

# User manual

## REGULATED CURRENT SOURCE

### SZP-73

- Firmware: v.5.00 or higher
- Output type: 4-20 mA, passive
- Two-colour display



Read the user's manual carefully before starting to use the unit or software.  
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 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.
- 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.



Protection level (depending on display size)

5 x 9mm version: IP 65 (from front), optional version with panel cut-out sealing available  
IP 20 (housing and connection clips)  
4 x 13mm version: IP 40 (from front)  
IP 20 (housing and connection clips)

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  
or -20°C to +50°C

Storage temperature (depending on version)

-10°C to +70°C  
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 diameter

2,5 mm<sup>2</sup>

Safety requirements

according to: PN-EN 61010-1  
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  
according to: PN-EN 61326-1

EMC



**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:

- 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).

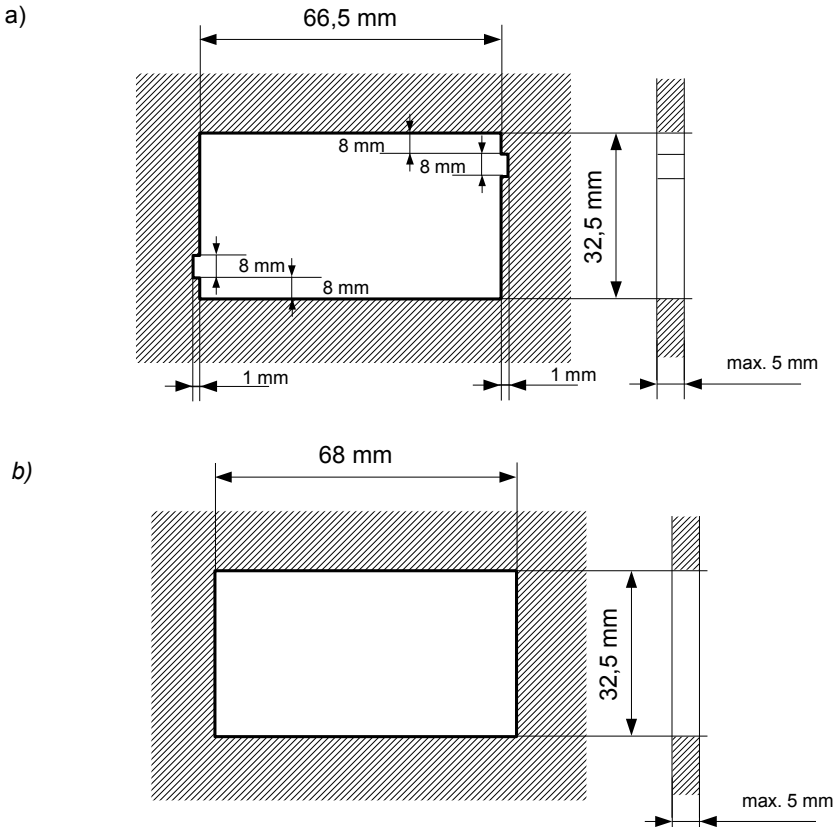


Figure 4.1. Mounting hole dimensions: a) recommended b) allowable

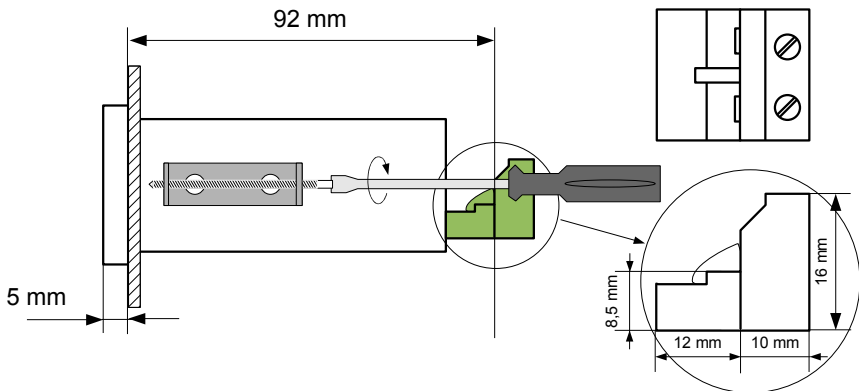


Figure 4.2. Installing of brackets, and dimensions of connectors.

