

USER MANUAL for flow meter with pulse input

family: **SIMFACT**

type: **SPI-94**

firmware version: 1.02 or higher



Read the user's manual carefully before starting to use the unit.
Producer reserves the right to implement changes without prior notice.

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Explanation of symbols used in the manual:



- This symbol denotes especially important guidelines concerning the installation and operation of the device. Not complying with the guidelines denoted by this symbol may cause an accident, damage or equipment destruction.

IF THE DEVICE IS NOT USED ACCORDING TO THE MANUAL THE USER IS RESPONSIBLE FOR POSSIBLE DAMAGES.



- This symbol denotes especially important characteristics of the unit. Read any information regarding this symbol carefully

1. BASIC REQUIREMENTS AND USER SAFETY



- **The manufacturer is not responsible for any damages caused by inappropriate installation, not maintaining the proper technical condition and using the unit against its destination.**
- Installation should be conducted by qualified personnel . During installation all available safety requirements should be considered. The fitter is responsible for executing the installation according to this manual, local safety and EMC regulations.
- The unit must be properly set-up, according to the application. Incorrect configuration can cause defective operation, which can lead to unit damage or an accident.
- **If in the case of a defect of unit operation there is a risk of a serious threat to the safety of people or property additional, independent systems and solutions to prevent such a threat must be used.**
- **The unit uses dangerous voltage that can cause a lethal accident. The unit must be switched off and disconnected from the power supply prior to starting installation of troubleshooting (in the case of malfunction).**
- Neighbouring and mating equipment must meet the requirements of appropriate standards and regulations concerning safety and be equipped with adequate anti-overvoltage and anti-interference filters.
- **Do not attempt to disassemble, repair or modify the unit yourself. The unit has no user serviceable parts. Units, in which a defect was stated must be disconnected and submitted for repairs at an authorized service centre.**



- In order to minimize fire or electric shock hazard, the unit must be protected against atmospheric precipitation and excessive humidity.
- Do not use the unit in areas threatened with excessive shocks, vibrations, dust, humidity, corrosive gasses and oils.
- Do not use the unit in explosion hazard areas.



- Do not use the unit in areas with significant temperature variations, exposed to condensation or icing.
- Do not use the unit in areas exposed to direct sunlight.
- Make sure that the ambient temperature (e.g. inside the control box) does not exceed the recommended values. In such cases forced cooling of the unit must be considered (e.g. by using a ventilator).



The unit is designed for operation in an industrial environment and must not be used in a household environment or similar.

2. GENERAL CHARACTERISTICS

Main task of **SPI-94** is measurement of instantaneous flow (flow rate), and counting of total flow (e.g. passage of fluid or gas). The device can be used as regulator, to control industrial process.

Measurement of instantaneous flow can be indicated in range: 0 to 999999 (plus decimal point) and can be expressed in combination of two cubic measures (Litre and m³) and three time measures (second, minute, hour). Total flow can be indicated in range from 0.000 to 4294967295 m³ with maximum resolution of 0.001 L. Device can operate with different flow sensors, acceptable flow factors of sensors from 0.01 to 10000.00 pulses per litre (with resolution 0.01 pulses/litre), additionally these flow sensors can be equipped with either electronic (open collector) or contact output.

Sensors can be powered from sensor supply output (stabilized, 24VDC +5%, -10% 100mA). The meter is equipped in 2 or 4 relay outputs or Open Collector outputs, which can be driven due to instantaneous or total flow. Optionally **SPI-94** with two relays outputs can be equipped with active current output. Build in RS 485 interface enables access to all internal registers, and supports MODBUS RTU communication protocol. The controller can be ordered in two power supply versions.

Modern design guarantees high operational reliability. Front panel is protected from dust and water spatters.

Additional features:

- settable width of measurement window (from 0.1 to 39.9 seconds),
- alarm preset; alarm signal is released when measurement exceeds measurement range,
- “**AccESS**” option enables direct access to relays thresholds settings, without password.

Flow counters can operate with flow sensors like **M1RSP**, equipped with contactron output.

3. TECHNICAL DATA

Power supply voltage (depending on version)	85... 230 ...260V AC/DC; 50 ÷ 60 Hz
External fuse (required)	19... 24 ...50V DC; 16... 24 ...35V AC
Power consumption	T - type, max. 2 A max. 4,5 VA @ 85 ÷ 260V AC/DC max. 4,5 VA @ 16V ÷ 35V AC max. 4,5 W @ 19V ÷ 50V DC
Inputs	fully Isolated
COM:	common (terminal no. 20)
zeroing of total counter:	active edge or level (terminal no. 18)
pulse input:	counting input with denouncing filter and pulse width control , max. input frequency 10.0 kHz (terminal no. 16)
Input levels	
low level:	0V ÷ 1V
high level:	10V ÷ 30V (about. 12 mA @ 24V)
Time between following pulses	settable from 0.1 to 39.9 sec.
Outputs	
relay:	2 or 4 NO, 1A/250V AC (cos φ = 1)
or OC-type:	2 or 4 30mA / 30VDC / 100mW
sensor power supply:	24V +5%, -10% / max. 100 mA, stabilized
active current:	range 0 ÷ 24 mA, max. load resistance 700 Ω (option, for two relays version only)
Instantaneous flow range	0 ÷ 999999, plus decimal point
Frequency measurement accuracy	± 0.02% (full temperature range)
Precision of flow readout	equivalent to used flow sensor precision
Instantaneous flow precision	Selected from range: 0 ÷ 0.00000
Instantaneous flow unit	L or m ³ per min. or sec. or hour
Total flow range	over 4 x 10 ⁹ m ³ (max. 16 digits)
Total flow precision	Selected from range: 0 ÷ 0.000
Total flow unit	L or m ³
Communication interface	RS 485, 8N1 / Modbus RTU, not separated
Baud rate	1200 bit/s ÷ 115200 bit/s
Display	LED, 6 digit, 13mm height, red
Data memory	non-volatile memory, EEPROM type
Protection level	IP 65 (from front, after using waterproof cover) IP 40 (from front) IP 20 (housing and connection clips)

Housing type	panel
Housing material	NORYL - GFN2S E1
Housing dimensions	96 x 48 x 100 mm
Panel cutout	90,5 x 43 mm
Assembly depth	102 mm
Panel thickness	max. 5 mm
Operating temperature	0°C to +50°C
Storage temperature	-10°C to +70°C
Humidity	5 to 90% no condensation
Altitude	up to 2000 meters above sea level
Screws tightening max. torque	0,5 Nm
Max. connection leads diameter	2,5 mm ²
Safety requirements	according to: PN-EN 61010-1:1999 + PN-EN 61010-1/A2:1999 installation category: II pollution degree: 2 voltage in relation to ground: 300V AC insulation resistance: >20MΩ insulation strength between power supply and input/output terminal: 1min. @ 2300V insulation strength between relays terminal: 1min. @ 1350V
EMC	PN-EN 61326:2003



This is a class A unit. In housing or a similar area it can cause radio frequency interference. In such cases the user can be requested to use appropriate preventive measures.

4. DEVICE INSTALLATION

The unit has been designed and manufactured in a way assuring a high level of user safety and resistance to interference occurring in a typical industrial environment. In order to take full advantage of these characteristics installation of the unit must be conducted correctly and according to the local regulations.



- Read the basic safety requirements on page 3 prior to starting the installation.
- Ensure that the power supply network voltage corresponds to the nominal voltage stated on the unit's identification label.
- The load must correspond to the requirements listed in the technical data.
- All installation works must be conducted with a disconnected power supply.
- Protecting the power supply clamps against unauthorized persons must be taken into consideration.

4.1. UNPACKING

After removing the unit from the protective packaging, check for transportation damage. Any transportation damage must be immediately reported to the carrier. Also, write down the unit serial number on the housing and report the damage to the manufacturer.

Attached with the unit please find:

- assembly brackets - 2 pieces,
- warranty,
- user's manual for **SPI-94** unit (device)

4.2. ASSEMBLY



- The unit is designed for mounting indoor inside housings (switchbox, switchboard) assuring appropriate protection against electric impulse waves. Metal housing must be connected to the grounding in a way complying with the governing regulations.
- Disconnect the power supply prior to starting assembly.
- Check the correctness of the performed connections prior to switching the unit on.



In order to assembly the unit, a 90,5 x 43 mm panel cutout (Figure 4.1) must be prepared. The thickness of the material of which the panel is made must not exceed 5mm. When preparing the cutout take the grooves for catches located on both sides of the housing into consideration (Figure 4.1). Place the unit in the cutout inserting it from the front side of the panel, and then fix it using the brackets (Figure 4.2). The minimum distances between assembly holes' axes - due to the thermal and mechanical conditions of operation - are 115 mm x 67mm (Figure 4.3).

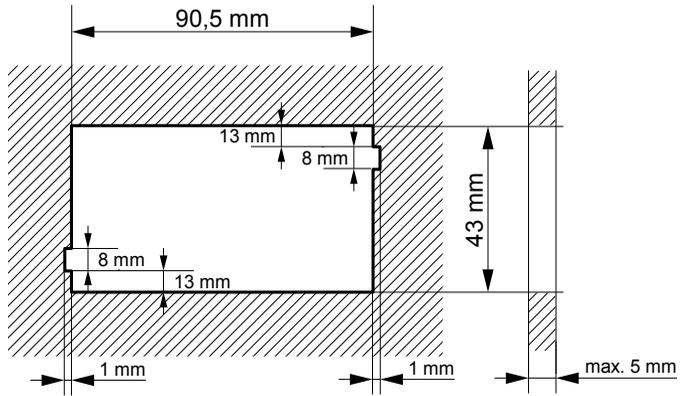


Figure 4.1. Panel cutout dimensions

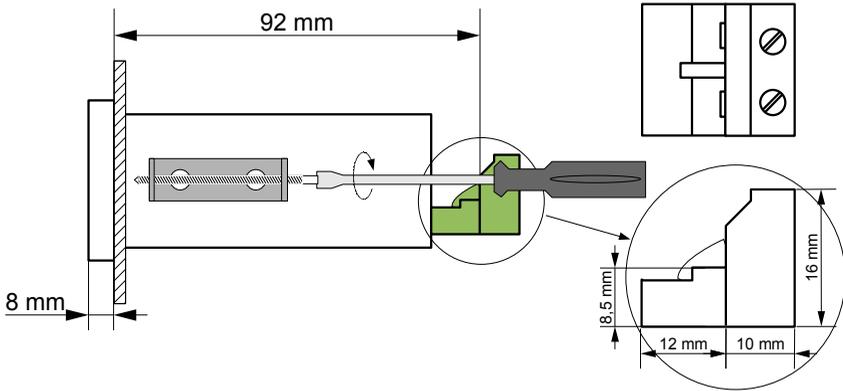


Figure 4.2. Installing of brackets, and dimensions of connectors.

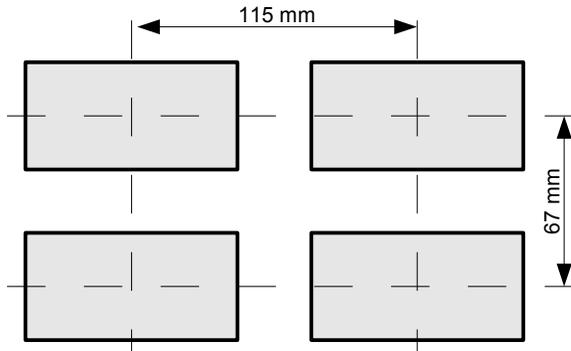


Figure 4.3. Minimum distances between axes of devices when assembly of a number of units

4.3. CONNECTION METHOD

Caution



- Installation should be conducted by qualified personnel . During installation all available safety requirements should be considered. The fitter is responsible for executing the installation according to this manual, local safety and EMC regulations.
- The unit is not equipped with an internal fuse or power supply circuit breaker. Because of this an external time-delay cut-out fuse with minimal possible nominal current value must be used (recommended bipolar, max. 2A) and a power supply circuit-breaker located near the unit. In the case of using a monopolar fuse it must be mounted on the phase cable (L).
- The power supply network cable diameter must be selected in such a way that in the case of a short circuit of the cable from the side of the unit the cable shall be protected against destruction with an electrical installation fuse.
- Wiring must meet appropriate standards and local regulations and laws.
- In order to secure against accidental short circuit the connection cables must be terminated with appropriate insulated cable tips.
- Tighten the clamping screws. The recommended tightening torque is 0.5 Nm. Loose screws can cause fire or defective operation. Over tightening can lead to damaging the connections inside the units and breaking the thread.
- In the case of the unit being fitted with separable clamps they should be inserted into appropriate connectors in the unit, even if they are not used for any connections.
- **Unused clamps (marked as n.c.) must not be used for connecting any connecting cables (e.g. as bridges), because this can cause damage to the equipment or electric shock.**
- If the unit is equipped with housing, covers and sealing packing, protecting against water intrusion, pay special attention to their correct tightening or clamping. In the case of any doubt consider using additional preventive measures (covers, roofing, seals, etc.). Carelessly executed assembly can increase the risk of electric shock.
- After the installation is completed do not touch the unit's connections when it is switched on, because it carries the risk of electrical shock.

