MPI-C
MPI-CN
MPI-CL
version 1.29

MPI-C, MPI-CL, MPI-CN
Multi-channel
electronic recorder

USER'S MANUAL

Version: 180601EN

This User's Manual is available also in digital version on CD-ROM.

metronic

Before installation, carefully read all the instructions, especially those concerned with safety.

The recorder has been manufactured according to the requirements of relevant EU directives.

These instructions must be stored in a safe place near the installation of the steam flow computer at all times.

Information from the Manufacturer

All functions of the recorder are subject to modifications for the benefit of technical progress.

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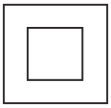
Sections marked with are available only in the CD-ROM version of this Manual attached to the recorder.

1. MARKING AND DOCUMENTATION



Equipment protected throughout by double insulation or reinforced insulation.

Functional earth (ground) terminal, to enable the product to function correctly. Not used to provide electrical safety.

Caution, risk of electric shock.

Caution, risk of danger, refer to accompanying documentation.

Caution, Electrostatic Discharge (ESD) sensitive circuit. Do not touch or handle without proper electrostatic discharge precautions.

Important comments and information.

2. SAFETY INFORMATION

Safe operation of this product can only be guaranteed if it is properly installed, commissioned, used and maintained by qualified personnel in compliance with the operating instructions. General installation and safety instructions for pipeline and plant construction, as well as the proper use of tools and safety equipment must also be complied with.

Warning

This product is designed and constructed to withstand the forces encountered during normal use. Use of the product other than as a steam flow computer, or failure to install the product in accordance with these Instructions, product modifications or repair could:

- Cause damage to the product / property.
- Cause injury or fatality to personnel.
- Invalidate the CE marking.
- Void your warranty.

Isolate the mains supply before opening the product as hazardous voltages may be exposed.

Warning

This product complies with the requirements of the following directives and harmonized standards:

Electromagnetic Compatibility (2014 / 30 / UE) by meeting the standards of:

- For EMC immunity for industrial environments according to EN 61326-1:2013 Table 2.
- For EMC conductive and radiated emissions Group1 Class A equipment according to EN 55011:2009+A1:2010.

LVD Directive 2014/35/EC (for MPI-CN, MPI-CL) to the following standards and specyfications:

- Overvoltage category II, pollution degree 2 equipment according to EN 61010-1_2010.

RoHS Directive 2011/65/EU.

- The product or its wiring is located near a radio transmitter.
- Excessive electrical noise occurs on the mains supply. Power line protectors (ac) should be installed if mains supply noise is likely. Protectors can combine filtering, suppression, surge and spike arrestors.
- Cellular telephones and mobile radios may cause interference if used within approximately 1 metre (39") of the product or its wiring. The actual separation distance necessary will vary according to the surroundings of the installation and the power of the transmitter.

Intended use

- Check that the product is suitable for use with the application.
- Determine the correct installation situation.

- Prior to installation Metronic AKP products should take into account any environmental limitations of devices, specified in the manual.

Access

Ensure safe access and if necessary a safe working platform (suitably guarded) before attempting to work on the product.

Lighting

Ensure adequate lighting, particularly where detailed or intricate work is required.

Hazardous environment around the product

Consider: explosion risk areas, lack of oxygen (e.g. tanks, pits), dangerous gases, extremes of temperature, hot surfaces, fire hazard (e.g. during welding), excessive noise, moving machinery.

The system

Consider the effect on the complete system of the work proposed. Will any proposed action put any other part of the system or any personnel at risk?

Dangers might include isolation of vents or protective devices or the rendering ineffective of controls or alarms.

Tools and consumables

Before starting work ensure that you have suitable tools and / or consumables available.

Protective clothing

Consider whether you and / or others in the vicinity require any protective clothing to protect against the hazards of, for example, chemicals, high / low temperature, radiation, noise, falling objects, and dangers to eyes and face.

Permits to work

All work must be carried out or be supervised by a suitably competent person. Installation and operating personnel should be trained in the correct use of the product according to the Installation and Maintenance Instructions. Where a formal 'permit to work' system is in force it must be complied with. Where there is no such system, it is recommended that a responsible person should know what work is going on and, where necessary, arrange to have an assistant whose primary responsibility is safety.

Post 'warning notices' if necessary.

Storage

If an energy monitor is to be stored for a period prior to installation, the environmental storage conditions should be at a temperature between -30°C and 70°C (-22°F and 158°F), and between 5% and 95% relative humidity (non-condensing).

Before installing and connecting the power ensure there is no condensation within the unit.

Cleaning and maintenance

Metronic AKP products require no maintenance beyond periodic battery replacement. Expected battery life is 10 years after the expiry of which must be returned to the manufacturer for a replacement.

From time to time you should clean the casing with a dry, soft cloth. When cleaning machine, do not use solvents or abrasives. They may cause discoloration or scratch the surfaces of device.

Disposal

The MPI-C / MPI-CN / MPI-CL contains a battery. On disposal of the unit or component, appropriate precautions should be taken in accordance with Local / National regulations.

Unless otherwise stated in the Installation and Maintenance Instructions, with the exception of the battery, this product is recyclable and no ecological hazard is anticipated with its disposal providing due care is taken.

Returning products

Customers and stockists are reminded that under EC Health, Safety and Environment Law, when returning products to Spirax Sarco they must provide information on any hazards and the precautions to be taken due to contamination residues or mechanical damage which may present a health, safety or environmental risk. This information must be provided in writing including Health and Safety data sheets relating to any substances identified as hazardous or potentially hazardous.

Prior to shipment, each product Metronic AKP is tested, calibrated and inspected to ensure proper operation.

Warning

Each carton should be inspected at the time of delivery for possible external damage. Any visible damage should be recorded immediately on the carrier's copy of the delivery slip. Each carton should be unpacked carefully and its contents checked for damage.

If it is found that some items have been damaged or are missing, notify Metronic AKP immediately and provide full details. In addition, damage must be reported to the carrier with a request for their on-site inspection of the damaged item and its shipping carton.

3. INTENDED USE OF THE DEVICE

3.1. Intended use

MPI-C / MPI-CL / MPI-CN are versions of a multi-channel microprocessor-based measuring device with electronically recorded measurement results. The recorder is intended to measure process signals in industrial settings, temperature values and other physical quantities processed into a standard current signal 0/4-20mA, and in particular, humidity, pressure, flow, level and chemical composition, etc. With the special structure of the processing route applied, this recorder is perfectly suited for slow variable runs with changes taking place at a few seconds intervals. With results recording function and the high number of measuring channels, this instrument is appropriate for use in monitoring parameters in warehouse settings, process lines where multipoint measurements are necessary, especially in the glass making industry, food processing, refineries, as well as chemical and pharmaceutical industries. The volume of data saved as well as process display and browse functions makes the device suitable for use as a paper-less electronic recorder.

The recorder is available in two versions, depending on its intended application:

- basic version includes 8 analog channels, 2 binary (two-state) inputs and 16 calculation channels (math channels),
- full version includes 16 analog channels, 4 binary (two-state) inputs and 16 calculation channels (math channels).

Three types of housings are available – for mounting in panels (MPI-C), portable version (MPI-CL) and wall-mounted (MPI-CN). All versions provide the same metrological functions and similar functions related to the intended use. MPI-CL and MPI-CN versions can be powered from a 230V AC mains supply.

Devices are available in four language versions:

- Polish,
- English,
- French,
- German.

Language change is available from the device keyboard.

! Only small differences exist between the versions MPI-C, MPI-CL and MPI-CN, and this Manual describes the MPI-C version only. The differences between MPI-CL and MPI-CN are listed in Section 13 and 14.

3.2. Basic functions

- **Analog inputs**

The instrument has 8 or 16 analog measurement inputs. Resistance temperature sensors (Pt-100, Pt-200, Pt-500, Pt-1000, Ni-100), thermocouples (J, L, K, T, U, E, N, B, R, S,), and other transducers with a standard current output 0/4-20 mA and lineal voltage of -0,8 V…+0,8 V or resistant voltage within the range of 0…5 kΩ can be directly connected to the recorder inputs. Standard signal values can be assigned an appropriate range of processed values in physical units (pressure, flow, humidity, level, etc.)

- **PULS-type inputs**

Four (or two in the eight-channel version) independent PULS-type inputs can operate in the binary input mode, in the frequency measurement or pulse counting mode.

Binary inputs can trace binary signals: shorting / disconnection. Each of the two binary conditions can have any analog value assigned (e.g. -1.00 / +10.0). The value corresponding to a specific binary condition can be used in simple controlling operations or as a value in calculation channels (flow direction, etc.).

PULS-type inputs can be used to measure frequency within the range of 0.001 Hz - 10 kHz. Within the programmed frequency range, the measured value can be translated into engineering units (e.g. flow).

The pulse counting mode should be selected if a transducer with constant pulse weight is connected to the binary input.

Inputs can cooperate with binary pulse transmitter (contact, transistor in OC configuration), the source of voltage or current pulses and in the NAMUR standard.

- **Calculated values**

Based on the measurement results, intermediate values can be calculated and defined with user-specified formulas. The recorder handles addition, subtraction, multiplication, division and extraction of roots, as well as multiplication or addition of a fixed value. You can add channel values (e.g. to define the total value of several flows), calculate arithmetic or geometric mean (e.g. average temperature), compare two values (e.g. percentage share of either of two compared flows), difference (e.g. pressure difference between two independent pressure sensors). There are 16 calculation channels available that offer the same functions as analog channels and can support alarm, control and recording functions.

- **Totalisers**

Each measurement input (incl. binary inputs) and each calculated value have two independent totalisers assigned. Totalisers can measure slow variable flows, etc. Totalisers for pulse inputs can provide precise pulse aggregation.

- **Results recording**

Measurement and calculation results as well as totaliser readings can be recorded in the recorder’s internal memory with the capacity of 2 GB. Data are saved as text files protected with encoded checksum. Apart from the measured values, the recorder also saves events (power loss, resetting, exceeded threshold values, etc.) and authorized operations. Internal memory can save up to 250 files.

- **Results displaying**

Measurement results can be displayed on the recorder screen or moved to a PC. There is a backlit TFT LCD display and three two-color LEDs on the face plate. Depending on the configuration, the measurement and calculation results are displayed as large digits, analog information or graphs. The results can be also displayed collectively as tables or bar charts. Measurement screens can be browsed sequentially or set to a selected channel.

- **Functional buttons**

MPI-C has seven functional buttons. Buttons can have different functions, depending on the currently displayed information. The button functions include, in particular, results

display, recording control and recorder settings. MPI-CL and MPI-CN are fitted with an extended keyboard featuring 19 buttons.

The key functions can be protected with a password and user name.

- **Alarm and control inputs**

Exceeded threshold signaling and simple binary control can be performed by means of eight semiconducting output relays as well as alarm / control thresholds. The relay can be set to any configuration and can have threshold exceedances assigned for specific measurement and calculation channels.

- **Communication with a computer system**

The recorder can be connected to a master computer system by means of:

  - RS-485 serial port; ASCII protocol and Modbus RTU,
  - Ethernet port; Modbus TCP protocol and www server.

- **Supplementary software (optional)**

Additional MPI-C-Raport software facilitates the recorded results overview and handles basic mathematic processing and data selection.

4. OPERATING FUNCTIONS

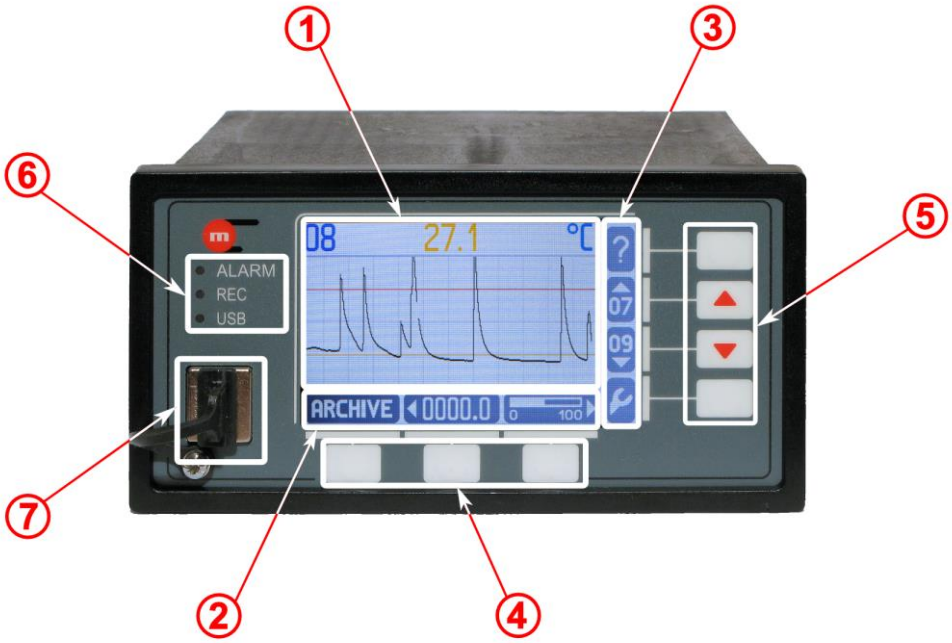


Fig. 4.1 Face plate

4.1. Display layout

The display with buttons is the key element in machine-man communication and offers the following functions:

- displaying measurement results,
- displaying messages,
- displaying recording control menu and functions,
- displaying recorder programming menu and functions,
- displaying icons for functional buttons (keyboard).

The display can be divided into three areas:
1) results display area ①,
2) icons of lower functional buttons ②,
3) icons of four side functional buttons ③.

Icons of measuring channels:

channel 01

channel 03

Other channels as above.

Additional screen icons:

„Main archive”

„Data and time”

„Relay outputs”

„Threshholds”

„Bar chart”

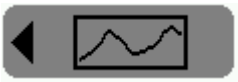
„Table”

Summary screen icons:

„Table” defined by user

Measurement screen icons:

“Large digits” – digital display with large digits



“Trend graph” – graphical display of data

“Bar graph” – display with an analog line

„Min, max” – minimum / maximum / average values in a table

„Min, max” – minimum / maximum / average values in an analog line

Other icons:

Settings – return to the MAIN MENU and settings

Full screen display (archive browsing)

Help – help function call and additional information

Recorder name, firmware version, serial number and recorder description (can be edited by user)

„Exit” – exit to the previous menu or abandoning an operation

„Enter” – go to the next menu

, 

„OK” – confirm a message or accept an operation

4.2. Functional buttons

There are 7 (MPI-C) or 19 functional buttons (MPI-CL, MPI-CN) on the face plate. The buttons can have different functions, depending on the information displayed and operating capacities of the recorder. In order to provide user-friendly operation, icons are shown for active buttons that indicate currently available functions.

4.3. Signaling LEDs

The front panel features three LEDs ⑥:

- ALARM – blinking or continuously lit red LED indicates alarm conditions and is accompanied by a message indicating the cause of the alarm; green LED indicates that the user is logged-in and is reminded to log-out after authorized operations are completed,
- REC – indicating the status of the internal memory. Green continuously lit LED indicates data recording in internal memory, green blinking LED indicates that a file is closed / opened, red continuously lit LED indicates an error of the recording function.
- USB – Yellow LED is lit when an external USB memory controller is ON, green and yellow blinking LED means that data are recorded or read, red continuously lit LED signals an error (e.g. absence of USB flash drive when the recorder attempts to save / read data).

4.4. USB port

The USB port socket is located on the face panel and is intended for connecting an external mass storage device (USB flash drive) are plugged to upload or copy data from the internal memory to a PC. The data are moved as files. The socket protection class is IP54 (dust and water protection), and is also fitted with a special plug to prevent dust and water from entering the USB socket.

! MPI-C cannot support advanced directory and subdirectory structure that can be saved on an USB flash drive. It is recommended to use a suitable USB mass storage device (USB flash drive) that can be supported by the recorder.

Fig. 4.2 USB port

! If the mass storage device is disconnected from the USB port when the USB LED is lit (yellow and green-red), all data saved on the mass storage device can be lost.

4.4.1. Data upload to USB flash drive

In order to copy files to a USB mass storage device, go to → **Main menu** → **Copy files.** Select **Current archives** to copy the current archive file, totaliser archive file and log files. Select **Choose file** to be able to select files from a list. When the files are being copied, the USB mass storage device must be plugged into the USB socket. The 'copy' function can be password-protected and available to authorized users only.

Files can be also moved or deleted. Note that specific files are accessible to SERVICE users only.

To read data, plug the USB flash drive into USB port on a PC. The mass storage device will be displayed as an additional computer disc, and the data will be saved as text files.

Fig. 4.3 Mass storage device (USB flash drive)

4.5. RS-485 Port

The device features RS-485 Port to connect the recorder to a master computer (PC, PLC). ASCII and Modbus RTU protocols are available. The following data can be remotely accessed via RS-485 port:

- current results (ASCII and Modbus RTU),
- current results recorded in the archive (the most recent file only, ASCII and Modbus RTU),
- 500 recently recorded events (ASCII only),
- 500 recently recorded authorized operations (ASCII only),
- totaliser files, event log and authorized operations log (ASCII only),
- status and information about the current results recorded in the archive (ASCII and Modbus RTU),
- recording control (start, stop etc., ASCII only).

Connecting GSM module to RS485(2) port enables to transfer as a text messages (SMS) information about selected alarms and failures and measurement values and totalisers.

! The read-outs of measurement data via the RS-485 port have no effect on communication via the Ethernet port and vice versa, the read-outs of data via the Ethernet port have no effect on the communication via the RS-485 port.

4.6. Ethernet port

The device features an Ethernet communication module to connect the recorder to a master computer (PC, PLC) via industrial Ethernet network by means of Modbus TCP protocol. The following data can be remotely accessed via Ethernet port:

- current results,
- current results recorded in the archive (the most recent file only),
- status and information about the current results recorded in the archive.

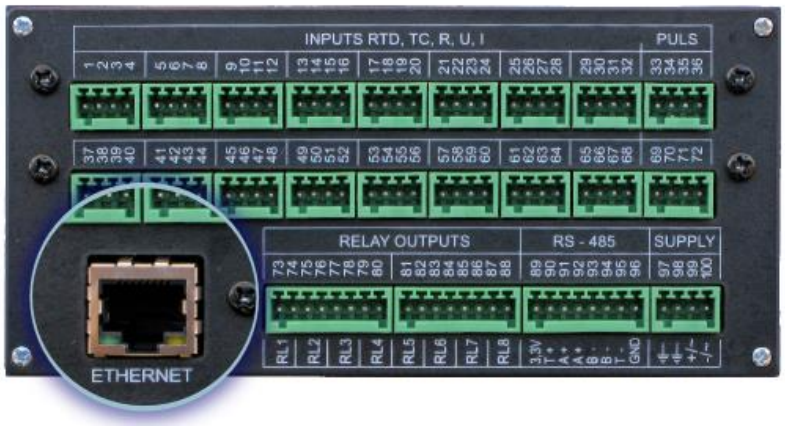


Fig. 4.4 Ethernet Port

With the Ethernet connectivity, the recorder can handle simultaneously up to 4 clients using the Modbus TCP protocol. Thus, it is possible to query the device from 4 different computers or from 4 different systems. Data from measuring channels are available in two formats: Integer and Floating point.

Additionally, a web server is available, accessible from a standard web browser. It is sufficient to enter the IP address (configurable in the **Settings → Ethernet Port** menu) of the recorder in the address bar. In this manner, you can monitor all current measurement inputs (1…20 tags – analog and PULS channels as well as 21…36 – calculation channels) and totalisers (totaliser readings for a specific channel, if configurable, are displayed below the current value), check the status of the analog output and relay outputs as well as visualize the obtained data in a graph representation (TREND tag).

You can specify the refresh time of the graph (delays in refreshing result from delays in web communication and can vary from fractions of a second up to several seconds, depending on the network.) Select *Settings* to define channels to be displayed on the graph and to change the trend line color.

The web server is available in four languages: English, German, French and Polish.

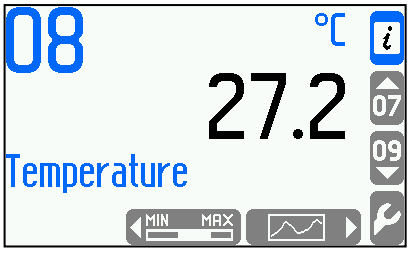
! The site was tested in Explorer 8, Opera, Mozilla Firefox, Chrome and Safari browsers.

4.7. Display measurement results, calculation results and additional information

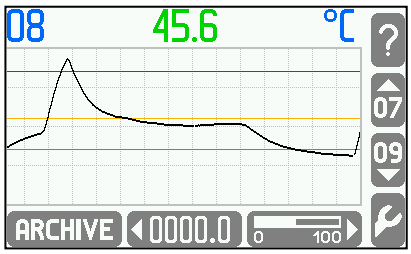
4.7.1. Individual screens

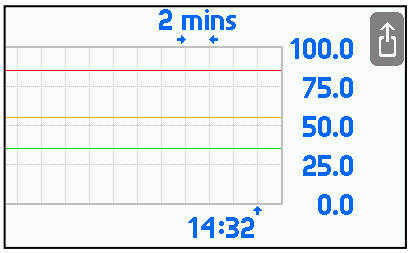
Measurement and calculation results can be displayed in six various forms, as measurement screens.

1. „Large digits” – measuring channel number and results are displayed in large, easy to read digits (approx. 12 mm) along with channel description and unit.



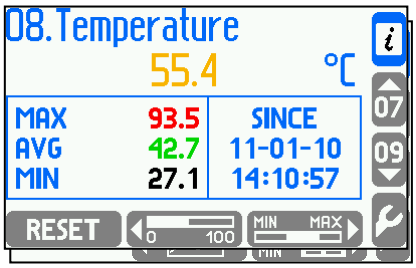
2. „Trend graph” – graphic representation of the measured quantity with results displayed on a time graph (for at least 353 recent measurement points) along with digital read-out of instantaneous value and unit. Alarm / control thresholds are displayed on the graph (if set for the relevant channel), and the instantaneous value is displayed in the assigned color after a specific threshold is exceeded (yellow in the shown example). With ? button, you can monitor the time axis scale and graph value.



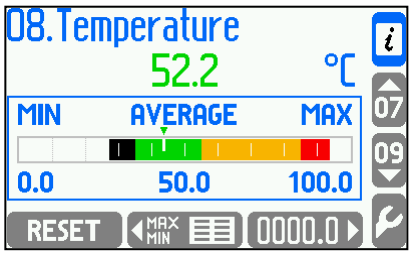


3. „Bar graph” (analog line) – digital result along with a unit and description and an analog line indicating the location of an instantaneous read-out against a pre-defined scale; the analog line also shows the points of alarm/control thresholds (if set).

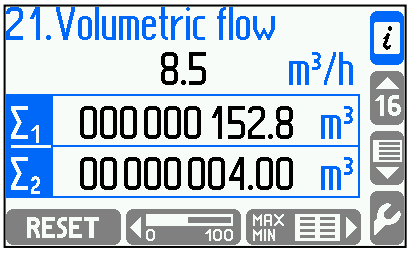
4. „Min, max” (minimum, maximum, average) – digital result along with a unit and description and a table with minimum, maximum and average values saved, and the date and time of the beginning of calculation. Use RESET to reset the values. A password might be required.



5. „Min, max (bar)” – digital result along with a unit and description and an analog line (bar graph) indicating the minimum, maximum and average value against a pre-defined analog scale. Likewise, use RESET to reset the values. This function might be pass-word protected.



6. „Totalisers” – digital result along with a unit and description and the totaliser status. Use RESET to reset one or both totalisers. This function might be password-protected.



! When setting the parameters, you can also select the way the results are displayed and switch off specific measurement screens. It is easier to operate the recorder by limiting the number of superfluous functions.

One of the active screens can be set to a "default screen" displayed when a specific measuring channel is selected. Each channel can have a different number of screens and a different default screen assigned. Measuring channels can be browsed manually or can be displayed in a sequence.

Manual channel selection:
To select a measuring channel, use the middle buttons from the four side buttons (▼,▲). Press and release a button to display the next measuring channel. The available channel number is indicated with the button icon. In the manual mode, all enabled channels are available.

