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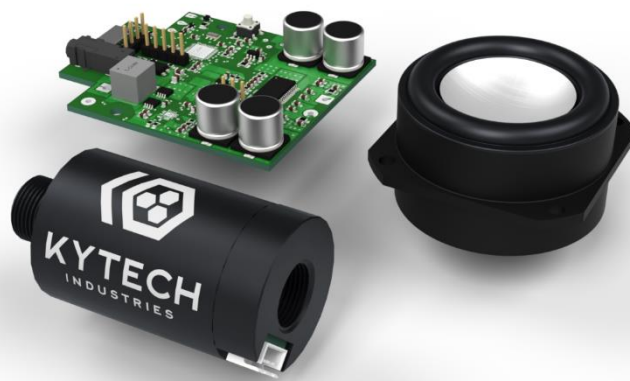
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Custom Sound Device – Maker’s Kit User Manual



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Overview

Welcome to your new Custom Sound Device Makers Kit! We're thrilled to have you as a customer and thank you for your support. We hope you have as much fun using your Maker's Kit as we had developing it.

In this manual, we've included everything you need to integrate your Maker's Kit into your next project, but should you have any questions or need assistance, please don't hesitate to reach out at contact@kytechindustries.com.

1. Specifications

Battery Input Voltage	6.5 – 15V
Trigger Input Voltage	3.3 – 13 V
Low Voltage Cutoff 2S	6.1 V
Low Voltage Cutoff 3S	9.1 V
Amplifier Gain (on audio signal)	20dB
Max Amplifier Power	50 Watts
Idle Power Consumption	0.5 Watt

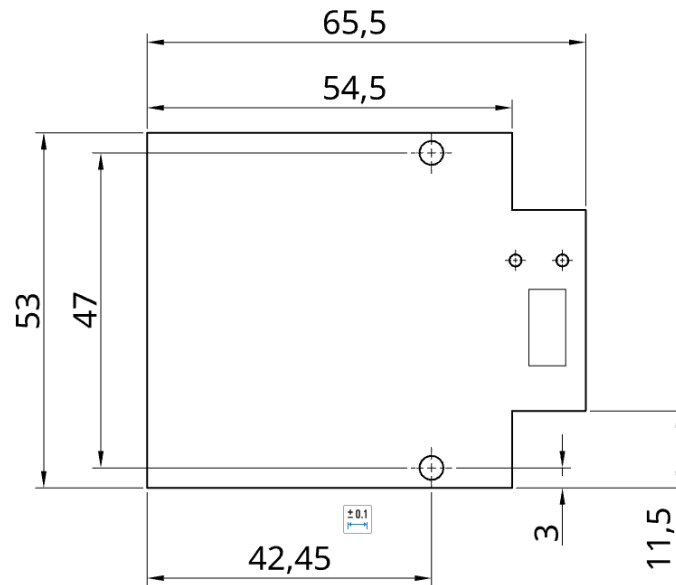
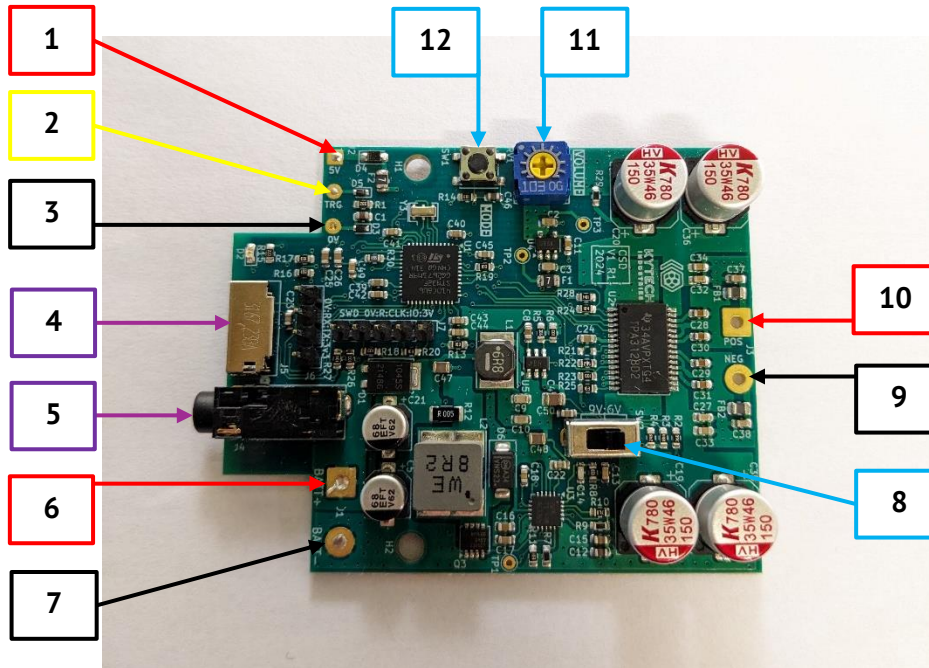


Figure 1 - PCB Dimensions (millimetres)

2. Basic Operation

Your Custom Sound Device (CSD) Maker's Kit (MK) comes ready to go and wired up in standard form (see section 4 for alternate wiring options) and can be used right away. We've included a micro SD with a few sounds to get you started.



- (1) Trigger Sensor 5V supply
- (2) Trigger Input
- (3) Trigger 0V
- (4) Micro SD Card Mount
- (5) 3.5mm Audio Jack Output
- (6) Battery Positive
- (7) Battery Negative
- (8) Voltage Cut-Off Selection Switch
- (9) Speaker Negative
- (10) Speaker Positive
- (11) Volume Adjustment Pot
- (12) Mode Button

Figure 2 - Main PCB Inputs and Outputs

2.1. Powerup

On powerup, your CSD will make some tones indicating the status of the SD card:

Tone Sequence	State Indication
3 beeps, ascending tones	Success! SD card is installed, and sound files are present



3 beeps, descending tones	Fault: SD card is not installed. Playback will default to a single tone
4 beeps, descending tones, last two beeps at same tone.	Fault: SD card is installed, but no sound files are detected. Playback will default to a single tone

2.2. Mode Selection

To cycle through the playback modes, single tap the **Mode Button** (Figure 2, 12). While cycling through the modes, the device will play a number of beeps indicating the selected mode number.

