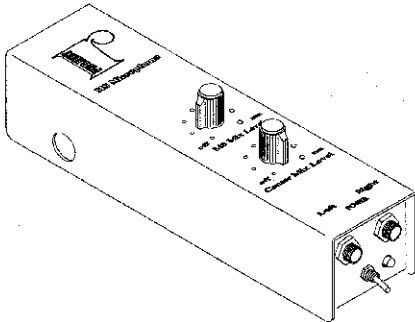


# PAiA MS Stereo Mic

## Model 9506 Assembly and Using Manual



It's no secret that stereo makes a big difference in recordings. But every method for recording stereo has some drawbacks ... which the Project-r MS Stereo Mic addresses.

The principle behind this mic, MS miking, has been around for a while.

The standard MS techniques uses two mics: an omni facing forward and a figure 8 or bipolar pattern facing to the side to pick up off-axis and reflected room sounds. The mic facing forward is mixed equally in both the right and left channels (your basic mono); it provides the "M", or middle signal. The figure 8, "S", (for side ) mic signal is split into two signal paths, one of which is panned hard right and the other inverted in phase and panned hard left: Bringing up the relative level of the side mic increases the perceived width of the stereo effect.

A nice benefit to MS miking is its mono-compatibility--when the stereo signal is collapsed into mono, the side signals cancel out, leaving the pure mono signal unaffected. Traditional MS miking's biggest complication is that the figure 8 mic has to be a dual diaphragm type - typically AKG-414s, Neumann U-87s or similar mics are used. Also, not all mixers make it easy to split the side signal and invert one channel--a difficulty that the Project-r MS Stereo mic deals with by including everything in one box.

The MS sound is especially well suited for applications like acoustic guitars, overhead drum miking and stereo sampling.

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## ASSEMBLING THE MS Stereo Microphone

Before beginning assembly, go through the manual. Look at the drawings. Feel the parts. You're naturally eager to plunge right in, but take a few deep breaths first.

Notice that each step in the manual is marked with a checkoff box like this:

DESIGNATION	VALUE	COLOR CODE
( ) R27	100 ohm	brown-black-brown

Checking off each step as you do it may seem silly and ritualistic, but it greatly decreases the chance of omitting a step and also provides some gratification and reward as each step is completed.

Numbered figures are printed in the Illustrations Supplement in the center of this manual. These pages may be removed for easy reference during assembly.

### Updates to the 9506d Board

Wiring points M, SL and SR are for optional external mic wires.

The DC connector area includes separate circuits for power ground and signal ground, which matches our 9770 series power supplies and power connector kits. With the normal ac power input, a jumper must be installed to link these grounds at the point labeled by an arc next to the letter G between Cs 9 and 10.

There is a new jumper that is missing a 'jumper graphic' (line). This jumper should install in the two holes adjacent to the '5' in the IC5 designator. It carries the negative dc supply over to this and the other 5532 ICs, pin 4.

### TOOLS

You'll need a minimum of tools to assemble the kit - a small pair of diagonal wire cutters and pliers, screwdriver, sharp knife, ruler, soldering iron and solder.

Modern electronic components are small (in case you hadn't noticed) and values marked on the part are often difficult to see. Another handy tool for your bench will be a good magnifying glass. Also

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use the magnifier to examine each solder joint as it is made to make sure that it doesn't have any of the problems described in the SOLDERING section which follows.

#### SOLDERING

Select a soldering iron with a small tip and a power rating not more than 35 watts. Soldering guns are completely unacceptable for assembling solid state equipment because the large magnetic field they generate can damage components.

Use only rosin core solder (acid core solder is for plumbing, not electronics work). A proper solder joint has just enough solder to cover the soldering pad and about 1/16-inch of lead passing through it. There are two improper connections to beware of: Using too little solder will sometimes result in a connection which appears to be soldered when actually there is a layer of flux insulating the component lead from the solder bead. This situation can be cured by reheating the joint and applying more solder. If too much solder is used on a joint there is the danger that a conducting bridge of excess solder will flow between adjacent circuit board conductors forming a short circuit. Accidental bridges can be cleaned off by holding the board upside down and flowing the excess solder off onto a clean, hot soldering iron.

Use care when mounting all components. Never force a component into place.

**Tips from the Pros:** Your first step should always be to check the parts list in this manual (usually the last page). Hard as it is to admit that we make mistakes, it is not unheard of for us to mispack the bag. We ship missing parts *quick*, but there's nothing more aggravating than discovering a missing part in the middle of assembly, at 10:00 PM. Checking the parts also gives you the opportunity to handle them, making sure you know what they are.

Look through the manual fully before you begin assembly, it wouldn't hurt to check the parts supplied against the drawings in the manual. The more you think about what you're going to be doing before you do it, the better.

### Wire Jumpers

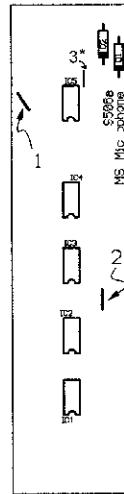
Assembly begins by forming and installing the two wire jumpers indicated by bold lines on the circuit board parts placement designators and numbered in the illustration to the right. For each jumper, cut a length of the bare wire supplied by measuring it against the distance between the circuit board holes and adding about 1/2". Bend 1/4" of each end down and push through the circuit board holes. Press the jumper fully against the board and solder both ends. Trim off excess wire flush with the solder joint.

