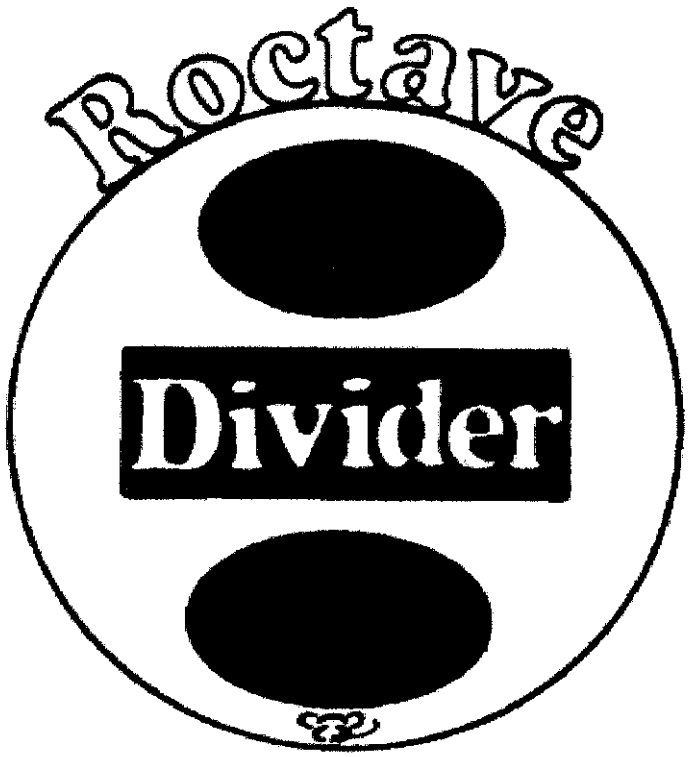
Roctave Divider

Model 5760
Assembly and Using Manual

PAIA 5760



OUT

max
LEVEL ÷2
min

max
LEVEL ÷4
min

IN

hi
TONE
low

max
FUND. LEVEL
min

CANCEL

IMPORTANT - Before beginning assembly of your new kit, check the supplied parts against the following parts list. If parts are missing or damaged contact PAiA Electronics Inc., phn: (405) 340-6300 , email: *info@paia.com*

5760 Packing List

Qnty	Value	Desc (alternate markings)
All resistors 1/4W. 5%		
1	100 ohm	brown-black-brown
1	1000 ohm	brown-black-red
1	4700	yellow-violet-red
9	10K	brown-black-orange
2	22K	red-red-orange
3	30K	orange-black-orange
2	47K	yellow—violet-orange
2	100K	brown-black-yellow
1	270K	red-violet-yellow
1	470K	yellow-violet-yellow
1	680K	blue-gray-yellow
2	1 Megohm	brown-black-green
1	2.2 Megohm	red-red-green
Polystyrene Capacitors		
1	330 pF	330
3	0. 1 uF.	104
2	0.22 uF.	224
Electrolytic Capacitors:		
2	1 uF / 16V	Greater voltage ratings acceptable
3	2.2 uF / 16V	
1	4.7 uF / 16V	
2	10 uF / 16V	
1	33 uF / 16V	
1	100 uF / 16V	
Semiconductors:		
1	1N4148 or 1N914 Silicon Signal Diode	
1	1N4001 - 1N4003 Power Diode	
2	2N4126 PNP Silicon Transistor	
1	4136 Quad OpAmp	
1	570 or 571 Compander IC	
1	4013 CMOS Dual Flip Flop	
Potentiometers:		
4	5K Panel Mount	
Misc:		
1	Open Circuit 1/4" Phone Jack	
1	Stereo (TRS) 1/4" Phone Jack	
1	Push On/Push Off Foot Switch	
2	14 Pin IC Socket	
1	16 Pin IC Socket	
1	Battery Connector	
1	Battery Holder	
4	Set Screw Knobs	
4.5"	Double Stick Foam Tape	
7"	Bare Wire	
45"	#22 Insulated Stranded Wire	
1	5760 Circuit Board	
2	Roctave Divider	

INTRODUCTION

Thank you for buying the PAiA 5760 ROCTAVE DIVIDER kit. We realize that you are anxious to get on with the assembly, but before you start, please take the time to read the hints and suggestions that follow.

—BEFORE YOU BEGIN—

Familiarize yourself with this manual. It's not necessary to read the whole thing in detail, but at least go through and look at the illustrations. Get a feel for the parts and how they fit together. It is particularly important to check the parts supplied against the parts list in the front of this manual. This is a relatively simple kit and it will not take long to assemble. Nevertheless, please do us all a favor - TAKE YOUR TIME. Time invested in careful assembly now will pay great dividends in the time saved trouble-shooting when you're done.

SOLDERING

Successful operation of your kit, as well as it's longevity, is probably more dependent on how the components are soldered in place than any other one thing that the assembly involves. There are three key rules to go by, these are as follows:

TYPE OF SOLDER: Use ONLY ROSIN CORE SOLDER. Acid core solder or silver solder / paste flux should never be used to assemble electronic circuitry.

SOLDERING. TOOL: Use a soldering iron with a power rating of about 25 watts to 35 watts, and a small pointed tip. Soldering guns are completely unacceptable for soldering solid state components, as the large magnetic fields they generate can easily damage some components. Be sure to keep your soldering iron tip clean. Before soldering a connection, wipe the tip on a damp sponge - This will aid in heat transfer and prolong tip life.

