



PAIA Electronics, Inc.



## DIRECT INTERFACE

### ASSEMBLY AND OPERATION INSTRUCTIONS

If you record guitarists in your studio, or play guitar yourself, this direct box is for you. The 9110 is optimized for guitar, bass and Stick and matches these instruments as well as guitar-level signal processors to pro-style balanced gear.

The DI buffers them from the loading effects of long cable runs or signal processors/amps with low impedance inputs thus improving clarity and reducing muddiness. It also mixes stereo instruments to mono and delivers 6 to 24 dB of gain.

### SPECIFICATIONS

Frequency response:  $\pm 0.2$  dB, 20 Hz - 80 kHz

Signal to noise ratio:

Output 1:  
(unweighted, 6 dB gain) -102 dB

Output 2:  
(unweighted, 6 dB gain) -96 dB

Signal to noise ratio:  
(unweighted, 24 dB gain) better than -88 dB

Input impedance, J3: >400K ohm

Input impedance, J1: >1 meg ohm

Output impedance: 600 ohm

Max headroom  
( $\pm 15$ V power supply): >26V peak to peak

Gain range: 6 dB to 24 dB

Circuit design by: Craig Anderton & Associates  
Kit design and production: PAIA Electronics, Inc.

## PARTS LIST

Check the parts supplied against this parts list before beginning assembly. Report any shortages or discrepancies immediately.

- 1 5532 op amp
  
- 1 closed circuit phone jack with mounting hardware
- 3 open circuit phone jack with mounting hardware
- 2 stereo phone jack with mounting hardware
- 1 female panel mount XLR connector
  
- 1 DPDT slide switch
  
- 1 100K potentiometer
- 1 push on knob
  
- 2 270 ohm resistors (red-violet-brown)
- 1 4700 ohm resistor (yellow-violet-red)
- 2 10K ohm resistors (brown-black-orange)
- 4 22K ohm resistors (red-red-orange)
- 1 470K ohm resistor (yellow-violet-yellow)
  
- 1 .05 mfd. ceramic disc capacitor
- 2 .1 mfd. mylar capacitor
- 3 33 mfd. 16 v. electrolytic capacitor
  
- 1 5 ft. length of 22 gauge stranded hook-up wire
- 1 6 in. length of RG-174U Coaxial cable
  
- 2 4-40 X 1/2 inch machine screws
- 2 4-40 X 1/4 inch machine screws
- 4 4-40 nuts
- 1 3/8 inch hexagonal potentiometer nut
  
- 1 9110 Direct Interface circuit board

## ASSEMBLY

### CLEAN THE CIRCUIT BOARD

To assure good solder connections first clean the circuit board with a scouring cleanser, rinse with clear water and dry completely.

### SOLDERING

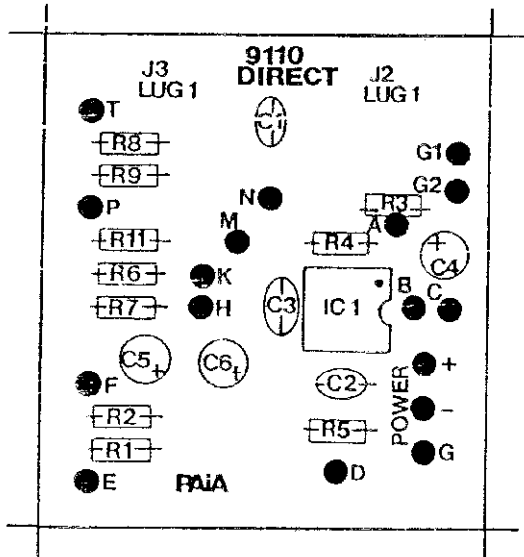
Use a pencil-type soldering iron with a small tip and a power rating of 25 to 35 watts. Soldering guns are completely unacceptable for assembling electronic circuits because the large magnetic field they generate can damage solid state components.

never used for electronic circuits.

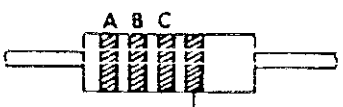
Keep the soldering iron tip clean and avoid excessive heat when soldering components in place.

**INSTALL COMPONENTS ON THE CIRCUIT BOARD**

Following the parts placement diagram (figure 1) and the designations printed on the circuit board install the components on the circuit board in the order listed below. Clip excess component leads off flush with the connection after soldering in place.



**FIGURE 1**  
**CIRCUIT BOARD PARTS PLACEMENT DIAGRAM**



Silver or gold - disregard this band.

