

Iron Chip Sensor (type: **LWTX-07**)

instruction

manual

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1 Product Overview

The Slippery Oil Dust Online Monitor is an industry-leading online condition monitoring system that safely and reliably monitors metal particles in gearboxes due to wear and tear.

The SOM detects the number, size and rate of occurrence of metal particles in the lubrication system and determines the properties of the particles (ferromagnetic or non-ferromagnetic). By capturing and analysing metal particles in the lubrication system in a timely manner, it provides reliable early warning and life prognosis for machinery and equipment.

2 Product features

The Slick Oil Metal Chip Online Monitor has the following features:

- Online monitoring, 100% capture of metal particles generated by wear
- Continuous monitoring of gearbox wear and estimation of remaining gearbox lifetime
- Rugged mechanical construction for use in harsh environments and easy installation.
- Signal output via 485 communication.

3 Product performance and working environment

On-line monitors for slippery oil metal chips have been developed, and their basic performance indicators are shown in Table 1.

Table 1 Sensor models and performance parameters

Type	Through Hole Diameter (mm)	Detectable size range (μm)		flow rate (L/min)	weight (kg)	Outline Dimension (mm) (L×W×H)	fluid fitting
		Minimum ferromagnetic particle	Smallest non-ferromagnetic particle				
LWTX-07	Φ 7	65	300	0.5~60	3	115×125×90	SAE flange connection, flange size 3/4'

3.1 Work environment:

- Oil pressure: 20 bar (300psi) max.
- Oil temperature: -40°C ~ 85°C
- Ambient temperature: -40°C ~ 70°C
- Vibration: 10Hz~50Hz: 3mm (displacement)

- 50Hz~300Hz: 15g (Acceleration)

Fluid compatibility: hydraulic/lubricants, synthetics/minerals, solvents/detergents.

4 Product Composition

The on-line monitor for metal chips in sliding oil mainly consists of a sensor, a signal connection line and other parts. The sensor is installed in the lubrication system oil circuit to monitor the metal particles in the oil circuit. The signal connection line is used to connect the sensor and the user terminal equipment.



line number	Lead Wire Colour	Signal Definition
1	Red	Positive power supply
2	Black	Power Input Ground
3	Green	Signal ground
4	Yellow	RS-485 (B-)
5	Blue	RS-485 (A+)

The products are shown in Figure 1.

Figure 1 Product Schematic

5 Mounting dimensions and electrical connections

5.1 Description of mechanical connections

The sensors are connected with SAE flanges and the connection and external dimensions are shown in Fig. 2 and Fig. 3.

Caveats:

- 1, the sensor installation position must be stable and reliable, and away from strong magnetic fields, strong vibration environment.
- 2、 When connecting the oil pipe, make sure that the 4 sets of screws and nuts for flange mounting are connected reliably.
- 3, pay attention to the protection of the sealing surface, the seal is intact, so as to avoid oil leakage phenomenon.
- 4, pay attention to the direction of the flow of liquid and the direction of the sensor marking the same.

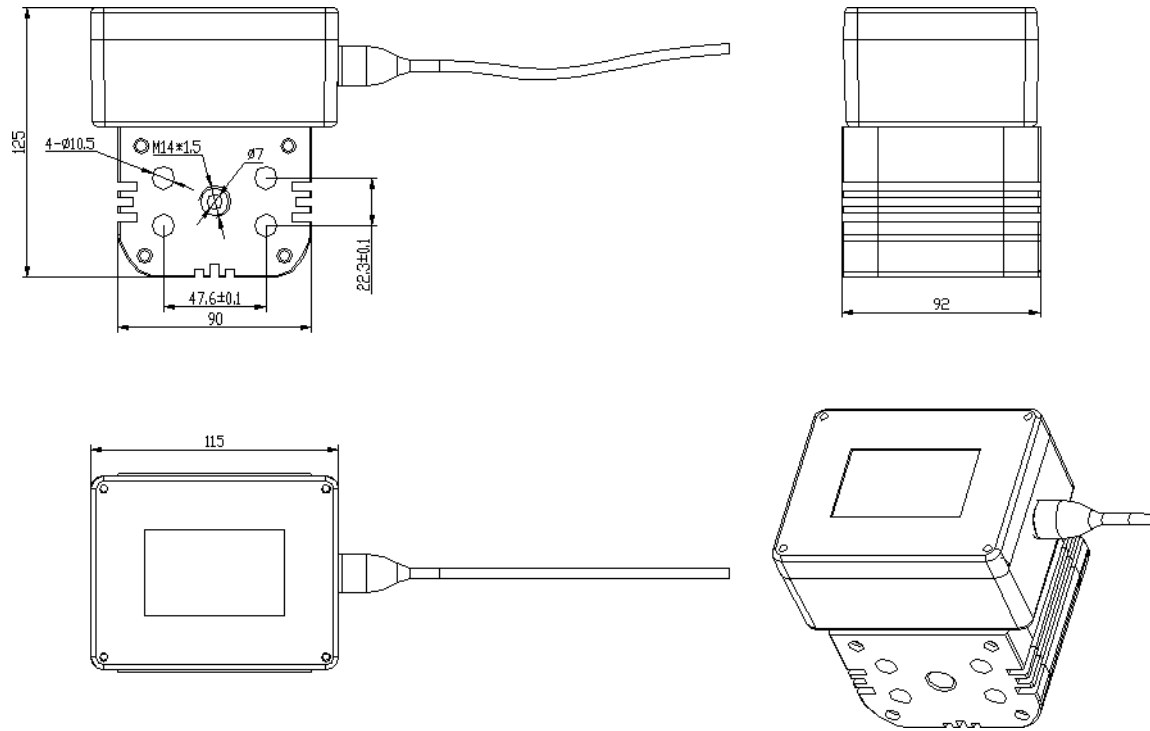


Figure 2 Sensor mounting dimensions

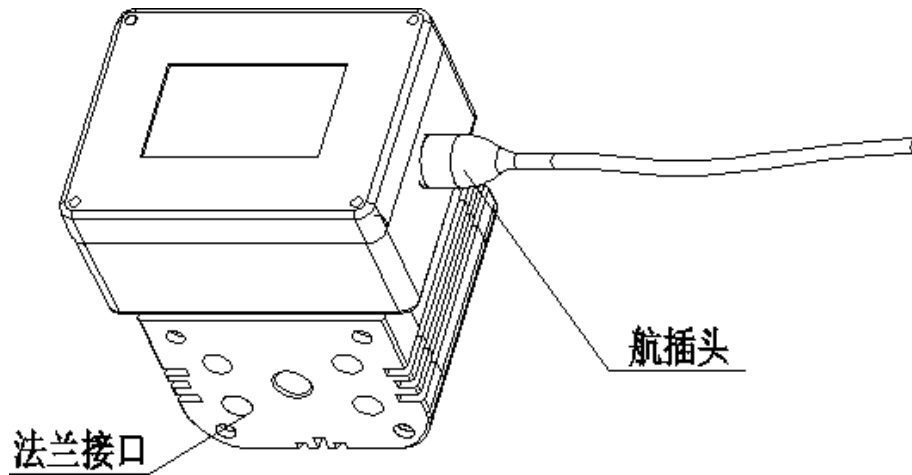


Fig. 3 Sensor appearance

5.2 Electrical interface description

The electrical interface of this product is protected by a granular head, which improves the waterproof and anti-pollution ability of the product. In order to facilitate the user to connect and disassemble, the wiring is in the form of aviation plugs, and the electrical interface wiring sequence is shown in Table 2.

