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Date 10/2003

## **Basic information**

**The inductive flow meter M-900** is a device designed to measure, indicate and record the instantaneous and total flow of the flowing media through the sensor. The flow meter M-900 records both forward and reverse flows. As there are no moving mechanical parts in the flow profile the M-900 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 M-900 is for use in the Chemical Industry, Paper Industry, Water and Wastewater Treatment Industry and most other process industries.

**Features.**The inductive flow meter M-900 is a highly accurate and stable device. The construction of the M-900 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.** Flow meter M-900 is equipped with 4 standard isolated outputs: 4 to 20mA either active or passive, frequency output, pulse output and RS232 output. The user can configure both frequency and pulse output. The RS232 output is of an infrared type. Through this output the flow meter periodically sends data containing reading and status information. This function enables easy scanning of information from several flow meters via a portable PC with an infrared input.

**Power supply.** Both versions of the standard 115V/230V power supply and 24V DC/AC power supply are available.

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

## **Preparing for start up**

### ***Inspecting contents of the package***

Basic package includes the following items:

- Flanged sensor
- Electronic Transmitter ( can be integral or remote)
- Spare fuse
- RS-232 cable, type CK9BB3M (standard 1:1)
- Software WinFlow and WinCal, 2 discs
- Operating manual.
- Calibration certificate

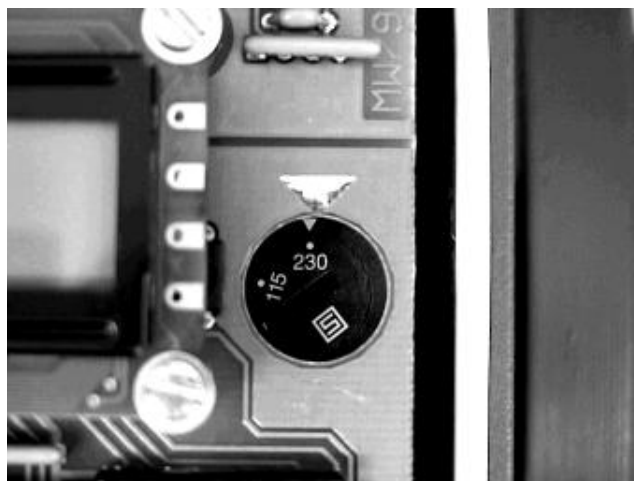
The flowmeter is ready for use after connecting to the power supply. Only use a power supply with the appropriate voltage and frequency. The flowmeter can be supplied with either 230/115V 50/60Hz, or 24V DC/AC power supply, see ordering information in chapter “Specification”

With the application software WinFlow and RS232 cable various functions of digital outputs can be programmed. For more details see chapter “WinFlow-programme for configuration”.

### ***Power supply voltage selection (230/115 V version only)***

The flowmeter 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:

- Remove the 4 screws from the cover of the transmitter unit.
- Selector is located behind the display on the lower board.
- Use a screwdriver to change the voltage setting. Push the end of screwdriver through the hole in upper board to the selector slot. Rotate to set the required voltage (115 or 230) on the selector against the white arrow on



the upper board. The selector has only two positions.

- Connect the power supply as described in the section headed - **Installation**.
- Replace the transmitter cover.

*Note:*

The flowmeter is always delivered with the voltage set to 230V!

## ***Fuse replacement***

A mains fuse is located behind the power terminals on the power board. The fuse must only be changed by a competent person. Procedure is as follows:

- Disconnect the power supply from the flowmeter.
- Remove the 4 screws from the cover of the transmitter and remove the cover.
- The fuse holder is located behind the power supply terminals. Remove the fuse. Replace it with new fuse with the same rating.
- Replace the transmitter cover.
- Reconnect the power supply.

*Note:*

- 315mA fuse is used for both 115V and 230 V power line voltage.
- 1A fuse is used for 24V DC/AC power supply

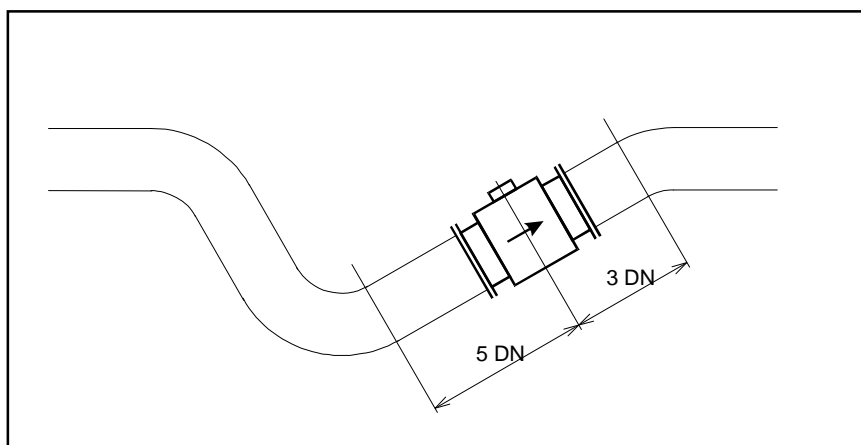
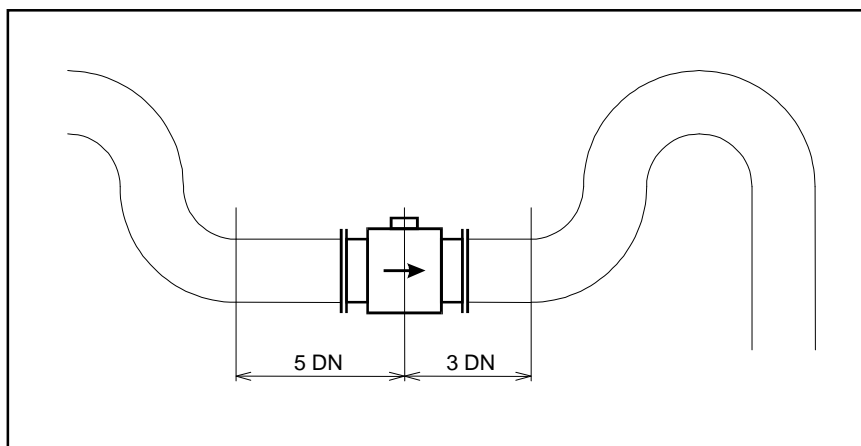


## Installation

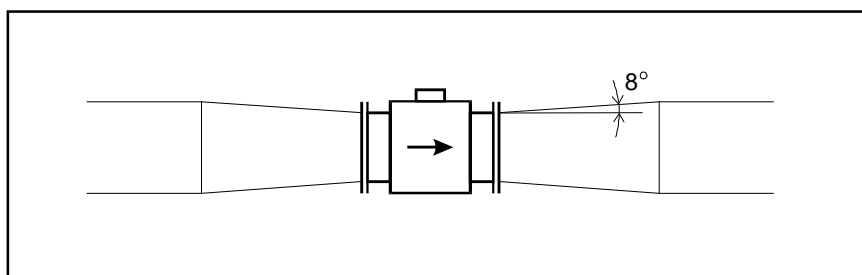
### Sensor location

To avoid measuring errors due to gas/air entrainment or to a partly filled pipe, please observe the following:

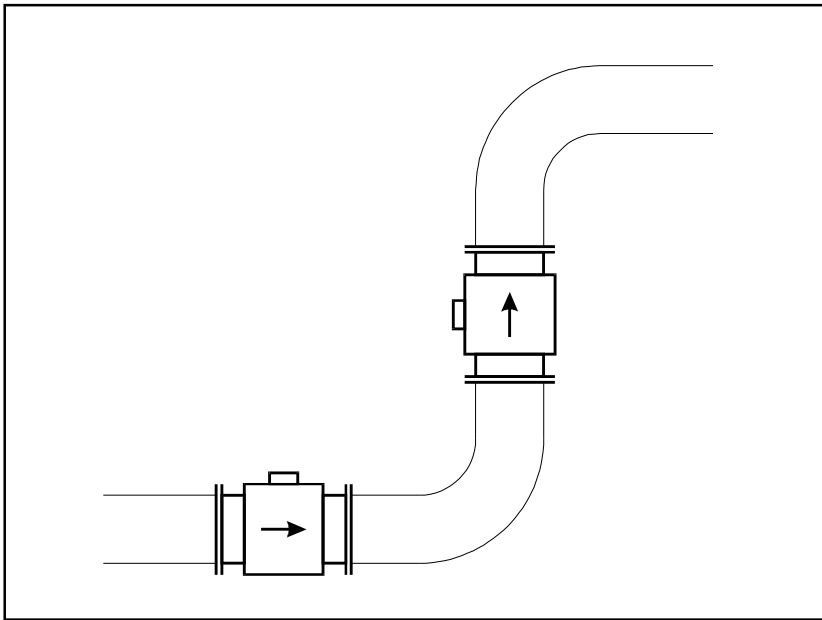
The sensor tube must always remain full. The best way to achieve this is to locate the sensor in a low section of pipe, see the following picture. It is recommended to install the sensor in a section of straight pipe with at least 5 times the pipe diameter before sensor and 3 times after sensor.