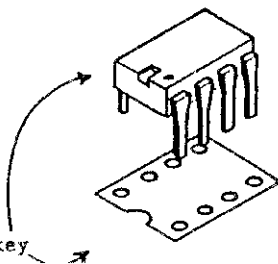
**RESISTORS**

DESIGNATION	VALUE	COLOR CODE A-B-C
R1, R2	270 OHM	red-violet-brown
R3	4.7K / 4K7	yellow-violet-red
R4, R5	10K	brown-black-orange
R6 thru R9	22K	red-red-orange
R11	470K	yellow-violet-yellow

**INTEGRATED CIRCUIT**

Install the NE5532 IC. Note that the notch or dot on one end of the integrated circuit aligns with the semi-circular key on the parts placement designator on the circuit board and shown in figure 1.

Avoid damaging heat build up by heat sinking the leads of the IC while soldering in place.



IC1 NE5532



ceramic



mylar

## CAPACITORS

DESIGNATION	VALUE/TYPE	MARKINGS
C1	.05 mfd. ceramic	
C2, C3	.1 mf mylar	100n

Note that the following electrolytic capacitors are polarized and must be oriented according to the parts placement diagram and pc board designations.

Either the positive (+) or negative (-) lead of these capacitors may be marked. The positive lead must be installed in the circuit board hole marked (+) in order for the circuit to function.



electrolytic cap.

C4, C5, C6	33 mfd./16v. electrolytic	polarized
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## PANEL MOUNTED COMPONENTS

Following figure 2, install jacks J2 and J3 on the front panel (or other enclosure) using the hardware supplied. Orient as illustrated in figure 2 .

J2, J3	1/4 inch open circuit phone jacks
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Once these two jacks have been mounted on the front panel, the circuit board is soldered directly to the lower lugs (lug 1) of the jacks. Note that the circuit board component side faces up as shown in figure 2. Melt solder onto the circuit board solder pads and the jack lugs then press the board against the lugs while reheating with the soldering iron to make each connection.

Bend the jack lugs that the circuit board is attached to so that the circuit board is at a right angle to the panel.

Mount the remaining jacks on the front panel.

J1	1/4 inch closed circuit phone jack
J4	1/4 inch open circuit phone jack
J5, J6	1/4 inch stereo phone jacks

Mount the XLR connector using the 1/2 inch machine screws and nuts provided.

Mount the slide switch on the front panel using the 1/4 inch machine screws and nuts provided.

S1 Double Pole Double Throw slide switch

Mount the potentiometer using the 3/8 inch hex nut.

R10 100K linear taper potentiometer

### CIRCUIT BOARD/PANEL WIRING

Once the jacks and controls have been mounted on the panel and the circuit board attached, make the following connections between controls on the panel. Use the 22 gauge insulated wire to make these connections. Prepare each wire by cutting to the recommended length, stripping 1/4 inch of insulation from each end. Twist the exposed strands together and "tin" by melting a small amount of solder into the wire.

The recommended wire lengths include adequate length to neatly dress the wires by routing along the circuit board and front panel.

PANEL LOCATION	TO	PANEL LOCATION	WIRE LENGTH
S1 LUG 1		S1 LUG 6	1 inch
S1 LUG 4		S1 LUG 3	1 inch
J7 LUG G		J4 LUG G	4 inch
J4 LUG G		J5 LUG G	2-1/2 inch
J5 LUG G		J6 LUG G	7 inch
J6 LUG G		J3 LUG G	2 inch
J3 LUG G		J2 LUG G	1-1/2 inch
J2 LUG G		J1 LUG G	3-1/2 inch
S1 LUG 3		R10 LUG 3	3-1/2 inch
R10 LUG 3		R10 LUG 2	3/4 inch
J5 LUG 1		J4 LUG 1	2-1/2 inch
J4 LUG 1		J7 LUG 2	3-1/2 inch
J7 LUG 3		J5 LUG 2	4-1/2 inch

Using 22 gauge insulated wire make the following ground connections from the circuit board to the panel:

PC POINT	TO	PANEL LOCATION	WIRE LENGTH
G1		J1 LUG G	1 inch
G2		J7 LUG 1	13 inch

Using 22 gauge wire make the following connections between circuit board points and front panel controls.

