DODOTRONIC

ULTRAMIC384KBLE

Ultrasonic USB microphone and recorder

with Bluetooth for an easy configuration via Android smartphone

USER GUIDE

0.4.6

Summary

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Overview

The Ultramic384K is a high quality - professional digital **audio and ultrasonic microphone** that can work as both:

- Ultrasonic USB microphone

- Unattended audio and ultrasonic recorder

The Ultramic384K has an integrated analog-to-digital converter able to achieve a 384 Khz data sampling rate; this mean that you can record sounds up to about 190 Khz.
The USB 2.0 full speed port allows an easy connection to your PC, iOS, Android smartphone or tablet and to embedded Linux systems.
When used with an external USB battery, the Ultramic384K's low power, integrated 32 bit microcontroller makes it the perfect device for long term autonomous recording.
Only 30 mA @5 Volts of power are required when operating at full speed.
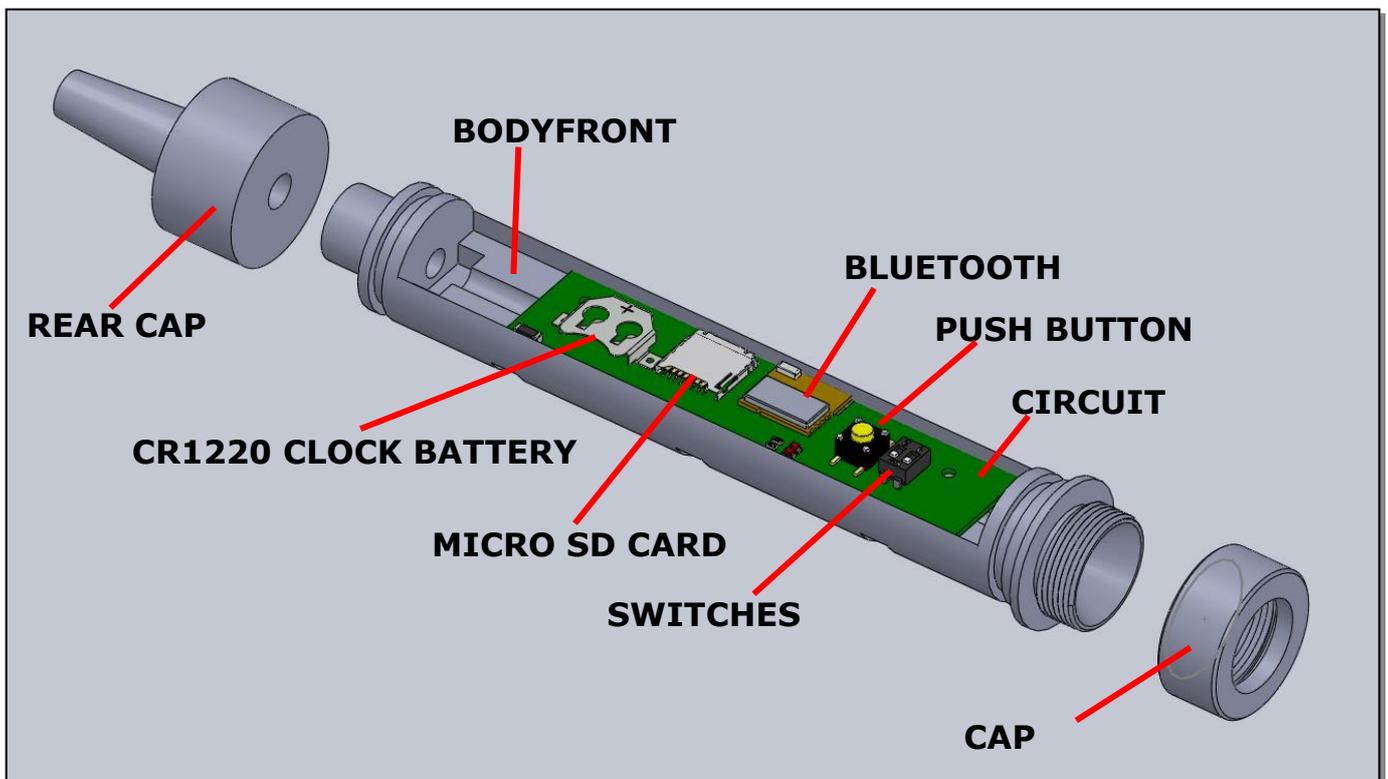
Features

- A high performance - omnidirectional audio and ultrasonic microphone
- **USB 2.0** full speed connection using a driverless - standard audio class UAC 1.1 interface for an easier communication with host devices
- Hardware amplification gain is settled via two switches
- Easy disassembly to access the SD card slot, the backup battery, the preamplification switches and button.

Applications

- BIOACOUSTICS:

  o Detecting and recording of biological ultrasounds for **bioacoustics studies** on insects, cetaceans, rodents, and bats.
  o Environmental studies to assess the impact of **wind farms** on bats.
  o Recording and analyzing mice ultrasonic vocalizations for **pharmacological studies**.
  o Soundtracks and special effects (such as slowing down the recorded ultrasounds).

- INDUSTRIAL:

  o **LEAK detection**
  o **Predictive motor fault monitoring**
  o Detection of **high-frequency noises** emitted by switching power supplies, LCD screens, or the turbines of car and truck engines, energy saving lamps.

