VYMPEL

Precision | Economy | Safety

Operating Manual

Hygrovision BL

Dew point analyzer

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1. GENERAL DESCRIPTION

1.1. PURPOSE AND FIELD OF APPLICATION

This manual provides a description of the construction and function of the **Hygrovision BL** dew point analyzer, model number KRAY2.844.007 (also called HV BL, Hygrovision, device, instrument, and analyzer in the text).

The Hygrovision BL is a compact portable analyzer used to establish the dew point temperature of water and hydrocarbons.

This portable hygrometer (hereinafter analyzer) functions according to the principal of direct measurement. It employs a temperature-controlled mirror upon which condensation forms to establish dew point.

The Hygrovision is one of a series of revolutionary new high-precision chilled-mirror analyzers that are characterized by the inclusion of a supplemental visualization system. This system makes it possible to physically observe the condensation (dew point) process. In addition, this system has two different illumination options, which makes it possible to easily distinguish between water condensation and the formation of hydrocarbon condensates.

PURPOSE

The analyzer is designed to measure the dew point of water (hereinafter also: W dew point, WDP, dpW) and the dew point of hydrocarbons (hereinafter also HC dew point, HCDP, dpHC) in natural gas and other gaseous media at operating pressures. It is also intended for the visual monitoring of the condensation process.

FIELD OF APPLICATION

Hygrovision BL dew point analyzer are designed to be used for:

Spot checking in the field

Checking the functionality of permanently installed dew point analyzers

Corroborating the accuracy of the measurements made by permanently installed units

Regular direct measurement of water and carbohydrate dew points in locations that are not equipped with automatic through-flow analyzers are where such analyzers cannot be installed

Checking the results of various manufacturing and working processes (such as the drying and vacuuming of equipment and systems, damp presses, processes involving the use of steam, regeneration, evacuation, etc.)

TYPES OF INSTALLATIONS

The BL can be employed by a variety of sectors, including the gas, oil, and chemical industries, metallurgy, the power industry, equipment manufacturing, and many other branches where the quality of manufacturing and operating process can be evaluated through the control of water and hydrocarbon dew points.

INSTALLATION AND OPERATING REQUIREMENTS

Only by qualified personnel may carry out the installation and maintenance of the analyzer.

Operating personnel must be familiar with the requirements and instructions contained in this manual and must be trained in the operation of explosion-protected equipment.

It is strongly recommended that this training be provided by the Vympel company.

1.2. EXPLOSION PROTECTION

The analyzer consists of an electronics module and a measurement module. (see point 1.4).

The electronics module conforms to all of the requirements for explosion-protected equipment in accordance with GOST R 52350.0-2005. The explosion Protection categories "flameproof enclosure (d)" according to GOST R 52350.1-2005 and "Intrinsically safe circuit (i)“ according to GOST R 52350.11-2005 identify the instrument as safe for use in explosion hazard zones both inside closed facilities and outside in the field according to GOST R 52350.14-2006.

Electronic Components of the HV BL	Ex protection markings
Electronics module	1 Ex d[ib] IIA T5 X
Electrical devices associated with the electronics module (thermoelectric battery, temperature sensor, photo diodes)	These are located with the flameproof enclosure and therefore do not have Ex protection
Light diode	As a simple electrical apparatus according to GOST R 52350.11 it has no Ex protection markings.

Attention!

To ensure that the Hygrovision BL is safe with regard to explosions, it is important to regularly purge the analyzer with air and to always fill the measurement chamber with sample gas before switching the device on.

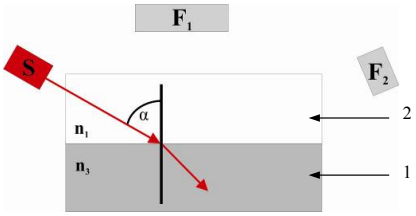


ILLUSTRATION 1: Total refraction

ILLUSTRATION 2: Clean mirror surface under side lighting

ILLUSTRATION 3: Clean mirror surface under microscope (vertical) lighting

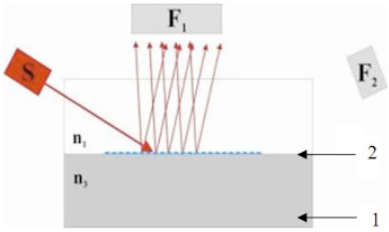


ILLUSTRATION 4: Scattering of light rays due to water condensation

1.3. MEASUREMENT PRINCIPLE

The Hygrovision BL is a compact, portable analyzer used for taking automatic and manual measurements of the dew point temperature of water and/or hydrocarbons.

This portable chilled-mirror automatic hygrometer operates according to the principle of direct measurement and employs a temperature-controlled mirror to establish the dew point. During the measurement process the reflectivity of the mirror is measured. As the temperature of the mirror is lowered, its reflectivity begins to go down when the dew point is reached and condensation begins to form. In this process condensates are deposited on the mirror (reflective surface).

A special system uses optical properties to register the formation of this condensate film.

This system utilizes the phenomenon of total refraction to register dew point.

A laser emitting vertically polarized light illuminates the interface of a heterogeneous media (gas) 1 and a reflective dielectric surface (temperature controlled mirror) 2 at a specific angle. This angle is known as Brewster's Angle.

When the dew point mirror (dielectric surface) is clean, in other words, when no condensate has formed, the polarized light rays falling on the interface between the gas and the mirror's surface are completely refracted. As a result no light is reflected onto either of the photo detectors (F1 and F2). This results in a null signal from the sensors (ILLUSTRATION 1). With the microscope attached, total refraction can be observed visually under both side lighting and vertical lighting. Under side lighting*, the surface of the dielectric mirror appears black (illustration 2). Under microscope (vertical) lighting the mirror's surface appears light blue (ILLUSTRATION 3).

*Please note: the side-lighting unit and the laser are not the same component.

In the case of water vapor, as the temperature of the mirror is lowered and condensation droplets begin to form, the angle at which the polarized light strikes the surface changes with the result that refraction no longer occurs. Instead, the light rays are reflected and scattered. The photoelectric registration system records an increase in the intensity of the light detected by the photo detector located in position F_1 (ILLUSTRATION 4). The signal intensity (aka signal level) is dependent on the amount of water condensation.

Under side lighting, water condensation appears in the form of an accumulation of luminous, somewhat similarly sized red droplets

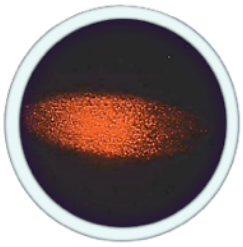


ILLUSTRATION 5: W condensation as seen under side lighting

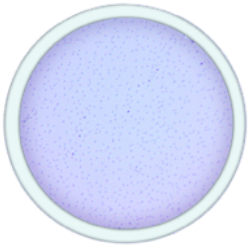


ILLUSTRATION 6: W condensation as seen under vertical lighting

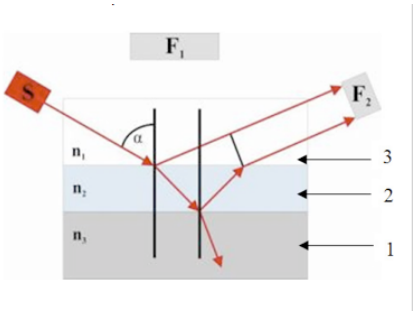


ILLUSTRATION 7: Light ray diffraction and reflection due to HC condensation

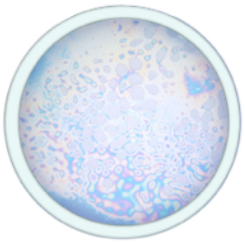


ILLUSTRATION 8: HC condensation (including heptanes)

in the middle of the mirror's surface (ILLUSTRATION 5). Under vertical lighting this condensation appears as an accumulation of little round black spots evenly distributed over the entire surface of the condensation mirror (ILLUSTRATION 6).

In the case of hydrocarbons, precipitated condensates accumulate in the form of a thin film on the surface of the mirror (Illustration 7). The building of a contiguous condensate layer (2) on the mirrors surface (1) results in a change in the angle at which the polarized light strikes the surface of the dielectric mirror.

The beam of light emitted by the laser is partially reflected as it encounters the gas/condensate interface (3/2). This set of light rays is then registered by the photo detector at position F_2.

At the same time, due to the condensate film's high degree of transparency, a set of slightly refracted light rays, passes through the gas/condensate interface and is reflected as it strikes the condensate/mirror interface (2/1). These light rays are then also registered by the photo detector at position F_2. This second set of rays is now slightly out of phase with the first set.

As a result, the registration system records two distinct light signals detected by the F_2 sensor. These two light signals create an interference pattern due to the slight phase difference.

The intensity of the light signal detected by the sensor is directly dependent on the quantity of hydrocarbon condensates in the condensation film.

The hydrocarbon condensation process can only be observed visually under vertical illumination. In contrast to water vapor condensation, the process of HC condensation cannot be made visible under side lighting, so even though the sidelight is activated, the mirror remains dark (ILLUSTRATION 2).

Hydrocarbons up to and including Heptanes form rainbow colored spots. These spread out until they link up to form one continuous thin iridescent film. (ILLUSTRATION 8). If the mirror continues to be cooled further, this thin iridescent film becomes a colorless plastic layer covering the entire condensation mirror's surface.

Octane and heavier hydrocarbons condense onto the mirror in the form of small dark semi-transparent dots. With further cooling, these dots grow to become small droplets and spots (ILLUSTRATION 9).

Continuation of the cooling process causes these small droplets to continue to grow, eventually forming large colorless drops of condensate on an iridescent background.

For further images of water and hydrocarbon condensation refer to **Appendix N**.

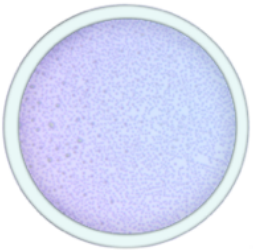


ILLUSTRATION 9: HC condensation (octane and heavier)

1.4. ANALYZER CONSTRUCTION

The analyzer's cold-body housing (see ILLUSTRATION 10 and ILLUSTRATION 11) consists of the high-pressure chamber (1) a sample sized receptacle (hereafter in the text the measurement cell (2)) a removable visualization system with 40 power magnification (hereafter in the text microscope (16) and an electronic module with an integrated touch screen display (10). The analyzer's high-pressure chamber is designed for a working pressure of up to 300 bar, and serves to supply and remove the sample gas that passes over the condensation mirror. In order to observe the condensation process, the high-pressure chamber is fitted with a small window upon which the visualization system can be mounted.

The microscope is mounted directly onto the Hygrovision's high-pressure chamber.

The electronic module controls the analyzer's processes (cooling/heating); records the mirror temperature and regulates the photoelectric registration system.

The Hygrovision BL is operated by means of control buttons and the touch screen display.

Recorded dew point values can be downloaded by means of an IR port and an RS 485 interface.

In order for the analyzer to operate independent of an external power supply, a slot for a storage battery is integrated into the Hygrovision‘s housing, as is a socket for connecting the unit to an external power supply (12–32V, 15W).

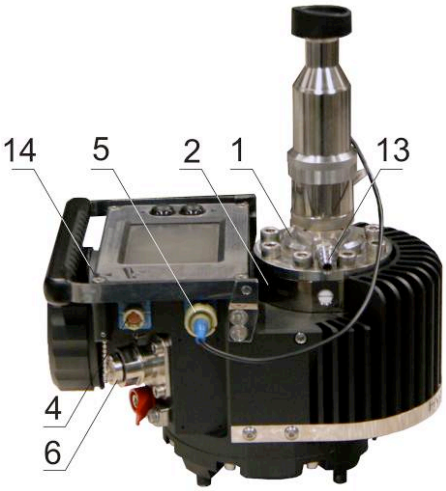


ILLUSTRATION 10: Main components of the Hygrovision BL (1)

Main components
(see ILLUSTRATION 10 and ILLUSTRATION 11)

- Gas delivery block (Pos.1);
- Measurement cell (PIP) (Pos.2);
- Battery compartment cap (Pos.3);
- Connection for the pressure sensor (Pos.4);
- Plug connector for the light emitting diode (Pos.5);
- RS 485 Modbus interface (Pos.6);
- Ventilation channel for supplementary cooling (Pos.7);
- IR port (Pos.8);
- On/off button (Pos.9)
- Touch screen (Pos.10);
- Control buttons (Pos.11);
- Sample gas inlet nozzle (Pos.12);
- Sample gas outlet nozzle (Pos.13);
- Stylus for use with the touch screen (Pos.14);
- Battery cap securing device (Pos.15).

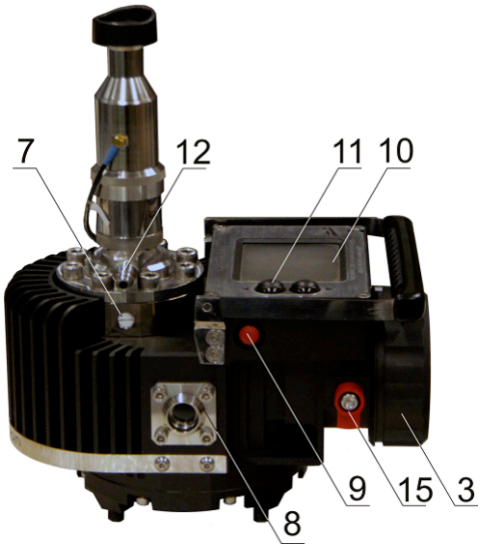


ILLUSTRATION 11: Main components of the Hygrovision BL (2)

The measurement cell, the electronic module with integrated touch screen and the power supply module (storage battery) are enclosed within the analyzer's metal housing (see Appendix A). The housing is made up of three chambers.

Two of the three chambers (chambers 1 and 2) are pressure resistant encapsulations. These chambers house the circuit boards for the electronic module (chamber 1) and the storage battery (chamber 2). The connection points for the external power supply and the IR data port are located on the side of chamber 1.

The third chamber (chamber 3) houses all of the electronic module's control and display elements. The touch screen display is integrated into the top of chamber 3. Connection points for an external pressure sensor and the microscope's side-lighting element are located on the side of this chamber. All of the electrical circuits housed in chamber three meet the requirements for intrinsic safety.

BATTERY PACK

ILLUSTRATION 12: Rechargeable battery pack

1.5. ANALYZER POWER SUPPLY

Hygrovision series analyzers have an independent onboard power supply, the BP-06 power supply unit (hereinafter also referred to as the rechargeable battery, battery, BP)

Important technical data for the BP:

Battery type	LIR18650 (Li-Ion);
Number of elements	6
Rated voltage	11.1 V
Max. discharge current	≤ 3 A
Electrical capacity	4 A h
Service life	300 recharging cycles (max. 2 years)
Operating conditions	-20 °C – + 60 °C

A detailed description of the BP unit's operating requirements can be found in the manual (KRAY5.549.006 ET) (included in delivery).

It is strongly recommended that only the (KRAY4.841.082) connection cable be used to connect the Hygrovision BL to an external power source (12 – 32V DC). This cable is designed specifically for this purpose (ILLUSTRATION 13).

Refer to ILLUSTRATION 35 when connecting the analyzer to an external power supply.

The Hygrovision's battery pack should only be recharged using the specially designed battery charger (KRAY5.122.007) included with

ILLUSTRATION 13: Battery charger (accessory)

delivery. Information about the use of the charger can be found on the label (KRAY5.122.007ET).

1.6. ADDITIONAL COMPONENTS AND ACCESSORIES

Additional components include those systems and accessories that ensure the optimal performance of desired analyzer functions.

Additional components fall into one of two categories:

- Additional components included as part of the Hygrovision BL's standard equipment;
- Additional components supplied at the customer's request.

Standard equipment

Included with delivery as standard equipment:

- Microscope (KRAY3.821.003);
- Gas flow and gas pressure control system Model 001 (VMPL5.183.001);
- Gas delivery system Model 001 (VMPL6.450.001)Model -001 VMPL6.450.001;
- Filter for the control of glycols and heavy hydrocarbons;
- Accessories used for the installation and maintenance of the measuring system and for individual analyzer modules.

MICROSCOPE

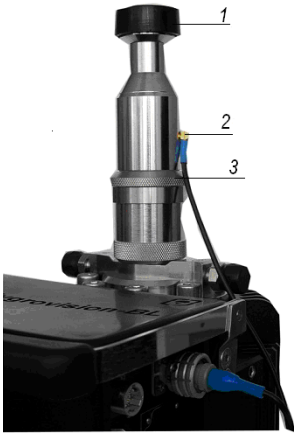


ILLUSTRATION 14: Microscope

ILLUSTRATION 14 is an exterior view of the microscope (KRAY3.821.003).

The optical system is positioned immediately above the high-pressure chamber. Equipped with 40X magnification, this system makes it possible to directly monitor processes taking place on the mirror's surface inside the measurement chamber to visually evaluate the compositional quality of the gas (see also 1.3).

The microscope is mounted onto the analyzer by way of a threaded coupling integrated into the housing for this purpose.

Important components:

- Eyepiece (Pos.1);
- Electrical socket for the lighting system LED (Pos.2);
- Focusing ring (Pos.3)

Gas flow / gas pressure control system (Model 001)

ILLUSTRATION 15: Gas flow and gas pressure control system

The gas flow / gas pressure control system Model 001 (VMPL5.183.001) (ILLUSTRATION 15) displays information about the operating pressure within the analyzer's measurement chamber. This system also provides a means to not only adjust the pressure but also regulate the gas flow rate during the measurement process (0.5 – 1NL/min).

Included in delivery of the gas flow / gas pressure control system are:

- Manometer (Pos.1);
- Float flow meter with metal housing (Pos.2);
- Flow rate fine adjustment valve (Pos.3);
- Mounting and connecting elements

Refer to Appendix C for a mounting diagram of the gas flow and gas pressure control system.

Please note:
Most of the systems and system modules are attached to the analyzer by means of quick-coupling connectors. The advantage such connectors provide is that no tools or special skills are needed for the installation of various modules and installation can be accomplished in the shortest mount of time.

GAS DELIVERY SYSTEM MODEL 001

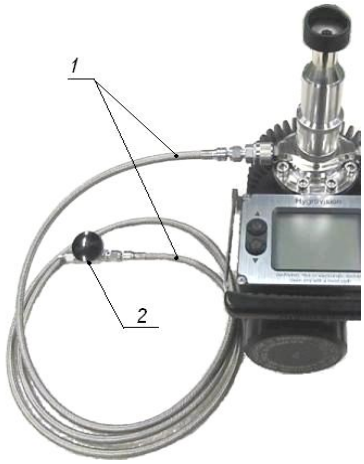


ILLUSTRATION 16: Gas delivery system

The gas delivery system provides a hermitically sealed connection between the analyzer and the sample extraction site. In addition, this system makes it possible to evenly regulate delivery of the sample gas to the Hygrovision's measurement chamber.

Included in delivery of the gas delivery system are:

- Flexible high pressure hose (Pos.1; ILLUSTRATION 16);
- Fine control valve (Pos.2; ILLUSTRATION 16)

Refer to Appendix D for gas delivery system assembly instructions.

Please note:
The fittings included in delivery make it possible to connect the analyzer with various measurement equipment, devices, and systems in the shortest amount of time and do not require additional tools or specialized skills.

