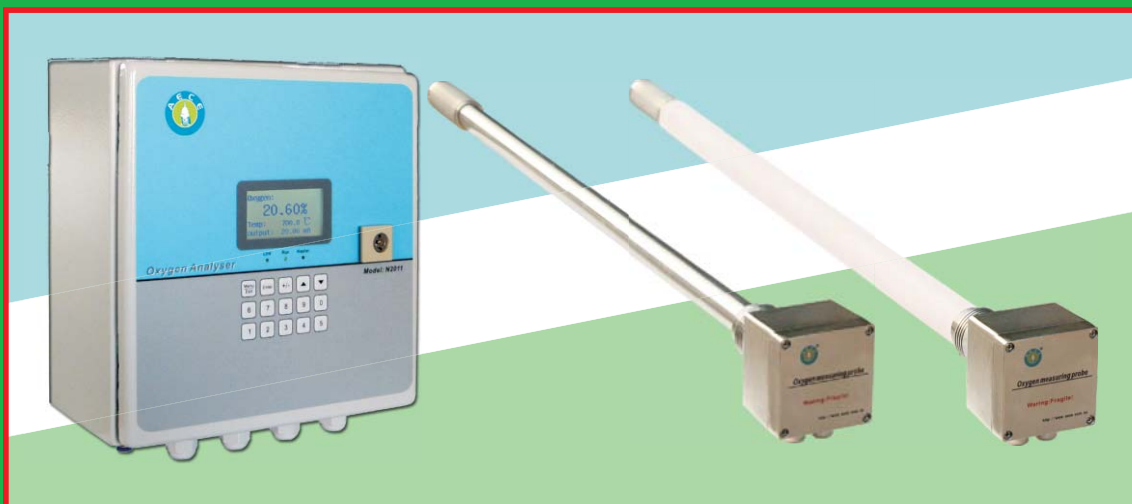




N2000 Series Zirconia Oxygen Analyzer

Operating Instruction



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1. PREFACE

- 1.1 Thank you very much for choosing our products and giving us the opportunity to provide you with our quality service, and we promised to make every effort to keep the unimpeded communication between us. We know very well that the quality of products and service are of equal importance, therefore, we will do our best to ensure every contact of us be a pleasant and memorable experience. Thank you again for choosing this system and we hope that we can have the opportunity to provide further services for you.
- 1.2 This system is stable in performance and easy in use. In order to bring this system into full play, we strongly recommend the users to read this instruction carefully.

2. NOTICE

- 2.1 Improper usage and operation could lead to unexpected electric shock, therefore, during the period when the probe and the analyzer power on, except for the instrument operation panel, all the other operations are forbidden to be conducted in case of the occurrence of electric shock.
- 2.2 The core component inside the probe—Zr pipe is made of fragile and breakable corundum ceramics, therefore it must be handled with care and avoid collisions which may lead to irreversible damages.
- 2.3 This instruction shall be protected by the copyright related laws of the People's Republic of China, and without consent, it is not allowed to be reprinted in any forms, otherwise it will be considered as infringement and the legal liability must be ascertained!
- 2.4 Please send this instruction to the ultimate user of this system.

3. OVERVIEW

- 3.1. N2011 type zirconia analyzer is widely applied to industrial fields such as coal burning boiler, gas-fired boiler, coke oven, furnace, melting furnace, garbage incinerator and pure gas manufacturing, and applied to the control of burning supervision, emission inspection and industrial processes. Compared with the vast majority of gases, the oxygen ion exhibits paramagnetic property of which the N2011 type zirconia analyzer makes use to measure the oxygen density. In the non-uniform magnetic field, because of its paramagnetic property, the oxygen ion will move toward the field direction; and when two kinds of gases of different oxygen move in the same field, we know that in electricity, the movement of electric charge will definitely produce electromotive force. Within the sensor, under the constant temperature, the millivolt value of the ceramic two Zr head faces of the Zr pipe will reflect the oxygen density of the two Zr head faces directly. Because that one of the Zr head faces is filled with air, and the other face is filled with the tested gas, and we know that the oxygen content in the air is considered as a stable value, and the oxygen content of the gas is ever-changing. Therefore, the changing millivolt value of the two Zr heads also reflects the oxygen content change of the gas.
- 3.2. Components of the oxygen measuring system: probe installed inside the flue, oxygen analyzer (transmitter), reference source gas, electric cable and reference air pipe.

4. PRINCIPLES OF MEASUREMENT

- 4.1 N2011 type zirconia analyzer is applicable to the on-line real-time measurement of the oxygen content of flue gas in the process of burning, and also applicable to the on-line measurement of the oxygen content of the non-combustion gas; because that chemical reactions are usually more obvious in high temperature environment, and the Zr head can work in 700°C high temperature environment,

a heater is installed inside. The surface of the Zr head is coated with oxygen concentration difference cell made of porous platinum electrode, only when the oxygen concentrations of the two Zr head faces are different, will the oxygen ion exhibit its paramagnetic property and move towards the field direction, and hence the two end faces of the Zr heads will definitely produce an electromotive force. The size of the electric potential will reflect the amount of the oxygen content of the flue gas.

- 4.2 In a constant temperature condition, the electric potential of Zr cell can be calculated by the following formula (Nernst Equation)

$$mV = 0.0496T \lg \frac{P_1}{P_2} + C \text{ (mV)}$$

mV: the millivolt value produced by the two Zr head faces.

T: The environmental temperature in which the Zr cell works. (absolute temperature $K = 273^\circ C + 700^\circ C$)

P1: The inside head face of the Zr cell, the reference gas and oxygen density, defaults to the oxygen density of the air, which is 20.6%

P2: The outside head face of the Zr cell, the oxygen density of the tested gas (the flue gas).

C: The Zr cell constants. That is the millivolt value produced when both the two head faces of the Zr cell are air.

4.3 Definitions

- ✧ Reference gas—the gas in comparison, namely air. The reference gas should be dry and oilless air (oxygen content 20.6%), when the gas densities of the two Zr head faces are different, due to the paramagnetic property of oxygen, the oxygen ion will move from the higher side to the lower side, and the Zr cell will reflect the oxygen density value of the tested gas by the logarithmic rule.
- ✧ Zr cell—the Zr head of the Zr pipe, core component of the oxygen probe.

- 4.4 The oxygen potential and oxygen content: fill the reference gas into the inside of the Zr cell, and when the millivolt values of both ends of the Zr cell become smaller, the oxygen density of the tested gas becomes higher, and vice versa. The millivolt values become higher, and the oxygen density of the tested gas becomes smaller. The Zr cell can work in 700°C environment, and please see the Appendix 2: Zirconia Oxygen Concentration Potential Comparison Table.

5. MEANING OF MEASUREMENT

- 5.1 The application of oxygen analyzer in burning control should avoid two situations, one is oxygen-excess combustion, and the other is oxygen-deficient combustion. The oxygen-excess combustion can take away excess heat, and therefore waste too much energy. While the oxygen-deficient combustion is also a kind of energy waste due to its insufficient burning which will lead to significant pollution to the atmosphere.
- 5.2 The ideal combustion is one in which the air and fuel mixed to a scale and decomposed completely and produce heat, water vapor and carbon dioxide. However, the fact is different from the ideal. During the real combustion process, the heat value of the fuel and the daily climate change as well as the change in the control methods will all have an impact on the safety and heat efficiency of the combustion. How much air should be needed to participate in the combustion? If the air is too less, it won't be burned completely and will enter the flue which will lead to the energy waste and explosive atmosphere. But if the air is too much, the excess heat will enter the flue and lead to heat loss. Correct way of controlling the combustion will not only reduce the energy waste but also decrease the pollution to the environment.

6. EXTERNAL DIMENSIONS

- 6.1 The external dimensions of N2011 type zirconia analyzer
(L)3000mm×(W)280mm×(H)150mm.



Instrument Appearance Figure

7. INSTALLATION PRECAUTIONS

- 7.1 **Inspections prior to installation:** please check whether the package is complete or not, when open it up check whether the instrument attachments are complete or not, whether the external appearance is good, whether there is any damages and if conditions permit, conduct a power-on test. In order to ensure the stability of the system performance, the installation should be executed under instructions from professional staff.
- 7.2 **Installation of the instrument:** the zirconia analyzer belongs to electronics, the installation environment range of which should be $-20^{\circ}\text{C} \sim 50^{\circ}\text{C}$, and the installation should be conducted away from the heat source and the vertical distance from the heat source should be no less than 60 cm, and the air switch of the instrument power supply should be no less than 5 A. Otherwise, the system will trip out and be wrongly judged as short trouble. The signal shielding layer should conduct single point grounding, the high voltage and low voltage lines should be laid separately to avoid signal interference. The cable connecting the instrument and the probe should be remained as “U” shape, and a small hole should be made at the bottom of the “U” shape to prevent the rainwater flowing

into the probe or the instrument along the cable. The Signal produced by the instrument itself belongs to active signal and is standard signal current 4~20 mA.

- 7.3 **Installation of the probe:** the position of installation should be corners avoiding the flue in order to prevent flue gas vortex which might lead to measurement deviations; it is suggestive to select some representative average sample gas and the installation should be executed in the position which has stable and smooth airflow, less vibration, near the furnace wall without air leakage and properly sealed, besides space for maintenance is also necessary. The installation of flange should be welded closely with the flue, and there should be no leakage. The installation could be inclined horizontally downward 30 degrees and be conducted vertically downward, but the vertically upward installation is not allowed; during installation, the axis of the flange should maintain horizontal or incline to the inside of the flue to prevent smoke and condensate flow into the oxygen sensor and rust it. Asbestos-cloth sealing gasket should be installed between the furnace wall flange and the probe flange, and tighten the screws. The blocked core of the test port of the probe should be sealed by thread seal tape to avoid leakage (air leak). See the detailed installation methods in the attachments in the last pages of this instruction.

8. ZIRCONIA ELECTRICAL PRECAUTIONS

- 8.1 Zr pipe, heater and its matching thermocouple, 316Lstainless steel protective pipe shell are the core components inside the zirconia probe, and the three units of signal lines of the junction box are: ① two power input lines of the heater and the signal is alternating without positive and negative difference; ② two K type thermocouples with positive and negative difference; ③ two zirconia cells (Zr probe) with positive and negative difference; see the specified connecting method in the terminal mark on the junction box.

- 8.2 The core component of the zirconia probe is fragile ceramics which must be handled with care and avoid collisions in any forms.

8.3 Electrical Connection

The high voltage part: the instrument power supply adapts AC220V, and it is suggested use air switch of no less than 5A as the power switch of the instrument.

The high voltage consists of two units, including the instrument power supply and the heater power supply. The power supply of the heater is extracted from the inside of the instrument and both of them are alternating signals without positive and negative difference.

The low voltage part: The low voltage part consists of three units which is the positive and negative of the zirconia analyzer Zr cell, the positive and negative of the thermocouple, as well as that of the output current signals. See the detailed wiring method in the appendix 4: N2011 Type Zirconia Analyzer System Wiring Diagram in the last pages of this instrument.