2.3. Modes

Mode	Name	Description
1	Random Playback	Random audio file playback with each triggering of the device.
2	Sequential Playback	Audio files are sorted alphabetically, with playback incrementing through the files with each triggering of the device.
3	Burst	See below Section 2.3.1
4	Track Select	Each triggering of the device plays the selected audio file. To select a file, double-tap the Mode Button while the device is in Mode 4 to cycle through the available options. The device will play a preview (3 seconds) of the currently selected file.

2.3.1. Burst Mode

Burst Mode allows you to playback a specific audio file when burst-fire is detected. For example – you want to the device to play the national anthem (or The Imperial March) while you’ve got the trigger pinned laying down some suppressing fire.



Burst Mode Track Selection

Burst Mode automatically plays the first audio track on the SD card. Tracks on the SD card are sorted in alphabetical order, so to set a specific burst playback track, you must name the file so that it is indexed first on the SD card. Adding "AA" to the start of the file name is the best way to achieve this. Example:

AANATIONALANTHEM.wav

For full details on correct file formatting, please see Section 3.

The burst mode parameters can be adjusted:

Parameter	Description
Shot-Count	The number of shots required to trigger burst mode for the given checking time
Burst-Time-Ms	The period of time which the shot count must be achieved within to trigger burst mode
Time-Out-Ms	The burst playback will automatically stop if no new shots are detected within the timeout period after the last recorded shot.

The default Burst parameters are:

Shot-Count: 10

Burst-Time-Ms: 3000 milliseconds (3 seconds)

Time-Out-Ms: 3000 milliseconds (3 seconds)

When in default, the user must shoot 10 shots in less than 3 seconds to trigger the mode. If the user takes too long to fire the required shots, the timing and counter resets after 3 seconds. Once the burst audio starts playback, if no shots are detected within 3 seconds, playback will stop.

To assign custom Burst Mode parameters, you must include a text file on the SD card named settings.txt. The format of the text file must be:

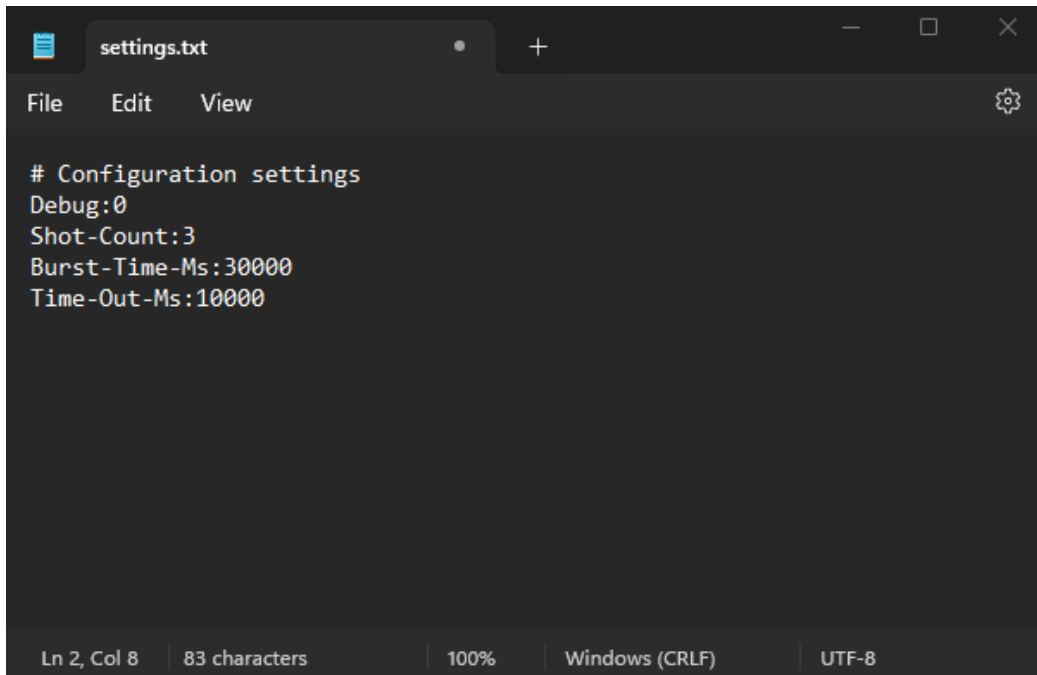
```
# Configuration settings
```

```
Debug:0
```

```
Shot-Count:10
```

```
Burst-Time-Ms:3000
```

Time-Out-Ms:3000



```
settings.txt
File Edit View
# Configuration settings
Debug:0
Shot-Count:3
Burst-Time-Ms:30000
Time-Out-Ms:10000
Ln 2, Col 8 | 83 characters | 100% | Windows (CRLF) | UTF-8
```

Figure 3 - Example settings.txt file with some long time values

2.4. Volume Adjustment

The volume can be adjusted by turning the **Volume Adjustment Pot** (Figure 2, 11).

- To increase the volume, turn the pot clockwise.
- To reduce the volume, turn the pot anti-clockwise.

Generally, you'll want this set to maximum, and use audio file adjustments for the desired volumes on a per-file basis.

2.5. Low Voltage-Cutoff (LVC) Selection

Use the **LVC Selection Switch** (Figure 2, 8) to set the low voltage cutoff according to your battery type. The switch position (2S or 3S) is labelled on the PCB.

- For a 2S LiPo, set the switch to 2S.
- For a 3S LiPo, set the switch to 3S.

2S

3S



Low Battery Warning Voltage	7.0V	9.5V
LVC Voltage	6.5V	9.0V

The device will emit a low battery warning, 3 low frequency beeps, when voltage levels are approaching the LVC Voltage. The low battery warning will repeat every 60 seconds until the LVC Voltage is reached where the device will shut down and remain off to protect the battery.

If the LVC Voltage is violated, the device may experience brown out (turning off and on again), unstable operation, or will power down completely until a charged battery is connected.

We advise switching to a charged battery as soon as the low battery warning is heard.

2.6.External Audio Output

Audio playback can be routed to an external powered speaker through the 3.5mm Audio Jack Output (Figure 2, 5). If a speaker is also soldered to the PCB, audio will be simultaneously output through both the onboard and external speakers.

3. Installing Audio Files

The CSD uses a Micro SD card to read sound files. To add a sound file, simply drag and drop the .wav file from your computer onto the SD card, then insert the card into the



Micro SD port on the PCB (Figure 2, 4). To work with the CSD, sound files must be formatted as described in the following sections.