- ( ) As outlined above, form and install the two wire jumpers used on the circuit board.

### Resistors

Solder each resistor in place following the parts placement designators printed on the circuit board and the assembly drawing fig 1. Note that resistors are nonpolarized and may be mounted with either lead in either of the holes in the board. Before mounting each resistor, bend its leads so that they are at a right angle to the body of the part. Put the leads through the holes and then push the resistor firmly into place. Cinch the resistor in place by bending the leads on the solder side of the board out to an angle of about 45 degrees. Solder both ends of each resistor in place as you install it. Clip each lead flush with the solder joint as the joint is made.

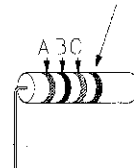
DESIGNATION	VALUE	COLOR CODE A-B-C
listed below:	100	brown-black-brown
( ) R10	( ) R15	( ) R27 ( ) R34
listed below:	100k	brown-black-yellow
( ) R6 ( ) R25	( ) R11 ( ) R37	( ) R22 ( ) R23



There are two wire jumpers on the board.

*There is a new jumper that is missing a 'jumper graphic' (line). This jumper should install in the two holes adjacent to the '5' in the IC5 designator. It carries the negative dc supply over to this and the other 5532 ICs, pin 4.*

Silver or Gold (disregard)



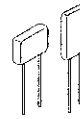
DESIGNATION	VALUE	COLOR CODE A-B-C
listed below:	10k	brown-black-orange
( ) R2	( ) R12	( ) R14 ( ) R19
( ) R29	( ) R31	( ) R33
( ) R8	2200	red-red-red
( ) R20	2200	red-red-red
( ) R32	2200	red-red-red
( ) R35	220	red-red-brown
( ) R39	220	red-red-brown
listed below:	22k	red-red-orange
( ) R3	( ) R4	( ) R5 ( ) R7
( ) R9	( ) R16	( ) R17 ( ) R21
( ) R24	( ) R26	
( ) R1	330	orange-orange-brown
( ) R18	330	orange-orange-brown
( ) R28	330	orange-orange-brown
( ) R30	39k	orange-white-orange

### Mylar Capacitors

Three of the capacitors used in the MS Mic are non-polarized Mylar types. For all of these, either lead can go in either of the holes in the circuit board. The leads of the capacitors are already parallel to each other but still may need to be bent slightly to match the spacing of the circuit board holes. Like the resistors, insert the leads of these parts through the holes in the board and push the part against the circuit board as far as it wants to go. Don't force it, it's OK if it sits a little off the board.

### Capacitors

Mylar

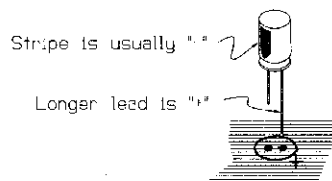


DESIGNATION	VALUE	MARKING
( ) C2	0.1 uF	104
( ) C4	0.1 uF	104
( ) C7	0.1 uF	104

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## Electrolytic Capacitors

The remaining capacitors are electrolytic types. Unlike the previous components, electrolytic capacitors are polarized and the leads are not interchangeable. Leads are marked "+" and/or "-" and the "+" lead must go through the "+" hole in the circuit board. Frequently the positive lead of the capacitor is significantly longer than the negative lead.



Usually the Negative lead of the capacitor is marked rather than the positive. It naturally goes through the unmarked hole.

Save a couple of the longer lead clippings for later use.

Capacitors supplied with specific kits may have a higher Voltage (V) rating than the minimum specified below.

### DESIGNATION VALUE

listed below: 220uF 25V Electrolytic

( ) C8 ( ) C9 ( ) C10 ( ) C11

( ) C1 47uF 10V Electrolytic  
( ) C3 47uF 10V Electrolytic  
( ) C6 47uF 10V Electrolytic  
( ) C5 100uF 10V Electrolytic

## Diodes

Like the Electrolytic Capacitors, diodes are polarized and must be installed so that the lead on the banded end of the part corresponds to the banded end of the designator on the circuit board. Bend the leads so they are at right angles to the body of the part and insert them through the holes provided in the circuit board.

Diodes are also somewhat heat sensitive so the soldering operation should be done as quickly as possible.

### DESIGNATION TYPE

( ) D1 1N400x (may be 4001, 4002, 4003, etc.)  
( ) D2 1N400x

6 MS Stereo Mic

## Integrated Circuits

Of all the parts, the ICs are the most easily damaged and should be treated with some respect. In particular, they may be destroyed by discharges of static electricity. Modern ICs are not nearly as sensitive to this kind of damage as were earlier versions, but it is still good practice to handle these parts as little as possible. Also good practice: don't wear nylon during assembly. Don't shuffle around on the carpet immediately before assembly (or if you do, touch a lamp or something to make sure you're discharged). Don't be intimidated. It's rare for parts to be damaged this way.

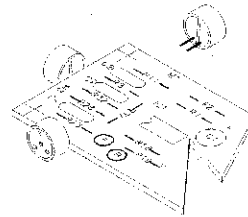
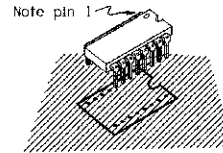
ICs are polarized in one or both of two ways; A dot formed into the case of the IC corresponding to pin 1 or a semicircular notch that indicates the end of the package with pin 1. Take care that this polarizing indicator corresponds to the similar indicator on the circuit board graphics.

