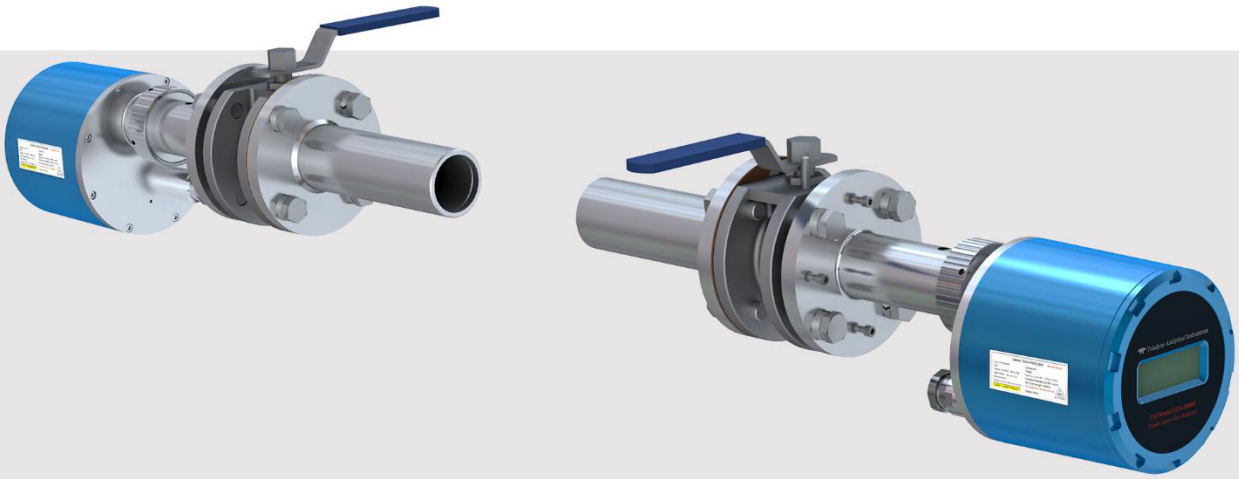
Teledyne Analytical Instruments

LGA-4000Z

Diode Laser Gas Analyzer



User Manual

Teledyne Analytical Instruments

DECLARATION OF CONFORMITY

This declaration of conformity is issued under the sole responsibility of the manufacturer

APPLICATION OF COUNCIL DIRECTIVE	**: 2014/34/EU**
STANDARDS TO WHICH: CONFORMITY IS DECLARED	**EN 60079-0: 2012+A11:2013 ; (IEC 60079-0 : 2011)** **EN 60079-1: 2014 ; (IEC 60079-1 : 2014-06)** **EN 60079-28: 2015 ; (IEC 60079-28: 2015)** **EN 60079-31: 2014 ; (IEC 60079-31: 2013)**
MANUFACTURER'S NAME	**: TELEDYNE ANALYTICAL INSTRUMENTS**
MANUFACTURER'S ADDRESS	**: 16830 Chestnut Street** **City of Industry, CA 91748** **U.S.A.**
TYPE OF EQUIPMENT	**: LGA-4000Z Diode Laser Gas Analyzer**
EQUIPMENT CLASS	**: Ex II 2 G D Ex db op IIC T6 Gb** **Ex tb op is IIIC T80°C Db Ta=-20°C to +60°C IP66**
MODEL NUMBER	**: LGA-4000ZA**

I, THE UNDERSIGNED, HEREBY DECLARE THAT THE EQUIPMENT SPECIFIED ABOVE CONFORMS TO THE ABOVE STANDARD(S) PER 2014/34/EU and have been type-approved by CML B.V., Hoogoorddereef 15, Amsterdam, 1101 BA, The Netherlands. CML notified body identification number: 2776. Mark: Ex II 2 G D. Code: Ex db op is IIC T6 Gb, Ex tb op is IIIC T80°C Db
EC Type Certificate Number: CML 18ATEX1399X
IECEx Certificate Number: IECEx NEP 18.0020X

SIGNATURE: Roger Starlin

FULL NAME: Roger Starlin

POSITION: QA Manager

Date: 2-20-19

PLACE: City of Industry, California

SIGNATURE: Angel Alegria

FULL NAME: Angel Alegria

POSITION: New Products Manager

Date: 2-20-19

PLACE: City of Industry, California

Special Conditions for Safe Use

The following conditions relate to safe installation and/or use of the equipment.

- The flameproof joint dimensions differ to the values listed in Table 2 of EN 60079-1, therefore, they shall not be repaired or modified by anyone other than the manufacturer.

- The stainless-steel screws used for receiver unit and transmitter unit fastening shall have a property class higher or equal to A2-70.

- Only the following shall be used with the entries of the equipment

Name:	Type:	Manufacturer:	Certificate No.
DQM-II Series Cable Gland	M25*1.5	WAROM Technology Incorporated Company	IECEx LCI 08.0011X
BPT Stopping Plug	M20*1.5 or M25*1.5	WAROM Technology Incorporated Company	IECEx LCIE 15.0070U

Contents

1 Introduction

1.1 User Notice

Thanks for choosing our product.

Please read this manual carefully before performing installation, wiring, operation, and maintenance. Please keep this manual properly for future reference.

The manual is addressed to technically qualified personnel who are specially trained or who have the relevant knowledge of instrumentation and control technology.

It is very important to know the safety information, warning information and technically correct operation. It is the precondition to ensure safe during installation, commission, performance and maintenance of this system.

If some unexpected problems or any details during installation, operation and maintenance are not described in this manual, please contact our technical team for more information or technical support.

All or partial products, services, or characters described in the manual may not include in your scope of purchase or application. Our company does not make any expression, statement or guarantee to the content of this manual, unless otherwise specified in the contract.

Again, we would like to express our gratitude to you for selecting this product. We apologize if the product you received is inconsistent with the diagram in the manual due to product improvement.

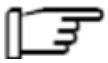
1.2 Marks Instruction

This manual provides you with information on system principle, parameters, usage, operation and maintenance about the device.

Pay more attention to all the special information and warnings, which is used to avoid the risk of personal injury in operating and property losses. The information is marked with the corresponding marks to provide useful tips and to avoid faulty operation. The terminology used in this manual and the information on the system has the following meanings:

Note:

Exposition, explanation or supplement for details during instrument operation.



Caution:

Important information needed to pay special attention when operating the product.

Warning:

Personal injury and property loss may result if proper precautions are not taken.

Danger

Tremendous personal injury and property loss will result if proper precautions are not taken.

1.3 Applicable Personnel

It may cause personal injury or property damage if any mal-operation is carried out on the product, or warning information is not followed. Therefore, only qualified person is allowed to operate the product.

The qualified persons who can understand the safety information described in this manual or indicated on the product are as follows:

- Professional instrument engineer who is familiar with technology and safety information of this product;
- Operator who has been well trained and has completely grasped the operation information described in this manual;
- Personnel who have received professional training according to the established safety measures.

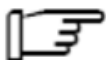
Note:

Relevant training & guidance will be provided for customers and related personnel after installation and debugging to ensure customer can use this product correctly and effectively.

1.4 Package and Transport

The transport scope of each part is decided by the effective contract described in the attached transport document.

Please follow the related instructions to open the packing case. After unpacking, timely check the articles according to the shipping list. In addition, please inspect if the articles received are deformed or damaged. Please properly keep the related documents for installation and operation. In the package, there is a Shipping List. When the content described in shipping list is inconsistent with the articles in the box, please contact us.



Caution:

Please properly keep the attached parts so as to avoid inconvenience like long maintenance time caused by the missing parts.

1.5 Precautions

In the operation, maintenance and repair process of this equipment, please obey the following general safety precautions.

- The equipment shall be well grounded.
  Correct grounding can reduce electric shock risk to the minimum.
- When the power is on, it is not allowed to do operations that might damage the equipment, including disassembling, assembling, debugging, pulling and plugging the connecting line. In order to avoid electric shock and equipment damage, before carrying out any operation, please take down the power cable and make sure electric energy of internal circuit is completely discharged.
- Don’t take the circuit board with bare hands, in case of damage arisen from static electricity.
- Use the protective tools.

During the operation process, the protective tools like high temperature gloves should be worn according to the practical demands, so as to avoid scalding or scratching hands.

If the safety precautions are not followed, or the warning on the specific matters described in this manual is not observed, it will violate the safety regulations on the design, manufacturing and purpose of this equipment.

Our company is not responsible for the damages caused by user’s nonfeasance.

1.6 Quality and Warranty

1) Within warranty period, we will provide free maintenance service for the damages involved in guarantee scope, including product maintenance, spare part maintenance and replacement, technical support, etc.
2) The following faults encountered in or out of warranty period are not involved in the maintenance range. The service will be charged. The faults include but not limit to the following issues:
    a. Damage caused by force majeure factors (earthquake, lightning stroke, flood, etc.).
    b. Damage caused for poor grounding which doesn't meet requirement.
    c. Natural wear and tear.
    d. Damage caused by mal-operation (corrosion, fire, strong current attack, etc.).
    e. Damage caused by the modification of product part without prior permission.
    f. Damage caused by modifying technical and functional parameters of product without prior permission.
    g. Damage caused as the product is not used, stored, maintained according to user manual and training regulations.
    h. Damage caused as the product is not used according to the user manual and training regulations.
    i. The product label is torn off by the user.
3) When the parts of the analyzer reach to service life or are damaged, they should be safely disposed according to local waste management and environmental regulations.

For the detailed quality and maintenance requirements, please refer to the provisions specified in the purchase contract.

2 Overview

2.1 Product Certification

2.1.1 CE Certification

Our LGA-4000Z Diode Laser Gas Analyzer has obtained certification of CE-EMC, RoHS and Safety under CE Certification. The result indicates the instrument meets standards of IEC 62321-1:2013, IEC 62321-2:2013, IEC 62321-3-1:2013, IEC 62321-4:2013, IEC 62321-5:2013, IEC 62321-6:2015, IEC 61010-1:2010, IEC 60825-1:2014, EN 61326-1:2013, IEC 61000-4-2:2008, IEC 61000-4-3:2010, IEC 61000-4-4:2010, IEC 61000-4-5:2005, IEC 61000-4-6:2008, IEC 61000-4-8:2009, etc.

CE

2.1.2 Explosion-proof Certification

The certification result shows the Ex-mark of the LGA-4000Z Diode Laser Gas Analyzer is:
Ex db op is IIC T6 Gb
Ex tb op IIIC T80℃ Db
It is applied to explosive gas atmosphere of area 1 and 2, and explosive dust atmosphere of area 21 and 22, meeting the following standards:
EN 60079-0:2012+A11:2013, EN 60079-1:2014, EN60079-28:2015, EN 60079-31:2014;
IEC 60079-0:2017 Edition:7.0, IEC 60079-1:2014-06 Edition:7.0, IEC 60079-28:2015 Edition:2, IEC 60079-31:2013 Editon:2.

Special condition for safe use:

a). Repairs of the flameproof joints may only be made by the manufacturer or on behalf of the manufacturer and on his own responsibility. Repair in compliance with the values in IEC 60079-1 is not accepted.

b). The external earth connection facility shall be connected reliably.

c). The stainless steel screws used for receiver unit and transmitter unit fastening must have a property class higher or equal to A2-70.

d). The cable entries could be connected only with the cable gland which is DQM-I Series cable gland from WAROM Technology Incorporated Company with M25*1.5 size and Certificate number is IECEx LCI 08.0011X and BPT Stopping plug from WAROM Technology Incorporated Company with M20*1.5 and or M25*1.5 size and Certificate number is IEC LCIE 15.0070U.

2.2 Working Principle

The LGA-4000Z Diode Laser Gas Analyzer is based on Tunable Diode Laser Absorption Spectroscopy (TDLAS) for measurement, obtaining the characteristic absorption spectral line of the measured gas. The semiconductor laser emits laser beam in specific wavelength (only can be absorbed by the measured gas). According to the function relationship between the decay of laser

intensity and the concentration of the measured gas when passing through the measured gas, the quantitative analysis can be carried out.

The TDLAS technology mainly takes advantage of the tenability of laser wavelength that the emission wavelength changes with the working temperature and current. It can make the laser wavelength changes periodically in small range through the periodic regulation of the current. In each period, "single absorption spectrum" data and spectrum data with interference factors of background gas and dust for the measured gas can be obtained. To improve the detection sensitivity, proper absorption line and modulation parameters of laser device will be selected according to actual on-site condition. The functional block diagram of Diode Laser Gas Analyzer is shown as following figure 2.1.

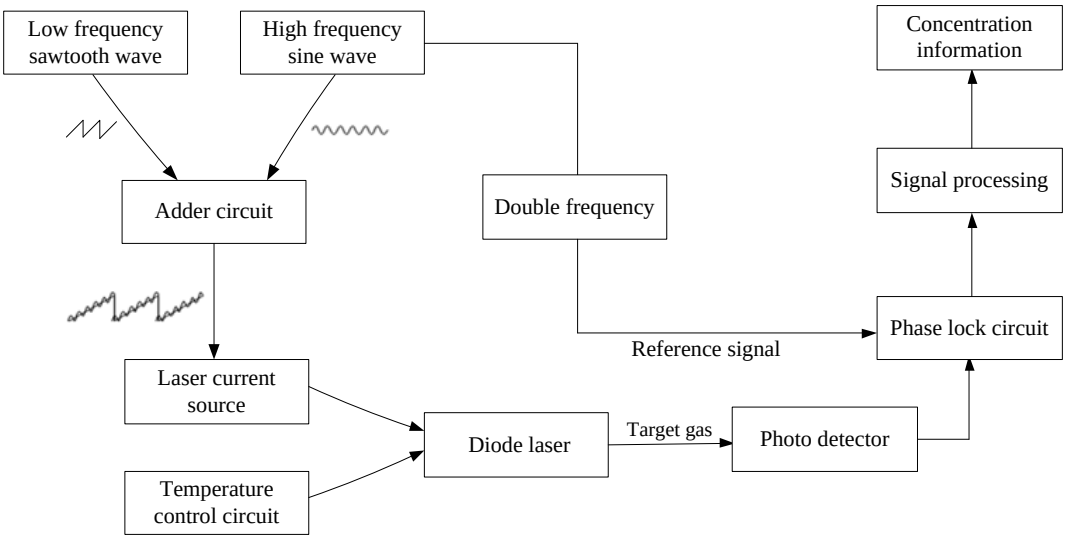


Fig. 2.1 Functional block diagram of Diode Laser Gas Analyzer

2.3 Technical Advantages

The LGA-4000Z Diode Laser Gas Analyzer can be directly installed in process gas pipeline, with the advantages of no complicated sampling, no pre-treatment system, simple structure and no moving parts. It employs OLED screen for display, which has advantages of low power consumption, wide angle of view, excellent low temperature performance (can display properly under -40℃). Moreover, it employs high-sensitive Hall buttons, which can quickly response to magnetic pen operation. In addition, the product also has the following features:

1) Not affected by background gases

The spectral width of semiconductor laser that TDLAS technology employs is less than 0.0001nm, which is $1/10^6$ of spectral width of infrared light source, and far less than the spectral width of absorption spectral line of the measured gas. Its scanned area of frequency modulation only consists of single absorption spectral line for the measured gas (therefore, the Semiconductor Laser Absorption Spectroscopy is also called Single line Spectroscopy), thus it successfully

eliminates the cross interference of background gases. The schematic diagram of laser "single-line spectrum" is shown as the following figure 2.2.

