PhyMetrix®

YK-SM-1908-13

DPT-990-Ex

Dewpoint Analyzer

Manual

Safety Instructions

Product Overview

Operation

Maintenance

Specifications

Read this manual before using the analyzer.
Keep the manual properly ,you can read it at any time.
Make sure you thoroughly understand the contents before installing, using, or maintaining this analyzer.

About the User Manual

Preface

Read this manual before using the analyzer. Keep the manual properly ,you can read it at any time. Make sure you thoroughly understand the contents before installing, using, or maintaining this analyzer.
First read
Provide information on product installation and quick operation.
Instructions
Provides guidance on using the product, maintenance, and problem solving.

Valid range of this manual

DPT-990-Ex online Dewpoint analyzer

Legal information

Warning notice system
This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

⚠**DANGER**
indicates that death or severe personal injury **will** result if proper precautions are not taken.

⚠**WARNING**
indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠**CAUTION**
indicates that minor personal injury can result if proper precautions are not taken.

NOTICE
indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product / system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of PhyMetrix products

Note the following:

⚠ **WARNING**
PhyMetrix products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by PhyMetrix. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by ® are registered trademarks of PhyMetrix. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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1 Safety Instructions

Read me first

For personal and system safety, and for optimum product performance, make sure you thoroughly understand and follow this contents.

⚠ DANGER
Do not allow this product to be hit by falling, or exert greater pressure on the product. If the environment is prone to impact, damage or distortion of the product, please stop using it immediately. When measuring inflammable, explosive and poisonous gases, be sure to discharge the gas to safety and proper places. When measuring high pressure gas (no more than 20psia), the system must decompress before connecting or removing the sample tube. Avoid overheating (e.g. proximity to fire, strong light source) Do not open with charged Do not perform any installation or replacement operations during thunderstorms.

⚠ WARNING
Immediate action is needed The product may be damaged by improper use or negligence. When the product is seriously damaged, it must be inspected by authorized maintenance personnel and repaired when necessary before it can be reused. If any of the following conditions are found (although these conditions are unlikely to occur), or if there is any concern about the safety of the product, please stop using this product and disconnect it from the power supply and communication lines, and then contact the technical service department for further guidance. Product cable break, break or damage. Signs of overheating, smoke, spark or fire. The product is cracked, hissed or cracked or has a strong odor. Liquid containers, metal objects or other foreign matter accumulated on this product.

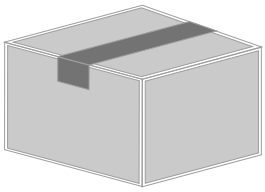
⚠ CAUTION
Keep your skin away from this product when used in hot or cold conditions. It may cause burns, low temperature burns or frostbite. Install the product using the relevant installation components configured by the product.

NOTICE
Do not measure gases containing contaminants and liquids. Avoid corrosive gases. The gas conditions of the sample meet or close to the requirements of the product. The environmental conditions shall meet or be close to the environment requirements of the product. No rain, avoid extreme temperature, pressure and mechanical vibration. Install the product away from the strong magnetic field, otherwise the data in the product may be lost. Since the analog signal output of this product is non-isolated output, safety gate is recommended. Warning signals must be used in strict accordance with their load specifications. Grounding is always required for the analyzer.

Information for use

Detailed list

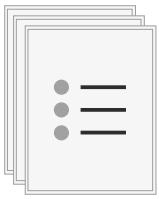
NOTICE
Confirm the attachment of this product. If there is any loss or damage, inform the transportation agent immediately.



case

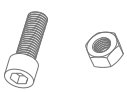


electronic manual

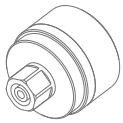


packing list
manual
quick operation manual
calibration report





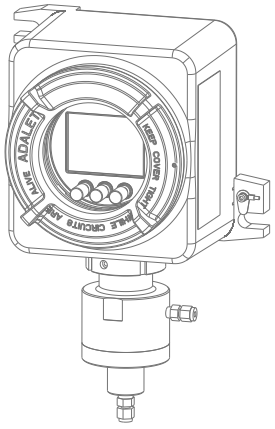
installation fittings



drying device



cap



analyzer

Receiving confirmation

Please check the following points:
Inspect packing and goods for damage.
Check whether the quantity and model of the goods conform to the order.
Check if the selected parts conform to the order and are damaged.

Transport

The following points should be noted in the process of transportation:
Please do not remove the original packing during transportation.
The protective cover of the interface or cover protects the instrument from mechanical damage during transportation and storage, and therefore cannot be removed until immediately prior to installation.
Because the weight of the analyzer itself is about 10Kg, it must be confirmed that the analyzer will not happen accidental rotation and slip during lifting and hoisting.

Storage

Please note the following:
The analyzer should be packaged against impact during storage and transportation. Its original packaging provides optimal protection.
The allowable storage temperature is 0 °C to °C (32 °F to 122 °F), preferably 20 °C (68 °F).
The analyzer must be placed in a sheltered area and stored away from direct sunlight to prevent surface temperature rise.
The humidity of the storage environment should be 10% to 80% and must be non-condensing. Do not expose the analyzer to any corrosive environment.

If the analyzer is in use/operation, the following precautions should be followed before storage:
First disconnect the sample gas, clean and purify the whole system with dry nitrogen, and then turn off the power supply of the whole system.
All connections and ports (gas and electrical) to the analyzer or sample system (if provided) shall be protected by a protective cover.
If the analyzer is not moved from its original installation position, the electrical grounding of the analyzer shall be maintained in place.

The installation conditions

The installation, power supply connection, gas line connection, commissioning and maintenance of the analyzer must be carried out by authorized and trained personnel who must read and properly understand and comply with these instructions before operation.
The analyzer must be operated by an authorized and trained person and strictly in accordance with the instructions.

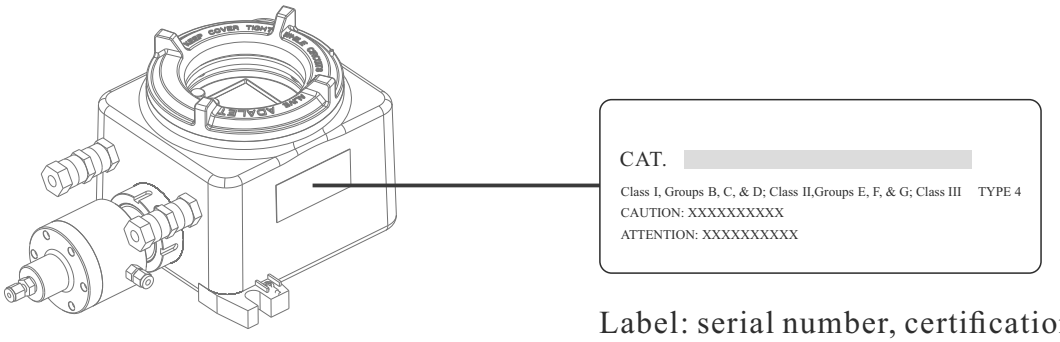
If pipeline welding is performed at the sampling point, the welding equipment cannot be grounded by the analyzer.
The installer must ensure that the measuring system is properly wired according to the wiring diagram. The analyzer must be grounded unless special protection measures are taken, such as isolation source SELV (additional safety low voltage) or PELV (additional protection low voltage).
Comply with all local regulations when opening and maintaining electrical equipment.

The operational safety

Please note the following:
The cover analyzer is designed to meet the highest safety requirements. It has been tested and delivered in a safe operating state. The analyzer follows appropriate standards and specifications. Please pay special attention to all the safety marks in this manual. For measuring systems used in explosive hazardous situations, this operating instruction and the relevant documentation must be strictly observed.

Identification

Nameplate

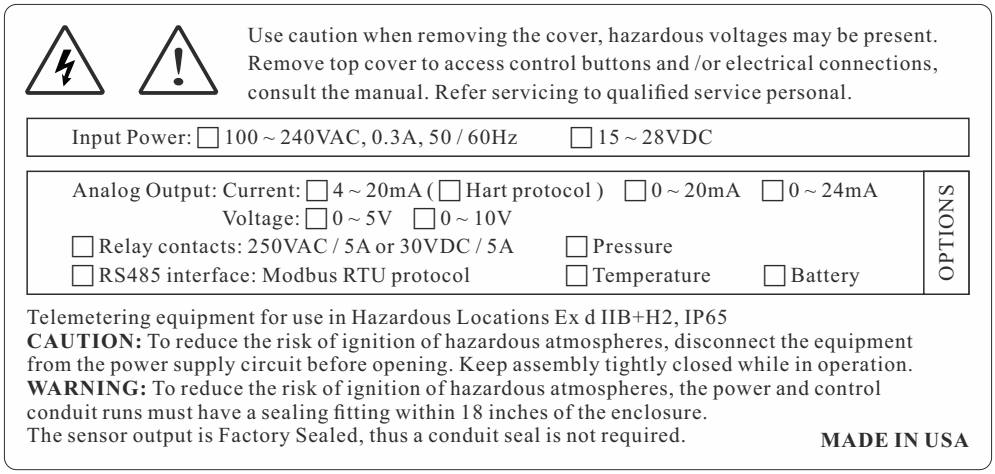


Label: serial number, certification safety instructions, etc

Certificate

Class I, Groups B, C, & D Class II, Groups E, F, & G Class III	UL 1203 CSA C22. 2 No. 25 & 30
TYPE 4	UL 50

Analyzer nameplate



Input Power: Power specification

Options: Analog Output: current or voltage

Relay contacts: 250VAC/5A or 30VDC/5A

RS 485 Interfac:Modbus RTU

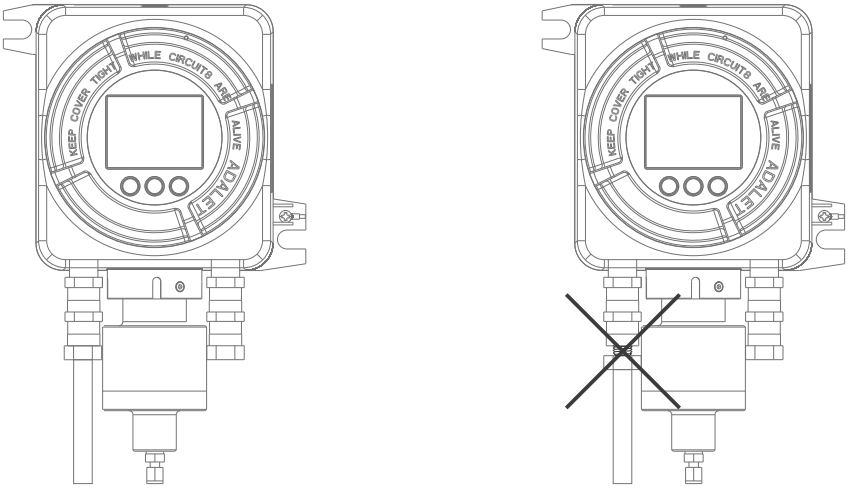
Temperature sensor, pressure sensor, battery

Protection class

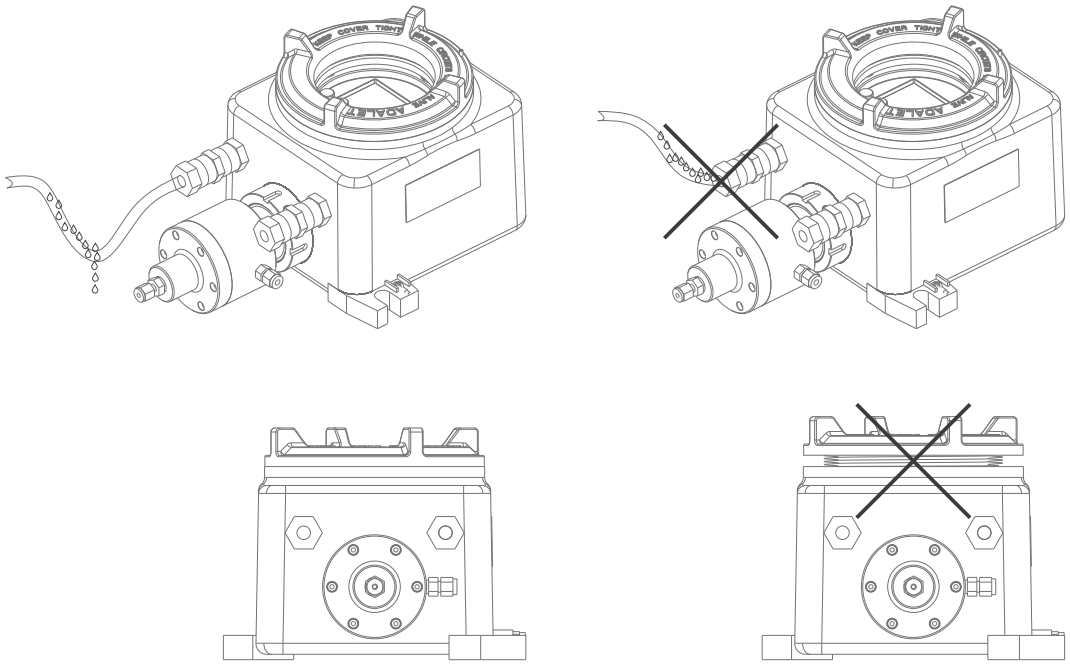
The analyzer meets all the requirements of Ip65

⚠CAUTION
All screw fasteners and capping must be tightened. The outer diameter of the cable used for wiring must conform to the regulations. The cable gland must be tightened. The cable port should not be up. Use a plug when no cable passes through the cable entrance.

Vertical



Horizontal



2 Product Overview

The Online analyzer

Online analyzer usually refers to a kind of instrument which is directly installed in the field of industrial production process or other sources and continuously or periodically performs self-determined analysis and detection of material composition or physical property parameters. Online analysis is usually used for real-time continuous detection of components, and the on-line analysis component information is used for automatic monitoring of product quality in process or automatic control of safe and efficient operation of process equipment.

Introduction

DPT-990-Ex online dewpoint analyzer combines micro-controller with digital signal processing technology. Using nano-technology and metal oxide film technology, the sensor can quickly and accurately measure the moisture content of the analyzed gas in the range of -110 °C~+20 °C dewpoint temperature.
This product has the advantages of high reliability, fast response and high accuracy.
It is widely used in low humidity, inflammable, explosive and other areas with strict environmental requirements. The explosion-proof dew point meter can be calibrated to international standards, providing a traceable calibration certificate.

Characteristics

Analyzer USES high-speed 32-bit microprocessor, 24 micro-power AD converter, with 3.5 "LCD display, graphic heuristic UI, support the switch in both Chinese and English, offers a variety of display parameters, programmable data storage function, high precision temperature and pressure compensation algorithm is designed, the output interface is rich, simple mechanical structure, operation and maintenance is convenient.

Main parts

The analyzer consists of a dew point measurement sensor unit and an electronic control unit. The sensor unit is encapsulated in the sampling cavity, and the electronic control unit is encapsulated in the Exd shell. Achieve electrical isolation.
Enclosure certification: refer to the marking label located on the right side of the analyzer to identify certification standards, etc.

