

Smith & Wesson

MAGNUM IV-A

Electronic Siren

1 -004-0061-02

Installation & Service Manual



Manual Number
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1.0 Introduction

Your Electronic Siren and Public Address Amplifier is a quality Electronic product which has been designed around modern integrated circuitry to provide years of reliable service with a minimum of care and maintainance. The Public Address feature permits "Push-To-Talk" operation for loud hailing and overrides all Siren signals automatically. Provisions have been made for auxiliary foot switching or horn ring switching as well as manual switching of the Siren tones.

The Siren is designed to operate with 12 volt negative or positive grounded systems, but polarity of the power leads must be observed.

The Siren sound output will be a minimum of 119 dB when ten feet from one speaker and a minimum of 121 dB when ten feet from two speakers.

2.0 Installation & Power Cable Connections

2.1 Amplifier Installation

The amplifier should be mounted in a position that is both comfortable and convenient for the operator. When this position is located, remove the mounting bale from the amplifier. Using the bale as a template, locate the mounting holes on the mounting surface. Drill two 1/4" mounting holes and mount the bale with the 1/4" machine screws and nuts supplied. The amplifier is then mounted to the bale with the two 1/4"-28 X 3/4" long hex head machine screws which are supplied.

2.2 Power Cable Installation

The power cable is included in the amplifier carton. The various wires must be connected as described below and shown in Figure I.

The amplifier will work on either positive or negative grounded systems. If the negative terminal of the battery is connected to the vehicle frame, the Siren red lead (positive) should be connected to the "Hot" positive side of the battery, and the plain black lead must be connected to the vehicle frame. If the positive terminal of the battery is connected to the vehicle frame, it will be necessary to connect the "Minus" black lead to the "Hot" negative side of the battery and the (positive) red lead must be connected to the vehicle frame.

2.3 Speaker Installation

Speakers are weatherproof and may be installed in any convenient location of your selection, whether on the roof, fender, behind the grille, or under the hood.

When one speaker is used, either wire may be connected to either SPKR terminal of TB101 as polarity is not a factor. When the amplifier is used with two speakers connected in parallel, it is necessary that the speakers be phased for optimum performance. This can be accomplished by connecting the two speaker leads that have a raised ridge to one SPKR terminal, and the two remaining leads without the raised ridge to the other SPKR terminal. (See Figure I)

2.4 Accessory Installation

The six foot green lead can be connected to an auxiliary siren control such as a foot switch or horn ring switch.

Foot switch installation on negative grounded vehicles is accomplished by connecting the green lead from the foot switch terminal on TB101 to a grounding type foot-switch. The switch must return to the negative side of the battery through frame and body. (See Figure I)

Foot switch installation on positive grounded vehicles is accomplished by connecting the green lead from the foot switch terminal of TB101 to a non-grounding foot switch. Connect the return lead from the foot switch to the negative side of the electrical system.

Horn ring installation on negative grounded vehicles is shown in Figure I. The green lead from the foot switch terminal of TB101 is connected to one outside terminal of a single pole double throw (SPDT) switch. Break the existing wiring between the horn ring and horn relay. Connect the horn relay to the remaining outside terminal on the switch and connect the wire from the horn ring switch to the center terminal of the SPDT switch.

The orange and blue wires should be connected to the RADIO terminals on TB101 and then to the two-way radio speaker. (See Figure I)

3.0 Operation (See Figure II)

3.1 ON-OFF Switch

The ON-OFF switch is incorporated in the volume control. The unit may be left on continuously without damage. Standby current is less than 0.6 amperes.

3.2 Volume Control

The volume control affects the output level of Public Address and Radio signals only. Siren signals will be at full volume regardless of the position of this control.

The maximum amplitude (clockwise) position of this control will be determined in most cases by the point at which "feedback" or "squeal" occurs. This will depend on the microphone gain, open window, speaker placement, proximity of reflecting surfaces such as buildings or other vehicles, etc. Adjust the gain control to a position below the point at which "feedback" occurs and speak loudly with the microphone held close to the lips when maximum volume is required.

3.3 Four Button Selector Switch

- a. Radio Position: In this position, incoming two-way radio messages are amplified and routed out through the Siren speaker. Gain (volume) may be controlled by the volume control. The radio volume may be adjusted to match the P.A. volume by means of screwdriver adjusted control accessible through the hole located on the bottom of the amplifier case. This control may be adjusted with a small screwdriver inserted through the access hole. It should be adjusted to obtain the desired volume of two-way radio signal through the siren speaker with the volume control set at the position normally used for P.A. operation.
- b. Wail: In this position the Siren will produce a continuous wailing sound up and down in frequency at a rate of approximately 10-12 seconds per cycle.
- c. Yelp: In this position a continuous rapid warbled tone is generated at a rate of approximately 170 cycles per minute.
- d. P.A. Manual Position: In this position the unit may be used for Public Address or Manual Siren operation. When using Public Address or loud hailing, press the "Push-to-Talk" button on the

3.3 Four Button Selector Switch (Continued)

microphone and speak distinctly. Pressing the microphone push to talk button will override all siren mode signals and permit loud hailing or announcements. Volume is controlled by the volume control. The push to talk button is also an effective brake on siren signals; when pressed the siren signal ceases instantly and remains suppressed as long as the button is held down.

