ul. Konstantynowska 79/81
95-200 Pabianice
phone/fax +48 42 215 23 83,
42 227 09 71
e-mail: biuro@fif.com.pl

Multifunctional network parameter indicator

DMM-5T-2

User manual

v. 1.0.1

GWARANCJA 24 miesiące GWARANCJA

Information about the safety of using the device is indicated by symbols. All information and recommendations bearing these symbols must be strictly observed.

	Danger of electric shock.
	A potentially dangerous situation that could endanger operating personnel or damage the unit.
Information on the construction, operation, and maintenance of the multimeter.	
	Important information, valuable tip.
	Practical advice, solution to the problem.
	Example of application or operation.

Table of contents

Introduction

The DMM-5T-2 is a multifunctional, universal board indicator designed for versatile monitoring of parameters of a single- or three-phase power line. The multimeter allows for high accuracy measurements of all relevant network parameters, such as phase voltages and currents, phase-to-phase voltages, active, reactive, apparent power, power factor. In addition, the multimeter provides a full four-quadrant measurement of energy (both imported and exported) and analyses the distribution of voltage and current harmonics up to and including 63-harmonic.

Technical data

Measuring system	
Electricity grid	1P2W - Single-phase, two-wire 3P3W – Three-phase, three-wire 3P4W – Three-phase, four-wire
Current measurement	
Rated current I_n	0.25 -5 (6) A
	(the actual value of the measured current will depend on the size of the current transformers used)
Power consumption	≤ 0.5 VA/phase
Voltage measurement	
Measurement range	58 – 276 V AC (phase voltage L-N)
	100 – 480 V AC (phase-to-phase voltage L- L)
Frequency	45 ~ 55 Hz
Operating conditions	
Total power consumption	typical ≤ 2 VA temporary ≤ 15 VA
Operating temperature	-25°C ~ 55°C
Storage temperature	-40°C ~ 70°C
Relative humidity	0 ~ 95% (without condensation or aggressive gases)
Class of contamination	2
Flammability of housing	UL94 – V0
Ingress protection	Front – IP54 Back – IP20
Housing size	96 x 96 x 62 mm
Mounting hole size	92 x 92 mm
Panel thickness	1 – 5 mm
Communication	
Pulse outputs	2
RS-485 port	Communication port compatible with Modbus RTU interface Baud rate 2400/4800/9600/19200/38400 bps Parity: none, even, odd Stop bits: 1, 2

Parameter	Displayed value	Accuracy
Voltage	0 ~ 9999.9 kV	0.2 %
Current	0 ~ 9999.9 kA	0.2 %
Power factor	-1 ~ +1	1 %
Frequency	45 ~ 65 Hz	0,2 %
Active power	0 ~ 3600 MW	0.5 %
Reactive power	0 ~ 3600 MVAr	1 %
Apparent power	0 ~ 3600 MVA	1 %
Active energy	0 ~ 9999999.9 kWh	Class 0.5S (IEC62053-22)
Reactive energy	0 ~ 9999999.9 kVArh	2 %
Phase angle		2 %
Total Harmonic Distortion of the current (total or individual from the second to the 63rd harmonic)	0 ~ 100%	2 %
Total Harmonic Distortion of the voltage (total or individual from the second to the 63rd harmonic)	0 ~ 100%	2 %

Installation

Security measures

	**Installation and connection of the multimeter should be carried out by the qualified personnel. All available protection requirements must be taken into account.**	

	**Power supply voltage** The DMM-5T-2 Multimeter is powered via the V1, V2, V3, N voltage terminals and does not require an auxiliary power supply. **It is recommended to protect the power supply and voltage circuits of the meter with a 1 A fuse-link.**	
	**Measuring voltage** The maximum value of the measuring voltage must not exceed 280 V AC (phase voltage between the L-N terminals) or 500 V AC (phase voltage between the L-L terminals). Exceeding the maximum value of the measuring voltage may result in damage to the device	
	**Measuring current** The multimeter is designed for indirect current measurement using current transformers with 5 A secondary current. If the measuring current exceeds 6 A, this can lead to damage to the device.	
	**Environmental conditions** The device is designed to operate at a temperature from -25° C to +55° C with air humidity below 90%. Exceeding the operating limits may result in incorrect operation or damage to the multimeter.	

An opening of 92x92 mm should be made in the panel, and the thickness of the material used to make the panel should not exceed 5 mm.

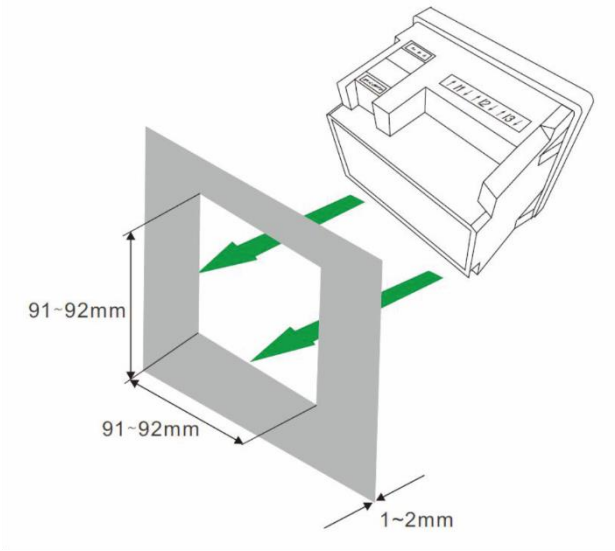


Fig. 1) Installation of the multimeter

Insert the multimeter from the front of the panel with all wires disconnected and press it against the surface of the panel. After mounting the multimeter on the panel, the cabling can be connected.

The diagram of the layout of the leads is shown in Fig. 2.

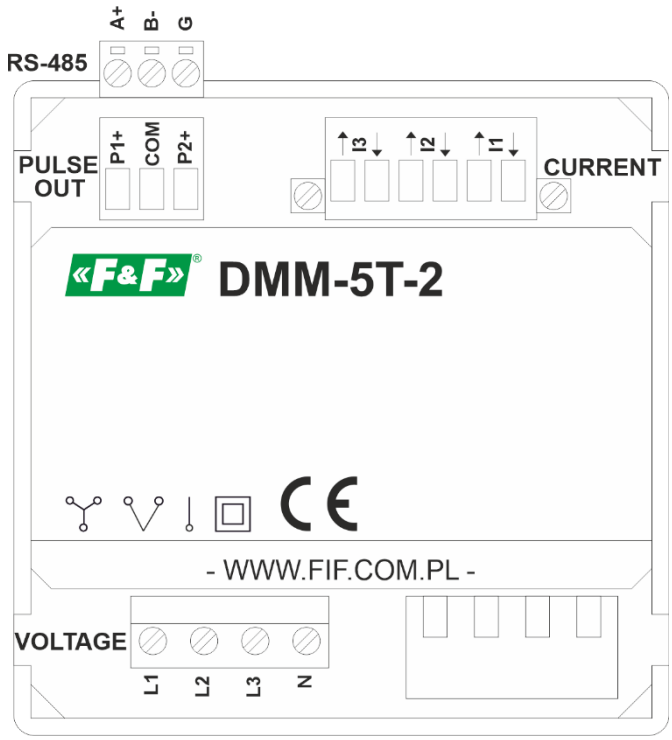


Fig. 2) View of the multimeter from the side of the connector plates

Functions of the terminals

Terminal strip	Terminal	Function	Notes	
VOLTAGE	L1	Voltage measurement chain Power supply of the meter	⚠	The method of connecting voltage terminals to the measured installation must be adapted to the type of measured network, in accordance with the diagrams in Fig. 3 - Fig. 7.
	L3			
	L3		⚠	The voltage circuits of the meter should be protected with a 1 A slow blow fuse-link
	N			
CURRENT	I1 ↑ I1 ↓	Current measuring chain	⚠	The current measuring chain is adapted to connect current transformers with 5 A secondary current and minimum power of 0.5 VA.
	I2 ↑ I2 ↓		🖹	The current input of the meter marked with the ↓ should be connected to the S1 terminal of the current transformer. The current input of the meter marked with the ↑ should be connected to the S2 terminal of the current transformer.
	I3 ↑ I3 ↓		⚠	To prevent high potentials from occurring at the transformer terminals, all S2 terminals of the transformers should be earthed.
PULSE	P1+ COM P2+	Pulse outputs	Passive pulse outputs (open collector) according to Class A IEC 62053-31 P1 – Programmable pulse output (function and number of pulses) P2 – Indication of energy consumption (3200 imp/kWh) COM – Common ground of P1 and P2 outputs.	
			⚠	Maximum load of a single output pulse: Voltage ≤ 30 V Current ≤ 20 mA
RS485	A+	RS485 communication interface	🖹	It is recommended to use shielded cables dedicated to RS485 communication. Terminating resistors with a value of 120 must be connected at the ends of the bus Ω. Up to 32 DMM-5T-2 meters can be connected in one branch of the RS485 bus.
	B-			
	G			