3.1. Sound File Format/Properties

For the device to recognize and process an audio file, it must have the following properties:

File Type	.wav
Audio Signal Type	Mono
Sample Rate	44.1 kHz
Encoding	Signed 16-bit PCM
File Name	All caps, no spaces or special characters. Example: MK416.wav

Files installed on the SD card are sorted alphabetically – you can manipulate the order of sound files by adding a leading designator to the file name:

AMK416.wav
BSUPRESSEDRIFLE.wav
CAR15.wav

3.2. Creating/Editing Sound Files with Audacity

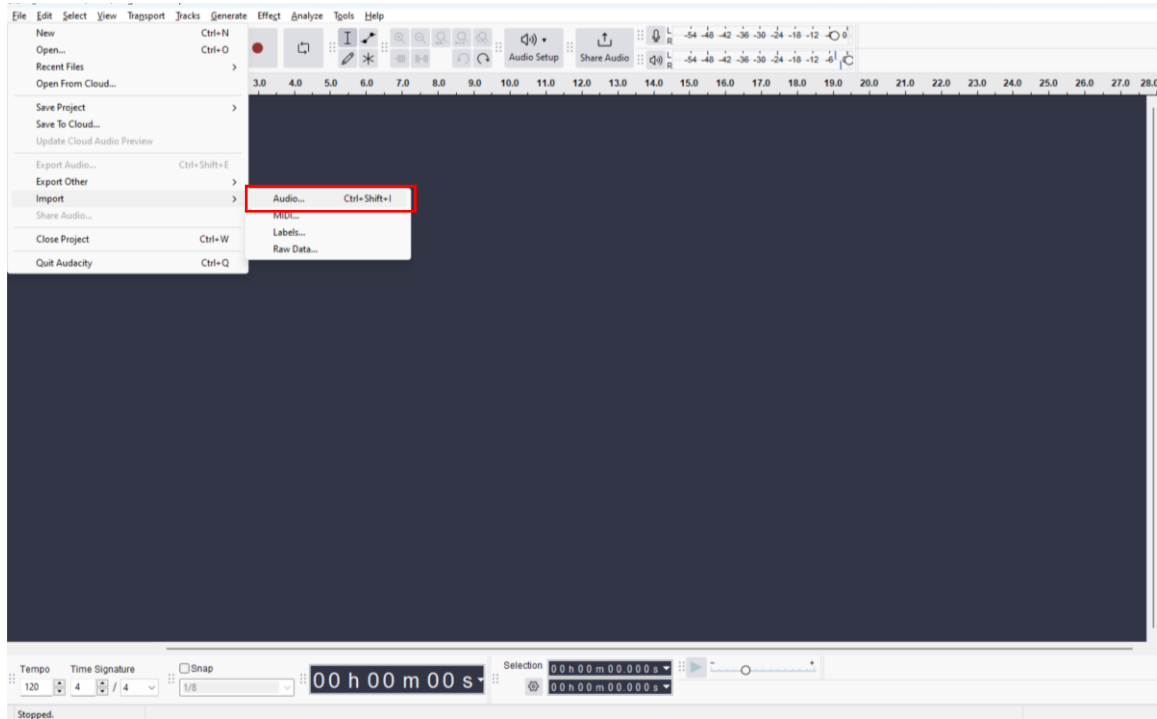
You can edit and create your own sound files using the free Audacity audio editing software.

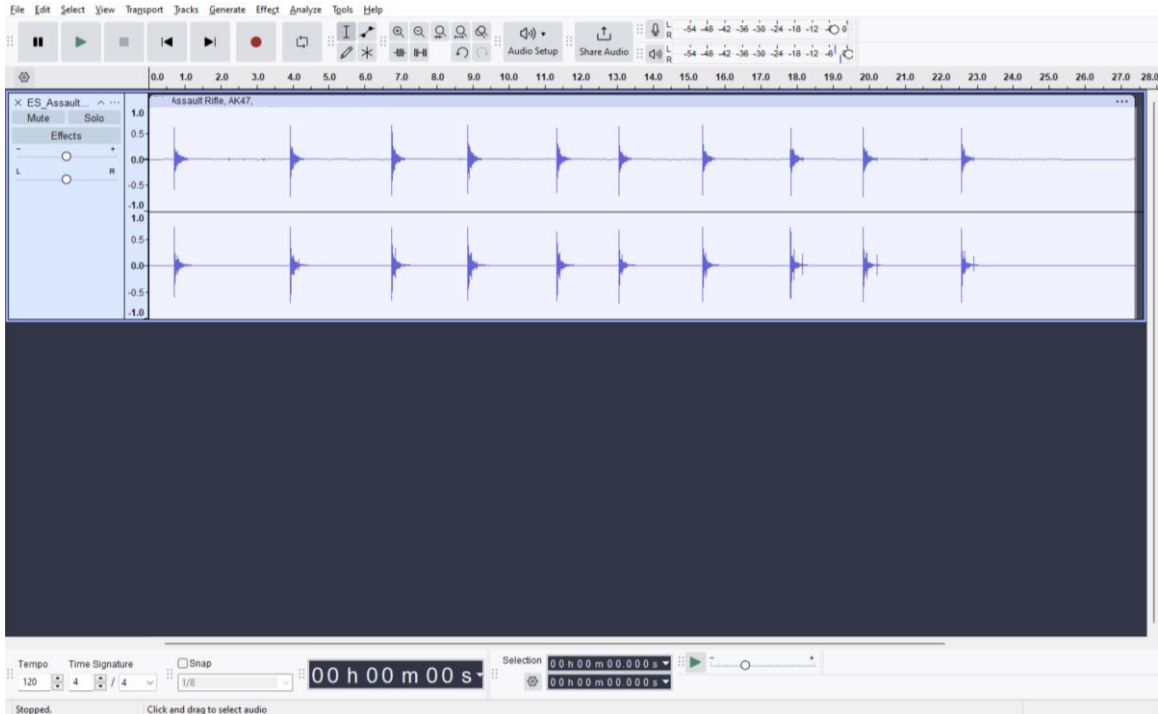
Download: <https://www.audacityteam.org/>