PARTICLE FILTER

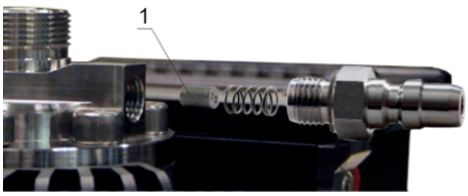


ILLUSTRATION 17: Position of the particle filter

The analyzer is also equipped with an integrated particle filter in order to remove solid particulates and other mechanical contaminates from the sample gas. This filter (FE73A-15) is positioned in the inlet side of the gas delivery housing (Pos. 1; ILLUSTRATION 17) and protects the condensation mirror from possible damage from solid particulates and contaminates in the gas mixture.

The particle filter is included with delivery of the analyzer and is preinstalled in the analyzer's housing prior to initial delivery.

A replacement filter cartridge is included with the additional components delivered with the analyzer as standard equipment.

Please note:
There is a replacement filter cartridge included with the analyzer as standard equipment. Additional replacement cartridges can be ordered from Vympel at any time.

GLYCOLS AND HEAVY HYDROCARBONS FILTER

When taking measurements to determine the dew point of water, it is common for a variety of gas mixtures to have high levels of glycol and heavy hydrocarbons. A specially designed filter (KRAY6.451.017) is used for the taking of measurements under these conditions. This filter is included as a standard additional component with the Hygrovision BL. (ILLUSTRATION 18).

The filter is installed directly in front of the fine control valve

ILLUSTRATION 18: Glycols and heavy HC filter

at the end of the flexible high-pressure hose of the gas delivery system (VMPL6.450.001).

In terms of active filtering, the average service life of the filter cartridge is eight hours. Therefore, the replacement interval depends in large measure on the type and composition of heavy hydrocarbons.

Usage requirements as well as detailed information about the filter can be found in the manual (KRAY6.451.017ET), which is included with delivery.

The glycol and heavy hydrocarbon filter is delivered with the analyzer as standard equipment.

EXTERNAL POWER SUPPLY CABLE

The external power supply cable (Illustration 20) is included with the analyzer as standard equipment. It serves not only to provide the device with electricity but also to transmit measurement data by way of the RS 485 interface using the standard Modbus/RTU protocol.

ILLUSTRATION 19: Power supply cable

Please refer to Table 5 for instructions concerning electrical configuration and connection.

IR ADAPTER

The analyzer's integrated infrared (IR) port can be connected to a computer by means of the IR adaptor (KRAY5.999.005).

ILLUSTRATION 20: IR Adapter

The position of the IR port is shown in Pos.8;
ILLUSTRATION 11.

Additional components that are available for order as optional accessories include:

- Supplemental cooling system VMPL5.880.003;
- Tripod (Libec TH-650DV);
- Sample extraction system KRAY4.078.091 (- 01);
- Pressure reduction system VMPL2.848.005;
- High-pressure outflow module VMPL4.078.025;
- For a detailed list of the Hygrovision BL's standard and optional components, please refer to Table 3, Point 1.12.

SUPPLEMENTAL COOLING SYSTEM

ILLUSTRATION 21: Supplemental cooling system

The supplemental cooling system (VMPL5.880.003) should be used when measuring dew point values below -30°C at ambient temperatures above +30°C and at pressures over 100 bar (ILLUSTRATION 21).

The cooling system consists of a container filled with carbon dioxide, two connector fittings, and a regulator valve to control the flow of refrigerant.

The system is connected to the outlet nozzle of the venting channel (Pos.7; ILLUSTRATION 11).

Please refer to Appendix E for mounting instructions.

For a detailed description of the supplemental cooling system please refer to “Special considerations when measuring dew point at very low temperatures ”

TRIPOD

In order to make operating the analyzer more convenient when in the field, the Hygrovision can be mounted on a Libec TH-650DV tripod.

A tripod attachment point is integrated into the underside of the Hygrovision’s housing. When mounted, the analyzer can be oriented in the desired position.

SAMPLE GAS EXTRACTION SYSTEM

The optional sample extraction system (KRAY4.078.091 or KRAY4.078.091-01) can be installed to create a stationary sample gas extraction site. The system set consists of the sample extraction apparatus (or a bypass valve) and a membrane filter for the removal of liquids and particulates from the gas sample.

Information regarding mounting and operating this system as well as ordering replacement filter elements can be found in the manual delivered with the set (KRAY4.078.091ET or KRAY4.078.091-01ET).

PRESSURE REDUCTION SYSTEM

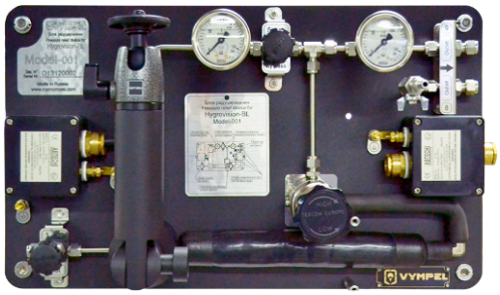


ILLUSTRATION 22

The pressure reduction system (VMPL2.848.005) provides for the reduction of the sample gas pressure from the working pressure (max. inflow pressure is 250 bar) to a pressure within the range 0.30 – 35 bar.

The module includes a heating element to pre-warm the gas sample in order to prevent premature condensation due to the Joule-Thomson effect (a drop in temperature that is a consequence of a drop in pressure in the gas mixture).

ILLUSTRATION 22 shows an overall view of the Pressure Reduction System (PRS). For a schematic drawing, please refer to Appendix F.

Detailed mounting and operating information can be found in the manual (VYMP2.848.005RE) delivered with the PRS.

HIGH-PRESSURE VENTING MODULE

The venting module (VMPL4.078.025) is used to channel the sample gases flowing out of the Hygrovision's measurement chamber into the main venting line, in those situations where the Hygrovision is used as a reference analyzer (Appendix G).

GAS PREPARATION SYSTEM SGA-003

ILLUSTRATION 23: SGA 003 incl. Hygrovision BL

The SGA 003 gas preparation system, or simply SGA, (ILLUSTRATION 23) provides for the removal of various aerosol and mechanical contaminants from the sample gas at a working pressure of up to 160 bar.

The SGA is designed to accommodate the optional use of a Hygrovision BL as a temporary reference analyzer. To that end, a foldout mounting arm, and supplemental sample gas connection points are integrated into the SGA's construction.

In addition, the SGA is also fitted with a supplemental access point on the explosion-proof terminal box in order to connect the Hygrovision BL to an external power supply and link it to the data transfer system.

1.7. CONTROL AND DISPLAY ELEMENTS

The analyzer has the following control elements:

- On / off button (Pos.9; ILLUSTRATION 11);
- Control buttons (Pos.11; ILLUSTRATION 11) for regulating the temperature of the condensation mirror.
- The touch screen display (Pos.10; ILLUSTRATION 11) is used to set and adjust the analyzer's operating parameters. The display presents information in the form of text and graphics.
- The touch screen stylus can be used to operate the display (Pos. 14; ILLUSTRATION 10).

1.8. THE ANALYZER'S MENU

TURNING ON THE ANALYZER

To turn on the Hygrovision BL press and hold the on/off button for several seconds (Illustration 24).

ILLUSTRATION 24

After the analyzer has been switched on, the touch screen will display the software version information for two to three seconds. (Illustration 25)

The BL is ready to begin measurement operations when the software message is no longer displayed. The analyzer will automatically revert to the operation at which it was set when turned off (Illustration 26, 27).

The following control "icons" are displayed on the analyzer's screen:

ILLUSTRATION 25

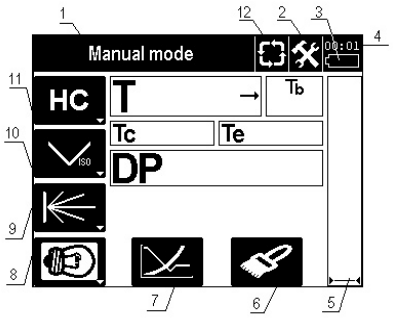


ILLUSTRATION 26

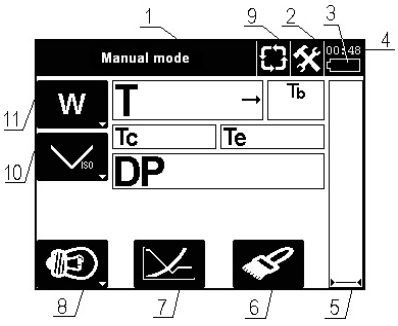


ILLUSTRATION 27

Operating mode

Shows the currently selected operating mode (Pos.1 ILLUSTRATION 26; ILLUSTRATION 27);

Mode selection

Used to select the desired operating mode (Pos.12, ILLUSTRATION 26; ILLUSTRATION 27);

Properties

Used to select and access the analyzer's basic operating parameters in order to make adjustments (Pos.2, ILLUSTRATION 26; ILLUSTRATION 27) A description of the properties menu is included in Appendix I.

Measurement channel

Used to select the desired measurement type:

- Dew point of water (channel W) or
- Dew point of hydrocarbons (channel HC)

(Pos.11, ILLUSTRATION 26, ILLUSTRATION 27);

Mirror-cooling modality

Used to select the mirror-cooling mode when taking measurements manually:

 a

- a) Cooling of the condensation mirror at a continuous preprogrammed rate (Pos.10, ILLUSTRATION 26; ILLUSTRATION 27);

 b

- b) Stepwise cooling of the condensation mirror by preprogrammed temperature intervals (Pos.10, ILLUSTRATION 26; ILLUSTRATION 27).

Laser activation icon

Used to switch the laser on and off (Pos.9, ILLUSTRATION 26; ILLUSTRATION 27).

This icon only appears when the microscope lighting button has been activated. The laser is preset in the on position.

Rough DP – Scan

This button activates a scanning process that finds a preliminary dew point value in order to establish the basic temperature range within which an accurate dew point value can be measured (Pos.7, ILLUSTRATION 26, ILLUSTRATION 27).

Microscope lighting

Used to switch the microscope (vertical) lighting on and off (Pos.8, ILLUSTRATION 26; ILLUSTRATION 27)

Mirror-cleaning mode

Used to activate the mirror-cleaning mode. In this mode the condensation mirror is heated to a specific temperature in order to free the mirror surface of condensate residue by means of evaporation (Pos. 6, ILLUSTRATION 26; ILLUSTRATION 27).

Measurement scale

Used to change the measurement scale during the measurement process (Pos. 5, ILLUSTRATION 26; ILLUSTRATION 27)

DISPLAYED INFORMATION

- Battery charge status – Pos.3 (ILLUSTRATION 26; ILLUSTRATION 27);
- Timer – Pos.4 (ILLUSTRATION 26; ILLUSTRATION 27);
- Current temperature of the condensation mirror – T;
- Housing temperature – Tb;
- Condensation temperature – Tc;
- Evaporation temperature – Te;
- Temperature interval during mirror cooling - T_L;
- Signal level of the photodiode - U;
- Dew point temperature – **DP.**

In stepwise cooling mode an automatic timer is activated which displays the time spent at each temperature level.

The battery status display consists of nine segments — each segment represents 10 percent of the battery's charge.

PROPERTIES

When the 

icon is tapped, additional information is displayed.

The window that opens when the properties icon is tapped displays information about the operating system (ILLUSTRATION 28), the time and date (ILLUSTRATION 29), and the battery status (ILLUSTRATION 30).

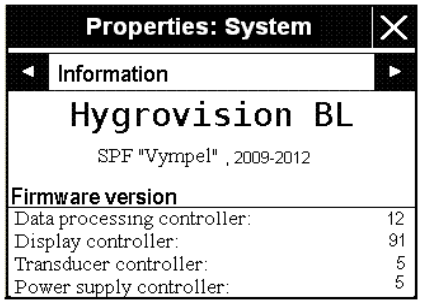


ILLUSTRATION 28: Properties: System – Operating system

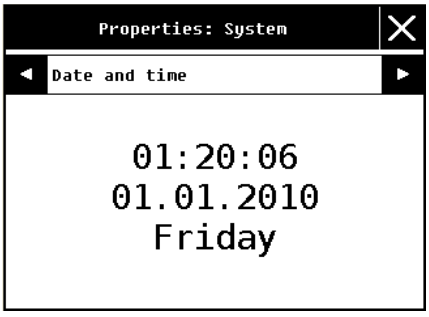


ILLUSTRATION 29: Properties: System – Date and time

Use the < and > icons to navigate between individual menu points.

Please note that the date and time are set using the Settings menu (see also Appendix I).

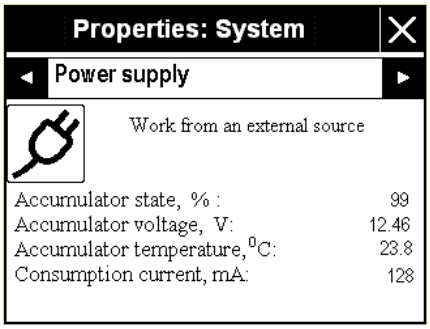


ILLUSTRATION 30: Properties: System – Power supply

The Hygrovision's battery should be fully recharged as described in the manual (KRAY5.122.007 ET) when the charge falls below 20%.

ANALYZER CHECK

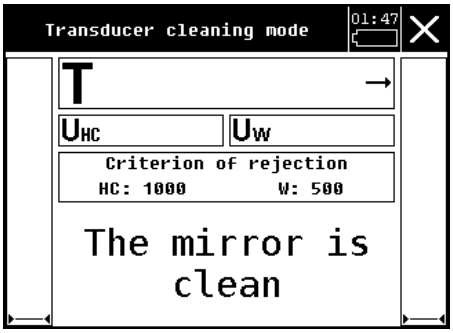


ILLUSTRATION 31: Transducer cleaning mode

In order to check the functionality of the analyzer follow these steps:

Tap the  icon to switch to the mirror-cleaning mode (Pos.6, ILLUSTRATION 26; ILLUSTRATION 27)

The analyzer's display will show the "Transducer cleaning mode" window (ILLUSTRATION 31)

If the device is operating normally, the condensation mirror should heat to temperature of +50° ± 0.1° C (**T** value).

Please note:
Should there continue to be residue on the surface of the mirror after the mirror-cleaning cycle has been completed, the error message "The mirror is dirty" will be displayed. In this case it is necessary to repeat mirror cleaning as described in Point 5.2.

Tap the  icon to switch to the main menu.

Check that the microscope lighting is working properly by tapping the  icon.

When the microscope lighting is switched on, the symbol appears as a black drawing on a light background.

When this lighting is switched off, the symbol, appears as a light drawing on a dark background.

AUTOMATIC DEW POINT MEASUREMENT MODE

Tap the  icon (Pos12, ILLUSTRATION 26; ILLUSTRATION 27) to switch to automatic dew point measurement mode.

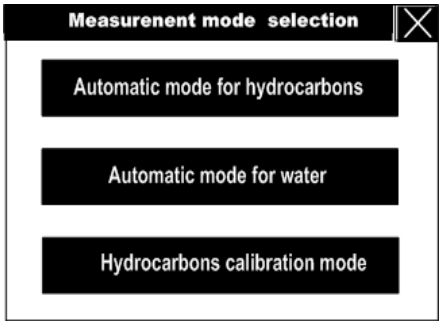


ILLUSTRATION 32

Select one of the three modes that displayed in the window that opens (ILLUSTRATION 32):

- Automatic mode for hydrocarbons
- Automatic mode for water
- Hydrocarbons calibration mode

To activate the desired mode, simply tap the related field.

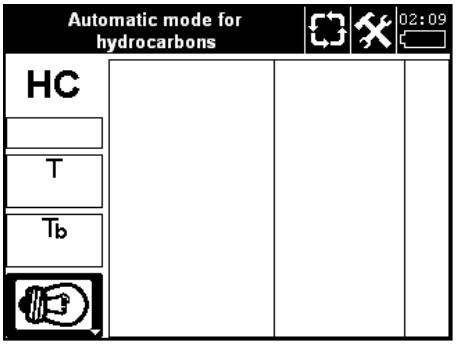


ILLUSTRATION 33

In order to visually observe the measurement process in automatic mode for hydrocarbons, the microscope lighting must be activated by tapping the  icon. (ILLUSTRATION 33).

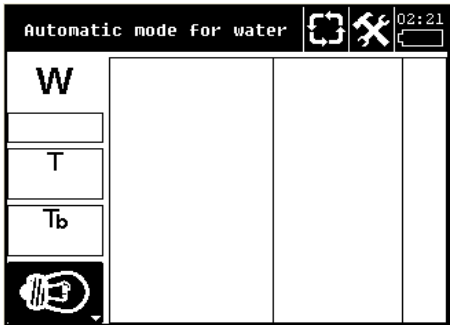


ILLUSTRATION 34

In the automatic mode for water, the microscope lighting is switched off (ILLUSTRATION 34). Visual monitoring of the measurement process in this mode is carried out with the microscope lighting turned off.

In order to switch between modes tap the  icon again (Pos.12, ILLUSTRATION 26; ILLUSTRATION 27) and select the desired operation by tapping the related field (ILLUSTRATION 32).

TURNING OFF THE ANALYZER

To turn off the analyzer, press the red button on the left side of the touch screen housing (Pos. 9, ILLUSTRATION 11) and hold it down until the display switches off (about five seconds).

1.9. CONNECTING PERIPHERAL DEVICES

The following connection points are located on the right side of the analyzer's housing:

- XP2 – used for maintenance purposes
- XP3 – microscope lighting connection socket (Pos.5 ; ILLUSTRATION 10)
- XP1 – socket for connecting the analyzer to an external power supply and for transferring measurement data over a RS-485 interface using the Modbus/RTU – Protocol (Pos.6; ILLUSTRATION 10)

A description of the Modbus register is included in Appendix J.

Attention!

The sockets (Pos. 4, 5) are intrinsically safe devices.
Sockets XP2 and XP3 have light blue caps.

The IR port is located on the left side of the analyzer's housing (Pos.8; ILLUSTRATION 11). This connection port makes it possible to connect the Hygrovision to an terminal module or computer in order to transfer measurement data via the IR adapter (KRAY5.999.005), which is included with delivery as a standard component.

Measurement data is transferred using the standard terminal programs Hygrovision.exe.

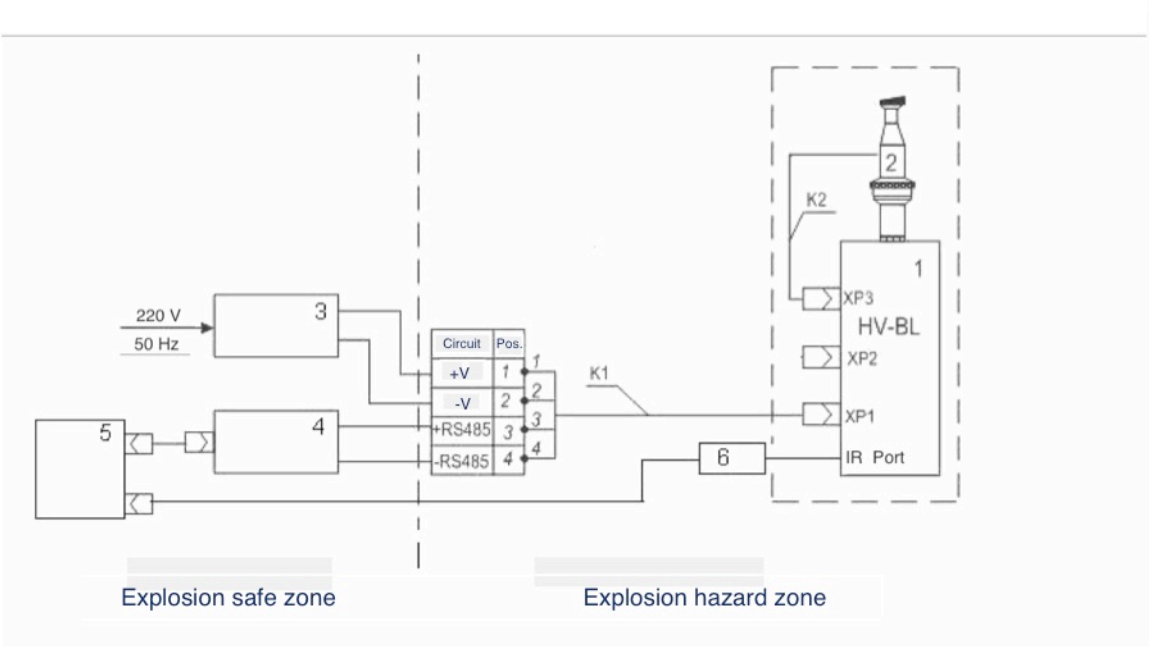


ILLUSTRATION 35: Schematic drawing for the connection of peripheral devices

Position of elements in illustration 35:

1 – Hygrovision BL dew point analyzer

2 – Microscope (KRAY3.821.003)

3 – AC power adapter (12- 32) V / 15 W

4 – Interface connector RS – 232 / 485

5 – Computer terminal

6 – IR Adapter (KRAY5.999.005)

K1 – Cable (KRAY4.841.082)

K2 – Cable (VMPL4.841.007)

Attention!

