Энергия –
Источник

БПКМ POWER SUPPLIES WITH ROOT EXTRACTION

Data Sheet

User Manual

АОС.69.00.000ПС

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CONTENTS

Version:
06.08.2018_A6

Data Sheet and User Manual contain the specifications, the rules of operation, and an operating-principle description for БПКМ power supplies with root extraction ("the Units"), as well as information on its acceptance, packaging, and verification.

1 INTENDED USE

1.1 The Units are designed for supplying power to sensors with unified 4...20, 0...20, 0...5 mA output signal, as well as for converting that signal into different-level signals via a root-extracting channel ("the REC").

1.2 Each Unit contains a stabilized DC 36 V (or customized 24 V) power supply ("the PS") with an overload and short-circuit protection device.

1.3 The Units are designed for electrical-enclosure, wall, or NS35\7.5 DIN-rail mounting. Dimensions are given in Appendix A.

1.4 In accordance with GOST 14254, the Units have one of the following degrees of protection:

- IP20 for DIN-rail or wall mounting;
- IP30 for enclosure mounting.

1.5 The Units generate no industrial noise.

1.6 In terms of weather resistance, the Units are Category 3.1 NF unit per GOST 15150, and Group C3 units per GOST 52931; however, their operating temperature range is limited to -10...+60 °C.

1.7 It is permissible to expose the Units to:

- 5 to 25 Hz 0.1 mm vibrations;
- DC and AC magnetic fields with a frequency of (50 ± 1) Hz and a strength of up to 400 A/m;
- relative humidity of 30 to 80 % as long as the temperature is within the operating range.

1.8 The Units are repairable.

1.9 The Manufacturer reserves the right to amend the technical documentation for this Product without prior notice as long as the functionality and purpose are not altered.

2 TECHNICAL SPECIFICATIONS

2.1 The Units are powered by 184...242 V 49...51 Hz AC mains.

2.2 The Units are designed to supply power to sensors from their built-in 36 or 24 V DC power supplies protected against short-circuits and overloads.

2.3 Rated power-supply load current is (50 ± 5) mA.

2.4 Overload protection is triggered by currents not exceeding 75 mA; short-circuit currents must not exceed 45 mA.

2.5 The Units consume 7.0 V·A at max.

2.6 Input and output circuitry is designed for connecting circuits with unified 0...5, 0...20, 4...20 mA current signals.

2.7 Maximum input impedance is 500 Ohms for 0...5 mA signals, 200 Ohms for 0...20 mA and 4...20 mA signals.

2.8 REC output circuitry is designed to sustain maximum loads of 750 Ohms for 0...20 mA or 4...20 mA signals, or 2.5 kOhms for 0...5 mA signals including the communication-line resistance. As long as the load is within the specified range, it does not affect the Unit's basic fiducial error.

2.9 Unit-sensor communication-line cable resistance must not exceed 100 Ohms.

2.10 Basic fiducial-error range: ± 2 % for REC as the input signal alters from 0 to 5 %; ± 0.15 % or ± 0.25 % (customized per order) as the input signal alters from 5 % to 100 %; range is given as a percentage of the output-signal range; for the PS, U_{out} deviates from the rated value by ± 0.2 % at max.

2.11 Additional REC error induced by supply voltage altering within the limits per para 2.1 normally does not exceed the limits of the basic fiducial REC error.

2.12 PS voltage deviates by ± 0.1 % of the rated PS voltage at max., as induced by the supply voltage altering within the limits per para 2.1.

2.13 Additional REC error due to ambient-air temperatures changing within a range of -10 to +60 ºC normally does not exceed the basic fiducial REC error per 10 ºC.

2.14 PS voltage deviations due to due to ambient-air temperatures changing within a range of -10 to +60 ºC normally do not exceed ± 0.1 % of the rated PS voltage per 10 ºC at the rated load current.

2.15 Vibration-induced additional output-signal error normally does not exceed ± 0.2 % of the REC output-signal range and ± 0.2 % of the rated PS output voltage.

2.16 Ripple voltage at the PS output normally does not exceed ± 0.1 % of the rated voltage at the nominal load current.

2.17 Maximum permissible ripple voltage at the REC input is ± 0.2 % of the measured voltage value.

2.18 Maximum permissible REC output-signal ripple is ± 0.2 % of the output-signal range.

2.19 The electric-circuit insulation between the combined XP1 mains-connector pins has been positively tested to sustain 1.5-kV (50 ± 1) Hz voltage for 1 minutes at (23 ± 5) °C and a relative humidity of up to 80 %, whereas the insulation between the combined XP2...XP4 terminal-block pins and the ground has sustained 0.3 kV.

2.20 The inter-circuit /circuit-enclosure insulation has a minimum resistance of:

- 40 MOhms at (23 ± 2) °C and a relative humidity of up to 80 %;
- 10 MOhms at (50 ± 1) °C and a relative humidity of up to 80 %.

2.21 Average service life is 12 years.

2.22 Max. weight is 0.5 kg for enclosure-mounted units, 0.4 kg for DIN- or wall-mounted units.

2.23 When packed for transport, the Units must survive shaking at an acceleration of 30 m/s^2 with frequencies ranging from 10 to 120 impacts per minute as per GOST R 52931.

