Scientific & Production Firm «Vympel»

Interferometric dew point analyzer CONG−Prima−10

Operational Manual
VYMP2.844.005OM

Dear customer,

Thank you for buying “CONG – Prima-10” Interferential Dew Point Analyzer made by our company “Vympel”.

Perhaps you are experienced enough in using our products or probably this dew point analyzer is your first instrument made by our company.

In any case we kindly ask you not to put aside this description without having thoroughly read it.

We hope this information will be helpful to you since it is based on our up-to-date knowledge and advanced experience of many years.

The Manufacturer guarantees that the products being supplied are in compliance with the technical data given in this description and meet safety and quality requirements.

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Make sure you have attentively read all limitations and recommendations given in this-description.

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Please contact us about any operational or design faults as well as about your observations and proposals regarding our operational documentation at:

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We wish you success in your work.

«Vympel» 2006
Russian Federation

Reg. 10.08.2007

CONTENT

This Operational Manual covers the design and functioning principles of "CONG-Prima-10" VYMP2.844.005 interferential dew point analyzer (hereinafter referred to as the Analyzer) and helps you to learn its operational rules (use in accordance with its purpose, maintenance, storage and transportation).

1 DESCRIPTION OF THE ANALYZER

1.1 Purpose of the Analyzer

The Analyzer is intended for automatic measuring of both dew point (hereinafter referred to as DPT) of moisture and dew point of hydrocarbons in natural gas or other gases at working pressure. Besides, it can be used as a standard measuring device for calibration operations.

The Analyzer can be applied in gas, oil & chemical industry and also in metallurgy, power industry, device-making etc. for quality check of technological processes using moisture and hydrocarbons dew point parameters.

1.2 Components and delivery package of the Analyzer

1.2.1 Delivery package of the Analyzer is given in Table 1.

Table 1

Description of delivery package component	Qty.
Dew point transducer VYMP2.848.004 (VYMP2.848.004-01, VYMP2.848.004-02) *	1
Interface unit VYMP3.622.002-01	1
Gas preparation system VYMP2.848.002 (VYMP2.848.003) *	1
Portable technological computer with special software**	1
Set for connecting gas preparation system, VYMP4.078.026 (VYMP4.078.026-01)*	1
Set of operational documents	1
Calibration Manual VYMP2.844.005MP	1

* - quantity and model are specified when ordering;
** - supplied by separate orders. It is allowed to change it for a similar computer with RS-232 interface.

1.3 Measurement method

Condensation method is used when measuring dew point. This method involves measurement of temperature to which it is necessary to cool wet gas layer adjoining the surface being cooled in order to bring it to saturated condition at working pressure. The present method corresponds to GOST 20060 "Combustible natural gases. Methods for determining water vapors presence and moisture dew point" and GOST 20061 "Combustible natural gases. Method for determining hydrocarbons dew point temperature".

1.4 Technical characteristics of the Analyzer

1.4.1 The Analyzer provides:

- moisture and (or) hydrocarbons dew point temperature measurement;
- registration of dew point measured values (data archives), positive pressure and controlled medium temperature values (when additional pressure and temperature sensors are connected to the Analyzer) and recording of these values to the Analyzer's nonvolatile memory);
- digital indication of measured dew point values (°C), and, in case pressure and temperature sensors are connected: positive pressure (MPa), temperature (°C) of controlled atmosphere;
- transfer of the Analyzer's operation data to other measuring and information sys-

tems via RS-485 interface (in compliance with Appendix N);

- recalculation of measured dew point temperature values (°C) into other humidity units (mg/m^3) as well as recalculation of measured dew point temperature values from real pressure into contract pressure according to GOST 20060-83 (when an additional pressure gauge is connected to the Analyzer) in compliance with Appendix M;

1.4.2 DPT being operated as the Analyzer's component performs the following functions:

- measuring of primary signals and their normalization;
- automatic control over measuring process taking into account settings preset from IU;
- automatic diagnosis of DPT components and transfer of information on self-diagnostics to UI;
- visualization of measured values on built-in indicator.

1.4.3 IU as part of the Analyzer performs the following functions:

- measurement process control in dew point transducer and processing of measurement results;
- control of additional cooling stage (ACS) operation;
- adjustment of process parameters;
- storing of dew point temperature measurement data, temperature and pressure (provided temperature and pressure gauges are connected) within not less than 2 years;
- transfer of data to other information systems via RS232 and RS485 using standard Modbus protocol;

1.4.4 Special software VYMP2.844.005D21 is being installed on a portable computer and provides:

- visualization of dew point temperature measurement process (Appendix O);
- processing of data stored in the Analyzer's interface unit using terminal program "TRASSA-2" (Appendix M).

1.4.5 Dew point transducers incorporated into the Analyzer are made explosion-proof, correspond to the requirements of EN50014, EN50018 and can be mounted in hazardous areas in accordance with II 2G EExdIIAT5 marking.

Interface unit is intended for use outside hazardous areas.

1.4.6 Technical characteristics of the Analyzer are shown in table 2.

Table 2

Parameter description		Model	Value
Dew point measurement method		condensational (according to GOST 20060-83, GOST 20061-84)	
Dew point temperature measurement range	by moisture	DPT VYMP2.848.004, DPT VYMP2.848.004-01	from – 30 to +30 °C
		DPT VYMP2.848.004-02 [1)]	from – 50 to +10 °C
	by hydrocarbons	DPT VYMP2.848.004, DPT VYMP2.848.004-01	from – 30 to +30 °C
		DPT VYMP2.848.004-02	from – 30 to +10 °C
Limits of dew point measurement allowable absolute error *[1)]	by moisture		±0,25 °C [2)], ±0,5°C ±1°C
	by hydrocarbons		±1, ☛2 °C (pure propane)
Dew point temperature measurement cycle duration		DPT VYMP2.848.004, DPT VYMP2.848.004-01	from 10 to 30 minutes
		DPT VYMP2.848.004-02	from 20 to 120 minutes
Gas sample characteristics			
Pressure		DPT VYMP2.848.004, DPT VYMP2.848.004-01	up to 10 MPa
		DPT VYMP2.848.004-02	up to 25 MPa
Temperature			from –20 to +50°C

Table 2 (continuance)

DPT characteristics:			
Electrical connection		cable 4x0,75 мм^2 , outside diameter (6 – 12) mm	
Materials in contact with measured gas		Stainless steel 12X18N10T (TU14-1-3957-85), fluoroplastic 4, quartz, silicon	
Average gas flow rate through measuring chamber		DPT VYMP2.848.004-01 DPT VYMP2.848.004-02	(1– 2) norm.l/min [3)]
Average gas flow rate through additional cooling channel (when measuring dew point below minus 30°C), not more [(*2)]		DPT VYMP2.848.004-01 (- 02) with VYMP2.848.003 gas preparation system	15 norm.l/min
DPT explosion protection marking			II 2G EExdIIAT5
DPT ingress protection level			IP54
Mounting		DPT VYMP2.848.004	indoor or outdoor facilities (hazardous area)
		DPT VYMP2.848.004-01 DPT VYMP2.848.004-02	in heated box /room (hazardous area)
Connection to process		DPT VYMP2.848.004	installed directly on pipeline into mounting bushing with M33x2 internal thread
		DPT VYMP2.848.004-01(-02) with VYMP2.849.002(003) gas preparation system	Swagelok connection for tube of 6mm outside diameter
Characteristics of interface unit			
Output signal	Digital	RS232 /RS485 protocol Modbus/ RTU, insulation 500 V	
	Analog	2 outputs (4-20) mA, loading 400 Ohm (max), insulation 500 V	
	Discrete	2 outputs of “electronic key” type, loading 30 V/2 A (max), insulation 500 V	
Analog output power (4-20) мА		From power source built in secondary unit	
Input signals		Analog (1output) for connecting resistance thermometer	
		Analog (4-20) mA (1 output) for connecting pressure gauge	
Connection of resistance thermometer		4-wire line, length up to 300 m	
Power supply		Power supply unit RP1072-24	~ 50 Hz, 220 $^{+22}_{-33}$ V, 3 А
		DPT, solenoid (from IU)	= (20 – 27) V 30 VA
		IU VYMP3.622.002-01 (with RP1072-54 power supply unit)	= (20 – 27) V 3 VA
Weight and dimensional characteristics:			
Mass, not more		DPT	6,5 kg
		DPT with VYMP2.848.002 (003) gas preparation system	17 (20) kg
		IU VYMP3.622.002-01	0,85kg
		Power supply unit RP1072-24	0,68 kg
Overall dimensions, not more		DPT VYMP2.848.004	240x130x460 mm
		DPT VYMP2.848.004-01	240x120x270 mm
		DPT VYMP2.848.004-02	240x120x280 mm
		DPT with VYMP2.848.002 (003) gas preparation system	580x410x185mm (580x423x185)mm
		IU VYMP3.622.002-01	190x191x103 mm
		Power supply unit RP1072-24	97x40x128 mm

Operational conditions of the Analyzer		
Ambient working temperature	DPT VYMP2.848.004	from minus 40 to +40 °C

	DPT VYMP2.848.004 -01 DPT VYMP2.848.004-02	from +10 to +40 °C [4]
	IU VYMP3.622.002-01	from +1 to +35 ^{0}C
Relative air humidity	DPT	up to 98 % at +35 °C and below without moisture condensation (without direct exposure to atmospheric precipitation)
	IU	up to 80 % at +35 °C
Atmospheric pressure:	from 84 to 106,7 KPa (from 630 to 800 mm of Hg column)	
Mechanical actions:	DPT	amplitude of vibromovements up to 0,15mm in (10−55) Hz frequency range
	IU	amplitude of vibromovements up to in 0,1 mm in (10−25) Hz amplitude
Distance from DPT to IU	not more than 1000 m	
Average life, not less	10 years [5]	

There shall be no static or variable magnetic fields of commercial frequency with intensity of more than 40 (400 for DPTs) A/m.

[1] – with GPS VYMP2.848.003

[2] – Moisture dew-point measurement absolute error ± 0.25 in range -30...+30 only, at use of analyser as working standard.

[3] – norm.l/min – is liter in minute at 0.1 MPa pressure.

[4] – temperature in box/rooms, measuring chamber temperature and sample delivery lines temperature shall exceed measured dew point by not less than 5°C;

[5] – PIS average life not less of 3 year.

1.5 Description and operation of the Analyzer's component parts

1.5.1 Dew point transducer (DPT).

1.5.1.1 Structurally, DPT comprises sensor 1, case 2, covers 3, 4, gas inlet 5 and electronic unit inside case 2 (see Appendixes B, C, D). Both two-line indicator designed to be used for indicating measured moisture and hydrocarbons dew point values during the Analyzer's operation and case heating indicator (green – heating is OFF, red – heating is ON) can be found on DPT front cover under a transparent window.

Terminal box designed to be used for connecting both 4-wire cable and RS485 interface can be found under DPT rear cover. Appendix B shows numeration and purpose of terminals. Cable is connected to DPT terminal box via cable lead-in 8 (see Appendixes B, C, D).

DPT is connected to gas inlet using eight mounting stainless steel bolts. Connection of relevant DPT to a pipeline is discussed in Section 2.

1.5.1.2 Functionally, DPT comprises three complete units:

- primary information sensor (PIS);
- electronic unit (EU);
- gas inlet.

1.5.1.3 Primary information sensor (PIS) being part of DPT (see Appendix E) is a laser transducer. It transforms both input optical signal and sensing element temperature into output electrical signals of photodiodes and thermal sensor, accordingly. DPT design allows free access to PIS sensing element for cleaning the latter.

Laser light diode 10 is a source of radiation. Its polarized light reaches dielectric mirror 9 at a certain angle via a system of optical lenses 4, 11. Mirror 9 is being cooled using three-cascade battery 8. The light reflected from mirror 9 is being registered with three photodiodes: photodiode 5 that registers directed light reflection, and photodiodes 6 and 7, that register diffused (dissipated) light reflection.

The principle for registering condensate film formation on a mirror is based on Bruster's effect.

Differences in reflection properties of the film formed on a mirror are used in order to define physical nature of moisture and/or hydrocarbons being condensed from gas. Structures of

hydrocarbons and water films on a mirror are of different quality due to different surface tension coefficients of moisture and hydrocarbons. The film of hydrocarbons is uniform and that of water phase is not uniform and consists of a great number of micro drops. Due to this, condensate films of different physical nature redistribute the reflected light differently. In case fractions of hydrocarbons are being condensed on a mirror, the light reflected from a film surface is a directed light, and in case of moisture condensation the reflected light is a diffused one.

In connection with the above discussed physical nature of condensation, three light receivers 5, 6 and 7 (see Appendix E) are being used in the Analyzer's primary transducer in order to define condensation moment and to identify both moisture and hydrocarbons being condensed from gas.

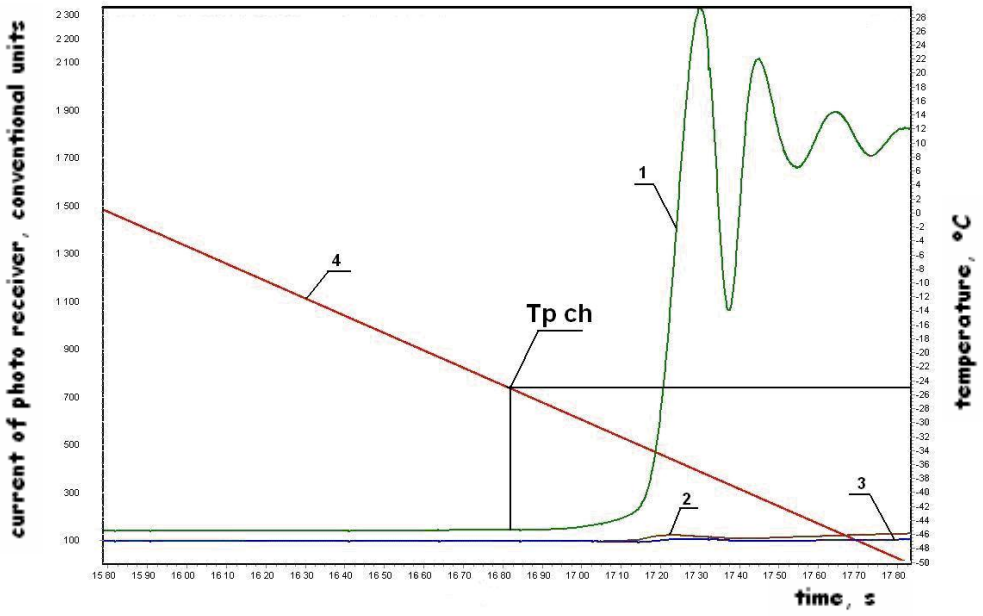


Figure 1 – Behavior of informational signals of photo receivers versus current mirror temperature during hydrocarbons condensation process:
1 – signal of directed reflection photo receiver 5;
2 – signal of directed-diffused reflection photo receiver 6;
3 – condensation mirror temperature;
4 – condensation mirror temperature.

1.5.1.4 The principle for measuring a dew point is as follows. Polarized laser ray is being directed via a light pipe at Bruster's angle to a dielectric mirror soldered to a thermoelectric battery (designed to be used for controlling a mirror's temperature). When a mirror is clean (i.e. no moisture film on it) all the falling light becomes refracted and there is no any reflected wave. When a mirror is being cooled and fluid film appears, part of the light flow is reflected due to the violation of Bruster's condition. When a uniform film of hydrocarbons appears on a mirror, the light falling from a source of radiation is being reflected from two interfaces of the following media: "gas – condensate film" and "condensate film – mirror"). Therefore, formation of such a uniform film of hydrocarbons results in two reflected signals that can make each other stronger or weaker depending on fluid film thickness. These modifications of signals are registered using photo receiver 5 opposite source of radiation 10. Besides, the photo receiver registers directed light reflection. Photo receiver 5 shows interferential picture of the two reflected signals with phase differential depending on the thickness of hydrocarbons film. Mirror temperature measured when signal of directed reflection photo receiver 5 becomes more intensive is considered hydrocarbons dew point temperature (Figure 1).

Photo receivers 6 and 7 are designed to be used for fixing distribution non-uniformities of water condensate ("drops") or ice crystals and hydrates on a sensing element. Since the photo receivers fix modifications of diffused light reflection, they are installed from one side of both guiding prism and photo receiver 5 that registers straight reflected signal. Photo receiver 6 fixes modifications of directed-diffused light reflection intensity along laser light flow (during mois-

ture condensation process), and photo receiver 7 fixes modifications of diffused reflection intensity which rises drastically during crystallization process of moisture drops (icing). Two diffused reflection photo receivers allow additional measuring of “water - ice” or “water - gas hydrate” phase transfer point (depending on both content and pressure of gas atmosphere).

Mirror temperature measured when intensity of signals of photo receivers 6 and 7 changes is considered moisture dew point temperature (Figure 2).

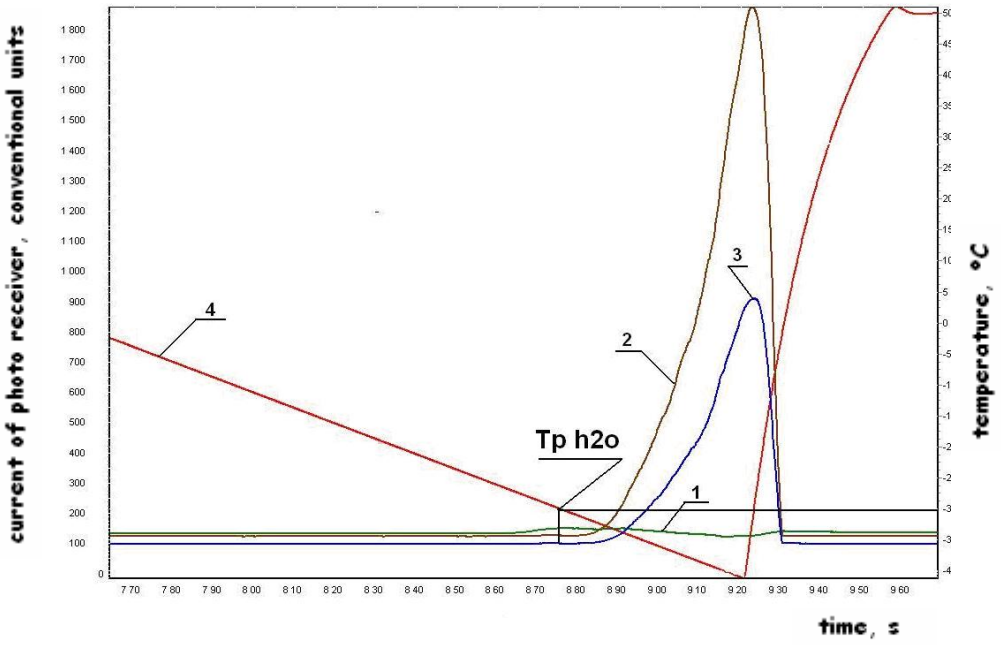


Figure 2 – Behavior of informational signals of photo receivers versus current mirror temperature during moisture condensation process:
1 – signal of directed reflection photo receiver 5;
2 – signal of directed-diffused reflection photo receiver 6;
3 – signal of diffused reflection photo receiver 7;
4 – condensation mirror temperature.

Therefore, three informational canals (i.e. three receivers of photo signals) allow high accuracy and adequate identification of condensation on hydrocarbons and moisture Analyzer’s mirror. Besides, it’s worth saying that moisture and hydrocarbons gas dew point temperatures can be defined irrespective of their mutual arrangement according to condensation starting temperature.

1.5.1.5 Dew point transducer (DPT) is made in several models depending on gas inlet and PIS type:

- DPT of VYMP2.848.004 model with immerged gas inlet is designed to be installed directly on pipelines;
- DPT of VYMP2.848.004-01 model with flowing gas inlet to be connected to pipelines according to flowing sample, e.g. via VYMP2.848.002 gas preparation system. DPT completed with VYMP2.848.002 gas preparation system can be used for measuring dew points up to minus 30°C at working pressure of up to 10 MPa;
- DPT of VYMP2.848.004-02 model in contrast to DPT of VYMP2.848.004-01 model uses elements of higher strength that allow to operate it at maximum working pressure of up to 25 MPa. Besides, DPT sensor is heat insulated from its housing. This provides more efficient cooling of DPT sensor when the latter is being used in the set with VYMP2.848.003 gas preparation system (with additional cooling) and eliminates moisture condensation on DPT housing (it is important for applications having high ambient air humidity).
- Specific features of measuring low dew point temperatures.

1.5.1.6 In order to make measurement range wider to involve lower dew point temperatures DPT housing shall be additionally cooled by passing cooling agent via special channel

in sensor's case. Temperature to which DPT housing shall be additionally cooled depends on both measured atmosphere pressure and gas composition. Figure 3 shows this dependence for natural gas.

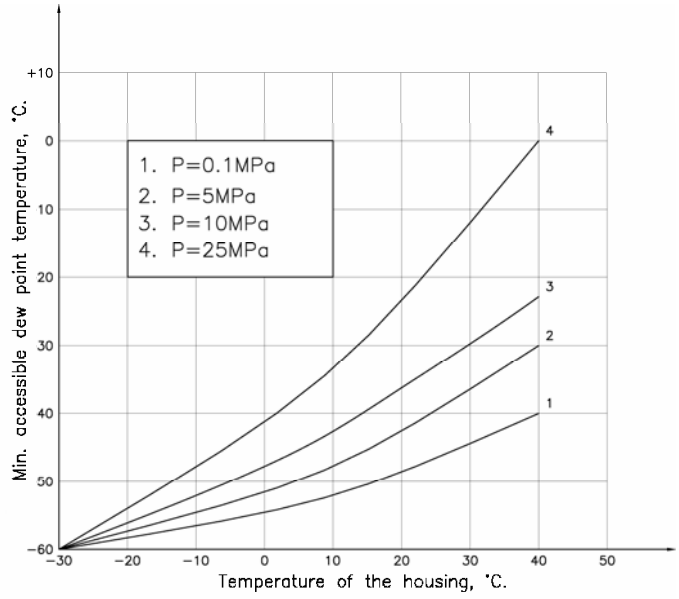


Figure 3 – Low measurement limit of the Analyzer versus DPT housing temperature at various working pressures of measured atmosphere.

