Module for measuring electrical network parameters MIPS-48V

USER MANUAL

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Introduction

This manual contains information on the purpose, technical characteristics, installation procedure and safe operation of the Electrical Network Parameter Measuring Module "MIPS-48V" or "MIPS-02" (hereinafter referred to as the meter or device) and is intended for service personnel.

1 Purpose of the device

The device “Network Parameter Measurement Module” MIPS-02-48V (hereinafter referred to as the meter or device) is a means of automating the monitoring process and provides simultaneous measurement of voltage and current values across six measuring channels.

The device is designed to operate as part of the Jcom-IoT production monitoring system and is designed for continuous operation.

Main functional capabilities of the MIPS-02 device:

– monitoring of voltages and currents for six independent channels via RS485 interface;

– voltage measurement directly at the input of one of the six voltage measurement channels;

– voltage measurement from the voltage output of the current sensor for one of the six current channels of the MIPS-02;

– The use of contactless current sensors in current measuring channels ensures ease of connection and allows for coverage of a wide range of currents;

– solid state relay for signaling the occurrence of a programmed event;

– the possibility of integrating the MIPS-02 device into the automated information and measurement system for metering and commercial accounting,

– the ability to configure the device via the RS485 interface through the Element Manager MIPS-02 program locally or remotely.

The kit includes the MIPS-02 device (in a DIN rail housing) and current sensors based on current transformers (e.g., type 3E SC1V-100A). These sensors are mounted directly on the cable and their measuring output is connected to connector I on the lower board. The bipolar voltage required to power the sensors is generated by a separate power source located on the upper board.

The overall dimensions of the MIPS device are shown in Figure 1.

