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MB401 300 Watt MOSFET Power Amplifier

500W into 4 Ohm

300W into 8 Ohm



Features

The MB401 is a mono MOSFET power amplifier for high quality audio reproduction. The construction is all heavy-duty. The amplifier is housed in an aluminum chassis. Heatsinks on the rear of the unit provide the cooling. Inside is a toroidal power transformer and power supply with large storage capacitors. The amplifier is designed for use with a 4 or 8 Ohm load, but it is stable with any output load.

XLR Balanced inputs RCA Selector switch Binding Posts Fuse Thermal cutout Power entry connector	Balanced inputs for high noise immunity Standard line level inputs Switch between balanced and standard inputs Connection for the loudspeakers Protects the amplifier in case of overload Protects the amplifier in case it gets too hot Standard line cord for 120V AC 1-phase operation.
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Specifications.

Frequency response:	20Hz - 20KHz +/- 1 dB
Harmonic Distortion @ 1KHz, 10W	0.02% or better
Sensitivity	1.28VRMS
Voltage gain	32dB(40X)
Input impedance (RCA)	500 KOhm
Short circuit output current	20 A peak, 15A Continuous
Output load	8 or 4 Ohm, stable with any load
Max power output	500W into 4 Ohm, 300W into 8 Ohm
Power requirement	120VAC, 6A fuse; 240 VAC available
Construction	All metal cabinet, black with white legend
Dimensions:	17" x3.5" x 11" (WxHxD)
Weight:	22 lbs

