ЭЛЕМЕР

THE RESEARCH AND PRODUCTION ENTERPRISE

SAFE MEANS AND SYSTEMS
OF TECHNOLOGICAL MONOTORING

# TECHNOLOGICAL MEASURING CONTROL

# ИРТ 5320Н, ИРТ 5321Н

**OPERATION MANUAL**

**НКГЖ.405100.001-01РЭ**

Подп. и дата | Инв. № дубл. | Взам. инв. № | Подп. и дата | Инв. № подл.

**CONTENT**

## 1. INTRODUCTION

1.1. Operation manual contains information on design, principle of operation, on characteristics of the technological measuring controls ИРТ 5320Н, ИРТ 5321Н (hereinafter – ИРТ) listed in the table 1.1 and instructions , necessary for safe and correct operation.

Table 1.1

| Modification code | Designation | Installation variants | Design features* |
|---|---|---|---|
| ИРТ 5320Н | НКГЖ.405100.001-01 | Panel | Logic of relay operation:<br>first relay – lowering setting, second relay – setting for increasing and relay operation in case of breaking the circuit of primary converter<br>(Factory setting ) |
| ИРТ 5321Н | НКГЖ.405100.001-03 | | Freely configured logics of relay operation (Factory setting – in accordance with the order) |
| Notes –* It is possible to change configuration of relay operation by means of software. | | | |

## 2. DESCRIPTION AND OPERATION

### 2.1. Function of the device

2.1.1. ИРТ 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 is used in different technological processes of industry.

2.1.3. ИРТ is a microprocessor device, that can be rearranged by a user with a display of a current value of a converted value and it is designed for functioning in autonomous mode.

Review and changing of parameters of ИРТ configuration is performed with the aid of software “Tuning of ИРТ 53 XX” when connecting ИРТ to a computer. Connection of ИРТ and a computer is performed with the aid of interface RS 232C (by the circuit “dot-dot”).

Indication of measured values in ИРТ is performed on the LED display. Indication of settings operation is performed with the aid of single LED indicators. ИРТ performs the control function of reliability of input signals.

2.1.4. ИРТ 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. ИРТ has got two settings.

2.1.6. ИРТ comprises an incorporated voltage source 24 V, designed for power supply of primary converters with a unified input signal of direct current.

2.1.7. In accordance with All-Union State Standard 9736-91 ИРТ belongs to:

- as to the number of converted input signals - single- channel;
- as to the number of signalization channels - two-channel;
- 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 (ТП) or with a linear dependence and with a square-rooting function for a unified input signal.

2.1.8. In accordance with an all-Union State Standard 25804.1-83 ИРТ belongs to:

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

2.1.9. In accordance with an all-Union State Standard 14254-96 the degree of protection from water, dust and hard particles getting inside ИРТ it belongs to:

- front panel IP54;
- body IP20.

2.1.10. According to stability to mechanical effects during operation ИРТ belongs to the execution group M6 by all-Union State Standard 17516.1-90.

2.1.11. In accordance with an all-Union State Standard 12997-84 as to climatic impact resistance during operation ИРТ correspond to:

- production group C3 at the temperature of ambient air from minus 10 up to plus 50 °C (for order index t1050);
- production group C4 at the temperature of ambient air from minus 30 up to plus 50 °C (for order index t3050)*.

2.1.11.1. ИРТ in expert execution steady to influence of temperature of ambient air from minus 30 up to plus 70 °C (for order index t3070).

2.1.12. In accordance with all-Union State Standard P 50746-2000 ИРТ are stable to electromagnetic disturbances, indicated in the table 2.1.

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* by separate order.

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 51317.4.5-99 | Microsecond spikes of large energy(МИП):<br>• amplitude of noise pulse in the circuit input - output (wired - ground) | | ±1 kW | III | A |
| 3 ГОСТ Р 51317.4.5-99 | Microsecond spikes of large energy (МИП):<br>• amplitude of noise pulse in the circuit of power supply | (wire-wire) | ±1kW | III | A |
| | | (wire-ground) | ±2 kW | III | |
| 3 ГОСТ Р 51317.4.4-99 | Nanosecond spikes (НИП):<br>• amplitude of noise pulse in the circuit input- output | | ±1kW | III | A |
| 3 ГОСТ Р 51317.4.4-99 | Nanosecond spikes (НИП):<br>• amplitude of noise pulse in the power supply circuit in the circuit ~220 V | | ±2 kW | III | A |
| 3 ГОСТ Р 51317.4.2-99 | Electrostatic discharges:<br>• contact discharge | | ±6 kW | III | A |
| | • air discharge | | ±8 kW | III | A |
| 4 ГОСТ Р 50648-94 | Magnetic field of mains frequency<br>Long magnetic field | | 30 A/m | III | A |
| 4 ГОСТ Р 50648-94 | Magnetic field of mains frequency<br>Short magnetic field 3sec | | 400 A/m | III | A |
| 3 ГОСТ Р 51317.4.3-99 | Radio-frequency electromagnetic fields in frequency band 80-1000 mHz | | 10 V/m | IV | A* (0,3 %) |
| 2 ГОСТ Р 51317.4.6-99 | Conductive interferences in frequency band 0,15-80 mHz:<br>• circuits input - output | | 3 V | II | A |
| | • frequencies of power supply in the circuit ~220 V | | 3 V | II | A |
| 3 ГОСТ Р 51317.4.6-99 | Conductive interferences in frequency band 0,15-80 mHz:<br>• circuits input- output | | 10 V | III | A |
| | • power supply circuits in the circuit ~220 V | | 10 V | III | A* (0,4 %) |
| 3 ГОСТ Р 51317.4.11-99 | Dynamic voltage changes of power supply<br>• brownouts<br>• interruptions<br>• power surge | | 1000ms/70%U<br>100ms/0%U<br>1000ms/120%U | III | A |
| ГОСТ Р 51318.22-99 | • Emission of man-made noise in the frequency band 30-230 mHz in surrounding ambient space | | 40 dB | – | Correspondent for TC** grade A*** |
| ГОСТ Р 51318.22-99 | • Emission of man-made noise in the frequency band 230-1000 mHz in surrounding ambient space | | 47 dB | – | |

Notes

1 * Auxiliary error during influence of interferences does not exceed 0,3 % (0,4 %) from maximum value of output signal .

