



# **XIAOZHOU ZIRCONIA ANALYZER**

## **PRODUCT MANUAL**

**Shanghai XiaoZhou Electric Co.Ltd.**

**Room 103~104, No.62, Xi Yin Road**

**Shanghai, China**

**Tel:86-021-58724933 50870018**

**Fax:86-021-50870018-816**

版权所有©

## 1. General

The XiaoZhou series zirconia analyzer is made up of the **YYF** series zirconia detector and the **YYF\_94Q** type transmitter. The zirconia detector, using electrochemistry, is a new measurement device theory. While the transmitter, with the micro-controller system, is a brand-new type as well.

Firstly the detector converts the oxygen density of gas into mil-volt signal. Then the transmitter shall sample output of detector and the temperature of zirconia tube. Follow up calculates oxygen density of measured gas and finally it outputs the standard current signal.

As the zirconia analyzer can be worked with packaged instrument, assembled instrument and computer system, it is widely used in power plant, metallurgy, petroleum, chemical industry, light industry and so on. Through the automatic control system it can adjust airflow, allow the proper ratio of air and fuel. As a result, the benefit from economizing energy and reducing the environment pollution is conspicuous.

## 2. YYF series Zirconia Detector

### 2.1 Product Highlight

With the special coating art and the up-to-date producing technology, the detector has the advantage of electrical alertness, duration and sensitiveness. Adopted advanced technology of all closed vitrification chinaware and sealing metal through high temperature, it can avoid the hidden trouble such as sealing

materials aging, chapping of the sealing materials and so on.

Carrying standard air specimen, the detector can be tested and corrected in need.

## 2.2 Working Principle

In fact, the detector is an oxygen differential density battery that is made of zirconia solid electrolyte over 600°C. There is air on one side of zirconia tube and the measured flue gas on another side. The differential oxygen percentage in the air of two sides will spontaneously produce a relevant voltage.

According to Nestorius Formula, we can get the quantity of the oxygen in the measuring flue gas.

$$E=(RT/nF)\ln(P_0/P)$$

In formula:

E=voltage of oxygen differential density(V)

R=perfect gas constant, 8.314J/(mol K)

F=Faraday constant, 964870C/mol

N=the number of electron transmitted by oxygen molecule in reaction,4

T=absolute centigrade(K)

P<sub>0</sub>=the oxygen density of the air

P=the oxygen density of the measuring flue gas

## 2.3 Notes on usage and Notice

The temperature of testing point is in the range of 0~700°C, please choose inserting straightly type with electric heater, when the working temperature of

detector is requested higher than 600°C.

When the temperature of testing point is in the range of 600~900°C, please choose inserting straightly type without electric heater. In this condition, the detector should be heated over 600 centigrade by high temperature gas.

If the temperature of testing point is in the range of 900~1450°C, please chose pump gas type, otherwise the detector will be destroyed by very high temperature gas.

Don't bump the detector, we suggest that the detector should be inserted into testing point straightly only once.

When installing detector, please notice whether the flange in the furnace body is welded in horizontal position, permissible error is from -30~+30 degree. Usually, the flange is welded in horizontal position, and stretches from the furnace wall about 200mm. The asbestos board shall be installed between the two flanges' body, the screw shall be tightly screwed up. It is not permissible that air be leaked to the furnace from here.

The detector mustn't be installed in the zones of containing and invisible fire, because in these conditions there are a lot of poisonous materials that would destroy the electrode and zirconia battery.

The material, temperature and electrode coat of zirconia battery causes the background voltage of the detector. It should be adjusted it before leaving the factory. **YYF** series zirconia detector's normal background voltage should be lower than 4mV(absolute value).

The aging of the zirconia tube means that the zirconia resistance is raised or the background voltage is higher than normal value. There are three ways to decide whether the zirconia tube is an aged one or not(working at 700°C).

- a. the zirconia tube resistance is higher than 1000Ω
- b. the background voltage is lower than -30mV
- c. the background voltage is higher than 500mV, at the same time, the zirconia tube voltage will jump or respond slowly very much.

