Easy Spin Assembly Instructions

Super Easy DSP
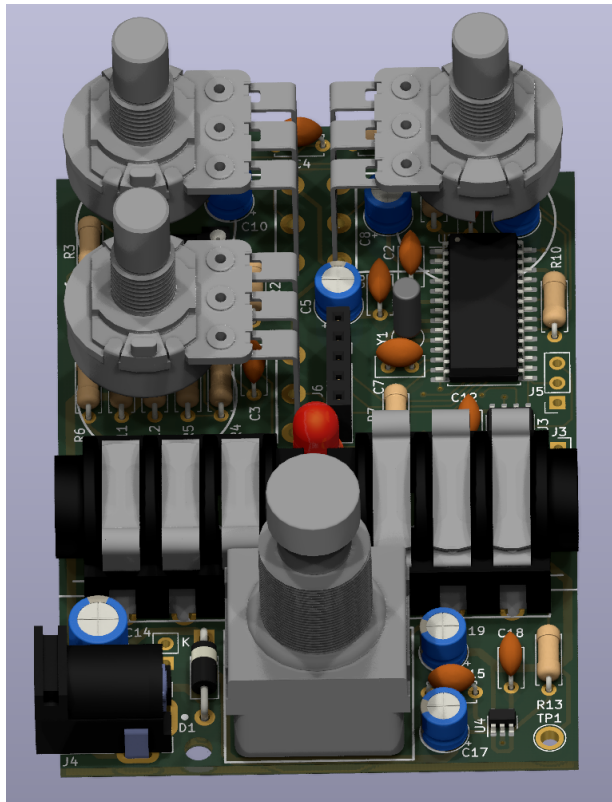
DSP PCB
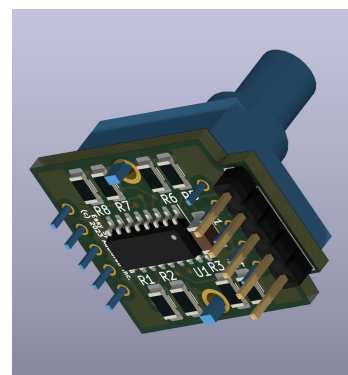
Switch PCB

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Introduction

The Easy Spin is an FV-1 based DSP pedal that makes it easy (and fun) to build your own digital effects. Part of what makes the Easy Spin super easy is the Audiofab USB-based programmer and programming software. This combination offers quick and easy programming of the pedal with DSP programs you develop yourself or download from the Internet.

Easy Spin supports eight digital effects, selected by a rotary switch. The adjustable parameters of each digital effect can be controlled via three potentiometers.

Features

- Powerful FV-1 audio DSP
- Ultra low noise power supply and an enhanced PCB layout to ensure the lowest possible system noise
- Easy to use programming software that supports quick download and EEPROM layout
- Integrated programming jack for connecting to the Audiofab USB Programmer
- True bypass switching
- Internal 9V battery or external 9V PSU input
- LED indicator
- Rugged 1590B aluminum enclosure

Controls

- Three potentiometers for adjusting effects parameters
- Eight position selector switch
- True bypass footswitch

The FV-1 is supported by a thriving ecosystem. To get started with programming, we recommend [SpinCAD Designer](). It is a powerful and easy to use block diagram programming tool that has found strong support in the FV-1 community.

For more advanced programming, you can use assembly language. The Audiofab programming software integrates the [asfv1]() assembler so you can directly assemble and download assembly language programs. See the Audiofab USB Programmer manual for more information.

There is a great [repository of FV-1 programs](). We'll also be developing and offering some DSP programs for free -- see our [Downloads]() page.

The Audiofab programming software can be downloaded and installed as per the instructions in the Audiofab USB Programmer manual.

Easy Spin is available as a fully assembled pedal, a PCB set with surface-mount components installed or a raw PCB set. We also offer a kit of the key electromechanical parts. The Audiofab USB programmer is sold fully assembled and can be purchased separately.
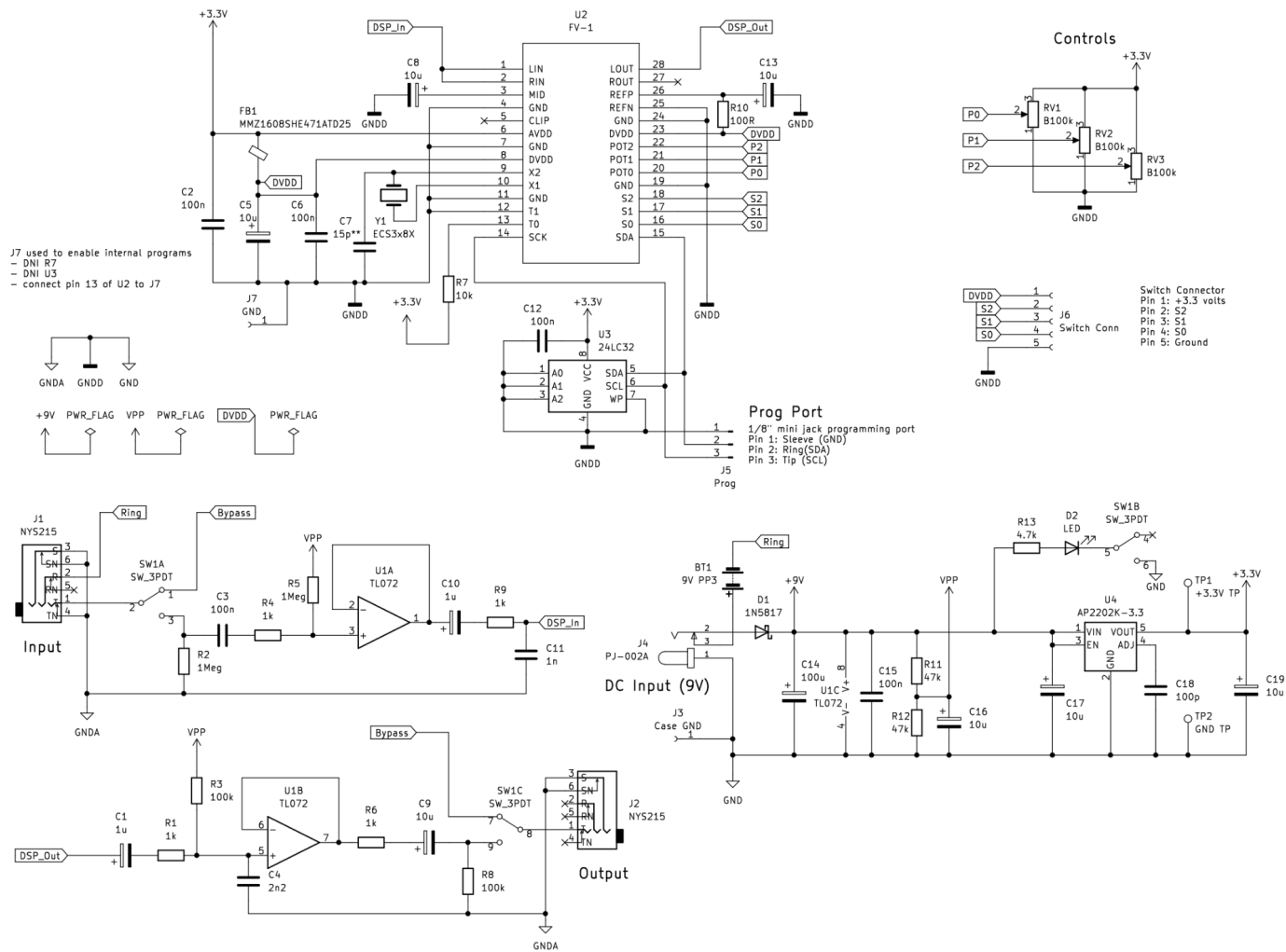
This document covers the assembly of the main DSP board and the switch board that comprise the Easy Spin effects pedal. It also provides an overview of programming and use of the Easy Spin.
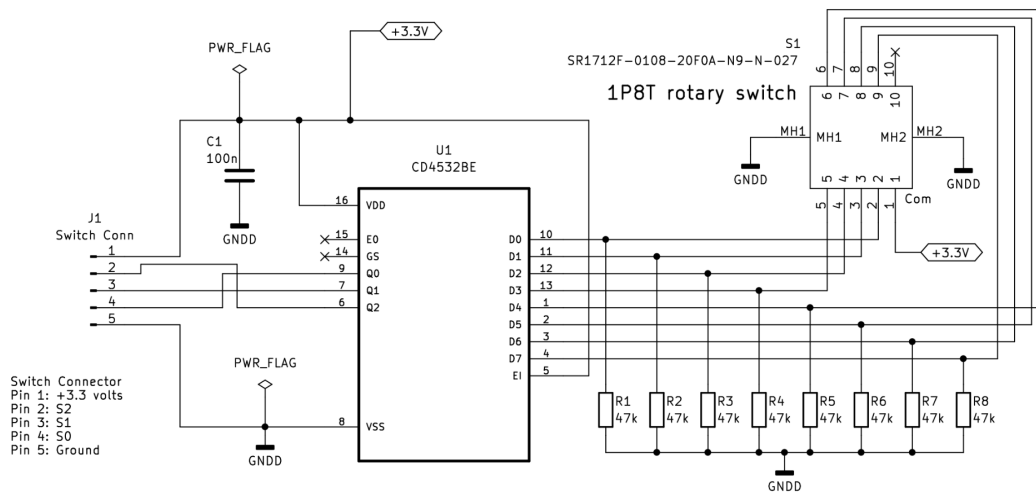
Schematics

