

License for production  
№ ЦО-12-101-1898 of 01 July 2003  
was issued by ЦМТО of Gosatomnadzor of Russia



**RELIABLE DEVICES AND SYSTEMS  
OF TECHNOLOGICAL MONITORING**

# THE MODULAR MEASURING CONVERTER ИПМ 0399/М3А

Operation manual  
НКГЖ.411531.001-05РЭ



For APP

Инт. № подл.	Подп. и дата	Взам инв. №	Инт. № дубл	Подп. и дата

## CONTENTS

1. Introduction	3
2. Description and operation of the product	3
2.1. Use of the product	3
2.2. Characteristics	5
2.3. Device and its operation	11
2.4. Error messages	23
2.5. Operation features	24
2.6. Marks and sealing	24
2.7. Packing	24
3. Use of the product for application	25
3.1. Product preparation for use	25
3.2. Using of the product	27
4. Checking technique	28
5. Maintenance service	44
6. Keeping	45
7. Transportation	45
Appendix A. The connection circuit of ИПМ 0399/М3А	45
Appendix B. The connection circuits of ИПМ 0399/М3А to the IBM	48

## 1. INTRODUCTION

1.1. The manual contains data on a design, a principle of action, characteristics of the modular measuring converter ИПИМ 0399/М3А (further - ИПИМ 0399/М3А) and the guidelines, which are necessary for the proper and safe operation.

1.2. The attendants should have skills of work with a IBM and learn attentively the present manual for the proper ИПИМ 0399/М3А operation.

## 2. DESCRIPTION AND OPERATION OF THE PRODUCT

### 2.1. Use of the product

2.1.1. ИПИМ 0399/М3А is intended for converting of the resistance thermoelements (RT) and the thermoelectric converters (TC) with the unified output signals into the unified signals of a direct current 0...5, 0...20 or 4...20 mA.

2.1.2. ИПИМ 0399/М3А (with increased reliability) is used as a component of control system of operational processes of atomic power plants (APP), and it is specially designed for its possible operation in «Busher» APP in IRI and other recently projected APPs.

2.1.3. ИПИМ 0399/М3А is a microprocessor, reconfigured by the device consumer, with indication of the current values of the sizes being converted and intended for functioning both in an independent mode, and also under the computer program control.

2.1.4. ИПИМ 0399/М3А carries out a function of the signal system and the automatic regulation of the controllable parameters.

Individual point relays of signalling channels support commutation:

- of alternating current system frequency:
  - at the voltage of 250 V till 5 A on resistive load ,
  - at the voltage of 250 V till 2 A on inductive load ( $\cos \varphi \geq 0,4$ );
- of direct current:
  - at the voltage of 250 V till 0,1 A on resistive and inductive loads,
  - at the voltage of 30 V till 2 A on resistive and inductive loads.

**Notes.** *On inductive load it is recommended to install spark suppression circuits to the clamps of the instrument or to the inductive load itself Spark suppression circuit should consist of series connected peresistor 50...100 Ohm, 0,5 W and a capacitor 10...100 nF at the voltage not less than 630 V.*

2.1.5. ИПМ 0399/М3А has three settings. The input procedure and a change of the setting changing are protected by the password against the non-authorized access.

2.1.6. ИПМ 0399/М3А includes: a built-in voltage source, intended for powering of the initial converters with a unified output signal of a direct current.

2.1.7. According to the all-Union State Standard 13384-93, ИПМ 0399/М3А is:

- a signal-channel - on the number of the converting input signals;
- a two-channel with an independent parameter installations of the output channels – on the number of the output signals;
- a three-channel with an independent adjustment of each channel on operation of any setting – on the number of channels of the signal system;
- with a linear dependence for the input signals from the RT, TC or with a linear dependence and with a function of a square root extraction for the unified input signal – on dependence of the output signal from the input one;
- without any galvanic connection – on connecting between the input and output circuits.

2.1.8. In accordance with all-Union State Standard 25804.1-83 ИПМ 0399/М3А belongs to:

- category B as to the operation mode – the equipment of continuous application;
- the type I as to the number of levels of operation quality – the equipment with two quality degrees of functioning – the nominal level and refusal.

2.1.9. According to ИП-001-97 (ОПБ - 88/97), ИПМ 0399/М3А concerns to:

- the elements of normal operation – on using;
- the important elements for safety – on influencing safety;
- the managing elements – on the character of the carried out functions.

Example of classification designations 2НУ or 3НУ.

2.1.10. The protection degree against penetrating of any firm bodies and water corresponds to IP 20 according to the all-Union State Standard 14254-96.

2.1.11. ИПМ 0399/М3А concerns to execution group M6 in accordance with the all-Union State Standard 17516.1-90 – on the stability against any mechanical influences while operating.

2.1.12. ИПМ 0399/М3А concerns to execution group C4 according to the all-Union State Standard 12997-84 about the stability to climatic influences of the environment.

2.1.13. According to seismic impact stability

- ИПМ 0399/М3А belongs to the Ist category of the seismic stability according to ИП-031-01 and to the Б group of execution 3 according to ПД 25 818-87;
- ИПМ 0399/М3А of 4H category is designed for operation at the APP «Busher» and belongs to the IIIst category of the seismic stability according to ПНАЭГ -5-006-97 and no demands as to seismic stability are made to it.

ИПМ 0399/М3А is proof, solid and steady against influencing of earthquake with a level of seismicity of 8 points on the MSK-64 scale at the setting level up to 40 m according to the all-Union State Standard 25804.3-80.

2.1.14. By stability to electromagnetic disturbances:

- ИПМ 0399/М3А corresponds to the execution group III, the criteria of the functioning quality – A in accordance with State Standards P 50746-2000;
- ИПМ 0399/М3А of 4H category designed for operation at the APP «Busher» corresponds to the execution group III in accordance with State Standards P 50746-2000.

## 2.2 Characteristics

2.2.1. The basic metrological characteristics of ИПМ 0399/М3А are given in table 1.

Size being measured	Converting range**	Limits of the admitted basic given error $\gamma_0, \%$			Initial converter type	$W_{100}$
		for the unified output signal		on the size being measured		
		0...5 or 4...20 mA	0...20 mA			
1	2	3	4	5	6	7
Temperature	-50...+200 °C	±0,25	±0,2	±(0,2+*)	50M, 53M, 100M	1,4280
					50П, 100П	1,4260
		Pt100	1,3910			
		Pt100	1,3850			
	-50...+600 °C	±0,2	±0,15	±(0,15+*)	50П, 100П	1,3910
					Pt100	1,3850
	-50...+600 °C	±0,5	±0,4	±(0,4+*)	TXK(L)	-
	-50...+1100 °C					
	-50...+1300 °C					
	0...+1700 °C					
+300...+1800 °C						
0...+2500 °C	TTP(B)					
TBP(A-1)						

Continuation of the table 1

1	2	3	4	5	6	7
Current	0...5 mA***	±0,2	±0,15	±(0,2+*)	With the unified output signal	
	4...20 mA***			±(0,15+*)		
	0...20 mA***			±(0,1+*)		
Voltage	0...75 mV***	±(0,1+*)				
	0...100 mV***					
<b>Notes:</b>	1) * One unit of the last category expressed in percentage of the transformation range. 2) ** The sub-ranges of transformations are configured by a consumer within the limits of the specified ranges. In this case limits of the admitted basic given error $\gamma$ are defined under the formula $\gamma = \gamma_0 \cdot A_{mArc} / A_n$ , $A_{mArc}$ is the transformation range equal to a difference of the top and bottom limits of the size being measured, specified in column 2; $A_n$ is a normalizing value of the transformation sub-range equal to a difference of the top and bottom limits of the sub-range, established by a consumer. 3) *** For the unified signals with the root executing dependence, the basic error is determined in ranges: 0,1...5 mA; 4,3...20 mA; 0,4...20 mA; 1,5...75 mV; 2...100 mV.					

2.2.2. The operation set time (preliminary warming up) is no more 30 minutes.

2.2.3. The limits of the admitted basic error correspond to the values established in item 2.2.1 and the pulsation of the output signal does not exceed 0,25 % of the top change limit of the output signal at the grounding of one of the output clips (contacts) of the output circuits of ИПИМ 0399/M3A at which the input and output circuits are galvanically not connected,

2.2.4. The limit of the admitted variation of the output signal of ИПИМ 0399/M3A does not exceed 0, 2 limits of the admitted basic error.

2.2.5. The limit of the ИПИМ 0399/M3A admitted additional error, caused by changing of the air temperature from normal (20±5) °C up to any temperature within the limits of working temperatures for each 10 °C of the temperature change, does not exceed 0,5 limits of the admitted basic error.

2.2.6. The limit of the ИПИМ 0399/M3A admitted additional error, caused by influencing of the enhanced humidity (up to 95 % at 35 °C), does not exceed 0,5 limits of the admitted basic error.

2.2.7. The limit of the admitted additional error does not exceed a limit of the admitted basic error at the time of the vibration influence.

2.2.8. The limit of the ИПИМ 0399/M3A admitted additional error, caused by influencing of some constant magnetic fields and (or) some variable fields of the network frequency intensity up to 300 A/m, does not exceed 0,5 limits of the admitted basic error.

2.2.9. The limit of the ИПИМ 0399/M3A admitted additional error, caused by changing of a power voltage from the nominal value 220 V in the limits (176...253) V, does not exceed 0,5 limits of the admitted basic error.

2.2.10. The limit of the ИПМ 0399/M3A additional error, caused by a deflection of the loading resistance from the limiting value  $R_{\text{пред}}=2$  kOhm for an output 0...5 mA and  $R_{\text{пред}} = 0,5$  kOhm an output 4...20 (0...20) mA to a minus of 25 %, does not exceed 0,5 limits of the admitted basic error.

2.2.11. The limit of the ИПМ 0399/M3A admitted additional error, caused by the simultaneous resistance change of each wire of the ИПМ 0399/M3A connection line with the RT on  $\pm 10$  % of the set value according to item 2.2.22, does not exceed 0,5 limits of the admitted basic error.

2.2.12. The limit of the admitted additional error, caused by a voltage influence of a handicap of the consecutive type of the alternating current with the average quadratic value equal 50 % of a range of the ИПМ 0399/M3A input signal, operating between the input measuring clips, also consistently with an input signal and having any phase corner, does not exceed 0,5 limits of the admitted basic sinfulness.

2.2.13. The limit of the admitted additional error, caused by a voltage influence of a general view handicap of a constant or an alternating current with the average quadratic value equal to 100 V, working between any input measuring clip and the earthed case (output) and having any phase corner, does not exceed 0,5 limits of the admitted basic error.

2.2.14. The limit of the ИПМ 0399/M3A admitted additional error for a configuration with TC, cause by the temperature change of their loose ends in the range of the working temperatures, does not exceed a limit of the admitted basic error.

2.2.15. The giving scope of the settings corresponds to the measuring range.

2.2.16. The operation hysteresis on the settings of ИПМ 0399/M3A symmetric, programs independently on each setting and is adjusted within the limits of the all measuring range through.

2.2.17. The limit of the operating ИПМ 0399/M3A signal system (blocking) in the admitted basic error does not exceed a limit of the admitted basic error of the measurements.

2.2.18. The limit of the operating ИПМ 0399/M3A signal system (blocking) in the additional basic error, caused by the air temperature change from normal up to any temperature within the limits of working temperatures for each 10% of the temperature change, does not exceed 0,5 limits of the admitted basic error of the blocking operation.

2.2.19. The limit of the admitted additional error of the ИПМ 0399/M3A signal system (blocking) operation, caused by a voltage change of power from nominal up to any one within the limits of operating conditions of application, does not exceed 0,5 limits of the admitted basic error of the blocking operation.

2.2.20. The pulsation of the ИПИМ 0399/M3A output signal does not exceed 0, 25 % of the top limit of changing of the output signal.

2.2.21. The input resistance of ИПИМ 0399/M3A, intended for operating with the TC, is not less than 100 kOhm.

2.2.22. The maximal resistance of each wire of the ИПИМ 0399/M3A connection with the RT - 15 Ohm.

2.2.23. The resistance of loading is no more:

- 2 kOhm - for the output signal 0...5 mA;
- 0,5 kOhm - for the output signal 0...20, 4...20 mA.

2.2.24. The power is carried out from a network of an alternating current with frequency  $(50 \pm 1)$  Hz and voltage  $(220_{-44}^{+33})$  V.

2.2.24.1. The output characteristics of the built-in source of a voltage of a direct current:

- the rated voltage is  $(24 \pm 0,48)$  or  $(36 \pm 0,72)$  V;
- the maximal current of loading is 22 mA.