A new detector won't work correctly until six hours later for the first time.

## 2.4 Specification

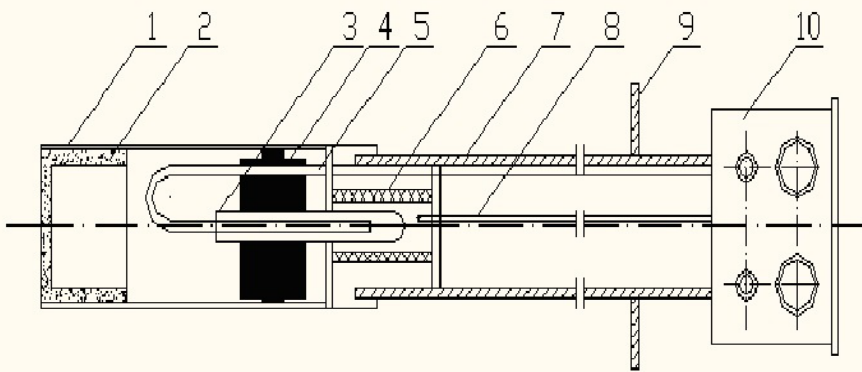
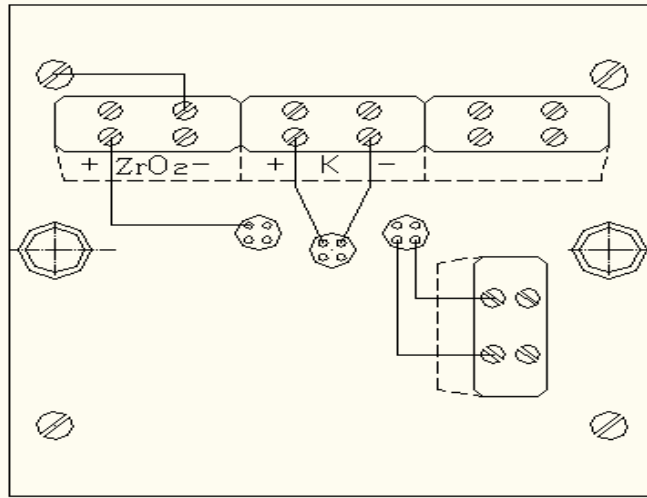
- Span:0.1%~20%
- Accuracy:1.5%FS
- Repeat error:≤0.5%FS
- Steady error:≤1.5%FS
- Resistance of detector:<500Ω(600°C);  
<100Ω(700°C);  
<25Ω (800°C);

## 2.5 Attachment

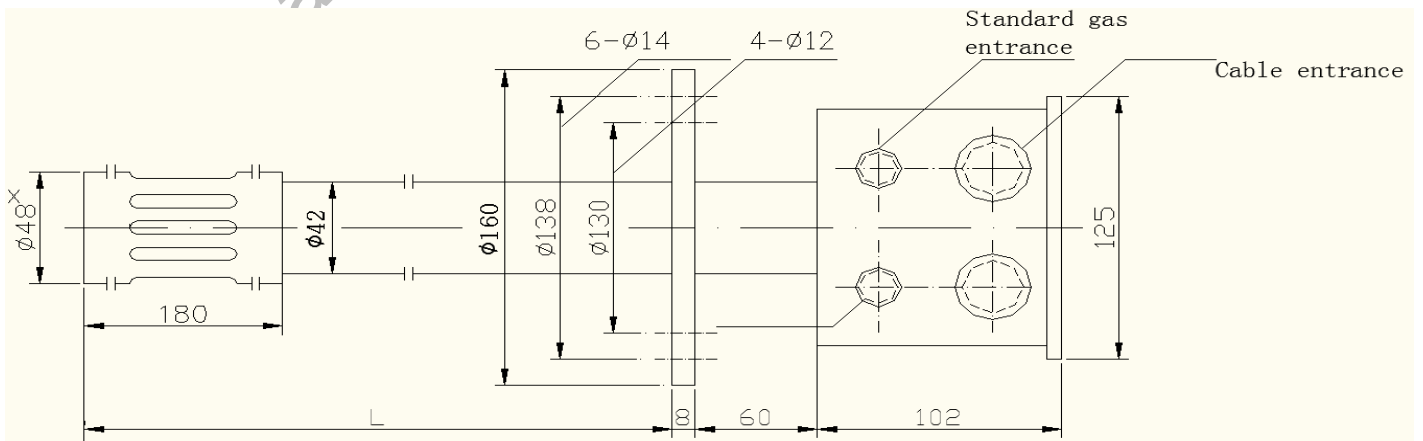
Attachment 1:YYF series zirconia detector type

