



SCIENTIFIC-PRODUCTION ENTERPRISE
VIBROBIT LLC

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EQUIPMENT "VIBROBIT 100"

SETUP INSTRUMENT ПН11

Operations and Maintenance Manual

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The Operations and Maintenance Manual (OMM) is designed to familiarize users (operation personnel) with purpose and operation of the setup instrument ПН11.

The user should know the rules of electrical appliances operation, have experience in radiometric equipment operation, as well as know the purpose and operation of the equipment "VIBROBIT 100".

03.12.19 (version 7)

1 Description and operation

1.1 Purpose of the setup instrument ПН11

The setup instrument ПН11 is designed to test the technical condition of the equipment "Vibrobit 100" during installation, adjustment, mounting and maintenance.

The instrument is used to check and calibrate:

- sensors with converters;
- sensors with comparators;
- control boards;

The instrument is used for adjustment and testing of both the equipment individual units and measurement channels.

1.2 Item components

- setup instrument ПН11 1 pc.;
- signaling cable 1 pc.;
- power cord 1 pc.;
- storage battery (SB) Ni-MH (AA) 4 pcs.

1.3 Specifications and characteristics

Main Specifications are given in Table 1.

Table 1 - Main specifications of the setup instrument ПН11

Parameter description	Normal value
Output voltage of positive polarity, V	24 ± 0.5
Load current, not less than, A	0.15
DC current measurement ranges (from and to inclusive), mA	0 - 5 0 - 20
DC voltage measurement ranges (from and to inclusive), V	0 - 20 0 - 40
Range of voltage measurement on storage battery (from and to inclusive), V	0 - 10
Vibration velocity RMS measurement ranges (from and to inclusive), mm/s	0 - 15 0 - 30
Maximum measurement error, %, not more than	1,5
AC supply voltage range with frequency of 50 (60) Hz, V	150 - 250
Maximum power consumption, W, not more than	6.0
Overall dimensions, mm	196x100x40
Mass, kg, not more than	0,3

1.3.1 The instrument retains its parameters

- at a temperature from plus 5 to plus 50°C;
- at a temperature of plus 35°C at a relative humidity up to 80% without moisture condensation.

1.3.2 Warm-up time does not exceed 1 minute.

1.3.3 Insulation electrical resistance in ~220 V circuits, not less than:

- 40 MOhm under normal operating conditions;
- 2 MOhm at a temperature of plus 35°C and relative humidity of 80%.

The insulation of electrical circuits with a voltage of ~220 V withstands the exposure to a test voltage of 0.9 kV for one minute.

1.3.4 Industrial radio interference voltage, dB mkV, not more than:

- on frequency from 0.15 to 0.5 MHz 80;
- on frequency from 0.5 to 2.5 MHz 74;
- on frequency from 2.5 to 30 MHz 60.

1.3.5 The instrument average service life is 5 years. The service life does not apply to storage batteries, for which the service life depends on the number of charge-discharge cycles.

1.4.2. The instrument design and principle of operation

1.4.1 Structurally, the instrument is made in a portable version in a standard BOS800 case made of impact-resistant phenol-formaldehyde plastic manufactured by “BOPLA” (Germany).

1.4.2 The control and indication elements are located on the top front panel in accordance with Appendix A.

The purpose of the control and information elements is shown in Table 2.

Table 2 - Control and information elements

Control and information elements	Purpose
Button "POWER ON"	Switching on the instrument.
Button "POWER OFF"	Switching off the instrument.
Fusible insert "2.0A"	Primary circuit fuse (БП-1-1 2A) (CAREFULLY ! 220 V);
Modular plug "220 V"	Power cord connection; (CAREFULLY ! 220 V);
Modular plug "CIRCUIT"	Signaling cable connection
Indicator light "POWER ON"	Indicates the instrument operating mode
Indicator light "220 VAC ON"	Indicates the 220 V AC mains voltage presence
Indicator light "BATTAREY CHARGE"	Indicates the battery charge mode
Buttons and indicator lights to select the measuring parameter (MEASURING PARAMETER)	
Button "V _{DC} "	Switching on the DC voltage measurement mode.
Indicator light "V _{DC} "	Indicates the DC voltage measurement mode
Button "I _{DC} "	Switching on the DC current measurement mode.
Indicator light "I _{DC} "	Indicates the DC current measurement mode
Button "RMS"	Switching on the vibration velocity measurement mode.
Indicator light "RMS"	Indicates the vibration velocity measurement mode.
Button "V _{BAT} "	Switching on the DC voltage measurement mode on storage batteries.
Indicator light "V _{BAT} "	Indicates the DC voltage measurement mode on storage batteries.
Buttons and indicator lights for selecting measurement ranges (RANGE)	
Button "1...5"	Switching on the measurement mode of: <ul style="list-style-type: none"> • DC current in the range from 0 to 5 mA, • DC voltage in the range from 0 to 20 V • vibration velocity RMS in the range from 0 to 15 mm/s