2.24 When packed for transport, the Units must survive temperatures ranging from -50 to +60 °C as per GOST R 52931.

2.25 When packed for transport, the Units must survive humidity of up to 98 % at 35 °C without condensation.

3 DESIGNATION FOR ORDERING

Sample designation for ordering:

БПКМ	005	420	36	0.15	01	360	ГП
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**

where 1 is the name;

2 is the input-signal range:

- 005 for 0…5 mA;
- 420 for 4…20 mA;
- 020 for 0…20 mA;

3 is the output-voltage range:

- 005 for 0…5 mA;
- 420 for 4…20 mA;
- 020 for 0…20 mA;

4 is the power-supply voltage:

- 24 to 24 V;
- 36 to 36 V;

5 is the basic fiducial-error range:

- 0.15 to 0.15 %;
- 0.25 to 0.25 %;

6 is the version:

- DIN for DIN-rail or wall mounting;
- 01 is for electrical-enclosure mounting;

7 is for extra runtime (up to 360 hours);

8 signifies whether the Unit has been state-verified.

Note NS35/7.5 DIN rails available on request.

4 PACKAGING INCLUDES

4.1 Package contents must match the list in Table 1.

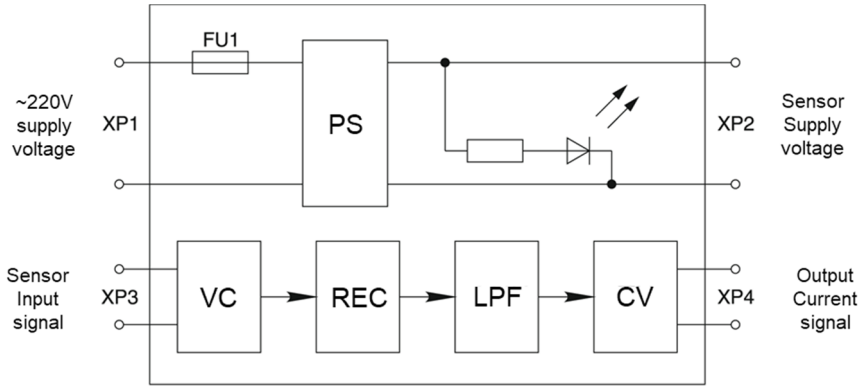
Table 1. Package Contents

Name	Designation	Number	Note
БПКМ Power Supply with Root Extraction	АОС.69.00.000 (АОС.70.00.000)	1	as ordered
Data Sheet User Manual	АОС.69.00.000ПС	1	
2РМ14КПН4Г1В1 socket		1	
DIN rail	NS35\7,5	m	as ordered

5 DESIGN AND OPERATING PRINCIPLE

5.1 Each Unit consists of a front panel, a circuit board with electroradiocomponents, and an enclosure with input/output connectors.

5.2 Functional diagram of the Unit is shown in Figure 1.



- PS is a 36-V, 50-mA or 24-V, 50-mA power supply (as ordered);
- CV is a current-voltage converter;
- REC is root-extracting circuitry;
- LPF is a low-pass filter;
- VC is a voltage-current converter.

Figure 1. Unit Functional Diagram

5.3 The power supply supplies stabilized 36 V or 24 V DC voltage (as ordered) to the output (XP2 terminal block). Overloads and short-circuits cause the front-panel LED to fade out. The supply recovers its normal operation as soon as overloads and short-circuits are eliminated.

5.4 0...5, 0...20, 4...20 mA input signal is received by the XP3 terminal block, converted into voltage, then transmitted to the root-extracting circuitry. The latter transmits an output signal proportional to the square root of the input signal per the formula (1).

$$I_{out.} = I_{out.min} + \sqrt{\frac{(I_{in.} - I_{in.min}) \cdot (I_{out.max} - I_{out.min})^2}{I_{in.max} - I_{in.min}}}, \quad (1)$$

where $I_{out.}$ is the REC output signal, mA;

$I_{out.\ min}$, $I_{out.\ max}$ are the limit values of the output-signal range, mA;

$I_{in.\ min}$, $I_{in.\ max}$ are the limit values of the input-signal range, mA;

$I_{in.}$ is the REC input signal, mA.

The signal is further filtered by the LPF and converted into a 0...5, 0...20, 4...20 mA output current signal, further transmitted to the XP4 terminal block.

6 SAFETY MEASURES

6.1 To be allowed to operate the Units, a person must receive a safety briefing for ≤ 1,000 V units and study this Data Sheet and User Manual.