- 8.4 Notice before starting:

AC220+10V。

Power voltage: AC220+10V。

The reference pipe of the probe should be connected to the pipe joint of the instrument.

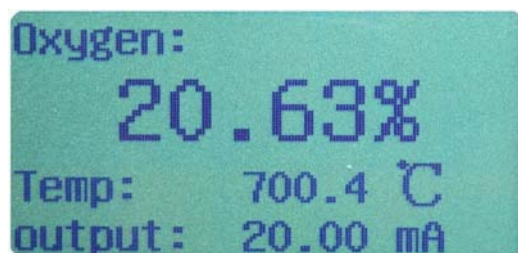
Flange seal, the seal of the probe blocked core, no leakage (air leak) near the flue.

Ground the shielding layer of the signal line at a single point.

Proper cable connection between the probe and the instrument.

9. SYSTEM OPERATION

9.1. The Operating Interface



The above diagram exhibits the operating state of the probe in air, consisted of three parameters:






- ✧ **Oxygen:** The main interface displays the oxygen content. The oxygen content in air is 20.6%.
- ✧ **Temp:** The current temperature of the heater, and the normal working temperature is $700^{\circ}\text{C} \pm 1^{\circ}\text{C}$.
- ✧ **Output:** The standard of the instrument output is 4~20 mA current signal value, which is real-time signal, and the value is corresponding to the signal value sent to the master control room.

Panel status indicator lights



- ✧ **Link:** Remote communication function status indication.
- ✧ **Run:** Instrument operation status indication.
- ✧ **Heater:** Heater operation status indication.

9.2. The instrument operation panel: N2011 type zirconia analyzer panel includes 15 toggle buttons, among which 0~9 are digital input buttons and

the other five are 、、、、 respectively.

As shown in the following figure:



9.3. The button function instructions:



: Menu, 1. Enter the inner menu of the system. 2. Return and exit.



: Confirm enter, all the corresponding parameter modifications in the system should confirm enter, otherwise the operation will be considered invalid.



: Positive/negative bottom, used for the positive and negative modification of log value.



: Up-arrow button, enter the inner menu of the system, used for the upward selections of menu items.



: Down-arrow button, enter the inner menu of the system, used for the downward selections of menu items.

9.4. System mune: mune of this system consists the following interfaces:

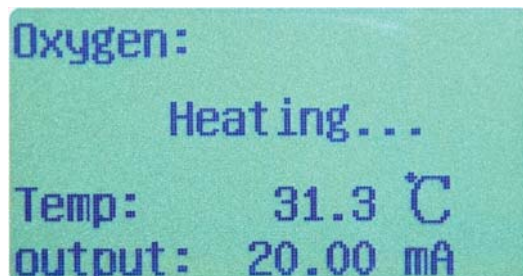
```
Menu: Enter<3 sec>
1. Parameter setup
2. Relay output set
3. Zero calibration
4. Slope calibration
```

- ✧ **Parameter setup:** The parameter setups item
- ✧ **Relay output set:** The alarm setups item of the top and bottom limitations of oxygen content

- ✧ **Zero calibration:** Single-point calibration.
- ✧ **Slope calibration:** Double-point calibration.

Notice: Each menu item consists of several sub-menu items, please pay attention to the contents of the interface during operation!


9.5. SETUP: When the installation of the connecting wires between the instrument and the probe, conduct a power-on operation and the power-on interface should be as follows:

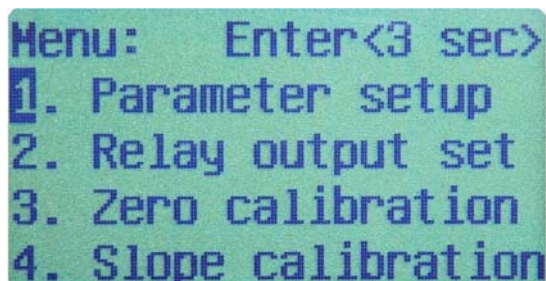


```
Oxygen:
      Heating...
Temp:    31.3 °C
output:  20.00 mA
```

Because the stability of oxygen content is related to temperature, the 31.3°C in the above figure indicates the environmental temperature of the probe before heating, and the instrument will always display...(in heating) unless the design temperature of 650°C is achieved, indicating that the instrument is providing heating voltage for the heater; and when the temperature of the heater reaches above 650°C, the oxygen content will display. When the temperature of the heater is stable in 700°C, the oxygen content will become more normal.

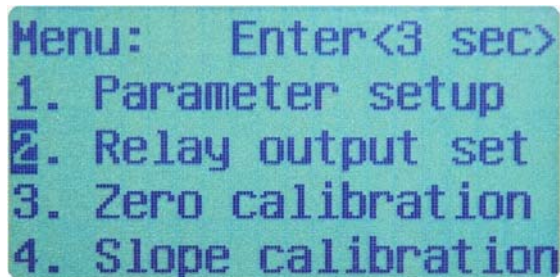


9.6. Menu switch: press the mune button  to enter the system, and the marker will remain at the first position. As shown in the following interface contents.





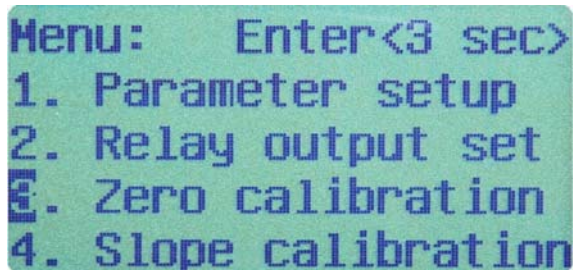
```
Menu: Enter<3 sec>
1. Parameter setup
2. Relay output set
3. Zero calibration
4. Slope calibration
```

Press the down-arrow button  and the marker will jump to the next menu item, as shown in the following interface.

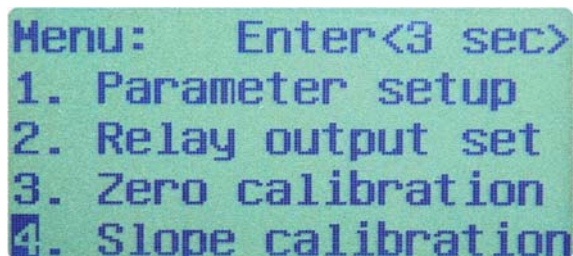


Menu: Enter<3 sec>
1. Parameter setup
2. Relay output set
3. Zero calibration
4. Slope calibration

The rest can be done in the same manner, press the marker button  and , switch to different menu items.



Menu: Enter<3 sec>
1. Parameter setup
2. Relay output set
3. Zero calibration
4. Slope calibration



Menu: Enter<3 sec>
1. Parameter setup
2. Relay output set
3. Zero calibration
4. Slope calibration

9.7. Measurement range and temperature setup

9.7.1. Only one parameter of the system should be setup in advance: the measurement range, the setup of which should remain the same with that of the DCS system on-site; otherwise, the measurement range observed in the master control room will be different from the oxygen content seen from the on-site instrument display. The setup of the measurement range should accord to the oxygen content range in the furnace.


9.7.2. The setup of the measurement range should remain the same with that of the DCS system in the master control room, otherwise, the oxygen content data displayed by the instrument itself will not be corresponded to that displayed by the DCS system in the master control room. For example, 10% measurement of the instrument setup, the output resolution is 1% of the oxygen content jump, and the output current signal variation is 1.6 mA, and the rest can be done in the same way, when the measurement range of the instrument is 20%, the output current variation of every 1% oxygen content jump is 0.8 mA. Therefore, the resolution of DCS system current must be the same with that of the instrument. The relational expression is as follows:

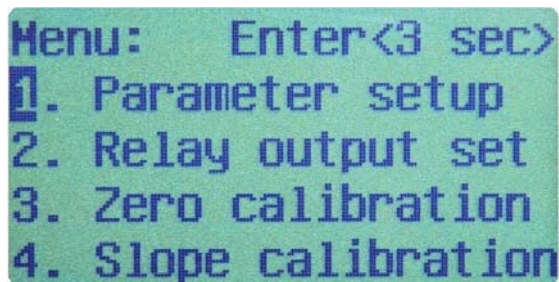
When the current output is 4-20 mA, the current output equation is

$$\text{mA} = (20 - 4) \times \frac{P}{R} + 4$$


P: the oxygen concentration of the tested gas

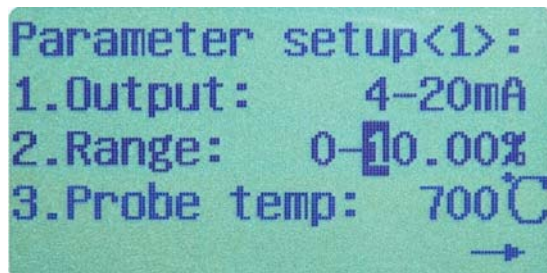
R: the specified output measurement rang.

Press the menu button  to enter the system, and the marker will remain at the first position. As shown in the following interface.




```
Menu:  Enter<3 sec>
1. Parameter setup
2. Relay output set
3. Zero calibration
4. Slope calibration
```

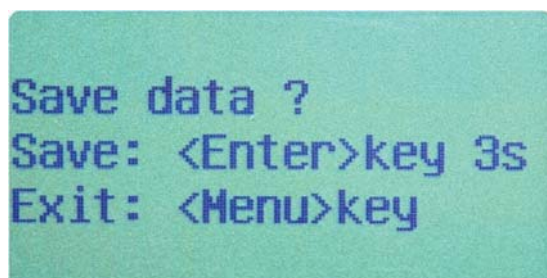
According to the screen tips, press the enter button  and after 3 seconds enter the second set of measurement range setup. As the following interface shown.



Parameter setup<1>:
1.Output: 4-20mA
2.Range: 0-10.00%
3.Probe temp: 700°C
→

Type in the corresponding digits on the operating panel directly, and the marker will jump to the next position, set up the values and the measurement width range should be set around 0~99.99% ,the default measurement range of the system is 0~10%. As to the third setup of temperature, it mainly aims to the optimal working temperature setup of various types of probes; except for special probes, it is generally suggested adapt the default value

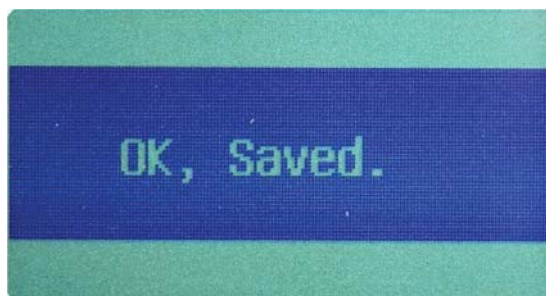
of 700°C; when all the parameters are setup, press the enter button  for 3 seconds for saving. The saving of parameters can be done either by saving all the setup parameters together or by saving them item by item, which should be depend on the convenience of the user's operation. If you do not want to save the parameters, press the menu button to return. As the following interface shown.



Save data ?
Save: <Enter>key 3s
Exit: <Menu>key

Please pay attention to the content indication of the interface !

