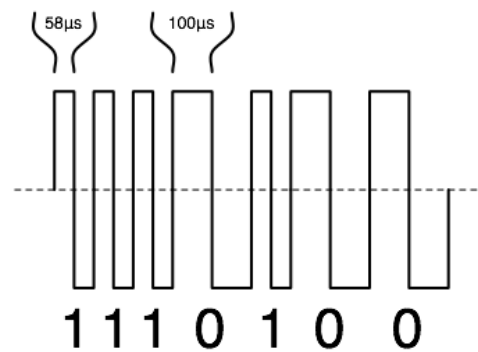
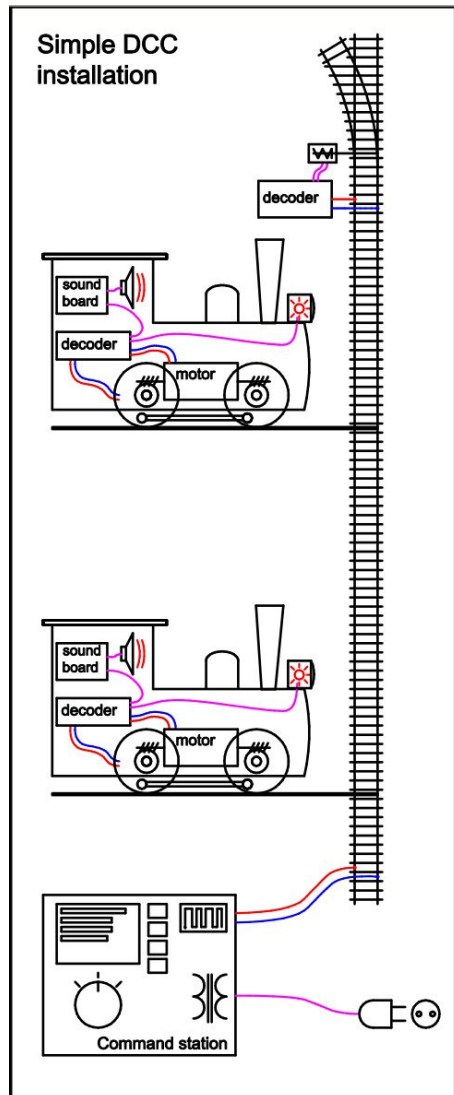






