Eddy current flaw detector

User's manual

Note：

Various products are similar in use, and the interface has similar style.The illustrations shown in this manual take single channel as an example.

Other products have similar operation methods.Only the interface layout is slightly different.This manual is not enumerated.

Nanjing BKN Automation System Co., Ltd.

Ø Instrument description

This instrument is guaranteed for one year. During the warranty period, the quality problem of the instrument is free.The maintenance fee is maintained outside the warranty period.Users of this instrument can be consulted by the manufacturer for life.(The detection probe has a shelf life of three months, except for a specially customized long life probe.) Please note that the following is not a free warranty:

1、 There is mechanical damage. Failure caused by dropping, bumping and not being handled lightly.

2、Failure or damage caused by self renovation, adjustment and maintenance.

3、Failure to carry out external wiring according to regulations, and overload of circuit caused by inconformity of input and output electrical specifications.

4、Damage caused by force majeure, such as natural disasters.

5、This guarantee is effective throughout the world.

➢Precautions for use

1、The power supply specifications of this instrument are:

Voltage：180~240VAC

Frequency：50/60Hz

Ensure that the enclosure is reliably grounded before power is put on.(Please use the three core power socket with safe grounding.) Failure of the power source other than the specification shall not be covered by the warranty.

2、The ambient temperature of the instrument is 0 ~40 C, and the humidity is 10%~85%.

3、The grounding resistance of this instrument shell should be less than 100 Ω.

4、Do not open the enclosure when the instrument is energized.

5、 This instrument is a precision equipment. It should be handled gently in the process of transportation. Special packing boxes should be used for transportation.