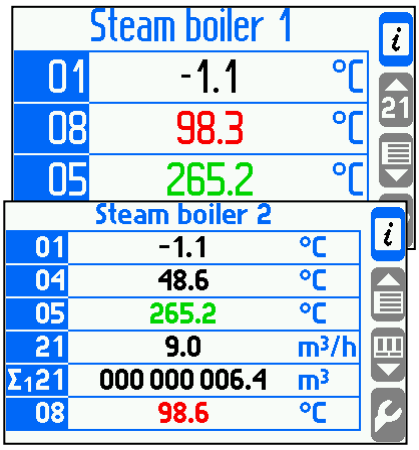
Auto-browsing of channels:
Press and hold the channel selection button (▼,▲) when browsing through measurement screens to switch to automatic display of measurement results from subsequent channels, in an ascending or descending manner, respectively. Only channels set to **Auto-browse → YES** under device settings will be displayed in the automatic mode. You can now browse through a selection of only the most important channels shown in a sequence. The remaining channels are available in the manual mode. To disable the “auto” mode, press and release any button.

Changing measurement screens:
Use the middle and the right button from a group of three buttons at the bottom of the display to change the measurement screen. Only screens defined as **Visible** or **Primary** under device settings are available. You can set different screens for each channel. The next available screen is indicated with the button icon.

4.7.2. Summary screens

Apart from individual screens and special screens, summary screens are also available. You can define up to 3 tables, and each of the tables (depending on the type: uppercase or lowercase) can include 6 or 3 results (measurement results, calculation results, totalisers).

- „Table” – defined by user, featuring three result lines. The table names can be edited by the user.
- „Table” – defined by user, featuring six result lines.



Summary screens are available in the manual and sequence mode. Press to go to the next/previous table.

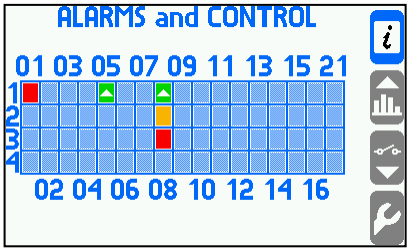
Auto-browsing of summary screens:
Press and hold the channel selection button (▼,▲) when displaying summary screens to go to automatic display of subsequent tables, in an ascending or descending manner, respectively. Only tables set to **Auto-browse → YES** under device settings will be

displayed in the automatic mode. You can now browse through a selection of only the most important tables shown in a sequence. The remaining tables are available in the manual mode. To disable the “auto” mode, press and release any button.

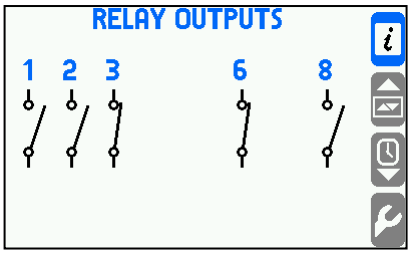
4.7.3. Special screens

Apart from individual screens and summary screens, special screens are also available.

1. „Thresholds” – this screen displays exceeded pre-programmed alarm/control thresholds. Each measuring channel can have up to four thresholds assigned; ▲ or ▼ indicates that the max or min threshold has been exceeded, respectively.

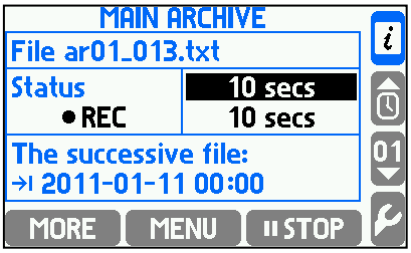


2. „Relay outputs” – this screen illustrates the current status of eight output relays. Relays set to “disabled” (deactivated) mode are not displayed.

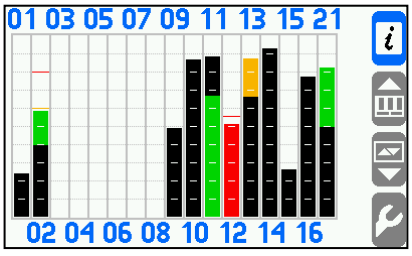


3. „Data and time” – this screen indicates the clock settings. Press CHANGE to introduce new time settings. Clock settings are important when the measurement data are recorded. You might need a password to change the date and time.

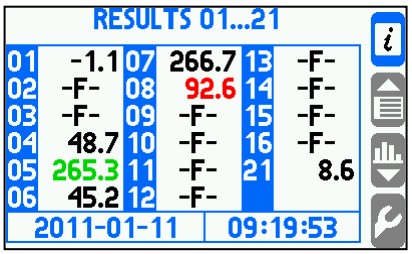
4. „Main archive” – this screen shows the recording status: recording, stop (recording hold-up), current recording speed and memory usage indicator. Press ●REC / ⏸STOP to start/stop recording. Press MENU to go to advanced archive control functions (setting up a new archive, resetting the memory usage indicator). Press MORE to display detailed information about the recording status. You may need a password to control the recording function.



5. „Bar chart” – a summary screen with results arranged into a bar chart.



6. „Table” – a summary screen with results arranged into a table.



„Special screens” can be set as **Visible** or **Invisible** (not shown on the display) under device settings. Additional screens are displayed when results are browsed manually (using ▲, ▼ buttons), following the last measurement screen. The special screens can be disabled in a sequence browsing mode.

4.8. Messages

The MPI-C interface is intended to make device operation as user-friendly as possible. Many states and reactions of the device trigger the display of information messages. These messages need to be confirmed with the OK button. Messages will only disable measurement functions in the event of a critical emergency status.

4.9. Failure symbols

Failures associated with particular channels are marked with appropriate symbol on the display.

Symbols of failure:

- -F- failure of RTD sensor, thermocouple, transducer with voltage or resistive output;
- -||- failure of 4-20mA transducer, loop current below 3.6 mA;
- -E- failure of 0/4-20mA transducer, loop current above 22 mA;
- -R- value out of the range;
- -W- waiting;
- -C- error of internal communication in the device.

Failure symbols are displayed instead of measurement results for all channels concerned.

4.10. Authorized functions, user login and logout

Some functions can be password-protected. Up to 25 users can be defined, and each user will be assigned a unique password. ADMIN is the user who can operate all functions (apart from servicing). Depending on the intended use of the recorder, each user can have individual password-protected operations assigned. Specific operations can be also accessible to all logged-in users.

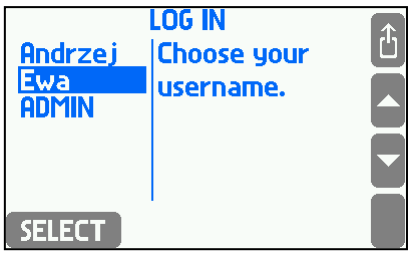
Password-protected functions can be accessed as follows:

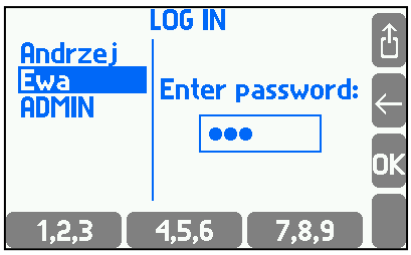
- Each time the function is selected, the user needs to enter the login and password.
- When the login and password are entered, a green ALARM LED is lit. The user is then authorized to use all password-protected functions (if authorized to do so) without the need to enter the password before each single operation. Remember to log out when you are finished. Otherwise you will be automatically logged out after 30 s, 1, 2, 3, 5 or 10 minutes (idle time).

User login:

Press (Settings) in the **Main menu** to select **Log in** and then chose the user from the list. Press SELECT and enter the password. The password can be composed of 3 to 6 digits (excl. 0). Use the lower buttons to enter the password, press each button twice. For

example, to enter 4, first press the group of three digits 4,5,6, and then press 4. To log out, select **Log out** function in the **Main menu**.





Administrator is the only user authorized to define protection functions and to enter new and delete existing users. Administrator can also change the password of any user without the user's prior consent. Each standard user will be only authorized to change his/her own password.

Password-protected functions (when pre-programmed):

- Recording control functions (stopping and restarting the recording of measurement results).
- Deleting, copying and transferring files (except for log files that can be only deleted/removed by SERVICE users).
- Resetting min and max values (minimum, maximum and average value settings).
- Clock settings.
- Totaliser resetting.
- Basic settings (all recorder settings except for those listed below).
- Threshold settings (alarm/control thresholds).
- Display settings (display settings of results).
- Archive settings (recording settings).

Functions available to the Administrator only (password-protected):

- Logs (browsing).
- Administrator menu (protected operations, defining users and passwords, changing user passwords).
- Changing administrator password.
- New firmware (new firmware installation).

Functions reserved for SERVICE users (ADMINISTRATOR with servicing authorizations):

- Calibration of measurements inputs.
- Deletion/transfer of Event Log files and Authorized Operations Log files.

! Administrator password (ADMINISTRATOR user) of a new recorder: **1.** The administrator password is composed of a single digit only to facilitate the first recorder programming. The administrator should change the first administrator password immediately after the recorder programming is finished.
Service password: To get the service password, you should contact the manufacturer. Generate the same numerical code as when the administrator password is lost.

4.10.1. Change user password

Each user can change his/her user password. To change your password, log in and select **Change password** in the **Main menu** and enter a new password.

Instructions on how to change administrator password are provided below.

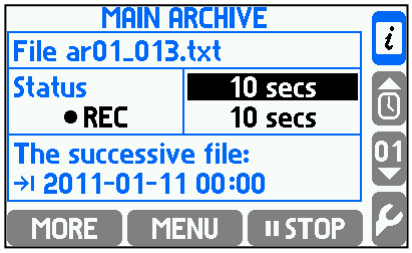
! The administrator can change each user password even if you have forgot the password.

■ If the administrator password is forgotten, it is necessary to contract the manufacturer. You will then be asked to provide a numerical code. To generate the code, enter any password and select NEW. A new password will be assigned on the basis of this numerical code.

4.11. Archive control

The recorder has an internal memory with the capacity of 2 GB. The recording process can be set with the buttons on the face plate:

- creating a new archive file,
- starting (restarting) the recording of current results,
- finishing (stopping) the recording of current results,
- resetting the memory usage indicator.



After the archiving process if finished, data can be uploaded to a PC by means of a portable mass memory storage device plugged into the USB socket. Optional *MPI-C-Raport* software can analyze the results and draw up and print reports (see Section 15).

4.11.1. Create new Archive File.

To create a new archive file, go to: „Main archive" special screen or call up the **Main menu → Archiving commands** function.

Press MENU on „Main archive" screen to select **Archiving commands → New file** and then press →□. When the question „Do you want to create a New Main archive file?" is displayed, press YES to confirm. Green REC LED will blink for a few seconds until the operations are finished. *ar[addr]_[number].txt* text file will be created in the internal memory, where *addr* is the device address and *number* is the consecutive number of the created file (archive files must have different names when saved on the same recorder). Example name of a file: *ar01_004.txt*.

> **!** To differentiate files from different recorders, it is recommended to configure different addresses even if the RS-485 port is not used in data transmission.

The display will then show a message indicating that a new archive file was successfully created and will show the estimated time when the memory becomes full along with the question: „Do you want to START RECORDING?”. To start recording to a new archive file, press YES.

This function can be password-protected. Even if a user is authorized to control the recording process, he/she will not be necessarily authorized to delete archive files.

To create a new archive file, you can also press → **Main menu** → **Archiving commands** → **New file**.

4.11.2. Initiate, restart and stop recording

It is most convenient to start / stop the recording process from the „Main archive” screen. If the recording has been suspended, you can use the quick start button ●REC. If the recording is enabled, the same button is shown as ■STOP and can be used to stop the process. After the recording has been stopped, press ●REC to resume the process, and the results will be added to the current file created in the internal memory. To start and stop the recording, each choice must be confirmed twice. Some functions can be password-protected.

Both functions can be activated by pressing MENU on the „Main archive” screen and after calling up the settings function (🔧) in **Main menu** → **Archiving commands** → **Resume recording** or **Stop recording**.

4.11.3. Memory usage indicator

The „Main archive” screen shows information on the percentage of internal memory filled-up and the date and time when the memory will be full. These are estimated values only. In particular, if the recorder operates at double recording speeds (depending on whether the alarm thresholds are exceeded), these values can vary considerably. Likewise, if the recording is stopped, the time until the memory is full will be prolonged.

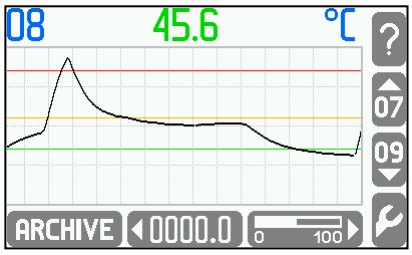
In the Successive files recording mode, if 24H / Week / Month is set as a recording limit, the date and time when another file is created will be displayed instead of the time until the memory is full.

In the overwrite mode (**Mode** → **Overwrite**), the function of the memory usage indicator is considerably different. The indicator can be reset. Indicator resetting means that the archive reading time is defined. The memory usage indicator will then indicate that the results are overwritten from the last reading. To reset the memory usage indicator, press MENU → **Reset usage indicator** on the „Main archive” screen, or go to settings 🔧 → **Main menu** → **Archiving commands** → **Reset usage indicator**.

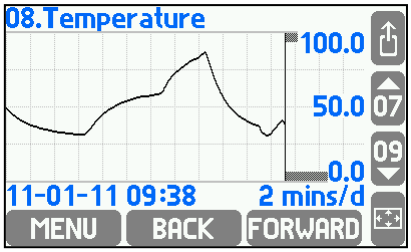
4.12. Browse measurement results recorded in the Archive

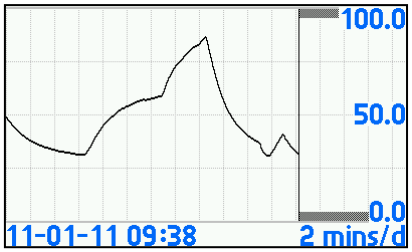
Results recorded in the internal memory can be browsed back on the recorder display, and can be shown in graphs or in tables. The function works as a preview option.

Advanced results analysis should be preferably done on a PC, using suitable software with highly developed processing options.



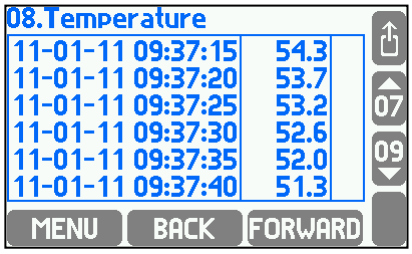
To access the archive browser, go to **Archiving commands**: → **Main menu** → **Archiving commands** → **Browse** or go to „Trend graph" measurement screen and press ARCHIVE. To go to **Archiving commands**, you can also press MENU on the „Main archive" screen. Use BACK and FORWARD buttons to browse the archive on a time axis, and press „▲" or „▼" to switch between measuring channel within the selected time frame.





The displayed time frame depends on the recording interval (interval I and interval II) and cannot be changed when the results are browsed through. The display can be enlarged to full screen mode with (press any button to return to the previous screen size). Press MENU to display additional archive browsing functions: searching results corresponding to specific date and time criteria, results displayed in tables, and OPTIONS:

- **Autoscaling** – automatic rescaling of the chart in Y axis if the measurement results are outside the predefined scale,
- **Substituted values** – displaying also emergency results (substituted measurement valued if any failure of the measuring sensor is identified; the proper function needs to be also activated in the measuring input settings),
- **Large chart legend** – description of time axis if the chart is enlarged to full screen.



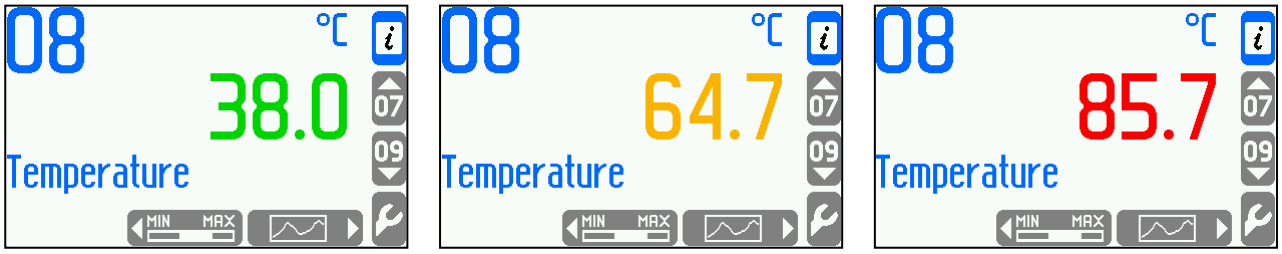
4.13. Totaliser Archive

Totaliser results are recorded every 15 minutes. Totaliser Archive file is saved in the internal memory and created automatically (even if the file is deleted or transferred). The Totaliser Archive file name is *artot_[addr].txt*, where *addr* indicates a two-digit recorder address. The file can be copied or transferred to a USB mass storage device, and then

uploaded to a PC (see Section 4.4.1). Data in the file are protected with check boxes to make sure that no data modification takes place outside the recorder.

4.14. Notifications on exceeded alarm thresholds

You can set four alarm/control thresholds for each measuring channel. Each threshold has an individual actuation threshold, hysteresis, „High" or „Low" status, as well as alarming or controlling function assigned. In addition, each alarm threshold can have a color (green – low priority, yellow, red – high priority) assigned. If the threshold is exceeded, the result is displayed in a different color. If the threshold is exceeded more than once, the highest priority color is displayed.



Alarm functions (signaling functions):

- Notification on exceeded alarm threshold – red ALARM LED blinks on the face plate and the channel number as well as notification date and time are shown on the display. If the threshold is exceeded several times, the notifications are arranged in a queue. Press OK to read all subsequent notifications. Press ALL to confirm all notifications at once. When the notification is confirmed, the red ALARM LED lights up continuously if the threshold is still exceeded. LED goes off if the exceedance ceases. If a specific exceedance reappears without being confirmed earlier, the notification queue will include the first notification only.
- If the threshold is exceeded, the relevant result is displayed in a different color (assigned to the specific alarm threshold).
- Relay actuation – alarm notifications can actuate specific relays (to enable audio signals, etc.) The relay will be disabled after the notification is confirmed. The signaling relays and alarm thresholds should be defined under device settings.
- Exceeded thresholds on the „Thresholds" screen – exceeded alarm thresholds are displayed with ▲ or ▼ indicating maximum and minimum thresholds, respectively, and in the assigned colour. Exceeded control thresholds are also shown on the same screen.
- Exceeded thresholds are recorded in the Event Log – as notification, notification and return to normal, or return to normal. Notification confirmations are not recorded.

4.15. Control functions

The recorder can support simple „On/Off" control functions based on four alarm/control thresholds (with a hysteresis) and eight (or four in an eight-channel version) freely programmable outlet relays.

The control operations can be implemented without user involvement, and you can monitor the threshold exceedance status on the „Thresholds" screen, and the relay

actuation status on the „Relay outputs" screen, unless the screens are set to be hidden. Exceeded thresholds can be also recorded in the event log.

4.16. Analog input failure notifications

Analog inputs are fitted with circuits that signal the following failures:

- for 4-20 mA inputs – loop circuit is broken (I_{WE} < 3.6 mA) – indicated with „-||- " symbol, loop current exceeded (I_{WE} > 22 mA) - indicated with „-E-" symbol,
- for 0-20 mA inputs – loop current exceeded (I_{WE} > 22 mA) - illustrated with „-E-" symbol,
- for 3-wire RTD inputs – short-circuit between A RTD and B RTD line, gap in A RTD, B RTD or/and C RTD – indicated with „-F-" symbol (short-circuit in the B RTD and C RTD line is not detectable),
- for 2-wire RTD inputs – short-circuit between A RTD and B RTD line, gap in A RTD and/or B RTD line – indicated with „-F-" symbol.
- for TC inputs – gap between +TC and -TC - indicated with „-F-" symbol (short-circuit in the +TC and -TC line is not detectable),
- for "Voltage" and "Resistance" inputs – measurement range exceeded by ± 5% – indicated with „-F-" symbol. For inputs operating according to user characteristics, the measurement range will correspond to the limit signal values from the table.

Failure can be signaled with a notification shown on the display, and this type of notification needs to be confirmed even if the cause of the failure is eliminated. Depending on recorder settings, the failure can actuate the respective signaling relay until the failure is confirmed or until the cause of the failure is eliminated. Likewise, the failure and its elimination can be recorded in the event log.

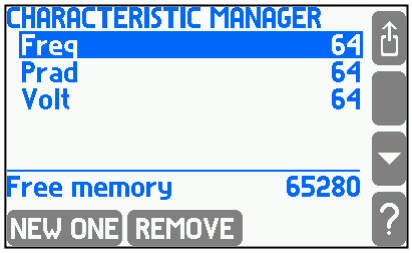
4.17. User characteristics

User characteristics can be introduced for current inputs, PULS inputs, voltage inputs and resistance inputs. The user characteristics can be introduced as a file copied from USB flash memory. The file can be created on PC in a text editor or a calculation sheet, and then saved on USB flash memory. User characteristics addition/deletion can be classified as an authorized password-protected function.

The user characteristics file must start with #chka, followed by a name (up to 12 characters), and a table composed of numbers arranged in tables: signal pairs for mA, Hz, mV or Ω, respectively, and a value measured in specific units. The table values must be arranged in ascending order. In the example below, 100 Hz frequency corresponds to 30.0. Intermediate values between points are interpolated linearly, i.e. 150 Hz corresponds to 35.0. Out-of-table values are extrapolated linearly, i.e. 50 Hz corresponds to 25.0, and 400 Hz corresponds to 64.0.

```
#chka Char
100.0   30.0
200.0   40.0
300.0   52.0
```

Transducer characteristics are saved into a dedicated database. To browse the database content and to add or delete a characteristic, select **Characteristic manager** in the main menu.



To add a new characteristic, plug USB flash memory where the characteristic file is saved in the main directory into the USB socket on the face plate and press NEW ONE. Select a file from the list. The list will only include .txt or .csv files. A new characteristic can be also added when the input is configured, without having to enter the dedicated database. Select **From file…**from **Char**. A list of available files will be displayed. Characteristic saved in the selected file will be added to the database and set as the default characteristic of the relevant input.

To delete a characteristic, press REMOVE. All characteristics will be deleted from the database. Individual characteristics cannot be deleted.

The characteristic name is displayed along with its size. The available memory capacity is displayed at the bottom of the screen. The database can include up to 16 different characteristics.

4.18. Logs

The recorder offers three logs that include different types of measurement events and user operations: Event Log, Authorized Operations Log and Calibration Log. The logs are saved in the internal memory. Logs can be accessed from the display, via RS-485 port (when MPI-C-Raport software is used, Event Log and Authorized Operations Log can only be displayed) and after transferring data by means of USB flash drive.

4.18.1. Event Log

The following events are recorded in the Event Log:

- power switched on and off,
- reprogramming the recorder settings,
- date or time changed,
- resetting min, max and average values (restarting the tracking function),
- resetting the totalisers,
- starting and finishing date and time of selected ‘alarm/control threshold exceeded’ conditions,
- shorting / disconnecting selected binary inputs,
- starting and finishing date and time of an alarm condition on selected analog inputs,
- new firmware version installation.

Set the thresholds, binary inputs and analog inputs which need to be recorded in the Event Log if exceeded, shorted / disconnected or failed, respectively (see Section 10.5, 10.7 and 10.8).

The date and time of each event will be also recorded.

4.18.2. Authorized Operations Log

The Authorized Operations Log lists all operations that are reserved for authorized users only (see Section 4.9 and 10.2). Authorized operations can include:

- creating a new archive file,
- restarting or stopping the recording,
- resetting min, max and average values (restarting the tracking function),
- date or time changed,
- resetting the totalisers,
- changing the default settings (other than listed above),
- changing the level and hysteresis settings of alarm/control thresholds,
- changing display settings (configuring screens, display backlight and contrast),
- changing the recording settings (recording interval, list of recorded results and recording mode),
- new firmware version installation.

The operation date and time and user name are recorded.

4.18.3. Calibration Log

The Calibration Log lists all calibration procedures carried out by servicing personnel and the manufacturer. Each record features the following information:

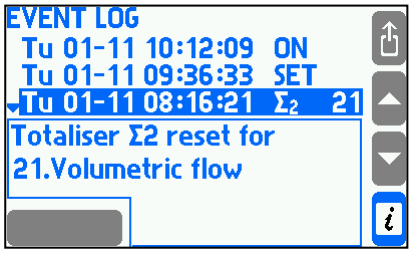
- calibration time and date,
- calibration carried out by… (service or manufacturer),
- list of calibration operations: calibration of analog inputs, calibration of temperature drift, deletion of the previous calibration, etc.