6.2 Safety briefing is absolutely mandatory for operating or servicing any Unit.

6.3 In terms of electric-shock protection, the Unit is a Class 01 unit per GOST 12.2.007.0-75.

6.4 Load the units only when powered off.

6.5 The Units must be connected to a ground circuit.

7 INSTALLATION

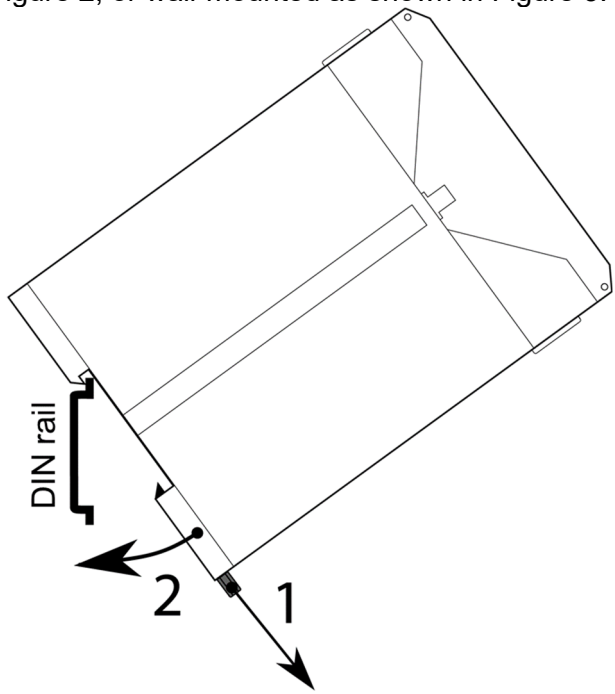
7.1 In the winter, the Unit must be unboxed in a heated room only; before unboxing, the box must be kept in such a heated room for at least 8 hours.

7.2 Before mounting, the Units must be visually inspected. Verify that conformity of markings and make sure there are no dents or other visible mechanical damage to the enclosure.

7.3 The Units are mountable in an enclosure, on a DIN rail, or wall-mounted depending on the version. The installation location must be easily accessible for mounting, dismounting, and maintenance.

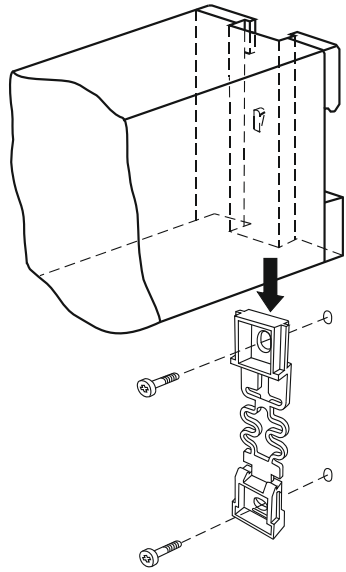
7.4 Notches in the enclosures for mounting 01 units must be arranged as shown in Figure A.3, Appendix A.

7.5 DIN units are mounted on DIN rails by a special latch as shown in Figure 2, or wall-mounted as shown in Figure 3.



1 release the latch;
2 mount the Unit on the DIN rail, fasten the latch.

Figure 2. DIN-Rail Mounting



1 remove the latch from the Unit;
2 fix the latch onto the wall;
3 mount the Unit on the latch.

Figure 3. Wall Mounting

7.6 Connect the Units by a screwdriver for 0.5x3.0 mm sockets. Screw-tightening torque must be equal to 0.5 N·m.

8 GETTING STARTED

8.1 Before powering on a unit, make sure it is installed and mounted as specified in sections 6, 7 hereof. Study this Data Sheet and User Manual.

8.2 Supply mains voltage. When powered on, the output-voltage LED lights up to indicate normal output voltage. Units are now ready for use.

8.3 The unit-using company must periodically check up the condition of units at its own discretion.

8.4 Checkups include:

- visual inspection;
- health check.

8.5 Visual inspection must verify:

- the presence of markings;
- no breakages in, or damage to, cables;

— whether cables are connected reliably;
— the absence of breakages in grounding wires;
— whether the grounding is fixed firmly;
— whether the unit is clean;
— the absence of dents and apparent mechanical damage to the enclosure;
— the integrity of the channel-status LED.

8.6 Damaged or faulty units must not be used.

8.7 Units rejected by visual inspection are subject to no further checkup.

9 VERIFICATION PROCEDURE

9.1 Units are to be verified by the State Metrology Service or other authorized bodies empowered to verify. Requirements to the organization, verification procedure, and presentation of verification results are set forth in the Procedure for Verification of Measuring Instruments, Requirements to Verification Signs and Certificates ("the Procedure") as approved by the Order of the Ministry of Industry and Trade of the Russian Federation dd. July 2, 2015 No. 1815.

9.2 Verification must be carried out every two years.

9.3 Verification instruments and tools:
— R331 100 Ohm reference resistance coil, 0.01 % accuracy class;
— P4831 resistance box, 0.02 % accuracy class;
— PC5000 multimeter, 0.05 % accuracy class;
— ИКСУ-2000 metering calibrator, accuracy class A per MP KGZh.408741.001RE.

Sundry standard instruments are allowed to use if properly certified and featuring similar or better performance.

9.4 Verification includes:
— visual inspection of units;
— measuring the PS output voltage;
— measuring the REC output current;
— calculating the fiducial REC error;
— calculating the PS voltage deviations.

9.5 Visual inspection must verify:
— the presence of markings;
— the absence of external damage;

— the condition of the mains connector and input/output terminal blocks.

Units with mechanical damage to the enclosure and connections, and/or with contaminated contacts are to be rejected.