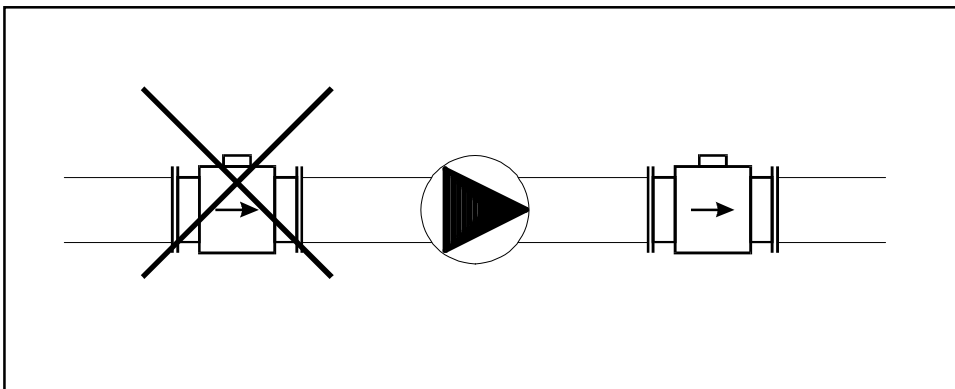
If the pipe diameter is not the same as the diameter of sensor, then pipe reducers can be used. So as not to lose accuracy of the measurement, the slope of reducers should not exceed  $8^\circ$ .



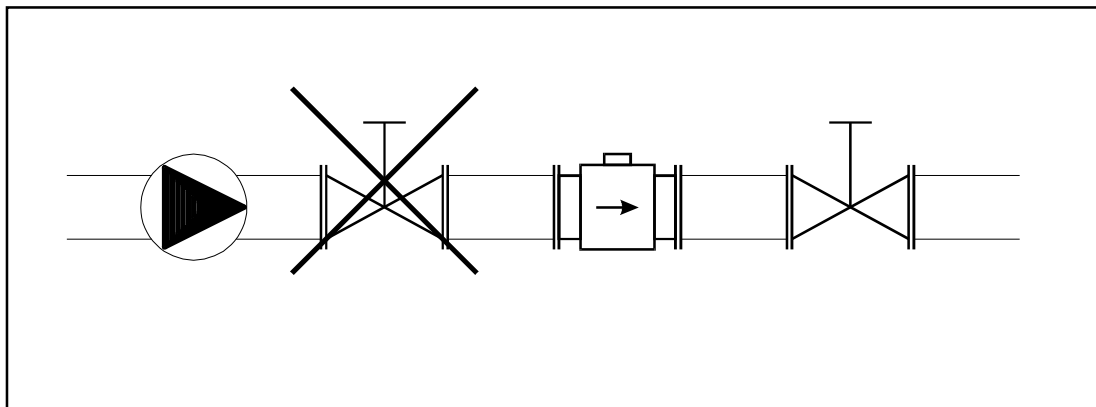
When the sensor is mounted on vertical section of pipe, the flow direction must be upwards. In the case of a downward flow direction, air bubbles can collect in the sensor and the measurement could be unstable and inaccurate.



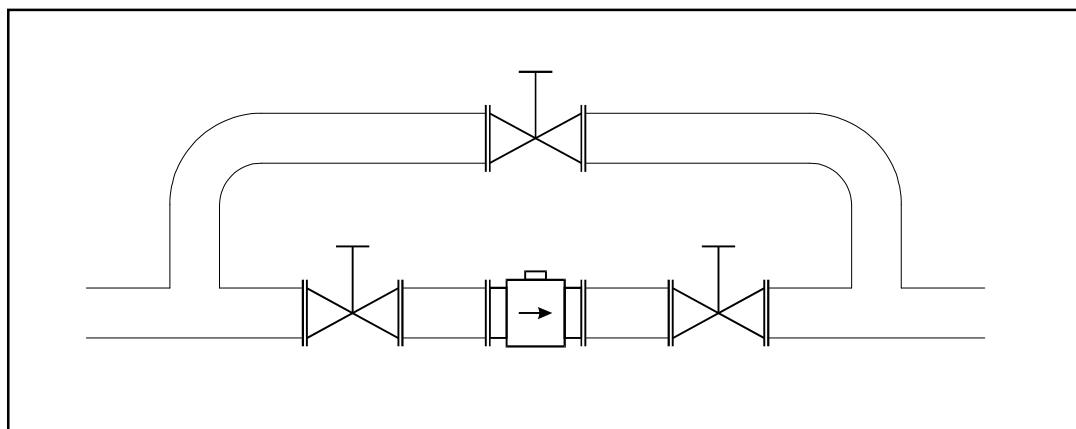
Never install the sensor on the suction side of a pump or on a section of pipe where a vacuum is possible.



Suitable location of the sensor is downstream of a pump.



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



## **Electrical connection**

Only a competent person should 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.

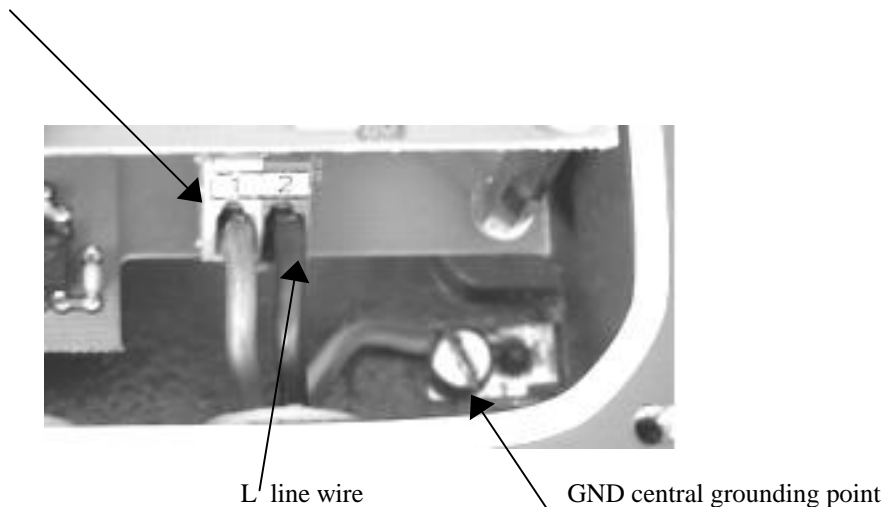
In the case of a **cable and plug** it is recommended that the cable has a cross-section of 3 x 1 mm<sup>2</sup> or 3 x 1.5mm<sup>2</sup> and with a minimum length of 1 m.

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

The following procedure should be followed to connect the flowmeter:

- Remove the transmitter cover.
- Connect the earth wire (yellow-green colour) to the central grounding point inside the case.
- Connect Live and Neutral power cables to the power line terminal clamps ( WAGO) with labels 2 (L-wire, grey terminal colour) and 1 (N-wire, blue terminal colour).

N line wire



- Reinstall the cover.
- Switch on the power supply.

*Note:* You should use cables with diameter between 5 and 10 mm.