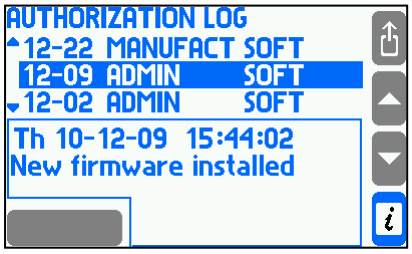
Calibration Log can be only shown on the recorder display.

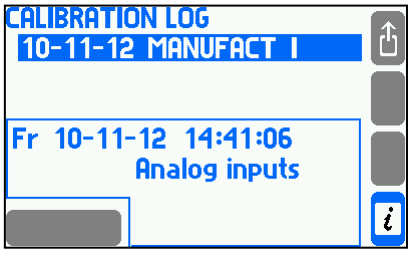
4.18.4. Browse logs on recorder display

Logs can be browsed by the administrator only. To display logs, go to → **Main menu** → **Audit trail** and select the appropriate log from the menu. The administrator (or service user) must be logged in to be able to access the menu.

The logs are displayed as a drop-down list. Each line corresponds to a single record (event or operation). Three records are displayed at a time. Additional information about the record marked with a cursor is shown at the bottom of the screen.







Up to 500 most recent events, 500 authorized operations and 50 calibrations can be displayed.

4.18.5. Event Log Files and Authorized Operations Log Files

Event Log and Authorized Operations Log files are available for users. Event Log file is called *event_[addr].txt* and Authorized Operations Log file is called *a_log_[addr].txt* where *addr* means a two-digit device address.

Files are created automatically, and can be deleted only by the SERVICE user.

The files can be uploaded to a PC via USB flash drive (see Section 4.4.1). This function can be password-protected. Data in the file are protected with check boxes to make sure that no data modification takes place outside the recorder.

4.18.6. Remote reading of the Log

MPI-C-Raport can be used to browse the contents of the Event Log and the Authorized Operations Log via RS-485 port. This is how data saved on the recorder internal memory (500 recently saved records) and 2GB flash drive (via RS-485 port only) can be browsed.

5. INTERNAL DATA MEMORY

The recorder has 2GB internal memory. Relatively large data volumes can be saved in the internal memory (see the Table), i.e. up to 250 files.

Backup copies of data saved on the internal memory must be created at suitable time intervals. Files should be copied from the internal memory and saved on a PC, on recordable media (CDs, etc.) or printed on a regular basis.

The following data are stored in the internal memory:

- Main archive (archive of current results),
- Totaliser archive,
- Event Log Files and Authorized Operations Log Files.

There are three methods of data saving in the main archive: **Overwrite**, **One file**, **Successive files**. **Overwrite** means that the oldest files are overwritten, in the **One file** mode data are recorded until the file size reaches the level set in the **File size.** In the **Successive files** mode, if the recorded file size reaches the level set in the **File size,** the recording continues until the next file is automatically created.

You can set the maximum file size (**File size**) of the main archive (see Section 10.10).

Data saved on the internal data memory can be:

- uploaded to a PC via RS-485 or Ethernet port. In this configuration, the transmission rate is relatively low, and the data should be uploaded at relatively short time intervals, in smaller “potions”.
- Data files (archive files of current results, totalisers and logs) can be copied from the device to USB flash drive, and then uploaded to a PC.

Table 3.1. Examples of recording intervals of measurement results in the 2GB internal memory. Note! The information in the Table are provided as a reference only.

Recording interval	3 s	10 s	30 s	1 min	5 min	10 min
16 channels	over a year	over 4 years	over 10 years	over 20 years	over 130 years	over 260 years
8 channels	over 2 years	over 7 years	over 20 years	over 40 years		
4 channels	over 3 years	over 10 years	over 30 years			
1 channel	over 4 years	over 15 years	over 40 years			

6. TECHNICAL DATA

Technical data are provided for both recorder versions, mounted in panels and portable. Where appropriate, different parameters are indicated for MPI-C, MPI-CL and MPI-CN, respectively.

FRONT PANEL	
Type of display:	Full color graphic TFT LCD, 272 x 480 p.
Reading field size:	43,8 mm x 77,4 mm
Indication:	3 three-color LEDs (green, yellow and red)
Keyboard:	Membrane, 7 or 19 buttons (MPI-CN and MPI-CL)
ANALOG OUTPUTS	
Number of inputs:	16 or 8, multiplexed with signal relays
Galvanic separation between channels:	Yes, 100 VDC or 100 V_{p-p}
Galvanic separation from supply voltage:	Yes, 500 VDC or 500 V_{p-p}
RTD inputs	
Sensor type:	(see Table below)
Sensor current:	200 μA
Sensor connection type:	3-wire or 2-wire
Wire resistance compensation in the 3-wire connection:	Automatic + constant within the range of –99,99 Ω up to +99.99Ω
Wire resistance compensation in the 2-wire connection:	Constant within the range of -99.99 Ω to +99.99 Ω
Maximum resistance of wires supplying power to the sensor:	50 Ω
Resistance input:	
Sensor type:	Resistance within the range of 0 - 5000 Ω (2)
Conversion characteristic:	Linear / user-defined
Current:	200 μA
Sensor connection type:	3-wire or 2-wire
Wire resistance compensation in the 3-wire connection:	Automatic + constant within the range of –99,99 Ohm up to +99.99 Ω
Wire resistance compensation in the 2-wire connection:	Constant within the range of -99.99 Ω to +99.99 Ω
Maximum resistance of wires supplying power to the sensor:	50 Ω
TC inputs	
Sensor type:	(Table below)
Cold junction compensation:	Any other temperature measuring channel (in °C)

	or a constant value for thermocouple B – no compensation
Cold junction compensation range:	-50,0° C to +99,9 °C
Maximum input voltage:	30 VDC or 30 V_{p-p} (between any of +TC and –TC clamps)
Maximum resistance of compensation wires (connected to the TC sensor):	As RTD
Voltage input:	
Sensor type:	-0,8 V up to +0,8 V (3)
Conversion characteristic:	Linear / user-defined
Maximum input voltage:	50 Ω
Input resistance:	> 10 kΩ
Maximum resistance of wires supplying power to the sensor:	50 Ω;
0/4-20mA inputs	
Input resistance:	20 Ω +/-10%
Conversion characteristic:	Linear / root-shaped (4) / user-defined
Transducers powered from recorder:	None (MPI-C) 24 VDC / 0.4 A common (MPI-CN – special version, MPI-CL)
Measurement error	
Measurement accuracy (at ambient temp. of 25 ℃):	As specified in the table for the given sensor type
Temperature drift (between 0 and 50 ℃):	0,025% of the range /10 °C
Signal connections:	MPI-C, MPI-CL: 16 (16-channel version) or 8 (8-channel version) 4-position pin type spring terminal blocks, max. cable diameter: 0.5 mm^2 MPI-CN: spring terminal block, cable diameter: 0.2 mm^2 – 1.5 mm^2
BINARY INPUTS	
Number of inputs:	4 in 16-channel version 2 in 8-channel version
Maximum input voltage:	30 VDC or 30 V_{p-p}
Measurement range:	0.001 Hz - 10 kHz. (0.001 Hz - 1 kHz if the filtrating capacitor is connected)
Minimum pulse width:	20 µs (0.5 ms if the filtrating capacitor is connected)
Configuration: OC / contact	
Voltage (OC):	12 V

Current (contact):	12 mA
Switch on / off threshold:	2.7 V / 2.4 V
Configuration: input voltage	
Input resistance:	> 10 kΩ
Switch on / off threshold:	2.7 V / 2.4 V
Voltage (OC):	12 V (see *Fig. 9.7*)
Namur configuration:	
high impedance: s	0.4 mA – 1 mA,
low impedance:	2.2 mA – 6.5 mA,
Signal connections:	MPI-C, MPI-CL: 1 (8-channel version) or 2 (16-channel version) 4-position pin type spring terminal blocks, max. cable diameter: 0.5 mm^2 MPI-CN: spring terminal block, cable diameter: 0.2 mm^2 – 1.5 mm^2
TWO-STATE OUTPUTS	
Number of outputs:	8
Type of outputs:	Semiconductor relays
Maximum load current:	100 mA AC/DC
Maximum voltage:	60 V AC/DC
Wire connection:	MPI-C, MPI-CL: two 8-position pin type spring terminal blocks, max. cable diameter: 0.5 mm^2 MPI-CN: spring terminal block, cable diameter: 0.2 mm^2 – 1.5 mm^2
RS-485 SERIAL PORT	
Signals output on terminal block:	A(+), B(-),GND RS, +3,3 V RS (max 10mA), T(+), T(-)
Galvanic separation:	No
Maximum load:	32 receivers / transmitters
Transmission protocol:	ASCII Modbus RTU
Maximum length of line:	1,200 m
Transmission rate:	1.2, 2.4, 4.8, 9.6 ,19.2, 38,4, 57.6, 115.2 kbps
Parity control:	Even, Odd, None
Frame:	1 start bit, 8 data bits, 1 stop bit
Maximum differential voltage A(+) – B(-)	+/-14V
Maximum total voltage A(+) – “ground” or B(-) – "ground"	-8 V ... +13 V
Minimum output signal of transmitter:	1,5 V (at R_0= 54 Ω)
Minimum sensitivity of receiver:	200 mV / R_{WE}= 12 kΩ
Minimum impedance of data transmission line:	27 Ω

Short-circuit / thermal protection:	Yes
Internal terminating resistor:	Yes (activated by shorting the pins on the terminal block / DIP-switches)
Wire connection:	MPI-C, MPI-CL: 1 8-position pin type spring terminal blocks, max. cable diameter: 0.5 mm^2 MPI-CN: spring terminal block, cable diameter: 0.2 mm^2 – 1.5 mm^2
USB port	
Port socket	A socket, as per USB standard
Version:	USB 1.1
Protection class	IP54
Recorded format:	Text file, FAT16 (within a limited scope)
Recording indication:	Green – red LED on the face plate.
ETHERNET PORT	
Transmission protocol:	Modbus TCP, ICMP (ping), DHCP server, http server
Interface:	10BaseT Ethernet
Data buffer:	300 B
Number of connections opened simultaneously:	4
Connection	RJ-45
Indication LEDs:	2, in RJ45 socket
INTERNAL DATA MEMORY	
Capacity	2 GB
Estimated recording time for recording speed every 3 s for 16 measuring channels	ca. 400 days
Recording indication:	Green – red LED on the face plate.
SUPPLY (MPI-C)	
Supply voltage:	24 VAC (+5% / -10%) 20 ... 30V DC (any polarity)
Power consumption:	4 W max
Wire connection:	1 6-position pin type spring terminal block, max. cable diameter: 0.5 mm^2
VOLTAGE (MPI-CL, MPI-CN)	
Supply voltage:	230 VAC (+5% / -10%)
Power consumption:	typically 12 VA, 30 VA max
Wire connection:	MPI-CL: IEC 60320 C14 connector (power cord with plug C13 included) MPI-CN: spring terminal block, cable diameter: 0,2 mm^2 – 1,5 mm^2
MECHANICAL DIMENSIONS – HOUSING (MPI-C)	

Type of housing:	For mounting in panels, non-flammable plastic “Noryl”
Dimensions (h x w x d):	72 mm X 144 mm X 130 mm
Dimensions of panel cut-out:	138^{+1}mm X $68^{+0.7}$mm
Maximum panel thickness:	5 mm
Weight:	ca. 1.1 kg
Protection class on front panel side:	IP54
Protection class on rear panel side:	IP30
MECHANICAL DIMENSIONS – HOUSING (MPI-CL)	
Type of housing:	Stand-along, ABS plastic
Dimensions (h x w x d):	90 mm X 260 mm X 250 mm (without a handle) 90 mm X 300 mm X 305 mm (with a handle)
Weight:	ca. 2.1 kg
Protection class:	IP30
MECHANICAL DIMENSIONS – HOUSING (MPI-CN)	
Type of housing:	It can be suspended, ABS plastic
Dimensions (h x w x d):	216 mm X 260 mm X 125 mm (without cable glands) 246 mm X 260 mm X 125 mm (with cable glands)
Weight:	ca. 2.1 kg
Protection class:	IP54
Climate conditions	
Ambient temperature	MPI-C: 0 .. +50 °C MPI-CN: 0 .. +50 °C MPI-CL: 0 .. +40 °C
Realitive humidity	0 .. 75% (without steam condensation)
Storage temperature	-20 .. +80 °C
Overvoltage category	OVII
Pollution degree	PD2
LVD (safety)	EN 61010-1
EMC	EMC Directive 2014/30/UE EN 61326-1:2013 Tabela 2 (Immunity) EN 55011:2009+A1:2010 Class A (Radiated and conducted emissions)
Installation location	Indoor use only

Table of temperature sensor types

INPUT TYPE	RANGE	PITCH	MEASUREMENT ACCURACY	CHARACTERISTIC
Pt100 *K (K=1..11)	-200 up to +850° C	0.1° C (1)	+/-0.5° C	IEC751
Ni100 *K (K=1..11)	-60 up to +250° C	0.1° C (1)	+/-0.5° C	DIN43760
J (Fe - CuNi)	-200 up to +1000°C	0.1° C (1)	+/-0.5° C	IEC584
K (NiCr - Ni)	-250 up to +1300°C	0.1° C (1)	+/-0.5° C	IEC584
T (Cu - CuNi)	-270 up to +400° C	0.1° C (1)	+/-0.5° C	IEC584
E (NiCr - CuNi)	-270 up to +1000°C	0.1° C (1)	+/-0.5° C	IEC584
N (NiCrSi - NiSi)	-50 up to +1300° C	0.1° C (1)	+/-2° C	IEC584
B (Pt30Rh -Pt6Rh)	300 up to +1800° C	0.1° C (1)	+/-2° C	IEC584
R (Pt13Rh - Pt)	0 up to +1750° C	0.1° C (1)	+/-2° C	IEC584
S (Pt10Rh - Pt)	0 up to +1750° C	0.1° C (1)	+/-2° C	IEC584
4-20 / 0-20mA	-9999 up to +9999	0.0001 up to 1	+/-0.1% scope	Linear / root-shaped (2) / user-defined

(1) – real measurement pitch, the pitch range can be set within the range of 0.0001 - 1.
(2) – the resistance sensor can be set within a sub-range (200 - 600 Ohm), but it limits the signal processing performance.
(3) – the voltage can be set within a sub-range (0 mV - 50 mV), but it limits the signal processing performance.
(4) – root-shaped characteristics within the initial range is carried out according to the following algorithm: linear characteristics at inclination 1 for the initial value of 0 – 0.01, linear characteristics with inclination 10 within the range of 0.1 – 0.0247, root-shaped characteristics within the range of 0.0247 - 1.

7. ENTITY LAUNCHING THE PRODUCT ON THE EU MARKET

Manufacturer: METRONIC AKP s.c.
31-426 Kraków, ul. Żmujdzka 3
Tel.: (+48) 12 312 16 80
www.metronic.pl

Sales Department:

Notes:

8. FITTINGS AND ACCESSORIES

8.1. Basic components

- MPI-C, MPI-CL or MPI-CN 1 pc
- Power cable 1 pc (MPI-CL)
- Housing mount 2 pc (MPI-C)
- DTR documentation – hard copy 1 pc
- Warranty card 1 pc
- DTR documentation – electronic copy 1 pc
- Terminal block 1 set (MPI-C and MPI-CL only)
- Cartoon package 1 pc

8.2. Configuration description

A factory configuration code is stated on the name plate.

MPI-C-xx-y

Where: xx – number of analog channels: 08 – eight
16 – sixteen
y – number of binary channels: 2 – two
4 – four

Example:
MPI-C -16-4
A device with sixteen analog channels and two binary channels.

The following configurations are available:

- MPI-C-08-2 and MPI-C-16-4
- MPI-CL-16-4
- MPI-CN-16-4

8.3. Accessories

- CONV 485USB-I (USB / RS-485) adapter with galvanic separation
- CONV485USB (USB / RS-485) service adapter w/o galvanic separation
- CONV 485E (Ethernet / RS-485) adapter
- GSM module
- *MPI-C-Raport* data visualization and processing software
- PSS 10VA 230/24V AC supply transformer (manufacturer: Breve) (for MPI-C only)
- PSS 30VA 230/24V AC supply transformer (manufacturer: Breve) (for MPI-C only)
- Relpol SA PI6-1P-24VAC/DC transmitter with LED to be fitted on 6A/230V AC TS-35 rail.

CONV485USB-I, CONV485USB and CONV485N adapters (Metronic AKP)

BREVE PSS30 230V /24V and PSS10 230V/24V transformers
and Relpol SA PI6-1P 24VAC/DC transmitter
(all elements are mounted on TS-35 bus bar)

GSM module

9. ASSEMBLY AND INSTALLATION

9.1. Assembly

The MPI-C recorder is a panel-mounted device. It can be built into panels thicker than 1 mm. Before installation, a 138 (+1) mm x 68 (+0.7) mm rectangular opening needs to be cut out in the panel. The mounting depth of the device is 127 mm. In order to ensure easy installation of electrical connections, it is recommended to leave an extra space of approx. 30 mm behind the device. When installing the recorder in the mounting opening, insert and fit a gasket between the rear wall of the frame and the panel. After fitting the recorder in, install the latch fasteners on its side walls and then tighten the set screws. With the removable screw terminal block, you can first install electrical connections and then fit the recorder.

	MPI-C
Mounting cut-out in panel – width	138 $^{+1}$ mm
Mounting cut-out in panel – height	68 $^{+0,7}$ mm
Depth of mounting	ca. 127 mm

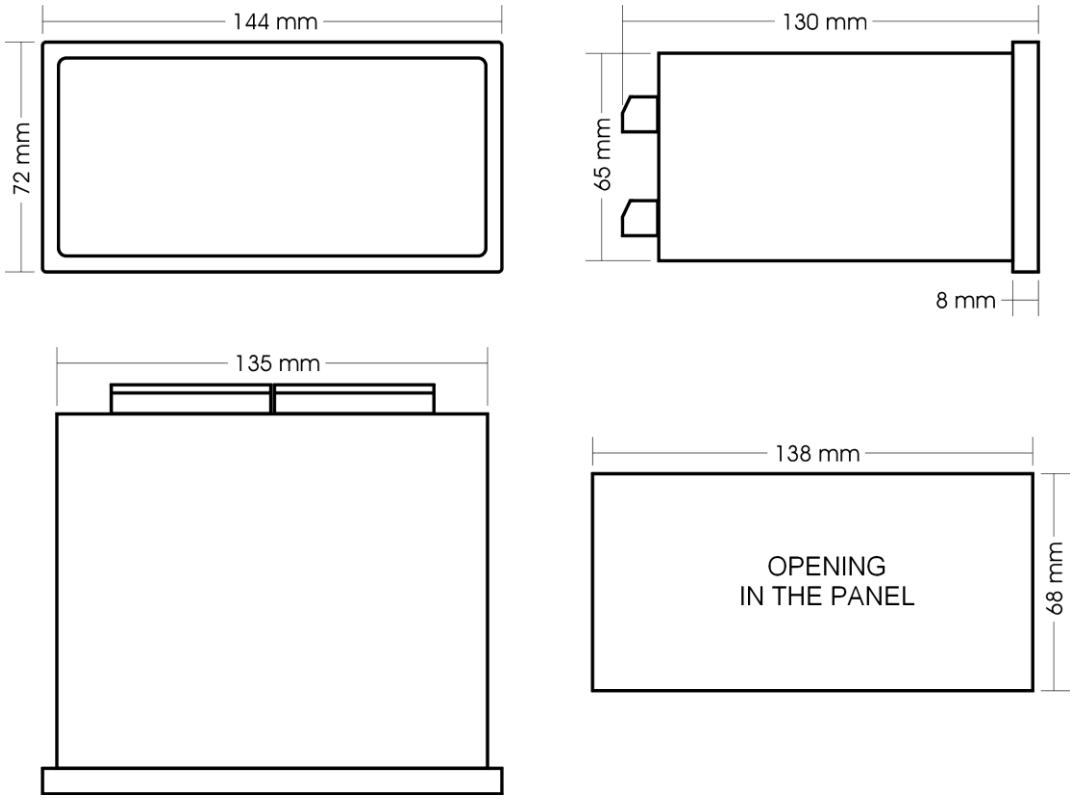


Fig. 9.1 Housing dimensions and cross-section dimensions of an assembly panel

The recorder cannot be exposed to direct heat generated by other equipment.
When assembled, the device operation cannot be affected by interference from other components (contacts, power relays, inverters).

9.2. Electrical connections

All electrical circuits are led out to screw terminal blocks located in the rear panel of the device. The terminal blocks can be connected to up to 0.5 mm^2 cables. Cable ends should be screened along 8- 10 mm section. Both types of cables, wire cables and cord cables, can be connected. If larger cables are used, it is recommended to use an intermediate terminal block in the measurement cabinet between the facility wiring and the recorder.

