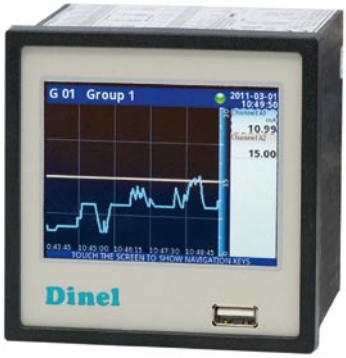
Dinel®

INSTRUCTION MANUAL



MULTIFUNCTIONAL GRAPHICAL UNIT MGU–800

Firmware version 2.27.0 or higher

Read carefully the instructions published in this manual before the first use of the level meters. Keep the manual at a safe place. The manufacturer 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.

- GND input of device should be connected to PE wire;

- 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 of 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 characteristic

The **MGU-800 unit** is a sophisticated multichannel unit which allows simultaneous measurement, visualisation and control of numerous channels. This device can operate autonomously or with cooperation with external measurement devices and actuators. Essential features of **MGU-800** are listed and briefly described below.

- ***Advanced processing unit and system based on LINUX***
  The powerful **MGU-800** processor allows the device to run under the control of a LINUX operating system. Such a solution makes the firmware flexible and gives the possibility of simultaneous operation of many processes (like: measurement, communication, visualisation). The use of LINUX also makes software independent of installed hardware.

- ***Colour TFT display with Touch-panel***
  The **MGU-800** displays all data and dialogue on a legible, 320x240 pixels, colour TFT screen. Full control of the device is realised using the built-in touch-panel which makes operating the **MGU-800** easy and intuitive.

- ***Hardware flexibility and a large variety of possible configurations***
  MGU-800 is designed as modular device consisting of a ***base*** and optional ***input and output modules***. The ***base*** contains:
  - main processor,
  - display with touch-screen,
  - Switch Mode Power Supply
    - 19V...24...50V DC, 16V...24...35V AC
    - 85V...**230**...260V,
  - basic communication interfaces (USB and RS485).
  - three slots (marked as A, B, C) designed for installation of measurement and/or output modules.
  - one slot (marked as D) used for advanced communication module (additional USB Host, RS-485, RS-485/RS-232 and Ethernet).

All measurement and output modules are optional and can be installed inside the device according to the customer's needs.

Input modules that can be installed:
- 4/8/16 Voltage/Current input module,
- 8 Optoisolated digital input,

Output modules that can be installed:
- 8 Relay module 1A/250V,
- 2 Passive current output module.

- ***Full freedom of data sources, presentation modes and controlling methods***
  The multi level structure of the **MGU-800** firmware allows for selection of presented data sources, presentation modes and controlling methods. The **MGU-800** displays the values of virtual ***logical channels*** which can be fed with:
  - measurement data from built-in physical channels,
  - measurement data from remote channels (other devices connected to the **MGU-800** by RS-485 interface),
  - output states and quantities (looped back results of controlling processes),
  - generate profiles/timers or also the mathematical combination of one or more ***logical channels***.

  All of these can be freely named and described by the user, and presented in many forms:
  - as numerical values,
  - vertical and horizontal charts,
  - vertical and horizontal bars,
  - as needle graphs.

  Every ***logical channel*** (visualised or not) can be used as input data for one or more controlling process. The **MGU-800** implements many different controlling methods:
  - above defined level,
  - below defined level,
  - inside defined range,
  - outside of defined range,
  - PID control.

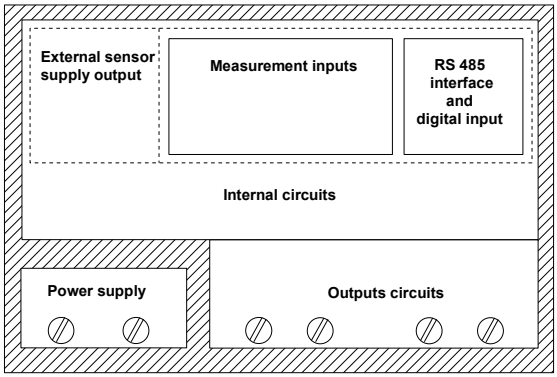
3. Device installation

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 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 connections against unauthorized persons must be taken into consideration.

This is a class A unit. Class A equipment is suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.
This is group 1 unit. Group 1 contains all equipment in the scope of this standard which is not classified as group 2 equipment. Group 2 contains all ISM RF equipment in which radio-frequency energy in the frequency range 9 kHz to 400 GHz is intentionally generated and used or only used, in the form of electromagnetic radiation, inductive and/or capacitive coupling, for the treatment of material or inspection/analysis purposes.

Carefully check that the insulation used with the unit meets the expectations and if necessary use appropriate measures of over voltage protection. Additionally, insure the appropriate air and surface insulation gaps when installing.



Insulation strength 1min @ 2300V AC
Insulation strength 1min @ 500V AC
No insulation

Schematic diagram showing the insulation between individual circuits of the unit.

3.1. 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 located on the housing and report the damage to the manufacturer.

Attached with the unit please find:
- assembly brackets - 2 pieces,
- warranty,
- user's manual for **MGU-800** unit (device),

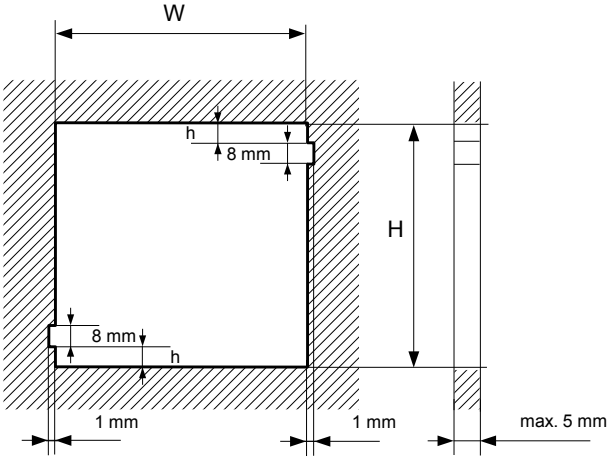
3.2. Assembly

- 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 mounting hole must be prepared according to Figure. 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. Place the unit in the mounting hole inserting it from the front side of the panel, and then fix it using the brackets The minimum distances between the centre points of multiple units - due to the thermal and mechanical conditions of operation.

Small housing:
H, W = 90.5 mm
h = 16 mm

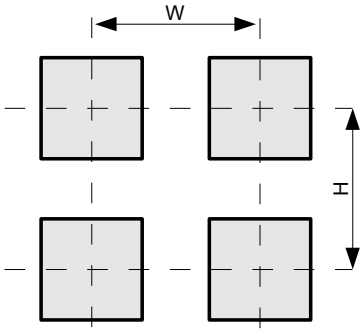
Large housing:
H, W = 137 mm
h= 38.5 mm



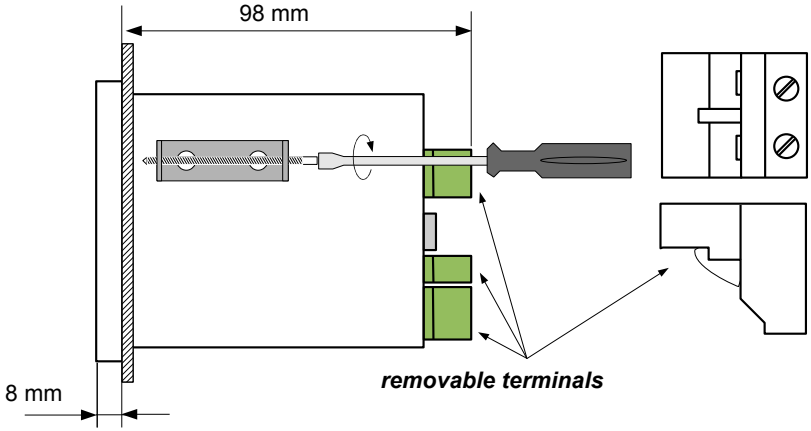
Mounting hole dimensions

Small housing:
H, W = 115 mm

Large housing:
H, W = 165 mm

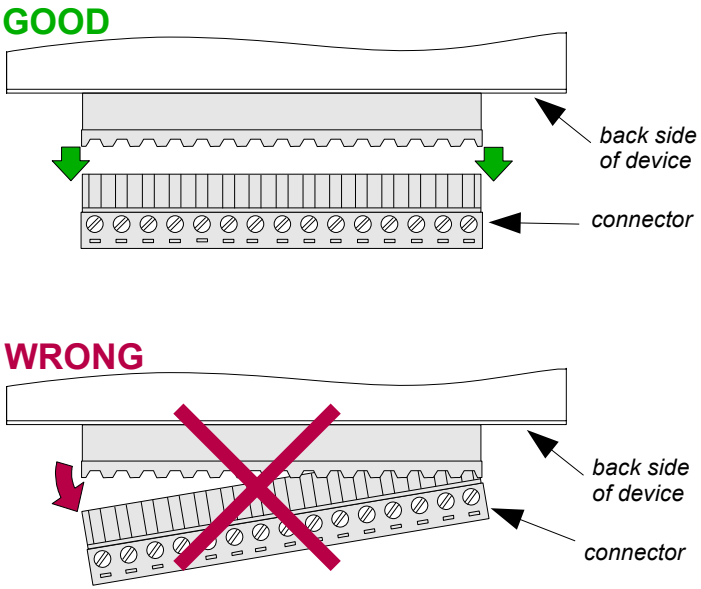


Minimum distances when assembly of a number of units



Installing of brackets

To avoid connectors slots destruction use the method shown on Figure.



Connectors removing method

3.3. 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 a small 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 active wire (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.

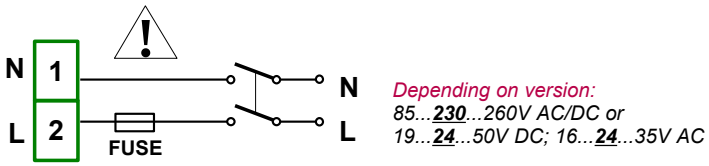
- In the case of the unit being fitted with separable clamps they should be inserted into appropriate connectors in the unit, even if they are not used for any connections.

- Unused terminals (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 to 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.

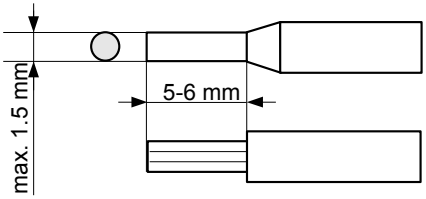
- After the installation is completed do not touch the unit's connections when it is switched on, because it carries the risk of electrical shock.

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.



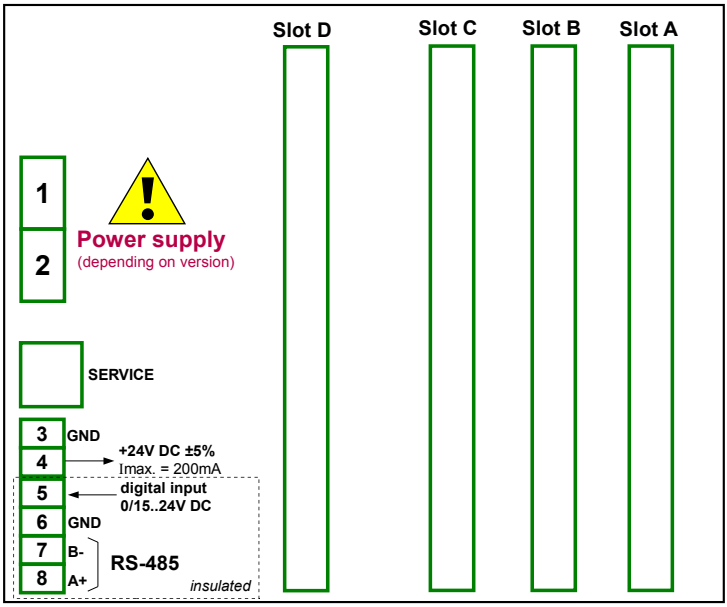
Connection of power supply

- Avoid running signal cables and transmission cables together with power supply cables and cables controlling inductive loads (e.g. contactors). Such cables should cross at a right angle.
- Contactor coils and inductive loads should be equipped with 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 pair signal cables is recommended. Twisted pair (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 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 earth with the largest possible surface. The cables connected to the filter output must not be run with cables with interference (e.g. circuits controlling relays or contactors).



Method of cable insulation replacing and cable terminals dimensions

All connections must be made while power supply is disconnected !



Terminals description

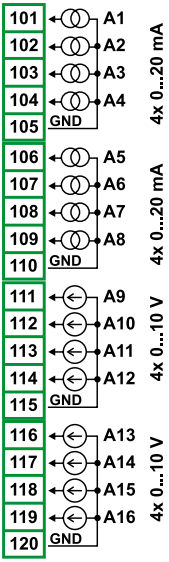
The basic performance of the device contains only the extreme left terminals:

- Power supply,
- SERVICE,
- Sensor supply output +24V DC Imax=200mA,
- Digital input 0V...15...24V DC (low state: 0÷5V, high state:8÷24V)
- Interface RS-485,

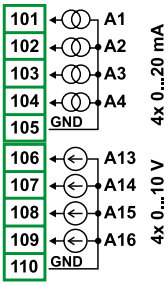
Depending on customer's needs, the basic version of the device can be upgraded with up to:

- three I / O modules (installed in a place designated as **Slot A**, **Slot B**, **Slot C**),
- advanced communication module (additional serial, USB and Ethernet interfaces installed in **Slot D**).

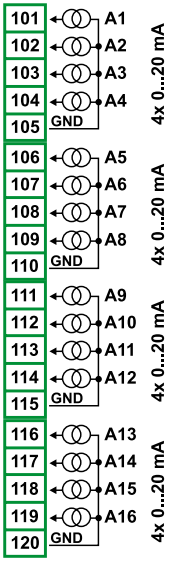
IUI8
8 Current inputs
8 Voltage inputs



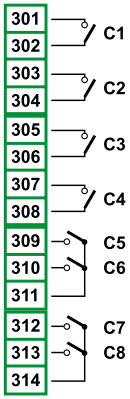
IUI4
4 Current inputs
4 Voltage inputs



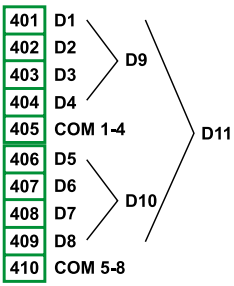
II16
16 Current inputs



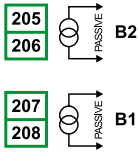
OR8
8 Relay outputs
(1 A / 250 V)



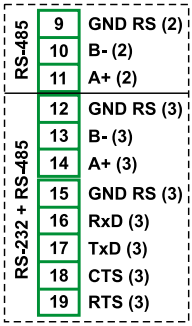
ID8
8 Digital inputs



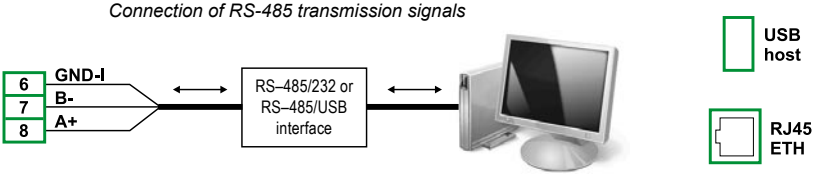
OI2
2 Passive current output



ACM communication module



Connection of RS-485 transmission signals



The MGU-800 device supports the following converters:
USB / RS-485 converter or RS–232 / RS–485 converter.

3.4. 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 the unit's 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 of electronic products.

4. INTRODUCTION TO MGU–800

4.1. UNDERSTANDING MULTIFUNCTIONAL GRAPHICAL UNIT MGU–800

The **MGU-800** device was developed as a universal multichannel controller. To maintain this concept its firmware was written with multi level structure. The device runs under the control of a LINUX operating system keeping all subsystems ready to use and allowing independent and simultaneous operation of many processes (communication, data acquisition, post-processing, visualisation etc.). Such an approach gives great advantages to high level applications, making it flexible and dynamically configurable. Similarly data structures and streams were implemented in quite a different way than in most similar devices. The main difference is the concept of using ***Logical Channels*** as a bridge: physical inputs and outputs - visualisation and controlling processes. Designers of **MGU-800** decided to use such solution to increase functionality of the device and make software near fully independent on the hardware.

4.1.1. Logical channels

A **Logical Channel** is a data stream existing in the memory of the device, having it's own name and can be displayed in almost any way. **Logical Channels** can be used as:

- measurement inputs,
- data source of control loop,
- control source of the physical outputs,
- input data to other **Logical Channels**,
- data source for visualisation and logging.
- states and data coming from outputs of controlling processes,
- generated profile/timer
- states of virtual input channels, and timers,
- mathematical combination of other ***Logical Channels***.

4.2.1. Groups

More information about Logical channels and samples of configuration Logical channels are presented in **Chapter 6.8 LOGICAL CHANNELS**.

To make visualization clearer ***Logical Channels*** can be gather into ***Groups***.

5.1.2. Groups

A ***Group*** is a set of 1-6 ***Logical Channels***. The **MGU-800** can show on the same screen only channels belonging to the same ***Group,*** additionally each ***Group*** has its own individual name making operation with the device very clear. Every ***Logical Channel*** can belong to one or more groups simultaneously, and also not to belong to any group (then it will not be shown, but it can still be used for other processes). It is common that channels belonging to the same ***Group*** are related to one another in some way (for example representing parameters of single object or representing similar parameters of few separate objects) but it is also possible to create a ***Group*** consisting of completely unrelated channels.

4.2. HARDWARE CONFIGURATIONS

The functionality of **MGU-800** can fit to the user's needs. The ***base*** of the **MGU-800** contains: the main processor, display with touch-screen, Switch Mode Power Supply (in one of two versions: 19V...**24**...50V DC 16V...**24**...35V AC and 85V..230..260V AC) and basic communication interfaces like USB and RS485. See Figure - most far left connectors. All other modules are optional and can be installed inside the device according to customer's needs. Next to the basic connectors is the slot for an advanced communication module. In the simplest version this module can be equipped only with rear USB Host connector (this is standard for the IP-65 version of the **MGU-800**). The full version of this module contains also 2 additional serial ports (RS485 and RS485/RS232) and a 10Mb Ethernet RJ-45 connector.

Three slots designed for built-in hardware inputs and outputs are installed on the right side of the case (terminals marked: slot A, slot B and slot C). The number and size of these terminals varies depending on module type. Brief descriptions of available modules are shown in Figure. Measurement and actuator modules are constantly being developed, so the current list of available modules varies (visit manufacturers website to check current list of **MGU-800** modules).

Basic measurement modules are:
- 4/8/16 Voltage/Current input module,
- 8 Digital input

Output modules are:
- 8 Relay 1A/250V module,
- 2 IO passive current output.

Communication module:
- ACM - advanced communication module.

5. WORKING WITH THE MGU–800

5.1. MGU–800 POWER UP

After powering up a starting Logo is showed on the **MGU-800** display. While the operating system is being loaded a progress bar is visible in the middle of the screen. During this process the view of screen may stay dimmed for 3-5 seconds. Please wait until the end of this operation before starting to operate the device. Additionally, in the last phase of loading in the lower left corner displays the software version. After that the main application is started. The view of the main program depends of the **General settings** (see the **Chapter 6.7. GENERAL SETTINGS**) and **Group** settings (see **Chapter 6.14. GROUPS**). An example view of the main program shown in Figure.

5.2. THE USE OF TOUCH-SCREEN

Do not use pointers with sharp edges (like tips of pencils and pens, knifes, scissors, needles, wires, nails, bolts etc.) while working with touch-screen. It is strongly recommended to use a special stylus made of plastic or another soft material with round ends (for example the stylus delivered with the device) or a finger. The display of the **MGU-800** should also be protected against aggressive substances and extremely high and low temperature(see technical data in **Chapter 7. TECHNICAL DATA**).

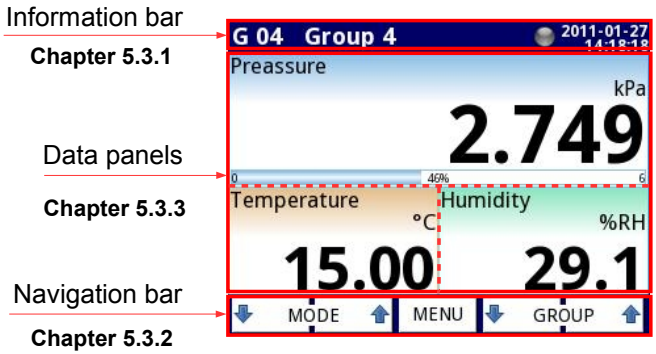
To clean the LCD screen you should use a special detergent designed for LCDs and a soft cloth.

5.3. DISPLAY

The **MGU-800** displays all data and dialogue on a 3,5" 320x240 pixel, colour TFT screen with embedded touch screen panel. New devices have the display protected with a thin transparent plastic cover. This protective layer should be removed before use to ensure perfect visibility of pictures and sensitivity of the touch-screen.

While normal operation the **MGU-800** displays data in a form selected by user, at any time it is possible to switch presentation mode and group or show configuration menu. All details of the user interface are designed to make use of device easy and intuitive. To change display mode, group or to enter the menu, touch the screen of the **MGU-800** and press appropriate button in the **Navigation bar**.

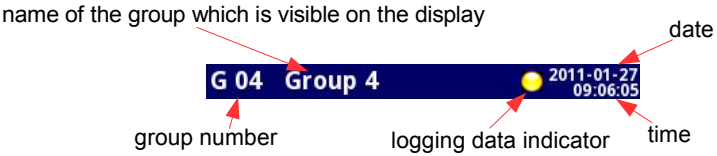
Further information about menu and presentation modes are described in further chapters.



*Typical view of a **MGU-800** main page, after touching display*

5.3.1. Information bar

The **Information bar** informs the user about current, display group, logging, actual date and time.



View of information bar

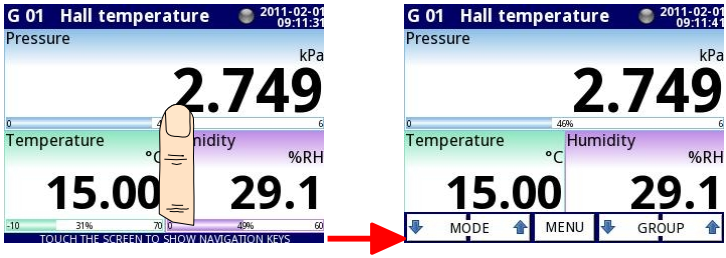
Information bar displays:

- **name of the Group** visible on the screen, in place of standard name (e.g. **Group 4**). It is possible to enter a more descriptive name for clarity (for more information see **Chapter 6.14. GROUPS**),
- **group number** - number of the currently displayed Group, to change the displayed **Group** press button **[↓GROUP]** or **[GROUP↑]** in the **Navigation bar** (see **Chapter 5.3.2. Navigation bar**),
- **time** and **date** - actual time and date display on the right upper corner on the screen can be set in **General settings** (see **Chapter 6.7. GENERAL SETTINGS**),
- **logging data indicator** - located in the **Information bar** the **logging data indicator** changes color depending of state logging:
  - **gray color** - data logging option is not activated (to activate the data logging option you need to enter the licence key provided by the manufacturer - see **Chapter 6.4. DEVICE INFORMATION** or
    when the logging option is activated but is disabled.
  - **green color** - after activation the data logging option indicator changes to green when the data logging is enabled (for more information about setting data logging see **Chapter 6.14.2. Groups - Logging options**),
  - **yellow color** – It is possible to log data in the device but there is only **10MB** of free memory remaining (to clear the memory you need to move onto a removable flash drive any important data logging files and possibly the Modbus templates, after which remove them from the device - more information see **Chapter 6.3. FILES MANAGEMENT**),
  - **red color** - warning about the lack of space on memory card, meaning data logging would not be possible until space is freed in the memory (how to remove data and exchange data with a flash drive is shown in **Chapter 6.3. FILES MANAGEMENT**)
  - **alternately blinking green with a blue color** - when the indicator flashes blue the logged data is moved to memory (Note! at this time you must not turn off the device because it may cause a loss of recently logging data).

In order to turn off the device especially when the data logging is **ON** it is recommended to use the safe-off device by pressing the button **Safe-shutdown** in the main menu.

5.3.2. Navigation bar

The touching the screen at any place causes the **Navigation bar** to display which allows the user to switch between visualisation modes, groups and to enter the menu.

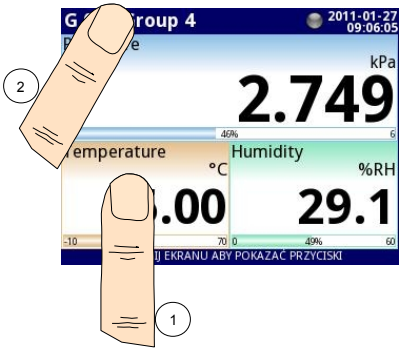


*Main window of device – displaying the **Navigation bar***

This bar contains three kinds of buttons shown in Table.

MODE	switching between visualisation modes of current group (for possible modes see **Chapter 5.3.3. Data panels** and **Chapter 6.14. GROUPS**)
MENU	entering the main menu (see details in **Chapter 6. CONFIGURATION OF THE MGU-800**
GROUP	switching between presented groups of logical channels (activation and settings for **Group** view see **Chapter 6.14 GROUPS**)

Tab. 6.1 Buttons of the navigation bar



*Methods for direct entry to **Logical channel** configuration **(1)** and **Group** configuration **(2)***

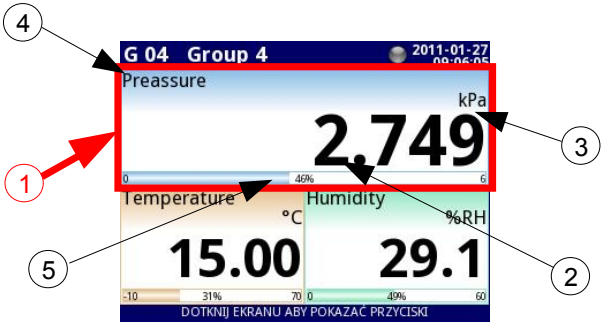
To enter directly into the configuration menu of particular **Logical channel**, press and hold screen over the channel data panel for 3-4 seconds (see option **(1)** in the entering configuration of the **logical channel** named **'Temperature'**).
Similarly to go directly to configuration of displayed **Group**, touch and hold **the group number** or **group name** in the upper **Information bar** for a few seconds (see option **(2)** in the entering configuration of the **Group** named **'Group 4'**). In both cases if a password is set (see **Chapter 6.17. ACCESS OPTIONS**) then the user has to enter the password before entering the configuration.

5.3.3. Data panels

The great deal of the screen is being used for channel visualisation. Data can be presented in one of the following modes:

- as numerical values,
- as charts,
- as bars,
- as needle dials.

All channels of the current group are simultaneously presented in the same mode. In the current version of software there is no possibility to mix different modes in one view.
The switching between visualisation modes can be done by pressing the buttons **[MODE↑]** or **[MODE↓]** in the **Navigation bar** (see **Chapter 5.3.2. Navigation bar**).
Switching between groups can be done by pressing the buttons **[GROUP↑]** or **[GROUP↓]**.



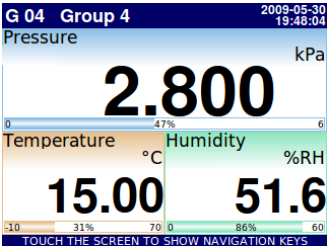
*View of the **Data panel***

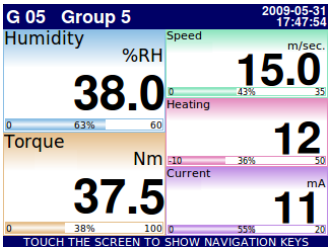
In all data panels (a sample of a data panel is shown inside the frame marked **(1)** in Figure) the following information is available:

- value of the logical channel (denoted by **(2)** in Figure),
- data unit (denoted by **(3)**),
- channel's name (denoted by **(4)**),
- on some modes there is also a visible percentage indicator of the value in relation to it's full scale (denoted by **(5)**),

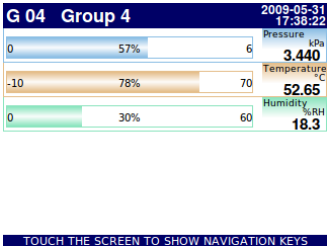
Every ***Group*** of ***Logical Channels*** can be presented in one of 6 modes:

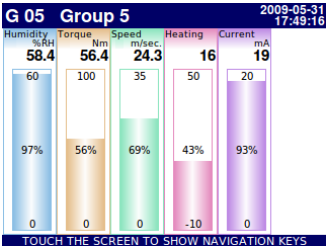
- as numerical values
- as horizontal bars
- as vertical bars
- as horizontal charts
- as vertical charts
- as needle dials



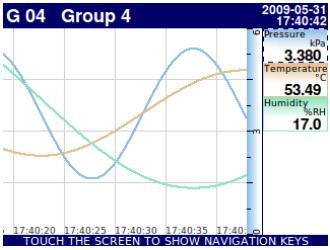


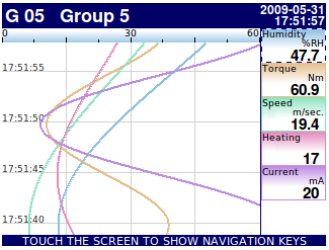
*Examples of **Numerical Values** presentation mode*



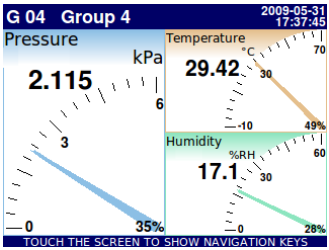


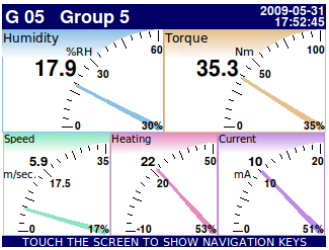
*Examples of **Horizontal** (for 3 channels) and **Vertical Bars** (for 5 channels)*



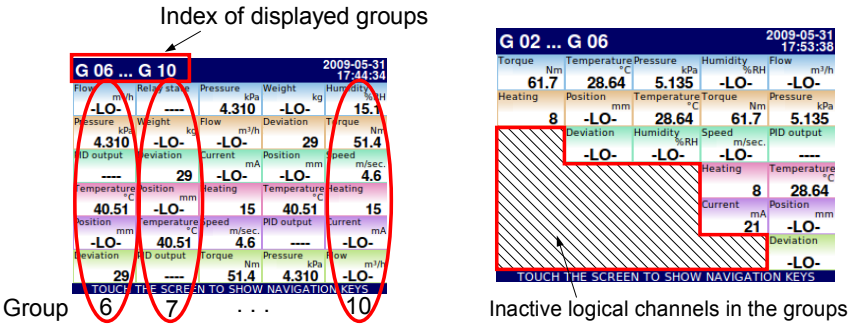


*Examples of **Horizontal** (for 3 channels) and **Vertical Charts** (for 5 channels)*





*Examples of **Needle Dials** for 3 channels and for 5 channels*



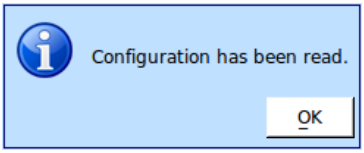
*Examples of simultaneous presentation of **Many Groups***

There is also the possibility to show many groups on a single screen. In this mode channels belonging to the same group are displayed under one another, and groups are placed side by side. As much as 5 groups can be displayed simultaneously on a single screen (for example, groups starting from group 8 will display on the screen, starting from the left side of the page, groups: 8, 9, 10, 1, 2),

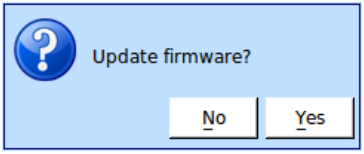
See **Chapter 6.14. GROUPS** for more information about **Groups**.

5.3.4. Important messages

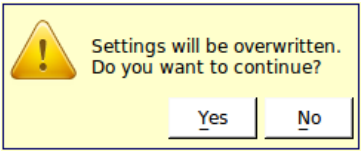
The user will sometimes be asked, informed and alerted about a variety of events by messages displayed on the screen. Next figures show present examples of message types.