Operating mode involving additional cooling is used in VYMP 2.848.003 gas preparation system. It allows to measure dew point in the range of up to minus 50 °C at working pressure of 25 MPa.

1.5.2 Interface unit (IU)

Figure 4 shows general view of interface unit. IU overall dimensions are given in Table 2 and Appendix J.

Figure 4

1.5.2.1 Interface unit is made in plastic housing having IP54 dust and moisture protection level according to GOST 14254.

The following parts can be found under front transparent cover:

- LCD indicator with illumination that shows data on the Analyzer's operation;
- Signal LEDs;
- keyboard having five buttons. The keyboard can be accessed without opening the transparent cover.

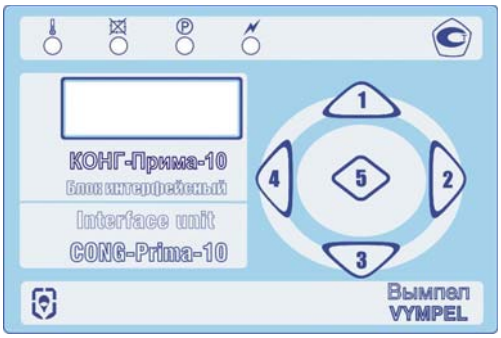
The following parts can be found under removable (non-transparent) front cover:

- threaded terminals for connecting external circuits;
- replaceable power sourc.

Electric cables from external devices are being entered into the housing through hermetic lead-ins sealed by rubber rings.

1.5.2.2 The following controls and indicators are on IU front panel:

a) light diodes used to indicate the below service signals:



– DPT overheat indicator;

– no-communication with DPT indicator. Communication line with DPT is disturbed. IU-DPT connection shall be checked for integrity;;

– ON-indicator for cleaning mode of DPT sensing element;

– IP power indicator. It signals voltage supply (absence) from power supply unit.

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Actions of personnel when switching light diode indicators on are described in i. 4.2.8.

b)control buttons of the Analyzer's operation modes:

- **1** and **3** – moving through menu, change of digits up or down by one;
- **2** – entry or change of digits when defining a value;
- **4** – exit or change of digits when defining a value;
- **5** – confirmation or exit.

It's possible to connect a terminal computer with special software to a terminal on the side wall of IU housing. The terminal computer provides:

- visualization of dew point temperature measuring process (Appendix O);
- processing of data stored in the Analyzer's CU using "Trassa-2" terminal program (Appendix M).

A plate with external connections diagram is inside IU removable cover.

1.5.3 Power supply unit (PU)

Figure 5 shows RP1072-24 power supply unit delivered together with IU. PU is intended for supplying DC power of (20 – 27) V to the Analyzer (IU).

PU overall dimensions are given in Table 2. Dust and moisture protection level is IP20 according to GOST 14254.

Appendix A shows diagram of the Analyzer's electrical connections.

Figure 5

1.5.4 Gas preparation system (GPS)

1.5.4.1 Gas preparation systems of VYMP2.848.002 and VYMP2.848.003 models are used:

- when measured gas has fluid drops, e.g. when DPT is installed close to (less than 50 m away) from absorber and, hence, sorbents are carried away with drops;
- when it is required to measure humidity of gas supplied from several pipelines using one DPT;
- when it is required to sample gas to be measured from places which are difficult to access (underground pipelines or high-installed pipelines etc.) where it is impossible

to use DPT of VYMP2.848.004;

- when analyzed gas sampling place has vibrations over 0,1mm in the frequency range of 10-25 Hz (vibration exceeds vibration allowable for DPT).

Besides, gas preparation system of VYMP2.848.003 model is used:

- when analyzed gas contains admixtures that condense earlier with the dew point temperature exceeding moisture dew point by over 20 °C;
- when additional cooling of DPT of VYMP2.848.004-02 model is required.

1.5.4.2 VYMP2.848.002 gas preparation system provides filtering of mechanical impurities and control over gas pressure and flow rate via DPT measuring chamber at working pressure of 10 MPa.

VYMP2.848.003 gas preparation, in addition to the above functions, provides preparation o gas for cooling sensor's housing when measuring dew point temperatures in the range of minus 50 to 10 ^{o} C at gas working pressure of up to 25 MPa.

1.5.4.3 Overall and mounting dimensions of the systems are given in Appendixes G and H.

Components of VYMP2.848.002 gas preparation system are as follows (see Appendix G):

- control valve (pos.2) used for smooth filling of measuring chamber with gas;
- ball cock (pos.3) in «**Outlet 1**.» position allows purging of sampling main; in «**Vent**» position – purging of filter (pos.8);
- terminal box (pos.4) used for connecting DPT to external power networks (power supply, data transfer);
- manometer (pos.5) used for measuring pressure in the Analyzer's measuring chamber;
- pressure regulator (pos.6) used for keeping gas pressure within specified limits (2-3 kgf/cm^2) upstream of gas flow regulator (e.g. rotameter with control valve);
- flowmeter (pos.7) with control valve used to regulate and control gas flow rate via measuring chamber;
- filter (pos.8) with replaceable elements intended for cleaning analyzed gas from mechanical impurities.

Components of VYMP2.848.003 gas preparation system are as follows (see Appendix H):

- control valve (pos.2) used for smooth filling of measuring chamber with gas;
- ball cock (pos.3) in «**Outlet 1**.» position allowing purging of sampling main; in «**Vent**» position – purging of filter (pos.8);
- terminal box (pos.11) used for connecting both DPT and solenoid valve to external power networks. In order to meet explosion protection requirements, explosion-proof fuse of 2 A, 250 V is built in terminal box;
- manometer (pos.5) used for measuring pressure in the Analyzer's measuring chamber;
- pressure regulator (pos.6) used for keeping gas pressure within specified limits (2-3 kgf/cm^2) upstream of gas flow regulator (e.g. rotameter with control valve);
- flowmeter (pos.7) with control valve used to regulate and control gas flow rate via measuring chamber;
- filters (pos. 8 and pos. 10) intended for cleaning from mechanical impurities of both analyzed and coolant gases, accordingly;
- solenoid valve (pos.9) used for opening/closing of cooling agent passage via special channel in DPT sensor and, hence, for automatic regulating of sensor's housing temperature. The Analyzer's CU controls the valve;
- cooling device (restrictor and heat exchanger pos. 12). Gas is being cooled according to Joule-Thompson's effect (gas is cooled when being expanded).

1.5.4.4 All components of gas preparation system are mounted on load-bearing metal panel that is wall-fixed using four M8 bolts.

GPS uses Swagelok fixtures and fittings. Swagelok SS-6MO-61 couplers to the right of GPS intended for connecting tubes of 6 mm outside diameter are used for connecting to inlet/outlet pipelines in GPS.

VYMP2.848.002 gas preparation system is connected to sampling main using "**Inlet port"** union. Both outlet of analyzed gas and purging of sampling main are performed using tubes connected to "**Outlet Port"** and **"Vent. port"** unions, correspondingly.

VYMP2.848.003 gas preparation system is connected to sampling main using "**Inlet port"** union. Both outlet of analyzed gas and purging of sampling main are performed using tubes connected to "**Analyzed Gas Outlet Port"** and **"Vent. port"** unions, correspondingly. Inlet of coolant gas is being conducted using "**Coolant Gas Inlet Port"** union**.** Outlet of coolant is being conducted using tubes connected to "**Coolant Gas Putlet Port"** union**.**

1.6 Connection of additional gauges to the Analyzer

Pressure and temperature gauges can be additionally connected to IU in accordance with Appendix A.

1.6.1 Connecting pressure gauge

Positive pressure transformer with electric current output of 4…20mA must be connected to IU in order to recalculate dew point values measured at working pressure into dew point values corresponding to conditional (contract) pressure.

When selecting and mounting primary pressure transformer the following must be taken into consideration:

- error of primary pressure transformer must be within ± 0,25%;
- when pressure measured using primary transformer deviates from pressure in DPT measuring chamber by 1 kgf/cm^2 due to error of primary transformer or long distance between the latter and DPT, dew point temperature changes by value within 0,4°C.

For instance, when primary pressure transformer with upper limit of 10 MPa is selected, error when recalculating dew point value into contract pressure due to primary transformer error will be within 0,1°C.

The above recalculation is conducted using Trassa-2 terminal program (Appendix M). Therefore, no recalculated values are displayed on DPT and IU indicators.

1.6.2 Connecting temperature gauge

Temperature gauge is connected to the Analyzer for recalculating measured dew point values into relative humidity values (at present this function is not realized). Measured temperature values are displayed on IU indicator.

1.7 Communication capabilities of the Analyzer

The Analyzer has the following devices used for connecting it to measuring-informational systems:

- serial interface RS232;
- serial interface RS485;
- analog outputs 4-20 mA;
- discrete outputs.

Serial interface RS232. This port is used for connecting a terminal computer used for the following:

- reading of data archives from the Analyzer's built-in memory;
- visualization of condensation-evaporation processes when measuring dew points.

Connector for connecting a computer is on a side wall of IU housing. This port can be used for transferring measurement data to an external computer according to ModBus/RTU protocol. The interface has galvanic insulation; insulation voltage is 500 V DC.

Serial interface RS485 (N1). This port is used for transferring measurement data to an external computer according to ModBus/RTU protocol. Galvanic insulation is 500 V DC. RS485 connector is on IU front panel under a removable cover. It is connected in compliance with a table on IU removable cover and Appendix A.

Note – Data exchange between IU and external computer at current time can be conducted via one of interfaces – RS232 or RS485(N1). Switching to corresponding interface must be conducted before exchange in IU menu starts (see i. 2.7.2, “Link”).

Serial interface RS485 (N2). This port is used for data exchange between IU and DPT. Interface has no galvanic insulation. DPT is connected to IU via RS485 connector in accordance with both Appendix 2 and a table on IU removable cover.

Analog outputs 4-20 mA. Number of outputs – 2. These outputs receive measured moisture and hydrocarbons dew point values. Maximum load resistance at each output must be within 400 Ohm. The output is active since it is powered from IU built-in power supply unit. Galvanic insulation is 500 V DC. Outputs are not insulated between themselves.

Ratio between dew point values (T_P) displayed on IU indicator (DPT) as digits and current (I) values at analog outputs is as shown below:

$T_P = 3{,}75\ (I - 4) - 30$ – by moisture and hydrocarbons for minus 30… + 30 ^{0}C range
$I = 0{,}267\ (T_P + 30) + 4$

$T_P = 3{,}75\ (I - 4) - 50$ – by moisture for minus 50…+ 10 ^{0}C range
$I = 0{,}267\ (T_P + 50) + 4$

$T_P = 2{,}5\ (I - 4) - 30$ – by hydrocarbons for minus 30…+10^{0}C range
$I = 0{,}4\ (T_P + 30) + 4$

Discrete outputs. Number of outputs – 2. Outputs are used for formation of signals “Attention” (“Attention 1” – moisture dew point is not within measurement range and “Attention 2” – hydrocarbons dew point is not within measurement range). Electronic keys with load capability of 30 V, 2 A are used as commuting elements. Galvanic insulation – 500 V DC. The Analyzer’s analog and discrete outputs are connected in accordance with a table on IU removable cover.

1.8 Description of the Analyzer’s functioning algorithm

The Analyzer is an automatic device for measuring both moisture and hydrocarbons dew points. In case hydrocarbons dew point is higher or equal to moisture dew point, both dew points are measured during one basic measurement cycle. In case moisture dew point exceeds hydrocarbons dew point by more than 5 °C, the Analyzer’s operating algorithm provides additional hydrocarbons dew point measurement cycle.

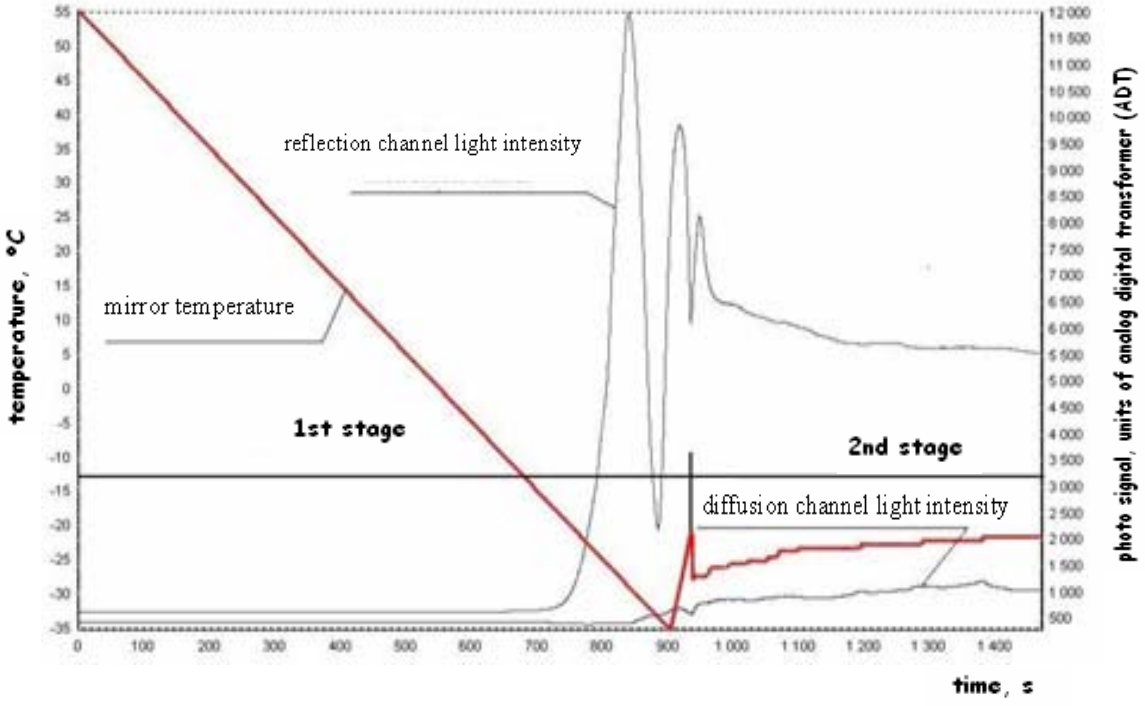


Figure 6 – Basic measurement cycle

In case one or both dew points are not within the Analyzer's low measurement range, DPT and IU indicator displays "**NO"** in the corresponding icon-place.

Measurement cycle involves two stages (Figure 6). First stage is a slow cooling (0,2°/s) of mirror to moisture condensation starting temperature with its subsequent heating to moisture film evaporation temperature. Preliminary moisture dew point is being determined at this stage, and hydrocarbons dew point is being fixed (in case its temperature exceeds minimum mirror temperature during its cooling). Since dew points are being fixed using two different measuring channels, both moisture and hydrocarbons dew points are measured even in case of their coincidence.

At second stage preliminary moisture dew point is determined more precisely by analyzing signal intensity of light dissipated from mirror's surface while mirror temperature (starting with preliminary moisture dew point) is being kept at a specific value. Increase or reduction of diffused reflection signal intensity signals about condensation or evaporation process, correspondingly.

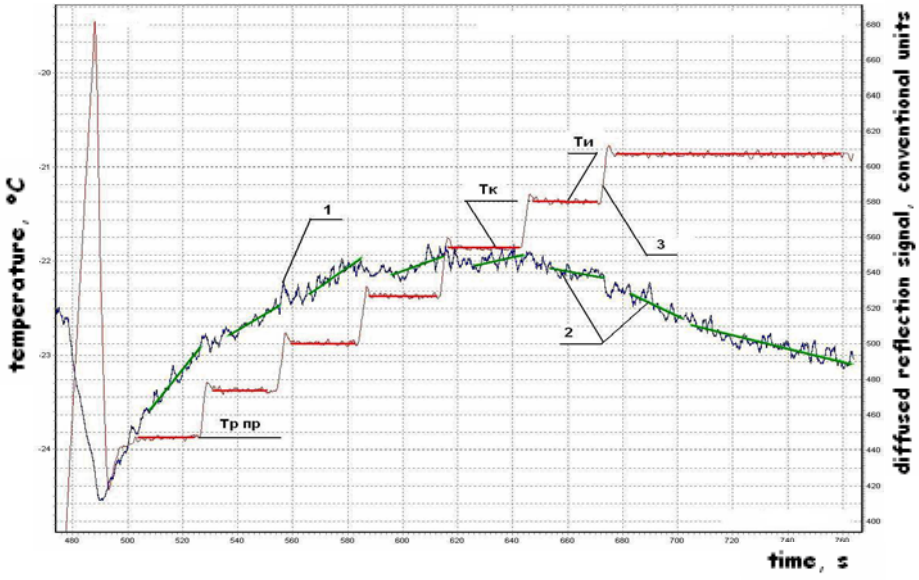


Figure 7 – Illustration of moisture dew point exact determination process:
1 – diffused reflection signal; 2 – diffused reflection signal linear approximation; 3 – current mirror temperature

As it can be seen on Figure 7, that illustrates moisture dew point precise determination process, photo receiver's real signal is being linearly approximated at temperature stabilization area when calculating signal speed change. Accordingly, approximated straight line incline angle defines both speed and direction of diffused reflection signal change at this area. Therefore, moisture dew point temperature precise determination involves determination of mirror temperature at which moisture film evaporates Ти provided condensation of the latter (Тк temperature) has been fixed earlier (at lower mirror temperature) and vice versa (in case dew point temperature is approached differently). Dew point temperature is being calculated as an average value between Ти and Тк temperatures that differ from each other by mirror temperature change value step during measurement process.

Additional measurement cycle for hydrocarbons dew point (Figure 8) is used in case a customer needs data on the presence of hydrocarbons condensing after moisture in gas. This information is not required as far as natural gas preparation and transport are concerned. Hence additional measurement cycle is not used when the Analyzer works in a regular mode.

Additional measurement cycle involves light intensity analysis only via reflection channel responding to condensation of hydrocarbons when mirror is being cooled. In case light intensity via reflection channel is not considerably increased during mirror cooling (i.e. confirmation level is not approached), hydrocarbons dew point is not fixed (hydrocarbons dew point is lower than the Analyzer's measurement range or hydrocarbons are not present in gas sample).

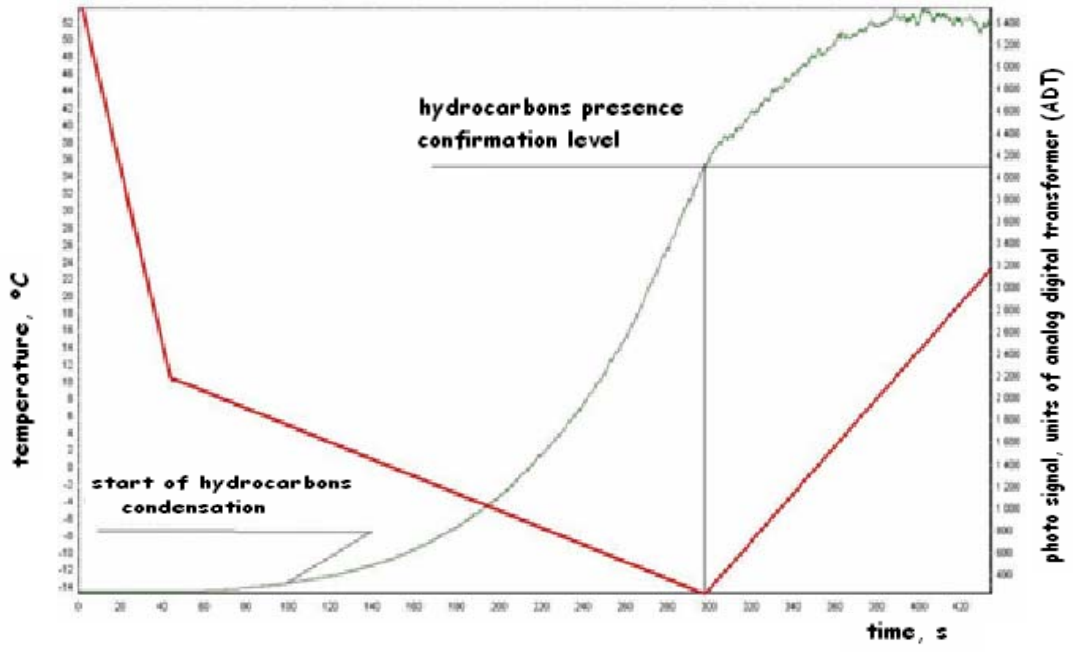


Figure 8 – Additional measurement cycle using hydrocarbons

Prior to each cycle both contamination level of sensing element (SE) and current temperature of DPT housing are being determined. In case DPT housing is heated over critical temperature (41°C) or sensor contamination signal becomes unstable, contamination indicator blinks on IU panel, and DPT SE is being heated (55°C) until it starts functioning again.

1.9 Marking and sealing

1.9.1 DPT marking and sealing.

Each DPT shall have a plate with the following data on it:

- manufacturer's name;
- name of the device including number of its model;
- explosion protection marking II 2G EExdIIAT5;
- number of Ex-certificate;
- CE-marking;
- environmental protection level marking (IP54);
- measured dew point range;
- output signal;
- maximum allowable operating positive pressure;
- operating temperature of the instrument of −40º≤ta≤+40ºC;
- allowable supply voltage range and power consumption;
- factory number of the transducer;
- date of manufacture (month and year);
- fabrication location.