SOLDERING TECHNIQUE: Look at the solder connections on commercially available amps and effects units and try to imitate them as closely as possible. A proper circuit board solder joint has just enough solder to cover the soldering pad and about 1/16" (2mm) of the component lead passing through it.

To solder, hold the tip of the iron against both the wire to be soldered and the circuit board trace (or jack lug, switch lug, or whatever). Hold it there for a second or two to let things heat up, then feed a small amount of solder onto the connection. Do not simply feed the solder onto the tip of the iron and expect it to run down onto the connection. Continue holding the iron against the connection until the solder melts fully and flows freely over the connection. Then remove the iron and let the joint cool. Do not move any of the wires while the solder is cooling; if this happens, re-heat the connection, feeding in a tiny bit more solder.

There are two types of improper connections to watch out for; using too little solder (or too little heat) will result in a connection which will appear to be soldered when actually there is a layer of flux or oxidation insulating the component lead. To cure this, re-heat the connection and flow a small additional amount of solder on the joint. Using too much solder can lead to excess solder flowing between adjacent terminals or traces of a circuit board, causing a short circuit. Unintentional solder bridges of this type can be cleaned off onto the tip of a CLEAN, hot soldering iron while holding the board upside down. Another problem with using too much solder is that it can flow over to an adjacent hole, blocking it with solder.

If this happens, again hold the board upside down and flow solder away from the blocked hole and onto the tip of a clean hot iron. Use a pin to poke through any remaining solder left in the hole.

Finally, avoid using too much heat or leaving the iron on a connection for too long. Excessive heat can damage many types of electronic parts, and in extreme cases can cause the foil conductors to lift from the circuit board.

CIRCUIT BOARD PREPARATION

( ) Prepare the 5760 circuit board for assembly by thoroughly cleaning the conductor side with a scouring cleanser (rinse completely with clean water and allow to dry) or Scotch Bright (R) or a clean steel wool pad. DO NOT USE PRE-SOAPED PADS. The board must be bright and shiny to accept the solder and failure to clean the board will result in poor solder joints.

BARE WIRE INSTALLATION

( ) Using the BARE wire provided, form and install the 6 wire jumpers on the circuit board. The designator for the jumpers are the solid lines broken with the letter "J" printed on the component side of the board and in the parts placement drawing figure 1. Note that the wire supplied can be straightened by pulling it between your pinched thumb and forefinger several times.

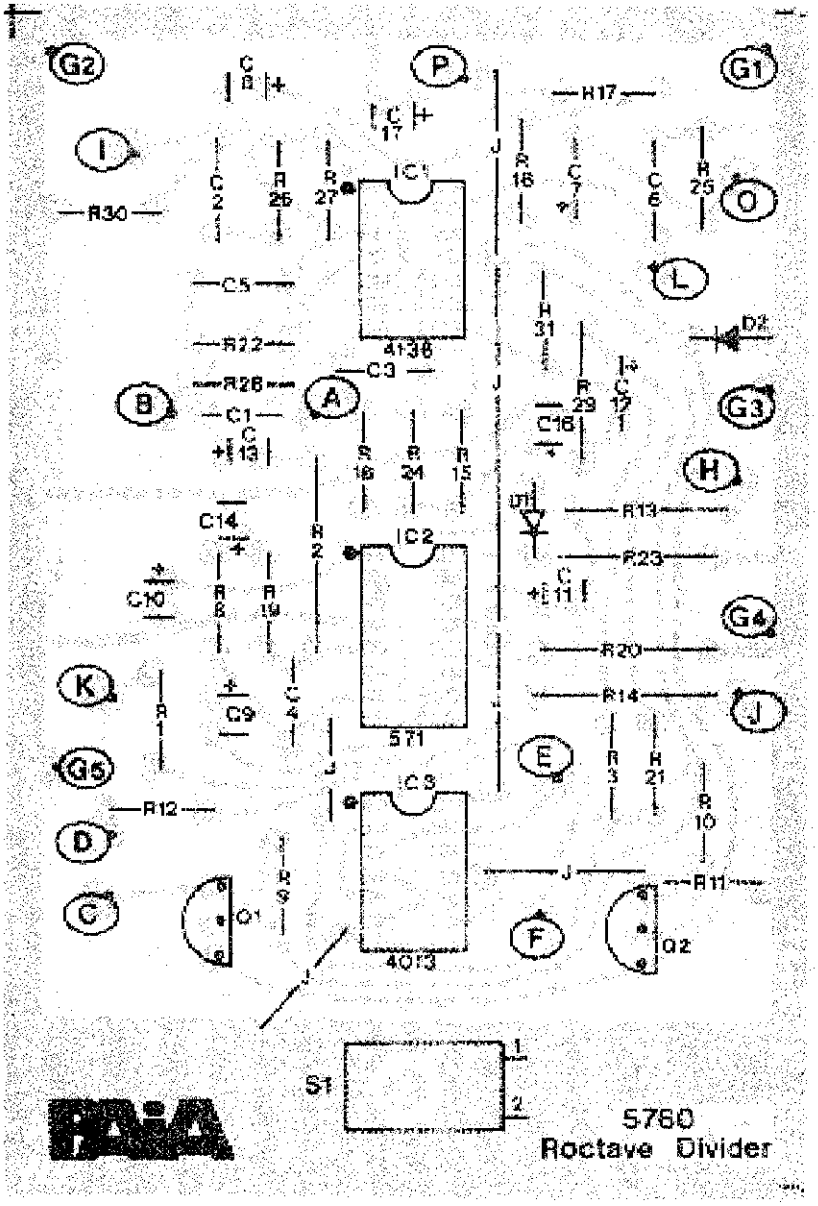
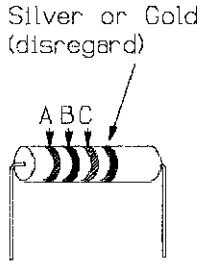