The Circuit

INPUT CONNECTOR
+5V
INPUT −
INPUT +
RS232 RX
RS232 TX
GROUND
 +1.5V

USB CONNECTOR
+5V
D-
D+
GROUND

Backup and clock battery

Ampification switches

Push button

Bluetooth

SD card

PROGRAMMER CONNECTOR

DODOTRONIC
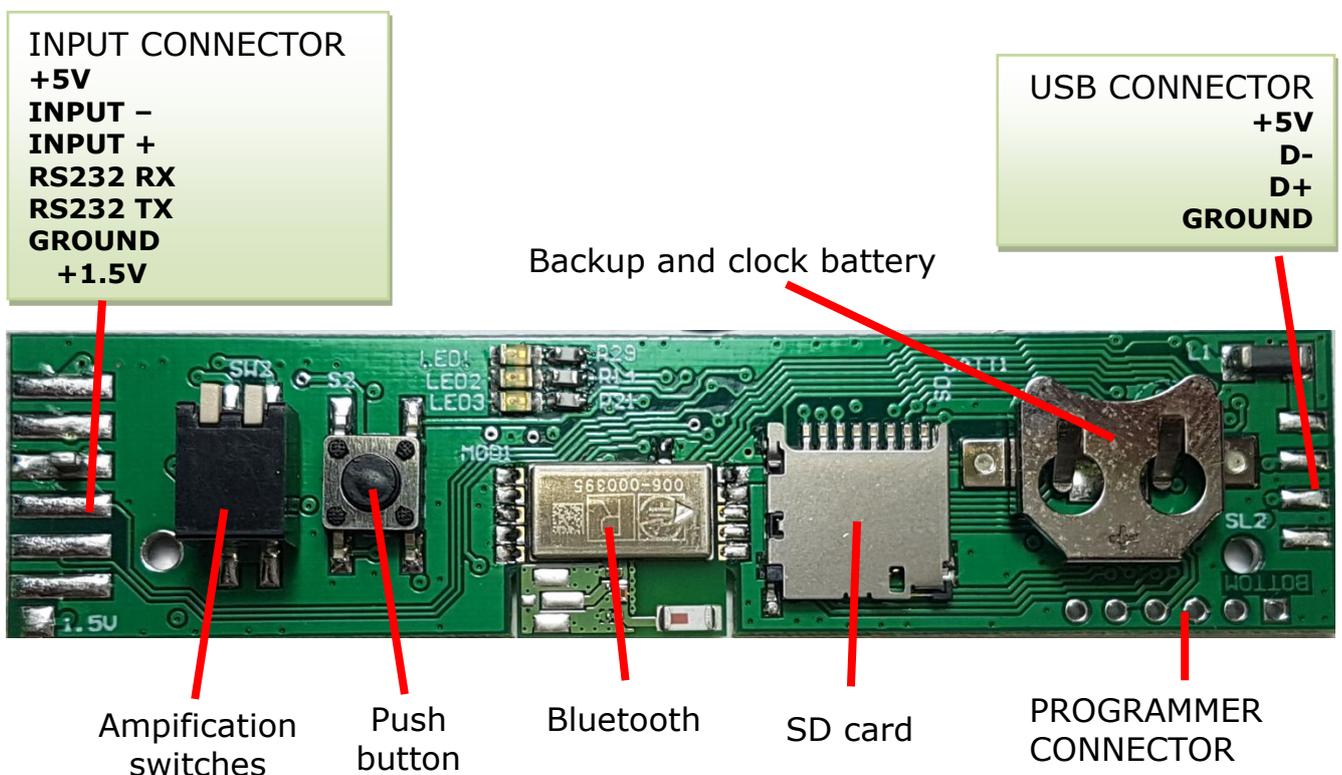
Disassembly

To disassemble the UM384K you can simply unscrew the back ring and keep the metal tube with one hand and push the plastic component.
To reassemble the UM384K you can push back the plastic into the metal tube.
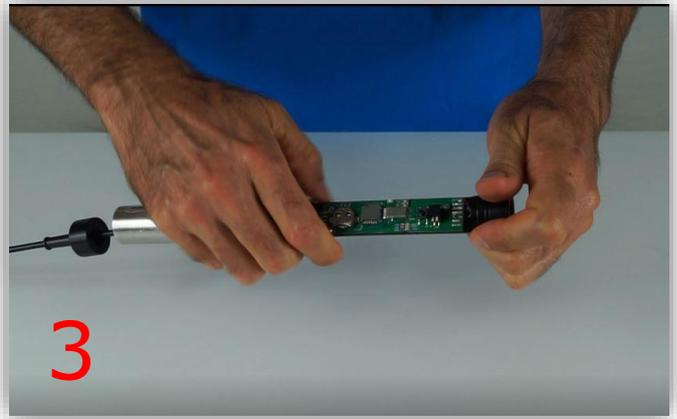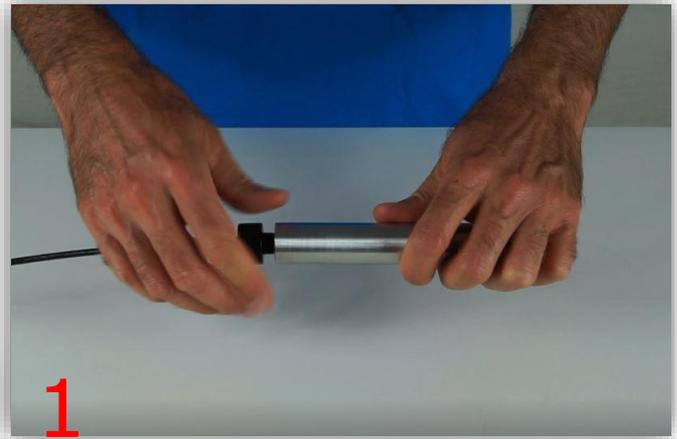
⚠ Take care with the O-Ring!!! A bad insertion can cut the sealing, vanishing the waterproof protection.

Versions

Three UM384K versions are available:
- UM384K USB MICROPHONE
- UM384K BOTTOM RECORDER
- UM384K CIRCUIT ONLY

The different versions have the same circuitry and as a consequence the same functionality.

UM384K USB MICROPHONE
The easiest way to detect and record ultrasound, all integrated in a **delrin** container and aluminum tube.

UM384 BOTTOM RECORDER
The hydrophone version. The bottom recorder is essentially an Ultramic installed into a plastic case specifically designed to support high pressure for deep sea recordings.

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UM384K CIRCUIT ONLY

The availability of the **circuit UM384K only** allows a customized integration of the UM384K for many different applications, such as the combination with a specific sensor to detect - vibrations, piezo ultrasound detector, infrasound, etc.
Please, be aware that using this circuit outside of its specification may damage the circuit.

Waterproof

Ultramic384Kis a waterproof IP67 microphone when the front cap is tightly screwed. The USB connector is – not a waterproof device, therefore it must be protected from humidity and dust. The microphone sensor is protected by a PTFE membrane glued to the black front cap.
Even if the membrane is very small it will block a part of ultrasonic sounds. If you don't need the waterproof protection or if you have provided a custom shelter for UM384K from rain than unscrew the front cup so you'll got all the sensitivity of UM384K.
While the Ultramic384K is water resistant and designed to operate in an outdoor environment, it is strongly recommended that the Ultramic384K must be protected from the direct rain or snow. In addition, please note that it will be difficult for the sound to be captured by the sensor if the windscreen or the sensor becomes wet.

Finally, please ensure that the USB cable leads down from the device so that any water is channeled away from the microphone, minimizing the chance of water infiltration through the grommet.

> ⚠ The front membrane **greatly decrease** the sensitivity **in ultrasonic range** so provide a shelter from rain and unscrew and remove the front membrane to have a better sensitivity.

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USB Microphone

Ultramic384k is commonly used as a USB ultrasonic microphone.
You simply have to:
- Remove the internal SD card
- Connect the USB connector to your PC, smartphone or tablet.

The use of standard USB audio class allows the microphone to be used as a standard Plug & Play device with no driver installation required.

… WITH YOUR PC

Insert the USB connector of the microphone to the USB connector of your PC.
Less than a minute is required for the operating system of your PC to install the required software.
Install your preferred audio software. The list of compatible software can be found on:
www.dodotronic.com

… WITH YOUR SMARTPHONE OR TABLET

Use a USB OTG adapter and connect the Ultramic to your Android smartphone.
Download the BAT RECORDER app and open it.
Connect your headphones to listen the ultrasound translated in audio range. The online user guide will lead you to understand the many available features.

Smartphone and UM384K with the microphone metal holder.

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> The list of compatible devices and other compatible apps can be found on:
> www.dodotronic.com

… WITH YOUR iOS DEVICE

With the lightening USB adapter connect your microphone to your iPad, iPod or iPhone. Download the ULTRASONIC ANALYZER app to capture the ultrasound.

> Visit: www.dodotronic.com to find the updated list of devices, apps and more regarding the use of Ultramic384k.

Unattended Recorder

The Ultramic384K is also an embedded recorder and nothing else is required but an external USB power supply and a formatted SD card.

There are three ways of recording:

- ❖ **ONE HOUR RECORDING MODE**
- ❖ **MINUTES RECORDING MODE**
- ❖ **SCHEDULED RECORDING MODE**

One Hour Recording Mode

This is the simplest way to use it as an autonomous recorder. No scheduling is needed.
This mode allows you to make a single, one hour length recording each time the microphone is powered on. After one hour the file is closed and the Ultramic384K will go into a low power mode.

How to setup the autonomous **one - hour recording mode**:
- Open the Ultramic384k by unscrewing the back.
- Insert a formatted **SD card** into the slot on the circuit board.
- Reassemble the device.
- Power the device via an **USB power supply** such as wall adapter or a USB power bank.

Then the device starts recording at 384Khz sampling rate.
Every 8 seconds the **RED led** emits a blink indicating the beginning of recording.
If you want to **stop the recording press the button** for a few seconds. Consequently the **green led** blinks rapidly to state the stop of the current recording.

Every time **Ultramic384K** is powered on, it creates a new folder - sequentially named using the format **PWRxxxxx** - where xxxxx is a sequential number. A maximum of 6 files is saved in the folder, each file up to 480 Mbytes in size (approximately 10 minutes recording).
If you need **another hour recording**, then repower the device again.
Note:
- As an alternative, you could use an external timer connected to a USB wall mount adapter so that the timer powers the microphone for a periodic one - hour recording.

> ✋ In both One Hour Recording Mode and in Minutes Recording Mode no scheduling must be present in the memory of the UM384K. Please check the memory and erase it as explained in the **SCHEDULING DELETION** chapter.

Minutes Recording Mode

In this recording mode you can do recordings with a specified length and sampling rate, with no need to do a complex scheduling.
For example if you need to record for 70 minutes at 48 Khz in a simple way please consider the following steps:
-   By using a simple text editor with your PC create two files with the following extension:
    70.rec and ***48.spr***
    - copy the files in a micro SD card
    - power the Ultramic, it will start recording at 48 Khz for 70 minutes.
    If you need different times, please change the "70" file name with the correct one. If you need other sampling frequencies, please change the "48" file name with the preferred frequency.
    Allowed frequencies in Khz are:
-   384
-   192
-   96
-   48
-   200
-   250

Allowed file name for minutes are between ***11.rec*** and ***90.rec*** (the range is between 11 and 90 minutes).

NOTE:
-   If no sampling rate is specified it will record at 384 Khz.
-   **No scheduling must be present in the memory of UM384K** else, the scheduling mode is followed instead of Minutes Recoding mode.

> 🖐 When the Ultramic is recording it is important not to power off the device, this will compromise the FAT damaging all files stored in the SD card.
> **SOLUTION**: while recording (beware of the blinking RED led) you can stop the device by pressing the button for few seconds. Then the green led will blink and the recorded file closed correctly.

Scheduled Recording Mode

The scheduled recording mode allows a wide flexibility in record planning.
For example, you can record a bird's song every day from 5:00 a.m. for 2 hours at 48Khz and then **bat's calls** from 10:00 p.m. for 50 minutes at 384Khz and so on.
Another recording scheme mainly used in **soundscape recording** can be as follow: you can record a sound for 10 minutes then keep the device off for 50 minutes and then repeat the cycle.