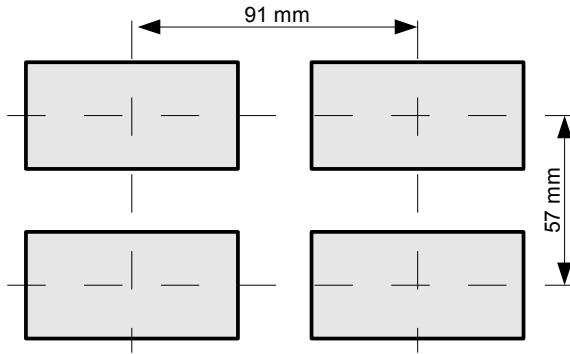


Figure 4.3. Minimum distances when assembly of a number of units

### 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 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.

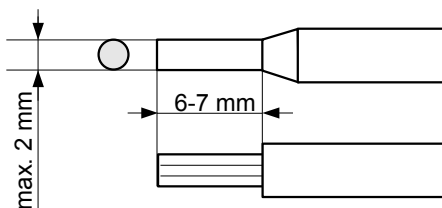


Figure 4.4. Method of cable insulation replacing and cable terminals

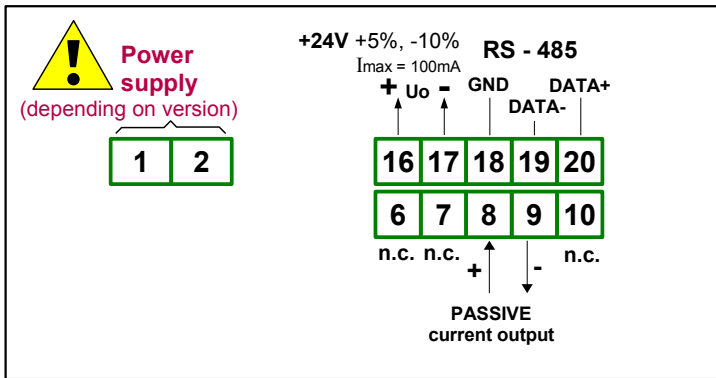


Figure 4.5. Terminals description



All connections must be made while power supply is disconnected !

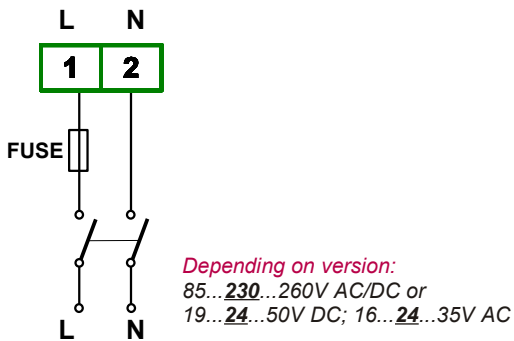


Figure 4.6. Connection of power supply

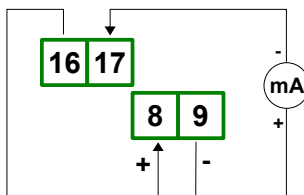


Figure 4.7. Example of passive current output connections

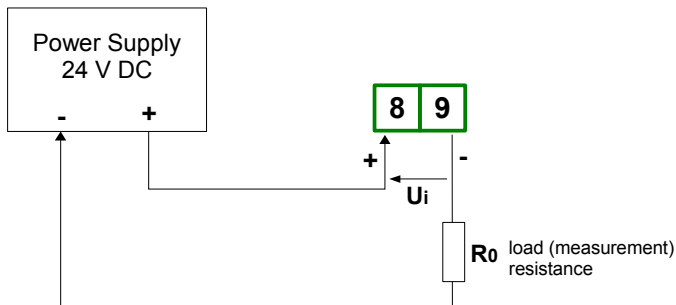
**4.3.1. Calculation of max. permissible load resistance**