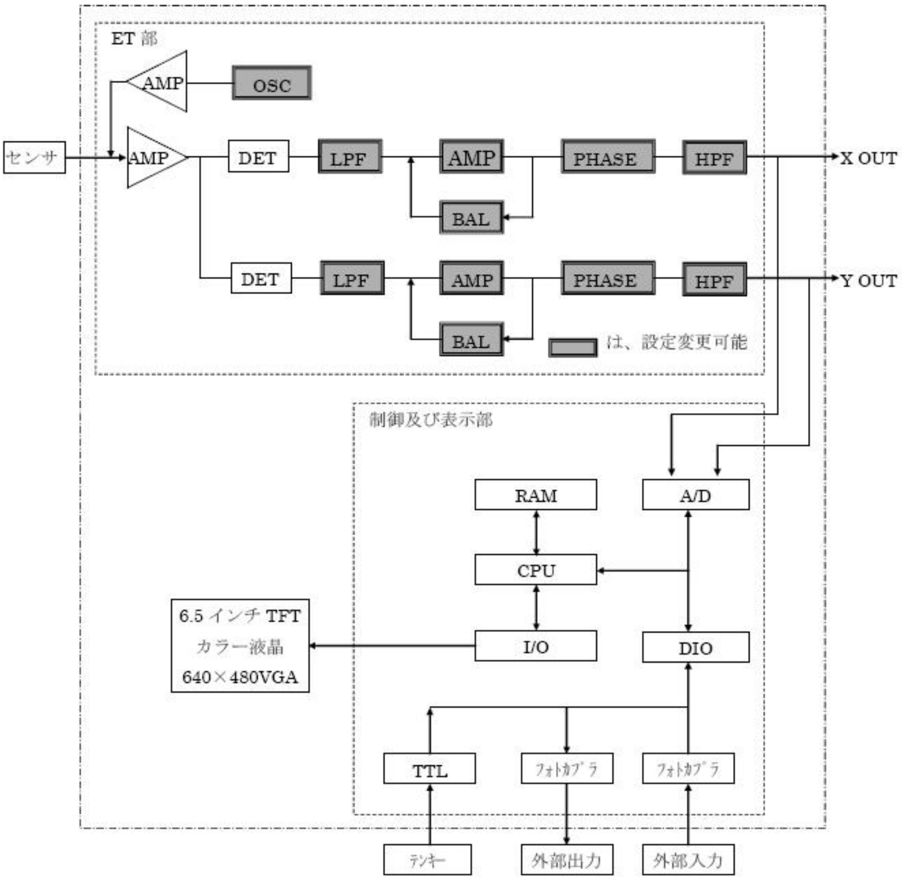
➢General

Computerized tester is a multi-functional, practical, high-performance/price-ratio instrument, which has many years of experience in manufacturing eddy current tester to meet the needs of various users. It can be widely used in all kinds of non-ferrous metals, ferrous metal tubes, rods, wires, wires, profiles on-line and off-line flaw detection.It has high detection sensitivity for defects of metal tubes, bars, wires, wires and profiles, such as surface cracks, dark cracks, slag inclusion and open cracks.

It uses Windows Chinese / English interface, modular operation,provides a variety of display modes for selection, and apply full digital design technology, it changes product specifications without re-adjusting the instrument to achieve fool operation.

➢Detection principle and composition

The instrument passes through the testing coil with alternating current of a certain frequency. When the test piece approaches the coil, the geometric size, conductivity and permeability of the test piece, as well as the metallurgical and mechanical defects of the test piece will cause the impedance change of the testing coil.The testing instrument will amplify and convert the electric signal produced by the change of the coil impedance to drive the alarm or display device, and finally detect the defective sample.


ET 部
AMP
OSC
センサ
AMP
DET
LPF
AMP
PHASE
HPF
X OUT
BAL
DET
LPF
AMP
PHASE
HPF
Y OUT
BAL
は、設定変更可能
制御及び表示部
RAM
A/D
CPU
6.5 インチ TFT
カラー液晶
640×480VGA
I/O
DIO
TTL
ﾌｫﾄｶﾌﾟﾗ
ﾌｫﾄｶﾌﾟﾗ
ﾃﾝｷｰ
外部出力
外部入力

The oscillator produces a frequency of 100Hz to 1MHz adjustable dual sine wave. One of the way is sent to the wide frequency power amplifier as the driving probe of the excitation source, the probe constitutes the bridge arm for measuring the AC bridge. When the probe detects the sample, the eddy current induced by the excitation source changes with the change of the physical properties of the sample. As a result, the original impedance (real component R and imaginary component X) of the probe changes, thus destroying the balance of the original AC bridge, the complex voltage U containing the detection signal is obtained. The signal is sent to the X, Y decomposer after broadband preamplifier.

The bridge balance circuit is used to counteract the unbalanced initial complex voltage U of the AC bridge. The oscillator outputs two orthogonal sinusoidal waves to the sampling pulse generator, which generates quadrature sampling pulses for X and Y decomposers. After the manual signal of the preamplifier is sampled and decomposed, the X and Y components of the probe are amplified by the filter amplifier and sent to the A/D interface circuit. The measurement signal is processed by the microcomputer system, the measurement result is displayed directly, and the control signal is output to realize the acoustooptic alarm, marking and automatic sorting.

➢Main technical indicators:

1. Speed of detection:：≥0.5 M / min
2. Frequency range：100Hz～1MHz
3. Gain: 40～99dB，regulated quantity 0.1dB/ file
4. High pass: 0.1Hz～650Hz
5. Low pass: 1Hz～10000Hz
6. Advanced filtering: Yes
7. Computerized full digital parameter adjustment
8. Real time impedance plane display
9. Provide X-t, Y-t, V-t three time base scanning real time display mode for choice.
10. High precision real time, alarm output
11. Multi phase / amplitude alarm technology
12. Eddy current testing signal playback, analysis, save, print function
13. Automatic generation of test report content, Windows operation interface, Modular human-machine conversation
14. Power Supply：180V～240V 50Hz
15. Ambient temperature：－20℃～＋40℃