## **Sensor grounding**

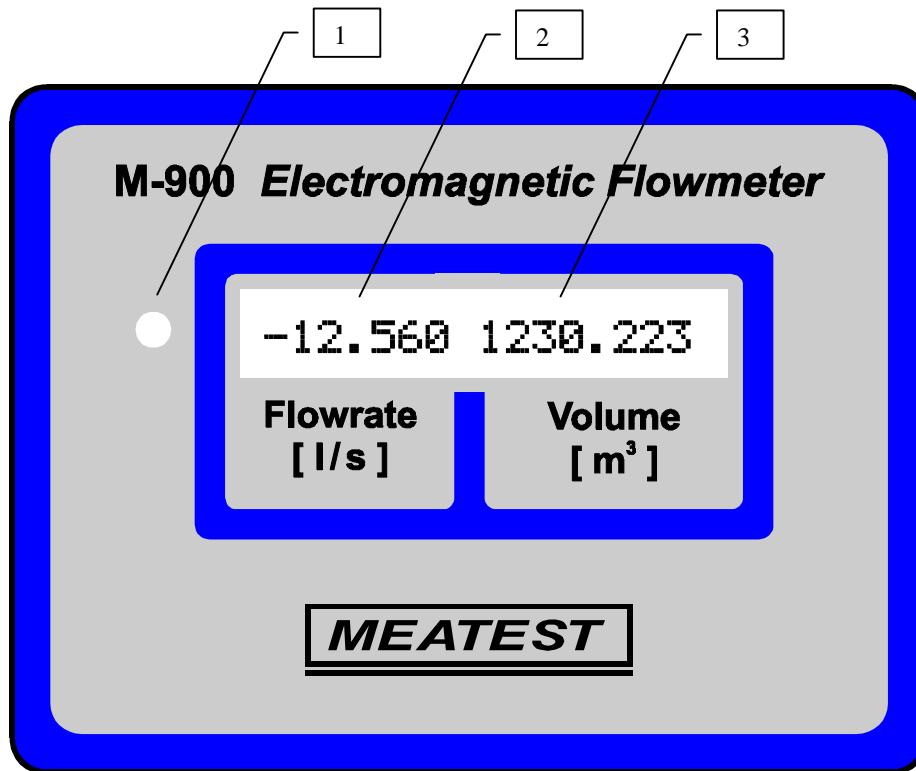
To ensure the correct operation of the flowmeter a ground connection between the sensor and pipeline must be made. The sensor is equipped with screw connection for a grounding wire. This screw has to be connected to the flange on the pipeline. Use Copper wire to connect between the flange and the earth screw on the sensor..

If pipeline is manufactured from a non-electrically conductive material, or if the pipe is lined with a similar material, special grounding rings must be installed between flanges.

The flowmeter must not be switched on, if the sensor is not connected /earthed to the rest of pipeline.

## Front panel

The one-row LCD display also has a port for infrared data transfer from the flowmeter to the computer. The front panel is displayed as follows.



### 1 Window

This window is the infrared output port for transferring data from the flowmeter to the computer. A special cable with infrared sensor M90001 connected to the serial port of PC must be used for this operation. This cable is not supplied as standard and has to be ordered separately. See chapter “Programme Flow Base” for more detailed information.

### 2 Flowrate

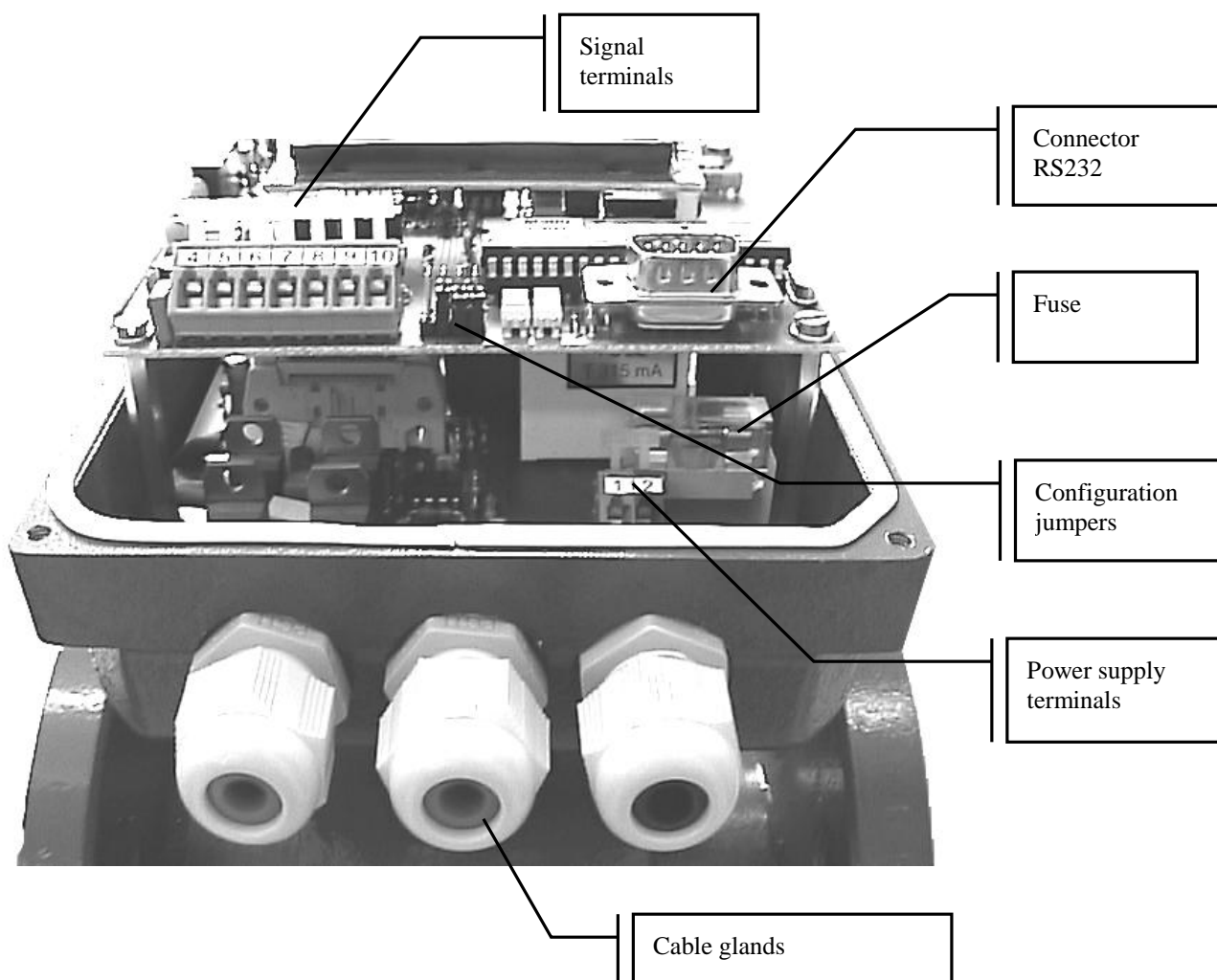
The instantaneous flowrate is displayed on the left side of the display. A decimal point is not fixed and it depends on the nominal diameter of the flowmeter.

### 3 Volume

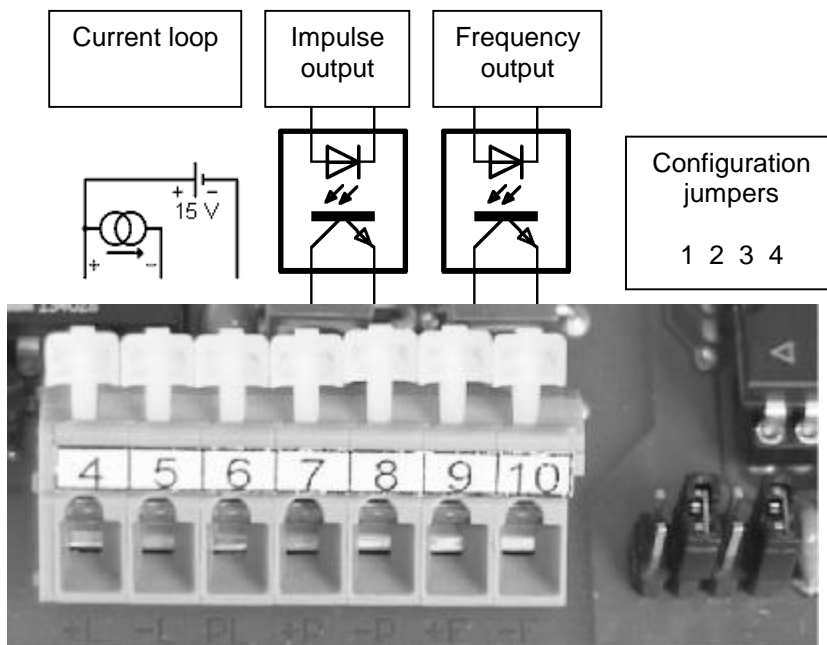
Total volume is displayed in right side of display in  $m^3$ . The decimal points are not fixed. It depends on measured value of total volume. When the displayed volume is lower than  $10000 m^3$ , three decimal places are shown. When the displayed volume is higher than  $10000 m^3$ , no decimal point is displayed.

## Terminals

The mains fuse is located under the PC board .