Both covers shall have "ОТКРЫВАТЬ, ОТКЛЮЧИВ ОТ СЕТИ ~ DO NOT OPEN WHEN ENERGIZED" inscription.

Plate with power supply parameters and connection diagram shall be glued inside terminal block cover.

Grounding mark according to GOST2113 shall be inscribed on the lid near grounding bolt.

Electronic unit mounted inside DPT shall be closed by lid and sealed at factory-manufacturer.

1.9.2 IU marking.

IU housing shall have the following marks and inscriptions:

- name of product;
- manufacturer's trade mark;

- ISO certification symbol;
- marking of protection level against solids and water according to GOST 14254 (IP54);
- allowable supply voltage range;
- product factory number;
- date of manufacture (month/year).

1.10 Packaging

1.10.1 Prior to packaging all the Analyzer's units shall be preserved in accordance with GOST9.014 requirements (VZ-10 protection type) and design documents for packaging. Prior to packaging DPT sensing element shall be closed by a special protection cap preventing sensing element from mechanical damages and contamination.

Analyzers are packed according to factory-manufacturer's drawings in closed ventilated rooms at ambient air temperature from +15°C to +40°C and relative air humidity of up to 80 % without any aggressive impurities in ambient air.

Packing protects analyzers during cargo operations, transportation and storage as well as against various climate factors and mechanical loads.

Analyzers' packing has means for their amortization in shipping containers.

Operational and transportation documents are wrapped with waterproof material and placed under container's cover in the upper layer of packing material.

1.10.2 When transporting DPT (without gas inlet) for calibration or repairing its sensing element must be covered using a special protection cap (from the delivery package) to avoid mechanical damages and contamination

2 DESIGNATED APPLICATION

2.1 Operational restrictions

2.1.1 IU is intended for use in explosion protection areas.

2.1.2 The Analyzer's DPT can be mounted in explosive areas of indoors and outdoors facilities in compliance with IEC 60079-14, part. 7.3 of EIC and with other normative instructions regulating application of electric equipment in explosive areas.

2.1.3 The Analyzer's operational conditions are in accordance with i. 1.4.6 of the present manual.

2.1.4 When the Analyzer is operated in the range of negative temperatures, accumulation and freezing of condensate in DPT measuring chamber and gas supply lines shall be excluded. To do this DPT measuring chamber and gas supply lines shall be heat insulated with a warmth-keeping jacket included in the delivery package or with any other means, allowing to maximally use pipeline thermal power. DPT has a built-in heating element of 20VA (max) used to stabilize housing temperature at the preset level (in the range of (10…30)°C provided heat insulation is sufficient).

2.1.5 For DPT with flowing gas feed temperature of sampling system shall exceed measured dew point by not less than 5 ˚C. To meet this condition you will probably have to heat sampling system elements beforehand

2.1.6 DPT shall be mounted at the ambient temperature of not lower than minus 5 °C and in the absence of atmospheric precipitation.

2.1.7 It is allowed to mount DPT on underground gas pipelines provided all the above conditions are observed.

2.2 Preparation of the Analyzer to operation

2.2.1 On receiving the Analyzer make sure that its container is not damaged. Other-wise a special protocol shall be drawn up.

2.2.2 In winter shipping container shall be unpacked in a heated room in not less than 12 hours after it is brought inside.

2.2.3 Check availability of the Analyzer's component parts according to its specification.

2.2.4 Then the Analyzer must be depreserved and visually inspected.

2.2.5 On receiving the Analyzer it is recommended to make a register for its operating time and failures.

2.3 Installation and mounting of the Analyzer

2.3.1 Table 4 shows tools and accessories used during installation, mounting and maintenance operations.

Table 4

Tool description	Toll size	Note
Double-ended wrench	24X27	
Double-ended wrench	17X19	
Double-ended wrench	12X14	
Double-ended wrench	8X10	
Socket wrench	10	To fix stop bushes
Screwdriver		
Special wrench	VYMP8.331.003	For DPT covers
Set for SE cleaning		

2.3.2 General provisions:

- when mounting/dismounting DPT pressure in gas inlet shall be reduced to normal;
- DPT is fixed to sampling device (of any model) by using eight M6 (M8 – for VYMP2.848.004−02 model) special bolts made of stainless steel (breaking strength 830 MPa). **It is forbidden to use other bolts to fix DPT;**
- depending on the complete set, electric wiring of the Analyzer must be performed in accordance with the electric diagram of connections shown in Appendix A;
- it is recommended to use a special protective cap (from DPT package) to protect DPT sensing element against damages;
- it is also recommended to use a technological lid (from DPT package) to protect gas inlet inner space against dust and atmospheric moisture (with removed DPT).

2.4 : Requirements to DPT's location

2.4.1 The following shall be taken into consideration when selecting DPT installation place:

- DPT installation place shall provide convenient conditions for its servicing and dismounting;
- DPT installation place (sampling place) shall be on pipeline linear section;
- pipeline linear section shall have no constrictions or obstructions over the length equal to 5 pipeline diameters downstream and to 3 pipeline diameters upstream DPT installation place;
- gas sampling shall be performed from flow depth;
- ambient air temperature and relative humidity shall correspond to values specified in section 1.4;
- atmosphere around DPT shall have no impurities causing corrosion of DPT parts;
- strength of magnetic fields caused by external AC sources (50 Hz) or DS sources shall not exceed 400 A/m.

2.4.2 Installation of DPT of VYMP2.848.004 model (with submerged sampling device).

Sampling device (without DPT) is mounted in the following sequence:

- weld a bush of M33x2 internal thread (included in DPT delivery package) vertically (allowable deviation is ±10˚) into pipeline;
- make sure that gas inlet has O-ring;
- screw gas inlet in mounting bush as far as it will go;
- orient gas inlet on gas flow according to the arrow by rotating it anticlockwise but not for more than one revolution;
- fasten locknut;
- place gas inlet ball cock cradle in "CLOSE" position (see Appendix F);
- fill pipeline with gas and check it for leaks at working pressure. To do this soap slots between locknut and mounting bush. If bubbles appear, tighten locknut.

Mount DPT on gas inlet in the following sequence:

- purge gas inlet. To do this open gas inlet ball cock for 5-10 seconds;
- fix DPT on sampling device by using eight bolts (from DPT package);
- make sure that connections have no leaks. For this open ball cock and soap ball cock stem seal, needle valve 9, purging bolt 11, slot between sensor flange 1 and gas inlet. If bubbles appear, tighten the appropriate connections;
- perform electric wiring of DPT according to Appendix A;
- ground DPT. To do this connect DPT grounding terminal to grounding busbar using insulated copper conductor of not less than 1,5 mm^2 section (4 mm^2 – in case non-insulated copper conductor is used);
- if necessary, mount sun shed on DPT (see Appendixes K) and heat-insulating cap (from DPT package).

DPT is dismounted from sampling device in the reverse order. After DPT is dismounted, gas inlet shall be closed by technological lid to protect it against dust and atmospheric moisture.

2.4.3 Installation of DPT of VYMP2.848.004-01 model (with flowing sampling device):

- fix DPT gas inlet using four M8 bolts vertically on horizontal surface (see Appendix C, view A);
- fix DPT on gas inlet using eight bolts (from DPT package);
- connect gas inlet to sampling system (provided by Customer). Analyzed gas flows via **In.** inlet and **Out.2** gas inlet outlet. **Out.1** outlet is used for purging pipeline when performing preventive maintenance works;
- check connections for leaks. To do this fill measuring chamber (gas inlet) with gas at working pressure and soap slot between sensor flange 1 and gas inlet as well as sealing points of all unions. If bubbles appear, tighten the appropriate connections;
- perform electric wiring of DPT according to Appendix A;
- ground DPT. To do this connect DPT grounding terminal to grounding busbar using insulated copper conductor of not less than 1,5 mm^2 section (4 mm^2 – in case non-insulated copper conductor is used);
- if necessary, mount a sun shed on DPT (see Appendixes K) and heat-insulating cap (from DPT package).

DPT is dismounted from gas inlet in the reverse order. After DPT is dismounted, gas inlet shall be closed by technological lid to protect it against dust and atmospheric moisture.

2.4.4 Installation of DPT of VYMP2.848.004-01 model with VYMP2.848.002 gas preparation system (GPS).

Basic requirements to be taken into consideration when mounting gas preparation system are as follows:

- uninterrupted ascent of pipeline between sampling device and gas preparation system shall be assured;
- connecting pipeline shall be as short as possible;
- warming up of the whole sampling track, including GPS components shall be provided at the level exceeding measured dew point maximum predicted value by 5-10 ^0C;
- pipeline shall be made of stainless steel of 316ss or the like type. Pipeline diameter is 2…6 mm.

Installation is carried out in the following sequence:

- fix GPS vertically on the wall by using four M8 bolts;
- connect inlet and outlet pipelines to GPS couplings. When gas is removed from GPS ("**Out. port**" and "**Vent. port**") to atmosphere it is allowed to connect GPS outlets to a common collector;
- connect DPT power cable to GPS terminal block in accordance with connection diagram (see Appendix A);
- ground DPT. To do this connect DPT grounding terminal to grounding busbar using insulated copper conductor of not less than 1,5 mm^2 section (4 mm^2 – in case non-insulated copper conductor is used).

After installation is finished, connections shall be checked for leaks. To do this open control valve pos. 2 and fill gas inlet with gas to working pressure with ball clock pos. 3 and pressure regulator pos. 6 in closed position. Soap the slot between sensor flanges and gas inlet as well as sealing points of **IN, OUT.1, OUT.2** unions. If bubbles appear, tighten the appropriate connections.

To dismount DPT from GPS (see Appendix G) proceed as follows:

- switch IU power off;
- close control valve pos. 2;
- place ball cock pos. 3 in **"Vent"** position;
- disconnect DPT power cable from terminal block and remove it from terminal box

pos. 11;

- disconnect gas supply tubes from **IN, OUT.1, OUT.2** DPT inlets;
- unscrew the four bolts that fix DPT to bracket;
- remove DPT from bracket.

2.4.5 Installation of DPT of VYMP2.848.004−01 (–02) model with VYMP2.848.003 gas preparation system.

Basic requirements to be taken into consideration when mounting gas preparation system are the same as specified in i. 2.3.6.

Installation is carried out in the following sequence:

- fix GPS vertically on the wall by using four M8 bolts;
- mount pressure regulator in cooling manifold;
- connect inlet and outlet pipelines to GPS couplings (see Appendix H). When gas is removed from GPS ("Out. port" and "Vent. port") to atmosphere it is allowed to connect GPS outlets to a common collector;
- connect DPT power cable to GPS terminal block in accordance with connection diagram (see Appendix A);
- ground DPT and solenoid valve. To do this connect DPT and solenoid valve grounding terminals to grounding busbar using insulated copper conductor of not less than 1,5 mm^2 section (4 mm^2 – in case non-insulated copper conductor is used).

After installation is finished, connections shall be checked for leaks (see i.2.3.6).

To dismount DPT from GPS (see Appendix H) proceed as follows:

- switch IU power off;
- close control valve pos. 2;
- place ball cock pos. 3 in **"Vent"** position;
- disconnect DPT power cable from terminal block and remove it from terminal box pos. 11;
- disconnect cooling channel tubes from unions on sensor flange;
- disconnect tubes from **IN, OUT.1, OUT.2** DPT gas inlet unions;
- unscrew the four bolts that fix DPT to bracket;
- remove DPT from bracket.

2.4.6 Mounting of interface unit (IU).

2.4.6.1 The following must be taken into consideration when selecting IU mounting place:

- IU must be installed indoors outside explosive areas;
- IU installation place must be convenient for its maintenance;
- operating conditions must meet the requirements given in Table 2.

2.4.6.2 Fix IU on its installation place. To do this, first unscrew two screws on IU housing cover and open the housing. Then fasten IU with three M5 screws using a tab and two mounting holes. Using 22x24wrench loosen nuts for the required number of pressurized feed-throughs near the clamps to which lead-outs will be connected and unplug them. Non-used pressurized feed-throughs must be plugged. Connect cable lead-outs into pressurized feed-throughs so that their external insulation was 5-10 mm inside the housing. Using 22x24wrench tighten nuts of pressurized feed-throughs preventing lead-outs from being twisted by more than half a turn.

Insert terminals of lead-outs into clamps. Lead-outs must be placed in the housing without any tension using hinges with radius of not less than 15 mm. r

2.4.6.3 Depending of the complete set, electric wiring must be performed in compliance with Appendix A.

2.4.6.4 Carefully close IU housing and smoothly tighten mounting screws preventing its cover from being warped.

Notes:

1) In case IU is being operated in indoor facilities with high humidity, both cover warp and improperly installed pressurized feed-through can make its housing less pressurized and thus lead to IU damage due to moisture and dust entering the housing.

2) The line for connecting DPT to IU must have the following parameters:
– connection line must not be longer than 1000 m;
– connection cable ohmic resistance is selected in order to provide input voltage at DPT power source of not less than 20 V at DPT consumption current of 1,5 A;
– special interface cable (e.g., cable 3106A, Belden Inc., USA) must be used for data transfer (interface RS485). In case DPT is not more than 200 m away from IU, it is allowed to use cable similar to cable used for supplying power to DPT.

IU is dismounted in the reverse order.

Power unit is mounted in compliance with its operating manual. Network power must be supplied to power unit using external fuse with operating current of 2 A.

2.5 Getting ready to operation

2.5.1 Thoroughly study "Analyzer Operational Manual" VYMP2.844.005OM.

2.5.2 Prior to starting the Analyzer, make sure all the mounting requirements specified in i.i.2.1-2.3 of the present Manual are observed.

2.5.3 Getting VYMP2.848.002 (003) gas preparation system ready to operation

Prior to starting the system, all valves and cocks must be closed (Appendixes G, H).

In case gas preparation system (GPS) is started for the first time after conducting mounting works or after a long-term operational break, sampling main must be purged. To do this ball cock pos. 3 must be placed in **"Vent"** position for 1-2 minutes. Within this time mechanical impurities left after mounting works and moisture in liquid phase (if any) will be removed from sampling main. After sampling main is purged, ball cock pos. 3 must be closed (closed position is a middle position).

Then proceed as follows to start GPS:

- slowly open control valve pos. 2 and fill DPT gas inlet at the same time but not faster than 0.5 MPa per second (pressure in gas inlet is controlled using manometer pos. 5). After pressures in both gas inlet and pipeline become equal, valve pos. 2 must be fully opened;
- turning valve on flowmeter pos. 7, set gas flow via gas inlet at 1.5±0.5 normal liters/min. (graduated characteristic of flowmeter can be found in its operational certificate);
- for purging gas inlet place cock pos.3 in "Outlet 1" position for 10-15 minutes. After gas inlet is purged, cock pos. 3 must be closed (closed position is a middle position).

After that gas preparation system is considered to be in working condition.

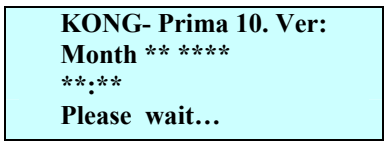
Study "Operational Manual" for the Analyzer.

Make sure that the Analyzer's installation and mounting are in compliance with the requirements specified in i. 2.3.2 -2.3.8 of the present Manual.

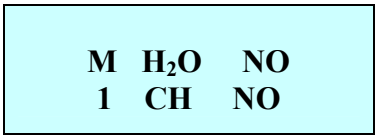
Make sure that safety regulations specified in i. 3 of the present Manual are observed.

2.6 Powering on of analyzer

2.6.1 To start the Analyzer supply voltage to RP1072-24 power unit. Then IU indicator appears as below:



After the software is loaded, indicator will show basic mode of indication:



In this mode indicator is divided into two parts:

The upper part indicates moisture dew point temperature values measured in automatic mode and lower part - hydrocarbons dew point measured values

2.6.2 Designations used in basic mode of indication

The following designations are used in basic mode of indication:

- **M** – IU operating mode;
- **1** – ordinal number of operating mode (five operating modes are provided all in all);
- **H_2O** ∗ ∗, ∗ – last moisture dew point temperature value measured in automatic mode. In case the Analyzer has been just enabled or measurements in automatic mode have not been performed, instead of ∗ ∗, ∗ "NO" is indicated. If at least one moisture dew point has been measured in automatic mode, instead of ∗ ∗, ∗ measured dew point in degrees Celsius (^{0}C) is indicated;
- **CH** ∗ ∗, ∗ – last hydrocarbons dew point temperature value measured in automatic mode. In case the Analyzer has been just enabled or measurements in automatic mode have not been performed as well as in case hydrocarbons in gas are not present (hydrocarbons dew point value is below moisture dew point value), instead of ∗ ∗, ∗ "NO" is indicated. If at least one correct measurement of hydrocarbons dew point has been performed in automatic mode, instead of ∗ ∗, ∗ measured dew point in degrees Celsius (°C) is indicated.

2.7 Main Menu of the Analyzer

2.7.1 When you push one of the buttons (right, left or middle) «**Regime**» menu is displayed. «**2**» and «**4**» buttons are used for transition between submenus. «**1**» and «**3**» buttons are intended for moving through submenu items, and «**5**» or «**2**» button is used to enter submenu items.

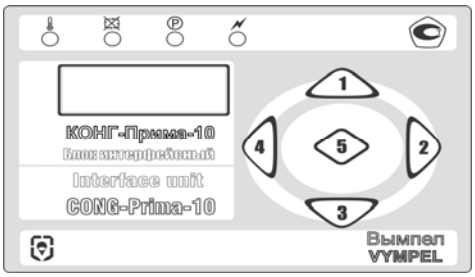


Figure 9 – Face panel of IU

The Analyzer's Menu has three sections. It can be accessed by pressing «**2**» button. Navigation through the Menu is based on the following principle:

- **1** and **3** – moving through menu and changing of digit by one unit up or down;
- **2** – entry or change of digits when specifying value;
- **4** – exit or change of digits when specifying value;
- **5** – confirmation or entering menu item.

Structure of the Menu is given in Fig. 10.

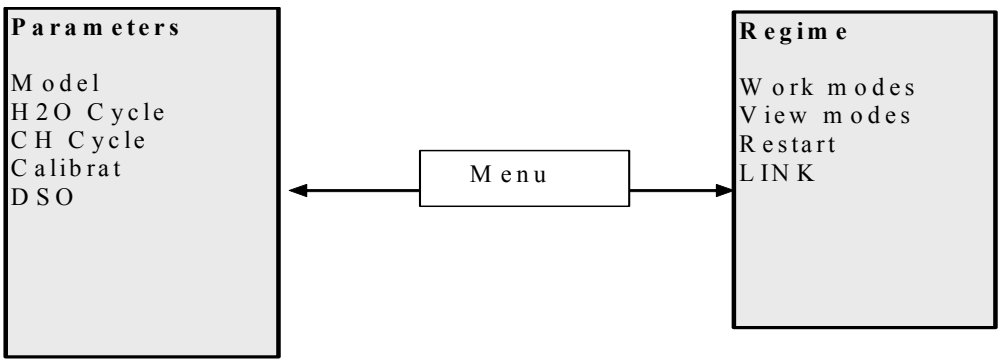


Figure 10 – Interface unit menu structure

2.7.2 Description of the Menu.

2.7.2.1 Menu **«Regime»** includes the following elements:

♦ «**Work modes»** – determines selection of the Analyzer's work mode. It consists of 5 various dew point measurement algorithms **Mode 1 – Mode 5**. Table 5 describes the Analyzer's work modes.

Table 5.

Mode (as displayed on IU indicator)	Description of work mode	Purpose of mode
Mode 1 (M 1)	Moisture dew point measurement mode and hydrocarbons dew point measurement mode if it is equal or exceeds moisture dew point	Basic work mode of analyzer
Mode 2 (M 2)	Hydrocarbons dew point measurement mode irrespective of moisture dew point	This mode is used when calibrating hydrocarbons analyzer
Mode 3 (M 3)	Moisture dew point measurement mode and hydrocarbons dew point measurement mode irrespective of their mutual temperature position	This mode is used for measuring hydrocarbons dew point if it is below moisture dew point
Mode 4 (M 4)	Reserved	
Mode 5 (M 5)	Reserved	

♦ **«Restart»** – restart of dew point measurement process. This element is used for forced reloading of the Analyzer's software.

♦ «**View modes**» - - mode used to test the Analyzer's functioning. This service mode is used to view pressure and temperature values provided appropriate sensors are connected.

♦ «**Link»** – determines parameters of ModBus protocol;

It contains the following parameters:

– Channel – selection of physical interface for data exchange with external computer, RS232/RS485 (on default – RS 232);

– Baudrate – specifies speed of data transfer – 2400, 4800, 9600, 19200, 38400. 38400 is recommended;

– Parity – specifies parity – No, Odd, Even. NO is recommended;

– Stopbits – specifies stop bits – 1 or 2. 1 is recommended;

– Address – specifies address of this device when several devices are being connected. May be from 1 to 247.

2.7.2.2 «**Parameters**» menu contains five of groups of the Analyzer's operational parameters that directly influence both measurement process and data presentation correctness and are not subject to any modifications.

♦ «**Model**» contains a group of parameters that specify adjustment of the Analyzer's general functioning algorithm.

♦ «**H2O Cycle**» contains a group of parameters that specify moisture dew point measurement algorithm.

♦ «**Calibrat**» contains calibration coefficients of measurement cycles (by moisture and by hydrocarbons). In case you change calibration coefficients yourselves, the Analyzer's metrology characteristics can be affected. .

♦ «**DSO**» contains operation adjustment parameters for additional cooling system. These parameters are used when the Analyzer is being operated together with VYMP 2.848.003 gas preparation system.