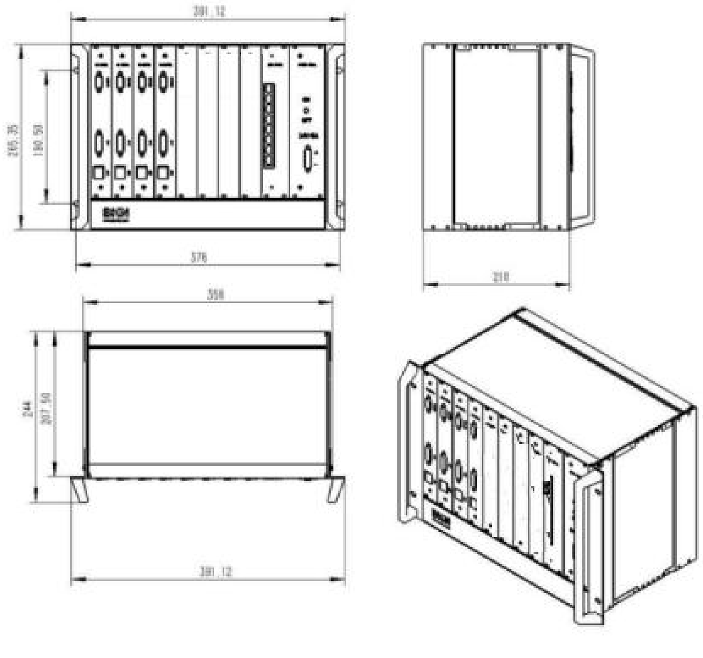
➢Component Name

The eddy current flaw detector is an integrated machine. The display screen and the eddy current main engine are connected together. The configuration of the four-channel eddy current flaw detector is different according to the detected objects. The whole flaw detection system may include: probe device, alarm device and marking device.

Eddy current mainframe: according to the principle of eddy current testing, eddy current testing circuit should contain at least the following functions:

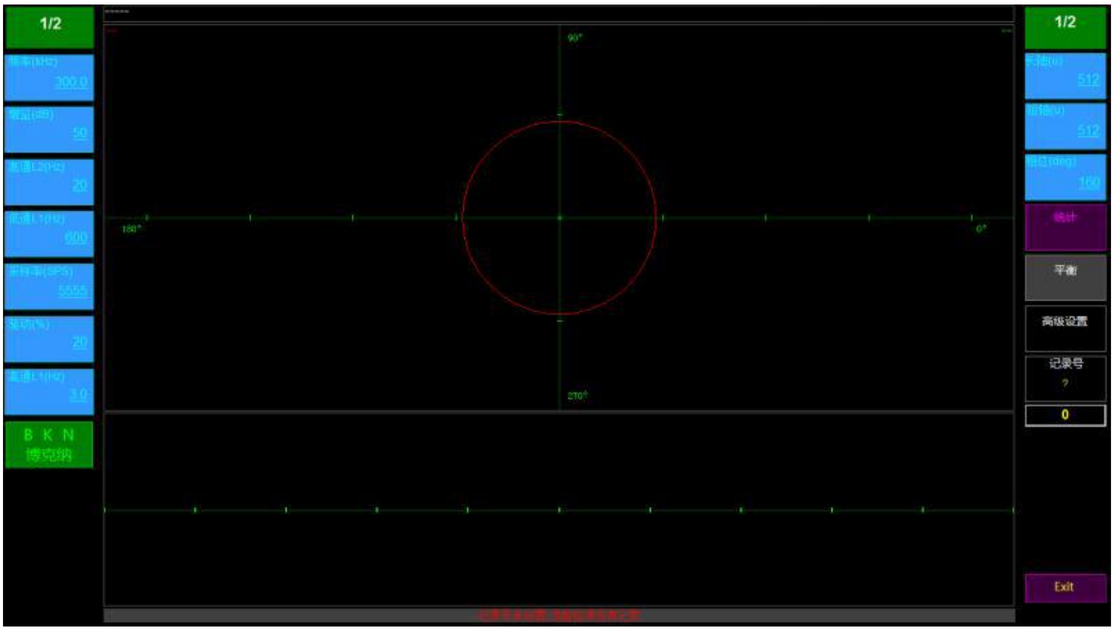
1) A set frequency AC signal is generated and output to the detection probe to excite eddy current in the detection object.
2) The eddy current signal of the detected object is picked up by detecting probe, and the signal is amplified, detected and filtered.
3) Communicate with the upper tablet computer, receive all kinds of test parameters set by the user, and set the circuit to achieve the desired test results.
4) The eddy current signal processed by the circuit is decomposed into X and Y components and output to the master computer for acquisition and analysis.