DSP PCB Schematic

Switch PCB Schematic

PWR_FLAG
+3.3V

S1
SR1712F−0108−20F0A−N9−N−027
1P8T rotary switch

C1
100n

U1
CD4532BE

16 VDD

J1
Switch Conn
1
2
3
4
5

GNDD

15 E0
14 GS
9   Q0
7   Q1
6   Q2

D0 10
D1 11
D2 12
D3 13
D4 1
D5 2
D6 3
D7 4
EI 5

MH1 MH1   MH2 MH2
GNDD   GNDD
Com
+3.3V

PWR_FLAG

Switch Connector
Pin 1: +3.3 volts
Pin 2: S2
Pin 3: S1
Pin 4: S0
Pin 5: Ground

8   VSS

GNDD

R1   R2   R3   R4   R5   R6   R7   R8
47k   47k   47k   47k   47k   47k   47k   47k

GNDD

Parts List

DSP PCB

Ref	Value	Qty	Comments	Alternate / Comments
PCB	PCB1	1	Easy Spin DSP printed circuit board from Audiofab	
BT1	9V battery clip	1	232 Keystone Electronics	
C5, C8, C9, C13, C16, C17	10u	6	106RSS035M	
C2, C3, C6, C12, C15	100n	5	100n / 50v / COG / 5mm lead spacing	
C1, C10	1u	2	1u / 50v / 1.5mm lead spacing	
C4	2n2	1	2n2 / 50v / COG / 5 mm lead spacing	
C7	15p**	1	15p / 100v / COG / 2.5 mm lead spacing	
C11	1n	1	1n / 50v / COG / 5 mm lead spacing	
C14	100u	1	100u / 25v / 2.5 mm lead spacing	
C18	100p	1	100p / 50v / 5 mm lead spacing	

C19	10u	1	[10u low ESR capacitor](#)	Using a low ESR capacitor is critical. See AP2202 datasheet.
R1, R4, R6, R9	1k	4	1/4w resistor	
R2, R5	1Meg	2	1/4w resistor	
R3, R8	100k	2	1/4w resistor	
R11, R12	47k	2	1/4w resistor	
R7	10k	1	1/4w resistor	
R10	100R	1	1/4w resistor	
R13	4.7k	1	1/4w resistor	
D1	1N5817	1	[1N5817](#)	
D2	LED	1	[LTL2P3KGKNN Lite-On](#)	Any 5 mm LED should work.
U1	TL072	1	[TL072CP](#)	
U2	FV-1	1	Available from Audiofab or other sources	[FV-1](#)
U3	24LC32	1	[32kbit EEPROM](#)	
U4	AP2202K-3.3	1	[3.3v low noise, low drop-out regulator](#)	
Y1	ECS3x8X	1	[ECS-3X8X](#)	
SW1	SW_3PDT	1	[3PDT Footswitch - Solder Lug - Alpha](#)	Also available from Tayda
RV1, RV2, RV3	B100k	3	[16mm Potentiometer - Tall PCB Leg](#)	Alpha RV16AF-42-15R1 - Also available from Tayda
FB1	MMZ1608SHE 471ATD25	1	[Ferrite bead - 470 ohms](#)	
J1, J2	NYS215	2	[NYS215 REAN](#)	
J3	Bare solid wire	1	See assembly instructions	
J4	PJ-002A	1	[PJ-002A CUI Devices](#)	
J5	STPX-3501-3N-1	1	[STPX-3501-3N-1](#)	See assembly instructions
J6	Switch Conn	1	[1x5 / 0.1" header](#)	
LED bezel		1	[5mm LED Bezel - Low Profile](#)	Also available from Tayda
Case	Hammond 1590B	1	[1590B Enclosure](#)	Also available from Tayda
Knobs		4	[Davies 1900 Clone Knob](#)	Also available from Tayda

9V battery	1		

** Value may need to change if you use a different crystal than the one specified

You can use 1/4w carbon film or metal film resistors. 5% tolerance is fine. 1% tolerance is better but likely won't make a huge difference in the sound.