- «**DPT INNER**» contains individual parameters of gauge used in the Analyzer. These parameters are stored in the gauge's memory during its manufacturing and are not subject to any modifications. In case the Analyzer's gauge or DPT is replaced, new individual parameters are being read out from the gauge's memory automatically.

Important!
Any modifications of the Analyzer's parameters can result in its failure.

Appendix P shows values of all parameters specified in the Analyzer during its manufacturing (parameters on default).

3 ANALYZER EXPLOITATION

3.1 Safety requirements

3.1.1 General provisions.

The Analyzer can be only operated by specially trained personnel.

The Analyzer's operation shall be regulated by the below documents:

- "Electric Installation Rules", 2003;
- Part 3.4. "Electric installations in explosive areas" of Operating rules for electric installations of loads" (deliveries to Russia);
- Technical operating rules for electric installations of loads (PEEP), 2003, (deliveries to Russia);
- Intersectoral labor safety regulations during operation of electric installations (POT RM-016-2001);
- GOST 12.2.003 SSBT. Production equipment. General safety regulations;
- GOST 12.2.007.0 SSBT. Electric devices. General safety regulations;
- GOST 12.3.009 SSBT. Cargo operations. General safety regulations;
- IEC 60079-14 "Explosion-proof electric equipment. Part 14. Electric equipment in explosive areas (except underground workings)";
- IEC 60079-17 "Explosion-proof electric equipment. Part 17. Control and maintenance of electric equipment in explosive areas (except underground workings)";
- IEC 60079-19 "Explosion protected electric equipment. Part 19. Repair and check of the equipment used in explosive gas atmospheres (except underground workings or applications involving processing and production of explosives)";
- EN50014. Electrical apparatus for potentially explosive atmospheres – General requirements;
- EN50018. Electrical apparatus for potentially explosive atmospheres – Flameproof enclosures 'd'.

3.1.2 The Analyzer must not be used for measuring parameters of atmospheres aggressive to materials (steel 12X18H1010T, fluoroplastics 4, quartz, brass AC59 coating Chem.H9) in contact with atmosphere being measured.

3.1.3 The Analyzer must be connected and disconnected from measured atmosphere supply main only after closing valve on the line downstream DPT. The Analyzer's DPT must be disconnected after pressure in a gas inlet is reduced to atmospheric pressure using bolts 11 (see Appendix B) for DPT with immerged gas inlet and using a cock at Out. 1 for DPT with flowing gas inlet (see Appendixes C, D).

3.1.4 By its protection method against electric shock the Analyzer belongs to class 01 according to GOST12.2.007.0 SSBT.

Connection cables and wires shall be connected only after they are de-energized from power source.

3.1.5 To observe safety requirements and electromagnetic compatibility when operating DPT, both IU and power unit RP1072-24 must be grounded. Earth circuit resistance must be within 4 Ohm.

3.1.6 Besides, other safety regulations, such as fire protection and sanitary norms, labor safety rules etc, acting at the customer's facilities, must be observed when operating analyzers.

3.2 Provision explosion protection

3.2.1 Provision of DPT explosion protection

DPT incorporated into the Analyzer, is certified for the compliance with EN50014 and EN50018 requirements. Explosion protection marking is II 2G EExdIIAT5.

Explosion protection of DPT is assured by explosion protection type – "flame-proof enclosure" according to EN50018.

"Flame-proof enclosure" explosion protection type is provided by encasing electric elements of electronic unit in the enclosure of high mechanical strength according to EN50014 that withstands explosion pressure and prevents explosion from coming into ambient hazardous atmosphere.

Explosion protection of DPT enclosure is provided using threaded and cylindrical explosion-proof connections. The drawing of explosion protection means (Appendix L) marks these connections as "Explosion" and gives allowable explosion protection parameters according to EN50018.

Electric connection between sensor electric elements in high-pressure area (inside pipeline) and electronic unit inside flameproof enclosure is provided via conductors pasted in holes drilled in sensor housing. The length of adhesive joint is not less than 20 mm. Optical path elements are sealed by rubber rings loaded by metal locknuts.

Space «J» where inconsiderable amounts of gas from high-pressure area can be leaked in, shall be filled with VESTOBLAST quartz sand of 600-800 μm fraction via threaded hole that is closed by M5 screw. Gas is removed from «J» space to atmosphere via four slots of 3x0,3 mm size.

Terminals of thermosensors, microcooler and soldering points are covered by a double layer of UR-231 (9.3 TU6-10-863-84) varnish.

Sight glass in the enclosure is fixed on epoxide compound. The length of adhesive joint is not more than 12,5 mm.

Explosion protection of cable lead-in is provided by its sealing using elastic rubber ring. Its dimensions are given on diagram of explosion protection means (Appendix L)

Temperature of outer surface of the explosion-proof enclosure as well as of electric elements inside it does not exceed allowable temperature for electric equipment of T5 (100 °C) temperature class.

Flame-proof enclosures are tested for strength according to EN50014 and EN50018. Each enclosure is subject to hydraulic tests using positive pressure that exceeds explosion pressure by 1,5 at the manufacturer-factory.

The drawing of explosion protection means (Appendix L) also shows means that help to maintain explosion protection of the instrument during its operation: corrosion-preventive compound, self-unscrewing preventive means (spring washers, locknuts, securing of threaded parts on glue), protective sockets of fastening bolts.

Removable lids of the enclosure are preventively "ОТКРЫВАТЬ, ОТКЛЮЧИВ ОТ СЕТИ ~ DO NOT OPEN WHEN ENERGIZED".

Adhesive joints are tested for leaks during by-the piece tests using 10MPa pressure (25 MPa – for sensors of DPT of VYMP2.848.004-02 model).

Maximum heating temperature of sensor's electric parts is lower than working temperatures of VK-9 compound (+125 °C) by more than 20°C.

Insulation of sensor's electric parts withstands test for electric strength by voltage of 500V.

3.2.2 Provision of explosion protection during DPT mounting

DPT can be mounted in hazardous areas of indoor and outdoor facilities according to Electric Installation Rules and other normative documents regulating application of electric equipment under hazardous conditions.

Prior to mounting DPT shall be visually inspected to make sure that it is in compliance with the drawing of explosion protection means (Appendix L). To do this the following shall be checked: explosion protection marking, grounding connections and fixing elements. Besides, check housing and components of the instrument for integrity.

Electric wiring of DPT shall be conducted in accordance with the diagram of external connections given in Appendix A.

DPT housing shall be grounded.

After mounting is completed, grounding resistance shall be checked. Grounding line resistance shall not exceed 4 Ohm.

During mounting DPT shall not be exposed to friction or shocks that can be resulted in spark formation.

When conducting installation works:

- Make sure that cable lead-in unit is assembled in the proper way and check sealing ring for integrity (in case of cracks and breaks replace the ring);
- when mounting lids on enclosure make sure that threads on lids and housing are fully mated and locking of lids is secure.
- VYMP2.848.003 gas preparation system incorporates Burkert valve type 2400. Magnet coil (electric magnet) of this valve is made explosion-proof and can be used in explosive areas in compliance with Part 7.3 of “Electric Installation Code” with explosion protection marking 1ExmIIT4 (Explosion Protection Certificate N 481). Magnetic coil power circuit must have a fuse of maximum 2 A in GPS terminal box.

3.2.3 VYMP2.848.003 gas preparation system incorporates Burkert valve type 2400. Magnet coil (electric magnet) of this valve is made explosion-proof and can be used in explosive areas in compliance with Part 7.3 of “Electric Installation Code” with explosion protection marking 1ExmIIT4 (Explosion Protection Certificate N 481). Magnetic coil power circuit must have a fuse of maximum 2 A in GPS terminal box.

Both VYMP2.848.002 and VYMP2.848.003 gas preparation systems incorporate explosion-proof terminal box that can be used in explosive areas in compliance with Part 7.3 of “Electric Installation Code” with explosion protection marking 2ExeIIT6X (Explosion Protection Certificate N CTB-556.02). Cable lead-ins providing protection level of not lower than IP54 according to GOST 14254-96 must be used when mounting the terminal box. During operation the terminal box can be wiped using only wet cloth. The terminal box incorporates cable lead-ins Stahl type 8161 with explosion protection marking 2ExeIIT6 (Explosion Protection Certificate N A-0846).

3.3 Actions under extreme conditions

Conditions are considered extreme in case there exists a danger of gas pollution (exceeding values specified in Electric Installation Code) of DPT installation place. Besides, conditions under which the Analyzer cannot function properly are considered extreme, too.

3.3.1 To eliminate gas pollution:

- switch the Analyzer’s power off;
- ventilate DPT installation place;
- close cut-off cocks;
- locate leakages by soaping connecting point and check it for leaks making sure there no bubbles;
- eliminate leaking connection by tightening thread connections or replacing washers or sealing rings;
- after leaking connection is eliminated, the Analyzer is put into operation again.

3.3.2 Besides, the Analyzer cannot function properly in case sampling main is overcooled below measured dew point temperature and in case there are moisture drops inside the

Analyzer's measuring chamber.

In this case it is recommended to purge measuring chamber (slightly open purging valve 9 (see Appendix B) or outlet **Out1** (see Appendixes C, D), increasing gas flow via measuring chamber. Then the Analyzer's indications are getting normal very quickly and become true in some time.

In case purging of measuring chamber does not help or the Analyzer cannot start functioning normally for a long time, it is recommended to purge sampling main too.

4 MAINTENANCE

4.1 General recommendations

Maintenance involves measures taken to control the Analyzer's technical condition and to maintain it in running order as well as to prevent failures and to make its service life longer.

Technical director of the enterprise operating the instrument is responsible for its maintenance.

Prior to starting the Analyzer an official order, appointing a person responsible for the Analyzer's operation shall be issued.

Maintenance of the Analyzer involves its regular metrological testing and check of its technical condition in accordance with section 4.2.1 and, if necessary, cleaning of the Analyzer's sensing element according to item 4.2.2. Metrological characteristics of analyzers within calibration interval correspond to set standards provided consumer observes storage, transportation and operating regulations given in the present Operational Manual.

Repairs connected with opening of seals shall be conducted only by the manufacturer or organization specially authorized by the latter. The Analyzer shall be operated only by specially trained personnel allowed to access the Analyzer's maintenance operations.

The Analyzer can be put into operation and maintained by SPC VYMPEL under a separate contract or by customer itself in compliance with Section 2 of the present Operational Manual.

In case the Analyzer is put out of operation for a long time and its maintenance is suspended, "Maintenance Suspension Protocol" shall be drawn up.

After the Analyzer is switched on, "Protocol of Technical Acceptance for the Analyzer's Operation" shall be drawn up.

In case the Analyzer fails, self-diagnostics code is displayed on DPT and IU indicators (see i. 4.2.5).

4.2 The Analyzer's maintenance order

Humidity measurement adaptive algorithms installed in the Analyzer's software allow its operating for a long period of time, measuring dew point in multi-component gas atmosphere without any maintenance.

4.2.1 Recommended maintenance types and intervals are in compliance with Table 6.

Table 6

Description of operation	Maintenance types				Notes
	Weekly	Monthly	Quarterly	Yearly	
Test of sampling device and gas preparation system for leaks	+	+	+	+	
Check of flow rate via measuring chamber	+	+	+	+	For sampling systems in flow
Check of sensor SE	+	+	+	+	
Metrological calibration	-	-	-	+	
Check for conformity with explosion protection requirements	-	+	+	+	

4.2.2 It is recommended to check both sampling main and gas preparation system for leaks after their mounting.

Check thread connections for leaks with opened gas supply cock at sampling device. If there are leaks, make the corresponding connections tight.

4.2.3 Check of gas flow via gas inlet

4.2.3.1 For DPT with immerged gas inlet (VYMP2.848.004 model) gas inlet is purged using needle cock 9 (see Appendix B).

Gas flow rate is regulated using a special wrench (delivered together with needle cock) and must be (1±0.5) normal liters/min. You can use any suitable devices to control gas flow rate. It is forbidden to increase gas flow rate drastically or use large gas flow rate since it can result in contamination of DPT gas inlet with dirt, moisture or sorbents.

4.2.3.2 For DPT with flowing gas inlet (VYMP2.848.004-01(-02) models) completed with gas preparation system gas flow rate via gas inlet (1±0,5 normal liters/min) is regulated using valve on flowmeter (pos.7). Gas flow rate must be controlled using flowmeter (Appendixes G and H).

4.2.4 In case sensing element is contaminated, light diode Ⓟ blinks on IU front panel. During this time the Analyzer is in sensing element cleaning mode. The sensing element is being cleaned by heating to 55ºC. The mode is on until photo signal is stabilized both by basic channel and dissipation channel (stabilization of signals at specified level indicates that condensate evaporation processes on sensing element have finished).

In case cleaning mode indicator is ON for a long time (for more than 60 minutes), sensing element (mirror) must be cleaned.

To do this the following operations shall be performed:

- switch DPT power off;
- dismount DPT;
- very carefully clean sensing element with a soft brush moistened in alcohol (see Appendix E, view A);
- dry sensing element within an hour. If sensing element is not dry enough, period of its transition to standard mode at low measured dew point values (below minus 5 °C) can be increased by up to several hours. To make such drying faster you may blow sensing element down with dry air and (or) expose the instrument to temperature of plus 50 °C;
- mount DPT in the reverse order.

Attention!

Sensing element is a silicate plate. One should be very careful when cleaning it, taking into consideration its very small size and brittleness. DPT is not subject to guarantee repair in case sensing element has any mechanical damages.

4.2.5 Calibration of the Analyzer

The Analyzer is calibrated in compliance with VYMP2.844.005MP calibration procedure.

The Analyzer's metrological characteristics during calibration interval correspond to set norms taking into consideration the Analyzer's no-failure operation and provided storage and operation regulations specified in the present Manual are observed by the Customer.

In case moisture or hydrocarbons dew point measurement absolute errors are not within allowable range of values, the Analyzer must be calibrated.

4.2.5.1 Calibration of the Analyzer and correction of calibration characteristic

Calibration is divided into calibration by moisture and calibration by hydrocarbons:

a) calibration by moisture using calibration coefficients A, b, b1:

- set calibration coefficients of both moisture cycle and test moisture cycle A=0.0; b=1.00; b1=1.00;
- proceed as it is described in i.6.3 of Calibration Procedure VYMP2.844.005MP not

including absolute error calculation;

- after the Analyzer's indications become constant, register three successive dew points measured by the Analyzer and the corresponding set dew points;
- calculate calibration coefficients for each point using the below formulas (coefficients b and b1 for set dew point of 0 °C are not calculated).

Calculation formula for calibration coefficients (initial values: A=0.0; b=1.00; b1=1.00):

$$b = \frac{T_{калиб}}{T_{изм}}, \text{ at } T_{калиб} > 0$$

$$b1 = \frac{T_{калиб}}{T_{изм}}, \text{ at } T_{калиб} < 0$$

$$A = T_{калиб} - b \cdot T_{изм}, \text{ at } T_{калиб} > 0$$

$$A = T_{калиб} - b1 \cdot T_{изм}, \text{ at } T_{калиб} < 0$$

where:

$T_{калиб}$, $T_{изм}$ − dew point temperature set at "CONG" test complex and dew point temperature measured by the instrument (average of three measurements), correspondingly.

- calculate average value of coefficients A, b and b1;
- enter the resulted calibration coefficients into the Analyzer's memory;
- check dew point measurement basic error in compliance with i. 6.3 of VYMP2.844.005MP.

b) calibration by hydrocarbons:

- start calibration mode by hydrocarbons;
- set calibration coefficients by hydrocarbons A=0.0; b=1.00; b1=1.00;
- proceed as it is described in i. 6.4 of Calibration Procedure VYMP2.844.005MP not including absolute error calculation;
- after the Analyzer's indications become constant, register three successive dew points measured by the analyzer and propane pressure value (by manometer). $T_{калиб}$ value is selected according to Table 4 VYMP2.844.005MP;
- calculate calibration coefficients for each point using the below formulas (coefficients b and b1 for set dew point of 0 °C are not calculated).

Calculation formula for calibration coefficients (initial values: A=0.0; b=1.00; b1=1.00):

$$b = \frac{T_{калиб}}{T_{изм}}, \text{ at } T_{калиб} > 0$$

$$b1 = \frac{T_{калиб}}{T_{изм}}, \text{ at } T_{калиб} < 0$$

$$A = T_{калиб} - b \cdot T_{изм}, \text{ at } T_{калиб} > 0$$

$$A = T_{калиб} - b1 \cdot T_{изм}, \text{ at } T_{калиб} < 0$$

where:

$T_{калиб}$, $T_{изм}$ – dew point temperature set at test complex and measured by the instrument (average of three measurements), correspondingly.

- alculate average value of coefficients A, b and b1;
- enter the resulted calibration coefficients into the Analyzer's memory;
- check dew point measurement basic error in compliance with i.6.4 of VYMP2.844.005MP.

4.2.6 Check for meeting explosion protection requirements

When operating explosion-proof DPT incorporated into analyzers, all procedures must be in full compliance with i. 3.2.

The following must be checked during DPT visual inspection:

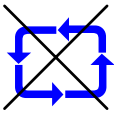
- safety of seals;
- availability and fixing tightness of electronic unit lids;
- absence of breaks or damages in connection cable insulation;
- absence of breaks in grounding cable;
- reliability of cable connection;
- fixing strength of DPT component parts and of grounding connection;
- absence of dents or other visible mechanical damages as well as of dirt and dust on the Analyzer's housing.

DPT conformity with the requirements given on the drawing of explosion protection means (see Appendix L) must be controlled during its visual inspection.

It is strictly forbidden to operate DPT in case it has damages or malfunctions.

4.2.7 Under certain conditions diagnostic messages regarding the Analyzer's operation shown in Table 7 can regularly appear on IU indicator.

Table 7

LED is lit	Message cause	Recommended actions
DPT is over-heated. 	DPT temperature ex-ceeds maximum al-lowable temperature of plus 40 ^{0}C	Message is displayed when DPT housing temperature exceeds plus 40 °C. This message is not caused by any malfunctions in the Analyzer's operation or by failures of its components. In this case DPT does not measure dew points and is in passive cooling condition. If housing temperature is below plus 40°C, DPT will start measuring dew points automatically. In case such mes-sage is displayed, make sure that warmth-keeping jacket used when ambient temperature is below plus 5 °C is removed from the instrument and sun shed is mounted in a proper way.
Sensor is dirty. 	. Message is caused by contamination of sens-ing element.	Sensing element shall be cleaned (see i.4.2.2)
No DPT. 	Communication line with DPT is disturbed	Check IU- DPT connection for integrity

5 RUNNING REPAIR OF THE ANALYZER

Repairs of the Analyzer connected with restoring or manufacturing of its component parts that provide its explosion protection must be only performed by licensed repair enterprises specially authorized to conduct such works.

Repairs of the Analyzer that do not affect its explosion protection must be performed by operating personnel in compliance with Safety Regulations, Electric Installation Code and POT RM-016 in force.

Repairs connected with unsealing and opening of CU electronic boards must be only performed by the manufacturer or by other enterprises specially authorized by the manufacturer for conducting such works.

6 STORAGE

Packed analyzers shall be stored in consignor's and consignee's storage premises that provide their protection against mechanical damages, contamination and aggressive atmospheres under storing conditions 3 according to GOST 15150.

It is allowed to store analyzers in transportation containers during up to 6 months. In case the instruments are stored fro more than 6 months, they shall be withdrawn from transportation containers and kept under storing conditions 1 according to GOST 15150. General requirements to Analyzer's storing heated storages are according to GOST 12 997.

7 TRANSPORTATION

7.1 General requirements to transportation

General requirements to transportation of analyzers shall correspond to GOST12997.

7.2 Transportation conditions

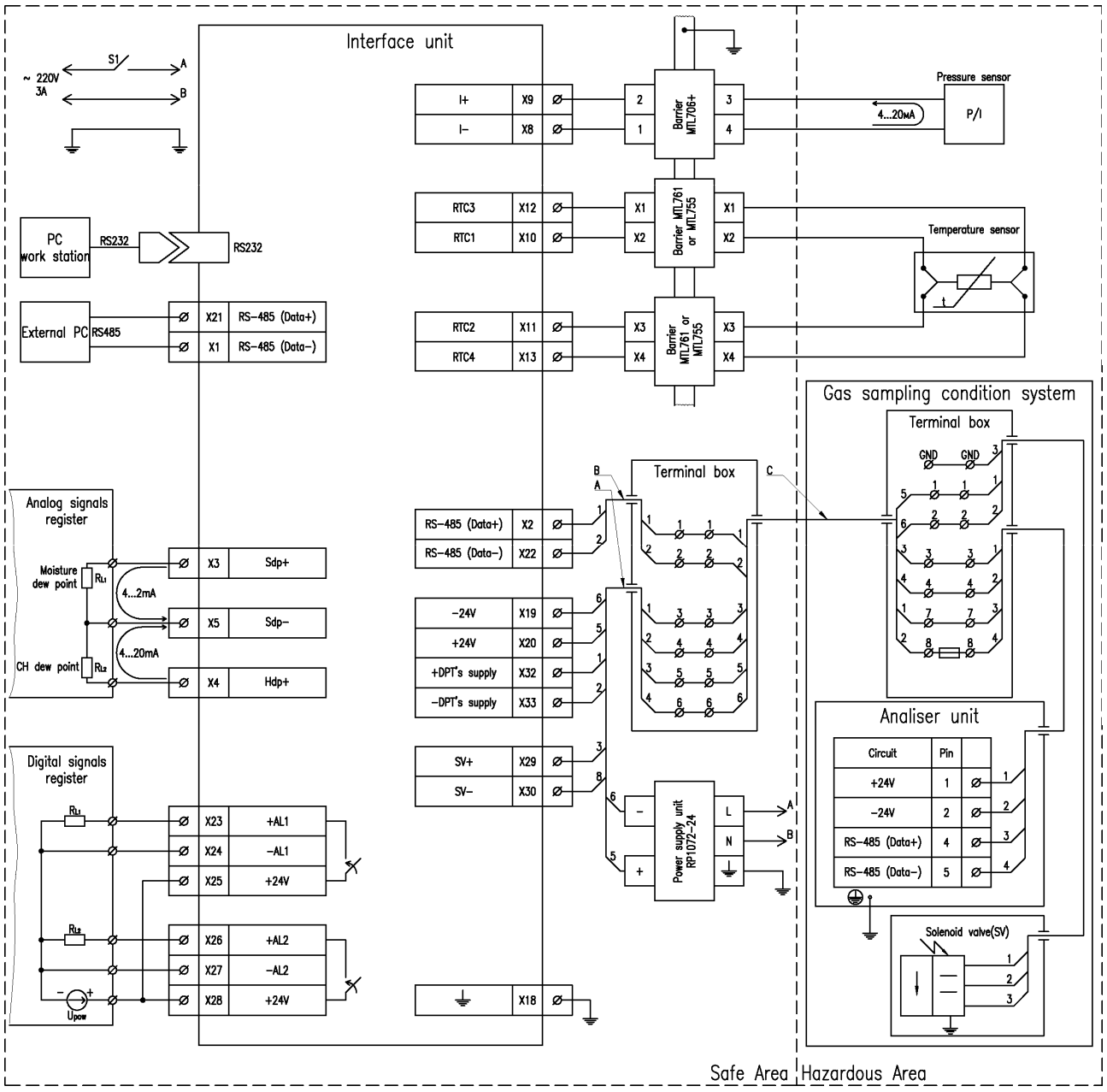
Packed instruments shall be transported in closed transport means by all types of transport including air transport in heated hermetic compartments in accordance with the rules of cargo transportation regulating each kind of transport.

