

# **S14F ULTRASONIC WATER METER**

## **Technical Description**

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# 1 General description

The ultrasonic water meters type S14F are designed to measure, memorise and display the volume at metering conditions of water passing through the measurement transducer in the sense of the Directive 2014/32/EU of the European Parliament and of the Council of the harmonisation of the laws of the Member States relating to the making available on the market of measuring instruments (implemented in Czech Republic by Government Order No. 120/2016 Coll.), as amended.

The ultrasonic water meters type S14F intended for metering cold potable and hot water, based on an ultrasonic transit-time principle. Ultrasonic waves are in turn transmitted downstream and upstream the flow; current volumetric water flow rate is measured based on the difference between the propagation times of said waves.

The meter is complete meter. It consists of measurement transducer with installed flow sensors, electronic calculating/indicating device and temperature sensor.

The temperature is measured by calibrated Pt1000 platinum temperature sensor. Calibration coefficients are entered into the calculator thus allowing to measure the temperature with very high accuracy. The meter can be supplied without temperature sensor (if temperature of water is up to 70 °C) or with one calibrated temperature sensor 5 mm in diameter. This temperature sensor is installed into the flow metering body (measurement transducer).

The measured volume is displayed in cubic meters (m<sup>3</sup>). Indicator displays 8 significant digits.

The indicator will never be turned off thus allowing to monitor operation of the meter and to take readings without pressing any pushbuttons.

Additional measured and displayed parameters (measurement units are shown in brackets) includes:

- flow rate (m<sup>3</sup>/h or l/h)
- accumulated volume (m<sup>3</sup>)
- accumulated mass (t).

The meter includes 4 tariff counters to accumulate data on the volume.

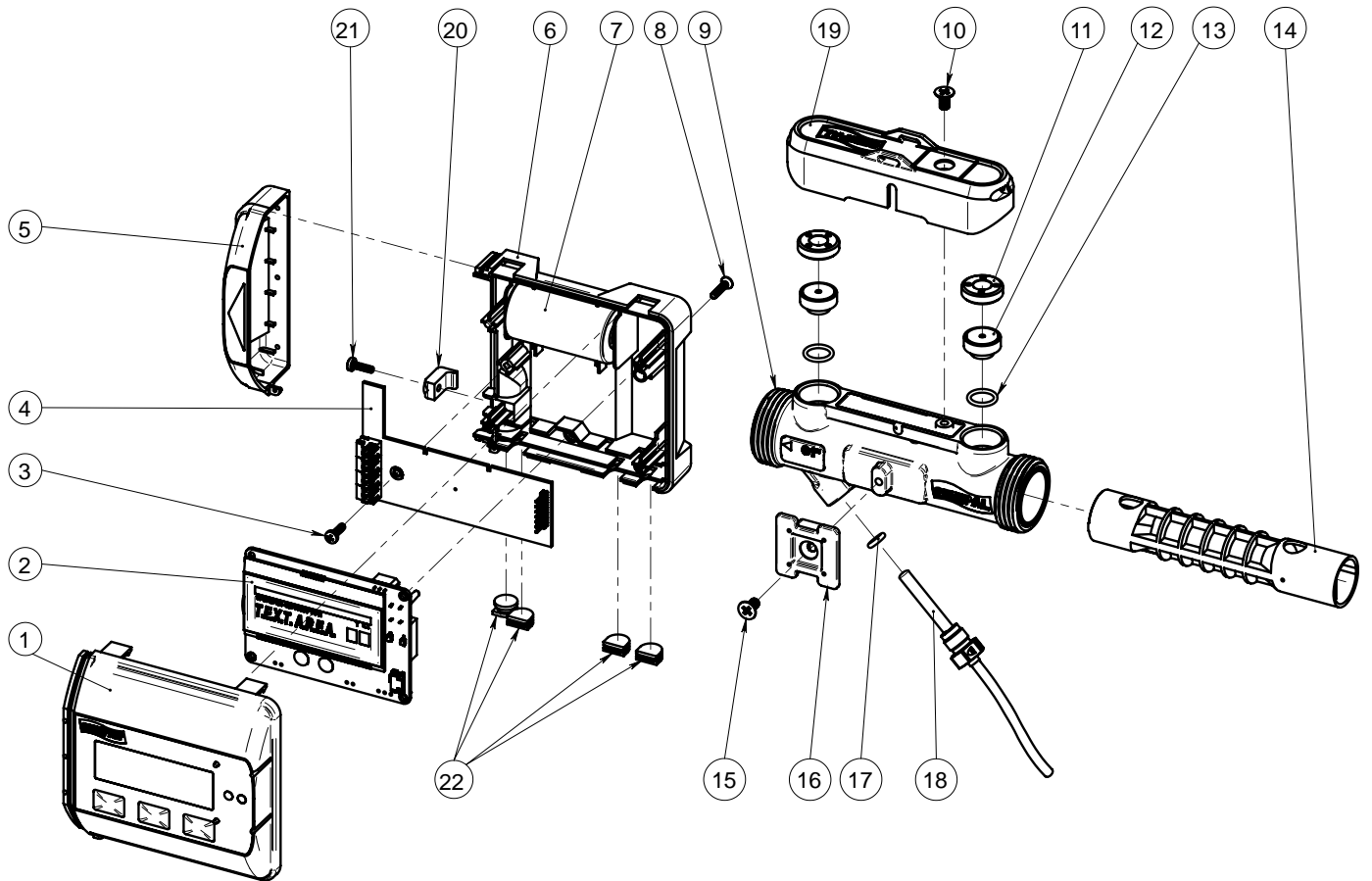
Power source of the meter - built-in lithium battery. Service life of such battery is 16 years.

The meter may be equipped (in the course of its manufacture) by an additional communication module extending communication ability of the meters (M-Bus, RS232...) thus allowing to connect two additional flow meters with output pulse signals to register water consumption.

Besides the built-in communication modules, data may be obtained from the meter through an iRDA head at the rate of 300 baud or 9600 baud. EN1434 A Mode and Sempal protocols are supported.

This technical description is intended for operating service units, installers and for verifying and testing organizations.

## 1.1 Structure of the meter



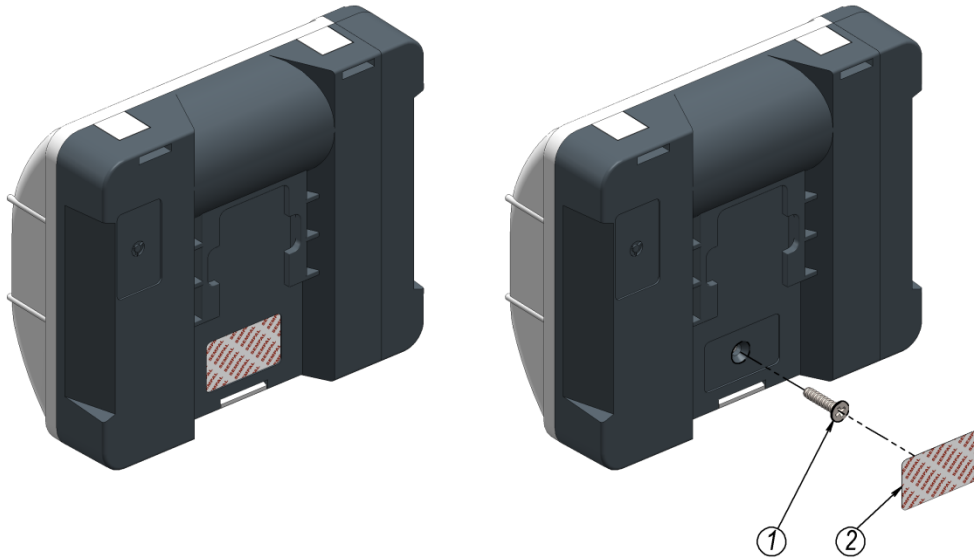
Item No.	Description	Item No.	Description
1	Upper calculator cover	10	Screw fastening of the flow metering section cover
2	Printed board with electronics	11	Clamp of flow sensor
3	Screw fastening the communication module	12	Flow sensor
4	Communication module	13	Flow sensor sealing element
5	Side calculator cover	14	Measuring insert
6	Lower calculator cover	15	Screw fastening of the calculator holder
7	Battery	16	Calculator holder
8	Screw fastening the upper cover	17	Sealing element of temperature sensor
9	Flow metering body	18	Temperature sensor
		19	Flow metering body cover
		20	Fastener of cable for communication module
		21	Screw fastening of the cable for communication module

## 1.2 Sealing

### 1.2.1 Calculator sealing

The upper cover of the calculator is connected with the lower one by means of three snaps that are not sealed. To seal the calculator a fastening screw is used, head of which is covered with a sealing sticker.

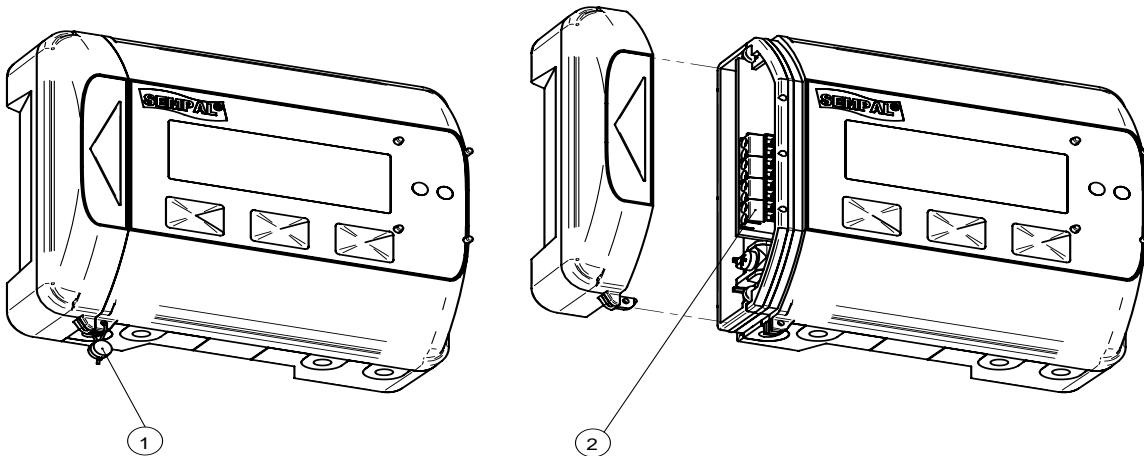
If the screw is not removed, the calculator may be disassembled only by breaking the snaps.



1 – fastening screw; 2 – sealing sticker

If the snaps or the sealing sticker is damaged, the meter may not be used for billing and its warranty will become null and void.

The side cover providing access to communication module contacts will be sealed by an organization registering the instrument.



1 – lead sealing; 2 - contacts for the communication module connection

### 1.2.2 Electronic sealing of the calculator

As electronic sealing is used special key which is disconnected on opening the cover.

The fact of cover removing is displayed by the meter indicator. Such signal may be disabled only when you enter into Setup or Test mode.



Such text on the indicator evidences that the upper cover of the meter has been opened.

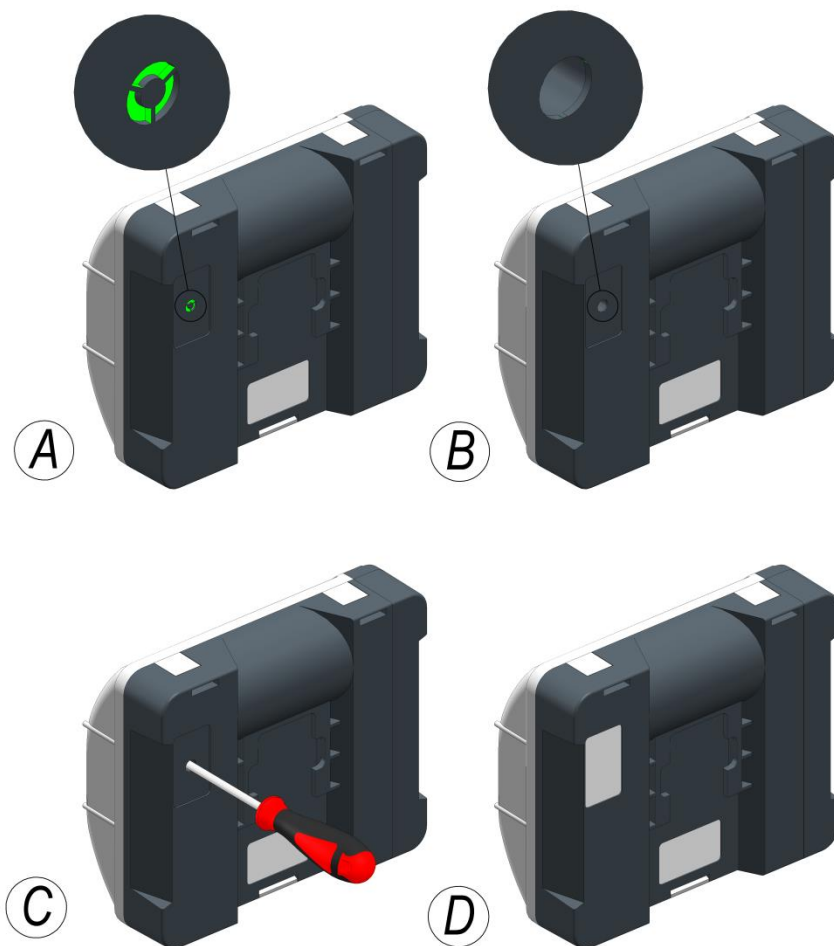
### 1.2.3 Transition to Setup and Test modes

**Setup** mode is used for initial setting of the instrument, while **Test** mode is used for its regular verifications.

Entering into **Setup** mode doesn't require the following instrument verification.

Transition to these modes will be carried out by depressing a special pushbutton located on the lower calculator cover.

After manufacture, this pushbutton is hidden under a solid plastic protecting element. Access to the pushbutton will be provided only if such protecting element is broken. Such protecting element will be glued with a sealing label after the check.