Press the enter button  for 3 seconds for saving, or press the menu button to exit,



Saved!

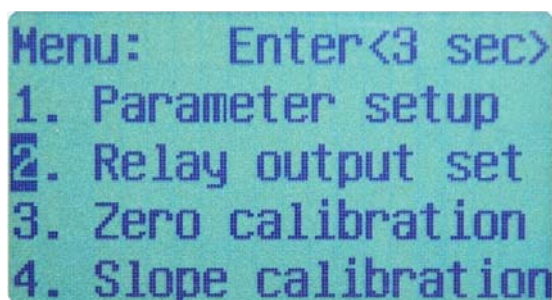
If the save is successful, press the menu button directly to exit, and the parameter setup is completed.

9.8. Alarm of the top and bottom limitations of oxygen content

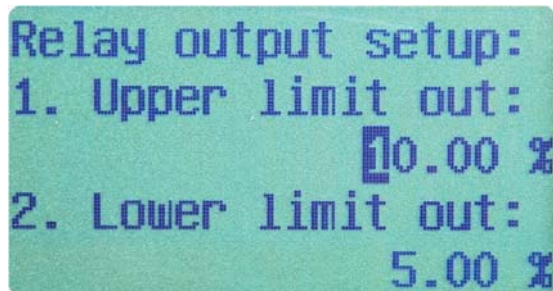
9.8.1. The factory measurement range default of this system is 10.00%. And we set this value as the top limitation, and 5% as the bottom limitation. The using of these two limitations should accord to the actual situation on-site (this setup won't be taken into consideration if there is no requirement of the top and bottom limitations alarm). This function can be set according to the actual need on-site. If the oxygen content of the instrument exceeds 10%, the output of CN3 relay terminal K1 on the main instrument panel should be the top limitation alarm (switch signal), and the relay K2 is the bottom limitation (switch signal). Please pay attention to the printed marking on the main panel of the instrument.



9.8.2. Setting method: press the menu button to enter the system, and the marker should be at the second position. As shown in the following interface.



According to the indication of the screen, press the enter button for 3 seconds to enter the second menu setting item. As shown in the following interface.



```
Relay output setup:
1. Upper limit out: 10.00 %
2. Lower limit out: 5.00 %
```



If the modification of data is necessary, press the enter button to save them and exit, according to the previous chapter.

10. CALIBRATION



10.1. The probe and the analyzer are precise instrument, and because of the manufacturing process of each component and the specific measuring environments in which the measurement is conducted, the tested basic parameters are not exactly the same. After a period of operation, the probe will be aging which will lead to measured derivation, and so will the analyzer (transmitter) do, therefore the calibration of the system is necessary. Filling standard gas in is a common method. If conditions permit, the calibration must be conducted to the newly launched system and component changes. Whether it is necessary to conduct the calibration in intervals after launching or in the periodic maintenance should subject to and is determined by the precision requirement of the user. The suggestive two-point calibration frequency of the instrument in normal operation should be: 1 year/1 time (See the details in two-point calibration operation in the last two chapters).

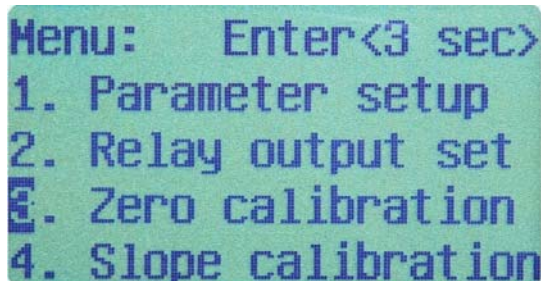
10.2. 1000cc/min.Standard gas: It generally takes two kinds of standard gases, one is hyperoxia and the other is hypoxia. The hyperoxia usually takes the air as nitrox (the theoretical oxygen content of air is 20.6%), and the mixture of nitrogen and oxygen of the hypoxia (0.1% ~7%) is standard gas. In calibration, the flow amount of gas will have an impact on the calibration quality, and therefore the standard gas filled in should be no more than 1000cc/min.


10.3. Single-point calibration

10.3.1. The single-point calibration is taken as a usual calibration method of routine maintenance, and it is supposed to calibrate the constants of the Zr cell (the standard potential—zero), and the constants of the Zr cell is usually considered as the millivolt values produced when both the inside and outside of the cell are air; the frequency of calibration should accord to the actual usage status, and under normal operation conditions, calibration is not necessary, and the single-point calibration should only be conducted for the occurrence of derivation in the oxygen content test (unacceptable range).

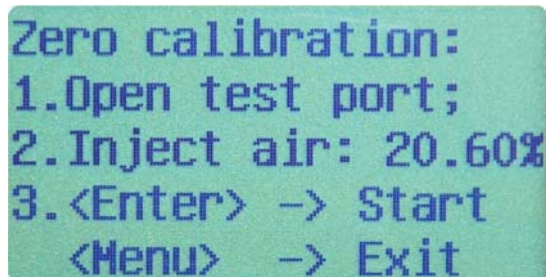
10.3.2. The required calibration tools: 1 adjustable wrench (specifications 25×300), and 1 row of raw material.

10.3.3. Follow the procedures: press the menu button  to enter the system when the instrument is under operation conditions, and press the  button to shift to the third menu, as shown in the following interface:



As shown in the screen content indications, press the enter button  for 3 seconds to enter the single-point calibration menu. After 3 seconds the interface will shift to the following interface automatically as is indicated. Such as in the screen content indication, the first step: open the test port. The second step: inject air into the probe test port with 20.6% air. Press the enter button to commence the calibration operation of the contents in

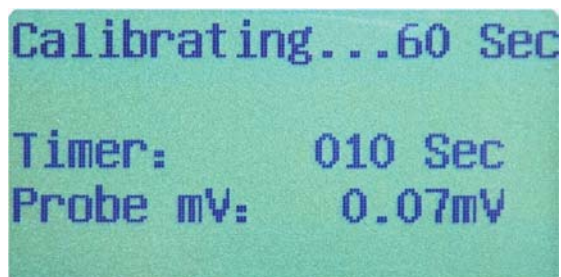
the third step, and press the menu button  to exit the calibration procedure.



Zero calibration:
1.Open test port;
2.Inject air: 20.60%
3.<Enter> -> Start
 <Menu> -> Exit



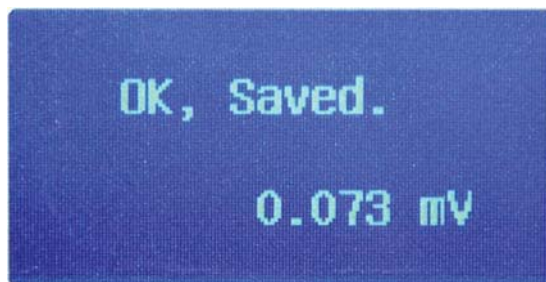
Press the enter button to continue the procedure. The interface will shift to the calibrating timing interface. The timing procedure will take 60 seconds as its period, and when the timer reaches 60 seconds, the system will save the data automatically and return to the operating interface of the instrument. The timer accumulates the judgments of the mv value stability of the Zr cell, and when the order of magnitude of the mv value changes, the timer will be refreshed and the timing will start over. As shown in the following interface.



Calibrating...60 Sec
Timer: 010 Sec
Probe mV: 0.07mV

Calibrating....

Timer is the calibrating timer. When the timer reaches 60s, the system will save the data automatically, and the interface will shift back to the operating interface automatically. The theoretical value of the Zr cell constant is 0 mV. Constants of Zr cells from different probes are always different, and constants of probe Zr cells of high quality tend towards the theoretical value. During the calibration process, if the value observed by the user is stable, in order to save the usage amount of the standard gas and time, it is recommended to press the enter button in 30s to enforce the data saving; and in addition, the stable mV value of the probe in 60s is a very strict calibration requirement. Because of the environmental interference on-site, it is generally recommended to press the enter button to enforce the saving of mV value.



Data saved.

Shift to the operating interface automatically



Single-point calibration

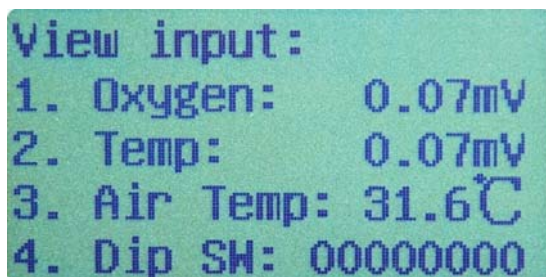
completed.

10.4. Shortcuts

10.4.1. In the operating interface of the above figure, press the up-arrow button




to shift to the following interface, and this interface is very convenient in maintenance which is also a great advantage of this system.

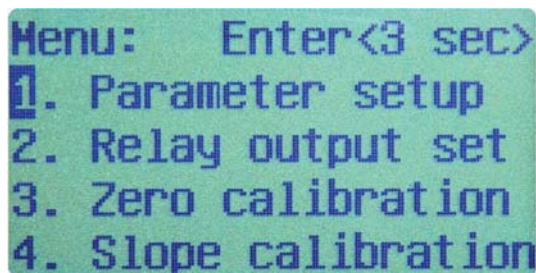


The first parameter in the above figure indicates the millivolt value produced by the Zr cell in the testing of air, and the theoretical value is 0.00mV, but in actual applications, the value rises and falls, because in the most operations of the furnace, it is very likely to produce negative pressure and at that time when open the test port of the probe, air will flow into the probe through the test port. This value will tend towards the change of the theoretical value, and when this value stabilizes for 20s, write down the records, and enter the system to set this recorded value into the system to finish the single-point calibration. Meanwhile, the size of


this value will reflect the testing performance of the probe, and if the value tends to 0mV, it is suggested a positive testing performance of the probe.

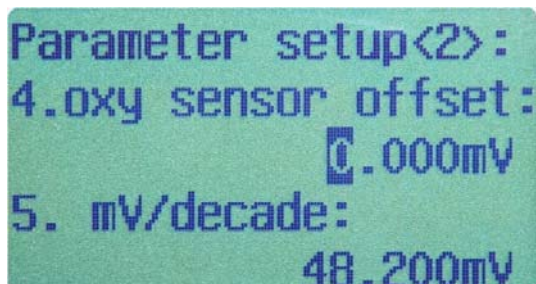
10.4.2. Follow the steps below: record the mV value stabilizing for 20s in the above

interface, and press the menu button  to enter the system, which is shown in the following interface.



```
Menu: Enter<3 sec>
1. Parameter setup
2. Relay output set
3. Zero calibration
4. Slope calibration
```

Press the enter button  for 3s to shift to the second screen interface of the sub menu under the first item. As shown in the following interface.



```
Parameter setup<2>:
4.oxy sensor offset:
    0.000mV
5. mV/decade:
    48.200mV
```

NOW FILL THE RECORDED mV VALUE INTO THE FOURTH ITEM IN THE ABOVE FIGURE AND PRESS THE ENTER BUTTON, IF THE SCREEN INDICATES SAVING, IT MEANS THAT THE SINGLE-POINT CALIBRATION IS COMPLETED.