Table 2 Airline plug electrical interface wiring sequence

line number	Lead Wire Colour	Signal Definition	typology	Electrical Description
1	red	Positive power supply	Input, DC Voltage	24VDC, 最大功耗 10W, 416mA@24VDC。
2	black	Power Input Ground		
3	green	signal ground		GND
4	yellow	RS-485(B-)	Output, Logic Level	485 communication port
5	blue	RS-485(A+)	Output, Logic Level	485 communication port
6	NC	NC	NC	NC
7	NC	NC	NC	NC

Caveats:

- 1, the product has been pre-connected to the signal line, the user will be directly connected to the connector can be used without additional wiring.
- 2, to ensure that the wiring order is correct, so as not to cause damage to the product wrong connection.
- 3, to ensure that the cables are properly placed to avoid confusion on the scene may cause tripping and other personal injury.

6 Instructions for installation and use

- (1) The sensor is installed on the oil line to be detected, pay attention to the installation of stable;
- (2) The electrical connectors are installed firmly;
- (3) Turn on the power to use;
- (4) The arrow on the sensor points to the direction of particle flow, please follow this direction when conducting particle testing.

Caveats:

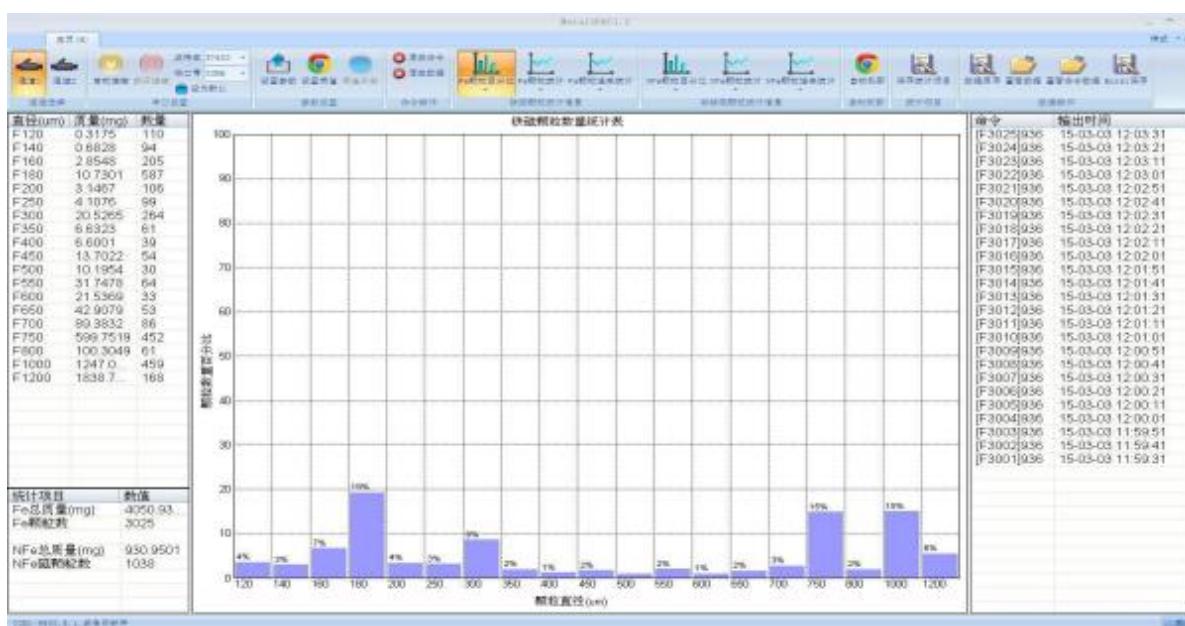
Be sure to install the equipment in the order described above and ensure that the connections are tightly connected. Do not hot-swap any

of the connecting cables as this may endanger your personal safety and damage the equipment!

7 Equipment Maintenance

1. Switch off the power when the device is not in use.
2. Do not hot-swap or hot-plug the plug with electricity.
3. Minimise the number of times the plug is loaded and unloaded. 4.
4. When the device is in storage, protect the pins on the sensor with a protective sleeve to prevent oxidation of the pins. Keep the device in a dry and ventilated place at room temperature.
5. Do not open the sensor and the equipment casing by non-manufacturer's professional maintenance personnel.

Instruction manual for MetalSPEC 1.2, the software for detecting and analysing metal particles in slippery oils



1. Overview of the software system

On the basis of the LUWATECH oil slick metal particles monitoring system, the MetalSPEC oil slick metal particles real-time measurement software was designed according to the specific requirements of oil slick metal particles data analysis and processing, which realises a number of functions, such as real-time collection and storage of oil slick metal particles data, real-time display of the diameter and mass of particles as well as the percentage of the number of particles, and real-time display of the number and mass of particles and the sampling time. The software package includes a number of functions such as real-time display of particle diameter and mass, particle count and mass, and sampling time.

2. Software system function module division

The main interface of the software is shown in Figure 1 and consists of a real-time display of the diameter, mass and quantity of the metal particles, a real-

time display of the total mass and quantity of the metal particles, a statistical table of the percentage of diameter and mass of the various particles, a real-time display of the diameter of the particles and the corresponding time of collection, and buttons for each function.