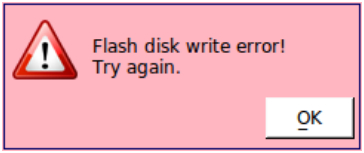
Information message



Question message



Warning message



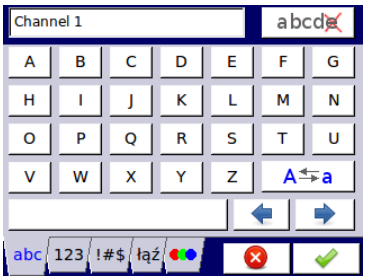
Alert message

6. Configuration of the MGU–800

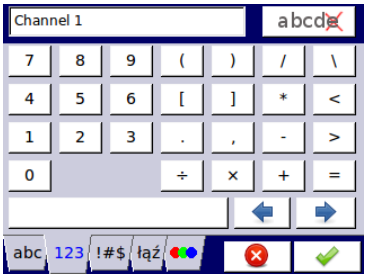
6.1. Edit dialogues

Configuration process are based on edit dialogues. Some of the dialogues are common to different menus, such dialogues are:

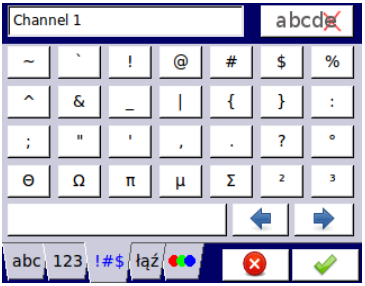
- text editor, which is divided into tabs:
  - letters
  - numbers and arithmetic signs
  - the special symbols
  - diacritical letters
  - font and background colours
- values editor, which is divided into tabs:
  - decimal form
  - hexadecimal form
  - binary form
- switch editor, which is divided:
  - single choice type options
  - multiple choice type options
- file editor, which is divided:
  - single file selection
  - multiple files selection



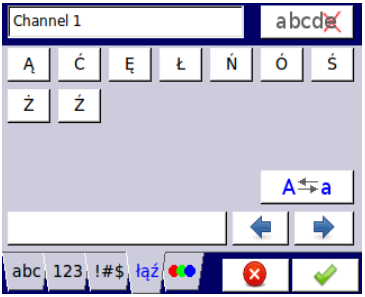
Text editor – letters



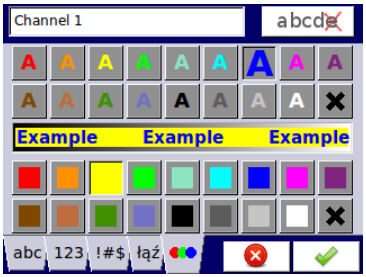
Text editor – numbers



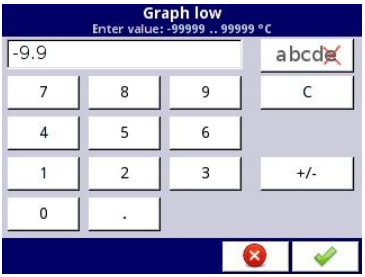
Text editor – special symbols



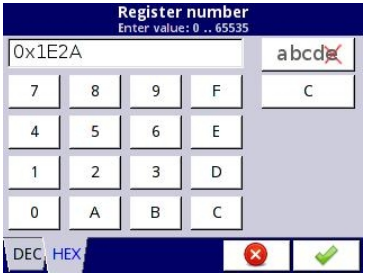
Text editor – diacritical letters



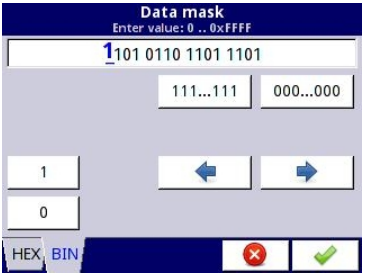
Text editor – font and background colour selection



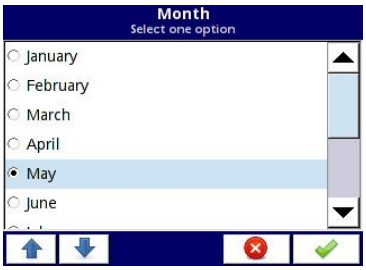
Value editor – decimal form



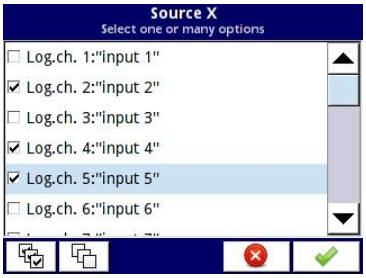
Value editor – hexadecimal form



Value editor – binary form



Single choice type editor

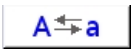
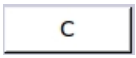
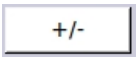


Multiple choice type editor

File editor - single file selection

File editor - multiple file selection

Functions of common buttons

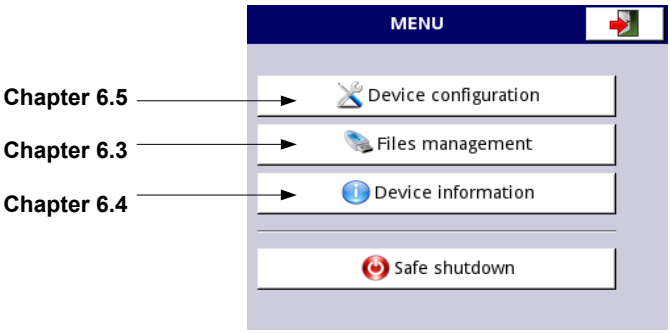
	"**Exit**" - exits from current menu or sub-menu
	"**OK**" - accept choice or changes of edit dialogue (and exit from this dialogue)
	"**Cancel**" - reject entered choice or changes of edit dialogue (and exit from this dialogue)
	Selection of element for editing. Arrow buttons allow the user to select successive elements (groups, logical channels, controllers or outputs). The middle button allows a direct selection of particular element from the list.
	Navigation keys in choice type dialogues.
	Move arrows. Allow to move cursor along the edited text.
	"**Caps lock**" - switches between lower and upper case letters.
	"**Backspace**". When editing values, pressing this button deletes last visible number. When editing text, the last edited symbol shown directly before cursor is deleted.
	"**Clear**" - clears the whole number when editing values.
	"**Sign**" - changes the sign of the edited value.
	This button deletes the selected file.
	"**All**" - selects all the available options.
	"**None**" - deselects all the available options.
	Press this button to enter Text editor window.
	Add a new object
	Delete a selected object

Button functions common for different views

6.2. MAIN MENU SELECTION PANEL

Pressing the **[MENU]** button on the ***Navigation bar*** (see **Chapter 5.3.2. Navigation bar**) enters the main selection panel. This panel allows users to select between entering the **Device Configuration** menu, **Files management** menu and **Device Information** window.

Further information about the different menus are described in further chapters.

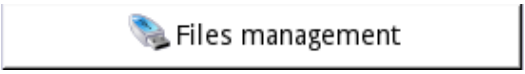


Main menu window

The **Safe shutdown** button allow for a safe power down of the device. After pressing the button and accepting the **warning message** the screen will look like in the Figure. Now, the user can power off the device. The manufacturer recommends turning off the device this way. This method is especially recommended when data logging is enabled. Not complying with these instructions could couse loss of recently logged data samples.

*The view of the screen after pressing the **Safe shutdown** button*

6.3. FILES MANAGEMENT



This button allows to entry to the files management menu

After pressing **MENU -> Files management** we enter the files management menu which is used to exchange data with a flash drive.

Requirements for a flash drive:

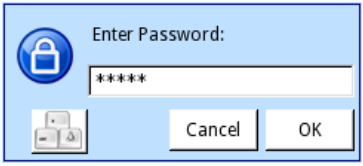
- Maximum current consumption is 100mA. Some flash drives with large capacities are not supported by the device (in this case can use an external USB hub with power supply). The manufacturer recommends the use of flash drives of 2GB in size.
- The flash disk must be formatted for Windows as FAT (NOTE!! not FAT32).
- update files, configurations files, and Modbus templates must be located in the main folder (the root of the drive).

A view of the main menu of **File management** is shown in Figure. There are two buttons called **Logging files** and **Configuration files** when in the device has the data logging option activated (more information about the licence key for data logging is located in **Chapter 6.4**), otherwise there is only one button named **Configuration files**.

To prevent accidental or unauthorized changes to the settings in the **Device configuration** menu and **File management menu**, the user can set an access password. If the user has

enabled the access options (see **Chapter 6.17. ACCESS OPTIONS**) then before going to the next menu level they will be asked for a password as in Figure "Files management menu".

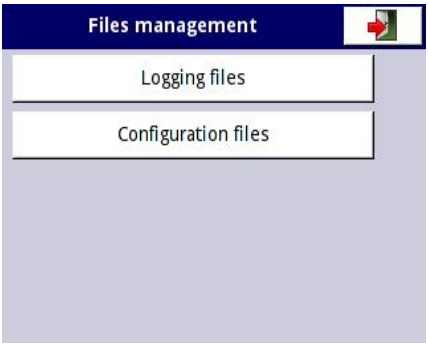
Pressing this button open the text editor window to enter the password. When the user enter the password, characters are replaced with '*'.



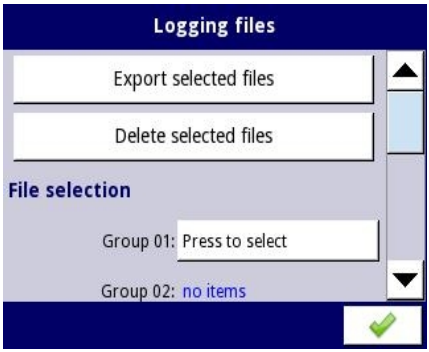
Enter password dialogue

The **Logging files** button opens the logging files management menu. This button exists only when the user has has input a valid licence for logging data. To export and/or delete logged files follow these steps:

- select a file/s of logged data from a group,
- select the more files in the other groups (if needed),
- export selected files to flash drive,
- and / or delete selected logged data files,



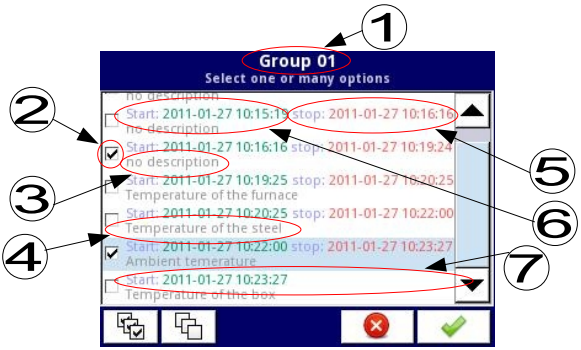
***Files management** menu*



***Logging files** menu*

The **Logging files** menu is consists of buttons:

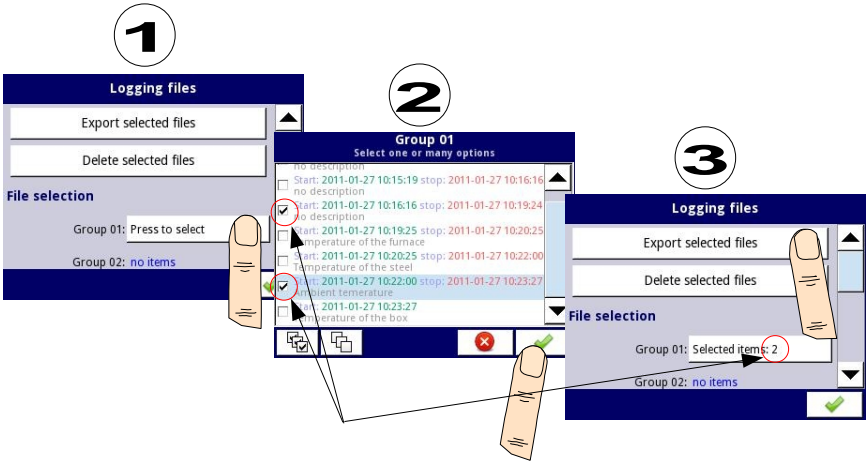
- **Export files** - after pressing this button the selected logged files will be exported to a flash drive,
- **Delete files** - after pressing this button the selected logged files will be removed from the device,
- **Press to select** next to the **Damaged files** label- (this button is visible if at least one damaged file exists) when the user presses this button the window with a list of damaged files is dispayed (the damaged logging files are those that contain errors caused by inappropriate shutdown the device during data logging). There is no guarantee that this logged data will be readable,
- **Press to select** next to **Group number** label - if the user has enabled the logging of particular group of logical channels (see **Chapter 6.14.2. Groups - Logging options**) in the **Logging files** menu next to the label of the group number appears the button **'Press to select'**. Depending on how many groups (the device can define 10 groups) logging is enabled (past or present) as many **'Press to select'** buttons will be active.



A sample view of selected logged files from Group 1

In Figure presents a sample view of selected logged files from Group 1. The numbers refer to:

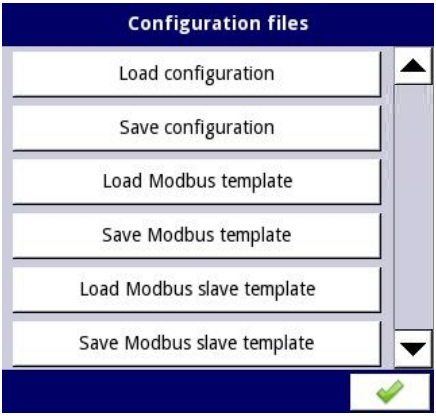
- **(1)** - group number,
- **(2)** - the selected logged file,
- **(3)** - no description for the logged file,
- **(4)** - description defined by the user (a description of the logged file is defined in the Groups menu - see **Chapter 6.14.2. Groups - Logging options**
- **(5)** - date and time of the end of the logged data file,
- **(6)** - date and time of the start of the logged data file,
- **(7)** - date and time of the start of the logged data file whose logging has not yet ended.



Steps of exporting logged files to flash drive

After exporting logged files a folder is created on the flash drive with the same name as the product identification number, which includes a folder with the selected logged files.

Deleting files from the device is similar export logging files, the difference is that instead of pressing the **Export selected files** button in **(3)** step, press the **Delete** button.



View window when the configuration changes

The second button on the **File management** menu is the **Configuration files** button. Pressing this button, will open the menu shown in which allows the user to load/save the configuration and Modbus templates. **Load/save configuration** will load/save the configuration defined by the user, which includes:

- general settings (see **Chapter 6.7. GENERAL SETTINGS**),
- logical channel settings,
- built-in, external inputs settings,
- built-in, external output settings,
- Modbus protocol settings,
- profile/timer settings,
- control settings,
- network settings,
- group settings,

Load/save Modbus templates allows the user to load/save the configuration of the Modbus MASTER protocol, e.g.:

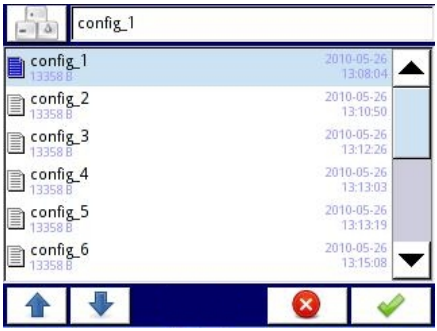
- name,
- configuration of the device channels (the list of inputs and outputs)
- configuration of register blocks (block list) - see **Chapter 6.15.3. Modbus - MASTER mode**,

Having saved these Modbus templates means the user can at any time quickly establish a connection between the MGU and the SLAVE devices, needing only to choose the appropriate address of the SLAVE devices (more about templates in **Chapter 6.15.3. Modbus - MASTER mode,**).

Load/save Modbus slave templates allows the user to load/save the configuration of the Modbus SLAVE protocol with a defined block of registers, e.g.: register type (Holding/Input), write mode of register, data format (16 bits or 32 bits). For configuration of Modbus SLAVE see **Chapter 6.15.2. Modbus - SLAVE mode**,

The process of exchanging configuration files or Modbus templates between the MGU and flash drive starts when you plug the flash drive to the unit. Then enter **MENU -> File management -> Configuration Files**. If you want to **Load configuration/template** the window panel will show a view of the contents of the flash drive with the available files:

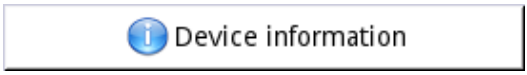
- for **configuration file** with extension **.cfg**,
- for **Modbus template file** with extension **.mcfg**,



Example of logging and configuration files

Please note that the file name is defined by the user. If the user wants to **Save configuration/Modbus template**, press the **Save configuration** or **Save Modbus template** button. A window appears with the available files that can be overwritten or a new file can be created by pressing button with keys symbol ( ) in the upper left corner.
After confirming the write process the data is stored on the flash drive.

6.4. DEVICE INFORMATION



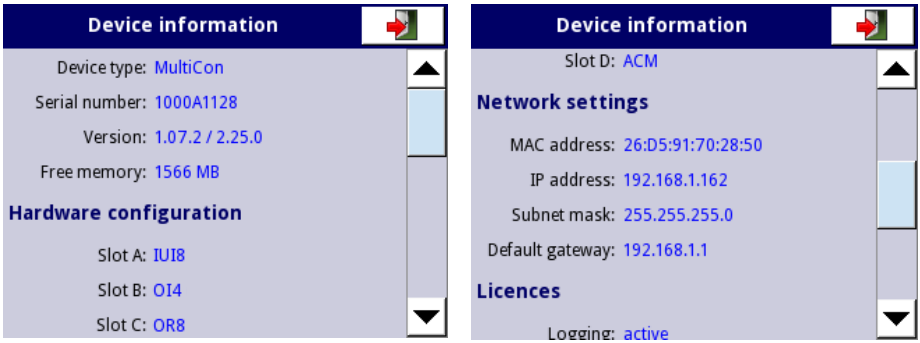
The button which will show information about the device

The **Device information** menu gives basic information about the device and allows the user to enter a licence key for data logging, perform a firmware update of the device, run displaying on the remote screen and download a user manual to the flash drive.

Pressing the **MENU -> Device information** button will show window (see example window information) with basic information about software and hardware on the device, such as:

- type of device,
- version of the software
- available free memory,

– hardware configuration - a list of installed modules (**number of slot: module type**)
– network settings,
– active licences.



Device Information screens

Enter licence key button allows the user to enter a licence key purchased from the manufacturer (or supplier), enabling additional software options which enhance the functionality of the device. After entering and accepting the licence key the device automatically starts up with new software options (if the licence key for data logging is entered the text under the **Licences** heading appears as: **Logging**: the period of validity.

Firmware update button allows the user to update the device software.

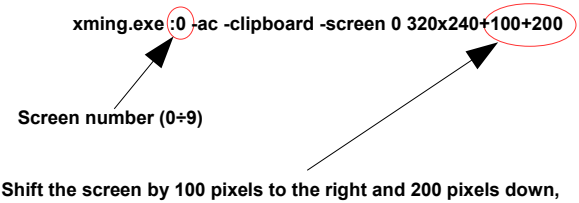
Device information menu

The **Remote display** button allows the MGU to communicate with the PC to display the screen of the **MGU-800** on the PC monitor to configure and view the data.

This button is available only for devices with an installed ACM module.

Below please find a step by step description of how to configure the **MGU** with a PC.

1. Download free **"Xming"** software from www.dinel.cz
2. Install "**Xming**" on your PC using default settings. During installation enable create a desktop icon for "**Xming**" option and disable "**Launch Xming**" option.
3. After installation of "**Xming**" use the right mouse button to open the properties window for desktop icons of the "**Xming**" and replace the "**-multiwindow"** with "**-ac -screen 0 320x240+300+300"**, then close the window properties. "**Xming**" in cooperation with the **MGU** device allows to change the following parameters selected below:



Screen number in "**Xming"** we set the same as the value of the **Screen number** parameter in **Network settings** submenu in **MGU** device (see below the point **5**).

4. Next close the window properties and run "**Xming**" using desktop icon.
5. In "**Network settings**" of the device in the group "**Remote Display**" enter the **IP address** of your computer and "**Screen number=0"**, then exit menu and save configuration changes.

6. In the "**Device information**" menu press the "**Remote display**" button and confirm switching to remote display. After a while the device screen will be redirected to your computer screen.

The **Export manual** button allows you to download the user manual on to the flash drive.

The **Service options** button allow the user to delete current configuration and restore default settings. After pressing the button the user should enter the password **"RENEW CONFIGURATION"** and accept by pressing **"OK"** button.

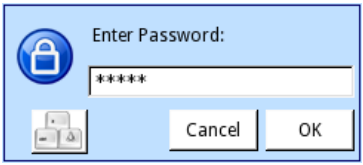
6.5. DEVICE CONFIGURATION

The device configuration menu

The **Device configuration** menu is the main menu of the device that allows the user to configure all inputs and outputs of the device to measure and control the system.

To prevent accidental or unauthorized change the settings in the **Device configuration** menu the user can set the access password. If the user has enabled the access password (see Chapter **6.17. ACCESS OPTIONS**), before proceeding to the next menu level you will be asked for password.

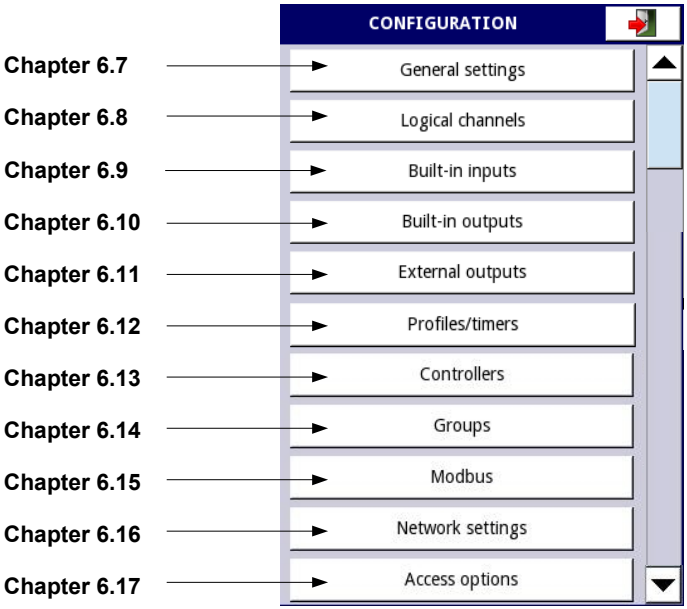
Pressing this button displays the keyboard allowing user to enter a password. When entering the password, displayed signs are replaced with '*'.



Enter password dialogue

After pressing the **MENU -> Device configuration** button and correctly entering the password (if the user has enabled access protection).

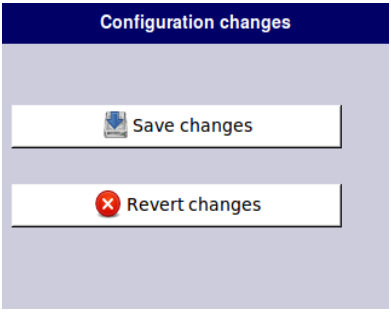
More information about selected sub-menus is described in further Chapters.



Main menu selection panel

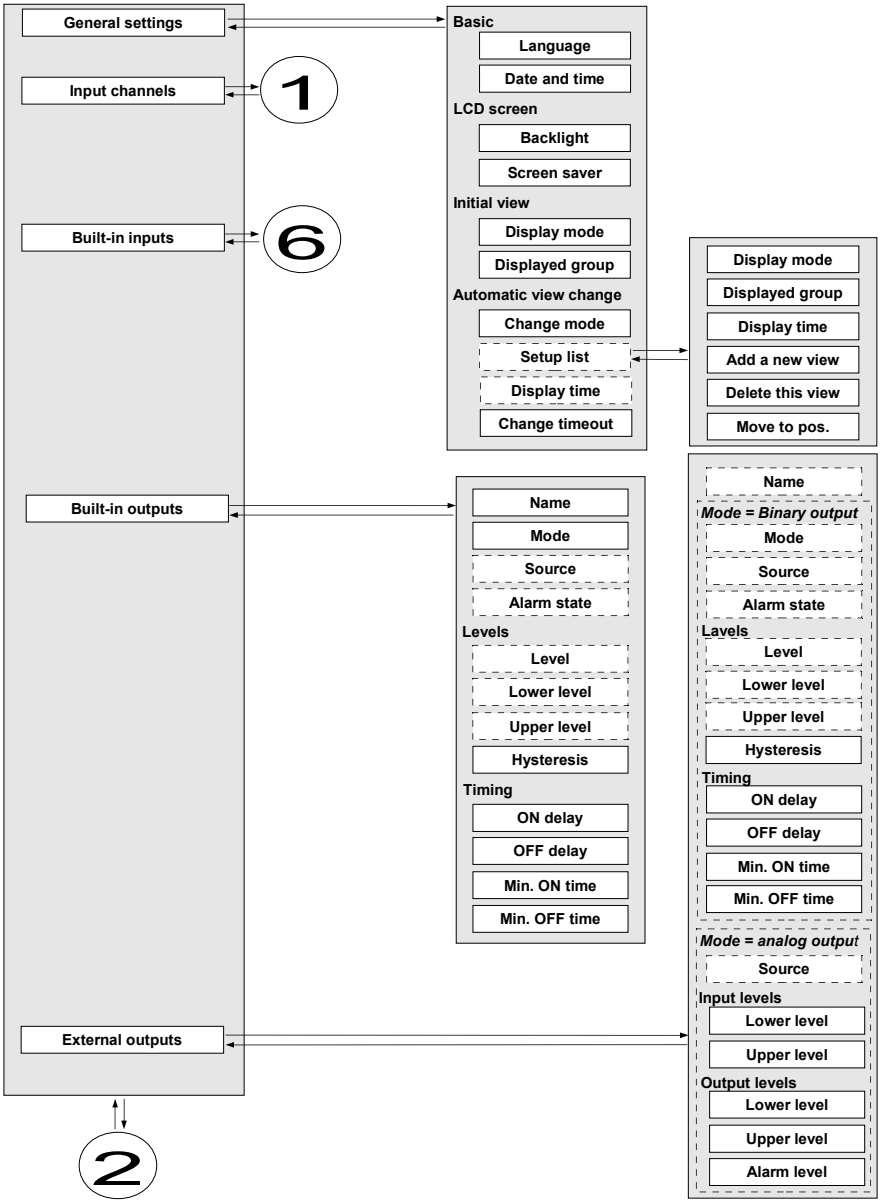
To exit the main menu, press the button located in the upper right corner of the screen. Due to the fact that the configuration process takes place in real time, all changes must be confirmed before saving them. In the confirmation window, you can **Save** or **Revert the changes**.

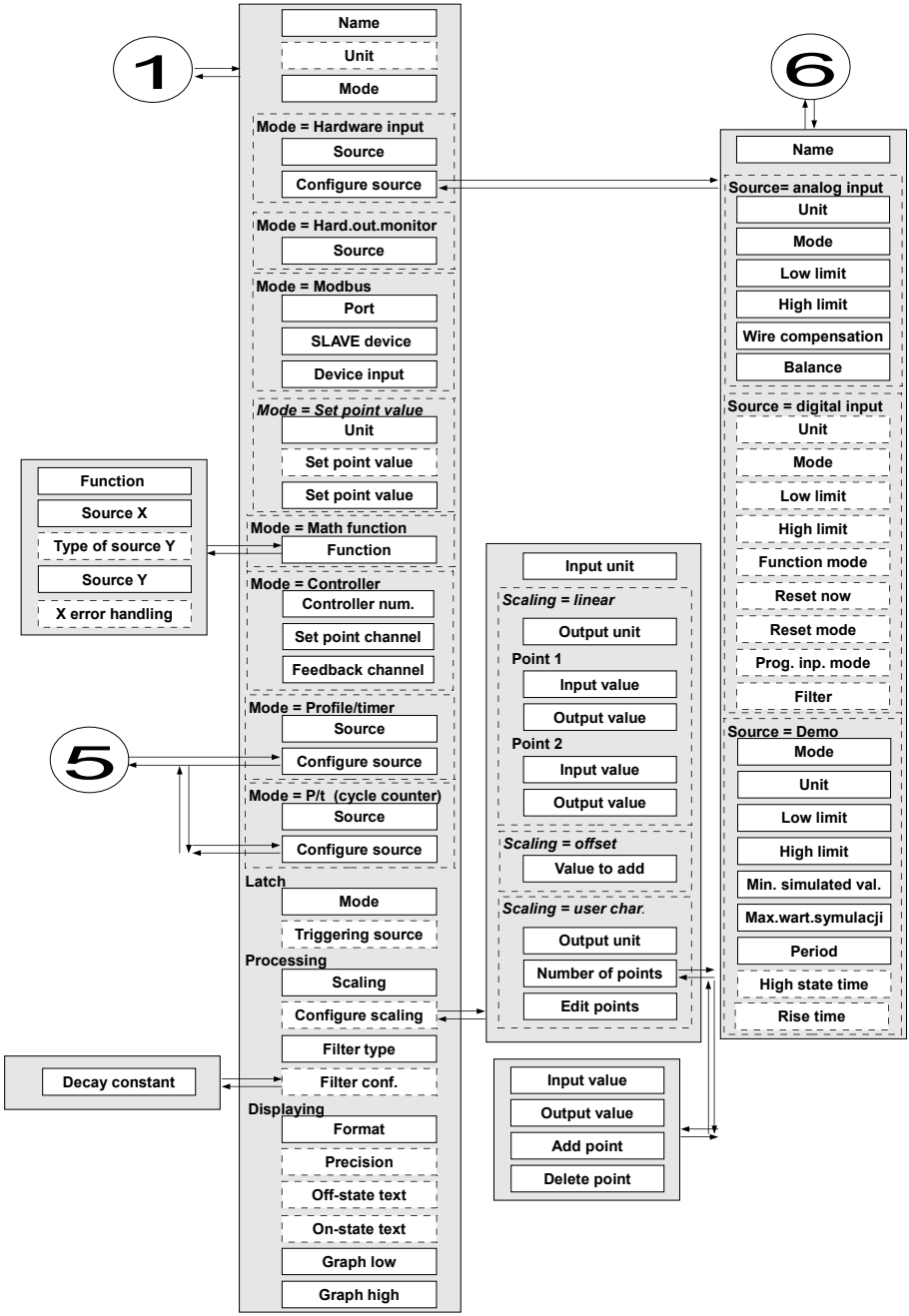
The **Service options** button in the **Device information** menu allows the user to delete the current configuration and restore default settings. After pressing the button the user should write the password **"RENEW CONFIGURATION"** and accept by pressing the **"OK"** button.

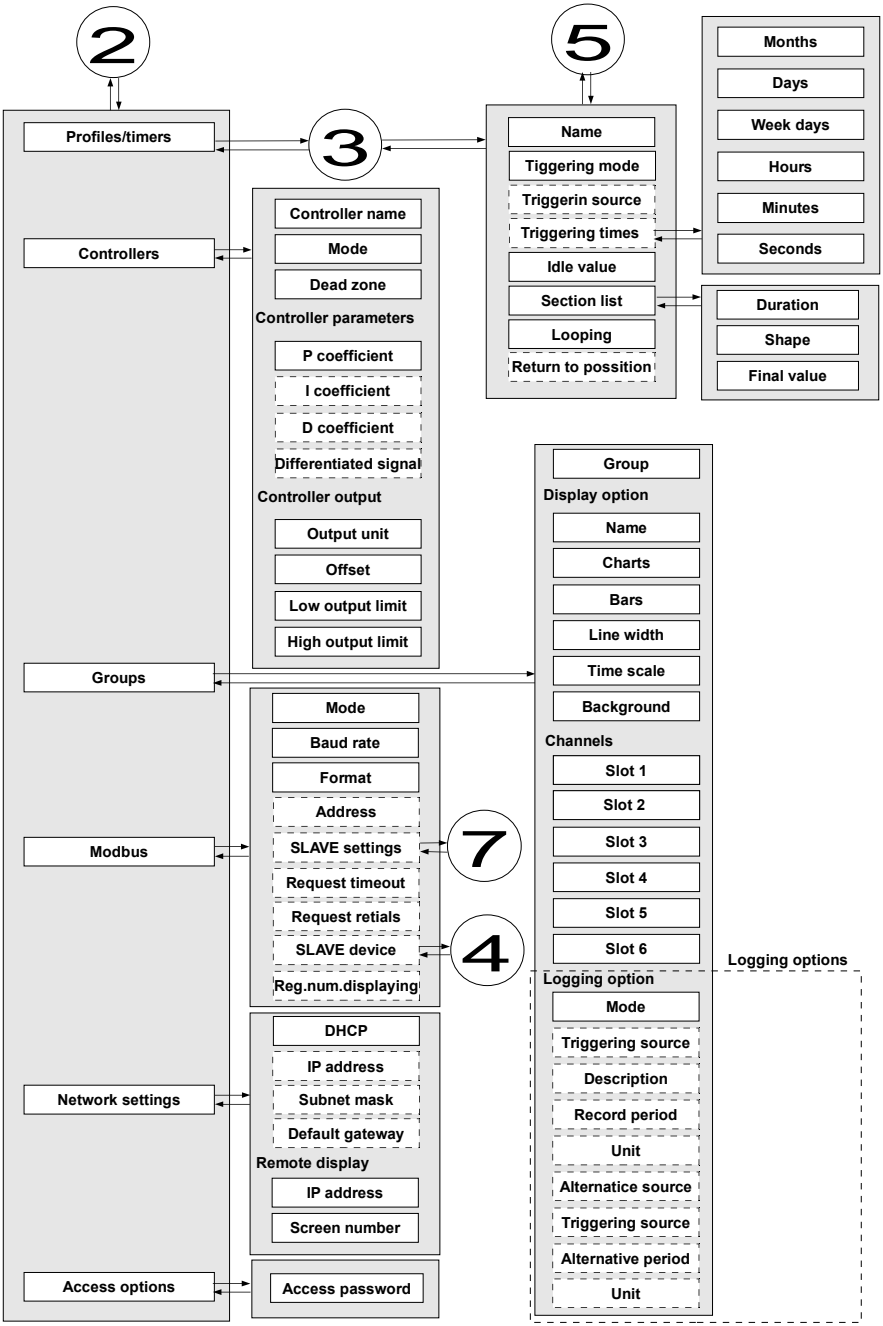


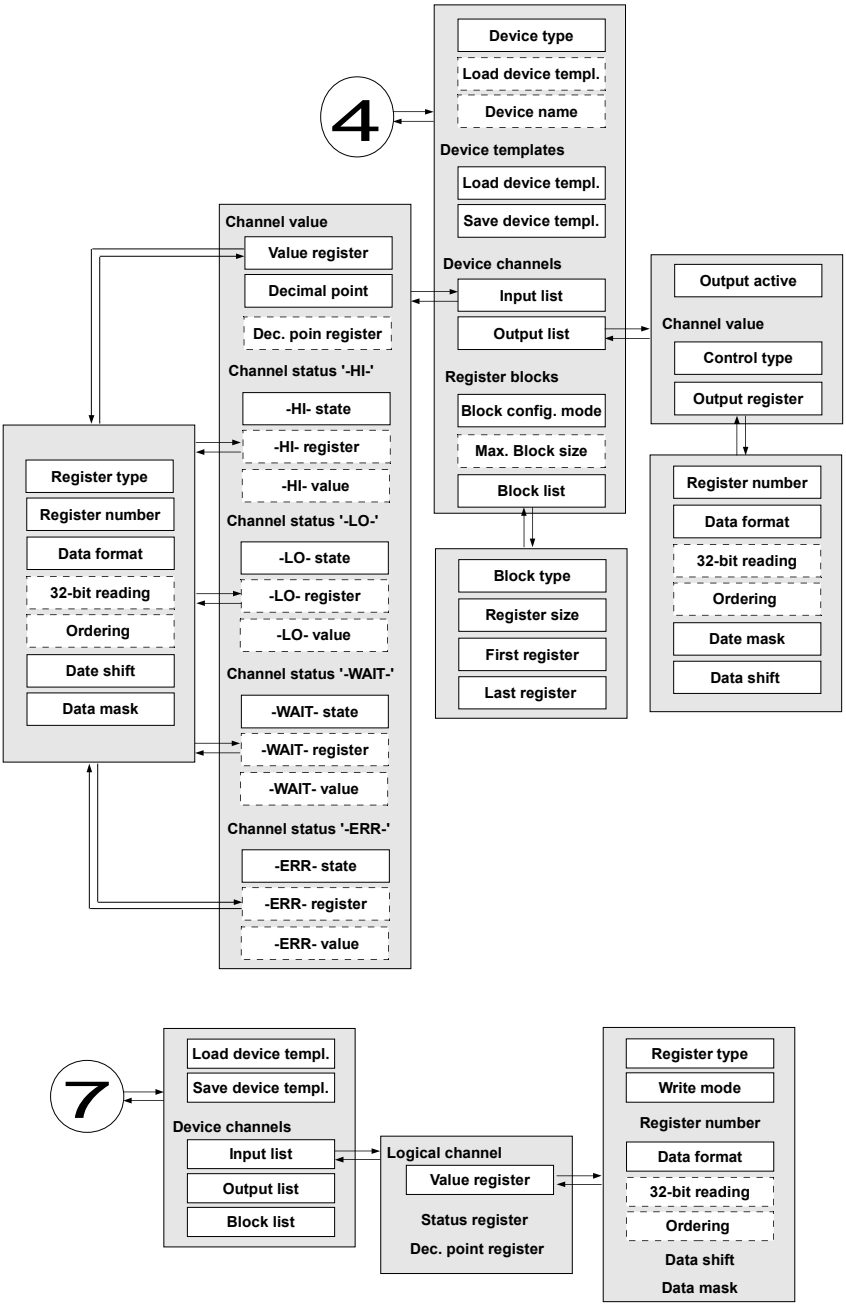
Save / revert changes window

6.6. CONFIGURATION MENU STRUCTURE

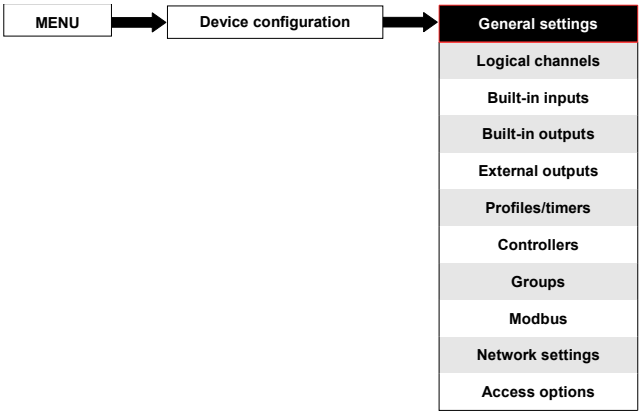



1
Name
Unit
Mode
Mode = Hardware input
Source
Configure source
Mode = Hard.out.monitor
Source
Mode = Modbus
Port
SLAVE device
Device input
Mode = Set point value
Unit
Set point value
Set point value
Mode = Math function
Function
Mode = Controller
Controller num.
Set point channel
Feedback channel
Mode = Profile/timer
Source
Configure source
Mode = P/t (cycle counter)
Source
Configure source
Latch
Mode
Triggering source
Processing
Scaling
Configure scaling
Filter type
Filter conf.
Displaying
Format
Precision
Off-state text
On-state text
Graph low
Graph high
Function
Source X
Type of source Y
Source Y
X error handling
5
Decay constant
Input unit
Scaling = linear
Output unit
Point 1
Input value
Output value
Point 2
Input value
Output value
Scaling = offset
Value to add
Scaling = user char.
Output unit
Number of points
Edit points
Input value
Output value
Add point
Delete point
6
Name
Source= analog input
Unit
Mode
Low limit
High limit
Wire compensation
Balance
Source = digital input
Unit
Mode
Low limit
High limit
Function mode
Reset now
Reset mode
Prog. inp. mode
Filter
Source = Demo
Mode
Unit
Low limit
High limit
Min. simulated val.
Max.wart.symulacji
Period
High state time
Rise time


2
5
Profiles/timers
3
Name
Tiggering mode
Triggerin source
Triggering times
Idle value
Section list
Looping
Return to possition
Months
Days
Week days
Hours
Minutes
Seconds
Duration
Shape
Final value
Controllers
Controller name
Mode
Dead zone
Controller parameters
P coefficient
I coefficient
D coefficient
Differentiated signal
Controller output
Output unit
Offset
Low output limit
High output limit
Group
Display option
Name
Charts
Bars
Line width
Time scale
Background
Channels
Slot 1
Slot 2
Slot 3
Slot 4
Slot 5
Slot 6
Groups
Mode
Baud rate
Format
Address
SLAVE settings
Request timeout
Request retials
SLAVE device
Reg.num.displaying
7
4
Modbus
Logging options
Logging option
Mode
Triggering source
Description
Record period
Unit
Alternatice source
Triggering source
Alternative period
Unit
DHCP
IP address
Subnet mask
Default gateway
Network settings
Remote display
IP address
Screen number
Access options
Access password


4
Device type
Load device templ.
Device name
Device templates
Load device templ.
Save device templ.
Device channels
Input list
Output list
Register blocks
Block config. mode
Max. Block size
Block list
Block type
Register size
First register
Last register
Channel value
Value register
Decimal point
Dec. poin register
Channel status '-HI-'
-HI- state
-HI- register
-HI- value
Channel status '-LO-'
-LO- state
-LO- register
-LO- value
Channel status '-WAIT-'
-WAIT- state
-WAIT- register
-WAIT- value
Channel status '-ERR-'
-ERR- state
-ERR- register
-ERR- value
Register type
Register number
Data format
32-bit reading
Ordering
Date shift
Data mask
Output active
Channel value
Control type
Output register
Register number
Data format
32-bit reading
Ordering
Date mask
Data shift
7
Load device templ.
Save device templ.
Device channels
Input list
Output list
Block list
Logical channel
Value register
Status register
Dec. point register
Register type
Write mode
Register number
Data format
32-bit reading
Ordering
Data shift
Data mask

6.7. GENERAL SETTINGS



The **General settings** menu allows you to configure user interface display settings, the default screen when the device powers on and automatic view change settings.

