

Portable Ultrasonic Camera

BATCAM 2.0

User Manual



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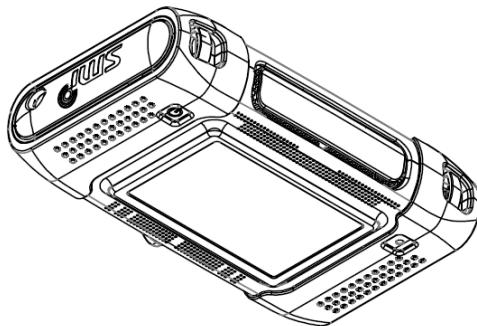
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General Outline

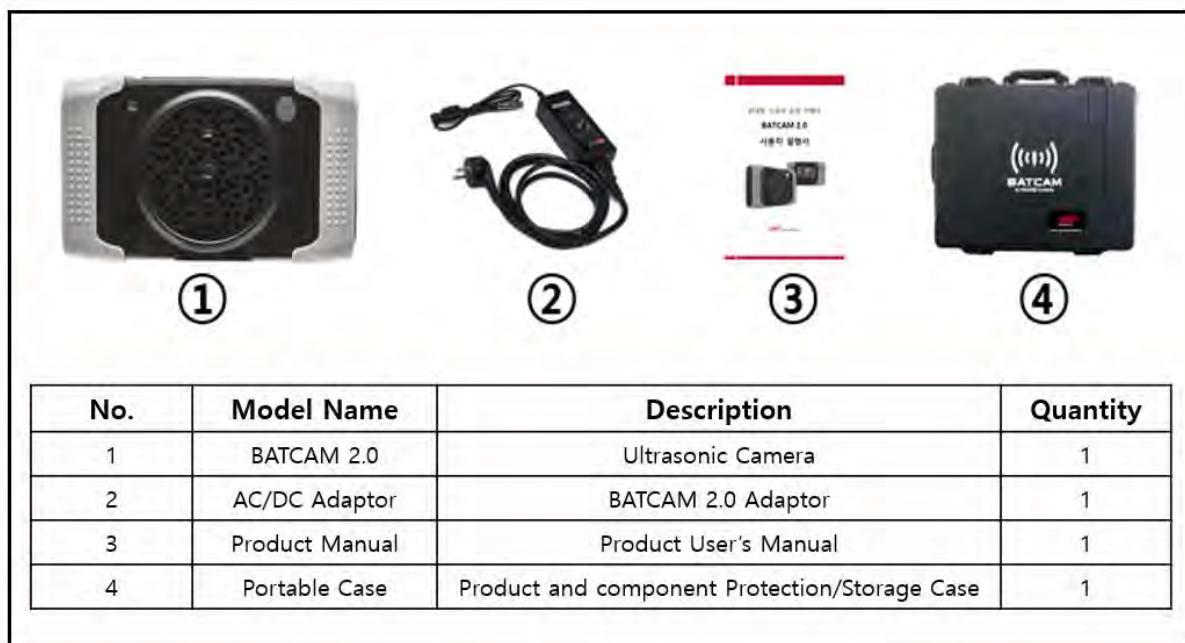
BATCAM 2.0 is a portable ultrasonic camera that provides visual insight into an array of microphones and abnormal locations such as gas, air leaks and electrical discharges with high-speed FPGA-based processors.

This document describes the components of BATCAM 2.0 and provides information on how the device works.



Product Configuration

The BATCAM 2.0 product consists of the following:



No.	Model Name	Description	Quantity
1	BATCAM 2.0	Ultrasonic Camera	1
2	AC/DC Adaptor	BATCAM 2.0 Adaptor	1
3	Product Manual	Product User's Manual	1
4	Portable Case	Product and component Protection/Storage Case	1

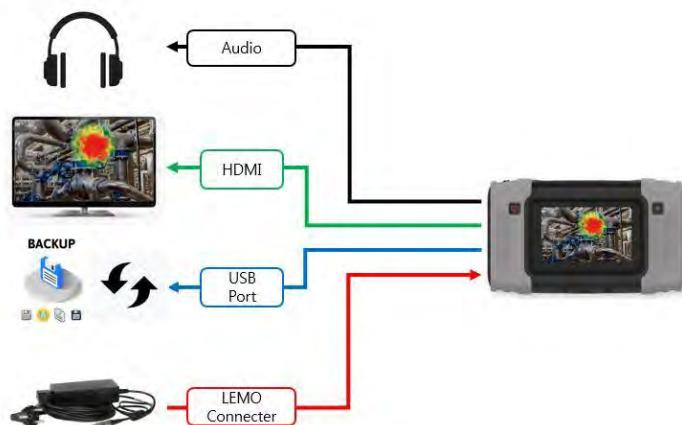
Hardware Feature and Configuration

The hardware features and configurations of BATCAM 2.0 are shown below.



Connect External Device and How to Use the Device

BATCAM 2.0 device body is equipped with an external device, such as a monitor, and a connector to connect the power cable as shown below.



I. Connection Port Description

- 1) **LEMO Connector:** Connect the connector on the power adapter to the BATCAM 2.0 LEMO connector to supply power and charge the internal battery.
- 2) **Audio Jack:** User can listen to the sound by connecting earphones to the audio jack of BATCAM 2.0.
- 3) **HDMI Port:** BATCAM 2.0 and the monitor can be connected to the HDMI connector to output the videos being filmed or stored to the monitor.
- 4) **USB Port:** User can copy data stored in BATCAM 2.0 to a USB memory device or update internal software.

II. How to Connect Power Adaptor



Connect the LEMO connector of the BATCAM 2.0 power adapter in the direction shown.



When using the LEMO connector, connect and use the connector by aligning the power connector groove inside the left rubber packing with the red dot on the LEMO connector.

