

# Pettersson M500 USB Ultrasound Microphone

## User Manual



Pettersson Elektronik AB  
[www.batsound.com](http://www.batsound.com)



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# Pettersson M500 USB Ultrasound Microphone

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Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment under FCC rules.

## INTRODUCTION

The M500 USB Ultrasound Microphone enables you to make high-quality, full spectrum recordings of bat calls or other ultrasonic signals with a Windows tablet PC or laptop.

The M500 comes in a small and durable aluminium enclosure. It utilizes the same advanced electret microphone technology as the well-known D500X detector and can be used both in directional and omnidirectional modes (with or without the directional horn).

Low-noise technology, high sampling frequency and efficient anti-aliasing filter provide highest quality recordings.

The microphone comes with an easy-to-use Windows recording program, BatMicRecorder, that saves the recordings as 16 bit wav files. Real-time display of the waveform and the spectrogram as well as real-time monitoring of the bat calls are also available. The program offers various triggering modes; manual and automatic, with or without pre-trigger, level triggered or frequency triggered operation.

BatMicRecorder can only be used with the M500, not with other sound devices.

## SYSTEM REQUIREMENTS

- Computer with Windows Vista SP2, Windows 7, Windows 8 or Windows 8.1 operating system.
- Microsoft .NET Framework 4.5 (included in Windows 8/8.1)\*
- Microsoft Visual C++ Redistributable Package for Visual Studio 2013\*
- USB 2 High-speed interface/host type with USB bus power (minimum 200 mA).

Using certain lower-performing computers, it may be necessary to disable some software functions in order to obtain error-free recordings. Please refer to the section Show Menu in this manual for more information.



**IMPORTANT! Do not plug the M500 into a USB port on your computer yet. The M500 software and driver must be installed first! Please refer to the section Software Installation for more information.**

\* Available for download at [www.microsoft.com](http://www.microsoft.com):

<http://www.microsoft.com/en-us/download/details.aspx?id=40773>

<http://www.microsoft.com/en-us/download/details.aspx?id=40784>

*In order to check if the software packages are installed on your computer, open Control Panel and select Programs (or Programs and features). This will show a list over the installed programs.*

*Microsoft Visual C++ Redistributable Package for Visual Studio 2013 is available in a 32-bit (x86) and a 64-bit (x64) version. If you have a Windows 32-bit operating system, install the x86 version, if you have a 64-bit Windows version, install both the x86 and x64 versions.*

## SOFTWARE INSTALLATION

Before installing the software and driver for the M500, please make sure that your Windows operating system is up to date, including the software packages mentioned under System Requirements. If Windows Update is enabled on your computer, the operating system is normally updated automatically.

Do not plug the M500 into a USB port yet. The M500 software and driver must be installed first!

## INSTALLING THE M500 RECORDING SOFTWARE

### Windows Vista and Windows 7

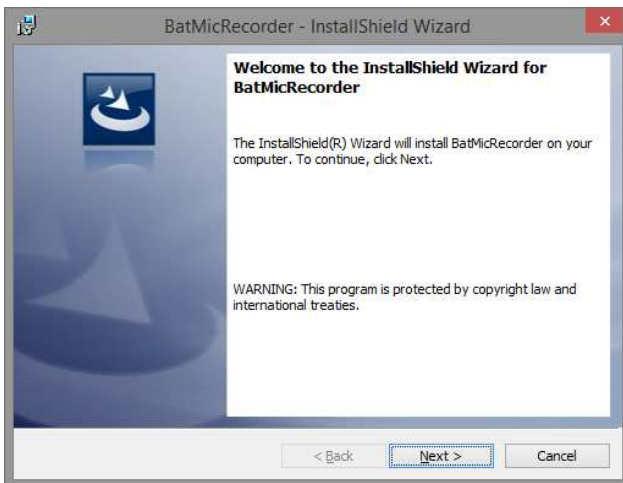
Run the setup program by doubleclicking on the file setup\_Vista\_W7.exe. If you receive the message "Do you want to allow the following program from an unknown publisher to make changes to this computer", please click Yes.

### Windows 8 and 8.1


Run the setup program by doubleclicking on the file setup\_W8.exe. If you receive the message "Do you want to allow the following program from an unknown publisher to make changes to this computer", please click Yes.