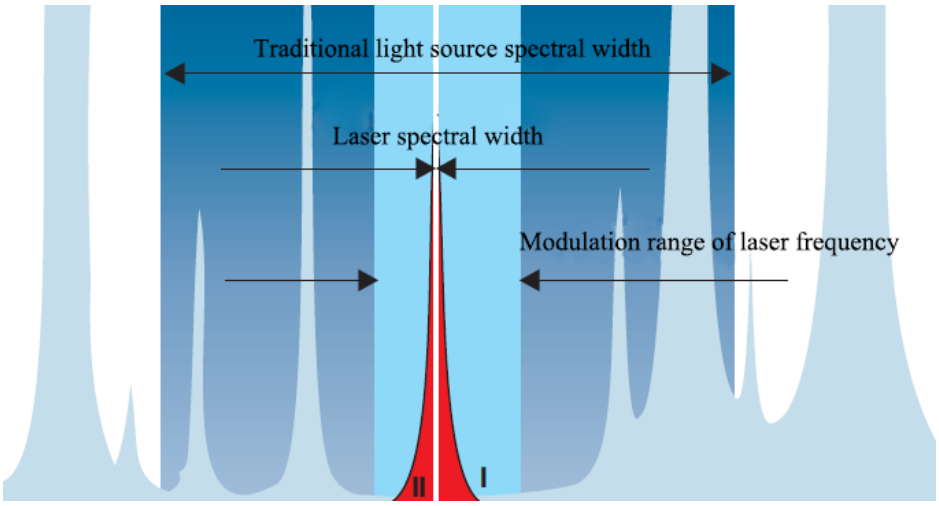


Fig. 2.2 Schematic diagram of laser "single-line spectrum"

2) Not interfered by dust and window pollution

The semiconductor laser wavelength can be scanned through modulating working current, which makes the laser wavelength not only scans the district with gas absorption, but also the district without gas absorption. The total light transmittance T_1 of gas, dust and window can be measured when the wavelength stays in the area with gas absorption; while the light transmittance T_2 of dust and window can be obtained when the wavelength stays in the area without gas absorption, from which, the light transmittance T_g of the measured gas can be accurately calculated by the formula $T_g = T_1/T_2$. The TDLAS technology amends the interference of dust and window pollution towards the measurement by using laser wavelength scanning technique

3) Automatic temperature and pressure compensation of the measured gas

The temperature and pressure variation of the measured gas will cause the change of spectral line intensity and spectral width. Thus, it will affect the accuracy of measurement results without correction of temperature and pressure signals. However, the TDLAS analyzes the single absorption spectral lines of the measured gas, and it can easily correct the effect of temperature and pressure. Therefore, the instrument is internally installed with the function of temperature and pressure correction, which can automatically amend the measurement value of the gas components according to actual temperature and pressure of the measured gas to achieve accurate online gas analysis.

Dispensing with sampling system, the LGA-4000Z Diode Laser Gas Analyzer greatly reduces maintenance of the system. The analyzer has small drift and good stability. Generally, the zero drift and span drift meets ≤±1%F.S/six months. With long calibration period, the calibration workload can be reduced.

2.4 Product Index

Table 2.1 Product Index

Measurement data			
Measuring principle	TDLAS (Tunable Diode Laser Absorption Spectroscopy)		
Light source	Semiconductor laser (imported)		
Technical index	Length of optical channel	≤20m	
	Response time	≤1s	
	Linearity error	No more than ±2%F.S.	Standard range
	Repeatability	≤2%	
	Zero drift	No more than ±2% F.S./7d	
	Span drift	No more than ±2% F.S./7d	
	Maintenance period	≤2 times/year, clean optical window	
	Calibration period	≤2 times/year	
	Ex-mark	Ex db op is IIC T6 GbEx tb op is IIIC T80℃ Db	
	IP grade	IP66	
Interface signal	Analog output	2×4-20mA output (isolation, max load of 750Ω)	
	Analog input	2×4-20mA input (temperature, pressure compensation)	
	Switch output	3×output	
	Switch input	2×input	
	Digital output	RS485/RS232	
Application data			
Working condition	Sample gas temperature	Adjustable, e.g.(0~500)℃	
	Sample gas pressure	Adjustable, e.g. (0.7~2)bar	
	Water vapor content	No condensate water	
	Dust content	Standard configuration≤1g/m^3	
	Ambient temperature	(-20~60)℃	
	Ambient humidity	≤90% RH	
Instrument data			
Mainframe dimension	Transmitting unit(D×H)	Φ170mm×331mm	
	Receiving unit(D×H)	Φ170mm×347.5mm	
	Junction box (L×W×H)	264mm×261mm×192mm	
Purging unit	Dimension (L×W×H)	422mm×280mm×162.5mm	
	Pressure range	(0.3~0.8)MPa	
	Flow range	(0~4300)L/h	
	Purge port specification	Φ8mm	
Power supply	AC (100~240)V or DC 24V ; 50（1±2%)Hz		
Weight	Mainframe	<30kg	
	Flange (include root valve)	≤35kg (standard version)	
Calibration information	Calibration method	Offline calibration	
	Calibration gas chamber	Length 0.5m, customizable	

2.5 Safety Information

The LGA-4000Z Diode Laser Gas Analyzer has been taken full account of the safety of operator on design. According to the standards of IEC 60825-1:2007, it is the Class 1 laser product in normal use. However, there are laser devices of Class 3R containing in some analysis products, thus please do not open the transmitting unit and receiving unit of the product without permission to assure the safety of operator

During installation and maintenance of the transmitting unit and receiving unit, please pay more attention to the protection of laser beam. For the detailed process of installation and maintenance, please read this manual carefully or contact our technical department for support.

Warning:

The wavelength of laser device is in range of (0.7m~2.5) μm, and it is invisible near-infrared light. Please do not observe the invisible laser light with naked eyes or through optical instrument.

3 Product Introduction

3.1 Composition

The LGA-4000Z Diode Laser Gas Analyzer adopts integrated structure. Its main function module is composed of transmitting unit and receiving unit. The transmitting unit is mainly to drive the semiconductor laser to emit laser, which passes through measured environment and obtains the measurement results after photovoltaic conversion, signal processing, and analysis of spectral data by receiving unit.

The product employs in-situ installation. The transmitting unit and receiving unit are directly installed on process pipeline through connection unit. The connection unit contains purge interface, optical path adjustment structure, root value and mounting flanges, etc. The dimension of transmitting unit and receiving unit are shown as follows.

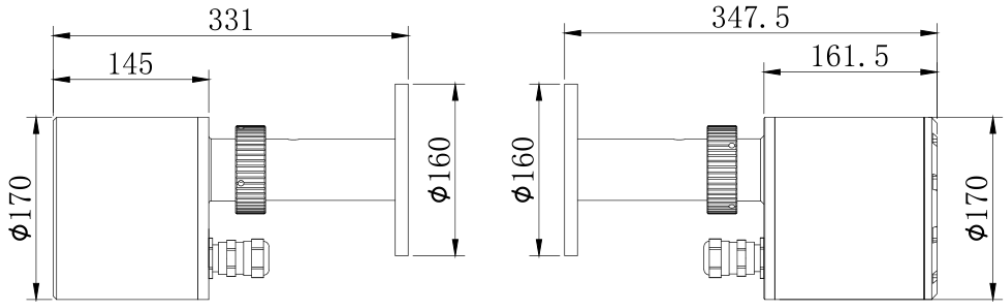


Fig. 3.1 Dimension diagram of LGA-4000Z Diode Laser Gas Analyzer

3.2 Transmitting Unit

The transmitting unit connects to measuring pipeline through mechanical connection flange. It consists of semiconductor laser, collimating optical system, drive circuit board and temperature control circuit board. For gas detection, the laser has been adjusted to specific wavelength and frequency. During cleaning and other maintenance of the transmitting unit, root valve in the mechanical connection flange plays a role of isolating process pipeline and operating environment and preventing leakage of dangerous gas. The external view of transmitting unit is shown as below.

Fig. 3.2 Transmitting unit

3.3 Receiving Unit

The receiving unit connects to measuring pipeline through mechanical connection flange. It consists of photoelectric sensor, lens, receiving mainboard, sensor board and display board. The lens focus collimating laser on the photoelectric sensor, then convert the detected optical signal into electrical signal for processing. It detects second harmonic signal information and then convert the detected second harmonic signal information into concentration information, which will be displayed on OLED screen of receiving end. The external view of receiving unit is shown as below.

Fig. 3.3 Receiving unit

3.4 Purging Unit

To ensure the LGA-4000Z Diode Laser Gas Analyzer can continuously work in poor environment for a long term, purge gas is required to clean optical windows on the transmitting and receiving unit to prevent dust or other pollutants in environment from polluting the optical windows and

affect measurement. The purging unit consists of filter, reducing valve and flow stabilizer to provide stable purge gas source. The interface definition and dimension diagram of purging unit is shown as follows. The following figure is the interface definition and dimension diagram of purging unit.

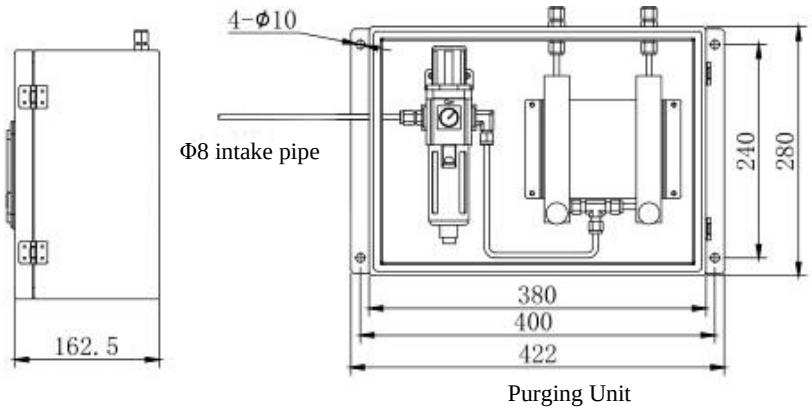


Fig. 3.4 Purging unit

3.5 Junction Box

The junction box contains output signal interface (making it easy for user to connect to power line), 4-20mA output line and relay line. The external view and dimension diagram of junction box are shown below.

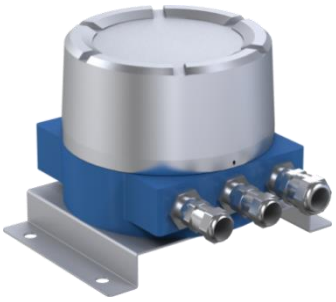


Fig. 3.5 Junction box

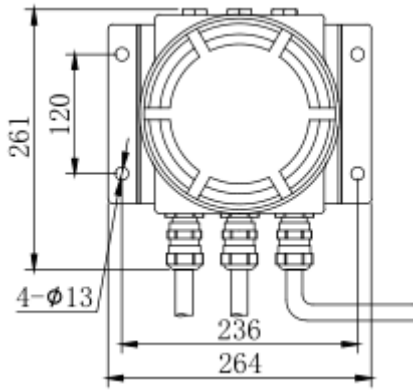


Fig. 3.6 Dimension of junction box

4 Installation

4.1 Unpacking for Confirmation

（1） It is required that there shall be the third party personnel present during unpacking.

（2） Check if the wooden box is broken before unpacking, if it is, it needs to be photographed.

（3） Check if the instrument is in good condition after unpacking, and verify whether there is missing part according to parts list.

Before installation, please read installation procedure and introduction of the LGA-4000Z Diode Laser Gas Analyzer carefully. It is necessary to make sure the power is cut off before cable connection.

The installation mainly consists of flange welding, installation of transmitting and receiving unit, installation of purging device, initial adjustment of optical path, electrical connection and optical path optimization. This chapter will introduce all the installation operations. The LGA-4000Z Diode Laser Gas Analyzer adopts in-situ installation method. For detailed installation diagram, please refer to the following figure 4.1.

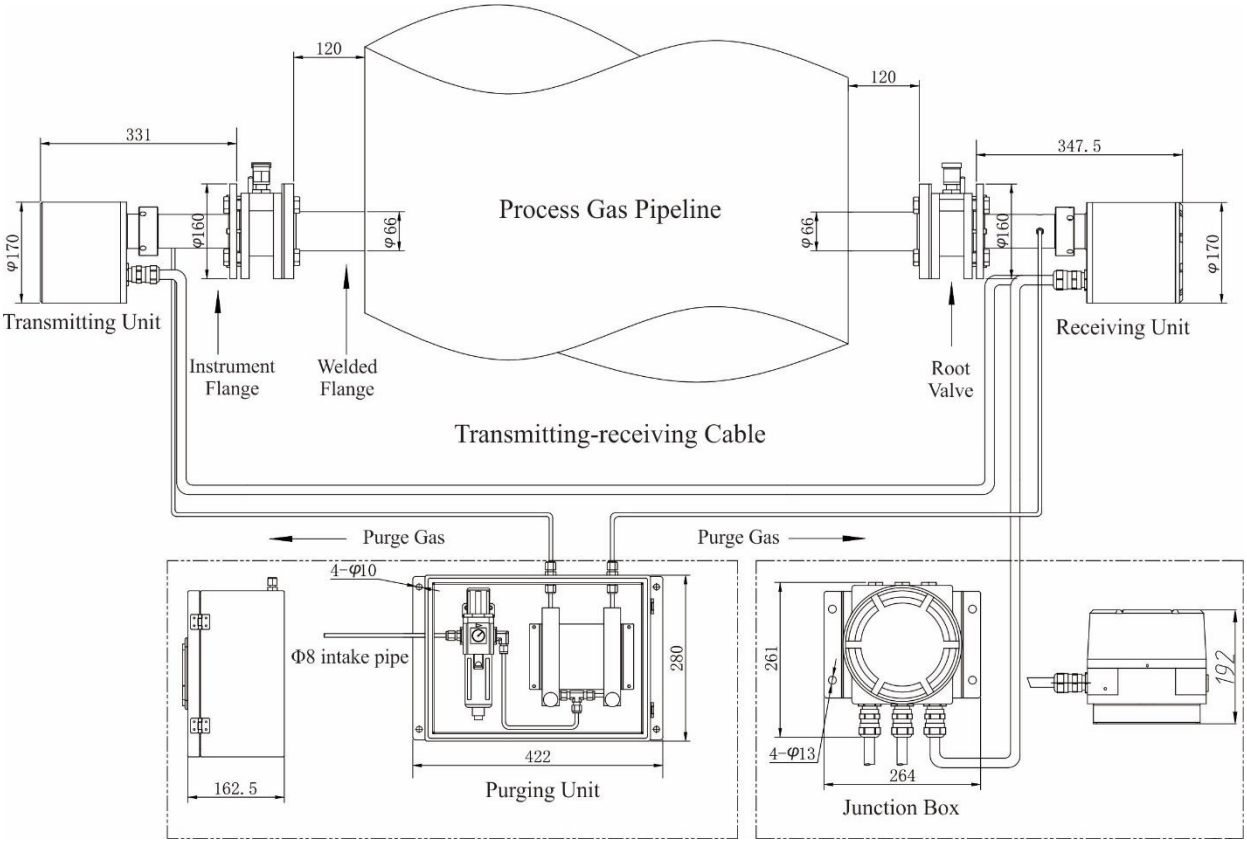


Fig. 4.1 Installation diagram of LGA-4000Z Diode Laser Gas Analyzer

No.	Name	Instruction
(1)	Transmitting unit	Drive gas source to emit detection signal
(2)	Receiving unit	Receive detection signal; analyze, calculate and display concentration information, etc.
(3)	Process gas pipeline	
(4)	Instrument flange	Connect transmitting or receiving unit
(5)	Welded flange	
(6)	Root valve	Turn on or off sample gas channel
(7)	Transmitting-receiving cable	Transmit communication signals between transmitting unit and receiving unit
(8)	Φ8 intake pipe	Inlet of purge gas source
(9)	Purging unit	Control purge gas flow
(10)	Junction box	Provide power supply and signal input/output for the instrument

4.2 Installation Point Selection

To install welded DN50 flange, the aperture diameter of pipeline at installation position shall be at least 65mm.

