MN-HSM-SXXX-E

HSM-S
HANDHELD XRF ALLOY ANALYZER
OPERATION MANUAL

PLEASE SCAN QR CODE TO
WATCH OPERATION VIDEO
OF THE PRODUCTS.

VIDEO

INSIZE

Important matter

Thank you very much for purchasing the HSM-S series handheld X-ray fluorescence spectrometer from INSIZE Co., Ltd. T he HSM-S series handheld X-ray fluorescence spectrometer (hereinafter referred to as HSM-S) mainly used to evaluate metal materials, environmental assessment, RoHS compliance, consumer safety, jewelry and other fields.

Instruction Manual

Please read the instruction manual carefully before using the product. When using the product, follow the instructions in the manual. INSIZE is not responsible for any adverse consequences arising from not using this manual.

INSIZE Co., Ltd. (hereinafter referred to as INSIZE) is the copyright owner of this manual and will reserve all rights. This manual may not be reproduced, translated or distributed without the express written permission of INSIZE. The content contained in this manual and the details of instrument components may differ, but the principle of instrument operation is the same without prior notice. The company name and product names appearing in this manual are registered trademarks.

When receiving the goods, please carefully and thoroughly inspect them external or internal damage that may occur during transportation. If there is any damage, you must notify the staff of INSIZE in time, and we will help you deal with the claim for loss.

Storage and Transportation

- Storage

HSM-S series product is a kind of precision instrument and must be stored with care. When the instrument is not in use, it needs to be disconnected from the power supply and stored in a suitable temperature and dry environment. Avoid using the instrument in a humid and high temperature environment, as this can prolong the service life of the instrument.

- Transportation

The relevant radiation management agencies in China have not made any control or restriction on X-ray analyzers. When transporting the HSM-S serries XRF analyzer in China, we recommend that you pack the analyzer thickly to protect the precision parts inside the analyzer. If you use the analyzer outside of mainland China, please follow local laws.

Precautions for Instruments

Note the following when using:

1. Do not use the instrument in an explosive gas or dangerous atmosphere, otherwise it will cause an explosion.
2. Do not use the instrument in a harmful environment.
3. Please do not remove the instrument cover without the permission of our engineer. If you disassemble the instrument without the authorization of INSIZE, we will not be responsible for the safety and performance of the instrument.
4. Please keep the surface of the instrument clean and hygienic.
5. If you use the instrument frequently, INSIZE recommends that you do a maintenance check on the instrument every year.

Warning

General Warning

1.Please read the user manual carefully before turning on the instrument.
2.Please keep the user manual in a safe place for future reference.
3.Follow the installation and operation procedures.
4.Be sure to follow the safety warnings on the instrument and the user manual.
5.If the instrument is used in a manner not specified in the user manual, the protective function of the instrument may be damaged.
6.Do not install replacement parts or make unauthorized modifications to the instrument.
7.Instrument maintenance or repairs should only be performed by specially trained staff. To avoid the risk of electric shock, only qualified personnel should perform maintenance on the instrument. For any failure or problem about the instrument, please contact INSIZE or INSIZE authorized agents.
8.Do not allow metal or foreign objects to enter the instrument through the interface or any other parts. Otherwise, the instrument may malfunction or be subject to electric shock.

X-Ray Warining

1.Generally, no radiation damage will be caused to the exposed personnel during an accident, and its safety and protection requirements are relatively simple.
2. Although the design of this instrument takes into account comprehensive protection, if it is not handled properly, it may still be exposed to X-rays.Therefore, you must pay attention to safety when using X-ray equipment and avoid being exposed to X-ray radiation.
3.This instrument will only generate X-rays directly in front of the test window during operation. There is a metal shielding shell in front of the instrument test window, which provides reliable and safe protection for the use of the instrument. Therefore, during operation, do not point the instrument test window at yourselfor others.

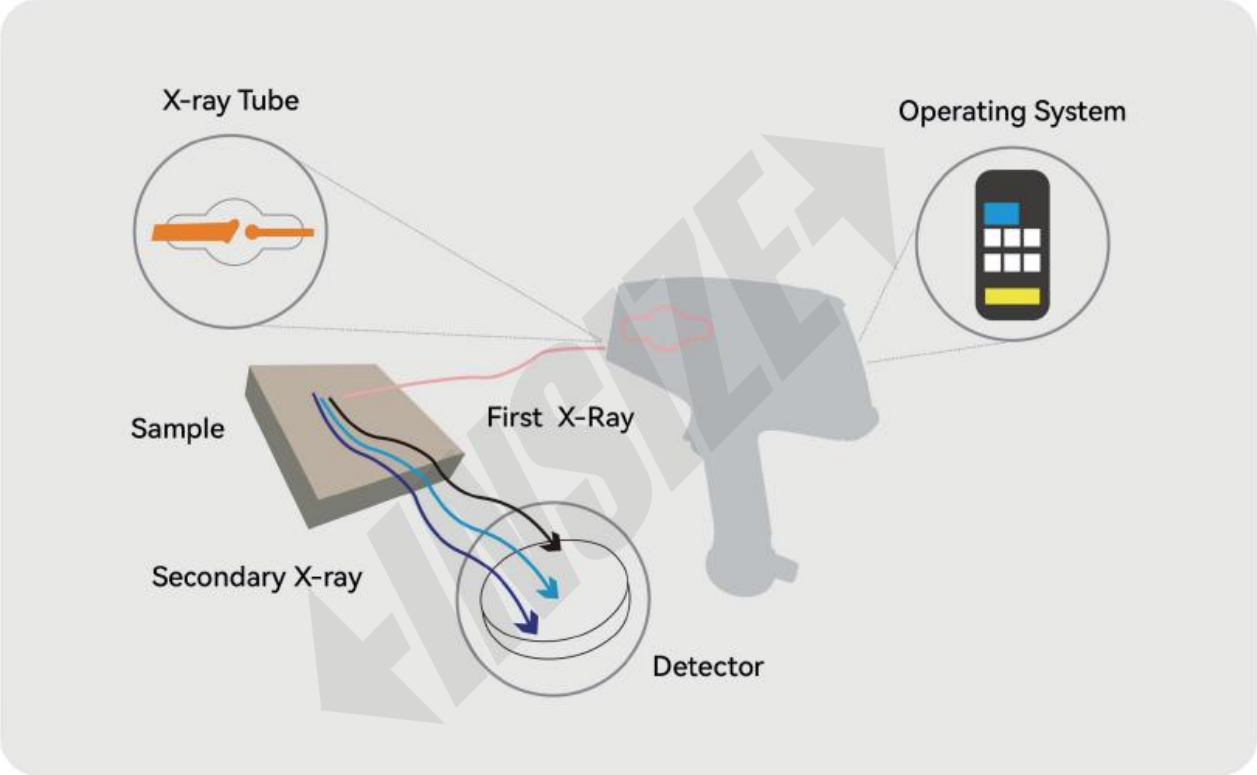
Chapter1 Instrument Overview

1.1.HSM-S introduction

The HSM-S handheld X-ray fluorescence spectrometer is a fast, nondestructive material measurement tool that uses X-rays to excite the object being measured and analyzes X-ray fluorescence to obtain the elemental composition and element content of the object being measured. It has rapid detection. It is durable, lightweight, compact, and easy to operate. It is widely used in many fields such as metal materials, environmental protection, precious metal detection, and industrial testing, and can meet multiple applications.

1.2.HSM-S principle

The working principle of XRF is to bombard the sample with X-rays, and the sample produces X-ray fluorescence after being excited. X-rays usually knock out the inner electrons from the K and L layers of element atoms, and the holes created are filled by high-energy outer electrons. The high-energy electrons added to the low-energy orbit radiate the excess energy as X-ray fluorescence. These radiated spectral lines contain the characteristics of various elements. Like a fingerprint, it has a chemical valence independent of atoms. The intensity of radiation is directly proportional to the concentration of that element in the sample.



HSM-S working principle diagram

1.3.HSM-S SPECIFICATION

Code	HSM-S110	HSM-S130	HSM-S620	HSM-S640
Analysis mode*	alloy analysis	alloy analysis plating analysis	alloy analysis	alloy analysis plating analysis
Detector	Si-PIN		SDD	
Elemental analysis range	Ti~U		Mg~U	
Target material	Ag target		Rh target	
Excitation source	50kV/200μA Max			
Heat dissipation	dedicated T-slot heat sink enhances thermal dissipation performance of the instrument			
Display	4.3-inch industrial-grade resistive touchscreen			
Operation system	Android			
Safety	air-test protection against untargeted operation			
Memory module	32G			
Data interface	mini-USB			
Data processing	reports can be generated in EXCEL and PDF formats, and users can customize the content			
Battery	6600mAh			
Working environment	-35~60°C			
Dimension (L×W×H)	254×79×280mm			
Weight	1.6kg			

*can be customized according to user requirements: RoHS analysis mode, ore analysis mode

1.4.HSM-S components

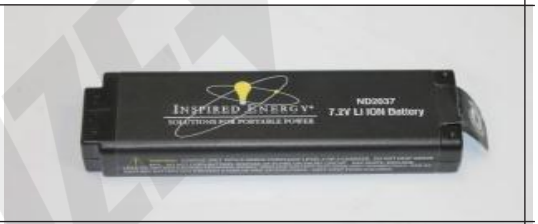
A complete set of HSM-S handheld X-ray fluorescence spectrometer includes instrument components, accessories and optional accessories.

1.4.1.Instrument components

HSM-S components and accessories list

Item	Compents name
1	Shipping box
2	Handheld XRF analyzer
3	316 Standard sample
4	Battery charging stand
5/6	Battery
7	Window protective film
8	USB Cable
9	Adapter

Detailed display of some components

Component name and introduction	Picture
Battery: Each HSM-S unit comes with two lithium batteries as standard. There is a micro-display on the other end of the battery charging electrode, which can directly display the battery power	
Adapter: This adapter is a universal adapter that can be charged directly through the adapter interface at the rear of the instrument, or the battery can be charged through a charger. The adapter comes with a working indicator light. The input voltage of the adapter is 100-240VAC; the output voltage is 9V.	
USB data cable: When you have exported the data you need in the historical data, you can connect the USB data interface with the instrument through a USB data cable, and then view your exported data on your computer.	
Standard calibration sample The standard calibration sample provided by our company can be used as a calibration optical path in self-test mode, and can also be used in test mode to compare test results with standard results to determine whether the instrument is accurate.	
Charging base: For battery and backup battery charging.	

1.4.2.Instrument Accessories.

The following is the optional accessories list's introduction

HSM-S test stand:
When you need to measure some special samples or need to connect the instrument to test samples through PC software, you can install the HSM-S XRF analyzer on the test stand as shown below to meet your special testing needs.

Portable Bluetooth Printer:
Our company has equipped the INSIZE handheld X-fluorescence spectrometer with a portable Bluetooth printer. When the printer and instrument are turned on, they will automatically connect. Users only need to click the print button to print data, which is convenient and fast.