Display and operation unit

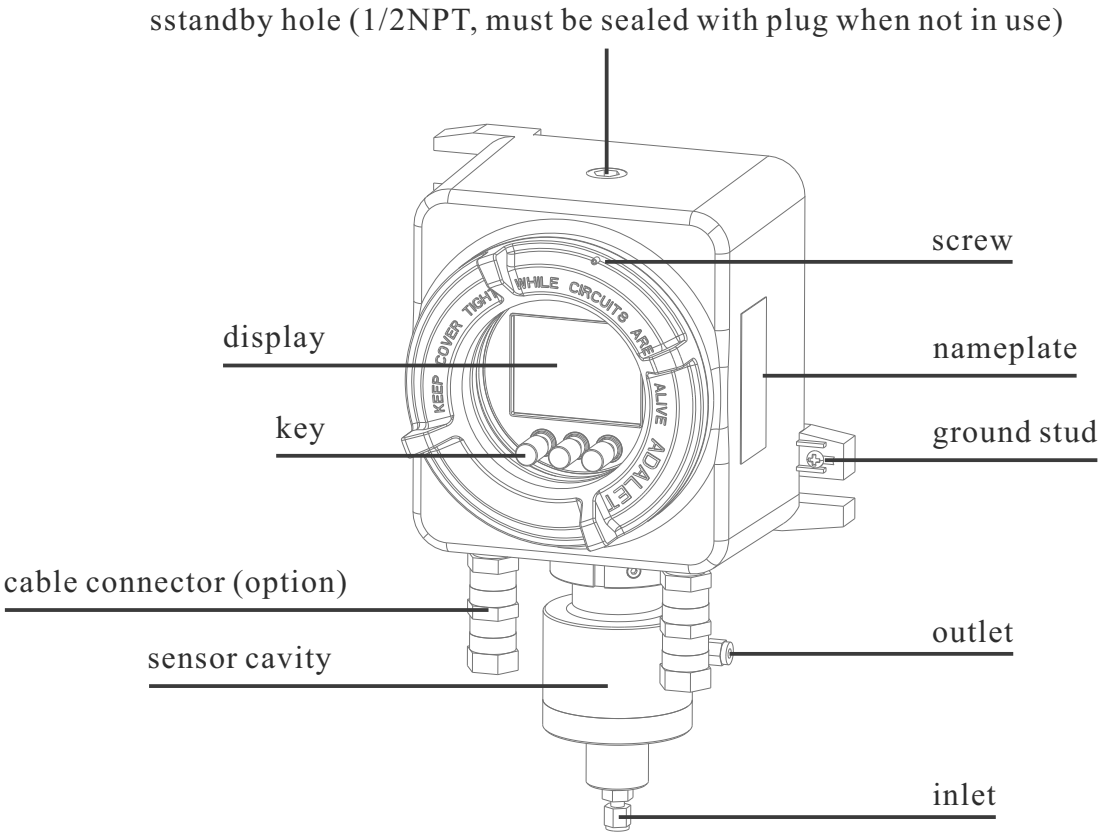
The display and operation unit of the analyzer are presented through the round window of the enclosure. The operation is achieved through a unique system that allows full control through the glass of the housing cover.

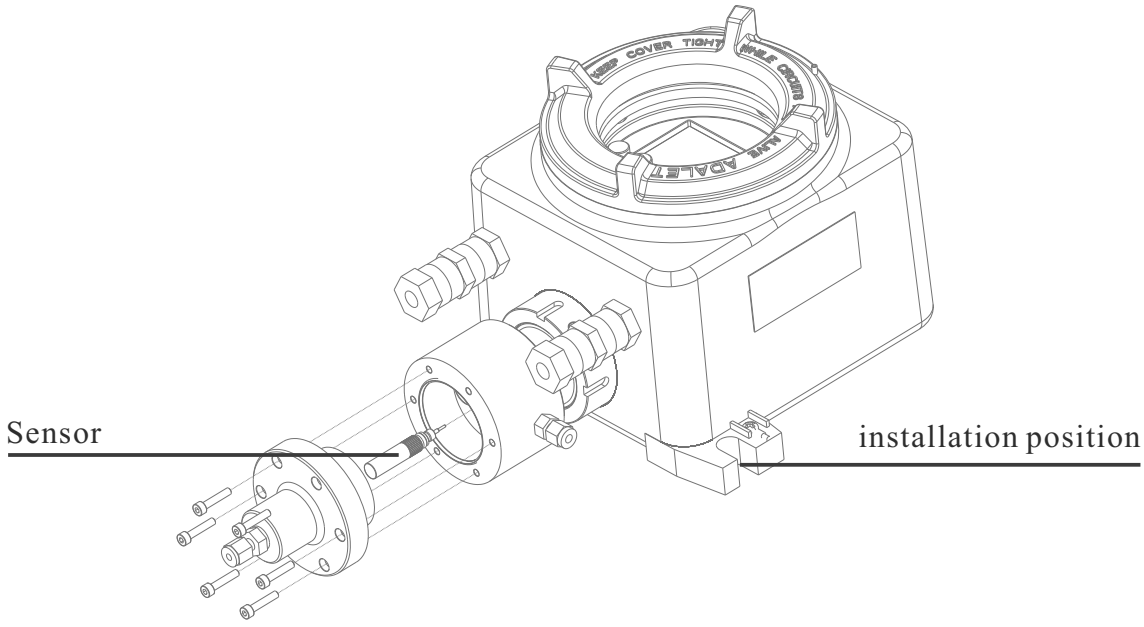
During the installation and initial setup of the instrument, the outer cover is fully removable for easier access to the interior of the housing.
The cap must be fully secured during normal operation of the instrument.

Communication

The analyzer is equipped with a high-precision, fully integrated 16-bit digital-to-analog converter, designed to meet the requirements of industrial control applications. Current outputs ranging from 4mA to 20mA, 0mA to 20mA or 0mA to 24mA can be programmed. Or as a voltage output in the range 0V to 5V, 0V to 10V, may exceed the range by 10%. The device can add an external HART® Signal, designed as HART FSK half duplex modem, meet the requirements of HART physical layer. To realize HART network communication. The analyzer is also equipped with RS 485 communication interface, which meets the requirements of Modbus protocol. The transmission mode is RTU mode. The alarm output interface of the analyzer is a two-way programmable SPDT type passive alarm relay with contact capacity of 250VAC/5A and 30VDC/5A (resistive load).

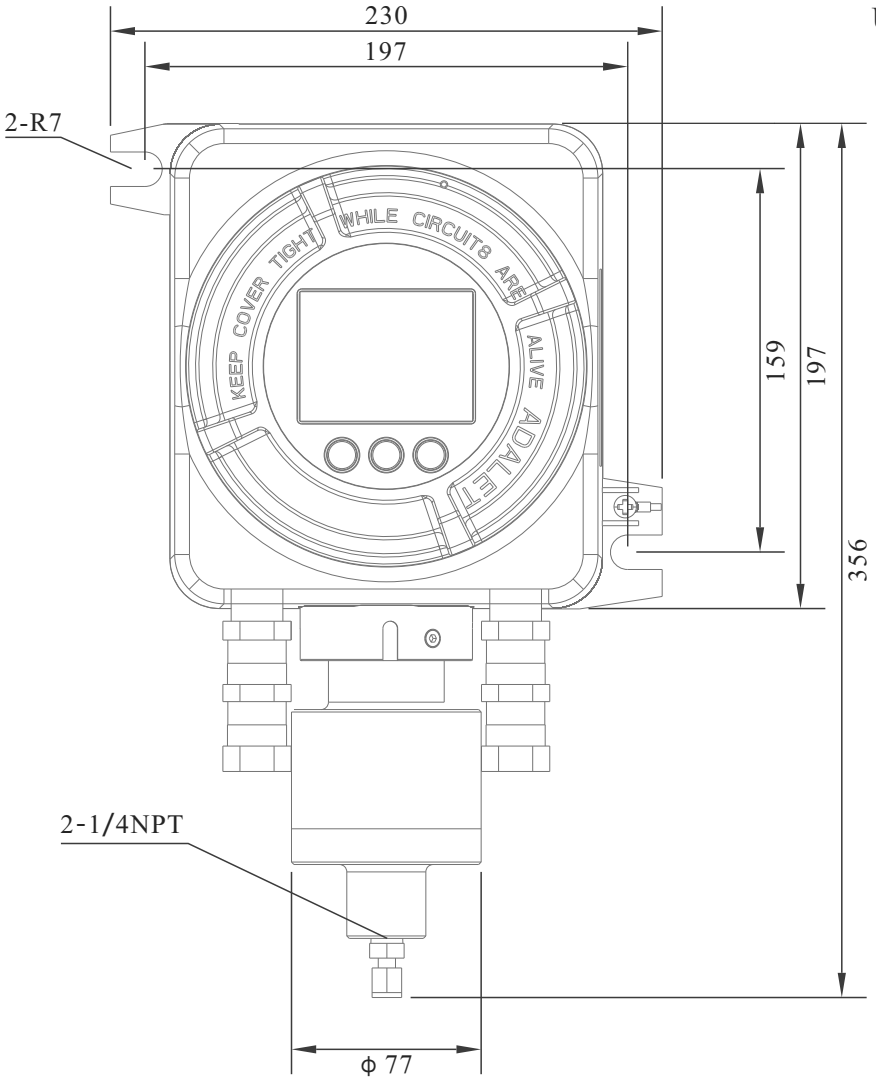
External view

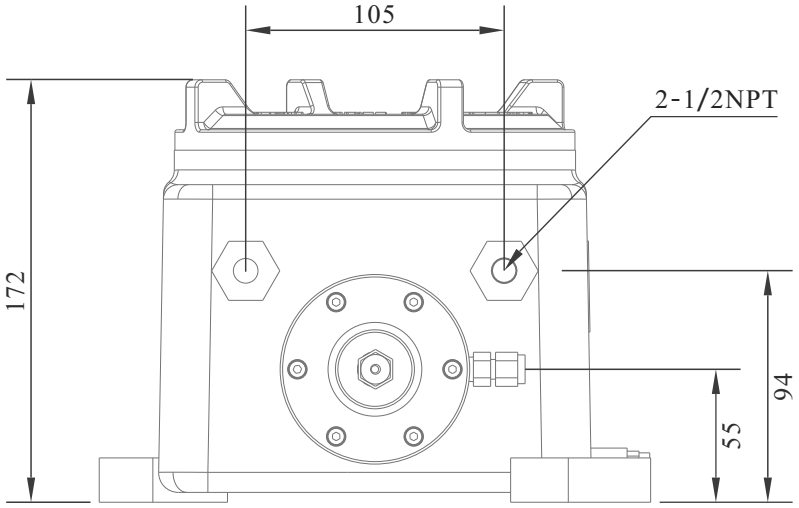




Machine dimension

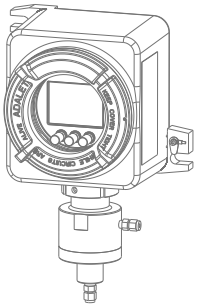
Unit: mm





Installation guide

Installation preparation



analyzer



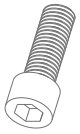
Spring Washer
(ϕ 12)



flat washer
(ϕ 12)



nut(M12)



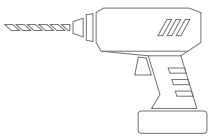
hexagon socket
head cap screw
(M12*45)



cable
connector
(option)



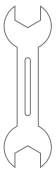
socket head
screw wrench
(4&10mm,1/16inch)



Electric drill



screwdriver



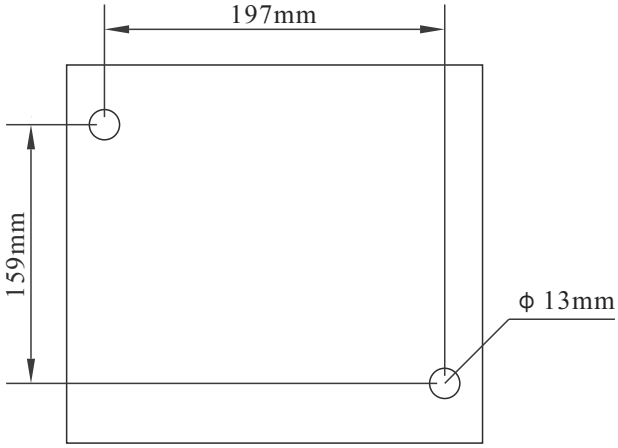
Wrench
(14mm)



power / signal cable

Installation conditions

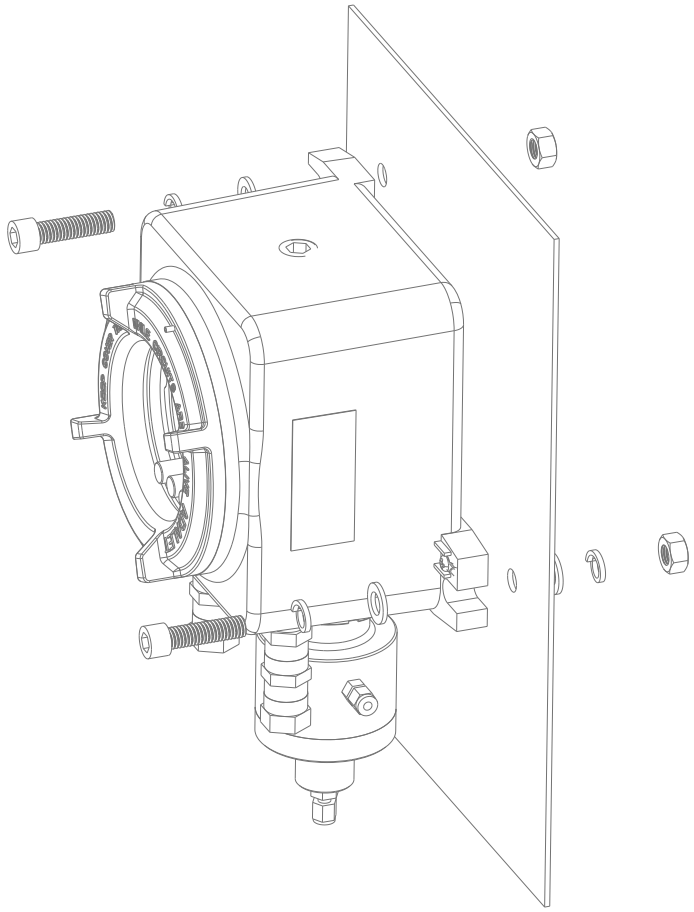
Ambient temperature: 0~45°C
Environmental humidity: <80RH%
Avoid direct sunlight

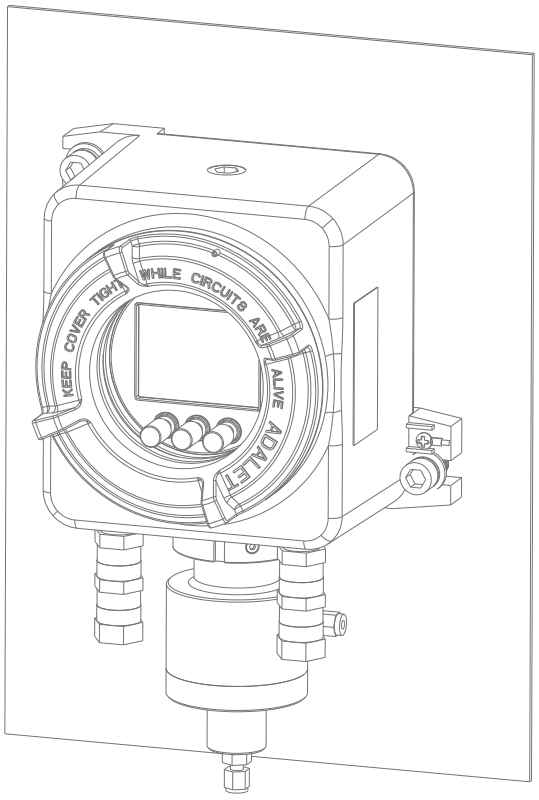


Size of plate

⚠ DANGER
Do not open with charged. Do not perform any installation or replacement operations during thunderstorms.

