EZ MIDI CONTROL 2.0

Evaluation version using the Bluepill development board.

Please read this page before getting started

Introduction:

EZ MIDI is the easy way to add MIDI, presets, tap tempo and LFOs to effects.

EZ MIDI is used both as the “brain” of the EZ MIDI programmer board and to control effects circuits. This document primarily focuses on using the bluepill board as the programmer which allows you to customize EZ MIDI to suit your needs.

While many of the features have been tested, EZ MIDI 2 is still in BETA. If you run into anything that seems like a but you can email us.

Assumptions:
If you are reading this we assume you have basic knowledge of guitar effects, electronics and basic prototyping materials like breadboards, LEDs, capacitors, resistors, diodes, etc.

You can find more information for building EZ MIDI into an effects unit in other documentation.

What you’ll need to get started:
Bluepill board.
ST LINK programmer.

Additional parts:
6N138 optoisolator (for midi)
5 pin midi jack
24LC32 EEPROMs
MCP42xxx digital potentiometers
Three panel breadboard

Limitations of the evaluation version:

The evaluation version of EZ MIDI is only for personal use, prototyping, evaluation and general setup for later use with EZ MIDI Pro. The evaluation version is not for commercial use.

The evaluation version has all the capabilities of EZ MIDI 2 which include MIDI, presets, LFOs and tap tempo. It is limited in operation time to approximately 90 minutes. After 90 minutes it will stop functioning until it has been powered off and back on again.

FEATURE OVERVIEW:

MIDI SAVABLE PRESETS TAP TEMPO

Easily Customize the EZ MIDI platform with the EZ Wizard board without coding. Use the features you need without worrying about the ones that you don't.

- 7 PWM / Control voltage outputs.
- Control up to 3 MCP42xxx dual digital pots.
- Over 200 LFO/Modulation sources available.
- Supports analog switch or latching relay bypass.

CONTENTS:

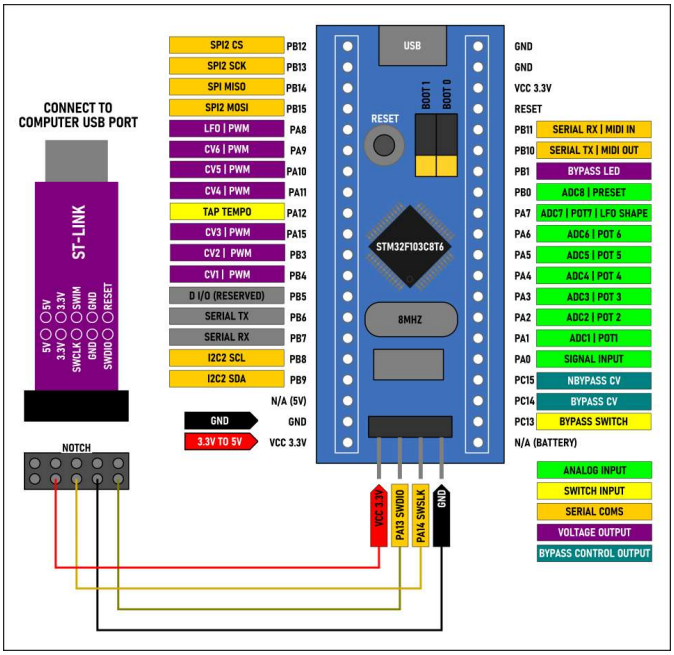
This document was believed to be accurate at the time it was created. Specifications are subject to change without notice.

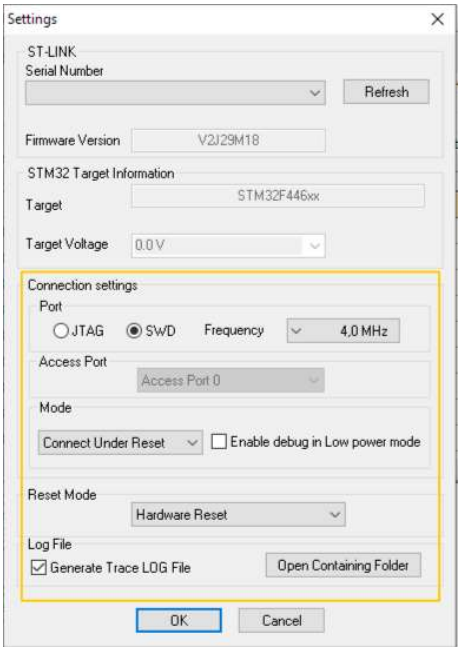
Bluepill board & EZ MIDI

The Bluepill board is based around the STM32F103C8T6, the same microcontroller used by EZ MIDI. The Bluepill is breadboard is breadboard friendly.
Before you can use the Bluepill board you will need to flash the EZ MIDI EVAL bin file.

