



## **VA302 SERIES**

*Vocal Master*

# **OPERATING AND SERVICE MANUAL**

Manufactured by  
SHURE BROTHERS INC.  
222 Hartrey Avenue  
Evanston, Illinois 60204 U.S.A.

# VA302 Series Vocal Master

## SPECIFICATIONS

### VA302 Series Console

|                                                             |                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Amplifier Type .....                                        | All silicon transistor mixer/power amplifier                                                                                                                                                                                                                                                       |
| Power Output .....                                          | 100 watts continuous (RMS); (to 8 ohm load, see Figure 3, Page 7)                                                                                                                                                                                                                                  |
| Voltage Gain .....                                          | 80 db Input Attenuator "Out" (8 ohm load)<br>65 db Input Attenuator "In" (8 ohm load)                                                                                                                                                                                                              |
| Frequency Response .....                                    | $\pm 2$ db 40 Hz. to 20,000 Hz. (typical)                                                                                                                                                                                                                                                          |
| Input Impedance .....                                       | 320 ohms Input Attenuator "Out"<br>500 ohms Input Attenuator "In"                                                                                                                                                                                                                                  |
| Distortion .....                                            | 5% maximum at rated output at 1 KHz.                                                                                                                                                                                                                                                               |
| Hum and Noise .....                                         | 60 db below rated output                                                                                                                                                                                                                                                                           |
| Speaker Load Impedance .....                                | Nominal 8 ohms; operational 5.3 ohms minimum<br>(See Figure 3, Page 7)                                                                                                                                                                                                                             |
| Input Clipping Level .....                                  | Greater than 25 Mv. Input Attenuator "Out"<br>Greater than 150 Mv. Input Attenuator "In"                                                                                                                                                                                                           |
| Bass Control Action .....                                   | $\pm 13$ db at 100 Hz. with respect to "flat" setting                                                                                                                                                                                                                                              |
| Treble Control Action .....                                 | $\pm 10$ db at 10,000 Hz. with respect to "flat" setting                                                                                                                                                                                                                                           |
| "Aux. Hi-Level" Output Jack .....                           | Impedance 5,000 ohms; Output 19 db below speaker<br>output (to 8 ohm load); nominal — 2 V at 50 watts to speakers, Clipping Level 4 V.                                                                                                                                                             |
| "Mic. Level" Output .....                                   | Hi-Z: impedance 1,000 ohms; Output 30 db below auxiliary output;<br>nominal 60 Mv. Clipping Level 120 Mv.<br>Lo-Z: impedance 36 ohms; Output 52 db below auxiliary output;<br>nominal 5 Mv. Clipping Level 10 Mv.                                                                                  |
| Echo-"To Input" Jack (Output To External Echo Unit) .....   | Impedance 10,000 ohms;<br>Output 20 db above microphone inputs with individual volumes at "10"; Clipping Level 3 V.                                                                                                                                                                                |
| Echo-"To Output" Jack (Input From External Echo Unit) ..... | Impedance 40,000 ohms;<br>Sensitivity 200 Mv. for rated amplifier output with "Echo Gain" Control and<br>"Master Volume" Control at maximum settings; Clipping Level 2 V. with maximum<br>setting of "Echo Gain" control. Clipping level increases with reduced<br>setting of "Echo Gain" control. |
| "Reverb Switch" Jack .....                                  | D.C. switching (no audio), parallels the Master Reverb<br>In-Out Switch. Any cable with a resistance of less<br>than 5,000 ohms may be used.                                                                                                                                                       |
| Center Notch Frequencies of "Anti-Feedback" Filters .....   | Filter "A" 5,000 Hz.<br>Filter "B" 2,200 Hz.<br>Filter "C" 1,000 Hz.<br>Filter "D" 155 Hz.                                                                                                                                                                                                         |

### Console (Continued)

|                                 |                                                                                                                          |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| Power Supply: VA302-C .....     | 120 volts, 60 Hz.                                                                                                        |
| VA302E-C .....                  | 120/240 volts, 50/60 Hz.<br>Factory wired for 240 volt operation.                                                        |
| VA302E6-C .....                 | 100, 120, 140, 200, 220, 240 volts, 50/60 Hz.<br>Switch selectable.                                                      |
| Power Consumption .....         | 80 watts maximum with no signal in.<br>180 watts with 1 KHz. signal and 100 watts output,<br>400 watts maximum operating |
| Ambient Temperature Range ..... | -7°C. to 43°C. (20° F. to 110°F.) without derating                                                                       |
| Dimensions .....                | 213 mm height x 635 mm width x 375 mm depth<br>(8 $\frac{3}{8}$ in. x 25 in. x 14 $\frac{3}{4}$ in.)                     |
| Weight: VA302-C .....           | 18.61 kg (41 lb)                                                                                                         |
| VA302E-C and VA302E6-C .....    | 19.05 kg (42 lb)                                                                                                         |

### VA300-S Speaker Column

|                               |                                                                                                                     |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Power Rating .....            | 100 watts                                                                                                           |
| Impedance .....               | 16 ohms                                                                                                             |
| Frequency Response .....      | 50 Hz. to 10,000 Hz.                                                                                                |
| Horizontal Distribution ..... | 140°                                                                                                                |
| Vertical Distribution .....   | 65°                                                                                                                 |
| Dimensions .....              | 1594 mm height x 400 mm width x 222 mm depth<br>(62 $\frac{3}{4}$ in. x 15 $\frac{3}{4}$ in. x 8 $\frac{3}{4}$ in.) |
| Weight .....                  | 31.78 kg (70 lb) including cable                                                                                    |

## DESCRIPTION

The Shure Model VA302 Vocal Master Sound System consists of one Control Console (VA302-C) and two Speaker Columns (VA300-S).

