

ULTRASOUND DETECTOR D1000X USER'S MANUAL



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Introduction

General information

The D1000X is an ultrasound detector with three independent ultrasound conversion systems, heterodyne, frequency division and time expansion. In addition to this, the D1000X also has a built-in high-speed recording system that uses a Compact Flash (CF) card (type I) as storage medium. The resulting sound files are in “wav” format. Using a commonly available card reader, the sound files can be transferred to a PC for analysis. For further information about managing the files created with the D1000X, please refer to the section “File management”.

The CF card is used for recording sound, but also for temporary storage when the detector is used in the time expansion mode, so in these operation modes, it is necessary to have a CF card installed in the CF slot of the detector. Before using the CF card in the D1000X, the card has to be prepared in the detector or in a PC using the software supplied with the detector. For information about this, please refer to the section “Formatting and preparing a CF card”.

Although the D1000X is mainly intended for use with ultrasonic signals such as bat calls, it can also be used to record audible signals. If the highpass filter in the detector is disabled, the detector can be used at frequencies down to about 500 Hz. This makes it suitable for recording e.g. bird song. On request, the detector can be modified to allow use at even lower frequencies. For optimum sound quality at frequencies below 5 kHz, another microphone than that supplied with the D1000X may be required.

This manual describes the various functions of the detector and examples of different set-ups suitable in various situations are given. It does not, however, attempt to give any in-depth information regarding actual field work and identification of bat species. For such information, the user is referred to other available literature, such as Barataud: The inaudible world (CD and booklet, Sittelle) or Ahlén and Baagoe: Use of ultrasound detectors for bat studies in Europe: experiences from field identification, surveys and monitoring. Acta Chiropterologica 1(2): 137-150.

The microprocessor program (the firmware) of the D1000X is upgradeable. The main program of the D1000X can be upgraded by the user, using an upgrade file supplied by Pettersson Elektronik.



Caution. Always follow the instructions supplied with the CF card you are using. Specifically, always switch off the power to the D1000X before removing or inserting a CF card. Never switch the power off or plug/unplug external DC power while the D1000X is accessing the CF card, i.e. while recording, playing or formatting the CF card. Doing so can cause loss of recorded files and/or corruption of the CF card.

Powering the detector

The detector can be powered either from internal batteries or from an external power supply. In the case of internal batteries, 5 AA cells are used. Alkaline batteries or rechargeable NiMH cells are recommended – please note the polarity as indicated in the battery compartment! To open the battery compartment lid, remove the lock screw using the edge of the red microphone protection cap, a small coin or similar. An external power supply or battery of 7-10 V DC can also be connected to the DC jack. When external power is plugged in, the internal batteries are automatically disconnected. The center pin of the DC jack is the positive pole of the power supply, as shown on the panel label. The Main Power switch disconnects the battery or external power supply when set to OFF, to avoid unintentionally switching the detector on. When this switch is set to ON, the detector can be switched on by pressing the ON/OFF key for at least 1.5 seconds. To switch the detector off, press the ON/OFF key for 3 seconds.

In order to constantly maintain power to the real-time clock and some other parts of the detector, a small rechargeable battery is incorporated in the detector. This battery is automatically charged from the regular batteries/power supply. The rechargeable battery will keep the real-time clock running for about one month also when the regular power supply/batteries are removed.



Caution. Carefully note the polarity of the batteries and/or the external power supply. Reverse polarizing the supply voltage as well as exceeding the maximum voltage may cause permanent damage to the detector!

Never allow any of the battery terminals or battery clips of the D1000X to get in contact with the metal housing of the detector, either directly or through a metal object. This may happen e.g. if the batteries are removed by means of a small screwdriver. If you need to use an aid to remove the batteries, you should use an electrically insulated (i.e. non-metal) object. Never use batteries with a damaged insulation layer over the housing. If the metal housings of two adjacent batteries make contact, one or more batteries will be short-circuited. If any of the above conditions occurs, damage to the detector and/or batteries may result. The batteries may also become very hot, causing the danger of personal injury and/or fire.



Battery handling precautions. Incorrect use or handling of the batteries can cause them to leak or burst and create the danger of fire and personal injury as well as damage to the detector.

Remove the batteries from the D1000X if you do not plan to use it for more than two weeks.

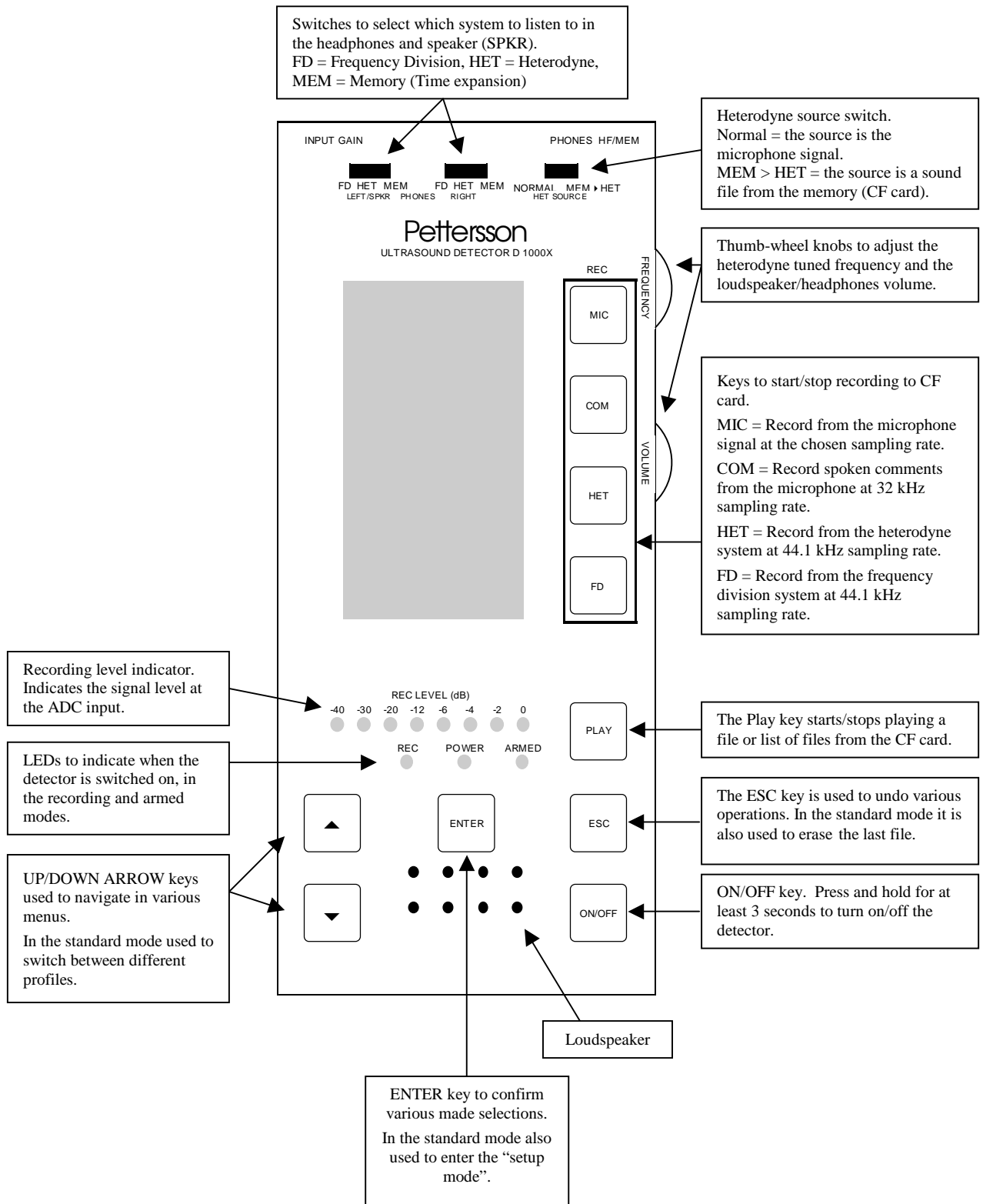
Never recharge batteries, never allow direct connection between two ends of a battery and never try to take batteries apart.

Do not expose batteries to direct heat or dispose of them by burning. Doing so can create the danger of explosion.

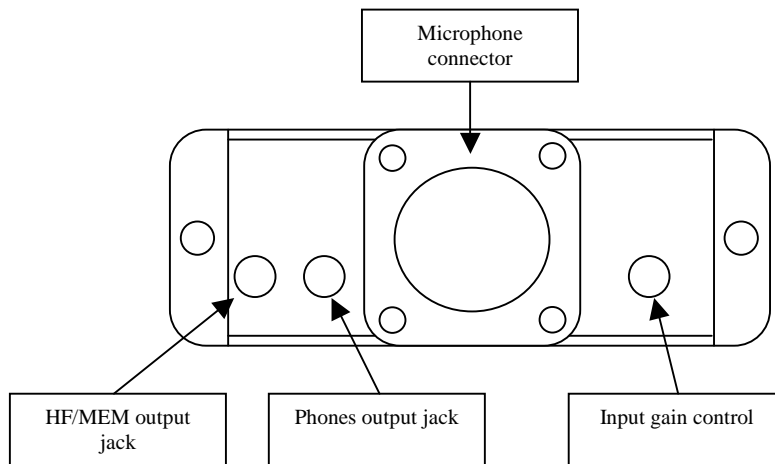
Never mix batteries of different types.

Dead batteries are susceptible to leakage, which can cause serious damage to the D1000X. Remove batteries from the detector as soon as you notice they are dead.

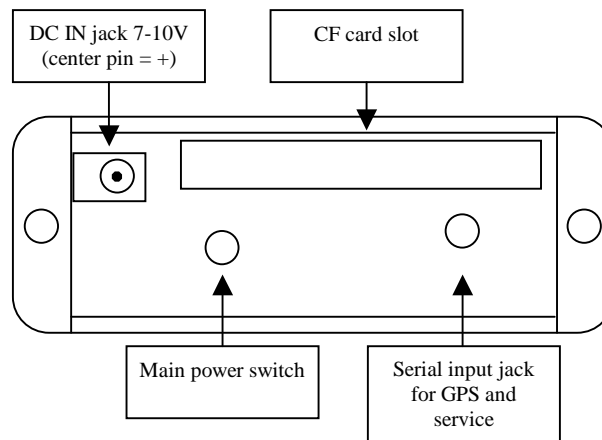
Top panel overview



Front panel overview



Rear panel overview



Getting started

Software installation

For information on the computer requirements please refer to the Specifications section of this manual.