DCC Command Station using TAPAS

stefaandesmet2003@yahoo.co.uk

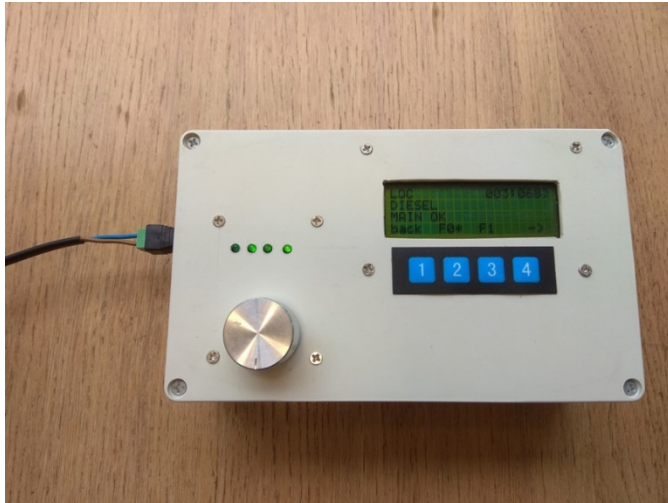
DCC = Digital Command Control



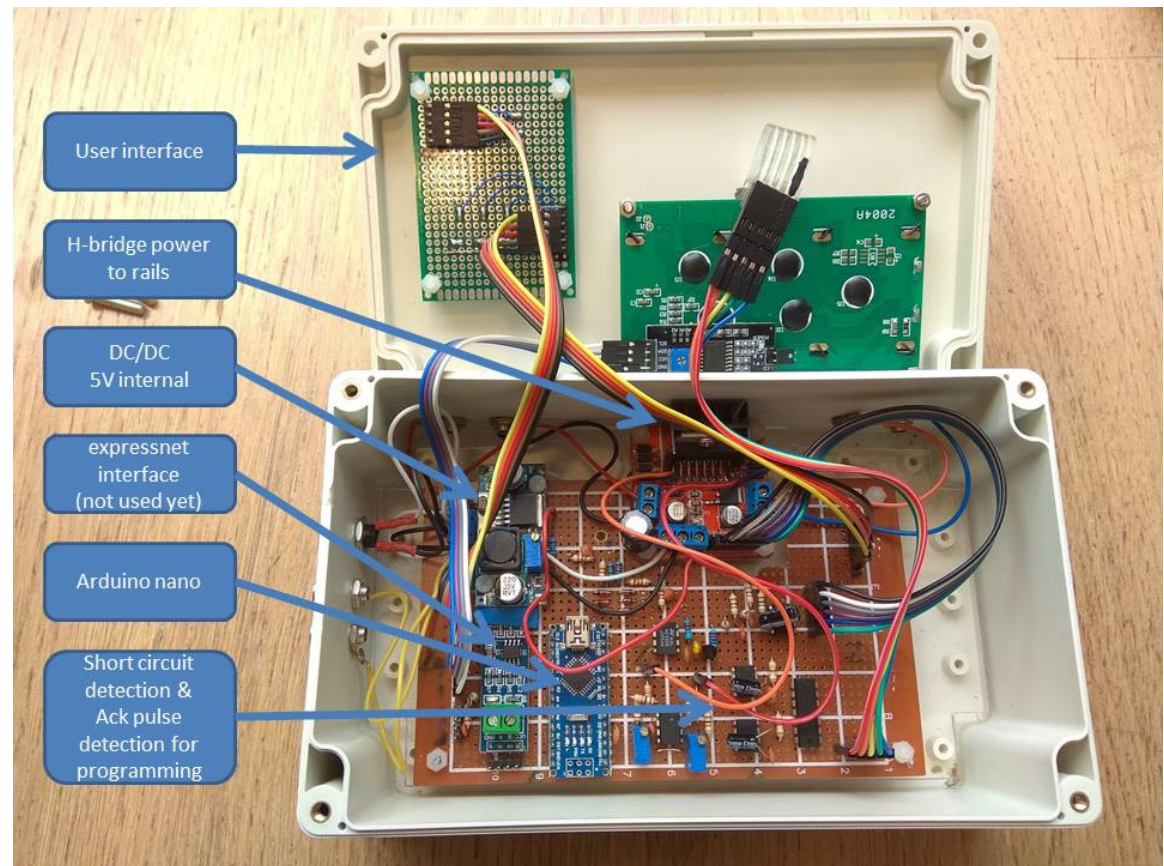
DCC track signal format

-  Locomotives on the same track can be independently controlled
-  Loc decoders offer advanced features such as load-dependent acceleration, lighting, sound, etc.
-  Control of accessories (turnouts, signals, servos, ...)
-  Computer-controlled model train layouts

