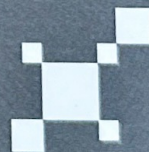


UNI-T®



UT568B

User Manual



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1. Overview

UT568B Acoustic Imager is used to detect and locate audible sound or ultrasonic sound source.

Defective high-voltage insulator can lead to partial discharge. Leaked high-voltage air pipeline causes high-speed air to spray out. Partial discharge and high-speed air stream result in the generation of sound and ultrasonic wave in the air. Acoustic imager is capable to detect sound and ultrasonic wave, thus locating the discharge and leakage.

Acoustic imager consists of microphone array, visible light camera, processor and display screen. Microphone array is a set of microphones laid out in a specific mode. Acoustic imager creates acoustic images by receiving sound signals from all microphones and obtaining images from the camera. Acoustic images of partial discharge and leakage are shown in Figure 1.

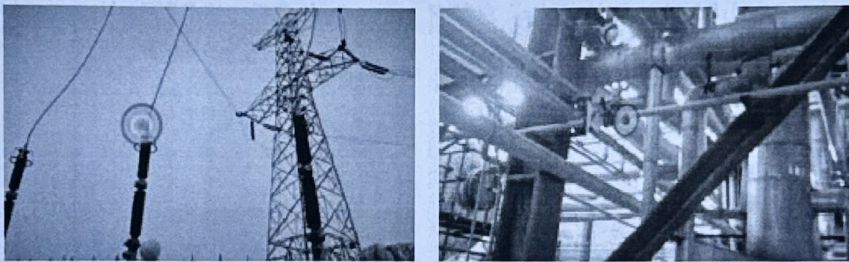


Figure 1: Ultrasonic imaging

Acoustic image is a composite image. According to the sound pressure levels at different locations, colors are superimposed on visible-light image translucently. The colors "red, yellow, green, blue, and purple" represent different sound pressure levels (from Red to Purple: Red is highest; Purple is Lowest). Generally, red area is the center of sound source.

Exact location of partial discharge and leakage can be identified by the use of acoustic image and video. Through the sound pressure level and other parameters, acoustic imager can estimate leakage rate, air pressure, temperature, geometric shape of crack, etc.

2. Getting Started

2.1 Features

UT568B Acoustic Imager is a multifunctional high-performance acoustic imager. It can be used to detect discharge, leakage, etc. The features of UT568B Acoustic Imager include:

- 138 high-sensitivity digital MEMS microphones
- 4.3-inch touch screen and navigation button
- Replaceable lithium battery
- Capable to detect partial discharge and leakage, identify discharge type automatically, and estimate leakage ratio and economic loss.
- Designed with USB Type-C interface, 3.5mm audio interface, and TF card interface.

UT568B Acoustic Imager can perform real-time imaging at a rate of 25 frames/s for steady or transient sound sources. It has multiple functions such as photo/image taking, text/voice annotation, etc.

UT568B Acoustic Imager has abundant configurable parameters to define its behaviors and functions, thus offering best user experience. Configurable parameters mainly include imaging frequency, operating modes, locating modes, dynamic range, etc.

UT568B Acoustic Imager is equipped with PC software for data processing and report generation. The pictures and videos stored in the imager can be exported to PC via card reader. Massive test reports (.docx format) can be generated via PC software.

Acoustic imager consists of microphone array, camera, touch screen, buttons, laser ranger, fill light, etc. As shown in Figure 2 & Table 1 below.

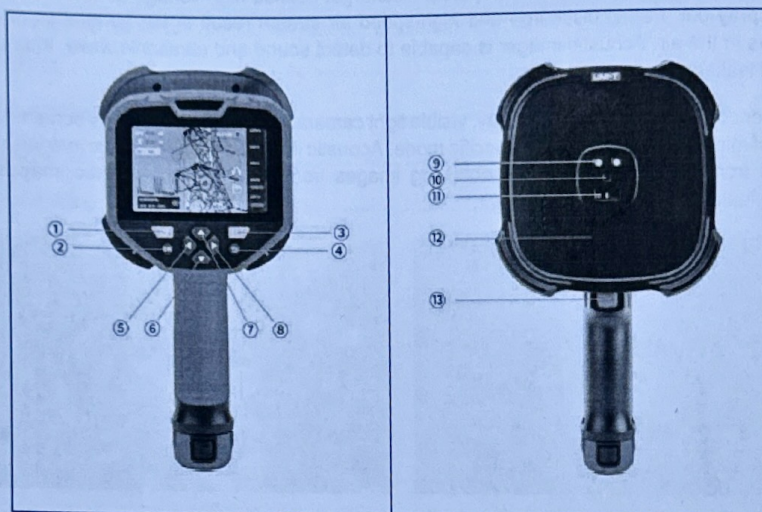


Figure 2: Components

Table 1: Descriptions of components

Components	Functions	Components	Functions
1	Power on/off	8	Rightwards
2	OK	9	Fill light
3	Browse	10	Camera
4	Return	11	Laser ranging
5	Leftwards	12	Microphone array
6	Downwards	13	Trigger
7	Upwards		

2.2 Power on/off

Power on: Hold down the power button, then release it after the buzzer sounds.

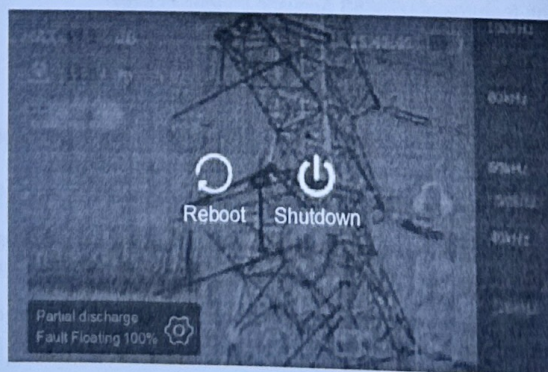


Figure 3: Power off

Power off: Hold down the power button, tap "Restart" or "Power Off" to restart or power off the imager, or tap other area to cancel shutdown. As shown in Figure 3.