The D1000X Utility program comes on the CF card that is supplied with the D1000X. Insert this card in a CF card reader connected to your computer and copy the file “D1000X Utility.exe” from the CF card to the desired folder on your computer. To run the program, locate the file “D1000X Utility.exe” in Windows Explorer and double-click it. You can also create a shortcut to this file by right-clicking on its name in Windows Explorer and selecting “Create shortcut”.

The D1000X Utility serves several purposes. First, it formats and prepares the CF card to enable it to record the sound files at highest speed. It is necessary to perform this step before the card can be used in the D1000X. The CF card can also be formatted and prepared directly in the D1000X.

Optionally, the D1000X Utility can also be used to generate a number of so called “profiles”. Each profile contains all of the selectable settings such as sampling rate, time expansion factor, LED intensity and so on. The profiles are stored in a file on the CF card. This file is read by the D1000X as the card is installed, making it possible to select between the profiles you have generated with the D1000X Utility. If no profiles are stored on the CF card, the D1000X will use a set of predefined profiles instead.

The D1000X can play files from the CF card either one by one or from a “play list”. The D1000X Utility can be used to generate a play list with a number of files to be played in a sequence. The name of the play list file should have six characters. The extension .LST will be added by the D1000X utility.

The D1000X Utility is also used to load a new firmware file onto a CF card, in order to reprogram the firmware of the detector. As new firmware upgrades become available, such firmware upgrade files will be supplied by Pettersson Elektronik along with upgrade instructions.



Caution. *Formatting a storage medium erases all data previously stored. Make sure you don't inadvertently format a card or other storage device that contains data you wish to retain!*

Preparing the detector for use

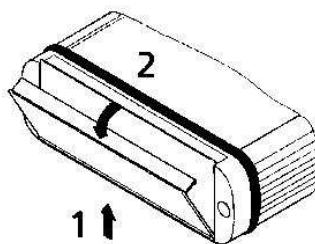
Insert a set of new batteries into the battery holder of the D1000X. The holder takes 5 AA cells. Alkaline batteries or NiMH cells are recommended. To open the battery compartment lid, remove the lock screw using the edge of the red microphone protection cap, a small coin or similar. Alternatively, an external battery pack can be connected to the DC jack. In either

case, make sure the batteries are connected with the indicated polarity, or damage to the D1000X may result.

Before using the D1000X you should format and prepare a CF card and install it in the CF card slot of the detector. The CF card can be prepared using the D1000X Utility as described above or directly in the D1000X as described in the section *Formatting and preparing a CF card*. When selecting the type of CF card, it is important to select a card with sufficiently high read and write speed, or recording and/or playback at high sampling rates may fail. Please refer to the section Specifications for information on suitable cards.

The CF card that is supplied with the D1000X is already formatted and prepared, so it can be used immediately. If you wish to delete sound files on the CF card, use the ESC key on the detector to delete single files or use the “Format and Prepare” function in the D1000X Utility program to delete all files on the card. Deleting files from the computer, while the CF card is in a card reader should be avoided since this will not free any space for making new recordings with the D1000X.

To access the CF card slot, open the hinged flap on the rear of the D1000X. The flap is opened by gently pressing the hinge upwards (1) while pulling the flap open (2) (see below).



CF card precautions.

Always follow the instructions supplied with the CF card and any CF card reader you are using. To read files from the CF card in your PC using a USB card reader, insert the card in the reader and then plug the USB connector into a USB port of the computer. To remove the CF card from the computer, use the Safely Remove Hardware application, if the Safely Remove Hardware icon appears in the notification area on the computer screen (click on the icon and follow the instructions).

Make sure the D1000X is turned off using the ON/OFF key or the Main Power switch before you insert a CF card into the CF card slot or remove a CF card from the slot.

Never switch the power off while the D1000X is accessing the CF card, i.e. while recording, playing or formatting the CF card. Doing so can cause loss of recorded files and/or corruption of the CF card.

When inserting a CF card into the D1000X, make sure that the card is oriented correctly. Make sure that the correct side of the card is facing up and that you insert the correct side of the card into the detector.

Static electricity, electromagnetic radiation and other electrical phenomena can cause corruption or loss of data stored on the CF card. For this reason, you should always make backup copies of important sound files on other media such as computer hard disk or CD.

CF card problems can usually be corrected by formatting the card. Formatting a CF card deletes all information stored on the card, including sound files and profiles. Before formatting a card you should copy all files you wish to keep on other media. If you plan to use the D1000X where you don't have access to other storage devices, it is a good idea to take along a few extra CF cards just in case you experience an unexpected CF card problem.

Formatting is recommended for any CF card that you suspect contains corrupted files or for newly purchased CF cards.

Before starting a format operation in the D1000X, make sure the batteries are fresh or use a reliable external power supply. Interruption of power to the detector during the format operation results in improper formatting, making it impossible to use the card.



Caution. *Should water or any foreign matter get into the CF card slot, immediately turn off power, remove the batteries and/or unplug the external power supply.*

Using the detector the first time



The D1000X Main Screen

Make sure the Main Power switch is ON. Switch on the power to the detector by pressing the ON/OFF key for at least 1.5 seconds. As the display shows “D1000X Release key” release the ON/OFF key. The text “BOOTING” followed by “SEARCHING GPS” is displayed. For more information on using a GPS receiver with the D1000X, please refer to the section “Using a GPS receiver” in this manual. When the main screen is shown (see figure), the detector is ready to be used.

The main screen shows the most important recording parameters, the name of the active “profile”, the recording mode, the sampling frequency, the time expansion (TE) factor and the Pre/post trigger time. The name of the last recorded file and the time (HH.MM.SS) is also shown.

The two indicators show the remaining free space of the CF card and the battery/external power supply voltage. When all segments of the battery indicator turn blank, the battery voltage is approximately 5.3 V and the batteries should be replaced. At a battery voltage of approximately 5.0 V, the detector will automatically turn off. The heterodyne tuned frequency is shown at the bottom.

It should be noted that the battery indicator shows the battery voltage, and not necessarily the remaining battery life. Different battery types exhibit different voltage characteristics and some types may remain at almost full voltage until its capacity is nearly exhausted.

To test the **heterodyne system**, set the left FD/HET/MEM switch to the HETerodyne position and the NORMAL/MEM→HET switch to the NORMAL position. Adjust the VOLUME control so that a weak noise is heard in the loudspeaker. If necessary, you can also adjust the gain with the INPUT GAIN control at the front panel. Then turn the FREQUENCY control to give a display reading of approximately 20 kHz and gently snap your fingers near the microphone. A scraping sound should be heard in the loudspeaker. Another good ultrasound source is a jingling bunch of keys.

The frequency control is only used for the heterodyne system and works in the following way. The display shows the center of the frequency range (approximately 10 kHz wide), to be transformed. If the control is set to 20 kHz, you can listen to ultrasonic frequencies between approximately 15 and 25 kHz.

To test the **frequency division system**, change the FD/HET/MEM switch to the FD position and repeat the exercise above. In this case the frequency control has no influence, all signals over the entire frequency range of the detector will be transformed.

The **time expansion/direct recording system** can be configured in a variety of ways, so we will here only test a few basic functions. Set the FD/HET/MEM switch to the MEMory position.

The detector has ten different predefined profiles, containing different combinations of settings, each suitable for a certain situation. These profiles can be used as they are, or modified by the user. Let's start with one of the existing profiles and make a change to this. Use the UP or DOWN ARROW keys to browse through the available profiles and select the "MAN 384" profile. This profile uses the sampling frequency 384 kHz and manual start/stop of each recording.

To change the settings, press the ENTER key once to enter the settings menu. In this mode, the different recording parameters can be selected. Each parameter can be changed using the UP and DOWN ARROW keys. The "active" parameter, that is currently being changed is shown with a frame around it. Press the ENTER key to accept the displayed value. Set the parameters as follows:

Recording mode: MAN
Sampling frequency fs: 384 kHz
Time expansion factor, TE: 10
Pre-trigger time PRE: OFF
Post-trigger time POST: MAN
Replay mode: AUTO
Save mode: AUTO
High-pass filter HP: ON
LED intensity: 3

As you see, the only parameter that needs to be changed is the Save mode. Setting this to AUTO means that all recordings you make will be automatically saved as a file on the CF card.

When you have entered the parameter values as indicated above, you must select SAVE at the bottom of the screen. If you select QUIT, the changes you just made will be discarded.

Note: Changing the recording parameters as described above is usually not the preferred method in the field. Preparing the desired profiles on the CF card using the D1000X Utility gives you a much quicker way to change the settings and is the recommended method in most cases.

For more information on the meaning of the different parameters, please refer to the detailed description in the next section of this manual.

To make a time expansion recording, press the MIC key once to start recording, generate some sound, e.g. by snapping your fingers, and then press the MIC key a second time to stop recording. The detector has here been configured to automatically replay the recorded sequence in time expanded fashion, so you will now hear the time expanded sound. Replaying the entire sequence will take ten times longer than the actual recording time. With the selected settings, the time expanded sequence is automatically saved in a file on the CF card. This file can be replayed again by pressing the PLAY key on the detector (see the section Playing Files).

Setting the clock

The sound files stored on the CF card will have the date and time saved in the file properties, so it is important to set the system clock before starting to make recordings. Under normal circumstances, this only has to be done once. A small backup battery will keep the real-time clock running even if the detector is out of batteries for a period of about one month. This battery is automatically charged by the main batteries and the user does not need to pay any attention to it.

To set the clock, turn off the detector. Press the ON/OFF button for at least 1.5 seconds. The text “D1000X Release Key” will appear. Release the ON/OFF key and the text changes to “D1000X Booting”. While this text is shown, press and hold the PLAY button until the text “SET CLOCK” appears. Enter the time and date using the UP/DOWN ARROW and ENTER keys. The format for the date is YYMMDD and for the time HHMM. After you have set the minutes and press the ENTER key, the detector will start from the chosen HHMM time and with the seconds starting from 00. On the display the time will be shown in HH.MM.SS 24-hour format.