Manual siren control is accomplished by means of this manual button or by an auxiliary switch such as a foot switch or horn ring control. Operation is similar to that of a conventional electro-mechanical siren.

4.0 Maintenance & Repair

- a. Access to Interior: It is unnecessary to remove the mounting bale from its location or to remove the amplifier case from the bale. Simply remove the four screws on the underside. The entire chassis and control panel then slides out like a drawer.
- b. Removal from Car: To remove the entire amplifier from the vehicle for bench inspection, simply remove all leads from J101, J102, and TB101.
- c. Removal of Circuit Board: The board is attached to the chassis with four screws and the volume control R16. Removing the screws and the volume control knob and nut permits the board to be swung out of the chassis without breaking any of the electrical connections providing ample access to all components.

4.1 General

Maintenance and repair to electronic equipment are easily accomplished when the technician understands the circuit and its operation. Before maintenance or repairs are attempted, it is important that the following paragraphs be read and understood.

The majority of the sweep and tone generation functions in the siren as well as microphone preamplification are performed by the single integrated circuit used. This integrated circuit contains four identical differential input amplifiers which operate in a manner similar to an operational amplifier but are designed to be used

with a single supply voltage. Operation of these amplifiers is best explained by stating that the difference between the currents flowing into the inverting (-) and noninverting (+) inputs flows through external feedback components from the output to the inverting (-) input to produce the output voltage.

Since this integrated circuit performs most of the tone generation and preamplification functions, it is likely to be the faulty component in most cases where no siren tones or P.A. signals reach the driver amplifier. Because of the low cost of the integrated circuit, it is advisable in most such cases to simply replace the IC rather than spend a great deal of time in attempting to isolate the fault more closely. The best method to replace the IC is to cut all its leads on the top of the board so it can be lifted free, then unsolder the portions of the leads remaining in the board one at a time. The holes can be cleared with a solder removal tool or by blowing through them, after which a new IC can be installed.

Refer to Figure III Block Diagram and Figure IV Schematic Diagram in conjunction with the following paragraphs.

The Block Diagram shown in Figure III illustrates the basic functional blocks of the unit while the Schematic Diagram shown in Figure IV illustrates the overall circuit. The following subparagraphs describe briefly the function of each section.

4.2 Output Amplifier

Transistors Q101 and Q102 and transformer T102 form a Class B push-pull power amplifier. In the siren modes of operation, Q101 and Q102 will conduct on alternate half cycles of the signal. In Radio and P.A. modes of operation, one end of R23 is grounded. R23 and Q4 then form a divider which forward biases the output transistors slightly to avoid "crossover" distortion which would be objectionable on speech signals. CR3 provides a return current path for the bases of the output transistors. Q4 and CR3 also provide thermal compensation for the output stage.

4.3 Driver Amplifier

Transistor Q3 and power transistor Q4 in conjunction with T101 and associated components R17-R22, R25, C7, C8, and C10, form a Class A power amplifier. The amplified signal is coupled to the bases of the output transistors by T101.

4.4 Tone Oscillator

Two sections of integrated circuit Z1 with associated components R12-R15, C5-C6, and CR1-CR2 form a voltage controlled astable multivibrator. Operation is the same as for a conventional transistorized multivibrator. In Radio and P.A. modes, the cathode of CR5 is grounded, turning the oscillator off.

4.5 Sweep Generator

A third section of integrated circuit Z1, together with R2-R3, R5-R7, and C1-C2 forms the sweep generator. If the current into the + input of the amplifier exceeds the current into the - input, the output of the amplifier will be high (about 6.5V), charging C2 (For YELP) or the parallel combination of C1 and C2 (For WAIL and MANUAL) through R7. If the current into the - input of the amplifier exceeds that into the + input, the output will be low (essentially ground) and the selected capacitance will then discharge through R7 to the output of the amplifier. When the unit is on, with all buttons out, the + input of the amplifier is grounded through the WAIL, YELP, and MANUAL switches and transistor Q1 which is normally turned on. If MANUAL is pressed or the foot switch terminal is grounded (turning Q1 off) this ground is lost and current flows into the + input through the parallel combination of R2 and R3. Capacitors C1 and C2 then charge until the voltage across them is sufficient to produce the same current into the - input through R5 as is flowing into the + input. When the button or foot switch is released, the + input is again grounded, the amplifier output is low, and the capacitors discharge to ground. When either WAIL or YELP is pressed, the ground connection on the + input is again broken, and current now flows into the + input through R2 and R6. Since R6 is connected to the amplifier output, there are two distinct current levels, one with the output high, the other with the output low. Initially, the output is high and current into the + input consists of current from the supply voltage through R2 plus current from the amplifier output through R6. The capacitors then charge until they produce the same current into the - input. At this point, the output goes low and a smaller current now flows into the + input because there is no longer any significant current from the output through R6. The capacitors now discharge until they produce this lower current into the -input. At this point, the output goes high again and the cycle repeats. WAIL and YELP both operate in this manner,

