Bias Scout™ Kit
Assembly Manual

TUBEDEPOT
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Version 3.1 – 25 March 2015

1 Inventory of Parts

skill level for this kit

easy 1 **2** 3 4 5 hard

1 ea octal socket
1 ea octal base, brown (1 3/16" dia x 7/8" high)
1 ea 1.0 / 1W metal oxide, flame proof resistor
1 ea 100 / 1/8W, CMF55 (MIL-SPEC) metal film, 1%
1 ea 1M / ½W, metal film, 1%

*Note: **colors and styles of resistors are subject to change***
However, values and wattage ratings will remain the same.
The value of an unknown resistor can be determined by measuring the resistance with a multimeter.

2 ft techflex, 1/8”
2 ft heat shrink, 1/8" clear, flexible
3 in. heat shrink, 1/4” black, flexible
2 ft wire, 22AWG tefzel - red
2 ft wire, 22AWG tefzel - white
2 ft wire, 22AWG tefzel - black
6 in wire, 22AWG tefzel – blue (but color varies)
2 ft wire, 22AWG solid buss wire
3 in PVC insulation, clear, #20
1 ea wire tie, plastic, 4" – natural color
1 ea banana plug black, Johnson style
1 ea banana plug red, Johnson style
1 ea banana plug white, Johnson

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2 Recommended Tools / Supplies

- soldering iron, 25W – 40W (35W recommended). I do not recommend using soldering guns (nothing with triggers and / or light bulbs).
- solder, electronics grade with rosin core
- wire cutters, diagonal (flush cut preferred)
- wire strippers, 22 AWG
- needle nose pliers
- hobby knife
- scale / ruler – imperial graduations (in inches)
- multimeter (able to measure DC millivolts and DC resistance / continuity)
- heat gun (for shrinking heat shrink).
- super glue (or similar fast acting adhesive)

(instructions continued on next page)

3 Wire Bundle Assembly

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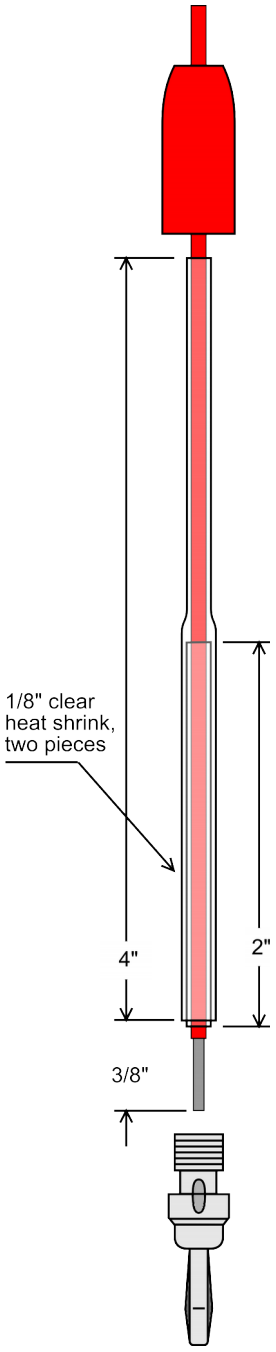
Step 1 – Cut three 4" lengths of clear 1/8” heat shrink tubing (this is not the #20 clear insulation tubing which is used for a later step).

drawing 3.1



Step 2 – Cut three 2" lengths of clear 1/8” heat shrink tubing (this is not the #20 clear insulation tubing which is used for a later step).

Step 3 – Shrink a 2" length of clear heat shrink tubing 3/8" from the end of the 22 AWG red, white, and black wires (drawing 3.1).

Step 4 – Shrink a 4" length of clear heat shrink tubing 3/8" from the end of each of these 22 AWG wires over the previously applied 2" length on all three wires (drawing 3.1)

Step 5 – Strip 3/8" of the wire insulation from the ends of each of the three 22 AWG wires where the heat shrink is applied (drawing 3.1).

Step 6 – Separate the two pieces from each of the red, white, and black banana plugs.

Step 7 – Solder a metal plug end onto the 3/8" stripped end of the 22 AWG wire (drawing 3.1).

Step 8 – Trim any wire that is exposed from the side solder hole so that the plug back will thread properly onto the metal plug.

Step 9 – Repeat the steps 7 and 8 for the remaining white and black wires.

Step 10 – Install the red back to the banana plug on the metal banana end attached to the red wire. Install the white back to the banana plug on the metal banana end attached to the white wire. Install the black back to the banana plug on the metal banana end attached to the black wire.

Step 11 – Loosely twist these three wires together starting at the point where the 4" clear heat shrink stops until the opposite end of the three wires. Be careful to keep the three banana plugs at the same length.

Heat Shrink, High Durability Covering Option (drawing 3.2):

Step 12a – Cut a 20" length of black, high flex heat shrink tubing. Slide this heat shrink tubing over the twisted wire bundle aligning this black heat shrink tubing to where it covers 1/4" over the three previously applied 4" clear heat shrink tubing.

Step 13a – Shrink this black tubing over the wire bundle making sure to maintain alignment.

Step 14a – Once the heat shrink is properly shrunk over the wires, on the end without the banana plugs, carefully trim back the heat shrink to expose 1-1/4" of the three wires.