The pins of the ICs may be splayed somewhat and not match up exactly with the holes in the circuit board. Carefully re-form the leads if necessary so that they are at right angles to the part. Solder each IC in place as it is installed by initially soldering two pins in diagonal corners of the pattern. Make sure that the part is seated firmly against the pc board by pressing it down while remelting the solder joint at first one corner, then the other. Finally, solder the remaining connections.

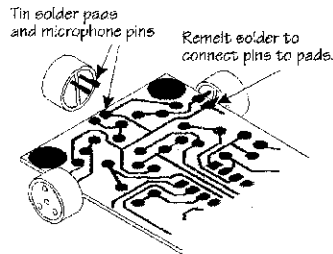
DESIGNATION	PART NO.	DESCRIPTION		
listed below:	5532	Dual OpAmp		
( ) IC1	( ) IC2	( ) IC3	( ) IC4	( ) IC5

## Mic Elements

The three Electret Microphone Elements attach by soldering their pins directly to pads on the edges of the circuit board as show in the illustration on the following page. The microphones are polarized by the off-center location of the pins and must all be oriented so that the largest part of the mic extends above the component side of the board as shown to the right.



"Tin" the microphone pins and circuit board pads by melting a little solder on to them. Install the microphone by holding the pins against the tinned pads and remelting the solder. When properly installed, the back of the Microphone will be touching the circuit board edge.



**DESIGNATION DESCRIPTION**

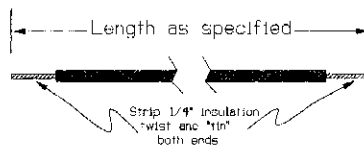
- ( ) M1 Electret Microphone
- ( ) M2 Electret Microphone
- ( ) M3 Electret Microphone

**"Flying" Wires**

(i.e. those which go from circuit board to panel mounted parts.)

In the following steps, wires will be soldered to the MS Mic board which in later steps will be connected to the front panel controls and switches. At each step, cut a piece of wire to the specified length and strip 1/4" of insulation from each end. Twist the exposed wire strands together and tin them by melting a small amount of solder into the strands. This will make soldering easier when the wires are installed and prevents fraying of the wire strands when they are pushed through the holes. Solder each connection as it is made and clip any excess wire from the solder side of the board.

PC POINT	LENGTH	PC POINT	LENGTH
( ) "A"	5"	( ) "H"	4-1/2"
( ) "B"	5"	( ) "I"	4-1/2"
( ) "C"	5-1/2"	( ) "J"	3"
( ) "D"	5-1/2"	( ) "K"	3-1/2"
( ) "E"	7"	( ) "N"	2"
( ) "F"	9-1/2"	( ) "SG"	3"

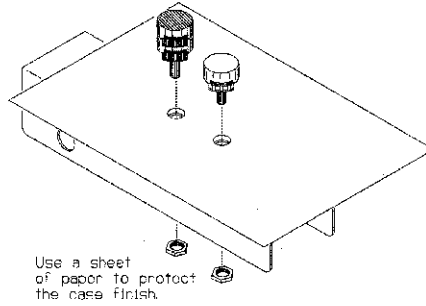


In the next section controls, jacks and the switch will be wired in preparation for final assembly. Take this opportunity to check your work so far. Check polarity of Diodes, Electrolytic Capacitors and ICs and critically inspect your soldering. Pay particular attention to pads that are close together to make sure there are no unintentional bridges of solder between them. If you find a solder bridge, remove it by holding the circuit board upside down and flowing the excess solder off onto the tip of a clean, hot soldering iron.



## Front Panel Controls

Now we will put the circuit board aside temporarily and wire the controls. Even experienced builders will find it easier to wire these parts before they go into the case, and this is easier if the case top is used as a temporary fixture to hold the parts in place while working on them as shown in the illustration.



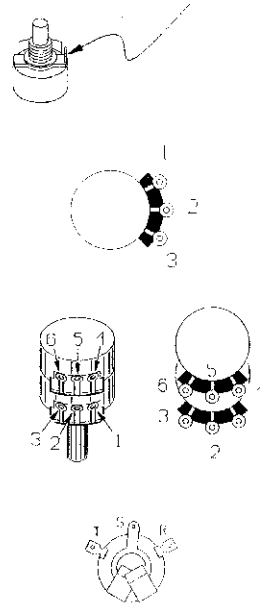
A paper bib will help protect the finish. Push the pots through from the top and secure with the nuts from the inside. Do not tighten, we will soon be moving them inside the case. Orient the lugs as shown in fig 2.

Before beginning to wire the panel components it will be helpful to tin the lugs of the pots and jacks by melting a small amount of solder onto them. Because of the mass of the lugs this will take a lot more heat than was required while soldering parts to the circuit board. Melt a little solder onto the tip of your iron and hold it against the lug until the lug is hot enough that fresh solder melts when touched to it. Leave the iron in place longer than you think you need to. Do not fill in the holes and do not leave large blobs of solder on the lug.

Now we'll wire the Controls as shown in fig 2. Notice that individual solder lugs are identified by part number and lug designation. For example R36-1 means the lug labeled "1" of the Potentiometer R36. Jack lugs are designated "T" (for the lug which will connect to the Tip of an inserted plug) "S", for Sleeve, and "R" for the Ring connection.

