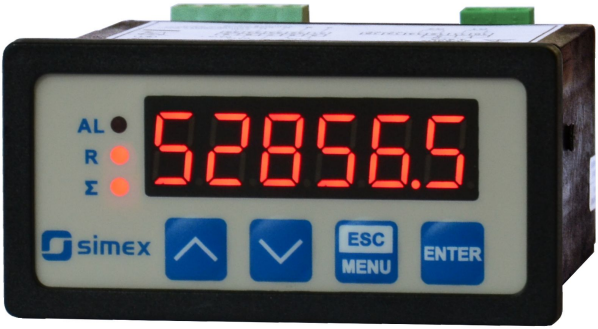
simex

**Assisting the automation industry since 1986**

# User manual
# FLOW METER
# SPI-73

- Firmware: v.5.08 or higher
- Input type: pulse
- Totalizer function




CE

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

# CONTENTS

***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 environmental conditions and using the unit contrary to its assignment.**
- 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.
- If the device is equipped with PE connector, it should be connected to PE wire. Otherwise PE wire should be connected to GND connector.
- 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 unit malfunction 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 connected equipment must meet the appropriate standards and regulations concerning safety and be equipped with adequate overvoltage and interference filters.
- **Do not attempt to disassemble, repair or modify the unit yourself. The unit has no user serviceable parts. Defective units 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 areas where there is risk of explosions.
- Do not use the unit in areas with significant temperature variations, exposure to condensation or ice.
- 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-73** 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.

easurement of instantaneous flow can be indicated in range: 0 to 999999 (plus decimal point) and can be expressed in any scalable user units of flow and three time measures (second, minute, hour). Total flow can be indicated in range from 0.000 to 4294967295 user units with maximum resolution of 0.001 units. Device can operate with different flow sensors, acceptable flow factors of sensors from 0.01 to 10000.00 pulses per unit (with resolution 0.01 pulses/unit), 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 device is equipped with one relay (or OC type) output, which can be driven due to instantaneous or total flow. 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),
- direct access to relays thresholds settings, without password,
- alarm pre-set; alarm signal is released when measurement exceeds measurement range,

Flow counters **SPI-73** can operate with flow sensors like **M1RSP**, equipped with contactron output.

## 3. TECHNICAL DATA

| | |
|---|---|
| Power supply voltage<br>(depending on version) | 85...**230**...260V AC/DC; 50 ÷ 60 Hz (separated)<br>or 19...**24**...50V DC and 16...**24**...35V AC (separated) |
| External fuse (required) | T - type, max. 2 A |
| Power consumption | max. 4.5 VA @ 85 ÷ 260V AC/DC<br>max. 4.5 VA @ 16V ÷ 35V AC<br>max. 4.5 W @ 19V ÷ 50V DC |
| Inputs | fully Isolated |
| COM: | common (terminal no. 10) |
| zeroing of total counter: | active edge or level (terminal no. 8) |
| pulse input: | counting input with denouncing filter and pulse width control, max. input frequency 10.0 kHz (terminal no. 6) |
| 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: | 0 or 1 NO 1A/250V AC (cos $\varphi$ = 1) |
| or OC-type: | 0 or 1; 30mA / 30VDC / 100mW |
| sensor power supply: | 24V +5%, -10% / max. 100 mA, stabilized |
| 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 | User unit per min. or sec. or hour |
| Total flow range | over 4 x $10^9$ units (max. 16 digits ) |
| Total flow precision | Selected from range: 0 ÷ 0.000 |
| Total flow unit | Any, with precision, settable by user |
| Communication interface | RS 485, 8N1 and 8N2, Modbus RTU, not separated |
| Baud rate | 1200 bit/s ÷ 115200 bit/s |
| Display | LED, 6 digit, 9mm height, red |
| Data memory | non-volatile memory, EEPROM type |
| Protection level | IP 65<br>optional version with panel cut-out sealing available |
| Terminals protection | IP 20 |

| | |
|---|---|
| Housing type | panel |
| Housing material | NORYL - GFN2S E1 |
| Housing dimensions | 72 x 36 x 97 mm |
| Mounting hole | 66.5 x 32.5 mm |
| Assembly depth | min. 102 mm |
| Panel thickness | max. 5 mm |
| Operating temperature (depending on version) | 0°C to +50°C<br>or -20°C to +50°C |
| Storage temperature (depending on version) | -10°C to +70°C<br>or -20°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 cross section | 2,5 $mm^2$ |
| Safety requirements | according to: PN-EN 61010-1<br>installation category: II<br>pollution degree: 2<br>voltage in relation to ground: 300V AC<br>insulation resistance: >20MΩ<br>insulation strength between power supply and input/output terminal: 1min. @ 2300V<br>insulation strength between relays terminal: 1min. @ 1350V |
| EMC | according to: PN-EN 61326-1 |

**This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.**

## *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.

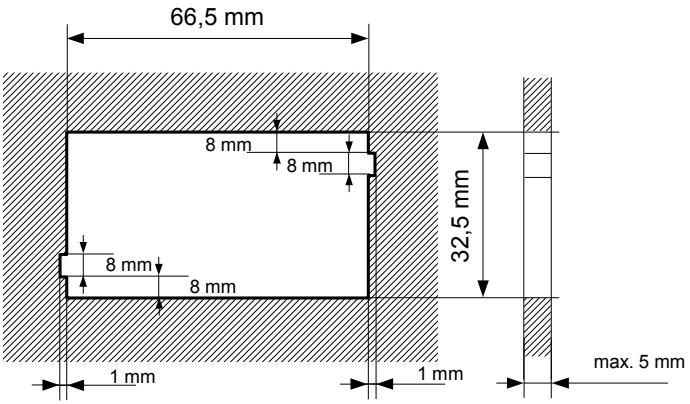
Attached with the unit please find:
- user's manual,
- warranty,
- assembly brackets - 2 pieces.

## 4.2. ASSEMBLY

- The unit is designed for mounting inside housings (control panel, switchboard) insuring appropriate protection against surges and interference. Metal housings must be connected to ground in a way that complies with the governing regulations.
- Disconnect the power supply prior to starting assembly.
- Check the connections are wired correctly prior to switching the unit on.

In order to install the unit, a 66.5 x 32.5 mm mounting hole (Figure 4.1) must be prepared. The thickness of the material of which the panel is made must not exceed 5mm. When preparing the mounting hole take the grooves for catches located on both sides of the housing into consideration (Figure 4.1). Place the unit in the mounting hole inserting it from the front side of the panel, and then fix it using the brackets (Figure 4.2). The minimum distances between the centre points of multiple units - due to the thermal and mechanical conditions of operation - are 91 mm x 57mm (Figure 4.3).

a)