Step 15a – Cut a 1/2" length of black, high flex heat shrink tubing.
slide this heat shrink tubing over the trimmed end and over the previously installed tubing. Align one end of this piece flush with the edge of the previously installed heat shrink.

Step 16a – Shrink this black tubing in place, creating a short second layer of heat shrink.
(proceed to step 17)

TechFlex Covering Option (drawing 3.3):

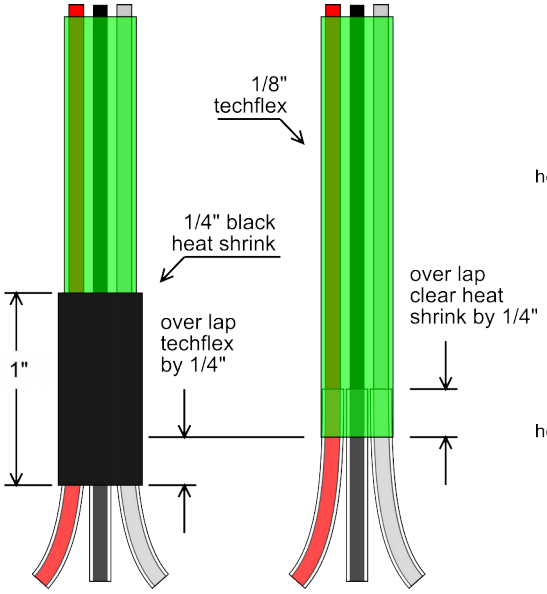
Step 12b – Slide the 1/8” techflex sleeving over the twisted wire bundle, aligning the techflex to where it covers 1/4" over the three previously applied 4" clear heat shrink tubing.

(instructions continued on next page)

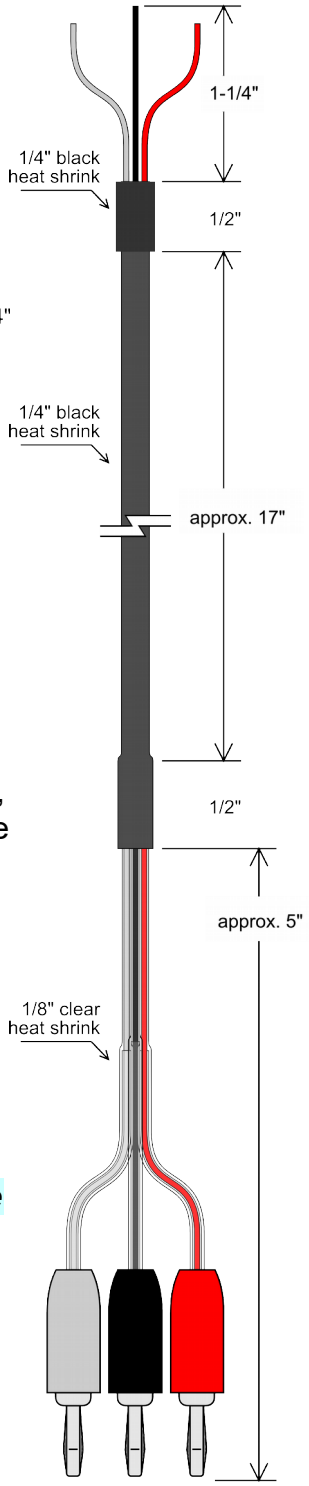
Step 13b – Cut a 1” length of 1/4” black heat shrink tubing and slide it over the techflex covering the wire bundle. This 1” black heat shrink should over lap the end of the techflex (at the clear heat shrink end) by 1/4” (drawing 3.4).
Step 14b – Shrink this 1” length of heat shrink in place, being VERY careful not to melt the techflex.

Note: use a small strip of masking tape or aluminum foil to protect the techflex when heating the heat shrink with a heat gun. Use isopropyl (or rubbing) alcohol to remove any adhesive left behind.

