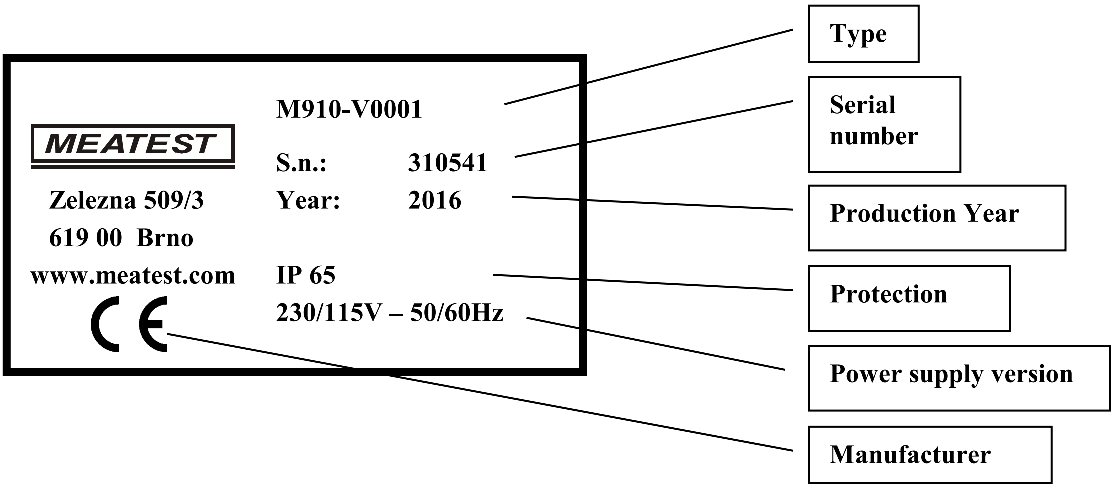


Remote version

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	0.1 to 10 m/s (0.01 to 5000 l/s) / (0.03 to 18000 m3/h)
Accuracy	• 0.5 % (0.5 to 10 m/s) of reading value • 1 % (0.1 to 0.5 m/s) of reading value
Maximum media temperature	70°C (158°F) for rubber liner 130°C (266°F) for PTFE liner in remote version
Minimum electrical conductivity	≥ 5 µS / cm
Ambient temperature	-20 to 60°C (-4 to 140°F)
Power supply	• 115/230V auto select (+10%,-15%), 50/60Hz (M910-Vxx0x) 115/230V manual select (+10%,-15%), 50/60Hz (M910E-Vxx0x) • 12V DC (+20%, -10%) (M910-Vxx1x), (M910E-Vxx1x) • 24V DC (+20%, -10%) (M910-Vxx2x), (M910E-Vxx2x) • 48V DC (+20%, -10%) (M910-Vxx3x), (M910E-Vxx3x)
Power consumption	10 VA (M910), 9 VA (M910E)
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 50 Hz with programmable volume, function and pulse width • Relay contacts 100V/0.5A with programmable function (M910 only) • Current loop 4 to 20 mA with programmable flowrate and function
Input	PLC digital input with programmable function (M910 only)
Communication	• RS485 (M910 only) • RS232
Displayed values	• Flowrate (m3/h, l/s, US.Gal/min, user) • Volume (m3, l, US.Gal, user) • Positive, total, negative and auxiliary (clearable, daily) volume
Control	• Keyboard (M910 only) • Magnetic pointer • RS232 and RS485

12 Ordering information - options

Liner

M910-V0xxx	hard rubber
M910-V2xxx	PTFE

Electrodes

M910-Vx0xx	CrNi steel
M910-Vx1xx	hastelloy C-4
M910-Vx2xx	tantalum

Power supply voltage/frequency

M910-Vxx0x	power supply 115V/230V, 50/60 Hz
M910-Vxx1x	power supply 12V DC
M910-Vxx2x	power supply 24V DC
M910-Vxx3x	power supply 48V DC

Construction

M910-Vxxx0	compact version
M910-Vxxx1	remote version

12.1 Example of order

M910-V0000 DN50 PN16

Liner: hard rubber
Electrodes: CrNi steel
Power supply: 115/230 V
Construction: compact version
Nominal diameter: 50 mm
Nominal pressure: 16 bar

M910E-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 M910 flowrates).

$Q_{5\%}$ - recommended minimum flowrate (least flowrate which has the best measuring accuracy – depends on diameter – see table 2 M910 flowrates).

Q_{N} - recommended nominal flowrate (nominal flowrate in which is flowmeter usually calibrated – depends on diameter – see table 2 M910 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 M910 flowrates).

$Q_{100\%}$ - maximum applicable flowrate (flowrate limit which has guaranteed measuring accuracy – depends on diameter – see table 2 M910 flowrates).

Q_{MAX} - maximum applicable overload (**$Q_{125\%}$**) (maximum flowrate which can be still measured – depends on diameter – see table 2 M910 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.

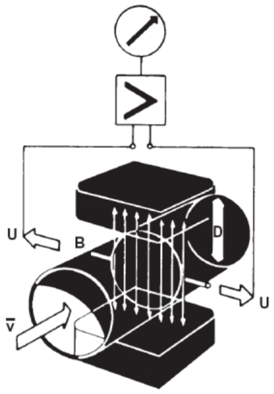
Auxiliary volume counter – second Total Volume counter. Can be cleared by pushing “RIGHT” key. It is usually used for measuring volume during day, month etc.

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 M910 Menu structure (M910 only)

There are three types of menu for parameters setting:

- ***Setup menu***
- ***Calibration menu***
- ***Service menu***

Access to these menus is enabled after pushing the key "ENTER" from the *Main menu*. Each menu has its own password and you can enter this menu using an appropriate password only. Setup password you can change in setup menu, calibration password you can change in calibration menu. Service password is fixed and can be used for service purpose only (it is not described in this manual).

Setup menu has following submenus:
1 INPUT/OUTPUT
2 FLOWMETER
3 GENERAL

Calibration menu has following submenus:
1 INPUT/OUTPUT
2 FLOWMETER
3 GENERAL
4 CALIBRATION

Service menu has following submenus:
1 INPUT/OUTPUT
2 FLOWMETER
3 GENERAL
4 CALIBRATION
5 SERVICE (not described in this manual)

Menu structure – password required

```
                              ESC
MAIN   -> ENTER - SETUP PASSWORD - ENTER               SETUP MENU
MENU   -> ENTER - CALIBRATION PASSWORD - ENTER         CALIBRATION MENU
       -> ENTER - SERVICE PASSWORD - ENTER             SERVICE MENU
```

SERVICE MENU	CALIBRATION MENU	SETUP MENU	1 INPUT/OUTPUT
			2 FLOWMETER
			3 GENERAL
			4 CALIBRATION
			5 SERVICE

INPUT/OUTPUT submenu structure

1 INPUT/OUTPUT	1.B RS485 Addr.	RS485 address	(0 … 255)
	1.A RS485 B.R.	Baud rate	(4800, 9600, 19200)
	1.9 Hysteresis	Flowrate for hyst.	
	1.8 Limit F2	Flowrate for F2	
	1.7 Limit F1	Flowrate for F1	
	1.6 Digital input (PLC)	Clear Volume	
		Dose	Dosing volume
		Off	
	1.5 Status output (relays)	On < F1	
		On > F1	
		Dose Off	
		Dose On	
		On Out	
		On In	
		On Negative	
		On Positive	
		Off	
	1.4 Pulse width	Pulse width in ms. Resolution 10 ms.	
	1.3 Pulse output	On < F1	
		On > F1	
		Dose Off	
		Dose On	
		On Out	
		On In	
		On Negative	
		On Positive	
		Absolute Flowrate	Volume for 1 pulse
		Negative Flowrate	Volume for 1 pulse
		Positive Flowrate	Volume for 1 pulse
		Off	
	1.2 Frequency output	Fixed Frequency	Frequency 0.01 … 12 kHz
		On > F2	
		On < F2	
		Dose Off	
		Dose On	
		On Out	
		On In	
		On Negative	
		On Positive	
		Absolute Flowrate	Flowrate for 1 kHz
		Negative Flowrate	Flowrate for 1 kHz
		Positive Flowrate	Flowrate for 1 kHz
		Off	
	1.1 Current output	Fixed Current	Current 4 … 20 mA
		Bipolar Flowrate	Flowrate for 20 mA
		Absolute Flowrate	Flowrate for 20 mA
		Negative Flowrate	Flowrate for 20 mA
		Positive Flowrate	Flowrate for 20 mA
		Off (current 4mA)	

Key UP ↑

Key ENTER →

← Key ESC

FLOWMETER submenu structure

2 FLOWMETER	2.A Datalogger	Sampling rate in minutes, datalogger clear	(OFF, 5, 10, 15, 30, 45, 60, 120, 180, 240, CLR)
	2.9 Date setting	Real time clock date setting	
	2.8 Time setting	Real time clock time setting	
	2.7 Time constant	Time for flowrate moving average	1...20 sec
	2.6 Low-flow cutoff	Flowrate for Low-flow cut-off	
	2.5 Flowrate direction	Positive	
		Negative	
	2.4 Volume resolution	0	
		0.0	
		0.00	
		0.000	
		0.0000	
	2.3 Volume units	m3 (cubic meter)	
		l (litre)	
		US.G (US gallon)	
		user (user defined units)	
	2.2 Flowrate resolution	0	
		0.0	
		0.00	
		0.000	
		0.0000	
	2.1 Flowrate units	l/s (litres per second)	
		m3/h (cubic meters per hour)	
		G/m (US gallons per minute)	
		User (user defined units)	

Key UP ↑

Key ENTER →

← Key ESC

GENERAL submenu structure

3 GENERAL	3.7 Password menu	Password changing
	3.6 Current loop test	On
		Off
	3.5 Self test	On
		Off
	3.4 Power supply	Information only (Power supply voltage and frequency).
	3.3 Serial number	Flowmeter serial number.
	3.2 Nominal range	Flowrate for Q_N.
	3.1 Diameter	Diameter in mm.