Table 2 (continued)

Control and information elements	Intended use
Indicator light "1...5"	Indicates the measurement mode of: <ul style="list-style-type: none"> • DC current in the range from 0 to 5 mA, • DC voltage in the range from 0 to 20 V • vibration velocity RMS in the range from 0 to 15 mm/s
Button "4...20"	Switching on the measurement mode of: <ul style="list-style-type: none"> • DC current in the range from 0 to 20 mA, • DC voltage in the range from 0 to 40 V • vibration velocity RMS in the range from 0 to 30 mm/s
Indicator light "4...20"	Indicates the measurement mode of: <ul style="list-style-type: none"> • DC current in the range from 0 to 20 mA, • DC voltage in the range from 0 to 40 V • vibration velocity RMS in the range from 0 to 30 mm/s
Buttons and indicator lights for selecting the measurement channel (CHANNEL)	
Button "CH1"	Switching on the DC current and vibration velocity value measurement mode in channel 1.
Indicator light "CH1"	Indicates the DC current and vibration velocity value measurement mode in channel 1.
Button "CH2"	Switching on the DC current and vibration velocity value measurement mode in channel 2.
Indicator light "CH2"	Indicates the DC current and vibration velocity value measurement mode in channel 2.

2 Intended use

2.2 Safety precautions

- During the instrument operation, the potentially lethal voltage is present on the circuit elements. It is strictly forbidden to break the instrument sealing and measure the electrical parameters inside the instrument.
- Disconnect the power cord from the instrument only after disconnecting the power cord from the mains.
- Fuse to be checked and replaced the only after disconnecting the instrument from the mains.
- The instrument can only be operated by persons with third Electrical level or higher.

2.2 Operation Procedure

Connect the signaling cable to the “CURCUIT” modular plug.

Attention! It is strictly forbidden to short the “ + 24 V” plug to the “CH1” and “CH2 “ plugs.

This can result in the current sensors overloading and failure.

Connect the unit under test, observing the circuits naming (indicated on the cable plugs). When operating from the mains, connect the power cord to the instrument and the cord itself – to the AC mains. This will light up the indicator light “220 VAC ON”, indicator light “POWER ON”, decimal point in the indicator third digit and the indicator light “BATTAREY CHARGE”, if the storage battery level is below the normal. Periodic flashing of the indicator light “BATTAREY CHARGE” indicates that there are no storage batteries in the battery compartment or that there is poor contact with the current-collecting bars.

When operating from storage batteries, the instrument is switched on by pressing and holding the “POWER ON” button until a decimal point appears in the indicator third digit. When storage batteries are discharged below the normal level, a message appears on the indicator: «-.-», after which the instrument automatically switches off.

To select the required measurement mode, use the buttons for selection of mode, measurement range and channel number. When the measured value exceeds the permissible limits, a message is displayed on the indicator: «--.--». At the end of the measurements, switch off the instrument by pressing and holding the “POWER OFF” button until the message “OFF” appears on the indicator. After that, if operating from storage batteries, the instrument will switch off, and if operating from the mains, the instrument will switch to low power consumption mode and continue charging the storage batteries to the nominal charge level, after which the charging will stop, the indicator light “BATTAREY CHARGE” will switch off. When charging is complete, unplug the power cord from the AC mains.

3The instrument maintenance

3.1 Routine repair

- Routine repair is carried out as the instrument fails.
- If the continuous operation time from fully charged storage batteries drops to 10-15 minutes, the storage batteries should be replaced. It is strictly forbidden to use storage batteries of a different type other than that specified in p.1.2. This can result in the instrument overloading and failure.
- All works on the instrument repair should be carried out with the disconnected power cord and with the storage batteries removed from the battery compartment. **Attention! When operating the instrument both in standalone mode and in AC mains mode, some circuit elements have dangerous high-frequency pulses with an amplitude of up to 600 V.**

3.2 Instrument testing

This section establishes the procedure for initial and periodical testing of the instrument.

Periodical testing is carried out during the instrument operation, during the routine or preventive repair of the monitored equipment, once a year.

The primary sensors and converters used with the instrument are tested separately according to the procedures specified in the operational documents.

It is permitted to test the equipment as part of the parameter measurement channel and directly on the monitored equipment.

Table 3 states the operations performed and testing means applied during the testing.

Table 3 - Operations and testing means

Operation	Testing item No.	Testing means	Operation is mandatory during testing	
			initial	periodical
Visual inspection	3.2.3		Yes	Yes
Tryout	3.2.4	Milliammeter M2020 Voltamperemeter B7-40, B7-43, M2044	Yes	Yes
Determination of the basic measurement error	3.2.5	Resistance box P4831 Power supply module МП24	Yes	Yes
Note - It is permitted to use other testing means with identical metrological parameters.				

