



THE RESEARCH AND PRODUCTION ENTERPRISE

SAFE MEANS AND SYSTEMS
OF TECHNOLOGICAL MONITORING

TECHNOLOGICAL MEASURING CONTROL (UNIVERSAL MILLIVOLTMETERS)

ИРТ 5920Н, ИРТ 5920НМ

OPERATION MANUAL

НКГЖ.411618.004-08РЭ



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

CONTENT

1.	Introduction	3
2.	Description and operation	3
2.1.	Function of the device	3
2.2.	Technical characteristics	6
2.3.	Design and operation	13
2.4.	Setting of configuration parameters (manual mode)	15
2.5.	Assigning of IMC parameters	16
2.6.	Assigning of setting values	16
2.7.	Internal calibration	17
2.8.	Error reporting	18
2.9.	Special operation features	19
2.10.	Marking and sealing	20
2.11.	Packaging	20
3.	Use of the device according to its function	21
3.1.	Preparation of the device for operation	21
3.1.1.	Safety measures instructions	21
3.1.2.	External inspection	21
3.1.3.	Device assembly	21
3.1.4.	Test run	22
3.2.	Using the device	22
4.	Verification technique	23
5.	Maintenance service	35
6.	Storage	35
7.	Transportation	35
APPENDIX A.	The circuit of electronic connections of IPT 5320H, IPT 5920HM	36
APPENDIX Б.	The connection circuit of IPT 5920H, IPT 5920HM to a computer, using the circuit “point-point” via RS 232 C interface	37
APPENDIX B	Connection circuit of IPT 5920H, IPT 5920HM to signal converter	41
APPENDIX Г	An example of designation recording when ordering IPT 5920H, IPT 5920HM	42

1. INTRODUCTION

1.1. Operation manual contains information on design, principle of operation, on characteristics of the technological measuring controls (millivoltmeters multi-purpose) ИРТ 5920Н and ИРТ 5920НМ (hereinafter – ИРТ 5920), listed in the table 1.1 and instructions, necessary for safe and correct operation.

Таблица 1.1

Modification code	Designation	Installation variants	Design features
ИРТ 5920Н	НКГЖ.411618.004-08	Panel	Main four-digit LED indicator with symbols 14 mm high
ИРТ 5920НМ	НКГЖ.411618.004-08.01		Basic five -digit LED indicator with symbols 14 mm high

2. DESCRIPTION AND OPERATION

2.1. Function of the device

2.1.1. ИРТ 5920 is designed for measuring and control of temperature and other non-electric values, transformed into electrical signals of current strength and voltage and active resistance to continuous current.

2.1.2. ИРТ 5920 is used in different technological processes of industry.

2.1.3. ИРТ 5920 is a microprocessor device, that can be rearranged by a user with a display of a current value of a converted values and it is designed for functioning in autonomous mode, as well as in combination with other instruments, combined into a local computer network.

Review and changing of parameters of ИРТ 5920 configuration is performed with the aid of a keyboard as well as with the aid of software “Tuning of instruments of ИРТ 5900 and ИПМ 0399 series” when connecting instruments to a computer. Connection of the instrument and a computer is performed with the aid of interface RS 232C (by the circuit “point- point”) or RS 232 or RS 485, the interface type is underlined at the device order.

Indication of measured values in ИРТ 5920 is performed on the main LED display. Indication of settings operation is performed with the aid of single LED indicators. On the additional four-digit LED indicator one from three possible settings is displayed. Indication of setting operation is performed with the aid of single LED indicators. ИРТ 5920 performs the control function of reliability of input signals.

2.1.4. ИРТ 5920 performs the function of signalization and automatic regulation of controlled parameters.

Actuation relays of signalling channels support commutation:

- of alternating current system frequency :
 - at the voltage of 250 V up to 5 A on resistive load ,
 - at the voltage of 250 V up to 2 A on inductive load ($\cos \varphi \geq 0.4$);
- of direct current:
 - at the voltage of 250 V up to 0,1 A on resistive and inductive loads,
 - at the voltage of 30 V up to 2 A on resistive and inductive loads.

2.1.5 IPT 5920 has got three settings. The input procedure and the possibility of settings alteration is protected by the parole from unauthorized access.

2.1.6. IPT 5920 may comprise an incorporated measuring converter, designed for conversion of the measured value into a unified output signal of direct current 0...5, 0...20 or 4...20 mA.

2.1.7. IPT 5920 comprises an incorporated power supply source of 24V, designed for power supply of primary converters with a unified output signal of direct current.

2.1.8. In accordance with All-Union State Standard 9736-91 IPT 5920 belongs to:

- as to the number of converted input signals - single-channel;
- as to the number of output channels - single-channel;
- as to the number of signalling channels - three – channel with an independent tuning of every channel for operation by every setting;
- as to dependence of the output signal on the input one - with linear dependence for input signals of resistance thermo converters (TC), thermo-electric converter (TII) or with a linear dependence and with a square-rooting function for a unified input signal.
- on communication between entrance and target chains - without galvanic communication.

2.1.9. In accordance with a State Standard 25804.1-83 IPT 5920 belongs to:

- category B - the equipment of continuous application;
- the type I - the equipment with two quality degrees of functioning – the nominal level and fault.

2.1.10. In accordance with a State Standard 14254-96 the degree of protection from water, dust and hard particles getting inside IPT 5920 it belongs to:

- front panel IP54;
- body IP20.

2.1.11. According to stability to mechanical effects during operation IPT 5920 belongs to the execution group M6 by the State Standard 17516.1-90.

2.1.12. In accordance with the State Standard 12997-84 as to climatic impact resistance during operation IPT 5920 correspond to production group C3 at the temperature of ambient air from minus 10 up to plus 50 °C (for order index t1050).

2.1.12.1. Export version of IPT 5920 are durable for influence of ambient air from minus 30 up to plus 70 °C (for order index t1070).

2.1.13. In accordance with the State Standard P 50746-2000 IPT 5920 are stable to electromagnetic disturbances, indicated in the table 2.1.

Table 2.1

Degree of fixity of electromagnetic environment by State Standards	Characteristics of all kinds of interferences	Value	Execution group	Criteria of quality of functioning according to State Standards P50746-2000
2 ГОСТ Р 51317.4.5	Microsecond spikes of large energy(МИП): • amplitude of noise pulse in the circuit input - output	± 1 kW	III	A
3 ГОСТ Р 51317.4.5	Microsecond spikes of large energy (МИП): • amplitude of noise pulse in the circuit of power supply	± 1 kW/ ± 2 kW	III	A
3 ГОСТ Р 51317.4.4	Nanosecond spikes (НИП): • amplitude of noise pulse in the circuit input- output	± 1 kW	III	A
3 ГОСТ Р 51317.4.4	Nanosecond spikes (НИП): • amplitude of noise pulse in the power supply circuit in the circuit ~220 V	± 2 kW	III	A
3 ГОСТ Р 51317.4.2	Electrostatic discharges: • contact discharge • air discharge	± 6 kW	III	A
		± 8 kW	III	A
3 ГОСТ Р 50648	Magnetic field of mains frequency Long magnetic field	30 A/m	III	A
4 ГОСТ Р 50648	Magnetic field of mains frequency Short magnetic field 3sec	400 A/m	III	A
3 ГОСТ Р 51317.4.3	Radio-frequency electromagnetic fields in frequency band 80-1000 mHz	10 V/m	IV	A
3 ГОСТ Р 51317.4.6	Conductive interferences in frequency band 0,15-80 mHz: • circuits input - output • frequencies of power supply	10 V	IV	B
		10 V	IV	A
3 ГОСТ Р 51317.4.11	Dynamic voltage changes of power supply • brownouts • interruptions • power surge	1000ms/70%U 100ms/0%U 1000ms/120%U	III	A
ГОСТ Р 51318.22	Emission of man-made			Correspondent for TC* grade A

Notes

1 * TC – technical means.

2 ИРТ 5920Н, ИРТ 5920НМ function normally and do not create interferences in conditions of joint operation with equipment of systems and elements, for which they are designed, as well as with equipment for other purposes, which may be used together with the present ИРТ 5920Н, ИРТ 5920НМ in a typical interference situation.

2.2. Technical specifications

2.2.1. Measurement ranges, input parameters and the limits of the tolerable basic reduced error with consideration of configurations of IPT 5920 correspond to the ones provided in the tables 2.2 and 2.3.

Table 2.2 – IPT 5920 for configurations with input electric signals from resistance thermal converters (TC) according to the State Standards P 8.625-2006, State Standards 6651-94 and thermal electric transducers (TII) according to the State Standards P 8.585-2001

Type of primary Converter	W_{100}^{**} ($\alpha, ^\circ\text{C}^{-1}$) ^{***}	Range of measurements, $^\circ\text{C}$	Input parameters			Limits of tolerable basic reduced error $\gamma_0, \%$						
			by HCX		Input Resistance, kOhm	IPT 5920H	IPT 5920HM					
			Resistance, Ohm	Т.Э.Д.С., мV								
50M	1,4280**	-50...+200	39,23...92,78									
53M			41,58...98,34									
50M	(0,00428) ^{***}		39,23...92,8									
50M	1,4260**		39,35...92,62									
53M			41,71...98,17									
50П	1,3910**		40,00...88,53									
50П	(0,00391) ^{***}		40,00...88,52									
100M	1,4280**		78,45...185,55									
100M	(0,00428) ^{***}		78,46...185,60									
100M	1,4260**		78,69...185,23									
100П	1,3910**	80,00...177,05										
100П	(0,00391) ^{***}	80,00...177,04										
Pt100	1,3850**	-50...+200	80,31...175,86	-	-	$\pm(0,2 + *)$						
Pt100	(0,00385) ^{***}											
50П	1,3910**		40,00...158,59									
100П			80,00...317,17									
50П	(0,00391) ^{***}		40,00...158,56									
100П			80,00...317,11									
Pt100	1,3850**		80,31...313,71									
Pt100	(0,00385) ^{***}											
ТЖК(J)	-		-50...+1100					-2,431...63,792	-	not less 100	$\pm(0,5 + *)$	$\pm(0,25 + *)$
ТХК(L)			-50...+600					-3,005...49,108				
ТХА(K)		-50...+1300	-1,889...52,410									
ТПП(S)		0...+1700	0...17,947									
ТПП(B)		+300...+1800	0,431...13,591									
ТБП(A-1)		0...+2500	0...33,640									

NOTES

1 * One unit of the last order, indicated in percentage from the measurement range.

2 ** According to State Standards 6651-94.

3 *** According to State Standards P 8.625-2006.

4 **** Excluding the sub range -50...+200 $^\circ\text{C}$.