The Shure Model VA302E Vocal Master Sound System consists of one Control Console (VA302E-C) and two Speaker Columns (VA300-S).

The Shure Model VA302E6 Vocal Master Sound System consists of one Control Console (VA302E6-C) and two Speaker Columns (VA300-S).

Designed specifically for the performing vocalist, the Vocal Master Sound System provides the required portability, flexibility, and dependability demanded by professional entertainers.

The mixer/power amplifier Control Console permits the user to mix up to six microphones with individual control over volume, tone and reverberation. A solid-state 100 watt R.M.S. power amplifier is incorporated in the Console. Unique circuitry design protects the solid-state components against damage as a possible result of open-circuit

or short-circuit conditions of the amplifier outputs. The output transistors are also protected against overheating by the use of automatic thermal sensors. All components of the Vocal Master Sound System are conservatively rated and are operated well within their respective tolerances to assure long life and trouble-free performance.

The VA302-C is Underwriters' Laboratories, Inc. listed, and is listed by the CSA Testing Laboratories as certified.

The VA300-S Speaker Columns are highly directional, wide range, line-radiators. A rear-ported enclosure is utilized which contributes to the directional characteristics of the Speaker Column and is crucial in reduction of feedback.

The VA300-S employs four special 8-inch loudspeakers and two special 10-inch loudspeakers providing a total cone area of 2,310 cm<sup>2</sup> (358 in<sup>2</sup>).

Each Speaker Column is furnished with a 15m (50 ft), #18 gauge, 2-conductor rubber jacketed cable with locking phone plugs attached.

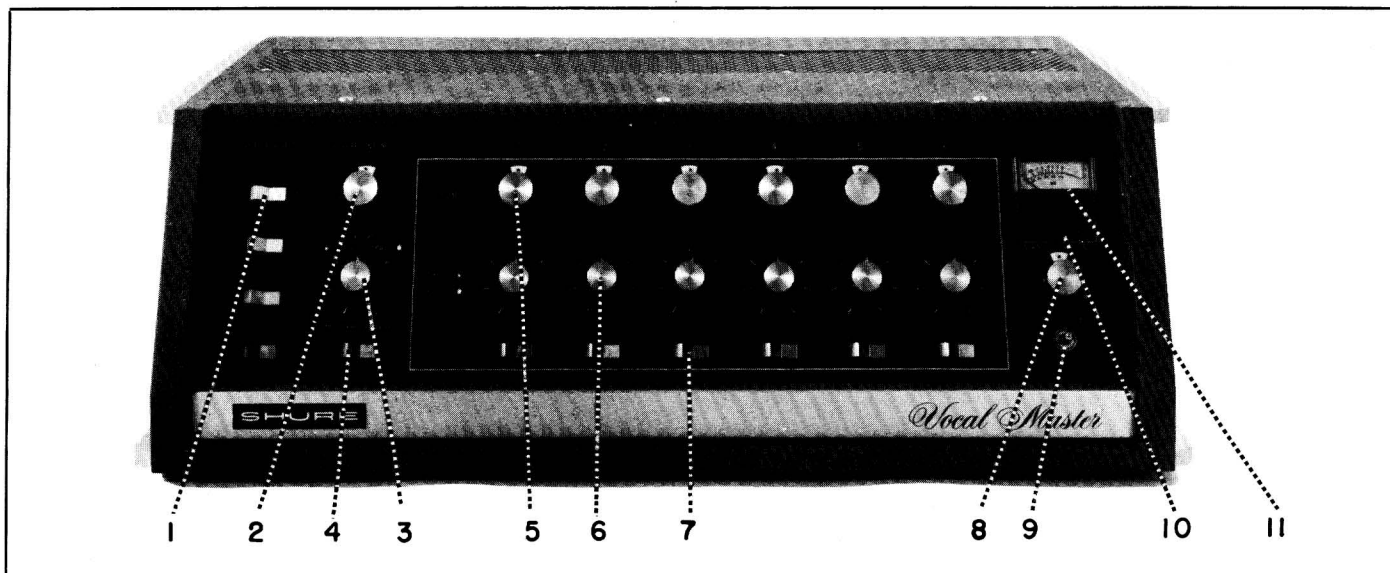


FIGURE 1.

**Front Panel Controls** (Refer to Figure 1)

1. "Anti Feedback" Switches (Four).
2. "Reverb Intensity" Control.
3. "Reverb Treble & Bass" Controls (Dual Concentric).
4. "Master Reverb" Switch.
5. Individual Channel "Volume" Controls (Six).
6. Individual Channel "Treble & Bass" Controls (Six, Dual Concentric).
7. Individual Channel "Reverb" Switches (Six).
8. "Master Volume" Control.
9. "On-Off-On" Power Switch.
10. V.U. Meter "Hi/Lo" Sensitivity Switch.
11. V.U. Meter.