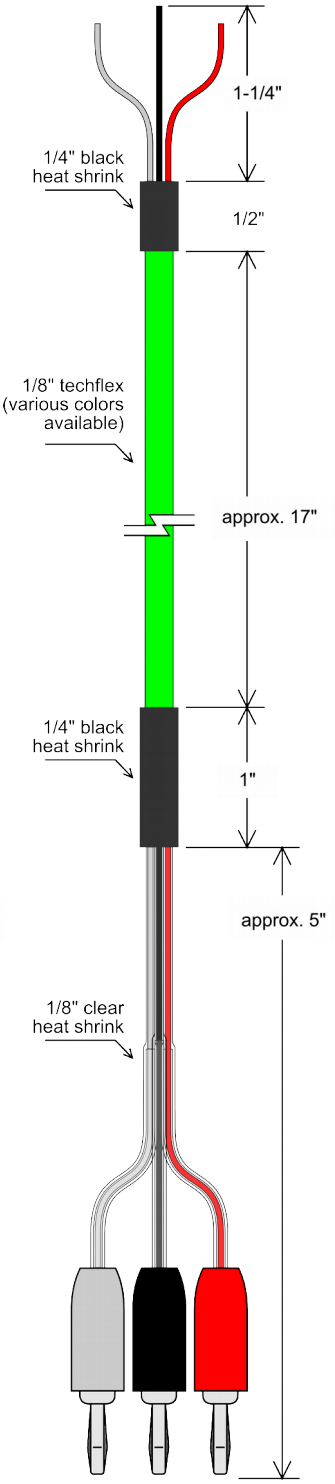
drawing 3.4



drawing 3.2



drawing 3.3



Step 15b – Trim back the end of the techflex (opposite the plugs) to expose 1-1/2” of the three 22AWG wires.
Step 16b – Cut a 1/2” length of black heat shrink and slide it onto the techflex on the end with the exposed wires. With 1/4” of the heat shrink covering the techflex, shrink in place, again being VERY careful not to melt the techflex (see above note).
Step 17 – strip 1/4” of insulation from each of the three 1-1/4” length of exposed 22 AWG wires.
Step 18 – lightly tin the ends of these wires with solder.
Step 19 – strip 1/4” of insulation from the 6” length of 22AWG wire (blue is shown but the kit may come with other colors).
Step 20 – lightly tin the end of this wire with solder.

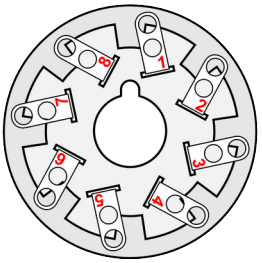
Note: tinning refers to applying just enough solder to the stripped ends of the wires to hold the stranded wires together. The solder should lightly cover the strands and fill in the spaces between the strands. It should be the same thickness along the length and should not be excessive or thick at any one point.

(instructions continued on next page)

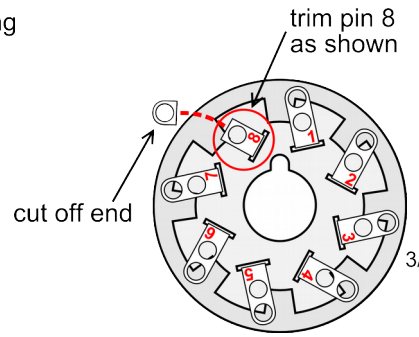
4 Socket Preparation

Step 1 – With socket in hand, refer to drawing 4.1 to confirm correct terminal numbering. The numbering on the actual socket is misleading so be cautious. Use the guide pin orientation and drawing 4.1 for accurate reference.
Step 2 – Locate terminal 8 and cut off the end (drawing 4.2). Before cutting, make sure to properly identify which is terminal 8.
Step 3 – Cut seven (7) 3" lengths of 22 AWG buss wire.
Step 4 – Form a small hook at the end of each of these 3" wires.
Step 5 – Attach these wires to the terminals (1 – 7) as shown (drawing 4.3) and solder in place (drawing 4.4). Do not connect a wire to terminal 8.
Step 6 – Cut seven (7) 3/8" lengths of clear 1/8" heat shrink and slide them over terminals 1 – 7 (drawings 4.5 and 4.6) and shrink into place.

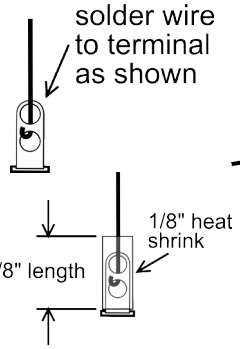
drawing 4.1
note correct pin numbering
(as annotated in red)