2 ** ТС – technical means.

3 *** Grade A – category of equipment of equipment by State Standards Р 51318.22-99.

4 ИРТ 5320Н, ИРТ 5321Н 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 5320Н, ИРТ 5321Н 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 ИРТ 5320Н, ИРТ 5321Н correspond to the ones provided in the tables 2.2 and 2.3.

Table 2.2 – ИРТ 5320Н, ИРТ 5321Н 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 (ТП) according to the State Standards P 8.585-2001

| Type of primary Converter | $W_{100}$** ($\alpha$, ºC$^{-1}$)*** | Range of measurements, °C | Input parameters | | | Limits of tolerable basic reduced error $\gamma_0$, % |
|---|---|---|---|---|---|---|
| | | | by НСХ | | Input Resistance, kOhm | |
| | | | Resistance, Ohm | т.э.д.с., мV | | |
| 50М | 1,4280** | -50…+200 | 39,23…92,78 | - | - | ±(0,25 + *) |
| 53М(Гр 23) | | | 41,58…98,34 | | | |
| 50М | (0,00428)*** | | 39,23…92,8 | | | |
| 50М | 1,4260** | | 39,35…92,62 | | | |
| 53М(Гр 23) | | | 41,71…98,17 | | | |
| 50П | 1,3910** | | 40,00…88,53 | | | |
| 50П | (0,00391)*** | | 40,00…88,52 | | | |
| 100М | 1,4280** | -50…+200 | 78,45…185,55 | | | |
| 100М | (0,00428)*** | | 78,46…185,60 | | | |
| 100М | 1,4260** | | 78,69…185,23 | | | |
| 100П | 1,3910** | | 80,00…177,05 | | | |
| 100П | (0,00391)*** | | 80,00…177,04 | | | |
| Pt100 | 1,3850** | | 80,31…175,86 | | | |
| Pt100 | (0,00385)*** | | | | | |
| 50П | 1,3910** | -50…+600**** | 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 | ±(0,5 + *) |
| ТХК(L) | | -50…+600 | | -3,005…49,108 | | |
| ТХА(K) | | -50…+1300 | | -1,889…52,410 | | |
| ТПП(S) | | 0…+1700 | | 0…17,947 | | |
| ТПП(R) | | 0…+1700 | | 0…20,222 | | |
| ТПР(B) | | +300…+1800 | | 0,431…13,591 | | |
| ТВР(A-1) | | 0…+2500 | | 0…33,640 | | |
| ТНН(N) | | -50…1300 | | -1,268…47,513 | | |
| ТМК(T) | | -50…400 | | -1,819…20,872 | | |

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 °C.

Table 2.3 – ИРТ 5320Н, ИРТ 5321Н for configuration with input electrical signals in the form of strength, voltage of constant current

| Input signal | Measurement range for the dependence of measured value on an input signal | | Input parameters | | Limits of tolerable basic reduced error $\gamma_0$, % |
|---|---|---|---|---|---|
| | | | Input resistance , kOhm | | |
| | linear | With the function of square rooting | not less than | not more than | |
| Current | 0…5 мА | 0,05…5 мА | - | 0,01 | ±(0,25 + *) |
| | 0…20 мА | 0,2…20 мА | | | |
| | 4…20 мА | 4,16…20 мА | | | |
| Voltage | 0…75 мВ | 0,75…75 мВ | 100 | - | |
| | 0…100 мВ | 1…100 мВ | | | |
| | 0…10 В** | 0,1…10 В** | | | |
| NOTES<br>1 * One unit of the last order, indicated in percentage from the measurement range<br>2 ** By a separate order. | | | | | |

2.2.2. The time of operational mode setting is not more than 30 minutes.

2.2.3. The limit of the tolerable additional error of ИРТ by measurement does not exceed 0.2 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 2.1.11;
- when increased humidity is present up to 95% at 35 °C;
- when power supply voltage varies from nominal (220V, 50 Hz) in the range from 90 to 249V, 50 Hz.

2.2.4. The limit of the tolerable additional error of ИРТ for the configuration with ТП, caused by temperature of its free ends within the range of operating temperatures does not exceed 0.2 of the limit of tolerable basic error

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

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

2.2.7. 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 10º C of measured temperature does not exceed 0,2 of the limit of tolerable basic error of signalling actuation

2.2.8. Maximum resistance of every wire of connection of ИРТ to ТС – is 15 Ohm.

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

2.2.10. Output characteristics of the inbuilt voltage stabilizer:

- rated voltage…….. +(24±0,48) V;
- maximal load current ……..…… 25 mA.

2.2.11. Power supply of ИРТ 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.

2.2.12. Power consumed by ИРТ from the alternating current source at rated voltage of mains- does not exceed 5 VA.

2.2.13. 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.

2.2.14. 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.

2.2.15. Electric resistance of insulation of current-conducting circuits of ИРТ 5922А as to its housing and between themselves is not less:

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

2.2.16. ИРТ are durable and resistant to ambient air temperature from minus 10 up to plus 50 ºС, from minus 30 up to plus 50 ºС and from minus 30 up to plus 70 ºС correspondingly.

2.2.17. ИРТ are durable and resistant to effect of humidity up to 95 % at the temperature of 35 ºС.

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

2.2.19. ИРТ 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.

2.2.20. ИРТ 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 $m/s^2$.

2.2.21. ИРТ 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.

2.2.22. ИРТ 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.

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

2.2.24. Overall dimension, mm, no more:

- front panel 96x48;
- assembly depth (including connectors) 125;
- slot in the panel 88 x 46;
- maximum panel thickness 10.

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

**2.3. Design and operation**

2.3.1. ИРТ comprises:

- commutation and power supply unit with pulse voltage stabilizer for +25V ( with a galvanic separation from the circuit) with two relays of signaling channels and an interface module RS 232C;
- unit of analog-digital converter module (ADC) with a supply source of +24 V ;
- indication and control unit with an operation keyboard and an encoder;

2.3.1.1. Commutation and power supply unit provides power supply of all units of ИРТ, it also carry out commutation of all signaling channels.

