USER GUIDE

MPAC208

Megger Professional Acoustic Imager

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EN
ENGLISH

This manual supersedes all previous issues of this manual.

Please ensure that you are using the most recent issue of this document.

Destroy any copies that are of an older issue.

Declaration of Conformity

Megger Instruments Limited hereby declares the MPAC208 professional acoustic camera has been built in conformity with the following European Directives where they apply:

2011/65/EU

2014/30/EU

2014/34/EUh

Hereby, Megger Instruments Limited declares that radio equipment manufactured by Megger Instruments Limited described in this user guide is in compliance with Directive 2014/53/EU. Other equipment manufactured by Megger Instruments Limited described in this user guide is in compliance with Directives 2014/30/EU and 2014/35/EU where they apply.

Contents

1. Introduction

This guide explains how to use the Megger professional acoustic camera MPAC208. Please read the guide carefully before you start using the camera.

MPAC208 is the latest generation of portable acoustic imaging cameras, revolutionising industrial inspections with advanced features and capabilities.

The MPAC208 excels at pinpointing leaks, identifying electrical partial discharge, and detecting mechanical deterioration.

In gas leak detection mode, the camera can quickly pinpoint the location of gas leaks and estimate leakage volume as well as economic losses in real time.

In partial discharge detection mode, the acoustic imaging camera can display PRPD graphs in real time and identify discharge types to assist in further decision-making.

In the Mech-Mode, mechanical issues can be identified and located, helping to reduce costly downtime.

The acoustic imaging camera utilises microphone array beam-forming technology to obtain sound source distribution data which is coupled with a high-definition camera to capture real-time video footage. By combining the sound source distribution data with the video footage, the device performs sound-image fusion, allowing the dynamic sound source status and position to be displayed in real time on the device's screen.

Using the camera with the analysis software, the users can analyse, edit, and generate reports for audio, video, and image data. Visual tools and graphs help users to intuitively understand data and make accurate judgments and decisions.

Please ensure all the safety warnings within this manual are read and understood before operating the cameras.

1.1 Company web site

Occasionally an information bulletin may be issued via the Megger web site. This may concern new accessories, new usage instructions or a software update. Please occasionally check on the Megger web site for anything applicable to your Megger instruments.

2. Safety Warnings and Standards

These safety warnings must be read and understood before the instrument is used. Retain for future reference.

The cameras should only be operated by suitably trained and competent people.

2.1 Warnings, Cautions and Notes

This user guide follows the internationally recognised definition. These instructions must be adhered to at all times.

Description
WARNING : Indicates a potentially dangerous situation which, if ignored, could lead to death, serious injury or health problems.
CAUTION : Indicates a situation which could lead to damage of the equipment or environment
NOTE : Indicates important instructions to be followed to perform the relevant process safely and efficiently.

2.2 Safety Warnings

- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- There are no user-serviceable parts inside the cameras; all servicing must be referred to Megger approved service centres.
- Check the camera for damage before use. The camera must NOT be used if any part of it is damaged.
- The camera must NOT be used in the case of malfunction or abnormal heat.
- Do NOT place or store the camera near a heat source, flame or in a high temperature environment.
- It is recommended to store the camera within a temperature range of -20 °C to +40 °C. If storage exceeds two months, remove the battery from the camera.
- This camera contains a removable Lithium-ion battery.
  - The battery is NOT user serviceable. All servicing must be referred to Megger approved service centres.
  - Do NOT charge the battery in temperatures above 45°C.
  - Do NOT charge the battery at temperatures below 0°C.
  - Do NOT place or store the battery near a heat source, flame or in a high temperature environment.
  - Do NOT expose the battery to direct sunlight.
  - In the event of a battery cell leaking, do not allow the released fluid to come into contact with the skin or eyes.
  - If contact has been made, wash the affected area with plenty of water and seek medical advice immediately.

2.3 Additional Safety Warnings for IECEx model

This equipment is suitable for explosive atmospheres to Group II 3G Ex ic IIC T5 Gc, Group II Category 3 D Ex ic IIIC T100 ° Dc, according to conformity certificate IECEx TUR 24.0052X. Notified body: NB 0035

- It must be used in accordance with the explosion-proof marks in explosive environments.
- When using in an explosive environment, **DO NOT** remove or replace batteries or recharge the battery pack.
- In an explosive environment, **DO NOT** connect any USB devices, external power supplies, chargers or other peripherals.
- In an explosive environment, ensure that the silicon rubber socket cover stays firmly in place.
- **DO NOT** insert or remove the microSD card or connect the headset in an explosive environment.
- The electrical accessories provided with the MPAC208-IECEx are not to be used in an explosive environment.

2.3.1 Installation category definitions:

CAT IV - Measurement category IV: Equipment connected between the origin of the low-voltage mains supply and distribution panel.

CAT III -Measurement category III: Equipment connected between the distribution panel and electrical outlets.

CAT II - Measurement category II: Equipment connected between the electrical outlets and user's equipment.

Measurement equipment may be safely connected to circuits at the marked rating or lower. The connection rating is that of the lowest rated component in the measurement circuit.

2.4 Safety, Hazard and Warning symbols on the instrument

This paragraph details the various safety and hazard icons on the instrument's outer case.

Icon	Description
	Caution: Refer to user guide.
	EU conformity. Equipment complies with current EU directives.
	Complies with RCM standards or use in Australia and New Zealand.
	Do not dispose of in landfill, sewage systems or by fire.
	Hot surface
	Conforms to relevant FCC standards.

2.5 Limitations of the GHz Frequency Range

According to Article 10(10) of Directive 2014/53/EU, as indicated in the packaging instructions, when selling this radio equipment in Belgium (BE), Bulgaria (BG), Czech Republic (CZ), Denmark (DK), Germany (DE), Estonia (EE), Ireland (IE), Greece (EL), Spain (ES), France (FR), Croatia (HR), Italy (IT), Cyprus (CY), Latvia (LV), Lithuania (LT), Luxembourg (LU), Hungary (HU), Malta (MT), Netherlands (NL), Austria (AT), Poland (PL), Portugal (PT), Romania (RO), Slovenia (SI), Slovakia (SK), Finland (FI), Sweden (SE), Northern Ireland (UK), Turkey (TR), Norway (NO), Switzerland (CH), Iceland (IS), and Liechtenstein (LI), the wireless local area network (WLAN) function is restricted and limited to indoor use within the frequency range of 5150 to 5250 MHz.

This product includes Wi-Fi, Bluetooth, and GPS functionality. The wireless operating frequency bands include:

Bluetooth: 240 MHz~2480 MHz

Wi-Fi: 2.400 GHz~2.4835 GHz, 5.155.35 GHz, 5.475.725 GHz, 5.725~5.85 GHz.

3. Instrument Overview

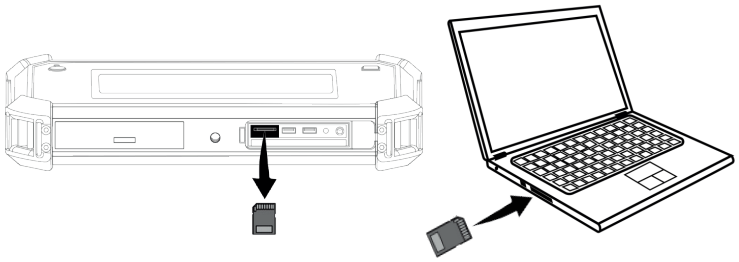
3.1 Instrument layout

Item	Description	Item	Description
1	Power button: To switch ON the camera, press and hold the power button for 5 seconds until the power indicator lights up. NOTE: Before powering on, ensure the battery is sufficiently charged. To switch the camera off, long press the power button or short press the power button and tap on 'Power Off'.	6	Power indicator: The power indicator remains lit when the camera is turned on. The power indicator LED will pulse slowly when the camera is in sleep mode. Press the Power Button to wake the camera.
2	Hot key: Short press the Hot key to take a picture and press for 2 seconds to start recording a video. Short press it again to stop recording.	7	LED Flashlight
3	Hand straps	8	Optical camera
4	Battery cover	9	Microphone array
5	8" Capacitive touch screen display		

3.2 Instrument layout continued

Item	Description	Item	Description
1	3.5mm audio jack: During the inspection test, plug in a 3.5mm earphone to hear the modulated ultrasonic sound signal.	5	MicroSD card slot: The photos and videos captured by camera can be stored on the inserted SD card.
2	SIM card slot: This feature is currently not supported	6	External analogue sensor input port: External sensors (up to 4) can be connected to the camera.
3	Charging indicator: After plugging in the charger, the light will remain on until fully charged. Full charge is reached in approximately 2.15 hours.	7	USB-C Thermal module input: The camera can display thermal images generated by an optional thermal imaging module.
4	USB-C Port (Charging and data export): The device can be charged using a USB-C data cable with a compatible charger. When connected to a computer via a USB-C cable, the user can export files or perform software upgrades. By using a USB-C to HDMI adapter the cameras screen can be mirrored onto an external display.		