2.3 Charging

Charge the battery via USB Type-C connector.

Allowable chargers: The supplied charger or any smartphone or laptop charger supporting USB PD 3.0 or earlier.

The battery power indicator flashes when battery is charged and lights off when fully charged.

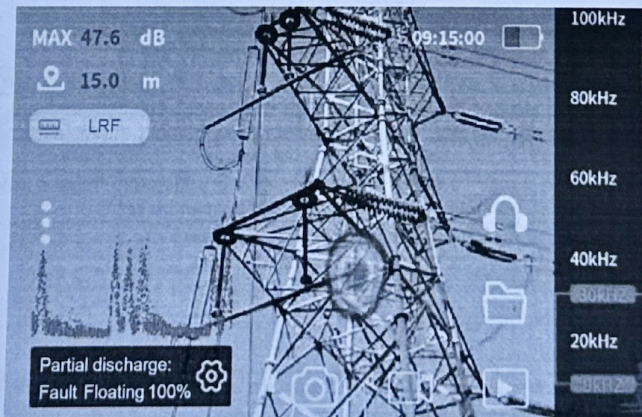
Short press the button at the battery to read current battery power.



Figure 4: Battery charging

2.4 Main interface

The main user interface is shown in Figure 5 below. The main interface shows acoustic video, sounds, signal power spectrum, PRPD pattern, leakage, and other details.



1	Maximum SPL	9	Sound playing
2	Distance	10	Storage directory
3	Laser ranging	11	Upper/Lower frequency band
4	PRPD pattern	12	Photo
5	Discharge type	13	Video
6	Time	14	Browse

7	Battery level	15	Main setting menu
8	Power spectrum		

Figure 5: Main interface

Press corresponding buttons in main interface to take photo/video, browse data, perform storage directory setting, frequency band setting, pop-up menu setting, etc.

Main buttons and controls and their functions are listed in Table 2.

Table 2: Buttons and controls on main interface

Component	Button/Control	Function
1	Maximum SPL	Displaying the maximum SPL at the imaging area.
2	Distance	Displaying current distance setting. The distance is the result of laser ranging. Tap to perform manual setting.
3	Laser ranging	Enable the laser ranging function. Tap again to disable this function.
4	PRPD pattern	Displaying PRPD pattern in real time. PRPD pattern is not displayed if setting the operating mode to "Leakage".
5	Discharge type	Displaying discharge types including corona discharge, discharge along dielectric surface, and discharge in the air. Estimated leakage rate is displayed when setting the operating mode to "Leakage".
6	Time	Displaying current time.
7	Battery level	Displaying current battery power.
8	Power spectrum	Displaying power spectrum of a sound in real time.
9	Real-time sound playing	Real-time sound monitoring. The signal (0~100kHz) of the sound monitored is compressed to an audible frequency band. The characteristic of the sound in ultrasonic frequency band can be monitored via earphones.
10	Storage directory	Displaying the storage directory of images and videos. Tap to perform such operations as create, rename, delete, clear, etc.
11	Upper/Lower frequency band	Select upper/lower frequency band.
12	Photo	Saving photo: Tap to take an acoustic image.
13	Video	Saving video: Tap to take an acoustic video.
14	Browse	Open the data management interface to browse acoustic image and video.
15	Main setting menu	In setting interface, operating modes, locating modes, supporting functions can be set.

2.5 Buttons

Buttons are shown in Figure 6, and the functions of buttons in different interfaces are shown in Table 3.



Figure 6: Buttons

1	Power on/off	5	Leftwards
2	OK	6	Downwards
3	Browse	7	Upwards
4	Return	8	Rightwards

Table 3: Functions of buttons

Interface/Status	Power off	Main interface	Setting menu	Data management	Data detail
Power supply	Press 1s to power on	Press 1s to pop up power-off confirmation			
OK		Pop up setting menu	Switch main menu	Enter data detail	Play video
Browse		Pop up data management interface	Pop up data management interface	Enter data detail	Play video
Return		/	Back to main interface	Back to main interface	Back to data management
Upwards		Frequency band moves up	Enter next menu	Switch the selected one	Previous data
Downwards		Frequency band moves down	Back to previous menu	Switch the selected one	Next data
Leftwards		Frequency band scales down	Switch parameters	Switch the selected one	Previous data
Rightwards		Frequency band scales up	Switch parameters	Switch the selected one	Next data
Trigger		Short press to take photo and long press to take video	/	/	/

2.6 Setting menu

The setting interface is shown in Figure 7 below. In main page, tap the main setting menu button “” or “OK” button to enter the setting menu page.

When the setting menu is enabled, tap "OK" button to switch the selected main menu option, or tap the left menu option to switch the selected main menu option. Tap the blank area on top menu or tap "Return" button to return to main interface from the setting menu. Main menu option includes locating mode, imaging area, dynamic range, supporting tool, and system setting.