Figure 4.8 Circuit used for calculations

Calculation of resistance  $R_0$  has been made using above circuit, following signatures has been assumed:

- $U_i$  - minimal current output supply voltage assuring its proper operation
- $I_{max.}$  - maximal current measured in current loop (20 mA)
- $U_s$  - external power supply voltage (24V)

$$R_{0 \max.} = \frac{U_s - U_i}{I_{max.}}$$

Values  $U_i = 6,5V$   $I_{max.} = 20 \text{ mA}$  and  $U_s = 24V$  gives:

$$R_{0 \max.} = \frac{24 - 6,5}{0,02} = 875 \Omega$$



Current output of **SZP-73** can be powered from device power supply output. To calculate max. resistance of the load, minimum available voltage (21.6V) should be used as supply voltage. Then  $R_{0 \max.} = 755 \Omega$ .

## 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:



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 current source mode),
- Cancel the changes made in parameter being edited



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

#### Functions:

- switching between displaying of direct current value and recalculated current value
- 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 output current value,
- 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 *current source mode*. After power on, output current can get default value (defined by user) or value equal to generated directly before power off (see **MENU DESCRIPTION**, parameters “**Init**” and “**IvAl**”).

### **6.1. CURRENT SOURCE MODE**

In this mode chosen output value is presented on the LED display. Pressing the **[ENTER]** button switches between displaying and regulation of direct current value and recalculated value (scaled to user defined range)

#### **6.1.1. Regulation and displaying of direct current value**

This mode is signaled by flashing decimal point (in orange colour if device is equipped with two-colour display) of displayed current value.

There are available values in range: 4mA (displayed as 4.00) up to 20mA (displayed as 20.00). Buttons **[^]** and **[v]** allows changing of present current value. If user presses and holds one of these buttons current is being changed with increasing speed.



The range of displayed and generated values is “**4.00**” ÷ “**20.00**” in this mode.

#### **6.1.2. Regulation and displaying of recalculated value**

In this mode displayed value is recalculated to output current value according to parameters “**OUtL**” and “**OUtH**” (see **OPIS MENU**). Decimal point position can be set to any decade using parameter “**Pnt**” (see **OPIS MENU**).

- if displayed value is equal to value of parameter “**OUtL**” - output current is equal 4 mA
- if displayed value is equal to value of parameter “**OUtH**” - output current is equal 20 mA
- all values between “**OUtL**” and “**OUtH**” are recalculated to output current according to formula:

$$I_{out} = \frac{Z - "OUtL"}{"OUtH" - "OUtL"} \times 16 mA + 4 mA$$

where **Z** denotes required value.

Buttons **[^]** and **[v]** allow to change of current value (recalculated value in this mode). If user presses and holds one of these buttons current is being changed with increasing speed.



The range of displayed and generated values is “**OUtL**” ÷ “**OUtH**” in this mode.

All accessible parameters 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).



Configuration of the device (via menu or RS 485 interface) **do not stops measures.**

## **7. DEVICE PROGRAMMING**

The device menu allow user to set all parameters connected to operation of current output, displaying mode and access settings. The meaning of the particular parameters is described in paragraph **MENU DESCRIPTION**.

### **7.1. PROGRAMMING MENU**

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

If the user password is defined (see parameter “**Scod**“), 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 current source mode).



After about 1 min. since last use of the buttons, device exits the menu mode and returns to the current source 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 store 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 store 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 and 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.



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 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 **"Err"**, and unit returns to current source mode.



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

### 7.3.1. **"OUTL" parameter**

This parameter defines lower border of recalculated current value, causing generation 4mA of output current. This parameter can be set to any value from range -999 ÷ 9999 (plus decimal point).

