



The research-and-production enterprise

# THE MEASURING CONVERTERS OF TEMPERATURE AND HUMIDITY

## ИПТВ-206А-М3-04

Manual

НКГЖ.405541.004-87ПС



For APP

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# 1. Use

The measuring converters of temperature and humidity ИПТВ-206А-МЗ-04 (further - ИПТВ-206А) are intended for the non-stop converting of temperature and relative humidity of gaseous environments into the unified electric output signal of a direct current.

ИПТВ-206А (enhanced reliability) are used in a structure of the managing systems of the technological processes of atomic power stations (APS).

According to all-Union State Standard 12997-84:

- ИПТВ-206А correspond to the products of the third order depending on the operational completeness;
- ИПТВ-206А correspond to execution group C4 on stability against any climatic influences while operating of ИПТВ-206А;
- by quantity of the channels of the converting channels are two-channels;
- on dependence of an output signal on the temperature being converted and the relative humidity - with a linear dependence.

ИПТВ-206А correspond to climatic modification ТВЗ according to all-Union State Standard 15150-69 and intended for operating in the APS (atomic power station) called "Бушер" in ИРИ.

On safety from influencing of the environment according to:

- all-Union State Standard 15150-69, ИПТВ-206А are executed in a non-corrosive climatic modification Т III;
- all-Union State Standard 15150-69, ИПТВ-206А are intended for working in the APS "Бушер" in ИРИ made in a non-corrosive climatic modification ТВЗ at the following maintenance of the active corrosive agents in the atmosphere:  
chlorides - 0,02 mg/m<sup>3</sup>,  
sulfates - 0,03 mg/m<sup>3</sup>,  
sulphurous gas - 0,03 mg/m<sup>3</sup>;
- all-Union State Standard 14254-96, ИПТВ-206А have a degree of protection against penetrating of any dust and water - IP54;
- all-Union State Standard 14254-96, ИПТВ-206А have a degree of protection against penetrating of any dust and water - IP55, intended for working in the ASP "Бушер" in ИРИ.

According to all-Union State Standard 25804.1-83, ИПТВ-206А:

- correspond to category Б on the application character – the equipment of continuous application;
- correspond to type I on the number of the quality levels of functioning – the equipment having two quality degrees of functioning – the nominal level and refusal.

According to ПНАЭ Г - 01 - 011 - 97 (ОПБ - 88/97), ИПТВ-206А concerns:

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

## 2. Specifications and characteristics

2.1. The range of the measurements and converting of the relative humidity is from 0 to 100 %.

2.2. The range of the output unified signal is 4...20 mA.

2.3. The range of the measurements and converting of the temperature is from 0 to 100 °C.

2.4. The admitted limits of the basic absolute errors of the measurements are:

- $\pm 0,4$  °C for the temperature;
- $\pm 2$  % for the relative humidity.

2.5. A constant of time, minutes, is no more:

- 0,3 on the relative humidity;
- 8 on the temperature.

2.6. The setting time of the output signal (it is the time while the output signal of ИПТВ-206A is coming into the limit zone of the admitted basic error) is no more:

- 5 minutes for the channel of the relative humidity measurements;
- 20 minutes for the channel of the temperature measurements.

2.7. The admitted limits of the additional errors of the temperature measurements and the relative humidity, caused by changing of the air temperature in 10 °C in the interval of the working values, are no more than 0,1 °C and 1,0 % accordingly.

2.8. The admitted limits of the additional errors of the relative humidity measurements, caused by changing of the temperature of the gas being analyzed for each 10 °C of the temperature change in the measuring range of the temperatures, are no more than 1,0 %.

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

2.10. The limit of the admitted additional error, caused by some voltage influence of a cross handicap of the alternating current with an effective value, equal 50 % of the maximal value of the electric input signal, working between the input measuring clips consistently with a useful signal and having any phase corner, does not exceed 0,5 limits of the admitted basic error.