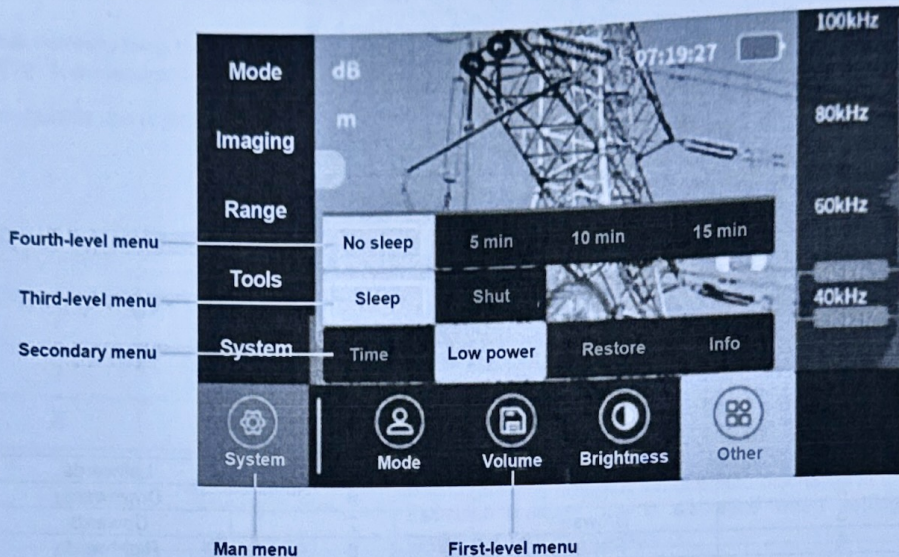


Figure 7: Setting menu

Tap the main menu option to display the corresponding tier-1 submenu on the bottom screen, tap the tier-1 menu option to display the corresponding tier-2 submenu on top tier-1 submenu, etc. Press main menu, tier-1 submenu, tier-2 submenu, tier-3 submenu and tier-4 submenu to set multiple parameters.

The setting option can be set on the touch screen directly. Switching, setting value modification and other operations can be performed by pressing Upwards, Downwards, Leftwards, Rightwards, OK, and Return buttons.

The main menu option setting and the setting contents of submenu are listed in Table 4 below.

Table 4: Setting the functions of main menu

Main menu	The setting functions of submenu
Locating modes	Locating modes: Single sound source; multiple sound sources; holographic.
Imaging area	Setting the imaging area to full-screen mode or focusing mode.
Dynamic range	Setting the dynamic range of facula.
Supporting tools	SPL measurement, fill light, Bluetooth, AP
System setting	Operating modes, volume, brightness, time, low power consumption, system information, restoring factory setting.

2.7 Taking acoustic image

Take acoustic images according to the following steps:

- Rub fingers to make a slight sound before the imager, then an acoustic image is shown on the display screen.
- Continue to rub fingers before the imager, then tap the "Photo" button on the display screen or short press the trigger to save the acoustic image.
- In the dialog box of saving acoustic image (as shown in Figure 8), tap the "Save" button to save the captured acoustic image. Image name can be changed and annotation can be added at the dialog box. Tap the "Save" or "Return" button at the dialog box to return to the main interface. In the saving interface, sound recording,

sound playing, and voice annotation deletion can be performed by pressing "Record", "Play", and "Delete" buttons.

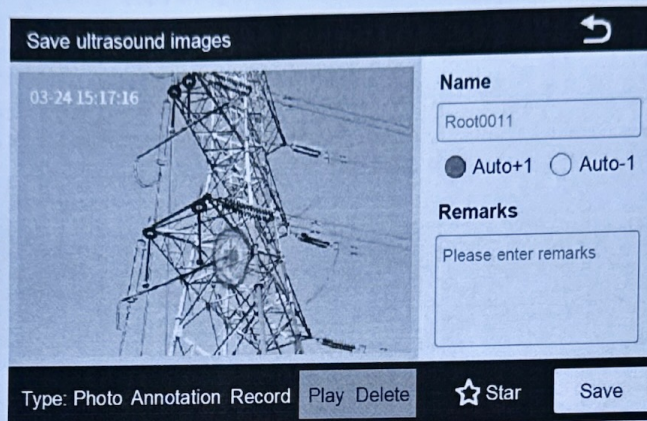


Figure 8: Data saving

Note: For testing the location accuracy, please simulate a sound source by using a device which makes sounds over a small area, i.e., lighter.

2.8 Taking acoustic video

Take acoustic video according to the following steps:

- Continue to rub fingers before images, tap "Taking Video" button or long press the trigger to start taking video, and tap "Taking Video" button again or release the trigger to stop taking video.
- Tap the "Save" button at the pop-up dialog box to save acoustic video. Modifying video name, adding remark, adding voice annotation can be performed at the dialog box.

2.9 Browsing images and videos

Tap the "Browse" button in main interface to open the "Data Management" interface, as shown in Figure 9.

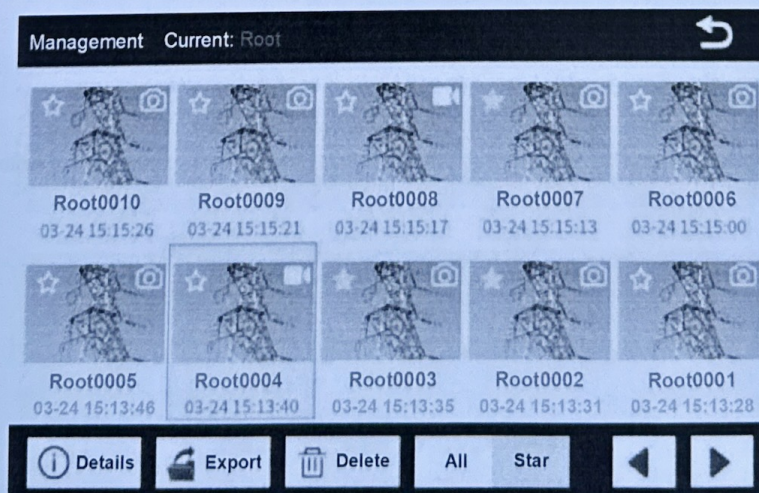


Figure 9: "Data Management" interface

In "Data Management" interface, all images and videos are listed on the current directory. The images and videos saved can be viewed and operated.