### 7.3.2. **"OUTH" parameter**

This parameter defines upper border of recalculated current value, causing generation 20mA of output current. This parameter can be set to any value from range -999 ÷ 9999 (plus decimal point).



The **"OUTL"** value can be greater than **"OUTH"** value. In such case current output range is switched upside down. It means that while displayed (recalculated) value is increased, output current decreases.

### 7.3.3. **"Pnt" parameter**

Decimal point position. It can be set to: **" 0"**, **" 0.0"**, **" 0.00"**, **"0.000"**  
 Decimal point position is changed by **[^]**, **[v]** buttons.



### **7.3.4. "Init" parameter**

This parameter defines current generated after power on. It can be set to the following values

- "UdEF" - user defined value equal to "IvAL" parameter
- "LAST" - value equal to value of current generated directly before power off (its value is stored automatically)

### **7.3.5. "IvAL" parameter**

If parameter "Init" is set to "UdEF", then parameter "IvAL" defines output current value after power on. It can be set to any value form range 4.00 – 20.00 mA.

### **7.3.6. "bri" parameter**

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

### **7.3.7. "CoL" parameter**

This parameter (available only for devices equipped with two-colour display) defines basic colour of the LED display:

- "grEE" - main colour is green,
- "rEd" - main colour is red.

### **7.3.8. "Scod" parameter**

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.

### **7.3.9. "rS" 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. It can be set to one of 8 possible values: **"1.2"**, **"2.4"**, **"4.8"**, **"9.6"**, **"19.2"**, **"38.4"**, **"57.6"**, **"115.2"**, which respond to the baud rates of 1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200 bit/s respectively.
- "mbAc"** - 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.
- "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 7.1 contains most frequently used values.

|                         |        |        |         |
|-------------------------|--------|--------|---------|
| <b>"bAud" parameter</b> | "38.4" | "57.6" | "115.2" |
| <b>"rESP" parameter</b> | " 10c" | " 20c" | " 50c"  |

Tab.7.1. Settings of **"rESP"** parameter

### 7.3.10. **"Edit" parameter**

This parameter allows to change the edition mode of numerical parameters:

- "dig"** - the change to "by digit" mode,  
**"Slid"** - slide change mode.