2.11. The limit of the admitted additional error caused by some voltage influence of a longitudinal handicap constant or an alternating current with an effective value, equal 100 % of the maximal value of the electric input signal, working between any measuring clip and the earthed case and having any phase corner, does not exceed 0,5 limits of the admitted basic error.

2.12. The limit of the ИПТВ-206A admitted additional error does not exceed the limit of the admitted basic error while influencing of the vibration.

2.13. The maximal resistance of loading is 0,5 kOhm. The limit of the admitted additional error, caused by a deflection of the loading resistance from the limiting value to minus 25 %, is no more than 0,2 limits of the admitted basic error.

2.14. The power of ИПТВ-206А is carried out from a direct power source by voltage  $(24 \pm 2,4)$  V.

The change of the power voltage does not cause changing of the absolute errors of the temperature and humidity measurements of ИПТВ-206А in the interval of the working values.

2.15. The power consumed by ИПТВ-206А does not exceed 1,2 W.

2.16. Overall dimensions, mm, are no more:

100x60x25 of the measuring block;

$\varnothing$  12 of the initial converter, the length of the assembly part is 80... 800.

The set of the converter on the object is carried out with the aid of union M20x1,5 through a special lining.

2.17. Weight, kg, is no more:

0,4 kg - at the length of the assembly part of 80 mm,

0,7 kg - -//- 800 mm .

2.18. The measuring ИПТВ-206А converters are steady against influencing of the air temperature from minus 30 up to plus 50 °C.

The measuring ИПТВ-206А converters are intended for working in the APS "Бушер" in ИРИ, are steady against influencing of the air temperature from minus 30 up to plus 60 °C.

2.19. The measuring ИПТВ-206А converters are steady against influencing of the humidity of the air temperature up to 95 % at the temperature 35 °C.

The measuring ИПТВ-206А converters, intended for working in the APS "Бушер" in ИРИ, are steady against influencing of the humidity of the air temperature up to 98 % at the temperature 35 °C and lower temperatures, without condensation of any moisture.

2.20. ИПТВ-206А maintain temperature up to plus 60 °C in a transport container.

2.21. ИПТВ-206А maintain temperature up to a minus 50 °C in a transport container.

2.22. ИПТВ-206А have durability to influencing of the air environment with a relative humidity of 98 % at the temperature 35 °C in a transport container.

2.23. ИПТВ-206А are steady against influencing of shock jolting with the number of impacts 80 a minute in a transport container with an average quadratic value of acceleration  $98\text{m/sec}^2$  and the influencing duration equal to 1 hour.

2.24. ИПТВ-206А have durability and stability against influencing of a sine wave vibration in the frequency range from 1 up to 100 Hz at the amplitude of vibro-acceleration  $20\text{m/sec}^2$ .

ИПТВ-206А, intended for working in the APS "Бүшep" in ИРИ, have durability and stability against influencing of a sine wave vibration in the frequency range from 1 up to 120 Hz with acceleration 1g.

2.25. ИПТВ-206А have no constructive elements and units with resonant frequencies from 5 up to 25 Hz.

2.26. ИПТВ-206А have durability and stability against influencing of any mechanical impacts of a single action with a peak shock acceleration  $20 \text{ m/sec}^2$ , a duration of a shock pulse from 2 up to 20 ms and a total of impacts 30.

2.27. ИПТВ-206А have durability and stability against influencing of any mechanical impacts of a repeated action with a peak shock acceleration  $30 \text{ m/sec}^2$ , with a preferable action duration of the shock acceleration 10 ms (the admitted duration is from 2 up to 20 ms) and the number of impacts in each direction 20.

2.28. ИПТВ-206А have durability at the seismic influences, equivalent to the vibration influencing with the parameters, given in table 3.