Table 2.3 – IPT 5920 for configuration with input electrical signals in the form of strength, voltage of constant current and resistance to direct current

Input signal	Measurement range for the dependence of measured value on an input signal		Input parameters			Limits of tolerable basic reduced error γ_0 , %	
			Input resistance, kOhm		Maximal current mA		
	linear	With the function of square rooting	not less than	not more than		IPT 5920H	IPT 5920HM
Current	0...5 mA	0,1... 5 mA	-	0,01	-	$\pm(0,25 + *)$	$\pm(0,05+*)$
	4...20 mA	4.32...20 mA					
	0...20 mA	0.4...20 mA					
Voltage	0...75 mV	1,5...75 mV	100	-			
	0...100 mV	2 ...100 mV					
Resistance	0...320 Ohm	-	-		0,35		

NOTES –* One unit of the last order, indicated in percentage from the measurement range

2.2.2. Parameters of IPT 5920 configuration are provided in tables 2.4 and 2.5.

Table 2.4

Parameter name	Parameter symbol			Factory setting
	Main display	Additional display		
		Menu	Submenu	
1	2	3	4	5
Permission of settings programming	0 – prohibited	PrUE	-	-
	1- permitted		-	1
Hysteresis* of the first setting (in parameter units)	0...9999	GS 1	-	0
Hysteresis* of the 2-nd setting (in parameter units)	0...9999	GS 2	-	0
Hysteresis* of the 3-rd setting (in parameter units)	0...9999	GS 3	-	0
Type of primary converter	According to table 2.5	dAt	-	U100
Signalization of open-circuit fault **	0 - prohibited	CutE	-	-
	1- permitted		-	1
Function of square rooting	0 - off	Sqrt	-	0
	1- on		-	-
Minimum of the range of conversion of input unified signal	-1999...9999	dPLo	-	0
Maximum of the range of conversion of input unified signal	-1999...9999	dPHi	-	100
Circuit of TC connection	0 – double-wire;	Lc	-	-
	1- three-wire			1
Resistance of double-wire communication line TC	0...9999	rL	-	-
Resistance of compensator at 0 °C	0...9999	rc0	-	50
Number of digits after comma	0, 1, 2 и 3	UF	-	3
Minimum value of IMC conversion range	-1999...9999	IoLo	-	0
Maximum value of IMC conversion range	-1999...9999	IoHi	-	100
Logics of relay operation K1 (entrance to submenu)	Sub	rL1	-	-
Condition of relay K1 relative to measured signal to the 1-st setting	0, 1, 2 ***	-	rL1.1	0
Condition of relay K1 relative to measured signal to the 2-nd setting	0, 1, 2 ***	-	rL1.2	0
Condition of relay K1 relative to measured signal to the 3-rd setting	0, 1, 2 ***	-	rL1.3	0
Condition of relay K1 relative to primary converter	0, 1 ****	-	rL1.C	0
Logics of operation of relay K2 (entrance to submenu)	Sub	rL2	-	-
Condition of relay K2 relative to measured signal to the 1-st setting	0, 1, 2 ***	-	rL2.1	0
Condition of relay K2 relative to measured signal to the 2-nd setting	0, 1, 2 ***	-	rL2.2	0
Condition of relay K2 relative to measured signal to the 3-rd setting	0, 1, 2 ***	-	rL2.3	0
Condition of relay K2 relative to primary converter	0, 1 ****	-	rL2.C	0
Logics of operation of relay K3 (entrance to submenu)	Sub	rL3	-	-
Condition of relay K3 relative to measured signal to the 1-st setting	0, 1, 2 ***	-	rL3.1	0
Condition of relay K3 relative to measured signal to the 2-nd setting	0, 1, 2 ***	-	rL3.2	0
Condition of relay K3 relative to measured signal to the 3-rd setting	0, 1, 2 ***	-	rL3.3	0
Condition of relay K3 in case of short circuit Of primary converter	0, 1 ****	-	rL3.C	0
Notes				
1 * Delay of relay operation relative to the setting				
2 ** Only for input signals U75 and U100 in accordance to table 2.5.				
3 *** 0 – condition of relay does not change; 1 – switched on at $U_{ИЗМ} < U_{УСТ}$, setting «for reduction»; 2 – switched on at $U_{ИЗМ} > U_{УСТ}$, setting «for increase»; ($U_{ИЗМ}$ – measured signal; $U_{УСТ}$ – setting).				
4 **** 0 – relay is switched off after break off the primary converter, 1 – relay is switched on after break of primary converter.				

Continuation of the table 2.4

1	2	3	4	5
Number of measurement for averaging of input signal	1...100	nSU	-	3
Indication of settings on the additional display	0, 1, 2, 3*	Ind	-	0
Network address of IPT 5920	0...255	Addr	-	1
Pass word (first copy)	-1999...9999	PSS1	-	0
Pass word (second copy)	-1999...9999	PSS2	-	0
Speed of exchange by interface	0,3...19,2 kbit/sec	SPd	-	9,6
Operation mode of IMC	1,2**	IOdP	-	2
Exit from menu of configuration parameter (return to measurement mode)	-	rEtU	-	-
Notes				
1 * 0 – no indication; 1 – indication of the 1-st setting; 2 – indication of the 2-nd setting; 3 – indication of the 3-rd setting.				
2 ** - 1 – range is switched on 0...20 mA (0...5 mA); 2 – switched on range 4...20 mA.				

Table 2.5

Designation of the type of the primary converter or input signal	Symbol HCX	W_{100}	Measurements range
1	2	3	4
Cu85	50M	1,4280	-50...+200 °C
Cu65	50M	1,4260	
Cu83	53M	1,4280	
Cu63	53M	1,4260	
Cu81	100M	1,4280	
Cu61	100M	1,4260	
PtH5	50Π	1,3910	-50...+600 °C
PtH1	100Π		
Ptb1	Pt100	1,3850	
HA	TXA(K)	-	-50...+1300 °C
FC	TЖK(J)	-	-50...+1100 °C
HE	TXK(L)	-	-50...+600 °C
PP	TΠΠ(S)	-	0...+1700 °C
Pr	TΠΠ(B)	-	+300...+1800 °C
bP	TBP(A-1)	-	0...+2500 °C
t05	-	-	0...5 mA
t020	-	-	0...20 mA
t420	-	-	4...20 mA
U100	-	-	0...100 mB
U75	-	-	0...75 mB
rr	-	-	0...320 Om

2.2.3. The time of operational mode setting (preliminary warming up) is not more than 30 minutes.

2.2.4. The limit of the tolerable additional error of IPT 5920 by measurement does not exceed 0,5 of the limit of tolerable basic error when one of the below factors are affecting it:

- when temperature changes for every 10°C in the operational range of temperatures, provided in item 2.1.12;
- when increased humidity is present up to 95 % at 35 °C;
- when power supply voltage varies from nominal (220 V, 50 Hz) in the range from 90 to 249 V, 50 Hz.

2.2.5. The limit of the tolerable additional error of IPT 5920 for the configuration with TΠ, caused by temperature of its free ends within the range of operating temperatures does not exceed the limit of tolerable basic error.

2.2.6. The area of assigning setting corresponds to the range of measurements.

2.2.7. The limit of the tolerable basic error of signalling actuation does not exceed the limit of tolerable basic error of measured values.

2.2.8. The limit of the tolerable additional error of signalling actuation caused by variation of ambient air from normal to any other one within the limits of operating temperatures for every 10 °C of measured temperature does not exceed 0,5 of the limit of tolerable basic error of signalling actuation.

2.2.9. The maximal resistance of every channel of connection of ИРТ 5920 to TC is 15 Ohm.

2.2.10. The range of the output unified signal depending on configuration of ИРТ 5920 ma be as follows:

- for the mode of conversion 0...5 mA: from 0 до 5,4 mA;
- for the mode of conversion 0...20 mA: от 0 до 21,5 mA;
- for the mode of conversion 4...20 mA: from 3,5 to 21,5 mA.

2.2.11. The limit of the tolerable basic error of Integrated Measuring Converter, is equal to $\pm(k \gamma_0 + 0,2)\%$,

where γ_0 – the limit of the basic reduced error from the tables 2.2, 2.3,

k – coefficient, equal to the ration of the range of measurements to the conversion range of Integrated Measuring Converter.

2.2.12. Resistance of the load for Integrated Measuring Converter is not more then:

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

2.2.13. The limit of the tolerable additional error for Integrated Measuring Converter caused by variation of temperature of ambient air from normal to any other one within the limits of operating temperatures for every 10 °C of temperature variation does not exceed 0,5 of the limit of tolerable basic error for Integrated Measuring Converter

2.2.14. The limit of the tolerable additional error for Integrated Measuring Converter caused by variation of load resistance from 0 to the maximal value, provided in the p. 2.2.12, does not exceed 0,5 of the limit of tolerable basic error for Integrated Measuring Converter .

2.2.15. The time of setting of the output signal for Integrated Measuring Converter (time, during which the output signal of Integrated Measuring Converter enters the zone of the limit of tolerable basic error) is not more then 2 sec. during the jump of input signal from 0 to 100% and the number averaging equal to 1.

2.2.16. Maximum current load of every commutation channel is:

- for alternate current of circuit frequency
 - at voltage of 250V up to 5A for a resistive load
 - at voltage of 250V up to 2A for an inductive load ($\cos \varphi \geq 0,4$);
- for direct current:
 - at voltage of 250V up to 0.1 A for resistive and inductive load
 - at voltage of 250V up to 2A A for resistive and inductive load

2.2.17. Hysteresis operation of IPT 5920 asymmetric by settings, is programmable independently for every setting and is regulated within the whole range of measurement.

2.2.18. Output characteristics of the inbuilt voltage stabilizer:

- rated voltage..... +24±0,48 V;
- maximal load current 30 mA.

2.2.19. Power supply of IPT 5920 comes from the mains of alternating current with frequency from 40 to 100Hz within the range from 90 to 249 V, at nominal values of frequency of 50 Hz and voltage of 220V.

2.2.20. Power consumed by IPT 5920 from the alternating current source at rated voltage of mains- does not exceed 7 VA.

2.2.21. Insulation of electrical circuits of power supply and electrical circuits of signaling between themselves and relative to all other circuits of input-output and protective grounding clamp depending on the testing conditions carries during 1 minute an affect of testing voltage of practically sinusoidal form of frequency from 45 to 65 Hz;

- 1500 V at temperature of ambient air (20±5) °C and relative humidity from 30 to 80 %;
- 900 V at relative humidity (90±3) % and at temperature of ambient air (25±3) °C.

2.2.22. Insulation of input and interface electrical circuits between themselves and relative to protective grounding clamp depending on testing conditions carries during 1 minute an affect of testing voltage of practically sinusoidal form of frequency from 45 to 65 Hz;

- 500 V at temperature of ambient air (20±5) °C and relative humidity from 30 to 80 %;
- 300 V at relative humidity (90±3) % and at temperature of ambient air (25±3) °C.

2.2.23. Electric resistance of insulation of current-conducting circuits of IPT 5920 as to its housing and between themselves is not less:

- 20 mOhm at the ambient air temperature of (20 ± 5) °C, and at the relative humidity from 30 up to 80 %;
- 5 mOhm at the ambient air temperature of (50 ± 3) °C and at the relative humidity from 30 up to 80 %;
- 1 mOhm at the relative humidity of (90±3) % and at the ambient air temperature(25±3) °C.

2.2.24. ИРТ 5920 are durable and resistant to ambient air temperature from minus 10 up to +50°C.

2.2.25. ИРТ 5920 are durable and resistant to effect of humidity up to 95 % at the temperature of 35°C

2.2.26. ИРТ 5920 are durable and resistant to effect of ambient air temperature from minus 40 to plus 70 °C.

2.2.27. ИРТ 5920 in transport tare are resistant to effect of vibration shocks with a number of shocks equal to 80 per minute, with quadric value of acceleration shock 98 m/s^2 and exposure duration of 1 hour.

2.2.28. ИРТ 5920 are durable and resistant to effect of sinusoidal vibration within the range of frequencies from 1 to 100 Hz at the amplitude of vibro - acceleration of 20 m/s^2 .

2.2.29. ИРТ 5920 are durable and resistant to impact of single mechanical shocks with a peak shock acceleration of 20 m/s^2 with duration of shock pulse from 2 to 20ms and the total number of shocks equal to 30.

2.2.30. ИРТ 5920 are durable and resistant to impact of multiple mechanical shocks with a peak shock acceleration of 30 m/s^2 and with a preferable operation duration of shock acceleration of 10 ms (permitted duration - from 2 to 20 ms) and the number of shocks in every direction equal to 20.