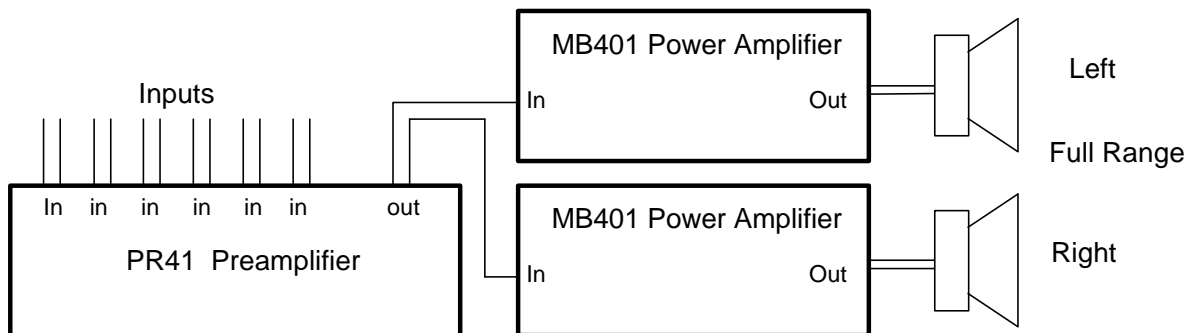


Figure 1 Typical Sound System

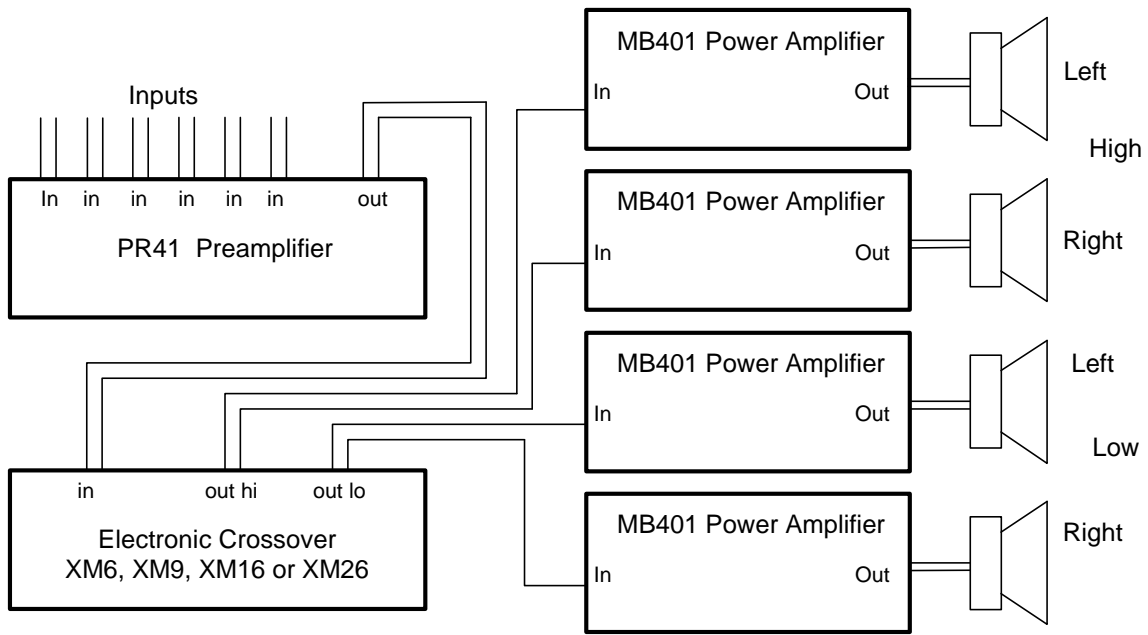


Figure 2 Sound System with 2-way Electronic Crossover Network

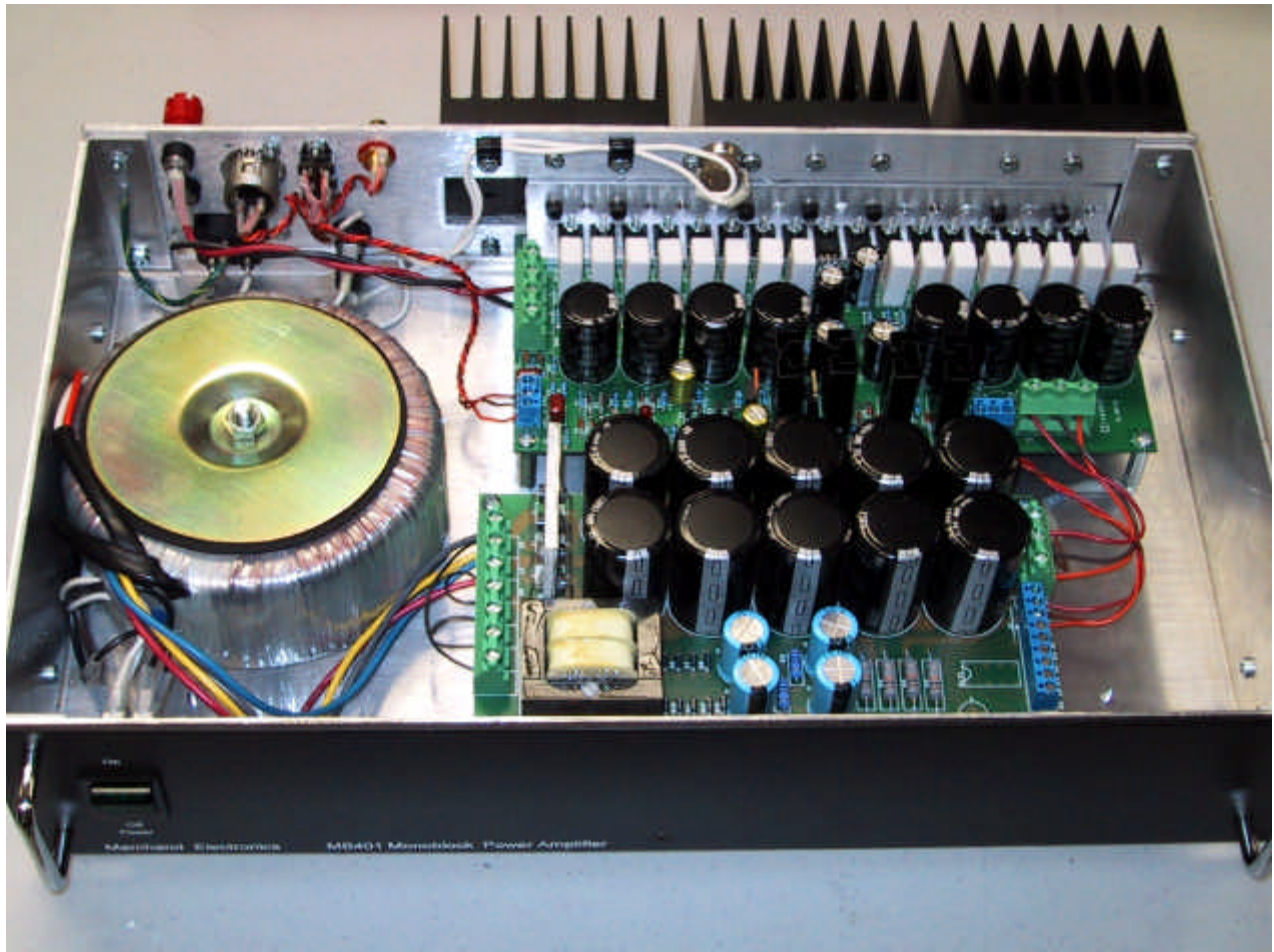


Figure 3: Inside view. Note the placement of the MB401 power amplifier board (mounted on heatsink on the rear of the unit) and the PS12 power supply board; (mounted onto the bottom of the chassis) . The toroidal power transformer is mounted near the left of the unit on the baseplate.