Installation Instruction



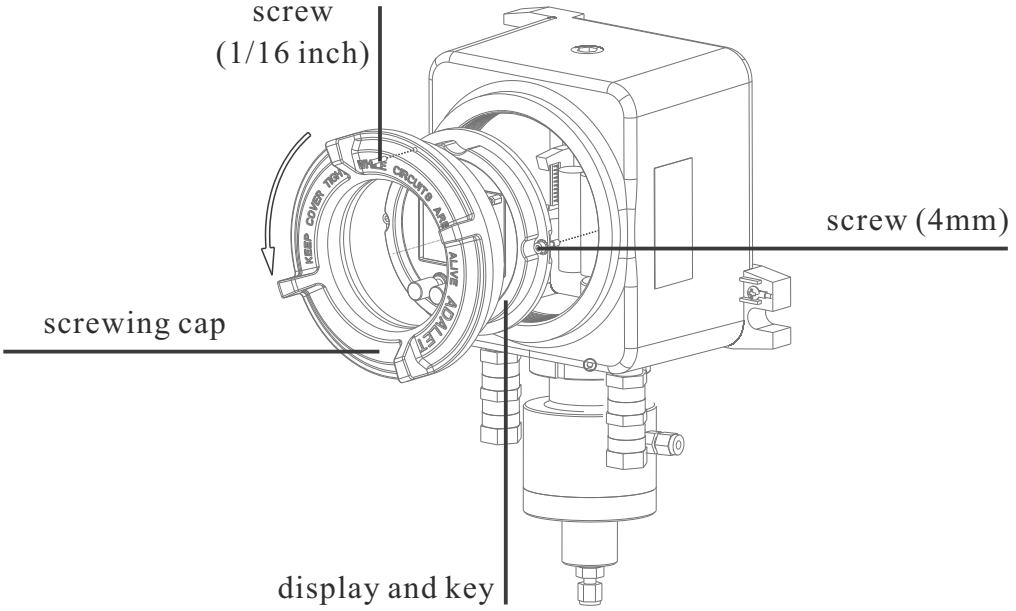


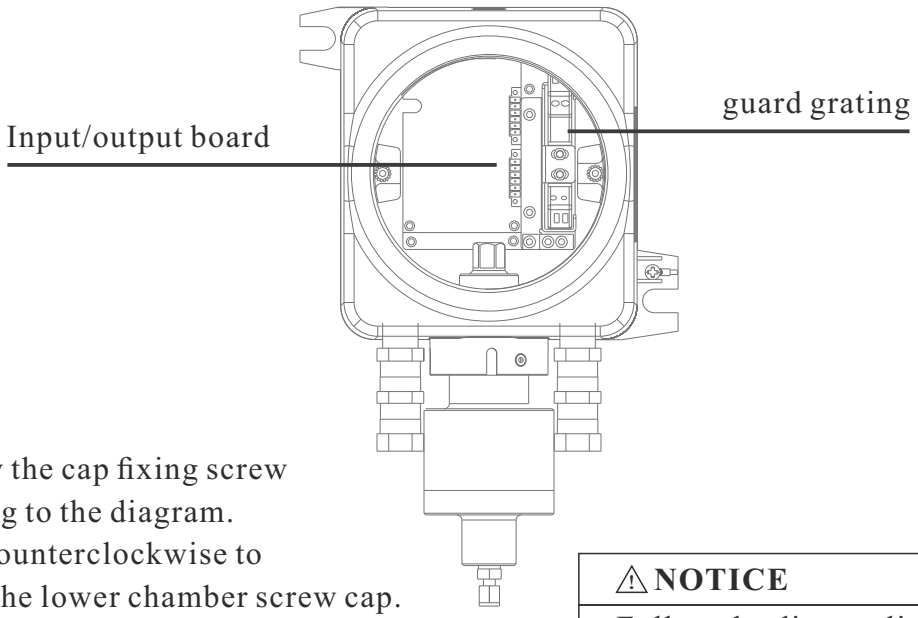
⚠NOTICE

The analyzer shall be inspected as follows after installation:
Analyzer condition and specification: instrument damaged?
The analyzer protect against moisture and direct sunlight?
The analyzer prevent overheating?
The analyzer prevent violent vibration?

Cable

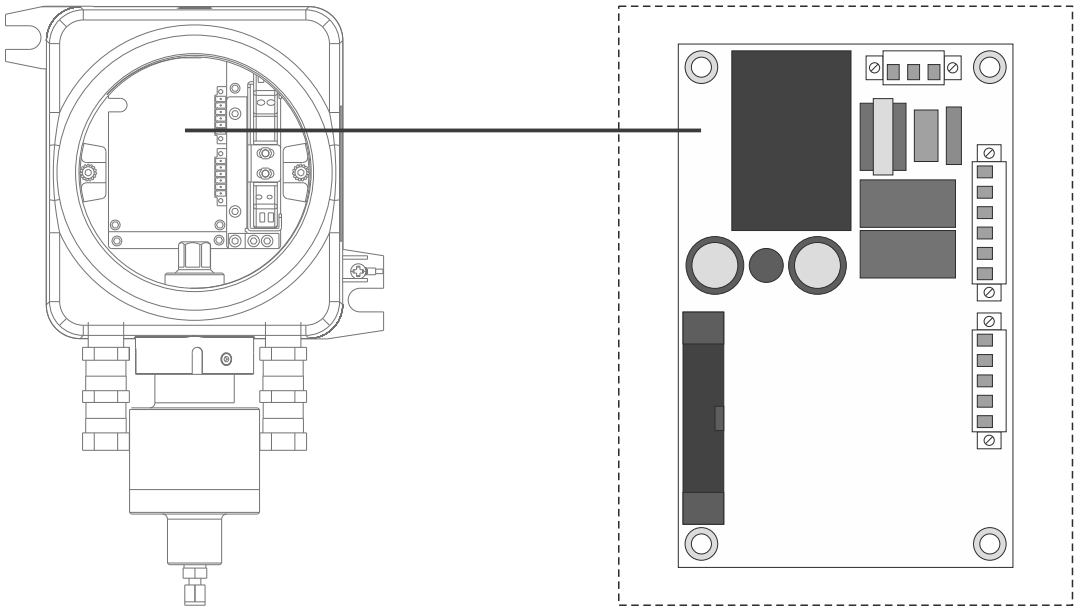
⚠ WARNING
The product / system described in this documentation may be operated only by personnel qualified for the specific task in accordance with the relevant documentation. Do not perform any installation or replacement operations in thunderstorm weather. Do not perform any installation, replacement or wiring operation while live. Be careful of electric shocks.





1. Unscrew the cap fixing screw according to the diagram.
2. Rotate counterclockwise to remove the lower chamber screw cap.
3. Loosen the setting screw of the display control unit.
4. Take out the display control unit completely.

⚠ NOTICE
Follow the dismantling instructions and procedures. All threads are right-handed (clockwise tightening).



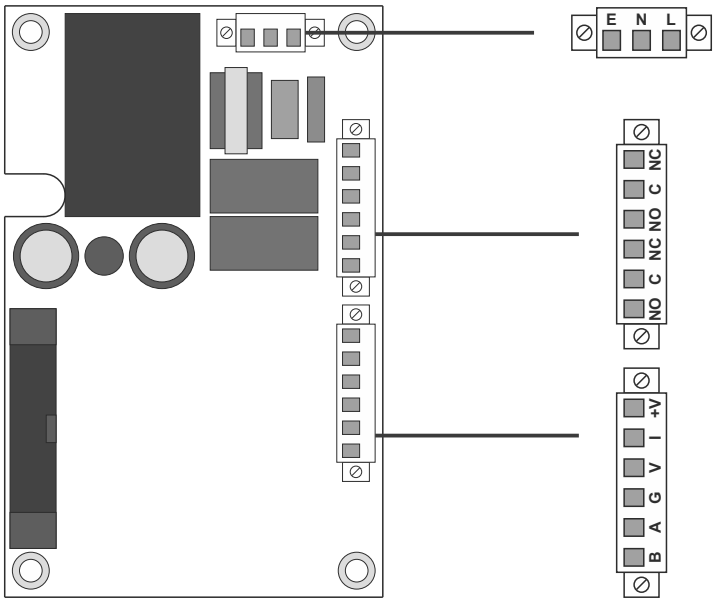
⚠ WARNING

Be careful to damage electronic components (ESD protection).
Static electricity can damage electronic components or reduce their maneuverability.
It can be prevented by using grounded work places.



If you are not able to ensure the insulation strength of the instrument during the wiring process, you must carry out appropriate checks according to the manufacturer's regulations.

Port definition

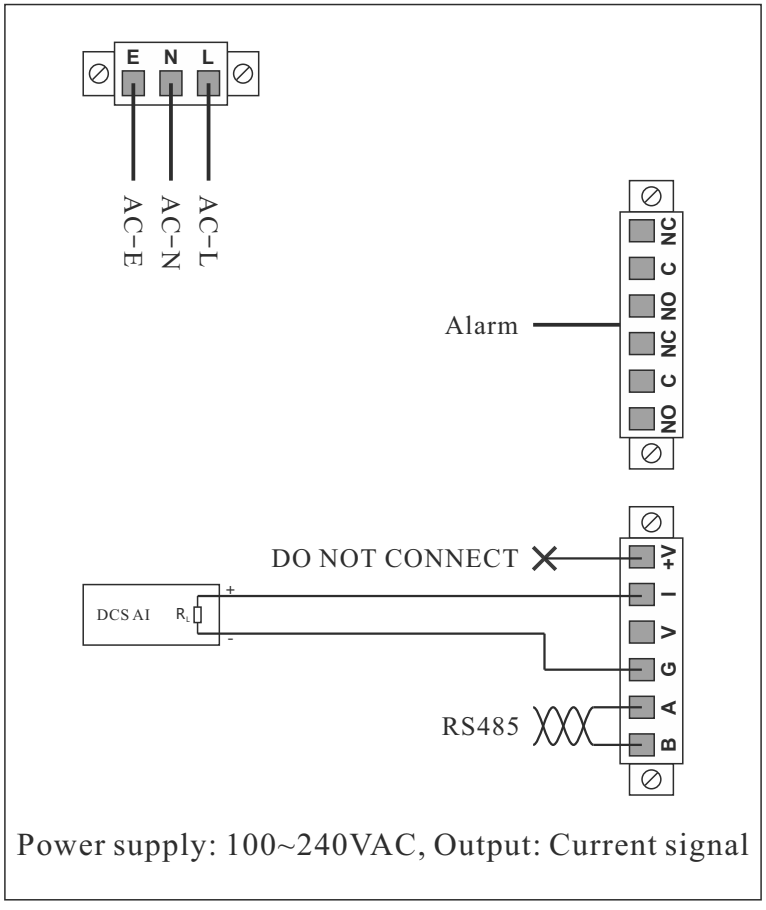


E N L			AC Power supply
E	N	L	100~240VAC，50/60Hz
AC-E	AC-N	AC-L	

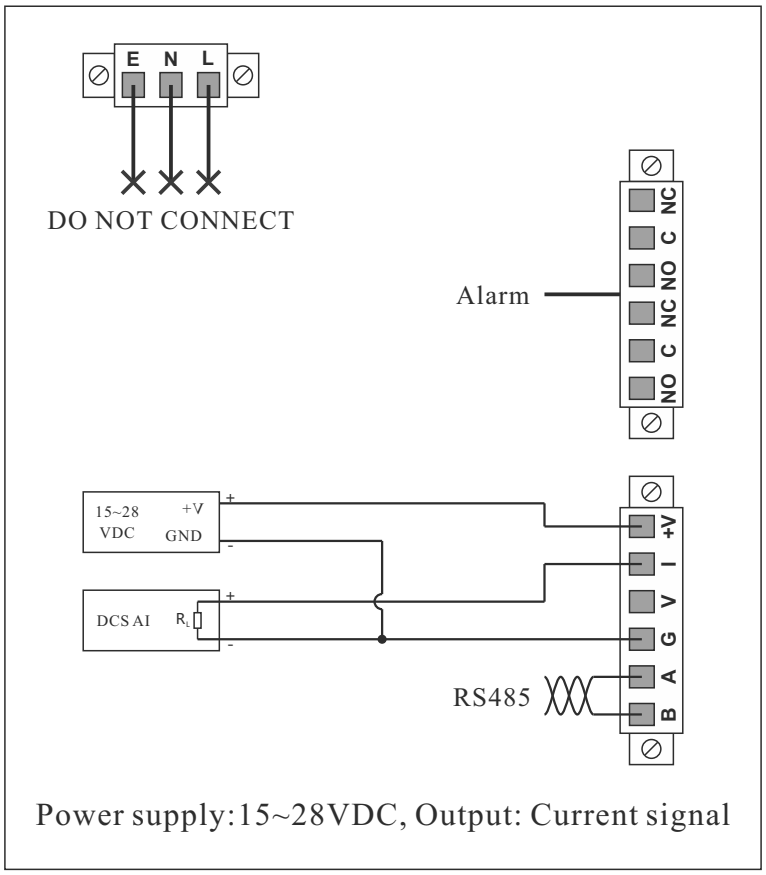
NO C NC NO C NC						Alarm
NO	C	NC	NO	C	NC	Relay contacts: 250VAC/5A, 30VDC/5A (Resistive load)
LO-Alarm			HI-Alarm			

B A G V I +V			DC power supply Communication interface		
B	A	G	V	I	+V
RS485-B	RS485-A	GND	Voltage Output	Current Output	15~28 VDC

Cable connection

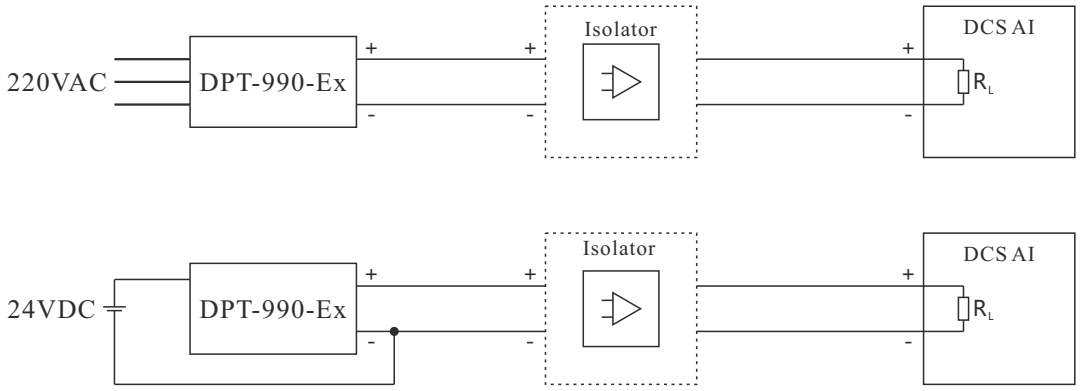


Power supply: 100~240VAC, Output: Current signal



Power supply:15~28VDC, Output: Current signal

Typical applications



specifications of isolators:
power supply: 24VDC±10%
Input signal: 4~20mA;
Power protection: short-circuit current, 40mA;
open circuit voltage, 26V
Input impedance:≤200Ω
Output load: 0 ~ 350Ω
Conversion accuracy: ±0.1%FS
Temperature drift: ±0.01%FS/°C
Insulation resistance: input/output/power, ≥100 MΩ (500 VDC)

NOTICE
Isolators are recommended.

