

# **Multifunctional Eddy Current Rapid Hardness Sorter**

## **Instruction manual**

**Nanjing BKN Automation System CO., LTD**

### ➤ The instrument description: •

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The instrument is guaranteed for one year. During the warranty period, the quality problems of the instrument will be repaired free of charge.

Pay for maintenance outside the warranty period. Users of this instrument can get consulting service from the manufacturer all their lives. Please note that the following conditions are not covered by free warranty:

1. Mechanical damage. Faults caused by falling, collision and not light handling.
2. Failure or damage caused by self-improvement, adjustment and maintenance.
3. Circuit overload caused by non-conformity of input and output electrical specifications due to external wiring.
4. Damage caused by force majeure factors such as natural disasters.
5. This warranty is valid all over the world.

### ➤ Precautions for use:

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1. The power supply specifications of this instrument are:

Voltage: 180~240VAC

Frequency: 50/60Hz

*Make sure that the device casing is securely grounded before powering up the device. (Please use a three-core power socket with a safety ground)*

*If the failure caused by the use of power supply specifications other than those specified is not covered by the warranty.*

2. The ambient temperature of the instrument is  $0^{\circ}\text{C}\sim 40^{\circ}\text{C}$ , and the humidity is 10%~85%.
3. The grounding resistance of the instrument case should be less than  $100\ \Omega$ .
4. Do not open the case when the instrument is powered.
5. This instrument is a precision equipment, which should be handled gently during transportation and transportation. A special packing box should be used for the transportation process.

## ➤➤ **Summary:**

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EC + computer hardness sorter is a multi-functional, practical, high performance/price ratio instrument that combines years of experience in the manufacture of eddy current hardness sorters to meet the needs of a wide range of users. It can be widely used to identify and classify the material composition, hardness, depth of surface hardening layer, tensile strength, heat treatment status, cracks, interlocking-tooth and mixtures of various non-ferrous metals, ferrous metal tubes, rods, metal parts, etc.

