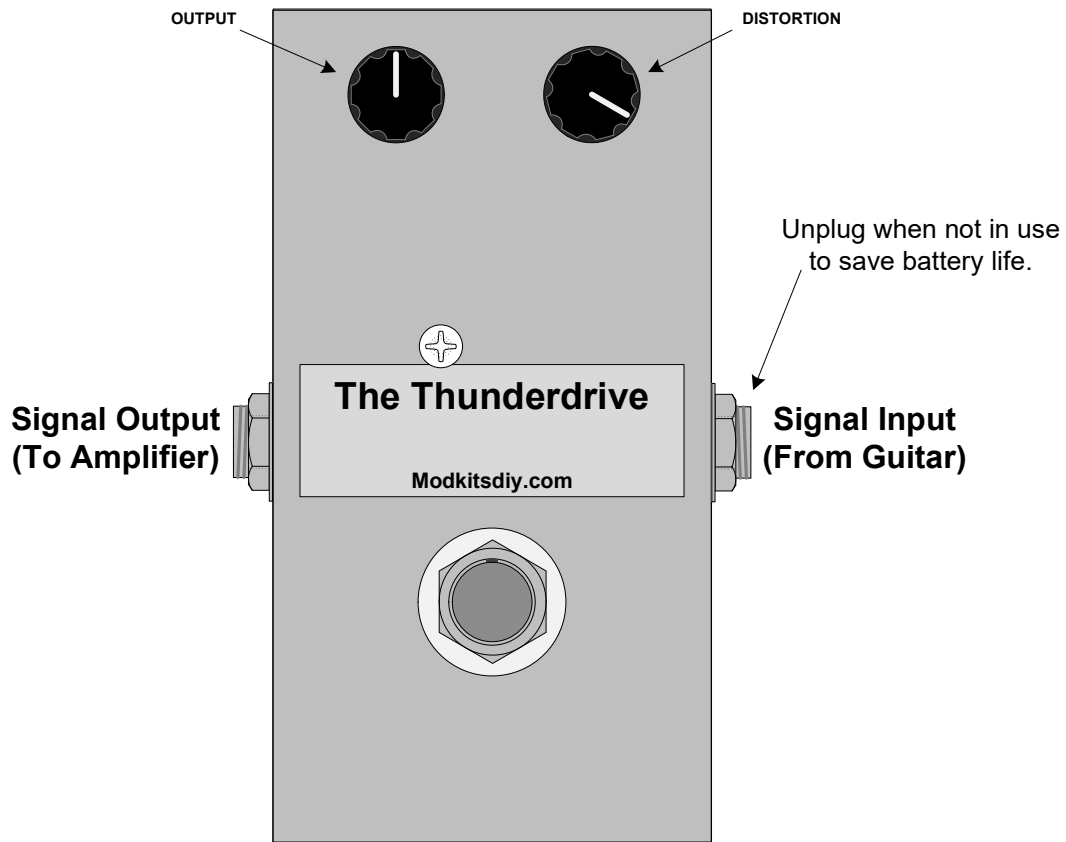


# THE THUNDERDRIVE (K-950)



## Use these instructions to learn:

- How to build an effects pedal for overdrive.

The Thunderdrive is an overdrive pedal kit that will provide a strong clean signal boost in the early gain settings and smooth distortion at maximum gain settings. Adjusting output and distortion controls provides a wide variety of tones in spite of its simple construction. It is capable of overdriving the preamp section of your guitar amp or adding its own layer of distortion at lower volume.

**Warning:** *This circuit was designed for use with a 9 VDC power supply only.*

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## **TABLE OF CONTENTS**

TOOL LIST .....	2
PARTS LIST DRAWINGS.....	3, 4
SOLDERING TIPS .....	5
STEP BY STEP ASSEMBLY INSTRUCTIONS .....	6
Section 1 – Mount ¼” Jacks and Terminal Strip Components .....	6
Section 2 – Mount Potentiometers and Footswitch .....	7
Section 3 – Mount and Connect Remaining Components .....	7
Section 4 – Wire Remaining Connections .....	7
 <b><u>ASSEMBLY DRAWINGS</u></b> (4 Drawings) .....	8, 9

These are the last 2 pages. They should be separated and used as a reference to help assemble the kit correctly.