Formatting and preparing a CF card

As mentioned previously in this manual, the CF card can be prepared either with the D1000X Utility program or directly in the detector. To perform this operation in the D1000X, turn the power off, install the CF card in the CF slot of the detector and press ON for at least 1.5 seconds. As the text “Release key” is displayed, press and hold the MIC button and then release the ON key. As the text FORMATTING appears on the display, release the MIC key. The D1000X will reserve a certain portion of the card storage capacity for standard Windows files (refer to the section File Management for more information on this). Per default, 1/100 of the card capacity will be reserved for Windows files. Before formatting the card, the D1000X displays the size of this as “DOS SPACE”.

To format and prepare the card, press ENTER as the text CONTINUE appears. To proceed without formatting/preparing the card, press ESC. While the D1000X formats and prepares a CF card, the current sector number will be shown to indicate the progress of the operation. Upon completion of this process, the detector automatically enters the normal operation mode. The detector must not be switched off during the formatting/preparation operations or damage to the CF card may result.

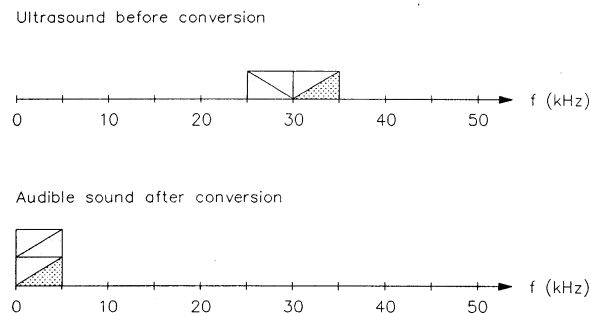
Formatting/preparing a card in the D1000X typically takes a few minutes. Performing the same in a PC with the D1000X Utility is much faster and is the recommended method. The latter method also permits the user to freely select the size of the area reserved for standard Windows files, which is particularly important if you wish to copy sound files from the PC to the CF card, in which case it is necessary to reserve a sufficiently large area for these files.

Note: The D1000X expects the CF card to have the FAT32 file system. If the CF card that you wish to prepare in the D1000X is new and you are unsure which file system it has, you should first format the CF card in a PC, selecting FAT 32 as file system.

Ultrasound conversion methods

The heterodyne system

There are several different principles to convert ultrasound into audible sound. As mentioned above, one of the systems in the D1000X is based on the heterodyne principle. This technique means that a limited frequency range is selected for conversion into the audible range. If the frequency control is set to 30 kHz, the range from approximately 25 to 35 kHz will be transformed. This is illustrated in the figure below.



Let's assume an ultrasonic signal with constant frequency is emitted. When the frequency control of the D1000X is turned from low frequencies to higher, a high-pitched tone will be heard in the loudspeaker when the frequency setting is appr. 5 kHz lower than the frequency of the ultrasound source. The closer the tuned frequency comes to the ultrasound's frequency, the lower the frequency of the loudspeaker tone gets. When both frequencies are identical the resulting output frequency becomes zero, i.e. nothing is heard in the loudspeaker. If you continue to turn the frequency control towards higher frequencies, a tone will again be heard in the loudspeaker, however this time the frequency will increase as the tuned frequency increases. By tuning the frequency control up and down it is possible to locate the frequency resulting in a zero Hz output frequency (the tuned frequency then equals the frequency of the ultrasound).

Note: The example above is only intended to illustrate the heterodyne principle. Constant frequency sounds are very rare in practice, so in most cases you will only be able to get an approximate measure of the signal frequency.

The frequency control of the D1000X changes the frequency in small steps, the size of which differ depending on the frequency. When tuning while listening to a constant frequency signal these steps are easily noticeable. The tuned frequency can be changed from 5 kHz to 235 kHz.

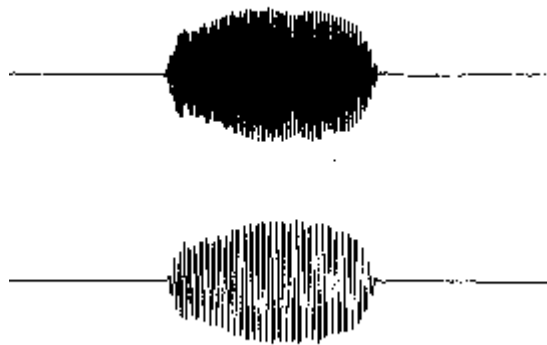
As an alternative to using the microphone real-time signal as input to the heterodyne system, it is also possible to use a sound file from the CF card. In that case, you can listen to the sounds over and over again through the heterodyne system, which can be helpful when attempting to identify the bats in the field. To use the recorded sounds as input to the heterodyne system, set the HET SOURCE switch to the MEM→HET position and start

playing the desired sound file. The signal is then replayed at its original speed and frequency regardless of the time expansion factor (TE) setting.

Note: In order not to interfere with the continued streaming of samples to the CF card at high sampling frequencies, the update and display of the tuned frequency and clock as well as the update of the battery indicator is disabled while recording with the two highest sampling frequencies, 750 and 768 kHz.

The frequency division system

Frequency division means that the frequency of the ultrasound is changed with a constant factor of 10. A frequency of 40 kHz becomes 4 kHz, a frequency of 50 kHz becomes 5 kHz etc. Using this system, any activity over the entire frequency range 10 – 200 kHz can be constantly monitored. Furthermore, the shape of the transformed signal closely follows that of the original signal, as shown in the figure below.



The frequency division is obtained by counting the number of “zero-crossings” made by the original signal. An output signal with one zero-crossing for each ten zero-crossings of the original signal is then generated. Normally, this gives an output signal with a frequency of one tenth of the original frequency. However, if the original signal has a strong harmonic component, extra zero-crossings will occur and the resulting output frequency will be higher than that corresponding to the fundamental frequency (the system transforms the harmonic frequency component, not the fundamental). This situation is relatively uncommon, except for e.g. the *Rhinolophus* species. Nevertheless, it is important to remember that it occasionally may occur.

The time expansion system

In a time expansion system, a sequence of the ultrasonic signal is captured and stored in a digital memory after which it is replayed at a slower speed. That way the frequency becomes

lower and the ultrasound becomes audible. Since the signal is stretched out in time, it is also possible to hear details in the sound, not audible with other ultrasound conversion systems.

In the D1000X the time expansion function is a part of the recording system described in the next section.

The recording and playback system

General

The high-speed recording system of the D1000X can also be configured to act as a time expansion system. High-speed playback is also possible with the D1000X. In addition to recording the ultrasonic signal directly, recording from the heterodyne and frequency division systems is also possible. This is done at a lower sampling rate (44.1 kHz) to save CF card space. Spoken comments can be recorded using the detector's microphone either in the normal, full-speed recordings (using the MIC key) or at reduced sampling rate (32 kHz) as special, commentary files (using the COM key). The choice of recording source is made by pressing the desired recording key; MIC, COM, HET or FD. Only one signal can be recorded at each time.

When a COM recording is made, the selected recording parameters (PRE and POST values) are overridden and the recording is started by pressing the COM key and stopped by pressing it a second time.

The recording parameters

The recording system is controlled by a number of parameters that can be changed in the settings menu or by assigning the desired values in externally created profiles.

If the CF card in the D1000X has a file with external profiles, the user will be prompted at power-on of the D1000X whether to use the external or internal set of profiles. If you confirm the question "LOAD INI-FILE?" by pressing the ENTER key, the set of external profiles is loaded into the D1000X from the CF card. To load the internal, default profiles instead, press the UP or DOWN ARROW key to display the text "LOADING DEFAULTS" and confirm this by pressing ENTER.

The recording parameters are:

- Recording mode – MAN or AUTO
- Sampling frequency (sampling rate)
- Time expansion factor
- Replay mode
- Save mode
- Pre/post trigger time
- Trigger source
- High-pass filter – ON or OFF
- LED and LCD backlight intensity

To change the recording parameters of the current profile, press ENTER while the detector is in its standard mode. The parameters are changed with the UP/DOWN ARROW keys and the selections accepted by pressing the ENTER key. Pressing ENTER makes the cursor move to the next parameter. After all parameters have been entered, they should be saved by selecting SAVE at the bottom of the settings menu.

In order to leave the settings menu without saving, either select QUIT at the bottom of the menu or press the ESC key.

Any changes made to existing profiles that are saved, will be kept in the detector until it is turned off. If you wish to permanently save a certain profile, please use the method with externally generated profiles instead. Please refer to the section about the D1000X Utility for information on this.

- Recording mode

The recording mode is either manual (MAN) or automatic (AUTO). In the manual mode, the user starts (and in some sub-modes also stops) the recordings by pressing the desired recording key, usually the MIC key. In the automatic mode, the detector “listens” for signals and starts a recording only in the presence of a signal that meets certain triggering criteria. In the AUTO mode, the detector can be left unattended for automatic recording of bat calls.

More information on this is found in the section “The details of the triggering parameters”.

- Sampling frequency

The sampling frequency (or sampling rate), f_s , determines the maximum signal frequency that can be recorded. The theoretical upper signal frequency limit is half the sampling frequency. In practice, the upper signal frequency limit is lower than that. The D1000X has an adaptive anti-aliasing filter that allows aliasing-free sampling up to about $0.4 \times f_s$. This filter is automatically adapted according to the chosen sampling frequency and does not require any action from the user.

A higher sampling frequency gives better sound quality at the expense of larger sound files, so it is usually a good idea not to choose an unnecessarily high sampling frequency. The following sampling frequencies are available in the D1000X:

32, 44.1, 48, 96, 100, 192, 200, 250, 300, 384, 400, 500, 750 and 768 kHz

Note: In order not to interfere with the continued streaming of samples to the CF card at high sampling frequencies, the update and display of the tuned frequency and the clock as well as the update of the battery indicator is disabled while recording with the two highest sampling frequencies, 750 and 768 kHz.