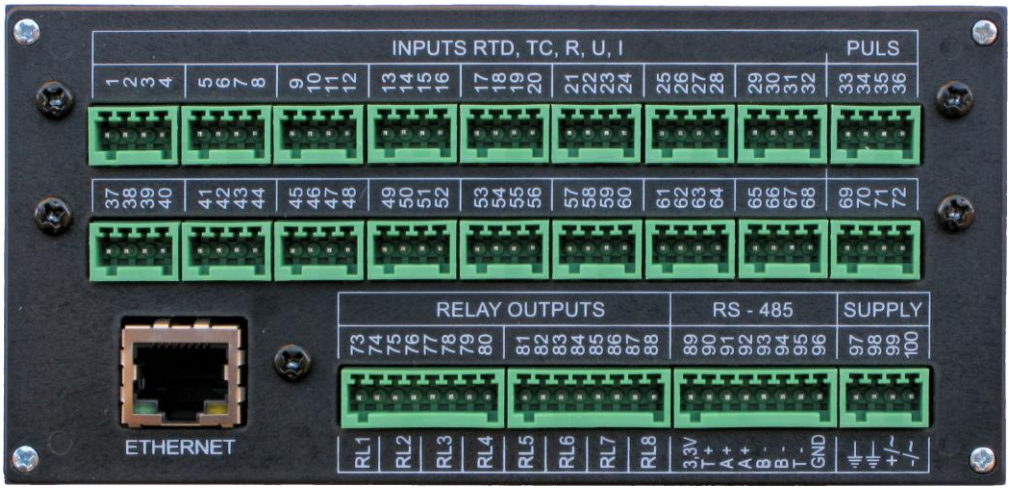


Fig. 9.2 Rear panel (w/o terminal blocks)

Table 9.1 MPI-C recorder terminal blocks

Terminal block no.	**SPECIFICATION**				
INPUTS					
ANALOG INPUTS IN 1.. IN 8 (upper terminal block, 8 x „4" pins)					
1	A	+TC	A RTD		IN 1
2	B	-TC	B RTD		
3	C		C RTD	-I	
4	D			+I	
...	X 8				
29	A	+TC	A RTD		IN 8
30	B	-TC	B RTD		
31	C		C RTD	-I	
32	D			+I	
DIGITAL INPUTS IN B1, IN B2 (upper terminal block, „4" pin)					
33	Puls+		IN 17 (PULS)		
34	Puls-				
35	Puls+		IN 18 (PULS)		
36	Puls-				
ANALOG INPUTS IN 9.. IN 16 (middle terminal block, 8 x „4" pins)					
37	A	+TC	A RTD		IN 9
38	B	-TC	B RTD		
39	C		C RTD	-I	
40	D			+I	
...	X 8				

65	A	+TC	A RTD		IN 16
66	B	-TC	B RTD		
67	C		C RTD	-I	
68	D			+I	
DIGITAL INPUTS IN B3, IN B4 (middle terminal block, „4" pins)					
69	Puls+		IN 19 (PULS)		
70	Puls-				
71	Puls+		IN 20 (PULS)		
72	Puls-				
OUTPUTS (bottom terminal block, 2 x "8" pins)					
73	+/~RL1		Relay output RL1 (0.1A/60V)		
74	-/~RL1				
75	+/~RL2		Relay output RL2 (0.1A/60V)		
76	-/~RL2				
77	+/~RL3		Relay output RL3 (0.1A/60V)		
78	-/~RL3				
79	+/~RL4		Relay output RL4 (0.1A/60V)		
80	-/~RL4				
81	+/~RL5		Relay output RL5 (0,.1A/60V)		
82	-/~RL5				
83	+/~RL6		Relay output RL6 (0.1A/60V)		
84	-/~RL6				
85	+/~RL7		Relay output RL7 (0.1A/60V)		
86	-/~RL7				
87	+/~RL8		Relay output RL8 (0.1A/60V)		
88	-/~RL8				
RS-485 (bottom terminal block, „8" pins)					
89	3,3 V		RS-485 power supply		
90	T (+)		Termination		
91	A(+)		RS-485 port		
92	A(+)				
93	B(-)				
94	B(-)				
95	T (-)		Termination		
96	GND		RS-485 power supply		
POWER SUPPLY (bottom terminal block, „4" pins)					
97	MASA		FRAME		
98	MASA				
99	+/~ 24V		Power supply		
100	-/~ 24V				

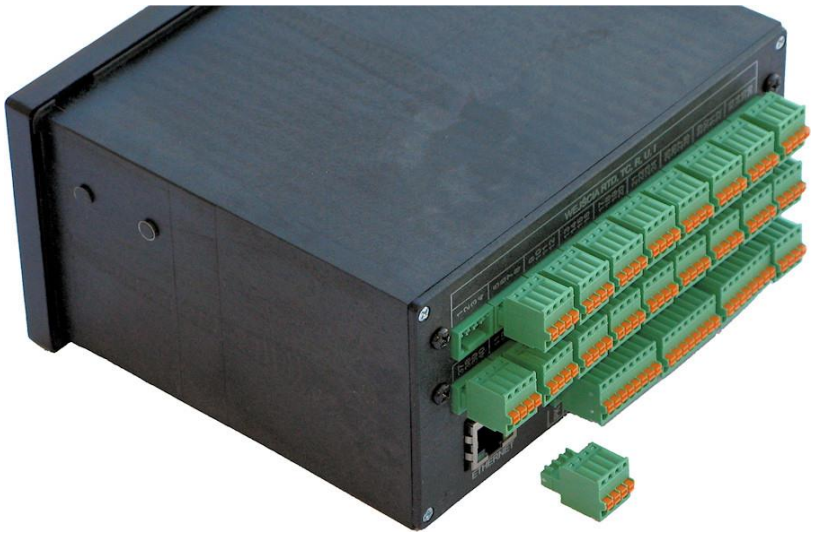


Fig. 9.3 Pin type spring terminal block

9.3. Galvanic isolation

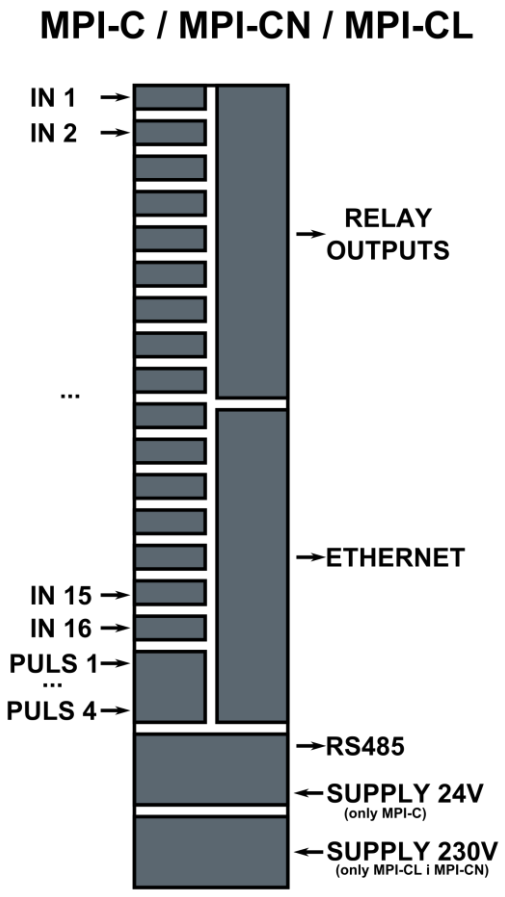


Fig. 9.1 Galvanic isolation in MPI-C / MPI-CN / MPI-CL

9.4. Power connection

The power adapter used with the device is capable of delivering stabilized and non-stabilized DC voltage, as well as AC voltage. It is recommended to power the recorder from a separating transformer 230/24 V AC. This type of transformer is available as an

accessory. To maintain the correct polarity for constant voltage power supply, a rectifier is provided on the input, although “+” pole should be connected to terminal no. 99, and “-“ pole should be connected to terminal no. 100, as prescribed. The power adapter is fitted with polymer fuses that break the power circuit in case of failure. When the cause of the failure is successfully removed, the normal fuse condition is restored after several minutes. 97 and 98 terminals are ground terminals. In order to eliminate interference, it is recommended to connect the ground wire to the terminal block of the measurement cabinet ground potential (ground wire or „0”).

To ensure safety, the recorder's supply must satisfy the conditions applicable to lower voltage sources SELV (Safety Extra Low-Voltage), supplied with the 24 V DC as per the IEC60950-1**.**

It is recommended (but not obligatory) to connect the ground wire to 95-98 terminals. In special cases, when the ground wire interference level is high, it can negatively affect the recorder operation. It is then recommended to switch the ground potential using suitable filters.

9.5. Connect analog transducers to measurement inputs

The recorder has 16 or 8 analog inputs to connect different types of measurement sensors:

- RTD resistance sensors in a two- or three-wire arrangement (Pt-100, Pt-500, Pt-1000, Ni-100),
- TC thermocouple (thermoelements),
- current sensors, 0-20mA or 4-20mA (current loop),
- transducers with -0.8 V up to +0.8 V output,
- transducers with resistance output (0 - 5 Ω).

Each input has a separate pin type four-wire terminal block. Terminal blocks are listed in *Table 9.1*. Connections of specific sensor types are shown in *Fig. 9.4* and *Fig. 9.5*.

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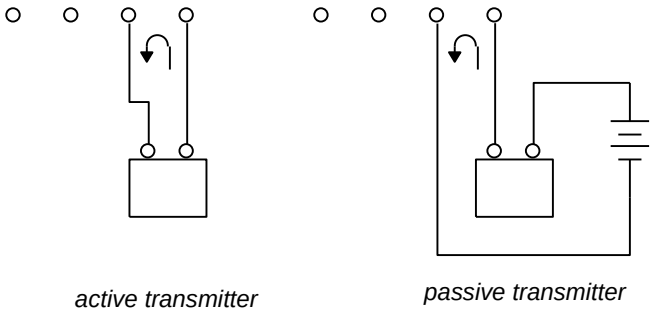


Fig. 9.4 0/4-20mA transducer connected to the recorder input

If the temperature is measured with thermocouples (TC), it is important to connect a cold junction compensation sensor. Any temperature sensor connected to any measurement input can be used for compensation purposes (except for by means of own value or between thermocouples). In particular, there can be more than one compensation

sensor (for several groups of thermocouples at distant locations and temperature differences). Instead of using a sensor, a fixed compensation temperature can be also set. However, an error can occur if the fixed and the actual temperature values differ significantly and it is not recommended for high-precision measurements. B type thermocouple is the only thermocouple that need not be compensated.

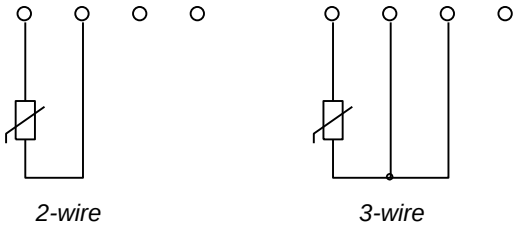


Fig. 9.5 Connecting RTD sensors and transducers with linear resistance output to the recorder input

Transducers with voltage output is connected the same as thermocouples (TC), and transducers with resistance output are connected as RTD sensors.

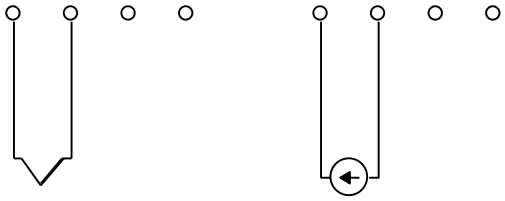


Fig. 9.6 Connecting TC sensors and transducers with linear voltage output to the recorder input

Signal inputs are switched (multiplexed) with special signal relays. Relays provide for complete galvanic separation between channels. Each input signal line is protected with a Transil LED to prevent overvoltage. For A, B and C lines, the LED activation threshold is 15 V, for D line – 36 V. One pole of the LED is connected to a common ground potential – analog ground of the input system. This solution provides separation between the lines at 24 V.

9.6. Connect signals to binary inputs

The recorder is fitted with four PULS inputs: IN 17 (33 and 34 terminals) and IN 18 (35 and 36 terminals) in the upper terminal block and IN 19 (69 and 70 terminals) and IN 20 (71 and 72 terminals) in the middle terminal block. These inputs can also operate in a frequency measurement mode. Depending on the current configuration, up to four different signal types can be connected to the input:

- passive signals – contact, or OC transistor signals – as a default,
- voltage signals with low impedance input – 220 Ω,
- active voltage signals – input impedance >10kΩ,
- NAMUR standard.

For contact-type input, the voltage is 5 V DC in disconnection state, and the current value in short-circuit state is approx. 5 mA.

In the current input configuration, the activation threshold is approx. 12,3 mA, and deactivation threshold is approx. 11 mA.

For high impedance voltage input, the activation threshold is approx. 2.7 V, and deactivation level is approx. 2,4 V. The range of the input voltage is 5V DC - 24V DC.

NAMUR standard:

- high impedance: 0.4 mA – 1 mA,
- low impedance: 2.2 mA – 6.5 mA,

! Binary inputs are configured for contact-type passive signals or OC transistor signals as a default. To change the input configuration, please contact the manufacturer.

For low frequency signals (< 1 kHz), and in particular, for signals from a mechanical contact, an additional low-pass filter with time constant of approx. 0.1 ms can be applied.

! To use an additional low-pass filter, please contact the manufacturer.

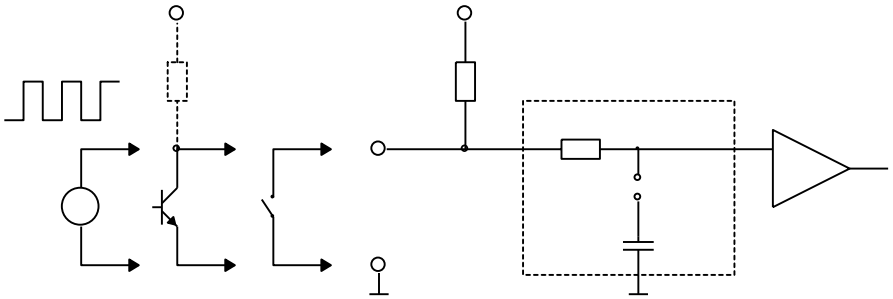


Fig. 9.7 Signal forming system for PULS inputs

9.7. Connect receivers to binary inputs

The recorder is fitted with 8 galvanically separated 100 mA/60V electronic relays and can control the operation of DC / AC powered receivers. To be able to control higher-power devices, intermediate relays should be used. Relpol SA PI6-1P 24VAC/DC transmitter is recommended for 6 A / 250 VAC to be fitted on TS-35 rail. The relay can be controlled from DC or AC mains, and in particular, from the same power source that feeds power to the device, e.g. Breve PSS-10 230V/24V transformer (both elements are available as additional accessories).

For inductive loads, use suitable overvoltage protectors (protection LED, varistor). Output terminals should be grouped in two plugs, 4 relays each, fitted with two independent terminals of the closing contact.

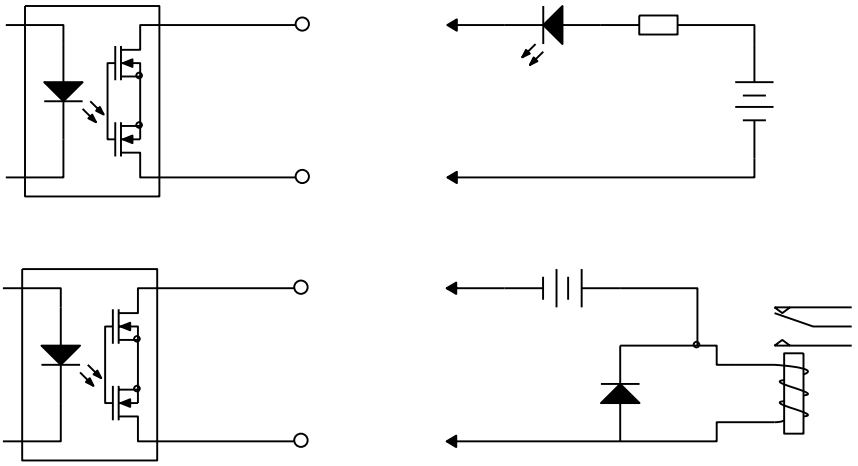


Fig. 9.8 Connecting receivers to binary inputs

Semiconductor relay inputs are protected with a serially-connected 30 Ω and 4.7 nF condenser and resistor to filter overvoltage when the inductive load is switched over (e.g. contactor coil). It is nevertheless recommended to use inherently protected induction elements.

9.8. Connect RS-485 data transmission line

The device is connected to a RS-485 serial bus bar, i.e. A(+) terminal (91 or 92) is connected to A line terminal, B(-) terminal (93 or 94) is connected to B line terminal. The terminal block will also have “GND” line output – terminal no. 96 and “+3.3 V” line output – terminal no. 89. “GND” terminal can be used to connect the ground potential or the data transmission cable screen. When A(+) and T(+) terminals as well as B(-) and T(-) terminals are shorted, the terminator is connected. Note that when the pin is unplugged, the resistor will be disconnected from the line, which can prevent data interchange between other devices. Double A(+) and B(-) line terminals can be used to connect another device in a chain. Note that the connection will be terminated when the pin is unplugged from the terminal block.

! The RS-485 bus bar should not be arranged into a star connection. Devices should be connected in sequence and line ends should be terminated with resistors ■ corresponding to wave impedance. In an industrial environment, it is imperative that the twisted pair be used, preferably screened. The screen should be grounded at least at one end of the line. The RS-485 standard supports a connection of up to 32 devices with the maximum length of the line set to 1,300 m. It is recommended to use a digital data transmission cable (Profibus, etc.).

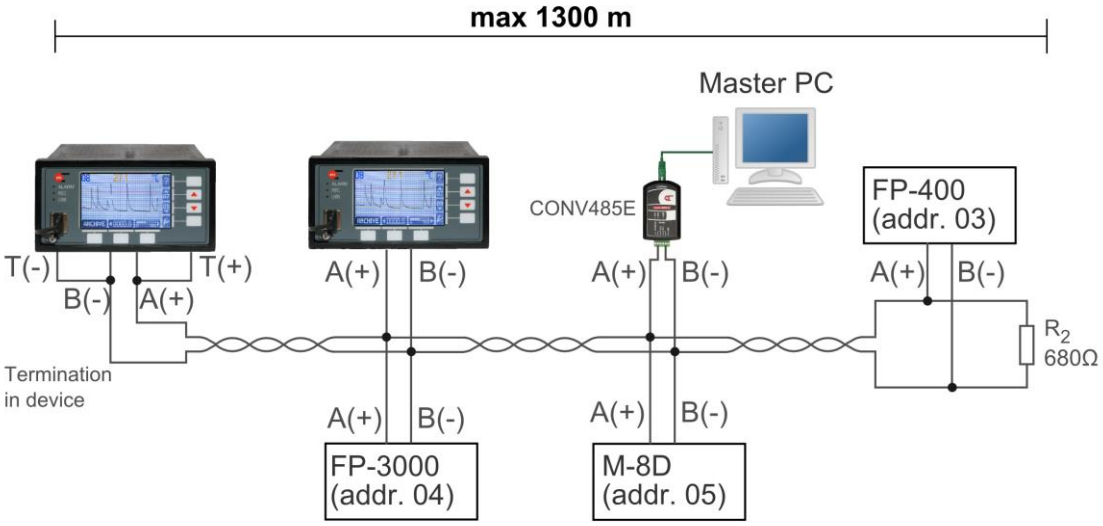


Fig. 9.9 Connecting devices to the RS-485 bus bar

9.9. Ethernet Port

In order to connect the device to a network, it is necessary to use a standard mains cable to connect the MPI-C recorder to a standard mains socket used by the PC.

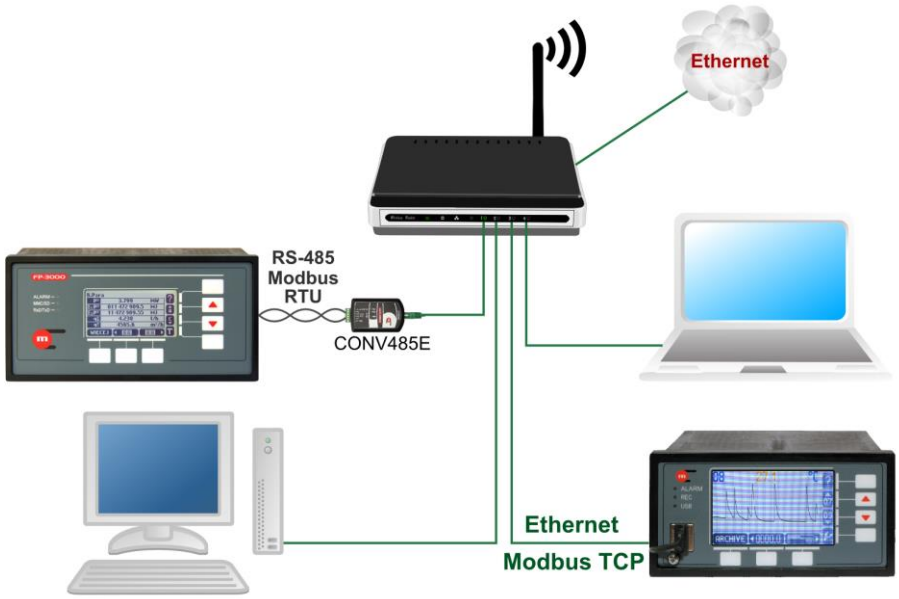


Fig. 9.1 Recorder operation in the Ethernet

To ensure proper communication between the recorder and the master system, all communication parameters need to be configured **(Settings → Ethernet Port**). The default settings are as follows:
IP: 1.0.0.1,
Port: 502,
Mask: 255.255.255.0,
Gate: 1.0.0.1,
DHCP server: Off,

Timeout: 60 secs.

IP address, sub-network mask and default gate parameters should correspond to the network where the recorder is intended to operate. Switch the DHCP server off. It is recommended to use the 502 port dedicated to Modbus TCP. Connection timeout defines the maximum time without data exchange between the master device and the recorder. If this time has lapsed, the connection is closed automatically (it is found inactive due to emergency deactivation of the master device, etc.)

10. SETTINGS

The first configuration should be performed by the administrator (ADMIN, password: 1).

The settings defined below can be also introduced by the user.

MPI-C is a universal device that can operate in a variety of measurement systems and can handle different functions tailored to individual user needs. A new device has default settings. To customize the settings to specific measurement requirements, the recorder needs to be reconfigured. Settings are entered via keyboard or by uploading a file from USB flash drive. The file can be saved in advance on the same or another device.

All settings can be introduced by means of seven (MPI-C) or nineteen buttons (MPI-CL, MPI-CN) and a simple user interface (selection menu shown on the display). Selected functions are displayed with a text description, and the device operation is intuitive.

The settings can be uploaded to USB flash prove plugged into USB port, and then copied to a PC. There are two files created: binary file: *SETT_[addr].SET* and text file: *SETT_[addr].TXT.*

It is recommended to save the new settings into a file, and then to copy *SETT_[addr].SET* and *SETT_[addr].TXT* files to a PC or CD as back-up copies. Text files can be printed and enclosed to device records.
Settings saved in *SETT_[addr].SET* binary file can be uploaded to the recorder (or any other device with the same firmware version).
When *SETT_[addr].SET* file is uploaded, all previous settings and user / password configurations will be permanently overwritten.

Device configuration with the a/m files is convenient when the settings are copied to another recorder and when the recorder is applied in various measurement environments that require customized settings (as the case may be with the portable MPI-CL recorder). You can then use several settings for a number of different configurations.

10.1. ORDER OF SETTINGS DURING CONFIGURATION

Individual parameters of the device can be configured in any order; however, some settings depend on other parameters. For example, it is not possible to assign an output relay to an alarm threshold if the input is not enabled beforehand. For this reason, we recommend the following order for the first configuration of the device:

- relay outputs,
- analog inputs,
- binary inputs,
- calculated values,
- signaling of measuring transducer failure,
- alarm/control thresholds,
- totalisers,
- recording measurement results,
- RS-485 transmission,
- Ethernet transmission,

- display of results,
- recorder description,
- LCD (contrast and backlight)
- password-protected operations,
- defining minimum password length,
- introducing user names and assigning user entitlements,
- changing administrator password.

10.2. Administrator login (ADMIN)

> The first setting should be introduced up by the administrator; use the administrator password: 1 to log in as an ADMIN.

Press to go to the login function and to display the Main menu:

MAIN MENU
Log in
Archiving commands
Copy files
Settings
Load or save settings
Characteristic manager
RS-485 monitor
Change the language

Select (with ▼ and ▲ buttons) the **Log in** function and press ( ), enter „1” and confirm (OK). You are now logged in as an administrator, and the Main menu features the following functions:

MAIN MENU
Log out
Archiving commands
Copy files
Settings
Load or save settings
Audit trail
Characteristic manager
Change password
Administrative data
Firmware and licences
Restore factory settings
RS-485 monitor
Change the language

The administrator has more control abilities than an ordinary user; he/she can add and remove users, assign passwords, define password-protected functions, update firmware and change the administrator password. The administrator password can be only disclosed to an authorized person.

Device settings can be entered in the following menus: **Settings**, **Administrative data**, **Change password**:

SETTINGS
- **Display**
- **Relay outputs**
- **Analog inputs**
- **Digital inputs**
- **Math channels**
- **Sensors failures**
- **Alarms and control**
- **Totalisers**
- **Nominal month beginning**
- **Main Archive**
- **Totalisers Archive**
- **RS485 port**
- **Ethernet port**
- **Text messages**
- **Device description…**
- **DST → Auto adjust** (Auto adjust, Not used) [1]

ADMINISTRATIVE DATA
- **Protected commands**
- **Users and entitlements**
- **Log out after → 10 min** (30sec, 1, 2, 3, 5, 10 mins) [2]
- **Min pass length → 3 digs** (3, 4, 5) [3]

Explanations:
[1]: „Auto adjust" means automatic winter-summer time change (recommended setting).
[2]: Idle time; automatic user logout after idle time. Users can obviously choose to logout any time before the idle time expires.
[3]: Minimum number of password characters.

10.3. Relay outputs

Relay outputs can support alarm or control functions, depending on the working mode. They can also signal exceeded alarm/control thresholds and / or measurement input failures.

→ MAIN MENU → SETTINGS → RELAY OUTPUTS

RELAY OUTPUTS
- **Output RL1** [1]
  - **Type → Alarm** (None, Alarm, Control) [2]
  - **Actives → Closed** (Closed, Open, Pulsing) [3]
- **Output RL2** [1]
  - **Type → Control** (None, Alarm, Control) [2]
  - **Actives → Closed** (Closed, Open) [4]
- **Output RL3** [1]
  - **Type → None** (None, Alarm, Control) [2]
- **Output RL4** [1]
  - **Type → None** (None, Alarm, Control) [2]
- **.....**
- **Output RL7** [1]
  - **Type → None** (None, Alarm, Control) [2]
- **Output RL8** [1]
  - **Type → None** (None, Alarm, Control) [2]

Explanations:

[1]: Each relay output can be individually set to a suitable working mode.