Figure 4 Rear view of the amplifier.

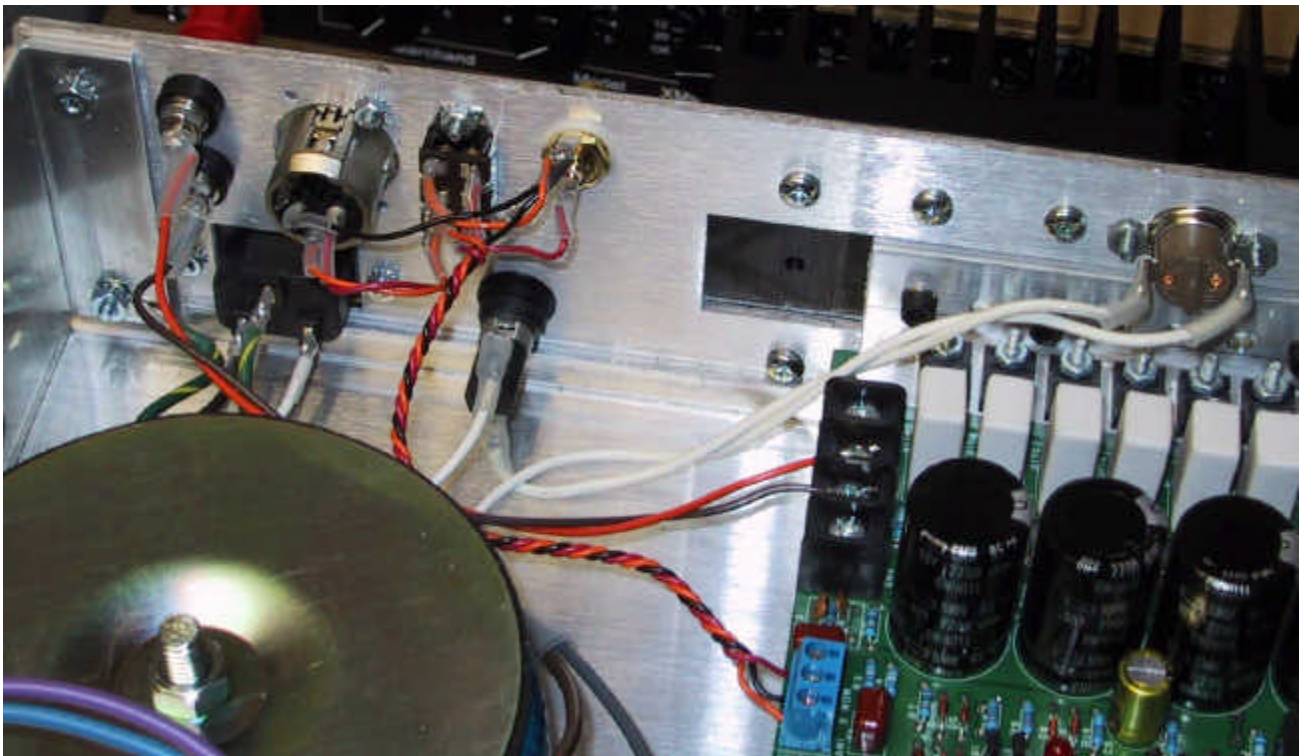


Figure 5 Inside view of the rear panel

Assembly Instructions for the MB401 Kit.

Parts list.

Qu. Description

1	MB401 board assembly
1	PS112 board assembly
1	chassis base
4	rubber feet
4	#6 x 1/2" selftap
1	front panel
1	front panel spacer
1	rear panel
3	heatsink
2	1.0" standoff
5	0.5" standoff
1	500VA xformer + hardware
1	RCA connector
1	XLR connector
1	fuse holder
1	fuse, 6A slowblow
1	power entry connector
1	speaker terminal connector
1	DPST power on/off switch
1	DPDT slide switch
1	thermal cutout
2	handles
4	6/32 x 5/8" sockethead
1	resistor 2.4KOhm, 2W
2	#6 solder lug
2'	heatshrink 1/8"
1'	heatshrink 1/4"
7	8/32 x 1/2" socket head
16	8/32 x 1/2" panhead
23	#8 split lockwasher
7	6/32 x 3/8" flathead
5	6/32 x 1/2" flathead
1	6/32 x 1/2" black flathead
1	6/32 x 1/2" oval head
7	6/32 x 1/4" panhead
6	#6 kepsnut
5	#6 split lockwasher
6	4/40 x 1/2" panhead
2	4/40 x 1/2" flathead
8	#4 kepsnut

2'	22 ga wire brown
2'	22 ga wire red
2'	22 ga wire orange
2'	18 ga wire brown
2'	18 ga wire red
2'	18 ga wire orange
1/2'	22 ga wire green/yellow UL
3'	22 ga black UL
3'	22 ga white UL
1	heatsink compound
1	line cord
1	Hex L-Key 3/32"
1	Hex L-Key 7/64"
1	Hex L-Key 9/64"

Assembly instructions.