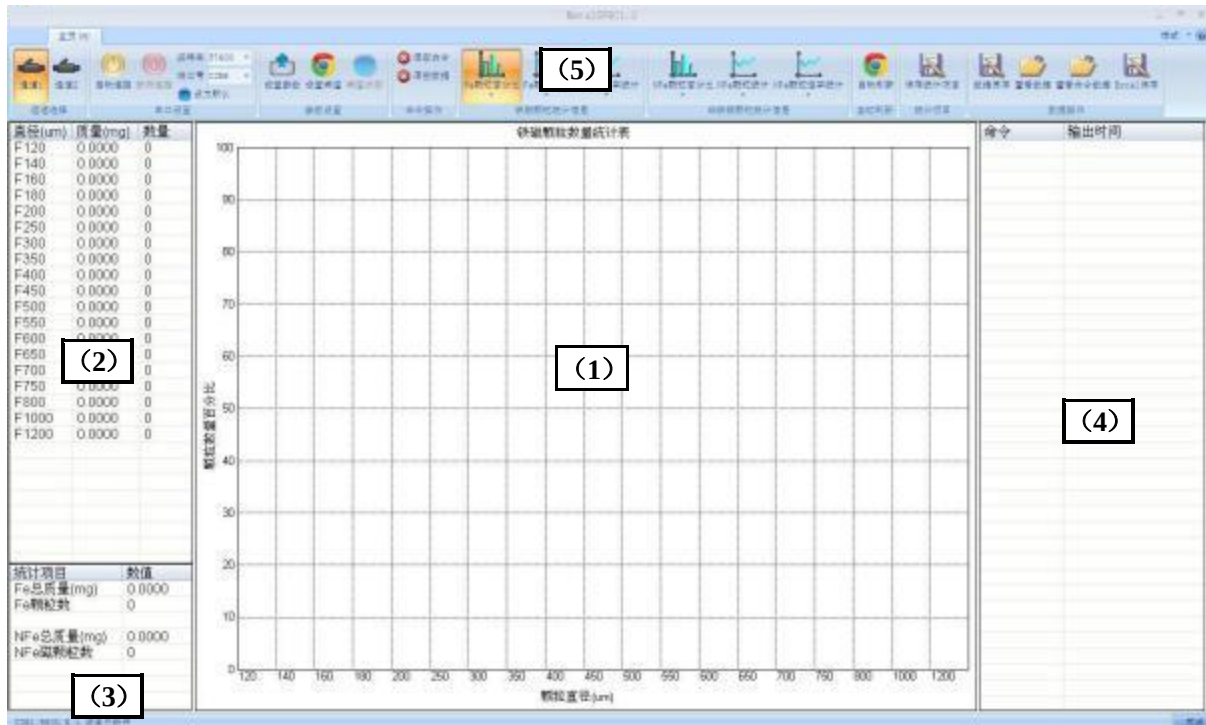


Fig. 1 Main interface

- Display window (1): real-time display of various particle diameters and mass percentages;
- Display window (2): real-time display of the diameter size, mass and quantity of metal particles;
- Display window (3): real-time display of the total mass and quantity of metal particles;
- Display window (4): real-time display of the particle diameter and the corresponding collection time;
- Display window (5): buttons for each function.

3. System use

The function buttons are shown in Fig. 2, including 8 function modules, such as channel selection, serial port setting, parameter setting, command operation, ferromagnetic particles statistics, non-ferromagnetic particles

statistics, automatic refresh, data operation, and so on.



Figure 2 Function buttons

3.1 Channel Selection

This module is to realise the selection of the channel and observe the data of the oil slick metal particles for the selected channel.

3.2 Serial port setting

The function of this module is to realise the setting of communication configuration between the oil metal particles monitoring system and the software of the host computer, including the baud rate and port number of the serial port transmission, in order to ensure that the communication between the two sides is normal. The baud rate is set to 57600 by default, and the port number is selected according to the actual interface of the computer.

- The ‘Start Connection’ button enables the connection between the system and the host computer software;
- ‘Disconnect’ button to switch off the system and disconnect it from the host computer software;
- The ‘Set as Default’ button saves the currently set ‘Baud Rate’ and ‘Port Number’ parameters to the system file and sets them as default values.

3.3 Parameterisation

3.3.1 Parameterisation

Clicking on the ‘Set Parameters’ button brings up the ‘Parameter Settings’ dialogue box. This dialogue box is used to set the phase angle, channel gain, minimum particle diameter, and sensor calibration coefficients for the metal particle monitoring system. This is shown in Figure 3.



Fig. 3 Parameter setting

- The 'Set' button enables the upper computer software to set the parameters of the system;
- 'Read' button to obtain the parameter values set by the current system;
- 'Clear' button clears the contents of the edit box.

3.3.2 Threshold setting

Clicking on the 'Set Thresholds' button brings up the 'Threshold Settings' dialogue box. This dialogue box is used to set the thresholds for the metal particle monitoring system, as shown in Figure 4.

- The 'Set' button enables the setting of the threshold.