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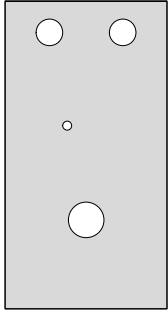
## **TOOL LIST**

- Wire Strippers
- Needle Nose Pliers
- Cutting Pliers
- Desoldering Pump
- Solder (60/40 rosin core)
- Soldering Station
- Phillips Head Screwdrivers
- Slotted tip screwdrivers (3 mm tip)
- Channellock Pliers (or similar type)
- Ruler
- Hobby Vise (or other means to secure box while working)

# PARTS LIST 1

Stranded Wire (22 AWG) - Blue  
K-PUL1569-BLUE (3 FT)

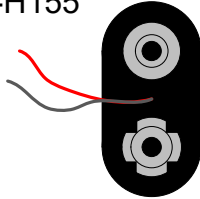
Enclosure  
P-H1590BCE (1)



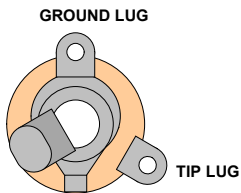
Knob (Scalloped Edge)  
P-K801 (2)



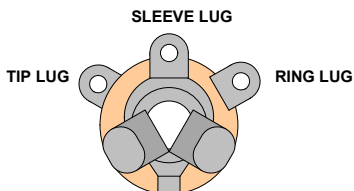
Battery Clip  
S-H155 (1)



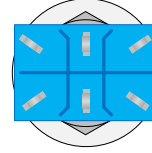
1/4" Mono Jack (Output Jack)  
W-SC-11-T (1)



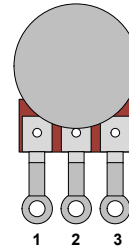
1/4" Stereo Jack (Input Jack)  
W-SC-12B (1)



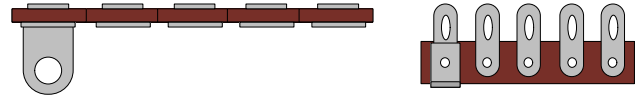
DPDT Foot Switch  
P-H498 (1)



250kΩ Potentiometer (Audio Taper)  
R-VBM-250KA-SS (2)



Terminal Strip with 5 Terminals  
P-0501H01 (1)



#4 Screw (3/8" long)  
S-HS440-38 (1)



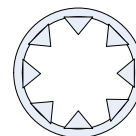
#4 Nut  
S-HHN440 (1)



#4 Lock Washer  
S-HLW4 (1)



3/8" Lock Washer  
S-HLW38 (2)

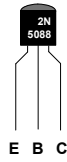


## PARTS LIST 2

NPN BJT (2N5088)

P-Q2N5088

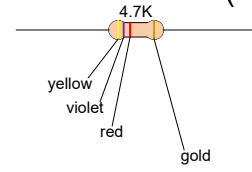
(1)



4.7k $\Omega$  Resistor  $\frac{1}{2}$  W

R-A4D7K

(1)



1N4148 HIGH SPEED SOLID STATE DIODE

P-Q971

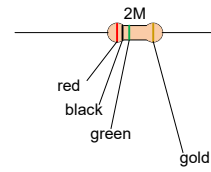
(2)



2M $\Omega$  Resistor  $\frac{1}{2}$  W

R-A2M

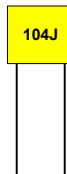
(1)



0.1 $\mu$ F Capacitor 50V

C-PFD1-50-R

(2)

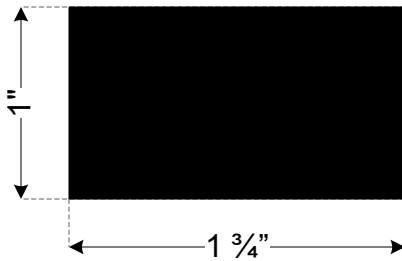


Insulating Tolex

(Use to insulate the battery from the footswitch lugs)

S-G312

(1)

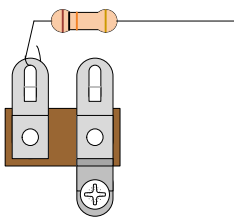


## SOLDERING TIPS

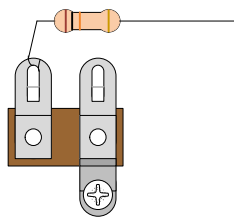
It is important to make a good solder joint at each connection point. A cold solder joint is a connection that may look connected but is actually disconnected or intermittently connected. (A cold solder joint can keep your project from working.)

Follow these tips to make a good solder joint. *Take your time with each connection and make sure that all components are connected and will remain connected if your project is bumped or shaken.*

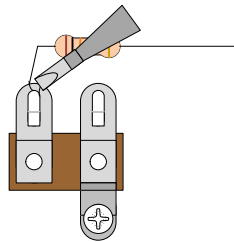
1. Bend the component lead or wire ending and wrap it around the connection point.
  - Make sure it is not too close to a neighboring component which could cause an unintended connection.
2. Wrap the component lead so that it can hold itself to the connection point.
3. Touch the soldering iron to both the component lead and the connection point allowing both to warm up just before applying the solder to them.
4. Be sure to adequately cover both component lead and connection point with melted solder.
  - Remove the soldering iron from your work and allow the solder joint to cool. (The solder joint should be shiny and smooth after solidifying.)
  - Cut off any excess wire or component leads with cutting pliers.
  - Clean the soldering iron's tip by wiping it across the wet sponge again after making the solder joint.