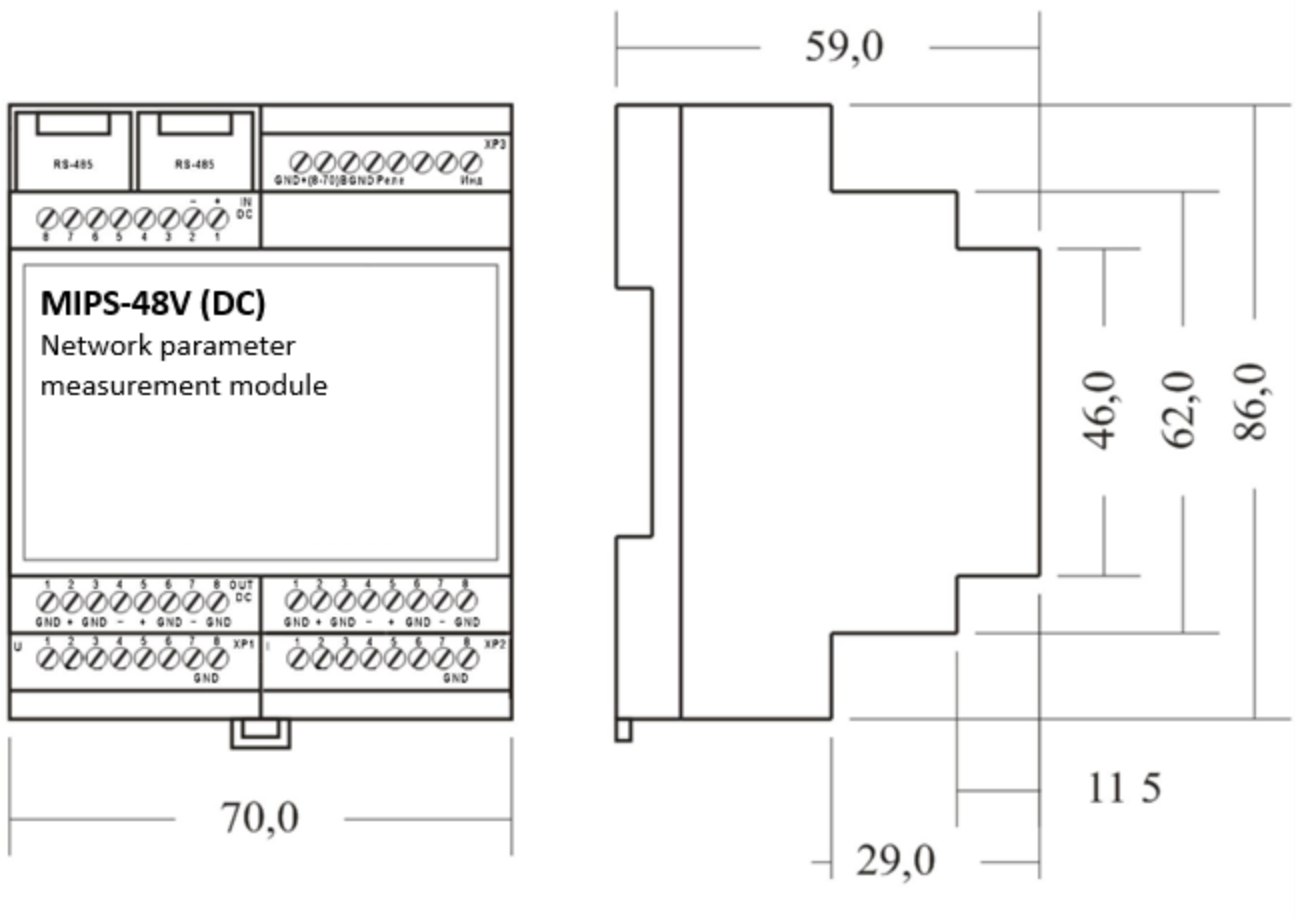

Figure 1

2 Technical specifications.

The main technical characteristics are presented in Table 1

Table 1

Device supply voltage: at contacts “+12”, “GND” at contacts “6...8”, “1...3” of the RJ45 connector	+8.0…+60.0 V +4.0…+12.0 V
Maximum permissible voltage for voltage measurement channels (inputs 1-3).	+133V
Maximum measurable DC voltage at the input of the voltage measurement channels (inputs 1-6 of the XP1 connector).	+100V
Maximum permissible voltage for current measurement channels.	+ 10V
Maximum measurable DC voltage at the input (inputs 1-6 XP2 connector) for current channels	+ 7.5 V
The range of measured currents is determined by the current transformers used.	Up to 500A
Sampling frequency for each voltage and current measurement channel	100Hz
Serial data transfer rate	9600 bit/s.
Current consumption (at supply voltage +10.0V)	no more than 25 mA

Mounting on a 35mm DIN rail. Free positioning.

The device provides the specified parameters under the following environmental conditions:

- ambient air temperature 0℃..+60 ℃;
- air humidity at +25 oC (30..80)%;
- atmospheric pressure (84..100) kPa.

The weight of the device is no more than 0.25 kg.
The overall dimensions are shown in Figure 1.

3 Device pin assignment

The type and purpose of the device terminals are shown in Table 2. The designations in the table correspond to the designations in Figure 1.

Table 2. Type and purpose of terminals

Output name	Output type	Purpose of the output	Number of pins
+12 contact 7 XP3	**In**	Power supply of the device “+” voltage 12V	1
GND contacts 8, 6 XP3	****	Device power supply “–” and low-voltage “ground”	2
1...6 channels U contacts XP1	**In**	DC Channel Inputs -	6
1...6 channels I contacts XP2	**In**	DC Channel Inputs	6
GND channels U 7,8 contacts XP1	****	"Measuring ground" of voltage channels	2
GND channels I 7,8 contacts XP2	****	"Measuring ground" of current channels	2
RS-485 connector RJ45	**in/out**	RS-485 data (contacts 4,5) and interface power (+12V contacts 6...8 and GND contacts 1...3 of the RJ45 connector)	8
Relay contacts 4.5 XP3	**Out**	The relay output is a reaction to an event that has occurred,	2
ind	**Out**	Discrete indication output, contact 1 XP3	1
2 contact XP3	**In**	not used/reserved	1
3 contact XP3	**In**	not used/reserved	1
1 contact XP1-2	**In DC**	Input "+" of constant supply voltage	1
2 contact XP1-2	**In DC**	Device power supply “–“ and low-voltage “ground”	1
3 – 8 XP1-2	**In DC**	not used/reserved	6
2.5 XP2-2, XP3-2	**Out DC +15V**	Output "+" of constant supply voltage of sensors	4
1,3,6,8 XP2-2,XP3-2	**Out DC GND**	"ground" of the bipolar power supply of the sensors	8
4.7 XP2-2, XP3-2	**Out DC -15V**	Output "-" of constant supply voltage of sensors	4

4 Device description

The device (or meter) is a means of automating the monitoring process and provides simultaneous measurement of voltage and current values across six measuring channels.

