DODOTRONIC

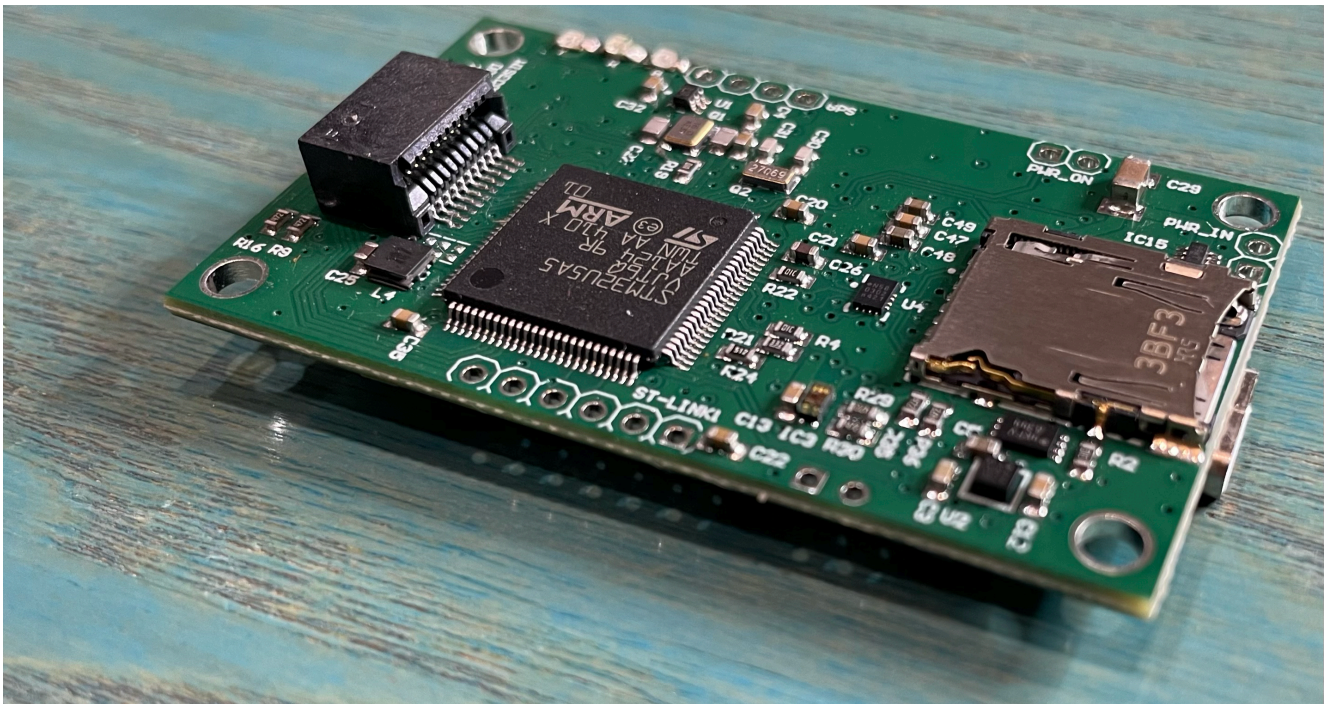
ELECTRONIC DEVICES

WISECORDER

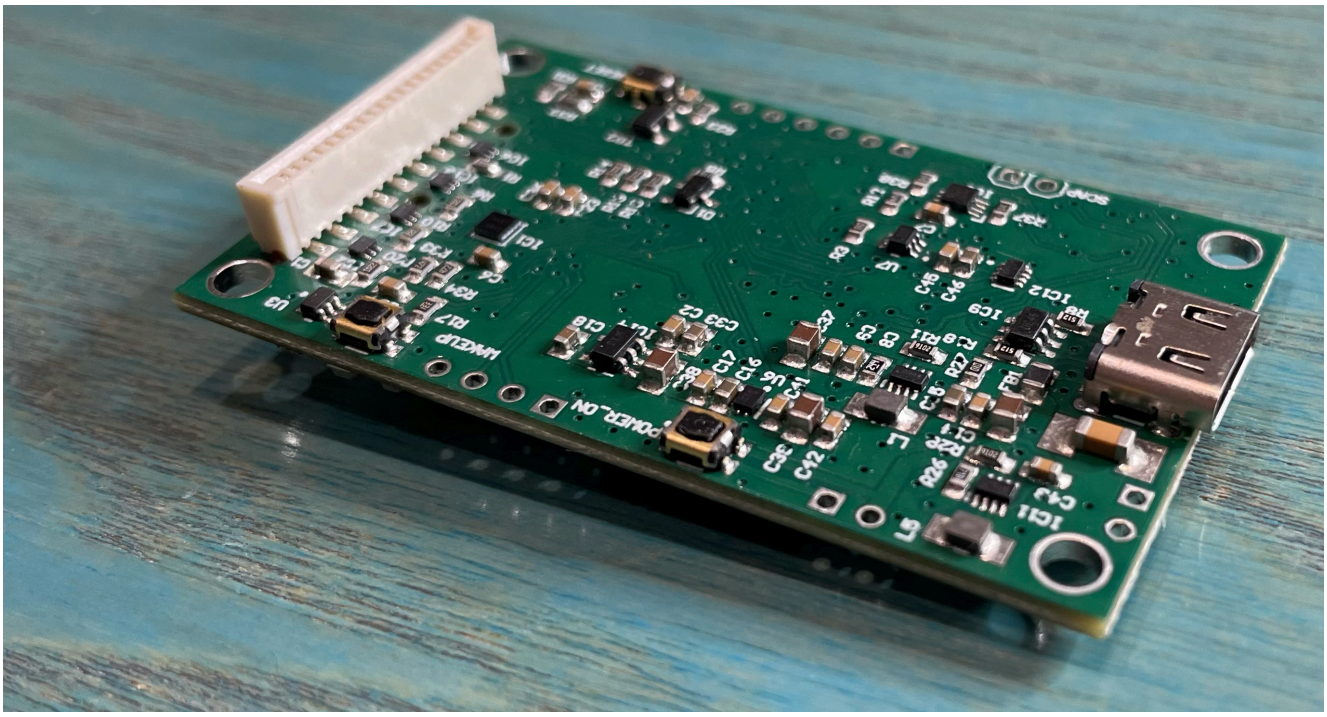
Audio and ultrasonic Multichannel Recorder

USER GUIDE

1.4



Wisecorder's Top Side



Wisecorder's Bottom Side

Overview

The **Wisecorder** is a *4-channel* recorder with simultaneous sampling up to *384 kHz* and *32-bit* resolution, capable of recording both audio and ultrasound. Its compact size and low power consumption make it particularly suitable for autonomous and long-term recordings.
It features also additional sensors to add useful information to each recording made, including a *3-axis accelerometer*, a *3-axis magnetometer* and a *Red-Green-Blue-White-Infrared Light sensor*.
It can be used as a single channel (mono) recorder or a 2 channels (stereo) recorder or 4 channel simultaneous sampling recorder.
The ability to perform simultaneous sampling on 4 channels allows for the precise localization of the sound source, making it the ideal tool for countless applications where identifying the position of the source is required.

Example of Applications:

- Study of vocalizations of both terrestrial and marine wildlife, such as insects, bats, marine mammals, etc.
- Environmental impact studies on wind farms
- Recording and analysis of laboratory animal vocalizations for pharmaceutical applications
- Soundscape studies and environmental acoustics analysis
- Localization of gas leaks in industrial environments
- Predictive analysis of mechanical failures
- Detection of high-frequency noise from electronic products

For example, you could use Wisecorder's great flexibility to record birds during the day, choosing a sampling frequency of 48 or 96 kHz (to record the standard audio range), and to record bats during the night time, choosing a sampling frequency of 192 or 384 kHz (to reach the ultrasound range), with a simple and intuitive interface that does not require particular technical knowledge, all in the same single device.

You can program the Wisecorder to target and detect a certain type of animal as just described in the previous example, or you can use it to record the ***soundscape*** of a certain environment. In this case, instead of a Scheduling Recording Mode you would want to choose a **Repeat** Recording Mode, which allows the Wisecorder to record a user-defined amount of time in different times of the day.

Also, in this case it’s necessary to use at least 2 channels, to have the stereophonic image of the environment that we want to capture the soundscape of.

Another great example of what Wisecorder excels at, is ***beam-forming***. Thanks to its 4 channels capability, Wisecorder is the perfect tool to be able to determine the coordinates of simultaneous sound sources inside the recording.

Glossary

	Description
Sampling frequency (sampling rate) [**Hz/ Khz**]	The rate or frequency at which an analog signal is analyzed to determine acoustic delicacies. A higher Sampling Frequency results in less difference in forward/backward sounds. Also, the Sampling Frequency determines which is the maximum recordable Frequency, which can be obtained by dividing the Sampling Frequency by 2. For example, a Sampling Frequency of 48 kHz allows us to record sounds that go up to 24 kHz; a Sampling Frequency of 96 kHz allows us to record sounds that go up to 48 kHz and so on.
Quantization bits (Bit Depth) [**bit**]	The number of quantization bits helps determine how much data is required to save a recording when digitizing analog signals (such as voice). A higher number of quantization bits results in higher Dynamic Range, therefore increasing the clarity of the recorded signal. A lower number of quantization bits allows for the recording to occupy less space on the SD card, but it reduces the Dynamic Range, possibly introducing noise and distortion.
Dynamic Range [**dB**]	The difference between the maximum and minimum representable signals. For example, if the lowest sound we can record is 5 dB, and the highest sound we can record is 110 dB, that would mean we have 105 dB of Dynamic Range.
Bit rate [**kbps**]	A Bit Rate indicates how many data bits are transmitted per second. A 128 kbps file, for example, uses 128 kbits per second to encode data. The smaller the bit rate you select, the worse the quality, and the smaller the size it will output. Even if the bit rates are the same, sound quality varies depending on the digital audio compression algorithm (such as MP3).
Linear PCM format	A linear PCM is an uncompressed way of encoding the recorded signal into a digital file. The linear PCM format is used so that no data gets lost due to compression and original sound stays intact. This format is widely used for music CDs (CD-DA).
Memory (media)	This is a storage system that does not lose the data stored on it even when the power is removed. In this manual, it refers to the built-in flash memory and the SD card.

Encoding	Encoding is a process in which the information obtained from a source is converted into data according to certain rules. Or it is a process in which data is converted from one format to another (such as audio compression) according to certain rules.
Firmware	Software installed on the Wisecorder board that enables the microphone recording according to the rules of the Firmware itself.
Mono	A recording in which there is only one channel, so based on a single microphone.
Stereo	A recording in which there are two channels, so based on two Mono microphones or a single Stereo microphone.
Stereophonic Image	The differences between the left side and the right side of a Stereo recording. These differences are mainly recognizable by analyzing the intensity of the recorded signal on the two channels: a source that produces a sound towards the left side, will have a higher intensity signal on the left channel, while it will have a similar signal but with lower intensity on the right channel.