A – status of the protecting element after manufacture; B- status of the protecting element when broken; C – depressing the pushbutton; D – installed sealing sticker

## 2 Specifications

### 2.1 Metrological parameters

Temperature measurement range       $\Theta$ : -49 °C ...+150 °C

Temperature sensors                      Pt1000 - EN60751, 2-wire fixed soldered connection

Rating of the characteristics            As provided for in ISO 4064:2014

Accuracy class                              2

Climatic environment class              A, C

Type of flow metering body	Permanent flow rate, Q3	Min. flow rate, Q1	Overload flow rate, Q4	Min. Cutoff	Flow rate limit	Pressure loss, $\Delta p@Q3$	Flow metering body connection	Length
	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[m <sup>3</sup> /h]	[bar]		[mm]
DN15A	1.6	0.016	2	0.003	5	0.17	G ¾ B	110
DN20A	1.6	0.016	2	0.003	5	0.1	G 1 B	130
DN25A	4	0.04	5	0.007	10	0.12	G 1 ¼ B	160
DN32A (B)	16	0.16	20	0.05	30	0.09	Flange Ø84 mm	180
DN32C (D)	16	0.16	20	0.05	30	0.09	M48x2	180
DN40A (B)	40	0.4	50	0.08	80	0.25	Flange Ø98 mm	200
DN40C	40	0.4	50	0.08	80	0.25	G 2 B	200
DN50A	63	0.63	78.8	0.13	80	0.22	Flange Ø122 mm	180
DN65A (B)	100	1.0	125	0.20	270	0.17	Flange Ø144 mm	200
DN80A	160	1.6	200	0.32	390	0.11	Flange Ø155 mm	210
DN100A	250	2.5	312.5	0.50	610	0.09	Flange Ø184 mm	230

### 2.2 Variants for supply

The meter can be supplied in following variants:

- For water with temperature 0...70 °C (without temperature sensor)
- For water with temperature 0...150 °C (with temperature sensor)

### 2.3 Electrical parameters

#### Calculator

Error of flow rate measurement

Maximum permissible error for the lower flowrate zone is  $\pm 5\%$   
 Maximum permissible error for the upper flowrate zone is  
 $\pm 2\%$  for water having a temperature  $\leq 30^\circ\text{C}$   
 $\pm 3\%$  for water having a temperature  $> 30^\circ\text{C}$

Indicator

Consists of two areas:  
 Main LCD – 8 significant digits. It is operated permanently.  
 Menu line: a text line. It is operable only during the navigation through menu.

Flow rate measurement units

m<sup>3</sup>/h or l/h

Archiving

1680 hours (70 days), 500 days, 36 months, 16 years.  
 User actions log – 100 entries

Clock/Calendar	Real time clock (clock deviation does not exceed 3 seconds a day); calendar with consideration of leap years, summer/winter time, accounting month commencement date
Data exchange through iRDA optical port	- EN1434 protocol for iRDA, mode A with CRC (read only) - Sempal protocol– reading and configuring
Communication modules	- <u>wired M-Bus</u> . Load: 1 unit (1.5 mA). EN 1434-3, EN 13757-2 and EN 13757-3. Transfer rate may be selected from the sequence: 300, 600, 1200, 2400, 4800 and 9600 baud. - <u>RS232</u> . Transfer rate is 9600 baud, 8 bit, parity check – none, 1 stop bit. Sempal protocol. - <u>pulse signal outputs</u> . Two passive pulse signal outputs. Maximum frequency is 100 Hz. Weight of a pulse and data to be transferred are adjustable.
Pulse signal inputs	Pulse signal inputs (up to 2 inputs) may be used only that the communication module is available. Such inputs are used to measure water volumes by meters with electrically isolated outputs. The loading resistance of 680 kOhm is connected with +3 V. Maximum pulse signal frequency is 1 Hz.
Electromagnetic compatibility	Meets requirements of EN1434, class C
Power supply voltage	3.6 <sup>+0.1</sup> <sub>-0.3</sub> B

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### Temperature measurement

Pt1000, two-wire connection; cable length is 1.15 m, unless the latter temperature sensor is built into flow metering section

Measurement range -49 °C ...+150 °C

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### Battery

3.6 V DC, 1 lithium cell of C size

Replacement interval

16 years<sup>1)</sup>

More frequent replacement may be needed when communication modules are used or data are read frequently or when the meter is used at a high temperature

Lithium content

2.5 g

<sup>1)</sup> Under the following operating conditions:

- integration period 4 seconds
- duration of menu navigation - 5 minutes per day
- Reading the hourly archive 1 time per hour (via one of the extension units)
- reading the current status 1 time per minute (via one of the expansion units)
- reading of all available information via iRDA port once a month



## 2.4 Structural features

Climatic Environment class C

	Ingress protection	Ambient temperature	Classification with respect to environment	
Calculator	IP65	5...55 °C	Non-condensed humidity	Indoors
Flow metering section (assembled)	IP68		Condensed humidity	

Water temperature	2...150 °C	If the water temperature is below 15°C or above 90°C, installation of the calculator on a wall will be obligatory requirement (to avoid moisture condensing and calculator overheating, respectively).
Storage temperature	-25...+60 °C	
Operating pressure	16 bar	
Testing pressure	25 bar	
Cable length to flow metering body	1 m (cannot be disconnected)	
Cable length to temperature sensor	1.15 m, 2 m, 3 m (cannot be disconnected)	

## 2.5 Materials

Wetted parts

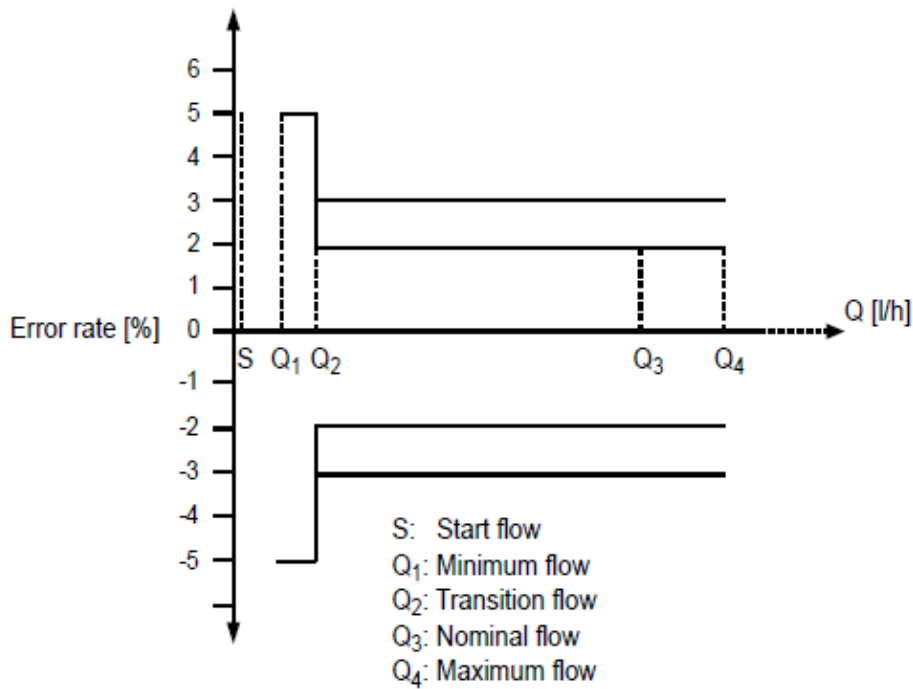
**For DN15...DN25:**

Flow metering body	CW617N
Flow sensor	PEEK+30%GF
Sealing elements	EPDM
Flow metering body cover, calculator, wall installation fixtures	ABS+PC
Cables	Cable: Silicone + PTFE

**For DN32 and more:**

flow metering body	AISI 304
flow sensor	PEEK+30%GF
sealing elements	EPDM
Flow metering body cover, calculator, wall installation fixtures	ABS+PC
Cables	Cable: Silicone + PTFE

## 2.6 Errors



### Accuracy

MPE (maximum permissible error)

MPE according to OIML R49

Meter approved 0.1...30 °C

± 5 % in range  $Q_1 \leq Q < Q_2$

± 2 % in range  $Q_2 \leq Q \leq Q_4$

At 30 °C < t < 150 °C

± 5 % in range  $Q_1 \leq Q < Q_2$

± 3 % in range  $Q_2 \leq Q \leq Q_4$

## 3 Meter type and configuration

### 3.1 Meter type

The meter type are indicated on the upper cover of the calculator and may not be changed.

**S14F -**

□□□□

#### Flow metering section (body)

qp [m <sup>3</sup> /h]	DN	Connection	Installation length [mm]	
1.6	DN15	Thread G ¾ B	110	015A
1.6	DN20	Thread G 1 B	130	032A
4.0	DN25	Thread G 1 ¼ B	160	025A
16	DN32	Flange Ø 84 mm	180	032A
16	DN32	Thread M48x2	180	032C
40	DN40	Flange Ø 98 mm	200	040A
40	DN40	Thread G 2 B	200	040C
40	DN50	Flange Ø 122 mm	180	050A
100	DN65	Flange Ø 144 mm	200	065A
160	DN80	Flange Ø 155 mm	210	080A
250	DN100	Flange Ø 184 mm	230	100A

An example of the meter type: **S14F - 032A**

### 3.2 Water meter configuration

Configuration will be shown in the menu line on the instrument indicator.

Cfg –		□□	□ –	1	□ –	□	1	□ –	□ –	□	□
<b>Communication module (3.3)</b>											
Not installed	00										
RS232	10										
M-Bus	20										
2 pulse signal outputs	30										
<b>Pulse inputs in the communication module</b>											
No pulse inputs	0										
Pulse inputs are available	1										
<b>Number of temperature sensors</b>											1\0
<b>Integration periodicity (3.3.1)</b>											
Integration period, s	Flow rate measurement period, s										
2	0.5										1
4	1										2
8	1										3
16	2										4
32	4										5
<b>Flow rate units system (3.3.2)</b>											
m <sup>3</sup> /h											1
l/h											2
<b>Tariffing (3.3.3)</b>											
Not used											0
Q (flow rate)											2
T1 (temperature )											4
Time											6
<b>Region code (3.3.4)</b>											
Ukraine											
<b>Interface language (3.3.5)</b>											
Russian											1
English											3

The meter are configured when put into operation by means of SmpSetup program (operable in Windows 7 and higher) or from the instrument keyboard. Any configuration can be changed only when the instrument is in **Setup** mode.

### 3.3 Communication modules

The Communication module is installed in the course of instrument manufacture and cannot be changed by the user.

#### Pulse inputs

*Each of communication modules may be delivered either with pulse signal inputs or without them.*

The meter will support up to 2 pulse signal inputs. Each of the inputs may be connected with an additional water meter with pulse signal outputs, for which the volume will be accumulated.

Parameters of pulse signal inputs:

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Pulse signal input class according to EN1434	IB
Maximum pulse repetition rate	1 Hz
Pulse duration	≥ 100 ms
Loading resistor (boosting to 3 V voltage)	680 kOhm

**Must be used only with electrically isolated contacts**

#### Communication module RS232

It uses TxD, RxD and GND signals

Port parameters:

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Dara transfer speed	9600 baud
Data length	8 bit
Parity check	None
Stop bit	1
Protocol used	Sempal

#### M-Bus communication module

Load	1 unit (1.5 mA)
Data length	8 bit
Parity check	Even
Stop bit	1
Speed	300, 600, 1200, 2400, 4800, 9600 baud
Addressing	Primary and secondary

#### Module of pulse signal outputs

Parameters of outputs:

Output class according to EN1434	OB
Pulse length	4 ms
Max frequency	100 Hz
Max voltage	30 V
Incorporation resistance	4 Ohm

### 3.3.1 Integration periodicity

Integration periodicity determines the time interval to calculate volume, thermal energy content and information updating on the indicator.

Periodicity of the flow rate measurement will depend on the integration periodicity.

Temperature measurement periodicity is always equal to 32 seconds.

### 3.3.2 System of flow rate units

The meter will always measure the flow rate in m<sup>3</sup>/h, while conversion to any other units will be made for indication purposes only.

Volume will always be displayed in m<sup>3</sup>.

Number of digits displayed on the indicator will depend upon the selected measurement units.

Total number of significant digits of the indicator will always be equal to 8. Only the number of figures after the decimal point will be changed:

Q3, m <sup>3</sup> /h	Number of digits (figures after decimal point)		
	m <sup>3</sup>	l/h	m <sup>3</sup> /h
1.6	3	0	3
2.5	3	0	3

Temperature will always be 0.01°C.

### 3.3.3 Tariffing

The instrument is provided with 4 tariff cells. Depending on the tariffing mode, different parameters will be stored in T1...T4 cells. Regardless of the mode, the tariffed value will be accumulated in any case in the basic adder and will additionally be accumulated in tariff counters. The tariffing will be described in more details below (clause 3.5).

### 3.3.4 Region code

The region code determines initial settings of time zone, usage of summer time ...

### 3.3.5 Interface language

The interface language will determine the language of inscriptions on the instrument and language of the instrument menu.

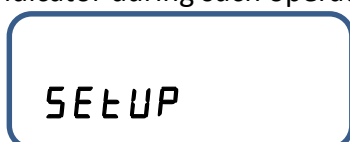
## 3.4 Setup and Test service modes

The meter has two service modes: **Setup** and **Test**

**Setup** mode will be used for initial setting of the instrument, while **Test** mode will be used for periodical verifications of the instrument.

These modes may be accessed by means of a special covered pushbutton placed on the rear instrument cover. When the instrument leaves the production line, said pushbutton is covered with a plastic protecting element to be broken if access to the pushbutton is needed. Further, this hole will be covered with a special sealing sticker.