If the message "The operating system is not adequate for running BatMicRecorder" is displayed when running the setup file, you have probably not chosen the correct version of the file. Please choose the correct version as described above. The setup program also copies the device drivers to the hard drive, if required.

1. The installation process is the same for Windows Vista, 7, 8 and 8.1. This is the start window. Click Next to start the installation.



2. Enter your personal information (User name and Organization). The Organization field can be left blank if desired. Click Next to continue.



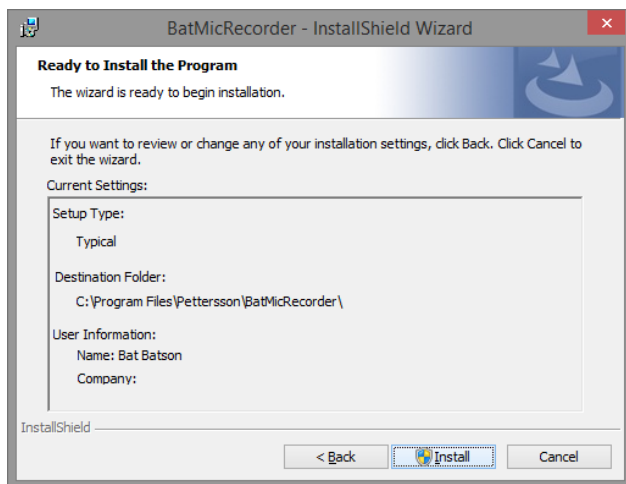
The screenshot shows the 'Customer Information' step of the 'BatMicRecorder - InstallShield Wizard'. The window has a title bar with the application name and a close button. Below the title bar is a blue header with the text 'Customer Information' and a sub-instruction 'Please enter your information.'. The main area contains two text input fields: 'User Name:' with the text 'Bat Batson' entered, and 'Organization:' which is empty. At the bottom, there is an 'InstallShield' progress bar and three buttons: '< Back', 'Next >' (which is highlighted with a blue border), and 'Cancel'.

3. If you want to install the software in a different folder than the suggested, please select Change. To accept the suggested folder, click Next.



The screenshot shows the 'Destination Folder' step of the 'BatMicRecorder - InstallShield Wizard'. The window has a title bar with the application name and a close button. Below the title bar is a blue header with the text 'Destination Folder' and a sub-instruction 'Click Next to install to this folder, or click Change to install to a different folder.'. The main area shows a folder icon next to the text 'Install BatMicRecorder to: C:\Program Files\Pettersson\BatMicRecorder\'. To the right of this text is a 'Change...' button. At the bottom, there is an 'InstallShield' progress bar and three buttons: '< Back', 'Next >' (which is highlighted with a blue border), and 'Cancel'.

- Review the installation settings and click Install to accept the settings and start the installation.



- The installation is now complete. Click Finish.





## INSTALLING THE M500 HARDWARE

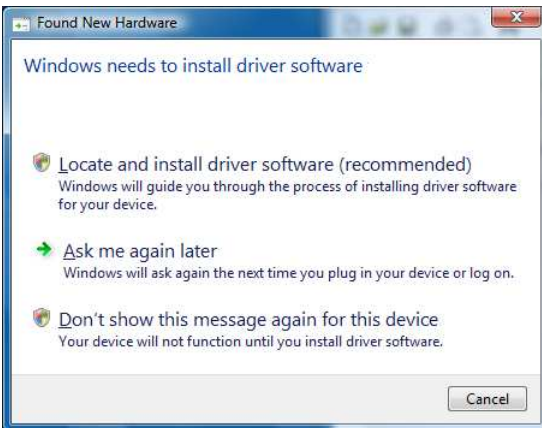
Make sure the software has been installed successfully as described in the previous section and then connect the M500 into a USB2.0 high-speed port of the computer, using the supplied cable. The first time this is done, it may take some time since the computer searches for and loads the driver. This works slightly different depending on the Windows version.

### Windows Vista

Immediately after plugging the USB cable from the M500 into the USB port, this popup message will appear:



If Windows is not able to automatically install the device driver, the Found New Hardware wizard will appear within several minutes:



Click "Locate and install driver software (recommended)" to continue with the installation. The popup message "Installing device driver software" will appear again. When the driver installation has been completed, a popup message will be displayed, saying that the device driver for a "WinUSB Device" has been installed.