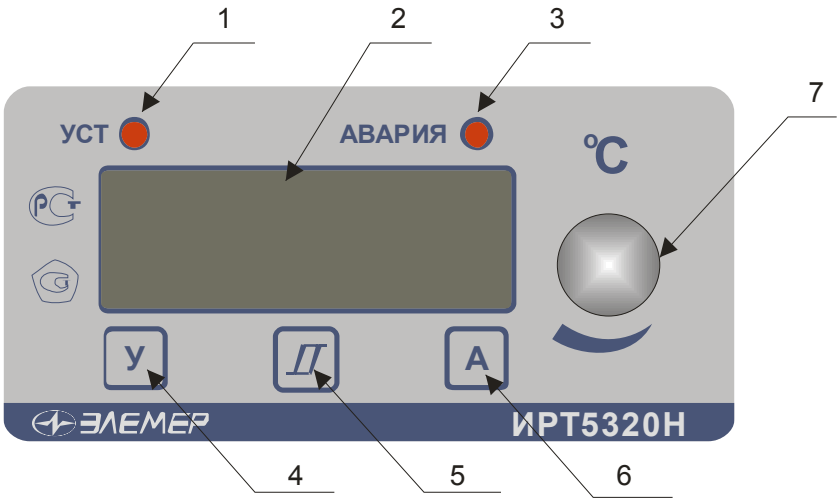
2.3.1.2. ADC module measures the values of input signals and provides 24 V voltage power supply of external devices. The measuring channel and the voltage source have a galvanic couple between each other and a common minus. When using an integrated power supply, connection to ИРТ of primary converters with an output of 4…20 mA, is executed using a double-wire circuit.

2.3.1.3. Indication and control unit performs analysis of the results of measurements, controls indication, interrogates the keyboard, encoder controls the actuating relay and provides connection with a PC via RS 232C.

2.3.1.4. Indication and control unit with a keyboard contains a four-digit LED indicator, two light diodes, three control buttons and an encoder.

2.3.1.5. Interface RS 232C is used for ИРТ configuration when connecting to a PC using the circuit «point – point» and does not support network operation of ИРТ, meanwhile a standard zero-modem cable may be used. The circuit of connection of ИРТ to PC is presented in the picture Б.1 of the appendix Б.

2.3.2. The front panel of ИРТ 5320Н is presented in the picture 2.1.

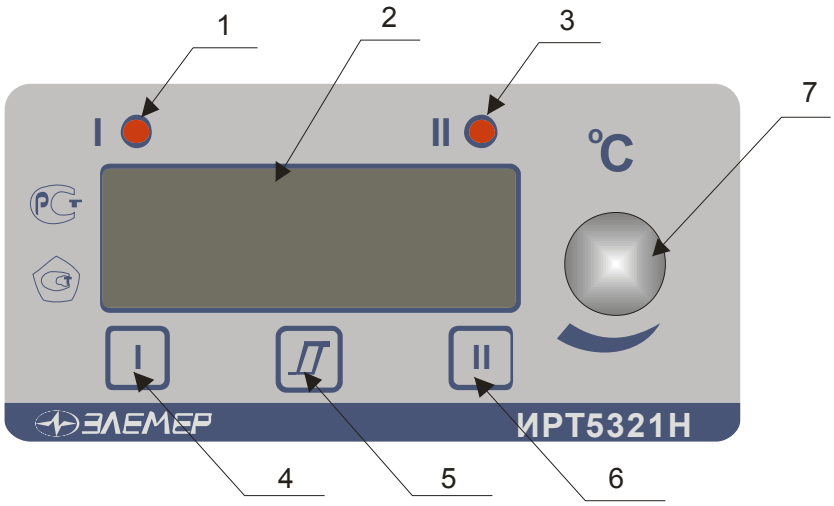



**Picutre 2.1**

To the picture 2.1:

1 - indicator «УСТ» – singular CD indicator of actuation of the 1st signaling channel;
2 – 4 digit CD seven-segment indicator of red luminescence with 14 mm symbol hight;
3 - indicator «TROUBLE» – singular CD indicator of actuation of the 2nd signaling channel;
4 - key **«У»** - a key for assigning a setting of the 1st signaling channel;
5 - key **«Д»** - a key for assigning of hysteresis of the 1st and 2nd signaling channels;
6 - key **«А»** - a key for assigning of a setting of the 2nd signaling channel;
7 – a handle of the encoder, for changing values of variable parameter.

2.3.3. Front panel ИРТ 5321Н is presented in the picture 2.2.




**Picture 2.2**

To the picture 2.2:

1 – indicator «I» – singular CD indicator of actuation of the 1st signaling channel;
2 - 4 digit CD seven-segment indicator of red luminescence with 14 mm symbol hight;;
3 - indicator «II» – singular CD indicator of actuation of the 2nd signaling channel;
4 - key **«I»** - key of assigning of a setting of the 1st signaling channel;
5 - key «⎍» - a key for assigning of hysteresis of the 1st and 2nd signaling channels;
6 - key **«II»** - a key for assigning of a setting of the 2nd signaling channel;
7 - a handle of the encoder, for changing values of variable parameter.

2.3.3.1. 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 case if a measured value can not be reflected in such a format, a number of digits is decreased. 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.

2.3.3.2. In the mode of assigning values of settings, of hysteresis, correction «0» and of the range on the main indicator a value of a measured parameter is indicated.

2.3.3.3. Keys «У», «А» for ИРТ 5320Н and «I», «II» for ИРТ 5321Н are designed for switching on of a scanning mode and assigning of setting values.

2.3.3.4. The key «⎍» is designed for scanning and assigning of a hysteresis of a setting. For switching on of the mode it is necessary to simultaneously press the key of a corresponding setting and the key of the hysteresis key.

2.3.4. On the front panel of ИРТ there are:

- clasp connector block for connection of circuit power supply, commutation circuits, primary converters, interface cables;
- keys of «0» adjustment and the range of measurement variation of ИРТ;
- protective grounding clasps.