USB Connection

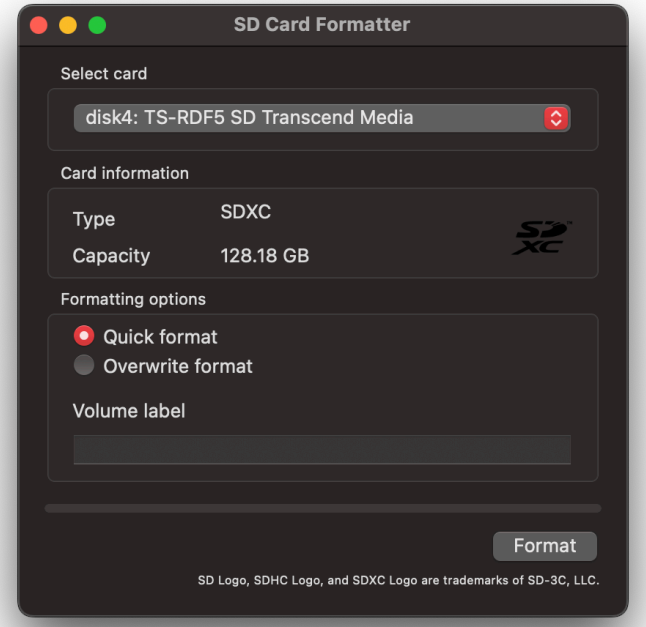
When configuring and operating the Wisecorder, it is of essential importance to understand the relationship between the Wisecorder and its Controller Android App (available for download on www.dodotronic.com).
The Wisecorder features three buttons: "Power ON", "Stop", "Reset". Please make sure to read carefully the chapters of **all three buttons** before using any one of them.

Power ON Button

The Power ON button turns on the Wisecorder. Before turning it on, it is mandatory to insert an **SD Card** and to supply it with charged **batteries**.

✋ The SD card **MUST** be formatted using the SD card formatter free software before any recording session is started:
https://www.sdcard.org/downloads/formatter

To insert and remove the SD card, simply push and pull. A click will occur when pushing.
Note also that faster data transfer speeds will result in better performance. Old or low quality SD cards could have a low transfer rate and data loss can occur during recordings.
Please also note that data transfer speed may gradually degrade depending on the type of SD card used. Specifically, your card performance may deteriorate if the SD card is repeatedly written to or erased. If this occurs, try to re-initialize the SD card using the above mentioned software.



If the Wisecorder has no configuration, by default it will start immediately recording on **1 Channel**, **24 bit** and **48 kHz** Sampling Rate. The active recording is recognizable by the **Red** LED flashing once every 5 seconds.

Otherwise, to configure the Wisecorder, **before turning it on** make sure to first download the Wisecorder Controller App from www.dodotronic.com, and to open it. The first time you open the App, it might ask you for permissions to read and write files on your device; these permissions are necessary only if you want to be able to save configuration presets in your smartphone's memory for later retrieval.

Once the App is opened, connect your smartphone to the Wisecorder via a USB cable. **Only now** you can turn on the Wisecorder via the Power ON button.
On startup, the Wisecorder will recognize that there is a USB Device connected and it will go into configuration mode. The configuration mode can be recognized by the **Green** LED being constantly ON. More details on how to use the App to configure the Wisecorder are available in the following chapters: [Quick Setup], [Configuration Diagram], [Manual Setup].

Once the configuration is sent over from the App to the Wisecorder, the App will dismiss the loader and it will show a confirmation message and a warning to unplug the phone. At this point you must unplug the USB cable. Then, the Wisecorder will process the uploaded configuration and will shut down, waiting in Sleep Mode for the first timer to start recording, or it will start recording immediately if a Timer has been configured for the current time.

✋ **IMPORTANT**: Do not keep the smartphone plugged via USB to the Wisecorder during recording. If the Wisecorder wakes up from Sleep Mode because of a recording timer and detects a USB Device connected, it will not start recording, and it will go into configuration mode instead.

Stop Button

The Stop button's purpose is to stop an active recording. Once the recording is stopped using this button, the Wisecorder will go back into Sleep Mode, waiting for the next Timer to start.

Reset Button

The Reset button is a kill-all switch which immediately cuts off all the power from the Wisecorder.

⚠ **WARNING**: Do **not ever** press the Reset Button without first pressing the Stop Button. Abruptly cutting off the power from the Wisecorder can lead to memory corruption in the SD Card.

USB Plug-in Behavior

The Wisecorder USB configuration is designed to be as much intuitive as possible. Here is a comprehensive list of what happens if you plug in your USB Device in every possible state:

Wisecorder State	USB Plug-in Behavior
Wisecorder is turned OFF	USB will be ignored. If you let the USB plugged in and turn the Wisecorder ON, it will go into configuration mode (constant **Green** LED ON)
Wisecorder is Starting Up	The behavior in this scenario depends on how quickly or slowly you plug in the USB Device, resulting in possibly starting configuration mode, starting a recording or going into Sleep Mode. We recommend plugging in the USB Device **before** turning the Wisecorder ON.
Wisecorder is currently recording	Plugging in the USB in this scenario will stop the active recording and start configuration mode (constant **Green** LED ON)

Wisecorder State	USB Plug-in Behavior
Wisecorder is in configuration mode	In this case you cannot plug-in a USB device, as the USB port is already used
Wisecorder is in Sleep Mode (waiting for the next Timer to start)	Plugging in a USB Device in this scenario will be ignored. **ATTENTION**: if you leave the USB Device plugged in and a Timer starts, Wisecorder will not start the recording and it will go into configuration mode instead.

USB Plug-out Behavior

On the other hand, this is what happens when the USB Device is disconnected in various states:

Wisecorder State	USB Plug-out Behavior
Wisecorder is turned OFF	No effect
Wisecorder is Starting Up	No effect
Wisecorder is currently recording	No effect
Wisecorder is in configuration mode	Wisecorder will end configuration mode and go back into Sleep Mode, waiting for the next Timer to start
Wisecorder is in Sleep Mode (waiting for the next Timer to start)	No effect **ATTENTION**: if you leave the USB Device plugged in and a Timer starts, Wisecorder will not start the recording and it will go into configuration mode instead.

Quick Setup

The Wisecorder allows, through its "Wisecorder Controller" App downloadable from www.dodotronic.com, to load the recording configuration via a USB connection directly from your Android smartphone.
The App features a variety of Quick Setup configurations, which can be found under the "**Record**" tab [1]. The available configurations are:

Configuration	Channel(s)	Sampling	Bit Depth
Bird	2	96 kHz	24 bit
Bat	1	384 kHz	16 bit
Dolphin	1	384 kHz	16 bit
Frog	1	48 kHz	24 bit

Configuration	Timer Start	Timer Stop	Active / Pause
Bird	06:00	19:00	55 min / 5 min
Bat	18:00	05:00	25 min / 5 min
Dolphin	06:00	15:00	55 min / 5 min
Frog	17:00	00:00	55 min / 5 min

To load a Quick Configuration, simply tap on the desired entry of the list. The App will then show you a popup message, which means the configuration is loaded into the smartphone memory and it's ready to be sent to the Wisecorder [2]. Then follow these steps:

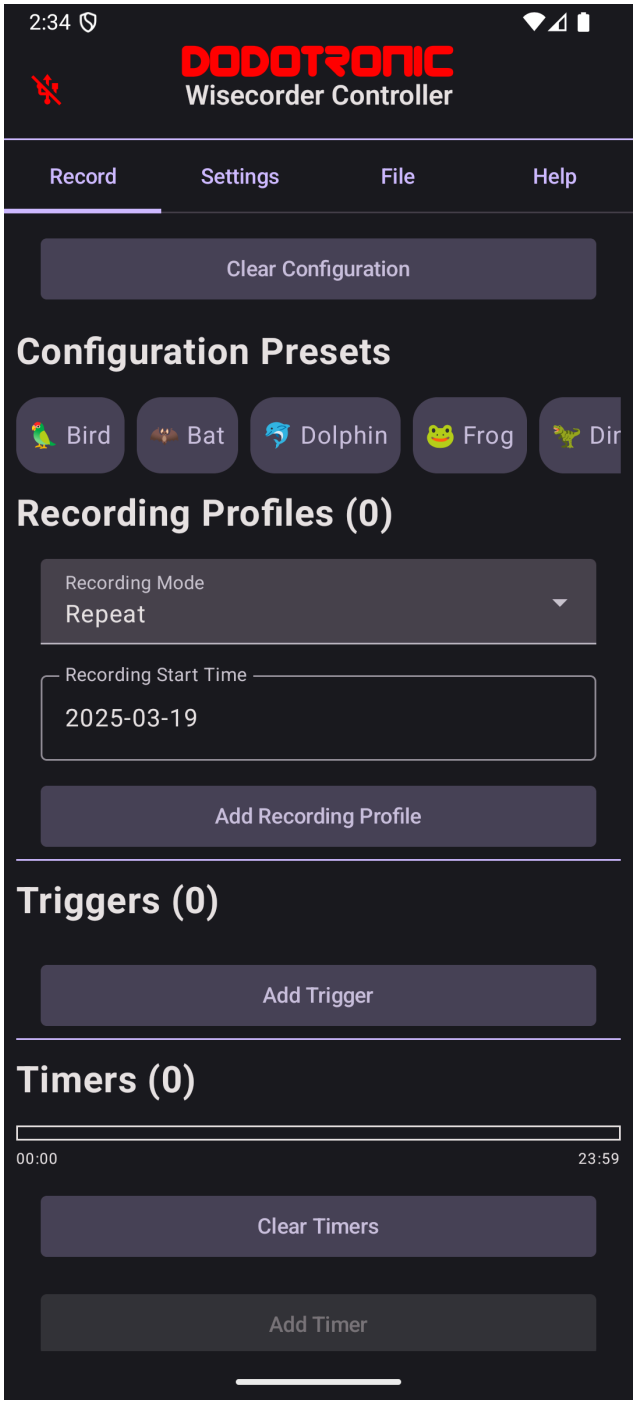
- Make sure the Wisecorder is supplied with batteries before setting it up. [4]
- In the Settings Tab, select the type and number of batteries that are being supplied to the Wisecorder. [15]
- Connect the smartphone via USB cable. [5]
- Turn on the Wisecorder (Power_On button) [6]

    - **ATTENTION**: Do not turn on the Wisecorder before the Smartphone is connected via USB cable, or the App might not recognize the Wisecorder.

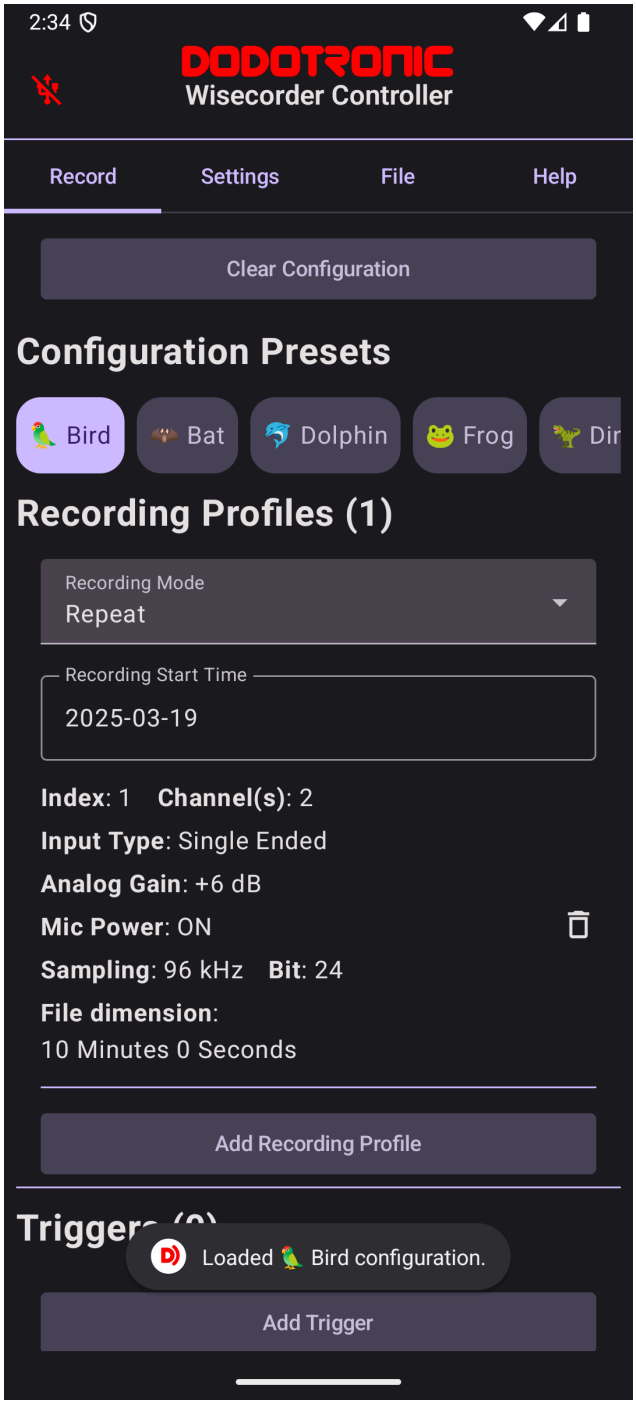
- Scroll to the end of the "**Record**" tab and tap on the "**Send Config**" button. [7]
- A loader will be displayed. Wait for the confirmation message which says the configuration has been sent successfully.

