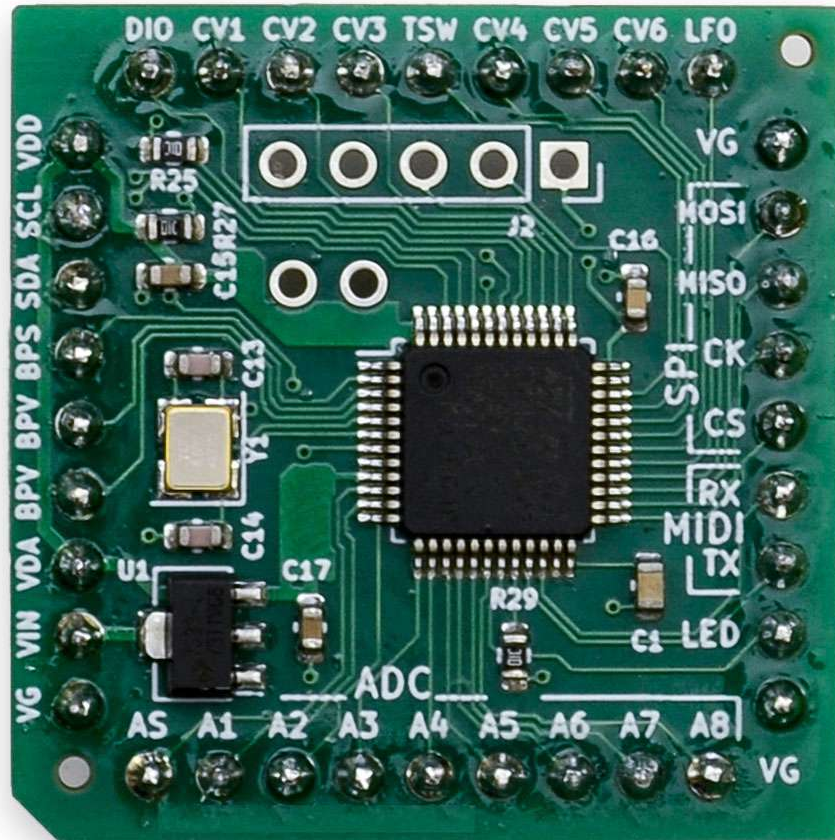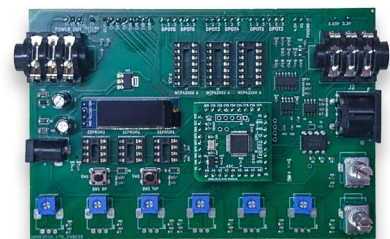# EZ MIDI CONTROL

EZ MIDI Control– The fastest way to add MIDI, savable presets and tap tempo to nearly an effect design. Easily Customize using the EZ Wizard board for your purposes without coding. Use the features you need and not 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.

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CONTENTS:

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

INTRODUCTION:

EZ MIDI Control is a flexible and accessible way to add MIDI, savable presets and tap tempo to nearly any effect design. Integrate this time saving solution into your effects designs with MCP42xxx digital pots and/or control voltages. Available as a 36 pin through hole solder board or as LQFP-48 ICs.

Inputs:
Up to 7 control pots, plus 1 pot for selecting presets.
2 momentary switches (used for bypass, saving presets & tap tempo)
MIDI input

Outputs:
Up to 7 PWM / control voltage outputs.
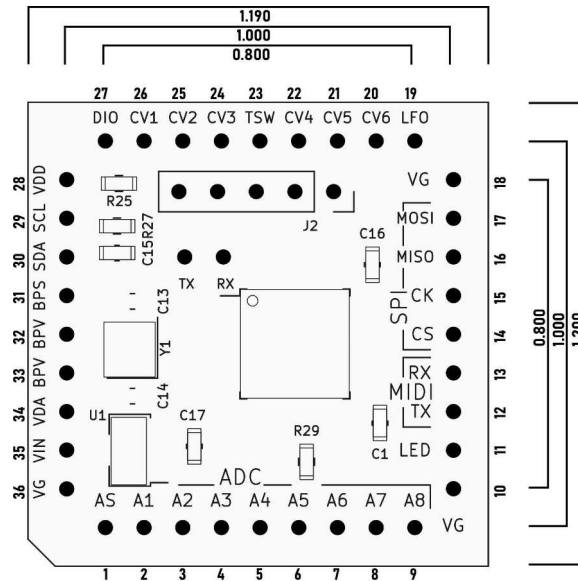Assign up to 11 LFO/Modulation sources with over 200 to choose from.
Up to 6 digital potentiometers (3 MCP42xxx with 2 pots per IC.

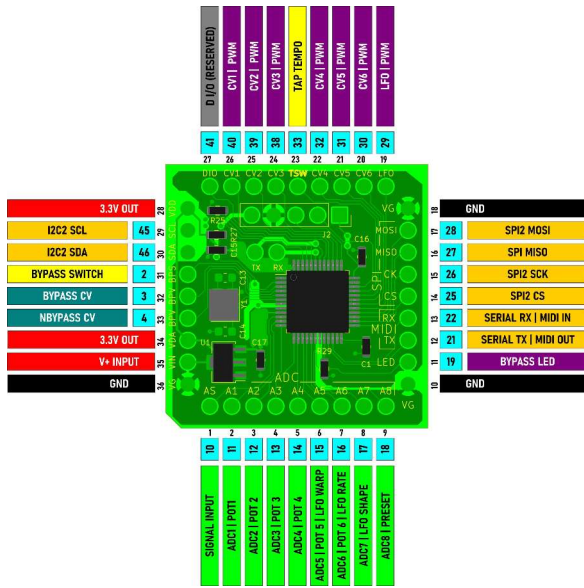Presets and customization data are stored to a 24LC32 or compatible EEPROM.
Customization is programmed with the EZ Wizard Board or can be directly written with an EEPROM programmer.

DIMENSIONS:

EZ MIDI DIMENSIONS

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EZ MIDI CONTROL PINS:

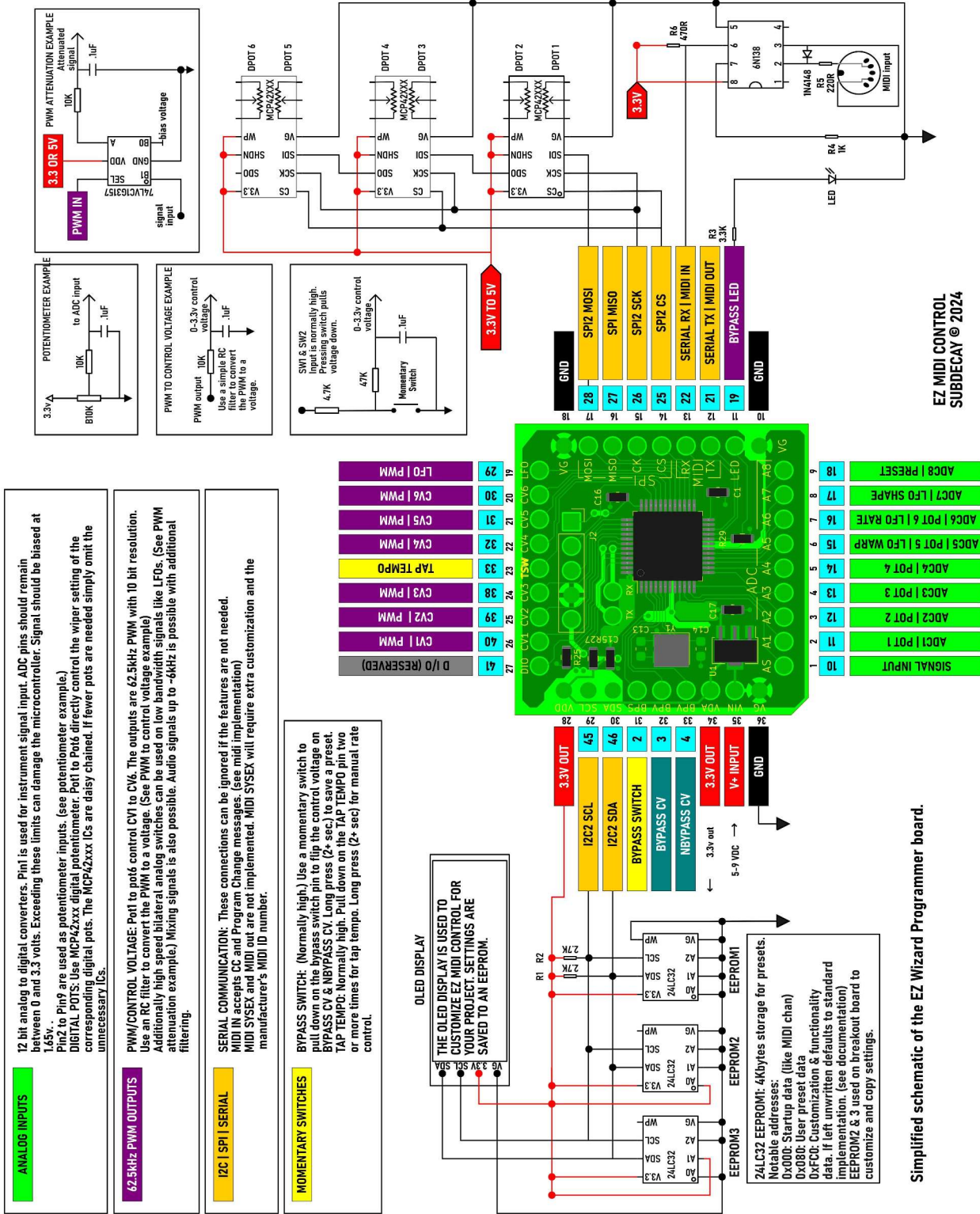| PINS	DESCRIPTION
	Some input pins can be damaged if the input voltage exceeds 3.3 volts. Some pins are 5 volt tolerant.
1	ANALOG SIGNAL INPUT: Biased to 1.65 volts. Used for envelope LFO/modulators.
2-9	Pot inputs. 0 – 3.3 volt input.
10	Ground
11	Bypass LED PWM output.
12	MIDI out: Not implemented on standard MIDI control board. For MIDI output setup or MIDI SysEx output contact us for options.
13	MIDI in: Should be used with a 6N138 circuit or similar.
14-17	SPI Serial pins. Used with MCP42xxx digital pots.
18	Ground
19-22& 24-26	PWM outputs. These pins output variable duty cycle pulse waves. Convert to control voltage with a simple RC filter. 0-3.3 volts. 62.5kHz.
23	SW2. Used for tap tempo. Voltage is normally high. Pull voltage down to activate.
27	Reserved for custom software.
28	VDD 3.3 volt (digital) power output. For use if using the on board 3.3 volt regulator. This can be useful for prototyping. For builds it is recommended to use an external 3.3 volt regulator.
29-30	I2C serial connection for eeprom and EZ Wizard breakout board's OLED display.
31	SW1 Used for bypass switch. Voltage is normally high. Pull voltage down to activate.
32-33	Bypass pins. 3.3 volt outputs. See documentation.
34	When using the on board 3.3 volt regulator use this pin as the analog 3.3 reference voltage for POT inputs. If using an external regulator (recommended for builds) use this pin as the 3.3 volt power input. Do not exceed 3.3 volts.
35	When using the onboard 3.3 volt regulator use this pin as the power input. 5 to 18 VDC.
36	Analog Ground. Reference voltage for POT inputs.

PINS	DESCRIPTION
	Some input pins can be damaged if the input voltage exceeds 3.3 volts. Some pins are 5 volt tolerant.
1	ANALOG SIGNAL INPUT: Biased to 1.65 volts. Used for envelope LFO/modulators.
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23	SW2. Used for tap tempo. Voltage is normally high. Pull voltage down to activate.
27	Reserved for custom software.

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Power filtering, bypass and effects signal not shown.

ANALOG INPUTS

12 bit analog to digital converters. Pin1 is used for instrument signal input. ADC pins should remain between 0 and 3.3 volts. Exceeding these limits can damage the microcontroller. Signal should be biased at 1.65v.. Pin2 to Pin9 are used as potentiometer inputs. (see potentiometer example.)

DIGITAL POTS: Use MCP42xxx digital potentiometer. Pot1 to Pot6 directly control the wiper setting of the corresponding digital pots. The MCP42xxx ICs are daisy chained. If fewer pots are needed simply omit the unnecessary ICs.

62.5kHz PWM OUTPUTS

PWM/CONTROL VOLTAGE: Pot1 to pot6 control CV1 to CV6. The outputs are 62.5kHz PWM with 10 bit resolution. Use an RC filter to convert the PWM to a voltage. (See PWM to control voltage example.) Additionally high speed bilateral analog switches can be used on low bandwidth signals like LFOs. (See PWM attenuation example.) Mixing signals is also possible. Audio signals up to ~6kHz is possible with additional filtering.

I2C | SPI | SERIAL

SERIAL COMMUNICATION: These connections can be ignored if the features are not needed. MIDI IN accepts CC and Program Change messages. (see midi implementation) MIDI SYSEX and MIDI out are not implemented. MIDI SYSEX will require extra customization and the manufacturer's MIDI ID number.

MOMENTARY SWITCHES

BYPASS SWITCH: (Normally high.) Use a momentary switch to pull down on the bypass switch pin to flip the control voltage on BYPASS CV & NBYPASS CV. Long press (2+ sec.) to save a preset. TAP TEMPO: Normally high. Pull down on the TAP TEMPO pin two or more times for tap tempo. Long press (2+ sec) for manual rate control.

OLED DISPLAY

THE OLED DISPLAY IS USED TO CUSTOMIZE EZ MIDI CONTROL FOR YOUR PROJECT. SETTINGS ARE SAVED TO AN EEPROM.

24LC32 EEPROM: 4Kbytes storage for presets.
Notable addresses:
0x000: Startup data (like MIDI chan)
0x080: User preset data
0xFC0: Customization & functionality data. If left unwritten defaults to standard implementation. (see documentation)
EEPROM2 & 3 used on breakout board to customize and copy settings.

Simplified schematic of the EZ Wizard Programmer board.