2.2.31. In accordance with State Standards P 50746-2000 ИРТ 5920 are resistant to electromagnetic interferences, provided in the table 2.1.

2.2.32. Overall dimension, mm, no more:

front panel	96 x 48;
assembly depth including connectors	120;
slot in the panel	88 x 46;
maximum panel thickness	10.

2.2.33. Mass, kg, is not more than 0,4.

2.3. Design and operation

2.3.1. IPT 5920 comprises:

- commutation and power supply unit with pulse voltage stabilizer (with a galvanic separation from the circuit) with three relays of signaling channels and power supply source of 24 V;
- unit of analog-digital converter module (ADC) with a module of current output (Integrated Measuring Converter) and interface module RS 232C or RS 232 or RS 485;
- indication and control unit with an operation keyboard ;

2.3.1.1. Commutation and power supply unit provides power supply of all units of IPT 5920, it also carry out commutation of all signaling channels and provides power supply of 24V to external devices.

2.3.1.2. ADC module measures the values of input signals and make their conversion (scaling, square – rooting, linearization), managing indication, interrogating a keyboard, it controls actuation relay and Integrated Measuring Converter, it also makes connection to a computer via interface.

2.3.1.3 Integrated Measuring Converter module converts the code of measured signal coming from the microcontroller via photon-coupled decoupling into output current , the value of which may variate within the limits:

- from 0 to 5,4 mA for the range - 0...5 mA, at $R_{H\text{ макс}} = 2 \text{ kOhm}$;
- from 0 до 21,5 mA for the range - 4...20 mA, at $R_{H\text{ макс}} = 0,5 \text{ kOhm}$;
- from 3,5 до 21,5 mA for the range - 0...20 mA, at $R_{H\text{ макс}} = 0,5 \text{ kOhm}$;

Switching of ranges 0...5 and 0...20 mA is performed with the aid of a switch , which is accessible from the rare panel of IPT 5920. At the same time the parameter «IOdP»of the IPT 5920 menu should be equal to 1.

The range of 4...20 mA is set only at the position of the switch «20 mA» in the parameter «IOdP» = 2.

Attention! *It is prohibited to install the switch in the position «5 mA» at the set parameter «IodP» = 2.*

2.3.1.4. Indication and control unit with a keyboard contains a seven-segment LED indicators, three light diodes, and three control buttons.

2.3.1.5. Unit of interface RS 232 or RS 485 is used for connection to a computer of 1 to 100 IPT 5920 which may be united into a network by means of certain interfaces. Interface RS 232C is used for connecting to a PC using the circuit «point – point» and does not support network operation of instruments, meanwhile a standard zero-modem cable may be used.

The circuit of connection of IPT 5920 to PC is presented in the picture Б.1, Б2, Б3 of the appendix Б.

2.3.2. On the front panel of IPT 5920 5320H the following is located:

- the main CD seven-segment indicator with 14 mm symbol height
 - 4-digit red luminescence for IPT 5920H;
 - 5 – digit green luminescence for IPT 5920H;
- additional 4 digit seven-segment CD indicator of red luminescence with 8 mm symbol height;
- indicator K1- a singular CD indicator of the 1st signaling channel actuation;
- indicator K2- a singular CD indicator of the 2nd signaling channel actuation;
- indicator K3- a singular CD indicator of the 3rd signaling channel actuation;
- key «↵» - the key for input;
- key «>» - the forward key;
- key «<» - the backward key.

2.3.2.1. In the measurement mode on the indicator the current value of a measured parameter is indicated. Digital values are displayed in the indicator with a preset number of digits after comma. In the indicator is also displayed information on breaking of a primary converter, exceeding by an input signal of preset limits of the range of a measured parameter lack of access to changing of the device parameters, report on errors. Brightness of luminescence may be changed with the help of the program “Tuning of the instruments of IPT 5900 and ИПМ 0399 series”.

2.3.2.2. In the programming mode on the main indicator there are values of set parameters displayed mnemonics of which is lit on the additional indicator.

2.3.2.3. Indicators K1, K2, K3 reflect the state of relay of commuted channels of signalization. The lighted indicators inform about switched on state of relay.

2.3.2.4. The key «↵» is designed for entering the mode of value setting and parameter values setting of configuration and input (recording) of revised values into memory of IPT 5920. After entering the mode of assigning the selected parameter the current digital value of this parameter is blinking and after input (recording) of the last one, blinking stops.

2.3.2.5. The key «>» is designed for scanning (selection) of settings (towards increase of their numbers) in the measuring and programming mode, for input (output) in the programming mode of parameters of instrument configuration jointly with the key «<» for selection of the parameter of configuration (in the direction forward) when programming the instrument.

2.3.2.6. The key «<» is designed for scanning (selection) of settings (towards decrease of their numbers) in the measuring and programming mode, for input (output) in the programming mode of parameters of instrument configuration jointly with the key «>» for selection of the parameter of configuration (in the direction backward) when programming the instrument.

2.3.3. On the rare panel of IPT 5920 there are:

- clasp connector block for connection of circuit power supply, commutation circuits, primary converters, current loads, interface cables;
- switches of range of Integrated Measuring Converter output signal;
- protective grounding clasps

2.4. Setting of configuration parameters (manual mode)

Attention! *It is not allowed during setting of instrument configuration in manual mode with the help of control menu to operate the instrument by computer interface by means of tuning program.*

2.4.1. IPT 5920 configuration parameters with their possible meanings in the order of their appearance on the indicator is presented in the table 2.4.

The list of configuration parameters has a two-level structure. The upper level – menu and the lower level- submenu. Submenu has got the parameters: «rL1>», «rL2>» and «rL3>», determining logics of relay operation.

2.4.2. In order to enter the mode of configuration setting – press simultaneously keys «<>» and «>>». On the additional indicator there appears one of the two names of the current parameter, namely: «PrUE» - permission of settings programing or «PASS» - password input.

2.4.3. When a query for password input appears - «PASS», on the main indicator there appears a blinking zero. By the key «<>» or «>>» set the password and press the key «↵». Parameter «PrUE» will appear on the additional indicator.

Notes – In case of a wrong input of a password attempts to change IPT 5920 configuration will be blocked after error indication – «Acde» (access denied).

2.4.4. In case of appearing of «PrUE» parameter equal to «0», set its value to be one. For this purpose press the key «↵», the value of the parameter will start blinking. Using the key «<>» or «>>» select 1 and press the key «↵».

2.4.5. Using the key «<>» or «>>» select the required parameter from the menu on the additional indicator. On the main indicator the value of the selected parameters will be displayed.

2.4.6. Press the key «↵».

2.4.6.1. The value of the parameter will start blinking (except for the value «Sub»).

Using the key «<>» or «>>» change the value of menu parameter for the required one and press again the key «↵».

2.4.6.2. The value «Sub» denotes entering submenu of parameters «rL1>», «rL2>» and «rL3>».

Using the key «<» or «>» select the required parameter of the submenu (except for «rEtU»), press the key «↵». The value of the submenu parameter will start blinking.

Using the key «<» or «>» change the value of submenu parameter for the required one and press again the key «↵».

2.4.6.3. To quit submenu select the parameter «rEtU» and press the key «↵». On the additional indicator there will appear the value «Sub». After that you may continue to program menu parameters (see. par. 2.4.5).

2.4.7. Exit form the mode of configuration setting of IPT 5920 is performed by two methods - either by simultaneously pressing keys «<» and «>», or by input of the command «rEtU» (on the additional indicator) by means of the key «↵».

Notes – Factory (initial) setting of IPT 5920 parameters corresponds to the table 2.4

2.5. Assigning of IMC parameters

2.5.1. Setting of the range of the output unified signal of Integrated Measuring Converter is performed according to the table 2.6 and paragraph 2.3.1.3.

2.5.2. The range of output unified signal of Integrated Measuring Converter should be less or equal to the range of instrument measurements, at the same time the error of the current output is determined according to the paragraph 2.2.11.

2.5.3. For setting of the converse characteristic of the current output the «IoLo» parameter should be larger than «IoHi parameter».

Table 2.6

IMC range	Menu parameter «IOdP»	Position of the range selector
0...5 mA	1	5 mA
0...20 mA	1	20 mA
4...20 mA	2	20 mA

2.6. Assigning of setting values

2.6.1. Press the key «>». On the additional indicator will be displayed the symbol of the first setting – «US_1», and on the main indicator will be displayed its value. Press the key «↵», the value of the setting shall start blinking. Using keys «<» and «>» set the required value of the setting and press the key «↵».

2.6.2. After that, using the key «>» select the second setting – «US_2». Set the required value according to paragraph 2.6.1.

2.6.3. After that, using «>» select the third setting – «US_3». Set the required value according to paragraph 2.6.1.

2.6.4. Press the key «>», IPT 5920 will change into measuring mode.

2.6.5. Transition from the setting «US_3» to settings «US_2» and «US_1» may be performed by pressing the key «<». Subsequent pressing of the key«<>» will return IPT 5920 into measuring mode.

- Notes:
- 1 Factory (primary) value of settings – zero.
 - 2 For programing of settings the parameter «PrUE» - the permission of settings programing should be equal to one.

2.7. Internal calibration

2.7.1. Internal calibrations of IPT 5920 which may be performed in an autonomous mode are as follows:

- calibration of the communication line resistance in case of a double wire circuit of TC connection;
- calibration of the compensator of the cold end when using TII (besides TII type of IIP(B) with the range of measurement 300...1800 °C).

2.7.1.1. Calibration of resistance of communication line in case of a double wire circuit of TC connection:

- connect TC to clamps K1, K3. Clamps K2 and K4 should be short-circuited (see the picture A.1 of the appendix A);
- switch on IPT 5920. Enter the mode of configuration programing and set corresponding type of primary thermo-converter (see paragraph 2.4);
- short circuit the TC clamps;
- select parameter «Lc» and enter its value equal to «0» - double wire circuit of TC connection.

Note – If the parameter «Lc» in the configuration menu is lacking, it is necessary to check the given type of primary converter and set the correct one.

- select the parameter «rL» and press the key «↵». On the main indicator the «CLbr» - graduation will be displayed. After completing graduation on the main indicator will be displayed the value of resistance of double-wire connection line of TC to IPT 5920.

2.7.1.2. Calibration of the cold end compensator when using TII:

- connect TII to clamps K1, K2 and place it into ice- water mixture;
- connect compensator to clamps K3, K4;
- switch on IPT 5920. Enter the mode of configuration programing. Enter the mode of configuration programing. Set the required type of primary converter, select parameter «rc0» and press the key «↵». On the main indicator «CLbr» - calibration will be displayed;
- after a few seconds on the main indicator provisional value of compensator resistance Rc will be displayed (thermal equilibrium is not attained yet) , that will be automatically taken into account when measuring;
- exit the programing mode into measuring mode and wait for thermal equilibrium: temperature gradient should not exceed 0,3 °C/min;

- enter programming mode again, select the parameter «rc0» and press the key «↵»;
- after accomplishing graduation (on the main indicator – the value Rc in conditions of thermal equilibrium) exit from the mode of programming. IPT 5920 is ready for operation.

2.8. Error reporting

2.8.1. In case of malfunctioning and faults of IPT 5920 on the additional indicator appears a message about an error – «Err», and on the main indicator – the name of the occurred error. Possible error messages:

“**AcdE**“ – no right of admission to for changing parameters and settings of IPT 5920.

This error is caused by entering the wrong password. Enter the correct password. If the password is not correct (forgotten), it is necessary to enter the new password using the computer program « Adjustment of the instruments of series IPT 5900 and ИПМ 0399».

“**EEPr**“ – error of ППЗУ of IPT 5920. It is possible that PROM is out of order, or there are wrong data in PROM. It is necessary to switch IPT 5920 on again. If the error does not disappear, the data in PROM may be rehabilitated via the computer program if there is an extra reserve copy of PROM data available.