Due to possible significant interference in industrial installations appropriate measures assuring correct operation of the unit must be applied. To avoid the unit of improper indications keep recommendations listed below.

- Avoid common (parallel) leading of signal cables and transmission cables together with power supply cables and cables controlling induction loads (e.g. contactors). Such cables should cross at a right angle.
- Contactor coils and induction loads should be equipped with anti-interference protection systems, e.g. RC-type.
- Use of screened signal cables is recommended. Signal cable screens should be connected to the earthing only at one of the ends of the screened cable.
- In the case of magnetically induced interference the use of twisted couples of signal cables (so-called "spirals") is recommended. The spiral (best if shielded) must be used with RS-485 serial transmission connections.
- In the case of interference from the power supply side the use of appropriate anti-interference filters is recommended. Bear in mind that the connection between the filter and the unit should be as short as possible and the metal housing of the filter must be connected to the earthing with largest possible surface. The cables connected to the filter output must not run in parallel with cables with interference (e.g. circuits controlling relays or contactors).

Connections of power supply voltage and measurement signals are executed using the screw connections on the back of the unit's housing (Figure 4.4 - 4.10).

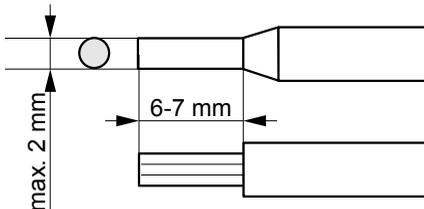


Figure 4.4. Method of cable insulation replacing and cable terminals

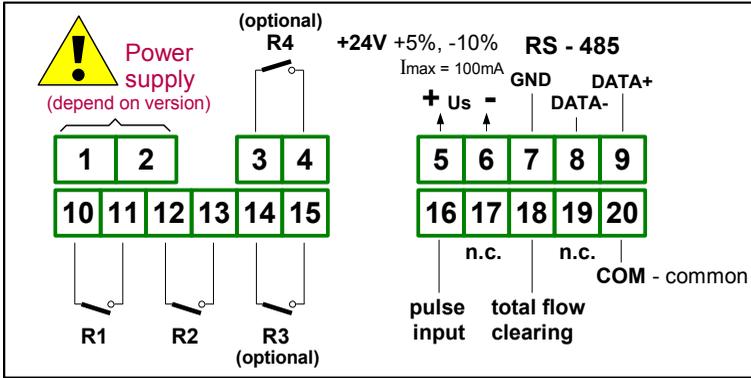


Figure 4.5. Terminals description (relay outputs, no current output version)

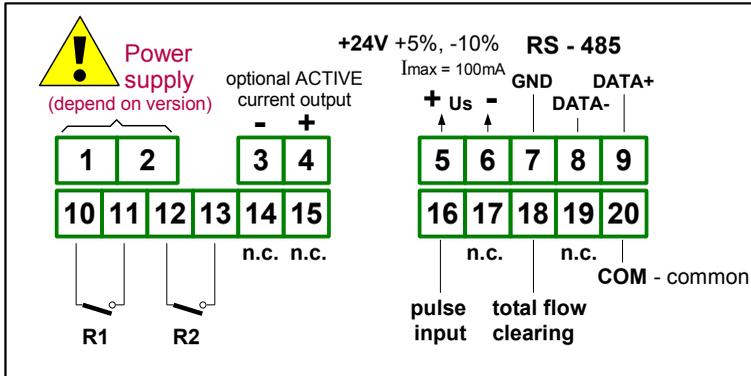


Figure 4.6. Terminals description (relay outputs, device with current output)

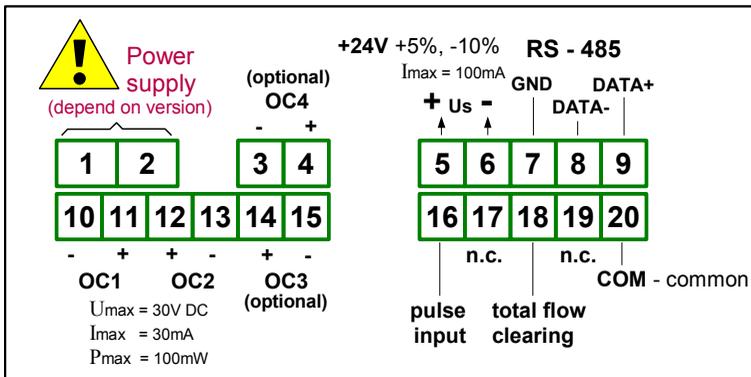


Figure 4.7. Terminals description (OC-type outputs)



All connections must be made while power supply is disconnected !

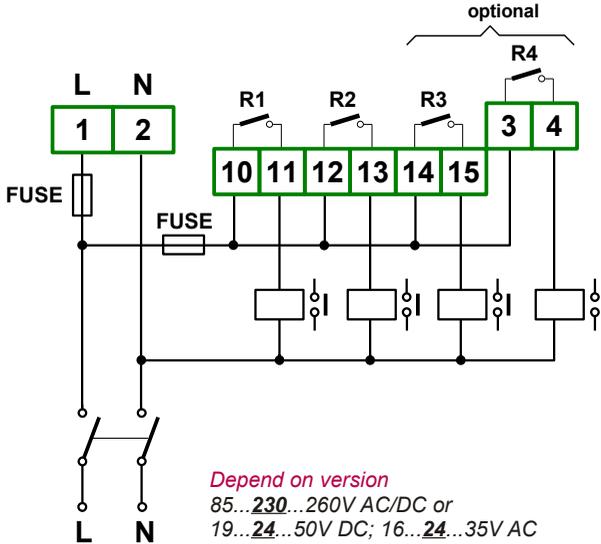


Figure 4.8. Connection of power supply and relays

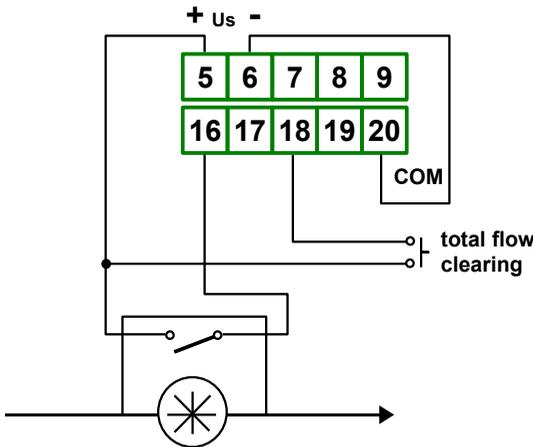


Figure 4.9. Example of connection between flow counter and flow sensor with contactron output

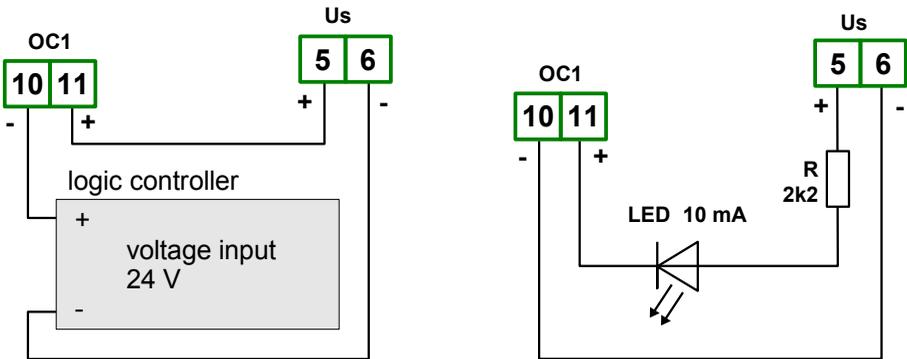


Figure 4.10. Example of OC-type outputs connection

4.4. MAINTENANCE

The unit does not have any internal replaceable or adjustable components available to the user. Pay attention to the ambient temperature in the room where the unit is operating. Excessively high temperatures cause faster ageing of the internal components and shorten the fault-free time of unit operation.

In cases where the unit gets dirty do not clean with solvents. For cleaning use warm water with small amount of detergent or in the case of more significant contamination ethyl or isopropyl alcohol.

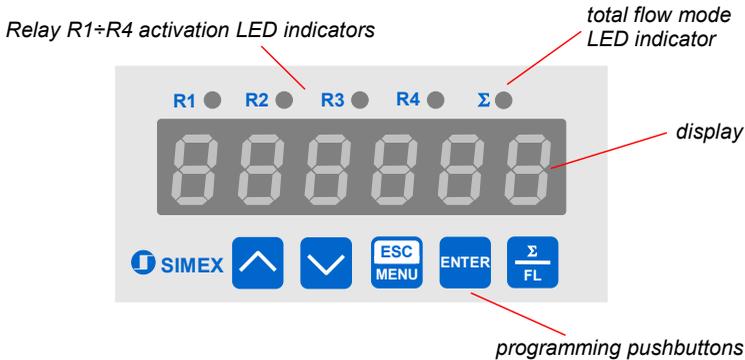


Using any other agents can cause permanent damage to the housing.



Product marked with this symbol should not be placed in municipal waste. Please check local regulations for disposal and electronic products.

5. FRONT PANEL DESCRIPTION



 LEDs named „R” indicates exceeding of the thresholds set in menus connected to relay outputs, even if some relays are not available (see „rELAY1” ÷ „rELAY4” menu).

Symbols and functions of pushbuttons



Symbol used in the manual: **[ESC/MENU]**

Functions:

- Enter to main menu (press and hold by at least 2 sec.)
- Exit the current level and Enter to previous menu (or measure mode)
- Cancel the changes made in parameter being edited



Symbol used in the manual: **[ENTER]**

Functions:

- Start to edit the parameter
- Enter to the sub-menu,
- Confirmation of changes made in parameter being edited



Symbol used in the manual: **[^] [v]**

Functions:

- Change of the present menu,
- Modification of the parameter value,
- Change of the display mode.



Symbol used in the manual: **[Σ/FL]**

Functions:

- switching of the display between total and instantaneous measurements

6. PRINCIPLE OF OPERATION

After turning the power supply on, device ID and software version are showed on the display, next the controller goes to the measurement mode.

6.1. MEASUREMENT MODE

In the measure mode, device displays total flow or instantaneous flow (equivalent to input current).

Instantaneous flow (flow rate) is displayed in units defined by parameter “**F unit**” (L or m³) and “**Ftunit**” (min., sec. or h), with resolution defined by “**F PrEc**” (max. 5 digits after decimal point). Pulses delivered to device's input (Figure 4.9) are recalculated according with procedure showed below:

- if duration of low or high level (between pulses) is lower than time defined by parameter “**FrEq**” (see Tab.7.1 page 27), these pulses are recognized as noise (or bouncing) and will be ignored
- if duration of both levels are in acceptable range, but input frequency is higher than defined by parameter “**FrEq**”, device goes to alarming state - relays and current output are switched to their alarm states defined by parameters “**ALArMS**” of particular menus. In alarm state flow counter displays “**-Hi-**” message, in place of flow result.
- In all other cases (while frequency and pulses duty cycle gets acceptable values) input pulses are delivered to internal prescaler. The prescaler (see description of parameter “**PULSEL**”) should be set to value equal to the quantity of pulses per one litre. Frequency after prescaler is recalculated accordingly to user defined unit (parameters “**F unit**” and “**Ftunit**”), and after that final flow value (in litres or cubic meters per hour, minute or second) is obtained. This result is displayed on the display and is used to determine states of relays and current output, additionally the result is accessible via RS 485 interface as a set of holding registers.



If input frequency is in acceptable range but result is longer than 6 digits, warning message “**-Ov-**” is displayed in place of the result. In that case parameters “**F unit**”, “**Ftunit**” and “**F PrEc**” should be corrected to obtain proper result.

Total flow is displayed in units defined by parameter “**t unit**” (L or m³), with resolution defined by parameter “**t PrEc**” (max 3 digits after decimal point). If total flow counter overflows, warning “**tot ov**” is displayed alternatively with maximum counter value. Total flow counter can be zeroed using “**Clrtot**” option of “**total**” submenu, electrically via *total flow clearing input* (see page 29) or via RS-485 interface by writing of value 0000h to any of total flow counter result registers.