1.4.3.Instrument's appearance

Item	Name	Item	Name
1	Touch screen	8	Detector
2	Turn on/off button	9	Tube
3	Cooling hatch	10	Test Window
4	Instrument w orking indicator light	11	Double Beam w indow
5	Trigger	12	USB data interface
6	Handle	13	Audio control interface
7	Battery compartment	14	Adapter interface

1.4.4.Appearance of charging base

Item	Name	Item	Name
1	Charging base w orking indicator light	3	Heat dissipation w indow
2	Battery charging interface	4	Adapter interface

Chapter2 Setting and Operation

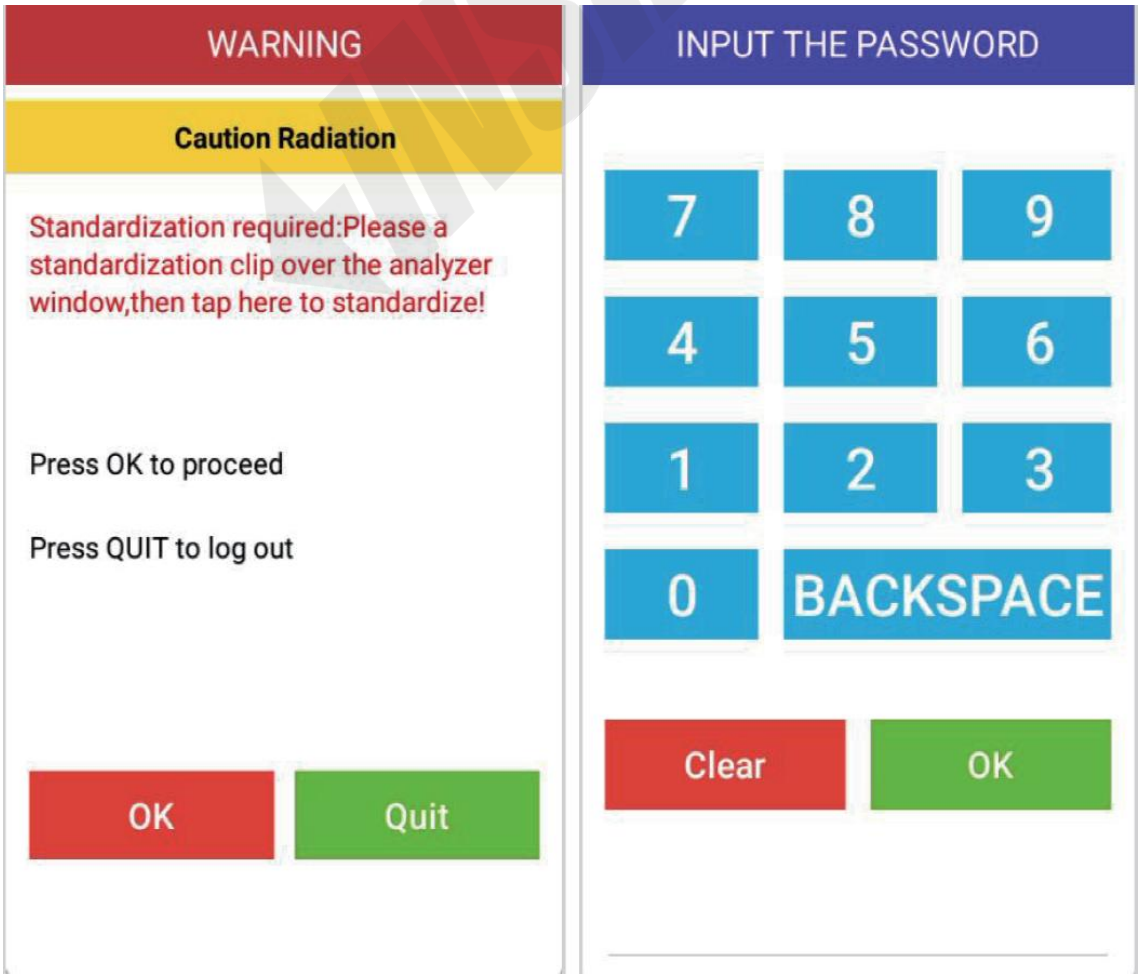
2.1.Basic operating of the instrument

2.1.1. HSM-S series handheld instrument's turn on

Load the battery, press and hold the power button for 3 seconds until the power light comes on, and just wait for the system to start.

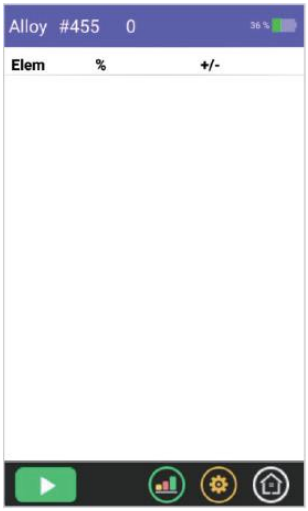
2.1.2.Enter login password

Enter the radiation warning interface, click "OK" , and then enter the initial password 1234, and the instrument directly enters the test interface.



2.1.3.Enter the test interface

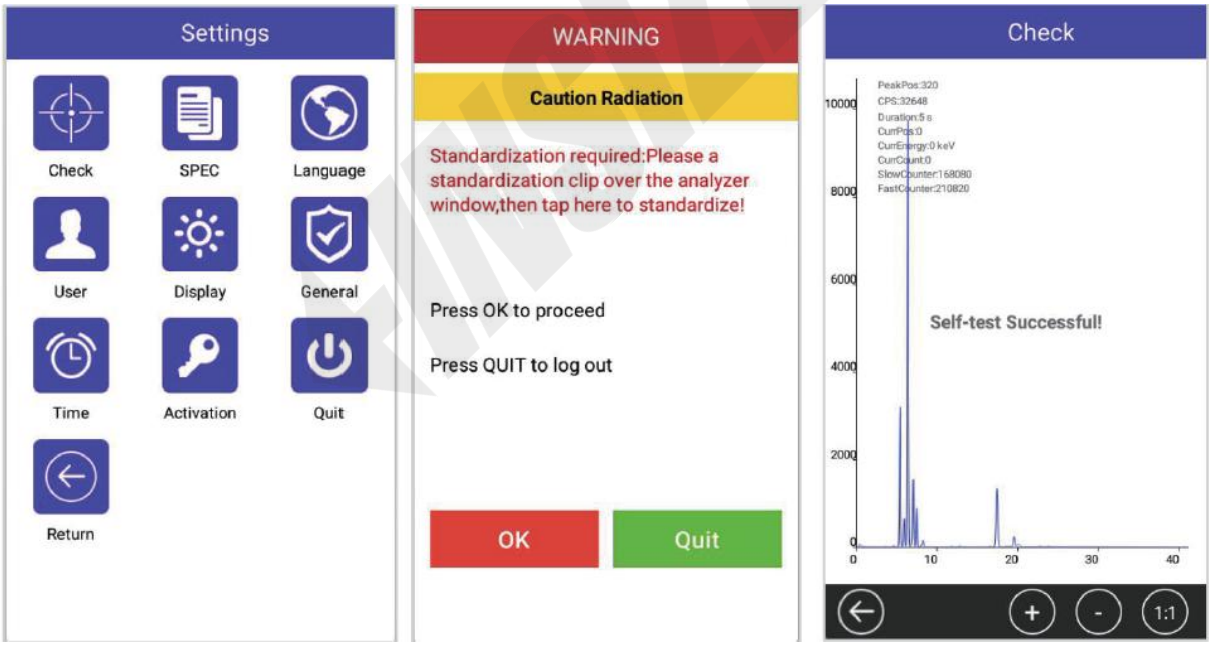
After logging in, the instrument will automatically load the application curves and parameters and directly enter the test interface. This instrument has a memory function and will directly log in to the mode you selected before exiting last time. If you need to use other modes, please return to the mode selection interface to select the mode.



2.1.4.Self-Test

In order to ensure the accuracy of the instrument's measurement data, it is recommended that you perform a self-test on the instrument after turning it on. Find "Self-test" in the setting model, click OK to perform self-test, and the instrument will automatically perform self-test. After the self-test is successful, you can start measuring. If the self-test fails, please contact the INSIZE after-sales service center in time.

Note: Before clicking OK to perform self-test, be sure to confirm that the sample being tested is the standard calibration sample provided by our company.



2.1.5.Model selection

After the self-test is completed, you can start testing. Before testing, you need to select the mode first. If you purchase our company's customized model, you need to select the mode you want to test on the mode selection interface before measuring. Once the selection is complete, you can start testing.

2.1.6.Start the test

Hold the instrument tightly , and then place the test window of the instrument close to the surface of the measurement object so that the test window is in full contact with the object. Then press the trigger, and the radiation indicator light of the instrument flashes alternately.

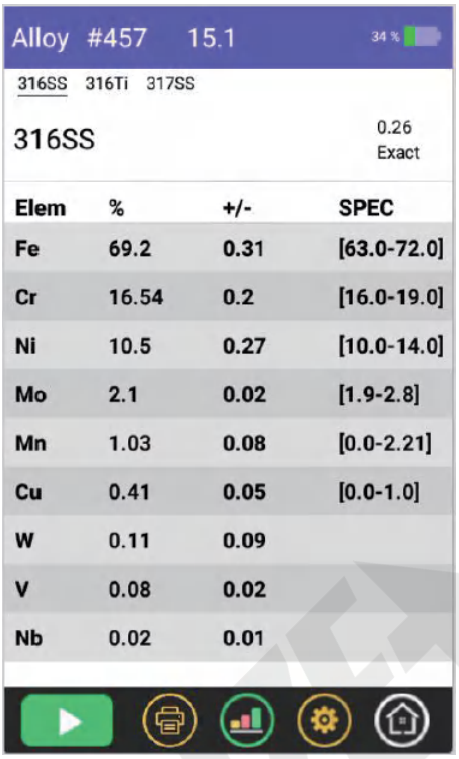
During the measurement process, pls keep the instrument in full contact with the object, and do not shake the instrument until the test is completed.

2.1.7.Stop the test

There are two ways to stop the test: the first is to manually terminate the test, when you feel that the instrument data has been stable and there is no need to continue the test, all you have to do is pull the trigger again and the instrument will stop testing. The second is that the instrument automatically stops the test. The instrument has a test time set, when the test time is over, the instrument will automatically stop the test.

When the test stops, the radiation indicator stops blinking and a tone is sounded to remind you that the test is over. Therefore, when the indicator light is not turned off and the tone is not heard, it means that the instrument has not completed the test. Do not move the instrument.

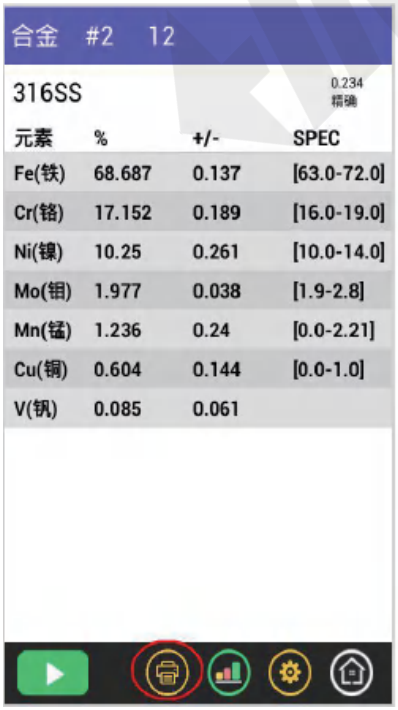
After the test, you can see all the data information measured by the instrument on the screen, and the meaning of each label on the screen will be described in detail in the software function.