Long press to enter multiple-selection mode. In multiple-selection mode, multiple items can be selected for deletion or multiple data can be selected for data export.

Select the data and tap the detail to enter the "Data Detail" page. In Data Detail page, viewing power spectrum, playing video, viewing and modifying annotation, and other operations can be performed, as shown in Figure 10.

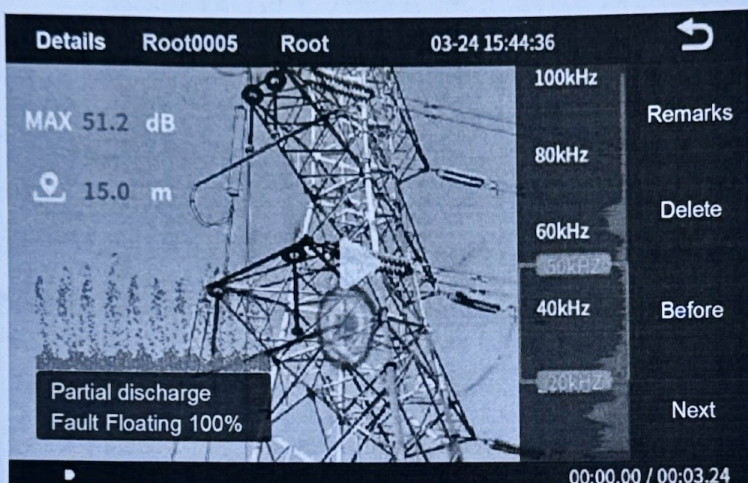


Figure 10: Detailed data

In "Data Detail" page, tap the "Remark" button to view data name and remark, tap the "Delete" button to delete current data, or tap the "Previous" and "Next" buttons to switch data. Tap the "Return" button to return to the main interface.

3. Operating Instructions

3.1 Operating modes

Tap the main setting menu button "⚙" to enter the setting menu, then switch to the submenu of system setting, as shown in Figure 11.

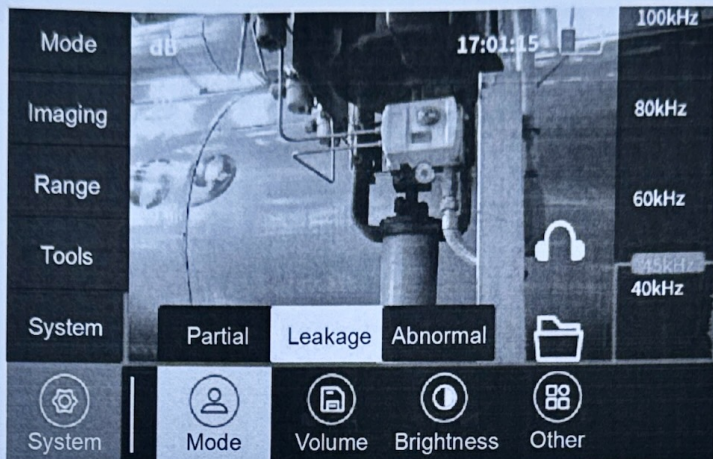


Figure 11: "Configuration" interface

Tap the "Modes" setting option to select operating modes (including "Partial Discharge Mode", "Leakage Mode", and "Abnormal Sound Mode"). The differences of the three operating modes are listed in Table 5.

Table 5: Comparison of operating modes

Mode	Interface behavior	Frequency range	Frequency band (Recommended)
Partial discharge mode	Displaying PRPD pattern and discharge types	2k~100kHz	30~50kHz
Leakage mode	Displaying estimated leakage rate and economic loss	2k~100kHz	15~40kHz
Abnormal sound mode	Hide PRPD pattern and estimated leakage rate	2k~60kHz	15~30kHz

In partial discharge mode, PRPD pattern and discharge type are displayed on the bottom left corner of the main interface, as shown in Figure 12.

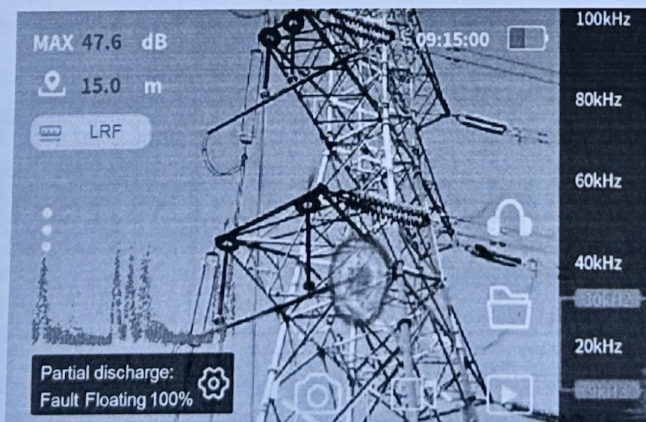


Figure 12: Partial discharge mode

In leakage mode, estimated leakage rate and economic loss are displayed on the bottom left corner of the main interface, as shown in Figure 13.