III. Product Action Status Indicator(LED)

1) Charging Status Indicator(Top Right)

When the power adapter connector is connected, charging is initiated and 'LED' is displayed on the right side of the top of the product as shown below.



Red(Charging) Green(Charging Complete)



Not Charged



Charging



Charging Complete

2) Power Status Indicator(Top Left)

The Power Condition Indicator(LED) at the top left of the product can be used to check the power condition of the product.



Green Light On(Power ON)

Green Light Off(Power OFF)



Power ON



Power OFF

IV. Interface Port Connection

1) HDMI Output



User can connect BATCAM 2.0 and monitor with HDMI cable so that BATCAM 2.0 screen is output to monitor as shown above.

2) USB Port

Image and video files stored in BATCAM 2.0 can be transferred to a memory device(FAT 32 format) via the USB port. Here's how to copy data: The amount of time that is transferred may vary depending on the number and capacity of the files stored. (There is no USB memory device available on the product.)

- ① Connect the USB memory device to the USB port located on the left.



- ② Connect the USB memory device and press the USB icon(object) on the right side of the BATCAM 2.0 main screen.



V. How to Use Power Button

With BATCAM 2.0 off, pressing the power button on the left side for 2 seconds will power on and the power status indicator on the left side of the product will illuminate green. To turn off the power, press the power button again for 2 seconds to turn off the power and the power status indicator lamp off.



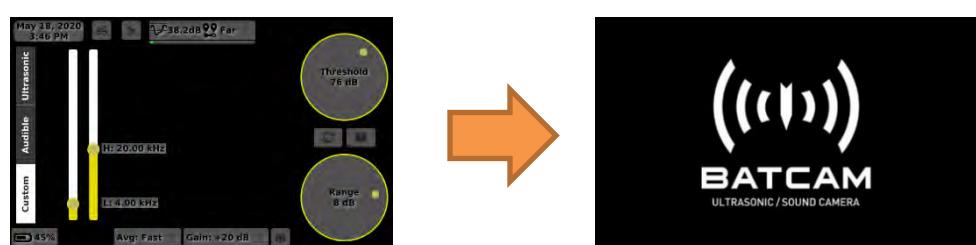
1) Power ON

When powered on, the company logo('SMI') and product logo('BATCAM') appear in order on the LCD screen, and the software operates.



2) Power OFF

When you turn off the power, the product logo below appears on the LCD screen and ends its operation.



VI. How to Use Record Button

The record button allows you to save the screen you are measuring as an image(JPG) or a video(AVI). Here's how to use it:



1) Save Image

A short press of the Record button saves the screen you are measuring as an image (JPG). The saved images can be viewed by clicking the directory icon(object)  on the right side of the main screen.



2) Save Video

Press and hold the Record button(2 seconds) to start filming the video(AVI) and an icon(object) appears at the top of the screen to indicate that you are recording, as shown in the figure below on the right. Press and hold the record button(for 2 seconds) to end the shoot and save the video automatically. User can view saved videos by clicking the  directory icon(object) on the right side of the screen.



VII. How to Operate Light Operation

The light icon(object) the top of the screen allows you to activate two lights mounted on the front of the product.



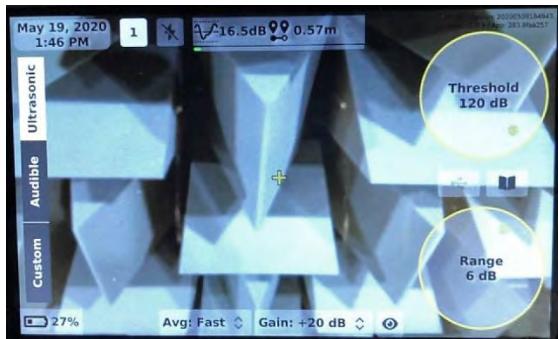
Light ON



Light OFF

1) Light ON

When the light is off and you press the icon(object), the light turns on immediately and the icon(object) is changed.



2) Light OFF

When the light is on, pressing the icon(object) immediately turns off the light and changes the icon(object).



Component Description

I. Power Device



AC/DC Adaptor(12 V, 3.5 A) + Power Cable

Power supply and internal battery charging for BATCAM 2.0 and a dedicated LEMO connector for connection between adapter and cable. Power units are recommended to use the power units included in the product.

II. User Manual



BATCAM 2.0 User Manual

This is a manual for BATCAM 2.0 users and provides a variety of use the product.

III. Portable Hard Case



BATCAM 2.0 Portable Hard Case

Waterproof case for storing or carrying BATCAM 2.0 product and components. It is recommended that you use it for storage and movement of product.



BATCAM 2.0 Hard Case Interior Appearance and Storage

IV. Hand Strap

On the right side of BATCAM 2.0 there is a hand strap which allows user to hold the product when measuring with hand as shown below. Care must be taken not to drop the product when using straps.