This convention will be followed in these steps:  
Do not solder a connection to a lug until told to do so with an instruction such as (s2), which means that at that point there will be two wires on the lug in question. If there are not the number of wires specified at the lug when you get ready to solder, recheck to see what has gone wrong. Connections which should not be soldered yet will be marked (ns) for NO SOLDER. On these unsoldered connections simply push the end of the wire through the lug and crimp it back to mechanically secure it.

Bend or remove this tab so that the pot will seat flush against the front panel.



Begin wiring using the single strand bare wire supplied. At each step cut the wire to the specified length. Slip the end through the lug specified so that about 1/8" protrudes through the lug and bend the end of the wire back to mechanically secure it. These wires will all be grounds, so it is OK for them to touch the case or the bodies of the pots, but do not allow them to touch any solder lugs other than those they are connected to. (see fig 2)

FROM	TO	LENGTH
( ) R36-1 (s1)	R13-1 (ns)	2"
( ) R13-1 (s2)	R13-4 (ns)	1"

( ) Strip and tin a 11" length of #22 stranded wire and connect one end to R13-4. Solder the two wires at this lug. The free end of this wire will be connected in later steps.

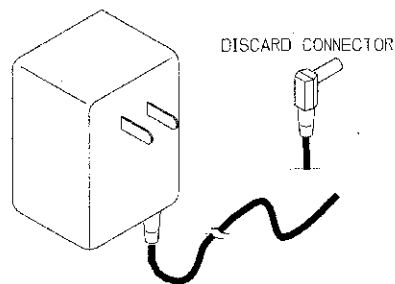
MS Mic wiring continues by connecting the wires previously soldered to the circuit board to the pots as detailed in fig 2.

FROM PC POINT	TO
( ) "A"	R13-3 (s1)
( ) "B"	R13-2 (s1)
( ) "C"	R13-6 (s1)
( ) "D"	R13-5 (s1)
( ) "E"	R36-3 (s1)
( ) "F"	R36-2 (s1)

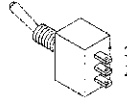
The case top and circuit board can now be put aside while assembly continues with installation and wiring of Power Transformer, Jacks and Switch in the Case Bottom. (see fig 3)

#### Power Transformer

Locate the Wall Mount Transformer (P1). If this part has a connector on the end of its cable, remove and discard it as shown.



- 
- ( ) Install the rubber grommet in the power supply cord hole in the end of the Case Bottom as shown in Fig 3. A pen point or small screwdriver may be helpful in deforming the grommet into the hole.
  - ( ) Pass the Transformer cord through the grommet from the outside of the case and put a knot in the cord 3" from the end. Separate the two wires from the loose end back to the knot. Strip 3/16" of insulation from the ends of both wires and twist and tin the exposed wire strands.
  - ( ) Using the nuts and washers supplied, mount the miniature toggle switch S1 as shown in fig 3. While the circuitry only requires a SPST switch (with two solder lugs) the parts supplied will most likely be SPDT types (with three lugs) and only two of the lugs will be used. Orient the switch as shown in fig 2 and fully tighten the nut to secure it.
  - ( ) Connect one of the wires from the Power Transformer to lug #1 of S1 and solder. The leads from the transformer are interchangeable and either may be used in this step. The free lead will connect to the circuit board in a later step.
  - ( ) Using the nuts and washers supplied with them, mount the 1/4" Stereo Phone jacks as shown in fig 3 and orient as shown in fig 2. Do not fully tighten these nuts. When assembly is complete some adjustment may be necessary to keep the lugs from touching one another and the case.
  - ( ) After tinning all six of the Jack's lugs, use a 2" length of the bare wire supplied to connect lug "S" of J1 to lug "S" of J2. Neither end of this wire will be soldered at this time. Simply push each end of the wire through the lug and crimp it back to mechanically secure it. (see fig 2)



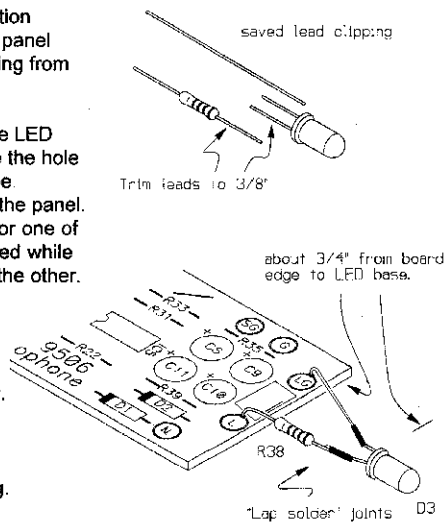
We will shortly mount the circuit board in the case bottom. Remove the pots from their temporary location on the outside of the case top and put the case top aside for the time being. Before continuing, there are some things we need to do to the circuit board.

## POWER LED

Note that the LED is polarized by the flat in the collar at the base of the part, but since it is powered by AC in this application, polarization is not important. The LED is a tight fit in the panel hole, try a test fitting and scrape the anodizing from the inside edge of the hole if necessary.

When the MS Mic is installed in its case, the LED will be supported by its leads and engage the hole in the front panel. Both leads will need to be extended to reach from the circuit board to the panel. R38 (1000 ohm, brown-black-red) is used for one of these extensions and the lead clipping saved while installing electrolytic capacitors is used for the other.