Fig 1: Circuit board Parts Placement

RESISTOR INSTALLATION

Solder each of the fixed resistors in place following the parts placement designators printed on the circuit board and shown in the assembly drawing figure 1. Note that the fixed resistors are non-polarized and may be mounted with either of their leads in either of the holes provided. Insert both leads in the mounting holes and push the resistor FULLY against the board. On the conductor side of the board, bend the leads outward to about a 45 degree angle to help hold the component in place while soldering. AFTER SOLDERING, clip off each lead end flush with the top of the solder joint.

DESIGNATION	VALUE	COLOR CODE (A-B-C)
( ) R1	100 ohm	brown-black-brown
( ) R2	1000	brown-black-red
( ) R3	4700	yellow-violet-red
listed below:	10K	brown-black-orange
( ) R8 ( ) R9		( ) R10 ( ) R11
( ) R12 ( ) R13		( ) R14 ( ) R15
( ) R16		

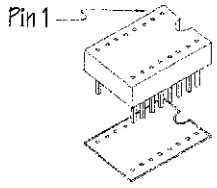


( ) R17	22K	red-red-orange
( ) R18	22K	red-red-orange
( ) R19	30K	orange-black-orange
( ) R20	30K	orange-black-orange
( ) R21	30K	orange-black-orange
( ) R22	47K	yellow-violet-orange
( ) R23	47K	yellow-violet-orange
( ) R24	100K	brown-black-yellow
( ) R25	100K	brown-black-yellow
( ) R26	270K	red-violet-yellow
( ) R27	470K	yellow-violet-yellow
( ) R28	680K	blue-grey-yellow
( ) R29	1m	brown-black-green
( ) R30	1m	brown-black-green
( ) R31	2.2m	red-red-green

SOCKET INSTALLATION

Install each IC socket by inserting its pins into the holes provided from the COMPONENT side of the board and then soldering each pin to its respective pad on the CONDUCTOR (foil) side of the board. BE SURE THE SOCKET IS PRESSED FIRMLY DOWN ON THE BOARD AND THAT ALL THE PINS ARE PROTRUDING THROUGH TO THE CONDUCTOR SIDE. Some sockets may bear orientation markings on one end. While there is no electrical significance to the orientation of the socket, it is good practice to acknowledge these markings and orient the socket accordingly. Normally the marked end will correspond to the semi-circle notch at one end of the parts placement designator drawn on the circuit board.

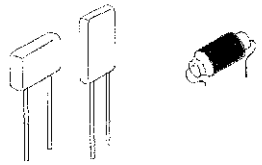
DESIGNATION	TYPE
( ) IC1	14 PIN
( ) IC2	16 PIN
( ) IC3	14 PIN



CAPACITOR INSTALLATION
Install the polystyrene capacitors in the same manner as above. These capacitors are also non-polarized and the value will be marked an the body of the part. Solder in place and clip the excess leads.

DESIGNATION	VALUE	ALTERNATE MARKING
( ) C1	330 pf	330
( ) C2	0.1 uF.	104
( ) C3	0.1 uF.	104
( ) C4	0.1 uF.	104
( ) C5	0.22 uF.	224
( ) C6	0.22 uF.	224

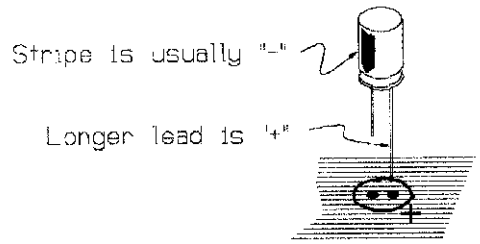
Capacitors



Up to this point, all components have been non-polarized, (i.e. either lead can go into either hole). Electrolytic capacitors are polarized; just like a battery they have a (+) and a (-) end; and like a battery, if installed incorrectly the circuit won't work. The capacitors supplied will have either the (+) or the (-) lead marked on the body of the part. The (+) lead must go through the circuit board hole which has been labeled positive (+). In the event that the capacitors have their negative (-) leads marked, this lead should go through the unmarked hole in the circuit board.
NOTE THAT THE SPECIFIED VOLTAGE RATING IS A MINIMUM RATING. CAPACITORS SUPPLIED WITH CERTAIN KITS MAY HAVE A HIGHER VOLTAGE RATING THAN THAT SPECIFIED.

DESIGNATION	VALUE
( ) C7	1 uF / 10V
( ) C8	1 uF / 10V
( ) C9	2.2 uF / 10V
( ) C10	2.2 uF / 10V
( ) C11	2.2 uF / 10V
( ) C12	4.7 uF / 10V
( ) C13	10 uF / 10V
( ) C14	10 uF / 10V
( ) C16	33 uF / 10V
( ) C17	100 uF / 10V

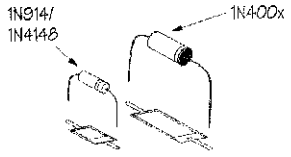
ALTERNATE MARKING
Greater voltage ratings acceptable



NOTE: There is NO C15.