Installation diagrams

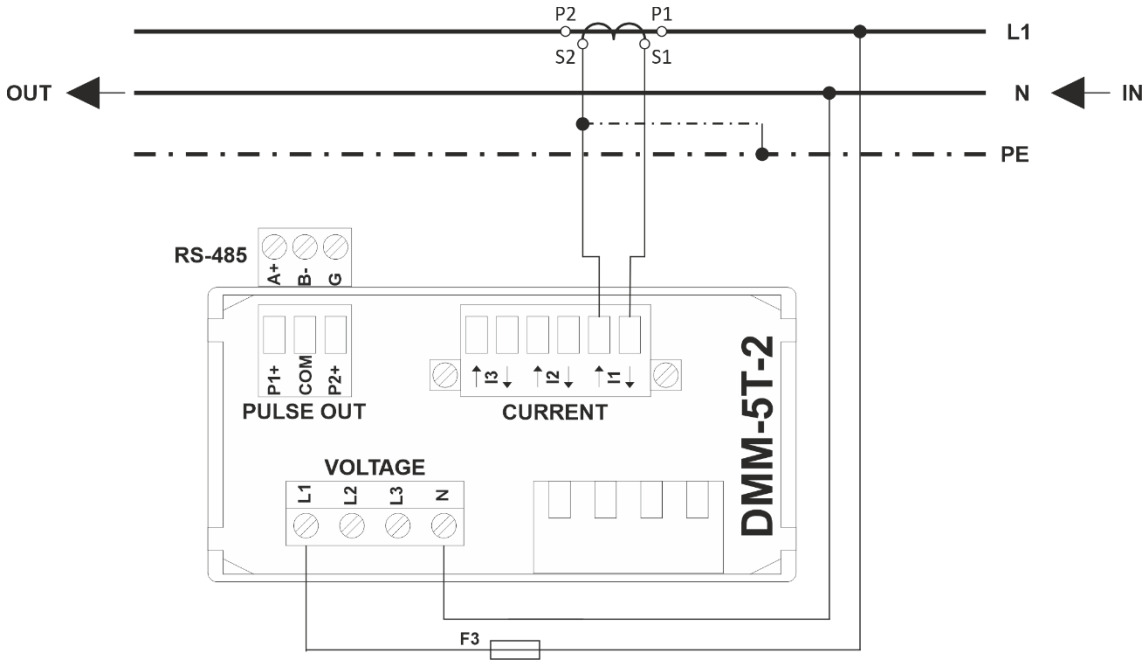


Fig. 3) 1P2W system - 1-phase, 2-wire network, semi-indirect measurement

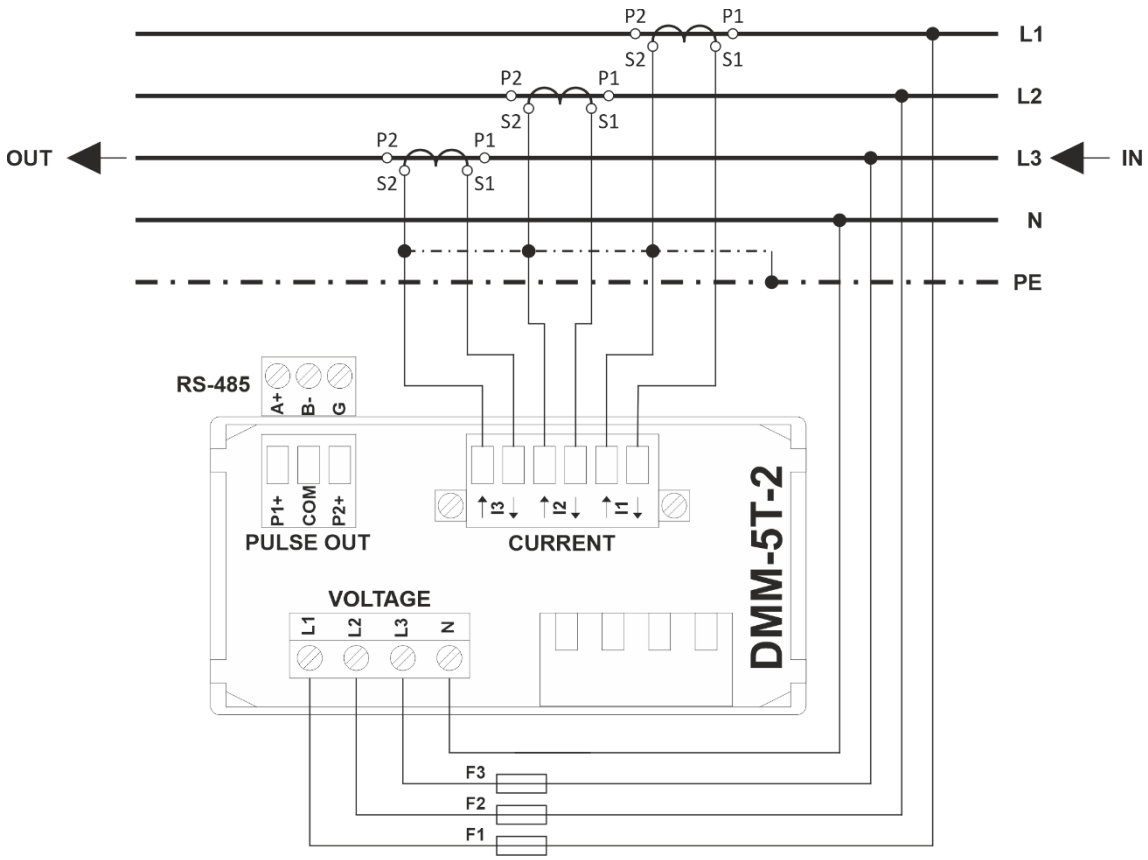


Fig. 4) 3P4W system - 3-phase, 4-wire network, semi-indirect measurement

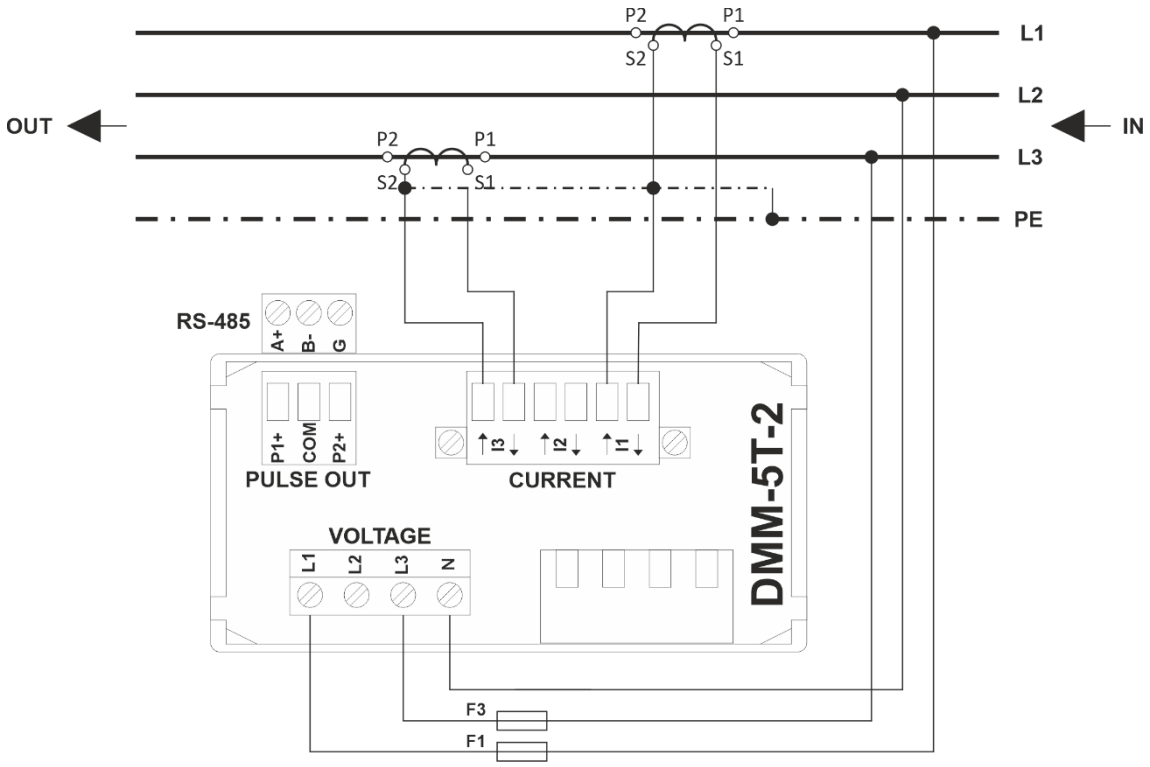


Fig. 5) 3P3W system - 3-phase, 3-wire network, semi-indirect measurement

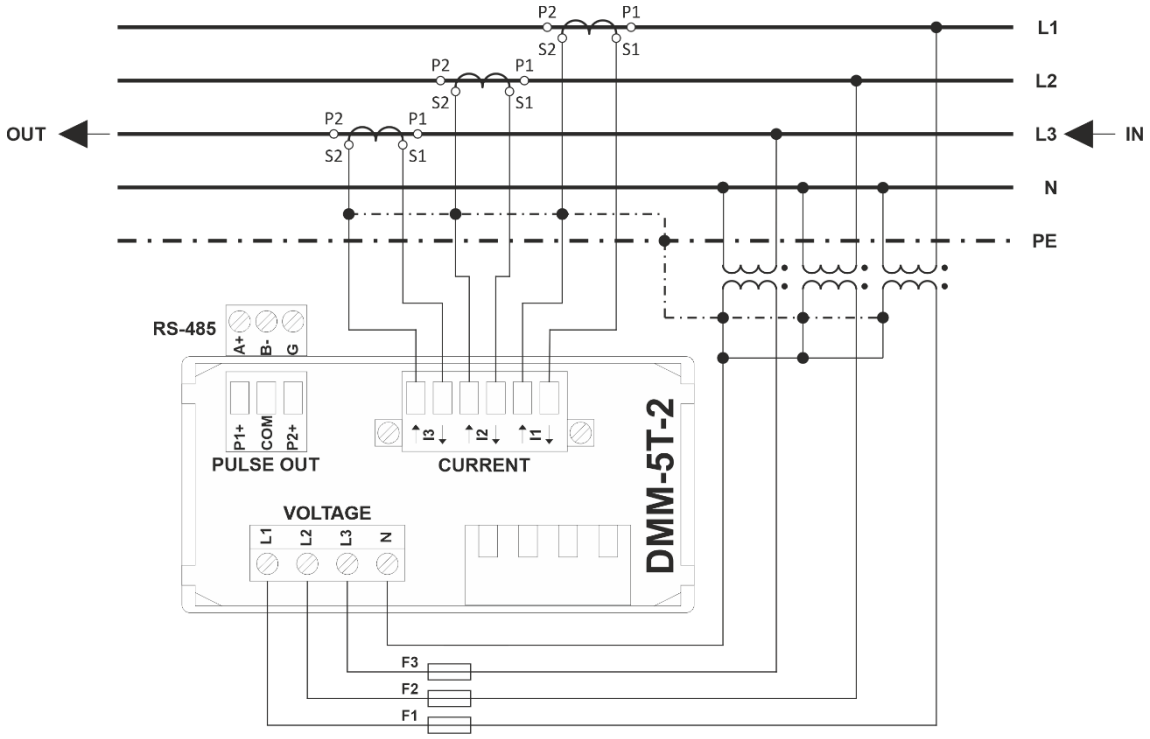


Fig. 6) 3P4W system - 3-phase, 4-wire network, indirect measurement

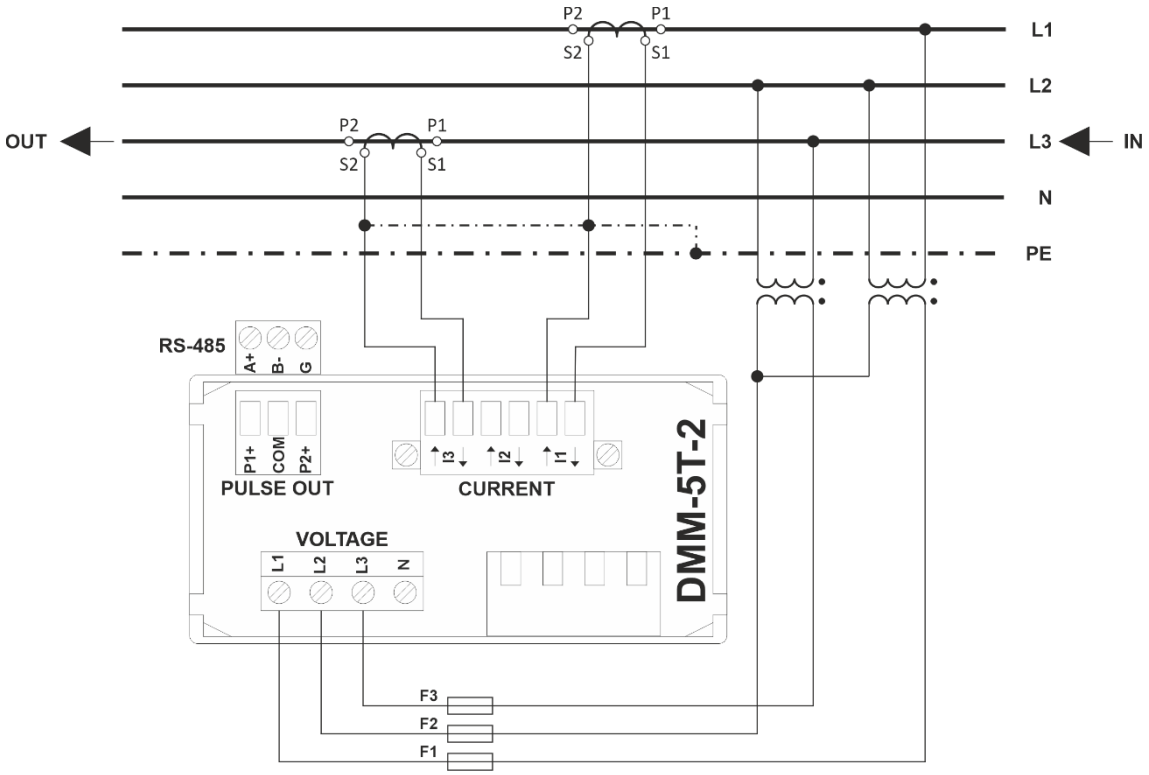


Fig. 7) 3P3W system - 3-phase, 3-wire network, indirect measurement

Multimeter support

Operator panel

The operator panel of the DMM-5T consists of two parts - a multifunctional LCD screen for comfortable reading of parameters, and five buttons for changing the displayed parameters and configuring the module.

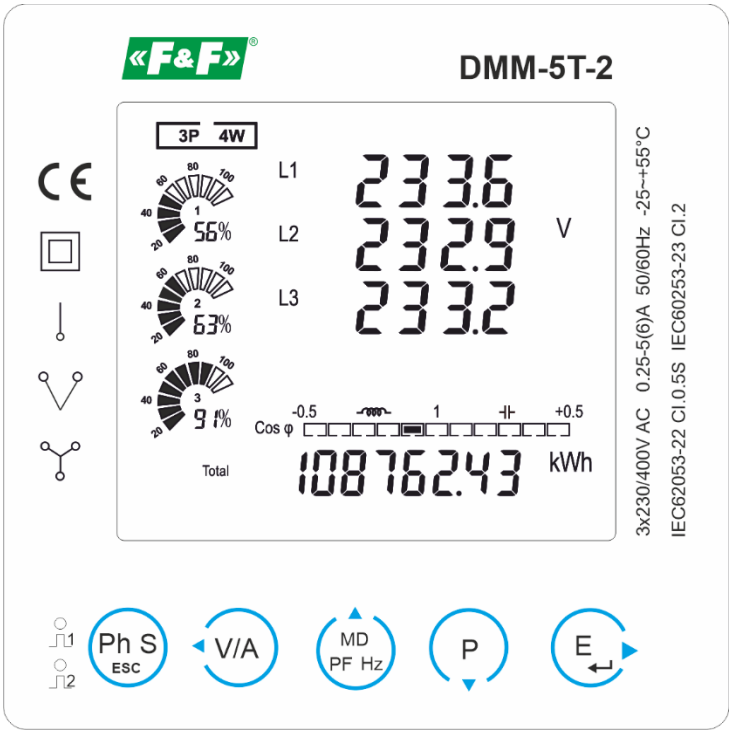


Fig. 8) View of the multimeter front panel

Button	Short press	Long press (2 seconds)
Ph S ESC	• Voltage, current, active and reactive power for individual phases; • In configuration mode, return to the previous menu by pressing the **ESC**.	• Enabling/disabling of the automatic view switching mode with measured values.
V/A	• Phase voltages; • Phase-to-phase voltage; • Phase currents; • Voltage and current harmonics (sum) by phase; • Phase sequence • While in configuration or value selection mode - the **Left** button.	• Voltage harmonics (from 1 to 63), change of the displayed harmonics using the **Up** or **Down** buttons.