Switching between current flow rate and total flow counter can be done pressing [Σ/FL] button. Kind of displayed value is signalled by “**Σ**” LED. It lights, while total flow is displayed.

Functions of [^] i [v] buttons depend on kind of presently displayed value:

- If instantaneous flow (flow rate) is displayed (LED named “Σ” is off) user can check main thresholds values. After pressing [^] or [v] button, name of the threshold (“rELPr1”, “rELPr2”, “rELPr3” or “rELPr4”) and his value will be displayed on the display in alternating mode.
If [^] or [v] will be pressed in 5 sec again, the next threshold will be displayed, else the device comes back to the measurement mode. If a **free access** is enabled (parameter “ACCESS” = “on”), user can change the value of particular threshold pressing button [ENTER] (see: **PARAMETERS EDITION**).
-  If particular parameter has been changed and confirmed in quick view mode, its new value is displayed in alternating mode with parameter name by few seconds. Confirmed changes may be checked or user can switch viewed parameter pressing [^] or [v] button.
- If total flow counter value is displayed (LED named “Σ” is on), and its length exceeds 6 digits, buttons [^] and [v] enable switching between more and less significant digits. Positions of currently displayed digits are signaled by flashing decimal points (see example below and Figure 6.1).

Example of switching between less and more significant digits of total flow result .

Let, total counter result be equal 1236789876543.21:

- while less significant 6 digits are displayed, flashing most left decimal point signalizes that result is longer than 6 digits, to show more significant digits press [^],
- while medium digits are displayed both most left and most right decimal points are flashing (Figure 6.1). Most right decimal point signalizes than result has less significant digits – to see these digits press [v] button. Most left decimal point signalizes additional more significant digits. Press [^] button to see these digits.
- while most significant digits are displayed, most right decimal point is flashing, and signalling that result has less significant digits, to see these digits press [v].

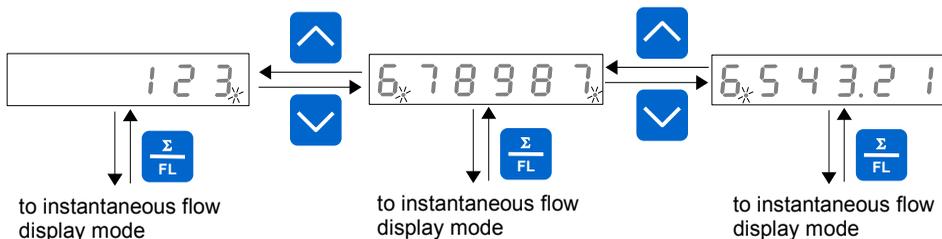


Figure 6.1. Switching between digits (screens) of total flow result.

All accessible parameters (e.g. pulse input settings, decimal point position) can be changed by entering the menu (see: **DEVICE PROGRAMMING**). Use the local keyboard or the remote controller to do it. (Note: all parameters can be remote changed via RS-485 interface).

- i** Counting of pulses and controlling of relays is realised regardless of operation mode (after entering to menu mode counting and controlling is continued in "background").

6.2. DETECTION OF THE PEAK VALUES

The flow meter is equipped with peaks detection function. It can detect a peaks of the input signal and display their values. Presets connected with this function are placed in "HOLD" menu (see description of "HOLD" menu). The detection of the peak can be done if the measured signal raises and drops of value at least equal to parameter "PEA". Detected peaks are displayed during the time defined by parameter "timeE". If a new peak will be detected while one is displayed, this new peak will be displayed and display time counter will be cleared (Figure 6.2). If no peaks are detected while time "timeE" elapses, device starts to show the current value of input signal again.

The relays/LEDs and the current output can be controlled depend on the current value of input signal or the peak value (see "HOLD" menu).

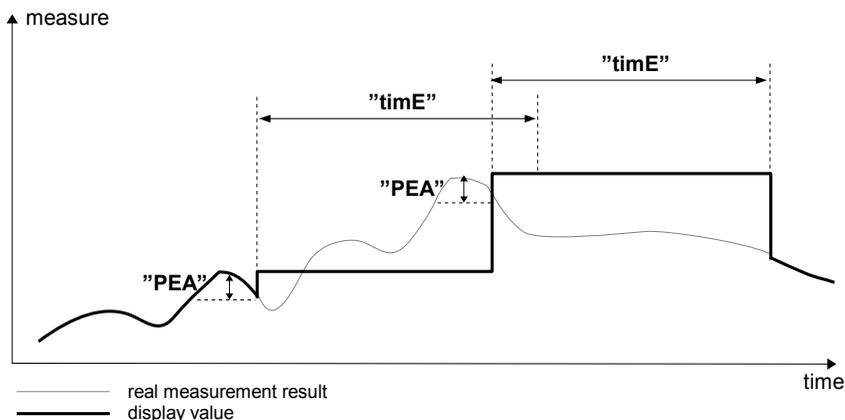


Figure 6.2. Process of peaks detection

6.3. CONTROL OF THE RELAY OUTPUTS

The control of the object (measured signal) is done due to instantaneous flow value (current flow rate) or total flow counter value, and is realized via relay outputs. Front panel LEDs named „R” indicates the state of particular relay output.

- i** If device is not equipped with one or more relay outputs, menus refer to this relays are available, but apply to LED indicators only. In such case LEDs indicates exceeding of particular thresholds.

Modes of the control can be changed depend on the values of parameters “vALUE”, “SEt P”, “SEt P2”, “HYSt”, “modE”, “t on”, “t OFF”, “unit” and “ALArMS” (available in “rELAY1” ÷ “rELAY4” menu). If relay is controlled due to total flow counter value (“vALUE” = “tot”), additional parameters are available in menu. Parameters “t PrEC” and “t unit” defining the unit and resolution of displayed thresholds and hysteresis of selected relay. Depend on “modE” parameter, relays can be not used or controlled over one or two thresholds values.

If one threshold is used (Figure 6.3) the relay can be turned on (“modE” = “on”) or off (“modE” = “off”) when the input signal value is contained in **zone A**. If two thresholds are used (Figure 6.4) the relay will be turned on when value of input signal is contained in **zone A** (“modE” = “in”) or **zone B** (“modE” = “out”) and turned off if the signal is contained in the second one.

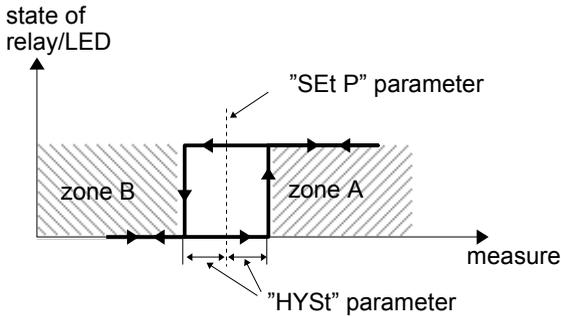


Figure 6.3. One threshold control of the relay outputs and LEDs R1÷R4

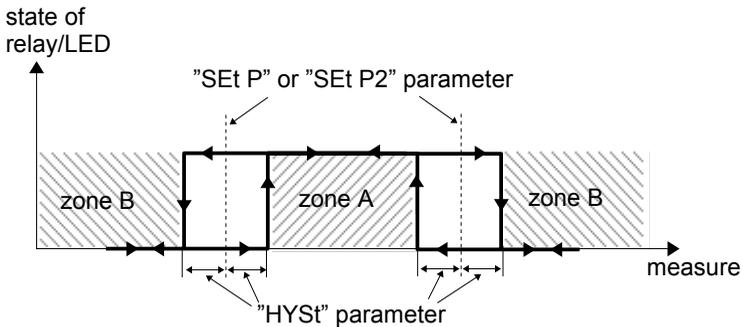


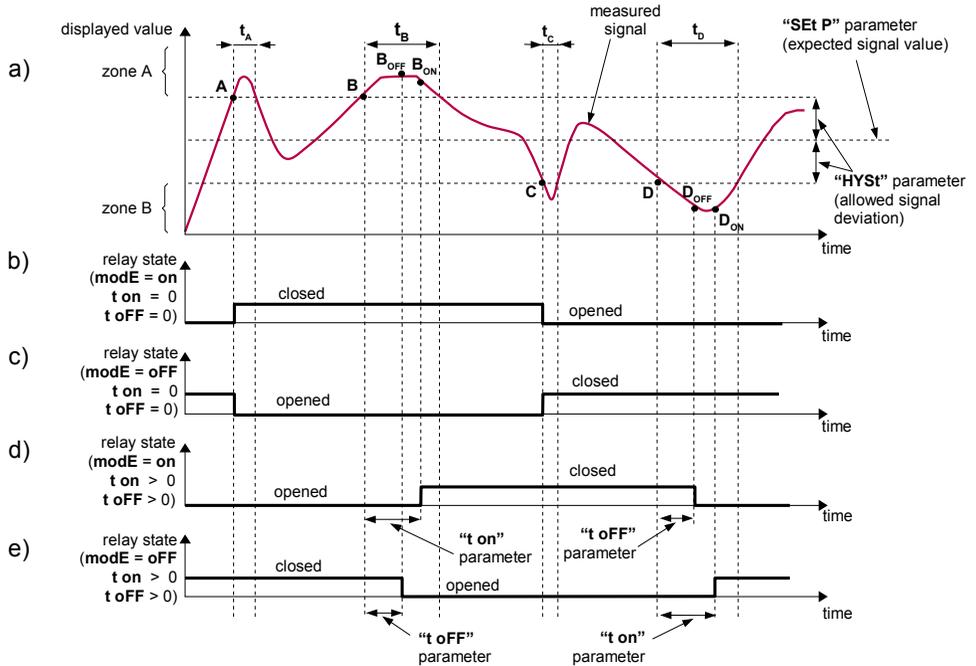
Figure 6.4. Two thresholds control of the relay outputs and LEDs R1÷R4



The relay outputs and LEDs R1 ÷ R4 can be controlled depend on both - the current value and the peak value (when peak detection is active, for flow rate only) of the input signal.

6.3.1. One threshold mode

Figure 6.5 presents the principle of relay outputs operation for one threshold mode, and an example values of other parameters.



Description:

- A, B, C, D - points where measured signal exceeds border values (expected value \pm allowed deviation)
- B_{ON}, B_{OFF}, D_{ON}, D_{OFF} - relays state changes moments: (for "t on" > 0, "t off" > 0)
- t_A, t_B, t_C, t_D - time periods while input signal is in zone A or zone B

Figure 6.5. Principle of LED/relay output operation for one threshold mode

Parameter "Set P" sets a **threshold** of the relay, and parameter "HYST" sets a **hysteresis** of the relay (Figure 6.5 a). The relay can change his state **only** when input value exceeds (over or under) **border value** and t_A, t_B, t_C, t_D times (Figure 6.5) are bigger than the time defined by parameters "t on", "t off" and "unit". **Border values** means values equal **threshold+hysteresis** and **threshold-hysteresis** respectively.

If "t on" and "t off" parameters are set to "0", then the relay state will be changed **as soon** as input value exceeds any of the **border values** (see points A and C, Figure 6.5 a, b, c).

If values of "t on" or/and "t off" are positive, then relay state will be turned on if the input value exceeds the **border values** and stay bigger (or lower) during at least "t on" (see points B_{ON}, D_{ON}, Figure 6.5 a, d, e). Similarly, the relay will be turned off if time "t off" elapse since the input signal value exceeds any of the **border values** (see points B_{OFF}, D_{OFF}, Figure 6.5 a, d, e).