DIODE INSTALLATION
Install the diodes on the circuit board. Like all semiconductors, the diodes are heat sensitive. To be an the safe side, heat sink each diode lead by grasping the lead with a pair of needlenose pliers or a small copper alligator-type clip at a point between the body of the component and the circuit board. Be sure to orient the diodes as shown in the adjacent drawing.

DESIGNATION	TYPE
D1	1N914 or 1N4148
D2	1N4001 - 1N4003

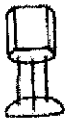


The polarizing color band corresponds to the filled end of the circuit board graphic.

TRANSISTOR INSTALLATION

Install the transistors. Note that there is a flat side on the transistor case and a corresponding flat spot on the graphic designation printed an the circuit board. Install the transistor so that the flats align. Transistors, like the diodes, are heat sensitive and the same care and heat sinking techniques should be used when installing these parts.

DESIGNATION	TYPE
( ) Q1	2N4126
( ) Q2	2N4126



FOOT SWITCH INSTALLATION

( ) Install the foot switch S1 by inserting the mounting shaft into the large hole in the circuit board from the COMPONENT side. Thread the hex nut provided onto the shaft of the switch and tighten it against the conductor side of the board. Orient as shown in figure 2.

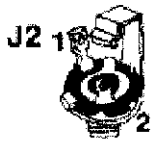
IC INSTALLATION

( ) Install the integrated circuits. Note that the orientation of the IC is keyed by a circular indentation or notch at one end of the component. This aligns with the semicircular key drawn on the circuit board graphics. Carefully insert the pins of each IC into the receptacles of the sockets installed earlier and press the device firmly into place. Be sure all the pins go into the sockets and do not get bent up under the IC.

DESIGNATION	TYPE
( ) IC1	4136 QUAD OP-AMP
( ) IC2	570 or 571 COMPANDER
( ) IC3	4013 CMOS DUAL FLIP FLOP

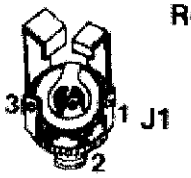
POINT TO POINT WIRING

Locate the four control potentiometers and the two 1/4 inch phone jacks. Before beginning the following wiring steps, be sure you can identify each of the jacks and pots as one of the types shown in the adjacent drawings. Note the lug numbers.



O.C. Jack

Potentiometer
R4,R5,R6&R7



Stereo Jack

It is good practice to tin the solder lugs on the jacks and controls before soldering the wire to it since the heat required to tin the lug may well be enough to melt the insulation on the stranded wire. Hold the component in a small vise during this operation. If no vise is available, a pair of needlenose pliers held closed with a rubber band will help. Tin the lugs by holding your soldering iron against them for a few moments to allow the lugs to heat up. After a few seconds, feed solder to the point where the lug and iron meet. If the solder does not flow out onto the lug, it is an indication that oxidation is interfering with the solder bond. Break down the oxidation by rubbing the soldering iron around while applying firm pressure until the solder adheres smoothly to the lug. Tin all the metal surface you can near the hole, but leave the hole open. Should the hole fill with solder, reheat the solder to melting and then "rap" the component on the work surface to knock the excess solder off the lug. Use a pair of pliers to hold the HOT component.