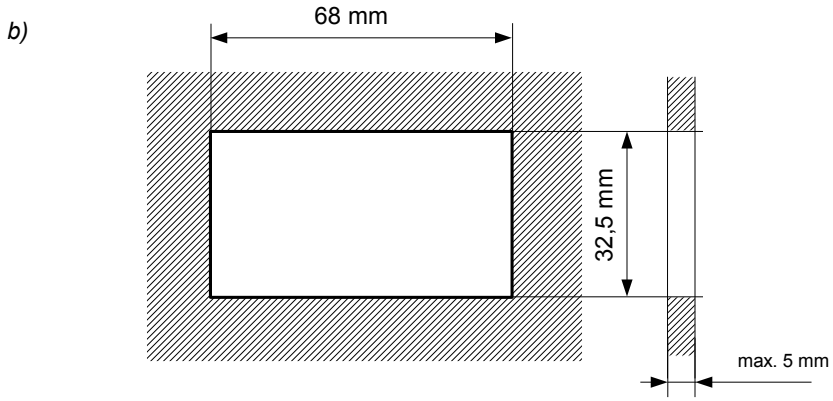



*Figure 4.1. Mounting hole dimensions: a) recommended b) allowable*

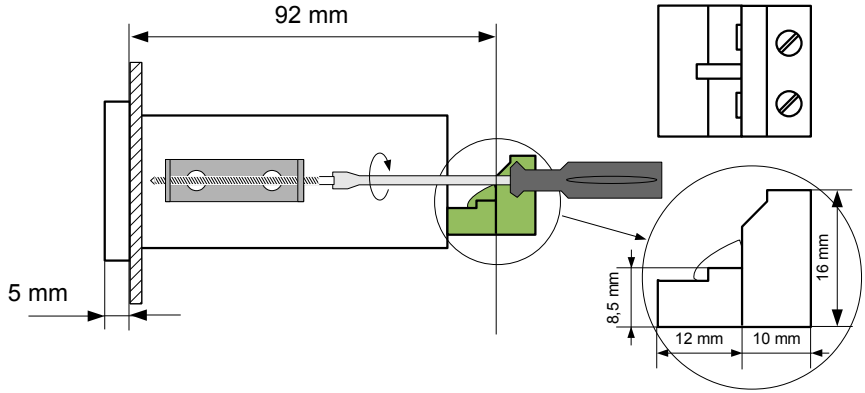



*Figure 4.2. Installing of brackets, and dimensions of connectors.*

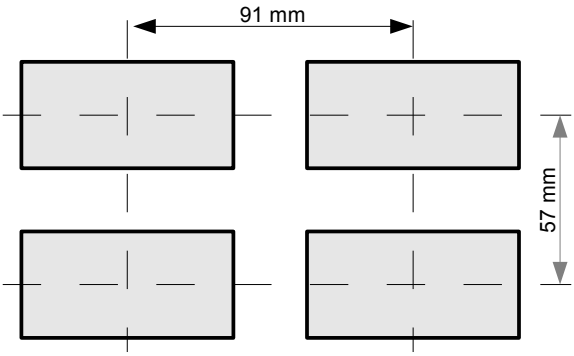



*Figure 4.3. Minimum distances when assembly of a number of units*

## *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 measurement or control signals are longer than 30m or go outside of the building then additional safety circuits are required.

- 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.

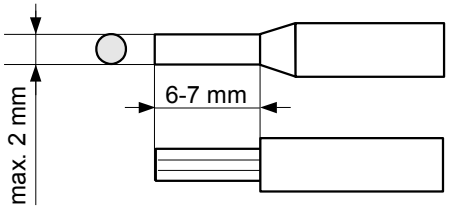



*Figure 4.4. Method of cable insulation replacing and cable terminals*

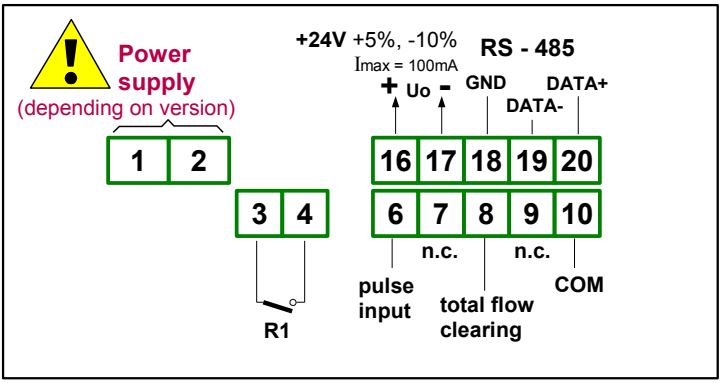



*Figure 4.5. Terminals description (relay outputs)*

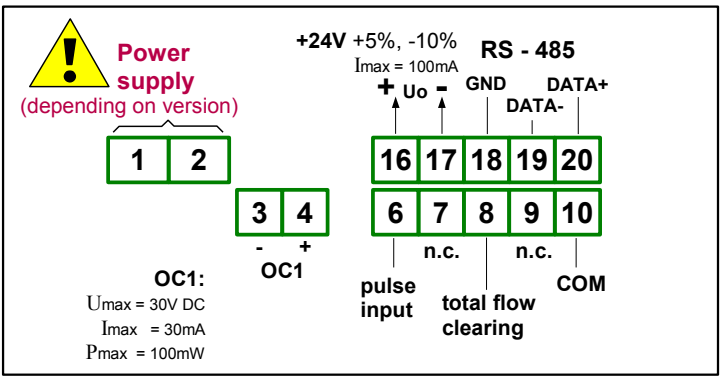



*Figure 4.6. Terminals description (OC-type outputs)*

**All connections must be made while power supply is disconnected !**

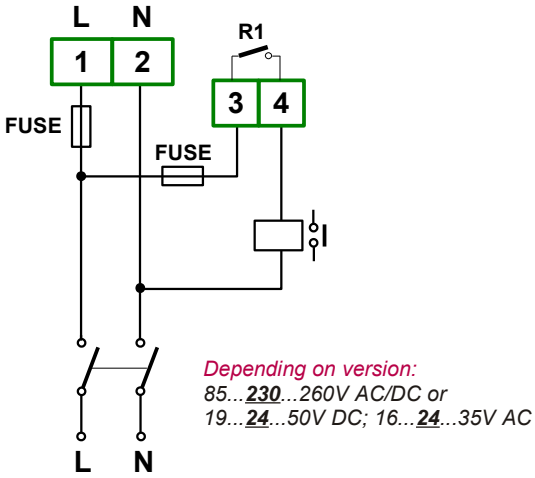



*Figure 4.7. Connection of power supply and relays*

**Contacts of relay outputs are not equipped with spark suppressors. While use the relay outputs for switching of inductive loads (coils, contactors, power relays, electromagnets, motors etc.) it is required to use additional suppression circuit (typically capacitor 47nF/ min. 250VAC in series with 100R/5W resistor), connected in parallel to relay terminals or (better) directly on the load. In consequence of using the suppression circuit, the level of generated electromagnetic disturbances is lower, and the life of relay contacts rises.**

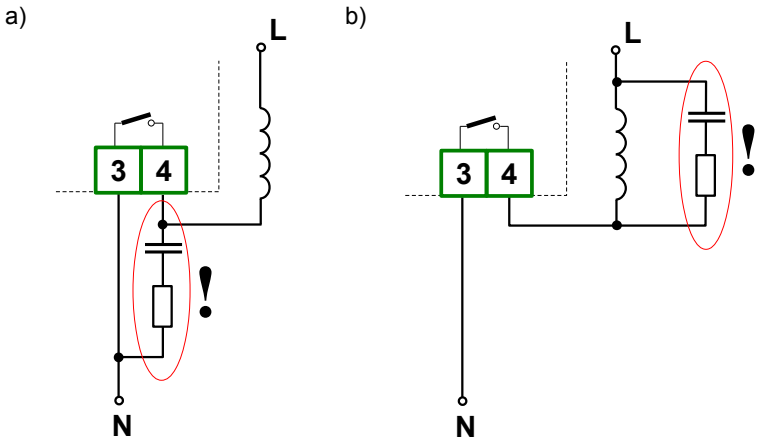



*Figure 4.8. Examples of suppression circuit connection:*
*a) to relay terminals; b) to the inductive load*

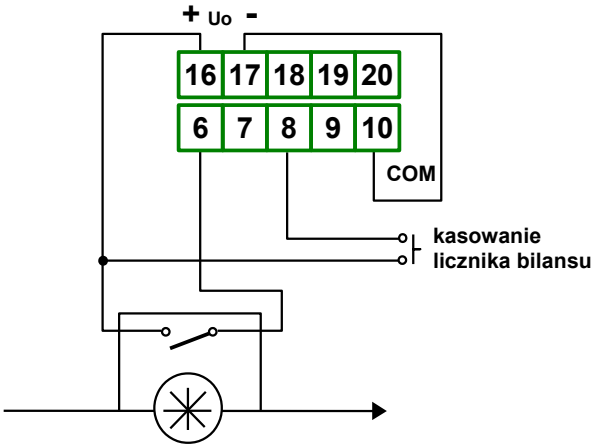



*Figure 4.9. Example of connection between flow counter and flow sensor with contactron output*