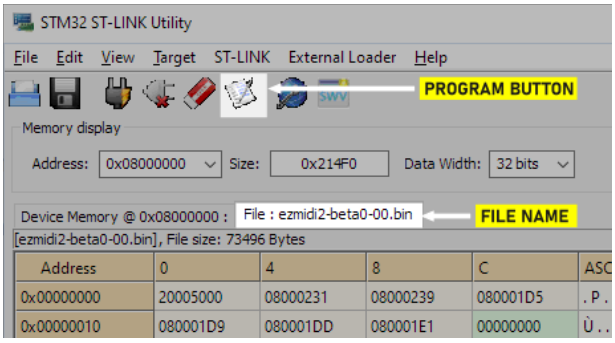
Download the bin file from our website.
Download and install the ST Link utility here: https://www.st.com/en/development-tools/stsw-link004.html.

Connect the ST Link to your computer's USB port and to the Bluepill's SWD pins.
Open the ST Link utility and verify the settings outlined in yellow below.





Open the bin file and verify that the file name is displayed. Then click the program button.



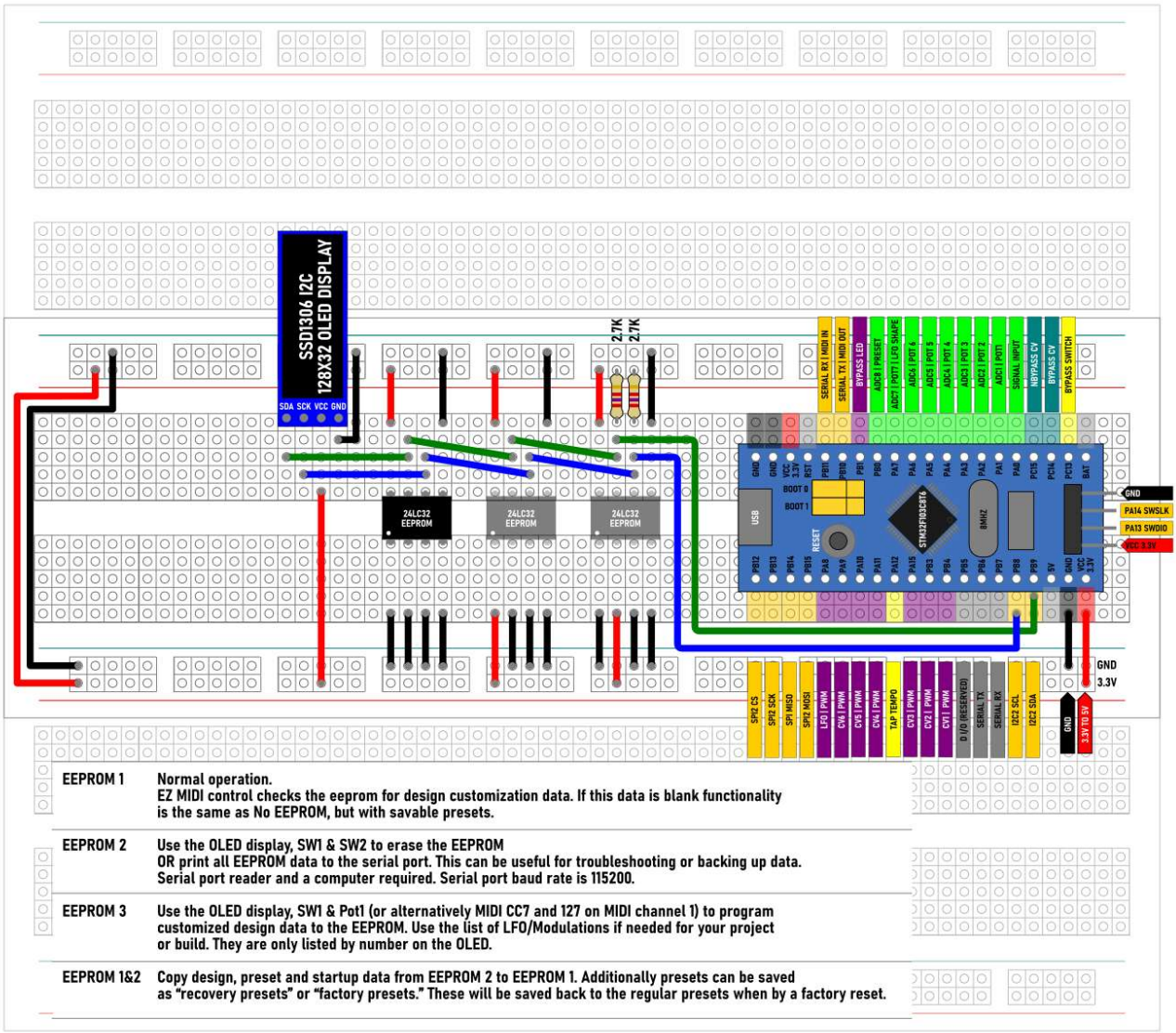
After clicking the program button a status bar will appear momentarily. If you don't receive an error messages the Bluepill board should be ready to go with EZ MIDI installed.