EZ MIDI CONTROL
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Power filtering not shown. Test with your design before integrating it into a build.
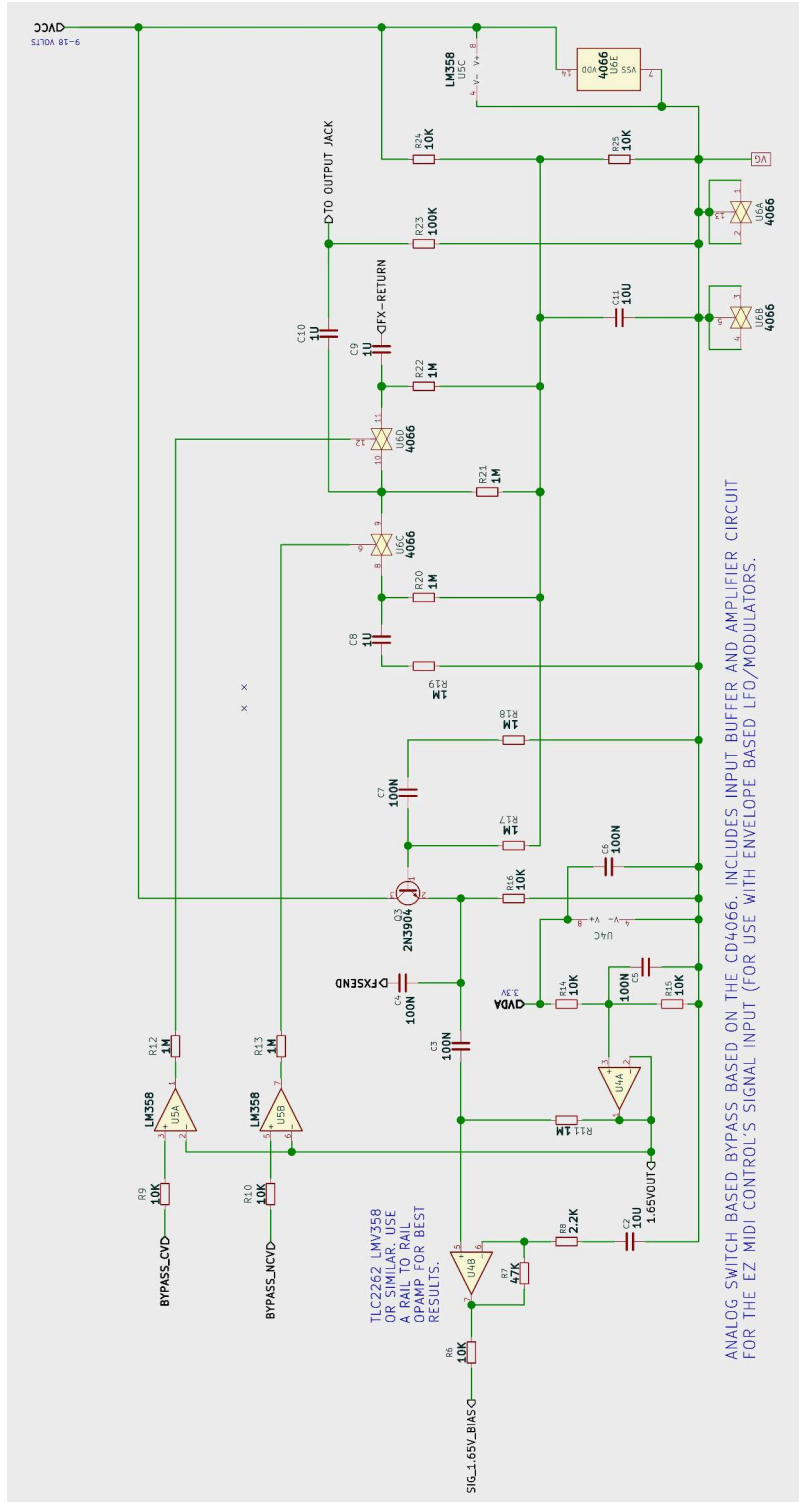
Power filtering not shown. Amplification of the pulse signal from the EZ MIDI control board are not shown. Be aware that latching relays require significant current to change state, and may be damaged if the coil voltage is exceeded. This schematic was tested with a TX-L2-5V latching relay. The L7805 is a 5 volt regulator. It is used in an unconventional way 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.
Test with your design before integrating it into a build.

SUBDECAY
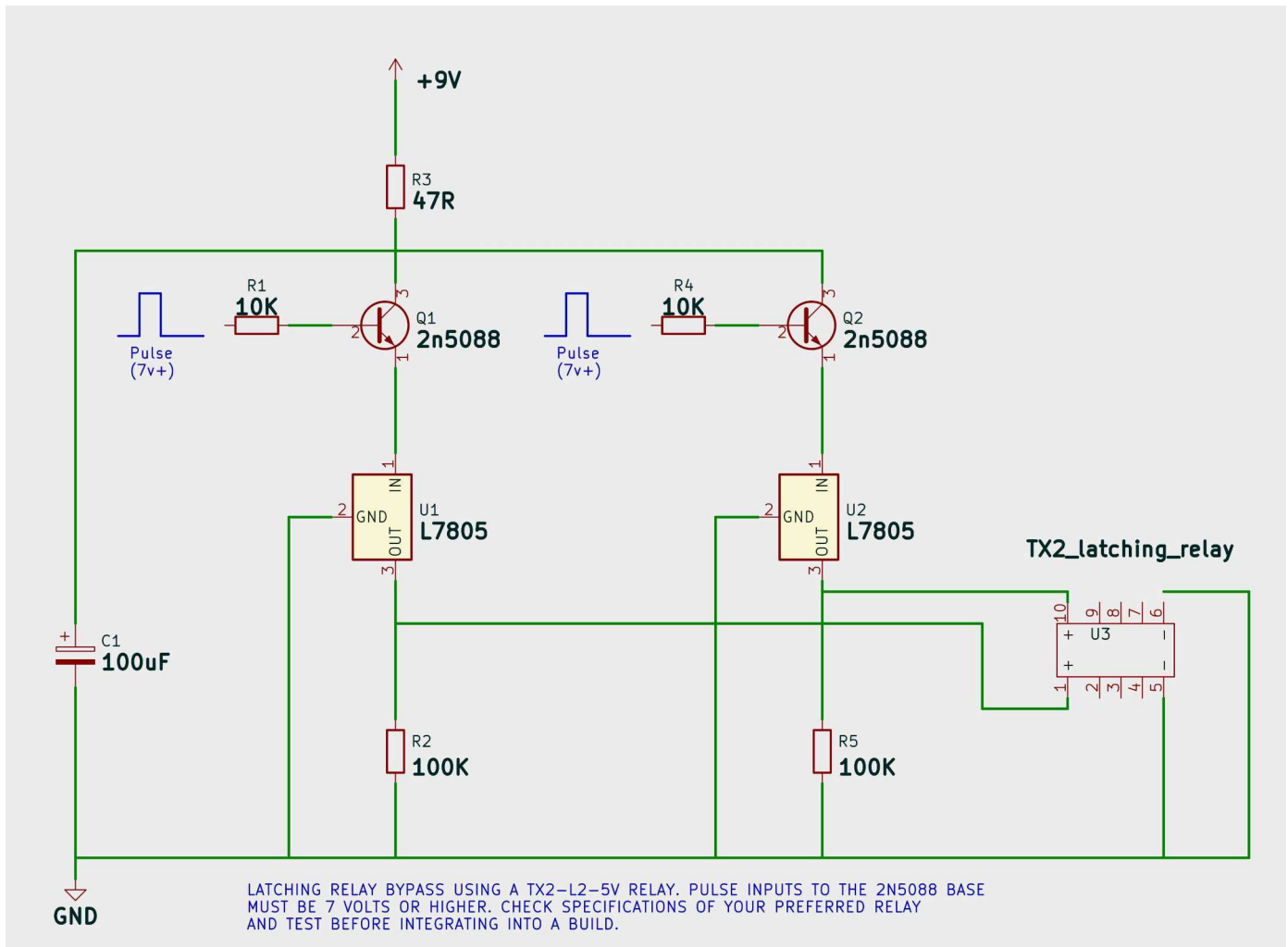
EZ WIZARD BREAKOUT BOARD:

The breakout board serves both as a prototyping platform and a quick way to customize EZ MIDI CONTROL's function for your builds or projects.
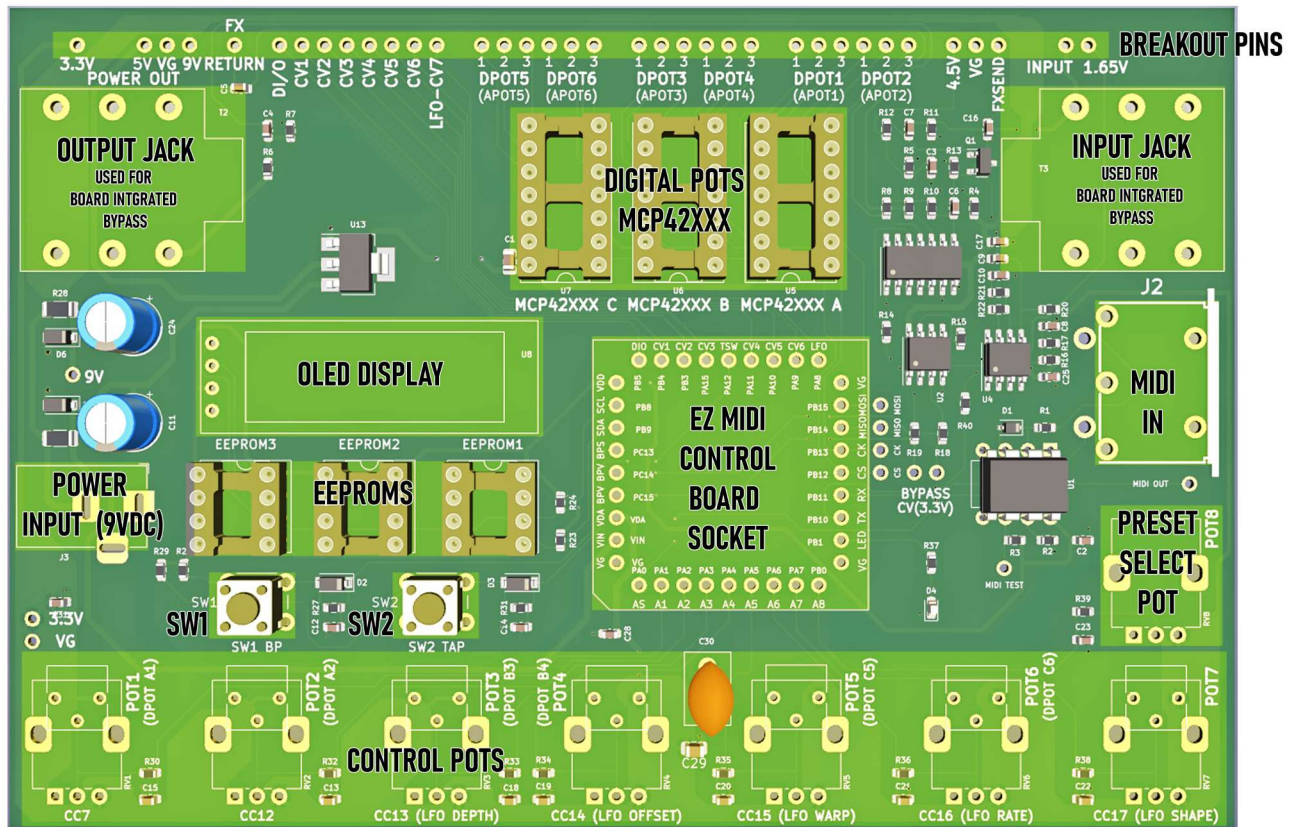
EEPROMs: On power up EZ MIDI Control will detect any EEPROMs present. For normal operation socket a 24LC32 or equivalent EEPROM in socket 1. Other configurations change functionality and allow copying presets, creating design setup data and troubleshooting.

OLED Display: The display is primarily for programming customization data to an eeprom to include in your project or build. It will display any changes to parameters if connected. This feature is **not recommended to include in builds.**

Breakout Pins: These are spaced perfectly to plug into a breadboard.

Input & output jack: Used with the on board bypass.

MIDI input: Use an external MIDI device to change parameters. MIDI CCs are listed below the control pots. Additional MIDI parameters are listed on the MIDI implementation page.

Control pots: Used to change parameters. Parameters in parentheses denote parameters as option per design setup customization.

Preset select pot: 11 detent pot used to select and save presets.

Digital pots: Use MCP42xxx digital pots. The MCP42xxx were chosen because they can be daisy chained. This allows for any unneeded ICs to be left out of your project. Socket up to 3 ICs. If using fewer than 3 ICs socket from right to left starting with socket A.

Power input: Negative center DC. 9-18 volts.

SW1: Used for Bypass and saving presets.

SW2: Used for tap tempo.

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.

CUSTOMIZATION OPTIONS: GETTING STARTED

There are 3 primary branches for customization. All three center around the function of Pot 7 changing the behavior of PWM/CV 4, 5, 6 & 7, and Pot 6. While these change most other functionality remains constant.

	Pot 7	Pot 6	PWM/CV output
Warp LFOs	Selects up to 11 warp LFO/Modulations.	Warps LFO/Modulation Controls digital pot 6 Controls PWM/CV6	PWM/CV 4, 5, 6 follow Pots 4, 5 & 6. PWM/CV7 is the LFO output.
Non Warp LFOs	Selects up to 11 non warp LFO/Modulations	Controls digital pot 6 Controls PWM/CV6	PWM/CV 4, 5, 6 follow Pots 4, 5 & 6. PWM/CV 7 is the LFO output.
No LFOs	Selects up to 11 variable control voltages for PWM/CV 4, 5, 6 & 7.	Controls digital pot 6	PWM/CV 4, 5 6 & 7 change to custom assigned values selected by Pot 7.

SUBDECAY

EZ MIDI CONTROL: CONTROL ROUTING FOR NON-LFO BASED DESIGNS.

INPUT	PARAMETER/ACTION	OUTPUT
SIGNAL INPUT 1.65V CENTER	N/A	N/A
CONTROL POT 1 MID CC7	PARAM 1 0-4095	DIGITAL POT A1 PWM/CV 1
CONTROL POT 2 MIDI CC12	PARAM 2 0-4095	DIGITAL POT A2 PWM/CV 2
CONTROL POT 3 MIDI CC13	PARAM 3 0-4095	DIGITAL POT B1 PWM/CV 3
CONTROL POT 4 MIDI CC14	PARAM 4 0-4095	DIGITAL POT B2
CONTROL POT 5 MIDI CC15	PARAM 5 0-4095	DIGITAL POT C1
CONTROL POT 6 MIDI CC16	PARAM 6 0-4095	DIGITAL POT C2
CONTROL POT 7 MIDI CC17 (76&77)	PARAM 7 0-10	SELECT VARIABLE OUTPUT FOR PWM/CV 4 5 6 & 7
PRESET POT (8) MID PC	PRESET POT (8) 0-10	SELECT 11 PRESETS
SW1 (BYPASS) MIDI CC99 MIDI CC100 MIDI CC101 MIDI CC102	BYPASS STATE	BYPASS FX ON/OFF BYPASS FX OFF BYPASS FX ON BYPASS FX ON/OFF BYPASS FX ON/OFF (ALT)
SW1 LONG PRESS	SAVE PRESET	SAVE 11 PRESETS
SW2	N/A	N/A

▮ = SAVABLE PARAMETER

PRESET PARAMETERS & RANGE:

PARAM 1: 0 – 4095

PARAM 2: 0 – 4095

PARAM 3: 0 – 4095

PARAM 4: 0 – 4095

PARAM 5: 0 – 4095

PARAM 6: 0 – 4095

PARAM 7: 0 – 10

PARAM 8: (RESERVED)

PARAM 9: (NOT USED)

PARAM 10: (NOT USED)

EEPROM DATA:

VARIABLE OUTPUT PWM/CV 4 5 6 & 7 POT 7 SELECTS UP TO 11 VARIATIONS OF THE PWM/CV OUTPUTS. THESE VALUES ARE STORED ON THE EEPROM. THESE CAN BE USED AS CONTROL VOLTAGES OR CONTROL ANALOG SWITCHES.