[2]: Relay output can be set to operate in a Signal or Control mode. The Signal mode means that a specific event actuates the output, which needs to be confirmed by the user, even if the cause of the event subsides until then. The Signal mode is typically used to enable visual or audio signaling to indicate exceeded alarm/control thresholds. The alarm will continue until it is confirmed by pressing a button on the face plate. In the Control mode, the relay output operates as a double-status control and switches on and off when the alarm/control threshold is exceeded / returns to normal, respectively.

[3]: **Alarm Closed** mode means that the relay circuit is closed when an event is reported (e.g. exceeded alarm/control threshold). When the alarm notification is confirmed with a button on the face plate, the relay reopens (the audio signal is switched off). In the **Open** mode, the relay circuit is normally closed, and is opened when an event is reported. **Pulsing** – it repeats the ALARM LED operation on the face plate. When an event is reported, the relay circuit is closed and opened in circles at approx. 1Hz frequency (e.g. a light indicator blinks - alarm notification). After the notification is confirmed, the relay circuit remains closed if the threshold continues to be exceeded (the indicator is lit). If the threshold returns to normal – the relay circuit will be opened.

[4]: In the **Control** mode, the output relay can actively close the circle if an event occurs – **Closed** (e.g. when an alarm/control threshold is exceeded). In the **Open** mode, the relay circuit is normally closed, and is opened when an event is reported.

10.4. Analog inputs (RTD, TC, 0/4-20mA, voltage, resistance)

The device has 8 or 16 universal analog inputs (depending on the recorder version). The universal analog inputs should be configured suitably to the connected sensors and measuring transducers, depending on the measurement process and its characteristics. If any parameter is set incorrectly, the measured values can be also incorrect.

 → **MAIN MENU** → **SETTINGS** → **ANALOG INPUTS**

ANALOG INPUTS

Input mux → 10 secs (3, 4, 5, 6, 10, 12, 15, 30secs, 1min) [1]

01. [Tag] [2]

Input type → **Pt100** (Pt100, Ni100, TC type J, L, K, T, U, E, N, B, R, S, 4-20mA,…) [3]

Multiplier = 1 (1,..,11) [4]

Connection → **3-wires** (3-wires, 2-wires) [5]

Adjustment = 0.00 Ω (-99,99Ω ... +99,9Ω) [6]

Filter → **Off** (Off, 2, 5, 10, 20, 30secs, 1, 2, 3, 5mins) [7]

Fail value → **None** (None, Last result, Enter…) [8]

Tag ... [9]

Format → **0000.0** (0.0000, 00.000, .., 00000) [10]

Bar 100% = 100.0 °C ([value]) [11]

Bar 0% = 0 °C ([value]) [12]

02. [Tag] [2]

Input type → **TC type J** (Pt100, Ni100, TC type J, L, K, T, U, E, N, B, R, S, 4-20mA,…) [13]

Compens. → **Input 16** (Input 01, .. Input 16, Const. value) [14]

Filter → **Off** (Off, 2, 5, 10, 20, 30secs, 1, 2, 3, 5mins) [7]

Fail value → **None** (None, Last result, Enter…) [8]

Tag ... [9]
Format → 0000.0 (0.0000, 00.000, .., 00000) [10]
Bar 100% = 100.0 °C ([value]) [11]
Bar 0% = 0 °C ([value]) [12]

03. [Tag] [2]
Input type → 4-20mA or **0-20mA** (Pt100, Ni100, TC type J, L, K, T, U, E, N, B, R, S,…) [15]
Unit → [None] ([text]) [16]
Char → Linear (Linear, Sqr Root, [user's characteristics], From file…) [19]
4 mA = 0 ([value]) or **0 mA = 0** ([value]) [17]
20 mA = 100 ([value]) [18]
Cutoff → None (None, Enter…) [20]
Filter → Off (Off, 2, 5, 10, 20, 30secs, 1, 2, 3, 5mins) [7]
Fail value → None (None, Last result, Enter…) [8]
Tag ... [9]
Format → 0000.0 (0.0000, 00.000, .., 00000) [10]
Bar 100% = 100.0 ([value]) [11]
Bar 0% = 0 ([value]) [12]

04. [Tag] [2]
Input type → Voltage (Pt100, Ni100, TC type J, L, K, T, U, E, N, B, R, S, 4-20mA,…) [21]
Unit → [None] ([text]) [16]
Char → Linear (Linear, [user's characteristics], From file…) [19]
0 mV = 0 ([value] = [value]) [22]
100 mV = 100 ([value] = [value]) [22]
Filter → Off (Off, 2, 5, 10, 20, 30secs, 1, 2, 3, 5mins) [7]
Fail value → None (None, Last result, Enter…) [8]
Tag ... [9]
Format → 0000.0 (0.0000, 00.000, .., 00000) [10]
Bar 100% = 100.0 ([value]) [11]
Bar 0% = 0 ([value]) [12]

05. [Tag] [2]
Input type → Resist. (Pt100, Ni100, TC type J, L, K, T, U, E, N, B, R, S, 4-20mA,…) [23]
Connection → 3-wires (3-wires, 2-wires) [5]
Adjustment = 0.00 Ω (-99,99Ω ... +99,9Ω) [6]
Unit → [None] ([text]) [16]
Char → Linear (Linear, [user's characteristics], From file…) [19]
0 Ω = 0 ([value] = [value]) [24]
100 Ω = 100 ([value] = [value]) [24]
Filter → Off (Off, 2, 5, 10, 20, 30secs, 1, 2, 3, 5mins) [7]
Fail value → None (None, Last result, Enter…) [8]
Tag ... [9]
Format → 0000.0 (0.0000, 00.000, .., 00000) [10]
Bar 100% = 100.0 ([value]) [11]
Bar 0% = 0 ([value]) [12]

06. [Tag] [2]
Input type → None (Pt100, Ni100, TC type J, L, K, T, U, E, N, B, R, S, 4-20mA,…) [25]

.....

15. [Tag] [2]
Input type → None (Pt100, Ni100, TC type J, L, K, T, U, E, N, B, R, S, 4-20mA,…) [25]
16. [Tag] [2]
Input type → None (Pt100, Ni100, TC type J, L, K, T, U, E, N, B, R, S, 4-20mA,…) [25]

Explanations:

[1]: **Input mux** is the measurement interval of all activated measuring channels. This parameter should be set to a value that will make changes in the measured values traceable. For example, if it is apparent from the process analysis that the

temperature inside a large water tank changes considerably within several seconds, it will be then sufficient to set the scanning interval to 15s. If the process changes every few seconds, the measurement interval every 1 minute can cause information loss in-between subsequent readings. The scanning times of less than 10s are measured at higher frequency of A/C transducer filter cut-off and can result in lower measurement precision. As a rule, the scanning time is set to 10.. 15 s.
Scanning time for specific measuring channel configurations:

- 280 ms for RTD inputs and resistance inputs (max 16 x 280 ms = 4480 ms)
- 210 ms for TC inputs (max 16 x 210 ms = 3360 ms)
- 160 ms for currency and voltage inputs (16 x 2560 ms).

It is therefore impossible to set the scanning interval to 3 s for 16 RTD channels, etc. When saving the settings, the recorder checks whether the selected scanning interval is sufficient. If not, a message appears on the display, and the scanning interval is corrected.

[2]: The number of measuring channel with description. Description in square brackets „[ ]" corresponds to the preset channel description. The description is set in the **Tag...** menu.

[3]: The measurement type corresponds to the type of measurement sensor connected to a specific analog output. In this case - resistance type sensor (RTD).

[4]: Use the multiplier to connect higher-resistance RTD sensors, e.g. Pt500 (multiplier 5). In special applications, several sensors can be connected serially (e.g. three Pt100 sensors – multiplier 3) to implement the averaged temperature measurement. Averaged measurement can be only implemented when temperature differences are small due to measurement error resulting from non-linearity of sensor characteristics.

[5]: RTD sensors can be connected in a three-wire configuration (with automatic resistance compensation of the connecting cables) or a two-wire configuration (no compensation).

[6]: Resistance correction allows the cable resistance values to be entered manually in the two-wire configuration. If the sensor is connected in a three-wire configuration (automatic compensation), the resistance correction can be used to compensate the sensor error by "offsetting" the characteristics by the positive or negative resistance value.

[7]: The filter function "smoothes out" sudden surges in the measured values or eliminates measuring noise. If the filter time constant is too high, the measurement value fluctuations can be falsified by "smoothing out" the ascending and descending slopes, or by eliminating short pulses. The filter time constant should be customized to the maximum speed of changes in the measured process.

[8]: The emergency value is the value which is displayed instead of the measurement result if the sensor is damaged. The emergency value can be set to a fixed value or the recently measured value. If the recently measured value is set, it is recommended to switch the filter to the highest time constant possible to eliminate a non-stationary state when the sensor fails. This function is used in advanced applications (in process control mode, etc.) and should be typically disabled.

[9]: Channel description is provided for reference purposes only and it provides an explanation of data currently shown on the display. The description can be entered with the keyboard from the Edit menu.

[10]: The interval is defined by the number of decimal places in the displayed result. It is unreasonable to set a too high interval as the measurement accuracy will not be improved (e.g. Pt100 sensor measurement set to three places after the decimal point will not provide for measurement accuracy of up to 0.001˚C). However, if a filter

is activated with sufficiently high time constant and if the interval is reasonably increased, the changes can be identified more clearly.

[11]: It defines the upper limit of the bar graph (trend graph) and the analog line (bar graph) range.

[12]: It defines the lower limit of the bar graph (trend graph) and the analog line (bar graph) range.

[13]: The measurement type corresponds to the type of measurement sensor connected to the specific analog output. In this case – thermoelement type sensor (thermocouple, TC).

[14]: The compensation method of thermocouple reference junction (cold junction compensation). Compensation can be provided by another measuring channel. Several compensation sensors can be used for a group of thermocouples. In particular, a fixed value can be selected for compensation; however, this type of measurement is likely to be incorrect. As a rule, Pt100 sensor connected to the last measuring channel (16) is used as a compensation sensor.

[15]: The measurement type corresponds to the type of measurement sensor connected to the specific analog output. In this case – standard analog current signal 0-20mA or 4-20mA (current loop),

[16]: The unit and the channel description are provided for reference purposes only. In the flow measurement mode, the last characters of the unit: „/s", „/min", „/h" are recognized as flow measurement units in seconds / minutes / hours, respectively. „Hz" means "pulse / s", and „kHz" – „1,000 pulses /s".

[17]: The minimum limit of the transducer range corresponding to 4 mA (or 0 mA) current is entered in the measured units (0.000 for 0 mPa – 2 MPa pressure transducer).

[18]: The upper limit of the transducer range corresponding to 20 mA current is entered in the measured units (2.000 for 0 mPa – 2 MPa pressure transducer).

[19]: A root-shaped characteristic is intended to measure the flow by means of an orifice and a pressure difference transducer and is available for 0/4-20mA inputs only. You can choose one of user characteristics available in the database or select **From file…** to add another user characteristic. An added user characteristic is automatically assigned to the configured input. The user characteristic is typically set to **Linear**.

[20]: This value is expressed in the units of a measurement range below which 0 is indicated. Cut-off can take place in flow measurements so that non-zero signal value will be indicate as an interrupted flow (indicated value = 0) in case of transducer or recorder calibration error. The cut-off value is typically set to up to 0.1% of the range. For example: flow transducer with the total range of 0.00 - 20.00 t/h, 0.02 t/h cut-off; a signal from the transducer corresponding to the range of 0.00 – 0.02 t/h is considered to equal 0.00 t/h.

[21]: The measurement type corresponds to the type of measurement sensor connected to the specific analog output. In this case, -800 mV …+800 mV voltage signal.

[22]: Selecting the measurement range and recalculating voltage into a measured value. If the measurement range is exceeded by ± 5%, the sensor (transducer) will be assumed to operate incorrectly.

[23]: The measurement type corresponds to the type of measurement sensor connected to the specific analog output. In this case, 0…5000 Ω resistance signal.

[24]: Selecting the measurement range and recalculating resistance into a measured value. If the measurement range is exceeded by ± 5%, the sensor (transducer) will be assumed to operate incorrectly. If the failure threshold is lower than 0 Ω, no failure will be indicated.

[25]: If the measurement is set to **None**, the relevant measuring channel will not be displayed and measured.

10.5. Digital inputs

The recorder can be fitted with 4 (in 16-channel version) or 2 (in 8-channel version) binary inputs (shorting / disconnection). Binary inputs can be used for status tracing, pulse counting and frequency measurement.

In the status tracing mode, shorting / disconnection status should have specific numerical values assigned. The measurement result will be expressed in one of these values, irrespective of the actual condition. In addition, each of the states can have a specific recorder response assigned, as is the case with exceeded alarm/control thresholds (see Section 10.8).

In the pulse counting mode, the instantaneous value is calculated on the basis of current frequency, and the totalisers assigned to this particular result count pulses multiplied by a set rate instead of counting subsequent instantaneous values.

The inputs can also measure frequency within the range of 0.001 Hz - 10 kHz. The frequency can be recalculated to a measured value according to linear characteristic or user characteristic. For linear characteristic, introduce two points, i.e. two values corresponding to two different frequencies. The measurement result can be also displayed as a measured frequency w/o being converted into other units. You only need to enter „Hz" or „kHz" units. For binary inputs in the frequency measurement mode, alarm/control thresholds can be used as well, the same as for analog inputs.

→ MAIN MENU → SETTINGS → DIGITAL INPUTS

DIGITAL INPUTS
17. [Tag] [1]
- **Type → State** (State, Frequency, Pulse, None) [2]
- **Unit → [None]** ([text]) [3]
- **Closed = 1** ([value]) [4]
- **Open = 0** ([value]) [5]
- **Action when closed**
  - **Alarm → No** (No, Message only, RL1, .., RL8) [6]
  - **Control → Nie** (No, RL1, .., RL8) [7]
  - **Event → No** (No, Yes) [8]
  - **Swap intervals → No** (No, Yes) [9]
- **Action when open**
  - **Alarm → No** (No, Message only, RL1, .., RL8) [6]
  - **Control → Nie** (No, RL1, .., RL8) [7]
  - **Event → No** (No, Yes) [8]
  - **Swap intervals → No** (No, Yes) [9]
- **Tag ...** [10]

18. [Tag] [1]
- **Type → Frequency** (State, Frequency, Pulse, None) [2]
- **Unit → [None]** ([text]) [3]
- **Char → Linear** (Linear, [user's characteristics], From file) [16]
- **0 Hz = 0** ([value] Hz = [value]) [15]
- **1 Hz = 0** ([value] Hz = [value]) [15]
- **Cutoff → None** (None, Enter…) [17]
- **Tag ...** [10]
- **Format → 0000.0** (0.0000, 00.000, .., 00000) [11]
- **Bar 100% = 100.0** ([value]) [12]

Bar 0% = 0 ([value]) [12]

19. [Tag] [1]

Type → Pulse (State, Frequency, Pulse, None) [2]
Unit → [None] ([text]) [3]
1 imp = 1[unit] ([value] imp. = value [unit]) [14]
Tag ... [10]
Format → 0000.0 (0.0000, 00.000, .., 00000) [11]
Bar 100% = 100.0 ([value]) [12]
Bar 0% = 0 ([value]) [12]

20. [Tag] [1]

Type → None (State, Frequency, Pulse, None) [2]

Explanations:

[1]: The number of a measuring channel with description. Description in square brackets „[ ]" corresponds to the preset channel description. The description is set in the **Tag...** menu.

[2]: Input operation mode: status tracing, frequency measurement or pulse counting.

[3]: The unit and the channel description are provided for reference purposes only. In the flow measurement mode, the last characters of the unit: „/s", „/min", „/h" are recognized as flow measurement units in seconds / minutes / hours, respectively. „Hz" means "pulse / s", and „kHz" – „1,000 pulses /s".

[4]: Numerical value is displayed (result) if the output is shorted.

[5]: Numerical value is displayed (result) if the output is disconnected.

[6]: A signal indicates a status change notification (shorting / disconnection) that needs to be confirmed by the user even when it subsides beforehand. Status change can be signaled with a message on the display (**Message only**) or additionally with a relay output (**RL1** - **RL8**). From the eight listed relays, you can only select relays pre-set as signaling relay outputs.

[7]: Control setting to either of the listed output relays activates the selected relay when the respective status (shorting / disconnection) is present on the input.

[8]: Status change notification (along with date and time) can be recorded in the Event Log.

[9]: Binary inputs can control the recording process of measurement results. Two different recording intervals can be set. The selected status can switch from **Rec interval I** to **Rec interval II**. In particular, if either recording interval is set to **PAUSE**, the status on the input can cause the recording to switch on / off.

[10]: Channel text description is provided for reference purposes only and it provides an explanation of data currently shown on the display. The description can be entered with the keyboard from the Edit menu.

[11]: The resolution is defined by the number of decimal places in the displayed result.

[12]: It defines the upper limit of the bar graph (trend graph) and the analog line (bar graph) range.

[13]: It defines the lower limit of the bar graph (trend graph) and the analog line (bar graph) range.

[14]: The pulse weight can be set by entering the value corresponding to a defined number of pulses.

[15]: Selecting the measurement range and recalculating the frequency into a measurement value (for linear characteristic only).

[16]: You can choose one of user characteristics available in the database or select **From file…** to add another user characteristic. An added user characteristic is

automatically assigned to the configured input. The user characteristic is typically set to **Linear**.

[17]: This value is expressed in the units of a measurement range below which 0 is indicated. Cut-off can take place in flow measurements so that non-zero signal value will be indicated as an interrupted flow (indicated value = 0) in case of transducer or recorder calibration error. The cut-off value is typically set to up to 0.1% of the total range. For example: flow transducer with the total range of 0.00 - 20.00 t/h, 0.02 t/h cut-off; signal from the transducer corresponding to the range of 0.00 – 0.02 t/h is considered to equal 0.00 t/h.

10.6. Math channels

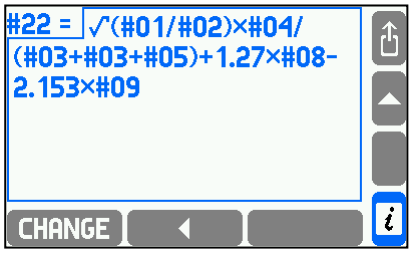
Up to 16 values can be calculated as the functions of measurement results. Each calculated value is defined with a separate formula. As is the case with measurement inputs, you can also define the unit, description, display interval and bar graph range. The calculated values are indicated with 21…36 symbols.

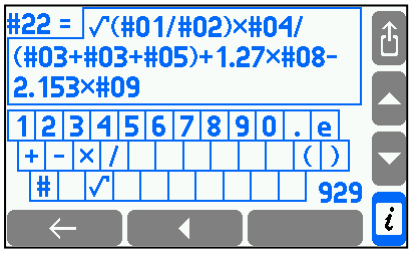
Formulas can be entered with a special editor. The formulas can consist of:

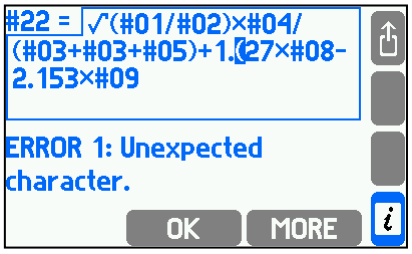
- the results from measurement inputs (**#01; #02; #18**),
- other calculated results (**#21; #22**),
- fixed values (**12; 15.0; 1.0e5; 3.3e-7**),
- calculation symbols: addition (+), subtraction (-), multiplication (x) and division (/),
- square root symbol,
- brackets to determine the order of calculations,

The total length of all formulas can consist of up to 967 characters. The editor in the right bottom corner of the screen displays the remaining number of characters. The symbols of measurement inputs and calculation values (**#01, #24**) are counted as a single character.

The editor checks the correctness of the entered formula syntax and indicates errors, where appropriate (with a message displayed).







Examples of formulas:

#01-#02	difference between the measurement result on input 01 and the result on input 02.
(#05+#06+#07+#08)/4	average value of measurement results on inputs 05, 06, 07 and 08.

`(#01+#02)/(#01+#02+ #03+#04+#05)x100`	percentage share of flows measured with inputs 01 and 02 in the total flow measured with inputs 01…05.

→ MAIN MENU → SETTINGS → MATH CHANNELS

MATH CHANNELS
- **21. [Tag]** [1]
  - **Formula …** [2]
  - **Unit → [None]** ([text]) [3]
  - **Tag ...** [4]
  - **Format → 0000.0** (0.0000, 00.000, .., 00000) [5]
  - **Bar 100% = 100.0** ([value]) [6]
  - **Bar 0% = 0** ([value]) [7]
- **22. [Tag]** [1]
  - **Formula …** [2]
- **.....**
- **36. [Tag]** [1]
  - **Formula …** [2]

Explanations:

[1]: The number of a calculated value with description. Description in square brackets „[ ]" corresponds to the preset channel description. The description is set in the **Tag...** menu.

[2]: The formula that defines the calculated value. If the formula is absent, the calculated value is disabled. The remaining menu settings are not displayed.

[3]: The unit and the channel description are provided for reference purposes only. In the flow measurement mode, the last characters of the unit: „/s", „/min", „/h" are recognized as flow measurement units in seconds / minutes / hours, respectively. „Hz" means "pulse / s", and „kHz" – „1,000 pulses /s".

[4]: Channel text description is provided for reference purposes only and it provides an explanation of data currently shown on the display. The description can be entered with the keyboard from the Edit menu.

[5]: The resolution is defined by the number of decimal places in the displayed result.

[6]: It defines the upper limit of the bar graph (trend graph) and the analog line (bar graph) range.

[7]: It defines the lower limit of the bar graph (trend graph) and the analog line (bar graph) range.

10.7. Failure signaling of measuring transducers

Analog inputs (measuring channel 01 – 16) can detect emergency conditions of the transducer (break, shorting, exceeded threshold – depending on the input type). Depending on the configuration, emergency status can be signaled with a message on the display, alarm notification, activation of control relay or an entry in the Event Log. If relay inputs are to signal a failure, they should be preset accordingly (see Section 10.3).

→ MAIN MENU → SETTINGS → SENSORS FAILURES

SENSORS FAILURES
- **01.[Tag]** [1]
  - **Alarm → No** (No, Message only., RL1, .., RL8) [2]

Control → No (No, RL1, .., RL8) [3]
Event → None (None, Both, Failure, Recovery) [4]
Send a text → No (No, Yes) [5]

02.[Tag] [1]
Alarm → No (No, Message only., RL1, .., RL8) [2]
Control → No (No, RL1, .., RL8) [3]
Event → None (None, Both, Failure, Recovery) [4]
Send a text → No (No, Yes) [5]

.....

16.[Tag] [1]
Alarm → No (No, Message only., RL1, .., RL8) [2]
Control → No (No, RL1, .., RL8) [3]
Event → None (None, Both, Failure, Recovery) [4]
Send a text → No (No, Yes) [5]

Explanations:

[1]: Each analog input (measuring channels 01 – 16) can have an individual reaction to an alarm condition assigned. Description in square brackets „[ ]" corresponds to the preset channel description.

[2]: A signal indicates a status change notification that needs to be confirmed by the user even when it subsides beforehand. Status change can be signaled with a message on the display (**Message only**) or additionally with a relay output (**RL1** - **RL8**). From the listed relays, you can only select relays preset as signaling relay outputs. As a rule, a single relay is selected to signal a failure (RL8, etc.) and connected to an audio or light indicator, and the failure status of all channels is assigned to this single relay. If the failure signaling is set to **No**, the failure will not be signaled. This setting is not recommended although can be desirable if the measurement sensor is frequently disconnected.

[3]: Control setting to either of the listed output relays activates the selected relay if any failure is detected. This setting is primarily assumed to define the recorder reaction if any measurement sensor fails during the control process. For example, if the device controls fan activation in response to exceeded temperature value limit, then if the sensor is broken, it can be defined whether the fan is to be switched on or off.

[4]: If any failure is detected on the measurement input, the failure can be entered in the Event Log (with its date and time). Depending on the settings, the Event Log can include **Both**, **Failure** or **Recovery** type entries.

[5]: Sending text message when failure occurs. This feature requires a GSM modem to be connected and properly configured.

10.8. Alarms and control

Each measuring channel can have four independent alarm/control thresholds (levels) defined. Each threshold can be set to „max" or „min" and used for alarm signaling and / or control, or can change either of the two recording intervals. Information on exceeded thresholds can be recorded in the Event Log. Each alarm/control threshold can have a colour assigned.