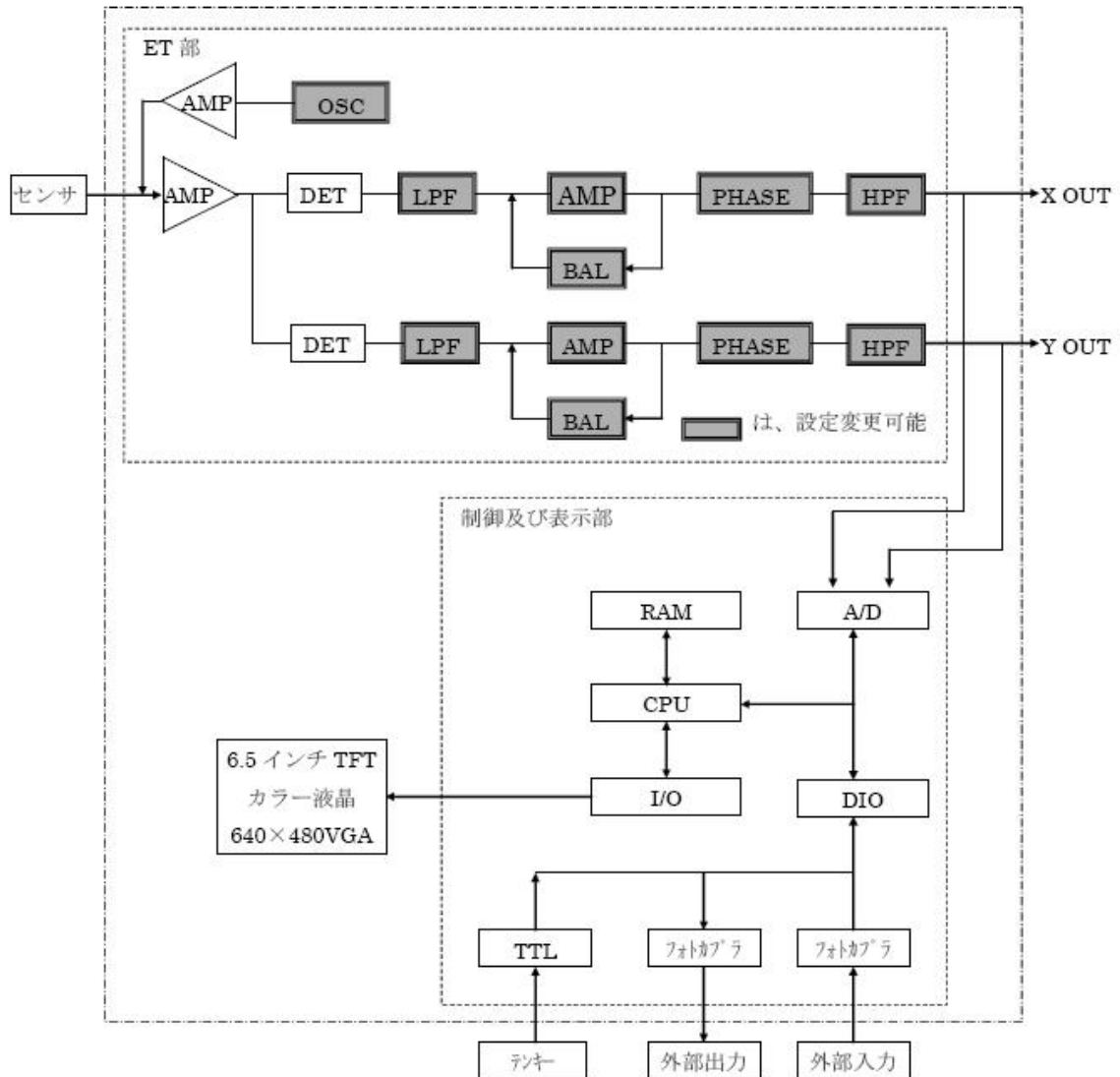
Using Windows Chinese operation interface, operates in modular mode, provides a variety of display modes to choose from, and applies all-digital design technology. When changing product production specifications, it is not necessary to re-adjust the instrument to realize fool-type operation.

## ➤ **Detection principle and composition:**

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The instrument passes two detection coils at a certain frequency of alternating current, one of which is placed in a standard part. When the test piece is placed in another coil, the hardness, electrical conductivity and permeability of the test piece and the metallurgical and mechanical parts of the test piece The defect will cause a change in the impedance of the detection coil. The detecting instrument drives the alarm or display device after the electric signal generated by detecting the change

of the coil impedance is amplified and converted, and finally detects the sample having the difference in hardness.



The oscillator generates an adjustable two-way sine wave with a frequency of 100 Hz to 1 MHz. All the way to the wide frequency power amplifier, as the excitation source of the driving probe, the probe constitutes the bridge arm for measuring the AC bridge. When the probe detects the sample, the eddy current field induced by the excitation source changes with the change of the physical properties of the sample.

As a result, the original impedance of the probe (real component R and virtual component X) changes, which destroys the balance of the original AC bridge, and the complex voltage U containing the detection signal is obtained. After the signal is sent to the X and Y decomposer through a broadband preamplifier, it is decomposed.

The bridge balance circuit is used to offset the AC bridge unbalance initial complex voltage U, and the oscillator outputs two orthogonal sine waves to the sampling pulse generator to generate mutually orthogonal sampling pulses for use by the X and Y resolvers. 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 microcomputer system processes the measurement signal, directly displays the measurement result, and outputs the control signal to realize the sound and light. Alarm, marking, automatic sorting, etc.