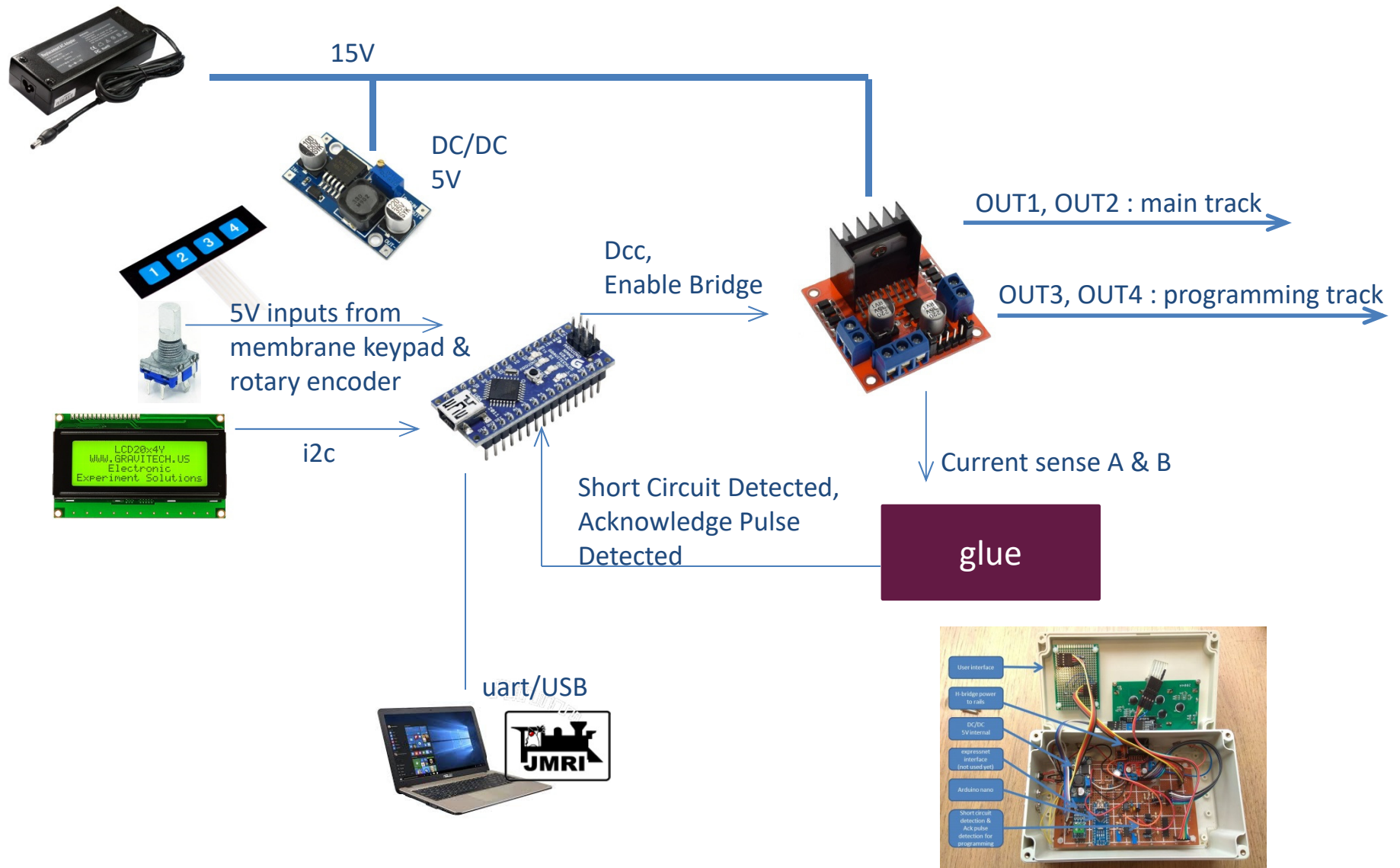
DCC Command Station



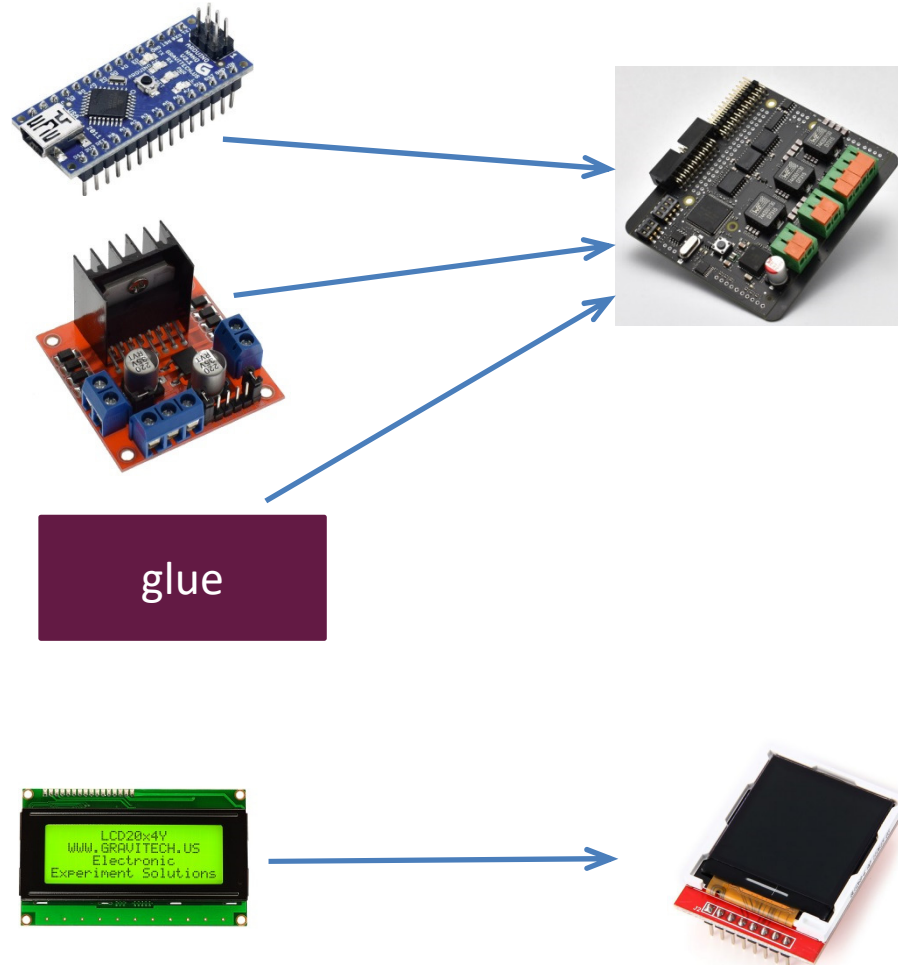
- 🔧 Built in 2016 using arduino nano
- 🔧 Software from opendcc.org ported to arduino (atmel328p)