➢ Description of backplane for single channel eddy current tester



- AC220V： Power supply socket
- I/O socket： Alarm output, marking output, synchronous input, etc, see the wiring diagram. DC24V Active output, can drive current load below 500mA. Such as warning lights, spray marker and so on.
- Probe socket: connect probe, DB9 socket.

➢Interface description


1/2
300.0
50
20
600
5555
20
3.0
B K N
博克纳
90°
180°
0°
270°
1/2
512
512
100
平衡
高级设置
记录号
?
0
Exit

❖ Parameter setting and specification

-

Frequency range： Frequency of eddy excitation signal. Usually the lower the frequency, the greater the depth of detection. For specific frequencies, please consult technicians according to the actual testing objects.**The probe is generally set to 100-600. Reference value 300.**

-

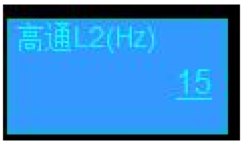
Gain： Decibel (dB) number of signal amplification.

dB=20 * LgGain

dB:Decibel gain

Gain:Gain multiplier

The gain is generally set to 40-66. The reference value is specific to sample tube.

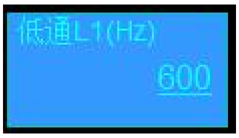
■ 

高通L2(Hz)
15

High pass L2： Signal filtering parameters. The lowest frequency allowed to pass the signal of this instrument.This parameter is related to the relative speed of the detected object and the probe. The faster the speed is, the greater the value is, and vice versa. Proper setting of this parameter can eliminate the useless signal caused by the unstable motion or slowly changing shape of the object under test. The unit is the unit Hz of frequency (the number of changes per second).The faster the speed, the higher the parameter should be set. The general relationship is as follows:

Line speed of object being detected (M / min)	High pass L2（Hz）
1	0.5
10	5
20	10
30	15
40	20

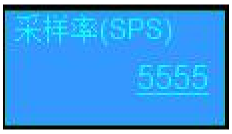
High pass L2 is generally set to 10-60. The reference value is 30 (specific to the test speed).

■ 

低通L1(Hz)
600

Low pass L1： Signal filtering parameters. The unit is the unit Hz of frequency (the number of changes per second). This parameter is mainly used to eliminate interference due to the electrical environment, or other possible high frequency interference. The smaller the parameter value is, the better the effect of eliminating interference is, but it also restrains the eddy current signal to a certain extent. Therefore, the value of this signal should be: "in the case of weak interference signal as far as possible to take a larger value." According to experience, in general, this value is generally set to 400~600. If the linear velocity of the detected object is very low (below 50 meters per minute), this value is set to 80-400 will not have a great impact on the test results. When the object is detected at high speed, the parameter value is usually raised accordingly. It should be determined in actual commissioning.

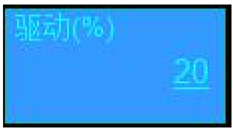
Low pass L1 is generally set to 200-1000. The reference value is 600 (specific to the test speed).