BYPASS:
BYPASS DEFAULT OPERATION IS FOR ANALOG SWITCHING LIKE A FET OR CD4066 BASED BYPASS SYSTEM CONTROLLED BY THE BYPASS AND NBYPASS CV PINS. PRESSING SW 1 WILL FLIP THE STATE OF BOTH PINS BETWEEN 0 & 3.3V. ADDITIONALLY THE LED PIN WILL FOLLOW THE BYPASS CV PIN.
LATCHING RELAY OPTION IS ALSO SUPPORTED. IT WORKS SIMILARLY TO ANALOG SWITCH OPERATION, EXCEPT THAT WHEN A PIN GOES TO 3.3V IT RETURNS TO 0V AFTER 100MS.

SUBDECAY

EZ MIDI CONTROL: CONTROL ROUTING FOR LFO BASED DESIGNS.

INPUT	PARAMETER/ACTION	OUTPUT
SIGNAL INPUT 1.65V CENTER	N/A	USED FOR ENVELOPE OUT LFOs
CONTROL POT 1 MID CC7	PARAM 1 0–4095	DIGITAL POT A1 PWM/CV 1
CONTROL POT 2 MIDI CC12	PARAM 2 0–4095	DIGITAL POT A2 PWM/CV 2
CONTROL POT 3 MIDI CC13	PARAM 3 0–4095	DIGITAL POT B1 PWM/CV 3 OPTIONAL: LFO DEPTH
CONTROL POT 4 MIDI CC14	PARAM 4 0–4095	DIGITAL POT B2 PWM/CV 4 OPTIONAL LFO OFFSET
CONTROL POT 5 MIDI CC15	PARAM 5 0–4095	DIGITAL POT C1 PWM/CV 5 LFO WARP
CONTROL POT 6 MIDI CC16	PARAM 6 0–4095	DIGITAL POT C2 PWM/CV 6 LFO RATE TAP TEMPO DIVISION
CONTROL POT 7 MIDI CC17 (76&77)	PARAM 7 0–10	SELECT LFO SHAPE LFO OUTPUT: PWM/CV 7 CC76 AND 77 ACCESS FULL RANGE OF LFOS
PRESET POT (8) MID PC	PRESET POT (8) 0–10	SELECT 11 PRESETS
SW1 (BYPASS) MIDI CC99 MIDI CC100 MIDI CC101 MIDI CC102	BYPASS STATE	BYPASS FX ON/OFF BYPASS FX OFF BYPASS FX ON BYPASS FX ON/OFF BYPASS FX ON/OFF (ALT)
SW1 LONG PRESS	SAVE PRESET	SAVE 11 PRESETS
SW2 (TAP TEMPO)	TAP TEMPO TIME PARAM 10 TAP TEMPO ON PARAM 9	
CC22	TAP TEMPO ON PARAM 9	
CC23	TAP TEMPO OFF PARAM 9	
SW2 (LONG PRESS)	TAP TEMPO OFF PARAM 9	

🟩 = SAVABLE PARAMETER

PRESET PARAMETERS & RANGE:

PARAM 1: 0 – 4095

PARAM 2: 0 – 4095

PARAM 3: 0 – 4095 – LFO DEPTH

PARAM 4: 0 – 4095 – LFO OFFSET

PARAM 5: 0 – 4095 – LFO WARP

PARAM 6: 0 – 4095 – LFO RATE/TAP DIV

PARAM 7: 0 – 10 – LFO SHAPE

PARAM 8: (RESERVED)

PARAM 9: 50000 –3000000 – TAP TEMPO PERIOD

PARAM 10: 0 – 1 – TAP TEMPO OFF/ON

EEPROM DATA:

LFO SELECTION:
POT 7 SELECTS UP TO 11 LFOs. EZ MIDI INCLUDES OVER 200 LFO SHAPES. THE LFO SELECTION FOR YOUR PROJECT IS SAVED TO THE EEPROM. IF THE EEPROM IS NOT PRESENT OR DOES NOT CONTAIN LFO DATA 11 STANDARD LFOS WILL BE ASSIGNED TO THE LFO KNOB.

LFO DEPTH AND OFFSET:
POT 3&4 (MIDI CC14&15) CAN BE ASSIGNED TO CONTROL THE LFO DEPTH AND OFFSET VIA EEPROM DATA.

LFO SMOOTHER:
SMOOTHS OUT THE EDGES OF THE LFO TO AVOID POPPING OR TICKING IF CONTROL VOLTAGE BLEED IS AN ISSUE.

BYPASS:
BYPASS DEFAULT OPERATION IS FOR ANALOG SWITCHING LIKE A FET OR CD4066 BASED BYPASS SYSTEM CONTROLLED BY THE BYPASS AND NBYPASS CV PINS. PRESSING SW 1 WILL FLIP THE STATE OF BOTH PINS BETWEEN 0 & 3.3V. ADDITIONALLY THE LED PIN WILL FOLLOW THE BYPASS CV PIN.
LATCHING RELAY OPTION IS ALSO SUPPORTED. IT WORKS SIMILARLY TO ANALOG SWITCH OPERATION, EXCEPT THAT WHEN A PIN GOES TO 3.3V IT RETURNS TO 0V AFTER 100MS.

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Preparation: The following items will be necessary.	* Optional MIDI controller: CC List		
• EZ MIDI CONTROL board with OLED Display • EZ WIZARD breakout board • 24LC32 EEPROM or compatible. • 9 volt DC power source • * Optional MIDI Controller	CC7	0-127	Equivalent to POT 1.
	CC127	>0	Equivalent to SW1 switch press.
	CC106	>0	decreases LFO selection by 1.
	CC107	>0	Increases LFO selection by 1.

Note: Pressing SW2 at any time during the Customization design setup process will restart the process.