2.2.25. The capacity consumed from a network of an alternating current doesn't exceed 11 V·A at the rated voltage.

2.2.26. The isolation of the electric circuits of powering and the electric circuits of the signal system concerning all other circuits of input-output and "ground" on conditions of tests stands an action of a test voltage practically of a sine wave form by frequency from 45 up to 65 Hz for a minute:

- 1500 V – at the air temperature  $(20 \pm 5)$  °C and the relative humidity from 30 up to 80 %;
- 900 V – at the relative humidity  $(90 \pm 3)$  % and the air temperature  $(25 \pm 3)$  °C.

2.2.26.1. The isolation of the input, output and interface electric circuits stands an action of a test voltage practically of a sine wave form by frequency from 45 up to 65 Hz among themselves depending on a test of specifications:

- 500 V – at the air temperature  $(20 \pm 5)$  °C and the relative humidity from 30 up to 80 %;
- 300 V – at relative humidity  $(90 \pm 3)$  % and temperature of air  $(25 \pm 3)$  °C.

2.2.27. The electric isolation resistance of the current carrying circuits of ИПИМ 0399/M3A is not less:

- 20 mOhm – at the air temperature  $(20 \pm 5)$  °C and the relative humidity from 30 up to 80 %;
- 5 mOhm – at the air temperature  $(50 \pm 3)$  °C and the relative humidity from 30 up to 80 %;
- 1 mOhm – at the relative humidity  $(90 \pm 3)$  % and the air temperature  $(25 \pm 3)$  °C.



2.2.28. The overall dimensions of ИПМ 0399/М3А, mm, are no more:

- Length - 125;
- Width - 70;
- Height - 75.

2.2.29. The weight of ИПМ 0399/М3А, kg, is no more - 0,5.

2.2.30. The requirements to stability and durability at the external influencing factors.

2.2.30.1. ИПМ 0399/М3А is steady against the temperature influence of the environmental air from minus 30 till plus 50 °С.

2.2.30.2. ИПМ 0399/М3А is steady against the humidity influence up to 95 % at the temperature 35 °С.

2.2.30.3. ИПМ 0399/М3А is solid to the air temperature influence from minus 50 till plus 50 °С.

2.2.30.4. ИПМ 0399/М3А is solid to the humidity influence up to 98 % at the temperature 35 °С.

2.2.30.5. ИПМ 0399/М3А is solid to the shock jolting influence with the number of impacts equal to 80 a minute, with an average quadratic speeding value of 98 m/sec<sup>2</sup> and the influence duration equal to 1 hour.

2.2.30.6. ИПМ 0399/М3А is solid and steady against the influence of a sine wave vibration in a range of frequencies from 1 up to 100 Hz at the vibrating acceleration amplitude 20 m/sec<sup>2</sup>.

2.2.30.7. ИПМ 0399/М3А has no constructive elements and units with resonant frequencies from 5 up to 25 Hz.

2.2.30.8. ИПМ 0399/М3А is solid and steady against influencing of any mechanical impacts of the single action having a peak shock acceleration of 20 m/sec<sup>2</sup> with duration of a shock pulse from 2 up to 20 ms. The total of impacts is 30.

2.2.30.9. ИПМ 0399/М3А is solid and steady against influencing of any mechanical impacts of the repeated action having a peak shock acceleration of 30 m/sec<sup>2</sup>, with preferable action duration of shock acceleration 10 ms (the admitted duration is from 2 up to 20 ms. The number of impacts in each direction makes 20.

2.2.30.10. ИПМ 0399/М3А concerns to category I of a seismic stability according to ИП-031-01 and execution group 3 according to ПД 25 818-87. ИПМ 0399/М3А has durability at the seismic influences equivalent to the vibration influence with the parameters, given in table 2.

Table 2

Frequency, Hz	1,0	2,0	3,0	4,0	5,0	6,0	8,0	10,0	15,0	20,0	30,0
Acceleration, m/sec <sup>2</sup>	6,0	15,0	29,0	51,0	48,0	43,0	38,0	31,0	20,0	19,0	14,0

2.2.31. The requirements on providing of the electromagnetic compatibility and the noise-immunity.

2.2.31.1. By stability to electromagnetic disturbances:

- ИИМ 0399/M3A corresponds to the execution group III, the criteria of the functioning quality – A in accordance with State Standards P 50746-2000;
- ИИМ 0399/M3A of 4H category designed for operation at the APP «Busher» corresponds to the execution group III in accordance with State Standards P 50746-2000.

2.2.31.2. ИИМ 0399/M3A normally functions and does not create any handicaps in conditions of teamwork with the equipment of systems and elements for which it is intended, and also with the equipment of other assignment which may be used together with data of ИИМ 0399/M3A in a typical handicap situations.

## ***2.3 Device and its operation***

2.3.1. ИПИМ 0399/M3A structurally consists of six modules:

- a module of power;
- a module of management;
- a module of analog-digital converter (ADC);
- a module of digital-to-analog converter (DAC);
- a module of the interface;
- a module of connections.

2.3.1.1. The power module converts the mains voltage into the two voltage of a direct current: +24 V and +5 V, and also produces a continuous sequence of pulses of the rectangular form (meander) for clocking converters of a voltage of the product modules.

2.3.1.2. The management module provides an interaction of the device units: ADC, DAC and the interface module, carries out the code converting taken from ADC, forms the DAC management code, provides information interchange with a computer network by means of the interface module, operates the block of the LED indication and the block of the relay channels of the signal system, incorporates the push-button keyboard for a manual management of the device: setting values and parameters of a configuration.

2.3.1.3. The ADC module carries out converting of the analog signal being measured into a digital code which then goes to the management module for the further processing. The ADC module contains the built-in source of the voltage +24 or +36 V for the external devices powering.

2.3.1.4. The DAC carries out converting of the digital code of the signal being measured, derived from the management module through the optron galvanic outcome, into the unified current signal. The module has two channels with an independent installation of the ranges of the output current for each channel and a galvanic outcome between the channels.

2.3.1.5. The interface module is intended for connecting with a computer and allows you to use ИПИМ 0399/M3A in the computer network structure together with other devices. The interface module provides the ИПИМ 0399/M3A galvanic outcome from a computer network. The interface module has two executions: RS232 and RS485.

2.3.1.6. The connection module structurally unites all the ИПИМ 0399/M3A modules, incorporates some screw clip connectors for connecting to wire communication lines and the three relays for switching channels of the signal system.

2.3.2. The face ИИМ 0399/M3A panel has:

- a alphanumeric display – a four-digit seven-segment LED indicator;
- three individual LED indicators of the signal system channels;
- a button «↵» – enter;
- a button «>» - forward;
- a button «<» - back;
- an interface socket RS 232 or RS 485.

**Attention!** *The numbering of the interface socket contacts is carried out from the top downward, the first contact is a top one.*

2.3.2.1. The alphanumeric display is intended for displaying of the numerical values of the current parameter being measured, the numerical and symbolical values of the programmed setting parameters and a hysteresis, and also any symbolical messages about the ИИМ 0399/M3A condition (error messages).

2.3.2.2. The LED indicators display a condition of the relay of the switched channels of the signal system. The luminous indicators inform on the switch on condition of the relay, i.e. a condition «is closed», of the appropriate channel.

2.3.2.3. The button «↵» is intended for entering a setting mode and a hysteresis, and also entering (recording) of the updated parameter values in the ИИМ 0399/M3A memory. After entering the setting mode of the chosen parameter, the current numerical value of the given parameter starts to blink, and after entering (recording) of the last one, the blinking fades away.

2.3.2.4. The button «>» is intended for sorting numbers of settings and a hysteresis to the rise side, changing of the values of the parameters to the increase side.

2.3.2.5. The button «<» is intended for sorting numbers of settings and hysteresis to the diminution side, changing of the values of the parameters to the decrease side.

2.3.3. Changing (viewing) of settings and a hysteresis from the push-button keyboard.

2.3.3.1. Press the button «↵». If the password was established for entering of settings, then the message «UPAS» will appear on the ИИМ 0399/M3A display – an inquiry about the password entering. Press any button, blinking zero will appear. Set a numerical value of the password with the aid of buttons «>», «<» and press the button «↵». The parameter «Ust1» will appear. If the password was not earlier set, the message «Ust1» will appear on the display by the first pressing the button «↵».

2.3.3.2. Using the buttons «>», «<», make a choice of the required parameter. The parameter choice occurs cyclically forward with the aid of the button «↵»: «Ust1» → «Gst1» → «Ust2» → «Gst2» → «Ust3» → «Gst3» → «rEtU» → «Ust1», and with the aid of the button «<» - cyclically back: «Ust1» → «rEtU» → «Gst3» → «Ust3» → «Gst2» → «Ust2» → «Gst1» → «Ust1». Here «Ust1», «Ust2», «Ust3» are the parameters of the settings; «Gst1», «Gst2», «Gst3» - parameters of the hysteresis; «rEtU» is the return command into the mode of measurements.

2.3.3.3. Having chosen the required parameter for viewing or changing, press the button «↵». The blinking numerical value of the parameter set earlier will appear. After viewing the parameter value, press the button «↵», thus rewriting of the value in the ИПИМ 0399/M3A non-volatile memory is not made. Use the buttons: «>», «<» and then press the button «↵» for changing of the parameter value thus rewriting of the value in the ИПИМ 0399/M3A non-volatile memory is made.

2.3.3.4. If the password is entered incorrectly, then the system will allow you to enter the change mode of values all the same, but in reply to an attempt to record the changed value of the setting or the hysteresis, the following message will appear on the ИПИМ 0399/M3A display «AcдE» - access is forbidden. The old parameter value will be kept.

2.3.3.5. Using the buttons: «>», «<» choose the command «rEtU» on finishing of entering (changing) of the values of the settings and the hysteresis. The device will return in the mode of measurements.

#### 2.3.4. The set of the parameters of the configuration

2.3.4.1. The parameters of the ИПИМ 0399/M3A configuration are given in table 3.

Table 3 – The parameters of the ИПМ 0399/M3A configuration

Parameter name	Factory setting	Parameter symbol
1	2	3
The network address	1	0...250
The exchange speed	9600	300, 600, 1200, 2400, 4800, 9600 и 19200 bit/sec
Type of the initial converter	Cu50 (1,428)	According to table 4
The control of an input circuit break	[x]	Switched on[x] / switched off[ ]
The connection circuit of the RT	A 3 wire	A 2, 3 and 4 wire
The range minimum of the unified signal converting	0	-1999...9999
The range maximal of the unified signal converting	20	-1999...9999
The number of measurements for averaging an input signal	3	1...10
The number of measurements for the majority relay operation	2	1...8
The extraction function of a square root for the unified signal	switched off	switched on / switched off
The linearization function of a square root near to zero	switched off	0,5%; 1%; 2%; 3% and switched off
The current range of the 1 <sup>st</sup> channel	4...20 mA	0...5 mA; 4...20 mA; 0...20 mA and switched off
The current value of an error for the 1 <sup>st</sup> channel in percentages from I <sub>max</sub> (the maximal current range)	105	0...110 %
The range minimal of converting of the 1 <sup>st</sup> channel	-50	-1999...9999
The range maximal of converting of the 1 <sup>st</sup> channel	200	-1999...9999
The current range of the 2 <sup>nd</sup> channel	4...20 mA	0...5 mA; 4...20 mA; 0...20 mA and switched off
The current value of an error for the 2 <sup>st</sup> channel in percentages from I <sub>max</sub> (the maximal current range)	105	0...110 %
The range minimal of converting of the 2 <sup>st</sup> channel	-50	-1999...9999
The range maximal of converting of the 2 <sup>st</sup> channel	200	-1999...9999
The number of categories after a comma	3	0, 1, 2 or 3
The password for changing of settings	0	-1999...9999
Setting 1	15	-1999...9999
Setting 2	15	-1999...9999
Setting 3	85	-1999...9999
Hysteresis on the 1 <sup>st</sup> setting	0	0...9999
Hysteresis on the 2 <sup>nd</sup> setting	0	0...9999
Hysteresis on the 3 <sup>rd</sup> setting	0	0...9999
Relay connection 1 with the 1 <sup>st</sup> setting	2	0, 1 or 2
Relay connection 1 with the 2 <sup>nd</sup> setting	0	
Relay connection 1 with the 3 <sup>rd</sup> setting	0	
Relay condition 1 at the gauge break	0	0 or 1
Relay connection 2 with the 1 <sup>st</sup> setting	0	0, 1 or 2
Relay connection 2 with the 2 <sup>nd</sup> setting	2	
Relay connection 2 with the 3 <sup>rd</sup> setting	0	
Relay condition 2 at the gauge break	0	0 or 1
Relay connection 3 with the 1 <sup>st</sup> setting	0	0, 1 or 2
Relay connection 3 with the 2 <sup>nd</sup> setting	0	
Relay connection 3 with the 3 <sup>rd</sup> setting	1	
Relay condition 3 at the gauge break	0	0 or 1
RL – the communication line resistance with the RT	0	0...9999
RC0 – the equalizer resistance	any	0...9999
Correction of zero	0	-1999...9999

2.3.4.2. The device network address is an integer value of the address through which ИПИМ 0399/M3A is identified in the computer network; it may accept values from 0 up to 250.