To enter into **Setup** mode, you have to depress the pushbutton and hold it depressed for 5 – 15 seconds. The indicator during such operation will display



If you release the pushbutton during the above-mentioned time interval, the instrument will switch over to **Setup** mode

If the pushbutton will be held depressed for another time interval (from 15 to 30 seconds), message on the indicator will be changed as follows:



On release the pushbutton during the above-mentioned time interval, the instrument will switch over to **Test** mode

If you continue to hold the pushbutton depressed, the indicator will be switched to the standard display mode and operating mode of the instrument will not change.

Configuration of the meter will be set before registration of the meter. Configuration can be set only in **Setup** mode.

When the meter leaves the production line, a special transport mode is set. This mode is equivalent to **Setup** mode, but unlike it, flow rate and temperature will be measured once every 60 seconds. The indicator is switched off and will be switched on when any pushbutton will be depressed.

**3.5 Tariffing**

The instrument has 4 tariff counters. Each tariff counter includes an adder (T1... T4) and a threshold (TT1... TT4). Logics of their operation depend on the type of the selected tariffing mode.

Regardless of the tariffing type, data is **ALWAYS** accumulated in the basic adder and is **additionally** summed in tariff adders in the events when a condition for relevant tariff is met.

Threshold values is set in the same units that are used to display data on the indicator.

**3.5.1 Tariffing mode 0**

When such mode is set, no tariffing will be carried out.

**3.5.2 Tariffing mode Q (code 2 in configuration)**

Volumetric flow rate is analyzed.

*Tariff counters will accumulate volume.*

$q \leq L1$	Basic register only
$L1 < q \leq L2$	Basic register and T1
$L2 < q \leq L3$	Basic register and T2
$q > L3$	Basic register and T3
$q < qi$	Basic register and T4. Values when the flow rate is below $qi$ but exceeds the sensitivity threshold will be added here

$L1 < L2 < L3$

**3.5.3 Tariffing mode T1 (code 4 in configuration)**

Water temperature is analyzed

*Tariff counters will accumulate volume.*

$t \geq L1$	Basic register only
$L2 \leq t < L1$	Basic register and T1
$L3 \leq t < L2$	Basic register and T2
$L4 \leq t < L3$	Basic register and T3
$t < L4$	Basic register and T4

$L1 > L2 > L3 > L4$

**3.5.4 Tariffing mode Time (code 6 in configuration)**

Tariffing is made depending on the time of the day

*Tariff counters will accumulate volume.*

Tariff threshold contain time of the day: hours and minutes

$L1 \leq \text{time} < L2$	Basic register and T1
$L2 \leq \text{time} < L3$	Basic register and T2

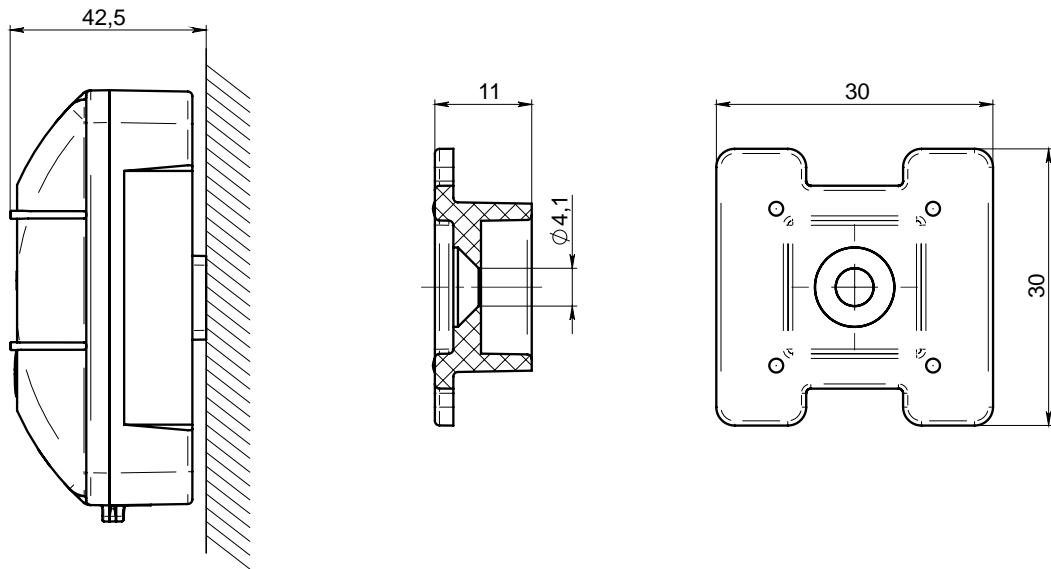
$L3 \leq \text{time} < L4$	Basic register and T3
$L4 \leq \text{time}$ or $\text{time} < L1$	Basic register and T4

$L1 < L2 < L3 < L4$

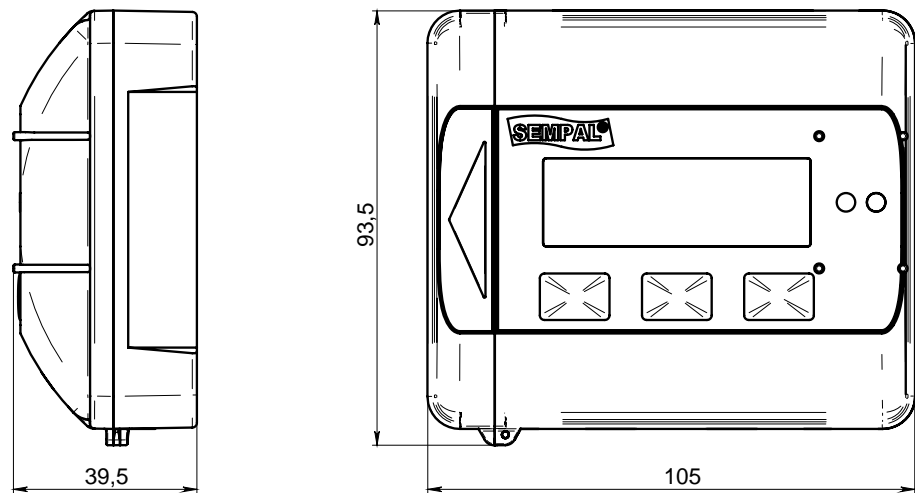
If some of the thresholds are not defined and if time is in interval between maximal threshold and TT1, then accumulation are produced in main register and T4. For example, if L3 and L4 are not defined, then if time exceeds L2 or less L1, accumulation will be in T4.

## 4 Overall dimensions

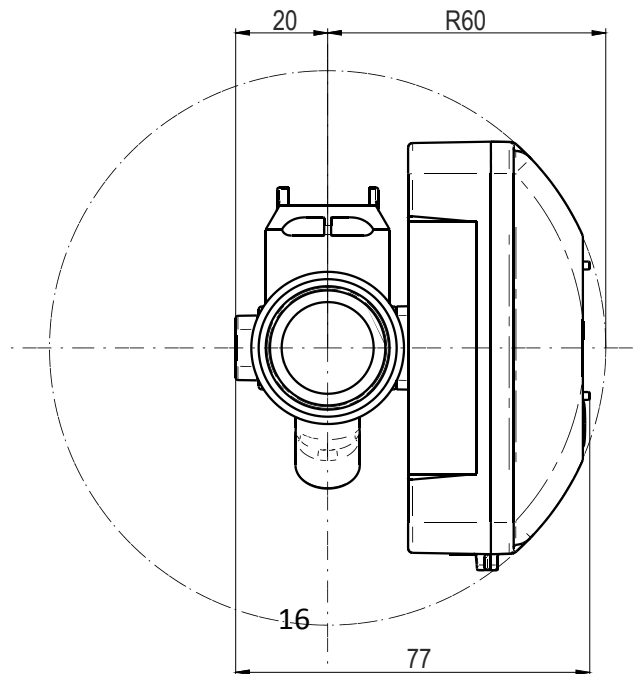
### Calculator



### Wall mounting

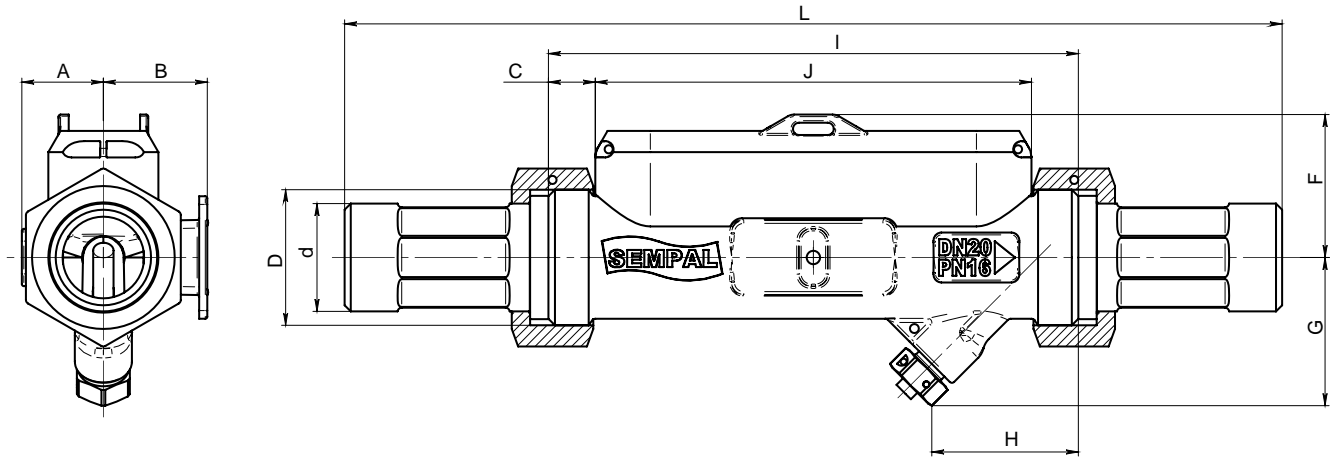


### Calculator installation onto flow meter body



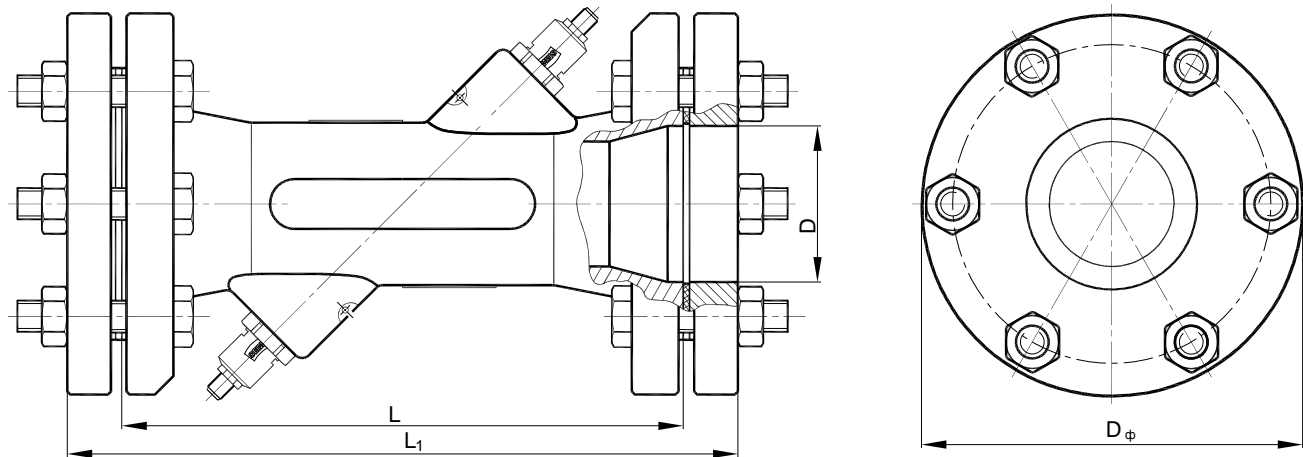


Flow meter body DN15...DN25



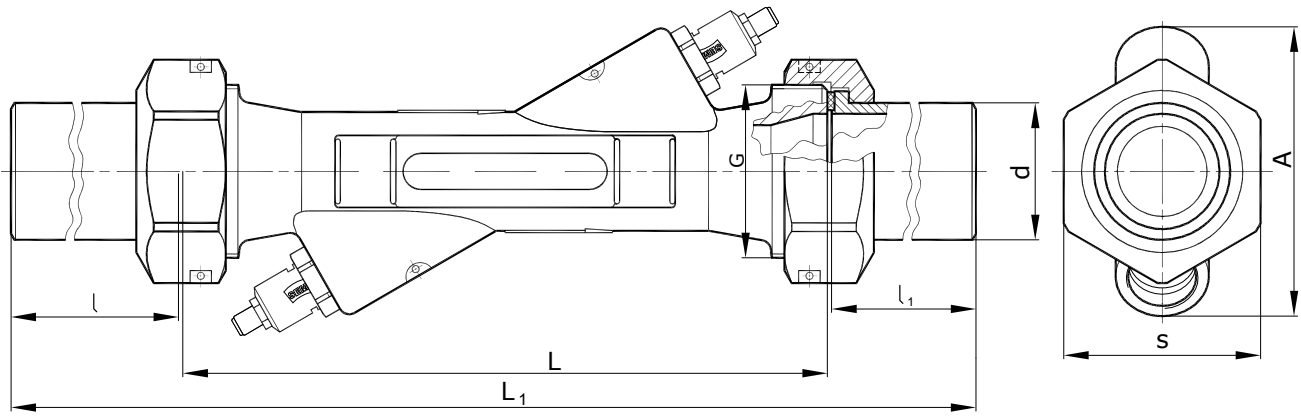
DN	D	d	A	B	C	F	G	H	J	L	I
15	G ¾ B	G1/2	20	25.5	11.5	35	36	36	107	180	110
20	G 1 B	G3/4	20	25.5	11.5	32.5	33	30	87	200	130
25	G 1 ¼ B	G1	24	29.5	16	39	40	40	128	260	160