Upon request from external devices (using the corresponding commands), an array of measured voltage and current values is transmitted to the user, and any transformations (point-by-point graphing, power calculation, etc.) necessary for subsequent analysis can be performed on the user side. For example, since voltage and current measurements are performed virtually simultaneously, the instantaneous power at the measurement points can be calculated on the user side by simply multiplying the corresponding voltages and currents.

The meters, both autonomously and as part of information-measuring systems, can be used to monitor the parameters of electrical installations, in technical diagnostic equipment, for the comprehensive automation of energy facilities, and in other areas of industry where multichannel measurements and control of direct voltages and currents are required.

The master device for polling the meter can be the PUMA Data Collection and Transmission Controller (DCT) or a PC with an RS485 converter.

Current measurements are performed using external (separate) current sensors, which determine the range of currents being measured. The voltage corresponding to the measured current from the sensor output must be fed to the measuring input of the device's current channel.

The measurement results are presented in the corresponding response data fields as unsigned integers; they are converted into real values using the following formulas:

Voltage channels:

$$U\_in = 0.0246 * value\_U \text{ [Volt]};$$

Current channels for sensors type 3E SC1V-100A:

$$I\_in = 0.0458 * value\_I \text{ [Ampere]};$$

for sensors type 3E SZ1K-150A:

$$I\_in = 0.0696 * value\_I \text{ [Ampere]},$$

Where is value_U - the value from the information field of the Get_Data command, corresponding to one of the 6 voltage channels, value_I - the value from the information field of the Get_Data command, corresponding to one of the 6 current channels.

The range of values value_I, value_U is within 0…4095.

The current sensors are designed using current transformers. A bipolar voltage source is used to power the current sensors. This source is a module, functionally and electrically independent of the meter, located on the top board of the device in a single housing with the meter. The power source is located on the top row of connectors. The meter is located on the bottom board of the device and is connected to the bottom row of connectors. When using other types of current sensors that do not require external power, the connectors on the top board are not used and can remain unconnected.

5. Operation of the device

Operating limitations:

– The meter is not intended for use in aggressive or explosive environments.

– When operating, the meter should not be exposed to temperatures exceeding 60°C. There should be no sudden temperature fluctuations in the room, and there should be no sources of strong electrical fields near the installation site.

5.1 Preparing the device for use

– Before you begin working with the meter, please read this Operating Manual.

– Upon receipt of the measuring instrument, perform a visual inspection to ensure there is no visible mechanical damage and that it is complete according to the list:

– measuring instrument (depending on the order) 1 pc.;

– a set of current sensors (type 3E SC1V-100A) up to 6 pcs. per 1 device;

– User manual 1 copy; passport 1 copy.

– In case of transportation or long-term storage of the meter in conditions different from normal, keep it in normal climatic conditions for 1 hour.

– Check Table 1 to ensure that the output parameters of the DC signal source correspond to the parameters of the meter's input signal circuit; and that the power supply parameters correspond to the parameters of the meter's power supply circuit. The corresponding voltages must not exceed the maximum permissible values specified in Table 1.

i.Assemble the connection diagram according to Figure A1 of Appendix A.

Current sensors (type 3E SC1V-100A) are connected to the current measurement inputs (contacts 1-6 of the XP2 connector). The "G" contact of the signal "ground" of the sensor connector is connected to contacts 7 and 8 of the "GND" of the XP2 connector. The power wire in which the current is to be measured is passed through the current sensor transformer ring, taking into account the direction of current inflow, which is indicated on the current sensor transformer housing by the => symbol. It is necessary that the actual flow of the load current coincides with the direction indicated by the arrow on the current sensor housing. The voltage across the load is measured on the voltage channel corresponding to the connected current channel on the XP1 connector. Therefore, the voltage and current from the same load should be fed to the same-named current and voltage measurement inputs of the XP2 and XP1 connectors. For example, consumer 1 – to contact 1 of the current measurement connector XP2 and contact 1 of the voltage measurement connector XP1, consumer 2 – to contact 5 of the current measurement connector XP2 and contact 5 of the voltage measurement connector XP1. When using current sensors of the 3E SC1V-100A type together with the device, a bipolar supply voltage (+15V, -15V, GND) is required to power the sensors, which is generated by the power source on the upper board of the device and supplied to the XP2-2, XP3-2 connectors of the upper board, and the +15V output of the upper board is supplied to the main power input of the meter (contact 7 XP3 of the lower board).