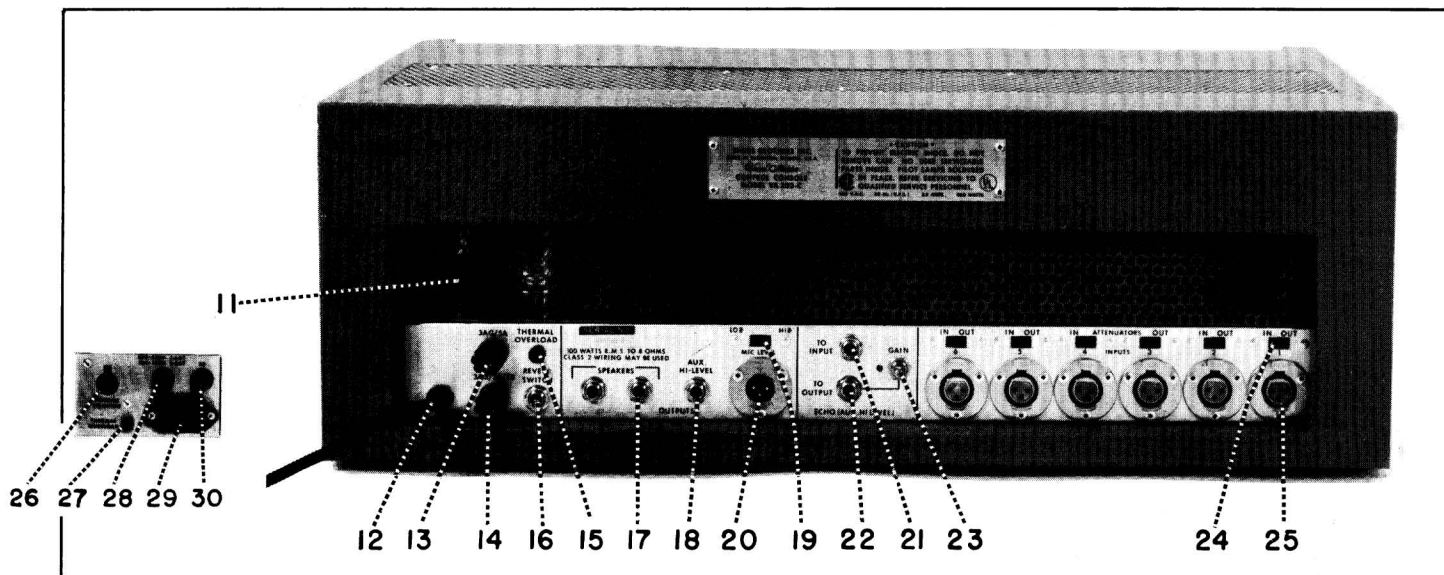


FIGURE 2.

**Rear Panel Controls and Connections** (Refer to Figure 2)

11. Line Cord Storage Spindles.
12. A.C. Line Cord.
13. D.C. Fuse (3AG/5A).
14. A.C. Fuse (3AG/3A/SB).
15. "Thermal Overload" Indicator Lamp.
16. "Reverb Switch" Remote Control Jack (Phone Type).
17. "Speaker" Output Jacks (Two, Phone Type).
18. "Aux. Hi-Level" Output.
19. "Low-Hi" Impedance Switch for Microphone Output
20. "Microphone" Level Output Connector (Male Cannon Type).
21. Echo-"To Input" Jack (Switching Phone Type).
22. Echo-"To Output" Jack (Switching Phone Type).
23. Echo "Gain" Control.
24. "In/Out" Input Attenuator Switches (Six).
25. "Input" Connectors (Six, Female Cannon Type).
26. "Voltage Selector" Switch.
27. "Thermal Overload" Indicator Lamp.
28. A.C. Fuse (1.6 AT or 3.0 AT).
29. A.C. Power (Mains) Connector.
30. D.C. Fuse (5.0 A).

