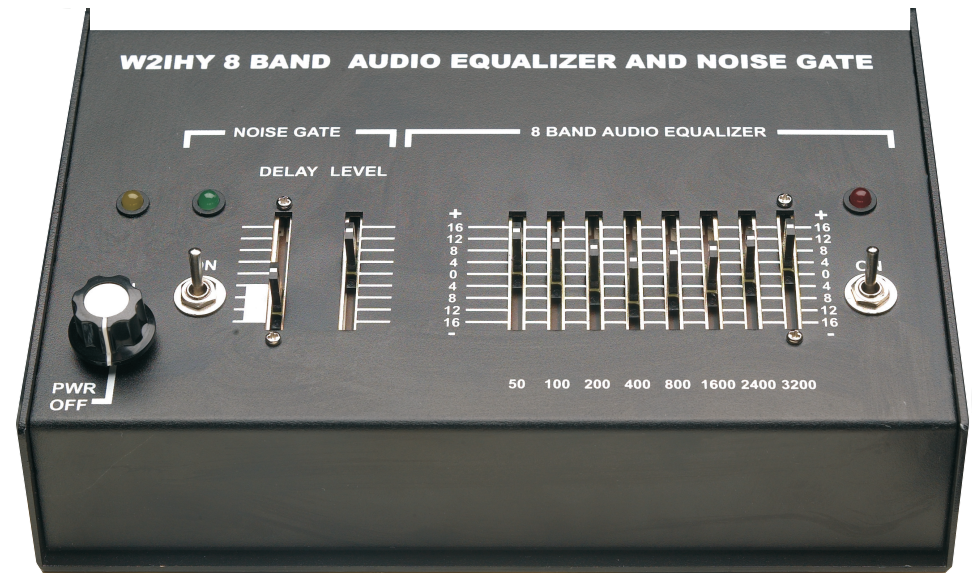


W2IHY 8 BAND AUDIO EQUALIZER AND NOISE GATE



OPERATING MANUAL

W2IHY 8 BAND AUDIO EQUALIZER AND NOISE GATE

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October 2003



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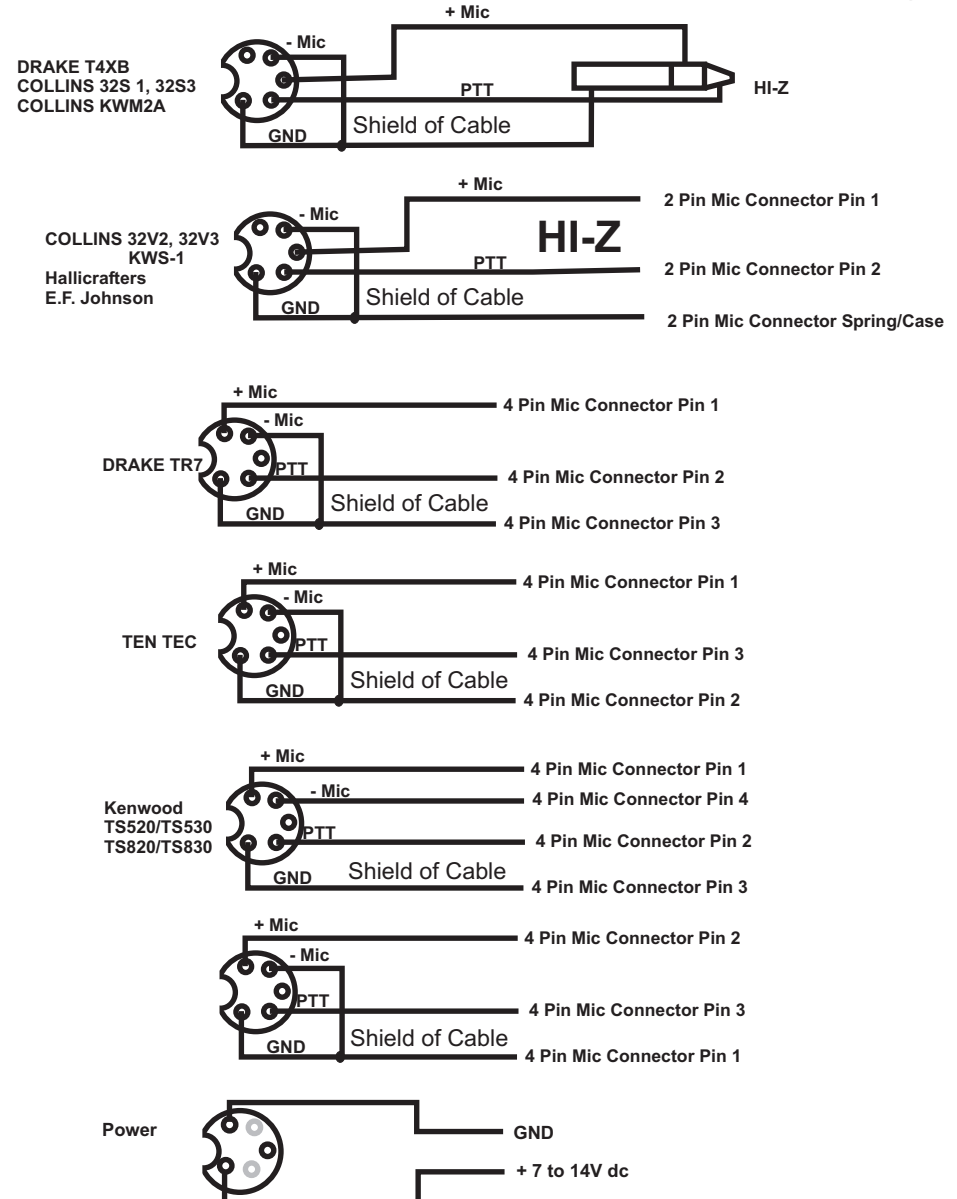
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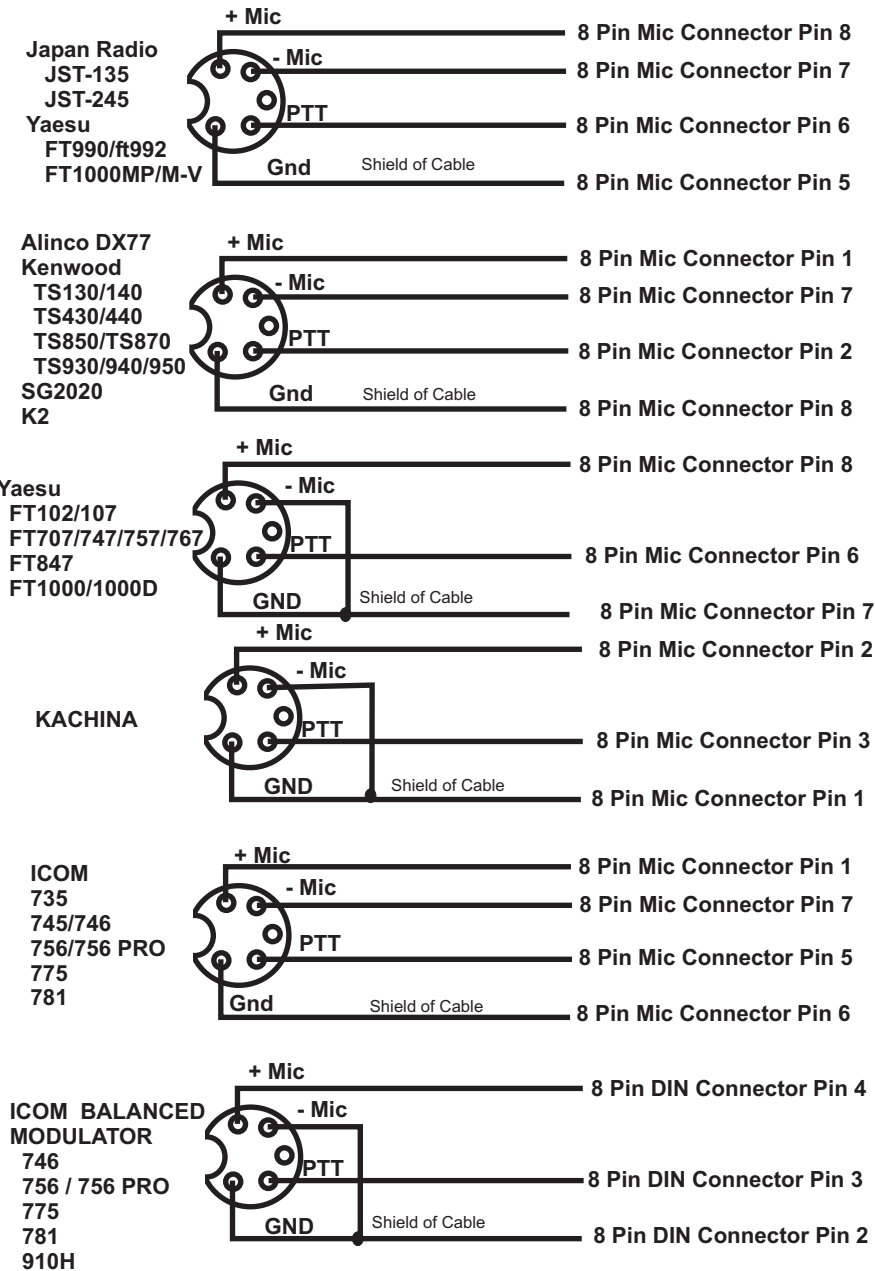
MIC OUT & POWER CABLE WIRING