“**Cut**” – open-circuit fault of an input circuit. This message appears during breaking of connections of TC or TII with outputs of IPT 5920. It is necessary to rehabilitate the connections of primary converters.

“**nrдY**” – data of ADC are not ready. This message always appears when IPT 5920 is switched on. The message is lighted during the time that is proportionate to the number of averagings of value of measured signal (from several to tens of seconds), after that it disappears.

“**brdr**” – overrunning the limits of the range. The message appears:

- when the measured signal from TII and TC overruns the limits of the measurement range;
- when the measured signal in the form of value resistance overruns 320 Ohm;
- when the measured signal in the form of direct current overruns the limits of the range.
- (-0,2...6) mA - for the signal 0..5 mA;
- (-0,2...22) mA – for the signal 0...20 mA;
- (2,5....22) mA – for the signal 4...20 mA.

After return of the signal in the measurement range the error report remains of the indicator for not more than 10 seconds.

“**AdC**” – no communication with ADC. Perhaps ADC is out of order or the connection of ADC controller with the device control unit.

2.9. Special operation features.

2.9.1. Setting (changing) of numeric values of parameters is performed by keys «<>» and «>>» in two modes: step-by-step and scanning.

Step-by-step mode – single pressing and releasing of the key as a result of that the value of parameter is changed for one unit of lower order bit.

Scanning mode – changing of parameter value by keeping the key pressed. While keeping the key pressed the variation of the value is performed bit-by-bit, starting from the lower order bit and completing with the high-order bit. At the same time, the value of every order is changed for ten units, starting from the current value. After changing the value of the current order for ten units the transition to scanning of the next high-order bit takes place.

Scanning is stopped:

- when the key is released;
- when the upper limiting value (9999) or lower limiting value (-1999) of the numerical range is reached;
- when the decimal point is passed.

Notes – For speedup of setting of required parameter value it is recommended to reduce the number of symbols after comma, by changing the value of the parameter «UF».

After accomplishing of scanning the new value starts blinking. Press the key «↵» for recording of renewed value into memory of IPT 5922.

2.9.2. Number of measurements for averaging of the input signal «nSU» – is the parameter, allowing to reduce noise of measured signal. When setting this parameter it is necessary to take into account, that the time of setting of measured value is equal to $nSU \times 1 \text{ sec}$. Besides, when switching on power supply of IPT 5920 or after elimination of input circuits short circuiting, the process of relay control starts after $nSU \times 1 \text{ sec}$. For IPT 5920HM we recommend to reduce noise to set the parameter «nSU» equal to 3.

2.9.3. IPT 5920 retains all current parameters of configuration and their values in case of disappearance of supply voltage in the circuit. For example, if the power supply stopped during parameters programming, the renewed values shall be retained without exiting the programming mode. In case of voltage interruption during the instrument programming, after voltage appears again it is necessary to perform a correct exit from the programming mode with the aid of the keyboard, via the menu «rEtU», or by simultaneous pressing the keys «<>» and «>>».

2.9.4. When determining the password, the value of the password set in the menu - «PSS2» should be analogous to the value set in the menu «PSS1».

2.10. Marking and sealing

2.10.1. Marking corresponds to State Standards 26828-86 E, State Standards 9181-74 E, State Standards 12.2.020-76 and the drawing НКГЖ.411618-08СБ for 5320Н, НКГЖ. 411618.004-08.01СБ for ИРТ 5920НМ.

2.10.2. ИРТ 5920 is sealed by a production control department representative of the manufacturer.

2.11. Packaging

2.11.1. Packaging is performed in accordance with State Standards 23170-78 E, State Standards 9181-74 E and it secures an absolute safety of ИРТ 5920.

3. THE USE OF THE DEVICE ACCORDING TO ITS FUNCTION.

3.1. Preparation of the device for operation

3.1.1. Safety regulations.

3.1.1.1. Considering the system of the electrical shock protection for people ИРТ 5920 corresponds to class I according to State Standards 12.2.007.0-75.

3.1.1.2. ИРТ 5920 has protective grounding terminals pursuant to State Standards 12.2.007.0-75.

3.1.1.3. Primary converters, output circuits interface circuits, signaling power supply circuits are to be connected according to marking, when supply voltage is switched off.

Attention! Connection to terminal blocks ИРТ 5920 should be performed by single wire or by bundled-wire with a soldered tip.

3.1.1.4. ИРТ 5920 is a fire-safe device, a possibility of fire in ИРТ 5920 is equal to 10^{-6} during a year period of time according to State Standards 12.1.004-85, that is in case of any malfunctions in ИРТ 5920 itself as well as in outside electrical circuits, connected to it, the device is not the cause of fire.

3.1.1.5. During use of ИРТ 5920 it is necessary that the requirements of State Standards 12.3.019-80, НП-001-97 (ОПБ-88/97), ПНАЭ Г - 1 - 024 - 90 (ПБЯ РУ АС-89), “Rules of technical operation of consumer electric installations”, “Safety standards during use of consumer electric installations”, “Rules of electric installations setup”, approved by State energy inspection should be observed.

3.1.2. External inspection

3.1.2.1. During the external examination the absence of mechanical damages, accuracy of marking and completeness of the set should be checked.

In case surface defects, which may influence working capacity of ИРТ 5920, or inadequacy of completeness, or of marking are found, the possibility of further use of ИРТ 5920 is to be determined.

3.1.2.2. Every ИРТ 5920 device should be supplied with an inspection checklist.

3.1.3. Device assembly

3.1.3.1. For installation of ИРТ 5920, there should be access to it from the rear side of the panel. Dimensions of the recess in the panel should agree with p.2.2.32.

Assembly order:

- put ИРТ 5920 into the recess in the panel;
- insert brackets into the inlets on the lateral sides of the case;
- attract the front side of ИРТ 5920 to the panel by screws.

Connecting of ИРТ 5920 to power supply, primary converters, switched channels and computer is effected through the terminal blocks, located on the rear panel, in accordance with Appendix A.

Cable laying and termination should be in accordance with the requirements of the current “Rules of electric installations setup”.

3.1.4. Test run

3.1.4.1. For naught checks of ИРТ 5920 configuration with ТС, connect ИКСУ-2000, or a resistance box, for configuration with ТП – ИКСУ-260, or ИКСУ-2000, or place thermo electrical converter into an ice-water mixture.

Set the zero value of temperature for corresponding type ТС or ТП.

3.1.4.2. For ИРТ 5920 configuration with input electric signals in the form of current strength and direct voltage, connect calibrated current and voltage supplies correspondingly to ИКСУ-260 or ИКСУ-2000. Set the value of input signal corresponding to

Set the input signals values, corresponding to the minimal of the conversion range of input unified signal.

3.2. Using the device

3.2.1. Set ИРТ 5920 on the control panel and safely fix it.

3.2.2. Make necessary connections of ИРТ 5920 in accordance with Appendix A.

3.2.3. Make assignment of configuration of ИРТ 5920 and settings according to items 2.4. and 2.6.

3.2.4. To carry out at necessity, internal graduation of ИРТ 5920, according to items 2.7.

Notes – Procedures according to paragraphs 3.2.3 and 3.2.4 may be performed with the help of a computer «Tuning of instruments of series ИРТ 5900 and ИИМ 0399».

4. VERIFICATION TECHNIQUE

4.1. IPT 5920 verification is carried out by State Standardising Authorities or by the authorised Metrological Service of the buyer, authorized to carry out such a verification. Verification requirements, its procedure and main phases are defined by ИП 50.2.006-94 “ГСИ. Measuring devices verification. Organization and procedure”

4.2. The recalibration interval makes two years.

4.3. The present method may be used for calibration of IPT 5920.

4.4. Operations and methods of verification.

4.4.1. When performing verification the following operations are carried out that are presented in the table 4.1.

Table 4.1

№ o/n	Verification operation	Number of item	Obligation of an operation	
			primary verification	periodic verification
1	External examination	item 4.7.1	Yes	Yes
2	Test-run	it. 4.7.2	Yes	Yes
3	Testing of electrical durability of insulation	it. 4.7.3	Yes	No
4	Testing of electrical resistance of insulation	it. 4.7.4	Yes	No
5	Determination of values of basic errors of IPT 5920 by the measured value, intended for operation with a variable configuration	it. 4.7.5.	Yes	Yes
6	Determination of the values of basic errors of IPT 5920 with a specific configuration	it.4.7.6.	Yes	Yes
7	Determination of output characteristics of the integrated voltage source	it.4.7.7.	Yes	Yes
8	Verification results registration	it.4.8.	Yes	Yes

4.4.2. During verification of IPT 5920 basic and auxiliary means are employed, provided in the table 4.2.

Table 4.2

№ o/n	Name of the verification means and designation of HTД	Basic metrological and technical characteristics of verification means
1	Measuring calibrator of unified signals reference ИКСУ-2000 ТУ 4381-031-13282997-00	Range of temperature representation (TC): minus 200...200 °C. Basic error $\pm 0,03$ °C. Range of temperature representation (TC): minus 200...600 °C. Basic error $\pm 0,08$ °C. Range of temperature representation (TII): minus 210...1300 °C. Basic error $\pm 0,3$ °C. Range of temperature representation (TII): plus 1200...2500 °C. Basic error $\pm 2,5$ °C. Range of voltage representation: minus 10...100 mV, 0...12 V. Basic error $\pm (7 \cdot 10^{-5} \cdot U + 3)$ mV, ± 3 mB Range of current representation: 0...25 mA. Basic error $\pm (10^{-4} \cdot I + 1,5)$ mA..
2	Resistors MJIT	MJIT-1-820 Ом $\pm 5\%$
3	Resistors MJIT	MJIT-0,125-470 Ом $\pm 5\%$.
4	Resistors MJIT	MJIT-0,125-1,8 кОм $\pm 5\%$
5	Resistors MJIT Plant for testing electrical safety GPI-745A	Range of output voltages of alternate current of frequency 50 Hz: 100...5000 V
4	Megohmmeter Ф4102/1-1M ТУ 25-7534.005-87	Range of measurement 0...20000 mOhm.
Notes: 1 Manufacturing company of verification means according to item 1 is SPC «ELEMER». 2. All enumerated in the table 4.2 measurement means should have actual verification certificate. 3. It is possible to use newly developed or already used verification means and equipment by its characteristics not inferior to those indicated in the present methods of verification.		

4.5. Safety requirements

4.5.1. During verification the following requirements of safety means should be followed that are provided in documentation for employed verification means and equipment.

4.6. Conditions of verification and preparation for it

4.6.1. During verification the following conditions are observed:

- | | |
|--|-----------------------------------|
| 1) temperature of ambient air, °C | 20 \pm 5; |
| 2) relative air humidity, % | 30...80; |
| 3) atmospheric pressure, kPa (mm merc. column) | 84,0...106,7
(630 \div 800); |
| 4) supply voltage, V | 220 \pm 4,4; |
| 5) mains supply frequency, Hz | 50 \pm 1,0. |

External electrical and magnetic fields should not exist or be far enough not to influence operation of IPT 5920.

Verified IPT 5920 and employed verification means should be protected from shocks, vibration affecting its operation.

4.6.2. Operations, performed with verification means and verified IPT 5920, should correspond to instructions provided in operation documentation.

4.6.3. Prior to verification the following preparation operations are performed:

4.6.3.1. IPT 5920 is kept in conditions provided in items 4.6.1.1), 4.6.1.3) during 4 hours.

4.6.3.2. Verification means are prepared for operation in accordance with operational documentation.

4.7. Verification procedure

4.7.1. External examination of verified IPT 5920 is done according to the item 3.1.2 of the present operation manual.

4.7.2. Testing of verified IPT 5920 consists of testing of its operation ability in accordance with the item 3.1.4 of the present operation manual.