### 2.4. Setting of configuration parameters

2.4.1. For ИРТ 5320Н, ИРТ 5321Н configuration is performed when manufacturing to the customer's order as well as reconfiguration of ИРТ by a customer with the aid of the program «Adjustment of ИРТ 53XX».

2.4.2. ИРТ 5320Н may operate with any type of primary converters, indicated in tables 2.2 and 2.3. Types of settings for ИРТ 5320Н are as follows:

- setting «У» is always configured «for decreasing», relay I operates at the value of measured signal less than the value of a setting, the value setting and hysteresis assigning is performed by a customer;
- setting «А» is always configured «for increasing», relay II operates at the value of measured signal exceeding the value setting, as well as when a primary converter is broken, the value setting hysteresis assigning is performed by a customer;

2.4.3. ИРТ 5321Н may operate with any type of primary converters, indicated in tables 2.2 and 2.3 Types of settings for ИРТ 5321Н may be of any kind.

2.4.4. In case of need a customer may change configuration of ИРТ. In ИРТ, manufactured for operation with an input signal 0…10 V, it is not possible to change the type of input signal. It is possible to change a measuring range, a number of averagings, a number digits after a comma, a relay logics, to switch on or switch off the function (block) of square rooting.

When operating with ТС, ТП may be changed: a type of primary converter, a number of averagings, a number digits after a comma, a relay logics.

When operating with a unified current signals and unified voltage signal of 100 mV it is possible to change the type of input signal, the range of conversion of an input signal, to change a number of digits after a comma, to change a number of averagings, to switch on or switch off the function of square rooting.

2.4.5. It is possible to change configuration with the aid of the software «Adjustment of ИРТ 53XX» ( this soft is presented on the site of SRE «ELEMER» www.elemer.ru).

2.4.5.1. Connect ИРТ to a COM-port of the CP with the aid of an interface cable, switch on ИРТ and PC.

2.4.5.2. Start on PC the software «Adjustment of ИРТ 53XX». On default ИРТ is tuned for the rate of 9600 bit/s with an address 1.

2.4.5.3. On display a window of an open program will appear.

2.4.5.4. Read the parameters of ИРТ configuration by pressing the key **«Read from the instrument»**.

2.4.5.5. The bookmark **«Channel tuning».** For this bookmark the following parameters of configuration are set:

- **«Minimum»** - minimum of the conversion range of a unified input signal, input of a number from –999 to 9999. For primary converters of TC and ТП values are inserted automatically form the table 2.2 and 2.3.
- **«Maximum»** - maximum of the conversion range of a unified input signal, input of a number from –999 to 9999. For primary converters of TC and ТП values are inserted automatically form the table 2.2 и 2.3.
- **«0»** - adjustment of the lower limit of the measurement range, the constant value, added to the measurement result, adjustment of «zero» of ИРТ. Displacement value is entered from the keyboard of the computer either with the help of the key «0» and encoder, factory setting 0.
- **«Range»** - adjustment of the upper limit of the measurement range , the constant value that is multiplied by the measurement result. Displacement value is entered from the keyboard of the computer either with the help of the key «Диап.» and the decoder, factory setting 1.
- **«Type of the detector»** - selection of the type of primary converter from the list provided by pressing «▼».
- **«Square rooting»** - setting of a tick in this window actuates the function of square rooting for unified input signals in accordance with the table 2.3.
- **«Setting I Type», «Setting I Type»** - selection of the type of a setting from the list provided by pressing «▼». **«No»** - the setting is not actuated. **«Decrease»** - the setting «for decreasing», the relay actuates at the value of measured signal less, than the value of a setting. **«Increase»** - the setting «for increasing», the relay actuates at the value of measured signal bigger than the value of the setting.
- **«Value I», «Value II»** - value of a corresponding setting.
- **«Hysteresis I», «Hysteresis II»** - the value of hysteresis of a corresponding setting.
- **«Interval of setting changing» -** the interval of changing of setting value is selected from the list provided by pressing «▼».
- **«Interval of hysteresis variation» -** an interval of hysteresis value variation is selected from the list, provided by pressing «▼».
- **«Averaging»** - selection of the number of measurements (from 1 to 10) for averaging of an input signal from the list provided by pressing «▼». When selecting the number of measurements for averaging «N» it is necessary to take into consideration, that the time of setting of a measured value is equal to N x 1 s. After switching on of power supply in order to avoid postponement of the results of measurement, the first measurement is done from N=1. After that the predetermined averaging value is used.
- **«Digits»** - selection of the number of digits after comma from the list, provided by pressing «▼».
- **«Observations»** - number of measurements for confirmation of relay actuation, factory setting 2.

2.4.5.6. At the bookmark setting **«Relay adjustment»** the following parameters of configuration are set:

- Connection of a relay with settings – for which purpose it is necessary to select a corresponding cell and press the left key of the mouse, at the same time in the cell a symbol «+» appears. Possible variations of connections of any relay with any setting. Connections of a relay are performed only with the settings selected in the item **« Setting I Type», «Setting II Type»** programs of the instrument configuration. Factory setting - the first relay is connected with the first setting, the second relay is connected with the second setting.
- Connection of the relay with a breaking of an input circuit – determines the condition of a relay in case of a breaking of an input circuit, for this purpose it is necessary to select a corresponding cell and press the left key of the mouse, at the same time in the sell a symbol «+» will appear**,** that means that the relay is actuated, in case of a circuit breaking.
- It is possible to connect a relay with any setting and simultaneously combine with breaking of an input circuit.
- It is possible to connect two relays with one setting.

2.4.5.7. After completing configuration, keep the parameters of configuration in ИРТ, by pressing the key **«Record in the instrument»**.

### 2.5. Assigning of setting values

2.5.1. For changing of a setting value it is necessary to press a key corresponding to a setting («У», «А» for ИРТ 5320Н and «I», «II» for ИРТ 5321Н) and by rotation of an encoder knob to assign the required value of a setting.

2.5.2. For changing values of hysteresis it is necessary to simultaneously press the key of a corresponding setting and the key of hysteresis «⊓» and rotating the knob of the encoder to set the required value of hysteresis of a setting.

2.5.3. Hysteresis of ИРТ actuation by settings is asymmetrical. If the setting operates «for decreasing», the value of a hysteresis is added to the value of a setting, if a setting - «for increasing », the value of hysteresis is deducted from the value of a setting.