Switch PCB

Ref	Value	Qty	Comments	Alternate
PCB	PCB2	1	Easy Spin switch printed circuit board from Audiofab	
C1	100n	1	50V 0.1uF X7R 1206	
R1, R2, R3, R4, R5, R6, R7, R8	47k	8	47 kOhms 250 mW 1206	
U1	CD4532BE	1	CD4532 SOIC-16	
S1	SR1712F-0108-20F 0A-N9-N-027	1	1-pole, 8-position rotary switch (Alpha)	Alps SRBV181004

Build Steps

The Easy Spin consists of two separate PCBs: a main DSP board that contains the FV-1, EEPROM, power supply and all of the audio circuitry and a separate switch PCB that plugs into the main DSP board.

We'll start the assembly with the main DSP board. Set aside the potentiometers, input / output jacks, footswitch, LED and the DC power jack. They will be installed after all of the other components. To simplify assembly, we recommend downloading and using the Interactive BOM (available from our Downloads page). You can download and open the Interactive BOM in any standard web browser.

WARNING

Both PCBs (the DSP board and the switch PCB) use surface mount components. If you are not experienced with surface mount assembly, we strongly recommend you purchase these boards with the surface mount components pre-installed.
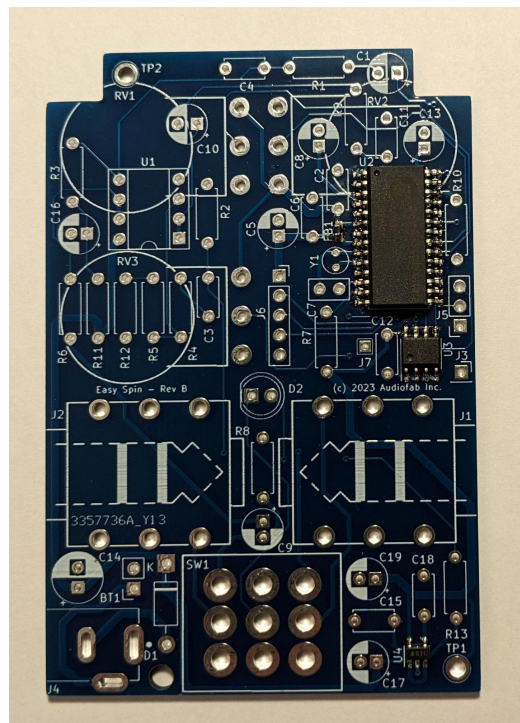
DSP PCB Assembly

The surface mount components must be installed first. This includes

- FV-1 DSP
- 24LC32A EEPROM
- AP2202 voltage regulator
- Ferrite bead (MMZ1608SHE471ATD25)

Once this has been completed your PCB should look as shown below.

Using the Interactive BOM (or the Schematic -- see above), carefully check the value of and install each resistor. Insert them so they are flush with the PCB and carefully solder each lead. Trim the leads on the solder side of the PCB after soldering.
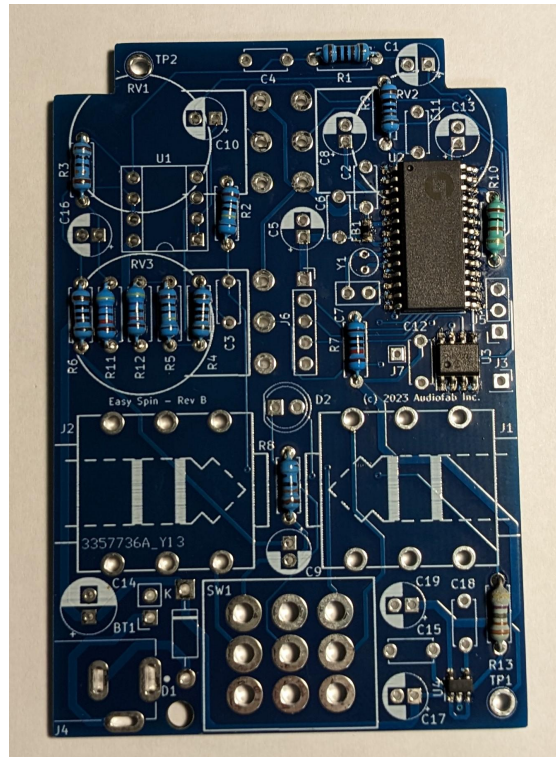
Next, install each of the capacitors. Carefully check the value of each capacitor before installation. Pay close attention to orientation of the polarized electrolytic capacitors (see below). If you are planning to substitute any of the electrolytic capacitors in the BOM, note that the height limitation for most capacitors is 7 mm. It is critical to use a low ESR capacitor for C19. Substitution of this capacitor is not recommended. Also note that all of the ceramic capacitors specified are high quality, C0G capacitors. We recommend using these to ensure the best performance.
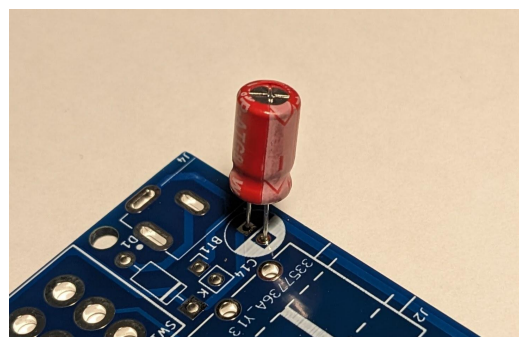
Insert capacitors so they are flush with the PCB and carefully solder each lead. Trim the leads on the solder side of the PCB for each one after soldering.

Next, install and solder the crystal (X1). When soldering, be careful not to overheat it -- solder one lead and allow it to cool before soldering the second lead.
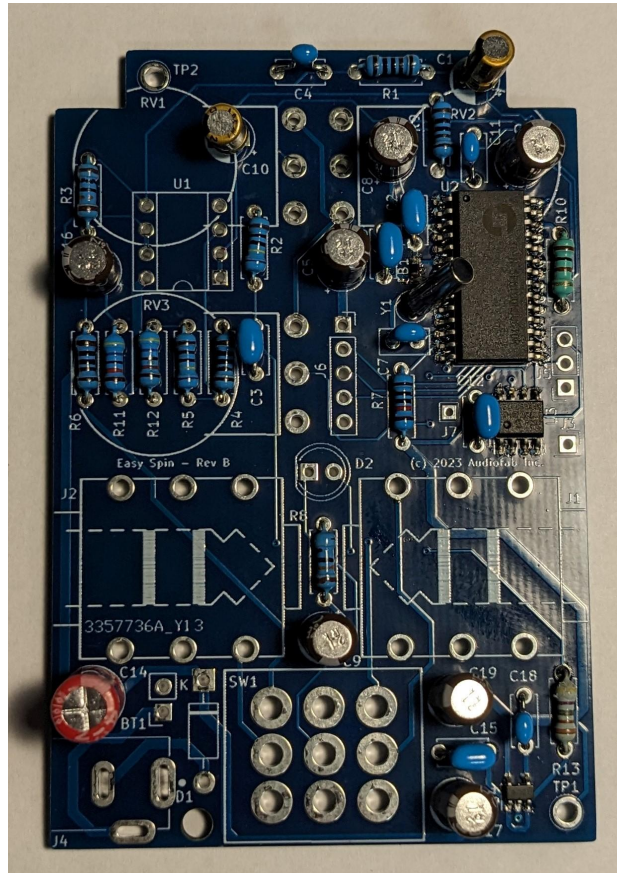