Equalizer / Noise Gate Mic Out to Xcvr cable wiring



DIN connectors shown on the side to be soldered
 DO NOT SOLDER TO SHIELD OF DIN

MIC OUT & POWER CABLE WIRING



DIN connectors shown on the side to be soldered
DO NOT SOLDER TO SHIELD OF DIN

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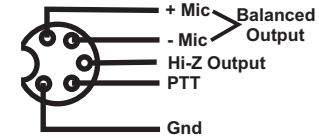
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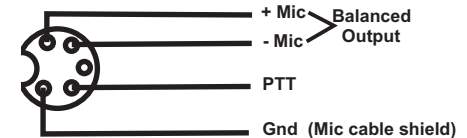
5 PIN DIN MIC OUTPUT CONNECTION

MIC OUT A/B
5 Pin Male DIN
Din connectors shown
on side to be soldered



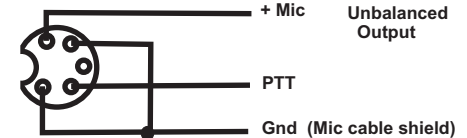
Low Impedance Balanced Output to Low Impedance Radio

MIC OUT A/B
5 Pin Male DIN
Din connectors shown
on side to be soldered



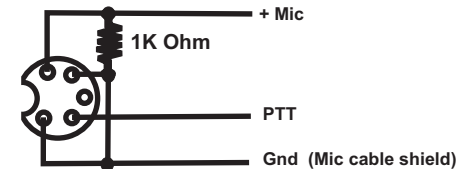
Low Impedance Unbalanced Output to Low Impedance Radio

MIC OUT A/B
5 Pin Male DIN
Din connectors shown
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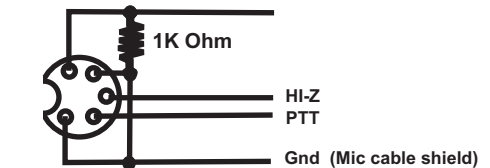
Low Impedance Unbalanced Output to High Impedance Radio