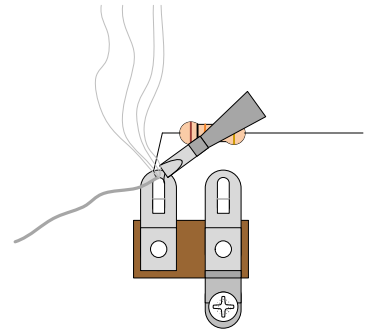
1. Bend the component lead and wrap it around the connection point.



2. Wrap the component lead so that it can hold itself to the connection point.

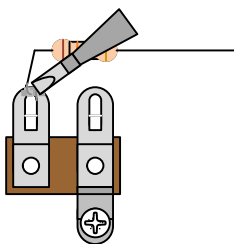


3. Heat up both component lead and connection point with the soldering iron.

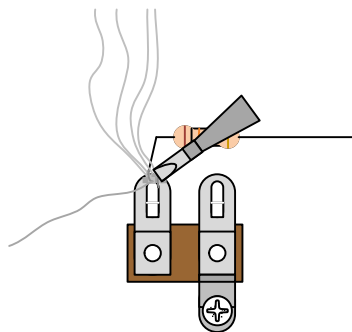


4. Apply solder to both component lead and connection point.

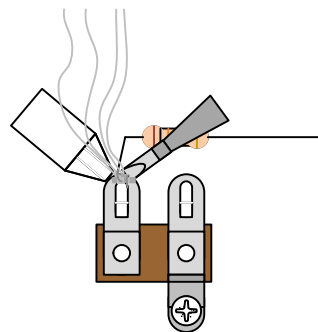
### De-Soldering Tip



1. Heat up old solder joint with the soldering iron.



2. Apply fresh solder to mix in with old solder joint



3. Use a de-soldering tool to remove the old solder joint while it is heated.

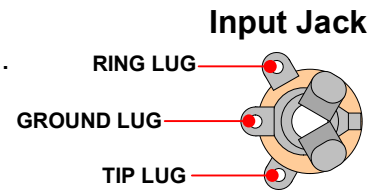
## SECTION 1 – Mount 1/4” Jacks and Terminal Strip Components

Please refer to **DRAWING 1** and **DRAWING 2**.

Orient the box with 1/2” hole nearest you.

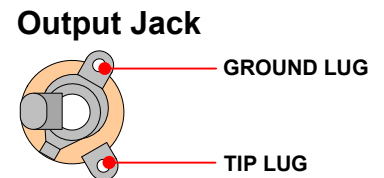
- Mount input jack in 3/8" hole on left side of box with hardware provided.

Washer goes under nut on outside of box. Make sure center “ground” lug of input jack is facing up. Correct positioning of jack will make soldering connections much easier. When positioned correctly, tighten nut.



- Mount output jack in 3/8" hole on right side of box with hardware provided.

Washer goes under nut on outside of box. Make sure the “tip” lug is on top (towards the enclosure opening) before tightening nut.



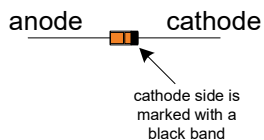
- Mount the terminal strip to the 1/8" hole as shown in drawing 2.

We will refer to terminal numbers from “1” to “5” as illustrated.

Unless noted otherwise, connect and solder all of the following to their respective connection points as stated. (Make sure none of the component leads are so close together that they could lead to an unintended connection). *Be careful not to overheat the solid state devices (diodes and transistor) when soldering.*

- Mount one end of the two diodes to terminal #1 on the terminal strip (leaving the other end free for now). Make sure to connect the diodes with the reverse polarity of one another. In other words, terminal #1 should be connected to one diode’s cathode as well as the other diode’s anode.

Keep the diode leads long so they can reach the volume pot to be mounted later in the instructions.

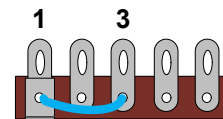


You might find it easier to mount these diodes by twisting their leads together first.



- Strip and tin a 1 1/2” piece of wire and connect terminal #1 to #3.

You might want to connect to the lower terminal holes to leave room for other components.

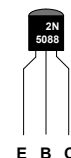


- Mount the 2N5088 transistor to terminals 3, 4 and 5. **Do not solder.**

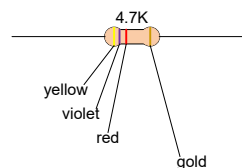
**Terminals #3:** Emitter

**Terminals #4:** Base

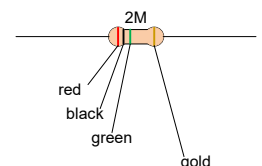
**Terminals #5:** Collector



- Mount the 4.7K resistor to terminals 2 and 5. **Do not solder.**



- Mount the 2M resistor to terminals 4 and 5. **Do not solder.**

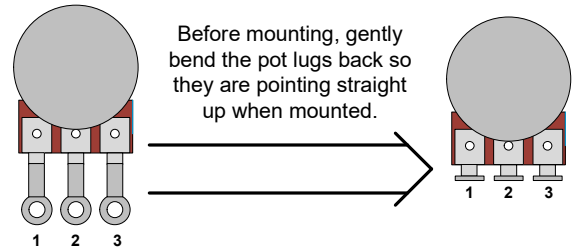


## SECTION 2 – Mount Potentiometers and Footswitch

Please refer to **DRAWING 3**.