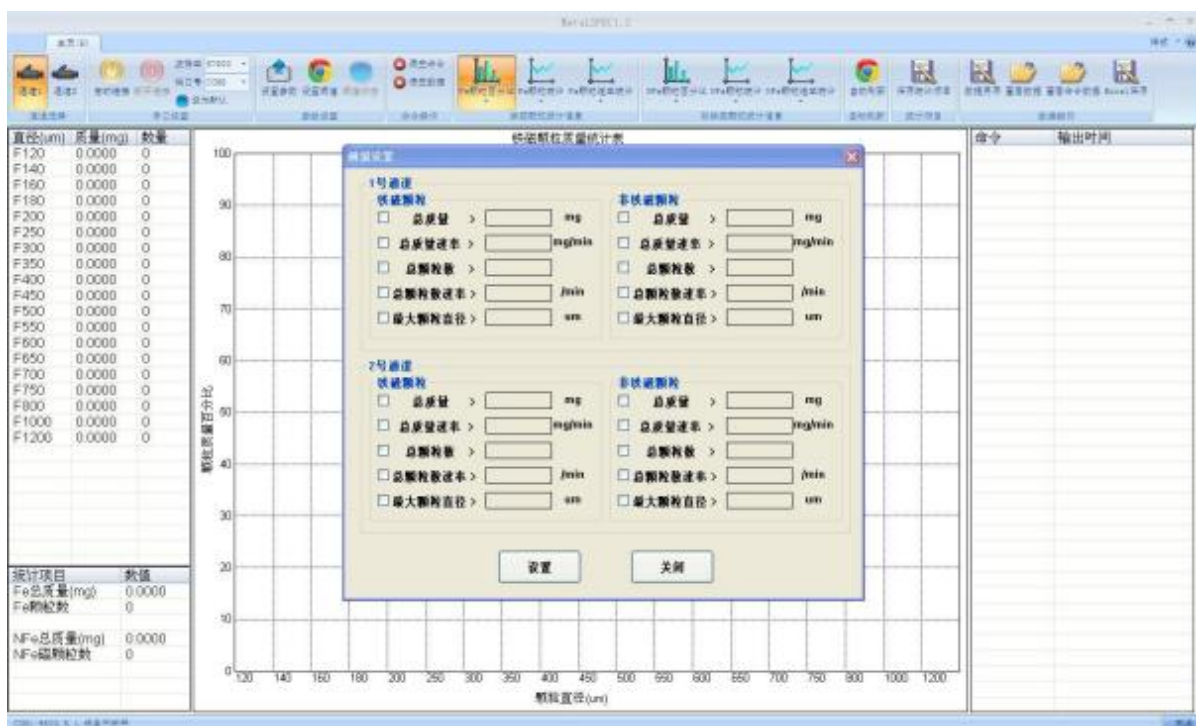


Fig. 4 Threshold setting

The types of thresholds are classified according to the type of particle as ferromagnetic or non-ferromagnetic, and according to the type of data as the total mass of the particles and the number of particles larger than a certain diameter. The significance of the thresholds set in Figure 4 is shown in Table 1.

Table 1 Threshold significance

channel	Particle type	total mass	total mass rate	Total number of particles	Total particle count rate	Maximum particle diameter
Channel 1	Ferromagnetic particles	Threshold for total mass of ferromagnetic particles	Threshold for total mass rate of ferromagnetic particles	Threshold for total particle number of ferromagnetic particles	Threshold for total particle number rate of ferromagnetic particles	Threshold for maximum diameter of ferromagnetic particles
	Non-ferromagnetic particles	Threshold for total mass of non-ferromagnetic particles	Threshold for total mass rate of non-ferromagnetic particles	Threshold for total particle number of non-ferromagnetic particles	Threshold for total particle number rate of non-ferromagnetic particles	Threshold for maximum diameter of non-ferromagnetic particles

When one of the channels reaches the threshold value set above during the system operation and monitoring, the software of the upper computer will pop up the ‘Threshold Status’ dialogue box and turn on the alarm switch. As shown in Figure 5.

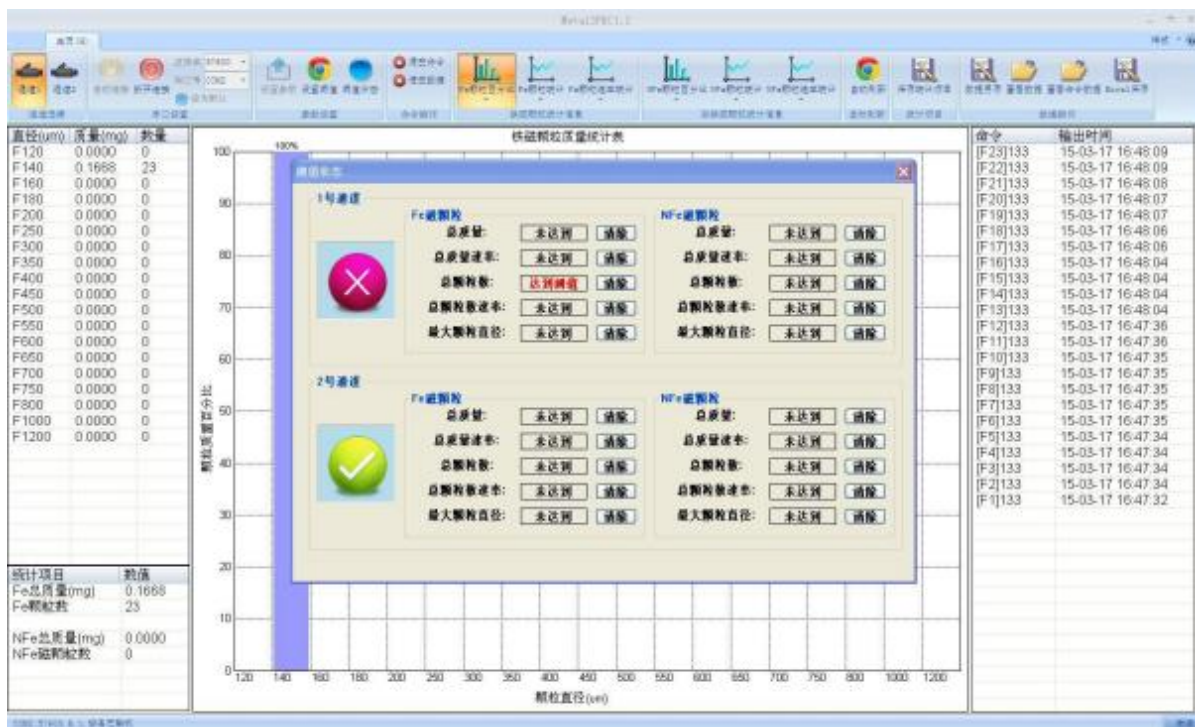


Figure 5 Threshold state

‘The Clear button in the Threshold Settings dialogue box is used to clear the threshold. When the Clear button is clicked, the threshold count for that option is set. The system will only turn off the alarm switch if none of the states in a channel have reached the threshold. This is shown in Figure 6.