Transportation conditions regarding exposure to climate factors shall correspond to condition group 5 (OJ4) according to GOST15150 for covered transportation means.

8 UTILIZATION

Materials and constructive devices used when manufacturing "CONG-Prima-10" interferential dew point analyzer both during its operation within its service life and after its service life is over are not dangerous for human health, industrial and storage premises, and environment. Utilization of failed "CONG-Prima-10" interferential dew point analyzers can be performed using any possible way.

Appendix A. Circuit diagram for connections of VYMP2.844.005 analyzer



A – 4-conductor cable according to IEC 60079-14;

B – RS485 interface cable (e.g. 3106 A, Belden Inc., USA).

C – cable 6x0,75 with outer Ø 6 – 12 mm according to IEC 60079-14, max. length 50 m;

Notes:

1. Total electric resistance of A and B cables is not more than 2,5 Ohm. If the distance from IU to DPT is not more than 200 m, C cable type can be analogous to power cable type.

2. The Analyzer's minimum configuration shall include DPT, IU power unit. Other devices shown on the diagram are connected if necessary.

3. Pressure and temperature transducers mounted in hazardous areas and connected to IU shall meet EN50014 requirements. The diagram shows one connection example using spark-proof interface.

Appendix A (continued)

Table 1. IU output terminals

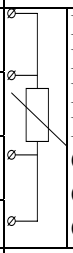
Circuit name		Designation	Terminal N	Load	Notes
Current input 4–20 mA from pressure transducer 1		1I-	X8		Pressure and temperature transducers mounted in hazardous areas and connected to IU shall correspond to EN50014 requirements.
		1I+	X9		
Temperature transducer input		RTC1	X10	 Pt50, Pt100, Pt'50, Pt'100, Cu50, Cu100, Cu'50,	
		RTC2	X11		
		RTC3	X12		
		RTC4	X13		
Attention 1: Moisture dew point is not within measurement range		+ AL1	X23	30 V, 2 A	
		– AL1	X24		
Attention 2: Hydrocarbons dew point is not within measurement range		+ AL2	X26	30 V, 2 A	
		– AL2	X27		
Solenoid valve control output		+F OUT1	X29	30 V, 2 A	
		-F OUT1	X30		
DPT power		+24V	X32	2 A	
		–24V	X33		
Data exchange DPT <–> IU	RS485	Data +	X22		According to EIA RS−485
		Data -	X2		
Current output 4 – 20 mA: moisture dew point		Sdp+	X3	Not more than 400 Ohm	Current loop
		Sdp-	X5		
Current output 4 – 20 mA: hydrocarbons dew point		Hdp+	X4	Not more than 400 Ohm	Current loop
		Hdp-	X5		
RS485		Data+	X21		
		Data-	X1		
IU power		–24V	X19		
		+24V	X20		
		⏚	X18		Grounding

Table 1 shows purpose of IU output terminals for one channel. Purpose of other channels (depending on IU model) is the same.

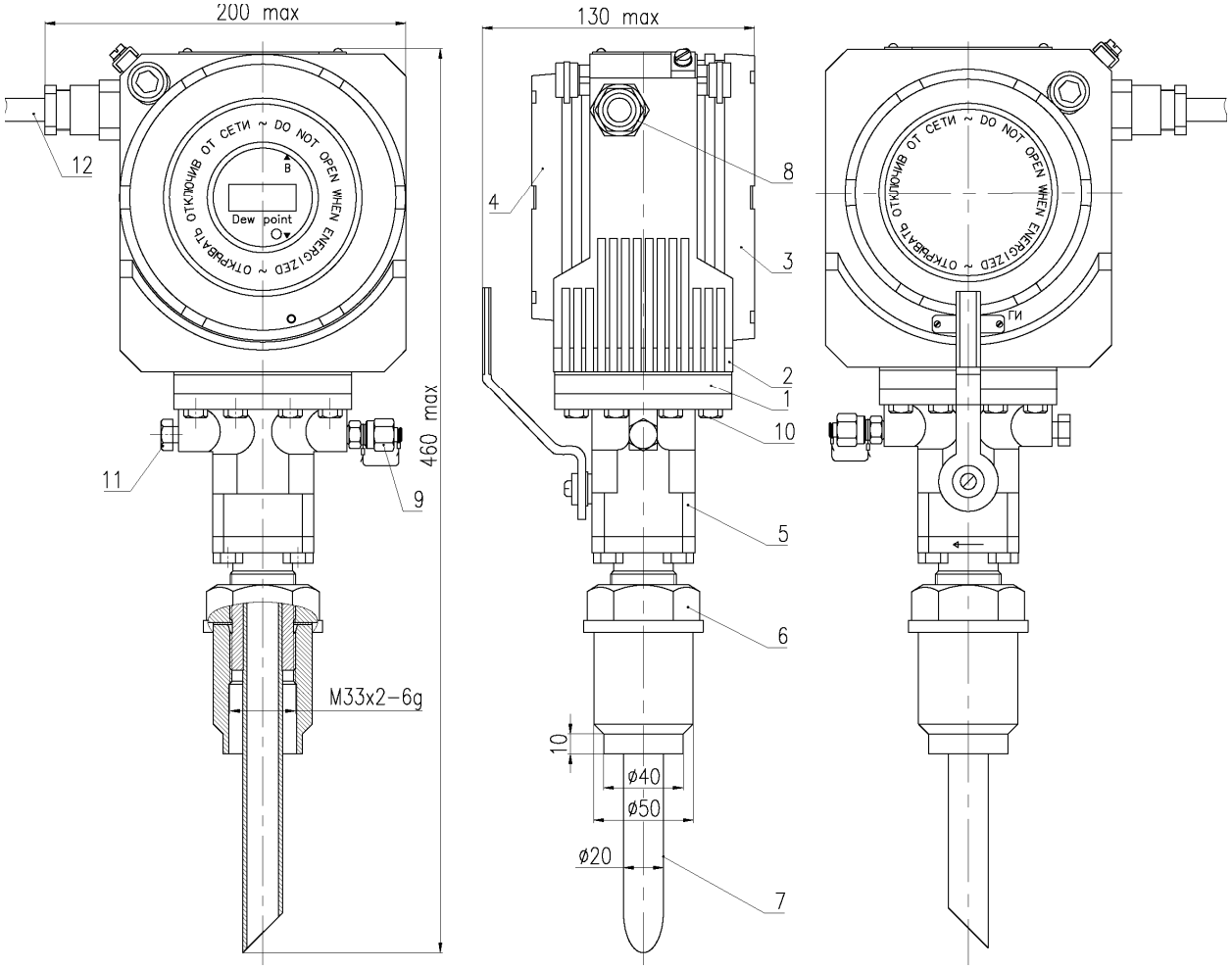
Table 2. DPT output terminals

Circuit name	Designation	Pos.	Note
DPT power	+24 V	1	Connect to IU/X32
	–24 V	2	Connect to IU/X33
Data exchange IU <–> DPT	Data+	4	Connect to IU/X22
	Data–	5	Connect to IU/X2

Table 3. Designation of VYMP4.841.011 cable connector (for RS232)

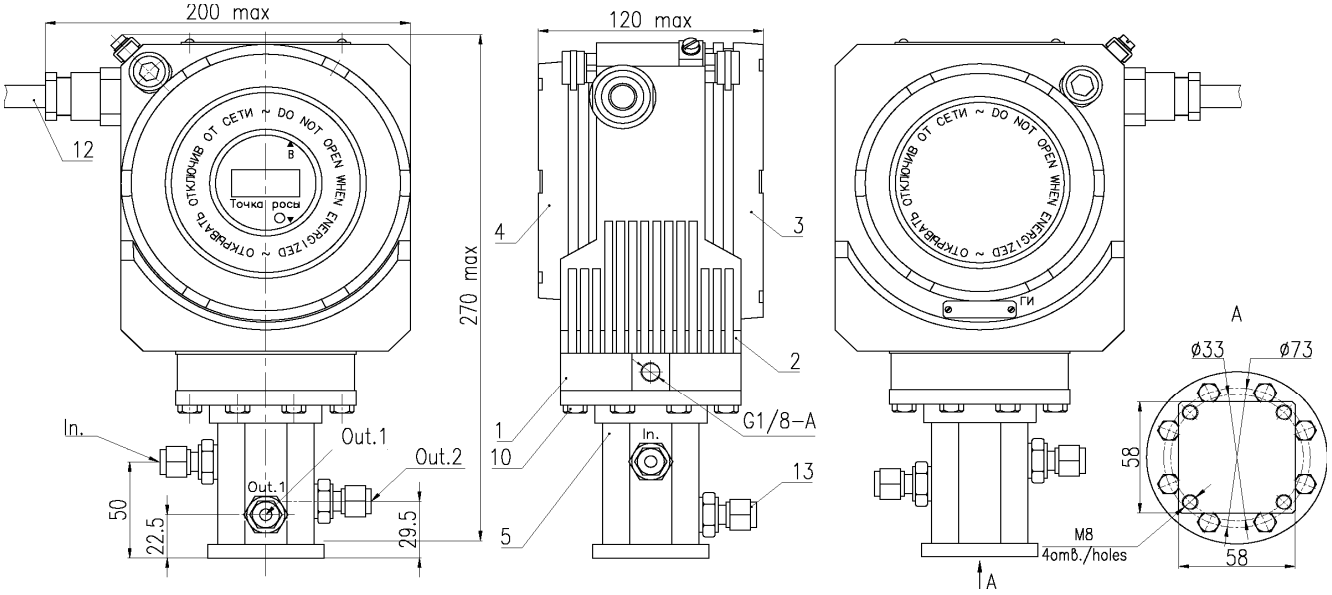
PC (socket DB9F)		IU (socket RS10TV)
2	⟷	7
3	⟷	6
4	⟷	4
5	⟷	10
6	⟷	5
7	⟷	8
8	⟷	9

Appendix B. General view, overall and mounting dimensions of VYMP2.848.004 dew point transducer



Pos.	Description	Designation	Quantity
1	Sensor	VYMP5.910.003	1
2	Housing	VYMP8.034.033	1
3	Lid	VYMP6.172.000	1
4	Lid	VYMP8.040.003	1
5	Sampling device	VYMP6.457.000	1
6	Locknut	VYMP8.930.006 or VYMP8.930.006−01	1
7	Tube	VYMP8.626.004	1
8	Cable lead-in	–	1
9	Needle cock	VYMP6.457.004	1
10	Fastening bolt	VYMP8.920.001	8
11	Blow-down bolt	VYMP8.920.004	1
12	Power cable Ø 12 mm(max)	–	1

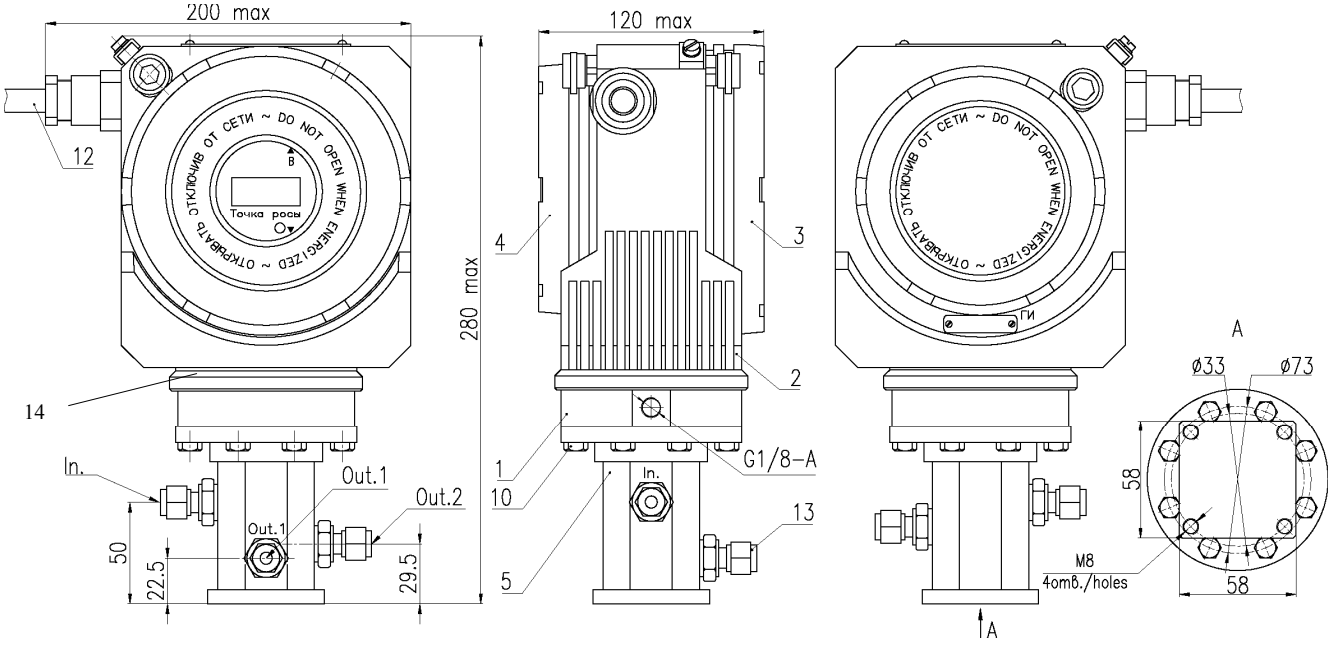
Appendix C. General view, overall and mounting dimensions of VYMP2.848.004-01 dew point transducer



Pos.	Description	Description	Quantity
1	Sensor	VYMP5.910.003	1
2	Housing	VYMP8.034.033	1
3	Lid	VYMP6.172.000	1
4	Lid	VYMP8.040.003	1
5	Sampling device (gas inlet)	VYMP6.457.001	1
8	Cable lead-in	–	1
10	Fastening bolt	VYMP8.920.001	8
12	Power cable Ø 12 mm(max)	–	1
13	Swagelok for tube of 6 mm diameter	SS–6MO–1–2	3

In. – analyzed gas inlet
Out.1 – gas inlet blow-down output
Out.2 – analyzed gas outlet

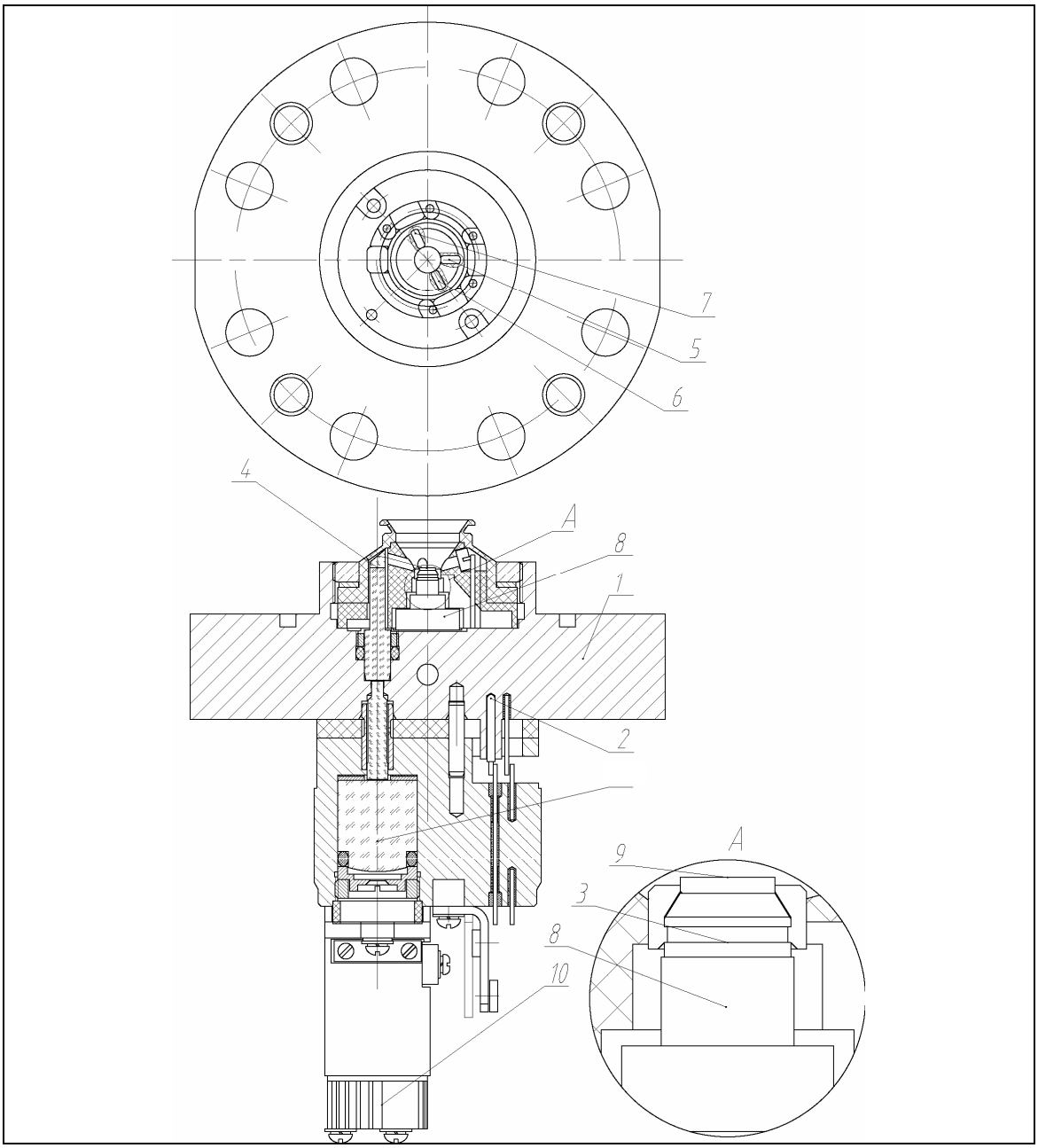
Appendix D. General view, overall and mounting dimensions of VYMP2.848.004-02 dew point transducer



Pos.	Description	Description	Quantity
1	Sensor	VYMP5.910.003	1
2	Housing	VYMP8.034.033	1
3	Lid	VYMP6.172.000	1
4	Lid	VYMP8.040.003	1
5	Sampling device (gas inlet)	VYMP6.457.002	1
8	Cable lead-in	–	1
10	Fastening bolt	VYMP8.920.008	8
12	Power cable Ø 12 mm(max)	–	1
13	SS–6MO–1–2	Swagelok for tube of 6 mm diameter	3
14	VYMP7.069.007	Heat-insulating washer	1