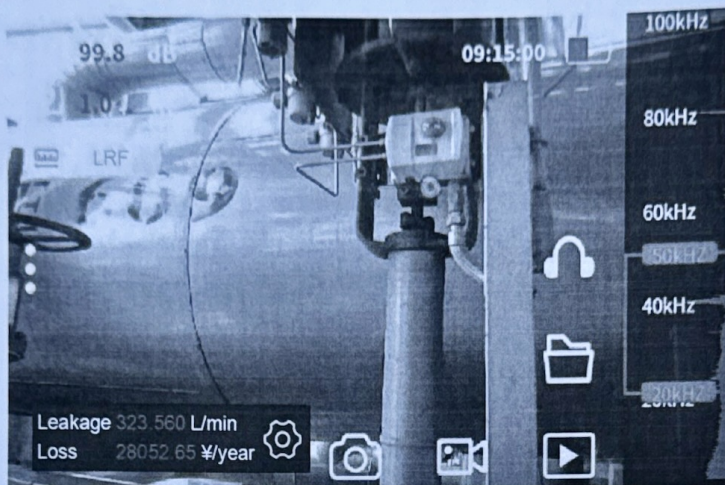
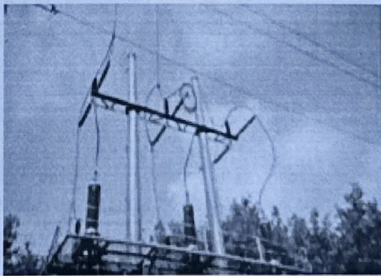


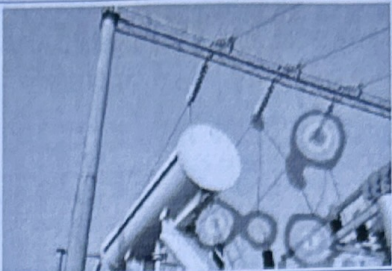
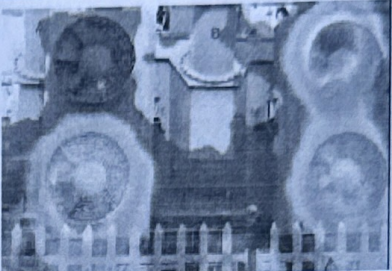
Figure 13: Leakage mode

3.2 Acoustic imaging modes

The imager receives acoustic signals from microphones and obtains images from visible-light camera, then calculates the distribution of sound pressure level. Different colors are superimposed on the visible-light images translucently. The sound pressure level at different locations are represented by colors. Single sound source, multiple sound source, and holography modes can be selected. The mode differences are listed on Table 6.

Table 6: Acoustic imaging

Mode	Function	Example
Single sound source	Displaying the sound source of maximum sound pressure level only.	

Multiple sound sources	Displaying multiple sound sources of relatively high sound pressure level.	
Holographic	Displaying all sound sources with sound pressure level higher than the threshold.	

If the SINR is relatively high, please select "Single sound source" or "Multiple sound sources" mode. In noisy environments or in a weak signal state, please select "Holographic" mode.

3.3 Frequency band configuration

The imager performs band-pass filtering on sound signals of all channels, so as to remove the signal components outside frequency band, then calculates the distribution of sound pressure level. The curve of real-time power spectrum of sound signal is displayed on the main interface. The acoustic imaging frequency can be set by sliding the cursor of upper and lower frequency band at the curve of real-time power spectrum.

In main interface, press the upwards or downwards button to move up/down the imaging frequency; press the leftwards or rightwards button to scale up/down the imaging frequency.

3.4 Setting acoustic imaging area

Tap "Imaging Area" menu option on the main menu to switch the area setting of acoustic imaging. When setting "Imaging Area" to "Focus", the imager only calculates the result of acoustic image on the round area displayed on main interface. When setting "Area Selecting" to "Full Screen", the imager calculates the result of acoustic imaging of all locations within the angle of view of the camera. When setting to "Focus", the effect of the sound outside the round area on the imaging inside the round area will be reduced, thus improving the possibility of detecting small signal to some extent.

3.5 Selecting data storage directory

Tap the storage directory button in main interface, then select a folder to store acoustic image and video in the pop-up dialog box.

The "Directory Listing" dialog box is shown in Figure 14 below.

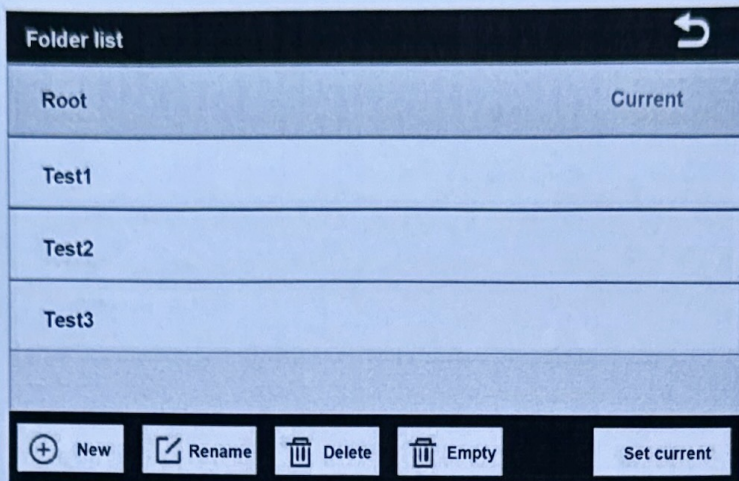


Figure 14: "Directory Listing" dialog box

Tap to select a folder for storing image and video, then tap the "Set as current directory" button and close the dialog box. Tap the "Create", "Delete" or "Rename" button to create a new folder, delete the selected folder or rename the selected folder. Tap the "Clear" button to delete all data of the selected directory.