Table 3

Frequency, Hz	1,0	2,0	3,0	4,0	5,0	6,0	8,0	10,0	15,0	20,0	30,0
Acceleration, $\text{m/s}^2$	6,0	15,0	29,0	51,0	48,0	43,0	38,0	31,0	20,0	19,0	14,0

ИПТВ-206А, intended for working in the APS " Бүшep " in ИРИ of safety class 3Н on ПНАЭ Г-01-011-97, correspond to category II of the seismic stability on ПНАЭ Г-5-006-97 and are steady against any seismic loadings of ПЗ on МУ 7.4-01. The converters are steady against the dynamic loadings caused by a shock wave and impact of the falling plane.

ИПТВ-206А, intended for working in the APS " Бүшep " in ИРИ of safety class 4Н on ПНАЭ Г-01-011-97, correspond to category III of the seismic stability on ПНАЭ Г-5-006-97.

2.29. The guarantee of the electromagnetic compatibility and noise immunity

2.29.1. ИПТВ-206А correspond to execution group III on stability to any electromagnetic handicapes in accordance with all-Union State Standard 50746-2000.

ИПТВ-206А correspond to the quality criterion of functioning A in the time of influencing of handicapes in accordance with all-Union State Standard P 50746-2000.

ИПТВ-206А, intended for working in the APS "Бүшep" in ИРИ of safety class 3Н on ПНАЭ Г-01-011-97, correspond to execution group IV, the functioning criterion A in accordance with all-Union State Standard P 50746-2000.

ИПТВ-206А, intended for working in the APS " Бүшep " in ИРИ, correspond to execution group III in accordance with all-Union State Standard P 50746-2000.

2.29.2. ИПТВ-206А normally function and they do not create any handicapes in conditions of teamwork with the equipment of systems and elements, for which they are intended, and also with the equipment of another use, which may be used together with data of ИПТВ-206А in a typical handicap situations.

### 3. Completeness

3.1. ИПТВ-206А are delivered in the complete set specified in table 3.

Table 3

Name	Designation	Quantity	Notes
The measuring converter of temperature and humidity			
ИПТВ-206А-М3-04	НКГЖ.405541.004-87	1	
Connective cable			
with connector 2РМ-14(ШР-14)	НКГЖ.685631.023	1	
The measuring converters of temperature and humidity			
(Modification ИПТВ-206А-М3-04 for APS). Manual	НКГЖ.405541.004-87ПС	1	
Special lining	НКГЖ.754152.018	1	set on the union of the device
Complete set ЗИП including:			
special lining	НКГЖ.754152.018	1	on a customer's
protective cap	НКГЖ.725322.001	1	demand
Technique of check	МИ 2409-2003	1	on a customer's
			demand

## 4. Device and its operation

4.1. ИПТВ-206А consists of a capacitor sensitive element of the relative humidity, a resistance thermo-convector, a protective filter, a case and an electronic measuring converter.

4.2. The principle of working of the sensitive element of the relative humidity based on the dependence of the dielectric permeability of the hydrosensitive layer on the humidity of the environment. The polymeric material is used as a hydrosensitive layer.

The metal thermometer of resistance is used as a sensitive element of the temperature made on the thin-film technology.

4.3. The sensitive elements of the relative humidity and temperatures are set on the end of the cylindrical probe and are closed with a metal cap, providing their protection against any mechanical damages and an easy approach of the analyzed environment.

4.4. The circuit of the signal formation of the current value of the temperature converts the initial converter signal into the scaled voltage.

The circuit of the signal formation of the current value of the relative humidity converts the initial converter capacity of the relative humidity into the scaled voltage and linearizes it.

4.5. The voltage converters in the current convert the scaled voltage, going to their inputs, into the output ИПТВ-206А current.

4.6. The ИПТВ-206А design allows to mount them in the closed channels at the pressure up to 2,5 MPa (picture 1).



Picture 1

4.7. Connecting of ИПТВ-206А to the power supply and alarm lines is executed with a tight electric socket 2PM-14 (ИП-14) through the cable input.



## 5. Instruction of safety measures

5.1. ИПТВ-206А correspond to class 0I of all-Union State Standard 12.2.007.0-75 about a person's protection from killing by current.

5.2. The initial converters, the executive devices are connected according to the marks at the switched-off voltage of the power.