2.3.4.3. The exchange speed on the computer interface is got out of the list of the values: 300, 600, 1200, 2400, 4800, 9600 and 19200 bits per second. It is necessary to use high speeds of an exchange for reduction of time for procedures of reading / record of the values of the configuration parameters.

2.3.4.4. The initial converter type is chosen from the list - the opening menu which appears by double pressing a range of the parameter values by the index of the mouse. The types of initial converters and input signals of ИПИМ 0399/M3A are given in table 4.

Table 4

Symbol HCX of the initial converter	$W_{100}$	Designation such as the initial converter or an input signal	Range of electric signals of HCX	Range of measurements	Parameters of the ИПИМ 0399/M3A input circuits		
50M	1,428	Cu50(1,428)	(39,23...92,78) Ohm	-50...+200 °C	The maximal current through the RT is no more 0,35 mA		
53M		Cu53(1,428)	(41,58...98,34) Ohm				
100M		Cu100(1,428)	(78,45...185,55) Ohm				
50M	1,426	Cu50(1,426)	(39,35...92,62) Ohm				
53M		Cu53(1,426)	(41,71...98,17) Ohm				
100M		Cu100(1,426)	(78,69...185,23) Ohm				
50Π	1,391	50Π 200(1,391)	(40,00...88,53) Ohm			-50...+600 °C	
100Π		100Π 200(1,391)	(80,00...177,05) Ohm				
Pt100	1,385	Pt100 200(1,385)	(80,31...175,89) Ohm				
50Π	1,391	50Π(1,391)	(40,00...158,56) Ohm				
100Π		100Π(1,391)	(80,00...317,17) Ohm				
Pt100	1,385	Pt100(1,385)	(80,31...313,71) Ohm				
TXK(L)	-	TXK(L)	(-3,005...49,108) mV	-50...+600 °C	RBX is not less 100 kOhm		
ТЖК(J)	-	ТЖК(J)	(-2,431...63,792) mV	-50...+1100 °C			
TXA(K)	-	TXA(K)	(-1,889...52,410) mV	-50...+1300 °C			
ТПΠ(S)	-	ТПΠ(S)	(0...17,947) mV	0...+1700 °C			
ТПΠ(R)	-	ТПΠ(R)	(0...20,222) mV	+300...+1800 °C			
ТПΠ(B)	-	ТПΠ(B)	(0,431...13,591) mV	0...+2500 °C			
TBP(A-1)	-	TBP(A-1)	(0...33,640) mV				
With the unified output signal	-	U 0...75mV	(0...75) mV	0...75 mV	RBX is no more 10 Ohm		
	-	U 0...100mV	(0...100) mV	0...100 mV			
	-	I 0...5mA	(0...5) mA	0...5 mA			
	-	I 4...20mA	(4...20) mA	4...20 mA			
	-	I 0...20mA	(0...20) mA	0...20 mA			

2.3.4.5. The control function of an input circuit break is switched on, when the mark «√» is set in the filed of the parameter value. The installation / removal of the mark is carried out by double pressing a field of the parameter value by the index of the mouse. The message «Cut» appears on the ИПИМ 0399/M3A display at the switched on control of the input circuit break, and in input circuits, the values of currents are set, described in item 2.3.4.12.

2.3.4.6. ИИИМ 0399/М3А, accepts a 2, 3 or 4 wire connection circuit of the RT, a choice of the connection circuit is executed by double pressing the button of the mouse in a field of the choice of the given parameter.

The choice of the 2 wire connection circuit demands the account of the RT cable resistance, which is carried out according to item 2.3.6. of the current manual.

The choice of the 4 wire connection circuit may demand a correction of zero of the converting characteristic, which is carried out according to item 2.3.8.

**Attention!** While choosing of a 2 or 3 wire connection circuit of the RT, it isn't supposed to use the built-in voltage source.

2.3.4.7. The minimum (dP<sub>Lo</sub>) and maximum (dP<sub>Hi</sub>) of the converting range of the unified signal are any numerical values out of the range minus 1999...9999, for which the minimal and maximal values of the unified signal being measured (see the range of measurements specified in table 4) are put in conformity.

**Example:** Let the input current is set «I 4...20 mA», dP<sub>Lo</sub> is equal to minus 100, dP<sub>Hi</sub> is equal to 100. Then indications on the ИИИМ 0399/М3А display will be how are shown in table 5 depending on a value of an input current.

Table 5

I <sub>BX</sub> ⇒	4 mA	8 mA	12 mA	16 mA	20 mA
Indications ⇒	-100	-50	0	50	100

2.3.4.8. The number of measurements for averaging of the input signal (nS) is a parameter, allowing to lower noise of the signal being measured. While installing of this parameter, it is necessary to take into account, that a time of installing of the size being measured with an accuracy 0, 5 % will be equal 2,9 x nS x 0,8 seconds at the step changing of the input signal on 10 %; with an accuracy 0,25 % will be equal 3,5 x nS x 0,8 seconds, where 0,8 seconds is a time of one cycle of measurements. Besides, while switching on of the ИИИМ 0399/М3А power or after elimination of the input circuits' break, the process of measurements and managements of the relay will begin after nS x 0, 8 seconds.

The range of the set values is from 1 up to 10.

2.3.4.9. The extraction function of a square root for the unified signal may be both switched on, and switched off. The choice of conditions is made by double pressing a range of the parameter values by the index of the mouse. If the function is switched off, then the dependence of the size being measured on the input signal is linear, and the indicating value, while measuring of current or voltage, is calculated under the formula



$$Value = \frac{(dPH_i - dPL_o) \cdot (I - I_{min})}{(I_{max} - I_{min})} + dPL_o,$$

where Value – is a value, being indicated on the indicator;

$I$  – the measured current or voltage value;

$I_{min}, I_{max}$  – are the limits of the current or voltage measuring;

$dPL_o, dPH_i$  – are the range limits of converting (see item 2.3.4.7).

If the function is switched on, so the dependence of the size being measured on the input signal – with a function of the square root extraction, and the indicating value, while measuring of current or voltage, is calculated under the formula

$$Value = \frac{(dPH_i - dPL_o) \cdot (I - I_{min})}{(I_{max} - I_{min})^{1/2}} + dPL_o.$$

2.3.4.10. The linearization function of a square root near to zero. It is used for reduction of noise outside of a range of measurements. The parameter value is expressed in percentages from a range of an input signal from the line: 0,5; 1,0; 2,0 and 3,0 %. The function will be linear in the range of the input signal from 0 up to the chosen value. If the given function is switched off, then the extraction function of a square root is switched on in the all range of the input signals. The choice of the parameter values of the linearization function is made by double pressing of the index of the mouse a field of values of the given parameter.

2.3.4.11. The current range of the ИИМ 0399/M3A input channels has three values: 0...5 mA, 4...20 mA, 0...20 mA. Any channel can be switched off if it is necessary. The choice of a range of each channel or its switching-off is made by double pressing of the index of the mouse a field of values of the given parameter.

There are values of the input signals and loading characteristics of ИИМ 0399/M3A given in table 6.

Table 6

The current ranges of input channels	The installation range of an error signal (failure)	The maximal value of loading resistance
0...5 mA	0...5,5 mA	2 kOhm
4...20 mA	3,5...22 mA	0,5 kOhm
0...20 mA	0...22 mA	0,5 kOhm

2.3.4.12. The current of the channel error is a current which is set on an output at the input circuit break of the initial converter. The current value of an error is set in integer interests from the current maximum of the set range for each channel (i.e. in % from 5 mA or 20 mA). The set current value of an error is made for each channel by entering a number of the range from 0 up to

110 in a field of values of the given parameter. The factory installation corresponds to the currents of the error equal of 105 % from  $I_{max}$ , i.e. 5, 25 mA, or 21 mA, depending on the chosen output channel in item 2.3.4.11.

*Note: if the output channel is adjusted on the range 4...20 mA, then the set of any parameter value of the error current less than 18 % (i.e. less than 3,6 mA) will cause setting of the error current equal 3,5mA.*

2.3.4.13. The converting range minimum of the output channel ( $I_{oLo}$ ) is a value of the size being measured, to which the minimum of the range current (0 or 4 mA) the output channel is put in conformity. The setting of the parameter value  $I_{oLo}$  is made by entering a number from the range of the measurements for each channel of the set initial converter (see table 4) in a field of values of the given parameter.

2.3.4.14. The converting range maximum of the channel is a value of the size being measured, to which the minimum of the range current (5 or 20 mA) the output channel is put in conformity. The setting of the parameter value  $I_{oHi}$  is made by entering a number from the range of the measurements for each channel of the set initial converter (see table 4) in a field of values of the given parameter.

2.3.4.15. The number of categories after a point, one can set from the lines of the values 0, 1, 2 and 3 by direct entering a field of values of the given parameter an integer. The measuring and indicating the parameter value on the display can be set as a number with a floating decimal point which is automatically displaced to the right at increasing of a value of the parameter being measured because of the limited word length of the ИПИМ 0399/M3A display.

2.3.4.16. The password for changing of settings is any integer, except for zero, from the range minus 1999...9999, entered the given parameter on the value field. Entering of a zero value of the given parameter means removing of the password for an opportunity of changing of settings and a hysteresis from the ИПИМ 0399/M3A push-button keyboard (see item 2.3.3).

2.3.4.17. The setting ( $U_{sti}$  where  $i = 1, 2, 3$ ) is any value taken from the range of the measurements of the RT and the TC (see table 4), or from the converting range of the unified signal of the set initial converter (see item 2.3.4.7). Entering a value setting is made by recording of a number on a field of the values of the given parameter, or with the aid of the push-button keyboard as it is described above in item 2.3.3.

ИПИМ 0399/M3A has three independent comparators of the settings, which can be adjusted for operating with the executive relays of the three channels of the signal system.

2.3.4.18. The hysteresis of the setting ( $G_{sti}$  where  $i=1,2,3$ ) is a delay value of the setting comparator operation, expressed in terms of the size being measured. This parameter has always positive value (or zero), and entering of the last one is made by recording of a number in the value field of the given parameter, or with the aid of the push-button keyboard as it is described above in item 2.3.3. The operation delay is symmetric concerning a setting value, i.e. the comparators of the settings are switched on, when  $A \geq U_{sti} + G_{sti}$ , and switched off, when  $A \leq U_{sti} - G_{sti}$ ,  $A$  – a size being measured.

2.3.4.19. The relay connection with the settings is a parameter determining a condition of the relay (switched on/switched off) on a condition of the comparators of the settings (switched on/ switched off). The parameter can accept values: 0, 1 and 2. In table 7 the interrelation of the values of the given parameters with the relay conditions and the setting comparators is shown. A value entering is made by recording a number on a field of the values of the given parameter.

Table 7

Parameter value of the relay connection with the relay with settings	Comparator condition of the settings	Relay condition
0	any	No changes
1	on	off
	off	on
2	on	on
	off	off

2.3.4.20. The relay condition at the gauge break is a parameter which can have two values: 0 or 1. If there is 0 - the relay is switched off at the gauge break, if there is 1, that is on the contrary, it is switched on. A value entering is made by recording a number on a field of the values of the given parameter.

2.3.4.21. RL is a resistance value (in Ohms) of a two-wire communication line of ИПМ 0399/М3А with a thermo-converting resistance. This parameter is defined as a result of the calibration procedure of the two-wire communication line with the aid of the program «Настройка приборов серии ИПМ 0399/М3А» / «Adjustment of the devices of the ИПМ 0399/М3А series» (the description of the calibration procedure is shown below in item 2.3.6).

2.3.4.22. RC0 – is a resistance value (in Ohms) of the thermo- equaliser at 0 °C, used while operating with the RT. This parameter is defined as a result of the calibration procedure of the equaliser with the thermocouple which is taking place in the environment with the temperature 0 °C, by means of the program «Настройка приборов серии ИПМ 0399/М3А» / «Adjustment of the devices of the ИПМ 0399/М3А series» (the description of the calibration procedure is shown below in item 2.3.7).

2.3.4.23. Correcting of zero is a value of the zero displacement of the characteristic of converting, taken with a character, which is opposite to the initial displacement for indemnification of an error of converting. The adjusting number is entered in terms of the size being measured on a field of the values of the given parameter.

2.3.4.24. The number of measurements for majority operation of the relay ( $n_{Sr}$ ) is a parameter protecting from any false operation of the relay in conditions of handicaps.

It can accept values from 1 up to 8.

While installing of this parameter, it is necessary to take into account increasing of time of the reaction of the setting operation which in conditions of handicaps absence will be equal  $(n_{Sr}-1) \times 0,8$  seconds.

2.3.5. The procedure of reading and recording of the values of the parameters of the configuration

2.3.5.1. Connect ИПМ 0399/М3А to a computer COM-port with the aid of the interface cable. Switch on the device and the computer.