Key UP ↑

Key ENTER →

← Key ESC

CALIBRATION submenu structure

4 CALIBRATION	4.6 Calibration Password	Calibration password changing.	
	4.5 Cal. Point 4	Nominal value of calibration point 4 (flowrate).	Calibration constant for calibration point 4.
	4.4 Cal. Point 3	Nominal value of calibration point 3 (flowrate).	Calibration constant for calibration point 3.
	4.3 Cal. Point 2	Nominal value of calibration point 2 (flowrate).	Calibration constant for calibration point 2.
	4.2 Cal. Point 1	Nominal value of calibration point 1 (flowrate).	Calibration constant for calibration point 1.
	4.1 Number of Cal. Points	Number of Calibration points.	2 … 4

Key UP ↑

Key ENTER →

← Key ESC

Appendix C M910 Material selection

HOW TO USE THIS GUIDE

Chemical names are listed in alphabetical order. Each chemical may have one or more temperature and concentration combination. In instances where the temperature limit is not given or the compatibility information is left blank, this indicates there is no information available.

Pipe Liner

Each liner material has two considerations— compatibility to the chemical and temperature limit. The following codes define the compatibility with each chemical listed:

Compatibility	***Code***
Resistant	A
Not Resistant	N
No Information	(Blank)

Temperature Limit	***Code***
248 °F (120 °C)	1
212 °F (100 °C)	2
176 °F (80 °C)	3
140 °F (60 °C)	4
68 °F (20 °C)	5

NOTE:

Temperature limit values are generally conservative and were chosen to best represent data available. Note that if an A1 code is specified the actual temperature limit of the material may be in excess of 248 °F.

Electrode Material

Each electrode material has two considerations—corrosion rate per year and temperature limit. The following codes define the compatibility with each chemical listed:

Corrosion Rate per Year	***Code***
Less than 0.002 in.	A
Less than 0.020 in.	B
Less than 0.050 in.	C
Greater than 0.050 in.	N
No Information	(Blank)

Temperature Limit	***Code***
248 °F (120 °C)	1
212 °F (100 °C)	2
176 °F (80 °C)	3
140 °F (60 °C)	4
68 °F (20 °C)	5

NOTE:

Temperature limit values are generally conservative and were chosen to best represent data available. Note that if an A1 code is specified the actual temperature limit of the material may be in excess of

Example

This example illustrates how to use the Material Selection Guide to choose compatible pipe materials for a given process. The example process fluid is 98% sulfuric acid at 100 °F (38 °C).

Process Liquid	Maximum Concentr.	PTFE Teflon	ETFE Tefzel	PFA	Polyurethane	Neoprene	Hard Rubber	316 SST	Hastelloy C-276	Tantalum	Platinum - 10 % Iridium	Titanium
		Pipe Liner						**Electrode Material**				
Sulfuric Acid	70%	A1	A1		N	A3	N	N	B3	B1	A1	N
Sulfuric Acid	80%	A1	A1		N	N	N	B5	A5	B1	A1	N
Sulfuric Acid	90%	A1	A1		N	N	N	B5	A4	B1	A1	
Sulfuric Acid	95%	A1	A1		N	N	N	B3		B1	A1	N
Sulfuric Acid	98%	A1	A1		N	N	N	B3	A5	B1	A1	
Sulfuric Acid	100%	A1	A1		N	N	N	B3	A5	B1	A1	N

Legend:

Liners:

A	= Resistant
N	= Not Resistant
Blank	= No Information
Miscellaneous Sat	= Saturated
Conc	= Concentrated

Electrodes: (Corrosion Rate per Year)

A	= Less than 0.002 inches
B	= Less than 0.020 inches
C	= Less than 0.050 inches
N	= Greater than 0.050 inches
Blank	= No information

Temperatures:

1	= 248°F (120 °C)
2	= 212°F (100 °C)
3	= 176°F (80 °C)

Liner Compatibility (from table)

- Teflon - resistant up to 248 °F (120 °C)
- Polyurethane - not resistant
- Tefzel - resistant up to 248 °F (120 °C)
- Neoprene - not resistant
- Natural Rubber - not resistant
- Ryton - not resistant

Electrode Compatibility (from table)

- 316 SST - corrosion rate of less than 0.020 in. per year, up to 176 °F (80 °C)
- Hastelloy C-276 - corrosion rate of less than 0.0020 in. per year, up to 68 °F (20 °C)
- Tantalum - corrosion rate of less than 0.020 in. per year, up to 248 °F (120 °C)
- Platinum-10% Iridium - corrosion rate of less than 0.0020 in. per year, up to 248 °F (120 °C)
- Titanium - corrosion rate of greater than 0.050 in. per year (not recommended)

The proper material selection would be a Teflon or Tefzel liner with platinum-10% Iridium electrodes.

		Flowtube Liner						Electrode Material				
Process Liquid	**Maximum Concentr.**	**PTFE Teflon**	**ETFE Tefzel**	**PFA**	**Polyurethane**	**Neoprene**	**Hard Rubber**	**316 SST**	**Hastelloy C-276**	**Tantalum**	**Platinum - 10 % Iridium**	**Titanium**
Acetaldehtde	100%	A1	A2	A1	N	A2	N	B4	A4	B5	A5	A1
Acetamide	100%	A1	A1	A1	N	A3	N	B1				
Acetic Acid	50%	A1	A1	A1	N	A4	N	B3	A3	A1	A	A1
Acetic Acid	75%	A1	A2	A1	N	A4	N	N	A1	A1	A	A1
Acetic Acid, Glacial	100%	A1	A2	A1	N	N	N	A1	A	A1	A	A
Acetic Anhydride	100%	A1	A1	A1	N	A5	N	B1	A1	A5	A2	A1
Acetone	50%	A1	A4	A1	N	N	N	B1	A3	A3	A	A3
Acetone	100%	A1	A4	A1	N	N	N	A1	A4	A1		A3
Acetophenone	100%	A1	A1	A1		N	N	B1	B3	B5		B3
Acetonitrile	100%	A1	A4	A1				B4		B5		
Acetyl Chloride (dry)	100%	A1	A4	A1	N	N	N	B1		B5	A2	
Acetylene	100%	A1	A1	A1		A3	A5	A1	B3	B5		B5
Acetylene Tebrabromide	100%		A									
Acetylene Tetrachloride	100%		A								A2	
Acid Mine Water	100%											
Acrylontrile	100%	A1	A4	A1		A4	A5	B3	B3	B3	A2	B3
Adipic Acid	100%	A1	A1	A1		A4	A5	B3	A3	B3		A1
Alcohol & Glycerin	100%	A		A	N	N		A	A	A	A	A
Alcohol, 2-Aminoethanol	100%											
Alcohol, Allyl	100%	A1	A3	A1		A5	A5	A1	B1	B1	A2	B3
Alcohol, Amyl	100%											
Alcohol, Butyl	100%											
Allyl Chloride	100%	A1	A3	A1		N	N	A5			A2	
Alum	10%	A		A		N		B	B	A	A	A
Alum	100%	A1	A1	A1		A3	A4	B3	B4	B5	A	A3
Alumina	100%	A		A	N	N		N	A	A	A	A
Aluminium Flouride	100%	A	A	A				N	N	N	A	
Aluminium Hydroxide	100%	A	A	A				B	N	A	A	
Aluminum Ammonium Sulfate	100%		A1									
Aluminium Sulfate	100%	A		A				B	B	A	A	B
Aluminum Chloride	20%	A	A	A	N	A		N	A	A	A5	B
Aluminum Chloride Aqueous	100%	A1	A1	A1	A5	A3	A4	N	A3	B1	A5	N
Aluminum Chlorohydrate	100%	A		A				N	B	A	A	
Aluminum Fluoride	Sat	A1	A1	A1	N	A3	A4	B5		N	A5	A5
Aluminum Hydroxide	100%	A1	A1	A1		A3		A1	B5	A5		B4
Aluminum Oxychloride	100%	A1	A1	A1								
Aluminum Nitrate	Sat	A1	A1	A1		A3	A4	B3	B	B5	A	A3
Aluminum Potassium Sulfate	100%	A1	A1	A1	N	A3	A4	N		B3	A3	A3
Aluminum Sulfate	Sat	A1		A1	N	A3	A4	B3	B3	A1	A2	A3
Amidosulfonic Acid	100%	A		A				N	N	A	A	
Amino Acids	100%		A									
Ammonia (Anhydrous)	100%	A1	A1	A1	A5	A3	N	A1	B1	A1		A1
Ammonium Bicarbonate	50%	A		A	N	N		B	N	A	A	A
Ammonium Bicarbonate	100%	A1		A1				B4	B5	B3	A2	A3
Ammonium Bifluoride	50%	A		A	N	N	N	N	B	N	A	N
Ammonium Bifluoride	100%	A1	A1	A1	N	N	N		B1		A5	