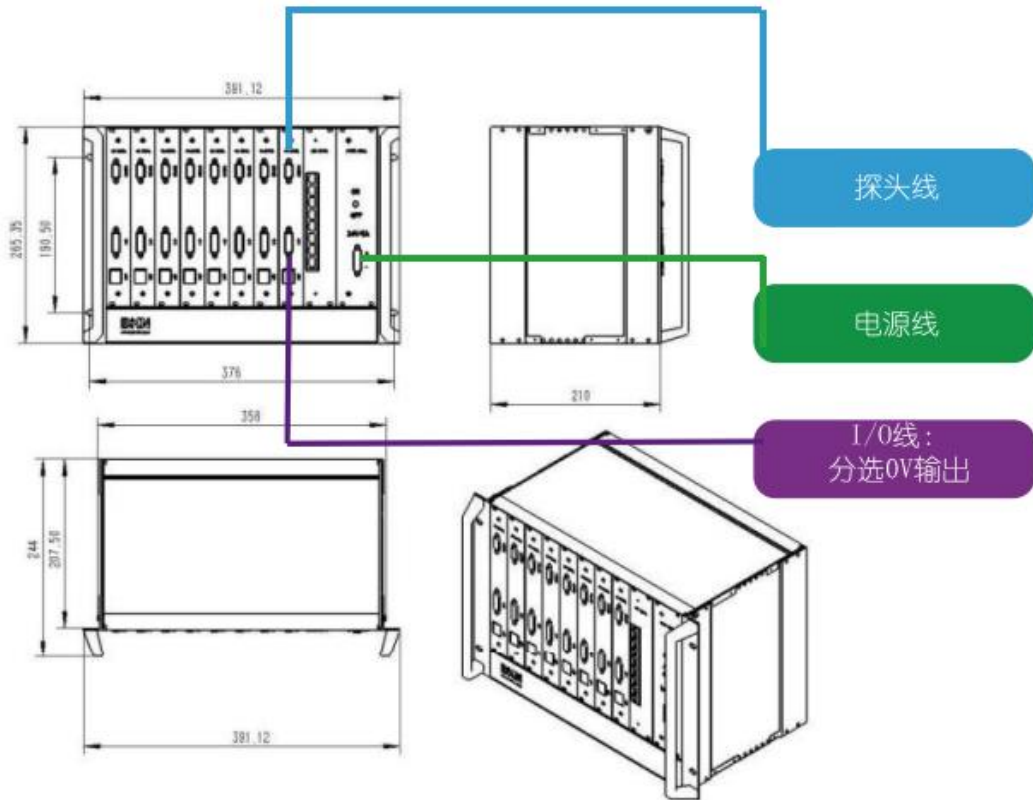
➤ **Main technical indicators:**

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1. Instrument detection speed: 1-5 / sec
2. Frequency range: 0.1KHz ~ 400KHz
3. Gain 23 ~ 69dB, adjustment amount 1dB / file
4. High pass: set to 0Hz
5. Low pass: 20Hz ~ 1000Hz

6. Advanced Filtering: Yes
7. Computer full digital parameter adjustment
8. Real-time impedance plane display
9. Resolution:  $\pm 2\text{HRC}$
10. High precision real time, alarm output c
11. Multiple phase/amplitude alarm techniques;
- 12.Windows operation interface, modular man-machine dialogue
13. Power supply: 180V ~ 240V 50Hz
14. Ambient temperature:  $-20^{\circ}\text{C} \sim +40^{\circ}\text{C}$
- 15.AC220V: Power cord socket.
16. I/O jack: alarm output port, marking output, sync input, etc. See the wiring diagram for details. The DC24V active output can drive current loads below 500mA. Such as alarm lights, fountains, etc.
17. Probe socket: Connect the detection probe, DB9 socket.

## ➤ Instrument mainframe backplane description:



■ AC220V: power cord socket

■ I/O line jack: alarm output port, sorting OK and NG signal output, see wiring diagram for details.

24V active output, can drive current load below 500mA (such as alarm light, kick cylinder, etc.)

■ Probe socket: Connect the detection probe to the DB9 socket.