1) Mount the two 250K potentiometers in the 3/8" holes at the top of the enclosure using hardware provided.

Remove nut and flat washer from potentiometers and place large lock washers (S-HLW38) over shaft of each pot before inserting them through their mounting holes. Fasten nut over flat washer and tighten.



2) Mount the DPDT footswitch in the 1/2" hole with its solder lugs oriented as in the drawing. (The top hex nut and large plastic washer should be fastened on the outside of the box).

## SECTION 3 – Mount and Connect Remaining Components

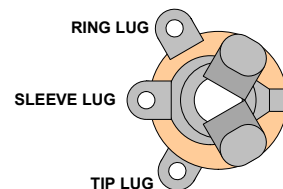
Please refer to **DRAWING 4**.

1) Connect the loose ends of the two diodes to output pot lug "1". **Do not solder.**

2) Connect one of the 0.1μF capacitors to output pot lug "1" and terminal #5 of the terminal strip. **Solder all connections at output pot lug "1" and terminal #5 now.**

3) Connect the other 0.1μF capacitor to terminal #4 and to both lugs "2" and "3" of the distortion pot. **Solder all connections at terminals #3, #4, #5 and distortion pot lugs "2" and "3" now.**

4) Locate the battery clip. Cut 1 1/2" length off the ends of each lead and discard (or save for other projects). Connect the black lead to the "ring" lug of the input jack. Connect the red lead to terminal #2 of the terminal strip. Solder these connections now.



## SECTION 4 – Wire Remaining Connections

1) Strip and tin a 1 1/2" piece of wire connect footswitch lugs "3" and "6".

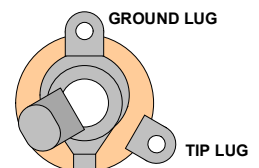
Leave the area behind the footswitch free from obstruction because it will be a tight fit for the 9V battery back there.

2) Strip and tin a 1" piece of wire and connect the input jack "tip" lug to the footswitch lug "2".

3) Strip and tin a 3 1/2" piece of wire and connect footswitch lug "1" to distortion pot lug "1".

4) Strip and tin a 1 3/4" piece of wire and connect the output jack "ground" lug to output pot lug "3".

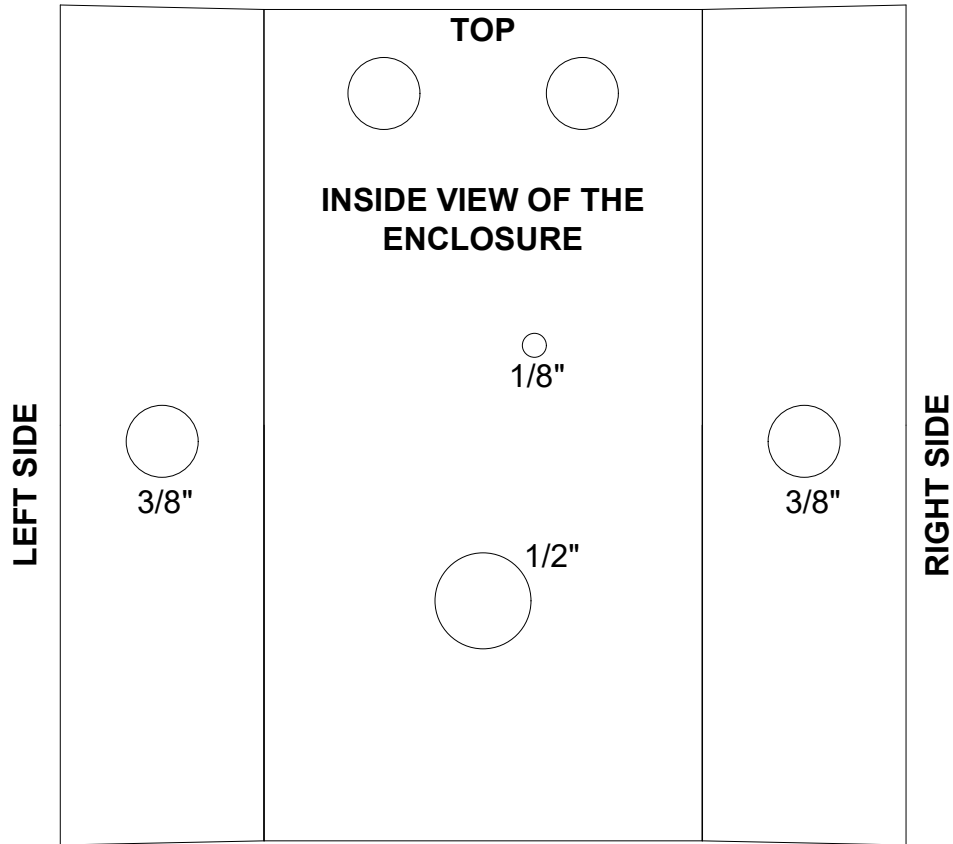
5) Strip and tin a 1 1/4" piece of wire and connect the output jack "tip" lug to footswitch lug "5".