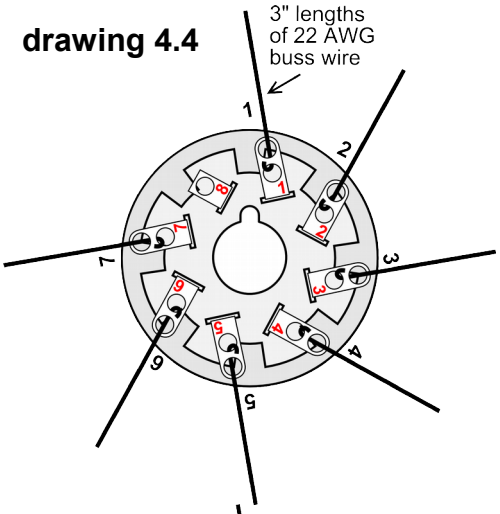
drawing 4.2



drawing 4.3

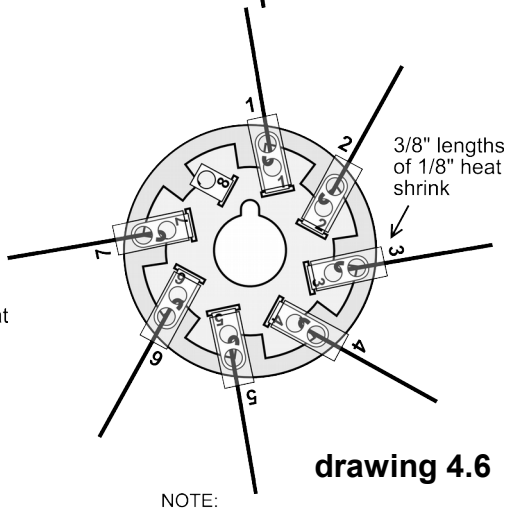


drawing 4.4



drawing 4.5

drawing 4.6

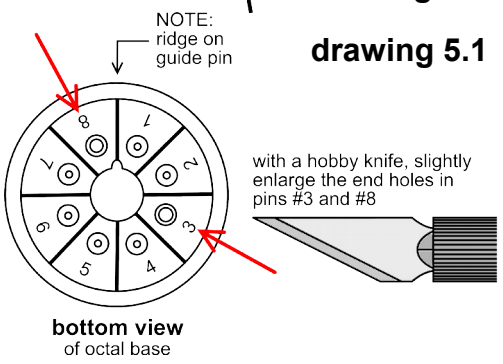


5 Base Preparation

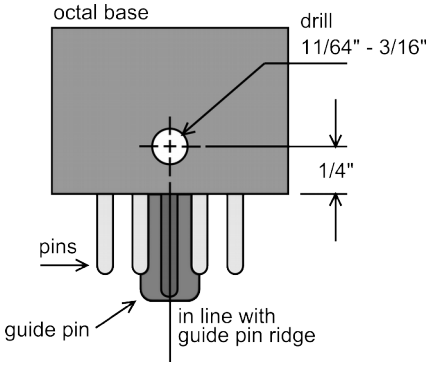
Note: All bases should be predrilled. However, in case your base doesn't come with a hole, refer to the neighboring drawing for drilling instructions.

Step 1 – With a sharp hobby knife, enlarge the holes at the ends of pins 3 and 8 (drawing 5.1). Test to insure these enlarged holes are able to accommodate both a 22AWG wire and the lead from the 1 ohm resistor at the same time. Enlarge as needed.
Step 2 – Cut a 1/4" length of #20 clear plastic insulation tubing (this is not the same as the 1/8" clear heat shrink tubing).
Step 3 – Cut a 7/16" length of #20 clear plastic insulation tubing (this is not the same as the 1/8" clear heat shrink tubing).
Step 4 – Locate the 1M ohm resistor.
resistor may have color bands; brown, black, black, yellow, brown
Step 5 – Slide the 7/16" length of #20 clear plastic insulating tubing onto one lead of the 1M resistor (drawing 5.2).
Step 6 – Bend the lead of the 1M resistor as shown in drawings 5.3, 5.4, and 5.5.

drawing 5.1

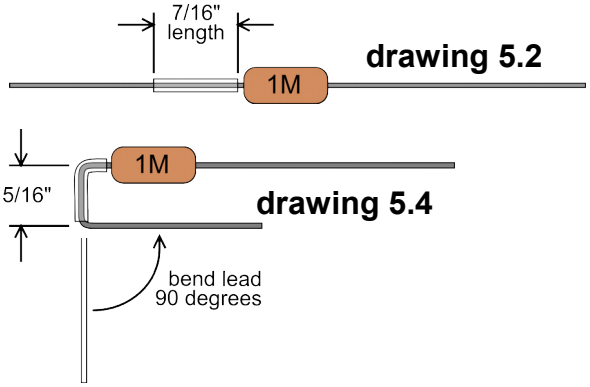


drilling guide for bases



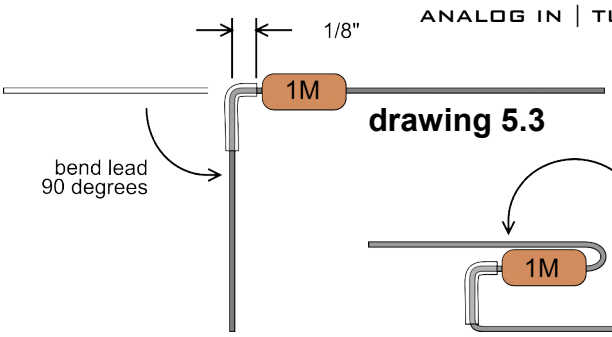
(instructions continued on next page)

Step 7 – Slide the 1/4” length of #20 clear insulating tubing on lead of the 1M resistor, see drawing 5.6.