Install the Schottky diode and op-amp. Pay close attention to the orientation of the Schottky diode and op-amp. We recommend using an 8-pin IC socket for the op-amp -- make sure that the notch on the 8-pin IC socket lines up with the notch on the PCB silkscreen. When soldering, be careful not to overheat them -- solder one lead and allow it to cool before soldering another lead. Carefully trim the leads on the solder side of the PCB after soldering.

Inspect all of your soldering work and double check all components are installed in the correct locations and with the correct orientation (note: resistors, non-polarized capacitors and the crystal can be installed either way).

DSP PCB Mechanical Components

Trim the battery snap leads so they are 6 cm (2.4 in) long (see below). Then, wire strip and tin the ends of the wires on the battery snap. Install the battery snap by looping the negative (black) lead through the hole in PCB to provide strain relief. Pull the positive (red) lead through the hole (no loop required). Note that the positive (red) lead connects to pin 1 of BT1, the square pad and the negative (black) lead connects to pin 2 of BT1, the round pad.
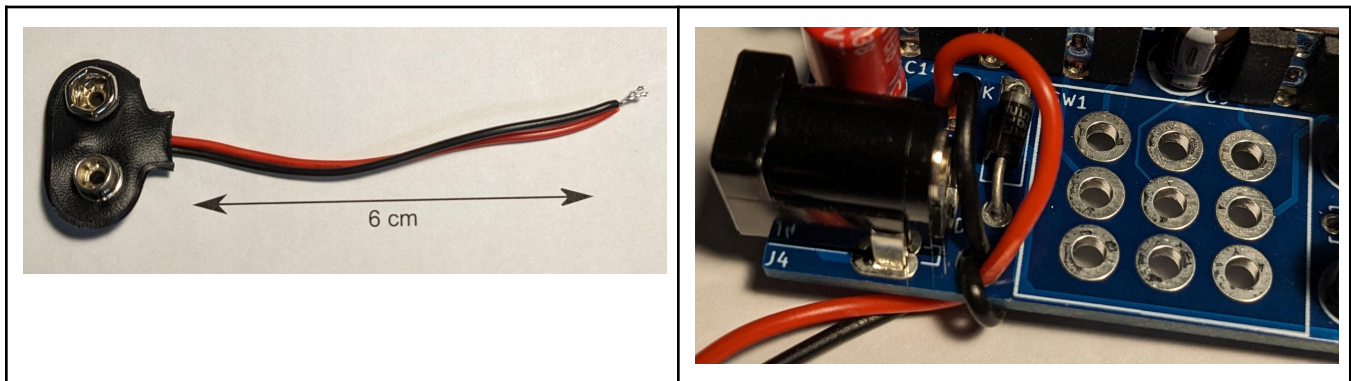
Install the DC jack (J4) and solder it. Ensure that it is flush and properly aligned with the PCB edge before soldering.
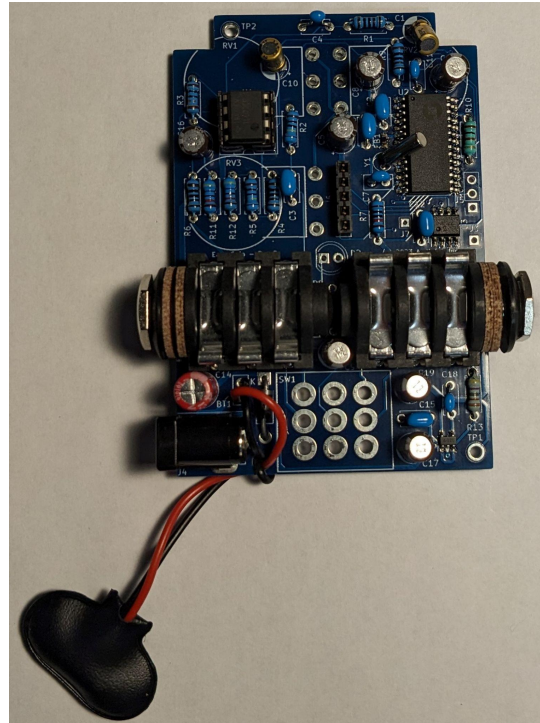
Install the input and output jacks (J1, J2). Ensure they are flush with the PCB before soldering them.

Finally, install the header socket (J6), ensuring that it is flush and at 90 degrees with the DSP PCB.

Install the opamp in the 8-pin socket. Ensure that the op-amp is correctly oriented in the socket (the notches on the IC and socket should line up).

Before installing the potentiometers, snap off the small metal nib on the face of the potentiometer using needle nose pliers. Then, install the potentiometers to the PCB ensuring that the PCB legs are flush with the surface of the PCB. Solder one pin of the potentiometer to hold it in place. Next, reflow the pin while aligning the potentiometer pins so they are flush with the PCB. Then, carefully solder each pin.
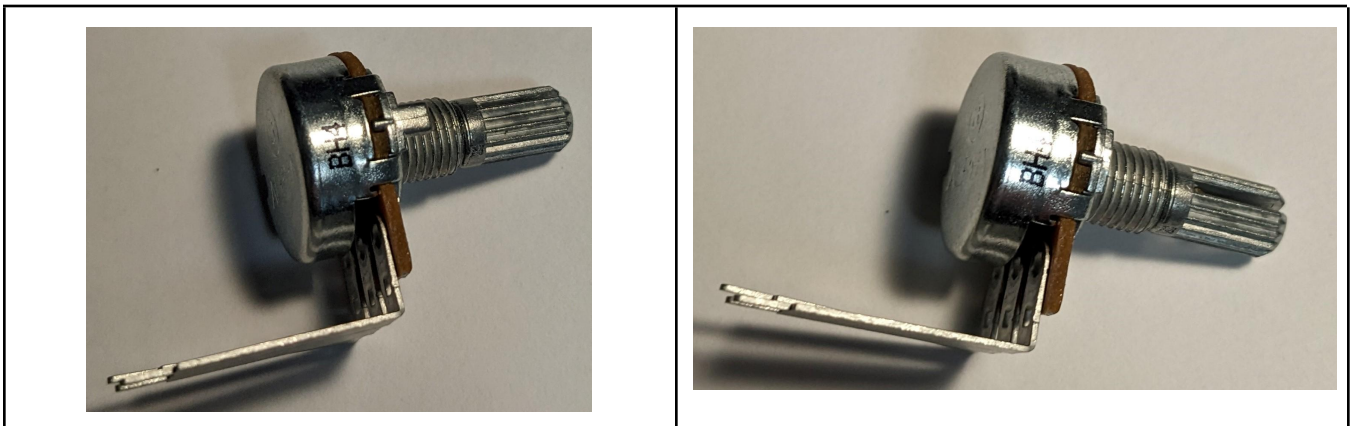

Install the 3PDT switch and solder it. Ensure that the base of the switch is flush with the PCB and that the switch is perpendicular (at a 90 degree angle) to the PCB.