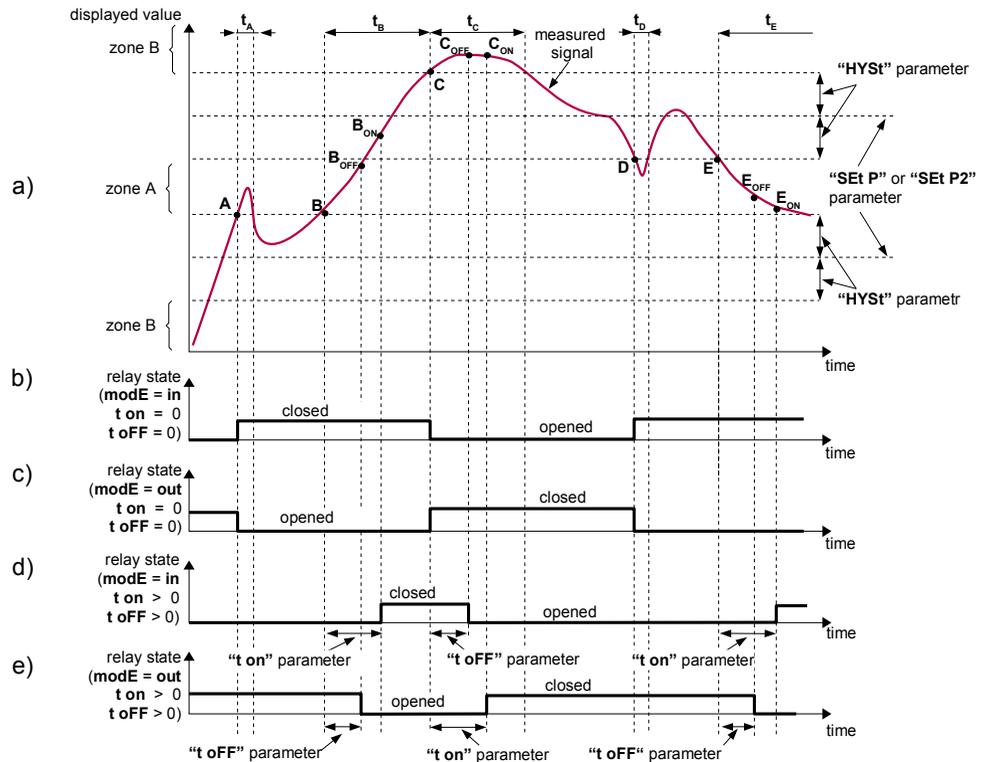
If t_A , t_B , t_C or t_D (when input signal stay in **zone A** or **zone B**) are lower than parameters “**t on**” or “**t off**”, the relay will not change his state (see points A and C, Figure 6.5 a, d, e).

The state of relay output while the input value exceeds the **border values** (points A, B, C, D) is described by parameter “**modE**”. The relay can be turned on (“**modE**” = “**on**”), or turned off (“**modE**” = “**off**”) when input signal value is contained in **zone A** (Figure 6.5 a).

The parameter “**ALARMS**” allow user to set the relay output behaviour in critical situations (e. g. Input values exceeds **permissible measurement range**). User can select that the relays will be turned on, turned off, or not changed in critical situations.

All parameters connected with relay outputs are described in paragraph “**rELAY1**” ÷ “**rELAY4**” menu.

6.3.2. Two thresholds mode



Description:

A, B, C, D, E - points where measured signal exceeds border values (expected value ± allowed deviation)

B_{ON} , B_{OFF} , C_{ON} , C_{OFF} , E_{ON} , E_{OFF} - relays state changes moments: (for “**t on**” > 0, “**t off**” > 0)

t_A , t_B , t_C , t_D , t_E - time periods while input signal is in zone A or zone B

Figure 6.6. Principle of LED/relay output operation for two thresholds mode

Figure 6.6 presents the principle of relay outputs operation for two thresholds mode, and an example values of other parameters. In this mode parameter “**SEt P2**” is accessible in common with “**SEt P**”, this parameter describes a second threshold of the relay output. The parameters “**HYSt**”, “**modE**”, “**t on**”, “**t OFF**”, “**unit**” and “**ALArms**” are connected with both “**SEt P**” and “**SEt P2**” thresholds. While the controlling process, the relay output changes his state depends of both “**SEt P**” and “**SEt P2**” thresholds in similar way as it was described in one threshold mode.

If two threshold mode is used, “**modE**” parameter defines state of the relay output when the input value occurs in a particular zone defined by **border values** of both **thresholds**. The relay can be turned on if the input value is contained in **zone A** (“**modE**” = “**in**”) or **zone B** (“**modE**” = “**out**”) and turned off if it is contained in the second one (Figure 6.6).



The sequence of thresholds “**SEt P**” and “**SEt P2**” can be set in any order, due to the control of relay outputs is done depend on difference between thresholds values (**zone A**) and outside of threshold values (**zone B**).

7. DEVICE PROGRAMMING

The device menu allow user to set all parameters connected to operation of measurement input, control modes, critical situations behaviour, communication via RS-485 and access settings. The meaning of the particular parameters is described in paragraph **MENU DESCRIPTION**.

Some of the parameters can be accessed without menu entering (quick view mode). If current flow is displayed (LED named “**Σ**” is off) user can check main thresholds values. After pressing [**^**] or [**v**] button, name of the threshold (“**rELPr1**”, “**rELPr2**”, “**rELPr3**” or “**rELPr4**”) and his value will be displayed on the display in alternating mode. If [**^**] or [**v**] will be pressed in 5 sec again, the next threshold will be displayed, else the device comes back to the measurement mode. If a **free access** is enabled (parameter “**ACCESS**” = “**on**”), user can change the value of particular threshold pressing button [**ENTER**] (see: **PARAMETERS EDITION**).



If particular parameter has been changed and confirmed in quick view mode, its new value is displayed in alternating mode with parameter name by few seconds. Confirmed changes may be checked or user can switch viewed parameter pressing [**^**] or [**v**] button.

7.1. PROGRAMMING MENU

To enter main menu (being in the measurement mode) operator must to press and hold at least 2 sec. [**ESC/MENU**] button.

If the user password is defined (see parameter “**SEtcod**“, menu “**SECU**”), operator have to enter correct one before proceeding to menu options . Entering of the passwords is similar to the edition of numeric parameters (see: **PARAMETERS EDITION**), however presently editing digit is showed only on the display, other digits are replaced by “-” sign.

After entering of last digit of the password first menu position will be displayed (if the password is correct) or warning "Err" in other case.



Pay attention when device parameters are being changed. If it is possible, turn off controlled installation (machine).

Functions of the buttons while sub-menu and parameters choice:



Selection of sub-menu or parameter for editing. Name of selected item (sub-menu or parameter) is displayed.



Operation of **[ENTER]** button depend on present menu position:

- if the name of some sub-menu is displayed - enter this sub-menu; name of the first parameter (or next level sub-menu) is displayed,
- if the name of some parameter is displayed - enter the edition of this parameter; present value of the parameter is displayed,



[ESC/MENU] button allow user to exit present menu level and goes to upper level menu (or measurement mode).



After about 1 min. since last use of the buttons, device exits the menu mode and returns to the measurement mode (only if no parameters are in editing mode).

7.2. PARAMETERS EDITION

To start edition of any parameter user should select name of desired one using **[^]** **[v]** buttons and then **[ENTER]**.

7.2.1. Numeric parameters

Numeric parameters constitute a series of digits that form a number in decimal format. Entering a new parameter value consists of changing the values of selected digits within the allowable range (using the **[^]**, **[v]** keys).

7.2.2. Switch parameters ("LIST" type)

Switch parameters can be described as a sets of values (a lists) out of which only one of the options available on the list can be selected for the given parameter. Options of switching parameter are selected using **[^]**, **[v]** keys.

Functions of buttons when editing numeric and switching parameters:



Change of current (flashing) digit value while editing numeric parameter, or value of switch parameter.



If numerical parameter is being edited, a short press of **[ENTER]** button change edited position. A long press of **[ENTER]** button (at least 2 sec.) causes of display a **"SET?"** ask, which allow user to make sure if change of the parameter value is correct. If switch parameter is being edited, a short press of **[ENTER]** button causes of display a **"SET?"** ask. When **[ENTER]** button is pressed again (while **"SET?"** is displayed) the new value of the parameter is stored in EEPROM memory.



Pressing this button operator can cancel the changes done up to now (if they were not approved by **[ENTER]** button after the **"SET?"** ask) and come back to menu

7.3. MENU DESCRIPTION

"- - -"

Password checking. If any password different from **,0000** is set, than every enter to main menu follows the entering of password. If entered password is correct first menu position will be displayed else warning **"Err"**, and unit returns to measurement mode.



Due to on 7 segment display it is impossible to show all ASCII symbols, some of them are exchanged by special symbols. For example the letter "m" is displayed as "ṁ". Although special symbols are used by the device, normal letters are used in instruction to made its easier to read (example: **"modE"**).

7.3.1. "rELAy1" ÷ "rELAy4" menu

This menu contains options of configuration of operation of relays R1÷ R4. Principle of the relays operation is described in paragraph **CONTROL OF THE RELAY OUTPUTS**.



The relay output can be controlled by due to current flow rate, stored peak value, or total flow counter.

"vALUE"

- parameter defining kind of result using to control state of this relay.
It can be set to one of two values:

"Flo"

- relay is controlled due to current flow rate value or stored peak of flow rate (see "Hold" menu),

"tot"

- relay is controlled due to total counter result

"SEt P"

- first threshold of the relay (range 0 ÷ 999999). **Threshold is the medium value of relay hysteresis.**

“**SEt P2**” - second threshold of the relay (range 0 ÷ 999999). This threshold is accessible when “**modE**” parameter is set to „**in**” or „**out**” value. **Threshold is the medium value of relay hysteresis.**

“**HYSt**” - Hysteresis of relay (range 0 ÷ 99999). Full hysteresis of the relay is equal to 2x “**HYSt**” parameter. The relay state can change when an input signal is out of **threshold-hysteresis** to **threshold+hysteresis** zone.



Presented parameters should be set to ensure that **SEt P + HYSt**, **SEt P2 + HYSt**, **SEt P - HYSt** and **SEt P2 - HYSt** do not exceeds the measure range. Additionally, in two threshold mode (“**modE**”= „**in**” or „**out**”), the hysteresis for both thresholds must not cover each other (in other case relay can't change his state).

“**t Prec**” - decimal point position (displaying precision of the relay thresholds) when relay is controlled due to total flow counter result. It can be set to:

“ 0 ”

“ 0.0 ”

“ 0.00 ”

“0.000”

Decimal point position is changed by [^], [v] buttons.

“**t unit**” - the unit of relay thresholds and hysteresis when relay is controlled due to total flow counter result. It can be set to:

“**lit.**” - Litres

“**m 3**” - cubic meters



Parameters “**t PrEc**” and “**t unit**” are available only if total flow counter is used to control relay output (“**vALUE**” = “**tot**”). When current flow rate is used to control relays, the unit and precision of the thresholds and hysteresis are defined by parameters “**F unit**”, “**Ftunit**” and “**F PrEc**” of menu “**Flouu**”.

“**modE**” - relay operation mode:

“**noAct**” - the relay is not active (permanent turned off)

“**on**” - one threshold mode, the relay is turned **ON** when input signal exceeds **SEt P + HYSt** value, and is turned off back when the input signal became lower than **SEt P – HYSt**,

“**oFF**” - one threshold mode, the relay is turned **OFF** when input signal exceeds **SEt P + HYSt** value, and is turned on back when the input signal became lower than **SEt P – HYSt**,

“**in**” - two threshold mode, the relay is turned **ON** when the input signal is bigger than “**lower threshold + HYSt**” and lower than “**bigger threshold – HYSt**”, and turned off when the input signal is contained in the second zone. The **bigger threshold** means bigger one of “**SEt P**” and “**SEt P2**” thresholds, the **lower threshold** means lower one of “**SEt P**” and “**SEt P2**” thresholds.

“out” - two threshold mode, relay is turned **OFF** when the input value is bigger than **“bigger threshold + HYS”** and lower than **“lower threshold – HYS”**, and turned on when the input signal is contained in the second zone. The **“bigger threshold”** means bigger one of **“SEt P”** and **“SEt P2”** thresholds, the **“lower threshold”** means lower one of **“SEt P”** and **“SEt P2”** thresholds.

“modbus” - the relay is controlled via RS-485 interface, independently on the input signal.



- **LEDs light when relays are closed**, independently of relays' mode.
- When power supply decay, unit do not store relays state selected by RS 485 interface.

“t on” - turn on delay time, the relay is turned on with delay equal **“t on”** if the input value exceeds appropriate **border value** (defined with **threshold** and **hysteresis**), at least **“t on”** time. **“t on”** range 0 ÷ 99.9, defined with 0.1 sec. resolution. Unit of this parameter is set by **“unit”** parameter.

“t off” - turn off delay time, the relay is turned off with delay equal **“t off”** if the input value exceeds appropriate **border value** (defined with **threshold** and **hysteresis**), at least **“t off”** time. **“t off”** range 0 ÷ 99.9, defined with 0.1 sec. resolution. Unit of this parameter is set by **“unit”** parameter.



If time when the input signal exceeds some border value is shorter than **“t on”** or **“t off”** time, the relay do not change his state (see paragraph: **CONTROL OF THE RELAY OUTPUTS**).

“unit” - unit of time for **“t on”** i **“t off”** parameters. Can be set on one of two values:

“min” - minutes,
“SEC” - seconds.