There are two ways to program the device for scheluding:

❖ By the **UM384BLE CONFIG** Android app (preferred)
❖ Manually editing the XML file

UM384BLE configuration app

The **UM384BLE CONFIG** app allows a complex recording scheduling. Follow these steps to set up your Ultramic:

- Download the **UM384BLE CONFIG** app from www.dodotronic.com

Install and launch the app. The following screen appears:

SCHEDULING TAB

TRIGGER

CONFIG. TAB

USER MENU
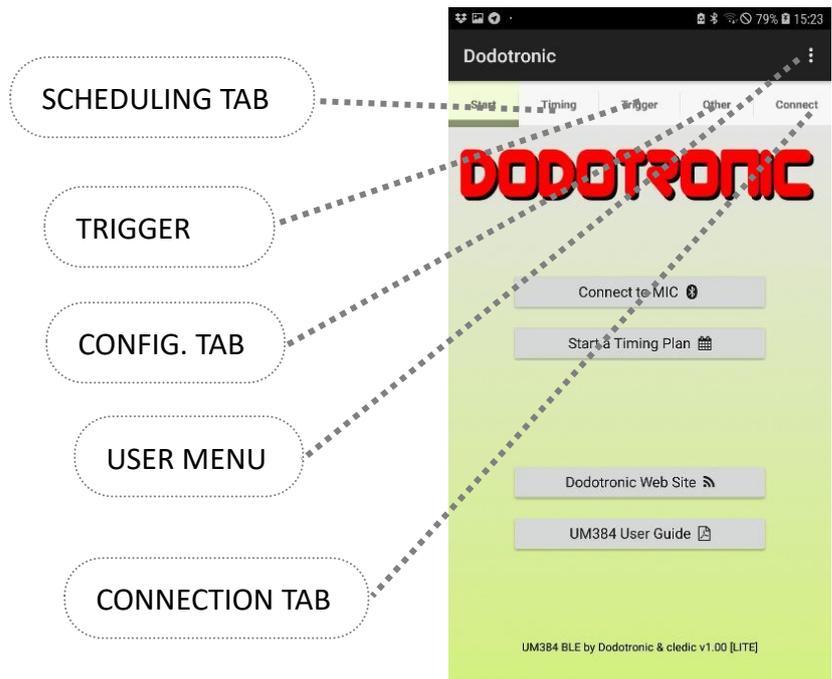
CONNECTION TAB

✋Only **Android devices** from **4.3** are **compatible** with Bluetooth low power!!

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HOW TO CONNECT UM384K
TO YOUR SMARTPHONE

- Go to the **CONNECT** tab on the screen and press the **Scan & Connect** button(the smartphone is now waiting for a connection).
- Insert a **micro SD** card in the UM384K.
- Power the UM384K via USB.
- Then **green led** blinks rapidly until the device is connected.

   The **systems** are **synchronized** and the following parameters are displayed:
- **SD Free space** in Mbytes
- Internal clock (click on the **SEND TIME** button to align the clock)
- Voltage of the **clock battery**.

> ✋ The clock battery is a coin battery inserted in the circuit and visible when opening the UM384K.
> This battery is used only to **keep the internal clock** on and it cannot supply any power to recording.
> The power to turn on the microphone comes only from the USB connector!

On the **CONNECT** tab the available buttons are:
- **Scan and Connect** - press this button to connect the smartphone to UM384K
- **Disconnect** - press this button to disconnect the Bluetooth connection
- **Conf erase** - it allows you to delete the configuration from the UM384k
- **Send Time** - it aligns the time (synchronizing) of the smartphone with the internal clock of the UM384K
- **Get Mic Info** - it updates the information on this page with the internal settings of the Um384K
- **Audio Level** - it shows the audio level in dB.
- **Send conf** – it send the configuration parameters to the UM384K

USB Power

In recording mode, the microphone needs to be powered continuously. If the power is interrupted the scheduling stops. If the power stops while the microphone is recording, the SD card can be corrupted with the loss of all files previously stored in the card.
Unfortunately the commercial power banks used to recharge smartphones, have got a circuit that stops the power at a defined minimum level of current. This happens when the Um 384k in scheduled mode sleeps between two recordings and the current falls below 1 mA.
On the website www.dodotronic.com you can find a way to modify the power bank in order to supply constantly the current even when there's no load at all.
Another possibility is to create a homemade power bank by using standard battery holder combined with a USB voltage converter (easily available on online electronics shop).
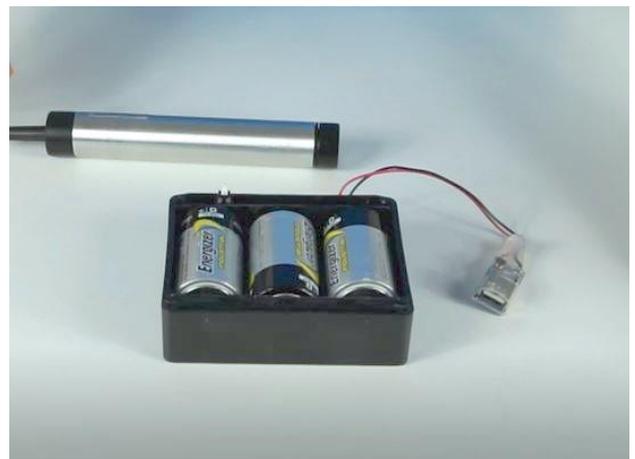
SD card

The SD card is inserted into the connector present in the integrated circuit board and used to record incoming data.
By default, the Ultramic384K behaves as a standard USB audio microphone without the need for a driver. If a SD card is present when the device is powered on, the Ultramic384K will behave as a recorder according to the previously mentioned modes.
If using a SD card, Ultramic384K requires a card with a 2 GB mininum storage capacity. 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.
To insert or remove the SD card, pull out from the micro connector.

> ✋ The SD card **MUST** be formatted using the SD card formatter free software every time a new recording session is started:
> https://www.sdcard.org/downloads/formatter_4/

Please 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.

Also note that the recorder may be incompatible with certain SD, SDHC or SDXC cards.
If your SD card is not recognized, please remove the SD card and then re-insert it to see if the recorder finally recognizes it.

XML File Editing

Recording by using the XML recording mode: - you can use the online configurator from www.dodotronic.com (the safest way to do it), or you can use a text editor such as Notepad (not very safe) to create an XML file that contains all the information to specify an autonomous recording plan.

Then:

- Save the XLM file in the root of the micro SD card.
- Open the Ultramic384K and insert the micro SD card into the slot on the circuit board.
- Power the Ultramic384K (the time stamp will be set according to time the device is powered up).

The Ultramic384K will now starts recording according to the XML file stored information. After the end of the recording session, the device will go into a sleep mode until the integrated timer wakes the device up again for the next recording session.

ATTENTION: Please **do not turn off the power** while recording, as this could **corrupt the FAT** partition on the SD card and all the stored files could be lost!

If a XML file is present in the micro SD card, recorded files will be stored in folders using the naming convention YYYYMMDD where YYYY stands for the year, MM for the

```
1.  <?xml version="1.0" encoding="UTF-8"?>
2.  <UltraMic384>
3.  <version>1.2</version>
4.  <config>
5.          <defaultsettings>
6.          <defaultrate>3</defaultrate>
7.          <trigger>1</trigger>
8.          <filedimension>10</filedimension>
9.          <devicename>UM_wind_1</devicename>
10.         <timeleft>1</timeleft>
11.         <stop_db>-35</stop_db>
12.         <start_db>-29</start_db>
13.         </defaultsettings>
14.  <scheduling>
15.         <modetime>
16.                 <start>06:00</start>
17.                 <duration>03:00</duration>
18.                 <samplingrate>4</samplingrate>
19.         </modetime>
20.         <modetime>
21.                 <start>19:00</start>
22.                 <duration>01:00</duration>
23.                 <samplingrate>4</samplingrate>
24.         </modetime>
25.         <modetime>
26.                 <start>20:10</start>
27.                 <duration>09:00</duration>
28.                 <samplingrate>1</samplingrate>
29.         </modetime>
30.         <modetime>
31.                 <start>11:00</start>
32.                 <duration>05:00</duration>
33.                 <samplingrate>3</samplingrate>
34.         </modetime>
35. </scheduling>
36. </config>
37. <setdatetime>2018-08-15T19:37:20</setdatetime>
38. </UltraMic384>
```

XML file example for **TIME MODE**

month and DD for the day. Each file in the folder will use the following naming convention: YYYYMMDDThhmmss.wav, where the last part of the file name corresponds to the starting hour, minutes and seconds respectively.

During recording, the red LED will blink every 8 seconds.

XML File Explanation

XML file configuration is a straightforward operation. The text file is composed of delineating tags. Each tag defines a specific parameter. Specifically, each parameter is surrounded by a start tag <xxx> and an end tag </xxx>, where xxx is the parameter name.

The following parameters are currently supported:

<UltraMic384> main tag

<version> version number

<config> configuration tag

<defaultrate> sampling rate definition: 1=384Khz, 2=192Khz, 3=96Khz, 4=48Khz, 5=200Khz, 6=250Khz, Default =1

<trigger> trigger activation: 2=on with HPF (high pass filter), 1=on, 0=off, Default = 0

<filedimension> is the dimension in which the file is split to be better processed in post-production (in minutes).

<devicename> this custom field can be used to set a name for a recording session.

```
1.  <?xml version="1.0" encoding="UTF-8"?>
2.  <UltraMic384>
3.  <version>1.2</version>
4.  <config>
5.      <defaultsettings>
6.      <defaultrate>1</defaultrate>
7.      <trigger>0</trigger>
8.      <filedimension>10</filedimension>
9.      <devicename>UM_CONTIN</devicename>
10.     <timeleft>1</timeleft>
11.     <stop_db>-45</stop_db>
12.     <start_db>-39</start_db>
13.     </defaultsettings>
14.  <scheduling>
15.  <moderepeat>
16.      <record>23:55</record>
17.      <pause>00:05</pause>
18.  </moderepeat>
19.  </scheduling>
20. </config>
21. <setdatetime>2018-08-15T19:37:20</setdatetime>
22. </UltraMic384>
```

XML file example for **REPEAT MODE**

<timeleft> is the remaining recording time in the SD card before the alert (defined by a yellow led fast blinking).

<stop_db> and <start_db> values are related to the trigger; if a signal goes over the start dB, then the recording starts and continues until a signal is present over the stop dB. If the signal is below the stop dB for at least 30 seconds then the recording is stopped.
Please, you may consider that when the signal exceed the start dB, then the record starts and the signal is not monitored for 15 seconds. Therefore if a single event is captured the minimum recording is (15 + 30 =) 45 seconds.