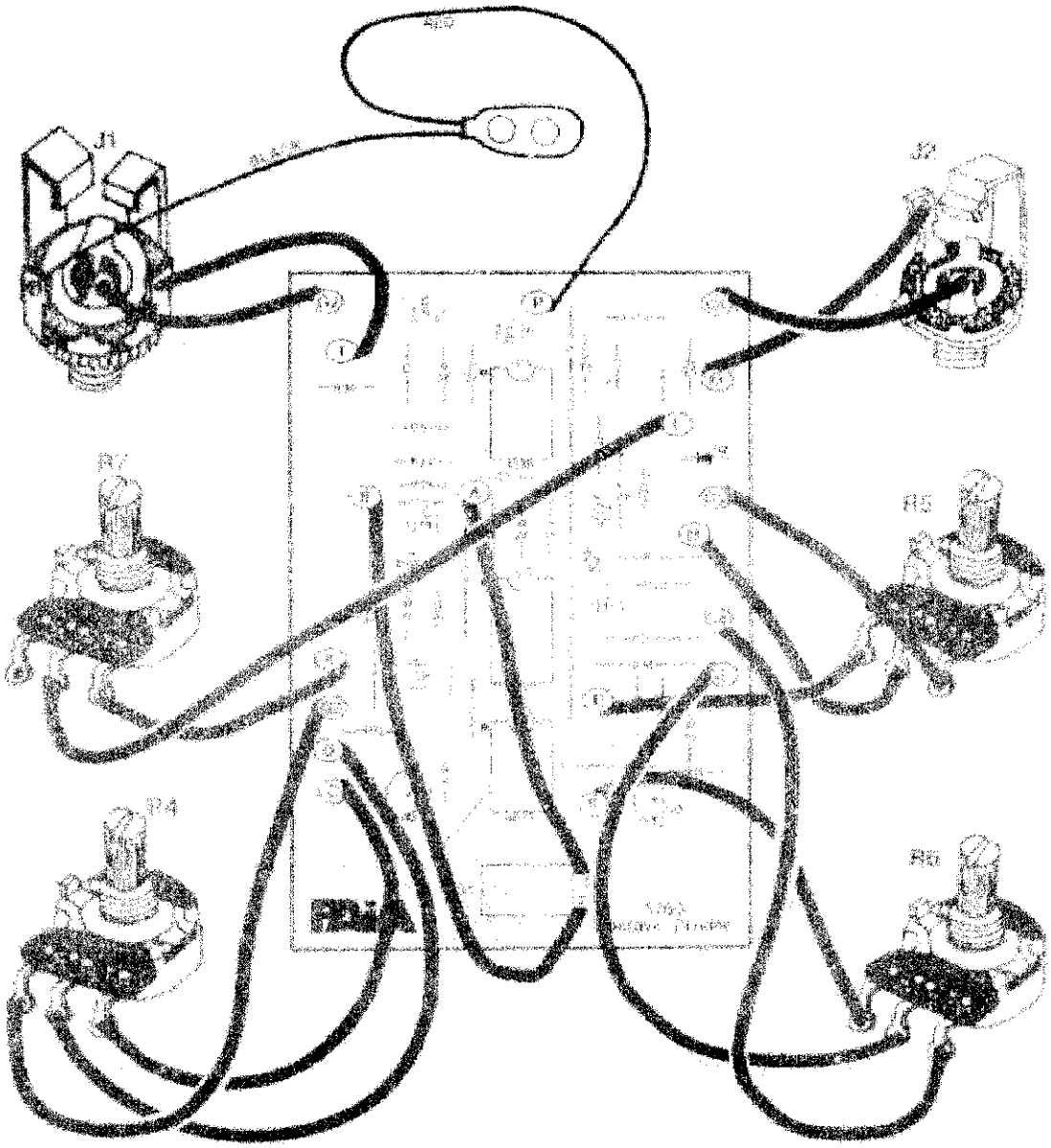
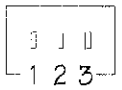


Fig 2. Wiring Diagram

In the following steps the insulated wire provided with this kit will be used to make the connections between the controls and jacks, and the circuit board. At each step, prepare the wire by cutting it to the specified length and stripping 1/4 inch (.7cm) of insulation from each end. "Tin" each end of the wire by twisting the strands together and melting just enough solder into the wire to hold the strands together. To be sure you will have sufficient wire for all steps, "rotate" through the strands available. At each step solder both ends of the wire. Refer to figure 2.

LENGTH	From	To
( ) 4- 1/2" (11.5cm)	S1 lug 1	A
( ) 4-1/2" (11.5cm)	S1 lug 2	B
( ) 2-1/4" (5.8cm)	R4 lug 3	C
( ) 2-1/4" (5.8cm)	R4 lug 2	D
( ) 2" (5.1cm)	R4 lug 1	G5
( ) 2-1/4" (5.8cm)	R5 lug 1	E
( ) 2-1/4" (5.8cm)	R6 lug 1	F
( ) 2-1/4" (5.8cm)	R5 lug 2	H
( ) 2" (5.1cm)	R5 lug 3	G3
( ) 2-1/4" (5.8cm)	J1 lug 1	I
( ) 2" (5.1cm)	R6 lug 2	J
( ) 2-1/4" (5.8cm)	R6 lug 3	G4
( ) 1-1/2" (3.8cm)	R7 lug 3	K
( ) 4-1/4" (10.8cm)	R7 lug 2	L
( ) 2-1/4" (5.8cm)	J2 lug 1	O
( ) 2-1/4" (5.8cm)	J2 lug 2	G1
( ) 2-1/4" (5.8cm)	J1 lug 2	G2



Note: The foot switch (S1) supplied with this kit has three lugs as shown above. The switch is symmetrical, use the center terminal for lug 2 and either of the end terminals as lug 1.

( ) Install the battery connector. Connect the RED wire to the circuit board hole labeled "P" and connect the BLACK wire to lug 3 of the input jack J1. Solder both connections.

This completes assembly of the 5760 PC board. If you have the optional case proceed with the installation of the circuit board and controls.

