SONAVU +

BRING RELIABILITY INTO **FOCUS**

USER MANUAL

VERSION 1.0.0

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Contents

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I Overview

The SonaVu+ is a portable ultrasonic camera equipped with 112 digital MEMS microphones and a high-speed FPGA-based processor. The SonaVu+ is designed to detect and visually display the location and severity of gas and air leaks or partial electrical discharges in industrial environments. The results are visually represented on a 5-inch LCD touchscreen integrated into the product, allowing users to quickly and easily identify the root cause of issues. The SonaVu+ also offers external connection ports for uploading measurement files and performing firmware updates. Users can upload measurement files to a PC or the cloud for data analysis and management.

II Product Configuration

The SonaVu+ product consists of the following.

No.	Model Name	Description	Quantity
1	Hard Case	Portable Protective Case	1
2	Ultrasonic Acoustic Camera Body	SonaVu+	1
3	supplementary battery	Portable Power Bank	1
4	Power Adapter	charging adapter	3
5	Power Adapter Accessories	Country-specific adapter accessories	4
6	USB-C Cable	Charging and data transfer cable	2
7	Neck strap	Neck Strap for Ultrasonic Acoustic Camera Connection	1
8	Manual	User's Guide	1

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III Hardware Features and Configuration

SonaVu+ hardware function and configuration are as follows.

No.	Model Name	Description	Qty
1	MEMS Microphones	Ultrasonic Acoustic Measurement Sensor	112
2	Camera	Video acquisition camera	1
3	a distance sensor	Distance measurement sensor	1
4	dual light	LED light	2
5	5" LCD display	5" Touch Display	1
6	Power button	Power on/off the product	1
7	Measurement button	Save measurement image photos/video	1
8	Status LED	Power/Charge Status Display	2
9	Ambient Light Sensor	Auto-adjust display brightness	1
10	1/4" Mount	For tripod mounts	1
11	USB-C Port	Power Charge/Data Backup Power	1
12	Audio Jack	3.5mm Audio Jack for Audio Listening	1
13	HDMI Port	For external monitor output	1

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IV External device connection and buttons

A terminal is provided to connect SonaVu+ external devices

IV.I Description of Connection Ports

- USB-C Port: Used for charging the product or transmitting measurement data. Use the cable and adapter provided by the manufacturer for charging and data transfer.
- Audio Output: Connect headphones to the audio output port of SonaVu+ to listen to ultrasonic signals. Audio output is provided only in ultrasonic measurement mode.
- HDMI Output: Connect SonaVu+ to a monitor using an HDMI connector to display the captured screen or stored images on the monitor.

IV.II Product Power/Charging Status LED

Charging starts when the USB-C power cable is connected, and the power (left) and charging (right) status LEDs are displayed in the upper left corner of the rear display as shown below.

IV.III Power/Capture Button Usage

The left button on the SonaVu+ display is the power button, and the right button is the capture button. Press and hold the power button for more than 2 seconds to turn the product ON/OFF. Press the capture button once to save a photo (JPG), and press and hold for more than 2 seconds to start/stop video (MP4) recording. While recording video, pressing the capture button briefly will save both video and photo simultaneously.

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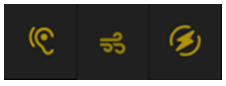
V User Interface

V.I Main Screen

No.	Feature	Description
1	Quick Settings	1. Choose from single-source mode, multi-source mode, or full-view mode  • Single source: only one of the largest sources (signals) in the camera's field of view • Multi-Source: Display up to 3 sources (signals) within the camera's field of view • Full View: Display the distribution of all measurable sources (signals) in the camera angle of view as a bloom (e.g., image range: 0, display reference: 0) 2. Light LED control: Front auxiliary light on/off  3. Set the measurement mode, leak mode, pd mode  4. Settings screen (refer to pages 6 and 7)

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2	Measurement information	Maximum beam power level (dB) and measurement distance display 4m within the measurement distance (dB)
3	Frequency Analysis	Display the frequency analysis results of the source (signal) and set the measurement frequency band
4	Battery status	Battery level indicator
5	Current time	Display current time (year, month, day, hour, minute)
6	Screen scaling	Display the current magnification information for the optical camera
7	Gallery	Gallery entry button for measurement result confirmation