	Power of electric heater	type	Length of detector(m)
No heater		204	0.4
		208	0.8
		210	1
		212	1.2
		215	1.5
Heater	50-110VDC	304	0.4
		308	0.8
		310	1
		312	1.2
		315	1.5

## Attachment 2: Structure schematic diagram



1. Protection cover 2. Carborundum ventilate tube 3. Zirconia tube 4. Sealing material 5. Blow tube  
6. Electric heater 7. Pipe 8. Thermocouple 9. Flange 10. Terminal box



L=(400. 800. 1000. 1200. 1500. special)

Total length=L+170

### 3. YYF-94Q Series Transmitter

#### 3.1 Product Highlight

##### Intellectualized instrument

The transmitter is based on micro-controller and all the processing function and controlling function will be completed by software.

##### Friendly operator interface and strong function

All relevant parameter can be monitored by operator interface and all adjustment parameter can be modified through operator interface.

##### Reliable power

The switch power, installed in transmitter, has wide range of supply power(100VAC~220VAC,50Hz)and high anti-jamming ability.

##### Modularity structure design,

All the input and output signals are processed by special module, so it has high reliability and easy maintenance.

#### 3.2 Description

According to Nestorius formula, the transmitter converts the oxygen voltage and zirconia tube temperature into current that is proportional to oxygen density of the measured gas.

Transmitter is made up of main board, operator interface, protective board and switch power(please refer to Attachment 4).Data sample, data calculation, current output and zirconia detector temperature controlling are completed by the main board.

All relevant parameter(please refer to table 1)can be monitored by operator interface

and all adjustment parameter (please refer to table 2) can be modified through operator interface. If the temperature of zirconia tube is higher than 850°C, the protective board should switch off the supply power of the electric heater automatically. Switch power converts 220VAC into 5VDC, +15VDC, -15VDC, and 24VDC for transmitter.

There is a set of 4 switches on the main board. No.3 is used to select maximum voltage supplying to electric heater. No.1,2,4 are used to set up transmitter's working mode (please refer to table 3).

Running mode is the normal mode for the transmitter. In this mode, operator interface only shows the parameter in table 1.

Modifying mode, in which operator interface can show contents of table 1 and table 2, can also modify the parameter in table 2.

Initialization mode, all parameter in table 2, will be defined to original value.

Output loop verifying mode, the current output, will be defined freely by operator through operator interface. It is used to test output loop.

There are six LEDs and four keys for operator interface. The former two LEDs are used to show series number or transmitter working mode, and the later four LEDs show the corresponding value. "SEL" key is used to select series number. "INC" key and "DEC" key are used to revise the value of adjustment parameter. "ENT" key is used to confirm the value.

Table 1 List of display parameter

<b>Series number</b>	<b>Content</b>
00	Oxygen density of measured gas
01	Zirconia tube temperature



02	Detector output voltage
03	Heat up conductance

Table 2 List of adjustment parameter

Series number	Content	Original value	Unit
04	Background voltage	0	mV
05	Damp time	0	Second
06	Upper limit	10	%
07	Lower limit	0	%
08	Integral time	10	Second
09	Proportional	10	%
10	Temperature set point	700	°C
11	Range of heat preservation	10	°C

Table 3 List of working mode

No.1	No.2	No.4	Working mode
arbitrariness	arbitrariness	OFF	Running
OFF	OFF	ON	Modifying
arbitrariness	ON	ON	Initialization
ON	OFF	ON	Output loop verifying

### 3.3 Notice

It must be shielded wire that transports the zirconia tube voltage from detector to transmitter. K type compensating wire shall be used from detector to transmitter. The wire connected to electric heater has not special request, but the signal wire shall not lie in same cable with power wire.