4.7.3. Testing of electrical durability of insulation

Testing of electrical durability of insulation is carried out using the installation GPI-745A.

Testing voltage should be performed gradually, beginning from zero till the testing one during 5-10 sec. Decreasing of voltage till zero should be carried out with the same speed.

Values of testing voltage for different circuits of IPT 5920 are provided in the table 4.3.

Table 4.3

Testing voltage, V	Tested circuits	Numbers of contacts in accordance with the pictures A.1 appendix A, united in groups	
		first	second
1500	Power supply circuit of alternate current, of an electrical circuit of signaling relative to: the clamp of protective grounding of input circuits and output circuit of an integrated power supply source (ИП) of interface circuits (DB-9)	7, 8; 9-17	1,2 3, 4, 5, 6, 18, 19 1-9
	The circuit of power supply of alternate current relative to: electrical signaling circuits	7, 8	9-17
500	The clasp of protective grounding relative to: output circuits and input signals of ИП interface circuits (DB-9)		1, 2 3, 4, 5, 6, 18, 19 1-9
	Interface circuits (DB-9) relative: input circuits and output circuits of ИП	2-7	3, 4, 5, 6, 18, 19 1, 2
	Output circuits relative: input circuits and output circuit ИП	1, 2	3, 4, 5, 6, 18, 19

Insulation is kept under influence of testing voltage within 1 min. After that voltage is gradually reduced till zero, after that the testing installation is switched off.

During verification there should be no disruptions in the surface of flashover insulation. .

4.7.4. Testing of insulation electrical resistance

4.7.4.1. Testing of insulation electrical resistance of IPT 5920 circuits is carried out using mega ohmmeter Ф4102/1-1М or any other instrument for measuring of electrical resistance with operational voltage of direct current of 100 and 500 V.

Readings counting out is carried out 1 minute after voltage application between contacts joined together of the first circuit under testing and connected together contacts of the second circuit under testing in accordance with the table 4.4.

Insulation resistance should be not more than 20 mOhm.

Table 4.4

Testing of voltage , V	Verified circuits	Numbers of contacts corresponding to pictures A.1 of Appendix A, united in groups	
		first	second
500	Power supply circuit of alternate current, electrical circuits of signaling relative to: clamps of protective grounding of input circuits and output circuits of incorporated power supply sources of interface circuits (DB-9)	7, 8; 9-17	1, 2 3, 4, 5, 6, 18, 19 2-7
	Power supply circuit of alternate circuit relative to: electrical signaling circuits	7, 8	9-17
100	Clamp of protective grounding relative to: input circuit and output circuit of incorporated power supply sources of interface circuits (DB-9)		1, 2 3, 4, 5, 6, 18, 19 2-7
	Interface circuits (DB-9) relative to: input circuits and output circuit of incorporated power supply source of input circuits	2-7	3, 4, 5, 6, 18, 19
	Output circuits relative to: input circuits and output circuits of incorporated power supply source	1, 2	3, 4, 5, 6, 18, 19

4.7.5. Determination of values of basic errors of IPT 5920 by measured value, designed for operation with variable configuration.

4.7.5.1. Determination of values of measuring channel of IPT 5920 may be carried out either autonomously (using a keyboard of IPT 5920 for its configuration and IPT 5920 indicator for reading data) or with the help of PC (using a keyboard of PC for configuration of IPT 5920 and PC screen for reading data).

For determination of values of basic reduced errors a measuring-calibrator of unified signals standard to ИКСУ-2000 (hereinafter – ИКСУ) is connected to ИРТ 5920, according to the present operation manual and operation manual of ИКСУ-2000.

4.7.5.2. Determination of values of basic errors of ИРТ 5920 when operating with TC is performed at points according to State Standards P 8.625-2006 or State Standards 6651-94, provided in tables 4.5, in the following sequence:

Table 4.5

Type of primary converter	Measuring range, °C	Input parameters			Limits of tolerable basic absolute error by measured value, °C	
		Verified point,				
		°C	Ohm, by State Standards		ИРТ 5920Н	ИРТ 5920НМ
50П	minus 50...200	minus 50	40,00	40,00	± 0,5	± 0,39
		150	79,11	79,11	± 0,5	± 0,39
100П	minus 50...200	150	158,22	158,23	± 0,5	± 0,26
	minus 50...600	550	300,63	300,67	± 1,3	± 0,65

4.7.5.2.1. ИКСУ and verified ИРТ 5920 are switched on and prepared for operation, ИКСУ and ИРТ 5920 is kept in switched on condition not less than 30 minutes.

4.7.5.2.2. ИРТ 5920 is connected to PC, power supply is switched on and the software «Adjustment of instruments of series ИРТ 5920 and ИПМ 0399» is started .

4.7.5.2.3. The following parameters of configuration of ИРТ 5920 are determined (configuration parameters and their designation correspond to item 2.2.2. of the present operation manual):

- type of the primary converter 50П [1,391 (0,00391 °C⁻¹)];
- diagram of TC connection 3-wired
- number of symbols after comma 2;
- number of measurements for averaging 3.

4.7.5.2.4. ИКСУ is switched on, it is prepared for operation in the mode of temperature emulation, corresponding to output signals from TC of 50П type, and it is connected to the input of ИРТ 5920 by a 3-wired circuit.

4.7.5.2.5. With the aid of ИКСУ emulated (actual A_{δ}) temperature value minus 50,0 °C (40,00 Ohm) is set.

4.7.5.2.6. The value of an absolute error ΔA is determined from the formula

$$\Delta A = A_{u3M} - A_{\delta}, \quad (4.1)$$

where A_{u3M} - the measured magnitude of the value in the verified point, read from ИРТ 5920 indicator or at in the window of the program «Adjustment of instruments of the series ИРТ 5900 and ИПМ 0399».

4.7.5.2.7. With the aid of ИКСУ emulated (actual A_{δ}) temperature value equal to 150 °C (79,11 Ohm) is set, and operations from the item 4.7.5.2.6 are repeated.

4.7.5.2.8. The parameters of configuration of ИРТ 5920 are changed, by setting:

- the type of primary converter 100П [1,391 (0,00391 °C⁻¹)];

The values of other parameters should correspond to item 4.7.5.2.3.

4.7.5.2.9. ИКСУ is prepared for operation in the mode of temperature emulation corresponding to input signals from EC of the type 100П.

4.7.5.2.10. In turn, with the aid of ИКСУ emulated (actual A_{θ}) temperature values are set equal to 150 °C [158,23 Ohm (158,22 Ohm)] and 550 °C [300,67 Ohm (300, 63 Ohm)], and operations as in item 4.7.5.2.6 are repeated.

4.7.5.2.11. To control the breaking of an input circuit - ИКСУ is disconnected from ИРТ 5920, on the indicator of ИРТ 5920 there should appear the message «CUt»..

4.7.5.3. Determination of values of basic errors of ИРТ 5920 with input signals in the form of direct current voltage in the range of 0...100 mV and with input signals from ТП is carried out in the verified points provided in the table 4.6, in the following order:

Table 4.6

Input signal	Input parameters			Limits of tolerable basic absolute error by converted value	
	Range of conversion	Verified point			
		mV	A_{θ}	ИРТ 5920H	ИРТ 5920HM
0...100 mV	5...105	0	5	± 0,023	± 0,0115
	minus 10...90	15	5	± 0,060	± 0,03
	minus 45...55	50	5	± 0,089	± 0,0443
	minus 90...10	95	5	± 0,15	± 0,0375

4.7.5.3.1. The following parameters of ИРТ 5920 configuration are set (parameters of configuration and their designation correspond to item 2.2.2 of the present operation manual):

- type of primary converter 0...100 mV;
- number of digits after comma 3;
- function of square rooting none;
- minimum of the range of conversion of input signal 5;
- maximum of the range of conversion of input signal 105;
- number of measurements for averaging 3.

4.7.5.3.2. ИКСУ is prepared in the mode of voltage emulation, voltage equal to 0 mV is set, the operations from the item 4.7.5.2.6. are performed.

4.7.5.3.3. In series ranges of conversion of input signals are changed and values of emulated voltages of ИКСУ are set in accordance with the table 4.6, the operations of the item 4.7.5.2.6 are carried out for every verified point.

4.7.5.4. Determination of the basic errors of IPT 5920 in configuration with unified signals in the form of direct current strength are carried out in verified points provided in the table 4.7, in the following order:

Table 4.7

Input parameters				Limits of tolerable basic absolute error by converted value	
Input signal	Conversion range	Verified point			
		mA	A_0	IPT 5920H	IPT 5920HM
0...5 mA	0...100	0	0	$\pm 0,2$	$\pm 0,05$
		2,5	50	$\pm 0,2$	$\pm 0,05$
		4,75	95	$\pm 0,2$	$\pm 0,05$
4...20 mA	0...100	4	0	$\pm 0,2$	$\pm 0,05$
		12	50	$\pm 0,2$	$\pm 0,05$
		19,2	95	$\pm 0,2$	$\pm 0,05$

4.7.5.4.1. The following parameters of configuration of IPT 5920 are set (configuration parameters and their designation correspond to item 2.2.2 of the present operation manual):

- type of the primary converter 0...5 mA;
- number of digits after comma 3;
- function of square rooting 0;
- the minimum of the range of conversion of an input signal 0;
- the maximum of the range of conversion of the input signal 100;
- number of measurements for averaging 3.

4.7.5.4.2. ИКСУ is prepared in the mode of current emulation, current equal to 0 mA is set, operations described in the item 4.7.5.2.6 are carried out.

4.7.5.4.3. In series The values of emulated currents of ИКСУ and the type of primary converter are set in series in accordance with the table 4.7, the operations envisaged by the item 4.7.5.2.6 are carried out for every verified point.

4.7.5.5. Determination of the values of basic errors of IPT 5920, is performed in points provided in the table 4.8 in the following order:

Table 4.8

Parameters of instrument configuratio				Value of current at output I_0 , mA	Limits of tolerable basic absolute error at output current, mA	
Input signal	Range of conversion of input signal	Range of conversion of IMC	Range of current output		IPT 5920H	IPT 5920HM
0...5 mA	5...5	0...100	0...5 mA	0,25	$\pm 0,01$	$\pm 0,01$
	50...50			2,5	$\pm 0,01$	$\pm 0,01$
	95...95			4,75	$\pm 0,01$	$\pm 0,01$
0...5 mA	0...0	0...100	4..20 mA	4	$\pm 0,032$	$\pm 0,032$
	50...50			12	$\pm 0,032$	$\pm 0,032$
	95...95			19,2	$\pm 0,032$	$\pm 0,032$

4.7.5.5.1. The following parameters of configuration of IPT 5920 are set (configuration parameters and their designation correspond to item 2.2.2 of the present operation manual):

- type of the primary converter 0...5 mA;
- number of digits after comma 3;
- function of square rooting 0;
- the minimum of the range of conversion of an input signal 5;
- the maximum of the range of conversion of the input signal 5;
- number of measurements for averaging 3.
- the minimum of the range of conversion of Integrated Measuring Converter 0;
- the maximum of the range of conversion of Integrated Measuring Converter 100;
- setting of the operation mode of Integrated Measuring Converter 1.

Selector of the range of Integrated Measuring Converter operation is in the position «5 mA».

4.7.5.5.2. To the lead-out wire of verified IPT 5920 the resistive load of 1,8 kOhm \pm 5 %, ИКСУ is connected in series with a load in the mode of current measurement.