+++++  
Flow meter body DN32...DN100 (with flanges)



DN	L	L1	D	Dφ
32	180	212	32	84
40	200	232	40	98
50	180	230	50	122
65	200	250	65	144
80	210	260	80	155
100	230	280	100	184

Flow meter body DN32...DN40 (with thread)

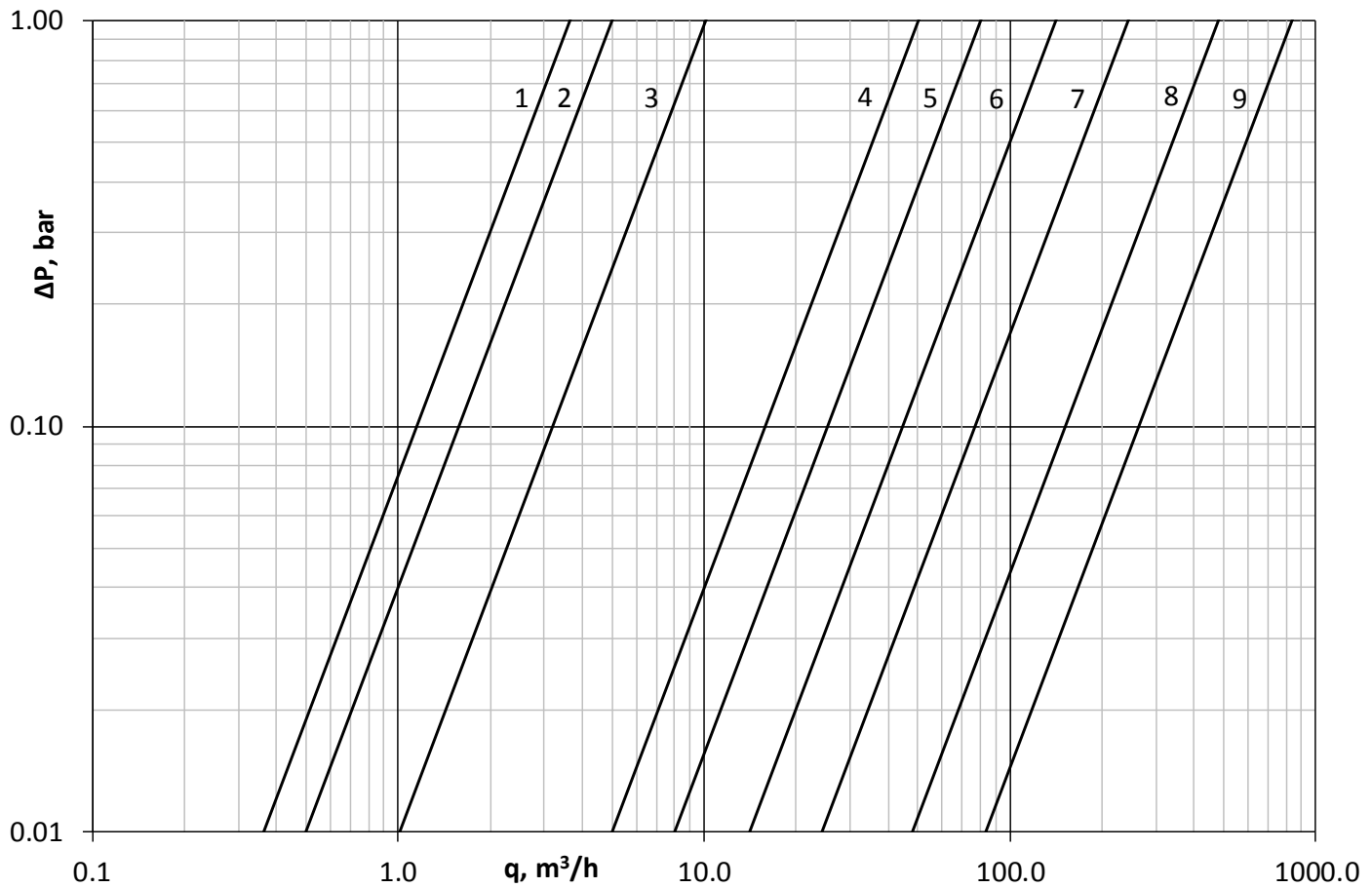


DN	G	L	L1	l	l1	d	s	A
		mm						
32	M48x2	180	662	320	160	38	55	79
40	G2"-A	200	802	400	200	31	70	85

## 5 Pressure losses

Pressure losses in flow metering section depend on the flow rate as a quadratic loss function. Pressure loss graph is shown below.

Flow metering section type in the type designation	$\Delta P @ q_p$ [bar]	Designation on the graph
015A	0.17	1
020A	0.09	2
025A	0.12	3
032 (A, B, C, D)	0.09	4
040 (A, B, C)	0.25	5
050A	0.07	6
065 (A,B)	0.17	7
080A	0.11	8
100A	0.09	9



Pressure losses graphs

## 6 Installation

### 6.1 Installation requirements

Prior to the meter installation, the system must be flushed to remove big pieces of iron scale, stones and the like. Flushing must be made with a repair insert.

Only new sealing elements included into the delivery set must be used for flow metering section installation.

Before tightening the screw connections to make sure that progress is sufficient to seal the thread

To facilitate maintenance of the meter, it is advisable to install ball cocks before and after the meter.

### Operating conditions

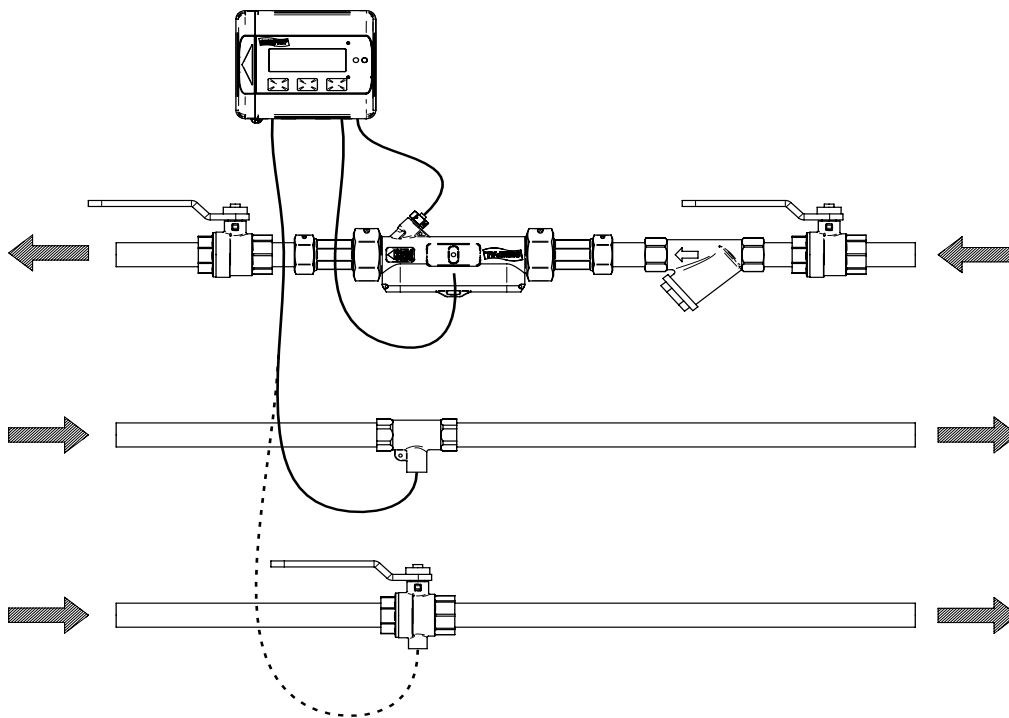
Ambient temperature	5...55 °C (indoors installation) The temperature must not exceed 30 °C for maximum lifetime of the battery
Water temperature	2...150 °C when the calculator is installed on a wall 15...90 °C when the calculator is installed onto the flow metering body
Pressure in the system	1...16 bar

There is no necessity in straight line sections before or after DN15...25 flow metering bodies under normal operating conditions.

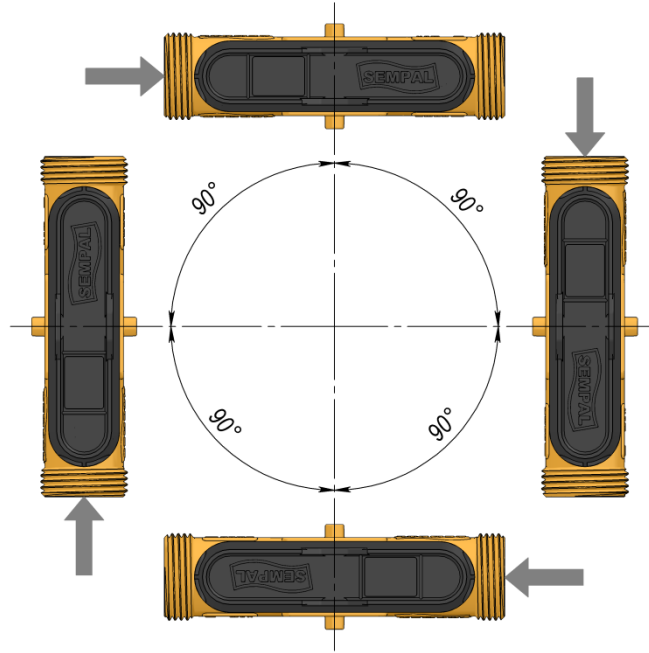
**Warning!** Installation of strainer before DN15...25 meters is obligatory.

### Maintenance

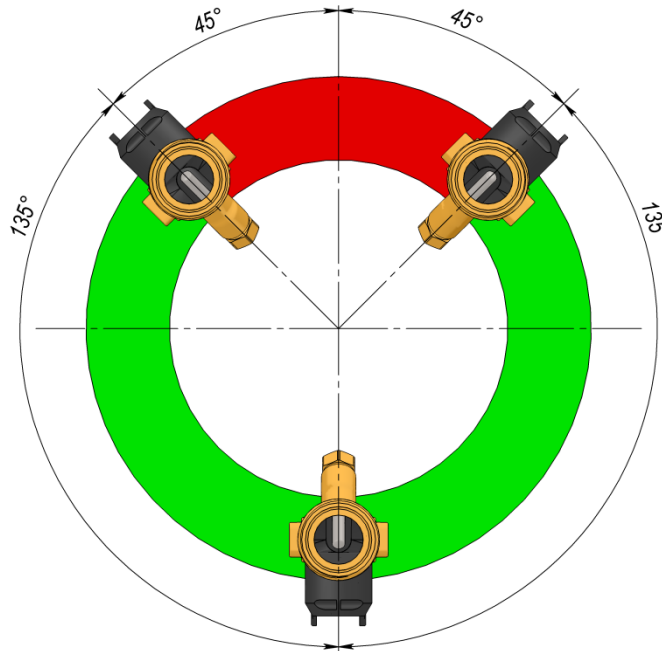
Once the meter is installed, any welding operations or meter freezing is not allowed. The meter must be removed prior to any welding operations.



## 6.2 Flow metering body location in a pipeline



Flow metering body may be installed vertically, horizontally or at any arbitrary angle. While installing flow metering body in downward flow its outlet pressure should be not less than 1 bar.

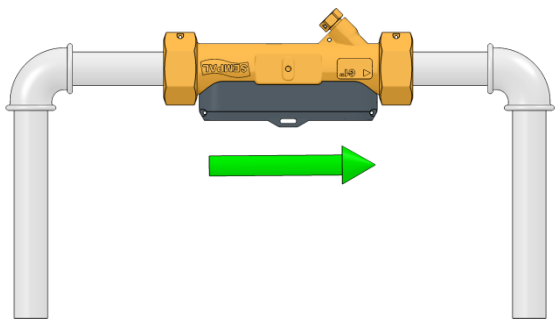
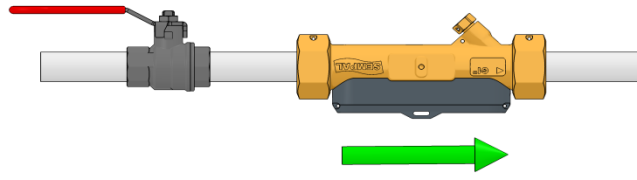
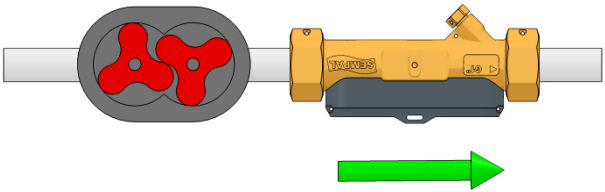
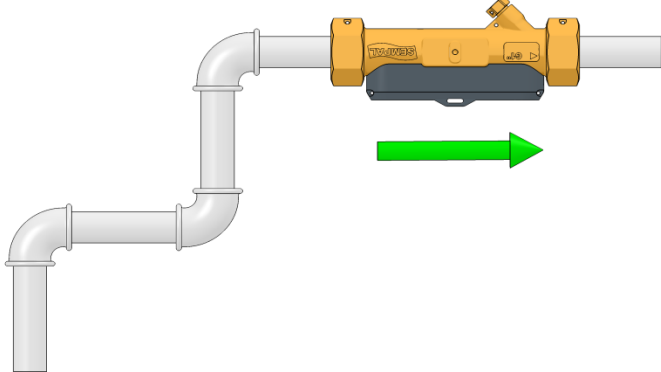


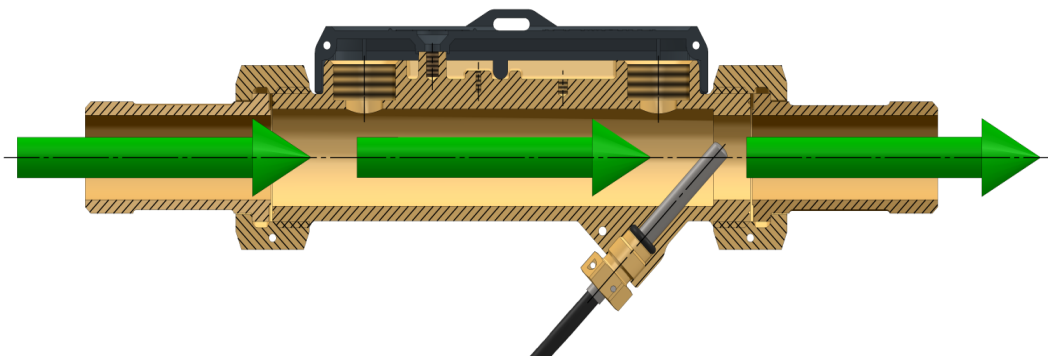
Flow metering body must be turned 45° and more degrees. Vertical installation or installation with the turn angle less than 45° is not allowed.