- Time expansion factor

When replaying recorded sound files (either immediately after the recording was made – with the Replay mode set to AUTO - or at a later time) the time expansion factor (TE) determines how much longer the replay takes compared with the original signal. If the TE factor is set to 10, the replay will take 10 times longer than the original signal and the frequencies will be 10 times lower than they originally were.

Files recorded with the COM, HET or FD keys will obtain a TE factor of 1, regardless of the TE value in the recording profile.

- Replay mode

The Replay mode can be set to manual (MAN) or automatic (AUTO). The latter means that after each high-speed recording, the recorded signal is automatically replayed using the current TE factor. That way the detector behaves like a time expansion detector. If the Replay mode is set to MAN, no replay of the recorded signal is made. It is of course still possible to manually replay a file recorded with these settings using the PLAY key.

- Save mode

The Save mode determines if and how sound files are saved and can be set to NO, AUTO or PROMPT. If set to NO, the recording just made will not be permanently saved to a file. This setting should typically only be used with the automatic replay mode (replay mode set to AUTO). Then the detector is only used as a time expansion detector, without saving any files.

If the Save mode is set to AUTO, all recordings will be automatically saved.

If set to PROMPT, the user is prompted after each recording whether to save it or not. To save a file, press ENTER as the text SAVE? appears on the display. To continue without saving the last recording, press ENTER as the text ERASE? is shown. To toggle between SAVE? and ERASE?, press the UP ARROW key or DOWN ARROW key.

When files are saved to the CF card, they are numbered sequentially. The prefix tells the type of recording (M=MIC, C=COM, H=HET, F=FD). I.e. the first “MIC“ recording you make on a new CF card, will obtain the name M00001.wav.

- Pre/post trigger time

The triggering system determines when a recording is started and stopped. The parameters that control the triggering system are the Recording mode (see above) and the Pre/post trigger time. The selectable values for Pre/post trigger time depend on the chosen sampling rate.

The pre trigger time is the time that is recorded prior to the triggering moment and the post trigger time is the time recorded after the triggering moment. The actual pre and post trigger time that is obtained may differ slightly from the value chosen in the D1000X settings.

More information on this is found in the section “The details of the triggering parameters”.

- Trigger source

The source of the level-activated triggering modes can be selected as

a) The ultrasonic signal

In this case, which is the typical and most common, any sound with a level exceeding the trigger threshold (and meeting all other triggering conditions) will trigger the recording system.

b) The output signal of the heterodyne system

This gives a frequency-selective triggering. Only signals that are audible from the heterodyne system (i.e. signals with a frequency close to the tuned frequency) will trigger the recording system.

c) An external trigger signal connected to the External Trigger Input jack

The jack is located above the Input Gain control on the front panel. This jack is an optional feature and is not available on the standard version of D1000X. The signal terminal is the tip and the ground terminal is the sleeve.

Connecting an external signal to the External Trigger Input makes it possible to control the recordings externally. This is an analog input that follows the same level settings as the other triggering sources. It can, however, also be used with digital signals. The trigger voltage is between ca. 2.5 and 4 V depending on the setting of the trigger level. The detector triggers on the negative-going edge of the trigger signal.



Caution. *The level of the signal connected to the External Trigger Input must not be lower than -0.3 V or higher than 5.3 V, referenced to ground, or damage to the D1000X may result. No signal at all should be applied when the D1000X is switched off.*

- High-pass filter enable/disable

The D1000X contains a high-pass filter at the input of the recording system. This is typically used to attenuate undesired low-frequency signals and noise (below 20 kHz). The high-pass filter can be disabled by setting the “HP” parameter to OFF.

- LED/LCD background intensity

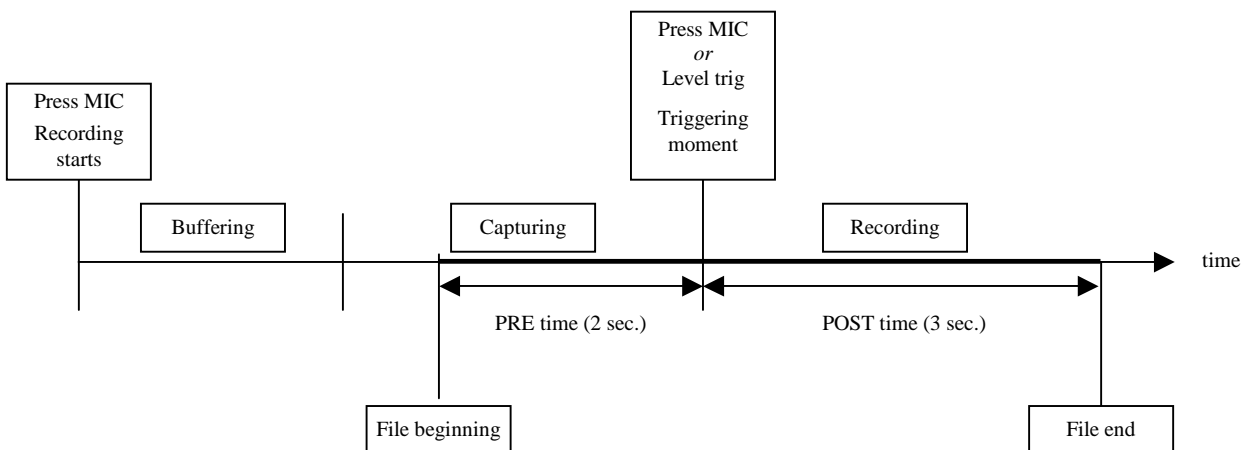
The intensity of the LED indicators and the LCD background light can be adjusted to the desired level with the LEDINT parameter. Eight different levels are available, where 0 turns all LEDs off.

The details of the triggering parameters

The manual recording mode

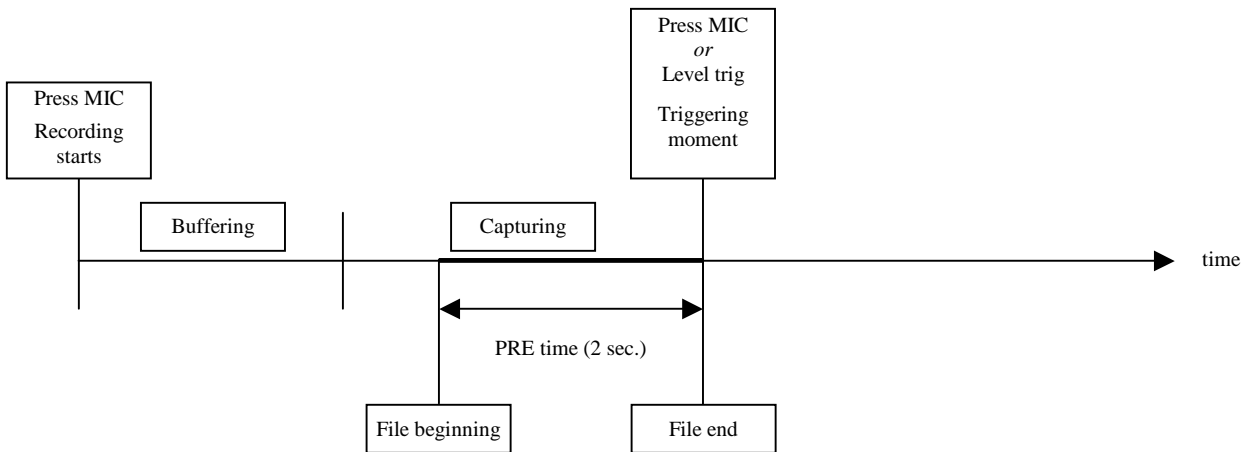
The manual recording mode is selected in the settings menu. In this mode, the recording is started by pressing the desired recording key. In order to record the ultrasonic signal from the microphone, press the MIC key and the recording starts. While the internal memory buffer is being filled, the text "BUFFERING" is shown on the display. As the memory buffer has been filled, the text changes to "CAPTURE" and the detector waits for the "trigger signal", which in the case of the manual recording mode usually means pressing the MIC key a second time (with some parameter settings, the system can also be triggered by the signal exceeding a certain level). After that, the recording continues for a time equal to the value of the POST parameter. The resulting sound file contains the time interval from PRE seconds before the triggering moment and to POST seconds after the triggering moment. This is illustrated in the figure below, where the PRE trigger time is 2 seconds and the POST trigger time is 3 seconds.

Note: The actual PRE and POST trigger time may differ slightly from the chosen value, depending on the PRE/POST values and the sampling rate. A low sampling rate and/or a short PRE/POST value will increase the deviation.



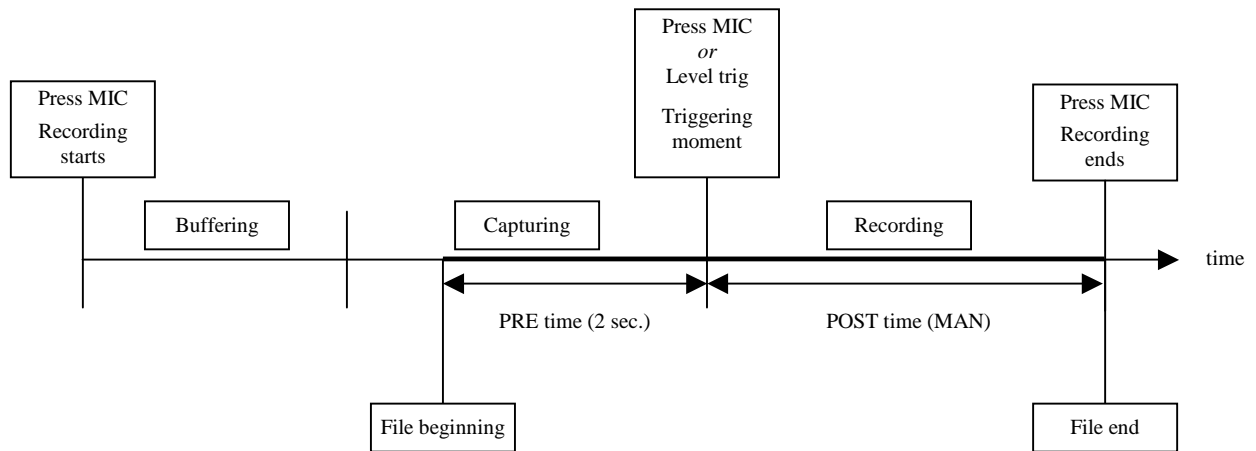
Manual recording mode with PRE = 2 seconds and POST = 3 seconds.