but in YELP, C1 is disconnected to obtain the faster sweep rate desired. C1 is also shorted out in YELP to insure that when switching from YELP to WAIL or MANUAL, the tone in the newly selected mode will always start at its lowest frequency.

4.6 Dynamic Microphone Preamplifier

The remaining section of integrated circuit Z1 together with R9-R11 and C3-C4 forms the dynamic microphone preamp. The ratio of $R11/R10 = .47$ sets the DC output level at about .47 times the supply voltage, and the ratio of $R11/R9 = 100$ sets the gain at 100. C3 limits low frequency response while C4 limits high frequency response. Frequency response is limited to about 400 to 4000 cycles. This is sufficient for good reproduction of speech and helps avoid "feedback" at the higher frequencies.

4.7 Miscellaneous Circuits

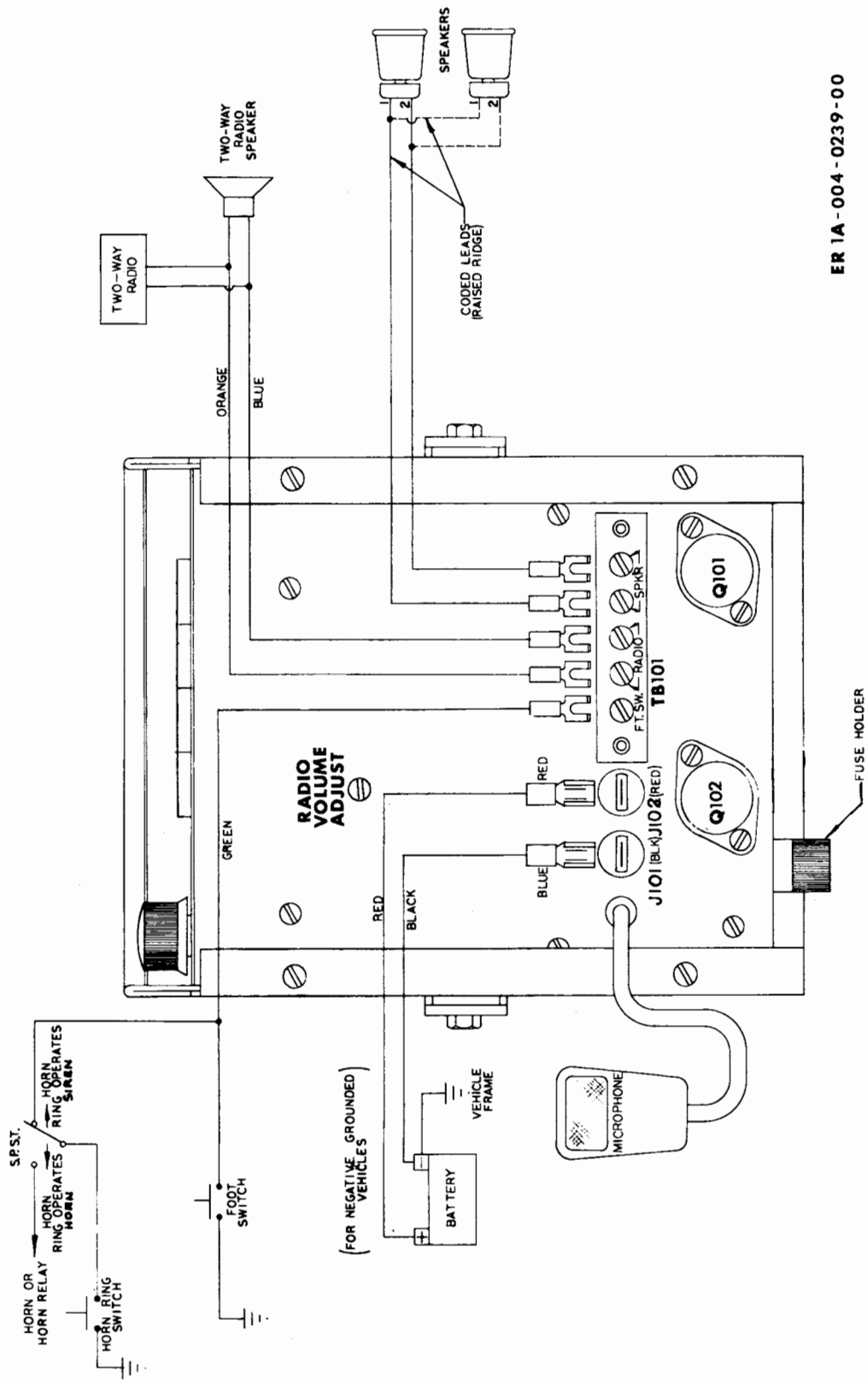
Q2 and R8 form a high input impedance buffer between the capacitor in the sweep circuit and the input of the voltage controlled oscillator. C11-C13, CR5, and R24 form a simple regulated power supply for the integrated circuit and other low power circuits. CR4 provides reverse voltage protection for components on the board. C101 helps eliminate alternator noise. T1 couples the Radio signal to the amplifier while providing DC isolation. R16 adjusts the output level for P.A. and Radio. R1 adjusts the Radio output level relative to the P.A. output level. DS101 illuminates the panel when the Siren is on and S101 is in its on position.