MD PF Hz	• Frequency and total power factor; • Power factor by phase; • Maximum and average current consumption; • While in configuration or value selection mode - the **Up** button (increasing the value).	• Current harmonics (from 1 to 63), change of the displayed harmonics using the **Up** or **Down** buttons.

P	• Active power by phase; • Reactive power by phase; • Apparent power by phase; • Total active, reactive and apparent power; • While in configuration or value selection mode - the **DOWN** button (decreasing the value).	• The operating time of the device.
E	• Total active energy; • Total reactive energy; • Imported active energy; • Imported reactive energy; • Exported active energy; • Exported reactive energy; • While in configuration or value selection mode - the **Right** button.	• Entering the configuration mode; • Confirmation of the parameter value.

Description of the display

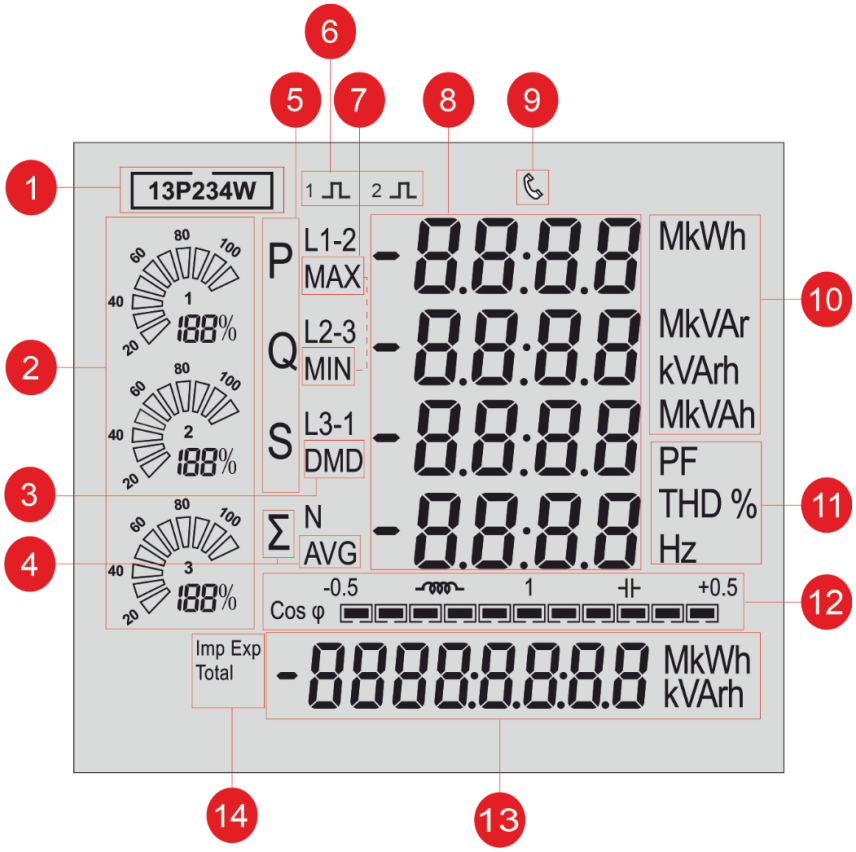


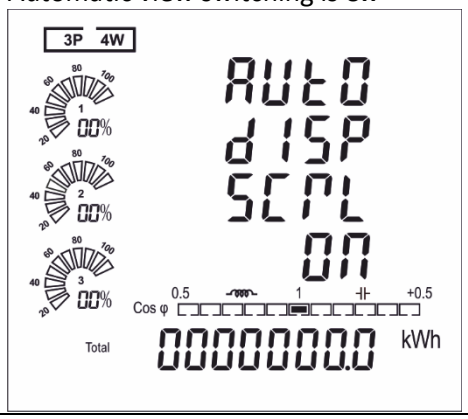
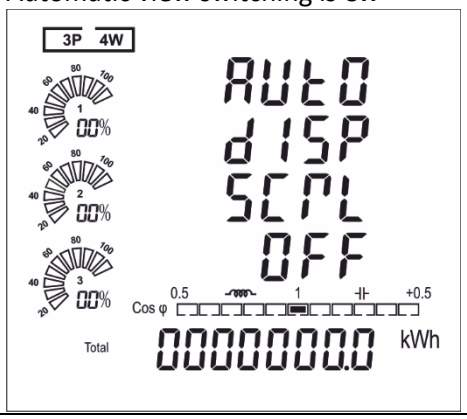
Fig. 9) Description of the display

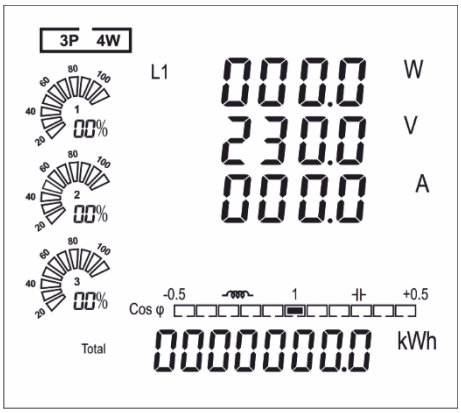
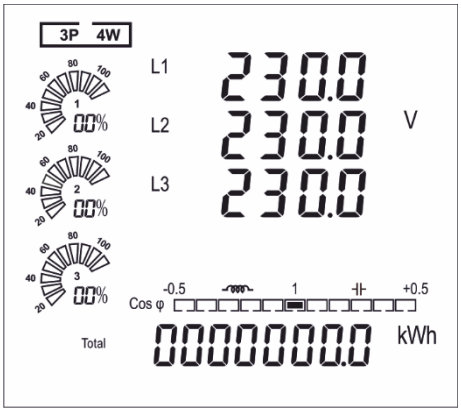
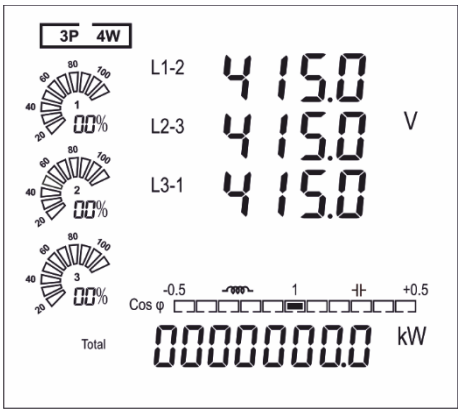
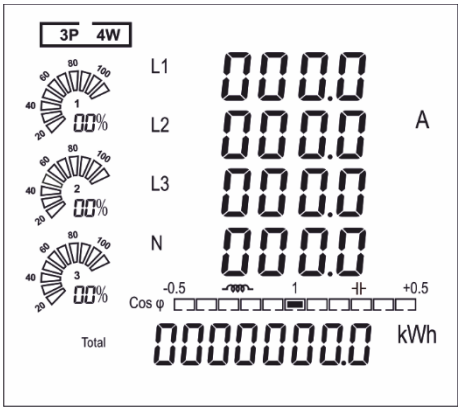
Number	Description
1	Indicator of selected network type: • **1P2W** – 1-phase, 2-wire installation, • **3P3W** – 3-phase, 3-wire installation, • **3P4W** – 3-phase, 4-wire installation.