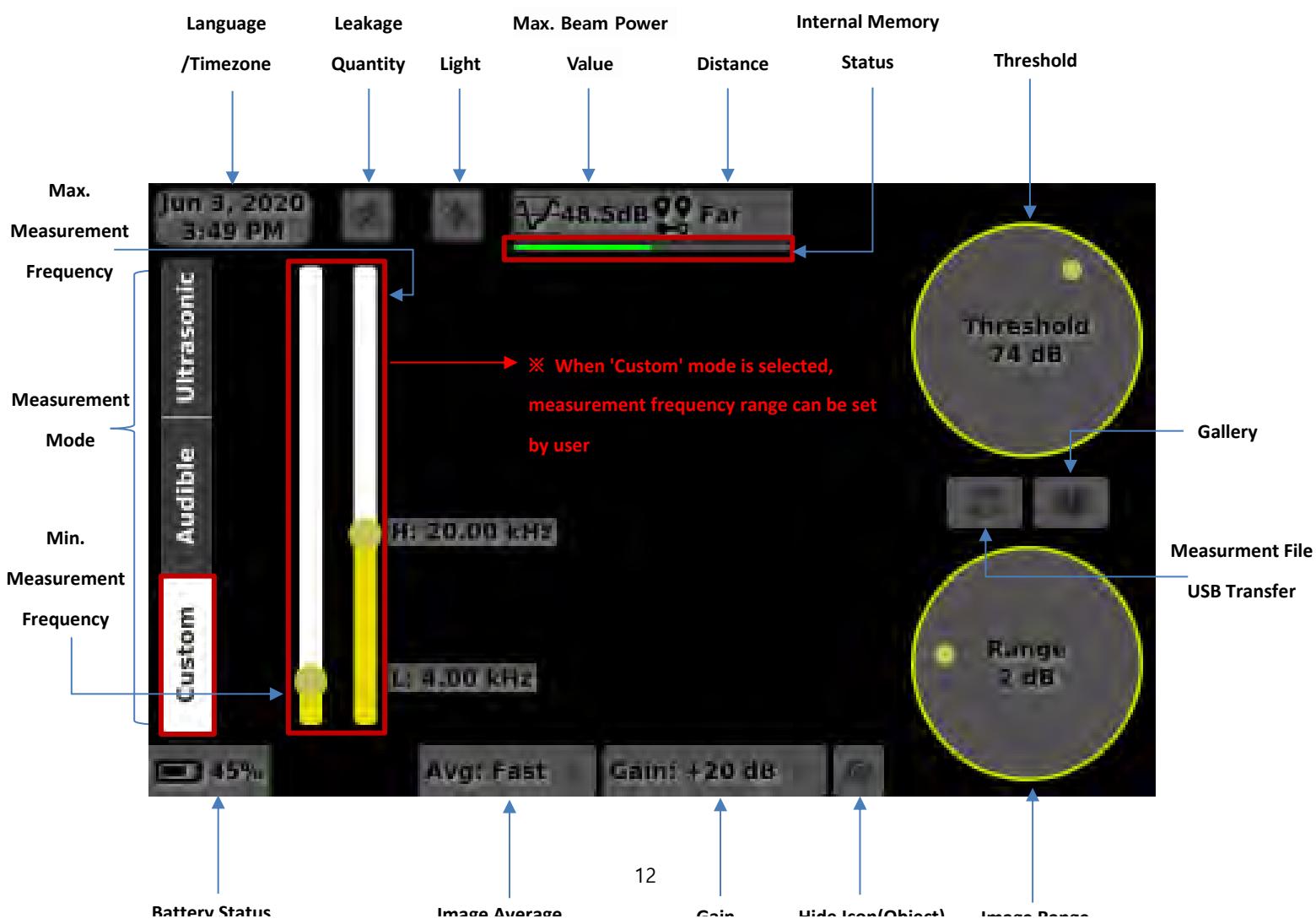


Software

I. Main Screen(User Interface)

When the BATCAM 2.0 software runs, it appears as shown on the main screen below. Users can set and view various measurements on the main screen without having to connect to a PC.

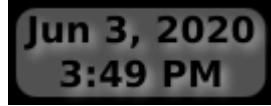
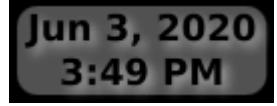
Settings consist of beamforming settings, measurement environments settings and other settings. First, the beamforming setting is for beam power, which shows the value of the size of the noise being measured in a rainbow colored chart. These settings include threshold(display reference value), image range, and image average settings. The measurement environment settings set the appropriate values for the characteristics and conditions of the noise to be measured, including measurement mode, distance between source and BATCAM 2.0, and gain settings. Other settings include language/time zone, hide icon(object), measurement file USB transfer, and gallery(check/delete measurement file) settings as settings for user convenience and measurement efficiency. The user can also estimate the degree of leakage occurring by the leakage quantity icon(object) at the top. Checking the internal memory and battery status is also available.



II. Icon(Object) and Function Description

Provide a detailed description of the icon(object) and functions displayed on the main screen. At the top, a total of four icons(objects) will be shown, and the functions, definitions, and descriptions of each icon(object) are shown in the table below.



Icon(Object)	Function	Description
	Language/Timezone Check and Setting	<p>This icon(object) indicates the current date/time. In addition, you can change the language of use as well as the time zone for each country by pressing and holding the icon(object). The method of change is as follows.</p> <p>1.</p>  <p><i>Press and hold the icon(object)</i></p> <p>2.</p> 

Asia/Seoul

Asia/Shanghai

Asia/Singapore

Asia/Srednekolymsk

Asia/Taipei

Asia/Tashkent

Asia/Tbilisi

Asia/Tehran

Asia/Thimphu

Asia/Tokyo

Touch the arrow in the red box to select the language/time zone you want to change

**Language: Support for Korean, English, Chinese and French*

**Time zone: Support for all countries*

3.

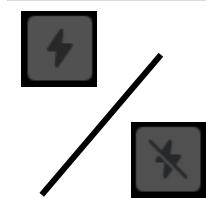
Press 'Apply' button to select language/time zone
Applies and when the 'Discard' button is pressed, the language/time change will be invalidated(pop-up window closed)



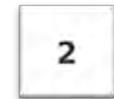
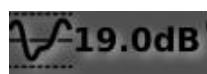
Leakage Estimation
Check Index

This icon(object) indicates the amount of Leakage that is occurring. Depending on the amount of leakage, it will be changed to a suitable number icon(object), and the criteria for distinguishing icons(objects) are as follows.

*Less than 200 cc/m*



Light ON/OFF

*Excess 200 Less than 400 cc/m**Excess 400 ~ Less than 600 cc/m**Excess 600 ~ Less than 800 cc/m**More than 800 cc/m*

Maximum Beam Power Value Check

User can turn on or off the light mounted on the front of the hardware with this icon(object). When pressing the icon(object) while the light is on, the light will be off. When pressing the icon(object) while the light is off, the light will be on.