If the POST time is set to OFF while keeping the PRE time as in the previous case, the recording will be interrupted as soon as the MIC key is pressed the second time or a level trigger is received as shown below.

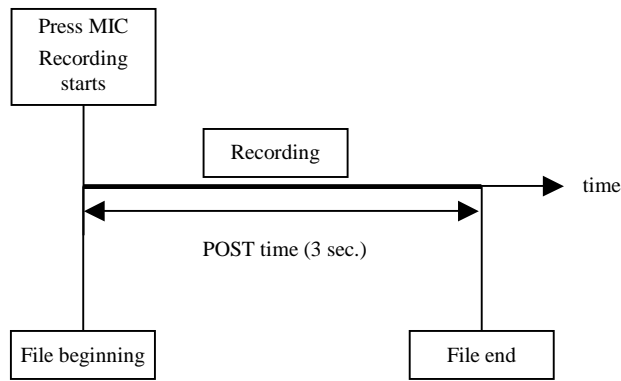


Manual recording mode with PRE = 2 seconds and POST = OFF.

Yet another alternative is setting the POST time to MAN. In this case the actual file end is determined by pressing the MIC key a third time.

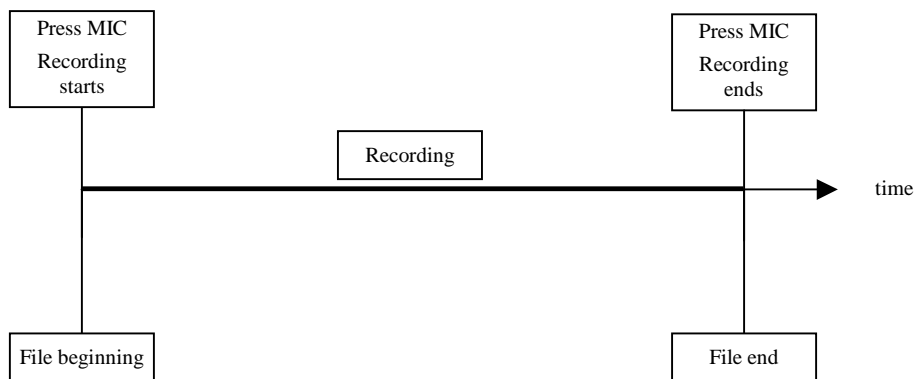


Manual recording mode with PRE = 2 seconds and POST = MAN.



Manual recording mode with PRE = OFF and POST = 3 seconds.

In order to obtain manual control over the recording process, PRE should be set to OFF and POST to MAN. In this mode, the recording is started as the MIC key is pressed the first time and stopped when it is pressed the second time.



Manual recording mode with PRE = OFF and POST = MAN.

The automatic recording mode

In the automatic recording mode, it is possible to make unattended, automatic recordings using a level-triggering mechanism. The automatic recording mode is selected in the settings menu.

The signal level above which the system is triggered can be changed each time a new recording session is initiated (the MIC key is pressed). The level can be set to one of eight values. After selecting the desired level, confirm this by pressing the ENTER key. Level 7 will require the highest signal level in order to trigger the system, with correspondingly lower signal levels for triggering levels from 6 and down. Level 0 will cause the system to trigger even in the absence of an input signal.

When the automatic recording mode is selected in the settings menu, the following triggering parameters should also be selected.

T = number of times the signal has to exceed the trigger threshold (“the number of triggering pulses”) in order to trigger the recording system.

P = the minimum spacing in milliseconds between two consecutive triggering pulses. If two pulses are closer than this value, the second pulse will not be counted.

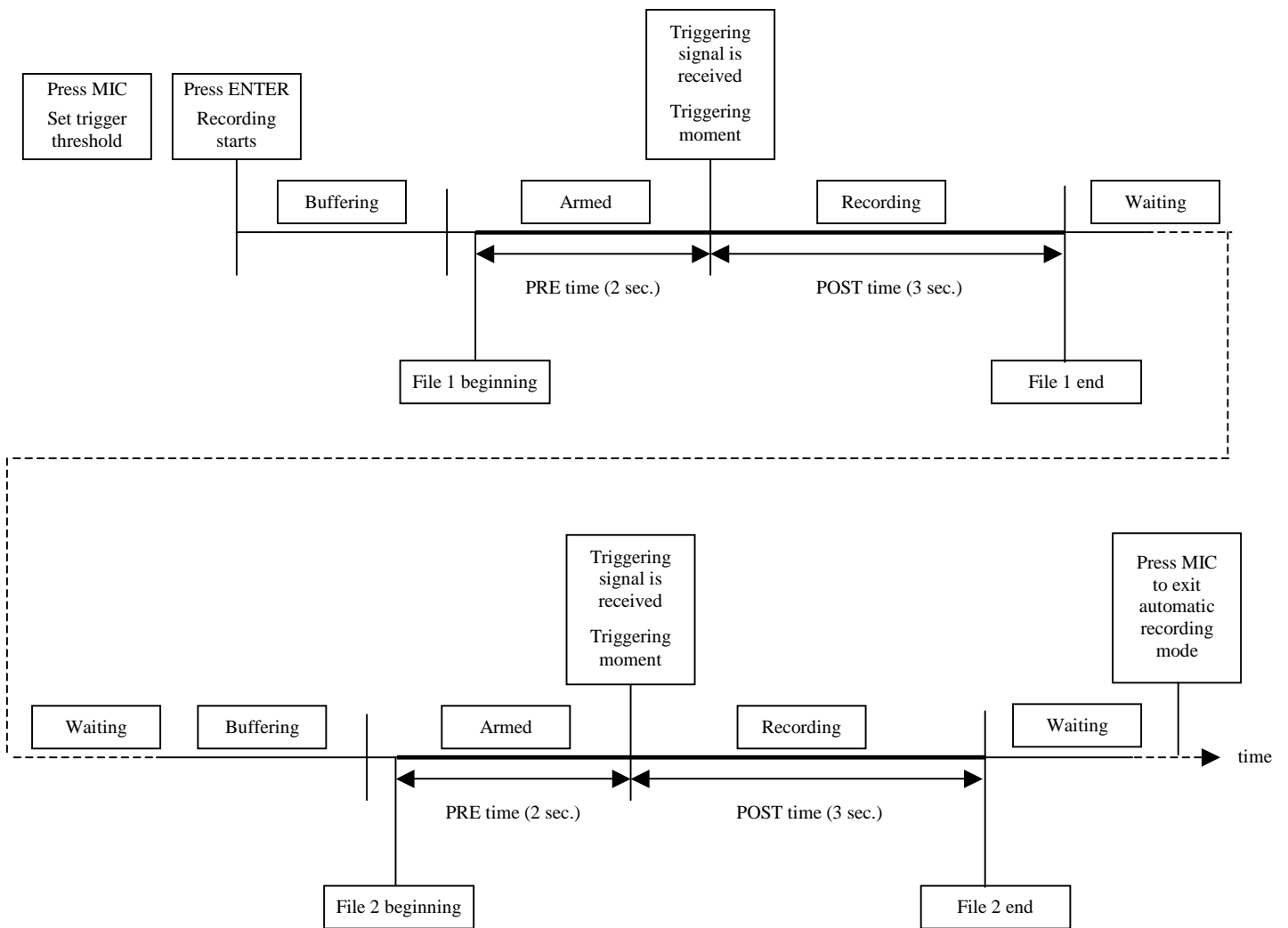
W = the count window, i.e. the time interval in tens of milliseconds within which the T pulses have to be counted in order for the recording system to be triggered. E.g., if a value of 3 is entered, the system will count pulses over an interval of $3 \times 10 = 30$ ms.

F = the minimum spacing in tens of seconds of two consecutive files. E.g., if a value of 3 is entered, the system will wait for $3 \times 10 = 30$ s after a recording is finished until it makes the system ready to record the next signal.

The P and F parameters, can take values between 0 and 9, while the allowed values for the T and W parameters are between 1 and 9. It should be noted, however, that some combinations are not allowed. For instance, if $T = 4$ and $P = 8$ at least 4 pulses within 24 (3×8) ms are required to trigger the recording system. In that case, setting the W parameter to a value of 2 (20 ms) or lower, means that the system would never be triggered. Such combinations are automatically eliminated as the parameters are entered.

After pressing MIC, selecting the desired trigger level and confirming this by pressing ENTER, the detector enters the automatic recording mode. When ARMED is shown on the display and the ARMED LED is lit, the detector awaits a trigger (the triggering conditions according to the chosen parameters are met). Upon receiving a trigger, a sound file is created with the length determined by the chosen values for PRE and POST. After finishing each recording, the detector waits for $F \times 10$ seconds and then becomes armed again. To exit the automatic recording mode, press MIC while the display shows “WAITING”. It is also possible to exit the ARMED condition by pressing the MIC key.

The figure below illustrates the Automatic recording mode.



Automatic recording mode with $PRE = 2$ seconds and $POST = 3$ seconds. This example shows the recording of two files only, but the recordings will continue until the automatic recording mode is exited by pressing the MIC key a second time. For $PRE = OFF$ the PRE interval becomes zero, for $POST = OFF$, the $POST$ interval becomes zero.

Note: If the recording is manually interrupted before the chosen recording time (PRE and/or $POST$ parameters) has elapsed, the text **ABORTED** is displayed. To continue, press the **ENTER** button. No file will be created. This is the case in both the manual and automatic recording modes.

Tips for making better recordings

While making recordings is very simple with the D1000X, there are a few things to think of in order to obtain the highest quality.

The recording level indicator, shows the actual signal level at the analog-to-digital converter (ADC). The indicator consists of eight LEDs. There are five green LEDs for the lower signal levels, two yellow LEDs for higher levels and one red LED indicating that the maximum signal level has been reached or exceeded. If the maximum signal level is exceeded, the recorded signal will be distorted. Obviously, this condition should be avoided.