The M500 is now ready and you can use the BatMicRecorder software to make recordings with it. The next time the M500 is plugged into the same USB port of your computer, the driver will install automatically.

If you don't see a message that the driver for a WinUSB Device has been installed, the driver probably was not installed successfully. Please disconnect the M500 from the USB port and then plug it in again and follow the instructions above. If it still does not work, please contact Pettersson for support.

**Note: If a dialog appears that asks you to allow Windows to search online for the driver software, DO NOT click Yes! Instead, click Don't Search Online.**

## Windows 7

Immediately after plugging the USB cable from the M500 into the USB port, this popup message will appear:



When the driver installation has been completed, a popup message will be displayed, saying that the device driver for a "WinUSB Device" has been installed.

The M500 is now ready and you can use the BatMicRecorder software to make recordings with it.

If you don't see a message that the driver for a WinUSB Device has been installed, the driver probably was not installed successfully. Please disconnect the M500 from the USB port and then plug it in again and follow the instructions above. If it still does not work, please contact Pettersson for support.

## Windows 8 and 8.1

Immediately after plugging the USB cable from the M500 into the USB port, a "USB connect" sound will be heard (if sound is enabled on your computer) and a progress indicator will appear in the Windows taskbar at the bottom of the screen. When the progress indicator shows "ready", the driver installation is complete.

The M500 is now ready and you can use the BatMicRecorder software to make recordings with it.

## THE RECORDING SOFTWARE

The BatMicRecorder software is provided free of charge with the M500 for the purpose of making recordings of bat calls. When the software is launched for the first time, the factory default settings are used, but after you have changed the settings and closed the program, the settings are saved and the next time you launch BatMicRecorder, your own settings will be used.

If the M500 is not connected when the BatMicRecorder software is launched or if the connection fails while in use, an error message will appear. In such case, close BatMicRecorder, unplug and re-connect the M500 and then start BatMicRecorder again.

### File Menu

Exit - closes the BatMicRecorder program.

### Settings Menu

Time Scale - the time scale of the diagrams can be changed (x1, x2, x4, x8). The actual time scale in milliseconds is also affected by the FFT size.

Recording Settings - enable/disable the oscillogram (waveform), spectrogram, grid and audio *while recording*. Disabling these options, decreases the system load while recording. This may be beneficial with certain, less powerful computers. Disabling the Audio feature has the additional advantage of keeping the recorded ultrasonic signal clean. With Audio enabled, the transformed bat calls will also appear in the recordings, superimposed on the ultrasonic signals.

Data Path - change the folder for saving the sound files. The default folder for saving files is MyDocuments\Pettersson\BatMicRecorder\Data (the full Windows path is C:\Users\(\your username)\Documents\Pettersson\BatMicRecorder\Data).

### Show Menu

Determines which diagrams to display (Oscillogram, Spectrogram and Grids). The displaying of the Throughput and Advanced settings can also be enabled here.

Enabling the The Advanced settings, opens a set of controls located below the graphics area (Spectrogram settings, FFT size, Oscillogram/Spectrogram scaling etc.).

The "Throughput" display (number of samples per second successfully transferred from the M500 to the host computer) can also be enabled/disabled. **Testing the throughput at least once for each computer configuration is recommended.** That way you will know if the performance is sufficient for error-free recording. To test the throughput, make sure "Throughput" is checked in the Show menu and then make a few recordings, at least 30 seconds each. Observe the Throughput number displayed at the bottom of the BatMicRecorder window. If the number is  $\geq 500000$  while the recording is in progress, the performance is sufficient. If the number is  $< 500000$  (shown in red) while the recording is in progress, the performance is insufficient and there may be some gaps or missing samples in the recording. The measurement of the Throughput is approximate so occasional readings below 500000 does not necessarily mean that there will be missing samples. *Please note that a recording has to be in progress in order for the Throughput number to be valid.*

If it turns out that a certain computer does not provide the required throughput, please try one or more of the following in order to increase the performance.