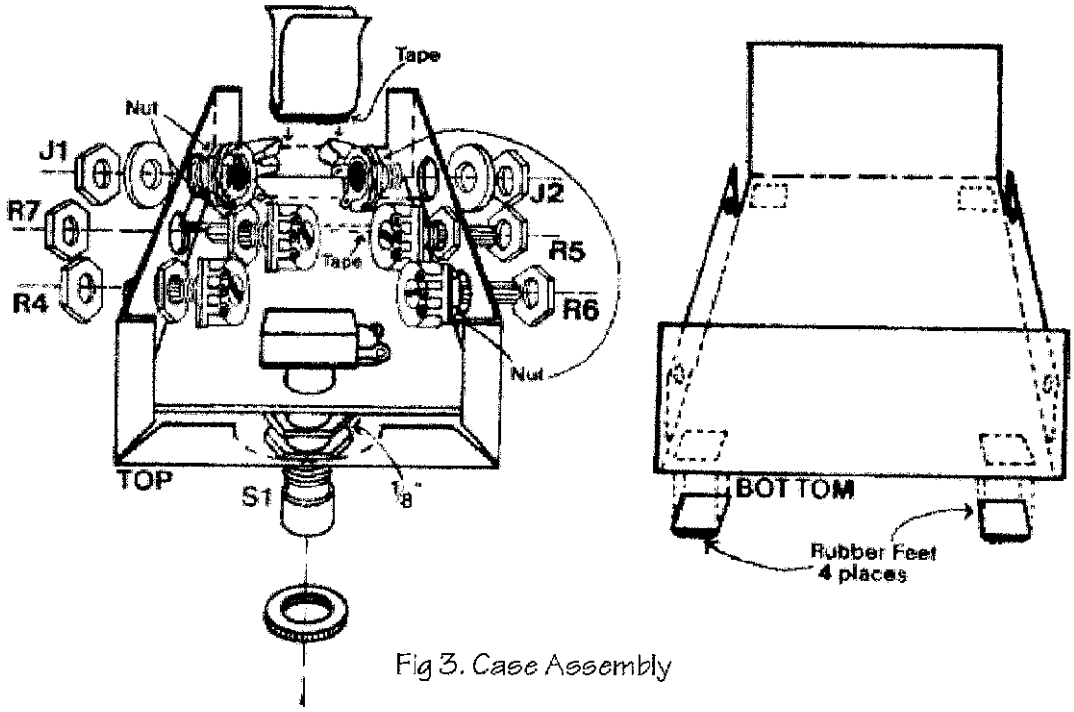


Fig 3. Case Assembly

CASE ASSEMBLY

( ) Locate the foam tape and cut off 1/2" (1.3cm) from the length provided.

Of these two pieces of tape, the shorter will be used to attach the battery holder to the case top and the longer will be used as an insulator to prevent the unsupported end of the circuit board from touching the case top.

To get a feel for the location of the small tape section and the battery holder, trial fit the circuit board by passing the shaft of the foot switch through the hole while dropping the board in place. Notice that a small space must be allowed between the holder and the folded lip of the case to provide clearance for the case bottom when it is installed.

Remove the circuit board and proceed.

( ) Install the longest piece of tape on the inside TOP of the case as shown in figure 3. REMOVE THE PROTECTIVE PAPER FROM ONLY ONE SIDE OF THE TAPE.

( ) Locate the "U" shaped battery holder and stick the small piece of tape to the bottom of it. Remove the paper from the other side of the tape and position it to the inside of the case top as shown in figure 3.

( ) Install the circuit board in the case by inserting the threaded shank of S1 up through the CANCEL hole from the inside of the case top. From the outside thread the knurled finish nut onto the shank of S1 and tighten firmly against the case top.

( ) Install J1 (IN) by inserting the threaded shank of the jack into the appropriate case hole from the inside and threading the nut onto it from the outside. If a washer is included, install it with the nut. Tighten securely.

( ) In the same manner, install J2 (OUT) in the appropriate hole.

( ) In a similar manner, install control potentiometer R7 (TONE) in the hole provided for it. marked . Orient the control pots so that the lugs point toward the front of the case where the foot switch mounts.

( ) In a similar manner, install control pot R4, (FUND LEVEL) in the appropriate hole.

( ) In a similar manner, install control pot R6 (÷4 LEVEL) in the appropriate hole.

( ) In a similar manner, install control pot R5 (÷2 LEVEL) in the appropriate hole.

( ) Locate the four rubber feet and install them on the outside of the case bottom. Remove them from the carrier and stick them in place.

TESTING

Before installing the case bottom we will test the ROCTAVE DIVIDER. Snap in a fresh 9 volt battery and plug your axe into the "IN" jack and patch the "OUT" to you amplifier. Set both ÷2 and ÷4 LEVEL controls to min. Set the FUND LEVEL and TONE controls to about 50%. Press the foot switch a few times and note that the sound goes from a normal clean sound to a distortion or fuzz type sound. While the effect is on (fuzz sound), turn the FUND LEVEL down low and bring the ÷2 control up to about 50%. You should hear the note you are playing PLUS a note one octave below that.
Now return the ÷2 Control to min and bring the ÷4 control up to about 50%. You should be able to hear the note you are playing PLUS a note that is two octaves below that.
REMEMBER, YOU MUST PLAY ONLY ONE NOTE AT A TIME, NOT CHORDS.

With the effect on, try turning the TONE control. You should hear more treble as the control is rotated toward hi.

Of course the CANCEL switch turns ROCTAVE off and on. When ROCTAVE is canceled the audio signal from your instrument is allowed to pass unmodified.

Note that plugging your cord into the "IN" turns the power on, so you must keep the input unplugged when the unit is not in use to get long life from the battery.

COMPLETE CASE ASSEMBLY

( ) After testing is complete, install the case bottom by slipping it into place and inserting the four #6-32 X 3/8" self-tap screws through the holes in the sides of the case top.

( ) Install the knobs. Set the controls to min and align the pointer on the top of the TONE and FUND LEVEL knobs so they are in about a 7:00 o'clock position, and align the ÷2 LEVEL and ÷4 LEVEL knobs so that they are in about a 5:00 o'clock position. Tighten the set screws to secure the knobs.

THIS COMPLETES ASSEMBLY OF THE 5760 ROCTAVE DIVIDER.