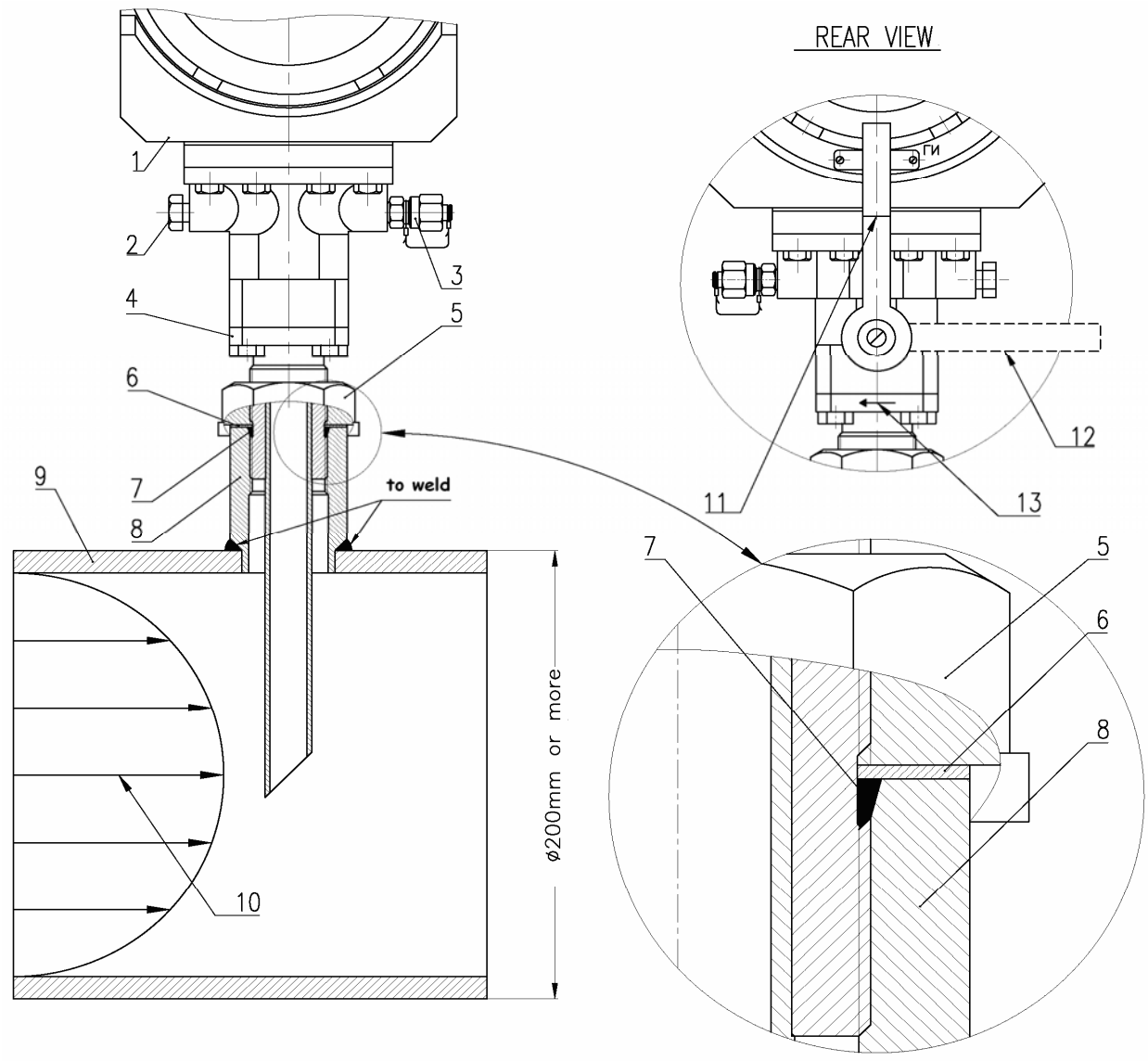
In. – analyzed gas inlet
Out.1 – gas inlet blow-down output
Out.2 – analyzed gas outlet

Appendix E. Primary information sensor VYMP5.910.003, component part of dew point transducer



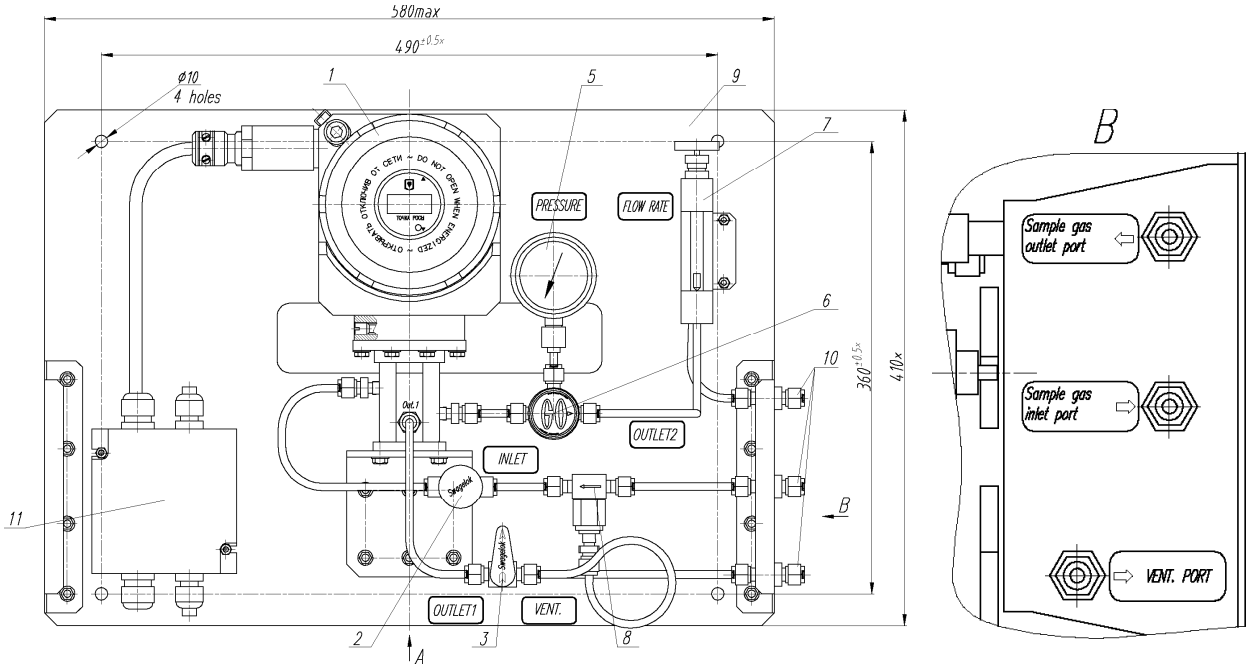
1– housing;
2– thermosensor of housing temperature;
3– thermosensor;
4– guiding prism;
5– direct light detector (photodiode);
6– scattered light front detector (photodiode);
7– scattered light rear detector (photodiode);
8– three-cascade thermoelectronic battery (Peltie element);
9– sensing element (silicon plate);
10– coherent emission source (laser);
11– optical path.

Appendix F. Mounting of VYMP2.848.004 dew point transducer



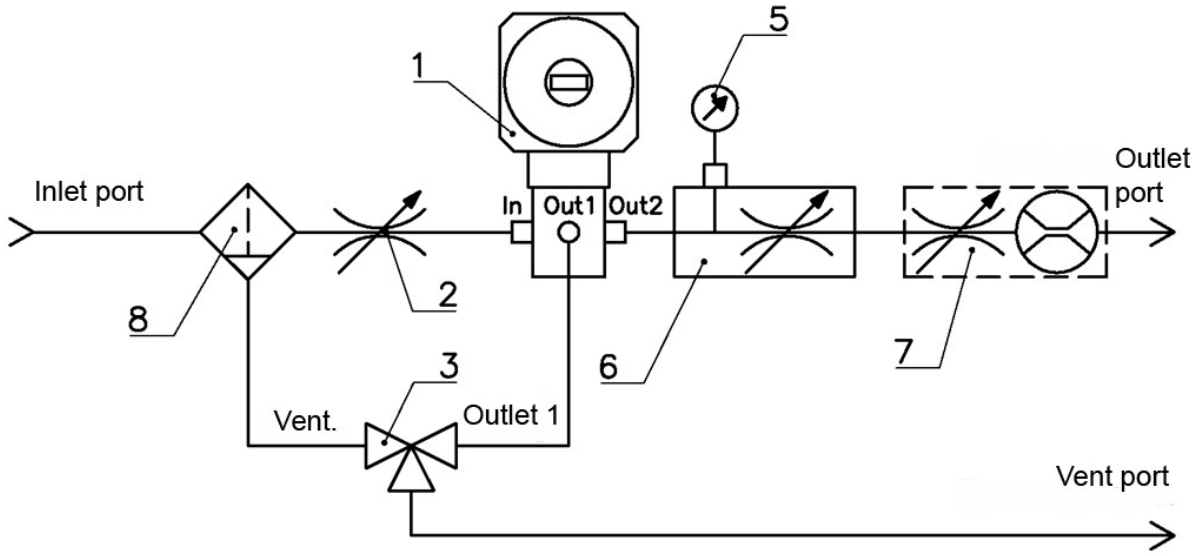
Pos.	Part number	Description	Quantity	Note
1	VYMP2.848.004	Dew point transducer	1	Vympel
2	VYMP8.920.004	Blowdown bolt	1	Vympel
3	VYMP6.457.004	Metering valve	1	Vympel
4	VYMP6.457.000 or VYMP6.457.000−01	Sampling device	1	Vympel
5	VYMP8.930.006 or VYMP8.930.006−01	Locknut	1	Vympel
6	VYMP8.942.009 or VYMP8.942.009−01	Buck-up washer	1	Vympel
7	16ST V19−OR−0916	O-ring	1	Swagelok
8	VYMP8.223.027	Bushing	1	Vympel
9	–	Gas pipeline	–	–
10	–	Gas stream direction	–	–
11	–	Cradle position of ball valve “Open”	–	–
12	–	Cradle position of ball valve “Close”	–	–
13	–	Gas stream direction arrow	–	–

Appendix G. VYMP2.848.002 high-pressure gas preparation system. Mounting diagram



Pos.	Part number	Description	Quantity	Note
1	VYMP2.848.004-01	Analyzer unit	1	Vympel
2	SS-1RS6MM	Needle valve	1	Swagelok
3	SS-43S6MM	Ball valve	2	Swagelok
5	111.11.063	Pressure gauge	1	WIKA
6	LG1-2G01ACE118	Pressure regulator	1	GO Inc.
7	RM-A-0,250GUZ-K	Flow meter	1	–
8	SS-6TF-MM-F2-15	Filter	1	Swagelok
9	VYMP8.046.021	Sheet	1	Vympel
10	SS-6MO-61	Bulkhead Union	3	Swagelok
11	8118/122-0	Terminal box	1	STAHL

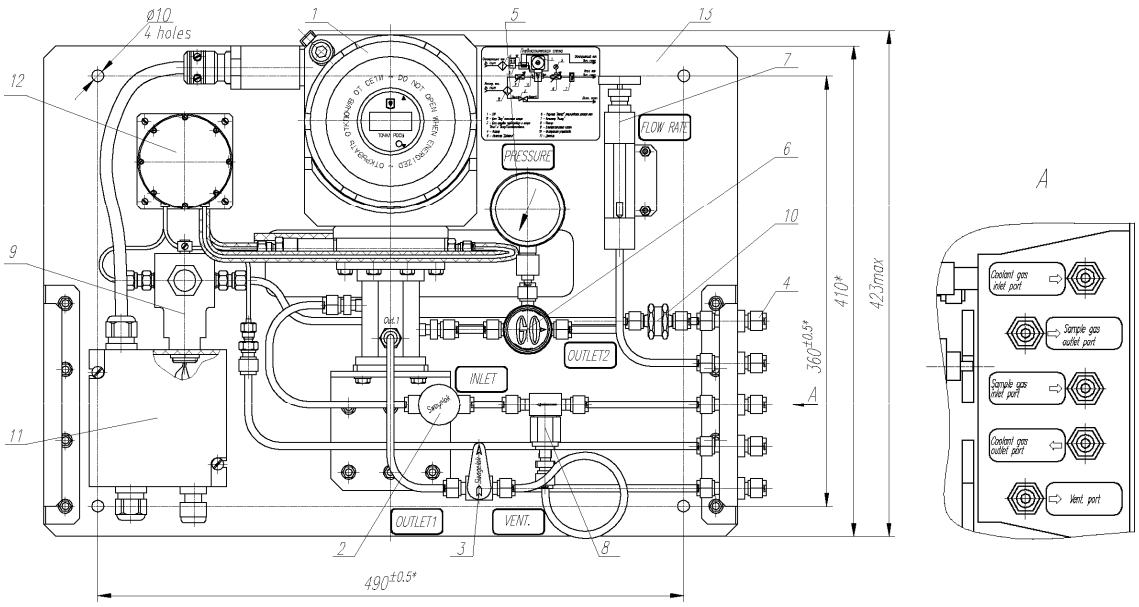
Appendix G. VYMP2.848.002 high-pressure gas preparation system for VYMP2.848.004–01 dew point transducer. Pneumatic diagram



1- analyzer unit; 2- needle valve; 3- ball valve; 5- pressure gauge; 6- pressure regulator; 7- flow meter; 8 – filter for mechanical admixtures with bypass.

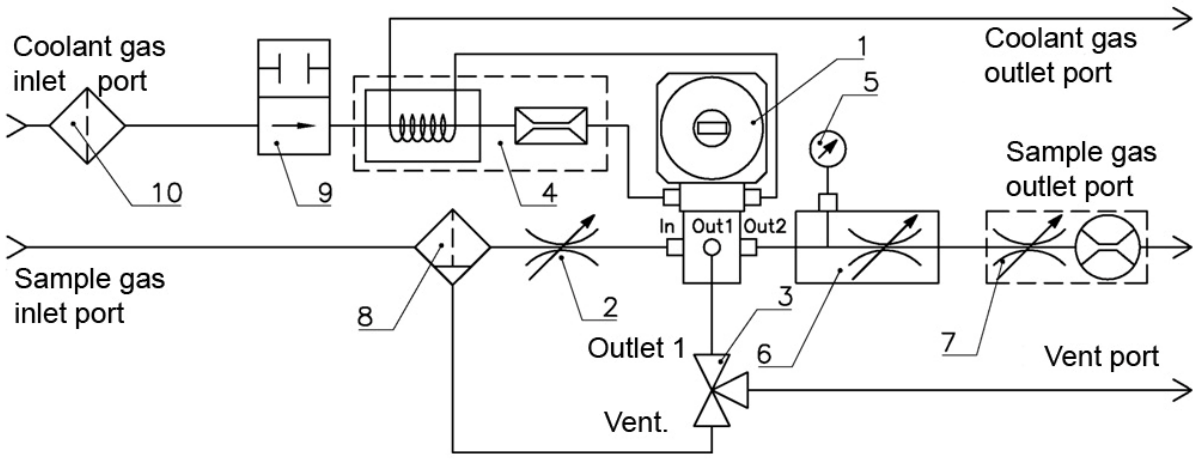
– « ***Inlet port***» – sample gas inlet port;
– «***Outlet port***» – sample gas outlet port;
– «***Vent port***» – outlet port for system purging.

Appendix H. VYMP2.848.003 high-pressure gas preparation system for VYMP2.848.004-02 dew point transducer. Mounting diagram



Pos.	Part number	Description	Quantity	Note
1	VYMP2.848.004-02	Dew point transducer	1	Vympel
2	SS-31RS6MM	Metering valve	1	Swagelok
3	SS-43XS6MM	3-way switching valve	1	Swagelok
4	SS-6MO-61	Bulkhead Union	5	Swagelok
5	213.53.063	Pressure gauge	1	WIKA
6	LG1-2G01ACE118	Pressure regulator	1	GO Inc.
7	РМ-А-0,250ГУЗ-К	Flow meter	1	–
8	SS-6TF-MM-F2-15	Filter	1	Swagelok
9	Type 2400(146 634)	Solenoid valve	1	Burkert
10	SS-6FW-MM-15	Filter	1	Swagelok
11	8118/122-0	Terminal box	1	STAHL
12	VYMP6.452.007	Cooling device	1	Vympel
13	VYMP8.046.043	Sheet	1	Vympel

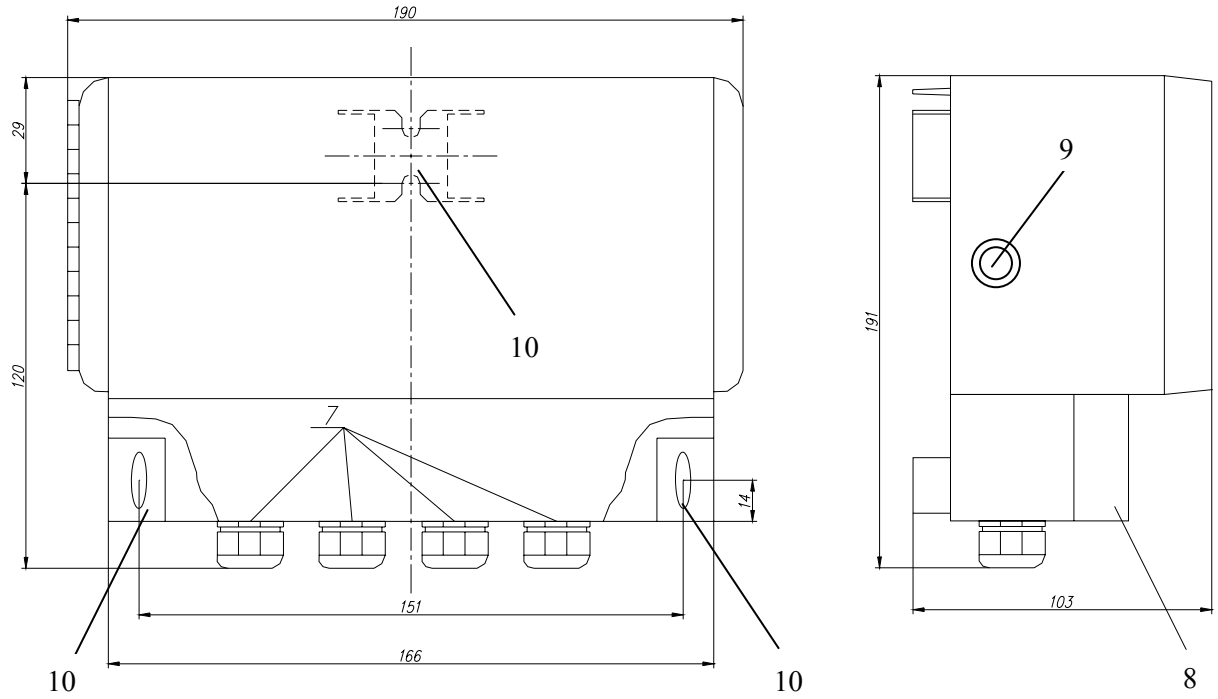
Appendix H. VYMP2.848.003 high-pressure gas preparation system for VYMP2.848.004-02 dew point transducer. Pneumatic diagram

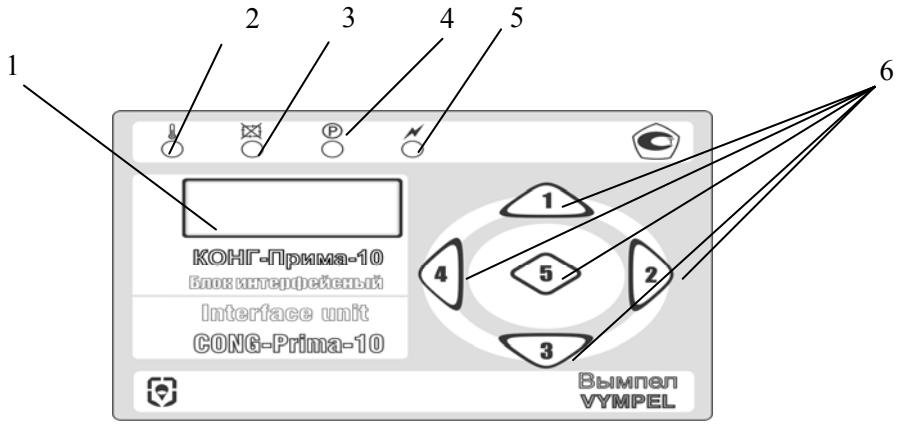


1 – dew point transducer; 2 – metering valve; 3 – 3-way switching valve; 4– bulkhead Union; 5 – pressure gauge; 6 – pressure regulator; 7 – flow meter; 8 – filter for mechanical admixtures with bypass; 9 – magnetic valve; 10 – filter for mechanical admixtures.

"***Analyzed gas Inlet port"*** - gas sample inlet;
"***Analyzed gas Outlet port"*** - gas sample outlet;
"***Vent. Port"*** - gas outlet for system purging;
"***Cooling gas Inlet port"*** - cooling gas inlet;
"***Cooling gas Outlet port"*** - cooling gas outlet.