BREADBOARD PREPARATION:

This section shows how to breadboard for creating EZ MIDI customizations and test that your customizations are working as expected. Additional EEPROM tools are also available. This is similar to the EZ MIDI programmer board, without the effects bypass circuit.

A quick note on the EEPROMs: An EEPROM is used to store customization data and user presets.
In a completed effect project you will only need EEPROM 1. This document focuses on creating and storing customization data. For this place EEPROM3. Leave EEPROM 1 & 2 empty (they will be useful later.) See the notes in the drawing for how each EEPROM configuration is used.

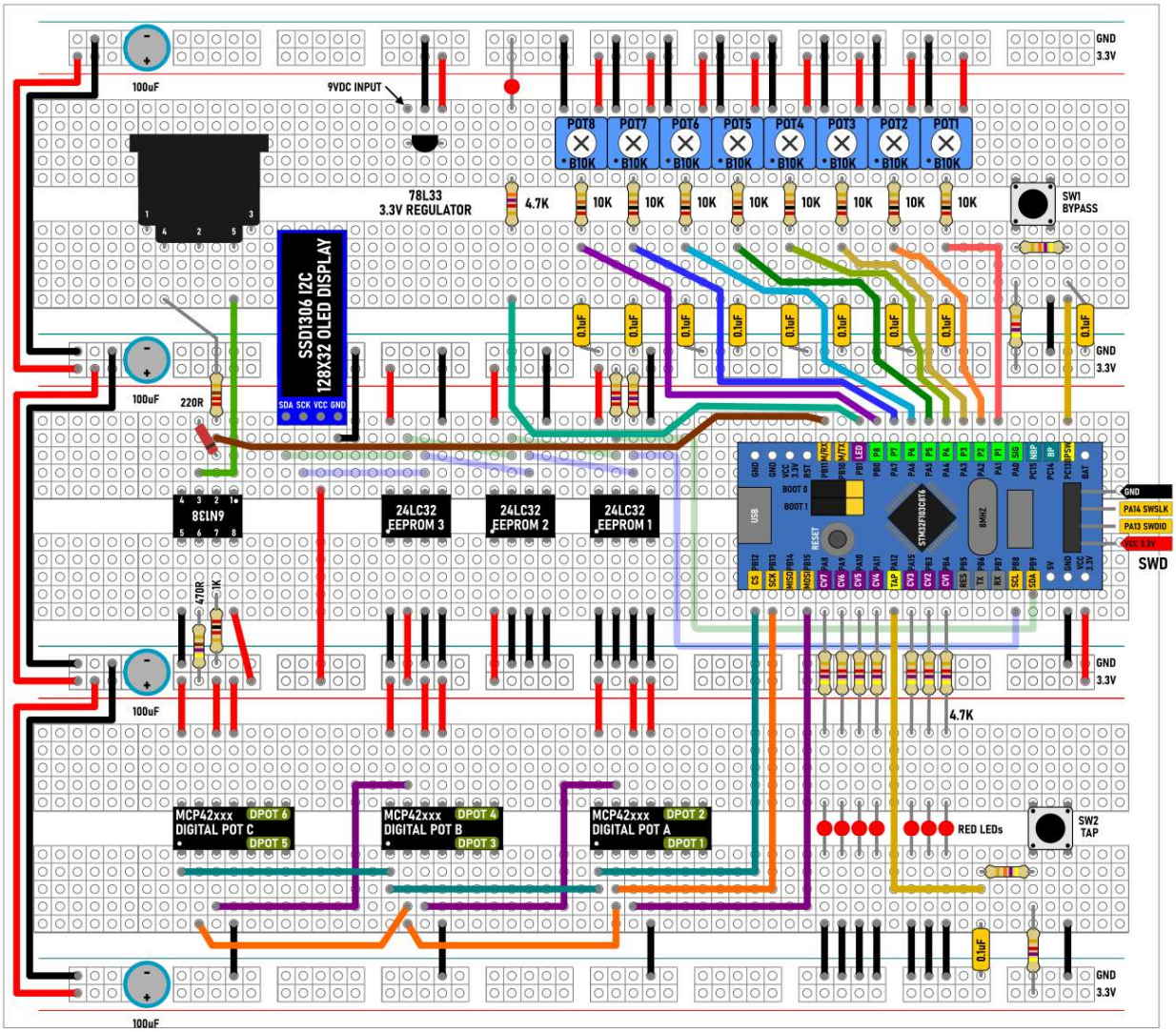
After installing EZ MIDI to the Bluepill board it's time to get it on a breadboard along with other parts for programming and testing.