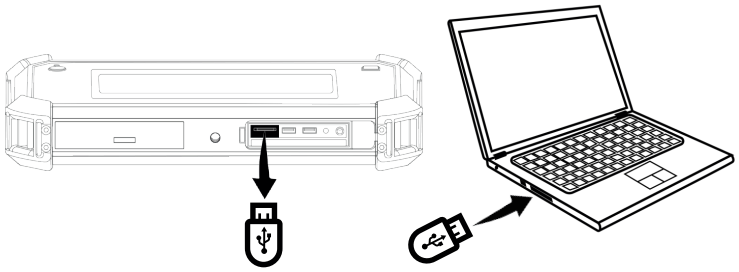
3.2.1 MicroSD (TF) card slot



CAUTION :

- Do not remove or insert the microSD (TF) card when video recording.
- After taking photos and recording videos, wait until the data is saved successfully before inserting the microSD (TF) card.
- Do not remove or insert the microSD (TF) card when browsing and marking data in the playback menu. Test data may not be correctly identified and displayed in the playback menu.

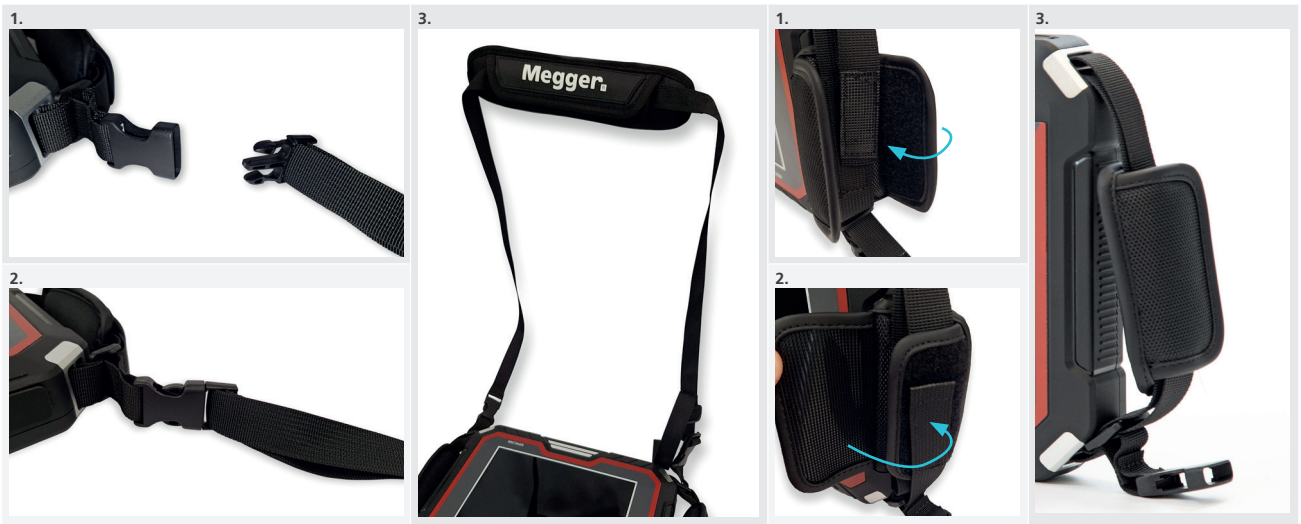
3.2.2 USB-C



CAUTION :

- Do not remove or insert the USB-C flash drive when video recording.
- After taking photos and recording videos, wait until the data is saved successfully before inserting the USB-C flash drive.
- Do not remove or insert the USB-C flash drive when browsing and marking data in the playback menu. Test data may not be correctly identified and displayed in the playback menu.
- Inserting either the USB-C flash drive or microSD (TF) card will initiate an automatic transfer of the images and videos stored in the camera's internal memory.
- The stored files can be transferred to the Megger Acoustic Analysis Software or downloaded for storage on a PC or laptop.

3.2.3 Shoulder straps and hand straps



CAUTION : ensure all strap connections are fitted correctly and secure before use.

4. Interface operation

4.1 Interface controls

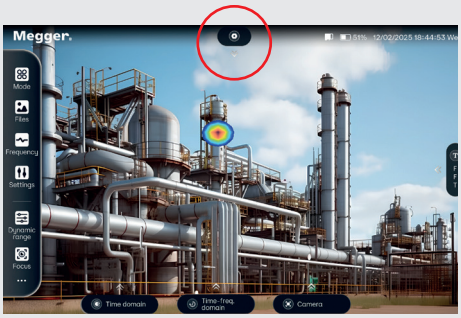
Item	Description	Item	Description
1	Function menu options (Mode, Files, Frequency, Settings)	5	User selectable custom options
2	Dropdown menu: Slide your finger from the top of the camera to access and customise various functions and open the system settings.	6	Sub-Display 1*
3	Status bar: Displays the current operational status of the device	7	Sub-Display 2*
4	Date and time	8	Sub-Display 3*
		9	Frequency selection box and FFT display

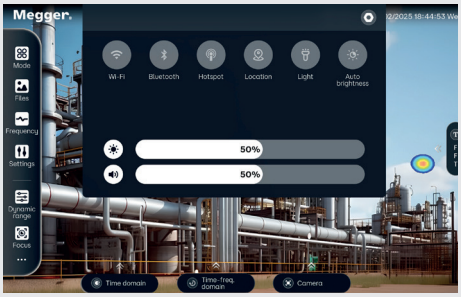
*Options: PRPD spectrogram, time-domain graph, thermal image (optional module required), time-frequency domain graph or camera image

Tap the screen to view the side function menu bar and other icons.

Tap the T FFT button on the right side of the screen to bring up the FFT display.
Tap FFT to collapse the display.

Tap the ⊙ on the top centre of the screen to view the **settings menu**. The menu can also be viewed by sliding the finger from the top of the screen downwards at any point.

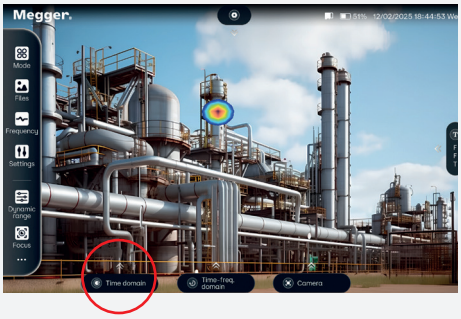


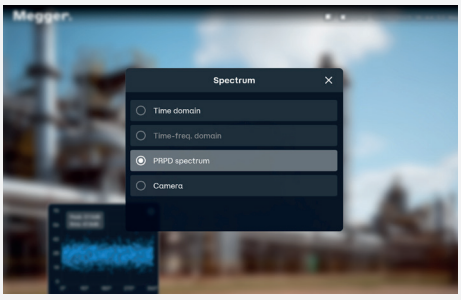


Interface operation

Three sub-displays are available on the MPAC cameras.
Tap the tabs at the bottom of the screen to bring up the display.
Tap the ⊙ in the top right corner of the sub-display to select the image to display. Slide down on the sub-display to minimise.

NOTE : The thermal image display requires an optional thermal imaging module plugged into the camera.





Short-press the MPAC hot key to capture an image and long-press (>2 seconds) to start recording a video. To stop the recording, short press the button again.

4.2 Mode

Tap on **Mode** to access the different camera modes available. This shows you the list of default operating modes as well as the customized user-added modes.

4.2.1 General Mode

When the camera is operating in the **General** mode, it can capture gas leaks, partial discharge and other noise signals. In this mode, the device displays the source location on the screen but does not support analysis capabilities.

4.2.2 Gas Leak Mode

When the camera is operating in the **Gas Leak** mode, it can capture gas leakage signals and display the source location on the screen. It also analyses the leakage volume for various gas types and different types of leakage, providing quantification information.

Leak volume: Estimated gas leakage volume as calculated by the algorithm.

Eco loss: Estimated economic loss caused by the gas leakage as calculated by the algorithm.

Distance: Estimated distance between the gas leakage points and the camera as calculated by the algorithm. Tap on Auto to automatically measure the distance to the sound source.