Arduino DCC Command Station Hardware Concept



Arduino → TAPAS

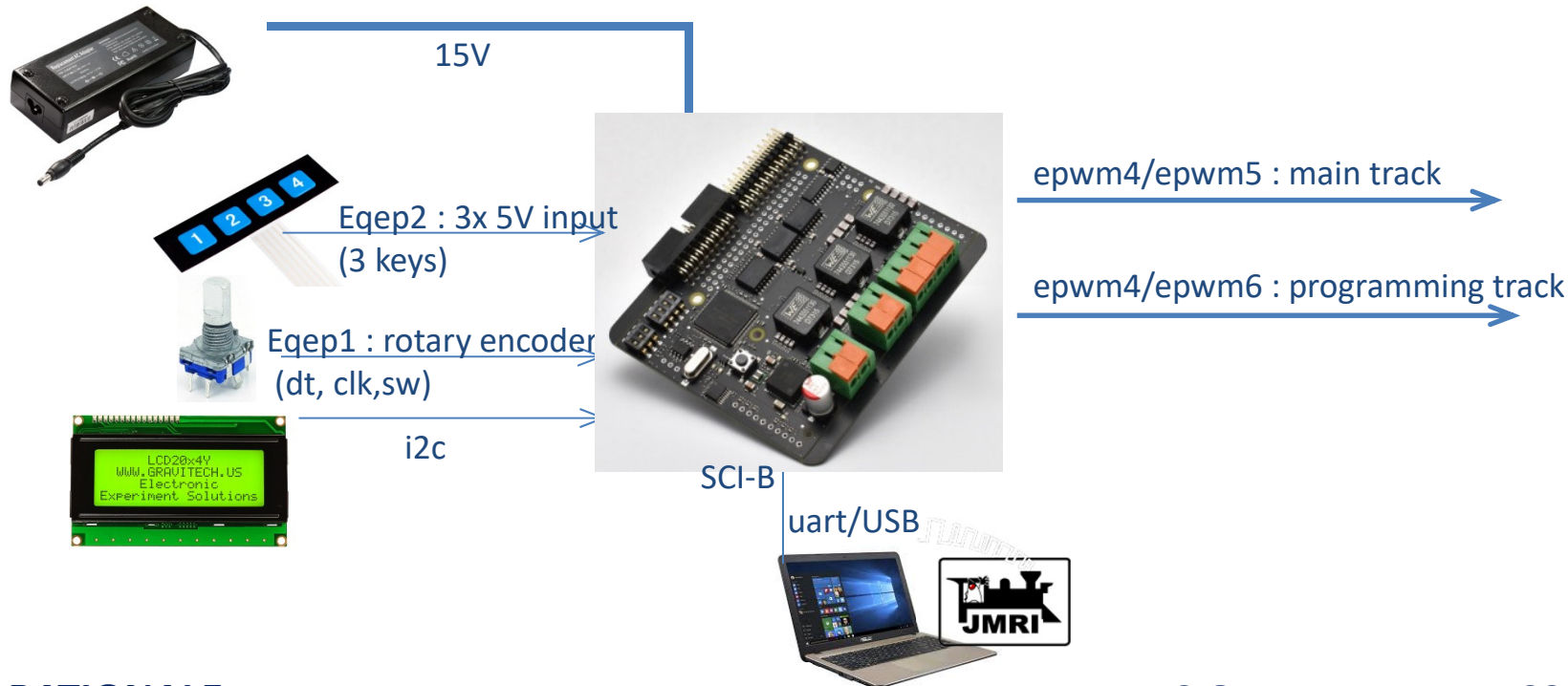


TAPAS advantages !