MIC OUT A/B
5 Pin Male DIN
Din connectors shown
on side to be soldered



High Impedance Unbalanced Output to High Impedance Radio

MIC OUT A/B
5 Pin Male DIN
Din connectors shown
on side to be soldered



**DO NOT CONNECT MIC WIRE SHIELD TO SHIELD OF DIN CONNECTOR
CONNECT ONLY AS SHOWN**

INTERNAL WIRING

Note that J1-X is the flat ribbon cable shown on page 15

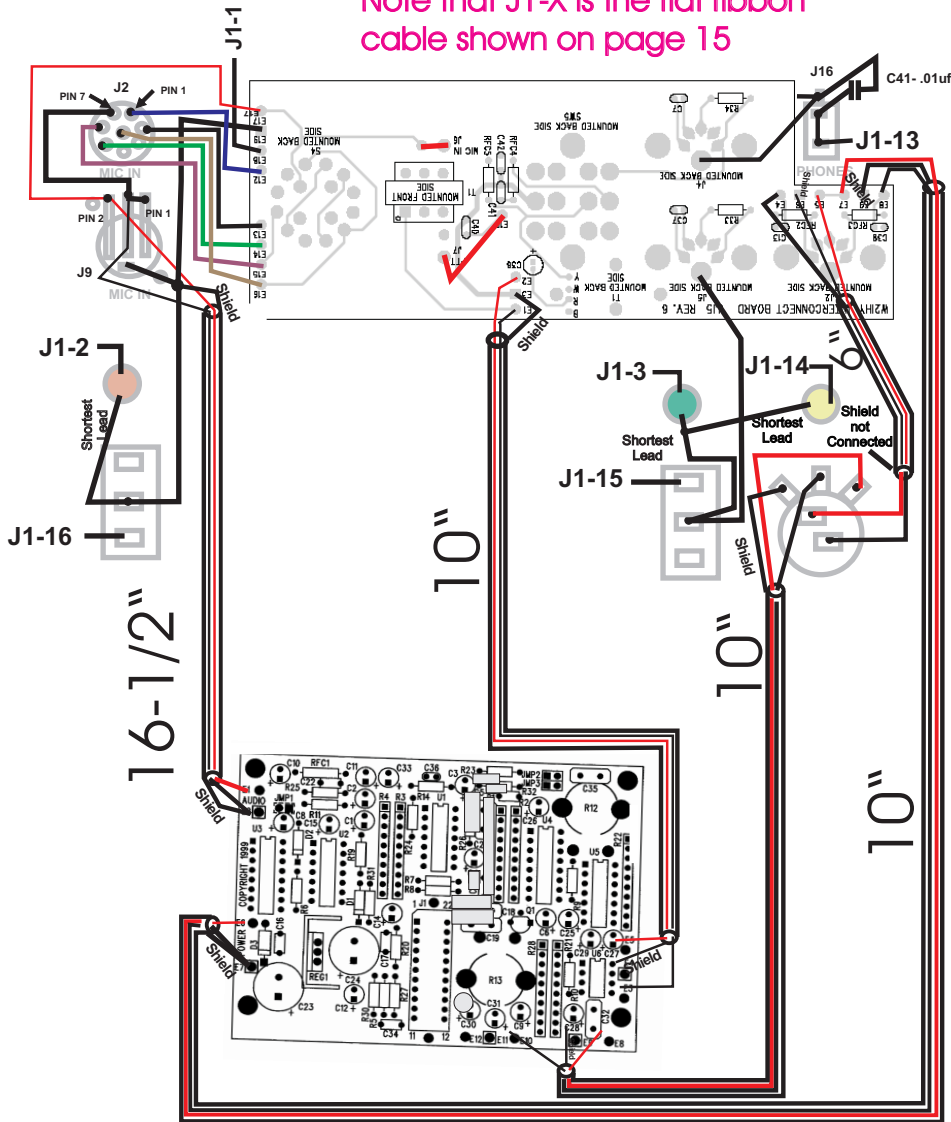


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INTRODUCTION

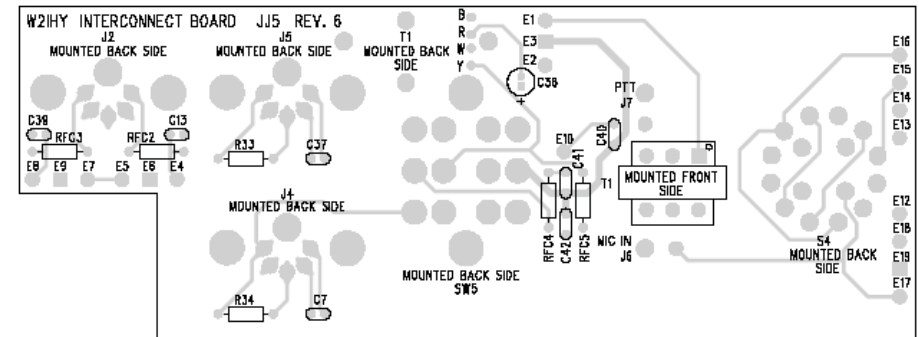
W2IHY AUDIO EQUALIZER AND NOISE GATE

Analog and digital technology have for many years been used in the audio industry to do audio equalization and noise reduction. Many amateurs have purchased audio equalizers and other equipment with the hope of improving their transmitted audio signal. The amateurs who have succeeded have in many cases had to pay premium prices for audio equipment that not only required modifying, to properly interface with their amateur stations, but also had to be hardened to tolerate R.F.

The W2IHY 8 Band Audio Equalizer and Noise Gate solves two basic problems many hams experience. The Audio Equalizer allows the user to change the transmitted audio frequency response without changing microphones or microphone cartridges. Transmitted audio, with substantial high frequency content, can be used to work DX or communicate in band conditions where there is a significant amount of noise. A balanced frequency response may be more desirable in strong signal, full noise quieting environments. Many amateur operators transmit audio in high ambient noise environments. Typical high noise sources include linear amplifier fans, dehumidifiers, room air conditioners, road and wind noise during mobile operation, etc.. The Noise Gate eliminates the aforementioned noise from being transmitted. On the air tests in high ambient noise conditions have shown the Noise Gate to be very effective. The removal of moderate to very high levels of ambient noise, from the transmitted audio signal, results in audio with increased clarity and presence.

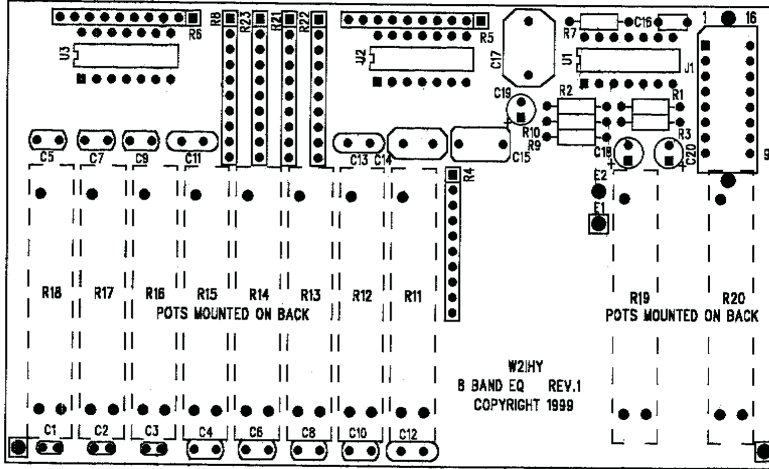
Extensive testing was done of the Noise Gate and Equalizer. The unit has been designed to work in high RF environments. We feel so confident that you will be delighted with the unit we offer a 30 day money back , no questions asked, guarantee. The W2IHY Audio Equalizer and Noise Gate represents affordable audio technology designed for amateur radio use.

8 BAND EQ REAR CONNECTOR PC BOARD LAYOUT AND PARTS



- C41, C42 - .001 uf mylar
- C40 - .01 mylar,
- C7, C13, C37, C39 - .1 uF ceramic monolithic
- C39 - 4.7 uf tantalum electrolytic
- J2, J4, J5 - Male 5 Pin DIN
- R33, R34 - 47K ohm 1/4 watt 5% resistor
- RFC2, RFC3 - 100 uh R.F. choke
- RFC4, RFC5 - 470 uh R.F. choke
- S4 - 4 pole 3 position rotary switch
- S5 - 4PDT slide switch
- T1 - 600 ohm: 600 ohm audio transformer