The parameters of the **General settings** menu are:

- **Basic** parameter block, this block includes two parameters:
  - **Language** - this parameter allows the user to select the language, available languages are: English, Polish, Spanish, German, Russian, French, Czech, Romanian and Hungarian.
  - **Date and time** - this parameter allows the user to set the current date and time,

- **LCD screen** parameter block:
  - **Backlight** - this parameter allows the user to set the level of the LCD backlight. Available levels are: 20% (least backlight), 40%, 60%, 80%, 100% (the most backlight),

- **Screen saver** parameter block - these parameters can reduce backlight level of the LCD screen (or make it completely blank) during normal operation, i.e. when the user does not touch the screen for a set time. This block has two parameters:
  - **Mode** - this parameter has the following options:
    - **disabled** - this option turns off screen savers, the LCD screen is illuminated at all times according to parameter settings: **Backlight** (see above **Screen saver** parameter block)
    - **1min, 5min, 10min, 30min**,
  - **Brightness** - this parameter is hidden for **Mode = disabled**, in the other modes (1min, 5min, 10min, 30min) this parameter is visible, the user can change the brightness level of the LCD screen after time set in parameter **Mode** elapses. The options are: 0% (screen blank), 20%, 40%, 60%,

- **Initial view** parameter block - this block allows the user to set the initial display screen on the LCD screen when the device is turned on, this block includes two parameters:
  - **Display mode** - select the presentation of data in the displayed group (see

parameter: **Displayed group**). For possible modes see **Chapter 5.3.3. Data panels**, and **Chapter 6.14. GROUPS**,
    - **Displayed group** - select a group displayed at startup, if you choose **Display mode = many groups**, the parameter **Displayed group** selects the first group (**many group** mode presents 5 groups in one window). For example, when the user sets **Display group = Group 8** then the unit will display: starting from the left side of: Group 8 -> Group 9 -> Group 10 -> Group 1 -> Group 2,

– **Automatic view change** parameter block - this parameter block allows the user to set the display to change every time period. The parameters of this block include:
    - **Change mode** - this parameter has the following options:
        - **disabled** - no changes in the display. For this mode the remaining parameters in this block are not visible,
        - **change modes** - this option allows the user to automatically change the displayed mode,
        - **change groups** - this option allows the user to automatically change displayed group,
        - **detailed list**,
    - **Display time** - this parameter is visible for the **Change mode**: **change modes**, **change group** - duration (set in seconds) for each screen,
    - **Setup list** button - this button is visible for **Change mode = detailed list**, this parameter is described below,
    - **Change timeout** - this parameter determines the time from last touching the screen to first view change,

Setup list parameter
After pressing the **Setup list** button the user enters the **View** menu allowing the creation of 1 to 20 views.

Arrows placed in the upper right corner of the screen allow you to move to the next view. The middle button allows you to directly select a particular view.

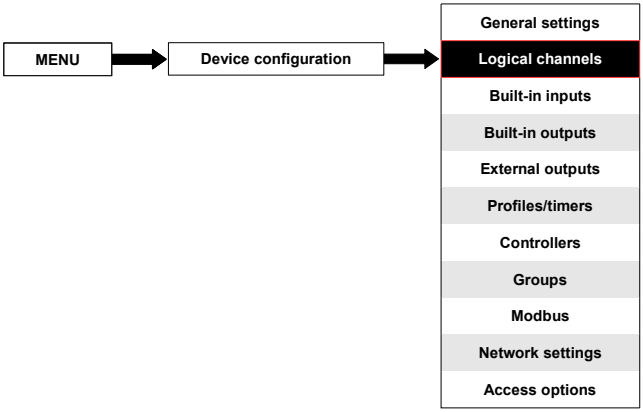
Parameters of **View** menu are:
– **Display mode** - this parameter allows you to select the presentation of the data in the displayed group (see parameter: **Displayed group**). For possible modes see **Chapter 5.3.3. Data panels**, and **Chapter 6.14. GROUPS**,
– **Displayed group** - allows you to select a group displayed at startup, if you choose **Display mode**: **many groups**, the parameter **Display group** selects the first group (mode many group presents 5 groups in one window), for example, when setting the parameter to **Display group=Group 8** then the display will show: starting from the left side of: Group 8 -> Group 9 -> Group 10 -> Group 1 -> Group 2,
– **Display time** - this parameter sets the duration (in seconds) of the selected view,
– **Add a new view** button - adds a new view to the list
– **Delete this view** button - delete selected view from the list,
– **Move to position** - this parameter allows you to move the current view to the appropriate position,

Example:
Steps to create four views are as follows:
1. In the **Change mode** parameter select **detailed list**,
2. Press the **Setup list** button and enter the **View** menu,
3. Set parameters for a first View,

Arrows placed in the upper right corner of the screen allow you to move to the next view. The middle button allows direct selection of a particular view.

4. To add or delete further views use the **Add a new view** button or **Delete this view** button, respectively,
5. When the user wants to add a view between the existing views, eg between views 2 and 3, user can choose two ways:
   - select the 2nd view (by the arrows in the upper right corner of the screen) and then add a new view by clicking the **Add a new view** button,
   - after adding new view on the end of the list, set the **Move to position** parameter to **value=3**,
6. When finished, the user can see all the defined views by clicking the middle button between the arrows in the upper right corner of the screen,

6.8. LOGICAL CHANNELS



The **Logical channels** menu is used to configure the logical channels. Channels can be treated as input data for outputs, controllers or other **Logical channels** and can be collected into **Groups** for simultaneous display. To see a detailed definition of **Logical Channel** see **Chapter 4.1.1. Logical channels**.

To enter directly into the configuration menu of particular channel, press and hold on the screen over the channel data panel for 3-4 seconds (see option **(1)** in the Figure enter ring configuration of logical channel named **'Temperature'**). If the password is set (see **Chapter 6.17. ACCESS OPTIONS**) then the user has to enter the password before entering the configuration.

6.8.1. Logical channels – General settings

Arrows placed in the upper right corner of the screen allow you to switch between a succession of logical channels. The middle button allows you to directly select a specific logical channel from the list.

The parameters of a logical channel depends on the **Mode** of the logical channel. The **Logical channel** has modes:

- **disabled**
- **Hardware input**
- **Hardware output monitor**
- **Modbus**
- **Set point value**
- **Math function**
- **Controller**
- **Profile/timer**
- **Profile/timer (cycle counter)**
- **Data from other channel**

The channel for **Mode=disabled** has only one parameter - the **name** of the channel. In other modes the **Logical channels** are **active** and may affect the processing and control data.

Parameters and blocks of parameters common for **active Logical channels**:

- **Name** - to rename a channel, press the button next to the **Name** label, and then set any name,
- **Unit** - is related with a data source of channel,
  - for **Built-in modules** it will automatically use a default **Unit**,
  - for **Mode=Set point value** and **Mode=Controller** the **Unit** can be defined freely, directly in the **Logical Channel** menu,
  - for **other modes** the **Unit** can be added only using the **Scaling** parameter (see below in this **Chapter** for discussion about the **Scaling** parameter),
- **Mode** - in this parameter the user selects the source of the data for logical channel. It is possible to select one of eight modes:
  - **disabled**
  - **Hardware input** - see Chapter 6.8.2,
  - **Hardware output monitor** - see Chapter 6.8.3,
  - **Modbus** - see Chapter 6.8.4,
  - **Set point value** - see Chapter 6.8.5,
  - **Math function** - see Chapter 6.8.6,
  - **Controller** - see Chapter 6.8.7,
  - **Profile / timer** - see Chapter 6.8.8,

- **Latch** parameter block - allows user to set the **latch function** which will hold the last value of a channel; this block has the following parameters:
  - **Mode** - this parameter allows the user to choose how to trigger the latch function; there are 2 options:
    - **disabled** - the latch function is disabled,
    - **from logic channel** - the latch function is activated depending of the value of channel selected in the **Triggering source** parameter,
  - **Triggering source -** this parameter is only visible if user sets

Mode=from logic channel; using this parameter the user chooses a logical channel which is the triggering source of the latch function (when the value of triggering channel is **≤0** the latch is **active**, for a value **>0** latch is **disabled**),

During device restart, the logical channels, which have the latch function enabled have value: '**0**' and on the LCD screen blinking dashes '----' appear in place of the value.

– **Processing** parameter block - is used for scaling and filtering data (for explanation see below)

– **Displaying** parameter block - for these parameters the user selects the format and range of the data displayed on the screen. For more information about **Displaying** parameters see below in this **Chapter**.

Processing parameter block
For this block the parameters are: **Scaling** and **Filter Type**.
To enter the scaling menu press the button next to the **Scaling** label. The menu has the following options:

a) **disabled** - no scaling of input data,
b) **linear** - in the **Configure scaling** menu for **linear** scaling, the user can change the **Unit** of the displayed data and can linearly scale the result using 2 data points.

Suppose that the data before scaling is denoted by a **'x'** and after scaling by **'y'**. The linear scaling function with parameters '**a**' and '**b**' is given by:

$$y = a \cdot x + b$$

For **Point 1** we have,

$$y_1 = a \cdot x_1 + b$$

,where $\mathbf{x_1}$ is the input value and $\mathbf{y_1}$ is the output value for Point 1

For **Point 2** we have,

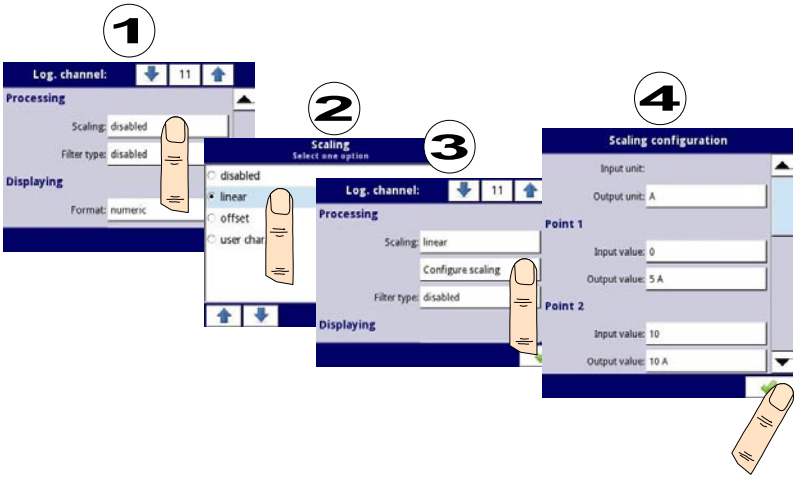
$$y_2 = a \cdot x_2 + b$$

,where $\mathbf{x_2}$ is the input value and $\mathbf{y_2}$ the output value for Point 2

Example (see Fig. 7.30):
We want to scale the input signal where the output value half of input value. The output signal is also shifted positively with a value of 5 and the **Unit=A**. The scaling function is given by formula:

$$y = \frac{1}{2} \cdot x + 5$$

For **Point 1** enter values:
x=0, **y=5**
For **Point 2** enter values:
x=10, **y=10**



Example of scaling configuration

c) **offset** - this function offset the data input by a fixed positive or negative value. The offset function is given by:

$$y = x + b$$

,where **x** - is the input value
y - output value
b - offset value

To offset the data input with a certain value the user must select **Scaling=offset** and press the **Configure scaling** button and then enter the value by pressing the button next to the **Value to add** label.

d) **user characteristics** - is defined as set of X-Y points. Number of the points is variable and may be set from 2 to 20 points which make linear segments. For 2 points the user characteristic behaves like a linear process (see subsection **b)**). For more than 2 defined points the user characteristic is a composite of the line characteristics therefore for input value **'x'** the user obtain an output value **'y'** which is described by the relationship:

$$y = a_n \cdot x + b_n$$

where **'a'** and **'b'** are coefficients of a segment contained between two points and **n = 1, 2 ..** is the number of the segment.

If the input exceeds the extreme **'x'** values of the designated points of $\mathbf{P_n}$, the output value is scaled by the functions defined at the extreme segments.

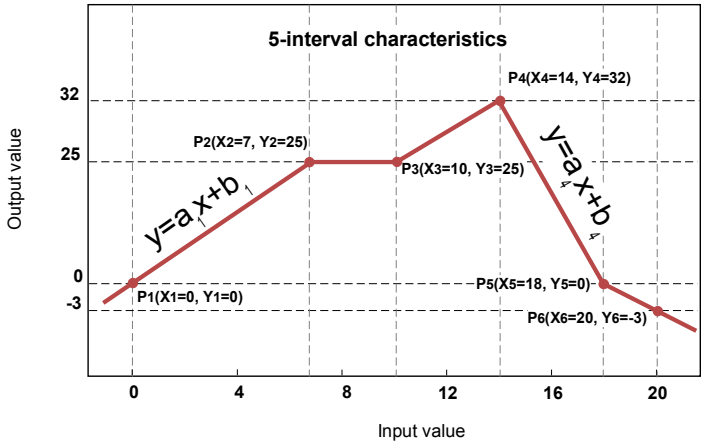
Example:
Steps to create a user characteristic consisting of 6 points:

1. Press the button next to the **Scaling** label and select **user characteristic** option (point **(1)** and **(2)**
2. Press the **Configure scaling** button and enter the **Scaling configuration** menu (point **(3)**
3. If you want to create an output **Unit**, which replaces the input unit, or if no unit is defined on the input, press the button next to **Output Unit** label.
4. Press the **Edit points** button (point **(4)**) and go to **Edit points** menu.

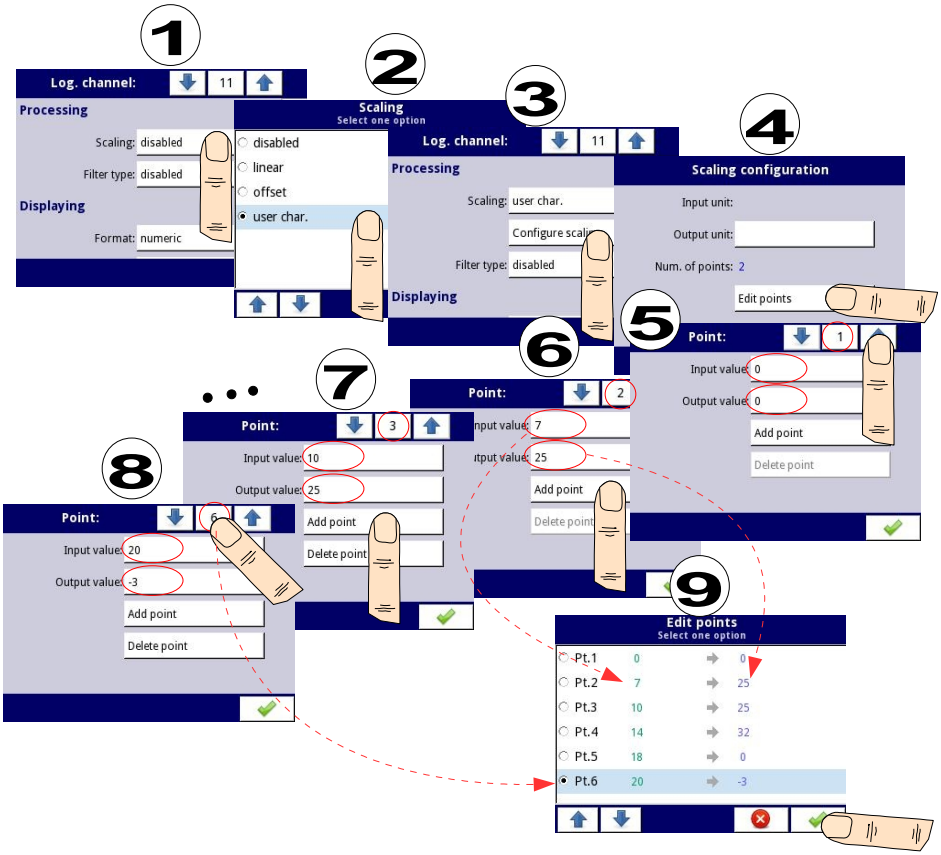
The arrows placed in the upper right corner of the screen allow you to switch between points. The middle button allow direct selection of a particular point from the list.

For **Point 1** set input and output value (point **(5)**).

5. Switch to **Point 2** by using the arrow keys and there also set the value of input and output (point **(6)**).
6. To **add** or **delete** points the user should use the **Add point** button or **Delete point** button, respectively,
7. When the user wants to add a new point between the existing point e.g. between 5 and 6, select the edit **Point 5** and then add a new point by press the **Add point** button.
8. At the end we check all the points defined by clicking the middle button between the arrows in the upper right corner of the screen (point **(8)** and **(9)**).



Example of user characteristic



Configuring the user characteristic

Filter type

The **Filter type** parameter has options:

- **disabled** - filtering of the input value is turned off,
- **exponential** - this option enables a filter that is expressed by the formula:

$$Y_n = X_n \cdot \left(1 - e^{\frac{-0{,}1\,sek.}{w}}\right) + Y_{n-1} \cdot e^{\frac{-0{,}1\,sek.}{w}}$$

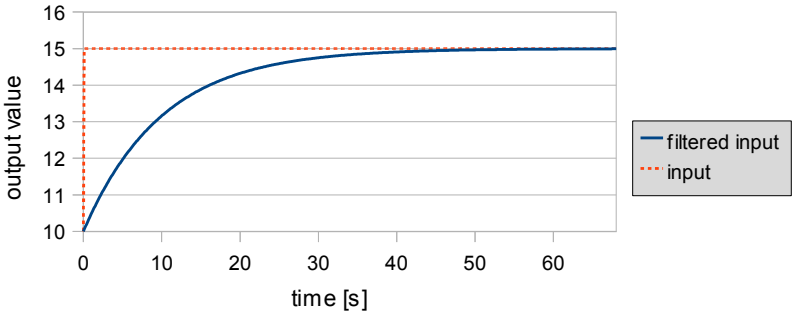
,where

n - number of sample, where n = 1, 2, 3 ...,
Y_n - output value for n-th sample,
Y_{n-1} - output value for n-1 sample,
X_n - input value for n-th sample,

w - time constant in seconds, this filter coefficient is defined by the user from the **Decay constant** parameter (a value of **'0'** for the filter is turned off),
0.1 sec. - sample time,

After selecting **Filter type= exponential** new button is available - **Filter configuration** which allows the user to enter a time constant with the **Decay constant** parameter (see above filter formula).

Example:
An example of the filtered input signal with a step change from **10 to 15** for **time constant of= 10s**



*Example of the filtered input signal for the **time constant = 10s***

Displaying parameter block
The constant parameters of **Displaying** block are:

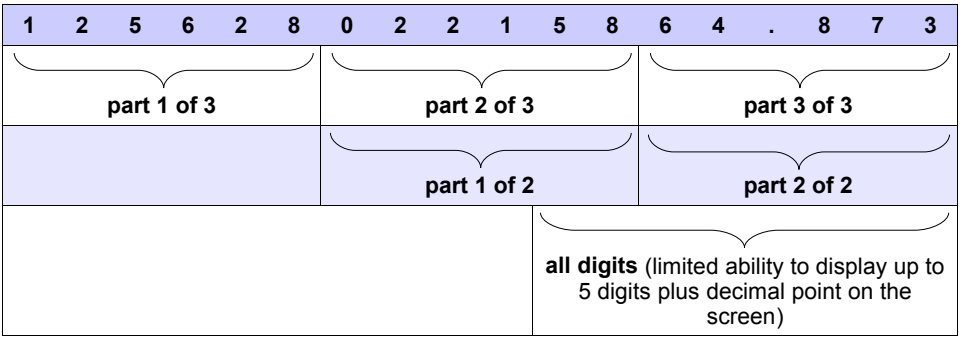
- **Format** - the logical channel data formats, which are:
  - **numeric**,
  - **binary** - only for values: **'0'** for low state and **'1'** for high state,
- **Precision** - this parameter is for **Format=numeric**, which specifies the precision to be displayed on the output value. The user can set: 0 (no decimal point), 0.0, 0.00 0.000, 0.0000 (to 4 decimal places). The default is '0',
- **Off-state text** - this parameter is for **Format=binary**, for when the input value is **≤ 0** the value is replaced by the text defined by the user, for default settings text is: **OFF**,
- **On-state text** - this parameter is for **Format=binary**, for when the input value is **>0** the value is replaced by the text defined by the user, for default settings text is: **ON**,

The text of **Off-state** and **On-state** can be:

- text with black font such as: ALARM, off, OK,
- text using numbers and special characters such as: ALARM_ #12
- text using font color and / or a background color for example: OFF ON
- no text, only a rectangle with the selected color - the width of the rectangle on the screen is defined by pressing the **Spacebar** (empty string), and the color of the rectangle is the background color, for example:

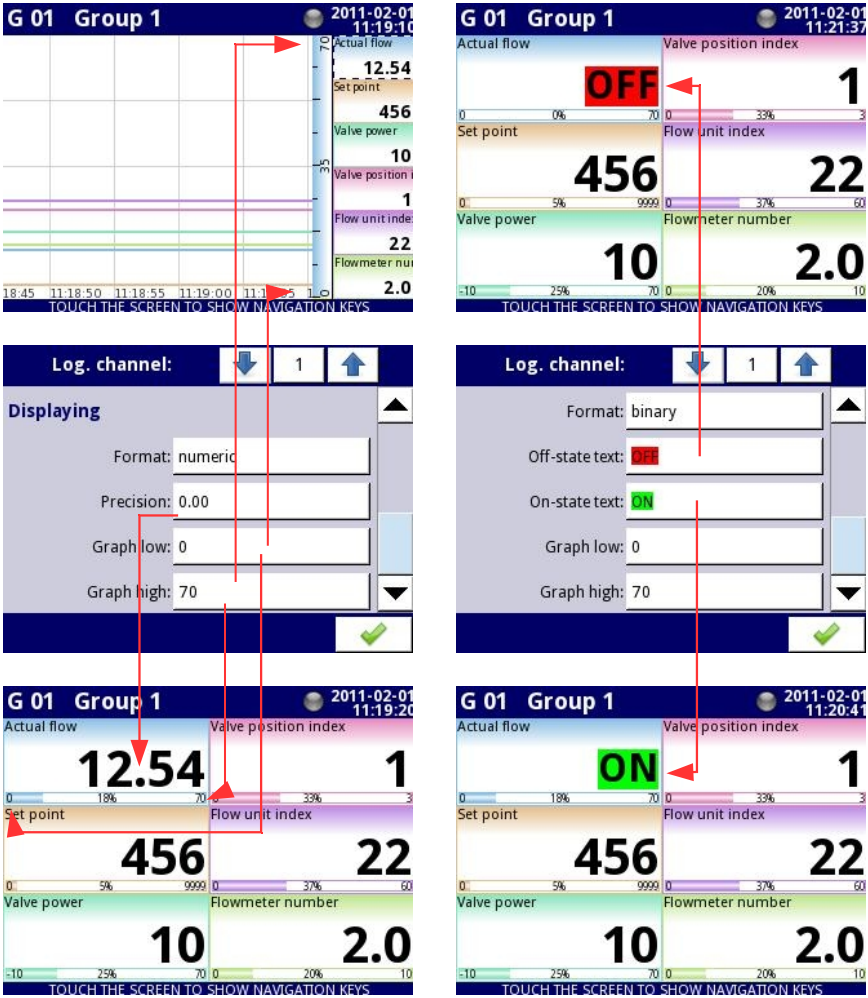
– **Digits** - this parameter is for **Format=numeric**, allowing you to choose the part of the number that is to be the value of the logical channel displayed on the screen,

Example of a number representing the value of the logical channel:



– Available options for **Digits** parameter are:
  - **all digits** – display all parts. With this option the number is limited to 5 digits + decimal point;
  - **part 1 of 2** - display the higher part of the number on the screen,
  - **part 2 of 2** – display the lower part of the number on the screen,
  - **part 1 of 3** – display the highest part of the number on the screen,
  - **part 2 of 3** - display the middle part of the number on the screen,
  - **part 3 of 3** - display the lowest part of the number on the screen,

– **Graph low** - minimum range value for graphs, bars, needle dials and percentage bars,
– **Graph high** - maximum range value for graphs, bars, needle dials and percentage bars,

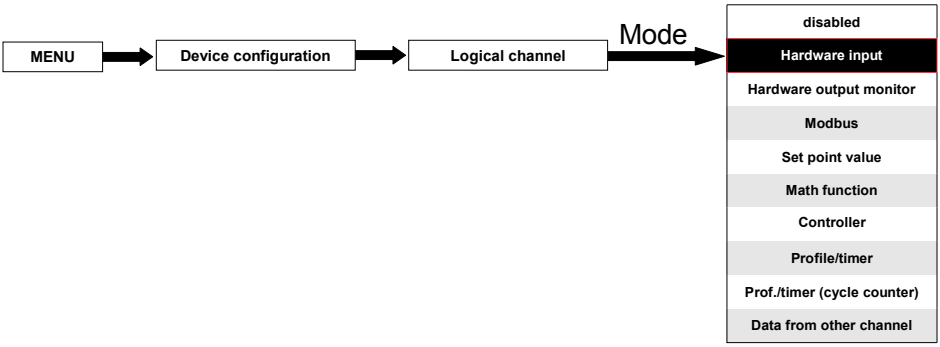


Input channels menu – 2 different kinds of Displaying parameters

Comments regarding the display:

- The precision of the displayed data can be set in the device with any accuracy (up to 4 decimal places), it must be remembered that the resolution and accuracy of external sensors connected to the device is finite, and usually not better than 0.1%.
- The time scale is common for the entire **Group** and can be set in the **Groups** menu (see **Chapter 6.14. GROUPS**).

6.8.2. Logical channels – Hardware input mode



This mode allows the user to measure data from installed input modules which can be displayed, and/or processed in any other logical channels (e.g. by mathematical function or virtual relay) or it can be the data source for controlling outputs.

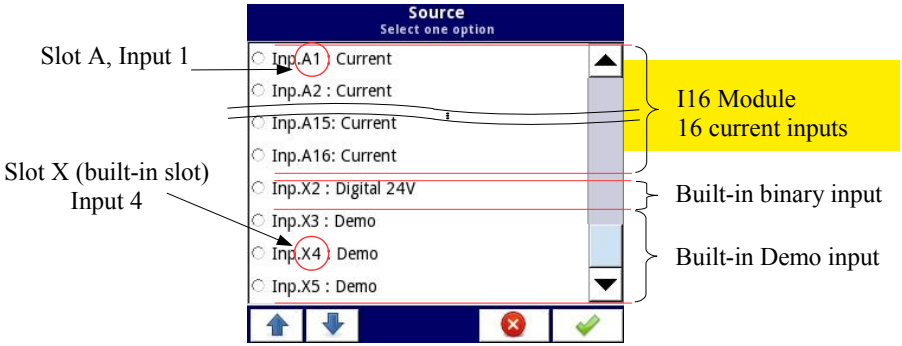
The Logical channels parameters in Hardware input mode are:

- **Name** - to rename a channel, press the button next to the **Name** label, and then set any name,
- **Unit** - for **Built-in modules** it will automatically use the default **Unit**, to change the unit use the **Scaling** parameter in **Processing** parameter block,
- **Mode=Hardware input** - in this parameter user can select the source of the data for the logical channel,
- **Source** - in this parameter user selects the source of the data from the hardware input list for the logical channel (see below in this **Chapter**),
- **Configure source** button - after pressing this button user can change the source configuration, e.g. the range of the input value (see below in this **Chapter**), another method to change the source configuration is to use the **Built-in inputs** menu,

- **Latch** parameter block - allows user to set the **latch function** which will hold the last value of a channel (discussed in **Chapter 6.8.1. Logical Channels - General settings**),

- **Processing** parameter block - is used for scaling and filtering data (discussed in **Chapter 6.8.1. Logical Channels - General settings**),

- **Displaying** parameter block - these parameters allow the user to select the format and range of the data displayed on the screen (discussed in **Chapter 6.8.1. Logical Channels - General settings**),



The view of a sample list of available hardware inputs for a device

In the device there are two methods to change the source configuration of the **Built-in inputs**:

- using **Configure source** button in **Logical channel** menu in **Hardware input** mode,
- using the **Built-in inputs** menu.

The **Source** for **Hardware input** mode can be (in the same order as list in the device:

a) installed **input modules** in the appropriate slots A, B or C - the list of currently available modules is on the website,

Description of input modules parameters is shown in **Chapter 6.9.2**.

The following steps change the **Source configuration** for the sample of 3 modules

- Step **(1)** - selection of **Source** for channel in **Hardware input** mode, for example: **Inp.A1:Current**, next press the **Configure source** button to enter **Source configuration** menu,
- Step **(2)** - press the **Mode** button to change range of the current input,
- Step **(3)** - choose from the list of available options for signal range - for example: **Current 0-20mA** (for current module),

b) built-in digital input is always designated as **Inp.X2: Digital 24V**

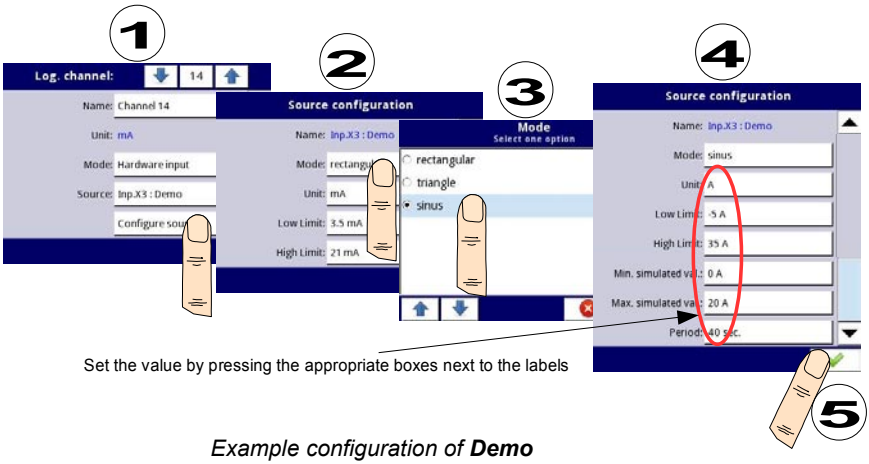
The device has a built-in digital input, which can be used, for example as a switch for a process. Descriptions of parameters is shown in **Chapter 6.9.3**.

c) built-in **Demo** input numbered **Inp.X3:Demo, Inp.X4: Demo, Inp.X5: Demo**

The device has 3 built-in simulation **Demo** inputs which can be defined by the user. Descriptions of parameters is presented in **Chapter 6.9.4**.

