Ultrasonic Flow Meter

SONOELIS SE4015
SONOELIS SE4025

CONTENT

1. APPLICATION

The **SONOELIS** ultrasonic flow meters of the type series **SE4015 / SE4025** are intended for measurements of instantaneous flow rate and the total volume passed through fully-flooded piping of a large diameter. The meter configuration includes both hardware and software for communication with higher-level control systems.

The measurement method used is suitable for measurement of fluids permitting propagation of ultrasonic waves including electrically non-conductive fluids. To ensure high measurement precision, the meters are calibrated on a test stand.

Flowmeters SONOELIS are used with one-beam (SE4015) or double-beam (SE4025) ultrasonic sensor.

2. MEASUREMENT PRINCIPLE

The meter uses the "transit-time" impulse method where the time needed for the ultrasonic signal to pass the distance between the probes imbedded in the fluid piping is measured and evaluated. To eliminate any error due to asymmetric placement of the ultrasonic probes, the ultrasonic ray is sent in turns in and against the fluid flow direction.

3. TECHNICAL DESCRIPTION

3.1 General information

The SONOELIS SE4015 / SE4025 ultrasonic flow meter is an electronic device used for the fluid flow measurements in a fully flooded piping. It consists of two parts: the flow sensor to be installed on the piping and associated electronic unit, usually attached to a vertical plate or wall and interconnected with the sensor by a cable.
The SE4015 / SE4025 flow meters can be used within piping systems of rated diameter between DN 200 and DN 1200 where the meters intended for piping sizes DN 200 to DN 500 have a slant of the probes under the angle α = 45° and those for piping sizes DN 600 to DN 1200 have a slant of the probes under the angle α = 60° (see the drawing below):

DN 200 ÷ DN 500 DN 600 ÷ DN 1200

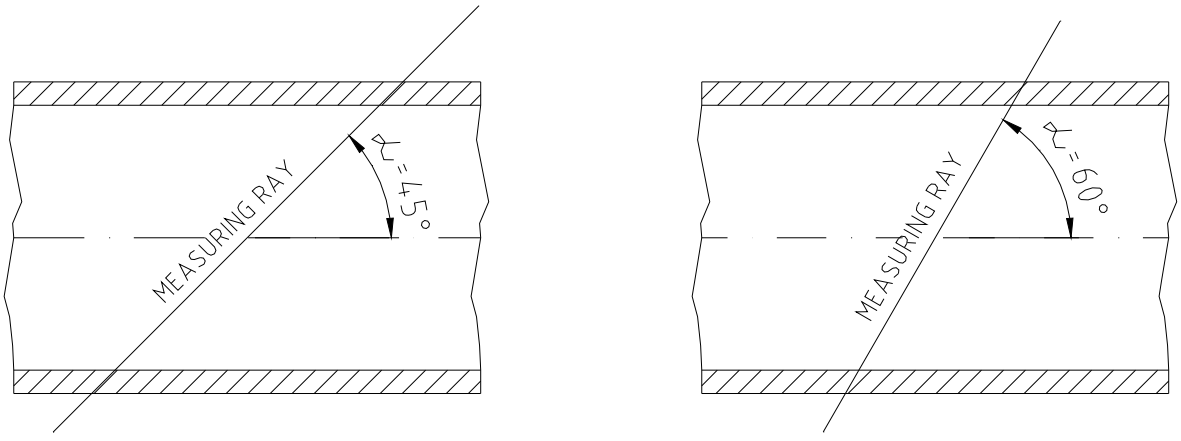


Fig.1 - The ultrasonic ray angle with respect to the piping axis

In its standard configuration, the flow meter includes one frequency and one impulse output, electrically insulated from the rest of the meter circuitry. On customer's request the meter can be provided with various optional devices such as interface to the RS 485 communication line or insulated current output. Upon adding the Pt 100 resistance sensor measuring the fluid temperature, it is possible, based on the measured fluid volume, to calculate the mass of the fluid passed through the piping. In another optional configuration the meter can measure the fluid flow in both directions and indicate the actual fluid flow direction.

On request, the meter sensor can be supplied in an IP 68 housing.

3.2 Design specifications

3.2.1 Sensor dimensions

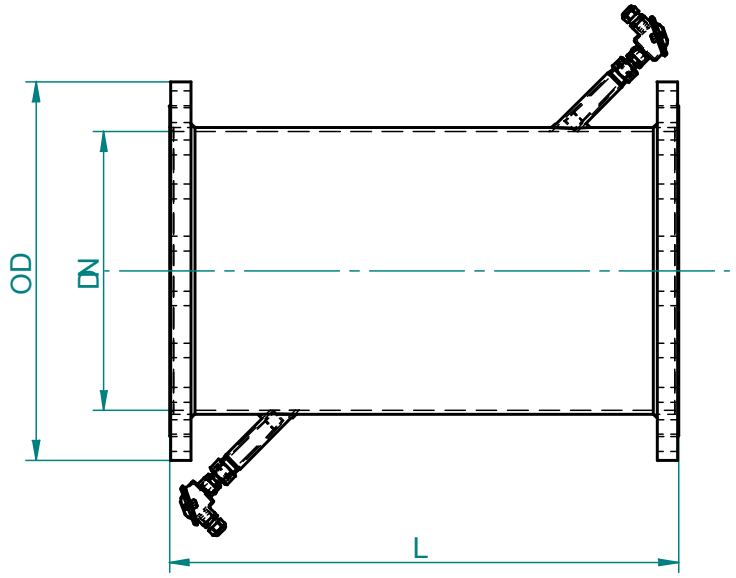


Fig.2 - Dimensional sketch of the meter sensor

DN	200	250	300	350	400	450	500	600	700	800	1000	1200
NPS	8“	10“	12“	14“	16“	18“	20“	24“	28“	32“	40“	48“
L [mm]	600	650	700	750	800	850	900	700	800	850	1000	1150
D [mm]	340	395	445	505	565	615	670	780	895	1015	1230	1455
Weight [kg]	41,5	53,5	68	89	113	136	161	182	292	378	632	978

Table 1 - Sensor dimensions

3.2.2 Electronic unit box dimensions

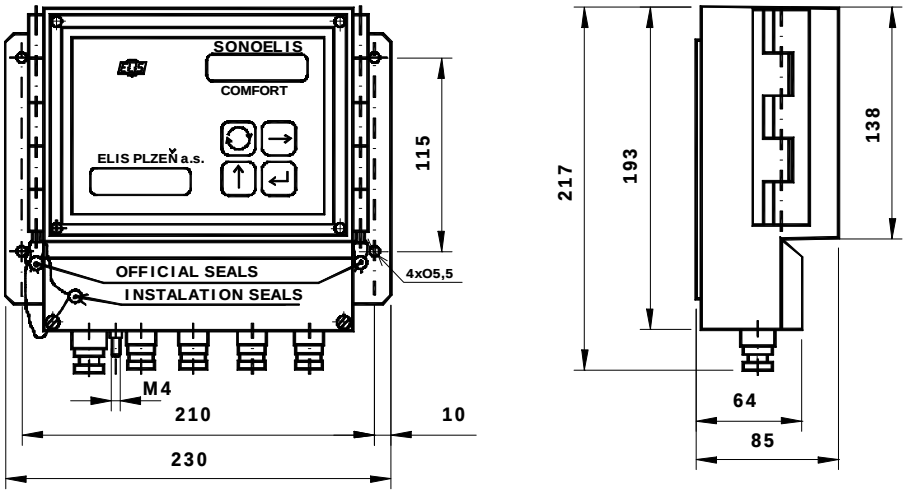


Fig. 3 - Dimensional sketch of the electronic unit box

3.2.3 Ultrasonic sensor

The sensor body is a welded piece consisting of two end flanges to be connected to the piping, the main pipe section and two pipe branches holding the ultrasonic probes (see Fig. 4). In the standard sensor version the body is designed for operating pressure PN 10, made of high-quality steel and the flanges are according to standard ČSN EN 1092-1; the whole assembly is coated with powder epoxy paint KOMAXIT E 2310 of light grey hue (RAL 7035).

On special request, the sensor body can be supplied:
- in a stainless-steel version
- with ANSI or JIS flanges
- in version for PN 16 or PN 25 (piping sizes up to DN 500)

Sensors for application in drinking-water supply systems are coated with powder epoxy paint KOMAXIT E 2110 of blue hue (RAL 5017).

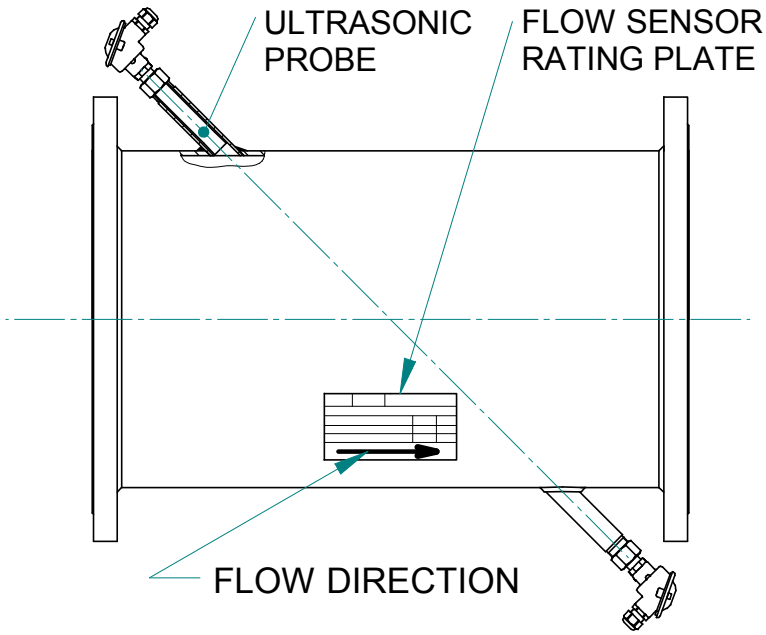


Fig. 4 - Ultrasonic sensor - description

3.2.4 Electronic unit

The flow-meter electronic unit (see Fig. 5) is embedded in a plastic box with a steel sheet attached at the back for vertical mounting. At the front panel on the box there are meter type designation and product name, production series number, manufacturer's name and logo, two-line back-lighted display unit and a membrane keyboard. At the bottom of the box under a removable plastic cover are plastic grommets for cables of circular cross-section (one PG 9 and six or seven PG 7 grommets). The grommets are intended for tight fitting of cables of external diameter 6 to 8mm (PG 9) and 4 to 6mm (PG 7). At the bottom of the box there is also an earthing bolt. Both the front panel and the terminal board cover can be sealed. Instead of one PG 7 grommet it is possible to fit a four-pole connector for the RS 485 communication line.

IMPORTANT NOTICE: Prior to putting the meter in operation, check the proper tightening of all grommets with cables and blinding of the unused ones.
IMPORTANT NOTICE: The electronic unit shall not be exposed to direct sunlight.

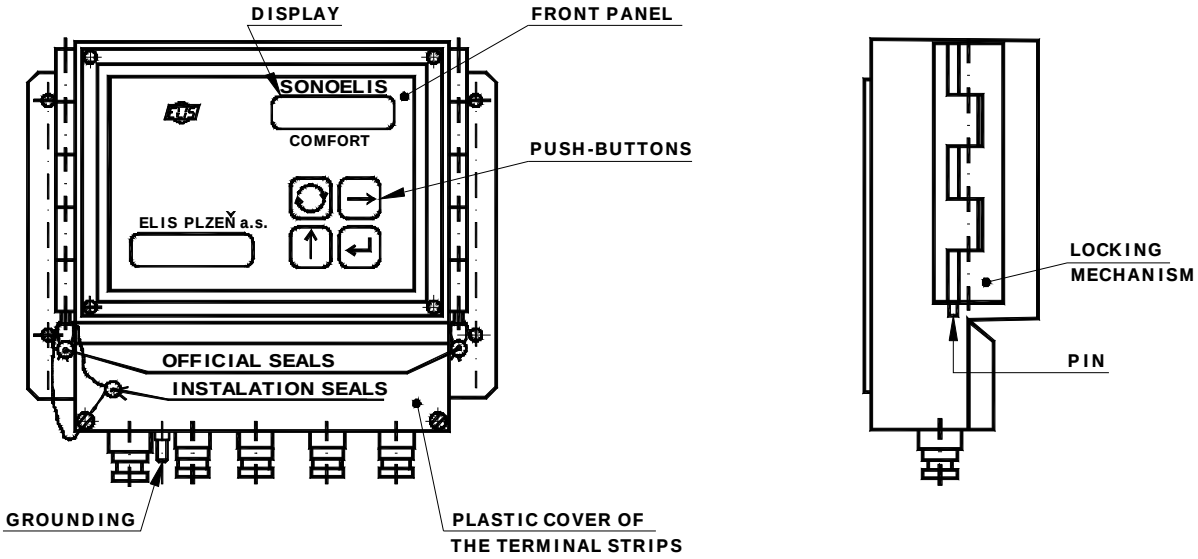


Fig. 5 - Electronic unit – description

3.2.5 Flow meter handling

The arrows indicate **the correct manner** of the meter sensor handling. Lift the sensor body holding it by the handling eyes screwed into both flanges (see Fig. 6).

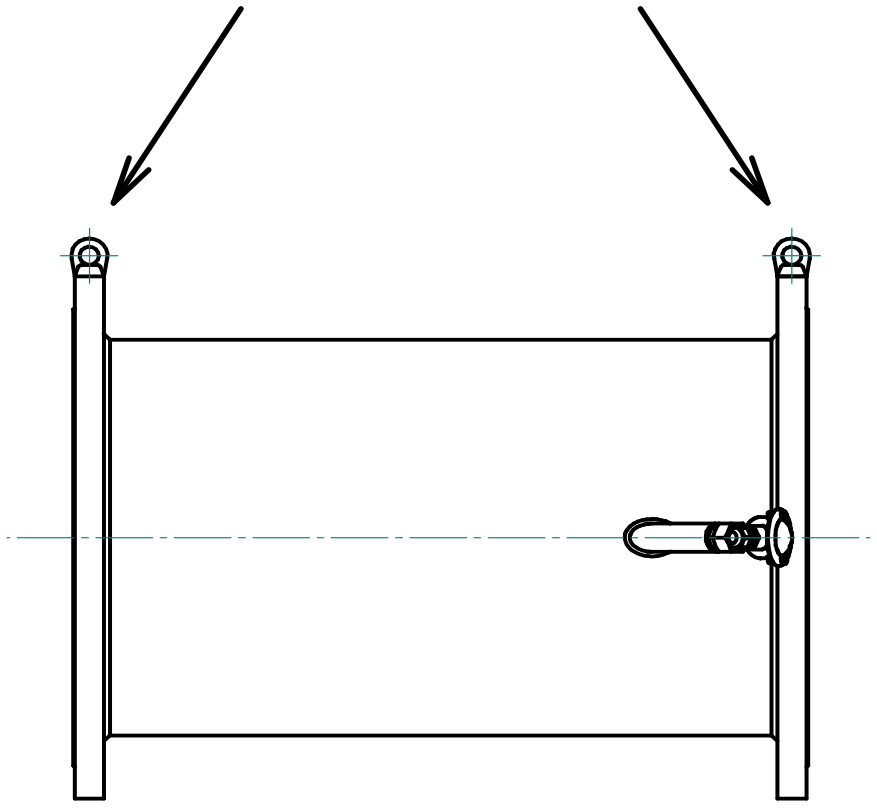


Fig. 6 - Correct grip on the meter sensor

4. TECHNICAL SPECIFICATIONS

Using Table 2, select the correct sensor size with respect to the required measuring range.