To ensure uniformity of gas flow inside pipeline, the installation point shall meet the following requirements:

a) It is suggested to select straight and flat pipeline where the gas flow is stable. Theoretically, the length of straight pipeline before the measuring point shall be at least twice (5 times are recommended) of the pipeline diameter while that behind the measuring point shall be at least 0.5 times (2 times are suggested) of the pipeline diameter. If condition allows, please do not install it in the environment with strong electromagnetic interference, strong radiation or strong corrosion.

b) The installation position shall have small vibration, which is easy to adjust optical path

c) If it is a square flue, the two sides of installation point shall be as parallel as possible.

d) If the measuring point contains heavy dust, transmittance will have large attenuation. Therefore, it is required to install a baffle in front of the flange.

e) When choosing installation point, first consider if explosion-proof cable is long enough and the optical length shall not be too large, otherwise, optical path will be difficult to adjust.

f) For installation and maintenance, the installation position shall be easy to reach. If necessary, build an installation & maintenance platform.

4.3 Sunshade Installation

For protecting the product and extending service life of instrument, it is suggested to install a sunshade above 0.5m of the transmitting terminal (if condition allows, install sunshades at both terminals). The dimension of the sunshade can be referred to the flowing figures.

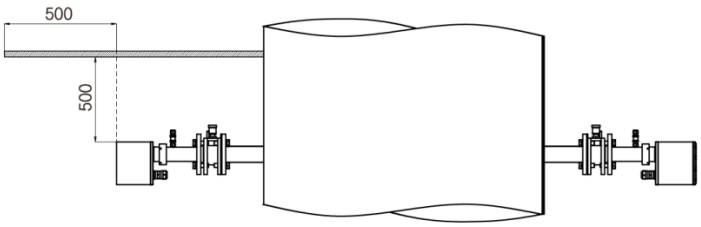


Fig. 4.2 Installation diagram of sunshade

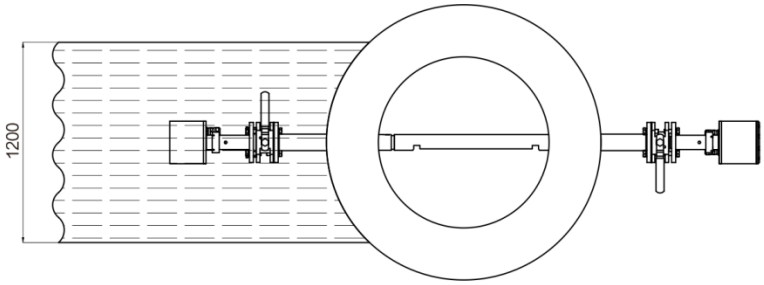


Fig. 4.3 Top view of sunshade installation

4.4 Hole Opening & Flange Welding

If condition allows, the flange installation and optical path adjustment shall be performed when furnace is shut down. If the condition does not permit, it is required for the professional to conduct operations like gas welding with good protection.

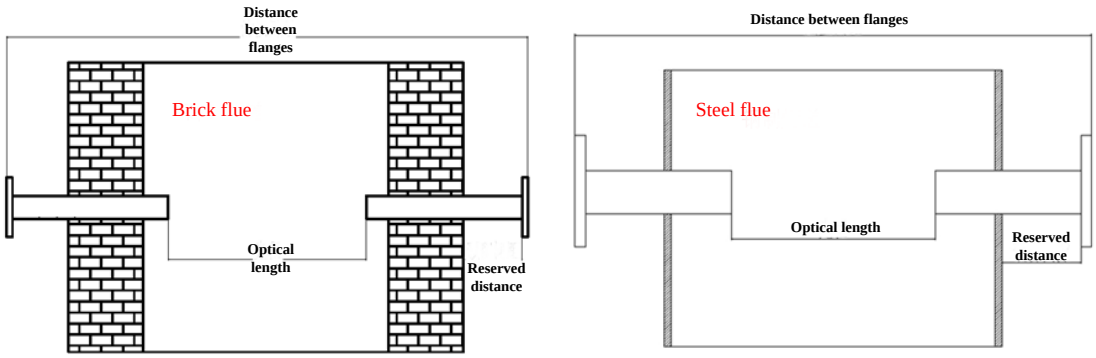


Fig. 4.4 General flange installation

a) Open holes

- If it is inflammable and explosive gas inside the flue, the furnace must be shut down before opening. For other situations, it also needs to stop the furnace in principle, depending on actual circumstances.
- To ensure flanges at two ends are at the same level, please use tape to determine vertical height of opening points. If the site is too high and it is difficult to use tape for vertical height determination, employ leveling pipe to make both ends at the same level, as show in the following figure.

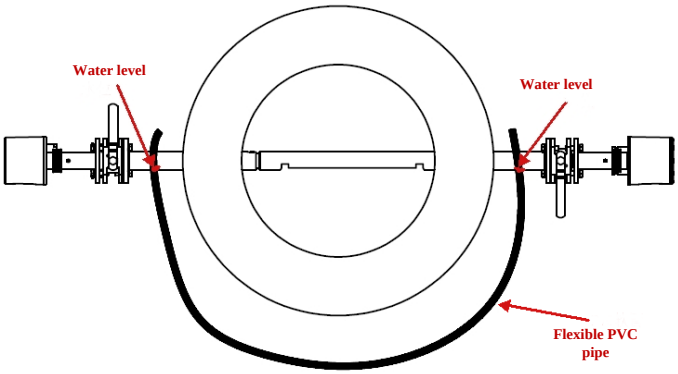


Fig. 4.5 Use of leveling pipe

Under the effect of gravity, the water levels on both sides of flexible pipe will keep horizontal; make the very bottom of opening positions at both sides flush with the water level, so that it can ensure the flange opening positions are in the same level.

- Use levelling instrument to determine whether welded flange is horizontal or not

  Cling datum plane of levelling instrument to welded flange disk, and pay attention to avoid the bolts to ensure that levelling instrument and welded flange cling tightly. Observe the bubble position in bubble tube and adjust flange angle to make the bubble move to the middle. As shown in figure 4.6.

Fig. 4.6 Use of leveling instrument

b) Weld flange

The coaxial deviation of the two flanges is required to be less than 2°. If it cannot meet the technical requirement, the instrument might be impossible to realize alignment of optical path by adjusting instrument flanges.

The installation angle of flange shall adopt the principle that the vertical center line and horizontal center line shall be in the middle of two bolt holes, which means the angle between centerline of flange and that of bolt hole is 45°.

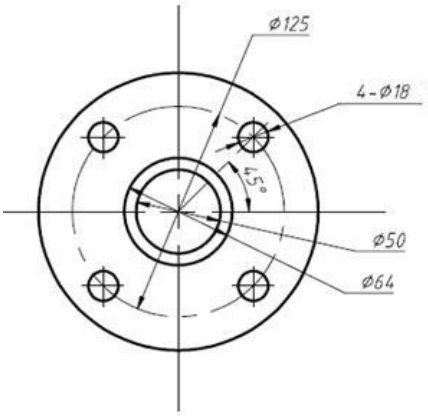


Fig. 4.7 Welded flange dimension

In order to ensure flanges at both ends have good coaxiality after welding; please refer to the following two installation methods:

a) If condition allows, use suitable steel pipe of which outer diameter is (48~50)mm. Open two parallel holes and pass the steel pipe through the two holes. Weld two flanges at two ends on the basis.

b) Normal welding

- Before welding, install optical path adjustment tools to one of flanges that is required to be welded and adjust flange position as well as angle to make the red light emitted by the adjustment tools can pass through the center of hole from the other end of pipeline (as shown in the figure 4.8).
- Install the optical path adjustment tools to the other flange and adjust flange position as well as angle to make the red light emitted by the adjustment tools can pass through the center of flange disk welded in the previous step (as shown in the figure 4.9).

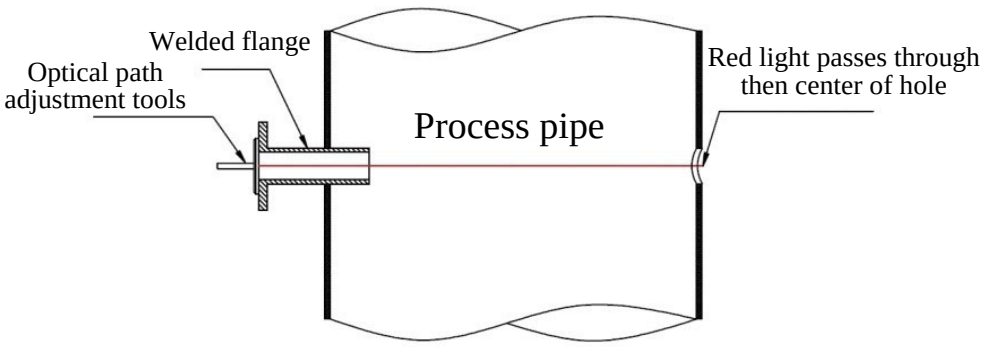


Fig. 4.8 Flange installation 1

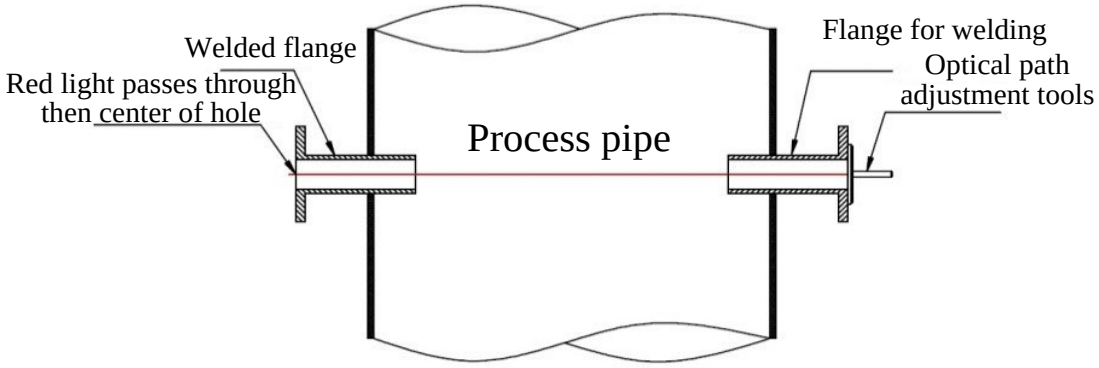


Fig. 4.9 Flange installation 2

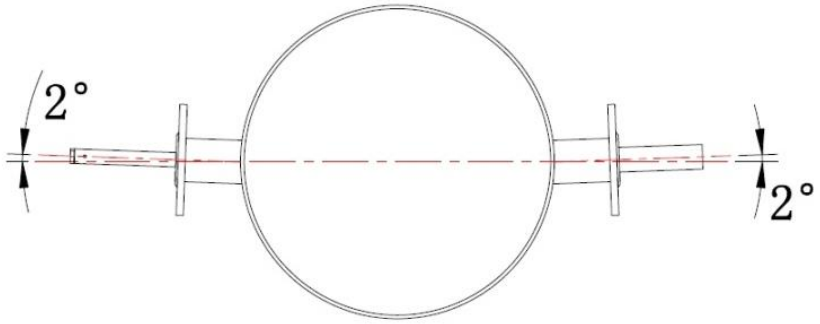


Fig. 4.10 Permissible error of coaxiality

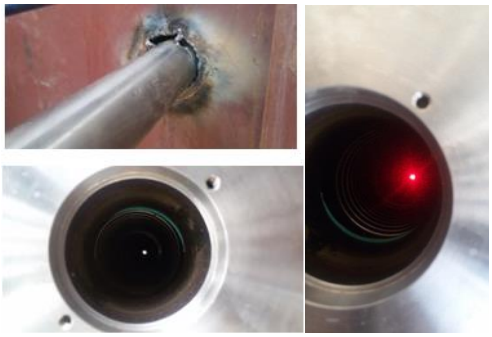


Fig. 4.11 Field installation

- After welding, support and bracket must be installed to prevent sag of two sides caused by excess weight of instrument or vibration and lead to shift of optical path, which will affect the measurement. The recommend support method is shown in the following figure.

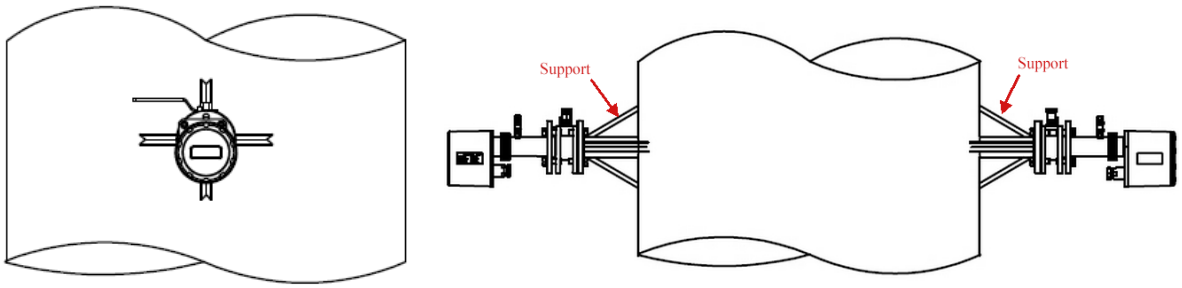


Fig. 4.12 Standard support of instrument installation

Caution:

For installation of support or bracket at site, please reduce standard operations and make it reliable and solid.