5.3. ИПТВ-206А is fireproof, the probability of a fire appearing in ИПТВ-206А does not exceed  $10^{-6}$  per one year according to all-Union State Standard 12.1.004-91.

ИПТВ-206А correspond to safety classes 3 and 4 on ПНАЭ Г-01-011-97.

5.4. While operating of ИПТВ-206А, it is necessary to follow the requirements of ПНАЭ Г - 01 - 011 - 89 (ОПБ-88/97), ПНАЭ Г-1 - 024 - 90 (ПБЯ РУ АС - 89), all-Union State Standard 12.3.019-80, "The guidelines of the security measures of the electrical installation of consumers" and " The guidelines of the security measures while operating of the electrical installation of consumers", authorized by Gosenergonadzor.

## 6. Preparation for work

6.1. Unpack ИПТВ-206А. Make an external examination; be sure that the conformity is set according to the following requirements:

- 1) ИПТВ-206А must be completed according to chapter 3 of this manual;
- 2) The factory number of ИПТВ-206А must correspond to the number specified in the manual;
- 3) ИПТВ-206А must not have any mechanical damages when its operation is not allowable.

6.2. The order of ИПТВ-206А set.

1) Place the working part of ИПТВ-206А into the chamber with the environment being measured and fix it with the aid of union M20x1,5 through a special lining.

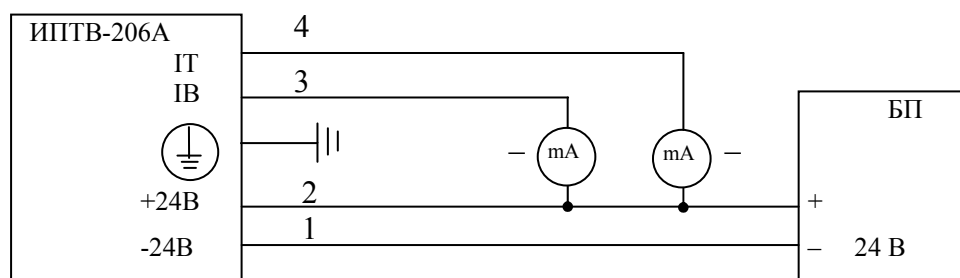
The environment being measured must not be explosive, must not contain any alkali and aggressive vapors in the concentration destroying metal.

2) Connect the electric socket with the bringing wires (picture 2).

3) While setting of the ИПТВ-206А converters, it is necessary to be guided by chapter 7.3 ПУЭ, edition 6, chapter Э.3.2 ПЭЭП and ПТБ, edition 4, the current documentation and another normative documents working in the given industry. Before setting it is necessary to examine the converters, having paid attention on the integrity of the case, the seals and marks availability.

Closing up of the cable and its connection is supposed to be executed at the switch-off voltage.

The measuring converters of temperature and humidity  
ИПТВ-206А-М3-04.  
The electric circuit of connections



**Note.** The unused current output (IT or IB) is to be connected with the plug +24 V БП.

Picture 2

## 7. Operating procedure

7.1. Attach the power supply of a direct current to ИПТВ-206А and milliammeters according to the electric circuit of the connections, given in picture 2.

7.2. Plug the power supply of a direct current; keep ИПТВ-206А in the switch-on condition within 30 minutes.

7.3. Measure the values of the ИПТВ-206А output currents with milliammeters.

7.4. Define the values being measured of the temperature and the relative humidity under the formulas:

$$T = \frac{I}{I_{\max}} \cdot (T_{\max} - T_{\min}) + T_{\min} , \quad (7.1)$$

$I$  – a value of the unified output signal of ИПТВ-206А, measured on channel IT, mA;  
 $I_{\max} = 20$  mA - the top limit of the unified output signal;  
 $T_{\min}$ ,  $T_{\max}$  - the bottom and top limits of the temperature measurements.

$$\varphi = \frac{I}{I_{\max}} \cdot 100 \% \quad (7.2)$$

$I$  – a value of the unified output signal of ИПТВ-206А, measured on channel IV, mA.  
 $I_{\max} = 20$  mA - the top limit of the unified output signal.