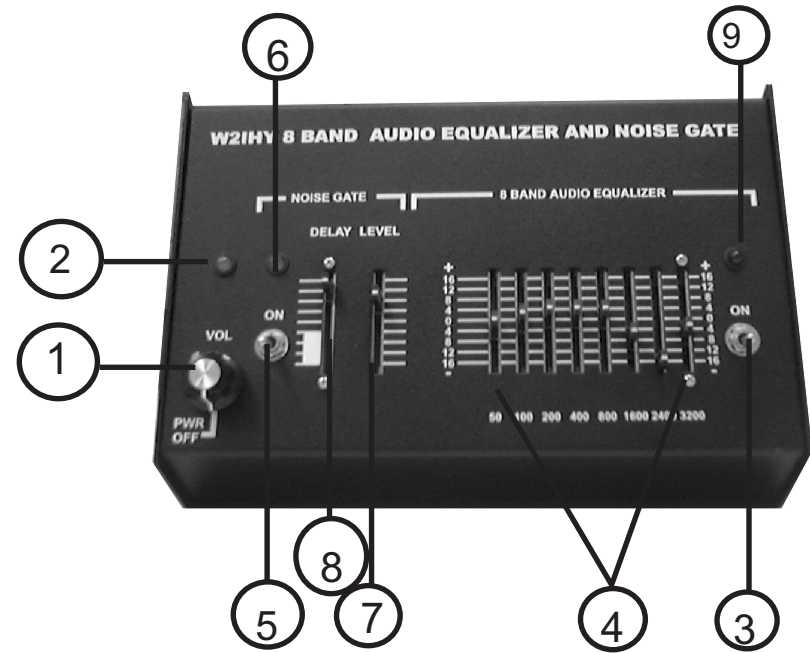
8 BAND EQ BOARD PC BOARD LAYOUT AND PARTS



- | | |
|---------------------|---|
| C1 - 300pF mylar | C15 - .1 uF mylar |
| C2 - 390 pF mylar | C16 - .1 uF monolithic |
| C3 - 560 pF mylar | C17 - .18 uF mylar |
| C4 - .0012 uF mylar | C18 - 19 - 4.7 uF Tantalum electrolytic |
| C5 - .003 uF mylar | C20 - 100 uF electrolytic |
| C6 - .0022 uF mylar | R1 - 10 ohm ¼ watt 5% Res |
| C7 - .0039 uF mylar | R2 -R3 1K ohms ¼ watt 5% Res |
| C8 - .0047 uF mylar | R4 - 3.3k ohm 10 pin 9 RES SIP |
| C9 - .0056 uF mylar | R5-R6 - 3.3K ohm 10 Pin 5 Res SIP |
| C10 - .01 uF mylar | R7 - 15.0K ohm ¼ watt 1% Res |
| C11 - .012 uF mylar | R8 - 100K ohm 10 Pin 9 Res SIP |
| C12 - .018 uF mylar | R9 - R10 10K ohm ¼ watt 5% Res |
| C13 - .022 uF mylar | R11 - R18, R20 100 K ohm Slide Pots* |
| C14 - .047 pF mylar | R19 5K ohm Slide Pot* |
| | R21 - 1M ohm 10 Pin 9 Res SIP |
| | R22 - R23 1m 10 Pin Res SIP |
| | U1- U3 TI074 or JRC2060 (14 Pin DIP) |
| | J1 (16 Pin DIP) |

* Mounted on pin side of P.C. board

FRONT PANEL CONTROLS



This section describes each of the controls on the front panel. You can read through this section now. Some of the descriptions will be more meaningful after you first work through the getting started tutorial.

(1) Power On/Off Switch (S1) / Phones (monitor) Volume Control (R29)

This switch and potentiometer (Pot.) turns the unit's power on and off and is also used to adjust the audio level into the Phone jack (18)

(2) Power on LED (LED3)

This LED goes on when power is on in the unit.

(3) Equalizer On/Off Switch (S3)

This switch turns the equalizer on and off. When the equalizer is off adjusting the equalizer's controls has no effect on the output audio.

FRONT PANEL CONTROLS

(4) Equalizer CONTROLS (R11-R18)

These slide potentiometers work only when the Equalizer On/Off Switch S3 is in the on position. The potentiometers control the output of 8 bandpass filters. The center frequency of these filters are 50 Hz, 100 Hz, 200 Hz, 400 Hz, 800 Hz, 1600 Hz, 2400 Hz and 3200 HZ. The scale, for setting these potentiometers, is calibrated between -16 db. to + 16 dB. Pushing a potentiometer forward (up) will increase the output of the equalizer within the bandpass of the filter whose slide potentiometer is changed. Pushing a potentiometer backward (down) will decrease the output of the equalizer within the bandpass of the filter whose slide potentiometer is changed. Setting all 8 potentiometers at the zero marking will produce audio at about the same output level as when the Equalizer On/Off Switch S3 (3) is in the off position.

Adjusting the equalizer 50 Hz, 100 Hz and 200 Hz slide pots affects the heaviness / weight of the audio. Adjusting the equalizer 400 Hz and 800 Hz slide pots affects the warmth of the audio. Adjusting the equalizer 1600 Hz, 2400 Hz and 3200 Hz slide pots affects the clarity and presence of the audio.

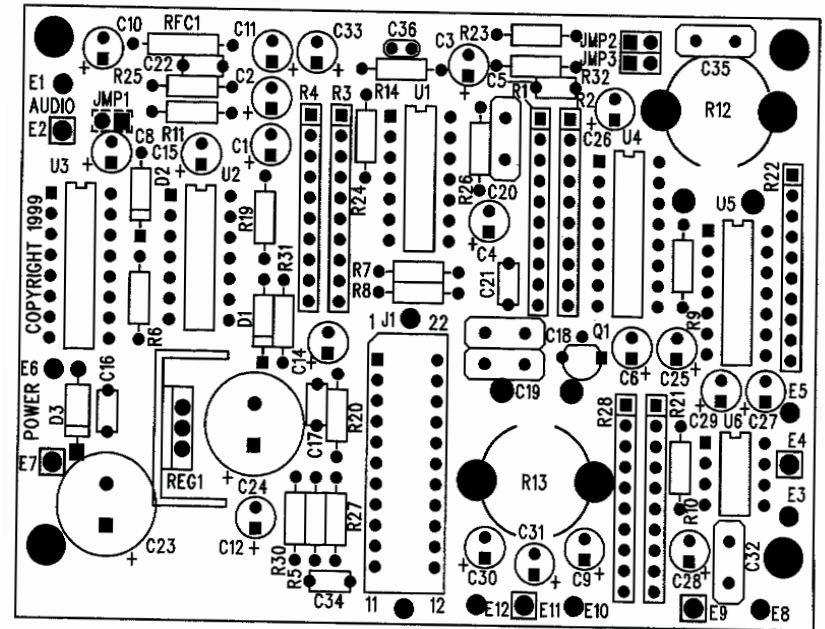
(5) Noise Gate On / Off Switch (S2)

This switch turns the noise gate on and off. When the noise gate is off changing the gate delay or level controls has no effect on the audio. When the noise gate is off audio is always being passed (gated) through the noise gate to the output.