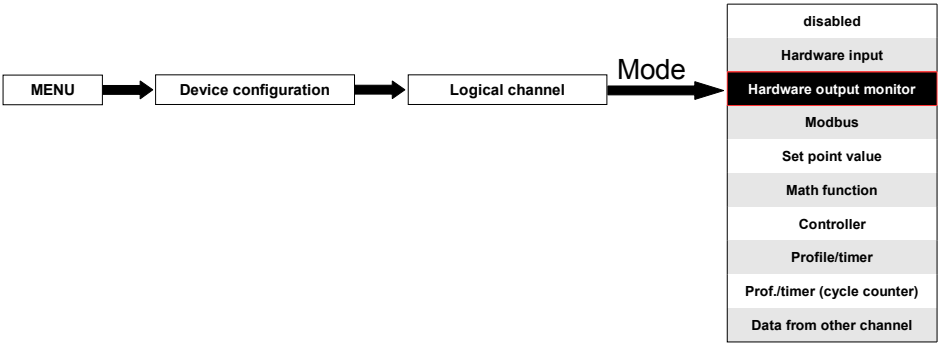
You can not use Demo inputs which have the same modes and different configuration of parameters, for example, you can not configure 2 Demos in sine mode which have periods of 10 sec. and 20 seconds.

Example configuration of a **Demo** for sinus mode.



*Example configuration of **Demo***

6.8.3. Logical channels – Hardware output monitor mode



This mode allows the user to display data from built-in output modules, processed in any other logical channels (e.g. by mathematical function or virtual relay) or it can be the data source for controlling another output.

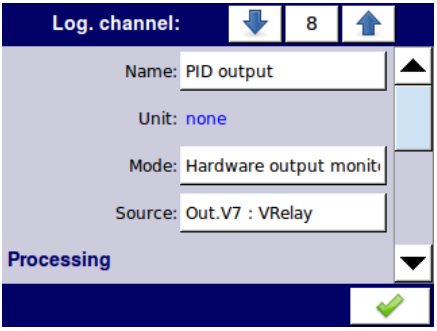
The parameters of a **Logical channel** in **Hardware output monitor** mode are:

- **Name** - to rename a channel, press the button next to the **Name** label, and then set any name,
- **Unit** - for **Built-in modules** it will automatically default to the unit of the module. To change the unit use the **Scaling** parameter in **Processing** parameter block,
- **Mode=Hardware output monitor** - in this parameter user selects the source of data for logical channel,
- **Source** - in this parameter user selects the source of data from the available built-in outputs list for the logical channel (see below in this **Chapter**),

– **Latch** parameter block - allows the user to set the **latch function** which will hold the last value of a channel (discussed in **Chapter 6.8.1. Logical Channels - General settings**),

– **Processing** parameter block - is used for scaling and filtering data (discussed in **Chapter 6.8.1. Logical Channels - General settings**),

– **Displaying** parameter block - these parameters allow the user to select the format and range of data displayed on the screen (discussed in **Chapter 6.8.1. Logical Channels - General settings**),

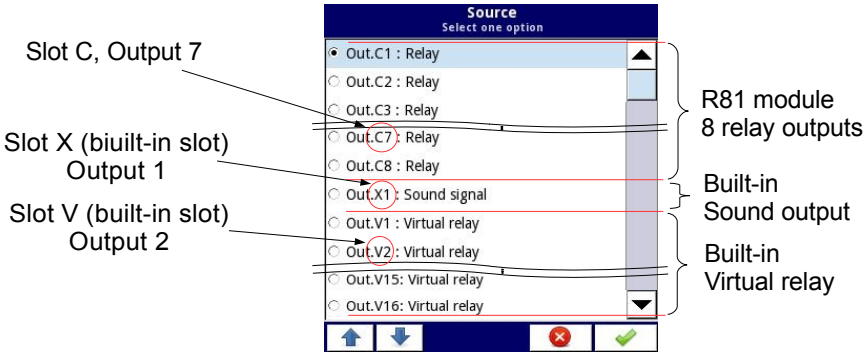


*Input channels menu – parameters specific for **Hardware Output Monitor** mode*

Source parameter in the **Hardware output monitor** mode
After pressing **Source**, a list of available hardware outputs appears. The selected option will be the source of data for that logical channel. An example list of available hardware outputs for the device with only one output module such as **OR8** - 8 relay outputs module.

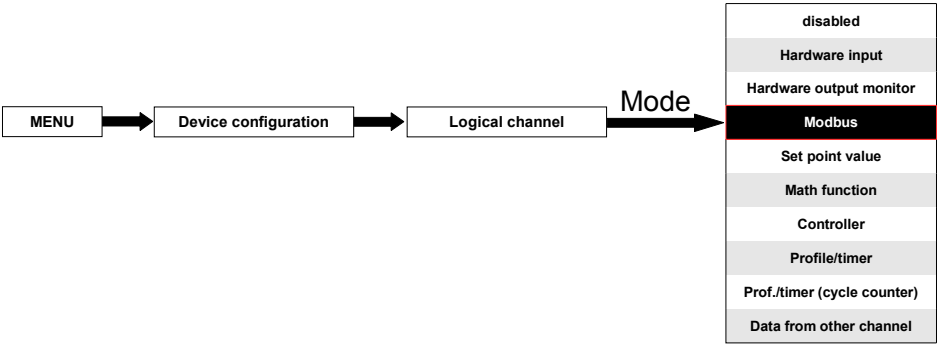
Source for the **Hardware output monitor** mode can be:

– installed hardware output modules in the respective slots A, B or C - a list of modules currently available is on the website; more about the output modules in **Chapter 6.10. BUILT-IN OUTPUTS**,
– built-in **Sound signal** output is always marked as **Out.X1: Sound signal** - more about the **Sound** outputs is in **Chapter 6.10. BUILT-IN OUTPUTS**,
– built-in **Virtual relays** marked as **Out. V1 - V16** - more about Virtual relay in **Chapter 6.10. BUILT-IN OUTPUTS**.



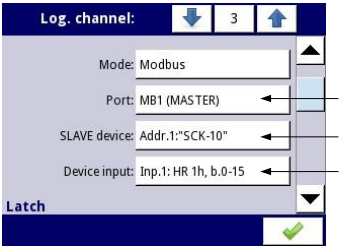
Sample list of available hardware outputs

6.8.4. Logical channels – Modbus mode



Modbus mode allows the user to configure the logical channel to:

- read the data from a SLAVE device transmitted over RS-485 Modbus RTU (MGU device in **MASTER** mode),
- read/write the data from/to logical channel of MGU device transmitted over RS-485 Modbus RTU (MGU device in SLAVE mode) or by Ethernet port (Modbus TCP/IP, MGU device in **SLAVE** mode)



Port MB1, MGU in MASTER mode for this port

Modbus address: '1', Device name: "SCK-10"

Input channel number: '1', HOLDING Register: '1h', size: 'b.0-15':

Sample Logical channel setting in Modbus mode

This data stored in the logical channel in Modbus mode can be display on screen, processed by other logical channels (e.g. by mathematical function or virtual relay) or it can be the data source for controlling an output.

The parameters of **Logical channel** in **Modbus** mode are:

- **Name** - to rename a channel, press the button next to the Name label, and then set any name,
- **Unit** - to create a unit use the **Scaling** parameter in **Processing** parameter block (more information see **Chapter 6.8.1. Logical Channels - General settings**),
- **Mode=Modbus** - in this parameter the user selects source of data for logical channel,
- **Port** - this parameter allows the user to select a serial/ethernet port from the list, the basic version of MGU has one built-in RS-485 port. The number of serial ports can be increased and one ethernet port added by installing a communication module into slot D of the device. This module offers 2 additional serial ports (one RS-485, and one RS-485/RS-232) and one ethernet port, which allows for an advanced Multi-Modbus system.
- **Slave device** - this parameter is only visible if the selected option in the **Port** parameter is in **Modbus MASTER** mode (see **Chapter 6.15.3. Modbus - MASTER mode**). Using this parameter the user can select the SLAVE device from the list defined in the **Modbus** menu to read the data from it,
- **Device input** - this parameter depend on the mode of the port
  - for **Modbus MASTER** mode (see **Chapter 6.15.3**), using this parameter the user can select the read register of the SLAVE device from the list defined in the **Modbus** menu,
  - for **Modbus SLAVE** mode (see **Chapter 6.15.2**), next to **Device input** label is the logical channel number and register number assigned to this logical channel are displayed,

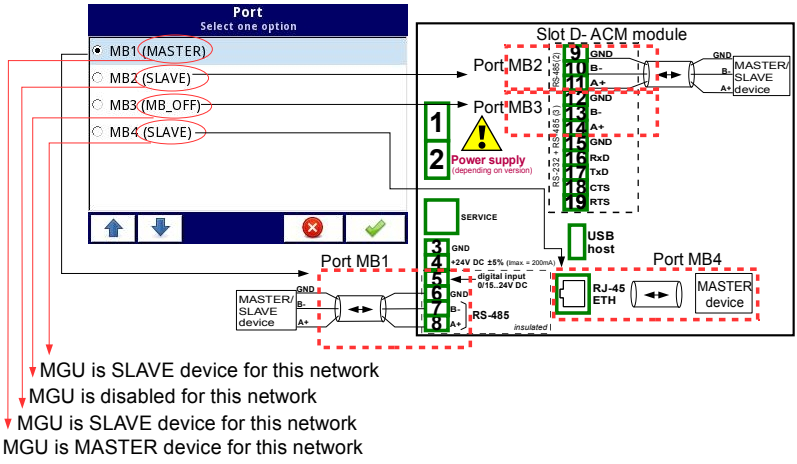
- **Latch** parameter block - allows user to set the **latch function** which will hold the last value of a channel (discussed in **Chapter 6.8.1. Logical Channels - General settings**),

- **Processing** parameter block - is used for scaling and filtering data (discussed in **Chapter 6.8.1. Logical Channels - General settings**),

- **Displaying** parameter block - these parameters allow the user to select the format and range of data displayed on the screen (discussed in **Chapter 6.8.1. Logical Channels - General settings**),

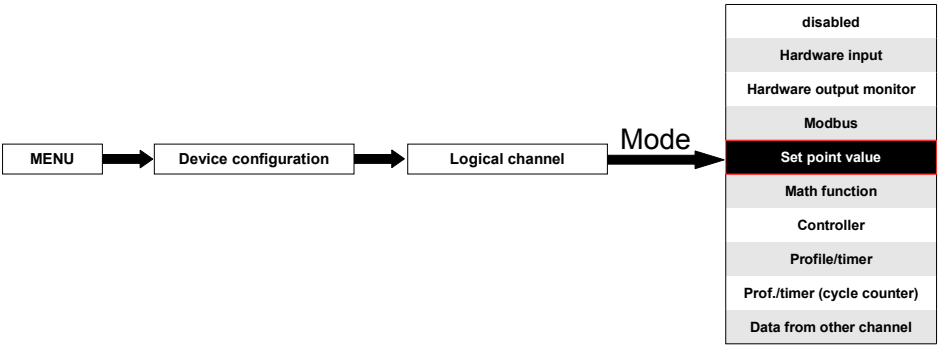
Logical channel's in Modbus mode reading registers from Slave devices that are not connected, will returns an error and instead of the value will display the state **-ERR-**.

For more information about the Modbus protocol implemented in the MGU see **Chapter 6.15. MODBUS**.



Sample list of available Modbus ports

6.8.5. Logical channels – Set point value mode



This mode allows the user to define the set point value for display on the screen, processed this data in any other logical channels (e.g. by mathematical function or controller, etc.) or it can be the data source for output to the control and settings of any object.

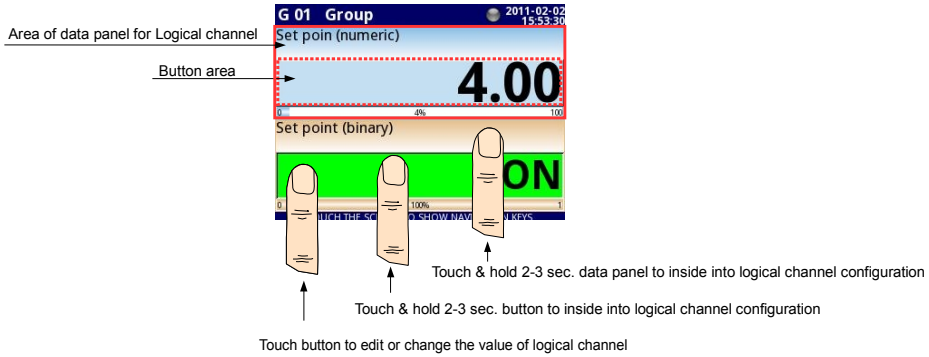
The parameters of the **Logical channels** in **Set point value** mode should be:

- **Name** - to rename a channel, press the button next to the Name label, and then set any name,
- **Mode=Set point value** - in this parameter user selects source of data for logical channel,
- **Unit** - this parameter allows the user to define any unit,
- **Set point value** - this parameter is visible only if **Edit button=disabled**, after pressing the button next to **Set point value** parameter appears in window allowing entry of a value, this value will be a source of data for this Logical channel.

– **Edit button** - this parameter allows you to activate the button in the panel data, this parameter has two options:
  - **disabled** - the button is disabled on the display, in this case the data source of logical channel will be the value set in the **Set point value** parameter,
  - **enabled** - this button is active, in this case the data source of logical channel will be the value set after pressing the button,

– **Latch** parameter block - allows user to set the **latch function** which will hold the last value of a channel (discussed in **Chapter 6.8.1. Logical Channels - General settings**),

– Displaying parameter block - for these parameters the user select format and range of data to be displayed on the screen (discussed in **Chapter 6.8.1. Logical Channels - General settings**),



*Data panels for Logical channel in **Set point value** mode*

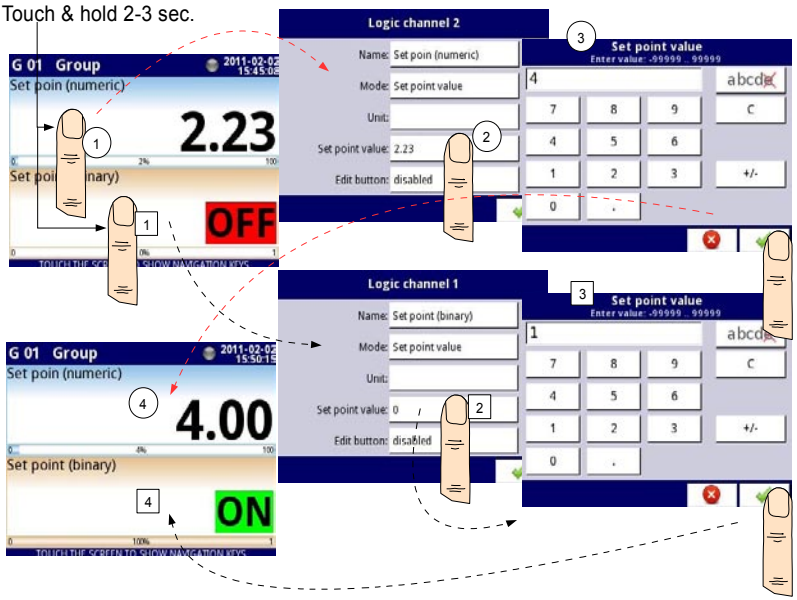
Manual operation of a button in the data panel

Action button in the data panel depends on the **latch function** set in the **Latch** parameter block (description of the **Latch** parameter block in Chapter **6.8.1. Logical Channels - General settings**) and on the **Format** parameter in the **Displaying** parameter block (description of the **Displaying** parameter block in Chapter **6.8.1. Logical Channels - General settings**).

a) **for disabled latch function**

For format:

– **numeric** - after pressing the button an edit window appears allowing entry of value this value will be a source of data for that Logical channel,
– **binary** - pressing the button causes a switch between the states (**'0'** and **'1'**) display in the data panel in accordance with the text states set in the parameters: **Off-state text** (channel value = **'0'**) and **On-state text** (channel value = **'1'**) in the **Displaying** parameter block,

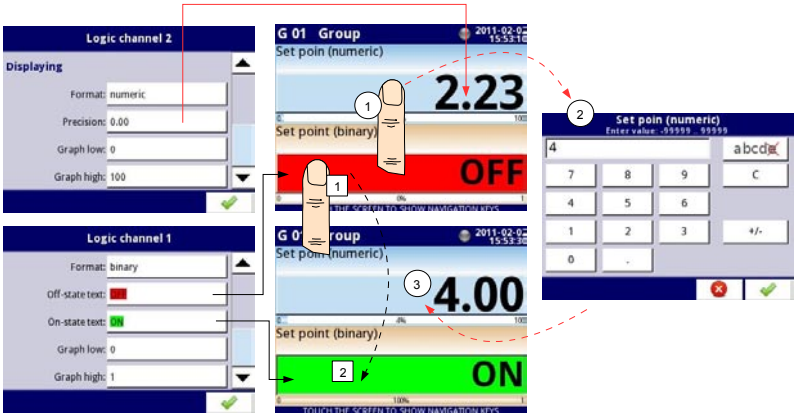


*Configuration of the value for Logical channel in **Set point value** for the disabled button*

b) for enabled latch function

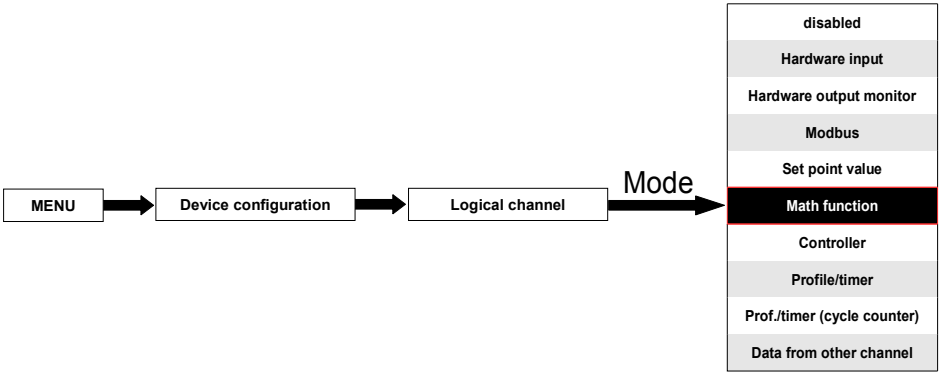
For format:

- **numeric** - after pressing the button an edit window appears allowing entry of value which enters the new value that isn't a data source for this channel but the value stored at the time of activation of the latch function, in the edit window the value of the button still appears a new value which will be the data source for that logical channel by disabling the latch function,
- **binary** - pressing the button does not switch between the states (**'0'** and **'1'**) displayed in the data panel in accordance with the text states set in the parameters: **Off-state text** (channel value = **'0'**) and **On-state text** (channel value = **'1'**) in the **Displaying** parameter block, but with each new press of the button the state of button is stored in the buffer and set the value of logical channel with the currently stored state when the latch function is disabled again.

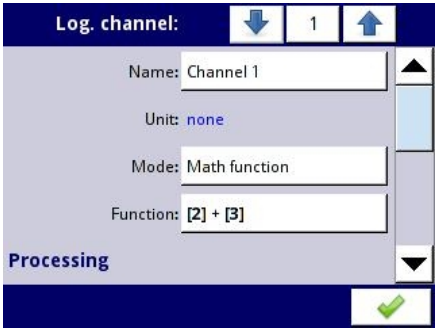


Manual operation of the button for numeric and binary format

6.8.6. Logical channels – Math function mode



MGU has a wide variety mathematical function which increases functionality and the range of the applications of the device. Figure presents parameters of **Input channel** into **Math function** mode. This mode allows the user to display channel value, process this data in any other logical channel or it can be the data source for an output to control and set any object.



Input channels menu - parameters specific for Math function mode

The parameters of **Logical channel** in **Math function** mode should be:

- **Name** - to rename a channel, press the button next to the Name label, and then set any name,
- **Unit** - to create a unit use the **Scaling** parameter (more information see **Chapter 6.8.1. Logical Channels - General settings**),
- **Mode=Math function**,
- **Function** - this parameter allow user to select math function from the list, for more information see below in this **Chapter**,

- **Latch** parameter block - allows user to set the **latch function** which will hold the last value of a channel (discussed in **Chapter 6.8.1. Logical Channels - General settings**),

- **Processing** parameter block - is used for scaling and filtering of data (discussed in **Chapter 6.8.1. Logical Channels - General settings**),

- **Displaying** parameter block - for these parameters the user select the format and range of data displayed on the screen (discussed in Chapter 6.8.1. Logical Channels - General settings),

Function parameter in the **Math function** mode

Basic math functions implemented into device are: addition, subtraction, multiplication and division. The unit allows the operation of logic functions, trigonometric, array operations, determining the arithmetic mean, finding maximum and minimum values, and many other function that are discussed in the table below. After pressing the button next to the **Function** label go to a math function menu. This menu consists of the following parameters (Note! Not all parameters are available for each function):

- **Function** - available for all math functions, by pressing the button next to the **Function** label a list of available math functions appears, from which we can select the appropriate function,
- **Source X** - available for all math functions, select logical channel or group of logical channels designated as **'X'** for math functions,
- **X error handling** - available for some math functions, depending on this parameter, the user can:

- **errors forwarded to result** - when the result of the selected channel (**Source X**) is a state: **Error**, **Hi**, **Lo**, or undefined then the output received states: Err, Hi, Lo,
- **skip erroneous channels** - means, that these channels, which result in a status of **Error**, **Hi**, **Lo** are ignored in the calculation of selected math function,

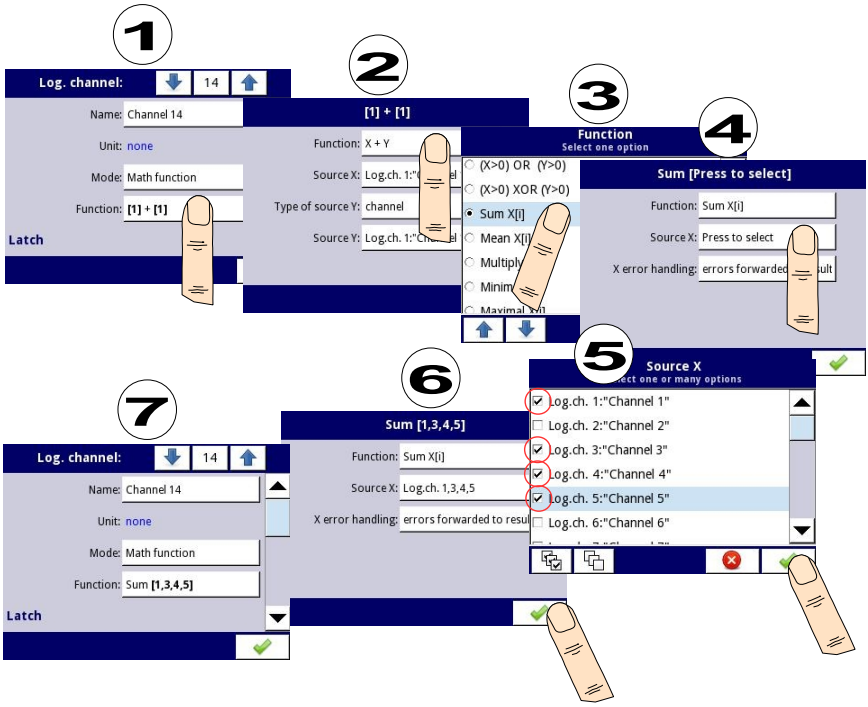
– **Type of source Y** - available for certain math functions. Available types are:
- **channel** - meaning that the **'Y'** source will be a logical channel selected from a list in **Source Y** parameter,
- **value** - means that the **'Y'** source will be a constant value entered in the **Source Y** parameter,

– **Source Y** - available for certain math functions. Depends of **Type of source Y** parameter. This parameter allows user to:
- select logical channel from list,
- or enter set point value (**Type of source Y=value**),

– **Unit** - available for certain trigonometric functions. Allow an option to be selected:
- **degree**
- **radian**

Example of configuration of logical channel in **Math function** mode

Steps to configure the function which summarizing values of logical channels: 1, 3, 4, 5 are shown in. If any logical channel has **Error** state or value exceeds the range of a logical channel (Hi, Lo) then output has the same state. The following steps are:
(1) - Select **Math function** mode in the appropriate logical channel (e.g. 14). Press the button next to the **Function** label to enter the **Function** menu,
(2) - Enter the **Function** sub-menu by pressing the button next to the **Function** label,
(3) - Choose function from the list, in this case: **Sum X[i]**,
(4) - Choose the appropriate source **'X'** by pressing the button next to **Source X** label,
(5) - Choose logical channel from a list, in this case **1**, **3**, **4**, **5**,
(6) - Set the **X error handling** parameter to **errors forwarded to result**,
(7) - If the function is configured correctly, we should get a description of function next to the **Function** label: **Sum [1, 3, 4, 5]**.



Sample configuration of logical channel in **Math function** mode

Explanation of the table:

Scaling of logical functions.

In the device the values of logical channel **≤ 0** are interpreted as a **'0'** logic, and the values of logical channel **> 0** as a **'1'** logic.

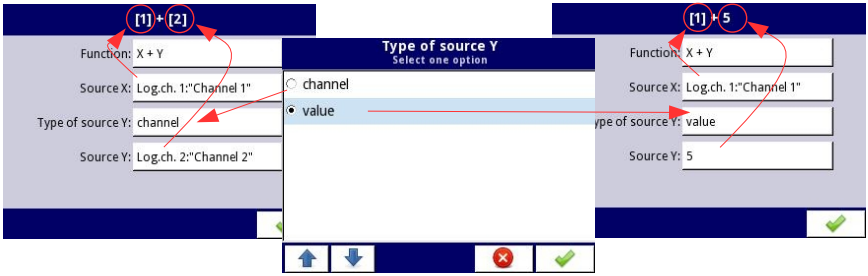
Math function	Description	Example
X+Y	The sum of two channel or channel and constant value[1]	**[1] + [2]** – The sum of channel 1 and 2
X-Y	The subtraction of two channels or channel and a constant value[1]	**[1] - [2]** – The subtraction of channel 1 and 2
X/Y	The ratio of two channels or channel and a constant value[1]	**[1] / [2]** – The ratio of the channel 1 to channel 2
X*Y	The product of two channel or channel and a constant value[1]	**[1] * [2]** – The product of channel 1 and channel 2

Math function	Description	Example
(X>0) AND (Y>0)	Logical AND	**[1] AND [2]** - result = 1, when the value of channel 1 and 2 is greater than 0
(X>0) OR (Y>0)	Logical OR	**[1] OR [2]** – result = 1, when the value of channel 1 or/and 2 is greater than 0
(X>0) XOR (Y>0)	Logical XOR	**[1] XOR [2]** – result = 1, when the value of the one channel is greater than 0 and the value of second channel is **≤ 0.** When both channels have values **≤ 0** or when both channels have values >0 then the result is 0.
SUM X[i]	The sum of selected channels	**SUM[1,2,3,4]** – the result is the sum of channels 1, 2, 3, 4
MEAN X[i]	The mean value of the selected channels.	**MEAN[1,2,3,4]** – the result is the arithmetic mean value of channels 1, 2, 3, 4
MULT X[i]	The product of the value of the selected channels.	**MULT[1,2,3,4]** - the result is the product of channels 1, 2, 3, 4
MIN X[i]	The smallest value of selected value of the selected channels	**MIN[1,2,3,4]** - the result is lowest value of the selected channels 1, 2, 3, 4
MAX X[i]	The largest value of selected value of the selected channels	**MAX[1,2,3,4]** - the result is highest value of the selected channels 1, 2, 3, 4
ANY X[i]>Y	The result = 1 if the value of any set of selected channels is greater than the value of the channel or constant value Y	**ANY[1,2,3,4]>[5]** – if the value of any set of channel 1, 2, 3, 4 is greater than the value of the channel 5 then the result is 1, otherwise it will be 0
ALL X[i]>Y	The result = 1 if all values of selected channels are greater than the value of the channel or constant value Y	**ALL[1,2,3,4]>[5]** – the result is 1 if all values of channels 1, 2, 3, 4 are greater than the value of the channel 5

Math function	Description	Example
ANY X[i]<Y	The result = 1 if the value of any set of selected channels is less than the value of the channel or constant value Y	**ANY[1,2,3,4]<[5]** - if the value of any set of channel 1, 2, 3, 4 is less than the value of the channel 5 then the result is 1, otherwise it will be 0
ALL X[i]<Y	The result = 1 if all values of selected channels are smaller than the value of the channel or constant value Y	**ALL[1,2,3,4]>[5]** – the result is 1 if all values of channels 1, 2, 3, 4 are less than the value of the channel 5
X[i] selected by Y	The result is a value of channel from list of channel X which selected by the value of channel Y	**[1,2,3,4]selected by[5]** - by the value of the channel 5 is selected appropriate value from channels 1, 2, 3, 4 (for value **≤ 0** of channel 5 will be selected value of channel 1; for value (0,1> of channel 5 -> value of channel 2; for value (1,2> of channel 5 -> value of channel 3; for value >2 of channel 5 -> value of channel 4). (see the *Example 6.8.11.7*, *Chapter 6.8.11*)
sin(X)	Sine value of the selected channel	**sin([17])** - sine value of channel 17
arcsin(X)	Arcsine value of the selected channel	**arcsin([8])** - arcsine value of channel 8
cos(X)	Cosine value of the selected channel	**cos([4])** - cosine value of channel 4
arccos(X)	Arccosine value of the selected channel	**arccos([1])** - arccosine value of channel 1
tan(X)	Tangent value of the selected channel	**tan([2])** - tangent value of channel 2
arctan(X)	Arctangent value of the selected channel	**arctan([4])** - arctangent value of channel 4
cot(X)	Cotangent value of the selected channel	**cot([10])** - cotangent value of channel 10
arccot(X)	Arccotangent value of the selected channel	**arccot([3])** - arccotangent value of channel 3

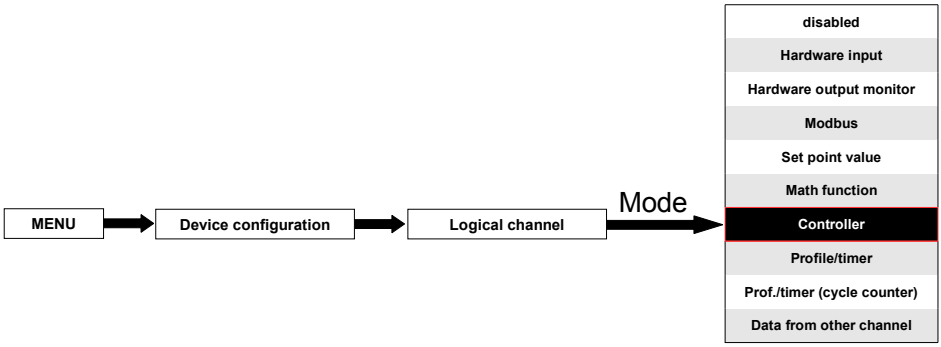
Math function	Description	Example
X^Y	Exponentiation - involving two numbers, the base **X** (value of selected channel) and the exponent **Y** (value of selected channel or set point value)[1]	**[1]**$^{[2]}$ - value of channel 1 to power to value of channel 2
$\log_Y(X)$	Logarithm of selected channel **X** with respect to base **Y** (value of selected channel or set point value)[1]	$\log_{[2]}([4])$ - logarithm of channel 4 with respect to base of channel 2
min(X) reset by Y	Minimal value of selected channel **X** if value of channel **Y≤0**, or current value of **X** (reset) if value of **Y>0**	**min([1]) reset by [4]** - minimal value of channel 1 reset by channel 4
max(X) reset by Y	Maximal value of selected channel **X** if value of channel **Y≤0**, or current value of **X** (reset) if value of **Y>0**	**max([1]) reset by [4]** - maximal value of channel 1 reset by channel 4

[1] the method of selecting logical channel or set point value is shown in next Figure

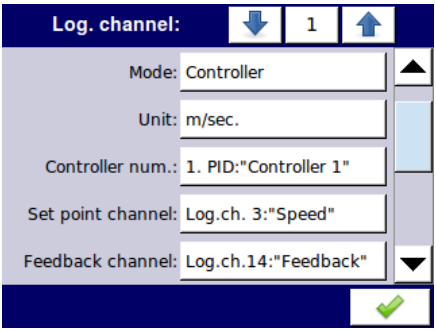


*The method of selecting a **channel** or a **set point value** for the **Source Y***

6.8.7. Logical channels – Controller mode



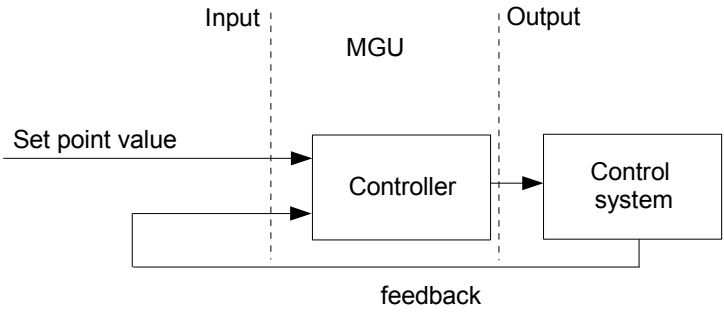
This mode allows the user to set up the PID control loop which may control the objects. To create **controlling process** the **Logical Channel** should be set in **Controller** mode as in Figure.