2.2.Optional accessories operation settings

2.2.1.Using a portable Bluetooth printer to print the result

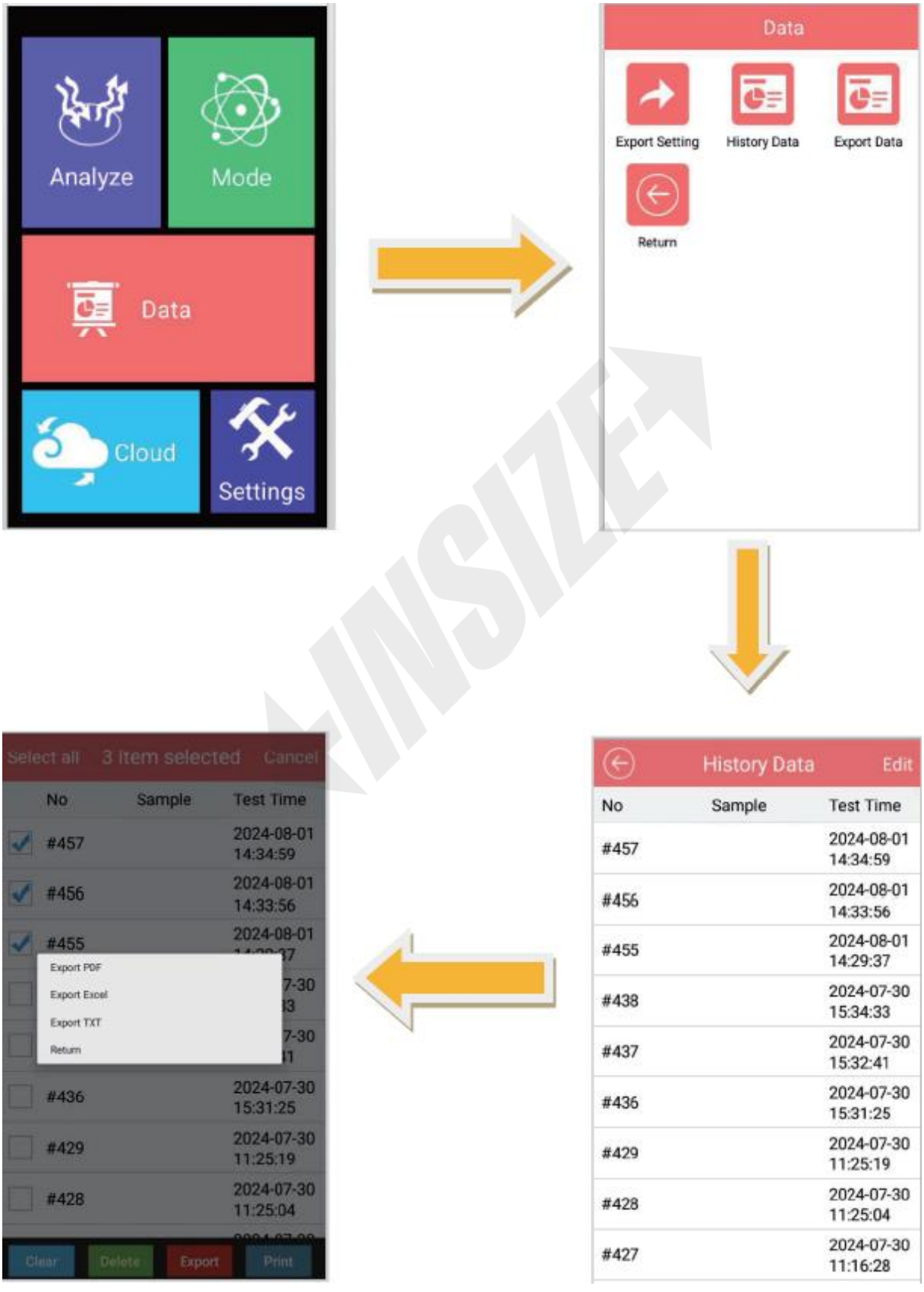
If equipped with a portable Bluetooth printer, you only need to press the printer's power button to start the printer. The printer will automatically match and connect to the instrument, and then click the print button on HSM-S to automatically print the results. For other functions and uses of the portable Bluetooth printer, please refer to the manual of the portable Bluetooth printer.



2.3.Export the historical data

2.3.1.Export reports from instruments

According to customer needs, HSM-S can export two report modes, such as PDF and EXCEL. First, find the data on the main interface, click to enter and select "Historical Data" to see previously measured data. At this time, click "Edit" in the upper right corner of the interface, and then the user selects the exported data and report format according to their own needs.



2.3.2.Connect the instrument to the computer

Open the connector cover of HSM-S, find the USB connection port, and then use the company's special USB cable and connect it to the computer.

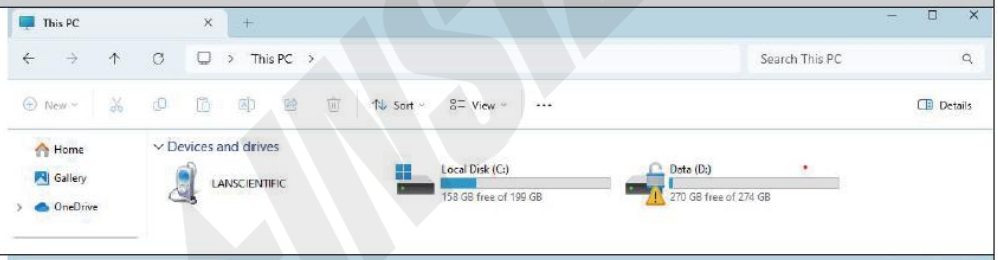
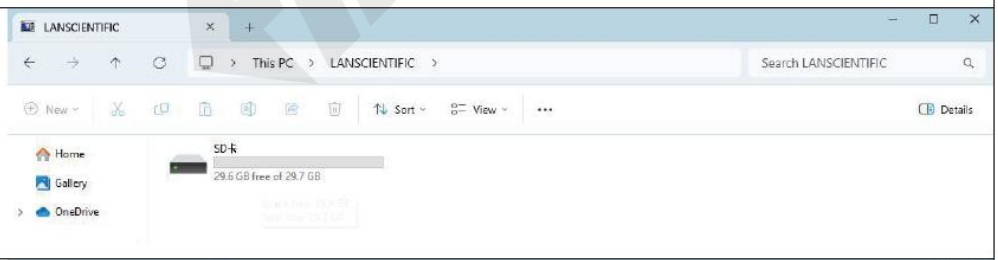
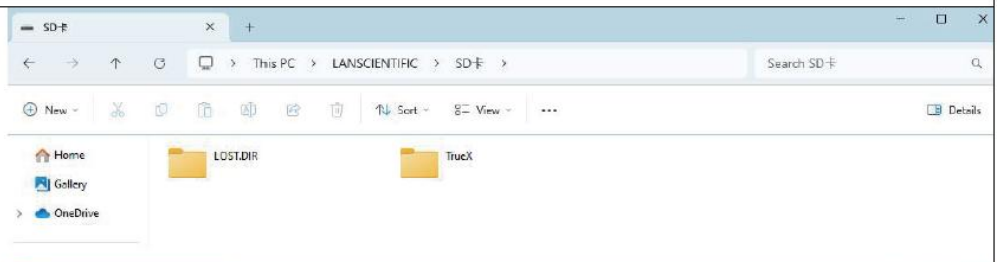
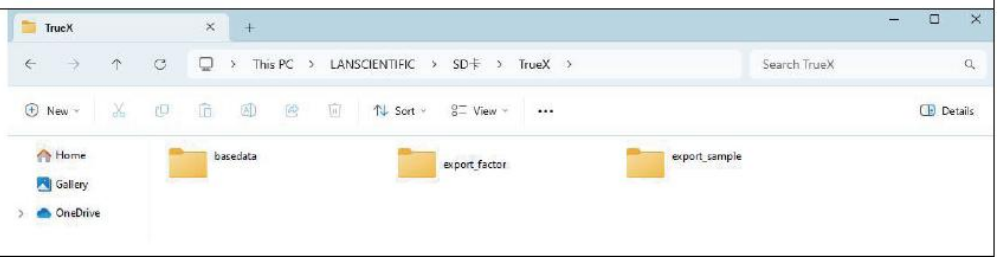
2.3.3.Print files on your computer

After successfully connecting the instrument to the computer, you can see the drive letter "INSIZE" in My Computer. In this drive letter, the user can find the exported data report.

Note: Since this drive contains the instrument's software and important database information, please strictly follow this process when searching for printed reports to prevent damage to the instrument's software.

Find the export data process:

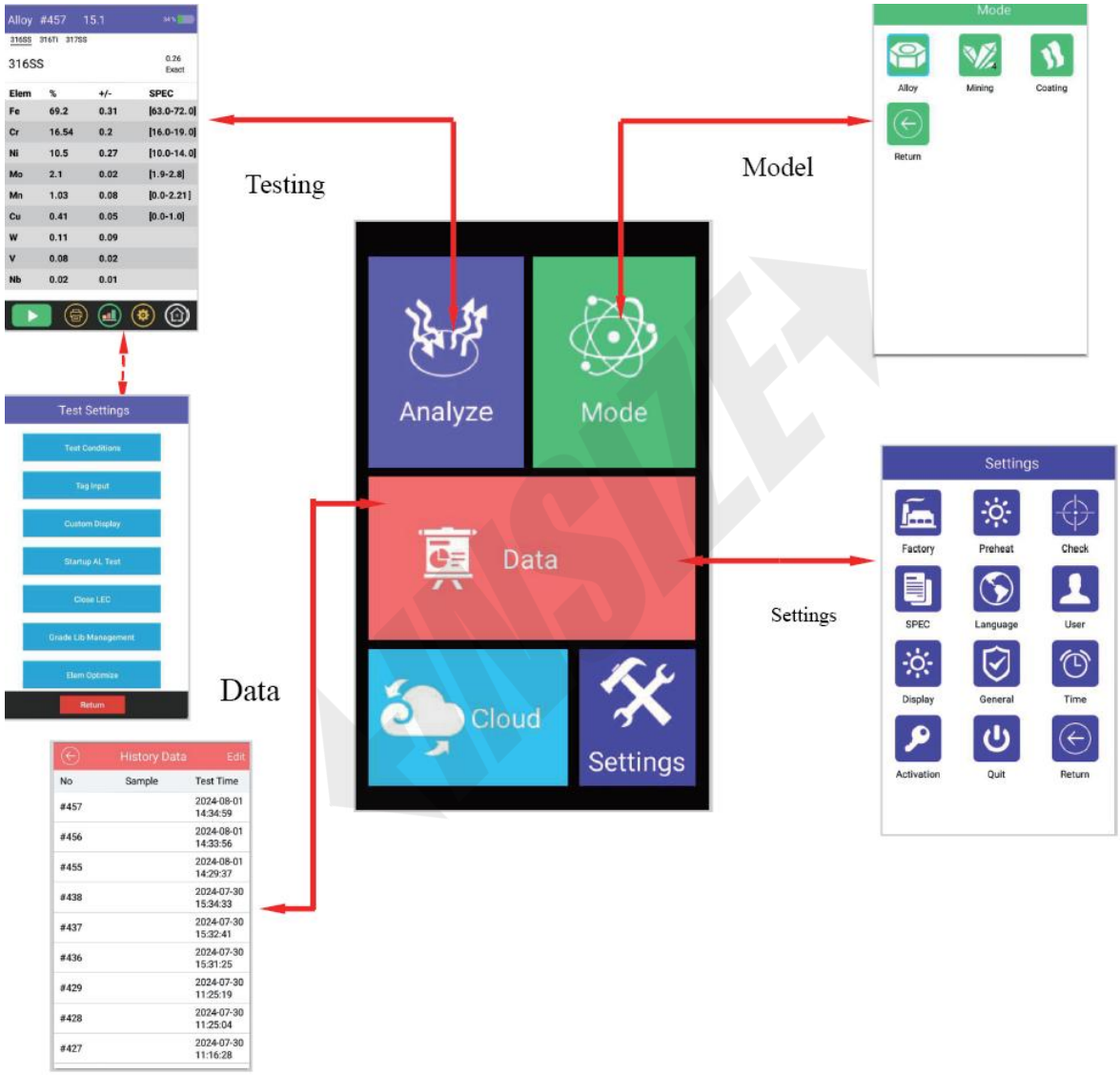
INSIZE Drive Letter》 Memory Device》 HSM-S》 export_sample》 Open the folder corresponding to the mode you need (here, alloy is used as an example)》 View your exported report and print it.