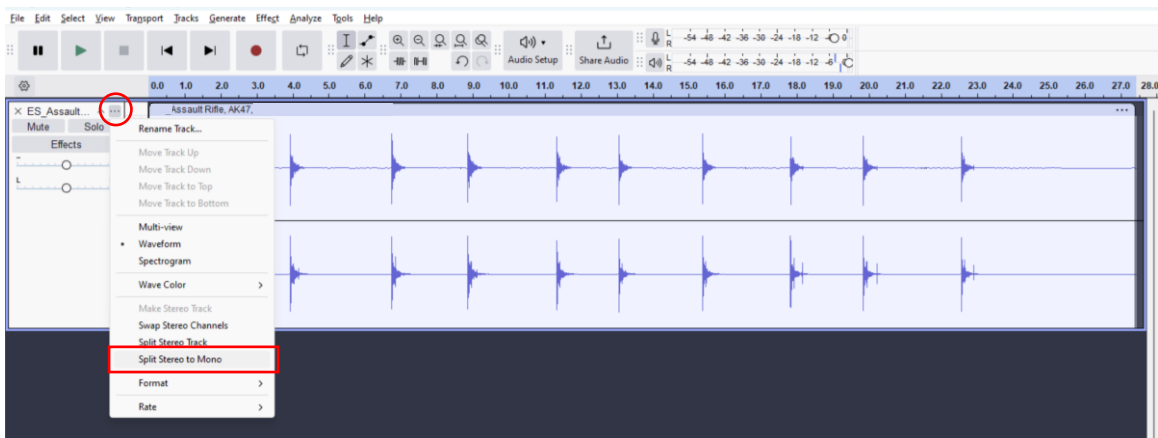
To create a sound file:

1. Download, install and launch Audacity.
2. Go to File > Import > Audio, and select the audio file you want to edit.

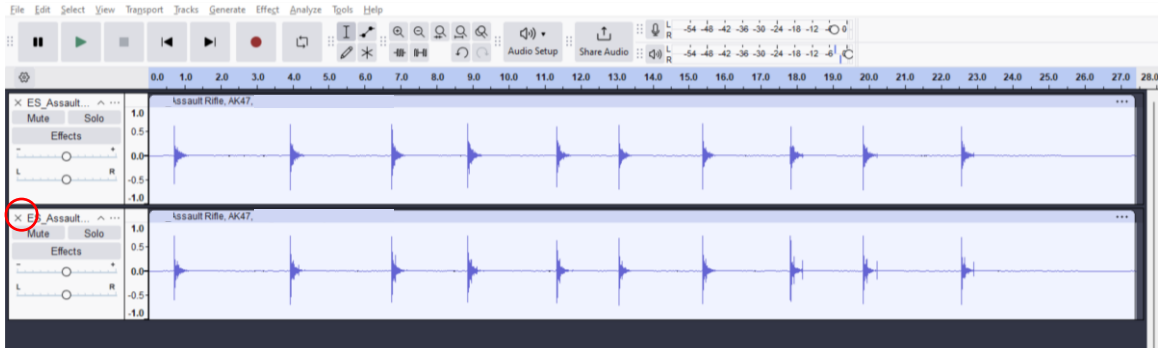




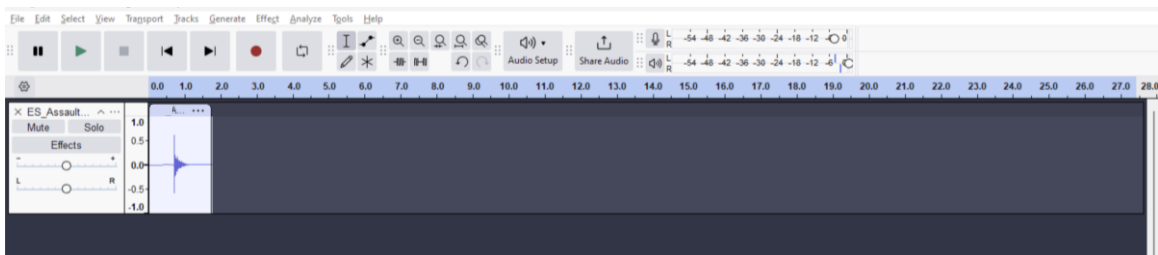
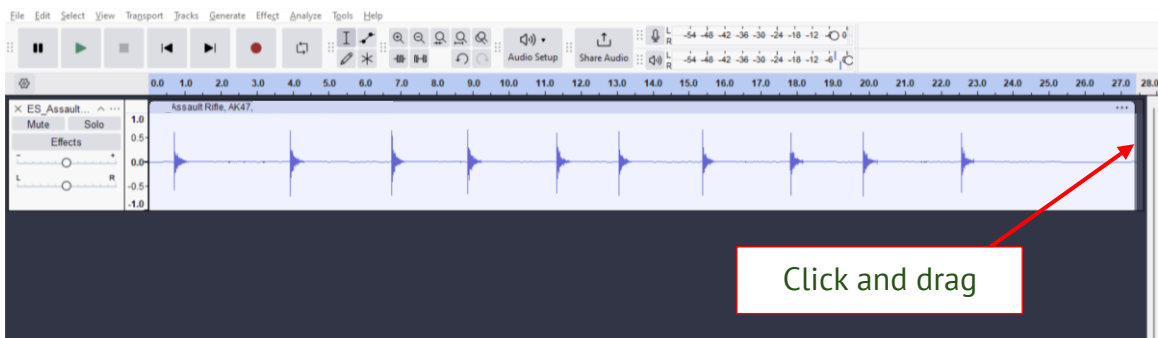
3. In the above example, we have a recording of multiple shots of an AK47, which we want to trim down to a single shot.
4. First, we will split the track to mono. Click the 3 dots above the Solo button, then select “Split Stereo to Mono”.