The AC power cable is connected to the analyzer via a supplemental junction box.

Within the junction box, connection of the intrinsically safe and not intrinsically safe electrical circuits must be carried out separately, in accordance with GOST R52350.11-2005 and Point 6 of this manual.

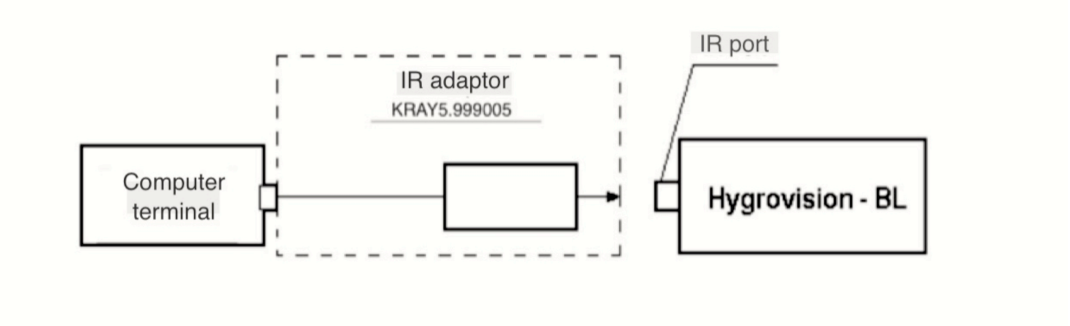


ILLUSTRATION 36: Connection of a computer terminal via the IR port

Attention!

The terminal computer and the IR adapter (KRAY5.999.005) are **not** explosion-proof devices.

For this reason, connection of these devices to the analyzer may only be carried out in explosion-proof zone.

Attention!

To ensure the analyzer's explosion safety, unused socket connections must be secured with the caps included with delivery.

1.10. SPECIFICATIONS

Table 1

Measurement range	Water	-30 ºC – T_H
	Hydrocarbons	-30 ºC – T_H
Measurement error	Water	±0.5 °C
	Hydrocarbons	±0.5 °C
Recommended gas-flow volume [2)]	0.5 – 1 Nl/min	

Electrical supply (Voltage / Power)	Battery-powered operation	= (8.4 – 12.6) V, 4 mA / 15 W
	External power supply	= (12 – 32) V / 15 W
Operating time	Battery-powered operation	4 h
	External power supply	Unlimited
Ambient Temperature	-10 – +50 ^{0}C	
Working pressure	≤ 250 bar (dependent on BL version)	
Level of housing protection	IP66	
Dimensions (without microscope)	165x204x257 mm	
Weight (without accessories)	7.5 kg	
Installation	Suitable for enclosed indoor spaces and open outdoor areas (hazardous zones)	
Sample extraction connection	Pipe connection module (Dk-Lok connection pipe with an outer diameter of ø 6mm)	
Service life: Analyzer Measurement cell Rechargeable battery	10 years 3 years 300 charge/ discharge cycles (max. two years)	

1.11. HYGROVISION BL STANDARD EQUIPMENT

Table 2 gives an overview of the important standard components delivered with the Hygrovision BL.

The positions in ILLUSTRATION 37, ILLUSTRATION 38, ILLUSTRATION 39 correspond to the numbering in table 2.

Table 2.

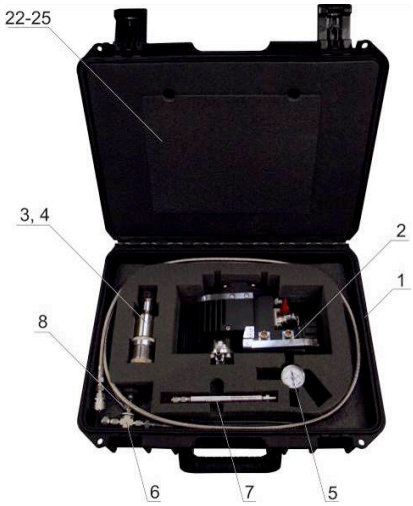


ILLUSTRATION 37

ILLUSTRATION 38

ILLUSTRATION 39

Table 2

Pos.	Article Number	Description	No.
	Main components:		
1	VMPL 4.161.003	Transport case	1
2	KRAY 2.844.007	Hygrovision BL dew point analyzer set (including the following accessories)	1
3	KRAY 3.821.003	Microscope	1
4	VMPL.841.007	Cable	
5	VMPL 5. 183.001	Gas flow and gas pressure control system Model 001	1
6	VMPL 6.450.001	Gas delivery system Model 001	1
7	KRAY 6.451.017	Filter for the control of glycols and heavy hydrocarbons	1

8	–	PVC pipe: inner diameter ø 6x1.5, length= 2500 mm	1
9	–	Mounting fittings (set)	1
10	VMPL 4.161.004	Transport case	1
11	KRAY 4.841.082	External power supply cable	1
12	KRAY 5.122.007	Battery charger	1
13	KRAY 5.549.006	AC adapter unit BP-06	1
14	KRAY 5.999.005	IR data connection line	1
15	–	Power supply adapter cord IBM 16B; 4.5A ; plug 5.5/2.5	1
16	–	Power cord with auto cigarette lighter plug 5.5/2.5	1
17	–	Eclipse optics cleaner (59 ml)	1
18	–	Cotton swabs (package of 50)	1
19	KRAY 4.160.001	Tube of replacement cartridges for filter KRAY6.451.017 (10 cartridges with adsorbent MAU)	1
20	VMPL 8.392.001	Special disassembly key	1
21	VMPL 8.248.005	Sealing ring	
	Operating documentation and software		
22	KRAY 2.844.007RE	Operating manual	1
23	KRAY2.844.007 FD	Form	1
24	KRAY 2.844.007ML	Verification methodology	1
25	KRAY 2.844.007-01 D21	Software	1
	Additional equipment*		
26	VMPL 5.880.003	Supplemental cooling system	
27	–	Element made of sintered steel (FE73A-15)	
	–	Libec TH-650DV tripod	
	KRAY 4.160.001	Tube containing additional replacement filter cartridges	
	KRAY 5.549.006	Power unit BP-06	
	KRAY 4.078.091 (- 01)	Sample extraction module	
	130-502	Membrane filter replacement membranes (5 pcs.) KRAY6.457.022(-01)	
	VMPL 2.848.005	Reduction unit model 001	
	VMPL4.078.025	High pressure venting module	
	* quantity dependent on customer order		

Please note:
Depending on technical developments, the shipment inventory and the design of individual elements may be different than what is depicted here, however these alterations will have no effect on basic function and intrinsic safety.

1.12. EXPLOSION SAFETY PROVISIONS

The analyzer is fitted with a flameproof enclosure and intrinsically safe electrical circuitry to provide safety against explosion (Table 1).

Other design features that ensure the Hygrovision BL is protected against explosion are:

Spark arresting insulation barriers that ensure the intrinsic safety of the electrical connections at the control buttons.

Bypass diodes and resistors that ensure the intrinsic safety of the electrical circuit connected to the display unit. These elements reduce the electrical current and voltage to the values allowed by GOST R 52350.11 for electrical devices in Group II B. This reduction applies for both normal and emergency operation modes. Electrical sparking is prevented through a combination of resistors and a fuse module.

The sum of the electrical capacity and the inductivity of the electrical circuit that connects the Hygrovision BL to external components via their individual intrinsically safe plugs conform to the values required by GOST R 52350.11.

Optoelectronic coupling provides galvanic separation of the signal and the internal circuitry of the Hygrovision BL.

Electrical clearances and seepage, and the stability of the electrical insulation of the intrinsically safe circuitry are in accordance with the requirements of GOST R 52350.11

The electrical load does not exceed two thirds of the nominal capacity of components that ensure intrinsic safety.

The construction and electrical properties of the LED conform to the specifications stated in GOST R 52350.0 and GOST R 52350.1.

The maximal temperatures generated through internal heating, to which the electrical components and the housing of the Hygrovision BL are exposed do not exceed those allowed in GOST R 52350.0 for temperature class T5.

The HV BL's electronics unit connection points through the flameproof enclosure meet the requirements of GOST R 523 50.1 for electrical apparatus of subgroup II B.

Lock nuts and adhesives are used to protect against the loosening of the screws, bolts, and nuts that secure the various elements of the flameproof enclosure as well as the conductor and grounding terminals. Similarly, locking devices are used to secure self-threading connectors. The heads of external fixing screws are recessed and can only be accessed using a special tool.

Cable entry points ensure that conductors have a stable and durable connection. Fasteners comply with the requirements of the GOST R 52350.1 – 2005 directive.

The mechanical strength of the flameproof enclosure meets the requirements of GOST R 52350.0-2005 for electrical apparatus of Group II that are exposed to a strong risk for mechanically inflicted damage. The surface areas of the LCD display and the IR interface are limited to pre-

vent the buildup of static electricity.

Integration of electrical ports into the flameproof enclosure complies with the requirements of GOST R 52350.0 und GOST R 52350.1.

The construction of the HV BL conforms to the general requirements of GOST R 52350.0-2005 for electrical equipment designed to be operated in explosion-hazard areas. The seals and connectors used for structural elements provide an IP 66 level of protection in accordance with GOST 14254.

All applicable explosion protection information is displayed on the housing of the Hygrovision BL as required by regulation.

2. SAFE OPERATION OF THE HYGROVISION BL

2.1. GENERAL SAFETY MEASURES

The Hygrovision analyzer is a class 0I electrical device (as defined by GOST Standards 12.2.007.0 SSBT), in terms of protection against electrical shock.

Do NOT use the HV BL to take measurements in situations where the analyzer will be exposed to corrosive media or an aggressive.

The charging unit must be plugged into a grounded socket (GOST Norm 12.1.030 SSB). Resistance in the grounding circuit must not exceed 4 ohms.

Installation and removal of the analyzer should be done only after the valve on the sampling device has been closed and the pressure within the sampling equipment has been adjusted to atmospheric pressure using the fine adjustment valve.

2.2. EXPLOSION-SAFE INSTALLATION AND OPERATION

Installation and maintenance of the analyzer may only be carried out by qualified personnel. The device should only be operated by individuals who are familiar with the unit's documentation and the guidelines for working in explosion-hazard areas. It is strongly recommended that users of the Hygrovision BL receive training and/or instruction provided by Vympel GmbH in order to fully comply with the above stated requirements.

The analyzer can be operated in both indoor and outdoor explosion-hazard areas in accordance with GOST R 52350.14-2006 and other normative standards that regulate the operation of electrical devices in explosion-hazard areas (see 1.2).

A visual inspection of the analyzer must be carried out before the unit is installed to ensure that the device is in accordance with the information presented in Appendix B. Specific points to check include but are not limited to the ignition-proof markings, the mechanical integrity of the housing, the state of the Hygrovision's various components, and the proper connection of the external intrinsically safe equipment (the microscope).

Make all necessary electrical connection in accordance with the schematic drawing in section 1.9. After the unit has been installed, check that it is properly grounded and that the grounding resistance does not exceed 4 ohms.

During installation, it is essential to avoid any friction or shocks that could lead to the creation of sparks.

Please observe the following guidelines during installation:

- Properly plug in all detachable connection;
- Make sure that all of the housing screw-connector coverings are fully in place, as are all of the lids and locking mechanisms.

When in operation, the analyzer should undergo a regular visual inspection that includes the following points:

- Check the integrity of all the seals;
- Check that all of the lids and caps are properly in place;
- Check the integrity of the insulation of all the wiring (power supply and data transfer);
- Check the integrity and connection of the grounding wire;
- Check for the presence of dents or other visible mechanical damage, dust, or contamination that could interfere with the analyzer's operation.
- Use of an analyzer that is damaged or defective is strictly prohibited.

3. PREPARING THE ANALYZER FOR OPERATION

3.1. GENERAL REQUIREMENTS

UNPACKING AND VISUAL INSPECTION

Upon receipt, please confirm that the packing in which the analyzer is delivered is in good condition. Should the packing show signs of damage, please document this, and contact customer services at Vympel GmbH.

Carefully unpack the analyzer and its accessories. Refer to the packing list to ensure that the delivery is complete.

Confirm that there has been no damage during transportation.

OPERATING RESTRICTIONS

Please refer to the restrictions that pertain to analyzer operation which are listed under point 2.2 of this manual.

Attention!

Completely charge the rechargeable battery of a new Hygrovision before putting the analyzer into operation for the first time.

PREPARING THE RECHARGEABLE BATTERY FOR ANALYZER OPERATION

A battery charger (KRAY5.122.007), specially designed for charging the Hygrovision's battery pack is included with delivery.

The battery can be charged by connecting it to either:

- a 220 V A/C power supply

  or

- a 12 V D/C power source

Instructions for using the battery charger can be found on the charger's label (KPAY5.122.007 ET).

Attention!

The Hygrovision's battery must be charged/recharged only in an explosion-proof zone.

SAMPLE EXTRACTION

When selecting a sample extraction site, the following points should be considered:

- The ambient temperature and the relative humidity lie within the parameters listed in table 1, point 1.1;
- The temperature of the sample gas as it enters the measurement chamber must not be lower than temperature of the gas at the extraction site.

If the temperature of the sample supply line (the ambient temperature) is below the temperature of the sample gas at the point of extraction, the sample supply line must be heated by means of an electric heating element.

3.2. CONNECTING THE ANALYZER

Place the analyzer on a level surface or mount it on the tripod near the extraction site. Take care that the bearing surface provides sufficient support for the analyzer.

Attach the gas delivery system (VYMP6.450.001; Pos.1, ILLUSTRATION 40) to the inlet port of the analyzer's measuring chamber. Confirm that the high-pressure valve is closed.

Next, attach the gas flow and gas pressure control system (VYMP5.183.001; Pos. 3, ILLUSTRATION 40) to the outlet port of the measuring chamber (Pos. 2). Confirm that the fine adjustment valve of the gas flow / gas pressure control system is closed.

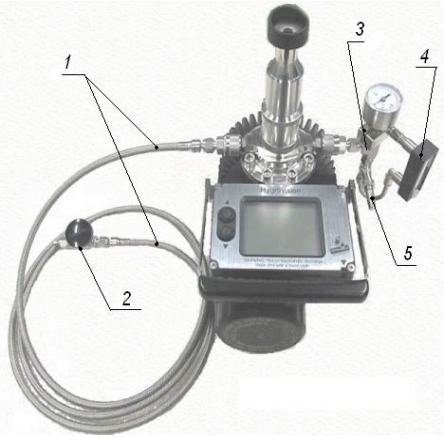


ILLUSTRATION 40

Both of these systems use quick-connect couplers to attach to the analyzer's inlet and outlet ports in order to not only reduce the time required for (de)installation but also to ensure an airtight seal at each of these points.

The analyzer connects to the gas supply by means of a flexible high-pressure hose equipped with a fine adjustment valve (Pos.2). Connect the end of the hose to the outlet port of the extraction system's shut-off valve. (Dk-Lok connector with an outer diameter of ø 6mm).

Gas that has passed through the measuring chamber is vented through a PVC hose (included with delivery) that is connected to the outlet nozzle (Pos.5) of the gas flow / gas pressure control system.

The gas flow can be altered as desired by means of the fine adjustment control valve on the gas flow / gas pressure control system. The manufacturer recommends an optimal volume flow of 0.5 – 1.0 Nl/min.

If the gas composition includes a large number of early-condensing hydrocarbons that interfere with the clear visual detection of the formation of water condensation, the user should install the supplemental filter for the control of heavy hydrocarbons (KRAY6.451.017; included with delivery).

This filter should be mounted between the high-pressure hose and the gas delivery system (VYMP6.450.001).

Attention!

When (de)installing pressurized devices in the sample gas extraction system or the gas preparation system (SGA), it is necessary to reduce the operating pressure to atmospheric pressure.

TESTING SEAL INTEGRITY

After the analyzer has been installed it is necessary to check that integrity of the sample delivery system connections using the following procedure:

1. Close the valve on the gas flow / pressure control system;
2. Slowly open the sample extraction system shutoff valve and the valve at the inlet port of the analyzer's measuring chamber;
3. Apply a soapy emulsion to the points of connection between the gas delivery system, the measuring chamber, and the gas flow and pressure control system, including between the locknut and connecting sleeve at each joint.

4. If bubbles are seen forming in the soapy emulsion it is a sign that the corresponding connection is not properly sealed. The connection seal must be reseated to ensure air tightness.

Attention!

In situations where the dew point of inflammable gases is being measured, it is necessary to ventilate the analyzer's measuring chamber and the sample gas delivery lines for 10 to 20 minutes before connecting the device to the power supply.

3.3. FUNCTIONAL TEST

When carrying out a functional test, use the following procedures (as described in detail below):

1. Switch on the analyzer;
2. Check the microscope lighting;
3. Check the condition of the condensation mirror;
4. Confirm that the thermoelectric battery is working properly;
5. Check that the date and time are correct;
6. Check the charge status of the rechargeable battery pack
7. Switch the analyzer off

SWITCHING ON THE ANALYZER

Press the red button on the left side of the analyzer to switch the device on (ILLUSTRATION 41).

ILLUSTRATION 41

The operating program (OP) requires one or two seconds to load. When the program has completed the startup sequence, the touch screen will display the last operating mode to which the device was set (ILLUSTRATION 26; ILLUSTRATION 27; ILLUSTRATION 33; ILLUSTRATION 34).

When the analyzer is switched on, the temperature of the condensation mirror (**T**) should largely correspond to the temperature of the housing ($\mathbf{T_b}$), with a maximum deviation of ≈ ± 0.5°C.

CHECKING THE MICROSCOPE LIGHTING

Confirm that the microscope lighting is operating properly by tapping the "microscope lighting" icon (Pos.8, ILLUSTRATION 26; ILLUSTRATION 27). Look through the microscope to visually confirm that the lighting switches on and off.

Make sure that the microscope is optimally adjusted for viewing the

surface of the condensation mirror.

Checking the condensation mirror and the thermoelectric battery

Use the focusing ring to adjustment the sharpness of the image. Activate the “Transducer Cleaning Mode” as described in Point 4.2. It should only take a few minutes for the condensation mirror to heat up to a “cleaning” temperature of about +50 °C ± 0.1 °C.