## ➤ Parameter settings and parameter description:

1 | 2

频率 (kHz) 0.5

增益 (dB) 45

高通L2 (Hz) 0

低通L1 (Hz) 200

采样率 (SFS) 5555

驱动 (%) 25

高通L1 (Hz) 0.2

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探头 BLN=227 ErrX=3 ErrY=5

Continue Testing

1#

0.00 0.85 1.00

合格 不合格

总计 合格 不合格  
20 20 0

记录号未设置, 当前检测按系统时间记录

硬度快速分选操作

Win1  Win2

Win1Set Win2Set

0.60  增强分选

Tolerance

2 - +

定标 清除定标

保存配置 数据统计

型号切换 记录设置

计数清零 高级设置

M  H

Exit

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1 | 2

分选模式 (1/2) 1

分选延迟 (ms) 10

分选脉宽 (ms) 200

探头 BLN=221 ErrX=2 ErrY=5

Continue Testing

1#

0.00 0.85 1.00

合格 不合格

总计 合格 不合格  
0 0 0

记录号未设置, 当前检测按系统时间记录

硬度快速分选操作

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保存配置 数据统计

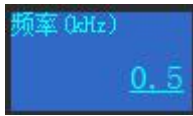
型号切换 记录设置

计数清零 高级设置

M  H

Exit

## I . The first page on the left side of the sorting software interface



- Frequency: Frequency of eddy current excitation signal. The range of parameter adjustment is 100Hz~1MHz, and the appropriate frequency can be selected according to the type of probe and the workpiece (technicians can be consulted)



- Gain: The number of decibels (dB) of the signal amplification.

$$\text{dB} = 20 * \text{LgGain}$$

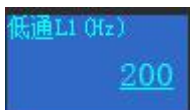
dB:decibels of gain

Gain:multiple of gain

**Gain adjustment range 23-69, according to interface graphic sensitivity adjustment**



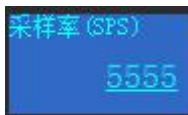
**High pass L2:** Signal filtering parameters. Must be set to 0.



- **Low pass L1:** Signal filtering parameters. The unit is the unit of frequency Hz (the number of changes per second). This parameter is mainly used to eliminate interference due to the electrical environment, or other possible higher frequency

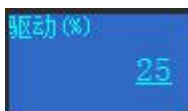
interference. The smaller the value of this parameter is, the better the effect of eliminating the interference is, but the eddy current signal required to be retained is also suppressed to some extent while eliminating the interference. Therefore, the principle of the value of this signal should be: "When the interference signal is not strong, try to take a larger value." Adjust according to experience.

**Low pass L1 is generally set to 200. Parameter adjustable 20-1000Hz**



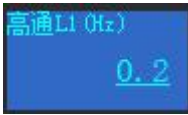
- **Sampling rate: The sampling rate is the rate at which an input signal is measured.**

**Sampling rate 2000-10000. Reference value 5555 (specific to the sample tube)**



- **drive (%): The current ratio of the excitation coil in the probe is up to 100. The larger the value, the larger the induced magnetic field. Note: The larger the value, the less easily the probe detection coil is balanced.**

**The drive is usually set to 5-100. See the interface signal size for details.**



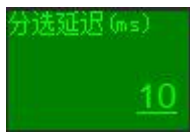
- High pass L1 Generally set to 0.2

## II The second page on the left side of the sorting software interface



- When the sorting mode is selected 1, the OK and NG signals of the instrument are normal; when the sorting mode is selected 2, the OK and NG signals of the instrument are opposite (self-adjusting according to their own technological requirements).

**The sorting mode is generally set to 1.**



This signal is the delayed output of the alarm signal. The set value is the delay (time unit of milliseconds).

The sorting delay is generally set to 10, which is adjustable.



The time delay of alarm output. (in milliseconds).