<scheduling> this tag defines the start of the scheduling tag.

TIME MODE

<modetime> in time mode the single programmed event is repeated daily

<start> start defines the starting time of a recording event (i.e. 19:00)

<duration> duration defines the length of the recording expressed in hours and minutes i.e. 05:00

<samplingrate> sampling rate definition: 1=384Khz, 2=192Khz, 3=96Khz, 4=48Khz. 5=200Khz, 6=250Khz. This tag overwrites the <defaultrate> tag and it is specific for the single event.

<setdatetime> defines the date and time clock. This tag is mandatory to synchronize the clock of the microphone with all the scheduling.

REPEAT MODE

<moderepeat> the event is repeated continuously starting when the UM384K is powered on.

<record> this is the time in hours and minutes for recording.

<pause> this is the pause between two records.

Comments can also be added using the following tag: <!-- xxx →>, where xxx represents the comment itself. Comments are ignored by the Ultramic384K.

How to load the XML file:
- Copy the XML file named ultramic384.xml in the root directory of a micro SD card
- Insert the SD card into the UM384K.
- Power the microphone (the yellow led is ON)
- After few seconds the green led will blink very fast.
- All the leds blink sequentially

This sequence indicates that the new scheduling is stored in the memory of the UM384K
If you check the SD card the file **ultramic384.xml** is renamed in **ultramic384.old**
If something is gone wrong, then the file is renamed **ultramic384.err** and the old scheduling is deleted. If the scheduling is not loaded at all then the file name **ultramic384.xml** remains unchanged.

Scheduling Deletion

The Ultramic384K stores the recording mode and ALL programming instructions into the internal memory. Even if the UM384K is disconnected from the USB all these values are retained into the memory supplied by the internal watch battery.
If you want to delete the scheduling there are three ways to do it:
- **Remove the backup battery**, every scheduling is deleted herein, included the internal clock.
- Use the **Android app** and once connected click on **CONF. ERASE**. The clock is maintained.
- Save the following **xml file** and store it into the UM384K as previously explained for normal scheduling:
-

Contrary to the standard scheduling programming, the **ultramic384.xml** file will be renamed in **ultramic384.err** and the scheduling will be deleted.

```
1.  <?xml version="1.0" encoding="UTF-8"?>
2.  <!-- THIS FILE MUST BE SAVED AS ultramic384.xml
    Configuration file to blank timer and date time
    on device -->
3.  <UltraMic384>
4.  <config>
5.          <defaultsettings>
6.          <filesize>460</filesize>
7.          <devicename>OFF</devicename>
8.          <timeleft>1</timeleft>
9.          </defaultsettings>
10.         <scheduling>
11.         </scheduling>
12. </config>
13. <setdatetime>2016-10-15T10:55:00</setdatetime>
14. </UltraMic384>
```

XML file example to **DELETE THE SCHEDULING**

🤚 Every time the file is renamed in **ultramic384.err** the previous configuration stored into the microphone **will be deleted!**

Amplification Settings

The integrated switches control the amplification level. By unscrewing the back of the device near the USB cable and then pushing on the aluminum tube you can access to the circuit board.

Turning on the switch n° 1 will result a 10 x amplification. (Default with the FG sensor)
Turning on the switch n° 2 will result a 100 x amplification.

Be sure to grease the o-ring when reassembling the device.
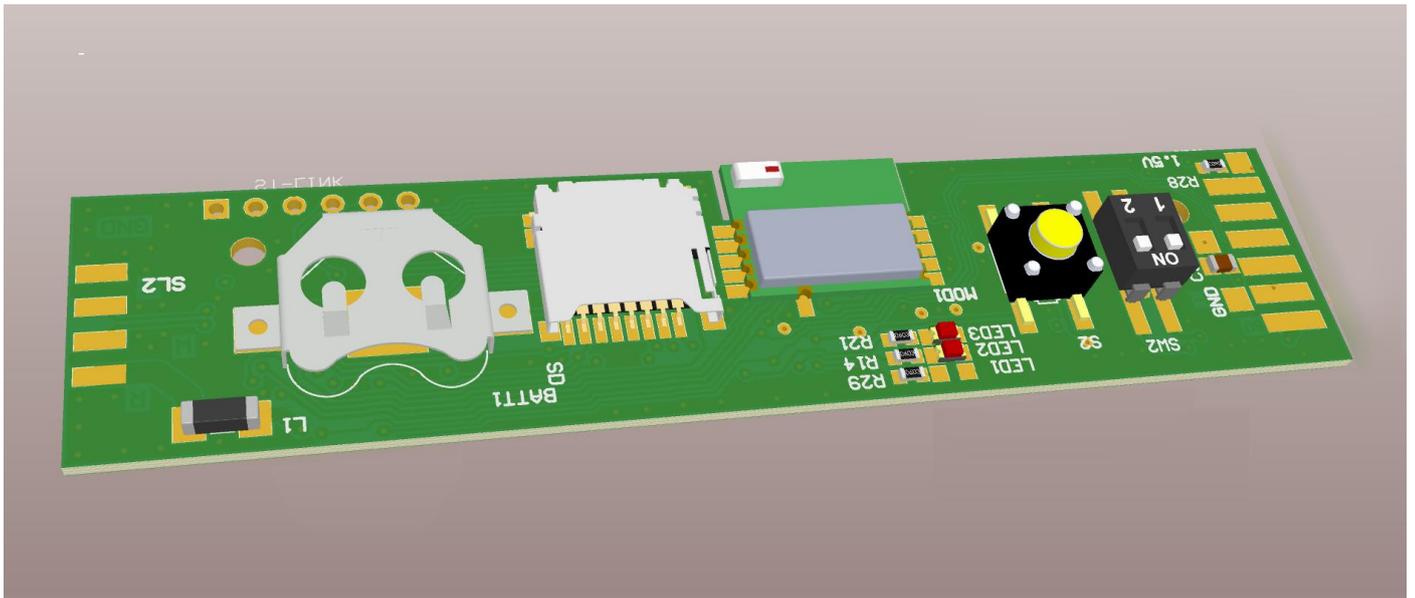
UM384K_BLE circuit board

PIN NUMBER	FUNCTION	NOTES
1	+5V	Directly connected to USB port
2	GROUND	Directly connected to USB port
3	SDA (I2C) – RS232 RX	TTL levels
4	SCL (I2C – RS232 TX	TTL levels
5	IN+	Positive differential input
6	IN-	Negative differential input

🖐 The Ultramic384K has no internal filter, and a voltage applied to IN+ and IN- will result in a DC sampling proportional to the voltage itself. This can be very useful to capture very low speed signals, such as vibration or infrasound.

Firmware Upgrade

Download the FIRMWARE.ENC file from www.dodotronic.com.

Store the file in the root directory of a micro SD card.

Insert the SD card into the Ultramic384k.

Power the microphone, the **yellow led** is on for some second and then the **green led** will blink up to the end of the firmware updating.

Remove the SD card.

> ✋ The filename FIRMWARE.ENC is mandatory!
> A different filename will not update the firmware.

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Simplified Flow Code

STARTUP

SD card? — NO → USB audio

YES

XML

YES →

**SET TIME AND DATE
LOAD ALARMS
SET THE FIRST ALARM**

RENAME THE XML TO "OLD"