If there are no problems during this process, it can be assumed that the thermoelectric element is functioning properly.

Check that the signal levels for U_{HC} und U_W are within tolerance.

If the system message “The mirror is dirty” is displayed, carry out technical maintenance as described in Point 5.2.

Date and time

Open the “Properties: System” menu window for “Date and Time” as described in Point 1.8. (ILLUSTRATION 29).

Should these parameters require correcting, go the “Properties” menu and follow the procedure as described in Appendix I.

Battery pack charge status

Open the “Properties: System” menu window for “Power supply” as described in Point 1.8 (ILLUSTRATION 30).

If the rechargeable battery pack (BP) is in good condition, the parameters that are displayed will be within the ranges depicted here.

Table 3

Parameter	Unit	Acceptable value
Charge status	Q_a	10 – 100%
Voltage	U_a	9.0 – 12.6 V
Operating current	I_a	0.01 – 2.5 A
Temperature	T_a	-20 °C – + 60 °C

If the charge status of the BP is below 20%, fully recharge it according to the instructions provided on the recharging unit label (KRAY5.122.007ET).

Switching off the analyzer

Switch the analyzer off by pressing and holding the red button until the touch screen goes off. (ILLUSTRATION 41).

4. Operating the Hygrovision BL

4.1. Precautionary measures

The analyzer may be operated in both indoor and outdoor explosion hazard areas in accordance with GOST R 52350.14-2006 and other normative documents that regulate the use of electrical devices in explosion hazard areas.

Only fully qualified personnel are to install and operate this device. Further, this device may only be used by persons who are completely familiar with the guidelines and normative documents pertaining to working in explosion hazard areas. It is therefore strongly recommended that the relevant personnel receive instruction and training from Vympel GmbH.

During installation of the analyzer it is essential to avoid any friction or shocks that could generate sparks.

Before the analyzer may be (de)installed the shut-off valve on the sample extraction system and the shutoff valve on the gas delivery system must both be in the closed position and the pressure within the analyzer's measurement chamber must be reduced to the ambient atmospheric pressure.

4.2. Handling the Hygrovision BL

Before taking any measurements, please make sure that the analyzer and its accessory parts are all in proper working order.

Preparing to take measurements

When preparing the Hygrovision BL for operation:

- Affix the analyzer to a tripod or place it on a level surface;
- Carefully mount the microscope and plug ends of the microscope lighting cord into the appropriate sockets;
- Connect additional accessories (computer terminal, pressure transmitter, etc.) to the analyzer at the appropriate points;
- Before switching on the analyzer make sure that all of the components are mounted in accordance with the requirements of Point 2.2;
- Carry out a functional test of the analyzer immediately before beginning to take measurements. Also check the power source as described in point 1.8 of this manual.

HEATING THE CONDENSATION MIRROR

Always clean the mirror before taking measurements by activating the “Transducer cleaning mode”.

Tap the  icon to activate this mode (Pos.6; ILLUSTRATION 26; ILLUSTRATION 27).

When the  icon is tapped the “Transducer cleaning mode” menu window is opened. The information displayed in this mode includes values for the mirror temperature (T), the signal levels for hydrocarbons (U_{HC}) and water (U_W), and signal level rejection criteria, as well as a text message confirming that the mirror is either clean or “dirty”. The process of heating the mirror to 50 °C is depicted as a changing value for T (ILLUSTRATION 42).

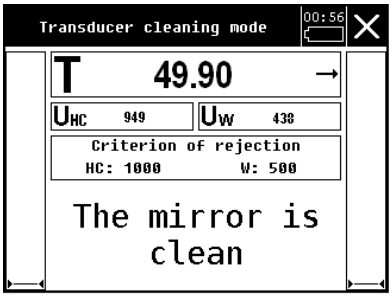


ILLUSTRATION 42

CLEANING THE MIRROR

If the message “The mirror is dirty” is displayed after the “Transducer cleaning mode” cycle is complete (ILLUSTRATION 43), it will be necessary to clean the condensation mirror according to the instructions found under Point 5.2.

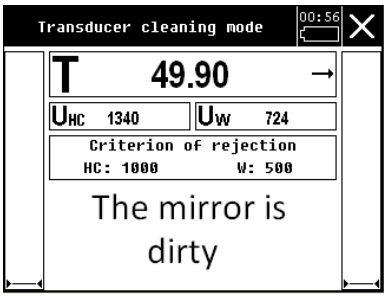


ILLUSTRATION 43

ADJUSTING THE LIGHTING INTENSITY

When the desired measurement pressure has been reached, ensure that the microscope and the microscope lighting are adjusted to provide optimal viewing of the surface of the condensation mirror.

Adjust the sharpness of the mirror’s image using the focus ring on the microscope (Pos.3 ILLUSTRATION 14)

When working out-of-doors it may be desirable to adjust the intensity of the condensation mirror illumination in response to various environmental factors and personal preference.

When taking dew point measurements, the process of condensation can be directly observed visually by means of the microscope (ILLUSTRATION 1; ILLUSTRATION 2) alternatively, condensation can be monitored on the display by means of the optical-electric registration system (measurement scale – Pos.5, ILLUSTRATION 26; ILLUSTRATION 27)

MIRROR SCAN /

SCANNING MODE

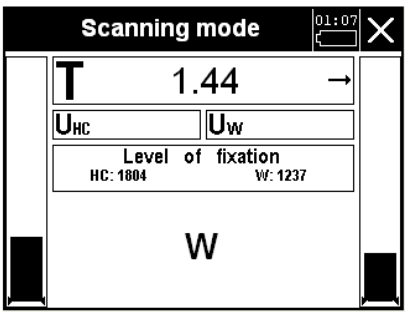


ILLUSTRATION 44

Scanning serves to simplify the process of registering the dew point manually. In scanning mode, the analyzer establishes an approximate dew point range within which lies the actually dew point.

Tap the  function icon (Pos.7; ILLUSTRATION 26; ILLUSTRATION 27) to begin the scanning process. In this mode the condensation mirror is cooled at a rate of 0.5 °C per second until reaching a temperature at which a condensation film of water or hydrocarbons begins to form. When this point is reached the mirror is automatically reheated to a temperature exactly 10 °C above that at which the formation of condensation was initially registered.

The signal strengths corresponding to water and/or hydrocarbons condensation are displayed in the U_W and U_{HC} menu windows.

In the “Level of fixation” window a value limit for the signal strength of the U_{HC} and U_W channels is displayed. When one of these values is exceeded the temperature of the mirror will stabilize at the corresponding level. The analyzer will determine whether the condensate is made of water or hydrocarbons based on which value is exceeded.

When the scanning process is completed, the letters **HC** will be displayed if the analyzer registers hydrocarbon condensation whereas the letter **W** will be shown for water condensation**.**

To end the scanning process, tap the  icon (ILLUSTRATION 44). The analyzer will then be set to standby mode and the mirror will be maintained at the approximation temperature established in scanning mode (condensation temperature +10 °C).

At this point, select the desired dew point measurement mode by tapping the corresponding icon (Pos.10, ILLUSTRATION 26; ILLUSTRATION 27) to begin the DP measurement process.

TAKING DEW POINT MEASUREMENTS

The Hygrovision BL is designed to provide two methods of dew point registration:

- Manually controlled dew point registration
- Automatic dew point registration

There are four options for manually controlled dew point registration:

- Hydrocarbon dew point measurement while cooling and heating the condensation mirror at a preprogrammed rate
- Hydrocarbon dew point measurement while cooling the condensation mirror step by step
- Water dew point measurement while cooling and heating the condensation mirror at a preprogrammed rate
- Water dew point measurement while cooling the condensation mirror step by step

There are two options for automatic dew point registration:

- Automatic measurement of the hydrocarbon dew point
- Automatic measurement of the water dew point

Dew point results registered in automatic mode are saved in the analyzers non-volatile memory and can be displayed at any time.

The Hygrovision BL is equipped with an IR-Port and an RS 485 interface for data transfer purposes. The corresponding computer software may be included in delivery.

Attention!

When taking measurements for the dew point of water, if a significant amount of early-condensing hydrocarbons are observed (the formation of non-water drop like condensation), it will be absolutely necessary to install the filter (KRAY6.451.017) used for the control of heavy hydrocarbons.

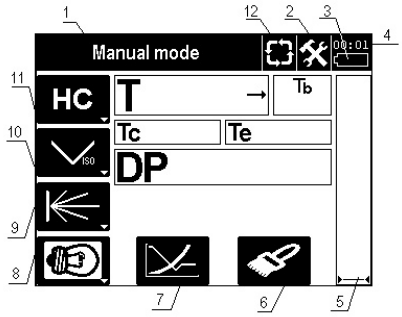


ILLUSTRATION 45

ILLUSTRATION 46

4.3. HC DEW POINT MEASUREMENT USING THE PREPROGRAMMED RATE OF COOLING / HEATING THE CONDENSATION MIRROR

1. Select the hydrocarbon measurement channel by activating the HC icon (Pos.11, ILLUSTRATION 45). Set the analyzer to the preprogrammed rate of cooling / heating (per ISO) mode by choosing the icon (Pos.10). Tap the icon to activate the microscope lighting (Pos.8).

2. Push the “down” button (Pos.14, ILLUSTRATION 46) to begin cooling the condensation mirror at the preprogrammed rate (the factory default setting is 1 °C per minute).

3. As soon as a visually observable film of condensation begins to form, fix the temperature of the condensation mirror by once again pushing the “down” button (Pos.14, ILLUSTRATION 46). This fixed temperature value is shown in the **T_c** field of the display and the mirror temperature is maintained at this level.

4. Now push the “up” button (Pos.13, ILLUSTRATION 46) to begin heating the mirror at the preprogrammed rate. As soon as the condensate is observed to begin evaporating push the “up” button again to fix this temperature. This second fixed temperature value is shown in the **T_e** field of the display.

In the case of hydrocarbons, the **T_c** value is, in fact, equivalent to the **T_e** value. In other words, condensation temperature and evaporation temperature are the same for hydrocarbons. The fixed **T_c** and **T_e** values may not diverge by more than 0.2 °C.

5. The measured dew point temperature is now shown in the **DP** field of the display and is stored in the analyzer’s memory.

6. To complete the measurement cycle, tap the icon (Pos.6, ILLUSTRATION 45) to switch the analyzer to mirror cleaning mode. At this point the condensation mirror will automatically be heated to 50 °C and the signal level will be reset to the starting value.

Pleas note:
Should concurrent condensation of water vapor impair the observation of hydrocarbon condensation, the laser diode can be switched off by tapping the icon.

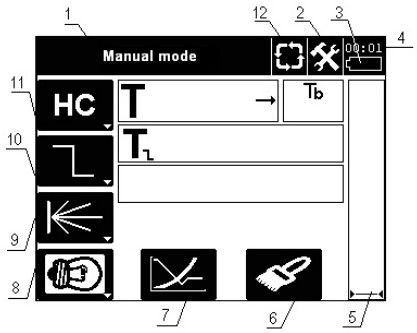


ILLUSTRATION 47

4.4. HC DEW POINT MEASUREMENT

COOLING THE MIRROR STEP BY STEP

1. Select the hydrocarbon measurement channel by activating the HC icon (Pos.11, ILLUSTRATION 47). Set the analyzer to step by step cooling mode by choosing the icon (Pos.10). Tap the icon to activate the microscope lighting (Pos.8).

2. Begin cooling the mirror by pushing the “down” button (Pos.14, ILLUSTRATION 46). When the “down” button is pushed the temperature of the condensation mirror is lowered by 1 °C (factory default setting). The current mirror temperature is shown in the **T** field of the display. A timer also appears on the display, which shows how long the mirror has been at its current temperature.

A newly entered temperature, in other words the next step to which the mirror will be further cooled, is shown in the T_L field of the display.

3. Each time the “down” button (Pos. 14, ILLUSTRATION 46) is pushed the newly entered temperature will be lowered by 1 °C and the timer will be reset to start over.

4. As soon as a visually observable condensation film begins to form, fix the **HC** condensation temperature by pushing the “up” button (Pos.13, ILLUSTRATION 46). The condensation mirror will also be raised by 1 °C and the timer will be reset.

5. Fixation of the evaporation temperature is analogous to the process described under point 4.3.

6. To complete the measurement cycle, tap the icon (Pos.6, ILLUSTRATION 47) to switch the analyzer to mirror cleaning mode.

Please note:
Should concurrent condensation of water vapor impair the observation of hydrocarbon condensation, the laser diode can be switched off by tapping the icon.

4.5. WATER DEW POINT MEASUREMENT USING THE PREPROGRAMMED RATE OF COOLING / HEATING THE CONDENSATION MIRROR

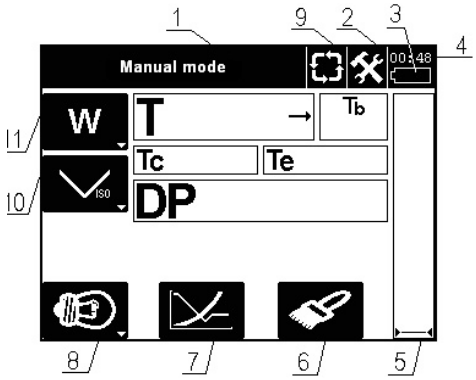


ILLUSTRATION 48

1. Select the water measurement channel by activating the W icon (Pos.11, ILLUSTRATION 48). Set the analyzer to the preprogrammed rate of cooling / heating (per ISO) mode by choosing the icon (Pos.10). Tap the icon to deactivate the microscope lighting (Pos.8).

2. Push the “down” button (Pos.14, ILLUSTRATION 46) to begin cooling the condensation mirror at the preprogrammed rate (the factory default setting is 1 °C per minute).

3. As soon as a visually observable film of condensation begins to form, fix the temperature of the condensation mirror by once again pushing the “down” button (Pos.14, ILLUSTRATION 46). This fixed temperature value is shown in the $\mathbf{T_c}$ field of the display and the mirror temperature is maintained at this level.

4. Now push the “up” button (Pos.13, ILLUSTRATION 46) to begin heating the mirror at the preprogrammed rate. As soon as the condensate is observed to begin evaporating push the “up” button again to fix this temperature. This second fixed temperature value is shown in the $\mathbf{T_e}$ field of the display.

The measured dew point temperature for water is now shown in the **DP** field of the display and is stored in the analyzer’s memory. The condensation mirror is maintained at the evaporation temperature. Stored dew point values can be accessed and displayed on the screen at any time.

5. To complete the measurement cycle, tap the icon (Pos.6, ILLUSTRATION 48). to switch the analyzer to mirror cleaning mode.

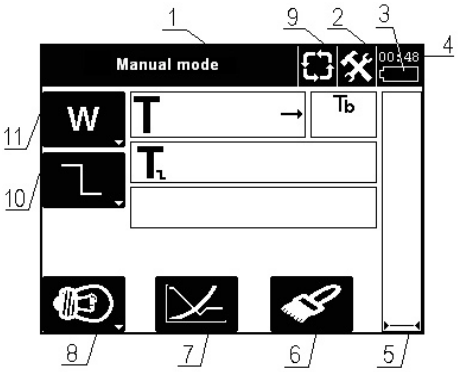


ILLUSTRATION 49

4.6. WATER DEW POINT MEASUREMENT

COOLING THE MIRROR STEP BY STEP

1. Select the water measurement channel by activating the W icon (Pos.11, ILLUSTRATION 49). Set the analyzer to step by step cooling mode by choosing the icon (Pos.10). Tap the icon to deactivate the microscope lighting (Pos.8).

2. Begin cooling the mirror by pushing the “down” button (Pos.14, ILLUSTRATION 46).

When the “down” button is pushed the temperature of the condensation mirror will be lowered by 1 °C (factory default setting). The current mirror temperature is shown in the **T** field of the display. A timer also appears on the display, which shows how long the mirror has been at its current temperature. A newly entered temperature, in other words the next step to which the mirror will be further cooled, is shown in the T_L field of the display.

3. Each time the “down” button (Pos. 14, ILLUSTRATION 46) is pushed the newly entered temperature will be lowered by 1 °C and the timer will be reset to start over.

4. As soon as a visually observable condensation film begins to form, fix the W condensation temperature by pushing the “up” button (Pos.13, ILLUSTRATION 46). The condensation mirror will also be raised by 1 °C and the timer will be reset.

5. Fixation of the evaporation and dew point temperatures is analogous to the process described under point 4.5.

6. To complete the measurement cycle, tap the icon (Pos.6, ILLUSTRATION 49) to switch the analyzer to mirror cleaning mode.

Please note:
The manufacturer recommends that during step by step heating and cooling, the mirror remain at each temperature for about 1 minute.

4.7. HC DEW POINT MEASUREMENT IN AUTOMATIC MODE

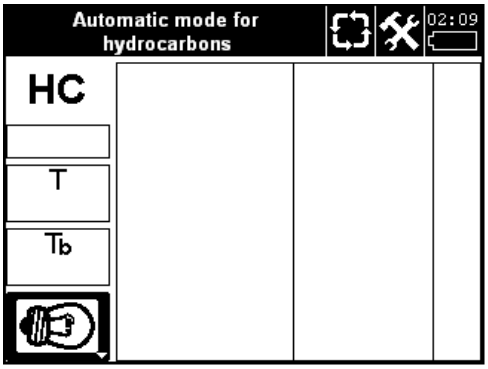


ILLUSTRATION 50

Tap the icon to set the analyzer to automatic mode for haydrocarbons. Refer to point 1.8.

When measuring the hydrocarbon dew point in automatic mode the following information will be shown on the left side of the display (see ILLUSTRATION 50):

- Current measurement mode **HC**;
- HC signal level;
- Current temperature of the condensation mirror **T**;
- Current temperature of the housing $\mathbf{T_b}$;
- Icon for activating the microscope lighting

Measurement of the HC dew point is done by slowly cooling the condensation mirror at a preprogrammed rate (the factory default setting is 1 °C/min.) until the temperature is reached at which hydrocarbons begin to form a condensation film.

The measurement results are listed in a table that shows the following information:

- Time of the measurement;
- Dew point value in °C;
- Pressure in bar (requires pressure gauge installatin)

To erase the analyzer's memory (measurement values shown in the table) push the "up" button (Pos. 13, ILLUSTRATION 46) and confirm your selection when prompted.

To change the parameters of the automatic measurement mode for hydrocarbons go to the "Settings: automatic mode" menu (Appendix I).

Please note:
Adjustments to the analyzer's sensitivity when measuring the hydro-carbon dew point can be made in the "HC- calibration" mode (refer to Appendix M).

Attention!

Values for the dew point of water that are registered in the HC mode are approximations and should only be used for purposes of general orientation. For accurate WDP values switch to the automatic mode for measuring the dew point of water.

4.8. WATER DEW POINT MEASUREMENT IN AUTOMATIC MODE

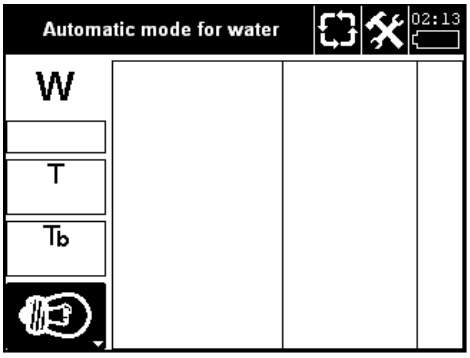


ILLUSTRATION 51

Tap the icon to set the analyzer to automatic mode for Water. Refer to point 1.8.