PC POINT	TO	PANEL LOCATION	WIRE LENGTH
A		R10 LUG 3	4-1/2 inch
D		S1 LUG 6	7-1/2 inch
E		S1 LUG 2	7-1/2 inch
F		S1 LUG 5	7-1/4 inch

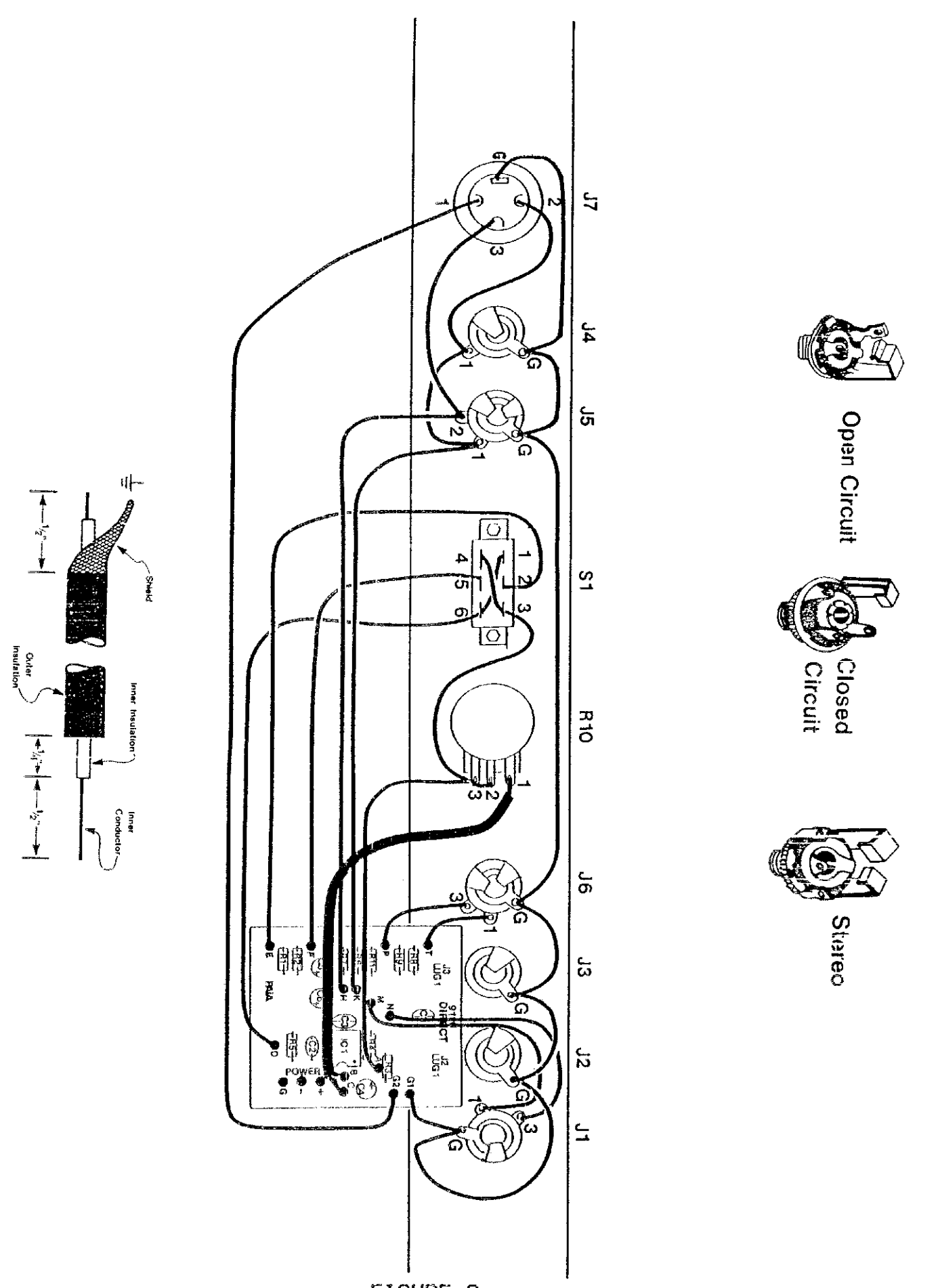


FIGURE 2

PC BOARD POINT	TO	PANEL	WIRE LENGTH
H		J5 LUG 2	8 inch
K		J5 LUG 1	8 inch
M		J1 LUG 1	4-1/2 inch
N		J1 LUG 3	3 inch
P		J6 LUG 3	1-1/2 inch
T		J6 LUG 1	1 inch

Prepare a 5 inch length of coaxial cable by stripping 1/2 inch of outer insulation from each end.

On one end carefully unbraid the shield wire and separate from the inner conductor. Twist the shield wire and tin with solder. Cut away 1/4 inch of insulation from the inner conductor and twist and tin the exposed strands.

On the other end carefully cut away the shield wire flush with the outer insulation. Strip 1/4 inch of insulation from the inner conductor, twist and tin.

Connect the inner conductor of the end of the cable with the shield cut away to lug 1 on R10.

Connect the inner conductor of the other end to circuit board point B and the shield to circuit board point C.