The BLUE & GREEN wire are the I2C bus. On startup EZ MIDI checks the bus for connected devices. If no devices are detected some versions of EZ MIDI may hang.

After wiring this portion continue on the next page.

These additional components add everything you need for customization and testing.



Customizations can be created via MIDI or using SW1, SW2 and POT1.
EZ MIDI 2 customizations are only available when created via MIDI.
Replace POT8 with an 11 detent pot for better control of presets.

Power:

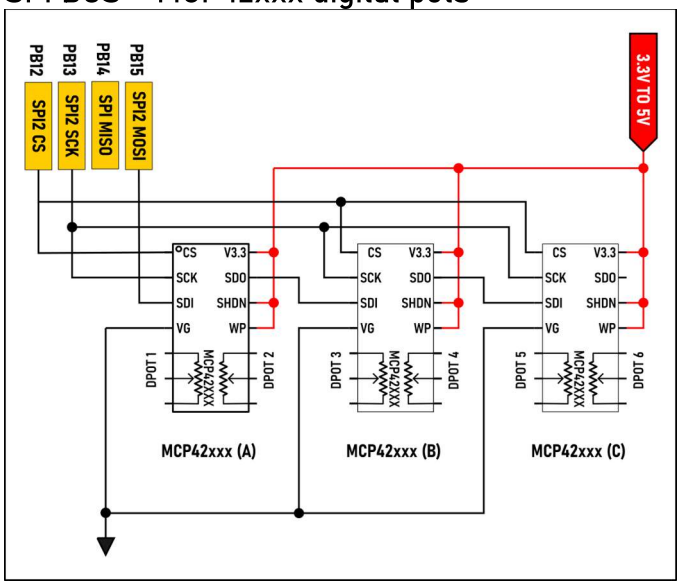
Note the power input at the 3.3v regulator. DO NOT APPLY 9V DIRECTLY TO THE POWER BUS STRIP.
It is possible to power the breadboard by leaving the ST-LINK connected to the SWD pins, however this is not recommended due to low power quality.

Other Pin connections:

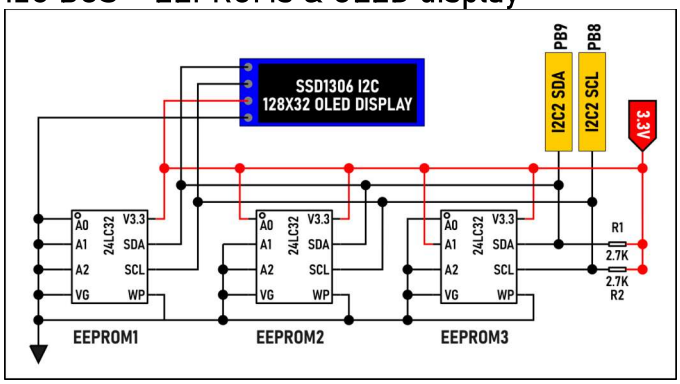
M/TX MIDI OUT (NOT USED) RES RSERVED	Reserved for EZ MIDI PRO.	SIG SIGNAL IN 1.65V BIASED	Signal input, used for envelope based modulation.
RX SERIAL RX TX SERIAL TX	Serial connection for debugging.	BP BYPASS CONTROL VOLTAGE NBP BYPASS CONTROL VOLTAGE	Used to control bypass.