When the Zr cell parameter exceeds +10mV, it will be considered as illegal, and the system will not record that data, and a new calibration will be needed. The illegal parameters occur only when the probe has been in operation for too long time or due to wrongly operations of the calibration.


10.5. Two-point calibration

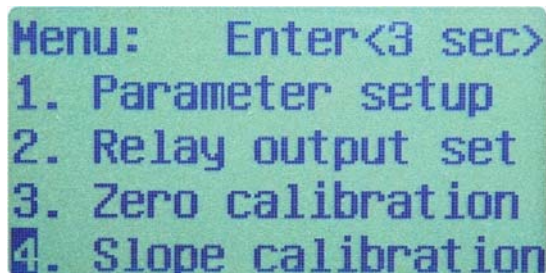
10.5.1. Two-point calibration applies to the testing environment of high precision, and the so-called two-point refers to filling the test port of the probe in with two

kinds of standard gases of different oxygen contents; and the usual procedure is to fill in with a hyperoxia gas (20.6%) first, which is air, and fill in with a hypoxia gas secondly, which is a mixture of the nitrogen and oxygen, namely the standard gas. The hypoxia gas is the standard gas specified by the user. The optimal oxygen content is below 7%. And inside the Zr cell, the reference gas (air) should be filled in all the time, and the only difference lies in the outside (the outside part is connected to the test port) of the Zr cell. In two-point calibration, fill in the outside of the Zr cell with air, which is to calibrate the background potential (constants of the Zr cell) of the Zr cell; after that procedure, fill in with the hypoxia gas (standard gas) and obtain a millivolt value of the hypoxia; and substitute these two millivolt values into the equation, and get a logarithmic curve which is also referred to as slope. Once the slope is determined, every change of the oxygen concentration in the tested gas will be reflected on the slope curve. And therefore improve the testing precision of the probe. The first step of two-point calibration is the same as that of single-point calibration, but attention should be paid to the second step in which the standard gas and oxygen contents must be setup.


10.5.2. Follow the procedures below:

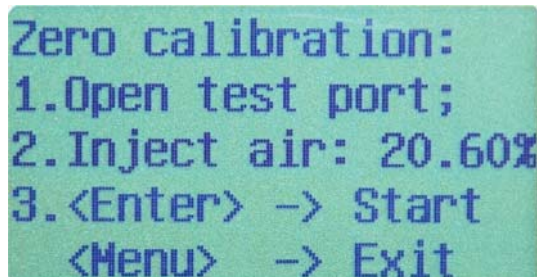
In operation interface, press the menu button  to enter the menu item of

the system, and press the marker  to shift to the fourth item, as shown in the following interface.





```
Menu:  Enter<3 sec>
1. Parameter setup
2. Relay output set
3. Zero calibration
4. Slope calibration
```


As indicated in the screen, press the enter button  for 3s and enter the two-point calibration menu, as shown in the following interface.

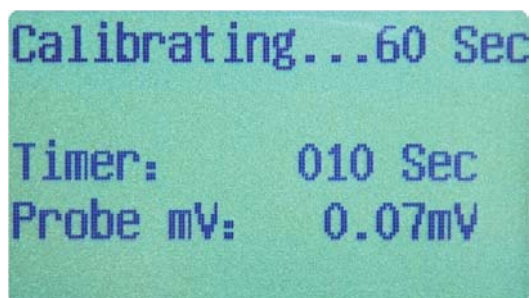


Zero calibration:
1.Open test port;
2.Inject air: 20.60%
3.<Enter> -> Start
 <Menu> -> Exit

As the screen contents indicating, the first item is to open the test port, and the second item indicates to fill in with 20.6% gas (air). The third item indicates to press the enter

button  to begin the calibration, and press the menu button  to return, and exit the calibration. Please do not press the menu button to return during the calibration.


Press the enter button  to begin the calibration, and the system will shift to the first background potential calibration interface, as shown in the following interface:

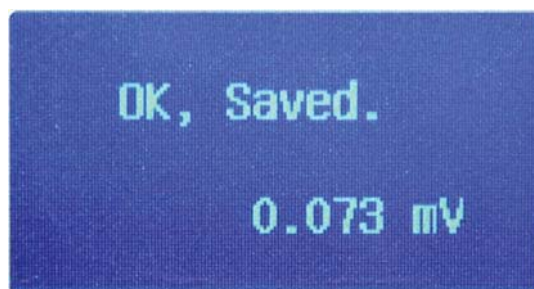


Calibrating...60 Sec
Timer: 010 Sec
Probe mV: 0.07mV

60s Timer


If the millivolt value of the probe zr cell conform to the requirement or press the enter


button  to enforce the writing-in, the interface will shift to the saving interface automatically.

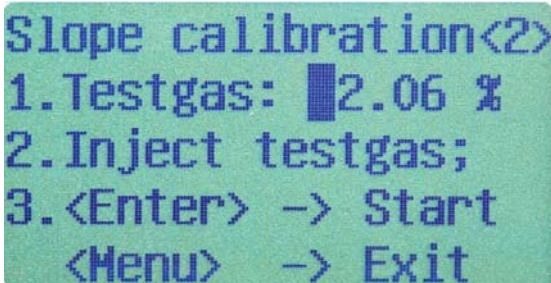


OK, Saved.
0.073 mV

Saved!



After the background potential mv value is stabilized or press the enter button  to enforce the writing-in, the system will shift to the second hypoxia calibration interface automatically, and in the hypoxia calibration interface, the first item testgas 2.06% indicates that the default oxygen content of the standard gas of the system is 2.06%. And that value should be set as the standard gas and oxygen contents of the on-site

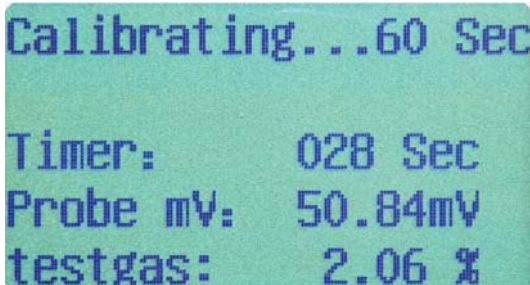
calibration. When the setup is finished, press the enter button  to begin the calibration of the second point. As shown in the following interface.



The first item should be set as the same as the data of the on-site standard gas content!


According to the indications in the above interface, set the x.xx% standard gas and

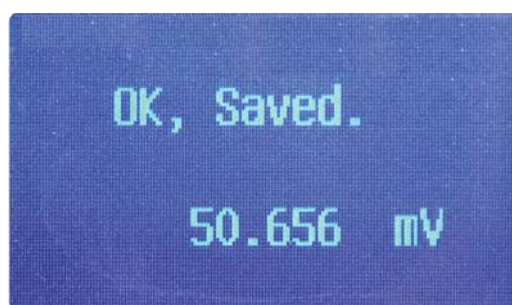
oxygen contents in the first item testgas, and press the enter button  to continue the procedure. The system will shift to the following interface automatically. Please confirm whether the system default 2.06% setup item conforms to the on-site standard gas oxygen content. If the result is negative, press the menu button  to return and reset it.



Default 2.06% interface.

As shown in the above interface, in order to save the standard gas, it is suggested to

press the enter button  to enforce the writing-in of parameters when the timer reaches 30s. Or when the timer reaches 60s, the system will save the data and return to the operation interface automatically. When the order of magnitude of the millivolt value changes, the timer will refresh itself and begin timing again until it reaches 60s or 30s which entails enforcing the writing-in procedure, and the system will save the data and return to the operation interface automatically.



Calibration completed.

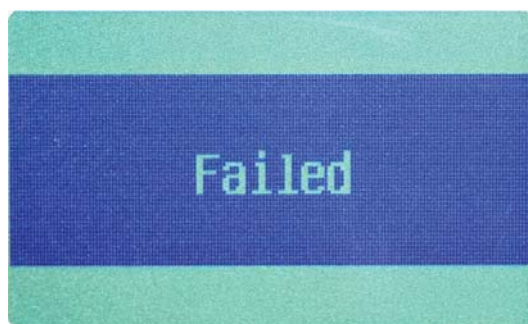
Correct calibration will make the system return to the operation interface automatically, and launch real-time testing.

As shown in the following interface:



Two-point calibration completed.

As to the occurrence of illegal parameters due to operational errors or probe ageing, as shown in the following interface, please conduct the calibration again. If the illegal parameters occur for several times under normal operations, it is suggested to replace the tested probe.



Illegal parameter!

10.6. Calibration in the Laboratory

- Steps: ① Open the unpacking and check whether goods are consistent with the record contents of list of goods. Take and put the probe gently and carefully, so as to avoid the damage of probe parts. ② Make sure the electrical connection between the instrument and probe in accordance with the wiring diagram. ③ Recheck and make sure that the wiring is correct and then connect the instrument power, and check the display, press key and air pump and other working conditions. ④ When the temperature reaches 700 °C, observe the change of the oxygen content display. ⑤ After the oxygen content is stable, the standard gas test and calibration can be carried out. ⑥ If there is no standard gas at the scene, single-point calibration can be carried out directly; if there is standard gas, two-point calibration is preferably carried out. ⑦ After the calibration is completed, the display changes in the oxygen content eventually return to the air oxygen content value 20.6%, and if the air or standard gas in the laboratory displays stable as well as air or standard gas oxygen content change trend is evident, the zirconium tube has no mechanical damage, proving that the probe and supporting analyzer can work properly.

10.7. Calibration Notes

- The instrument display screen prompts should be paid attention in the calibration, the ventilation flow to the probe test mouth should not be more than 1000cc/min, and the heating temperature is stable at 700 °C. Reference windpipe installment is good and in place, so as to ensure the reference gas

entering into the reference gas port of the probe. Misoperation will affect the working of the system, and the accuracy of the oxygen content of standard gas directly affects the quality of calibration, so the nominal value of the adopted standard gas should be accurate.

11. TECHNOLOGY

- 11.1 Instrument display: 160 × 80 dot matrix LCD display, with clear display and adjustable backlight, as well as industrial grade quality (-40 °C ~ +85 °C), displaying multi-line of English and number. Display the following information in the measuring: oxygen content, zirconium battery mV, probe constant temperature, output current signal value and so on. The instrument backlight selection can be switched with the short connector on the back of the monitor.
- 11.2 Keyboard input: membrane keypad, with key tone prompts when inputting for correct sound once and mistake sound twice. All parameters can be set via keys.
- 11.3 Probe temperature control: the instrument probe heater is with PID closed-loop control, precise temperature control and temperature control fluctuations ± 1 °C. Different temperature control range can be set by means of the system internal temperature parameters aimed at different probes.
- 11.4 Range of displayed value of measurement of oxygen content: 0 to 20.60% .
- 11.5 Instrument alarm: the instrument has self-diagnostic system, with automatic alarm display of the fault, including information such as thermocouple probe disconnection or reversion, legality of verification parameters, temperature ultralimit, oxygen content ultralimit, etc.. Besides, the upper and lower limit alarm of the oxygen content (K1/K2), disconnection or reversion of the thermocouple probe and the probe temperature out of control (K3) and other relay switch signals on the instrument motherboard hardware (CN3 terminals) are available for users.
- 11.6 Communication function: reserve one-way RS232 channel and two-way RS485 channel, which can be applied in different network communication occasions.