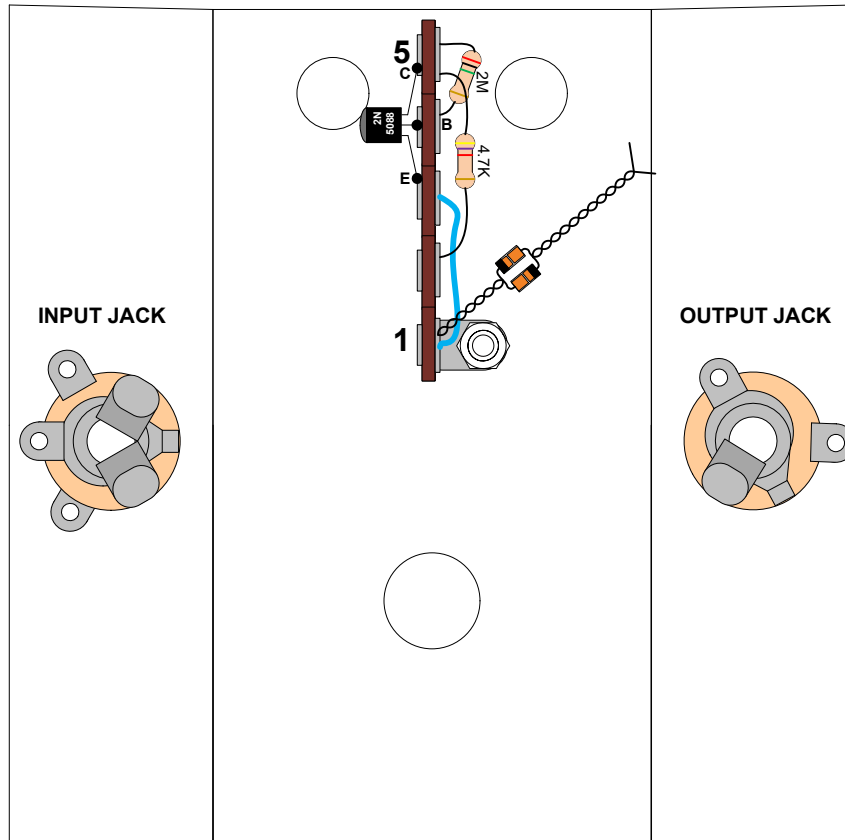
6) Strip and tin a 3 1/2" piece of wire and connect the output pot lug "2" to footswitch lug "4".

**Finish it off by double-checking all of your connections, connect and insert a 9V battery (with insulation), screw the lid on and fasten the knobs to both pot shafts.**