9.6 Verification is carried out under the following conditions:

— ambient-air temperature of (23 ± 2) ºC;
— atmospheric pressure of 86 to 106 kPa;
— relative humidity of 30 to 80 %;
— supply voltage of 220 ± 10 V;
— no external electric or magnetic fields, otherwise, such fields must not affect the Unit's performance;
— the Unit must be powered for at least 30 minutes before testing.

9.7 When measuring the PS output voltage, verify that:

— the built-in PS supplies 36 V or 24 V rated output voltage (as ordered);
— the PS protection-triggering current does not exceed 75 mA;
— the PS short-circuit current does not exceed 45 mA;
— the PS rated load current equals (50 ± 5) mA;
— the PS voltage must not deviate by more than ± 0.2 % of the output voltage.

9.8 When measuring the REC output current, check:

— input-signal values and respective output-signal values;
— basic fiducial error.

9.9 To calculate the basic fiducial error of the REC, the Unit is connected according to the diagram shown in Appendix C.

9.9.1 ИКСУ is powered up and set to generate current.

9.9.2 Use ИКСУ to configure the input signals as shown in Tables 2, 3, 4 (as ordered), and use the voltmeter to find the output signal.

9.9.3 Basic fiducial error is calculated as follows (2):

$$\gamma = (I_{out.i} - I_{out.d}) / (I_u - I_l) \cdot 100\%, \qquad (2)$$

where $I_{out.i}$ is the measured output-signal value, mA;
$I_{out.d}$ is the design output-signal value, mA, for the verified point, see Tables 2, 3, and 4;
I_u, I_l are the upper and lower limits of the output signal, mA.

9.9.4 Maximum basic fiducial error obtained must not exceed the Unit's permissible basic fiducial-error limit per para. 2.10.

Table 2. Output-Signal Values

Range of the output signal I_{in} = 0…5 mA		**Output-signal range**					
		I_{out} = 0…5 mA		**I_{out} = 4...20 mA**		**I_{out} = 0...20 mA**	
Measured value		**Design value**					
%	**I_{in}, mA**	**I_{out}, mA**	**U_{out}, V**	**I_{out}, mA**	**U_{out}, V**	**I_{out}, mA**	**U_{out}, V**
0	0	0	0	4.000	0.400	0	0
0.25	0.0125	0.250	0.025	4.800	0.480	1.000	0.100
1.0	0.0500	0.500	0.050	5.600	0.560	2.000	0.200
4.84	0.2420	1.100	0.110	7.520	0.752	4.400	0.440
5.29	0.2645	1.150	0.115	7.680	0.768	4.600	0.460
25	1.2500	2.500	0.250	12.000	1.200	10.000	1.000
49	2.4500	3.500	0.350	15.200	1.520	14.000	1.400
100	5.0000	5.000	0.500	20.000	2.000	20.000	2.000

Table 3. Output-Signal Values

Range of the output signal I_{in} = 4…20 mA		**Output-signal range**					
		I_{out} = 0…5 mA		**I_{out} = 4...20 mA**		**I_{out} = 0...20 mA**	
Measured value		**Design value**					
%	**I_{in}, mA**	**I_{out}, mA**	**U_{out}, V**	**I_{out}, mA**	**U_{out}, V**	**I_{out}, mA**	**U_{out}., V**
0	4.0000	0	0	4.000	0.400	0	0
0.25	4.0400	0.250	0.025	4.800	0.480	1.000	0.100
1.0	4.1600	0.500	0.050	5.600	0.560	2.000	0.200
4.84	4.7744	1.100	0.110	7.520	0.752	4.400	0.440
5.29	4.8464	1.150	0.115	7.680	0.768	4.600	0.460
25	8.0000	2.500	0.250	12.000	1.200	10.000	1.000
49	11.840	3.500	0.350	15.200	1.520	14.000	1.400
100	20.000	5.000	0.500	20.000	2.000	20.000	2.000

Table 4. Output-Signal Values

Range of the output signal I_{in} = 0…20 mA		**Output-signal range**					
		I_{out} = 0…5 mA		**I_{out} = 4...20 mA**		**I_{out} = 0...20 mA**	
Measured value		**Design value**					
%	**I_{in}, mA**	**I_{out}, mA**	**U_{out}, V**	**I_{out}, mA**	**U_{out}, V**	**I_{out}, mA**	**U_{out}, V**
0	0	0	0	4.000	0.400	0	0
0.25	0.050	0.250	0.025	4.800	0.480	1.000	0.100
1.0	0.200	0.500	0.050	5.600	0.560	2.000	0.200
4.84	0.968	1.100	0.110	7.520	0.752	4.400	0.440
5.29	1.058	1.150	0.115	7.680	0.768	4.600	0.460
25	5.000	2.500	0.250	12.000	1.200	10.000	1.000
49	9.800	3.500	0.350	15.200	1.520	14.000	1.400
100	20.000	5.000	0.500	20.000	2.000	20.000	2.000

9.10 It is admissible to verify the Unit at three points: zero-range, mid-range, and end-range (see Tables 2, 3, and 4).

9.11 To check the built-in power supply, switch SA3 switches to 1. The SA4 switch must be ON. Use the R7 resistor to set the current at 50 mA as measured by PA2. Use the PV2 readings to measure the PS output voltage.