Before assembling the MB401 amplifier complete the assembly of the MB401 power amplifier board and the PS111 power supply board.

Rear panel: Remove the rear panel from the cabinet before starting this assembly. Mount the following parts to the rear panel:

- 1 DPDT switch
 using 4/40 x 1/2" panhead + kepsnut.
- 1 XLR connectors
 using 4/40 x 1/2" panhead + kepsnut.
- 1 RCA connectors, .
- 1 Pair of binding posts
- 1 Fuse holder
- 1 Power entry module.
 using 4/40 x 1/2" panhead + kepsnut.
- 1 Thermal cutout
 using 4/40 x 1/4" flathead + kepsnut

Now mount the rear panel to the chassis using 5 6/32 x 1/2" flathead screws and kepsnuts. Note that the chassis bottom has a large hole in the bottom. This hole is used to mount the transformer. This hole should be on the left side of the chassis, as seen from the front.

Now mount the 3 heatsinks to the rear of the chassis. Make sure all previous steps have been completed because some screws can not be reached after the heatsinks have been monted. Use 16 8/32 x 1/2" screws for this. Do use split lockwashers on all 14 screws.

Front panel: Mount the front panel and front panel spacer to the chassis using the 4 6/32 x 5/8"

sockethead screws and the handles. Use lockwashers with these screws. Install the fifth screw in the bottom of the panel. Use a 6/32 black flathead with kepsnut for this.

Feet: Install the 4 rubber feet in the bottom of the cabinet using the #6 selftap screws.

Transformer: Install the transformer. See figure below.

PS112 Power supply: Install the power supply next to the power transformer using 5 hex 1/2" standoffs, as shown in fig x. Use 6/32 x 3/8 flatheads on the bottom and 6/32 x 1/4" panheads on top.

MB401 power amplifier board: Install the board onto the heatsink with the 7 8/32 bolts with hex head. Use a lock washer with each bolt. Access to the mounting bolts is difficult. Use a long hex-wrench for this. **IMPORTANT:** Use heat sink compound to cover the rear of the MB401 mounting bracket completely before installing. Locate the board as far to the right (away from the xformer) as possible. Use the two 1" hex standoffs to secure the board to the bottom plate.

Wiring: Wire up the rear panel according to the circuit diagram.

Wiring note: Use the #22 wire with the thick insulation for the AC wiring to and from the power transformer. Use the #18 wire for the wire to the loudspeaker terminals and between the PS111 and the MB401 board. Use #22 wire for all other interconnect.

Chassis grounding. Solder the 2400Ohm, 2W resistor to a solder lug. Solder a length of black wire to the other end of the resistor. Install solder lug under one of the hex standoffs of the MB401 board. Connect the wire the GROUND connection (terminal marked G of the three position terminal block) of the MB401 board. This will connect the chassis of the amplifier to the DC ground of the power supply.

!!!! Assembly is now complete. !!!!

Initial power up.

The first time power is applied observe any unusual events, like smoke, etc. Turn the power off immediately if this happens and check for correct construction. It is best to power up initially using a variable power transformer (variac) and observe operation at about half line voltage.

The bias current of the amplifier board now needs to be adjusted. Connect a DMM between testpoints TP1 and TP2. With no signal on the input and no loudspeaker connected use R33 to set the bias of the MB401 main amplifier board to 50mV.

The heatsinks will become warm during normal operation. When the amplifier is powered up but no power is delivered the heatsink should become just slightly warm to the touch. If they become hot in this mode check the bias current of the MB401 amplifier module.

With full AC voltage applied the V+ reading should be approx. 80V (referred to ground), the V- reading -80V, the V++ reading +92V and the V-- -92V.