(6) Noise Gate LED (LED1)

This LED is used to help properly adjust the noise gate level control and to indicate when audio is being sent (gated) to the output. The LED being on (green) indicates that audio is being gated through the unit to the output. The LED being off indicates that audio is not being passed (gated) through to the output. When the Noise Gate On / Off Switch (5) is in the off position the noise gate LED is on.

8 BAND EQ MOTHER BOARD PC BOARD LAYOUT AND PARTS



C1,C3, C4,C6,C14, C25-C28, C33 4.7 uF radial electrolytic	R1, R2, R22 - 10K ohm 5 Resistor 10 pin SIP
C7*, C13*, C16, C17, C32 .1 uF ceramic monolithic	R3 - 100 ohm 5 Resistor 10 pin SIP
C8 - 22 uF radial electrolytic	R4 - 1K ohm 5 Resistor 10 Pin SIP
C9, C29 - 4.7 uF non polarized radial electrolytic	R5, R6, R27, R30 - 10 ohm ¼ watt 5% Resistor
C10, C11, C12, C15, C31 - 100 uF radial electrolytic	R7, - 6.8K ohm ¼ watt 5% Resistor
C2, - 10 uF radial electrolytic	R8, R9 - 5.6K ohm ¼ watt 5% Resistor
C4 - 1 uF radial electrolytic	R10 - 10K ohm ¼ watt Resistor
C18 - C20 - .1 uF mylar	R11 - 2.2K ohm ¼ watt Resistor
C5 - .033 uF mylar	R12 - 100K ohm horizontal Pot mounted on PC board
C23 - C24 - 470 uF radial electrolytic	R13 - 20K ohm horizontal Pot mounted on PC board
C21, C34 - .01 uF mylar	R19 - 33K ohm ¼ watt 5% Resistor
C36 - 120 pf ceramic	R14 - 75K ohm ¼ watt 5% Resistor
C22, C35 - .001 uF mylar	R15* - R17* - 25K ohm Slide Pot
D1, D2 - 1N914	R18* - 5K ohm Slide Pot
D3 - 1N4001	R21 - 680 ohm 5 Resistor 10 Pin SIP
LED1 - Green LED; LED2 - Red LED; LED3 - Amber	R23 - 200 ohm ¼ watt 5% Resistor
Q1 - 2N3417	R20, R24, R25, R33*, R34* - 47K ¼ watt 5% Resistor
REG 1 - 7805 with heat sink	R26 - 0 Ohms (Piece of wire)
Rfc1 - 470 uH R.F. choke	R28 - 22K ohm 5 Resistor 10 pin SIP
	R29* - 10K Pot with Switch (Used for volume control)
	R31 - 1K ohm ¼ watt Resistor
	R32 - 33K ohm ¼ watt 5% resistor
	U1, U5 - T1074 or JRC2060; U2 - 74HC00;
	U3 - 74LS123; U4 - 74HC4053; U6 - LM 386-1

* Parts mounted on pin side of P.S. Board

FRONT PANEL CONTROLS

(7) Noise gate Level (R19)

This slide pot. works only when the noise gate is on. This pot. sets the level at which background noise will be not gated to the audio output. Pushing this control up will make the unit less sensitive to higher background ambient noise. Pushing this control down will make the unit, more sensitive to background noise.

(8) Noise Gate Delay (R20)

This control adjusts the length of time audio will be gated to the output after the noise gate has automatically turned off (Noise gate LED off). Pushing the delay slide pot. up increases the delay (decay) time. Pushing the pot. down decreases the delay time.

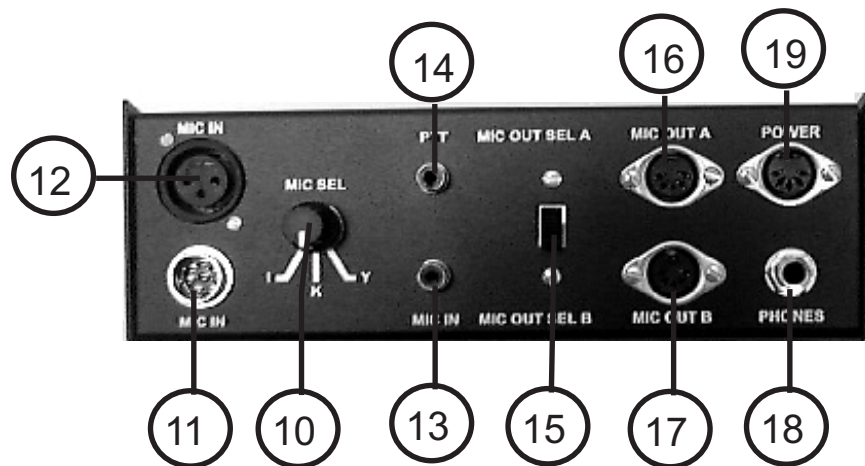
(9) Mic Gain LED (LED2)

This LED is used to help adjust the MIC In Gain pot. When the LED goes on this indicates that the EQ is being overdriven. **This LED should never go on.**