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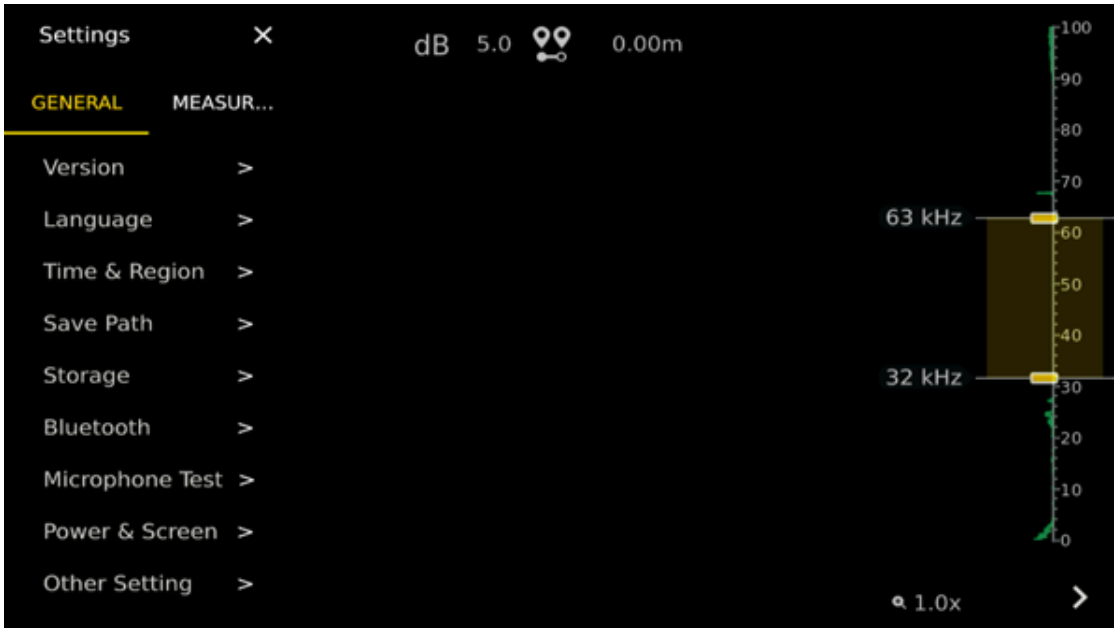
V.II Setting Screen (General)



No.	Feature	Description
1	Version	Displaying Software Versions and Product Information
2	Language	Set language usage language settings
3	Time & Region	Country and Time Zone settings
4	Save Path	Creating and setting folders for storing measurement data
5	Storage	Display file storage space information
6	Bluetooth	SonaVu+ App connection and Bluetooth earphone setup
6	Microphone Test	Full Microphone Normal Operation Test
7	Power & Screen	Power management and sleep settings
8	Other Settings	Display overlay settings and Device Reset