### 6.3 Requirements for straight line sections

For DN15...25 meters installation of straight line sections before and after the flow metering body are not required.

Such straight line sections are required only in the case of strong flow disturbance in front of flow metering body. Such disturbances may be caused by a pump, double bend in different planes, availability of shutoff fittings (fully opened full-bore ball cock excluded).

 <p>Installation at the highest point of the system is not allowed</p>	 <p>Installation after the valve at a distance shorter than 5D is not allowed (fully opened full-bore ball cock excluded).</p>
 <p>Installation after the pump at a distance shorter than 5D is not allowed</p>	 <p>Installation at a distance shorter than 5D to a double bend is not allowed</p>



For DN > 25 meters there are following requirements to straight line sections:

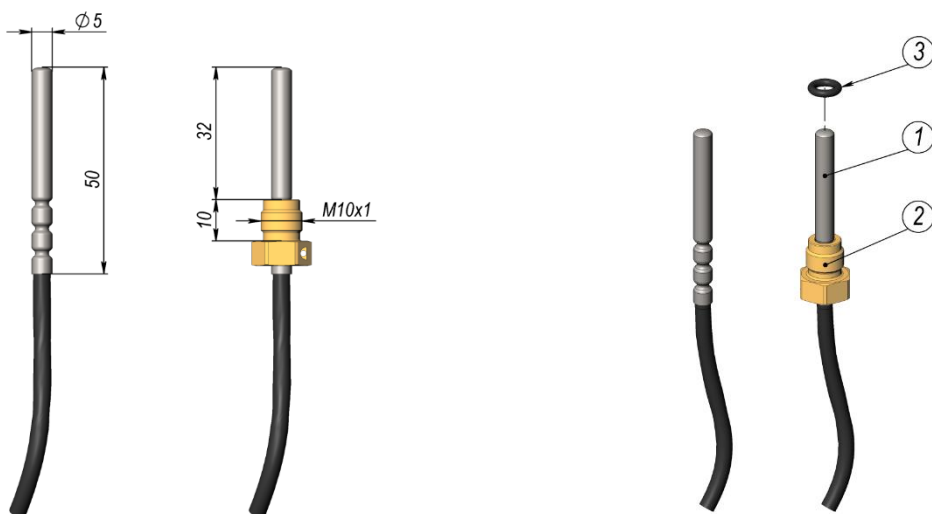
Flow disturbance	Straight line section	
	inlet	outlet
Reducing diameter with angle not more than 20 °	5 DN	3 DN
90 °-bend	7 DN	3 DN
Valves* or two 90 °-bends in perpendicular surfaces	10 DN	3 DN
Pump	15 DN	3 DN

Примечание:

\* Ball valve (should be completely open or completely closed) is classified as pipeline section with nominal DN.

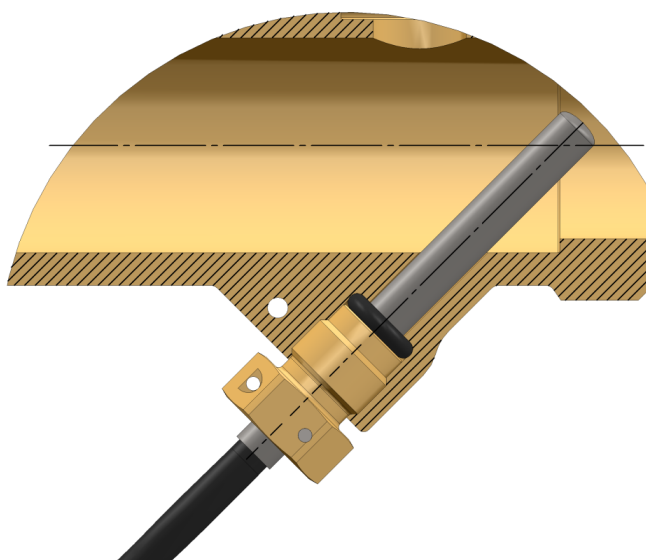
Inside diameter of straight line section should differ from nominal value DN not more than  $\pm 5\%$ .

#### 6.4 Temperature sensor installation

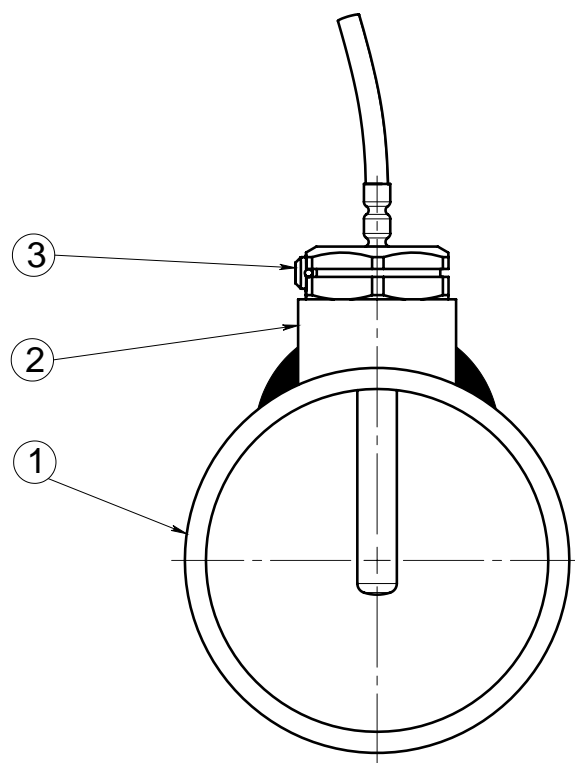
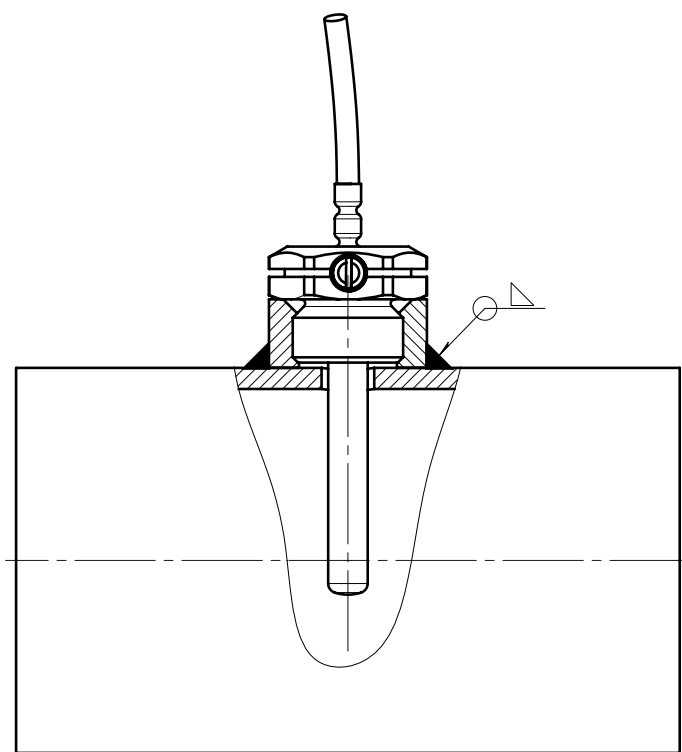


1 – temperature sensor; 2 – Temperature sensor holder; 3 – Sealing ring

For DN15...25 installation of temperature sensor is provided by design inside flow metering body as illustrated on Figure.

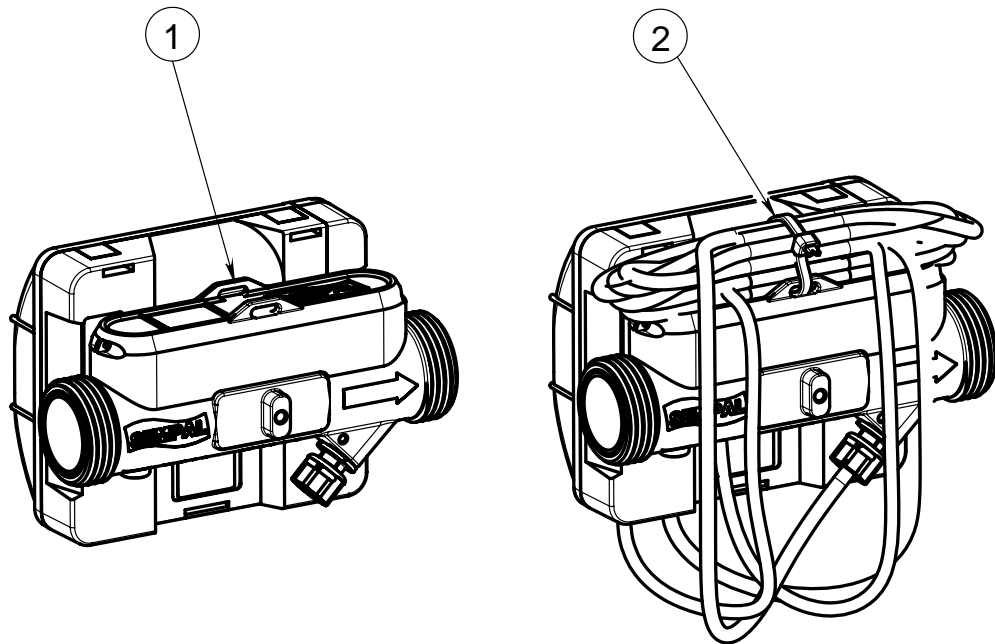


For DN32...100 meters installation of temperature sensor is provided by sleeve (pos.3) and welded boss (pos.2) of corresponding dimension, which are included in delivery set. Welding of boss to the pipeline (pos.1) is carried out at installation place.





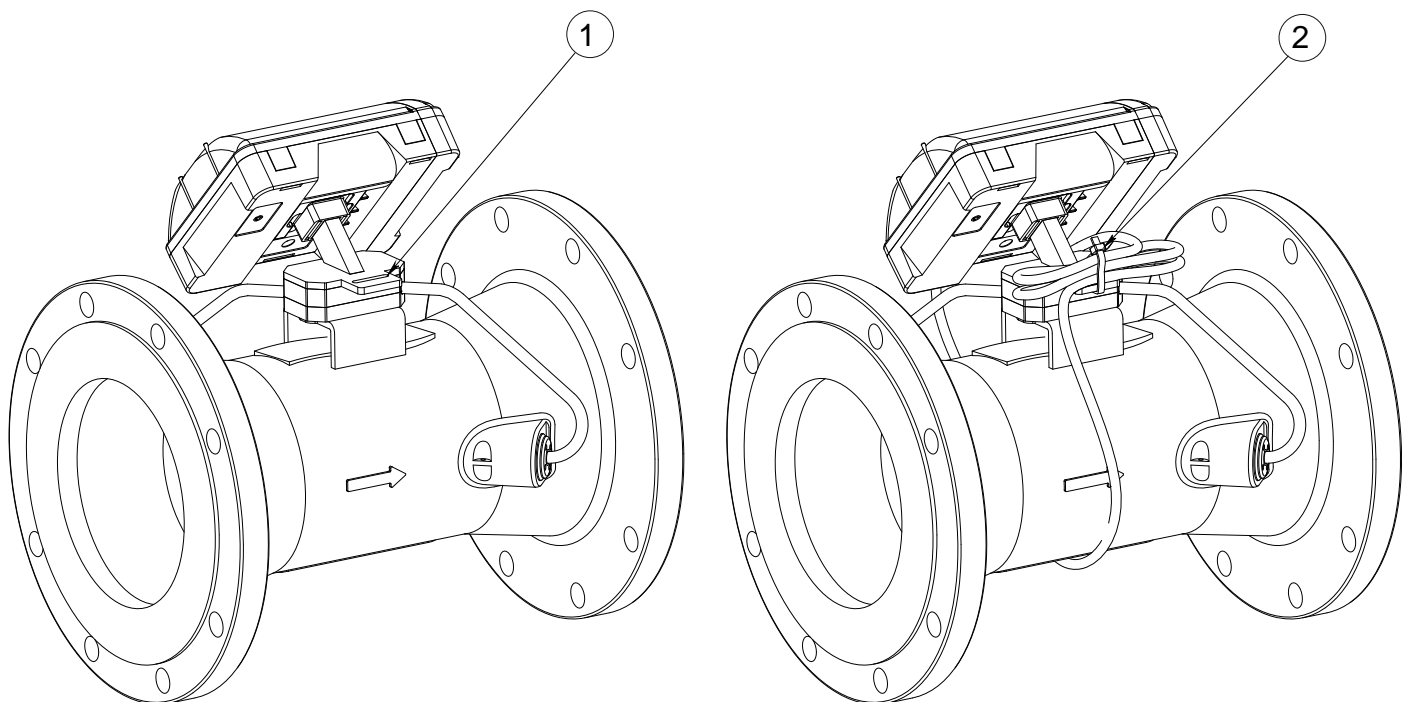
## 6.5 Cabling



Cabling for DN15...25

1 – cabling place

2 – plastic clamp from meter's delivery set



Cabling for DN32...100

1 – cabling place

2 – plastic clamp from meter's delivery set

## 6.6 Commissioning

After installation the Calculator should be set for certain configuration of measurement process.