Trim the leads on the input / output jacks, DC jack and 3PDT switch.

DSP PCB Finishing Up

J3 is used to ground the PCB to the case. You will need a piece of solid (not stranded) wire 3.5 cm (1.5 in) long that has been stripped -- 22 AWG is the preferred size. Bend the lead around the ferrule of J1 and insert one end into the J3 pad and solder it on the solder side of the PCB. Trim off any excess wire on the solder side of the PCB.
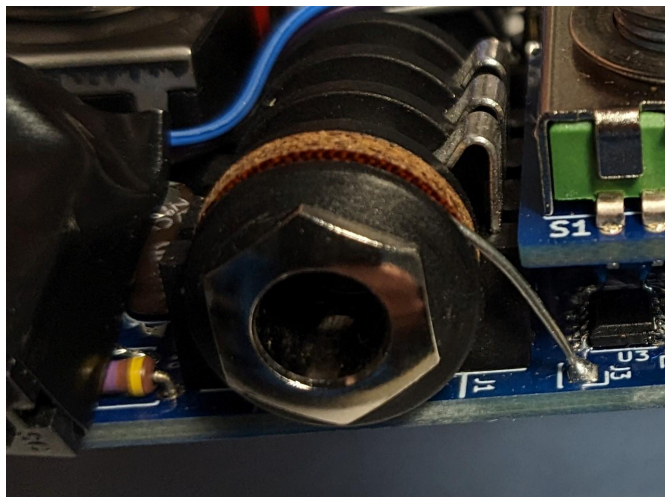

To ensure a successful final assembly, the LED must be installed so its surface is flush with the potentiometers, rotary switch and 3PDT switch.

The LED is polarized and must be installed in the correct orientation. Align the flat side of the silk screen symbol on the PCB with the flat side of the LED to ensure correct orientation. The LED must also be installed at the correct height (so it will protrude through the case). Align the flange at the bottom of the LED as shown in the photo below and then carefully solder each lead. Typically, the LED will be installed so there is 17 mm (0.67 in) from the PCB to the base of the LED. After soldering, trim the LED leads on the solder side of the PCB.
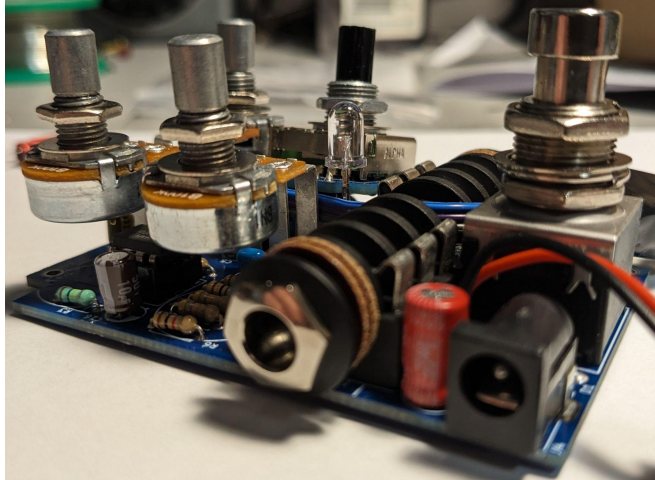
The programming jack requires off-board wiring and some pre-assembly. First, gently bend the pins of the jack as shown using needle nose pliers.
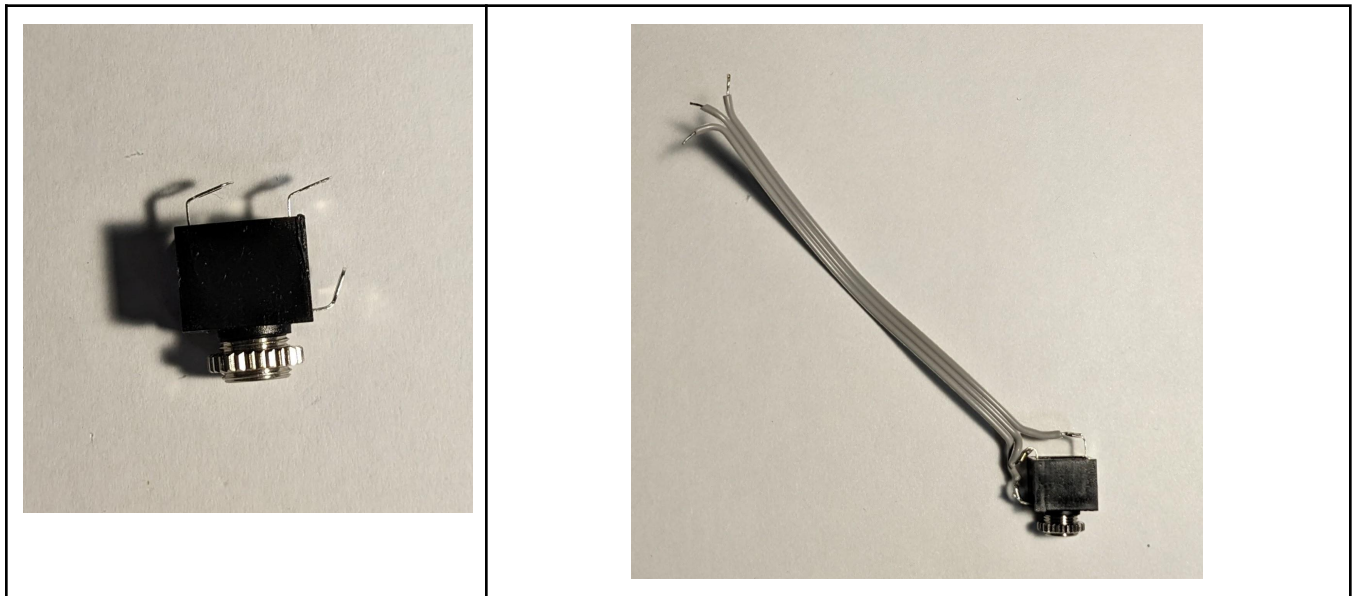
Next prepare a three-conductor wire that is 9.5 cm (2.75 in) long. Ribbon cable or shielded cable can be used. Strip and tin both ends of each of the wires that comprise the three-conductor wire.