		Flowtube Liner								**Electrode Material**		
Process Liquid	**Maximum Concentr.**	**PTFE Teflon**	**ETFE Tefzel**	**PFA**	**Polyurethane**	**Neoprene**	**Hard Rubber**	**316 SST**	**Hastelloy C-276**	**Tantalum**	**Platinum - 10 % Iridium**	**Titanium**
Ammonium Bisulfate	100%	A		A		A				A	A	A
Ammonium Bromide	5%	A1	A1	A1				B1	A5	B3	A2	
Ammonium Carbamate	50%	A		A	N	N		N	B			A
Ammonium Carbonate	50%	A	A	A	N	N		B	B	A	A2	
Ammonium Carbonate	Sat	A1	A1	A1		A3	A4	B1	B1	A3	A5	A3
Ammonium Chloride	50%	A1	A1	A1		A3	A4	N	A3	A3	A2	A3
Ammonium Chloride	Sat	A1	A1	A1	A	A3	A4	N	B1	A1	A2	A3
Ammonium Dichromate	100%	A										
Ammonium Flouride	10%	A1	A1	A1		A5	A4	B5	A3	N	A	B5
Ammonium Fluoride	25%	A1	A1	A1		A3	A5	N	A3	N	A	A5
Ammonium Fluoride	100%	A	A				A	N	B	N	A	
Ammonium Hydroxide	25%	A1	A1	A1	A5	A3	N	A5	B1	A1	A2	A5
Ammonium Nitrate	5%	A		A	A	N		A1	B	A	A1	A
Ammonium Nitrate	100%	A1	A2	A1	N	A3	A4	A1		A3	A1	
Ammounium Perchlorate	100%		A							A1	A1	
Ammonium Persulfate	100%	A1	A1	A1	N	A3	A5	N	N	A5	A2	B5
Ammonium Phosphate	100%	A1	A1	A1	N	A3	A4	N	N	A	A	A
Ammonium Sulfate	40%	A1	A1	A1	N	A3	A4	B1	B3	A1	A1	A3
Ammonium Sulfide	100%	A1	A1	A1		A4		B1		B5		
Ammonium Thiocyanate	100%	A1	A1	A1		A3		B5	B3	B5		
Amyl Acetate	100%	A1	A1	A1	N	N	N	A1	A1	B1	A2	A3
Amyl Alcohol	100%	A1	A1	A1	N	A4	A4	B1	B3	B1	A2	B4
Amyl Chloride	100%	A1	A1	A1		N	N	B4	A5	B1	A2	
Aniline	100%	A1	A2	A1	N	N	N	A1	B1	B3	A1	A3
Aniline Hydrochloride	100%	A1	A2	A1		N	N	N	N	B3	A2	A3
Anthraquinone	100%	A1	A1	A1					B3	B3	A2	
Anthraquinone-Sulfonic Acid	100%	A1	A1	A1					B5	B3		
Antimony Pentoxide	100%	A		A				N	N	A	A	
Antimony Trichloride	100%	A1	A3	A1		A4		N	B3	B3	A2	B5
Aqua Regia	100%	A1	A3	A1	N	N	N	N	N	A1	N	A5
Arsenic Acid	100%	A1	A1	A1		A3	A4	B1	B3		A2	
Arsenous Acid	100%	A		A				N	N	A	A	
Asphalt Emulsions	100%	A1		A1		N		A5				
Barium Acetate	100%	A		A				N	N	A	A	
Barium Carbonate	Sat	A1	A1	A1		A4	A3	B5	B1	B5	A	A5
Barium Chloride	Sat	A1	A1	A1		A3	A5	B3	A3		A2	
Barium Hydroxide	50%	A		A	A	A		A	B	A	A2	
Barium Hydroxide	Sat	A1	A1	A1		A3	A4	B1	B1	B1	A2	A3
Barium Sulfate	100%	A1	A1	A1	A	A4	A3	B3	N	B3	A	A3
Barium Sulfide	100%	A1	A1	A1		A4	A4	B3	N	B5	A4	B5
Battery Acid	100%		A									
Bauxite Slurry	100%	B		B	A	B		N	A	A	A	A
Beer	100%	A1	A1	A1	N	A5	A5	A1	A5	A5	A	B5
Benzaldehyde	100%	A1	A3	A1				B1	B3	B3	A2	B5
Benzene	100%	B1	A3	B1				B1	B3	A2	A2	A2
Benzene Sulfonic Acid	100%	A1	A3	A1			N	B3	B3		A2	B3
Benzoic Acid	100%	A1	A1	A1	N	A3	A4	B1		A3	A2	A1
Benzonitrile	100%	A1	A3	A1						A1	A2	A1
Benzoyl Chloride	100%	A1	A4	A1			N	A5		A1	A2	
Benzyl Alcohol	100%	A1	A1	A1		N	N	A1	B3	B3	A2	B3
Benzyl Chloride	100%	A1	A1	A1		N	N	B3		B2	A1	
Bismuth Carbonate	100%	A1	A1	A1						B5		
Black Liquor	100%	A1	A1	A1	N	A3	A5	B5	C1	N	A	B

Flowtube Liner Electrode Material

Process Liquid	Maximum Concentr.	PTFE Teflon	ETFE Tefzel	PFA	Polyur ethane	Neoprene	Hard Rubber	316 SST	Hastelloy C-276	Tantalum	Platinum - 10 % Iridium	Titanium
Bleach, Active Chlorine 12.5%	100%	A1	A3	A1	N	A5	A5	N	A4			
Borax	100%	A1	A1	A1	A	A3	A4	A1	A5	N	A	B3
Boric Acid	100%	A1	A1	A1		A3	A4	B1	A1	A1	A	A3
Boron Fluoride	100%	A		A				N	N	N	A	N
Brine Acid	100%	A1	A1	A1		A4	A3	N	A4	A	A	A
Bromic Acid	100%	A1	A1	A1		A5				B5	A2	
Bromine Liquid	100%	A1	A1	A1				N		A1		
Bromobenzene	100%	A1	A3	A1			N			A1	A2	A3
Bromoform	100%		A									
m-Bromotoluene	100%		A									
Butadiene (Butylene)	100%	A1	A2	A1	N	A5	N	B1	B3	B5		
Butane	100%	A1	A1	A1	A5	N	N	B1	B2	A5	A2	A5
Butanediol	100%		A							A1	A2	A1
Butyl Acetate	100%	A1	A2	A1		N	N	B1	B1	B5	A2	A3
Butyl Acrylate	100%		A									
Butyl Alchol	100%	A1	A1	A1		A3	A4	A1	B3	B5		B3
Butyl Alcohol Secondary	100%	A1	A1	A1				B5	B5	B5		B3
Butyl Alcohol Tertiary	100%	A1	A1	A1				B5	B5	B5		B3
n – Butylamine	100%	A1	A5	A1				B1	B3			B3
sec – Butylamine	100%		A									
tert – Butylamine	100%		A									
di-n-Butyl Amine	100%		A									
tri-n-Butyl Amine	100%		A									
Butyl Amine	100%											
Butyl Bromide	100%	A1	A1	A1								
Butyl Chloride	100%	A1	A1	A1		N		B5	B5	B3	A2	B5
Butyl Ether	100%	A1	A3	A1				A5				
Butyl Phenol	100%	A1	A2	A1		N		A1	B3	B2	A2	
Butyl Phthalate	100%	A1	A4	A1				B3	B3	B3		B3
Butylene (Butadiene)	100%	A1	A1	A1	N	A4	N	B1		B5		
Butyraldehyde	100%	A		A				A2	A2			
Butyric Acid	100%	A1	A1	A1		N	N	B1	A1	B1	A2	A3
n-Butyl Mercaptan	100%	A1	A1	A1				B3	B1			
Cadmium Chloride	100%	A		A				N	N	A2	A2	
Calcium Bisulfate	100%	A1	A1	A1				B3	N	A1	A	
Calcium Bisulfite	100%	A1		A1			A5	B1	B5	A5	A5	A3
Calcium Carbonate	100%	A1	A1	A1	A	A5	A3	B3	B3	A2	A2	A2
Calcium Chlorate	30%	A		A	N	A		B4	B3	B3	A2	B4
Calcium Chlorate	100%	A1	A1	A1		A3	A4	B3	B3	B3	A2	B4
Calcium Chloride	50%	A	A	A	A	A		N	A	A1	A2	A
Calcium Chloride	Sat	A1	A1	A1	A5	A3	A4	B3	A1		A2	A3
Calcium Hydroxide	25%	A1	A1	A1	A5	A2	A3	B3	A4	A1	A5	A2
Calcium Hydroxide	Sat	A1	A1	A1		A2	A3	B3		A1	A2	A2
Calcium Hypochlorite	Sat	A1	A1	A1		A5	A5	B5		B1	A2	A3
Calcium Nitrate	10%	A		A				B	B	A	A2	A
Calcium Nitrate	100%	A1	A1	A1	A5	A3	A4	B1	B3	B5	A2	B3
Calcium Oxide	100%	A1	A1	A1		A5		B5	B5			
Calcium Sulfate	10%	A	A	A	N	N		A		A	A2	A
Calcium Sulfate	100%	A1	A1	A1	N	A4	A3	B3	B1	B3	A	A3
Calcium Sulfide	100%		A									
Cane Sugar Juice	100%	A		A	N	A		A	A	A	A	A
Caprylic Acid	100%	A1	A3	A1				B1	B1	B1		B3
Carbon Dioxide (Dry)	100%	A1	A1	A1	A5	A3	A4	B1	A1	B1	A1	A5
Carbon Dioxide (Wet)	100%	A1	A1	A1	A5	A3	A4	B3	B3	A1	A1	A5
Carbon Disulfide (Bisulfide)	100%	A1	A4	A1		N	N	B1	B3	A5		A3
Carbon Slurry	100%	N		N	A	N		A	A	A	A	A
Carbon Tetrachloride	100%	A1	A1	A1	N	N	N	A1	A5	A1		A3
Carbonic Acid	100%	A1	A1	A1		A5	A3	B1	A5	B1	A1	A3
Castor Oil	100%	A1	A1	A1		A4	A4	B4	A5			
Caustic Soda	50%	A	A	A	N	N		B		N	A	B
Cellosolve	100%	A1	A1	A1		N	N	B1	B3	B3		B3
Cheese	100%	A		A	N	N		A	A	A	A	A
Chloral Hydrate	100%	A1	A3	A1								
Chlorinated Brine	100%		A									
Chlorinated Phenol	100%		A									
Chlorine (Liquid)	100%	A1	A	A1		N	N	N	A5	B1	N	
Chlorine Dioxide	15%	A1	A1	A1		N	N	N	A4	A1		A3