Input channel configuration in Controller mode

To the parameters of **Logical channel** in **Controller** mode should be:

- **Name** - to rename a channel, press the button next to the Name label, and then set any name,
- **Mode=Controller** - in this parameter user selects source of data for logical channel,
- **Unit** - this parameter allows the user to define the unit,
- **Controller number** - this parameter allows the user to select a controller from the list (1÷8). Before selecting or after selecting the controller from the list inside the Logical channel, user must configure the selected controller in the **Controllers** menu (overview and configuration parameters that define the controllers can be found in **Chapter 6.13. CONTROLLERS**).
- **Set point channel** - this parameter allows the user to select a logical channel with set point value, **Set point channel** defines input data for process control,
- **Feedback channel** - this parameter allow the user to select a channel with data returned from control system, **Feedback channel** define input data for process control,



The overall structure of control system implemented in the device

– **Latch** parameter block - allows user to set the **latch function** which will hold the last value of a channel (discussed in **Chapter 6.8.1. Logical Channels - General settings**),

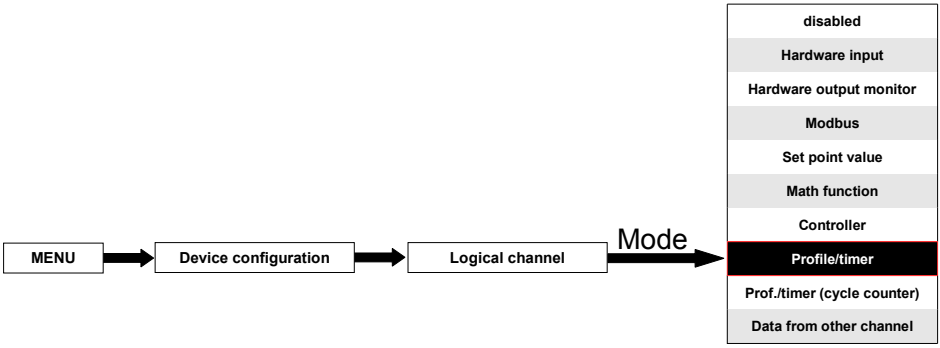
– **Processing** parameter block - is used for scaling and filtering data (discussed in **Chapter 6.8.1. Logical Channels - General settings**),

– **Displaying** parameter block - for these parameters the user select format and range of data displayed on the screen (discussed in **Chapter 6.8.1. Logical Channels - General settings**).

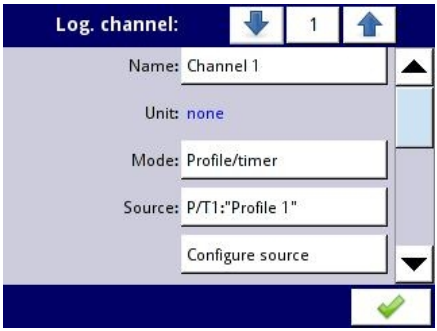
User must configure the controller parameters in the **Controllers** menu before using this controller to control real object (see **Chapter 6.13. CONTROLLERS**).

To read more about **Controllers profiles** see **Chapter 6.13. CONTROLLERS**.

6.8.8. Logical channels – Profile/timer mode



This mode allows the user to set up appropriate Profile/timer defined in **Profiles/timers** menu which may generate signal defined by the user to control any process. To create **Profile/timer** the **Logical Channel** should be set in **Profile/timer** mode as in Figure.



View of the input channel configuration in Profile/timer mode

The parameters of the **Logical channel** in **Profile/timer** mode should be:

- **Name** - to rename a channel, press the button next to the **Name** label, and then set any name,
- **Unit** - to create unit use the **Scaling** parameter in **Processing** parameter block (for more information see **Chapter 6.8.1. Logical Channels - General settings**),
- **Mode=Profile/timer** - in this parameter user selects source of data for logical channel,
- **Source** - this parameter allows the user to select a Profile/timer from the list (**8 Profiles/timers** are implemented in the device), which selected option will be data source for this logical channel. Before selecting or after selecting the **Profile/timer** from the list inside the Logical channel, the user must configure the selected Profile/timer pressing the **Configure source** button or enter into the **Profiles/timers** menu (overview and configuration parameters that define the Profiles/timers can be found in **Chapter 6.12. PROFILES/TIMERS**),
- **Configure source** - this button allows the user to configure **Profile/timer** selected in the **Source** parameter. For more information see below in this **Chapter**,

- **Latch** parameter block - allows the user to set the **latch function** which will hold the last value of a channel (discussed in **Chapter 6.8.1. Logical Channels - General settings**),

- **Processing** parameter block - is used for scaling and filtering data (discussed in **Chapter 6.8.1. Logical Channels - General settings**),

- **Displaying** parameter block - for these parameters the user select format and range of data displayed on the screen (discussed in **Chapter 6.8.1. Logical Channels - General settings**),

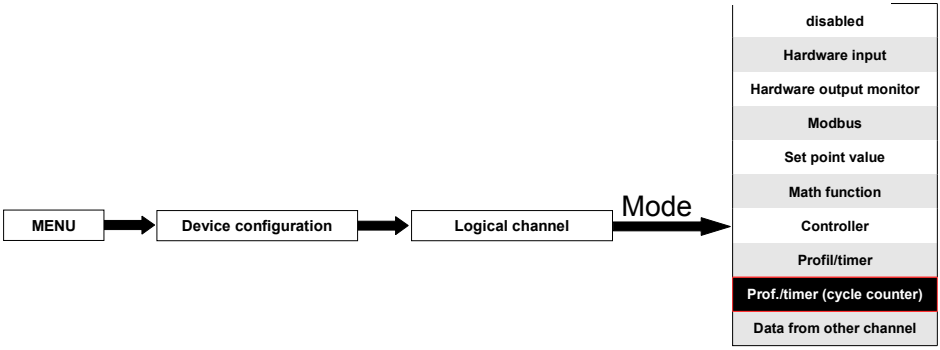
Configure source button in **Profile/timer** menu

There are two methods for configuring Profiles/timers:

- by the **Profiles/timers** menu, following steps: **MAIN->Device configuration-> Profiles/timers** (see **Chapter 6.12. PROFILES/TIMERS**),
- directly in the **Logical channel** in **Profile/timer** mode by pressing the **Configure source** button.

View of window of configuration the profile/timer in both cases is the same. Overview of setting profile/timer is presented in **Chapter 6.12. PROFILES/TIMERS**.

6.8.9. Logical channels – Profile/timer (cycle counter) mode



This mode is similar to **Profile/timer** mode but instead of using the signal generated by the Profile/timer, the number of cycles elapsed by the profile is transferred to the logical channel.

Cycle counter is generated depending on the **Looping** parameter value, ie when **Looping=disabled** the cycle counter is equal to 0.

The parameters of the **Logical channel** in **Profile/timer (cycle counter)** mode should be:

- **Name** - to rename a channel, press the button next to the Name label, and then set any name,
- **Unit** - for **Built-in modules** it will automatically use the default **Unit**, to change the unit use the **Scaling** parameter in **Processing** parameter block, to create unit use the **Scaling** parameter (for more information see **Chapter 6.8.1. Logical Channels - General settings**),
- **Mode=Profile/timer** - in this parameter user selects the source of data for the logical channel,
- **Source** - this parameter allows the user to select a Profile/timer from the list (**8 Profiles/timers** are implemented in the device), the selected option will be the data source for this logical channel.
- **Configure source** - this button allows the user to configure the **Profile/timer** selected in the **Source** parameter. For more information see below in this **Chapter**,

– **Latch** parameter block - allows the user to set the **latch function** which will hold the last value of a channel (discussed in **Chapter 6.8.1. Logical Channels - General settings**),

– **Processing** parameter block - is used for scaling and filtering data (discussed in **Chapter 6.8.1. Logical Channels - General settings**),

– **Displaying** parameter block - for these parameters the user selects the format and range of the data displayed on the screen (discussed in **Chapter 6.8.1. Logical Channels - General settings**),

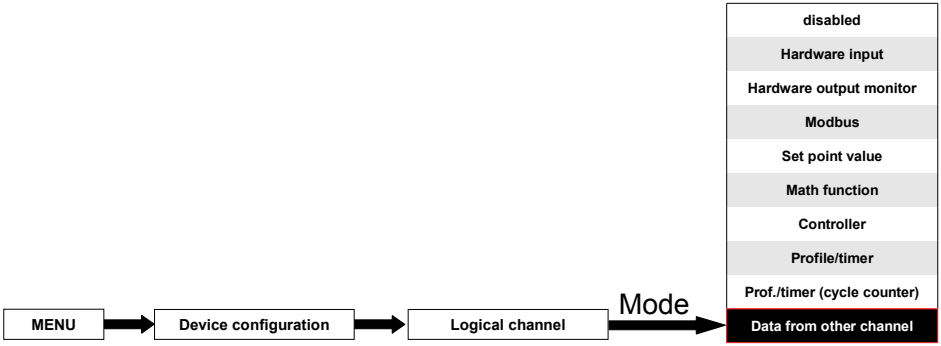
Before selecting or after selecting the **Prodfile/timer** from the list inside the Logical channel, the user must configure the selected Profile/timer pressing the **Configure source** button or enter into the **Profiles/timers** menu,

Configure source button in **Profile/timer (cycle counter)** menu
There are two methods for configuring Profiles/timers:

– by the **Profiles/timers** menu, take the following steps: **MAIN->Device configuration->Profiles/timers** (see **Chapter 6.12. PROFILES/TIMERS**),
– directly in the **Logical channel** in **Profile/timer** mode by pressing the **Configure source** button.

The configuration of the profile/timer in both cases is the same. An overview of settings of the profile/timer is presented in **Chapter 6.12. PROFILES/TIMERS**.

6.8.10. Logical channels – Data from other channel mode



The parameters of the **Logical channel** in **Data from other channel** mode should be:

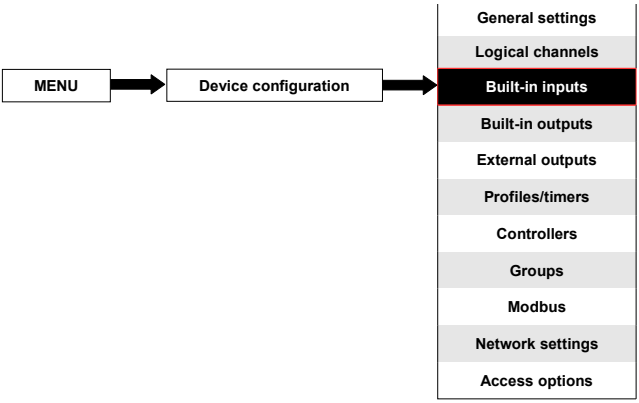
- **Name** - to rename a channel, press the button next to the **Name** label, and then set any name,
- **Unit** - the unit downloaded from the source logical channel; to change the unit use the **Scaling** parameter in the **Processing** parameter block (for more information see **Chapter 6.8.1. Logical Channels - General settings**),
- **Mode= Data from other channel** - in this parameter the user selects the source of data for the logical channel,
- **Source** - this parameter allows the user to select a logical channel from the list, the selected option will be the data source for this logical channel,
- **Quantity** - this parameter allows the user to select an element from the data source for a selected logical channel with one data source element, this parameter will have a default value,

- **Latch** parameter block - allows the user to set the **latch function** which will hold the last value of a channel (discussed in **Chapter 6.8.1. Logical Channels - General settings**),

- **Processing** parameter block - is used for scaling and filtering data (discussed in **Chapter 6.8.1. Logical Channels - General settings**)

- **Displaying** parameter block - for these parameters the user selects the format and range of data displayed on the screen (discussed in **Chapter 6.8.1. Logical Channels - General settings**),

6.9. BUILT-IN INPUTS



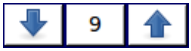
The **Built-in inputs** menu is directly related to the available inputs installed in the device. The basic version includes inputs:

- built-in **binary input** is always marked as **Inp.X2 : Binary 24V** - more about the **binary input** see **Chapter** ,
- 3 built-in **Demo** inputs marked as **Inp.X3 : Demo**, **Inp.X4 : Demo**, **Inp.X5 : Demo** - more about **demo** input see **Chapter**,

Depending on customer's needs, input modules (description of available intput modules is provided in **Appendix 8. APPENDIX - INPUT AND OUTPUT MODULES DESCRIPTION** and the producer's website) can be installed in respective slots A, B or C.

6.9.1. Built-in inputs – General settings

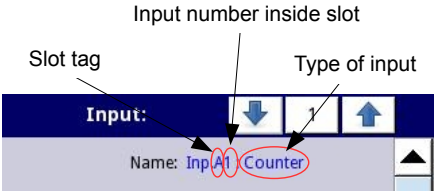
Available in the device in the basic configuration is **4 Built-in inputs** (**binary input** and **3 demo inputs**) and input modules installed in the device depending on the customer's needs. Configured inputs can be used to control any process or can be used by any logical channel. Switch to **Hardware input** mode in order to visualize the result, or use for further processing.



Arrows placed in the upper right corner of the screen allow you to switch between built-in inputs. The middle button allows you to directly select a specific built-in input from the list.

Parameters common for built-in inputs:

- **Name** - each input already has a name given by the device and user cannot



*Description of **Name** parameter in **Built-in inputs** menu*

Other parameters of **Built-in inputs** menu depend on the modules installed in the device.

To check the list of built-in input modules (slot tag and type of module) enter the **Device information** menu, and read the description of the modules (see **Chapter 6.4**).

In the device there are two ways to configure the hardware input:

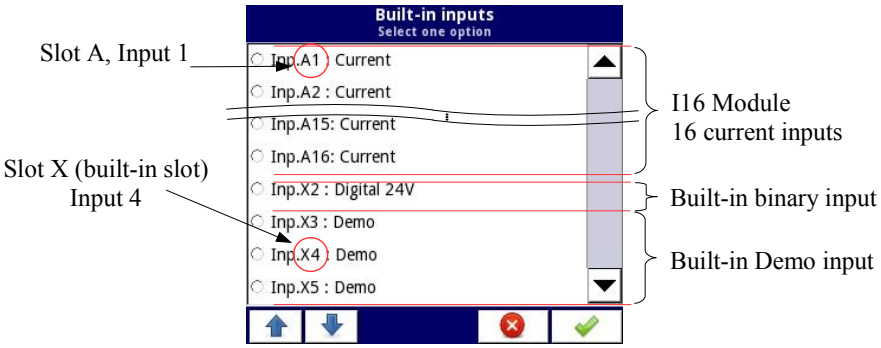
- using the **Configure source** button in the **Logical channels** menu in **Hardware input** mode,
- directly using the **Built-in inputs** menu.

The **Built-in inputs** can be (in the same order as list in the device):

a) installed **input modules** in the appropriate slots A, B or C - the list of currently available modules is on the website, see Chapter

b) built-in digital input is always designated as **Inp.X2: Digital 24V**

c) built-in Demo input numbered **X3**, **X4**, **X5**,



The view of a sample list of available built-in inputs for a device

6.9.2. Built-in inputs – Input modules

Short description of configuration of the physical input and is dependent on specific measurement modules. In the **Built-in inputs** menu for the module the user can:

- change the ranges covered (depending on module), see **Appendix 8. APPENDIX - INPUT AND OUTPUT MODULES DESCRIPTION**,
- change the connection method - it depends on the module (see **Appendix 8. APPENDIX - INPUT AND OUTPUT MODULES DESCRIPTION**), e.g. in the RTD module the user can select 2, 3 and 4-wire connections,
- change the type of reading of the input signal - depending on the module, e.g. a thermocouple module can read the temperature and voltage,
- change operation of the module - e.g. in counter module user can select function mode: add mode ("Function mode"="A+B"), subtract mode ("Function mode"="A-B"), quadrature mode 1 ("Function mode"="quad 1"), quadrature mode 4 ("Function mode"="quad 4"),

Parameters common for built-in inputs:

- **Name** - each inputs already has a name given by the device and the user cannot change it,

Other parameters of **Built-in inputs** menu depend on the modules installed in the device.

6.9.3. Built-in inputs – Binary input Inp.X2 : Digital 24V

The device has a built-in digital input, which can be used, for example as a switch for a process. Specifications of digital input are included in **Chapter 7. TECHNICAL DATA**. This digital input has levels:

	input voltage [V]			digital input
	min	type	max	
low level	0		5	0
prohibited level	>5		<8	x
high level	8		24	1

The **Binary input** has 2 parameters

- **Name** - each built-in inputs already has a name given by the device and user cannot change it, the built-in digital input is always designated as **Inp.X2: Digital 24V**,
- **Filter time** in which we can change the filter time from 0 to 1000 seconds. Filtering is disabled (0 sec.) by default. The **Filter time** parameter determines how quickly the input can change as noticed by the device. Filtration can be used if:
  - contact bounce occurs when switching,
  - you deliberately want to reduce the maximum frequency of the input.

Example of setting the value of the **Filter time** parameter:
When the **Filter time** parameter is set to 1 sec. then input changes which happen quicker than 1 second will be ignored.

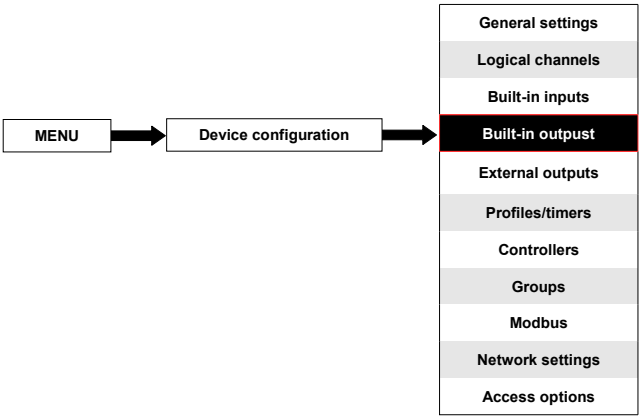
	input voltage [V]			digital input
	min	type	max	
low level	0		5	0
prohibited level	>5		<8	x
high level	8		24	1

The **Binary input** has 2 parameters

- **Name** - each built-in inputs already has a name given by the device and user cannot change it, the built-in digital input is always designated as **Inp.X2: Digital 24V**,
- **Filter time** in which we can change the filter time from 0 to 1000 seconds. Filtering is disabled (0 sec.) by default. The **Filter time** parameter determines how quickly the input can change as noticed by the device. Filtration can be used if:
  - contact bounce occurs when switching,
  - you deliberately want to reduce the maximum frequency of the input.

Example of setting the value of the **Filter time** parameter:
When the **Filter time** parameter is set to 1 sec. then input changes which happen quicker than 1 second will be ignored.

6.10. BUILT-IN OUTPUTS



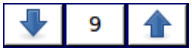
Build-in outputs menu is directly related to the available outputs installed in the device. The basic version includes outputs:

- built-in **Sound signal** output is always marked as **Out.X1: Sound signal** - more about the **Sound signal** output see **Chapter 6.10.2**,
- 16 built-in **Virtual relays** marked as **Out.V1: Virtual relay ÷ Out.V16: Virtual relay** - more about **Virtual relay** see **Chapter 6.10.2**,

Depending on customer's needs output modules (description of available output modules is provided in **Appendix 8. APPENDIX - INPUT AND OUTPUT MODULES DESCRIPTION** and the producer's website) can be installed in respective slots A, B or C.

6.10.1. Built-in outputs – General settings

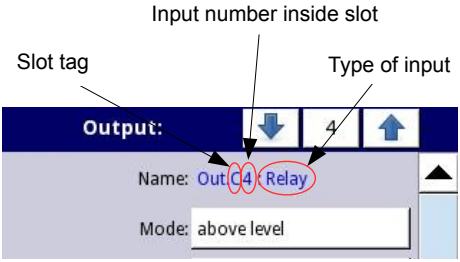
Available in the device in the basic configuration is **17 Built-in outputs** (**Sound signal** and **16 Virtual relay**) and output modules installed in the device depending on customer's needs. Configured output can be used to control any process or can be used by any logical channel switches to **Hardware output monitor** mode in order to visualize the result, or used for further processing the output data.



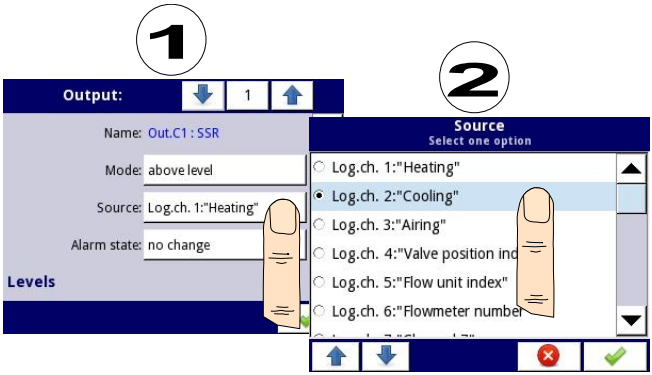
Arrows placed in the upper right corner of the screen allow you to switch between built-in outputs. The middle button allows you to directly select a specific built-in output from the list.

Parameters common for built-in outputs:

- **Name** - each outputs already has a name given by the device and user cannot change it
- **Source** - after pressing the button next to the **Source** label a list of logical channels appears (up to 60), where the selected logical channel will be a data source for this built-in output.



*Description of **Name** parameter in **Built-in outputs** menu*



Data source settings for built-in output

To check list of build-in output modules (slot tag and type of module) enter **Device information** menu, and read description of slots (see **Chapter 6.4**).

6.10.2. Built-in outputs – Relay, Sound signal, Virtual relay

The parameters of build-in outputs for: Relay, Sound signal, Virtual relay are:

- **Name** - each outputs already has a name given by the device and user cannot change it,
- **Mode** - this parameter allows the user to select the method of operation of the output, **Mode** parameter has options:
  - **disabled** - the built-in output is inactive,
  - **above level** - the result is a high state when the input data (see **Source** parameter) is above the level (see **Level** parameter block), otherwise the output is low state,
  - **below level** - the result is a high state when the input data (see **Source** parameter) is below the level (see **Level** parameter block), otherwise the output is low state,
  - **inside range** - the result is a high state when the input data (see **Source** parameter) will be within the range (see **Level** parameter block), otherwise the output is low state,
  - **outside range** - the result is a high state when the input data (see **Source** parameter) will be out of the range (see **Level** parameter block), otherwise the output is low state,

- **Source** - after pressing the button next to the **Source** label a list of logical channels appears (up to 60), where the selected logical channel will be the data source for this built-in output.

- **Alarm state** - the **Alarm state** is when the value of Logical channel in which the data source for built-in output returns **Error** state or the state of the exceeding range: the low **-Lo-** state and high **-Hi-** state. In this case, the device can detect this state and set the output value to:
  - **no change** - means that at the time of an alarm state there is no change in the output,
  - **immediate OFF** - means that in times of alarm state the device immediately switches the output to low state,
  - **immediate ON** - means that in times of alarm state the device immediately switches the output to high state,
  - **timed OFF** - means that in times of alarm state the device switches the output to low state after time delay set in **Timing** parameter block,
  - **timed ON** - means that in times of alarm state the device switches the output to low state after time delay set in **Timing** parameter block,

- **Levels** block parameter - these parameters allows the user to set range of changes of the output depending on the input signal, is discussed below in this **Chapter**,

- **Timing** parameter block - these parameters allows the user to set delay time change the output state and minimum duration of the output state, is discussed below in this **Chapter**,

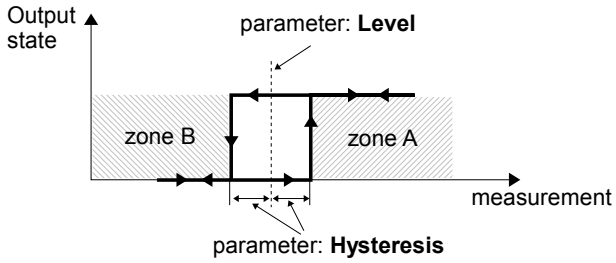
For **Built-in outputs**: **Relay**, **Sound signal** and **Virtual relay** the **low state** is value **'0'** and the **high state** is value **'1'**.

Levels parameter block

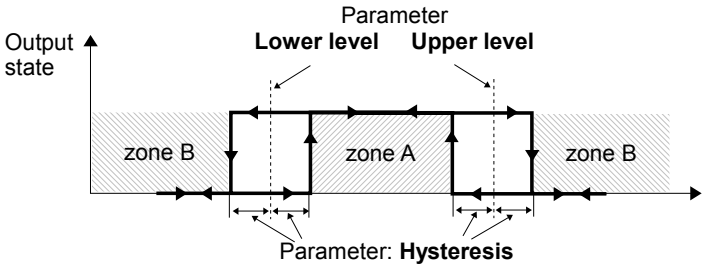
This parameters depends on the **Mode** parameter. The parameters are:

- **Level** - this parameter defines the source signal level at which the output switches the state (from low to high state or vice versa from high to low state), occurs for the mode:
  - **above level** - above the level at the output we get high state,
  - **below level** - below the level at the output we get high state,
- **Lower level and Upper level** - these parameters define the range at which a switches the output state (from low to high state or vice versa from high to low state), occurs for the mode:
  - **inside range** - if the input data is within the defined range at the output we get high state,
  - **outside range** - if the input data is outside the defined range at the output we get high state,

- **Hysteresis** - defining this parameter, the user can move the level (**upper** - value of **Level+Hysteresis** parameters and **lower** - value of **Level-Hysteresis** parameters) for changes in output state,



One threshold control of the relay outputs



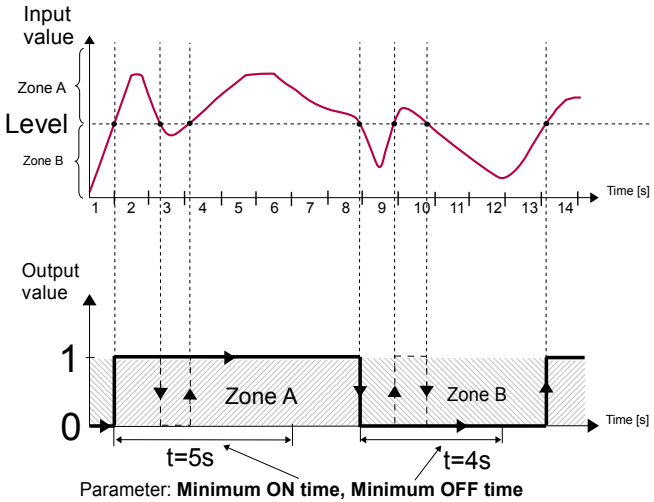
Two threshold control of the relay outputs

Timing parameter block

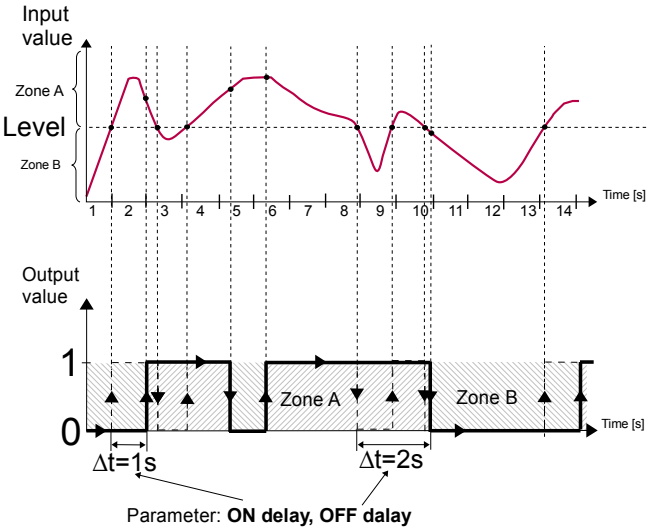
The parameters of this block include:

- **ON delay** - this parameter allows the setting of the time that must pass from the time of exceeds **Level** value until the output switch from low to high state,
- **OFF delay** - this parameter allows the user to set the time that must pass from the time of exceeds **Level** value until the output switch from high to low state

- **Minimum ON time** - the minimum duration of a high state (if the output switches to high state the low state will occur after the **Minimum ON time**),
- **Minimum OFF time** - the minimum duration of a low state (if the output switches to low state the high state will occur after the **Minimum OFF time**),

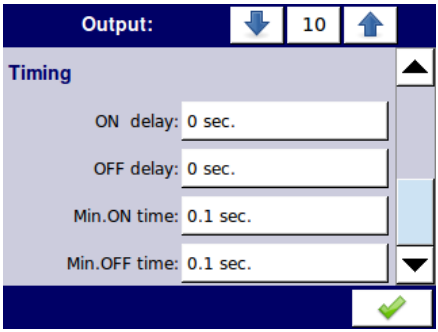


Principle of relay output operation for sample timing settings: ***Min. ON time****=5 sec.,* ***Min. OFF time****=4 sec.*



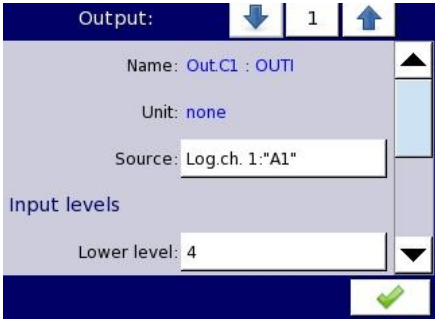
Principle of relay output operation for sample timing settings:

ON delay=1 sec., OFF delay=2 sec.



Timing settings for different modes

6.10.3. Built-in outputs – Current output



Menu of the Passive current output

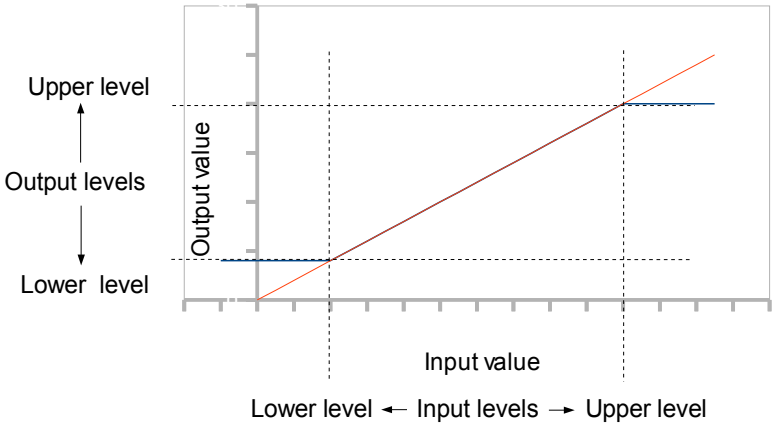
The parameters of built-in output for **Current outputs** module are:

- **Name** - each outputs already has a name given by the device and user cannot change it.
- **Unit** - for this module the unit is defined ([**mA**]) and user cannot change it,
- **Source** - after pressing the button next to the **Source** label a list appears of logical channels (60), where the selected logical channel will be a data source for this built-in output,

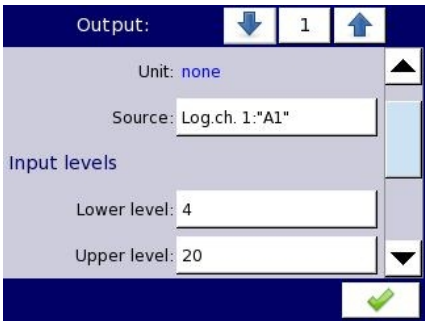
- **Input levels** parameter block - determine the range of data source for this built-in output, this block has parameters:
  - **Lower level** and **Upper level** - these parameters limit the range of the input signal selected in **Source** parameter, below this range input signal is **Lower level** value and above this range the signal will be **Upper level** value,

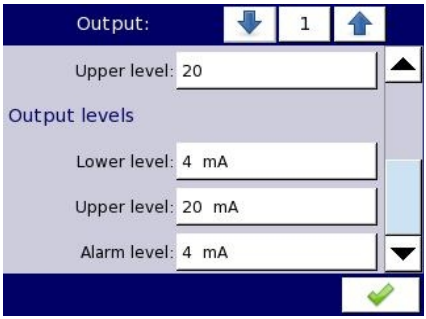
- **Output levels** parameter block - determine the range of output value, this block has the following parameters:
  - **Lower level** and **Upper level** - these parameters limit range of the output signal based on **Input levels** parameter, below this range input signal is **Lower level** value and above this range the signal will be **Upper level** value,
  - **Alarm level** - when input signal returns **Error** state or the state of exceeding range: the low **-Lo-** state and high **-Hi-** state the user can define output value for alarm state according to the parameters of **Lower level** and **Upper level**,

Lower level and **Upper level** parameter describe the transfer equation (linear).
Lower level of the output defines the current which can be generated when the value of the input signal is equal to the **Lower level**. **Upper level** of the output defines the current which can be generated when the value of the input signal is equal to the **Upper level**.



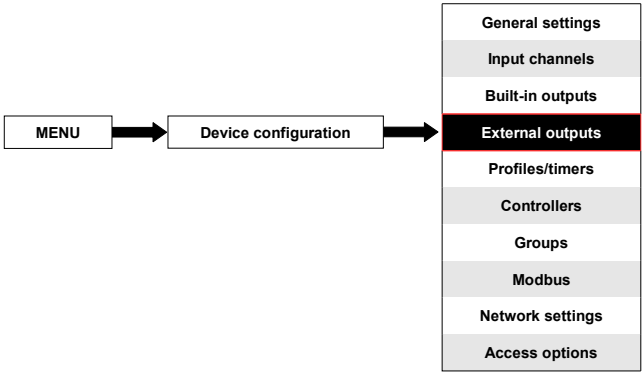
*Input (red)-output (blue) characteristic of signal in **Current output** mod*





*Parameters of the **Passive current** output*

6.11. EXTERNAL OUTPUTS

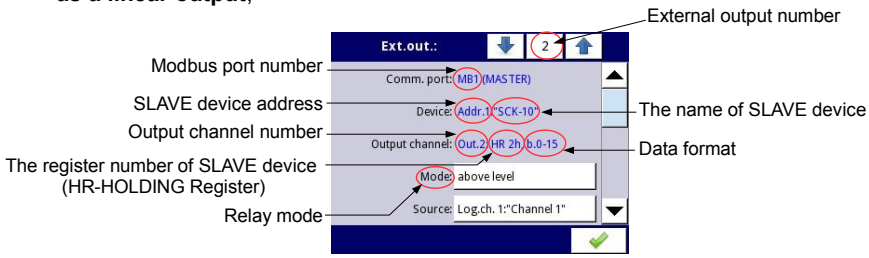


This menu is related to sending the date to SLAVE device using Modbus communication protocol. In this menu it is determined what data will be send to SLAVE device while the configuration of Modbus in Master mode (for example baud rate, define the SLAVE device, active output register list and etc.) is defined in the **Modbus** menu (see **Chapter 6.15.3. Modbus - MASTER mode**).