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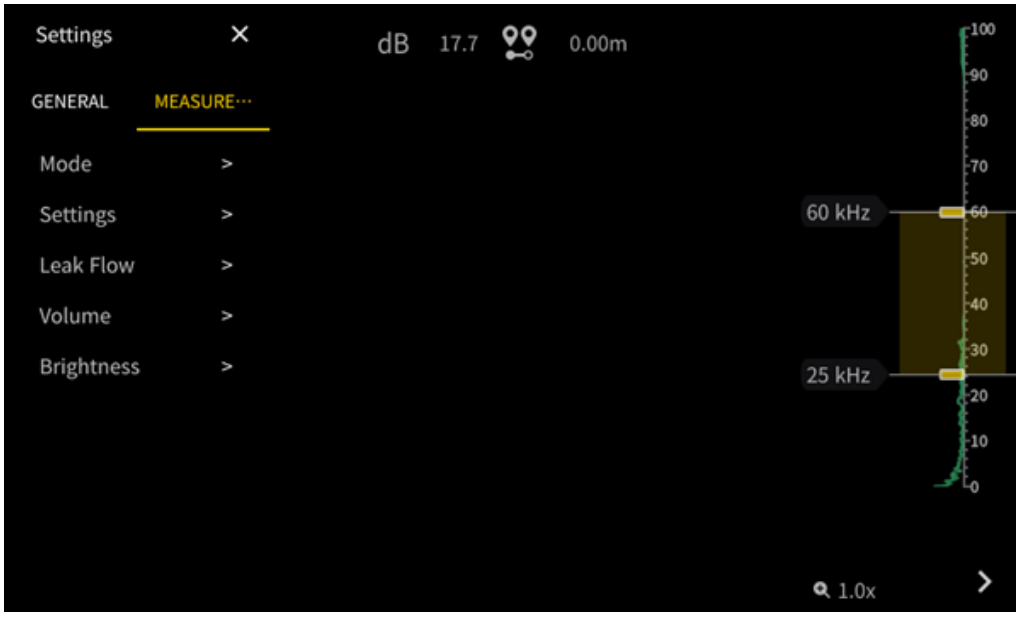
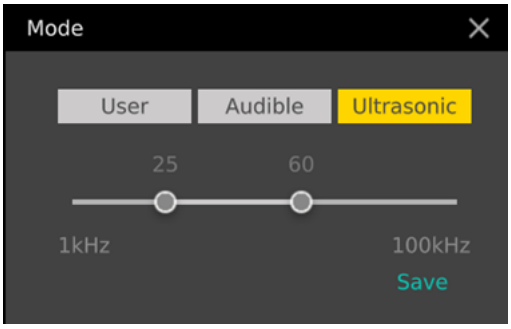
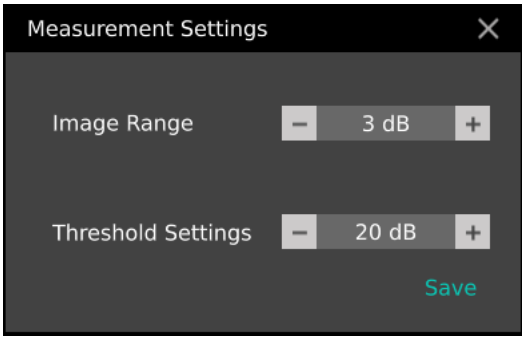
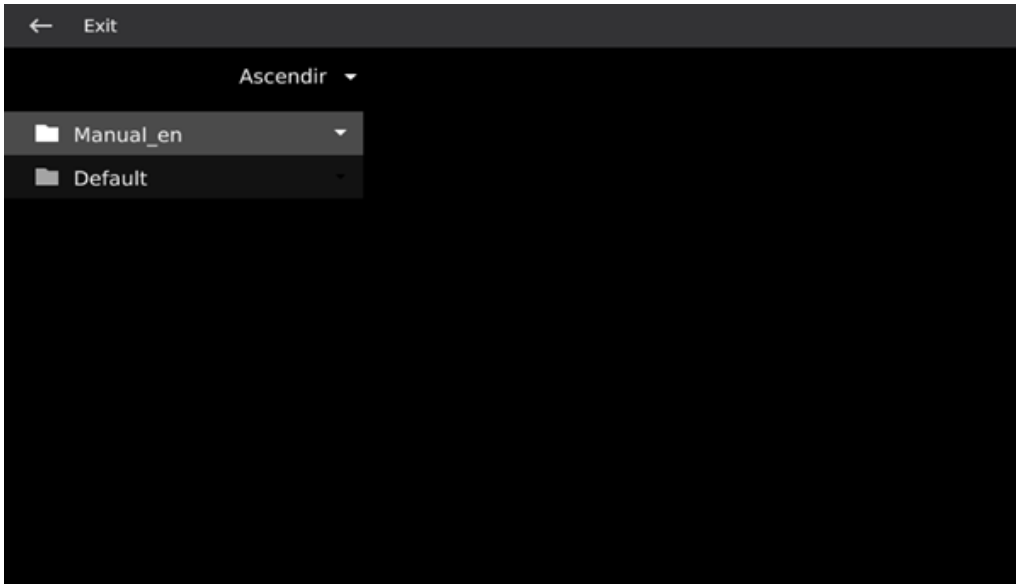
V.III Setting Screen (Measurement)