- During welding, first spot weld flange or weld a small part of it, and use optical path adjustment tools to observe coaxial situation of flange. If there is deviation, use hammer to knock the flange or use long steel pipe to regulate flange a little to make both ends of flanges remain coaxial. At last, full weld the flanges.
- After welding, if the corresponding optical paths of two ends are not in the same line or there is obvious deviation and the optical path is unable to adjust, the flanges are required to be welded again.

c) Integrated flange welding

- First confirm if the length of integrated flange fits the pipe at welding position because the installation position might mix up when multiple sets of equipment are installing at the same time, which will cause that the length of integrated flange is not matched with the actual installation position. As shown in the following figure, when the outer diameter of pipe is 2m, please make sure the outermost connecting hole position of the welded flange and adapter tube shall be a little bit smaller than the outer diameter of pipe in the figure, which is 2m.

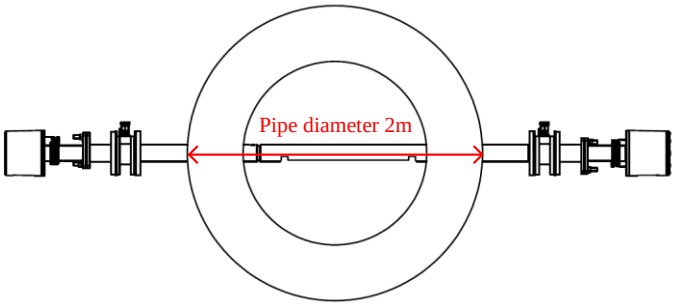


Fig. 4.13 Pipe diameter

Fig. 4.14 Connecting hole position of the welded flange and adapter tube

- The installation point of integrated flange is usually the occasion that the working condition is quite severe. It will be generally installed at the 2/3 position of the height of horizontal pipe and there will be a baffle installing to prevent transmittance from reducing rapidly in a short time.
- The welding of integrated flange is similar to that of conventional flange. To make sure the flanges at two ends are at the same level, please use tape to determine vertical height of opening points. If the site is too high and it is difficult to use tape for vertical height determination, employ leveling pipe to make both ends at the same level, as show in the figure 4.5.
- Before welding, install optical path adjustment tools to flanges on the short end that is required to be welded and adjust the flange position as well as angle to make the red light emitted by the adjustment tools can pass through the center of hole from the other end of pipeline (as shown in the figure 4.8). Then weld the integrated flange to ensure the optical path is level.
- Insert the long part of the integrated flange from the other end of the pipe, connect and fix inside the pipe.
- The installation angle of the integrated flange is shown as the following figure. The sheltering part shall stay at windward side for protecting from dust and other impurities, which can make sure the transmittance of the instrument keeps above 10%.

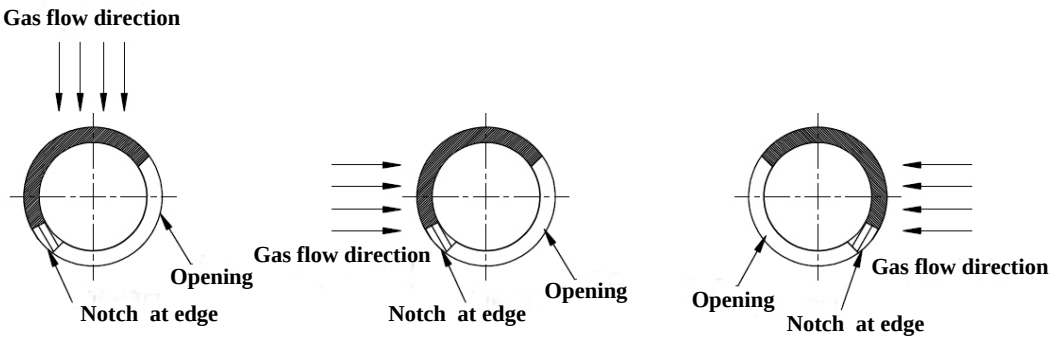


Fig. 4.15 Installation angle of integrated flange

- When the working condition is extremely bad, the sheltering performance of the integrated flange might not be very good. At this time, it is required to add a baffle or channel steel (width of 12m~15m) 10cm~15cm in front of the flange, as shown below. The criterion of specific dimension is that the wider the baffle is, the father the baffle shall keep away from the flange.

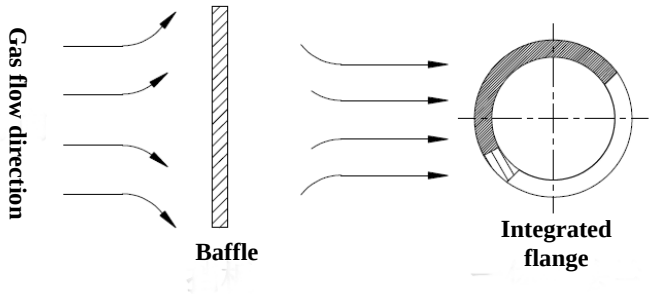


Fig. 4.16 Baffle installation

Based on actual condition, use channel steel or steel plate of which the width is (12~15)cm, length is 1m and the thickness is 5cm or above.

Take the pipe in the figure that the outer diameter is 2m as an example and user can choose the baffle of the following specification.

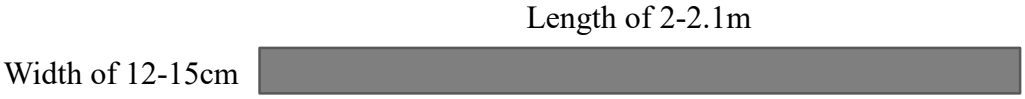


Fig. 4.17 Schematic diagram of steel pipe used for welding

- After installation, tighten all the nuts and bolts again to make sure there is no leakage.

The following figure shows the installation at site:

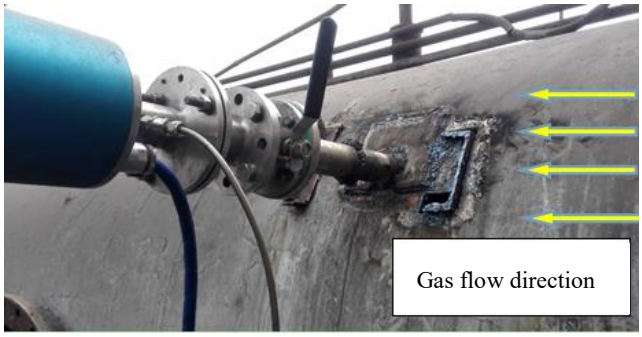


Fig. 4.18 Field installation diagram

4.5 Installation of Root Valve and Instrument Flange

Before shipment of welded flange, root valve and instrument flange, the company has already completed installation to form the whole flange. The installation diagram is shown as figure 4.13.

The instrument flange is fixed via four pairs of M16 bolts on root valve flange. During installation, please pay attention to the following matters.

- Pay attention to the direction of root valve direction shall be upward and one-way valve is necessary.
- There shall be an O-ring or other sealing materials between two flanges. Spring washers and flat washers must be installed on bolts.
- As there are gaps between bolts and bolt holes, instrument flange and root valve flange shall keep as coaxial as possible before tightening bolts.
- After fixing bolts, leave 6mm space between two flange surfaces for optical path adjustment. Please do not get too close.

There shall be four M6 hexagon bolts installing on the instrument flange for locking instrument flange after optical path adjustment.

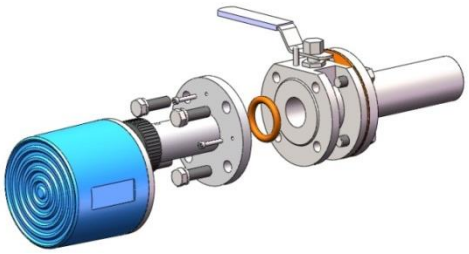


Fig. 4.19 Instrument flange installation diagram

Caution:

The installation method of flange depends on actual working condition (e.g. high dust content or large moisture content). If it requires slanting penetration method or integrate connection method, please contact us.

4.6 Coaxiality Adjustment of Flanges

Please use specialized optical path adjustment tools (contact our sales department if needed) to adjust coaxality of instrument flanges on both transmitting unit and receiving unit according to the following procedures,

a) Rotate laser emitting device to make notch upturn and then use two M4 screws to fix the optical path adjustment tools on the instrument flange; turn on light source by pressing button on the back; observe whether light spot on the other side is in the center of light target, if not, regulate four M16 bolts of instrument flange on transmitting terminal to make the light beam in the center of reticle, as shown in figure 4.14.

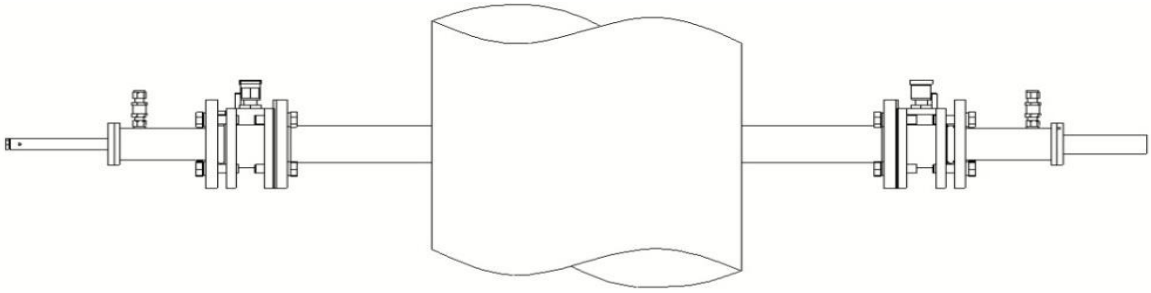


Fig. 4.20 Use laser pen to adjust instrument flange

b) Exchange light source and light target; repeat step (1)

c) Repeat step (2) for multiple times until light spot still places in the center of reticle after exchanging light source and light target.

d) Under the condition that light source keeps on, fix the four M6 hexagon bolts on the instrument flange that the light source stays at and pay attention whether light spot on the light target moves on the other end. If so, please repeat the step (1), (2) and (3) until the light spot dose not move.

e) Repeat step (4) to fix another instrument flange. Before delivery of welded flange, root valve and instrument flange, our company has already completed installation to form integrated connecting flange. The installation diagram is shown in figure 4.13.

4.7 Installation & Disassembly of Transmitting/Receiving Unit

Install the transmitting unit into the instrument flange (shown as figure 4.13), and pay attention to the position of locating pin; then fix with locking ring. Use the same method to install the receiving unit.

Hook spanner can be used when disassembling the transmitting unit and receiving unit. Put the hook spanner on the locking ring in front of transmitting unit or receiving unit. Rotate the hook spanner to disassemble the transmitting unit and receiving unit from instrument flanges and calibration gas chamber quickly. The disassembly diagram is shown as follows.

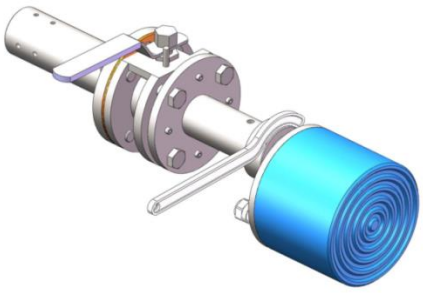


Fig. 4.21 Disassembly diagram of transmitting/receiving unit

When disassembling shell of transmitting unit and receiving unit, use 4mm Allen wrench to loosen the tightening screws on transmitting and receiving terminal in the counterclockwise

direction (don't have to remove screws completely). After loosening all the bolts, use both hands to hold the shell and move the shell along the axis line. Then the shell can be moved successfully. The disassembly diagram is shown as follows.

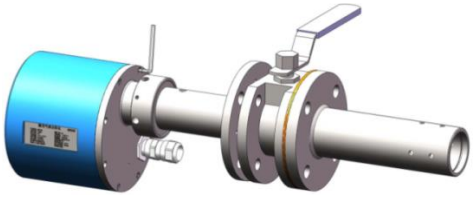


Fig. 4.22 Disassembly diagram of transmitting/receiving unit shell

Caution:

When disassembling the receiving unit shell, please pay attention to avoid not hitting the screen and circuit board.

4.8 Junction Box Installation

There are four holes on the back of Junction box, which can be fixed with M10 bolt to the maintenance platform or outside wall of stack where the temperature is low.

When disassembling the junction box, use 2mm internal hexagonal wrench to rotate the tightening screws on the side of top cover in the counterclockwise direction for two turns; use both hands to hold the top cover tightly and rotate in the counterclockwise direction to make it totally free from the base; uplift the cover to complete the disassembly of junction box, as shown below.

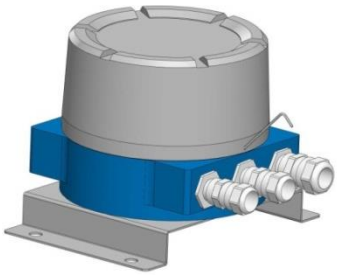


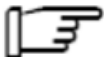
Fig. 4.23 Disassembly diagram of junction box

4.9 Purging Unit Installation

The purging unit of LGA-4000Z Diode Laser Gas Analyzer can employ compresses air (or nitrogen) as gas source. During installation, use M8 bolts to fix it between transmitting and receiving unit and connect the main pipe of gas source to the inlet; use 8mm copper/stainless steel/fluorine pipe to connect the outlet of purging unit to the purge gas inlet on the instrument flange of transmitting and receiving unit to make the gas source enters from the flange to clean the optical windows, thus preventing materials of dust, particles and tar from polluting the window.

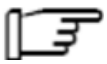
During installation of purging unit, please pay attention to the following matters:

- Air source pressure must be above 0.3MPa
- Air source shall be without water or oil
- Purge tools cannot have obvious leakage
- Can regulate the purge flow but must ensure that the flow is above 300L/h;
- Adjust the needle valve of flowmeter to ensure the needle valve can rotate smoothly and control the flow normally



Caution:

For oxygen measurement instrument, nitrogen must be used as purge gas source, of which the purity shall be ≥99.99%.



Caution:

When the analyzer stops working, please keep purging or close the root valve connecting to the connecting unit. Otherwise, the pollutants like dust from measuring environment will pollute optical elements in transmitter and receiving unit.