When the meter leaves the production line the Calculator is set in transportation mode, 7.2.1. The transportation mode is equivalent to **Setup** mode except for the periodicity of measurement and the indicator work.

This mode allows editing of parameters of device setup.

For commissioning following parameters should be set:

- Flow rate measuring units
- Date of month (to start accounting period)
- Configure pulse inputs, if they are available and will be used
- Set tariffication, if required

After finishing device configuring, check the correctness of all entered data and exit Setup mode. Thus device starts working in Normal mode and accumulates integral parameters and archive.

Following entry into Setup mode is possible only as described in item 1.2.3.

## 7 Calculator

### 7.1 Performance of measurements

Measurement cycle of a meter consists of two independent cycles – integration cycle and temperature measurement cycle. The integration cycle means periodicity with which data summation is carried out in cumulative counters.

The temperature measurement cycle during a normal measurement mode will always be equal to 32 seconds.

The integration cycle may be changed in the course of the meter setting (see clause 3.2). Flow measurement cycle depends on the integration cycle. Flow rate measurement cycle is connected to integration cycle:

Integration periodicity, sec	Flow rate measurement periodicity, sec
2	0.5
4	1
8	1
16	2
32	4

When the meter is shipped, its integration cycle will be set to 16 seconds. Periodicity of the flow rate measurement then will be once every two seconds.

If shorter measurement cycles are installed, you must take into account that service life of the battery will be shorter as a result.

### 7.2 Working modes of the meter

There are a few working modes of the meter:

- Transportation
- Normal
- Sleep
- Setup
- Test

#### 7.2.1 Transportation mode

The transportation mode is equivalent to **Setup** mode except for the periodicity of measurement and the indicator work.

This mode is set when the meter leaves the production line. It is intended for maximum curtailment of the consumption.

In this mode, the integration cycle and temperature measurement cycle will be equal to 60 seconds each one. The indicator is turned off. When any pushbutton is depressed, the indicator will be turned on. It will be turned off again 5 minutes thereafter, if no pushbutton is depressed.

When the possibility of correct flow rate measurement (flow metering body is filled with water) appears, periodicity of measurement becomes equal to that in normal operation mode.

If absence of water in flow metering body is registered for 5 minutes, the meter will be switched over to the transportation mode again.

### **7.2.2 Sleep mode**

In this mode, the integration cycle and temperature measurement cycle will be equal to 60 seconds each. The indicator is turned on.

Sleep mode of the meter will be turned on, if absence of water in flow metering body is registered for an hour.

If flow metering body is filled with water, the meter will be switched over to the normal mode. Parameters are archived.

### **7.2.3 Normal mode**

This is the main working mode of the meter. The integration cycle here is set to a value to be determined by the user. The temperature measurement cycle will be 32 seconds.

Indicator is on.

All measured parameters are archived and tarified in this mode.

### **7.2.4 Setup mode**

This mode is intended for initial meter setting.

Periodicity of measurements in this mode will correspond to the periodicity of measurements in the normal mode.

Integral parameters in this mode will be accumulated but will not be memorized. That is, when this mode is turned on, the integral parameters will have the same meaning as of immediately before entering this mode.

No archive is kept.

Log of user's actions is kept.

Duration of this mode will not exceed 2 hours if no pushbuttons are depressed. When this period expires, the instrument will automatically be switched over to the normal operation mode. If any introduced changes require archive emptying and initial parameters resetting, these will be performed automatically, without additional requests of the user.

### **7.2.5 Test mode**

This mode is intended for verification of the meter.

In this mode, integration cycle is 2 seconds, while periodicity of flow rate measurement will be 2 times a second. The temperature measurement cycle will be 2 seconds.

It is made to accelerate the verification process.

Integral parameters will not be memorized in this mode. That is, when you exit from this mode, the integral parameters will restore the values they have prior to entering this mode.

Duration of this mode will not exceed 8 hours if no pushbuttons are depressed.

## **7.3 Functions of the meter**

### **7.3.1 Log**

The meter will keep a log of user's actions to register everything that can influence over the measurement result.

The following events will be registered in the log:

- Entering into and exiting from **Setup** and **Test** modes;
- Editing of any parameters while in **Setup** mode

Depth of the logging: 100 entries

In addition, every entry into service modes will increment the relevant entry counter. Readings of these counters may be seen on the indicator and their current status may be read through any available interface.

### **7.3.2 Maximum values**

The meter will register maximum values of flow rate. Such values will be memorized in all archive types. This means that hourly, monthly and yearly maximum values will be stored.

Such maximum values will be calculated as the maximum for averaged measurement results during a fixed time interval. Possible values of the averaging interval: 1, 2, 3, 4, 5, 10, 15, 20, 30 minutes. When the meter is shipped, the averaging time is set to 30 minutes.

### 7.3.3 Archiving

When operated in the normal mode, the meter will keep the following archives:

Archive type	Depth
Hourly	1680 hours (70 days)
Daily	500 days
Monthly	36 months (3 years)
Yearly	16 years

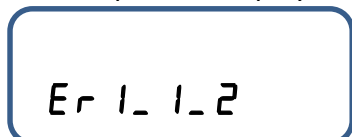
The following data will be placed into archives;

- date
- volume and mass (if temperature sensor is available)
- tariff counters (4 items) (if used)
- volumes by pulse signal inputs (if used)
- maximum values of volume
- codes and durations of errors registered during the time interval corresponding to the archive type

### 7.4 Processing errors

The meter in the course of its operation will continuously monitor correctness of completed measurements. If any errors are detected, they will be displayed in the main area of the indicator. If that is the case, the measured parameter will appear in turn with the error code with 4-second interval. The measured parameter will be displayed for 4 seconds followed by indication of the error for another 4 seconds. If several errors are detected simultaneously, they will be displayed in turn.

An example of a displayed error



Any error code consist of three groups of digits (from the left to the right)

- Error group
- Error No.
- Channel No. where the error took place

In the above example, error code indicates the following: error group – temperature measurement (1), error code – 1 (temperature sensor wiring break), Channel – 2 (error took place in Temperature sensor2).

More detailed description of any error may be seen in the instrument menu. In this case, the menu line will contain a text describing the error, while the main display will show the error code.

Error codes

Code error	Menu text	Description
<b>Error111</b>	TS1 break	Temperature sensor wiring break
<b>Error121</b>	TS1 short-circuit	Temperature sensor short-circuit
<b>Error131</b>	Coeff. TS1	Erroneous calibration coefficients $\Delta T1$
<b>Error141</b>	TS1 below limit	Temperature is below the permitted limit (-49 °C)
<b>Error151</b>	TS1 above limit	Temperature is above the permitted limit (+150 °C)
<b>Error311</b>	No water	No water
<b>Error321</b>	Low signal	Low signal level
<b>Error331</b>	Temp. FS	Determination of the water temperature in flow metering body is impossible
<b>Error341</b>	Flow exceeds	Flow rate exceeds a permitted limit
<b>Error351</b>	Reverse flow	Reverse direction of the flow

#### 7.4.1 System errors

System errors means errors in the calculator hardware, which make measurement impossible completely and cannot be remedied in site. To remedy any system errors (or faults causing systemic errors), the instrument will be sent to the manufacturing enterprise.

The system errors will be displayed on the indicator as follows:

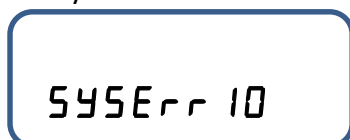


Figure denotes the error number.

#### 7.4.2 Setting date and time

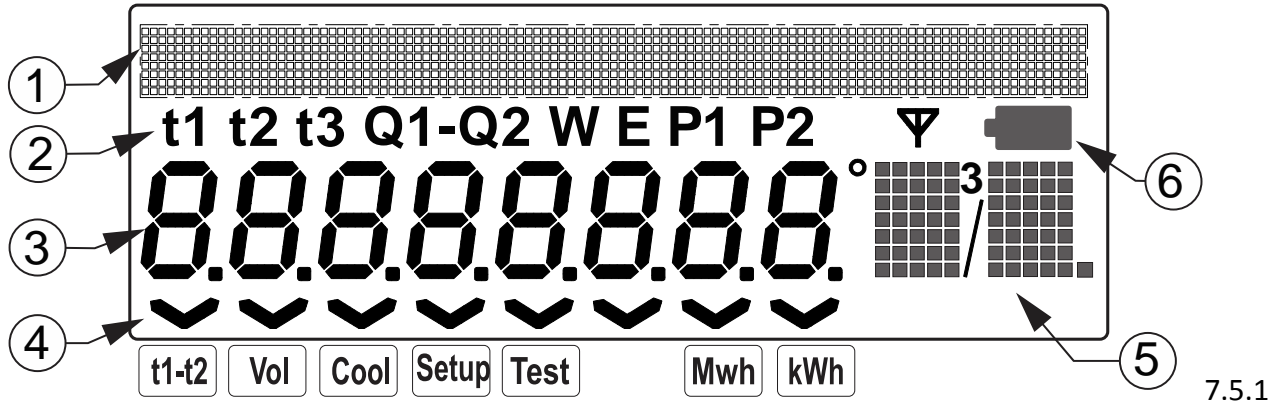
The instrument will be shipped with pre-set date and time corresponding to the relevant time zone of the supplying country.

Where necessary, date and time may be set by **SmpSetup** program. If no data is set, the following message will appear on the indicator



## 7.5 Indicator and keyboard

### 7.5.1 Indicator



- |                     |                              |
|---------------------|------------------------------|
| 1 – Menu line       | 4 – Mode indicators          |
| 2 – Displayed value | 5 – Measurement units        |
| 3 – Main screen     | 6 – Battery charge indicator |

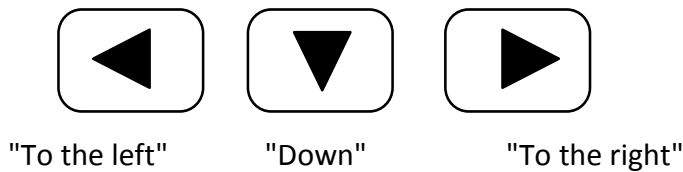
Indicator is divided into two areas: main screen and menu line

Main screen is operable always (except for transportation mode), while the menu line will be displayed only when work with menu is commenced. The menu will remain active for 2 minutes, if no pushbutton is depressed. If no pushbuttons were depressed for 2 minutes, the menu line will be turned off and the instrument will be switched over to the main indication mode.

Mode indicators in the bottom section of the indicator extend the displaying ability of the indicator main screen. Thus, when cooling energy will be displayed, the displayed value line will highlight 'E' together with the **Cool** mode indicator.

### 7.5.2 Keyboard

The meter is equipped with a keyboard comprising three pushbuttons: 'to the right', 'down' and 'to the left'



When you are navigating through menu, the left-side portion of the line will display the menu item number. Each digit in such number will correspond to the one menu nesting level.

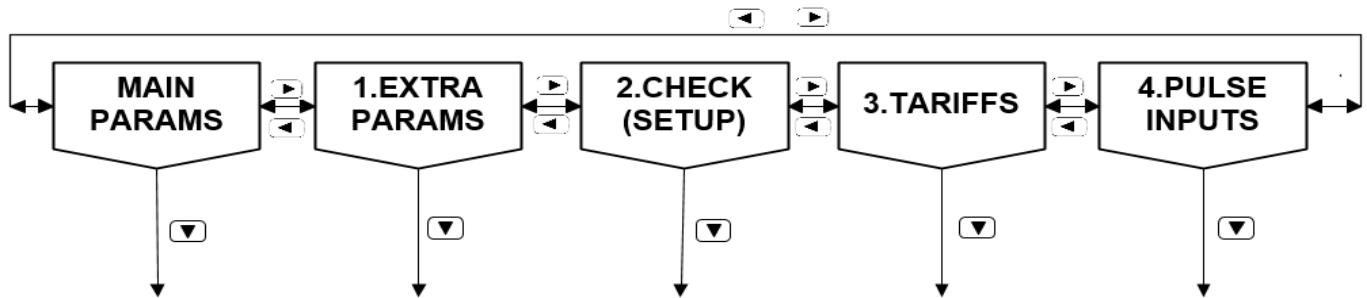
## 7.6 Structure of Water Meter menu.

Water Meter menu consists of five branches (so called submenus).

**Three menu branches - «Main parameters», «1. Extra parameters», «2. Check (Setup)» - are always activated.**

There are also other branches, *activated on demand*, like «Test», or branches included in case of special customer's order, like «3. Tariffs» and «4. Pulse inputs».

In item you may find connections between *headers* of these submenus.



Connections between Menu headers.

Directions of transitions between headers correspond to button pointers on device's front panel. To provide transitions between headers, please, make lasting, longer than 3 seconds, pressing of appropriate button, to the left or to the right. Transitions from a header to beginning of the branch is provided by «Down» button, and also transitions inside branches are carried out by short pressing of corresponding buttons. After transition to corresponding header or to any other menu item, its name is displayed in text row on the indicator within 2 minutes if no buttons have been pressed.

Menu items of «Main parameters», «1.Extra parameters», «2.Check» give possibility for a customer to consistently monitor values of all parameters measured and calculated by device.

*Header «2.Check» is displayed, if device is not in Setup mode, measured parameters may be monitored, but not changed.*

*Header «2. Setup» is displayed, if device is in Setup mode, measured parameters may be changed.*

Necessary clarification and designation of buttons are given near every menu item.

Device control in working mode is carried out by lasting 3-5 sec, or short, 1-2 sec pressing buttons on device front panel.

*Lasting pressings are used in following cases:*

- «To the left» and «To the right» buttons mean transitions between headers,
- «To the left» button means transition from any menu item to item of Main menu where volume V is displayed,

- «Down» menu means transition from any menu item to the header of current branch.