Distance is automatically assessed up to 5M. For more accurate results, any distance above 5 M should be manually programmed.

Gas pressure: Gas pressure of the pipe/vessel can be manually edited to provide a more accurate result.

Gas type: Users can choose from the given list of gas types based on the gas being measured.

Leak source: Users can choose from the list of leakage point types for more accurate leakage volume calculations and report integration.

To edit other related parameters, with gas Mode selected, tap on **Settings** from the **Function Menu** and then on **Mode parameters** and then select **Gas Leak**. The units and values of various parameters can be edited for a more accurate result.

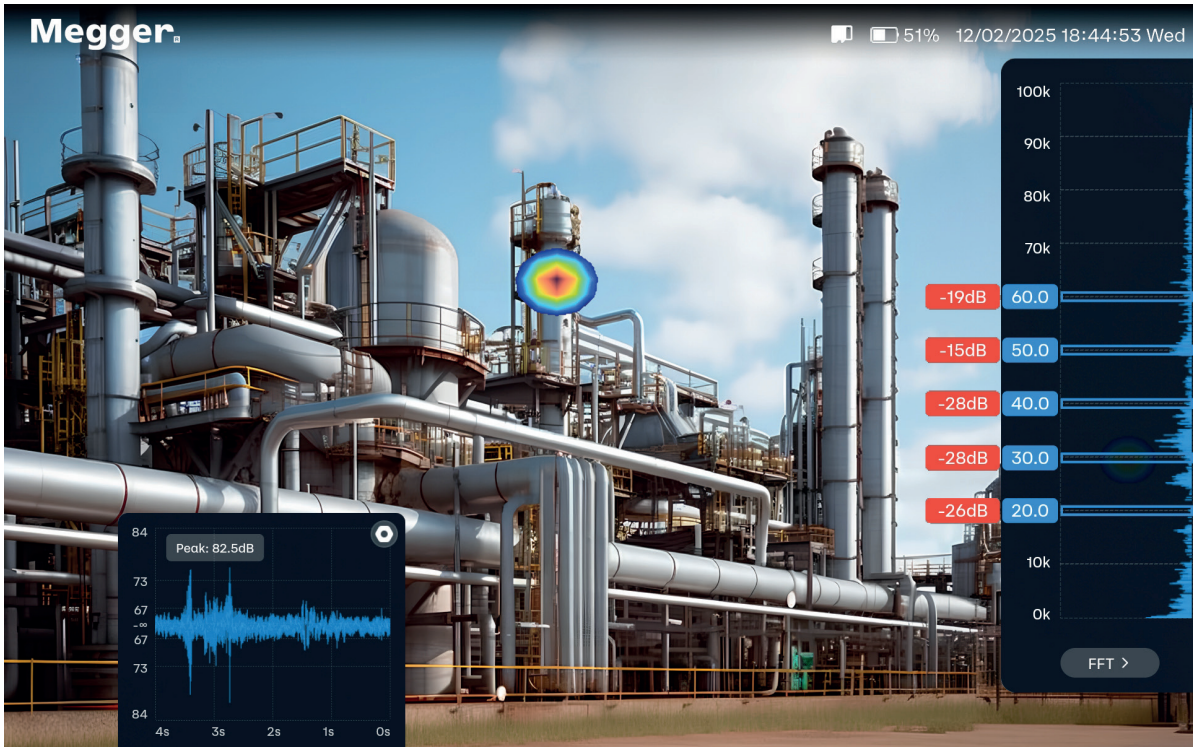
4.2.3 Partial discharge mode

When the camera is operating in the **Partial discharge** mode, it can capture partial discharge signals and display the source location on the screen as well as provide a PRPD Spectrum display.

To edit the fundamental frequency of the electrical system being monitored, tap on **Settings** from the **Function Menu** and then on **Mode parameters** and then select **Partial discharge**. Users can select the frequency for the power grid according to its operating frequency, the default value being 50 Hz.

4.2.4 Mech-Mode

When the camera is operating in the **Mech-Mode**, it can capture mechanical vibration sound signals and display the source location on the screen as well as perform additional analysis.



Tap on **Frequency** on the **Function Menu** to choose between single or multiple frequency measurement points. When multiple frequency points are selected, five frequency boxes will be displayed on the Frequency selection box on the right FFT display.

Tap on any of the frequency boxes to activate/deactivate them. Measured dB values are shown alongside each band that is currently active. Up to four frequency points can be deactivated.

Tap and drag a frequency box to change its position on the frequency range bar.

4.2.5 Thermal Mode

NOTE : Thermal Mode requires an optional thermal camera module.

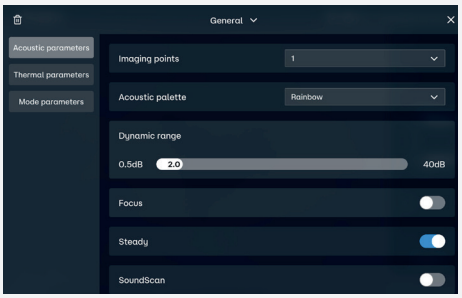
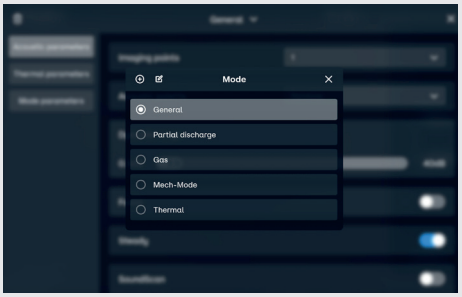
For more information on the MPAC-TM Thermal Module please visit Megger.com or scan the QR code	

When the camera is operating in Thermal Mode, it can display both PD acoustic and thermal images as a split-screen display. The thermal display provides centre point temperature measurement, as well as maximum and minimum temperature spot indicators.

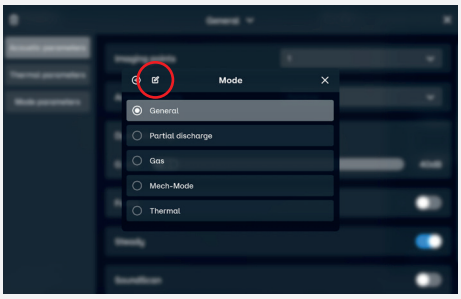
Multiple thermal parameters can be edited by accessing the thermal parameter menu. In Thermal Mode, select Settings from the Function Menu and select Thermal parameters.

All the thermal image information is captured when a thermal image video of photo is saved. This can then be further edited using the Megger Acoustic Analysis Software provided.

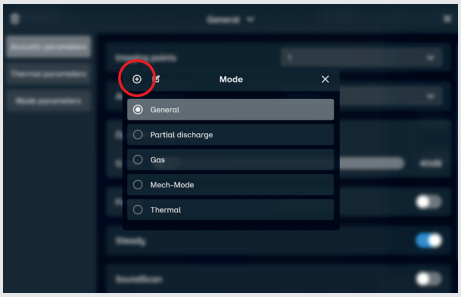
The Mode options can also be accessed and edited from Settings.

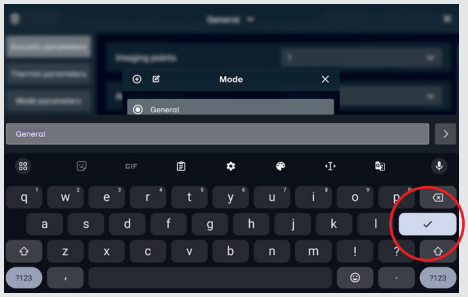
Tap on **Settings** on the Function Menu.	
Tap on the dropdown menu at the top centre of the screen.	
Tap on the Mode that you want to edit.	

When you have finished editing the default parameters, save and exit the editing screen by tapping the ⓧ button. The Mode name can also be edited by selecting the edit name icon in the Mode selection list menu. To save the changes to a Mode name, tap the tick button on the keyboard.

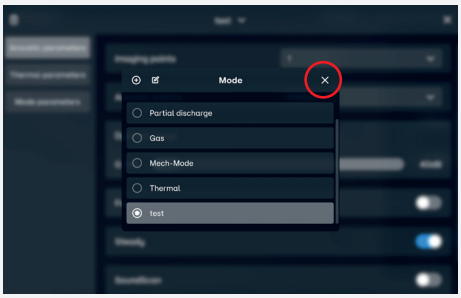


To create a new Mode, tap on the plus icon ⊕ and enter the name to be displayed.
After making any changes to the default parameters, type in a Mode name and tap the tick button on the keyboard.