# VA302 Series Vocal Master

## OPERATING INSTRUCTIONS

### General Operating Instructions:

1. Set all front panel controls in the following manner: All switches (1), (4), (7), set to "Out" position; "Reverb Intensity" Control (2), and all "Volume" Controls (5) and (8), set at "0"; all "Treble" and "Bass" Controls (3) and (6), set in the "flat response" position (indicator ribs at 12:00 o'clock); "On-Off-On" Switch (9) set in the "Off" position; "Hi-Lo" Sensitivity Switch (10) in the "Hi" position.
2. Unwrap the A.C. line cord (12) from the storage spindles (11); plug line cord into an outlet. The VA302-C is designed to operate from outlets supplying 110 to 130 volts, 60 Hz. The VA302E-C is wired at the factory to operate from outlets supplying 220 to 260 volts, 50 to 60 Hz. A simple wiring change allows the VA302E-C to operate on 110 to 130 volts, 50 to 60 Hz. See page 8 for instructions. The VA302E6-C is designed to operate from outlets supplying 100, 120, 140, 200, 220, or 240 volts, 50 to 60 Hz. as selected by an integral voltage-selector switch. See page 8 for instructions.
3. Remove the speaker cables from the storage compartments in the VA300-S Speaker Columns. Insert and lock the right angle phone plug on the cable into either of the two parallel-wired phone jacks; one on each Speaker Column. Connect the other end of each cable to the jacks on the rear panel of the Console marked "Speakers" (17). These plugs are provided with locking rings to lock the plug to the jack. Each speaker cable is 15m (50 ft) in length and is made from heavy duty 2-conductor, #18 gauge unshielded cable. Since each Speaker Column has a pair of parallel-wired input jacks, an alternate speaker hook-up would be to connect a speaker cable from the Console to one Speaker Column and then connect a second cable from this Speaker Column to the second Speaker Column. Either hook-up will provide an 8 ohm load. If longer speaker cables are required, see page 6.
4. Connect one or more low impedance microphones to the Console at the connectors marked "Inputs" (25). The Console is designed to operate with any high quality dynamic or ribbon-type low impedance microphone. For high impedance microphones see page 11.
5. Set all six Input Attenuator Switches (24) on the rear panel of the Console to "Out." These switches should generally be set in the "Out" position when using low impedance dynamic or ribbon microphones. See page 6 for a description of the switch function.
6. Turn on the Power Switch (9) located on the front panel of the Console. Set the "Master Volume" Control (8) to "5." While talking or singing into one of the microphones connected to the console, turn up the individual volume control for that microphone to a normal level. On Consoles with a three-position Power Switch (9), use the "On" position which results in the least amount of hum coming from the speakers.
7. Now turn up the other Individual Channel Volume Controls (5) which are being used. By use of the individual Channel Volume Controls (5), the microphones may be balanced for level so that the sound coming from the speakers is in proper balance for each microphone. Increasing or decreasing the Volume on one channel will have no effect on the other channels of the Console.
8. Note the action of the Individual Treble and Bass Controls (6); these controls are of the dual concentric type, the large knob being the Bass control and the smaller knob being the Treble control. Each of these knobs incorporates an indicating rib. Under average conditions, the controls should be set with indicating ribs facing straight up (12:00 o'clock position) to provide a normal "flat" frequency response. All Treble and Bass Controls on the Console operate in the same manner; turning the controls clockwise respectively increases Bass or Treble, counterclockwise decreases Bass or Treble. Note that changing the Bass or Treble Controls on one channel has no effect on the other channels of the unit.
9. Turn the Reverb Intensity Control (2) to a setting of "4." Set the Master Reverb switch (4) to the "In" position. Reverberation may now be selectively added to any of the six channels by setting the Individual Channel Reverb switches (7) to the "In" position. Note that different settings of the Reverb Intensity Control (2) will not affect the overall system gain. Generally a setting of "1" to "4" of the Reverb Intensity Control (2) is adequate for vocals. The Reverb Treble and Bass Controls (3) operate in the same manner as those of the individual channel Treble and Bass Controls but provide independent tonal balance of the reverberant signal only. These controls do not affect the tone of the individual channels. For example, increasing Treble and decreasing Bass will approximate the reverb sound of a tape-type reverberation unit while decreasing Treble and increasing Bass will approximate the sound of a plate-type reverberation device.
10. Set all four Anti Feedback switches (1) to the "Out" position. These switches can help eliminate feedback. Each switch cuts out part of the critical feedback-generating frequencies. See page 8 for a detailed description on how to effectively use them.
11. The Master Volume Control (8) will raise or lower the volume of all channels simultaneously without affecting the "balance," or "mix." NOTE: With the Console driven at or near full power, pilot lamps will dim or vary in brightness; this is a normal condition.
12. For most applications set the V.U. Meter Sensitivity Switch (10) to the "Hi" position. With an 8-ohm speaker load (two VA300-S), a reading of 0 db indicates 50 watts output. With the Sensitivity Switch set to the "Lo" position, a reading of 0 db indicates 2 watts output. Adjust the volume controls for the desired sound level. Note the meter reading and use it as a visual reference for the desired sound level. For further information on the V.U. Meter, see page 9.

### Input Connections:

Six individual input connectors are provided on the rear panel of the Console. These connectors are professional 3-pin female audio connectors (25). The Console is designed to operate with any high quality dynamic or ribbon-type low impedance microphone.

The main advantage of low impedance microphones is that virtually unlimited cable lengths may be used, whereas high impedance microphones require that cable length not exceed 6m (20 ft).

Low impedance microphones should be wired using low capacitance, two-conductor, shielded cable (such as Belden #8412, #8422). When wiring professional 3-pin audio connectors, the cable shield should be connected to Pin No. 1 and one of the two conductors to Pin No. 2, the other conductor to Pin No. 3. When using several microphones, consistency of cable wiring should be followed to insure that all microphones are "in phase."

To test two microphones and their cables for proper phasing, connect them to the Console. Talk or sing into the two microphones while holding them three or four inches apart. The amplified sound from the speaker column will be the same when talking directly into either microphone or directly between them if they are in phase with each other. If the sound drops drastically, or a dead spot is found when talking between the two microphones, one of them, or their cables, is out of phase.

To change the phase of the one microphone, or cable, interchange the conductors that are wired to Pins No. 2 and No. 3 of the 3-pin connector. Test all the microphones and cables this way to insure that they are all "in phase" with each other.

For high impedance microphones, see page 11.

For additional microphone inputs, connections from electrified musical instruments, and connections to play back a tape, see page 11.

### Input Attenuator Switches:

Six individual input attenuator switches (24) are located above the six input connectors. These screwdriver-slot slide switches allow the microphone input signal to be attenuated (reduced) before entering the preamplifier.

With the switch in the "Out" position, the signal from the microphone is switched directly to the preamplifier of the channel. With the switch in the "In" position, the signal from the microphone is attenuated by 15 db before entering the preamplifier.

This feature may be useful when working the microphones very close to the performer's lips as with "hard rock" vocalists, who may produce signals in excess of the clipping level of the preamplifiers; in such an instance, the attenuator will generally eliminate the distortion which would otherwise occur.

### Output Connections:

Two parallel-wired "Speaker" output connectors are provided on the rear panel of the Console. These connectors are standard phone jacks (17).

