

FP-401

version 1.16



FP-401

Flow totalizer
with result recording

OPERATING MANUAL

Version: 200331EN

metronic

Safety Information

- !** To ensure safe installation and operation, follow all instructions found in this Operating Manual.
- Incorrect installation of the device may cause serious health hazards and can be life threatening.

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

The device must not be installed in explosive environments.

Manufacturer's Information

- !** The Manufacturer reserves the right to modify some of the functions of the device.



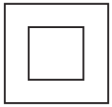
The device is compliant with EMC requirements (electromagnetic compatibility of industrial devices), as per Directive 2014/30/EU.

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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:

Low Voltage Directive (2006 / 95 / EC) by meeting the standards of:

- EN 61010-1: 2001 Safety requirements for electrical equipment for measurement, control and laboratory use.

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

- Immunity EN 61326-1:2013 Table 2
- Radiated and conducted emissions EN 61326-1:2013 Class A.

The product may be exposed to interference above the limits of EN 61326 if:

- 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 FP-401 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 Metronic AKP 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 Basic data

FP-401 is a flow totalizer with 2GB of internal memory for data recording. The device is highly configurable, allowing it to be adapted to the user's needs. The device has four measurement inputs:

- two analogue inputs (0/4÷20mA, RTD, R, U),
 - two pulse inputs (PULSE)
- and two calculation inputs.

The results from the measurement and calculation inputs are displayed on the large LED display. The values of totalizers (two L1 and L2 totalizers and two timers: T1 – total runtime and T2 – individual runtime of each input) are shown on the lower OLED display.

The device is intended primarily for the measurement of:

- flow of fluids,
- flow of vapour and process gases without compensation,
- measurement of flow and other values in one device (e.g. flow and temperature of fluid).

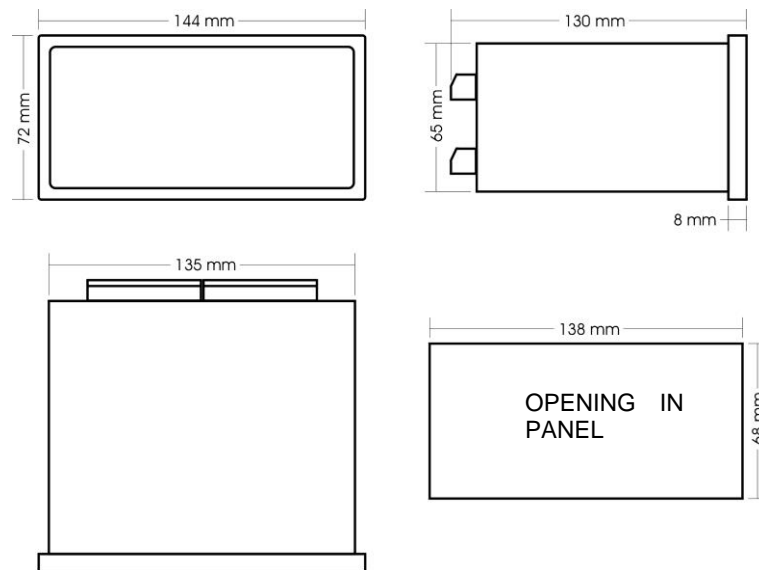
3.1 Available Versions

The device is available in versions with a 4-20mA analogue output. Options can be identified through the code:

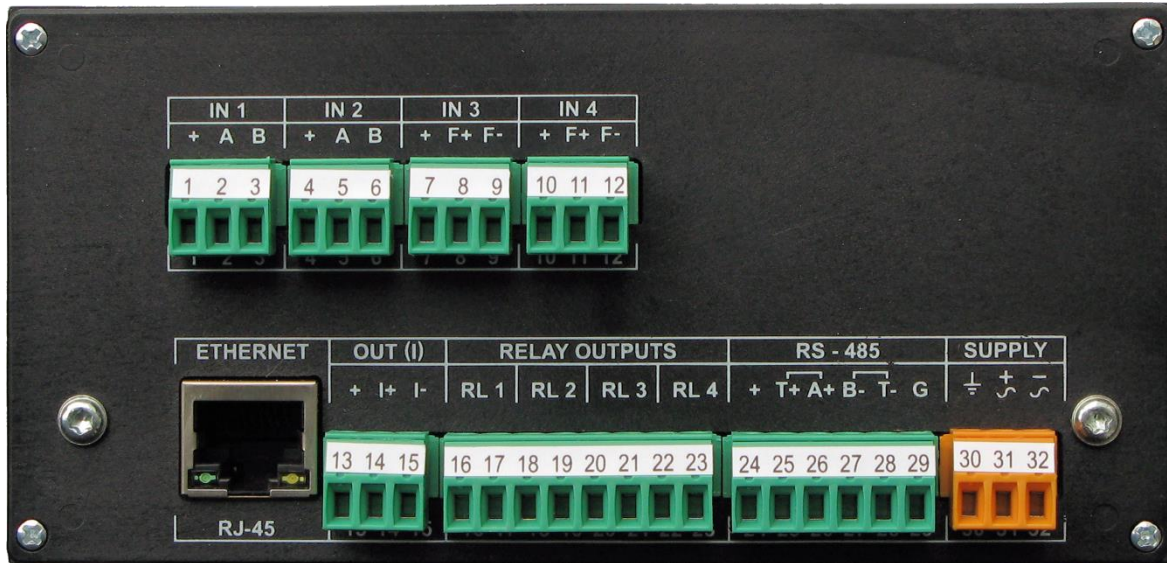
FP-401	- x	
	- 0	version without analogue output 4-20mA
	- 1	version with analogue output 4-20mA

4 Mechanical Assembly

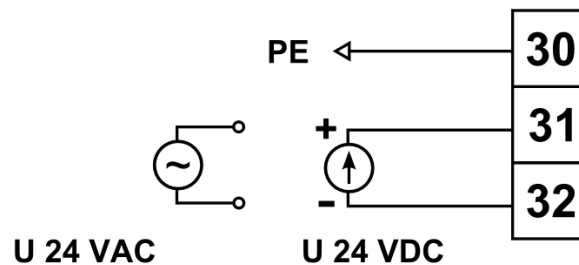
The FP-401 is suitable for panel mounting. It can be built into panels thicker than 1mm. Before installation, a 138 (+1) mm x 68 (+0.7) mm rectangular opening must be cut out in the panel. The mounting depth of the device is 127mm. To ensure easy installation of electrical connections, we recommend leaving an extra space of approx. 30mm behind the device. When installing the device in the opening of the panel, insert and fit a gasket between the rear wall of the frame and the panel. After mounting the device, attach the latch fasteners on the side walls and tighten the set screws. With the removable screw terminal strip, you can first install electrical connections and then fit the device.