Any loaded configuration can be Manually modified in any aspect. For example, you could change the **Start Time** and **Stop Time** of the configured Timer, change the **Number of Channels**, **Sampling Frequency** and **Bit Depth** or add a **Trigger**. To edit any existing part of the configuration, tap on the entry containing the details of that object – this will redirect you to the detail view of that object, where you will be able to change one or more parameters before saving the new. For example, if you want to load a Bird recording configuration as shown in [2] and change the Analog Gain, you can simply tap on the entry as shown in [3].

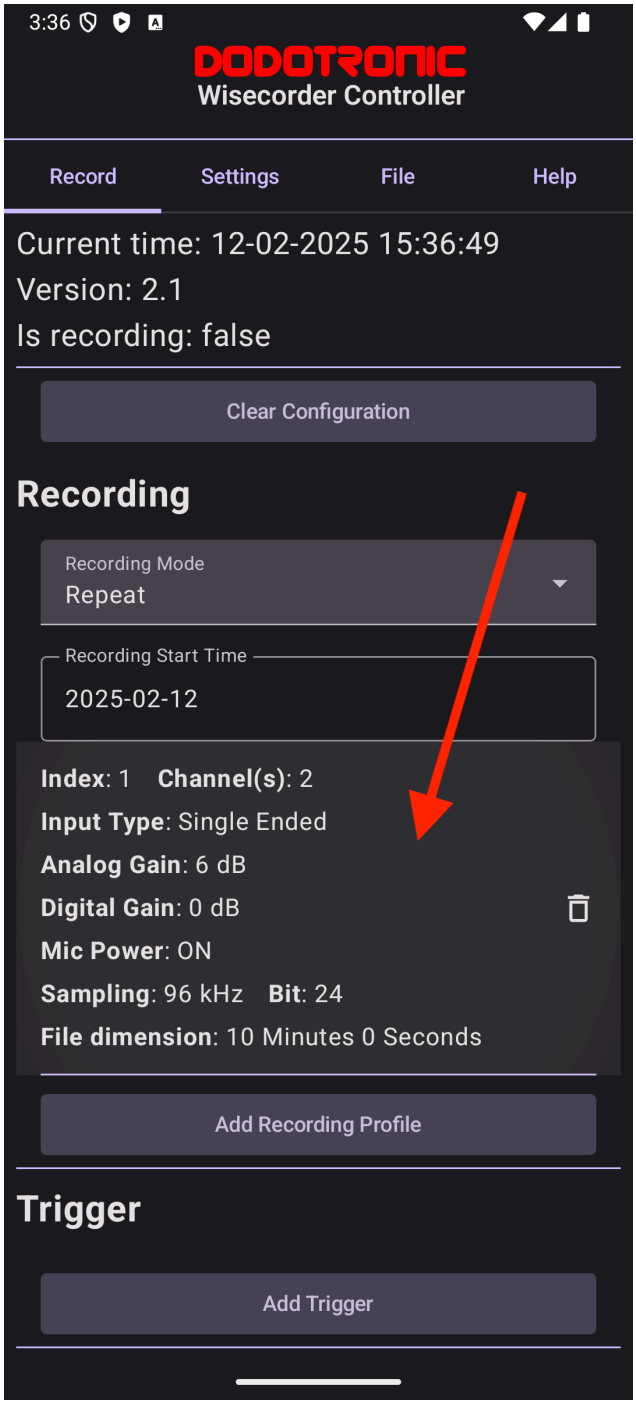
To further expand your knowledge on how to Manually edit a configuration on the App, please refer to the Chapters [Configuration Diagram] and [Manual Setup].



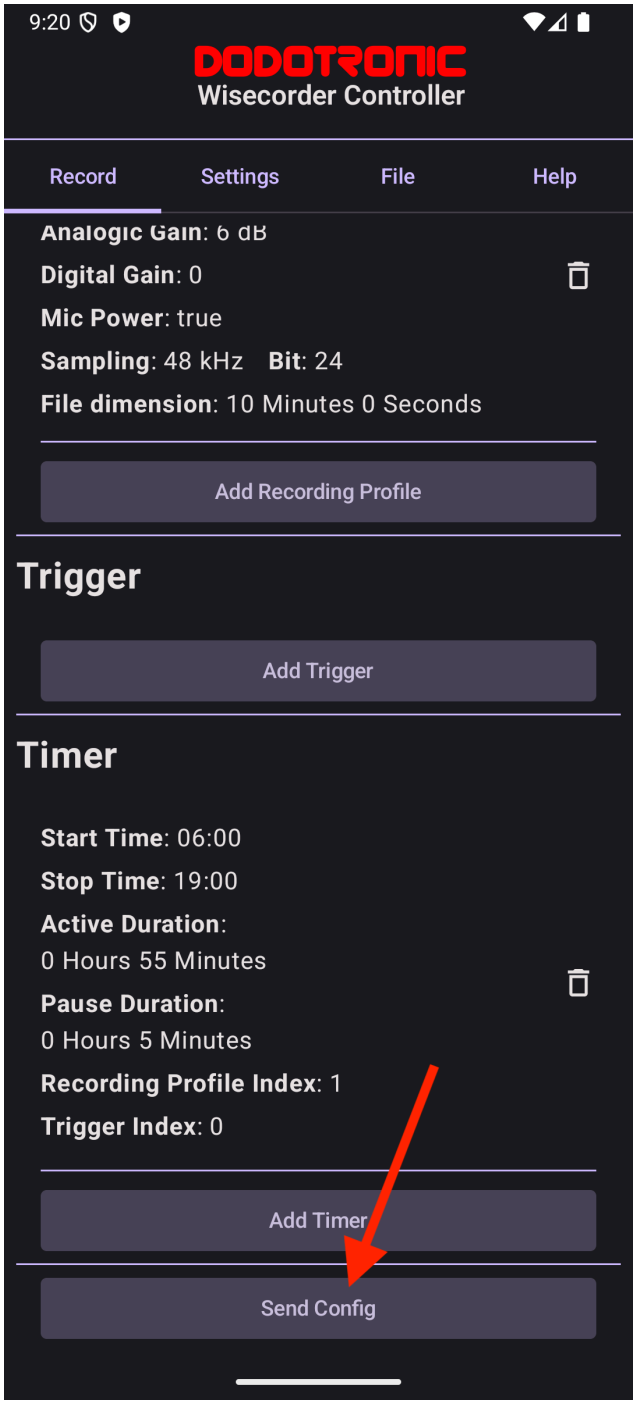
1: Quick Setup Configuration List



2: Successful Loading of Configuration

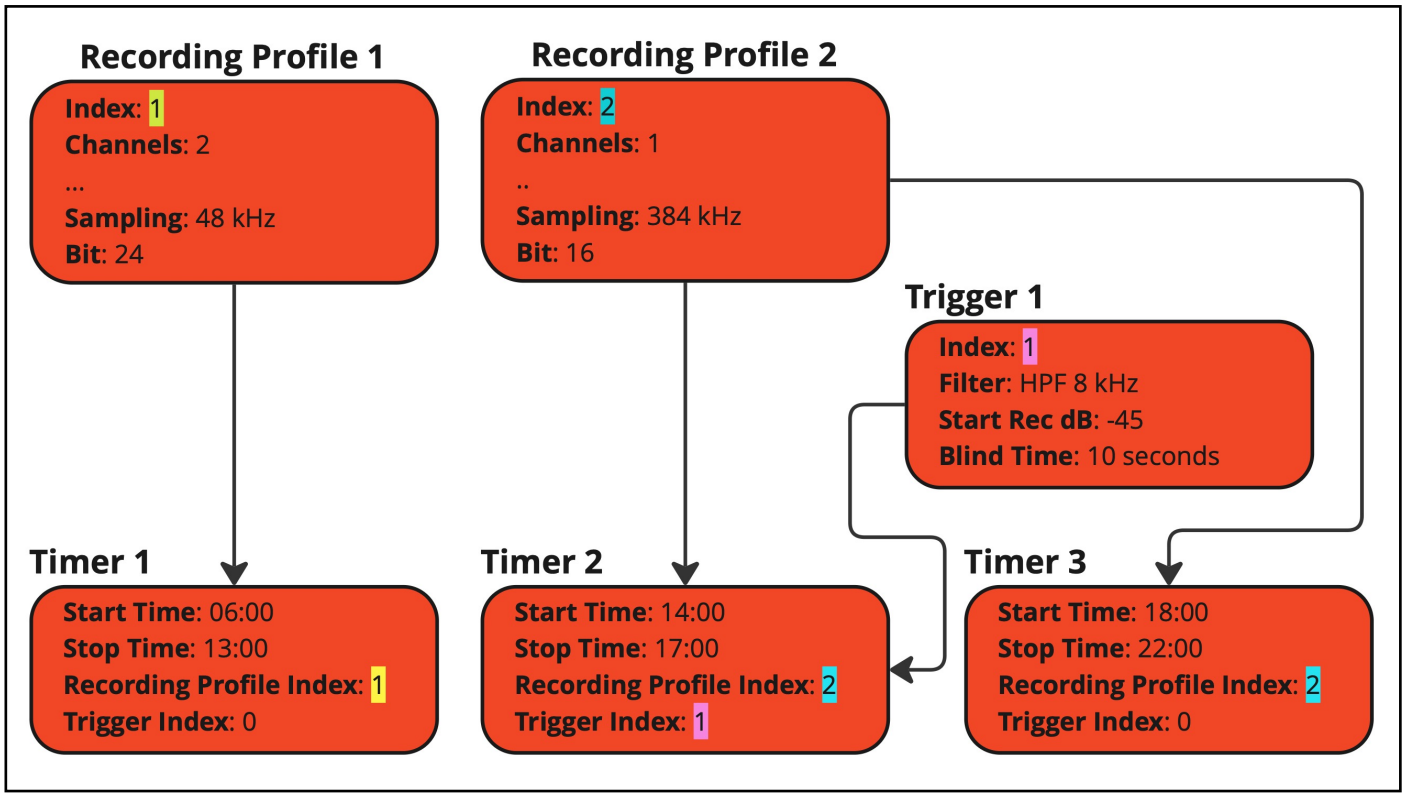


3: Example of Editing the Configuration



7: Send Config Button

Configuration Diagram



8: Example of Wisecorder Configuration Logic Diagram

To fully understand how to Configure the Wisecorder, the Configuration Logic Diagram can be a useful tool. The Wisecorder Configuration is structured so that it is possible to program **up to 8 Timers** throughout the day. Each Timer has a **Start Time** and a **Stop Time**, therefore each Timer describes a time of the day during which the Wisecorder will be recording (e.g. from 6 am, 06:00, until 5:30 pm, 17:30). The Timers' Start Time has to be a time of day that happens prior to the Stop Time. Also, it is not allowed for two different Timers to have overlapping time slots.