*Short pressings are used in following cases:*

- «Down» button means transition to the next (by order) menu item;
- «To the left» button means return to previous item (if necessary to check or reset previous value);
- Selecting one parameter from the list consisting of three and more positions: «To the right» button means start of selection, «Down» button means alternate selection, «To the left» button means fixation of selected parameter;
- Selecting one parameter from two: «Down» button means alternate selection, transition «To the left» or «To the right» in accordance with the instructions in the scheme is carried out with last selected parameter;
- Bit-by-bit number editing: «To the right» button means start of editing of the next bit (flashing with 1 sec frequency), «Down» button means alternate selection of digits of editing bit, after appearing of required digit by «To the right» button we provide transition to the next bit; finish of number editing is provided by pressing «To the left» button.

«2. Check» Menu gives a possibility to employee of service or inspecting organization to check correctness of setting of accounting parameters. Items 2.1, 2.2 help to evaluate facts of authorized, or unauthorized access to these parameters; item 2.8 – Meter configuration is given in Technical description; Item 2.14 is used if current information from device in special format should be transmitted.

«2.Setup» menu items are provided with detailed comments .

**CAUTION!** Exiting «2.Setup» menu, item 2.15, installer should consider that at every commissioning number of entering into “Setup” mode is increased by 1. Every unauthorized or erroneous entry may be classified by the inspecting authorities as an attempt to falsify. Completing this item an installer has a possibility:


- Return to beginning of the Menu, if necessary to provide a correction,
- Before commissioning save, or set to zero («Exit without reset», or «Exit with reset») previously accumulated parameters,

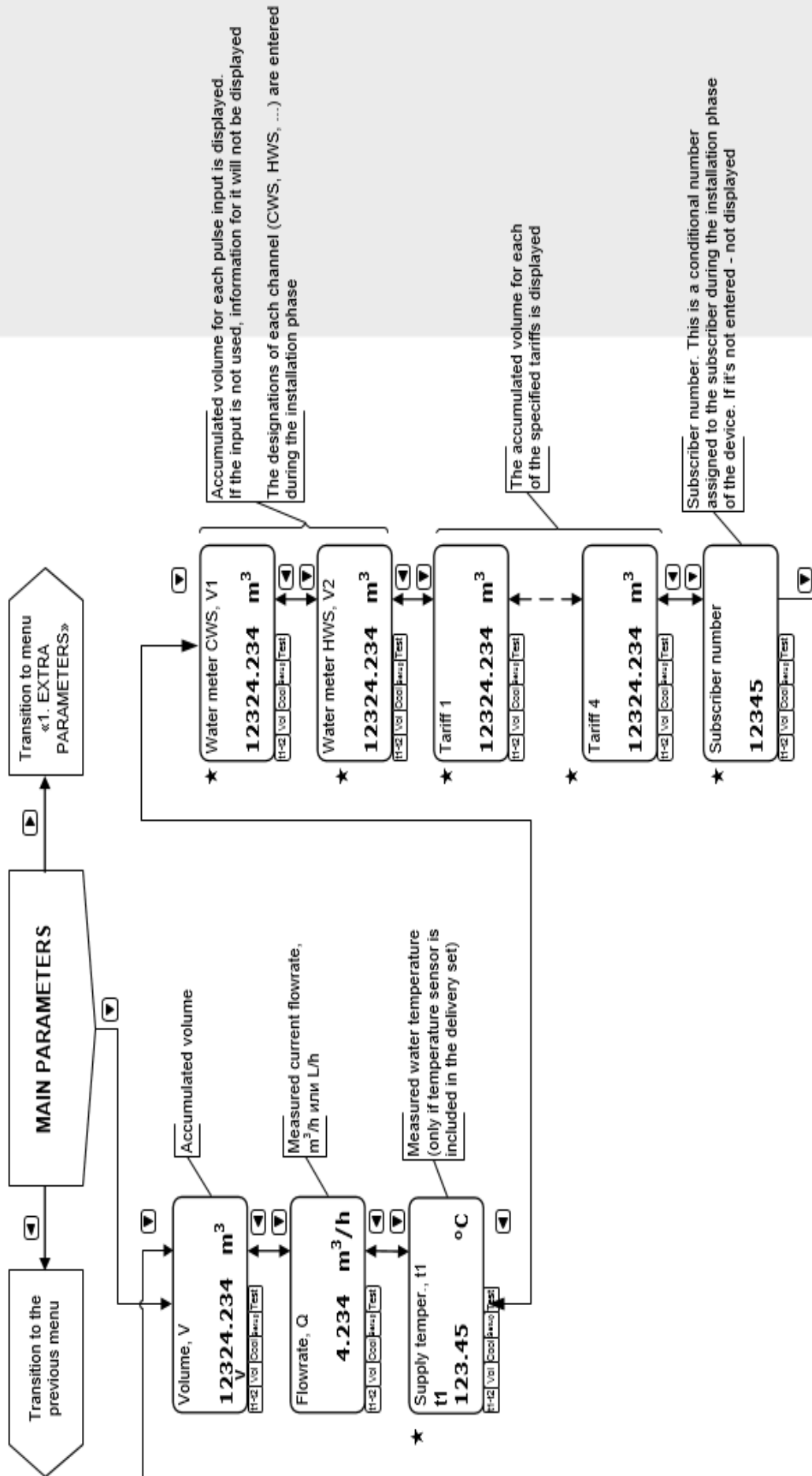


- And finally, just before commissioning, when an exclamation mark (“!”) appears on the screen, if there is a certainty that everything was done right before, to select «Yes» by «Down» button, and press «To the right» button; **thus, the device is commissioned, and is taken out of the Setup mode.**

«3. Tariffs» and «4. Pulse outputs» submenus are included only by order.


## 7.7 Main menu

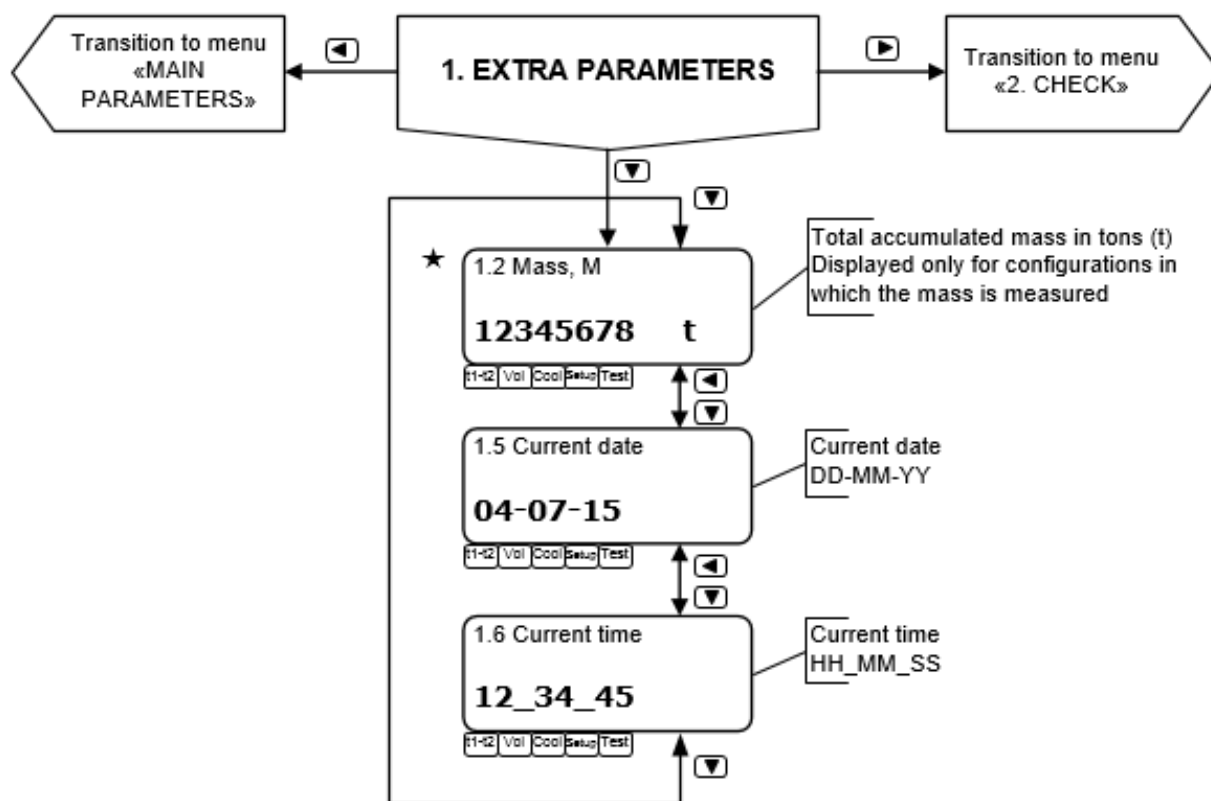
When the button  is pressed for longer than 3 seconds, the display changes to the name of the current menu




\* Denotes menu items visible under certain conditions depending on the configuration and instrument operation mode

## 7.8 Extra parameters


When the button  is pressed for longer than 3 seconds, the display changes to the name of the current menu

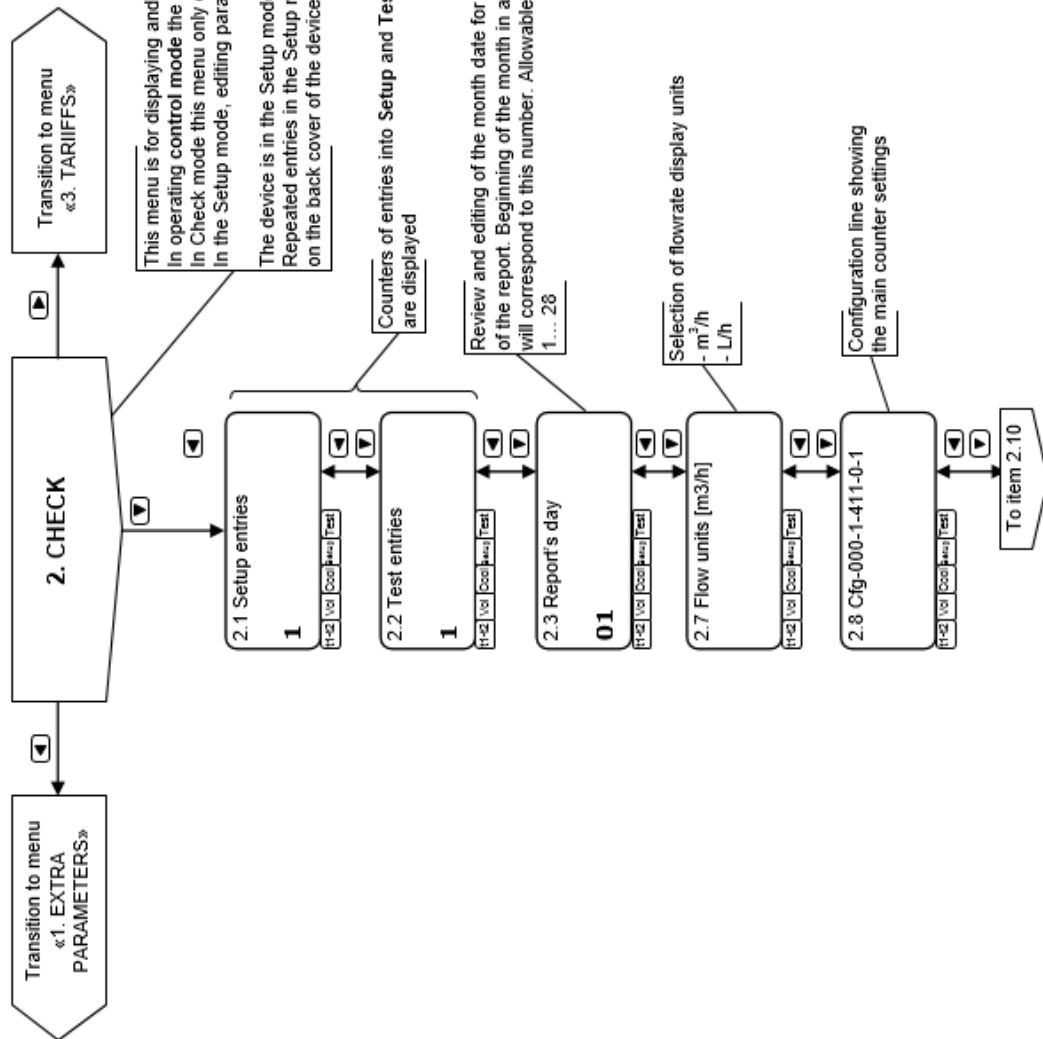


\* Denotes menu items visible under certain conditions depending on the configuration and instrument operation mode

When the button  is pressed for longer than 3 seconds, the display changes to indicating the main parameters in «MAIN PARAMS.» menu

## 7.9 Check (SETUP)

When the button  is pressed for longer than 3 seconds, the display changes to the name of the current menu



This menu is for displaying and editing device settings. In operating control mode the menu is called CHECK, in the setup mode - SETUP. In Check mode this menu only displays the parameters, editing is prohibited. In the Setup mode, editing parameters is allowed.

The device is in the Setup mode when it is released from production. Repeated entries in the Setup mode are possible only with the mode button located on the back cover of the device.