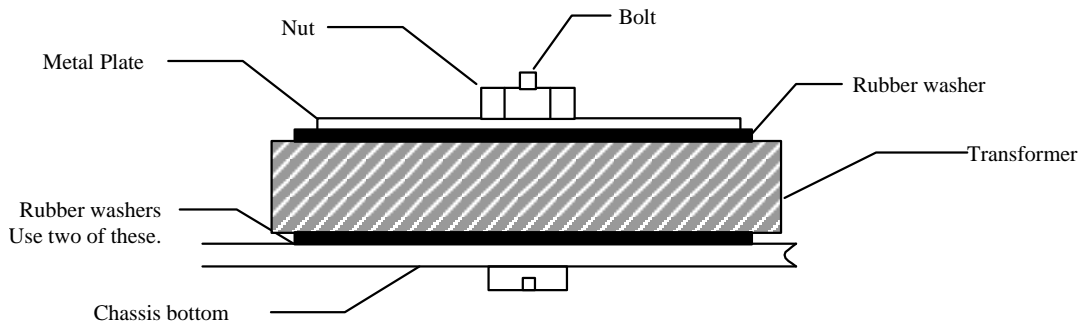
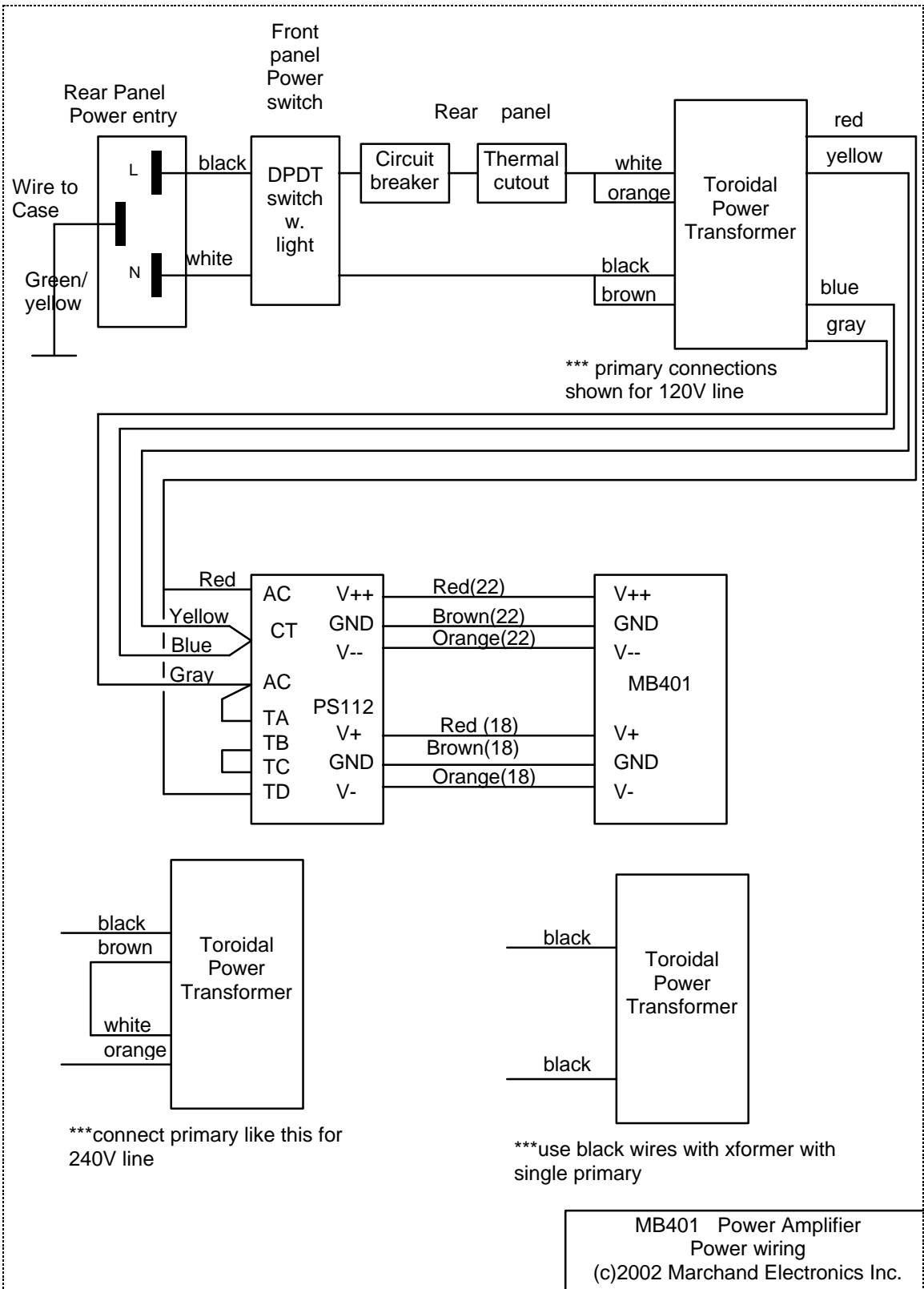