drawing 5.2

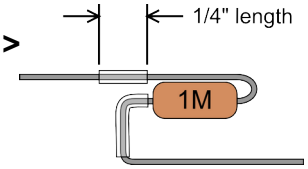
drawing 5.4



drawing 5.3

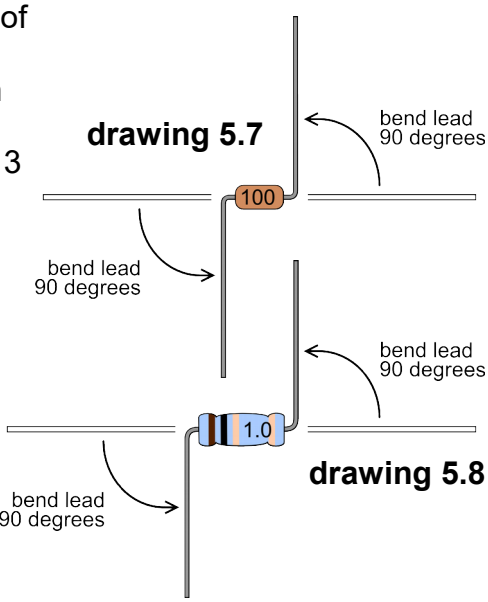
drawing 5.5

drawing 5.6 >

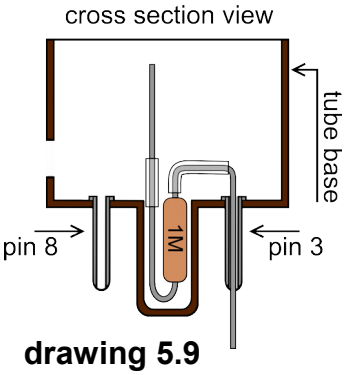


Step 8 – Locate the brown 100 ohm resistor (RN55).
Step 9 – Bend the leads of the 100 ohm resistor as shown in drawings 5.7.
Step 10 – Locate the blue 1.0 ohm / 1W resistor and bend the lead of this 1.0 ohm resistor as shown in drawings 5.8.
Step 11 – Install the prepared 1M resistor into the base as shown in drawing 5.9 (side view), 5.10 (top view). Slide the resistor into the hollow shaft of the guide pin and insert the appropriate lead into pin 3 of the octal base.

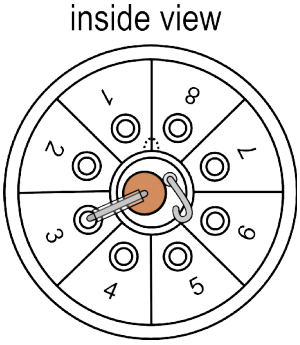
drawing 5.7



drawing 5.8

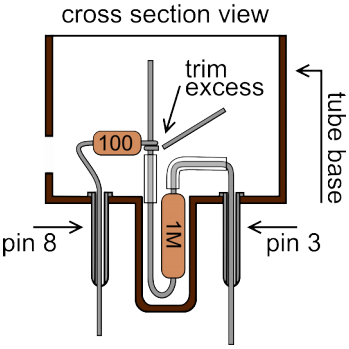


drawing 5.9

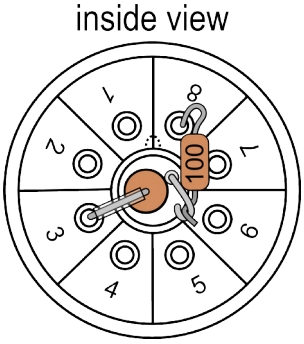


drawing 5.10

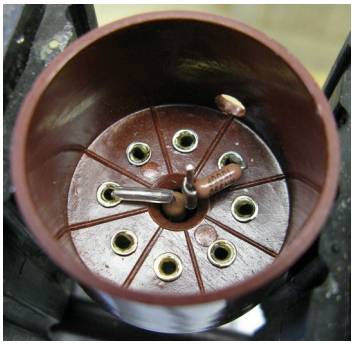
Step 12 – Slide one lead of the prepared 100 ohm resistor into pin 8 of the octal base as shown in drawing 5.11 (side view) and 5.12 (top view). Form the lead from the already inserted 1M resistor around the 100 ohm resistor lead as shown in the drawings and trim the excess.



drawing 5.11

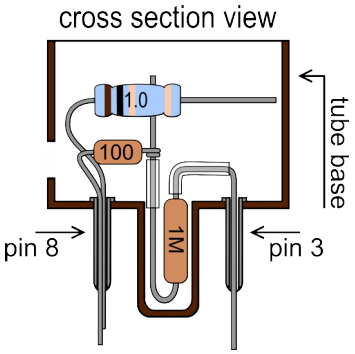


drawing 5.12

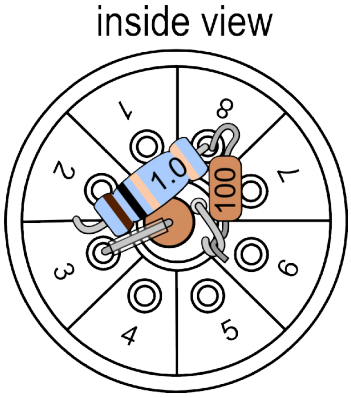


(instructions continued on next page)

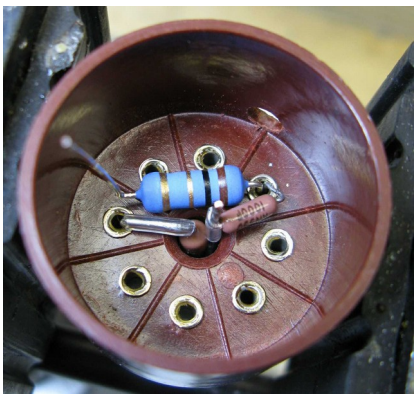
Step 13 – Slide one lead of the prepared 1.0 ohm resistor into pin 8 of the octal base (shared with lead of previously installed 100 ohm resistor) as shown in drawing 5.13 (side view) and 5.14 (top view). It is important that leads from both the 100 ohm resistor and the 1.0 ohm resistor exit the end of pin 8 of the octal base (see side view drawing 5.13).



drawing 5.13



drawing 5.14



6 Joining the Wire Bundle to the Octal Base

Step 1 – Feed the three 1-1/4” length of wires from the wire bundle into the opening in the tube socket base.

Step 2 – Press the stripped and tinned end of the black wire into pin 8 along with the 1.0 ohm resistor and the 100 ohm resistor leads. On the inside of the base, **solder in place** this black wire along with the two component leads at this point. It is not necessary to fill the entire pin with solder, just make a simple connection between the wire, the leads, and the top of pin 8 (photo 6.1).