USING THE ROCTAVE DIVIDER

Patch your axe into J1, patch J2 to your amp, and you should be ready to kick into action. Select the bass (rhythm/neck) pickup for beat results, and pick cleanly — if more than one string is vibrating at a time, the sound will be inconsistent. In most cases, you may leave the tone control at the full treble position, but if you have octave skipping problems, turn the tone control down. Start playing around the middle of the neck to familiarize yourself with the way the box tracks, and experiment with the various controls. Remember to pick more softly as you hit the lower end of the neck. Don't expect instant perfection, since octave dividers require practice for best results. You should have the box pretty well figured out in about half an hour or so.

For a fuzz-with-dynamics sound, turn the tone control all the way toward hi (full treble), turn up R4, and turn down R5 and R6. This sounds resembles that of the Ultra-Fuzz (project #6 in "Electronic Projects for Musicians"), but with added dynamics.

For a Wes Montgomery type of sound, turn the tone control full back for the bassiest sound, turn up R5, and turn down R4 and R6. Thanks to the dynamics and muted sound, the sound is quite warm and natural - not at all electronic sounding.

For a thick, monster rock lead sound, turn up the tone control, turn up R4, and turn up R5 and R6 to suit. You'll be amazed at the fullness of the sound. Adding a little equalization or chorusing only makes the sound bigger.

One caution: If you turn up R4, R5, and R6 close to maximum, the signal going through them might overload IC2b. This will make the dynamics circuitry behave improperly, and may produce ugly distorted sounds. Should these problems occur, trim back a bit on these controls.

CUSTOMIZATION

There are numerous changes you can make to the Roctave Divider. First, we'll discuss those which relate to playing style.

The Roctave Divider is intended to be compatible with the vast majority of guitars and playing styles. However, there are always those players with a very soft "touch" (or have guitars with weak pickups), and those who hit their strings as if they were mortal enemies. The symptoms of too soft a touch are inadequate divider level and poor sustain. If you experience these problems, increase C5 to 1 uF. and decrease R22 to 22K (if that doesn't make enough of a difference, try 10k).

If you play too hard, chances are the tracking will be erratic,
and the dynamics circuitry will not work correctly (and you could get ..sputtering" on the ends of notes as well). The cure is simple: increase the value of R22 to 100K, 150K, or if you have plutonium pickups and a bionic hand, then maybe even 220K will be necessary.

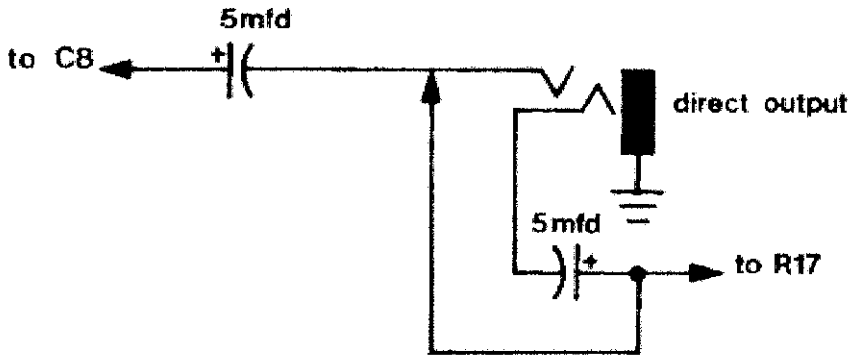
Here are some other possible modifications.

Unity gain through the effect: This box is set up to give a bit of boost at the output. If you don't want this, change R17 to 39K.

+15 volt operation: Change R19 to 68K and increase R12 through R14 to about 22K.
Greater overall output: increase R18.

Jazz tone only: If you're not much into rock and roll fuzz sounds, change C6 to 1 uF.

Stereo processing: Figure 4 shows how to insert three additional components (stereo closed circuit 1/4" jack and two 5 uF. electrolytic capacitors) between C8 and R17 to add a direct output to the Roctave Divider. This output carries the straight sound; the divided and fuzzed sounds, less any straight sound, appear at J2. You may pan this output and the direct output to opposite ends of the stereo field, plug them into two channels of a two channel amp, or add processing to the divided sound present at J2 without affecting the straight signal.



DESIGN ANALYSIS

Referring to the schematic, J1 is the input jack. When you plug a standard mono cord into this stereo jack, lug 1 contacts the tip of the plug and lug 3 contacts the sleeve, thus providing a path for the battery's (-) to ground through lug 3. Just make sure to unplug the input cord after you've finished playing for longest battery life.
IC1b amplifies and buffers your signal. This signal goes to two places: the output mixer (IC1c), which mixes this straight signal in with the divided sounds, and to IC1a. IC1a amplifies your signal a bit more to provide the beat match for the compressor built around IC2a.

IC2a is half of a 571 or 570 compander chip. It's set up so that C4 provides lots of low pass filtering, which emphasizes the fundamental and reduces the harmonic content in order to minimize "octave skipping" and other tracking problems. Using both filtering and compression produces a smooth, consistent signal which is easier to divide down than a straight guitar signal.