Figure 6 : Mounting of power transformer



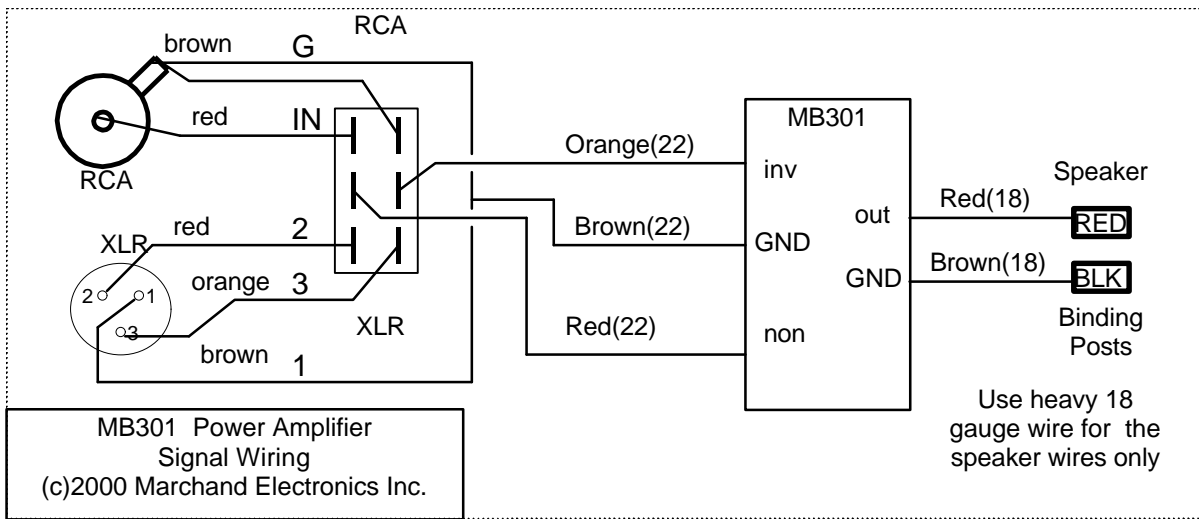


Figure 7 : Rear panel wiring for signal and speaker.

Assembly instructions for the MB401 main amplifier board.

Parts List

ID	Value	Description
Resistors		
R1	1.00M	1%, 1/4W, Metal Film
R2	1.00M	1%, 1/4W, Metal Film
R3	24.9K	1%, 1/4W, Metal Film
R4	24.9K	1%, 1/4W, Metal Film
R5	1.00M	1%, 1/4W, Metal Film
R6	1.00M	1%, 1/4W, Metal Film
R7	1.00M	1%, 1/4W, Metal Film
R8	10.0K	1%, 1/4W, Metal Film
R9	10.0K	1%, 1/4W, Metal Film
R10	100 Ohm	Trimmer Potentiometer
R11		not used
R12	100 K	1%, 1/4W, Metal Film
R13	2.00K	1%, 1/4W, Metal Film
R14	2.00K	1%, 1/4W, Metal Film
R15	2.00K	1%, 1/4W, Metal Film
R16	499 Ohm	1%, 1/4W, Metal Film
R17	499 Ohm	1%, 1/4W, Metal Film
R18	499 Ohm	1%, 1/4W, Metal Film
R19	100 Ohm	1%, 1/4W, Metal Film
R20	499 Ohm	1%, 1/4W, Metal Film
R21	100 Ohm	1%, 1/4W, Metal Film
R22	100 Ohm	1%, 1/4W, Metal Film
R23		Jumper
R24		Jumper
R25		not used
R26	100K	1%, 1/4W, Metal Film
R27		not used
R28	100K	1%, 1/4W, Metal Film
R29		not used
R30*	49.9 Ohm	1%, 1/4W, Metal Film
R31*	1 Ohm	5W Wirewound
R32*	2.00K	1%, 1/4W, Metal Film
R33	10 K	Trimmer Potentiometer
R34*	49.9 Ohm	1%, 1/4W, Metal Film
R35*	1 Ohm	5W Wirewound
R36*	2.00K	1%, 1/4W, Metal Film
R37		not used
*8 places		
Capacitors		
C1	1.0uF	Stacked Film
C2	1.0uF	Stacked Film
C3	1pF	Ceramic NPO
C4	1pF	Ceramic NPO
C5	47uf, 100v	Aluminum Electrolytic
C6	47uf, 100v	Aluminum Electrolytic
C7	1000 pF	Ceramic Disk
C8	4.7uf, 250v	Aluminum Electrolytic
C9	4.7uf, 250v	Aluminum Electrolytic
C10*	2200uf, 80v	Aluminum Electrolytic,SF
C11	6800uf, 6.3v	Aluminum Electrolytic
C12	6800uf, 6.3v	Aluminum Electrolytic
C13	6800uf, 6.3v	Aluminum Electrolytic
C14	0.22uf	Stacked Film
C15	6800uf, 6.3v	Aluminum Electrolytic
C16*	2200uf, 80v	Aluminum Electrolytic,SF
* 4 places		
SF Snap Fit		
Diodes		
D1	1N4735	6.2 Volt Zener Diode
D2	1N4148	Signal Diode
D3	1N4148	Signal Diode
D4	1N4148	Signal Diode
D5	1N4148	Signal Diode
D6	1N4735	6.2 Volt Zener Diode
D7		LED
D8	1N4148	Signal Diode
D9	1N4148	Signal Diode
D10		not used
D11		Jumper
D12		not used
D13		Jumper
D14	1N4735	6.2 Volt Zener Diode
D15	1N4735	6.2 Volt Zener Diode
D16	HER106	1 Amp. Diode
D17	HER106	1 Amp. Diode
Transistors		
Q1*	ZVNL120A	N-Channel SS MOSFET
Q2*	ZVNL120A	N-Channel SS MOSFET
Q3	ZVNL120A	N-Channel SS MOSFET
Q4	ZVP2120A	P-Channel SS MOSFET
Q5	ZVP2120A	P-Channel SS MOSFET
Q6	ZVNL120A	N-Channel SS MOSFET
Q7	ZVNL120A	N-Channel SS MOSFET
Q8	MTP2P50E	P-Channel MOSFET
Q9	MTP2P50E	P-Channel MOSFET
Q10	IRF710	N-Channel MOSFET
Q11	IRF710	N-Channel MOSFET
Q12		not used
Q13		not used
Q14	2N2222	NPN transistor
Q15	2N2907	PNP transistor
Q16	IRFI640	N-Channel Power MOSFET
Q17**	IRFI640	N-Channel Power MOSFET