5.0 PARTS LIST FOR THE SIREN AMPLIFIER

<u>Symbol</u>	<u>Part Number</u>	<u>Description</u>
	3C-004-0216-00	P.C. Board Assembly
C1	4A-517-0160-20	Capacitor, 10.0 uf, 16V, 10%
C2	4A-517-0160-22	" 1.0 uF, 16V, 10%
C3	4 -514-2000-06	" .2 uF, 200V
C4	4 -516-5000-09	" 100 pF, 500V
C5	4 -514-2000-05	" .01 uF, 200V
C6	4 -514-2000-05	" .01 uF, 200V
C7	4 -516-0100-04	" .2 uF, 10V
C8	4 -516-0100-04	" .2 uF, 10V
C10	4 -516-0500-19	" .005 uF, 50V
C11	4 -516-0100-07	" .1 uF, 10V
C12	4A-517-0150-03	" 500 uF, 15V
C13	4A-517-0150-00	" 1000 uF, 15V
C101	4 -517-0160-24	" 2000 uF, 16V
CR1	4 -603-0000-00	Diode, TI-51
CR2	4 -603-0000-00	" TI-51
CR3	4A-607-0202-00	" TA-5
CR4	4A-607-0202-00	" TA-5
CR5	4 608-0003-00	" Zener, 1N755A
CR6	4 -603-0000-00	" TI-51
DS101	4 -575-0009-00	Lamp, #1820
F101	4A-567-0001-00	Fuse, 3AG, 15 amp., 32V
J101	4 -547-0000-00	Jack, Red
J102	4 -547-0001-00	Jack, Black
Q1,Q2	4 -684-0601-00	Transistor, TIS-97
Q3	4 -684-0203-00	" 2N5137
Q4	4 -684-0206-00	" 2N6288
Q5	4 -684-0000-00	" 2N408
Q101	4A-684-0801-00	" DTG-110B
Q102	4A-684-0801-00	" DTG-110B
R1	4 -637-0003-00	Potentiometer, Trimmer, 10K Ω
R2	4A-629-4470-11	Resistor, Film, 47K Ω , 1/2w., 5%
R3	4A-629-4330-11	" " 3.3M Ω " "
R4	4A-629-1470-11	" " 4.7K Ω " "
R5	4A-629-4100-11	" " 1.0M Ω " "
R6	4A-629-4330-11	" " 3.3M Ω " "
R7	4A-629-3300-11	" " 300K Ω " "
R8	4A-629-2100-11	" " 10K Ω " "
R9	4A-629-2470-11	" " 47K Ω " "
R10	4A-629-4100-11	" " 1.0M Ω " "
R11	4A-629-3470-11	" " 470K Ω " "