11.7 Probe temperature type: low temperature type used for the flue gas temperature 0 ~ 400 °C; medium temperature type used for the flue gas temperature 0 ~ 700 °C; high temperature type used for the flue gas temperature 0 ~ 1200 °C.

11.8 Weight: the weight range of different types of chassis is from 3kg to 6kg.

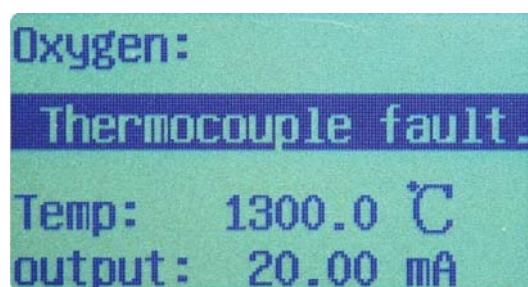
12. ROUTINE INSPECTION

12.1 During the system daily work, there is no need for maintenance, and in order to ensure normal and stable operation of the instrument, the following points need to be noted:

- ✧ Normal state: the control panel indicator light is with the running light (Run) long light and the heat lamp (Heater) flashing. Communication light (Link) lights during the data exchange and extinguishes without data exchange. Note: when only collecting the current signal at the scene, without the application of RS232 or RS485, the communication light extinguishes.
- ✧ Protection sleeve: under the environment with more dust, it is recommended to install the probe protection sleeve, and in order to maintain the accuracy of the measurement, prevent the dust from clogging the protection sleeve of the probe.
- ✧ Clogging: pass the compressed air periodically from the check mouth, so as to prevent the probe flue gas filter from clogging.
- ✧ Reference gas: maintain the reference gas unobstructed, and pay attention to the windpipe damage and air pump damage.
- ✧ Power supply environment: do not arbitrarily close the instrument power supply as soon as possible. Under non-fault conditions, even in the boiler maintenance period, do not power outage, and try not to turn off the power supply of the instrument.

- ✧ Calibration: the calibration cycle should not be too frequent. It is recommended that the calibration cycle should be once for 1 year during normal operation.

12.2 Temperature alarm display information: if the thermocouple probe is disconnected or reversed or the temperature exceeds 1300 °C, the screen will display the following information.



If the above information appears, check whether the thermocouple is reversed and whether the resistance value of the thermocouple is normal, with the normal value between 2Ω and 20Ω, and the thermocouple will disconnect with infinite value. Check whether the thermocouple terminals are loose or damaged; check whether the probe heater resistance is normal, with the normal value of about 110Ω; check whether the heater wiring is loose or damaged. And K3 relay on the CN3 terminals of the hardware has the switching signal output. (Note: the motherboard has k3 logo.)

Wiring fault: check the output value mv of zirconium battery of the analyzer, and if the mv value exceeds 100mv, the sensor signal may have not delivered to the oxygen analyzer; if the measured value of the multimeter does not match the displayed value of the instrument itself, the instrument itself is proved faulty. The reasons caused by the malfunction include the following points.

- ✧ The signal line shielding layer or zirconium battery cathode has external induced voltage entering in series.
- ✧ If the components of the input part of the oxygen analyzer are damaged, please contact our technical support.

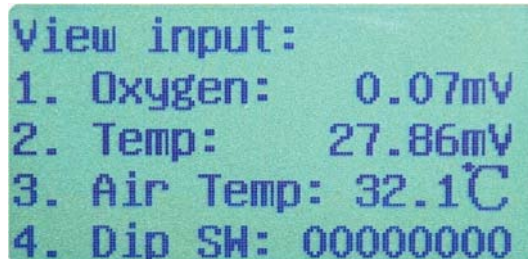
- ✧ Loose wiring results in open circuit interference voltage.
- ✧ Repeat the grounding, and the instrument requires single-point grounding.
- ✧ The signal line circuit breaks.

12.3 The oxygen content display fluctuates and is unstable; maybe the electrode in the zirconium battery has bad contact, and the probe installation location has excessive vibration, and directly measure whether mv values of the zirconium battery are consistent with the instrument display with a multimeter; the zirconium battery has surface oxidation, and disassemble the probe and take out the zirconium pipes, and polish the surface of the zirconium battery with the sandpaper more than 1000 roughness, making the zirconium battery show metal silver, and reloading the probe.

Check the signal situations: for example, the probe is placed in the air environment, with the operating temperature of 700 °C, and press the cursor key



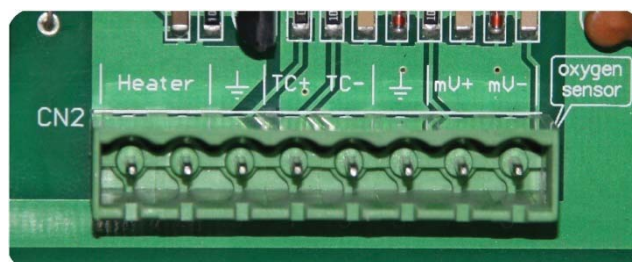
on the working interface to switch to the following interface.



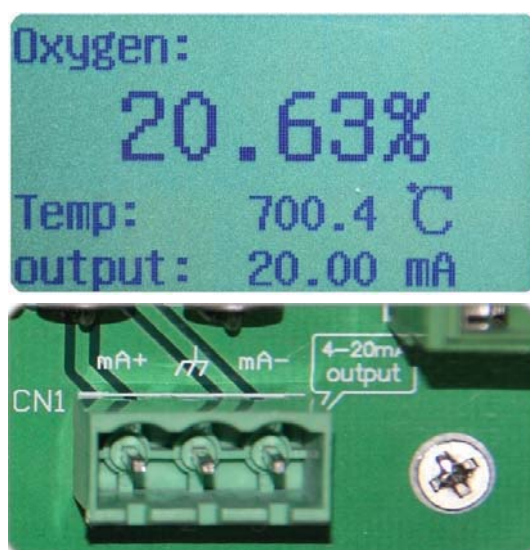
```
View input:
1. Oxygen:  0.07mV
2. Temp:    27.86mV
3. Air Temp: 32.1°C
4. Dip SW:  00000000
```

The first item is the signal mV of the oxygen battery, and the second item is the signal mV of the thermocouple.

Check whether two sets of signals on the circuit motherboard (PCB circuit board printing with TC + and TC-, mV + and mV-) correspond to the displayed value. As shown below. Similarly in this case, if the probe is placed in the flue gas, the size of the signal value of the first item is related with the oxygen concentration of the flue gas, and the size of the signal value of the first item changes due to the change of the oxygen concentration of the flue gas.



Oxygen analyzer current output is incorrect; disconnect all connections of CN1 terminals and measure whether the output signals are consistent with the instrument display with the current mA of the multimeter; if it is inconsistent and the instrument output element exists the malfunction, the manufacturer solves; if it is consistent, then there is a fault between the signal line and the main control room, and the oxygen analyzer output signal is active signal and the receiver must be passive; find out whether the cable of the receiving part has signal interference and whether the receiving part is active. Check whether the measurement range of the oxygen content of the instrument is consistent with the DCS system of the main control room.



This possibility of system parameters missing is very small, and if the parameter is missing, then power on again and re-calibrate the probe, or if the last calibration has data recording, re-enter the last calibration parameters.

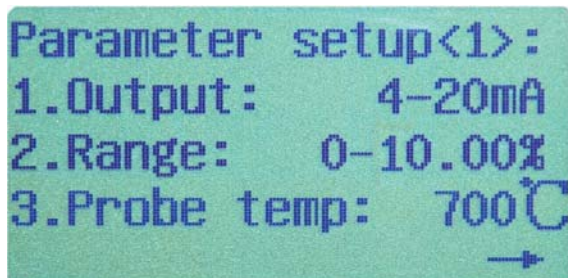
- 12.4 The power switch trips when the instrument starts up and powers on; check whether the probe heater has short circuit; check whether the resistance between

the heater heating wire and the probe collides with the probe. Check whether the capacity of power switch accords with the requirements, and whether the transformer coil inside the instrument has short circuit.

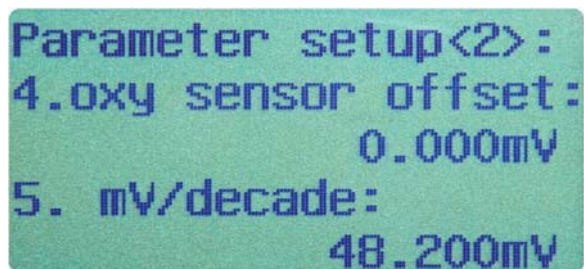
12.5 Parameters view: under normal working interface, directly press the up and down keys to check the setting of system parameters. There are four display interfaces, and under the state of view, the parameters can not be modified. Switching between the interfaces should be carried out with the up and down keys, shown as follows (the default value of system parameters).



Oxygen:
20.63%
Temp: 700.4 °C
output: 20.00 mA



Parameter setup<1>:
1.Output: 4-20mA
2.Range: 0-10.00%
3.Probe temp: 700°C
→



Parameter setup<2>:
4.oxy sensor offset:
0.000mV
5. mV/decade:
48.200mV



Relay output setup:
 1. Upper limit out: 10.00 %
 2. Lower limit out: 5.00 %

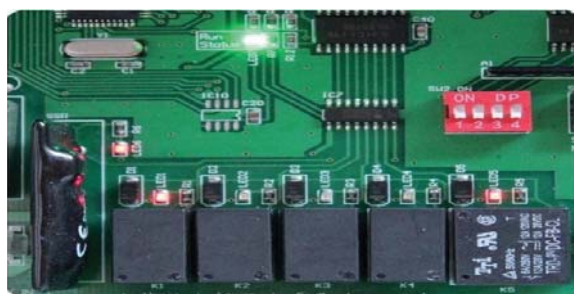


View input:
 1. Oxygen: 0.07mV
 2. Temp: 0.07mV
 3. Air Temp: 31.6℃
 4. Dip SW: 00000000



Oxygen:
 20.63%
 Temp: 700.4 ℃
 output: 20.00 mA

12.6 Motherboard status indicator: (the distribution location of all indicators is shown in the following area)



12.6.1 Function introduction of indicators is shown in the following table.

No.	Indicator No.	Indicator Meaning	Remarks
1.	LED1	Oxygen content upper limit alarm relay (K1) working indicator	If oxygen content is more than the upper limit of the oxygen content setting, the indicator light goes on
2.	LED2	LED2: Oxygen content lower limit alarm relay (K2) working indicator	If oxygen content is less than the lower limit of the oxygen content setting, the indicator light goes on
3.	LED3	Fault alarm relay (K3) working indicator	If the thermocouple probe is disconnected or reversed, the indicator light goes on
4.	LED4	Standby function relay (K4) working indicator	Reserved function (defined according to site requirements)
5.	LED5	Heater relay (K5) working indicator	It is bright for long time during the normal operation
6.	LED6	Heater solid state relay (K6) working indicator	It is bright for long time during the normal operation
7.	LED7	CPU chip working indicator	Alternately flash under the normal state

13. PREPARATION LIST

The instrument is with standard preparation, and different users under different working environment can purchase and prepare by themselves.