Q18** IRFI9640 P-Channel Power MOSFET

1 2N2222 NPN transistor
1 2N2907 PNP transistor

*Q1,Q2 come as a matched pair

**Q17 & Q18 8 places each matched sets

Q9,Q11,Q12,Q13 need heatsink

* Matched sets of power transistors

The MB401 main board kit contains the following parts:

Qu.	Value	Description
Resistors		
16	49.9 Ohm	1%, 1/4W, Metal Film
3	100 Ohm	1%, 1/4W, Metal Film
4	499 Ohm	1%, 1/4W, Metal Film
19	2.00K	1%, 1/4W, Metal Film
2	10.0K	1%, 1/4W, Metal Film
2	24.9K	1%, 1/4W, Metal Film
3	100K	1%, 1/4W, Metal Film
5	1.00M	1%, 1/4W, Metal Film
1	100 Ohm	Trim Pot, 10 turn
1	10 KOhm	Trim Pot, 10 turn
16	1.0 Ohm	5W Wirewound
Capacitors		
2	1.0uF	Stacked Film
2	1pF	NPO Ceramic
1	1000 pF	Ceramic Disk
1	0.22uf.	Stacked Film
2	4.7uf, 250v	Aluminum Electrolytic, R
2	47uf, 100v	Aluminum Electrolytic, R
4	6800uf, 6.3v	Aluminum Electrolytic, R
8	2200uf, 80v	Aluminum Electrolytic, SF
R: radial		
SF: snapfit		
Diodes		
4	1N4735	6.2 Volt Zener Diode
6	1N4148	Signal Diode
2	HER106	High Efficiency Diode
1		LED
Transistors		
1 pair	ZVNL120A	N-Channel SS MOSFET
3	ZVNL120A	N-Channel SS MOSFET
2	ZVP2120A	P-Channel SS MOSFET
2	IRF710	N-Channel MOSFET
2	MTP2P50E	P-Channel MOSFET
9*	IRFI640	N-Channel Power MOSFET
8*	IRFI9640	P-Channel Power MOSFET

Mechanical

Quantity	Description
2	3 Pos. Terminal block Blue
1	3 Pos. Terminal block Black
1	4 Pos. Terminal block Black
17	4/40x3/4" Machine Screw
17	4/40 Nut
17	#4 flat washer
34	#4 split lockwasher
1	Heat Sink Bracket
2	TO220 heatsink, TALL
1	Bag Heat Sink Compound
1	MB401 circuit board
2	testpoint

Assembly Instructions

Most parts are installed in the usual way. Insert the part at the location on the circuit board as indicated by the silk screen identification and solder on the solder side of the board. Start with installing smaller parts and install large parts last. This makes installation easiest. The circuit board has plated through holes, so parts need only be soldered on the solder side of the board.