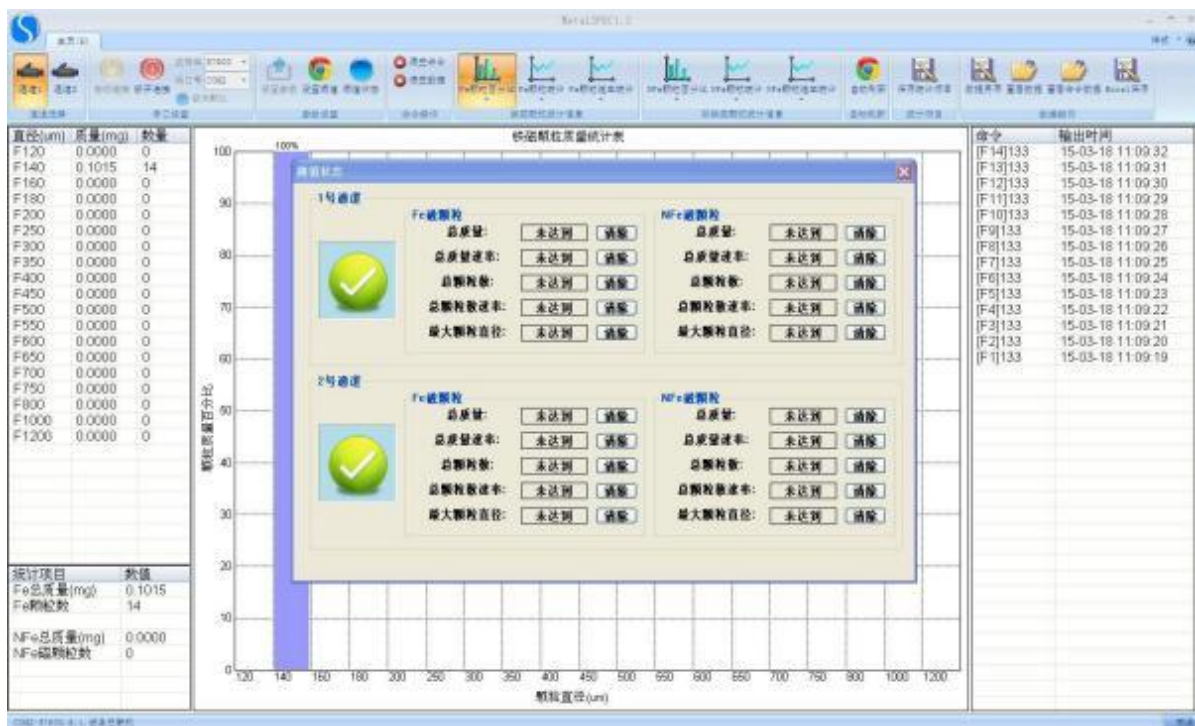


Fig. 6 Threshold state

3.3.3 Threshold state

Click the ‘Threshold Status’ button to bring up the ‘Threshold Status’ dialogue box, as shown in Figure 5 and Figure 6.

3.4 Command operation

- The ‘Clear command’ button clears the data in the ‘Main screen display window (4)’;
- The ‘Clear data’ button clears the data in the ‘Main interface display window (1), (2) and (3)’.

3.5 Statistical information on ferromagnetic particles

The function of this module is to realise the real-time display of the statistical table of the diameter and mass of ferromagnetic particles and the percentage of the quantity, the historical curve of the quantity and rate of various ferromagnetic particles, the historical curve of the total quantity and rate of ferromagnetic particles, the historical curve of the mass and rate of various ferromagnetic particles and the historical curve of the total mass and rate of ferromagnetic particles.

Click on the corresponding button to display the corresponding data.

3.6 Non-ferromagnetic particle statistics

The function of this module is to display in real time a statistical table of the diameter and mass of non-ferromagnetic particles as well as the percentage of the quantity, the quantity and rate history of the various non-ferromagnetic particles, the quantity and rate history of the total number of non-ferromagnetic particles, the mass and rate history of the various non-ferromagnetic particles, and the mass and rate history of the total number of non-ferromagnetic particles.

Refer to Ferromagnetic Particle Statistics for details.

3.7 Auto-refresh

Click on the ‘Auto Refresh’ button to automatically update the statistics of ferromagnetic particles and non-ferromagnetic particles at a rate of 1 update per minute;

Click ‘Auto Refresh’ button again to close the auto refresh function.

3.8 Statistical projects

Clicking on the ‘Save Statistical Items’ button saves the real-time data of the data in the Statistical Items list (bottom left corner of the screen) to an Excel file.

3.9 数据操作

The function of this module is to realise the saving of test data and the reading of historical data.

- ‘Data Save’ button enables the saving of the current test data;
- ‘View Data’ button to read the previous test data;

- ‘View Command Data’ button to read the previous test command data;
- ‘Excel Save’ button saves the test data to an Excel file.

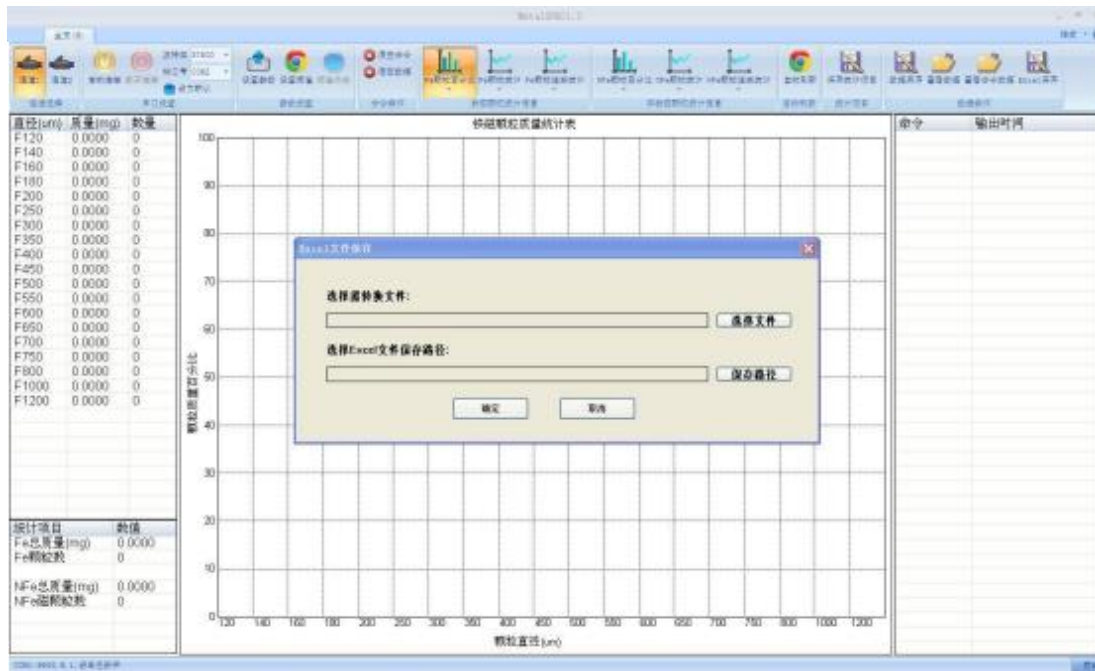


Figure 7 Excel save

Left mouse click on the ‘Excel Save’ button, the pop-up dialogue box shown in Figure 7. ‘Select File’ button, used to select the cfg file will be saved; “Save Path” button, used to enter the Excel file name and save the path.

After the selection is completed, as shown in Figure 8.