Solder one end of the three-conductor wire to the programming jack as shown above.
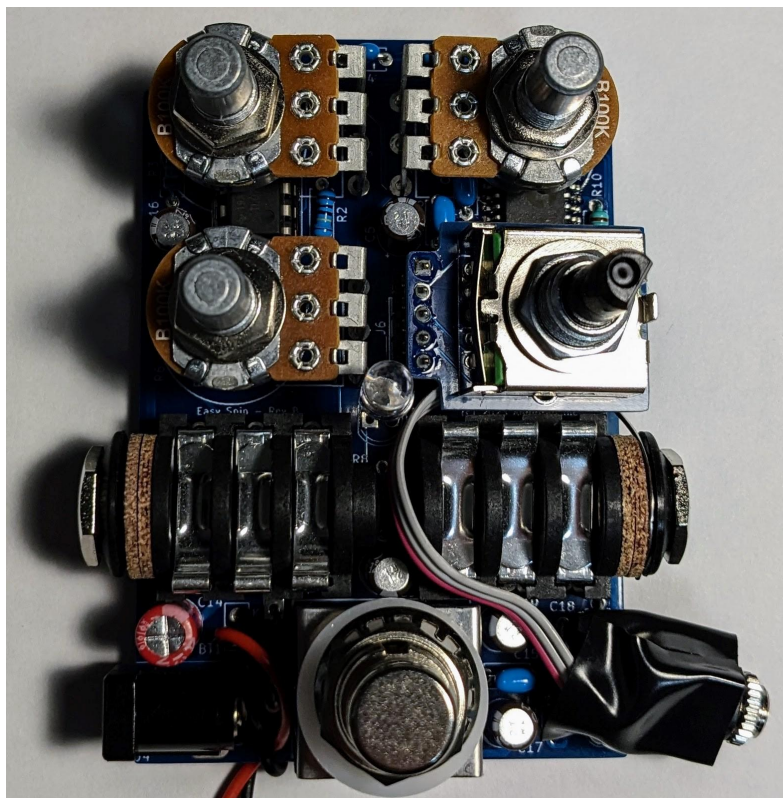
Position the jack next to the footswitch and route the three-conductor wire so the unsoldered end reaches J5 (see photo below).

Solder the wires to J5 as per the table below.

Jack pin	J5 pad*
Tip	3 (outer round pad)
Ring	2 (middle pad)
Sleeve	1 (outer square pad)

* See schematic

Carefully wrap the jack in electrically insulating tape as shown below.

Assembly of the DSP board is now complete.

Switch PCB Assembly

As noted above, SMT assembly is required to build the Switch PCB. If you are not proficient with SMT assembly, we strongly recommend that you purchase a Switch PCB with the SMT components pre-installed.

Once the SMT components are installed, the Switch PCB will look like this:
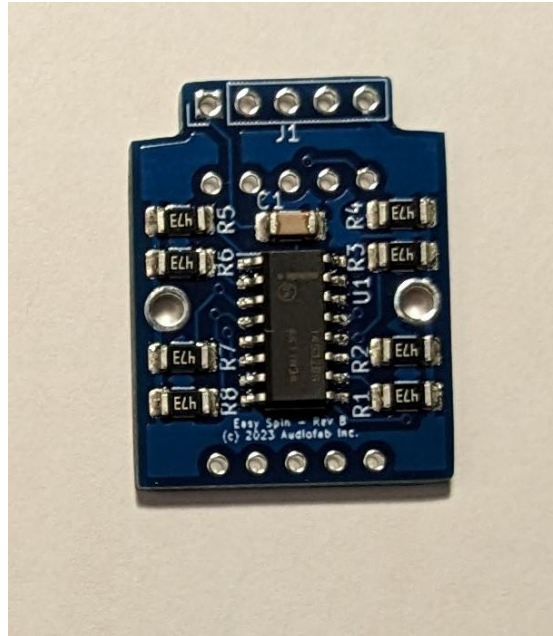
Next, install the 5-pin header at J1, ensuring that it is flush component side of the PCB and perpendicular to the PCB (see photo below). Solder each of the pins and then trim them.

Depending on which switch you purchased, you may need to trim the shaft. We recommend doing this before installing the switch on the PCB. If you do need to trim the shaft (to make it the same length as the potentiometer shafts), measure and mark a cut line that is 9 mm (0.35 in) from the top of the bushing. Clamp the shaft of the switch in a vice with the cut line exposed and use a hacksaw to cut the shaft to the desired length.

Finally, install the 8-position switch on the PCB -- it "snaps in" and will only install in one orientation. Solder each of the pins on the switch (including the ground pins) and then trim all pins.
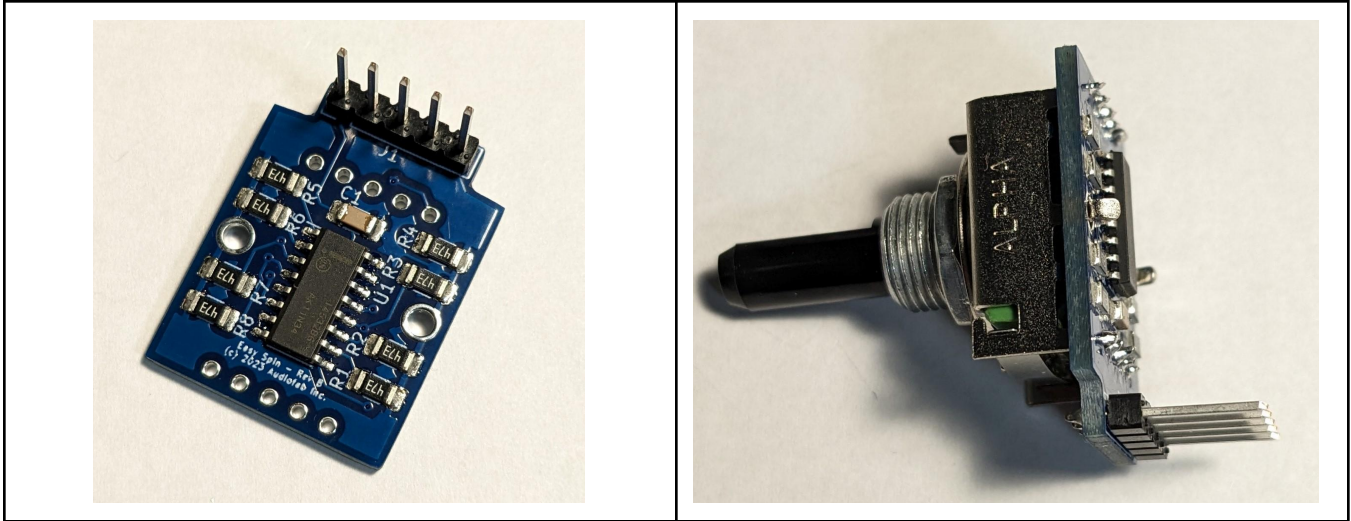
Assembly of the Switch PCB is now completed.