Rated piping size DN		200	250	300	350	400	450	500	600	700	800	1000	1200
Q_4 Overload flow rate	m^3/h	1000	1200	1500	1800	2000	2300	2500	3000	3600	4100	5100	6100
	G/min	4403	5283	6604	7925	8806	10127	11007	13209	15850	18052	22455	26857
Q_3 Steady-state flow rate	m^3/h	800	960	1200	1440	1600	1840	2000	2400	2880	3280	4080	4880
	G/min	3522	4227	5283	6340	7045	8101	8806	10567	12680	14441	17964	21486
Q_2 Transient flow rate	m^3/h	16	19,2	24	28,8	32	36,8	40	48	57,6	65,6	81,6	97,6
	G/min	70,44	84,53	105,67	126,80	140,89	162,02	176,11	211,34	253,60	288,83	359,27	429,72
Q_1 Minimum flow rate	m^3/h	10	12	15	18	20	23	25	30	36	41	51	61
	G/min	44,03	52,83	66,04	79,25	88,06	101,27	110,07	132,09	158,5	180,52	224,55	268,57
Q_{NEC} Threshold flow rate	m^3/h	2,3	3,6	5,1	7,0	9,1	11,5	14,2	15	18	20,5	25,5	30,5
	G/min	10,1	15,8	22,4	30,8	40,1	50,6	62,5	66,0	79,2	90,2	112,3	134,3

Table 2 - Ranges of measured values for given piping sizes

The threshold flow rate (Q_{NEC}) is the minimum flow rate at which the meter starts to indicate and process the fluid flow parameters. At the manufacturer's plant, Q_{NEC} is set at a value corresponding to the flow velocity of 20mm/s. On customer's request , the threshold flow rate can be set at any value within the range of Q_{NEC} = 0.1 ÷ 25% Q_4.

The maximum permitted error in fluid volume measurements at flow rates between Q_1 (including) and Q_2 (excluding) is: 5% irrespective of the fluid temperature.

The maximum permitted error in fluid volume measurements at flow rates between Q_2 (including) and Q_4 (including) is: 1% for the fluid temperature not exceeding 50°C, and
3% for the fluid temperature greater than 50°C.

Piping I.D.	DN 200 ÷ DN 1200
Rated pressure	PN 10, on request PN 16 or PN 25 for piping sizes DN 200 ÷ DN 500
Measurement precision	± 1% for flow rate Q > Q_2 (see Table 2) and fluid temperature up to 50°C (SE4015) ± 0,5% for flow rate Q > Q_2 and fluid temperature up to 50°C (SE4025)
Fluid temperature	0 ÷ +150°C
Ambient temperature	0 ÷ +50°C
Ambient relative humidity	not exceeding 80%
Storage temperature	-10 ÷ +70°C
Visual output via	two-line 16-character alphanumeric LC display unit
Power source	90 ÷ 260 V, 50/60 Hz
Back-up power source	Li battery 3 V (lifetime 5 years)
Power requirement	6VA
Line fuse	T 250mA, 250V
Protection against electric shock according to standard ČSN 332000-4-41	automatic disconnection from power source in the TN – S network
Protect. class; electronic unit	IP 65
Protect. class; sensor, probes	IP 54 (on request IP 68)
Outputs (insulated by means	impulse output, 0.1 ÷ 10,000 l/imp, impulse length 50ms
of optocouplers	frequency output 0 ÷ 1,000Hz (corresponding to flow rates 0 ÷ Q_4)
	relay output 24VAC/ 0.1A
	RS 485 line
Optional accessories	insulated current output 0/4 ÷ 20mA (corresponding to flow rates 0 ÷ Q_4)
	mass flow rate information
	flow-rate measurements in both directions, flow direction indication
	extended range of fluid temperature (up to +180°C)
	sensor protection class IP 68
	drinking-water meter version
	sensor flanges according to alternative standards (ANSI, JIS)

Table 3 - SE4015 / SE4025 flow meter specifications

5. PROJECT DESIGN AND METER INSTALLATION

5.1 Project design of systems including ultrasonic flow meters

In designing any project it is necessary to observe specific rules concerning placement of the meter sensors in piping so that the measuring precision would not be adversely affected. In the case of the SONOELIC flow meters, the required lengths of straight piping sections before and after the meter sensor are 5DN and 3DN, respectively (see Fig. 7).

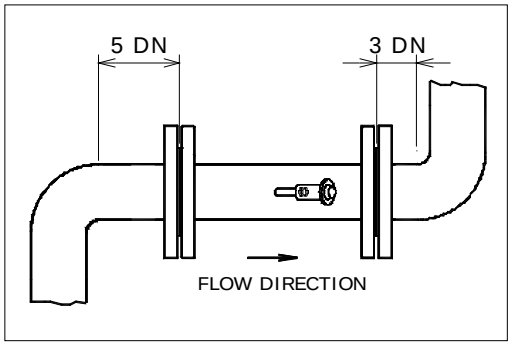


Fig. 7 - Minimum lengths of straight piping sections the input side of closing valve

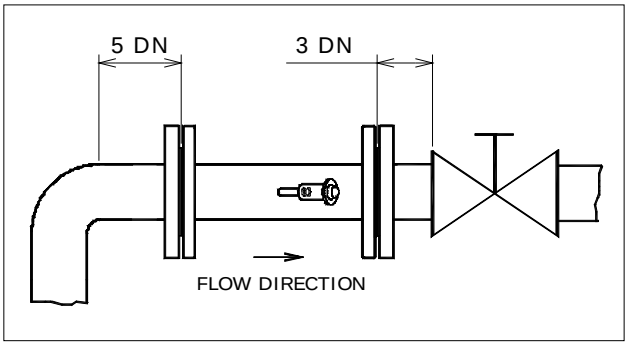


Fig. 8 - Minimum length of straight piping section at

If there is a pump near the meter sensor, it should be located at the distance of at least 20DN from the sensor output (see Fig. 9).

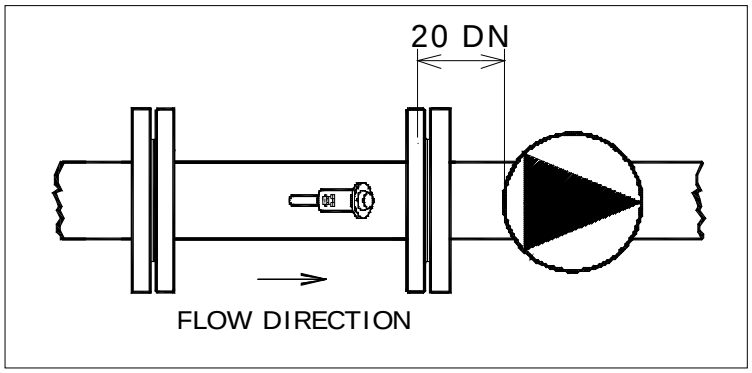


Fig. 9 - Minimum length of straight piping section before a pump

In cases where complete flooding of the piping cannot be guaranteed at all times, the meter sensor should be located so as to ensure meeting of this condition (see Fig. 10).

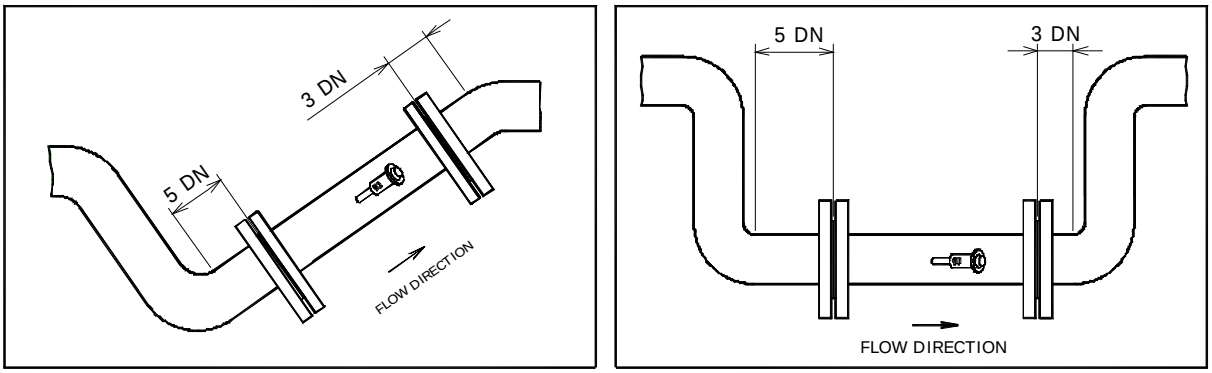


Fig. 10 - Sensor locations ensuring complete flooding at all times

If the sensor is to be fitted into a vertical piping section, the fluid flow direction in such section shall be upwards (see Fig. 11).

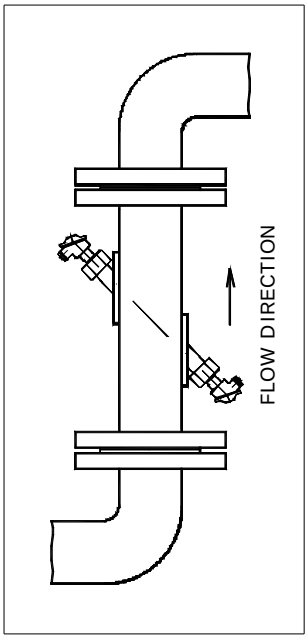


Fig. 11 - Sensor fitted into a vertical piping section

Errorless meter operation cannot be guaranteed unless the sensor is completely filled with the measured fluid at all times. Therefore the sensor should not be located at the highest piping sections or in vertical piping sections if the fluid flow direction is downwards, in particular in situations where there is a piping outlet into open reservoirs or tanks anywhere near (see Fig. 12).

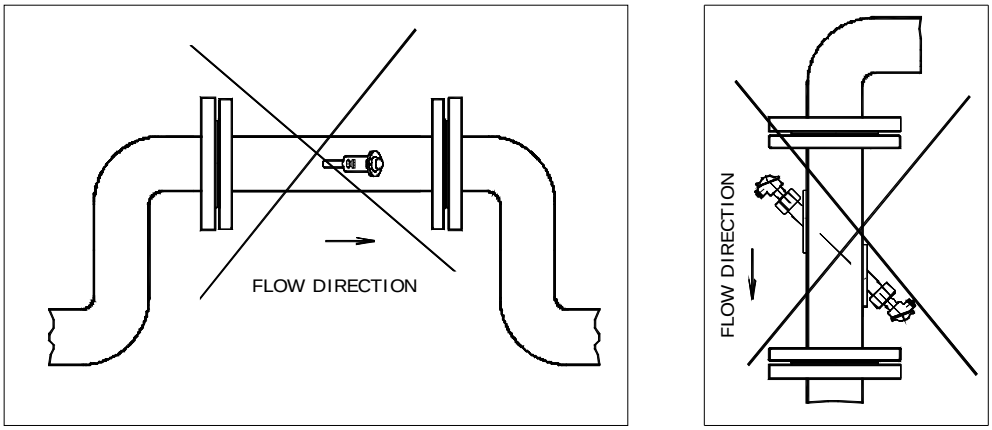


Fig. 12 - Examples of incorrect sensor placement

Another factor that may influence the meter function is the sensor angle position with respect to its longitudinal axis. Occasional air bubbles in the piping may get caught in the hollow welded-on probe holders where they would disrupt the measuring process. To effectively prevent this from occurring, the sensor probes should best be in the horizontal plane (see Fig. 13a). If for any reason such position is not possible, the sensor body may be fitted in angular position where the probe plane and horizontal plane form an angle of not more than 30°. The probes planes of double-beam sensors (SE4025) and vertical plane form an angle 45° (see Fig. 13b)