Appendix I. IU general view and overall dimensions

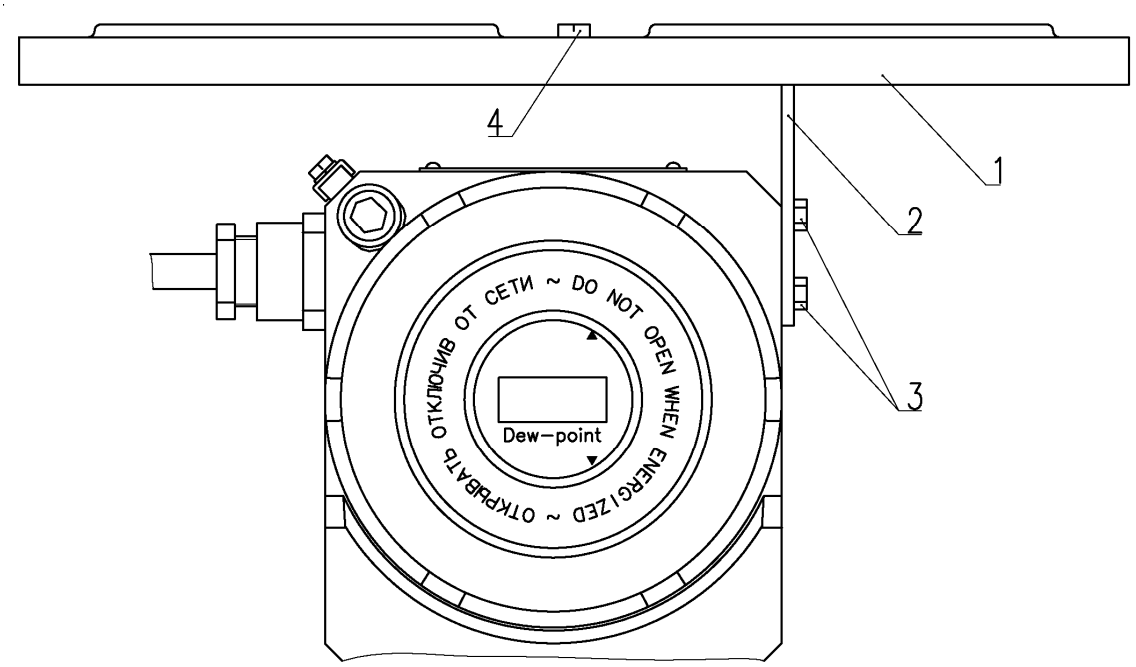




IU control panel

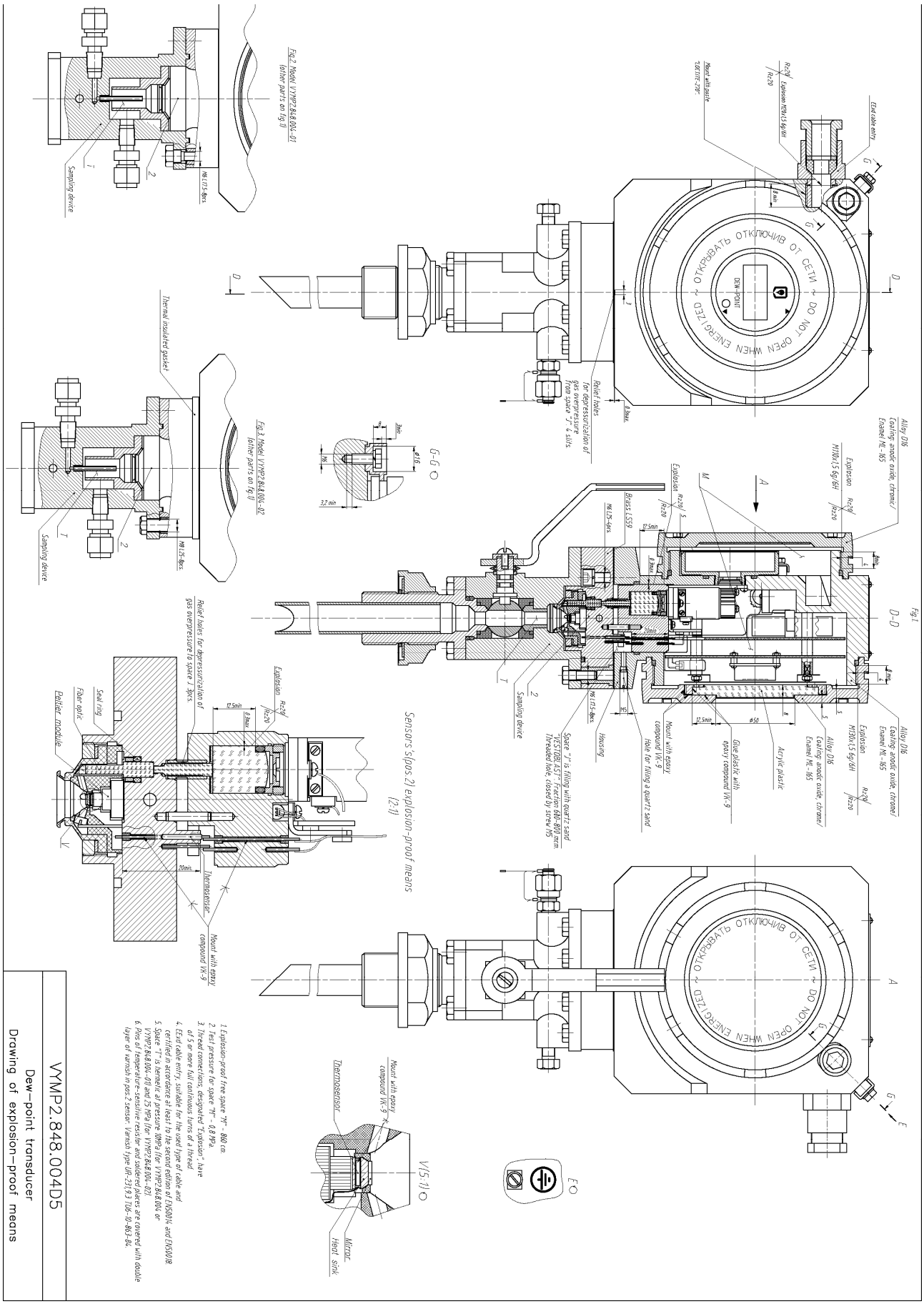
Pos.	Description	Qty
1	LCD indicator	1
2	DPT overheating indicator	1
3	“Failed connection with DPT” indicator	1
4	Indicator of DPT sensing element contamination	1
5	IU power indicator	1
6	Buttons to control the Analyzer’s operating modes and adjustment	5
7	Connectors (sealed lead-ins) for connecting external devices	4
8	Terminal unit lid	1
9	Connector for connecting PC– terminal	1
10	IU fixation points	3

Appendix K. Mounting of sun shed on DPT



Pos.	Designation	Description	Qty
1	VYMP8.050.008	Lid	1
2	VYMP8.090.005	Bracket	1
3	–	M5-6g bolt	3
4	–	Screw B.M4−6g×6.48.016 GOST1491-80	6

Appendix L. Dew point transducer. Drawing of explosion protection means



1. Explosion-proof free space "H" – 868 cm.
2. Test pressure for space "H" – 0.8 MPa.
3. Thread connections, designated "Explosion," have of 5 or more full continuous turns of a thread.
4. Ext cable entry, suitable for the used type of cable and certified in accordance at least to the second edition of EN50014 and EN50018
5. Space "I" is thermetic at pressure 10MPa (for VYMP2.848.004 or VYMP2.848.004-01 and 25 MPa (for VYMP2.848.004-02).
6. Pins of temperature-sensitive resistor and soldered places are covered with double layer of varnish in pos.2 sensor. Varnish type UR-231-9.3 TOK-10-863-84.

VYMP2.848.004D5
Dew-point transducer
Drawing of explosion-proof means

Appendix M. «Trassa-2» terminal program. User's manual.

1 INTRODUCTION

The present document describes "TRASSA-2" terminal program (hereinafter referred to as TP «TRASSA-2" used for picking up and analyzing data stored in interface unit (hereinafter referred to as IU) memory.

2 WHAT IS TP "TRASSA-2"?

TP "TRASSA-2" is a program that helps to perform the following functions:

- to arrange data as by-name objects stored in program data base;
- to pick up data from IU and record them into database;
- to scan data for each object on monitor in column or diagram format;
- to prepare and print out simple reports with selected data;
- to export data to Microsoft Excel program.

3 TP "TRASSA-2" APPLICATION CONDITIONS

To provide correct TP operation you will need the following hardware and software:

- IBM PC compatible computer with CPU not lower than "Pentium" and COM1 port;
- color monitor not lower than SVGA;
- Windows'9x operating system, WindowsNT, W2k or WindowsXP;

4 INSTALLATION OF "TRASSA-2"

Start " **Trassa32.exe**." file from installation disk (compact disk) and follow the instruction of installation master. Installation master will create "**Trassa**" folder in "Programs" section of "Start" menu. This holder will store shortcuts for programs "**Trassa**" (analysis program for data read from IU) and **"Removal"** (program for software removal). You may copy the shortcuts to desktop if necessary.

5 HOW TO START "TRASSA-2"?

Simply click **Trassa** icon twice on Windows desktop or call **Conductor,** find **Trassa** program and click it.

After you call "TRASSA-2" **Main Dialog Panel** (Figure 1) used to control all program functions will be displayed.

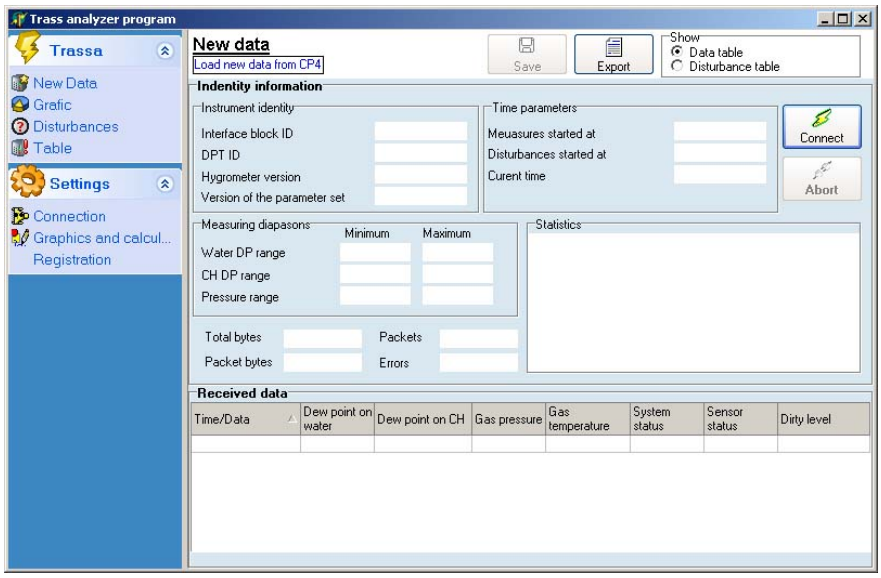


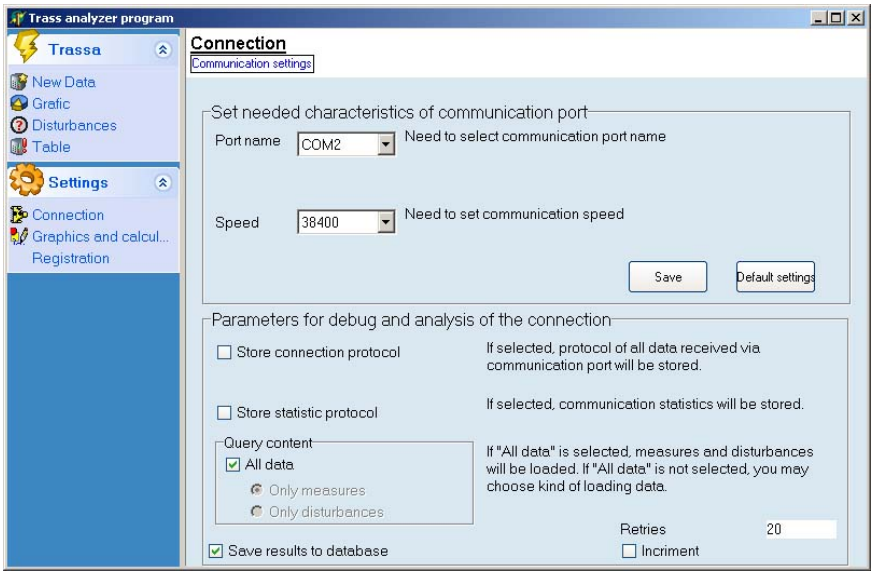
Figure 1– Main Dialog Panel

6 ADJUSTMENT OF COMMUNICATION PORT AND PROTOCOLS

To adjust parameters of communication between IU and technological computer:

1.Click 

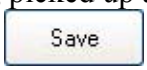
insert in Main Dialog Window. The following window will be displayed:



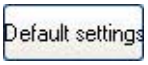
2. Port to which IU is connected shall be specified in **Port name** field (**com1** - on default).

3. Speed of exchange between IU and technological computer is specified in **Speed** field (**38400** – on default). It is forbidden to change the exchange speed.

4. Field **Parameters for communication adjustment and analysis** gives explanation on selection and setting of type of data (on measurement and/or intervention) being picked up from IU. Set selected types of data being picked up and also start **Increment polling.**

5. After data are modified press 

button.

6. To recover parameters on default press 

button.

7. Increment polling is a pickup of data from the last data reading.

8. The number of retries cannot be modified by user.

7 HOW TO PICKUP DATA FROM IU?

Prior to picking up data connect terminal computer COM-port with connector on CU front panel (IU left side panel) using special cable delivered together with CU (IU). Then in CU (IU) menu select interface RS232 used for exchange with external computer (see i. 2.6.2.1, "Exchange/channel").

Further push button 

on main dialog panel.

After that both CU(IU) and connected transducer identification data are being automatically displayed in "**Identification information"** field. Range of measured parameters specified in the Analyzer is being displayed in **"Measurement range"** field.

Message "Data are being received" appears in **"Exchange statistics"** field (see Figure 2).

Analyzed gas parameters picked up from CU(IU) are being displayed in **"Received data"** field.

After data are picked up, press 

button and only then start working with data.

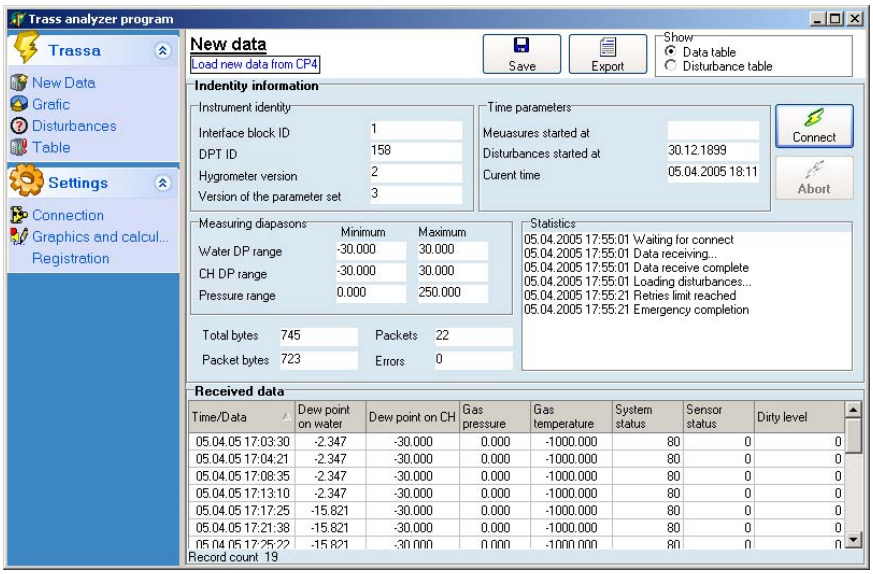


Figure 2– View of window during data pickup from IU

8 WHAT IS REGISTRATION?

Registration is a setting up of one-to-one correspondence between transducer's serial number and name assigned to it (Pseudonym).

It is assumed that transducer's installation place is specified as its pseudonym (e.g. "EUSGS, string N2»). It means that registration can be interpreted as creation of by-name source of data on controlled object.

Registration is performed after picking up of data from IU and allows user to access data stored in database by their name, and during data pickup "TRASSA-2" program automatically locates the place for recording new data by registered object serial number.

To carry out registration enter Registration menu in Main Dialog Window.

Enter transducer's name (Pseudonym) to **"Measuring unit name"** field in "**Registration"** window and click ✓ icon on bottom panel of the window by left mouse button (see Fig. 3).

You may enter any reference data necessary for user when working with the program to "**Additional user data".** Registration is performed after data pickup is completed.

Purpose of keys:

- (1-4) – movement through the base;
- 5 – removal of registration;
- 6 – corrections in registration (first press and then apply corrections).

9 HOW TO SCAN DATA?

"TRASSA-2" terminal program has several data scanning modes:

- scanning of data picked up from IU – "New data" insert (see "How to pick up data from IU" section);
- scanning of accumulated database in graph form – "History" insert;
- scanning of accumulated data in column form – "Reports" insert;
- scanning of interventions protocol – "Interventions' insert.

To select scanning mode move mouse cursor to necessary insert and click it by left button.

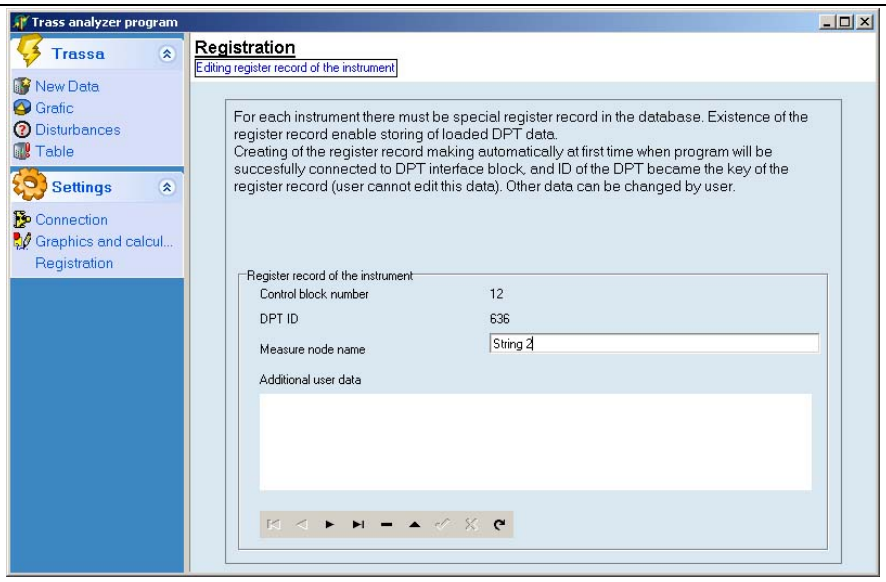


Figure 3 – Registration window

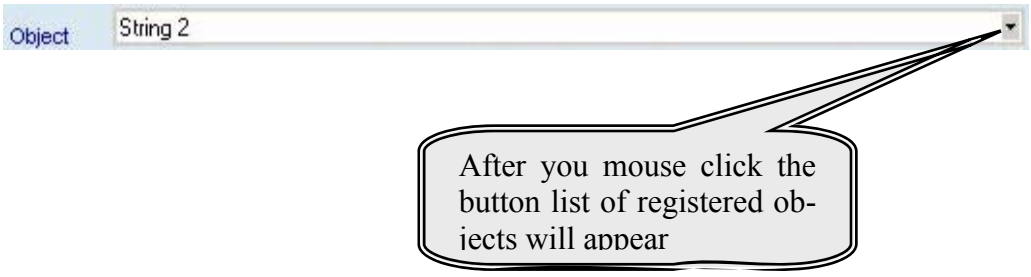
10 SCANNING OF ACCUMULATED DATABASE IN GRAPH FORM

In this mode “TRASSA-2” displays data of selected object as graphs of dew point, gas temperature and pressure as well as of moisture content.

Moisture content is a value calculated by the program using dew point and pressure values according to GOST 20060-83. If pressure sensor is not connected to IU, moisture content will not be calculated.

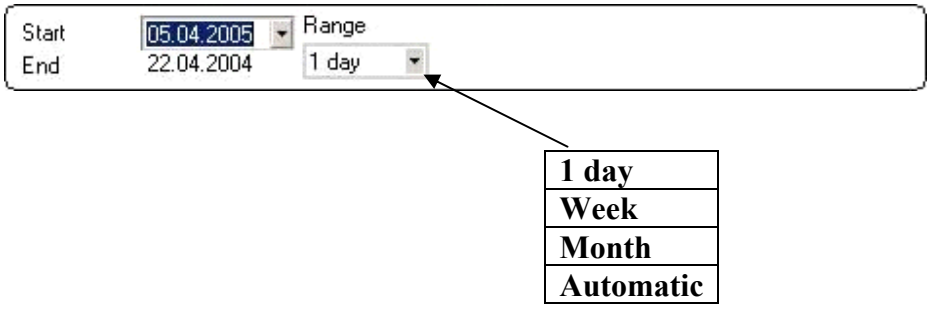
To enter graphical scanning mode click Grafic insert in Main Dialog Window.

Select necessary data scanning object in **“Object”** field of **“History”** window:



“Object” field with a list is used to select object to be scanned. After the list opens point mouse cursor to necessary object and click it by left button.

After object is selected specify starting date of picked up data scanning in **“Start”** field:



On default, after selection of object first data pickup date is taken as starting scanning date. You may select any date necessary for you.

To enter selected starting date specify necessary digit (date, month, year) by mouse cursor and click it by left button. Then enter value from computer keyboard.

After selection of date point mouse cursor to necessary range and click it by left button. In case you select **"Automat"** range all database will be shown on graph.

Figure 4– Window for presentation of data as diagrams

"Selection of graph for indication" panel is under the graph (see Fig. 5). It allows to activate/disable display of any graph, to change color of parameters curves and determine digital values of parameters in the selected point. Selected point is a point in which parameters curve intersects marker (black vertical line in Fig. 4).

To move marker proceed as follows:

- point mouse cursor to the marker;
- after cursor assumes ⟷ form, press left mouse button;
- holding left button move marker with mouse;
- digital values of selected points are induced in appropriate windows to the right of parameters designation.

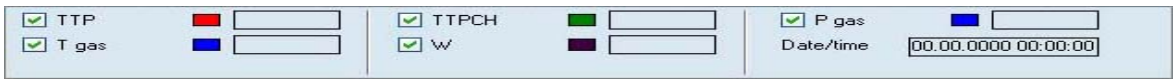


Figure 5 – "Selection of graph for indication" panel

The following conventions are used on selection panel:

TTP – dew point, °C;

TTPCH – hydrocarbons dew point, °C;

T gas – gas temperature, °C;

P gas – gas pressure, MPa;

W – moisture content, g/m^3;

Date/time 00.00.0000 00:00:00 – window for display of measured parameter date and time in selected graph point.

After you click color window with mouse left button, color palette that allows user to change color of curves on graph will appear.

Additional information on working with graphs is given in "Working with graphs" section.

11 WORKING WITH GRAPHS

To make working with graphs convenient user may:

- change names of measured parameters for each graph;
- change measurement scale range of each parameter;
- activate/disable representation of array lines;
- scan in detail any graph fragment without changing scale adjustments.

To enter mode of working with graphs mouse click 

insert in Main Dialog Window.