Step	Picture Presentation
First Step	
Second step	
Third Step	
Fourth step	

Chapter3 Software Introduction

3.1. HSM-S user interface

The HSM-S user interface is entered after completing password login and initialization. In each functional interface, users can perform related operations on the instrument. The main interface of the system displays the main function menu of the system. On this main interface, you can perform instrument testing, instrument self-test, data printing, etc. You can also enter the sub-interface by clicking on the five options in the main interface.



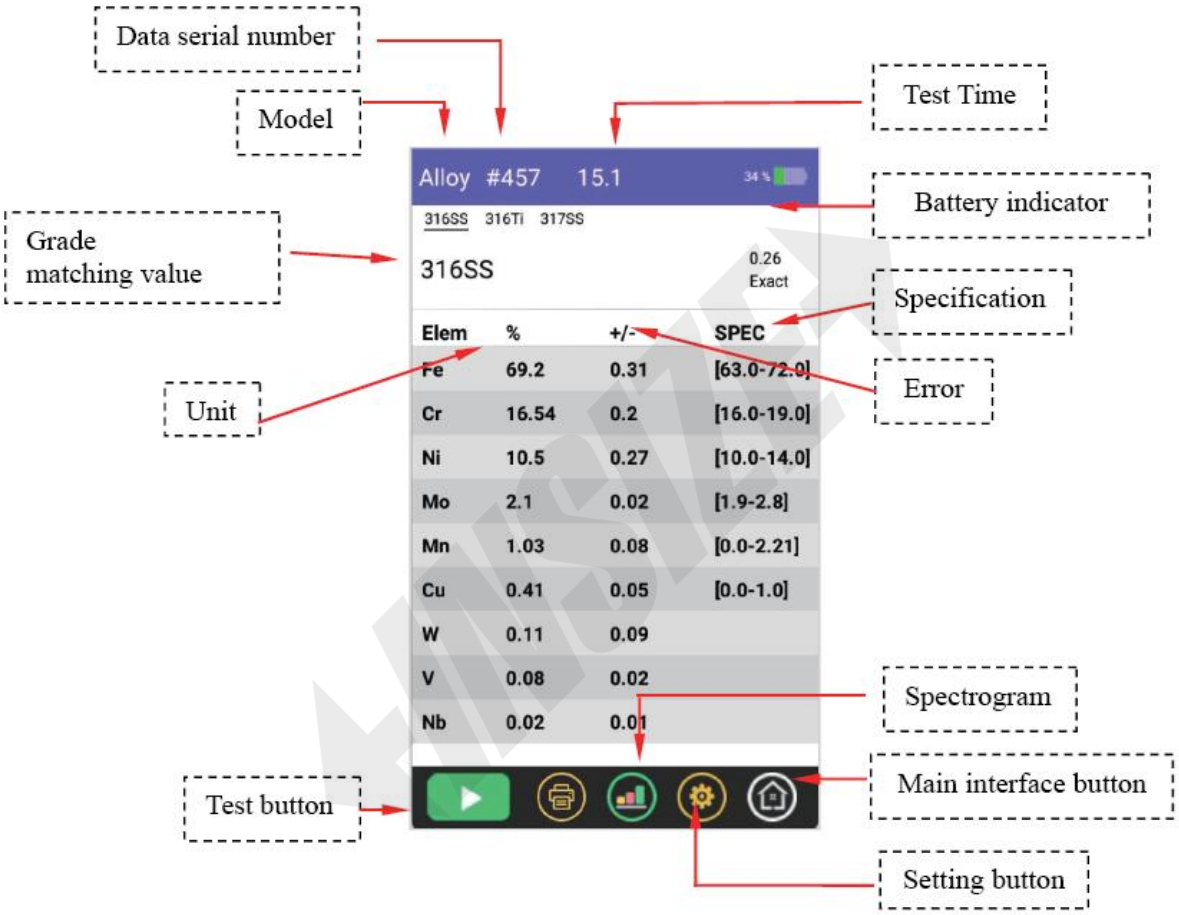
3.2.Introduction to analysis functions

3.2.1.Analysis interface

The Analyze option is the main channel for HSM-S series to conduct analysis and testing. Select analyzer to enter the test interface. The test interface defaults to the last analysis mode. If you need to adjust, return to the main interface and select the mode interface to make changes.

Before preparing to test, the sample to be tested needs to be completely covered in the XRF test window, maintain the correct testing posture. Clicking the test button or pulling the trigger of the instrument means to start the test; clicking the stop test button or pull the trigger again means to stop the test.

After the test is completed, the instrument will display the test results. The instrument will automatically save each test result. The test results are displayed as shown below:



The instrument will automatically save the test data according to the data serial number. The saved test data generally contains the following information:

Information content	Description
Test Time	The time for testing sample
Data serial number	Indicates how many tests this test is, and the serial number will be superimposed with the number of tests.
Model	Indicates whether the mode you are currently analyzing is alloy, ore or other modes.
Grade	During the test, the instrument will automatically search for the grade corresponding to the alloy in the grade library based on the test results if it is alloy sample. Swipe left or right to view multiple matching grades. If there is no corresponding grade in the instrument standard grade library, the instrument will not display the grade.
	Indicates how well the tested sample matches the standard grade. A smaller value indicates a better match. There are four matching levels in total: 0-0.5 is accurate, 0.5-1 is accurate, 1~ is set in grade management to be possible, and the grade will no longer be displayed if it exceeds the upper limit of brand management.
Elements name	Chemical symbols for each element.
Unit	The unit in which the measurement is expressed, such as % (percent) or PPM.
Error	The analytical error displayed by the instrument is ±2δ error, which is the 95% confidence interval.
Specification	The element content range of the currently best matched grade
Test button	This button can be used to operate the instrument to start testing or stop testing. (Note: If you use this button for testing, the trigger will not be able to stop the test. You can only end it by waiting for the test time to end or clicking the button again.)
Spectrogram	This interface is the spectrum of the measured sample, which is generally viewed by engineers when checking the instrument.
Setting button	Through this button, you can enter the test setting interface and make relevant settings.
Main interface button	This button allows you to enter the main user interaction interface
Battery indicator	The remaining battery power will be displayed in the upper right corner of the screen, and your current remaining power will be displayed through an icon, so that the instrument will not accidentally shut down due to lack of power. Next to the icon is a digital display of the current remaining battery percentage. If your battery is less than 20%, the icon will turn red. At this time, you need to replace the battery in time to prevent accidental shutdown from causing inconvenience to you.

On the sample analysis interface, you can also sort your measured data by the atomic number of the elements, or by the measured element content of the sample.

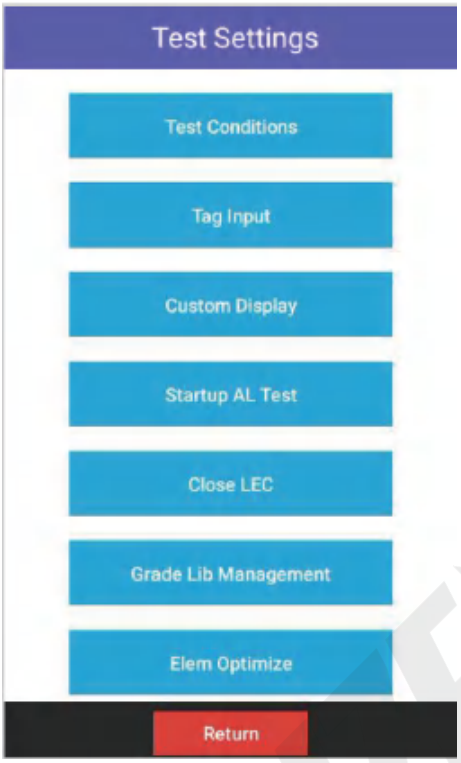
Of course, you can also sort it by RMS or by unit, which is very convenient for users to best combine the elements they are interested in. Just click on the "Element", "+/-", "% / ppm" text above.

When you need to exit the test interface, just click the main interface button on the lower right. (If you are testing, this button click has no effect)

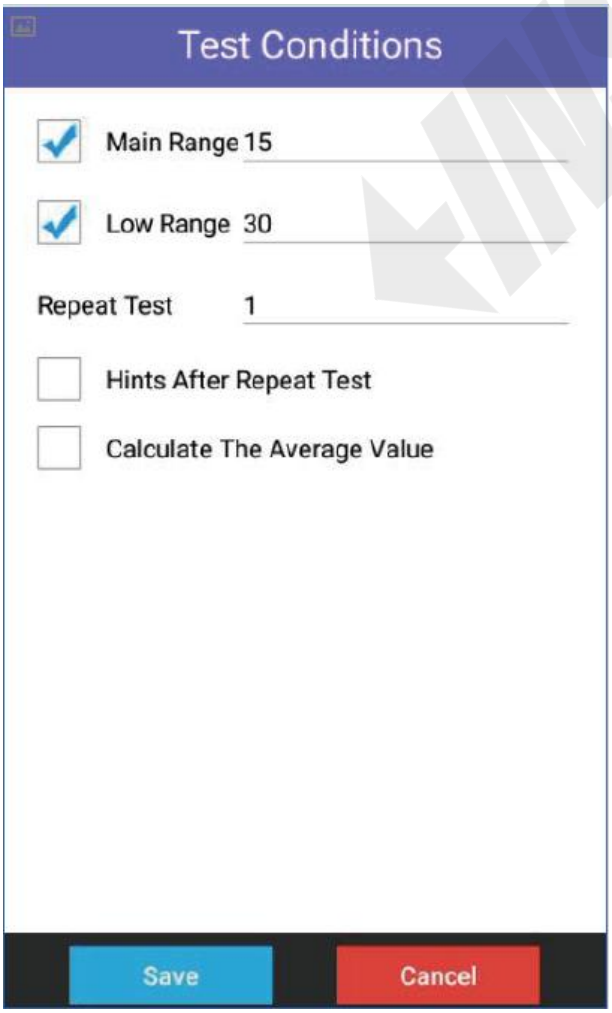
Note: The safe temperature range at which your spectrometer can be stored and operated is -20 ° C to 50 ° C. Testing outside this temperature range may cause damage to your spectrometer and is not recommended. If your instrument overheats, for example, it becomes hot to touch, please wait until the temperature of the instrument cools down before testing again.

3.2.2.Test Settings

Test settings is to set the parameters of the current test mode, through which relevant parameters can be adjusted.



3.2.2.1. Test conditions



Element times: Set the test time of main elements

Repeat test: Set the number of times to repeat the test

Prompt after repeat: each time the test is repeated, it is used to prompt how many times the test is repeated.

Generate average: After repeated testing, provide the average

Calibration time: Use the effective time as the test end parameter

3.2.2.2. Tag input

When testing a large number of samples, in order to avoid confusion in test results, users can label the samples by modifying the test labels. The label information includes sample name, origin, batch and other label information. Storage allows you to associate important information about a sample with readings so that different readings can be differentiated.

The tag input items have a memory function. Once you make tag notes for a test, the information will automatically pop up the content you may need to fill in based on your input during the next test note. If you are measuring many samples in a certain batch, you only need to enter the label-related information when measuring the first sample. The label information will not change in subsequent measurements, and you only need to change some information.