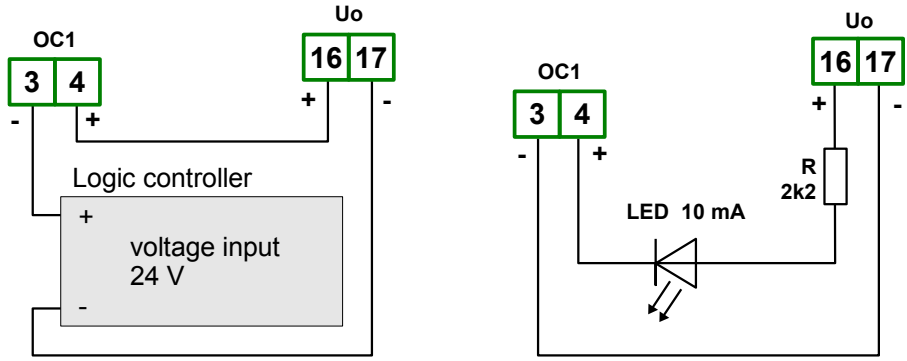



*Figure 4.10. Example of OC-type outputs connection*

## 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


***Symbols and functions of push-buttons:***

ESC MENU

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

ENTER

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
- switching of the display between total and instantaneous measurements

Symbol used in the manual: **[^] [v]**
Functions:
- Change of the present menu,
- Modification of the parameter value,
- Change of the display mode.

# 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

Instantaneous flow (flow rate) is displayed in units defined by parameter **"F unit"** 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:

Displayed value presentation is defined by parameters **"F unit"**, **"t unit"** and **"b unit"** with resolution defined by parameters **"F PrEc"**, **"t PrEc"** and **"b PrEc"**.

... 879 876 | 543 . 219
"F unit" "F PrEc"

... 876 543 . 219
"F unit" "F PrEc"

- if duration of low or high level (between pulses) is lower than time defined by parameter **"FrEq"** (see Tab.7.1 page 26), 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 unit.
  Frequency after prescaler is recalculated accordingly to user defined unit (parameters **"F unit"** and **"Ftunit"**), and after that final flow value in units or thousands of units (e.g. 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"** 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 **"CIrtot"** 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 by pressing [ ENTER] button**. Kind of displayed value is signalised 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 (e.g. **"rELPr1"**) 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 (see description of ***"SECu" menu***), 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 marked **"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 signalized by flashing decimal points (see example below).

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

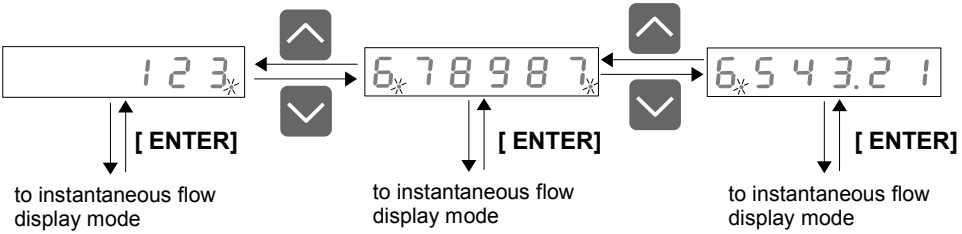



*Figure 6.1. Switching between digits (screens) of total flow result.*

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 signalising that result has less significant digits, to see these digits press [v].

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).

Counting of pulses and controlling or 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 **SPI-73** 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 **”timE”**. 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 **”timE”** elapses**,** device starts to show the current value of input signal again. If „**HdiS**”=”**HOLD**” then setting parameter **"timE"=0.0** causes holding peak value until **[ESC]** button is pressed. If „**HdiS**”=”**rEAL**” then value **"timE"=0.0** means no holding. Displaying peak value is signalized by flashing most right decimal point.

The relays/LEDs can be controlled depend on the current value of input signal or the peak value (see ***”HOLd” menu***).

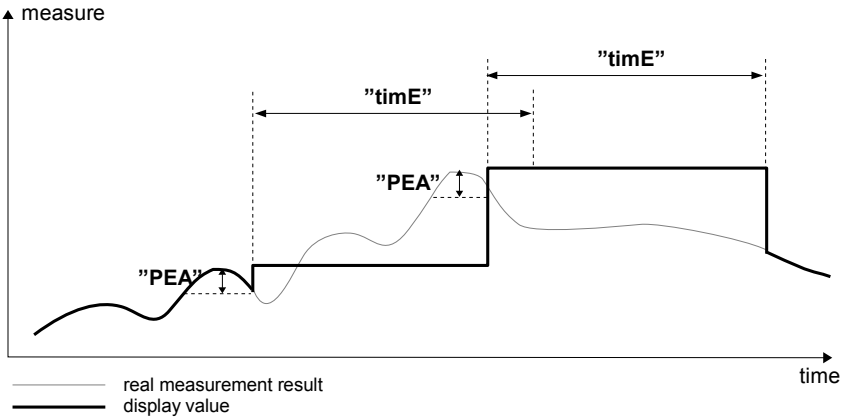



*Figure 6.2. Process of peaks detection*

## 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.

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 resolution and unit 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.

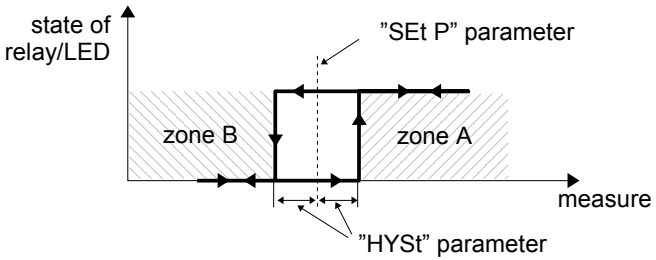



*Figure 6.3. One threshold control of the relay/LED outputs*

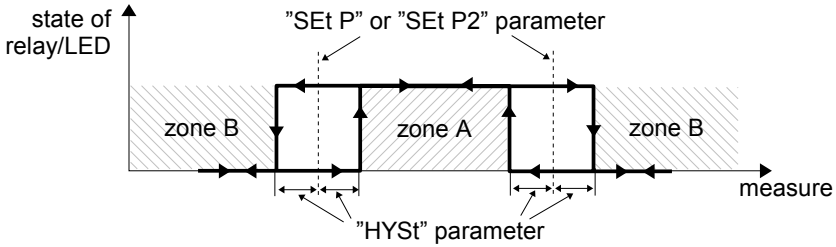
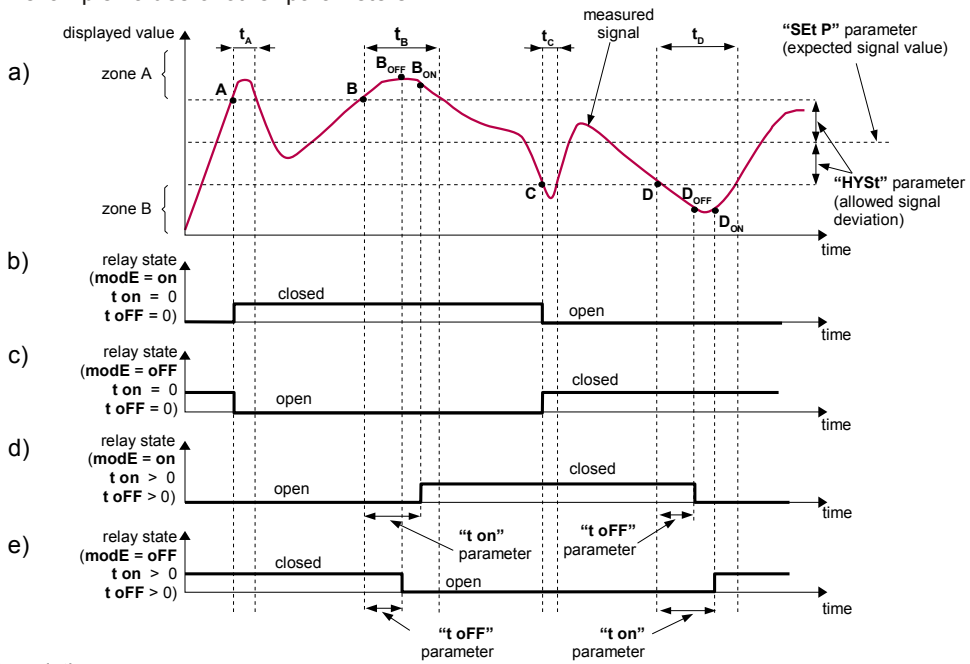



*Figure 6.4. Two threshold control of the relay/LED outputs*

The relay outputs and LEDs (named **R**) 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 ± 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 its 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).