4.10 Electrical Connection

The power of LGA-4000Z Diode Laser Gas Analyzer employs standard 24V DC voltage input, and the analyzer provides rich input/output signal interfaces, including relay output, 4-20mA output, 4-20mA compensating signal input and RS485/232 communication interface. The specific definition of electrical connection for the above interface signals can be seen in the following figure. Users can select the connection signal as required.

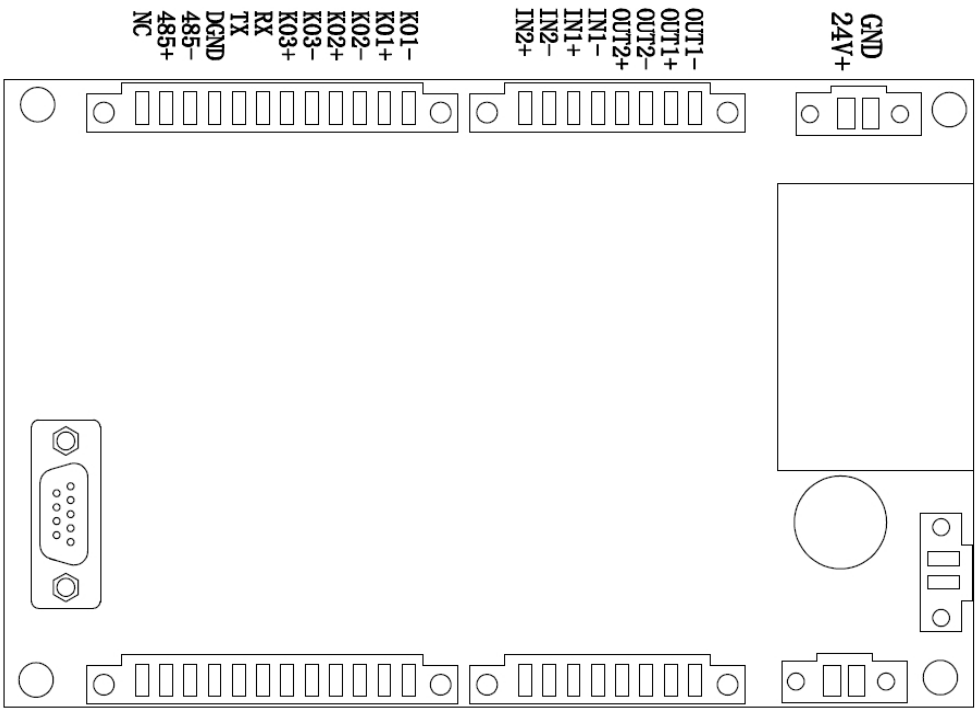
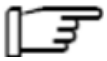


Fig. 4.24 Wiring board diagram

Electrical connection							
1×24V & 2 ×4-20mA Output & 2 ×4-20mA Input & 3 × digital quantity							
P1	Info	P6	Info	P4	Info	P4	Info
GND	GND	OUT1-	4-20mA OUT1-	KO1-	RELAY1-	RX	232_RX
24V	24V	OUT1+	4-20mA OUT1+	KO1+	RELAY1+	TX	232_TX
		OUT2-	4-20mA OUT2-	KO2-	RELAY2-	DGND	232_DGND
		OUT2+	4-20mA OUT2+	KO2+	RELAY2+	485-	485-
		IN1-	4-20mA IN1-	KO3-	RELAY3-	485+	485+
		IN1+	4-20mA IN1+	KO3+	RELAY3+	NC	NC
		IN2-	4-20mA IN2-				
		IN2+	4-20mA IN2+				

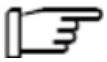
Fig. 4.25 Signal interface diagram of junction box

The outside diameter range of power line used for electric connection is (Φ6~Φ9)mm. Two-core power line of which the section is 1.5 mm^2 is the best. The outside diameter range of signal line is (Φ9.5~Φ16)mm, and (Φ12~Φ14)mm is recommended. Six-core signal line of which the section is 0.75mm^2 is the best.



Caution:

For product equipped with junction box, electrical connection can be accessed through the junction box, rather than connecting through receiving terminal directly.



Caution:

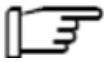
When unplugging the connector of circuit board, pay attention to whether the tightening screws of the connector loosen totally and try to avoid unplugging the socket because of large force.

4.11 Power Up

Before starting up, make sure that the gas supply, power supply and ground resistance confirm with specifications in technical protocol.

a) Connect the main pipe of gas source, and regulate adjusting knob of reducing value until the value displayed on pressure gauge is 0.35MPa. Keep the purge gas flow ≥ 5L/min and open root value to purge the pipe, which can clean up the impurities inside the pipe.

b) Power up the instrument, observe whether there is alarm information on OLED screen after self-test. If so, please refer to Section 6.1 for processing.



Caution:

When connecting to the power, it is not allowed to do operations that might damage the equipment, including disassembling, assembling, pulling and plugging the connecting line.

4.12 Optical Path Optimization

After completing installation, initial debugging and energization, the analyzer starts self-testing. Once it is done, the screen will display all kinds of measurement and status information. Then observe whether the transmittance displays “Normal” on status bar, if so, the installation and debugging is done and the analyzer can be used. Otherwise, optimize the optical path of transmitting/receiving unit according to the following steps.

a) Loosen four M6 inner hexagon screws on the instrument flange of transmitting unit (refer to Figure 4.13), and adjust four M16 bolts to make the transmittance displayed on the OLED screen on receiving unit become “Normal”, and then fasten these four M6 inner hexagon screws.

b) Loosen four M6 inner hexagon screws on the instrument flange of receiving unit, and adjust four M16 bolts to make the transmittance displayed on the OLED screen on transmitting unit become “Normal”, and then fasten these four M6 inner hexagon screws.

Caution:

To optimize the transmittance, view the detailed transmittance values on “TR” under “Meas. & Cal.” menu.

5 Software Operation

5.1 Keys Definition & Operations

There are 4 operation buttons on the panel of the analyzer. The definition of each button is shown as follows:

(Enter): confirm parameter and enter the submenu

: move the cursor up or left

: move the cursor down or right

: cancel parameter setting and exit

Fig. 5.1 Membrane key

The keys are high-sensitivity Hall buttons, which can respond to magnetic pen operation quickly. When using magnetic pen, please adopt point contact method to move the pen, ensuring there is some certain displacement between two touch screen operations.

5.2 Power-on Self-test

When connecting the instrument to the power, it will enter power-on self-test state. Under the state, the instrument mainly checks the working state of each function module. The process will take about 2min. At this time, the OLED screen will display the boot screen, which consists of the company name, instrument name and model, etc. The displayed screen is shown as below.

If self-test is successful, the instrument will enter main display interface and the working mode on the main interface is “Normal”.

If self-test is failed, the instrument will enter main display interface and the working mode on the main interface is “Alarm”.

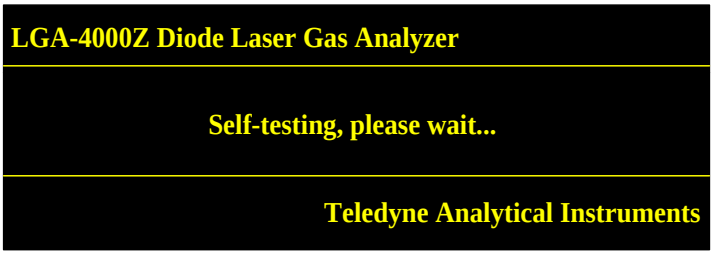


Fig. 5.2 Self-test interface

5.3 Main Interface

The main interface of the analyzer includes gas concentration, transmittance (TR), temperature (T), pressure (P), optical length (L), working mode (Normal/Alarm), working state (State), current time and product model, as shown below.

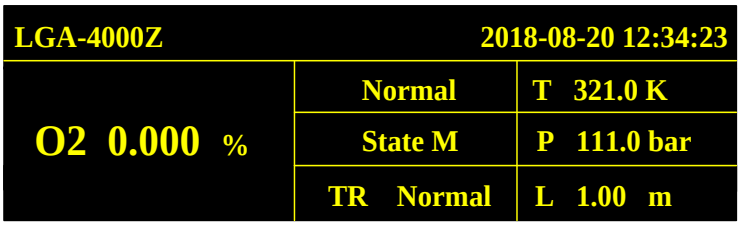


Fig. 5.3 Main interface

The meanings of parameters displayed on the main interface:

a) Gas concentration: the currently measured average concentration of the measured gas (take O_2 as an example here, if measuring other gases, the main interface will display the corresponding gas component and concentration.)

b) Transmittance (TR): the ratio between the light intensity of laser passing through the measured gas and that emitting to the measurement environment.

c) Normal/Alarm: working mode of the instrument; it will display “Normal” when the analyzer is in normal working while it will display “Alarm” if there is an exception.

d) Working state (State): the working status that the analyzer stays at, which divides into measuring state, calibrating and maintaining state.

e) Temperature (T): temperature of the measured gas

f) Pressure (P): pressure of the measured gas

g) Optical length (L): the length that laser passes through the measured gas

When there is alarm message, the working mode will switch from "Normal" to "Alarm" and the corresponding relay state set in "Dig. Output" will also change. At this time, check the first alarm message by clicking "  " key with magnetic pen and click "  " again to check the next alarm message. The alarm information interface is shown as follows.

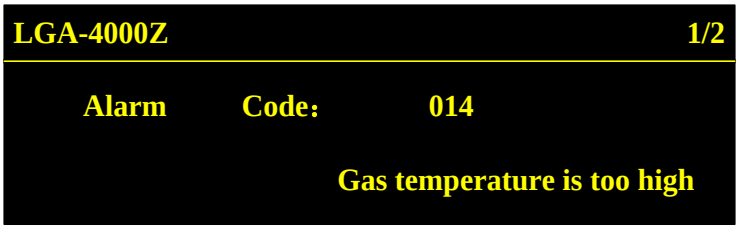


Fig. 5.4 Alarm information interface

Caution:

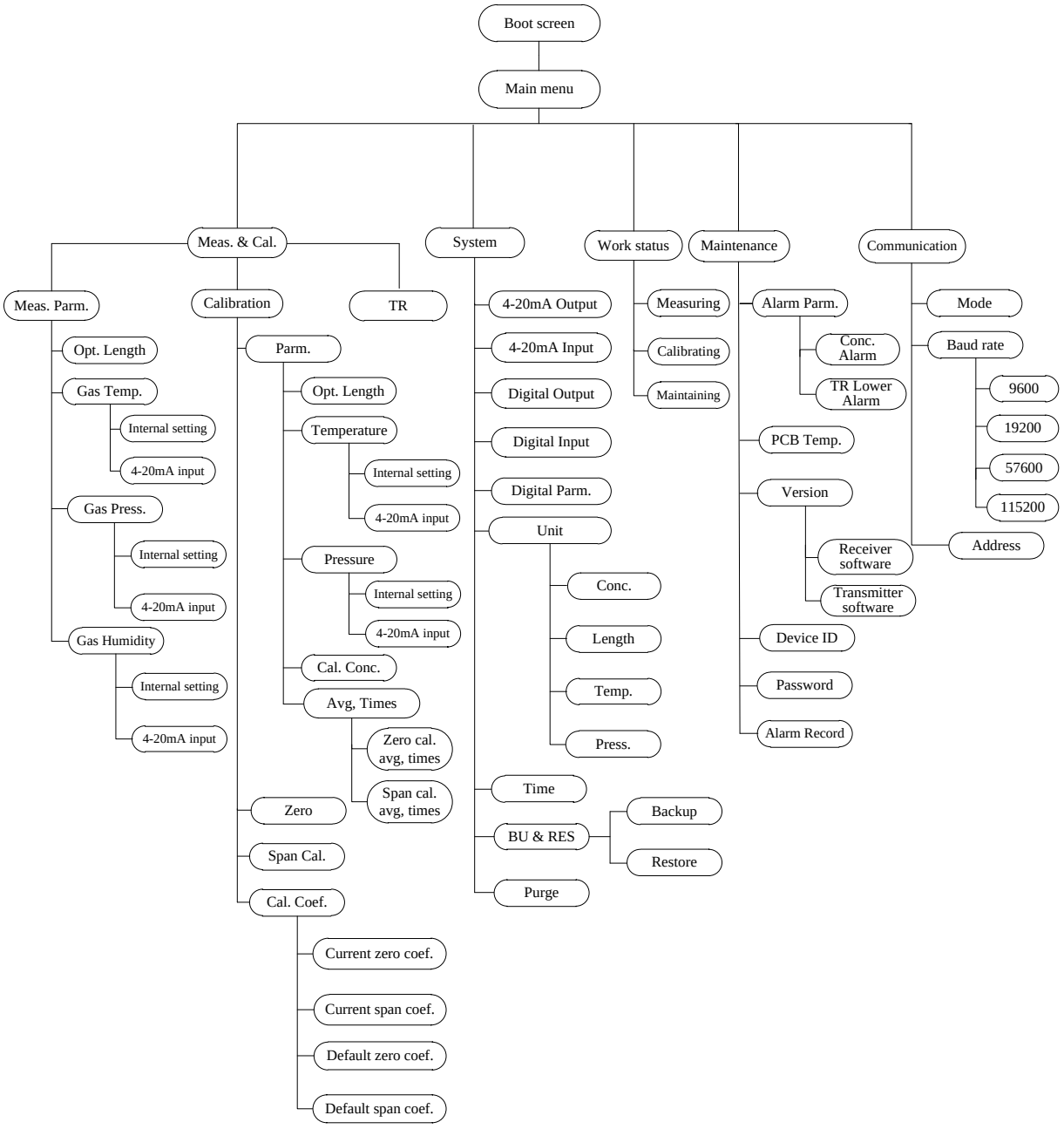
Under working mode of "Alarm", the deviation of the measurement value might increase. It is suggested to eliminate the alarm information or contact our technical personnel to check whether the alarm information will affect the measurement or not.

The working state of the analyzer is divided into measuring (M), calibrating (C) and maintaining (F). When installing the analyzer in the pipe of stack, choose the "Work Status" under "Main Menu" to be "Measuring" and set the temperature, pressure and optical length under this working state; when installing the instrument in the calibration chamber, select the "Work Status" under "Main Menu" to be "Calibrating" and set the temperature, pressure and optical length under calibrating state; when there is failure, choose "Maintaining" before maintenance (the concentration and analog output remain unchanged under this state).

Caution:

When using the product, it is necessary to select the correct working state. Otherwise, it will cause deviation.

5.4 Interface Menu



5.5 Keyboard Operation

The LGA-4000Z Diode Laser Gas Analyzer employs magnetic pen to operate Hall switch for key selection and operation. Under main interface, use magnetic pen to click "(Enter)" and it will prompt to enter correct password. The default password is 1122. Input the correct password to enter the main menu interface, as shown in figure 5.5.