NO →

FIRMWARE.EN
C PRESENT? — YES → **UPDATE THE
FIRMWARE**

NO

Are there
configured timers? — NO → **START ONE HOUR
RECORDING**

YES

START SCHEDULED RECORDING
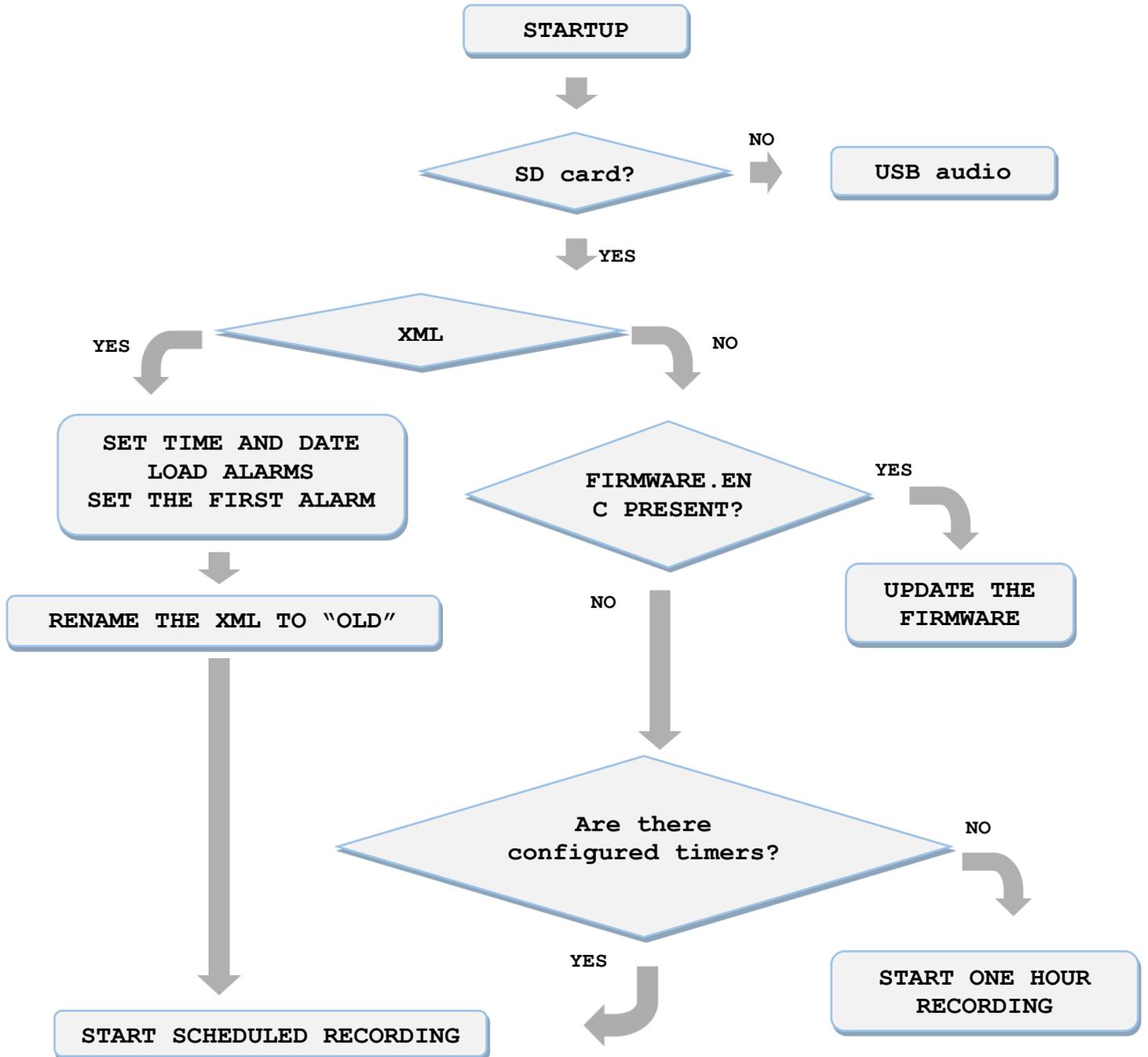
Led messages

RECORDING MESSAGES

	USB Audio Yellow led blinking every 5 seconds.
	Recording on SD card Red led blinking every 5 seconds.

MIX MESSAGES

	Entering in Stop mode Yellow and Green led alternating for about 3 seconds
	Alarm on SD card free space Fast yellow led blink for 3 seconds
	Low battery level Red and yellow led fast alternating for about 1 second

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	BLE connection **Fast green led** blinking: it is trying to connect with your Android smartphone via Bluetooth.

ERROR MESSAGES

	XML file errors Red led on and yellow led blinking for about 6 seconds. Malformed or incomplete tags, no matching starting and ending tags.
	Error on timer The timer was not found or wrong. Red led on and fast green led blinking for about 6 seconds.
	SD card error The RED led alone is **blinking quickly**. Problems may be regarding the SD card reading and/or writing. **Solution**: a fresh **formatting** with SD Formatter utility.
	Firmware upgrade: the yellow led stays on for few seconds and then the green led blink fast. At the end all the three leds are going to blink.

Technical Specifications

Recording format	Linear PCM (Pulse Code Modulation) format
Recording medium	SD card (512MB to 2GB) SDHC card (4GB to 32GB) SDXC card (64GB to 512GB)
Input	IN+ IN- 0 – 1 V differential voltage input
USB B connector	USB 2.0 Full Speed USB audio class 1.1
External dimensions	Total length 160 mm Diameter 25.4 mm
Weight	129g (coin battery included.)
Reference input level	Switch setting / HI / LOW — Level value / 114dBSPL / 74dBSPL
Sampling frequency	384 K sampling per second
Resolution	16 bit
Amplification	High quality, and low noise, differential analog amplification with no filter
CPU	32 bit integrated ARM Cortex M4 microcontroller
Power	35 mA power requirement in USB mode 30 mA mean power requirement in autonomous recording mode 140 mA maximum peak while recording
Update	Software upgradable via firmware file stored in the micro SD card
Microphone sensor	FG23629 from Knowles
Backup battery	CR1220 coin cell backup battery

The aluminum tube is connected to the circuit ground plane and it reduces the sensor vibration and minimizes electrical interference.

The FG microphone is the world's smallest electret condenser microphone; it is very sensitive, with a good signal/noise ratio and a flat frequency response.

Recording Times

It is important to use the right SD card capacity according to our planned recording session.
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
384Khz	8	2:53
384Khz	16	5:47
384Khz	32	11:34
384Khz	64	23:08
384Khz	128	46:17
48Khz	8	23:08
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.

UM384K Bottom Recorder

UM384K Bottom Recorder is an autonomous recorder based on UM384K board. The electret microphone present in the UN384K microphone is replaced by a preamplified microphone sensor, SQ29 specifically designed to bring the right sensitivity for marine environment.

This device implements all the characteristics of Um384K ultrasonic microphone.

The circuit board is integrated in a plexiglass can, with two caps and the hydrophone sensor placed in one of them. The container is tested for up to 500 mt deep use, and it is intended to be used only in autonomous mode.

The power is delivered by a 3 size D LR20 battery, allowing a long recording time. The battery length is related to many factors:

- Battery capacity
- Sampling rate
- Gap time between recordings
- Recording length

Bottom Recorder with the detail of the SQ26 sensor.

Examples

In this chapter you will find some recording examples on how to configure the UM384K as autonomous recorder.

1 BAT CALLS

"I want to record bat calls all night long avoiding blank spaces in recordings".

In this case we set the sampling rate at 384Khz and implement our trigger and high pass filter.

A – from the START menu click to

Connect to MIC
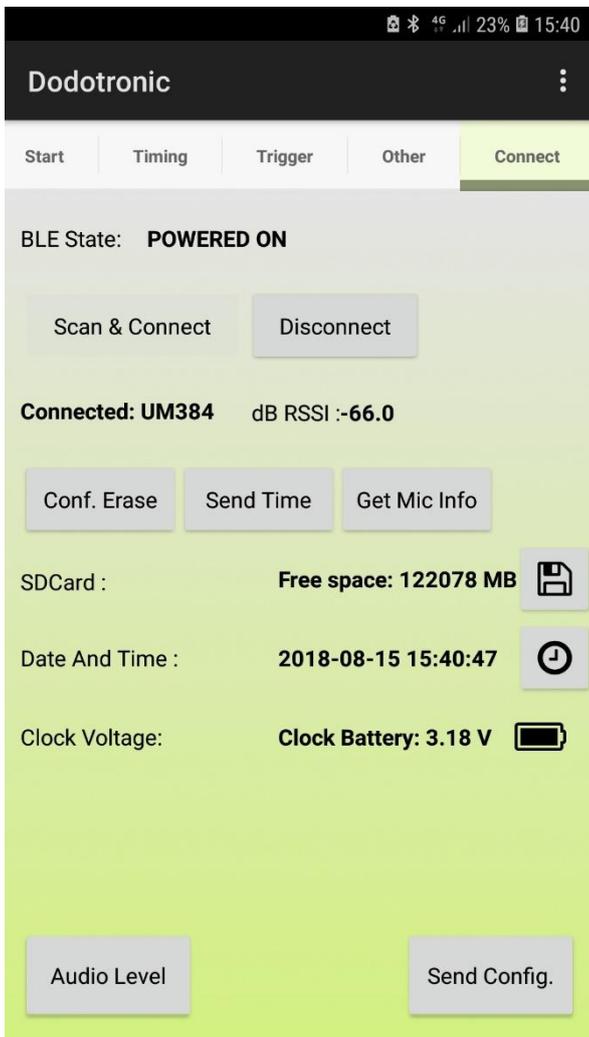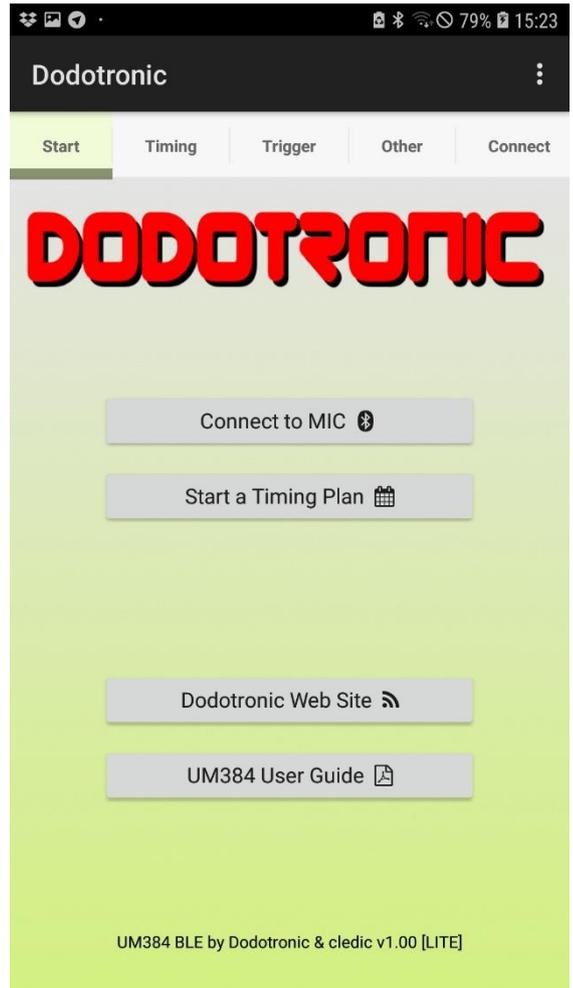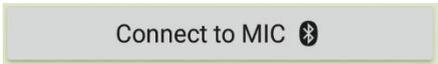
B – Unscrew the UM384K and insert a formatted SD card

C – Power the UM384K, the green led will blink rapidly and the following screen will appear. Info about the SD card free space, timer etc. is shown on the screen.

