BOKENA

Multifunctional Eddy current flaw detector

User's manual

Nanjing BKN Automation System Co., Ltd.

➢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.
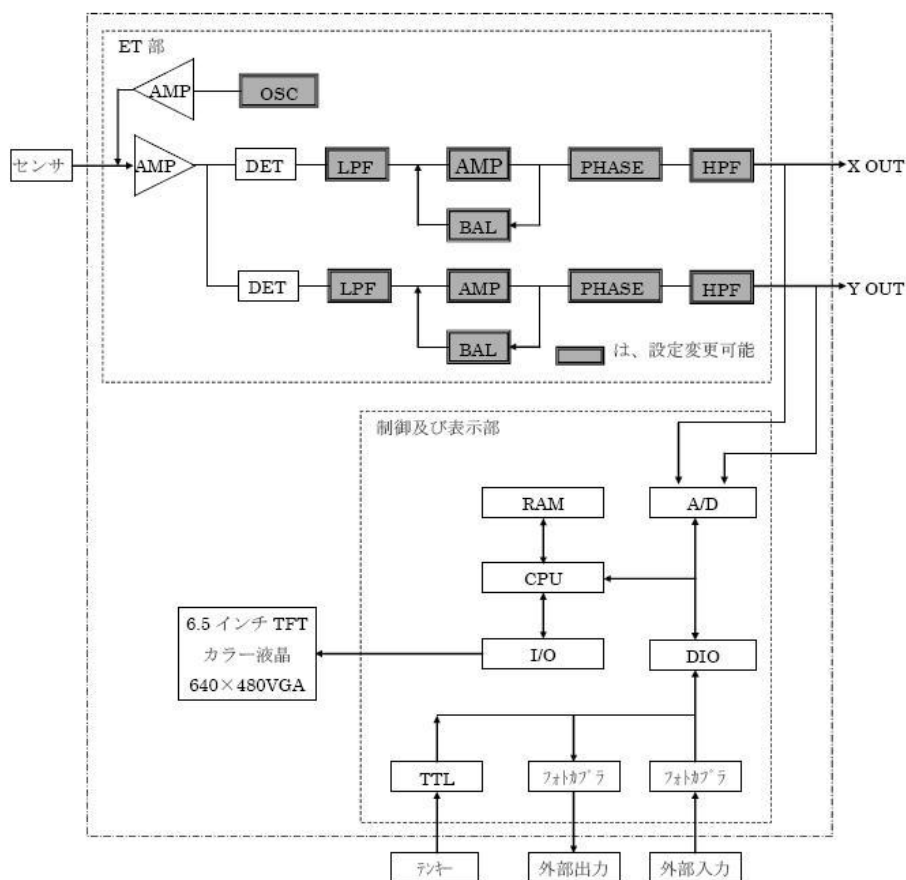
The oscillator produces a frequency of 100Hz to 1MHz adjustable dual sine wave. One of the way is sent to the wide frequency power amplifier as the driving probe of the excitation source, the probe constitutes the bridge arm for measuring the AC bridge. When the probe detects the sample, the eddy current 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℃

➤ Instrument Component

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.

➤ Instructions on the back of the instrument
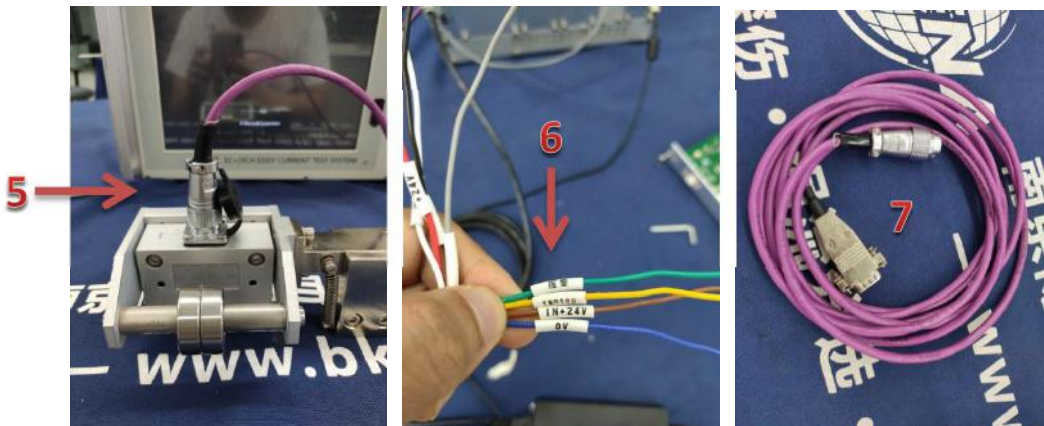
(1) Mark 1 is the power cord socket of the instrument.