2.3.5.2. Launch the program «Настройка приборов серии ИПМ 0399/М3А» / «Adjustment of the devices of the ИПМ 0399/М3А series». Open the project (the new or saved the earlier old one). The bookmark of «Настройка» («Advancements») will appear with the parameter list of the configuration described above in item 2.3.4.

2.3.5.3. Press the button «Настройка связи» («Connection adjustments») and enter the COM-port number, the exchange speed and the device address. By default ИПМ 0399/М3А is adjusted for speeding equal to 9600 bits per second with address 1.

2.3.5.4. Check up the computer connection with ИПМ 0399/М3А, having pressed the button «Проверка связи» («Connection check») and close the window of the adjustments, having pressed the button «ОК».

2.3.5.5. Read the configuration parameters of ИПМ 0399/М3А, having pressed the button «Чтение» («Reading»).

2.3.5.6. Set the required parameters of the configuration as it is described in item 2.3.4, and press the button «Запись» («Record») for saving of the parameters in the ИПМ 0399/М3А memory.

2.3.6. The calibration procedure of a two-wire line while operating with the RT.

2.3.6.1. Connect the RT to ИПМ 0399/М3А under the two-wire circuit according to picture A.1 of the appendix A.

2.3.6.2. Execute items 2.3.5.1, ... 2.3.5.5.

2.3.6.3. Warm up ИПМ 0399/М3А after switching on within not less than 30 minutes.

2.3.6.4. Set the required type of the RT in the list of the configuration parameters, the connection circuit of the gauge – the two-wire.

2.3.6.5. Put down the changed configuration parameters in ИПМ 0399/М3А, having pressed the button "Запись" («Record»).

2.3.6.6. Close the RT contacts.

2.3.6.7. Press the button «Калибровка» («Calibration»). In the opened window «Калибровка» («Calibration») press the button «Калибровать сопротивление линии (rL)» («To calibrate the line resistance»). The messages «CLbr» - «done» - «nrdY» - «0.000» will consistently appear on the ИПМ 0399/М3А display.

2.3.6.8. After finishing of the calibration, close the window, having pressed button «Закреть» («Close»).

2.3.6.9. Read the parameters from ИПМ 0399/М3А, the resistance of the two-wire communication line will be recorded in a field of the values of the parameter RL.

2.3.6.10. Set the necessary values in the list of the other configuration parameters, and make a record of the last ones in ИПМ 0399/М3А.

2.3.6.11. Open the RT contacts. The device is ready to operate.

2.3.7. The calibration procedure of the equaliser resistance while working with the TC

2.3.7.1. Connect the TC to ИПМ 0399/М3А and the equaliser according to picture A 1 of the appendix A.

2.3.7.2. Submerge the TC in an icy water mix.

2.3.7.3. Execute items 2.3.5.1, ...2.3.5.5.

2.3.7.4. Warm up ИПМ 0399/М3А after switching on within not less than 30 minutes.

2.3.7.5. Set the gauge type in the list of the configuration parameters appropriate to the TC connected.

2.3.7.6. Put down the changed configuration parameters in ИПМ 0399/М3А.

2.3.7.7. Wait for the thermal balance where the temperature indications should not exceed 0,3 °C/min.

2.3.7.8. Press the button «Калибровка» («Calibration») in the program. In the opened window «Калибровка» press the button «Калибровать сопротивление компенсатора (rC)» («To calibrate the equalizer resistance (rC)»). The messages «CLbr» - «done» - «nrdY» - «0.0» will consistently appear on the ИПМ 0399/М3А display.

2.3.7.9. On finishing of the calibration close the window, having pressed button «Закрывать» («Close»).

2.3.7.10. Read parameters from the device, the equaliser resistance will be put down in the field of the RC0 parameter values at the temperature of the operating sea  $T_{П}=0$  °C.

2.3.7.11. Set the values of the other parameters in the list of the configuration parameters, if it is necessary and make recording of the last ones in ИПМ 0399/М3А.

2.3.7.12. Take the TC out of the icy water mix. The device is ready to operate.

2.3.8. The procedure of the zero correction of the characteristic of converting.

2.3.8.1. To correct the zero in the configuration with the RT, connect a store of resistances and set the following values on it:

- 50 Ohm for converters such as 50M, 50П;
- 53 Ohm for converters such as 53M;
- 100 Ohm for converters such as 100M, 100П, Pt100.

2.3.8.1.1. Set the type of the chosen RT and the connection circuit of the resistance gauge: 2, 3, 4 or wire in the ИПМ 0399/М3А configuration parameters, following the guidelines of items 2.3.4 and 2.3.5 of the current manual.

2.3.8.1.2. Read the indication from the digital ИПМ 0399/М3А indicator.

2.3.8.1.3. Enter «Коррекция нуля» («Zero Correction») the read out indication taken with the opposite character in the field of the parameter values.

2.3.8.1.4. Carry out recording of the changed values of the ИПМ 0399/М3А configuration parameters as it is specified in item 2.3.5.

2.3.8.2. Connect the chosen thermocouple and the equaliser to the ИПМ 0399/М3А input for the zero correction in the configuration with the TC

2.3.8.2.1. Submerge the TC in an icy water mix.

2.3.8.2.2. Set the type of the chosen thermocouple in the ИПМ 0399/М3А configuration parameters according to the guidelines in items 2.3.4 and 2.3.5.

2.3.8.2.3. Wait for the thermal balance where the temperature indications should not exceed 0,3 °C/min.

2.3.8.2.4. Execute the operations of items 2.3.8.1.2...2.3.8.1.4.

2.3.8.3. Connect the sources of the calibrated currents or voltages to the ИПМ 0399/М3А input for correcting of zero in the configuration with the unified input signals.

2.3.8.3.1. Set the type of the chose unified input signal in the ИПМ 0399/М3А configuration parameters, following the guidelines of items 2.3.4 and 2.3.5 of this manual.

2.3.8.3.2. Set the zero value of the input signal for the gauges: 0...75, 0...100 mV, 0...5 and 0...20 mA.

2.3.8.3.3. Execute items 2.3.8.1.2...2.3.8.1.4.

2.3.8.3.4. Set the value of the input signal equal 4 mA for the gauge 4...20 mA

2.3.8.3.5. Read the indication from the digital ИПМ 0399/М3А indicator.

2.3.8.3.6. Enter the difference between the set input signal and the read out indication with the got character in the field of the parameter values «Коррекция нуля» («Zero Correction»).

2.3.8.3.7. Carry out recording of the changed values of the ИПМ 0399/М3А configuration parameters as it is specified in item 2.3.5.

## **2.4 Error messages**

2.4.1. «AcdE» - there is no access on changing of the values of the settings and the hysteresis. This message is caused by entering the wrong password. Enter the correct password. If the password is unknown, it can be read from ИПМ 0399/М3А with the aid of the computer program «Настройка приборов серии ИПМ 0399/М3А» «Adjustment of the devices of the ИПМ 0399/М3А series».

2.4.2. «Cut» - an input circuit break. This message appears at the RT and TC break with the ИПМ 0399/М3А inputs.

2.4.3. «nrdY» – ADC data are not ready. This message appears always at switching on of ИПМ 0399/М3А. The message appears during time, which is proportional to the number of the value averaging of the signal being measured (from units up to tens seconds), then disappears.

2.4.4. «brdr» - the output of the parameter being measured beyond the boundary lines of the range. The message appears in the following cases:

a) at the output of the signal being measured from the TC and the RT beyond the boundary lines of the range of the measurements;

b) at the output of the signal being measured as a direct current beyond the boundary lines of the ranges:

- 0,2 mA...6 mA - for the gauge «I 0...5mA»;
- 0,2mA...22 mA - for the gauge «I 0...20mA»;
- 2,5mA....22 mA - for the gauge «I 4...20mA».

After returning of a signal to the range of the measurements, the message is kept on the indicator for several seconds.

## ***2.5 Operation features***

2.5.1. Installing (changing) of setting values, a hysteresis and a password is made by the buttons «<>» and «>>» in the two modes: step-by-step and scanning.

2.5.2. The step-by-step mode is a mode where unitary pressing and releasing the button is carrying out measuring of the parameter value of the one unit of the minor category meaning (the m.c.m).

2.5.3. The scanning mode is a mode when changing of the parameter value is made by deduction of the button in the pressed position. Changing of the parameter value is carried out digit-by-digit, beginning from the minor category and finishing to the major one. Going to higher category occurs automatically on the tenth step of the scanning of the units of the current category.

Scanning stops in the following cases:

- while releasing the button;
- at the reach of the top (9999) or the bottom (-1999) of the limiting values of the numerical range;
- at moving to a decimal point to another character-place.

The beginning or renewal of scanning begins with the most minor category.

2.5.4. The button «↵» is used for recording of the set value of the parameter.

2.5.5. ИПИМ 0399/М3А holds changed and recorded the values of the parameter in the non-volatile memory at the loss of the power voltage while programming.

## ***2.6 Marks and sealing***

2.6.1. The marks correspond to the all-Union State Standard 26828-86 E, the all-Union State Standard 9181-74 E, the all-Union State Standard P 51330.10-99 and to the drawing НКГЖ.411531.001-05СБ includes the inscriptions given in pictures A.2 of the appendix A.

2.6.2. ИПИМ 0399/М3Аs are sealed up with the representative of the Quality Department of the enterprise - manufacturer.

## ***2.7. Packing***

2.7.1. Packing is made according to the all-Union Standard 23170-78 E, GOST 9181-74 E and provides with the drawing НКГЖ.411531.001-05УЧ and the full ИПИМ 0399/М3А retentivity.



### 3. USE OF THE PRODUCT APPLICATION

#### 3.1. Product preparation for use

##### 3.1.1. Guidelines of security measures.

3.1.1.1. ИПИМ 0399/М3А in accordance with ИП -001-97 (ОПБ – 88/97) belongs to safety grades 2, 3:

- as to its purpose - to the elements of normal operation;
- as to its influence on safety – to the elements important for safety;
- as to the nature of functions performed – to the controlling elements.

An example of classification designations 2 НУ or 3НУ.

3.1.1.2. ИПИМ 0399/М3А corresponds to class I in accordance with the all-Union State Standard 12.2.007.0-75 and corresponds to the safety requirements according to the all-Union State Standard P 51350-99 on the way of protection of a person against beating of the electrical current

3.1.1.3. One connects the initial converters, output circuits, circuits of the signal system and powering according to the marks at the switched-off power voltage.

3.1.1.4. ИПИМ 0399/М3А is fireproof, the probability of fire appearing in ИПИМ 0399/М3А does not exceed  $10^{-6}$  per one year according to the all-Union State Standard 12.1.004-85, i.e. at any malfunctions appearing both in ИПИМ 0399/М3А, and in the external electric circuits connected to it, it is not a source of ignition.

3.1.1.5. While operating of ИПИМ 0399/М3А, it is necessary to follow the requirements of ИП-001-97 (ОПБ-88/97), ПНАЭ Г-1 - 024 - 90 (ПБЯ РУ АС - 89), the all-Union State Standard 12.3.019-80, "The guidelines of the technical operation of the electrical settings of consumers" and "The guidelines of the safety precautions while operating of the electrical settings of consumers ", "The guidelines of the device electro installations".

##### 3.1.2. Examination

3.1.2.1. While the ИПИМ 0399/М3А examination, one is setting any mechanical damages absences, the correctness of the marks, check the completeness.

If there are any defects of the coverings influencing the serviceability of ИПИМ 0399/М3А, discrepancy of the completeness, the marks, one determines a chance of the further application.

3.1.2.2. One checks the presents of the data card with a mark of the Quality Department in each ИПИМ 0399/М3А.

### *3.1.3. Assembly of the devices*

3.1.3.1. ИПИМ 0399/М3А is mounted on the metal stick DIN 35 mm and fixed with the aid of a latch.

3.1.3.2. Connections of ИПИМ 0399/М3А are carried out according to the connection circuit of the given in picture A.1 of the appendix A.

### *3.1.4. Checking*

3.1.4.1. Connect a store of resistances to the input of ИПИМ 0399/М3А for checking of zeros in the configuration with the RT.

3.1.4.2. Set the following parameter values in the configuration parameters of ИПИМ 0399/М3А, following the instructions of item 2.3.4 of this manual:

- the type of the chosen RT,
- the connection circuit of the RT = 3 wire;
- the current range of both channels = 4...20 mA;
- the range minimum of converting of channels = 0;
- the range maximum of converting of channels = 200;
- zero correction = 0.

3.1.4.3. Set the following values in a store of resistances:

- 50 Ohm for the RT such as 50M, 50П;
- 53 Ohm for the RT such as 53M;
- 100 Ohm - for the RT such as 100M, 100П, Pt100.

3.1.4.4. Check the current values at the inputs of ИПИМ 0399/М3А by a milli-ammeter which are to be equal 4 mA.

3.1.4.5. Connect the chosen thermocouple and also the equalizer (from the complete set ) to the input of the device for checking of the ИПИМ 0399/М3А zeros in a configuration with the TC.