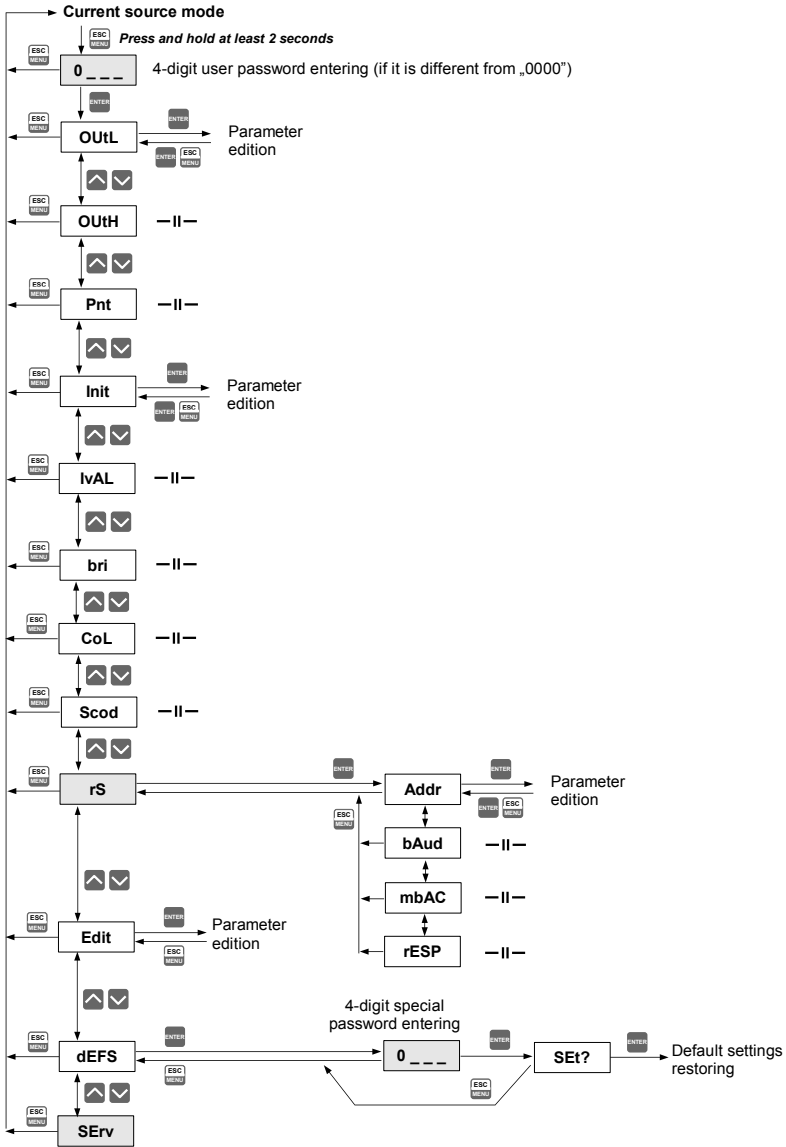
### 7.3.11. **"dEFS" parameter**

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.

### 7.3.12. **"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. MENU STRUCTURE



## 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

| Register         | Write | Range       | Register description   |
|------------------|-------|-------------|--|
| 01h <sup>1</sup> | Yes   | 400 ÷ 2000  | Generated current value (diect value) expressed in 0,01 mA   |
| 02h <sup>1</sup> | Yes   | -999 ÷ 9999 | Rescaled current value expressed according to "OUTL" and "OUTH"  |
| 06h              | Yes   | -999 ÷ 9999 | "OUTL" parameter, no decimal point included  |
| 07h              | Yes   | -999 ÷ 9999 | "OUTH" parameter, no decimal point included  |
| 08h              | Yes   | 0 ÷ 3       | "Pnt" parameter: <b>0</b> - "0"; <b>1</b> - "0.0"; <b>2</b> - "0.00"; <b>3</b> - "0.000"   |
| 09h              | Yes   | 0 ÷ 1       | "Init" parameter: <b>0</b> - UdeF option; <b>1</b> - LAST option   |
| 0Ah              | Yes   | 400 ÷ 2000  | "IvAL" parameter, expressed in 0,01 mA   |
| 20h <sup>2</sup> | Yes   | 0 ÷ 199     | Device address   |
| 21h              | No    | 2065h       | Device identification code (ID)  |
| 22h <sup>3</sup> | Yes   | 0 ÷ 7       | "bAud" parameter in "rS" menu (baud rate);<br><b>0</b> - 1200 baud; <b>1</b> - 2400 baud; <b>2</b> - 4800 baud; <b>3</b> - 9600 baud;<br><b>4</b> - 19200 baud; <b>5</b> - 38400 baud; <b>6</b> - 57600 baud; <b>7</b> - 115200 baud |
| 23h <sup>4</sup> | Yes   | 0 ÷ 1       | "mbAc" parameter in "rS" menu (permission to write registers via RS-485 interface); <b>0</b> - write denied ; <b>1</b> - write allowed   |
| 25h              | Yes   | 0 ÷ 5       | "rESP" parameter in "rS" menu (additional response delay);<br><b>0</b> - no additional delay; <b>1</b> - "10c" option; <b>2</b> - "20c" option;<br><b>3</b> - "50c" option; <b>4</b> - "100c" option; <b>5</b> - "200c" option;      |
| 2Dh              | Yes   | 1 ÷ 8       | "bri" parameter (display brightness);<br><b>1</b> - the lowest brightness; <b>8</b> - the highest brightness   |
| 2Eh              | Yes   | 0 ÷ 1       | "CoL" parameter (main colour of display): <b>0</b> - green; <b>1</b> - red   |
| 2Fh              | Yes   | 0 ÷ 1       | "Edit" parameter (numerical parameters edit mode);<br><b>0</b> - „dig" mode; <b>1</b> - „SLid" mode  |

1 - value stored to register 01h or 02h is automatically recalculated and stored to each other

2 - after writing to register no 20h the device responds with 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 "mbAc" 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 1).