→ MAIN MENU → SETTINGS → ALARMS AND CONTROL

ALARMS AND CONTROL
01.[Tag] [1]
Threshold 1 [▲58] [2]

Tryb → High (Off, High, Low) [3]
Level = 58 ˚C [4]
Hysteresis = 0.5 ˚C [5]
Alarm → No (No, Message only., RL1, .., RL8) [6]
Control → No (No, RL1, .., RL8) [7]
Event → None (None, Both, Crossing., Releasing) [8]
Send a text → No (No, Yes) [11]
Swap intervals → No (No, Yes) [9]
Colour → Red (No change, Green, Yellow, Red)[10]

Threshold 2 [▼-15] [2]
Tryb → Low (Off, High, Low) [3]
Level = -15 ˚C [4]
Hysteresis = 0.2 ˚C [5]
Alarm → No (No, Message only., RL1, .., RL8) [6]
Control → No (No, RL1, .., RL8) [7]
Event → None (None, Both, Crossing., Releasing) [8]
Send a text → No (No, Yes) [11]
Swap intervals → No (No, Yes) [9]
Colour → Red (No change, Green, Yellow, Red)[10]

Threshold 3 [2]
Tryb → Off (Off, High, Low) [3]
Threshold 4 [2]
Tryb → Off (Off, High, Low) [3]

02.[Tag] [1]
Threshold 1 [2]
Tryb → Off (Off, High, Low) [3]
Threshold 2 [2]
Tryb → Off (Off, High, Low) [3]
Threshold 3 [2]
Tryb → Off (Off, High, Low) [3]
Threshold 4 [2]
Tryb → Off (Off, High, Low) [3]

.....

36.[Tag] [1]
Threshold 1 [2]
Tryb → Off (Off, High, Low) [3]
Threshold 2 [2]
Tryb → Off (Off, High, Low) [3]
Threshold 3 [2]
Tryb → Off (Off, High, Low) [3]
Threshold 4 [2]
Tryb → Off (Off, High, Low) [3]

Explanations:

[1]: Each channel has four individually programmable alarm/control thresholds. Description in square brackets „[ ]" corresponds to the preset channel description.

[2]: All pre-programmed thresholds will have an operation mode **(▲- High, ▼- Low)** and the operation mode level indicated in brackets „[ ]".

[3]: The threshold can be set to **High** (active above a specific level) or **Low** (active below a specific level) operation mode.

[4]: The threshold level value is entered in the measured value units assigned to a specific measuring channel. The unit (˚C, etc.) is entered automatically.

[5]: The hysteresis value is the difference between the threshold value exceedance and return to normal. The threshold hysteresis value is entered in the measured value

units assigned to a specific measuring channel. The unit (˚C, etc.) is assigned automatically. For example, for a threshold set to **High**, 58 ˚C threshold level and 0.5 ˚C hysteresis means that the threshold will be exceeded above 58 ˚C, and will return to normal below 57.5 ˚C (58-0.5). For a threshold set to **Low**, -15 ˚C threshold level and 0.2˚C hysteresis means the threshold will be exceeded below -15 ˚C, and will return to normal above -14.8 ˚C (-(15-0.2)).

[6]: The same as for failure signaling. A signal indicates an exceeded threshold notification that needs to be confirmed by the user even when it subsides beforehand. Exceeded threshold can be signaled with a message on the display (**Message only**) or additionally with a relay output (**RL1** - **RL8**). From the listed relays, you can only select relays preset as signaling relay outputs. In a typical application, alarm signaling is arranged by grouping exceeded thresholds from different channels to a single or several relays.

[7]: Control setting to either of the listed output relays activates the selected relay if any alarm/control threshold is exceeded. Select appropriate threshold and hysteresis values to support simple binary on/ off control operations. For example, when a fan is connected to a correctly preset output relay and when the **High** threshold is set to 50 ˚C with 8 ˚C hysteresis, the fan will be switched on and off when the temperature level is above 50 ˚C or below 42 ˚C, respectively.

[8]: The same as for failure signaling, exceeded threshold notification (along with its date and time) can be recorded in the Event Log. Depending on the settings, the Event Log can include **Both**, **Crossing** or **Releasing** entry type.

[9]: The recording of measurement results can be controlled by means of exceeded alarm/control thresholds. Two different recording intervals can be set. The exceeded threshold can switched from **Rec interval I** to **Rec interval II**. In particular, if either recording interval is set to **PAUSE**, the recording can be switched on / off when the threshold (or several thresholds from different channels) is exceeded.

[10]: In addition, each alarm/control threshold can have a color (green - low priority, yellow, red – high priority) assigned. If the threshold is exceeded, the result is displayed in a different color. If the threshold is exceeded more than once, the highest priority color is displayed.

[11]: Sending text message when failure occurs. This feature requires a GSM modem to be connected and properly configured.

10.9. Totalisers

One or two totalisers can be used for each measurement output and calculated value with a flow unit. The flow unit needs to be entered as: „…/s”, „…/min”, „…/h”, „Hz” or „kHz”. The totaliser unit is created automatically be deleting the ending, i.e. if the totaled quantity is expressed in „kg/h”, the totaliser unit will be „kg”; if the total quantity is expressed in „Hz”or „kHz”, the totaliser has no unit assigned.

Each enabled totaliser is updated every 1 second according to the instantaneous value of the totaled quantity. The conversion factor is selected automatically based on the applicable unit. Example: if the totaled instantaneous value is 180 kg/h, 0.05 kg is added every second to the totaliser. The value added to the totaliser can be both, positive and negative.

Totaliser update for binary inputs operating in the frequency measurement mode is somewhat different. The totaliser value is increased / decreased every 1 second as well, but according to the number of pulses recorded within the last second. Example: water

mass flow is measured with a pulse water meter. The water meter is connected to a binary input set to the pulse counting mode. The pulse weight is 10 dm^3. At a specific speed of the water meter, subsequent pulses arrive every 20 seconds, and the frequency equals 0.05 Hz. Instantaneous value of the mass flow is 0.5 dm^3/s. The instantaneous value is not totaled by the totalisers (if assigned to the input), but instead the totalisers increase their status by 10 dm^3 every 20 seconds, with each incoming pulse.

→ MAIN MENU → SETTINGS → TOTALISERS

TOTALISERS
- **01.[Tag]** [1]
  - **Totaliser Σ1**
    - **Type → On** (Off, On) [2]
    - **Format → 00000** (0.0000, 00.000, .., 00000) [3]
  - **Totaliser Σ2**
    - **Type → Off** (Off, On) [2]
- **02.[Tag]** [1]
  - **Totaliser Σ1**
    - **Type → Off** (Off, On) [2]
  - **Totaliser Σ2**
    - **Type → Off** (Off, On) [2]

.....

- **36.[Tag]** [1]
  - **Totaliser Σ1**
    - **Type → Off** (Off, On) [2]
  - **Totaliser Σ2**
    - **Type → Off** (Off, On) [2]

Explanations:

[1]: There are two independent totalisers available for each channel (measurement input or calculated value). The Totalisers menu include no channels that are disabled or set to °C (that measure or calculate temperature).

[2]: Switching the totaliser on and off.

[3]: The number of decimal places displayed. It has no effect on the calculation accuracy and can be changed any time without affecting the totaliser status.

10.10. Nominal month beginning

This option applies to the periodically resetting totalisers and the monthly register ed totaliser log. Specifies the contractual beginning of the month as any full hour on any day of the month between 1 and 28 or the last day of the month.

→ MAIN MENU → SETTINGS → NOMINAL MONTH BEGINNING

Day = 1 ([value])
Hour = 0 ([value])

10.11. Record measurement results in the internal memory.

Select channel to be recorded, set the recording interval and mode (continuous or until the memory is full). The recorder can operate at two different recording intervals (I and II) and can be controlled by exceeded pre-programmed alarm/control thresholds or changes in the binary input status (see Section 10.5 and 10.8).

→ MAIN MENU → SETTINGS → MAIN ARCHIVE

MAIN ARCHIVE

Rec interval I → 10 secs (PAUSE, 3, 4, 5, 6, 10, 12, 15, 20, 30secs, 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30mins, 1, 2, 3, 4, 6, 8, 12, 24h) [1]

Rec interval II → 10 secs (PAUSE, 3, 4, 5, 6, 10, 12, 15, 20, 30secs, 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30mins, 1, 2, 3, 4, 6, 8, 12, 24h) [2]

Archived process values [3]

01	02	03	04	05	06	07	08
09	10	11	12	13	14	15	16
17	18	19	20				
21	22	23	24	25	26	27	28
29	30	31	32	33	34	35	36

Mode → Successive files (Successive files, One file, Overwrite) [4]

File size → Entire memory (Entire memory, 2 MB, 4 MB, 8 MB, 16 MB, 32 MB, 64 MB, 128 MB, 256 MB, 24H, Week, Month) [5]

Explanations:

[1]: The basic recording interval (I). Recording interval should correspond to the measurement process. If the recording interval is too short, the large data volumes will make it difficult to analyze the results. If the recording interval is too long, rapid changes in the measured values cannot be identified. If the recording is set to **PAUSE**, the recording will not take place even if the recording function is switched on. **PAUSE** settings can be preferably used for the second recording interval (II). The recording will be then normally paused, and the results will be recorded only if an alarm/control threshold is exceeded.

[2]: The second recording interval (II) is used when the recording is controlled by exceeded alarm/control thresholds (see Section 10.8). If this function is not typically used, set the interval to **PAUSE**. Other intervals can affect the time scale settings when the recorded results are displayed.

[3]: Select channels in the table that are to be recorded.

[4]: Results can be recorded in a **One file** mode, i.e. it will be discontinued when the file size reaches the level set in **File size**. In the **Successive files**, if the recorded file size reaches the volume set in the **File size,** the recording continues until the next file is created automatically. **Overwrite** mode means that the oldest files will be overwritten.

[5]: The archive file size can be limited. The file size limit makes it easier to process the files on a PC.

10.12. Totalisers Archive

Totalisers are typically archived every 15 minutes.

→ MAIN MENU → SETTINGS → TOTALISERS ARCHIVE

TOTALISERS ARCHIVE

Archived totalisers [1]

$\Sigma_1$01	$\Sigma_2$01	$\Sigma_1$02	$\Sigma_2$02
$\Sigma_1$03	$\Sigma_2$03	$\Sigma_1$04	$\Sigma_2$04
$\Sigma_1$05	$\Sigma_2$05	$\Sigma_1$06	$\Sigma_2$06
$\Sigma_1$07	$\Sigma_2$07	$\Sigma_1$08	$\Sigma_2$08
$\Sigma_1$09	$\Sigma_2$09	$\Sigma_1$10	$\Sigma_2$10
$\Sigma_1$11	$\Sigma_2$11	$\Sigma_1$12	$\Sigma_2$12
$\Sigma_1$13	$\Sigma_2$13	$\Sigma_1$14	$\Sigma_2$14
$\Sigma_1$15	$\Sigma_2$15	$\Sigma_1$16	$\Sigma_2$16
$\Sigma_1$17	$\Sigma_2$17	$\Sigma_1$18	$\Sigma_2$18
$\Sigma_1$19	$\Sigma_2$19	$\Sigma_1$20	$\Sigma_2$20
$\Sigma_1$21	$\Sigma_2$21	$\Sigma_1$22	$\Sigma_2$22
$\Sigma_1$23	$\Sigma_2$23	$\Sigma_1$24	$\Sigma_2$24
$\Sigma_1$25	$\Sigma_2$25	$\Sigma_1$26	$\Sigma_2$26
$\Sigma_1$27	$\Sigma_2$27	$\Sigma_1$28	$\Sigma_2$28
$\Sigma_1$29	$\Sigma_2$29	$\Sigma_1$30	$\Sigma_2$30
$\Sigma_1$31	$\Sigma_2$31	$\Sigma_1$32	$\Sigma_2$32
$\Sigma_1$33	$\Sigma_2$33	$\Sigma_1$34	$\Sigma_2$34
$\Sigma_1$35	$\Sigma_2$35	$\Sigma_1$36	$\Sigma_2$36

Explanations:

[1]: Select totalisers in the table that are to be recorded. If a selected totaliser is unavailable (no totalisers defined for a specific channel), it will be crossed out.

10.13. RS485 port

RS-485 port settings are essential if the device is to be connected to a PC. Recorder settings must correspond to the PC settings, otherwise the communication will fail.

→ MAIN MENU → SETTINGS → RS485 PORT

RS485 PORT

Type → ASCII (ASCII, Modbus RTU, GSM) [1]
Device Addr = 1 (0, 1, .., 99) [2]
Baud rate → 115200 (1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200) [3]
Parity → EVEN (NONE, EVEN, ODD) [4]
CRC7 check → Yes (No, Yes) [5]
Min delay → 50 ms (10, 20, 30, 50, 70, 100, 150, 200, 300, 400) [6]
Max delay → 700 ms (500, 600, 700, 800, 1000) [7]

Explanations:

[1]: Selecting the operation mode (protocol). ASCII protocol communicates with MPI-C-Raport software. Modbus RTU is a standard protocol that can communicate with universal visualization software. GSM protocol communicates with GSM module.

[2]: In RS-485 standard, up to 32 transmitters / receivers can be connected to the data transmission line. Each slave-type device has a different address assigned.

[3]: Transmission speed should be set to the highest value. For high distances or high interference level, data transmission speed should be perhaps decreased. Low transmission speed extends the reading time of results saved in the internal memory, which is particularly noticeable when the archive files are processed.
[4]: Parity control of each bite. It is recommended to set it to **EVEN** or **ODD** mode.
[5]: This setting applies to the ASCII mode only. CRC control – each string of characters that is sent to or from the recorder has a byte of the CRC checksum. If the PC software fails to calculate the CRC checksum in a command sent to the recorder, this particular parameter should be set to **No**. The recorder then ignores the checksum value (although it calculates and sends it in the response).
[6]: Minimum delay is the delay of responses (the recorder will send the requested data no sooner than after the minimum delay time). As a rule, the min. delay time should be set to 50 ms in applications for MS Win 98SE / XP. In radio modems and other special data transmission instruments, the minimum delay time should be perhaps set otherwise.
[7]: This setting applies to the ASCII mode only. The maximum delay is the time by which a response must be sent to the command received by the recorder. The maximum delay should be typically set to 700 ms. As a rule, the recorder "responds" immediately after the minimum delay, but at times the process can support other tasks of higher priority than data transmission via communication port. If the maximum delay is too long, the PC's maximum timeout can be exceeded.

10.14. Ethernet Port

Configuration of the Ethernet port parameters.

→ MAIN MENU → SETTINGS → ETHERNET PORT

ETHERNET PORT
IP → 1.0.0.1 [1]
Port = 502 [2]
Mask → 255.255.255.0 [1]
Gate → 1.0.0.1 [1]
DHCP server → Off (Off, On) [3]
Timeout = 60 secs [4]

Explanations:
[1]: These parameters should correspond to the network where the recorder is intended to operate.
[2]: It is recommended to use the 502 port dedicated to Modbus TCP.
[3]: Switch the DHCP server off.
[4]: Connection timeout defines the maximum time without data exchange between the master device and the recorder. If this time has lapsed, the connection is closed automatically (it is found inactive due to emergency deactivation of the master device, etc.)

10.15. Text messages

→ MAIN MENU → SETTINGS → TEXT MESSAGES

TEXT MESSAGES

PIN → None / Enter… [1]
Mobile numbers [2]
Unknown numbers → No / Yes [3]
Combine → No / Yes [4]
Header → No / Yes [5]
Report [6]
Process values to be sent [7]
Totalisers to be sent [8]
Send → On request / Daily / Weekly / Monthly [9]

Explanations:

[5]: The PIN code should be entered only if the SIM card installed in the GSM module is protected by the PIN code.

[6]: The phone numbers list (max 3) which will be sent the notifications of alarms, failures and periodic reports.

NEW ONE - addition of the new phone number

REMOVE - deletion the item from the list

TEST - sending selected phone number (currently highlighted) a test SMS

[7]: If the option **Unknown numbers** is marked as **No**, the incoming queries from beyond the configured in the device list of phone numbers will be ignored.

[8]: If the option **Combine** is marked as **Yes** the simultaneous events will be combined in a single message.

[9]: If the option **Header** is marked as **Yes** the header, which is consist with symbol, version and description of the device, will be attached to the message.

[10]: The submenu to configure the content and frequency of sending text messages with current process values and totalisers.

[11]: In the table the arrows are used to add (ADD ON) and remove (REMOVE) chosen current process values in the sent SMS.

[12]: In the table the arrows are used to add (ADD ON) and remove (REMOVE) chosen totalisers in the sent SMS.

[13]: If the option **On request** will be chosen the reports will be sent only as a response to the request from the user (a text message with the text "Report"). Otherwise the reports will be sent periodically, accordingly: daily (the hour which the SMS will be sent on should be specified), weekly (the hour and the day of week which the SMS will be sent on should be specified) and monthly (the hour and the day of month which the SMS will be sent on should be specified).

10.16. Results display

To configure the results display settings, go to the first item in **Settings** menu to be able to quickly and easily reset the results display settings during normal operation. When the recorder parameters are set for the first time, it is recommended to perform this operation at the end of the configuration procedure.

The results displaying mode should be customized to specific user requirements and needs. Users are offered numerous results display functions and options. It is at times unreasonable to make all the display options available in order to keep the recorder operation simple. It is therefore recommended to analyze the measurement needs and to limit the results displaying options.

→ MAIN MENU → SETTINGS → DISPLAY

DISPLAY

INDIVIDUAL SCREENS

Auto interval → 2 secs (0.7, 1, 1.5, 2, 3, 4, 5) [1]

01.[Tag] [2]

Auto-browse → Yes (Yes, No) [3]
Large digits → Primary (Primary, Visible, Hidden) [4]
Trend graph → Visible (Primary, Visible, Hidden) [4]
Bar graph → Visible (Primary, Visible, Hidden) [4]
Totalisers 1, 2 → Visible (Primary, Visible, Hidden) [4]
Min, max → Visible (Primary, Visible, Hidden) [4]
Min, max (bar) → Visible (Primary, Visible, Hidden) [4]

.....

36.[Tag] [2]

Auto-browse → Yes (Yes, No) [3]
Large digits → Primary (Primary, Visible, Hidden) [4]
Trend graph → Visible (Primary, Visible, Hidden) [4]
Bar graph → Visible (Primary, Visible, Hidden) [4]
Totalisers 1, 2 → Visible (Primary, Visible, Hidden) [4]
Min, max → Visible (Primary, Visible, Hidden) [4]
Min, max (bar) → Visible (Primary, Visible, Hidden) [4]

SUMMARY SCREENS

Table 1

Auto-browse → Yes (Yes, No) [3]
Print → Large (Large, Small) [6]
Line 1 → Empty (01, 02 … 36) [7]
Line 2 → Empty (01, 02 … 36) [7]
Line 3 → Empty (01, 02 … 36) [7]
Table tag…

…

Table 6

Auto-browse → Yes (Yes, No) [3]
Print → Small (Large, Small) [6]
Line 1 → Empty (01, 02 … 36) [7]
…
Line 1 → Empty (01, 02 … 36) [7]
Table tag…

SPECIAL SCREENS

Table → Visible (Visible, Hidden) [5]
Bar chart → Visible (Visible, Hidden) [5]
Thresholds → Visible (Visible, Hidden) [5]
Relay outputs → Visible (Visible, Hidden) [5]
Date and time → Visible (Visible, Hidden) [5]
Main archive → Visible (Visible, Hidden) [5]

LCD DISPLAY

Backgroud colour → White (Black, White) [8]
Backlight → 3 mins (1, 2, 3, 5, 7, 10 mins, still ON) [9]
Backlight brightness = 90% (50, 55 … 100%) [10]
Dimmed backlight = 35% (0, 5 … 45%) [11]

Explanations:

[1]: To display the measurement results in a sequence, press and hold „▲” or „▼”. Display time in the „auto” mode defines the display time of each result. This setting can be customized according to individual user preferences.

[2]: The results displaying mode can be set for each channel individually, according to user's preferences. Description in square brackets „[ ]" corresponds to the preset channel description.

[3]: "No" means that the channel will not be included in sequential browsing in the "auto" mode. In the "auto" mode, you will be able to browse through the selected most important channels only. All channels are available in the manual browsing mode.

[4]: The measurement results can be displayed as: large digits (**Large digits**), as a trend graph in time (**Trend graph**), as an analog line (**Bar graph**), along with totalisers (**Totalisers**), as a numerical result with the saved maximum, minimum and average value (**Min, max**) or as a line (**Min, max (bar)**). Each screen can be set to the **Hidden** mode. Only one screen can be set to a **Primary** status and shown as the first screen after switching to the applicable channel. When all channel screens are **Hidden**, the channel remains active but is not displayed. **Totalisers** screen is displayed in the menu only for channels with at least one active totaliser.

[5]: When the results from subsequent channels are browsed manually, special screens will be displayed after the last channel: tables (**Table**), bar charts (**Bar chart**), alarm/control thresholds (**Thresholds**), relay outputs (**Relay outputs**), real-time clock (**Date and time**), and archive status screen (**Main archive**). Each screen can be **Hidden**. Hidden screens will not be displayed, but the screen functions will remain active.

[6]: Tables show tabulated measurement results from several channels. If large digits option is selected, a single table can include the results from up to three channels. If small digits option is selected, a single table can include the results from up to six channels.

[7]: Selecting channels whose results are to be displayed in a specific table.

[8]: Selecting the background color. It can be black and white.

[9]: LCD backlight can be **still ON** (continuously active) or can go out after a preset idle time (1 min - 10 min). The LCD will be backlit after any button is pressed.

[10]: Backlight brightness can be set within the range of 50% - 100%, at 5% increments. Unlike all other functions, these settings are introduced instantly.

[11]: Backlight brightness can be set within the range of 0% - 45%, at 5% increments when the LCD backlight is off. Use TEST to display the changed dimmed backlight brightness.

10.17. Device description

→ MAIN MENU → SETTINGS

SETTINGS

Device description = Process Data Recorder

10.18. Automatic winter-summer time adjustment

→ MAIN MENU → SETTINGS

SETTINGS

DST → Auto adjust (Auto adjust, Not used) [1]

Explanations:

[1]: **DST** function when **Auto adjust** is on guarantees automatic clock adjustment when the winter / summer time change is due. This function should be switched off only if specifically required.

10.19. Saving to and loading settings from a file

Recording the device settings to an external USB data storage is available for all users. Loading settings is available for the administrator, for all users unless it was defined as protected activity (see Section 11.2), and for users with permissions to perform all activities protected.

 → MAIN MENU → LOAD OR SAVE SETTINGS

LOAD OR SAVE SETTINGS
Load [1]
Save [2]

Explanations:

[1]: The device settings can be loaded from a flash drive connected to the USB port on the front panel of the instrument. This feature allows to restore previous settings, copy settings to another device or device configuration in case of periodically work in different measuring systems. Loading setings irretrievably override all settings, including passwords.

[2]: Saving settings is possible only with the flash drive in USB port. Saving settings creates two files: *SETT_[addr].set* and *SETT_[addr].txt*. If in the memory flash drive files with the same name already exist, hey will be overwritten. In order to keep in storage a few different settings files, after saving the settings, change the file name *SETT _[addr].set* and *SETT _[addr].txt* but keep the extension "set" and ".txt". File *SETT _[addr].txt* is a text file for informational purposes only. Loading settings are made only from a binary file with the extension ".set".

11. FUNCTIONS AVAILABLE TO THE ADMINISTRATOR ONLY

Functions described in this section are reserved for the administrator only (ADMIN user, initial password: „1”).

11.1. Change administrator password

To change the administrator password, log in as an administrator and proceed as for user password changing.

→ MAIN MENU → CHANGE PASSWORD

The password is changed after a new numerical code is entered twice.

If the administrator forgets his/her password, it is necessary to contract the manufacturer. You will then be asked to provide a numerical code. To generate the code, enter any password and select NEW. A new password will be assigned on the basis of this numerical code.

The administrator can also change the password of any user without the user's prior consent. This function is defined in detail in the section **Administrative data → Users and entitlements**.

11.2. Administrative data

The administrator selects the functions that are to be protected with a password. He/she creates new users, assigns user names and generates passwords (numerical codes). The administrator also defines user entitlements.