3.1.4.6. Change the type of the type of the chosen initial converter so that it would correspond to the connected TC in the parameters of the ИПИМ 0399/М3А configuration.

3.1.4.7. Calibrate up the ИПИМ 0399/М3А according to item 2.3.7.

3.1.4.8. Check the current values of ИПИМ 0399/М3А at its inputs which are to be equal 4 mA.

3.1.4.9. Connect the sources of the calibrated currents or voltage accordingly to the device input for the ИПИМ 0399/М3А configurations with the input electric signals as force or voltage of a direct current.

3.1.4.10. Change the type of the chosen gauge in the parameters of the ИПМ 0399/M3A configuration so that it would correspond to the unified signal being measured, set the values of the minimum and the maximum of the range of the unified signal converting, and also the values of the minimum and the maximum of the range of the channels converting equal to the extreme values of the range of the measurements.

3.1.4.11. Set the values of the input unified signals, equal to the top limits of the size being measured.

3.1.4.12. Check the values of the currents at the inputs of ИПМ 0399/M3A which are to be equaled 20 mA.

### ***3.2. Using of the product***

3.2.1. Carry out the necessary ИПМ 0399/M3A connections according to picture A.1 of the appendix A.

***Attention!*** *Grounding of ИПМ 0399/M3A (through plug 14) increases a degree of the noise stability through the power circuits.*

3.2.2. Make installing and recording of the parameters of the ИПМ 0399/M3A configuration, being guided by item 2.3.4.

3.2.3. While using a two-wire circuit of connecting in the RT configuration, carry out the calibration of the ИПМ 0399/M3A communication line with the converter, referring to item 2.3.6.

3.2.4. While using ИПМ 0399/M3A in the RT configuration, carry out the calibration of the equalizer resistance included in the complete set with the aid of item 2.3.7.

3.2.5. Make the all connections of ИПМ 0399/M3A with cable communication lines at the switched - off voltage of the network power.

3.2.6. Use twisted pairs and apply shielding communication lines for a lining of the removed communication lines with initial converters with the purpose of increasing of the ИПМ 0399/M3A noise stability.

3.2.7. The input and interface terminal-block shoes are demountable, therefore pay special attention to the density of the connection of the demountable contact groups. Cover the demountable terminal-block shoes with the protective casings which are included in the complete set.

## 4. CHECKING TECHNIQUE

4.1. Checking of ИПИМ 0399/M3A is carried out by the bodies of the State metrological service or the metrological service of the consumer having the right of checking. The requirements to checking, the order, the basic stages of the checking realization are determined by ИП 50.2.006-94 "ГСИ. Checking of the means of the measurements. The organization and the realization order" and by the recommendation "Checking technique".

4.2. The Interesting interval makes two years.

4.3. The operations and the checking means

4.3.1. One carries out the operations specified in table 8 while checking.

Table 8

№ item	Checking operation	Number Of item	Compulsion of the operation realization	
			first	cyclic checking
1	Examination	item 4.6.1	Yes	Yes
2	Checking	item 4.6.2	Yes	Yes
3	Checking of the isolation electric durability	item 4.6.3	Yes	No
4	Checking of the isolation electric resistance	item 4.6.4	Yes	No
5	Defining the values of the basic ИПИМ 0399/M3A errors *	items 4.6.5.1-4.6.5.5	Yes	Yes
6	Defining of the output characteristics of the built-in voltage source	item 4.6.5.6.	Yes	Yes
7	Checking of the control of an input circuit break	item 4.6.5.7	Yes	Yes

\* It is acceptable to conduct the define of the basic error for the concrete ИПИМ 0399/M3A configuration.

4.3.2. One applies the basic and auxiliary means at the realization of the ИПИМ 0399/M3A checking specified in table 9.

Table 9

The name of the checking means and the number of reference document (the NRD)	The basic metrological and characteristics of the checking means
The reference calibrator – the measuring instrument of the unified signals ИКСУ-2000 TY 4381-031-13282997-00	The reproduction range of the resistance is 0...180 Ohm, 180...300 Ohm. The basic error is $\pm 0,015$ Ohm, $\pm 0,025$ Ohm. The reproduction range of the RT temperature is minus 200...550 °C. The basic error is $\pm 0,05$ °C. The reproduction range of the TC temperature is: minus 210...1300 °C. The basic error is. $\pm 0,3$ °C. The reproduction range of the voltage is minus 10...60 mV, 0...12 V. The basic error is $\pm 0,005$ mV, 3 мВ The reproduction range of the current is 0...25 mA. The basic error is $\pm 0,003$ mA.
The technological measuring regulator (the universal millivoltmeter) ИРТ 5920М TY 4210-019-13282997-00	The range of the measurements is 0...20 mA. The basic error is $\pm 0,05$ %.
Resistors MJIT	MJIT-1-1kOhm $\pm 5\%$ , MJIT-1-1,2 kOhm $\pm 5\%$ , MJIT-1-1,8 kOhm $\pm 5\%$
Resistor C2-29	C2-29-0,125 ВТ-100 Ом $\pm 0,5$ %
Resistor MJIT	MJIT-0,25-510 Ohm $\pm 5\%$ (2 pieces)
Resistor MJIT	MJIT-0,125-2 kOhm $\pm 5\%$ (2 pieces)
The installation of the screw-ring УПН-1М	Voltage 1500 V
Megaohmmeter Ф4102/1-1М TY 25-7534.005-87	The range of the measurements is 0...20000 MOhm.

*Note. It is acceptable to apply separate, newly developed or taking place in application the checking means and the equipment, under the characteristics which are not making a concession specified in the present technique of checking.*

#### 4.4. Safety requirements

4.4.1. While checking, one carries out the requirements of the safety precautions stated in the documentation on the used means of checking and the equipment.

#### 4.5. Conditions of checking and preparation for it(her)

4.5.1. While realization of checking, one should observe the following conditions:

- the air temperature, °C 20 $\pm$ 5;
- the relative humidity of the air, % 30÷80;
- the atmospheric pressure, kPa (mm of a hg) 84,0÷106,7  
(630 - 800);
- the voltage of power, V 220 $\pm$ 4,4;
- the frequency of a power line, Hz 50 $\pm$ 1,0.

4.5.2. The operations, carrying out with the ways of checking and with ИИМ 0399/М3А being checked, must be carried out according to the guidelines given in the operational documentation.

4.5.3. Before checking one carries out the following spadework:

4.5.3.1. ИПМ 0399/М3А is maintained for 4 hours in the conditions set in item 4.5.1.

4.5.3.2. The ways of checking are prepared for work according to the operational documentation.

4.6. The realization of checking

4.6.1. The examination of ИПМ 0399/М3А being checked, one carries out according to item 3.1.2 of this manual.

4.6.2. Approbation of ИПМ 0399/М3А being checked is included in check of its serviceability according to item 3.1.4 of this manual.

4.6.3. Check of electric resistance of isolation

The check of the electric isolation durability is conducted on the УИУ-1М installation, allowing increasing the voltage smoothly or in regular intervals by steps, which are not exceeding 10 % of the value of the test voltage.

The test voltage is ought to be increased smoothly, beginning from zero or from the value which is not to exceed the rated voltage of the circuit up to test during 5-10 seconds, but no more than 30 seconds. Decreasing of the voltage up to zero is not to be made with the same speed.

The error of the measurement of the test voltage is not to exceed  $\pm 5\%$ .

The values of the test voltage for the various ИПМ 0399/М3А circuits are specified table 10.

Table 10

Test voltage, V	Circuits being checked	Numbers of the contacts in conformity with the picture A 1 of the appendix A, united in groups	
		first	second
1	2	3	4
1500	The power circuit of an alternating current, the electric circuits of the signal system of:	15, 16, 5-13	
	The protective grounding clip		14
	The output current circuits		1-4
	The input circuits and the output circuit of the built-in power source (PS)		17-21, 22
	The interface circuits ("interface")		1-4
	The power circuit of an altering current of: The electric circuits of the signal system	15,16	5-13
500	The protective grounding clip of:	14	
	The output current circuits		1-4
	The input circuits and the output circuit of the PS		17-21, 22
	The interface circuits ("interface")		1-4
	The interface circuits ("interface") of: The input circuits and the output circuit of the PS		
	The output current circuits	1-4	17-21, 22 1-4
	The output current circuits of:	1-4	
	The input circuits and the output circuits of the PS		17-21, 22

The isolation is kept under the action of a test voltage for a minute. Then one decreases the voltage smoothly up to zero or a value, not exceeding the nominal one, after that the test set is disconnect.

There must be no breakdowns and superficial blocking of the isolation while checking.

#### 4.6.4. The check of the electric isolation resistance.

4.6.4.1. The checking of the electric isolation resistance of ИИМ 0399/M3A circuits is carried out with a megaohmmeter  $\Phi$  4102/1-1M or some other device for measurement of the electric resistance with a working voltage which is no more than 500 V and an error which is no more than 20 %.

The readout of indications is carried out after the expiration of 1 minute after the appendix of a voltage between the contacts of a tested circuit connected together and the case (a clip of protective grounding) or the contacts of other circuit connected together according to table 11

Table 11

Test voltage, V	Circuits being checked	Numbers of the contacts in conformity with the picture A 1 of the appendix A, united in groups	
		first	second
1	2	3	4
500	The power circuit of an alternating current, the electric circuits of the signal system of:	15, 16, 5-13	
	The protective grounding clip		14
	The output current circuits		1-4
	The input circuits and the output circuit of the built-in power source (PS)		17-21, 22
	The interface circuits ("interface")		1-4
	The power circuit of an altering current of: The electric circuits of the signal system	15,16	5-13
100	The protective grounding clip of:	14	
	The output current circuits		1-4
	The input circuits and the output circuit of the PS		17-21, 22
	The interface circuits ("interface")		1-4
	The interface circuits ("interface") of: The input circuits and the output circuit of the PS		
	The output current circuits	1-4	17-21, 22 1-4
	The output current circuits of:	1-4	
	The input circuits and the output circuits of the PS		17-21, 22

The isolation resistance must not be less than 20 MOhm.

4.6.5. The definition of the values of the basic ИПИМ 0399/M3A errors, the output characteristics of the built-in source of the voltage and checking of the control of the output circuit break.

4.6.5.1. One carries out the following operations to define the values of the basic errors:

1) to switch on and prepare for work a personal computer, the reference calibrator – the measuring instrument of the unified signals ИКСУ-2000 (further - ИКСУ), two universal millivoltmeter ИРТ 5920М (further - measuring current instruments);



2) to maintain ИКСУ an measuring current instruments in the switched on condition for an hour;

3) to power ИПМ 0399/М3А and keep it in the switched-on condition for not less than 30 min;

4) to connect ИПМ 0399/М3А to the IBM COM-port with the aid of the interface cable;

5) to connect the measuring current instrument to each output ИПМ 0399/М3А channel with a successively connected resistive loading, having two switched values of resistance:

- 500 Ohm of 5 % - for the output unified signal of the range 4...20 mA (0...20 mA);

- 2 kOhm of 5 % - for the out unified signal of the range 0...5 mA;

6) to launch the program «Настройка приборов серии ИПМ 0399/М3А» («Adjustment of the devices of the ИПМ 0399/М3А series») and set the connection of the computer with ИПМ 0399/М3А, following the instructions of item 2.3.5 of this manual.