5 Electrical Connections



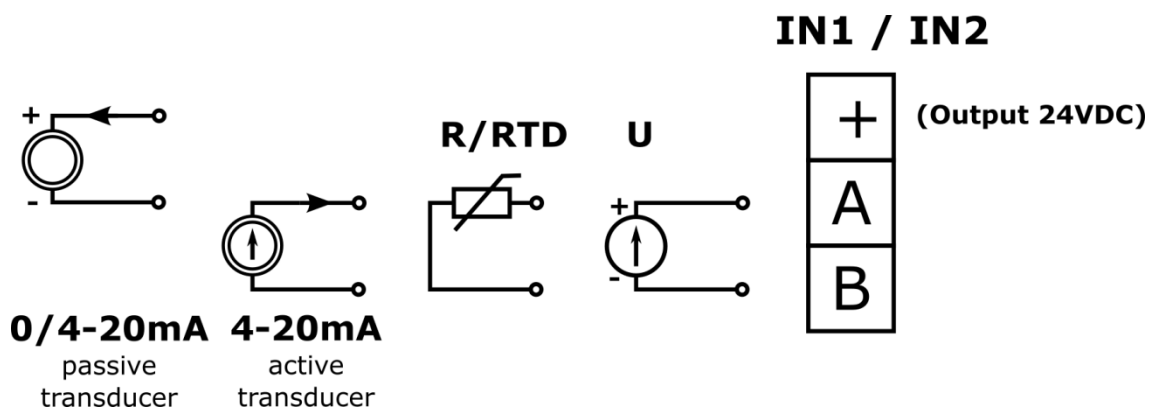
5.1 Power Connection



The design of the device allows powering with either direct current or alternating current 24V. In the case of direct current, polarity is irrelevant. The device has built-in maintenance free polymeric fuses which interrupt the power supply circuit in the case of an emergency. When the failure is finally resolved, the fuses will return to their normal state in a few minutes.

Terminal 30 is the ground terminal. In order to eliminate interference, it is recommended to connect the ground wire to the terminal block of the measurement cabinet ground potential (PE or „0“). This connection is recommended, but not obligatory. In special circumstances (incorrect ground potential) it may even be disadvantageous.

5.2 Connecting Transducers to Analogue Inputs

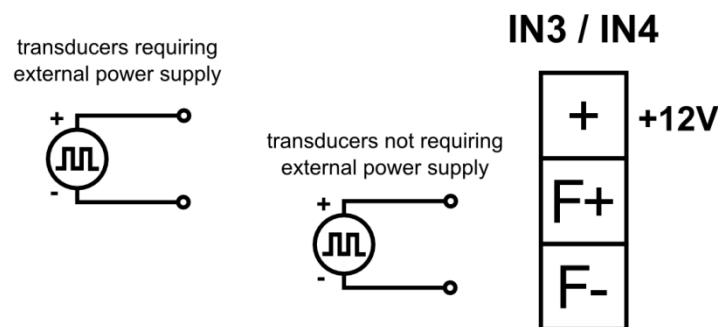


The following devices can be connected:

- passive transducer with 4-20mA current loop output signal; the passive transducer requires power supply and can be powered directly from the device (terminal „+“ is the 24VDC voltage powering the current loop) or from an external direct current power adapter;
- active transducer with 0-20mA or 4-20mA current loop output signal; the active transducer is a power source and does not require power supply;
- RTD temperature sensor (Pt100, Pt200, Pt500, Pt1000) 2-wire;
- transducer with resistance output 0 – 2.5k Ω ;
- transducer with voltage output $\pm 1V$, $\pm 10V$.

Note!

Connecting certain types of sensors or transducers may require switching jumpers inside the device. For details, see section 5.9.

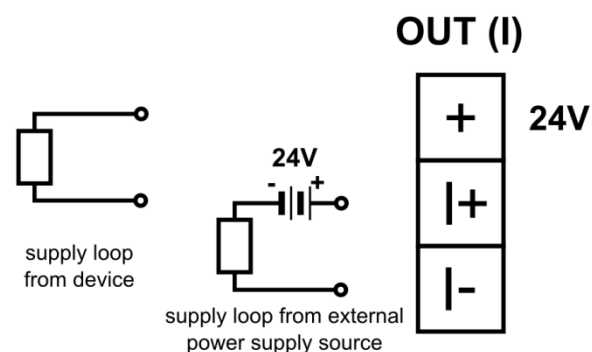
5.3 Connecting Transducers to PULSE Inputs


The following devices can be connected:

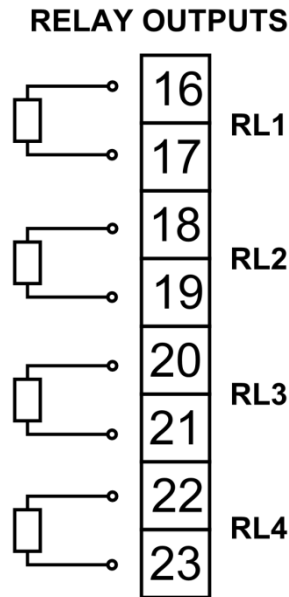
- passive contact (e.g. reed switch) or OC type output;
- current transmitter with switching threshold approx. 12.5mA (e.g. for operation with PROWRIL transducer by Endress+Hauser);
- NAMUR type current transmitter;
- active voltage transmitter.

Note!

Connecting certain types of sensors or transducers may require switching jumpers inside the device. For details, see section 5.9.

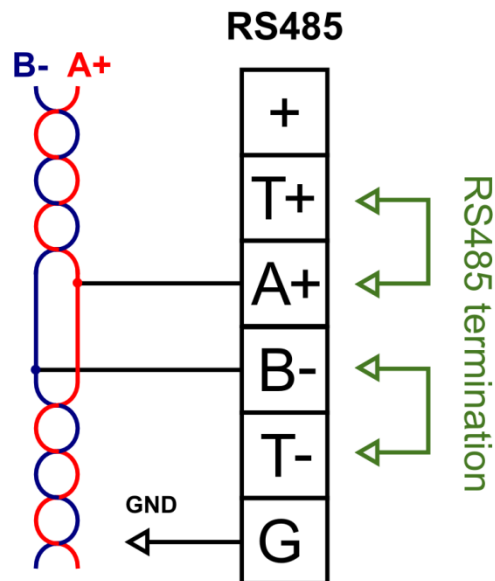
5.4 Connecting Analogue Output


5.5 Connecting Relay Outputs



The device is fitted with four galvanically separated 100mA/60V electronic relays and can control the operation of DC / AC powered receivers.

5.6 Connecting RS485



The device connects to an RS-485 serial busbar, i.e. 26 A(+) terminal is connected to A line terminal and 27 B- terminal to B line terminal. Terminal no. 29 GND can be used to connect the ground potential or the data transmission cable screen. Connecting the RS485 bus terminating system is possible by shorting terminal T+ with A+ and T- with B-.

5.7 USB Port

The A type USB port is located on the face plate. The port enables connection of external mass storage devices (pendrive).