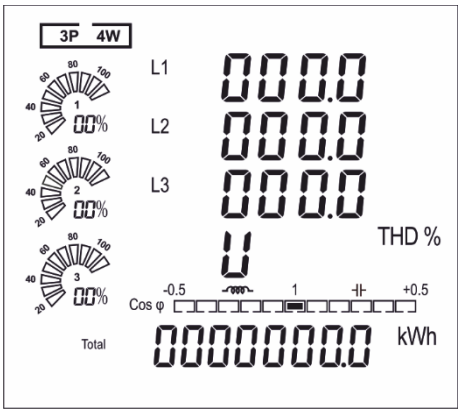
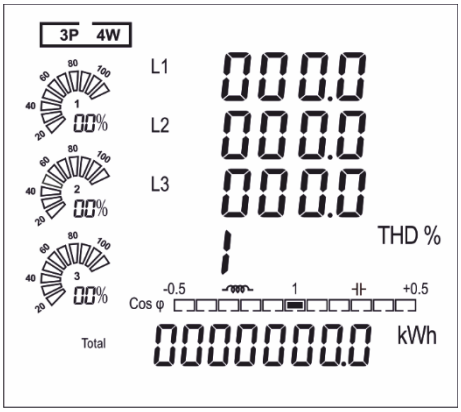
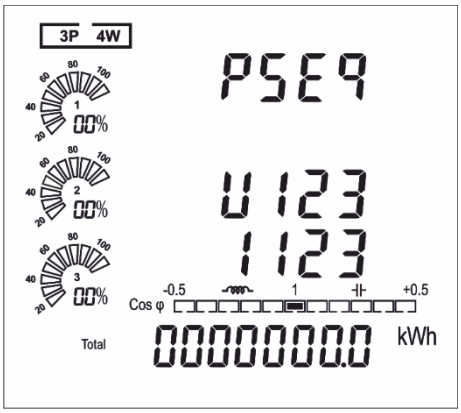
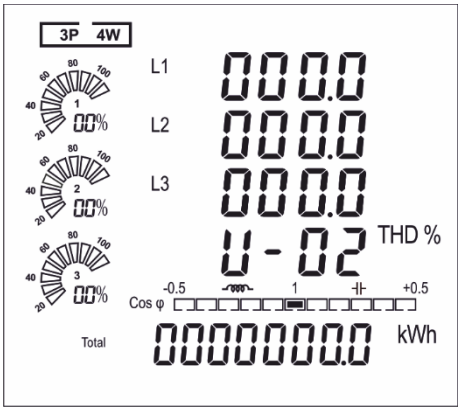
2	A bar graph indicating the power consumption of each phase
3	**DMD** – displaying the demand indication
4	**AVG** – displaying the average value from all of the phases
5	Power display indicator: • **P** – active power, • **Q** – reactive power, • **S** – apparent power.
6	Indication of the operation of the pulse outputs
7	Displayed values: • **MIN** – minimum value, • **MAX** – maximum value.
8	Indicators of measured values
9	Indicators of RS-485 communication
10	Indicates the units of displayed measured values
11	Indicators: • **PF** – power factor, • **THD %** - the percentage of total harmonic distortion, • **Hz** – frequency.
12	Graphical power factor indicator
13	Energy consumption index including unit
14	Indicates the type of energy displayed in field 13: • **TOTAL** – total energy consumption, • **IMP** – energy imported, • **EXP** – energy exported

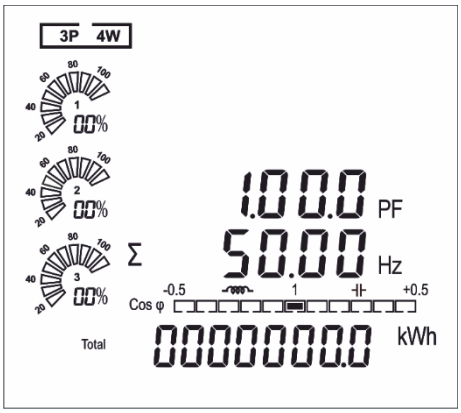
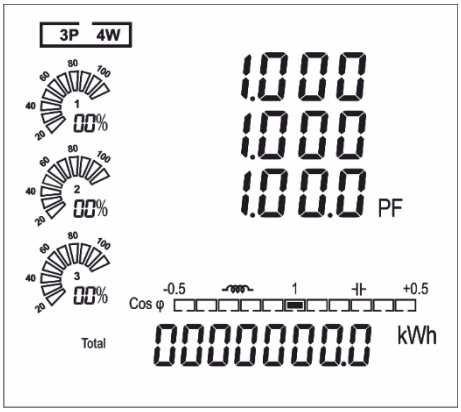
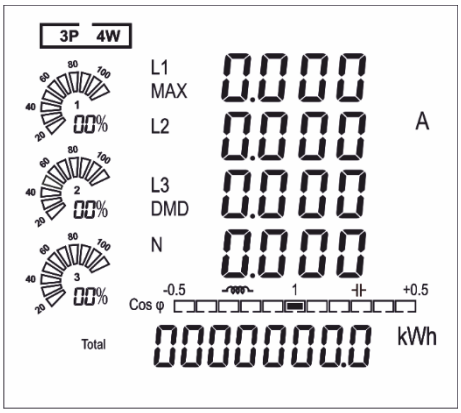
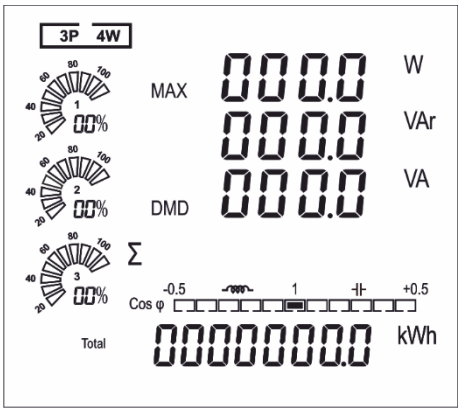
Indicator mode - displaying the network parameters

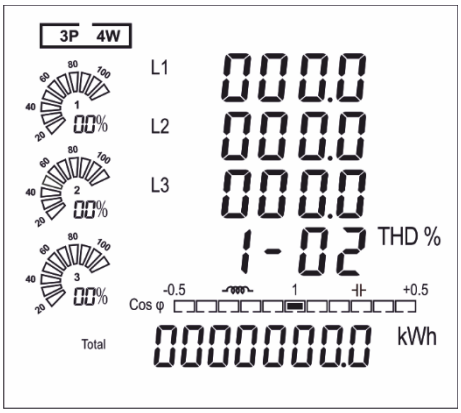
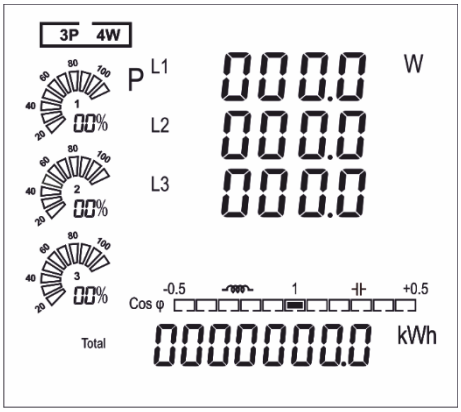
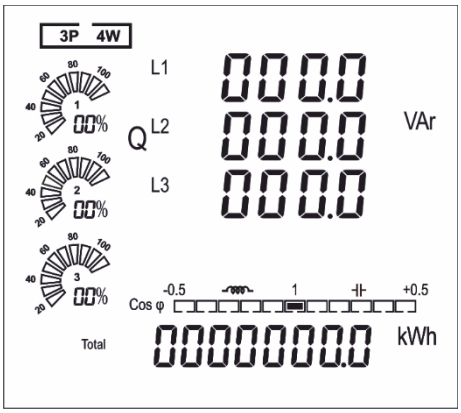
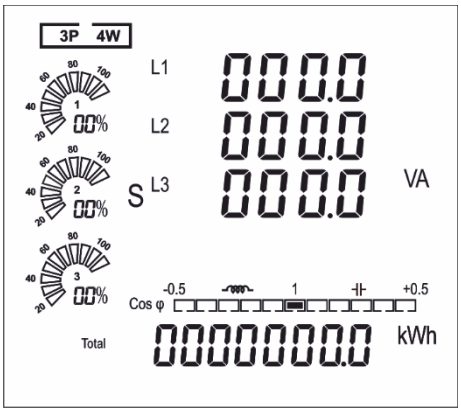
The selection of the displayed measured value is made by short or long pressing of the corresponding buttons on the front of the multimeter. The list of views with the corresponding buttons is shown in the table below.

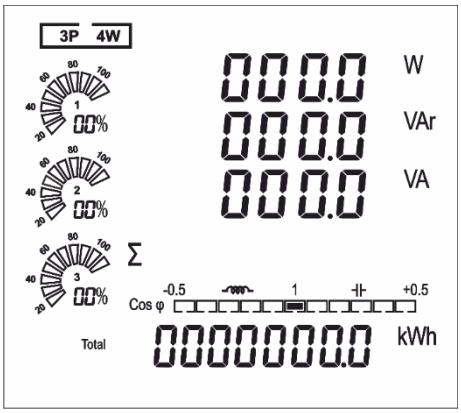
	The multimeter can display a permanently selected view with measured values or automatically switch views according to a preset cycle. A quick switchover between these settings is available after a long press of the **ESC** button.	
	Automatic view switching is **on** 	Automatic view switching is **off** 

Ph S ESC	Display the parameters of voltage, current, active power and active or reactive energy in relation to individual phases. The view is available by pressing the **ESC** button. Switching between successive phases and the view of active or reactive energy takes place after successive presses of the **ESC** button.	 Fig. 10
V/A	Phase voltage	 Fig. 11
V/A	Phase-to-phase voltage	 Fig. 12
V/A	Phase currents and neutral wire current	 Fig. 13

V/A	Total voltage harmonics by phase	 Fig. 14
V/A	Total current harmonics by phase	 Fig. 15
V/A	Phase sequence indicator (measured against voltage and current terminals)	 Fig. 16
V/A	Selected voltage harmonic Press the button for two seconds, and then use the **Up** or **Down** buttons to select the harmonic number.	 Fig. 17

MD PF Hz	Total power factor and frequency	 Fig. 18
MD PF Hz	Power factor for each phase	 Fig. 19
MD PF Hz	Maximum current demand	 Fig. 20
MD PF Hz	Maximum power demand	 Fig. 21

MD PF Hz	Selected voltage harmonic Press the button for two seconds, and then use the **Up** or **Down** buttons to select the harmonic number.	 Fig. 22
P	Active power by phase	 Fig. 23
P	Reactive power by phase	 Fig. 24
P	Apparent power by phase	 Fig. 25

P	Total active, reactive and apparent power	 Fig. 26
E	Total active energy	 Fig. 27
E	Total reactive energy	 Fig. 28
E	Consumed (imported) active energy	 Fig. 29
E	Returned (exported) active energy	 Fig. 30
E	Consumed (imported) reactive energy	 Fig. 31
E	Returned (exported) reactive energy	 Fig. 32

Configuration

	The method of editing parameter values is the same every time: If the parameter consists of a multi-digit number, only one "blinking" digit of this number is edited at a time. The value of a digit is increased by one by pressing the **Up** button. The value of a digit is decreased by one by pressing the **Down** button. To edit the next digit, click the **Left** or **Right** button. The parameter value is confirmed by pressing the **Right** button for at least two seconds. Exit the editing mode and return to the previous menu is carried out by pressing the **ESC** button.	