The ground of the upper board (contact 8 XP2-2 or XP3-2) is fed to contact 8 (GND) XP3 on the lower board. The upper board's power supply input (contact 1: + (18-70)V and contact 2: GND of the XP1-2 connector) is connected to the output of the external power supply.

ii. The meters are shipped pre-configured from the factory. Before use, ensure the COM port settings are correct and the RS485 interface address is set correctly (default address = 02, RS485 baud rate = 9600 bps, and the number of data bits = 8).

1. Connect the USB/RS485 interface converter. Turn on the power to the meter and run the program on the PC.

Apply the measured voltage to the load (consumer).

2. Test the functionality of the RS485 channel between the PC (master) and the measuring device (slave) by sending a test command (e.g., Get_Data or Get_ID), after setting the correct address. Any response to the request indicates the functionality of the RS485 interface.

3. By changing the parameters of the input signal (load) and sending the Get_Data data reading command, verify the functioning of the meter by monitoring the correctness of the change in the corresponding parameters.

5.2 Using the device

– All installation and operation work must be carried out in compliance with current regulations that ensure the safe maintenance and operation of electrical installations.

– Mount the meter on the site in accordance with Figures A1 and A2 of Appendix A. Install the device housing on the DIN rail.

– Check that the output parameters of the AC signal source correspond to the parameters of the input signal circuit of the meter; the parameters of the power source correspond to the parameters of the power supply circuit of the meter.

– Make all necessary external connections to the corresponding meter contacts according to the connection diagram (Figure A1, Appendix A). When connecting, consider the recommendations in sections 5.2.5 and 5.2.6.

Measuring connection

Option 1

To connect the meter to a PC via a two-wire RS-485 interface, connect the computer's COM port (via an RS232-RS485 interface converter) to interface inputs A and B (pins 5 and 4) of the RJ45 connector. Additionally, supply low-voltage power (+(5..12)V) to pins 6 and 7 of this connector, and ground the power supply (GND) (pins 2 and 3) to power the interface's galvanic isolation. The RJ45 connector pinout is shown in Figure 3.

Option 2

To connect the meter to the KSPDI "Puma," use a cable with RJ45 to RJ12 (TP-6P6C) connectors at each end, connecting it to the RS485 interface (RJ12 connector) of the KSPDI "Puma," and the other end to the RJ45 connector of the meter (MIPS). In this case, power for the galvanic isolation is supplied via the interface cable from the KSPDI.

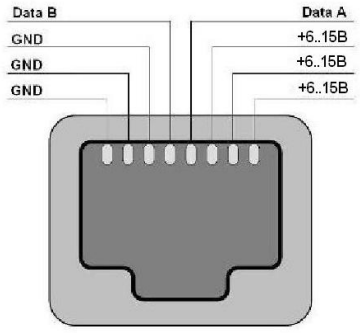

Figure 3

Apply supply voltage and then the input signal to the meter.

Send the Get_Data data reading command to the meter using the corresponding KSPDI command)

6. Maintenance

6.1 Security measures

– Maintenance work on meters must be performed by qualified personnel who are familiar with the design and operation of the meter within the scope of this Operation Manual.
– Do not make external connections without disconnecting the meter from the input signal source and from the power source.

6.2 Maintenance procedure

– Maintenance of measuring instruments consists of following the rules of operation, storage and transportation, systematic monitoring of correct operation, regular preventive inspection, periodic verification and troubleshooting.
– During operation of the unit during its service life, no maintenance work is required.

7. Storage and transportation rules

Climatic conditions for transportation must meet the following conditions:

- ambient air temperature from minus 20 °C to plus 50 °C;
- relative air humidity up to 98% at 25 °C;
- atmospheric pressure from 84.0 to 107.0 kPa (from 630 to 800 mmHg).

The devices can be transported by all types of transport (in covered wagons, closed vehicles, containers).

Devices should be stored only in the manufacturer's packaging in heated rooms at temperatures ranging from 0°C to +60°C and relative humidity no more than 80%. Storage areas must be free of aggressive impurities (such as acid or alkali vapors) that could cause corrosion.

8. Manufacturer's (supplier's) warranties

The warranty period for the device is set at 1 year, counting from the date the device is put into operation.

During the warranty period of the device, the manufacturer has the right to supervise the correct operation of the complex in order to improve the quality and efficiency of operation.

Device components that fail during the warranty period are subject to replacement or repair by the manufacturer at the manufacturer's expense.

The user loses the right to free repairs during the warranty period in the event of broken seals, mechanical damage by the user, or if the device was repaired by a person who is not authorized to perform repairs and maintenance.