5.8 Connecting Ethernet

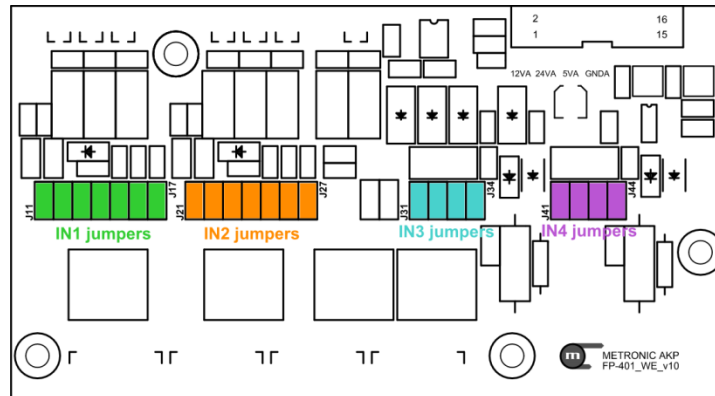
The Ethernet (100Base-T) port is located at the back of the device. The socket leads comply with EIA/TIA-568A/B. The socket enables connection of an 8-wire twisted pair cable with an RJ-45 plug.

5.9 Configuration of Jumpers Inside the Device

Changing the configuration of jumpers inside the device may be required in the case of:

- connecting transducers of a given type to analogue inputs,
- connecting transducers of a given type to PULSE inputs,
- connecting/disconnecting filters on PULSE type inputs.

This will require you to disassemble the case of the device.



5.9.1 Configuring Jumpers for Analogue Inputs

	INPUT 1							INPUT 2						
	J11	J12	J13	J14	J15	J16	J17	J21	J22	J23	J24	J25	J26	J27
RTD 2-p	•	•			•			•	•			•		
0/4-20mA	•			•			•	•			•			•
U (±10V)			•			•				•			•	

• indicates closed jumper

5.9.2 Configuring Jumpers for PULSE type Inputs

Input for operation with:	INPUT 3				INPUT 4			
	J31	J32	J33	J34	J41	J42	J43	J44
Endress+Hauser current transmitter	•				•			
NAMUR type current transmitter		•				•		
OC or passive contact type transmitter			•				•	
active voltage transmitter								
FILTER				•				•

• indicates closed jumper





6 Configuring Settings

There are three ways of programming settings:





- from the operator's panel,
- using configuration files stored on a pendrive,
- remotely, by using ports RS485 and Ethernet and the *FP-401.exe* program.

6.1 Configuring the device from the operator's panel

When navigating the *MAIN MENU*, buttons have the following functions:

-  exit one level higher / exit from *MAIN MENU*
-   cycle through options
-  select the currently displayed option (enter) / enter editing mode for currently displayed parameter

When editing parameters, the buttons have the following functions:

-  exit parameter editing, new value is cancelled
-   increase / decrease value of the edited parameter
-  confirm new parameter value

6.1.1 Logging in

To access device settings, log in as the ADMIN (see section 7.1).

6.1.2 Archive

MAIN MENU:

ARCHIVE

START/STOP	Start/stop archiving (default is stop).
FILE ID	Two digit file ID (default is 00). Enables differentiation between files from different devices.
REC. SPEED 1	Basic archiving speed: <i>paused</i> , <i>every 0.2s</i> , <i>every 1s</i> , every 10s , <i>every 30s</i> , <i>every 1min</i> , <i>every 10min</i> , <i>every 30min</i> , <i>every 1h</i> .
REC. SPEED 2	Second archiving speed. Activates when selected alarm thresholds are exceeded (see section 6.1.6): paused , <i>every 0.2s</i> , <i>every 1s</i> , <i>every 10s</i> , <i>every 30s</i> , <i>every 1min</i> , <i>every 10min</i> , <i>every 30min</i> , <i>every 1h</i> .
REC. SPEED TOT	Totalizer archiving speed: <i>paused</i> , <i>every 15min</i> , every 1h .
GATEING IN3 / IN4	Archiving can be stopped depending on the state of the binary input: none , <i>record when 0</i> , <i>record when 1</i> .
EVENTS IN3 / IN4	Save event when: none , <i>record when 0->1</i> , <i>record when 1->0</i> .


DELETE

Deletion of all archived data. The confirmation screen prevents unintended deletion of files.

6.1.3 Display
MAIN MENU:
DISPLAY
LANGUAGE

Choose menu language: **polski** (Polish), **english**.

DEVICE TAG

Configuration of totalizer description (16 characters, default is **Flow totalizer**). The description and ID are displayed upon activation of device and when pressing  during normal operation.

AUTO MODE

In auto mode, results from each measurement channel automatically scroll on the display. The user can determine how long each result is displayed: 0...9s (default is **3s**).

BRIGHTNESS

Adjustment of OLED backlight brightness: **100%**, 50%.

**DATE/TIME
SCRN**

Visible screen, invisible screen.

ARCHIVE

Visible screen, invisible screen.

6.1.4 Inputs
MAIN MENU:
INPUTS
INPUT MUX RATE

Inputs scanning rate: 0.2s, **1s**

**IN1 (analog.) / IN2
(analog.)**
INPUT TYPE

Measurement type setting: *channel disabled*, $U[\pm 1V]$, $U[\pm 10V]$, $R/RTD[\Omega/^{\circ}C/^{\circ}F]$, $I[0/4-20mA]$

RTD TYPE

If INPUT TYPE is set to R/RTD, enter the type of sensor (transducer) used for the measurement: *characteristic*, $Pt100+$, **Pt100**, $Pt200+$, $Pt200$, $Pt500+$, $Pt500$, $Pt1000+$, $Pt1000$. Choose *characteristic* in the case of resistance transducers. Input type $Pt100+$, $Pt200+$, $Pt200+$, $Pt1000+$ means measurement using Pt100, Pt200, Pt200, Pt1000 with accuracy increased by

TEMP.UNIT

If RTD TYPE is set to one of the sensors Pt100 ... Pt1000, choose the temperature unit: **°C**, °F.

R/RTD ADJUSTMEN

Function available only for RTD / R inputs; correction of input lead resistance, by default set to **0**.

CHARACTERISTIC

The user can select the characteristic:

- **LINEAR 4-20mA** (available only if $I[0/4-20mA]$ was selected as *Input type*; enter values corresponding to