## Signal terminals and configuration jumper description



### 1) Current loop 4 - 20 mA (version M-900-Vx1x and M-900-Vx2x only)

Current loop can be set as passive type between outputs 4, 5 (4 positive, 5 negative) or as active type between outputs 5, 6 (5 positive, 6 negative). In both cases outputs are galvanically separated 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 500  $\Omega$ .

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

- |                             |  |
|-----------------------------|--|
| a) <b>Positive flowrate</b> | indicates positive flow direction only ( 4 mA ... 0, 20 mA ... QI).                                |
| b) <b>Negative flowrate</b> | indicates negative flow direction only ( 4 mA ... 0, 20 mA ... -QI).                               |
| c) <b>Absolute flowrate</b> | indicates absolute flowrate value ( 4 mA ... 0, 20 mA ... QI or -QI).                              |
| d) <b>Bipolar flowrate</b>  | indicates both positive and negative direction of flow ( 4 mA ... -QI, 12 mA ... 0, 20 mA ... QI). |

QI value can be set independently to the nominal diameter of sensor. Following values are pre-set:

**Mode** „Positive flowrate“.

**QI** flowrate in [ $\text{m}^3/\text{h}$ ], corresponds flow velocity of 5 m/s

### 2) Impulse output

Impulse output is formed by 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 7, negative output is on terminal 8. The reed relay as special version is available on impulse output (M900-VxxxRR). Capability of contact is 100V and 500mA. It is not possible to use modes b), c) and d) with reed relay impulse output.

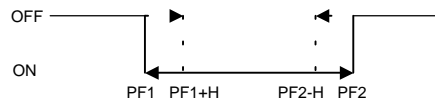
Impulse output can be programmed in one of the following modes:

- |                                   |  |
|-----------------------------------|--|
| a) <b>Off</b>                     | output is not active.  |
| b) <b>Pulse positive flowrate</b> | 1 impulse is generated when QP litre of liquid has flowed in a positive direction. |

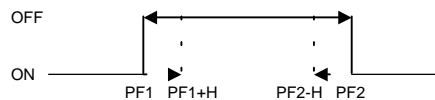
- |   |  |
|---|--|
| c) <b>Pulse negative flowrate</b>             | 1 impulse is generated when -QP litre of liquid has flowed in negative direction.            |
| d) <b>Pulse absolute flowrate</b>             | 1 impulse is generated when QP litre of liquid has flowed in negative or positive direction. |
| e) <b>On for positive flowrate</b>            | output is off in case of negative flow and made in case of positive flow.                    |
| f) <b>On for negative flowrate</b>            | output is off in case of positive flow and made in case of negative flow.                    |
| g) <b>On for flowrate in &lt;PF1,PF2&gt;</b>  | output is on, when flowrate is higher than PF1 and lower than PF2, otherwise it is off.      |
| h) <b>On for flowrate out &lt;PF1,PF2&gt;</b> | output is off, when flowrate is higher than PF1 and lower than PF2, otherwise it is on.      |
| i) <b>On for flowrate &gt; PF1</b>            | output is on, when flowrate is higher than PF1, otherwise it is off.                         |
| j) <b>On for flowrate &lt; PF1</b>            | output is off, when flowrate is lower than PF1, otherwise it is on.                          |

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 overcrossing of the pre-set limit), when the immediate flowrate overcrosses 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.

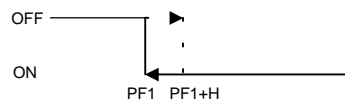
Mode g) with non-zero hysteresis:



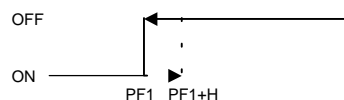
Mode h) with non-zero hysteresis:



Mode i) with non-zero hysteresis:



Mode j) with non-zero hysteresis:



Note:

Modes b), c) and d) aren't available for M900-xxxRR version (reed relay impulse output).

QP, PF1, PF2 and H values can be set independently with the sensor nominal diameter. The following values are pre-set:

- Mode** „Positive flowrate“  
**QP** according to the DN, the frequency of the impulse is 1 impulse/second for flow velocity 5 m/second .  
**PF1** flowrate corresponds to the flow velocity -5 m/s.  
**PF2** flowrate corresponds to the flow velocity 5 m/s.  
**H** flowrate corresponds to the flow velocity 0.5 m/s.

### 3) Frequency output

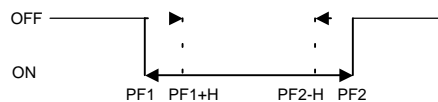
Impulse output is a galvanically isolated transistor NPN switch. Voltage drop on the switch is 1 V in the made status. Maximum switched voltage is 50 V. Maximum switched current should not exceed 100 mA. Positive output is on terminal 9, negative output is on terminal 10. Frequency range of the output is from 10 Hz to 15 kHz. Frequency 1 kHz or 10 kHz at nominal flowrate QF can be set with the configuration jumpers.

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

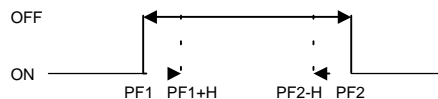
- |   |  |
|---|--|
| a) <b>Off</b>                                 | output is not active.  |
| b) <b>Freq. positive flowrate</b>             | 1 kHz frequency is generated when flowrate QP m <sup>3</sup> /h is indicated in a positive direction.                    |
| c) <b>Freq. negative flowrate</b>             | 1 kHz frequency is generated when flowrate - QP m <sup>3</sup> /h is indicated in a negative direction.                  |
| d) <b>Freq. absolute flowrate</b>             | 1 kHz frequency is generated when flowrate QP m <sup>3</sup> /h is indicated in either a negative or positive direction. |
| e) <b>On for positive flowrate</b>            | output is off in case of negative flow and made in case of positive flow.  |
| f) <b>On for negative flowrate</b>            | output is off in case of positive flow and made in case of negative flow.  |
| g) <b>On for flowrate in &lt;PF1,PF2&gt;</b>  | output is on, when flowrate is higher than PF1 and lower than PF2, otherwise it is off.                                  |
| h) <b>On for flowrate out &lt;PF1,PF2&gt;</b> | output is off, when flowrate is higher than PF1 and lower than PF2, otherwise it is on.                                  |
| i) <b>On for flowrate &lt; PF2</b>            | output is on, when flowrate is lower than PF2, otherwise it is off.  |
| j) <b>On for flowrate &gt; PF2</b>            | output is on, when flowrate is higher than PF2, otherwise it is off.   |

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 over crossing pre-set limit), when the immediate flowrate over crosses 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.

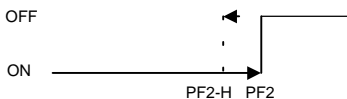
Mode g) with non-zero hysteresis:



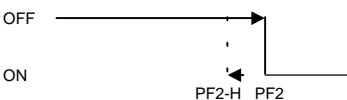
Mode h) with non-zero hysteresis:



Mode i) with non-zero hysteresis:



Mode j) with non-zero hysteresis:



QP, PF1, PF2 and H values can be set dependent on sensor nominal diameter. Following values are pre-set:

- Mode** „Positive flowrate“.
- QP** according to the DN, the frequency of impulses is 1 kHz for a flow velocity 5 m/s .
- PF1** flowrate corresponds to the flow velocity -5 m/s.
- PF2** flowrate corresponds to the flow velocity 5 m/s.
- H** flowrate corresponds to the flow velocity 0.5 m/s.

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

#### **4) Configuration jumpers**

The transmitter contains four configuration jumpers. The basic mode of the flowmeter can be set via jumpers without the need of a computer. A description of the jumpers is in following table. Pre-set position of all jumpers is OFF.

Jumper No	Description	State ON (with jumper)	State OFF (without jumper)
1	For service purpose	Don't install	
2	Flowrate quantity	[ m <sup>3</sup> / hour ]	[ 1 / s ]
3	Flow direction	negative	positive
4	Nominal frequency at flowrate Fimp.	10 kHz	1 kHz

#### **ATTENTION**

The standard unit of flowrate is 1/s in the M-900. This is also on the front panel foil under the value of the flowrate. When delivered jumper No 2 is always in the OFF position (i.e. 1 / s is set). The user can change the setting of this jumper to the ON position and display the flowrate in [ m<sup>3</sup> / hour ]. In this case the displayed value does not correspond to the unit value on the foil!