(2) Mark 2 is the instrument power switch, adjust to the top to turn on the instrument power, adjust to the bottom to turn off the instrument power. (Note: After confirming that there is no problem with the wiring of the probe line and I/O line, then open it)

(3) Mark 3 is the probe socket: the probe line marked 7 is connected to the mark 3 socket on the back of the instrument, the DB9 socket, and the other side is marked 5 to detect the probe socket.

(4) Mark 4 is the I/O communication line interface, mark 6 is the other side of the I/O communication line, and the signal line uses IN+24V (+24V power supply inside the instrument is connected to the red line of the alarm light and any one of the marker's line), alarm (low-level output connected to the blue line of the alarm light), probe (low-level output connected to another line of the marker)

## ➤ Interface description (parameter settings)

Parameters and settings on the first page of the left side of the interface

■ Frequency: The frequency of the eddy current excitation signal. Generally, the lower the frequency, the greater the depth that can be detected. Please consult technical personnel according to the actual detection object for which frequency to choose.

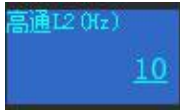Flaw detection sensor, reference value 60-200kHz.
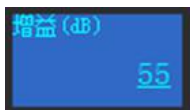
■ **Gain**：Decibel (dB) number of signal amplification.

$$dB = 20 * LgGain$$

dB:Decibel gain

Gain:Gain multiplier

Adjustable gain range 23-69

The reference value is generally set to 40-60dB. Reference value (specifically subject to standard sample).

■ **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:

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| 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 1-60. The reference value is 1-5 (The specific detection speed shall prevail, the faster the speed, the higher the High pass L2**).**
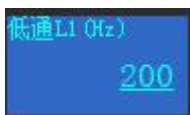
■ **Low pass L1：** Signal filtering parameters. The unit is the unit Hz of frequency (the number of changes per second). This parameter is mainly used to eliminate interference due to the electrical environment, or other possible high frequency interference. The smaller the parameter value is, the better 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 200~600. 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 100-1000. The reference value is 200 (specific to the test speed).
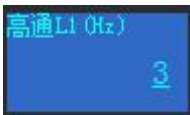
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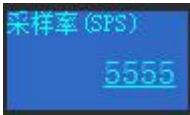
  The sampling rate is 3000-8000. The reference value is（3000−6000）(The specific sample is the standard).

- **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 20-80. The reference value is（60−70）.

- High pass L1：Signal filtering parameters (hardware).High pass L1 is normally set to 3.

Parameters and settings at the top of the interface

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Probe BLN: Probe index, which reflects the index value of the probe. The normal index is 100-2200. Adjust the frequency and probe drive parameters, and the probe index will also change.

Continue: (Continuous mode): Workpiece continuous detection, the interface detection graph disappears after being saved for a period of time, and the graph time is adjustable (advanced setting-curve graph setting-impedance graph cache data)

Synchro: (Synchronization Mode): (This mode is suitable for batch inspection of pipe fittings).

Testing: (open detection) When the sensor is placed in the detection position to start the detection, the switch from Stop to Testing.
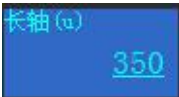
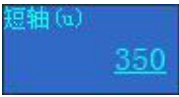Stop: (stop testing) The instrument does not detect.

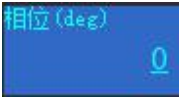Note: (If you find no detection pattern, please check the above function buttons)

Parameters and settings on the right side of the interface

Alarm parameter: The ellipse in the impedance graph (a circle when the long axis and short axis are equal) is called the alarm area. During detection, when the signal amplitude exceeds the range contained in the alarm zone, the detector will output an alarm signal, which is determined to be a defect. The shape, size and angle of the alarm zone are set according to the actual detection situation. Usually use the same specimen with known defects as the tested object for calibration. The principle of calibration is to ensure that normal workpieces do not exceed the alarm area, and reliable alarms for defective workpieces shall prevail.

- Blue area

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.