Step 3 – Form a small hook at the end of the remaining stripped ends of the two wires.

Step 4 – Solder the red wire to the juncture of the 1M and 100 ohm resistors (drawings 6.2).

Step 5 – Loop the hook of the white wire to the free end of the 1.0 ohm resistor.

Step 6 – Form a small hook at the end of the 6” length of 22AWG wire (blue is shown but the kit may contain other colors).

Step 7 – Loop the hook of this 6” wire to the free end of the 1.0 ohm resistor (along with the white wire from the bundle).

Step 8 – Solder both of the above wire ends in place at the end of the 1.0 ohm resistor.

Step 9 – Trim and remove excess component leads (drawings 6.2, and 6.3).

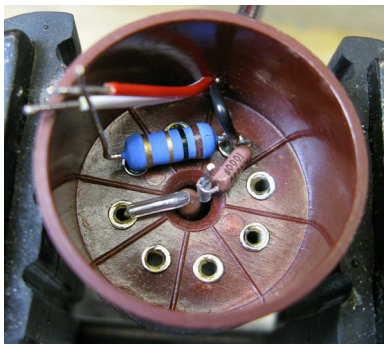
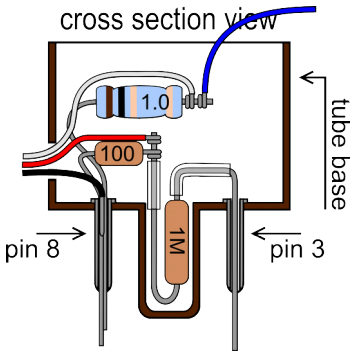
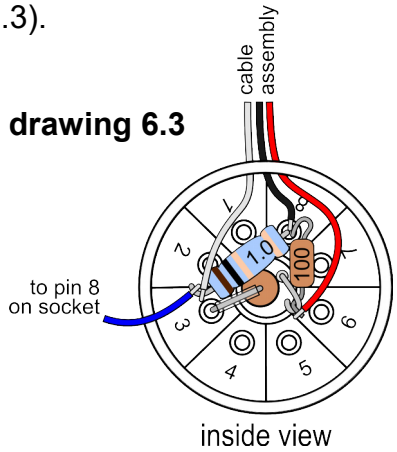


photo 6.1



drawing 6.2

drawing 6.3



Step 10 – Slowly feed this end of the wire bundle into the hole of the octal base until all the remaining 1-1/4” free wire is within the base.

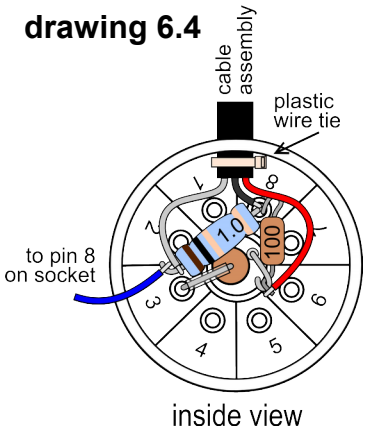
Step 11 – Firmly press a short portion of the black heat shrink into the base, until 1/4” of the heat shrink end is within the base.

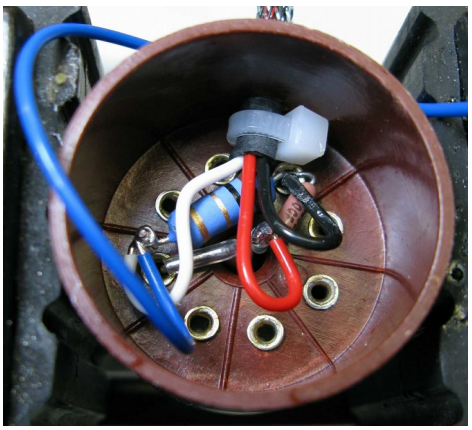
(instructions continued on next page)

Step 12 – Feed the wire tie around the end of the bundle within the base and position the tie as close to the edge of base. Pull the tie very tight and clip off the end. Rotate the tie end as close to the bottom of the base as possible (drawing 6.4).

Note: Once the 1.0 ohm resistor is in a safe position, apply a liberal dab of silicon sealant or glue (nothing water based) on the side of the 1.0 resistor facing the guide pin. This should hold the 1.0 resistor firmly away from pin 3 and / or the lead connected to pin 3.