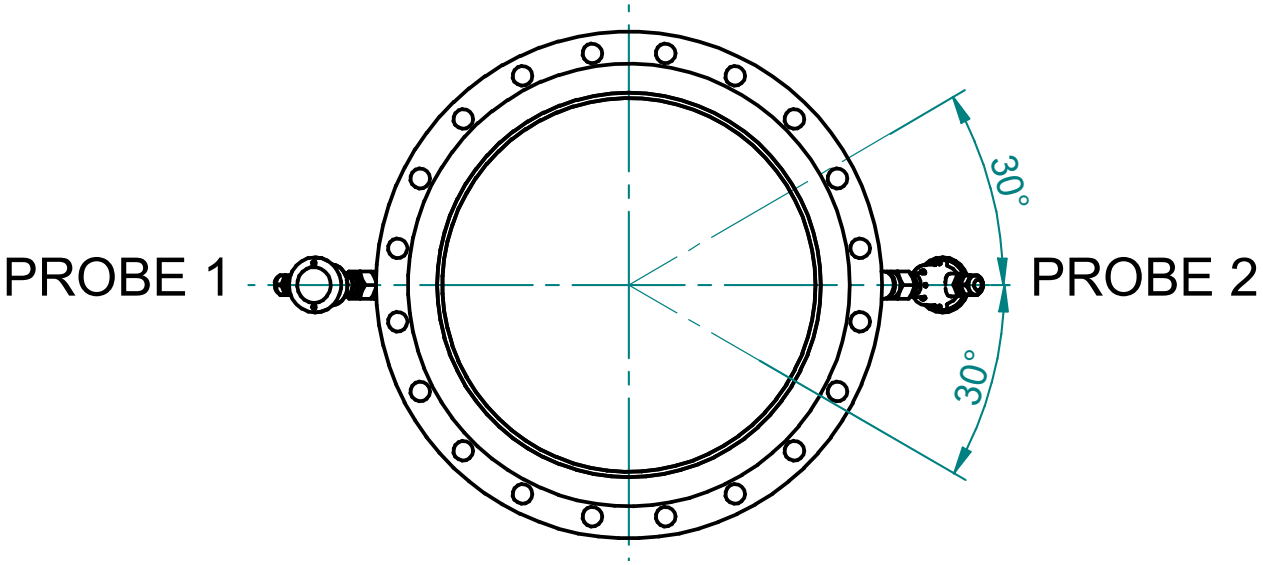
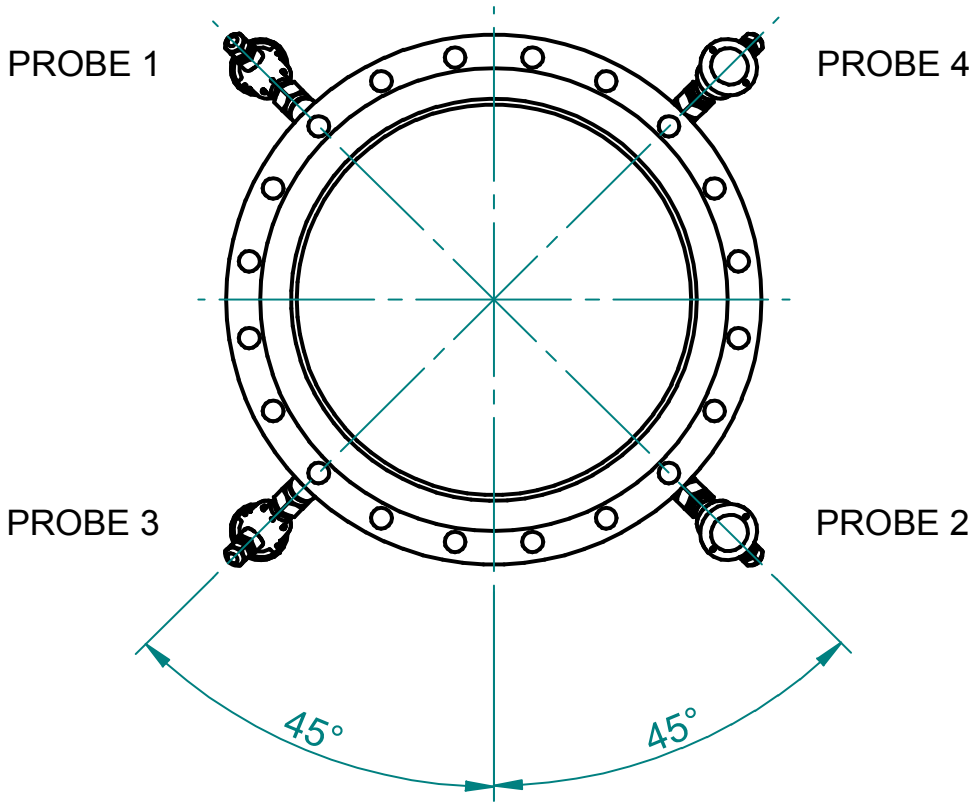


Fig. 13a - Permitted range of one-beam sensor rotation with respect to its longitudinal axis (SE4015)



Obr. 13b - Angel between probes planes and vertical plane at double-beam sensor (SE4025)

5.2 Assembly

5.2.1 General directions

In meter assembly/fitting, strict observance of the guidelines and principles given in this manual is necessary.
The meter installation shall be in compliance with the requirements of standard ČSN EN 14154-2, chapter 5.

To prevent undesirable electromagnetic interference, the power cables shall be laid at least 25cm away from the meter signal wires. Any signal wire connections shall be done by soldering and the soldered joints shall be protected against climatic and mechanical stresses by means of suitable installation boxes. All cables shall be lead outside thermal insulation layers on piping (if any). Connections to the Pt 100 temperature sensor, current output and RS 485 communication interface shall be done by shielded wires. The shielding shall be earthed at only one end (connected to the respective terminal on the X1 terminal strip in the meter electronic unit). Shielded conductors are also recommended to be used at the frequency and impulse outputs. The shielding shall be earthed at one end only, in this case on the side of the higher-level control system.
Both meter parts need be properly earthed. Use earthing conductor of cross-section of at least 4mm^2 to connect the earthing bolts on the electronic unit box and the flow sensor body as shown in Fig. 14..

Note

During using of RS 485 communication is needed to follow these instructions:

1) Frequency of device calls is max. once per ten seconds
2) Call repeating by unsuccessful call is possible first in five seconds (in the case the device didn´t respond)
3) It can be requested only one service by call proceeding

Test device is running during the communication too. This test could be guided with short-term display blink. It is not fault of device in any case.

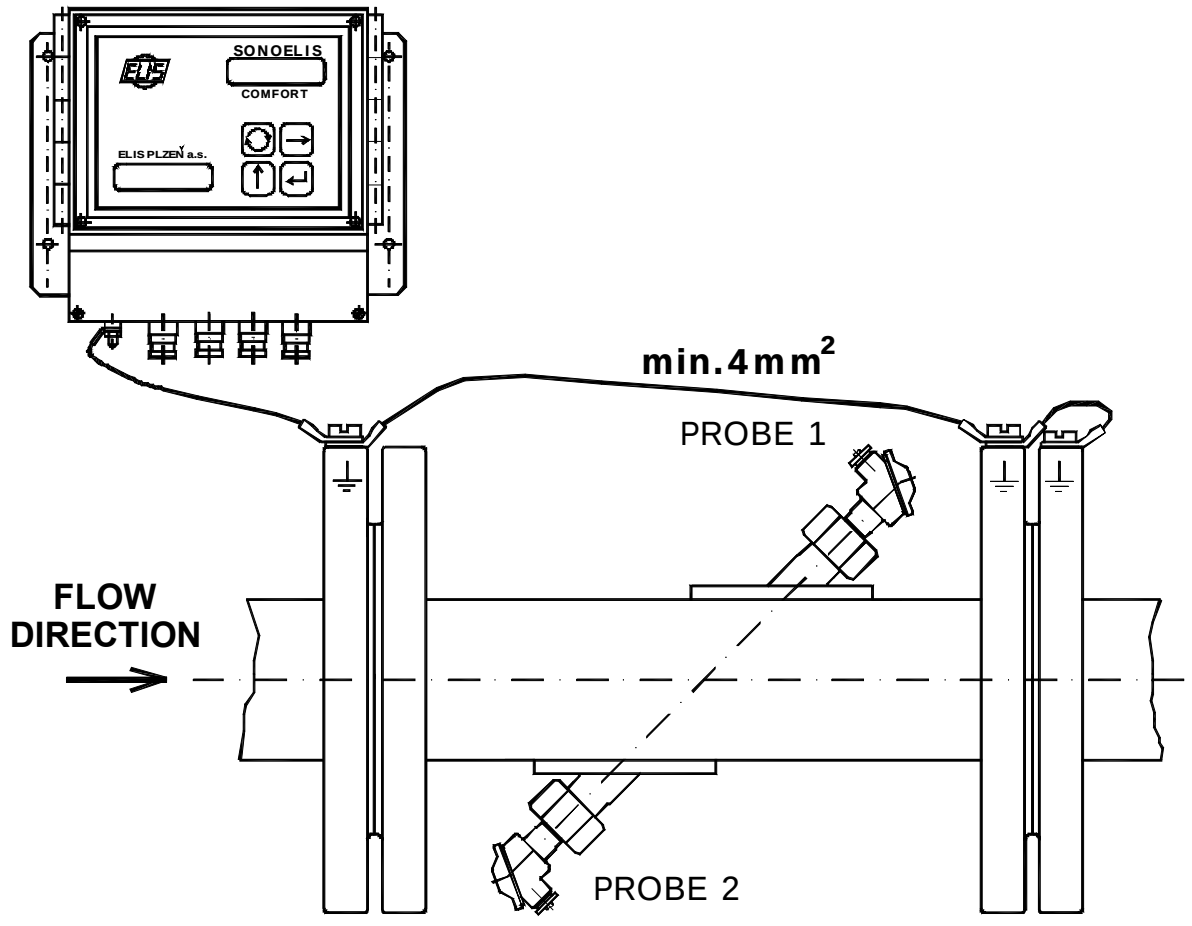


Fig. 14 - Earthing of the electronic unit and flow-meter sensor

IMPORTANT NOTICE: In the cases of outdoor installation, the electronic unit shall by protected from direct sunlight by means of a suitable sun blind. On the other hand, it shall not placed into an unventilated cabinet.

5.2.2 Mechanical connections

The ultrasonic sensor shall be fitted into the fluid piping by means of flanges ensuring exact match with the respective counter-flanges on the piping ends (see the specifications on the flange circumference). Unless required otherwise, the sensor shall be supplied with flanges according to standard ČSN EN 1092-1 (the alternative solutions are ANSI or JIS flanges).

5.2.3 Electrical connections

Remove the cover held in place by two M4 screws at the bottom part of the front panel on the electronic unit box to gain access to the terminals and connectors for external electrical connections to the unit as shown in the following figure:

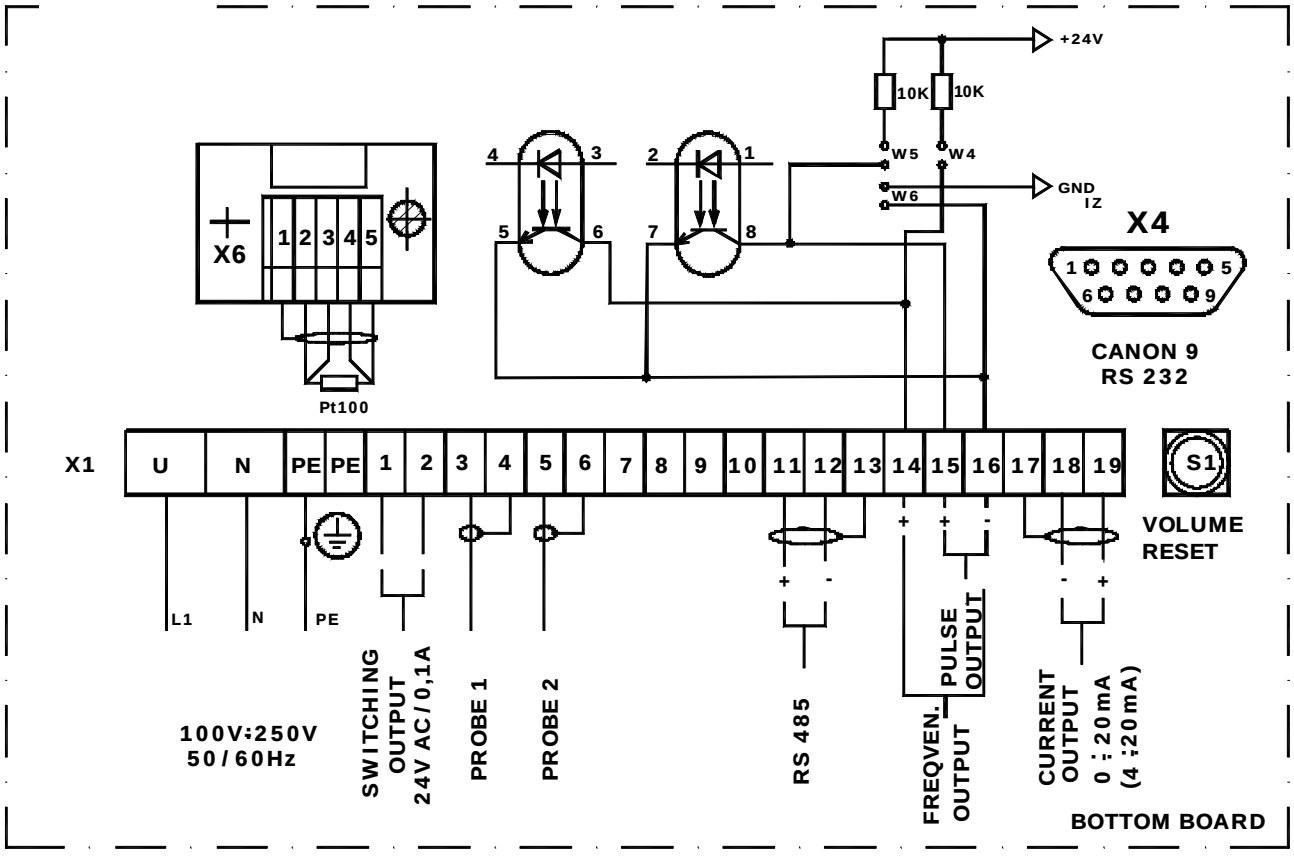


Fig. 15a - Schematic drawing of connections to the SE4015 ultrasonic flow meter

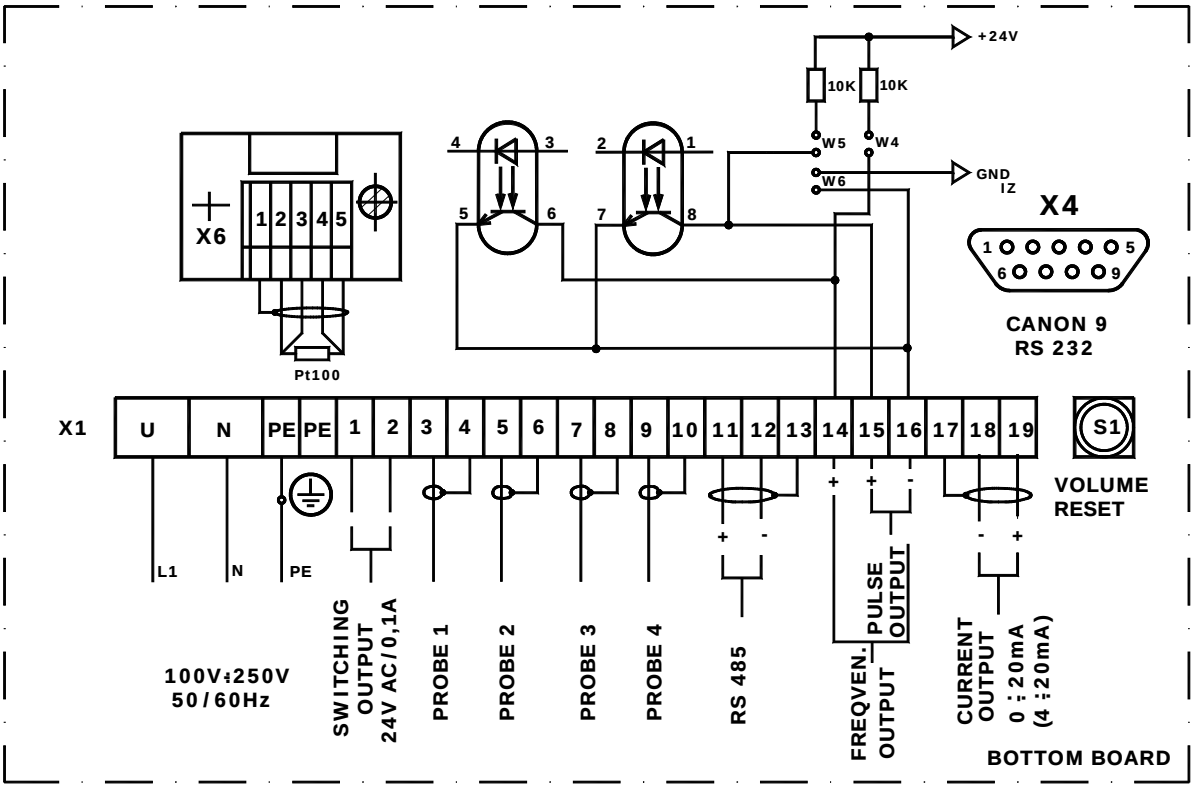


Fig. 15b - Schematic drawing of connections to the SE4025 ultrasonic flow meter

Note the connections of probes 1 and 2 (1,2,3 and 4 at SE4025), necessary for the correct meter operation. For probe marking see Fig. 13.
Connected to terminal strip X1 are, apart from the ultrasonic probes, the feeding power lines, signal outputs (the impulse, frequency, current and relay outputs) and the RS 485 communication interface.
The X4 CANON 9 connector serves the purpose of connecting the RS 485 interface used in the meter calibration, servicing and in-company operational setting.
The X6 terminal strip is used to connect the Pt 100 temperature sensor in the optional mass-flow-rate meter configuration.
By shorting the jumpers W4 and W6 the impulse output will be activated; the same action on jumpers W5 and W6 activates the frequency output. If the impulse or frequency outputs are used in the passive mode of operation (jumpers W4 through to W6 disconnected), the optron current shall not exceed 20mA. The S1 push-button can be used to reset the total fluid volume reading to zero; the same command can be sent via the RS 485 line. To indicate the fluid flow direction, connect to terminals 1 and 2 on terminal strip X1 a relay coil in series with external alternating voltage source 24 V/100 mA.

Push the arresting pin on the right-hand side of the electronic unit box upwards and lift off the front panel to the left to gain access to switch S3 through the respective circular hole in the top printed circuit board of the unit.

Note: Terminals X1 14 and 16 are used for uniform pulses

Switches S2 and S3 – location and functions

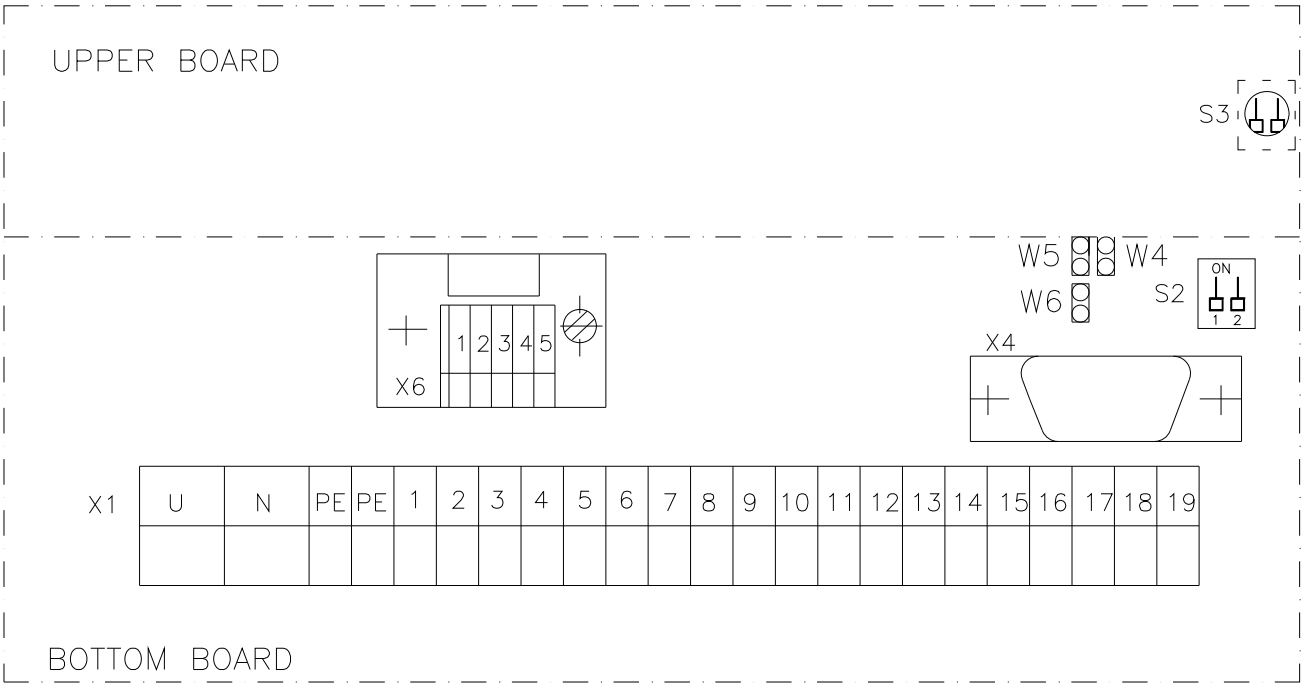


Fig. 16 - Location of switches S2 and S3

Flow meter mode of operation	***Information on the display unit***	***Combination of switch positions***
Measurement	Instantaneous flow rate	S2 ON 1 2 S3 ON 1 2
Measurement	Instantaneous velocity	S2 ON 1 2 S3 ON 1 2
Programming	EEPROM programming	S2 ON 1 2 S3 ON 1 2
Servicing	Service	S2 ON 1 2 S3 ON 1 2

The servicing mode is reserved for the purposes of meter production and special services by the manufacturer.

Product marking

Meter rating plate (located on the electronic unit box):

Manufacturer
Production series number
Type certification
Electromagnetic compatibility class (EMC)
Environment protection class
Ambient temperature
Communication address
Limit flow rate values Q_1, Q_3, Q_4
Output signals and calibration information
List of system components including type designation and production series numbers
System production series number / year of manufacture
List of all system components including type designation, quantity and production series numbers

Electronic unit rating plate (located on the electronic unit box):
Manufacturer
Type designation
Production series number / year of manufacture
Power source
Protection class information

Flow sensor rating plate (located on the flow sensor body):

Manufacturer
Production series number / year of manufacture
Type designation
DN information
Fluid temperature range
Rated pressure PN
Fluid flow direction
Protection class information

Sealing of technological meters

The SONOELIS flow meters are provided with clamping and stick-on factory and assembly seals – see Fig. 5. Should the factory seals be found removed or damaged, the product warranty shall be void.

6. Operational start and control of the meter functions

6.1 Operational start

6.1.1 Display data

6.1.1.1 Connecting the meter

The first three seconds after connecting the meter to the power source the display reads

Flow meter
E L I S

6.1.1.2 Meter status information

In the normal operation, the symbol appearing at the last digit position on the second line informs about the current mode of operation of the signal processing electronic unit. The characters used and their meanings are as follows:

I electronic unit initialisation
\+ measurements in the positive flow direction
\- measurements in the negative flow direction
C calculation of measured values, output signal generation and display
W stand-by mode
T data communication (data being sent).

Under normal operating conditions the above characters regularly replace one another. In the case of an error due to a sensor failure, loss of a sensor signal due to a cable failure, presence of an air bubble or a mechanical particle in the fluid flow, an “R” will appear at the last position on the first line and the “I” and “+” signs will appear in turns at the last position on the second line of the display unit. A failure of the electronic unit will usually be manifested by discontinued regular changes of the system status symbols on the display.

6.1.1.3 Display of measured data

Up to three measured quantities can be displayed simultaneously; one on the first line, and the other two in turns on the second line of the display unit. The switching frequency can be selected in terms of the number of measuring cycles per display time of one measured quantity.

Most often the first display line is used to show the volume flow rate (in m^3/hod) or the mass flow rate (in metric tons per hour), and the second display line to display the total volume (in m^3) or the total mass (in metric tons) alternatively with the fluid temperature in °C. However, the customer is free to define other combinations of the data to be displayed and/or to select other optional data units from the software menu available.

6.1.2 Review of the measured quantities

Volume flow rate
- Relative volume flow rate (in % of q_s)
- Mass flow rate [T]
- Relative mass flow rate (in % of q_s) [T]
- Volume (aggregate value)
- Volume + (volume of the fluid passed in the positive direction) [O]
- Volume - (volume of the fluid passed in the negative direction) [O]
- Mass (aggregate mass) [T]
- Mass + (mass of the fluid passed in the positive direction) [T], [O]
- Mass - (mass of the fluid passed in the negative direction) [T], [O]
- Temperature [T]
- Density [T]
- Sound propagation velocity
- Fluid flow velocity through the sensor flange
- Start of the measurement period (date and time of the last resetting command)
- Duration of the measurement period
- Duration of a meter error condition
- Duration of a power failure period
- Date
- Time

Comment:
Quantities denoted [T] will only be measured and displayed if the meter configuration includes a thermometer; quantities denoted [O] require that the flow meter has been set for measurements in both fluid-flow directions.

6.1.3 Review of the measured quantity units

Volume flow rate	Mass flow rate	Volume	Mass
m^3/hour	t/hour	1,000 m^3	1,000 t
m^3/min	t/min	m^3	t
m^3/s	t/s	l	kg
l/hour	kg/hour	1,000 bbl	1,000 tons
l/min	kg/min	bbl	ton
l/s	kg/s	1,000 ft^3	lb
bbl/hour	tons/hour	ft^3	
bbl/min	tons/min	1,000 gal	
bbl/s	tons/s	gal	
ft^3/hour	lb/hour		
ft^3/min	lb/min		
ft^3/s	lb/s		
gal/hour			
gal/min			
gal/s			

Temperature	Density	Velocity
°C	t/m^3	m/s
°F	kg/m^3	ft/s
	g/cm^3	
	tons/m^3	
	lb/ft^3	

Table 4 - Review of the measured quantity units

Names of selected units

bbl	American barrel
ft	Foot
gal	American gallon
ton	American ton
lb	Pound
m^3	Cubic meter
l	Litre

s	Second
min	Minute
hour	Hour
°C	Degree Celsius
°F	Degree Fahrenheit
t	Metric ton
kg	Kilogram

Table 5 - Names of selected units

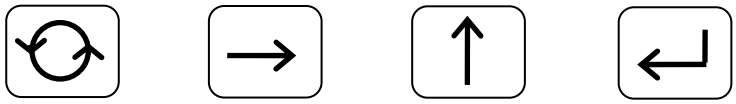
6.1.4 Unit conversion table

Volume flow rate	1 m^3/hour =	0.01666667 m^3/min 0.0002777778 m^3/s 1,000 l/hour 16.66667 l/min 0.2777778 l/s 6.289387 bbl/hour 0.1048231 bbl/min 0.001747052 bbl/s 35.31467 ft^3/hour 0.5885778 ft^3/min 0.009809630 ft^3/s 264.1708 gal/hour 4.402846 gal/min 0.07338077 gal/s
Mass flow rate	1 t/hour =	1.102311 tons/hour 0.01837185 tons/min 0.0003061975 tons/s 2,204.623 lb/hour 36.74371 lb/min 0.6123952 lb/s
Volume	1 m^3 =	6.289387 bbl 35.31467 ft^3 264.1708 gal
Mass	1 t =	1.102311 tons 2,204.623 lb
Density	1 t/m^3 =	1.102311 tons/m^3 62.42797 lb/ft^3
Temperature	t_F =	32 + 1.8 t_C
Velocity	1 m/s =	3.280840 ft/s

Table 6 - Unit conversion table

6.2 Keyboard control functions

The four-button keyboard allows for a wide range of the meter functions to be controlled and modified with respect to the requirements of particular operating conditions at the user's plant. The push-buttons T1 to T4 are provided with the following graphic symbols:



T1 **T2** **T3** **T4**

The push-button control of the meter is shown in a schematic diagram in Fig. 17. The system can be operated in two different modes where the switching-over action between the operation modes and individual functional blocks within a selected mode can be initiated by depressing the push-button the image of which is depicted at the given transition position. From the diagram it follows that a transition from one block to the next one (on the right-hand side) will be done by depressing the T2 button, while a transition to the previous block (next on the left-hand side) by depressing the T3 button. The Zero Reset block can only be activated in the cases of technological meters (the software switch in the "NF" position). In the case of commercial (invoicing) meters, where the switch is in the "F" position, the Zero reset block is missing.
Upon energising, the meter will automatically adopt the display mode with the pre-selected (initial) quantity displayed (see description below). The display mode will also become operative if no push-button has been depressed over the period of 300 measurement cycles (5 minutes for a measurement cycle of 1 s).
Any push-button control actions will not disturb the measuring functions of the meter in any way.
A detailed description of individual "block" functions controlled by the push-button unit is given in the following paragraphs.

6.2.1 Data display mode

The flow meter in full configuration can measure and evaluate any of the 20 physical quantities listed in section 6.1.2 above. In the data display mode, any of the measured quantities can be displayed. The display format is as follows:
Line 1 – name of the measured quantity in the selected language (Czech, English, German, Spanish, Italian or French);
Line 2 – the measured value in the selected unit system.

Upon switching the power on, the system activates the data display mode whereby the measured value of the pre-selected ("initial") physical quantity is displayed. Each of the 20 physical quantities available can be selected as the initial one.

If the operator depresses push-button T1, another measured quantity will be displayed (the next on the list in section 6.1.2). Then, unless T1 is depressed again within 5 minutes, the initial quantity will be displayed again.
To leave the Data Display Mode for the Parameter Setting Mode, depress push-button T4 (see Fig. 18). Select the desired operating mode (function block) by push-button T1 and confirm the selection by depressing T4 again.

6.2.1.1 Volume flow rate

The value of the measured volume flow rate is displayed as a 3- or 4-digit number (this is determined by the manufacturer with respect to the meter application). Provided the flow meter has been set for measurements in both directions of flow, the sign before the reading indicates the flow direction ("+" for the flow direction shown by the arrow sign on the meter body, "-" for the opposite direction).