3.2.2.3. Custom display

The user specifies the order in which elements are displayed. Please do not operate this function module without professional training。

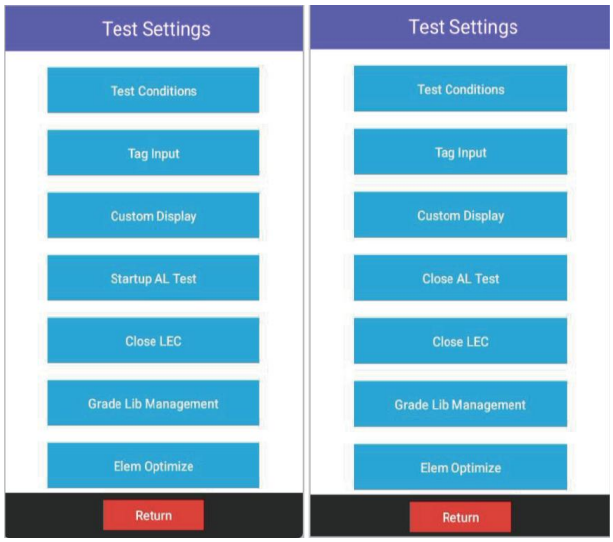
Note: Custom displays vary slightly in different modes.

3.2.2.4. Start up Al Test/Close Al Test

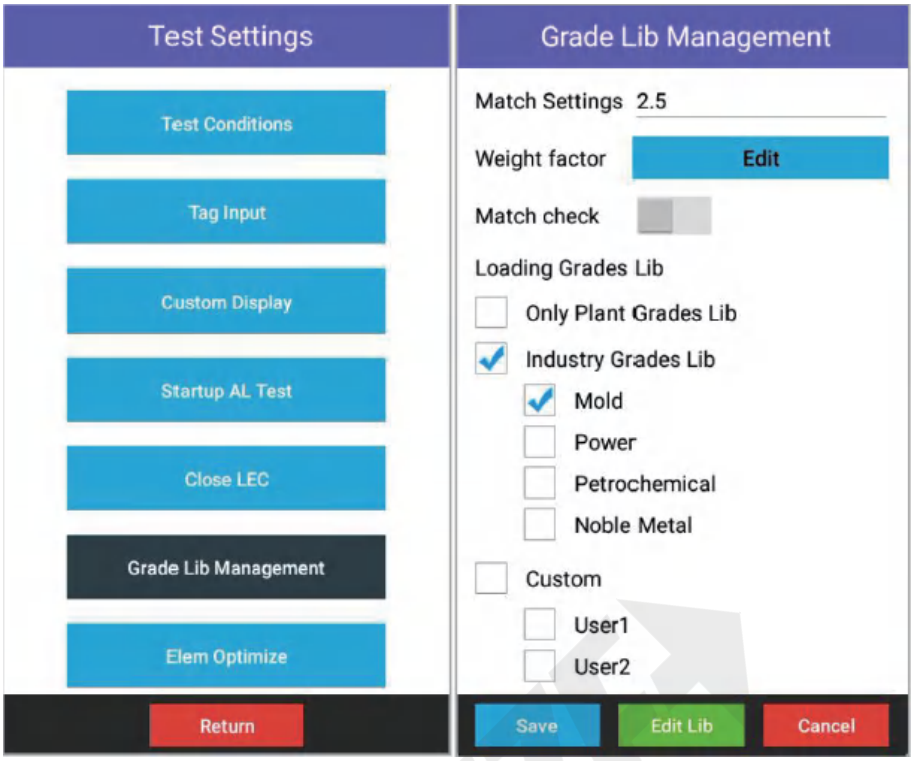
In alloy analysis, when calculating test results, the instrument usually assumes that the light element with an uncertain content is aluminum. When the instrument cannot receive X-rays reflected by certain objects that cannot be excited (such as wood, plastic, etc.), The instrument will also mistake these objects for aluminum. By switching the tool menu and selecting "Close Al Test", the instrument will no longer consider the content of these objects as the aluminum element content when calculating the analysis results, and will only display the content of each element in the sample tested by the instrument, thereby filtering out the reflection noise of these objects to avoid the interference of foils on the analysis results.

When the size of the test sample is smaller than the test window, and if the sample is movable, it is recommended to place the sample in the test window and lift the instrument upward to test the sample. If the valuable items must be placed on a substrate such as wood or plastic for testing, be sure to turn on the "Close Al Test" function to avoid the interference of the substrate on the analysis results.

Note: "Start up Al Test" is the default state of the instrument, and the total amount of undetected elements will be calculated as aluminum.



3.2.2.5. Grade Library management



Clicking on the "Grade Library Management" screen will display the existing database, where you can also view the metal chemical composition range of the alloy grade. Users can also edit the alloy library by themselves, adding, deleting or modifying alloy grades.

Matching settings: The alloy matching value refers to the maximum matching error that you can tolerate when performing grade analysis. When performing grade analysis, the smaller the matching value, the closer the analyzed elements are to the true grade specifications. When the analyzed matches When the value is greater than the maximum value set here, no alloy grade will be displayed.

The factory standard grade library, mold, electric power, and petrochemical industries are factory standard configurations.

The factory grade library and the industry grade library cannot be checked at the same time. When choosing to use a certain library, the corresponding alloy grade will be matched and queried from the currently selected library.

Editing the grade library will enable you to view, edit, delete, and modify the grades in the existing grade library.

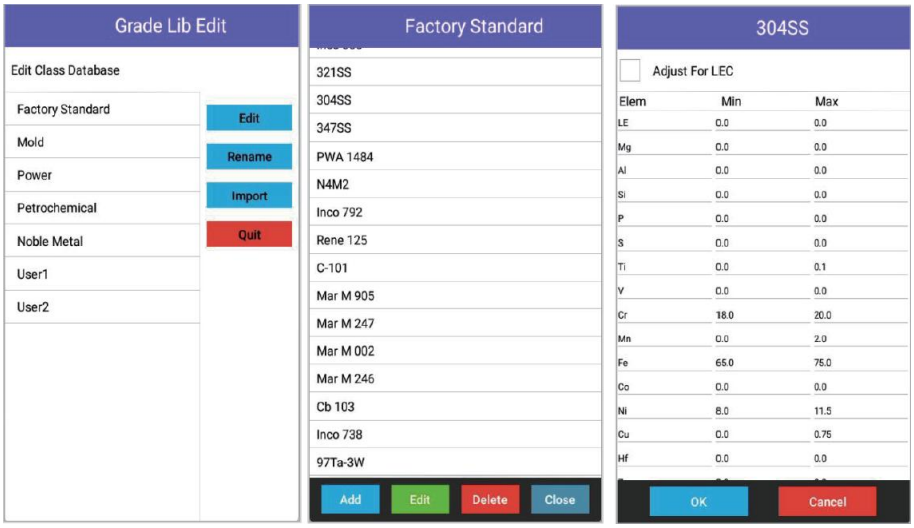
Among them, the factory standard grade library, mold, electric power, and petrochemical industry libraries can only be viewed and cannot be modified or renamed.

Under the user-defined grade library, users can use the "Edit" button to edit the grade library and add user-defined samples to the grade library.

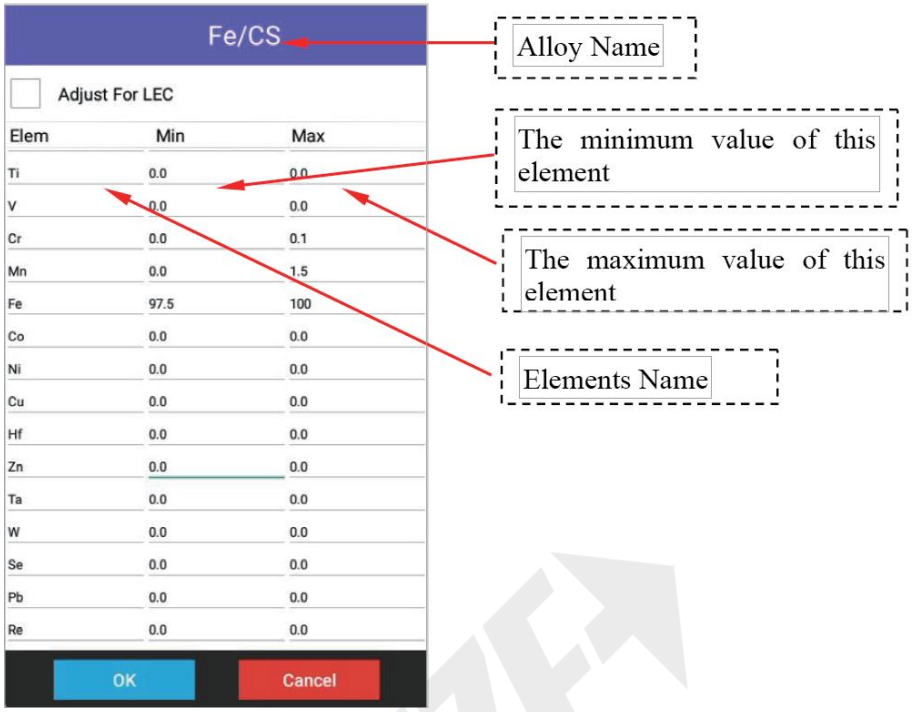
There are 4 buttons to choose from in this interface. Select the "Add" button to add new entries to the database, such as adding a new alloy. After editing the new entry name, click the "Confirm" button to return to the main editing interface. Click the "Edit" button under the main editing interface to enter editing interface.

Select the "Delete" button, and the instrument will ask the user again. Select "OK" to delete the entry in the database, and select "Cancel" to return to the previous directory. Select the "Close" button to return to the previous menu.

After the user completes editing the entry name, the user will enter the entry details editing interface. An example of this interface is as shown above.



Among them, "Alloy Name" represents the entry name. Contents of the following elements are user-definable. Click "Min" to edit the lowest percentage of the component such as Fe, and click "Max" to edit the highest percentage of the component such as Fe. You can select "Confirm" to save and complete editing of the entry, or select "Cancel" to cancel editing of the entry.



3.2.2.6. User factor

HSM-S's FP algorithm automatically corrects for matrix effects for most coexisting elements. However, for some special substances, such as ores, due to different origins, when using ores from other origins to measure ores from another origin, the accuracy will be greatly reduced. If more accurate data is required, HSM-S provides users with their own correction of the slope/intercept of the element of interest to improve the quality of the data. Individual elements can be corrected, or multiple elements can be corrected. The correction coefficients are indepen -dent of each other and do not affect each other.

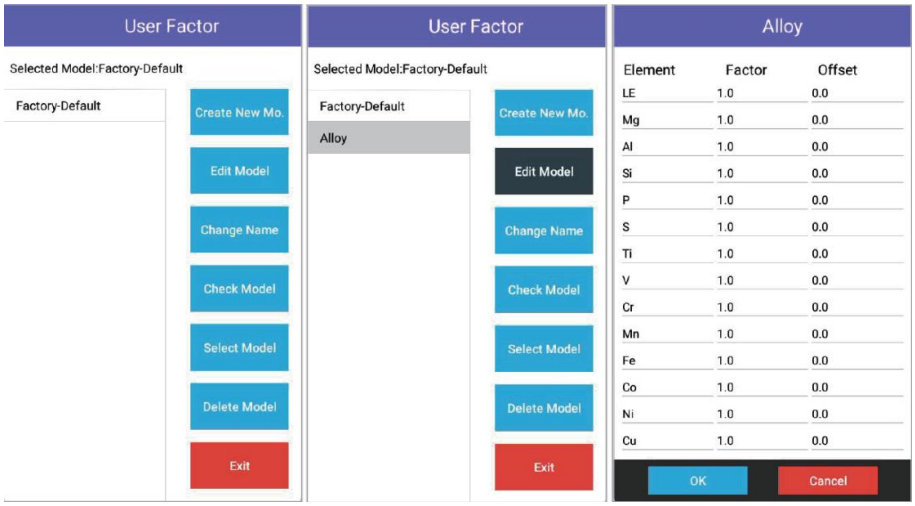
The allowable degree of deviation should be set before the routine inspection is carried out. Alternatives, such as the lab, are used to measure some samples and then measure them with HSM-S. If the results are already fully sufficient for the application, then the instrument does not need to be calibrated. If calibration is mandatory, then a correction factor should be established, and if the local geomorphological features have changed, the results must be rechecked to see if they are within the allowable tolerance.Here's how to build a user factor:

establish a user factor, five samples of known elemental content in the area are required (the more samples, the better, no less than three, and it is recommended that there should be no less than three), and there must be a gradient in the content of the elements of interest. Increasing the number of measured samples can increase the accuracy of the measurement.