“ALArMS” - This parameter defines the relay reaction when some critical situations occurs:

“noCHAn” - relay do not change his state,
“on” - relay will be turned on,
“oFF” - relay will be turned off.

If parameter **“modE”** is set to **“on”**, **“oFF”**, **“in”** or **“Out”**, the “critical situation” means that **permissible input frequency** is exceeded.

If parameter **“modE”** is set to **“modbus”**, the “critical situation” means communication delay (when no data is received) longer than **“mbtime”** parameter (see description: **“rS-485” menu**).



- If option “**noCHAN**” is selected for “**ALArMS**” parameter, behaviour of the relay may depend on “**vALuE**” parameter in “**FiLTeR**” menu in some cases. If “**vALuE**” is set to big value and the input signal drops, result value of the measure will change slow, causes of turning on or off relay due to thresholds values. The critical situation is slowly detected, so it is not possible to predict the relay state in that situations.
- If parameter „**ALArMS**” = „**on**”, the relay will be turned on in the critical situations, even if his parameter “**modE**” = “**noAct**”.

7.3.2. “bEEP” menu

This menu contains options connected with acoustic signal :

- "AL"** - if this parameter is set to “**on**”, any critical situation causes by acoustic signal
- "r1"** - if this parameter is set to “**on**”, activation of relay **R1** causes by acoustic signal
- "r2"** - if this parameter is set to “**on**”, activation of relay **R2** causes by acoustic signal
- "r3"** - if this parameter is set to “**on**”, activation of relay **R3** causes by acoustic signal
- "r4"** - if this parameter is set to “**on**”, activation of relay **R4** causes by acoustic signal



Acoustic signal (turned on by e.g. relay) can be turned off by pressing of any button

7.3.3. “inPUt” menu

This menu contains options related to measurement input parameters:

- “PuISEL”** - flow factor (quantity of pulses per litre). This parameter can be set in range 0.00 - 9999.99 pulses/litre.

Value 0,00 is interpreted as 10 000.00 pulses/litre.



Proper settings of this parameter is essential to device's operation.

- “FrEq”** - maximum input frequency. This parameter is expressed in Hz. Available values are showed in Tab.7.1.

Every value of “**FrEq**” has it's own minimum time period between low and high levels on the input. If particular level is present shorter than related time from Tab.7.1, then incoming pulse is recognized as noise (bouncing) and ignored.

Parameter "FrEq" (Hz)	Minimum time of low and high level	Acceptable duty cycle for max. frequency
„10”	5 ms	5%-95%
„15”	3,4 ms	5%-95%
„20”	2,5 ms	5%-95%
„30”	1,7 ms	5%-95%
„40”	1,3 ms	5%-95%
„50”	1 ms	5%-95%
„100”	500 μ s	5%-95%
„300”	167 μ s	5%-95%
„1 000”	50 μ s	5%-95%
„3 000”	33 μ s	10%-90%
„10 000”	33 μ s	33%-66%

Tab.7.1. Available settings of „FrEq” parameter, and related minimum duration of low and high levels

“**Zero t**” - maximum time between two following pulses. This parameter is defined with precision of 0.1 sec. in range 0 ÷ 39.9 sec. If time between two following pulses is exceeds this parameter, than device displays zero (no flow).

If parameter “**Zero t**” is set to value smaller than value of parameter “**mEAS t**”, as maximum time between two following pulses parameter “**mEAS t**” is used.

“**mEAS t**” - minimum width of *measurement window*. *Measurement window* means time while input pulses are counted, and after that recalculated to desired unit and displayed. This parameter is set with precision of 0.1 sec. and its range 0 ÷ 19.9).



If time periods between following pulses are higher than parameter “**mEAS t**” **then** width of *measurement window* is automatically adapted to input frequency.

7.3.4. "FLou" menu

This menu presets the measurement input and allows configuration of current flow rate displaying mode:

"F PrEc" - decimal point position (precision of flow rate displaying). It can be set to:

" 0"
" 0.0"
" 0.00"
" 0.000"
" 0.0000"
"0.00000"

Decimal point position is changed by [^], [v] buttons.



Change of displaying precision can require appropriate correction of relays thresholds and hysteresis. These parameters **are not** updated automatically, due to settings of "F PrEc" parameter.

"F unit" - the unit of volume (cubic measure) used for flow rate displaying . It can be set to: ("lit." - litres, or "m 3" - cubic meters). Units expressed by "F unit" and "t unit" are conventional, and can be exchanged to any other pair of units e.g. for powders it can be **kilogram** and **tonne**.

"Ftunit" - time unit used for flow rate displaying .It can be set to: ("SEC" - seconds, "min" - minutes or "hour" - hours).



The unit used to displaying the flow rate, depend on parameters "F unit" and "Ftunit" simultaneously, for example: L/min or m³/h etc.

7.3.5. "totAL" menu

This menu allows to configure total flow counter displaying mode.

"t PrEc" - decimal point position (precision of total flow counter). It can be set to:

" 0"
" 0.0"
" 0.00"
"0.000"

Decimal point position is changed by [^], [v] buttons.

"t unit" - the unit of volume (cubic measure) used for total flow counter displaying . It can be set to: ("lit." - litres, or "m 3" - cubic meters). Units expressed by "F unit" and "t unit" are conventional, and can be exchanged to any other pair of units e.g. for powders it can be **kilogram** and **tonne**.

“Clrtot” - this option allows zeroing of total flow counter. After selection of this option ask **“CLEAR?”** is displayed. If user press **[ENTER]** total flow counter is cleared, else action is cancelled
Zeroing of **total flow counter** is possible via RS-485 interface too. It can be done as write of 0000h to any one of registers referred to **total flow counter** (09h ÷ 0Ch) using RS 485 interface.



To protect total flow counter of unauthorised zeroing, it is recommended to set password to menu access (see menu **“SECU”**).

“E Clr” - this option allows selection of active level/edge of total flow zeroing input (see Figure 4.5). It can be set to one if following:

- “oFF”** - input disabled,
- “HI”** - zeroing while high level on the input
- “LO”** - zeroing while low level on the input
- “LO-HI”** - zeroing while rising edge on the input
- “HI-LO”** - zeroing while falling edge on the input



For settings “zeroing while high/low level” the selected level must be longer than 5ms.

7.3.6. “Init d” parameter

This Parameter defines type of the value displayed after power on the meter. It is possible to set it to:

- “Flo”** - current flow rate (instantaneous flow),
- “tot”**- lowest part of total flow counter (less significant digits),
- “tot2”** - medium part of total flow counter,
- “tot3”** -highest part of total flow counter (most significant digits),



If value **“tot2”** or **“tot3”** is selected, meter automatically switches display to non-zero part of total counter result. Flashing (or not, if result is shorter than 6 digits) decimal points indicates which one part is actually displayed.

7.3.7. “FILtEr” menu

This menu contains parameters referred to additional data (result) filtration.

“vALUE” - this parameter sets filtration rate. It can be set to values from 0 (no filtration) to 5 (strongest filtration – time window about 3.5 sec.).

“droP” - this parameter defines minimum percentage change of measured value which turns off (temporally) data filtration. Value of this parameter can be changed in range: 0 ÷ 199,9%. Main purpose of this parameter is acceleration of displaying data changes, when sudden changes of instantaneous measurements value occur (while parameter **“vALUE”** is set to high values).

7.3.8. "OUTPUT" menu

This menu contains parameters of current output control. Menu is available if the device is equipped with current output.

"**OUTmod**" - current output mode, can be set to values:

- "**oFF**" - current output disabled,
- "**0-20**" - current output enabled with 0 ÷ 20 mA mode,
- "**4-20**" - current output enabled with 4 ÷ 20 mA mode,
- "**modbus**" - current output controlled via RS-485 interface.

"**VALUE**" - this parameter defines kind of active current output controlling parameter, and can be set to one of two values:

"**Flo**" - active current output is controlled due to instantaneous flow (flow rate).

"**tot**" - active current output is controlled due to total flow counter result.

"**OUT LO**" - this parameter determines the input value for which the output current is minimal (0 mA or 4 mA depend of current output mode).

"**OUT HI**" - this parameter determines the input value for which the output current is equal 20mA.

The output current value is calculated due to formulas given below:

$$I_{out} = \frac{W - "OUt LO"}{"OUt HI" - "OUt LO"} \times 16 mA + 4 mA \quad \text{for output range } 4 \div 20 mA$$

$$I_{out} = \frac{W - "OUt LO"}{"OUt HI" - "OUt LO"} \times 20 mA \quad \text{for output range } 0 \div 20 mA$$

where "**W**" denotes the displayed value (measurement or peak value).



"**Out LO**" parameter can be greater than "**Out HI**". In this case the conversion characteristic is reversed, it means that if input value raises the output current falls.

"**t Prec**" - decimal point position (displaying precision of parameters "**Out LO**" and "**Out HI**") when active current output is controlled due to total flow counter result. It can be set to:

- " **0** "
- " **0.0** "
- " **0.00** "
- " **0.000** "

Decimal point position is changed by [**^**], [**v**] buttons.

"t unit" - the unit of parameters **"OUT LO"** and **"OUT HI"**, while active current output is controlled due to total flow counter result. It can be set to one of two values:

"lit." - Litres

"m³" - cubical meters



Parameters **"t PrEc"** and **"t unit"** are available only if total flow counter is used to control active current output (**"VALUE"** = **"tot"**). When current flow rate is used to control it, the unit and precision of **"OUT LO"** and **"OUT HI"** parameters are defined by parameters **"F unit"**, **"Ftunit"** and **"F PrEc"** of menu **"Flouu"**.

"Lo r", **"Hi r"** - this parameters define the output current range (maximum range 0 to 24 mA). If calculated output value I_{out} exceeds defined range then current output generates the current equal to upper or lower border of the defined range. The parameters define the percentage extension of nominal current range 4-20 mA (with 0,1% resolution).

Parameter **"Lo r"** defines lower border of the range due to formula:

$$I_{min} = 4 \text{ mA} - 4 \text{ mA} \times \text{"Lo r"} \%$$

This parameter can be set from 0 to 99.9%.

Parameter **"Hi r"** defines lower border of the range due to formula:

$$I_{max} = 20 \text{ mA} + 20 \text{ mA} \times \text{"Hi r"} \%$$

This parameter can be set from 0 to 19.9%.

The procedure of the current outputs determining is presented in details at page 37.

"AL" - This parameter determines the behaviour of current output if any critical situation occurs. The parameter can be set to one of the values:

- "noCHAn"** - current will not change,
- "22.1"** - current will be set to 22.1 mA,
- "3.4"** - current will be set to 3.4 mA,
- "0.0"** - current will be set to 0 mA,

When the critical situation goes, the current will be set to value calculated due to formulas given above.

If parameter **"OUTmod"** is set to **"on"**, **"oFF"**, **"0-20"** or **"4-20"**, the "critical situation" means that **permissible measurement range** is exceeded.

If parameter **"OUTmod"** is set to **"modbuS"**, the "critical situation" means communication delay (when no data is received) longer than **"mbtime"** parameter (see description: **"rS-485" menu**).

7.3.9. "briGHt" parameter

This parameter allows user to set bright of the LED display, bright can be set to conventional values from 1 to 8.

7.3.10. "HOLd" menu

This menu contains parameters connected with peak detection function. See also full description of the peak detection function in paragraph: **DETECTION OF THE PEAK VALUES**

"modE" - the type of detected changes of the input signal, can be set to values

"norm" - peaks, peak and next drop of the input signal of value equal at least **"PEA"**,
"inv" - drops, drop and next peak of the input signal of value equal at least **"PEA"**,

"PEA" - minimal detected signal change classified as peak or drop (see Figure 6.2),

"timE" - maximum time of displaying of the peak (drop) value, can be set from 1 to 19.9 sec., with 0.1 sec. resolution

"HdiS" - type of displayed values:

"rEAL" - current value is displayed,
"HOLd" - peak (drop) value is displayed,

"H r1" ... "H r4" - relay outputs operation mode:

"rEAL" - relay operates depend on the current value,
"HOLd" - relay operates depend on the peak (drop) value,

"HOUT" - current output operation mode:

"rEAL" - current output operates depend on the current value,
"HOLd" - current output operates depend on the peak (drop) value,

7.3.11. "SECu" menu

This menu contains presets connected with availability of other parameters :

"AccESS" - this option permits user ("**on**") or prohibits ("**off**") to modify the thresholds of the relays without knowledge about user password (see: **MEASUREMENT MODE**).

"SEtcod" - user password (4-digits number). If this parameter is set at value **"0000"**, user password is turned off.