No.	Feature	Description
1	Mode	Measurement frequency band setting (user, audible, ultrasonic) 
2	Setting	Detailed Heatmap Display Settings (Image Range, Set Display Threshold) 
4	Volume	System Volume Settings
5	Screen brightness	Set screen brightness automatically and manually

V.IV Gallery



No.	Feature	Description
1	Measurement File List	Display measurement file and folder list
2	Measurement Results (Photo/Video))	Display and playback measurement results (photo and video)
3	Memo Creation	Create user memo
4	Memo Display	Display user memo
5	File Sorting	Set file sorting method
6	Exit	End gallery

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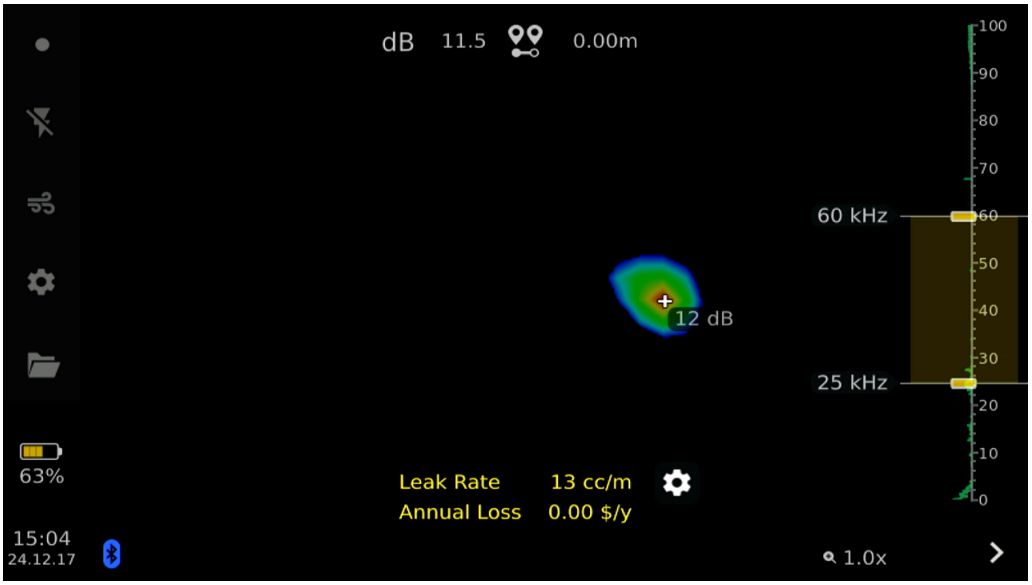
V.V Leak Settings



Touch the Settings Gear in the center of the screen to edit the compressor system settings for the leak calculations. (This only applies to the device display and not the Insights Reporting)

The Compressor Settings control the Leak calculations for the Annual Loss overlay displayed in Leak Mode on the SonaVu+.

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Leak Flow Settings

No.	Feature	Description
1	Display Annual Loss	Show Annual Loss overlay in leak mode
2	Type of Gas	Select the gas type being measured
3	System Pressure	Set the overall system pressure
4	System Pressure Unit	Set the units for the system pressure
5	Motor Output	Set the motor output in kW
6	Compressor Capacity	Set the compressor capacity in m3/min
7	Electricity Cost	Set the electricity cost per kW in US Dollars (only)
8	Annual Operating Time	Set the annual operating time in hours

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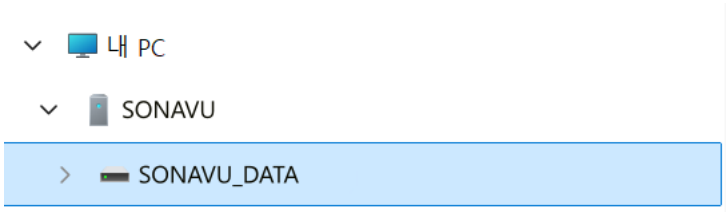
V.VI Main Operation

1. **Power and Charging** To turn the SonaVu+ on or off, press and hold the power button for more than 2 seconds. After powering on, the left LED will light up green, and the device will complete booting within approximately 30 seconds.
   The SonaVu+ uses a built-in lithium-ion battery for power. The built-in battery cannot be disassembled or modified arbitrarily. It is recommended to use the provided cable and power adapter for battery charging. The cable and power adapter for charging are included in the product package, along with adapters for different countries.