Flowtube Liner **Electrode Material**

Process Liquid	Maximum Concentr.	PTFE Teflon	ETFE Tefzel	PFA	Polyur ethane	Neoprene	Hard Rubber	316 SST	Hastelloy C-276	Tantalum	Platinum - 10 % Iridium	Titanium
Chlorine Dioxide	100%	A	A	A		N		N	N	A	N	A
Chlorine Water	Sat	A1	A5	A1		N	A4	N	A3	B1	A	A3
Chloroacetic Acid	100%	A1		A1	N	N	N	N	A4	A1	A2	A3
Chloroacetic Acid (50% H2O)	50%	A1	A2	A1		N	N	N	B3	A3	A2	A3
Chlorobenzene (Phenylchloride)	100%	A1	A3	A1		N	N	B1	A1	B1		B3
Chlorobenzyl Chloride	100%		A									
Chloroform	100%	A1	A2	A1	N	N	N	A5	B3	A3	A2	A3
ChlorohydrateAluminum	100%	A		A				N	N	A	A	
Chlorohydrin	100%		A								A1	
Chlorohydroxide (wet)	100%											
Chlorophenol, 5% Aqueous	100%	A1		A1				B1	A5		A2	
Chlorosulfonic Acid	100%	A1	A5	A1		N	N	N	A2	B3	A1	A3
Chlorosulfuric Acid	100%	A		A				N	B	A	A	
Chromic Acid	30%	A1	A4	A1		A5	N	B1	B3	B1	A2	A3
Chromic Acid	50%	A1	A4	A1		A5	N	B4	B3	A1	A2	A3
Chromic Acid	100%	A	A	A	N	N		N	N	A	A2	B
Chromic Chloride	100%		A									
Chromium Fluoride	100%	A		A								
Chromium Sulfate	50%	A		A	N	N		B	B	A	A2	
Chromium Sulfate	100%	A		A				N	B	A	A	
Chromyl Chloride	100%	A1	A3	A1				B3	B3	B3	A2	B5
Clorox Bleach Solution(5.5% Chlorine)	100%	A1	A3	A1		N	N	B5				
Citric Acid	50%	A1	A3	A1	N	A	A4	B1	A3	A1	A2	A3
Clay Slurry	100%	A		A	A	A		A	A	A	A	A
Coal & Water Slurry	100%	N		N	A	A		N	A	A	A	A
Coffee Extract	100%	A		A	A	A		A	A	A	A	A
Cola Syrup	100%	A		A	A	A		A	A	A	A	A
Copper Chloride	5%	A		A	A	A		N	B	A	N	A
Copper Chloride	100%	A1	A1	A1		A3	A4	N	B3	A1	N	A3
Copper Cyanide	100%	A1	A1	A1	A5	A4	A4	B3	A4	B1	A	A5
Copper Fluoride	100%	A1	A1	A1		A4		N	N	N	A	
Copper Nitrate	50%	A	A	A	A			B	N	A	A	A
Copper Nitrate	100%	A1	A1	A1		A3	A3	A1	B5	B1	A	A5
Copper Oxychloride	100%	A		A				N	N	N	A	
Copper Sulfate	40%	A		A	A	A		B	A	A	A2	A
Copper Sulfate	70%	A		A	A	A		B	A	A	A	B
Copper Sulfate	100%	A1	A1	A1		A3	A4	B1	A3	A1		A3
Copper Sulfide	100%	A		A				B	B	A	A	
Corn Oil	100%	A1		A1		A3	N	B1				
Cottonseed Oil	100%	A1		A1		A4	N	B4				
Cresol	100%	A1	A1	A1	N	N	N	B5	B3			B3
Cresylic Acid	100%	A1	A1	A1	N	N	N	B1	A1	B2		B5
Cresyldiphenyl Phosphate	100%											
Croton Aldehyde	100%	A1	A3	A1		A5			B3	B3		
Crude Oil	100%	A1	A1	A1	A5	N	N	A3	A5	A5		A5
Cupric Chloride	50%	A1		A1		A4		N	B3	A5	N	B3
Cupric Chloride	100%	A		A				N	N	A	A	B
Cyclohexane	100%	A1	A1	A1		N	N	B1	B3	B5	A2	A1
Cyclohexanol	100%	A1	A1	A1		N		B5	B5	B5	A2	B5
Cyclohexanone	100%	A1	A1	A1		N	N	B3	B3	B5		B5
DDT	100%		A							A2	A2	A2
Dairy Products	100%	A		A	N	N		A	A	A	A	A
Decalin	100%	A										
Decane	100%	A										
Detergents	100%	A1	A1	A1	A5	A3		B1	A5	A4		A4
Dextrin	100%	A1	A1	A1		A3			B5			
Diacetone Alcohol	100%	A1	A3	A1		N		B1	A3	A2	A2	A2
1.2 Dibromo Propane	100%		A									
Dibutyl Phthalate	100%	A1	A4	A1		N	N	B1	B3	B3	A1	B3
Dichloroacetic Acid	100%	A1	A4	A1		N				A1		A1
Dichlorobenzene	100%	A1	A4	A1		N	N	B5	A1		A2	
Dichloroethylene	100%	A1	A4	A1		N		B3	B3	B3	A2	B3
Dichloropropionic Acid	100%		A									
Diesel Fuel	100%	A1	A1	A1		A5	N	A5	B3			B3
Diethylamine	100%	A1	A2	A1		A5	A5	B1			A2	