Full rated output of the amplifier is obtained when the speaker load is 8 ohms (two VA300-S Speakers). Speaker loads of less than 5.3 ohms (more than three VA300-S Speakers) should not be used with this amplifier. No damage to the speakers or amplifier will occur, but thermal shutoff of the amplifier (overheating) may result.

It should be noted that various speaker loads will affect the output power of the amplifier. See Figure 3, page 7 to determine amplifier output power for the given speaker load.

**WARNING:** Do not interconnect the speaker output jacks or the speaker cables between two Vocal Master Amplifiers or the Vocal Master and any other amplifier. This may result in damage to one or both amplifiers, and is not covered by the Guarantee.

The Vocal Master does not use speaker output matching transformers and thus avoids the distortion, power loss and added weight inherent in such transformers. The speaker output voltage is 28.3 volts, to an 8-ohm load, for 100 watts. This allows long speaker lines with wiring practices consistent with those used for 25-volt speaker lines.

Up to 30m (100 ft) of #18 gauge two-conductor cable (such as Belden #8452, 8478, 8460, or 8461) may be used to connect from the Console to each 16-ohm (VA300-S) speaker. Greater cable lengths require heavier gauge wire to avoid appreciable power loss in the speaker cable. For 30 to 51m (100 to 170 ft), use #16 gauge; 51 to 81m (170 to 270 ft), use #14 gauge; and 81 to 128m (270 to 425 ft), use #12 gauge wire. To maximize the power to each speaker, a separate cable should be used to connect each speaker to the Console.

### Speakers:

Selection of speakers for use in a vocal music system is most critical. The factors which most significantly contribute to an outstanding vocal speaker system are correct frequency range, distortion-free reproduction, and enough sound power to fully penetrate the audience area.

The Shure VA300-S Speaker Column has been designed to provide all of these features. It is recommended that VA300-S Speaker Columns be used in pairs, each column having a nominal impedance of 16 ohms, which provides an impedance of 8 ohms when two are used. Each column utilizes two special 10-inch speakers and four special 8-inch speakers, and has a total speaker cone area of 2,310 cm<sup>2</sup> (358 in<sup>2</sup>) per column. The VA300-S Speaker Column delivers virtually uniform penetrating power over a 140° angle in the horizontal plane and a 65° angle in the vertical plane. The rear-ported enclosure of the VA300-S contributes to its highly directional pattern, which is critical in achieving maximum audience penetration and reduction of feedback.

The Shure VA301-S Speaker Column is intended primarily for use as an "on-stage monitor." While this speaker meets all of the criteria for an excellent vocal system speaker, its area of coverage is more localized than that of the VA300-S. The nominal impedance of the VA301-S is 32 ohms, so that when used in conjunction with two VA300-S Speaker Columns, the total system impedance becomes 6.4 ohms. An integral volume control on the VA301-S permits its use on-stage as a monitor at the highest possible sound level without feedback.

The following list shows various speaker combinations and the resultant impedance loads which are suitable for use with the Vocal Master Console:

| QUANTITY and<br>SPEAKER MODEL | IMPEDANCE<br>OHMS (NOMINAL) |
|-------------------------------|-----------------------------|
| 1 VA300-S                     | 16                          |
| 2 VA300-S                     | 8                           |
| 3 VA300-S                     | 5.3                         |
| 1 VA301-S                     | 32                          |
| 2 VA301-S                     | 16                          |
| 3 VA301-S                     | 10.6                        |
| 4 VA301-S                     | 8                           |
| 5 VA301-S                     | 6.4                         |
| 6 VA301-S                     | 5.3                         |
| 1 VA300-S and 1 VA301-S       | 10.6                        |
| 1 VA300-S and 2 VA301-S       | 8                           |
| 1 VA300-S and 3 VA301-S       | 6.4                         |
| 1 VA300-S and 4 VA301-S       | 5.3                         |
| 2 VA300-S and 1 VA301-S       | 6.4                         |
| 2 VA300-S and 2 VA301-S       | 5.3                         |

If additional speakers (more than in the table above) are required, use a Shure Power Master Amplifier to drive the extra speakers. See page 12 for instructions.

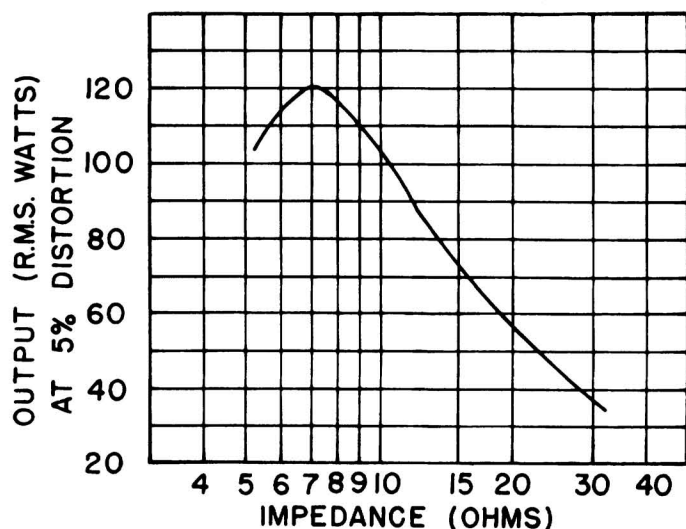


FIGURE 3. Typical output power vs. speaker load impedance for the Vocal Master Console.