The basic operation process of establishing a user factor is as follows, and the following steps are followed:

1.Select Factory-Default factor
2.Measure the sample for at least 80 seconds;
3.Determination of correction factors from samples with known contents;
4.Create a new model and input the determined correction factor into the corresponding element correction term in the new model
5.Select the new model as the calibration model for this type of sample.

In order to allow users to better understand the process of establishing user factors, the following is an example of practical operation:



Select Factory-Default, then click "Create Model", and enter a new model name, in this case, Tantalum and Niobium Ore as an example. Then click Tantalum and Niobium Ore to see that the current mode has been changed to Tantalum & Niobium Ore, and click "Edit Model" to enter the edit mode.

6.Correspond one to one between the measured value and the real value data, and record them in the EXCEL table. Note that the measured value comes first and the real value comes last, as shown in the figure 1.

Cu	TrueX	Standard
1#	17.242	17.50
2#	17.212	18.20
3#	18.689	19.00
4#	24.747	24.30
5#	24.359	24.30
6#	22.43	23.4
7#	23.369	24.00
8#	2.515	2.71
9#	2.236	2.32

figure 1

7.After selecting all the data with the mouse, select Scatter Plot under the Insert menu, as shown in Figure 2, and then select the first one to get Figure 3.

Figure 2

8.Put the mouse point on the data point in the coordinate, press the right button, and select in the column: Add trend line, the screen will display the dialog box, check the display formula, press close to get Figure 3.

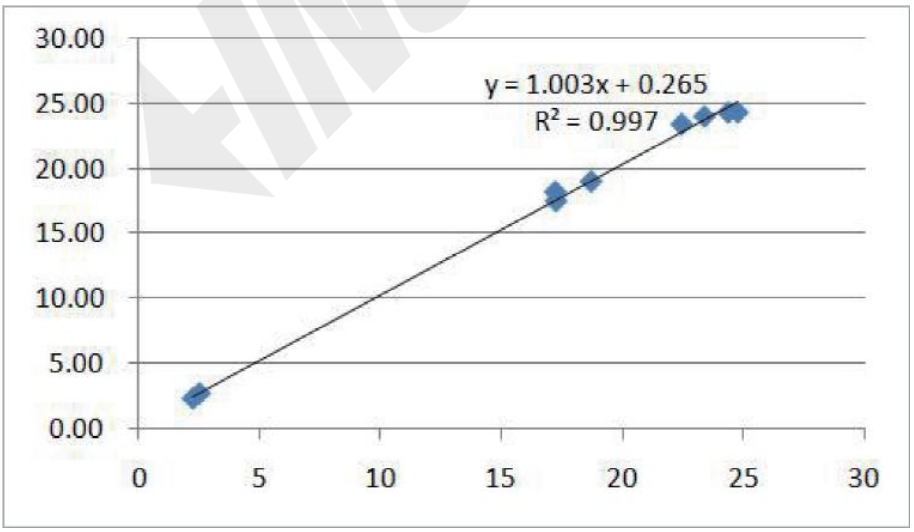
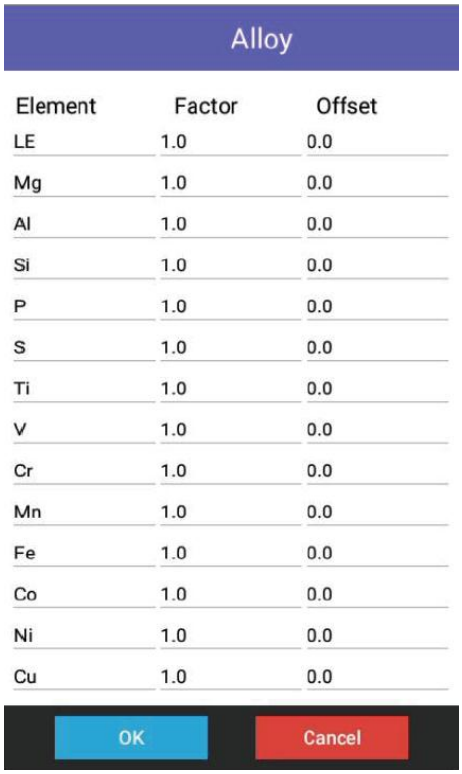


Figure 3

9.According to the formula in Figure 3 that is, y = 1.003x + 0.265, the correction coefficient can be obtained, 1.003 is the slope, and 0.265 is the intercept. (The slope is equivalent to the factor, and the intercept is equivalent to the offset)

图4

10.Add factors and offsets to the Cu element in the tantalum-niobium mode. As shown below:



Note: When setting the correction coefficient for other regions, you must first select the factory mode for the correction coefficient and measure the known samples separately, otherwise the results obtained will have a large deviation. The method for setting the correction coefficient is the same as above, and be careful to store it in different in mode.

3.3.Introduction for mode functions

Select the mode option on the main interface of the system to enter the mode interface, which lists the available working curves. The displayed items depend on the instrument configuration ordered by the user. Please contact our company if necessary. In this interface, users can select a curve to set as the default curve.

Click "Alloy" to enter the alloy test menu.
Click "ROHS" to enter the ROHS test menu.
Click "Ore" to enter the ore test menu.
Click "Soil" to enter the soil test menu.
Click "Precious Metals" to enter the precious metals test menu.
Click "Coating" to enter the coating test menu.
Click "TCB" to enter the TCB test menu.

3.4.Introduction to data functions

This function mainly provides users with two major functions: viewing and exporting historical data. When users click to enter the data, they will see two modules: export settings and historical data. We will elaborate on it below.

3.4.1.Export settings

This interface can modify the relevant information in the exported PDF document. For the LOGO, you only need to place the prepared image in the HSM-S directory. Users can 3modify the rest of the information as needed.

3.4.2.Historical Data

Click "Historical Data" to enter the relevant historical data of past measurements.

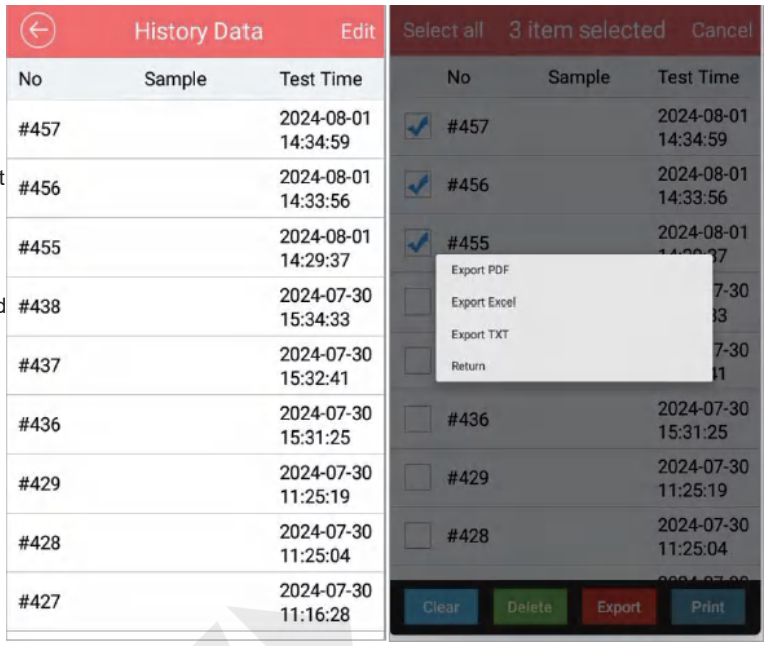
Click Edit in the upper right corner. A check box will appear in front of all data, and four option buttons will appear below.

Clear: No need to select data, click to clear the entire historical data. Please note that once data is cleared, it cannot be recovered.

Delete: Select the historical data to be deleted, and then click Delete. Please note that once data is deleted, it cannot be recovered.

Export: The historical data of the instrument can be exported as reports in both PDF and Excel formats. To generate a report, simply select the data you wish to export, then choose the desired report mode from the available options.

exported.Print: You can pick one single historical data to print, or you can also pick multiple historical data to print collectively.



3.5. Introduction to cloud service functions

In this functional mode, users can bind the smart devices equipped by the company and update software and data.

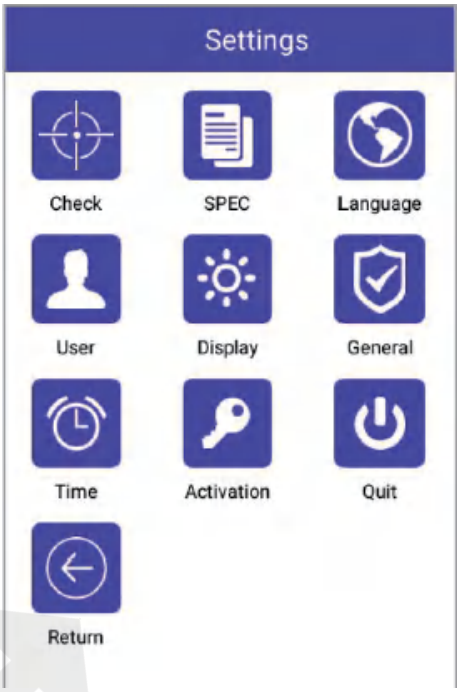
3.5.1.Smart devices

After clicking to enter, the user can see all the company's smart devices. When the user purchases the company's smart devices, the user can bind the smart devices on the current interface. Every instrument shipped by our company has been actively paired and connected to smart devices for users, so users do not need to pair and connect anymore. If you need a pairing connection, you can refer to the pairing connection method in Chapter 2.

3.5.2. Update application

When the company launches the latest software version, it will proactively update it for users. When the user receives the HSM-S.apk software sent by our company, place it in the HSM-S directory, and then click to update the application. The instrument will automatically update, and once the update is complete, the new software will be available.

3.6.Settings option



Click "Settings" on the main interface to enter the settings menu. Here you can perform regular operations such as changing time and date, viewing instrument specification information, security settings, language adjustment, self-test, adjusting screen brightness, and quit the instrument, etc.

Click the "Self-test" interface. The self-test module is used to verify the application capabilities of HSM-S. At the same time, during the verification process, the spectral line drift of the instrument caused by temperature, aging or other reasons can be corrected. The verification process is as follows:

a.In the main setting interface, click the screen self-test option to enter the self-test interface.

b.Before clicking the "Self-test" button, please align the HSM-S test window with the self-test standard calibration sample, and then click OK to enter the self-test spectrogram interface.

In the self-test spectrogram interface, when the self-test completion prompt message appears, it means that the self-test task is completed. At this time, the high-voltage radiation lamp is turned off. If the self-test is unsuccessful, you can continue the self-test task until the self-test task is completed. If multiple self-tests cannot be completed, please contact INSIZE for instrument inspection! INSIZE recommends that users do a self-test every time when they turned on the instrument and warmed up the instrument to ensure the accuracy of test.