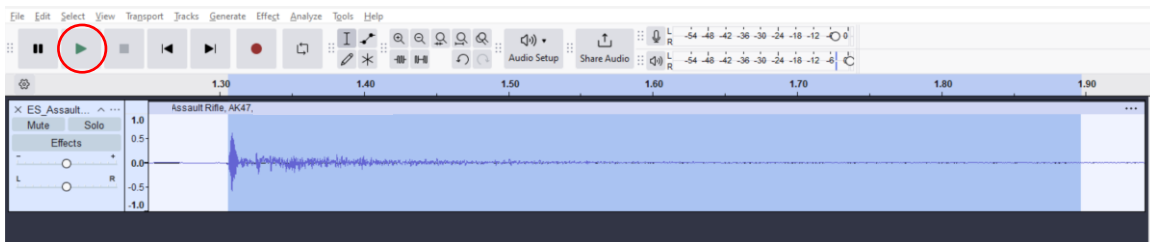
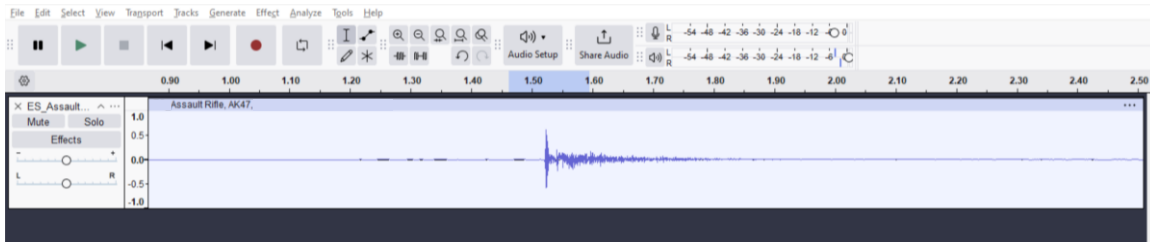
5. Click the X on the bottom track to delete it.



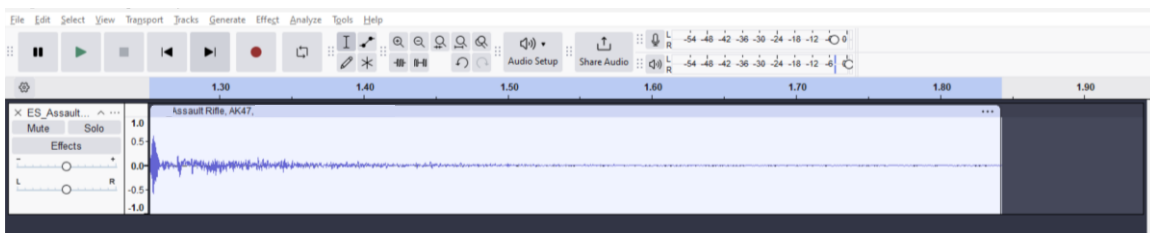
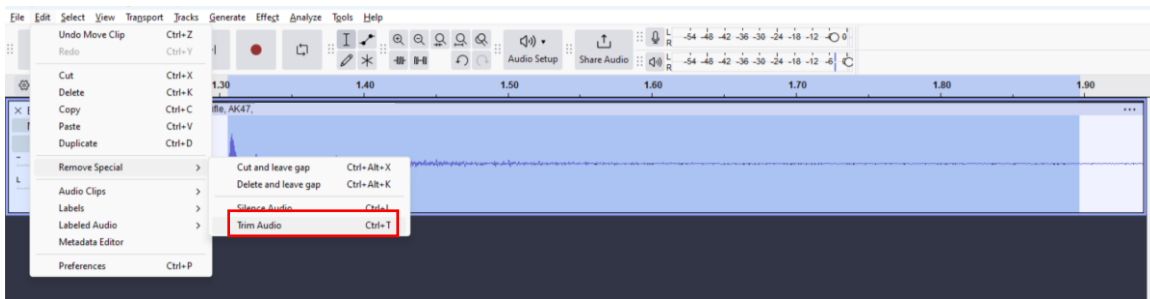
6. Next, do a coarse trim of the track by hovering over the far-right edge of the track, then click and drag to shorten the track to roughly the desired length.



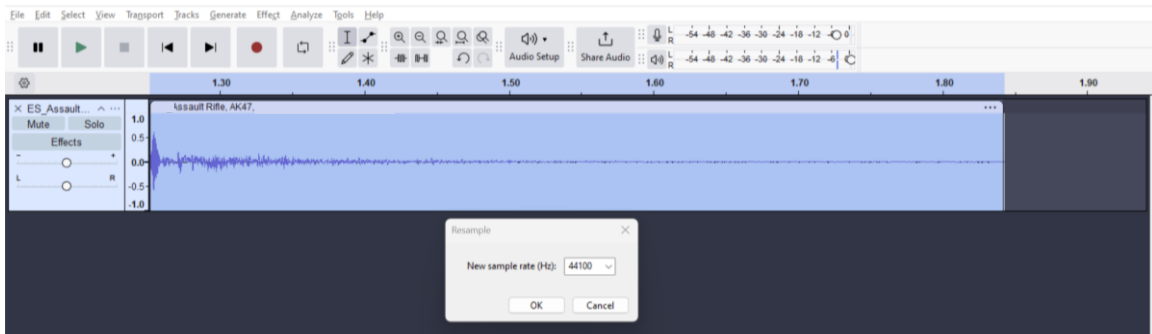
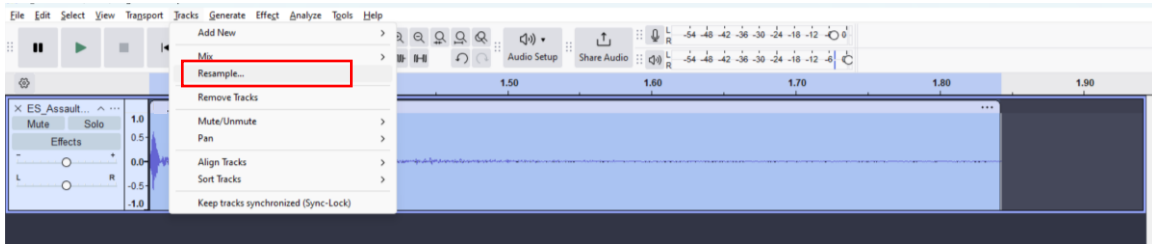
7. To fine trim the track:
 - a. With the mouse in the track area, hold Ctrl and use the mouse wheel to zoom in on the track.
 - b. Left mouse-click and drag to select the fine trim area – we want as little dead-zone on either side of the soundwave as possible.
 - c. Once highlighted, click the Play button to preview the selected area and ensure it captures the desired sound.