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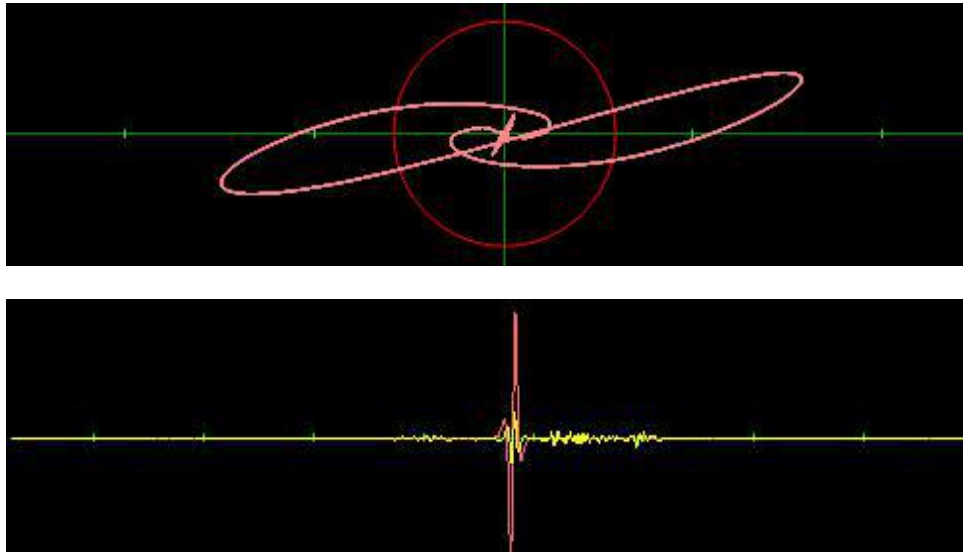
3) Phase：The angle of long axis of the ellipse in the alarm area of the impedance graph.

- ：Setting by manufacturer

- ：Number of alarms during detection.

- ：The eddy current flaw detection software exit button, and the online (offline) detection is over to close the software.

Instructions in the middle of the interface

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） Connect the power plug to the power port on the back of the instrument, and connect the 220V power on the other side. Do not turn on the power first. Then connect the probe line and I/O line. After confirming that there is no problem with the power, turn on the power switch.

（2）Turn on the computer power at the front of the instrument, press the lower right button of the computer, and wait to enter the system interface;

（3）Warm up for 5 minutes, double-click the eddy current flaw detection software to open the system interface
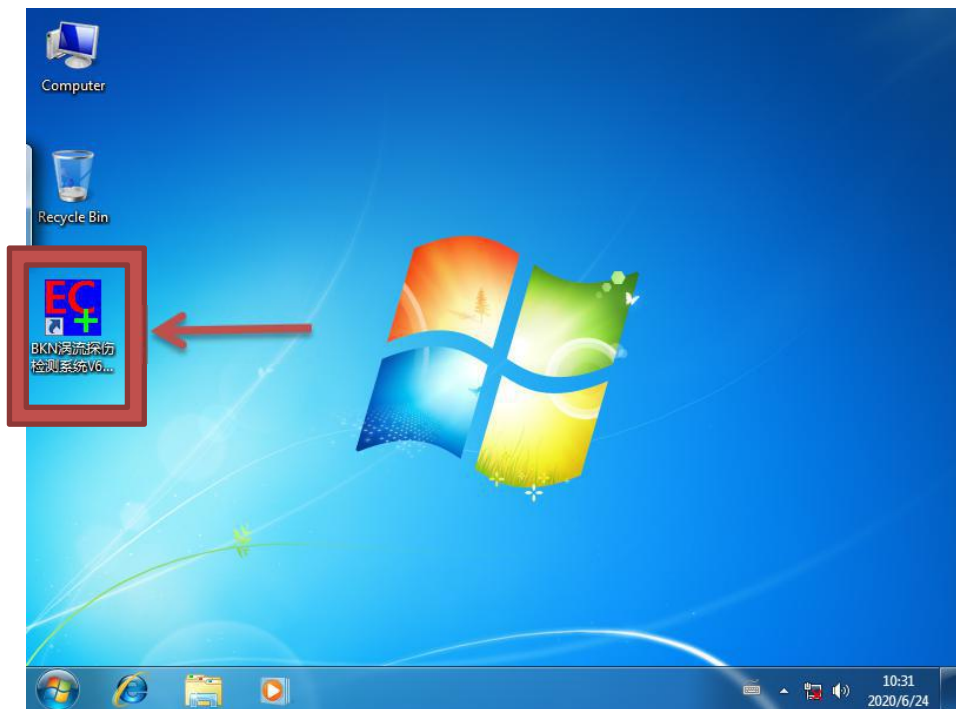
（4）Confirm that the interface on the left side of the instrument is Continuous (continuous online) and the right side of the instrument interface is the testing (opening detection) status as shown below

Note: If the status is not the same, please click the English function key in the red

探头 BLN=227 ErrX=3 ErrY=5

Continue 90° Testing

(5)Adjust the position of the sensor after calibration of the sample (the closer the distance between the sensor and the workpiece detection surface is adjusted between 0.8-1.4mm, the closer the detection sensitivity is, the more stable the workpiece is during detection, otherwise there will be a false judgment detection signal);