Click "Specification" to view instrument information.

Click "Language" to select the language displayed on the screen.

Click "User" to change the login password. The initial password is 1234.

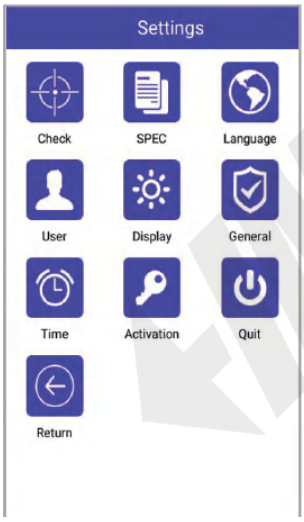
Click "Screen Brightness" to adjust the screen backlight off time.

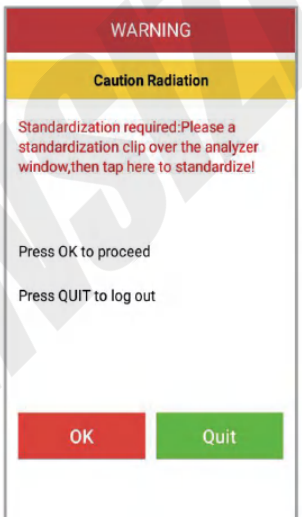
Click "Time Settings" to change the time and date.

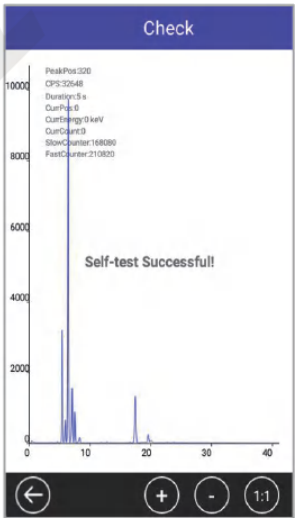
Click "Device Activation" to activate the mode of the instrument.

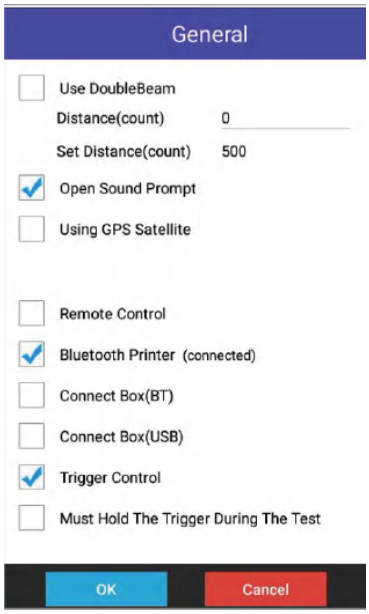
Click "Quit" to turn off the instrument.

Click "General Settings" to enter the general settings interface:









Picking up the DoubleBeam function means that the DoubleBeam detection function will be turned on. The built-in DoubleBeam™ technology can automatically sense whether there is a sample in front of the instrument, improving the safety and protection level of radiation. The sensing distance can be completed by setting the Count number of the distance. It is generally recommended to set it to 800count. Only when the number of photons received by DoubleBeam is greater than the set number, the ray tube is allowed to be turned on. Otherwise, even if the trigger is pulled, it will not work.

Select "Turn on sound prompt" to sound prompt the test time and grade matching and test end in different modes.

When the user purchases a Bluetooth printer, check "Bluetooth Printer" here to connect to the Bluetooth printer.

When the user selects "one-button trigger" to operate the instrument, the instrument starts testing by pulling the trigger, and the instrument stops testing by pulling the trigger again.

When the user selects "long press trigger" to operate the instrument, press and hold the trigger to start the test, and release the trigger to stop the test.

Chapter4 Sample Preparation

4.1.Sample preparation principles

In the daily sample measurement, the user receives various samples, and the preparation of these samples is particularly important. For different samples, users can choose to a rapid test without a prepare process of the sample, or they can choose to make a process of preparation sample for high-precision test needs. The following is an introduction to the corresponding sample preparation methods in different scenarios.

4.2.Rapid test

When the user simply needs to measure the presence or absence of an element, the sample can be measured directly (without the need for precise measurement data). Alternatively, the composition of the sample can be measured quickly and easily on site before deciding to take a sample. The following is a brief introduction to three application scenarios:

Direct testing to take data from the ore surface:

1.Select the location you want to measure and remove debris, vegetation and excess moisture from the surface of ore.
2.Select a position that is flush with the test window to measure, hold the instrument and start to test ore surface.
3.After the measurement, check the test window of instrument for contamination, otherwise it may affect the future analysis. If there is soil on the test window, pls wipe it with a soft cloth or paper.

Analyze the ore

1.Please take a short measurement every 15cm around the ore (about 15-30 seconds, if the content is very low, you can measure a little longer), the distance between the intervals depends on the consistency of the data you take each time.
2.A series of test result can tell you an approximate view of the elemental content in the ore along the depth direction.
3.If you average the test results, the results will show a rough average of the sample.

Analyze metals

1.Observe whether there is rust or other dirty objects on the surface of the metal to be measured, if so, please wipe it clean to avoid affecting the test results, if it has no impact on the measurement, it can be ignored.
2.Close the test window of the instrument to the metal to be measured and start the test. A few seconds are required to obtain an accurate value for common metals.

4.3.Accuracy measurement

When the sample received by the user may be in different shapes, but high-precision measurement data is required, rapid detection can no longer meet the user's measurement needs. Users need to process the sample before measurement to obtain more accurate data. Here are two simple sample preparation methods.

4.3.1. Prepare rough samples

1.Crush the sample with a hammer or pick a gravel-sized sample directly.
2.Place the sample in a polyethylene bag.
3.Take a few measurements. For example, at least 3 measurements should be made for a 15 cm * 30 cm bag. If the results are widely distributed, you will need to take several more measurements because the sample is not very homogeneous. And the more measurements you make, the more accurate the estimated data will be.
4.Average the test results.
5.If the average makes sense to you, send the sample to the lab for further analysis.
6.Because you are measuring the sample through a bag, the test results may differ from the results of the direct measurements. The results of this test depend on the element you want to analyze and the thickness of the plastic bag. Samples in bags can also be measured repeatedly, making the analysis results more accurate.

Warning! Always pay attention to radiation, never move the machine casually during the measurement process, point the measurement window elsewhere, and never point the instrument at yourself or anyone else during the detection process.

Note: It is not necessary to compare the results of the on-site handheld X-ray fluorometer with the results of the benchtop instrument in the laboratory. If comparisons are required, do the same for the samples before measurement. For more information, please refer to the requirements for off-site testing.

4.3.2.Preparation of sample cup samples

When the preparation of rough samples cannot meet the measurement needs of users, we need to carry out more rigorous processing of samples. Before testing, the material should be dry and homogeneous, and the following is an introduction to the production process for users.

4.3.2.1. Sample drying

If the sample is wet and clumpy, dry it first. Dry the sample in a drying oven at 150°C for approximately 2 hours until the sample no longer loses weight. (The drying method is not suitable for samples containing volatile components. For example, when lead appears in the form of tetra ethylene lead, it will volatilize when heated. Some forms of mercury and arsenic are also volatile and can be dried naturally in the air. better protect these volatile substances).

4.3.2.2. Sample crushing

In order to improve the measurement accuracy of the instrument when users want to measure irregular samples, such as ore samples, the samples need to be crushed, ground, and sieved first.
1.Place the sample into a mortar, and then mash the sample with a pestle. Crush the sample as much as possible to facilitate placement in the crusher. If the sample is large enough to fit into the crusher, skip this step.
2.Place the crushed sample into an electric crusher for further crushing to make the sample more uniform.

3.Use a 10-mesh or 20-mesh metal sieve to filter large samples (stones, organic matter, iron blocks, etc.). If there are large pieces of the sample, grind it again to ensure that the sample is better processed and more homogeneous. After filtering through 80 mesh and 100 mesh sieves, at least 10g of the sample must be obtained. Crush the material that did not pass again until all debris can be passed through and the finally mixed all the sample.

Warning! Crushing and sifting samples will produce dust. Even clean soil contains silica, which can be dangerous when airborne. Pls prepare all samples in a ventilated area, wearing a mask, gloves, apron, and a drop sheet.

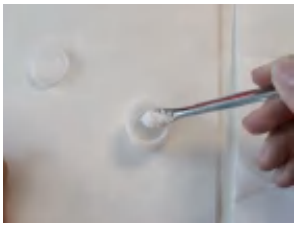
4.3.2.3. Making a sample cup

Our company is equipped with ready-made molded sample cups, which are simple, convenient and fast to operate. They can be used for metal heavy objects, liquid, slurry or powder samples. Customers can purchase them according to their needs when purchasing.

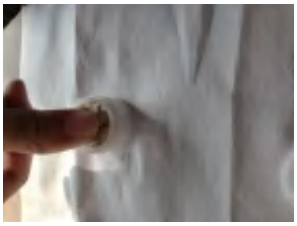
Solid samples

For solid samples, users only need to pour the solid sample into the sample cup, then compact it and fill the excess space with tissue.

Take out the sample cup and place it on clean dust-free paper



Place the sample into the sample cup and fill it to two-thirds of the cup



Compact the sample and fill the excess space in the sample cup with tissue

Fasten the sample cup lid with your hands

Sample production completed

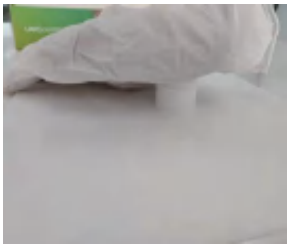
Liquid sample

For liquid samples, inject the liquid to be measured into the sample cup, preferably filling the entire sample cup (do not overflow the liquid to be measured).

Take out the sample cup and place it on clean dust-free paper

Use a dropper to draw about 5ml of the liquid to be tested

Inject the liquid to be measured into the sample cup



Cover the sample cup lid and press it gently with your palm. Then the sample cup is completed.

For mud samples, users can directly put the mud samples into the sample cup for on-site testing without any processing. If more accurate data is required, the mud sample needs to be dried, ground, and screened. The sample cup is then loaded in the same manner as a solid sample.

Chapter5 Daily Maintenance Guide

5.1.Battery and battery charging

Each HSM-S series instrument comes standard with 2 lithium-ion batteries. When fully charged, a single battery can continue to work for about 8 hours.

If you need to purchase batteries, please contact INSIZE. Our is not responsible for any damage to the instrument caused by the use of lithium-ion rechargeable batteries not officially provided by INSIZE.

Notice!

Before operating the instrument, make sure the battery has sufficient power!When not using the instrument for a long time, please take out the battery! When the instrument is not in use, please avoid direct sunlight on the instrument and batteries, and carefully place it in a waterproof box!

5.1.1.Replacing the battery

1.Hold the HSM-S series spectrometer firmly with your hands to prevent the instrument from falling and damaging the instrument.

2.Open the battery compartment at the bottom of the instrument, take out the old battery, insert the new battery into the battery c ompartment, and fasten the battery compartment.

5.1.2.Battery charging

1.It takes about 6 hours to fully charge the battery.

2.When the battery power is too low during work, please charge it in time.

3.Insert the battery into the smart charging stand to charge.

4.Insert the DC plug of the power adapter into the DC socket of the instrument, and then connect the 110~220V AC power supply**.** During the charging process, the green power indicator light of the instrument flashes. When the battery is fully charged, the green power signal light of the instrument is always on.

Notice!

Do not store batteries in direct sunlight!

When the battery is fully charged, please unplug the power plug to prevent overcharging and damaging the battery!