There are two types for the transmitter, suspensory type and spiral type, they just have the difference in mechanism structure and installing method. Please point out the type at order form.

There are two output current channels in main board, and only one channel is installed as usual. If the custom need two channels, please point out it at order form.

### 3.4 Specification

- Instrument accuracy:0.5%
- System accuracy:2%
- Oxygen density span:0.1%~25%O<sub>2</sub>
- Output signal: isolate direct current(4~20mA or 0~10mA),load:≤500Ω
- Temperature measurement span:0~1000°C
- Oxygen voltage span:-20~120mV
- Environment condition:0~40°C, relative humidity<90%
- Supply power:220VAC,50Hz
- Consume power: transmitter 10W,electric heater 100W
- Heat voltage:0~110VAC

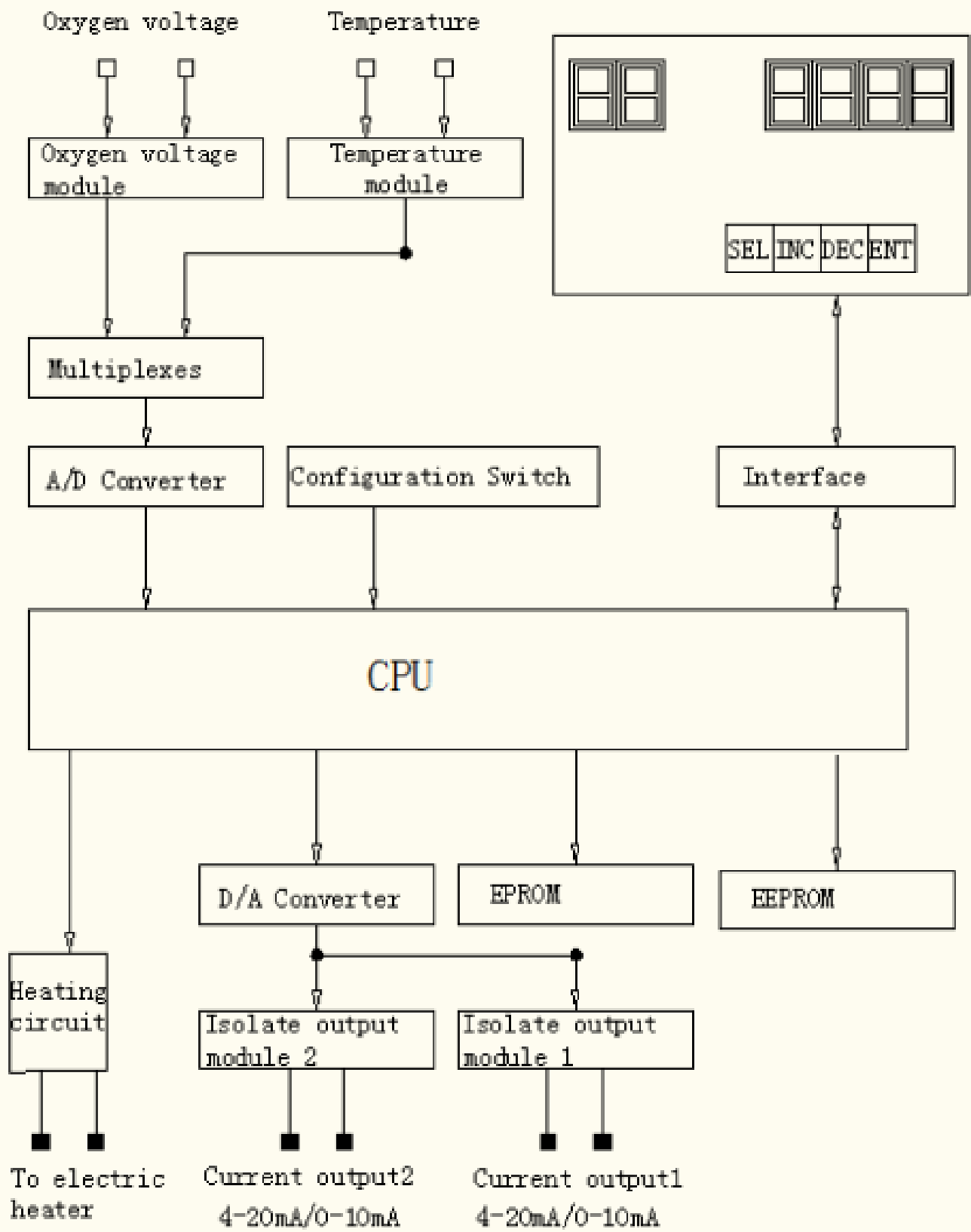


Chart 1 Transmitter schematic drawing

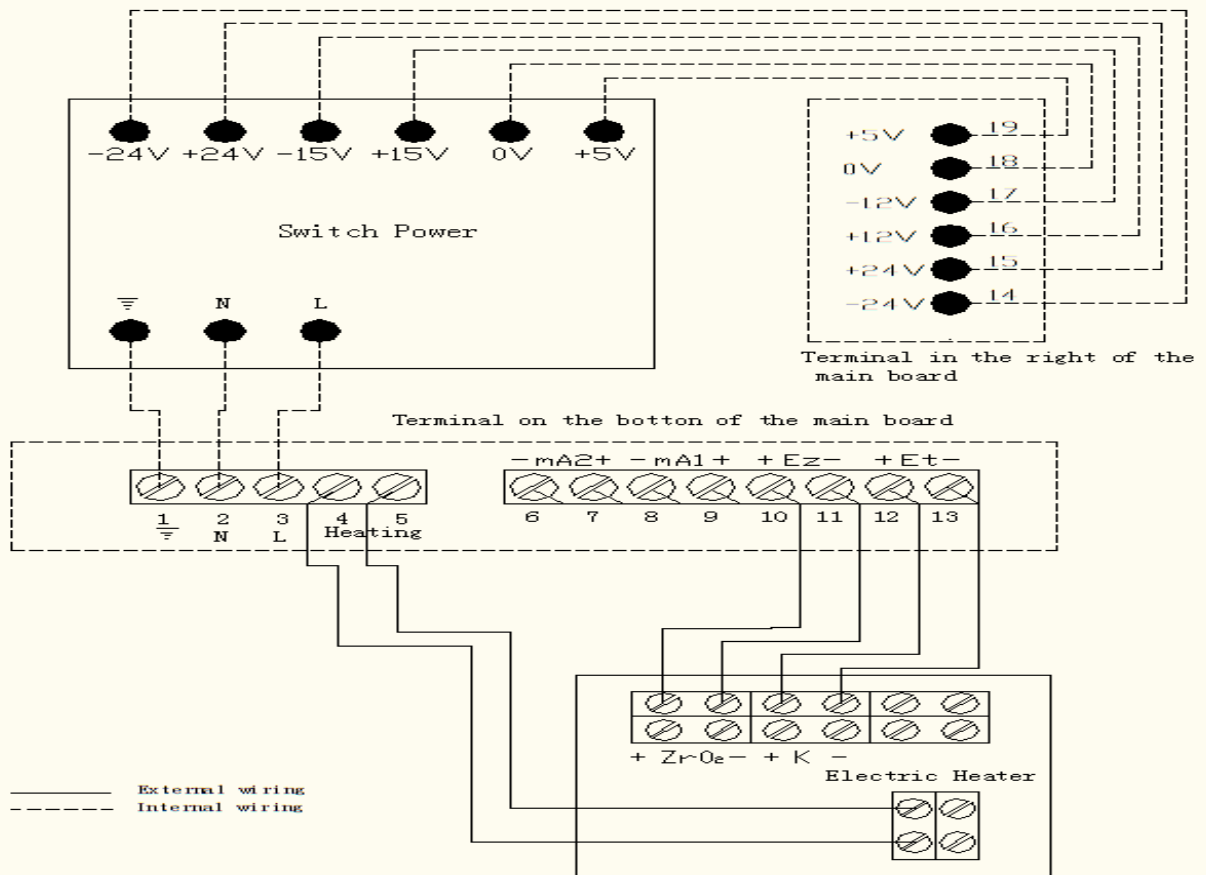


Chart 2 Connection drawing

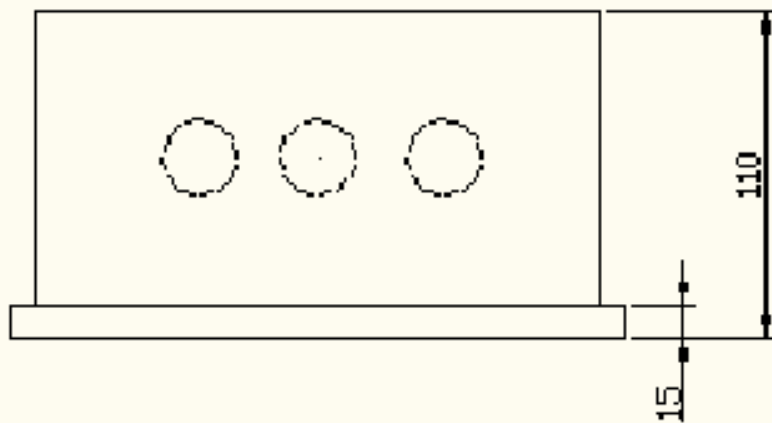
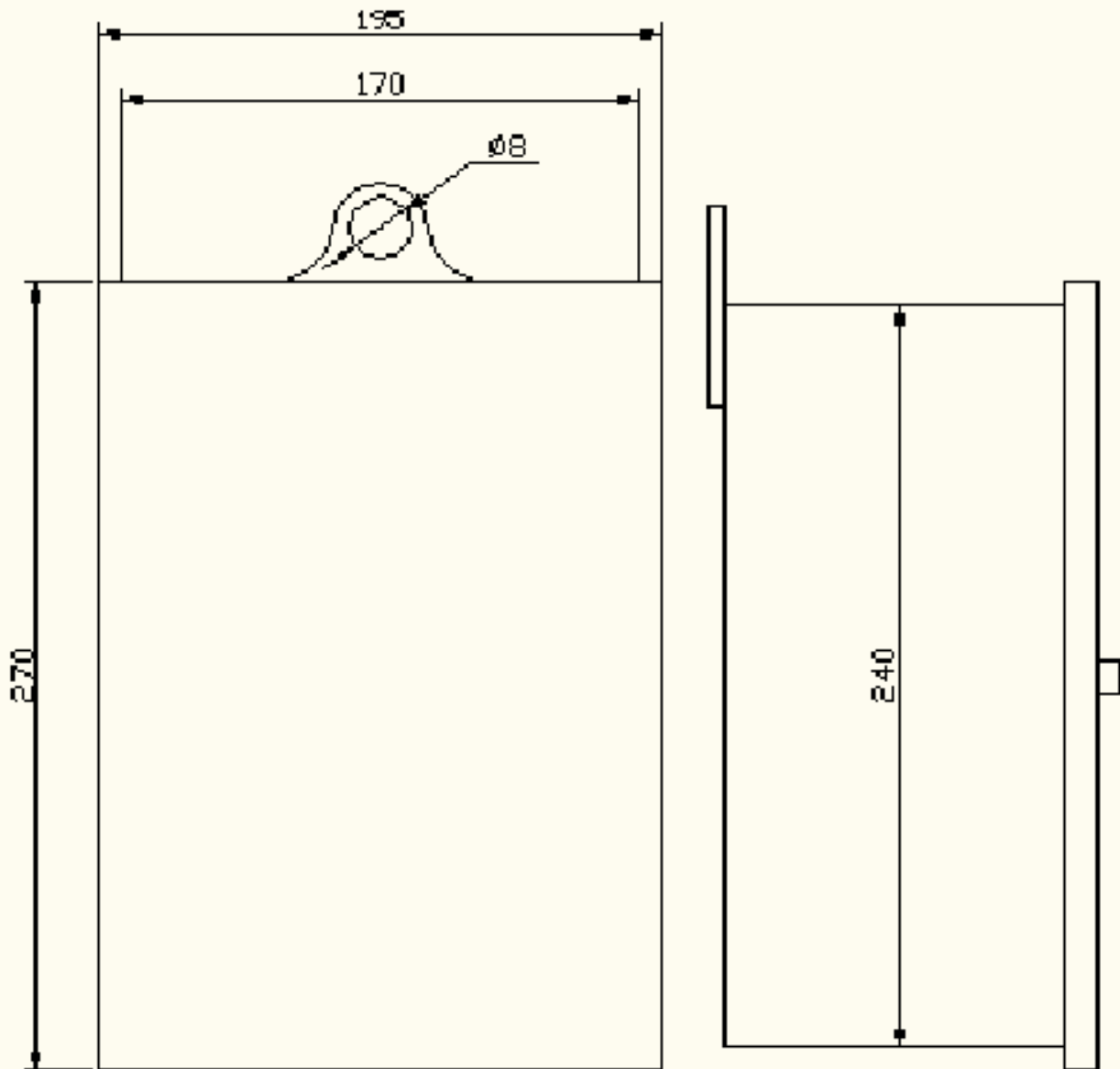