4.7.5.5.3. The value of output current Integrated Measuring Converter I_{out} is taken from ИКСУ and the value of absolute error ΔI of current output is determined according to the formula

$$\Delta I = I_{uzm} - I_0, \quad (4.2)$$

4.7.5.5.4. In order by changing conversion range of input signal of primary converter in accordance with the table 4.8, the operation described in the item 4.7.5.5.3 is performed for every verified point for the range of current output 0...5 mA.

4.7.5.5.5. Parameters of IPT 5920 configuration are changed by setting :

- the minimum of the range of conversion of an input signal 0;
- the maximum of the range of conversion of the input signal 0;
- setting of Integrated Measuring Converter operation mode 2.

Selector of the range of Integrated Measuring Converter operation is in the position «20mA».

The values of the rest parameters should correspond to item 4.7.5.5.1.

4.7.5.5.6. Resistive load of 470 Ohm \pm 5 %, is connected to the lead-out wire of verified IPT 5920 and ИКСУ in the mode of current measurement is connected in series with this load.

4.7.5.5.7. In order by changing conversion range of input signal of primary converter in accordance with the table 4.8, the operation described in the item 4.7.5.5.3 is performed for every verified point for the range of current output 4...20 mA.

4.7.6 Determination of values of basic errors of IPT 5920, configured for a certain type of primary converter.

4.7.6.1. For determination of the values of basic reduced errors to IPT 5920 the measuring - calibrator of unified signals standard ИКСУ is connected, in accordance with the present operation manual of IPT 5920H and operation manual for ИКСУ. When Integrated Measuring Converter is present in the verified instrument, to the lead-out wire of the verified IPT 5920 the a resistive load for lead-out wire of 0...20 or 4...20 mA of resistive value - 470 Ohm \pm 5 % and 1,8 kOhm \pm 5 % for lead-out wire of 0...5 mA is connected in series with the load ИКСУ is connected.

4.7.6.2. Determination of values of basic reduced errors of IPT 5920 in TC and ТП configurations is carried out in the points, corresponding to 5, 25, 50, 75, 95 % of measuring range, indicated in the table 2.2. Verification of IPT 5920, operating with TC is performed only by 3-wired circuit. When performing verification of IPT 5920 operating with ТП, it is necessary to perform calibration of compensator of cold end in accordance with item 2.7.1.2 Verification operation is performed in the following sequence:

4.7.6.2.1. ИКСУ and verified IPT 5920 are switched on and prepared to operation, ИКСУ and IPT 5920 are kept in switched on condition during 30 minutes.

4.7.6.2.2. With the aid of ИКСУ emulated (actual A_{θ}) temperature value in degrees is set, equal to 5, 25, 50, 75, 95 % of measuring range.

4.7.6.2.3. The magnitudes of measured value $A_{изм}$ are read from IPT 5920 indicator.

4.7.6.2.4. The values of the basic reduced error of IPT 5920 measurement is determined from the formula

$$\gamma = \frac{(A_{изм} - A_{\theta})}{(A_{ex\ max} - A_{ex\ min})} \times 100\%, \quad (4.2)$$

where $A_{ex\ max}$ - maximum of measurement range, from table 2.2;
 $A_{ex\ min}$ - minimum of measurement range, from table 2.2.

4.7.6.2.5. In emulated points from ИКСУ the value of output current of Integrated Measuring Converter $I_{\theta\text{вых}}$ is taken.

The value of measured temperature is calculated by the value of output current using the formula

$$A_{\theta} = \frac{(I_{\theta\text{вых}} - I_{\theta\text{вых}\ min})}{(I_{\theta\text{вых}\ max} - I_{\theta\text{вых}\ min})} \times (A_{\theta\text{вых}\ max} - A_{\theta\text{вых}\ min}) + A_{\theta\text{вых}\ min}, \quad (4.4)$$

where $I_{\theta\text{вых}}$ - measured value of output current, mA;
 $I_{\theta\text{вых}\ min}$ - minimum of the output current range 0 or 4mA;
 $I_{\theta\text{вых}\ max}$ - maximum of the output current range 5 or 20mA;
 $A_{\theta\text{вых}\ max}$ - maximum of the range of IMC conversion;
 $A_{\theta\text{вых}\ min}$ - minimum of the range of IMC conversion

4.7.6.2.6. The values of the basic reduced error of lead-out wire of ИРТ 5920 for TC and ТП from the formula

$$\gamma_I = \frac{(A_{\text{блх}} - A_{\text{д}})}{(A_{\text{блх max}} - A_{\text{блх min}})} \times 100\% \quad (4.5)$$

4.7.6.2.7. For control of open-circuit fault of the input circuit ИКСУ is disconnected from ИРТ 5920, on the indicator of ИРТ 5920 should appear a message «CUT», the value of the output current for the range of current output of 4...20 mA should be equal to (3,5±0,1) mA.

4.7.6.3. Determination of values of basic reduced errors of ИРТ 5920 in configuration with input unified signals in the form of direct current strength and voltage is performed in the points corresponding to 5, 25, 50, 75, 95 % of the measurement range, provided in the table 2.3, of the verification operation is carried out in the following sequence:

4.7.6.3.1. ИКСУ and verified ИРТ 5920 are switched on and prepared to operation, ИКСУ and ИРТ 5920 are kept in switched on condition during 30 minutes.

4.7.6.3.2. With the aid of ИКСУ emulated (actual $I_{\text{д}}$) value equal to 5, 25, 50, 75, 95 % of the measurement range is set.

4.7.6.3.3. The magnitudes of measured value A_{u3M} are read from ИРТ 5920 indicator.

4.7.6.3.4. The actual value of a measured parameter is calculated from the formula

$$A_{\text{д}} = \frac{(I_{\text{д}} - I_{\text{ex min}})}{(I_{\text{ex max}} - I_{\text{ex min}})} \times (A_{\text{ex max}} - A_{\text{ex min}}) + A_{\text{ex min}}, \quad (4.6)$$

where $A_{\text{д}}$ - actual value of measured parameter;

$I_{\text{д}}$ - actual value of input signal;

$I_{\text{ex min}}$ - minimum of input range;

$I_{\text{ex max}}$ - maximum of input range;

$A_{\text{ex max}}$ - maximum of the conversion range of the input unified signal;

$A_{\text{ex min}}$ - minimum of the conversion range of the input unified signal.

4.7.6.3.5. When the function of square rooting is switched on, the actual value of the measured parameter is calculated from the formula

$$A_{\text{д}} = \sqrt{\frac{(I_{\text{д}} - I_{\text{ex min}})}{(I_{\text{ex max}} - I_{\text{ex min}})}} \times (A_{\text{ex max}} - A_{\text{ex min}}) + A_{\text{ex min}} \quad (4.7)$$

4.7.6.3.6. The values of the basic reduced measurement error of ИРТ 5920 are determined from the formula (4.3).

4.7.6.3.7. In emulated points from ИКСУ the values of output current of ИМС $I_{\text{блх}}$ is taken.

4.7.6.3.8. The actual value of output current is calculated by the formula

$$I_{\text{вых}\delta} = \frac{(A_{\delta} - A_{\text{вых}\min})}{(A_{\text{вых}\max} - A_{\text{вых}\min})} \times (I_{\text{вых}\max} - I_{\text{вых}\min}) + I_{\text{вых}\min} \quad (4.8)$$

where $I_{\text{вых}\delta}$ - calculated value of output current;
 $I_{\text{вых}\min}$ - minimum of output current range 0 or 4 mA;
 $I_{\text{вых}\max}$ - maximum of output current range 5 or 20mA;
 A_{δ} - actual value of measured value (is calculated by the formula (4.6) or (4.7);
 $A_{\text{вых}\max}$ - maximum of the range of conversion of IMC;
 $A_{\text{вых}\min}$ - minimum of the range of conversion of IMC;

4.7.6.3.9. The value of the basic reduced error of current output of ИРТ 5920 is calculated by the formula

$$\gamma_I = \frac{(I_{\text{вых}} - I_{\text{вых}\delta})}{(I_{\text{вых}\max} - I_{\text{вых}\min})} \times 100\% \quad (4.9)$$

where $I_{\text{вых}\max}$ - maximum of the output current range;
 $I_{\text{вых}\min}$ - minimum of the output current range.

4.7.7. Determination of output characteristics of the incorporated power supply source is carried out in the following sequence:

4.7.7.1. ИКСУ is connected to the output of the incorporated power supply source of the verified ИРТ 5920 in the mode of voltage measurement in the range 0...120V.

4.7.7.2. The voltage value of idle run of the incorporated source is measured.

4.7.7.3. The value of the absolute error is determined from the formula

$$\Delta U_{xx} = U_{xx} - U_{\text{ном}} \quad (4.10)$$

where ΔU_{xx} - absolute error in idle run mode;
 $U_{\text{ном}}$ - nominal value of output voltage source, equal to 24;
 U_{xx} - measured value of the idle run voltage.

4.7.7.4. Load resistor of the type МЛТ-1-820 Ohm is connected to the output of the incorporated voltage source of verified ИРТ 5920.

4.7.7.5. The voltage value of the incorporated voltage source under load is measured.

4.7.7.6. The value of the absolute error is determined from the formula

$$\Delta U_{\text{нагр}} = U_{\text{нагр}} - U_{\text{ном}} \quad (4.11)$$

where $\Delta U_{\text{нагр}}$ - absolute error under load ;
 $U_{\text{нагр}}$ - measured value of voltage under load.

4.7.8. Processing of verification results.

4.7.8.1. When verifying IPT 5920, designed for operation with variable configuration, the values of the basic absolute errors by measured value, calculated from the formula (4.1) should not exceed the values provided in tables 4.5, 4.6, 4.7. The values of the basic reduced errors by the current output calculated from the formula 4.2 should not exceed the values indicated in the table 4.8.

4.7.8.2. When verifying IPT 5920, configured for the certain type of a primary converter, when operating with input signals TC and TII the values of basic reduced errors, calculated from the formula (4.3), should not exceed the values provided in the table 2.2.

4.7.8.3. When verifying IPT 5920 with input signals TC and TII, the values of the basic reduced errors of current output calculated from the formula (4.5), should not exceed the value of the error calculated in accordance with the item 2.2.11.

4.7.8.4. When verifying IPT 5920 with a unified input signals, the values of the basic reduced errors, calculated from the formula (4.3), should not exceed the values provided in the table 2.3.

4.7.8.5. When verifying IPT 5920 with a unified input signals, the values of the basic reduced errors of current output, calculated from the formula (4.9), should not exceed the values of error, determined in accordance with the item 2.2.11.

4.7.8.6. When determining the characteristics of an incorporated power supply source, the values of absolute errors, calculated from the formulas (4.10) and (4.11), should not exceed $\pm 0,48V$.

4.8. Registration of verification results

4.8.1. Positive results of IPT 5920 verification, for operation with a variable configuration are registered in the certificate of state standard verification according to ПП 50.2.006-94 or a marking in the registration certificate.

4.8.2. Results of IPT 5920 verification, configured for the certain type of a primary converter, are registered by issuing of a certificate of state standard verification according to ПП 50.2.006-94 or by marking in the registration certificate with specifying the certain verified range.

4.8.3. In case of negative results verification an IPT 5920 is not permitted to be used until the reasons of the fault are determined and it is eliminated.

After elimination of detected faults a second verification is carried out, the results of the second verification – are final.

5. MAINTENANCE SERVICE

5.1. IPT 5920 servicing comes to observing operation, storage and transportation rules, given in the present operation manual, maintenance inspections, periodic verification and repairs.

5.2. Maintenance inspections are carried out according to the rules, established by the organization, using IPT 5920, and they include:

- a) external examination;
- b) checking safety of connection of IPT 5920 communication circuits with the primary converters, power supply source, and commutation channels loads;
- c) performance check, the readings of the instrument approximately coincide with a measured value.