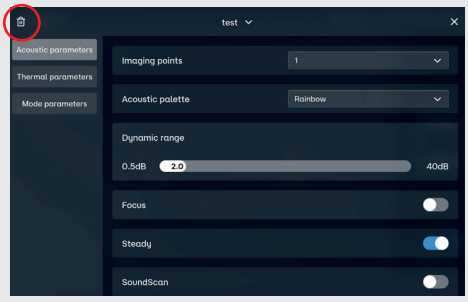


Tap the cancel icon ⓧ to save changes and exit the scene editing window.



To delete a selected Mode, tap the bin icon at the top left of the screen and confirm.

NOTE : The default Modes cannot be deleted.

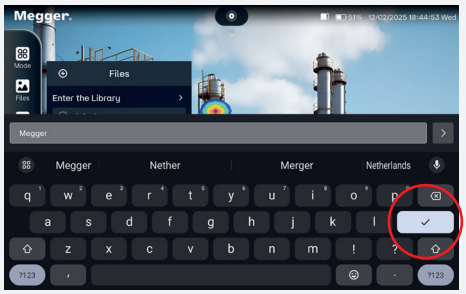


4.3 Files

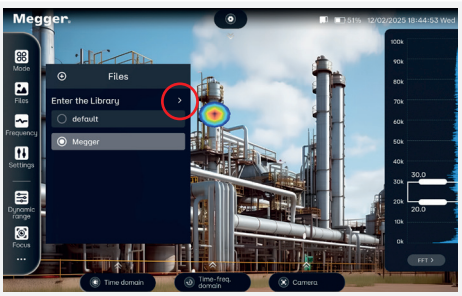
Tap on **Files** from the Function Menu for the Photos popup window to appear. The current list of available albums is shown. Tap on the album name to select it as location for saving the new images/videos..

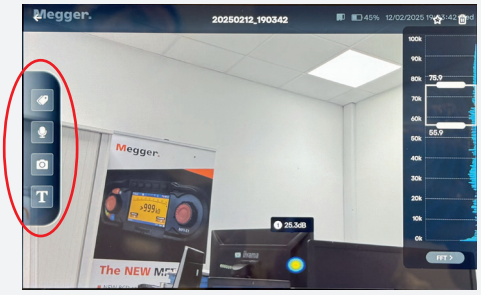
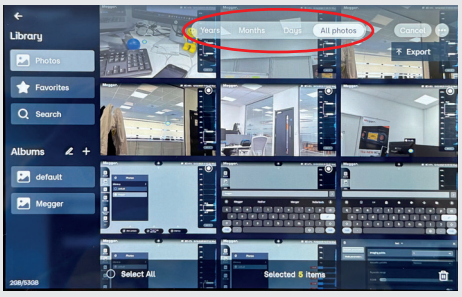
4.3.1 Creating a new album

To create a new album:

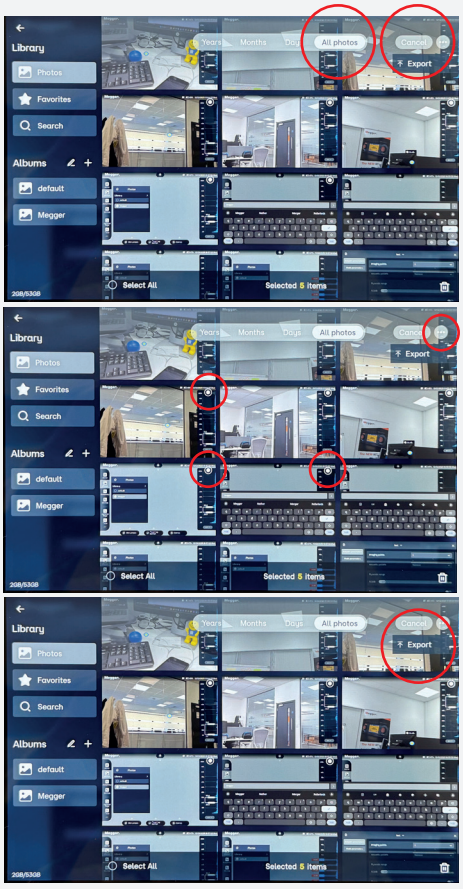
Tap on **Files** on the function menu.	
Tap on plus icon ⊕ to create a new album. Enter the name of the album using the pop-up keyboard and tap on tick to save it.	 

4.3.2 To view the saved photos and videos

Tap on **Files** on the function menu.	
Tap on **Library** to enter the Gallery view interface.	

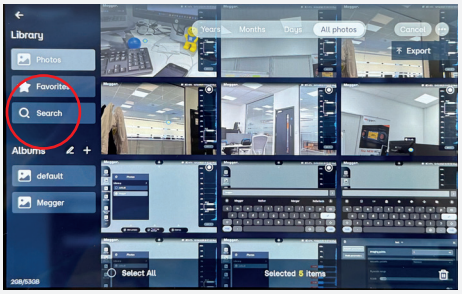
Tap on any thumbnail picture to open the image / video file.	
When a video or image file is open, tap on the star icon in the right top corner to mark it as favourite and add it to the Favourites list in the Gallery view.	
Tap on the bin icon on the right top corner to delete the file.	
With an individual file open, the sidebar can be used to add labels and audio/image/text tags to the open file. **See 4.3.3 Tagging a file on page 22.**	
The submenu bar at the top in the Gallery view can be used to display the saved files by year, month or days.	

With All Photos selected from the top sub-menu, individual files can be selected to be deleted, moved between Albums or exported to the micro-SD (TF) card. Tap the Select option and tap on the files you want to select.
A circular icon appears on the top right of selected files. Tap on the file again to de-select it.
Use Select All option at the bottom left to select all the files.
To delete the selected files, tap the bin icon at the bottom right.
To export or move the selected files between albums, tap the 3 Dot icons in the bottom right of the display.
To cancel the selection, tap Cancel at the top right of the screen.



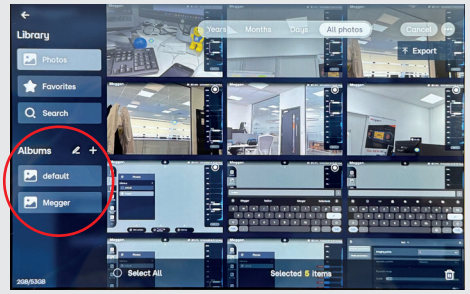
Any files marked as favourites can be found by tapping the **Favourites** tab on the **Library** sidebar menu.

Use the **Search** option on the sidebar to search for a specific file.
Tap on the search bar at the top of the screen for the keyboard to pop-up.
Type in time, location, album name or tag information to search.



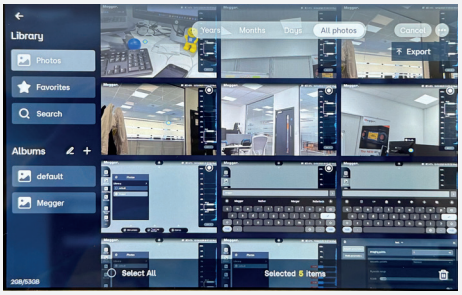
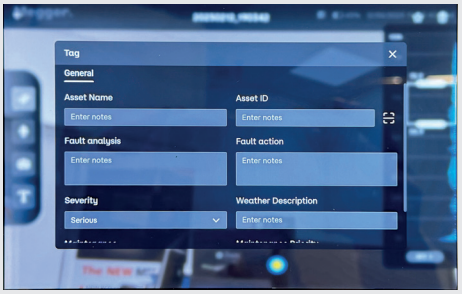
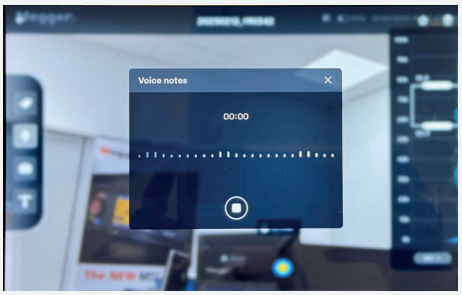
To view the files in a specific album, tap on the album name from the list on the sidebar under **Albums**.

Tap on the edit icon to edit the selected Album or the ⊕ icon to create additional albums.