#### Column Speaker Placement:

It must always be kept in mind that every room or space is acoustically unique and there are no set "rules" for speaker placement. A number of generalizations however may be made which will at least provide a good starting point under various conditions.

Always consider speaker placement in relation to microphone placement. It is desirable for the loudspeakers and microphones to be in close proximity in order to provide the illusion of source-oriented sound. Source-oriented sound, ideally, should provide the listener with the illusion that all of the sound is coming directly from the sound source, the stage or performance area. It is also desirable to keep loudspeakers and microphones separated in order to achieve a high threshold of acoustic feedback. While these statements are contradictory, a good solution to both can generally be accomplished.

When the VA300-S Speaker Columns are used on stage, as they most often are with a portable system, the speakers should be placed at the sides of the stage and as far forward as possible. With this setup, the entire stage area will be relatively free from acoustic feedback; also the illusion of sound coming from the center of the stage will be quite good except for the first few forward rows of seats.

The Shure VA300-S Speaker Column has been designed with rear ports to give the column a bidirectional horizontal polar pattern below 200 Hz. This design feature was decided upon in order to reduce low frequency acoustic feedback and provide a relatively "dead" area at the sides of the column with the result that microphones may be placed there with minimal feedback problems at low frequencies.

Try to keep the speaker columns above the heads of the audience. The easiest way to do this is put the speaker columns on the stage. If the stage is only a foot or two high, raise the speaker columns up by placing them on a solid platform or box.

Keeping in mind that the speaker columns have a narrow coverage angle in the vertical plane and a broad coverage angle in the horizontal plane, here are a few generalizations on speaker requirements for various room shapes.

A deep, narrow auditorium would generally require only two speakers if the seating is all on one level. If balconies were added to this same room, additional speaker columns would be required to aim sound up into them.

A shallow, broad room might require four speakers to be utilized in order to cover the extreme horizontal expanse. Again if balconies were added, four more speakers might be required to expand the vertical coverage.

The "Theatre-in-the-Round" will almost always necessitate the use of at least four columns. More speakers might be required to provide adequate horizontal coverage if the theatre is very deep.

To "aim" speakers up for effective coverage of a balcony, use the Shure Model A3S-S or A3S-T Speaker Stand. The A3S-S stand will provide added stability and approximately 15° of tilt. The A3S-T stand provides adjustable tilt of up to 30°. In an emergency, a spare microphone stand can be used to hold up a tilted speaker column. Adjust the height of the microphone stand to one or two inches less than the height of the top edge of the upper rear port on the back of the speaker. Tilt the speaker back until the top edge of the upper rear port rests on the top of the microphone stand. Changing the height of the microphone stand adjusts the amount of tilt on the speaker.

The VA300-S Speaker Column may be used on its side, though this reduces the horizontal coverage and the penetrating power. In a low ceiling, small intimate room such as a night club, horizontal mounting, at or near the ceiling level may be very successful. An alternate solution for this type of small room is to use VA301-S Monitor Speakers. It is not recommended that the VA300-S Speaker Column be used on its side in larger rooms.

It is not possible to adequately cover all phases of speaker placement in all types of rooms in this manual. Just remember that every room is acoustically different from any other and therefore speaker placement will vary from room to room.

Good speaker placement will provide the audience with even distribution of sound intensity, sound which is free from excessive reverberation and echoes, and the illusion of sound emanating from the real source.

### VA302 Power Requirements:

The VA302-C Vocal Master is furnished with a three-conductor power cable and three-prong plug. Connect the power cable to an outlet which supplies  $120 \pm 10\%$  volts A.C., 60 Hz power. The three-position toggle switch on the front panel controls power to the amplifier. This switch (9) is also used to reverse line polarity for minimum hum. If extension cords are required to supply power to the VA302, a high quality #18 gauge or larger cord should be used.

### VA302E Power Requirements:

The VA302E-C Vocal Master is furnished with a three-conductor power cable without a plug. To connect a plug to the power cable, attach the brown lead to the live (+) terminal of the plug, attach the blue lead to the neutral (—) terminal of the plug, and attach the green-yellow lead to the earth-ground terminal of the plug.

The VA302E-C is factory wired for operation from a nominal 240 volt power supply. Connect the power cable to an outlet which supplies  $240 \pm 10\%$  volts A.C., 50 to 60 Hz power. The three-position toggle switch on the front panel controls power to the amplifier. This switch (9) is also used to reverse line polarity for minimum hum. If extension cords are required to supply power to the VA302E, a high quality cable with conductors of 0.75 square millimeters cross-section or larger should be used.

An internal modification performed by *competent personnel* will allow the VA302E to be used with 120 volt, 50 to 60 Hz power. To change the power supply wiring for 120 volt operation, do the following:

1. UNPLUG THE AMPLIFIER POWER (MAINS) CABLE.
2. Remove the amplifier from its carrying case as described on page 14.
3. With the amplifier upside-down, note the six wires from the power transformer T1.
4. Unsolder the yellow-black transformer lead wire and the red-black transformer lead wire from their solder-lug.
5. Resolder the yellow-black lead wire to the solder-lug to which the all-black transformer lead wire is already attached.
6. Resolder the red-black lead wire to the solder-lug to which the green-black transformer lead wire is already attached.
7. Reinstall the amplifier in its carrying case.
8. Remove the four screws from the nameplate on the back of the amplifier. Turn the nameplate over and re-install. The nameplate nomenclature will now be suitable for 120 volt use.