# DRAWING 1

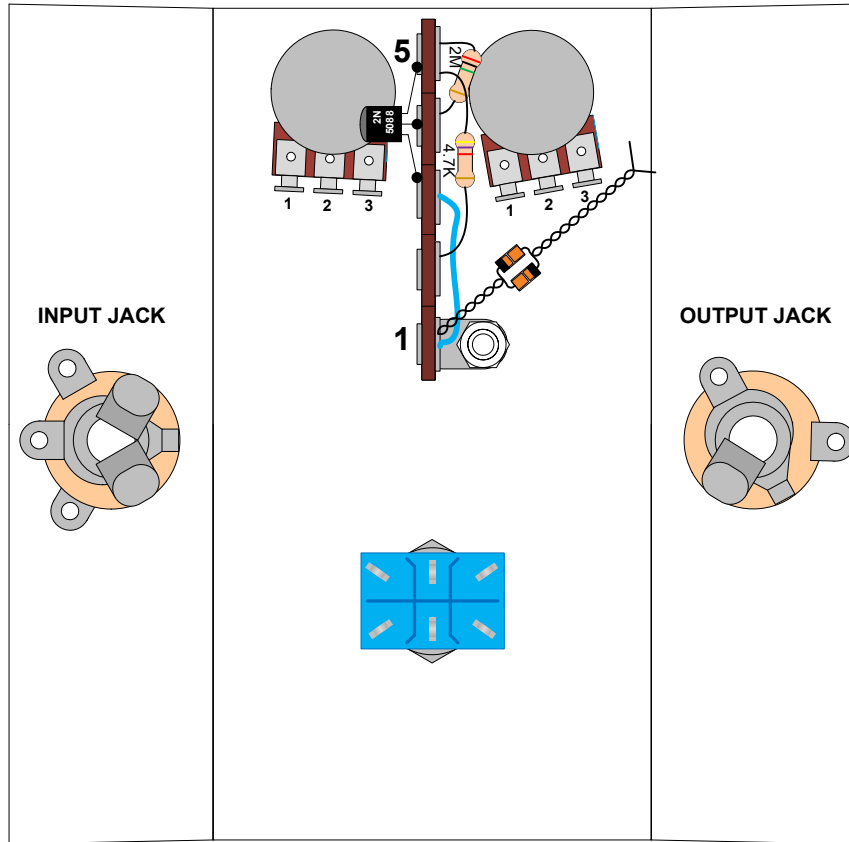


# DRAWING 2

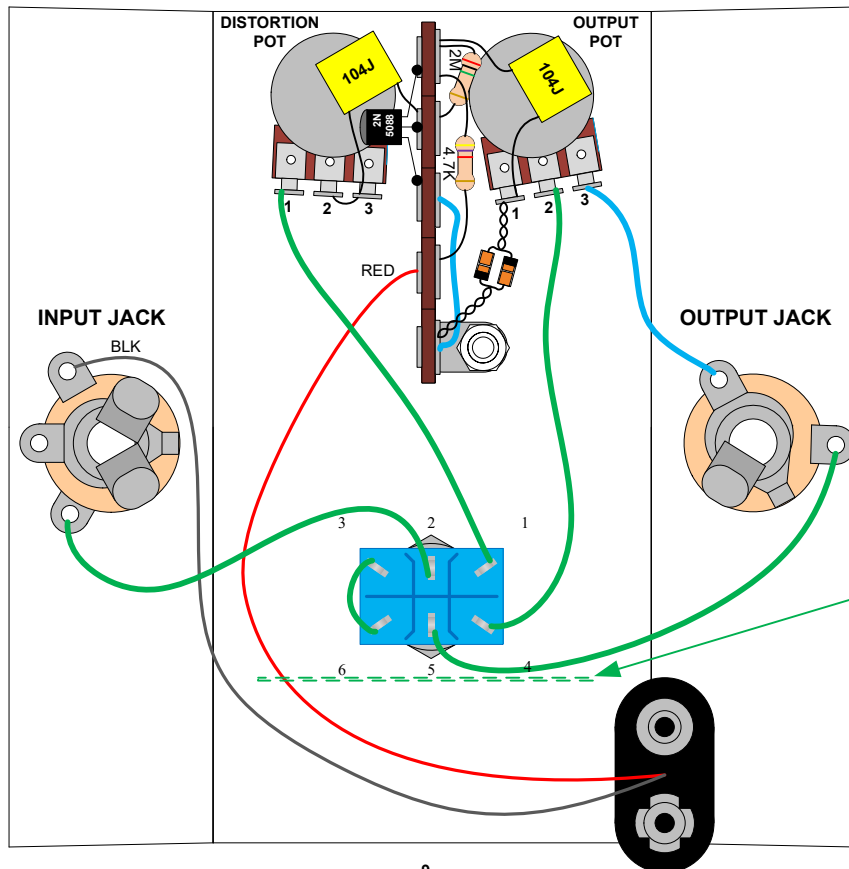




### DRAWING 3



### DRAWING 4



**Use this troubleshooting supplement to help:**

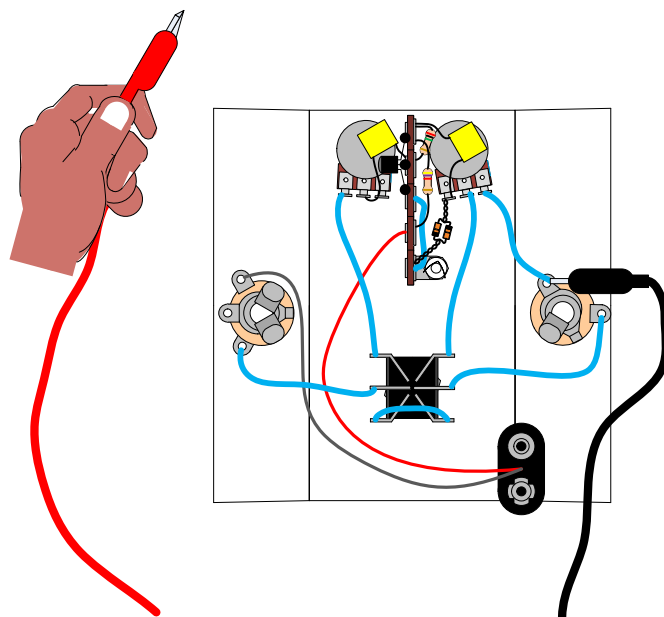
- Measure DC voltage test points to identify major discrepancies and locate problem areas.

(Keep in mind that the voltage measurements will vary slightly from kit to kit. The voltages you measure should be in the same ballpark, but do not expect to get the exact same value.)