Each Timer uses a **Recording Profile**, and it is therefore **mandatory** to select one when creating a Timer.
A **Recording Profile** is essentially the collection of rules that the Wisecorder will follow when recording. So while the Timer tells the Wisecorder **when** to record, the relative Recording Profile tells the Wisecorder **how** to record.
Simply put, a Recording Profile specifies for the Wisecorder on how many **channels** it should record, which **Sampling Frequency** and **Bit Depth** to use

while recording and other parameters. More information is available in the specific Chapter on [Recording Profile Parameters].
It is possible to program **up to 4 Recording Profiles**, and while a Timer uses one and only one Recording Profile, it is possible to use the same Recording Profile on multiple Timers, as shown in [8], where the "Recording Profile 2" is used for "Timer 2" and "Timer 3".

Each Timer **optionally** can also use a **Trigger**.
The **Trigger** is an advanced feature which should only be used after carefully reading the following paragraph and the Chapter on [Trigger Parameters].
A **Trigger** adds some rules to when the Wisecorder should record. It has a dB threshold value called "**Start Recording dB**" which tells the Wisecorder which is the minimum intensity the signal has to reach before starting recording. Also, it has a parameter called "**Blindtime**", which tells the Wisecorder for how long it should keep recording after reaching the threshold, before going back to the dB Trigger monitoring stage. Lastly, it also has the possibility to program a High-Pass Filter to be applied to the signal before comparing it to the threshold.
It is possible to program **up to 2 Triggers**, and a Trigger can be used by multiple Timers. Each Timer uses only one Trigger though. More information is available in the specific Chapter on [Trigger Parameters].

Recording Mode: Repeat vs Scheduling

What we just dived into in the last chapter is the **Scheduling Recording Mode** behavior of Timers. There is also a similar behavior, which is called **Repeat Recording Mode**.
The Recording Mode **affects only the Timer** programming. More specifically in the Repeat Recording Mode the user can define for each Timer an **Active Duration** and a **Pause Duration**. The Active and Pause durations divide the time of the day specified by the timer (e.g. 06:00 - 17:30) into alternated slots of recording and pausing. It's easier to understand with an example, so let's say that the timer's **Start Time** is 06:00, **Stop Time** is 17:30, **Active Duration** 2 hours and **Pause Duration** 1 hour. A Wisecorder configured with this Timer will record during the following times:

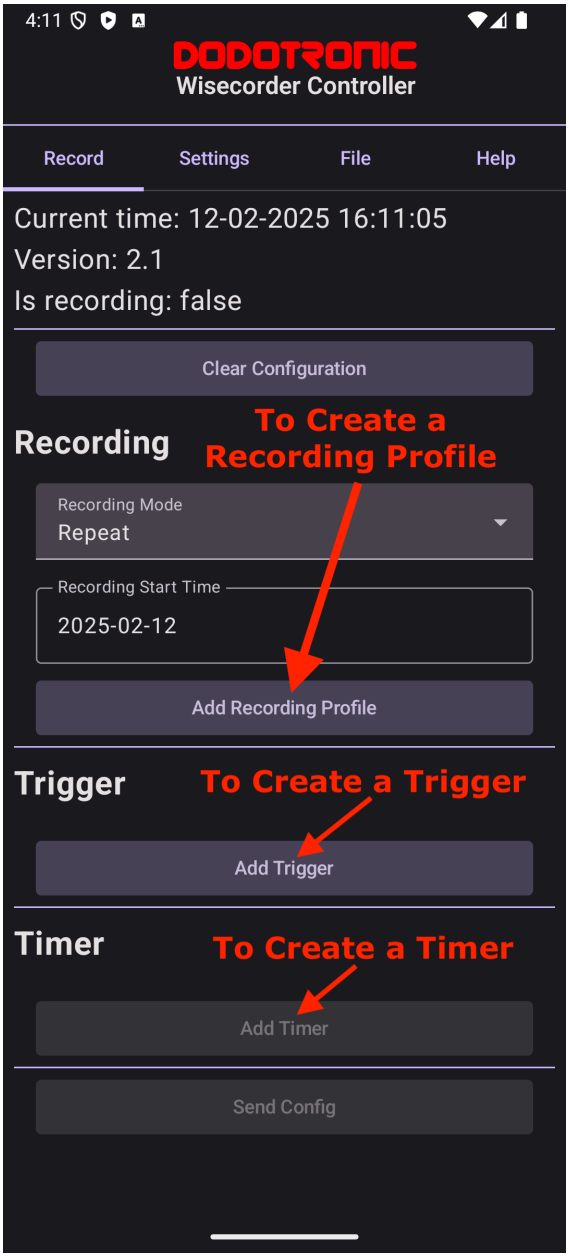
- 06:00 - 08:00
- 09:00 - 11:00
- 12:00 - 14:00
- 15:00 - 17:00

Manual Setup

On www.dodotronic.com the Wisecorder Configurator App is available for download. It's possible to load a Preset Configuration following the steps in the Quick Setup Chapter. Otherwise, it's also possible to use the Configurator App to create a Custom Configuration and send it to the Wisecorder.

How To Program the Wisecorder

The Wisecorder allows to program up to 8 ***Timers***, either in "**Repeat**" or "**Scheduling**" mode (the mode is the same for all ***Timers***). These ***Timers*** all must be configured specifying a "***Recording Profile***" to use. It's possible to program up to 4 different ***Recording Profiles***, and to use any combination of them in different ***Timers***. Optionally, the Timers can also be configured specifying a "***Trigger***" to use. It's possible to program up to 2 different ***Triggers*** and use any of them or none in any combination in all ***Timers***.



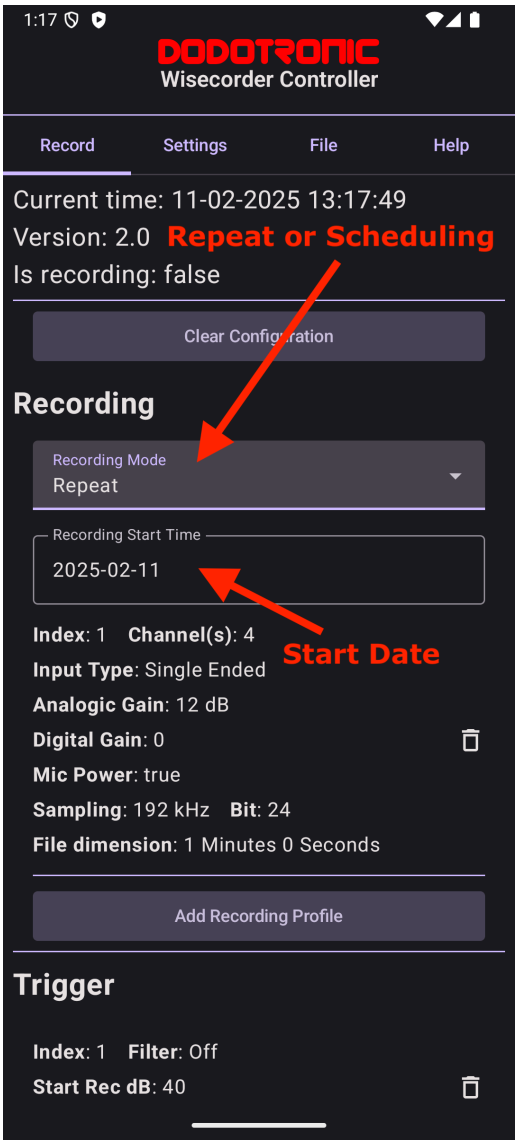
9: Add Recording Profile, Add Trigger, Add Timer Buttons

We'll later dive deeper into the specifics of each screen, but to sum it up in a series of steps, this is how to configure a Timer for the Wisecorder:

- Select the **Recording Mode** to be either *Repeat* or *Scheduling* [10]
  - More detail on *Repeat* vs *Scheduling* mode can be found in this chapter: [Recording Mode: Repeat vs Scheduling]
- Select a **Start Date** when the Wisecorder will start recording each day [10]
  - The **Start Date** is the first day on which the Wisecorder will record.

Every day since the Start Date, the Wisecorder will record during the time slots specified by the **Timers** in the Configuration.

- Create a ***Recording Profile*** tapping on "Add Recording Profile"
  - Select the desired parameter values
  - Tap on "Save Recording Profile"
  - More details are available in the Chapter [Recording Profile Screen]
- (Optionally) Create a ***Trigger*** tapping on "Add Trigger"
  - Select the desired parameter values
  - Tap on "Save Trigger"
  - More details are available in the Chapter [Trigger Screen]
- Create a ***Timer*** tapping on "Add Timer"
  - Select the desired **Start Time** and **Stop Time**, or alternatively select **Sunrise to Sunset** or **Sunset to Sunrise** times
  - If the **Recording Mode** is Repeat, also select the desired Active and Pause Durations
  - Select the previously created ***Recording Profile*** from the Dropdown List
  - Select the previously created ***Trigger*** from the Dropdown List, if needed. Again, specifying a ***Trigger*** is not mandatory.
  - Tap on "Save Timer"
  - More details are available in the Chapter [Timer Screen]



The Configuration is then ready to be sent to the Wisecorder, through the "**Send Config**" button [7].

Any ***Recording Profile***, ***Trigger***, or ***Timer*** that is saved in the configuration, can be modified by tapping on the cell which displays it in the Record Tab [3], or can be deleted by tapping on the Trash bin icon on the right of the cell.
Beware that any change made to the configuration will **not** be applied to the Wisecorder until the new configuration is sent.

10: Recording Mode & Start Date 18

Example of Use-Case

Let's say we want create a ***Recording Profile*** to record the birds' call in the morning and in the afternoon every day.
To choose a Sampling Frequency, we have to divide the Sampling Frequency by 2: the resulting number is the frequency corresponding to the highest pitch that we can record using that Sampling Frequency. So in the example of the bird song, **48 kHz** is ok as a Sampling Frequency, since the resulting maximum recordable pitch of 24 kHz is above the highest pitch sung by the birds. If we wanted to record bats for example, we could have not used 48 kHz, since bats easily produce pitches that go way higher than 24 kHz.

Moving on to bit depth, if you want to save space on the SD card then **16 bit** is a good choice. However, if you have a large dynamic range, i.e. there are both loud sounds and weak sounds that need to be recorded, then **24 bit** is a better choice. If you don't care about the size of the recorded files then you can choose **32 bit**.

The number of Channels is related to your recording hardware as well as whether the Input Type is **Differential** or **Single Ended**.

The Analog Gain is set according to the sensitivity of the microphone sensor as well as the Plug in Power.