						
	ESC	**Left**	**UP**	**Down**	**Right**	

Entering the PIN

To enter the parameter edit mode, the PIN code must be entered.

	By default, the multimeter is supplied with a **PIN** of **1000**.	

After the **PASS** message is displayed, enter the **PIN** of the controller and confirm the selection by pressing the **Right** button for two seconds. If you enter an incorrect PIN, an error message will be displayed.

Caution: You must enter the PIN code each time you enter the settings.

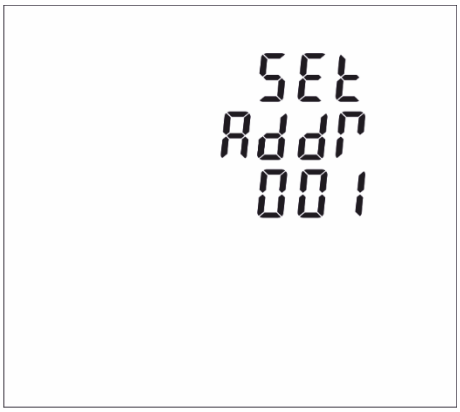
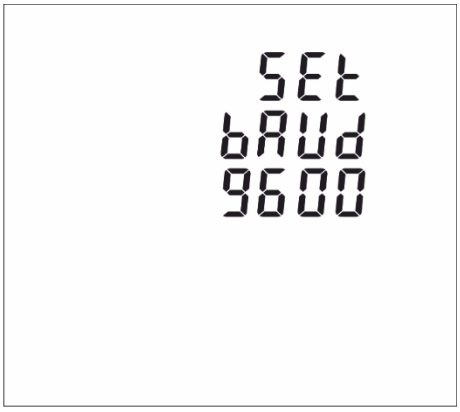
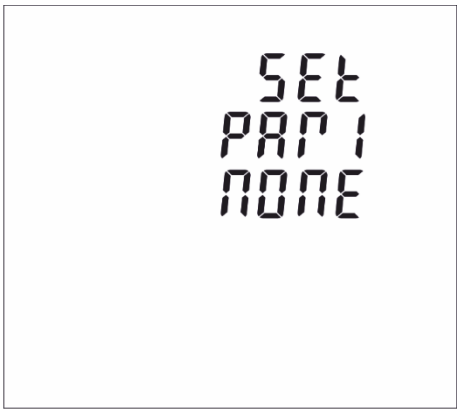
	WARNING: **Take all precautions to avoid losing or forgetting your password. If the password is lost, access to the configuration parameters of the meter will not be possible.**	

The DMM-5T-2 meter settings are divided into five basic groups. You can switch between the parameter groups by pressing the **Up** or **Down** keys. To enter the selected group, press the **Right** button for at least two seconds.

Symbol	Function
	Parameter of RS-485 communication: • device address in the Modbus RTU network, • communication rate, • parity, • the number of stop bits.
	Current ratio: • secondary side current, • primary side current.
	Voltage ratio: • secondary side voltage, • primary side voltage.
	The function of the first pulse output: • the indicated value, • number of pulses, • duration of the pulse.
	Calculating power demand: • the method the demand is calculated, • the length of the calculation period.
	Time parameters: • screen backlighting time, • the period of displaying the view in automatic view switching mode.
	System parameters: • type of the measuring system, • adjustment of current transformer connection direction, • PIN change, • start of the automatic view switching mode.
	Reset of the following meters: • energy meter, • power demand meter.

Communication parameters

Parameter group for connecting the multimeter as a slave device on the Modbus RTU communication bus.

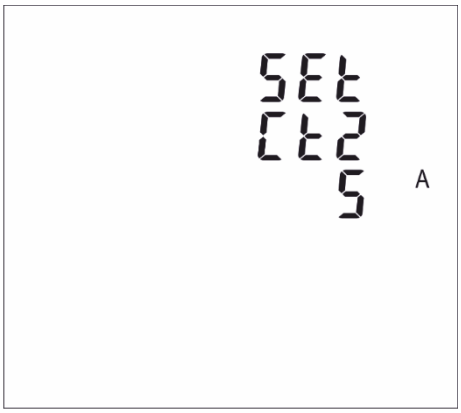
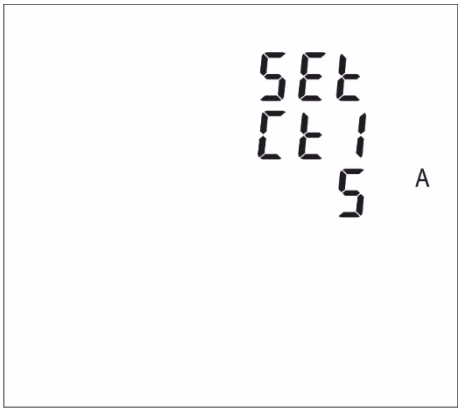
Network address	 Fig. 33	Multimeter address in the Modbus RTU network Setting range: **1 – 247** Default value: **1**
Baud rate	 Fig. 34	Communication rate in the Modbus RTU network Settings: **2400**, **4800**, **9600**, **19200**, **38400** bps Default value: **9600** bps
Parity	 Fig. 35	Transmission parity settings in Modbus RTU network Settings: **None** – no parity check **Even** – parity check **Odd** – odd number check Default value: **None**

Number of stop bits	 Fig. 36	Number of stop bits in the data byte Settings: **1, 2** Default value: **1**

Current transformer CT

Setting parameters of current transformers connected to DMM-5T-2.

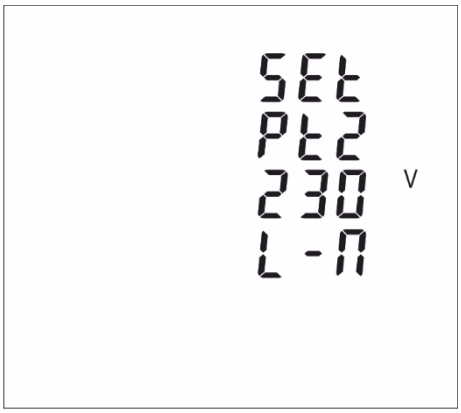
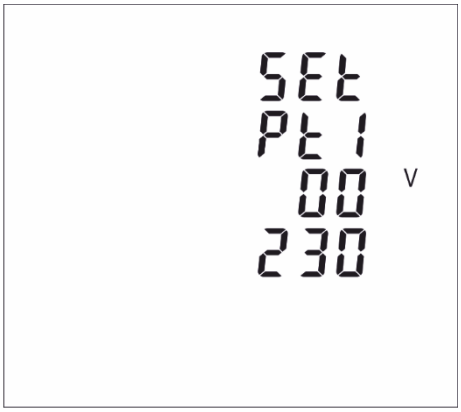
	When programming parameters of current transformers in the meter, it is necessary to set the value of the primary side to parameter CT1 and the secondary side to parameter CT2. For example, for a **100/5** transformer, you need to set the parameters as follows: **CT1 = 100** **CT2 = 5**	

CT2 – Current of the secondary side of the current transformer	 Fig. 37	Rated current of the secondary side of the current transformer Setting range: **1 or 5** A Default value: **5** A
CT1 – Current of the primary side of the current transformer	 Fig. 38	Rated primary side current Setting range: **1** – **9999** Default value: **5**

Potential transformer PT

Setting the parameters of potential transformers used in case of using the DMM-5T-2 meter in the system for indirect measurement.

	When programming parameters of current transformers in the meter, it is necessary to set the value of the voltage ratio of the $^{CT2}/_{CT1}$ transformer.	

PT2 – Current of the secondary side of the potential transformer	 Fig. 39	Rated current of the secondary side of the potential transformer The voltage of the secondary side of the potential transformer must be specified as L-N Setting range: **100 – 480 V** Default value: **100 V**
PT1 – Voltage of the primary side of the potential transformer	 Fig. 40	Rated voltage of the primary side of the potential transformer Setting range: **174 – 500000 V** Default value: **230 V**

PULSE pulse output

The DMM-5T-2 is equipped with two pulse outputs

Out-put:	Ter-min al	Function
Out 1	P1+	Universal, programmable pulse output. Selection of a function, number, and pulse length.
Out 2	P2+	Signalization of the consumption of **active energy.** Pulse constant **3200 imp./kWh**.

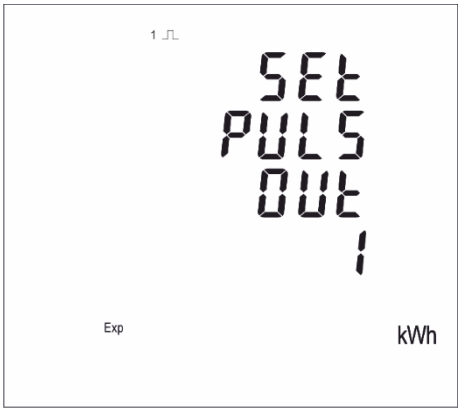
<table>
<tr>
<td>The function of the Out 1 output</td>
<td> 

Fig. 41</td>
<td>Selection of the measured value signaled at the pulse output Out 1.