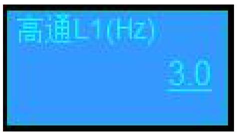
■ 

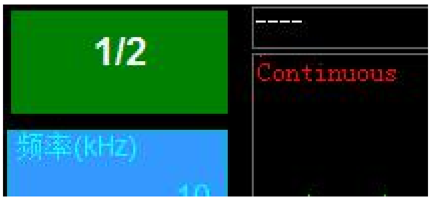
采样率(SPS)
5555

Sampling rate： The sampling rate is the rate of measuring an input signal.

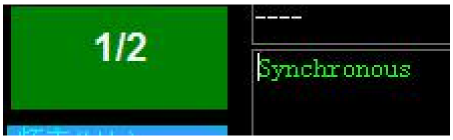
The sampling rate is 3000-8000. The reference value is 5555 (The specific sample is the standard).

- 
  驱动(%) 20
  Drive（%）：The current ratio of the excitation coil in the probe is 100.The larger the value is, the larger the induced magnetic field is. When the value is too large, the probe coil is not easy to balance.
  The driver is generally set to 20-35. The reference value is 20.

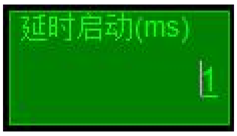
- 
  高通L1(Hz) 3.0
  High pass L1: Signal filtering parameter (Hardware). There are three set values: 3, 30and 300. The faster the speed, the greater the value. Normally set to 3.

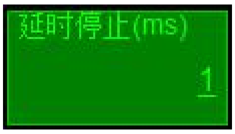
- 

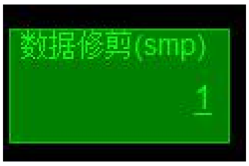
  Continuous
  Continuous: The workpiece is continuously detected without external switch control.

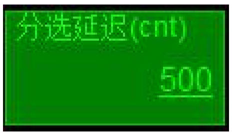
- 

  Synchronous
  Synchronous: The workpiece is controlled by external control. Normally set to this state.

- 
  延时启动(ms) 1
  ： When the flaw detector is in external control, the delay time of the flaw detector starts. The unit is milliseconds.

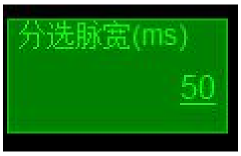
- 
  延时停止(ms) 1
  ： When the flaw detector is in external control, the delay time of the flaw detector stops. The unit is milliseconds. **It must be set to 1.**

- 
  数据修剪(smp) 1
  ： This parameter is used to remove the clutter of the tail, generally set at 1.



分选延迟(cnt)
500

- ：When set to 0, it is the good or bad signal of the probe. When the instrument receives the synchronous signal and the probe is normal, the signal is always effective. When the setting is not 0, It is the delayed output of the alarm signal. The setting time is the delay time.

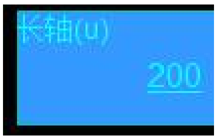


分选脉宽(ms)
50

- ：Duration of alarm delay output.

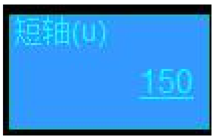
Alarm parameters: The ellipse (When the long axis is equal to the short axis, it is round.) in the impedance graph is called the alarm area. When the signal amplitude exceeds the range contained in the alarm area, the detector will output an alarm signal, which is judged as a defect. The shape, size and angle of the alarm area are set according to the actual detection conditions. Usually, the same specimen with known defects is used to calibrate. The principle of calibration ensures that the normal workpiece does not exceed the alarm area, while the defective workpiece sound the alarm.

- Blue area



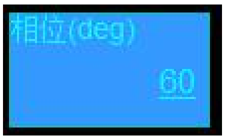
长轴(u)
200

1) Long axis A：The long diameter of the ellipse (When the long axis is equal to the short axis, it is round.) in the blue alarm area of the impedance graph.