PRELIMINARY EQUALIZER SETTINGS

	Mic In Jumper	Menu	Voice Qual	50 Hz	100 Hz	200 Hz	400 Hz	800 Hz	1600 Hz	2400 Hz	3200 Hz
EV 757B	Radio	Setting	DX	+12	+8	+4	0	+4	+4	+8	+14
MD1	FT1990	600 ohms	DX	+16	+12	+8	+4	+4	+8	+12	+16
Electrovoice 660	FT1000D	600 ohms	Rdg Chew	+12	+8	+4	0	0	+4	+12	+12
Electrovoice 660	FT1000D	600 ohms	DX	+4	+4	+4	0	0	+4	+12	+12
Electrovoice REZ7	FT1000D	200 ohms	Wide band	+12	-3	-4	-3	0	0	+4	+8
Heil Goldline	FT1000D	600 ohms	Wide band	+12	-3	-4	-3	0	0	+4	+8
D104 (100K ohms)	FT1000D	H-Z	Rdg Chew	+12	+12	+6	0	0	+4	+10	+10
Heil HM-10	FT1000D	H-Z	DX	+4	+4	+4	0	0	+4	+10	+10
Heil HM-10	FT1000D	600 ohms	DX	+12	+12	+6	0	0	0	+6	+6
Yaesu MH-1BB	FT1000D	600 ohms	Rdg Chew	+4	+16	+8	0	0	0	+4	+6
Yaesu MH-1BB	FT1000D	600 ohms	DX	+4	+4	+4	0	0	+4	+12	+12
Kenwood MC50	FT1000D	600 ohms	Rdg Chew	+16	+16	+8	0	0	+4	+8	+8
Kenwood MC50	FT1000D	600 ohms	DX	+4	+4	+4	0	0	+4	+4	+8
ATM41a	FT1000MP	600 ohms	Rdg chew	+12	+10	+8	+6	+4	+4	+8	+12
AKG C3000	FT1000MP	600 ohms	Rdg Chew	+12	+12	+4	0	0	+8	+12	+12
AKG C5900	FT1000MP	600 ohms	Rdg Chew	+4	-4	-4	-4	+2	0	+8	+4
AKG C5900	FT1000MP	600 ohms	Rdg Chew	+4	-4	-4	-4	+2	0	+8	+4
Heil HC5	Kachina	600 ohms	Rdg Chew	0	+8	0	0	+8	+8	+8	+12
Heil Goldline	Kachina	600 ohms	Rdg Chew	0	0	0	+4	+8	+8	+8	+12
Heil Goldline	Kachina	600 ohms	Rdg Chew	0	+8	+4	+4	+8	+12	+14	+16
Electrovoice RE 20	TS870	200 ohms	Rdg Chew	+16	+2	0	0	0	+2	+6	+12
Gold Line Full Range	TS870	600 ohms	rag Chew	0	+4	-16	-12	0	+4	0	0
HC5	TS870	600 ohms	Rdg Chew	+12	+8	-3	-3	+3	-6	+2	+7
Lab Tech C-324	IC744	600 ohms	Rdg Chew	+2	+2	+16	0	+2	+2	+10	+10
Lab Tech C-324	IC744	600 ohms	DX	-4	-4	0	+4	+6	+12	+12	+8
HM36	IC744	600 ohms	Rdg Chew	0	0	0	+4	+12	+12	+14	+8
Shure Dynamic 564SA	IC744	600 ohms	DX	0	0	0	+4	+12	+12	+14	+8
Heil HC4	IC775DSF	600 ohms	DX	-3	-4	0	-6	+8	+2	+8	+4
Heil Gold Line	IC775DSF	600 ohms	Rdg Chew	-12	0	0	+4	+8	+8	+12	+12
D104 (with battery)	ICOM 774	600 ohms	General	+16	+4	+4	-3	0	+4	+3	-4
JRC NVF-56	JRC JST-135	600 ohms	General	+8	+3	0	+2	0	+2	+3	+4
Electrovoice 676	TS870	H-Z	Rdg Chew	+16	0	0	0	+4	0	0	+4
Leitch 705	OMNI V	600 ohms	Rdg Chew	+16	+16	+16	+12	+4	+4	+4	+8

REAR PANEL CONTROLS



(10) Mic Select (S4)

This three position switch selects the ICOM, KENWOOD or YAESU microphone plugged into the 8 pin Mic Input J8 (11).

(11) Mic Input (J8)

8 Pin microphone male connector. Do not use this connector when Mic in J6 (13) or Mic In J9 (12) are being used.

J8 Pin	Icom	Ken	Yaesu
1	+Mic	+Mic	
2	+5V	PTT	+5V
5	PTT	+5V	PTT Gnd
6	PTT Gnd		PTT
7	Gnd	- Mic	Gnd
8		Gnd	+Mic

GETTING STARTED TUTORIAL

The **Noise Gate Delay** control sets the decay time of the trailing edge of the **Mic Out** Audio, when the noise gate turns off. This circuitry exponentially reduces the audio output when there is no audio present in the **Mic In**. (The delay circuitry helps to make the transitions of gating and not gating of audio smooth and more pleasing to the ear.) The duration of the exponential decay is dependent on the setting of the **Noise Gate Delay** control. The delay control set at a minimum value (the slide pot all the way down) will exponentially decay the audio in about 100 milliseconds. The delay control set at a maximum value will allow the audio to decay over a few seconds. On the air tests show the white bar part of the Noise Gate Delay range gives very pleasing audio transitions. (decay time of about .3 to .5 second). You can experiment on your own to find the best setting for you.

If you have medium-to-high levels of ambient noise present when you are transmitting, with the **Noise Gate Switch** in the off position, when you stop talking your power meter will indicate R.F. still being transmitted. (set power meter on avg. power to do this experiment). When the noise gate is turned on and properly adjusted when you stop talking the power output will drop to the bottom of the scale (no power output). People who listen to your signal will be able to hear the difference and they will wonder where the noise went.

Adjusting The Audio Equalizer

Turn the **Equalizer Switch** on. Set all 8 equalizer slide potentiometers to the 0 db point (marked on the case). Refer to the Preliminary Equalizer Setting table on page 20. Use this table, as a guide to determine initial starting points for equalizer settings. It is suggested that the phones monitor be utilized to assist in adjusting the equalizer. As you modify your equalizer settings (to determine what the optimal setting is for you) it is recommended that you make changes starting at the highest audio frequency (3200 Hz) first and change the next lowest frequency (band) next until the lowest frequency (50 hz) is adjusted. On the air experimentation will be required to find the optimal settings based upon the users voice characteristics and band conditions.

GETTING STARTED TUTORIAL

Before plugging the power transformer into the wall preset the following controls as indicated:

Power, Equalizer and Noise Gate switches all off.

Mic Select to select microphone you will be using.

Connect your microphone into the **Mic In** rear connector. Plug the power transformer (module) into the wall and into the **Power** connector of the unit. Attach the microphone cable between your transceiver/transmitter and the **Mic Out** of the unit. If the microphone being used is an electret mic (ICOM HM12, SM6,...) and requires D.C. on the mic line plug the shorting jumper supplied onto the **MIC Jumper** pins at the bottom of the case otherwise leave it off. Turn the **Power** switch on. The orange/yellow **Power on LED** should go on.

Adjusting the Mic Levels

While talking into the microphone, using a screwdriver, turn the **Mic In Level Control** (located at the bottom of the unit) clockwise until the **Mic LED** just goes on. Now turn the Mic in Level control counterclockwise such that the LED never goes on when you speak into the mic.

While talking into the microphone, using a screwdriver, turn the **Mic Out Level** control clockwise until the audio level, as shown by your transceiver's/ transmitters metering is at the proper level. If you are using push to talk on your transceiver you will have to push the PTT switch on your microphone while making this adjustment.

Noise Gate Adjustments

Turn the **Noise Gate Switch** on. (Please note that when the **Noise Gate Switch** is off the **Noise Gate LED** should always go on indicating audio is being sent / gated to the **Mic Out**. When the **Noise Gate Switch** is turned on the **Noise Gate LED** may be on or off depending on the position of the **Noise Gate Level** control and the **Mic In** audio level.) Adjust the Noise Gate Level control until the Noise Gate LED just goes off. This adjustment should be made with the level of ambient noise that will be present when you will be talking into the microphone. (If audio is coming from your transceiver's/ receiver's speaker you should turn off the audio.) When you now talk into your microphone the **Noise Gate LED** should go on indicating audio is being sent to the **Mic Out**. When you stop talking the **Mic Out LED** should turn off indicating that audio is not being sent and background noise is not being sent / gated to the **Mic Out**.

REAR PANEL CONTROLS

(12) MIC Input (J9)

This 3 pin XLR female connector works independent of the mic select switch and may be used as another mic source. Do not use this connector when Mic In J6 or J8 is being used.