drawing 6.4

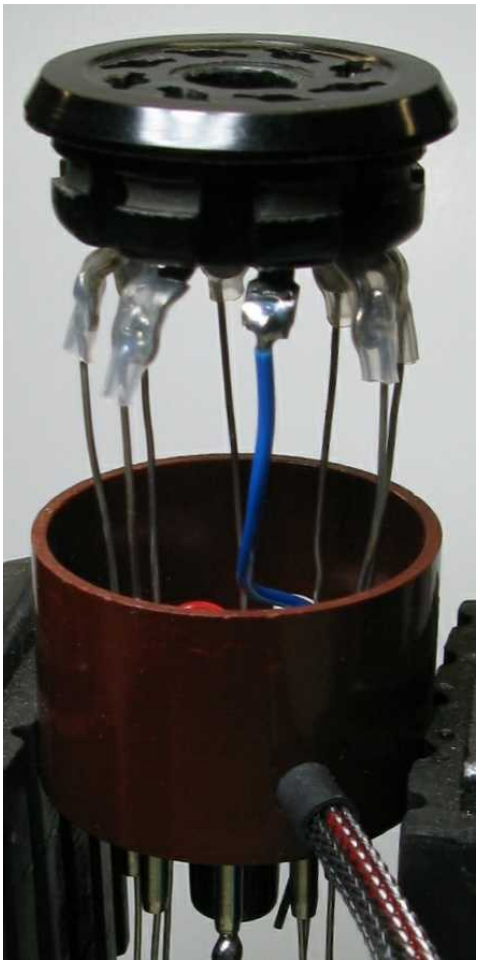




Note: before continuing, review your work to insure accuracy. Because, once the socket and base are connected, they cannot be separated.

7 Joining the Socket to the Octal Base

Photo 7.1



Step 1 – With the octal socket in hand, bend all seven of the 22 AWG wires straight and in a circular arrangement prepared for inserting into the base.

Step 2 – Move the end of the 6” length of wire attached to the end of the 1.0 resistor to the outside of octal base.

Step 3 – Beginning with the wire soldered to terminal three of the socket, begin feeding these wires into the appropriate pins of the base.

Step 4 – Feed all seven wires until they exit out the opposite end of the pins by about 1/2 inch.

Step 5 – Once all of the wires have been fed into the pins, trim the blue (or some other color) wire attached to the 1.0 resistor to 3”.

Step 6 – Strip and tin the end of this now 3” length of wire.

Step 7 – Bend a small hook at the end of this 3” length of wire and solder to terminal 8 of the socket (photo 7.1)

Step 8 – Push the socket into the base, pulling on the exposed wires from the pins.

Step 9 – If the socket doesn't fit flush with the base, then slightly pull the two parts apart and move wire(s) and possibly the plastic tie end and retry.

Step 10 – Repeat the above until the socket fits flush into the base. I recommend aligning the guide pin opening of the socket with the guide pin of the base as closely as possible.

Step 11 – Slightly pull the two parts apart and LIGHTLY apply super glue on the socket edge. Once the glue is in place, firmly press the two parts together and hold / clamp.

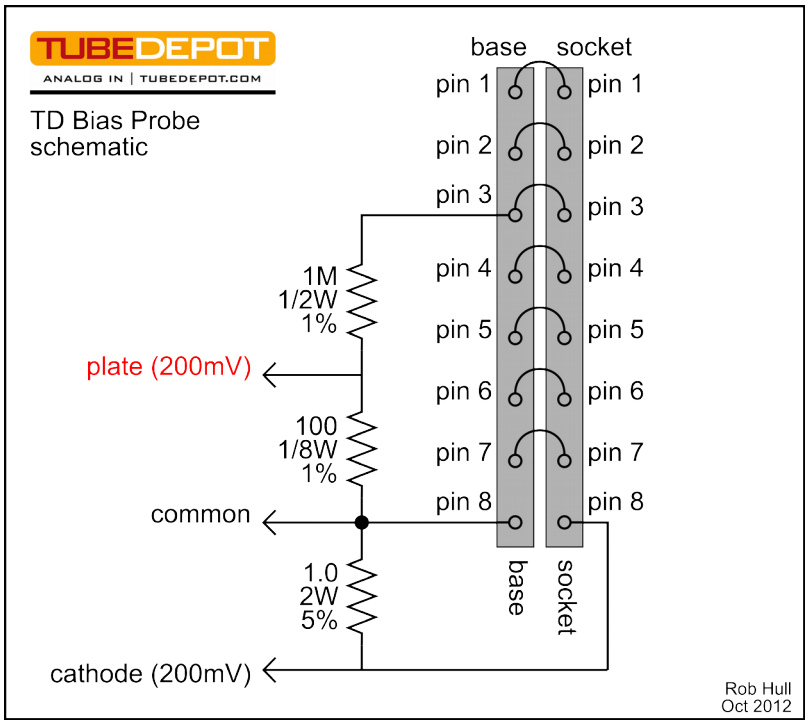
Step 12 – Once the glue has set, turn the base over and apply a small dab of solder into each of the ends of the base pins.

Step 13 – Remove any excess solder from around the ends of the pins with the hobby knife and flush cut the excess wires from the pins with the wire cutters.

(instructions continued on next page)

8 Testing Before Use

Note: Refer to the included schematic for electrical connections.



Step 1 – With your multimeter set on the "200 ohm" resistance scale (usually the lowest scale), short the red and black test leads together and adjust the meter to read zero ohms (if possible).
Step 2 – Insert the red lead of the meter into the socket, pin 1 and place the black lead of the multimeter on pin 1 of the base.
Step 3 – Verify that the resistance between these two points is approximately zero ohms.
Step 4 – Keeping the red lead in pin 1 of the socket, move the black lead to each of the other pins of the base.
Step 5 – Verify that between pin 1 socket and pins 2 – 8 of the base measure no resistance (infinity – therefore not shorted).
Step 6 – Repeat step 2 - 5 for the socket pins 2 – 7.

Note: If using an auto ranging meter, measurements between socket pin 3 and base pin 8; and between socket pin 8 and base pin 3, a 1M resistance is normal.