5.3. Periodic verification of IPT 5920 is carried out once in a two-year period, according to the instructions, given in Section 4 of the present operation manual.

5.4. IPT 5920 defects of which cannot be eliminated during the maintenance inspection, or the ones, which have not passed a periodic verification, are liable to a current repair.

Repair of IPT 5920 is performed by manufacturer.

6. STORAGE

6.1. Storage conditions of IPT 5920 packed in shipping container at the manufacturer's storage facilities should meet requirements of I State Standards 15150-69. The air should not contain active agents.

6.2. Stowage of IPT 5920 in storage facilities should ensure easy access to them.

6.3. IPT 5920 should be stored on the racks.

6.4. The space between the walls, the floor of the storage facility and IPT 5920 should not be less than 100mm.

7. TRANSPORTATION.

7.1. IPT 5920 is transportable by all kinds of transport in covered transport facilities. Strapping of package in a transport facility should be carried out according to the current regulations of the corresponding transport facilities.

7.2. IPT 5920 transportation conditions should meet requirements 5 according to State Standards 15150-69 at the ambient temperature from minus 50 to +50°C, and should comply with anti-shock and anti-vibration measures.

7.3. IPT 5920 should be transported parceled or separately.

7.4. If transported in boxes, requirements of State Standards 21929-76. should be observed.

Appendix A

The circuit of electrical connections of IPT 5920H, IPT 5920HM

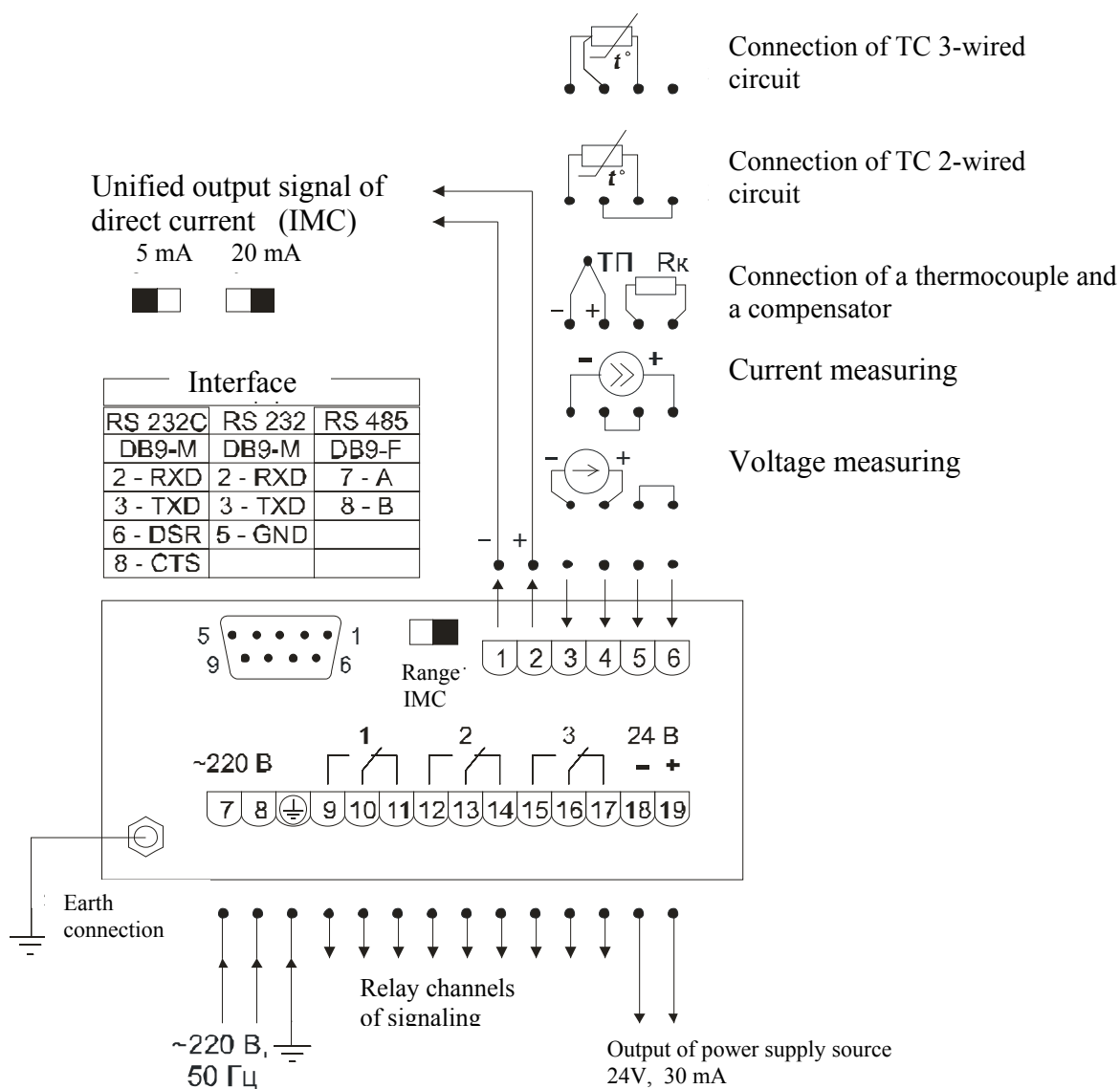
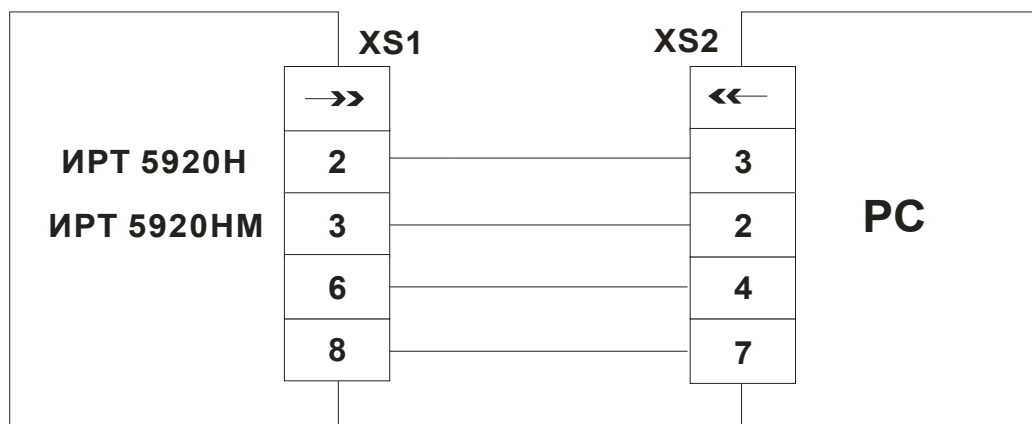


Figure A.1

Appendix Б

The connection circuit of ИРТ 5920Н, ИРТ 5920НМ to PC
using the circuit “point-point” via interface RS 232C

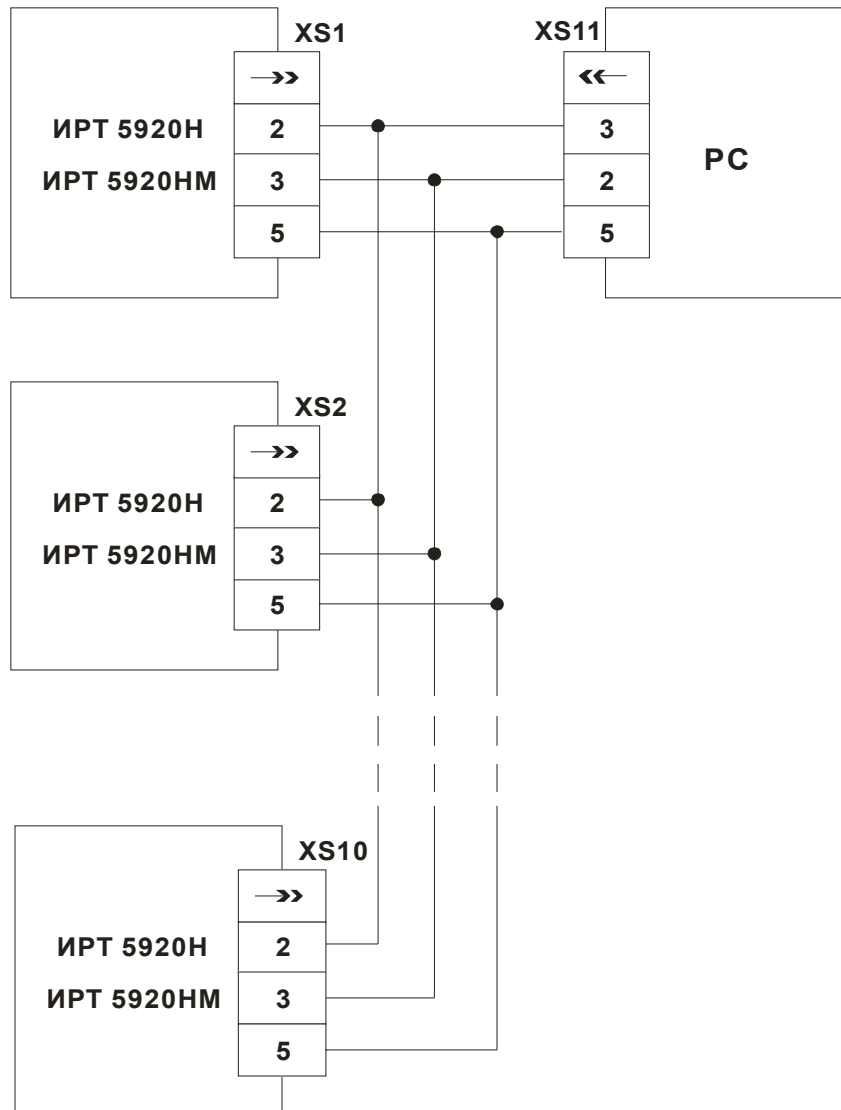


XS1,XS2 – outlet DB-9F

Picture Б.1

Contonuation of the apendix Б

Three- wire circuit of connection of ИРТ 5920Н, ИРТ 5920НМ to PC
via interface RS 232
(up to 10 ИРТ 5920Н, ИРТ 5920НМ with communication line up to 15 m long)