2. **Measurement and Storage** The SonaVu+ measures optical images and sound source distribution within the field of view. Data measurements are stored as photos (.jpg) or videos (.mp4). By briefly pressing the capture button located on the right side of the device, data is saved as a photo, while pressing and holding the button saves data as a video. Saved photos and videos can be viewed in the gallery.
   Photos are stored in JPG format, and videos are stored in MP4 format in the internal memory.

3. **Viewing and Backing Up Measurement Data** The SonaVu+ has a gallery mode where you can view measured data on the device. You can enter gallery mode by selecting the gallery icon at the bottom right of the main screen. In gallery mode, you can view measured photos, play videos, and add or modify user memos to the measurement results.
   The SonaVu+ can be connected to a user's PC using a USB-C port, allowing you to back up measurement photos, videos, and other data.



4. **Firmware Update** Firmware updates for the SonaVu+ can be performed using the USB-C port located on the side of the product, along with the provided USB cable. Connect the device to a PC and visit the official website of SDT North America Inc. (www.sonavu.com) to download and install the latest firmware version.

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VI Leak Detection and Measurement

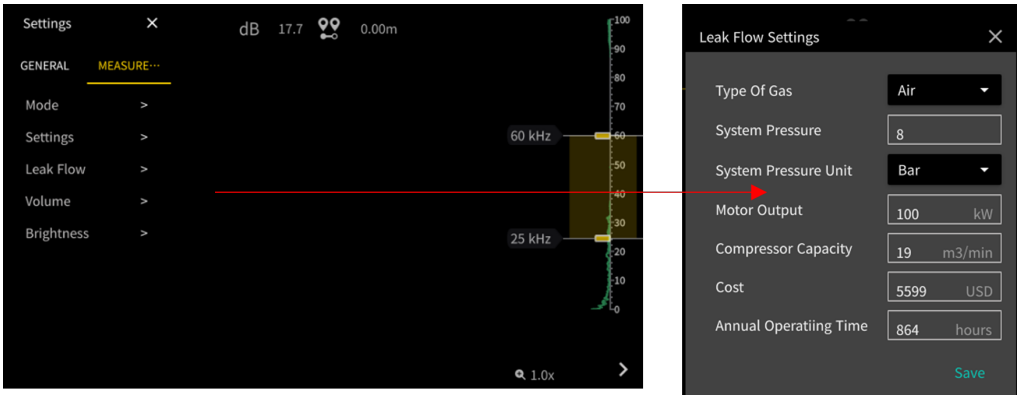
VI.I Overview

The SonaVu+ can detect and measure various types of leaks occurring in industrial environments. It detects the location and size of leaks from compressed air and gas valves, tanks, pipes, and other equipment. Using the leak measurement mode within the device, it can display the location, size, gas type of the leak, and its equivalent cost in real-time.

> This product is designed to evaluate gas leaks and achieve cost savings. However, due to environmental factors that can affect the accuracy of detection, the estimates provided are indicative and should only be used for informational purposes. The results displayed by the camera do not guarantee actual cost savings or specific conditions at the facility and may not accurately reflect the exact situation.

VI.II Basic Settings

In the quick settings of the SonaVu+, select the leak measurement mode to measure leaks. To accurately calculate leak costs, it is recommended to measure within the image area where the leak is most likely occurring. The amount of gas leaking and the distance between the leak and the camera's position are calculated based on the maximum decibel level detected. The gas leakage amount is displayed in the unit of volume per time, such as cc/min or L/min. You can calculate the cost of leaks for two types of gas (helium, oxygen, hydrogen, carbon dioxide, natural gas, LNG, LPG, and others). For compressed air, the cost is calculated based on the estimated pressure leak and power consumption. For general gases, the cost is calculated based on the market price per unit of gas. The settings for calculating annual cost savings can be adjusted in Leak Settings under the Measurement Settings menu.



VI.III Data Measurement and Storage

In the quick settings of the SonaVu+, select the measurement mode to Leakage Measurement Mode. Ensure the leak location is centred within the field of view and use the measurement button to capture. Real-time estimated leakage amount and loss value are only available in Leakage Measurement Mode.