Cable specifications

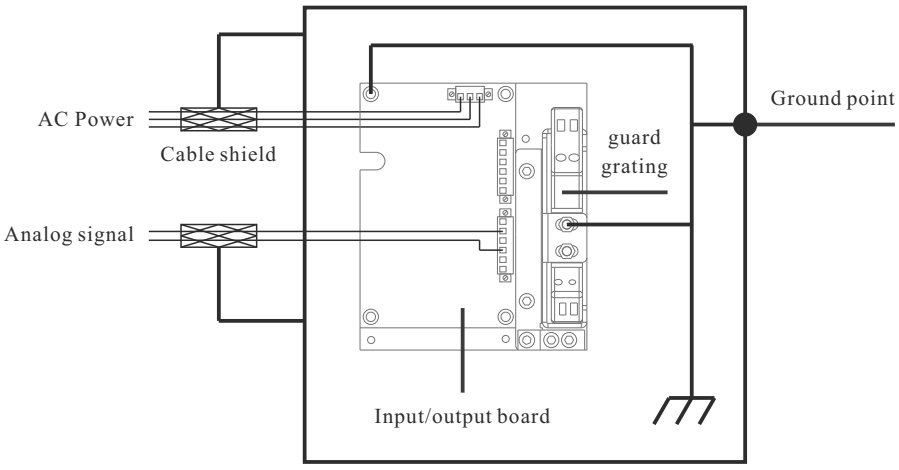
Conductor resistance: ＜50Ω/km
Operating voltage: ≥300V
Temperature range: -40°C ~ +80°C
Total nominal diameter: 8~12mm
Maximum cable length: 200m
Power cord: core sectional area ≥0.75mm^2
Signal cable: ≥0.5mm^2
Ground wire specifications: ≥2.5mm^2, the resistance is less than 3 Ω

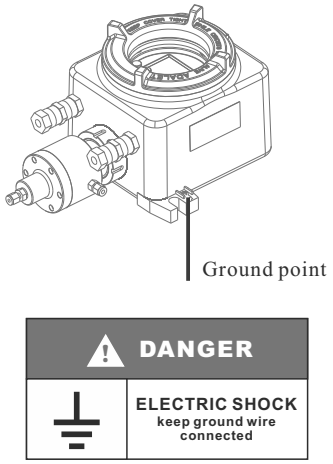
NOTICE
Cable installation must be firm to prevent movement. Cable diameter should ensure good sealing at cable cover.

Inspection of cable connection

After connecting the analyzer, the following inspection should be done:
Whether the cable or meter is damaged?
The power supply specification in accordance with the nameplate?
Cable specification correct?
The cable have enough tension?
The cables properly separated according to the type?
Surround or cross?
The power and signal cables correctly connected as indicated?
The terminal tightened?
The cable inlet installed, secured and sealed correctly?
The housing cap installed and secured?

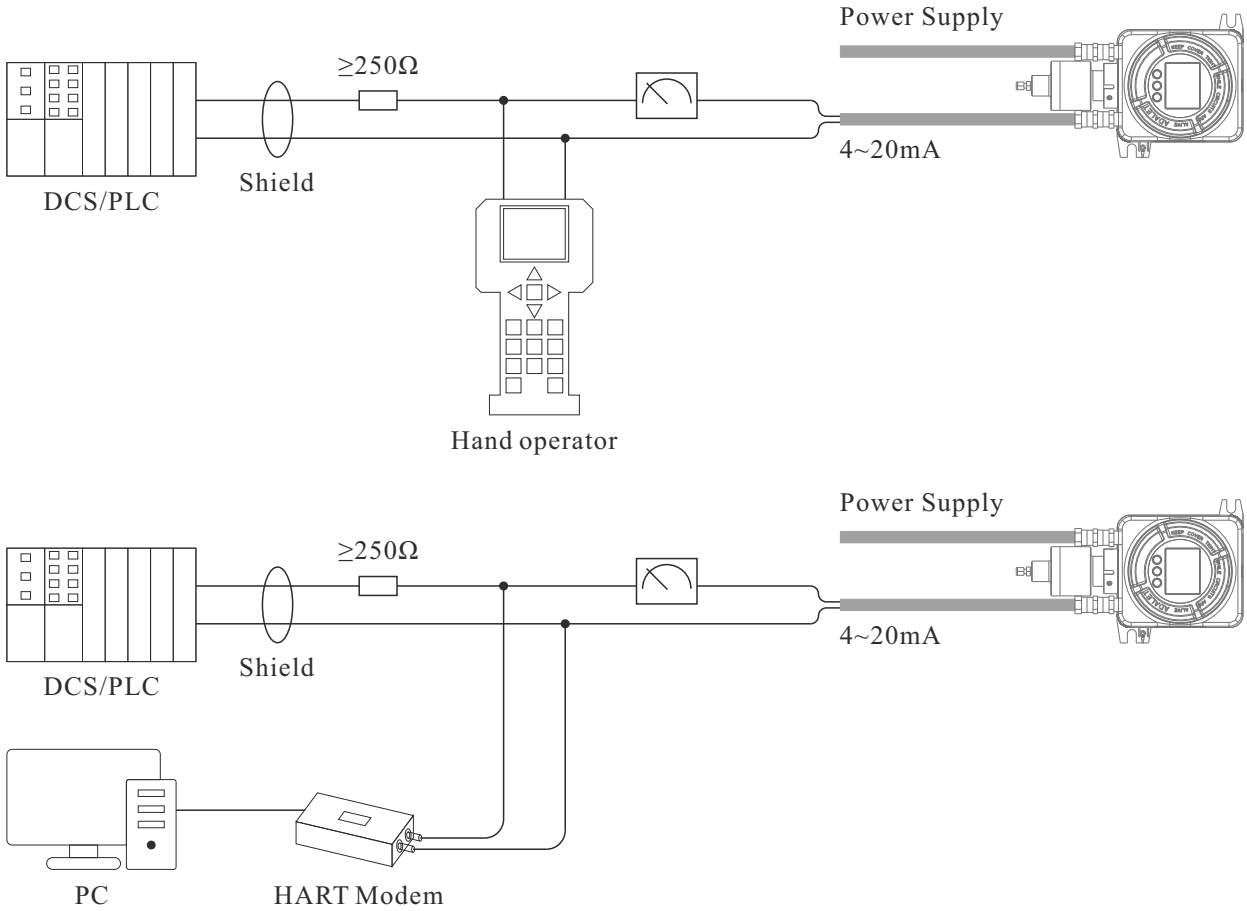
Earthing system





HART

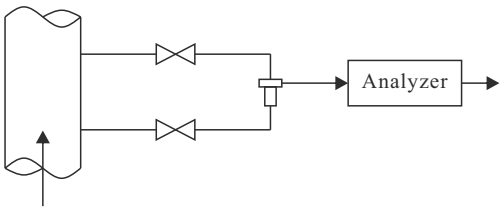
HART protocol is a powerful communication technology that can be applied to any application of digital field instruments. HART protocol can be used to carry out bidirectional digital communication with field intelligent instrument, which extends the performance of control system. HART equipment network structure can be arbitrarily taken in the following two ways: point-to-point connection or multi-point connection.
Point-to-point connection: In the point-to-point connection, 4~20mA signal is only used to transmit a process variable, while other process variables, configuration parameters and other types of equipment data are transmitted by HART protocol. 4~20mA signal (variation) has no influence on HART signal, but it can still be controlled in the usual way. HART digital communication signals allow the use of a second variable and other data to achieve operations. Purpose of debugging, maintenance, and diagnosis.
Multipoint connection: The multi-point connection mode requires only two wires to connect, if possible, with a safety grid and an auxiliary power supply for up to 15 field devices. All process variables are transmitted digitally. In multipoint connection mode, the address of all field instruments is greater than 0, and the current passing through each instrument is fixed at the lowest value (usually 4mA).



NOTICE
Consult documents published by HART,HCF-LTI-34: “HART application guide”.

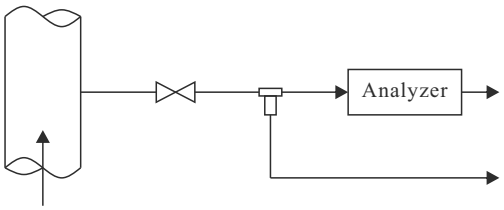
Gas connections

Cycle Loop



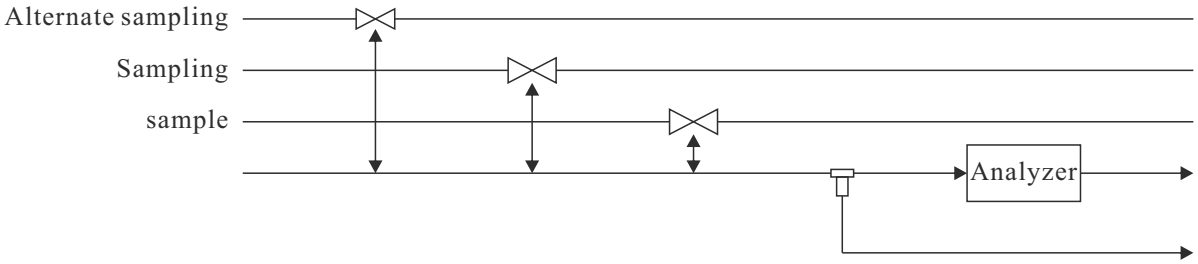
The Cycle loop shall ensure that the minimum sample loss is used, the sampling system lag time has been reduced, and the differential pressure caused by the control valve and throttle orifice plate shall be avoided. The flow of samples from the loop into the analyzer generally needs to pass through a bypass filter with self-cleaning function.

Bypass

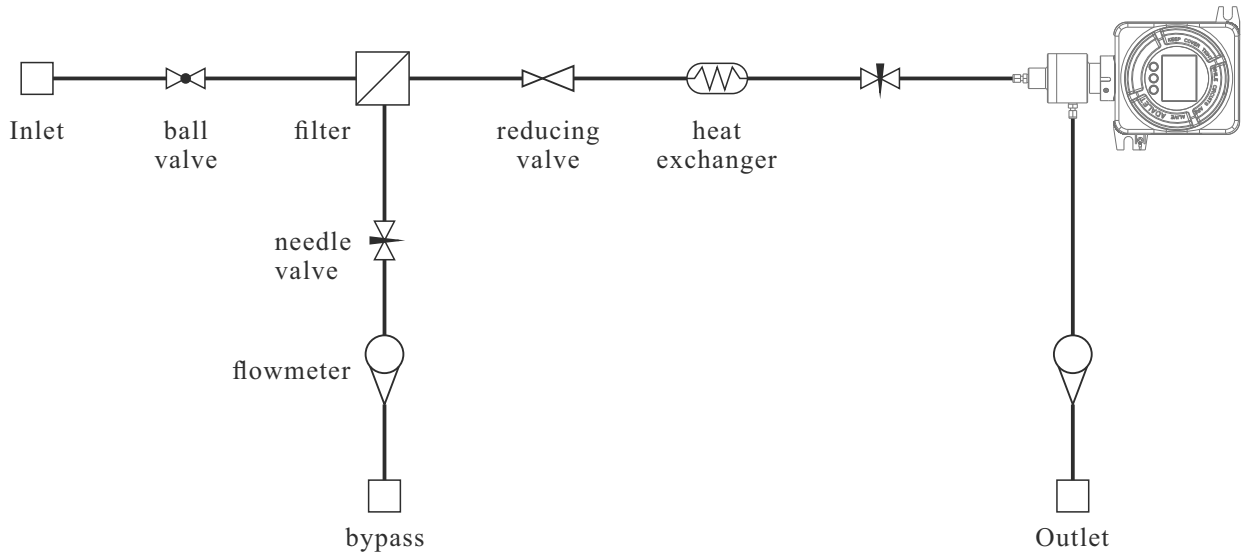


The bypass loop can reduce the lag time of the sampling system and is generally used without causing environmental hazards.
The sample loop through the analyzer can be drawn through a self-cleaning filter.

Multi-point sampling



Typical applications



Operation principle

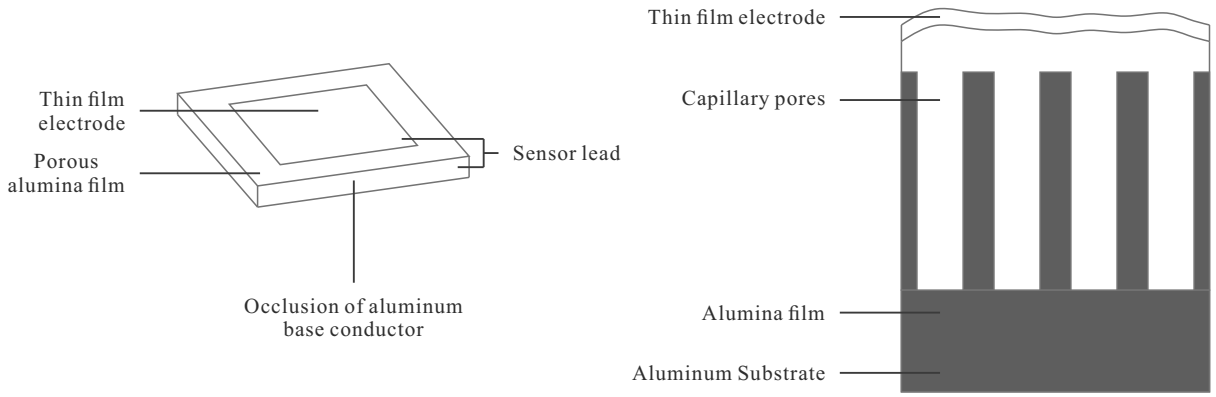
Principle

According to the principle of measurement, the online gas moisture analyzer is mainly divided into capacitor type, electrolytic type, crystal oscillation type, semiconductor laser type, infrared spectrum type, etc., and the electrochemical dew point detector and cold mirror type dew point detector are used for online measurement of dew point.