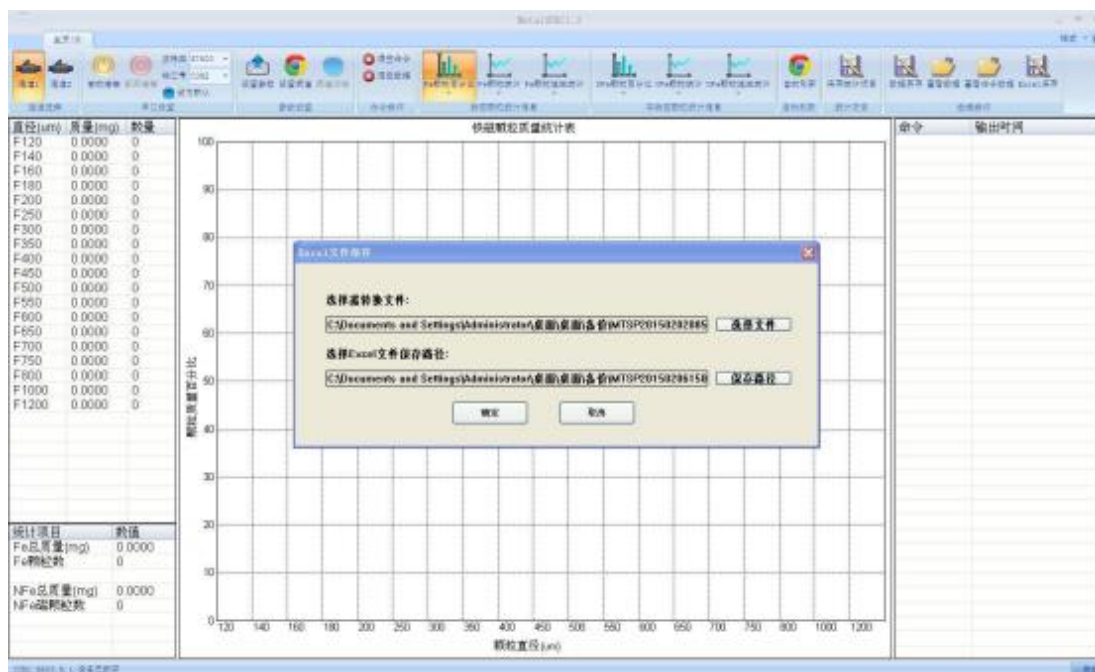


Figure 8 Excel save

Click on the OK button to save the Excel file.

Note:

The response time or speed required to save the Excel file will vary according to the size of the data to be converted. If the interface pops up a dialogue box as shown in Figure 9, it means that the program is saving, please wait patiently. If the saving is completed, a prompt dialogue box will pop up as shown in Figure 10. Excel