When measuring the water dew point in automatic mode the following information will be shown on the left side of the display (ILLUSTRATION 51):

- Current measurement mode **W**;
- Signal level **Uw**;
- Current temperature of the condensation mirror **T**;
- Current temperature of the housing $\mathbf{T_b}$;
- Icon for activating the microscope lighting

In this mode the microscope lighting should be turned off for visual observation of the condensation process.

The measurement results are listed in a table that shows the following information:

- Time of the measurement;
- Dew point value in °C;
- Pressure in bar (when a pressure analyzer is connected)

To erase the analyzer's memory (measurement values shown in the table) push the "up" button (Pos. 13, ILLUSTRATION 46) and confirm your selection when prompted.

If the message “<” is shown in the DP field it means that the dew point could not be registered during the current measurement cycle. In this situation the lowest temperature to which the condensation mirror was cooled is entered in the table.

If this message is shown on your analyzer’s display, you should attach the supplemental cooling module and repeat the measurement process.

Water dew point measurement is done by means of slowly cooling the temperature-controllable condensation mirror (the faculty default setting is 1 °C/min.) At the point that condensation begins to form on the mirror’s surface, the current temperature is fixed as the $\mathbf{T_c}$ value. Next the mirror’s surface is slowly heated to the point at which the condensation begins to evaporate. This is fixed as the $\mathbf{T_e}$ value. The dew point is the average of these two values.

To change the parameters of the automatic measurement mode for hydrocarbons go to the “Settings: automatic mode” menu (Appendix I).

4.9. SPECIAL CONSIDERATIONS WHEN MEASURING DEW POINT AT VERY LOW TEMPERATURES

MEASURING DEW POINT AT VERY LOW TEMPERATURES

The diagram in ILLUSTRATION 52 shows the effectiveness of the integrated cooling system with regard to controlling the temperature of the condensation mirror under a range of operating conditions.

The graph illustrates that the cooling system's achievable results are directly dependent on the operating pressure as well as the housing temperature, which in turn is dependent on the ambient temperature.

Please note that the mirror cooling process can lead to an increase in the housing temperature. This increase can result in a housing temperature that is 5 °C – 7 °C above the ambient temperature.

As a result it may occasionally be necessary to subject the housing to supplemental cooling for individual measurements (-50°C).

The housing can be cooled using a variety of refrigerant media such as water, propane, natural gas, etc.

The analyzer housing has a cooling channel that provides for the smooth circulation of liquid and gaseous media under a maximum pressure of 100 bar.

The inlet and outlet connections for the housing cooling channel are fitted with cylindrical G1/8 male threading.

Alternatively, the supplemental cooling system can be used when taking dew point measurements at extremely low temperatures and very high working pressures. For information about the construction and function of this system refer to Point 1.6.

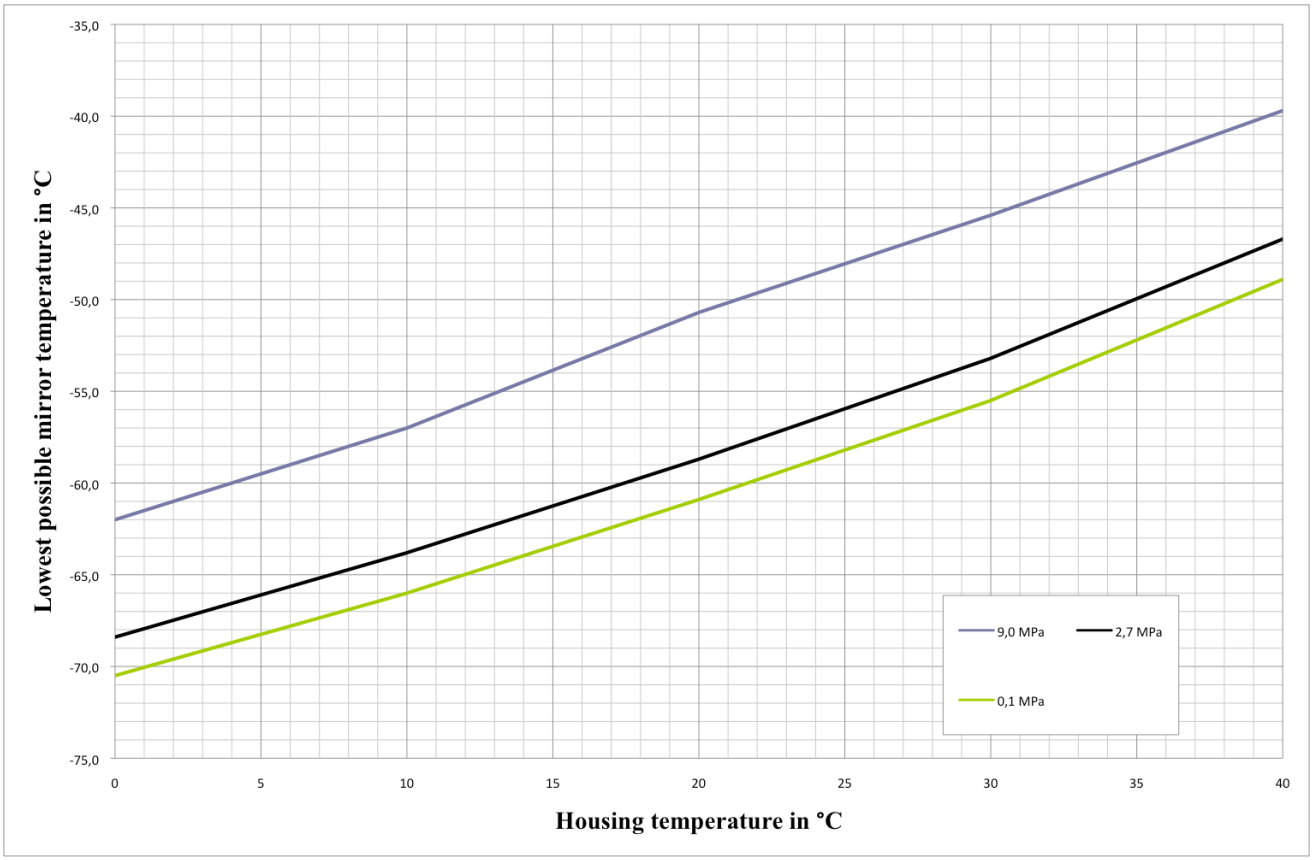


ILLUSTRATION 52

Please note:
The analyzer's housing temperature ($T_{housing}$ / T_b) must remain at least 5 °C above the dew point being measured for the entire period of any supplemental cooling.

SUPPLEMENTAL COOLING SYSTEM

ILLUSTRATION 53

The vortex tube-based supplemental cooling system (VMPL5.880.003) is available as an optional accessory module See ILLUSTRATION 53.

The system is employed to cool the condensation mirror for measurements below -20 °C under working pressure of more than 70 bar by means of the sample gas. For mounting and connection information refer to Appendix E.

The maximum allowable gas pressure at the entrance of the vortex tube is 17 bar. For this reason, the sample gas passes through a pressure regulator before reaching the vortex tube.

The recommended regulator output pressure is 7 – 9 bar (factory default setting).

Installation of the supplemental cooling system

Observe the following procedure when installing the supplemental cooling system:

1. Mount all of the cooling system's components as illustrated in Appendix E:
2. Install the inlet fitting (Pos.12, Appendix E) into the ventilation channel for supplemental cooling;
3. Install the outlet fitting (Pos.19, Appendix E) into the ventilation channel for supplemental cooling;
4. Connect the input of the gas delivery system to the supplemental cooling system by means of a T- junction (Pos. 8)
5. The T- junction is attached to the inlet fitting of the analyzer-gas delivery system (Pos. 12) by means of a quick-connect coupler.
6. Connect the outlet of the cooling system to the ventilation channel inlet fitting (Pos.18).
7. The sample gas is discharged from the end of the vortex tube through a vinyl hose (Pos. 1). The sample gas flow rate is adjusted by means of the pressure regulator.

The gas-flow volume passing through the vortex tube should be:

- 45L/min for cold gas;
- 32L/min for hot gas.

Using the supplemental cooling system

Use the following procedure to take dew point measurements when the supplemental cooling system is attached to the analyzer:

1. Connect the analyzer/supplemental cooling system assembly to the gas delivery system.
2. Initiate the flow of sample gas into the measurement chamber. Allow the gas to flow through the chamber for about five minutes at a volume flow rate of around 1L/min.
3. Switch on the analyzer.
4. Should the dew point lie beyond the range of the analyzer's integrated cooling system, it is necessary to also supply sample gas to the supplemental cooling system. To do this, open the valve at Pos. 11, Appendix E.
5. Use the microscope to visually monitor the condition of the mirror's surface. Determine at what temperature the condensation process begins, then, after the analyzer goes through a mirror cleaning cycle, take a dew point measurement.
6. Once dew point measurement is completed, close the valves controlling the gas flow and switch off the analyzer.

4.10. UNINSTALLING THE HYGROVISION BL

UNINSTALLING THE ANALYZER

Use the following procedure when uninstalling the analyzer:

1. Switch off the analyzer;
2. Close the high pressure valve on the gas delivery system (Pos. 2, ILLUSTRATION 16)
3. Use the fine control valve integrated into the flow control system (Pos.1, ILLUSTRATION 15) to adjust the pressure within the measurement chamber until it is reduced to coincide with the ambient atmospheric pressure.
4. Disconnect the flexible high-pressure hose from the analyzer (the hose connected to the sample extraction device.

5. TECHNICAL MAINTENANCE

5.1. GENERAL INSTRUCTIONS

In general, maintenance of the device consists of regular metrological recalibration, checking of the technical condition of the analyzer, and when appropriate, cleaning the mirror in accordance with Point 5.2.

Any repair that requires the opening of the analyzer's seals must be carried out by the manufacturer or the manufacturer's authorized agent.

5.2. MAINTENANCE PROCEDURES

Maintenance operations should include:

- Maintenance of the power supply unit (rechargeable battery pack);
- Inspection of the condition of the mirror and, when necessary, cleaning of the mirror;
- Checking the mirror cooling efficiency (the efficiency of the thermoelectric battery);
- Analyzer calibration;
- Visual inspection of the analyzer;
- Troubleshooting

MAINTENANCE OF THE POWER SUPPLY UNIT

Please observe the following guidelines to maximize the service life of the rechargeable battery pack:

- Continually monitor the charge status of the battery pack and recharge it when necessary;
- The charge status of the battery pack should be checked both during the preparation for taking dew point measurements as well as during the measurement procedure itself. For complete information refer to Point 3.3;
- When installing the battery pack, screw down the lid (Pos.3; ILLUSTRATION 11) that covers the battery pack slot until it is fully seated. Use the locking device (Pos.15; ILLUSTRATION 11) to secure the lid in place;
- If the analyzer is to be out of service for a period exceeding ten days, please remove the battery pack to avoid undesired battery discharge;
- All battery packs in storage should be checked once a month with regard to their charge status and when necessary fully recharged.

CLEANING THE CONDENSATION MIRROR

Inspection of the condensation mirror's surface is carried out in "Transducer cleaning mode".

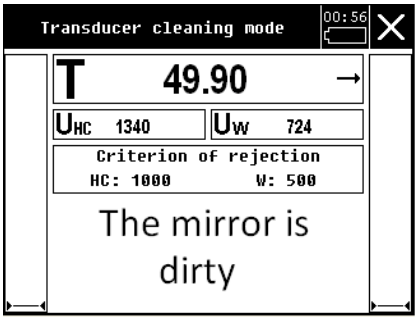


ILLUSTRATION 54

In “Transducer cleaning mode” the following elements are displayed on the touch screen:

- Temperature of the condensation mirror **T;**
- Signal levels $\mathbf{U_{HC}}$ and $\mathbf{U_W}$ (digital);
- Rejection criteria (maximum acceptable signal levels)

If the $\mathbf{U_{HC}}$ und $\mathbf{U_W}$ signal levels do not exceed the maximum acceptable values, it is not absolutely necessary to clean the condensation mirror.

If, after the “Transducer cleaning mode” cycle has complete, contaminants remain on the mirror’s surface, and these contaminants interfere with the visual observation and determination of the presence of water or hydrocarbon condensation on the mirror’s surface, please take the following steps before cleaning the mirror manually:

- Close the fine control valve (Pos. 2; ILLUSTRATION 16) on the gas delivery system;
- Adjust the pressure in the gas delivery system and the analyzer’s measurement chamber to the level of the ambient atmospheric pressure. Track changes in the pressure conditions by monitoring the flow control system’s manometer (Pos.1; ILLUSTRATION 15);
- Select the mode for water dew point measurement cooling the mirror step by step (see point 4.6);
- Set the target temperature (displayed in the $T_{\square}$ field) to a value of -25 °C to -30 °C by repeatedly pressing the down button (Pos.14; ILLUSTRATION 46);
- When the target temperature has been reached, select the “Transducer cleaning mode”;
- Repeat this procedure up to three times if necessary;

If there is no improvement after several repetitions, it will be necessary to clean the condensation mirror manually.

All of the necessary items required for this procedure are included in delivery.

Please note:
To increase the effectiveness of the sensor cleaning cycle, the manufacturer recommends the regularly purging of the analyzer’s measurement chamber using air or oxygen.

Attention!

Manual cleaning of the condensation mirror is ONLY to be carried out in an explosion safe environment!

CLEANING THE CONDENSATION MIRROR

ILLUSTRATION 55

Use the following procedure when cleaning the condensation mirror manually:

- Switch off the analyzer;
- Close the fine control valve of the gas delivery system (Pos.2; ILLUSTRATION 16);
- Adjust the pressure in the gas delivery system and the analyzer's measurement chamber to the level of the ambient atmospheric pressure. Track changes in the pressure conditions by monitoring the flow control system's manometer (Pos.1; ILLUSTRATION 15);
- Disconnect the analyzer from the gas supply line and take it to an explosion-safe area;
- Disconnect the lighting system cord and remove the microscope by unscrewing it from its mounting;
- Cover the eyepiece of the microscope with the specially designed cap;
- Now, loosen and remove the eight bolts that secure the measurement chamber. The measurement chamber may only be opened in a sterile environment;
- Switch on the analyzer and start the Transducer cleaning mode (as described above);
- Using a cotton swab dipped in cleaning fluid, cleanse the surface of the condensation mirror (ILLUSTRATION 55) employing very little to no pressure at all.

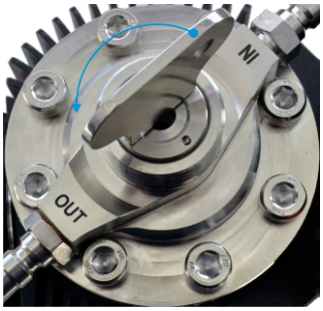


ILLUSTRATION 56

In some situations it is possible to carry out a “quick cleaning” of the condensation mirror.

Using the special key provided (VMPL 8.392001), unscrew the insert that houses the measurement chamber observation window and remove it (ILLUSTRATION 56). Once the insert is removed the surface of the condensation mirror is accessible and can be cleaned as described above (ILLUSTRATION 57).

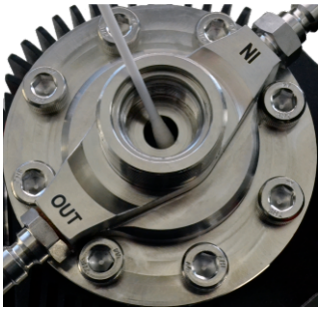


ILLUSTRATION 57

Attention!

Extreme care should be taken when cleaning the mirror manually. Possible damage in the form of scratches or scoring greatly reduces the efficiency of the analyzer. Mechanical damage to the condensation mirror is not covered under warranty.

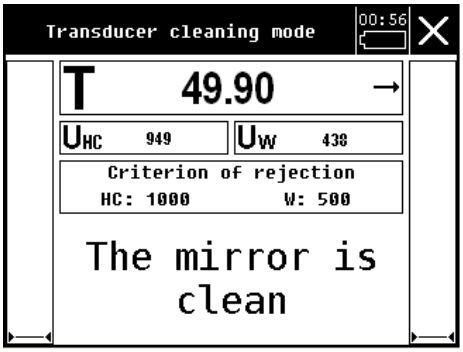


ILLUSTRATION 58

After cleaning has been completed, if the signal values for U_{HC} and U_w are once again within the normal range the message “The mirror is clean” will be displayed on the touch screen.

Reassemble the analyzer components following the above steps in reverse order.

Definitions for rejection criteria are initially set by the manufacturer (factory default settings). Changes to these values can be made under “Settings: Cleaning transducer” (see Appendix I).

Attention!

The rejection criteria are intended as recommendations from the manufacturer. These values serve to alert the operator that an excessive amount of contamination has accumulated on the surface of the condensation mirror and it should be inspected. If this contamination does not interfere with the measurement process, cleaning the mirror is not absolutely necessary.

TESTING THE THERMOELECTRIC BATTERY (TEB)

The efficiency of the thermoelectric battery should be checked prior to calibrating the Hygrovision BL, as well as whenever the analyzer malfunctions (Pos.6; Table 4).

Use the following procedure to check the thermoelectric battery:

1. Select the step by step mode for taking dew point measurements  (Pos.10; ILLUSTRATION 49);
2. Press the down button (Pos.14; ILLUSTRATION 46) until the target temperature is reached: T_L -60 °C;
3. After three minutes, fix the currently displayed mirror temperature **T** and the housing temperature $\mathbf{T_b}$;
4. Start the Transducer cleaning mode by tapping the  icon;
5. At a housing temperature of 25 °C (± 5°C), the fixed mirror temperature **T** should not exceed -50 °C (± 5°C).

CALIBRATING FOR HYDROCARBONS

6. The supplementary “Hydrocarbons calibration mode” makes it possible for the operator to fine tune the HC measurement channel when taking dew point measurements for hydrocarbons. For instructions on using this feature please refer to Appendix K.

Calibration of the analyzer is to be carried out in accordance with KRAY2.844.011MP.

The analyzer should be recalibrated about once a year.

5.3. LIST OF POSSIBLE ERROR MESSAGES

Table 4 contains a list of possible error messages that could be shown on the Hygrovision's touch screen display.

Table 4

Problem	Possible cause	Solution
The analyzer won't switch on	The battery pack has no charge	Recharge the battery pack
The battery pack doesn't recharge. (battery indicator light is red)	The battery temperature is outside the tolerance range: 0 °C to + 45 °C. The temperature control circuit is in some way defective. The battery is not making good contact with the recharging unit.	Inspect the relevant parameters and elements.
After starting the Transducer cleaning mode the error message "Clean the transducer" appears.	The signal level of the photo diodes exceeds the rejection criteria values.	
The lighting system for the microscope doesn't function.	The lighting cord is not plugged in properly or the circuit is defective.	Inspect the lighting system cord.
The image seen through the microscope cannot be brought into focus.	The optical system is not mounted properly.	Screw down the optical system (microscope) until it is fully seated. Ensure that the threading is properly aligned.
	The observation widow lens is dirty.	Clean the optical elements using the fluid provided for cleaning the condensation mirror.
	Condensation has accumulated in the space between the observation window and the lens of the microscope.	
The mirror temperature does not reach the preset temperature.	The thermoelectric battery is defective.	Replace the measurement cell.
	The flow rate of the sample gas through the measurement chamber is too high.	Reduce the gas flow rate through the measurement chamber to 0.5 Nl/min.
	The dew point is below -30 °C. The sample gas has a high content of early-condensing, light hydrocarbons.	Use external supplemental cooling of the condensation mirror.