	<p>4mA and 20mA),</p> <ul style="list-style-type: none"> • <i>LINEAR 0-20mA</i> (available only if <i>I[0/4-20mA]</i> was selected as <i>Input type</i>; enter values corresponding to 0mA and 20mA), • <i>USER'S</i> (enter values corresponding to 4mA and 20mA). <p>The <i>USER's</i> characteristic is provided as pairs of points: value respectively: measured resistance, current, voltage and value displayed in the appropriate units. The user can add NEW or DELETE points of the characteristic, whereas the minimum number of points is 2 and the maximum is 50. New points are added at the end of the characteristic, while deletion always applies to the last point.</p>
FILTER	The value entered is the time constant of the digital low-pass filter (0 .. 200s, default is 0s).
UNIT	Item disabled if measurement by means of temperature sensor was selected. There are 3 signs available.
FLOW MEASURE	If unit is set to m^3 , and flow measurement is set to /h, the current value will be displayed in m^3/h , and the totalizer in m^3 . Available options: <i>off</i> , /s, /min, /h.
RESOLUTION	Define the number of decimal places for result displaying: 1, 0.1, 0.01, 0.001.
TAG LINE 1	Configuration of description displayed in the upper line of the OLED (apart from the description, the unit of the current value, e.g. kg/h, is also displayed). 8 signs are available; default description is Measurement .
BARGRAPH / TAG	Choose whether the lower line of OLED is to display a bar graph or description.
TAG LINE 2	Configuration of description displayed in the lower line of the OLED (unavailable if bar graph is displayed). 16 signs are available; default description is ???.
BAR 0%	Configuration of lower bar graph range displayed in the lower line of the OLED (unavailable if description is displayed). Default is 0.000.
BAR 100%	Configuration of upper bar graph range displayed in the lower line of the OLED (unavailable if description is displayed). Default is 100,000.
DEFAULT SCRIN	Configuration of the default screen shown on the lower display.
COLOR	You can assign a display colour to each result (choose between green, orange, red).
IN3 (PULSE) / IN4 (PULSE)	
INPUT TYPE	Measurement type setting: <i>off</i> , frequency , <i>pulse</i> , <i>state</i> .

If *Input type* is set to *pulse*, set the weight of one pulse.

If *Input type* is set to *frequency*. The user can define the characteristic:

CHARACTERISTIC

- *LINEAR* 0-1kHz (choose two points of characteristic: value corresponding to 0Hz and value corresponding to 1000Hz),
- *USER'S* (identical to user defined characteristic for analogue inputs).

If *Input type* is set to *state*, define the values for shorting and disconnection.

FILTER

UNIT

FLOW MEASURE

RESOLUTION

TAG LINE 1

BARGRAPH/TAG

TAG LINE 2

BAR 0%

BAR 100%

DEFAULT SCRN

COLOR

As per analogue inputs IN1 and IN2.

IN5 (calc.) / IN6 (calc.)

Defining the method for performing operations in calculation channel:

off,

FORMULA

$A * Kx + B * Ky + C,$
 $A * Kx - B * Ky + C,$
 $A * Kx * B * Ky + C,$
 $A * Kx / B * Ky + C.$

CONSTANT A/B/C/

Defining constants in the operation; default is **1.000**.

VARIABLE Kx

Defining value of variable Kx: '**constant = 0**', value IN 1, value IN 2, value IN 3, value IN 4, value IN 5, value IN 6.

VARIABLE Ky

Defining value of variable Ky: '**constant = 0**', value IN 1, value IN 2, value IN 3, value IN 4, value IN 5, value IN 6.

CHARACTERISTIC

The user can only define the linear characteristic. The method for defining points of characteristic is identical as in the case of analogue inputs.

FILTER

As per analogue inputs IN1 and IN2.

UNIT

FLOW MEASURE

RESOLUTION

TAG LINE 1

Configuration of description displayed in the upper line of the OLED (apart from the description, the unit of the current value, e.g. kg/h, is also displayed). 8 signs are available; default description is **Result**.

BARGRAPH/TAG

TAG LINE 2

BAR 0%

BAR 100%

As per analogue inputs IN1 and IN2.

DEFAULT SCRN

COLOR

6.1.5 Totalizers

Totalizers are available only for inputs that measure flow values.

MAIN MENU:

TOTALIZERS

IN1 / IN2 / IN3 / IN4 / IN5 /

IN6

L1 RESOLUTION

Define the number of decimal places for displaying totalizer L1: 1, **0.1**, 0.01, 0.001.

L2 RESOLUTION

Define the number of decimal places for displaying totalizer L2: 1, **0.1**, 0.01, 0.001.

BUTTON RESET L2

Define whether totalizer L2 can be zeroed from the keyboard: **enabled**, disabled.

AUTO RESET L2

Configuration of automatic zeroing of counter L2: **disabled**, hourly, daily, monthly (every month).

RESET TIME

Defining the day, hour and minute of automatic zeroing of totalizer L2 (available if automatic zeroing is not disabled): dd hh:mm (default: **01 00:00**).

6.1.6 Alarms

MAIN MENU:

ALARMS

TRIGGER

Reaction to exceedance may occur upon the first or the second detection of exceedance (reaction after second

exceedance prevents alarms from being activated as a result of brief signal fluctuations): **after 1st**, **after 2nd**.

IN1 AL1 / IN1 AL2 / ... / IN6

AL2

TYPE	Defining type of alarm: off , low - exceedance occurs if measured value is lower than preset level, high - exceedance occurs if measured value is higher than preset level.
LEVEL	Exceeding this value causes alarm activation; the alarm level uses the same units as the measured value.
HYSTERESIS	Hysteresis is the difference between the threshold exceedance level and return. The hysteresis value uses the same units as the measured value.
ASSIGN	When the selected alarm threshold is exceeded, the selected relay output(s) can be activated (<i>RL1</i> , <i>RL2</i> , <i>RL3</i> , <i>RL4</i>).
ARCHIVE REC.	Exceedance of the alarm and control threshold can enable recording speed II: no action , change to rec.2 .
COLOR	The display colour of results can change every time the set alarm and control threshold is exceeded: green , orange , red . The colour assigned to alarm 2 has higher priority, i.e. if both thresholds are exceeded for the selected result, it will be displayed in the colour assigned to alarm 2.

6.1.7 Failures

MAIN MENU:

FAILURES

IN1 ... IN6

FAILURE ACTION	Configuration of reaction to a failure: <i>symbol failure</i> , <i>last value</i> , <i>constant value</i> .
VALUE	Define constant value displayed when failure occurs.
ASSIGN	Failure of the measurement transducer can cause activation of the selected relay output(s) (<i>RL1</i> , <i>RL2</i> , <i>RL3</i> , <i>RL4</i>).


6.1.8 Outputs

MAIN MENU:

OUTPUTS

OUTPUT 4-20mA

ASSIGN	The parameter defines the channel whose result is obtained in order to calculate the output current: none , <i>IN 1</i> , <i>IN2</i> , <i>IN3</i> , <i>IN4</i> ,
--------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------

	<i>IN5, IN6.</i>
VALUE 4mA	Lower limit of output range.
VALUE 20mA	Upper limit of output range.
ACTION	Setting this parameter to <i>last value</i> will freeze the last valid result in the case of failure of the assigned channel. Setting this parameter to constant value will cause a constant user defined current in the range 3.6÷22mA to be set in the output when failure of the assigned channel occurs.
VALUE	Define constant current value set in output when failure occurs.
OUTPUTS RL1 ... RL4	Setting this parameter to control will cause activation of relay when at least one alarm threshold assigned to it is exceeded. Return to inactive state will occur when all exceedances of alarm thresholds assigned to this relay have passed. Setting this parameter to <i>alarm</i> or <i>alarm (pulsing)</i> will cause activation of relay when at least one alarm threshold assigned to it is exceeded. Return to inactive state will occur after confirmation with button  on alarm notification panel, whether exceedances of assigned thresholds are still active or not. In <i>alarm (pulsing)</i> mode, the relay additionally pulsates with a frequency of 0.5Hz when activate.
MODE	
ACTIVE	Setting this parameter to NO will cause shorting of the relay in active state. Setting this parameter to <i>NZ</i> will cause disconnection of the relay in active state.