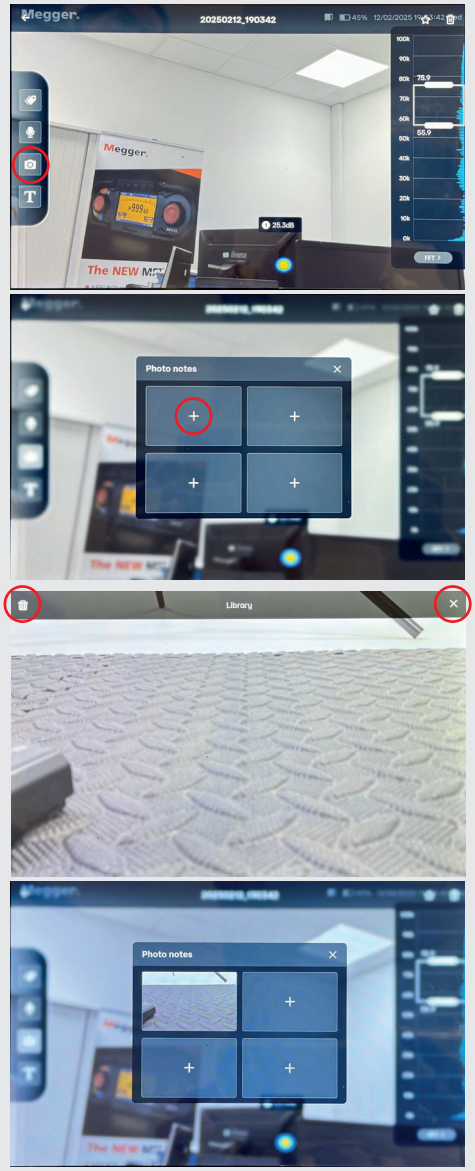


4.3.3 Tagging a file

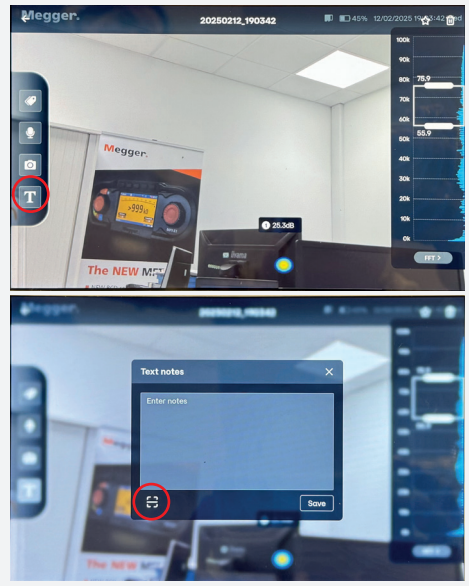
To add tagging information to a file,

Tap on **Files** on the function menu.	
Tap on **Library** to enter the Gallery view interface. Tap on the file thumbnail to open the image / video file.	
To add a **label** to the file, tap on the tag icon on the sidebar. This lets you add general information like asset information, fault diagnosis, weather notes, maintenance information. It also lets you add specific information based on the scene which was selected while capturing the image / video. Tap on ⓧ to save and close the label.	 
To add an audio tag to the file, tap on mic icon on the sidebar. Tap on the record icon to start recording. Tap it again to stop recording. To delete the audio file, tap on the bin icon and tap 'Yes'.	 

To add an image tag, tap on the camera icon on the sidebar.
Tap on plus icon to add an image tag. Up to four image tags can be added to a file.
Press the hot key to capture an image.
Tap on ✕ to save and close the image.
Tap on bin icon to delete it.



To add a text note to the file, tap the T icon on the sidebar.
Tap on the text box for the keyboard to pop up. After typing the note, tap on tick for the keyboard to disappear.
The camera can also scan a QR code to add the related text as a text note. Tap on the scanner icon to enter the scanning mode.
Tap on Save to save the added text.



4.4 Frequency

By default, the frequency range box shown on the FFT display is set to 20 kHz to 30 kHz for all scenes apart from Mech-Mode. As mentioned, the Mech-Mode scene has single and multiple frequency options. **See 4.2.4 Mech-Mode on page 16.**

To add a new frequency range for all other Modes:

Adjust the frequency selection box to the desired frequency range.	
Tap on Frequency on the Function Menu and then tap on the ⊕ icon to add this frequency range to the list.	
To delete a specific range, select Default and tap the bin icon next the range to be deleted. Saved ranges cannot be deleted if selected.	

When operating in Mech-Mode and the camera frequency measurement range is set to 2 kHz – 100 kHz, the default frequencies points are 10 kHz, 20 kHz, 30 kHz, 40 kHz, and 60 kHz, with a frequency bandwidth of 2 kHz. These values can be changed by sliding the frequency boxes on the frequency range.

To work with a single frequency point, select **Single** (20 kHz) frequency option from the **Function Menu**.

4.5 Settings

4.5.1 Acoustic parameters

- **Imaging points:** Set the maximum number of imaged sound sources to be visible on the screen. For example, when set to 3, the screen displays and reports the sound pressure level (SPL) of a maximum of 3 sound sources.
- **Acoustic palette:** Set the colour scheme for the sound cloud image for the acoustic image. Rainbow, Ironbow and Gray scale are the available options.
- **Dynamic range:** This defines the range of energy, or sound pressure, that is displayed in the acoustic cloud image. By increasing the Dynamic Range, sound sources with a smaller SPL are displayed.
- **Focus:** The focusing function can be used to pinpoint leaks and, by eliminating interference, detect much smaller leaks or sound sources. When detecting partial discharge, enabling the focus function enhances the accuracy of discharge type identification.
  - When focus is enabled, the size of the focus area can be selected using the slide bar. Only sound sources within the ring are displayed.
- **Steady:** Enabling the steady state function enhances the anti-interference capability and stabilises the image. Disabling this allows the detection of more transient sound signals.
- **SoundScan:** Enabling SoundScan will allow sound sources outside the visible field of view to be directionally indicated on the MPAC screen to aid location and pinpointing.
- **Advanced settings:** Tap on Advanced settings to view additional settings for acoustic parameters.
  - **Monitor:** Enabling Monitor allows for the ultrasonic signals to be modulated and heard through either Bluetooth headphones or headphones that are connected to the camera headphone socket.
  - **Imaging threshold:** Set the minimum sound pressure level (SPL) that the camera will detect. Only sound sources generating a sound pressure greater than the threshold value will be visible on the screen.
  - **Measuring bandwidth:** User can set the cameras sound frequency measurement bandwidth of either 2 – 100 kHz or 2 - 48 kHz.

4.5.2 Mode parameters

The Mode parameters differ based on the Mode selected. Below is the description for some of the mode parameters.

Gas Leak: The following parameters can be modified for **Gas Leak** Mode.

- **Leakage estimation**
  - **Gas type:** Specific gas can be selected from the drop-down menu for better reporting.
  - **Leak source type:** Specific leak source type can be selected from the drop-down menu for better reporting.
  - **Gas pressure:** Specific pressure of the gas within the pipe or vessel being measured. Measurement unit can be selected from the drop-down menu.
  - **Distance:** Approximate distance to the measured sound source. In "Auto" mode, this is adjusted automatically up to 5 m (16.4 ft). Measurement unit can be selected from the drop-down menu.
  - **Leakage unit:** Measurement unit can be selected from the drop-down menu.
- **Economic Loss Estimate**
  - **Ratio of power to flow rate:** The ratio of kW used to produce a specific volume of gas over a specified time period. Measurement unit can be selected from the drop-down menu.
  - **Cost of gas:** The cost of the gas per m3.
  - **Cost of electricity:** The cost of the electricity in kWh.
  - **Operating hours:** Number of hours that a compressor runs or the gas line is pressurised. Measurement unit can be selected from the drop-down menu.
  - **Currency:** Select the currency unit to be displayed.

- **Advanced settings**
  - **Leakage correction:** User can set a leakage correction value to help compensate for potential inaccuracies in the measurement based on measurement of a calibrated value. Regular verification using the MPAC-V should overcome the need to add a correction value.

Partial Discharge: The following parameters can be modified for **Partial Discharge** Mode.

- **Power frequency:** Select the operating frequency of the voltage between 50 and 60 Hz from the drop-down menu.
- **Asset:** Select an asset from the drop-down to be included in the report or as details for the image/video.
- **Sub-device Type:** A sub-device type can be selected from the drop-down menu to add in the report or as details for the image/video.
- **Voltage:** Rated operating voltage of the asset being monitored.
- **Distance:** Approximate distance to the measured sound source. In "Auto" mode, this is adjusted automatically up to 5 m (16.4 ft). Measurement unit can be selected from the drop-down menu.
- **PD count**
  - **PD count:** The PD count can be switched on/off by tapping on the toggle button.
  - **PD count correction factor:** The PD count correction factor is a scaling parameter used to adjust the PD count. This allows for calibration adjustment should the PD count differ from a known calibrated source.

Thermal: The following parameters can be modified for Thermal Mode.