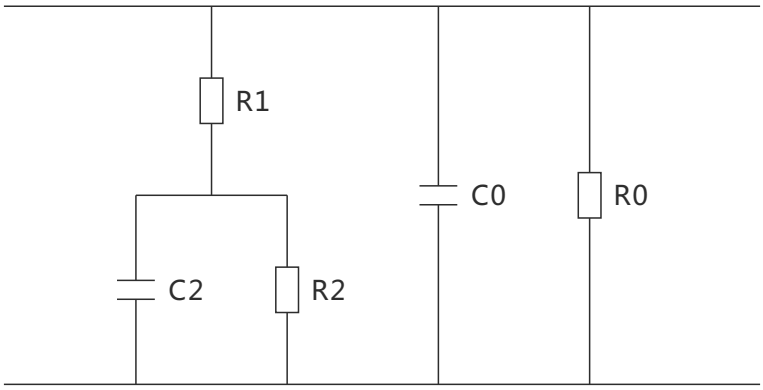
Alumina humidity sensor

The working principle of the alumina moisture sensor is based on the adsorption equilibrium of porous alumina layer to the measured gas. Its core is an absorbent layer of alumina. Alumina layer is made by special processing method, which is anodized on the surface of the plate or cylinder of pure aluminum to form porous alumina. The electrode film on the alumina layer is generally made of gold, platinum, palladium, nickel-chromium alloy, etc. The method of film formation is generally adopted by spraying or vacuum coating method. The aluminum substrate and the gilded layer form two electrodes, which are the two electrodes of the alumina capacitor.

Since water is needed to pass directly through the gold electrode film into the alumina layer, the thinner the gold electrode film, the better. Thin copper wire or gold wire is used for conducting the electrode, and silver conductive paint is used to stick on the film, and the wire keeps close mechanical contact with the film. Aluminum base wire can be occluded by aluminum strip and fixed by epoxy resin. The sensor is generally in the form of sheet or rod, and different forms adopt different structures. The sensor is fixed on a base with electrical insulation and mechanical stability.
Porous aluminum oxide layer has a large specific surface area, the water vapor has a strong adsorption ability, with the development of nanotechnology, nanotechnology based on pore structure design of the sensor under the condition of the water content is very little, using the capillary action of against moisture sensor internal and external balance, both inside and outside water concentration index proportion, so even if the sensor water content changed little, the capacitance variation is enough to test.

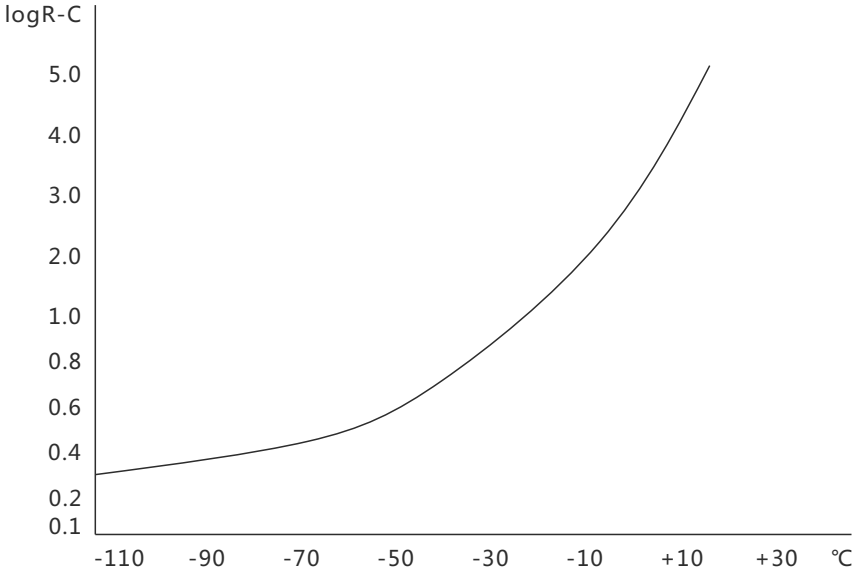


Alumina humidity sensor



Sensor equivalent circuit
R0- solid alumina resistor R2-hole resistor R1- variable resistor
C0- total oxide capacitance C2 hole capacitance

The diagram above shows the equivalent circuit of the working principle of the sensor, in which the oxide layer is divided into two parts, with the resistance R2 and capacitance C2 representing the base layer, the alumina layer containing holes being marked with R0 and C0, and the total reactance of this unit also includes the influence of the variable resistor R1, which is determined by the water content absorbed on the hole wall.



Dewpoint - signal curve

Sensor signal measurement

The signal generated by the sensor is processed by the most advanced digital circuit based on a low-power microprocessor. In the first stage, the signal is amplified; in the second stage, the low-frequency noise is eliminated; in the third stage, a high-frequency filter is used to compensate for the signal output changes caused by environmental temperature changes. So the measurement is a very stable signal. Amplification circuit interfaces are designed to have maximum resolution without increasing errors due to inaccurate summation of electronic components. Circuit design minimizes electronic noise. The amplifier circuit is physically close to the sensor, thereby reducing contact with the electromagnetic "noise" of the external environment.

Sampling system

Moisture System Considerations

This section is offered as background information. There are several considerations in keeping your system at a stable and pure moisture level, free of contamination from ambient air moisture:

The integrity of the materials isolating the pure gas from the external air, including leaks from poorly secured fittings.

The backflow of moisture through the exhaust outlet, the exhausts of both the analyzer and the user system under measurement should be considered.

The effects of temperature on the equilibrium of moisture and the surrounding materials, often observed as diurnal cycles in the measurement.

Integrity of the Materials of the User's System

Before considering the materials of a system where a specified dewpoint level must be maintained, one should review two concepts.

Compared to the structure of solids the water molecule is much smaller. This is true compared to even the crystalline structure of metals but especially important in the polymer structure of plastics.

Water vapor pressure in gasses obeys Dalton's law of partial pressures, which states that the overall pressure of a gas is the sum of its constituent gases. And each gas seeks to equilibrate its pressure across gradients of only its own gas pressure.

Let's consider air in a pipe at a total pressure of 100 psia, which has been dried down to -40°C dewpoint. The partial water vapor pressure in the pipe is 0.13mB. If the ambient temperature is 22°C with relative humidity of 30%, then the partial water vapor pressure in the surrounding atmosphere is 7.9mB or approximately 60 times great er than the partial water vapor pressure in the pipe. Thus even though the total pressure in the pipe is much greater that the pressure outside, the reverse is true for the water vapor pressure, and as we discussed earlier the water vapor seeks to equilibrate its pressure thus it "wants" to flow from the outside to the inside and will do so through the cracks in the joints, as well as through the walls of pipes tubes and other vessels.

The integrity of the system is extremely important in maintaining a stable low dewpoint; for dewpoints below -60°C always use stainless steel or PTFE, while for higher dewpoints you can use copper or galvanized steel; but never use rubber, Tygon, Nylon or other plastic or tubing. Pressure regulators often use rubber diaphragms, check and if necessary replace with a stainless steel diaphragm regulator. Filter bowls should be stainless steel or glass, plastic bowls should be avoided. If a flow meter is placed at the inlet of the analyzer it should have a glass tube and be rated for the expected pressure levels, however in general it is best to place flow meters at the analyzer exhaust.

Another material consideration relates to materials sealed in the system such as paper filters; these may not contribute to leak s but will greatly slow down the measurement because they will adsorb and desorb water molecules as the system dewpoint is changing.

Moisture Backflow Along the Walls of the Exhaust Tubing

The linear velocity of gas flowing in a tube is close to zero immediately along the wall of the tube. This coupled with the previously discussed “need” for the moisture to flow from the higher water vapor pressure to the lower one, allows for water molecules to flow against the flow through the exhaust outlet into the sampling chamber of th e analyzer. The fact that water molecules are highly polar further enhances their ability to migrate against the gas flow at the sampling chamber outlet. To prevent this backflow of moisture from influencing the measurement, the analyzer should have at least 12” in length of 1/8” dia. stainless steel tubing at its exhaust port, and a minimum flow of 2 SCFH (1SLPM) should be maintained; higher flows will produce faster equilibrium time and thus are desirable for quick measuring.

Temperature Dependant Equilibrium

The effect of ambient temperature on the gas partial water vapor pressure of a system can change the moisture content of the gas. This is not the temperature sensitivity of the measuring analyzer, rather the actual change of partial water vapor pressure in the user’s system due to increase in ambient temperature and thus the increase of energy of the water molecules on and in the walls of the system (tubing, vessels et c…). A typical example would be the observation of a daily cycling of the measurement in a system with tubing or other components exposed to direct sunlight. During the day as the sun transfers energy into the system , the dewpoint will appear to increase, while at night the dewpoint will appear to decrease. There may be other reasons for this daily dewpoint cycling such as the effect of sun / temperature on the efficiency of gas dryers etc.
It is possible to minimize this effect using sun shields and tubing insulators. Alternatively one may study the response of the particular system to ambient temperature, by logging data over several days during different seasons, and compensating the measurements for this effect. The temperature effect will vary greatly depending on the size and materials of the system, for example stainless steel walls will have a much smaller effect than brass or copper walls.

Sampling technique

Sample extraction

Sample extraction brief description: the function of extracting the required sample flow from the sample sampling point of the process source or the sample sampling point of the pollution emission source is called sample extraction, also known as sampling or sampling. The extracted sample stream should be representative and truly reflect the composition and nature of the source stream.

Classification of sample sampling: the requirements for sample extraction vary with the working conditions of the sampling points of the process source fluid. According to the pressure at the sampling point of the source sample, the sampling can be divided into positive pressure sampling (including high pressure and medium low pressure sampling) and negative pressure sampling (including micro positive pressure sampling).

No sampling pump is required for positive pressure sampling, but care should be taken to adjust the sample pressure reasonably to meet the sample handling requirements. Negative and micro positive pressure sampling must be equipped with sampling pumps to extract the sample flow to provide the driving force of the analyzer sample flow.

Sample transport

Sample transfer brief the function of transferring a sample stream from a sampling point to an online analyzer is called sample transfer. According to the characteristics of sample flow, suitable sample transmission pipeline should be selected and reasonable heat tracing and temperature control measures should be taken for the transmission pipeline.
Sample transmission requirements:

(1) the transmission lag time is generally from 20 to 30S and should not exceed 60S at most. The distance from the analyzer to the sampling point should be as short as possible (less than 15M is preferred), the volume should be as small as possible, the sample flow rate should be as fast as possible, 1-3l/min is advisable.

(2) under the allowable flow of the analyzer, if the lag time exceeds 60S, a fast loop system shall be adopted.

(3) the distribution tube from the sampling point to the analyzer should be bent as far as possible, elbows and corners should be minimized, and the dead volume should be as small as possible.

(4) for gas samples containing condensate, the transmission pipeline should maintain a certain slope (greater than 5°C), the lowest point is close to the analyzer, and a condensate collection tank should be provided.

(5) prevent phase transition. During the transmission process, the gas sample should remain completely gaseous and the liquid sample should remain completely liquid.

(6) the sample pipeline shall avoid passing through the extreme temperature change zone, which may cause uncontrolled changes in the sample conditions.

(7) there shall be no leakage in the sample transmission system to avoid sample leakage or ambient air infiltration.

The sample processing

Sample processing is the removal or alteration of the obstructing and interfering components of the sample stream. The physical and chemical properties of the sample stream are changed by the sample processing system, but the components are not changed, so as to meet the control requirements of the on-line analyzer.
Basic functions and requirements of sample treatment: the basic functions of sample treatment are dust removal, dehumidification, sampling pump and pressure flow regulation. The sample treatment scheme should be determined according to the process composition conditions of the sample flow. The special obstacle and interference components in the sample flow need special treatment measures.
Sample discharge: a sample discharge is a system that connects an outlet of an online analyzer or a point of a sample processing system to the discharge point. Attention should be paid to meeting the discharge requirements of the exhaust gas outlet of the online analyzer.
Poisonous, harmful, inflammable and explosive waste gas should be discharged with special attention to safety, and should be discharged after environmental protection and safe treatment if necessary. Special measures, such as reflux sampling techniques, are required for the return of waste flow of recycled samples to the process pipeline.

Sampling pipeline

The sample transfer line is the line that transfers the sample from the sampling probe to the sample processing system or analyzer. Such as the common stainless steel pipeline, special environment of the electrical tracing pipeline and steam tracing pipeline.
The pipe and fittings for sample transmission

(1) metal materials: common metal materials include carbon steel, stainless steel, special steel and synthetic gold materials, among which austenitic stainless steel is the most widely used. Austenitic stainless steel mainly includes types 302, 304, 316 and 316L.Type 304 and 316 stainless steel materials are most widely used, the maximum operating temperature of 304 stainless steel material piping is 538°C, the maximum operating temperature of 316 stainless steel material piping is 649°C. Other stainless steel materials include high strength stainless steel and martensite stainless steel. Stainless steel piping can be used in general conditions, corrosion resistance, low pressure and high pressure situations.

(2) plastics: the commonly used representative plastic materials are Nylon, polyamide, Teflon, polyvinyl chloride(PVC), polypropylene (PP), polyethylene (PE), etc. Teflon is one of the most commonly used tubes in the sample processing system. It is further divided into: tetrafluoroethylene (TFE), ethylene propylene fluoride (FEP), perfluorocarbon oxide resin (PFA), polytetrafluoroethylene (PTFE). The maximum temperature resistance of teflon material piping of general grade reaches 204°C. Different teflon materials have different permeability of various gases under normal pressure. Special attention should be paid to microanalysis.

(3) elastomer material: mainly refers to synthetic rubber, natural rubber and similar natural rubber materials. When selecting rubber materials as sealing materials, the system should pay attention to its tolerable operating temperature and chemical stability.

Pipes and fittings

Pipe and Tube

Pipe diameter is usually 15~1500mm (1/2~60in). Nominal diameter DN is adopted to represent Pipe diameter specification. Pipes, flanges, valves and joints of the same nominal diameter can be connected to each other. The connection mode is flange connection, thread connection or welding connection. Pipe is often used in process piping and utility piping.

Tube diameter is usually 3~12mm (1/8~1/2in). Outer diameter OD is adopted to represent the diameter specification of the Tube. The Tube wall is very thin. The Tube is used for the measurement line of the instrument, the start signal line, the sample line of the online analyzer, and the connection line inside the sample processing system.

Connection mode of pipe and fittings

(1) bayonet connection: it is used for connection of joints and tubes. It is connected and sealed by the compression force of circular annular clamps.

(2) screw type connection: it is used for connection of connector, instrument, auxiliary equipment, etc. There are two kinds of thread commonly used.

A. Taper pipe thread: NPT thread (60° dental Angle) and BSPT thread (55° dental Angle). Taper pipe thread with a certain degree of taper (taper Angle 1°47'), the more the more tight, using its own deformation can play a sealing role, known as the “pipe thread sealed with thread”. In practice, sealant should be added, such as PTFE belt to prevent leakage.

B. Cylindrical pipe thread: Straight thread (60° dental Angle) and BSPP (55° dental Angle) are available. Cylindrical pipe thread without taper, is a straight pipe thread, itself has no sealing function, known as “ non-thread sealing pipe thread”, when connected by gasket (gasket) to achieve sealing.

Sample handling system

An online sample processing system is a system that connects one or more online analyzers to one or more sources, discharge points, and utilities.
Sample processing system to be adapted to the different requirements of online analysis is put forward, through the optimization of technical solutions, to ensure that the analyzer in the shortest time lag and the best condition (temperature, pressure, cleanliness, velocity), the measured samples analysis, to obtain representative sample processing system must ensure that the online analytical analysis of the conditions of the sample.
The sample processing system shall meet the basic requirements of the on-line analyzer for samples, and the temperature, pressure and flow of sample gas entering the analyzer shall be within the specified working range of the analyzer. The sample processing system should handle or remove the interfering components and corrosive substances in the sample, so as to ensure the normal operation of the analyzer.