6.1.9 RS485 Port

MAIN MENU:

PORT RS485

ADDRESS MODBUS	Range between 1 and 247, unique address of device in RS485 network
BAUD RATE	Baud rate, supported speeds: 1200, 2400, 9600, 19200 , 115200, 230400.
PARITY	Select a parity control option: <i>none1</i> (none + 1 bit stop), <i>none2</i> (none + 2 bity stop), even , <i>odd</i> .
TIMEOUT	The minimum time before the device responds to an inquiry; can be set within the range of 0 ÷ 7,000ms.

6.1.10 Ethernet Port

MAIN MENU:

PORT ETHERNET

IP	Set according to the network in which the device will be operating, default is 1.0.0.1 .
PORT	Default is: 502 .
MASK	Set according to the network in which the device will be operating, default is 255.255.255.0 .
GATE	Set according to the network in which the device will be operating, default is 1.0.0.1 .
DHCP	Should be enable if device is connected directly to computer's network adapter; otherwise turn the DHCP server disable.
TIMEOUT	The minimum time before the device responds to an inquiry: 0 .. 65535s.

6.1.11 Date / time

MAIN MENU:

DATE/TIME

DATA	Date setting, format yyyy-mm-dd.
TIME	Time setting, format: hh:mm:ss.

6.1.12 Passwords



MAIN MENU:

PASSWORDS

USER PASS.	Change user password, default is: 0000 .
ADMIN PASS.	Change admin password, default is: 1000 .

6.2 Configuration Files

The device can be configured using settings stored in files. To copy settings from device to file or program the device with settings stored in a file:



1. install flash memory (pendrive) in the USB port of the device;
2. the device will detect the flash memory, the login screen will appear on the lower display, log in as *ADMIN* or *USER* (only saving settings from device to file), see section 6.1.1 for more details;
3. use  and  to choose a function:


USB ► SETTINGS
► ►►

Programming device with settings saved as *[any_name].PAR* in the main folder of the USB flash memory.

USB ► SETTINGS
► ◀◀

Storing device settings in configuration file: *FP401_[ID].PAR*.

4. when programming the device, after confirming function selection , choose the appropriate file from the list and confirm ; the device will be programmed with new settings and will reset;

5. when copying settings to a file, the setting will be saved after pressing .

Note!

Never remove the flash memory from the USB port when moving data between FP-401 and flash memory. Otherwise you may lose your data.





6.3 Remote Device Configuration

The device can be configured remotely through the RS485 port and Ethernet port by using the *FP-401.exe* program.

7 Operational Functions of Device

7.1 Logging in

To log in to the device:

- during normal operation press and hold  until you hear a sound,
- use buttons  and  to select *USER* (access only to start / stop archiving and copying settings from device to flash memory) or *ADMIN* and confirm 
- enter password:



exit, return to normal operation



incrementation of edited item



decrementation of edited item



confirm each sign

Note!

The default password of *ADMIN* is "1000".



The default password of *USER* is "0000".





The password can be changed (see section 6.1.12).

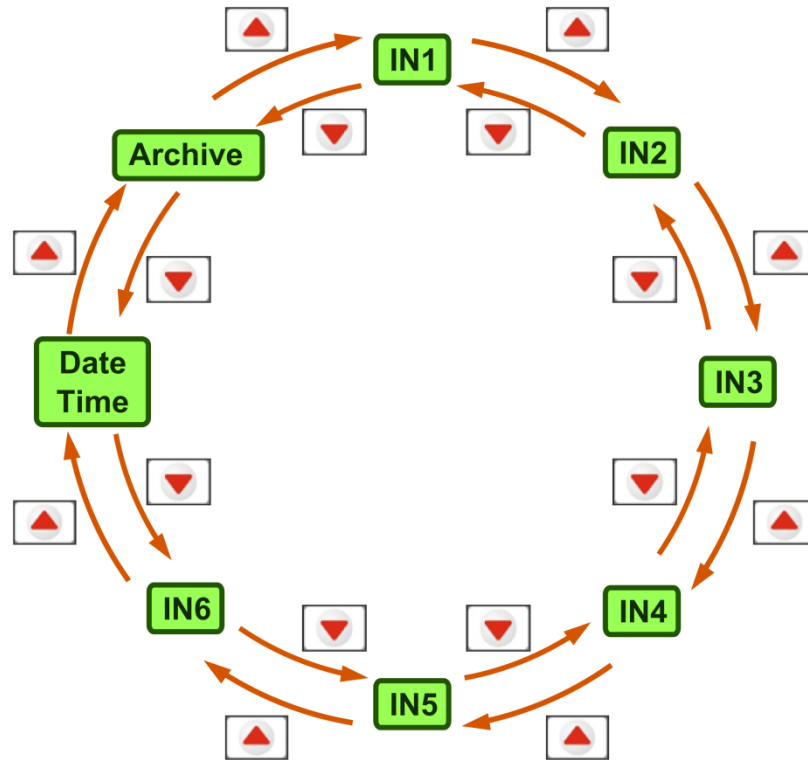
7.2 Viewing Results on the Screen


Current measurement results are displayed on the upper LED display. The lower OLED display shows information on:

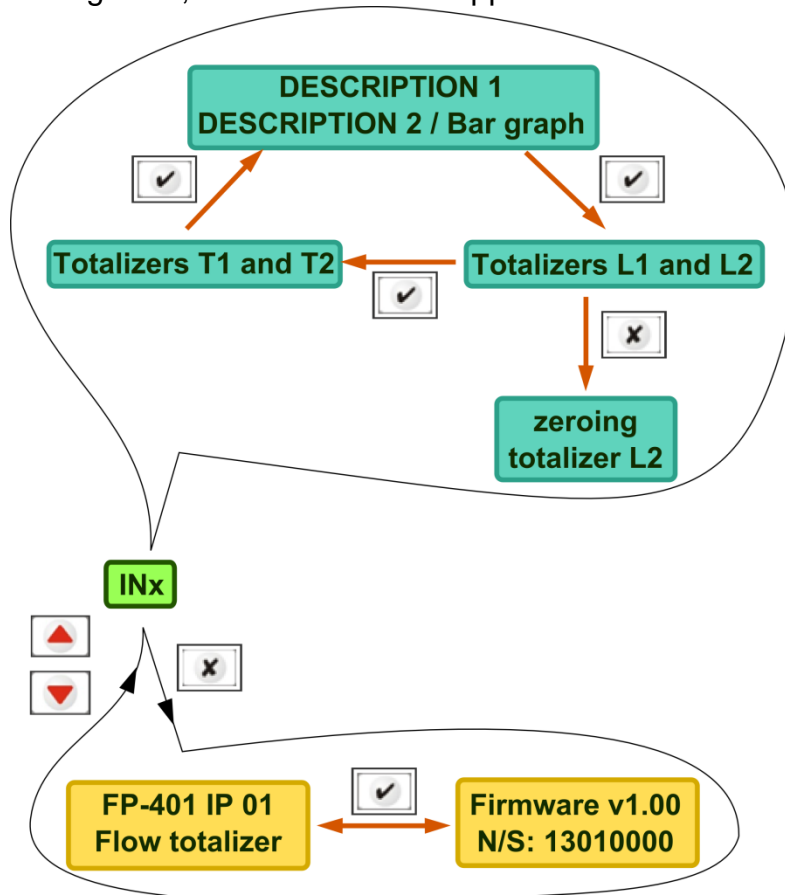
- operational status and portion of archive used,
- date and time,
- status of totalizers L1 and L2 and timers T1 and T2 for the input whose value is shown in the upper display,
- description and description/bar graph for the input whose value is shown in the upper display,
- firmware version and ID number of device.