4.6.5.2. The definition of the values of the basic ИПМ 0399/М3А errors in the RT configuration is carried out in the points being checked specified in table 12, in the following sequence:

Table 12

Input parameters				Limits of an admitted basic absolute error	
Type of the initial converter	Range of converting, °C	Point being checked		On the output signal	On the size being measured
		°C	Ohm		
50П_200	minus 50...200	minus 50	40,00	± 0,6 °C	± (0,5 + *) °C
		156,32	80,31		
50П	minus 50...600	550	150,33	± 1,2 °C	± (1,0 + *) °C
Pt100_200	minus 50...200	minus 50	80,31	± 0,6 °C	± (0,5 + *) °C
		131,32	150,33		
Pt100	minus 50...600	550	297,49	± 1,2 °C	± (1,0 + *) °C

\*– one unit of the last category, °C

1) Set the below listed configuration parameters for ИПМ 0399/М3А, the following instructions of item 2.3.4 of this manual:

- type of the RT = 50П\_200 (1,391);
- the connection circuit of the RT = 3 wire;
- the number of the measurements for averaging = 1;
- the current range of the both channels = 0...5 mA;
- the range minimum of converting = minus 50;
- the range maximum of converting of the channels = 200;
- zero correction = 0;

2) connect the RT to ИПМ 0399/М3А ИКСУ in the mode of the emulation of signals under the 3 wire circuit;

- 3) adjust ИКСУ for the emulation mode of the signals of the RT 50П;
- 4) set the emulated temperature value (valid  $T_{\delta}$ ) with the aid of ИКСУ, equal to minus 50 °C;
- 5) measure the output currents of the both channels of ИПИМ 0399/М3А in the range 0...5 mA at the loading of 2 Ohm;
- 6) calculate the measured value of the temperature under the formula

$$T_{u_{3M}} = \frac{(I_o - I_{\min}) \cdot (T_{\max} - T_{\min})}{(I_{\max} - I_{\min})} + T_{\min} \quad (4.1)$$

where  $I_o$  - the measured value of the output current, mA;

$I_{\min}$  - the minimum of the output current range, mA;

$I_{\max}$  - the maximum of the output current range, mA;

$T_{\max}$  - the range maximum of the input signal converting, °C;

$T_{\min}$  - the range minimum of the input signal converting, °C;

- 7) set a current range of output channel with the aid of the program = 4...20 mA;
- 8) measure the output currents of the both ИПИМ 0399/М3А channels in the range 4...20 mA at loading of 500 Ohm;
- 9) calculate the measured value of the temperature under the formula (4.1);
- 10) set a current range of output channel with the aid of the program = 0...20 mA;
- 11) measure the output currents of the both ИПИМ 0399/М3А channels in the range 0...20 mA at loading of 500 Ohm;
- 12) calculate the measured value of the temperature under the formula (4.1);
- 13) set the current range of the output channels equal to 0...5mA with the aid of the program;
- 14) read out the measured value of the temperature from the digital ИПИМ 0399/М3А indicator;
- 15) define the values of the absolute ИПИМ 0399/М3А errors under the formula

$$\Delta T = T_{u_{3M}} - T_{\delta}, \quad (4.2)$$

where  $T_{u_{3M}}$  - the measured value of the temperature, both the calculated one and the read out one from the digital ИПИМ 0399/М3А indicator under the formula (4.1);

$T_{\delta}$  - the valid value of the temperature (the point being checked);

- 16) set the emulated (valid  $T_{\delta}$ ) value of the temperature with the aid of ИКСУ equal to 154,68 °C;
- 17) carry out the operations of items 4.6.5.2.5),...4.6.5.2.15);
- 18) change the configuration parameters of ИПИМ 0399/М3А, having set:
  - the RT type = 50П (1,391);
  - the range maximum of converting of the channels = 600;
- 19) set the emulated (valid  $T_{\delta}$ ) value of the temperature with the aid of ИКСУ equal to 550 °C;
- 20) carry out the operations of items 4.6.5.2.5),...4.6.5.2.15);
- 21) change the configuration parameters of ИПИМ 0399/М3А, having set:
  - the RT type = 100П\_200 (1,391);
  - the range maximum of converting of the both channels = 200;
- 22) adjust ИКСУ for the emulation mode of the signals of the RT 100П;
- 23) set the emulated temperature value (valid  $T_{\delta}$ ) with the aid of ИКСУ, equal to minus 50 °C;
- 24) carry out the operations of items 4.6.5.2.5),...4.6.5.2.15);
- 25) set the emulated (valid  $T_{\delta}$ ) value of the temperature with the aid of ИКСУ equal to 129,26 °C;
- 26) carry out the operations of items 4.6.5.2.5),...4.6.5.2.15);
- 27) change the configuration parameters of ИПИМ 0399/М3А, having set:
  - the RT type = 100П (1,391);
  - the range maximum of converting of the both channels = 600;
- 28) set the emulated (valid  $T_{\delta}$ ) value of the temperature with the aid of ИКСУ equal to 550 °C;
- 29) carry out the operations of items 4.6.5.2.5),...4.6.5.2.15).

4.6.5.3. The definition of the values of the basic ИПИМ 0399/М3А errors in the RT configuration is carried out in the points being checked specified in table 13, in the following sequence.

Table 13

Input parameters				Limits of an admitted basic absolute error	
Type of the TC	Range of converting, °C	Point being checked		On the output signal	On the size being measured
		°C	mV		
TXK(L)	minus 50...600	0	0	± 3,2 °C	± (2,6 + *)°C
		300	22,843		
		600	49,108		
ТПП(S)	0...1700	0	0	± 8,5 °C	± (6,8 + *)°C
		800	7,345		
		1700	17,947		

\* – one unit of the last category, °C

1) Set the below listed configuration parameters for ИПМ 0399/М3А, the following instructions of item 2.3.4 of this manual:

- type of the TC = TXK(L);
- the number of the measurements for averaging = 1;
- the current range of the both channels = 0...5 mA;
- the range minimum of converting = minus 50;
- the range maximum of converting of the channels = 600;
- zero correction = 0;

2) connect the equaliser of a cold seal and ИКСУ to the input of the ИПМ 0399/М3А being checked in the emulation mode of signals ТП ХК (L) with a compensation cable. Keep ИПМ 0399/М3А in that condition for 30 minutes;

3) carry out the resistance calibration of the equaliser of a cold seal according to item 2.3.7;

4) consistently having set the emulated (valid  $T_0$ ) value of the temperature with the aid of ИКСУ equal to 0, 300 and 600 °C, carry out items 4.6.5.2.5),...4.6.5.2.12) for each point being checked;

5) change the parameters of the ИПМ 0399/М3А configuration, having set:

- the gauge type= ТПП (S);
- the range maximum of the both converting channels = 1700;

6) connect the resistor such as C2-29-100 Ohm and ИКСУ of a cold seal to the input of the ИПМ 0399/М3А being checked in the generation mode of the voltage of a direct current in the range minus 10 ... + 60 mV with an appropriate cable;

7) carry out the resistance calibration of the equaliser according to item 2.3.7;

8) one carries out the operations of items 4.6.5.2.5),...4.6.5.2.15) for the each point being checked, consistently having set the values of the output voltage, equal 0; 7,345 and 17,947 mV with the aid of ИКСУ, i.e. which are appropriate to the temperature values 0, 800 and 1700°C ТП ПП(S).

4.6.5.4. One carries out the definition of the values of the basic ИПИМ 0399/М3А errors in the configuration with the unified input signals of the voltage of a direct current in the points being checked specified in table 14, in the following sequence:

Table 14

Input parameters			Limits of an admitted basic absolute error	
Input signal	Range of converting	Point being checked	On the output signal	On the size being measured
0...100 mV	0...100 mV	0 mV	± 140 mkV	± (75 + *) mkV
		50 mV		
		100 mV		
0...5 mA	0...5 mA	0 mA	± 9 mkA	± (7,5 + *) mkA
		2,5 mA		
		5 mA		
0...20 mA	0...20 mA	0 mA	± 30 mkA	± (20 + *) mkA
		10 mA		
		20 mA		

\*– one unit of the last category, °C

1) Set the configuration parameters for ИПИМ 0399/М3А according to 2.3.4:

- type of the input signal = U0...100mV;
- the number of the measurements for averaging = 1;
- the extraction function of a square root = switched on
- the current range of the both channels = 0...5 mA;
- the range minimum of the input unified signal converting = 0;
- the range minimum of the input unified signal converting = 100;
- the minimum range of converting of the channels converting = 0;
- the maximum range of converting of the channels converting = 100;
- Zero correction = 0;

2) connect the voltage of a direct current of the ИПИМ 0399/М3А being checked;

3) set the emulated (the valid  $A_d$ ) value of the voltage equal to 0mV with the aid of ИКСУ.

4) measure the output currents of the both ИПИМ 0399/М3А channels in the range 0...5 mA at the loading of 2 kOhm;

5) calculate the measured value of the parameter under the formula

$$A_{u_{3M}} = \frac{(I_o - I_{\min}) \cdot (A_{\max} - A_{\min})}{(I_{\max} - I_{\min})} + A_{\min}, \quad (4.3)$$

where  $I_o$  - the measured value of the output current, mA;

$I_{\min}$  - the minimum of the output current range, mA;

$I_{\max}$  - the maximum of the output current range, mA;

$A_{\max}$  - the range maximum of the input signal converting;

$A_{\min}$  - the range minimum of the input signal converting;

6) set the current range of the output channels equal to 4...20 mA with the aid of the program;

7) measure the output currents of the both ИПМ 0399/M3A channels in the range 4...20 at the loading of 500 Ohm;

8) calculate the measured value of the parameter under the formula (4.3);

9) set the current range of the output channels equal to 0...20 mA with the aid of the program;

10) measure the output currents of the both ИПМ 0399/M3A channels in the range 0...20 mA at loading of 500 Ohm;

11) calculate the measured value of the parameter under the formula (4.3);

12) set the current range of the output channels equal to 0...5 mA with the aid of the program;

13) read out the measured value of the parameter from the digital ИПМ 0399/M3A indicator;

14) define the values of the absolute ИПМ 0399/M3A errors under the formula

$$\Delta A = A_{u_{3M}} - A_o, \quad (4.4)$$

where  $A_{u_{3M}}$  – the measured value of the parameter, as it is calculated under formula (4.3), as it is read out from the digital ИПМ 0399/M3A indicator;

$A_o$  – the valid value of the size in the point being checked;

15) Setting consistently the values of the voltages equal to 50 and 100 mV with the ИКСУ, carry out items: 4.6.5.4.4),...4.6.5.4.4.14) for each point being checked.

4.6.5.5. The definition of the values of the basic ИПМ 0399/М3А errors in the configuration with the unified input signals of a direct current, one carries out in the points being checked specified in table 14, in the following sequence:

1) Set the below listed configuration parameters for ИПМ 0399/М3А, the following instructions of item 2.3.4 of this manual:

- the input signal = 1 0...5mA;
- the number of the measurements for averaging = 1;
- the extraction function of a square root = is switched off;
- the current range of the both channels = 0...5 mA;
- the range minimum of the input unified signal converting= 0;
- the range maximum of the input unified signal converting= 5;
- the range minimum of converting of the channels = 0;
- the range maximum of converting of the channels = 5;
- zero correction = 0;

2) connect ИКСУ to the input of the ИПМ 0399/М3А in the generation mode of a direct current;

3) consistently setting the values of the current equal to 0; 2, 5 and 5 mA with the aid of ИКСУ, carry out items 4.6.5.4.4),...4.6.5.4.11) for the each point being checked;

4) change the configuration ИПМ 0399/М3А parameters, having set:

- the input signal = 1 0...20mA;
- the range maximum of the input unified signal = 20;
- the range maximum of converting of the channels = 20;

5) consistently setting the values of the currents with the aid of ИКСУ, equal to 0; 10 and 20 mA, carry out items 4.6.5.4.4), ...4.6.5.4.14) for the each point being checked.

4.6.5.6. The definition of the output characteristics of the built-in source of the voltage is carried out in the following sequence:

- 1) Prepare ИКСУ for operating in the mode of the voltage in the range from 0 up to 120 V;
- 2) Connect ИКСУ to plugs 18 (minus) and 22 (plus) of ИПМ 0399/М3А;
- 3) Measure the value of the voltage of idling of the built-in source of the voltage;
- 4) Define the value of the absolute error under the formula

$$\Delta U_{xx} = U_{xx} - U_{ном} , \quad (4.5)$$

where  $\Delta U_{xx}$  – the absolute error in the idling mode;

$U_{ном}$  – the nominal value of the output voltage of the source equal to 24 or 36 V;

$U_{xx}$  – the measured value of idling;

5) connect the loading resistor such as MJT-1-1,2 Ohm for the output voltage 24 V, or MJT-1-1,8 Ohm for the output voltage 36 V to plugs 18 and 22 of ИПМ 0399/М3А;

6) measure the voltage value under the loading of the built-in voltage source;

7) define the value of the absolute error under the formula

$$\Delta U_{\text{назр}} = U_{\text{назр}} - U_{\text{ном}}, \quad (4.6)$$

where  $\Delta U_{\text{назр}}$  – the absolute error under loading;

$U_{\text{назр}}$  – the measured voltage value under loading.

4.6.5.7. Check of the control of the input circuit break is carried out in the following sequence:

1) Set the below listed configuration parameters for ИПМ 0399/М3А, the following instructions of item 2.3.4 of this manual:

- the RT type = 50П (1,391);
- the connection circuit of the RT = 3 wire;
- the number of the measurements for averaging = 1;
- the current range of the both channels = 0...5 mA;
- the range minimum of converting of the channels = 50;
- the range maximum of converting of the channels = 200;
- the current value of an error of the both channels = 110 %;
- zero correction = 0;

2) connect ИКСУ to the input of the ИПМ 0399/М3А being checked in the emulation mode of signals of the RT under the 3 wire circuit;

3) adjust ИКСУ for the emulation mode of the RT signals 50П;

4) set one of the temperature values in the range from minus 50 till plus 200 °C with the aid of ИКСУ;

5) measure the output currents of the both ИПМ 0399/М3А channels at the loading of 2 Ohm;

6) disconnect ИКСУ off ИПМ 0399/М3А, the message «Cut» will appear on the ИПМ 0399/М3А being checked display;

7) the values of the output currents are to be in the range from (5,5±0,01) mA;

8) set the current range of the both channels = 4...20 mA and the loading resistance 500 Ohm;

9) measure the output currents of the both ИПМ 0399/М3А channels which are to be in the range from (22±0,04) mA;



10) set the current range of the both channels = 0...20 mA and the loading resistance 500 Ohm;

11) measure the output currents of the both ИПМ 0399/M3A channels which are to be in the range from  $(22 \pm 0,04)$  mA.