3.2.1 Safety requirements

The testing means, as well as auxiliary equipment, should have a protective grounding when carrying out the testing.

3.2.2 Testing conditions

The following conditions should be observed during testing:

- ambient air temperature $(+20 \pm 5)^{\circ}\text{C}$;
- relative air humidity from 30 to 80%;
- atmospheric pressure 650-800 mm Hg ((86-106.7) kPa);
- supply voltage $(+24 \pm 0.5) \text{ V}$;
- ПН11 setup instrument input voltage $(\sim 220 \pm 4) \text{ V}$, 50Hz;
- output unified signal load resistance:

(1-5) mA	$(2 \pm 0.005) \text{ kOhm}$;
(4-20) mA	$(500 \pm 10) \text{ Ohm}$;
- absence of vibration, external magnetic fields.

3.2.3 Visual inspection

When conducting a visual inspection, the following should be checked:

- the instrument cleanliness, condition of the front panel, indicators, controls;
- absence of damages.

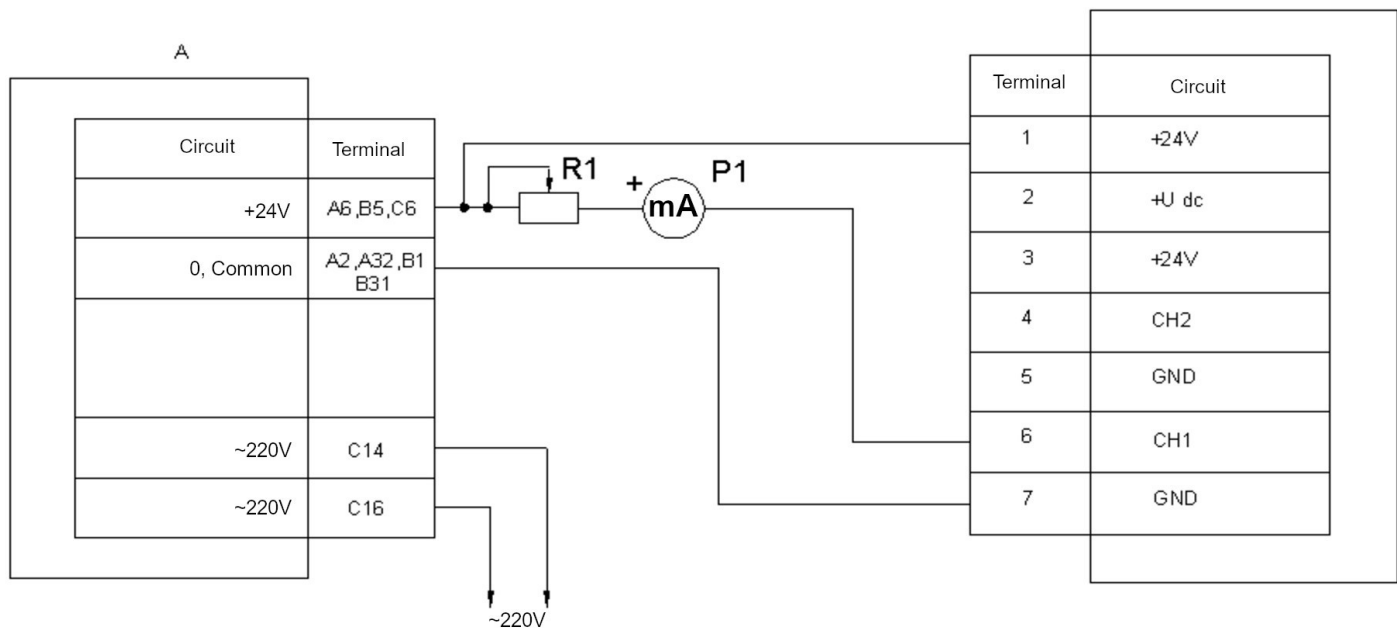
3.2.4 Tryout

During the instrument tryout, it is necessary to perform the following operations:

- assemble the electrical circuit for the instrument testing;
- feed several values of the electrical signal to the instrument input, to make sure that it is measured and displayed on the indicator, that there is a unified output signal.

3.2.5 Determining the measurement error of the ПН11 setup instrument

ПН11 is tested according to the electrical circuit in accordance with Figure 1.



A – МП24

B – ПН11

R1 – resistance box, 100 kOhm

P1 – DC milliammeter (0-20) mA, cl. 0.2

Figure 1 - Electrical circuit of the ПН11 testing

Use resistance box R1 to set a number of DC current (DC voltage) values by P1 instrument, and read (write) the parameter and the unified signal value by the instrument digital indicator.