Resistors: The 1% metal film resistors are identified with colored bands in the usual way. The 1% Metal film resistors have the following markings:

49.9 Ohm	Yellow-White-White-Gold--Brown
100 Ohm	Brown- Black -Black-Black--Brown
499 Ohm	Yellow-White -White -Black--Brown
2.00 K	Red -Black-Black-Brown--Brown
10.0 K	Brown-Black-Black- Red --Brown
24.9 K	Red-Yellow -White-Red--Brown
100 K	Brown-Black-Black-Orange--Brown
1.00 M	Brown-Black-Black-Yellow--Brown

The multiturn trimmer resistors should be installed so that the screw is at the location indicated by the white square.

Jumpers: Install wire jumper is location J1 and any other locations as shown in the parts list, using bare hookup wire. Make sure the bare wire of the jumpers does not touch the surface of the circuit board.

Capacitors: The Electrolytic capacitors are all radial type. Be **sure** to observe polarity markings when installing. The stacked film capacitors are brown and have marking 224 for .22 uF and 105 for the 1 uF part.

Note: The orientation of caps C11 and C12 is not shown on the circuit board. They should be oriented the same way as C10 and C16.

Diodes: Diodes are installed in the usual way. Make sure to observe polarity: the band indicated on the circuit board must coincide with the band on the device. The band indicates the cathode.

Transistors: Transistors Q1...Q9, Q14, Q15 are the small black parts with the three leads. Note that the black part has a big flat side and a round side. Note that Q1 and Q2 come as a matched pair in a separate bag. Make sure to use these in the locations Q1 and Q2. Install the transistors according to the marking on the circuit board.

Power transistors Q9 and Q11 are mounted with a heat sink. Q8 and Q10 need no heatsink.

Power transistors Q16 through Q18 are installed onto the heat-sink bracket.

Apply a thin uniform layer of the white silicone compound on the bottom of each transistor. Install the transistors with the 4/40 screws, two split lockwashers, flat washer and nut. See Figure 8. Orient the screws so that the head of the screw is on the solder side and the nut is on the component side. Solder the three transistor pins only after all the mounting screws have been tightened.

Header: Install the two 1-pin headers at locations TP1 and TP2. These are the testpoint that are used when adjusting bias.

Terminal Blocks: Install the two small 3-pin and large 3-pin and 4-pin terminal blocks at the edge of the circuit board.

The bias current of the amplifier must be adjusted by setting the potentiometer R22. First turn the potentiometer fully counterclockwise. This will set the bias current to zero. Hook the MB401 to a bipolar power supply. The supply voltage should be between +/- 30V and +/- 60 V. For doing this step it is best to use a 30V supply. This lower voltage will reduce chance of damage to the parts if there is an error in the installation of the parts. It is best to mount the MB401 onto a large heatsink during testing.

Connect a DVM or suitable voltmeter between the testpoint TP1 and TP2. If the DMM indicates a voltage of more than a few mV turn the power off **immediately** and check all parts placements. A very safe way to do this step is to use a variac to increase the power supply voltage slowly from zero to about 30V, while observing the DMM. Now slowly adjust R33 clockwise until a reading of 15 mV is shown on the DMM. Precise adjustment is difficult. But a value between 10 mV and 20 mV is acceptable. Note that the unit will start heating up a little. The adjustment should be made when cold. When the amplifier is hot, the bias current will change a little. This is normal.

Offset adjustment.

The offset voltage of the amplifier must be adjusted by setting the potentiometer R10. With no signal applied to the inputs, adjust R10 for minimum DC voltage at the outputs. A residual output voltage of a few mV is normal.

The assembly and adjustment of MB401 circuit board is now complete.

Power supply.

The power supply used is the PS112. It has two separate sets of outputs, one for the preamp part of the amplifier board and one set for the output stage. The preamp voltage is about 20V higher than the voltage for the output stage.

Output voltages of the PS112 (with 55V transformer)	
V+	+80V
V-	-80V
V++	+100V
V--	-100V

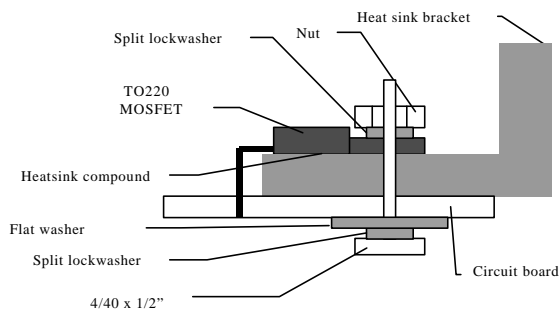


Figure 8 Mounting of power transistors.

Assembly is now complete. Take a few minutes to check all components and orientations. Also make sure there are no solder bridges.

Bias current adjustment (Class AB) .