Case Machining

The provided drilling template must be printed out 1:1 on paper (check this by measuring the dimension line on the page) and trimmed to make a "wrapper" for the 1590B case. Once you have trimmed out the case using scissors or an Exacto knife (including the slot for the DC jack), carefully fold along the dotted lines to make your "wrapper".
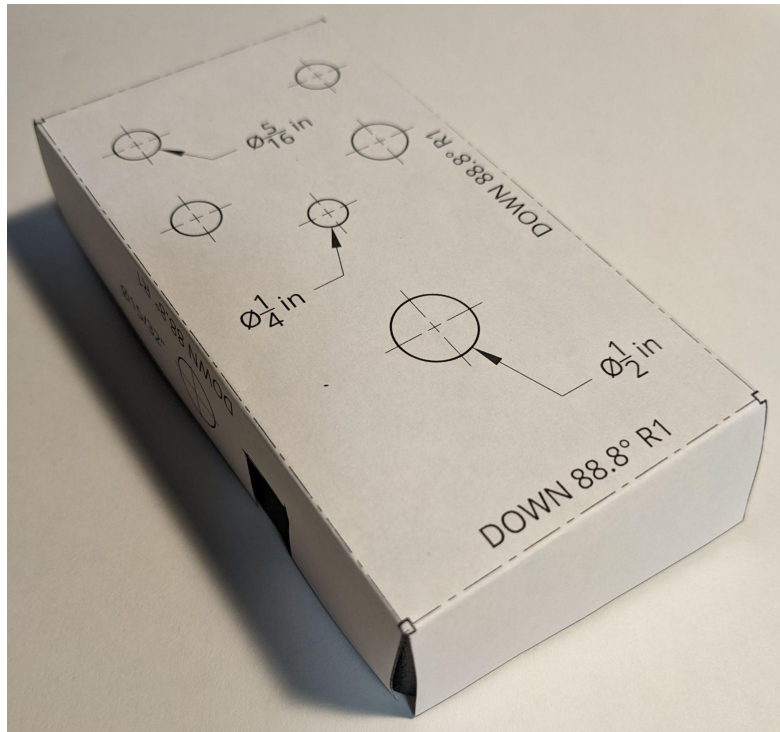
We recommend using a drill press along with proper safety equipment and procedures for machining the enclosure. It can be done with a hand drill, but is more challenging.

To begin, wrap the case with the drilling template and secure it to the edge using masking tape (or similar). Then, carefully center punch each hole (put an indentation in the metal at the center of the hole).

Mark the DC jack using a permanent marker or by carefully scratching into the enclosure finish. Remove the drilling template and tape from the case.

Begin by drilling each center punched hole with a small drill bit (recommended size 1⁄16"), ensuring that the bit aligns on the center punched hole. Next, drill the entire enclosure (all holes) with a ¼" size drill bit. Be sure to protect the case from scratches and nicks while you are drilling it.

Then drill all holes at the specified sizes. We recommend using a stepped drill bit as it simplifies things. With the exception of the LED, all holes are slightly oversized to ease final assembly.

Component	Hole size
Potentiometers	5⁄16"
Rotary Switch	23⁄64"
LED	¼"
Footswitch	½"
Input and output jacks	½"
Programming jack	¼"

For the DC jack, center punch a series of holes along the top edge and begin by drilling a series of small holes (recommended size 5⁄64") along the horizontal dimension of the DC jack -- ideally with one in each corner. Then, using a hacksaw carefully cut down the centerline of the vertical dimension and stop when you hit the hole in the corner. Snap the tab of metal out using a pliers and finish the hole with a file to make it neat and rectangular.
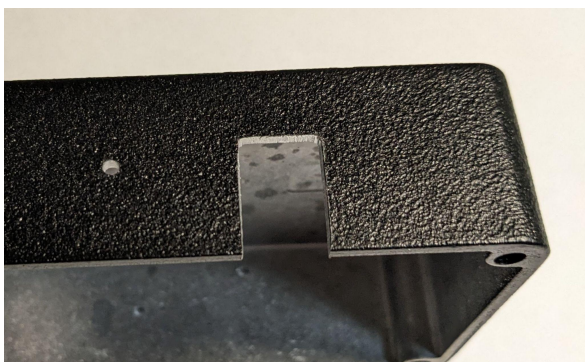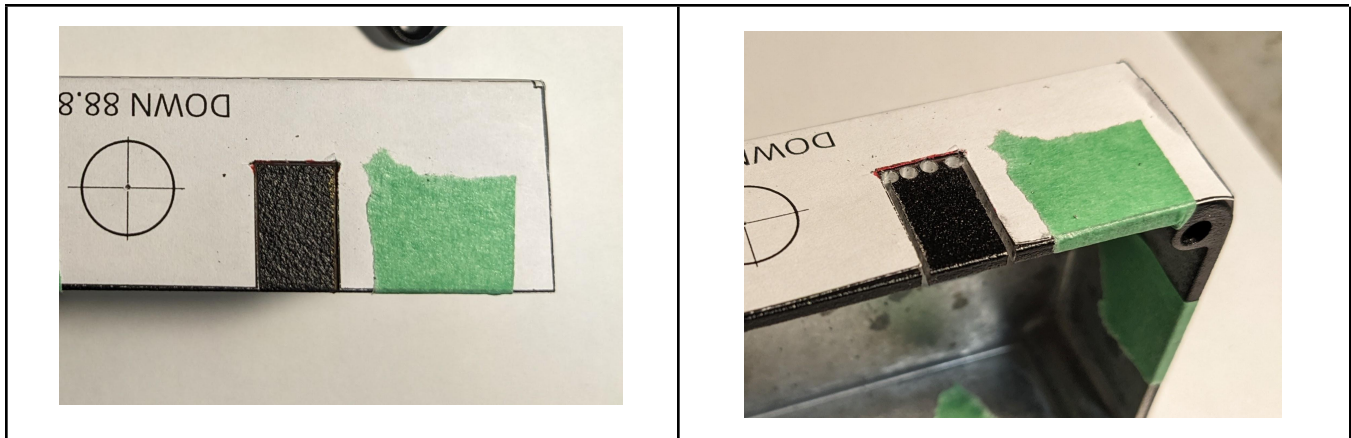
Labeling