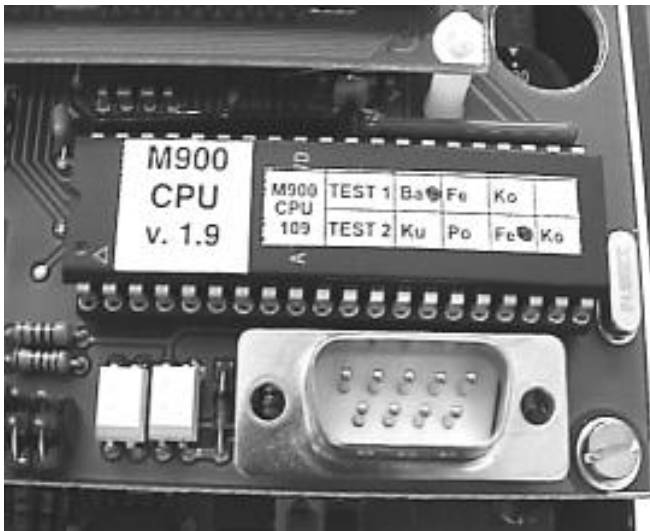
## **Serial port RS232**

Serial port RS232 is a standard function on all the flowmeters. The connector is located on the upper board and is accessible after removing the cover of electronic unit. On the picture below the meaning of the pins is described. RS232 enables you to connect the flowmeter to a personal computer. Over this connection and with the application software the following functions can be used:

- calibration of the flowmeter, programme WinCal (standard part of delivery)
- configuration of the flowmeter, programme WinFlow (standard part of delivery)
- read measured data, programme FlowBase (option)

For connection of the flowmeter to the PC a standard RS232 cable can be used. This cable is a standard part of delivery. To connect a PC to the flowmeter, follow this procedure:

- Remove the 4 screws from the cover on the electronic unit.



- Plug the one end of the RS cable onto the serial connector in the flowmeter.
- The opposite end connect to the serial port in the PC.
- Use the application software to enter new calibration data or to change settings of the flowmeter.
- Disconnect RS232 cable and replace the cover.

*Note:*

Serial port is galvanically isolated from other electronic circuits.

*Note:*

The flowmeter M900 is equipped with no mechanical buttons. The only possibility of changing parameters is to use the serial port.

## **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

In case of any error, the error message is displayed on the display for approx. 2 second. Last error message can be read through the sensor M90001. The sensor must be connected to the serial port of the computer. Last error message is deleted after switching flowmeter off and switching it on again.

After switching on, an internal test of the hardware is performed. If there was any error during the test, the flowmeter would display the appropriate error message. If the result of the test is O.K. the following message is displayed:

### M900 ready !

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

Error	Meaning	Troubleshooting
M900 ready !	Flowmeter is ready for use.	
Missing pulse !	Missing impulse.	If this message is displayed on several occasions, the power supply voltage is probably very noisy. An external power line filter is recommended in the power line.
Extra pulse !	More impulses were generated than should be.	If this message is displayed on several occasions, power supply voltage is probably very noisy. Rectify as above.
Converter !	DA converter error.	Switch off the flowmeter and then turn on again. If the error is repeated, contact your dealer.
Eeprom !	Back up memory error.	Switch off the flowmeter and then turn on again. If the error is repeated, contact your dealer.

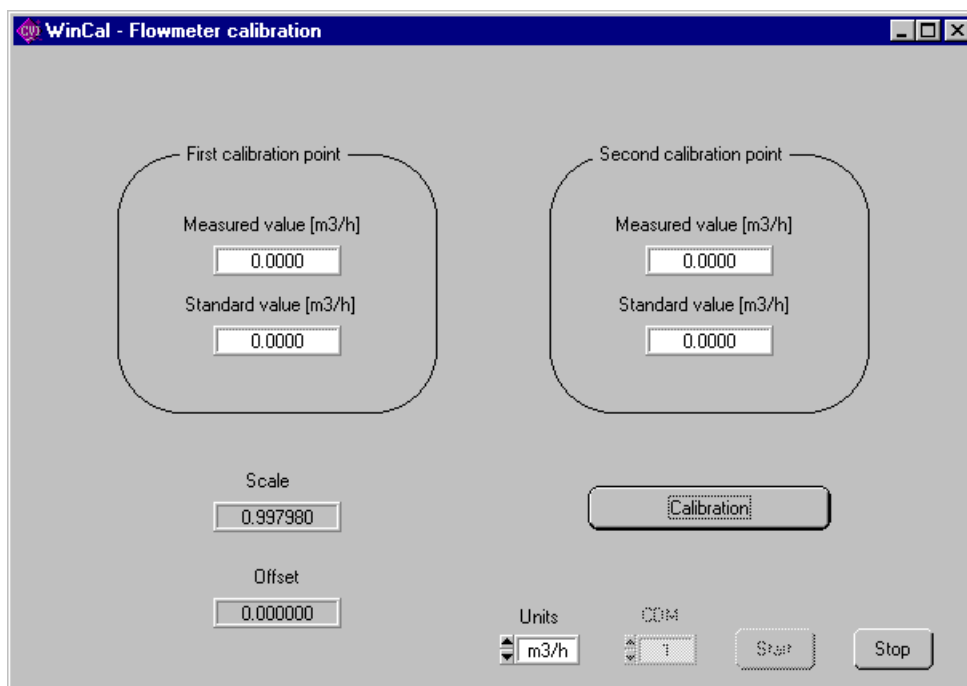
## WinCal – programme for calibration

**Programme WinCal should only be used in an accredited laboratory. Setting any new values during calibration procedures also changes calibration data !**

Software WinCal is a programme for periodical recalibration of the flowmeter. Calibration should be performed in an accredited laboratory only, equipped with appropriate calibration traceability with an accuracy 3 times better than that of the flowmeter. For recalibration, a computer connected to the flowmeter via the serial line RS232 is required. The recommended calibration procedure consist of calibration at two points. The first calibration point should be in range 5 – 20 % of the scale, the second in range 70 – 90 %.

Calibration procedure is as follows:

- Disconnect the flowmeter from the power line supply
- Remove the cover of the flowmeter.
- Connect the RS232 cable to the RS232 connector located on the PC board. The opposite end of the cable should be connected to the serial port of the computer.
- Connect the power supply.
- Run programme WinCal. Set appropriate serial port COM and push the START button.
- Select appropriate units (default setting is l/s).
- Run calibration trace.



- Stop calibration at the first calibration point in the range 5 – 20 % of the flowrate scale.

- Enter the measured value of the flowmeter under test in the field “Measured value” in the “First calibration point” section. Enter the measured value of the master flowmeter in the field “Standard value” in the “First calibration point” section.
- Run calibration again.
- Stop, when the second calibration point in range 70 – 90 % is reached. Enter the measured value of the flowmeter under test into the field “Measured value” in the “Second calibration point” section. Enter the measured value of the master flowmeter into the field “Standard value” in the “Second calibration point” section.
- Push the CALIBRATION button. The flowmeter saves all new calibration data into its memory. Calibration is finished.

*Note:* You can choose any pair of calibration points except two of the same value. In the case that both values are the same, the flowmeter will not save the new data.

## WinFlow – programme for configuration

**Programme WinFlow can only be used for digital output parameter configuration of the flowmeter.**

To use the WinFlow programme the serial port of the flowmeter is the only way of changing the settings.. WinFlow software is a standard part of the delivery. WinFlow configures the M900 outputs.

To configure the parameters first remove the top cover. Connect cable RS232 to the connector located on the PC board. Connect the opposite end to the computer serial port. Run the WinFlow programme. Choose the appropriate COM on the screen and push the button START. Program will load actual configuration of the flowmeter and display it, including serial number and nominal diameter of the pipe.

### Using the program

White fields on the screen can be used only for setting the parameters. The following parameters can be changed:

#### 1) Current output

Programme allows you to set following modes of current loop:

- |                             |  |
|-----------------------------|--|
| a) <b>Positive flowrate</b> | indicates positive flow direction only ( 4 mA ... 0, 20 mA ... QI).                                |
| b) <b>Negative flowrate</b> | indicates negative flow direction only ( 4 mA ... 0, 20 mA ... -QI).                               |
| c) <b>Absolute flowrate</b> | indicates absolute flowrate value ( 4 mA ... 0, 20 mA ... QI or -QI).                              |
| d) <b>Bipolar flowrate</b>  | indicates both positive and negative direction of flow ( 4 mA ... -QI, 12 mA ... 0, 20 mA ... QI). |

The current loop can be matched by changing the calibration constant **QI** for various applications. **QI** corresponds to the maximum value of flowrate in [m<sup>3</sup>/h] (“Flowrate for output current 20 mA”). Pre-set value of **QI** is matched to the maximum flow velocity 5 m/s. The following table shows default calibration constants **QI** for some pipe diameters.