*Light ON**Light OFF*

Distance Setting

This icon(object), allows the user to set the distance between the noise source or target being measured and the ultrasonic camera.

For accurate measurements, it is recommended that you set the distance before measuring. There is a total of three options and the selection criteria are as follows:

Near Distance(Near): If the measured target is

**Internal Memory Status Check**

within 5 m

Far Distance(Far): If the measured target is more than 5 m away

Automatic Distance Setting(Auto): When more precise measurements are required using distance sensor values(only possible if the distance between the source and BATCAM 2.0 is within 3 m)

When the Auto option is selected, the distance between the noise source and the ultrasonic camera can be viewed in real time(within 3 m).

Ex)



The user can check the internal memory status of BATCAM 2.0 under the 'maximum beam power value' and 'distance' icon(object). It is divided into three colors: green, orange and red, and the criteria for classification are as follows:

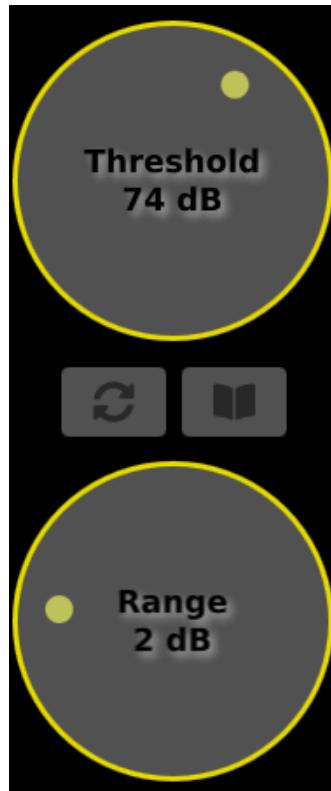
For your information, the internal memory capacity of BATCAM 2.0 is about 53 GB.

Green: Used less than 98 % internal memory

Orange: Used more than 98 % of internal memory less than 99 %

Red: Used more than 99 % of internal memory less than 100 % – Saving video is not available

Next, icons(objects) on the right side of the main screen. There are four icons(objects) on the right side of the screen, each icon's(object's) function, definition, and description are shown in the table below.



Icon(Object)	Function	Description
	Threshold (Display Reference Value) Setting	The beampower shown on the screen depends on the set reference value. This means that the noise you are trying to measure must be greater than or equal to the display reference value before the beam power appears on the screen. Inversely, if the noise is less than the set reference value, the screen does not display the beam power. For accurate measurements, it is recommended that you check the display reference value settings before the measurement, depending on your measurement environment. The reference value can be set from 0 dB to 120 dB, depending on the characteristics of the noise being measured and the measurement environment.
	Measurement	Mount the USB memory device in a USB port located on the left side of BATCAM 2.0(if user is viewing the screen), and press this icon(object) to copy the measured pictures and videos to the USB memory device.
	File(Image/Video) Transfer to USB	File(Image/Video) Transfer to USB

connected, it will be shown below.



USB Memory Device is not connected

When you connect the USB memory device and start transferring files, the icons(objects) below appear sequentially.



BATCAM 2.0 -> USB File Transfer in Progress



BATCAM 2.0 -> USB File Transfer Completed



Gallery
(Check/Delete
measurement file)

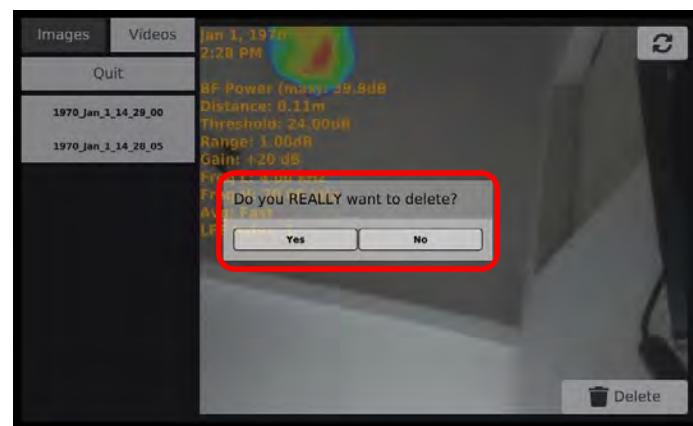
Press this icon(object) to check or delete the measurement file(image/video) of BATCAM 2.0.



Press 'Images' or 'Videos' to see or delete the measurement images or videos.

Press 'Quit' to return to the main screen, and press 'Delete All' to delete all files.

To delete only one file, select the file and press the 'Delete' button on the bottom right.



User can copy the selected file to the USB memory device by pressing the button on the top right.

Also, the measured image shows the information below.

(This will not be recorded in the measured video.)

Date/time at time of measurement

Maximum beam power value(dB) at time of measurement

Display Base(dB) at time of measurement

Image range value at time of measurement(dB)

Amplification value at time of measurement(dB)