During battery-powered operation, the analyzer switches itself off from time to time. The LED indicator flickers.	The battery pack is not securely in place.	Screw down the battery compartment lid until it is tightly seated.
The touch screen display does not respond normally or does not respond at all.	The touch screen calibration has been disrupted.	Check the calibration of the display by following these steps: 1. Switch off the analyzer; 2. Switch the analyzer back on while holding down the Down button (Pos.14; ILLUSTRATION 46) 3. The message “calibrate touch screen sensitivity” appears. 4. Click on the ⊞ icon. 5. The unit will carry out the touch screen display calibration procedure. 6. When calibration is completed the unit will restart automatically and switch to the manual dew point measurement mode

If there is a problem with your analyzer that is not listed in this table, please contact the manufacturer.

6. MARKINGS

Labeling on the analyzer's housing provides information about:

- Trademarks and the name of the Manufacturer
- Description of the device
- Markings about ignition protection
- Certifying authority and certification number
- Markings about protection against the effects of solid contaminants and moisture in accordance with IEC 60529:1992 (IP 54)
- Dew point measurement range
- Maximum permissible operating pressure
- Operating temperature of the analyzer
- Serial number
- Country of manufacture

7. PACKAGING

Proper steps must be taken to preserve the analyzer's various components before they can be packed.

The device must be packed in a closed, well-ventilated room with an ambient temperature of +15 °C to +40 °C and a relative humidity of no more than 80%.

The ambient atmosphere must be free of any aggressive constituents.

The packaging protects the device against climatic influences and mechanical stresses during loading and unloading, transportation, and storage.

Operating information and manuals are to be found in the closable compartment in the upper half of the carrying case. Shipping documents are also located in this compartment and are protected by watertight packaging.

8. STORAGE

The device may only be stored in a container made by the manufacturer that is specifically designed for this purpose. Such a container protects the device from mechanical damage, contamination, and the effects of aggressive media

For transportation purposes, analyzers can be temporarily stored in the specially designed transportation packaging (max. 6 months).

9. TRANSPORT

TRANSPORT CONDITIONS

ILLUSTRATION 59

Transportation requirements:

Analyzers may only be transported in closed containers on board closed climate controlled vehicles.

When in service, the device may only be transported in the carrying case included with delivery (ILLUSTRATION 59).

10. DECOMMISSIONING AN D DISPOSAL

The materials used in the manufacture of the Hygrovision dew point analyzer are environmentally friendly. As such, both during and after the service life of the device, no danger is posed to the health of the people who come into contact with it, nor is any risk posed to production and storage facilities.

With the exception of their batteries and battery pack, analyzers that have been decommissioned may be disposed of in any way deemed suitable by the user.

Old batteries and battery packs are to be disposed of by an appropriately licensed company or facility.

Attention!

Please dispose of (rechargeable) batteries that are no longer usable by means of specially equipped and licensed facilities or companies.

The disposal of lithium-ion batteries by way of regular household trash is expressly prohibited!!

11. APPENDIX A

11.1. HYGROVISION-BL ANALYZER: MAIN COMPONENTS

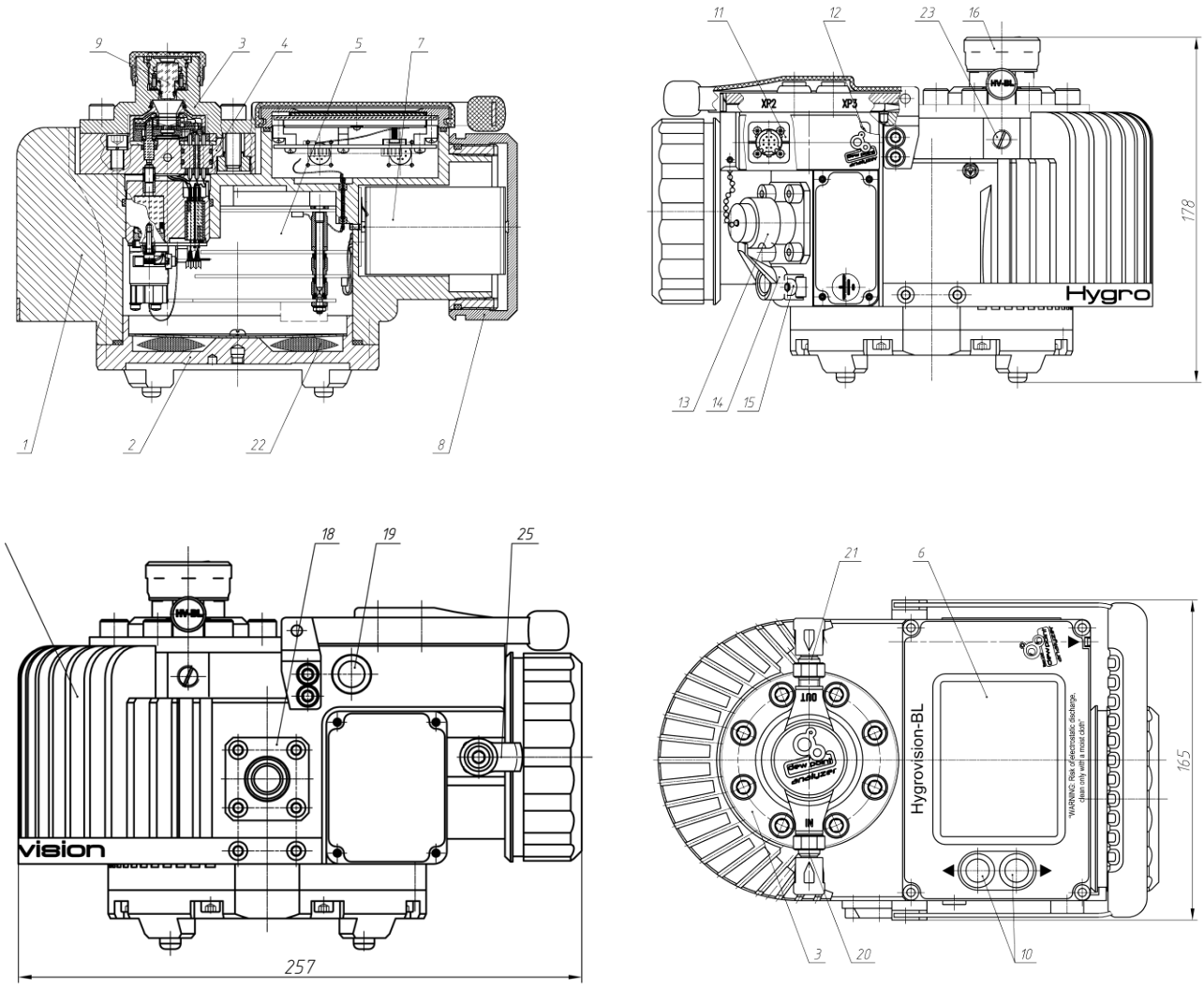


ILLUSTRATION 60

Pos.	Description	Pos.	Description
1	Housing	13	Socket for connecting an external power supply and the RS-485 Interface
2	Bottom cover	14	Locking device
3	Gas delivery	15	Ground terminal
4	Measurement cell	16	Gas inlet cover
5	Electronics block	17	Heat exchanger
6	Touch screen Display	18	Infrared port (IR – Port)
7	Power supply block	19	On / off button

8	Battery slot lid	20	Sample gas inlet fitting
9	Viewing window	21	Sample gas outlet fitting
10	Manual mode control buttons	23	Ventilation channel for additional cooling of the analyzer housing
11	Pressure transmitter socket	24	Moister absorber
12	Microscope lighting (vertical) connection socket	25	Battery cover locking device

12. APPENDIX B

12.1. HYGROVISION-BL EXPLOSION PROTECTION

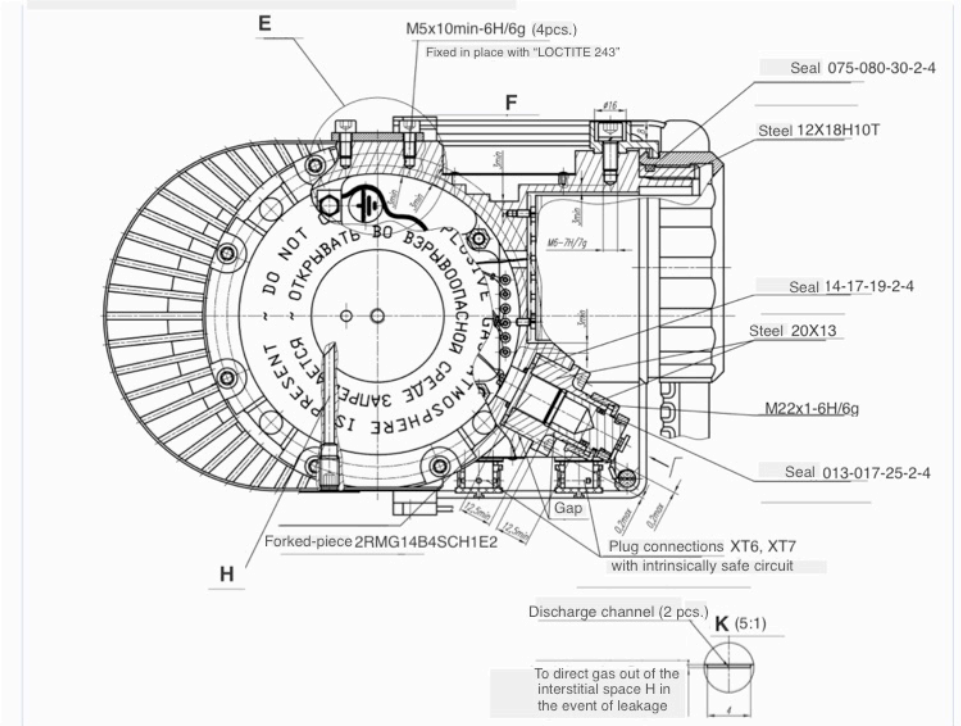


ILLUSTRATION 61: Explosion protection measures KRAY2.844.007D5

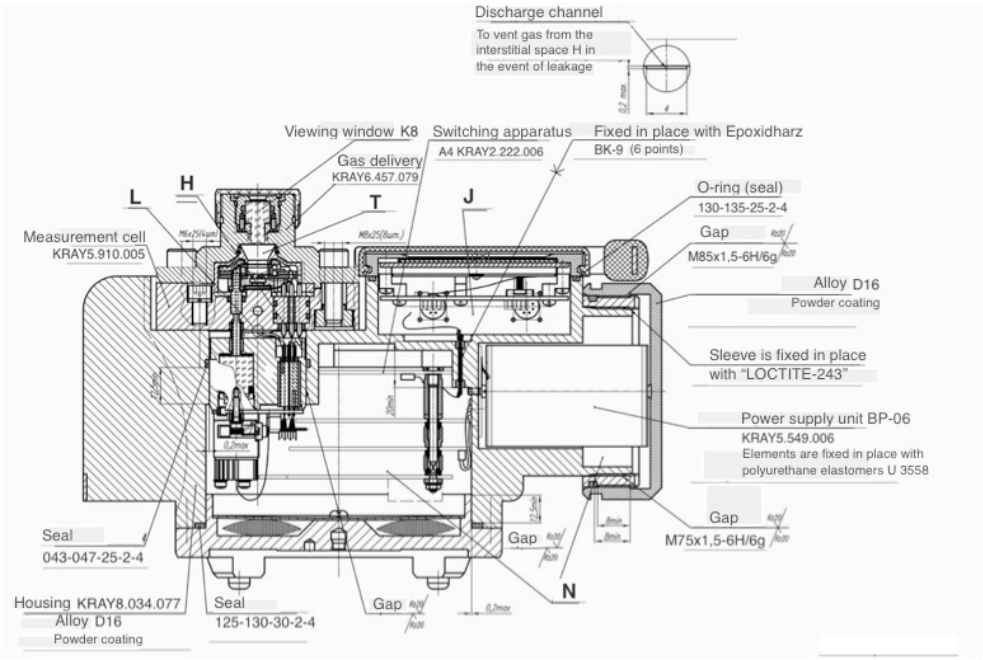


ILLUSTRATION 62: Explosion protection measures KRAY2.844.007D5

(continues on the following page)

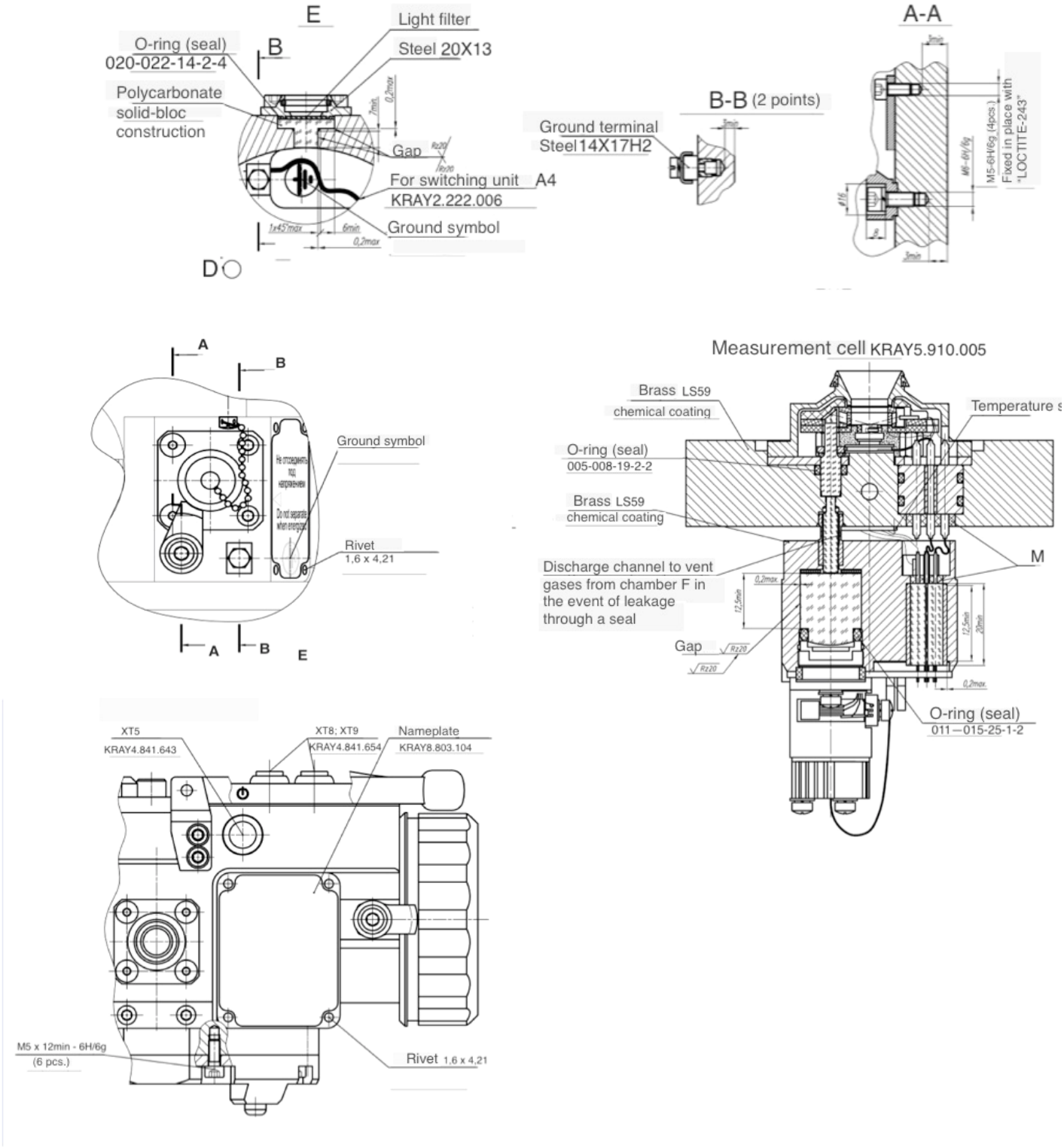


ILLUSTRATION 63: Hygrovision BL explosion protection measures KRAY2.844.007D5 (continuation)

13. APPENDIX C

13.1. FLOW CONTROL SYSTEM MODEL-001 VYMP5.183.001.

Construction drawing

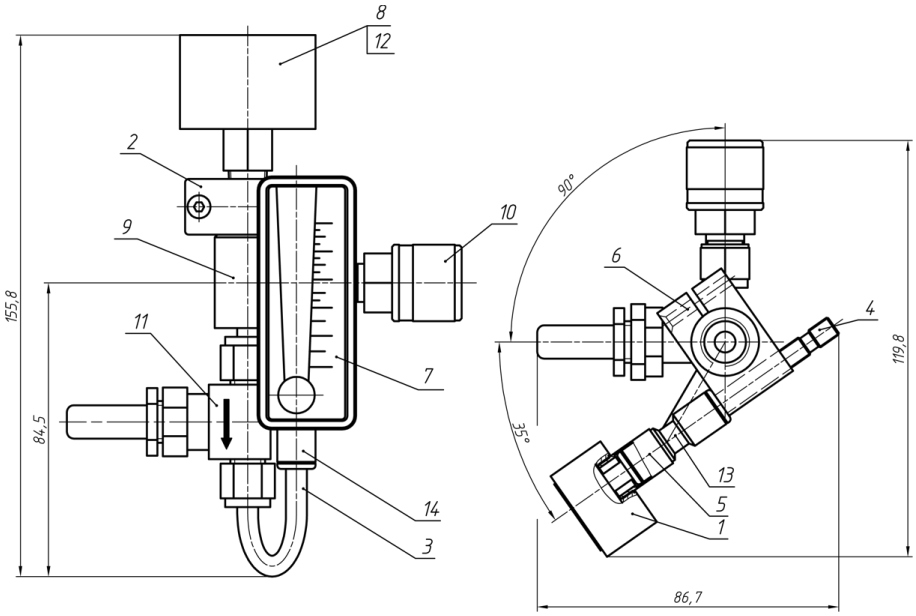


ILLUSTRATION 64: Construction schematic of the flow control system model 001

Pos.	Designation	Description	Qty.	Note
1	VMPL8.034.004	Housing	1	
2	VMPL 8.034.011	Housing	1	
3	VMPL 8.626.003-01	Tubing	1	
4	VMPL 8.626.003-02	Tubing	1	
5	VMPL 8.626.009	Tubing	2	
6		Screw M3x16 A2 DIN7991	1	
7		Flow measurement device Dwyer MMF-1	1	
8		Manometer 131.11.040, 0 – 160 bar	1	«WIKA»
9	DT2ARF-6M-4GG-6M-S	T-fitting	1	«Dk-Lok»
10	DFBA-D-6M-SA	Quick-coupler socket	1	«Dk-Lok»
11	VM1D-D-6M-S	Fine control valve	1	«Dk-Lok»
12	DGG-4	Seal	1	«Dk-Lok»
13		Intermediate collar	1	«Adria»
14		Corner piece	1	«Adria»