6.2.1.2 Relative volume flow rate

The displayed reading shows the ratio (in per cent) of the measured volume flow rate to the specified maximum volume flow rate.

6.2.1.3 Mass flow rate

The mass flow rate can be measured and the measured data displayed only on condition that the meter configuration includes a thermometer and that the fluid density vs. temperature characteristic is known. For more technical details of the readings see the comments to section 6.2.1.1 above. If a thermometer is not installed, the mass flow rate function block is skipped when selected by push-button T1.

6.2.1.4 Relative mass flow rate

See the comments to section 6.2.1.2 above concerning the relative volume flow rate.

6.2.1.5 Volume

The aggregate fluid volume passed through the flow sensor during the measurement period, i.e. from the moment the volume data were reset by the reset push-button on the meter, or since the measurement start command from the superordinated control system was received via the RS 485 communication line, or since the data-resetting command was actuated using the T push-buttons as described in section 6.2.2.8 below. The displayed value can have up to 7 digits; higher readings are shown in the form of products of real numbers and appropriate powers of 10 (the "E" format). The reading sensitivity is 0.01 l, the maximum reading is $2.8.10^9$ m^3. In the case of bi-directional measurement, the aggregate volume reading is the difference between the volume passed in the positive and the negative direction of the fluid flow. The displayed value includes the polarity sign.

6.2.1.6 Volume +

Applicable only in the case of bi-directional measurement. The reading represents the aggregate fluid volume passed in the positive flow direction (see the arrow on the meter body). The reading format and the range of the measured values are as described in section 6.2.1.5 above.

6.2.1.7 Volume -

See section 6.2.1.6, for the reverse flow direction.

6.2.1.8 Mass

See section 6.2.1.5, for the aggregate mass of the fluid passed through the flow sensor. The reading sensitivity is 0.01 kg.

6.2.1.9 Mass +

See section 6.2.1.6, for the aggregate mass flow in the positive direction.

6.2.1.10 Mass -

See section 6.2.1.7, for the aggregate mass flow in the reverse direction.

6.2.1.11 Temperature

The temperature reading is only available if a thermometer is included in the meter configuration. The reading sensitivity is 0.1 °C.

6.2.1.12 Density

The fluid density readings are available provided a thermometer has been installed.

6.2.1.13 Sound propagation velocity

Velocity of the acoustic signal propagating in the measured fluid.

6.2.1.14 Fluid flow velocity

Velocity of the fluid passing through the sensor flange.

6.2.1.15 Start of the measurement period

The calendar date, hour and minute when the measurement period commenced (the last resetting of the aggregate flow data).

6.2.1.16 Duration of the measurement period

The length of the period (in hours, minutes and seconds) from the measurement start (see section 6.2.1.15) during which the flow meter continuously performed the flow rate measurements.

6.2.1.17 Duration of failure condition

The total duration of the period (s) (in hours, minutes and seconds) from the measurement start during which the meter was energised but could not perform measurements due to a failure condition.

6.2.1.18 Power failure period

The total duration of the period (s) (in hours, minutes and seconds) from the measurement start during which the meter was not energised.

6.2.1.19 Date

The display shows the actual calendar date.

6.2.1.20 Time

The display shows the actual time of the day.

6.2.2 Parameter setting mode

When selecting the parameter setting mode (see section 6.2.1), the operator will be requested to enter a four-digit password.

6.2.2.1 Password

The first display line will read

PASSWORD

and the first digit position on the second line will display 0. Depress push-button T3 repeatedly to increase the number by 1 at a time (after 9 will follow 0 again). Select the correct number at the first digit position and then depress push-button T2 to move to the second digit position and repeat the number setting procedure with push-button T3. Progress to the third and fourth digit positions and enter the correct password – a combination of four numbers (see the schematic diagram in Fig. 19).

Confirm the entry of the correct password by depressing push-button T4. Provided the password entered is correct, the system will proceed to the language selection block. In the case of an incorrect password the system will request a new password entry. After three consecutive entries of incorrect passwords the system will switch over to the data display mode and will not permit further entry into the parameter setting mode. A new attempt at the password entry is only possible after system de-energising and repeated switching on of the power supply.

Should the operator forget the password, it is possible to use the manufacturer's password supplied with the system (0200). This shall be done as follows: switch off the power, depress and hold push-button T4 and switch the power on again.

The user password can be changed at any time in the parameter setting mode using the procedure described in section 6.2.2.5 below.

6.2.2.2 Meter setting procedures

The meter parameters that can be defined or re-defined in the parameter setting mode include: the language of the messages appearing on the display, units of the displayed quantities, the user password required for entry into the parameter setting mode, the initial measured quantity, specified values of some measured quantities (q_s, impulse number – litres per imp., threshold/sensitivity level, and the maximum/limit values of fluid flow rate, volume and temperature), as well as the date, day of the week, time of the day, start of the measurement period and meter zero position (only with the technological meters).

The procedures to be used in setting particular parameters are described below. Upon initialisation of a particular parameter setting mode, the name of the function block concerned will appear on the first line of the display in block letters, e.g.

LANGUAGE

At the same time, the current parameter name or value will appear on the second line. If you wish to pass on to the next parameter, depress T2; by depressing push-button T3 you will return to the previous parameter. Any parameter changes are done using push-button T1, confirmation of the new value by push-button T4. The display will then read

PARAMETER SET

To leave the current parameter setting mode and proceed to another parameter block, depress push-button T2. If you wish to return to the previous block, depress T3. To leave the parameter setting mode completely (and enter the data display mode for the parameter just set), depress push-button T4.

6.2.2.3 Language selection

The operator can choose from any of the six languages available (see Fig. 20). The language setting mode will be initiated as soon as the system acknowledges the correct user password. The first line on the display will then read

LANGUAGE

or a message to the same effect in the actually defined language. On delivery, the language selected will be Czech unless the customer has specified their required language in the product order. The second display line will identify one of the languages available (e.g. English). Depress repeatedly push-button T1 to select the desired language. Upon selecting the language, confirm the setting by depressing push-button T4. The message on the display will inform the operator of completion of the parameter setting in the newly selected language.

6.2.2.4 Measuring unit selection

In this parameter setting mode, the desired measuring unit can be associated with each measured physical quantity (see Fig. 21). Upon initiating this mode, the first line of the display will read

UNITS

while the name a physical quantity will appear on the second line. Depress repeatedly push-button T1 to select the desired quantity and confirm by depressing T4. The quantity name will then appear on the first line and the second line will display one of the measuring units available. Select the desired unit by T1 and confirm by T4. Depress push-button T3 to access another measured quantity or use T2 to proceed to another parameter to be set.

6.2.2.5. New password definition

NEW PASSWORD

In this mode, the operator/user may modify the existing password used to access the parameter setting mode (see Fig. 22). Depress push-button T4. The first digit position on the second line will display 0. Set the new password (a combination of four numbers) using the procedure described in section 6.2.2.1 above. Upon final confirmation by depressing push-button T4, the legend Parameter Set will appear on the display. From then on, only the new password will be effective.

6.2.2.6 Initial quantity selection

Upon accessing this parameter setting mode, the first line of the display will read

INITIAL QUANTITY

and the second line will give the quantity's name (see Fig. 23). Select the desired initial quantity using push-button T1 and confirm the selection by T4.

6.2.2.7 Definition of limit values

LIMIT VALUE

Here the operator can set altogether 11 (limit) values of parameters. The detailed description of the procedures concerned is shown in Fig. 24. Select the desired parameter by push-button T1 and confirm the selection by T4. The name of the parameter and the associated measuring unit will then appear on the first line of the display and the second line will show the previously defined limit value (with the exception of the date and time). The limit value unit shall always be the same as that selected for data display. For example, if the volume flow rate is displayed in litres per second, the limit value of volume flow rate shall also be defined in l/s. If the mass flow rate measurement mode is selected and the data are displayed in metric tons, the impulse number shall also be defined in t.

Upon depressing push-button T2, the previously set limit value will disappear from the second line and 0 will be displayed in the first digit position. Use push-buttons T3 and T2 to set the digital value and T1 to insert the division signs (a comma in the position of a decimal point, dot in the date and colon in the case of time).

The day in the week information is to be set as follows:
0 – Sunday
1 – Monday
2 – Tuesday
3 – Wednesday
4 – Thursday
5 – Friday
6 – Saturday

A figure entered may have up to seven digits. The date and time data shall include initial zeroes; e.g. the date of 3 July, 2001 shall be recorded as 03.07.01 and the time 7 minutes past 9 a.m. as 09:07:00. Confirm the selection by depressing push-button T4. In the case of a commercial (invoicing) meter, neither q_s, impulse number or sensitivity (low flow cutoff) can be reset by the user as these settings are reserved to the duly authorised testing authority. Therefore, for commercial meters, these parameters will not appear on the list of limit values to be reset.

List of parameters (limit values, date and time)

Qmax	Maximum (overload) flow rate q_s in the given measuring units
ICIS	Impulse number, defining fluid volume or mass (in selected units) per one impulse at the impulse output
Date	The actual calendar date
Day of the week	The actual day of the week
Time of the day	The actual time of the day
Low flow cutoff	The flow rate level, in per cent of q_s, below which the meter will display and at its outputs indicate zero flow rate
Vol. flow limit	Maximum volume flow rate level; where a binary output is associated with this parameter, it will indicate values exceeding this limit
Mass flow limit	Maximum mass flow rate; where a binary output is associated with this parameter, it will indicate values exceeding this limit
Volume limit	Maximum aggregate volume; where a binary output is associated with this parameter, it will indicate values exceeding this limit
Mass limit	Maximum aggregate mass; where a binary output is associated with this parameter, it will indicate values exceeding this limit
Temp. limit	Maximum temperature; where a binary output is associated with this parameter, it will indicate values exceeding this limit value.

Comment: The limit values for all the above parameters shall be given in units selected using the procedure described in section 6.2.2.4 above. Should new parameter units be selected, the limit values need be re-defined accordingly; otherwise the meter function would be incorrect.

6.2.2.8 Resetting aggregate quantities

Upon entering this mode, the corresponding message will appear on the display (see Fig. 25). If resetting of aggregate quantities is not required, depress push-button T2 to access the next parameter-setting block. Confirm your intention to reset the aggregate quantities by depressing T4. The display will then ask

RESET ?

At this stage, you can still return to the initial step of the resetting mode by depressing T3. Depress T4 to reset the aggregate readings of the flow volume and flow mass, the operational information (the meter operation time, the error time and power loss time) and define the start of a new measurement period (the date, hour and minute of the same). The system will respond with a confirming message (Parameter Set).

6.2.2.9. Meter zero setting

Before leaving the manufacturing plant, every flow meter is carefully set for correct operation. One of the key parameters in this respect is the meter zero. A correctly set meter zero implies that at zero flow rate (or zero fluid flow velocity through the meter sensor) the meter indicates a zero flow rate (zero fluid flow velocity). The setting value (a meter zero shift) is expressed in mm per second. The meter zero shift as identified in the manufacturing plant is stored in the meter memory under the name of initial (in-production) zero setting value.

Meter component ageing and other factors acting over long-term operational periods may result in minor meter zero displacements. To eliminate these, use the automated zero resetting function. However, great care should be taken in employing this function. First of all, the zero flow rate condition shall be ensured (make sure that the closing valve in the piping is not leaking). Only then the zero resetting function may be used.

A detailed description of the zero resetting block is shown in Fig. 26. Upon initiating this function, the operator shall select either the in-production or automated meter zero setting mode. The selection is done by push-button T1, confirmation by T4. When the in-production setting mode is selected, the meter zero is reset using the zero shift value determined in the manufacturing plant.

In the automated zero setting mode, the meter will first ask whether the fluid flow rate through the meter sensor is really zero (the main requirement for a successful zero setting). If it is not so, cancel the setting process using push-button T3. Upon confirmation by push-button T4 the display will show the message “WAIT FOR 100”. The zero setting procedure lasts 100 measuring cycles. The actual number of measuring cycles performed is shown on the second display line.

After 100 measuring cycles the zero displacement is evaluated. If it is smaller than 50 mm/s, the shift value is stored and the display with read “PARAMETER SET”. If the value is greater than 50 mm/s, a notice to this effect is displayed. However, this is highly unlikely; in such as case it is recommended to check again whether the fluid flow has indeed been completely stopped. Use push-button T3 to invalidate the setting and push-button T4 to run the setting procedure anew.
The meter zero setting function is available only with technological flow meters.

6.2.2.10 End of parameter setting

At the end of the parameter setting procedure, the display will read

PAR. SETTING END

Depress push-button T4 to access the data display mode. However, should you wish to perform any additional parameter setting action, depress T3 to return to the previous parameter setting function block (see Fig. 27).

6.3 Automated meter test

The test shall only be used in extraordinary situations where the meter function is incorrect although all operational conditions are within specified limits. Its purpose is to handle extraordinary situations where the meter function is incorrect although all operational conditions are within specified limits.

Prior to initialising the test, check the correct interconnection between the evaluation electronic unit and the meter sensor, the power supply line, the full sensor flooding and zero flow rate. Then switch off the power, depress push-button S1 (resetting the aggregate volume) and, with S1 depressed, switch on the power again. Upon releasing S1, the display will read

TEST SENSOR FULL?

Depress and release S1 again, whereby, provided the sensor is fully flooded, the following message will appear on the display:

LIQUID DOES NOT FLOW?

Check the zero flow rate condition and depress and release S1. The test will continue by checking whether the passage route for the ultrasonic ray in one direction is free. The display will read

TEST UTS THROUGH.1

If this test is successful, the message “OK” will appear on the display for four seconds, whereby a test of the ray passage route in the other direction will commence.

TEST UTS THROUGH.2

After successfully passing this test section, the display will show the amplification values associated with the ultrasonic ray passage in both directions; e.g..

UTS THROUGHPUT D1 = 4,56 D2 = 4,55

Under normal circumstances, the amplification values should be between 4.50 and 4.60, and their difference should not exceed 0.10.

After four seconds, the measurement of the ultrasonic wave propagation velocity will commence. The message on the first display line will read:

UTS RATE

After the velocity measurement, which takes approximately 1 s, the measured value will appear on the second line, e.g.

1510.6 m/s

If the measured value lies within the limits specified for the given fluid, the following message will appear on the display

RATE LIMITS OK
END OF TEST

and, after another 4 seconds, the meter will resume the normal measurement mode.
Should a fault be indicated at the ray passage test stage, the display will show ER instead of OK. After 4 seconds, automated probe cleaning procedure will start and last for 5 minutes. The display will then read

CLEAN.UTSP 5 MIN
11111111 ……...