6.11.1. External outputs – General settings

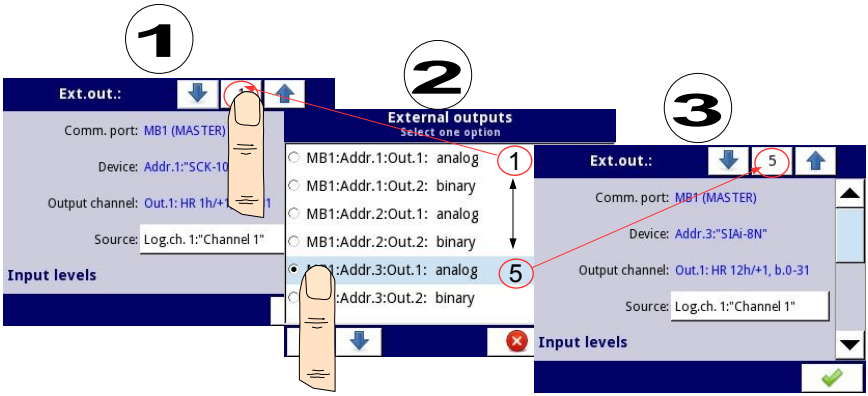
In the device there are as many external outputs as will be defined in the **Modbus** menu are available (see **Chapter 6.15.3. Modbus - MASTER mode**). In case when the external outputs are not defined or inactive than in **External outputs** menu is an empty list. External outputs have a control type (control type setting, see **Modbus MASTER- Device channels parameter block**):

- **as a relay**,
- **as a linear output**,

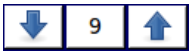


View of External outputs menu for 'as a relay' type control

View of **External outputs** menu is created for two types of control: as a relay (digital output) and a linear output (analog output).



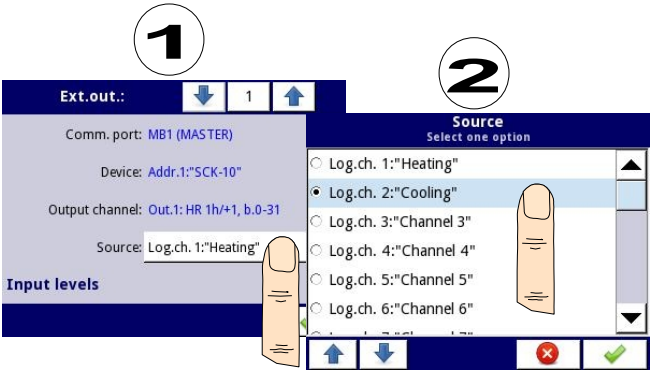
View of External outputs menu for 'as a linear output' type control



Arrows placed in the upper right corner of the screen let you switch between a succession of external outputs. The middle button allows direct selection of a specific external output from the list.

The parameters that are common for the **External** outputs:

- **Communication port** - this parameter is read only, and indicates the Modbus port number, a description of Modbus ports configuration and view of the Modbus port connectors is located in **Chapter 6.15. MODBUS**,
- **Device** - this parameter is read only, it shows address and name of the SLAVE device configured in Modbus menu (**Chapter 6.15.3. Modbus - MASTER mode**),



*Sample selection of **Source** for External output*

– **Output channel** - this parameter is read only, it shows output channel number, type of register and data format configured in Modbus menu (each SLAVE device as defined in a specific address, has its output list individually numbered),
– **Source** - after pressing the button next to **Source** label a list appears of Logical channels where the selected Logical channel will be data source for External output,

6.11.2. External outputs – Control type = as a relay

The output has two state, **low state**: **value '0'** and **high state**: **maximal value** (for 16-bit format is the value 65535),

The parameters of **External outputs** in the type of control **as a relay** are:

– **Communication port** - this parameter is read only, device displays here parameter the Modbus port number, a description of Modbus ports configuration and indication of the Modbus port connectors is located in **Chapter 6.15. MODBUS**,
– **Device** - this parameter is read only, it shows address and name of the SLAVE device configured in **Modbus** menu (**Chapter 6.15.3. Modbus - MASTER mode**),
– **Output channel** - this parameter is read only, it shows output channel number, type of register and data format configured in Modbus menu (each SLAVE device as defined in a specific address, has its output list individually numbered),
– **Mode** - this parameter allows the user to select the method of operation the external output, **Mode** parameter has options:
  • **disabled** - for **Mode=disabled** further parameters are not visible,
  • **above level** - the result is a high state when the input data (see **Source** parameter) is above the level (see **Level** parameter block), otherwise the output is low state,
  • **below level** - the result is a high state when the input data (see **Source** parameter) is below the level (see **Level** parameter block), otherwise the output is low state,
  • **inside range** - the result is a high state when the input data (see **Source** parameter) will be within the range (see **Level** parameter block), otherwise the output is low state,
  • **outside range** - the result is a high state when the input data (see **Source** parameter) will be out of the range (see **Level** parameter block), otherwise the output is low state,

– **Source** - after pressing the button next to **Source** label a list appears of Logical channels where the selected Logical channel will be data source for External output,
– **Alarm state** - the **Alarm state** is when the value of Logical channel which the data source for built-in output returns **Error** state or the state of exceeding range: the low **-Lo-** state and high **-Hi-** state. In this case, the device can detect this state and set the output value to:
  • **no change** - means that at the time of an alarm state there is no change on the output,
  • **immediate OFF** - means that in times of alarm state the device immediately switches the output to low state,
  • **immediate ON** - means that in times of alarm state the device immediately switches the output to high state,
  • **timed OFF** - means that in times of alarm state the device switches the output to low state after time delay set in **Timing** parameter block,

- **timed ON** - means that in times of alarm state the device switches the output to low state after time delay set in **Timing** parameter block,

– **Levels** block parameter - these parameters allow the user to set range of changes of the output depending on the input signal, is discussed below in this **Chapter**,

– **Timing** parameter block - these parameters allow the user to set delay time change the output state and minimum duration of the output state, is discussed below in this **Chapter**,

Levels parameter block

This parameters depends on the **Mode** parameter. The parameters are:

– **Level** - this parameter defines the source signal level at which the output switches the state (from low to high state or vice versa from high to low state), occurs for the mode:
  - **above level** - above the level we get high state at the output,
  - **below level** - below the level we get high state at the output,

– **Lower level and Upper level** - these parameters define the range at which a switch the output state (from low to high state or vice versa from high to low state), occurs for the mode:
  - **inside range** - if the input data is within the defined range at the output we get high state,
  - **outside range** - if the input data is outside the defined range at the output we get high state,

– **Hysteresis** - defining this parameter, the user can move the level (**upper** - value of **Level+Hysteresis** parameters and **lower** - value of **Level-Hysteresis** parameters) for changes in output state,

Timing parameter block

The parameters of this block include:

– **ON delay** - this parameter allows the user to the time that must pass from the time of exceeds **Level** value being exceeded until the output switch from low to high state to be set

– **OFF delay** - this parameter allows the user to the time that must pass from the time of exceeding **Level** value until the output switch from high to low state to be set

– **Minimum ON time** - the minimum duration of a high state (if the output switches to high state the low state will occur after the **Minimum ON time**)

– **Minimum OFF time** - the minimum duration of a low state (if the output switches to low state the high state will occur after the **Minimum OFF time**)

Note! If external output is active (see the parameter **Output active=yes** in the **Modbus MASTER- Device channels parameter block**) for **Mode=disabled** the MGU send to Slave device value **'0'**.

The parameters of **External outputs** in the type of control **as a linear output** are:

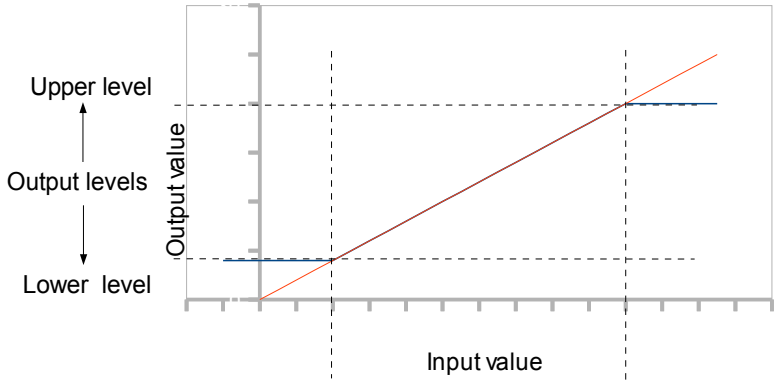
- **Communication port** - this parameter is read only, device display in this parameter the Modbus port number, a description of Modbus ports configuration and view of the Modbus port connectors is located in **Chapter 6.15. MODBUS**,
- **Device** - this parameter is read only, it shows address and name of the SLAVE device configured in **Modbus** menu (**Chapter 6.15.3. Modbus - MASTER mode**),
- **Output channel** - this parameter is read only, it shows output channel number, type of register and data format configured in Modbus menu (each SLAVE device as defined in a specific address, has its output list individually numbered),
- **Source** - after pressing the button next to the **Source** label a list of logical channels appears (60), where the selected logical channel will be a data source for this external output,

- **Input levels** parameter block - determine the range of data source for this external output, this block has parameters:
  - **Lower level** and **Upper level** - these parameters limit the range of the input signal selected in **Source** parameter, below this range input signal is **Lower level** value and above this range the signal will be **Upper level** value,

- **Output levels** parameter block - determine the range of output value, this block has parameters:
  - **Lower level** and **Upper level** - these parameters limit the range of the output signal based on **Input levels** parameter, below this range input signal is **Lower level** value and above this range the signal will be **Upper level** value,

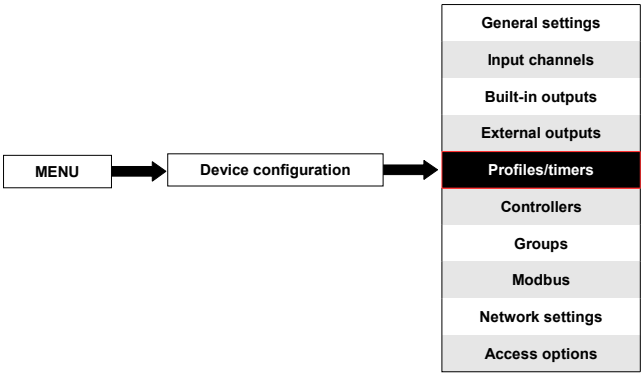
  - **Alarm level** - when input signal returns **Error** state or the state of exceeding range: the low **-Lo-** state and high **-Hi-** state the user can define output value for alarm state according to the parameters of **Lower level** and **Upper level**,

Lower level and **Upper level** parameter describe the transfer function).
Lower level of the output defines the value which can be generated when the value of the input signal is equal to the input **Lower level**. **Upper level** of the output defines the value which can be generated when the value of the input signal is equal to the input **Upper level**.



*The relation between the input and output for **External output***

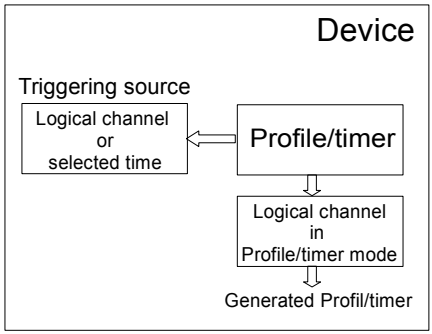
6.12. PROFILES/TIMERS



Profiles/timers menu allow the user to defined any profile/timer which can be used to control any process.

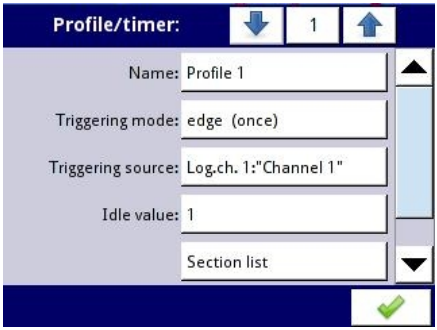
6.12.1. Profile/timer – General settings

In the MGU is there are **8 independent settings of Profiles/timers** available. Configured **Profile/timer** can be used by any **Logical channel** switched to **Profile/timer** mode (see also **Chapter 6.8.8. Logical Channels - Profile/timer mode**).



Block diagram of the device configuration for generating Profiles/timers

The window with basic parameters of the **Profile/timer** shown on Figure.



View of the configuration Profiles/timers window

In **Profiles/timers** menu user can set:

Arrows placed in the upper right corner of the screen allow you to switch between Profile/timer. The middle button allows you to directly select a specific Profile/timer from the list.

Common parameters for **Profile/timer** are:

- **Name** - to change a name of Profile/timer press the button next to the Name label,
- **Triggering mode** - using this parameter user select a way to generated Profile/timer, there are five modes of triggering:
  - **disabled**,
  - **level (gate)** - this means that which was configured by user **Profile** is generated when source signal will have a value > 0, otherwise (if source value ≤ 0) defined Profile will not be generated,
  - **edge (once)** - this means that which was configured by user **Profile** will be triggered by rising edge signal (from values ≤ 0 to the value > 0) come from source signal. After the rising edge the **Profile** will be generated in whole (once), regardless of further changes to the signal source,
  - **edge (re-triggering)** - this means that configured by user **Profile** will be triggered by rising edge signal (from values ≤ 0 to the value > 0) that comes from source signal. However, in this mode, unlike the **edge (once)** mode a defined **Profile** will be generated from the beginning every time when the Triggering source signal will generate a edge, whether that Profile had been completed or not,
  - **on time** - in this mode the **Profile/timer** is generated in selected time (using parameter **Triggering times**),
- **Idle value** - is the value before and after generating the defined the Profile,
- **Section list** - invokes sub-menu which the user sets shape of the Profile,
- **Looping** - each Profile can be repeated:
  - **disabled** - the **Profile** is generated only once,
  - **counted** - this option allows the user to generated **Profile** specified number of times defined using **Loop count** parameter,

  - **from logical channel** - this option allows the user to run a **Profile** a specified number of times set in the sellected logical channel defined by the **Looping source** parameter,
  - **infinite** - this option allows the user to infinite repeated of generated **Profile**,
- **Loop count** - this parameter is visible only for **Looping=counted**, allows the user to enter number of repetitions generated Profile,
- **Looping source** - this parameter is visible only for **Looping=from logical channe**l. It allows the user to select the logical channel from which the value determines the number of repetitions of the Profile,
- **Return to position** - this parameter is invisible for **Looping=disabled**, allows user to select a fixed position from which it is to be generated each successive Profile,

Section list Sub-menu

This sub-menu allows the user to defined shape of the **Profile** signal, that is: duration, shape and final value of each section.

This button allows the addittion of a new section to list.

This button allows the removal of the section from the list.

Arrows placed in the upper right corner of the screen allow switching between sections. Middle button allows direct selection of a specific section.

The **Section list** parameters are:

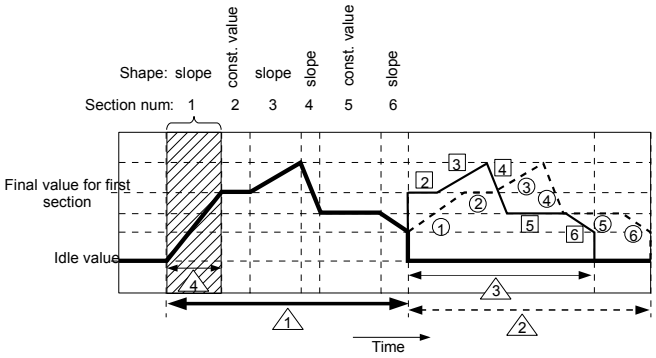
- **Duration** - the duration of the section depends on the **Unit** parameter,
- **Unit** - user can select available options: **second**, **minute**, **hour** which sets unit of the duration,
- **Shape** - user can select any of these available options: **constant value**, **slope** which sets the shape of the defined section,
- **Final value** - this parameter allows the setting of the final value of the defined section,

Comments for **Looping** parameter

If the user select: **counted** or **infinite**, repeats of the Profile/timer the user has:

- if the section from which begins the next repeat Profile/timer is a **ramp**, then in the whole duration of this section is linear generating the output signal from the **final value** of the previous section to **final value** this section.

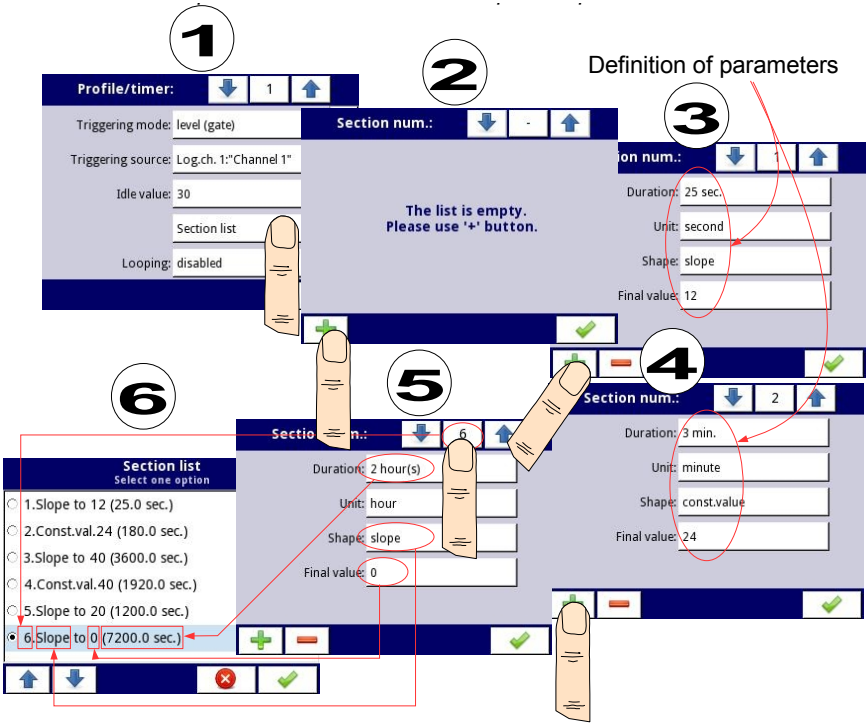
- if the section from which the next repeat of the Profile/timer begins is a constant value, then Profile signal quickly transient (0.1 seconds)from the **final value** of the previous section to a **constant value** in this section.



Legend:

1	Section for Profile without looping
①	Section for Profile with looping -> Retur to position 1 (slope)
2	Section for Profile with looping -> Retur to position 2 (const. value)
1	The duration of the Profile without looping
2	Looping of the Profile -> Return to position 1
3	Looping of the Profile -> Return to position 2
4	Duration of the section 1

Sample of Profile/timer with description of parameters

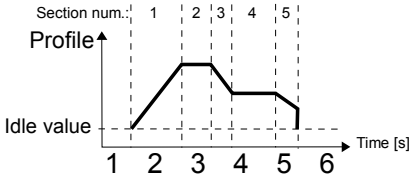


Sample of Profile/timer configuration

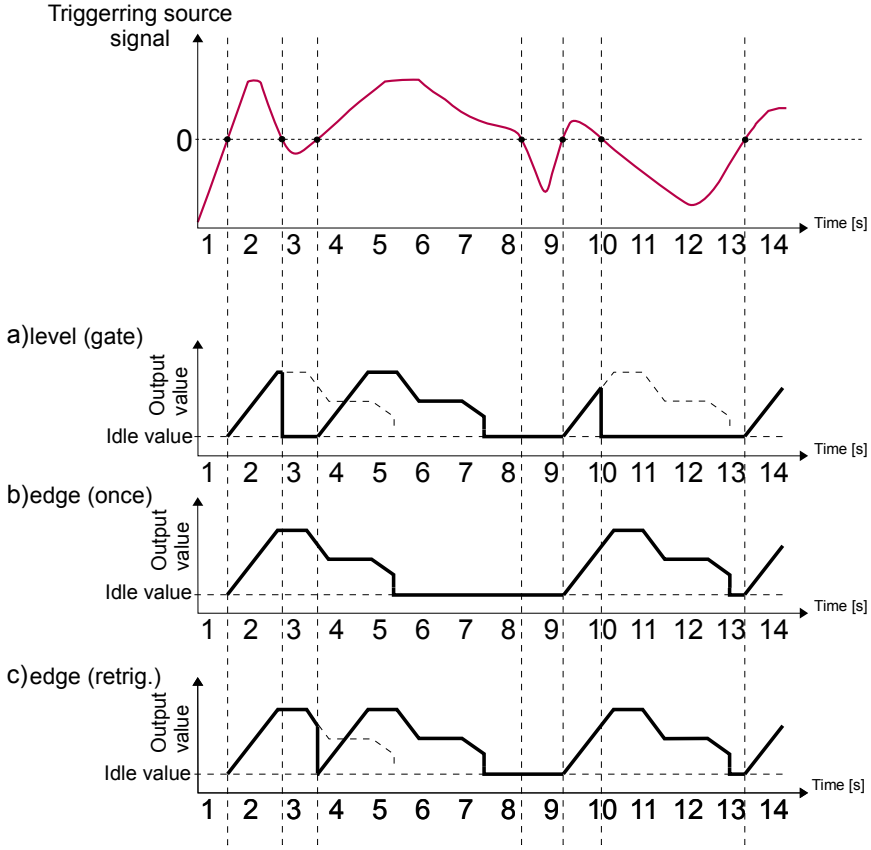
6.12.2. Profile/timers – Triggering mode: level (gate), edge (once), edge (retrig.)

The parameters of Profiles/timers for triggering mode: level (gate), edge (once), edge (retrig.) are:

- **Name** - to change a name of Profile/timer press the button next to the Name label,
- **Triggering mode** - by using this parameter the user selects a way to generate Profile/timer, there are five modes of triggering:
  - **disabled**,
  - **level (gate)** - this means that configured by user **Profile** is generated when source signal will have a value **> 0**, otherwise (if source value **≤ 0**) defined Profile will not be generated, see example **a)**
  - **edge (once)** - this means that configured by user **Profile** will be triggered by rising edge signal (from values **≤ 0** to the value **> 0**) from source signal. After the rise edge the **Profile** will be generated in whole (once), regardless of further changes to the signal source, see example **b)**,
  - **edge (re-triggering)** - this means that configured by user **Profile** will be triggered by rising edge signal (from values ≤ 0 to the value > 0) come from source signal. However, in this mode, unlike the **edge (once)** mode a defined **Profile** will be generated from the beginning every time when the **Triggering source** signal will generate a edge, whether that Profile had been completed or not, see example **c)** ,
  - **on time** - in this mode the **Profile** is generated in selected time (using parameter **Triggering times**),
- **Triggering source** - after pressing the button next to the **Triggering source** label a list of Logical channel appears (from 60) which selected Logical channel will be triggering source of Profile/timer,
- **Idle value** - is the constant value which is the set point before and after generating the defined Profile,
- **Section list** - invokes sub-menu which user set shape of Profile,
- **Looping** - each Profile can be repeated:
  - **disabled** - the **Profile** is generated only once,
  - **counted** - this option allows the user to generated **Profile** specified number of times defined using **Loop count** parameter,
  - **from logical channel** - this option allows the user to run a **Profile** a specified number of times set in the selected logical channel determined by the **Looping source** parameter,
  - **infinite** - this option allows the user to infinite repeated of generated **Profile**,
- **Loop count** - this parameter is visible only for **Looping=counted**, allows the user to enter number of repetitions generated Profile,
- **Looping source** - this parameter is visible only for **Looping=from logical channe**l. It allows the user to select the logical channel from which the value determines the number of repetitions of the Profile,
- **Return to position** - this parameter is invisible for **Looping=disabled**, allows user to select a fixed position from which it is to be generated each successive Profile,



Sample of Profile/timer



*Samples of **Profile** output waveforms defined in Figure, triggered by signal selected in **Triggering source** parameter*

6.12.3. Profile/timers – Triggering mode: on time

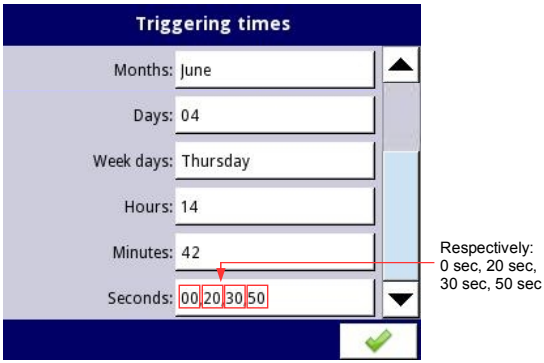
The parameters of **Profiles/timers** for **triggering mode**: **on time** are:

- **Name** - to change a name of Profile/timer press the button next to the **Name** label,
- **Triggering mode=on time** - in this mode the **Profile** is generated in selected time (using parameter **Triggering times**),
- **Triggering times** - this button enters sub-menu and allows the user to defining of triggering times of generated Profile, see below for more information about this sub-menu,
- **Idle value** - is the constant value of output signal which set before and after generating the defined Profile,
- **Section list** - invokes sub-menu in which the user configures the shape of Profile divided to sections,
- **Looping** - each Profile can be repeated:
  - **disabled** - the **Profile** is generated only once,
  - **counted** - this option allows the user to generation of number of times the specified **Profile** has occurred, defined using **Loop count** parameter,
  - **from logical channel** - this option allows the user to run a **Profile** a specified number of times set in the selected logical channel determined by the **Looping source** parameter,
  - **infinite** - this option allows the user to infinite repeated of generated **Profile**,
- **Loop count** - this parameter is visible only for **Looping=counted**, allows the user to enter number of repetitions generated Profile,
- **Looping source** - this parameter is visible only for **Looping=from logical channe**l. It allows the user to select the logical channel from which the value determines the number of repetitions of the Profile,
- **Return to position** - this parameter is invisible for **Looping=disabled**, allows user to select a fixed position from which it is to be generated each successive Profile,

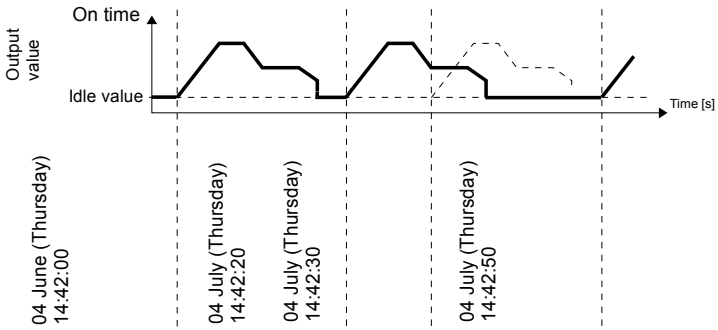
Triggering times

In shown an example of **Triggering times** menu which allows the user to set up the time of generating the Profile. This menu has parameters:

- **Months** - in this parameter and all below parameters in this menu the user can select one or more options, if user does not select any option next to this parameter appears the description **'Press to select'** and in this case Profile/timer will not be generated,
- **Days**,
- **Week days**,
- **Hours**,
- **Minutes**,
- **Seconds**,



*Samples of time settings for **Profile/timer***



*Waveform for **'on time'** triggering mode and time parameters.*

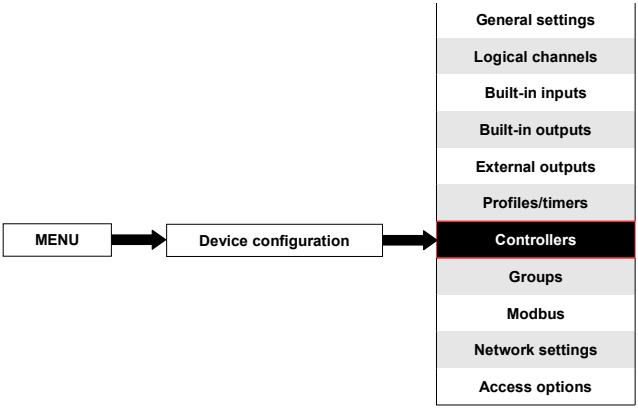
Triggering times configuration and output waveform. Operation of Profile in **'on time'** mode is similar to **edge (once)** mode - see **Chapter 6.12.2** because after the rising edge of the triggering source the **Profile** will be generated in whole, regardless of further changes of the signal source at time generating the Profile.

There are two methods to configure Profiles/timers, first in the ***Profiles/timers menu*** and second in the ***Logical channel*** in the ***Profile/timer mode***. In this case presents the first method. We enter to the ***Device configuration*** → ***Profiles/timers*** menu and using *arrows* or pressing middle button with a number in *upper navigation bar* select ***Profile/timer 1***. Next we can change the name to "***My Profile***". We select ***level (gate)*** in the parameter ***Triggering mode***. In the parameter ***Triggering source*** we select ***Logical channel 1*** "***Triggering***" which be defined later. **Idle value** sets to 0, the parameter ***Looping*** as a disabled. We go to ***Section list*** menu by pressing the button. In the menu the mark '**+**' means adding new section and mark '**-**' - delete selected a section. In the block of parameters: ***Duration***, ***Shape*** and ***Final value*** we set appropriate values as defined above e.g. first section: ***Duration*** 5s, ***Shape***: ramp and ***Final value***: 10. Exit from the configuration source.

In the next point enter ***Input channels*** menu and define ***logical channel*** in the ***Profile/timer*** mode and select the Profile ("***My Profile***") that is configured above. Finally, after defining the Logical channel and add to the Group the result should be visible in the display.

The second method is described in **Chapter 6.8.11 Examples of Logical Channels configuration**

6.13. CONTROLLERS

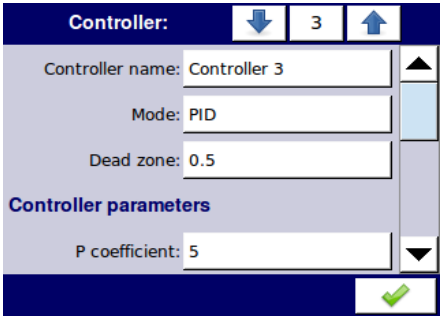


Although most controlling processes can be realised using simple ON - OFF mode, there is sometimes necessity of application of more advanced way of driving the actuators. The MGU has implemented **proportional–integral–derivative controllers** (**PID controllers**) which is a generic control loop feedback mechanism (controller) by calculating an "error" value as the difference between a measured process variable and a desired setpoint. The controller attempts to minimize the error by adjusting the process control outputs. In the system is available 8 independent settings of PID type controllers

6.13.1. Controllers – General settings

In the system there are **8 independent settings of PID type Controllers** available which can by used by any **Logical channel** switched in **Controller** mode - see **Chapter 6.8.7. Logical Channels - Controller mode**.

The window with basic parameters of the **Controller**.



Main configuration of an Controller profile

Arrows placed in the upper right corner of the screen allow switching between controllers to configure settings of controller parameters. The middle button allows direct selection of specific controller from the list.

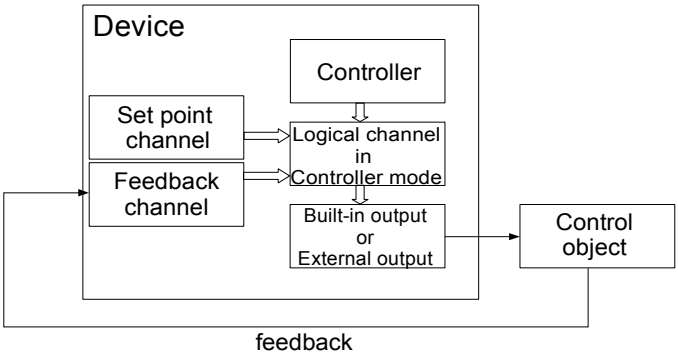
The parameters of **Controllers** are:

- **Name** - to change a name of **Controller** press the button next to the **Name** label,
- **Mode** - in this parameter user can select control mode which is used to controller calculation (algorithm), there are 3 options:
  - **PD** - proportional–derivative mode,
  - **PI** - proportional–integral mode,
  - **PID** - proportional–integral–derivative mode,
- **Dead zone** - this parameter determines how much the process variable must change in relation to its value in the previous cycle before it will be noticed by the controller, it means that the output of the controller will be changed if the difference between **Set point channel** value and **Feedback channel** value (more about **Set point channel** and **Feedback channel** parameters see **Chapter 6.8.7. Logical Channels - Controller mode**) exceeds the **Dead zone** value,

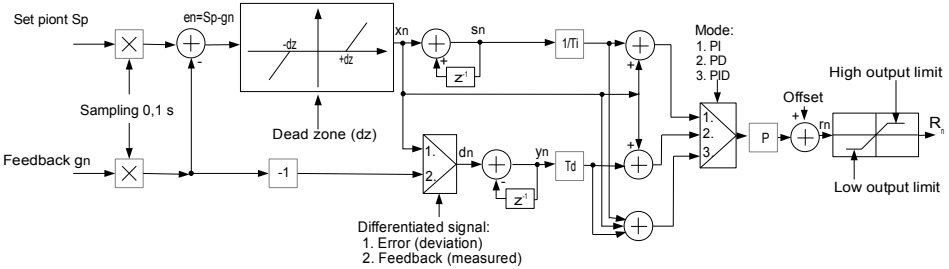
- **Controller parameters** parameter block - this block allows the user to set **PID** coefficients:
  - **P coefficient** - in this parameter user enter proportional gain,
  - **I coefficient** - this parameter is available for **PI** and **PID** mode and allows the entry of integral value,
  - **D coefficient** - this parameter is available for **PD** and **PID** mode and allows the entry of derivative value,
  - **Differentiated signal** - this parameter is available for **PD** and **PID** mode and allows the selection of the option:
    - **feedback (measured)** - in this option the value of **Feedback channel** is

directly sent to **D term**, which allows the fast response of the device to fast changes with the controlled object,
    - **error (deviation)** - in this option the value of **Feedback channel** is send to **D term** after calculation of error output and checking exceeds the range of **Dead zone**, this option is set for slow changes controlled object,
- **Controller output** parameter block - this block has parameters:
  - **Offset** - value of this parameter causes offset of controller output value, **Note!** after offset the output signal the output value is limited to the range set in **Low output limit** and **High output limit** parameters:,
  - **Low output limit** and **High output limit** - these parameters limit the output range of controller signal,

In Figure shows the block diagram of a control process of an object with the **Controller** implemented in the device. Set the setting of the selected Controller to be connected to the **Logical channel** operating in the **Controller** mode. In this **Logical channel**, select a **Set point channel** and the **Feedback channel**, which store the data required to control the object. Respectively, **Set point channel** contains a destination value of the process, while the **Feedback channel** includes the value of feedback coming from the object controlled. MGU uses data collected from these channels and the corresponding Controller controls the object.



Block diagram of the control loop of the object by MGU

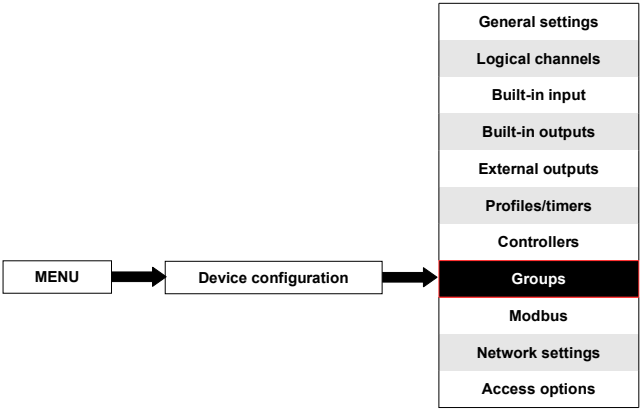


*Block diagram of the **Controller** implemented in the device*

Formula for **Controller** output:

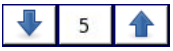
$$r_n = P \cdot \left[x_n + \underbrace{\frac{1}{I} \cdot \left(x_n + s_{n-1} \right)}_{\text{integral term}} + \underbrace{D \cdot \left(x_n - y_{n-1} \right)}_{\text{differentiator}} \right]$$

6.14. GROUPS



As it was mentioned **Groups** have the sets of 1-6 **Logical Channels** collected together for clearance. To see detailed definition of **Group** see **Chapter 4.1. UNDERSTANDING controller/data recorder MGU.** If the MGU has license for data logging then each Group is able to log the data coming from Logical channel included in this Group.