If the user do not remember his password, the access to the menu is possible by the "one-use password". To get this password please contact witch Marketing Division. Please set new user password immediately after use of the "one-use password" - see "SEtcod" parameter.



The “one-use password” can be used one time only, it is impossible to use it again! The “one-use password” can be restored by Service Division only.

7.3.12. “rS-485” menu

This menu is connected with RS-485 interface, and sets his properties:

- “Addr”** - this parameter defines the address of the device, accordingly to Modbus protocol. It can be set in range from 0 to 199. If the value 0 is set then device, responds to frames with address 255 (FFh).
- “bAud”** - this parameter determines RS-485 interface baud rate in bit/s. It can be set to one of 8 possible values: **“1200”**, **“2400”**, **“4800”**, **“9600”**, **“19200”**, **“38400”**, **“57600”**, **“115200”**.
- “mbAccE”** - this parameter sets the access to the configuration registers of the device. Possible values:
- “on”**- configuration registers can be set via RS-485 interface,
 - “off”** - configuration registers can not be set via RS-485 interface.



The access to registers no 05h i 06h cant be denied by **“mbAccE”** parameter (see: **LIST OF REGISTERS**).

- “mbtimeE”**- this parameter defines maximal time (sec) between following frames received by the device. If the delay will be greater than the value of **“mbtimeE”** parameter, the relays and current output which are controlled via RS-485 interface, will set to alert state (see **“ALArmS”** parameter in **“rELAy1”**-**“rELAy4”** and **“OUtPUt”** menu description). Parameter **“mbtimeE”** can be set to values from 0 to 99 seconds. The value 0 means that the time will be not controlled.
- “rESP”** - this parameter defines minimal (additional) delay between the Modbus message and the answer of the device (received and sent via RS-485 interface). This additional delay allows the device to work with poor RS-converters which do not works properly on baud rates higher than 19200. This parameter can be set to one of values:

- “Std”** - answer as quick as possible, no additional delay
 - “ 10c”**
 - “ 20c”**
 - “ 50c”**
 - “100c”**
 - “200c”**
- } - answer delayed of 10, 20, 50, 100 of 200 chars respectively, where one character time depends on selected baud rate



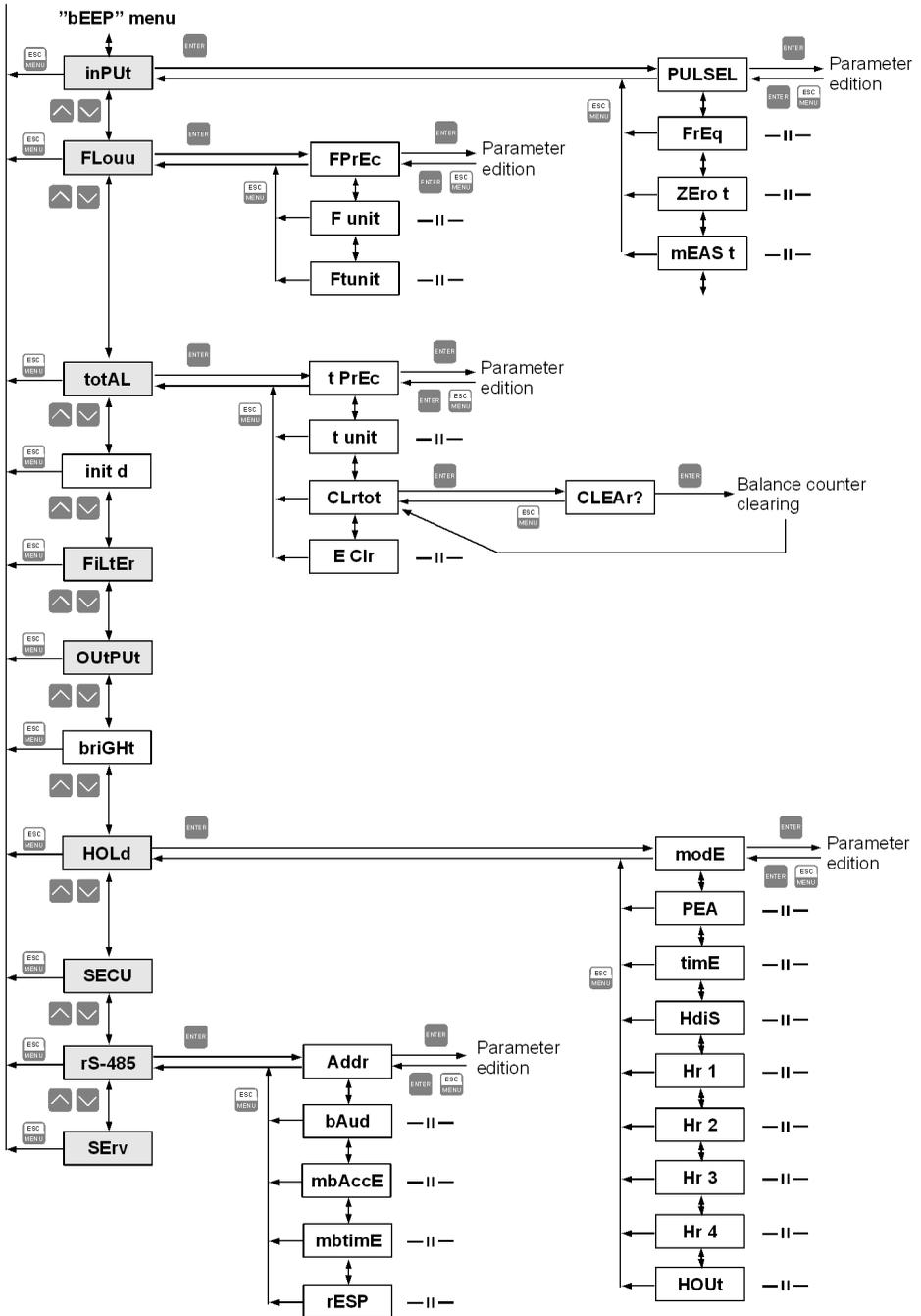
In the most cases parameter **“rESP”** should be set to **“Std”** (no additional delay). Unfortunately for some third party RS-converters **“rESP”** should be adjusted experimentally. Table below contains most frequently used values.

"bAud" parameter	"rESP" parameter
"38.4"	" 10c"
"57.6"	" 20c"
"115.2"	" 50c"

Tab.7.2. Settings of "rESP" parameter

7.3.13. "SErv" menu

This menu contains the parameters for authorized service only. To enter this menu proper service password must be entered. Improper settings can causes of damage of the device.



8. CURRENT OUTPUT VALUE CALCULATION

Let the current output parameters be:

“**OUTmod**” = “on”, “**OUT LO**” = 100, “**OUT HI**” = 200, “**Lo r**” = 5.0, “**Hi r**” = 5.0
Parameters “**Lo r**” and “**Hi r**” define working range of current output to 3,8 ÷ 21 mA.
Output current will be calculated for three displayed values „**D**”:

a) **D** = 175

According to formula from page 30:

$$I_{out} = (175-100) / (200-100) \times 16 \text{ mA} + 4 \text{ mA} = 0,75 \cdot 16 + 4 = 16 \text{ mA}$$

Calculated I_{out} do not exceeds the output working range (3 - 21 mA).

b) **D** = 205

According to formula from page 30:

$$I_{out} = (205-100) / (200-100) \times 16 \text{ mA} + 4 \text{ mA} = 1,05 \times 16 + 4 = 20,08 \text{ mA}$$

Calculated I_{out} do not exceeds the output working range (3 - 21 mA).

c) **D** = 300

According to formula from page 30:

$$I_{out} = (300-100) / (200-100) \times 16 \text{ mA} + 4 \text{ mA} = 2 \times 16 + 4 = 36 \text{ mA}.$$

Calculated I_{out} exceeds the output working range (3 - 21 mA), so current output will generate current equal to the upper border of range defined by parameter “**Lo r**” i “**Hi r**” (it means 21 mA).

9. THE MODBUS PROTOCOL HANDLING

Transmission parameters: 1 start bit, 8 data bits, 1 stop bit, no parity control

Baud rate: selectable from: 1200 to 115200 bits/second

Transmission protocol: MODBUS RTU compatible

The device parameters and measurement result are available via RS-485 interface, as HOLDING-type registers of Modbus RTU protocol. The registers (or groups of the registers) can be read by 03h function, and wrote by 06h (single registers) or 10h (group of the registers) accordingly to Modbus RTU specification. Maximum group size for 03h and 10h functions can not exceeds 5 registers (for single frame).

The device interprets the broadcast messages, but then do not sends the answers.

9.1. LIST OF REGISTERS

Some parameters are located on two registers (higher word in first register, and lower word in next one). After writing of one of them device controls result of their 32-bit value, and if it is necessary corrects value of second register automatically. If appropriate modification is impossible, both registers stay unaffected and device responds with error code 03h. (see: **TRANSMISSION ERRORS DESCRIPTION**).

Register	Write	Range	Register description
01h ¹ 02h ¹	No	0 ÷ 999999	Current measurement value (no decimal point)
03h	No	0h, 20h, A0h,	The status of the current measurement; 0h - data valid; 20h – device wait for first pulse; A0h – alarm state, input signal exceeds maximum frequency
04h	Yes	0 ÷ 5	“ F PrEc ” parameter in “ FLouu ” menu (precision of flow rate displaying). Identical as reg. 12h
05h	Yes	0 ÷ 31	State of the relays and alarm LED (binary format) (1 - on, 0 - off): 00000000 000edcba a - relay R1; b - relay R2; c - relay R3; d - relay R4; e - alarm state indicator; If written, only a , b , c , d bits are important (others are ignored) these bits allows user to control the relays via RS-485 interface
06h ²	Yes	0h ÷ 1800h	State of current output, expressed in 1/256 mA units – it means that high byte express integer part, and low byte fractional part of desired output current.
07h ¹ 08h ¹	No	0 ÷ 999999	Current peak (drop) value (no decimal point)
09h ¹ 0Ah ¹	No	0÷999999999	Total flow counter result - quantity of m ³
0Bh ¹	No	0÷999	Total flow counter result - quantity of l
0Ch ¹	No	0÷999	Total flow counter result - quantity of ml
10h	Yes	0 ÷ 10	“ FrEq ” parameter in “ inPUt ” menu (input filter): 0 - 10Hz; 1 - 15Hz; 2 - 20Hz; 3 - 30Hz; 4 - 40Hz; 5 - 50Hz; 6 - 100Hz; 7 - 300Hz; 8 - 1kHz; 9 - 3kHz; 10 - 10kHz
12h	Yes	0 ÷ 5	“ F PrEc ” parameter in “ FLouu ” menu (precision of flow rate displaying): 0 - “ 0 ”; 1 - “ 0.0 ”; 2 - “ 0.00 ”; 3 - “ 0.000 ”; 4 - “0.0000”; 5 - “0.00000”;
13h	Yes	0 ÷ 2	“ Ftunit ” parameter in “ FLouu ” menu (the unit of time while flow rate displaying): 0 - SEC; 1 - min; 2 - hour;
14h	Yes	0 ÷ 1	“ F unit ” parameter in “ FLouu ” menu (the unit of volume while flow rate displaying): 0 - lit.; 1 - m ³ ;
16h 17h	Yes	0 ÷ 999999	“ PULSEl ” parameter in “ inPUt ” menu, flow sensor factor (quantity of pulses per litre) expressed in 0.01 pulses/lighter. Value 0 is interpreted as 10 000.00 pulses/litre
18h	Yes	0 ÷ 399	“ ZErO t ” parameter in “ inPUt ” menu, expressed in tenth of seconds
19h	Yes	0 ÷ 199	“ mEAS t ” parameter in “ inPUt ” menu, expressed in tenth of seconds
1Ah	Yes	0 ÷ 5	“ VALUE ” parameter in “ FilTEr ” menu (measurement filtering rate)
1Bh	Yes	0 ÷ 1999	“ droP ” parameter in “ FilTEr ” menu, in 0,1%
1Ch	Yes	0 ÷ 1	“ t unit ” parameter in “ totAl ” menu (the unit of volume while total flow counter result displaying): 0 - lit.; 1 - m ³ ;