No.	Content	Quantity	Remarks
1.	Oxygen analyzer	1	Standard preparation
2.	Instrument door key	1	Standard preparation
3.	Instruction book	1	Standard preparation
4.	Instrument installation angle iron	4	Standard preparation
5.	Oxygen probe	1	Standard preparation
6.	Pot wall flange	1	Standard preparation
7.	Probe adapter flange	1	Standard preparation
8.	Graphite gasket	1	Standard preparation
9.	Φ6mm windpipe	10m	Standard preparation
10.	Two-wire power cord	10m	Standard preparation
11.	Four-core signal cable (shielded)	10m	Standard preparation
12.	Standard gas	1	Optional
13.	SMC float flowmeter	1	Optional
14.	Gas cylinder pressure reducer	1	Optional
15.	Probe protective sleeve	1	Optional

14. FAULT LOOKUP TABLE

No.	Fault phenomenon	Fault cause and judgment	Handling method	Remarks
1.	Heater open circuit	Ambient temperature display	Heater connecting line is loose and faulty, or replaces the heater.	/
2.	Heater short circuit	1. The transmission trips. 2. The heater resistance measured by the multimeter is zero or 10Ω or less.	1. Check the heater resistance, with normal value of about 110Ω , infinitely small in short circuit and infinitely large in open circuit, and change the heater. 2. Check whether the heater connection is short.	/
3.	Without reference gas	1. The oxygen content display is a little higher. 2. The oxygen content is constant and immutable.	1. Ensure the reference gas pipes unobstructed. 2. Whether the air pump is working properly. 3. Input anhydrous and oilless analyzer gas with the flow of 50ml/min.	/
4.	Thermocouple	1. Show 1300. 2. Show: Thermocouple fault	1. The thermocouple is reversed or disconnected. 2. Check the thermocouple connection. 3. Measure the thermocouple resistance as zero or infinitely large, and replace the thermocouple.	/
5.	Instrument system parameter missing	1. Thunder and lightning or high voltage interference, and power failure and other non-human factor interference 2. The instrument is stored for long time. 3. Measurement data errors.	Power on and operate again	/
6.	Zirconium pipe rupture	1. The oxygen content display is a little higher. 2. The oxygen content in the air occur trend change. 3. The standard gas is instable and fluctuated with the change in time	Replace the zirconium pipe	/
7.	Instrument control panel failure	1. Keys do not respond. 2. Do not display any content. 3. Pull and insert the data cable again but do not respond	1. Do not show the potentiometer behind the control panel, and change the contrast. 2. Replace the data cable and try again. Replace the panel	Whether the temperature of the installation position is too high, affecting the LCD

No.	Fault phenomenon	Fault cause and judgment	Handling method	Remarks
				work
8.	The main circuit board fault	1. The key is invalid, and the display is not normal 2. Motherboard running indicator light is bright for long time or is not bright. 3. The output current is much higher than 20mA	Replace the circuitmotherboard	Contact the manufacturer
9.	Signal line and heaterwire mix.	1. Temperature and oxygen content and other display is unstable and trips. 2 The heater wireis high voltage signal, and the signal line is mV / mA level of signal	1. Separate wiring as far as possible, especiallywhen the line is a little longer 2. Check whether the signal cable shielding layer implements single-point grounding.	/
10.	The mv line of zirconium battery is reversed	1. The oxygen content displays error. 2. Measure 7 feet and 8 feet of CN2 terminals of the motherboard terminals, 7 feet positive and 8 feet negative in normal situation.	Reconnect after the positive and negative terminals are reversed	/
11.	The probe has water	1. Burn the probe. 2. The oxygen content and temperature is not normal. The oxygen content deviates from the normal value, and the temperature can not be constant at 700 °C .	1. Prevent rainwater from entering the probe. 2. The connection line between the instrument and the probe should be “U” shape.	/
12.	Zirconium battery surface oxidation	1. The oxygen content display deviates. 2. Measure the resistance at 20K or more, with the zirconium pipe aging.	Replace the inner electrode and replace the zirconium pipe.	/
13.	The flue gas filterclogging	The oxygen content display is inaccurate and changes slowly.	Remove the filter for dedusting.	/
14.	Heating transformer shortcircuit	1. The transmission trips. 2. Measure the transformer outlet resistance, and distinguish the categories based on color, and when the resistance is zero, indicating the transformer short circuit.	Replace the transformer.	/
15.	The probe inside has moisture, impurities, combustible material and inert gas	1. The oxygen content display is close to 0% or deviates from the normal value. 2. The probe had just installed, appearing when powering on again or completing the verification.	Inlet the air from the probe test port, washing the probe until stable at about 21%. Normally work again after it is energized for a day or two.	/

No.	Fault phenomenon	Fault cause and judgment	Handling method	Remarks
16.	High oxygen content	1. There is no reference gas. 2. There is leakage in certain location of the probe installation. 3. The mv signal of zirconium battery and the instrument display is inconsistent.	1. Connect the reference gas with the flow of 50ml/min 2. Check the flange silk mouth, the test mouth blocking and the sealing situation of the gasket between the flange and the flange. 3. The signal of zirconium battery should be consistent with the instrument display, and if it is inconsistent, unless the instrument is faulty, power on again.	/
17.	The oxygen content displayed locally is not consistent with the oxygen content in the master control room	The setting of measuring range of the oxygen content is inconsistent.	The measuring range should be set in line with the master control room DCS system.	/
18.	Buzzer sounding for long time	Data cable is not plugged in place.	Pull and connect the data cable again.	/
19.	The capacity of user air switch is not enough.	Sometimes switch on, sometimes switch on and immediately trip, or switch on for a while and then trip.	Replace the switch 5A above.	/
20.	Oxygen content display is a little lower	1. Whether the temperature is stable at 700 °C. 2. Whether the resistance of zirconium battery is below 20K, 20K or more, with zirconium head aging. 3. Whether the mv value of zirconium battery displayed by the instrument is consistent with the mv value measured by the multimeter. 4. Dust is clogged. 5. The inner electrode contact resistance is large. 6. Installation location	1. It can not be stabilized at 700 °C, and check the thermocouple and heater 2. If it is 20K or more, replace the zirconium pipe. 3. If it is inconsistent, check whether the wiring is loose and correct, and whether there is signal interference. 4. Clean up the flue gas filter. 5. Draw out the inner electrode and reload the probe after polishing with 1000 or more roughness of sandpaper. 6. The actual location can be the position with lower oxygen content.	/

Appendix 1 K-type Thermocouple ReferenceTable

Indexing number: K (reference temperature of 0 °C)

Temperature	0	1	2	3	4	5	6	7	8	9
	Thermal signal millivolt value									
350	14.292	14.334	14.376	14.418	14.460	14.502	14.544	14.586	14.628	14.670
360	14.712	14.754	14.796	14.838	14.880	14.922	14.964	15.006	15.048	15.090
370	15.132	15.174	15.215	15.258	15.300	15.342	15.384	15.426	15.468	15.510
380	15.552	15.594	15.636	15.679	15.721	15.763	15.805	15.847	15.889	15.931
390	15.974	16.016	16.058	16.100	16.142	16.184	16.227	16.269	16.311	16.353
400	16.395	16.438	16.480	16.522	16.564	16.607	16.649	16.691	16.733	16.776
410	16.818	16.860	16.902	16.945	16.987	17.029	17.072	17.114	17.156	17.199
420	17.241	17.283	17.326	17.368	17.410	17.453	17.495	17.537	17.580	17.622
430	17.664	17.707	17.749	17.792	17.834	17.876	17.919	17.961	18.004	18.046
440	18.088	18.131	18.173	18.216	18.258	18.301	18.343	18.385	18.428	18.470
450	18.513	18.550	18.598	18.640	18.683	18.725	18.768	18.810	18.853	18.895
460	18.938	18.980	19.023	19.065	19.108	19.150	19.193	19.235	19.278	19.320
470	19.363	19.405	19.448	19.490	19.533	19.576	19.618	19.661	19.703	19.746
480	19.788	19.831	19.873	19.916	19.959	20.001	20.044	20.083	20.129	20.172
490	20.240	20.257	20.299	20.342	20.385	20.427	20.470	20.512	20.555	20.598
500	20.640	20.683	20.725	20.768	20.811	20.853	20.896	20.938	20.981	21.024
510	21.066	21.109	21.152	21.194	21.237	21.280	21.322	21.365	21.407	21.450
520	21.493	21.535	21.578	21.621	21.663	21.706	21.749	21.791	21.834	21.876
530	21.919	21.862	22.004	22.047	22.090	22.132	22.175	22.218	22.260	22.303
540	22.346	22.388	22.431	22.473	22.516	22.559	22.604	22.644	22.687	22.729
550	22.772	22.815	22.857	22.900	22.942	22.985	23.028	23.070	23.113	23.156
560	23.198	23.241	23.284	23.326	23.369	23.411	23.454	23.497	23.539	23.522
570	23.624	23.667	23.710	23.752	23.795	23.837	23.880	23.923	23.965	24.008
580	24.050	24.093	24.136	24.178	24.221	24.263	24.306	24.348	24.391	24.434
590	24.476	24.519	24.561	24.604	24.646	24.689	24.731	24.774	24.817	24.859
600	24.902	24.944	24.987	25.029	25.072	25.114	25.157	25.199	25.242	25.284
610	25.327	25.369	25.412	25.454	25.497	25.539	25.582	25.624	25.666	25.709
620	25.751	25.794	25.836	25.879	25.921	25.964	26.006	26.048	26.091	26.133
630	26.176	26.218	26.260	26.303	26.345	26.387	26.430	26.472	26.515	26.557
640	26.599	26.642	26.684	26.726	26.769	26.811	26.853	26.876	26.938	26.980
650	27.022	27.065	27.107	27.149	27.192	27.234	27.276	27.318	27.361	27.403