- **Thermal palette:** Allows selection of the thermal imaging colour palette from White-hot, Black-hot, Ironbow, HC Rainbow, Rainbow, and Gray scale.
- **Temperature scale:** The user can select a temperature measurement range of either -20°C to 120°C or 120°C to 550°C
- **Temperature unit:** Allows selection of Celsius (°C), Fahrenheit (°F) or Kelvin (K) as the temperature unit for measurement and display.
- **Distance:** Allows input of the distance between the temperature source and the camera during measurement.
- **Emissivity:** Set the emissivity value for the material of the measured item. Setting the appropriate emissivity value is paramount for accurate temperature measurements.

NOTE : Emissivity tables are freely available online.

- **Thermal correction:** User can set a thermal correction value to help compensate for potential inaccuracies in the thermal image based on the specific environment and materials being inspected.
- **Ambient temperature:** Allows the input of the ambient temperature during measurements to increase accuracy.
- **Reflection:** The "reflection" setting is used to adjust for the amount of heat being reflected off the surface of surrounding objects, allowing the camera to provide a more accurate temperature reading of the measured asset by compensating for the influence of reflected infrared radiation. This feature is especially useful when dealing with highly reflective surfaces like polished metal or glass.
- **Humidity:** Allows the input of the ambient humidity during measurements.

4.6 Custom buttons:

Two custom buttons can be added to the Function Menu sidebar for quick access. The default custom buttons present on the sidebar are Imaging points and SoundScan. Tap the three dots at the bottom of the sidebar to edit these options.

Tap on ⊖ to the left of the current option to be removed and displayed under Show on navigation bar.	
To add a new custom option, choose one from the More section and tap on ⊕ next to it to add it to the sidebar. **NOTE : The options on the More section become available only if there is space on the Navigation bar. Only two options can be selected at any time.**	
Tap on ⊗ or **Yes** to save and exit the editing window. Tap on **Reset** to go back to the default options.	

4.7 Dropdown menu

The quick access dropdown menu is found by sliding your finger down from anywhere across the top edge of the display area. The options are used to set up the key communication features, turn the LED flashlight on or off or make adjustments to the display and audible parameters. Display brightness and the audible sound level are adjusted using the appropriate slide bars. Tap on any of the communication icons to switch the feature on or off. Press and hold the icon to open the settings menu for the corresponding function.

Tap on the ⊙ on the top right of the dropdown menu to open the **System Settings** for the camera.

4.7.1 Bluetooth

The camera's Bluetooth name is **MPAC208**. External headphones can be connected to the camera via Bluetooth using the following steps:

Tap on the toggle button to switch Bluetooth ON. Tap on it again to switch it OFF. **NOTE : Ensure the Bluetooth feature for the headphones you wish to pair with is turned on.**	
Tap on **Refresh** to update the list of available Bluetooth devices. Recently connected devices will appear under Paired devices.	
Tap on a Bluetooth device under **Add Device** to pair with it. Tap on **Yes** on the pairing confirmation pop-up to complete the pairing process.	
After connecting to the device, tap on the device name or the ❯ to view details. To delete this device, tap on **Delete this device** and confirm. Tap ⊗ to save and exit.	

4.7.2 Wi-Fi

Tap on the toggle button to switch Wi-Fi ON. Tap on it again to switch it OFF.	
Tap on Refresh to update the list of available Wi-Fi connections. Recent Wi-Fi connections will appear under Networks.	
Tap on a Wi-Fi network from the list under Networks and input the password in the pop-up window to connect to it, if required. Tap on OK to confirm.	
After connecting to the network, tap on the name or the ❯ to view details. Tap on **Delete this network** and confirm to delete the Wi-Fi network. Tap on the toggle button for **Auto connect** for the device to connect automatically to this network when Wi-Fi is switched on. Tap on **Password** to view the current saved password. IPV4 settings can be used to view the network information and choose between automatic IP configuration or manual configuration. Tap ✕ to save and exit.	

4.7.3 Network sharing

To access the files (images/videos) from the MPAC208 series from the software, Ethernet or Hotspot functionality can be used. Tap on the toggle button to switch on/off the Ethernet and Hotspot for the camera. Tap on **Download camera photos** to view instructions and QR codes to view reports.

Tap on the toggle button to switch Network sharing ON. Tap on it again to switch it OFF.	
Tap on Name to modify the device's name. Type in the name using the pop-up keyboard and tap on tick to save.	
Tap on Password to modify the device's name. Type in the name using the pop-up keyboard and tap on tick to save. Tap ✕ to save and exit.	

NOTE : Network sharing and Wi-Fi cannot be enabled simultaneously, the device can operate only in one of these modes.

4.7.4 Display and brightness

Select between Light and Dark theme for the camera User Interface (Currently under development at time of launch).	
The brightness of the camera screen can be adjusted using the horizontal slide bar.	
Tap on the toggle button to turn Auto brightness on or off. When on, the brightness is adjusted automatically based on the ambient lighting conditions.	
To have the Megger logo on the display screen, toggle the logo button on. Tap on it again to hide the Logo.	
Tap ✕ to save and exit.	

4.7.5 Date and time

Tap on the Time calibration toggle button to enable automatic time calibration. When this is enabled and camera is connected to the internet, the camera will automatically adjust the time to match the internet time.

Tap on the **Time zone** drop-down menu to select the relevant time zone.

Tap on the **Set date** drop-down menu to set the date manually.

Tap on the **Set time** drop-down menu to set the time manually.

Tap on the **Date format** drop-down menu to set the displayed date format.

Tap ✕ to save and exit.

4.7.6 Language and region

Tap on the Language drop-down menu to set the relevant language for the camera user interface.

4.7.7 Power settings

In order to reduce battery consumption, Auto sleep and Auto power off features can be used.

Tap on the Auto sleep drop-down menu option to set the time after the last user input before the camera enters its low energy sleep mode.	
Tap on the Auto power off drop-down menu option to set the time after the camera entered sleep mode before the camera initiates shut down and turns off.	

4.7.8 Device info

Device information such as device Name, Model number, Serial number, Firmware and System versions can be found under this tab.

4.7.9 Software update

The MPAC range of Acoustic Cameras can be updated by users in the field. Firmware updates for the camera can be found using the QR code located on the first page of this manual.

To update the firmware, first download the file from the Megger website and load it onto the microSD (TF) cards root directory. Place the microSD (TF) card into the camera (**See 3.2.1 MicroSD (TF) card slot on page 11.**)

Start the camera and select **Software Update** from the main settings menu. Tap on **Check for updates** to view the update files present in the microSD (TF) card. The latest firmware version should be selected. Follow the on-screen directions to complete the firmware update.

4.7.10 Verification

To ensure optimal performance of any acoustic imager, regular verification of the measured parameters should be undertaken. The Megger MPAC range have been designed to be user verified using the optional MPAC-V Verifier. This is a calibrated sound source that will provide a pre-defined sound pressure output at multiple frequencies.

The verification procedure is explained in detail within the MPAC-V user guide (visit **megger.com** for more information on the MPAC-V).

4.7.11 Help

The help feature gives the user access to keyword associated help, as well as the full user manual (in English).

4.7.12 Aftersales

Tap on **Details** to view a list of Megger global offices with contact details for aftersales help and support.

4.7.13 Microphone test

The MPAC208 has a built-in microphone array testing feature. Tap on **Start testing** to begin the test. This tests each individual microphone and should be run on a regular basis to ensure optimal performance of the camera. Should an anomaly be reported by the test procedure, please contact your local Megger office to arrange for servicing and repair of the camera. **See 15. Worldwide Sales Offices on page 44.**

5. Thermal module

Using an optional thermal imaging module allows both acoustic and thermal images to be displayed on the MPAC screen. This gives the user a comprehensive maintenance and analysis tool, catering for multiple applications. In addition, both acoustic and detailed thermal analysis that can be undertaken and reported on using the Megger Acoustic Analysis Software.

Plug in the thermal module at the top (refer image in 3.1) to be able to view thermal imaging screen on the display. If the thermal image is not clear, it is possible the focal length of the thermal module requires adjustment. The focal length of the thermal module is adjusted by turning the lens of the module.

For more information on the MPAC-TM Thermal Module and Megger Acoustic Analysis Software please visit Megger.com or scan the QR code

5.1 Display interface switching

Selecting Thermal Mode from the Function Menu will automatically provide a split screen view of the acoustic and thermal images.

In all modes, the thermal image can be added as a sub-display, or alternatively, switched to the split screen or full screen mode.

With the Thermal Image selected on a sub-display, long press the image and move it up to show the two display options. Slide the image to the preferred location and release. The split screen mode will initiate.