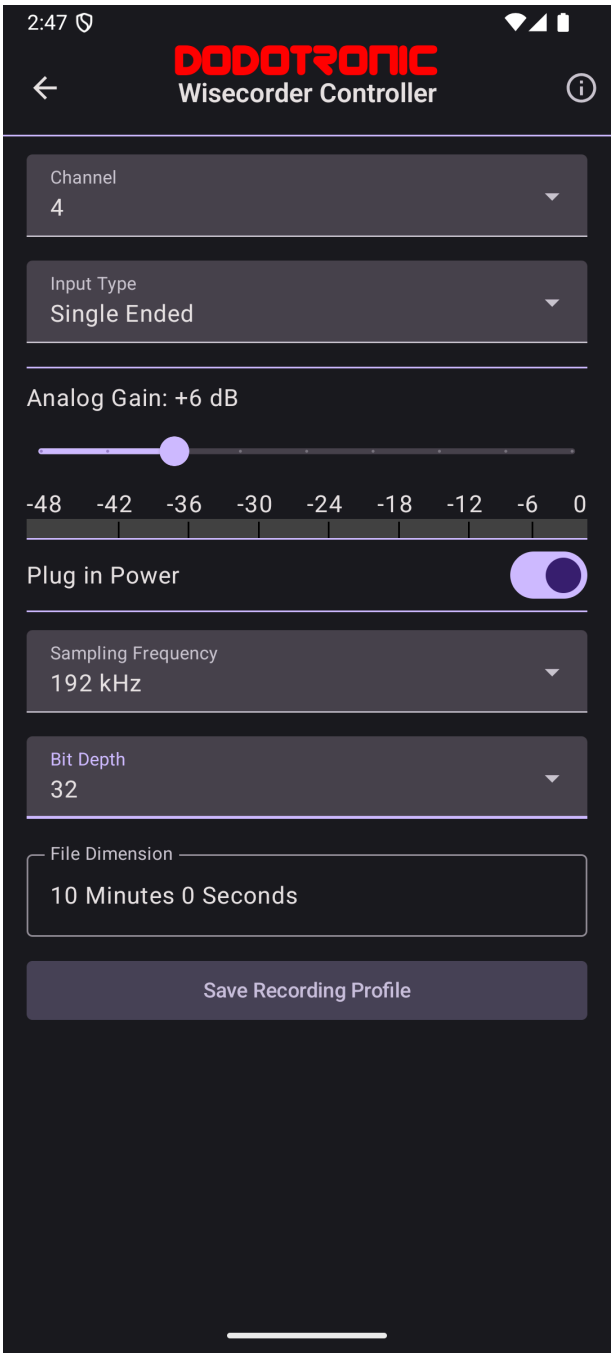
So for example, a good configuration for recording Birds could be:
- **1** or **2** Channels
- **Single Ended** or **Differential** Input based on the type of microphone you're using
- Analog Gain value based on sensitivity of the microphone you're using
- Plug in Power **ON** if you're using a microphone that needs Voltage power to operate, **OFF** if its transduction principle is based on dynamic principles.
- Sampling Frequency **48 kHz**
- **16 bit**

You could set two ***Timers***: one for the morning and the second for the evening, linking these two timers to the above described ***Recording Profile***.

Recording Profile Parameters

To create a ***Recording Profile***, it's possible to select the following parameters:

- **Channel**: **1** channel (mono recording), **2** channels (stereo recording) or **4** channels.
- **Input Type**: **Single Ended** or **Differential**.
- **Analog Gain**: From a minimum of **0** dB to a maximum of **+24** dB, in steps of 3 dB.
    - If the Wisecorder is turned on, is connected to the App and has a microphone connected on the **first channel**, it's possible to view the real-time analysis of the microphone intensity efficiency with the current settings.
- **Sensitivity Adjustment**: From a minimum of **-42** dB to a maximum of **+5** dB, in single unit steps, this is the Digital Gain which is applied by the board after the Analog to Digital conversion.
    - It is advisable to keep the Sensitivity Adjustment to a value of **0 dB**, unless you want to fine-tune the microphone input.
    - This parameter is not supported by the real-time intensity analysis.
- **Plug in Power**: Turns the microphones power **On** or **Off**.



11: Recording Profile Detail Screen

- **Sampling Frequency**: Frequency that will be used in the Analog to Digital Conversion. Available Frequencies: **384** kHz, **192** kHz, **96** kHz, **48** kHz.
- **Bit Depth**: Depth Resolution that will be used in the Analog to Digital Conversion. Available Depths: **16** bit, **24** bit, **32** bit.

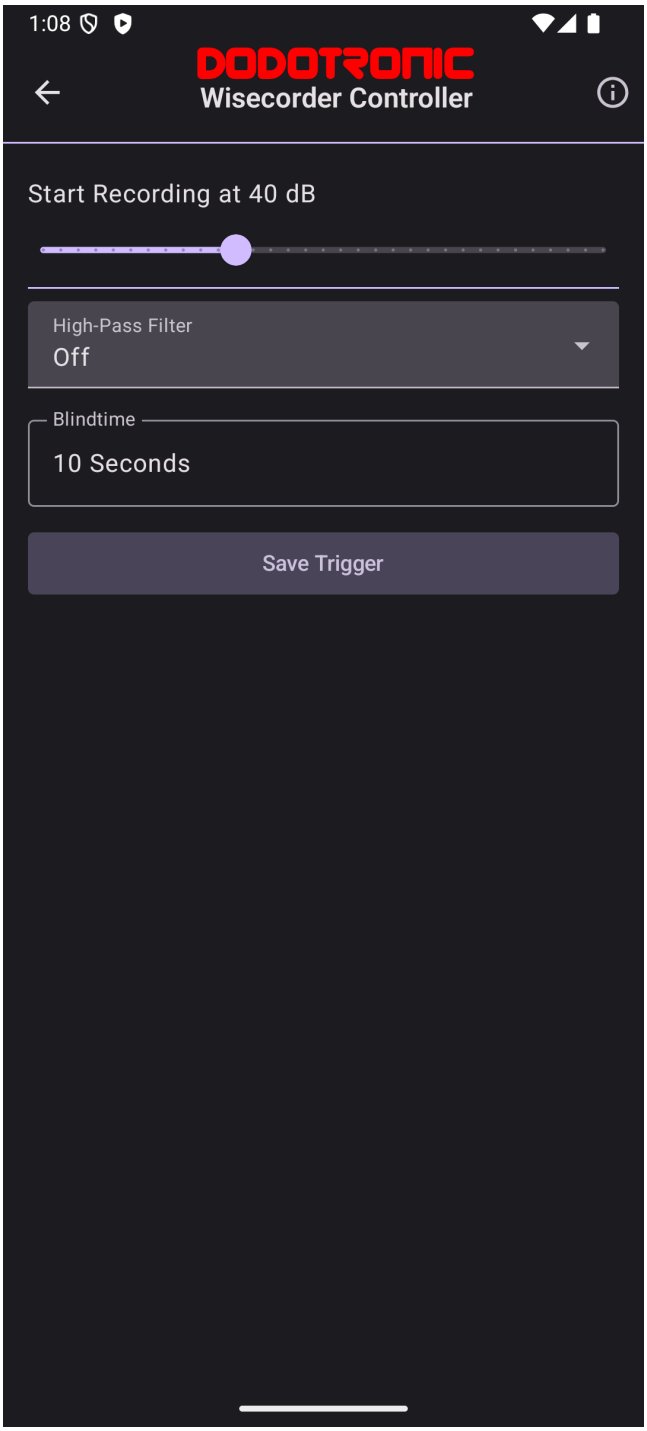
    - If you're trying to record at **4** Channels using a Sampling Frequency of **384** kHz, it's only possible to record with a Bit Depth of **16** bit.

- **File Dimension**: How the recording will be split in different Files on the SD Card. It's relevant mainly for the **Scheduling** Recording Mode.

Trigger Parameters

To create a ***Trigger***, it's possible to specify the following parameters:

- **Start dB**: The recording will **not** start until the source intensity goes above this threshold. Minimum of **30** dB, maximum of **60** dB in single unit steps.
- **High-Pass Filter**: It's possible to set a High Pass Filter (HPF for short) to be applied to the source signal before comparing it to the **Start dB** threshold. Available filters:
    - **Off** (No filter)
    - HPF **8** kHz
    - HPF **16** kHz
    - HPF **24** kHz
- **Blindtime**: Once the source signal goes above the **Start dB** threshold, the Blindtime parameters tells the Wisecorder for how long it should keep recording before re-enabling the ***Trigger***. Minimum value of **1** second, maximum value of **15** seconds.

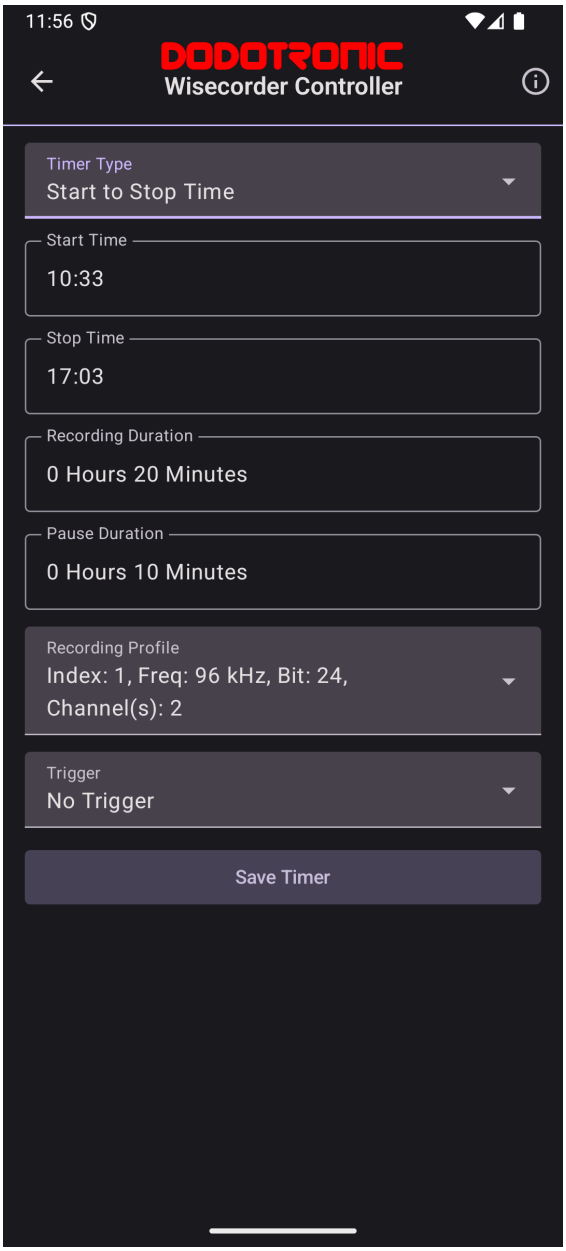


12: Trigger Detail Screen

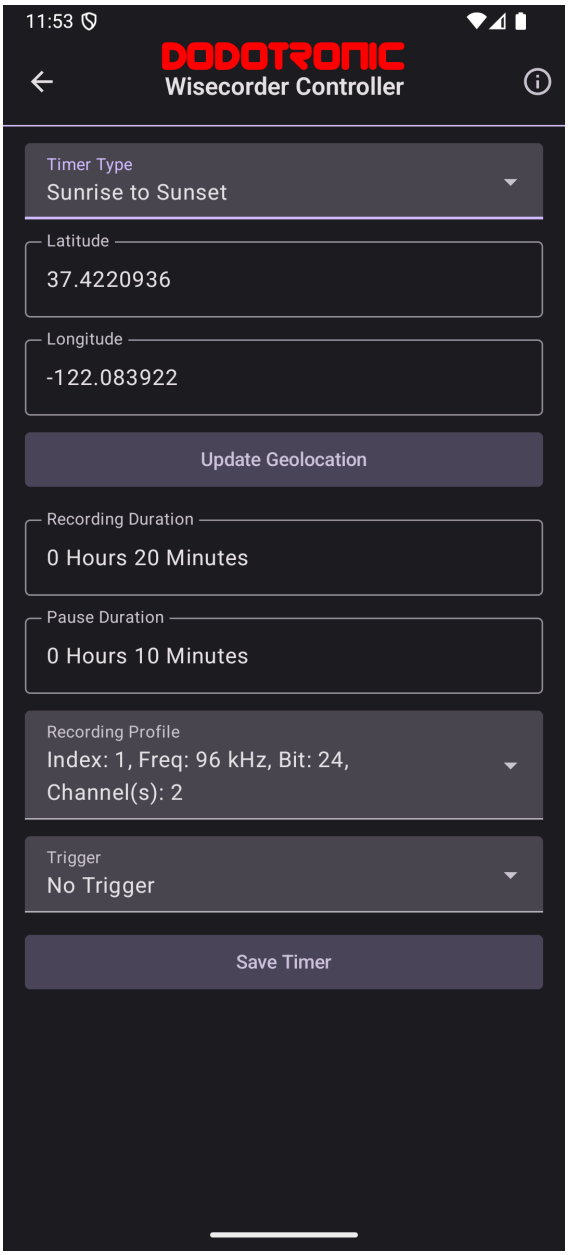
Timer Parameters

To create a ***Timer***, it's possible to specify the following parameters:

- **Timer Type**: Selects whether the timer will have a Start and Stop Time, or if it will go from Sunrise to Sunset or viceversa
- (*Only in Sunrise to Sunset or Sunset to Sunrise*) **Latitude**: The latitude of the user's Phone. Can be updated manually by tapping on it
- (*Only in Sunrise to Sunset or Sunset to Sunrise*) **Longitude**: The longitude of the user's Phone. Can be updated manually by tapping on it
- (*Only in Sunrise to Sunset or Sunset to Sunrise*) **Update Geolocation**: Tapping on this button will fetch the Latitude and Longitude of the user's phone, if the necessary permissions were granted
- **Start Time**: When the recording will start, written in form HH:mm
- **Stop Time**: When the recording will stop, written in form HH:mm
- *(Only in Repeat Mode)* **Recording Duration**: Inside the time frame described by Start Time and Stop Time, for how long the Wisecorder will continue recording before going in standby mode.
- *(Only in Repeat Mode)* **Pause Duration**: Inside the time frame described by Start Time and Stop Time, for how long the Wisecorder will stay in standby mode before resuming the recording.