CIRCUIT ELEMENTS:

SPI BUS – MCP42xxx digital pots

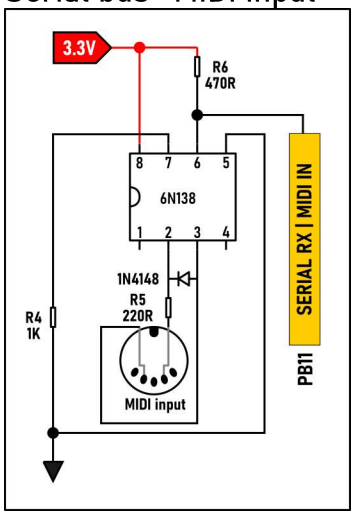


I2C BUS – EEPROMs & OLED display



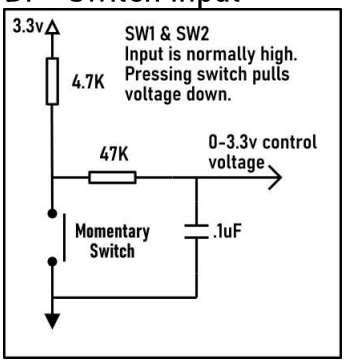
On power up EZ MIDI scans for I2C devices. Functionality is determined by what is connected to the I2C bus. If no devices are connected EZ MIDI may hang.

Serial bus- MIDI input



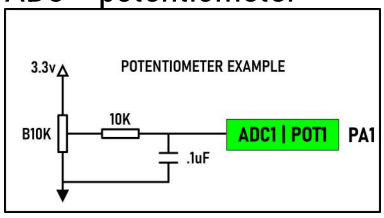
The 6N138 is recommended because it works well at 3.3v and 5v.

DI – switch input



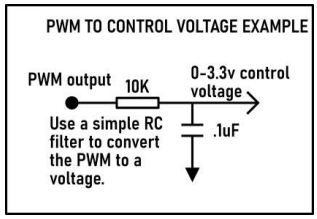
The 47K resistor and .1uF capacitor filters the switch signal to avoid noise and mis-triggers.

ADC - potentiometer



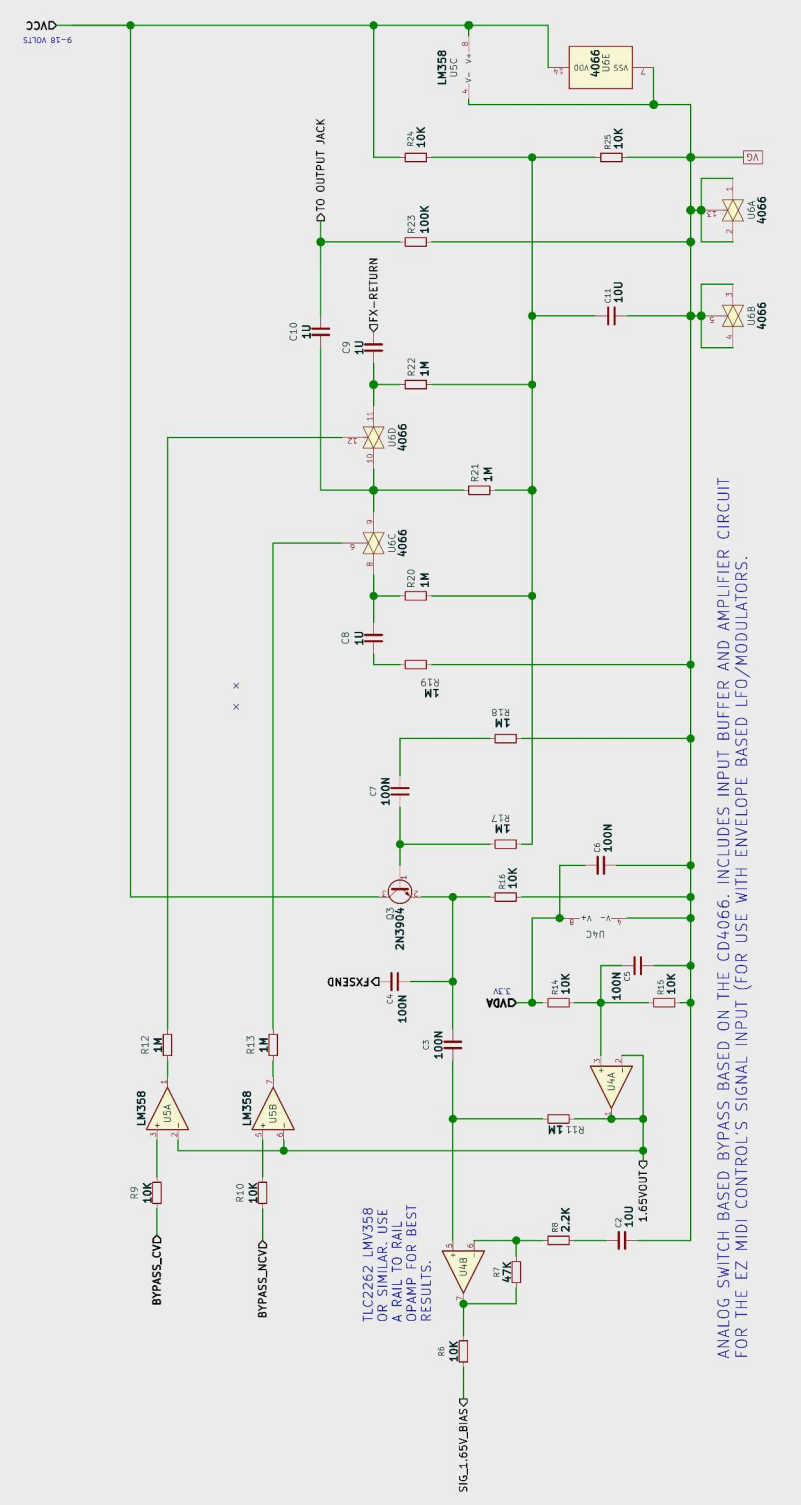
The 10K resistor and .1uF capacitor filter noise for a reliable signal to EZ MIDI's Analog to Digital converters.