(6) Adjust the left parameter frequency, gain, drive, high-pass filter, low-pass filter and the size of the alarm ring on the left side of the instrument using the workpiece sample or standard injury (ensure that the detection signal of the qualified part is in the alarm circle, standard injury detection The signal is out of the alarm circle) as shown below; (red is the alarm circle, the middle part is the qualified detection pattern, and the alarm circle 8-shaped signal or abnormal signal is the detection pattern of the defective part)
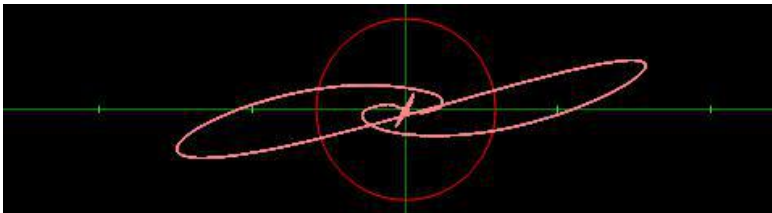
The pattern of the software interface is another display mode. The signal in the first half is qualified in the steady state, the detection signal with a peak signal defect in the middle is unqualified, and the signal in the second half is qualified in the stable state.
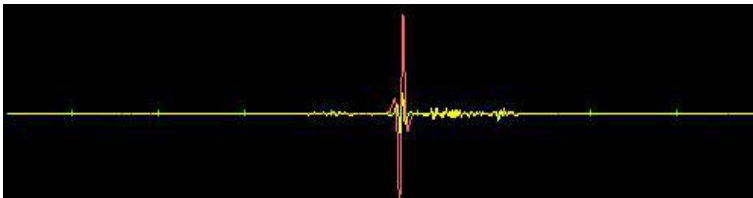
(7) After adjusting the parameters, use the sensor to detect the parts of the workpiece that need to be detected, observe the detection graph, if the detection signal goes out

of the alarm circle, it will be judged as the crack defect signal, if the detection signal is in the alarm circle, it will be judged as the qualified signal.

（8）After the inspection, click the exit button at the bottom right of the interface to exit the eddy current inspection system;
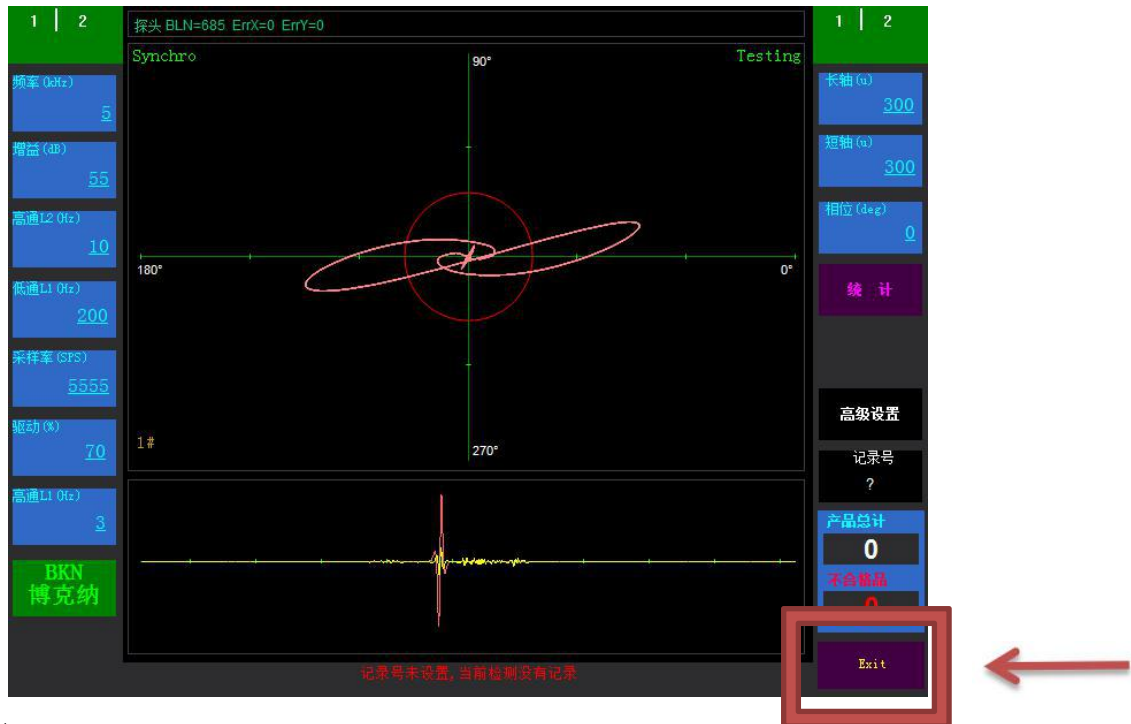
(9) Turn off the computer system first, then turn off the power switch on the back of the instrument;

(10) Instrument maintenance.