- Close all other programs running on the computer, if possible.
- Disable anti-virus scanning, if an anti-virus program is used.
- Shut off computer functions that you do not need, e.g. WiFi and Bluetooth.
- Configure the computer settings for optimum performance if possible (not all computers may offer this option).
- Do not use the Large Spectrogram option (in the Show menu) or disable the spectrogram display altogether (in the Settings menu/Recording Settings).
- Disable the oscillogram display (in the Settings menu/Recording Settings).
- Disable Audio (in the Settings menu/Recording Settings).
- Disable the Smooth spectrogram option

## Options Menu

The various controls and text boxes (e.g. Recording Settings, Spectrogram Settings) can be enabled/disabled. Disabling controls that you are not using, gives a better overview of the BatMicRecorder window and also prevents inadvertently changing those settings.

Hiding a specific control does not disable the function itself, e.g. hiding the Audio controls while the Audio Enable box has been checked, does not shut the audio off.

## About Menu

"About BatMicRecorder" shows the program version and "USB Strings" shows information about the M500 hardware and firmware versions and the serial number.

## The Recording Settings section

In this section the recording length, pre-trigger length, auto-arm and circular buffer options are selected.

The recording length can be chosen in steps from 0.3 sec and up to 1 minute (in circular mode up to 10 sec) and the pre-trigger length can be chosen from 0 and up to 1 sec. The total length of a recording is "recording length" + "pre-trigger length".

The "Auto" (auto-arm) mode means that after completing a recording, the unit is armed again automatically, waiting for the next signal to come. Typically, this mode is used for automatic recording of bat calls.

The "Circular" mode uses a circular memory buffer with size corresponding to the selected recording length. When Record is pressed, the recording starts and continues until Stop is pressed. Then the last x seconds is saved in the file. This mode can only be used for manual recording.

The default folder for saving files is MyDocuments\Pettersson\BatMicRecorder\Data (the full Windows path is C:\Users\your username\Documents\Pettersson\BatMicRecorder\Data). If desired, you can change this to another folder (Settings menu/Data Path).

## The Trigger Settings section (Trig Settings)

In this section the settings for the triggering system are selected.

When "Level" is selected, the program waits for the waveform display (oscillogram) to exceed the selected level (% of full scale). When the selected level is exceeded, this is considered a trigger and a recording is started.

When "Frequency" is selected, the spectrogram is used to test for a trigger. If a spectrogram level of at least x dB (the dB value selected) within the selected frequency range is detected, the system is triggered and a recording is started.

If the "Show Trig" box is checked, the trig level is shown in the oscillogram (Level mode) or the frequency range is shown in the Spectrogram (Frequency mode).

If the "Single" box is checked, the display update stops and the display freezes when the signal has been triggered. This allows you to study the signal in more detail.

## The Oscillogram/Spectrogram Scaling section

These controls allow you to change the vertical scale of the diagrams. E.g. selecting 50% for the oscillogram will show only the amplitude interval +/- 50%, making it easier to view low-level signals.

Selecting 50% for the spectrogram zooms in on the frequency axis so that rather than displaying the frequency interval from zero and up to half the sampling frequency (default), the interval up to 1/4 the sampling frequency is displayed.

If most of the signals of interest are in the lower half of the spectrogram window, it is usually better to use the 50% spectrogram scaling.

## The Audio section

The BatMicRecorder program allows you to monitor the ultrasonic signals in "real time" (a very small delay will appear). This monitoring function is only intended to make the ultrasound audible and it is not possible to use this signal for any analysis purposes. The ultrasound is made audible through under-sampling, which converts the ultrasound into the audible frequency range.

To enable the monitoring function, check the box "Enable" and adjust the slider to the desired volume. This function uses the regular sound card of the computer for playing the sound, so if not already enabled, this must also be enabled. Please refer to the operating instructions of the computer for more information about this.

The M500 is also sensitive for parts of the audible frequency range, so if the monitoring volume is high, acoustic feedback is likely to occur. To avoid this, reduce the audio volume and/or use headphones (connected to the Headphones jack of the computer). Using headphones is also recommended in order not to get the monitoring signal recorded together with the ultrasonic signal in the sound files. The latter can also be achieved by disabling audio while recording (in Settings/Recording Settings).