Step 7 – Insert the red meter lead into the socket, pin 8 and place the black lead of the multimeter on pin 8 of the base and verify that the resistance between these points is approximately 1 ohm.
Step 8 – With the red lead still inserted into pin 8 of the socket, place the black lead on the end of the white banana plug and verify that the resistance between these two points is zero ohms.
Step 9 – With the red lead still inserted into pin 8 of the socket, place the black lead on the end of the black banana plug and verify that the resistance between these two points is approx. 1 ohm.
Step 10 – With the red meter lead still inserted into pin 8 of the socket, place the black meter lead on the end of the red banana plug and verify that the resistance is approximately 101 ohms.
Step 11 – Move the red meter lead to the end of the red banana plug and place the black lead on the end of the black banana plug and verify that the resistance between these points is approx.100 ohms.
Step 12 – Move the red lead of the meter to the white banana plug and the black lead to the end of the black banana plug and verify that the resistance is approximately 1 ohm.
Step 13 – Change the resistance measurement range on the meter to the "20M" setting (often the highest setting).
Step 14 – Insert the red meter lead into pin 3 of the socket and place the black meter lead on the end of the red banana plug and verify that the resistance is approximately 1M (1,000,000) ohms.

END – You are ready to use your completed Bias Scout™ .

(instructions continued on next page)

9 Using the Bias Scout™

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!!! Read these safety precautions before continuing !!!

ALL tube amplifiers contain **LETHAL VOLTAGES,** often several hundred volts which **WILL** leave burnt entrance and exit wounds in skin if accidentally touched. These voltages have the potential to cause **permanent physical damage and death**. These voltages are present when the amp is turned on and also for some time after the amp has been turned off. **You can still get shocked with a tube amp turned off and disconnected from AC power.**

The above statement is a bit scary, but we want to stress that every piece of electronic equipment must be treated with respect. When AC power is applied, there is always a chance for injury or death. With tube amps, even when the AC power is not applied there is still danger. Being shocked with high voltage is very painful and we do not want anyone finding out the hard way.

When building this kit, we want your experiences to be both enjoyable and safe. There are more kits to assemble and we want you to enjoy building and using them all.

- DISCLAIMER -
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Biasing an amp will likely expose you to very dangerous voltages. If you are uncomfortable or if you lack proper experience or training, then refer biasing to a qualified amplifier technician.

Note: The following biasing procedure is for a correctly functioning amplifier with a class AB output stage. This amp should have a single adjustable bias (not balance) control.

Note: Because all amps are different, refer specific biasing questions to either the appropriate amp manufacturer or to a qualified tube amplifier technician.

Note: This tester will NOT work with 7591 power tubes.

Step 1 – Remove the power tubes of the amp you are preparing to bias.
Step 2 – Locate the adjustable bias control.
Step 3 – Apply AC mains power to the amp but keep the amp on standby.
Step 4 – With your multimeter set to the highest DC voltage setting (500V or more), insert the red meter lead into pin 5 of one the empty tube sockets and place the black meter lead against the metal chassis of the amp.
Step 5 – You should be reading a negative voltage. Adjust the bias control for the most negative voltage as read on the meter.
Step 6 – Disconnect power from the amp and remove the meter leads.
Step 7 – Install a power tube into the socket of the TD Bias Scout ™ and install the tube and Bias scout ™ into one of the empty tube sockets.
Step 8 – Install the remaining power tubes.
Step 9 – Make sure the amp is properly connected to a speaker load. Turn all the volume and tone controls to zero / minimum.
Step 10 – Set the multimeter to the 200 millivolt **DC** setting (200m).

(instructions continued on next page)

Step 11 – Insert the black banana plug of the Bias Scout © into the "COM" of the meter.
Step 12 – Insert the red banana plug of the Bias Scout © into the "VOLTS" input of the meter.
Step 13 – Apply power to the amp (the amp should be on standby) and allow the power tubes to warm up for a few minutes.
Step 14 – After the tubes have warmed up, take the amp off of standby (as if you are going to play)
Step 15 – The meter should display a millivolt reading. This reading represents the PLATE VOLTAGE of the amp. Write this number down.
Step 16 – Place the amp on standby and remove the red banana plug from the meter.
Step 17 – Insert the white banana plug in place of the red plug in the "VOLTS" input of the meter.
Step 18 – Take the amp off of standby (like you are going to play the amp)
Step 19 – The meter should display a millivolt reading. This reading represents the CATHODE CURRENT of the individual tube.

This cathode current is the measurement to be adjusted.

Step 20 – Using the amp's bias control, adjust the level of CATHODE CURRENT as recommended by the amp manufacturer and based on the level of your plate voltage (as measured earlier).

Note: Playing the amp with the Bias Scout ™installed runs the risk of damaging the Bias Scout™.

Step 21 – Once the bias is set, remove AC power from the amp. Remove the power tube and the Bias Scout™ from the amp. Remove the tube from the Bias Scout™ and insert the tube into your amp.

Your amp is now properly biased and ready to play …

Final note … we are continually making improvements to this assembly manual in an effort to provide the best instructions possible. Therefore, we welcome any ideas you have that will make the assembly a better experience. Send your ideas to:

info@tubedepot.com