WARP LFOs:

STEP	DISPLAY	
STEP 1	Remove the EZ Wizard board from power. Place the EZ MIDI board in the in the EZ Wizard 36 pin socket. Be sure the notched corner is oriented correctly. Place a 24LC32 EEPROM in EEPROM socket 3. Be sure the IC is oriented correctly.	
STEP 2	Power the EZ Wizard board with a 9 Volt DC power supply. Options will appear on the OLED display.	
STEP 3 BYPASS	Bypass (option)	Use Pot 1 to select either analog switch or relay bypass. Then press SW1.
STEP 4 POT 7	Pot 7 (option)	Use Pot 1 to select quantity of warp LFOs to be assigned to Pot 7. Then press SW1.
STEP 5 LFO QTY	Warp LFOs #? (option)	Assign LFOs to be select-able by Pot 7. Then Press SW1. Repeat until all LFOs are assigned. (LFOs listed on page 19)
STEP 6 DEPTH & OFFSET CONTROL	POT3 LFO DEPTH POT4 LFO OFFSET (YES OR NO)	Select yes for Pot 3 and Pot 4 to control LFO depth and offset. Select no if this is not necessary or will be controlled by other means. The press SW1.
STEP 7 SOFTEN LFO EDGE	ANTI POP FLTR (option)	For some modulation effects, quick changes to control voltage can cause audible popping or ticking noises. Use higher values to reduce the slope of sudden changes in control voltage. If ticking noises are a problem start with a high value of 100 and work your way up or down as necessary. *Ticking can also be affected by the RC filter used to convert the PWM output to a voltage.*
STEP 8 SAVE	WRITE TO EEPROM? SW1 YES SW2 RESTART	Press SW2 to restart the process. Press SW1 to save the design customization settings to the EEPROM. Afterward EZ MIDI control will start normal operation with design settings in effect. *(saving presets is disabled while the EEPROM is in socket 3)*

CUSTOMIZATION OPTIONS: SETUP USING THE EZ WIZARD BREAKOUT BOARD

NON WARP LFOs:

STEP	DISPLAY	
STEP 1	Remove the EZ Wizard board from power. Place the EZ MIDI board in the in the EZ Wizard 36 pin socket. Be sure the notched corner is oriented correctly. Place a 24LC32 EEPROM in EEPROM socket 3. Be sure the IC is oriented correctly.	
STEP 2	Power the EZ Wizard board with a 9 Volt DC power supply. Options will appear on the OLED display.	
STEP 3 **BYPASS**	Bypass (option)	Use Pot 1 to select either analog switch or relay bypass. Then press SW1.
STEP 4 **POT 7**	Pot 7 (option)	Use Pot 1 to select quantity of non warp LFOs to be assigned to Pot 7. Then press SW1.
STEP 5 **LFO QTY**	Warp LFOs #? (option)	Assign LFOs to be select-able by Pot 7. Then Press SW1. Repeat until all LFOs are assigned.
STEP 6 **DEPTH & OFFSET CONTROL**	POT3 LFO DEPTH POT4 LFO OFFSET (YES OR NO)	Select yes for Pot 3 and Pot 4 to control LFO depth and offset. Select no if this is not necessary or will be controlled by other means. The press SW1.
STEP 7 **SOFTEN LFO EDGE**	ANTI POP FLTR (option)	For some modulation effects, quick changes to control voltage can cause audible popping or ticking noises. Use higher values to reduce the slope of sudden changes in control voltage. If ticking noises are a problem start with a high value of 100 and work your way up or down as necessary. *Ticking can also be affected by the RC filter used to convert the PWM output to a voltage.*
STEP 8 **SAVE**	WRITE TO EEPROM? SW1 YES SW2 RESTART	Press SW2 to restart the process. Press SW1 to save the design customization settings to the EEPROM. Afterward EZ MIDI control will start normal operation with design settings in effect. *(saving presets is disabled while the EEPROM is in socket 3)*

SUBDECAY

NO LFO:

STEP	DISPLAY	
STEP 1	Remove the EZ Wizard board from power. Place the EZ MIDI board in the in the EZ Wizard 36 pin socket. Be sure the notched corner is oriented correctly. Place a 24LC32 EEPROM in EEPROM socket 3. Be sure the IC is oriented correctly.	
STEP 2	Power the EZ Wizard board with a 9 Volt DC power supply. Options will appear on the OLED display.	
STEP 3 BYPASS	Bypass (option)	Use Pot 1 to select either analog switch or relay bypass. Then press SW1.
STEP 4 POT 7	POT 7 (option)	Use Pot 1 to select "ASSIGN CVs NO LFO." Press SW1 to continue.
STEP 5 CV QTY	CV PRESET QTY (option)	Select the number of control voltages to assign to PWM/CV 4, 5, 6 & 7.
STEP 6 CV VALUES	CV PRESET # CV PIN # (option)	Assign values for PWM/CV 4, 5, 6 & 7 to be selected by Pot 7.
STEP 7 SAVE	WRITE TO EEPROM? SW1 YES SW2 RESTART	Press SW2 to restart the process. Press SW1 to save the design customization settings to the EEPROM. Afterward EZ MIDI control will start normal operation with design settings in effect. *(saving presets is disabled while the EEPROM is in socket 3)*

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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

EZ MIDI Control combined with the EZ Wizard breakout board will prepare EEPROM data and copy EEPROMs ready for your project or build. This can also be done with an EEPROM programmer. Memory and storage addresses are usually referred to in hexadecimal. Any hexadecimal numbers below will be prefixed with 0x.

The 24LC32 EEPROM's data capacity is 32Kbits. This is a total of 4096 bytes. EZ MIDI control addresses the EEPROM's storage in 128 byte "sectors."

EEPROM sector contents

Sector 0	startup data.
Sector 1 – 11	preset 1–11 data
Sector 12–15	not used
Sector 16	startup data factory setting backup
Sector 17–27	preset data factory setting backup
Sector 18–30	not used
Sector 31	design customization data

Visual overview of EEPROM data:

SUBDECAY
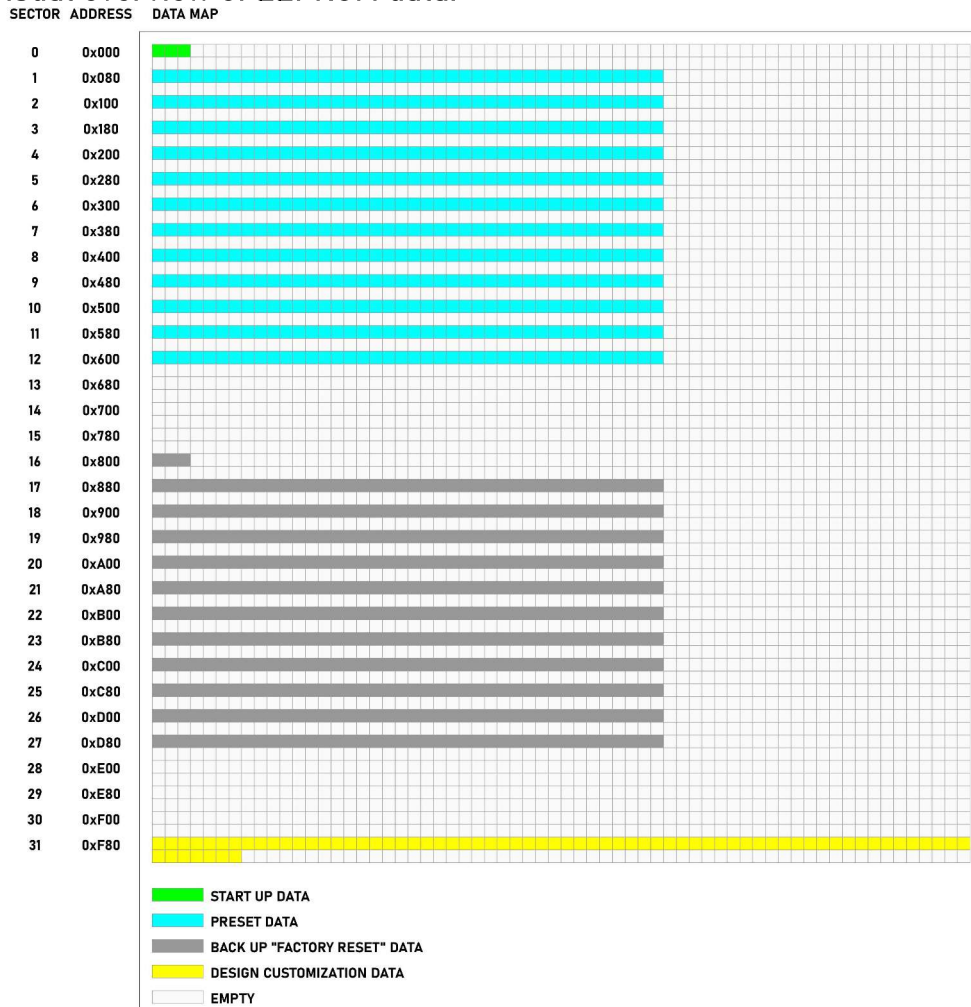
THIS PAGE IS RELEVANT FOR MANUALLY CREATING AN EEPROM HEX FILE OR TROUBLESHOOTING EEPROM DATA.