To change the VA302E back for use with 240 volt power, reverse the above steps. Be careful to reconnect the yellow-black and red-black transformer lead wires to an UNUSED-UNGROUNDING solder-lug. A pictorial diagram of the transformer lead wire connections is located on the inside of the chassis. The circuit diagram for both 120 volt and 240 volt operation is shown on page 22 of this manual.

### VA302E6 Power Requirements:

The VA302E6-C Vocal Master is supplied with a detachable three-conductor A.C. power (mains) cable without a connector on the "mains" end. To attach a connector, con-

nect the brown conductor of the cable to the "live" terminal of the connector, the blue conductor to the "neutral" terminal, and the green-yellow conductor to the "earth" ( $\perp$ ) terminal.

The VA302E6-C is designed to operate from 100, 120, 140, 200, 220, or 240 volts, 50 to 60 Hertz power (mains). An integral voltage-selector switch, located on the rear panel, allows selection of the proper voltage.

As shipped from the factory, the VA302E6-C is set to operate from 240 volts.

The A.C. fuseholder, located nearest the voltage-selector switch, contains a 1.6 ampere slow-blow fuse (1.6 AT) which should be used when the unit is operated from 200 through 240 volts. When operated from 100 through 140 volts, this fuse should be changed to a 3 ampere slow-blow type (3.0 AT). The fuseholder located farthest from the voltage-selector switch contains a 5 ampere (5.0 A) fuse which should not be replaced by other values under any circumstances. Each of the three fuses mentioned is a 5mm x 20mm type, and two of each value are supplied with the unit.

**CAUTION** — DO NOT CHANGE VOLTAGE-SELECTOR SWITCH SETTING OR ATTEMPT TO REPLACE FUSES WITHOUT FIRST DISCONNECTING THE A.C. POWER (MAINS) CABLE.

### Thermal Overload/Ventilation:

The Console is equipped with thermal sensing switches on the heat-sinks of the output transistors. The thermal switches are set to shut off AC power to the amplifier when a temperature of 90°C. (194°F.) is attained on the heat-sinks; the switches will automatically recycle and return AC power when the heat-sink temperature reduces to 73°C. (164°F.). A thermal overload light (15), located on the rear panel, will indicate if thermal cycling has occurred. Thermal cycling may occur if air is not allowed to circulate through the grilles of the amplifier, if there is a prolonged short-circuit on the speaker output, or if the ambient temperature exceeds 43°C. (110°F.) while the console is operating at or near full power. Thermal cycling may also occur if the speaker load impedance is less than 5.3 ohms. See page 6, *Output Connections*, for instructions on speaker connections.

### Anti Feedback Switches:

Acoustic feedback (a howl or squeal in the speakers) may occur, depending on room acoustics and the physical placement of microphones in relation to the speakers, when volume is increased or when Bass or Treble controls are boosted. To minimize feedback, four Anti Feedback switches (1) are incorporated in the Console. These switches operate four "notch filters" which modify the frequency response of the unit. Each switch controls part of the audio spectrum. The top switch (A-yellow colored) filters the highest feedback pitch (squeal), while the bottom switch (D-deep orange colored) filters the lowest feedback pitch (howl). The middle switches (B and C) filter the middle feedback pitches. The action of each filter, with the exception of the (D) filter, has very little effect on the tonal quality of the voice. When using the (D) filter, a decrease in Bass tones may be noticed. To compensate for this simply increase all the individual Channel Bass controls slightly for the desired sound. This feedback switch (D) may be used in a very "boomy" environment to eliminate some of the low frequency room reverberation.

If feedback occurs, locate the one Anti Feedback switch (1) which eliminates the feedback. Gain may then be increased or tone control increased until another feedback pitch is apparent. One of the other filters may then be introduced which will eliminate that feedback. **IMPORTANT: no more than two filters should be used simultaneously; the effect of more than two filters is one of reducing overall gain and the overall tonal quality of the system may be significantly affected.**

### Mixing:

Each of the six channels employ an individual Volume control, Bass control, Treble control, and reverberation selector switch.

Individual Volume controls permit proper mixing of the various inputs.

The Bass control allows 13 db of boost or attenuation at 100 Hz. It permits enhancement of a thin voice and is often useful as a low frequency attenuator in "boomy" rooms.

The Treble control permits 10 db of boost or attenuation at 10 KHz, and is useful to "brighten" an otherwise flat-sounding voice. It is often used to great advantage to reduce high frequency acoustic reverberation in reflective rooms.

The Master Volume control (8) adjusts the output level of the total mixed output, allowing simultaneous increase or decrease of all channels without affecting the mix of the inputs.

### Reverb:

The Vocal Master Console includes a built-in electro-mechanical spring-type reverberation device utilizing a total of four coil springs in two transmission paths. Reverberation is accomplished by driving the input ends of the springs in a torsional mode and transferring the torsional movement at the other end of the springs back into an electrical signal which exhibits time delay with a long decay time. Since the reverberation device is an electro-mechanical device, it is sensitive to mechanical shock. It is recommended that if the console is moved while operating, the Master Reverb In-Out switch (4) be set to the "Out" position. This will avoid the possibility of jarring the springs and producing unwanted sounds.

Unique to the Vocal Master is the fact that no matter how much reverberation is used, there is always a backbone of "dry" signal on the total output. Of great importance to the user, and also unique to the Vocal Master, is the system which permits the reverb intensity to be increased without increasing overall gain. In most units which employ artificial reverberation, as the intensity of the reverberant signal is increased, the total gain also increases; this usually leads to acoustic feedback. The reverb mixing system used in the Vocal Master reduces the "dry" signal as the reverberant signal is increased; this accounts for an almost constant gain and reduces the possibility of feedback as reverb is added.