PS output-voltage deviations are calculated as follows (3):

$$\gamma = (U - U_{Rt}) \cdot 100 / U_{Rt}, \quad (3)$$

where γ is the deviation, %;

U is the actual output-voltage value, V;

U_{Rt} is the rated output-voltage value, V.

Units are deemed to have passed the test if the basic fiducial error for the REC and the PS parameters are in line with what is specified in para. 2.2, 2.4, and 2.10.

9.12 Registration of verification results.

9.12.1 Verification results are recorded in the Verification Certificate (Appendix 1 to the Procedure), whereby the results themselves are specified on the reverse side (or in an arbitrary protocol); otherwise, they may be presented in this Data Sheet and User Manual, whereby they are to be witnessed by the Verification Officer's seal.

9.12.2 If the Unit does not pass verification, it is rejected; the form presented in Appendix 2 to the Procedure is therefore used to notify that the Unit is not ready for service.

10 MARKING AND SEALING

10.1 The Units are marked in accordance with GOST 18620-86; the marking contains the following:

- Unit name;
- connector designations;
- supply voltage;
- mains frequency;
- output voltage;
- input/output signal range;
- operating temperature range;
- basic fiducial-error range
- year of manufacture;
- ordinal number of the Unit (per the Manufacturer's numbering system).

10.2 Units are sealed at the front-panel and enclosure-base junction for DIN versions or at the upper right screw of the front panel for 01 versions by sticking a warranty sticker with the Manufacturer's logo.

11 PACKAGING

11.1 Unit packaging ensures safety during transport.

11.2 The Units and their operational documents are contained in plastic bags. The bags are placed in corrugated-cardboard boxes.

11.3 Cardboard boxes with Units are placed in Type IV boxes per GOST 5959 for transport.

11.4 Box insides must be lined with a water-proof material to protect from dust and water.

11.5 Pursuant to GOST 14192, the transport container must bear indelibly-painted additional information labels and handling signs with the following meanings: Fragile, Caution, Top, Protect from Moisture

12 TRANSPORT AND STORAGE

12.1 Unless unboxed, the Units are transportable by any mode of transport, including air carriage in heated pressurized compartments; transport is subject to all the effective transport-specific regulations.

12.2 Transport conditions must be compliant with Condition Group 5, GOST 15150.

12.3 Unit storage for transport must be compliant with Condition Group 5, GOST 15150.

13 DISPOSAL

13.1 The Units are non-hazardous for human life and health or for the environment during and after its service life.

13.2 The Units contain no precious metals.

13.3 The Units must be disposed of by the user organization in due compliance with all the regulations effective in the area.

14 ACCEPTANCE CERTIFICATE

БПКМ Power Supply with Root Extraction_____

_____

serial number _____ is compliant with specifications per ТУ4218-002-51465965-2010 and is therefore found ready for service.

Date of issue _____.

L.S.

QA Team representative _____ / _____ /.
(signature, surname)

Primary verification (calibration) results

БПКМ Power Supply with Root Extraction_____

_____

serial number _____ positive.

Verification (calibration) date _____.

L.S.

Verification Officer _____ / _____ /.
(signature, surname)

The Unit has run for an additional _____ hours.

15 CERTIFICATE OF PACKAGING

БПКМ Power Supply with Root Extraction_____

_____

serial number _____ is packed in full compliance with the effective design documentation.

Date of packing _____.

Packed by _____ / _____ /.
(signature, surname)

16 MANUFACTURER'S WARRANTY

16.1 The Manufacturer guarantees the Units' proper operation for 36 months since the day of commissioning provided that the actual transportation, storage, and operating conditions are in line with the conditions herein specified.

16.2 Warranty storage period is 6 months since the date of manufacture. Excess storage is deduced from the warranty period.

16.3 Date of commissioning _____.

16.4 Position, surname, and signature of the officer witnessing the verification of the Unit's condition and its commissioning: _____.

17 COMPLAINT HANDLING

17.1 Complaints about units that have been found non-compliant with the TU specifications during its warranty period or warranty storage period shall be submitted to the Manufacturer.

17.2 Defect remedy shall be the Manufacturer's responsibility.

17.3 Complaints about units, the defects whereof have been caused by improper transportation, operation, or storage, shall be rejected.