#### THIS COMPLETES ASSEMBLY

At this point you should double check your assembly against the diagrams in figures 1 and 2 before powering up the unit.

#### POWER UP

The power supply can be any well-filtered, bi-polar, DC power supply between +/- 9 and +/- 18 volts (more volts gives you more headroom). You can even use two pairs of 9v. batteries (wired in series) if hum is a problem, or to help avoid shock hazard.

The PAIA BPS-15 regulated power supply is a good choice for power, and its connections are described below.

Connect power supply +, -, and G leads to circuit board points +, -, and G respectively.

#### USING IT

The DI is well-suited to driving any kind of balanced input (e.g., pro signal processor or console) with an unbalanced out, particularly if it's low level. Choose the right kind of input and output connector, adjust the polarity switch as needed, and set the gain for the desired kick.

**IMPORTANT:** Don't overlook using the unbalanced output (J4) to drive studio-oriented signal processors that, even through they have a 1/4 inch phone jack input, load down pickups due to a low input impedance (even some guitar boxes do this). Using the DI to provide proper matching between the guitar and processor can greatly increase the guitar's "sparkle".

## HOW IT WORKS

IC1A provides the amplified, non-inverting ("hot") signal and also feeds unity gain inverting amp IC1B, which generates the inverting ("cold") signal. S1 routes the two op amp outputs to the output connectors differently, depending on which polarity you select.

Regarding the inputs, J3 provides traditional capacitive coupling and a discharge path to ground (R11). R11's high resistance avoids loading down an instrument's sensitive pickups, but unfortunately, higher resistance leads to more noise.

Plugging a guitar into J1 improves the noise performance, especially if the instrument's volume control is all the way up. In this case, the op amp "sees" a low resistance path to ground through the pickup wiring, which reduces noise; meanwhile, the pickup "sees" the op amp's high input impedance. The result: very little loading and very low noise. THE NE5532 (IC1) is a dual op amp that features high slew rate, quiet operation, and the ability to drive 600 ohm lines.

NOTE that the schematic parts values are in international notation but the parts list gives values in both American and international notation. The main conversion to remember is that 1 nanofarad (nF) = 1000 pF = 0.001 mF.

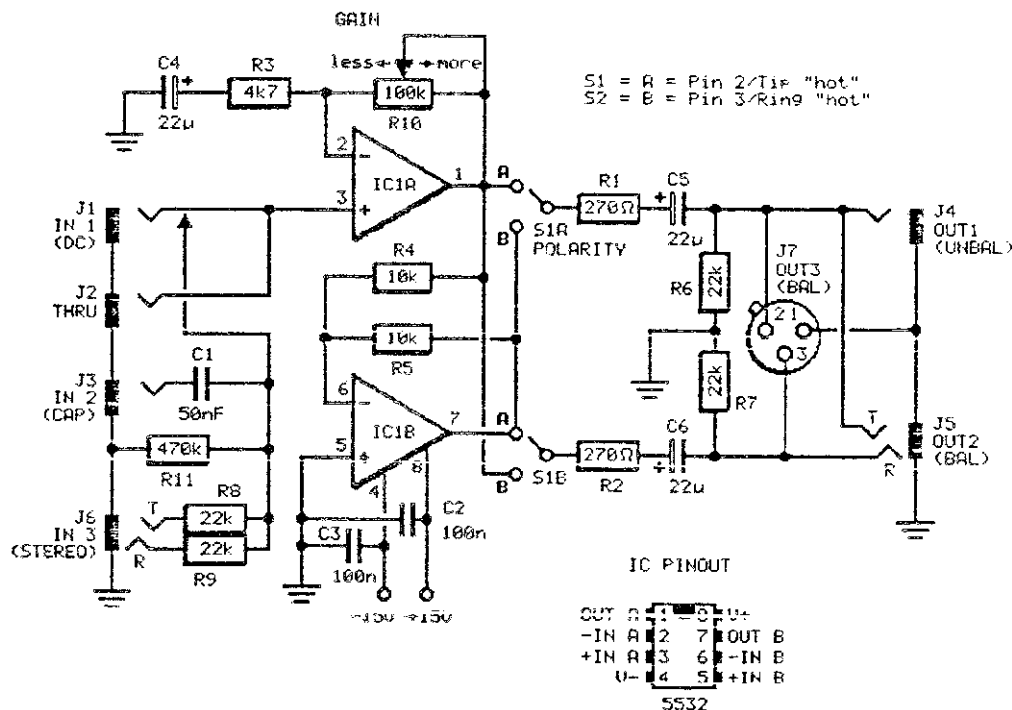


FIGURE 3