The input gain control located on the front panel should be adjusted to keep the level indicator in the green and yellow areas. It is usually a good idea to set the input gain control at a relatively low gain. This will keep the noise at a low level, resulting in a high dynamic range.

If the heterodyne or frequency division signal is monitored through the loudspeaker, this sound will also be recorded by the detector, even if the sound source is the original signal (a MIC recording is made). Enabling the highpass filter will attenuate these signals as well as other low-frequency signals, but will not eliminate them completely. For this reason it is recommended to use headphones rather than the built-in loudspeaker while making the recordings.

In many cases, you may not wish to save every recorded file. Choosing PROMPT as Save mode will give the option of saving or erasing the file immediately after the recording has been made. Another way to do this, which is quicker if you know that you will want to keep most of the recordings, is to use the AUTO Save mode and manually erase the few files that you do not wish to keep. Manually erasing the last file is made with the ESC key when the detector is in the standard mode.

If you wish to erase sound files on the CF card, use the ESC key on the detector to erase single files as described above or use the "Format and Prepare" function in the D1000X Utility program to erase all files on the card. Erasing files from the computer, while the CF card is in a card reader should be avoided since this will not free any space for making new recordings with the D1000X.

Playing files

The D1000X can play any file that has been saved on the CF card. The replay sampling frequency is determined by 1) the sampling frequency that was used when the file was recorded, 2) the value of the TE (time expansion) factor and 3) the setting of the switch “Heterodyne source”. If this switch is set to NORMAL, the sampling frequency is determined by 1) and 2) above, while setting it to MEM>HET gives a replay sampling frequency equal to the recording sampling frequency regardless of the TE factor.

As an example, if the file was recorded with a sampling frequency of 500 kHz and the TE factor is 10, then the replay sampling frequency will be 50 kHz if the MEM>HET switch is set to NORMAL.

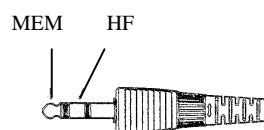
To play a file, press the PLAY key. The alternatives “PLAY” and “LIST” are displayed. To play a single file, select PLAY. To play a list of files (generated with the D1000X Utility), select LIST, and then move to the desired entry.

If you select PLAY, the files present on the CF card will be listed. The last file is selected by default, but using the UP/DOWN ARROW keys, any other file can be selected. To play the selected file, press PLAY again. Changing the TE factor in the settings menu, will affect the subsequent replay of files. A file replay in progress can be interrupted at any time by pressing the PLAY key.

If you select LIST and press ENTER, the play lists currently available on the card will be displayed. Move to the desired entry and press ENTER. The files in the selected play list will be displayed. To start playing, press ENTER. The files in the selected play list will be replayed in an “endless loop” fashion. To interrupt playing, press the PLAY key. In the “play list” play mode, the files will be replayed at the original speed, i.e. the time expansion factor will be 1 regardless of the chosen value in the current profile.

When the built-in loudspeaker or headphones are used, it is obviously only meaningful to replay audible signals, including ultrasonic signals replayed with the appropriate TE factor. In order to reproduce ultrasonic signals, an ultrasonic loudspeaker is required. In most cases, the signal also has to be amplified before connecting it to the loudspeaker. The memory replay output is located at the front of the detector, next to the microphone. The jack is marked “HF/MEM” and the connection is shown below. The HF signal is the amplified microphone signal, which can be used for making recordings of the unchanged, ultrasonic signal on other recording devices. For both outputs, the load impedance should be 500 ohms or higher.

Note: When connecting a cable to the HF output jack, you should use the supplied cable or another cable with a similar plug or the plug may not fit properly into the jack.



Note: Some combinations of sampling frequency and TE factor may result in too low a replay sampling frequency. The minimum replay sampling frequency is 12.5 kHz and if the

requested replay sampling frequency is lower than that, an asterisk (*) will appear to the left of the sampling frequency and the closest allowable sampling frequency will be used by the D1000X. Please note that this will result in a different time expansion factor than the expected. This only affects what is being played by the detector. The sound file on the CF card is recorded with the correct sampling frequency.

Note: The files created by the D1000X are standard “wav” files that can be read by PCs. However, in order to optimise the read and write speed, the files are stored in a special manner by the D1000X (see the section File Management). If wav files are copied from a PC to the CF card using standard Windows programs (such as the Windows Explorer), they will be located in the “Windows reserved area” of the CF card. If you wish to store a large number of files from the PC onto the CF card, you have to reserve a sufficiently large area when the CF card is prepared in the D1000X Utility. Preparing the CF card directly in the detector does not give the user the option of selecting the size of the Windows reserved area.

Note: Any wav files copied from a PC onto the CF card have to follow the same name convention as the other D1000X sound files, but with the prefix “P”, e.g. P00001.wav. The D1000X will only accept “external” files with the name “Pxxxxx.wav”, where xxxxx is a 5 digit number.

Which recording settings to use in different situations

The D1000X offers a high degree of flexibility and the number of different settings combinations is large. The user is strongly advised to use the concept of “profiles” to change between different settings. The detector is equipped with ten predefined profiles which can always be used. It is easy to modify any of these to fit a particular situation. Such modifications will be kept as long as the detector power is turned on. In addition to this, the user can also design new sets of profiles to load into the detector from the CF card.

If the CF card in the D1000X has a file with external profiles, the user will be prompted at power-on of the D1000X whether to use the external or internal set of profiles. If you confirm the question “LOAD INI-FILE?” by pressing the ENTER key, the set of external profiles is loaded into the D1000X from the CF card. To load the predefined, default profiles instead, press the UP or DOWN ARROW key to display the text “LOADING DEFAULTS” and confirm this by pressing ENTER.

The following ten predefined profiles are available in the D1000X.

1) “384 10”. General monitoring with time expansion. Listening to the real-time signal with heterodyne or frequency division system. Pre-trig mode.

384 10	MAN: The manual recording mode is used, which means that the user decides when to make a recording.
MAN	
fs=384.0kHz	fs=384.0kHz: A sampling rate of 384 kHz is used, meaning that signal frequencies up to about 150 kHz can be recorded.
TE=x10	TE=x10: A time expansion factor of 10 is used.
PRE POST	PRE=3s, POST=OFF: When the recording is stopped, the sound file will always contain the last 3 seconds, i.e. you can stop the recording after an interesting event has occurred.
3s OFF	
PLAY AUTO	PLAY AUTO: Upon completion of each recording, it will automatically be replayed, like a time expansion bat detector.
PROMPT	PROMPT: After listening to the time expanded recording, you can decide whether or not to permanently save the recording as a sound file on the CF card.
TRIG HP	TRIG EXT: The trigger source is external trigger. Since no signal is connected to the external trigger input, this means that the recording system will be triggered only by the user pressing the recording (MIC) key.
EXT ON	
LEDINT 3	HP ON: The high-pass filter is enabled. LEDINT 5: The LED and LCD background intensity level is 3.

2) “384 20”. Same as 1) except the time expansion factor is 20. Suitable for studying bats using higher frequencies.

3) “300 10”. Same as 1) except the sampling frequency is 300 kHz. The maximum signal frequency is 120 kHz.

4) “300 20”. Same as 3) except the time expansion factor is 20. Suitable for studying bats using higher frequencies.

5) “200 10”. Same as 1) except the sampling frequency is 200 kHz. The maximum signal frequency is 80 kHz.

6) “AUTO”. Unattended, automatic recording.

T P W F	
AUT 2 1 2 1	AUT: Automatic recording mode.
f s=300.0kHz	T=2, P=1, W=2, F=1: In order for the recording system to trigger, 2 trig pulses (T=2) have to be detected within 20 ms (W=2x10ms), with a minimum spacing of 1 ms (P=1). After each recording, the system will wait 10 seconds (F=1x10 sec) before “listening” for the next signal to record.
TE=x10	
PRE POST	
1s 2s	PRE = 1s, POST = 2 s: The sound file contains the recording from appr.1 second prior to the triggering moment to 2 seconds after that.
PLAY MAN	
AUTO SAVE	TRIG HF: The HF signal (the amplified microphone signal) is used as trigger source.
TRIG HP	
HF ON	
LEDINT 3	

7) “AUTO HET”. Unattended, automatic recording triggered by the heterodyne signal.

The settings are the same as in 6) except that the trigger source is the heterodyne signal. This means that the system will trigger only on those signals that are audible in the heterodyne system, i.e. those with a frequency close to the tuned, heterodyne frequency.

8) "MAN 384". Same as 1) except the recording is started by pressing the MIC key and stopped by pressing the same key a second time.

```
MAN 384
MAN
fs=384.0kHz
TE=x10
PRE      POST
OFF      MAN
PLAY AUTO
PROMPT
TRIG     HP
EXT      ON
LEDINT 3
```

9) "MAN 500". Same as 8) expect the sampling frequency is 500 kHz.

10) "AUDIO". Suitable for making recordings of audible signals such as bird song.

```
AUDIO
MAN
fs=44.1kHz
TE=x1
PRE      POST
OFF      MAN
PLAY MAN
AUTO SAVE
TRIG     HP
EXT      OFF
LEDINT 3
```

File management

The CF card used in the D1000X has a Windows compatible file system, which means that the files can be read with a Windows PC equipped with a CF card reader. In order to efficiently stream the sampled signal onto the CF card at high sampling rates, the card first has to be prepared in a special manner. Preparation of the card is made either in the D1000X (see the section Formatting and preparing a CF card) or with a PC using the D1000X Utility. One, usually small, portion of the card is reserved for standard Windows files. Examples of files that are stored in this area are system files, files that contain user-created profiles and wav files copied from a PC, to be played on the D1000X. The rest of the card is reserved for storing recordings made with the D1000X. If you examine the prepared CF card in a PC, using e.g. the Windows Explorer, the card will appear almost full. The only free space reported by Windows Explorer is the free space in the area reserved for standard Windows files. This is normal and does not necessarily mean that there is no space for more sound files using the D1000X. To see the actual space available for making recordings with the D1000X, insert the card in the D1000X and turn it on. The CF indicator will show the remaining space.

The files recorded with the D1000X will appear as standard Windows files if viewed in the Windows Explorer.