Available values:

<table>
<tr><td>Total kWh</td><td>Total active energy consumption</td></tr>
<tr><td>Total kVarh</td><td>Total reactive energy consump-tion</td></tr>
<tr><td>Imp kWh</td><td>Imported (consumed) active en-ergy</td></tr>
<tr><td>Exp kWh</td><td>Exported active energy</td></tr>
<tr><td>Imp kVarh</td><td>Imported (consumed) reactive energy</td></tr>
<tr><td>Exp kVarh</td><td>Exported reactive energy</td></tr>
</table>

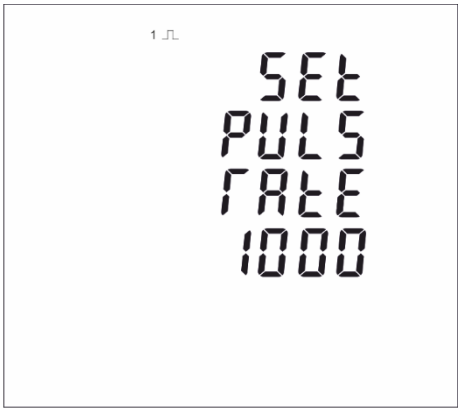
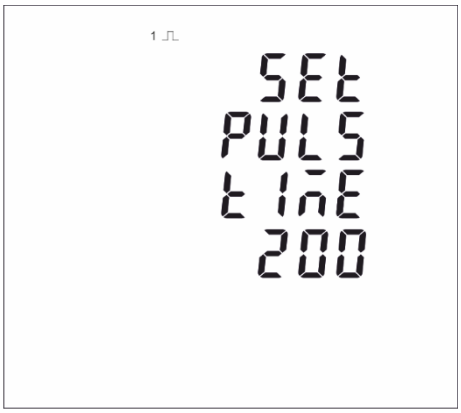
Default value: Exp kWh</td>
</tr>
<tr>
<td>Pulse constant for OUT 1 output</td>
<td> 

Fig. 42</td>
<td>The number of pulses at the OUT 1 output per change of the monitored value by 1 kWh / 1 kVarh.

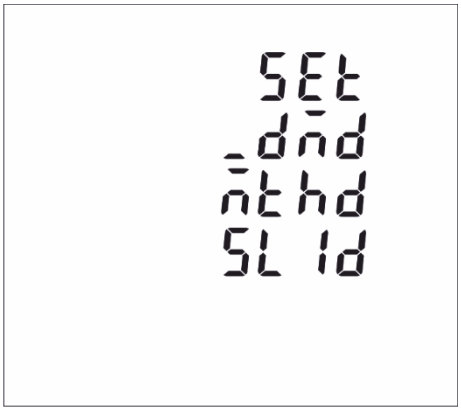
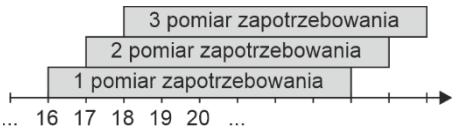
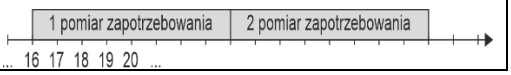
Available values: 0.001, 0.01, 0.1, 1, 10, 100, 1000 imp./(kWh, kVarh)

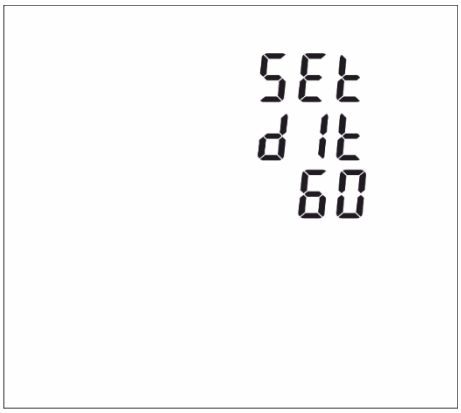
Default value: 0.001 imp./(kWh, kVarh)</td>
</tr>
</table>

Pulse duration for the OUT 1 output	 Fig. 43	Pulse duration at the OUT 1 output Available values: **60**, **100**, **200** ms Default value: **100** ms

Power demand

Parameters that allow you to define the method of calculating power demand and to determine the period from which the value of maximum demand for power and current will be determined.

The method of calculating power demand	 Fig. 44	A parameter that determines how the maximum demand for current and power will be calculated. Available settings: **SL id** — Current and energy consumption are measured every 1 minute. Each new measurement and (n-1) of previous measurements are used to determine the current power demand.  **FIX** — Current and energy consumption are measured every 1 minute. The power demand is calculated only after full n measurements have been done.  The power demand indicates the highest value of power demand for a given period. Reducing or removing the load does not reduce the calculated demand. To reset the current demand, use the rest menu described below.

The period of calculating power demand	 Fig. 45	The period that is included in the calculation of the maximum power demand. Available settings: **OFF** (power calculation disabled), **5**, **8**, **10**, **15**, **20**, **30**, **60 min**. Default value: **60 min**.

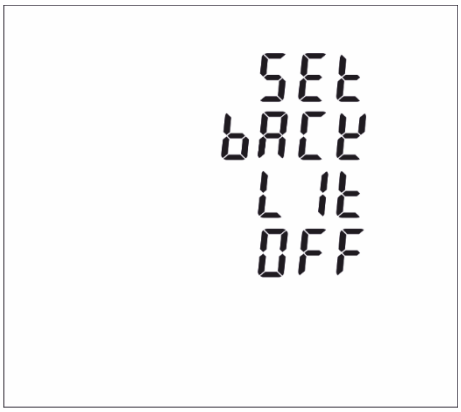
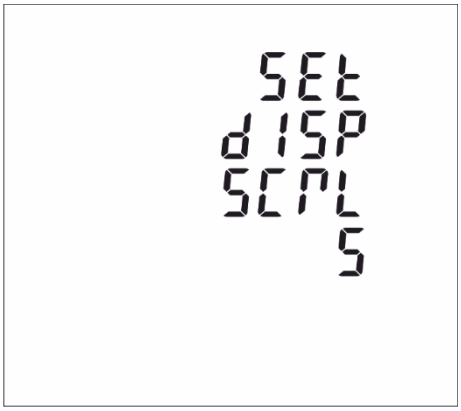
Pierwszy pomiar zapotrzebowania - First measurement of the demand

Drugi… - Second measurement of the demand

Trzeci – Third measurement of the demand

Time functions

A group of parameters related to

Display backlighting time	 Fig. 46	A parameter that sets the period of inactivity (measured from the last press of a button) after which the LCD backlight will be switched off. Available settings: **OFF** (always off), **ON** (always on), **5**, **10**, **30**, **60 min**. Default value: **60 min**.
Frequency of automatic view switching	 Fig. 47	If the option to automatically switch the view with measured values is enabled in the meter, this parameter determines how long a single view is displayed. Available settings: **1 – 255 s.** Default value: **5 s**. The automatic view can be switched on/off via the **Syst** menu or by the long press of the **ESC** button.

System parameters:

Group of parameters related to:

- selection of the measuring system,
- adjustment of current transformer connection direction,
- PIN change,
- start of the automatic view switching mode.

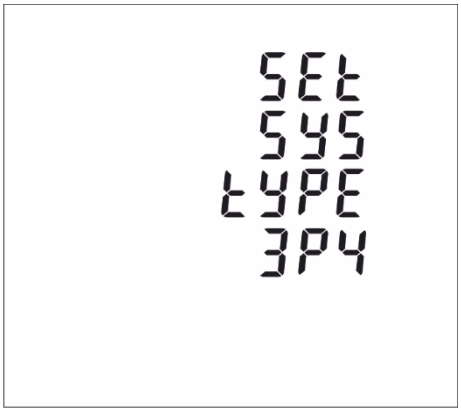
<table>
<tr>
<td>Configuration of the measuring system</td>
<td> 

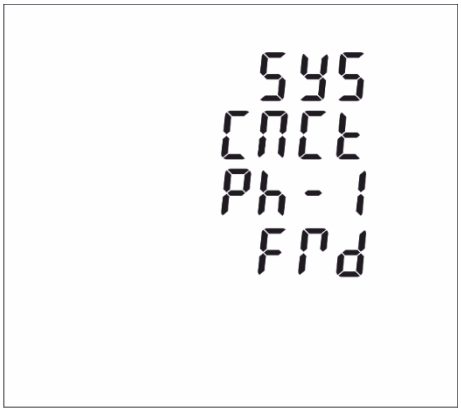
Fig. 48</td>
<td>Selection of the measuring system
<table>
<tr><td>⚠</td><td>The type of measuring system set here must be consistent with the actual connection system of the meter and the type of electrical network being measured.</td></tr>
</table>
Available settings:
<table>
<tr><td>1P2</td><td>Single-phase, two-wire network (L + N)</td></tr>
<tr><td>3P3</td><td>Three-phase, three-wire network (L1 + L2 + L3)</td></tr>
<tr><td>3P4</td><td>Three-phase, four-wire network (L1 + L2 + L3 + N)</td></tr>
</table>
</td>
</tr>
<tr>
<td>Adjustment of current transformers connection</td>
<td> 

Fig. 49</td>
<td>If the direction of the secondary windings of current transformers is incorrectly connected, it can be programmatically corrected without the need for changes in the wiring.

First, use the Up or Down keys to select the number of the phase for which the correction is to be made, then confirm the selection with a long press of the OK key, then use the Up or Down keys to select and confirm the appropriate option.

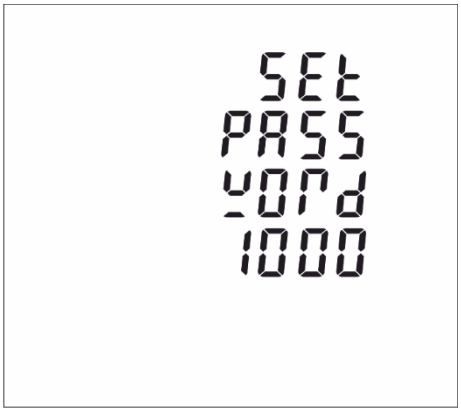
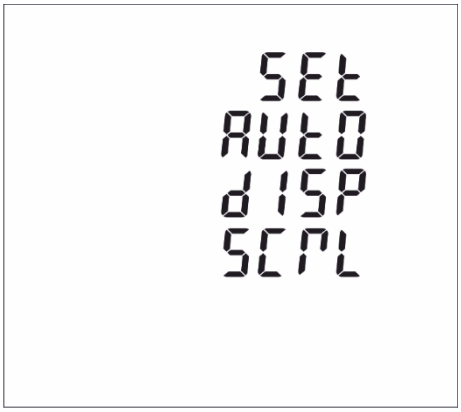
Available settings:
<table>
<tr><td>FnD</td><td>If the current transformer is connected correctly</td></tr>
<tr><td>rEV</td><td>If the current transformer is connected backward</td></tr>
</table>
</td>
</tr>
<tr>
<td>PIN</td>
<td> 

Fig. 50</td>
<td>Enter a new PIN to restrict access to the meter.