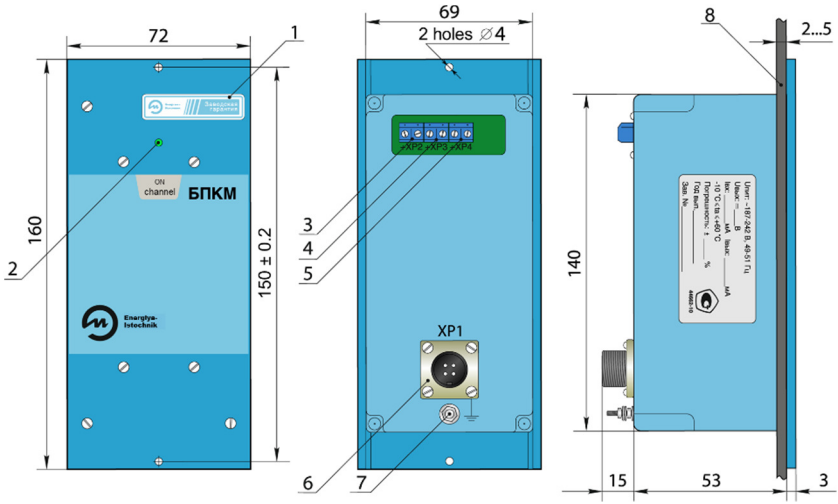
Manufacturer: **Energiya-Istochnik LLC**
Russia, 454138 Chelyabinsk,
290 Prospekt Pobedy, Office 112,
phone/fax: +7 (351) 749-93-60,
+7 (351) 742-44-47, 749-93-55,
http://www.eni-bbmv.ru
E-Mail: info@en-i.ru

18 VERIFICATION RESULTS

Date of verification	Verification results	Signature

APPENDIX A

Dimensions



1 is the warranty label;
2 is the channel-status LED;
3 is a DG301-5.0-02P terminal block for connecting sensor supply voltage;
4 is a DG301-5.0-02P terminal block for connecting the sensor current signal (the input current signal);
5 is a DG301-5.0-02P for connecting the load (the output current signal);
6 is a 2РМ14КПН4Ш1В1 connector for supplying mains voltage;
7 is the ground bolt;
8 is the electrical enclosure.

Figure A.1. БПКМ Dimensions
(01 Version)

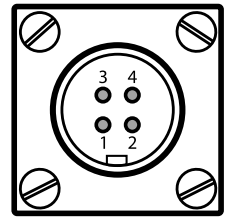


Figure A.2. Pin Numbering of XP1 Connectors for Supply Voltage
(01 Version)

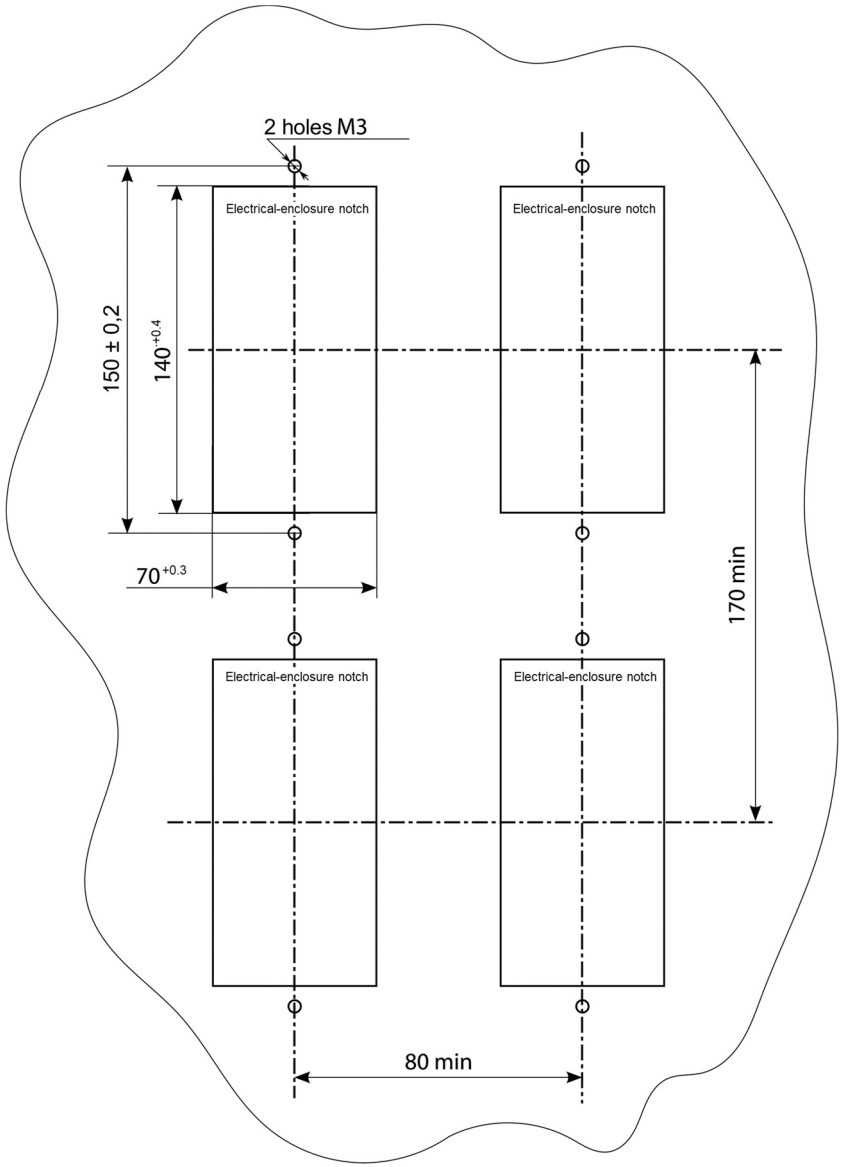
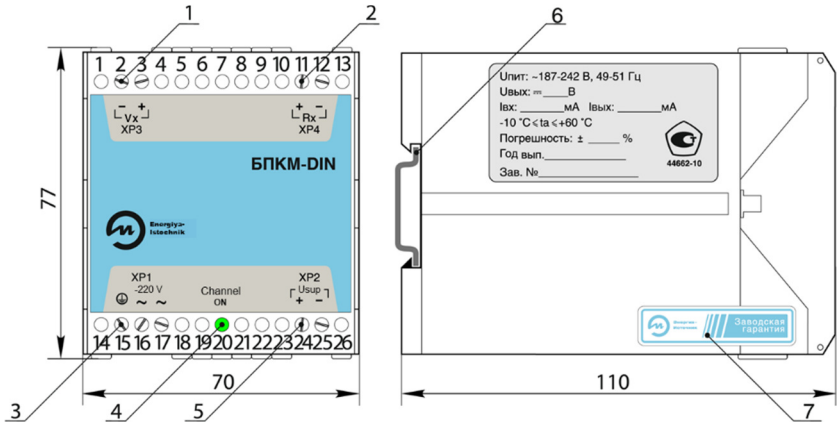