6. Basic measurement advice

6.1 Capturing the sound source

Some acoustic images are harder to pinpoint than others. When first using the camera, always ensure the FFT display is visible. Monitor the spectrogram to see if there are any prominent spikes. If a spike is visible, adjust the measurement frequency band by pressing between the bars and sliding up and down to ensure the spike falls between them. The measurement range box defaults to a span of 20 kHz, but this can be reduced by sliding either the upper limit bar down or lower limit bar up..

If you adjust the dynamic range to a larger value, the target sound source should become prominent but the camera may simultaneously display more than one sound source on the screen. When the sound pressure level (SPL) of multiple sources on the picture differ significantly, even a small increase in dynamic range may cause the sound sources with greater energy to drown out the those with a relatively small SPL.

6.2 Reflected sound

On discovering a sound source, users should check to see if this is in fact a true source or an image caused by reflected sound. The easiest way to confirm this is to adjust your position and view the sound source from different angles. If the sound source remains steady, this indicates an actual sound source. A reflected sound source may move or disappear altogether when measured from different angles.

6.3 Noise interference

Acoustic measurement can be impacted by environmental noise, especially in the low frequency band. If possible, it is recommended to adjust the measurement frequency band to eliminate lower frequencies to help determine the exact location of the sound source and the energy it is generating (SPL).

In addition, a relatively narrow measurement band is always recommended to minimise or eliminate interference noise.

Once a sound source is identified, using the Focus function will allow the camera to filter out additional background noise and produce a more accurate reading of the SPL or determine the PD type. In addition, this will provide a more accurate reading of the Time-Domain and Time-Frequency Domain values.

7. Maintenance

NOTE : There are no user replaceable parts within this product.

7.1 General maintenance

Ensure the unit is kept clean and dry after use.

Close all covers when not in use.

Keep acoustic sensor holes clean and prevent dust accumulation; if the holes have dust, blow air gently to clean using the provided lens cleaner blower and brush, or similar.

When not in use for a long period of time, charge the battery and store at room temperature in the supplied carry case.

Regular inspection and charging can effectively increase service life of the battery.

7.2 Cleaning

Disconnect from mains power / charger.

Switch off and remove battery cells.

Wipe the instrument case with a clean cloth dampened with either water or isopropyl alcohol (IPA). Do not use abrasive cleaners as damage may occur.

Proprietary screen cleaners or screen wipes are recommended for cleaning the instrument display

7.3 Battery

WARNING : Always set the instrument to Off before battery cells are removed or installed.

CAUTION : Old batteries must be disposed of in accordance with local regulations.

CAUTION : Only use approved batteries as defined below.

To help maintain the health, reliability and longevity of the installed batteries:

Remove battery cells if the instrument is not going to be used for a long period.

Store batteries in a cool, dry place. Batteries can be damaged when exposed to heat.

7.3.1 Battery status

Battery condition icon is positioned at the top right hand corner of display. This icon is displayed at all times when the instrument is switched on. When running the icon will indicate state of charge, the icon will be filled in proportion to the state of charge.

8. Battery information

WARNING : Switch off the instrument and remove any connection before removing the battery cover.

CAUTION : Batteries should not be left in the instrument if remaining unused for an extended period.

CAUTION : Only use OEM replacement batteries to avoid damage to the camera.

8.1 About the battery

The MPAC208 series is supplied with two 6600 mAh 7.2 V Lithium-ion rechargeable batteries. These are lighter, charge faster and last longer compared to traditional batteries, with a higher power density for greater performance. Each battery will provide approximately 5 hours operational use.

8.2 Battery compliance

The battery has been tested and meets the requirements of the following standards:

1. Section 38.3 of the United Nations Manual of Tests and Criteria.
2. Complies with CE, and FCC requirements.
3. Complies with CE-RoHS requirement.

8.3 Battery charge state and replacing the battery

To check the battery charge state and replace a battery, carry out the following:

1. On the bottom of the camera, rotate the battery compartment cover retaining screw to the unlock position and carefully lift the cover. NOTE: The battery cover is connected to the device with a retaining wire to prevent loss.
2. Hold the battery tab and pull gently to remove the battery.
3. To check the battery charge level, press the button on the battery marked PUSH. There are five LED indicator lights, and each LED relates to 20% of battery charge.
4. When re-inserting a battery, ensure the battery tag is visible, and the battery is pushed down firmly. Replace the battery compartment cover and rotate the retaining screw to the locked position.

8.4 Charging the battery

The battery charge icon and exact charge % is indicated on the MPAC screen at all times.

The user is notified by an on-screen warning when the battery level falls to 20% and the battery icon turns red. For optimum performance, it is recommended that the battery is recharged when it reaches this level. There are two methods available to recharge the battery.

8.4.1 Using USB-C

1. Carefully lift the silicon-rubber port cover on the bottom of the MPAC. There is a retaining wire connected to the cover to prevent loss.
2. Insert the provided USB-C charging plug into a suitable power outlet. Connect the USB-C charging cable using one of the sockets on the charging plug. Insert the other end into the MPAC208 USB-C charging port on the bottom of the camera. The white charging LED next to the USB-C charging port on the MPAC will be lit during charging.

NOTE : The device supports the USB Power Delivery (USB PD) 'quick charging' protocol. It is recommended to use a power adapter or power bank with a 9 V output and a minimum output power of not less than 27 W to charge the device.

3. The MPAC may be used during charging, so as to support the use of an external power supply or portable power banks.
4. Once fully charged, the white USB-C charging LED will go off, and the on-screen battery indication will show 100%.

8.4.2 Using the external charging kit

1. Insert the provided USB-C charging plug into a suitable power outlet. Connect the USB-C to DC plug charging cable using one of the sockets on the charging plug. Insert the DC plug into the provided battery charging cradle.
2. When the full battery light comes on, remove it from the charger.

CAUTION : If you suspect there may be liquid in the charging port of MPAC208, DO NOT plug the USB-C charging cable in. Remove the battery and ensure the port is clean and dry before proceeding.

8.5 Battery care

- Do not leave batteries charging in the device or charging cradle for more than 24 hours.
- If being stored for long periods, it is recommended to charge the batteries every two months to 80%.
- For daily use, charge the device when battery level is below 20%.
- It is recommended to store the batteries between 10°C and 30°C for optimal performance.

NOTE : All batteries have limited recharge cycles and may eventually need to be replaced. Battery life and charging times vary by use, environment and settings. If you find yourself charging your device more frequently, it is recommended the battery is replaced. Do not disassemble the batteries.

9. Emissivity values

Typical Emissivity Values			
Substance	**Emissivity**	**Substance**	**Emissivity**
Asphalt	0.90 – 0.98	Aluminium foil	0.04
Concrete	0.94	Aluminium (oxidized)	0.01 – 0.40
Cement	0.96	Brass (oxodized)	0.50 – 0.65
Sand	0.90	Chromium oxides	0.81
Earth	0.92 – 0.96	Copper oxides	0.78
Water	0.92 – 0.96	Copper (oxodized)	0.20 – 0.88
Ice	0.96 – 0.98	Steel (oxodized)	0.79 – 0.80
Snow	0.83	Zinc (oxodized)	0.10 – 0.11
Glass	0.90 – 0.95	Iron (oxodized)	0.50 – 0.90
Ceramic	0.90 – 0.94	Iron (rust)	0.65 – 0.96
Marble	0.94	Wood	0.80 – 0.90
Plaster	0.80 – 0.90	Graphite	0.70 – 0.80
Plasterboard	0.91	PVC	0.91 – 0.93
Mortar	0.89 – 0.91	Coal	0.80
Brick	0.93 – 0.96	Cardboard	0.81
Rubber (black)	0.94	Cloth (black)	0.98
Plastic	0.85 – 0.95	Human skin	0.97 – 0.99
Textiles	0.90	Charcoal (powder)	0.96
Paper	0.70 – 0.94	Electrical Terminal Blocks	0.60