Pump, pressure, flow regulation

Pump

Sample pump (also known as sampling pump, sampling pump) is an important part of sampling online analysis sample processing system. For the sampling system, when the sampling pressure ≤0.02Mpa, the sample pump should be used. The pumps used in the sample processing system include diaphragm pump, jet pump, bellows pump, electromagnetic pump, piston pump, centrifugal pump, gear pump, peristaltic pump and other types. Diaphragm pump and jet pump are the most commonly used sample handling systems. Sample pressurized discharge commonly used electromagnetic pump, piston pump, centrifugal pump. Peristaltic pump is commonly used in gas-liquid separation system instead of gas-liquid separation valve to isolate and drain liquid.

When sampling pump extracts samples, it will compress the sample fluid, and compression is also a heating process. Therefore, when the sampling pump increases the sample pressure, the sample temperature will also increase. The temperature rise of the sample will not affect the detection of the analyzer in general. If the transferred sample may react in the pump due to compression heating, or generate compounds due to pressure increase and compression heating, the phase state of the sample will change, which will seriously affect the accuracy of the analysis value.

Online analysis system of sample sampling pump preferred diaphragm pump. Some special requirements of the use of jet pump, such as in explosion-proof occasions, or when the need to jet pump high temperature steam sample processing.

The selection of the pump should meet the use requirements, the corrosive samples should win the corrosion resistance pump, high temperature pump, explosion-proof occasions must choose explosion-proof sampling pump. Sampling pump selection and use requirements are as follows.

(1) determine the pumping volume of the sampling pump according to the length and specification of the sample transmission pipeline, the required response time, the pressure and flow rate of the sample, etc. The pumping volume of the sample pump in the online analysis system is mostly 4~6l/min.

(2) the sample pumping flow rate is related to the sample inlet temperature and pressure of the sample pump, and the negative pressure of the pump inlet shall not exceed the pumping capacity of the pump.

(3) the condensate and dust content of the gas sample will affect the work of the pump, and the viscous liquid will also affect the driving device of the pump.

(4) the material directly in contact with the pump head of the sample pump and the sample should take into account the influence factors of chemical compatibility, physical compatibility, corrosion resistance, temperature and pressure. The electrical parameters of the pump match the electrical hazard level of the installation position.

(5) during the use of the sample pump, it is necessary to pay attention to the dust, water, corrosiveness, sample temperature, negative pressure and other factors of the inlet sample gas. When it does not meet the requirements, it is easy to cause damage to the sample pump.

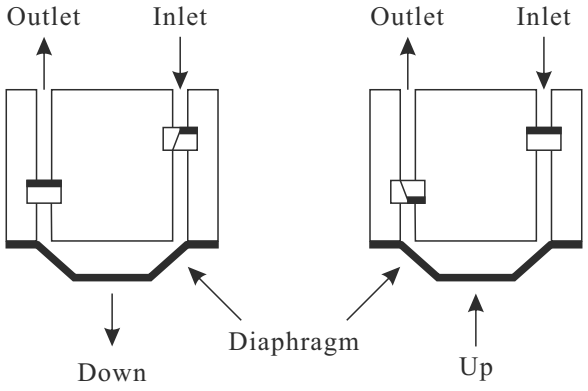
(6) the vibration of the pump will have a bad effect on the analysis system, and independent supports and flexible joints should be used for isolation.

(7) the sample pressure pulsation caused by the action of the pump may have harmful effects on the analyzer and the pressure reducing valve.

Diaphragm pump working principle and operating requirements

The diaphragm pump consists of a piston and the attached flexible diaphragm. Increase and decrease the volume of the pump chamber by positioning the inlet and outlet check valves, forcing the sample fluid to flow in only one direction. As the diaphragm moves downward, the volume of the cavity increases, the inlet check valve opens and the outlet check valve closes, allowing the process fluid to enter the cavity. When the diaphragm moves upward, the cavity volume decreases, the inlet check valve closes, the outlet check valve opens, and the process fluid is discharged from the pump.

The flow rate of the diaphragm pump can be controlled by: installing a throttle valve in the discharge line of the pump; Or between the suction valve and the discharge valve of the pump, a bypass line with a needle valve is connected in parallel; It is also possible to design a bypass release loop to control the flow after the pump. In most applications, the use of bypass needle valves to control flow or bypass release loop schemes are more appropriate.



Diaphragm pump

Principle and application of jet pump

Jet pump is also known as jet pump, extraction principle is venturi principle, jet pump is also known as venturi suction device, is a use of high-speed second fluid (water, air or steam, also known as working fluid) in the venturi tube produced by the low pressure to sample suction out of the device.

The jet pump is small in size, simple in structure and low in failure rate. As long as the sample flow of the gas phase does not contain large particles or has a large content of particles, and the pressure and temperature of the sample flow are constant, the jet pump can provide a mixture flow composed of sample gas with a known ratio and a stable ratio to meet the flow requirements of the analyzer.

Sample flow measurement

(1) rotor flow meter: rotor flow meter is a commonly used flow measurement device in the online sample processing system for analysis. It can directly measure the flow by observing the float at the corresponding scale position of the flowmeter.
Rotor flow meter, also known as float flowmeter, is commonly used in the measurement of low volume velocity. Its hammer shape round tube material has glass and metal two kinds, float material has stainless steel, copper, aluminum, plastic and precious stone, float shape is a typical spherical or cylindrical body with conical shape. Float materials have different densities and can be used to measure gases or fluids of different densities.
When the gas or fluid enters the rotor flow rate, the float begins to rise until the space between the float and the inner wall of the conical tube is large enough for the gas to flow freely, and the float ceases to rise. The rotor flow meter is affected by temperature and pressure changes, and only when the outlet pressure of the flowmeter is the same as the pressure when the flowmeter is calibrated can the reading be accurate.

(2) electronic mass flowmeter: the electronic mass flowmeter measures the flow through the flow sensor. The flow sensor is measured by the wheatstone bridge, which consists of two adjacent temperature sensitive coils outside the capillary tube, one measuring element and the other reference element. When the gas flows through the sensor, part of it flows through the capillary tube. The heat conduction of the flowing gas causes the measuring coil to cool, making the measuring bridge unbalanced, thus producing an electrical signal proportional to the flow rate. This signal is amplified and linearized and converted into 0~5VDC signal output.
The electronic mass flowmeter does not depend on the pressure in essence, but is determined by the heat conduction of gas.

Pressure regulation

The pressure reducing valve should be set according to the flow pipe pressure for positive pressure sampling analysis. When the sample pressure of the process pipeline is greater than 1MPa, the root valve must be set to relieve pressure at the sampling point. High-pressure gas with the sample pressure greater than 6MPa must use the root valve with heating. When the sample pressure is larger than 0.02mpa, or the sample pressure can ensure the flow required by the analysis system, direct sampling can also be taken. In order to ensure the pressure control valve inlet pressure requirements of sample processing, direct sampling shall be taken when the sample pressure is greater than 0.1mpa.For the micro positive pressure and negative pressure of the sample pressure lower than 0.02mpa, sampling method should be adopted. In the actual application process, sampling pump should be used when the sample pressure is also relaxed to the micro positive pressure of 0.01mpa.

Notes for pressure regulation:

(1) high-pressure gas (above 6MPa) : the pressure of high-pressure gas is low after reducing pressure through the pressure reducing valve at the root, and the volume expands. The process of reducing pressure and throttling the expansion of the gas will cause a sharp drop in the gas temperature. When the pressure difference before and after decompression is large, the sharp drop in temperature may lead to the condensation and precipitation of some sample components, and the moisture in the surrounding air may freeze on the pressure reducing valve and cause failure. In order to ensure the safety of the analyzer, the sample transmission pipeline after high-pressure gas decompression should be equipped with explosion-proof sheet protection before entering the analysis system to prevent the analyzer from being damaged by sudden changes in pressure.

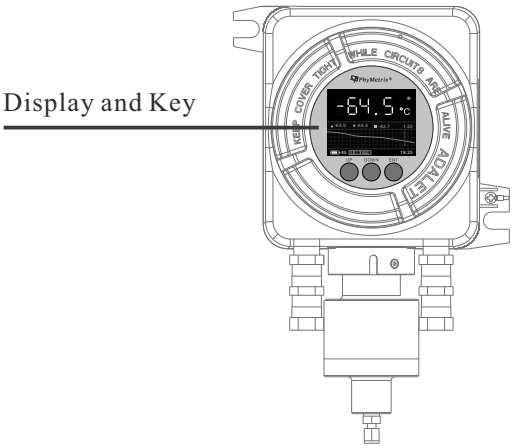
(2) of the installation and the use of the pressure reducing valve need to conform to the requirements of the safety regulations, especially in the application of high pressure reducing valve, shall comply with the rated pressure range of use, and should take appropriate overvoltage protection, pay attention to the working temperature allows for the use of high pressure reducing valve, should choose high temperature resistant material in high temperature situation (such as seals, using high temperature resistance of fluorine rubber) or stainless steel diaphragm, etc.

(3) the selection of decompression regulating valve should be noted: valve specifications, structure, rated inlet pressure, outlet pressure, working flow characteristics, accuracy, inlet pressure loss, throttle aperture, full open velocity and response speed.

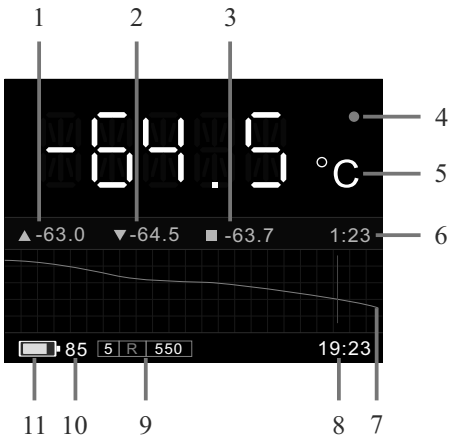
3 Operation and Debugging

Display and keys

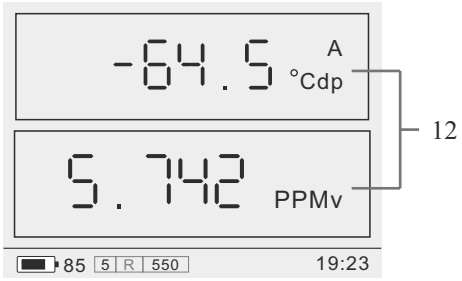
The display control unit of the analyzer is presented through a circular window in the case.
Operation is achieved through a unique system, using capacitive touch normal mode (electrostatic mode) : interactive operation is completed by bare hand touch. The system allows full control through the glass of the housing cover. The cap must be fully secured during normal operation of the instrument.



Display



Display Mode 1

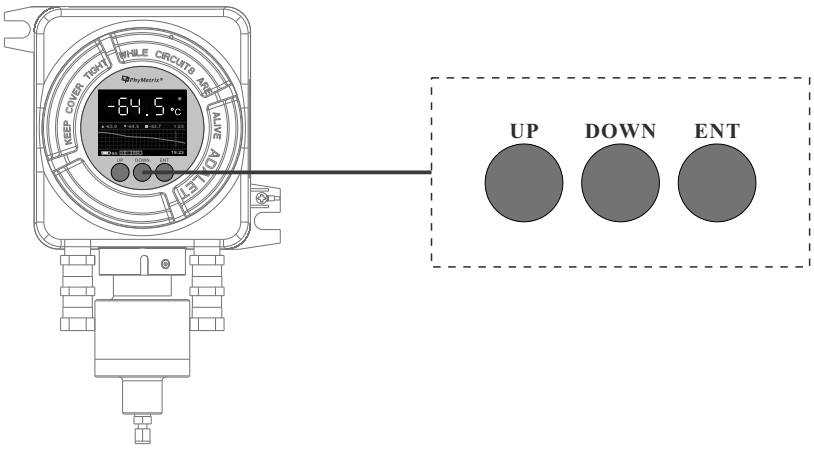


Display Mode 2

1	Maximum value in the curve	2	Minimum value in the curve
3	Average in the time	4	Value indicates stability
5	Dew Point	6	Time of Curve
7	Dew Point Curve	8	System time
9	Storage	10	% of Power
11	Battery	12	Other display information

NOTICE
10 % of Power,11 Battery 12 Other display information: In display mode 2, press UP or DOWN (3S) to select the different unit. Press INT to confirm. The information available for display includes: $^{\circ}C_{dp}^{A}$ (dew point under atmospheric pressure), $^{\circ}C_{dp}^{P}$ (dew point under other working pressure), °F, psia, PPMv, PPMw, RH(%), μB, mg/m^3, Lbs/mmscf.

Keys

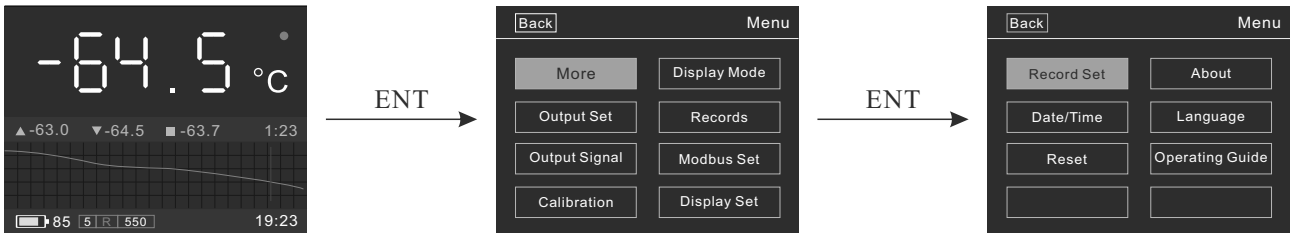


	UP	Up / Value+, Change theme,
	DOWN	Down / Value-, Clear the curve
	ENT	Menu (1S), Start / stop recording (3S)

NOTICE
Sleep mode: the backlight of the display screen is turned off to enter the energy-saving mode (no key operation within 5 minutes). Wake up in sleep mode: press any key to wake up. ON / OFF the analyzer: UP+DOWN+ENT three keys are pressed at the same time (it is valid when the battery is selected). When the shell screw cap is not fully fastened, the screw cap glass may not have normal contact with the key, and there may be no response to the operation through the glass. After installation, the user needs to confirm that the screw cap must be fully secured.

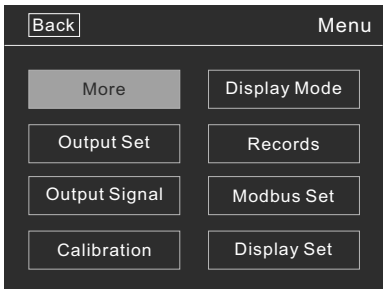
Menu

The analyzer is equipped with a 3.5"LCD display screen, which is intuitive to display. The menu is a graphics-guided UI, which supports chinese or english switching and provides multiple display parameters. After the user's installation and wiring inspection, the analyzer can be operated with electricity. After the power is switched on, the measurement interface will be automatically entered. The user uses the UP/DOWN/ENT key for debugging.