If you wish to view and edit the sound files with a sound analysis software such as BatSound, we recommend that you first copy the files from the CF card to the hard disk drive of the computer. Altering the sound files on the CF card from the PC, may render the card unusable for making further recordings on the D1000X. If this has happened, the card should be formatted and prepared again.

In a sound file recorded with the D1000X, the first samples contains control information used by the detector. The actual recorded sound follows immediately after these samples. In most cases this is not audible when the file is played. If desired, the first samples can be removed using e.g. the BatSound software or any other sound editing software. The "Clean file" command in the D1000X Utility program can also be used to remove these first samples.

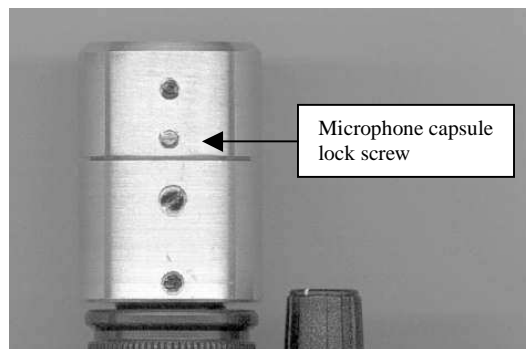
It is possible to erase the most recently made recording in the D1000X. To do this, press the ESC key. The text "Erase file Mxxxxx.WAV NO/YES" appears. Use the UP/DOWN arrow keys to set the frame around YES and then press ENTER to actually erase the file (this may take a few seconds - the "standard screen" reappears when it is finished). Please note that it is only possible to erase the last file you recorded with the D1000X. This is made on purpose, to avoid accidentally erasing files that you wish to keep.

Erasing individual files on the CF card in a PC will not free any space on the card for making new recordings. If you wish to erase the entire card, format and prepare the card in the D1000X Utility or in the D1000X.

The microphone

The microphone is a solid-dielectric capacitance microphone, with a built-in preamplifier. This type of microphone requires a polarizing voltage (200 volts), which is generated by a DC/DC converter in the detector. This voltage is present at the microphone socket. To remove the microphone from the detector, turn off the detector and unscrew the grooved, green ring and gently pull the microphone off the socket. When attaching the microphone again, make sure the ring is properly tightened. If the microphone membrane has been worn or punctured, it may be necessary to replace it. The microphone capsule (the upper part of the microphone with the membrane) is replaceable and is available as a spare part. To remove the microphone capsule, loosen the lock screw (see figure below) slightly with a suitable screwdriver and pull the microphone capsule from the microphone housing. Do not unscrew any other screws on the microphone – this may cause damage to the microphone and/or the microphone capsule!

An extension cable for the microphone is available from Pettersson Elektronik.



Caution. *The microphone membrane is easy to damage. Touching the microphone membrane should always be avoided! If the microphone membrane has been punctured, electrical discharges may occur. Although the energy stored in the microphone capsule is very limited, as any electronic equipment the detector should not be used in areas with explosive gas.*

The serial input

The serial input is located beneath the CF card slot and is used to connect a GPS receiver to the D1000X. This should be done only with a cable supplied by Pettersson Elektronik or a cable manufactured according to instructions from Pettersson Elektronik.

The serial input is also used for certain service operations by Pettersson Elektronik or another approved service center.

Using a GPS receiver

A GPS receiver can be connected to the serial input of the D1000X, provided it meets the requirements shown in the section “D1000X Specifications” in this manual. To connect the D1000X to the GPS receiver, a “serial cable” is required. Such cables are available from Pettersson Elektronik and it should be connected to a “serial PC cable” (with a 9-pole female D-sub connector) from the GPS receiver. Please note that only GPS receivers with a serial/RS-232 output can be used and that you may have to alter the settings of the GPS receiver to meet the requirements of the D1000X (NMEA mode/4800 Baud). In order to avoid the bulky connectors joining the two cables, a dedicated cable can be manufactured. For information about this, please contact Pettersson Elektronik.

The GPS receiver should be connected to the D1000X and turned on before the D1000X is turned on. The D1000X will check for a connected GPS receiver each time it is turned on (the text “Searching GPS...” is shown) and if a GPS receiver is found, the GPS position information and time will briefly be displayed and the GPS function in the D1000X will be enabled until the D1000X power is turned off or the GPS receiver is disconnected/turned off. When the D1000X has found a connected and working GPS receiver, this will be indicated with a “G” to the right of the time on the display. A connected GPS receiver with poor reception quality will be indicated as “0” and with no connected GPS receiver, no indication is made on the display.

When a GPS receiver is connected to the D1000X, the current position data and time will be stored in each of the recordings made. The recorded values are taken immediately before the recording started. To retrieve this information, please use the D1000X Utility program or the BatSound software (versions higher than 3.31). The current GPS position data can be shown on the D1000X display by momentarily pressing the ON/OFF key. After about 5 seconds, the display will return to its normal view again.

The GPS position data has the format:

Latitude: (N/S) DD MM SS.SSSS
Longitude: (E/W) DDD MM SS.SSSS

D = degrees, M = minutes, S = seconds

Note: If the D1000X does not receive any GPS data from the receiver (e.g. due to poor reception), the position data in the files may be invalid or old.

Battery life guidelines

The battery lifetime guideline values given below indicate the approximate amount of time at room temperature (20° C) until power automatically turns off due to battery failure. The actual life of a set of batteries is affected by many different factors, including the battery manufacturer, the amount of time the batteries spent in storage before they were used, the temperature and the D1000X settings.

Heterodyne and/or frequency division systems active. No recordings made, 44.1 kHz sampling frequency, LED intensity level 3:

Alkaline batteries, LR6:	9 hours*
NiMH accumulators, 2300 mAh:	11 hours*
Lithium batteries, FR6:	15 hours*

Heterodyne and/or frequency division systems active. Recording continuously, 300 kHz sampling frequency, LED intensity level 3:

Alkaline batteries, LR6:	5 hours
NiMH accumulators, 2300 mAh:	7 hours
Lithium batteries, FR6:	8 hours

In order to prolong the battery life, the following could be considered.

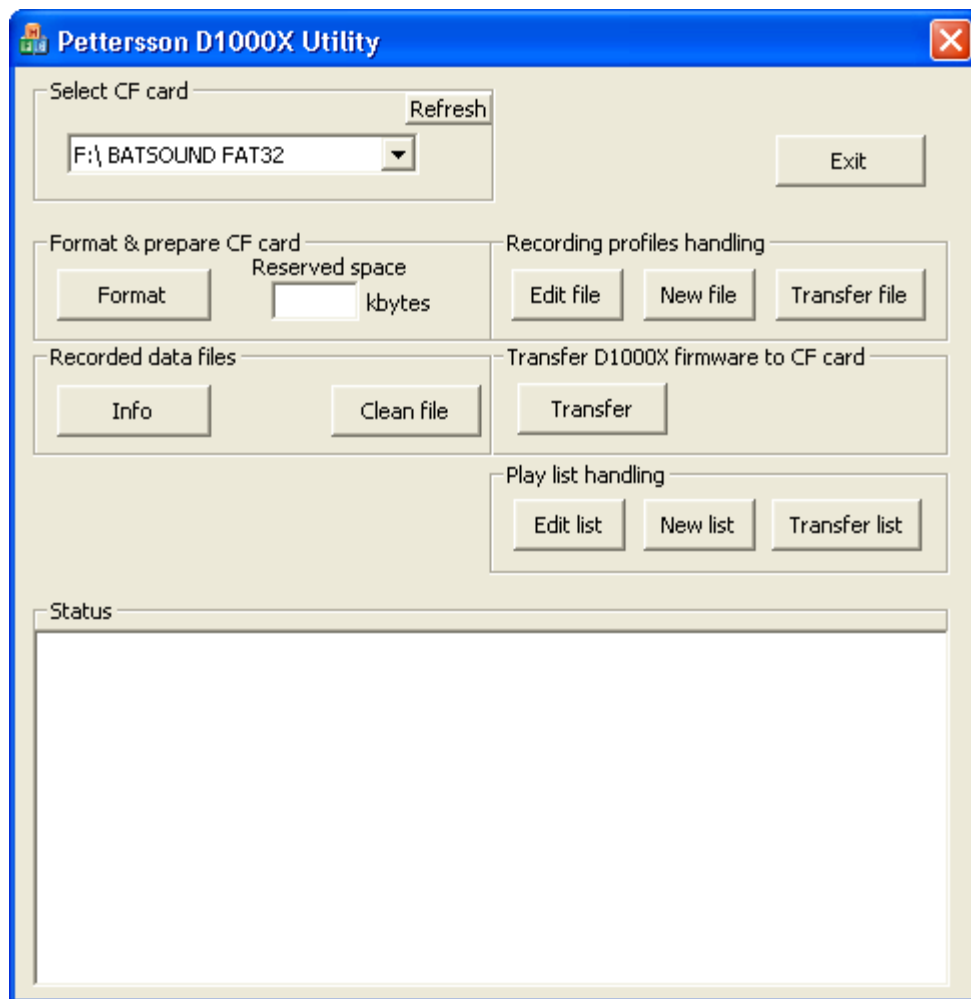
- Use a low/moderate LED intensity.
- Avoid using unnecessarily high sampling frequencies.
- Avoid recording continuously.
- Use headphones rather than the built-in loudspeaker

* When a GPS receiver is connected to the serial input of the D1000X the battery life is approximately 25% shorter.

The D1000X Utility software

The D1000X Utility software is a Windows program to facilitate the use of the CF cards with the D1000X. This program is used to:

- Format and prepare the CF card for use in the D1000X
- Create D1000X profiles and transfer these onto the CF card
- Create D1000X play lists and transfer these onto the CF card
- Transfer D1000X firmware upgrade files to the CF card



The first step in using the D1000X Utility is to select the drive that has the CF card. This is done in the “Select CF card” section in the D1000X Utility main window. Please make sure you select the correct drive or the following operations (including formatting) will be performed on a disk in a drive you did not intend.

Format & prepare CF card

This function will perform a “quick format” of the CF card in the selected drive. In order to work as intended, the CF card should already be in the FAT32 format. If it is not or if you are unsure about its format, please first format the card using the Windows formatting procedure, selecting FAT32 as format. After formatting the CF card it is also “prepared” to make it ready to be used in the D1000X.