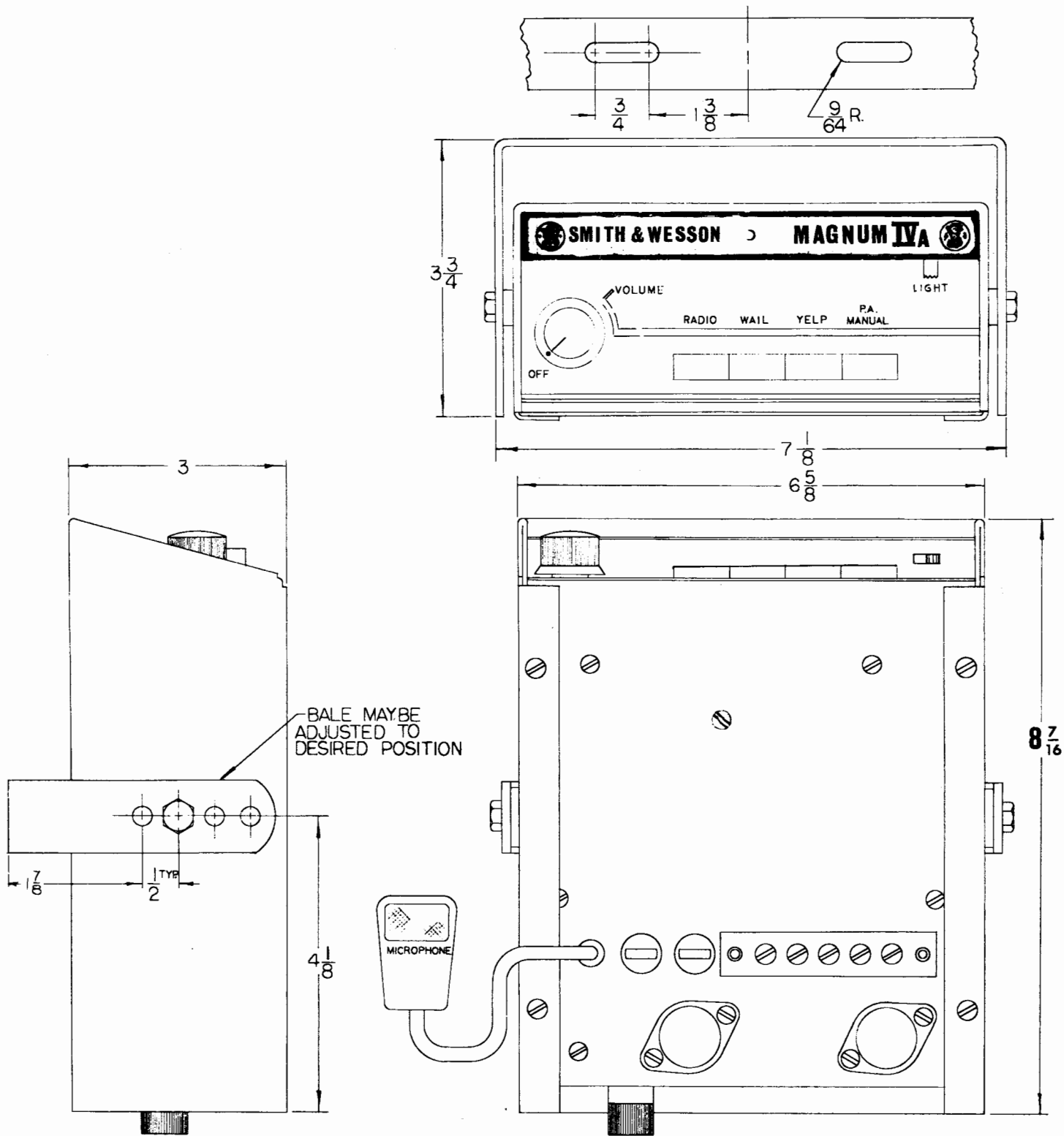
5.0 PARTS LIST FOR THE SIREN AMPLIFIER (CONTINUED)

<u>Symbol</u>	<u>Part Number</u>	<u>Description</u>
R12	4A-629-3110-11	Resistor, Film, 110K Ω , 1/2w., 5%
R13	4A-629-3110-11	" " 110K Ω " "
R14	4A-629-2220-11	" " 22K Ω " "
R15	4A-629-2220-11	" " 22K Ω " "
R16	4 -637-0022-01	Potentiometer w/Switch, 10K Ω
R17	4A-629-2150-11	Resistor, Film, 15K Ω , 1/2w., 5%
R18	4A-629-2150-11	" " 15K Ω " "
R19	4A-629-2330-11	" " 33K Ω " "
R20	4A-629-1820-11	" " 8.2K Ω " "
R21	4A-629-2470-11	" " 47K Ω " "
R22	4A-629-8100-11	" " 1.0 Ω " "
R23	4A-629-1560-11	" " 5.6K Ω " "
R24	4A-629-0330-11	" " 330 Ω " "
R25	4A-629-0680-11	" " 680 Ω " "
R26	4A-629-2820-11	" " 82K Ω " "
R27	4A-629-2820-11	" " 82K Ω " "
R28	4A-629-3150-11	" " 150K Ω " "
S1	4 -649-0011-01	Switch, Pushbutton, 4 module
S101	4A-655-0000-00	" , Slide
T1	4 -678-0002-00	Transformer, Radio Input
T101	4B-678-0000-00	" , Driver
T102	4B-678-0003-00	" , Output
TB101	4B-669-0000-00	Board, Terminal, Feedthru
Z1	4 -692-0067-00	Integrated Circuit, LM3900 or equiv.
M1	4A-585-0003-00	Magnetic Microphone
	OR	
M2	4A-585-0001-01	Noise Cancelling Microphone
	(OPTION)	
	436-0007-01	Pushbutton, Black
	436-0007-03	Pushbutton, White
	436-0007-04	Pushbutton, Red
	436-0007-05	Pushbutton, Gray