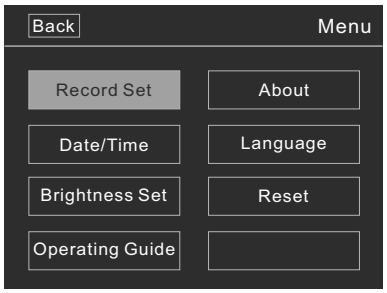
Display interface　　main menu　　submenu

Main menu



More: inter submenu
Display model: change display model
OutputSet: alarm and signal range
Records: data storage
Output signal: signal type
ModBus Set: RS485 parameter settings
Calibration: calibrate submenu
Display Set: curve display set
Back: return to previous menu

Submenu



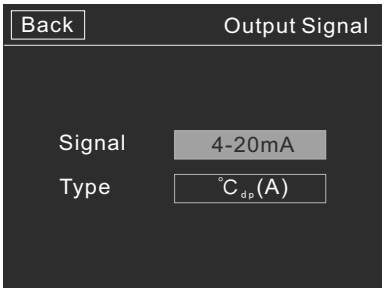
Record set: data record interval, delete data, etc
About: analyzer information
Time Set: adjust system time
Language: Chinese / English
Reset: Restore the factory settings
Operating Guide: Operating Guide and Cautions
Reset: Restore the factory settings

NOTICE
The main menu contents may be different from your products, please refer to the actual operation of the product.

Operation

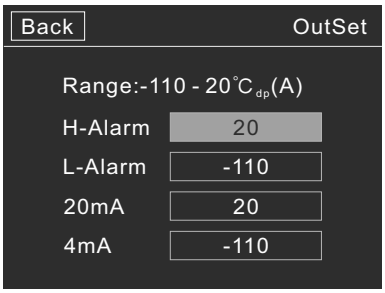
Output signal

The user can choose the type of analog signal output according to the actual working condition, which must be consistent with the type of PLC/DCS signal acquisition port. The type of analog signal output provided by the analyzer is as follows:
4~20mA (default , HART support), 0~20 mA,0~24 mA
0~5V, 0~10V (option)
When the output signal is a current signal, the load resistance is required to be less than 500Ω. When the output signal is a voltage signal, the load resistance is required to be greater than 10KΩ. The user selects the output signal option from the main menu and then enters the output signal sub-menu.



Signal: analog signal type
Type: Engineering Units

Output signal setting



Range: range of analyzer
High alarm: High alarm signal output
when higher than the set value
Low alarm: low alarm signal output
when lower than the set value
20mA: the upper limit of measurement
when the output is 20mA
4mA: the lower limit of measurement
when the output is 4mA

Analog Output vs Dewpoint

The current output of the analyzer, varies with the measured dewpoint. To use the current to calcu-late the value of the dewpoint measurement, one must know the settings of the low and high ends of the analog output range, then:

D=(I-Z)*(H-L)/S+L

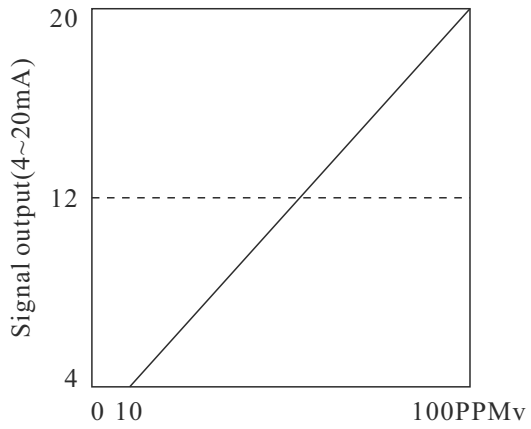
I = current supplied by analyzer analog output in mA.
Z = value of zero output of current loop in mA: for 4/20 = 4, for 0/24 = 0.
H = value of High end of Analog Output range, converted to selected engineering units
L = value of Low end of Analog Output range, converted to selected engineering units
D = dewpoint measured by instrument in selected engineering units.
S = span in mA of current loop output: for 4/20 = 16, for 0/24 = 24.

For example a unit with factory default settings, supplying 12mA is computed to be measuring a dewpoint of -45°C:
(12-4)*(20-(-110))/16+(-110)=-45

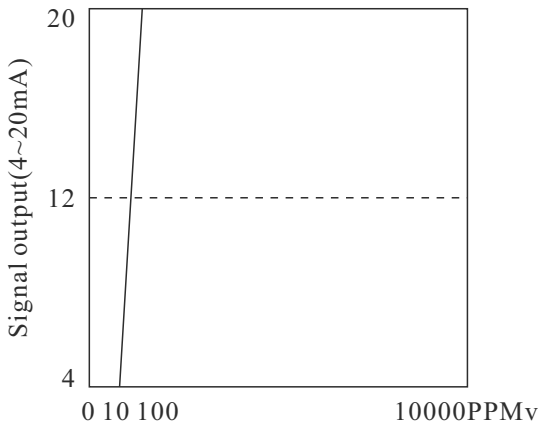
NOTICE
The current is linear to the selected engineering units.

In general, if the dewpoint is monitored in °C or °F, there is no need to change the factory default -110°C to +20°C settings, because the 4-20mA provides sufficient resolution to measure the out-put better than the specified accuracy of the sensor.

When the monitoring unit is PPMv, Lbs/ MMSCF or mg/m3 and other units, the user needs to adjust the upper and lower limits of measurement corresponding to 20mA and 4mA, so that the current in the output loop changes about 10mA.
For example: user detection range for 10 ~ 100 PPMv, user Settings of 4mA, 20mA, the corresponding measurement range of 0 ~ 10000 PPMv, in 10 ~ 100 PPMV detection range, variation of output current is too small, in most applications display value measurement and the output of the inherent not one-by-one correspondence, bring greater difficulties brought signal acquisition, cause greater error systems. In this case, the measurement range corresponding to 4mA and 20mA is set as 0~100PPMv. Within the detection range of 10~100PPMv, the variation range of output current is relatively broad. It is good for the detection of PLC/DCS signal acquisition port.



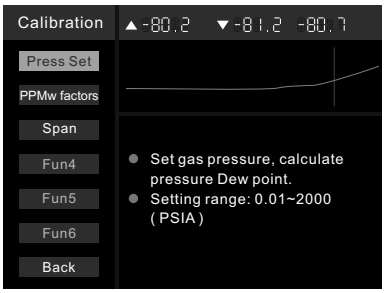
Set: 0~100PPMv, Detection range: 10~100PPMv



Set: 0~10000PPMv, Detection range: 10~100PPMv

Calibration

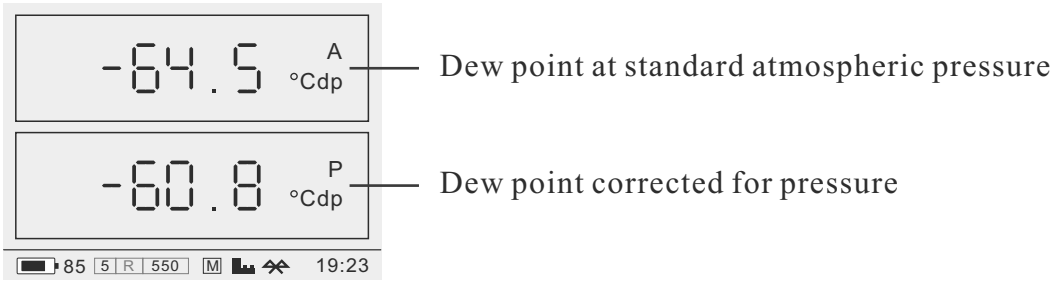
Users can enter the analyzer calibration submenu through the main menu calibration option.
This analyzer includes pressure setting, PPMw factors setting, span calibration, air calibration, user can carry out analyzer calibration according to the way we suggest.



Calibration Submenu

Pressure setting

The pressure is set as the gas pressure correction, and the user can get the dew point value under the corresponding pressure parameter by entering the gas pressure value.
The range can be set to 0.01Psia-2000Psia, and the analyzer default is 14.69 Psia, that is, a standard atmospheric pressure.
In display mode 2, press UP or DOWN (3S) to select the different unit. Press INT to confirm.



PPMw factors

allows the user to select the method of PPMw computations.
The user can select measurement in gas and the molecular weight of the gas or measurement in liquid and henry' constant associated with the liquid.

Span calibration

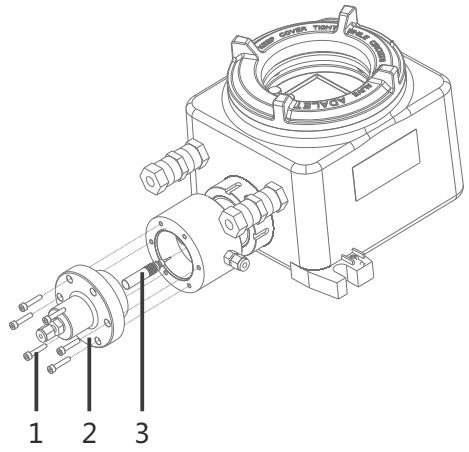
The span calibration is based on the current calibration range of the standard gas humidity. The user can calibrate the device by accessing a gas with a known water content. The range is determined by the moisture content of the current gas.

Sensor Replacement

The Al2O3 sensor is designed to be highly reliable, robust and maintenance-free, and has been proven in field use. But almost all sensors are present when drift and temperature drift. Since the humidity sensor must be in contact with water vapor in the gas, it cannot be sealed. This determines its stability and life is limited. Under normal use, the calibration cycle of the sensor is 1 year and the service life of the sensor is more than 5 years.

The following conditions may seriously affect the service life of the sensor:
Expose sensors to corrosive gases such as chlorine, ammonia, hydrogen chloride, etc.
The sensor is exposed to liquid water.
Blow air directly at the sensor, causing condensation water to damage the sensor.
Install sensors next to heat sources, such as radiators and air-conditioning ducts.
Install sensors in places of intense mechanical vibration and shaking, and if unavoidable, use elastic fixtures.
Remove the filter from the sensor.
Possible contaminants (e.g. oil, liquid water).

Mechanical shock and vibration may affect the inner structure of the sensor and so should be avoided. Temporary fluctuations in the sensor's output signal may result due to shock and vibration. Depending on the severity of vibration or shock imparted on each oxygen sensor, the signal may recover to its original state after the sensor is kept motionless in normal operating temperature. If the mechanical shock or vibration is great, an irreversible change in the output signal may occur due to structural damage within the sensor. Shock absorbing measures should be used to protect the sensor during transportation or when used for applications in where shock or vibration is likely to occur.



1	Hexagon socket head cap screw M4*16
2	Sealing cover
3	Sensor

⚠ **WARNING**

The analyzer must disconnect the power supply before replacing the sensor.
Beware of static electricity (ESD protection).
If the instrument measures moisture in toxic or flammable or explosive gases, replace the remaining gas in the analyzer with a safe sample gas before replacing the sensor.
If high pressure gas is being measured, make sure the sampling system has been de-pressurized before installing or removing components such as sensors.
A desiccant is placed in the protection cylinder of the sensor to ensure that the sensor is dry during transportation and avoid the condensation water from damaging the sensor.
Do not remove the sensor from the cartridge unless it is about to be installed.
After the sensor is taken out, the protective cylinder of the sensor should be closed quickly to avoid the decrease of drying performance.
Keep the sensor protection cylinder for use when returning to the factory for verification and transportation of sensors.
To avoid prolonged drying time (when the measured gas dew point is below -65°C), do not expose the sensor to air for more than 2 minutes.
Replace the sensor and check the tightness after connecting the sampling pipeline.

4 Maintenance

Using cautions

Notes for use of online dew point analyzer

When the online dew-point analyzer is used, the influence of field background gas and working environment on the instrument analysis process must be considered, and the influence can be eliminated or reduced by various methods.

(1) Pollution: the sample must reach the standard of clean gas, liquid particles and pollutants affect measurement, especially influence the reaction time, in order to improve the measurement and prolonging the life of the sensor, must remove the pollutants in the samples, to ensure that the sampling parts are with the right material, avoid using paper or other fiber filter core, using stainless steel instead.
For example, if the dew point is below -50°Cdp(39ppm), avoid using plastic filter cores and use stainless steel or tempered glass instead. When the analyzer is used in other locations, ensure that highly hygroscopic contaminants (natural gas is dried using triethylene glycol) do not enter and form a membrane on the sensor, they will disturb the balance of the sensor system and greatly affect sensor measurements and response times. Drain liquid from the filter element.

(2) pressure: pressure changes affect the measured value, higher pressure is more likely to produce condensation, resulting in incorrect readings, and even damage to the sensor. If sampling pressure needs to be reduced, suitable pressure relief devices, such as stainless steel needle valve or pressure regulating valve with stainless steel diaphragm, can be used. Ensure that the joule-thomson effect is not colder than the hydrocarbon and dew point temperatures.

(3) piping: ensure that all connecting pipes are made of materials suitable for low dew point measurement, e.g. stainless steel or teflon pipes, do not use rubber pipes. Check for leaks after connection. A flow meter is a source of water into the system, especially if it has a plastic pipe; The flowmeter is connected to the air outlet of the analyzer, not the air inlet, however, the metering valve should be in the air inlet to maintain a constant pressure in the sampling chamber.

(4) compactness: in order to keep the dew point stable, consider the material of the sampling system first. Compactness of system to maintain a stable low dew point is very important, for example, dew point lower than 60°C, always use a stainless steel pipe or PTFE tube, high dew point measurement, can use copper or galvanized steel pipe, but you must not use plastic or rubber hose, rubber diaphragm pressure regulator often use, it is recommended to use stainless steel diaphragm valve, filter filter using the material of stainless steel or tempered glass, avoid using the plastic filter. If the flowmeter is placed at the inlet end of the analyzer, the flowmeter has a section of glass tube material, and there is a flow rate according to the required pressure, it is better to place the flowmeter at the exhaust port of the analyzer.

Another material factor is the tightness of the material structure of the system, such as paper-core filters, which, although they do not contribute to leakage, make the measurement time very slow because they will adsorb and release water molecules, causing the dew point of the system to change.

(5) temperature: the environment temperature influence the water vapor partial pressure of system, change the humidity of the gas content, this is not a analyzer measurement is sensitive to temperature, due to environment temperature, the kinetic energy of the water molecules, thus increasing the system pipe wall in water vapor partial pressure in the system to a certain extent, the actual change (tube, container, etc.). The temperature effect varies greatly with the material and size of the system. For example, the stainless steel tube wall has less effect than the brass or copper tube wall.

Troubleshooting

Measurement is dryer than is expected	
Likely Source of Proble	Analysis-Remedy
Equilibrium	Before concluding that there is an incorrect measurement, equilibrium? Use the mode 1 display and wait for equilibrium.
Sampling point	Consider if the sampling point could be dryer than the rest of the system? If necessary find a more appropriate sample point.
Damage, Corrosion Abrasion	Contaminants can damage the sensor abrasion. Remove contaminants from the sample and increase the filter element of stainless steel.
Needs recalibration	The calibration cycle may be shortened. Calibration cycle: 1 year(recommendation).