The CF card used in the D1000X has a Windows compatible file system, which means that the files can be read with a Windows PC equipped with a CF card reader. In order to efficiently stream the sampled signal onto the CF card at high sampling rates, the card first has to be prepared in a special manner. One, usually small, portion of the card is reserved for “standard Windows files”. Examples of files that are stored in this area are system files, files that contain user-created profiles, play list files and wav files copied from a PC, to be played on the D1000X. The rest of the card is available for storing recordings made with the D1000X. If you examine the prepared CF card in a PC, using e.g. the Windows Explorer, the card will appear almost full. The only free space reported by Windows Explorer is the free space in the area reserved for standard Windows files. This is normal and does not necessarily mean that there is no space for more sound files using the D1000X. To see the actual space available for making recordings with the D1000X, insert the card in the D1000X and turn it on. The CF indicator will show the remaining space.

In the D1000X Utility, you can enter the desired space to reserve for “standard Windows files”. The number of kilobytes to reserve should be entered in the “Reserved space” box prior to clicking Prepare.

Recorded data files

Clicking on Info will display some information from the file, e.g. the GPS data, if any.

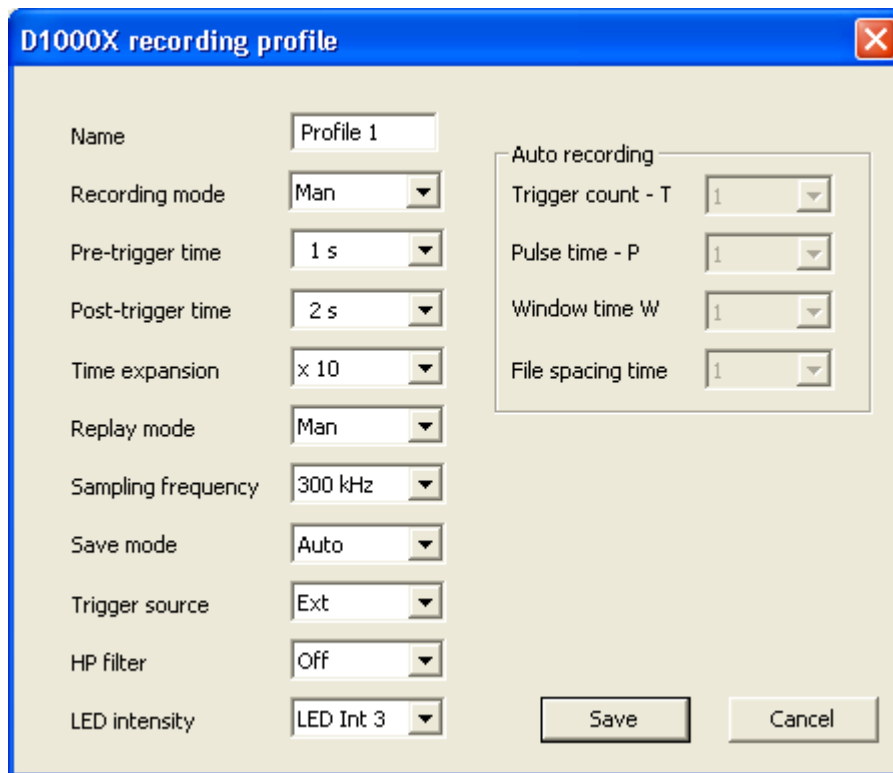
Clicking on Clean file will remove the extra information that is stored in the file (e.g. GPS data). This information is stored at the beginning of the file and can be seen in the spectrogram or oscillogram as a very short transient. Usually, this transient is so short that it is not noticed. Please note that after using the Clean file command, the information erased from the file cannot be retrieved, so it is advisable to perform this operation on a copy of the original file.

Recording profiles handling

The full sets of recording parameters of the D1000X are contained in so called profiles, as described in the section “The recording parameters” in this manual. A maximum of ten profiles can be stored in the D1000X. The D1000X Utility enables the user to create customized profiles to be loaded into the D1000X from the CF card.

To create a new profile, click on New file and Add new. This will open the D1000X recording profile window. First, enter the desired name for the profile. The name can have up to ten characters. After selecting the desired parameters, click Save. To add more profiles, select

Add new once more and repeat the steps above. To save the profiles you have created to a file, select Save file and enter the desired name for this set of profiles.



To transfer the saved profile file to the CF card, you should first make sure you have a formatted and prepared CF card in the selected drive. Then click "Transfer file" and select the file to transfer.

An existing profile file can be edited by selecting Edit file.

Transfer D1000X firmware to CF card

This function transfers a firmware upgrade file from the PC to the CF card in order to upgrade the D1000X firmware through a special procedure. Firmware upgrade are supplied by Petterson Elektronik as they become available, along with instructions on how to upgrade the D1000X.

Play list handling

The D1000X can be used to play a single file or to play files from a play list. To generate a play list, click on "New list" and "Add" to add the desired file. Please note that if the files you wish to play will be copied from the PC onto the CF card, they have to follow the name convention described in the section "Playing files", i.e. they must have a name of the type Pxxxxx.wav, where xxxxx is a 5-digit number. You must rename the desired files to follow this convention before copying them onto the CF card. It is of course also possible to include files already residing on the CF card in the play list, e.g. Mxxxxx.wav files. The name of the

play list file should have a maximum of six characters. The D1000X Utility automatically adds the extension .LST to the name you selected.

To transfer the saved play list file to the CF card, you should first make sure you have a formatted and prepared CF card in the selected drive. Then click “Transfer file” and select the file to transfer. Please note that this only transfers the play list file to the CF card. If the required wav files are not already present on the CF card, the user should copy these files to the CF card using e.g. Windows Explorer.

Trouble-shooting

Symptom	Cause/remedy
No free CF card space reported (0 kB/0 MB or empty CF indicator).	<p>There is no space left on the CF card to make further recording.</p> <p>The CF card has not been formatted and prepared for use in the D1000X.</p>
The detector shuts down when I try to make a recording/play a file.	<p>The D1000X will automatically shut down if the battery voltage goes below a certain level. The higher power consumption during recording and playback may make the detector shut down even if the batteries are not fully exhausted.</p> <p>Replace the batteries.</p>
The detector will not start even with fresh batteries.	<p>The main power switch may be in the OFF position.</p> <p>One or more batteries may be incorrectly polarized.</p> <p>The protection fuse may have blown due to an internal short-circuit or if a power supply voltage outside the allowed range has been applied. To replace the fuse, the detector has to be opened. Please contact Pettersson Elektronik for further instructions.</p>
The detector has locked up and does not respond to any key strokes.	<p>Wait some time to make sure the detector is not just busy. Then toggle the Main Power switch off and on and restart the detector.</p>
The detector works, but I don't hear any sound in one or both channels.	<p>The volume control may be set too low.</p> <p>One or both PHONES switches may be set incorrectly. Make sure each switch is set to one of the three distinct positions.</p>
There is no sound from the heterodyne system.	<p>The HET SOURCE switch may be in the MEM>HET position. Set it to the NORMAL position.</p>

Error messages.

Message	Meaning/possible cause
DISKERR	A Disk Error (a problem with the CF card) has been detected. This can be because there is no card in the CF slot. The card in the CF slot can also be defective or the card may not have been formatted and prepared for the D1000X.
NO PART	No partition found on the CF card. The card may not have been formatted.
DISK FULL	There is no space left on the CF card to make further recordings.
OVERFLOW	The data cannot be written to the CF card fast enough, so some samples were lost. The recording is interrupted. This may occur if the CF card has too low a write speed.
UNDERFLOW	The memory buffers for recording or playback are not filled fast enough.
CF ERR xx	An error has occurred accessing the CF card. xx is a number describing the error type, as reported by the CF card.
P ERR xx	An error has occurred while playing a file. This may be because the file does not contain any data or is in an unexpected format. xx is a number describing the error type.
ABORTED	A recording was aborted since the internal memory buffer had not been filled completely. At low sampling frequencies filling the buffer will take a few seconds. Also, do not interrupt a recording while the display shows "BUFFERING".

Note: To clear any error message, press the ENTER key. If this does not help, wait a while, then toggle the Main Power switch off and on and restart the detector.

Requirements

In order to copy the files from the CF card to a PC, a Windows XP/Vista/7 operating system and a CF card reader is required.

The D1000X accepts type I CF cards. Although any CF card with sufficient read and write speed should work, the following card types have been tested with good results:

- Sandisk Ultra II
- Sandisk Extreme III
- Lexar 40x
- Lexar 80x
- Kingston Elite Pro

D1000X Specifications

Type:	Heterodyne, frequency division (x10), time expansion and direct recording
Frequency range:	5 – 235 kHz (frequency division and heterodyne) 5 kHz – 0.4 x sampling frequency (time expansion and direct recording) Activating the high-pass filter results in a lower frequency limit of about 20 kHz.
Heterodyne freq. resolution:	0.1 kHz ($f < 17.8$ kHz) 0.2 kHz ($18 < f < 43$ kHz) 0.5 kHz (43.5 kHz $< f < 107$ kHz) 1 kHz ($108 < f < 235$ kHz)
Headphones output:	3.5 mm stereo jack, load impedance 32 ohms or greater
HF/MEM output:	3.5 mm stereo jack, load impedance 500 ohms or greater, ca 600 mV _{rms} at 0 dB
Recording/playback system	
ADC resolution:	16 bits
Anti-aliasing filter:	Yes, adaptive
Sampling rates:	32, 44.1, 48, 96, 100, 192, 200, 250, 300, 384, 400, 500, 750, 768 kHz
Time expansion factors:	1, 2, 3, 5, 10, 20, 30
DAC resolution:	12 bits
GPS connection requirements:	
Interface:	RS-232
Protocol:	NMEA 0183
Decoded sentences:	GPGLL, GPGGA and GPRMC
Baud rate:	4800 Baud
Batteries:	5 x AA size, Alkaline or NiMH recommended
External DC supply:	7-10 V, 250 mA (average), 700 mA (peak)
Size:	170 x 80 x 35 mm, excl. microphone
Weight:	600 g incl. batteries

Using the detector in intense electromagnetic fields may cause interference and/or temporary signal loss.