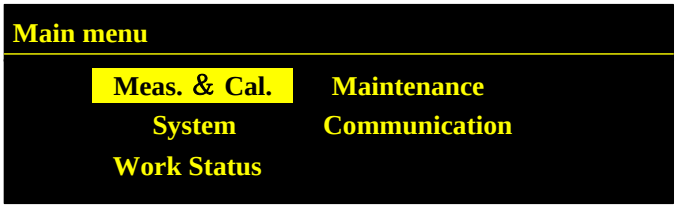


Fig. 5.5 Main menu

Caution:

If there is no operation within 15 min after entering the main menu, it will return to main interface automatically in order to ensure the security of user information.

5.6 Measurement & Calibration Setting

After inputting the correct password to enter the main menu, select "Meas. & Cal." and enter the following interface. The interface consists of measurement parameter, calibration setting and transmittance.

Fig. 5.6 "Meas. & Cal." interface

5.6.1 Measurement Parameter

Select "Meas. Parm." to enter the measurement parameter interface, which can set optical length, gas temperature, gas pressure and gas humidity. Operator can enter the corresponding interface and select the needed parameter by "↵", "<", ">", and "⇥".

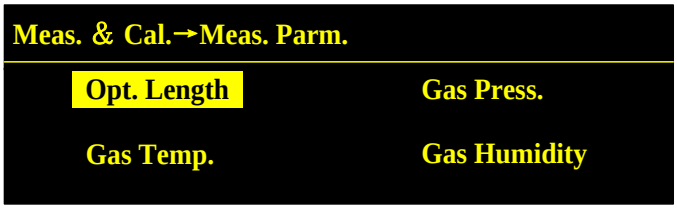


Fig. 5.7 "Meas. Parm." Interface

The optical length interface is shown as follows.

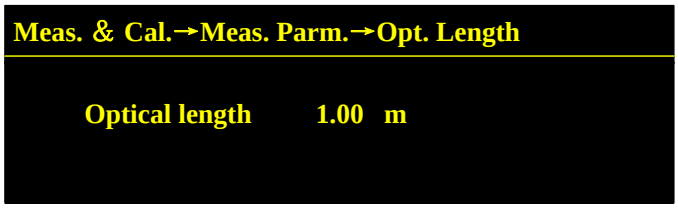


Fig. 5.8 "Opt. Length" interface

The temperature compensation method can choose internal setting or 4-20mA input. When the measured gas temperature is known and the change of gas temperature is small, internal setting mode can be selected. If the change of gas temperature at site is large, it is necessary to install a temperature transmitter, which outputs signal in form of 4-20mA to compensate the instrument. The gas temperature interface is shown as follows.

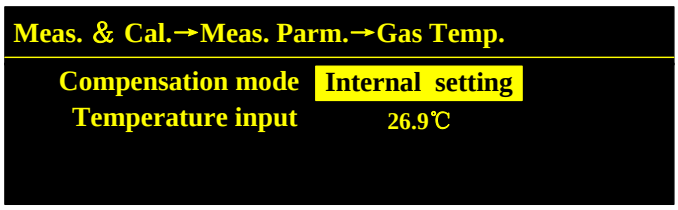


Fig. 5.9 "Gas Temp." interface

The pressure compensation method can choose internal setting or 4-20mA input. When the measured gas pressure is known and the change of gas pressure is small, internal setting mode can be selected. If the change of gas pressure at site is large, it is necessary to install a pressure transmitter, which outputs signal in form of 4-20mA to compensate the instrument. The gas pressure interface is shown as follows.

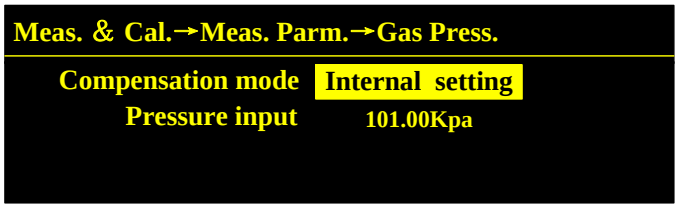


Fig. 5.10 "Gas Press." interface

The humidity compensation method can choose internal setting or 4-20mA input. When the measured gas humidity is known and the change of gas humidity is small, internal setting mode can be selected. If the change of gas humidity at site is large, it is necessary to install a humidity transmitter, which outputs signal in form of 4-20mA to compensate the instrument. The gas humidity interface is shown as follows.

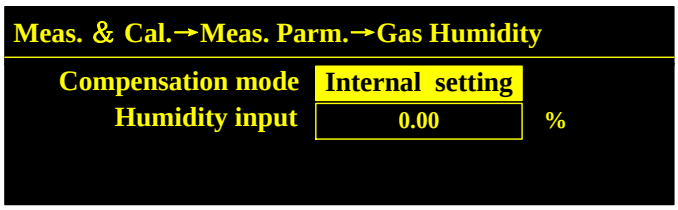


Fig. 5.11"Gas Humidity" interface

Caution:

When temperature/pressure compensation mode is set to be "4-20mA input", first configure 4-20mA input parameter under "System".

5.6.2 Calibration Setting

The parameters on "Calibration" interface are mainly used during zeroing and span calibration. Install the transmitting unit and receiving unit on the calibration gas chamber during calibration. The "Calibration" interface is shown as follows.

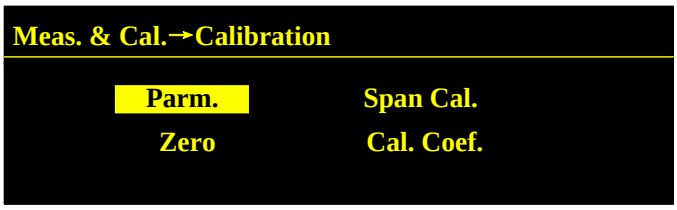


Fig. 5.12 "Calibration" interface

Select "Parm." and enter the calibration parameter interface to set optical length, gas temperature, gas pressure, calibration average times and calibration concentration. Operator can enter the corresponding interface and select the parameter for setup by "↵", "<", ">", and "⎆".

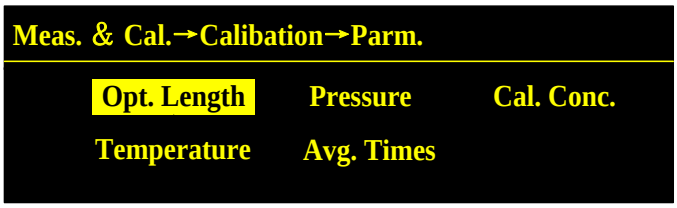


Fig. 5.13 "Parm." interface

Under calibrating state, the calibration optical length, gas temperature and gas pressure shall be set. Please refer to Section 5.6.1.

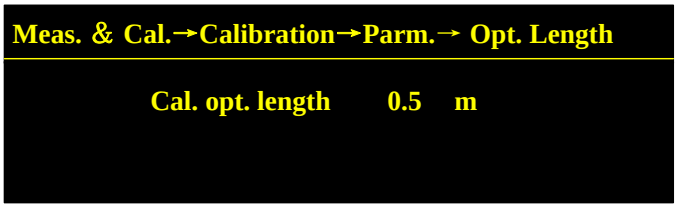


Fig. 5.14 "Opt. Length" interface

The calibration average times are the corresponding spectrum average number during calibration, of which the set range is 1~16.

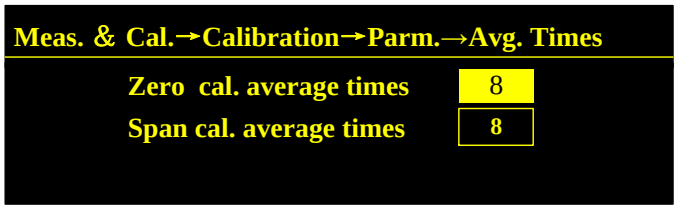


Fig. 5.15 "Avg. Times" interface

When preparing zeroing, first inject zero gas (nitrogen of which the purity is larger than 99.99% is highly recommended). Wait until the measured concentration stabilizes and enter "Zero" interface. Use magnetic pen to click "(Enter)" and the instrument will enter zeroing state. After zeroing, the measured value shall be around zero. The zeroing interface is shown below.

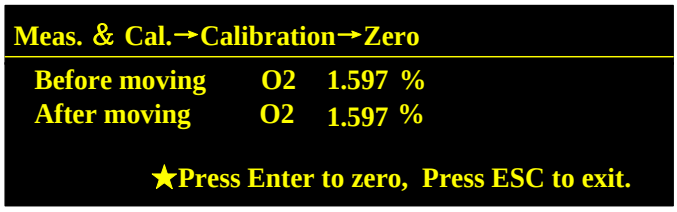


Fig. 5.16 "Zero" interface

When preparing span calibration, first enter "Cal. Conc." interface to set the calibration concentration and then inject span gas (measured gas based on nitrogen). Wait until the measured concentration stabilizes and enter "Span Cal." interface. Use magnetic pen to click "(Enter)" and the instrument will enter calibrating state. After span calibration, the measured value shall be around the calibration concentration. The calibration concentration interface and span calibration interface are shown below.

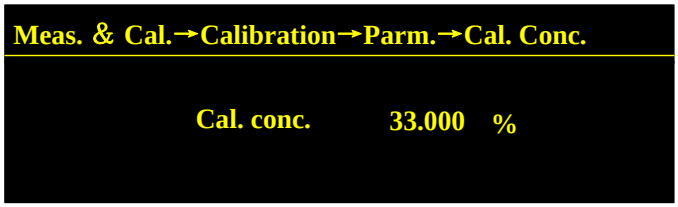


Fig. 5.17 "Cal. Conc." interface

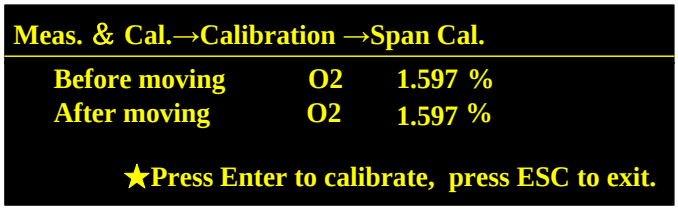


Fig. 5.18 "Span Cal." interface

After zeroing and span calibration, view current calibration coefficient, default calibration coefficient and the corresponding update time on "Cal. Coef." interface, as shown below.

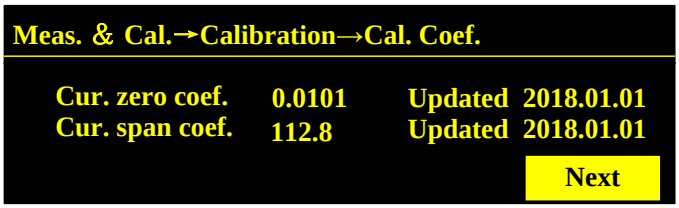


Fig. 5.19 Current calibration coefficient interface

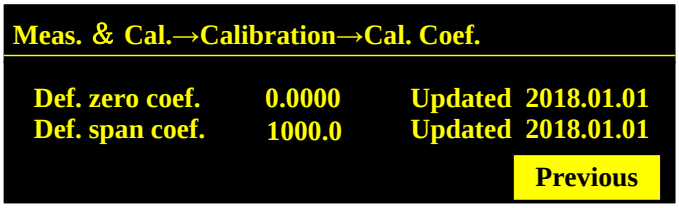


Fig. 5.20 Default calibration coefficient interface

Caution:

When conducting calibration, the analyzer shall be installed in calibration gas chamber and set the parameters correctly under calibrating state, including optical length, gas temperature and gas pressure, etc.

5.6.3 Transmittance

The "TR" interface is used to view the currently displayed value of transmittance, as shown below.

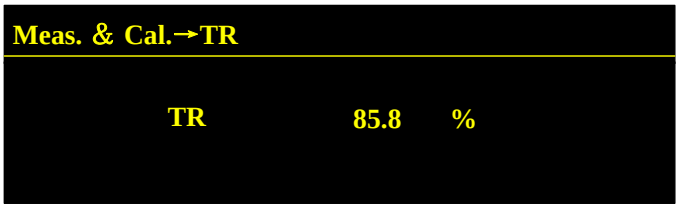


Fig. 5.21 "TR" interface

5.7 System Management

The "System" interface is mainly used to realize analog input/output configuration, digital input/output configuration, parameter backup and restoring. The interface is shown as follows.

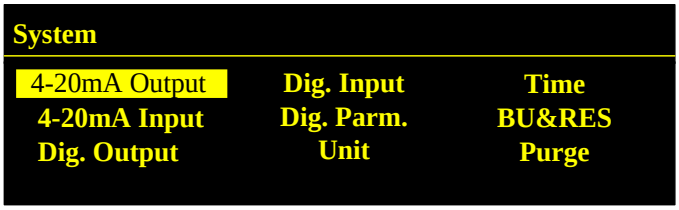


Fig. 5.22 "System" interface

There are two 4-20mA outputs which can set to be gas concentration, transmittance, higher calorific value, lower calorific value and Null. The set concentration of 4mA must be less than the that of 20mA, otherwise the system will prompt an error.

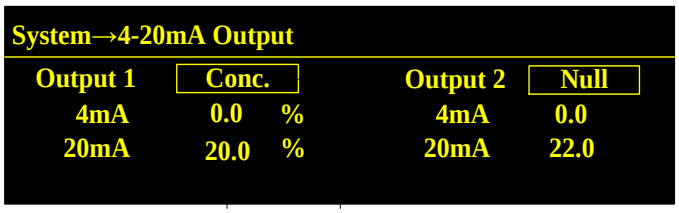


Fig. 5.23"4-20mA Output" interface

There are two 4-20mA inputs, which can set to be temperature, pressure, Null, purge concentration and humidity. The set concentration of 4mA must be less than the that of 20mA, otherwise the system will prompt an error.

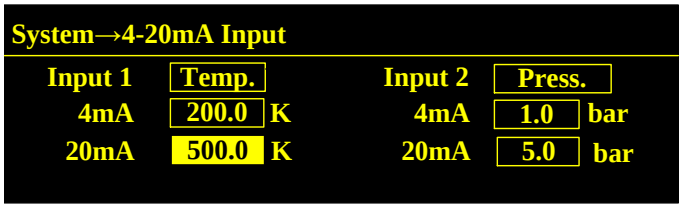


Fig. 5.24 "4-20mA Input" interface

There are two digital outputs, which can configure to be Null, fault, alarm, zeroing, span calibration, TR alarm, lower limit of first concentration, upper limit of first concentration, lower limit of second concentration and upper limit of second concentration. When the analyzer appears the configured status, the relay status will change too. The interface is shown below.