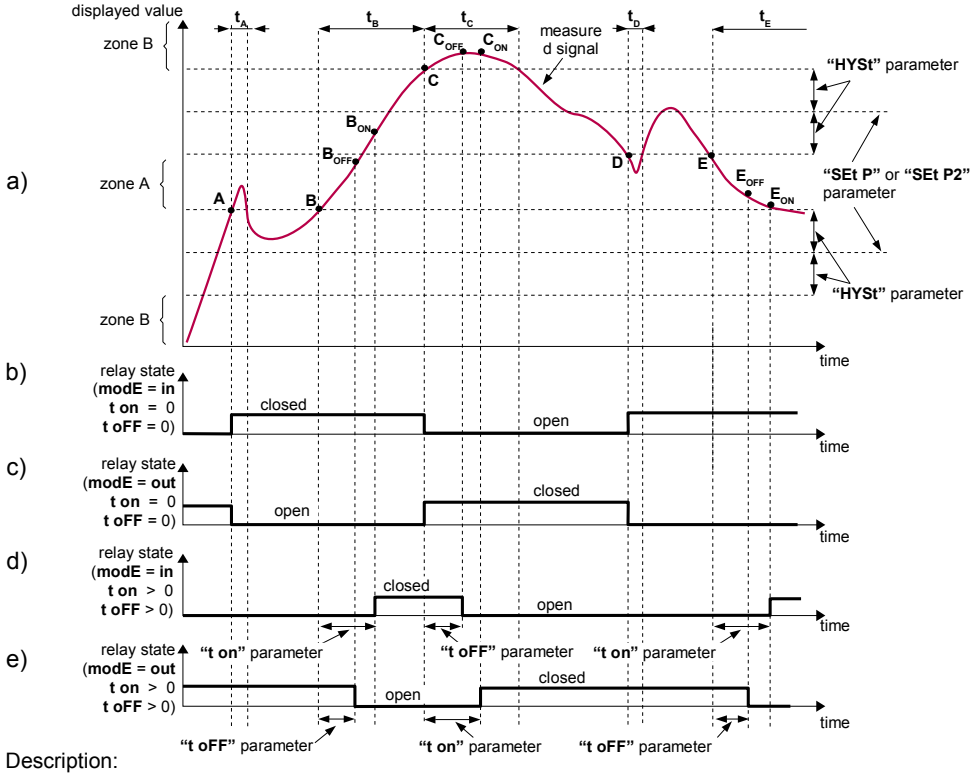
If $t_A$ ,$t_B$ ,$t_C$ or $t_D$ (when input signal stay in ***zone A*** or ***zone B***) are lower than parameters "**t on**" or "**t oFF**", the relay will not change his state (see points A and C, Figure 6.5 a, d, e).

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 input frequency***). 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" 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 P2"**, 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 (e.g.**"rELPr1"**) 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 (see description of ***"SECU" menu***), 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 "**Error**" 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.

or



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 press **[ENTER]**.

### *7.2.1. Numeric parameters (digit change mode)*

Numerical parameters are displayed as decimal numbers. The mode of its new value entering depends on chosen edit method ( see parameter „**Edit**").

In mode "by digit" („**Edit**"="**dig**") pressing one of the keys **[^]** or **[v]** causes change of current position (flashing digit) or the sign (+/-). Short pressing of the **[ENTER]** button causes change of the position (digit).

Press **[ENTER]** at least 2 seconds to accept the changes, after that question **"SEt?"** is displayed, and user must to confirm (or cancel) the changes. To conform changes (and story it in EEPROM) press **[ENTER]** button shortly after **"SEt?"** is displayed. To cancel the changes press **[ESC]** button shortly after **"SEt?"** is displayed. After that device returns to the menu.

### *7.2.2. Numeric parameters (slide change mode)*

In "slide change" mode („**Edit**"="**Slid**"), buttons **[^]** and **[v]** has different functions. To increase edited value press (or press and hold) **[^]** button only, the increasing became quickest as long as button **[^]** is pressed. To slow down the increasing, button **[v]** can be used. If **[v]** is pressed shortly (and button **[^]** is still pressed), increasing slow down for a moment only, if **[v]** is pressed and held while button **[^]** is still pressed the increasing slow down and will be kept on lower speed.

To decrease edited value press (or press and hold ) **[v]** button only. The decreasing became quickest as long as button **[v]** is pressed. To slow down the decreasing, button **[^]** can be used. If **[^]** is pressed shortly (and button **[v]** is still pressed), decreasing slow down for a moment only, if **[^]** is pressed and held while button **[v]** is still pressed the decreasing slow down and will be kept on lower speed.

Press **[ENTER]** at least 2 seconds to accept the changes, after that question **"SEt?" is** displayed, and user must to confirm (or cancel) the changes. To conform changes (and story it in EEPROM) press **[ENTER]** button shortly after **"SEt?"** is displayed. To cancel the changes press **[ESC]** button shortly after **"SEt?"** is displayed. After that device returns to the menu.

### *7.2.3. 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.

Short pressing of **[ENTER]** causes in displaying of the acknowledge question (**"SEt?"**). If key **[ENTER]** is pressed again, the changes are accepted, stored in EEPROM end the edition process finished. Pressing the key **[ESC]** after **"SEt?"** causes in cancelling of made changes and returning to menu.

***Functions of buttons when editing numeric and switching parameters:***

While editing numeric parameter:
- change of current (flashing) digit
- slide change of value (acceleration, deceleration, direction change)

While editing switch parameter - selection of switch parameter.

or



If numerical parameter is being edited, a short press of **[ENTER]** button change edited position. A long press of **[ENTER]** button (at lest 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 some password different from „**0000**" is set, then every enter to main menu follows the entering of password. If entered password is correct then first menu position will be displayed else warning "**Error**", and unit returns to measurement mode.

Due to problem with direct displaying of "**m**" letter, it is exchanged with special sign " ṁ ". Independently in user manual letter „**m**" is used to make it more readable (example: **"modE"**).

### *7.3.1. "rELAy1" menu*

This menu allows to configure the operation mode of relays and LEDs marked „**R**" (e.g. „**R1**"). If there are few relay outputs available, then every output has its own configuration menu (e.g. menu „**rELAy2**" for relay (LED) „**R2**"). Principle of the relays operation is described in paragraph ***CONTROL OF THE RELAY OUTPUTS***.

- The relay outputs and LEDs (named **R**) can be controlled by due to current flow rate, stored peak value, or total flow counter,
- 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.

**"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"** or **"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:
***"unit"*** - units
***"1000un"*** - thousands of units

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*** + **HYSt**" and lower than "***lower threshold*** – **HYSt**", 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 fail, 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 its 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 its 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***).

### *7.3.2. "inPUt" menu*

This menu contains options of pulse input configuration:

**"PulSEL"** - flow factor (quantity of pulses per litre). This parameter can be set in range 0.00 - 9999.99 pulses/unit. **Value 0.00 is interpreted as 10 000.00 pulses/unit.**

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

**"FrEq"** - maximum permitted frequency of pulses delivered to the input. This parameter is expressed in Hz. And can be set to one of all values showed in Tab.7.1.