D – Press the AUDIO LEVEL button and the current SPL is shown in real time.

E - Switch to the trigger and select Trigger.
Start dB and Stop dB is shown, these values are the reference for the trigger: the start dB limit is considered when the registration starts, and if a signal exceed this limit trigger the record will start for xxxx seconds.
The Stop dB is the level at which the record will be stopped. If the level falls below this limit the registration will be stopped.
…Furthermore, if bat call trigger the signal then the record starts for xxx second even if the signal goes below the Stop dB limit, if another signal over the Stop dB is sensed then the record will continue for xxxx seconds.

Enabled HPF is set if you want to avoid low signal below xxx Khz.

It's hard to understand the sound level and if you prefer to precisely adjust the upper and lower audio level according to your specific application, you may go to - after enabling the **Trigger**, to the **Connect** tab and then to the **Audio Level** settings. You can change the settings by tapping and sliding up and down the red and blue areas. Or you can use the slides on the left side of the dB values below.
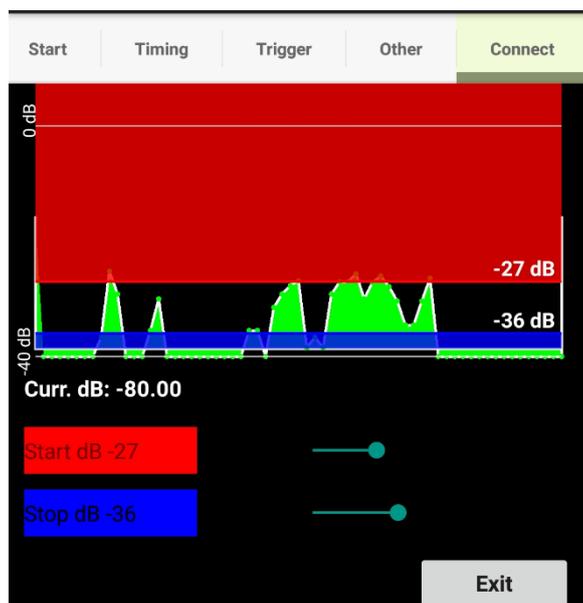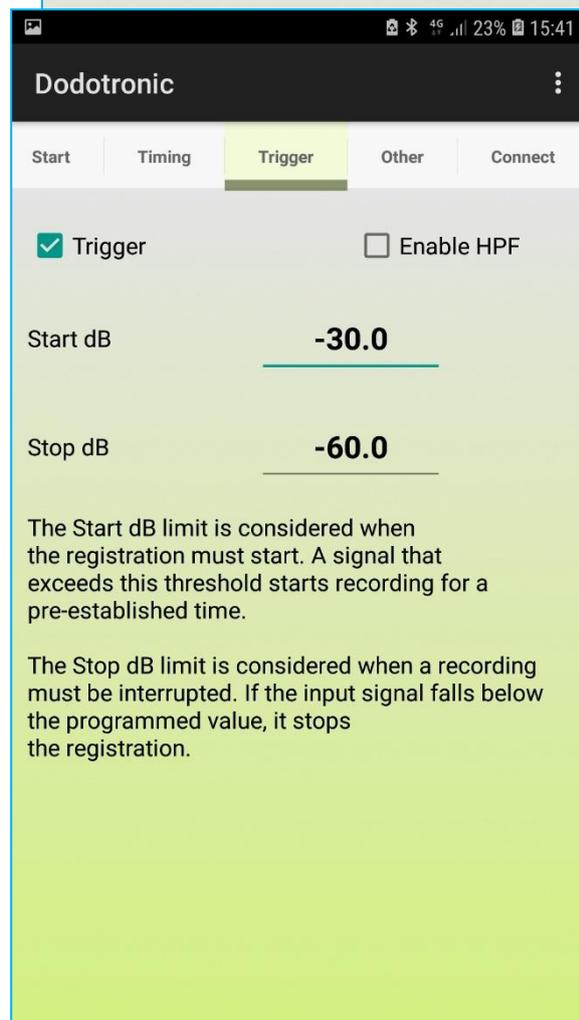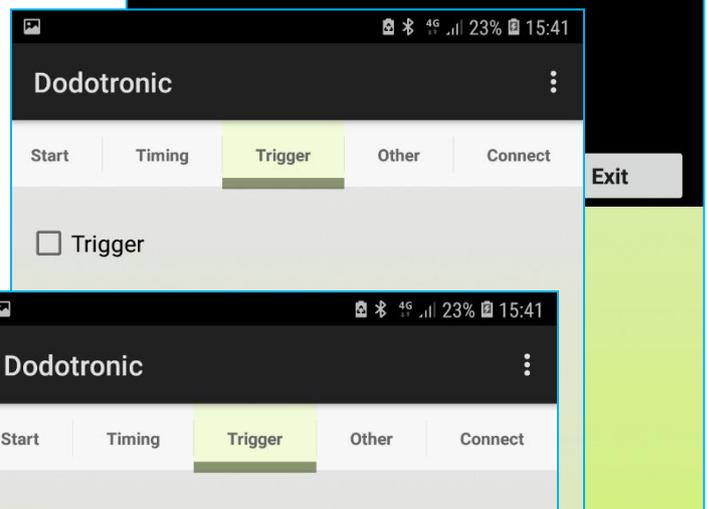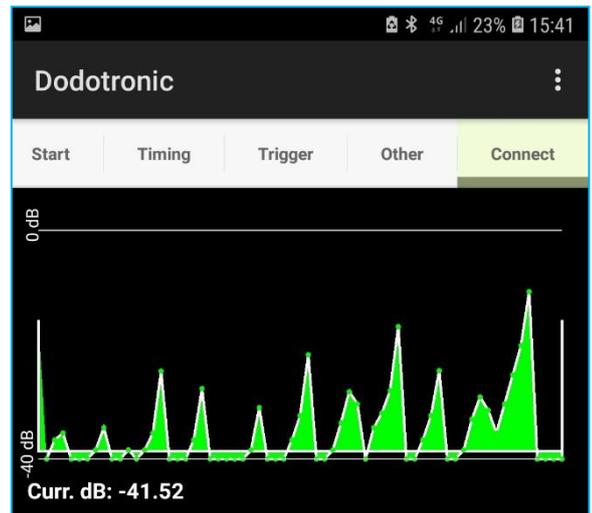
F – Set the Timings from the menu by clicking on Add Time, and set the start time and the duration.
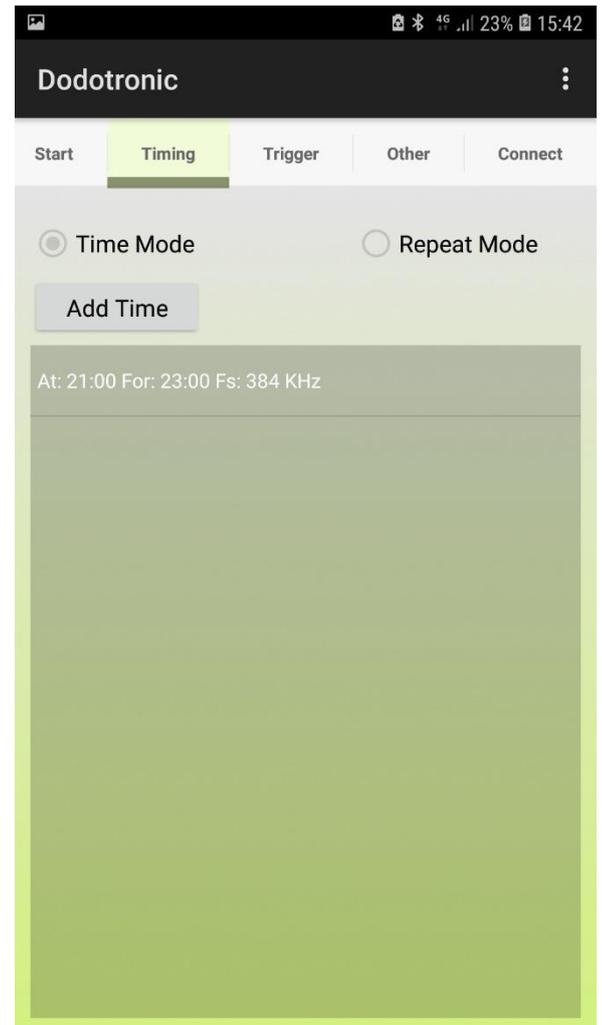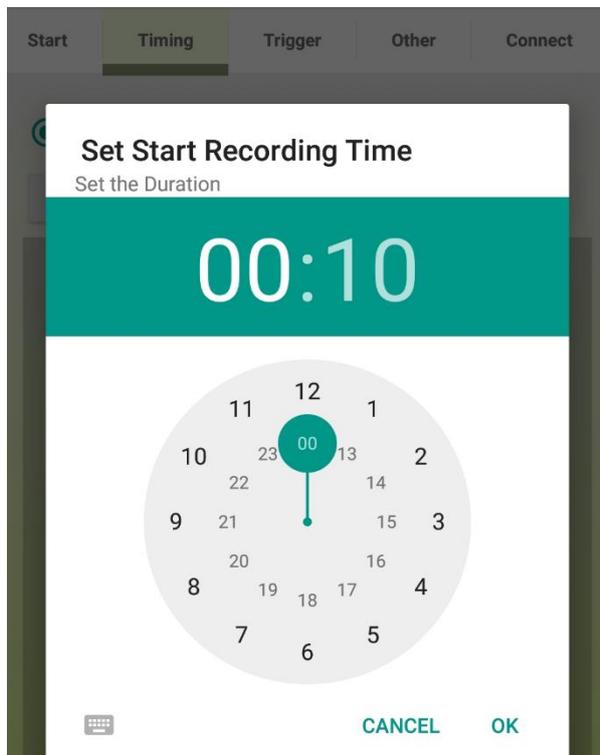
✋ In the page **OTHER** you can set the alert time: an alert for the space limit in the SD card.