2.5.4. For one turn of an encoder the value of the assigned parameter is changed for 16 units. The minimal values of variation of an assigned parameter - settings, hysteresis, «0» adjustment, range adjustment depending on a range of measurement are provided in the table 2.4.

Table 2.4

| Absolute value of measuring range maximum | Minimal value of variation of an assigned parameter | | | |
|---|---|---|---|---|
| | Setting | Hysteresis | Adjustment of «0» | Adjustment of the range |
| 0…0,999 | 0,001 | 0,001 | 0,0001 | 0,00001 |
| 1…9,999 | 0,01 | 0,01 | 0,001 | 0,00001 |
| 10…99,99 | 0,1 | 0,1 | 0,01 | 0,00001 |
| 100…9999 | 1 | 1 | 0,1 | 0,00001 |

2.5.5. An interval of setting and hysteresis variation can be set by a customer using the software «Adjustment of ИРТ 53XX»: parameters «Interval of setting variation» and «Interval of hysteresis variation».

### 2.6. Calibration procedure

2.6.1. Calibration of ИРТ is performed in an autonomous mode and includes:

- tuning of the lower limit of the measuring range («zero»);
- tuning of the upper limit of the measuring range

2.6.2. In order to tune «zero» of ИРТ it is necessary to deliver the value of an input signal to the ИРТ input corresponding to the lower value of the required measuring range, and, to press the key «0», and rotating the encoder button, to correct a result of a measurement.

2.6.3. In order to tune the measuring range of ИРТ it is necessary to deliver the value of an input signal to the ИРТ input corresponding to the upper value of the required measuring range, and, to press the key «Range.» and rotating the encoder button, to correct a result of a measurement.

### 2.7. Error reporting

2.7.1. In case of malfunctioning and faults of ИРТ on the indicator appears a message. Possible error messages:

**« . . . . »** – dots in every order – breaking of an input circuit. This message appears in case of breaking of connection of ТС or ТП with inputs of ИРТ. It is required to rehabilitate connections of primary converters.

**«1»** – blinking in a binominal order - overrun of the range limits. This message appears in case of a measured signal from ТС and ТП overrunning the measurement range limits,
In case of a measured signal in the form of direct current overrunning the range limits:

- (-0,5…5,5) mA - for a signal 0..5 mA;
- (-2…22) mA - for a signal 0…20 mA;
- (3,8….22) mA - for a signal 4…20 mA.

After returning of the signal within the measurement range limits the error message is preserved on the indicator during not more than 10 seconds.

**«E»** – message «E» and the number error. Elimination of this error is possible only by the manufacturer.

### 2.8. Special features of operations with ИРТ

2.8.1. The standard connection circuit of ТС to ИРТ is 3-wired. When connecting ТС to ИРТ using 2-wired circuit it is required to correct «zero» of the measurement range.

2.8.2. When operating with ТП, connection of the converter to ИРТ is carried out by a compensation cable. As a compensator of a cold end only the special compensator of a cold end may be used that is included in the complete delivery set.

2.8.3. In order to increase noise immunity of ИРТ and to increase relay replacement life, in ИРТ parallel to relay contacts RC-circuits are installed, at voltage of ~220V through RC-circuit the current of less than 1 mA is flowing.

2.8.4. To avoid misoperation of the relay when switching on power supply of ИРТ the process of relay operation will start 10 seconds later.

### 2.9. Marking and sealing

2.9.1. Marking corresponds to State Standards 26828-86 E, State Standards 9181-74 E, State Standards 12.2.020-76 and the drawing НКГЖ.405100.001-01СБ for ИРТ 5320Н, НКГЖ.405100.001-03СБ for ИРТ 5321Н.

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

### 2.10. Packaging

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

## 3. THE USE OF THE DEVICE ACCORDING TO ITS PURPOSE.

### 3.1. Preparation of the device for use

3.1.1. Safety regulations.

3.1.1.1. Considering the system of the electrical shock protection for people ИРТ 5922А corresponds to class I according to GOST 12.2.007.0-75.

3.1.1.2. ИРТ has protective grounding terminals pursuant to State Standards 12.2.007.0-75. Quality of grounding should be checked before starting operation.

3.1.1.3. Primary converters and execution units are to be connected according to marking, supply voltage switched off.

3.1.1.4. ИРТ is a fire-safe device, a possibility of fire in ИРТ 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 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 it is necessary that the requirements State Standards 12.3.019-80, “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.

### 3.1.2. External examination

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, or inadequacy of completeness, or of marking are found, the possibility of further use of ИРТ is to be determined.

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

### 3.1.3. Device assembly

3.1.3.1. For installation of ИРТ, there should be access to it from the rear side of the panel. Dimensions of the recess in the panel should agree with p.2.2.25.

Installation order:

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

Connecting ИРТ 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.

***Attention! Connection to the terminal blocks of ИРТ should be performed using a single-wire or stranded cable with a soldered tip, the maximal section of the wire is 1.5 mm$^2$.***

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

Test running of ИРТ should be performed only when it is grounded.

### 3.1.4. Testing

3.1.4.1. For naught checks of ИРТ configuration with ТС, connect ИКСУ-200, ИКСУ-260 or resistance box, for configuration with ТП – ИКСУ-200, ИКСУ-260 (hereinafter ИКСУ), or place thermo electrical converter into an ice-water mixture.

Set with the help of ИКСУ the zero value of temperature for corresponding type ТС or ТП and, in case of need, tune "zero" of ИРТ.

3.1.4.2. For ИРТ configuration with input electric signals in the form of:

- current strength and direct voltage, connect calibrated current and voltage supplies to inputs (ИКСУ in the mode of current generation).
- voltage of direct current to its input connect a source of calibrated voltages (ИКСУ in the mode of voltage generation).

Set the input signals values, corresponding to the minimal of the conversion range of input unified signal and, in case of need, tune "zero" of ИРТ.

### 3.2. Using the device

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

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

Connect grounding, circuits of primary converter, signalling circuits (if they are useed), power supply circuits.