14. APPENDIX D

14.1. GAS DELIVERY SYSTEM MODEL-001 VYMPL6.450.001.

Construction drawing

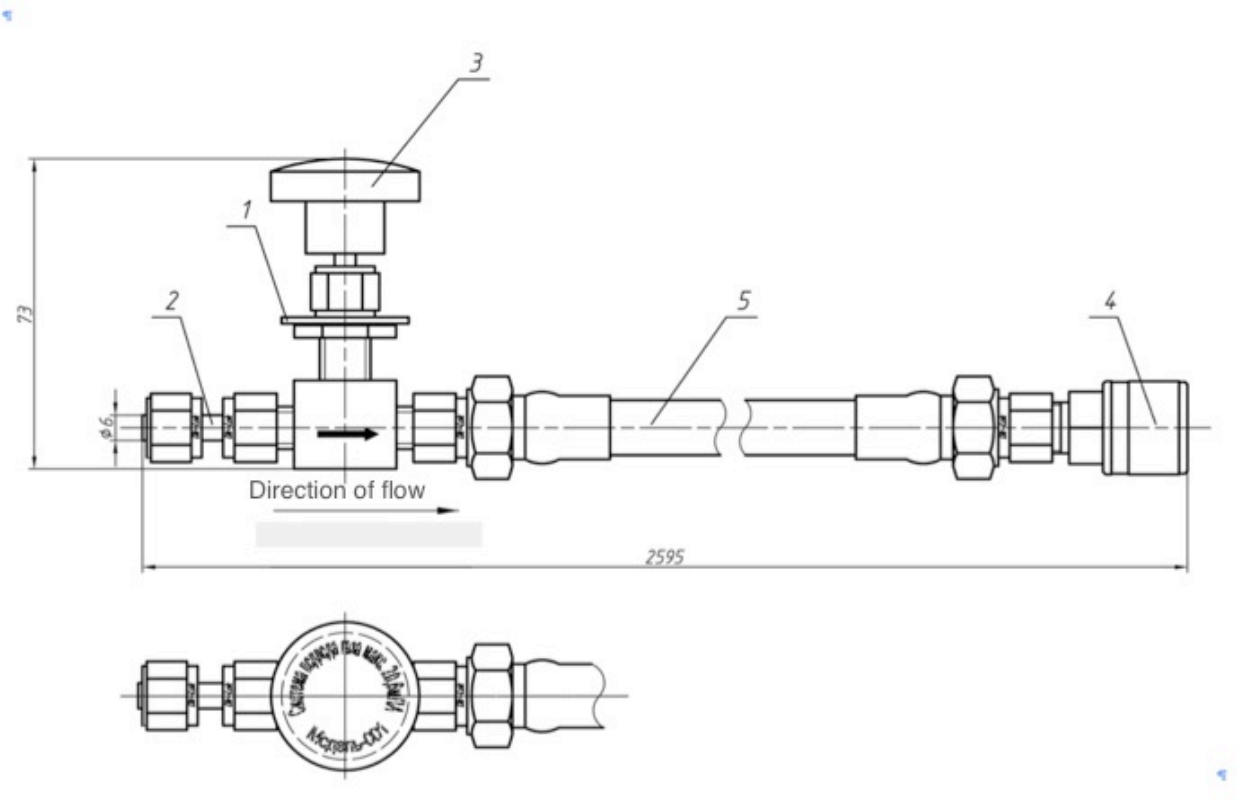


ILLUSTRATION 65

1.) All measurements are intended as reference information.

2.) Connection to the flow-through channel (Pos. 3) as well as both ends of the hose (Pos.7) are made by holding down the quick-release mechanism. Insert the plug end of the fine control valve set (Pos.4) into the socket of the quick-coupling connector.

3.) The supporting disk (Pos.1) is to be mounted above the fine control valve (Pos.4).

4.) All connections are to be tested in accordance with VMPL1.456.002I: Directions for testing the integrity and tightness of connections.

5.) Further technical requirements to comply with OST4 GO.070.015

Pos.	Designation	Description	Qty.	Note
1	VMPL8.600.004	Supporting disk	1	
2	DCP- 6M	Flow-through channel connector	1	«Dk-Lok»
3	V15B-D-6M-R-S	Fine control valve	1	«DRK-Lok»
4	DFBA-D-6M-SA	Quick-coupler socket	1	«DRK-Lok»
5	MFH4P-TM6-4 0CM-S	Hose	1	«DRK-Lok»

15. APPENDIX E

15.1. COOLING MODULE VYMP5.880.003.

CONSTRUCTION DRAWING

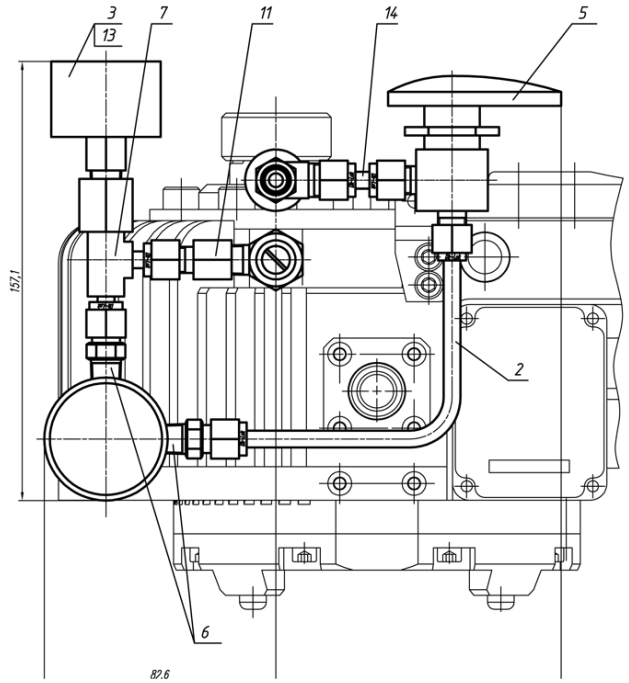


ILLUSTRATION 66

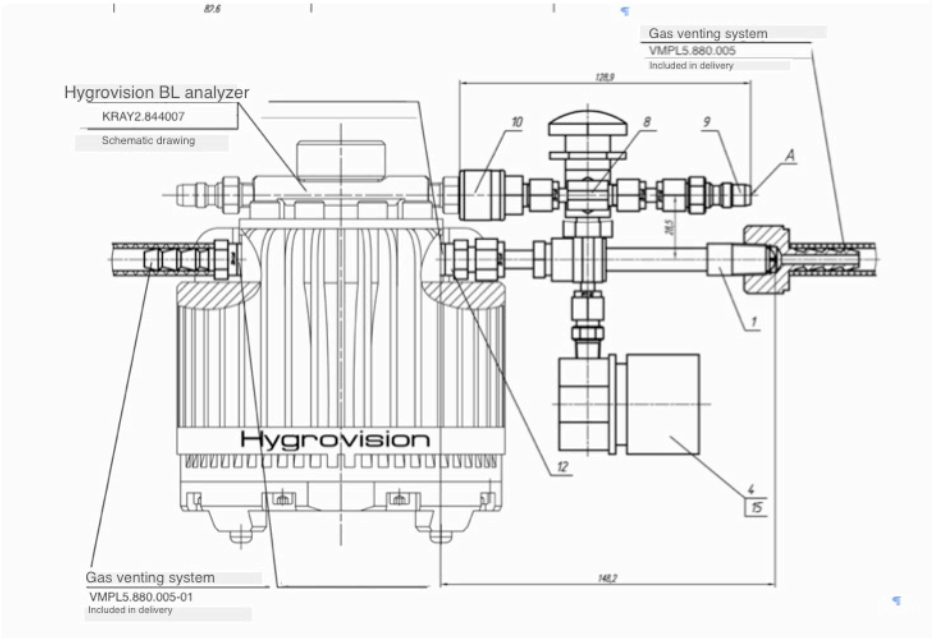


ILLUSTRATION 68

Pos.	Designation	Description	Qty.	Note
1	VYMP5.880.004	Vortex tube	1	
2	VYMP 8.626.002	Tubing	1	
3	Model 131.11.40	Manometer: 0 – 25 bar	1	«WIKA»
4	BB-13AH1KN99004-S	Pressure regulator	1	«Dk-Lok»
5	VL82B-D6M-A	Ball valve (angular configuration)	1	«Dk-Lok»
6	DMC6M-2N-SA	Connector fitting	2	«Dk-Lok»
7	DT2ARF-6M-4GG-6M-S	T-fitting	1	«Dk-Lok»
8	DTRA-6M-SA	T-fitting	1	«Dk-Lok»
9	DFSA-D-6M-SA	Quick-coupler plug	1	«Dk-Lok»
10	DFBA-D-6M-SA	Quick-coupler socket	1	«Dk-Lok»
11	DCF 6M-2N-SA	Adapter	1	«Dk-Lok»
12	DMC8M-2G-SA	Connector fitting	2	«Dk-Lok»
13	DGG-4	Seal ring	1	«Dk-Lok»
14	DCP-6M	Connecting element for the flow-through channel	2	
15	Article: 8203-22-125	Filter	1	

16. APPENDIX F

16.1. PRESSURE REDUCTION MODULE VMPL2.848.005.

Main view / overall dimensions

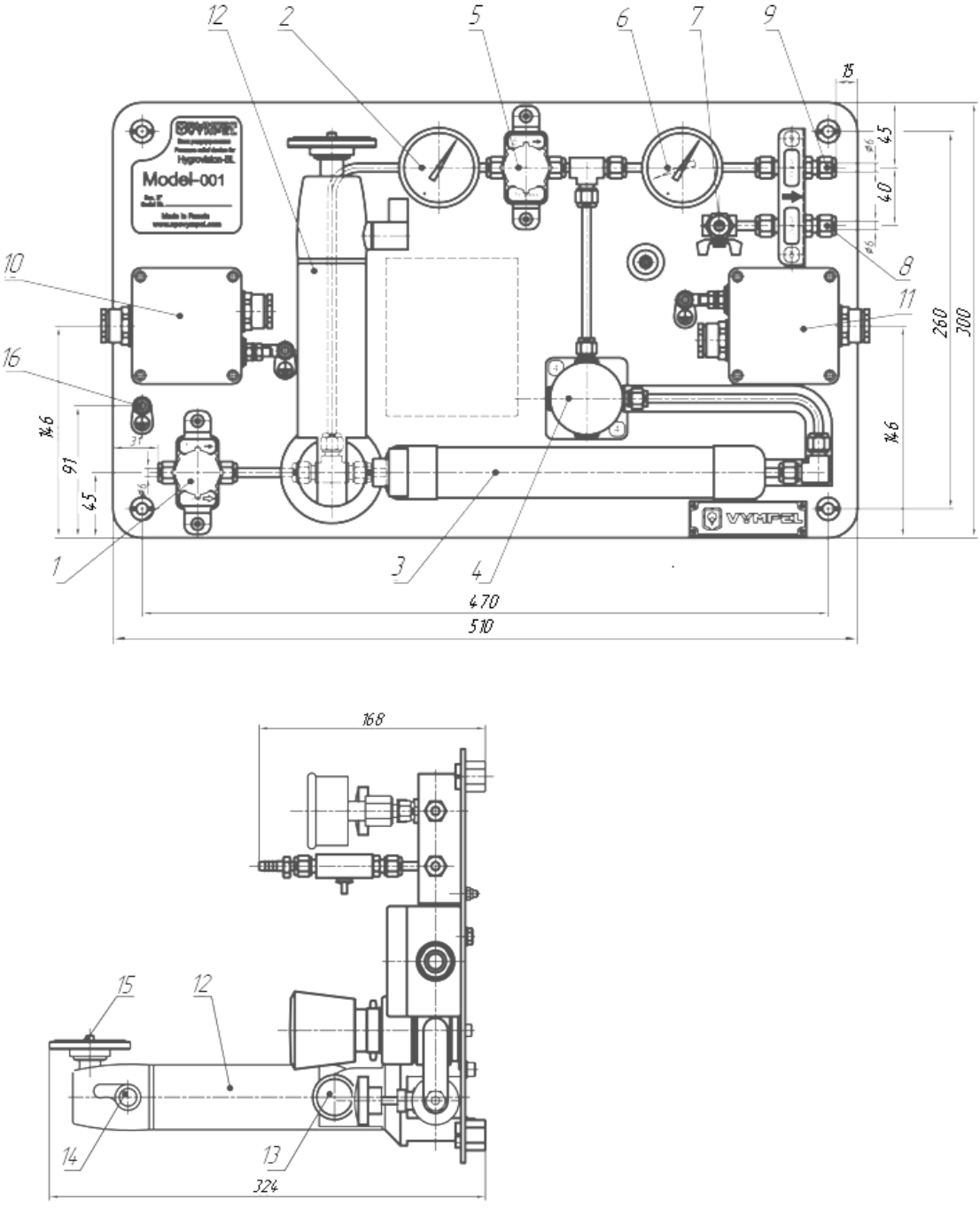


ILLUSTRATION 69: Main view / overall dimensions

Pos.	Designation	Description	Qty.
1, 5	V15B-D-6M-R-S	Fine control valve	2
2, 6	Model 213.53.50	Manometer: 0 – 160bar; connector on the back: G 1/4"	2
3	VMPL 5.863.004	Heating element	1
4	44-2264-221-S	Pressure regulator	1
7	V81A-D-6M-BF-S	Ball valve	1
8, 9	DUB-6M-SA	Coupling rail	2
10	BPGC01.00-029	Terminal box	1
11	BPGC01.00-027	Terminal box	1
12	VMPL 6.854.002	Fold-out support	1
13	VMPL 8.220.005	Locking knob	1
14		Position lock	1
15		Removable pedestal	1
16	VMPL8.942.001	Washer	1

17. APPENDIX G

17.1. HIGH-PRESSURE GAS RELEASE MODULE

Construction drawing

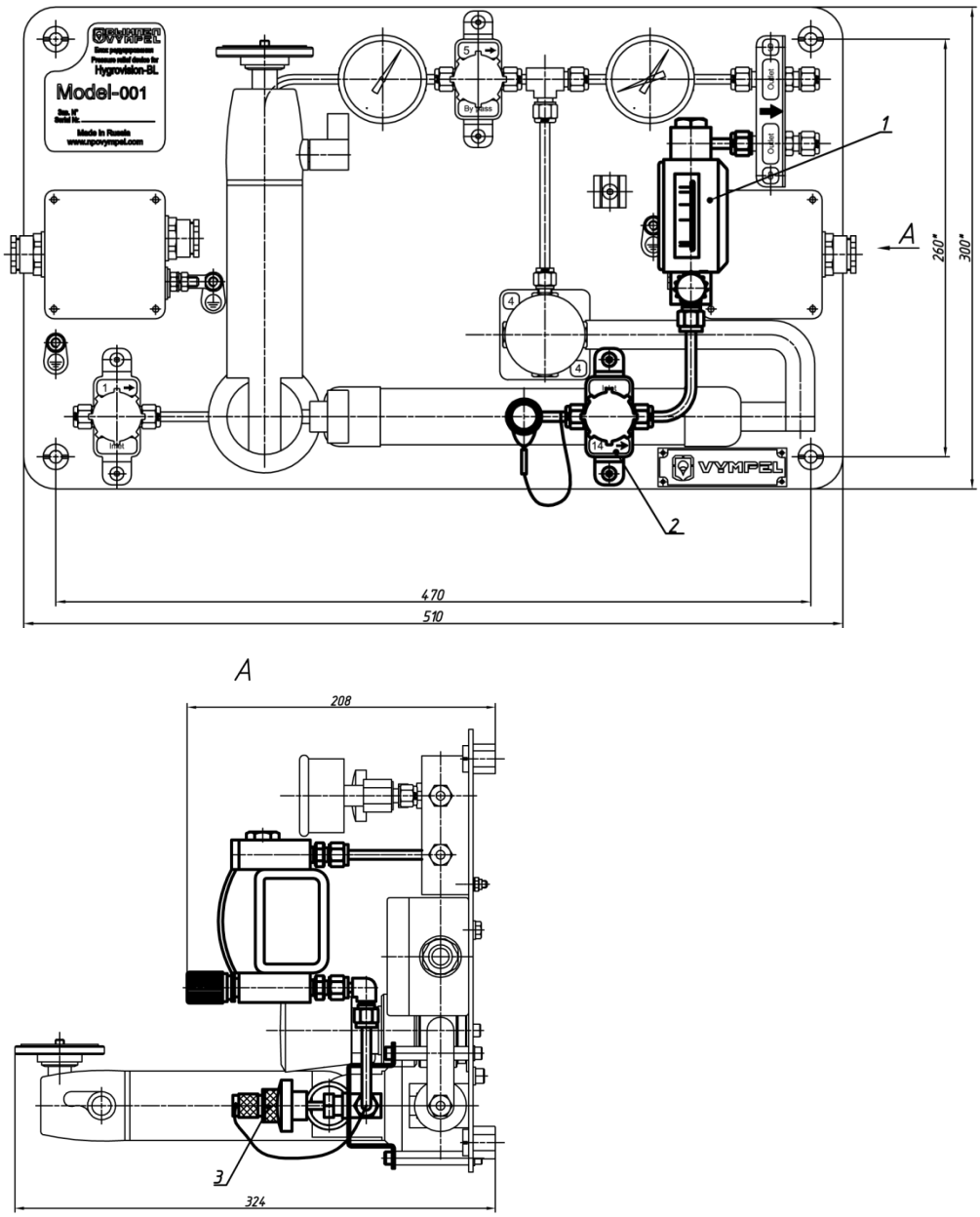


ILLUSTRATION 70: Construction drawing: gas-release module

Pos.	Designation	Description	Qty.
1	DK 32	Flow regulator: Measurement media – Methane Flow volume: 0 – 1 Nl/min Connector: G 1/4"	1
2	V15B-D-6M-R-S	Fine control valve	1
3	DFBA-D-6M-SA	Quick-connect plug	1

18. APPENDIX H

18.1. ELECTRICAL PARAMETERS OF THE HYGROVISION BL'S PLUGS

The following tables list the parameters for the plugs and electrical circuits

Plug XP3: used for connecting the microscope lighting

Table 5

Contact	Description	Circuit characteristics
6	+ LED	Output signal, U_0: 7 V, I_O: 27 мА
10	GND	

Plug XP1: electrical supply and data link

Table 6

Contact	Description	Circuit characteristics
1	+24V	Electrical properties, U_{max}: 32 V, I_{max}: 2 A
2	-24V	Electrical properties, U_{max}: 32 V, I_{max}: 2 A
3	Data+	Input - output, U_{max}: 6 V, I_{max}: 200 мА
4	Data-	Input - output, U_{max}: 6 V, I_{max}: 200 мА

Circuit parameters: XP3

Table 7

Contact	Description	Circuit characteristics
6	+LED	Input signal, U_i: 7 V, I_i: 30 мА
10	GND	

19. APPENDIX I

19.1. SETTINGS MENU

MENU DESCRIPTION

The Settings menu can be accessed from any mode by tapping the  icon.

A menu window will open displaying the icons for functions that have parameters which can be adjusted:

 - Automatic mode

 - Manual mode

 - Transducer cleaning

 - Microscope lighting

 - Display

 - Electrical supply

 - Date and time

 - Language

 - Data output

MANAGEMENT AND ADJUSTMENT OF FUNCTION PARAMETERS IN THE SETTINGS MENU

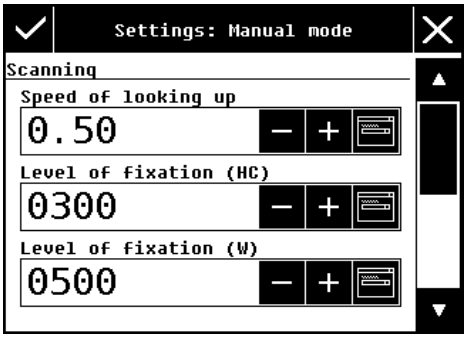


ILLUSTRATION 71

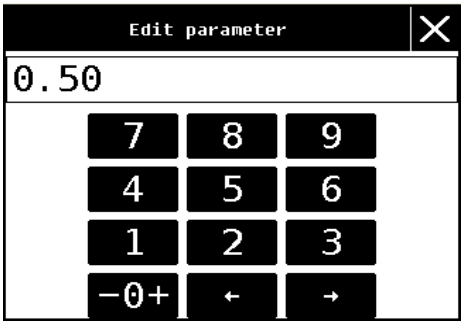


ILLUSTRATION 72

To open a given function, tap the corresponding icon once to select and a second time to confirm.