Register	Write	Range	Register description
1Dh	Yes	0 ÷ 3	“ t PrEc ” parameter in “ totAL ” (precision of of total flow counter result displaying): 0 - “0”; 1 - “0.0”; 2 - “0.00”; 3 - “0.000”
1Eh	Yes	0 ÷ 4	“ E clr ” parameter in “ totAL ” menu (active level/edge of total flow zeroing input): 0 - “oFF”; 1 - “HI”; 2 - “LO”; 3 - “LO-HI”; 4 - “HI-LO”
1Fh	Yes	0 ÷ 3	“ init d ” parameter (kind of value displayed after power on): 0 - “FLo”; 1 - “tot”; 2 - “tot2”; 3 - “tot3”
20h ³	Yes	0 ÷ 199	Device address
21h	No	2083h	Device identification code (ID)
22h ⁴	Yes	0 ÷ 7	“ bAud ” parameter in “ rS-485 ” menu (baud rate); 0 - 1200 baud; 1 - 2400 baud; 2 - 4800 baud; 3 - 9600 baud; 4 - 19200 baud; 5 - 38400 baud; 6 - 57600 baud; 7 - 115200 baud
23h ⁵	Yes	0 ÷ 1	“ mbAccE ” parameter in “ rS-485 ” menu (permission to write registers via RS-485 interface); 0 - write denied ; 1 - write allowed
24h	Yes	0 ÷ 1	“ AccESS ” parameter in “ SECU ” menu (permission to change of the thresholds without knowledge of the user password); 0 - changes denied; 1 - changes allowed
25h	Yes	0 ÷ 5	“ rESP ” parameter in “ rS-485 ” menu (additional response delay); 0 - no additional delay; 1 - “ 10c ” option; 2 - “ 20c ” option; 3 - “ 50c ” option; 4 - “ 100c ” option; 5 - “ 200c ” option;
27h	Yes	0 ÷ 99	“ mbtime ” parameter in “ rS-485 ” menu (maximum delay between received frames); 0 - no delay checking; 1 ÷ 99 - maximum delay expressed in seconds
28h	Yes	0 ÷ 1	“ AL ” parameter in “ bEEP ” menu: 0 - off; 1 - on
29h	Yes	0 ÷ 1	“ R1 ” parameter in “ bEEP ” menu: 0 - off; 1 - on
2Ah	Yes	0 ÷ 1	“ R2 ” parameter in “ bEEP ” menu: 0 - off; 1 - on
2Bh	Yes	0 ÷ 1	“ R3 ” parameter in “ bEEP ” menu: 0 - off; 1 - on
2Ch	Yes	0 ÷ 1	“ R4 ” parameter in “ bEEP ” menu: 0 - off; 1 - on
2Dh	Yes	1 ÷ 8	“ brighT ” parameter (display brightness); 1 - the lowest brightness; 8 - the highest brightness
Parameters of relay R1 operation			
30h 31h	Yes	0 ÷ 999999	“ SEt P ” parameter in “ rELAy1 ” menu, no decimal point included
32h 33h	Yes	0 ÷ 999999	“ HySt ” parameter in “ rELAy1 ” menu, no decimal point included
34h	Yes	0 ÷ 5	“ modE ” parameter in “ rELAy1 ” menu (operation mode of relay) 0 - no active; 1 - “ on ” mode; 2 - “ oFF ” mode; 3 - “ in ” mode; 4 - “ out ” mode; 5 - the relay controlled via RS-485 interface
35h	Yes	0 ÷ 999	“ t on ” parameter in “ rELAy1 ” menu, expressed in tenth of seconds or tenth of minutes depend on “ unit ” parameter in “ rELAy1 ” menu)

Register	Write	Range	Register description
36h	Yes	0 ÷ 999	“ t oFF ” parameter in “ rELAy1 ” menu, expressed in tenth of seconds or tenth of minutes depend on “ unit ” parameter in “ rELAy1 ” menu)
37h	Yes	0 ÷ 1	“ unit ” parameter in “ rELAy1 ” menu (the time unit of relay); 0 - seconds; 1 - minutes
38h	Yes	0 ÷ 2	“ ALArMS ” parameter in “ rELAy1 ” menu (the state of relay, while critical situation occurs); 0 - no changes; 1 - on; 2 - off
39h 3Ah	Yes	0 ÷ 999999	“ SEt P2 ” parameter in “ rELAy1 ” menu, no decimal point included
3Bh	Yes	0 ÷ 1	“ VALUE ” parameter in “ rELAy1 ” menu (kind of value controlled relay): 0 - “Flo”; 1 - “tot”;
3Ch	Yes	0 ÷ 3	“ t PrEc ” parameter in “ rELAy1 ” menu (precision of thresholds and hysteresis while relay is controlled due to total flow counter value): 0 - “0”; 1 - “0.0”; 2 - “0.00”; 3 - “0.000”
3Dh	Yes	0 ÷ 1	“ t unit ” parameter in “ rELAy1 ” menu (the unit of thresholds and hysteresis while relay is controlled due to total flow counter value): 0 - lit.; 1 - m ³ ;
Parameters of relay R2 operation			
40h 41h	Yes	0 ÷ 999999	“ SEt P ” parameter in “ rELAy2 ” menu, no decimal point included
42h 43h	Yes	0 ÷ 999999	“ HySt ” parameter in “ rELAy2 ” menu, no decimal point included
44h	Yes	0 ÷ 5	“ modE ” parameter in “ rELAy2 ” menu (operation mode of relay) 0 - no active; 1 - “on” mode; 2 - “oFF” mode; 3 - “in” mode; 4 - “out” mode; 5 - the relay controlled via RS-485 interface
45h	Yes	0 ÷ 999	“ t on ” parameter in “ rELAy2 ” menu, expressed in tenth of seconds or tenth of minutes depend on “ unit ” parameter in “ rELAy2 ” menu)
46h	Yes	0 ÷ 999	“ t oFF ” parameter in “ rELAy2 ” menu, expressed in tenth of seconds or tenth of minutes depend on “ unit ” parameter in “ rELAy2 ” menu)
47h	Yes	0 ÷ 1	“ unit ” parameter in “ rELAy2 ” menu (the time unit of relay); 0 - seconds; 1 - minutes
48h	Yes	0 ÷ 2	“ ALArMS ” parameter in “ rELAy2 ” menu (the state of relay, while critical situation occurs); 0 - no changes; 1 - on; 2 - off
49h 4Ah	Yes	0 ÷ 999999	“ SEt P2 ” parameter in “ rELAy2 ” menu, no decimal point included
4Bh	Yes	0 ÷ 1	“ VALUE ” parameter in “ rELAy2 ” menu (kind of value controlled relay): 0 - “Flo”; 1 - “tot”;
4Ch	Yes	0 ÷ 3	“ t PrEc ” parameter in “ rELAy2 ” menu (precision of thresholds and hysteresis while relay is controlled due to total flow counter value): 0 - “0”; 1 - “0.0”; 2 - “0.00”; 3 - “0.000”

Register	Write	Range	Register description
4Dh	Yes	0 ÷ 1	" t unit " parameter in " rELAy2 " menu (the unit of thresholds and hysteresis while relay is controlled due to total flow counter value): 0 - lit.; 1 - m ³ ;
Parameters of relay R3 operation			
50h 51h	Yes	0 ÷ 999999	" SEt P " parameter in " rELAy3 " menu, no decimal point included
52h 53h	Yes	0 ÷ 999999	" HySt " parameter in " rELAy3 " menu, no decimal point included
54h	Yes	0 ÷ 5	" modE " parameter in " rELAy3 " menu (operation mode of relay) 0 - no active; 1 - " on " mode; 2 - " oFF " mode; 3 - " in " mode; 4 - " out " mode; 5 - the relay controlled via RS-485 interface
55h	Yes	0 ÷ 999	" t on " parameter in " rELAy3 " menu, expressed in tenth of seconds or tenth of minutes depend on " unit " parameter in " rELAy3 " menu)
56h	Yes	0 ÷ 999	" t oFF " parameter in " rELAy3 " menu, expressed in tenth of seconds or tenth of minutes depend on " unit " parameter in " rELAy3 " menu)
57h	Yes	0 ÷ 1	" unit " parameter in " rELAy3 " menu (the time unit of relay); 0 - seconds; 1 - minutes
58h	Yes	0 ÷ 2	" ALArMS " parameter in " rELAy3 " menu (the state of relay, while critical situation occurs); 0 - no changes; 1 - on; 2 - off
59h 5Ah	Yes	0 ÷ 999999	" SEt P2 " parameter in " rELAy3 " menu, no decimal point included
5Bh	Yes	0 ÷ 1	" vALUE " parameter in " rELAy3 " menu (kind of value controlled relay): 0 - "FLO"; 1 - "tot";
5Ch	Yes	0 ÷ 3	" t PrEc " parameter in " rELAy3 " menu (precision of thresholds and hysteresis while relay is controlled due to total flow counter value): 0 - "0"; 1 - "0.0"; 2 - "0.00"; 3 - "0.000"
5Dh	Yes	0 ÷ 1	" t unit " parameter in " rELAy3 " menu (the unit of thresholds and hysteresis while relay is controlled due to total flow counter value): 0 - lit.; 1 - m ³ ;
Parameters of relay R4 operation			
60h 61h	Yes	0 ÷ 999999	" SEt P " parameter in " rELAy4 " menu, no decimal point included
62h 63h	Yes	0 ÷ 999999	" HySt " parameter in " rELAy4 " menu, no decimal point included
64h	Yes	0 ÷ 5	" modE " parameter in " rELAy4 " menu (operation mode of relay) 0 - no active; 1 - " on " mode; 2 - " oFF " mode; 3 - " in " mode; 4 - " out " mode; 5 - the relay controlled via RS-485 interface
65h	Yes	0 ÷ 999	" t on " parameter in " rELAy4 " menu, expressed in tenth of seconds or tenth of minutes depend on " unit " parameter in " rELAy4 " menu)

Register	Write	Range	Register description
66h	Yes	0 ÷ 999	“ t oFF ” parameter in “ rELAy4 ” menu, expressed in tenth of seconds or tenth of minutes depend on “ unit ” parameter in “ rELAy4 ” menu)
67h	Yes	0 ÷ 1	“ unit ” parameter in “ rELAy4 ” menu (the time unit of relay); 0 - seconds; 1 - minutes
68h	Yes	0 ÷ 2	“ ALArMS ” parameter in “ rELAy4 ” menu (the state of relay, while critical situation occurs); 0 - no changes; 1 - on; 2 - off
69h 6Ah	Yes	0 ÷ 999999	“ SEt P2 ” parameter in “ rELAy4 ” menu, no decimal point included
6Bh	Yes	0 ÷ 1	“ vALUE ” parameter in “ rELAy4 ” menu (kind of value controlled relay): 0 - “FLo”; 1 - “tot”;
6Ch	Yes	0 ÷ 3	“ t PrEc ” parameter in “ rELAy4 ” menu (precision of thresholds and hysteresis while relay is controlled due to total flow counter value): 0 - “0”; 1 - “0.0”; 2 - “0.00”; 3 - “0.000”
6Dh	Yes	0 ÷ 1	“ t unit ” parameter in “ rELAy4 ” menu (the unit of thresholds and hysteresis while relay is controlled due to total flow counter value): 0 - lit.; 1 - m ³ ;
70h	Yes	0 ÷ 1	“ modE ” parameter in “ HOLd ” menu (type of detected changes): 0 - peaks; 1 - drops
71h	Yes	0 ÷ 9999	“ PEA ” parameter in “ HOLd ” menu (minimum detectable change, no decimal point included)
72h	Yes	1 ÷ 199	“ timE ” parameter in “ HOLd ” menu, maximum peaks' (or drops') display time expressed in seconds
73h	Yes	0 ÷ 1	“ HdiS ” parameter in “ HOLd ” menu (the type of values displayed on the display): 0 - current measurement value; 1 - peaks (or drops) values
74h	Yes	0 ÷ 1	“ H r1 ” parameter in “ HOLd ” menu (the control mode of relay R1 and LED R1) : 0 - control depends on current measurement values; 1 - control depends on peaks (or drops) values;
75h	Yes	0 ÷ 1	“ H r2 ” parameter in “ HOLd ” menu (the control mode of relay R2 and LED R2) : 0 - control depends on current measurement values; 1 - control depends on peaks (or drops) values;
76h	Yes	0 ÷ 1	“ H r3 ” parameter in “ HOLd ” menu (the control mode of relay R3 and LED R3) : 0 - control depends on current measurement values; 1 - control depends on peaks (or drops) values;
77h	Yes	0 ÷ 1	“ H r4 ” parameter in “ HOLd ” menu (the control mode of relay R4 and LED R4) : 0 - control depends on current measurement values; 1 - control depends on peaks (or drops) values;