Frequency band(kHz) set at time of measurement

Image mean setting at time of measurement

Estimated amount of leakage at time of measurement(LFE) index value

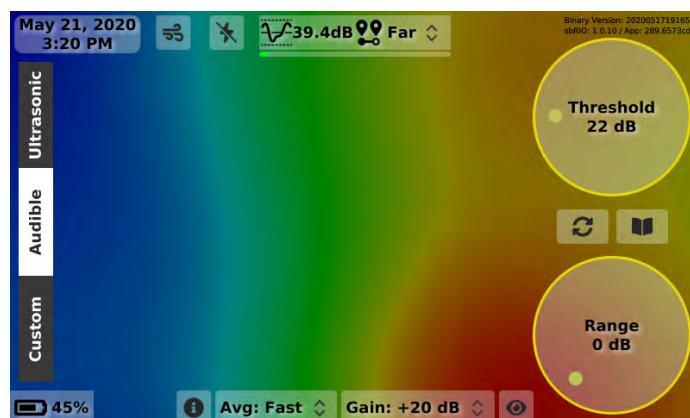


Image Range

Setting

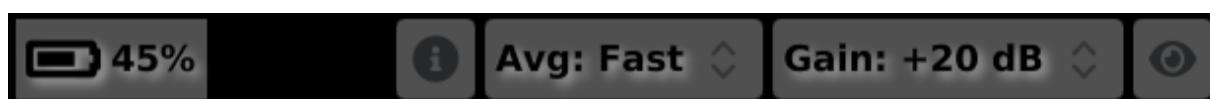
This function sets the range of the minimum(blue) and maximum(red) values of the beam power displayed on the screen. This means that the width of the beam power can be adjusted. User can set a minimum of 0 dB(full range) to a maximum of 10 dB, and the higher the value, the greater the width of the beam power.

If the image range is set to 0 dB, beamforming is applied throughout the screen(Full Range).



※ For a detailed description of the display threshold and image range, refer to the 'Beam Forming Setting' section.

At the bottom of the main screen, there are five icons(objects) shown below. The function, definition and description of each icon(object) are as below.



Icon(Object)	Function	Description
	Battery Status Check	This icon(object) allows the user to check the current battery status. The battery status is expressed in four images below, depending on the range. When the battery is fully charged, the BATCAM 2.0 operates smoothly for about four hours.



Battery Capacity 2 ~ 9 %



Battery Capacity 10 ~ 29 %



Battery Capacity 30 ~ 72 %

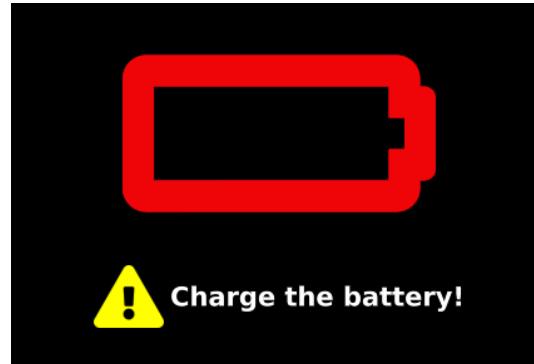


Battery Capacity 73 ~ 97 %

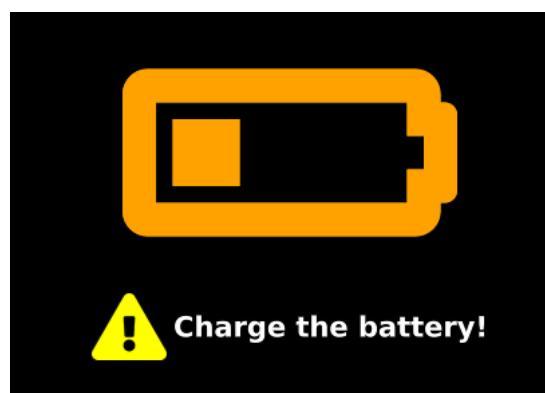


Battery Capacity 98 ~ 100 % (Full Charged)

If the battery is below 1 %, a warning message below will appear.
If this warning message appears, connect the BATCAM 2.0 power unit and charge it.



Once the power supply has stabilized, the screen below will be switched to. If the battery is charged more than 15 % then BATCAM 2.0 can be used again.





Microphone
Status Check
*Only Visible
In Audible
Mode

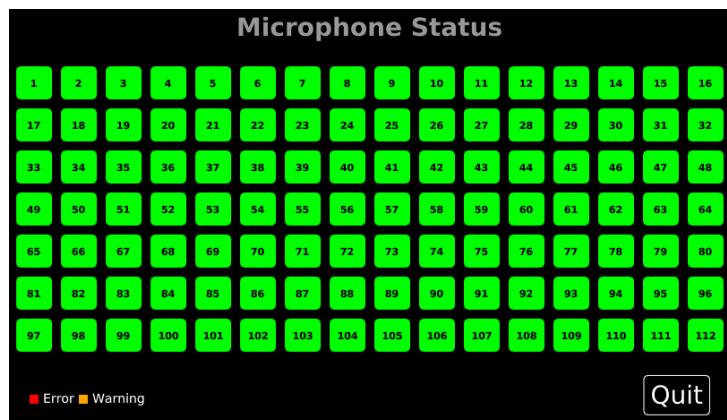
Press this icon(object) to check the operation of 112 microphones mounted on the front of BATCAM 2.0 (only visible in audible mode). The colors of each icon(object) by operating state are as follows:

Green: Normal

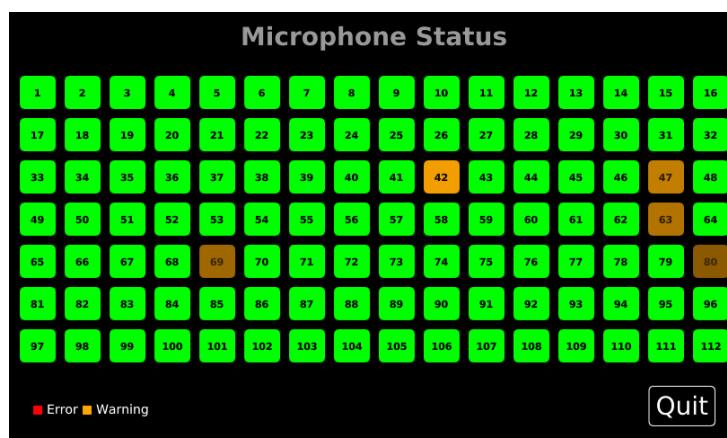
Orange: Dangerous

ex) When the microphone is blocked by alien substances

Red: Abnormal



Ex) All 112 microphones are normal



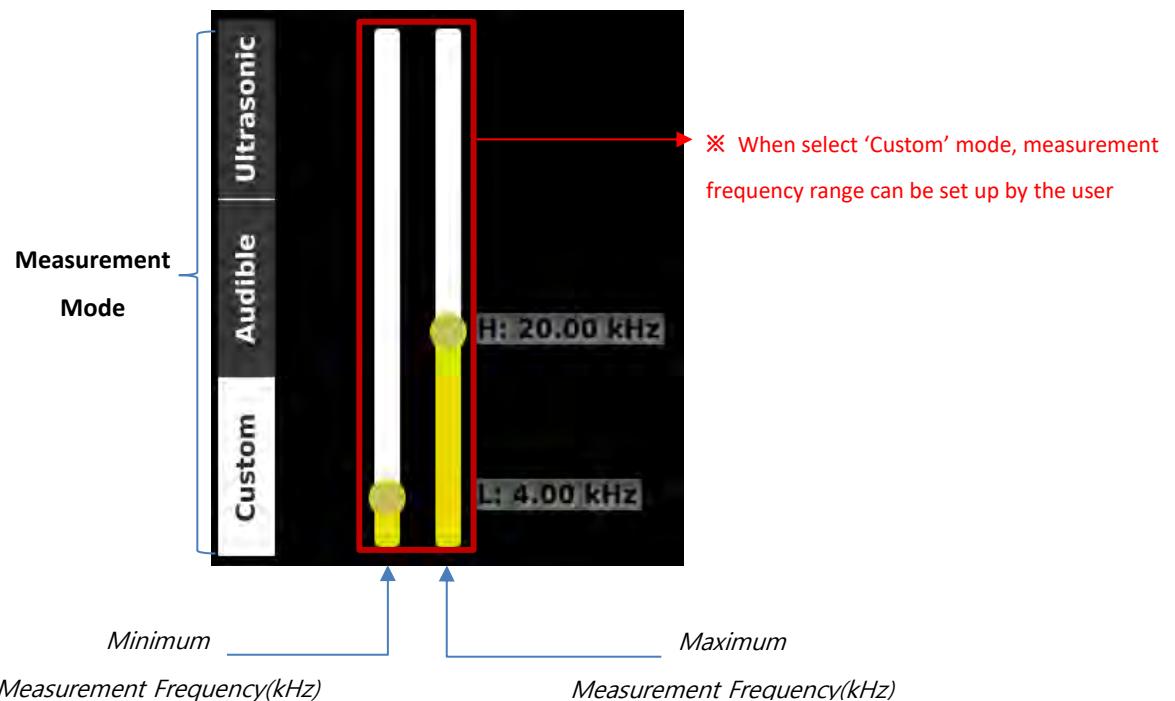
Ex) No 42,47,63,69,80 microphones are blocked
by alien substances

Avg: Short ▼

Image
Average
Setting

Image average is another way of setting up the beam power image on the screen. Depending on the type or characteristics of the noise, user can set the appropriate image average. There are two options in total and the selection criteria are as follows:

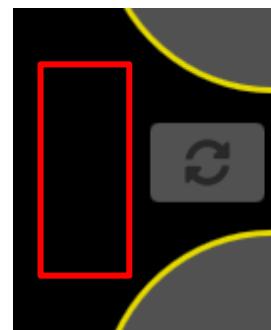
		Fast: average update of normal speed Slow: Update slowly with slightly longer average values
		Slow settings can be updated slowly for fast changing sound signals to determine the location of the noise source. For a detailed description of the image average, see 'Beamforming Setting'.
	Gain Setting	<p>Depending on the amount of noise, user can set the appropriate gain value. User can select from 0, +10, +20, or +30 dB, and can apply the appropriate value depending on the size of the noise.</p> <p>A reasonable gain value for normal-sized noise measurements: +20 dB</p> <p>*The smaller the sound, the better it is to increase the gain value.</p>
	Hide Icon(Object)	This icon(object) provides a clearer picture of the screen being measured by hiding the objects 'Threshold', 'Image Range', 'Measurement File USB Transfer' and 'Gallery' on the right side of the screen. If user is using custom mode, the frequency setting slide will be also hidden. Touch the icon (object) one more time to release the hidden processing.



Finally, on the left side of the main screen, there is an area for simple selection of measurement mode or for the user to set the measurement frequency area directly. It is configured in the 'ultrasonic', 'audible', and 'custom' mode, each of which is described as follows:

The 'ultrasonic' mode automatically sets the band pass filter at 25 kHz to 40 kHz for the ultrasonic frequency area and is suitable for measuring gas/air leaks and electrical discharge. When 'Audible' mode is selected, the band pass filter is automatically set from 4 kHz to 20 kHz for the audible frequency area and is suitable for measuring human audible noise and joints.

User can listen to the sound sources measured in either 'ultrasonic' or 'audible' mode, when user can adjust the volume of the audio output. User can adjust the volume adjustment number by scrolling up and down the empty area(the red display area below) on the left side of the 'Measurment File USB Transfer' icon(object). The volume can be adjusted from 0 to 20. Volume control is not possible if 'Hide Icon(Object)' has been activated.