Note: Space or other special characters are not allowed in the folder name.

3.6 Taking image and video

Tap the "Photo" button in main interface or short press the trigger to hold the current acoustic images and pop up a dialog box to save images.

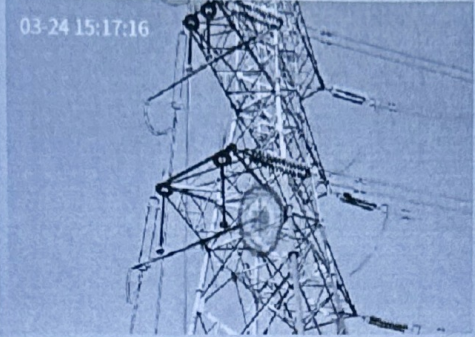
Press the "Taking video" button to start taking acoustic video, press again to stop taking video and save the video in the pop-up dialog box. (or long press the trigger for >1s to start taking video and release to stop).

The pop-up dialog box of saving image or video is shown in Figure 15. Tap the "Name" and "Remark" controls to edit the name and remark of the data respectively.

In the dialog box of saving image or video, sound recording, sound playing and voice annotation deletion can be performed. Tap the "Record" button to start recording voice annotation until the "Stop" button is tapped. Tap the "Play" or "Delete" button to play or delete the voice annotation.

Save ultrasound images

03-24 15:17:16



Name

Root0011

☒ Auto+1
 ☐ Auto-1

Remarks

Please enter remarks

Type: Photo Annotation Record

Play Delete

☆ Star

Save

Figure 15: "Saving image and video" dialog box

For key data, please tap the "Favorite" control to set the favorite label. In "Data Management" interface, the data can be filtered to display the data with favorite label, for further analysis and processing on the key data.

3.7 SPL measurement

In main interface, the maximum SPL control and the center SPL control respectively show the maximum sound pressure level and the sound pressure level of center mark within the angle of view of imaging.

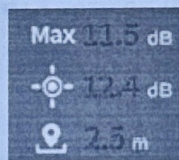


Figure 16: "Maximum SPL" and "SPL of center mark"

If the sound pressure level of the center mark is not displayed on the main interface, you can select opening or closing SPL measurement in "Supporting tools" menu in the setting interface, as shown in Figure 17 below.

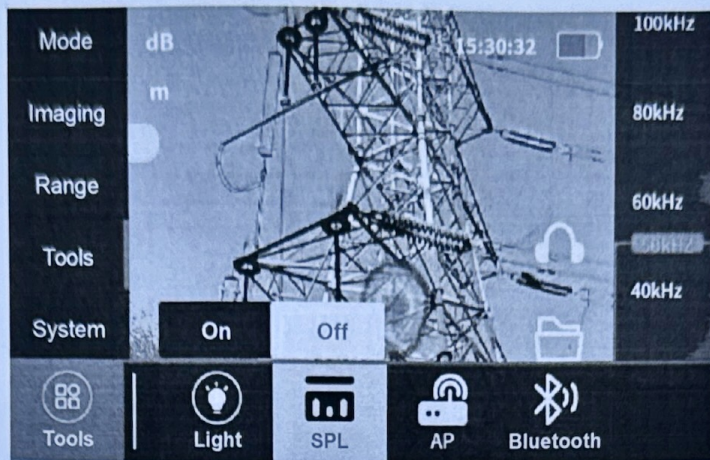


Figure 17: SPL measurement

3.8 PRPD parameters setting

In partial discharge mode, tap the parameters setting button in main interface, as shown in Figure 18.

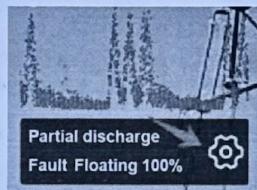


Figure 18: PRPD parameters setting button

The PRPD parameters setting interface pops up, then you can set displaying PRPD pattern and power signal frequency, as shown in Figure 19 below.

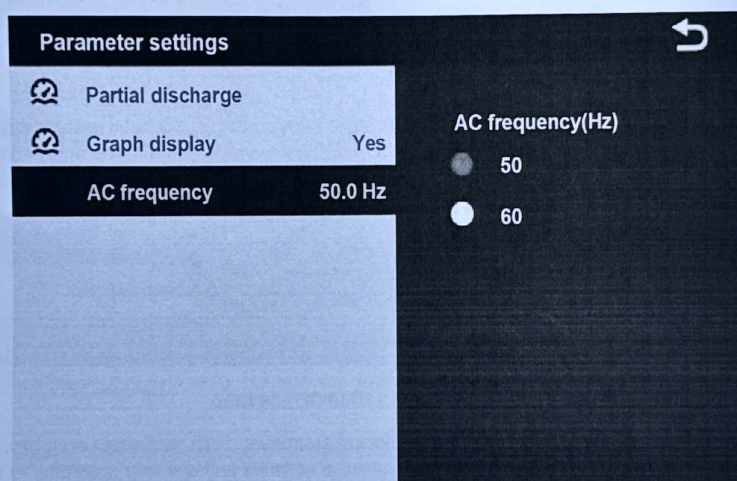
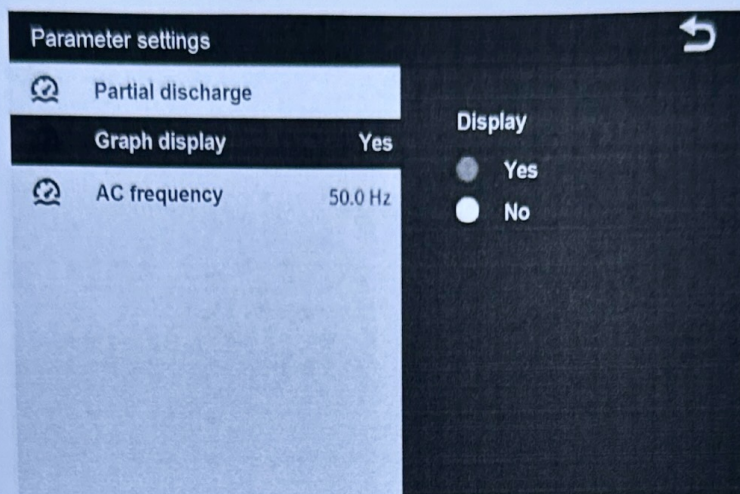