短轴(u)
150

2) Short axis B：The short diameter of the ellipse (When the long axis is equal to the short axis, it is round.) in the blue alarm area of the impedance graph.



相位(deg)
60

3) Phase：The angle of long axis of the ellipse in the alarm area of the impedance graph.

-

：Balance (Selection function)
-

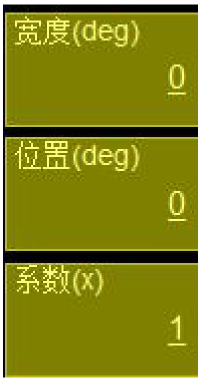
：Advanced setting (Manufacturer's use)

Window 1(Generally not used)： Set a gap in the selected location of the alarm area. Even if the detection signal at the gap position exceeds the scope of the alarm area, the instrument does not send out the alarm signal. The purpose is to shield some specific interference signals.

1)
宽度 (deg) 0
Window width 1： The width of the notch is set at the angle of the connection with the center point of the impedance graph.

2)
位置(deg) 0
Angle of window 1: The angle between the center of the notch and the point line in the impedance diagram.

3)
系数(x) 1
Coefficient 1: Multiple relative to the basic alarm area.

- **Window 2(Generally not used)：** The function is the same as that of **Window 1**, if necessary, another gap can be set to eliminate more interference.
- 
宽度(deg) 0
位置(deg) 0
系数(x) 1
Parameter setting reference **Window 1**

❖ Impedance diagram

1. Impedance diagram is a two-dimensional graph, which represents the change of impedance characteristics of the detected object. When the detected object is continuous and uniform (It means that the relative motion locus between the probe and the detected object is homogeneous without mutation.), its impedance is unchanged. Impedance plots also show small curves. When a sudden change occurs in the detected object (defect, crack, uneven material, size, etc.), the impedance characteristics will change. This change is picked up by the instrument and the corresponding curve is drawn on the impedance diagram. When the curve exceeds the alarm area (circle) set in the impedance diagram, the instrument outputs an alarm signal to indicate the detection problem.The value of the X direction in the impedance graph represents the resistance characteristic, and the value in the Y direction represents the inductance characteristic.
2. Impedance graph analysis is a classical analysis method of eddy current testing technology. The main debugging process of eddy current testing is also carried out around the impedance diagram.
3. BKN has a unique method in impedance analysis technology, which not only greatly simplifies the debugging process, but also improves the reliability and sensitivity of detection, leading the industry in the international scope.

➢Steps for testing instruments

1) Turn on the display power, turn on the computer and wait to enter the test screen;

2) Preheat for 5 minutes;

3) Connect probe and alarm;