XLR PIN	Description.
1	gnd. / shield
2	+ Mic
3	- Mic

(13) Mic Input (J6)

This RCA female connector is used as an auxiliary microphone input. This connector works independent of the mic select switch and may be used for another audio source or microphone. This input is also low impedance. Do not use if mic is connected to J8 (11) or J9 (12).

(14) PTT INPUT (J7)

RCA female connector for auxiliary push to talk control. A foot switch or other control may be connected to this connector. Grounding the center jack of the connector grounds the push to talk line on the Mic Out.

(15) MIC Out Select A/B (S4)

This two position slide switch directs audio to the 5 Pin DIN Mic Out A (16) or the 5 Pin DIN Mic Out B (17).

(16) Mic Output A (J5)

5 Pin female DIN connector that has noise gate / equalizer audio plus push to talk outputted. This connector is active only when the Mic Out Slide Switch S4 (15) is in the Mic Out Select A position.

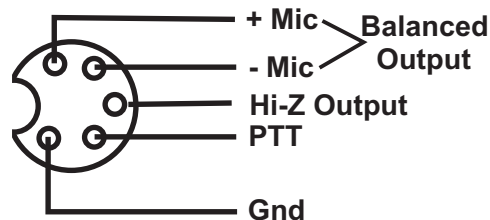
REAR PANEL CONTROLS

(17) Mic Output B (J4)

5 Pin female DIN connector that has noise gate / equalizer audio plus push to talk outputted. This connector is active only when the Mic Out Slide Switch S4 (15) is in the Mic Out select B position.

**MIC OUT A/B
5 Pin Male DIN**

Din connectors shown on side to be soldered



(18) Phones (J3)

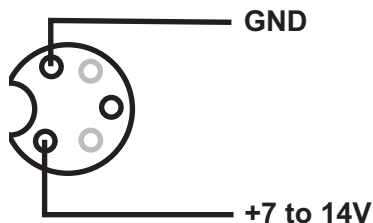
1/4" Stereo headphone connector used to monitor audio from the equalizer. The output level of this connector is controlled by phone volume control R29 (1) **Headphones using other than 1/4" stereo connectors may not operate properly when plugged into stereo phones connector J3.** (An inline adapter should be used with headsets that do not use 1/4" stereo connectors. Stores like Radio Shack have audio plug adapters available.)

(19) Power

5 Pin Din connector. 7 - 14 VDC input at 100 ma.

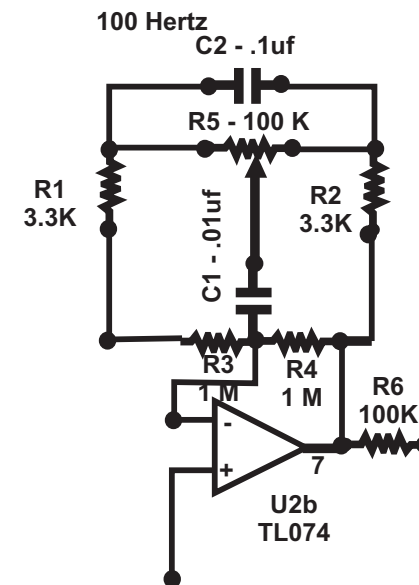
**Power
5 Pin Male DIN**

Din connectors shown on side to be soldered



CHANGING EQ BANDPASS FILTER CENTER FREQUENCIES

Each EQ bandpass filter is very similar. The center frequencies, of each bandpass filter is determined by the values of the capacitors and resistors used. The equations below define what capacitor values are required for a given center frequency. Below is a schematic of a bandpass filter with a center frequency of 100 Hz.



$$C1 = (.9046) / (\text{Freq in Hz.}) \leq \ln \text{uf} \Rightarrow C2 = C1 \times 10$$

The above equations are valid for only the resistor values shown in the schematic above.

The bandpass filter in the schematic has a center frequency at 100 hz.

example: The capacitor values required to obtain a bandpass filter center frequency of 4800hz is calculated as follows:

$$C1 = .9046 / \text{FREQ} = .9046 / 4800 = .0001885 \text{UF} = 188.5 \text{ PF}$$

$$C2 = C1 \times 10 = .001885 \text{uf}$$

The closest real value capacitors that can be purchased are as follows

- C1 calculates to be 188.5 pf. The closest real value that can be purchased is 180 pf

- C2 calculates to be .001885 uf. The closest real value that can be purchased is .0018uf

BOTTOM PANEL CONTROLS



(20) Mic Jumper

Plugging the jumper (shorting block) puts +5V on the Mic In line of the microphone's cartridge (11, 12 & 13). Required for mic's such as ICOM's Hm12, HM36 and Sm6 and the Heil Hmi and MH2 (made for the Elecraft radio's) and other electret microphones.

(21) Mic In Gain (R12)

This pot., when turned clockwise, increases the microphone amplifier's gain. The gain should be changed while speaking into microphone until Mic LED (10) just barely goes on. Now turn the pot counterclockwise, while speaking into the mic til the LED NEVER goes on. (The LED going on indicates that the EQ is being overdriven.) **Microphone cartridges with very low output (Like a Heil HC4 or Heil HC5) may require the Mic In Gain Control to be adjusted to maximum gain.**