13: Timer Detail Screen (Repeat Mode)



14: Timer Detail (Sunrise to Sunset)

- **Recording Profile**: Which Recording Profile to use to record inside the time frame described by the ***Timer***. (The Recording Profile must be created before accessing the Timer Creation View)
- **Trigger**: Which Trigger to use to record inside the time frame described by the ***Timer***. (The Trigger must be created before accessing the Timer Creation View)
    - If no Trigger is selected, the recording will start based on the Timer settings only.

15: Timer Detail Screen (Scheduling Mode)

App's Advanced Features

With the Wisecorder's Controller App it's possible to access some additional functions, which we'll dive into in this following Chapter.

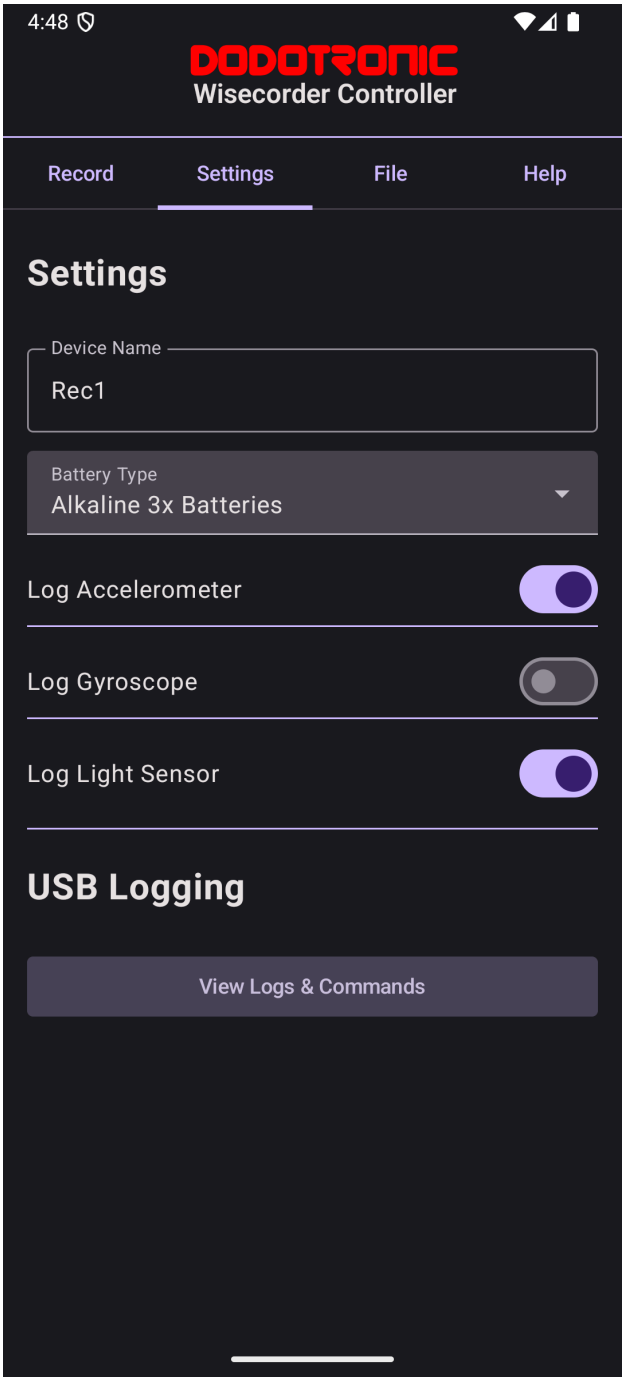
Device Name, Battery Type, Wisecorder Logs

In the Settings Tab, it's possible to set the **Device Name** for the Wisecorder that is being configured, with a maximum of 5 characters. It's also possible in the same tab to select the type and number of batteries that are being supplied to power the Wisecorder: **Alkaline x3**, **Alkaline x2, NiMH x3** or **Lithium x1**.

In the same section, there are three switches that turn On or Off the three available Wisecorder Logs: **Accelerometer**, **Gyroscope** and **Light Sensor**.

The Accelerometer and Gyroscope Logs can be useful to understand whether the Wisecorder has fallen due to the wind or due to some animal.
The Light Sensor Logs can be particularly useful to understand the weather conditions, for example you could link a cloudy weather during a recording to a lack of recorded animals.

In general, the Logs add some environmental knowledge of the recording environment, which provides an additional point of view while reviewing the recorded data.

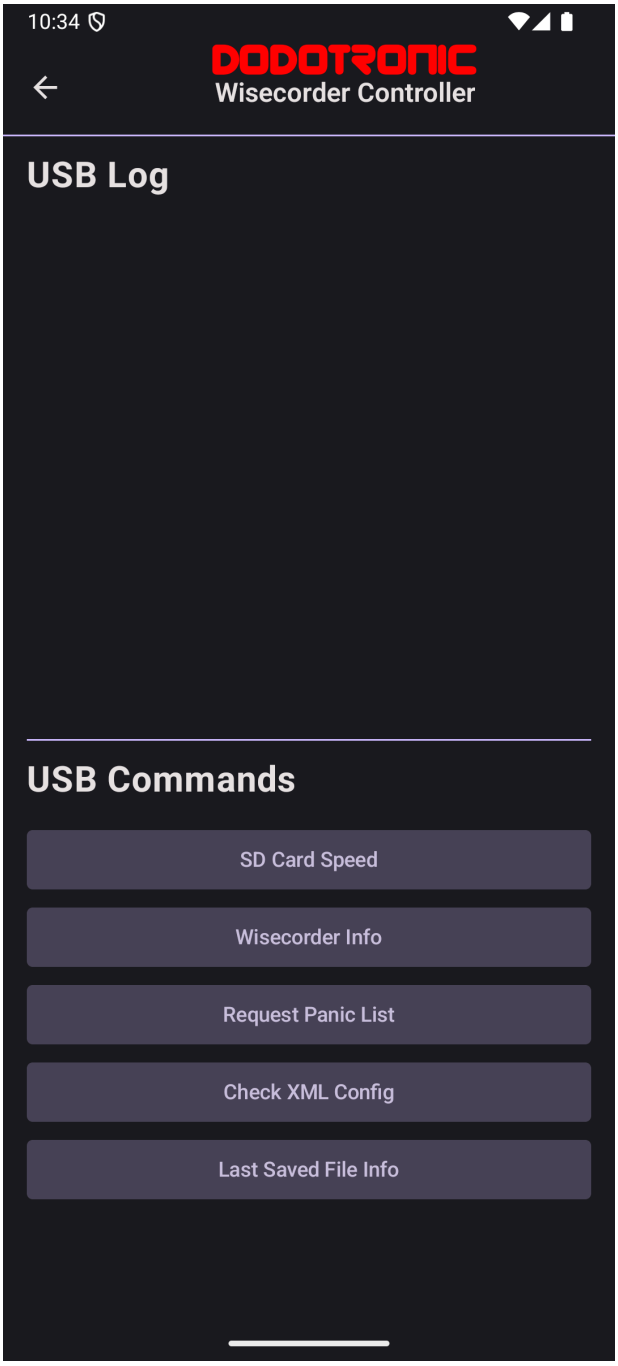


16: Settings Tab

USB Logs & Commands

In the Settings Tab, it's possible to access the USB Logs and Commands by tapping on the "View Logs & Commands" button [15]. The resulting view that is being presented is divided in half vertically.
The top half ("USB Log") is an interactive window that shows the latest message received from the Wisecorder.
The bottom half ("USB Commands") contains a series of buttons which allow the user to request some information from the Wisecorder:

- **SD Card Speed**: Runs a ping test to determine the speed of the inserted SD Card. This response to this command might take a few seconds before showing.
- **Wisecorder Info**: Returns the overall status of the Wisecorder, regarding Time-Date, Firmware version, Recording and File Info. More details available in the table in the next page.
- **Request Panic List**: Returns the list of the Alert messages generated by the Wisecorder
- **Check XML Config**: Returns the XML Configuration File, if present. If there is no Configuration, it returns the "N" character.
- **Last Saved File Info**: Returns the information regarding the last saved file. More details available in the table in the next page.



17: USB Commands

To request the information via Command Buttons, the Wisecorder needs to be first supplied with battery power, connected to the phone via USB and turned on.

List of Available Commands

Command	Description
SD Card Speed	SD card speed test
Wisecorder Info	Info request. The Wisecorder replies with the following fields: • Current Date-Time • Wisecorder Firmware Version • FileName of the last saved recording • How many files was the last recording split into • *Overflow Exceptions & Last Recording Outcome*: these two numerical values are equal to 0 if no error occurred • Last Recording Duration in Minutes • Whether the Wisecorder is currently recording • Whether the last recording was stopped by the Firmware • Whether the last recording was stopped by the User • Whether the last recording was stopped because an error occurred • Whether the last recording was stopped because of Low Battery • SD Card Speed • Current dBFS RMS measured on the Channel 1 • Remaining Space Available on SD Card. **This info is available only if you first use the "SD Card Speed" command.** • Internal register corruption status (OK or KO)

Command	Description
Request Panic List	Panic list request The Wisecorder replies with the messages generated during the recording session
Check XML Config	Returns the XML file if present, “N” otherwise”
Last Saved File Info	Last recording info request. The Wisecorder replies with the following fields: • FileName of the last saved recording • How many files was the last recording split into • *Overflow Exceptions & Last Recording Outcome*: these two numerical values are equal to 0 if no error occurred • Last Recording Duration in Minutes • Whether the Wisecorder is currently recording • Whether the last recording was stopped by the Firmware • Whether the last recording was stopped by the User • Whether the last recording was stopped because an error occurred • Whether the last recording was stopped because of Low Battery

Configuration Files

It’s possible to save on your Mobile Phone’s internal memory storage the current Recording and Settings Configuration, for later retrieval. By default, the App saves all the changes made to the Record Tab and retrieves them throughout different sessions without the need of user intervention. However, it can be useful to have more than one Custom Configuration saved on the Phone at a time, to be able to switch between them in an easy and quick way.