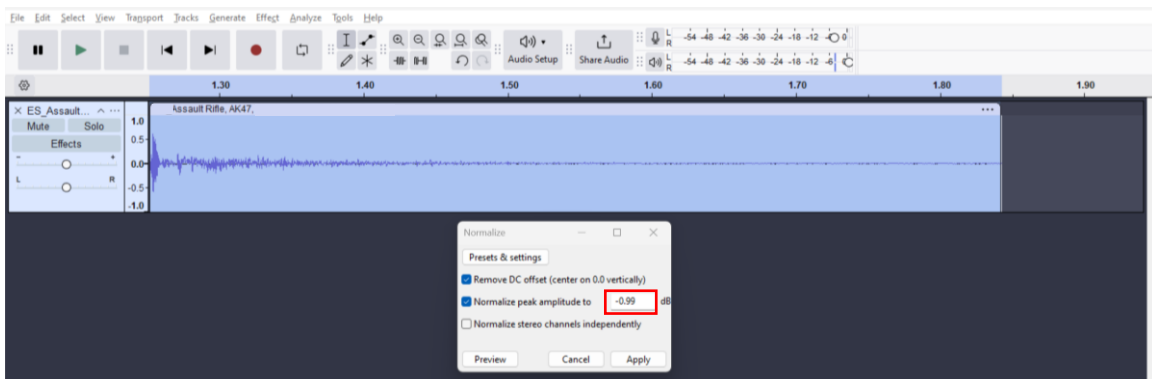
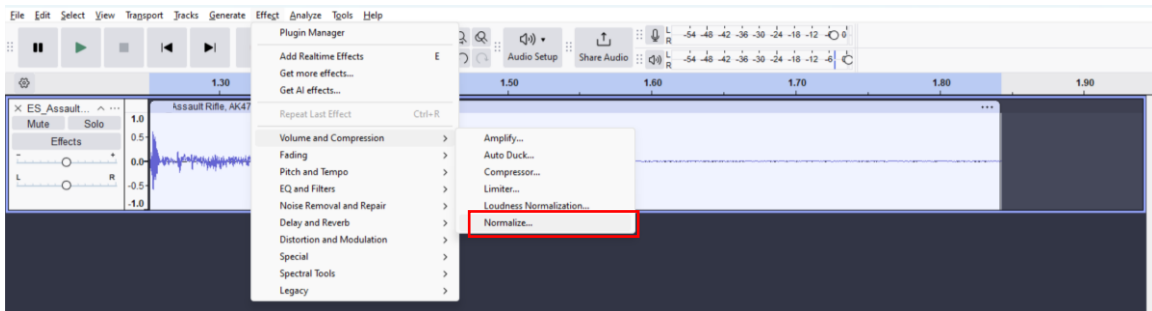
d. Go to Edit > Remove Special > Trim Audio.



8. Hover over the top bar of the audio track and left-click to select the whole track.
9. Go to Tracks > Resample...
10. Set the Sample Rate to 44100.



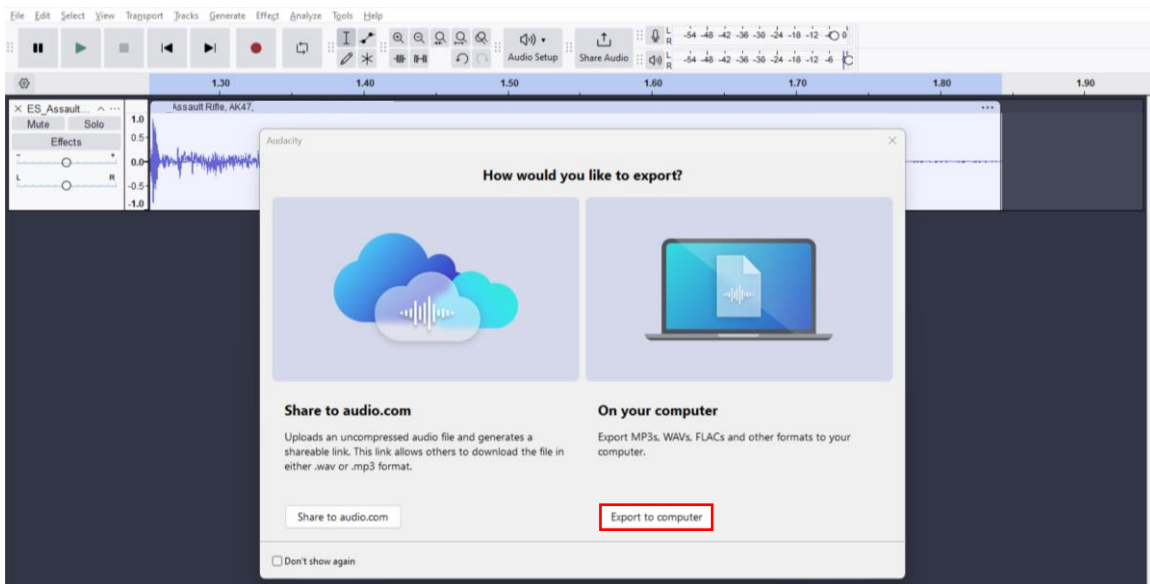
11. Hover over the top bar of the audio track and left-click to select the whole track.
12. Go to Effect > Volume and Compression > Normalize...
13. Set Normalize peak amplitude to -0.99 and click apply.

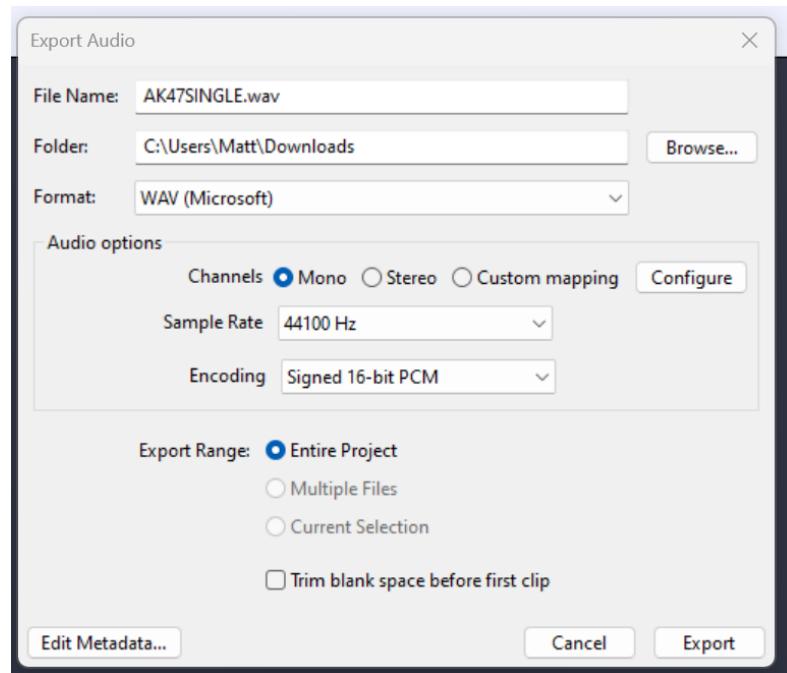




14. Export the edited track:

- Go to File > Export Audio.
- Click Export to Computer.
- Name the file as per the file naming convention: all caps, no spaces or special characters. Example: **MK416.wav**
- Select your export location.
- Confirm “Mono” is selected.
- Confirm the Sample Rate is 44100 Hz.
- Confirm the encoding is Signed 16-bit PCM.
- Click Export.