Chart 3 Dimension drawing of suspensory type

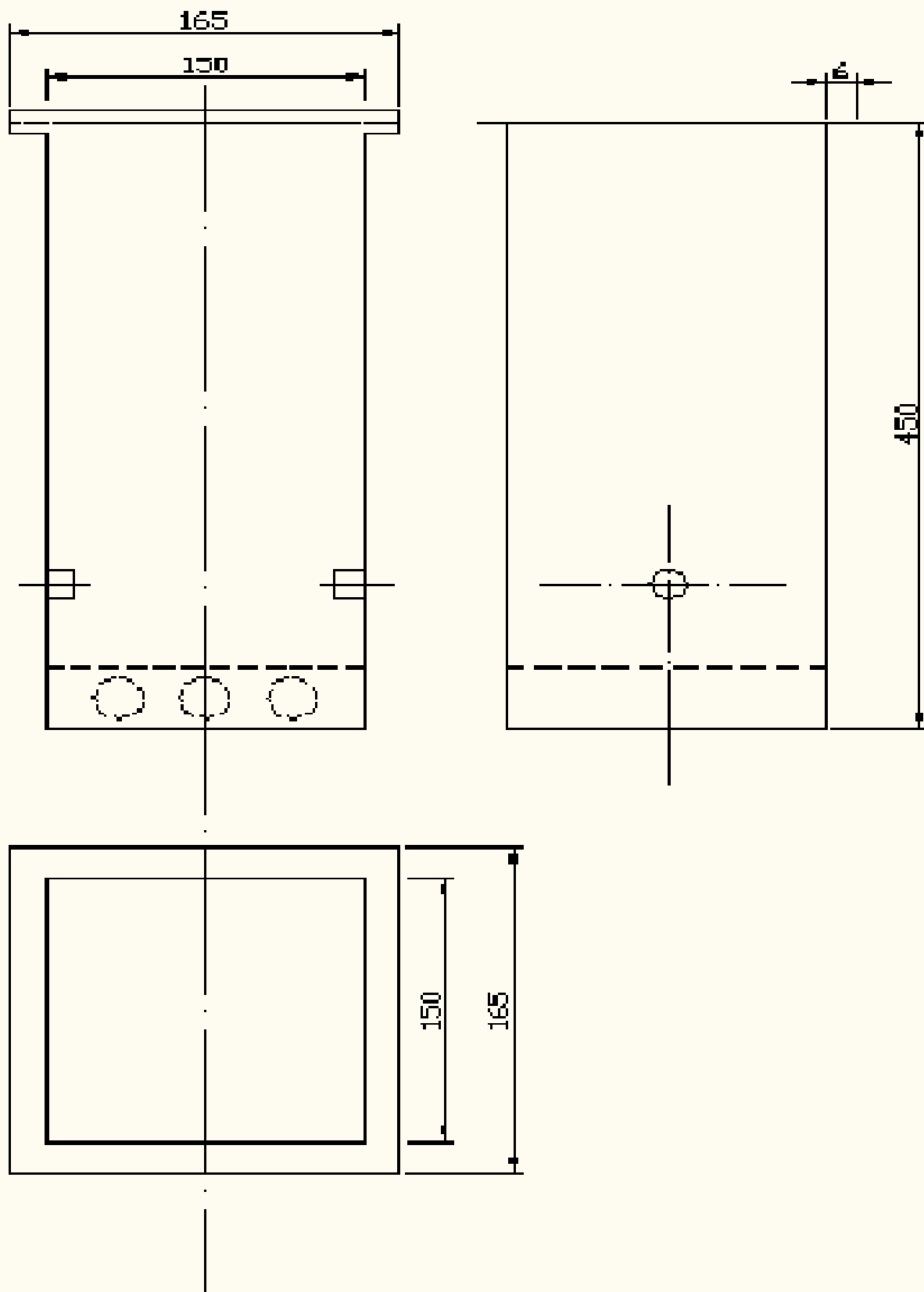


Chart 4 Dimension drawing of spiral type

### Attachment 3: the relation ship between gas temperature and oxygen density

<div style="display: flex; justify-content: space-between; align-items: center;"> <span>%O<sub>2</sub></span> <span>mV</span> <span>°C</span> </div>	0.1	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0	19.0	20.0	
	500 (20.640mV)	88.73	50.38	38.84	32.08	27.29	23.58	20.54	17.97	15.75	13.79	12.04	10.45	9.00	7.76	6.43	5.28	4.21	3.20	2.25	1.35	0.49
600 (24.902mV)	100.20	56.90	43.86	36.23	30.82	26.63	23.20	20.30	17.79	15.57	13.59	11.80	10.16	8.66	7.26	5.97	4.75	3.61	2.54	1.52	0.56	