Figure A.3. Arrangement of Notches in the Electrical Enclosure (01 Version)



1 is a DG301-5.0-02P terminal block for connecting the sensor current signal (the input current signal);

2 is a DG301-5.0-02P for connecting the load (the output current signal);

3 is a DG301-5.0-02P terminal block for supply voltage;

4 is the channel-status LED;

5 is a DG301-5.0-02P terminal block for connecting sensor supply voltage;

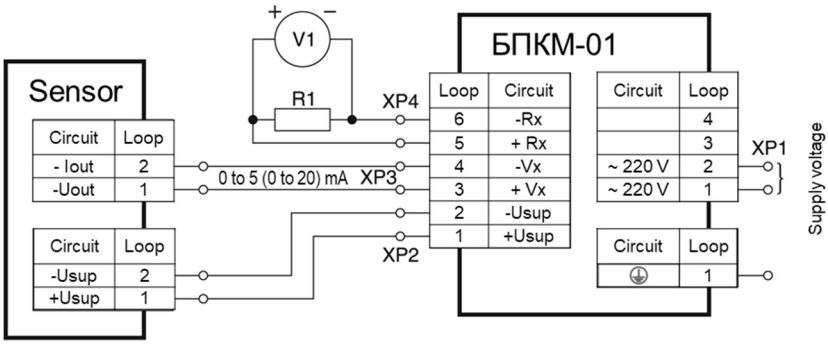
6 is a DIN rail;

7 is the warranty label.

Figure A.4. БПКМ Dimensions
(DIN Version)

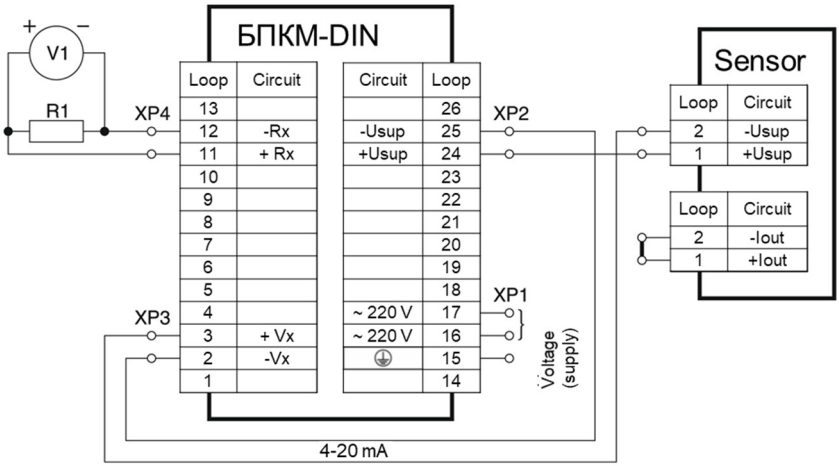
APPENDIX B

Wiring Diagrams



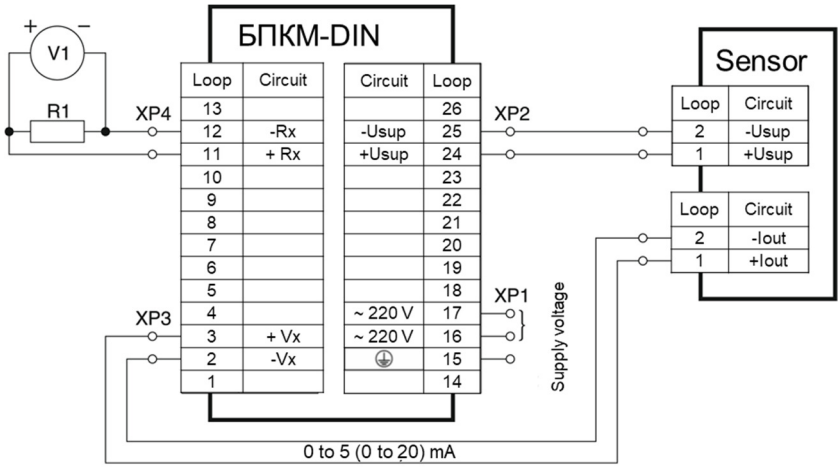
V1 is a multimeter;
R1 is the load resistance.