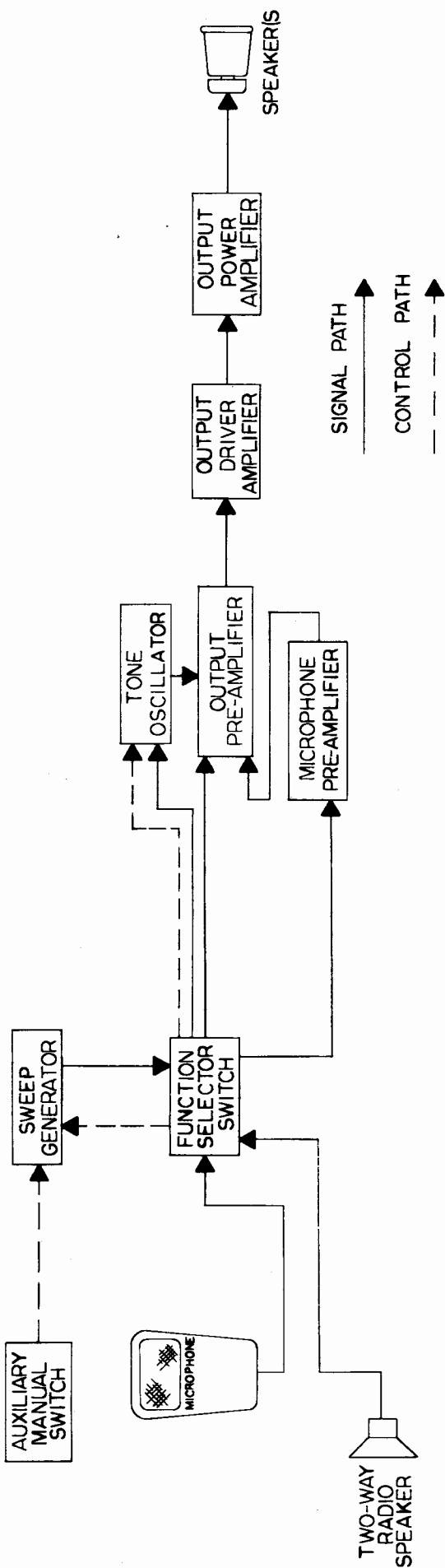
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FIGURE I INSTALLATION INSTRUCTIONS



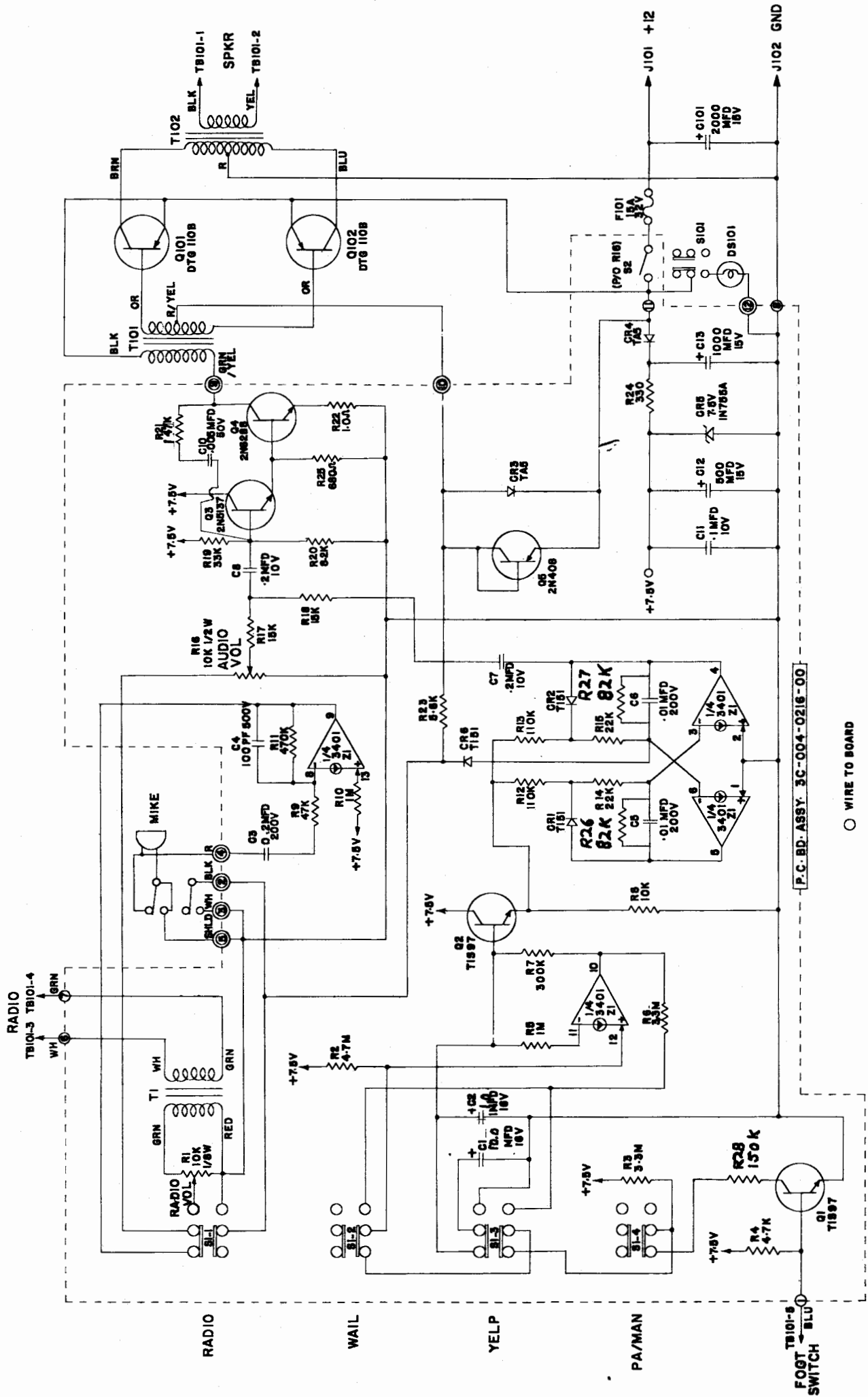
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FIGURE II OUTLINE & MOUNTING