700 (29.128mV)	111.68	63.41	48.88	40.38	34.35	29.68	25.86	22.62	19.83	17.36	15.15	13.15	11.33	9.65	8.10	6.65	5.30	4.03	2.83	1.69	0.62	
800 (33.277mV)	123.15	69.93	53.91	44.53	37.88	32.73	28.51	24.95	21.86	19.14	16.71	14.50	12.49	10.64	8.93	7.33	5.84	4.44	3.12	1.87	0.68	
900 (37.325mV)	134.65	76.45	58.93	48.68	41.42	35.78	31.17	27.27	23.90	20.92	18.26	15.85	13.65	11.63	9.76	8.02	6.39	4.85	3.41	2.04	0.75	
1000 (41.269mV)	146.10	82.96	63.95	52.83	44.95	33.83	33.83	29.60	25.94	22.71	19.82	17.20	14.82	12.63	10.59	8.70	6.93	5.27	3.70	2.22	0.81	
1100 (45.108mV)	157.58	89.48	68.98	56.98	48.48	41.88	36.48	31.92	27.97	24.49	21.37	18.56	15.98	13.62	11.42	9.38	7.47	5.68	3.99	2.39	0.87	
1200 (48.828mV)	169.05	95.99	74.00	61.13	52.01	44.93	39.14	34.25	30.01	26.27	22.93	19.91	17.15	14.61	12.26	10.07	8.02	6.10	4.28	2.57	0.94	