Counters of entries into Setup and Test modes are displayed

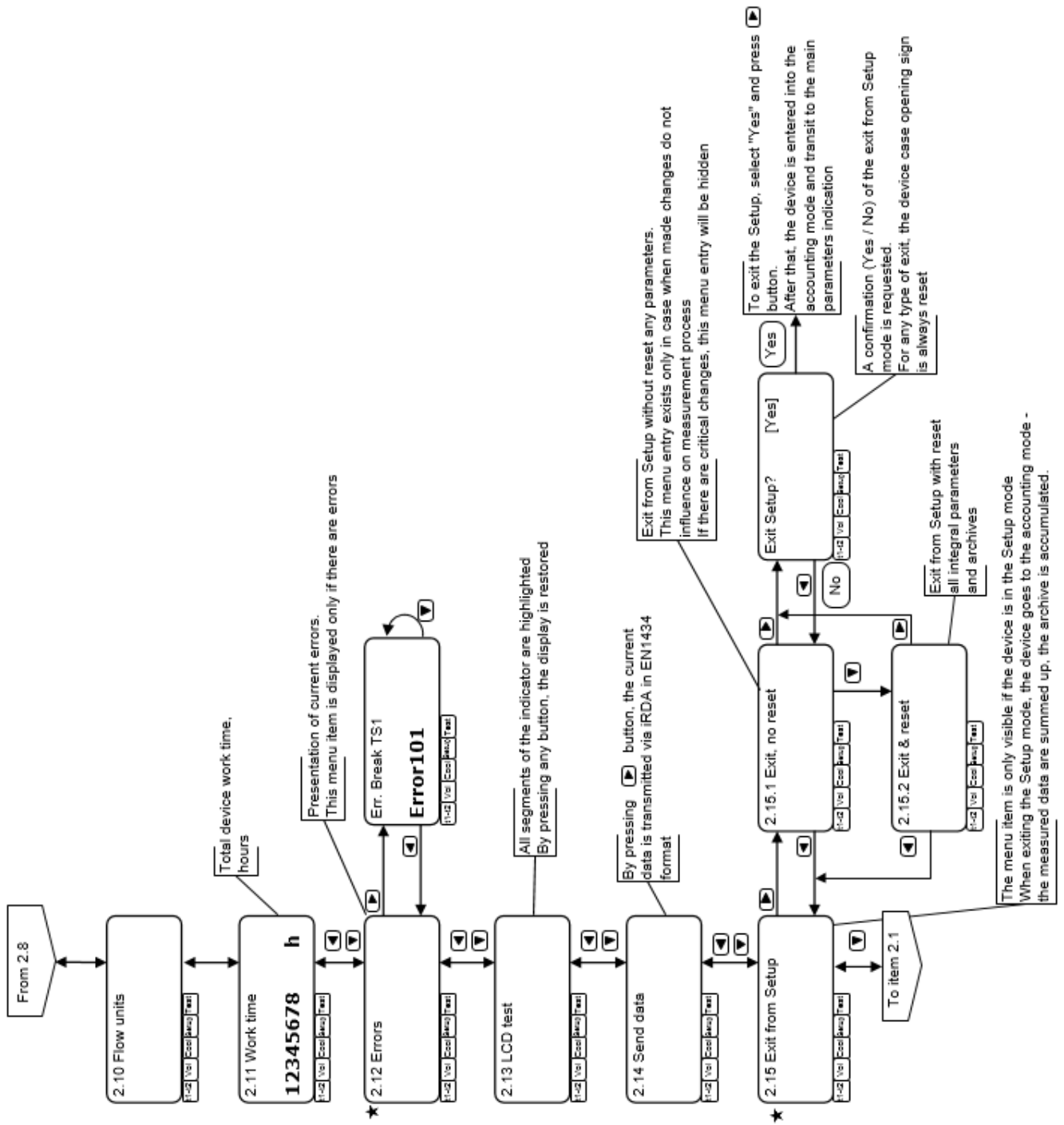
Review and editing of the month date for delivery of the report. Beginning of the month in archive will correspond to this number. Allowable values 1... 28


Selection of flowrate display units - m<sup>3</sup>/h - L/h

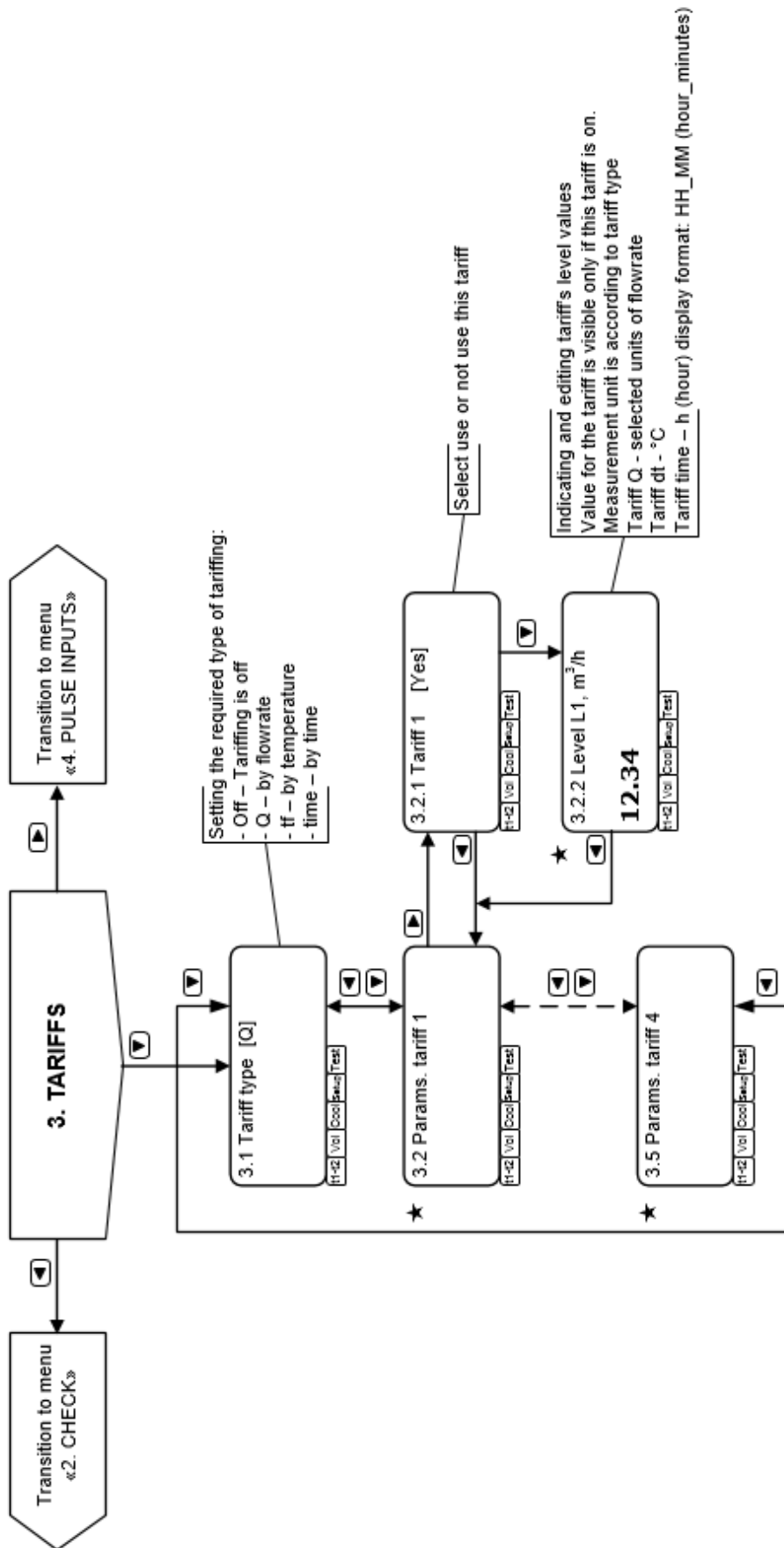
Configuration line showing the main counter settings


★ Denotes menu items visible under certain conditions depending on the configuration and instrument operation mode


When the button  is pressed for longer than 3 seconds, the display changes to indicating the main parameters in «MAIN PARAMS.» menu

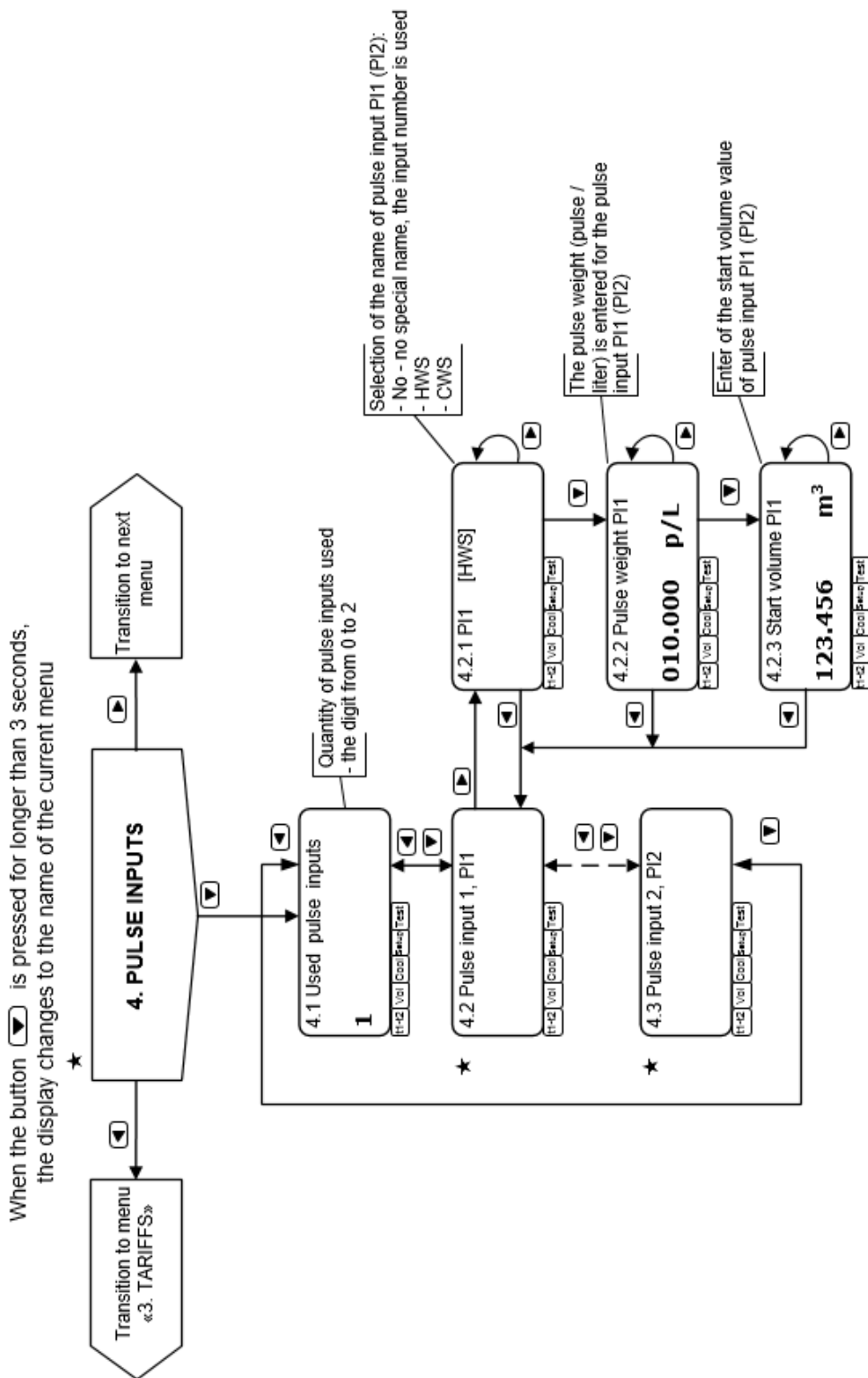


When the button  is pressed for longer than 3 seconds, the display changes to the name of the current menu



\*  Denotes menu items visible under certain conditions depending on the configuration and instrument operation mode

When the button  is pressed for longer than 3 seconds, the display changes to indicating the main parameters in «MAIN PARAMS.» menu



★ Denotes menu items visible under certain conditions depending on the configuration and instrument operation mode

When the button is pressed for longer than 3 seconds, the display changes to indicating the main parameters in «MAIN PARAMS.» menu

## 8 Manufacturer's warranty

The manufacturer warrants operation of the meter for 5 years following the shipment date of the meter to a user.

The warranty provides for replacement of any defective parts and checking operability of the instrument within the premises of a service centre of the manufacturing enterprise.

The warranty covers defects of any component parts of the instrument included into the delivery set if caused by workmanship defects, defects of materials and component items.

Any failed instrument must be delivered to the manufacturing enterprise for testing and repairing.

The calculator may not be opened (integrity of seal lead may not be damaged) under any circumstances prior to redelivery of the instrument to the manufacturing enterprise.

Warranty will not include any indemnification of any costs related to de-installation, return and reinstallation of the instrument, as well as indemnification of any consequential damages related to the failure.

If any defect is found during the warranty term, the user will be obliged to produce the claim to the manufacturing enterprise at the following address:

**3 Kulibina Street, Kyiv 03062, Sempal Co. Ltd.**

**Phone/fax: (+38044) 239-21-97, 239-21-98**

No claims related to the water meter will be recognised in the following cases:

- Installation and commissioning works have been carried out by any organisation not authorised by the manufacturing enterprise to carry out such works;
- Integrity of lead seals on the calculator is damaged;
- Expiry of the warranty period;
- Infringement by user of the operation, storage and transportation rules as prescribed in operating documentation.

If the warranty period expires or if the right for free of charge warranty services is lost, the manufacturing enterprise will carry out paid repair of the heat meters.

## 9 Utilization

Utilization of the meter parts:

<b>Description</b>	<b>Material</b>	<b>Utilisation method</b>
Lithium battery C	Lithium and thionyl chloride 2.5 g of lithium	Certified places for storage of lithium batteries
Printed circuit board without LCD	Metallized glass fiber laminate with components installed thereon	Metal extraction from the printed circuit boards
Liquid crystal display	Glass and liquid crystals	LCD recycling
Cables to temperature sensor and flow sensor	Copper and silicone casing	Cable recycling
Upper calculator cover Lower calculator cover Calculator holder	Polycarbonate Acrylonitrile-butadiene-styrene Polycarbonate	Plastics recycling
Flow metering section	Brass	Metal recycling
Package	Cardboard	Waste paper recycling