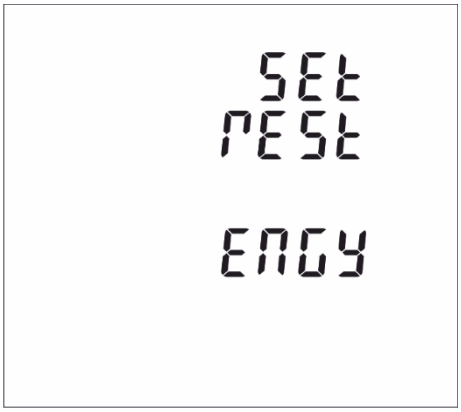
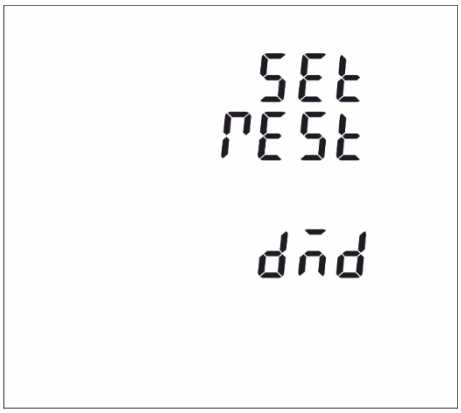
Available settings: 0 - 9999

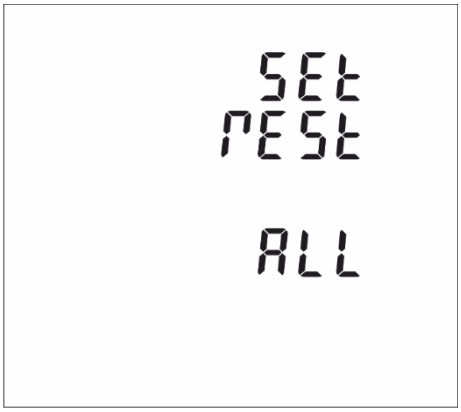
Default value: 1000.
<table>
<tr><td>⚠</td><td>WARNING:
Take all precautions to avoid losing or forgetting your password. If the password is lost, access to the configuration parameters of the meter will not be possible.</td><td>⚠</td></tr>
</table>
</td>
</tr>
</table>

Automatic view switching	 Fig. 51	The parameter that determines whether the meter will display one view with the measurement results all the time or whether the views will be switched automatically. Available settings: OFF – Automatic view switching is **off** ON – Automatic view switching is **on** The display time of a single view is set in the **time** menu, in the **disp SCrL** parameter

Reset of the meters

A group of parameters designed to reset the energy consumption meters and power demand calculations.

Reset of the energy meters	 Fig. 52	Reset of all active and reactive energy meters. To reset the indications of the meters, press the **OK** button until the **Engy** symbol flashes. Then release and long-press the **Engy** button again.
Reset of the power demand indicators	 Fig. 53	Reset of the power and current demand indicators To reset the indications of the power demand, press the **OK** button until the **dmd** symbol flashes. Then release and long-press the **dmd** button again.

Reset of all of the meters	 Fig. 54	This option allows you to simultaneously reset the energy consumption meters and electricity demand indicators To reset the indications of all of the meters, press the **OK** button until the **ALL** symbol flashes. Then release and long-press the **ALL** button again.

Communication

How to connect

The communication lines A and B of the RS485 interface should be connected to terminals A+ (line A) and B- (line B) of the multimeter.

It is recommended to use dedicated communication cables adapted to carry the RS485 transmission. In any case, the communication cable should be shielded and one end of the screen should be connected to **PE** level.

Read/write parameters via RS485

The access to the parameters is carried out in accordance with the Modbus RTU standard. The available parameters are divided into two groups - in the first group all measurement results are available, in the second group configuration parameters of the meter are collected.

List of registers with measurement results

Readout of the measurement records:

- command **0x04 – Read Input Registers**

Recording to measurement registers is unavailable

Data format:

- **Float** – Floating point number, 32-bits (4-bytes))

The availability of measurement results depends on the chosen measurement system

- **T** – measurement available for selected measurement system
- - - measurement not available

Modbus Register		Parameter	Unit	Measuring system		
				3P4W	3P3W	1P2W
Dec	Hex					
0	0x0000	Phase L1 – phase voltage (L1 – N)	V	T	-	T
2	0x0002	Phase L2 – phase voltage (L2 – N)	V	T	-	-
4	0x0004	Phase L3 – phase voltage (L3 – N)	V	T	-	-
6	0x0006	Phase L1 – current	A	T	T	T
8	0x0008	Phase L2 – current	A	T	T	T
10	0x000A	Phase L3 – current	A	T	T	T
12	0x000C	L1 phase - active power	W	T	-	T
14	0x000E	L2 phase - active power	W	T	-	-
16	0x0010	L3 phase - active power	W	T	-	-
18	0x0012	L1 phase - apparent power	VA	T	-	T
20	0x0014	L2 phase - apparent power	VA	T	-	-
22	0x0016	L3 phase - apparent power	VA	T	-	-
24	0x0018	L1 phase - reactive power	Var	T	-	T
26	0x001A	L2 phase - reactive power	Var	T	-	-
28	0x001C	L3 phase - reactive power	Var	T	-	-
30	0x001E	L1 phase - power factor (1)	-	T	-	T
32	0x0020	L2 phase - power factor (1)	-	T	-	-
34	0x0022	L3 phase - power factor (1)	-	T	-	-
36	0x0024	Phase L1 – phase shift	°	T	-	T
38	0x0026	Phase L2 – phase shift	°	T	-	-
40	0x0028	Phase L3 – phase shift	°	T	-	-
42	0x002A	Average phase voltage (L - N)	V	T	T	T
46	0x002E	Average phase current	A	T	T	T
48	0x0030	Sum of phase currents	A	T	T	T
52	0x0034	Total active power	W	T	T	T
56	0x0038	Total apparent power	VA	T	T	T
60	0x003C	Total reactive power	Var	T	T	T
62	0x003E	Total power factor (1)	-	T	T	T
66	0x0042	Total angular displacement	°	T	T	T
70	0x0046	Voltage frequency	Hz	T	T	T
72	0x0048	Imported active energy (since last reset)	kWh	T	T	T
74	0x004A	Exported active energy (since last reset)	kWh	T	T	T
76	0x004C	Imported reactive energy (since last reset)	kVArh	T	T	T
78	0x004E	Imported reactive energy (since last reset)	kVArh	T	T	T
80	0x0050	Vah number (since last reset)	kVAh	T	T	T
82	0x0052	Ah number (since last reset)	VAh	T	T	T
84	0x0054	Total power demand (2)	W	T	T	T
86	0x0056	Maximum power demand (2)	W	T	T	T
88	0x0058	Power import demand	W	T	T	T
90	0x005A	Maximum power import demand	W	T	T	T
92	0x005C	Power export demand	W	T	T	T
94	0x005E	Maximum power export demand	W	T	T	T
100	0x0064	Total apparent power demand	VA	T	T	T
102	0x0066	Maximum apparent power demand	VA	T	T	T

Modbus Register		Parameter	Unit	Measuring system		
				3P4W	3P3W	1P2W
Dec	Hex					
104	0x0068	Neutral wire current demand	A	T	-	-
106	0x006A	Maximum neutral wire current demand	A	T	-	-
108	0x006C	Total reactive energy demand (2)	VAr	T	-	T
110	0x006E	Maximum reactive energy demand (2)	VAr	T	-	T
160	0x00A0	Phase sequence (measurement at voltage inputs) 1 - matching phase order 2 - reversed phase order	-	T	T	-
162	0x00A2	Phase sequence (measurement at current inputs) 1 - matching phase order 2 - switched phase order	-	T	T	-
192	0x00C0	The resultant nature of the load 1 - resistive 2 - inductive 3 - capacitive	-	T	T	T
194	0x00C2	Phase L1 - nature of the load 1 - resistive 2 - inductive 3 - capacitive	-	T	T	T
196	0x00C4	Phase L2 - nature of the load 1 - resistive 2 - inductive 3 - capacitive	-	T	T	-
198	0x00C6	Phase L3 - nature of the load 1 - resistive 2 - inductive 3 - capacitive	-	T	T	-
200	0x00C8	Phase-to-phase voltage L1 - L2	V	T	T	-
202	0x00CA	Phase-to-phase voltage L2 - L3	V	T	T	-
204	0x00CC	Phase-to-phase voltage L3 - L1	V	T	T	-
206	0x00CE	Average phase-to-phase voltage	V	T	T	-
224	0x00E0	Neutral wire current	A	T	-	-
234	0x00EA	Phase L1 – the percentage of voltage harmonics (L1 – N)	%	T	T	T
236	0x00EC	Phase L2 – the percentage of voltage harmonics (L2 – N)	%	T	-	-
238	0x00EE	Phase L3 – the percentage of voltage harmonics (L3 – N)	%	T	-	-
240	0x00F0	Phase L1 – the percentage of current harmonics	%	T	T	T
242	0x00F2	Phase L2 – the percentage of current harmonics	%	T	T	-
244	0x00F4	Phase L3 – the percentage of current harmonics	%	T	T	-
248	0x00F8	Average phase percentage of voltage harmonics	%	T	-	T
250	0x00FA	Average phase percentage of current harmonics	%	T	T	T
258	0x0102	Phase L1 – demand for current	A	T	T	T
260	0x0104	Phase L2 – demand for current	A	T	T	-
262	0x0106	Phase L3 – demand for current	A	T	T	-
264	0x0108	Phase L1 – Maximum demand for current	A	T	T	T
266	0x010A	Phase L2 – Maximum demand for current	A	T	T	-
268	0x010C	Phase L3 – Maximum demand for current	A	T	T	-

Modbus Register		Parameter	Unit	Measuring system		
Dec	Hex			3P4W	3P3W	1P2W
334	0x014E	Phase-to-phase voltage L1 - L2: the percentage of harmonics	%	T	T	-
336	0x0150	Phase-to-phase voltage L2 - L3: the percentage of harmonics	%	T	T	-
338	0x0152	Phase-to-phase voltage L3 - L1: the percentage of harmonics	%	T	T	-
340	0x0154	Phase-to-phase voltage: average percentage of harmonics	%	T	T	-
342	0x0156	Total active energy consumption (3)	kWh	T	T	T
344	0x0158	Total reactive energy consumption (3)	kVArh	T	T	T
346	0x015A	L1 phase: imported active energy	kWh	T	T	T
348	0x015C	L2 phase: imported active energy	kWh	T	T	-
350	0x015E	L3 phase: imported active energy	kWh	T	T	-
352	0x0160	L1 phase: exported active energy	kWh	T	T	T
354	0x0162	L2 phase: exported active energy	kWh	T	T	-
356	0x0164	L3 phase: exported active energy	kWh	T	T	-
358	0x0166	L1 phase - total active energy consumption	kWh	T	T	T
360	0x0168	L2 phase - total active energy consumption	kWh	T	T	-
362	0x016A	L3 phase - total active energy consumption	kWh	T	T	-
364	0x016C	L1 phase: imported reactive energy	kVArh	T	T	T
366	0x016E	L2 phase: imported reactive energy	kVArh	T	T	-
368	0x0170	L3 phase: imported reactive energy	kVArh	T	T	-
370	0x0172	L1 phase: exported reactive energy	kVArh	T	T	T
372	0x0174	L2 phase: exported reactive energy	kVArh	T	T	-
374	0x0176	L3 phase: exported reactive energy	kVArh	T	T	-
376	0x0178	L1 phase - total reactive energy consumption	kVArh	T	T	T
378	0x017A	L2 phase - total reactive energy consumption	kVArh	T	T	-
380	0x017C	L3 phase - total reactive energy consumption	kVArh	T	T	-
402 524	0x0192 – 0x020C	Phase L1: Voltage harmonics (2 … 63)	%	T	T	T
526 – 648	0x020E – 0x0288	Phase L2: Voltage harmonics (2 … 63)	%	T	T	-
650 – 772	0x028A – 0x0304	Phase L3: Voltage harmonics (2 … 63)	%	T	T	-
774 – 896	0x0306 – 0x0380	Phase L1: current harmonics (2 … 63)	%	T	T	T
898 – 1020	0x0382 – 0x03FC	Phase L2: current harmonics (2 … 63)	%	T	T	-
1022 – 1144	0x03FE – 0x0478	Phase L3: current harmonics (2 … 63)	%	T	T	-
1146	0x047A	Phase L1: Sum of voltage harmonics	%	T	T	T
1148	0x047C	Phase L2: Sum of voltage harmonics	%	T	T	-
1150	0x047E	Phase L3: Sum of voltage harmonics	%	T	T	-
1152	0x0480	Phase L1: Sum of current harmonics	%	T	T	T
1154	0x0482	Phase L2: Sum of current harmonics	%	T	T	-
1156	0x0484	Phase L3: Sum of current harmonics	%	T	T	-

(1) The power factor has a sign indicating the direction of the current flow.
(2) The total power demand is calculated as the difference between imported and exported value (import - export)
(3) The total consumption of active and reactive energy is calculated as the sum of imported and exported energy (import + export).