3.2.3. Assign the value of settings and hysteresis of ИРТ, following item. 2.5

3.2.4. Carry out in case of need a calibration of ИРТ, following item 2.6.

## 4. VERIFICATION TECHNIQUE

4.1. ИРТ 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 ПР 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 ИРТ.

4.4. Operations and methods of verification.

4.4.1. When performing verification the following operations are carries 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 | it. 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 ИРТ by the measured value, intended for operation with a variable configuration | it. 4.7.5. | No | Yes |
| 6 | Determination of the values of basic errors of ИРТ 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 handling | it. 4.7.8 | Yes | Yes |
| 9 | Verification results registration | it. 4.8. | Yes | Yes |

4.4.2. During verification of ИРТ 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 НТД | 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 (ТС): minus 200…200 °С. Basic error ±0,03 °С.<br>Range of temperature representation (ТС): minus 200…600 °С. Basic error ±0,05 °С.<br>Range of temperature representation (ТП): minus 210…1300 °С. Basic error ±0,3 °С.<br>Range of temperature representation (ТП): plus 1200…2500 °С. Basic error ±2,5 °С.<br>Range of voltage representation: minus 10…100 mV<br>Basic error $\pm(7\cdot10^{-5}\cdot\|U\| + 3)$ mkV<br>Range of voltage measurement: 0…120 V.<br>Basic error ± 20 mV<br>Range of current representation: 0…25 мА.<br>Basic error $\pm(10^{-4}\cdot I + 1,5)$ mkA. |
| 2 | Resistor МЛТ | МЛТ-1-910 Ohm ±5 % |
| 3 | Plant for testing electrical safety GPI-745A | Range of output voltages of alternate current of frequency 50 Hz: 100…5000 V |
| 4 | Megohmmeter Ф4102/1-1М ТУ 25-7534.005-87 | Range of measurement 0…20000 mOhm. |
| Notes:<br>1 Manufacturing company of verification means according to item 1 is SPC «ELEMER».<br>2. All enumerated in the table 4.2 measurement means should have actual verification certificate.<br>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, °С | 20 ± 5; |
| 2) relative air humidity, % | 30…80; |
| 3) atmospheric pressure, kPa (mm merc. column) | 84,0…106,7 (630 ÷ 800); |
| 4) supply voltage, V | 220 ± 4,4; |
| 5) mains supply frequency , Hz | 50 ± 1,0. |

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

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

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

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

4.6.3.1. ИРТ 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 ИРТ is done according to the item 3.1.2 of the present operation manual.

4.7.2. Testing of verified ИРТ 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 spped.

Values of testing voltage for different circuits of ИРТ 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:<br>the clamp of protective grounding of<br>input circuits and output circuit of an integrated power supply source (ИП)<br>of interface circuits (DB-9) | 1, 2;<br>3, 4, 5, 6, 7, 8 | Grounding<br>9, 10, 11, 12, 13<br><br>2, 3, 5, 6, 8 |
| | The circuit of power supply of alternate current relative to: electrical signaling circuits | 1, 2 | 3, 4, 5, 6, 7, 8 |
| 500 | The clasp of protective grounding relative to:<br>Input circuits and output signals ИП<br>interface circuits (DB-9) | Grounding | 9,10,11,12,13<br>2, 3, 5, 6, 8 |
| | Interface circuits (DB-9) relative: input circuits and output circuits of ИП | 2, 3, 5, 6, 8 | 9, 10, 11, 12, 13 |

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 ИРТ 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 Apendix 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) | 1, 2; 3, 4, 5, 6, 7 ,8 | Grounding 9, 10, 11, 12, 13 2, 3, 5, 6, 8 |
| | Power supply circuit of alternate circuit relative to: electrical signaling circuits | 1, 2 | 3, 4, 5, 6, 7, 8 |
| 100 | Clamp of protective grounding relative to: input circuit and output circuit of incorporated power supply sources of interface circuits (DB-9) | Grounding | 9,10,11,12,13 2, 3, 5, 6, 8 |
| | Interface circuits (DB-9) relative to: input circuits and output circuit of incorporated power supply source | 2, 3, 5, 6, 8 | 9, 10, 11, 12, 13 |

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

4.7.5.1. Determination of values of measuring channel of ИРТ may be carried out only with the help of a PC (using a keyboard with a PC for configuration of ИРТ 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, according to the present operation manual and operation manual of ИКСУ-2000.

4.7.5.2. Determination of values of basic errors of ИРТ 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

| Input parameters | | | | | Limits of tolerable basic absolute error by measured value, °C |
|---|---|---|---|---|---|
| Type of primary converter | Measuring range, °C | Verified point, | | | |
| | | °C | Ohm, by State Standards | | |
| | | | P 8.625-2006 | 6651-94 | |
| 50П | minus 50…200 | minus 50 | 40,00 | 40,00 | ± 0,63 |
| | | 150 | 79,11 | 79,11 | ± 0,63 |
| 100П | minus 50…200 | 150 | 158,22 | 158,23 | ± 0,63 |
| | minus 50…600 | 550 | 300,63 | 300,67 | ± 1,63 |

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

4.7.5.2.2. ИРТ is connected to PC, power supply is switched on and the software «Adjustment ИРТ 53XX» is started .

4.7.5.2.3. The following parameters of configuration of ИРТ are determined (configuration parameters and their designation correspond to item 2.4. of the present operation manual):

- type of the primary converter 50П [1,391 (0,00391 ºC$^{-1}$)];
- correction of «0» 0;
- range correction 1;
- number of symbols after comma 2;
- number of measurements for averaging 1.

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 by a 3-wired circuit.

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

4.7.5.2.6. The value of an absolute error $\Delta A$ is determined from the formula

$$\Delta A = A_{изм} - A_д , \qquad (4.1)$$

where $A_{изм}$ - the measured magnitude of the value in the verified point, read from ИРТ indicator or at the bookmark "Current values" of the program «Adjustment of ИРТ 53XX».

4.7.5.2.7. With the aid of ИКСУ emulated (actual $A_д$) 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 are changed, by setting:

- the type of primary converter 100П [1,391 (0,00391 ºC$^{-1}$)];.

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 ЕС of the type 100П.