Sector 0: power up data bytes: Only 3 bytes are used in this sector.		
	Byte 0	**Byte 1**	**Byte 2**
start addr 0x00	Power up byte	MIDI channel	MIDI clock enabled
	Expects 0 on startup. 0 normal startup 255 factory reset attempt	Range 0-15 Sets MIDI channel offset by 1 0= channel 1 15= channel 16	0 Disabled 1 Enabled

Off the shelf an EEPROM is blank. A blank byte is set to 0xFF (255.) If the startup byte = 255 a factory reset will be attempted. If factory reset is not available it will use default design settings.

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.

Sector 1-11: Presets

Presets store 10 parameters. Each parameter consists of 4 bytes which are read as 32bit numbers with the least significant byte to the left.

The range of Parameters 1-6 are 0-4095. (0x000 – 0xFFF)
For example Preset 1's parameter 1 looks like this in memory with different parameter values.

value	start addr	0x080	0x081	0x082	0x083
0 (0x000)	0x080	0 (0x00)	0 (0x00)	0 (0x00)	0 (0x00)
1 (0x001)	0x080	1 (0x01)	0 (0x00)	0 (0x00)	0 (0x00)
255 (0x0FF)	0x080	255 (0xFF)	0 (0x00)	0 (0x00)	0 (0x00)
256 (0x100)	0x080	0 (0x00)	1 (0x01)	0 (0x00)	0 (0x00)
1023 (0x3FF)	0x080	255 (0xFF)	3 (0x03)	0 (0x00)	0 (0x00)
1024 (0x400)	0x080	0 (0x00)	4 (0x04)	0 (0x00)	0 (0x00)
4095 (0xFFF)	0x080	255 (0xFF)	15 (0x0F)	0 (0x00)	0 (0x00)

	Base 10	hexadecimal
Parameter 7 range (LFO or PMW/CV selection):	0-10*	(0x00 – 0x0A)
Parameter 8 is not used and should always =	0	(0x00)
Parameter 9 range (Tap Tempo on/off):	0-1	(0x00 – 0x01)
Parameter 10 Range (Tap Tempo rate in µseconds)	50000-3000000	(0X00C350 – 0x2DC6C0)

* If using LFO based design customization Parameter 7's range is 0-215 allowing selection of the full LFO list. LFO shapes not assigned to Pot 7 can only be set via MIDI. See MIDI implementation.

SUBDECAY

STARTUP PARAMETERS: Applicable when EZ MIDI Control is built into an effect with EEPROM1 configuration.

On startup EZ MIDI control reads the EEPROM to retrieve customization design data, user presets and power up data. The power up data consists of two parameters, the MIDI channel and MIDI clock enabled/disabled.

After loading the data the LED flashes momentarily. While the LED is flashing press SW1 (bypass switch) enter the setup "menu"

The menu's only user feedback is a flashing LED, and uses POT 8 and SW1.
The LED flashes according to the Pot 8's position. One long flash followed by two groups of short flashes confirms the selection.

POT8	Flash 1	Flash	Flash	Action
1	Long	2x	1x	Factory Reset
2	Long	2x	2x	Reset power up settings (MIDI chan1, MIDI clock enabled)
3	Long	2x	3x	Not used
4	Long	2x	4x	Set MIDI Channel 1-10
5	Long	3x	1x	Set MIDI channel 11-16
6	Long	3x	2x	Set MIDI clock enabled
7	Long	3x	3x	Set MIDI clock disabled
8	Long	3x	4x	Not used
9	Long	4x	1x	Not used
10	Long	4x	2x	Serial Print EEPROM data
11	Long	4x	3x	Exit

After setting Pot 8, press SW1 to start the action.

After a factory reset or resetting power up settings the effect will restart.
After setting the MIDI channel or MIDI clock settings the effect will remain in the setup menu until 11 is selected and SW1 is pressed.