6.14.1. Groups – General settings

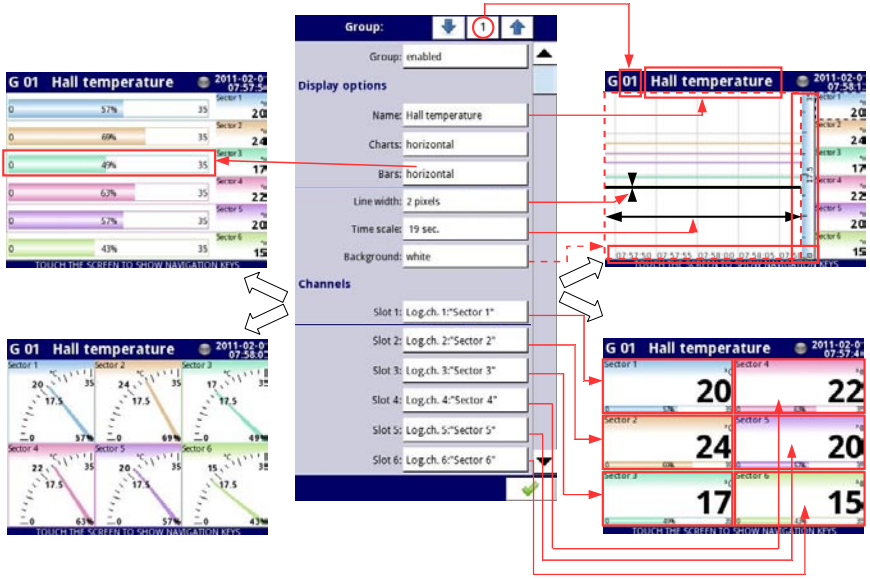


Arrows placed in the upper right corner of the screen allow switching between groups to configure settings of group parameters. The middle button allows direct selection of specific group from the list.

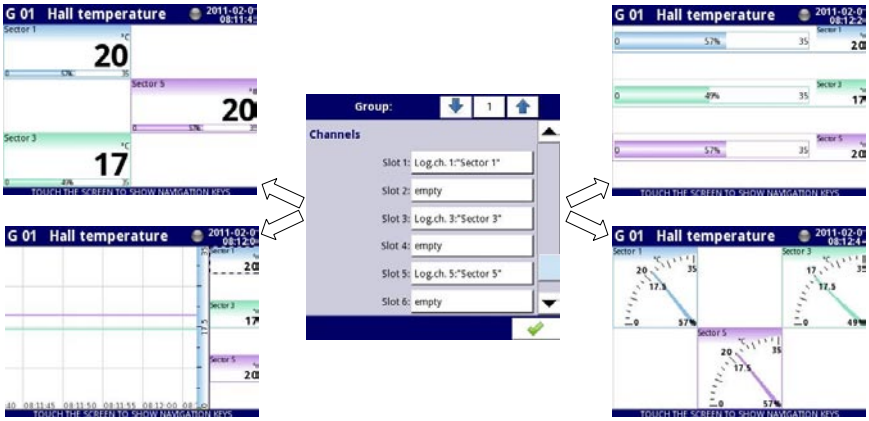
The parameters of **Group** are:

- **Group** - each group can be:
  - **disabled** - after selecting this option, the other parameters are not visible, the **Group = disabled** is not visible when you exit the menu,
  - **enabled**, - for this option the group is active,
- **Display options** parameter block - this block has parameters:
  - **Name** - to rename a group, press the button next to the **Name** label, and then set any name,
  - **Charts** - this parameter has option:
    - **horizontal** - time axis is in horizontal position,
    - **vertical** - time axis is in vertical position,
  - **Bars** - this parameter has option:
    - **horizontal** - horizontal direction of bars position,
    - **vertical** - vertical direction of bars position,
  - **Line width** - this parameter has option:
    - **1 pixel** - the char line one pixel width,
    - **2 pixels** - the char line two pixels width,
    - **3 pixels** - the char line three pixels width,
  - **Time scale** - this parameter has option:
    - **19 sec.** - time scale of window displaying a graph is 19 sec., the significant graduation is 5 sec.,
    - **48 sec.** - time scale of window displaying a graph is 48 sec., the significant graduation is 15 sec.,
    - **95 sec.** - time scale of window displaying a graph is 95 sec., the significant graduation is 25 sec.,
    - **3 min.** - time scale of window displaying a graph is 3 min., the significant graduation is 50 sec.,
    - **6 min.** - time scale of window displaying a graph is 6 min., the significant graduation is 95 sec.,
    - **12 min.** - time scale of window displaying a graph is 12 min., the significant graduation is 190 sec.,
  - Background - this parameter has option:
    - **white** - the background of window displaying the chars is white,
    - **black** - the background of window displaying the chars is black,
- **Channels** parameter block - this block defines the number and location of Logical channels that are displayed in the Group, includes the parameters:
  - **Slot 1**,
  - **Slot 2**,
  - **Slot 3**,
  - **Slot 4**,
  - **Slot 5**,
  - **Slot 6** - in each slot user can select a option:
    - **disabled** - disabled position is skipped which reduces the number of position to deploy in the display window,
    - **empty** -the empty position remain empty so that in contrast to the disabled position it doesn't reduce the number of position to deploy in the display window,
    - selected **Logical channel** from list, user can select 1 from 60 available Logical channel which will be displayed in the specific location on the screen,

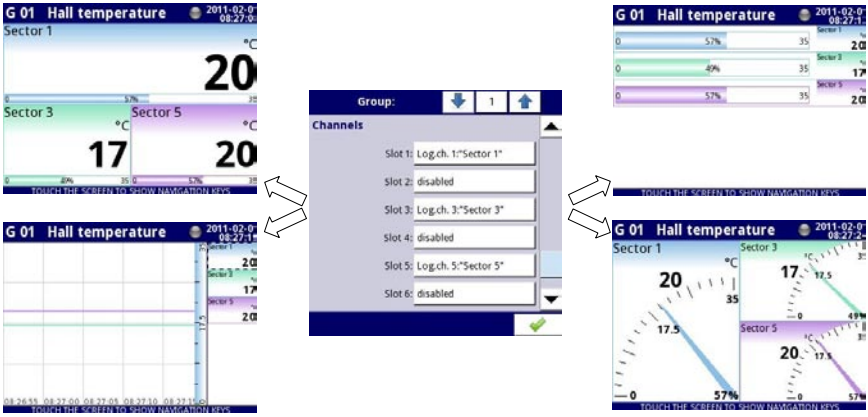
– **Logging options** parameter block - logging options are available only in the device having a license for logging the data (for more information about the logging license is in **Chapter 6.4**); parameters of this block shown and described in the **Chapter 6.14.2. Groups - Logging options**.



*Sample of **Group** parameters settings - all Slot set to **Logical channel***



*Sample of **Group** parameters settings - Slots set to **Logical channel** and set to **empty***



*Sample of **Group** parameters settings - Slots set to **Logical channel** and set to **disabled***

6.14.2. Groups – Logging options

Logging options are available only in the device having a license to log the data (for more information about the logging license is in **Chapter 6.4**). To log the data from the Logical Channel should be:

- **Logical channel** attached to **Group** using the **Channels** parameter block,
- **enable** the data logging by setting the options in block of parameters -> **Logging options**,
- after exiting the menu accept the changes by **writing configuration**,
- received logging data files can be sent to flash drive (form more information about files management see **Chapter 6.3. FILES MANAGEMENT**)

Each Group has its own data logging options and the MGU can log the 10 independent Groups of Logical channels at the same time .

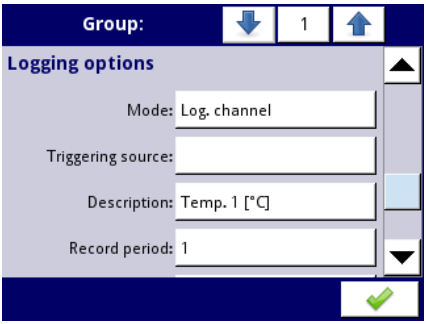
Logging of the data in the device is hardware limited, so the producer recommends to limit the logging to less than 200 samples per second (e.g. at the maximum sampling frequency of 0.1 sec. user should not log more than 20 Logical channels at one time). Failure to comply with these restrictions may cause the device to slow down .

Logging options parameter block has the following parameters:

- **Mode** - this mode has options:
  - **disabled** - logging of selection Group is disabled,
  - **always** - logging is continuous in time,
  - **from logical channel** - this option activate new parameter - **Triggering source** which enabled logging the data when the value of **Triggering source > 0**,
- **Triggering source** - this parameter is visible for **Mode=from log.channel**, when value of this source **> 0** than the **data logging is enabled**,
- **Description** - user can set a description of a data logging file by pressing the button

next to the **Description** label and then setting any text,

- **Base period** and **Base unit** - this parameters set duration of the sample of data logging, these parameters have the following options:
  - **unit: second ->** duration form **0.1** to **3600 sec.**,
  - **unit: minute ->** duration form **0.1** to **1440 minute**,
  - **unit: hour ->** duration form **0.1** to **24 hour**,
- **Alternative mode** - this mode allows the user to log data in special situation where a deeper analysis is required (for example in critical state of object),this parameter has the following options:
  - **disabled** - alternative logging of selection Group is disabled,
  - **from logical channel** - this option activate new parameter - **Triggering source** which enabled logging the data when the value of **Triggering source > 0**,
  - **Alternative source** - this parameter is visible for **Mode=from log.channel**, when value of this source **> 0** than the **data logging** for alternative mode is **enabled**,
- **Alternative period and Alternative unit** - this parameters set duration of the sample of data logging for alternative mode, these parameters have options:
  - **unit: second ->** duration form **0.1** to **3600 sec.**,
  - **unit: minute ->** duration form **0.1** to **1440 minute**,
  - **unit: hour ->** duration form **0.1** to **24 hour**,

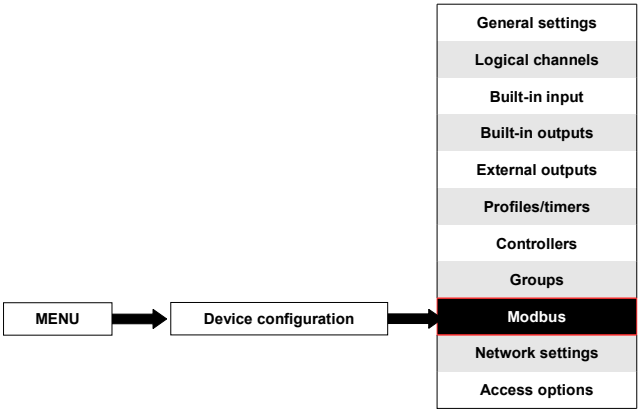


The Logging options block parameters

For any changes to the settings of the configuration of logging Group (e.g. a change in the logging parameters, changing parameters of **Display options** parameter block or change parameters of Logical channel included in logging Group) creates a new logging file. If user shuts down the device or changes other parameters independent of logging Group new logging file is not created.

6.15. MODBUS

The basic version of MGU has one RS-485 port built-in. The communication ability can be increased by installing a communication module into slot D of the device.
This module offers 2 additional serial ports (one RS-485, and one RS-485/RS-232) and one ethernet port, which allows the creation of an advanced Multi-Modbus system. In the current software version, a MODBUS RTU and MODBUS TCP/IP protocol are available and every port can be switched to Slave or Master (except port 4 which can be only SLAVE) mode.



The basic version of MGU has one RS-485 port built-in. The communication ability can be increased by installing a communication module into slot D of the device.
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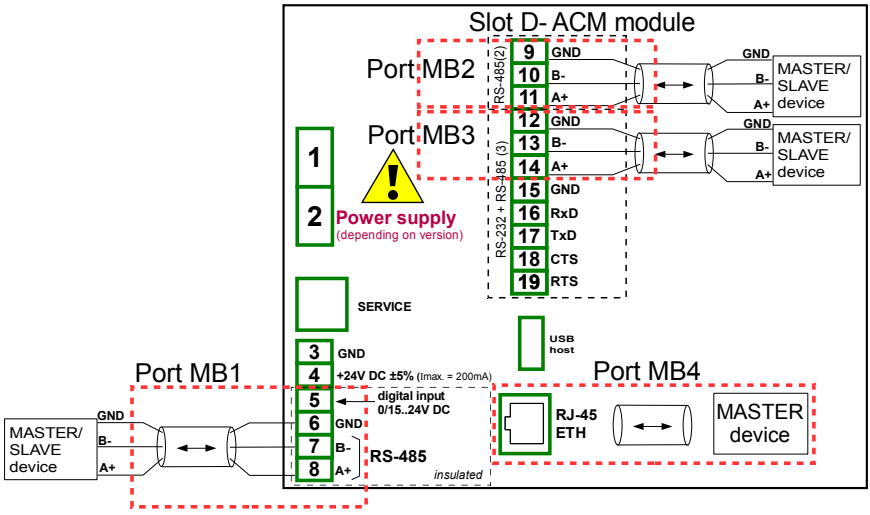
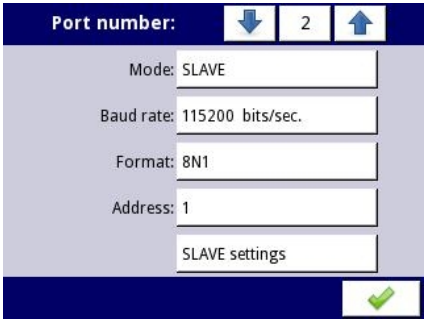


Serial communication ports available in the device

6.15.1. Modbus – General settings

Window with basic parameters of communication interfaces.



*Configuration parameters for **SLAVE** mode*

Arrows placed in the upper right corner of the screen allow switching between available serial ports. The middle button can be used for direct selection of a specific communication port from the list.

Parameter common for all Modbus protocol modes is:

- **Mode** - which has option:
  - **disabled**, the selected Modbus port is inactive,
  - **SLAVE** - this device is SLAVE device, see **Chapter 6.15.2 Modbus - SLAVE mode**,
  - **MASTER** - this device is MASTER device and manages the Slave devices, see **Chapter 6.15.3. Modbus - MASTER mode**

6.15.2. Modbus – SLAVE mode

The parameters of the Modbus RTU protocol (serial communication) for SLAVE mode are:

- **Mode = SLAVE**,
- **Baud rate** - this parameter determines the baud rate of the RS-485 interface, available options are: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bit./sec.,
- **Format** - data format of the RS-485 interface, available options are shown in the Tab. 7.4.

Format	Number of data bits	parity control	Number of stop bits
8N1	8	N - none	1
8N2	8	N - none	2
8E1	8	E - even	1
8E2	8	E - even	2
8O1	8	O - odd	1
8O2	8	O - odd	2

Data format of the RS-485 interface

- **Address** - SLAVE device address, available address range: 1÷255,
- **SLAVE settings** - this button goes to the slave devices submenu, where the user can configure available read and/or write registers. For more information see below,

In this mode the device parameters and measurement result are available via RS-485 interface, as HOLDING and INPUT type registers of the Modbus RTU protocol. The registers (or groups of the registers) can be read by 03h function, and written by 06h (single registers) or 10h (group of the registers) according to the Modbus RTU specification. See **Modbus SLAVE - The Modbus protocol handling** for a detailed description of MODBUS protocol handling in the MGU device.

The parameters of the Modbus TCP/IP protocol (ethernet communication) for SLAVE mode are:

- **Mode = SLAVE**,
- **SLAVE settings** - this button cause to go to submenu, that is ability configure available read and/or write registers, for more information see below,

In this mode the device parameters and measurement result are available via the ethernet interface, as HOLDING and INPUT type registers of Modbus TCP/IP protocol. The registers (or groups of the registers) can be read by 03h function, and written by 06h (single registers) or 10h (group of the registers) accordingly to Modbus TCP/IP specification. See **Modbus SLAVE - The Modbus protocol handling** for detailed description of MODBUS protocol handling in MGU device.

Notes on Modbus TCP/IP:

- allows the device to keep up to 3 connections, more connections disconnect the one that is the longest in the network,
- not implemented queuing priorities of customers,
- no access control to device based on client IP address,

SLAVE settings menu

This menu allows the user to define type, data format and activity registers which are available to the MGU device. In this menu the user can also view the assignment of groups of registers to logical channels as well as other important parameters of devices.

The list of parameters of SLAVE settings menu:

- **Load device template** - this button allows the loading of a template with predefined blocks of input registers,
- **Save device template** - this button allows saving of templates of predefined blocks of input registers,
- **Device channels** parameters block - this block of parameters allows the user to define type, data format and activity registers, the user can also preview the list of registers to read and blocks of registers to transmit into modbus frames,

Modbus SLAVE - Modbus Templates for SLAVE mode

In the **SLAVE settings** menu there are 2 buttons for modbus templates:

- **Load device template** - this button allows for loading a template with predefined blocks of input registers. Pressing this button invokes a file selection window. Templates can be imported into the MGU using a **File Management** menu,
- **Save device template** - this button allows the user to save in templates the predefined blocks of input registers. Saved template can be used for:

- fast copying/moving of the SLAVE device settings to another port (using **Load device template** button),
- easy exchange of templates between different MulitCon devices (using **File management** menu),

Template selection window

This button invokes software keyboard window allowing write or search the template name.

This button allows the user to delete selected template.

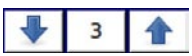
Navigation keys allows the user to select appropriate template.

Modbus SLAVE - Device channels for SLAVE mode

Device channels parameter block has 3 buttons:

- **Input list** - pressing the **Input list** button enters **Input channels** submenu where the user can configure registers of available logical channels. In this submenu the user decide which registers are read only or read and write.
- **Output list** - pressing the **Output list** button enters the **Output channels** submenu where the user can review registers of available logical channels and other important registers of the MGU. This submenu is only for review.
- **Block list** - pressing the **Block list** button enters the **Block list** submenu where the user can review the block of registers configured automatically by device. This submenu is only for review.

In the submenu of the **Device channels** parameter block the visible buttons are:



Arrows placed in the upper right corner of the screen allow the user to switch between channels/blocks of input/output registers. The middle button moves directly to specific channel/block of Input/Output registers from the list.

Input list submenu
This menu consists of following fields:

- **Value register** - by pressing the button next to the **Value register** label, the user goes to the submenu where the details of the Modbus register can be set,
  - **Register type**, a user can select two types:
    - **HOLDING** - holding registers of SLAVE device compatible with the Modbus protocol
    - **INPUT** - input registers of SLAVE device compatible with the Modbus protocol
  - **Write mode** - this parameter for HOLDING register type allows the user to select whether the register is to be read only or read-write, for INPUT type this parameter is read only,
  - **Register number** - read-only parameter
  - **Data format**, we can select one of these options:
    - **16 bits, signed** - integer value, the most significant bit is the sign bit,
    - **16-bits, unsigned** - integer value without information about the sign,
    - **32 bits, signed**, integer value, the most significant bit is the sign bit,
    - **32-bits, unsigned** - integer value without information about the sign,
    - **32 bits, float**, floating point IEEE 754 format,
    - **16-bits, BCD**, unsigned BCD value, write two digits in each byte,
    - **32-bits, BCD**, unsigned BCD value, write two digits in each byte,
  - **32 bit reading**, this parameter is only for 32-bit format, user can select one of these options:
    - **two 16-bit registers**,
    - **one 32-bit register**
  - **Ordering** - this parameter is only for 32-bit formats, the letters **ABCD** means: **A** - most significant byte of high words (word = 2 bytes), **B** - least significant byte of the high words, **C** - most significant byte of low words, **D** - least significant byte of the low words,
    - **ABCD (standard)**
    - **CDAB**,
    - **DCBA**,
    - **BADC**,
  - **Data shift** - read-only parameter, no data shift,
  - **Data mask** - read only parameter, no data mask,
- **Status register** - this parameter allows the user to review the number and data format of the status register,
- **Dec. point register** - this parameter allows the user to review the number and data format of the decimal point register,

Output list submenu.
This menu is read only and consist of following fields:

- **Value register** - this parameter allows the user to review the number and data format of the value register,
- **Status register** - this parameter allows the user to review the number and data format of the status register,
- **Dec. point register** - this parameter allows the user to review the number and data format of the decimal point register,

Block list submenu
This submenu is read only and consist of following fields:

- **Block type** - read only parameter, user can review the options that were set in the **Input list** submenu. Available options:
  - **read HOLDING register** - read only register,
  - **write HOLDING register** - read and write register,
  - **read INPUT register** - read only register,
- **Register size** - defines data size, can be set to:
  - **16-bit registers** - data is read/preset as 16 bit registers; this value can be also used for 32-bit registers reading/preseting. In a such case data is composed as two 16-bit registers,
  - **32-bit registers** - for 32-bit registers reading/preseting only, data is read as one 32-bit register.
- **First register** - value indicating the number of the first register of the block,
- **Last register** - value indicating the number of the last register of the block, for a single block with one 16-bit register the parameter **First register** and **Last register** must be the same number register,

Modbus SLAVE - The Modbus protocol handling

Parameters for Modbus RTU implemented in MGU

Transmission parameters: 1 start bit, 8 data bits, 1/2 stop bit, no/even/odd parity control
Baud rate: selectable from: 1200 to 115200 bits/second
Transmission protocol: MODBUS RTU compatible

Modbus SLAVE - List of registers

The device parameters and measurement result are available via RS-485 interface, as HOLDING and INPUT type registers of Modbus RTU protocol and via Ethernet interface as HOLDING and INPUT type registers of MODBUS TPC/IP. The registers (or groups of the registers) can be read by 03h function, and written by 06h (single registers) or 10h (group of the registers) accordingly to Modbus RTU and TCP/IP specification.

Register	*Write*	*Range*	*Register description*
20h	No	0÷199	Address of device
21h	No	2050h, 2060h	Device identification code **2050h** - device in big housing (5.7” display), **2060h** - device in small housing (3.5” display).
Measurements results (floating point format) [1]			
200h	Yes	0÷0FFFFh	Measurement result for logical channel 1 (high word)
201h	Yes	0÷0FFFFh	Measurement result for logical channel 1 (low word)

Register	Write	Range	Register description
202h	Yes	0÷0FFFFh	Status for logical channel 1: **0h** - data valid, **1h** - data not ready, **20h** - software error, **40h** - bottom border of the software measurement range is exceeded, **80h** - top border of the software measurement range is exceeded, **2000h** - hardware error, **4000h** - bottom border of the hardware measurement range is exceeded, **8000h** - top border of the hardware measurement range is exceeded, **FFFFh** - data not available (e.g. logical channel not configured)
203h	Yes	0÷6	Decimal point for logical channel 1
Register from 204h to 2F0h			Measurement results, status and decimal point for Logical Channels 2÷60
Measurements results (integer format) [1]			
400h	No	0÷0FFFFh	Measurement result for logical channel 1 (high word, not considering the decimal point)
401h	No	0÷0FFFFh	Measurement result for logical channel 1 (low word)
402h	No	0÷0FFFFh	Status for logical channel 1: **0h** - data valid, **1h** - data not ready, **20h** - software error, **40h** - bottom border of the software measurement range is exceeded, **80h** - top border of the software measurement range is exceeded, **2000h** - hardware error, **4000h** - bottom border of the hardware measurement range is exceeded, **8000h** - top border of the hardware measurement range is exceeded, **FFFFh** - data not available (e.g. logical channel not configured)
403h	No	0÷6	Decimal point for logical channel 1
Register from 404h to 4F0h			Measurement results, status and decimal point for Logical Channels 2÷60

[1] IEEE 754 standard, Float point format represents data as precision as possible. Integer 32 represents value with constant precision,selected by decimal point position. When decimal is set for example 0.0 then Int32 format represents integer part of the value contained in float registers and multiplied by 10 (e.g.: float is 1.2345, D.P. = 0.0, then Integer = 12). Similarly when decimal pint is 0.000 then integer represents integer part of the value contained in float registers and multiplied by 1000 (e.g.: float is 1.2345, D.P = 0.0, then Integer = 1234)

List of register available in the device

Modbus SLAVE - Transmission errors handling

If during reading or writing one of registries an error occurs then the unit shall return the frame containing the error code (according to the Modbus protocol).

Error codes should be interpreted as follows:
01h - illegal function (only functions 03h, 06h and 10h are available),
02h - illegal register address
03h - illegal data value

Modbus SLAVE- Example of query/answer frames

The examples concern a unit with address 1. All values are given in the hexadecimal system.
Designations:

ADDR	Address of the device in the system
FUNC	Function number
REG H,L	Higher and lower part of registry number, to which the command refers to
COUNT H,L	Higher and lower part of registry counter number, to which the command refers to, starting with the register, which is defined by REG (max. 32)
BYTE C	Number of higher bytes in the frame
DATA H,L	Higher and lower part of data word
CRC L,H	Higher and lower part of CRC sum

1. Read of ID code

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

The answer:

ADDR	FUNC	BYTE C	DATA H,L		CRC L,H	
01	03	02	20	60	A1	AC

DATA H,L - identification code (2060h)

2. Read of the registers 401h, 402h and 403h 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	04	01	00	03	55	3B

COUNT L - the count of being read registers (max. 32)

The answer:

ADDR	FUNC	BYTE C	DATA H1,L1		DATA H2,L2		DATA H3,L3		CRC L,H	
01	03	06	00	0A	00	02	00	00	18	B4

DATA H1, L1 - 401h registry (10 – high word of value for channel 1, no decimal point),
DATA H2, L2 - 402h registry (2 – low word of value for channel 1, no decimal point),
DATA H3, L3 - 403h registry (0 – status for channel 1).

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

6.15.3. Modbus – MASTER mode

The parameters of a Modbus protocol for MASTER mode are:

- **Mode = MASTER**,
- **Baud rate** - this parameter allows the user to select baud rate RS-485 interface, available option: 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bit./sec.,
- **Format** - data format of the RS-485 interface, available options are shown in the Tab. 7.6.

Format	Number of data bits	parity control	Number of stop bits
8N1	8	N - none	1
8N2	8	N - none	2
8E1	8	E - even	1
8E2	8	E - even	2
8O1	8	O - odd	1
8O2	8	O - odd	2

Data format of the RS-485 interface

- **Request timeout** - is the amount of time (any value between 0.01 to 3 sec.) the Master device waits for a response from the Slave device after sending a query,
- **Request retrials** - this is the number of times (integer value between 1 to 5) a Master device tries to send a message,
- **Slave device** - this Button enters submenu allows to define the list of Slave devices connected to the current serial port of MGU and configure registers for read and/or write. See below for more informations about this menu.
- **Reg. num. displaying** - this parameter allows to change mode of displaying the Register addresses for **Logical channel** and **External output** menu. Two formats are available:
  - **hexadecimal** - the registers are displayed in hexadecimal format. To indicate that data has a hexadecimal format, the letter '**h**' is added at the end - for example, 12h (0x12),
  - **decimal** - the registers are displayed in decimal format (without any marker) e.g. 123

SLAVE device menu

MGU allows to address as many as 255 slave devices on the addresses from 1 to 255. The Idea of SLAVE devices menu is based on defining the devices connected to the MASTER on a specific addresses. To define external data source, first an address must be chosen, next further parameters of the SLAVE device (having this address) set.

Arrows placed in the upper right corner of the screen allow switching between addresses of SLAVE devices to define or modify the settings of Slave devices in specific address. The middle button allows direct selection of specific address from the list.

If the particular address is not used, then a *short menu* is displayed:

- **Device type** which has the following options:
  - **not present** - means that this address is not used (in other words - there is no SLAVE device with this address connected),
  - **defined** - after selecting this option an extended list of SLAVE device parameters will appear, see below for details
- **Load device template**, this button allows the loading a template with predefined blocks of input and / or output registers. Pressing this button invokes a file selection window (Fig 7.104). After successful loading of the template an extended list of SLAVE device parameters will appear, see below for details. Templates can be imported into the MGU using a **File Management** menu and also created by the user using **Save device template** button after fully configuration of a slave device.

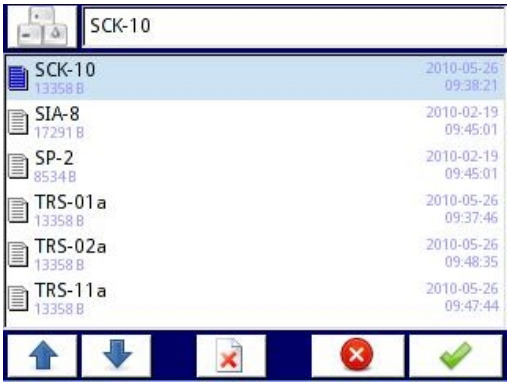
If the **Device type** is set to **defined** or a Template has been loaded, then *extended SLAVE device menu* is shown. This menu as following fields:

- **Device type = defined**,
- **Device name** - to create or change the name of a SLAVE device, press the button next to the **Device name** label and enter the name using displayed editor,
- **Device templates** parameter block,
- **Device channels** parameter block,
- **Register blocks** parameter block,

Modbus MASTER - Device templates parameter block

This block is composed of 2 buttons:

- **Load device template** - function is the same as presented in short menu description
- **Save device template** - allows the user to save a configured SLAVE device as a template for further usage. Saved template can be used for:
  - fast copying/moving of the SLAVE device to another address (use **Load device template**)
  - easy creation of similar SLAVE devices by loading the template in another address and modification of parameters.
  - easy moving exchange of templates between different MGU devices (using **File Management** menu).



Template selection window

This button invokes software keyboard window allowing write or search the template name.

This button allows the user to delete selected template.

Navigation keys allows the user to select appropriate template.

Modbus MASTER- Device channels parameter block

This block includes following buttons:

- **Input list** – this button runs submenu related to the Inputs of SLAVE device
- **Output list** – this button runs submenu related to the Outputs of SLAVE device

Both these submenus has basic icons presented below. Their functions are as follow:

This button allows the user to add a new Input/Output to Input list / Output list,

This button allows the user to delete the Input/Output from Input list / Output list

Arrows placed in the upper right corner of the screen allows user to switch between Inputs/Outputs. The middle button moves directly to specific Input/Output channel selected from the list.

Input List submenu.

When at least one Input Channel is added to the **Input list**, then an Input channel menu is displayed. This menu consist of following fields:

- **Channel value** parameters block composed of buttons:
  - **Value register** - by pressing the button next to the **Value register** label, the user goes to the menu where the details of the Modbus register serving data of input being can be set.
  - **Decimal point** - pressing of the button next to **Decimal point** label a list of available decimal point positions appears, in a last place there is an option: *** exp (-point register).** Selecting this value a new field (**Decimal point register)** will appear in the **Channel value** block.
  - **Decimal point register** - this parameter appears when the **Decimal point** parameter is set to *** exp (-point register)** option and allows the user to select the SLAVE device's register containing information about decimal point position. Using this parameter, the **Channel value** is being displayed according to formula:

$$(data\ of\ Value\ register)\cdot 10^{(-Decimal\ \ point\ register)}$$

- **Channel status '-HI-'** parameter block, gathers parameters defined when a status **-HI-** should be displayed (returned) in a place of numerical value of Input Channel. In this block a following parameters can be displayed
  - **-HI- state** - it has 3 options:
    - **never** – do not display status **'-HI-'**; for this option, other parameters of **Channel status '-HI-'** block are invisible,
    - **if register = value** - state **'-HI-'** is returned if data read from **'-HI- register'** equals to **'-HI- value'** parameter,
    - **if register ≠ value** - state **'-HI-'** is returned if data read from **'-HI- register'** differs from **'-HI- value'** parameter,
  - **-HI- register** - allows the user to select a status register to be read (see above)
  - **-HI- value** - allow the user to define the value being returned corresponding to status **-HI-** (see above),

- **Channel status '-LO-'** parameter block, gathers parameters defining status **-LO-:**
  - **-LO- state** - it has 3 options:
    - **never** – do not display status **'-LO-'**; For this option, other parameters of **Channel status '-LO-'** block are invisible,
    - **if register = value** - state **'-LO-'** is returned if data read from **'-LO- register'** equals to **'-LO- value'** parameter,
    - **if register ≠ value** - state **'-LO-'** is returned if data read from **'-LO- register'** differs from **'-LO- value'** parameter,
  - **-LO- register** - allows to select a status register to be read (see above)
  - **-LO- value** - allow to define value returned corresponding to status **-LO-** (see above),

- **Channel status '-WAIT-'** parameter block, gathers parameters defined when a status **-WAIT-**
  - **-WAIT- state** - it has 3 options:
    - **never** – do not display status **'-WAIT-'**; For this option, other parameters of

Channel status '-WAIT-' block are invisible,
    - **if register = value** - state **'-WAIT-'** is returned if data read from **'-WAIT- register'** equals to **'-WAIT- value'** parameter,
    - **if register ≠ value** - state **'-WAIT-'** is returned if data read from **'-WAIT- register'** differs from **'-WAIT- value'** parameter,

- **-WAIT- register** - allows the user to select a status register to be read (see above),
- **-WAIT- value** - allows the user to define value returned corresponding to status **-WAIT-** (see above),

– **Channel status '-ERR-'** parameter block , gathers parameters defining when a status **-ERR-**
- **-ERR- state**, - it has 3 options:
    - **never** – do not display status **'-ERR-'**; For this option, other parameters of **Channel status '-ERR-'** block are invisible,
    - **if register = value** - state **'-ERR-'** is returned if data read from **'-ERR- register'** equals to **'-ERR- value'** parameter,
    - **if register ≠ value** - state **'-ERR-'** is returned if data read from **'-ERR- register'** differs from **'-ERR- value'** parameter,
- **-ERR- register** - allows the user to select a status register to be read (see above),
- **-ERR- value** - allows the user to define value returned corresponding to status **-ERR-** (see above),

When a **Logical channel** is configured to **Modbus** mode then while reading the registers from SLAVE device if connection to the SLAVE device is lost, the device returns an error and displays the state **-ERR-**.

Output list submenu
This submenu allows the user to edit the output channels registers to be written. When at least one Output Channel is added to the list, then an Output channel menu is displayed.