When the device settings are introduced for the first time, it is recommended to start with password assignment, and then to create users and assign specific user entitlements.

→ MAIN MENU → ADMINISTRATIVE DATA

ADMINISTRATIVE DATA
- **PROTECTED COMMANDS** [1]
  - **Archiving commands → No** (Yes, No) [2]
  - **Copy files → No** (Yes, No) [3]
  - **Resetting min,max → No** (Yes, No) [4]
  - **Adjusting clock → No** (Yes, No) [5]
  - **Resetting totalisers → No** (Yes, No) [6]
  - **Main settings → No** (Yes, No) [7]
  - **Threshold settings → No** (Yes, No) [8]
  - **Screen settings → No** (Yes, No) [9]
  - **Archiving settings → No** (Yes, No) [10]
- **USERS AND ENTITLEMENTS** [11]
- **Log out after → 3 mins** (30 secs, 1, 2, 3, 5, 10 mins) [12]
- **Min. pass length → 3 digs** (3, 4, 5) [13]

Explanations:

[1]: User operations are divided into groups. Each group of operations can be protected with a password and user name. The passwords can be assigned to none of the user operations (it is always necessary to type a password from the keyboard, which can be time consuming), to specific user operations (new settings, etc.) or to all possible operations (whenever measurements and recordings need to be documented and many unauthorized persons can tamper with the settings). Select **Yes** to assign a password to the selected group of operations.

[2]: With the **Archiving commands** function, you can stop the recording (STOP), resume the recording (REC) and create a new file – be careful not to delete another file from the internal memory.

[3]: With the **Copy files**, you can copy / remove / delete a file from the internal data memory.

[4]: **Resetting min, max** is the resetting function of the maximum / minimum / average value on measurement screens.

[5]: **Adjusting clock** refers to date and time adjustment of the real-time clock (date and time is recorded in the archive along with measurement results).

[6]: **Resetting totalisers**.

[7]: With the **Main settings**, you may add user characteristics and change the recorder settings, except for alarm/control threshold setting, measurement screen display settings and archive settings.

[8]: **Threshold settings** – setting the alarm/control thresholds.

[9]: **Screen settings** refer to the measurement results displayed on measurement screens, collective screens and special screens.

[10]: **Archiving settings** (recording interval, channels, operation mode).

[11]: In the **Users and entitlements** menu, the administrator defines users and assigns user entitlements by selecting the function group the user will be authorized to operate after entering a correct password. After a new user is created, a new numerical password is created automatically. Do not create too simple passwords (11111). Each user has an individually defined scope of entitlements. The entitlements can only apply to password-protected functions. In this menu, the administrator can also change user name and password or/and delete a user.

[12]: **Log out after** defines the idle time after which the user will be automatically logged out. This function prevents unauthorized persons from interfering with the operating parameters.

[13]: The password cannot be shorter than the minimum password length. The longer the password, the more difficult it is to break it, but it will take more time to type it in.

11.3. Load and save settings

→ MAIN MENU → LOAD AND SAVE SETTINGS

LOAD AND SAVE SETTINGS

Load [1]

Save [2]

Explanations:

[3]: Device settings can be uploaded from USB flash drive plugged into USB port on the face plate. With this function, you can restore previous settings, copy settings of

another recorder, or configure the recorder for temporary operation in different measurement systems (for portable MPI-CL). When new settings are read, all previous settings and user / password configurations will be permanently overwritten.

[4]: Settings can only be saved when USB flash drive is plugged into the USB socket. When the settings are saved, two files will be created: *Sett_[adr].set* and *Sett_[adr].txt*. If the same files are already saved on USB flash drive, they will be overwritten. To save several different settings files on USB flash drive, change *Sett_[adr].set* and *Sett_[adr].txt* file names, but leave the „.set" and „.txt" extensions. *Sett_[adr].txt* is a text file and is created for reference purposes only. Settings are read from the binary files with „.set" extension.

11.4. New firmware, license activation

! The firmware can be changed to a newer or extended version. Firmware exchange can be only handled by the administrator. If the firmware needs to be exchanged, it should ■ be done with extra care. The device can cooperate with a PC and other equipment, and new firmware can alter the metrological properties of the recorder.

→ MAIN MENU → FIRMWARE AND LICENCES

FIRMWARE AND LICENCES
- **Load and install** [1]
- **Licences granted** [2]
- **Firmware version** [3]
- **Serial number** [4]

Explanations:

[1]: Use USB flash drive plugged into USB socket on the face plate to install new firmware or to activate a license. Insert the USB flash drive to the USB socket and select **Load and instal** menu. The files containing the new firmware and licenses will be recognized automatically. Press INSTALL to upload the firmware code to the internal memory. It takes a few minutes to install the firmware. Selected firmware versions can be incompatible with the existing version, and the device will refuse to install the incompatible firmware. Firmware featuring special functions may require an additional license.

[2]: List of licenses. Selected firmware can be only installed on devices with specific licenses. In addition, some functions may require additional licenses as well.

[3]: **Firmware version** – information of the new firmware version installed.

[4]: The unique serial number is saved in the internal memory. The same number is shown on the serial plate. The serial number is also saved in the archive file to be able to trace measurement results back to the recorder.

11.5. Restore factory settings

→ MAIN MENU → SETTINGS

SETTINGS
- **Restore factory settings** [1]

Explanations:

[1]: Use this function to restore factory settings changed by user. All parameters in the **Settings** menu will be restored, excluding all other data saved in the internal memory. Use this function in exceptional circumstances only, for example to reset the device step-by-step.

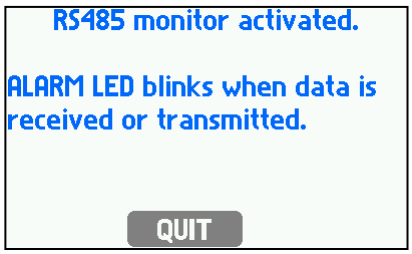
11.6. Service functions

Service users (ADMIN with a service password) can additionally access calibration functions and are authorized to delete / remove Event Log and Authorized Operations Log files. Both functions are at the end of the main menu.

! Unlike other users, SERVICE user (ADMIN with service password) cannot be automatically logged out after specific idle time. SERVICE – ADMINISTRATOR users must remember to log out.

12. SERVICE FUNCTIONS

RS485 monitor is a service-restricted function. When selected, the ALARM LED blinks when data is received or transmitted via RS-485 bus bar. To switch the function off, press QUIT



13. MPI-CL - PORTABLE VERSION

The portable and panel-mounted recorder versions offer similar functions. This section lists features specific to MPI-CL recorder. MPI-CL recorder is available in a 16-channel version only.

13.1. Housing and face plate

Fig. 13.1 MPI-CL recorder face plate

The portable version is fitted with a plastic housing. The handle can be used to carry the device and to position it at four different angles to make the reading as convenient as possible. The device can be also conveniently positioned with the front feet.

Apart from functional buttons identical with the MPI-C recorder, MPI-CL has a power switch on the face plate.

Fig. 13.2 Front feet to position the device at convenient angle

13.2. Rear plate

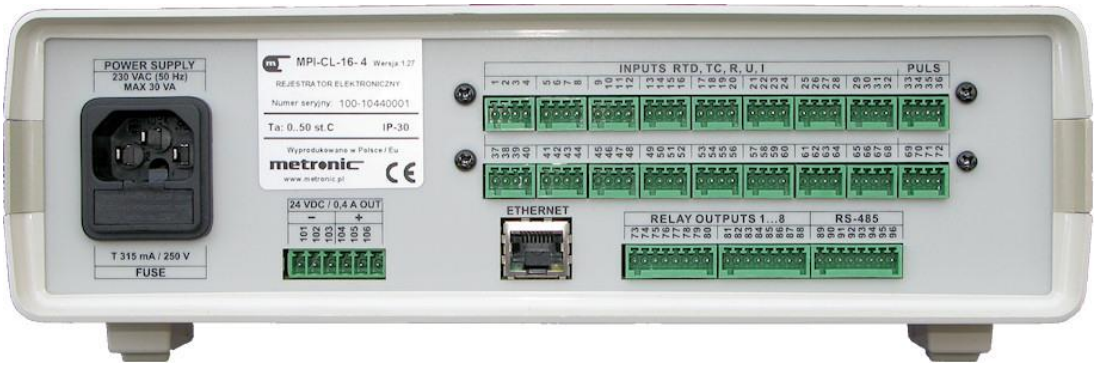


Fig. 13.3 MPI-CL recorder rear plate

24V= / 0.4A output voltage socket (constant non-stabilized voltage) is located between the power supply socket and the Ethernet port socket and is intended to power additional devices, such as 0/4-20 mA analog signal transducers.

There is a power cable socket on the left. The device can be powered from a 230V AC mains supply. The socket has a fuse accessible after the cable is connected.

An emergency fuse can be placed inside the fuse holder.

13.3. Connect electrical signals on MPI-CL recorder

Table 13.1 MPI-CL recorder terminal blocks

Terminal block no.	**SPECIFICATION**				
INPUTS					
ANALOG INPUTS IN 1… IN 8 (upper terminal block, 8 x „4” pins)					
1	A	+TC	A RTD		IN 1
2	B	-TC	B RTD		
3	C		C RTD	-I	
4	D			+I	
...	X 8				
29	A	+TC	A RTD		IN 8
30	B	-TC	B RTD		
31	C		C RTD	-I	
32	D			+I	
DIGITAL INPUTS IN B1, IN B2 (upper terminal block, „4” pins)					
33	Puls+		IN 17 (PULS)		
34	Puls-				
35	Puls+		IN 18 (PULS)		
36	Puls-				
ANALOG INPUTS IN 9.. IN 16 (middle terminal block, 8 x „4” pins)					
37	A	+TC	A RTD		IN 9
38	B	-TC	B RTD		
39	C		C RTD	-I	
40	D			+I	
...	X 8				

65	A	+TC	A RTD		IN 16
66	B	-TC	B RTD		
67	C		C RTD	-I	
68	D			+I	
DIGITAL INPUTS IN B3, IN B4 (middle terminal block, „4" pins)					
69	Puls+		IN 19 (PULS)		
70	Puls-				
71	Puls+		IN 20 (PULS)		
72	Puls-				
OUTPUTS (bottom terminal block, 2 x „8" pins)					
73	+/~RL1		Relay output RL1 (0,1A/60V)		
74	-/~RL1				
75	+/~RL2		Relay output RL2 (0,1A/60V)		
76	-/~RL2				
77	+/~RL3		Relay output RL3 (0,1A/60V)		
78	-/~RL3				
79	+/~RL4		Relay output RL4 (0,1A/60V)		
80	-/~RL4				
81	+/~RL5		Relay output RL5 (0,1A/60V)		
82	-/~RL5				
83	+/~RL6		Relay output RL6 (0,1A/60V)		
84	-/~RL6				
85	+/~RL7		Relay output RL7 (0,1A/60V)		
86	-/~RL7				
87	+/~RL8		Relay output RL8 (0,1A/60V)		
88	-/~RL8				
RS-485 (bottom terminal block, „8" pins)					
89	3,3 V		RS-485 power supply		
90	T (+)		Termination		
91	A(+)		RS-485 port		
92	A(+)				
93	B(-)				
94	B(-)				
95	T (-)		Termination		
96	GND		RS-485 power supply		
WY 24V= / 0,4A POWER SUPPY TO ACCESSORIES („6" pin terminal block)					
101	-		Negative pole „ – "		
102	-				
103	-				
104	+		Positive pole „ + "		
105	+				
106	+				

13.4. Extended keyboard

Extended keyboard version (7 + 12 keys) makes it easier to enter and edit numbers, text, formulas and passwords. Use the keyboard like a keyboard in your mobile phone, e.g. the button 2 has the following characters assigned: a, b, c, 2.

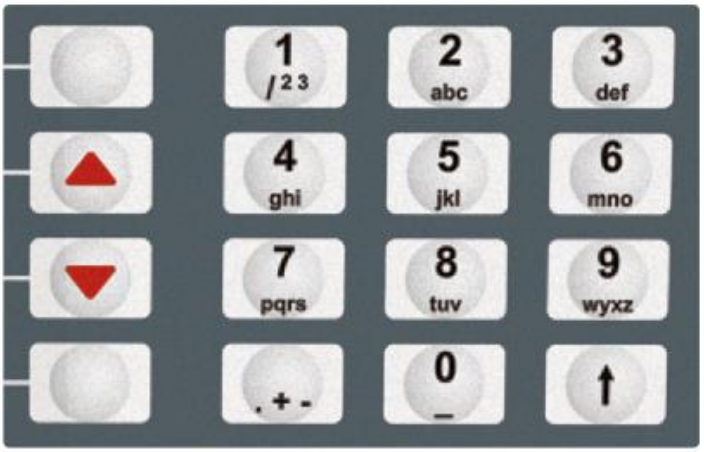


Fig. 13.4 Extended keyboard – button layout

14. MPI-CN - WALL-MOUNTED VERSION

The wall-mounted and panel-mounted versions offer similar functions. MPI-CN recorder is powered with 230V AC. MPI-CN recorder is available in a 16-channel version only.

14.1. Housing

Fig. 14.1 MPI-CN recorder face plate

14.2. Connect electrical signals on MPI-CN

All electrical circuits are connected to a screw terminal block.

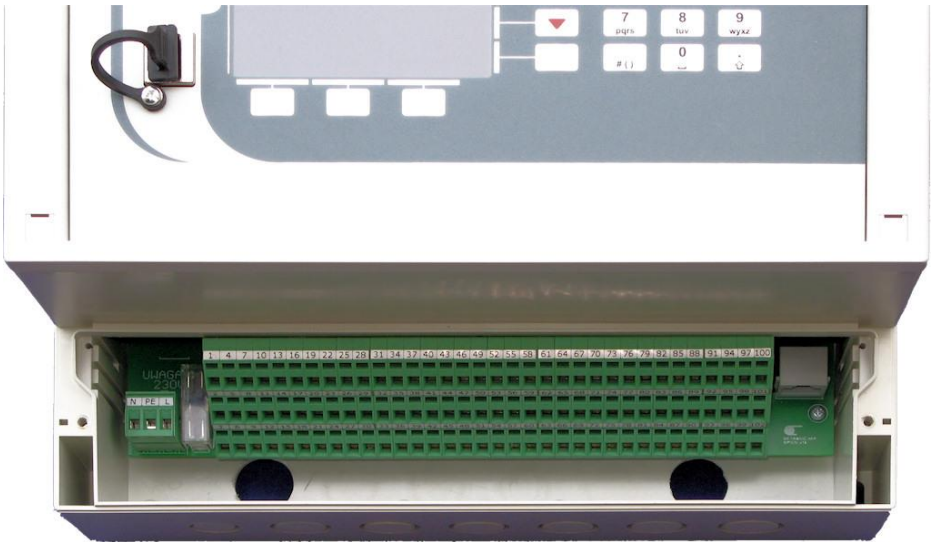


Fig. 14.2 Pin type spring terminal block in MPI-CN recorder

0.2 mm^2 - 0.5 mm^2 cables can be connected to the terminal block, and it is recommended to use cables with smaller diameters to save some space in the cable glands.

Fig. 14.3 Connecting cable lines

Table 14.1 MPI-CN recorder terminal blocks

Terminal block no.	**SPECIFICATION**				
INPUTS					
ANALOG INPUTS IN1.. IN8					
1	A	+TC	A RTD		IN 1
2	B	-TC	B RTD		
3	C		C RTD	-I	
4	D			+I	
...	X 8				
29	A	+TC	A RTD		IN 8
30	B	-TC	B RTD		
31	C		C RTD	-I	
32	D			+I	
DIGITAL INPUTS IN B1, IN B2					
33	Puls+		WE 17 (PULS)		
34	Puls-				
35	Puls+		WE 18 (PULS)		
36	Puls-				
ANALOG INPUTS IN9.. IN16					
37	A	+TC	A RTD		IN 9
38	B	-TC	B RTD		
39	C		C RTD	-I	
40	D			+I	
...	X 8				
65	A	+TC	A RTD		IN 16
66	B	-TC	B RTD		
67	C		C RTD	-I	
68	D			+I	

DIGITAL INPUTS IN B3, IN B4		
69	Puls+	IN 19 (PULS)
70	Puls-	
71	Puls+	IN 20 (PULS)
72	Puls-	
OUTPUTS		
73	+/~R1	Relay output RL1 (0,1A/60V)
74	-/~RL1	
75	+/~RL2	Relay output RL2 (0,1A/60V)
76	-/~RL2	
77	+/~RL3	Relay output RL3 (0,1A/60V)
78	-/~RL3	
79	+/~RL4	Relay output RL4 (0,1A/60V)
80	-/~RL4	
81	+/~RL5	Relay output RL5 (0,1A/60V)
82	-/~RL5	
83	+/~RL6	Relay output RL6 (0,1A/60V)
84	-/~RL6	
85	+/~RL7	Relay output RL7 (0,1A/60V)
86	-/~RL7	
87	+/~RL8	Relay output RL8 (0,1A/60V)
88	-/~RL8	
RS-485		
89	3,3 V	RS-485 power supply
90	T (+)	Termination
91	A(+)	RS-485 port
92	A(+)	
93	B(-)	
94	B(-)	
95	T (-)	Termination
96	GND	RS-485 power supply
WY 24V= / 0.4A POWER SUPPLY TO ACCESSORIES		
97	-	Negative pole „-”
98	-	
99	-	
100	+	Positive pole „+”
101	+	
102	+	
POWER SUPPLY		
N		230 VAC power supply
PE		
L		

A different terminal block arrangement can be available upon request.

14.3. Extended keyboard.

For more information on the extended keyboard version, go to the section on portable MPI-CL recorder (Section 13.4).

15. MPI-C-RAPORT RESULTS VISUALIZATION SOFTWARE

Measurement results in the electronic form are recorded in a format that is easy to view and process using available software. The 2GB capacity of the internal memory enables recording of large volumes of results. As a rule, there is no need to analyze all data in detail. It is therefore recommended to preselect data (from a specific time frame, lower or higher average / minimum / maximum values, in a chronological order, etc.) Use *MPI-C-Raport* (auxiliary equipment) to create a new, smaller file of source data. The selected data can be displayed either on graphs or in tables and printed (report).

In order to ensure authenticity of original data, special techniques of encrypting data and keeping the order of records are used. Modification of original data is easy to perform (e.g. to calculate average values), however, it results in the encryption word being altered.

If recorded measurement results need to be stored, ensure proper procedures for storing original data to avoid loss or falsification. Data reading, backup creation and recording to recordable media (e.g. CDs) should be performed as frequently as possible. From time to time, you can also print reports.

16. Modbus RTU and Modbus TCP Protocol

Only few Modbus functions are implemented in MPI-C. Using Modbus functions user can transfer data to computer system:

- results of measuring process,
- archived data,
- date and time from RTC (Real Time Clock can also be set),
- alarms status.

There are four Modbus functions implemented:

- 02 – Read Discrete Inputs
- 04 – Read Input Registers
- 08 – Diagnostics
  10 – Write Multiple Registers

Modbus RTU is available at RS-485 port and Modbus TCP is available at Ethernet port.

16.1. Serial port settings RS-485 for Modbus RTU

Default setting for port RS-485 is ASCII mode. It has to be set to Modbus RTU mode. Other parameters have to be set to correspond to computer or PLC settings:

- Address (01, .. , 99, addresses 100 to 247 are not implemented)
- Baud rate (2400, .. , 230,4k)
- Parity (NONE, ODD, EVEN)

Transmission parameters do not allow to set maximum time („Response delay (max):”) because response to a command is sent immediately in Modbus RTU mode. The maximum delay is no longer than few ms.

According to MODBUS standard in RTU mode the frame is as follows:

Start	Address	Function	Data	CRC control	End
T1 ... T4	1 byte	1 byte	n bytes	2 bytes	T1 ... T4

Information transmitted from the master computer to the device is a Query, whereas the device sends a Response.

16.2. Ethernet port settings for Modbus TCP

- IP (IP address assigned to MPI-C)
- Port (typically 502)
- Mask (subnet mask, e.g. 255.255.255.0)
- Gate (e.g. 1.0.0.1)
- DHCP server (OFF for normal operation)

- Timeout (typically 60 s)

Note: Using port 502 is recommended, since it is registered for Modbus TCP.

According to MODBUS standard in TCP/IP mode, the frame is as follows:

MBAP Header	Function	Data
7 bytes	1 byte	n bytes

Information transmitted from the master computer to the device is a Query, whereas the device sends a Response.

16.3. Readout of current results and totalisers

Readout function (query) has a form:

Function (1B)	Initial address (2B)	Number of registers (2B)

Function – 04 HEX – current results readout.
Initial address – an address of a register from which data are to be sent.
Number of registers – two-byte registers to readout.

In response the device transmits a sequence of characters in form of:

Function (1B)	Number of bytes (1B)	Data sequence (nB)

Function – acknowledgement, in case of error 80 HEX value is added on to the command code.

Error codes possible for the device are:

- 01 HEX – incorrect function (in case of diagnostics also impermissible subfunction),
- 02 HEX – incorrect initial address,
- 03 HEX – incorrect number of points.

Queries are not confirmed by a response in case of:

- parity error,
- CRC errors,
- address error.

Number of bytes – n bytes transmitted in response (but not number of registers).
Data sequence – n bytes of register contents.

16.3.1. Register addresses for current results

Current results in MPI-8v3 device are available in single floating point format, according to IEEE-754 standard for 32-bit numbers (4 bytes).

Registers` addresses		Description
DEC	HEX	
128,129	0080, 0081	Current value from input IN1
130,131	0082, 0083	Current value from input IN2
132,133	0084, 0085	Current value from input IN3
134,135	0086, 0087	Current value from input IN4
136,137	0088, 0089	Current value from input IN5
138,139	008A, 008B	Current value from input IN6
140,141	008C, 008D	Current value from input IN7
142,143	008E, 008F	Current value from input IN8
144,145	0090, 0091	Current value from input IN9
146,147	0092, 0093	Current value from input IN10
148,149	0094, 0095	Current value from input IN11
150,151	0096, 0097	Current value from input IN12
152,153	0098, 0099	Current value from input IN13
154,155	009A, 009B	Current value from input IN14
156,157	009C, 009D	Current value from input IN15
158,159	009E, 009F	Current value from input IN16
160,161	00A0, 00A1	Current value from input IN17
162,163	00A2, 00A3	Current value from input IN18
164,165	00A4, 00A5	Current value from input IN19
166,167	00A6, 00A7	Current value from input IN20
168,169	00A8, 00A9	Calculation value from input IN21
170,171	00AA, 00AB	Calculation value from input IN22
172,173	00AC, 00AD	Calculation value from input IN23
174,175	00AE, 00AF	Calculation value from input IN24
176,177	00B0, 00B1	Calculation value from input IN25
178,179	00B2, 00B3	Calculation value from input IN26
180,181	00B4, 00B5	Calculation value from input IN27
182,183	00B6, 00B7	Calculation value from input IN28
184,185	00B8, 00B9	Calculation value from input IN29
186,187	00BA, 00BB	Calculation value from input IN30
188,189	00BC, 00BD	Calculation value from input IN31
190,191	00BE, 00BF	Calculation value from input IN32
192,193	00C0, 00C1	Calculation value from input IN33
194,195	00C2, 00C3	Calculation value from input IN34
196,197	00C4, 00C5	Calculation value from input IN35
198,199	00C6, 00C7	Calculation value from input IN36

IEEE-754 standard for 32-bit floating point numbers of single precision:

Register	30002 (address 0001)				30001 (address 0000)	
Byte	4		3		2	1
Bit	31	30..24	23	22..16	15..08	07..00
IEEE-754	S	E (8b)		M (23b, only fraction part)		

where:

- M (mantissa): is a normalized value from the range [1;2)- right side open interval. Only fraction part of mantissa is noted (e.g. for binary number 1,1011101 mantissa equals to 1011101, more precisely in notation on 23 bits: 10111010000000000000000).
- E (exponent): exponent value is shifted by 127 (bias)
- S (sign): 0 – positive number, 1 – negative number.

The number value can be calculated from the formula:

$$x = (-1)^S * M * 2^{(E-bias)}$$

where bias: 127

For example, a sequence of response characters (HEX):

01 04 04 **9E E4 43 1C** A4 A2 (read from device)

- acknowledgment of an address (01) and function (04), number of bytes (04),
- value 9E E4 43 1C, in sequence register 0000 and 0001,
- CRC (A4 A2).