- ⚙ Much higher power output, for use on large layouts or size “1” gear
- ⚙ Glue replaced with code : short circuit & acknowledge pulse detection (programming track) can be implemented in software using on-board current sensors
- ⚙ More flash & more cycles -> SPI color LCD for user interface upgrade

TAPAS DCC Command Station

Initial Concept



RATIONALE

- 2 output phases needed for DCC signal with alternating polarity
- JP12 digital inputs designed for 24V level -> use EQEP1&2 (5V)
- I2C & SCI-A muxed on same pins, & io32/io33 not routed -> use SCI-B for uart

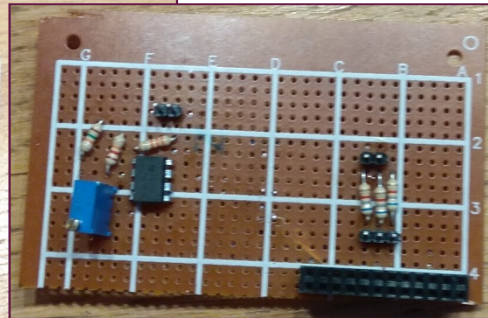
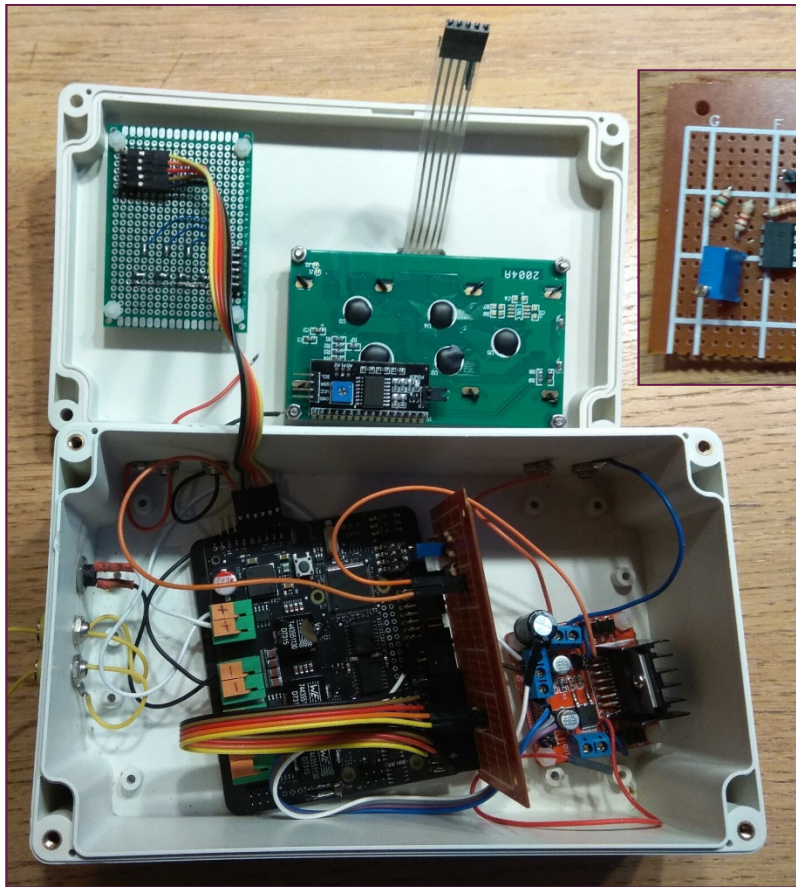


TAPAS OUTPUT FILTER ISSUE!

- Filters 4kHz & 8kHz DCC base frequencies very effectively ☹️
- filter draws >2A with outputs disconnected -> unusable!
- For reference : stereo audio amplifier use case would face a similar issue

TAPAS DCC Command Station

Proof of Concept Implementation



DEMO!