Minimum permitted duration time of Low and High states are related to every value of **"FrEq"** parameter. If particular state is shorter than showed in Tab.7.1, it is interpreted as disturbance and ignored.

| ***Parameter "FrEq" (Hz)*** | ***Minimum duration of low and high states*** | ***Permitted 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 μs | 5%-95% |
| „300" | 167 μs | 5%-95% |
| „1 000" | 50 μs | 5%-95% |
| „3 000" | 33 μs | 10%-90% |
| „10 000" | 33 μs | 33%-66% |

*Tab.7.1.Allowable settings of **„FrEq"** parameter, and related with them minimum durations of logical states*

**"ZEro t"** - assumed maximum delay between pulses. This parameter is defined with 0.1 second precision, in range 0 ÷ 39.9. If time between two following pulses exceeds this parameter, than device displays zero (no flow).
If parameter **"ZEro t"** is set to value lower than parameter **"mEAS t"**, the **"mEAS t"** value is used as maximum time between two following pulses.

**"mEAS t"** - minimum *measurement window* width. The „*measurement window*" means the time period after which counted pulses are recalculated and displayed, and it is similar to refresh rate. This parameter can be set with 0.1 sec. resolution in range 0 ÷ 19.9 sec.

If time delays between successive pulses are longer than **"mEAS t"** time, then measurement window width is automatically fitted to input frequency.

### *7.3.3. "FLouu" 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 coEF"** - conversion coefficient. Changes pulse input unit to any unit used to calculate flow by multiplying value in **"PuISEL"** parameter by value in **"F coEF"** parameter. Firstly, parameter editing requires to enter a value (by entering a digit in each blinking display separately), secondly to select decimal point position (blinking dot on selected position). There are following decimal point position options:

000000. - integer value, no decimal places,
00000.0 - one decimal place,
0000.00 - two decimal places,
000.000 - three decimal places,
00.0000 - four decimal places,
0.00000 - five decimal places,
000000 - six decimal places,

For example: 1 [ l ] = 0,264172 [US gallon ],
so **F coEF** = 264172 (no decimal places)

Decimal point position in „**Piont**" and „**F coEF**" parameters does not affect on each other.

**"F unit"** - the unit of volume used for flow rate displaying . It can be set to: (***"unit"*** - units, or ***"1000un"*** - thousands of units). Units expressed by **"F unit"** are conventional, and can be exchanged to any other pair of units e.g. for powders it can be **kilogram** and **tonne**, and for liquids it can be **litres** or **cubic meters**.

**"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 $m^3/h$ etc.

### *7.3.4. "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 coEF"** - conversion coefficient. Changes analogue input unit to any unit used to calculate total flow by multiplying current flow measurement value (after calculating user characteristics in **"I CHAr"** parameter) by value in **"t coEF"** parameter. Firstly, parameter editing requires to enter a value (by entering a digit in each blinking display separately), secondly to select decimal point position (blinking dot on selected position). There are following decimal point position options:

000000. - integer value, no decimal places,
00000.0 - one decimal place,
0000.00 - two decimal places,
000.000 - three decimal places,
00.0000 - four decimal places,
0.00000 - five decimal places,
000000 - six decimal places,

For example: 1 [ l ] = 0,264172 [US gallon ],
so **t coEF** = 264172 (no decimal places)

Decimal point position in "**t PrEc**" and "**t coEF**" parameters does not affect on each other.

If total flow counter value in **not converted** units reaches limit value (which is **4294967295 999. 999**), then total flow counter value in converted units will be automatically set on **4294967295 999, 999** value and overload status in Modbus register will be also set. This situation can occur when "**t coEF**" parameter is greater than 1. In order to resume counting a user should reset the total flow counter.

If total flow counter value in **converted** units reaches limit value (which is **4294967295 999. 999**), then value in registers and on display will be locked on **4294967295 999. 999** overload status in Modbus register will be also set. This situation can occur when "**t coEF**" parameter is equal or lower than 1. In order to resume counting a user should reset the total flow counter. Not converted total flow value will be still counted according to settings.

**"t unit"** - the unit of volume used for total flow counter displaying . It can be set to: (***"unit"*** - units, or ***"1000un"*** - thousands of units). Units expressed by **"t unit"** are conventional, and can be exchanged to any other pair of units e.g. for powders it can be **kilogram** and **tonne**, for liquids it can be **litre** or **cubic meter**.

**"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 CIr"** - this parameter allows selection of active level/edge of total flow zeroing input (see Figure 4.9). It can be set to one of 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.

### *7.3.5. "Init d" parameter*

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

***"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.

### *7.3.6. "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).

### *7.3.7. "briGHt" parameter*

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

### *7.3.8. "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 0.0 to 19.9 sec, with 0.1 sec. resolution. If „**HdiS**"="**HOLD**" then setting parameter **"timE"=0.0** causes holding peak value until **[ESC]** button is pressed. If „**HdiS**"="**rEAL**" then value **"timE"=0.0** means no holding.

**"HdiS"** - type of displayed values:

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

**"H rEL"** - relay/LED output (R) operation mode:

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

### *7.3.9. "SECU" menu*

This menu contains presets connected with availability of other parameters:

**"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 with Marketing Division. "Single use password" can be used only one time, after that it is destroyed. Entering this password causes in clearing of user password, it means sets the user password to „0000".**

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.

**"Acc r"** - this option permits user (**"on"**) or prohibits (**"oFF"**) to modify the thresholds of the relay/LED R without knowledge about user password.

### *7.3.10. "rS-485" menu*

This menu is connected with RS-485 interface, and sets its 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. 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 04h i 05h cant be denied by **"mbAccE"** parameter (see: ***LIST OF REGISTERS***).

**"mbtimE"** - this parameter defines maximal time (sec) between following frames received by the device. If the delay will be greater than the value of **"mbtimE"** parameter, the relays which are controlled via RS-485 interface, will set to alert state (see ***"OUtPUt" menu*** and ***"rELAy1" menu*** description). Parameter "**mbtimE**" 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 7.2 contains most frequently used values.

| ***"bAud" parameter*** | "38.4" | "57.6" | "115.2" |
|---|---|---|---|
| ***"rESP" parameter*** | " 10c" | " 20c" | " 50c" |

*Tab.7.2. Settings of "**rESP**" parameter*

### ***7.3.11. "Edit t" parameter***

This parameter allows to change the edition mode of numerical parameters:
***"dig"*** - the change to "by digit" mode,
***"Slid"*** - slide change mode.

### ***7.3.12. "dEFS" parameter***

This setting allows to restore the factory settings of the device. To get the access to this option special password is required: „5465", next the device displays acknowledge question **„SEt?"**. Press **[ENTER]** to acknowledge the restoring of factory settings or **[ESC]** to cancel.

### ***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.

## 7.4. UNITS CALCULATIONS EXAMPLES

During work with the device, there could be a need to recalculate measured value in a unit into another. In the device there is a possibility to do so independently for flow, total flow and batcher using parameters "**F coEF**", "**t coEF**" respectively. Examples of recalculations for some measurement units are shown below.

| Flow, Tot, Bat: / Input: | litre [ l ] | US gallon [ gallon ] | UK gallon [ gallon ] | US ounce [ US fl oz ] | UK ounce [ UK fl oz ] | US beer barrel [ bbl ] | UK beer barrel [ imp. bl. ] |
|---|---|---|---|---|---|---|---|
| litre [ l ] | 1 | 0,264172 | 0,219969 | 33,814 | 35,1957 | 0,00629 | 0,00611 |
| US gallon [ gallon ] | 3,78541 | 1 | 0,832675 | 128 | 133,23 | 0,02381 | 0,02313 |
| UK gallon [ gallon ] | 4,54608 | 1,20094 | 1 | 153,721 | 160,003 | 0,028594 | 0,027778 |
| US ounce [ US fl oz ] | 0,029574 | 0,007812 | 0,006505 | 1 | 1,04086 | 0,000186 | 0,000181 |
| UK ounce [ UK fl oz ] | 0,028413 | 0,007506 | 0,00625 | 0,960742 | 1 | 0,000179 | 0,000174 |
| US beer barrel [ bbl ] | 158,987 | 42 | 34,9723 | 5376 | 5595,68 | 1 | 0,971454 |
| UK beer barrel [ imp. bl. ] | 163,659 | 43,2341 | 36 | 5533,98 | 5760,11 | 1,02938 | 1 |