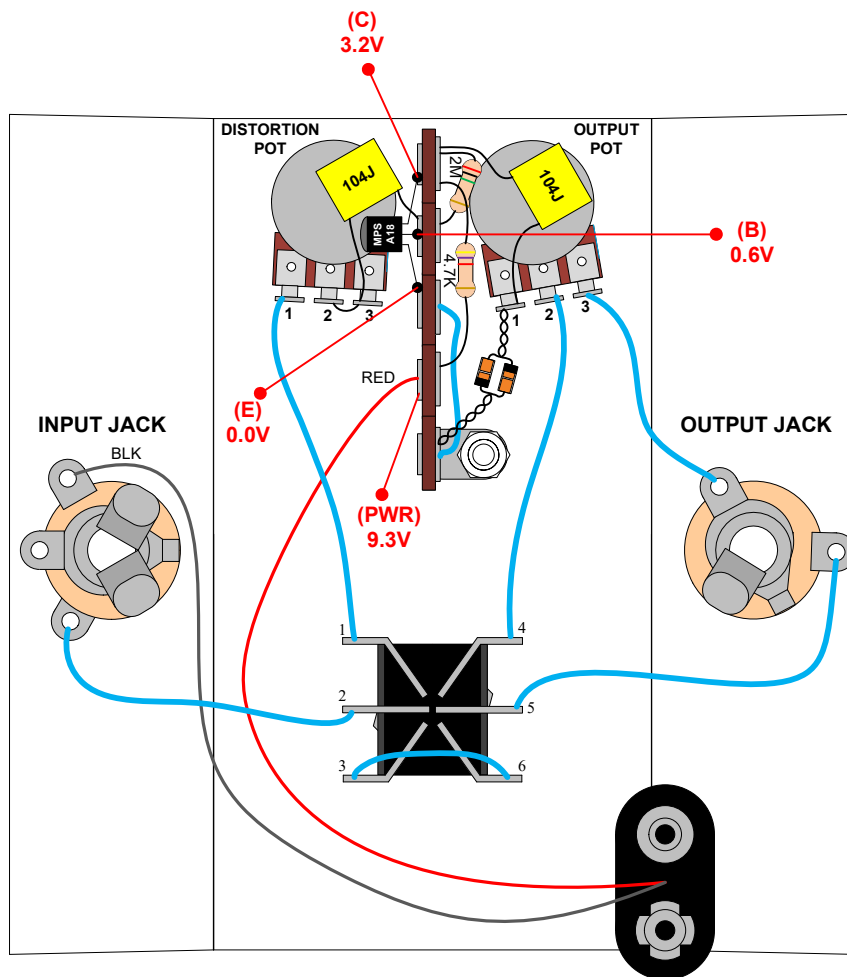
Test Point	Location Description	DC Voltage Measurement
E	Transistor's Emitter	0.0 VDC
B	Transistor's Base	0.6 VDC
C	Transistor's Collector	3.2 VDC
PWR	Power Supply	9.3 VDC

Using a volt meter, connect the ground side lead of the meter to any ground point on the pedal. One ground point would be the output jack's ground lug. The other volt meter lead will be used to measure DC voltage at the test points listed above and shown in the drawing on the next page.

***You must plug a guitar cable into the input jack when taking the voltage measurements because the input jack is set up to disconnect power from the circuit when unplugged.***



## DC Test Points

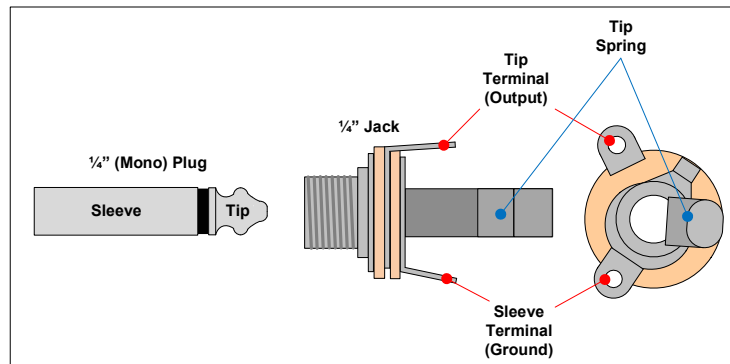


## Measuring AC Voltages from the Guitar Signal

Once your DC voltages are in order, if your kit is still not working properly, you can measure AC voltages along the signal path to troubleshoot further.