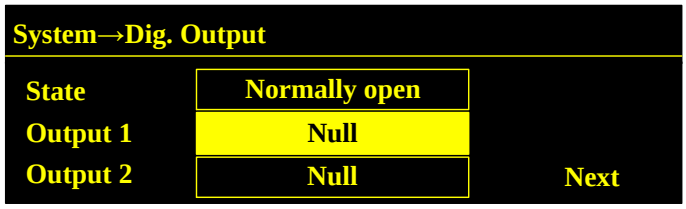


Fig. 5.25 "Dig. Output" interface

There are two digital inputs, which can configure to be auto zeroing, probe purge and Null. The interface is shown below.

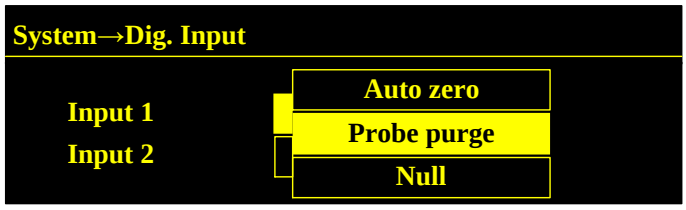


Fig. 5.26 "Dig. Input" interface

The digital parameters can be read and set on "Dig. Parm." interface, as shown below.

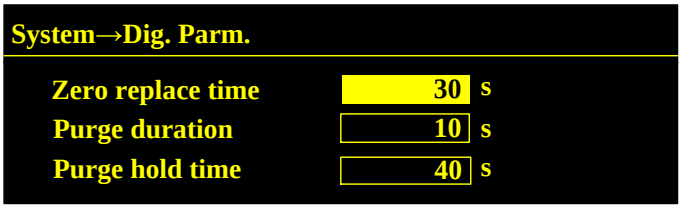


Fig. 5.27 "Dig. Parm." interface

The unit of concentration, length, temperature and pressure can be set on "Unit" interface. The concentration unit choose from "ppm", "%", "mg/m^3" and "g/m^3"; length unit can select "m" and "inch"; the temperature unit includes "°C", "K" and "°F"; the pressure unit contains "bar", "MPa" and "kPa". The interface is shown as follows.

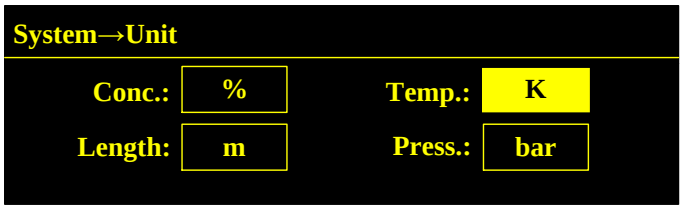


Fig. 5.28 "Unit" interface

The year, month, day, hour and minute of instrument can be set on "Time" interface, as shown below.

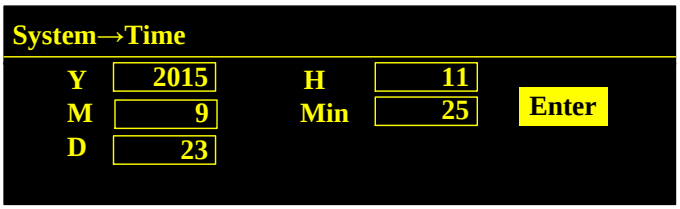


Fig. 5.29 "Time" interface

The "BU & RES" interface is for parameter backup and restoring. After parameter backup, the backup span calibration coefficient and zeroing coefficient will be stored. When there is an exception in calibration, user can restore the backup parameters. The interfaces are shown below.

Fig. 5.30 "BU & RES" interface

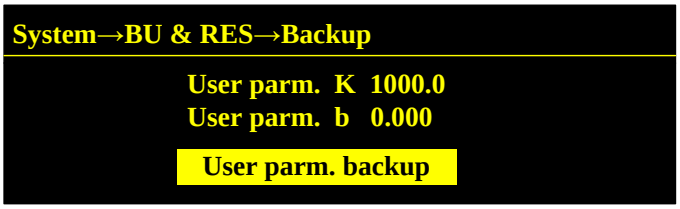


Fig. 5.31 "Backup" interface

If user is not satisfied with the calibration result and cannot get a better one temporarily, user can restore the backup span calibration coefficient and zeroing coefficient (factory setting or backup earlier). The restoring interface is shown as follows.

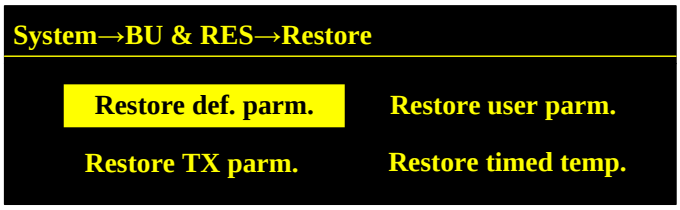


Fig. 5.32"Restore" interface

【Purge】 The interface is set to compensate the oxygen content when the purge gas contains a small amount of oxygen.

The interface includes setting of purging light path, purging temperature, purging pressure, purging mode, purging state and purging concentration, which is convenient for customers to set purging parameters reasonably, as shown in the following figure.

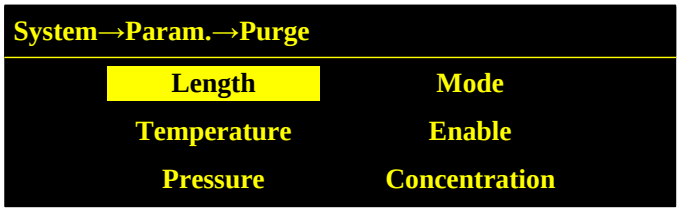


Fig. 5.33 Purge parameters interface

Caution:

The purging parameter interface can be set only for the laser oxygen analyzer. The purging parameter of the non-oxygen laser analyzer is set to disable. There is no need to set the parameter.

The purging path is the length of the purging gas through the optical path, which can be directly input through the man-machine interface.

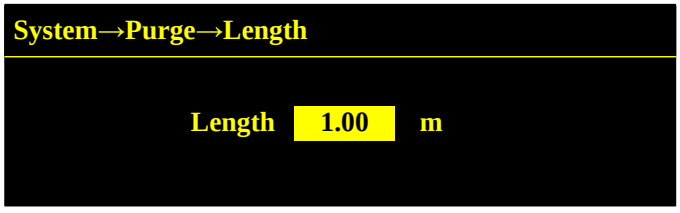


Fig. 5.34 Purge light path interface

The purge temperature and purge pressure can be set by manually entering fixed temperature and pressure values.

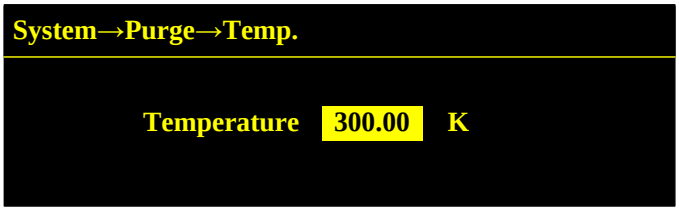


Fig. 5.35 Purge the temperature interface

Fig. 5.36 Purge the pressure interface

The purging mode can be selected from internal input mode, oxygen meter mode and 4-20mA input mode.

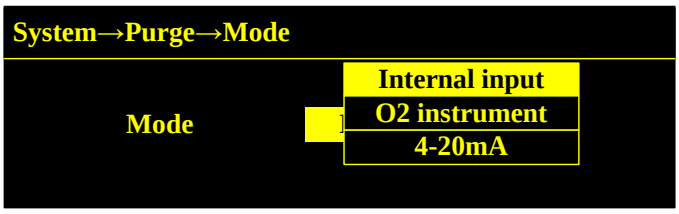


Fig. 5.37 Purge mode interface

【Enable】 The interface can be set to enable or disable the purging state. When the purging enable state is set to Enable, the purging state will be enabled.

When the purge enabled status is set to Disable, the purge status is off.

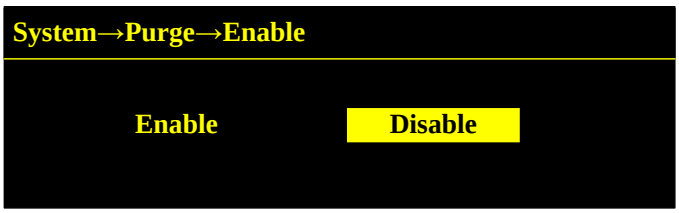


Fig. 5.38 Purge the enable interface

When the purge mode is set to internal input, enter a fixed concentration value in the Purge Concentration interface

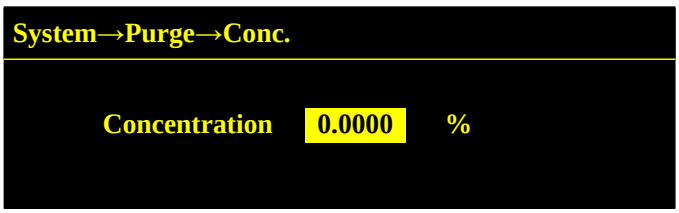


Fig. 5.39 Purge concentration interface

5.8 Working State

The working state indicates the status the instrument stays at. When the analyzer is installed in stack pipeline for sample gas measurement, select "Measuring" on the "Work Status" interface. If choosing "Measuring" successfully, the main interface will display "State M". When the analyzer is installed in calibration gas chamber and inject calibration gas based on N_2, select "Calibrating". If choosing "Calibrating" successfully, the main interface will display "State C". If the analyzer is maintaining, select "Maintaining" and the main interface will display "State F".

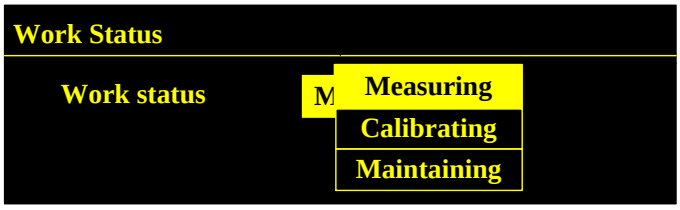


Fig. 5.40 "Work Status" interface

5.9 Maintenance Information

The "Maintenance" interface consists of alarm parameter, circuit board temperature, version information, password, device ID and alarm record, which can read and set the following parameters. The interface is shown as follows.

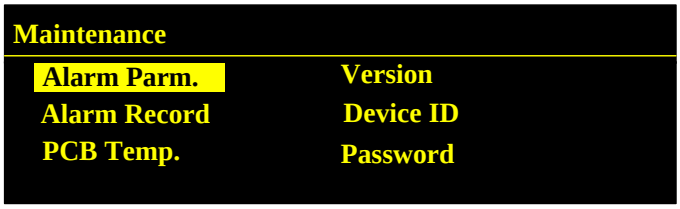


Fig. 5.41 "Maintenance" interface

User can set the upper/lower limit of concentration and lower limit of transmittance on the "Alarm Parm." interface. When exceeding the upper/lower limit, the system will appear alarm information (concentration is too high or too low). If the transmittance is lower than the lower limit, the system will appear alarm information that the transmittance is too low. The corresponding interfaces are shown as follows.

Fig. 5.42 "Alarm Parm." interface

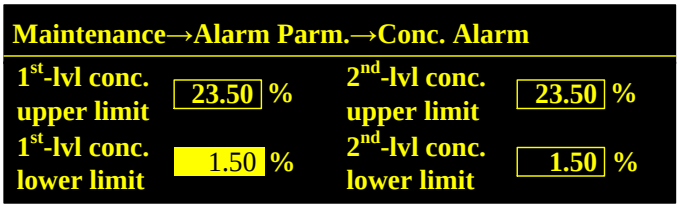


Fig. 5.43 "Conc. Alarm" interface

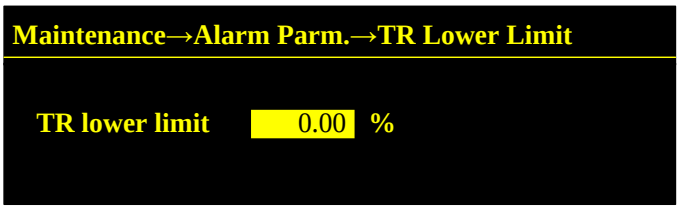


Fig. 5.44 "TR Lower Limit" interface

User can read temperature of receiver and transmitter on "Circuit Board Temp." interface, as shown below.

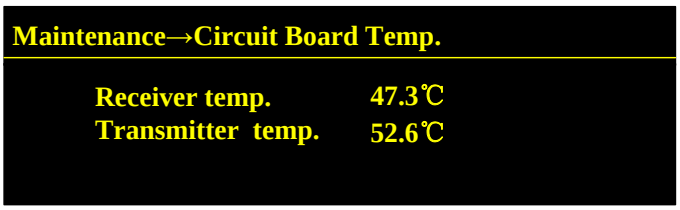


Fig. 5.45 "Circuit Board Temp." interface

User can check software version of receiver and transmitter on "Version" interface, as shown below.

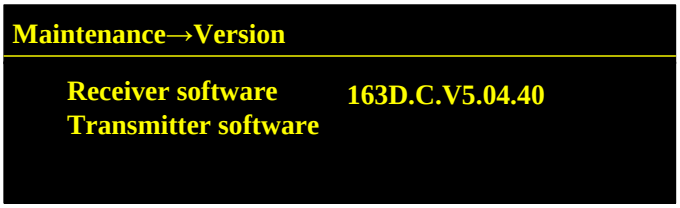


Fig. 5.46 "Version" interface

User can read the serial number of device on "Device ID" interface, as shown below.

The "Password" interface is used to modify the operation password, as shown below.

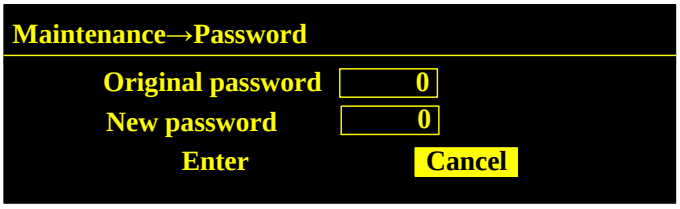


Fig. 5.47 "Password" interface

The "Alarm Record" is used to view the historical alarm information in a period, as shown below.

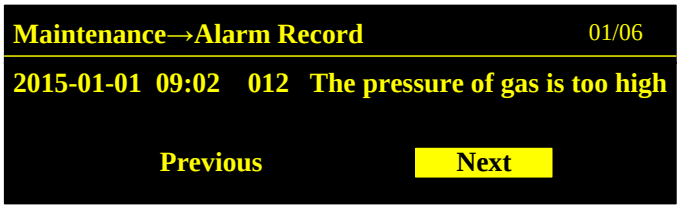


Fig. 5.48 "Alarm Record" interface

5.10 Communication Setting

The "Communication" interface is used to realize communication configuration between instrument and upper computer. The communication mode is RS232/485 and the baud rate can choose from 4800, 9600, 19200 and 57600. The communication interface is shown as follows.