On the second line is displayed step by step, the actual number of the minute of the cleaning procedure is displayed. Every fourth seconds one numeral is added, the line will be filled up by 15 same numbers within 1 minute, after elapsing this time the displayed numbers disappear and next new numbers start to display for a time 1 minute. After the probe cleaning, another ray passage test is performed. Should even then the test result be negative, the following message will appear on the display:

DEFECT
END OF TEST

The meter needs be put out of service and either sent for repair to the manufacturing plant or a service technician be asked to come and repair the meter on site.

Should a fault be indicated at the ultrasonic wave propagation velocity measurement and the measured velocity lie outside the range of physically defined limits (VUTS < 900 m/s, VUTS > 1700 m/s), the probe cleaning procedure will be initiated (unless it has already been performed) and the velocity measurement will be repeated. Should even then the test result be unsatisfactory, the display will read:

DEFECT
END OF TEST

and the test sequence will be terminated.

Should the measured velocity lie outside preset limits but within the range of physically possible values, the following message will appear on the display

UTS RATE LIMITS
ADJUSTMENT

and the actual limits will automatically be re-adjusted with respect to the measured value. The display will in that case read

RATE LIMITS OK
END OF TEST

and, after another 4 seconds, the meter will resume the normal measurement mode.
Should the meter function still be unsatisfactory, it is possible to repeat the tests. In the case of repeated failure to set the meter right, contact the meter manufacturer.

PUSH-BUTTON CONTROL OF THE FLOW METER FUNCTIONS

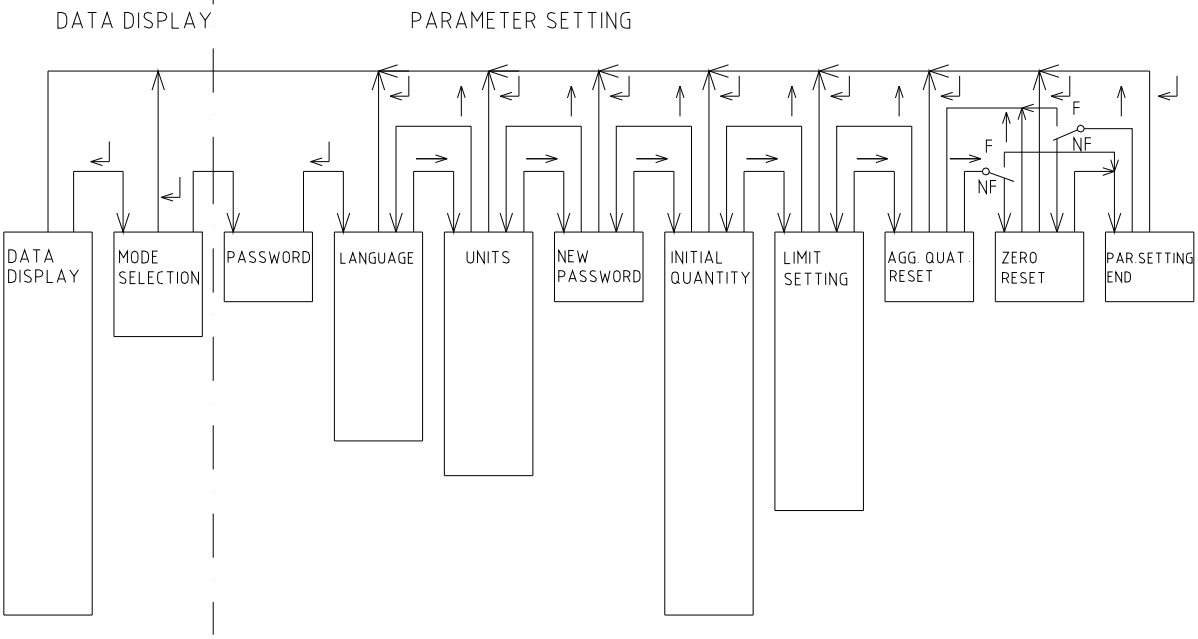


Fig. 17

DATA DISPLAY

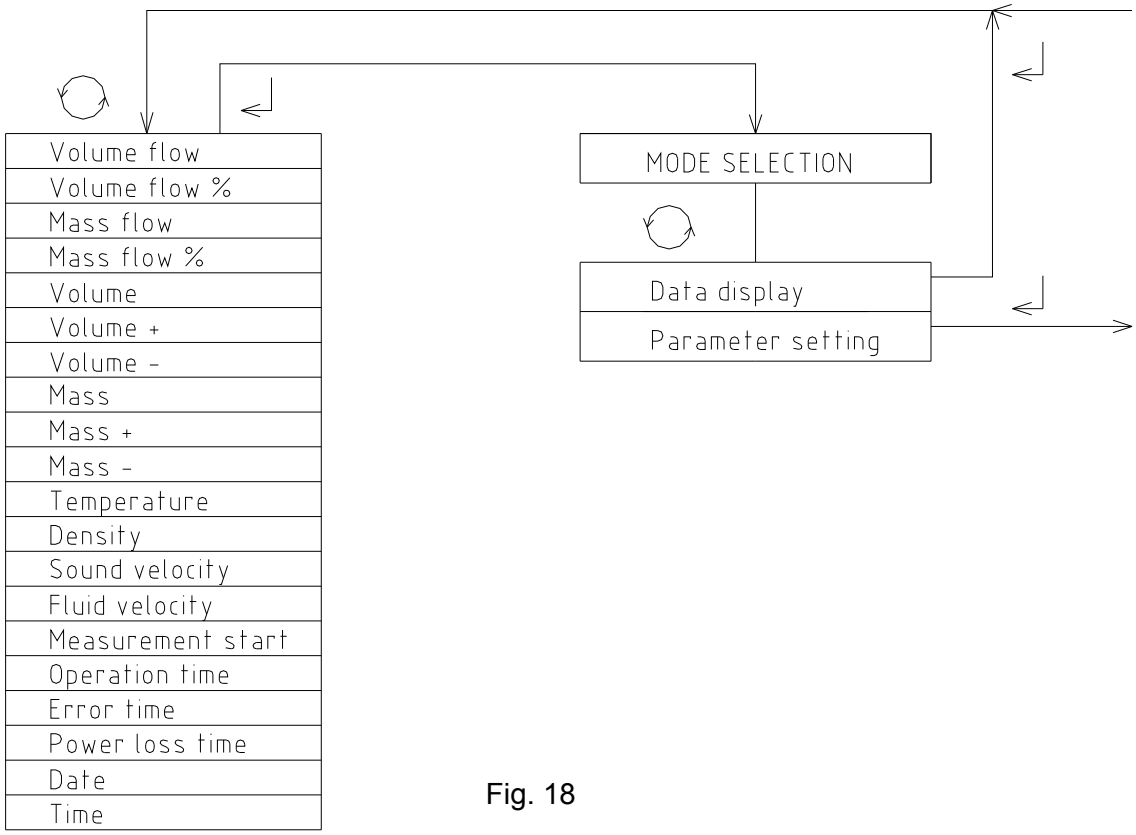


Fig. 18

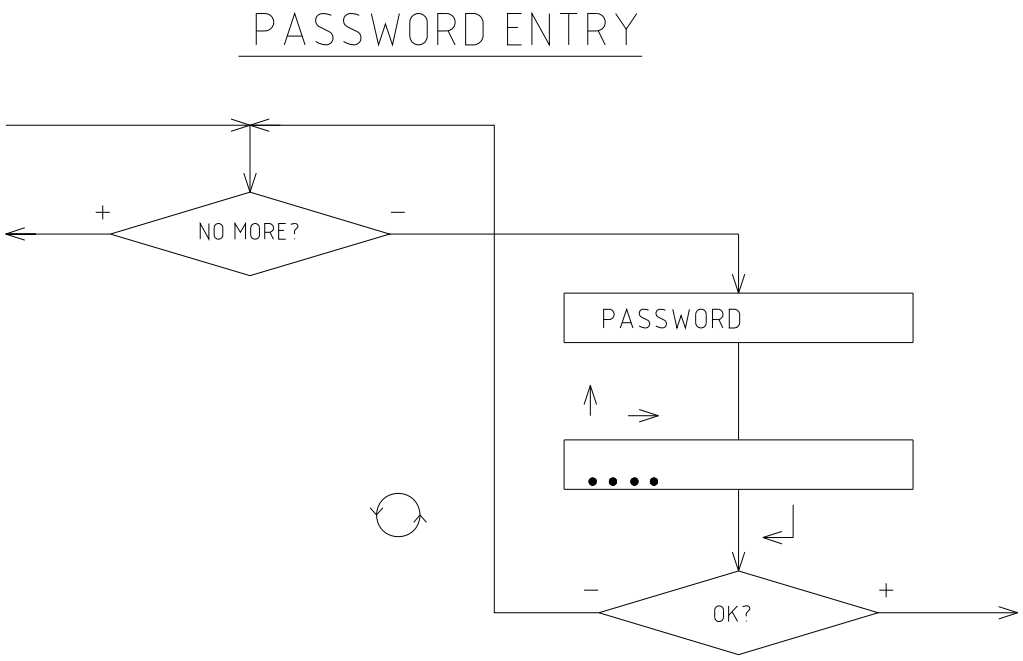

PASSWORD ENTRY
+
NO MORE?
–
PASSWORD
• • • •
–
OK?
+

Fig. 19

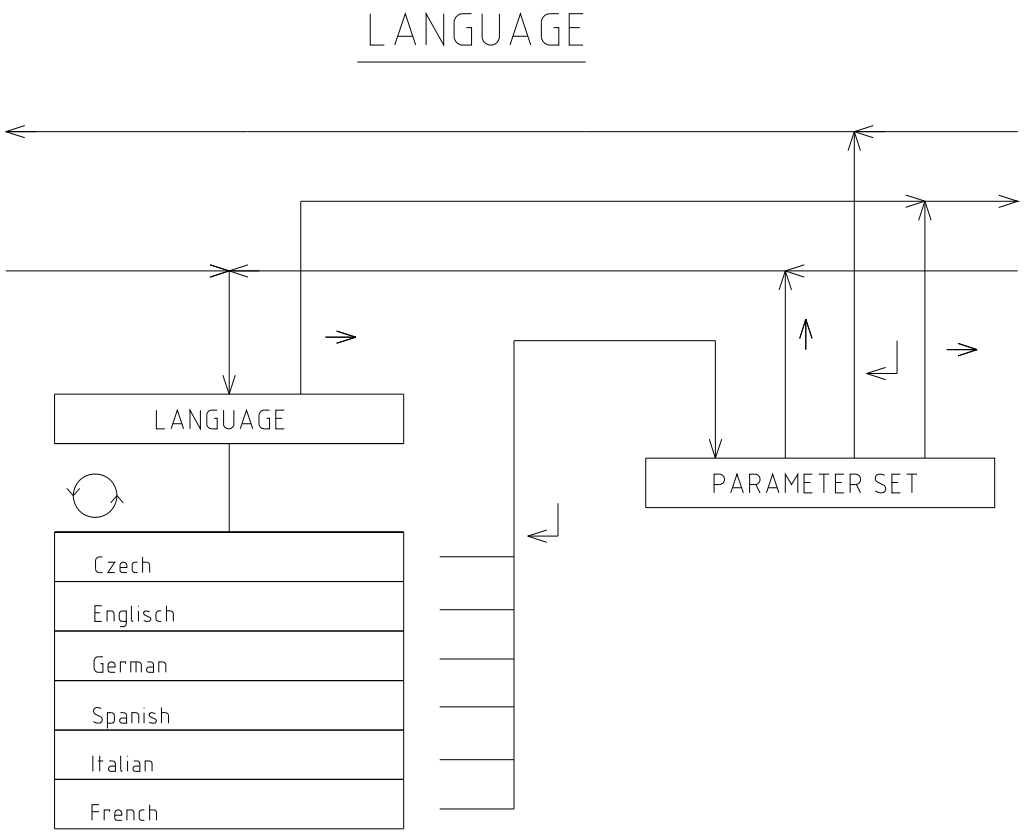

LANGUAGE
LANGUAGE
PARAMETER SET
Czech
Englisch
German
Spanish
Italian
French

Fig. 20

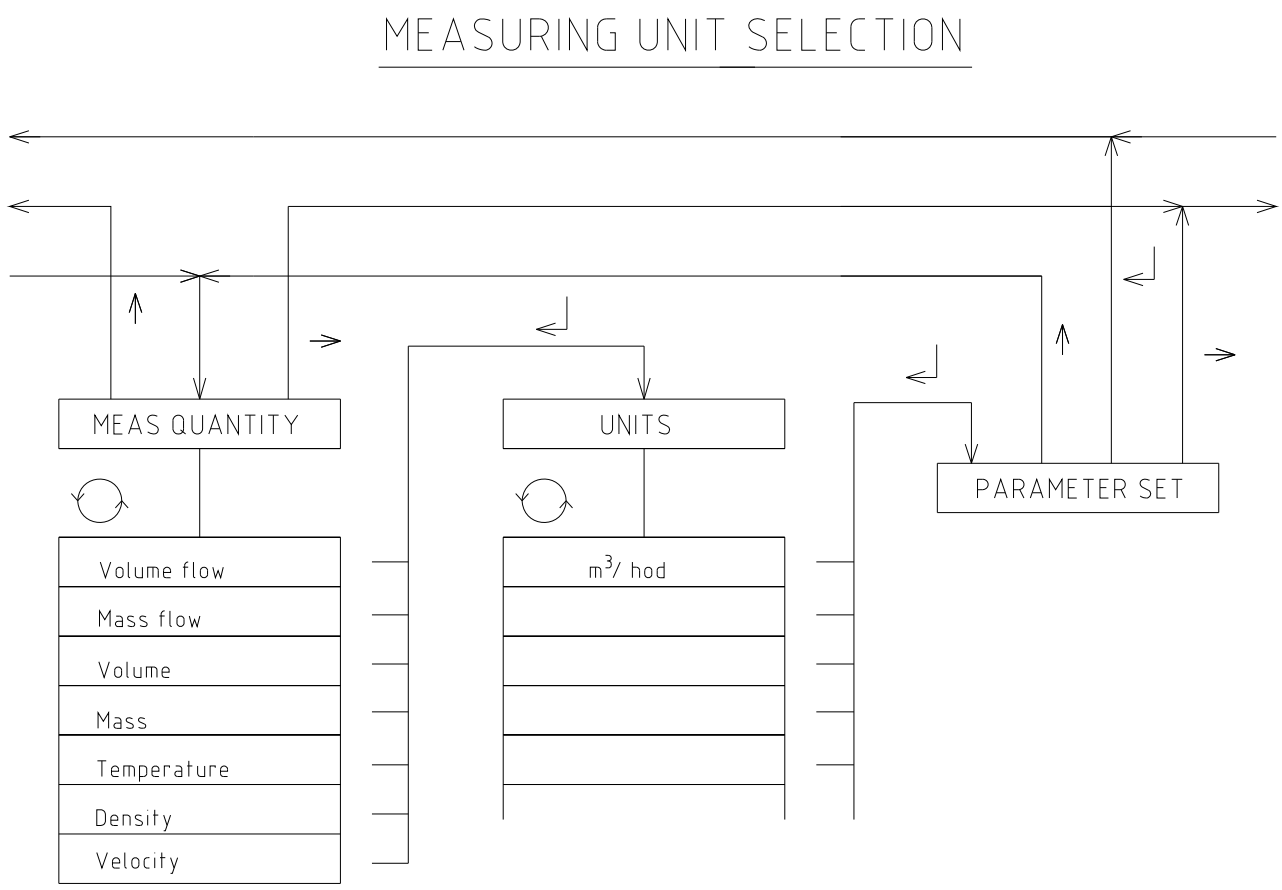

MEASURING UNIT SELECTION
MEAS QUANTITY
UNITS
PARAMETER SET
Volume flow
Mass flow
Volume
Mass
Temperature
Density
Velocity
m3/ hod