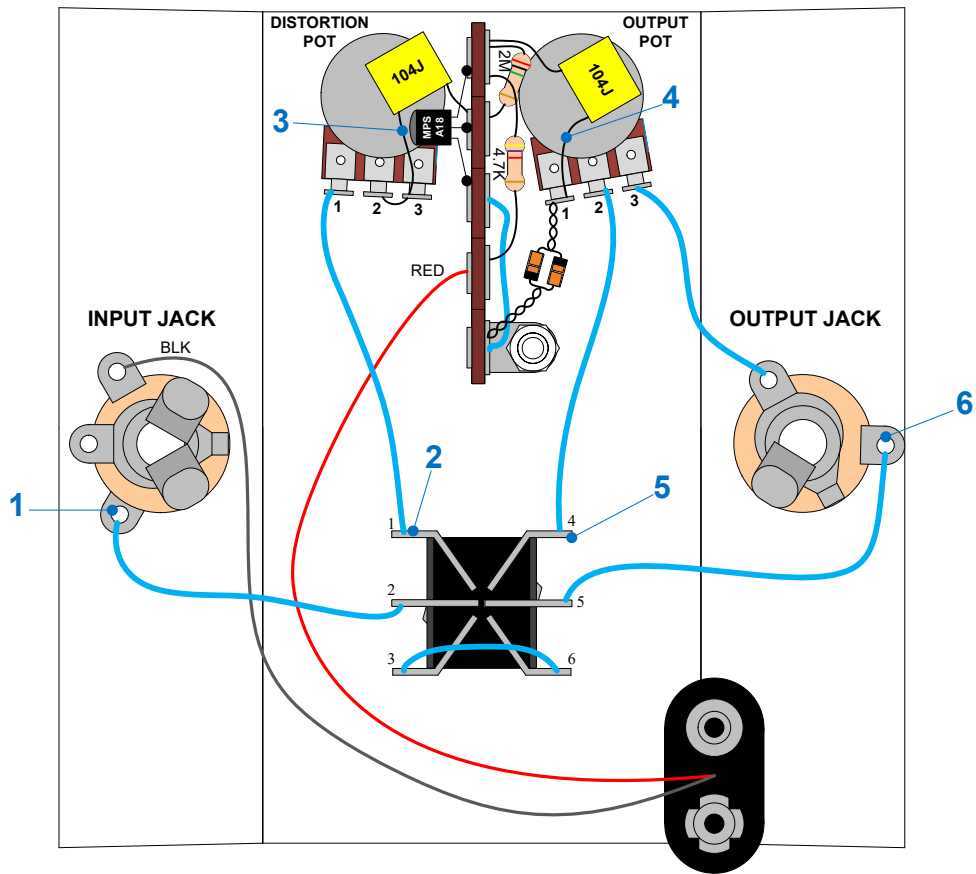
You will need a volt meter that can measure the small signal AC voltages that electric guitars put out. The output signal from your guitar will be less than 1 V.

First, measure the output signal directly from your guitar. You can do this by plugging your guitar cable into the guitar and leaving the other end of the cable disconnected. Connect your meter across the disconnected  $\frac{1}{4}$ " plug's "tip" and "sleeve" sections. Make sure your guitar's volume and tone controls are turned up and strum a chord. When you strum, you should see the AC voltage reading on the meter quickly rise to some maximum value and then fall back to 0 VAC when you stop strumming.

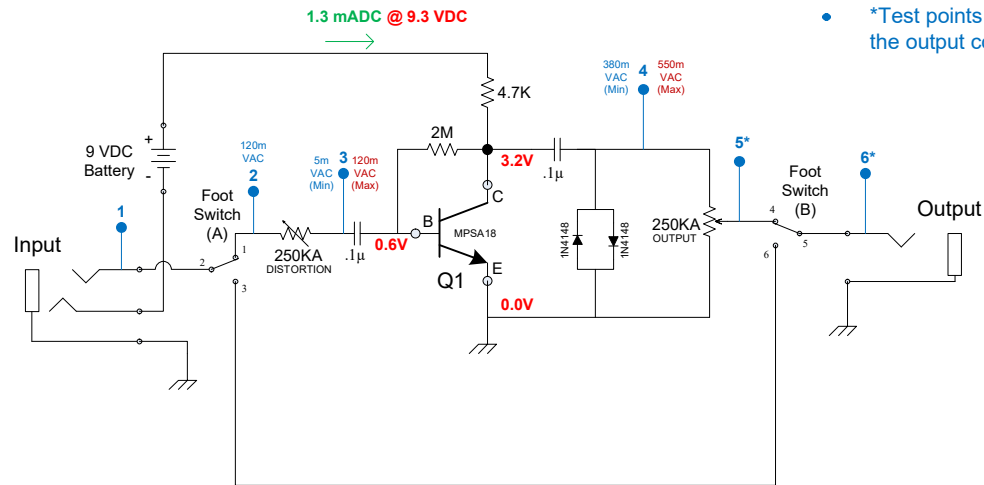


Once you are able to measure the output signal from your guitar directly, plug the guitar into the input jack of your kit and use the AC test point drawing to measure the guitar signal along the signal path. Start with test point one and move along in order. You should be looking to identify the last test point where the signal seems normal and the first test point where the signal seems unusual or where it is no longer even present.

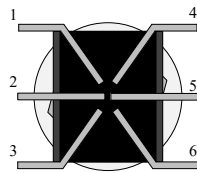
## AC Test Points



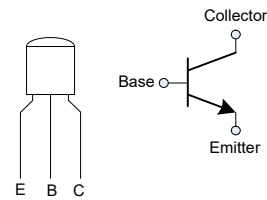
- Test points 3 and 4 have two measurements: the lower value with the distortion control set to min and the higher value with it set to max.
- \*Test points 5 and 6 should match test point 4 with the output control set to max.



DPTD Foot Switch



MPSA18  
NPN BJT



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**"The Thunderdrive" (K-950)  
Schematic**