Moreover, you can set the File Split Size in minutes. It must be remembered that the file size for long time recording can generate huge files. The formula to calculate the file size is:
time length in seconds x 2 bytes (16bit) x sampling rate. If you set the **FILE SPLIT** size to 60 minutes at 384Khz you will got:
60 (minutes) x 60 (seconds) x 2 bytes x 384K = 2764800 Kbytes = file size of 2.764 Giga Bytes.
It is a good practice to have small file size to be easily handled by your PC software.

! In timing mode you can **delete** the single row by pressing the row for 2 seconds

G – Save the configuration for future use (optional) from the menu or eventually load the saved configuration
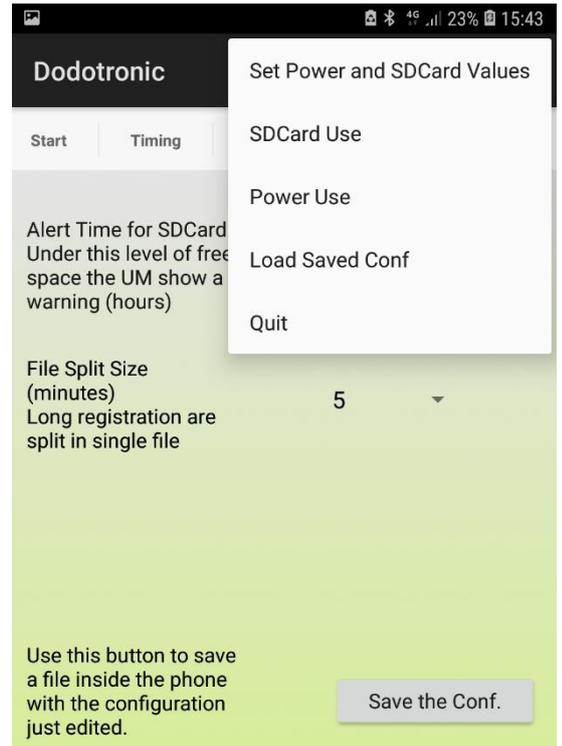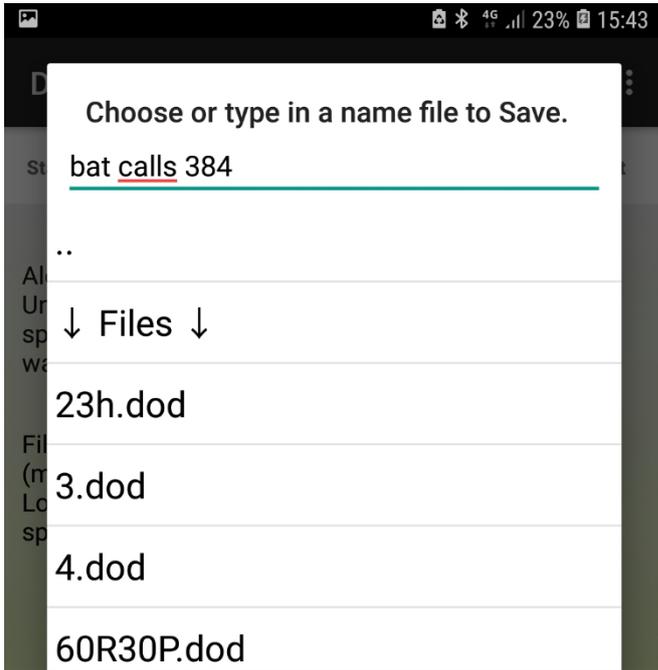
H - At this point you can send the configuration to the microphone from the **CONNECT** menu.

When the configuration is uploaded to the microphone, it will restart, and it will operate according to the uploaded information.

DODOTRONIC
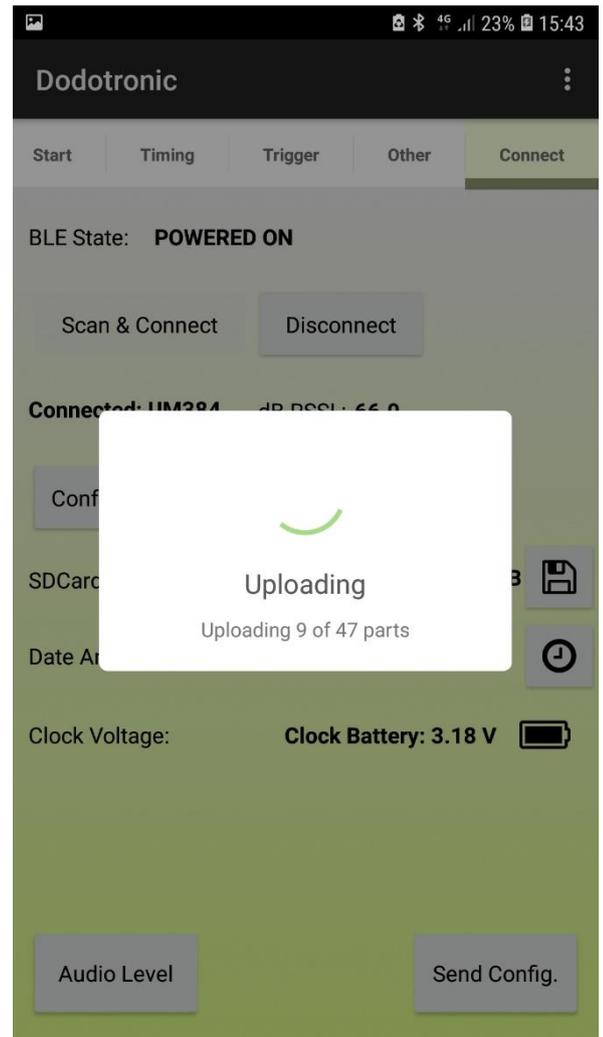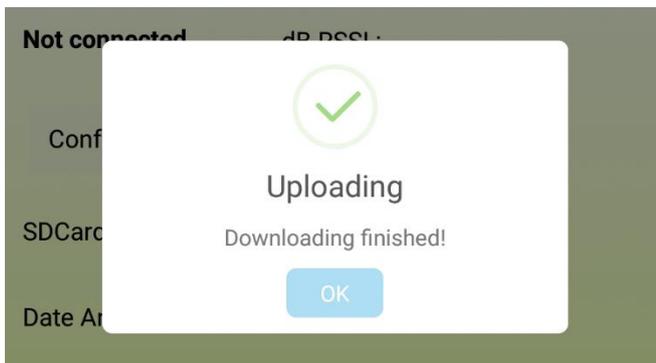
2 BIRD, INSECT AND BAT CALLS

*"I need to record a **bird song** in the morning from 6:00 to 9:00 then from 19:00 to 20:00.*

*I want to record **bat calls** from 20:10 up to 5:10. I need also to record **cicada and other insect calls** in ultrasonic range to from 11:00 to 16:00".*

CONSIDERATIONS: First, we need to understand the sampling rate for each kind of animals.

Bat calls are in ultrasonic range; the greatest part of calls is below 100Khz, but we want to be sure to capture all the calls even at higher frequencies. Therefore, we set 384Khz for bat calls since the bandwidth is about the half of the sampling rate, and for 384Khz the bandwidth is about 190 Khz and we can record all bat calls.

A bird song is in audio range, and for a better quality recording, we set 48Khz as sampling rate for bird songs.

Cicada calls too are in audio range but some insects go over 20Khz and we set 96Khz sampling rate for insects, and consequently the bandwidth is about 48Khz.

HOW TO:

Follow the steps as in chapter 1 **Bat calls** from point **A** to point **C**.

D – In Timing page set the **Time Mode** and click on add time.

E – Insert the following times

- At: 6:00 for: 3:00 sampling frequency 48Khz.
- At: 19:00 for: 1:00 sampling frequency 48Khz.
- At: 21:10 for: 9:00 sampling frequency 384Khz.
- At: 11:00 for: 5:00 sampling frequency 96Khz.