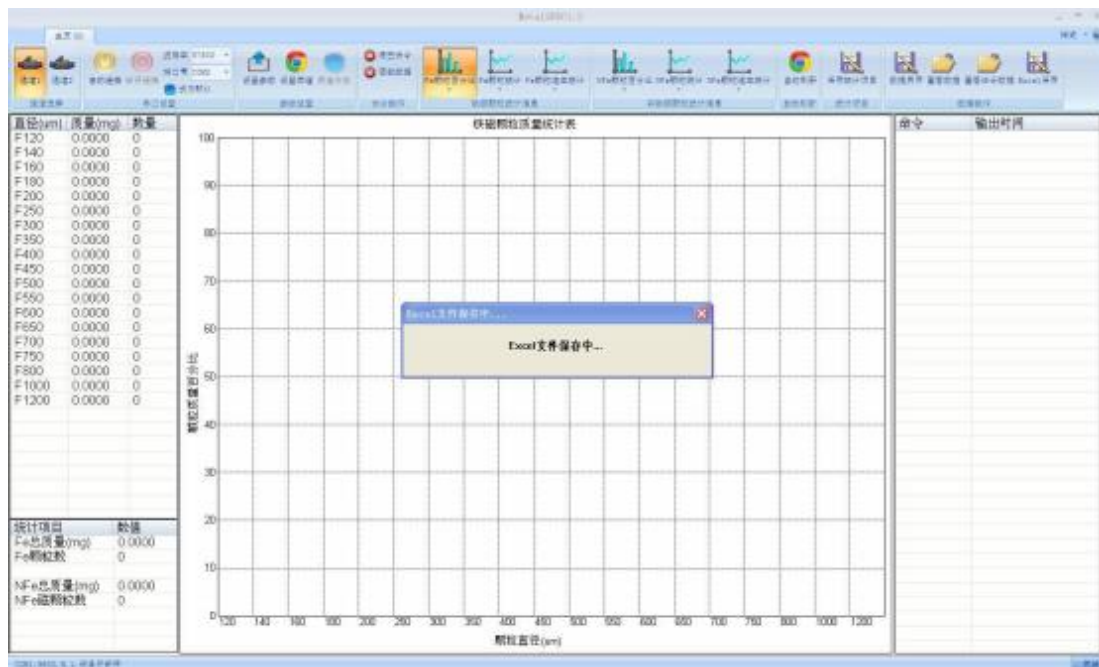


Figure 9 Excel save

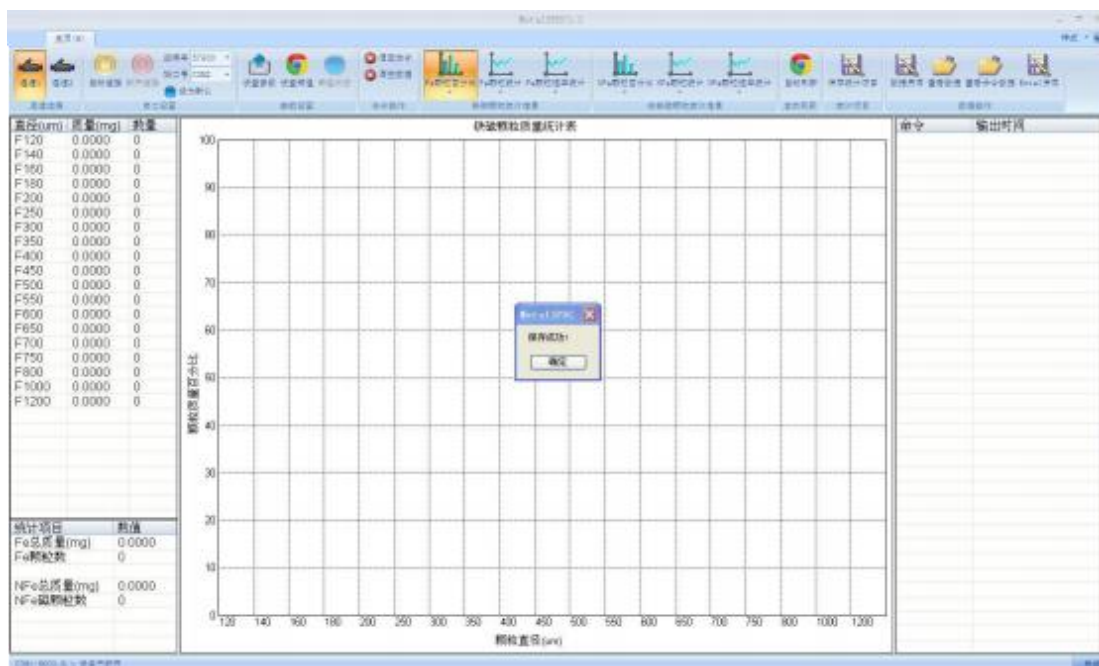


Figure 10 Excel save

3.10 Layer operation

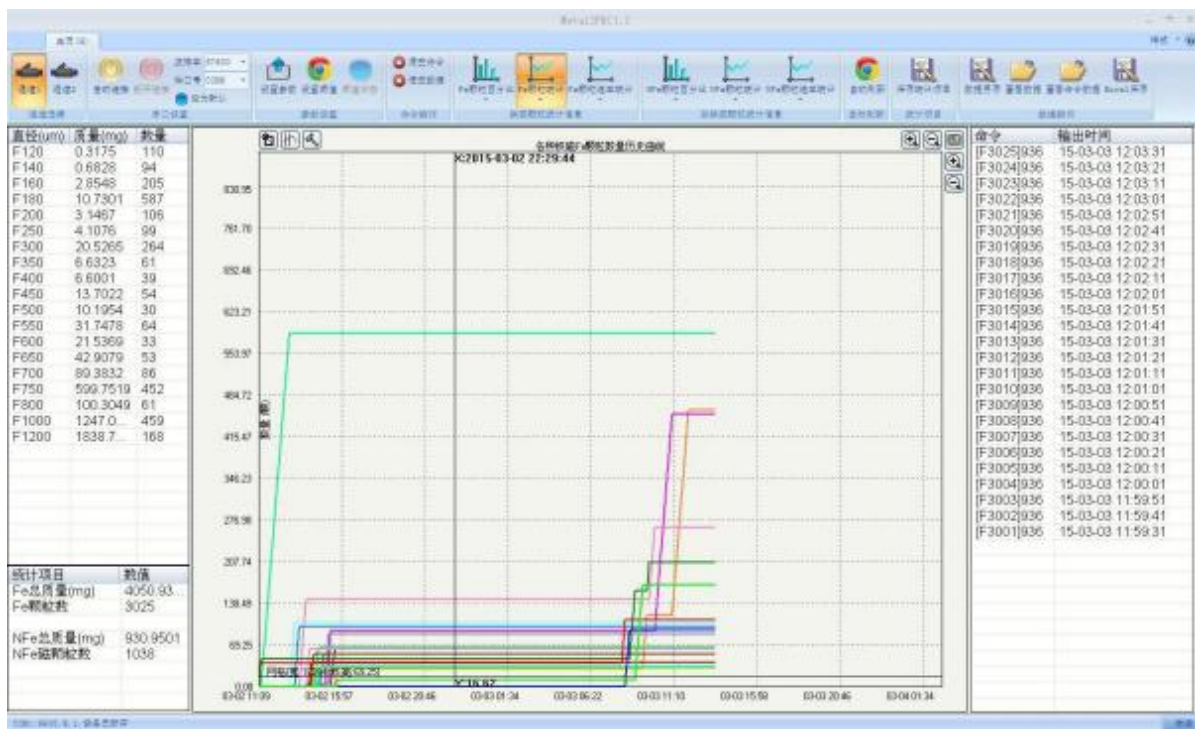


Figure 11 Historical data

When viewing the historical curve data, the interface is shown in Figure 11. Click the right mouse button, the menu appears as shown in Figure 12. When users want to view the data of a certain time period, click 'Set A Label' and 'Set B' label in the corresponding position, as shown in Figure 13. Then click the third button 'Select Axis Range' in the upper left corner of the picture, as shown in Figure 14.