Register	Write	Range	Register description
78h	Yes	0 ÷ 1	“ HOUT ” parameter in “ HOLd ” menu (the control mode of current output): 0 - control depends on current measurement values; 1 - control depends on peaks (or drops) values;
A0h ²	Yes	0 ÷ 2	“ OUTmod ” parameter in “ OUTPUT ” menu (current output mode) 0 - current output disabled; 1 - current output enabled with 0÷20mA mode; 2 - current output enabled with 4÷20mA mode; 3 - current output controlled via RS-485 interface
A1h ² A2h ²	Yes	0 ÷ 999999	“ OUT LO ” parameter in “ OUTPUT ” menu, no decimal point included
A3h ² A4h ²	Yes	0 ÷ 999999	“ OUT HI ” parameter in “ OUTPUT ” menu, no decimal point included
A5h ²	Yes	0 ÷ 499	“ Lo r ” parameter in “ OUTPUT ” menu, expressed in 0,1%
A6h ²	Yes	0 ÷ 99	“ Hi r ” parameter in “ OUTPUT ” menu, expressed in 0,1%
A7h ²	Yes	0 ÷ 3	“ AL ” parameter in “ OUTPUT ” menu (current output value on critical exception): 0 - no change; 1 - 22,1 mA; 2 - 3,4 mA; 3 - 0 mA
A8h ²	Yes	0 ÷ 1	“ vALUE ” parameter in “ OUTPUT ” menu (kind of value controlled active current output): 0 - “FLo”; 1 - “tot”;
A9h ²	Yes	0 ÷ 3	“ t PrEc ” parameter in “ OUTPUT ” menu (precision of “ OUT LO ” and “ OUT HI ” parameters displaying, while active current output is controlled due to total flow counter value): 0 - “0”; 1 - “0.0”; 2 - “0.00”; 3 - “0.000”
AAh ²	Yes	0 ÷ 1	“ t unit ” parameter in “ OUTPUT ” menu (the unit of “ OUT LO ” and “ OUT HI ” parameters displaying, while active current output is controlled due to total flow counter value): 0 - lit.; 1 - m ³ ;

- 1 - it is recommended to read these registers simultaneously – (1,2) and (7,8) in 2-registers frames, and registers (9,A,B,C) in 4-registers frames.
If single registers are read, data errors are possible because of changes of read value between successive registers readings. Zeroing of total flow counter is possible by preset of 0000h to any one of it's registers (09h + 0Ch).
- 2 - these registers are active only if device is equipped with active current output
- 3 - after writing to register no 20h the device responds with an “old” address in the message.
- 4 - after writing to register no 22h the device responds with the new baud rate.
- 5 - the value of the “**mbAccE**” parameter is also connected to write to this register, so it is possible to block a writes, but impossible to unblock writes via RS-485 interface, The unblocking of the writes is possible from menu level only.

9.2. TRANSMISSION ERRORS DESCRIPTION

If an error occurs while write or read of single register, then the device sends an error code according to Modbus RTU specifications (example message no 5).

Error codes:

- 01h** - illegal function (only functions 03h, 06h and 10h are available),
- 02h** - illegal register address
- 03h** - illegal data value
- 08h** - no write permission (see: “**mbAccE**” parameter)

9.3. EXAMPLES OF QUERY/ANSWER FRAMES

Examples apply for device with address 1. All values are represent hexadecimal.

Field description:

- ADDR** Device address on modbus network
- FUNC** Function code
- REG H,L** Starting address (address of first register to read/write, Hi and Lo byte)
- COUNT H,L** No. of registers to read/write (Hi and Lo byte)
- BYTE C** Data byte count in answer frame
- DATA H,L** Data byte (Hi and Lo byte)
- CRC L,H** CRC error check (Hi and Lo byte)

1. Read of the displayed value (measurement), the device address = 01h:

ADDR	FUNC	REG H,L		COUNT H,L		CRC L,H	
01	03	00	01	00	03	54	0B

The answer :

ADDR	FUNC	BYTE C	DATA H1,L1		DATA H2, L2		DATA H3.L3		CRC L,H	
01	03	06	00	01	86	A0	00	00	2A	B4

- DATA H1, L1 - reg. 01h (1 - high word of measurement value)
- DATA H2, L2 - reg. 02h (86A0h - low word of measurement value),
- DATA H3, L3 - reg. 03h (0 - measurement status).

In this example measurement value is equal 186A0h (100 000 in decimal format).



Decimal point position is not included in measurement value (reg. 01h and 02h).
 Decimal point position can be read from reg. 04h (“**F PrEc**” parameter).

2. Read of ID code

ADDR	FUNC	REG H,L		COUNT H,L		CRC L,H	
01	03	00	21	00	01	D4	00

The answer:

ADDR	FUNC	BYTE C	DATA H,L		CRC L,H	
01	03	02	20	83	E0	25

DATA - identification code (2083h)

3. Change of the device address from 1 to 2 (write to reg. 20h)

ADDR	FUNC	REG H,L		DATA H,L		CRC L,H	
01	06	00	20	00	02	09	C1

DATA H - 0

DATA L - new device address (2)

The answer (the same as the message):

ADDR	FUNC	REG H,L		DATA H,L		CRC L,H	
01	06	00	20	00	02	09	C1

4. Change of baud rate of all devices connected to the net (BROADCAST message).

ADDR	FUNC	REG H,L		COUNT H,L		CRC L,H	
00	06	00	22	00	04	29	D2

DATA H - 0

DATA L - 4, new baud rate 19200 baud



Device do not reply to BROADCAST-type messages.

5. Try to write improper data to register (register 04h):

ADDR	FUNC	REG H,L		DATA H,L		CRC L,H	
01	06	00	04	00	10	C9	C7

DATA H, L written value (10h = 16) out of allowable range (0 ÷ 5)

Device response (with exception code 03h):

ADDR	FUNC	ERR	CRC L,H	
01	86	03	09	C1



There is no full implementation of the Modbus Protocol in the device. The functions presented above are available only.

10. DEFAULT AND USER'S SETTINGS LIST

Parameter	Description	Default value	User's value	Desc. page
Parameters of relay R1 operation ("rELAy1" menu)				
vALUE	Kind of value controlled relay state	FLo		23
SEt P	Relay first threshold	20.0		23
SEt P2	Relay second threshold	30.0		24
HYS t	Hysteresis of relay	0.0		24
t PrEc	Precision of thresholds and hysteresis displaying (while relay is controlled due to total flow counter value)	0		24
t unit	The unit of thresholds and hysteresis displaying (while relay is controlled due to total flow counter value)	lit.		24
modE	Operation mode of relay	„in”		24
t on	Turn on delay of relay	0.0 (sec.)		25
t oFF	Turn off delay of relay	0.0 (sec.)		25
unit	Unit of “t on”, “toFF” parameters of relay	„SEC”		25
ALArmS	Reaction for critical situation of relay	„oFF”		25
Parameters of relay R2 operation ("rELAy2" menu)				
vALUE	Kind of value controlled relay state	FLo		23
SEt P	Relay first threshold	40.0		23
SEt P2	Relay second threshold	50.0		24
HYS t	Hysteresis of relay	0.0		24
t PrEc	Precision of thresholds and hysteresis displaying (while relay is controlled due to total flow counter value)	0		24
t unit	The unit of thresholds and hysteresis displaying (while relay is controlled due to total flow counter value)	lit.		24
modE	Operation mode of relay	„in”		24
t on	Turn on delay of relay	0.0 (sec.)		25
t oFF	Turn off delay of relay	0.0 (sec.)		25
unit	Unit of “t on”, “toFF” parameters of relay	„SEC”		25
ALArmS	Reaction for critical situation of relay	„oFF”		25
Parameters of relay R3 operation ("rELAy3" menu)				
vALUE	Kind of value controlled relay state	FLo		23
SEt P	Relay first threshold	60.0		23
SEt P2	Relay second threshold	70.0		24

Parameter	Description	Default value	User's value	Desc. page
HYSt	Hysteresis of relay	0.0		24
t PrEc	Precision of thresholds and hysteresis displaying (while relay is controlled due to total flow counter value)	0		24
t unit	The unit of thresholds and hysteresis displaying (while relay is controlled due to total flow counter value)	lit.		24
modE	Operation mode of relay	„in”		24
t on	Turn on delay of relay	0.0 (sec.)		25
t oFF	Turn off delay of relay	0.0 (sec.)		25
unit	Unit of “t on”, “toFF” parameters of relay	„SEC”		25
ALArmS	Reaction for critical situation of relay	„oFF”		25
Parameters of relay R4 operation (“rELAy4” menu)				
vALUE	Kind of value controlled relay state	FLo		23
SEt P	Relay first threshold	80.0		23
SEt P2	Relay second threshold	90.0		24
HYSt	Hysteresis of relay	0.0		24
t PrEc	Precision of thresholds and hysteresis displaying (while relay is controlled due to total flow counter value)	0		24
t unit	The unit of thresholds and hysteresis displaying (while relay is controlled due to total flow counter value)	lit.		24
modE	Operation mode of relay	„in”		24
t on	Turn on delay of relay	0.0 (sec.)		25
t oFF	Turn off delay of relay	0.0 (sec.)		25
unit	Unit of “t on”, “toFF” parameters of relay	„SEC”		25
ALArmS	Reaction for critical situation of relay	„oFF”		25
Activation of acoustic signal (“bEEP” menu)				
AL	Activation of acoustic signal by critical situation	„oFF”		26
r1	Activation of acoustic signal by relay R1	„oFF”		26
r2	Activation of acoustic signal by relay R2	„oFF”		26
r3	Activation of acoustic signal by relay R3	„oFF”		26
r4	Activation of acoustic signal by relay R4	„oFF”		26
Configuration of measurement input (“inPUt” menu)				
PULSEL	Flow sensor factor (quantity of pulses per litre)	1.00		26
FrEq	Maximum input frequency	300 (Hz)		26

Parameter	Description	Default value	User's value	Desc. page
ZErO t	Maximum time between two following pulses	1.0 (sec.)		27
mEAS t	Width of <i>measurement window</i>	0.5 (sec.)		27
Configuration of current flow display ("FLouu" menu)				
F PrEc	Decimal point position (precision of flow rate displaying)	0.0		28
F unit	The unit of volume (Cubic measure) for flow rate displaying	lit.		28
Ftunit	The unit of time for flow rate displaying	min		28
Configuration of Total Flow Counter displaying mode ("total" menu)				
t PrEc	Decimal point position (precision of total flow counter displaying)	0.000		28
t unit	The unit of total flow counter displaying	lit.		28
E Clr	Active level/edge of total flow zeroing input	oFF		29
Power on initialization configuration				
Init d	Kind of value displayed after device power on	FLo		29
Configuration of data filtration ("FiLrEr" menu)				
vALUE	Filtering ratio	0		29
droP	Measured value change causing of temporal filtering deactivation	20.0 (%)		29
Active current output configuration ("OUTPUt" menu)				
OUtmod	Current output mode	„0-20" (mA)		30
vALUE	Kind of value controlled active current output	FLo		30
OUt LO	Display value for 0 mA or 4 mA (depend „OUtmod") current output	0.0		30
OUt HI	Display value for 20 mA current output	200.0		30
t PrEc	Precision of "OUt LO" and "OUt HI" parameters displaying, while active current output is controlled due to total flow counter value.	0		30
t unit	The unit of "OUt LO" and "OUt HI" parameters displaying, while active current output is controlled due to total flow counter value.	lit.		31
Lo r	Extension of the bottom of the nominal output range	5.0		31
Hi r	Extension of the top of the nominal output range	5.0		31
AL	Current output value on critical exception	22.1 (mA)		31
Display parameters				
briGHt	Display brightness	„bri 6"		32

<i>Parameter</i>	<i>Description</i>	<i>Default value</i>	<i>User's value</i>	<i>Desc. page</i>
Configuration of peaks detection function ("HOLD" menu)				
modE	Kind of detected changes	„norm”		32
PEA	Minimum detected change	0.0		32
timE	Maximum time of peak displaying	0.0 (sec.)		32
HdiS	The type of displayed value	„rEAL”		32
H r1	Source of relay R1, and LED R1 control	„rEAL”		32
H r2	Source of relay R2, and LED R2 control	„rEAL”		32
H r3	Source of relay R3, and LED R3 control	„rEAL”		32
H r4	Source of relay R4, and LED R4 control	„rEAL”		32
HOUt	Source of current output control	„rEAL”		32
Settings of access to the configuration parameters ("SECU" menu)				
AccESS	Permission to changes of relays thresholds without of the user password knowledge	„on”		32
RS 485 interface configuration ("rS-485" menu)				
Addr	Device address	0		33
bAud	Baud rate	9600 (b./sec.)		33
mbAccE	Blocking of access to the configuration registers	„on”		33
mbtimE	Maximum delay between received messages	0		33
rESP	Additional delay of answer transmission	„Std”		33



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