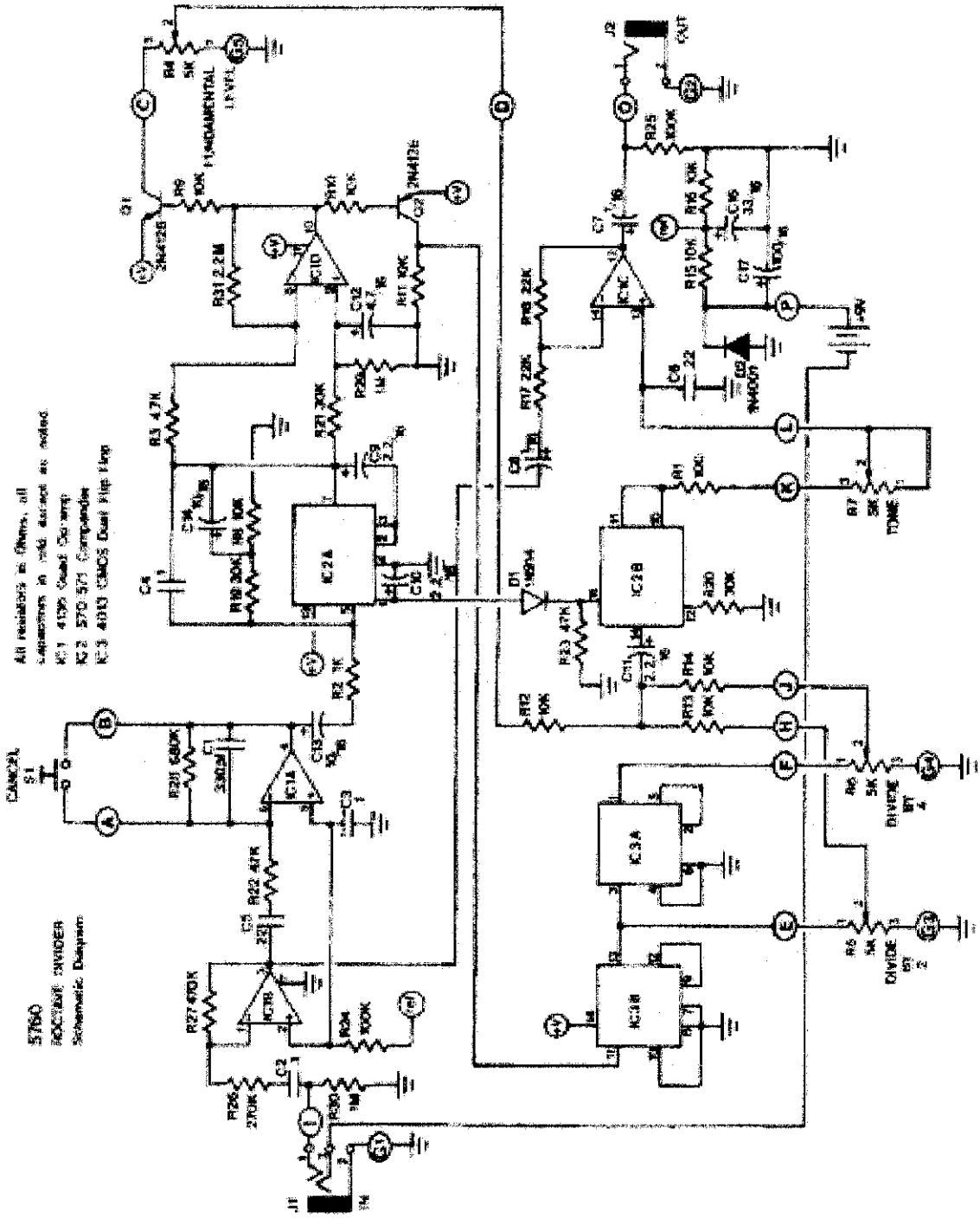
After being conditioned, the guitar signal hits IC1d. This is a comparator with a self-adjusting threshold; the self-adjusting feature means that you get maximum possible sustain out of this stage. IC1d then feeds two transistors. Q1 produces a square wave whose frequency equals that of the note you're playing on the guitar. R4 taps this square wave, and sends it to expander IC2b prior to going to the output mixer. Q2 acts in a similar fashion to Q1. It conditions the signal coming out of IC1D and drives the actual octave dividers, IC3b and IC3a.

IC3a is a CMOS dual flip-flop, where both stages are set up to divide by 2. Thus, IC3b's output is a square wave one octave below your guitar signal (tapped by R5), and IC3a's output is a square wave two octaves below your guitar signal (tapped by R6). These two outputs, along with the output tapped by R4, mix together through R12 - R14 and feed IC2b.

IC2b is set up as an expander, but we've done something a little unusual here. By tying pin 16 to pin 1, the dynamics of this stage will follow the dynamics of IC2a, which in turn follows the dynamics of your guitar note. D1 reduces the voltage going to IC2b somewhat, which is why the divided note always decays just a little bit before your straight signal. IC2b's output feeds tone control R7, which enters output mixer IC1c via pin 13. In the meantime, the straight signal goes into IC1c via pin 14. IC1e's output couples through C7 to J2, the output jack.

Note that all points marked with a circled (+V) connect to the 9 volt power supply. The Roctave Divider also requires a 4.5V supply, provided by the voltage divider made up of R15 and R16. The junction of these two parts is labelled (ref) in a circle. This point connects to R24 (just below IC1b an the schematic).

S1 is the bypass switch. With S1 open, the octave divider works normally, with the straight signal and divided signals appearing at IC1c's output. With S1 closed, IC1A essentially "turns off", thus leaving only the straight signal present at the output. Simple, yes ... but it works and provides a noiseless switching action.



PAiA Electronics, Inc
phn 405-340-6300
email: info@paia.com