DN [ mm ]	QI [ l/s ]
50	9,82
80	25,13
100	39,27

Table 1 Flowrate values for sensor diameters for a flow velocity of 5 m/s.

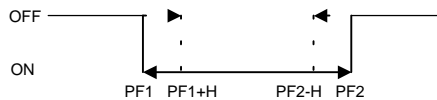
2) *Impulse output*

Program allows you to set following modes of impulse output:

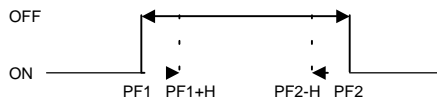
- a) **Off** output is not active.
- b) **Pulse positive flowrate** 1 impulse is generated when QP litre of liquid has flowed in a positive direction.
- c) **Pulse negative flowrate** 1 impulse is generated when -QP litre of liquid has flowed in negative direction.
- d) **Pulse absolute flowrate** 1 impulse is generated when QP litre of liquid has flowed in negative or positive direction.
- e) **On for positive flowrate** output is off in case of negative flow and made in case of positive flow.
- f) **On for negative flowrate** output is off in case of positive flow and made in case of negative flow.
- g) **On for flowrate in <PF1,PF2>** output is on, when flowrate is higher than PF1 and lower than PF2, otherwise it is off.
- h) **On for flowrate out <PF1,PF2>** output is off, when flowrate is higher than PF1 and lower than PF2, otherwise it is on.
- i) **On for flowrate > PF1** output is on, when flowrate is higher than PF1, otherwise it is off.
- j) **On for flowrate < PF1** output is off, when flowrate is lower than PF1, otherwise it is on.

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

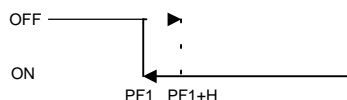
Mode g) with non-zero hysteresis:



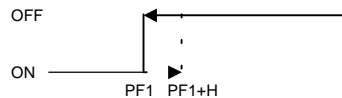
Mode h) with non-zero hysteresis:



Mode i) with non-zero hysteresis:



Mode j) with non-zero hysteresis:



Note:

Modes b), c) and d) aren't available for M900-xxxRR version (reed relay impulse output).

The impulse output can be matched by changing the calibration constant **QP** for various applications. **QP** represents the total volume in litres ("Flow volume for 1 output impulse"). Pre-set value of **QP** corresponds to the generation of 1 impulse/second at flow velocity 5 m/s. The following table shows default calibration constants **QP** for some pipe diameters.

DN [ mm ]	QP [ l ]
50	9,82
80	25,13
100	39,27

Table 2 The flow volume per 1 second on pipe diameter for flow velocity 5 m/s.

Parameters **PF1**, **PF2** a **H** represent flowrate value in [m<sup>3</sup>/h]. Following values are pre-set as default:

**PF1** flowrate corresponds to the flow velocity -5 m/s.

**PF2** flowrate corresponds to the flow velocity 5 m/s.

**H** flowrate corresponds to the flow velocity 1.0 m/s.

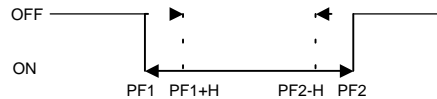
### 3) Frequency output

Program allows you to set the following modes of frequency output:

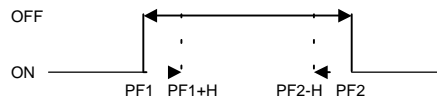
- a) **Off** output is not active.
- b) **Freq. positive flowrate** 1 kHz frequency is generated when flowrate **QP** m<sup>3</sup>/h is indicated in a positive direction.
- c) **Freq. negative flowrate** 1 kHz frequency is generated when flowrate - **QP** m<sup>3</sup>/h is indicated in a negative direction.
- d) **Freq. absolute flowrate** 1 kHz frequency is generated when flowrate **QP** m<sup>3</sup>/h is indicated in either a negative or positive direction.
- e) **On for positive flowrate** output is off in case of negative flow and made in case of positive flow.
- f) **On for negative flowrate** output is off in case of positive flow and made in case of negative flow.
- g) **On for flowrate in <PF1,PF2>** output is on, when flowrate is higher than **PF1** and lower than **PF2**, otherwise it is off.
- h) **On for flowrate out <PF1,PF2>** output is off, when flowrate is higher than **PF1** and lower than **PF2**, otherwise it is on.
- i) **On for flowrate < PF2** output is on, when flowrate is lower than **PF2**, otherwise it is off.
- j) **On for flowrate > PF2** output is on, when flowrate is higher than **PF2**, otherwise it is off.

When the flow limit is chosen, hysteresis **H** can be set too. Hysteresis is a tolerance field on one side of flow limit **PF1** and **PF2**. The output status is changed (indicates overcrossing pre-set limit), when the immediate flowrate overcrosses 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.

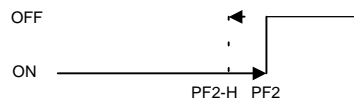
Mode g) with non-zero hysteresis:



Mode h) with non-zero hysteresis:



Mode i) with non-zero hysteresis:



Mode j) with non-zero hysteresis:



The frequency output can be matched by changing the calibration constant **QF** for various applications. **QF** represents flowrate in [m<sup>3</sup>/h] (“Flowrate for 1kHz output frequency“). Pre-set value of **QF** corresponds to the generation of 1 kHz signal at flow velocity 5 m/s.

**QF**, **PF1**, **PF2** and **H** values can be set dependent on sensor nominal diameters . The following values are pre-set:

- PF1** flowrate corresponds to the flow velocity -5 m/s.
- PF2** flowrate corresponds to the flow velocity 5 m/s.
- H** flowrate corresponds to the flow velocity 1.0 m/s.

Pushing the button “Reading from flowmeter“. Actual setting of the flowmeter is refreshed

Pushing the button “Writing to flowmeter“. Actual values displayed on the screen are transferred to the flowmeter memory.

Pushing the button “Default setting“. Recommended configuration of flowmeter for pipe diameter used is loaded. The values are not written to the flowmeter.

Pushing the button „Clear volume“. Volume is set to “0.000 m<sup>3</sup>”.

**Attention! It’s impossible to recover this operation.**

In the window “Units” it is possible to select m<sup>3</sup>/h (default setting) or l/s.

Pushing the button “Stop“. Exits the program.

## **Program FlowBase**

FlowBase software is not a standard part of basic instrument. It has to be ordered as a separate option. FlowBase enables you to load measured data from the flowmeter to the computer. An infrared interface is used in this programme.

Connect the cable with the sensor to the serial port of the computer. Run the FlowBase programme on the computer and put the sensor M90001 on the scan window of infrared transmitter. The programme will start reading data from the flowmeter. Transferred data is displayed and saved as Excel file "xls", suitable for further recalculation. Each flowmeter has got its own name of data file (differs in serial number).

The flowmeter send data every 5 seconds via the infrared interface. Only one reading from one flowmeter is transferred into database. to avoid multiple readings from the same flowmeter. Content of the data is as follows:

1. immediate flowrate [l/s]
2. total flow through volume [m3]
3. total flow through volume in negative direction [m3]
4. serial number
5. last error
6. total work time

Values are saved in the Excel file in the above order. Actual date and time are added to this data in the computer. The exact position of the values in the file is controlled according to the configuration file "FlowBase.ini". When a new file is created (data transferring from a new flowmeter), file "FlowBase.xls" is used as an original format.

The above method enables easy creation of flowrate graphs, statistical evaluation of measured values etc. All measured values can be also printed.

## Maintenance

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

### Advice for correct operation

The following principles should be consider during installation:

- *Do not use incorrect power supply, check selector switch (standard 230 V, 50 Hz).*
- *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 against mechanical damage, especially during installation or cleaning.*

### 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 non-conductive cover (like oil film) from the liner. A very dirty liner could cause inaccuracy of the measurement. Check mechanical state of the liner.

### 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 on of 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. Contact the your dealer.