Your sound file is now ready for use!

General tips for audio files:

- they should be short and start loud to give the best effect with automatic fire rates.
- Aim for sound files around 0.1 to 1.0 seconds long.
- Avoid long trailing reverb/echo sounds or low volume crackle at the end of the tracks.
- If your soundtrack has a long wind-up before the bulk of the audio is heard, then you should choose to fire in semi-auto or have a slow fire rate (with MOSFET controlled rate of fire) so that you get the best outcome. Retriggering the sound file before you've reached the main part of the sound effect means until the very last shot you will not hear it properly. Experiment with sound file lengths and fire rates.



4. Wiring

Your Custom Sound Device comes pre-wired in the default configuration with the Sensor Cable, Battery Cable, and Speaker soldered to the PCB. Adapting the configuration to suit your custom setup is encouraged and will require some basic soldering work if you wish to extend or replace the cables.

4.1. Triggering System

The Custom Sound Device can be triggered either using the supplied Sensor Unit, or by an external voltage source between 5V and 13V.

4.1.1. Using Included Sensor

To use the included Sensor Unit, simply connect the Sensor Cable to the Sensor Unit.

Cable requirements for custom made cables:

- Wire: **24 AWG minimum**
- Sensor Connector:
 - CONNECTOR: **JST part number XHP-3**
 - CRIMPS: **JST part number SXH-001T-P0.6**

4.1.2. Using Alternate Trigger Method

The Main PCB can be wired directly to your AEG's trigger or microswitch/MOSFET fire control unit for shot triggering. Note that this wiring configuration only supports semi-automatic firing mode. If you pull and hold the trigger down, only one shot will trigger for each pull of the trigger (needs a transition of voltage).

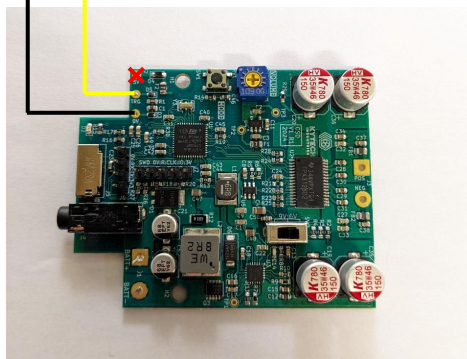
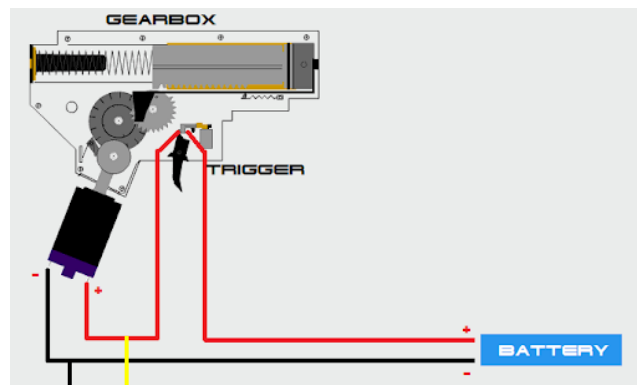


Figure 4 - Wiring Directly to AEG Trigger



5. Sensor Unit



5.1. Overview + Specs

The included Sensor Unit is plug-and-play with the Makers Kit using the supplied Sensor Cable. The sensor utilises transmitting and receiving UV diodes to trigger the CSD when a projectile passes through the barrel of the sensor.

The Sensor Unit also doubles as a tracer unit, compatible with green tracer BB's. Please note that the tracer functionality will not work with red tracer BB's.

Input Voltage	5V
Output Voltage (signal)	5V
Connector (sensor side)	JST XH Series Part Number: S3B-XH-SM4-TB
Connector (cable side)	JST XH Series Part Number: XHP-3