Cut the LED and resistor leads to 3/8" and tin them with a little solder. Join the resistor lead to the LED lead by holding the two together while remelting the solder. A twisted connection is not necessary, surface tension of the solder will pull the two leads together. Similarly extend the other LED lead with the saved wire clipping.



- ( ) Push the free resistor lead from the above assembly through hole "L" on the circuit board and the extended LED lead through hole "LG". Bend the assembly over so that there is about 3/4" to 7/8" distance from the board to the base of the LED and solder the leads. Clip off excess flush with the solder joint.
- ( ) Connect the free end of the wire originating at circuit board point "N" to lug #2 of S1 and solder this connection (see fig 2).
- ( ) Connect the free end of the transformer wire entering the case through the grommet to circuit board point "G" and solder the connection. Trim any excess flush with the solder joint.
- ( ) Ease the circuit board into place so that the LED engages the hole provided for it. Fasten the board in place using the four each of 4-40 X 1/2" machine screws, #4 standoffs and #4 machine nuts supplied. Tighten this hardware.

Finish wiring by connecting the remaining wires from the circuit to the Jacks as detailed on the facing page. (see fig 2)

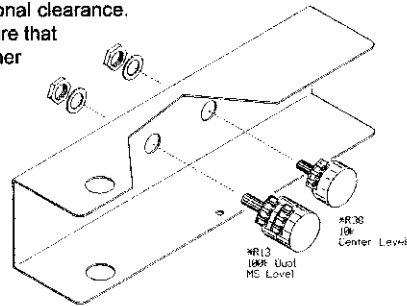
PC POINT TO

( ) "SG" J2-S (s2)  
( ) "H" J1-T (s1)  
( ) "I" J1-R (s1)  
( ) "J" J2-T (s1)  
( ) "K" J2-R (s1)

( ) Connect the free end of the wire originating at lug R13-4 to J1-S and solder the two wires at this lug.

Adjust the orientation of the jacks so that their solder lugs do not touch one another or the case top when it is installed. If necessary, use a sturdy pair of needle nose pliers to bend the lugs to right angles with the panel for additional clearance. Insert plugs into the jacks and check to make sure that the contact blades do not short against each other when displaced by the Plug.

Gather the wiring between the circuit board and potentiometers R13 and R36 into a bundle and cinch with the wire tie supplied. Mount the pots in the case top using the flat washers and nuts that were supplied with them as shown in the illustration. Tighten all hardware.

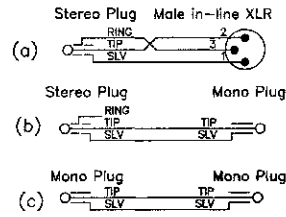


**This completes the electronic assembly** of the MS Stereo Mic. Before plugging the unit in and testing it, take a well earned break then come back and check your work completely. Don't be afraid to tug on wires to test connections, now's a good time to find out whether they will hold or not. Check the wiring around the Power Switch S1. There's some point-to-point wiring involving D3 and R38 that is susceptible to wires touching and shorting.

#### POWER UP & TESTING

Plug the wall-mount Power Transformer into an electrical outlet. Toggle the Power Switch up to turn the unit on. The LED should light and if it doesn't, stop immediately and find out why. It may be something as simple as a dead electrical outlet, or it may be a bad connection or solder bridge on the circuit board. If the LED lights, let the unit idle for a few minutes while you check for overheating components (in particular the ICs). R35 and R39 will quickly become very warm but not too hot to touch. All other components should remain only slightly above ambient temperature.

If everything checks out so far, turn both panel controls fully Counter ClockWise and connect the mic to a mixing board or audio amplifier. Be aware that the outputs are line level signals. The typical microphone input will need to be padded down by 40-50dB to keep from being overloaded. The illustration shows how to wire a 1/4" Balanced-out to XLR output adapter (a). Belden 9501 or similar Twin-ax wire is a good choice. To connect to the typical 1/4" mono input it is best to float the "cold" output by not connecting to the Ring of a the stereo plug as shown in (b). In a pinch, a guitar cord can be used without any problems (c).



As you turn up the Mid Level the MS Mic should act like a mono microphone and you should hear sound coming evenly from both right and left channels. There should be no distortion in the MS Mic circuitry across the full travel of the control, though of course high output levels may overdrive the mixer or amp.

If this test fails, but the following test of the side mics show that they are working then examine carefully the circuitry around IC2:a and the wiring from circuit board points "E" and "F" to the Center Mix control R36.

The procedure for checking out the side microphones is similar. It may not be immediately apparent if only one side is working because of their close proximity to one another, but here's a simple test: Return the Mid Level control to fully CCW and turn up the Side Level control far enough to hear that the side microphones are working. Gently rub M1 and M2 with your fingertip. Both mics should sound the same; if one is louder than the other, the quieter one is not working for some reason and you are picking up the rubbing sound from the other microphone.

If one of the side mics is not working, check the circuitry associated with that microphone. If the right mic isn't working, check the circuitry around IC1:b and the wires that connect points "C" and "D" to the Side Level control R13. If the left mic isn't right, check around IC1:a and the wiring from "A" and "B" to R13.