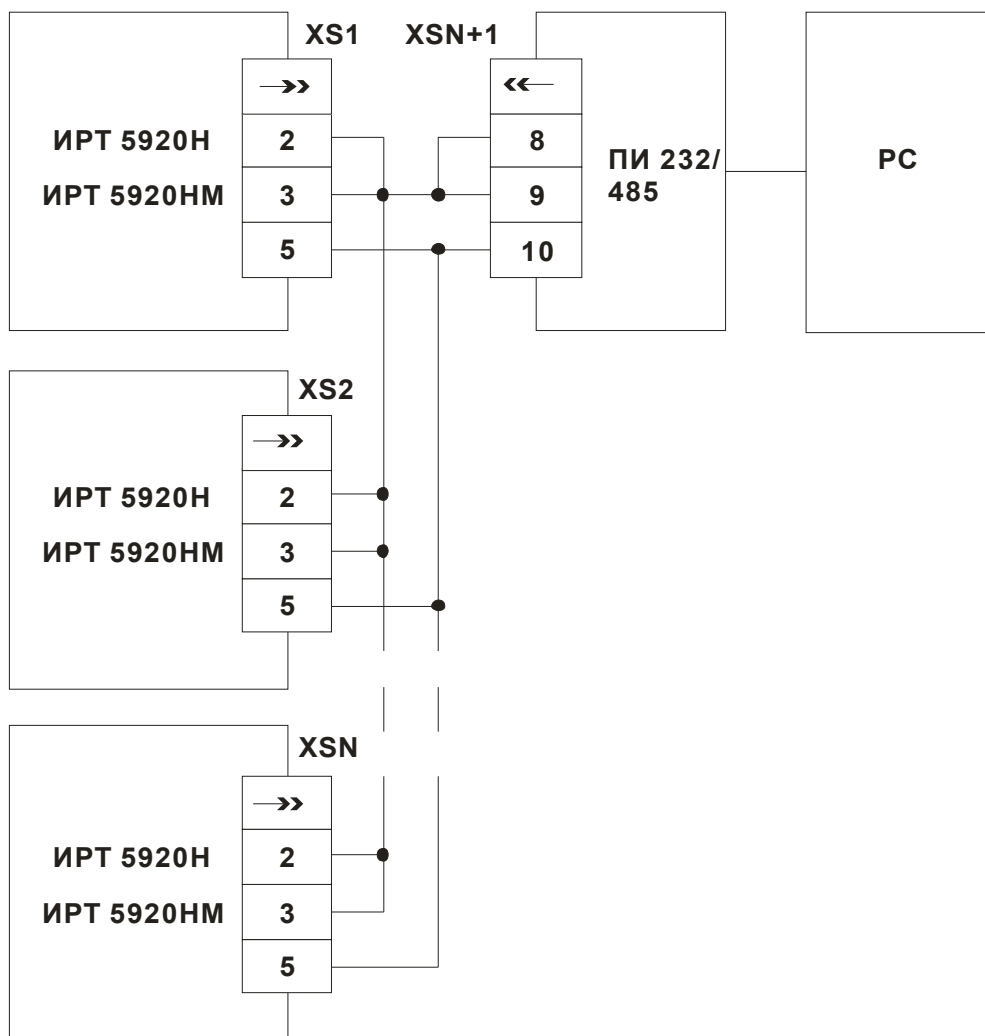


XS1...XS10, XS11 – outlet DB-9F.

Picture Б.2

Continuation of the appendix Б

**Double - wire circuit of connection of ИРТ 5920Н, ИРТ 5920НМ to PC
via interface RS 232
(up to 100 ИРТ 5920Н, ИРТ 5920НМ with communication line up to 1000 m long)**



XS1...XSN – DB-9F.

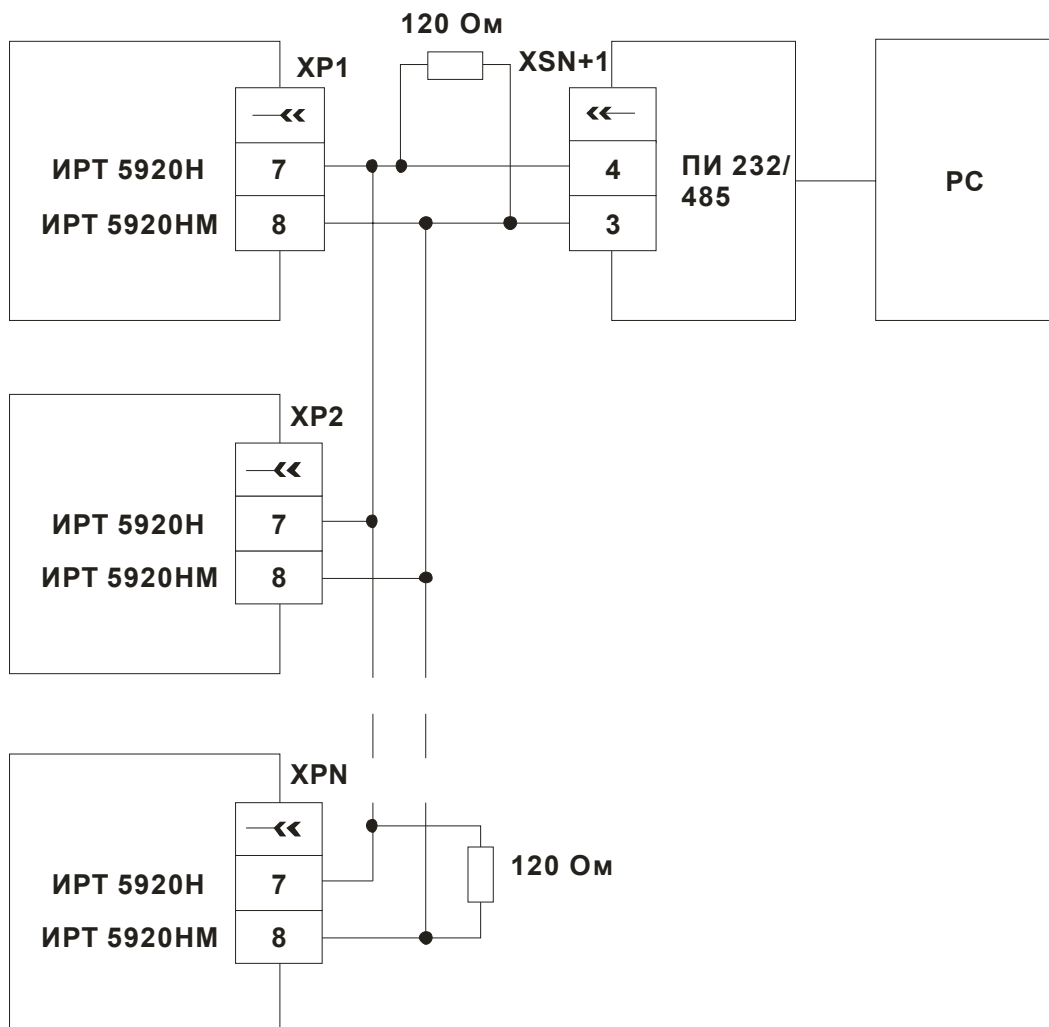
XSN+1 – outlet 2ESDV-10P.

ПИ 232/485 – interface converter produced by SPE «Elemer».

Picture Б.3

Continuation of the appendix Б

Double - wire circuit of connection of ИРТ 5920Н, ИРТ 5920НМ to PC
via interface RS 485
(up to 100 ИРТ 5920Н, ИРТ 5920НМ with communication line up to 1000 m long)



XP1...XPN – outlet DB 9M.

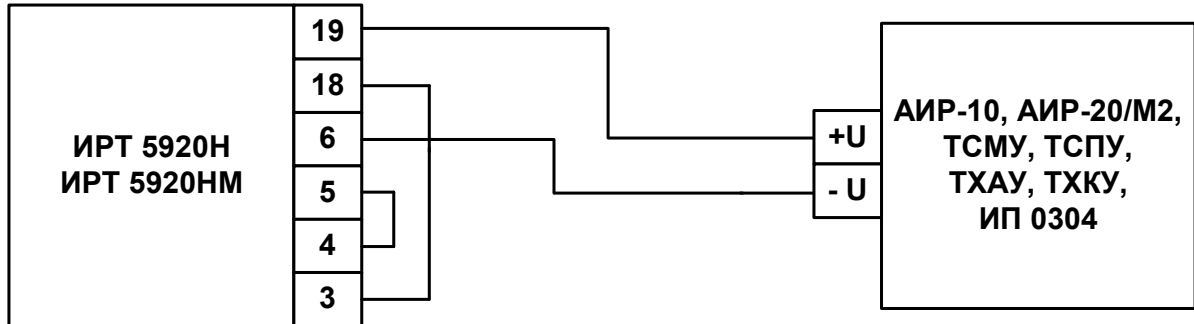
XSN+1 – outlet 2ESDV-10P.

ПИ 232/485 – interface converter manufactured by SPE «Elemer».

Picture Б.4

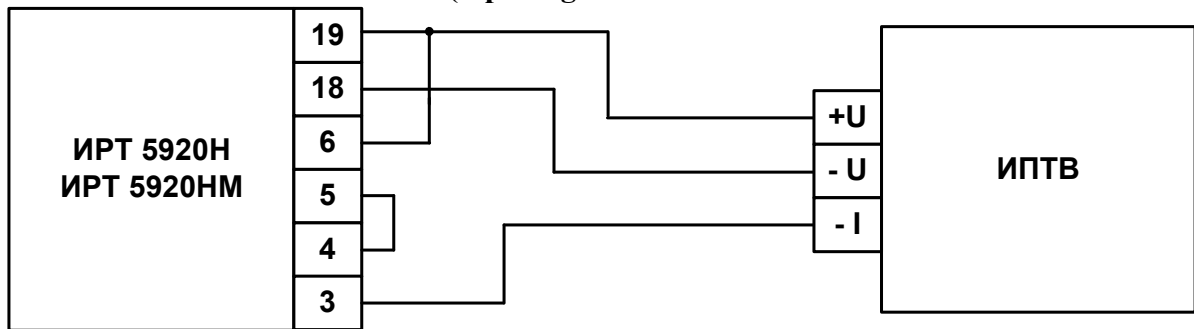
APPENDIX B

**Connection circuit of IPT 5920H, IPT 5920HM to signal converter
by double –wire connection circuit
(input signal 4...20 mA)**



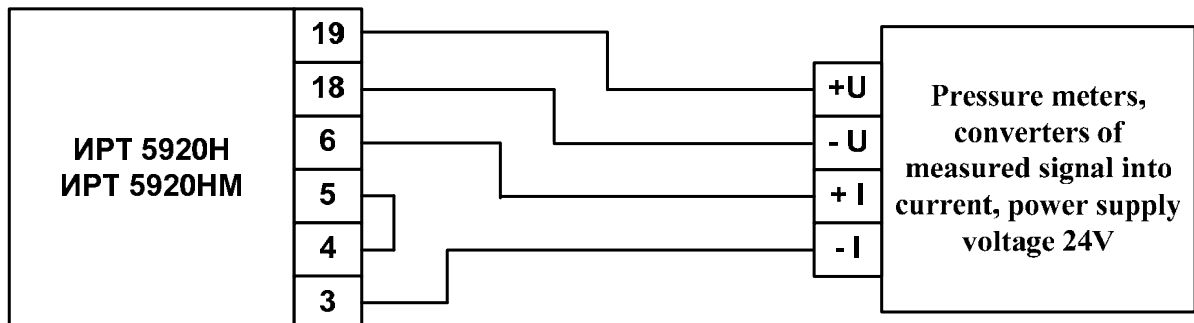
Picture B.1

**Connection circuit of IPT 5920H, IPT 5920HM to signal converter
by three –wire connection circuit
(input signal 0...5 mA)**



Picture B.2

**Connection circuit of IPT 5920H, IPT 5920HM to signal converter
by four –wire connection circuit
(input signal 0...5, 4...20 mA)**



Picture B.3

Appendix Г

An example of designation recording when ordering ИРТ 5920Н, ИРТ 5920НМ

<u>ИРТ 5920</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>
1	2	3	4	5	6	7

1. Type of the instrument (ИРТ 5920Н, ИРТ 5920НМ)
2. Presence of the lead-out wire of IMC (0...5 мА и 4...20 мА) (optional)
3. Type of interface (optional) RS 232 or RS 485
4. Climatic version t1050, t3070 (according to item 2.1.12)

Basic version – t1050

5. Additional stand testing during 360 hours (order index 360 П)
6. State calibration (order index ГП)
7. Designation of technical conditions

Order example

<u>ИРТ 5920Н</u>	<u>–</u>	<u>ИМС</u>	<u>–</u>	<u>RS 232</u>	<u>–</u>	<u>t1050</u>	<u>–</u>	<u>360П</u>	<u>–</u>	<u>ГП</u>	<u>–</u>	<u>ТУ 4210-019-13282997-06</u>
1		2		3		4		5		6		7