10. Specifications

Specification	Detail
Acoustic Specification	
Microphone array	208 channels MEMS microphones
Effective bandwidth	2 kHz – 100 kHz
Dynamic range	User adjustable, 0.5 dB to 12 dB
Sound pressure level range	28 to 13 dB
Auto max/min dB gain	User adjustable, minimum test bandwidth 1 kHz
Number of digits	24 bit
Sound image FOV	Horizontal: 178° Vertical: 178°
Sound image frame rate	At least 25 FPS
Detect distances	0.3 to 200 m (white noise sound source measured at 96 dB)
Leak detection rate	0.0019 l/m (2.5 m @ 5 Bar) 0.0022 l/m (6.0 m @ 5 Bar)
Camera	
Camera FOV	Horizontal: 66° Vertical: 54°
Camera focal length	4.3 mm (0.17") fixed focal length
Camera pixel	13 Million pixels
Display	
Resolution	1920 x 1200 with 6 x digital zoom
Size	8 Inch Capacitive touchscreen
Brightness	Adjustable to a maximum 600 nits
Photo notes	Add pictures, voice and typed notes as well as asset details
Source	Show single or multiple sources
Standard palettes	3: Grayscale, Ironbow, Rainbow
Playback function	View photos, videos, and add notes or tags
Storage	
Internal storage	Up to 64 Gb
External storage	MicroSD card, USB-C memory stick, at least 64 Gb, expandable to 256 Gb
Data storage format	.jpg Picture, .mp4 Video, .wav Recording
Video length	10 minutes
Digital export	MicroSD (TF) card, USB-C memory stick, Wi-Fi Hotspot

Specification	Detail
Power	
Battery capacity	6600 mAH @ 7.2 V Rechargeable Li-Ion
Battery life	~ 5 hours under full load state
Charger	Dual USB Type-C port USB Power Delivery (USB PD) protocol supported, 15 W
Battery charging	1.5 hrs via charging cradle 2.5 hrs via camera
Energy management	Sleep/Auto power off modes
Interface	
USB 3.0 Type-C USB host port	
3.5 mm headphone socket	
Operating Environment	
Operating environment	-20° C to + 50° C (4° F to 122° F) 10% to 95%, no condensation
Storage temperature	-20° C to + 60° C (4° F to 140° F)
Charging temperature	10° C to + 45° C (50° F to 113° F)
General Specification	
Ingress Protection (IP)	IP54
Size	207 x 190 x 51 mm
Weight	1.4 kg (3.08 lbs)
Warranty	2 years
Self-diagnostic notification	Array-health test function to identify when microphone array needs attention
Operating System	Android OS
Certification	CE, FCC, RoHS-compliant, MSDS.
Supported Language	See camera language selection for latest options
Software	
Report types	PD, Gas and Thermal
Analysis	Waveform, spectrum, spectrogram, leakage assessment, discharge type discrimination, thermal

11. Accessories and Equipment

11.1 Included accessories

Item	
Hand Straps	
Shoulder strap	
Universal dual USB-C mains charger	
USB-C to USB-C charge cable	
Headphones	
Hard protective carry case	

Item	
64 Gb microSD (TF) card	
USB-A microSD (TF) card reader	
8 Gb USB-C/USB-A memory stick	
Cleaning tools	
Smart battery pack (Two supplied) Order number 1016-924	
Smart battery charging cradle and lead	

11.2 Optional accessories

Item	Order No.	
MPAC verification unit	1016-919	
Thermal imaging camera module 384 x 288 resolution	1016-920	
Thermal imaging camera module 640 x 512 resolution	1016-921	

12. Terminology

Term	Description
USB Power Delivery (USB PD)	A power delivery protocol based on USB3.0, which is often used to transmit higher power using a USB interface.
Decibel (dB)	A ratio used to express the magnitude of sound waves compared to a reference level at 0 dB.
Sound Pressure Level (SPL)	A physical quantity used to express the magnitude of sound waves, in decibels (dB) and is referenced to a standard sound pressure in air. Also expressed as dBSPL (or SPL).
Audible domain	The frequency range of sound that can be perceived by human ears normally 20 Hz to 20 kHz.
Ultrasonic	Frequencies higher than the human ear can perceive, normally >20 kHz.
Sound image	The two-dimensional data table representing the intensity distribution of sound sources in the space plane after the signal collected by microphone array is calculated by the sound source location algorithm.
Palette	The colour data used in the colour mapping of a sound cloud chart.
Sound cloud image	The sound pressure level data of each resolution point on the sound image is mapped on the palette (according to a conversion formula) to form a colour image, which is superimposed over the visible image to form a sound cloud image.
Test frequency range	When a defined frequency range is selected within the full frequency range supported by the device, the device will measure and display a sound cloud image/sound map that is within the defined range. Sound outside this frequency range will not be displayed.
Frequency peak	Denotes a strong sound energy distribution at a particular frequency.
Dynamic range	The scale of the intensity of the sound source that can be shown on the sound cloud image/sound map.
Field of view	For the camera and the microphone array, the solid angles subtended by the edges of their respective images to the face of the instrument.
General mode	Represents the fundamental operational scenarios for the device. In this scenario, the device possesses basic acoustic imaging capabilities, supporting time-domain analysis and spectogram analysis. Users can use the thermal module for thermal image or video.
Gas leak mode	Involves the cameras being used to detect gas leaks in industrial settings, such as compressed air leaks and carbon dioxide leaks. In this scenario, besides time-domain analysis, spectrogram analysis, and viewing of thermal screen, analysis can also be conducted on gas leak volume, economic losses, and more. Labels can be edited during the playback of recorded images or videos.
Partial discharge mode	Involves the detection of partial discharge in electrical equipment, such as surface discharge occurring along insulators. In this scenario, besides time-domain analysis, spectrogram analysis, and viewing of thermal screen, analysis can also be conducted on acoustic signals, plotting into PRPD charts. This allows the user to quickly identify the type of PD.
Mechanical mode	Involves the detection of mechanical anomalies causing ultrasound, such as damaged conveyors. In this scenario, besides time-domain analysis, spectrogram analysis, and viewing of thermal screen, multiple frequency points and single frequency points can be set to analyse the equipment under test.
Thermal mode	With an optional thermal imaging module connected, the camera will show both acoustic and thermal images simultaneously, side by side, on the display.

13. Calibration, Repair and Warranty

Warranty Period: Two years from the date of purchase.

Megger operate fully traceable calibration and repair facilities to make sure your instrument continues to provide the high standard of performance and workmanship that is expected. These facilities are complemented by a worldwide network of approved repair and calibration companies, which offer excellent in-service care for your Megger products.

Within two years from the date of purchase, we provide free warranty service for abnormal, and malfunction caused by product quality. Free warranty service does not include the non-product quality problems caused by improper use, accidental drop, etc.

In case of equipment failure caused by improper use or accidental drop, we promise to provide maintenance service at cost price.

The equipment has been calibrated when delivered to the user. However, in the long-term use process, we suggest that you send the equipment to our office every two years for equipment calibration, testing and maintenance.

13.1 Return procedure

WARNING : DO NOT remove the battery cells before shipping this instrument. The MPAC can only be shipped with the Lithium-ion batteries installed in the instrument or within the carry case. Faulty battery modules MUST NOT be shipped to Megger or anywhere else.

UK and USA Service Centres

1. When an instrument requires recalibration, or in the event of a repair being necessary, a Returns Authorisation (RA) number must first be obtained from one of the addresses shown above. The following information is to be provided to enable the Service Department to prepare in advance for receipt of your instrument and to provide the best possible service to you:
   - Model (for example, MPAC208).
   - Serial number (found on the display under settings, device information, or on the rear cover and by the batteries or on the calibration certificate).
   - Reason for return (for example, calibration required, or repair).
   - Details of the fault if the instrument is to be repaired.
2. Make a note of the RA number. A returns label can be emailed or faxed to you if required.
3. Pack the instrument carefully to prevent damage in transit.
4. Before the instrument is sent to Megger, freight paid, make sure that the returns label is attached or that the RA number is clearly marked on the outside of the package and on any correspondence. Copies of the original purchase invoice and packing note should be sent simultaneously by airmail to expedite clearance through customs. In the case of instruments which require repair outside the warranty period, an immediate quotation can be provided when obtaining the RA number.

14. Decommissioning

14.1 WEEE Directive

The crossed out wheeled bin symbol placed on Megger products is a reminder not to dispose of the product at the end of its life with general waste.

Megger is registered in the UK as a Producer of Electrical and Electronic Equipment. The Registration No is WEE/ HE0146QT.

For further information about disposal of the product consult your local Megger company or distributor or visit your local Megger website.

14.2 Battery disposal

The crossed out wheeled bin symbol placed on a battery is a reminder not to dispose of batteries with general waste when they reach the end of their usable life.

For disposal of batteries in other parts of the EU contact your local Megger branch or distributor.

Megger is registered in the UK as a producer of batteries (registration No.: BPRN00142).

This instrument is manufactured in China.

The company reserves the right to change the specification or design without prior notice.

Megger is a registered trademark

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Megger

MPAC208_UG_EN_V03