#### 4.6.6. Processing results of checking

4.6.6.1. While checking of ИПМ 0399/M3A with the input signals from the RT such as 50П and 100П, the values of the absolute errors calculated under the formula (4.2), must not exceed the values specified in table 12.

4.6.6.2. While checking of ИПМ 0399/M3A with the input signals from the TC such as TXK (L) and ТПН (S), the values of the absolute errors determined under the formula (4.2), must not exceed the values specified in table 13.

4.6.6.3. While checking of ИПМ 0399/M3A with the input unified signals, the value of the absolute errors, calculated under the formula (4.4), must not exceed the values specified in table 14.

4.6.6.4. While defining of the output characteristics of the built-in voltage source, the absolute errors must not exceed  $\pm 0,48$  V for the voltage 24 V,  $\pm 0,72$ V for the voltage 36 V as under the loading, as in the idling mode.

4.6.7. The definition of the values of the basic ИПМ 0399/M3A errors, the initial converter configured under the concrete type.

4.6.7.1. The basic error of ИПМ 0399/M3A for the configurations with the RT and TC (item 2.2.1, table 1) one defines in the points appropriate of 0, 20, 40, 60, 80, 100 % of a range of change of an output signal.

4.6.7.2. The nominal static characteristics of converting of the RT are to correspond to the all-Union State Standard 6651-94; the nominal static characteristics of converting of the TC are to correspond to the all-Union State Standard P 8.585-2001.

4.6.7.3. Measurements for definition of the basic ИПМ 0399/M3A errors in the configuration with the RT and the TC are carried out by the techniques stated in items 4.6.5.2 and 4.6.5.3, accordingly.

4.6.7.4. Calculate the basic error  $\gamma_1$  under the formula (4.7) in the each point being checked. An error is expressed as the given one in percentages of the normalizing value. The difference of the top and bottom limiting values is accepted for the normalizing value of the converting range.

$$\gamma_1 = \frac{A_{u3M} - A_0}{A_6 - A_H} \cdot 100\% , \quad (4.7)$$

where  $A_H, A_6$  - the bottom and top limited values of the converting range;

$A_0$  - the valid value of the size in the point being checked;

$A_{u3M}$  - the measured value of the size.

The greatest of the designed values of the basic given error must not exceed the appropriate value specified in table 1.

4.6.7.5. The basic ИПИМ 0399/M3A error is defined in the points being checked appropriate of 0, 20, 40, 60, 80, 100 % of the change range of the output signal for the configurations with the input unified electric signals as the force and the voltage of a direct current (item 2.2.1, table 1).

4.6.7.6. Measurements for the definition of the basic ИПИМ 0399/M3A errors in the configuration with the unified input signals are carried out by the techniques stated in items 4.6.5.4 and 4.6.5.5.

4.6.7.7. The valid values of the sizes being measured  $A_0$ , appropriate to the values of the input signal in the points being checked, one calculates under formulas 4.8...4.11. For the dependence of size being measured on the input signal:

- linear

$$A_0 = \frac{A_6 - A_H}{I_6 - I_H} \cdot (I_{ex.i} - I_H) + A_H \quad (4.8),$$

$$A_0 = \frac{A_6 - A_H}{U_6 - U_H} \cdot (U_{ex.i} - U_H) + A_H \quad (4.9);$$

- with a function of a square root extraction

$$A_0 = \frac{A_6 - A_H}{\sqrt{I_6 - I_H}} \cdot \sqrt{I_{ex.i} - I_H} + A_H \quad (4.10),$$

$$A_0 = \frac{A_6 - A_H}{\sqrt{U_6 - U_H}} \cdot \sqrt{U_{ex.i} - U_H} + A_H, \quad (4.11)$$

where  $I_H, I_6, U_H, U_6$  - the bottom and top limiting values of the ranges of the force and the voltage of a direct current, accordingly;

$I_{ex.i}, U_{ex.i}$  - the values of the input signal in the point being checked as the force and the voltage of a direct current, accordingly.

The basic given error of the measuring channel is calculated under formula (4.7).

The greatest of the designed values of the basic given error must not exceed the appropriate value specified in table 1.

#### 4.7. The registration of the checking results

4.7.1. The positive checking results of ИИМ 0399/М3А are made out by the certificate on the state checking of the set form according to ПП 50.2.006-94.

4.7.2. The results of the ИИМ 0399/М3А checking, configured under the concrete initial converters, are made out by the certificate on the state checking the set form according to ПП 50.2.006-94 with the indication of the results of checking on its back (or the report of the any form).

***Attention!** It is not supposed to use ИИМ 0399/М3А with the other configurations in this case.*

4.7.3. It is not supposed to apply the device before finding out of the reasons of the malfunctions and their elimination at the negative results of the ИИМ 0399/М3А checking.

After elimination of the found out malfunctions, they make a repeated check, the results of the repeated check are final.

## 5. MAINTENANCE SERVICE

5.1. The maintenance service of ИПМ 0399/М3А goes to following the rules of operation, keeping and transportation, stated in the given «Руководстве по эксплуатации» («Manual on operation»), routine inspections, periodic checking and repair work.

5.2. The routine inspections are conducted in the order set on the objects of the ИПМ 0399/М3А operation, but not less often two once a year and include:

- a) Examination;
- b) Checking of the fastening durability of the communication lines of ИПМ 0399/М3А with epy initial converters, the power supply and the loadings of the channels of the switching;
- c) Checking of the device serviceability;
- d) The internal ИПМ 0399/М3А calibration;
- e) Checking of the accuracy of the ИПМ 0399/М3А measurements in the points appropriate of 5, 50, 95 % of the range of the sizes being measured according to chapter 4 of this manual.

In the realization conditions of checking of the serviceability, when the opportunity of using of any auxiliary means of the measurements is excluded, ИПМ 0399/М3Аs are not subject to be checked on the accuracy of measurements. In this case ИПМ 0399/М3Аs are checked only on functioning. ИПМ 0399/М3Аs are considered functioning if their indications roughly coincide with the size being measured.

5.3. The periodic ИПМ 0399/М3А checking is made not less often than once in two years according to the guidelines given in chapter 4 of this manual.

5.4. The ИПМ 0399/М3Аs with malfunctions, which can't be subjected to elimination at the routine inspection, or, which didn't not have the periodic checking are subject to an operating repair.

The ИПМ 0399/М3А repair is made at the enterprise-manufacturer under the separate contract.

## **6. KEEPING**

6.1. The conditions of ИПМ 0399/M3A keeping in a transport container in a warehouse of the manufacturer and the consumer must correspond to conditions 1 in accordance with the all-Union State Standard 15150-69.

6.2. The placing of ИПМ 0399/M3As is to provide an easy reach to them in storehouses.

6.3. ИПМ 0399/M3A is ought to be kept on racks.

6.4. The distance between the walls, the floor of the storehouse and ИПМ 0399/M3A is to be not less than 100 mm.

## **7. TRANSPORTATION**

7.1. ИПМ 0399/M3A is transported by all means of transport in covered vehicles. Fixing of container in vehicles should be made according to the guidelines working on the appropriate means of transport.

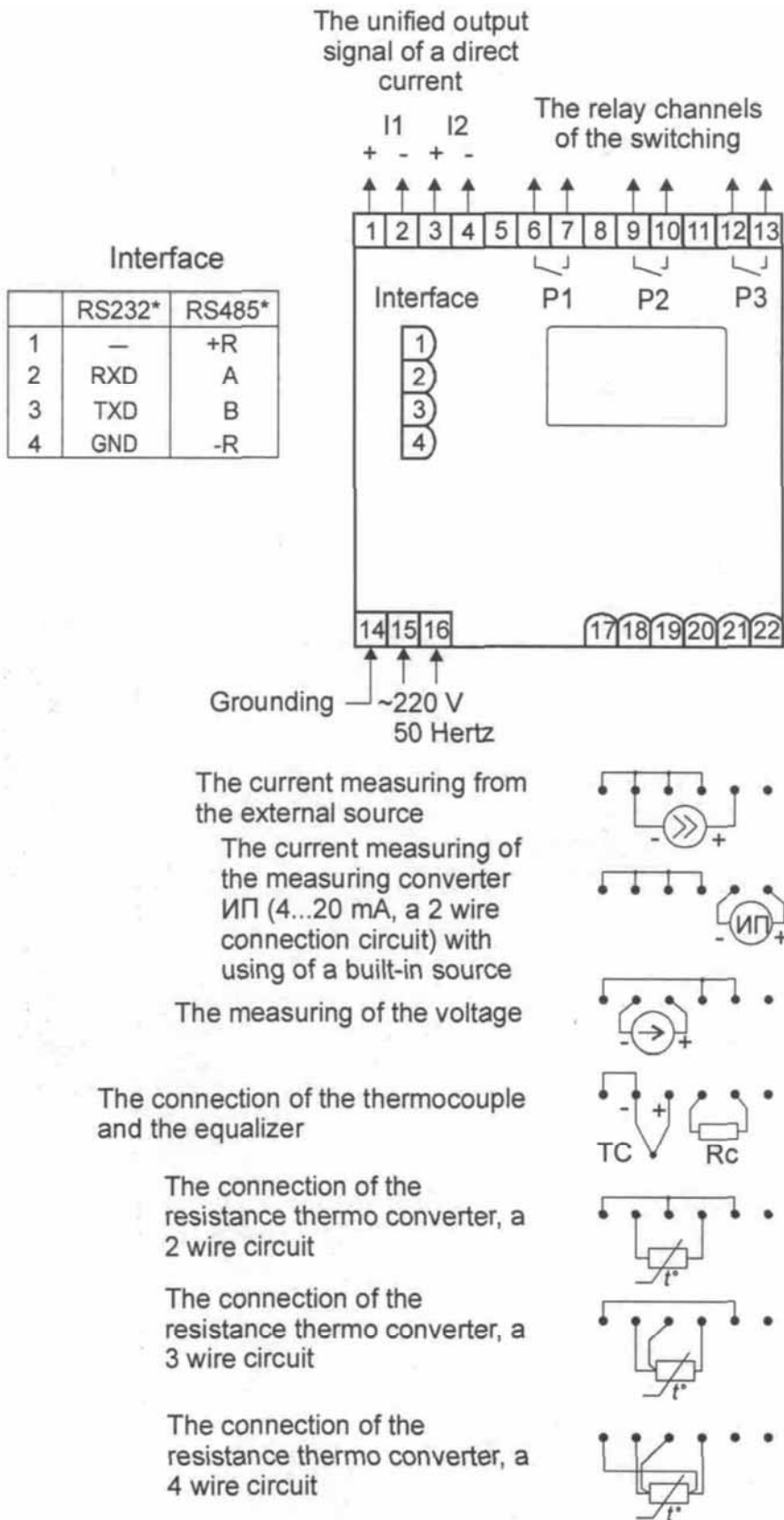
7.2. The conditions of ИПМ 0399/M3A transportation must correspond to conditions 5 in accordance with the all-Union State Standard 15150-69 at the air temperature from - 50 till + 50 °C with observance of protection measures from impacts and vibrations.

7.3. While transporting of ИПМ 0399/M3A, the device ought to be packed in packages or by the piece.

7.3. The transportation of ИПМ 0399/M3A in boxes is to correspond to the requirements of the all-Union State Standard 21929-76.