SUBDECAY

#	Name	#	Name	#	Name	#	Name
0	SineSquare	58	HardFadeToZeroTri16	117	SoftFadeOutInToCenterSine	176	HardFadeToZeroSqr8
1	TriSquare	59	SoftFadeOutInToCenterSaw	118	SoftFadeOutInToZeroSine	177	HardFadeToZeroSqr16
2	DutyCycle	60	SoftFadeOutInToZeroSaw	119	SoftFadeToCenterSine	178	NWTri
3	Random	61	SoftFadeToCenterSaw	120	HardFadeToCenterSine	179	NWTriCenter
4	WarpEnvUp	62	HardFadeToCenterSaw	121	SoftFadeToZeroSine	180	NWSine
5	WarpEnvDn	63	SoftFadeToZeroSaw	122	HardFadeToZeroSine	181	NWSineCenter
6	SqrTriMix4	64	HardFadeToZeroSaw	123	SoftFadeOutInToCenterSine2	182	NWRamp
7	SqrTriMix8	65	SoftFadeOutInToCenterSaw4	124	SoftFadeOutInToCenterSine4	183	NWSaw
8	SqrTriMix16	66	SoftFadeOutInToCenterSaw8	125	SoftFadeOutInToCenterSine8	184	NWRandom
9	RndTriMix4	67	SoftFadeOutInToCenterSaw16	126	SoftFadeOutInToCenterSine16	185	NWPulse25
10	RndTriMix8	68	SoftFadeOutInToZeroSaw4	127	SoftFadeOutInToZeroSine2	186	NWPulse33
11	RndTriMix16	69	SoftFadeOutInToZeroSaw8	128	SoftFadeOutInToZeroSine4	187	NWSqr
12	StepTri	70	SoftFadeOutInToZeroSaw16	129	SoftFadeOutInToZeroSine8	188	NWPulse66
13	StepSine	71	SoftFadeToCenterSaw2	130	SoftFadeOutInToZeroSine16	189	NWPulse75
14	StepSaw	72	SoftFadeToCenterSaw4	131	SoftFadeToCenterSine2	190	NWSineLog
15	StepRamp	73	SoftFadeToCenterSaw8	132	SoftFadeToCenterSine4	191	NWSineExp
16	Tri3XMix	74	SoftFadeToCenterSaw16	133	SoftFadeToCenterSine8	192	NWTriLog
17	Tri4XMix	75	HardFadeToCenterSaw2	134	SoftFadeToCenterSine16	193	NWTriExp
18	Tri5XMix	76	HardFadeToCenterSaw4	135	HardFadeToCenterSine2	194	NWRampLog
19	Sine3XMix	77	HardFadeToCenterSaw8	136	HardFadeToCenterSine4	195	NWRampExp
20	Sine4XMix	78	HardFadeToCenterSaw16	137	HardFadeToCenterSine8	196	NWSawExp
21	Sine5XMix	79	SoftFadeToZeroSaw2	138	HardFadeToCenterSine16	197	NWSawExp
22	SawExpLog	80	SoftFadeToZeroSaw4	139	SoftFadeToZeroSine2	198	NWSlowEnvUp
23	RampExpLog	81	SoftFadeToZeroSaw8	140	SoftFadeToZeroSine4	199	NWMedEnvUp
24	TriExpLog	82	SoftFadeToZeroSaw16	141	SoftFadeToZeroSine8	200	NWFastEnvUp
25	SineExpLog	83	HardFadeToZeroSaw2	142	SoftFadeToZeroSine16	201	NWExpEnvUp
26	SinePulseDistortion	84	HardFadeToZeroSaw4	143	HardFadeToZeroSine2	202	NWLogEnvUp
27	DblPhaseDistortion	85	HardFadeToZeroSaw8	144	HardFadeToZeroSine4	203	NWSinEnvUp
28	DblSinePhaseDistortion	86	HardFadeToZeroSaw16	145	HardFadeToZeroSine8	204	NWSlowEnvDn
29	SinePhaseDistortion	87	SoftFadeOutInToCenterRamp	146	HardFadeToZeroSine16	205	NWMedEnvDn
30	PhaseDistortion	88	SoftFadeOutInToZeroRamp	147	SoftFadeOutInToCenterSqr	206	NWFastEnvDn
31	SyncRamp1to8	89	SoftFadeToCenterRamp	148	SoftFadeOutInToZeroSqr	207	NWExpEnvDn
32	SyncTri	90	HardFadeToCenterRamp	149	SoftFadeToCenterSqr	208	NWLogEnvDn
33	WindowedSyncTri	91	SoftFadeToZeroRamp	150	HardFadeToCenterSqr	209	NWSinEnvDn};
34	WindowedSyncSine	92	HardFadeToZeroRamp	151	HardFadeToCenterSqr		
35	SoftFadeOutInToCenterTri	93	SoftFadeOutInToCenterRamp2	152	SoftFadeToZeroSqr		
36	SoftFadeOutInToZeroTri	94	SoftFadeOutInToCenterRamp4	153	HardFadeToZeroSqr		
37	SoftFadeToCenterTri	95	SoftFadeOutInToCenterRamp8	154	SoftFadeOutInToCenterSqr2		
38	HardFadeToCenterTri	96	SoftFadeOutInToCenterRamp16	155	SoftFadeOutInToCenterSqr4		
39	SoftFadeToZeroTri	97	SoftFadeOutInToZeroRamp2	156	SoftFadeOutInToCenterSqr8		
40	HardFadeToZeroTri	98	SoftFadeOutInToZeroRamp4	157	SoftFadeOutInToCenterSqr16		
41	SoftFadeOutInToCenterTri4	99	SoftFadeOutInToZeroRamp8	158	SoftFadeOutInToZeroSqr2		
42	SoftFadeOutInToCenterTri8	100	SoftFadeOutInToZeroRamp16	159	SoftFadeOutInToZeroSqr4		
43	SoftFadeOutInToCenterTri16	101	SoftFadeToCenterRamp2	160	SoftFadeOutInToZeroSqr8		
44	SoftFadeOutInToZeroTri4	102	SoftFadeToCenterRamp4	161	SoftFadeOutInToZeroSqr16		
45	SoftFadeOutInToZeroTri8	103	SoftFadeToCenterRamp8	162	SoftFadeToCenterSqr2		
46	SoftFadeOutInToZeroTri16	104	SoftFadeToCenterRamp16	163	SoftFadeToCenterSqr4		
47	SoftFadeToCenterTri4	105	HardFadeToCenterRamp2	164	SoftFadeToCenterSqr8		
48	SoftFadeToCenterTri8	106	HardFadeToCenterRamp4	165	SoftFadeToCenterSqr16		
49	SoftFadeToCenterTri16	107	HardFadeToCenterRamp8	166	HardFadeToCenterSqr2		
50	HardFadeToCenterTri4	108	HardFadeToCenterRamp16	167	HardFadeToCenterSqr4		
51	HardFadeToCenterTri8	109	SoftFadeToZeroRamp2	168	HardFadeToCenterSqr8		
52	HardFadeToCenterTri16	110	SoftFadeToZeroRamp4	169	HardFadeToCenterSqr16		
53	SoftFadeToZeroTri4	111	SoftFadeToZeroRamp8	170	SoftFadeToZeroSqr2		
54	SoftFadeToZeroTri8	112	SoftFadeToZeroRamp16	171	SoftFadeToZeroSqr4		
55	SoftFadeToZeroTri16	113	HardFadeToZeroRamp2	172	SoftFadeToZeroSqr8		
56	HardFadeToZeroTri4	114	HardFadeToZeroRamp4	173	SoftFadeToZeroSqr16		
57	HardFadeToZeroTri8	115	HardFadeToZeroRamp8	174	HardFadeToZeroSqr2		
58	HardFadeToZeroTri16	116	HardFadeToZeroRamp16	175	HardFadeToZeroSqr4		
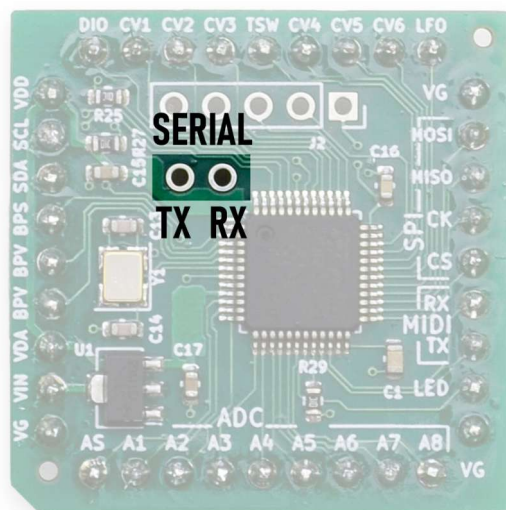
On power up EZ MIDI control sends start up data to the serial pins.

Additionally there are serial print options via midi and the setup menu. This is useful for storing data on a computer and writing to EEPROMs from the computer.

Writing data to the EEPROM:
This is the official programmer from the manufacturer or 24xxxx EEPROMs:
https://www.microchip.com/en-us/development-tool/DV243003
There are many USB EEPROM programmers available, but they are not all the same. Before purchasing one be aware that **some low cost EEPROM programmers can overload a computer's USB power if misused.** Choose an I2C programmer compatible with the 24LC32. Read documentation, read reviews and follow instructions.

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 7 & 8)
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.

SUBDECAY

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EZ MIDI CONTROL INTEGRATION EXAMPLE
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Notes: When integrating into an effect pedal it is recommended to provide 3.3V to EZ MIDI CONTROL externally. power EZ MIDI Control with an external 3.3v regulator. Pin 35 should be left unconnected. Use pin 36 as the ground connection.

EZ MIDI CONTROL BOARD

PWM / CONTROL VOLTAGE OUTPUTS

MCP42XXX SHOWN POWERED AT 5 VOLTS.
MCP42XXX DIGITAL POTS ARE AVAILABLE IN 10K 50K AND 100K
ICs are connected via daisychain If 2 pots are needed omit IC B & C.
If only 4 pots are needed omit IC C.

Input, output and effects circuit goes here