5.2. Disassembly

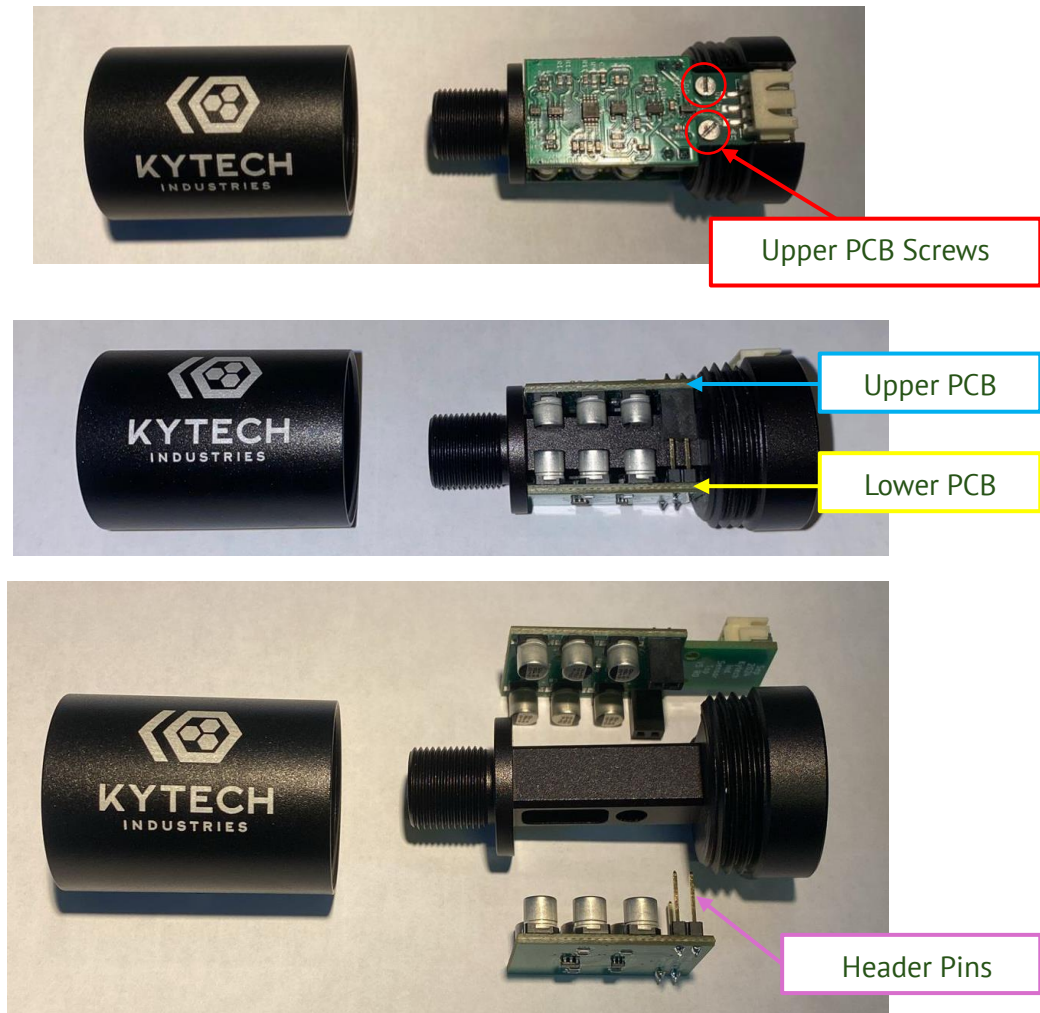


Figure 5 - Sensor Disassembly

To disassemble the Sensor Unit:

1. Disconnect and remove the sensor unit from your device.
2. Remove the Sensor Unit Outer Housing by unscrewing it clockwise.
3. Remove the 2 x M2 screws securing the Upper PCB to the Sensor Unit Inner Part.
4. Carefully wiggle the upper and lower PCB's to separate them from the Inner Part.
5. To reassemble the Sensor Unit, repeat steps 1 through 4 in reverse order, taking care to ensure that the header pins connecting the upper and lower PCB's are aligned and securely seated.



5.3.Wiring

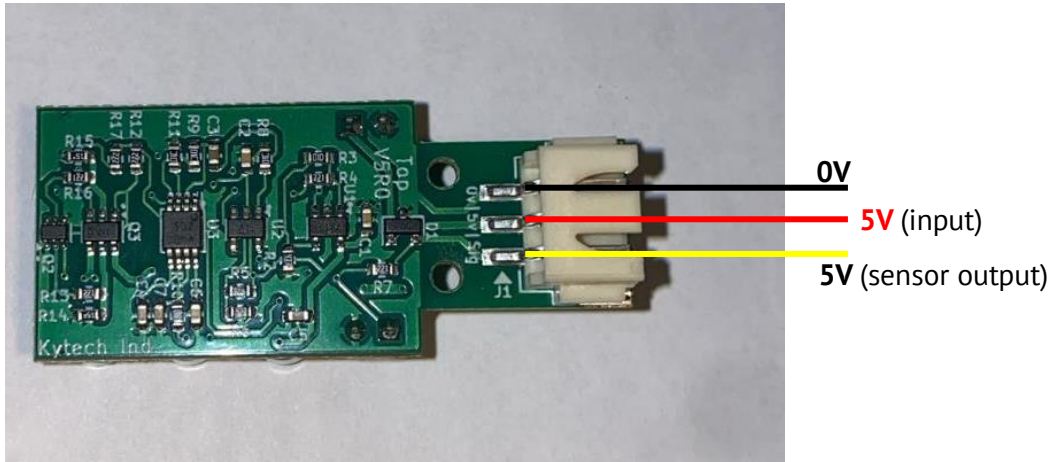


Figure 6 - Sensor Wiring



6. Troubleshooting

Concern	Diagnosis Steps
Device not powering on	<ul style="list-style-type: none"> - Check battery is sufficiently charged - Confirm LVC switch is set correctly - Check physical connections and connectors
Device not playing sound when triggered	<ul style="list-style-type: none"> - Check sensor connector is properly seated - Check sensor cable connections at Main PCB - Check SD is installed - Check volume is turned up - Check sound files are correctly formatted - Test using the supplied SD and files - Check sensor is triggering: <ol style="list-style-type: none"> 6. Unscrew sensor outer housing 7. With the device powered on, insert a q-tip into the sensor barrel – a blue UV light will flash if the sensor is triggered
Device restarts when triggered	<ul style="list-style-type: none"> - Generally caused by battery voltage dropping below the low voltage cutoff upon playing the sound. - If you are experiencing device restarts before the low battery warning is sounded, we recommend either: <ol style="list-style-type: none"> a. Lower the volume of the device b. Lower the volume of the audio track c. Use a freshly charged battery d. Power the device using a 3S 11.1V battery <p>For maximum volume and loudness, we recommend using a 3S 11.1V battery.</p> <p>Note that some audio files are “louder” than others and will cause a more significant load and resulting voltage drop when triggered. We recommend tuning your audio file volume along with the device volume to achieve optimal performance for your application.</p>



If you are still experiencing concerns with your device, please get in touch at contact@kytechindustries.com. To help us assist you, please provide a debug file as per the instructions below.

To create a debug file:

1. Create a .txt file called settings.txt
2. Populate settings.txt with debug set to 1 as below. Other settings can just be the defaults shown:

```
# Configuration settings
```

```
Debug:1
```

```
Shot-Count:10
```

```
Burst-Time-Ms:3000
```

```
Time-Out-Ms:3000
```

3. Put settings.txt on your micro SD card and insert it in the CSD.
4. Replicate the concern you are experiencing with the device.
5. Remove the SD and access it with your computer.
6. Open the SD and save the file DEBUGLOG.txt somewhere onto you computer.
7. Send the file to us for review.

```
settings.txt
File Edit View
# Configuration settings
Debug:1
Shot-Count:2
Burst-Time-Ms:3000
Time-Out-Ms:3000
Ln 2, Col 8 | 81 characters | 100% | Windows (CRLF) | UTF-8
```

Figure 7: Example settings.txt file content with debug enabled