*Tab.7.3. Coefficients for volume units*

| Flow, Tot, Bat: / Input: | kilogram [ kg ] | ounce [ oz ] | pound [ lb ] | stone [ st ] | gran [ gr ] | UK ton [ t ] | US ton [ t ] |
|---|---|---|---|---|---|---|---|
| kilogram [ kg ] | 1 | 35,2739 | 2,20462 | 0,157473 | 15432,3 | 0,000984 | 0,001102 |
| ounce [ oz ] | 0,02835 | 1 | 0,0625 | 0,004464 | 437,5 | 0,000028 | 0,000031 |
| pound [ lb ] | 0,453592 | 16 | 1 | 0,071429 | 7000 | 0,000446 | 0,0005 |
| stone [ st ] | 6,35029 | 224 | 14 | 1 | 98000 | 0,00625 | 0,007 |
| gran [ gr ] | 0,000065 | 0,002286 | 0,000143 | 0,00001 | 1 | - | - |
| UK ton [ t ] | 1016,04 | 35840 | 2240 | 160 | - | 1 | 1,12 |
| US ton [ t ] | 907,184 | 32000 | 2000 | 142,857 | - | 0,892857 | 1 |

*Tab.7.4. Coefficients for weight units*

### *7.4.1. Units recalculating examples*

Task:

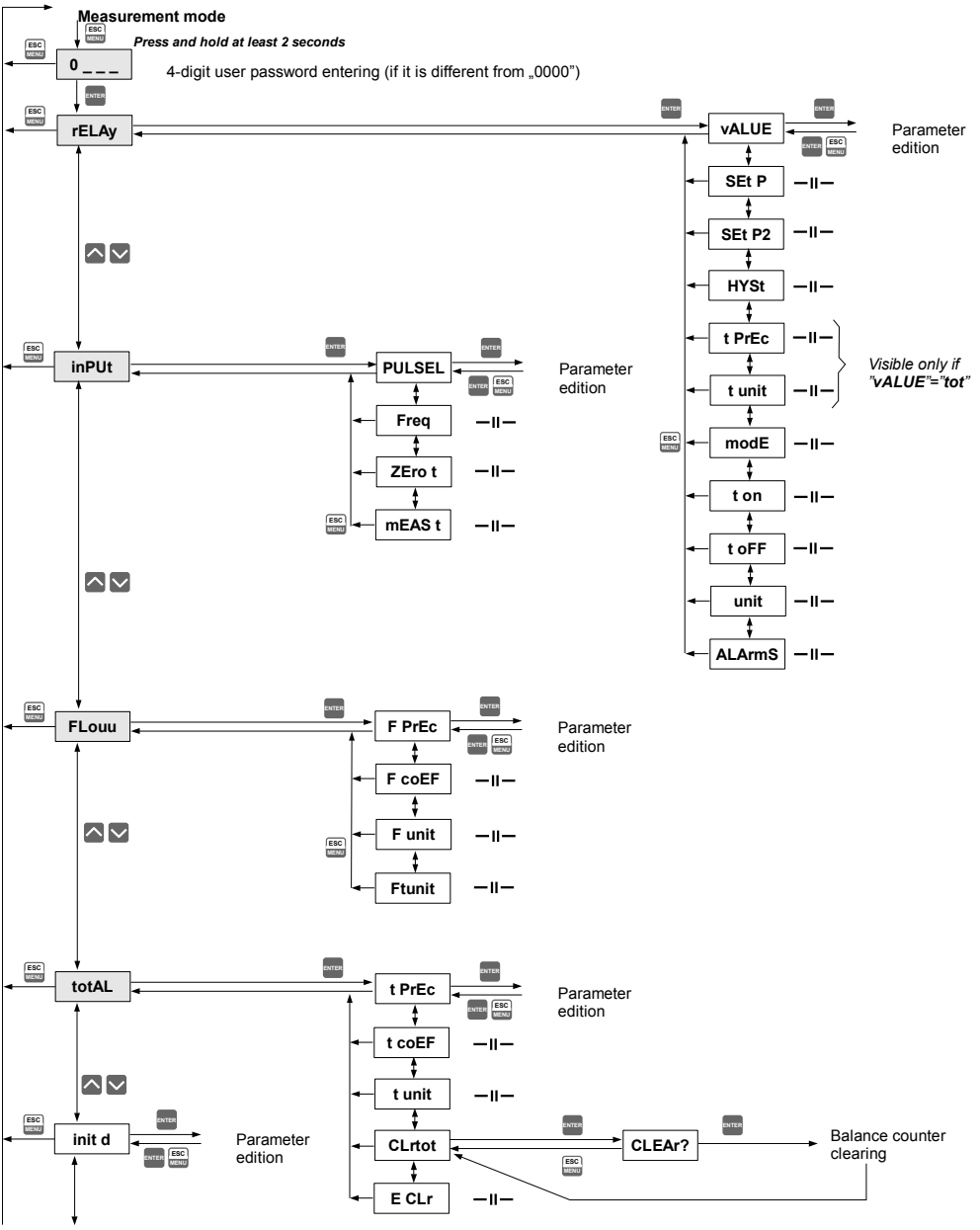
Lets assume that we have a device which woks with sensor scaled in litres. We want, that flow measurement is displayed in US ounces, total flow in hundreds of US gallons and batcher in US gallons.

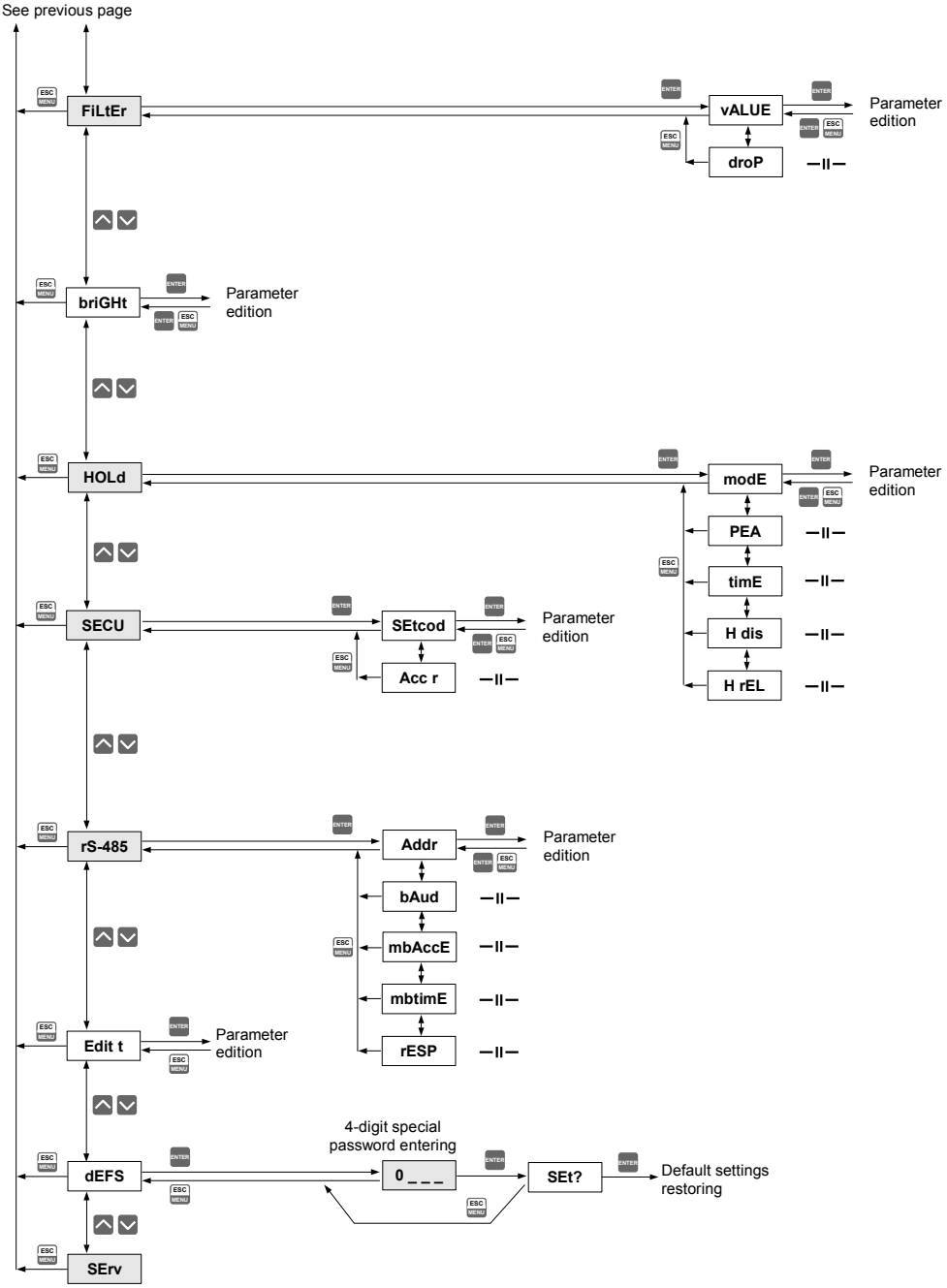
Solution:

Using Tab.7.3 (number value in table corresponds to number of input units – left column, in one output unit – upper row) set:

"**F coEF**" parameter as: 33,814,
"**t coEF**" parameter as: 0,002641.

## 7.5. MENU STRUCTURE




See previous page
FiLtEr
vALUE
droP
Parameter edition
briGHt
Parameter edition
HOLd
modE
PEA
timE
H dis
H rEL
Parameter edition
SECU
SEtcod
Acc r
Parameter edition
rS-485
Addr
bAud
mbAccE
mbtimE
rESP
Parameter edition
Edit t
Parameter edition
4-digit special password entering
dEFS
0 _ _ _
SEt?
Default settings restoring
SErv

# 8. THE MODBUS PROTOCOL HANDLING

Transmission parameters: 1 start bit, 8 data bits, 1 or 2 stop bit (2 bits are send, 1 and 2 bits are accepted when receive), no parity control
Baud rate: selectable from: 1200 to 115200 bits/second
Transmission protocol: MODBUS RTU compatible

The device parameters and display value are available via RS-485 interface, as HOLDING-type registers (numeric values are given in U2 code) 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 16 registers (for single frame).

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

## 8.1. 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]<br>02h[1] | No | 0 ÷ 999999 | Measurement value (no decimal point) |
| 03h | No | 0-FFh | The status of the current measurement. **0** – data valid;<br>**20h** – device waits for first pulse;<br>**A0h** – alarm state, allowable frequency range is exceeded |
| 04h | Yes | 0 ÷ 5 | "**F PrEc**" parameter in "**FLouu**" menu. The same as 12h register |
| 05h | Yes | 0 ÷ 31 | State of the relays and alarm LED (binary format)<br>(1 - on, 0 - off): **00000000 000e000a**<br>**a** - relay R; **e** - alarm state indicator;<br>If written, only **a** bit is important (others are ignored) this bit allows user to control the relay via RS-485 interface |
| 07h[1]<br>08h[1] | No | 0 ÷ 999999 | Peak (drop) value (no decimal point) |
| 09h[1]<br>0Ah[1] | No | 0÷FFFFFFFFh | Total flow component expressed in thousands of units e.g.:<br>**999999999** 999 . 999 |
| 0Bh[1] | No | 0÷999 | Total flow component expressed in units e.g.:<br>999999999 **999** . 999 |
| 0Ch[1] | No | 0÷999 | Total flow component expressed in thousandths of units e.g.:<br>999999999 999 . **999** |

| Register | Write | Range | Register description |
|---|---|---|---|
| 10h | Yes | 0 ÷ 10 | **"FrEq"** parameter in **"inPUt"** menu (input filter):<br>**0** - 10Hz; **1** - 15Hz; **2** - 20Hz; **3** - 30Hz; **4** - 40Hz; **5** - 50Hz;<br>**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";<br>**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** - unit; **1** - 1000un; |
| 16h<br>17h | Yes | 0 ÷ 999999 | **"PULSEL"** parameter in **"inPUt"** menu, flow sensor factor (quantity of pulses per unit) expressed in  0.01 pulses/lighter. Value  0  is interpreted as  10 000.00 pulses/unit |
| 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 ÷ 199 | **"vALUE"** parameter in "**FiLtEr"** menu (measurement filtering rate) |
| 1Bh | Yes | 0 ÷ 1999 | **"droP"** parameter in **"FiLtEr"** menu expressed in tenth of percent |
| 1Ch | Yes | 0 ÷ 1 | **"t unit"** parameter in **"totAL"** menu (the unit of volume while total flow counter result displaying): **0** - unit; **1** - 1000un; |
| 1Dh | Yes | 0 ÷ 3 | **"t PrEc"** parameter in **"totAL"** (precision of of total flow counter result displaying):<br>**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):<br>**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):<br>**0** - "FLo"; **1** - "tot"; **2** - "tot2"; **3** - "tot3" |
| 20h[2] | Yes | 0 ÷ 199 | Device address |
| 21h | No | 2067h | Device identification code (ID) |
| 22h[3] | Yes | 0 ÷ 7 | **"bAud"** parameter in **"rS-485"** menu (baud rate);<br>**0** - 1200 baud; **1** - 2400 baud; **2** - 4800 baud; **3** - 9600 baud;<br>**4** - 19200 baud; **5** - 38400 baud; **6** - 57600 baud; **7** - 115200 baud |
| 23h[4] | 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 | see descr. | Parameters of "**SECU**" menu (binary format (0 - „**oFF**", 1 - „**on**"):<br>**bit 0** - "**Acc r**" parameter |
| 25h | Yes | 0 ÷ 5 | **"rESP"** parameter in **"rS-485"** menu (additional response delay);<br>**0** - no additional delay;  **1** - "**10c**" option; **2** - "**20c**" option;<br>**3** - "**50c**" option;  **4** - "**100c**" option;  **5** - "**200c**" option; |

| Register | Write | Range | Register description |
|---|---|---|---|
| 27h | Yes | 0 ÷ 99 | **"mbtimE"** parameter in **"rS-485"** menu (maximum delay between received frames); **0** - no delay checking;<br>**1** ÷ **99** - maximum delay expressed in seconds |
| 2Dh | Yes | 1 ÷ 8 | "**briGHt**" parameter (display brightness);<br>**1** - the lowest brightness; **8** - the highest brightness |
| 2Fh | Yes | 0 ÷ 1 | "**Edit**" parameter (numerical parameters edit mode);<br>**0** - „**dig**" mode; **1** - „**SLid**" mode |
| Parameters or relay R operation | | | |
| 30h<br>31h | Yes<br>Yes | 0 ÷ 999999 | "**SEt P**" parameter in "**rELAy**" menu, no decimal point included |
| 32h<br>33h | Yes<br>Yes | 0 ÷ 99999 | "**HySt**" parameter in "**rELAy**" menu, no decimal point included |
| 34h | Yes | 0 ÷ 5 | "**modE**" parameter in "**rELAy**" menu:<br>**0** - "**noACt**" mode; **1** - "**on**" mode; **2** - "**oFF**" mode; **3** - "**in**" mode;<br>**4** - "**out**" mode; **5** - "**modbuS**" mode |
| 35h | Yes | 0 ÷ 999 | **"t on"** parameter in **"rELAy"** menu, expressed in tenth of seconds or tenth of minutes depend on **"unit"** parameter |
| 36h | Yes | 0 ÷ 999 | **"t oFF"** parameter in **"rELAy"** menu, expressed in tenth of seconds or tenth of minutes depend on **"unit"** parameter |
| 37h | Yes | 0 ÷ 1 | **"unit"** parameter in **"rELAy"** menu:<br>**0** - seconds; **1** - minutes |
| 38h | Yes | 0 ÷ 2 | **"ALArmS"** parameter in **"rELAy"** menu:<br>**0** - no changes; **1** - on; **2** - off |
| 39h<br>3Ah | Yes<br>Yes | 0 ÷ 999999 | "**SEt P2**" parameter in "**rELAy**" menu, no decimal point included |
| 3Bh | Yes | 0 ÷ 1 | **"vALUE"** parameter in **"rELAy"** menu (kind of value controlled relay): **0** - "FLo"; **1** - "tot"; |
| 3Ch | Yes | 0 ÷ 3 | **"t PrEc"** parameter in **"rELAy"** menu (precision of thresholds and hysteresis while relay is controlled due to total flow counter value):<br>**0** - " 0"; **1** - " 0.0"; **2** - " 0.00"; **3** - "0.000" |
| 3Dh | Yes | 0 ÷ 1 | **"t unit"** parameter in **"rELAy"** menu (the unit of thresholds and hysteresis while relay is controlled due to total flow counter value):<br>**0** - unit; **1** - 1000un; |
| | | | |
| 70h | Yes | 0 ÷ 1 | "**modE**" parameter in "**HOLd**" menu (type of detected changes):<br>**0** - peaks; **1** - drops |
| 71h<br>72h | Yes | 0 ÷ 999999 | "**PEA**" parameter in "**HOLd**" menu (minimum detectable change, no decimal point included) |
| 73h | Yes | 0 ÷ 199 | "**timE**" parameter in "**HOLd**" menu, maximum peaks' (or drops') display time expressed in seconds |