Convert PWM to CV



EZ MIDI can't produce analog voltages. It can create PWM outputs that are easily converted to voltages with a resistor and capacitor.

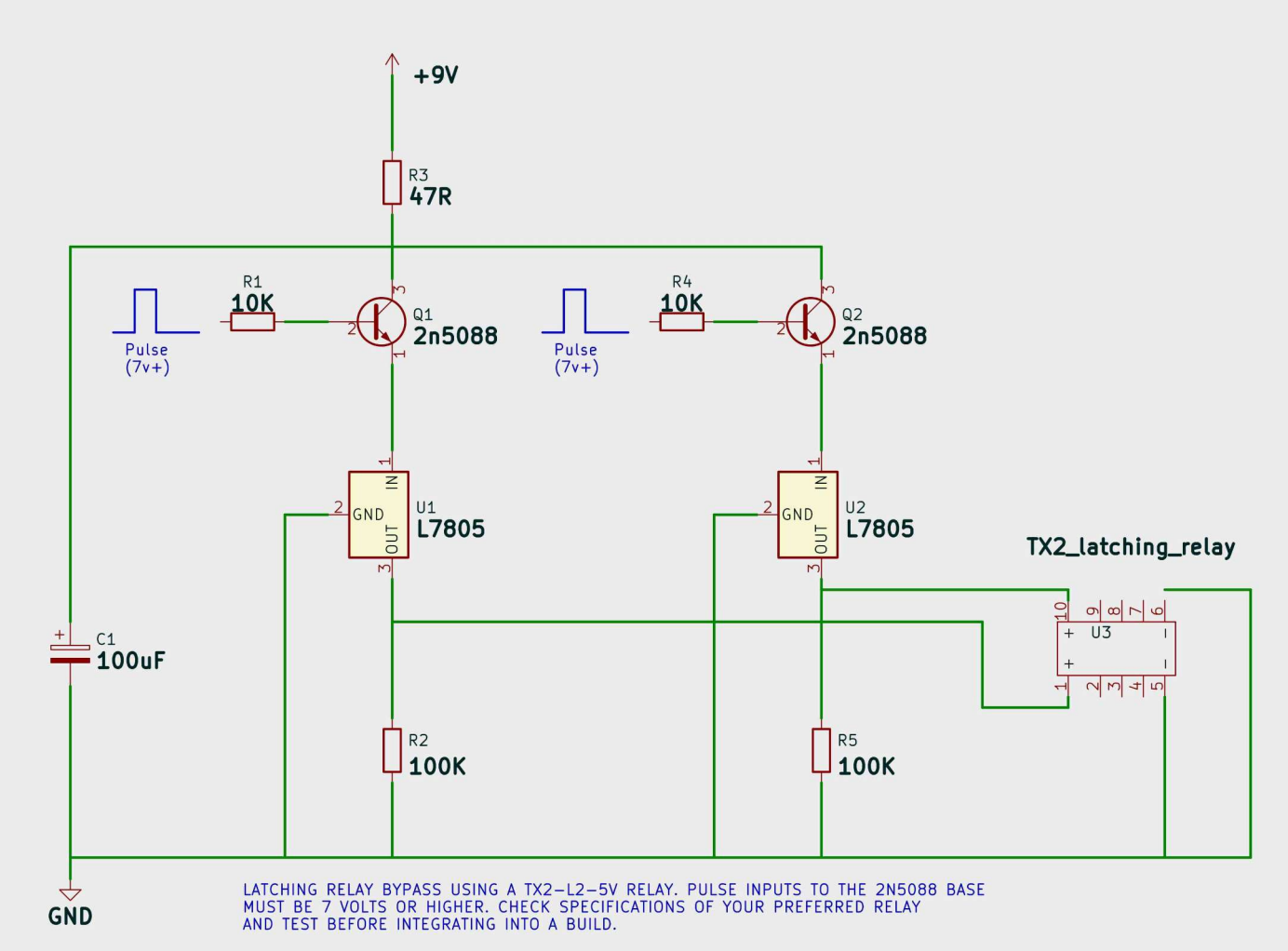
EXAMPLE SCHEMATIC USING CD4066 FOR ANALOG SWITCH BYPASS:



Power filtering not shown. Test with your design before integrating it into a build.