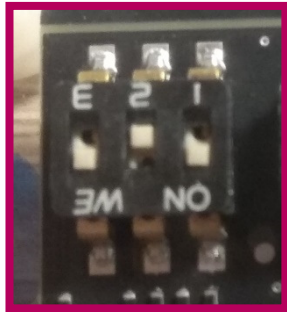
<https://www.youtube.com/watch?v=X4YIN5SQy1U>



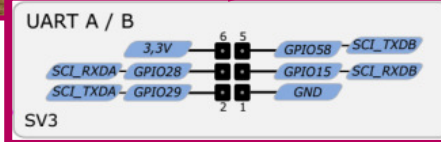
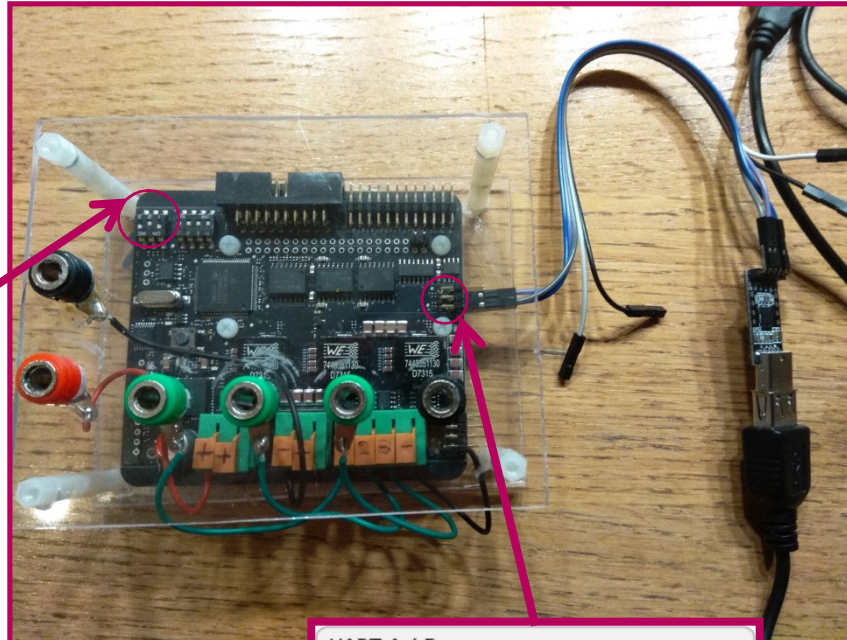
MOVING FORWARD

- Remove output filter ?
- Use L298N module ?

A word on my development setup

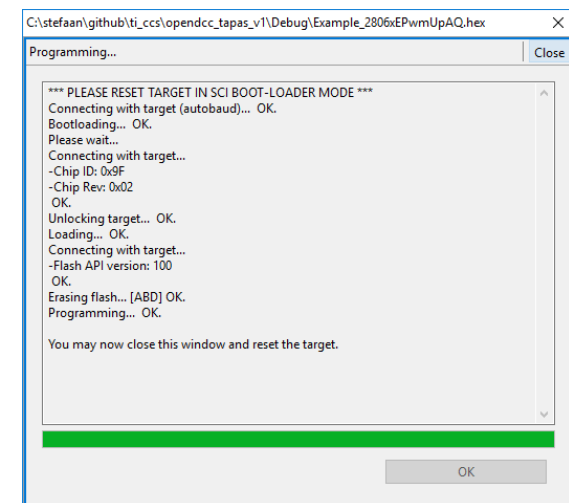


SCI boot mode



DEVELOPMENT SETUP

- Code Composer Studio
- TAPAS board in SCI boot mode
- CP2102 3V3 uart/usb adapter
- serial_flash_programmer tool to load .hex in RAM (28069_RAM_Ink.cmd)
- 'arduino-style' debugging : serial prints & on-board leds (io34/io39)
- Serial_flash_programmer or C2Prog for flashing code (F28069M.cmd)



Lessons learnt

- 🏠 TAPAS H-bridges definitely need dead-band settings (L298N module does not)
→ thanks TAPAS team for sending a new board after I destroyed the power stage unintentionally!
- 🏠 Arduino style environment would be nice for makers using C2000. Energia does not yet officially support C2000 → will test later!
- 🏠 A TAPAS board variant without filter would be nice (or an easy(?) way to couple in/out the filter stage).
This board variant would also allow a stereo audio amplifier application for example
- 🏠 Wiring tms320 io32/33 to a connector (SV4?) would be nice; then i2c can be used together with sci-a & sci-b
- 🏠 Digital inputs at 5V level : for example adding solder bridges to short the 47K resistors (R68/70/72/74) would be nice.
- 🏠 My journey with TAPAS has only begun..