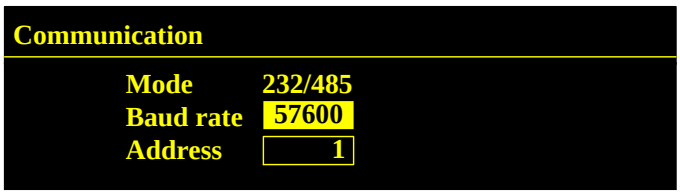


Fig. 5.49 "Communication" interface

6 Maintenance & Calibration

6.1 Alarm Information

If there is any exception in running, the alarm will be displayed on OLED screen. Meanwhile, there is a change on the status of relay output. The main alarm information is shown in table below. And if there is any exception cannot be solved, please contact our technical department.

Table 6.1 Alarm Information

Code	Meaning	Possible Reason	Solution
005	Spectral line drifts out of range	The output wavelength of laser is beyond the working range	Contact our technical department
011	Pressure of measured gas is too low	4-20mA input signal of pressure is less than 2mA	Check whether the output current of pressure transmitter is less than 2mA
012	Pressure of measured gas is too high	4-20mA input signal of pressure is larger than 22mA	Check whether the output current of pressure transmitter is larger than 22mA
013	Temperature of measured gas is too low	4-20mA input signal of temperature is less than 2mA	Check whether the output current of temperature transmitter is less than 2mA

Code	Meaning	Possible Reason	Solution
014	Temperature of measured gas is too high	4-20mA input signal of temperature is larger than 22mA	Check whether the output current of temperature transmitter is larger than 22mA
017	Measured gas concentration is out of range	The measured gas concentration is larger than the set value of range	Check if the set value of range is too low
018	Key exception	Key conflict or failure	Check whether the FPC line is broken or in short circuit
019	Display screen exception	Display screen failure	Contact our technical department
020	Internal signal exception	Internal register failure	Contact our technical department
021	Fail to read clock	Receiver fails to read the clock	Contact our technical department
022	Low purging concentration	The input 2-20mA is too low	Contact our technical department
023	Communication failure of oxygenmeter	Signal of oxygenmeter interrupts	Check communication lines of oxygen meter
024	The first level concentration of gas 1 is too high	The first level concentration of gas 1 is higher than upper limit of alarm	Check if the set upper limit of alarm is too low
025	The first level concentration of gas 1 is too low	The first level concentration of gas 1 is lower than lower limit of alarm	Check if the set lower limit of alarm is too high
026	The second level concentration of gas 1 is too high	The second level concentration of gas 1 is higher than upper limit of alarm	Check if the set upper limit of alarm is too low
027	The second level concentration of gas 1 is too low	The second level concentration of gas 1 is lower than lower limit of alarm	Check if the set lower limit of alarm is too high
028	The first level concentration of gas 2 is too high	The first level concentration of gas 2 is higher than upper limit of alarm	Check if the set upper limit of alarm is too low
029	The first level concentration of gas 2 is too low	The first level concentration of gas 2 is lower than lower limit of alarm	Check if the set lower limit of alarm is too high
030	The second level concentration of gas 2 is too	The second level concentration of gas 2 is higher than upper limit of	Check if the set upper limit of alarm is too low

Code	Meaning	Possible Reason	Solution
	high	alarm	
031	The second level concentration of gas 2 is too low	The second level concentration of gas 2 is lower than lower limit of alarm	Check if the set lower limit of alarm is too high
101	Temperature of transmitter board is too high	The temperature of transmitter board is higher than 85℃	Check if the ambient temperature is higher than 70℃
102	Temperature of transmitter board is too low	The temperature of transmitter board is lower than -40℃	Check if the ambient temperature is lower than -50℃
103	Temperature of receiver board is too high	The temperature of receiver board is higher than 85℃	Check if the ambient temperature is higher than 70℃
104	Temperature of receiver board is too low	The temperature of receiver board is lower than -40℃	Check if the ambient temperature is lower than -50℃
105	EEPROM communication is abnormal	EEPROM failure	Contact our technical department
106	EEPROM storage is abnormal	EEPROM storage failure	Contact our technical department
107	Working temperature of laser device is too high	The working temperature of laser device is higher than 50℃	Contact our technical department
108	Working temperature of laser device is too low	The working temperature of laser device is lower than -10℃	Contact our technical department
109	Working current of laser device is too small	The working current of laser device is smaller than the lower limit	Contact our technical department
110	Working current of laser device is too large	The working current of laser device is larger than the upper limit	Contact our technical department
111	Signal synchronization exception	Signal synchronization exception	Contact our technical department
112	Internal communication exception	Internal communication signal interrupts	Contact our technical department
113	Wiring anomaly of transmitting unit	The wiring of transmitting unit is abnormal	Contact our technical department
114	Internal signal failure	The drive signal of laser device is abnormal	Contact our technical department
115	External signal failure	External DA signal is abnormal	Contact our technical department
116	Reading failure of	The reading signal of thermostat is	Contact our technical department

Code	Meaning	Possible Reason	Solution
	thermostat	abnormal	
117	Thermostat exception	The feedback of thermostat is abnormal	Contact our technical department
118	Transmittance is too low	The pressure of purge gas is not enough, which causes optical window pollution; dust content in measurement environment is too high	Check if the optical window is polluted
119	Transmittance is too high	Transmittance signal is saturated	Contact our technical department
120	Measured signal saturation	The signal adopted by the measured gas is saturated	Contact our technical department
121	DC signal is abnormal	Direct current signal sampling failure	Contact our technical department
122	Thermostat returns abnormally	The returned value of thermostat is abnormal	Contact our technical department
123	Software service expires	The software is beyond service time	Contact our technical department
124	TEC protection	The workload of TEC is too large	Contact our technical department

6.2 Regular Maintenance

The maintenance work in normal use mainly consists of the following matters:

a) Regularly check if the flow of purge gas meets the operating requirement
b) Check if the optical window is polluted; if so, clean it up.
c) Optimize optical length of instrument.

The purging unit is used to protect optical elements on transmitting and receiving unit from polluting by the dust in measurement environment. Therefore, purge gas in a certain flow shall be kept ensuring the normal working of the instrument. However, the dust in the measurement environment might contaminate the optical window after long-term use and make the optical transmittance reduce. Thus, periodic cleaning is necessary.

The optical length of transmitting and receiving unit might drift away from the optimum working condition. It is necessary to optimize the optical length. In addition, please check regularly if the structural parts loosen.

6.2.1 Optical Window Cleaning

For most occasions, the maintenance period of optical window cleaning is usually above three months. Generally, it is suggested to clean the optical window every 3~6 months to ensure the instrument can measure continuously and accurately. In normal use, if the flow of purge gas is too

small, it might cause that the transmittance reduces. If the transmittance alarm occurs, please clean the optical window.

Caution:

The effect of transmittance change on measurement has been taken full consideration during design of LGA-4000Z Diode Laser Gas Analyzer. When transmittance alarm occurs, the measurement deviation might be ≥±1% F.S.

Before cleaning optical window, first remove the transmitting and receiving unit from the instrument flange. If the optical window is polluted, please use mixing solution of alcohol and ether (volume ratio is 1:1) for cleaning. If the optical window is damaged or cracked, please replace the optical window immediately.

The procedure of optical window cleaning is shown as follows:

a) Turn off the root valve to isolate the process gas in measuring pipe from the external atmospheric environment.
b) Loosen the locking ring and remove the transmitting unit as well as receiving unit from instrument flange separately.
c) Check the pollution condition of optical window. If it is damaged (including cracks), it shall be replaced.
d) Use clean cloth or paper to clean the optical window, ensuring there is no obvious stain on the surface of optical window.
e) If the optical window cannot be cleaned completely, it shall be replaced.
f) Reinstall the transmitting unit and receiving unit. Check the transmittance information on OLED screen. If the transmittance alarm still exists, please optimize the optical length according to Section 6.2.2.

6.2.2 Optical Length Optimization

To ensure normal operation of the analyzer, please optimize the optical length according to Section 4.12 when OLED screen displays the transmittance is low.

6.2.3 Instrument Calibration

Zeroing and span calibration has been conducted before delivery of LGA-4000Z Diode Laser Gas Analyzer, thus there is no need to calibrate the product on the first use. However, system parameters will drift along with the aging of electronic device, which will affect the accuracy of measurement. Therefore, the LGA-4000Z is required to be calibrated regularly. It is suggested to perform calibration every 3~6 months.

The LGA-4000Z Diode Laser Gas Analyzer adopts off-line calibration. The procedure is shown as follows.

a）Before calibration, first remove the transmitting and receiving unit from instrument flanges and check if the optical window is clean and in good condition (without cracks); if so, take the next step. Otherwise, please refer to Section 6.2 for processing.

b）Install the removed transmitting and receiving unit on calibration gas chamber as shown in the figure below. Tighten the locking ring and connect the gas path according figure 6.2 for calibration preparation.

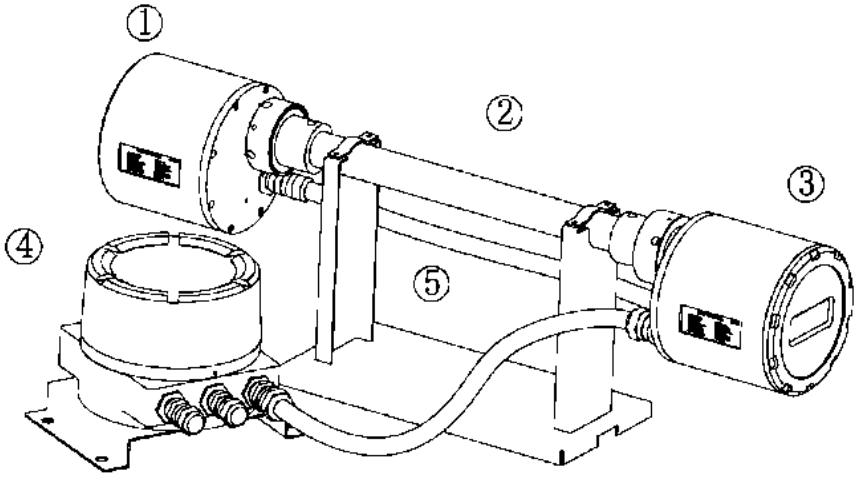


Fig. 6.1 Install the transmitting and receiving unit on calibration gas chamber

No.	Name	Specification
(1)	Transmitting unit	Drive gas source to emit detection signal
(2)	Calibration gas chamber	
(3)	Receiving unit	Receive detection signal; analyze, calculate and display concentration information, etc.
(4)	Junction box	Provide power supply and signal input/output for the instrument
(5)	Support of calibration gas chamber	Support calibration gas chamber

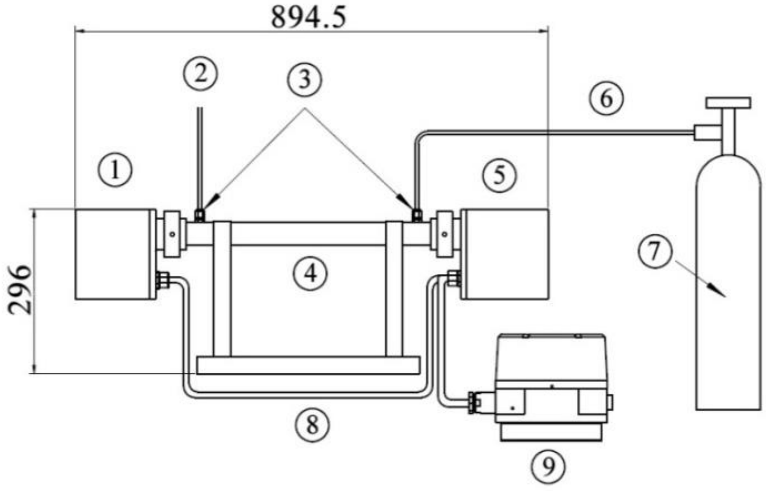


Fig. 6.2 Calibration gas path connection

No.	Name	Specification
(1)	Transmitting unit	Drive gas source to emit detection signal
(2)	Vent	Outlet of standard gas
(3)	Pipe joint	
(4)	Calibration gas chamber	
(5)	Receiving unit	Receive detection signal; analyze, calculate and display concentration information, etc.
(6)	Φ8 flexible pipe	
(7)	Standard gas	
(8)	Transmitting-receiving cable	Transmit communication signals between transmitting unit and receiving unit
(9)	Junction box	Provide power supply and signal input/output for the instrument

c）Power the instrument on and check if there is alarm information after self-test. If it is normal, take the next step. Otherwise, please refer to Section 6.1 for processing.

d）Input correct password to enter the “Work Status” interface, and select “Calibrating”. Then enter the “Calibration” interface to check and set gas temperature, gas pressure, optical length and calibration concentration.

e）Inject zero gas (usually adopt ≥99.99% N_2), and wait until the measured value stabilizes, and then enter “Calibration” interface for zeroing.

f）Inject standard gas of full range into the calibration gas chamber and wait until the measured value stabilizes, and then enter “Calibration” interface for span calibration.

g）Remove the transmitting and receiving unit from the calibration gas chamber, and reinstall them on the instrument flanges.

h）Power the instrument on and input the correct password to enter “Work Status” interface after self-test. Set the status to be “Measuring”. Check and set parameters including gas temperature, gas pressure, optical length, etc.

Caution:

The calibration gas used in span calibration shall be the standard gas based on N_2.

If there is problem during calibration which cannot be solved based on the above method, please contact the company's after-sales technician.

Appendix

A.1 Specifications

Analytical Performance

Length:	≤ 20m
Response Time:	≤ 1 s
Linear Error:	≤ ±1% F.S.
Repetition:	≤ 1%
Span Drift:	≤ ±1%F.S. in 6 months
Maintenance Cycle:	≤ 2 times per year, clean optical window
Calibration Cycle:	≤ 2 times per year

Signal Interface

AO:	2×4-20mA output (isolated, max load 750Ω)
AI:	2×4-20mA input (TEMP. and PRESS. compensation)
Digital Output:	RS485/RS232/GPRS
Relay Output:	2 outputs (24V, 1A)

A.2 Recommended Spare Parts List

Qty.	P/N	Description
1	Txxxx	Transmitter module
1	DPxx	Receiver module
1	P2123	Transmitter board
1	P2124	Receiver board
1	P2125	Temperature control board
1	P2126	Interface board
1	DP31	Display module,
1	T1853	Magnetic pen

Note: Orders for replacement parts should include the part number (if available) and the model and serial number of the instrument for which the parts are intended.

Orders should be sent to:

TELEDYNE Analytical Instruments

16830 Chestnut Street
City of Industry, CA 91749-1580

Phone (626) 934-1500, Fax (626) 961-2538

Web: www.teledyne-ai.com
or your local representative.

A.3 Reference Drawings

Refer to Addendum for reference drawing list. Drawings may be found at the back of the manual.