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FIGURE III BLOCK DIAGRAM



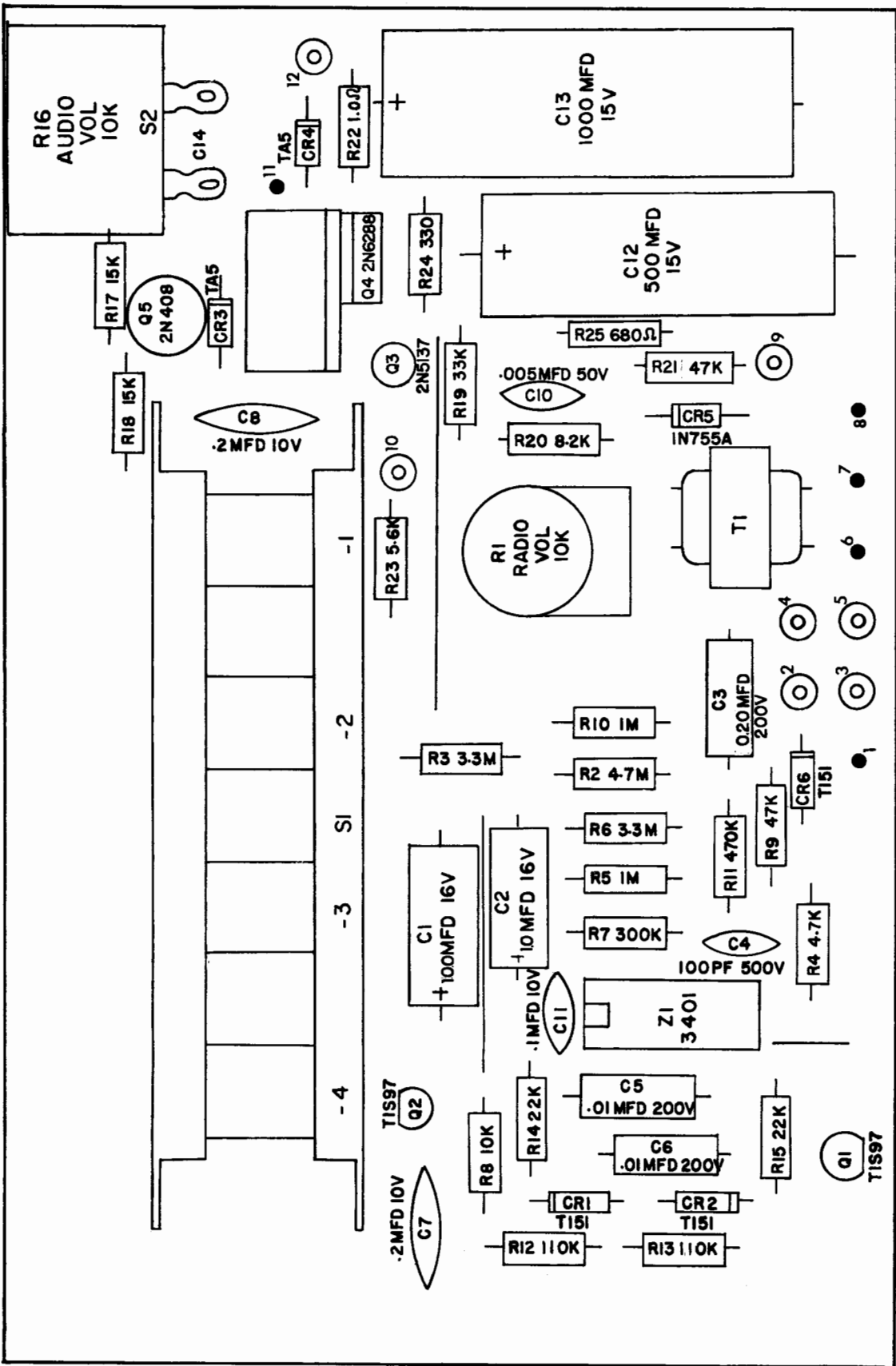
○ WIRE TO BOARD
 ⊙ TERMINAL

NOTES
 1. PIN 7 OF Z1 TO GND, PIN 14 TO +7.5V
 2. ALL RESISTORS 1/2 W 5% FILM
 UNLESS OTHERWISE NOTED

P.C. BD. ASSY. 3C-004-0216-00