Measurement is wetter than is expected	
Likely Source of Proble	Analysis-Remedy
Equilibrium	Before concluding that there is an incorrect measurement, equilibrium? Use the mode 1 display and wait for equilibrium.
Sampling point	Consider if the sampling point could be dryer than the rest of the system? If necessary find a more appropriate sample point.
Condensation	Refer to the “Measurement is not changing”.
Damage, Corrosion Abrasion	Contaminants can damage the sensor abrasion. Remove contaminants from the sample and increase the filter element of stainless steel.
Incompatible materials in system with low dewpoint	The rationality and compactness of the material used in the sampling system. Replace inappropriate materials.
Leaks	Check for leaks around all interconnections. Tighten fittings. Repair the leaks.
Needs recalibration	The calibration cycle may be shortened. Calibration cycle: 1 year(recommendation).

Measurement is slower than is expected	
Likely Source of Proble	Analysis-Remedy
Equilibrium	The rate at which the system will reach equilibrium depends on the system particulars, such at ambient temperature, internal pressure, flow rates, system materials of construction, surface area of system internals. Previous experience may be indicative of the response time. It is common for systems to take hours to equilibrate.
Sampling point	Is the sampling point in the direct flow of the system gas, or is it at a dead end of the distribution system? Sample in the direct flow
Contamination	Are there hygroscopic contaminants? Install filters.
Out-gassing	Are there materials in the system that could be out-gassing? Replace the hygroscopic materials.
Leaks	Check for leaks around all interconnections. Tighten fittings. Repair the leaks.
Large diameter sampling tubing	Larger diameter tubing have larger surfaces. Use smallest practical tubing diameter, 1/4" recommended.
Low flow rate	Response time is normally greatly influenced by flow rate, but if the measurement value is influenced by flow rate there may be a leak. Flow rate should be greater than 2l/min.

Measurement has a daily cycle	
Likely Source of Proble	Analysis-Remedy
Thermally induced water vapor pressure change	The increase of ambient temperature increases the kinetic energy of the water molecules in the system, and the water vapor pressure in the system is changed to a certain extent. Use insulation to reduce the temperature. Record the data of several days in different seasons, and compensate the data of temperature impact measurement. The sampling line and filter are replaced by stainless steel.

Measurement is not changing, close to ambient temperature	
Likely Source of Proble	Analysis-Remedy
Condensation	Condensation may have occurred from a slug of water or from previous conditions where the gas dewpoint was greater than than the ambient temperature. Condensation typically accumulates in filter bowls or other low points in the system, Then evaporates and produces a high dewpoint. Drain the condensate and allow the system to dry down.

Help

If the measurement is suspected to be erroneous, before calling for support, it may be helpful to have the following information:

- Type of gas being measured.
- Expected dewpoint.
- Nominal pressure (consider back pressure).
- Nominal temperature.
- Nominal flow rate though the analyzer.
- Flow diagram or description of system, showing items and their materials of construction. Include materials of filer elements, regulator diaphragms, and valve seats.
- Possible contaminants (particulates, liquids, oil, glycol, cleaning solutions, etc.).
- Are the pipes and analyzer purged before measuring? How long? Flow rate? With the same gas that will be measured?
- If other equipment was used to verify the dewpoint, what is the equipment (include model number)? What is its specified measuring range? When was it last calibrated / certified?
- If using bottled gas for reference: Manufacturer? Content and accuracy markings? What is the pressure in the bottle at time of comparison? What is the ambient temperature where the bottle is stored? What are the materials of construction of the pressure regulator, especially the diaphragm?

Anti-interference measures

Source of disturbance

(1) interference components of samples: in the online analysis of non-measured components (i.e., background components of samples), all components that can produce non-negligible interference errors are interference components.

(2) measuring principle and anti-interference design of the analyzer: whether a non-measuring component is an interfering component or not should be analyzed according to the measuring principle, structural design and measuring range (range) of the selected analyzer, including whether effective anti-interference measures have been taken in the instrument design.

(3) sampling system: sampling for online analysis must be typical and timely. The selection of sampling points, the structural design of sampling probe and sampling port, and installation and construction will all affect the representativeness of sampling, and then involve the generation and change of generalized interference errors.

(4) sample processing system: in order to maintain the representativeness of the sample during the transmission and processing of the sample, the sample gas shall not have phase transition, dissolution loss, adsorption or release, infiltration or leakage.

(5) electromagnetic interference and electrical interference: in order to ensure the measurement accuracy of online analysis, electromagnetic interference of online analysis and electrical interference of online analysis system must be designed and handled with professional level.

Environmental conditions

(1) environmental vibration: avoid vibration in the installation environment, and install vibration damping if necessary.

(2) environmental humidity: most online analyzers are used in environments less than 45°C, and some are less than 40°C. When the analyzer approaches the temperature upper limit, the temperature influence error is large, or even the constant temperature is out of control, which makes the measurement accuracy difficult to be guaranteed. For engineering projects with ambient temperature over 40°C, it is necessary to take effective cooling measures in the analysis system, such as air conditioning system.

(3) humidity: the humidity should be no more than 80%RH, but in engineering application sites, especially in southern rainy season, the environmental humidity > 90%RH is not uncommon, which will lead to reduced electrical performance of electronic devices, reduced electrical safety performance of instruments and systems, or even unqualified.

(4) stay away from large production equipment with large electromagnetic interference: this is the most intuitive measure to avoid electromagnetic interference.

(5) avoid direct sunlight: avoid sharp temperature changes and increase the temperature error.

Electromagnetic interference and lightning protection

Anti-electromagnetic interference

Classification:

(1) voltage short interruption or drop: DCS and PLC allow interruption time less than 10~20ms.

(2) electrical fast transient pulse group: frequency range 1~100MHz, sometimes up to 300MHz, and its severity is expressed by voltage peak and repetition frequency.

(3) surge: the main source is the interference caused by lightning and switching transients of the power system, including voltage surge and current surge. The rising edge has fast changing speed, large transient power, high peak value and the greatest threat.

(4) static electricity: it has the greatest influence on CMOS devices, such as power frequency magnetic field, pulsed magnetic field, radio frequency magnetic field and conducting interference of radio frequency magnetic field induction.

Basic ways for anti-interference:

(1) signal isolator: in principle, serial signal isolator is required when the detection signals of the analysis system are uploaded to DCS, which can effectively reduce electrical interference and protect the DCS system.

(2) high-frequency electromagnetic radiation film: in some application environments with particularly high requirements for accuracy and stability, in order to deal with the impact of high-frequency electromagnetic radiation on the analysis system, the core analog sampling circuit or display screen of the analyzer can be affixed with high-frequency electromagnetic radiation film.

(3) grounding: the first role of grounding is to protect equipment and personal safety, such as protection, lightning protection, safety, anti-static, etc. The second is to suppress interference, that is, signal voltage or system voltage provides a stable potential reference point. Grounding technology focuses on grounding structure and grounding resistance value. The grounding of control system has been realized from independent grounding to equipotential connection by using common grounding grid.

(4) cable: flame-retardant copper core insulated wire is used for power cord. Core cross-sectional area: analyzer power supply, $\geq 0.75mm^2$, utility power supply, $\geq 2.5mm^2$. Signal wire: copper core multi-stranded polyethylene insulation, PVC sheath, flame retardant multi-core soft cable is preferred. The shielding mode is copper tape wrapping screen, copper wire preparation screen. For signals of 4~20mA, core cross-sectional area is generally $\geq 0.5mm^2$. Ground wire specifications: $\geq 2.5mm^2$, the grounding resistance is less than 3Ω.

(5) electrostatic shielding and electromagnetic shielding: use twisted pair of shielded cables to suppress the capacitive coupling and inductive coupling to noise in the signal transmission process. It is advisable to use twisted pair of cables with a stranding distance of about 50mm. In principle, one end of the cable shielding layer should be grounded while the other end is suspended. However, single-end grounding can only prevent electrostatic induction, and can not inhibit the invasion of lightning waves.

Lightning protection

Hazard forms of lightning strike to the analysis system:

(1) direct lightning strike: the lightning strike directly strikes the field instrument equipment or the pipeline connected with it, which usually damages the sensor module of the instrument and may damage the transmitter electronic circuit board. The strong inductive magnetic field generated by the lightning can coupling the signal transmission circuit to DCS and other electronic equipment, damaging the whole system.

(2) lightning shock induction: lightning shock induction is electrostatic induction. When the thunder cloud comes, the conductor accumulates a large amount of charge to produce discharge, discharge current if enter the field instrument and electrical equipment, cause equipment damage. Lightning current generates electromagnetic field around its channel and radiates electromagnetic wave outward. It is coupled to computer, instrument, field instrument and various metal conductors in the control room to generate induced electromotive force or induced current, causing equipment failure and damage to the control system.

(3) invasion of lightning over voltage: direct lightning strike or lightning induction may cause over voltage in wires or metal pipes. Over voltage may introduce high potential into the instrument system along various metal pipes, cable grooves and cable lines, causing interference and damage.

(4) countering: flashing lightning protection device, wiring equipment, introduced powerful lightning current moment, thunder and lightning charge can't discharge quickly to the earth, will inevitably cause local potential rise, instrument control system earthing and which do not have enough safe distance, between them will produce discharge, cause the counter current, can be directly breakdown with electrical insulating parts, can produce interference or damage to instrument control system.

Lightning protection measures for instrument system:

(1) lightning connection: as long as the direct lightning protection is realized by building lightning protection device, the field instrument system lightning protection and the surrounding equipment lightning protection measures instrument design.

(2) voltage equalization: when lightning strikes, the path of lightning transient current will generate a transient potential increase, resulting in a transient potential difference between the path and the surrounding metal objects. This transient potential difference exceeds the insulation tolerance strength between the two, which will lead to dielectric breakdown discharge. Eliminate lightning transient current path and disruptive discharge between metal objects, all field instruments can be metal shell, frame, the production of metal equipment, facilities, instrument control room equipment, components, and components of metal shell, metal facilities, together with the instrument grounding system connected to the control room to form a perfect equipotential connection.

(3) grounding: mainly floating and multi-point connection. Float means that the instrument works with the building grounding system to maintain insulation, the electromagnetic interference in the building grounding system will not conduct to the instrument system, the potential change has no impact on the instrument system.

However, the instrument shell should be protected by grounding. When the lightning is strong, there may be a high voltage between the electronic circuits inside the instrument shell, which will break down the insulation gap between the two and cause damage to the electronic circuit. Multi-point connection refers to the instrument, DCS, PLC and other equipment working ground and protection of the separate, the outstanding advantage of this grounding mode is that can be nearby grounding, wiring parasitic inductance small above two ways such as can not meet the needs of lightning protection, can consider the protection and work connected, access lightning strike system.

(4) shielding: shielding to block or attenuate electromagnetic pulse energy transmission is an effective protective measure. Lightning shielding includes control room shielding, field instrument shielding, signal line and power line shielding, etc. If the field instrument can use metal instrument box to realize lightning shield, instrument box and the field metal facilities to achieve equipotential connection.

5 Specifications

⚠CAUTION
The analyzer described in this manual is only used to measure the dew point of the gas. At the same time, the analyzer can also measure the temperature and pressure of the gas . If the analyzer is not used correctly or beyond the normal range of use, the safety of operation of the analyzer cannot be guaranteed, and the manufacturer will not be responsible for the damage caused thereby.

Function

Principle	Resistance and Capacitance dew point
System	Sensor, Electronic system, Display and Key

Input

Process variables	Dewpoint, Temperature, Pressure(option)
Range	Dewpoint: -110°C~+20°C Temperature: -40°C~+70°C, ±2°C Pressure: 0~300PSIA, ±1°C

Output

Analog output	4~20mA (default, option: HART) /0~20mA/0~24mA (<500Ω) Electrical isolation: Load resistance: <500Ω 0~5V/0~10V (>10KΩ) Electrical isolation: Load resistance: >10KΩ
Alarm	2 - way programmable SPDT passive alarm relay Contact capacity: 250VAC/5A, 30VDC/5A (resistive load) Malfunction or a power failure, it is in the “off power” state
Load	Reference Analog output
Electrical isolation	Input, output and power supply

Power supply

Power supply	100~240VAC, 0.3A, 50/60Hz 15～28VDC, 1A
Electrical connections	Reference Installation
Cable specification	Power/signal cable (input/output) : Cable diameter: 8~12mm Cable connection thread: 1/2 NPT
Cable laying	Reference Installation
Power consumption	AC: 60W DC: 24W
Power failure	The power supply loop shall maintain at least one power supply cycle: FRAM or NOR FLASH storage system, measuring data. At the last value determined, the accumulator stops
Potential balance	No necessary measures

Specifications

Accuracy	±2°C
Linearity error	≤±1%FS
Drift	Zero drift≤±1%FS, Span Drift≤±1%FS (24h) Zero drift≤±1%FS, Span Drift≤±1%FS (7d)
Resolution	0.1°C
Repeatability	0.8°C
response time	T90<10S°C (-60→+20°C), T90<10min (-20→-60°C) (25°C / 0.1MPa / 4SCFH)
Temperature stability	≤1%FS (5~35°C)
Pressure stability	≤1%FS (±3kPa)
Sensor life	>5 years
Calibration cycle	>1year
Calibration conditions	Under the condition of ambient atmospheric pressure and humidity control, temperature ±0.5°C NIST calibrations
Minimum maintenance cycle	>7 days

Operating conditions: installation

Installation guide	Refer to installation
Straight pipe	Inlet and outlet:>10CM
Maximum cable length	200m
Options	Protected Cable Sealing Join Battery

Operating conditions: environment

Environment	Temperature: -20°C~45°C Humidity < 80RH% Pressure: 80kPa~110kPa
Storage	0°~50°C (32~122°F), The optimum temperature is 20°C (68°F)
Protection class	IP65
Impact resistance	IEC 60068-2-31
Vibration Resistance	Maximum acceleration: 1g,10~150Hz, IEC60068-2-6
EMC	IEC/EN 61326

Operating conditions: sample gas

Temperature range	0~45°C
Pressure range	95~105Kpa
Pressure loss	Maximum 2mbar (0.029psi)
Flow	1~2l/min (recommended), 5l/min (limit value)

Mechanical structure

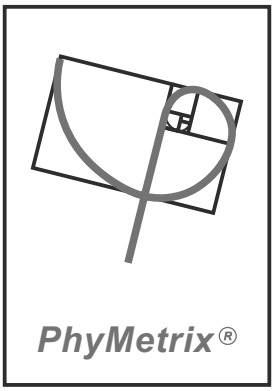
Dimension	355mm（H）*224mm（W）*172mm（D）
Weight	10Kg
Inlet and Outlet	1/4"Tube fittings
Material	Case: Cast Aluminum Sensor Cavity/Gas connect: 316L Stainless Steel

User interface

Display	3.5"LCD
Key	(UP/DOWN/ENT)
Unit	°C, °F, psia, PPMv, PPMw, RH, μB, mg/m^3, Lbs/mmscf
Language	Chinese/English
Remote Operation	HART/MODBUS RTU

Accreditation and Approval

Ex	Ex d IIC T4 UL 1203, CSA C22.2 No. 25 & 30 Class I, Groups B, C, & D, Class II, Groups E, F, & G, Class III UL 50 TYPE 4
Other standard	EN60529 Degrees of protection provided by enclosures (IP Code) EN61010-1 Safety requirements for electrical equipment for measurement, control, and laboratory use EN61326-1 Electrical equipment for measurement, control, and laboratory use-EMC requirements


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