Figure B.1. БПКМ(01)-to-Sensor Wiring Diagram for Output Currents of 0...5 or 0...20 mA



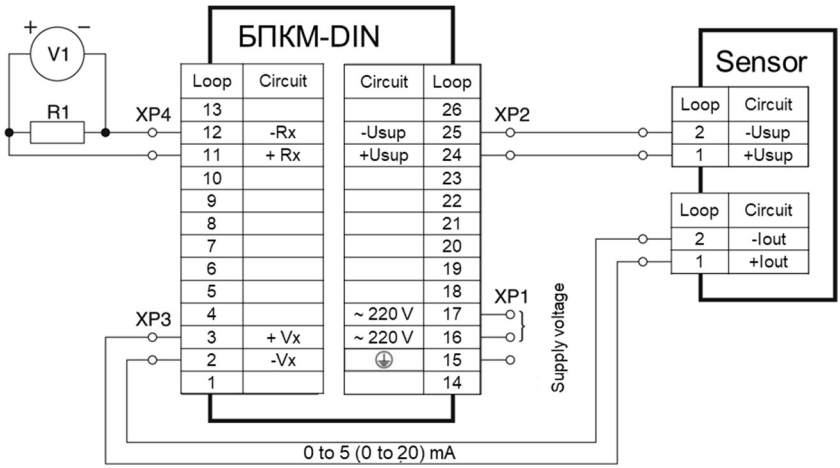
V1 is a multimeter;
R1 is the load resistance.

Figure B.2. БПКМ(01)-to-Sensor Wiring Diagram for Output Currents of 4...20 mA



V1 is a multimeter;
R1 is the load resistance.

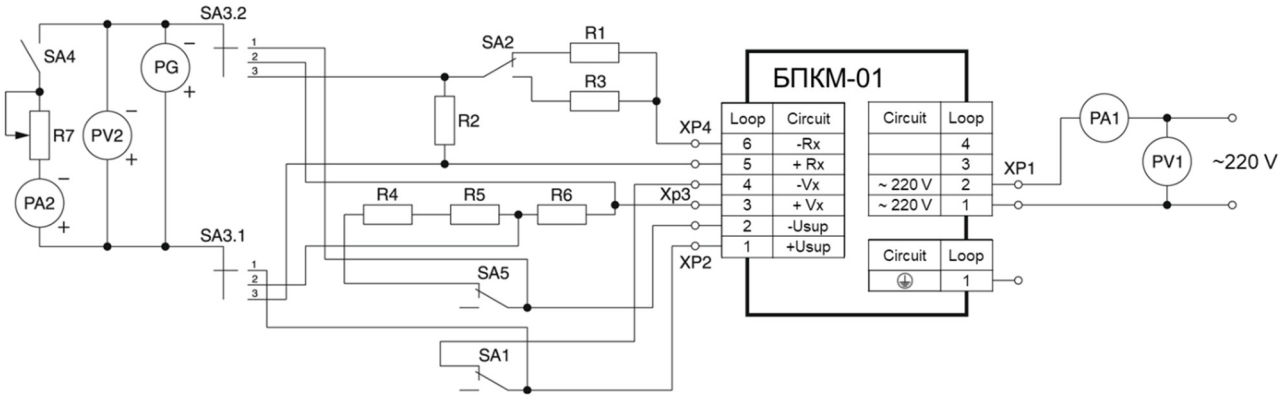
Figure B.3. БПКМ(DIN)-to-Sensor Wiring Diagram for Output Currents of 0...5 or 0...20 mA



V1 is a multimeter;
R1 is the load resistance.

Figure B.4. БПКМ(DIN)-to-Sensor Wiring Diagram for Output Currents of 4...20 mA

APPENDIX C
Verification Diagram



R1 is a C2-29B-0.25-2.4 kOhm ± 0.5 % resistor;
R2, R6 is an P331 100 Ohm reference resistance coil;
R3 is a C2-29B-0.25-649 Ohm ± 0.5 % resistor;
R4 is a C2-29B-0.25-1 kOhm ± 0.5 % resistor;
R5 is a P4831 resistance box, 0.02 % accuracy class.
R7 is a ППЗ-40 1 kOhm ± 10 % resistor;
T is an AOCH-20-220-75 Hz lab transformer;
PA1 is a PC5000 multimeter configured to measure AC current;
PA2 is a PC5000 multimeter configured to measure DC current;
PV1 is a PC5000 multimeter configured to measure AC voltage;
PV2 is a PC5000 multimeter configured to measure DC voltage;
PG is an C1-74 oscilloscope;
SA1, SA2, SA4 are П2Е 13 switches;
SA3.1, SA3.2 is a ПГЗ-11П-2Н rotary switch.

Figure C.1. Unit Verification Diagram

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