If there is no output from one whole side of the mic, check the output stage associated with that side. If there is no Left output, check the circuitry around IC4 and wiring from "H" and "I" to the output jack J1. No right output should cause you to suspect IC5 and associated circuitry and the wiring from "J" and "K" to J2.

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If you don't have any output for any of these tests, it is an indication that something in common with all the circuits is not functioning properly. Check the power supply components D1, D2 and electrolytic capacitors C8 - C11 for proper installation and polarization. Check the reference voltage supply source R25, R30, C5 and opamp IC2:b. You should read a voltage of about 2.5V at pins 5, 6 and 7 of IC2:b.

#### **FINAL CASE ASSEMBLY**

When you've verified that the MS Mic is working and unlikely to go up in smoke, it's time to finish assembly.

- ( ) Install the knobs. Rotate the shaft of the control on which the knob will be placed fully Counter ClockWise and align the knob pointer with the marking at the extreme CCW end of the dial. Loosely tighten the set screw and rotate the knob back and forth to see how well it's range of rotation is balanced with the panel graphic. Reorient if not satisfied and then firmly tighten the set-screw.
- ( ) When joining the case top and bottom, fold the wire bundle between the two toward the front (mic) end of the case. Fasten the top of the case in place using the #4 X 1/4" self-tap screws supplied as shown in fig 4.

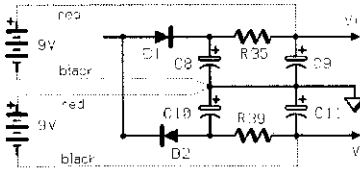
#### **Using the MS Stereo Mic**

The left and right stereo outputs can be used either as balanced or single ended outputs simply by using either stereo or mono plugs. When using a mono plug the out-of-phase leg of the balanced output will be shorted to ground by the sleeve and this is by design. On stereo plugs notice that the Tip is "hot", the Ring is "cold" (out-of-phase) and the Sleeve is ground.

The Project-r Stereo MS mic is perfect for acoustic stringed instruments. Place the MS mic about 8" to 14" from the sound hole with the side microphones in line with the Strings. Turn the Side Level control to "off" and advance the Mid Level control as needed for proper recording or sound reinforcement, making small adjustments in mic position for the best sound. Now, bring up the side channel for the desired stereo spread. If there's too much stereo during the recording process, simply pan the two channels towards the center instead of hard left and right when you mix.

For use as an overhead drum mic place the MS Mic about five feet above and a couple of feet in front of the drum kit. This creates an awesome stereo spread of all the cymbals.

The MS Mic can run on a couple of 9V batteries for a few hours and is great for going places that would be inappropriate for a \$2000 vintage condenser. Try taking it outside on a summer night to record crickets and other night sounds in stereo - a summer's ambiance bank for replay on cold winter nights. If you need to record strange sounds for foley work, protect the MS Mic by wrapping it in a sheet of Saran wrap and then go for those really close up mud splats.



### How it works

The MS Stereo Mic consists of three electret condenser microphones, three preamps, two phase inverting networks, two summing busses, and left and right balanced line output stages. The complete schematic is shown in Fig 5. The two side-facing mics take the place of the single dual-diaphragm microphone that is typically used in MS techniques.

The microphones M1, M2 and M3 are electret condenser types. Unlike larger condenser mics, where a relatively high voltage supplies an electric field to the diaphragm and back plane, these use an "electret", which has a permanent electric field in the same way that a lodestone has a magnetic field. Instead of using a vacuum tube as a charge amplifier, as is often the case in condenser mics, these electret mics have an internal FET charge amplifier.

Operating voltage for the microphones is derived from the voltage divider network R25, R30 and C5. Opamp IC2:b is wired as a voltage follower buffer and provides a low impedance output to prevent coupling between the preamps. Each microphone receives its supply voltage via a 2200 ohm resistor (R8, R20 and R32) which also serves as the load resistor for the signal output.

The preamps built around IC1:a, IC1:b and IC2:a are identical non-inverting opamp gain stages. Taking the right mic pre (IC1:b) as typical, the gain of the stage is set to essentially 30dB by the ratio of R2 to R1. C1 and R1 together form a high pass network with a corner frequency of about 12Hz. The signal from the microphone is AC coupled to the noninverting input of the stage by C2 with R11 providing a DC path to ground for the opamp. Together, C2 and R11 form a second high pass filter with a cutoff frequency of 16Hz.



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Combined, these two filter sections give the preamp stage a -12dB / octave low frequency response.

The center channel preamp signal is fed to a 10 kOhm potentiometer level control, R36, and from there to both left and right summing amplifiers equally by way of R9 and R26.

The right and left side channel preamps (IC1:b & :a respectively) each feed one section of R13, a Dual section 100 kOhm pot. Taking the left side-channel as typical, the wiper of the level control goes to both the same-side summing buss IC4:a and associated components, and to a unity gain inverting opamp stage IC3:b. The inverted signal is fed to the opposite side's summing buss, which is where the stereo field is generated. The left and right summing amplifiers each consist of three 22 kOhm input resistors, an opamp (IC4:a for left and IC5:a for right), and a 100 kOhm feedback resistor. In addition to summing all the required signals, they provide an additional 13dB of gain, giving an overall end-to-end gain of 43dB.