## 8. Technique of check

8.1. Checking of ИПТВ-206А is supposed to be done according to the technique of checking МИ 2409-97.

8.2. The interesting interval is 2 years.

## 9. Maintenance service

9.1. Maintenance service is conducted during some preventive works on that equipment where ИПТВ-206А is operated, and also at any infringements in working of the devices connected to the control of the relative humidity.

9.2. Turn off the filter carefully and wash out the sensitive element with a technical ethyl rectifying spirit (a soft brush) in accordance with all-Union State Standard 18300-87.

**ATTENTION!** *It is forbidden to clean the sensitive element mechanically. It is impossible to use any chemical solvents.*

Clean off any dirty, wash out the metal filter and cautiously set it in its place.

## **10. Guidelines of transportation and keeping**

10.1. ИИПТВ-206А stand transporting for any distances: auto and railway means of transport (in the closed transport means), water transport (in holds of vessels), air transportation (in the hermetically sealed compartments). The fastening of the containers in the means of transport is executed according to the rules working on the appropriate means of transport.

10.2. The conditions of ИИПТВ-206А transportation is to correspond to conditions 3 in accordance with all-Union State Standard 15150-69 at the air temperature from - 50 till + 60 °C with observance of protection measures from impacts and vibrations.

10.3. The conditions of ИИПТВ-206А keeping in a transport container are to correspond to conditions 1 in accordance with all-Union State Standard 15150-69.

10.4. The keeping conditions after removing of packing must not differ from the operation conditions and must correspond to the air temperature from plus 1 up to plus 60 °C. The relative humidity of the air must be up to 98 % at the temperature plus 35 °C and lower temperatures without condensation of any moisture.

There should not be any aggressive impurities in relation to the used materials.

10.5. The arrangement of the converters in storehouses must provide an easy access to them.

## 11. Acceptance certificate

The measuring converter of temperature and humidity ИПТВ-206А-М3-04, length of the assembly part \_\_\_\_\_ mm, execution of the back panel     P    ,

P or K

factory number № \_\_\_\_\_, safety class \_\_\_\_\_ on ОПБ-88/97

made and accepted according to the obligatory requirements of the state standards, the current documentation and recognized serviceable.

Quality Department Chief

Stamp \_\_\_\_\_  
(personal signature)                      \_\_\_\_\_  
(signature decoding)

\_\_\_\_\_  
(year, month, date)

Manufacturing of the equipment was conducted under supervision.

Representative of FSUE VO «Safety»

Stamp \_\_\_\_\_  
(personal signature)                      \_\_\_\_\_  
(signature decoding)

\_\_\_\_\_  
(year, month, date)

## 12. Certificate on packing

12.1. The measuring converter of temperature and humidity ИПТВ-206А-М3-04 with factory number № \_\_\_\_\_ is packed by the research-and-production enterprise “ЭЛЕМЕР” according to the requirements established by the design documentation.

Date of packing \_\_\_\_\_

Stamp

Packed by \_\_\_\_\_  
(signature)

The product after packing has been accepted by \_\_\_\_\_  
(signature)

## 13. Manufacturer's guarantees

13.1. The manufacturer guarantees the conformity of ИПТВ-206А to the requirements of specifications at the following of the consumer of conditions of operation, storage and transportation.

13.2. The warranty operation period is established in 24 months from the day of sale.

## 14. Data on claims of replacement

14.1 In case of loss of ИПТВ-206А serviceability or reduction of the parameters given in the technique conditions, under condition of observance of requirements of the chapter of "Manufacturer's guarantees", a consumer should fill in a damage statement in the set order and dispatch it to the address:

124460      Russia,  
Moscow  
Zelenograd, 1145, n/p 1  
The research-and-production enterprise «Elemer»  
Phone: (495) 925-5147  
Fax: (499) 710-0001  
e-mail: elemer@elemer.ru

















## 22. Special marks