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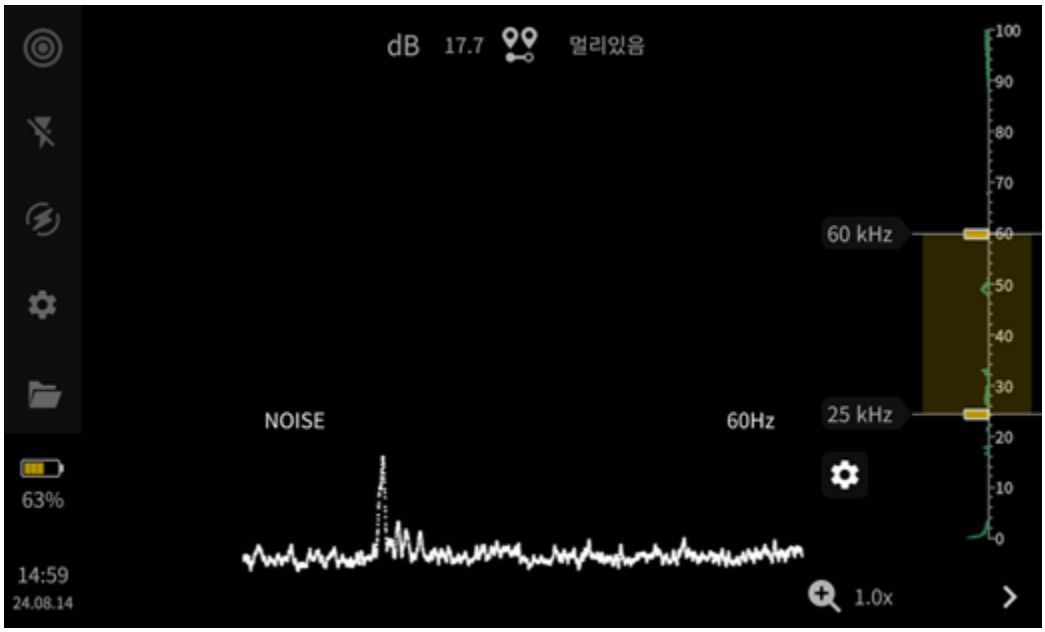
VII Partial Discharge (PD) Measurement

VII.I Overview

The SonaVu+ can detect and measure partial discharges occurring in various power equipment. It detects and measures the presence, location, and magnitude of partial discharges. Additionally, it analyses partial discharge signals to provide real-time PRPD graphs. The advanced AI classification algorithm categorizes partial discharges into four types: Corona, Surface, Floating, and Noise, and delivers these classifications to the user in real-time.

VII.II Basic Settings

In the quick settings of the SonaVu+, select the measurement mode to Partial Discharge Measurement Mode. It is recommended that the discharge location is in the central area of the field of view for accurate classification of the discharge type. Set the power frequency (50Hz, 60Hz) to match that of the measurement target for PRPD analysis and classification of partial discharge types (Corona, Surface, Floating, Noise).



VII.III Data Measurement and Storage

In the quick settings of the SonaVu+, select the measurement mode to Partial Discharge Measurement Mode. It is recommended to centre the discharge location within the field of view for accurate classification of the discharge type. PRPD graphs and classifications can only be saved when a photo is taken.

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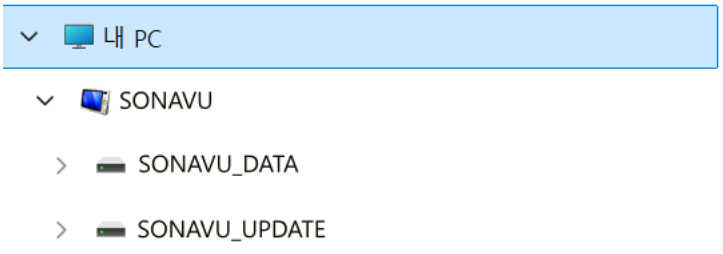
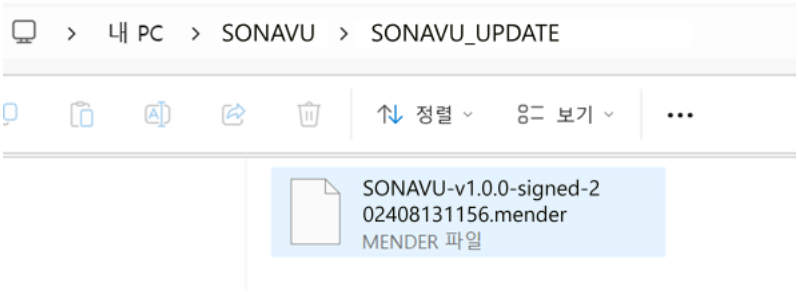
VIII How to Update the Firmware