EXAMPLE SCHEMATIC USING A TX2-L2-5V LATCHING RELAY.

Be aware that latching relays require significant current to change state, and may be damaged if the coil voltage is exceeded. This schematic was tested with a TX-L2-5V latching relay.
The L7805 is a 5 volt regulator. It is used unconventionally ensuring the relay coil's voltage does not exceed 5 volts. The pulse voltage inputs must exceed 7 volts to engage the relay's coils. The resting voltage should be below 0.6v to ensure no current passes through the relay's coil when not in use. R2 and R5 may not be necessary.



Power filtering not shown.
Amplification of the pulse signal from the EZ MIDI control board is not shown.
Test with your design before integrating it into a build.

EEPROM CONFIGURATION:

EEPROM PRESET	FUNCTION
No EEPROM	Default operation. Saving presets is disabled. 11 Default LFOs are loaded. POT 3 & 4 do NOT control LFO depth and offset.
EEPROM 1	Normal operation. EZ MIDI control checks the eeprom for design customization data. If this data is blank functionality is the same as No EEPROM, but with savable presets.
EEPROM 2	Use the OLED display, SW1 & SW2 to erase the EEPROM OR print all EEPROM data to the serial port. This can be useful for troubleshooting or backing up data. Serial port reader and a computer required. Serial port baud rate is 115200.
EEPROM 3	Use the OLED display, SW1 & Pot1 (or alternatively MIDI CC7 and 127 on MIDI channel 1) to program customized design data to the EEPROM. Use the list of LFO/Modulations if needed for your project or build. They are only listed by number on the OLED.
EEPROM 1&2	Copy design, preset and startup data from EEPROM 2 to EEPROM 1. Additionally presets can be saved as “recovery presets” or “factory presets.” These will be saved back to the regular presets when by a factory reset.
EEPROM 1&3 EEPROM 2&3 EEPROM 1 2&3	Invalid configuration.

MIDI CC IMPLEMENTATION:

MIDI CC MAP: FUZZ MODE

MIDI CC	RANGE	PARAMETER
7	0-127	PARAM 1
12	0-127	PARAM 2
13	0-127	PARAM 3 *LFO DEPTH
14	0-127	PARAM 4 *LFO OFFSET
15	0-127	PARAM 5 *LFO WARP
16	0-127	PARAM 6 *LFO RATE/DIVISION
17	0-10	LFO OR PWM/CV 4,5,6&7 SELECTION.
22	>0	*TAP TEMPO ON
23	>0	*MANUAL LFO RATE CONTROL (TAP TEMPO OFF)
76	0-127	FULL LFO SELECTION PART 1
77	0-127	FULL LFO SELECTION PART 2
99	>0	BYPASS EFFECT
100	>0	ENGAGE EFFECT
101	>0	FLIP BYPASS STATE
102	0-127	0 BYPASS EFFECT | >0 ENGAGE EFFECT
106	>0	LFO SELECT -1 (FROM FULL LFO LIST IF WARP LFOs ARE ENABLED)
107	>0	LFO SELECT +1 (FROM FULL LFO LIST IF WARP LFOs ARE ENABLED)
FOR TROUBLE SHOOTING AND DATA		
125	>0	SERIAL PRINT ALL EEPROM1 DATA
126	>0	SERIAL PRINT ALL DESIGN CUSTOMIZATION DATA
127	>0	SERIAL PRINT CURRENT PARAMETERS

Sending MIDI PC messages 0-10 will change the current preset.

**If enabled by design customization*

Default design settings:
Presets parameters all set to 0
11 standard warp LFOs assigned to pot 7.
POT 3&4 do NOT control LFO depth and offset.
MIDI Channel 1
MIDI clock enabled.