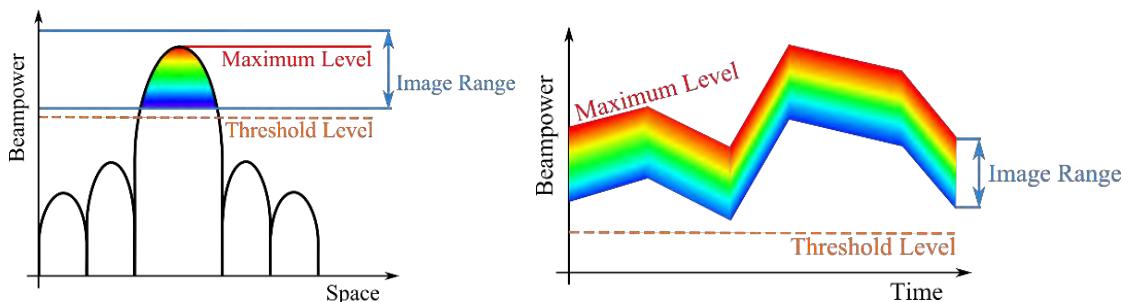
Measurement Mode	Frequency Range	Remark
Ultrasonic	25 kHz ~ 40 kHz	Auto Set
Audible	4 kHz ~ 20 kHz	Auto Set
Custom	Set up by user	When 'Custom' mode is selected, measurement frequency range can be set by user

III. Beam Forming Setting

The Beam forming setting sets the various values of beam power that show the characteristics of the measured noise in rainbow-shaped color scheme, including the display reference, image range, and image average setting. The beam power visually shows the amount of sound pressure produced in the direction of measurement of the ultrasonic camera. The beam power displayed on the screen can show both the size and distribution of the noise generated, but it usually depends on the display reference setting value. Also, the beam power, calculated as 25 frames per second, will be visible on the screen at a resolution of 640 x 480.

1) Threshold(Display Reference Value)

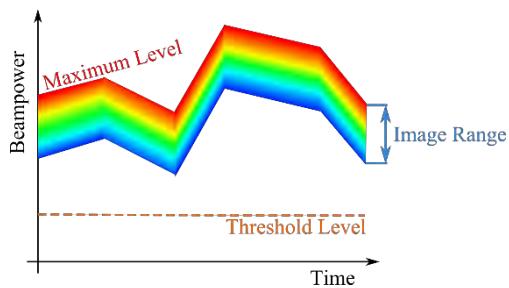
The beam power that appears on the screen depends on the set display threshold. This means that the noise you are trying to measure must be greater than or equal to the Threshold before the beam power appears on the screen. Conversely, if the noise is less than the set display threshold, beam power will not be displayed on the screen. For accurate measurements, it is recommended that you set the Threshold before measurements, depending on your measurement environment. The display reference value can be set from a minimum of 0 dB to a maximum of 120 dB, depending on the nature of the noise you want to measure and the measurement environment.



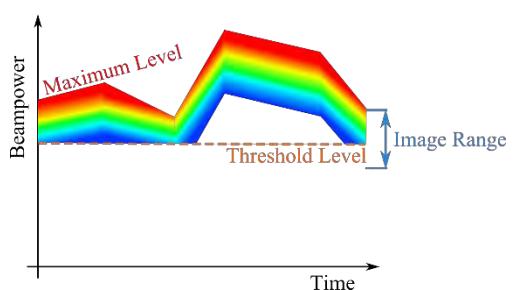
The Threshold setting is set as the minimum value of the noise source you want to measure, and only above the set value is displayed on the screen. Values below the setting are not displayed on the screen. The range of images is expressed in color for the noise source being measured, as shown in the graph above, with the minimum and maximum values being expressed in the image portion as values greater than the threshold value. The color scheme shown on the screen represents the level of sound pressure from maximum(Red) to minimum (blue).

2) Image Range

This function sets the range of the minimum(Blue) and maximum(Red) values displayed on the screen. This means that you can adjust the width of the beam power displayed. A minimum of 0 to 10 dB can be set, and the higher the value, the greater the width of the beam power.



The range of images varies with the maximum value, such as the sound pressure changing in the left graph, with the minimum value changing with the maximum value.

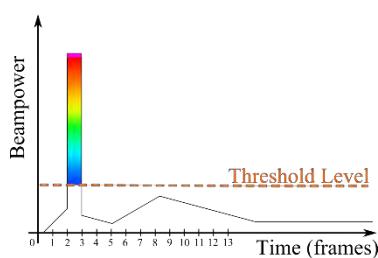


If you raise threshold, it affects the beam power displayed on the screen regardless of the setting value of the image range. For example, if the minimum setting value for the image range is less than the display reference value, as shown in the graph on the left, then the display reference value is set to the minimum value and displayed on the screen.

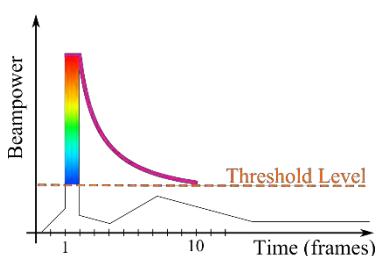
3) Image Average

This function sets the way the beam power image is displayed on the screen (beam power image average).

Depending on the type or characteristics of the noise, the user can set the appropriate average.



If there is no image average, the current noise is immediately displayed on the screen. If you look at the graph on the left, the current noise is indicated by a black line, and an orange dotted line shows the threshold. The screen shows the part displayed by the rainbow colored chart, and updates are made immediately for each frame that is processed. In these settings, it is difficult to visually identify short-lived sounds.



Exponential Average: Fast / Quick Response

This feature allows you to see changes in sound by applying different average parameters depending on your selection options. Typically, you can set it to Fast Response to measure it, and user can change it to slow response so that it can be updated slowly.

IV. Additional Setting

1) Software update

The software information in BATCAM 2.0 currently in use is displayed in the upper right corner of the main screen.

To update to the latest software in BATCAM 2.0, you can proceed in sequence below. The update will take up to 5 minutes to complete, and be careful that an error may occur if BATCAM 2.0 is turned off while the update is in progress. Update files can be obtained at a later notice(E-mail or Website).