4.7.5.2.10. In turn, with the aid of ИКСУ emulated (actual $A_\partial$) 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, on the indicator of ИРТ there should appear the message **«….»**.

4.7.5.3. Determination of values of basic errors of ИРТ 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 parameters | | | | Limits of tolerable basic absolute error by converted value |
|---|---|---|---|---|
| Input signal | Range of conversion | Verified point | | |
| | | mV | $A_\partial$ | |
| 0…100 mV | 5…105 | 0 | 5 | ± 0,023 |
| | minus 10…90 | 15 | 5 | ± 0,060 |
| | minus 45…55 | 50 | 5 | ± 0,089 |
| | minus 90…10 | 95 | 5 | ± 0,188 |
| XK(L) | - | 0 | 0 | ±3,25 |

4.7.5.3.1. The following parameters of ИРТ configuration are set (parameters of configuration and their designation correspond to item 2.4 of the present operation manual):

- type of primary converter 0…100 mV;
- correction of «0» 0;
- range correction 1;
- 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 1.

4.7.5.3.2. ИКСУ is prepared in the mode of voltage emulation and it is connected to the input of ИРТ, 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.

4.7.5.3.4. The following parameters of ИРТ configuration are set (parameters of configuration and their designation correspond to item 2.4 of the present operation manual):

- type of primary converter ХК(L);
- correction of «0» 0;
- range correction 1;
- number of symbols after comma 3;
- number of measurements for averaging 1.

4.7.5.3.5. The compensator of a cold end and ИКСУ in the mode of emulation of thermocouple signals ТП ХК(L) are connected to the verified ИРТ.

4.7.5.3.6. With the aid of ИКСУ the emulated (actual $A_д$) temperature value equal to 0 °C, and operations from item 4.7.5.2.6 are carried out.

4.7.5.4. Determination of the basic errors of ИРТ 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 | $A_д$ | |
| 0…5 mA | 0…100 | 0 | 0 | ± 0,25 |
| | | 2,5 | 50 | ± 0,26 |
| | | 4,75 | 95 | ± 0,26 |
| 4…20 mA | 0…100 | 4 | 0 | ± 0,26 |
| | | 12 | 50 | ± 0,26 |
| | | 19,2 | 95 | ± 0,26 |

4.7.5.4.1. The following parameters of configuration of ИРТ are set (configuration parameters and their designation correspond to item 2.4 of the present operation manual ):

- type of the primary converter 0…5 мА;
- correction «0» 0;
- correction of the range 1;
- number of digits after comma 3;
- function of square rooting no;
- 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 1.

4.7.5.4.2. ИКСУ is prepared in the mode of current emulation and it is connected to the input of ИРТ, 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.

4.7.6. Determination of the values of basic errors of ИРТ, configured for the certain type of a primary converter.

4.7.6.1. In order to determine the values of the basic reduced errors, measuring calibrator of unified signals standard to ИКСУ is connected to ИРТ.

4.7.6.2. Determination of values of basic reduced errors of ИРТ in ТС 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 ИРТ, operating with ТС is performed only by 3-wired circuit. Verification operation is performed in the following sequence:

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

4.7.6.2.2. With the aid of ИКСУ emulated (actual $A_д$) 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 ИРТ indicator.

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

$$\gamma = \frac{(A_{изм} - A_д)}{(A_{вх\max} - A_{вх\min})} \times 100\%, \qquad (4.2)$$

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

4.7.6.2.5. For control of open-circuit fault of the input circuit ИКСУ is disconnected from ИРТ, on the indicator of ИРТ should appear a message **«….»**.

4.7.6.3. Determination of values of basic reduced errors of ИРТ 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 are switched on and prepared to operation, ИКСУ and ИРТ are kept in switched on condition during 30 minutes.

4.7.6.3.2. With the aid of ИКСУ emulated (actual $I_д$) value equal to 5, 25, 50, 75, 95 % of the measurement range is set.

4.7.6.3.3. The magnitudes of measured value $A_{изм}$ are read from ИРТ indicator.

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

$$A_д = \frac{(I_д - I_{вх\,min})}{(I_{вх\,max} - I_{вх\,min})} \times (A_{вх\,max} - A_{вх\,min}) + A_{вх\,min}, \quad (4.3)$$

where $A_д$ - actual value of measured parameter;
$I_д$ - actual value of input signal;
$I_{вх\,min}$ - minimum of input range;
$I_{вх\,max}$ - maximum of input range;
$A_{вх\,max}$ - maximum of the conversion range of the input unified signal;
$A_{вх\,min}$ - 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

$$A_д = \sqrt{\frac{(I_д - I_{вх\,min})}{(I_{вх\,max} - I_{вх\,min})}} \times (A_{вх\,max} - A_{вх\,min}) + A_{вх\,min} \quad (4.4)$$

4.7.6.3.6. The values of the basic reduced measurement error of ИРТ are determined from the formula (4.2).

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 (contacts 9 «minus», 13 «plus»), 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

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

where $\Delta U_{xx}$ - absolute error in idle run mode;
$U_{ном}$ - 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-1-910 Ohm is connected to the output of the incorporated voltage source of verified ИРТ.

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

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

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

4.7.8. Processing of verification results.

4.7.8.1. When verifying ИРТ, 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.

4.7.8.2. When verifying ИРТ, configured for the certain type of a primary converter, when operating with input signals ТС and ТП the values of basic reduced errors, calculated from the formula (4.2), should not exceed the values provided in the table2.2.

4.7.8.3. When verifying ИРТ with a unified input signals, the values of the basic reduced errors, calculated from the formula (4.2), should not exceed the values provided in the table 2.3.

4.7.8.4. When determining the characteristics of an incorporated power supply source, the values of absolute errors, calculated from the formulas (4.5) and (4.6), should not exceed ±0,48 V.

4.8. Registration of verification results

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

***Attention!*** *In this case it is not permitted to use ИРТ with other configurations.*

4.8.2. Positive results of ИРТ verification, for operation with a variable configuration are registered in the certificate of state standard verification according to ПР 50.2.006-94 or a marking in the registration certificate.