## The FFT Size section

The FFT size affects the frequency resolution, the time resolution and the time scale of the spectrogram. A larger FFT size gives a higher (better) frequency resolution but poorer time resolution and vice versa. The time scale of the spectrogram (and oscillogram) becomes shorter if a smaller FFT size is used. We recommend that you test the different settings to find out which one is best for your purpose.

## The Spectrogram Settings section

These settings affect the colours in the spectrogram.

The Threshold determines the lowest dB value that is used for the colour mapping. The MaxdB and MindB values can be set between 0 dB and Threshold dB.

The settings of the Spectrum Colours control the colour mapping (dB vs colours). Checking the "Test" box will display the colour mapping with the "highest-dB" colour at the top and the "lowest-dB" colour at the bottom.

The MaxdB and MindB settings determine the dB range that will be fit into the range of colours obtained by the Spectrum Colours setting. It is usually best to set the MindB so that the background noise is not displayed (or just barely displayed) and to set the MaxdB so that the desired signals (bat calls) are clearly visible.

## USING THE M500

### Getting started

Connect the M500 to a USB 2.0 high-speed port of your computer, using the supplied USB cable. A sound will be heard from the computer as an acknowledgement and the text "Pettersson" on the M500 will be illuminated to indicate that the M500 receives power from the computer. This process may take a few seconds. The M500 is now ready to be used.

If no "USB device connected" acknowledgement sound is heard and/or the red indicator remains constantly on after plugging the M500 into the USB jack, please disconnect the M500 a few seconds and then connect it again and wait to let it establish the USB connection.

To make a recording, start the BatMicRecorder software. Make any adjustments that you want to do in order to get the settings right. The oscillogram and spectrogram show the ultrasound in "real-time" (a small delay is normal, though), so if you rub two fingers in front of the microphone you will "see" this sound on the screen.

Select Rec Length 5 sec, Pre length 0 sec, Level trig 40% and then click Record. This will put the unit in the Armed mode, which means it is waiting for a signal to trigger the recording. The red indicator on the M500 will flash once every second while the unit is in the armed mode and light constantly while recording\*.

Snap two fingers close to the microphone or make a sound loud enough to trigger the unit. The text "Armed" will change to "Recording" and after completing the recording (5 seconds), the software will return to the "Listening" mode. The recorded file is now available in the MyDocuments\Pettersson\BatMicRecorder\Data folder. The file name is BM\_yymmdd\_hhmmss\_abcd.wav, where yymmdd is the year/month/date, hhmmss is the time in 24 hour format and abcd is the serial number of the M500 unit.

*\* This is when BatMicRecorder is used. Other programs may use the red indicator in a different way.*

## **Changing the microphone directionality**

The M500 comes with a detachable directional horn. In order to obtain a more directional microphone characteristic as well as a higher on-axis sensitivity, the directional horn should be used.

To remove the horn, pull the horn straight away from the microphone tip. When the horn is put back on the microphone tip, please hold the horn at the edge while pressing it onto the tip. This avoids increasing the air pressure over the microphone port, which might occur if the horn opening is closed e.g. with a finger.

## **Computer performance verification**

In order to ensure that the computer performance is sufficient, you should test the "throughput" (samples per second) using the Throughput option in the Show menu. Please refer to the Show Menu section of this manual for detailed information. Insufficient performance may result in data transmission errors/lost samples.

## **Weather protection**

The M500 is not waterproof and should be protected against the elements if used e.g. under humid conditions. The housing and circuit board are relatively insensitive to humidity, but the microphone element and USB connector may require protection.

## **UPDATING THE M500 FIRMWARE**

As new versions of the M500 firmware become available, you can upgrade your M500. Please contact Pettersson Elektronik for information about this.

## M500 Specifications

Microphone:	Advanced electret
Sampling frequency:	500 kHz
ADC resolution:	16 bits
Interface:	USB 2.0, high speed
Anti-aliasing filter:	8th order, 190 kHz
Real-time monitoring:	Through the PC sound card (under-sampling)
Size:	42 x 114 x 23 mm (incl microphone horn)
Weight:	75 g
Power:	USB bus powered (5 V, 200 mA max)
Operating system:	Windows Vista SP2, Windows 7, Windows 8, Windows 8.1