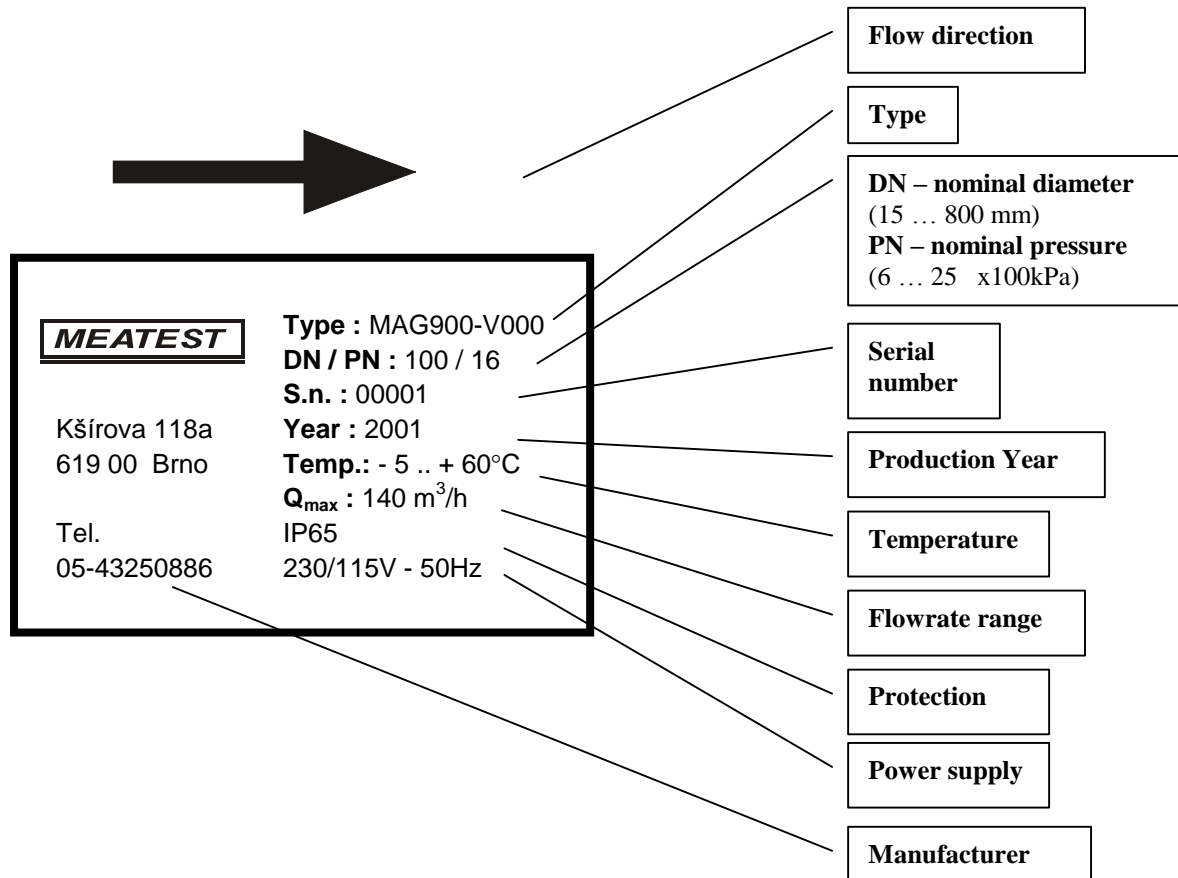
**Hidden faults** can cause different symptoms. Usually, they cause instability of some parameters. Hidden defects can be caused by unacceptable distortion, degraded insulation etc. In this case contact your dealer.

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.

## Type plate

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



## Specification

Meter size :	DN 15 to DN 800
Pressure rating PN :	PN 6 to PN 25
Flowrange :	0.1 to 10 m/s (0.0177 až 5027 l/s)
Accuracy of flowrate :	0.5% (0.5 to 10 m/s) of reading value 1 % (0.1 to 0.5 m/s) of reading value
Temperatures range :	-5 to +60 °C
Liquid temperature :	max. 130 °C for separated version with PTFE liner max. 60 °C for compact version
Electrical conductivity :	≥ 5 µS / cm
Liner :	hard or soft rubber, teflon PTFE
Outputs :	frequency, impulse, status, RS-232, 4 to 20mA.
Electrodes :	CrNi steel, hasteloy
Power supply :	230/115V ( +10%, -20%), 50/60Hz (for M900-Vxx0 model) 24V DC (+20%, -10%) or 24V AC 50/60Hz (+10%, -10%) (for M900-Vxx2 model)
Fuse :	T 315mA L250 (for M900-Vxx0 model) T 1A L250 (for M900-Vxx2 model)
Power consumption :	max. 8 VA
Protection category :	IP 65 for compact version IP 68 sensor, IP 65 electronic converter – separate version
Dimensions:	electronic unit                    140 x 160 x 80 mm sensor                                depends on diameter

## Ordering information

Power supply voltage/frequency

**M900-Vxx0**    power supplying 115V/230V, 50/60 Hz

**M900-Vxx2**    power supplying 24V DC/AC, 50/60 Hz

Current loop output

**M900-Vx0x**    no current output

**M900-Vx1x**    with passive current output 4-20 mA

**M900-Vx2x**    with active current output 4-20 mA

Liner

**M900-V0xx**    hard rubber

**M900-V1xx**    soft rubber

**M900-V2xx**    teflon PTFE

Reed relay impulse output

**M900-VxxxRR**    with reed relay on impulse output (100V, 500mA). Standard transistor output is 50V, 100 mA).

Example of order:

M900-V010 DN50 PN16            hard rubber, passive current output, power supply 230/115V - 50Hz, sensor pipe diameter 50mm, nominal pressure 16 bar

M900-V200 DN15 PN10            teflon liner, without current output, power supply 230/115V - 50Hz, sensor pipe diameter 15mm, nominal pressure 10 bar

### **Options**

<b>FlowBase</b>	Software for data reading and saving	2discs
	M90001 cable with infrared sensor	1 pc

## **Appendix 1 Separate version**

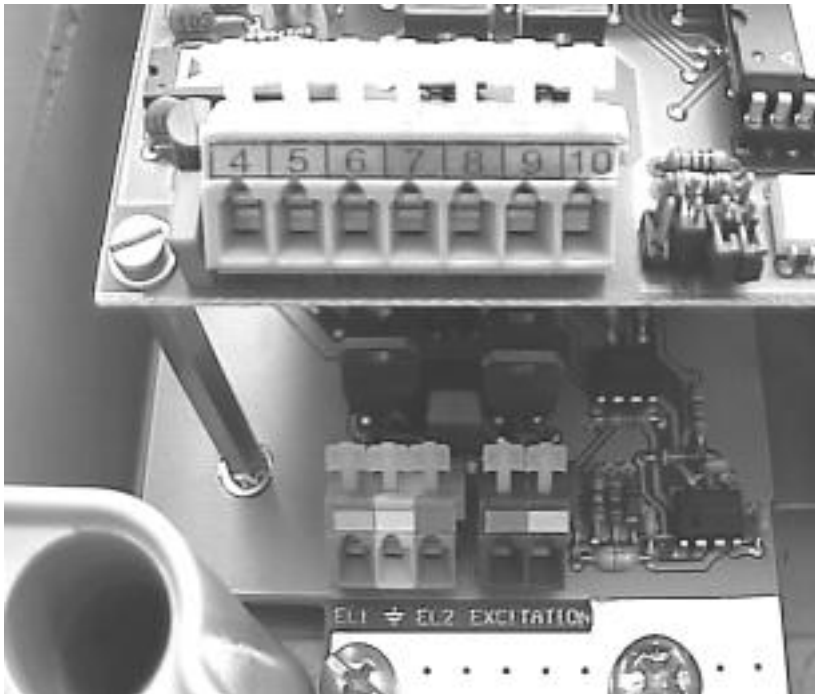
### ***Electric connection between converter and sensor***

For separate version electronic transmitter and flanged sensor are connected with 5-wire shielded cable. Standard length of the cable is 6 meter. It is recommended to mount the transmitter not too far from the flanged sensor. Use cable as short as possible. The cable can be disconnected on the transmitter side only (see picture below).

Five-terminal connector is located on the front side of transmitter PCB. Colours of wires are following :

Grey :	Electrode 1 (EL1)
White :	Ground
Brown :	Electrode 2 (EL2)
Green :	Excitation 1 (EXCITATION)
Yellow :	Excitation 2 (EXCITATION)

Shielding is connected to the white wire.