The in-phase side of the balanced output is taken directly from the output of the left and right summing amps. The out-of-phase output is derived with the unity gain inverting stages composed of IC4:b, IC5:b and four 10 kOhm resistors. The 100 Ohm resistors between amps and jacks provide short circuit protection for the outputs.

Power for the MS Mic is provided by the 12VAC Wall Mount Transformer. AC current from the transformer is half-wave rectified by D1 and filtered by C8, C9 and R35 for a V+ supply of about 15V. The negative supply line is rectified by D2 and filtered by C10, C11 and R39.

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## NOTES

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**NOTES**

**MS Stereo Mic  
Bill of Materials**

Quan	Desc.	Designation
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**Capacitors**

3	.1uF Mylar Capacitor	C2,C4,C7
4	220uF 25V Electrolytic	C8,C9,C10,C11
3	47uF 10V Electrolytic	C1,C3,C6
1	100uF 10V Electrolytic	C5

**Panel mount potentiometers (with hardware)**

1	10k Potentiometer	R36
1	100k Dual Element Pot.	R13

**1/4W. 5% resistors all values in ohms**

1	1000	brown-black-red	R38
4	100	brown-black-brown	R10,R15,R27,R34
6	100k	brown-black-yellow	R6,R11,R22,R23,R25, R37
8	10k	brown-black-orange	R2,R12,R14,R19,R29, R31,R33
2	220	red-red-brown	R35,R39
3	2200	red-red-red	R8,R20,R32
10	22k	red-red-orange	R3,R4,R5,R7,R9,R16, R17,R21,R24,R26
3	330	orange-orange-brown	R1,R18,R28
1	39k	orange-white-orange	R30

**Semiconductors**

5	5532 Op Amp	IC1,IC2,IC3,IC4,IC5
2	1N4001	D1,D2
1	Red LED	D3

**Misc.**

3	Electret Condenser Mic	M1,M2,M3
2	1/4" Stereo Phone Jacks	J1,J2
1	SPDT Min. Toggle Switch	S1
1	12VAC Wall Mount Transformer	P1
1	9506 Circuit board	
1	Instruction Manual	
2	Set Screw Knobs	
2	4 ft. lengths #22 Insulated Stranded Wire	
1	9 in. length Bare Wire	
1	Nylon Wire Tie	

**Case Parts**

1	Case Bottom
1	Case Top
4	#4 X 3/16" Standoffs
4	4-40 X 1/2" Machine Screws
4	#4 nuts
2	#4 X 1/4" Self Tap
1	1/4" Rubber Grommet

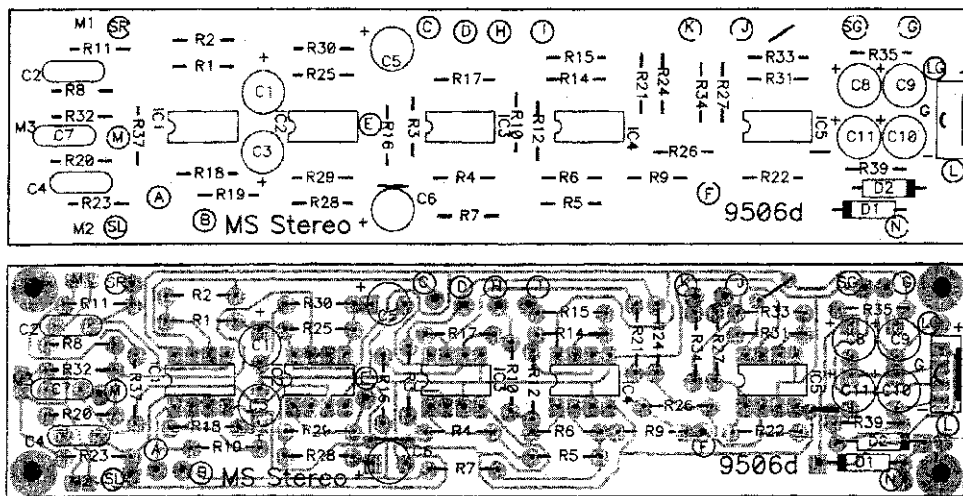
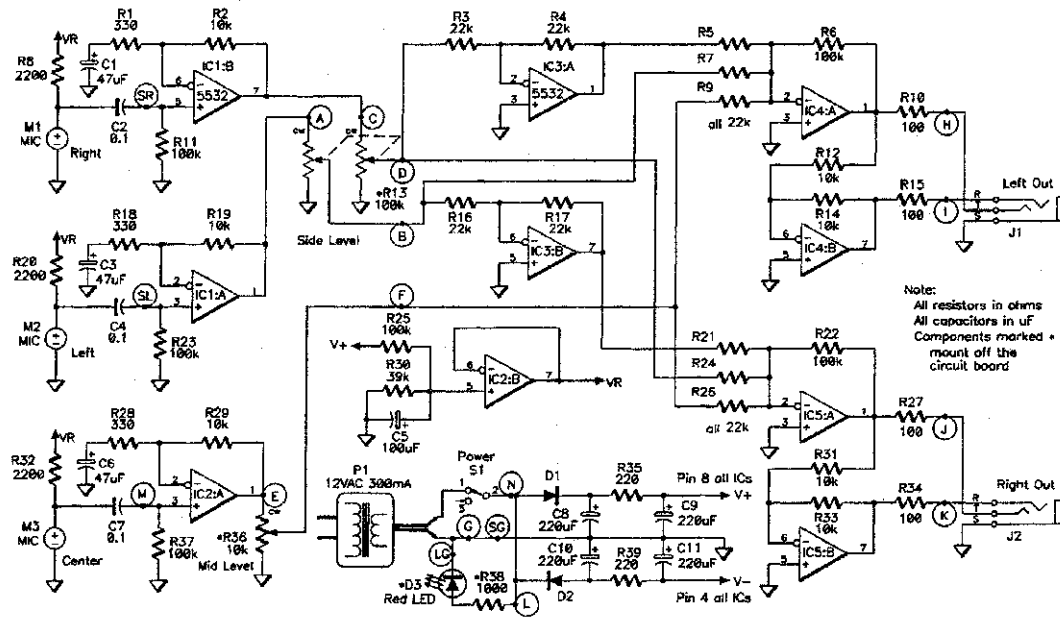