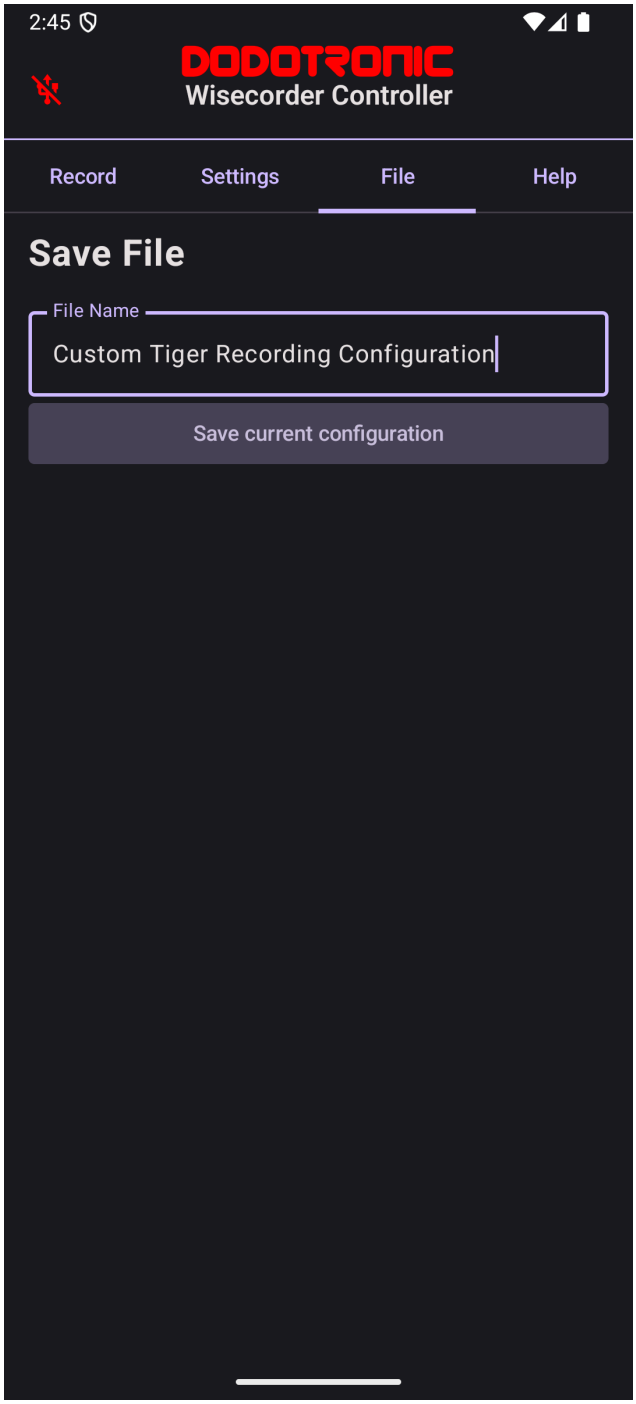
To save a Custom Configuration on your Phone:

- Create all the necessary **Recording Profiles**, **Triggers** and **Timers** that you want to save.
- Optionally, also specify the necessary values in the Settings Tab.
- Lastly, in the **File Tab**, type in a File Name and tap on “**Save current configuration**”. [17]

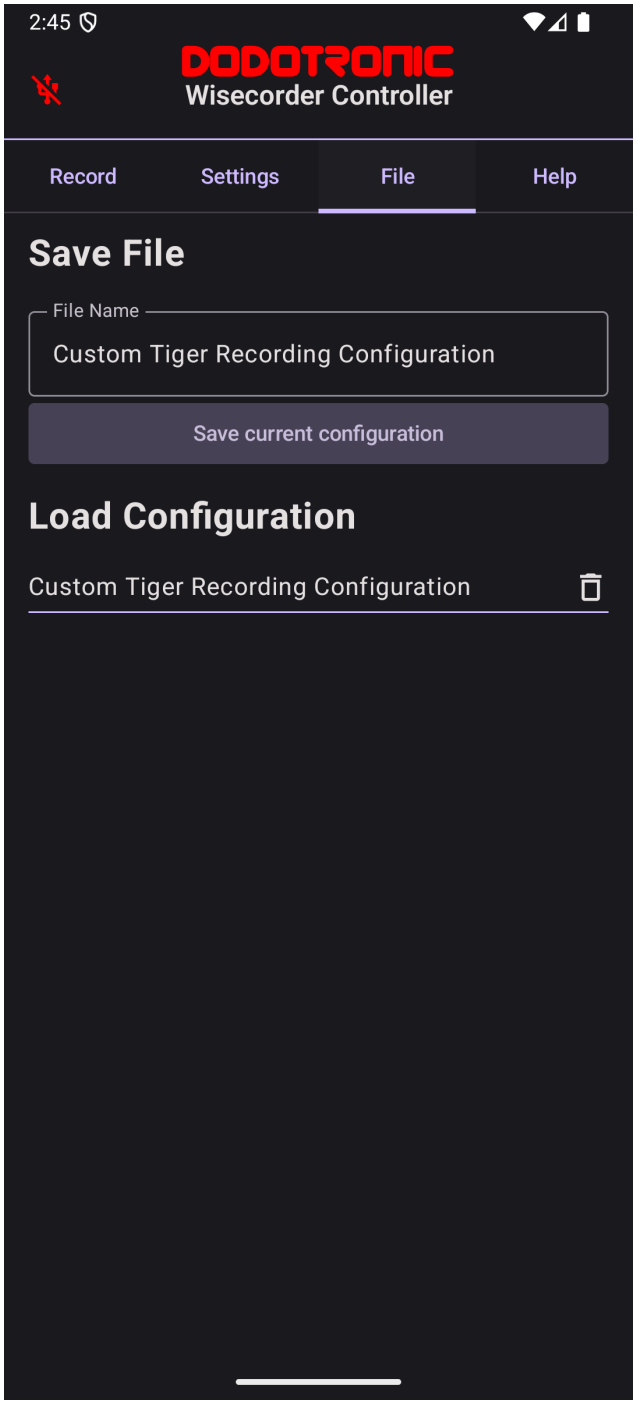
A new list of configurations will pop up in the File Tab, with the title “**Load Configuration**”. [18]

To load the saved configuration, simply tap on the Configuration from the list. The App will redirect you to the Record Tab and a popup message will show up, confirming the successful Configuration Loading.

The “Load Configuration” list shows all the configurations that are saved on the Mobile Phone, and is not visible if there are no configurations saved. The entries of the list can all be singularly deleted from the Phone’s internal memory storage by tapping on the Trash bin icon displayed at the right, next to the Configuration File Name.



18: File Tab Without Configurations



19: One Configuration Saved

LEDs

The Wisecorder has 3 LEDs: Green, Red and Yellow. These three LEDs react based on the Wisecorder status, according to the following table.

LED State	Wisecorder State
Red LED blinks every 5 seconds	Wisecorder is currently recording
Green LED blinking approximately every 250 milliseconds	Wisecorder is starting up
Green LED constantly ON	Wisecorder is ON and connected to a USB device
Yellow LED constantly ON	XML Configuration upload is in progress
Green LED blinking approximately every 2 seconds	Wisecorder is waiting for USB to be unplugged after XML upload
Green LED blinks once	XML Configuration Success
Red LED is ON for approximately 3 seconds	XML Configuration Failure
Yellow LED blinking fast	Firmware update in progress. More info on how to update the Firmware in [Firmware Upgrade].

Firmware Upgrade

To update the Wisecorder to the latest Firmware version, follow these steps:

1. Download the **FIRMWARE.ENC** file from www.dodotronic.com.
2. Store the file in the root directory of a formatted micro SD card.
3. Insert the SD card into the Wisecorder.
4. Turn the Wisecorder ON. You should see the **Yellow** LED flash quickly.
5. Once the **Yellow** LED turns off, the firmware upgrade is finished and the Wisecorder will automatically turn ON.

Tips & Tricks

How to set the right sampling rate?

The sampling rate setting is related to what you need to record.
According to the Shannon-Nyquist theorem the bandpass must be at least the double of the incoming signal. So if you are plannig to record birds or mammals then a 48 kHz is enough since the vocalization of birs and mammals is below 48kHz.
If your target are bats and marine mammals such as dolphins then you need an higher sampling rate such as 384 kHz, in this case the bandwith is about 192 kHz, enough for the greatest part of animals.

Technical Specifications

Recording format	Linear PCM (Pulse Code Modulation) format
SNR	S/N, DR: 109 dB, THD+N: −87 dB (Gain = 0 dB) S/N, DR: 100 dB, THD+N: −86 dB (Gain = +18 dB)
Bandwidth -3,0dB	22,8 kHz @fs = 48 kHz -3,0 dB 45,6 kHz @fs = 96 kHz -3,0 dB 78 kHz @fs = 192 kHz -6,0 dB 186,5 kHz @fs = 384 kHz
Input Capacitance	64pF
Input full-scale voltage	2,93 Vpp single ended @0 dB gain ±2,93 Vpp differential input @0 dB gain
Dynamic Range (-60 dBFS, A-weighted)	109 dB @0dB gain
Interchannel Isolation	100 dB
Recording medium	SD card (512MB to 2TB)
Input	IN+ IN- 0 – 1 V differential or single ended voltage input
USB C connector	USB 2.0 High Speed
Weight	50g board only
Sampling frequency	48, 96, 192, 384 K sampling per second
Resolution	16, 24, 32 bit PCM
Amplification	High quality, and low noise, analog amplification

CPU	32 bit integrated ARM Cortex M33 microcontroller
Power	45 mA @ 5V mean power requirement in autonomous recording mode during recording
Update	Software upgradable via firmware file stored in the micro SD card

Recording Times

It is important to use the right SD card capacity according to our planned recording session.
If you record at 16 bit resolution, the formula to calculate the space required is:
Time = SD card capacity / (sampling rate x 2)
For example a 32GB SD card can contain about 11 hours if the sampling rate is 384Khz = 41666 seconds = ~11 hours.

Recording format	Capacity	Time HH:MM:SS
384Khz	8	2:53:00
384Khz	16	5:47:00
384Khz	32	11:34:00
384Khz	64	23:08:00
384Khz	128	46:17:00
48Khz	8	23:08:00
48Khz	16	1 day & 22 hours
48Khz	32	3 days & 20 hours
48Khz	64	7 days & 17 hours
48Khz	128	15 days & 10 hours

Customization

For specific application where the plastic components and aluminum tube are not required and a specific sensor is needed, the bare circuit can be used.
Due to the high versatility and the very low noise circuitry, the board can be used in a variety of custom applications.
The microcontroller integrated into the Wisecorder, although low-power, allows for AI operations on the recorded audio, enabling sound classification to categorize the acoustic data.
The simultaneous sampling performed on 4 microphones allows for source direction localization through beamforming.

Tag Description

The programming of the Wisecorder is managed by the Wisecorder Controller Android App, which generates a configuration file that is uploaded into the SD card of the Wisecorder. The more curious and experienced users can use the following chapter to manually edit the configuration file that is being saved on the SD card. The configuration file is in XML format and follows the specifications outlined below.

✋ **ATTENTION**: Only edit the XML Configuration file manually if you know what you are doing. A malformed Configuration file could potentially block the Wisecorder, resulting in the need to format the SD Card as described before.

The structure is organized into blocks, as previously described in the Chapter [Configuration Diagram].

For each block, a tag containing information of that block exists. For Recording Profiles there is the **<rec>** tag; for Trigggers there is the **<trigger>** tag; for Timers there is the **<timer>** tag.

On top of these tags, there are two additional tags which are generated by the App and which are necessary for the correct configuration of the Wisecorder: **<general>** and **<session>**.