*BATCAM 2.0 Software Update Procedure

- ① Connecting USB Memory Devices to a PC or laptop
- ② Creates a folder named 'BATCAMV2_UPDATE' inside the USB memory device. All must be capitalized in English and does not matter if there is a folder with a different name inside the USB
- ③ Download latest software files to your PC or laptop. The file extension is .mender
- ④ Copies downloaded files into the 'BATCAMV2_UPDATE' folder created in 2.
 - The downloaded update file name must be in the following structure
 - └-- BATCAMV2_UPDATE
 - └-- SMI-BATCAMV2-v0.0.0-signed-2020xxxxxxxx.mender

(v0.0.0 : Firmware version, xxxxxxxxx : Date+Time Format)



Update in progress for BATCAM 2.0

- ⑤ Safely remove USB memory device from PC or laptop
- ⑥ Connect USB memory device to BATCAM 2.0 hardware USB port
- ⑦ When USB memory device is connected, updates are automatically made and progress can be checked on the screen. Up to 5 minutes for update to complete
- ⑧ Update completed and all procedures completed when BATCAM 2.0 is rebooted

V. Product Management and A/S

1) Product management

There are 112 microphone sensors in front of BATCAM 2.0. If the microphone is dirty or clogged with debris, etc., it can be cleaned at a distance of approximately 30cm under low air pressure from the compressed air injector. Do not spray too much pressure with air pressure. Also, keep the product in its case when not in use.

2) A/S

- ① Free A/S: Free A/S for one year from the date the customer receives the product, provided that the following is a paid A/S.
- ② Paid A/S:
 - ✓ In case the warranty period for free of charge has expired
 - ✓ Defects caused by customer negligence or careless handling
 - ✓ Defects caused by natural disasters, accidents, disasters, etc.
 - ✓ Defects caused by external factors other than defects in quality or performance of the main body of the product.

Product Specification

Item	Specification
Microphone Array	
Microphone Type	Digital MEMS
Number of Microphones	112 EA
Measurement Frequency Range	2 k ~ 48 kHz
Microphone Sensitivity	-41 dBFS
Signal to Noise Ratio (SNR)	66 dB(A)
Camera View Angle	Horizontal 66 degree, Vertical 54 degree
Measuring Distance	0.3 m ~ 50 m(Vary depending on the measurement environment)
Display Type	5" Color LCD
Data Acquisition and Processing	
Sampling Rate	96 k S/s
Image Frame Rate	25 FPS
Image Resolution	640 x 480
Internal Memory	53 GB(About 25 MB for 5 minutes, 7 days for continuous video storage)
Measurement Circumstances	
Operating Temperature	-20 ~ 50 °C
Operating Humidity	10 ~ 85 %
Internal Batterypack	
Battery Type	Lithium ion battery pack
Battery Capacity	49.5 Wh
Battery Operating Time	4 hours

Components and other specifications

Item	Specification
External Batterypack	
Battery Type	
Battery Quantity	(TBD)
USB	
Memory Type / Support Format	2.0 / FAT 32

Product Certification

I. Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for measurement, control and sensitive electronic equipment used in laboratories. EN 55032:2015/AC:2016

- ✓ EN 55035:2017
- ✓ EN 61000-3-2:2014
- ✓ EN 61000-3-3:2013

II. FCC Compliance

This product meets the essential requirements of the applicable U.S. Directive as follows:

- ✓ FCC Part 15 Subpart B, Class A

III. CE Compliance

This product meets the essential requirements of the applicable European Directive as follows:

- ✓ 2004/108/EC; Electromagnetic Compatibility Directive(EMC)

IV. KC Compliance

This product proves that it has been registered in accordance with paragraph 2-3 of Article 58 of the Radio Wave Act.(The Clause 3, Article 58-2 of Radio Waves Art.)

V. Battery

This product uses lithium ion batteries.

Do not use the product in environments where it can be wet, wet, or corroded. Do not store or place the product in or near the source of heat in a high temperature, strong direct sunlight, microwave or pressurized container. Also, do not expose to temperatures above 122 °F / 50 °C. Failure to follow these instructions may result in acid leak, heat, explosion or ignition, causing injury and damage. Do not drill, open or disassemble the battery. If the battery is in contact with the leaked fluid, rinse it with water sufficiently and seek a

consultation with a steam doctor. Charging does not occur at low temperatures(32 °F / 0 °C or below) or high temperatures(113 °F / 45 °C or above).

※CAUTION: If the battery is not replaced with the correct type, there is a risk of explosion.

Do not attempt to remove or remove a battery that the user cannot replace. If there is a problem with the battery,

The batteries contained in this product must be disposed of in accordance with local laws and regulations.

- ✓ IEC 62133:2012
- ✓ EN.62133:2013
- ✓ UN 38.3(ST/SG/AC.10/11/Rev.6/Amend.1

Precautions

※ Precautions before use ※

- Be sure to follow the instructions for operation of the device.
- Install the product in a stable and horizontal position.
- If the product is on and stored in a case, there is a risk of product damage and fire.
- Do not allow vibration or shock to be transmitted directly to the product.
- Do not drop or cause any impact.
- Be careful not to step on the power cable or trip the object during charging. An open circuit in the cable may cause a product to fail.
- Do not store in hot and humid places, places with a lot of direct sunlight, or places with a lot of dust.
- Do not store chemicals in the storage area or in the place where
- Do not use this device outside of the range of temperature used.(appropriate temperature range: -20 C to 50°C)
- Do not use it in places where there are strong magnets, power meters, etc.
- If you are connecting or disconnecting each cable or cord from the main body, do not grab the part of the cable, but hold the part of the plug and connect or disconnect it.
- Do not allow foreign substances to enter the product between the surface of the microphone or the heat shield.
- Do not disassemble or modify without approval from the manufacturer.
- In the event of a failure or damage to the main body or accessories, specify the details of the failure or damage and contact the dealer or our service representative.
- Dispose of this product in accordance with the national or local government ordinance.