The parameters of the **Output channels** are:
- **Output active ,**
    - **no** - the output channel is defined but invisible in the **External output** menu,
    - **yes** - the output channel is defined and visible in the **External output** menu.

Channel value parameter block – gathers following fields:
- **Control type**
    - **as a relay** - the output has two state, low state: value '0' and high state: maximal value (for 16-bit format is the value 65535),
    - **as a linear output** - can take any value depending of the settings in **Output register** and settings the parameters in the **External outputs** menu,

– **Output register** submenu - by pressing the button next to the **Output register** label user goes to the menu where user can set details of the Modbus register to be written.

Modbus MASTER- Register setting

The submenu of **registry** settings in the Modbus protocol has the following fields:

- **Register type**, this parameter is only for the register settings in the **Input list** menu (for the **Output list** menu the registers are HOLDING type), a user can select two types:
  - **HOLDING** - holding registers of SLAVE device compatible with Modbus protocol
  - **INPUT** - input registers of SLAVE device compatible with Modbus protocol

- **Register number** - any value from 0 to 65535

- **Data format**, we can select one of these options:
  - **16 bits, signed** - integer value, the most significant bit is the sign bit,
  - **16-bits, unsigned** - integer value without information about the sign,
  - **32 bits, signed**, integer value, the most significant bit is the sign bit,
  - **32-bits, unsigned** - integer value without information about the sign,
  - **32 bits, float**, floating point IEEE 754 format,
  - **16-bits, BCD**, unsigned BCD value, write two digits in each byte,
  - **32-bits, BCD**, unsigned BCD value, write two digits in each byte,

- **32 bit reading**, this parameter is only for 32-bit format, user can select one of these options:
  - **two 16-bit registers**,
  - **one 32-bit register**

- **Ordering** - this parameter is only for 32-bit formats, the letters ABCD means: A - most significant byte of high words (word = 2 bytes), B - least significant byte of the high words, C - most significant byte of low words, D - least significant byte of the low words
  - **ABCD (standard)**
  - **CDAB**,
  - **DCBA**,
  - **BADC**,

- **Data shift** - values can be bit moved to the right any integer value in the range:
  - for 16-bit format from 0 to 15,
  - for 32-bit format from 0 to 31, shift not exist for float format,

- **Data mask**, the device allows the user to use the masking of data on individual bits, mask 0xFFFF for 16-bit format is means that the entire value of register is visible, while the 0x0 mask (no mask) means that the value is zero,

Modbus MASTER- Register blocks parameter block

The device has the ability to read data from the SLAVE devices using multi register queries. By default this feature is configured automatically, but can be switched to manual mode.

Register blocks group has following fields:

- **Blocks config. mode**
  - **automatic** - the device automatically creates a blocks of registers to be read using the list defined in **Device channels** sub-menu. Then the **Block list** is informal only and cannot be edited.

- **manual** - user must create a list of registers blocks using **Block list** parameter

– **Maximum block size** - occurs only for the **Blocks configuration mode = automatic.** This parameter allows user to limit number of data registers to be read at once. It can be very useful when SLAVE devices has a limitation of max. number of registers read in a single frame.

– **Block list** - invokes informal screen in **automatic** mode and a sub-menu in **manual** mode,

Block list submenu

This button appears only for manual configuration mode and allows the user to add a new block of registers to list of register blocks.

This button appears only for manual configuration mode and allows the user to remove the block of registers from the list of register blocks.

Arrows placed in the upper right corner of the screen allow switching between register blocks. Middle button allows direct selection of a specific register block.

To the **Block list** parameters are:

– **Block type** - defines the function used for data reading/writing, can be set to:
  - **read Holding register** - register or group of registers read by **03h** function,
  - **read INPUT register** - register or groups of of registers read by the **04h** function,
  - **write HOLDING register** - preset single register by the **06h** function and preset multiple registers by the **10h** function,

– **Register size** - defines data size, can be set to:
  - **16-bit registers** - data is read/preset as 16 bit registers; this value can be also used for 32-bit registers reading/preseting. In a such case data is composed as two 16-bit registers and params: **First register** & **Last register** must select a minimum of 2 registers (e. g. **First register: 3h**, **Last register: 4h)**. The important parameter is then also **Ordering**
  - **32-bit registers** - for 32-bit registers reading/preseting only, data is read as one 32-bit register.

– **First register** - value indicating the number of the first register of the block,
– **Last register** - value indicating the number of the last register of the block, for single block with one 16-bit register the parameter **First register** and **Last register** must be the same number register,

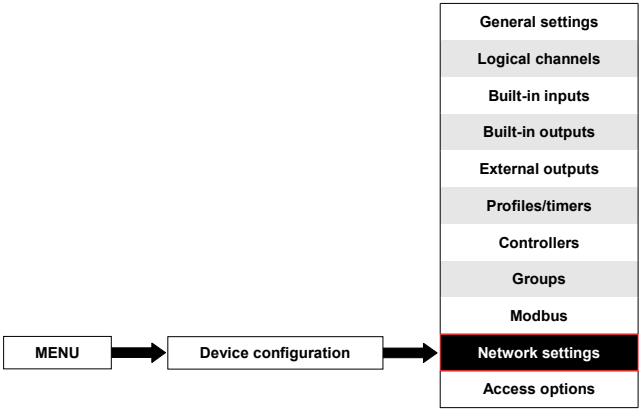
Manual mode configuration of registers blocks introduces a freedom when setting **Block list** parameters. Take care to set **Block list** parameters according to **Input list** and **Output list** in **Device channels** parameter block of the device (see above in this Chapter). If user creates a block of registers to read / preset in which there were not registers appearing on the Input list and Output list in the **Device channels** parameter this device in the case of:

- **read** - the read whole register block and registers undefined in Input list menu will not be visible in the Logical channel in Modbus mode which cannot be read either a data from this registers and to use this registers to control and regulating process,

- **preset** - will send the frame to preset the entire block of registers and registers which not defined in the **Output list** will not appear on the **External output** menu

Warning! in this case to Slave devices will be sent to a random value of these registers, uncontrolled by the user,

6.16. NETWORK AND REMOTE DISPLAY SETTINGS



Network settings allows the user to configure the network settings by downloading and visualizing the data from the device through the Ethernet connection. **Remote display** settings allow the user to configure the MGU and to display any data with an external PC.

Parameters of the **Network settings** menu should be:

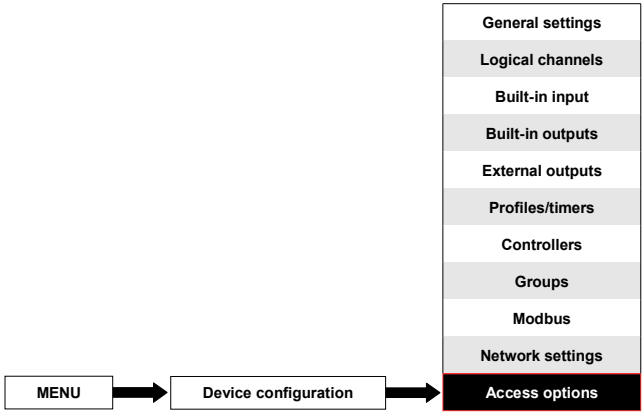
- **DHCP** (Dynamic Host Configuration Protocol) - allows a device to be configured automatically, eliminating the need for intervention by a network administrator,
  - **disabled** - **DHCP** is disabled, the user needs to manual enter an **IP address** and **Subnet mask** in the following fields, and a **Default gateway** address if required.
  - **enabled** - the network settings are automatically generated by the DHCP server, after setting the DHCP, it takes several seconds before the IP address is obtained from the DHCP server, if user set this option other parameters in this menu is invisible,
- **IP address** - this parameter is visible only for **DHCP=disabled**, the user may enter a static IP address,
- **Subnet mask** - this parameter is visible only for **DHCP=disabled**, sets a range of IP addresses that can be accessed,
- **Default gateway** - this parameter is visible only for **DHCP=disabled**, and allows the user to enter a gateway IP address for use when the device is to communicate outside the local network.

– **Remote display** parameter block - this parameters let the user configure the MGU with an external PC to display the screen of MGU on the PC monitor, parameters of this block are:
  - **IP address** - IP address of external PC,
  - **Screen number** – can bet set from 0-9 in the MGU allowing the PC to display up to 10 devices' screens,

For **DHCP=disabled** the parameters **IP address** i **Subnet mask** must be configured correctly, depending on the local network settings which will work with the device. User should contact with network administrator in case of errors in communication.

The actual network settings are visible in the **Device Information** menu (see **Chapter 6.4**).

6.17. ACCESS OPTIONS



To prevent accidental or unauthorized change the settings in the **Device configuration** menu and **File management**, the user can set in the **Access options** menu the access password. If the user has enabled the access options then before going to the next menu level will be asked for password.

If user want to activate the access password they need to press the button next to **Access password** label and enter any password. In place of the text will be displayed asterisk **'*'**. After accepting this password in place of the entered password will be 8 asterisks regardless of password length.

If user wants to inactivate the access password then the user needs to press the button next to **Access password** label and delete password. After accepting this the text editor will place an empty field in place of the **Access password** label.

7. Technical data

Technical specification – unit		
Power supply voltage (depending on version)*		230 V AC or 24 V AC/DC
Power consumption		typically 15 VA
External Fuse (required)		max. 2 A (T – type)
LCD display		colour TFT 3.5" with LED backlight
Display resolution		320 x 240 pixel
Sensor power supply output*		24 V DC (max. 0,2 A)
Basic communication interfaces*		RS–485 (Modbus RTU), USB
Digital input*		0 ... 24 V DC, galvanic insulation
Optional communication module*		USB; RS–485; RS–485/232; Ethernet
Optional input modules*	IUI4 IUI8 II16 ID8	4 Current + 4 Voltage 8 Current + 8 Voltage 16 Current 8 Digital (binary)
Optional output modules*	OR8 OI2	8 Relay (1 A / 250 V) 2 Passive current output (4 ... 20 mA)
Protection class		IP 40 (front) IP 20 (housing and terminal)
Housing material		NORYL – GFN2S E1
Housing dimensions		96 x 96 x 100 mm
Mounting hole		90.5 x 90.5 mm
Panel thickness		max. 5 mm
Ambient temperature range		0 ... +50 °C
Storage temperature		-10 ... +70 °C
Humidity		5 ... 90% no condensation
Altitude		max. 2000 m.n.m.
Max. conductor size		2.5 mm^2
Weight		340 g (only base)

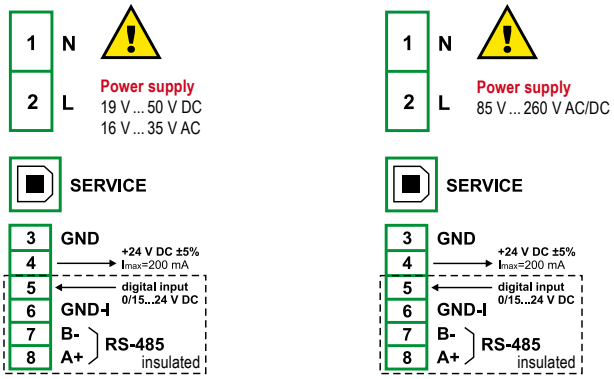
*) See the full specification in the appendix

8. Appendix – Input and Output modules descriptions

8.1. Power supply module

The power supply module is a component of MGU–800 which is present in all variants. It includes power supply that supplies the main parts of the MGU–800 and expansion modules. It provides also the basic data communication of the MGU–800 (RS–485 and USB port on front panel).

Technical specification – Power supply modules			
		provedení 24 V	**provedení 230V**
Power supply voltage		19 ... 50 V DC 16 ... 35 V AC	85 ... 260 V AC/DC 50 ... 60 Hz
USB		Servis port (Type B), Front panel (Type A)	
Sensor power supply output		24 V DC ± 5 % (0.2 A)	
Permissible Long time overload		20 %	
Digital input	Parameters Power consumption Insulation	0 ... 24 V DC, with galvanic insulated 7.5 mA / 24 V 1 Min (500 V DC)	
Input signals voltage levels	Logical low state Logical high state	U_{IN} < 5 V U_{IN} > 8 V (Max. 24 V)	
Interface		RS–485 (Modbus RTU); 1200 ... 115200 b/s	
Weight		65 g	



All connections must be made while power supply is disconnected !

8.2. Current and Voltage measurement modules IUI4, IUI8, II16

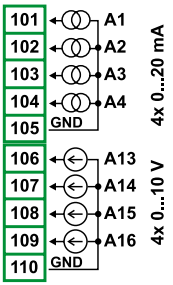
Inputs are gathered into groups to make connections easier. All ground terminals of a particular module are common, but separated from power supply and other modules. If it is necessary to measure Voltages with different ground potentials, several UI modules have to be installed into MGU-800 unit.

Technical specification – Current and Voltage modules

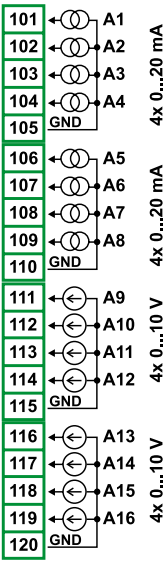
		IUI4	IUI8	II16
Number of inputs		4 Voltage 4 Current	8 Voltage 8 Current	16 Current
Hardware measurement ranges	Voltage input Current input	-2 V ... 13 V -2 mA... 30 mA	-2 V ... 13 V -2 mA... 30 mA	– -2 mA... 30 mA
Hardware resolution	Voltage input Current input	1 mV 1 µA	1 mV 1 µA	– 1 µA
Precision		0.25 %	0.25 %	0.25 %
Permissible Long time overload		20 %	20 %	20 %
Software measurement ranges		0 ... 5 V 1 ... 5 V 0 ... 10 V 2 ... 10 V 0 ... 20 mA 4 ... 20 mA	0 ... 5 V 1 ... 5 V 0 ... 10 V 2 ... 10 V 0 ... 20 mA 4 ... 20 mA	0 ... 20 mA 4 ... 20 mA
Internal impedance	Voltage input Current input	100 kΩ typ. 100 kΩ	100 kΩ typ. 100 kΩ	– typ. 100 kΩ
Protection	Voltage input Current input	No 50 mA *	No 50 mA *	– 50 mA *
Weight		32 g	32 g	42 g

*) Auto-reset fuse

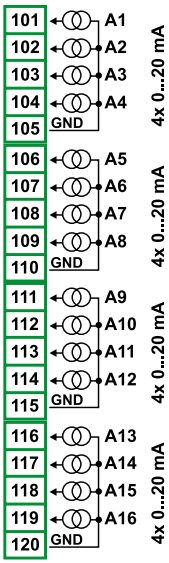
IUI4



IUI8



II16

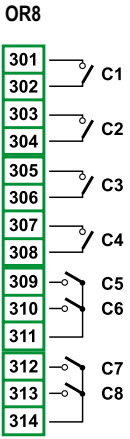


8.3. Relay modules OR8

OR8 is the output module with 8-relay switching contacts. The outputs are divided into two groups of 4, the first group has individual contacts electrically isolated, the second group is divided into pairs and each pair has a common contact (see block diagram).

Technical specifications – relay modules	
	OR8
Number of relays	8x SPST NO
Maximum load per relay	1 A, cos φ = 1 (resistive load)
Voltage switched by relay	Max. 250 V AC
Insulation strength*	≥ 1000 V AC (60 s)
Weight	74 g

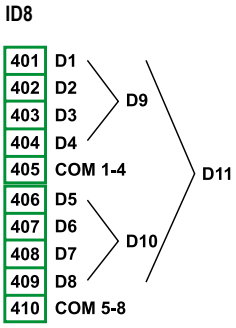
*) Relay to relay, relay to MGU–800 supply

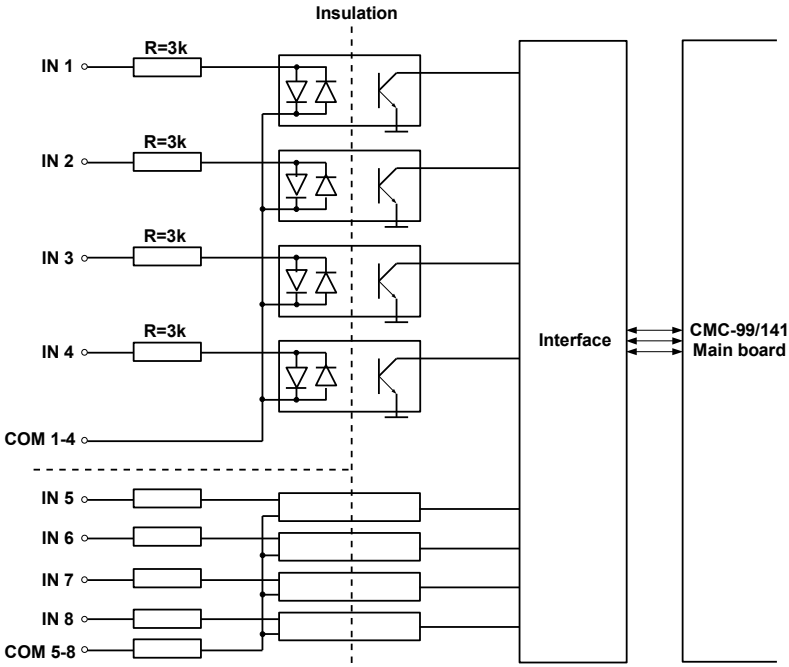


8.4. Optoisolated digital inputs module ID8

ID8 is module with 8 digital inputs respectively. Inputs are divided into groups of four input every. Every group has own common terminal, and is optically isolated from others groups and MGU–800 GND signal as well.

Technical specifications – Digital inputs module		
		ID8
Number of inputs		8 (2 groups 4 inputs every, optoisol. from others signals)
Input signals voltage levels	Logical low state Logical high state	U_{IN} < 1 V U_{IN} > 4 V
Maximum input voltage		30 V
		20 %
Input current consumption		approx. 15 mA (24 V) approx. 5 mA (10 V) approx. 2 mA (5 V)
Insulation strength		500 V
Input signals representation		8 single bits **D1 – D8** 2 nibbles **D9 – D10** 1 byte **D11**
Weight		40 g



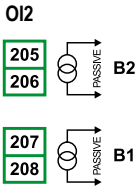


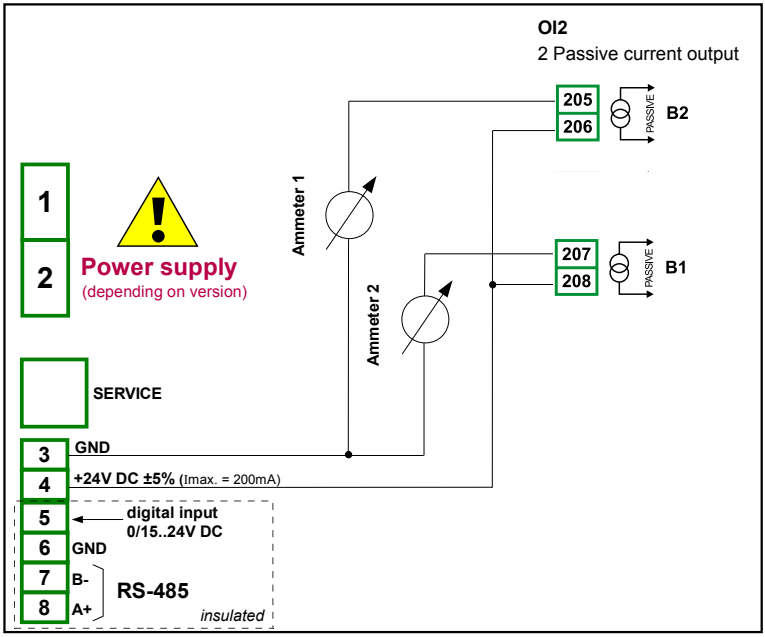
Internal structure of the optoisolated digital input module

8.5. Passive current output module OI2

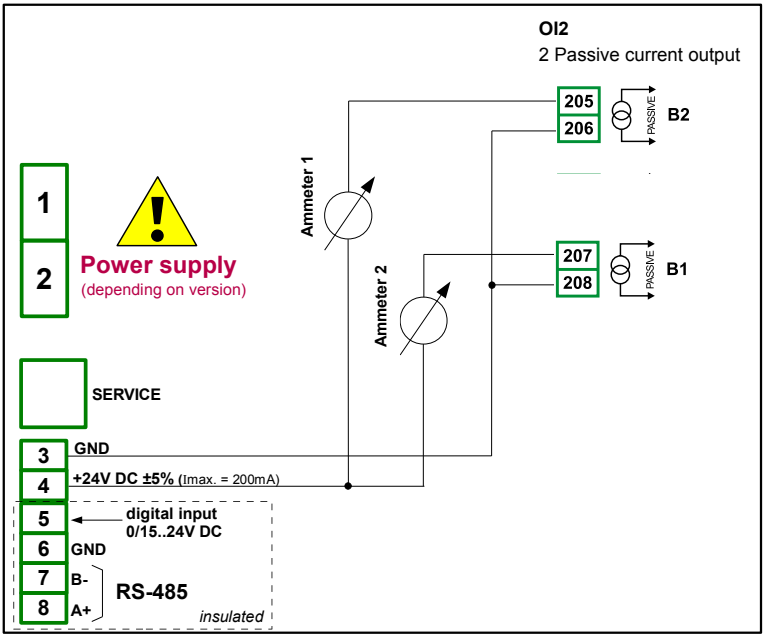
OI2 is a module with two passive current outputs (4 ... 20 mA). These outputs require an external power supply through the loop. For its supplying can be used internal power source. The polarity of power can be arbitrary.

Technical specifications – Passive current output	
	OI2
Number of inputs	2
Output type	Passive current output 4…20 mA
Hardware output limitation	3…22 mA
Output voltage dropout	Max. 9 V
Overload protection	Internal resettable fuse 50 mA
Loop supply range	9…30 V
Output current precision	0.1 % (25°C), 50 ppm/°C
Resolution	12 bit
Weight	23 g





Connections for the Passive current output from Power supply side



Connections for the Passive current output from GND side

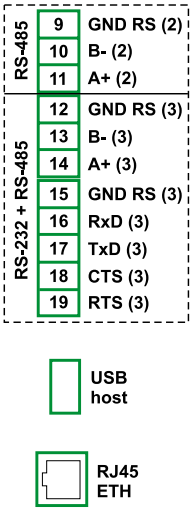
8.6. Communications module

MGU–800 unit is equipped with basic communication module, which is located together with the power module. It includes RS–485 ports, USB port (front panel) and USB service port (on the rear panel). Additionally, the unit can be equipped with communication expansion module with 2 ports RS–485, 1x RS–232, USB (back panel) and Ethernet. A variant with the basic module only is marked with number **1**; with the basic and extension module is marked by **2**.

Technical specification – Communications module

		Version 1	Version 2
Input / output type		1x RS–485 1x USB (front)	3x RS–485 1x RS–232 1x USB (front) 1x USB (back) 1x Ethernet (RJ45)
Hardware output limitation		Max. 100 mA (USB)	Max. 100 mA (USB)
Baudrate	USB host	12 Mb/s	12 Mb/s
	RS–485 (RS–232)	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 b/s	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 b/s
	Ethernet	–	10 Mb/s
Data format RS–232/485		8N1, 8N2, 8E1, 8E2, 8O1, 8O2	8N1, 8N2, 8E1, 8E2, 8O1, 8O2
Weight		–	48 g

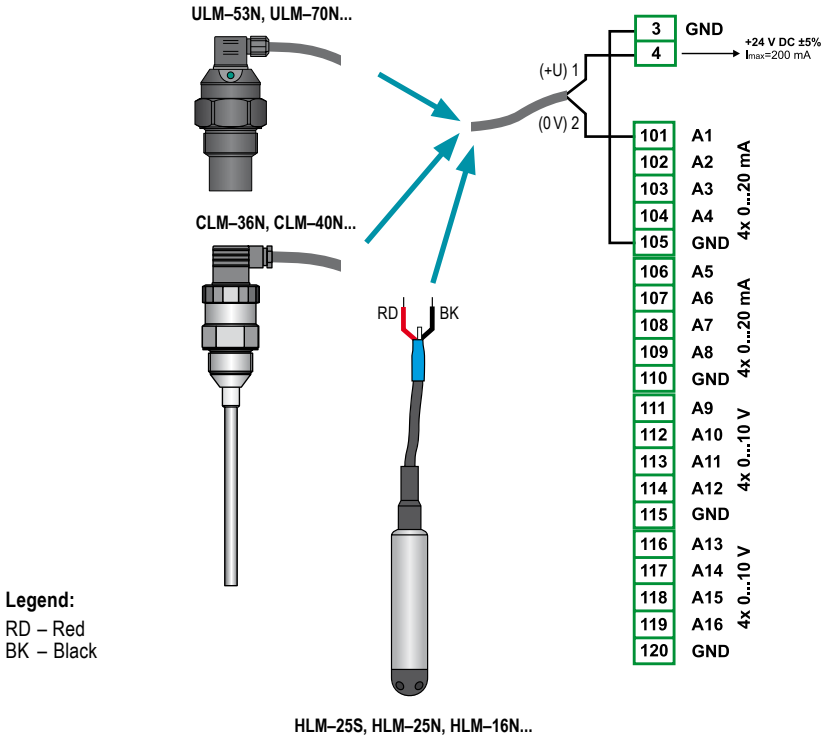
Communication module



9. Examples of electrical connections

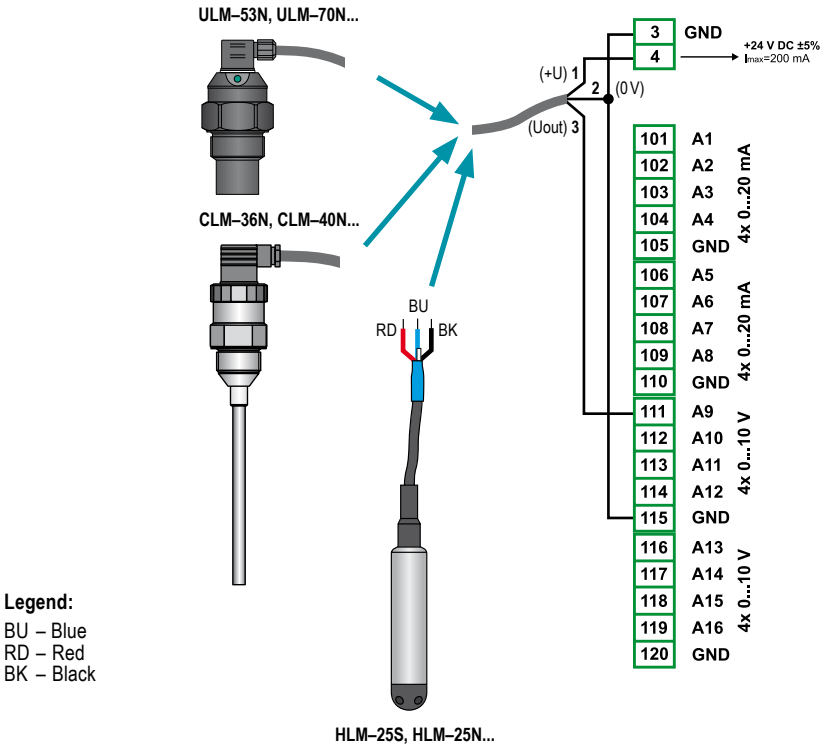
Here are some examples of the connection unit MGU–800 with Dinel level sensors (CLM, ULM, HLM). The examples are with the **IUI8** module. Similar connection is applied to modules **IU4** and **II16**.

9.1. Examples of the connection Dinel level meters with current outputs



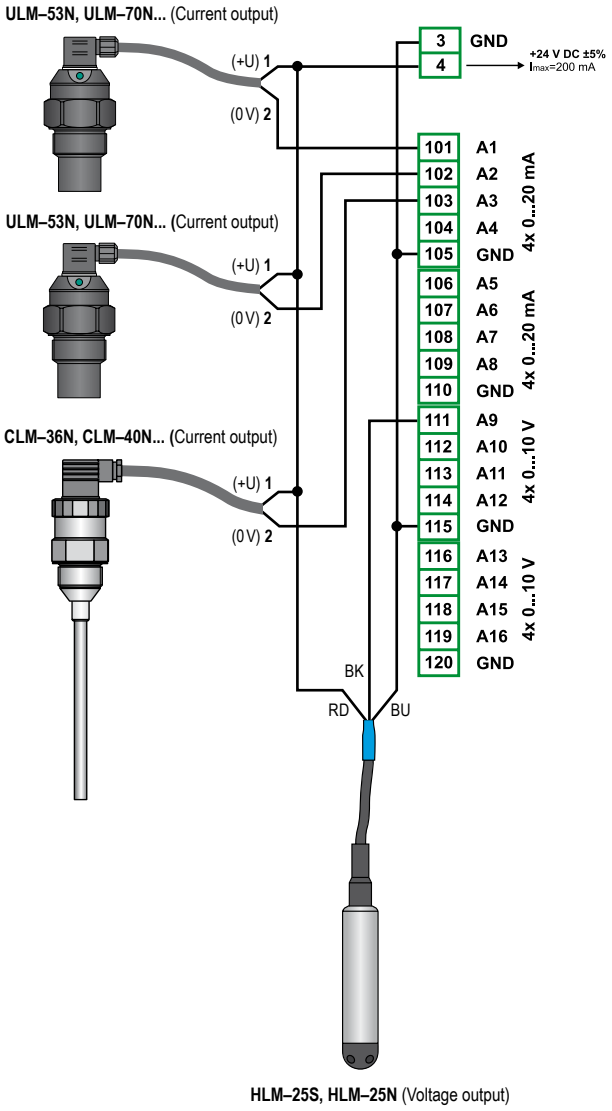
The individual connector pins (of dismountable connector) which is a standard accessory to level sensors ULM-53, CLM-36 are numbered (1 and 2). Hydrostatic level meter HLM has color-coded wires: RD = 1, BK = 2.
The unit MGU–800 can be connected in the same way with other types of level sensors (level meters, gauges). Specific connections are always given in instruction manuals of the product.

9.2. Examples of the connection Dinel level meters with voltage outputs



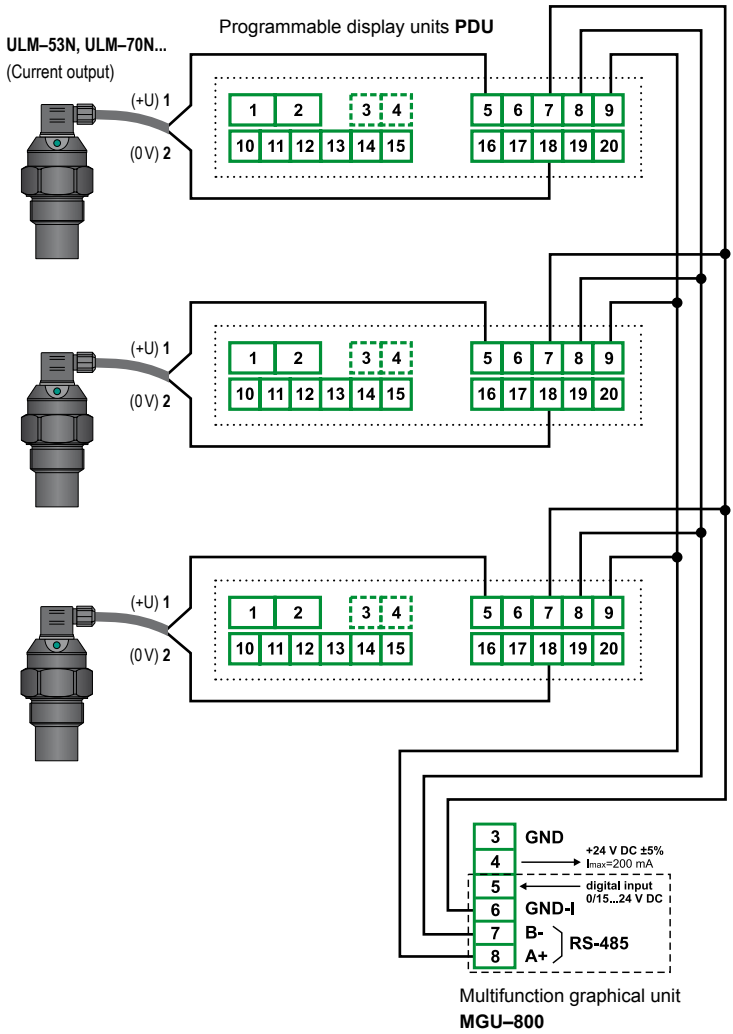
To terminals A4 ... A16 can be connected in the same way next level sensors (gauges). In the configuration with the module IUI8 it can be 8 pieces of level sensors with the current output and 8 pieces with voltage output.

9.3. Examples of the connection Dinel level meters with various outputs

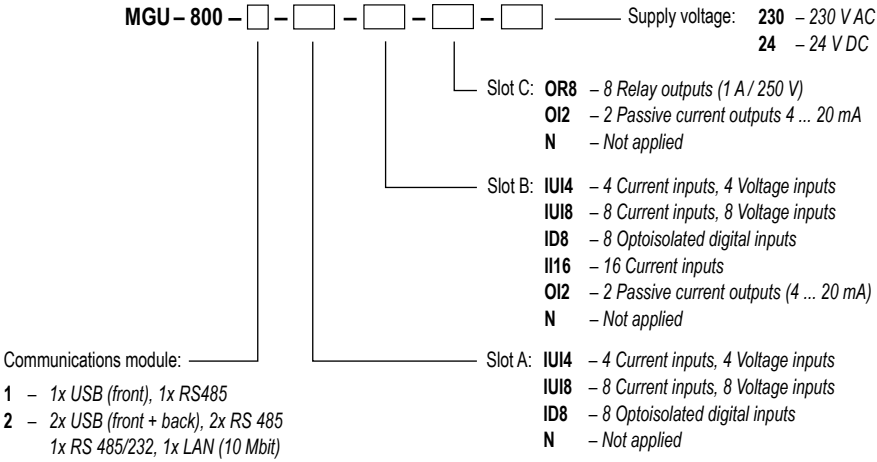


Legend:
RD – Red
BU – Blue
BK – Black

9.4. Examples of the connection Dinel display units PDU–4xx with Modbus



10. Order code



11. Accessories

Standard – included in the unit price

- 1pc of Touch pen
- 2pcs of Assembly brackets
- 1pc of USB Protective cover

12. Safety, protection and compatibility

Connection to supply voltages must be done through fuse or circuit breaker (2 A). Electrical equipment of protection group II. Electrical safety according to EN 61010-1.

Electromagnetic compatibility is provided by conformity with standards EN 61326-1.

Insulation resistance >20MΩ, insulation strength between power supply and input/output terminal: 2300 V (1 min).

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