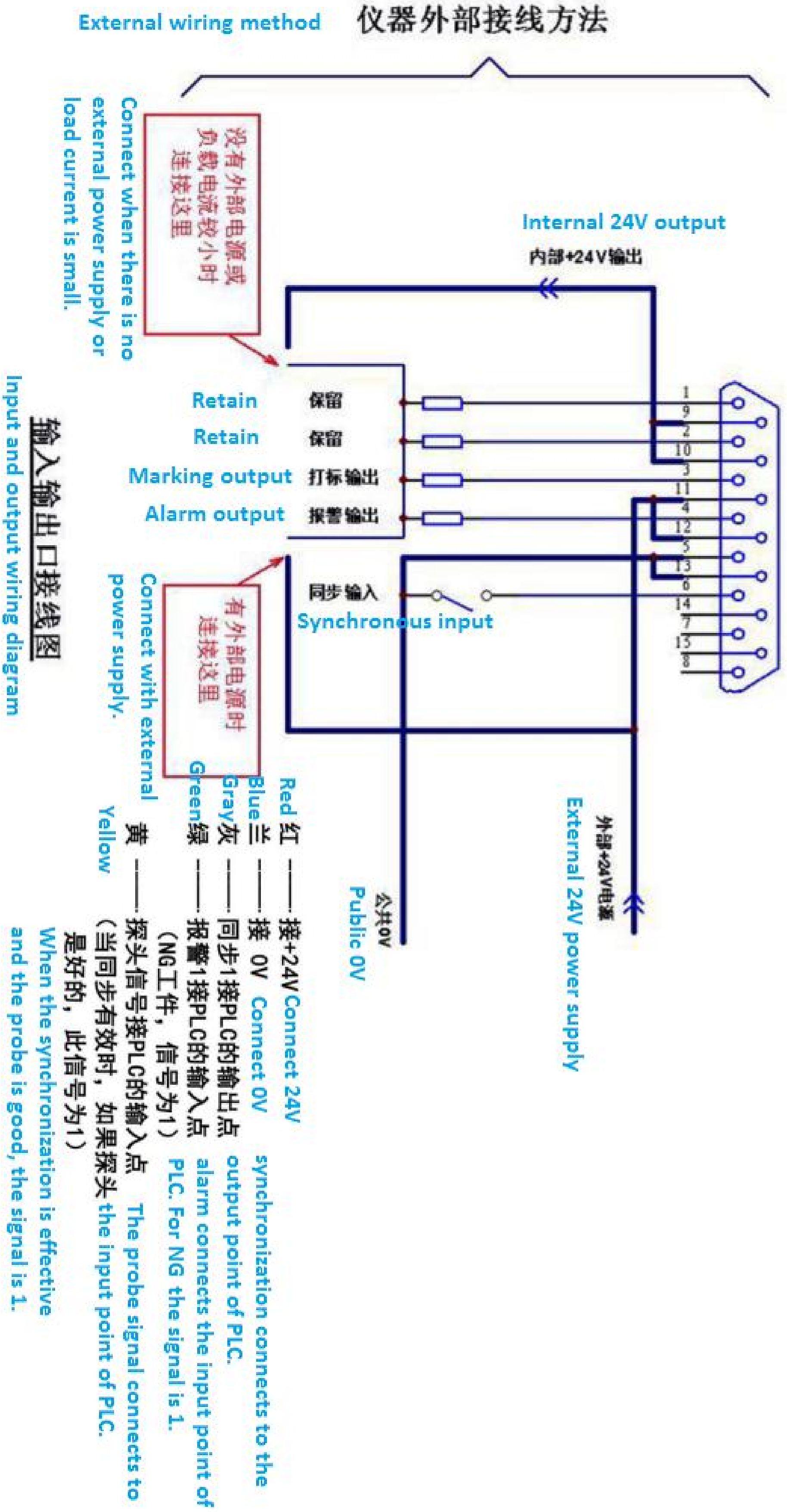
4) Adjust the parameters;

5) Select the synchronous button;

6) After testing, quit the system;

7) Shut down computer.

➢External wiring method (Circuit diagram)


External wiring method
仪器外部接线方法
没有外部电源或负载电流较小时连接这里
Connect when there is no external power supply or load current is small.
Internal 24V output
内部+24V输出
Retain 保留
Retain 保留
Marking output 打标输出
Alarm output 报警输出
同步输入
Synchronous input
有外部电源时连接这里
Connect with external power supply.
输入输出口接线图
Input and output wiring diagram
公共0V
Public 0V
外部+24V电源
External 24V power supply
1
9
2
10
3
11
4
12
5
13
6
14
7
15
8
Red 红 ——接+24V Connect 24V
Blue 兰 ——接 0V Connect 0V
Gray 灰 ——同步1接PLC的输出点 synchronization connects to the output point of PLC.
Green 绿 ——报警1接PLC的输入点（NG工件，信号为1） alarm connects the input point of PLC. For NG the signal is 1.
黄 Yellow ——探头信号接PLC的输入点（当同步有效时，如果探头是好的，此信号为1） The probe signal connects to the input point of PLC. When the synchronization is effective and the probe is good, the signal is 1.