We provide 1:1 artwork that you can use to label your pedal. We've had good luck with a number of methods. For one-off home use, water slide decals work well and can be clear-coated with Krylon (or similar) to protect them.
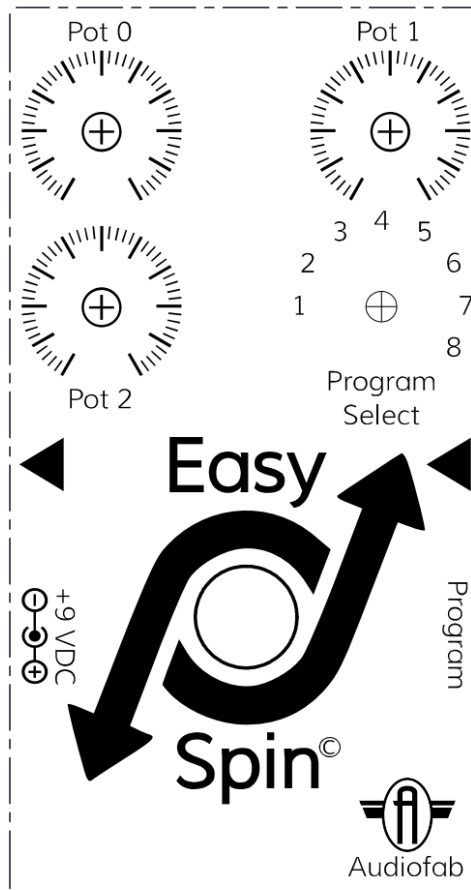
Final Assembly

Assuming everything was done as described above, final assembly is straightforward.

The ground wire that was installed at J3 must be able to make a good electrical connection to the case. Inspect the inside of the case where the input jack will be located. If there is paint or powder coat around the input jack hole on the inside of the case, you will need to remove it to expose bare metal. If you need to remove and paint or powder coat, use sandpaper or something similar to expose bare metal around the jack to ensure that the wire makes good electrical contact with the case.

Remove nuts and washers from potentiometers and switches. Remove the ferrules and plastic outer rings from the input and output jacks. Make sure that the fiber washers (two per jack) stay on the input and output jacks.

If it is not already done, plug the Switch PCB into the DSP PCB using the 5-pin connector. Confirm that the programming jack and wiring are positioned and routed as noted above.

Install the LED bezel into the top of the finished case (it just snaps in).

Put one nut on the 3PDT footswitch and tighten it down as far as it will go. Put the lock washer on top of the nut. (This will ensure the proper height for the footswitch).

Carefully insert the board assembly (DSP board with Switch board plugged into it) into the case, aligning the DC jack, rotary switch and potentiometers as you go. Ensure that the J3 wire contacts the case and doesn't block the input jack. It can sometimes take a few minor adjustments to get everything aligned and the board installed. Be patient!

If things are not fitting together easily, remove the PCB from the case and make small adjustments to the alignment of the potentiometers, LED etc.

Aligning the programming jack can be a bit tricky. You may need to use a wire or some small needle nose pliers to get the bushing through the hole in the case. Once you have it through, put the nut on but do not tighten it all the way -- keep it loose for now.

Once the board is in place (with the potentiometers, switches and LED protruding through the case), install the washers and nut and hand tighten everything down, including the programming jack nut. Next, install the plastic outer rings and ferrules on the input and output jacks and hand tighten them.

Alternately tighten the input and output jack ferrules using a nut driver or wrench until they are snug (don't over torque them). Then, tighten down all the remaining nuts using a nut driver or wrench (again, don't over torque them).
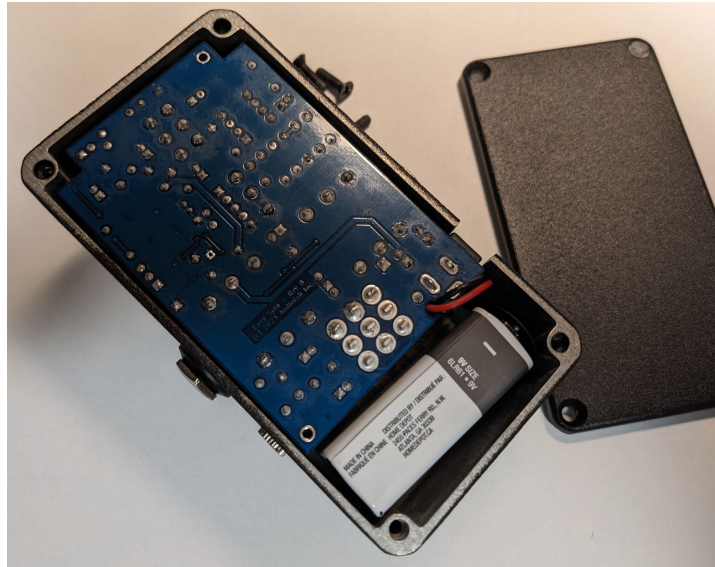
Check the clearance between the back edge of the case and the solder side of the PCB. It should be uniform all around the enclosure and roughly 3 mm (0.04 in). If it is not, you will need to disassemble the pedal, determine what went wrong and correct it.

Once the assembled PCB is properly spaced and installed, you can install the knobs, install a 9V battery and close up the case using the four screws that came with the case.

Programming and Use

The EEPROM in the Easy Spin pedal must be programmed before the pedal can be used. If the EEPROM is not programmed with a valid DSP program, there will be no audio output from the Easy Spin pedal.

We provide a test bank of programs and a document describing them in our [Downloads](#) area that you can use to program and test the Easy Spin. Create a directory where you will store all of your Easy Spin programs; then, download the test programs and the document.

Next, refer to the Audiofab USB Programmer manual and download the latest version of the programming software to your computer. Once this software is downloaded and installed, you can program and test the Easy Spin.

Connect the Audiofab USB programmer to the Easy Spin pedal using the ⅛" mini jack. Then, connect the Audiofab USB programmer to your PC using a USB cable (note that you need to provide the USB cable).

The Easy Spin pedal must be powered when programming. We recommend connecting an external 9 volt power supply to the Easy Spin. However, if this is not possible you can program the Easy Spin using the internal 9 volt battery -- just make sure that you have a good (fresh) battery installed and that you insert a ¼" jack into the input plug on the Easy Spin to enable power. (Note that plugging into the input jack is not required when you use an external 9 volt power supply.)

Then, follow the instructions in the Audiofab USB Programmer manual to program your pedal. The document provided with the bank of test programs also provides information on how to test your pedal.

Once the EEPROM is programmed with one or more DSP programs, you will need to reboot the pedal or switch away from and back to the program you want loaded to force the FV-1 to load the desired program.

… and then rock and roll!

Terms

Other than this documentation, Audiofab does not provide any direct support for our projects. You will need some pedal building experience before building one of our pedals.

No refunds or replacements are offered unless it can be shown that our documentation or the circuit contain a reproducible error.

You are free to use our projects for any purpose, provided you retain our copyright notices and give appropriate attribution to Audiofab.

Revision History

Version	Date	Comments
1.0	August 14, 2023	Initial release
1.1	August 15, 2023	BOM corrections
1.2	August 21, 2023	Updated drill hole sizes