Temperature	0	1	2	3	4	5	6	7	8	9
	Thermal signal millivolt value									
660	27.445	27.487	27.529	27.572	27.614	27.656	27.698	27.740	27.783	27.825
670	27.867	27.909	27.951	27.993	28.0035	28.078	28.120	28.162	28.204	28.246
680	28.288	28.330	28.372	28.414	28.456	28.498	28.540	28.583	28.625	28.667
690	28.709	28.751	28.793	28.835	28.877	28.919	28.961	29.002	29.044	29.086
700	29.128	29.170	29.212	29.254	29.296	29.338	29.380	29.422	29.464	29.505
710	29.547	29.589	29.631	29.673	29.715	29.756	29.798	29.840	29.882	29.924
720	29.965	30.007	30.049	30.091	30.132	30.174	30.216	30.257	30.299	30.341
730	30.383	30.424	30.466	30.508	30.549	30.591	30.632	30.674	30.716	30.757
740	30.799	30.840	30.882	30.924	30.965	31.007	31.048	31.090	31.131	31.173
750	31.214	31.256	31.297	31.339	31.380	31.422	31.463	31.504	31.546	31.587
760	31.629	31.670	31.712	31.753	31.794	31.836	31.877	31.918	31.860	32.001
770	32.042	31.084	32.125	32.166	32.207	32.249	32.290	32.331	32.372	32.414
780	32.455	32.496	32.537	32.578	32.619	32.661	32.702	32.743	32.784	32.825
790	32.866	32.907	32.948	32.990	33.031	33.072	33.113	33.154	33.195	33.236
800	33.277	33.318	33.359	33.400	33.441	33.482	33.523	33.564	33.604	33.645
810	33.686	33.727	33.768	33.809	33.850	33.891	33.931	33.972	34.013	34.054
820	34.095	34.136	34.176	34.217	34.258	34.299	34.339	34.380	34.421	34.461
830	34.502	34.543	34.583	34.624	34.665	34.705	34.746	34.787	34.827	34.868
840	34.909	34.949	35.990	35.030	35.071	35.111	35.152	35.192	35.233	35.273
850	35.314	35.354	35.395	35.435	35.476	35.516	35.557	35.597	35.637	35.678
860	35.718	35.758	35.799	35.839	35.880	35.920	35.960	36.000	36.041	36.081
870	36.121	36.162	36.202	36.242	36.282	36.323	36.363	36.403	36.443	36.483
880	36.524	36.564	36.604	36.644	36.684	36.724	36.764	36.804	36.844	36.885
890	36.925	36.965	37.005	37.045	37.085	37.125	37.165	37.205	37.245	37.285
900	37.325	37.365	37.405	37.445	37.484	37.524	37.564	37.604	37.644	37.684
910	37.724	37.764	37.803	37.843	37.883	37.923	37.963	38.002	38.042	37.082
920	38.122	38.162	38.201	38.241	38.281	38.320	38.360	38.400	38.439	38.479
930	38.519	38.558	38.598	38.638	38.677	38.717	38.756	38.796	38.836	38.875
940	38.915	38.954	38.994	39.033	39.073	39.112	39.152	39.191	39.231	39.270
950	39.310	39.349	39.388	39.428	39.467	39.507	39.546	39.585	39.625	39.664
960	39.703	39.743	39.782	39.821	39.861	39.900	39.939	39.979	40.018	40.057
970	40.097	40.136	40.175	40.214	40.253	40.292	40.332	40.371	40.410	40.449
980	40.488	40.527	40.566	40.605	40.645	40.684	40.723	40.762	40.801	40.840
990	40.879	40.918	40.957	40.996	41.035	41.074	41.113	41.152	41.191	41.230
1000	41.269	41.308	41.347	41.385	41.424	41.463	41.502	41.541	41.580	41.619

Appendix 2 Zirconium Oxygen Concentration Potential Comparison Table

	650℃	700℃	750℃	800℃	850℃
0.1	105.11	110.86	116.61	122.36	132.25
0.2	91.857	96.882	101.907	106.932	115.575
0.3	84.088	88.688	93.288	97.888	105.8
0.4	78.147	82.422	86.697	90.972	98.325
0.5	73.577	77.602	81.627	85.652	92.575
0.6	70.378	74.228	78.078	81.928	88.55
0.7	67.179	70.854	74.529	78.204	84.525
0.8	64.437	67.962	71.487	75.012	81.075
0.9	62.152	65.552	68.952	72.352	78.2
1	59.867	63.142	66.417	69.692	75.325
1.1	58.039	61.214	64.389	67.564	73.025
1.2	56.211	59.286	62.361	65.436	70.725
1.3	55.297	58.322	61.347	64.372	69.575
1.4	53.469	56.394	59.319	62.244	67.275
1.5	52.098	54.948	57.798	60.648	65.55
1.6	50.727	53.502	56.277	59.052	63.825
1.7	49.356	52.056	54.756	57.456	62.1
1.8	48.442	51.092	53.742	56.392	60.95
1.9	47.528	50.128	52.728	55.328	59.8
2	46.157	48.682	51.207	53.732	58.075
2.1	45.234	47.718	50.193	52.668	56.925
2.2	44.329	46.754	49.179	51.604	55.775
2.3	43.415	45.79	48.165	50.54	54.625
2.4	42.501	44.826	47.151	49.476	53.475
2.5	42.044	44.344	46.644	48.944	52.9
2.6	41.13	43.38	45.63	47.88	51.75
2.7	40.216	42.416	44.616	46.816	50.6
2.8	39.759	41.934	44.109	46.284	50.025
2.9	38.845	40.97	43.095	45.22	48.875
3	38.388	40.488	42.588	44.688	48.3
3.2	37.017	39.042	41.067	43.092	46.576
3.4	35.646	37.596	39.546	41.496	44.85
3.6	34.732	36.632	38.532	40.432	43.7
3.8	33.361	35.186	37.011	38.836	41.975
4	32.447	34.222	35.997	37.772	40.825
4.3	31.076	32.776	34.476	36.176	39.1
4.6	29.705	31.33	32.955	34.58	37.375

	650℃	700℃	750℃	800℃	850℃
4.9	28.334	29.884	31.434	32.984	35.65
5	27.877	29.402	30.927	32.452	35.075
5.5	26.049	27.474	28.899	30.324	32.775
6	24.678	26.028	27.378	28.728	31.05
6.5	22.85	24.1	25.35	26.6	28.75
7	21.479	22.654	23.829	25.004	27.025
7.5	20.108	21.208	22.308	23.408	25.3
8	18.737	19.762	20.787	21.812	23.575
8.5	17.366	18.316	19.266	20.216	21.85
9	16.452	17.352	18.252	19.152	20.7
9.5	15.538	16.388	17.238	18.088	19.55
10	14.167	14.942	15.717	16.492	17.825

Appendix 3 Zirconia Probe Transportation & Storage and Installation Precautions

Probe zirconium pipes are ceramic! Put down gently! Prevent collisions!

1. Collision resistance measures

The key component of zirconium oxide probe is zirconium oxide pipe, which belongs to ceramic product, easily broken, so in the handling, storage, installation and use process, the impact, hit and strong vibration between the probe and any other objects on the ground may result in gasification zirconium probe scrapped. Therefore, pay attention to the following matters:

- Store properly the probe; and the storage from the probe put into the storage to the probe installation should avoid moving frequently.
- When installing, first install the furnace wall matched flange, and the probe installation should be carried out by the specially assigned person. Do not rush to bring the probe to the boiler.
- In the case of inside repair or installation of the boiler, install the probe again after all work inside the boiler ends.