Fig 1. Parts mount on the circuit board at the locations shown. The phantom view will be useful if you need to trace out the circuit.

Fig 5. The MS Stereo Mic circuitry comprises preamps for the mics, inverters for the side signals, stereo summing busses and balanced line output drivers.



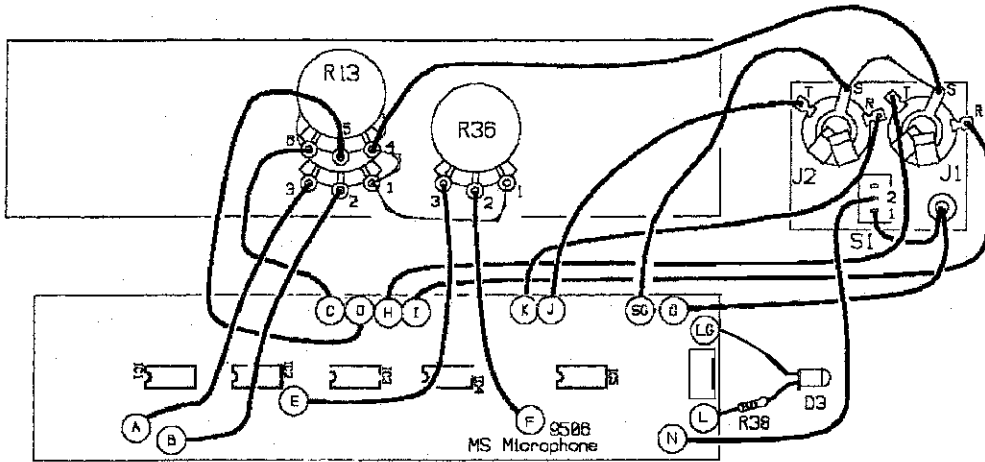


Fig 2. Bare wire and #22 insulated, stranded wire are used to make connections between controls, jacks and power switch as shown.

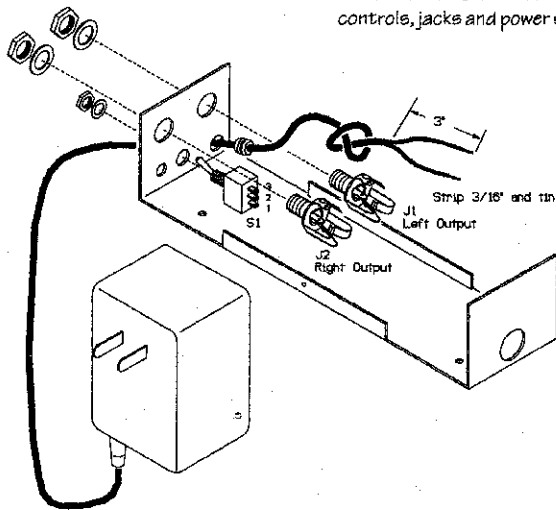


Fig 3. The jacks and power switch mount in the case bottom as shown.

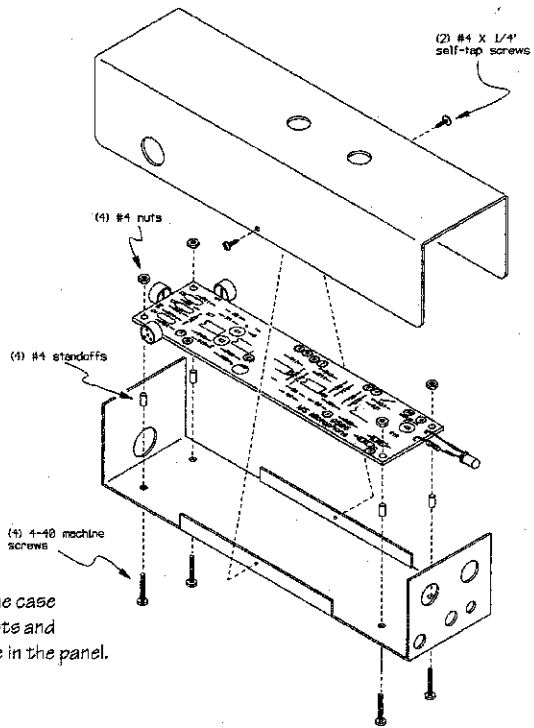


Fig 4. The circuit board mounts in the case bottom using #4 machine screws, nuts and standoffs. The LED fits into the hole in the panel.