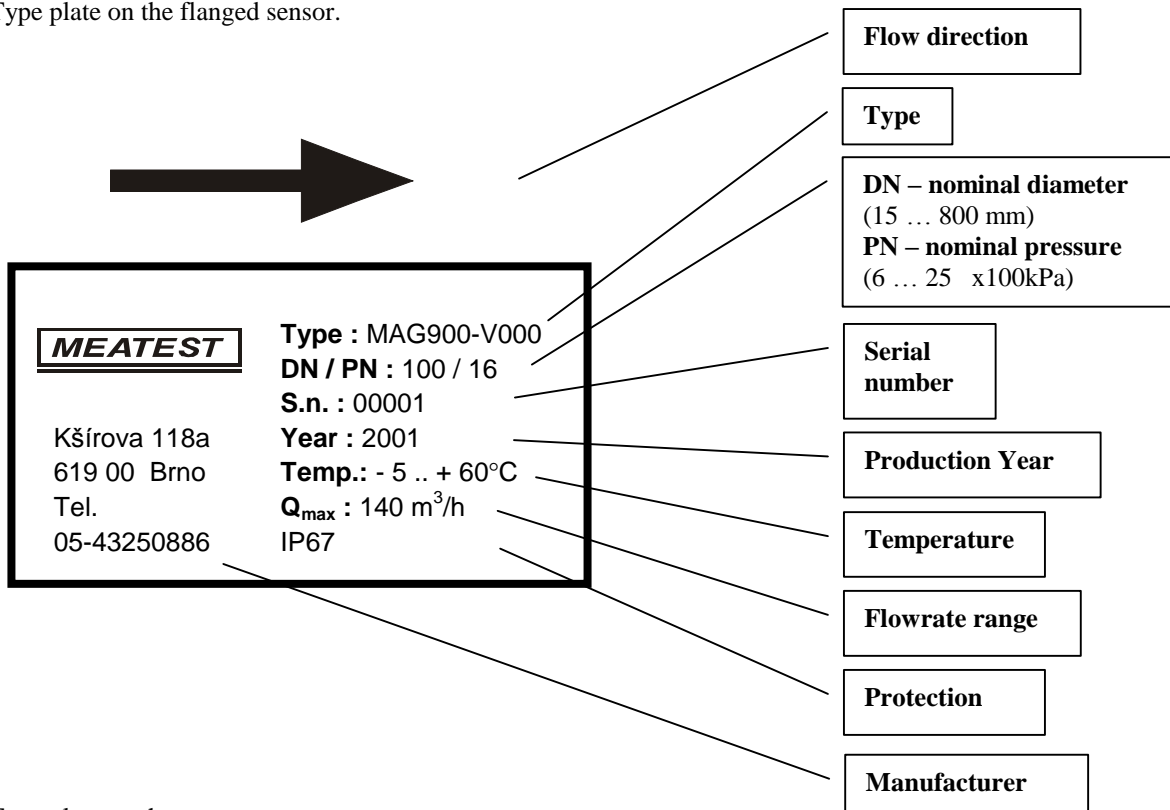


Following procedure should be observed to connect sensor cable to the transmitter :

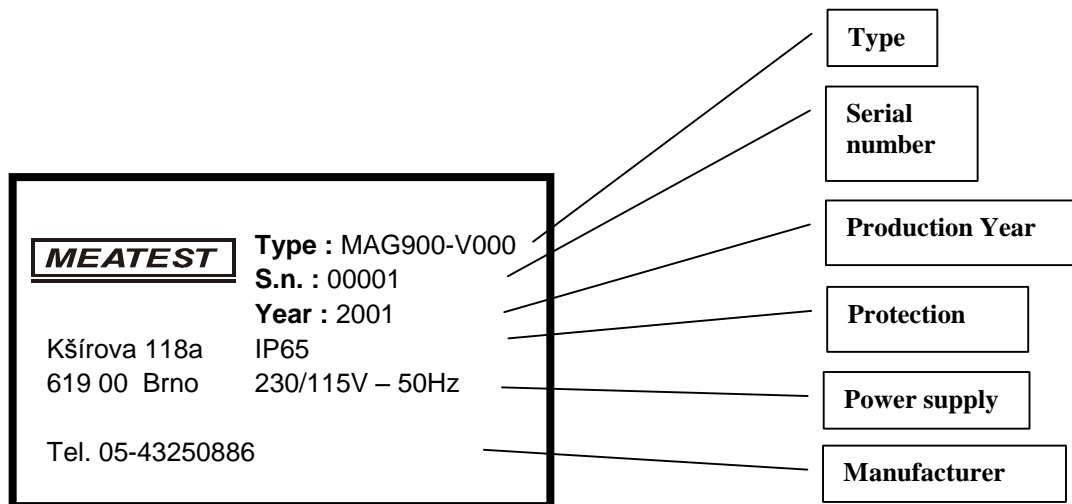
- Switch off power supply.
- Dismount top cover of electronic transmitter. Four screws must be removed.
- Connect 5 sensor wires (grey, white, brown, green and yellow) to the connector.
- Mount the cover back.
- Switch on power supply.

### Type plates for separate version

Type plate on the flanged sensor.

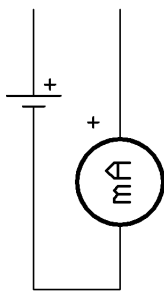
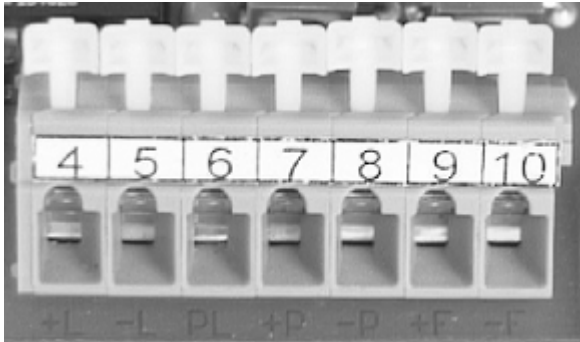


Type plate on the converter.

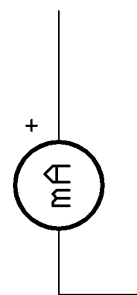
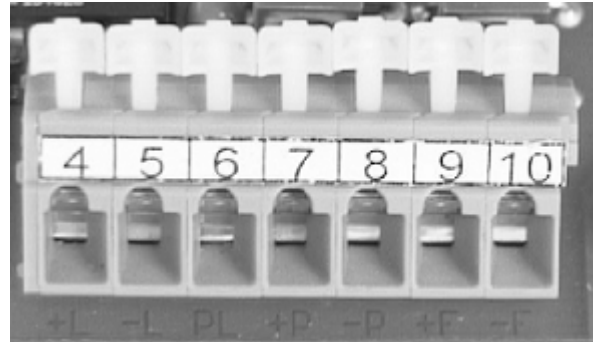


## Appendix 2 Examples of outputs connection

Example of current output connection:

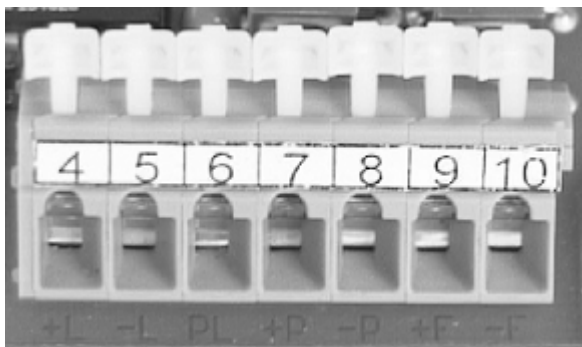


**Passive** current output connection

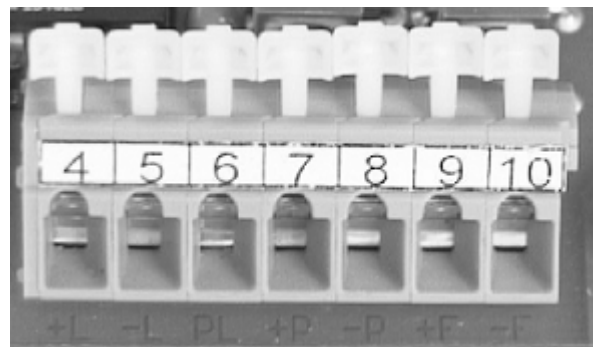
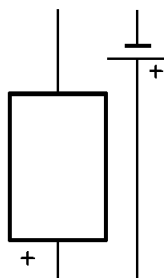


**Active** current output connection

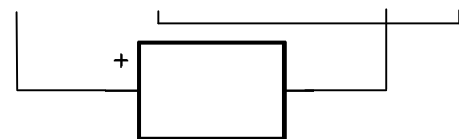
Example of frequency (pulse) output connection:



**Passive** frequency output connection



**Active** frequency output connection



*Note: Active frequency output uses power supply of current output. Total current take-off from this power supply (terminal nr. 4) must be less than 40 mA. Active frequency output is galvanically connected to current output.*