		Flowtube Liner						Electrode Material				
Process Liquid	**Maximum Concentr.**	**PTFE Teflon**	**ETFE Tefzel**	**PFA**	**Polyurethane**	**Neoprene**	**Hard Rubber**	**316 SST**	**Hastelloy C-276**	**Tantalum**	**Platinum - 10 % Iridium**	**Titanium**
Diethyl Benzene	100%		A									
Diethyl Cellosolve	100%	A1	A1	A1		A5		B3				
Diethyl Ether	100%	A1	A3	A1		N	N	B2	B5	B5		B5
Diethylene Triamine	100%	A1	A3	A1						B5		A5
Diglycolic Acid	100%	A1	A3	A1		A3		B1	B3	B3	A2	B3
Diisobutyl Ketone	100%		A									
Diisobutylene	100%		A									
Dimethylamine	100%	A1	A5	A1		N				B5	A2	
Dimethyl Aniline	100%	A1	A1	A1		N	N				A2	
Dimethyl Formamide	100%	A1	A1	A1		A4	N	B1				
Dimethyl Phthalate	100%	A1	A3	A1		N	N	A5				
Dimethyl Sulfate	100%		A									
Dimethyl Sulfoxide	100%	A1	A3	A1								
Dioctyl Phthalate	100%	A1	A4	A1		N	N	B5			A2	
Diphenyl Ether	100%		A									
Disulfide	100%											
p-Dioxane	100%		A									
Divinyl Benzene	100%		A									
Dowtherm (Diphenyl)	100%	A1	A4	A1		A3	N	B3	B3	B3		B3
Dyes	100%	A	A	N		N	A	A	A	A		A
Pichlorhydrin	100%	A1	A4	A1		N	N	B1	A5	B5	A2	
Ethylamine	100%		A									
Ethers	100%	A1	A3	A1		N	N	A3	B3	B3		B5
Ethyl Alcohol	100%	A1	A1	A1				B1	A2	A3		A3
Ethyl Acetate	100%	A1	A4	A1	N	N	N	B1	B1	B3	A1	A3
Ethyl Acrylate	100%	A1	A3	A1		N	N	B3	A3	B5	A2	
Ethyl Chloroacetate	100%		A									
Ethyl Chloride	100%	A1	A1	A1		N	N	A1	B3	A3	A1	A3
Ethyl Cyanoacetate	100%		A									
Ethyl Acetoacetate	100%		A									
Ethylene Bromide	100%	A1	A1	A1		N	N	A3	A3	B5		B3
Ethylene Chloride	100%	A1	A1	A1		N	N	B2		B3		A3
Ethylene Chlorohydrin	100%	A1	A4	A1		N	N	B3	B3	B3		B3
Ethylene Diamine	100%	A1	A5	A1		N	A5	B1	N	B5	A2	A5
Ethylene Dichloride	100%	A1		A1		N	N	B1	B2	A3	A2	B3
Ethylene Glycol	100%	A1	A1	A1	A5	A4	A4	B1	A1	A5	A2	A3
Ethylene Oxide	100%	A1	A2	A1		N	N	B1	A5	A5	A2	A5
Esters	100%		A									
Fatty Acids	100%	A1	A1	A1		A4	N	A1	A1	A1	A1	A3
FerricChloride50% H2O	50%	A1	A1	A1		A4	A4	N	B3	A3	A	A3
Ferric Hydroxide	100%	A1	A1	A1		A5		A5	A5	A3	A5	B3
Ferric Nitrate	10%	A1	A1	A1		A3	A4	B1	A5	B3	A2	A5
Ferric Nitrate	100%		A1								A2	
Ferric Sulfate	10%	A		A				A3	A4	A2	A2	A2
Ferric Sulfate	100%	A1	A1	A1		A3	A4	N	B	A3	A	A
Ferrous Chloride	10%	A		A	N	N		N	N	A	A2	A
Ferrous Chloride	Sat	A1	A1	A1		A5	A4	N	B1	A3	A2	A3
Ferrous Hydroxide	100%		A									
Ferrous Nitrate	100%	A1	A1	A1		A3	A4	B5	B	A	A	A
Ferrous Sulfate	10%	A		A	N	N		N	N	A	A	A
Ferrous Sulfate	50%	A1		A1	N	N		N	N	A	A	A
Ferrous Sulfate	100%	A1	A1	A1		A3	A4	B3	B2	B1	A	A5
Fluoroboric Acid	100%	A1	A1	A1		A4	A4	N	A3	N		N
Fluosilicic Acid	40%	A		A	N	N		N	N	N	A	N
Fluosilicic Acid	100%	A1	A1	A1		A4	A5	B3	B5	N		N
Formalhehyde	35%	A1	A2	A1	N	A4		A3	B3	A1	A2	A3
Formic Acid	50%	A1	A1	A1	N	A4	N	B1	A2	A1	A2	B5
Formic Acid	80%	A1	A1	A1	N	A4	N	B1	A3	A1	A2	B5
Formic Acid	100%	A1	A1	A1	N	A5	N	B3	A2	A1	A2	B5
Freon F-11	100%	A1	A3	A1	A5	A3	N	B1				
Freon F-12	100%	A1	A2	A1	A5	A3	N	B1	A5	B5		B5
Freon F-22	100%	A1	A2	A1	N	A5	N	B1	B1	B5		B5
Fruit Juices, Pulp	100%	A1		A1	N	A3		B1	A3	A5	A	A5
Fuel Oil	100%	A1	A1	A1		A4	N	B4	B3	B3		A5
Fumaric Acid	100%		A									
Furane	100%		A									
Furfural	100%	A1	A3	A1	N	A3	N	B1	B5	A1		A3
Gallic Acid	100%	A1	A3	A1	N	A5	A4	B1	B3	B5		
Gas Oil	35%	A		A				N	B	N	A	
Gas Oil	100%	A		A				N	N	N	A	

		Flowtube Liner						Electrode Material				
Process Liquid	**Maximum Concentr.**	**PTFE Teflon**	**ETFE Tefzel**	**PFA**	**Polyur ethane**	**Neoprene**	**Hard Rubber**	**316 SST**	**Hastelloy C-276**	**Tantalum**	**Platinum - 10 % Iridium**	**Titanium**
Gas –Manufactured	100%	A1	A1	A1				B5				
Gasoline – Leaded	100%	A1	A1	A1	A5	A5	N	B5	A5	A5		A5
Gasoline – Unleaded	100%	A1	A3	A1	A5	A5	N	B5	A1	A5		B5
Gasoline – Sour	100%	A1	A1	A1	A5	A5	N	B5	B1	B5		
Glacial Acetic Acid	100%	A		A				N	A	A	A	
Glucose (Corn Syrup)	100%	A1		A1		A5	A5	B1	A	A	A	A
Glycerin (Glycerol)	100%	A1	A1	A1	A5	A3	A4	A3	A1	B5	A	A3
Glycol	100%	A1	A1	A1		A4	A5	B5				
Glycolic Acid	100%	A1	A1	A1		A3		B1	B3	B3		A3
Green Liquor	100%	A1		A1	N	A4	A4	B	B	A	A	A
Heptane	100%	A1	A1	A1		A3	N	B1	A3	B3	A2	B3
Hexane	100%	A1	A1	A1	A5	A5	N	A1	A1	B5	A2	A4
Hormaldehyde	100%	A		A				N	B	A	A	
Hydrazine	100%		A									
Hydrazine Dihydroanioride	100%		A									
Hydriodic Acid	100%		A									
Hydrobromic Acid	50%	A1	A1	A1	N	N	A5	N	B5	A1	A2	A3
Hydrochloric Acid	5%	A		A				N	N	A	A2	
Hydrochloric Acid	20%	A1	A1	A1	A5	A5	A4	N	A5	A1	A2	N
Hydrochloric Acid	40%	A1	A1	A1		A5	A3	N	A5	A1	A2	N
Hydrocyanic Acid	10%	A1	A1	A1	N	N	A5	B3	B	A	A2	B
Hydrofluoric Acid	20%	A1	A1	A1	N	A3	A5	N	B3	N	A2	N
Hydrofluoric Acid	35%	A1	A1	A1	N	A3	A5	N	B3	N	A2	N
Hydrofluoric Acid	70%	A1	A1	A1	N	A3	N	N	B3	N	A2	N
Hydrofluorosilicic Acid	35%	A1	A1	A1		A4	A5	B5	B5	N	A	N
Hydrofluorosilicic Acid	100%		A									
Hydrogen Cyanide	100%	A1	A1	A1		N	A5	A5	A5	B5	A	
Hydrogen Fluoride	100%	A1		A1		N	N	A5	B1	N	B	A5
Hydrogen Peroxide	30%	A1	A1	A1	N	N	N	B1	A5	B1	A2	A3
Hydrogen Peroxide	50%	A1	A4	A1	N	N	N	B1	B5	B1	A2	A3
Hydrogen Peroxide	90%	A1	A4	A1	N	N	N	A5	A3	B1	A2	B3
Hydrogen Sulfide	100%	A1	A1	A1		A3	N	B1	A5	A1		A5
Hydrogen Phosphide	100%	A1	A4	A1								
Hydroquinone	100%	A1	A1	A1		A3	A5	B1	B3	B3	A1	B3
Hydroxy Acetic Acid	35%	A1		A1				B	B	A	A	
Hydroxy Acetic Acid	70%	A1		A1				B	B	A	A	
Hypochlorous Acid	20%	A		A				N	B	N	A	B
Hypochlorous Acid	100%	A1	A1	A1	N	N	A4	N	B5	B1	A2	B5
Iodine	100%	A1	A2	A1		N	N	N	A1	B1	A1	A5
Idoform	100%	A1	A2	A1				A1	N	B3	A2	B2
Iron Chloride	100%	A		A				N	B	N	A	
Iron Nitrate	100%	A		A				N	B	A	A	
Iron Sulfate	100%	A		A				N	B	A	A	A
Isobutyl Alcohol	100%		A									
Isopropylamine	100%		A									
Jet Fuels - JP4	100%	A1	A2	A1	N	N	N	B1	A5			A5
Jet Fuels - JP5	100%	A1	A2	A1	N	N	N	B1	A5			A5
Kerosene	100%	A1	A1	A1	N	A3	N	B1	B2	B5		A5
Ketones	100%	A1	A1	A1		N		B1	A5			A5
Kraft Liquor	100%	A1		A1		A5		A5	A5			
Lactic Acid	100%	A1	A1	A1		A5	A5	B1	B2	A1	A2	A1
Lard Oil	100%	A1	A1	A1		N	N	B5	A5	A5		
Latex	100%	A		A	N	N		A	A	A	A	A
Lauric Acid	100%	A1	A1	A1				B5	B5		A2	
Lauryl Chloride	100%	A1	A1	A1								
Lauryl Sulfate	100%		A									
Lead Acetate	100%	A1	A1	A1		A3	A5	B3	B3	B3	A2	A3
Lead Nitrate	100%	A1	A5	A1		A3	A3	B5	B3	A	A2	
Lime Slurry	100%	A		A	A	A		A	A	A	A	A
Linoleic Acid	100%	A1	A1	A1		N	N	B1	B1	B1		B3
Linseed Oil	100%	A1	A1	A1		A3	N	B5	B5	B3		A5
Lithium Bromide	100%	A1	A1	A1		A3		B1				
Lithium Chloride	30%	A1	A5	A1				N	A3	A3	A	A3
Lithium Chloride	100%	A		A				N	A	A	A	A
Lithium Hydroxide	10%	A1	A1	A1				B3	B3	B3		
Lubricating Oil	100%	A1	A1	A1		A3	N	B4				A5
M-Cresol (crude)	100%											
Magnesium Bisulfate	100%	A		A				B	B			
Magnesium Carbonate	10%	A		A				B	B	A		