## APPENDIX A




### The circuit of ИИМ 0399/M3A connection



**Picture A.1**

The continuation of the appendix A

Sings with marks

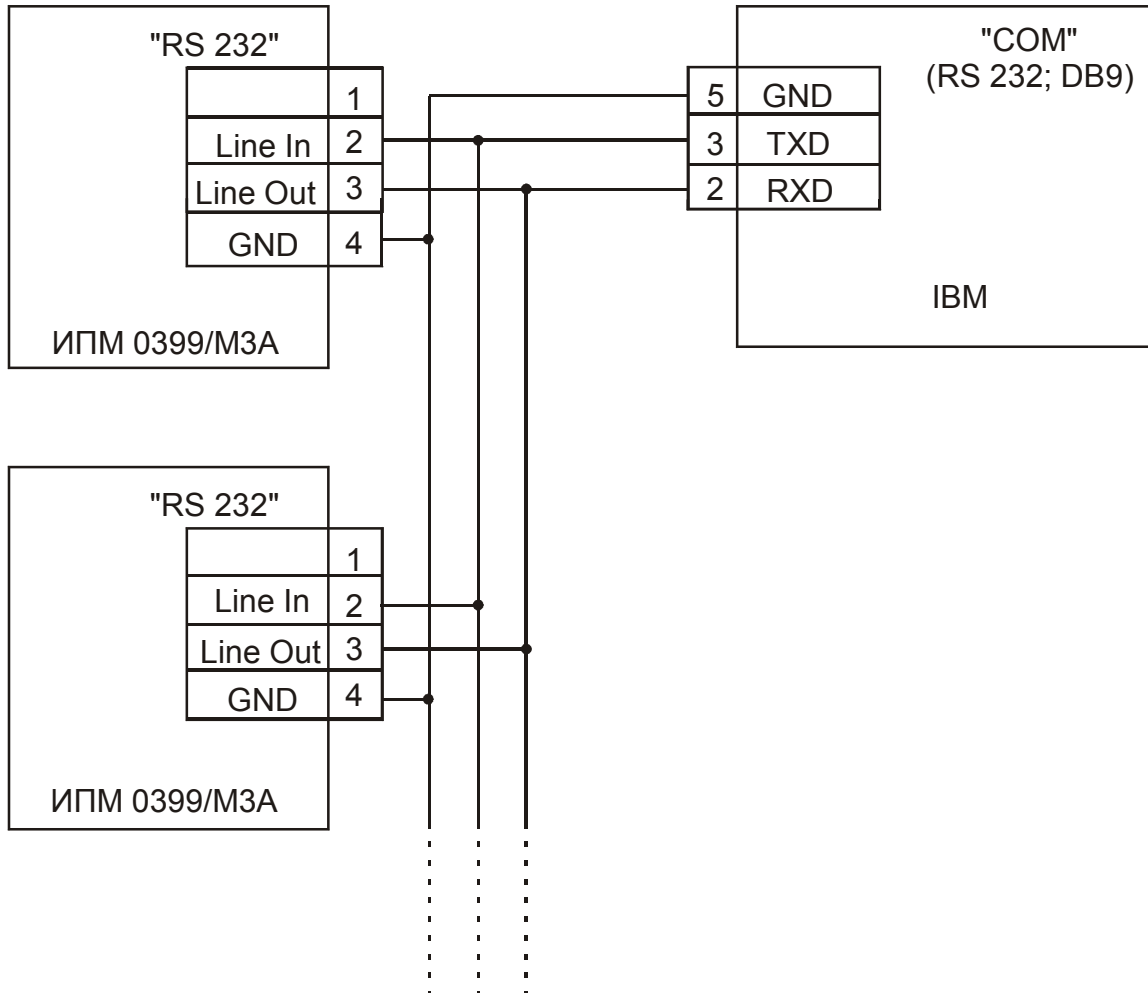
		<b>Для АЭС</b>
 ЭЛЕМЕР	<b>ИПМ 0399/МЗА</b>	
Зав. №	<input type="text"/>	
Дата вып.	<input type="text"/>	200 <input type="text"/> г.
<p><math>U_{пит} \sim 176 \dots 253 \text{ В}, 50 \text{ Гц}; P_{пот} \leq 11 \text{ Вт}</math> <math>I_{вых} = 0 \dots 5 \text{ мА}</math> при <math>R_{нагр} \leq 2 \text{ кОм}</math> <math>I_{вых} = 4 \dots 20 \text{ мА}</math> при <math>R_{нагр} \leq 0,5 \text{ кОм}</math> <math>I_{вых} = 0 \dots 20 \text{ мА}</math> при <math>R_{нагр} \leq 0,5 \text{ кОм}</math> <math>U_{встр.ист.} = \text{ } \text{ В}</math> при <math>I_{макс} = 22 \text{ мА}</math></p>		

Picture A.2

## Appendix B

### THE CIRCUITS OF THE ИПМ 0399/M3A CONNECTION TO THE IBM

The 3 wire connection circuit of ИПМ 0399/M3A to the IBM  
(up to 10 of ИПМ 0399/M3A with a communication line of the length up to 15 m)



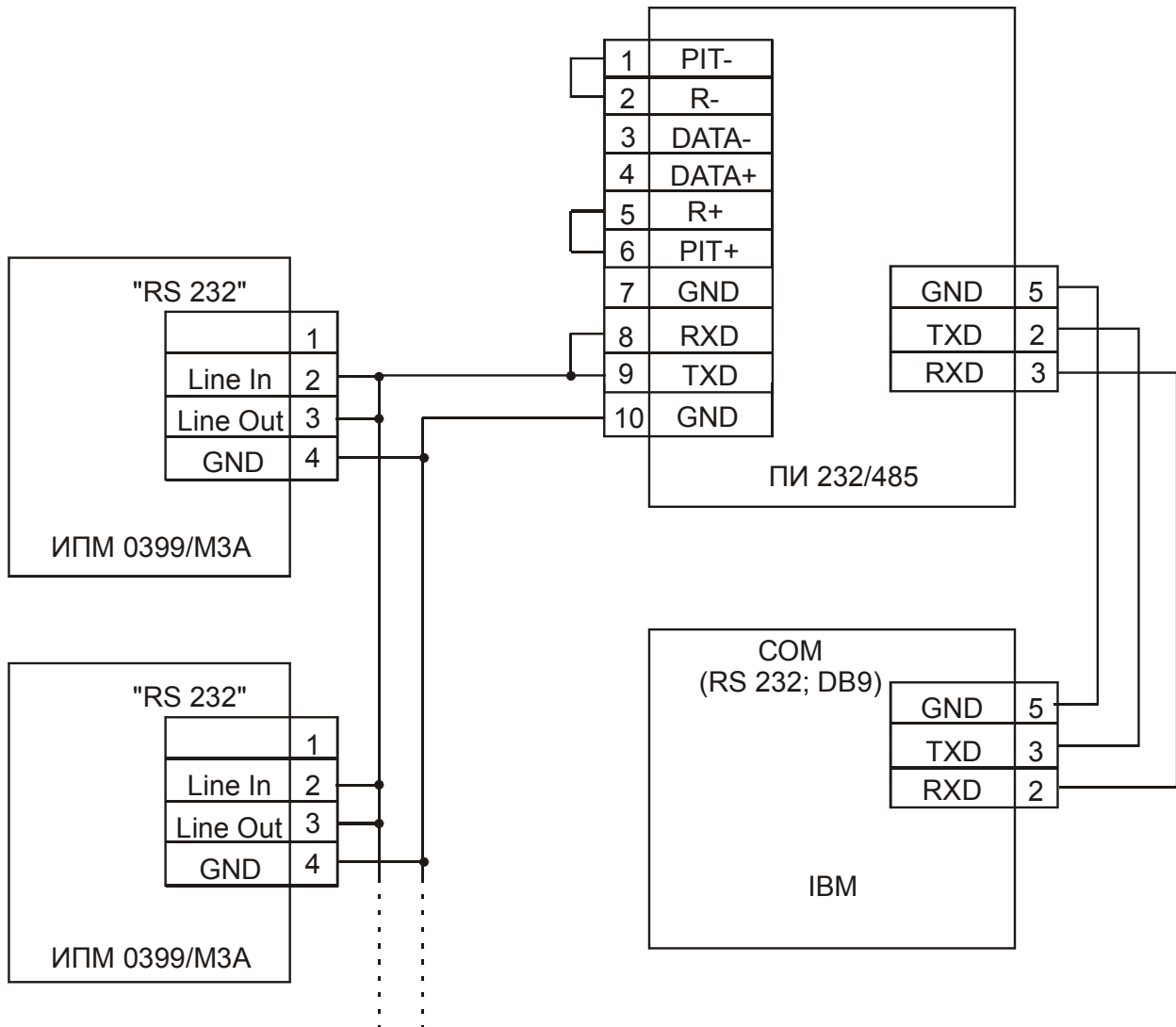
IBM – is an international business machine

Picture B.1



The continuation of the appendix B

The 3 wire connection circuit of ИПМ 0399/М3А to the IBM  
(up to 100 of ИПМ 0399/М3А with a communication line of the length up to 1000 m)



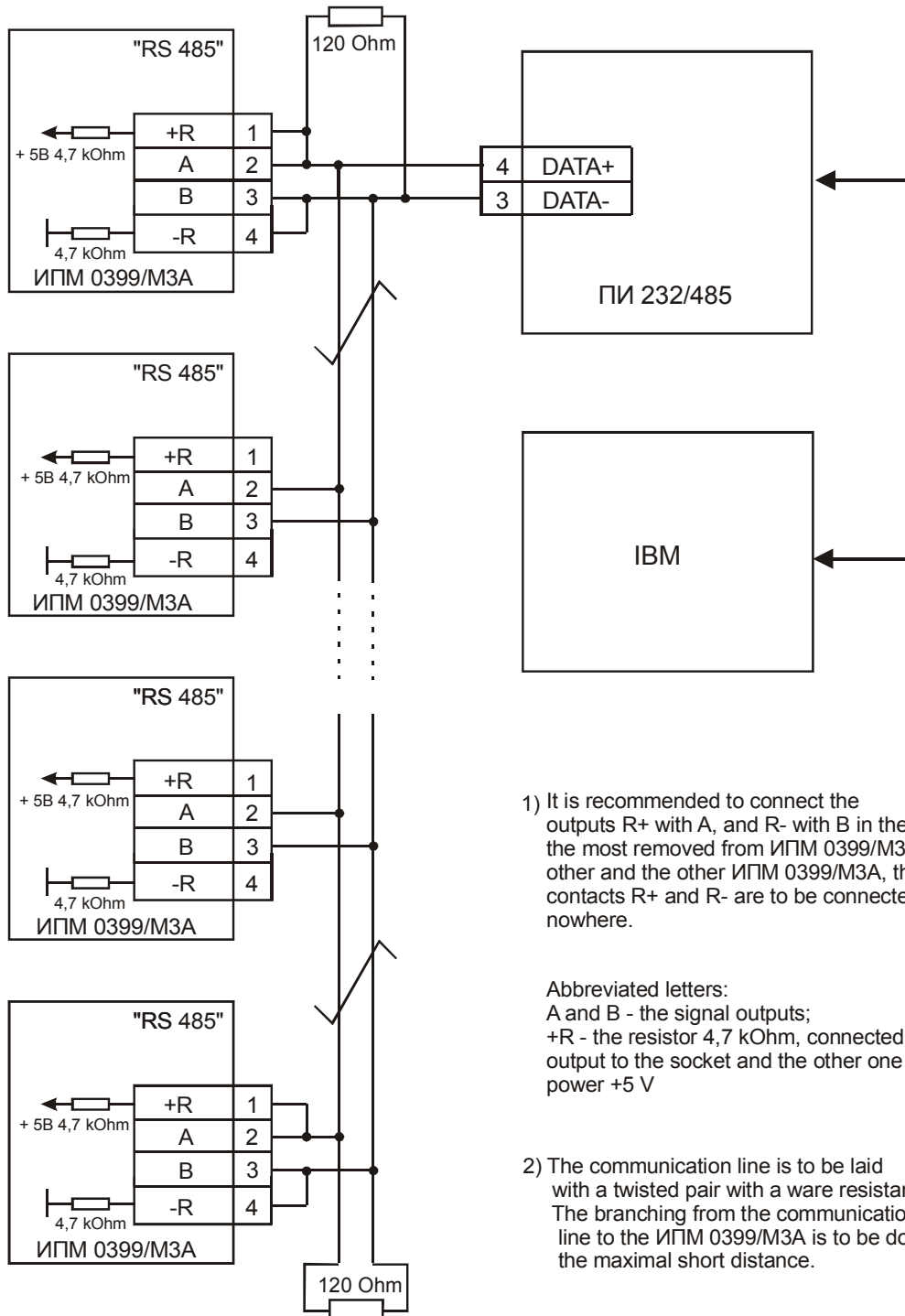
ПИ 232/485 – is the converter of the RS of 232/485 interface of manufactured by ИПП "Элемер".

The communication line is desirable for conducting with a twisted pair; branching from the communication line to devices of ИПМ 0399/М3А is to be done in the maximum short distance.

Picture B.2

## The continuation of the appendix B

The 2 wire connection circuit of ИПМ 0399/М3А to the IBM with using of the converter of the RS 485/RS 232 interface (up to 32 of ИПМ 0399/М3А with a communication line of the length up to 1000 m)



- 1) It is recommended to connect the outputs R+ with A, and R- with B in the both the most removed from ИПМ 0399/М3А each other and the other ИПМ 0399/М3А, the contacts R+ and R- are to be connected nowhere.

Abbreviated letters:

A and B - the signal outputs;  
+R - the resistor 4,7 kOhm, connected by one output to the socket and the other one to the power +5 V

- 2) The communication line is to be laid with a twisted pair with a wave resistance 120 Ohm. The branching from the communication line to the ИПМ 0399/М3А is to be done in the maximal short distance.
- 3) The matching resistors 120 Ohm are to be put on the extreme ends of the communication line (cable).

\* The converter is to be with an automatic switch of a direction of the sending signal.

Picture B.3



