

 [rkmtlab](#) / [multi-ems](#)




Join GitHub today












[Dismiss](#)

GitHub is home to over 36 million developers working together to host and review code, manage projects, and build software together.

[Sign up](#)

EMS with multiple channels, for prototyping etc.

 89 commits 9 branches 1 release 2 contributors MITBranch: [multi-ems-3.2.2](#) ▼[New pull request](#)[Find File](#)[Clone or download](#) ▼

 mkono505 Merge pull request #11 from mkono505/patch-1 ...	Latest commit b77d2d0 12 days ago
 board_data	2N5551 changed to ECB 11 months ago
 case	add img, case, code etc. 11 months ago
 codes	P5 code update 11 months ago
 images	add img, case, code etc. 11 months ago
 .gitignore	Add .gitignore 2 years ago
 LIABILITYWAIVER.md	add liabilitywaiver last year
 LICENSE.md	Rename LICENCE.md to LICENSE.md 2 years ago
 README.md	add notes and version info 15 days ago
 TERMSOFUSE.md	add liabilitywaiver last year
 partslist.txt	Update partslist.txt 11 months ago

 [README.md](#)

multi-ems

"multi-channel EMS" with Processing and Arduino.
Simultaneous output of maximum of 20 channels are available.

This version has several significant improvements from the prior version.

Branches

A prior stable version can be found in [multi-ems-Apr18](#).
A C++ formatted version (for a prior ver.) can be found in [multi-ems-cpp](#).

Description

The Processing sends serials to a master Arduino.
The master Arduino communicates with the slave Arduino via I2C.

One board has 4 output channels.

However, the channels can be increased by using multiple boards.

In this case, minor revision is required for the source codes.

The board has monophasic signals default.

You can combine 2 channels to use biphasic signals (i.e., one board for 2 channel biphasic output).

READ BEFORE USE

You must read the following document before usage. [TERMSOFUSE.md](#)

By using the repository, you are confirming and agreeing to the terms in the [document](#).

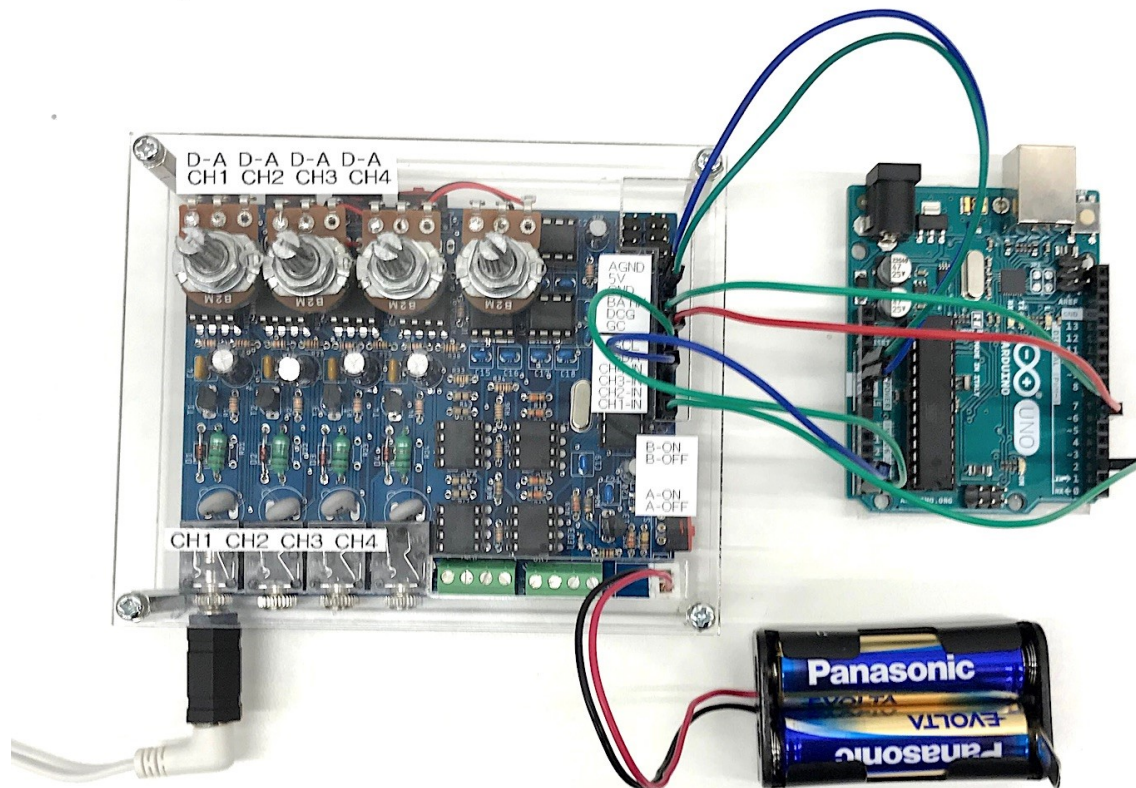
Dependencies

- [StandardCplusplus](#)
- [Metro](#)

Files

- multiEMSUI: The Processing code - GUI
- multiEMSDA: The master Arduino for EMS pulse generation
- multiEMSSlave: The slave Arduino for voltage adjusting pulse generation (500 Hz max)
- /case/multiems.ai: Case data for 3mm plastic

Board Detail



Connect GC to D6, DCG to D7 default.

You can use either the battery connector or the socket (BATIN and GND).

AGND and GND are isolated. AGND is for the Arduino and GND is for the external power source (battery).

Change between Digital (D) and Analog (A) intensity adjustment with the switches for each channels.

Developing your own Board

Follow the partslist.txt.

- There are optional parts for implementation, where you can adjust some parameters by yourself.
- Audio jacks are optional, which you can simply use the other sockets for electrode connection.
- The audio jacks are compatible with [Omrons cables](#) and [electrodes](#) and other EMS standard plugs.
- Use the Arduino bootloader and duplicate the Arduino with ATmega328P (or buy one from [stores](#)). Then write the 'multiEMSSlave.ino' to the microcomputer.

Notes

- The voltage changes exponentially.
- Do not use the audio jack and the socket outputs simultaneously (however, it is possible to do so, but you must understand the theory of the circuit to do so).
- There is an optional socket for battery connection (CN6). You can use this for Li-po batteries etc. Be careful not to use them simultaneously with other Vin sockets. Please double check the polarity because old versions of the boards have the socket built on the oppersite way.
- If you find the output stimulation too weak, you may change the inductor or power source (battery, 3.7V or 4.5V maybe). For the inductor, consider using inductors with a larger ampacity (e.g., 200mA~). I currently use 1mH inductors at 200mA.
- The board has 4 channels. In case for testing, you can simply implement the circuit only for one channel. This will save time and will be a safer approach instead of implementing the whole board at once.

Versions

I've uploaded several versions of the board (sch and brd). 3.2.4 is the latest and the best data, however, it seems that sometimes it is required to adjust the wiring a bit when outsourcing the PCB. Therefore, 3.2.3 is the stable version (however, the CN6 is connected the oppersite way). 3.2.2 is a earlier version, which I personally use for my own boards.

Authors

Michinari Kono, U-Tokyo ([mchkono\[at\]acm.org](mailto:mchkono[at]acm.org))

Copyrights, License

Copyright (c) 2017 Michinari Kono
Released under the MIT license