Figure 19: PRPD parameters setting

In PRPD parameters setting interface, tap "Partial discharge detected" to display the specific characteristics of current partial discharge. As shown in Figure 20 below.

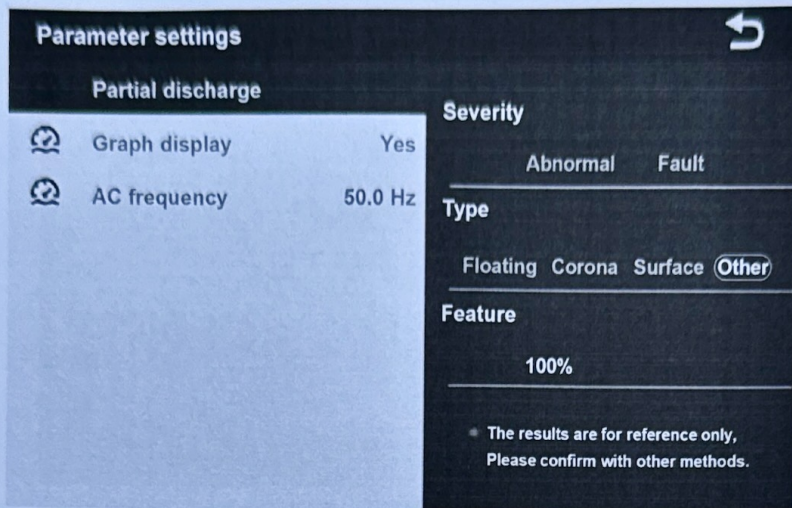


Figure 20: Characteristic of partial discharge

3.9 Leakage parameters setting

In leakage mode, tap the leakage parameters setting button. As shown in Figure 21 below.

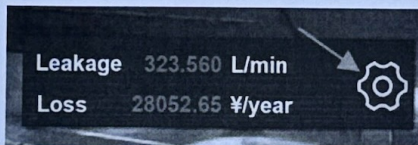


Figure 21: Leakage parameters setting

The leakage parameters setting interface includes multiple parameters, such as system pressure, gas type, gas price, electricity price, etc. These parameters are used to estimate leakage rate according to the sound pressure level, thereby calculating the economic loss incurred by leakage.

In the system pressure setting interface, the gas pressure (unit: MPa or bar) of high-pressure gas pipeline or tank can be set. As shown in Figure 22 below.

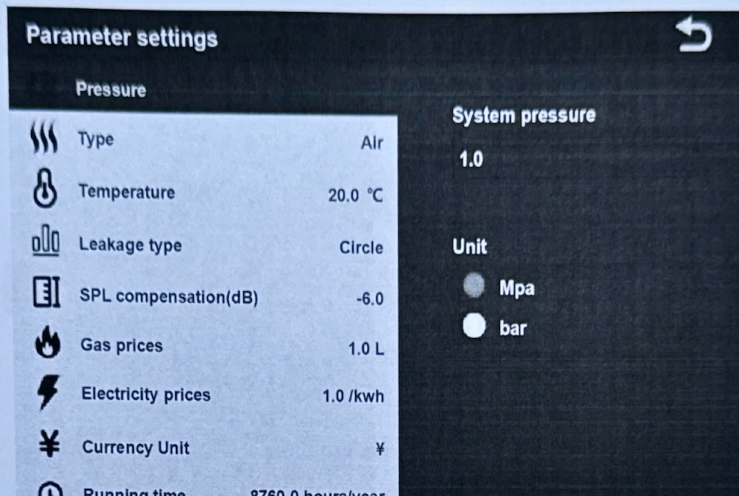


Figure 22: System pressure setting

In the gas types setting interface, air, hydrogen, carbon dioxide, methane, and other gas types can be selected. If the actual gas type is not listed, please select "Others" and then input the molecular mass and heat capacity ratio of the actual gas type. As shown in the Figure 23 below.

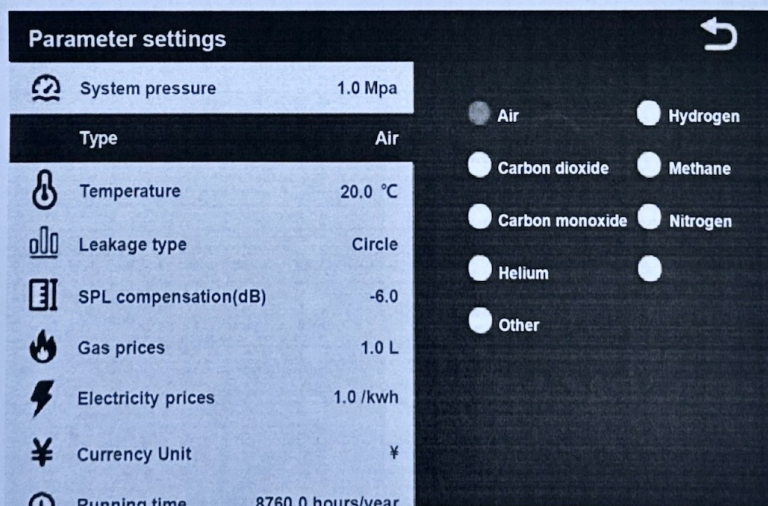


Figure 23: Gas types setting

In the gas temperature setting interface, Celsius degree and Fahrenheit degree can be set. As shown in Figure 24 below.