Switching between current results in upper display and between archive screens and date/time follows the pattern below when pressing  and .

There is also an automatic display mode for values of inputs. For this, press and hold (until you hear a sound) either  or . The time a single result is displayed in auto mode is adjustable. To leave auto mode, press either  or .





The method of navigation between totalizer statuses, descriptions and device information is shown below. After pressing , the first screen to appear is the default one.



7.3 Totalizer Resetting







To reset totalizer L2 (if totalizer resetting from the keyboard was not locked during device configuration) assigned to a particular input INx:

- go to INx result indication (on upper display) and totalizer result screen (OLED display),
- press and hold (until you hear a sound) ,
- confirm operation with .

7.4 Recording Measurement Results







Results are stored in the 2GB internal memory of the device. Recording frequency can be adjusted in steps of 0.2s – 1h. The user can define two recording speeds (speed II is activated when the set alarm and control thresholds are exceeded).

7.4.1 Start / Stop Archiving

1. Log in as *ADMIN* or *USER* (see section 7.1).
2. In the main menu use  and  to select *ARCHIVE* → *START /STOP*; confirm with .
3. Use  and  to select *stop* if you wish to stop archiving or *start* to start archiving; confirm with .

Archive status and memory usage are displayed on the archive screen.

7.4.2 Copying Data to Mass Storage Device

1. Install flash memory (pendrive) in the USB port of the device.
2. The device will detect the flash memory and the login screen will appear on the lower display. Log in as *ADMIN* (see section 6.1.1) or *USER* (see section 5.1);
3. Use  and  to choose *ARCHIVE D* (copy data from one day) or *ARCHIVE M* (copy data from one month) and confirm with .
4. Use  and  to choose the data you wish to copy; in the case of *ARCHIVE D*, the device will display the date as *yymmdd*, in the case of *ARCHIVE M* - *yymm*; confirm with .
5. The copying process will start. Progress is displayed in per cent.
6. When copying is finished, the date appears again. Two files are created in the main folder of the flash drive:
 - a. one containing current values [*IDyymmdd*].*dat*.
 - b. one containing totalizer values [*IDyymmdd*].*tot*.

Note!

Never remove the flash memory from the USB port when moving data between FP-401 and flash memory. Otherwise you may lose your data.

7.5 Alarm and Control Functions

Two alarm and control thresholds can be set per each channel (input). Each threshold can be configured as:

- high – exceeded when value rises above the set limit
- low – exceeded when value falls below the set limit

Alarm level and hysteresis are set separately for each threshold. Exceedance can be assigned to one of four output relays. It can also cause the recording frequency or the result display colour to change.

Each output relay can operate in two modes:

- signalling – relay activation (continuous or cyclic), return occurs after confirmation of exceedance;
- control mode – enables simple on/off control.

7.6 Operation in a Computer-based Measurement and Control System

The device has two communication ports (data can be read through two independent ports at the same time):

- RS485 with Modbus RTU protocol,
- Ethernet port with Modbus TCP protocol and WWW server.

For details on Modbus RTU and Modbus TCP protocols (available functions, maps of registers), see section 11.

7.6.1 WWW Server

To interface with the WWW server of the device, use a standard Internet browser. Simply enter the IP address of the device in the browser address bar. The WWW server provides overview of current results. The website should be correctly displayed in Internet Explorer, Mozilla Firefox, Chrome, Opera and Safari browsers (slight differences in website appearance may occur).

8 Technical Data

FRONT PANEL	
Type of display:	LED: 7-segment, 3-colour (green, orange, red), height of digits 14,2 mm OLED: graphic 100 x 16 px, yellow
Indication:	3 two-colour LEDs (red and green) „ALARM”, „REC”, „USB”
Keyboard:	4 buttons
USB port:	USB type A compliant
REAR PLATE	
Wire connection:	Screw-type terminal blocks, max wire section 1.5mm ² six 3-position terminal blocks one 6-position terminal blocks one 8-position terminal blocks
ETHERNET port:	RJ-45
INPUTS	
Number of inputs:	2 analog 0/4-20mA / RTD / U (set input type using jumpers inside device) 2 PULSE type
Frequency measurement / comb filter ⁽¹⁾ :	0,2 sec / 19.6 Hz ; 1 sec / 4.17 Hz
Digital low-pass filter ⁽¹⁾ :	Programmed time constant in the range of 0 to 60 s
Galvanic separation between inputs:	None
Galvanic separation from other circuits:	Functional, 250 VAC
Maximum input voltage:	±30VDC between A(I+) and B(I-) terminals
0/4-20mA input	
Measurement range:	0 ÷ 22 mA
Input resistance:	92 Ω±10%
Measurement accuracy (T _a = 25 °C)	±0,1% of range (typically ±0,05% of range)
Conversion characteristic:	Linear or user defined up to 50 points with linear interpolation between the points
Transducers powered from recorder:	24 VDC (+10/-20%), 24 mA (current-limited polymer fuse)
RTD/R input	
Sensor type:	Pt100, Pt200, Pt500, Pt1000, resistance
Connection:	2-wire
Current:	210µA
Wire resistance compensation in the 2-wire connection:	Constant within the range of -9,99 ohm to 9,99 ohm
Resistance of wires (to the sensor):	max 50 ohm
Transducer resistance range:	0 ... 2500 ohm
Measurement accuracy (T _a = 25 °C)	± 0,1% of range
Conversion characteristic for R:	Linear or user defined up to 50 points with linear interpolation between the points
Range for Pt sensors / measurement accuracy	-200° C ... +850° C -50° C ... +250° C (for Pt+) (charakterystyka wg normy PN-EN 60751:2009)
Measurement accuracy (T _a = 25 °C)	± 0,5 °C (typically ± 0,3° C) ± 0,3 °C (for Pt+)
U (±1 V / ±10 V) input	
Input type:	Voltage
Transducer voltage range::	- 1 V ... +1 V or -10 V ... +10V
Input resistance:	>10 kΩ
Conversion characteristic:	Linear or user defined up to 50 points with linear interpolation between the points
Measurement accuracy (T _a = 25 °C)	± 0,5% of range