Use the ▲ ▼ icons to navigate between individual parameter points (ILLUSTRATION 72).

Confirm parameter settings by tapping the ✓ icon.

To return to the main Settings menu tap the ✕ icon.

Tap the − + icons to adjust parameter values. As these icons are relatively small, the manufacturer recommends using the stylus for this purpose.

Alternatively, a desired value can be entered directly using the number pad, which can be opened by tapping the ▤ icon (ILLUSTRATION 73).

After parameter settings have been changed, tap the ✓ icon to confirm the new settings.

Automatic mode

The following automatic mode parameters can be adjusted:

- General
- HC cycle
- W cycle

Manual mode

This menu includes all of the parameters for the scanning mode as well as those for taking dew point measurements in the stepwise cooling mode.

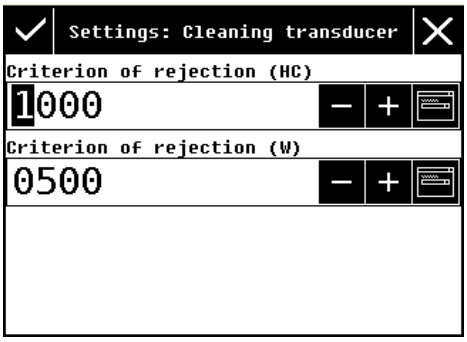


ILLUSTRATION 73

Transducer cleaning mode

In this menu the two parameters that determine contamination tolerance of the mirror can be adjusted in, i.e. the signal levels for criterion of rejection for hydrocarbons (HC) and for water (W) (ILLUSTRATION 73). Should the signal output of either or both of the sensors exceed the values entered here, the system error message “The mirror is dirty” will be displayed.

Refer to point 5.2 for further information.

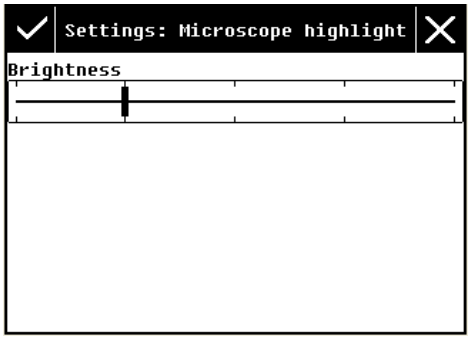
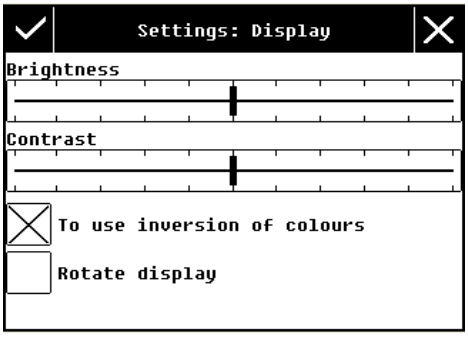


ILLUSTRATION 74

Microscope lighting

The intensity of the microscope lighting can be adjusted in this menu by sliding the indicator to the left (dimmer) or the right (brighter).



Display

In this menu the brightness and contrast of the display can be adjusted by sliding the corresponding indicator to the left (dimmer/less contrast) or to the right (brighter/ sharper contrast) (ILLUSTRATION 76)

Additionally, by activating the appropriate menu field ☐ the display can switch to inverted colors and the orientation of the displayed image can also be rotated 180°.

ILLUSTRATION 75

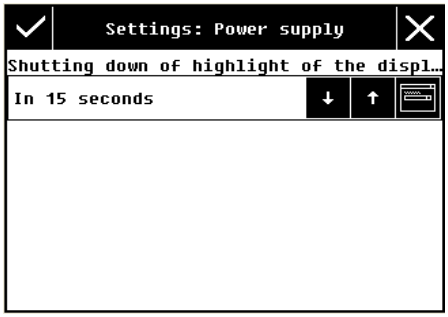


ILLUSTRATION 76

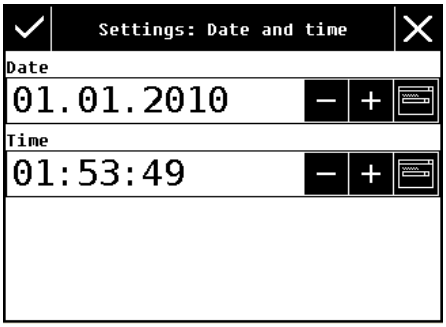


ILLUSTRATION 77

ILLUSTRATION 78

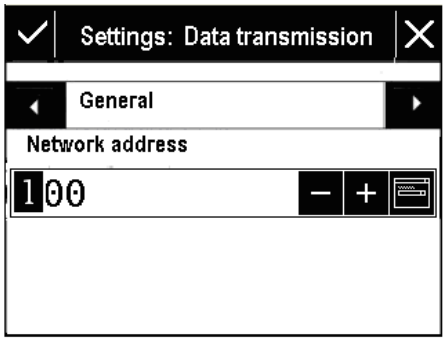


ILLUSTRATION 79

Power supply

The display will switch to standby mode after a given period of time if it is not actively operated. This period can be altered in the Power supply menu. Proper adjustment of this value will maximize the period of battery-powered operation. The following options for this setting are available:

- In 15 seconds
- In 30 seconds
- In 1 minute
- In 2 minutes
- In 3 minutes
- never

The  icons can be used to change the value of this setting (ILLUSTRATION 76).

Date and time

Changes to the settings for date and time can be made in the menu (ILLUSTRATION 77).

Language

The language for all of the information displayed on the touch screen can be set In this menu. (ILLUSTRATION 78). Here the options are:

- English
- German
- Russian

Data transmission

The Data transfer menu has two windows. The first window is labeled General. In this window changes can be made to the unit's network address (for purposes of transmitting data from the onboard memory. The factory default setting for this address is 100 (ILLUSTRATION 80).

The second window is labeled Interface RS-485. In this window alterations can be made to the parameter settings for data trans-

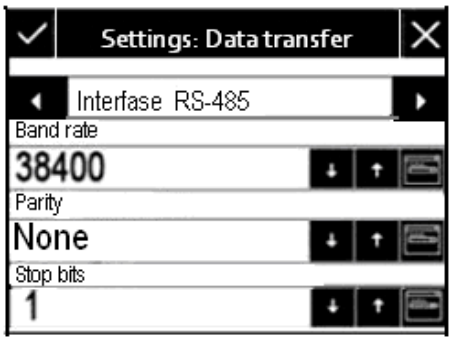


ILLUSTRATION 80

fer via the RS-485 interface. (ILLUSTRATION 81). The settings shown in the illustration are the factory default values for the Modbus / RTU protocol.

20. APPENDIX J

20.1. THE MODBUS REGISTER

Table 8

ModBus/RTU protocol parameters:	
Baud rate	38400
Parity	No
Stop-Bit	1
Address	Modbus address: 100

Table 8: Modbus input register

Table 9

Register address	Type	Parameter description
6-7	uint32_t	Current time. Number of seconds elapsed since 0:00:00 Jan. 1, 1970
14-15	float	Pressure
16	uint16_t	Pressure indications
17	float	Housing temperature in °C
Dp(HC) – Measurement process		
19-20	uint32_t	Current time. Number of seconds elapsed since 0:00:00 Jan. 1, 1970
21-22	float	Dp(HC), in °C
23-24	float	Pressure at which dp(HC) was measured
25	uint16_t	Dp(HC) – Codes
Dp(W) – Measurement process		
26-27	float	Current time. Number of seconds elapsed since 0:00:00 Jan. 1, 1970

28-29	uint16_t	Dp(W), in °C
30-31	uint32_t	Pressure at which dp(W) was measured
32		Dp(W) – Codes
Battery pack parameters		
44	uint16_t	Charge status in %
45-46	float	Voltage, V
47-48	float	Battery pack temperature in °C
49	uint16_t	Battery pack condition – Codes
Dp(HC/W) – Codes include the following information:		

Bit-Number	Parameter	
8	DP measurement mode:	0 – for hydrocarbons
		1 – for water
14	More than 4 hours have elapsed since the dew point was measured	
15	DP measurement mode:	1 – manual mode
		0 – automatic mode
Charge status codes include the following information		
Bit-Number	Parameter	
0	External power supply is connected	
1	The battery pack is charging	

21. APPENDIX K

21.1. DESCRIPTION OF THE CALIBRATION PROCEDURE FOR HYDROCARBONS

In order to increase accuracy, settings for the hydrocarbon measurement channel can be fine tuned in the Hydrocarbons calibration mode.

Calibration is carried out using a reference medium.

The hydrocarbon dew point is given by the generator (connected to the analyzer for purposes of calibration) or determined under operating conditions with the aid of a reference analyzer.

Connect the analyzer to a sampling device delivering gas that has a known dew point value.

Tap the  icon (ILLUSTRATION 81) and select Hydrocarbons calibration mode.

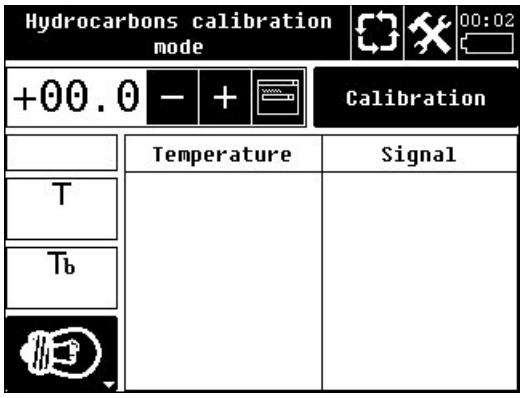


ILLUSTRATION 81

Enter the dew point value that was determined using the reference medium (or generator) in the “T” (temperature) field.

Next, tap the field labeled “Calibrate”.

This will switch the analyzer to HCdp mode. The dew point values measured now are determined based on the newly defined parameters and signal level values.

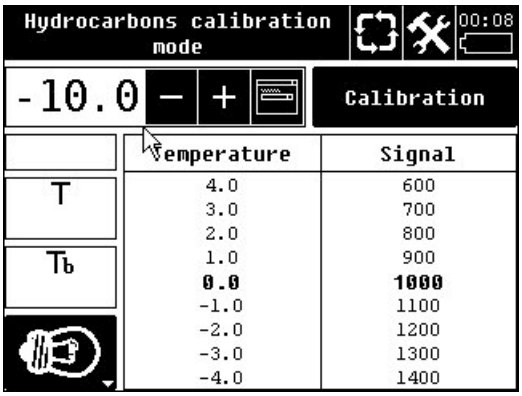


ILLUSTRATION 82

Individual calibration results are listed in the table on the analyzer’s display (T_{given} ±2 °C in 0.5 °C intervals).

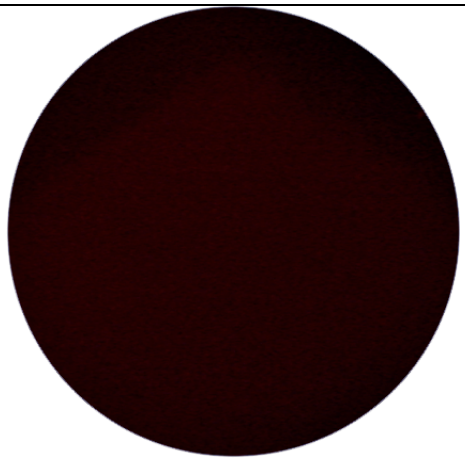
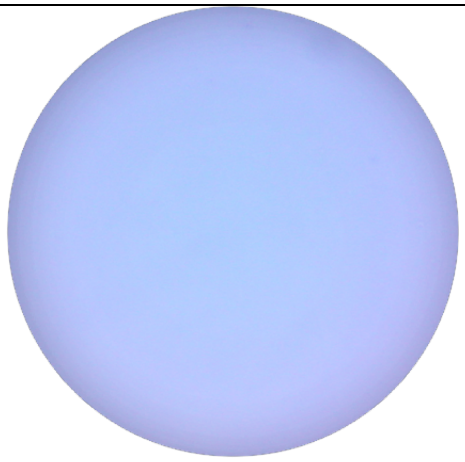
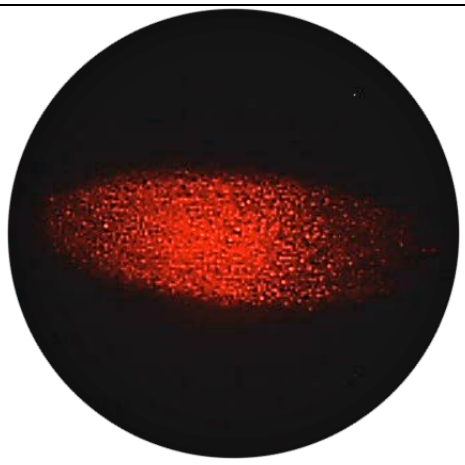
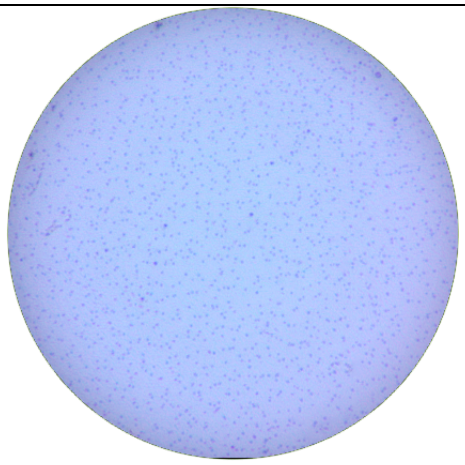
The signal level that corresponds to the given HC dew point (in bold) will automatically be stored in the analyzer’s memory as the HC calibration parameter.

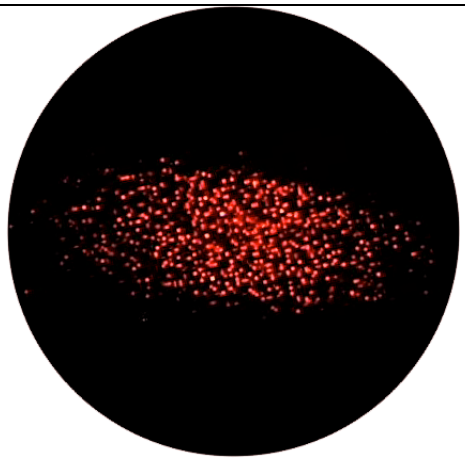
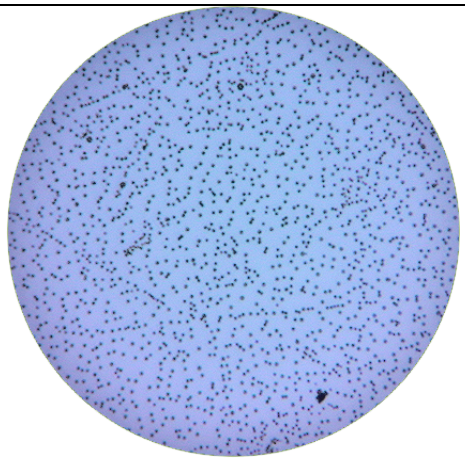
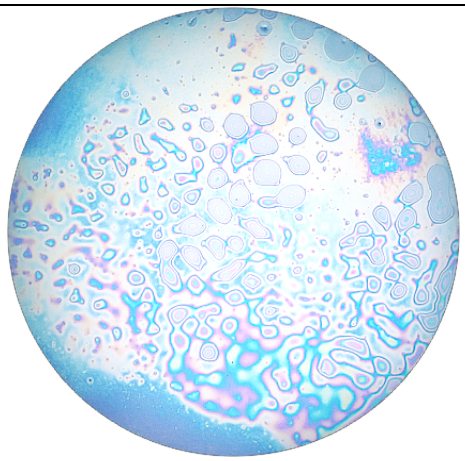
Until the first calibration is carried out, the calibration parameter “HC calibration” will be the same as the signal level for U_{HC}.

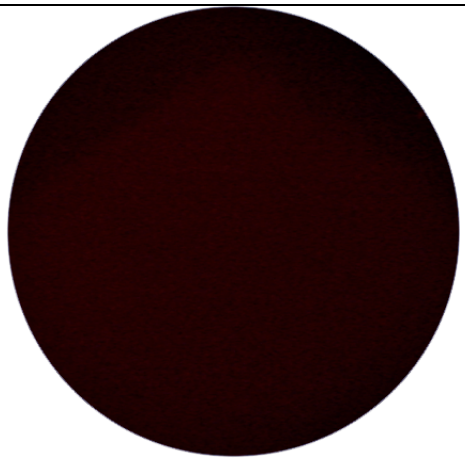
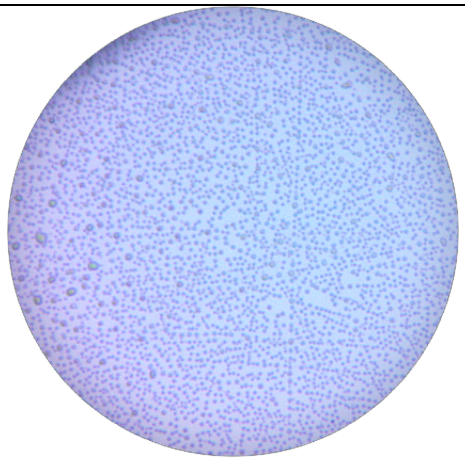
After calibration is complete, tap the  icon to switch to automatic HC dew point measurement mode. To reset the HC calibration parameter, open the menu “Settings; Parameters for the automatic mode; HC cycle” or, alternatively, recalibrate the analyzer using the Hydrocarbons calibration mode (as described here).

22. APPENDIX L

22.1. EXAMPLES OF HC AND W CONDENSATION

Side lighting	**Microscope lighting (vertical lighting)**
Clean condensation mirror	
	
The surface of the mirror appears dark.	The surface of the mirror appears light blue.
Condensation of water vapor as a liquid	
	
Many tiny red dots create an oval pattern in the middle of the mirror's surface.	Many small black dots are evenly distributed across the light blue surface of the mirror.

<table>
<tr><td colspan="2">Condensation of water vapor as solid crystals</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>Many individual bright red dots create an oval pattern in the middle of the mirror’s surface.</td><td>Many black dots are evenly distributed across the light blue surface of the mirror.</td></tr>
<tr><td colspan="2">Condensation of hydrocarbons</td></tr>
<tr><td rowspan="2"></td><td>  </td></tr>
<tr><td>Lighter hydrocarbons (up to heptanes) condense as iridescent spots that quickly cover the entire mirror as a rainbow-like film.</td></tr>
</table>

	
Hydrocarbon condensation is not visible under side lighting so the mirror remains dark.	Octane and heavier hydrocarbons condense in the form of small semi-transparent dark spots, gradually becoming more opaque drops.

23. APPENDIX M

23.1. DOCUMENTATION CHART

No.	Page:				Total number of document pages	Document no.	Signature	Date
	Altered	Replaced	New	Cancelled				