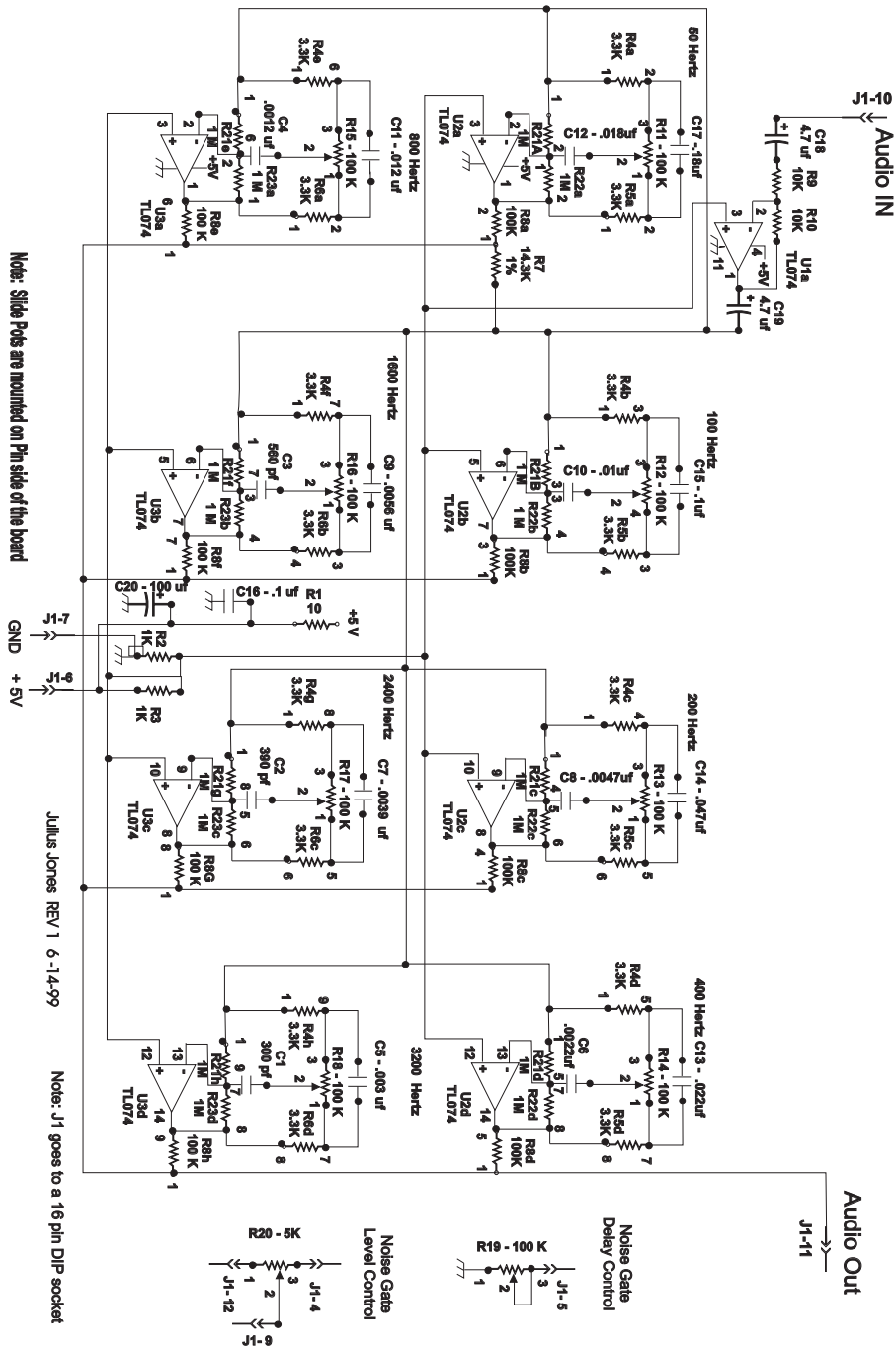
(22) Mic Output Level (R13)

Changes the unit's audio output. (Clockwise rotation increases output.)

(23) Mic Input Impedance

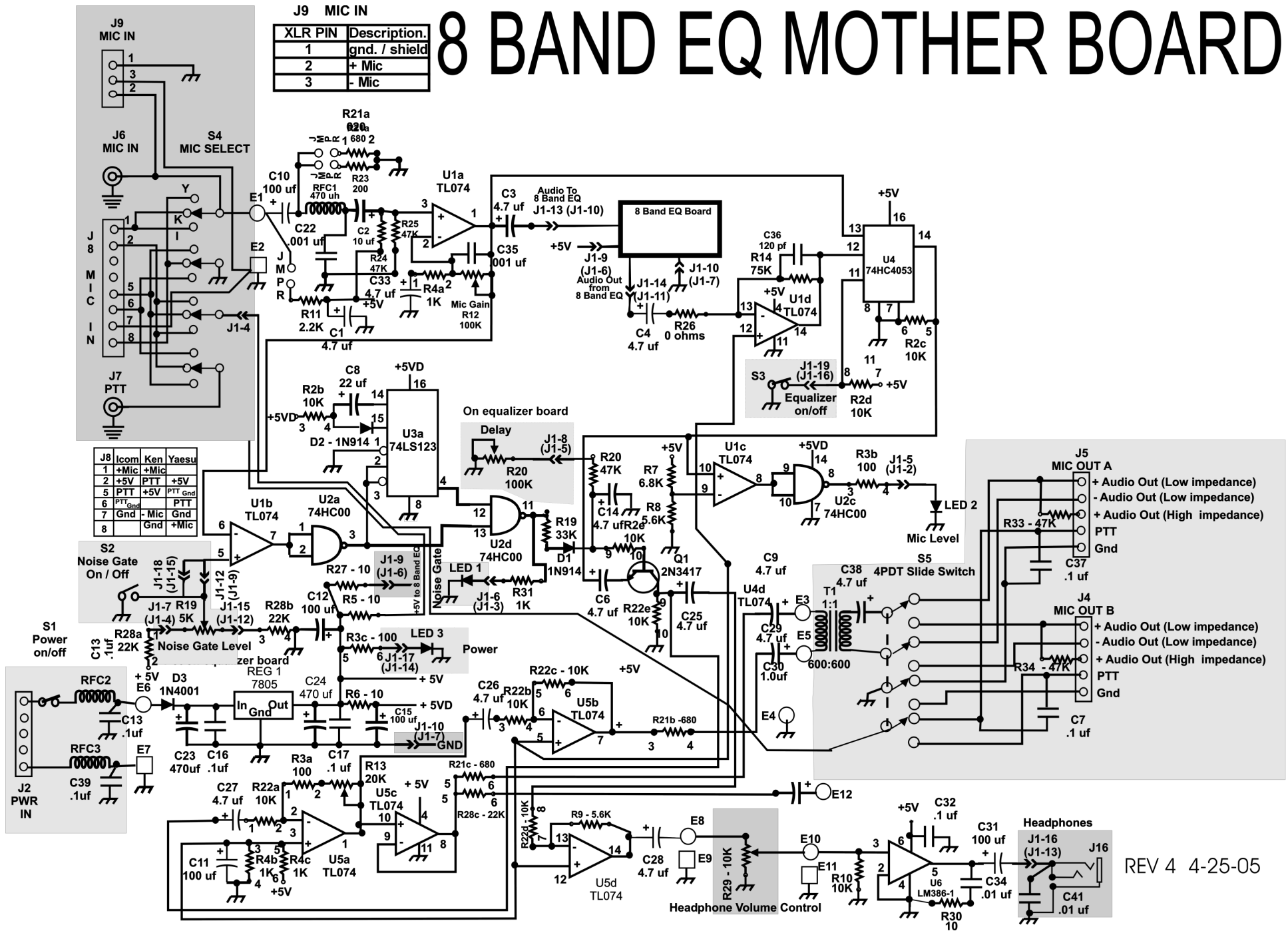
Insertion of one of these jumpers (shorting blocks) selects 200 or 600 ohm input impedance. No jumpers connected selects high impedance.

8 Band Equalizer Pot Board with Noise Gate Pots



8 BAND EQ MOTHER BOARD

J9 MIC IN	XLR PIN	Description.
	1	gnd. / shield
	2	+ Mic
	3	- Mic



REV 4 4-25-05

Grey area not on this P.C. Board