**The sorting pulse width is generally set to 200, which can be adjusted.**

## III. Directly above the sorting software interface



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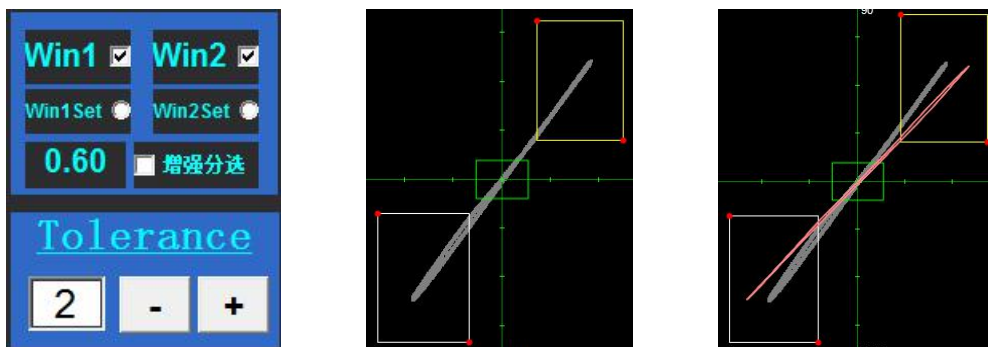
Probe BLN: Probe index, index value of the reaction probe, normal index at 100-2200, adjustment frequency and probe drive parameters, the probe index will also change.

Continue:(Continuous mode): Workpiece continuous detection, interface detection graphics disappear after a period of time, graphics time adjustable (Advanced Settings - Curve Settings - Impedance Diagram Cache Data)

Synchro:(Synchro mode): Interface detection graphics are retained every time.

Testing / Stop: Software runs and stops switching.

#### IV: Right side of the sorting software interface



1.Win1 and Win2: For the selective box, select the appropriate frequency, first qualify the qualified workpiece, then test the unqualified workpiece (the rightmost picture), two kinds of graphics appear, you can circle two Position, be sure to choose the position

with the largest difference in phase angle. The larger the difference in the circled position, the lower the pass rate value at the bottom of the interface, so that the unqualified workpiece can be sorted more accurately, and Win1 and Win2 can be directly selected. One is circled and the user can use it selectively according to his own process requirements.

2. Win1Set and Win2Set: Select one of them to adjust the size of the corresponding box.

3. Enhanced sorting: special sorting function (if there is no difference in phase angle between the two workpiece inspection patterns, only the length difference and the detection pattern overlap can use this function)

4. Tolerance (tolerance zone): the thickness of calibration trajectory.

The greater the sensitivity, the lower the false alarm rate. The numerical value can be amplified in the case of proving sensitivity. The general setting value is 3, which is selected according to the process requirements.

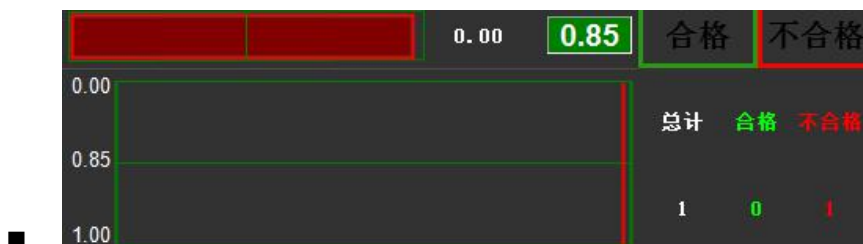


1. Calibration: Qualified workpieces are tested by the probe (15-20 workpieces are scaled), and the current inspection pattern is saved

according to “calibration”

2. Clear calibration: clear the detection pattern saved on the interface
3. Save configuration: save the current interface parameter settings
4. Data statistics: observe the total number of workpiece sorting, the number of qualified, the number of unqualified
5. Record setting: record the detection of each batch of workpieces
6. Count clear: the statistics below the interface are cleared.
7. Advanced settings: software selection features.

#### V . Below the sorting software interface




1. The upper middle 0.85 is a settable value. The larger the set value is, the higher the sorting detection accuracy is. The number on the left side is the actual value detected. When the actual value is greater than or equal to the defined value, it is determined that the workpiece is an OK piece, and vice versa. Maximum 1.00 (100%)


Reference value 0.85-0.90

2. The left side below is the sorting detection percentage chart.
3. The lower right side is the statistical quantity, the qualified quantity

and the unqualified quantity.