The operating logic is based on the work session. The recording modes, any trigger modes, and timers must be defined. The session tag groups all these tags and defines the recording mode.
The general tag defines the global settings of the session

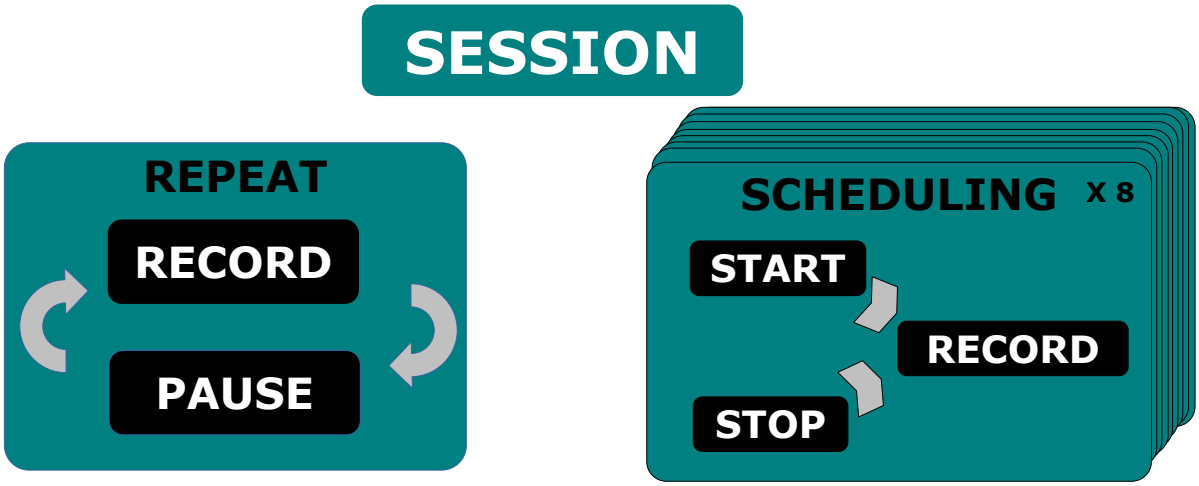
```
<general
  devicename   =  "phon"
  version      =  "1.3"
  setdatetime  =  "2025-01-22T08:00:00"
  batt_level   =  "2.4"
  log_accel    =  "OFF"
  log_gps      =  "OFF"
  log_light    =  "OFF"
/>
```

The "general" TAG contains information that is always valid, regardless of the type of recording.
It contains the following configuration fields:
- “devicename”: Allows the user to specify a name, which will be added to the beginning of every saved file name on the SDCard. It can be up to 5 alphanumeric characters long.
- “version”: Indicates the version of the XML file. It will allow the microphone to interpret new or differently defined TAGs depending on the version. The string is composed of 5 characters separated by a dot: "vv.vv" with leading zeros. Please do not change this field.
- “setdatetime”: Sets the date and time in the microphone. The string format is ISO, like: “YYYY-MM-DDTHH:MM:SS”, with leading zeros.
- “batt_level”: Configures the battery level in Volts at which the device should enter low power mode. Format is “x.y”, where x is the units and y is the one position precision decimal.

The sensor setup defines if the sensors on the board or external devices such as GPS are active or not. If they are in ON state then at the beginning of every recording session a log file will be saved on the sd card with the sensor status.
- “log_accel”: Related to 3 axis accelerometer + 3 axis gyroscope + 3 axis magnetometer
- “log_gps”: GPS position
- “log_light”: Red, Green, Blue, Infra red and Clear

SESSION

In the session, the mode in which the recorder will operate is defined.
In the repeat mode, a recording phase alternates with a pause phase, repeating in sequence.
This sequence starts from the scheduled date and ends when the batteries are exhausted or the SD card is full.
In scheduling mode, up to 8 recordings per day can be defined, and for each recording, a start time and an end time are specified.



TAG “session”
```
<session
  index      = "1"
  mode       = "SCHEDULING"
  start_date = "2023-10-22"
  timer_used = "1,2,5-8"
/>
```

The "session" TAG appears only once in the file and specifies the programming mode and recording times. Below are the supported fields:
- “index”: Not used, always set to “1”.
- “mode”: Specifies the two programming modes for timers, indicated by the strings: “SCHEDULING” and “REPEAT”.
- “start_date”: The user specifies a date when the programmed timers should start recording. The format is “YYYY-MM-DD”, with leading zeros where necessary. This date **must** be set in the future in comparison to the setdatetime field of the general tag.
- “timer_used”: This TAG contains the list of programmable timers. Up to eight timers can be set for recordings, specified by separating the timer numbers (1 to 8) with commas or grouping consecutive numbers with a hyphen. Example: "1,2,5-8" means timers 1, 2, and 5 to 8 (5, 6, 7, 8).

TIMER

TAG “timer”
```
<timer
  index        = "1"
  start_time   = "08:03"
  stop_time    = "08:06"
  active       = "00:1"
  pause        = "00:1"
  rec_used     = "1"
  trigger_used = "0"
/>
```

The "timer" TAG configures the recording times that the user wants the microphone to perform. There are 8 available timers. Configuration fields include:
- “index”: A number ranging from “1” to “8”.

- “start_time”: Specifies the hour and minute to start recording. It consists of 5 characters for hours and minutes: “HH:MM”, with leading zeros. This is used for both “SCHEDULING” and “REPEAT” modes.
- “stop_time”: Specifies the hour and minute to stop recording. It also consists of 5 characters for hours and minutes: “HH:MM”, with leading zeros.
- “active”: Used for “REPEAT” mode. Indicates the recording duration in hours and minutes. The format is “HH:MM” or just minutes “MMM” (up to 240 minutes), with leading zeros.
- “pause”: Used only for “REPEAT” mode. Indicates the pause duration in hours and minutes. Same format as “active”.
- “rec_used”: Specifies the recording configuration used for this timer, a number from “1” to “4” (limit of 4 configurations).
- “trigger_used”: Specifies the trigger configuration. Values: “0” (no trigger), “1” or “2” (for the two programmable trigger setups).

REC

TAG “rec”

```
<rec
  index      = "1"
  channel    = "1"
  input      = "SI"
  gain_ana   = "0"
  gain_dig   = "0"
  mic_pwr    = "ON"
  sampling   = "192"
  bit_len    = "32"
  file_dim   = "1M"
  filter_hpf = "OFF"
  filter_lpf = "OFF"
/>
```

The "rec" TAG configures the recording modes that the user wants the microphone to perform.
You can define a maximum of 4 recording profiles. Configuration fields include:
- “index”: A number ranging from “1” to “4”.
- “channel”: Specifies the number of channels to record on. Possible values: “1”, “2”, and “4”.
- “input”: Specifies how to set the microphone input. Values: “SI” for single-ended and “DI” for differential input.

- “gain_ana”: Configures the codec gain. Allowed values are from “0” to “24” in steps of 3dB. No negative values are allowed.
- “gain_dig”: Configures microphone sensitivity. Allowed values range from “+5” to “-42”.
- “mic_power”: provides the Plug in Power to microphones. The PIP is essential if you want the electret microphones to be powered during recording.
- “sampling”: Specifies the sampling frequency. Allowed values: “48” for 48kHz, “96” for 96kHz, “192” for 192kHz, and “384” for 384kHz.
- “bit_len”: Specifies the bit length of the recorded sample. Allowed values: “16”, “24”, and “32”.
- “file_dim”: For long recordings, files may become too large to handle. This parameter allows the user to specify the file size for splitting the recording into smaller, more manageable files. The format is: “30S” for 30-second files or “5M” for 5-minute files.
- “filter_hpf”: (no further explanation provided)
- “filter_lpf”: (no further explanation provided)

TRIGGER

The purpose of the trigger is to remain in listening mode until a sound event occurs that exceeds the trigger threshold. This function is useful when you want to save space on the SD card by avoiding recording silences. In this operating mode, the Wisecorder must remain always active, and therefore it will consume energy even when not recording.

TAG “trigger”

```
<trigger
  index      = "1"
  mode       = "ON"
  start_db   = "45"
  blindtime  = "5"
  pretrigger = "0"
/>
```

The "trigger" TAG configures the properties of the trigger for the recording. There are 2 available trigger profiles. Configuration fields include:
- “index”: A number ranging from “0” (no trigger) to “1” or “2” (for the two available trigger profiles).
- “mode”: Programs the trigger as ON or OFF. Allowed values: “ON” and “OFF”.
- “start_db”: Specifies the threshold in dB for starting the recording when the signal exceeds this value. Values range from “30” to “60”.

- “blindtime”: Specifies the recording duration, in seconds, during which the microphone will continue recording regardless of whether the signal exceeds the start threshold. Values range from “1” to “15” seconds.
- “filterHPF”: Applies a filter to the signal before comparing it to the start_db threshold. Specified value must be one from: “Off” (no filter), “HPF_8KHZ”, “HPF_16KHZ”, “HPF_24KHZ” (High-Pass Filter with cutoff frequency at 8, 16 or 24 kHz respectively)

FAQ

Q: How can I set the Wisecorder to record bats?

A: Insert a formatted SD card in the slot. Power the microphone - after the startup the green LED will blink every 8 seconds. Push the button when you need to stop the recording. Both the green and yellow LED will blink. Remove the SD card and analyze your files using your preferred app.

Q: How can I connect the Wisecorder to my own analog recorder?

A: Wisecorder doesn’t need a separate recorder and cannot be connected to an analog recorder since the only output is digital (USB). Use the integrated recorder instead.

Q: I want to record each day from 8:00 to 8:55 and from 13:00 to 13:15, how can I do it?

A: Take a look at [RECORDING MODE] section above.

Q: I need to record cetacean vocalizations.

A: Connect your preamplified hydrophone to the 6 pole connector of the Wisecorder and use it as a standard USB microphone or recorder.

TIPS and TRICKS

1 – Remove the front cap to improve the overall microphone sensitivity and if you place the microphone outside provide a shelter to protect it from rain.

2 – Keeping far from the power the battery supply will reduce the noise due to the switching regulator of the USB converter.

3 – Usually a continuous line in a spectrogram is not a symptom of the microphone malfunctioning, but a noise generated by some device around you such as PC power supply, low power light and so on. To check it you can try to go outside and check again.

Technical assistance and support

Send request to:
info@dodotronic.com

For customers in Europe

CE mark indicates that this product complies with the European requirements for safety, health, environment and customer protection.

This symbol [crossed-out wheeled bin WEEE Annex IV] indicates separate collection of waste electrical and electronic equipment in the EU countries.
Please do not throw the equipment into the domestic refuse. Please use the return and collection systems available in your country for the disposal of this product.

This symbol [crossed-out wheeled bin Directive 2006/66/EC Annex II] indicates separate collection of waste batteries in the EU countries. Please do not throw the batteries into the domestic refuse. Please use the return and collection systems available in your country for the disposal of the waste batteries.

DODOTRONIC

ELECTRONIC DEVICES

Safety Precautions

Before using this device, read this manual carefully to ensure that you know how to operate the Wisecorder safely and correctly. Be sure to keep this manual on hand so that you can refer to it at any time.

Important safety instructions

- Important safety instructions are indicated by symbols and text as shown below. Be sure to follow these instructions to protect yourself and others from personal injury or damage to property.
- The meanings of the symbols are as shown below.

Instructions for use

- Do not leave the product where it will be subject to high temperatures and/or in direct sunlight.
- Do not use organic solvent such as alcohol or thinner for cleaning.
- Do not apply strong vibration or shock to the product.
- Use appropriate cables

⚠ Warning

- Do not disassemble, repair, or modify the product except for the instructions reported below.
- Do not insert a card other than SD, SDHC or SDXC card into the recorder.

⚠ Caution

- Stop using the product if you notice an abnormality such as unusual odor, abnormal sound, or smoke.
- Do not leave the product where it will be subject to high temperatures.

⚠ Danger
This sign indicates that incorrect handling could lead to serious danger causing death or severe injury.

⚠ Warning
This sign indicates that incorrect handling could lead to death or severe injury.

⚠ Caution
This sign indicates that incorrect handling could lead to injury or property damage.

Conformity declaration

model: Wisecorder

Wisecorder is in conformity with the protection and compliance requirements of the following EC Directives:

– 2004/108/CE

– 2006/95/CE

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Made in Italy