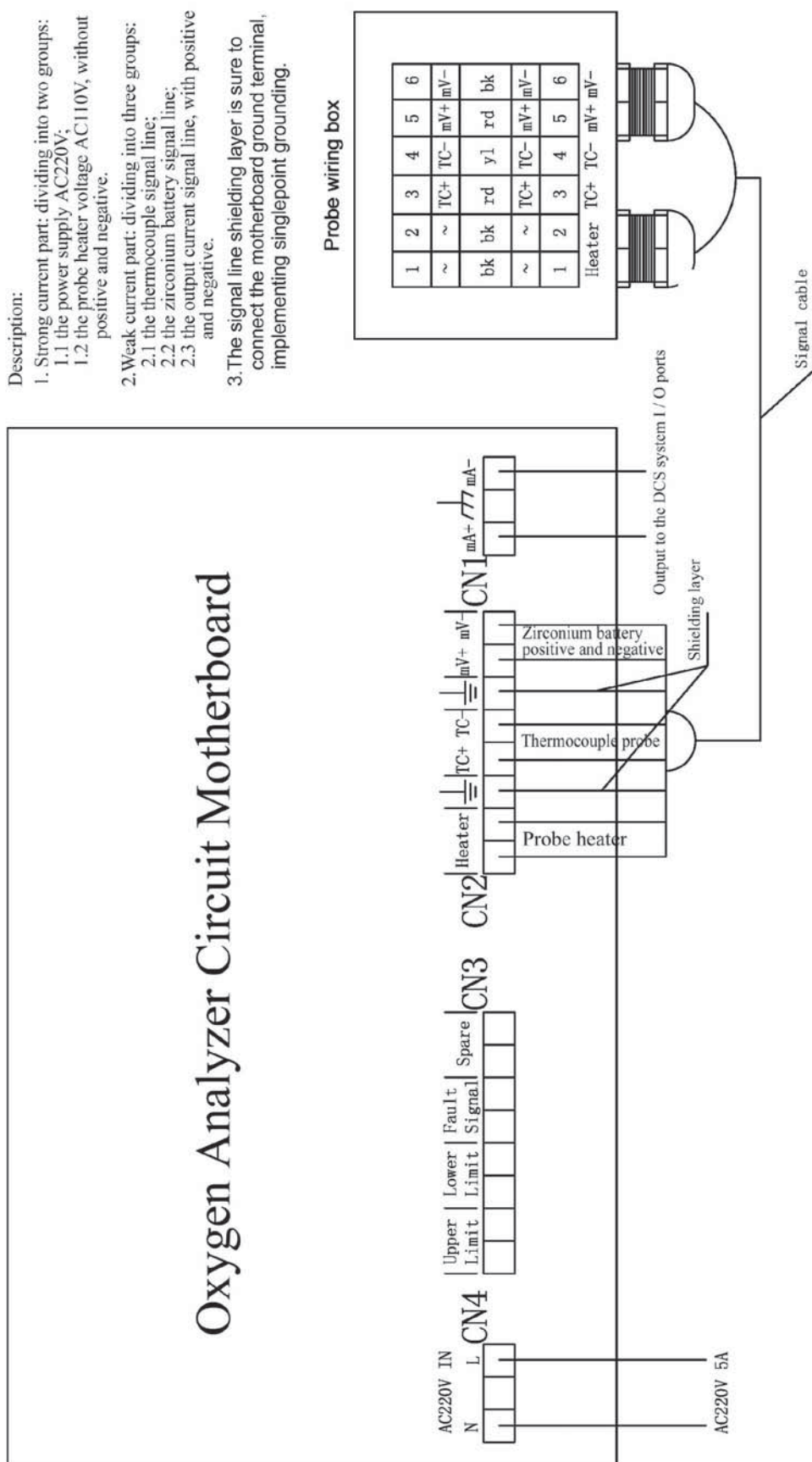
2. Waterproofing measures

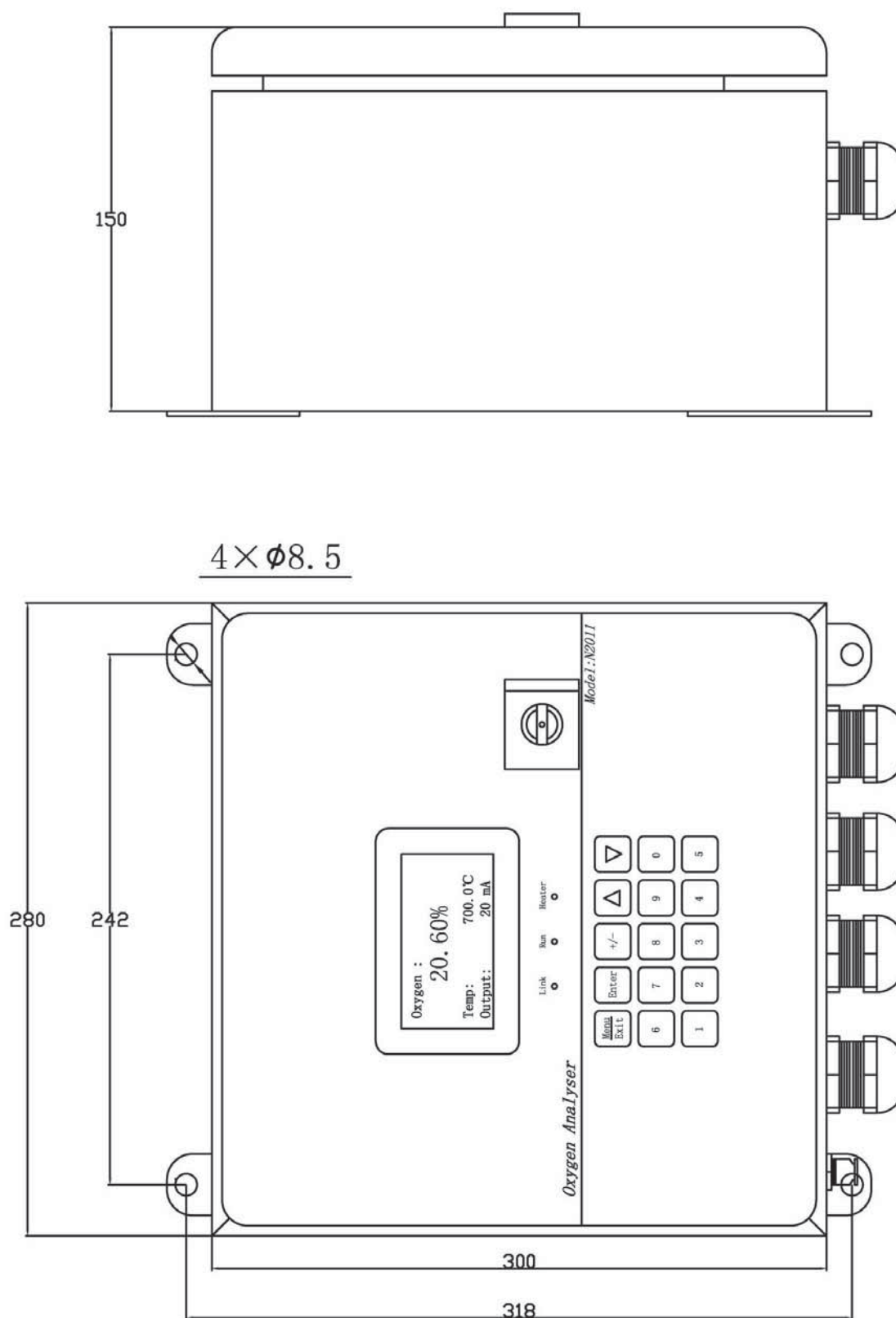
Rain can cause damage to the probe if entering into the probe, so pay attention to the following matters in the installation process:

- Prevent the rainwater from flowing into the inside of the probe along the cable, and the instrument and the probe cable forms “U” shape, and one small hole should be dug at the bottom of the “U” shaped outer protective hose.
- When installing in stormy days, make sure that rainwater does not flow into the probe from the cable access hole.
- After installing, tighten the probe cover.

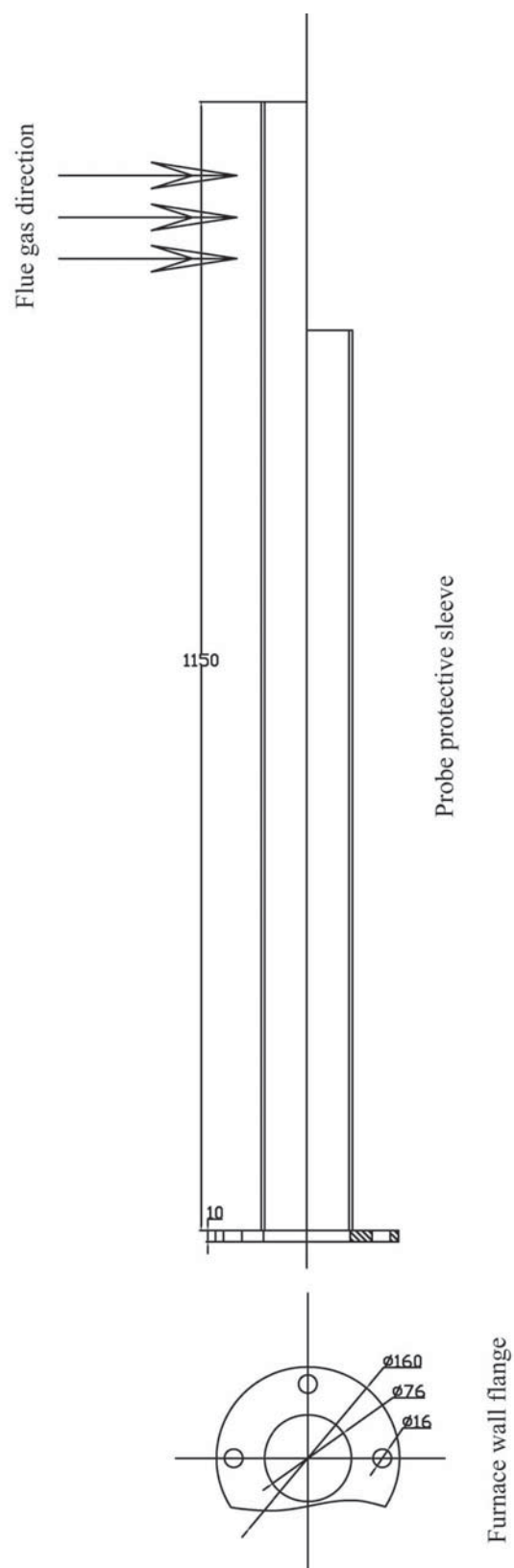
3. The combination of flue gas and condensate water is corrosive, making the condensation acidic liquids flow to the probe junction box terminal, thus causing damage to the probe heater, and in order to avoid such occurrences, the level slopes down 15 degrees, making the acid liquid flow to the heater heating end, with the high temperature of 700 °C enough to make the acidic solution evaporate.

Appendix 4 N2011 Type Zirconium Analyzer System Wiring Diagram

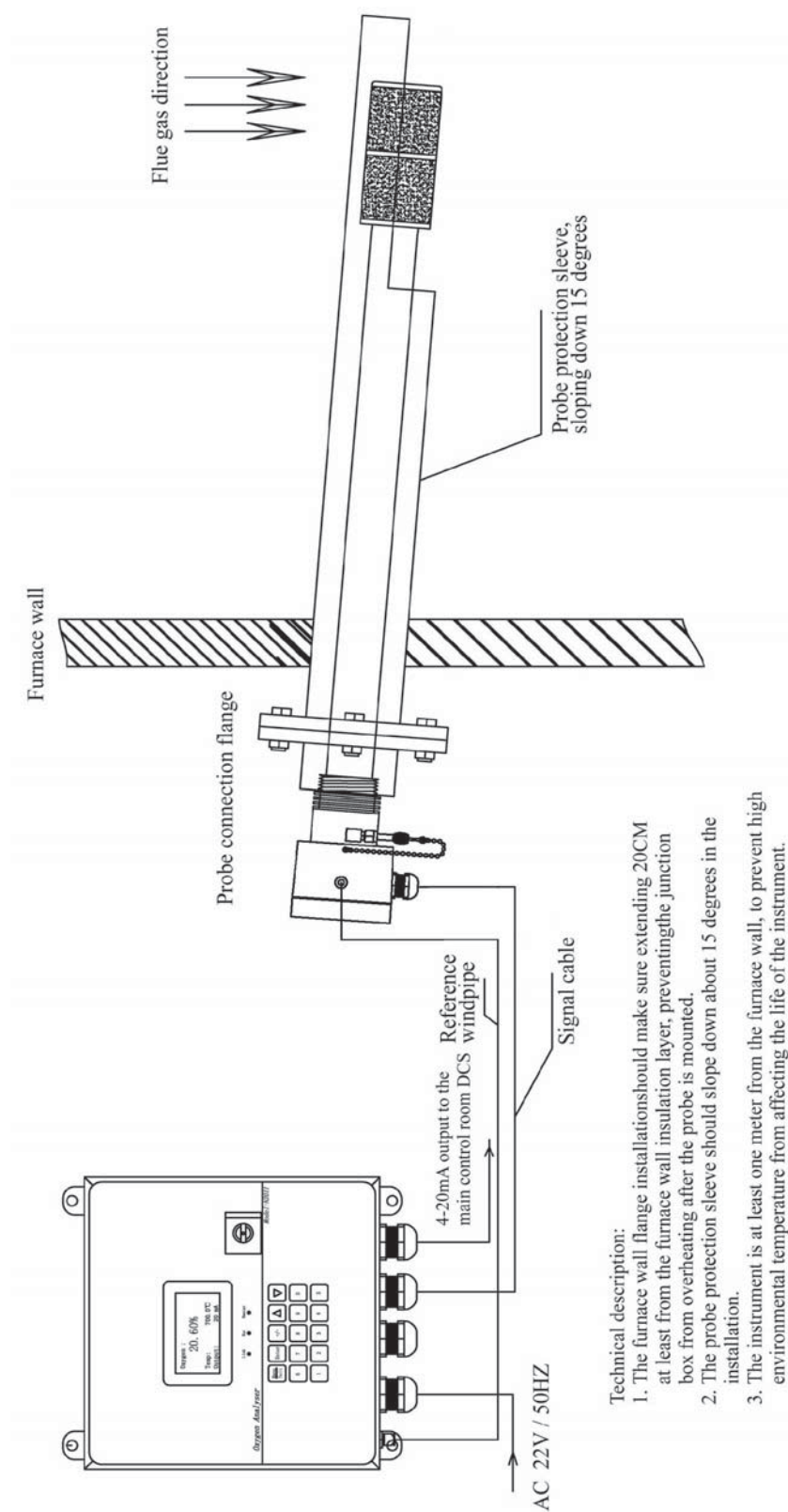


Appendix 5 N2011 Type Oxygen Analyzer Installation Size Map

Appendix 6 N2011 Type Zirconia Probe Protective Cased Pipe and Flange Size Map



Appendix 7 N2011 Type Zirconia Analyzer System Installation Diagram





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