When using the spectrometer for battery charging, please do not perform material analysis to avoid affecting the test results!

5.2.Maintenance, cleaning and repair

To ensure instrument reliability, please keep the instrument clean, especially the test window at the front of the detector. If the Mylar film on the test window is dirty, please replace it with a clean Mylar film in time to avoid affecting your test data. If the surface of your instrument needs to be wiped, you can use the dust-free cloth provided by our company to wipe the instrument. If it is difficult to wipe, you can dip it in alcohol and then wipe it. Do not use detergents or solvents to clean the instrument!It is prohibited to put the instrument into water for cleaning!

If the test window is worn or damaged or contaminated by other metal particles, please contact INSIZE's after-sales service center to replace the test window with a new one in time.When your touch screen really needs to be cleaned, INSIZE recommends that you use the dust-free cloth provided by the company for cleaning. Do not clean your touch screen with water to prevent damage to the touch screen and instruments.

Notice!

Except for surface cleaning and replacement of the mylar film in front the test window test, all other services must be authorized by the INSIZE Service Center. Please do not repair the instrument yourself. We will not be responsible for the damage caused, and the warranty stated in the instrument contract The time limit will automatically expire!

5.3.Replace mylar film of test window

1.Remove the two Phillips head screws.

2.Remove the test window front panel.

3.Remove old test membrane.

4.Clean the back of the test window front panel and install the new test film.

5.Align the front panel of the test window with the screw holes on the front of the instrument and adjust the position carefully.

6.Carefully screw the Phillips screw into the screw hole. Do not overtighten the screw.

5.4. Handle samples safely

During instrument testing, never place any part of your body in front of the detection window. This is the safest way to handle it. If you encounter test samples that are irregular, too small, or have low density, it is recommended that you choose an instrument test stand to protect your own radiation safety.

Small sample :

Because the substance is too small, the sample cannot cover the test window and cannot block the entire main X-ray beam, which will result in a larger radiation dose in front of the test window.

Irregular samples:

Due to the complex shape of the sample, the entire main X-ray beam cannot be blocked, and it will also cause X-ray scattering.

Low-density samples:

The blocking of primary X-rays is much lower than other high-density materials, which results in higher scattered radiation doses.

5.5.Emergency handling

5.5.1.Minor damage/malfunction

If the appearance of the instrument is basically intact and there is no major damage,but there are local problems, such as display failure, power switch failure, power indicator light failure, or abnormal radiation lamp, etc., please follow the steps below:

1.Turn off the power and stop using the instrument. At this time, the instrument will no longer produce radiation and the next step of processing can be carried out safely.

2.Place the instrument in the configured safety box.

3.The person in charge or manager of the relevant instrument shall notify the INSIZE after-sales service center as soon as possible.

5.5.2.Severe damage

If the instrument is seriously damaged, please follow the steps below:

1.Follow the steps for minor injuries. Turn off the power and stop using the instrument to ensure that the instrument does not produce radiation.

2.Collect and install all scattered parts, put them together with the instrument into a safety box, and contact the INSIZE after-sales service center as soon as possible.

5.6. INSIZE After-Sales Service Center

CHINA
INSIZE CO., LTD.
Add: 80 Xiangyang Road, Suzhou New District, 215009 China
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台灣英示科技有限公司
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Tel: +07-3221787
Fax: +07-3221783
Email: kaohsiung@insize.com
Website: www.insize.tw

Chapter6 Safety Information

This chapter covers matters related to radiation safety and general safety standards when using HSM-S. Before you start testing with HSM+S, be sure to familiarize yourself with this chapter. In addition to reading the contents of this chapter, INSIZE recommends that you attend the customer instrument instruction manual training course held by our company.

Warning!
During instrument testing, do not point the instrument test window at yourself or others!

6.1.Radiation safety information

There are three basic principles of radiation protection, namely justification, optimization and individual dose limits. Radiation protection is divided into external radiation protection and internal radiation protection. The basic methods of external radiation protection include time protection, distance protection and shielding protection. Controlling these factors is key to maintaining the lowest radiation dose reasonably achievable.

Time

The most direct way to reduce radiation exposure is to reduce the time you spend working with X-rays or in the vicinity of radiation sources. If the time of exposure to radiation is reduced by half, the amount of radiation received is reduced by the same proportion.

Distance

Distance can effectively reduce the amount of radiation. When a worker's distance from a radiation source increases by a factor of 2, the amount of radiation received from the source decreases by a factor of 4. This is the inverse square law, which states that the intensity of radiation from a point source decreases as the square of the distance from the source.

Shield

Shielding materials can be applied to any material that reduces the intensity of radiation. Shielding materials achieve shielding effects by absorbing or attenuating radiation from a source.

6.2.HSM-S series radiation dosage

The maximum annual radiation dose of HSM-S is less than 2mSv. The maximum annual radiation dose was detected by INSIZE staff using a radiation receiver worn on the chest when producing the product. When you test samples, choose a test bracket or other protective measures under the following circumstances!

- •Plastic or low-density samples
- •Very thin samples, such as paper, oil, aqueous solution, etc.
- •Samples that cannot fully cover the test window

6.3.X-ray radiation indicator light

When the indicator light turns red, the micro-X-ray tube inside the spectrometer is turned on, and the X-ray beam radiates from the test window. When the X-ray radiation indicator light goes out, it means that the X-ray tube is closed and no radiation will be generated in the test window. When the X-ray radiation indicator light is on, do not point the test window of the instrument at yourself or others, and do not look at the test window with your eyes.

Appendix

Element X-ray energy table

Element	Number	weight	Kα	Kβ	Lα	Lβ	Ly	Le
Al	13	26.99	1.49					
Si	14	28.09	1.74	1.84				
P	15	30.97	2.02	2.14				
S	16	32.06	2.31	2.47				
Cl	17	35.45	2.62	2.82				
Ar	18	39.94	2.96	3.19				
K	19	39.1	3.31	3.59				
Ca	20	40.08	3.69	4.01	0.34	0.34		
Sc	21	44.96	4.09	4.46	0.4	0.4		
Ti	22	47.9	4.51	4.93	0.45	0.46		
V	23	60.94	4.95	5.43	0.51	0.52		
Cr	24	51.99	5.41	5.95	0.57	0.58		
Mn	25	54.94	5.9	6.49	0.64	0.65		
Fe	26	55.84	6.4	7.06	0.7	0.72		
Co	27	58.93	6.93	7.65	0.78	0.79		
Ni	28	58.7	7.47	8.27	0.85	0.87		
Cu	29	63.54	8.04	8.91	0.93	0.95		
Zn	30	65.38	8.63	9.57	1.01	1.03		
Ga	31	69.72	9.24	10.26	1.1	1.12		
Ge	32	72.5	9.88	10.98	1.19	1.22		
As	33	74.92	10.53	11.73	1.28	1.32		
Se	34	78.9	11.21	12.5	1.38	1.42		
Br	35	79.9	11.91	13.29	1.48	1.53		
Kr	36	83.8	12.63	14.12	1.59	1.64		
Rb	37	85.47	13.38	14.97	1.69	1.75		
Sr	38	87.82	14.14	15.85	1.81	1.87		
Y	39	88.91	14.93	16.75	1.92	2		
Zr	40	91.22	15.75	17.69	2.04	2.12	2.3	1.79
Nb	41	92.91	16.58	18.65	2.17	2.26	2.46	1.9
Mo	42	95.94	17.44	19.63	2.29	2.39	2.62	2.01
Tc	43	99	18.33	20.65	2.42	2.54	2.79	2.12
Ru	44	101	19.24	21.69	2.56	2.68	2.96	2.25
Rh	45	102.9	20.17	22.76	2.7	2.83	3.14	2.38
Pd	46	106.4	21.12	23.86	2.84	2.99	3.33	2.5
Ag	47	107.9	22.1	24.99	2.98	3.15	3.52	2.63
Cd	48	112.4	23.11	26.14	3.13	3.32	3.72	2.77
In	49	114.8	24.14	27.38	3.29	3.49	3.92	2.9

Element	Number	weight	Kα	Kβ	Lα	Lβ	Lγ	Le
Sn	50	118.6	25.19	28.6	3.44	3.67	4.13	3.04
Sb	51	121.7	26.27	29.85	3.61	3.84	4.35	3.19
Sb	51	121.7	26.27	29.85	3.61	3.84	4.35	3.19
Te	52	127.6	27.38	31.13	3.77	4.03	4.57	3.34
I	53	126.9	28.51	32.44	3.94	4.22	4.8	3.48
Xe	54	131.3	29.67	33.78	4.11	4.42	5.04	3.64
Cs	55	137.3	30.85	35.15	4.29	4.62	5.28	3.79
Ba	56	137.3	32.07	36.55	4.47	4.83	5.53	3.95
La	57	138.9	33.3	37.99	4.65	5.04	5.79	4.12
Ce	58	140.1	34.57	39.45	4.84	5.26	6.05	4.29
Pr	59	140.9	35.86	40.95	5.03	5.49	6.32	4.45
Nd	60	144.2	37.19	42.48	5.23	5.72	6.6	4.63
Pm	61	147	38.54	44.05	5.43	5.96	6.89	4.82
Sm	62	150.4	39.91	45.65	5.64	6.21	7.18	4.99
Eu	63	152	41.32	47.28	5.85	6.46	7.48	5.18
Gd	64	157.2	42.76	48.95	6.06	6.71	7.78	5.36
Tb	65	158.9	44.23	50.65	6.28	6.98	8.1	5.55
Dy	66	162.5	45.73	52.38	6.5	7.25	8.42	5.74
Ho	67	164.9	47.26	54.16	6.72	7.53	8.75	5.94
Er	68	167.2	48.82	55.96	6.95	7.81	9.09	6.15
Tm	69	168.9	50.41	57.81	7.18	8.1	9.42	6.34
Yb	70	173	52.04	59.69	7.41	8.4	9.78	6.54
Lu	71	175	53.59	61.61	7.65	8.71	10.14	6.75
Hf	72	178.4	55.38	63.56	7.9	9.02	10.51	6.96
Ta	73	180.9	57.11	65.56	8.15	9.34	10.81	7.17
W	74	183.8	58.86	67.59	8.4	9.67	11.28	7.39
Re	75	186.2	60.66	69.66	8.65	10.01	11.68	7.6
Os	76	190.2	62.48	71.78	8.91	10.35	12.09	7.82
Ir	77	192.2	64.35	73.93	9.17	10.71	12.51	8.04
Pt	78	195	66.25	76.13	9.44	11.07	12.94	8.27
Au	79	197	68.19	78.37	9.71	11.44	13.38	8.49
Hg	80	200.5	70.16	80.66	9.99	11.82	13.82	8.72
Tl	81	204.3	72.18	82.99	10.27	12.21	14.28	8.95
Pb	82	207.2	74.23	85.36	10.55	12.61	14.76	9.18
Bi	83	208.9	76.32	87.77	10.84	13.02	15.24	9.42
Po	84	209	78.46	90.24	11.13	13.44	15.74	9.66
At	85	210	80.64	92.75	11.42	13.87	16.25	
Rn	86	222	82.86	95.32	11.72	14.32	16.77	
Fr	87	223	82.12	97.93	12.03	14.77		
Ra	88	226	87.44	100.6	12.34	15.23	17.8	10.62
Ac	89	227	89.79	103.3	12.65	15.71	18.41	
Th	90	232	92.19	106.1	12.97	16.2	18.98	11.12
Pa	91	231	94.64	108.9	13.29	16.7	19.55	11.36
U	92	238	97.14	111.8	13.61	17.22	20.16	11.62

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