PULSE type inputs	
Measurement range:	0,001Hz ÷ 10kHz (0,001Hz ÷ 1kHz, if filtrating condenser is connected)
Minimum pulse width:	50 µs (0,5ms, if filtrating condenser is connected)
Maximum input voltage:	±30 VDC
Frequency measurement	
Conversion characteristic:	Linear or user defined up to 50 points with linear interpolation between the points
Measurement accuracy (T _a = 20 °C)	0,02%
Pulse counting	
Conversion characteristic::	Linear, direct counting of pulses in totalizers multiplied by the weight of the pulse
Configuration: OC / contact	
Open contact voltage:	(default, filtrating condenser disconnected) ca. 4,3V
Short circuit current:	ca. 4,3 mA
Switch on / off threshold:	ca. 2,4 V / 2,7 V
Maximum short circuit resistance:	100 Ω
Configuration: NAMUR	
Input resistance:	1,5 kΩ
Switch on / off threshold:	ca. 1,6mA / 1,8mA
Configuration: current input EH	
Input resistance:	200Ω
Switch on / off threshold:	ca. 12 mA / 13,5 mA
Configuration: voltage input	
Input resistance:	>10kΩ
Switch on / off threshold:	ca. 2,4 V / 2,7 V
Maximum input voltage:	±30 VDC
RELAY OUTPUTS	
Number of outputs:	4
Outputs type:	Solid state relays
Maximum voltage:	60 V AC/DC
Maximum load current:	0,1 A
ANALOG OUTPUT 4-20mA (option)	
Output signal:	4-20 mA
Maximum voltage between I+ and I-:	28 VDC
Loop resistance (for U _{cc} = 24 V):	0 .. 500 Ω
Current loop supply:	External or from internal unit supply 24 V DC / 22 mA
Galvanic isolation to supply voltage:	Functional, 250 VAC
RS-485 PORT	
Signals output on terminal block:	A(+), B(-), T(+), T(-), +5 VDC, GND
Galvanic isolation:	None
Maximum load:	32 receivers / transmitters
Transmission protocol:	Modbus RTU
Maximum length of line:	1200 m
Transmission rate:	1.2, 2.4, 9.6, 19.2, 115.2, 230.4 kbps
Parity control:	Even, Odd, None
Frame:	1 start bit, 8 data bits, 1 stop bit (1 or 2 stop bits for None)
Minimum timeout:	0 ÷ 7,000ms – programmable
Maximum differential voltage A(+) – B(-):	±14 V
Minimum output signal of transmitter:	1,5V (at R ₀ =27Ω)
Minimum sensitivity of receiver:	200mV / R _{WE} =12kΩ
Minimum impedance of data transmission line:	27Ω
Short-circuit / thermal protection:	Yes
Internal terminating resistor:	Yes

ETHERNET PORT	
Transmission protocol:	Modbus TCP, ICMP (ping), DHCP Server, http server
Interface:	100BaseT Ethernet
Number of connections opened simultaneously:	4
USB PORT	
Version:	USB 2.0
Function:	Record archive data, saving the settings, loading settings, upgrade firmware
Data format:	FAT16
INTERNAL DATA MEMORY (RECORDING)	
Capacity:	2 GB, Flash
POWER SUPPLY	
Supply voltage:	24 V AC (+10% / -20%) 20 ... 30V DC
Power consumption:	Max 6 W (typically 4 W)
WORKING CONDITIONS	
Working temperature:	0° C do +55° C
Relative humidity during operation:	5 do 95% (without condensation)
Storage temperature:	-30° C ÷ +70° C
Protection class from the front panel:	IP54
Protection class from the rare panel:	IP30
MECHANICAL DIMENSIONS – HOUSING	
Housing type:	For panel surface, nonflammable plastic material „Noryl“
Dimensions (height x width x depth)	72mm X 144mm X 127mm
Dimensions of panel cut-out:	138 ⁺¹ mm X 68 ^{+0.7} mm
Panel maximum thickness	5 mm
Weight:	ok. 0,5 kg

- (1) - Device has two low-pass filter: comb filter designed to eliminate interference from power grid 50 Hz set automatically depending on the frequency of measurement and digital low-pass filter first class with time constant programmable by the user.

9 Complete delivery and accessories

9.1 Content of FP-401

- Device FP-401 1 pcs.
- 3-position terminal blocks 6 pcs.
- 6-position terminal blocks 1 pcs.
- 8-position terminal blocks 1 pcs.
- Printed User's Manual 1 pcs.
- CD-ROM (manual in electronic version and software) 1 pcs.
- Warranty card 1 pcs.

9.2 Accessories

- Service-type RS485 ↔ USB converter (no galvanic separation) [CONV485USB.](#)
- RS485 ↔ USB converter with galvanic separation [CONV485USB-I.](#)
- RS485 ↔ Ethernet converter [CONV485E.](#)

10 Entity Launching the Product on the EU Market

Entity Launching the Product on the EU Market:

Manufacturer: METRONIC AKP sp. z o.o. sp. k.
st. Żmujdzka 3
PL 31- 426 Kraków, Poland
Tel.: (+48) 12 312 16 80
www.metronic.pl

Vendor:

11 Modbus RTU / Modbus TCP protocol

The device utilises the following Modbus functions:

- **03** (0x03) *Read Holding Registers*,
- **04** (0x04) *Read Input Registers*,
- **06** (0x06) *Write Single Register*,
- **16** (0x10) *Write Multiple Registers*,
- **08** (0x08) *Diagnostic*:
 - subfunction 0 – "echo",
 - subfunction 1 – restart communications options.

Modbus RTU is available through the RS485 port, and Modbus TCP through the Ethernet port.

11.1 Serial transmission parameters for Modbus RTU

Set the transmission parameters according to master system settings:

- address: 01 (01, .. , 247),
- rate: 19,200 (1,200, 2,400, 9,600, 19,200, 115,200, 230,400),
- parity: even (none+ 1 stop bit, none + 2 stop bits, odd, even),
- timeout: 0ms (0 ÷ 7,000ms).

In compliance with the Modbus RTU standard, the frame (information sent) is in the form of:

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

Information sent from the master computer to the device is in the form of Queries, whereas the device itself sends Responses.

11.2 Ethernet Port Settings for Modbus TCP

- IP address,
- port,
- mask (e.g. 255.255.255.0),
- gateway (e.g. 1.0.0.1),
- DHCP server (disabled),
- timeout (usually 60s).

In compliance with the MODBUS standard, the frame (information sent) in TCP/IP mode is in the form of:

Header MBAP	Function	Data
7 bytes	1 byte	n bytes

Information sent from the master computer to the device is in the form of Queries, whereas the device itself sends Response

11.3 Reading and Saving Device Settings

11.3.1 Function 30 – *Read Holding Registers*

Function 03 (0x03) Read Holding Registers allows the device's operational parameters to be read. Command 03 is in the form of:

Function (1B)	Init. address (2B)	Number of registers (2B)
---------------	--------------------	--------------------------

Function – 03 HEX – readout of device parameters.