Fig. 21

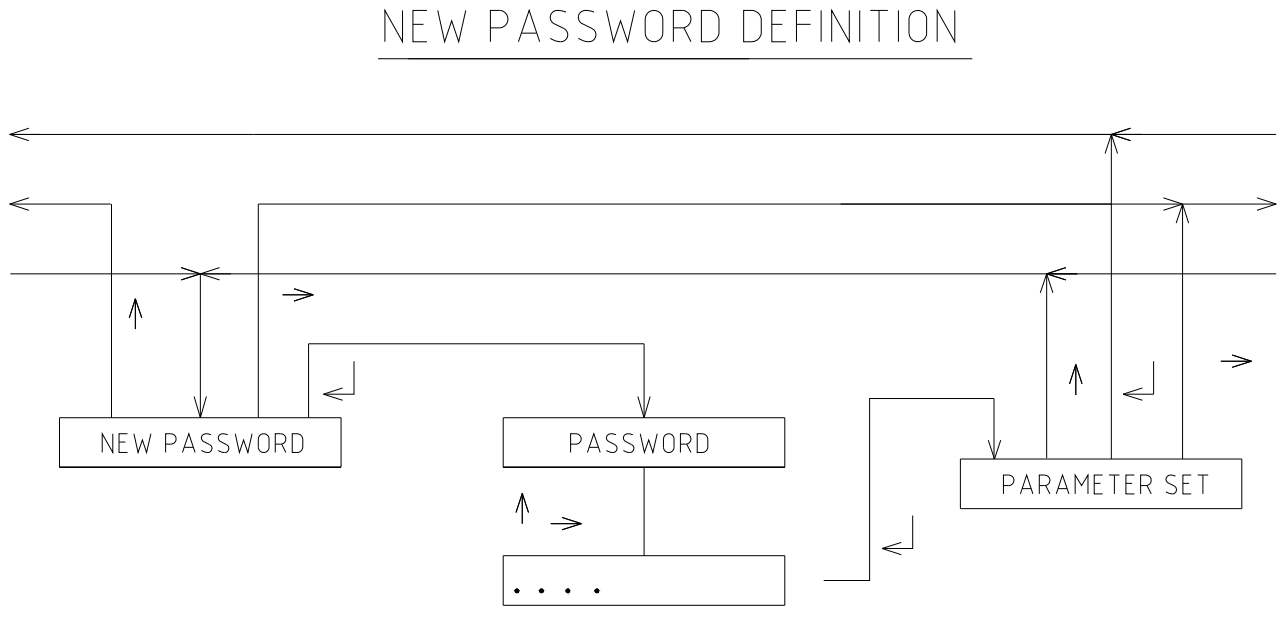

NEW PASSWORD DEFINITION
NEW PASSWORD
PASSWORD
PARAMETER SET
. . . .

Fig. 22

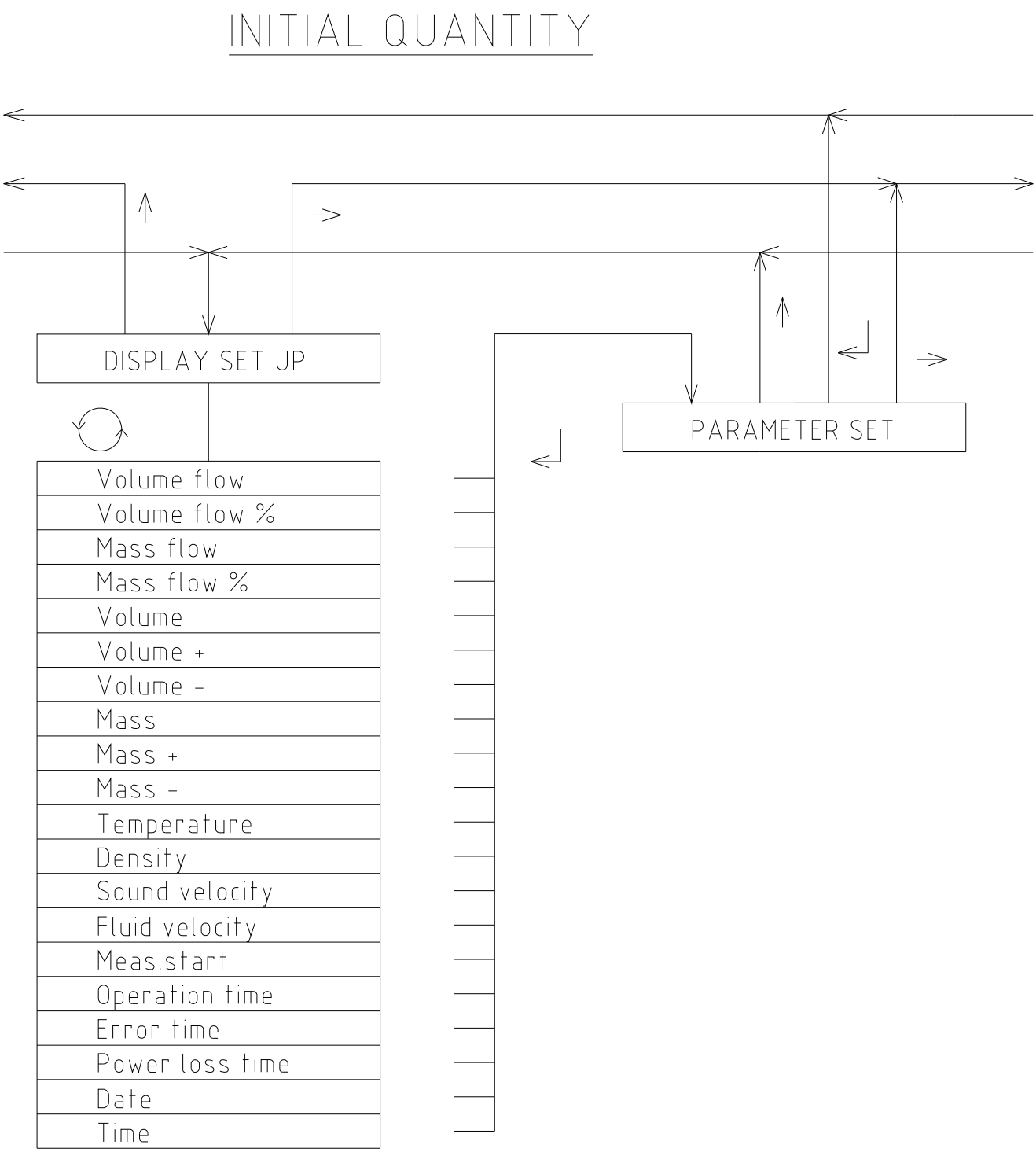

INITIAL QUANTITY
DISPLAY SET UP
PARAMETER SET
Volume flow
Volume flow %
Mass flow
Mass flow %
Volume
Volume +
Volume -
Mass
Mass +
Mass -
Temperature
Density
Sound velocity
Fluid velocity
Meas.start
Operation time
Error time
Power loss time
Date
Time