1. Locate and download the latest firmware file (.mender) from the product page.
2. Connect the device to the PC using the USB cable included in the product package.



3. The internal storage of the device will be recognized and added as external storage on the PC. (PC \SONAVU \SONAVU_UPDATE)



4. Once the firmware file copy is complete, disconnect from the PC and remove the USB cable.
5. After disconnection from the PC, the firmware update will begin within the device. If the added firmware version is lower than or equal to the version installed on the device, the update will not proceed despite the disconnection.

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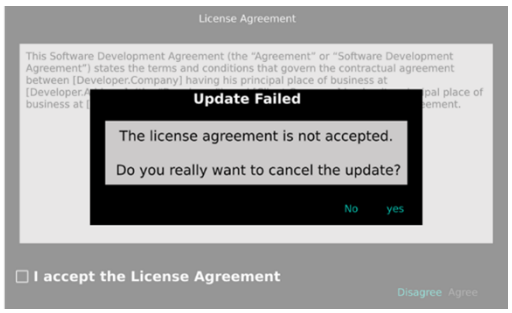
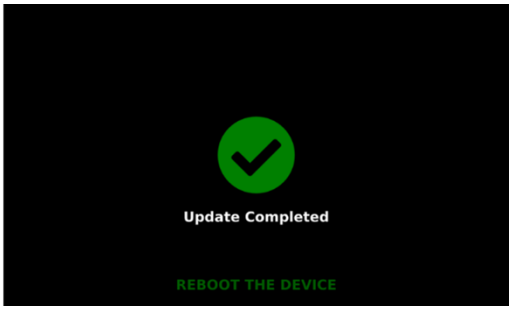
6. When the firmware update begins, a license agreement screen will appear. If you do not agree to the license, you can exit the update process.



7. During the firmware update, progress information will be displayed on the device screen. Once the update is successfully completed, restart the device for use.



Caution – Even if the firmware update progress reaches 100%, the update may still be in progress. Please do not perform any operations until a message appears confirming the firmware update has fully completed.

8. If the firmware file is corrupted or not copied correctly, the firmware update will be automatically canceled and fail during the process. If the update fails repeatedly, please copy the firmware file again.

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IX Product Specifications

Item	Specification
Microphone Type Number of Microphones	Digital MEMS Microphones 112ea
Measurement Frequency Range Microphone Sensitivity	2 k 100 kHz Detection Thresholds 2 kHz: 2.34 dB SPL 20 kHz: 2.22 dB SPL 40 kHz: 1.90 dB SPL 55 kHz: 1.22 dB SPL 70 kHz: 1.84 dB SPL 100 kHz: 20.10 dB SPL
Measurement Distance	0.5 m 200m
Camera Resolution / Field of View	8MP, 63° horizontal, 40° vertical
Image Resolution	1024 x 600
Video Frame Rate	25 FPS
Digital Zoom / Focus Adjustment	3x zoom, LED x2
Display Type (Resolution)	5" Color LCD(800 x 480)
Display Brightness	1000 nits (Auto and Manual Adjustment)
Touch Screen	Capacitive Touch Screen
Data Format	JPG (Image), MP4 (Video), WAV (Audio)
Storage Capacity / Video Length	21 GB (approximately 84,000 images, 20 hours of video storage) / 30 minutes
Data Interface	USB-C, Bluetooth 5.0 Supported
Hardware Ports	USB-C, 3.5mm audio output, HDMI output
Battery Life (Charging Time)	Up to 5 hours (4-hour charging time)
Product Dimensions / Weight	237 x 146 x 56(mm) / 1.1Kg
Certifications	KC, CE, FCC certification
Supported Languages	Chinese (Simplified, Traditional), Croatian, Dutch, English, French, German, Japanese, Korean, Portuguese, Russian, Spanish, Thai, Turkish
GPS Information	Mobile Phone Bluetooth Connection
Report Program	SonaVu Insights (Web, App)
APP	IOS, Android