Initial address – address of the register from which data will be sent.

Number of registers – number of 2 byte registers to read.

In response, the device will send a string of characters in the form of:

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

Function – return confirmation; in the event of an error, 80 HEX is added to the command code value.

Number of bytes – n bytes sent in response (instead of the number of registers).

Data – n bytes of register content.

11.3.2 Function 06 – *Write Single Register*

Function 06 (0x06) Write Single Register is in the form of:

Function (1B)	Address (2B)	Data (2B)
---------------	--------------	-----------

Function – 06 HEX – saving device parameters.

Address – address of the register to which data will be stored.

Data – data to be saved.

In response, the device will send a string of data in the form of:

Function (1B)	Address (2B)	Data (2B)
---------------	--------------	-----------

Function – return confirmation; in the event of an error, 80 HEX is added to the command code value.

Address – return confirmation.

Data – contents of the register.

11.3.3 Function 16 – *Write Multiple Registers*

Function 16 (0x10) Write Multiple Registers is in the form of:

Function (1B)	Init. address (2B)	Number of registers (2B)	Number of bytes (1B)	Data (2nB)
---------------	--------------------	--------------------------	----------------------	------------

Function – 10 HEX – saving device parameters.

Initial address – address of the register from which data will be stored.

Number of points – number of 2 byte registers to store.

Number of bytes – number of data bytes.

Data – 2n bytes of data to be saved.

In response, the device will send a string of data in the form of:

Function (1B)	Init. address (2B)	Number of registers (2B)
---------------	--------------------	--------------------------

Function – return confirmation; in the event of an error, 80 HEX is added to the command code value.

Initial address – return confirmation.

Number of registers – return confirmation.

11.3.4 Map of Registers for Reading / Saving Device Parameters

reg. addr. DEC	reg. addr. HEX	description	value range	default	type	notes
date and time						
1738	06CA	date - year	0...65535	-	Int (16b)	
1739	06CB	date - month	1...12	-	Int (16b)	
1740	06CC	date - day	1...31	-	Int (16b)	
1741	06CD	date - hours	0...23	-	Int (16b)	
1742	06CE	date - minutes	0...59	-	Int (16b)	
1743	06CF	date - seconds	0...59	-	Int (16b)	
Registers with addresses between 0 and 1737 are hidden						

11.4 Readout of results

11.4.1 Function 04 – Read Input Registers

Function 04 (0x04) *Read Input Registers* enables readout of:

- measured electrical values ([mV] for TC/U sensors; [Ω] – for RTD/R sensors; [mA] – for 0/4-20mA transducers);
- measured temperature ($^{\circ}\text{C}$, $^{\circ}\text{F}$) or the values calculated using the linear characteristic;
- readings from the internal temperature sensor used for cold junction temperature compensation of thermocouples (ambient temperature).

Readout function (04 – Read Input Registers) is in the form of:

Function (1B)	Init. address (2B)	Number of registers (2B)
---------------	-----------------------	-----------------------------

Function – 04 HEX – readout of current results.

Initial address – address of the register from which data will be sent.

Number of registers – number of 2 byte registers to read.

In response, the device will send a string of characters in the form of:

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

Function – return confirmation; in the event of an error, 80 HEX is added to the command code value.

Number of bytes – n bytes sent in response (instead of the number of registers).

Data – n bytes of register content.

11.4.2 Map of registers for reading results

reg. addr. HEX	reg. addr. DEC	description	type
0000...0001	0...1	Value of channel 1 (measured value + characteristic)	Float (32b)
0002...0003	2...3	Value of channel 2 (measured value + characteristic)	Float (32b)
0004...0005	4...5	Value of channel 3 (measured value + characteristic)	Float (32b)
0006...0007	6...7	Value of channel 4 (measured value + characteristic)	Float (32b)
0008...0009	8...9	Value of channel 5 (calculated value + characteristic)	Float (32b)
000A...000B	10...11	Value of channel 6 (calculated value + characteristic)	Float (32b)

000C...000D	12...13	Value of channel 1 (measured value + characteristic + filter)	Float (32b)
000E...000F	14...15	Value of channel 2 (measured value + characteristic + filter)	Float (32b)
0010...0011	16...17	Value of channel 3 (measured value + characteristic + filter)	Float (32b)
0012...0013	18...19	Value of channel 4 (measured value + characteristic + filter)	Float (32b)
0014...0015	20...21	Value of channel 5 (calculated value + characteristic + filter)	Float (32b)
0016...0017	22...23	Value of channel 6 (calculated value + characteristic + filter)	Float (32b)
0018...001B	24...27	Value of totalizer 1 of channel 1 multiplied by 1000	Long (64b)
001C...001F	28...31	Value of totalizer 2 of channel 1 multiplied by 1000	Long (64b)
0020...0023	32...35	Value of totalizer 1 of channel 2 multiplied by 1000	Long (64b)
0024...0027	36...39	Value of totalizer 2 of channel 2 multiplied by 1000	Long (64b)
0028...002B	40...43	Value of totalizer 1 of channel 3 multiplied by 1000	Long (64b)
002C...002F	44...47	Value of totalizer 2 of channel 3 multiplied by 1000	Long (64b)
0030...0033	48...51	Value of totalizer 1 of channel 4 multiplied by 1000	Long (64b)
0034...0037	52...55	Value of totalizer 2 of channel 4 multiplied by 1000	Long (64b)
0038...003B	56...59	Value of totalizer 1 of channel 5 multiplied by 1000	Long (64b)
003C...003F	60...63	Value of totalizer 2 of channel 5 multiplied by 1000	Long (64b)
0040...0043	64...67	Value of totalizer 1 of channel 6 multiplied by 1000	Long (64b)
0044...0047	68...71	Value of totalizer 2 of channel 6 multiplied by 1000	Long (64b)
0048...004B	72...75	Timer 1	Long (64b)
004C...004F	76...79	Timer 2 channel 1	Long (64b)
0050...0053	80...83	Timer 2 channel 2	Long (64b)
0054...0057	84...87	Timer 2 channel 3	Long (64b)
0058...005B	88...91	Timer 2 channel 4	Long (64b)
005C...005F	92...95	Timer 2 channel 5	Long (64b)
0060...0063	96...99	Timer 2 channel 6	Long (64b)

Note!

Float is a 32-bit floating-point number compatible with the IEEE 754

11.5 Diagnostic Command

The device supports two diagnostic functions:

- return of sent control data ("echo"): subfunction 0,
- restart of communication option: subfunction 1.

The diagnostics command is in the form of:

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

Function – 08 HEX – diagnostics.

Subfunction – only 0000 HEX – return received data.

Data – 2 bytes of data of any value.

In response, the device will send a string of characters in the form of:

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



Function – return confirmation; in the event of an error, 80 HEX is added to the command code value.

Subfunction – return confirmation.

Data – return of two bytes of data received.