		Flowtube Liner						**Electrode Material**				
Process Liquid	**Maximum Concentr.**	**PTFE Teflon**	**ETFE Tefzel**	**PFA**	**Polyurethane**	**Neoprene**	**Hard Rubber**	**316 SST**	**Hastelloy C-276**	**Tantalum**	**Platinum - 10 % Iridium**	**Titanium**
Magnesium Carbonate	100%	A1	A1	A1		A3	A3	B3		B3	A	5
Magnesium Chloride	42%	A1	A1	A1	A5	A2	A4	B2	A1	A1	A	A1
Magnesium Chloride	100%	A1	A1	A1	A5	A3	A4		A1			
Magnesium Hydroxide	100%	A1	A1	A1		A3	A3	A2	A2	A5	A	A5
Magnesium Nitrate	100%	A1	A1	A1		A3	A4	B1	A5	B3	A	A5
Magnesium Sulfate	25%	A		A				B	N	A	A	B
Magnesium Sulfate	40%	A		A				A	B3	A4	A	A
Magnesium Sulfate	100%	A1	A1	A1	A5	A3	A4	B1	A	A4	A	B3
Maleic Acid	100%	A1	A1	A1	A5	N	A5	B1	B3	B3		A3
Maleic Anhydride	100%		A									
Malic Acid	100%	A1	A1	A1		A5	A5	A1	B3	B3		A3
Mercuric Chloride	60%	A		A	N	A		N	N	A	A	A
Mercuric Chloride	100%	A1	A1	A1		N	A4	B1		A1	A2	B3
Mercuric Cyanide	100%	A1	A1	A1		N	A4	B5	B5	B1		A5
Mercuric Nitrate	100%	A1	A1	A1		A5	A5	N		B1	A2	
Mercury	100%	A1	A1	A1	A5	A3	A4	A1	A1	B1	N	A1
Methacrylic Acid	100%		A									
Methane	100%	A1	A1	A1		A3	N	A1	A3	B1		A3
Methane Sulfonic Acid	50%	A1	A2	A1								
Methyl Alcohol	100%	A1	A1	A1	A5	A3	A4	B1	A1	B1		B3
Methyl Benzoate	100%		A									
Methyl Bromide	100%	A1	A1	A1		N	N	B1			B3	
Methyl Cellosolve	100%	A1	A1	A1		A3		B1		B5		
Methyl Chloride	100%	A1	A1	A1		N	N	A1	B5	B3		A3
Methyl Chloroform	100%	A1	A4	A1		N						
Methyl Chloromethyl Ether	100%		A									
Methyl Cyanoacetate	100%		A									
Methyl Ethyl Ketone	100%	A1	A2	A1	N	N	N	B1	B3	B3		B3
Methyl Methacrylate	100%	A1	A4	A1		N	N	B5		B5		
Methyl Salicylate	100%	A1	A3	A1			N			B5		
Methyl Sulfuric Acid	100%	A1	A3	A1				B5		A1		
Methyl Isobutyl Ketone	100%	A1	A1	A1		N	N	B1	B3	B3		B3
Methyl Trichlorosilane	100%		A									
Methylene Bromide	100%		A									
Methylene Chloride	100%	A1	A3	A1	N	N	N	B1	A3	N		A3
Methylene Iodide	100%		A									
Milk	100%	A1		A1	A5	A3	A5	A1	A5	A1	A	A5
Mineral Oil	100%	A1	A1	A1	A5	A3	N	B1		A1		A5
Molasses	100%	A1		A1	N	A3	A4	A1	A5	A5	A	A
Monochlorobenzene	100%	A1	A2	A1		N	N	B5	B5	B4		B4
Monoethanolamine	100%	A1	A4	A1		A5	A5	A3	B3	A3	A2	B3
Morpholine	100%	A1	A4	A1		N		B1			B2	
Motor Oil	100%	A1		A1				B1				
Mud Drilling	100%	N		N	A	N		A	A	A	A	A
Naphtha	100%	A1	A1	A1	A5	N	N	B3	B3	B5	A2	B5
Naphthalene	100%	A1	A1	A1		N	N	A1	B3	B3	A1	A3
Nickel Chloride	10%	A		A				N	A	B	A	B
Nickel Chloride	20%	A		A				N	N	A	A	N
Nickel Chloride	100%	A1	A1	A1		A3	A4	B5	N	B3	A2	A3
Nickel Nitrate	10%	A		A					B	B	A	
Nickel Nitrate	100%	A1	A1	A1		A3	A4	A1	B1	B3	A2	A5
Nickel Sulfate	10%	A		A				B	B	A3		B3
Nickel Sulfate	100%	A1	A1	A1		A3	A4	B3	B3	N	A2	N
Nicotine	100%	A1	A3	A1		N		B3		B5		
Nicotonic Acid	100%	A1	A1	A1		A3		B1				
Nitric Acid (Anhydrous)	100%	A1	N	A1	N	N	N	A5	B5	A1	A2	B3
Nitric Acid	10%	A1	A4	A1	N	N	N	A3	A3	A1	A	A1
Nitric Acid	20%	A1	A4	A1	N	N	N	A5	A4	A1	A2	A1
Nitric Acid	40%	A1	A4	A1	N	N	N	A5	A5	A1	A	A1
Nitric Acid	50%	A1	A4	A1	N	N	N	A5	A5	A1		A1
Nitric Acid	70%	A1	A5	A1	N	N	N	A5	A5	A1	A	A1
Nitric Acid-Sulfuric Acid	50%/50%	A1	A3	A1				A4		B5		
Nitrobenzene	100%	A1	A1	A1	N	N	N	B1	N	B3	A2	A3
Nitrogen	100%	A1	A1	A1		A3	A3	A1	A1	A1		
Nitrogen Dioxide	100%	A1	A3	A1						A1		
Nitromethane	100%	A1	A3	A1		N	A5	B5		B5		
Nitrous Acid	Conc	A1	A3	A1		N	N	B5	N	B1	A2	