Follow the steps from point F to H like in the previous chapter 1 **Bat Calls**.
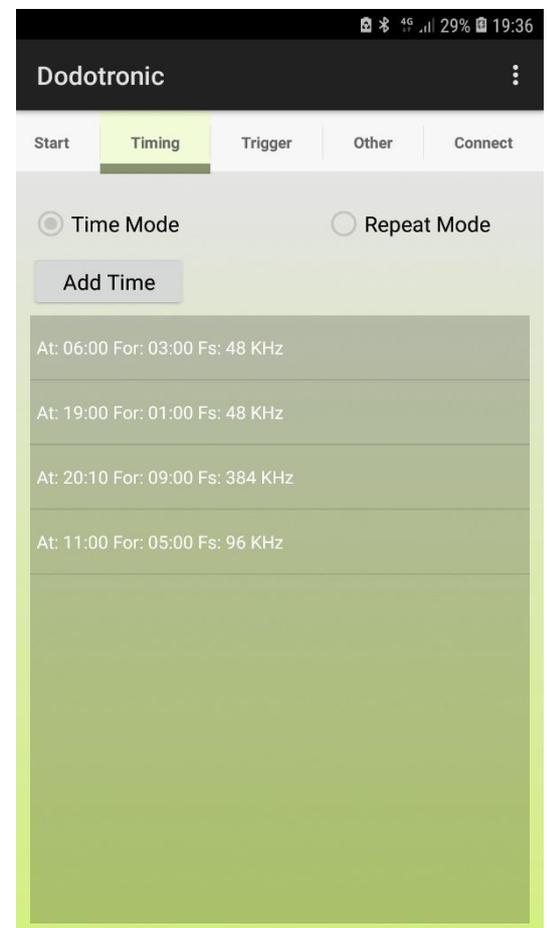
! The trigger is applied to all the recordings, please use it with care.

3 SOUNDSCAPE

"I want to have a soundscape of the environment recording in audio range for 10 minutes every hour continuously".

HOW TO:

Follow the steps of chapter 1 **Bat calls** from point A to point C.

D – In the **Timing** tab set the Time Mode and click on **Add time**.

E – Insert the following time

- Rec f: 6:00 for: 00:10 pause for: 00:50 Sampling frequency 48Khz.

Follow the steps from point F to H like in the previous chapter 1 **Bat Calls**.
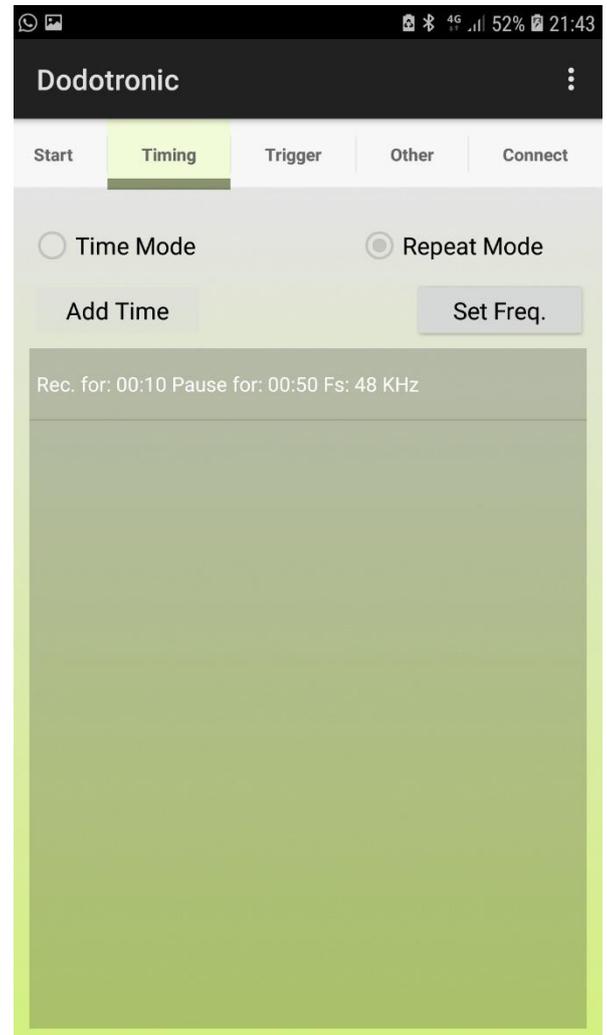
4 CALLS RECORDING

"I need to know when someone is talking in a room".

HOW TO:

Follow the steps of chapter 1 **Bat calls** from point A to point C.

D – in the **Timing** tab set the Repeat Mode and click on **Add time**.

E – insert the following time

- Rec. for: 23:59 Pause for: 00:01 Sampling frequency 48Khz.

Follow the steps from point F to H like in the previous chapter 1 **Bat Calls**.
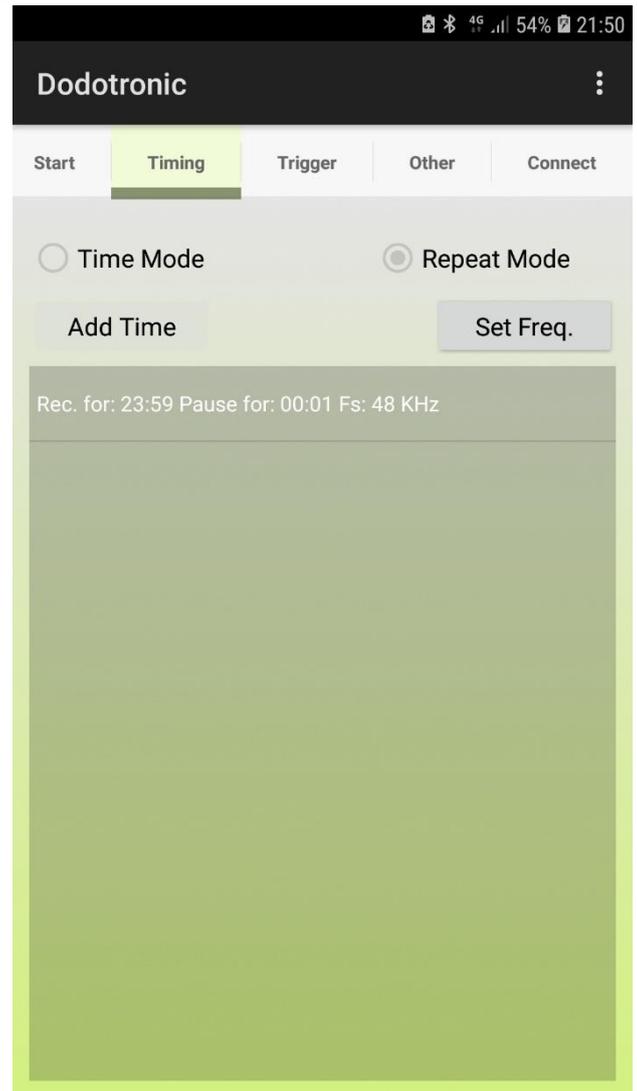
5 MONITOR PREDICTIVE

"I need to record bearing noise in industrial environment in order to know how ultrasonic spectrum normal operating conditions".

If you need to monitor in real time then you must remove the SD card and use it as an USB microphone. If you need to monitor an industrial environment then use the preferred unattended previous recording modes.

FAQ

Q: How can I record 10 minutes without having to program the Ultramic384K?

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 Ultraimc384K to my own analog recorder?

A: Ultramic384K 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 XML RECORDING MODE section above.

———————————————————————

Q: I don't want to record but just listen or view the spectrogram of acoustical signals.

A: Connect your Ultramic384K to your smartphone, tablet or PC and use your preferred app. The list of compatible apps is available on www.dodotronic.com.

———————————————————————

Q: I need to record cetacean vocalizations.

A: Connect your preamplified hydrophone to the 6 pole connector of the Ultramic384K and use it as a standard USB microphone or recorder.

———————————————————————

Q: I have connected UM384K to my PC but it isn't recognized.

A: Probably there's and SD card inserted and so it works as a recorder and not as an USB microphone. Try to change the USB port of your PC.
If it's the first time you connect the UM384K to your PC it will take some time to load the windows drivers.

———————————————————————

Q: My software can't get the audio stream from UM384K.

A: Not all the softwares allow a so high sampling rate, check if the sampling rate can be set to 384 Khz.
Select the right sound source.

———————————————————————

Q: I'm recording in real time but from the spectrogram I see only a valid bandwidth up to 20 Khz.

A: probably you have chosen the wrong sound source, try to change the sound source from the PC microphone to UM384K.

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.

Glossary

	Description
Sampling frequency (sampling rate) [**Hz/Khz**]	The rate or frequency at which an analogue signal is analyzed to determine acoustic delicacies. The higher sampling frequency produces less difference in forward/backward sounds.
Quantization bits [bit depth][**bit**]	The number of quantization bits helps determine how much data is required to save a record when digitizing analog signals (such as voice).
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. The sound quality varies depending on digital audio compression algorithms (such as MP3), even if the bit rates are the same. 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 format is used so that no data gets lost due to compression and original sound stays intact. This format is used for music CDs (CD-DA).
Memory (media)	This is a storage system that do 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 that make the microphone to work.
BLE	Bluetooth Low Power. A wireless communication systems that allow the UM384K to work as unattended recorder.

Technical assistance and support

Send request to:
info@dodotronic.com

Ultramic has been developed with the scientific support of CIBRA / University of Pavia.

Safety Precautions

Before using this device, read this manual carefully to ensure that you know how to operate the Ultramic384K 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.

Trademarks and registered trademarks

⚠ **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.

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• SD, SDHC, and SDXC are trademarks of SD Card Association.
• Macintosh and iTunes are trademarks of Apple Corporation.
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Conformity declaration

model: ULTRAMIC384K BLE

Ultramic is in conformity with the protection and compliance requirements of the following EC Directives:
− 2004/108/CE
− 2006/95/CE

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