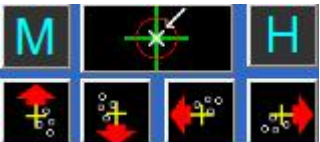
The picture  shows the homing function key. You must press this function key before each workpiece calibration to see if the red origin in the interface is in the middle of the coordinate axis. If there is a large deviation from the center of the coordinate axis, check if there is a problem with the parameter setting value.

■  Software exit button, sorting detection end shut down the software.




➤ Test instrument use steps:

- (1) Turn on the monitor, turn on the computer, and wait for the test screen;
- (2) preheating for 5 minutes;
- (3) Observe the middle right side of the interface, it must be in the Testing mode to work normally.

(4) Select the appropriate parameters, click back to the origin


button  (the middle key) several times and then press




the key  to make the box in the center position . Take 15 to 20 qualified workpieces for inspection by sensors, take their qualified waveform trace patterns, and click the calibration button. .

(5) Put the unqualified standard parts, observe the difference between the track pattern and the calibration track pattern, and reasonably determine the box positions of Win1 and Win2 according to the difference size, and try to make the circle circle the most obvious difference, if the difference Larger ones can also be circled one of Win1 and Win2, and the circled position depends on the actual graphics.

(6) It must be in the testing state to work properly.

(7) Parameters on the right side of the interface . The selection of the tolerance zone is selected according to the difference of the pattern of the qualified component and the unqualified component. The difference can be adjusted to be larger, the difference is small, and the adjustment is required. The user needs to set according to the process requirements. The reference value is generally set to 0.85-0.90

(8) Press the count clear button  to open to automatic sorting and perform batch sorting detection.

**Note: 1. The calibration track graphics can't be too small or too big. It's best to be two-thirds of the size of the screen!**

2. The distance between the two workpieces should not be smaller than the diameter of the sensor. The interval is too small to detect the graphics of the two workpieces, directly affecting the sorting effect, the count will also be wrong!

(9) The figures of qualified workpiece calibration and unqualified samples are as follows:

Figure 1 is the calibration graphic

Figure 2 shows the sample graphic



Figure 1

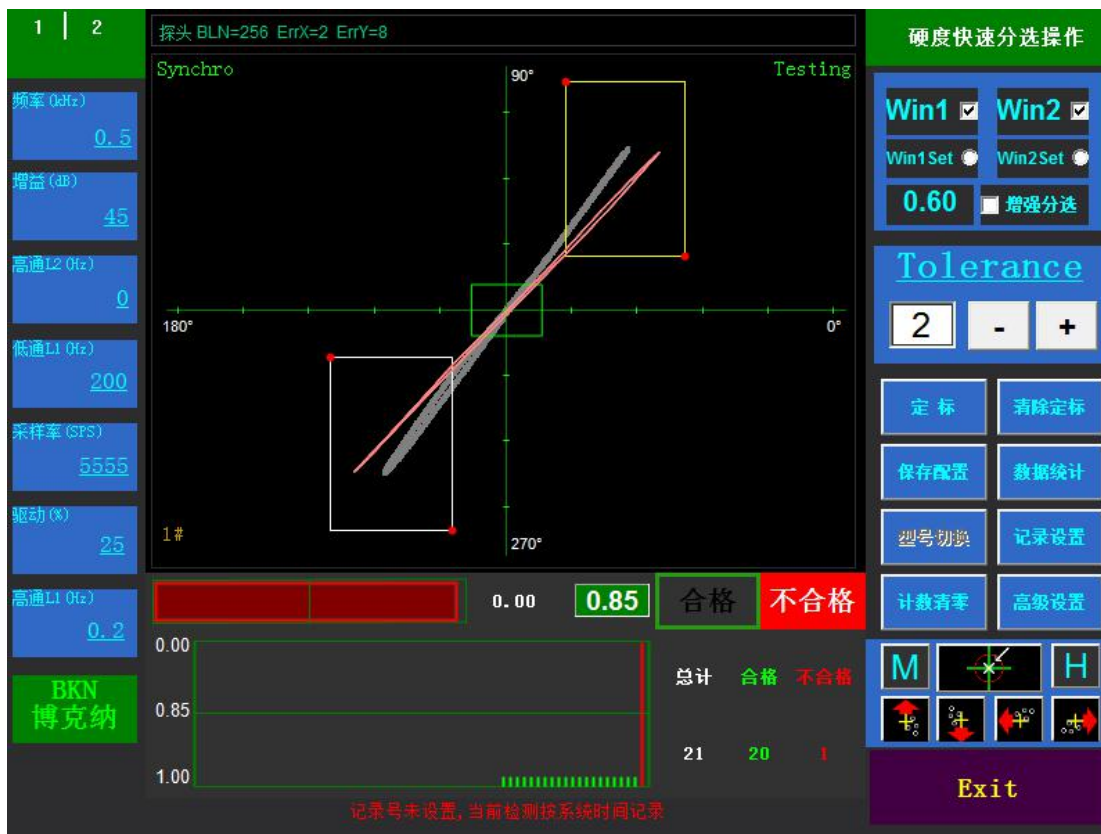


Figure 2

➤ **Hardness sorting external I / O line wiring method:**

**+24V-----External power supply +24V**

**0V-----External power supply 0V**

**Marking ----- Sorting and detecting NG signal (low level output)**

**Probe ----- Sorting detection OK signal (low level output)**

**Please consult the relevant technical personnel before wiring!**

**After the user connects, you must check whether the line is wrong. If the relay is transferred, pay attention to the relay and do not pull it out.**

**You must have a load to open the instrument switch.**

## ➤ Common problems and troubleshooting methods of rapid hardness

sorting: \_\_\_\_\_

I .High pass L1 (HZ) regulation: there are "0.2", "0.3" and "3" three parameters.

Set the value to 0.2: General parameter.

Setting value is 0.3: After opening the instrument and software, press "origin" first, and then preheat the instrument.

Five minutes later, set High pass L1 as "0.3" and put it into OK part calibration directly.

Set the value of 3: before setting the parameter of "3", first confirm whether the speed of the workpiece of the equipment transmission structure or slideway structure is stable and there is no dull phenomenon; this parameter can only be used for stable equipment.

### II. Counting Problem

(1) When the workpiece passes through the detection probe slowly, the number of counts is multiplied, and the "sampling rate" parameter value needs to be reduced to be adjusted to count accurately.

(2) When the workpiece passes through the detection probe at a high speed, the counting is multiple. It is necessary to adjust the advanced settings —global settings —graphic parameter display settings— zero area, and change the parameter to "300-600". Adjust to count accurately.

### **III. OK and NG signals**

**(1) On the contrary of OK and NG signals, the second page parameter "sorting mode 1/2" on the left side of the adjustment interface is generally set to "1".**

**(2) OK and NG signals can not receive pulse signals. First check the I/O wiring, adjust the parameters of the second page on the left side of the interface, "sorting delay" set to 1-10; and "sorting pulse width" set to 50-200.**

**According to the parameters of pulse signal regulation, the acquisition speed of PLC also needs to be adjusted.**

**(3) There is always NG signal, the instrument always alarms, first of all, to confirm whether the calibration is wrong, whether the origin of the interface center is deviated, and whether the location of the box circle is in any position of the calibrated figure.**

**NG workpiece outputs OK signal after coil detection and checks the location of sorting box.**

### **IV. Preparation after parameter debugging:**

**(1) The use and location of the sorting Window, Win1 and Win2, the user selects one or two according to the process requirements, and can not be set arbitrarily according to the detection result to determine the**

**position.**

**(2) The use of tolerance zone ,the tolerance zone use range, should be selected according to the difference of the trajectory of OK and NG workpieces, can not be set arbitrarily, according to the test results.**

#### **V. Interface detection without graphic display after booting**

**(1) Check the instrument probe line and I/O line for looseness.**

**(2) Check that the computer IP and instrument IP "192.168.1.2" are consistent.**

**Whether the "probe BLN=XXX" is displayed at the upper left position in the middle of the software interface.**