		Flowtube Liner						Electrode Material				
Process Liquid	**Maximum Concentr.**	**PTFE Teflon**	**ETFE Tefzel**	**PFA**	**Polyurethane**	**Neoprene**	**Hard Rubber**	**316 SST**	**Hastelloy C-276**	**Tantalum**	**Platinum - 10 % Iridium**	**Titanium**
Octane	100%	A1	A1	A1		A2		B5				
Octene	100%		A									
Oleic Acid	100%	A1	A1	A1	A5	N	N	A1	B3	B3	A1	A5
Oleum	100%	A1	A4	A1	N	N	N	B5		N	A	N
Oxalic Acid	Sat	A1	A2	A1		N	A4	N	B3	A3	A	B5
p-Dioxane	100%											
Palmitic Acid	Conc	A1	A1	A1		N		B1	B5			
Paper Stock	100%	A1	A1	A1				A	A	A	A	A
Perchloric Acid	10%	A1	A2	A1	N	A5	A4	N		A1		N
Perchloric Acid	70%	A1	A4	A1	N	N		N	B2	A1	A	N
Perchloric Acid	100%	A		A				N	N	A	A	
Perchlorethylene	100%	A1	A1	A1	N	N	N	A5	B3	B3		A3
Petrolatum	100%	A1	A1	A1		A3		B1		A5		
Petroleum Oils, Refined	100%	A1	A1	A1		A5	N	B5		A1		
Petroleum Ether	100%	A1	A3	A1				A5	A5	A5		A5
Phenol	10%	A1	A2	A1	N	N	A5	B3	B1	B1	A	B5
Pheno (Carbolic Acid)	100%	A1	A3	A1	N	N	N	A1	A1	B1	A1	A5
Phenolsulfonic Acid	100%		A									
Phenylhydrazine	100%	A1	A3	A1		A5	A5				A2	
Phenylhydrazine Hydrochloride	100%	A1	A3	A1							A2	
o-Phenylphenol	100%		A									
Phosgene Liquid	100%	A1	A3	A1				B2		B1	A1	
Phosphate Slurry	100%	A		A				N	A	A	A	A
Phosphoric Acid	30%	A1	A1	A1	A5	A3	A4	B3	A4	A1		C5
Phosphoric Acid	85%	A1	A1	A1	N	N	A5	B1	A3	A1	A	C5
Phosphoric Anhydride	100%	A1		A1		A5		B3		A5	A2	
Phosphorus	100%	A1		A1				A5	A4	B1		
Phosphorus Pentoxide	100%	A1	A2	A1				B5	N	B5	A2	
PhosphorusOxychloride	100%	A1	A3	A1				N	B3	B1	A2	A5
Phosphorus Pentachloride	100%		A								N	
Phosphorus Trichloride	100%	A1	A1	A1		N		A5	B5	A1	N	A5
Photographic Solutions	100%	A1		A1	N	A3	A4	A1		A5		B5
Phthalic Acid	100%	A1	A3	A1		A3		A1	B1	B1	A1	A5
Phthalic Anhydride	100%	A1	A3	A1			A4	A1	A1	B1		
Picric Acid	100%	A1	A5	A1		A3	N	B1	B1	B3		A5
Polyvinyl Acetate	100%	A1	A1	A1		A3		A3		B5		
Potassium Aluminum Chloride	100%		A									
Potassium Aluminum Sulfate	50%		A									
Potassium Aluminum Sulfate	100%	A1		A1	N	A4		B5	A5	A3	A	A3
Potassium Bicarbonate	30%	A1	A1	A1	N	N		A3	B3	B5		A3
Potassium Bicarbonate	100%	A	A	A				B	B	A	A	
Potassium Borate	100%	A1	A1	A1		A4						
Potassium Bromate	100%	A1	A1	A1		A4						
Potassium Bromide	30%	A1	A1	A1		A4	A4	B1	B5	A5		A3
Potassium Carbonate	50%	A1	A1	A1		A3	A4	A3	B3	B1	A2	A3
Potassium Chlorate, Aqueous	30%	A1	A1	A1		A5		A1	B3	B5	A2	A3
Potassium Chloride	30%	A1	A1	A1	N	A4	A4	A1		A1	A	A3
Potassium Chloride	60%	A		A				B	N	A	A	B
Potassium Chloride	100%	A	A	A	N	A		N	A	A	A	A
Potassium Chromate	30%	A1	A1	A1		A5		B1	B3	B5		A3
Potassium Cyanide	30%	A1	A1	A1		A3	A4	B3	B3	A5	A2	N
Potassium Dichromate	30%	A1	A1	A1	N	N	N	A1	B3	A1	A	A3
Potassium Dichromate	60%	A		A	N	A	A		B	A	A2	A
Potassium Ferricyanide	30%	A1		A1		A2		N	N	A5	N	A5
PotassiumFerrocyanide	30%	A1	A1	A1		A3		N	N	B3	N	A5
Potassium Fluoride	100%	A1	A1	A1			N	B3		B5		N
Potassium Hydroxide (Caustic Potash)	10%	B		A	N	N		B	N	N	A1	A
Potassium Hydroxide (Caustic Potash)	50%	A1	A3	A1		A3	A5	B1	B1	N	A1	A3
Potassium Hypochlorite	40%	A		A	N	N		N	B	B		A
Potassium Hypochlorite	100%	A1	A1	A1				B5	B3	B3		

		Flowtube Liner								Electrode Material		
Process Liquid	**Maximum Concentr.**	**PTFE Teflon**	**ETFE Tefzel**	**PFA**	**Polyurethane**	**Neoprene**	**Hard Rubber**	**316 SST**	**Hastelloy C-276**	**Tantalum**	**Platinum - 10 % Iridium**	**Titanium**
Potassium Nitrate	80%	A1	A1	A1	N	A3	A4	B1	B3	B1	A	A3
Potassium Nitrite	100%	A1		A1				N	N	A	A	B3
Potassium Perborate	100%	A1	A1	A1								
Potassium Perchlorate	100%	A1	A3	A1				B1				
Potassium Permanganate	10%	A1	A1	A1		A5	N	B1	A5	B3	A2	B5
Potassium Permanganate	100%	N	A	N				N	N	A	A2	A
Potassium Persulfate	10%	A		A				A	N	A	A	A
Potassium Persulfate	100%	A1	A4	A1		A4		B1	N	A	A	
Potassium Sulfate	10%	A1	A1	A1	A5	A3	A4	A1	A3	A5	A1	A5
Potassium Sulfate	20%	A		A	N	A		A	A	A	A1	A
Potassium Sulfate	100%	A	A	A	N	A		A	A	A	A	A
Potassium Sulfide	10%	A		A				B		B		A
Potassium Sulfide	100%	A1	A1	A1		A5		B3	B5	A5		A5
Propane	100%	A1	A1	A1		A5	N	B1	B5	B5		B5
Propionic Acid	100%	A1	A3	A1		N		B3	A1		A1	
Propyl Alcohol	100%	A1	A3	A1		A3	A4	A1	A5	B5		A5
Propylene Chlorohydrin	100%											
Propylene Dibromide	100%		A									
Propylene Dichloride	100%	A1	A3	A1		N						
Propylene Glycol	100%	A1		A1		A5		B3	B5	A5		A5
Propylene Oxide	100%	A1	A4	A1		N	N		B5			
Pyridine	100%	A1	A4	A1		N	N	B1	A4	B1	A2	B2
Pyrogallol	100%	A1	A4	A1				B2	B2			
Salicyalldehyde	100%	A1	A3	A1								
Salicylic Acid	100%	A1	A1	A1	N	A5	A5	B1	A1	B3	A2	A5
Salt Brine	100%		A									
Sea Water	100%	A	A	A	N	A		N	A	A	A	A
Sewage, Raw	100%	A		A	N	N		A	A	A	A	A
Silicon Tetrachloride	100%		A									
Silver Chloride	100%	A1	A1	A1				N		A5		A5
Silver Cyanide	100%	A1	A1	A1		A3		A5	A5	A5		A5
Silver Nitrate	50%	A		A				A5	A5	A1		A5
Silver Nitrate	100%	A1	A1	A1	A5	A3	A4	N		A	A	A
Sludge, Activated	100%	A		A	N	A		A	A	A	A	A
Sludge, Primary	100%	A		A	N	A		A	A	A	A	A
Sludge, Thickened	100%	A		A	A	A		A	A	A	A	A
Sludge, Waste	100%	A		A	A	A		A	A	A	A	A
Soap Solutions	100%	A1		A1	A5	A3	A4	B5	A5	A5	A	A5
Sodium Acetate	100%	A1	A1	A1	N	A3		B1		A5	A1	A2
Sodium Benzene-Sulfonate	100%		A									
Sodium Benzoate	100%	A1	A1	A1					B5	A5		A5
Sodium Bicarbonate	20%	A1	A1	A1		A3	A4	A1		A4	A	A3
Sodium Bicarbonate	100%	A	A	A		A		B	B	A	A	A
Sodium Bisulfate	40%	A	A	A	N	A		N	N	A	A2	
Sodium Bisulfate	100%	A1	A1	A1		A3	A4	N	N	A	A	A
Sodium Bisulfide	100%	A		A				N	B	A	A	
Sodium Bisulfite	40%	A		A				B2	B2		A2	B2
Sodium Bisulfite	100%	A1	A1	A1		A3	A4	B1	B3	B5	A5	
Sodium Borate (Borax)	100%	A1	A3	A1		A3	A4	B3	B3	A5	A	A5
Sodium Boric Acid	100%	A		A				N	N	A	A	
Sodium Bromide	100%	A1	A3	A1		A5				B1	A	B5
Sodium Carbonate	10%	A		A	N	A		A	A	A2	A2	A
Sodium Carbonate	20%	A		A				A	A	A2	A2	A
Sodium Carbonate	100%	A1	A1	A1		A3	A3	B1	B3		A2	A3
Sodium Chloride	Sat	A1	A1	A1	A5	A3	A5	N	A	A1	A2	A3
Sodium Chlorate	40%	A		A	N	A		B	B	A		A
Sodium Chlorate	100%	A1	A1	A1		A5	A4	N		N	A	A3
Sodium Chloride	30%	A		A		A		B1	B2	A	A	A
Sodium Chlorite	10%	A		A				N	B	A	B	
Sodium Chlorite	100%	A1		A1			A3	N	N	A1	B	
Sodium Chromate	80%	A1	A1	A1		A5		A3	A3	A	A	A
Sodium Cyanide	100%	A1	A1	A1		A3	A3	A1	B5	B2	N	A5
Sodium Dichromate	100%	A1	A3	A1		N		B5	A5	A5		
Sodium Ferricyanide	100%	A1	A1	A1		N		B1	A3	A5		
Sodium Ferrocyanide	100%	A1	A1	A1				B5	B	A5		
Sodium Fluoride	100%	A1	A1	A1		A4	A4	N	B3	N		A5
Sodium Glutamate	100%		A									