Values of the instrument input signals, for which the measurement error is determined:

1.0;	2.0;	3.0;	4.0;	5.0	mA
4.0;	8.0;	12.0;	16.0;	20.0	mA

The measurement error is determined by the formula:

– for a digital indicator:

The instrument setting corresponds to the input signal current measurement

$$\delta = \frac{I_y - I_i}{I_i} \cdot 100\% \quad (1)$$

The instrument setting corresponds to parameter measurement, input signal - current

$$\delta = \frac{K_1 \left(1 + \frac{4([S_M] + S_i)}{S_{PR}} \right) - I_i}{I_i} \cdot 100\% \quad (2)$$

$$S_{PR} = [S_M] + [S_P] \quad (3)$$

where: I_i – input current by P1 milliammeter, mA;

I_y – current by the digital indicator readings, mA;

K_1, K_2 – scaling factors:

Input signal	K_1	K_2
current 1 - 5 mA	1.0	0.25
current 4 - 20mA	4.0	1

S_i – digital indicator reading, mm/s;

S_M, S_P – range limits (with a minus, plus sign), mm/s;

S_{PR} – parameter measurement range, mm/s;

The measurement error maximum value should comply with table 1.

- Determine the measurement error for all channels of the instrument.
- The measurement error maximum value for all channels should comply with table 1.

4 Transportation and storage

The setup instrument ПН11 in the package withstands transportation to any distance by road and rail (in enclosed vehicles), water transport (in ship holds), air transport (in pressurized compartments).

Transportation conditions - Ж according to ГОСТ 25804.4–83.

The packaged instrument withstands the following transportation conditions:

- temperature from minus 50°C to plus 50°C;
- relative humidity of 95% at 35°C;
- vibration (acting along the three mutually perpendicular axes of the container) when transported by railway, motor vehicle and aircraft within the frequency range (10 – 55) Hz at the vibration displacement amplitude of 0.35 mm and vibration acceleration of 5g;
- impacts with the shock acceleration peak value of 10g, shock pulse duration 10 ms, number of impacts (1000 ± 10) in the direction indicated on the container.

The instrument storage as to environment climatic aspects influence should comply with the conditions 3 (Ж3) as per ГОСТ 15150–69. Storage period shall not exceed 24 months from the date of manufacturing.

Long-term storage of the instrument shall be carried out in the packaging, inside the heated premises as per 1 (Л) according to ГОСТ 15150–69.

Appendix A

(informative)

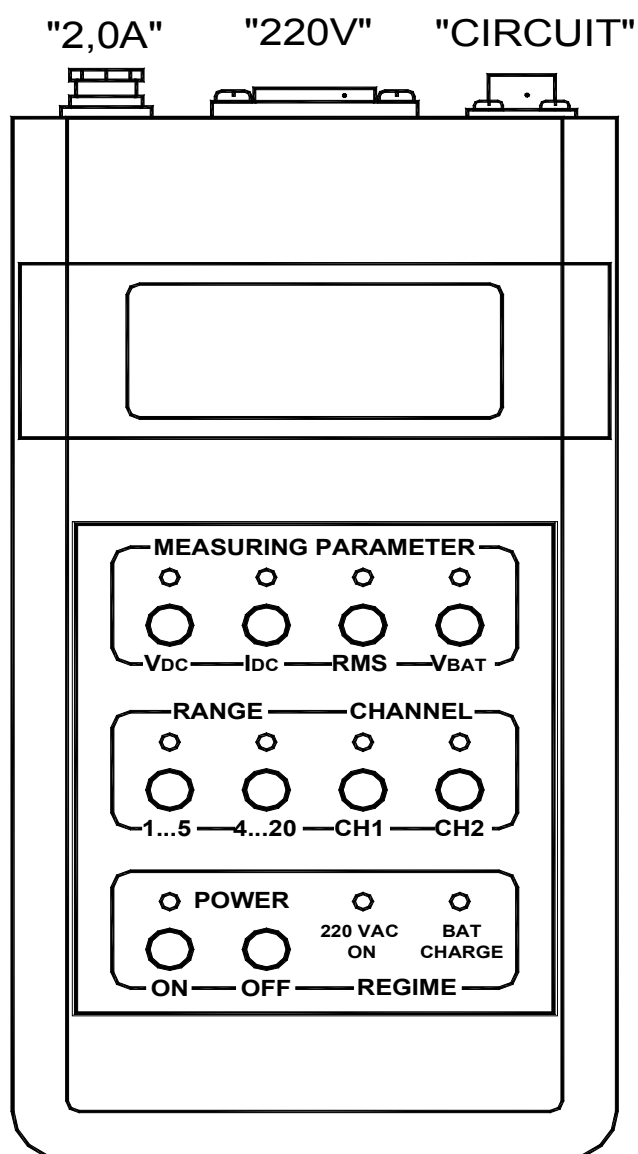


Figure A.1 - Appearance of setup instrument ПН11