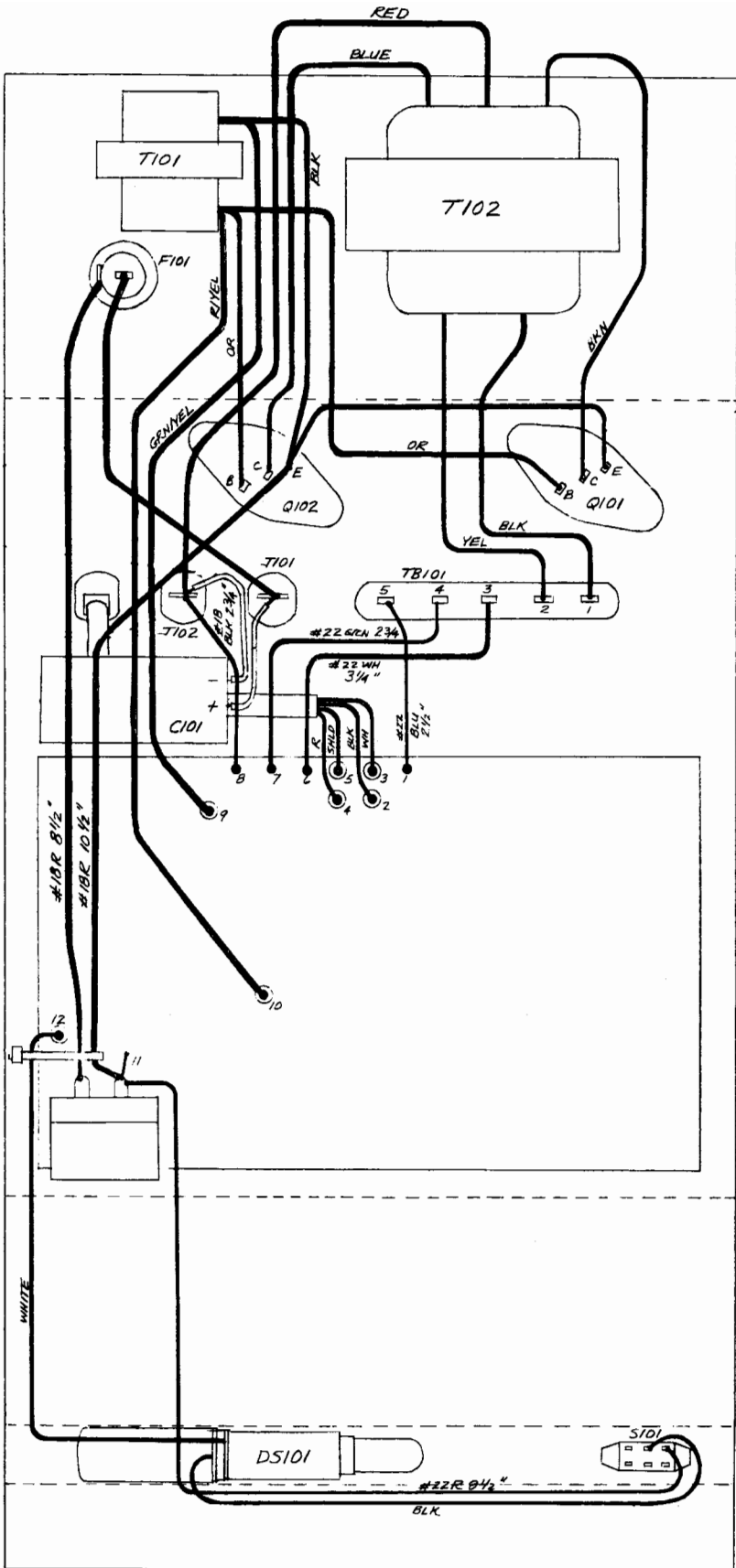
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FIGURE IV SCHEMATIC DIAGRAM



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FIGURE V P.C. BD. COMPONENT LAYOUT



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FIGURE VI INTERNAL WIRING DIAGRAM