"Graphs and calculations" window is displayed (Fig. 6):

This window has five fields for working with graphs:

- scale can be adjusted, its name can be changed and diagram network display can be enabled/disabled in **"Left axis", "Right axis"** and **"Positive axis"** fields;
- time network display is enabled/disabled in **"Time axis"** field;
- both "Contract hour" (starting and finishing times for determining average daily values of measured parameters) and conversion table for dew point values – Table 1 or Table 2 – are being specified in **"Calculations"** field.

For detailed viewing of some diagram fragment without changing scale adjustments highlight this fragment as follows:

- move a cursor to fragment start point;
- click mouse left button;
- holding mouse left button, highlight the required part of diagram as a frame, moving a mouse diagonally from upper corner to lower one;
- release mouse left button – the highlighted part of diagram will occupy the whole diagram field.

To return to original scale, highlight any part of diagram as above and move a mouse in the opposite direction.

Diagrams can be moved along axes using a mouse and moving a cursor to the required point in diagram field holding mouse right button.

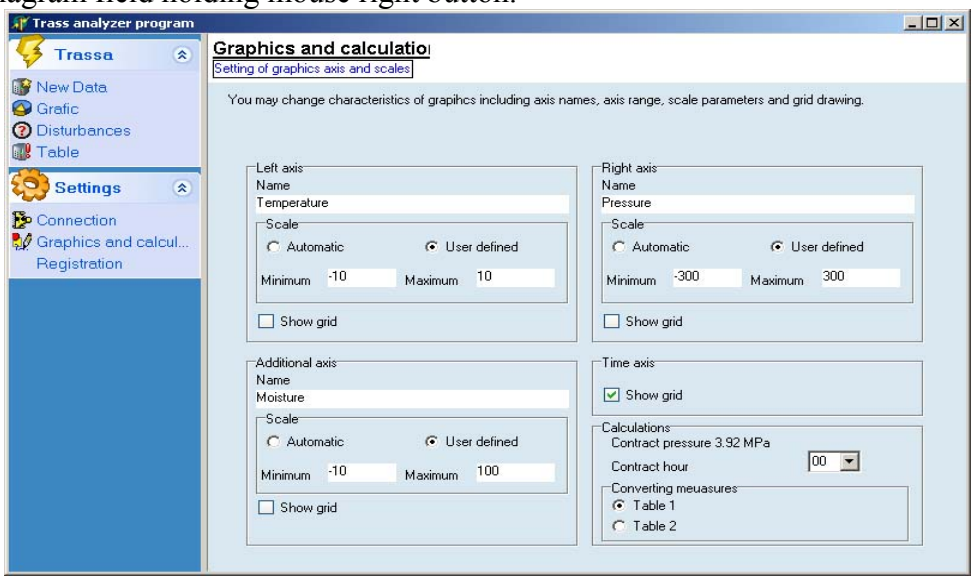


Figure 6

12. CONVERSION OF DEW POINT VALUES TO CONTRACT PRESSURE AND OTHER HUMIDITY UNITS

«TRASSA -2» recalculates dew point values measured at working pressure to values corresponding to contract pressure as well as dew point values (°C) to absolute moisture values (g/m^3). The calculation is performed using one of the below procedures:

- GOST 20060-83 “Methods for determination of water vapors content and moisture dew point”;
- «TABLES for determination of natural gas moisture dew point temperatures reduced to pressure of 3,92MPa and of water vapors concentrations» approved by JSC «GASPROM» and NAC «Ukraine Nephtegas» developed in compliance with GOST20060-83.

«TABLES …» are developed on the basis of GOST 20060-83 and intended for use when performing commercial calculations during gas transfer from supplier to customer (between Russia and Ukraine).

Selection of recalculation method according to GOST 20060-83 or in compliance with «TABLES…» is made in «**Calculations**» field (see Fig. 6).

The following shall be selected in the above field:

- «Table 1»– when performing recalculations according to GOST 20060-83;
- «Table 2» – when performing recalculations in compliance with «TABLES for determination of natural gas moisture dew point temperatures reduced to pressure of 3,92 MPa and of water vapors concentrations».

When conversion procedure is being changed during current work with the program, data will be renewed after the latter is reloaded.

Error for conversion of measured dew point values to values corresponding to contract pressure (without taking pressure measurement channel error into account) is within 0,05 ^{0}C. Technical requirements to pressure measurement channel are in compliance with i. 1.5.6.

Error for conversion of dew point measured values to absolute humidity values is absent (or is too inconsiderable and can be neglected).

13 CANNING OF ACCUMULATED DATABASE IN COLUMN FORM

To enter mode of data scanning in column form click Table insert in Main Dialog Window.

Then **“Reports”** window will open (Fig. 7) in which data are presented in column form.

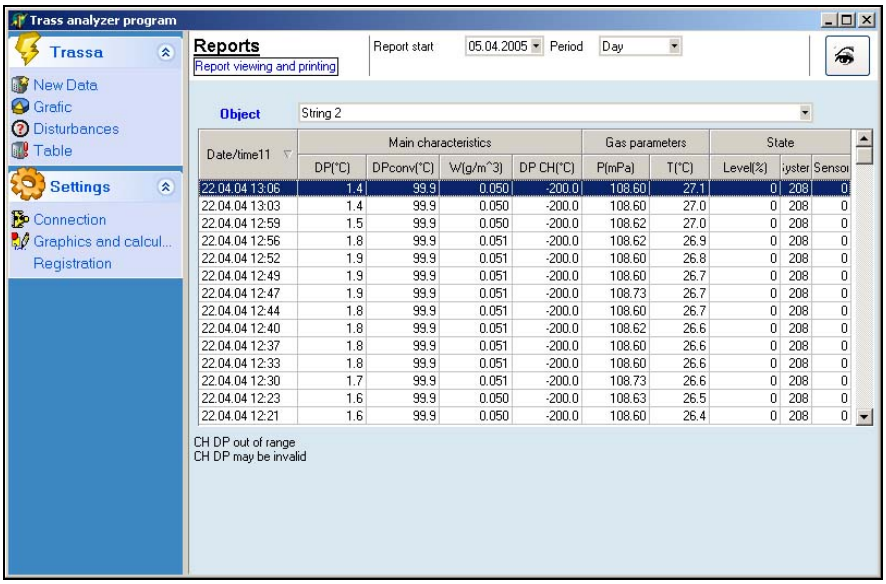


Figure 7 – Window for data scanning in column form

Select necessary data scanning object in **“Object”** field:

Specify the date from which report will be generated in **“Start of report”** field:

“**Period”** field sets period of time (day, month, quarter) for data display in column form.

After ”Month” or “Quarter” period is selected, the panel will show additional field for selection of particular month (quarter).

After the above parameters are specified, the window will show data within selected period of time in column form.

After separate line in the table is activated (by cursor and left mouse button click), additional data on measured parameters not within measurement range or their incorrectness within specified period will be displayed in left bottom part of the table:

14 OW TO PRINT OUT A REPORT?

Copy of the selected object data table is called a report. In order to print it out, first select object and report period (see “SCANNING OF ACCUMULATED DATABASE IN COLUMN FORM” section and Fig. 8).

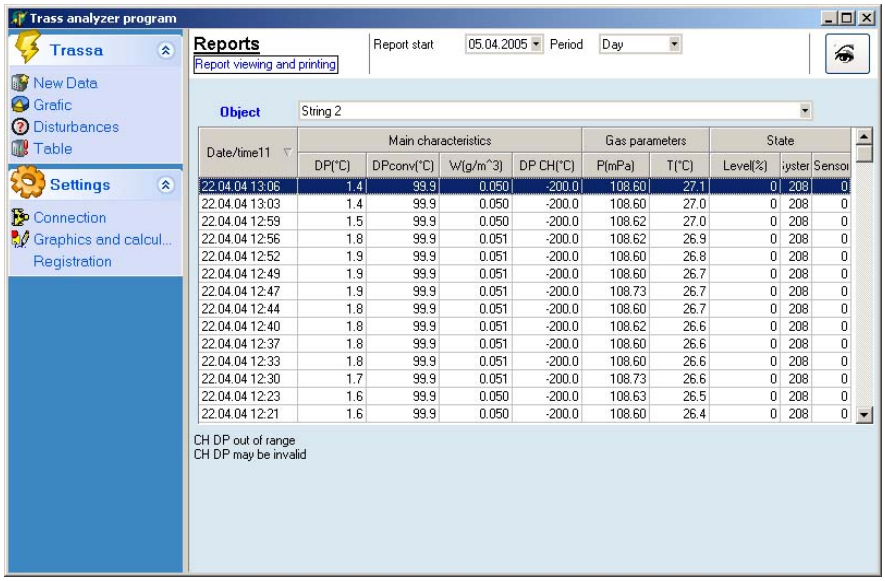


Figure 8 – View of “Preliminary scanning” window

”Scanning and printout” button

When you push this button, “Preliminary scanning” window will be displayed (Fig. 8).

”Report printout” button

To print out a report press this button on tools panel of ”Preliminary scanning” window.

15 ANSFERRING DATA TO MICROSOFT EXCEL PROGRAM

”TRASSA-2” can be used to transfer data from accumulated database to Excel program.

To enter this mode mouse click 

insert in Main Dialog Window.

In displayed **“New Data”** window press 

button (see Fig. 2).

After you press **“Export**” button, first enter export file name to the window and then select the place for its storing on disk. After that store the file by pressing **“Open”** button.

16 ANNING OF INTERVENTIONS PROTOCOL

Interventions protocol registers operations performed with interface unit (restart, modification of calibration coefficients) as well as state codes for the system and sensor.

a) list of interventions:

- modification of parameter;
- loading of parameters on default;
- modification of system parameters;
- restart of the instrument;
- modification of calibration coefficients;
- removal of calibration point;
- modification of calibration point;
- reset of calibration table;
- modification of time.

b) system state codes:

- failure;
- moisture dew point temperature (DP) exceeds limit value;
- hydrocarbons DP exceeds limit value;
- moisture DP is not within the range;
- hydrocarbons DP is not within the range;
- moisture DP is incorrect;
- hydrocarbons DP is incorrect.

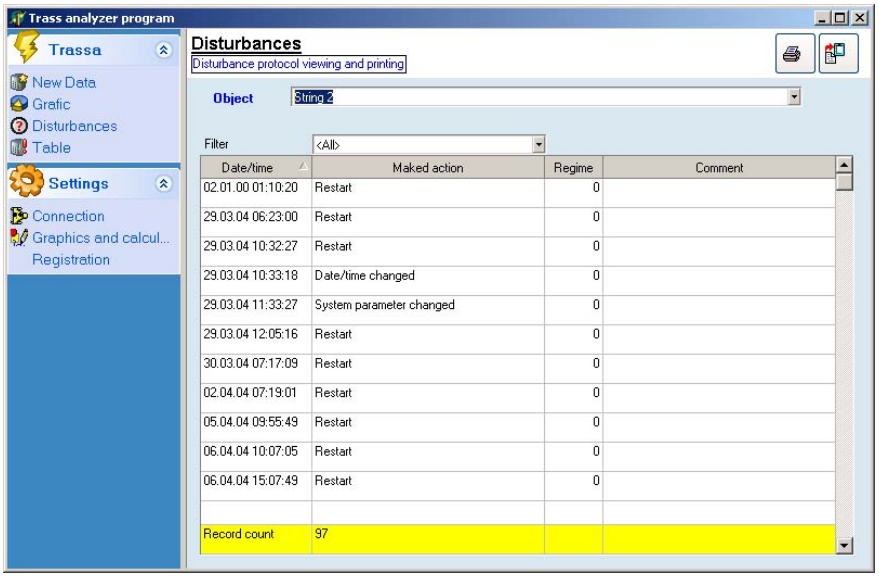


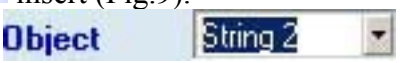
Figure 9

c) sensor state codes:

– overheating of the instrument;
– sensor is contaminated for more than 50 %;
– absence of thermal regulation.

To scan disturbances protocol select 

insert (Fig.9).

Select necessary data scanning object in **“Object”** field: 

To make scanning convenient use **“Filter”** field in order to prevent scanning of unnecessary interventions.

Appendix N. Description of modbus protocol for analyzer "CONG-Prima-10"

Input registers*

0-1	DWORD	id CU (or IU)	Identifier CU
2	WORD	DevCount	amount of connected DTPs
3	WORD	Not used	Not used
4-5	DWORD	Id DPT [1]	Identifier of first DPT
6-7	Float	DP [1]	First DPT – dew-point temperature on moisture
8-9	Float	DP CH [1]	First DPT – dew-point temperature on CH
10-11	Float	P [1]	First DPT – pressure
12-13	Float	T [1]	First DPT – temperature
14-17	Double	Time [1]	First DPT – time
		……..	
228-229	DWORD	LogId [1]	Message identifier in log (0 – no message)
230-231	Float	Par1 [1]	First parameter of message
232-233	Float	Par2 [1]	Second parameter of message
234-235	Float	Par3 [1]	Third parameter of message
236-237	DWORD	HygroVersion [1]	DPT firmware version
		……	
388-389	DWORD	DwHPId [1]	Procedure's code
390-391	DWORD	DwStateId [1]	Procedure's state
392-393	DWORD	DwElapsed [1]	Time, remained before state finish
394-395	Float	FPct [1]	Current level of photosignal, percents from uf0
396-397	DWORD	dwHygrometerVersion [1]	DPT firmware version
398-399	Float	FPctWork [1]	Operating level of cycle, percents
		……	
582-583	Float	T1 [1]	Temperature
584-585	Float	Tk [1]	DPT's housing temperature
586-587	Float	Uf0 [1]	Photosignal (moisture)
588-589	Float	Uf1[1]	Photosignal (CH)
590	WORD	Cv [1]	
591	WORD	Unused	

Digital inputs*

0	Failure [1]	First DPT: Analyser failed
1	Alarm_Water [1]	First DPT: Moisture dew-point temperature above alarmed level.
2	Alarm_CH [1]	First DPT: CH dew-point temperature above alarmed level
3	OutOfDiapason_Water [1]	First DPT: Moisture dew-point temperature out-side of range
4	OutOfDiapason_CH [1]	First DPT: CH dew-point temperature outside of range
5	MayBeBad_Water [1]	First DPT: Moisture dew-point temperature may be false.
6	MayBeBad_CH [1]	First DPT: CH dew-point temperature may be false.
7	Unused	Not used
8	Overheat [1]	First DPT: Device overheating
9	Fatal_Dirty [1]	First DPT: Fatal dirty
10	No_Thermoregulation [1]	First DPT: failure of management by sensor's temperature
11	Unused	Not used
12	Unused	Not used
13	Unused	Not used
14	Unused	Not used
15	Unused	Not used

Coils*

0	NextLog [1]	Save - request about shift of log's sequence
	…….	
16	NextGraph [1]	Save - request about shift of graphics sequence

* - designation of data type is in accordance with standard description of Modbus (RTU) protocol

Appendix O*(compulsory)*. Technological program Kp4P_PC.exe

1 Purpose

This program is intended for visualization of condensation-evaporation processes when measuring dew points.

2 System requirements

- IBM PC-compatible computer with CPU of no earlier version than “Pentium II” (Celeron) with COM port;
- operating system Windows’9x, WindowsNT, W2k or WindowsXP;
- operative memory – not less than 64 Mb;
- free space on hard disk – not less than 40Mb;
- color monitor of no earlier version than SVGA;
- coordinate input device of “mouse” type

3 Installation

Copy **“Terminal program”** folder from compact disk VYMP2.844.005 D21, delivered together with the Analyzer, to the computer’s hard disk.

4 Connecting IU (CU) and technological computer

To start operation, connect IU (CU) to the computer’s COM- port using interface cable delivered together with the Analyzer. Then start Kp4P_PC.exe program or its label on Windows desk. After the program is started, the window shown below appears:

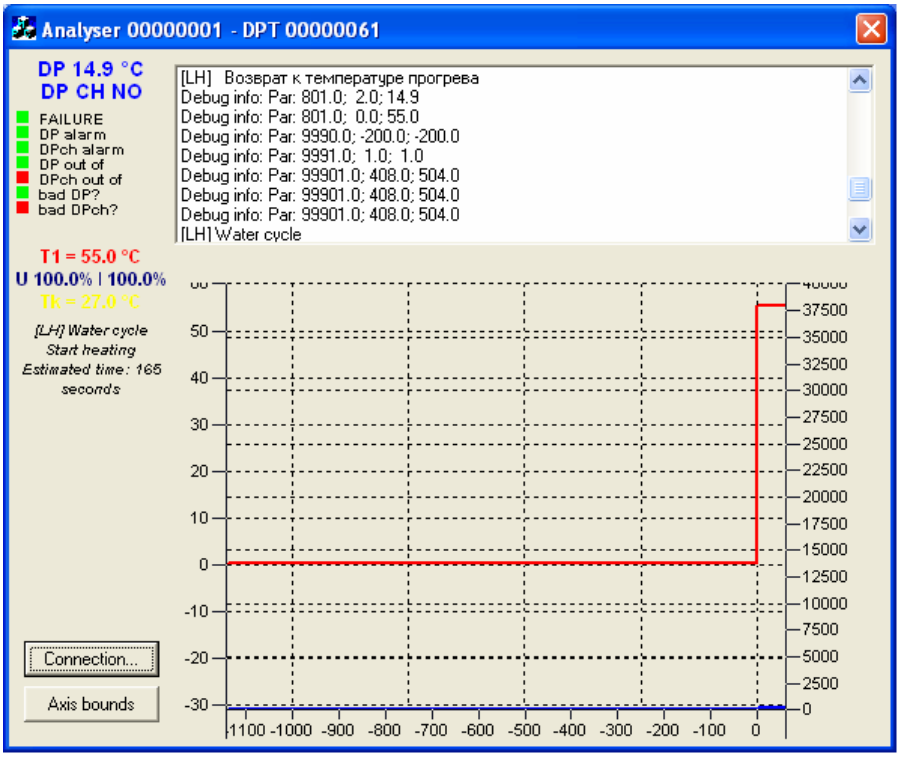


Figure 1

In case IU (CU) is connected to com1, exchange with IU (CU) starts automatically. In case IU (CU) is connected to COM-port having another number, COM-port number must be changed by pushing **“Exchange parameters”** icon (Figure 1) in order to connect IU (CU) and computer. Then the window shown below appears:

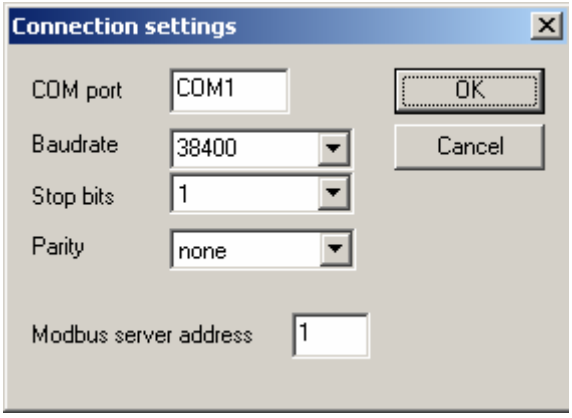


Figure 2

In COM-port window COM-port required number is specified. Other exchange parameters must be in compliance with the values shown in Figure 3.

On order to change parameters of measurement process visualization mode press “Diagram” icon shown in Figure 3.

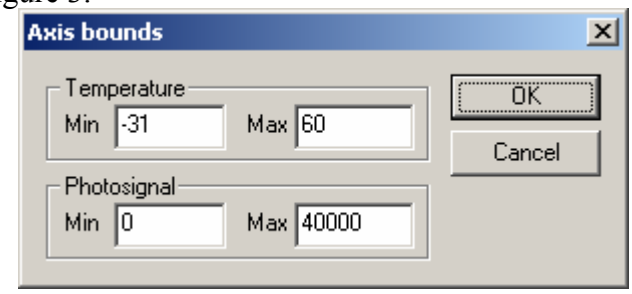


Figure 3

Changing of values in windows shown in Figure 3 allows changing of both temperature scale and the Analyzer’s gauge photo signal scale. Horizontal scale shows current time since starting the visualization program.

Appendix P *(compulsory)*. Table of Analyzer's default parameters stored in IU "Parameters" menu

Group	*Parameter*	*Value*
Model	0101	5
	0102	0
	0103	0 – Mode1, Mode 4, Mode 5 ; 1 – Mode 3; 3 – Mode 2
	0104	0 – Mode1, Mode 3…Mode 5; 1 – Mode 2
	0105	55
	0106	240 - 480
	0107	2
	0108	30
	0109	1
	0110	1
	0111	2
	0112	-2 - Mode1… Mode 3, Mode 5 ; -1 - Mode 4
	0113	10
	0114	35
H2O Cycle	0201	-0,2 - Mode1… Mode 3, Mode 5 ; -1 - Mode 4
	0202	900 - 1800
	0203	-60
	0204	1
	0205	600
	0206	0
	0207	0
	0208	0
	0209	3
	0210	-60
	0211	7
	0212	1
	0213	10
	0214	1,5 – 3,0
	0215	3
	0216	-15
	0217	1
	0218	1,11
	0219	1
	0220	60

Group	*Parameter*	*Value*
	0221	0,5
	0222	1
	0223	5
	0224	10
	0225	300
	0226	-2
	0227	3
	0228	1
	0229	10
	0230	1
	0231	1
	0232	65300
CH Cycle	0301	-0,2 - Mode1… Mode 3, Mode 5; -1 - Mode 4
	0302	900-1800
	0303	-33
	0304	-100
	0305	2
	0306	1
Calibrat	A, B, B1	Calibration coefficients
DSO	0501	0
	0502	60
	0503	60
	0504	5
	0505	40
	0506	5
	0507	10
	0508	10
	0509	60
	0510	0
	0511	0
	0512	0
DPT	0001…0024	Individual parameters of gauge