4.8.3. In case of negative results verification an ИРТ 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. ИРТ 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 ИРТ, and they include:

a) external examination;

b) checking safety of connection of ИРТ 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 ИРТ is carried out once in a two-year period, according to the instructions, given in Section 4 of the present operation manual.

5.4. ИРТ 5922А, 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 ИРТ is performed by manufacturer.

## 6. STORAGE

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

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

6.3. ИРТ should be stored on the racks.

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

## 7. TRANSPORTATION

7.1. ИРТ 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. ИРТ transportation conditions should meet requirements 5 according to State Standards 15150-69 at the ambient temperature from minus 50 to +50$^{o}$C, and should comply with anti-shock and anti-vibration measures.

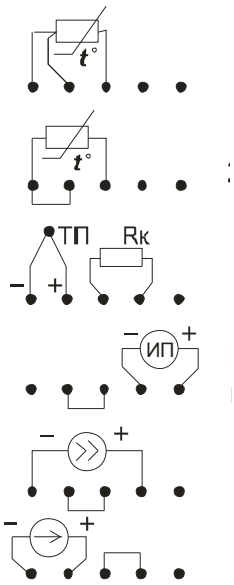
7.3. ИРТ should be transported parceled or separately.

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

# Appendix A

## The circuit of electrical connections of

## ИРТ 5320Н, ИРТ 5321Н




Connection of TC 3-wired circuit

Connection of TC 2-wired circuit

Connection of a thermocouple and a compensator

Measuring converter 4….20 mA

Current measuring from out side source

Voltage measuring 100mV, 10 V

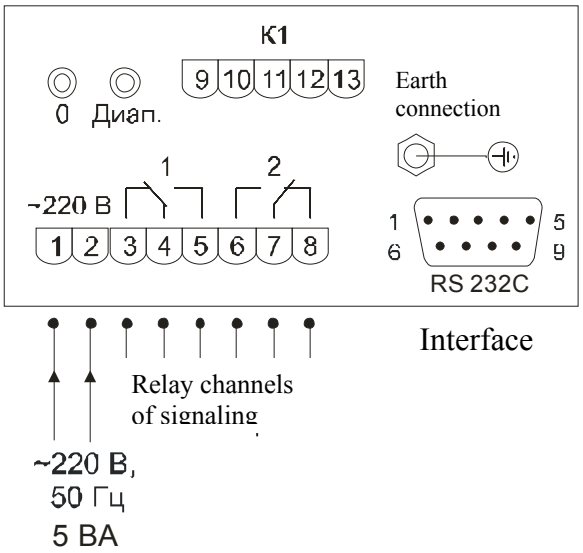
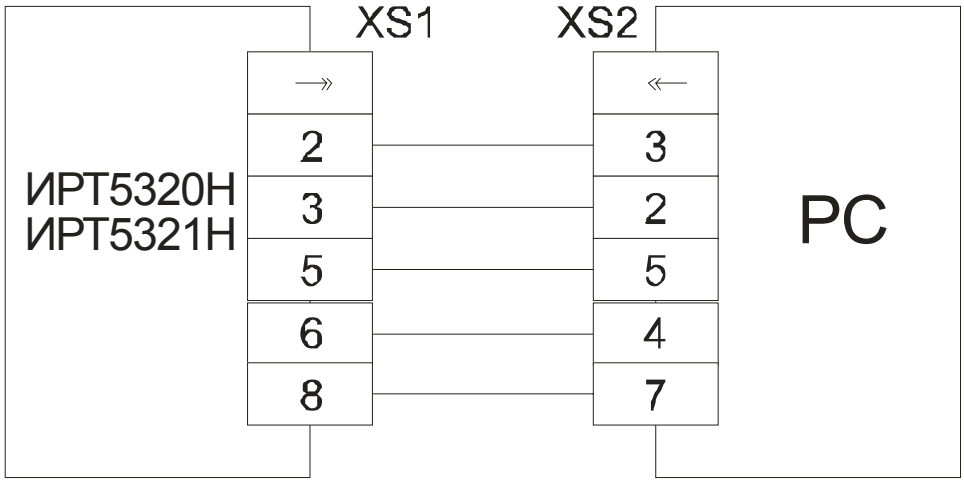



**Figure A.1**

# Appendix Б

**The circuit of connection of ИРТ 5320Н, ИРТ 5321Н to PC using the circuit “point-point” via interface RS 232C**




**Picture Б.1**

# Appendix B

**An example of designation recording when ordering ИРТ 5320Н, ИРТ 5321Н**

| ИРТ 5321Н | x | x | x | x | x | x | x | x | x | x |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |

1. Type of the instrument (ИРТ 5320Н, ИРТ 5321Н)
2. Indication color
   - red (basic version)
   - green (by order)
3. Type of input signal (tables 2.2, 2.3)
4. Range of conversion of input signal for instruments with a unified input signal
5. Unit of measurement. Basic version – *°С*
6. Presence of the function (unit) of square rooting (order index: БИК)
7. Type of settings, for ИРТ 5321Н: 11 – two settings «for decreasing»,
   12 – 1st setting «for decreasing»,
   2nd setting «for increasing»,
   22 – two settings «for increasing»
   Basic version – *12*
8. Presence of compensator of cold end (index of order: К), for ИРТ operating with input signals from thermo electrical sensors is delivered in all cases.
9. Climatic version: t1050, t3050, t3070 (in accordance with item 2.1.11)
   Basic version – *t1050*
10. State verification (index of the order: ГП)
11. Designation of technical conditions

**Order example**

***Basic version***

| ИРТ 5321Н – | red – | 4-20 – | 0-100 – | ° С – | / - / – | 12 – | / - / – | t1050 – | / - / – | ТУ 4210-002-13282997-01 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |

***Version with consideration of all positions of the order form (special version)***

| ИРТ 5321Н – | green – | 4-20 – | 0-100 – | т/ч – | БИК – | 12 – | К – | t3050 – | ГП – | ТУ 4210-002-13282997-01 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |

## List of changes registration

| Chan. | Number of lists (pages) | | | | Total number of pages in documents | № docums. | Reg. number of covering documents and data | Sig-nature | Data |
|---|---|---|---|---|---|---|---|---|---|
| | | replaced | new | annulled | | | | | |
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