| Register | Write | Range | Register description |
|---|---|---|---|
| 74h | Yes | 0 ÷ 1 | "**HdiS**" parameter in "**HOLd**" menu (the type of values displayed on the display):<br>**0** - current measurement value; **1** - peaks (or drops) values |
| 75h | Yes | 0 ÷ 1 | "**H rEL**" parameter in "**HOLd**" menu (the control mode of relay R and LED R) :<br>**0** - control depends on current measurement values;<br>**1** - control depends on peaks (or drops) values; |
| | | | |
| E0h<br>E1h | Yes | 0 ÷ 999999 | Value of **"F coEF"** parameter in **"Flouu"** submenu, without decimal point. Value of 0 in interpreted as 1 000 000. |
| E2h | Yes | 0 ÷ 6 | Decimal point of **"F coEF"** parameter in **"Flouu"** submenu<br>**0** - " 0"; **1** - " 0.0"; **2** - " 0.00"; **3** - "0.000"; **4** - "0.0000";<br>**5** - "0.00000", **6** - "0.000000"; |
| E3h<br>E4h | Yes | 0 ÷ 999999 | Value of **"F coEF"** parameter in **"totAL"** submenu, without decimal point. Value of 0 in interpreted as 1 000 000. |
| E5h | Yes | 0 ÷ 6 | Decimal point of **"F coEF"** parameter in **"totAL"** submenu<br>**0** - " 0"; **1** - " 0.0"; **2** - " 0.00"; **3** - "0.000"; **4** - "0.0000";<br>**5** - "0.00000", **6** - "0.000000"; |
| E9h<br>EAh | No | 0 ÷ 999999 | Calculated flow (multiplied **"PuLSEL"** and **"F coEF"** values) expressed in user units (value without decimal point) |
| EBh<br>ECh | No | 0 ÷ 999999999 | Calculated total flow component (multiplied **"PuLSEL"** and **"t coEF"** values) expressed in thousands of user units (value without decimal point):<br>**999999999** 999 . 999 |
| EDh | No | 0 ÷ 999 | Calculated total flow component (multiplied **"PuLSEL"** and **"t coEF"** values) expressed in user units (value without decimal point):<br>999999999 **999** . 999 |
| EEh | No | 0 ÷ 999 | Calculated total flow component (multiplied **"PuLSEL"** and **"t coEF"** values) expressed in thousandths of user units (value without decimal point):<br>999999999 999 . **999** |

1 - it is recommended to read these registers simultaneously – in 2-registers frames. If single registers are read, data errors are possible because of changes of read value between successive registers readings.
2 - after writing to register no 20h the device responds witch an "old" address in the message.
3 - after writing to register no 22h the device responds with the new baud rate.
4 - 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.

## 8.2. 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)

## 8.3. 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) and status, 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 device 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 | 67 | E0 | 6E |

DATA - identification code (2067h)

**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):

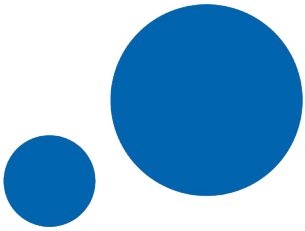
| ADDR | FUNC | ERR | CRC L,H | |
|---|---|---|---|---|
| 01 | 86 | 03 | 09 | C1 |

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

# 9. DEFAULT AND USER'S SETTINGS LIST

| *Parameter* | *Description* | *Default value* | *User's value* | *Desc. page* |
|---|---|---|---|---|
| **Parameters of relay R1 operation ("rELAy" menu)** | | | | |
| vALUE | Kind of value controlled relay state | FLo | | 30 |
| SEt P | Relay first threshold | 20.0 | | 24 |
| SEt P2 | Relay second threshold | 30.0 | | 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) | unit | | 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 |
| **Configuration of measurement input ("inPUt" menu)** | | | | |
| PULSEL | Flow sensor factor (quantity of pulses per unit) | 1.00 | | 26 |
| FrEq | Maximum input frequency | 300 (Hz) | | 26 |
| ZEro t | Maximum time between two following pulses | 1.0 (sec.) | | 27 |
| mEAS t | Width of *measurement window* | 0.5 (sec.) | | 27 |
| **Configuration of current flow display ("FLouu" menu)** | | | | |
| F PrEc | Decimal point position (precision of flow rate displaying) | 0.0 | | 27 |
| F coEF | Flow calculation coeffitient | 1.000 | | 27 |
| F unit | The unit of volume (Cubic measure) for flow rate displaying | unit | | 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 coEF | Total flow calculation coeffitient | 1.000 | | 28 |
| t unit | The unit of total flow counter displaying | unit | | 29 |
| E Clr | Active level/edge of total flow zeroing input | oFF | | 29 |

| *Parameter* | *Description* | *Default value* | *User's value* | *Desc. page* |
|---|---|---|---|---|
| **Power on initialization configuration** | | | | |
| Init d | Kind of value displayed after device power on | FLo | | 29 |
| **Configuration of data filtration (”FiLtEr” menu)** | | | | |
| vALUE | Filtering ratio | 0 | | 30 |
| droP | Measured value change causing of temporal filtering deactivation | 20.0 (%) | | 30 |
| **Display parameters** | | | | |
| briGHt | Display brightness | „bri 6” | | 30 |
| **Configuration of peaks detection function (“HOLd” menu)** | | | | |
| modE | Kind of detected changes | „norm” | | 30 |
| PEA | Minimum detected change | 0.0 | | 30 |
| timE | Maximum time of peak displaying | 0.0 (sec.) | | 30 |
| HdiS | The type of displayed value | „rEAL” | | 30 |
| H rEL | Source of relay R1, and LED R1 control | „rEAL” | | 30 |
| **Settings of access to the configuration parameters (“SECU” menu)** | | | | |
| Acc r | Permission to changes of relay R1 threshold without of the user password knowledge | on | | 31 |
| **RS 485 interface configuration (“rS-485” menu)** | | | | |
| Addr | Device address | 0 | | 31 |
| bAud | Baud rate | 9600 (b./sec.) | | 31 |
| mbAccE | Permission to changes of configuration registers | „on” | | 31 |
| mbtimE | Maximum delay between received messages | 0 | | 31 |
| rESP | Additional delay of answer transmission | „Std” | | 31 |
| **Configuration of numerical parameters edition** | | | | |
| Edit t | Numerical parameters edit mode | dig | | 32 |



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