Fig. 23

DEFINITION OF LIMIT VALUES

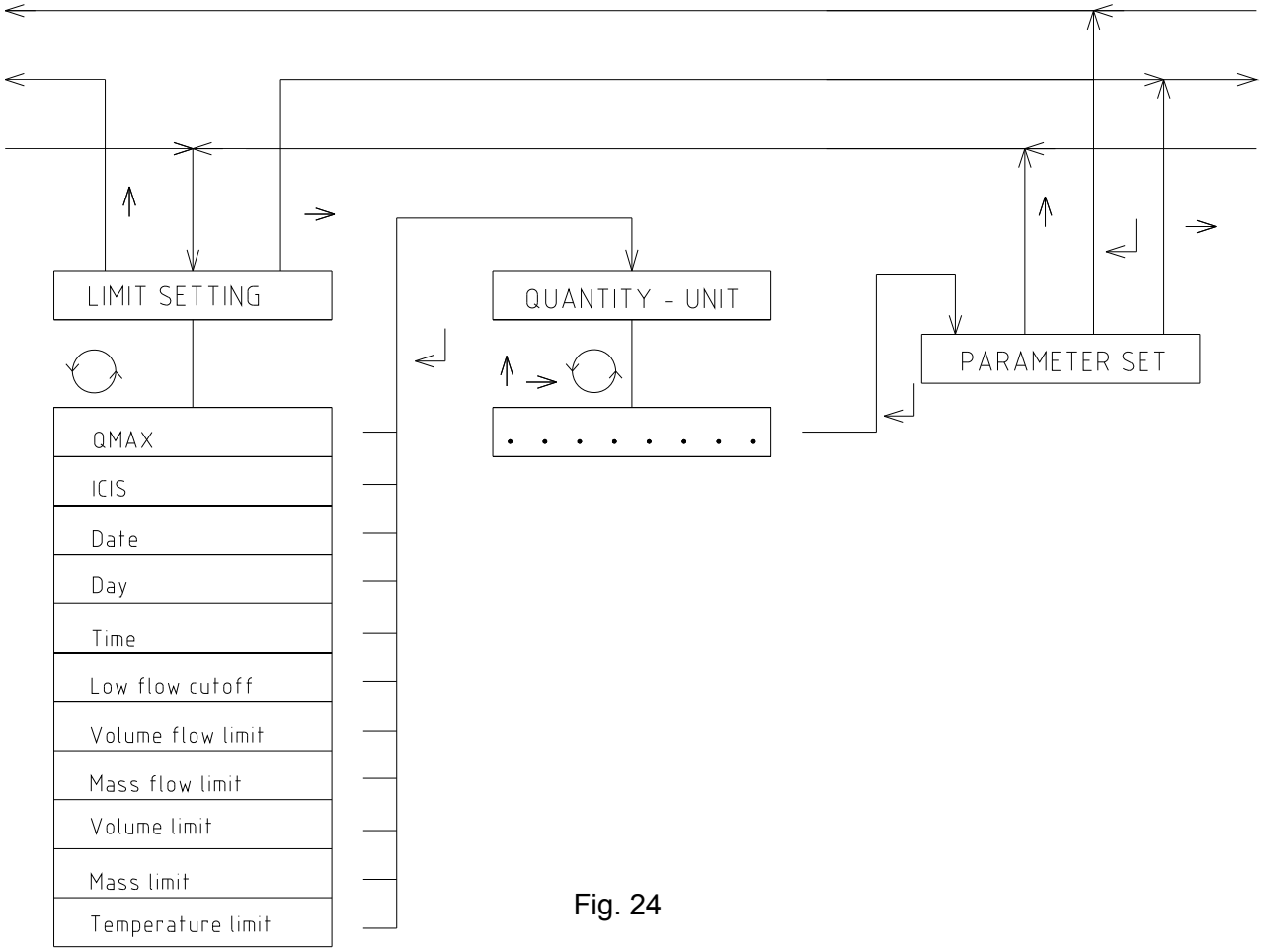


Fig. 24

RESETTING AGGREGATE VALUES

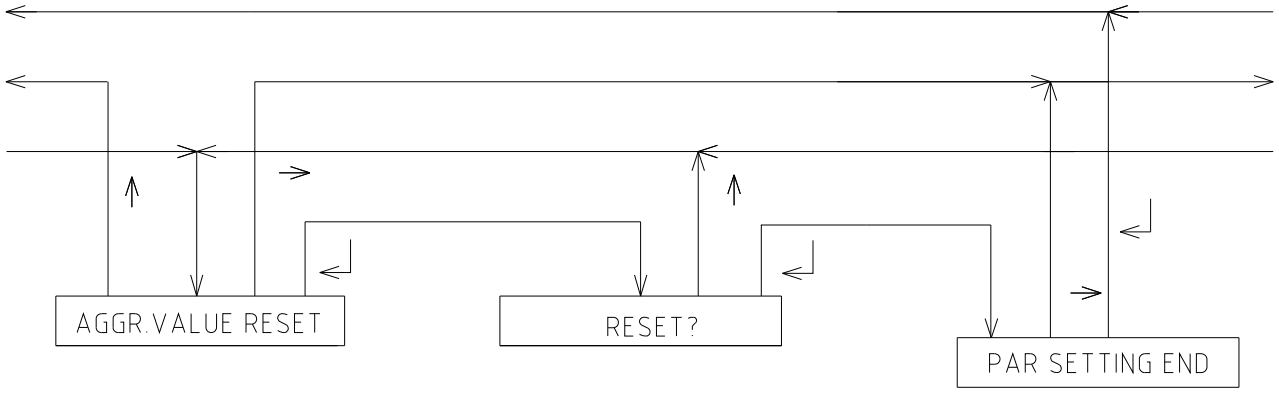


Fig. 25

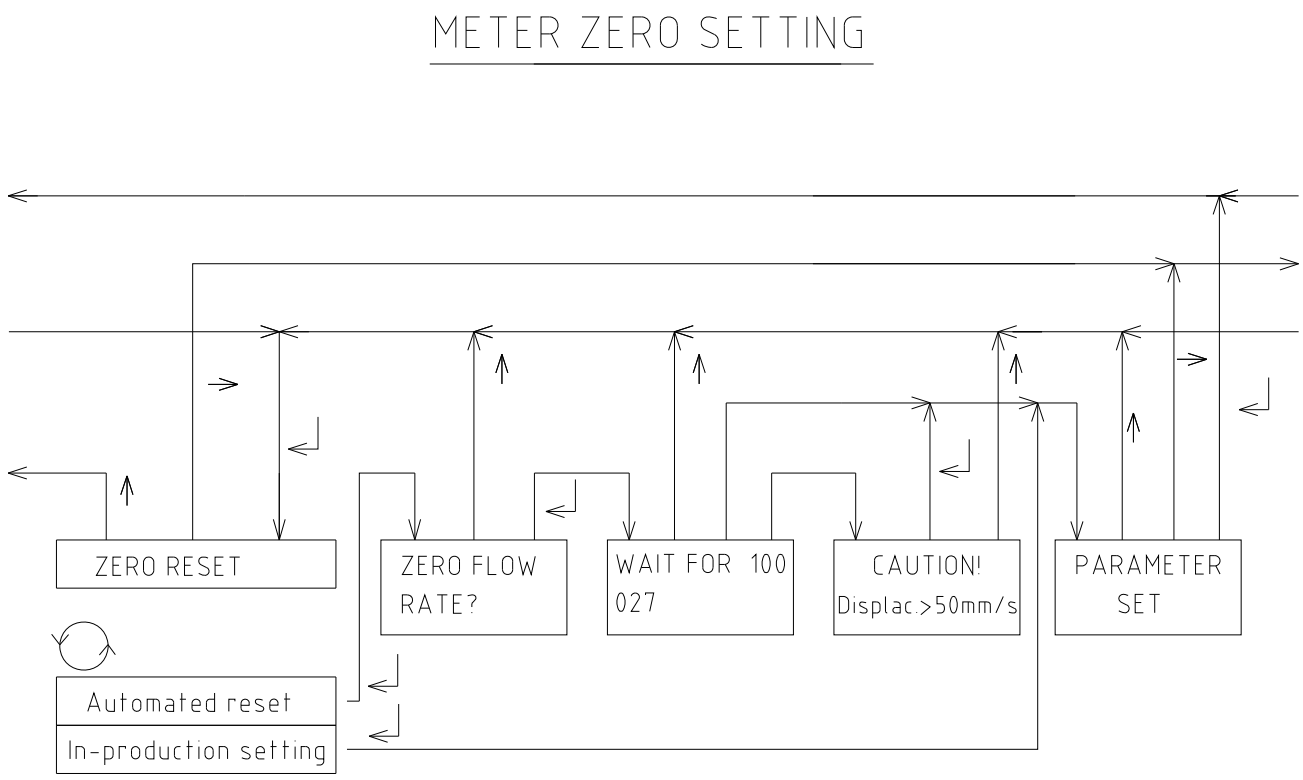

METER ZERO SETTING
ZERO RESET
ZERO FLOW RATE?
WAIT FOR 100 027
CAUTION! Displac.>50mm/s
PARAMETER SET
Automated reset
In-production setting

Fig. 26

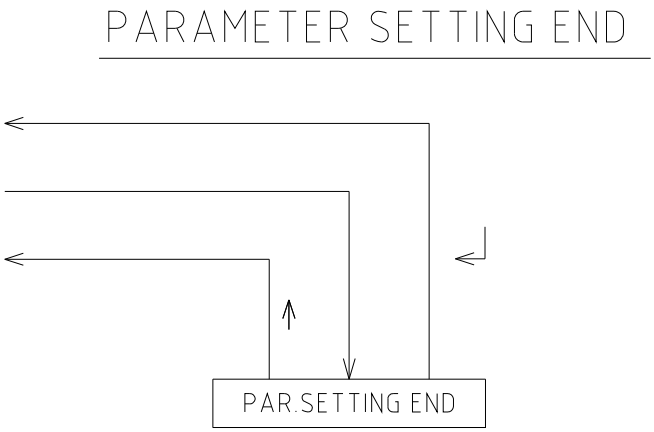

PARAMETER SETTING END
PAR.SETTING END

Fig. 27

7. WARRANTY AND POST-WARRANTY SERVICES

7.1 Warranty services

The product warranty services are provided free of charge throughout the agreed warranty period either at the manufacturer's factory or at the premises of a duly licensed servicing organisation.
The warranty repair is understood to be repair a product defect caused by defective material, product component part or workmanship, performed free of charge within the agreed warranty period.
Should a product prove irreparable due to any of the above defects, it shall be replaced free of charge.
Warranty repair work can only be performed by the product manufacturer (ELIS PLZEŇ a. s.) or a duly licensed servicing organisation or an official product distributor (having a licence in writing to do so and duly trained to perform the product repair work by the manufacturer).

Exempt from the product warranty are:
- products with damaged company;
- product defects due to incorrect assembly or fitting;
- product defects due to non-standard product use;
- products stolen or otherwise disposed of;
- product defects due to events of force majeure including natural disaster.

A requirement for warranty repair shall be communicated to the manufacturer by a notice in writing (by e-mail, fax or registered letter).
Should the manufacturer find the warranty claim unjustified, the claiming customer shall be informed accordingly by a notice in writing and the repair costs shall be invoiced to the same.

7.2 Post-warranty services

Post-warranty services include all repairs of product defects originating or identified after the end of the agreed warranty period. All such repairs, whether performed at the manufacturer's factory or elsewhere as directed by the customer shall be invoiced to the same.

A requirement for post-warranty repair shall be communicated to the manufacturer by a notice in writing (by e-mail, fax or registered letter).

8. TESTING

Every product is subject to individual checks on product completeness and quality in reference to the respective quality-assurance directive of the manufacturer. Then the product is tested using the approved test procedure. Finally, prior to shipment, the product is subject to at least 15-hour burn-in test at the factory test station.

9. PACKAGING

Unless agreed otherwise with the customer, the product shall be packed in a suitable way to withstand the stresses associated with domestic and international transport.
The product packaging shall comply with the requirements of the internal directive of the company ELIS PLZEŇ a. s.

10. PRODUCT ACCEPTANCE

The product acceptance procedure consists of visual inspection and checking the completeness of the delivered product in reference to the delivery note.
The standard delivery package includes the complete SE4015 system, optional assembly and testing fixtures, this manual, a statement on the product compliance and delivery note.

11. WARRANTY CONDITIONS

Unless agreed otherwise between the manufacturer and customer, the product warranty term is 12 months counted from the date of sale. During the warranty period all product defects due to faulty materials or component parts shall be repaired or otherwise made good free of charge. The warranty term shall be extended by the time the defective product was under repair. This warranty shall not cover any product defects due to incorrect assembly, incorrect operation, wilful damage, product disposition or damage due to any force-majeure event.

12. ORDER NUMBER

When you order your SONOELIS flow meter, make sure you specify correctly your requirements using the following table to identify the correct product order number. The same table can be found on the Internet address www.elis.cz.

Position in order number		1	2	3	4	5	6	-	7	8	9	10	11	12	13	14	15
	ORDERING No.:	S	E	4	0												

TYPE IDENTIFICATION

Type of sensor	one beam	1
	dual beam	2
Flow meter design and equipment	ECONOMIC, remote	1
	STANDARD, remote	3
	COMFORT, remote	5

TECHNICAL PARAMETERS

Dimension of sensor DN [mm]/ nominal flow rate Q3[m^3/h, t/h]	200/800	0	1
	250/960	0	2
	300/1200	0	3
	350/1440	0	4
	400/1600	0	5
	450/1840	0	6
	500/2000	0	7
	600/2400	0	8
	700/2880	0	9
	800/3280	1	0
	1000/4080	1	1
	1200/4880	1	2
	non-standard	X	X
Sensor flanges	ČSN EN 1092-1	1	
	ANSI B 16.5	2	
	BS 4504	3	
	JIS B2210	4	
	non-standard	X	
Material of sensor, surface treatment	carbon steel, painted of polyurethane	1	
	complete stainless steel 1.4301	2	
	non-standard	X	
Nominal pressure PN [bar]	6	1	
	10	2	
	non-standard	X	
Maximum temperature of measured fluid [°C]	50	1	
	90	2	
	130	3	
	150	4	
	180	5	
	non-standard	X	
Length of cable for remote version [m]	6	0	1
	10	0	2
	15	0	3
	20	0	4
	30	0	5
	40	0	6
	50	0	7
	60	0	8
	70	0	9
	80	1	0
	90	1	1
	100	1	2
	non-standard	X	X
Power supply	100 ÷ 230 V AC, 50 ÷ 60 Hz		1
	non-standard		X

Position in order number		-	16	17	-	18	19	20	21	22
MEASURED MEDIUM										
Type of measured liquid	water		0	1						
	non-standard		X	X						
FLOW METER SETTINGS										
Measurement type	one-directional, volume					1				
	one-directional, mass					2				
	bi-directional, volume					3				
	bi-directional, mass					4				
	non-standard					X				
Non-sensitivity of measurement	standard q_{NEC} according to manual						1			
	standard ± 10 mm/s						2			
	standard ± 0,3 % q_p						3			
	non-standard						X			
Pulse output	not required							1		
	50 l/pulse / 50 kg/pulse to DN350 including							2		
	100 l/pulse / 100 kg/pulse to DN500 including							3		
	200 l/pulse / 200 kg/pulse to DN1000 including							4		
	300 l/pulse / 300 kg/pulse for DN1200							5		
	non-standard							X		
Frequency output	not required								1	
	0 to q_s ~ 0 to 500 Hz								2	
	0 to q_s ~ 0 to 1 kHz								3	
	0 to q_s ~ 0 to 5 kHz								4	
	0 to q_s ~ 0 zo 10 kHz								5	
	non-standard								X	
Current output	not required									1
	0 to q_s ~ 0 to 20 mA									2
	0 to q_s ~ 4 to 20mA									3
	non-standard									X

Position in order number		23	24	25	26	27	28	29
Binary output	not required	0	1					
	fluid flow direction upstream switch on	0	2					
	fluid flow direction upstream switch off	0	3					
	total fluid volume level on exceeding switch on	0	4					
	total fluid volume level on exceeding switch off	0	5					
	total fluid mass level on exceeding switch on	0	6					
	total fluid mass level on exceeding switch off	0	7					
	volume level on exceeding switch on	0	8					
	volume level on exceeding switch off	0	9					
	mass level on exceeding switch on	1	0					
	mass level on exceeding switch off	1	1					
	temperature level on exceeding switch on	1	2					
	temperature level on exceeding switch off	1	3					
	non-completely filled piping on failure switch on	1	4					
	non-completely filled piping on failure switch off	1	5					
	non-standard	X	X					
Display 1st line	volume flow			1				
	mass flow			2				
	non-standard			X				
Display 2nd line	volume				1			
	mass				2			
	volume + temperature				3			
	mass + temperature				4			
	non-standard				X			
Units of volume flow	flow is not displayes					0	1	
	m^3/h					0	2	
	m^3/min					0	3	
	m^3/s					0	4	
	l/h					0	5	
	l/min					0	6	
	l/s					0	7	
	bbl/h					0	8	
	bbl/min					0	9	
	bbl/s					1	0	
	ft^3/h					1	1	
	ft^3/min					1	2	
	ft^3/s					1	3	
	gal/h					1	4	
	gal/min					1	5	
	gal/s					1	6	
	% q_p					1	7	
	non-standard					X	X	
Units of volume	volume is not displayes							1
	m^3							2
	$m^3 . 10^3$							3
	l							4
	bbl (US barrel)							5
	ft^3 (cubic feet)							6
	gal (US gallon)							7
	non-standard							X

Position in order number		30	31	32	33	34	35	-	36	37	38	39	40	41	42	43
Units of mass flow	flow is not displayes	0	1													
	t/h	0	2													
	t/min	0	3													
	t/s	0	4													
	kg/h	0	5													
	kg/min	0	6													
	kg/s	0	7													
	ton/h	0	8													
	ton/min	0	9													
	ton/s	1	0													
	lb/h	1	1													
	lb/min	1	2													
	lb/s	1	3													
	% q_p	1	4													
	non-standard	X	X													
Units of mass	mass is not displayes			1												
	t			2												
	t . 10^3			3												
	kg			4												
	ton (US ton)			5												
	lb (libra)			6												
	non-standard			X												
Units of temperature	°C				1											
	°F				2											
Units of velocity	m/s					1										
	ft/s					2										
Language	Czech						1									
	English						2									
	German						3									
	Spanish						4									
	Italian						5									
	French						6									
COMMUNICATION SETTINGS																
Communication RS485	Baud rate [Bd]	not required							0							
		600							1							
		1200							2							
		2400							3							
		4800							4							
	Parity	no parity								1						
		even - odd - eo								2						
		odd - even - oe								3						
		even - even - ee								4						
		odd - odd - oo								5						
	Group	000									0	0	0			
		001									0	0	1			
		002									0	0	2			
		...														
		255									2	5	5			
	Address	000												0	0	0
		001												0	0	1
		002												0	0	2
		...														
		255												2	5	5

Position in order number		-	44	45	-	46	47	48	-	49
CALIBRATION, METROLOGICAL VERIFICATION										
Calibration	without calibration		1							
	standard calibration in 3 points without calibration certificate		2							
	standard calibration in 3 points with calibration certificate		3							
	standard calibration in 5 points without calibration certificate		4							
	standard calibration in 5 points with calibration certificate		5							
	standard calibration in 9 points without calibration certificate		6							
	standard calibration in 9 points with calibration certificate		7							
	standard calibration for metrological verification		8							
	non-standard		X							
Metrological verification	no metrological verification			1						
	metrological verification without protocol			2						
	metrological verification with protocol			3						
	non-standard			X						
PURCHASE CONDITIONS										
Packing	unpackaging					1				
	standard					2				
	export					3				
	non-standard					X				
Delivery	personally						1			
	by shipping agent on supplier's costs						2			
	by shipping agent on buyer's costs						3			
	non-standard						X			
Warranty	6 months							1		
	12 months							2		
	18 months							3		
	24 months							4		
	36 months							5		
	non-standard							X		
IDENTIFICATION CODE										
Number of manual flow meter	Es90337K/e									1

Manufacturer's address:

ELIS PLZEŇ a. s.
Luční 15, P. O. BOX 126
304 26 Plzeň
Czech Republic
Tel.: +420/377 517 711
Fax: +420/377 517 722
e-mail: sales@elis.cz
http://www.elis.cz

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