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X Product Certification

X.I Electromagnetic Compatibility (EMC)

This product meets the requirements of the following EMC standards for sensitive electronic equipment used in measurement, control, and laboratory settings:

- ✓ EN 55032:2015+A1:2020
- ✓ EN 55035:2017+A11:2020
- ✓ EN IEC 61000-3-2:2019+A1:2021
- ✓ EN 61000-3-3:2013+A1:2019+A2:2021

X.II FCC Compliance

This product complies with the essential requirements of the following U.S. guidelines:

- ✓ FCC Part 15 Subpart B, Class A
- ✓ ANSI C63.4-2014

X.III CE Compliance

- ✓ This product complies with the essential requirements of the following European directive:
- ✓ 2014/30/EU; Electromagnetic Compatibility Directive (EMC)

X.IV KC Compliance

This product is registered in accordance with Clause 3, Article 58-2 of the Radio Waves Act.

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X.V Battery

- ✓ This product uses a lithium-ion battery
- ✓ Rechargeable Li-ion Battery/LV0202-35E(48.24 Wh), Samsung SDI INR18650-35E cell

Do not use the product in environments that are damp, wet, or corrosive. Do not store or place the product in high temperatures, direct sunlight, inside or near a microwave oven, or near a heat source in a pressurized container. Do not expose the product to temperatures above 122°F/60°C. Failure to follow these instructions may result in battery leakage, overheating, explosion, or ignition, leading to injury and damage. Do not puncture, open, or disassemble the battery. If the battery leaks and the leaked fluid comes into contact with your skin or eyes, rinse thoroughly with water and seek medical attention immediately. Charging will not occur at low temperatures (below 32°F/0°C) or high temperatures (above 113°F/45°C)

CAUTION: There is a risk of explosion if the battery is replaced with an incorrect type.
Do not attempt to remove or replace a battery that is not user-replaceable. If you encounter any issues with the battery, please contact the Technical Sales Team at SDT North America, Ltd.

- ✓ The battery included in this product must be disposed of in accordance with local laws and regulations.
- ✓ IEC 62133-2:2017
- ✓ EN.62133-2:2017
- ✓ UN 38.3 (ST/SG/AC.10/11/Rev.8)

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XI Precautions

※ Before Use ※

- Ensure that you operate the device according to the user manual.
- Install the product on a stable, level surface.
- Do not store the product in its case while it is powered on, as this may cause damage or fire.
- Avoid direct transmission of vibrations or shocks to the product.
- Do not drop the product or subject it to any impact.
- When charging, be careful not to step on the power cable or trip over objects that could damage the cable, which may lead to product malfunction.
- Do not store the product in places with high humidity, direct sunlight, or excessive dust.
- Do not store the product in places where chemicals are stored or gases are emitted.
- Do not use the device outside the recommended operating temperature range (-20 to 60 °C)..
- Do not use the device in areas with strong magnetic or electric fields.
- When connecting or disconnecting cables or cords to the main unit, hold the plug, not the cable.
- Prevent foreign substances from entering the microphone surface or the gaps in the heat sink.
- Do not disassemble or modify the product without the manufacturer's approval.
- In case of malfunction or damage to the main unit or accessories, clearly describe the issue and contact the retailer or our service representative.
- When disposing of this product, please follow the regulations of your country or local municipality.

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XII Customer Support / Contact Information

We at SonaVu strive to respond to customer inquiries and requests as quickly as possible.
For additional materials regarding the SonaVu+ ultrasonic camera, please refer to the SonaVu website at www.sonavu.com.

For any other inquiries or requests, please contact us via the email/phone number below, and we will respond promptly.

Email: sales@sonavu.com
Phone: 1-800-667-5325
Address: 7677 County Rd 2, Cobourg, ON K9A 0X4 Canada

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