List of registers with meter configuration

Readout of the measurement registers:
- command **0x03 – Read Holding Registers**

Data writing to configuration registers:
- command **0x10 – Write Multiple Register**

Access to registers:
- **R** – read-only register
- **R/W** – read/write register
- **W** – write-only register

Data format:
- **Float** – Floating point number, 32-bits (4-bytes)
- **U16** – Integer, no sign, 16-bits (2-bytes)

Register		Access	Format	Function
Dec	**Hex**			
0	0x0000	R	Float	Remained time in minutes until the first full power demand is determined. If this value is greater than zero, it means that the calculation of demand has not been completed.
2	0x0002	R/W	Float	The period from which the current and power demand will be calculated. Setting range: **0 – 60 min**.
4	0x0004	R/W	Float	In the case of setting the "striding (Slide)" method of calculating the power demand, this parameter defines every how many minutes the value of power and current demand will be refreshed. Setting range: 1 – (Register 0x0002 – 1)
6	0x0006	R/W	Float	The method of calculating power demand Settings: 0 – SL id – The value is calculated from the period set in the register 0x0002, but the value will be updated with the step set in the register 0x0004. 1 – FIX – The value is calculated from the period set in the register 0x0002 and updated at the end of the full calculation period.

<table>
<tr><th colspan="2">Register</th><th rowspan="2">Access</th><th rowspan="2">Format</th><th rowspan="2">Function</th></tr>
<tr><th>Dec</th><th>Hex</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>10</td><td>0x000A</td><td>R/W</td><td>Float</td><td>Selection of the measuring system

Settings:<table><tr><td>1</td><td>  </td><td>Single-phase, two-wire network</td></tr><tr><td>2</td><td>  </td><td>Three-phase, three-wire network</td></tr><tr><td>3</td><td>  </td><td>Three-phase, four-wire network</td></tr></table><table><tr><td></td><td>The change requires entering the PIN code in the 0x000E registry first and unlocking access to critical settings.</td></tr></table></td></tr>
<tr><td>12</td><td>0x000C</td><td>R/W</td><td>Float</td><td>Pulse output OUT1 - pulse duration</td></tr>
<tr><td>14</td><td>0x000E</td><td>R/W</td><td>Float</td><td>Unlocking access to critical meter settings.<table><tr><td></td><td>Some of the parameters that are relevant to the correct operation of the meter require additional confirmation in the form of entering a PIN code.

Once entered, the PIN code unlocks access to the configuration until the power supply is switched off, or access is blocked by entering an incorrect PIN in this register.</td></tr></table>Read:<table><tr><td>0</td><td>Access to critical parameters blocked</td></tr><tr><td>100</td><td>Access to critical parameters unblocked</td></tr></table>Write: PIN code of the meter</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>18</td><td>0x0012</td><td>R/W</td><td>Float</td><td>RS485 communication - Parity control and number of stop bits.

Settings:<table><tr><td>0</td><td>1 stop bit, no parity control</td></tr><tr><td>1</td><td>1 stop bit, parity control (even)</td></tr><tr><td>2</td><td>1 stop bit, oddity control (odd)</td></tr><tr><td>3</td><td>2 stop bits, no parity control</td></tr></table></td></tr>
<tr><td>20</td><td>0x0014</td><td>R/W</td><td>Float</td><td>RS485 communication - Meter address in Modbus network

Settings: 1 – 247</td></tr>
<tr><td>22</td><td>0x0016</td><td>R/W</td><td>Float</td><td>Pulse output OUT1 - pulse constant

Settings:<table><tr><td>0</td><td>0.001 pulse/kWh</td></tr><tr><td>1</td><td>0.01 pulse/kWh</td></tr><tr><td>2</td><td>0.1 pulse/kWh</td></tr><tr><td>3</td><td>1 pulse/kWh</td></tr><tr><td>4</td><td>10 pulse/kWh</td></tr></table></td></tr>
</table>

Register		Access	Format	Function
Dec	Hex			
				5 — 100 pulse/kWh 6 — 1000 pulse/kWh
24	0x0018	R/W	Float	PIN Writing to register 0x0018 changes the PIN code of the controller Settings: 1 - 9999
28	0x001C	R/W	Float	RS485 communication - baud rate Settings: 0 — 2400 bps 1 — 4800 bps 2 — 9600 bps 3 — 19200 bps 4 — 38400 bps 5 — 1200 bps
46	0x002E	R/W	Float	Voltage ratio - Primary voltage PT1 Rated voltage of the primary side Settings: 174 – 500000 V The change requires entering the PIN code in the 0x000E registry first and unlocking access to critical settings.
48	0x0030	R/W	Float	Voltage ratio - Secondary voltage PT2 Rated voltage of the secondary side Settings: 100 – 480 V The change requires entering the PIN code in the 0x000E registry first and unlocking access to critical settings.
50	0x0032	R/W	Float	Current ratio - Primary voltage CT1 Rated current of the secondary side of the current transformer Settings: 1 9999 A The change requires entering the PIN code in the 0x000E registry first and unlocking access to critical settings.
52	0x0034	R/W	Float	Current ratio - Secondary current CT2 Rated current of the secondary side of the current transformer Settings: 1 — 1 A 5 — 5 A The change requires entering the PIN code in the 0x000E registry first and unlocking access to critical settings.
56	0x0038	R/W	Float	Adjustment of current transformer connection direction.

<table>
<tr><th colspan="2">Register</th><th rowspan="2">Access</th><th rowspan="2">Format</th><th rowspan="2">Function</th></tr>
<tr><th>Dec</th><th>Hex</th></tr>
<tr><td></td><td></td><td></td><td></td><td>
The parameter enables software correction of the direction of the current transformer connection.

If the transformer on a given phase is connected correctly, then option T should be selected, in case of reverse connection - option N.

Settings:
<table>
<tr><td></td><td>Phase L1</td><td>Phase L2</td><td>Phase L3</td></tr>
<tr><td>0</td><td>T</td><td>T</td><td>T</td></tr>
<tr><td>1</td><td>N</td><td>T</td><td>T</td></tr>
<tr><td>2</td><td>T</td><td>N</td><td>T</td></tr>
<tr><td>3</td><td>N</td><td>N</td><td>T</td></tr>
<tr><td>4</td><td>T</td><td>T</td><td>N</td></tr>
<tr><td>5</td><td>N</td><td>T</td><td>N</td></tr>
<tr><td>6</td><td>T</td><td>N</td><td>N</td></tr>
<tr><td>7</td><td>N</td><td>N</td><td>N</td></tr>
</table>
The change requires entering the PIN code in the 0x000E registry first and unlocking access to critical settings.
</td></tr>
<tr><td>58</td><td>0x003A</td><td>R/W</td><td>Float</td><td>
Measurement view switching period

If the option to automatically switch the view with measured values is enabled in the meter, this parameter determines how long a single view is displayed.

Setting range: 1 – 255 s
</td></tr>
<tr><td>60</td><td>0x003C</td><td>R/W</td><td>Float</td><td>
Display backlight time

A parameter that sets the period of inactivity (measured from the last press of a button) after which the LCD backlight will be switched off.

Setting range: 0 – 120 min.

Value 0 means that the display will be backlit all the time
</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td>86</td><td>0x0056</td><td>R/W</td><td>Float</td><td>
Pulse output OUT1 - the selection of the indicated value

Selection of the parameter whose change will be signaled on the pulse output OUT1

Settings:
<table>
<tr><td>1</td><td>Imported active energy</td></tr>
<tr><td>2</td><td>Total active energy</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th colspan="2">Register</th><th rowspan="2">Access</th><th rowspan="2">Format</th><th rowspan="2">Function</th></tr>
<tr><th>Dec</th><th>Hex</th></tr>
<tr><td></td><td></td><td></td><td></td><td><table>
<tr><td>4</td><td>Exported active energy</td></tr>
<tr><td>5</td><td>Imported reactive energy</td></tr>
<tr><td>6</td><td>Total reactive energy</td></tr>
<tr><td>8</td><td>Exported reactive energy</td></tr>
</table></td></tr>
<tr><td colspan="5"></td></tr>
<tr><td>61456</td><td>0xF010</td><td>W</td><td>U16</td><td>Reset of the meter indicators

Settings:<table>
<tr><td>0</td><td>Reset of the current and power demand indicators</td></tr>
<tr><td>3</td><td>Reset of the energy meters</td></tr>
</table></td></tr>
</table>

Change history

2020.02.06	Issue of the first version of the DMM-5T-2 multimeter manual

WARRANTY

1. The multimeter is covered by a 24-month warranty. The warranty period is measured from the moment of the purchasing of the device.
2. The warranty is valid only with proof of purchase.
3. A warranty claim should be submitted at the point of purchase or directly to the manufacturer:

F&F Filipowski sp. j.
ul. Konstantynowska 79/81
95-200 Pabianice
Phone (+48 42) 227-09 71
e-mail: dztech@fif.com.pl

4. The complaint should be accompanied by written information about the nature of the fault and the circumstances in which it occurred.
5. F&F Filipowski sp. j. commits to process complaints under the provisions of Polish law.
6. The choice of how the complaint will be settled: the replacement of the faulty goods with the defect-free, repair or refund belongs to the manufacturer.
7. The warranty does not cover:
    a. Mechanical and chemical damage
    b. Damage caused by improper use or use not in accordance with the operating instructions
    c. Post-sale damage resulting from accidents or other events for which the manufacturer or the point of sale is not responsible, such as damage during transport.
8. The warranty does not cover activities that according to the instructions should be performed by the user, such as the installation of the multimeter, electrical installation, installation of other required electrical protection.
9. The guarantee shall not limit the rights of the buyer arising from the non-conformity of the goods with the contract.