REFERENCES:

24LC32 EEPROM: https://ww1.microchip.com/downloads/en/DeviceDoc/21072G.pdf
MCP42xxx Digital potentiometer: https://ww1.microchip.com/downloads/en/devicedoc/11195c.pdf

11 Detent potentiometer (Used for Pot 8 to select presets)
16 mm Alpha: https://mou.sr/4fhTMq9
https://smallbear-electronics.mybigcommerce.com/alpha-single-gang-16mm-solder-lug-11-detents/
9MM: https://smallbear-electronics.mybigcommerce.com/single-gang-9mm-right-angle-pc-mount-11-detents-6-mm-shaft/

OLED Display: https://www.amazon.com/dp/B07FMDB6TR?th=1

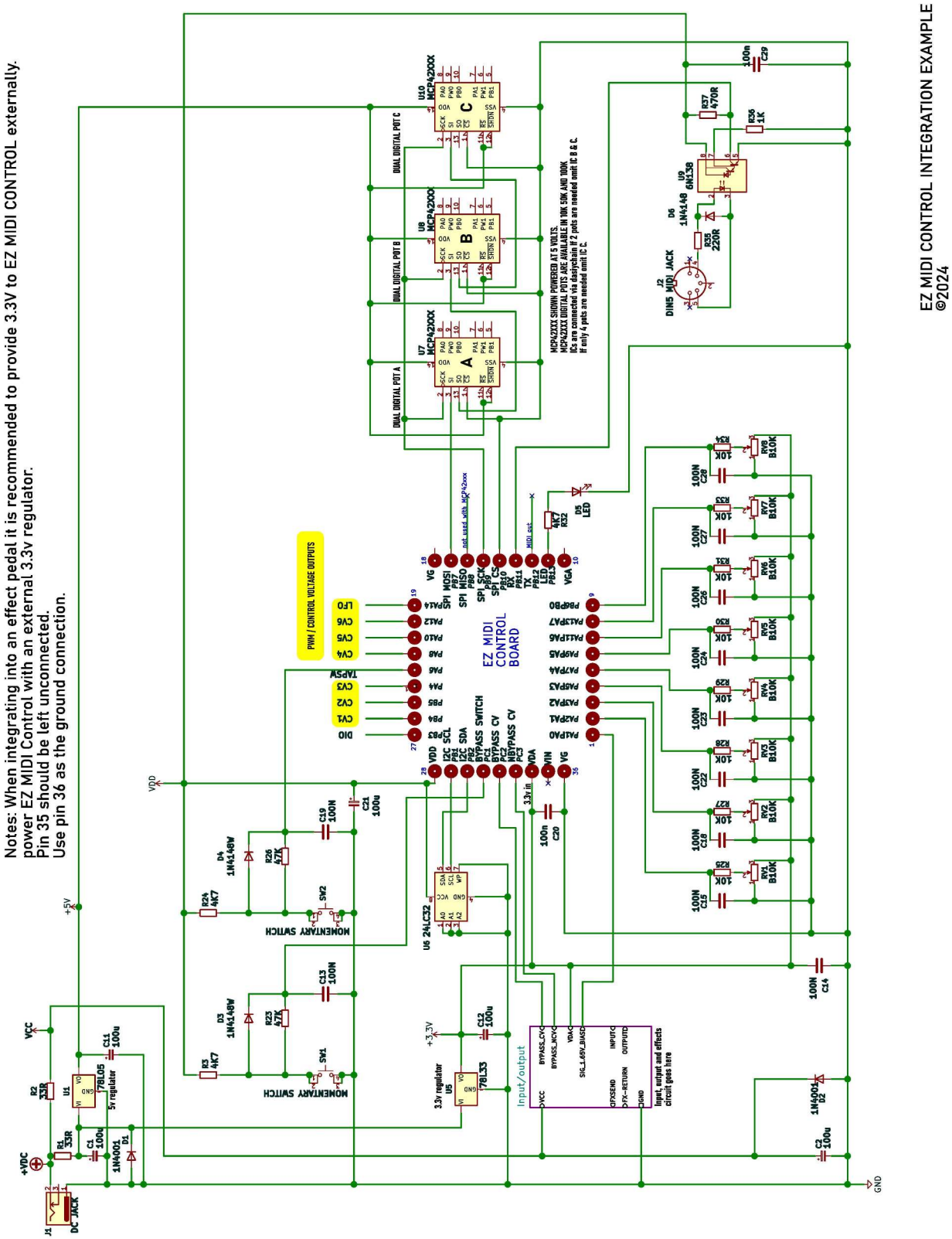
MIDI Jack: https://www.adafruit.com/product/1134

6N138 High Speed Optocoupler (used for MIDI in): https://mou.sr/3zZqXi6

Power up: Refers to powering on EZ MIDI control and/or relevant data that is used when first powered up.

Design data or Design customization data: Data stored on the eeprom used to customize functionality.

Simplified schematic of the EZ MIDI control programmer board. The full schematic can be found on our website.



SUBDECAY