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: “mbAc” 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), SZP-73 device address = 01h:**

| ADDR | FUNC | REG H,L |    | COUNT H,L |    | CRC L,H |    |
|------|------|---------|----|-----------|----|---------|----|
| 01   | 03   | 00      | 01 | 00        | 01 | D5      | CA |

a) The answer (we assume that device works in direct current displaying mode):

| ADDR | FUNC | BYTE C | DATA H,L |    | CRC L,H |    |
|------|------|--------|----------|----|---------|----|
| 01   | 03   | 02     | 01       | C2 | 38      | 45 |

DATA H, L - displayed value = 450, no decimal point included.  
 Decimal point position can be read from reg. 08h.

b) The answer (if an error occur):

| ADDR | FUNC | ERROR | CRC L,H |    |
|------|------|-------|---------|----|
| 01   | 83   | 02    | C0      | F1 |

ERROR - error code = 02h, illegal register address

## 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       | 65 | 61      | AF |

DATA - identification code (2065h)

## 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. Read of the registers 6, 7 and 8 in one message (example of reading a number of registries in one frame):**

| ADDR | FUNC | REG H,L |    | COUNT H,L |    | CRC L,H |    |
|------|------|---------|----|-----------|----|---------|----|
| 01   | 03   | 00      | 06 | 00        | 03 | E5      | CA |

COUNT L - the count of being read registers (max.16)

The answer:

| ADDR | FUNC | BYTE C | DATA H1,L1 |    | DATA H2,L2 |    | DATA H3,L3 |    | CRC L,H |    |
|------|------|--------|------------|----|------------|----|------------|----|---------|----|
| 01   | 03   | 06     | 01         | 90 | 07         | D0 | 00         | 02 | 61      | F5 |

DATA H1, L1 - reg. 06h (0190h - it means that "OutL" = 400),

DATA H2, L2 - reg. 07h (07D0h - it means that "OutH" =2000 ),,

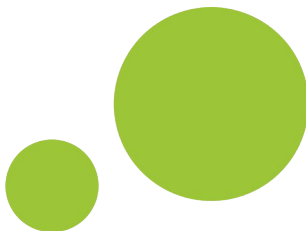
DATA H3, L3 - reg. 08h (0002h - it means decimal point position = " 0.00").



**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 |
|--|--|---------------|--------------|------------|
| OutL   | Value displayed for current equal 4 mA           | 0             |              | 16         |
| OutH   | Value displayed for current equal 20 mA          | 100.0         |              | 16         |
| Pnt  | Decimal point position                           | 0.0           |              | 16         |
| Init   | Mode of i current value initialisation           | UdEF          |              | 17         |
| IvAL   | Current after power on (if Init is set to UdEF)  | 4.00          |              | 17         |
| <b>Display parameters</b>                            |  |               |              |            |
| bri  | Display brightness                               | bri6          |              | 17         |
| CoL  | Basic colour of the display                      | grEE          |              | 17         |
| <b>RS 485 interface configuration (menu "rS")</b>    |  |               |              |            |
| Addr   | Device address                                   | 0             |              | 17         |
| bAud   | Baud rate  | 9.6           |              | 18         |
| mbAc   | Permission to changes of configuration registers | on            |              | 18         |
| rESP   | Additional delay of answer transmission          | Std           |              | 18         |
| <b>Configuration of numerical parameters edition</b> |  |               |              |            |
| Edit   | Numerical parameters edit mode                   | dig           |              | 18         |



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