Presenting the value in appropriate sequence (0001 and 0000):
43 1C 9E E4

and in binary form:

01000011 00011100 10011110 11100100

one can read

- mantissa: 1,0011100 10011110 11100100 (in decimal notation: approx. 1,22265625)
- exponent: 10000110 – 01111111 = 00000111 (in decimal notation: 7)
- sign: 0

what gives a decimal result:

$(-1)^0 * 1{,}22265625 * 2^7 = 156{,}5$

16.3.2. Register addresses for totalisers

Totalisers in MPI-C device are available in two formats: in special integer format (4 bytes) and in double floating point format, according to IEEE-754 standard for 64-bit numbers (8 bytes).

NOTE!

Totalisers values in Modbus registers are updated every 2 sec.

Registers` addresses		Description	Format
DEC	HEX		
1024 … 1027	0400 … 0403	Totaliser 1 for input IN1	floating point double
1028 … 1031	0404 … 0407	Totaliser 2 for input IN1	floating point double
1032 … 1035	0408 … 040B	Totaliser 1 for input IN2	floating point double

1036 … 1039	040C … 040F	Totaliser 2 for input IN2	floating point double
1040 … 1043	0410 … 0413	Totaliser 1 for input IN3	floating point double
1044 … 1047	0414 … 0417	Totaliser 2 for input IN3	floating point double
1048 … 1051	0418 … 041B	Totaliser 1 for input IN4	floating point double
1052 … 1055	041C … 041F	Totaliser 2 for input IN4	floating point double
1056 … 1059	0420 … 0423	Totaliser 1 for input IN5	floating point double
1060 … 1063	0424 … 0427	Totaliser 2 for input IN5	floating point double
1064 … 1067	0428 … 042B	Totaliser 1 for input IN6	floating point double
1068 … 1071	042C … 042F	Totaliser 2 for input IN6	floating point double
1072 … 1075	0430 … 0433	Totaliser 1 for input IN7	floating point double
1076 … 1079	0434 … 0437	Totaliser 2 for input IN7	floating point double
1080 … 1083	0438 … 043B	Totaliser 1 for input IN8	floating point double
1084 … 1087	043C … 043F	Totaliser 2 for input IN8	floating point double
1088 … 1091	0440 … 0443	Totaliser 1 for input IN9	floating point double
1092 … 1095	0444 … 0447	Totaliser 2 for input IN9	floating point double
1096 … 1099	0448 … 044B	Totaliser 1 for input IN10	floating point double
1100 … 1103	044C … 044F	Totaliser 2 for input IN10	floating point double
1104 … 1107	0450 … 0453	Totaliser 1 for input IN11	floating point double
1108 … 1111	0454 … 0457	Totaliser 2 for input IN11	floating point double
1112 … 1115	0458 … 045B	Totaliser 1 for input IN12	floating point double
1116 … 1119	045C … 045F	Totaliser 2 for input IN12	floating point double
1120 … 1123	0460 … 0463	Totaliser 1 for input IN13	floating point double
1124 … 1127	0464 … 0467	Totaliser 2 for input IN13	floating point double
1128 … 1131	0468 … 046B	Totaliser 1 for input IN14	floating point double
1132 … 1135	046C … 046F	Totaliser 2 for input IN14	floating point double
1136 … 1139	0470 … 0473	Totaliser 1 for input IN15	floating point double
1140 … 1143	0474 … 0477	Totaliser 2 for input IN15	floating point double
1144 … 1147	0478 … 047B	Totaliser 1 for input IN16	floating point double
1148 … 1151	047C … 047F	Totaliser 2 for input IN16	floating point double
1152 … 1155	0480 … 0483	Totaliser 1 for input IN17	floating point double
1156 … 1159	0484 … 0487	Totaliser 2 for input IN17	floating point double
1160 … 1163	0488 … 048B	Totaliser 1 for input IN18	floating point double
1164 … 1167	048C … 048F	Totaliser 2 for input IN18	floating point double
1168 … 1171	0490 … 0493	Totaliser 1 for input IN19	floating point double
1172 … 1175	0494 … 0497	Totaliser 2 for input IN19	floating point double
1176 … 1179	0498 … 049B	Totaliser 1 for input IN20	floating point double
1180 … 1183	049C … 049F	Totaliser 2 for input IN20	floating point double
1184 … 1187	04A0 … 04A3	Totaliser 1 for calculation result IN21	floating point double
1188 … 1191	04A4 … 04A7	Totaliser 2 for calculation result IN21	floating point double
1192 … 1195	04A8 … 04AB	Totaliser 1 for calculation result IN22	floating point double
1196 … 1199	04AC … 04AF	Totaliser 2 for calculation result IN22	floating point double
1200 … 1203	04B0 … 04B3	Totaliser 1 for calculation result IN23	floating point double
1204 … 1207	04B4 … 04B7	Totaliser 2 for calculation result IN23	floating point double
1208 … 1211	04B8 … 04BB	Totaliser 1 for calculation result IN24	floating point double
1212 … 1215	04BC … 04BF	Totaliser 2 for calculation result IN24	floating point double
1216 … 1219	04C0 … 04C3	Totaliser 1 for calculation result IN25	floating point double
1220 … 1223	04C4 … 04C7	Totaliser 2 for calculation result IN25	floating point double
1224 … 1227	04C8 … 04CB	Totaliser 1 for calculation result IN26	floating point double
1228 … 1231	04CC … 04CF	Totaliser 2 for calculation result IN26	floating point double
1232 … 1235	04D0 … 04D3	Totaliser 1 for calculation result IN27	floating point double
1236 … 1239	04D4 … 04D7	Totaliser 2 for calculation result IN27	floating point double
1240 … 1243	04D8 … 04DB	Totaliser 1 for calculation result IN28	floating point double
1244 … 1247	04DC … 04DF	Totaliser 2 for calculation result IN28	floating point double
1248 … 1251	04E0 … 04E3	Totaliser 1 for calculation result IN29	floating point double
1252 … 1255	04E4 … 04E7	Totaliser 2 for calculation result IN29	floating point double
1256 … 1259	04E8 … 04EB	Totaliser 1 for calculation result IN30	floating point double
1260 … 1263	04EC … 04EF	Totaliser 2 for calculation result IN30	floating point double

1264 … 1267	04F0 … 04F3	Totaliser 1 for calculation result IN31	floating point double
1268 … 1271	04F4 … 04F7	Totaliser 2 for calculation result IN31	floating point double
1272 … 1275	04F8 … 04FB	Totaliser 1 for calculation result IN32	floating point double
1276 … 1279	04FC … 04FF	Totaliser 2 for calculation result IN32	floating point double
1280 … 1283	0500 … 0503	Totaliser 1 for calculation result IN33	floating point double
1284 … 1287	0504 … 0507	Totaliser 2 for calculation result IN33	floating point double
1288 … 1291	0508 … 050B	Totaliser 1 for calculation result IN34	floating point double
1292 … 1295	050C … 050F	Totaliser 2 for calculation result IN34	floating point double
1296 … 1299	0510 … 0513	Totaliser 1 for calculation result IN35	floating point double
1300 … 1303	0514 … 0517	Totaliser 2 for calculation result IN35	floating point double
1304 … 1307	0518 … 051B	Totaliser 1 for calculation result IN36	floating point double
1308 … 1311	051C … 051F	Totaliser 2 for calculation result IN36	floating point double

IEEE-754 standard for 64-bit floating point numbers of double precision :

Register address	e.g.: 0213 (hex)				e.g.: 0212 (hex)		e.g.: 0211 (hex)		e.g.: 0210 (hex)	
Byte	8		7		6	5	4	3	2	1
Bit	63	62..56	55..52	51..48	47..40	39..32	31..24	23..16	15..8	7..0
IEEE	S	E (11b)		M (52b, fraction part only)						

Where:

- M (mantissa): is a normalized value within the interval [1;2)- right side open interval. Only fraction part of mantissa is noted
- E (exponent): exponent value is biased by 1023 (bias).
- S (character): 0 – positive number, 1 – negative number

The number value can be calculated from the formula:

$$x = (-1)^S * M * 2^{(E-bias)}$$

where bias: 1023

The totaliser values are also available in double integer (4 byte) format. Only not rounded integer part of the totaliser value is available in this format in range from –999 999 999 to 999 999 999.

Each totaliser value is 2 registers long (4 bytes).

Registers` addresses		**Description**	**Format**
DEC	**HEX**		
1536 … 1537	0600 … 0601	Totaliser 1 for input IN1	integer
1538 … 1539	0602 … 0603	Totaliser 2 for input IN1	integer
1540 … 1541	0604 … 0605	Totaliser 1 for input IN2	integer
1542 … 1543	0606 … 0607	Totaliser 2 for input IN2	integer
1544 … 1545	0608 … 0609	Totaliser 1 for input IN3	integer
1546 … 1547	060A … 060B	Totaliser 2 for input IN3	integer
1548 … 1549	060C … 060D	Totaliser 1 for input IN4	integer
1550 … 1551	060E … 060F	Totaliser 2 for input IN4	integer
1552 … 1553	0610 … 0611	Totaliser 1 for input IN5	integer
1554 … 1555	0612 … 0613	Totaliser 2 for input IN5	integer
1556 … 1557	0614 … 0615	Totaliser 1 for input IN6	integer
1558 … 1559	0616 … 0617	Totaliser 2 for input IN6	integer
1560 … 1561	0618 … 0619	Totaliser 1 for input IN7	integer
1562 … 1563	061A … 061B	Totaliser 2 for input IN7	integer
1564 … 1565	061C … 061D	Totaliser 1 for input IN8	integer

1566 … 1567	061E … 061F	Totaliser 2 for input IN8	integer
1568 … 1569	0620 … 0621	Totaliser 1 for input IN9	integer
1570 … 1571	0622 … 0623	Totaliser 2 for input IN9	integer
1572 … 1573	0624 … 0625	Totaliser 1 for input IN10	integer
1574 … 1575	0626 … 0627	Totaliser 2 for input IN10	integer
1576 … 1577	0628 … 0629	Totaliser 1 for input IN11	integer
1578 … 1579	062A … 062B	Totaliser 2 for input IN11	integer
1580 … 1581	062C … 062D	Totaliser 1 for input IN12	integer
1582 … 1583	062E … 062F	Totaliser 2 for input IN12	integer
1584 … 1585	0630 … 0631	Totaliser 1 for input IN13	integer
1586 … 1587	0632 … 0633	Totaliser 2 for input IN13	integer
1588 … 1589	0634 … 0635	Totaliser 1 for input IN14	integer
1590 … 1591	0636 … 0637	Totaliser 2 for input IN14	integer
1592 … 1593	0638 … 0639	Totaliser 1 for input IN15	integer
1594 … 1595	063A … 063B	Totaliser 2 for input IN15	integer
1596 … 1597	063C … 063D	Totaliser 1 for input IN16	integer
1598 … 1599	063E … 063F	Totaliser 2 for input IN16	integer
1600 … 1601	0640 … 0641	Totaliser 1 for input IN17	integer
1602 … 1603	0642 … 0643	Totaliser 2 for input IN17	integer
1604 … 1605	0644 … 0645	Totaliser 1 for input IN18	integer
1606 … 1607	0646 … 0647	Totaliser 2 for input IN18	integer
1608 … 1609	0648 … 0649	Totaliser 1 for input IN19	integer
1610 … 1611	064A … 064B	Totaliser 2 for input IN19	integer
1612 … 1613	064C … 064D	Totaliser 1 for input IN20	integer
1614 … 1615	064E … 064F	Totaliser 2 for input IN20	integer
1616 … 1617	0650 … 0651	Totaliser 1 for calculation value IN21	integer
1618 … 1619	0652 … 0653	Totaliser 2 for calculation value IN21	integer
1620 … 1621	0654 … 0655	Totaliser 1 for calculation value IN22	integer
1622 … 1623	0656 … 0657	Totaliser 2 for calculation value IN22	integer
1624 … 1625	0658 … 0659	Totaliser 1 for calculation value IN23	integer
1626 … 1627	065A … 065B	Totaliser 2 for calculation value IN23	integer
1628 … 1629	065C … 065D	Totaliser 1 for calculation value IN24	integer
1630 … 1631	065E … 065F	Totaliser 2 for calculation value IN24	integer
1632 … 1633	0660 … 0661	Totaliser 1 for calculation value IN25	integer
1634 … 1635	0662 … 0663	Totaliser 2 for calculation value IN25	integer
1636 … 1637	0664 … 0665	Totaliser 1 for calculation value IN26	integer
1638 … 1639	0666 … 0667	Totaliser 2 for calculation value IN26	integer
1640 … 1641	0668 … 0669	Totaliser 1 for calculation value IN27	integer
1642 … 1643	066A … 066B	Totaliser 2 for calculation value IN27	integer
1644 … 1645	066C … 066D	Totaliser 1 for calculation value IN28	integer
1646 … 1647	066E … 066F	Totaliser 2 for calculation value IN28	integer
1648 … 1649	0670 … 0671	Totaliser 1 for calculation value IN29	integer
1650 … 1651	0672 … 0673	Totaliser 2 for calculation value IN29	integer
1652 … 1653	0674 … 0675	Totaliser 1 for calculation value IN30	integer
1654 … 1655	0676 … 0677	Totaliser 2 for calculation value IN30	integer
1656 … 1657	0678 … 0679	Totaliser 1 for calculation value IN31	integer
1658 … 1659	067A … 067B	Totaliser 2 for calculation value IN31	integer
1660 … 1661	067C … 067D	Totaliser 1 for calculation value IN32	integer
1662 … 1663	067E … 067F	Totaliser 2 for calculation value IN32	integer
1664 … 1665	0680 … 0681	Totaliser 1 for calculation value IN33	integer
1666 … 1667	0682 … 0683	Totaliser 2 for calculation value IN33	integer
1668 … 1669	0684 … 0685	Totaliser 1 for calculation value IN34	integer
1670 … 1671	0686 … 0687	Totaliser 2 for calculation value IN34	integer
1672 … 1673	0688 … 0689	Totaliser 1 for calculation value IN35	integer
1674 … 1675	068A … 068B	Totaliser 2 for calculation value IN35	integer
1676 … 1677	068C … 068D	Totaliser 1 for calculation value IN36	integer
1678 … 1679	068E … 068F	Totaliser 2 for calculation value IN36	integer

16.4. Readout alarm threshold exceedances – function 02

In case of readout of alarm threshold exceedances (function 02 HEX), a sequence bit values will be transmitted. Alarmed state for each threshold is coded on two bits.

Readout function (query) has a form:

Function (1B)	Initial address (2B)	Number of points (2B)

Function – 02 HEX – reading out alarm threshold exceedances.
Initial address – a number of bit from which data are to be sent.
Number of points – number of bits.

In response the device transmits a sequence of characters in form of:

Function (1B)	Number of bytes (1B)	Data sequence (nB)

Function – acknowledgement, in case of error 80 HEX value is added on to the command code.

Error codes possible for the device are:

- 01 HEX – incorrect function (in case of diagnostics also impermissible subfunction),
- 02 HEX – incorrect initial address,
- 03 HEX – incorrect number of points.

Queries are not confirmed by a response in case of:

- parity error,
- CRC errors,
- address error.

Number of bytes – n bytes transmitted in response (8 bites = 1 byte, if query declares number of bits indivisible by 8, the last bits are completed by value 0 to number divisible by 8).

Data sequence – n bytes of registers' contents.

16.4.1. Numbers of bits for reading out alarm threshold exceedances

Number of bit (DEC)	Number of bit (HEX)	Meaning
0 … 7	0000 … 0007	Reserve
8	0008	Channel 1 threshold 4 H
9	0009	Channel 1 threshold 4 L
10	000A	Channel 1 threshold 3 H
11	000B	Channel 1 threshold 3 L
12	000C	Channel 1 threshold 2 H
13	000D	Channel 1 threshold 2 L
14	000E	Channel 1 threshold 1 H
15	000F	Channel 1 threshold 1 L
16 … 23	0010 … 0017	Reserve
24	0018	Channel 2 threshold 4 H

25	0019	Channel 2 threshold 4 L
26	001A	Channel 2 threshold 3 H
27	001B	Channel 2 threshold 3 L
28	001C	Channel 2 threshold 2 H
29	001D	Channel 2 threshold 2 L
30	001E	Channel 2 threshold 1 H
31	001F	Channel 2 threshold 1 L
…	…	…
560 … 567	0230 … 0237	Reserve
568	0238	Channel 36 threshold 4 H
569	0239	Channel 36 threshold 4 L
570	023A	Channel 36 threshold 3 H
571	023B	Channel 36 threshold 3 L
572	023C	Channel 36 threshold 2 H
573	023D	Channel 36 threshold 2 L
574	023E	Channel 36 threshold 1 H
575	023F	Channel 36 threshold 1 L

H	L	Description
0	0	No exceedance.
0	1	Exceedance notified unconfirmed (only for alarm exceedance).
1	1	Exceedance notified confirmed (for alarm exceedance).
1	1	Exceedance (for control exceedance).

16.5. Reading out archives

Two function are used to readout archives: 04 (Read Input Registers) and 10 (Write Multiple Registers).

The modification of values, required to readout archives, is possible by function 10 (Write Multiple Registers):

- step (see registers' addresses for archive of current value – register 0200),
- time (see registers' addresses for archive of current value – registers 0201, 0202 and 0203),
- number (see registers addresses for archive of current value – registers 0204 and 0205).

In addition, function allows clock's settings to be modified (see section "Readout and settings of clock").

Record function (query) has a form:

Function (1B)	Initial address (2B)	Number of registers = N (2B)	Number of data bytes (1B)	Data to record (N x 2B)

Function – 10 HEX – record to one or several registers.
Initial address – an address of first register .
Number of registers – two-byte registers for record.

Number of data bytes – number of bytes which will be recorded.
Data to record – data bytes which will be record to specified registers.

In response the device transmits a sequence of characters in form of:

Function (1B)	Initial address (2B)	Number of registers (2B)

Function – acknowledgement, in case of error 80 HEX value is added on to the command code.

Error codes possible for the device are:

- 01 HEX – incorrect function (in case of diagnostics also impermissible subfunction),
- 02 HEX – incorrect initial address,
- 03 HEX – incorrect number of points.

Queries are not confirmed by a response in case of:

- parity error,
- CRC errors,
- address error.

Initial address – an address of first register contenting recorded data.
Number of registers – number of registers contenting recorded data.

NOTE!!!

It's possible to record just one field(step, number or time) in single 10 query.

Queries containing more than one field or any field partially (ex. only 0116 register), will be rejected with error code 02.

Algorithm to readout archive of current results:

- To readout an archive of current results is useful 04 function.
- Registers 0100…0116 contain general information,
- Registers 0206…02FF contain one record or one headline.
- Every readout query containing registers 0204 or 0205 causes move on to consecutive record (number of record is increased by value of register 0200, default 1, can be substituted by input of new value using 10 function) or to consecutive headline.
- After readout of registers 0204 and 0205, new record or next headline will be available at registers 0206…02FF,
- Readout of last headline or last record causes move on to first record.
- To move on to selected headline, record selected number to registers 0204 and 0205 is required,
- To move on to selected record, it's required to record selected number or time of record to proper register (0204, 0205 – number of record, 0201…0203 – time of record) using an 10 function.

16.5.1. Registers' addresses for readout of archive of current results

Registers` addresses		Format	Description
DEC	HEX		
General information			
256,257	**0100, 0101**	Ulong	Number of available records
258,259	**0102, 0103**	Ulong	Number of saved records

260,261	**0104, 0105**	Ulong	Fill, number of records saved since indicator of memory space usage was reset.
262,263	**0106, 0107**	Ulong	Last saved record, consecutive number of last saved record.
264,265, 266	**0108, 0109, 010A**	Time	Time of highest record
267,268, 269	**010B, 010C, 010D**	Time	Time of lowest record
270,271, 272	**010E, 010F, 0110**	Time	Time of memory space usage indicator reset
273,274, 275	**0111, 0112, 0113**	Time	Expected time of end of memory space. Values of 0x00 denote that archive is fulfilled. Values of 0xFF denote that expected time won`t be in 21st century
276	**0114**	Uint	Status
277	**0115**	Uint	Size of record in bytes (without end of line characters)
278	**0116**	Uint	Size of headline
Record or headline			
512	**0200**	Uint	Step, number of records to move on after every readout. Don't concern headline readout.
513,514, 515	**0201, 0202, 0203**	Time	Time of record save. If there's no record in registers 0206…02FF, then value in this field is random.
516,517	**0204, 0205**	Ulong	Points which record or which headline's is currently available in registers 0206…02FF: 0xFFFFFFFF – no data in registers 0206…02FF, 0…0x7FFFFFFF – consecutive records, Up from 0x80000000 – number of headline **NOTE! For example, line 3 is 0x80000002**
518	**0206**	2 x char	Record or headline in string form ended by null digit . There are two ASCII chars in each register (first one is on the highest bytes). Late, unused registers are filled by zero digits. String doesn't contain end of line characters.
…	**…**	…	
767	**02FF**	2 x char	

Table formats:

Uint – unsigned integer saved in one register (2bytes),

Ulong – unsigned integer saved in two registers (4 bytes), in first register are saved lowest 16 bites of them,

Time, consecutive:

- Year (High byte of first register),
- Month (Low byte of first register),
- Day (High byte of second register),
- Hour(Low byte of second register),
- Minutes (High byte of third register),
- Seconds (Low byte of third register).

Char – one char on one byte.

NOTE!!! For instance, for 4 byte number ABCD:
CD – low 16 bits (low byte),
AB – high 16 bits (high byte).

16.5.2. Registers' addresses to which recording is possible.

Registers' addresses		Format	Description
DEC	HEX		
512	**0200**	Uint	Step, number of records to move on after every readout. Don't concern headline readout.
513, 514, 515	**0201, 0202, 0203**	Time	Time of record save. If there's no record in registers 0206…02FF, then value in this field is random
516, 517	**0204, 0205**	Ulong	Points which record or which headline is currently shared in registers 518…767: 0xFFFFFFFF – no data in registers 0206…02FF, 0…0x7FFFFFFF – consecutive records , Up from 0x80000000 – number of headline **NOTE! For example, line 3 is 0x80000002**

Time, consecutive:

- Year (High byte of first register),
- Month (Low byte of first register),
- Day (High byte of second register),
- Hour(Low byte of second register),
- Minutes (High byte of third register),
- Seconds (Low byte of third register).

Char – one char on one byte.

NOTE!!! For instance, for 4 byte number ABCD:
CD – low 16 bits (low byte),
AB – high 16 bits (high byte).

16.6. Readout and settings of clock

Current time is read by 04 command.

To modify clock's settings user should use 10 command. This command have to contain strictly all three registers. In another time will be rejected with error code 02.

16.6.1. Registers' addresses of clock

Registers' addresses		Format	Description	
DEC	HEX			
			High byte	Low byte
32	0020	Time	Year	Month
33	0021	Time	Day	Hour
34	0022	Time	Minute	Second

NOTE!!!
For instance, for 2 byte number AB:
B – low 8 bits (low byte),

A – high 8 bits (high byte).

Year, month, Day, hour, minute, second should be entered in HEX system. In the following table is an example for date 2009-12-25 and time 15:40:00:

Registers' addresses (HEX)	Number
0020	090C
0021	190F
0022	2800

16.7. Function 08 (Diagnostics)

The MPI-C device accepts only one diagnostics command – return of received control data ("echo").

Diagnostics function (query) has a form:

Function (1B)	Subfunction (2B)	Data (2B)

Function – 08 HEX – diagnostics.
Subfunction – only 0000 HEX – return of received data.
Data – two bytes of data in any value.

In response, the device transmits a sequence of characters in form of:

Function (1B)	Subfunction (2B)	Data (2B)

Function – acknowledgement, in case of error 80 HEX value is added on to the command code.

Error codes possible for the device are:

- 01 HEX – incorrect function (in case of diagnostics also impermissible subfunction),
- 02 HEX – incorrect initial address,
- 03 HEX – incorrect number of points.

Queries are not confirmed by a response in case of:

- parity error,
- CRC errors,
- address error.

Subfunction – acknowledgement.
Data – return of two received bytes of data.