Process Liquid	Maximum Concentr.	Flowtube Liner: PTFE Teflon	ETFE Tefzel	PFA	Polyur ethane	Neoprene	Hard Rubber	Electrode Material: 316 SST	Hastelloy C-276	Tantalum	Platinum - 10 % Iridium	Titanium
Sodium Hydrosulfite	100%	A1		A1				B	A5	A5	A	
Sodium Hydroxide	5%	A1		A1	N	N		A		N	A	A
Sodium Hydroxide	10%	A1	A3	A1	A5	A3	A4	A1	B2	N		A3
Sodium Hydroxide	25%	A		A	N	N		N	A	N	A	A
Sodium Hydroxide	30%	A1	A2	A1	A5	A3	A4	A4	B3	N	A	A3
Sodium Hydroxide	40%	A		A				B	A	N	A	A
Sodium Hydroxide	50%	A1	A2	A1	A5	A3	A4	A4	A3	N	A	A5
Sodium Hypochlorite	Conc	A1	A1	A1	N	N	A5			B1		
Sodium Hypochlorite	15%	A		A				N	B	B	A2	B
Sodium Hypochlorite	20%	A1	A1	A1	N	N	A5	N	N	B1	A2	B3
Sodium Hypochlorite	25%	A1		A1				N	B	B	A2	B
Sodium Hyposulfite	5%	A1	A1	A1				N	A5	A5		
Sodium Iodide	100%	A1	A1	A1		A4				B5		
Sodium Lignosulfonate	100%		A									
Sodium Metasilicate	100%		A									
Sodium Methane	100%	A		A								
Sodium Nitrate	40%	A		A	N	A		A		A	A2	A
Sodium Nitrate	50%	A		A				N	B	A	A2	A
Sodium Nitrate	100%	A1	A1	A1	A5	A3	A4		N	B1	A2	A5
Sodium Nitrite	40%	A		A				B2	B2	A	A	A
Sodium Nitrite	100%	A1	A1	A1		A4		N	N	B3	A	A3
Sodium Perborate	10%	A1	A3	A1		A3	A4	B1	B3			
Sodium Perchlorate	100%		A								A2	
Sodium Peroxide	10%	A1	A1	A1		A3	A4	B1	B3		A2	
Sodium Persulfate	100%		A									
Sodium Phosphate (Mono-Basic)	100%	A	A	A	N	A		B	A	A5	A2	A2
Sodium Phosphate (Tri-Basic)	100%	A1	A1	A1	A	A4	A4	B3	B3	B2	A2	B3
Sodium Silicate	100%	A1	A1	A1		A3	A3	B1	B3	B1	A2	A3
Sodium Silicofluoride	100%		A									
Sodium Sulfate	20%	A		A					B	A1	A2	A2
Sodium Sulfate	30%	A		A	N	A		B	B	A	A2	B
Sodium Sulfate	100%	A1	A1	A1	A5	A3	A4	A1	B3			
Sodium Sulfide	10%	A1	A1	A1		A3	A4	B2	B2	B2	A2	B2
Sodium Sulfide	50%	A1	A1	A1		A3	A4	B3	B3		A2	
Sodium Sulfide	100%	A	A	A		N		N	N		A	
Sodium Sulfite	10%	A1	A1	A1		A3	A4	A3	N		A2	
Sodium Sulfite	30%	A		A				B	N	A	A2	A
Sodium Sulfite	100%	A	A	A		N		B	N	A	A	A
Sodium Tetraboric Acid	100%	A		A				B	B	A	A	
Sodium Thiosulfate (Hypo)	100%	A1	A1	A1	A5	A3	A4	B1	B5		A2	
Sorbic Acid	100%		A									
Sour Crude Oil	100%	A1	A1	A1	A5				A4			
Stannic Chloride	100%	A1	A1	A1		A3	A4	N		B1	A	
Stannous Chloride	100%	A1	A1	A1		A4	A4		B3	B3	A2	A5
Stannous Fluoride	100%		A									
Stearic Acid	100%	A1	A1	A1	A5	A3	N	A1	A1	B1	A1	A1
Stoddard's Solvent	100%	A1	A1	A1		N	N	B5	A5			
Styrene Monomer	100%		A									
Succinic Acid	100%	A1	A1	A1				B3	B3	B1		A1
Sulfamic Acid	100%	A1	A3	A1		A4	A4			B1		A3
Sugar Juice	100%	A		A	N	N		A	A	A	A	A
Sulfinol	100%											
Sulfolane	100%											
Sulfur Dioxide (Wet)	100%	A1	A2	A1		N	N	B4	A4	B1	A1	N
Sulfur Trioxide	100%	A1	A5	A1		N	A4	B1	B1	N		N
Sulfuric Acid	10%	A1	A1	A1	N	A3	A4	N	A3	B1	A1	N
Sulfuric Acid	30%	A1	A1	A1	N	A3	A4	N	A5	B1	A1	N
Sulfuric Acid	50%	A1	A1	A1	N	A3	A5	N	A5	B1	A1	N
Sulfuric Acid	60%	A1	A1	A1	N	A3	N	N	A1	B1	A1	N
Sulfuric Acid	70%	A1	A1	A1	N	A3	N	N	B3	B1	A1	N
Sulfuric Acid	80%	A1	A1	A1	N	N	N	B5	A5	B1	A1	N
Sulfuric Acid	90%	A1	A1	A1	N	N	N	B5	A4	B1	A1	
Sulfuric Acid	95%	A1	A1	A1	N	N	N	B3	A4	B1	A1	
Sulfuric Acid	98%	A1	A1	A1	N	N	N	B3	A5	B1	A1	N
Sulfuric Acid	100%	A1	A1	A1	N	N	N	B3	A5	B1		N
Sulfuric Acid (Fuming)	100%	A1	A5	A1		N		A5	B5	N	A1	N
Sulfurous Acid	100%	A1	A2	A1	N	N	N	A5	B1	A1	A2	A4

Flowtube Liner **Electrode Material**

Process Liquid	Maximum Concentr.	PTFE Teflon	ETFE Tefzel	PFA	Polyur ethane	Neoprene	Hard Rubber	316 SST	Hastelloy C-276	Tantalum	Platinum - 10 % Iridium	Titanium
Tall Oil	100%	A1	A1	A1		N	N	B1	A1	B1		
Tannic Acid	100%	A1	A1	A1		A3	A5	B3	N	B3	A2	
Tartaric Acid	100%	A1	A1	A1		A3	A4	A1	B3		A2	
Tetraethyl Lead	100%	A1	A1	A1				B1				
Tetrahydrofuran	100%	A1	A3	A1		N	N	B1	A5			B3
Tetramethyl Ammonium Hydroxide	50%	A1	A3	A1								
Thionyl Chloride	100%	A1	A3	A1		N	N	N		B1		
Tin Chloride	100%	A1		A1		A3	A4	B4	B1	A5		
Tin Tetrachloride	100%		A									
Titanium Dioxide	100%	A	A	A	A	A		A	A	A	A	A
Titamium Tetrachloride	100%	A1	A2	A1		N	N	B5	B5	A5		A1
Toluene	100%	A1	A1	A1	N	N	N	A1	A3	A1	A2	A3
Tomato Juice	100%	A1	A3	A1		A3		B1	B5	A5		
Tributyl Phosphate	100%	A1	A4	A1		N	N	B5	B5			
Trichloroacetic Acid	100%	A1	A3	A1	A5	N	N	N	B3	B1		N
Trichlorethylene	100%	A1	A1	A1	N	N	N	B1	A3	B3		A3
Trichloromethane	100%		A									
Triethanolamine	100%	A1	A4	A1	N	A4	A5	B5	B3	B3	A1	
Triethylamine	100%	A1	A2	A1				B5		A3		
Triethyl Phosphate	100%											
Triphenyl Phosphite	100%											
Trisodium Phosphate	100%	A1	A1	A1	A5	A3	A4			B5	A	
Turpentine	100%	A1	A1	A1	N	N	N	A3	B5	B5	A1	B5
Urea	50%	A1	A1	A1	N	A4	A4	B3				A3
Varsol	100%		A									
Vinegar	100%	A1	A3	A1	N	A3	A4	B3	B5	A5		A5
Vinyl Acetate	100%	A1	A1	A1		A5		A4	A1			
VinylChloride(Monomer)	100%	A									A1	
Water (Pure)	100%		A									
Water, Clean or Dirty	100%	A		A	A	A		A	A	A	A	A
Water, Deionized	100%											
Water, Fresh	100%	A		A	A	A		A	A	A	A	A
Water, Salt	100%	A1	A1	A1	N	A3	A4	B1	A1	A5		A5
Water, Sea	100%	A1	A1	A1	A5	A3		B1	A1	A5		A3
Water Sewage	100%	A1	A1	A1		A4		B5		A5		A5
Wax	100%	A										
White Liquor	100%	A1		A1	N	A4	N	B5	B5	N	A	A
Xylene	100%	A1	A1	A1	N	N	N	B3	A1	A3	A1	A3
Zinc Acetate	100%		A									
Zinc Chloride	20%	A	A	A	N	A		B3	B1	A2	A2	A3
Zinc Chloride	50%	A		A				N	N	A	A2	A3
Zinc Chloride	100%	A1	A1	A1		A4	A4	N	B1	A3	A	
Zinc Hydrosulfite	10%		A									
Zinc Sulfate	Sat	A1	A1	A1	N	A4	A4	A2	A2	A5	A2	A5
Zinc Sulfide	100%		A									
Zinc Sulfate	50%	A	A1	A	N	A4	A4	B3	B3	A5		A5

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