Parameter settings	
System pressure	1.0 Mpa
Type	Air
Temperature	20.0 °C
Leakage type	Circle
SPL compensation(dB)	-6.0
Gas prices	1.0 L
Electricity prices	1.0 /kwh
Currency Unit	¥
Running time	8760.0 hours/year

Temperature
 20.0
Unit
☒ °C
☐ °F

Figure 24: Gas temperature setting

In the leakage point types setting interface, round hole, fast connector, gap, and threaded connector can be selected, as shown in Figure 25 below. Different types correspond to different correction factors of aperture sizes, which slightly affects the estimation of leakage. Round hole is selected as the test type typically. If the type is selected as "User-defined", please input the customized correction factor of aperture size. Under same sound pressure level, the higher the correction coefficient, the higher the estimated leakage rate obtained. The range of correction coefficient is 0~1.0 (0.5~0.9 typically).

Parameter settings	
System pressure	1.0 Mpa
Type	Air
Temperature	20.0 °C
Leakage type	Circle
SPL compensation(dB)	-6.0
Gas prices	1.0 L
Electricity prices	1.0 /kwh
Currency Unit	¥
Running time	8760.0 hours/year

☒ Circle
☐ Connectors
☐ Crack
☐ Threaded joints
☐ Customize

Figure 25: Leakage point types setting

In the SPL compensation setting interface, the difference between the SPL of measured equipment and the SPL of leakage estimation model can be compensated, as shown in Figure 26 below. The SPL of measured equipment and the SPL compensation setting are used as the input of SPL of leakage estimation model. The higher the set compensation value of SPL, the higher the estimated leakage rate.

Parameter settings

System pressure

1.0 Mpa

Type

Air

Temperature

20.0 °C

Leakage type

Circle

SPL compensation(dB)

-6.0

SPL compensation(dB)

Gas prices

1.0 L

Electricity prices

1.0 /kwh

Currency Unit

¥

Running time

8760.0 hours/year

Figure 26: SPL compensation setting

Gas price, electricity price, currency unit, and operating time are used to calculate the annual economic loss incurred by leakage. The specific power of compressor is used to set the electric energy consumed by gas volume generated by compressor in unit time. The unit of specific power of compressor is kW/(100L/min) or kW/CF (1CFM=28.3168L/min). As shown in Figure 27 below.

Parameter settings

Type

Air

Temperature

20.0 °C

Leakage type

Circle

SPL compensation(dB)

-6.0

Gas prices

1.0 L

Electricity prices

1.0 /kwh

Currency Unit

¥

Running time

8760.0 hours/year

Power ratio

0.01

Unit

☒ kW/(100L/min)

☐ kW/CFM

Power ratio

0.01 kW(100L/min)

Figure 27: Setting specific power of compressor

4. Specifications

Function	Acoustic imaging	Application field	Partial discharge detection	Description
			Air leakage detection	
Number of microphones	138			
Microphone type	High-sensitivity digital MEMS microphone			

Microphone array	Spiral
Size of array plane	About 150mm
Microphone sensitivity	-26dBFS@1kHz
SPL for imaging	Lower limit<20dB; Upper limit>120dB
SINR	64dB@1kHz
Imaging frequency	2kHz~100kHz
Locating distance	0.3~150m
Frame rate of imaging	25FPS
Size of display screen	4.3-inch color display with capacitive touch screen
Angle of view of camera	60° (H)*40° (V)
Pixel of camera	13-megapixel
Port	Type-C, TF card, earphone
Temperature range	-20°C~50°C
Drop proof	1m
Minimum detectable leakage rate	0.15ml/s (0.5m, 0.5MPa); 0.2ml/s (1m, 0.5MPa)
Sound sampling rate	200ks/s
Focal length of lens	3.4mm
Discharge type detection	Detecting corona discharge, discharge along dielectric surface, discharge in the air, etc.
Display modes	Single sound source; multiple sound sources; holographic (sound field distribution)
Photo/Video taking and viewing	√
Wireless connection	Supports Wi-Fi and Bluetooth
Communication port	Supports USB data transmission and report exporting
Annotation function	Text and voice annotations
Data storage format	.jpg (picture); .wav (sound recording); .mp4 (video)
Memory	128GB (TF card)
Laser ranging	30m
Audio output interface	3.5m
Ultrasonic monitor	Reducing ultrasonic frequency and monitoring via earphones
Focusing function	The nephogram of acoustic image is focused on a small area to reduce interference from other noise nephograms.
Dynamic range adjustment	Adjusting the size of nephogram so as to detect small leakage.
File management function	Supports creating/deleting/switching target folder.
Report analysis software	Offline PC software creates reports automatically; Exporting and importing data automatically; Viewing time-domain waveform, spectrogram, and PRPD pattern.
Language	English
Weight	1.35kg
Dimension	163×286×140mm

5. Packing list

Item	Quantity
Acoustic imager	1
Charging adapter (Type-C)	1
Type-C charging cable	1
128G TF card (Installed)	1
SD card reader	1
Earphone	1
Rechargeable lithium battery (UT-M23)	2
Quick start guide	1
User manual	1