Figure 12 Menu

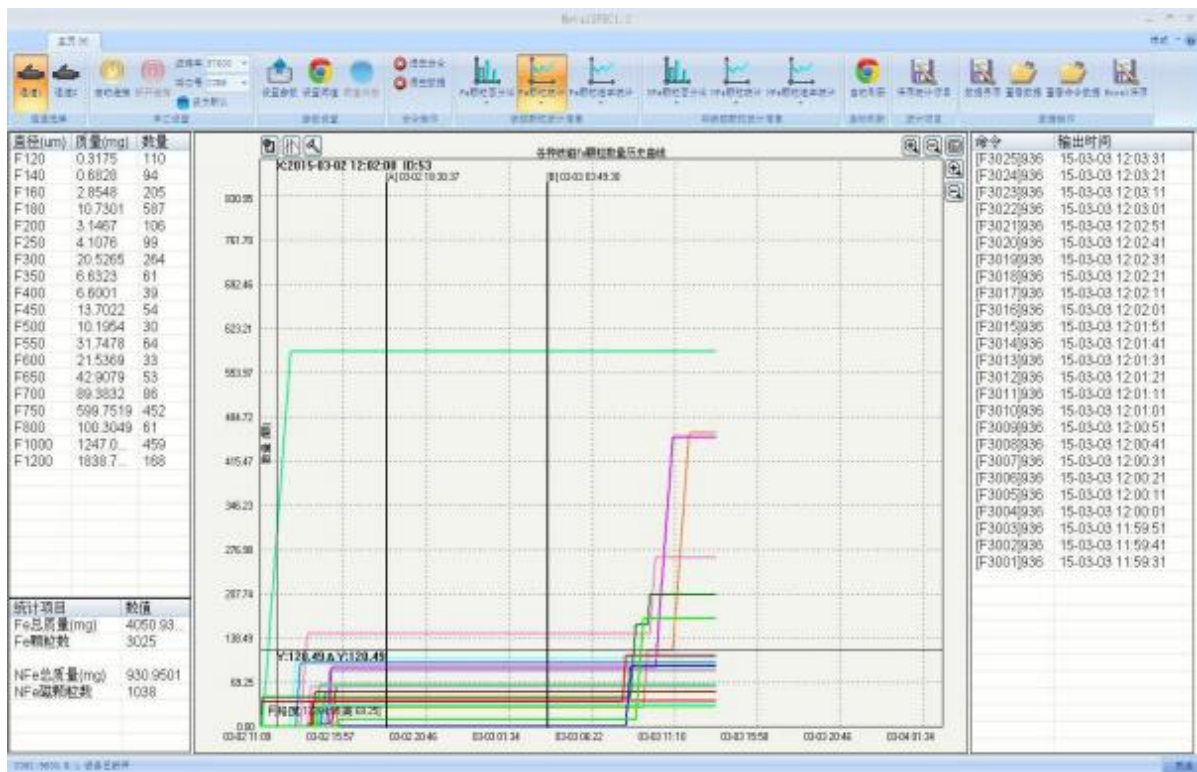


Figure 13 Setting up labels

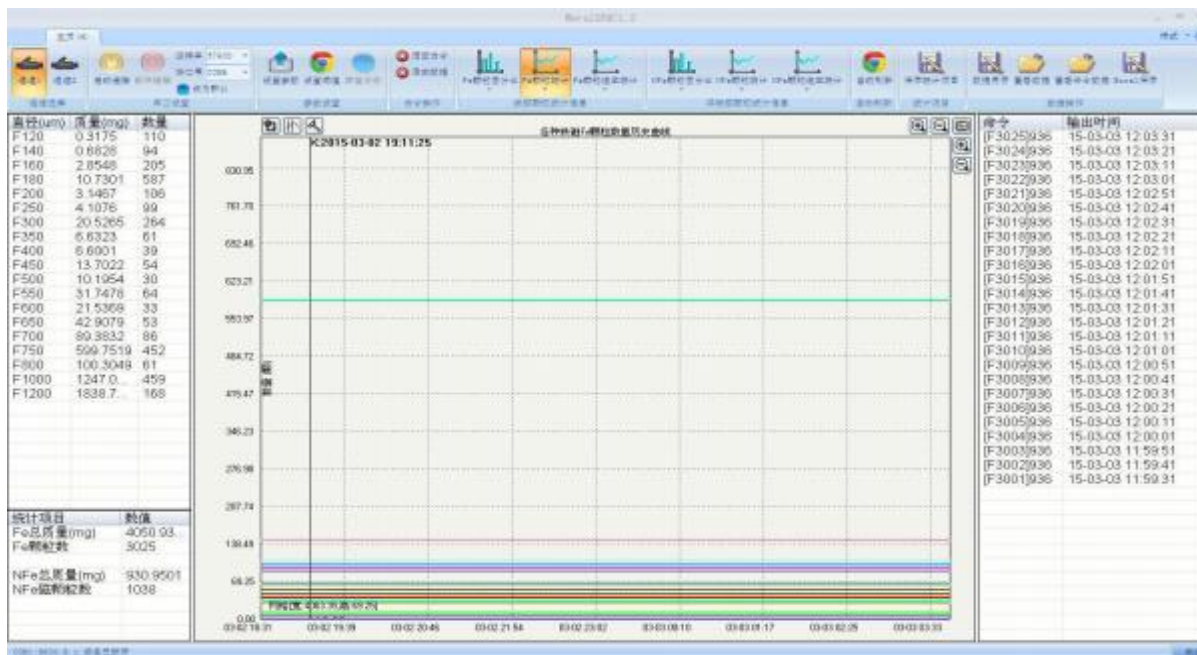


Figure 14 Selected coordinate range

4. Software Processing Flowchart

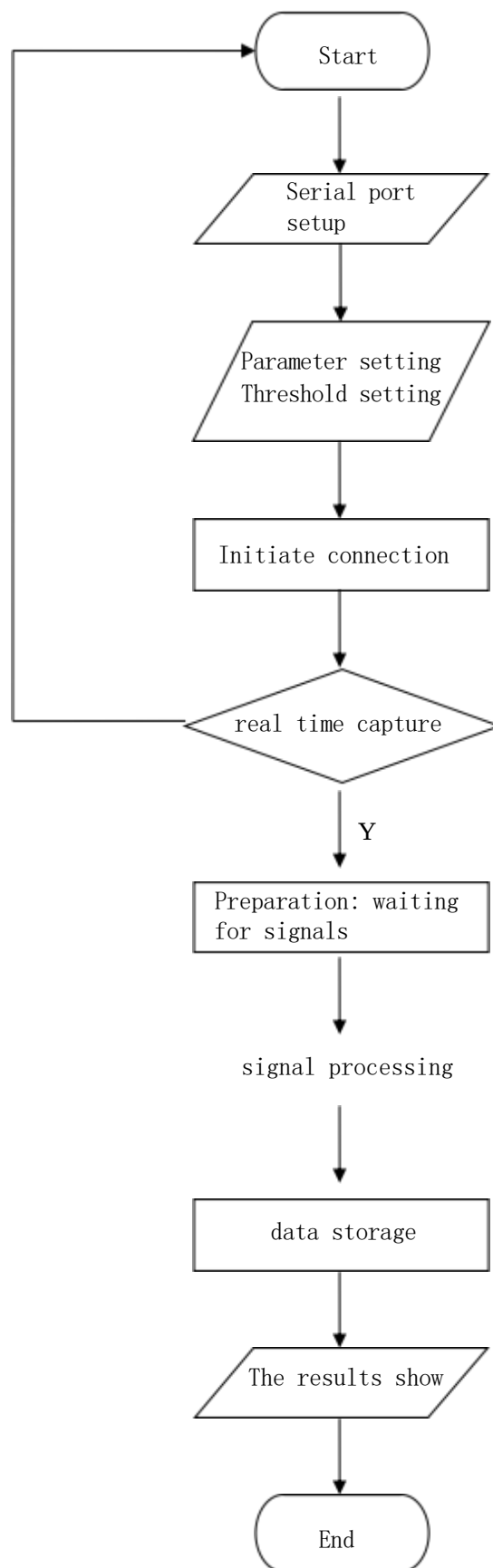


Fig. 15 Schematic diagram of software flow

5. Software Installation and Instructions

This product is supplied in a green package, users can directly double-click 'MetalSPEC.exe' to start the software.

Note: If a previous version of MetalSPEC is already installed on your computer, please uninstall the programme before installing it.

Note: When using or reinstalling the software for the first time, please set the parameters according to the following table (see 3.3. 1).

Parameter schedule

Equipment number		20160706001	
Parameter name		parameter value	note
Phase angle setting	Fe phase angle	298	
	NFe phase angle	20	
Channel Gain Setting	Fe gain	10	
	NFe gain	10	
Minimum particle diameter	sensorFe	200	
	sensorNFe	500	
1# Sensor calibration factor	Fe parametric 1	25.074	
	Fe parametric 2	0.4051	
	NFe parametric 1	156.72	
	NFe parametric 2	0.2594	

Equipment number		20160706002	
Parameter name		parameter value	note
Phase angle setting	Fe phase angle	165	
	NFe phase angle	241	
Channel Gain Setting	Fe gain	10	
	NFe gain	10	
Minimum particle diameter	sensorFe	200	
	sensorNFe	500	
1# Sensor calibration factor	Fe parametric 1	29.16	
	Fe parametric 2	0.393	
	NFe parametric 1	181.61	
	NFe parametric 2	0.242	

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