Three controls are pertinent to the Vocal Master Reverb operation. The amount of reverb is selected by the Reverb Intensity control (2). Generally, this control is not used above a setting of "5" for vocalists, though higher settings may be required for instruments. Separate Reverb Bass and Treble controls (3) are provided for the reverb signal only and are independent of the other tone controls on the unit. These controls modify the reverberant signals in es-

entially the same way the individual channel tone controls modify the non-reverb, or "dry" tones. The reverb tone controls allow the user to change the reverberant sound to compensate for the reverberation of each room in which the system is used. In a "boomy" sounding room, decrease the Reverb Bass control or increase the Reverb Treble control, or do both to equalize the reverb signals for the desired sound.

The individual channel reverb In-Out switches (7) are basically intended to allow the user the option of having reverb on one or more channels while retaining a "dry" (non-reverb) signal on the other channels. These switches can also be used to perform a variety of other functions which are described under *Special Operating Instructions*.

The Master Reverb In-Out switch allows instantaneous reverb turn-on or shut-off, no matter how the individual channel reverb selector switches are set. This feature allows the user to "pre-program" the console for reverberation.

A phone jack marked "Reverb Switch" (16) is located on the rear panel of the console. This jack parallels the Master Reverb "In-Out" switch (4) and allows the reverb to be remotely turned on and off when the Master Reverb switch is in the "In" position. The Master Reverb switch will always override the remote switch and turn off the reverb, so care should be taken to insure that the Master Reverb switch is in the "In" position if an external remote switch is desired to control the reverb switching. If an external remote switch is used, and is in the "Off" position, the Master Reverb "In-Out" switch cannot override it and activate the reverb.

Since the remote switching is D.C., and no audio appears on this jack, any length of unshielded cable can be used between the Console and the remote switch without hum or noise. The remote switch can be any single pole, single throw switch.

### VU Meter:

The VU Meter measures the voltage on the "Speaker" jacks and, with a given speaker load, indicates the Console output power to that load. A 3 db increase indicates a doubling of output power, while a 3 db decrease halves output power. The VU Meter Sensitivity Switch increases the sensitivity of the VU Meter by 14 db when set to the "Lo" position. With the Sensitivity Switch in the "Lo" position "0" VU on the meter corresponds to 4 volts on the "Speaker" jack, which is 2 watts with an 8-ohm load (two VA300-S Speakers). In the "Hi" position "0" VU corresponds to 20 volts on the "Speaker" jack, which is 50 watts with an 8-ohm load.

With an 8-ohm speaker load (two VA300-S) zero VU is 50 watts. Output power for other VU readings is shown in the table below.

#### SENSITIVITY SWITCH IN "HI" POSITION

| VU  | Power to 8-ohm load |
|-----|---------------------|
| +3  | 100 watts           |
| 0   | 50 watts            |
| -3  | 25 watts            |
| -7  | 10 watts            |
| -10 | 5 watts             |

#### SENSITIVITY SWITCH IN "LO" POSITION

| VU  | Power to 8-ohm load |
|-----|---------------------|
| +3  | 4 watts             |
| 0   | 2 watts             |
| -3  | 1 watt              |
| -7  | 0.4 watts           |
| -10 | 0.2 watts           |

It should be noted that operation of the Console with the meter reading into the red portion of the scale does *not* indicate any type of overload. "Pinning" the meter, while not a good practice, will not damage it. If the Console is operated without a speaker load (nothing plugged into the "Speaker" jacks) the VU meter readings are meaningless because the Console is delivering zero power. Just disregard the meter readings if the Console is operated in this manner.

#### Auxiliary Hi-Level Output:

A phone jack on the rear panel marked "Aux. Hi-Level Output" is provided for connections to tape recorders for making recordings, or to additional power amplifiers, such as the Shure Power Master PM300 Series. For specific instructions for such connections, see the section marked *Special Operating Instructions*.

The signal at this jack is the same signal that drives the console power amplifier and is considered to be an auxiliary, high impedance output for driving high-level, high-impedance inputs. Note that all the Console controls, Master Volume, Anti Feedback, Reverb, etc., affect this signal.

The interconnecting cable used with this jack should be a low capacitance, single conductor, shielded cable (such as Belden #8401, #8410, #8411).

Limit the cable length to 15m (50 ft) to avoid loss of high frequency signal and to reduce the possibility of hum pickup.

#### Microphone Level Output:

A microphone level output connector is provided on the rear panel of the Console. This connector is a professional three-pin male audio connector (20). A "Lo Z-Hi Z" impedance selector switch (19) is located above the output connector. This screwdriver-slot, slide switch selects the

impedance of the microphone output. The signal at this connector is the same signal (but at mic. level) that drives the Console power amplifier and is designed to work into an amplifier or tape recorder microphone input. This output is useful for providing a signal feed to a house P.A. system for coverage in other rooms, or for low level fill in difficult coverage areas of irregularly shaped rooms.

With the "Lo Z-Hi Z" switch in the "Lo Z" position the microphone output connector is switched to a balanced low impedance transformer; connector Pins 2 and 3 are "hot" and Pin 1 is "ground." With the switch in the "Hi Z" position the connector is switched to provide a high impedance output; connector Pin 3 is "hot" and Pin 1 is "ground." See figure 4.

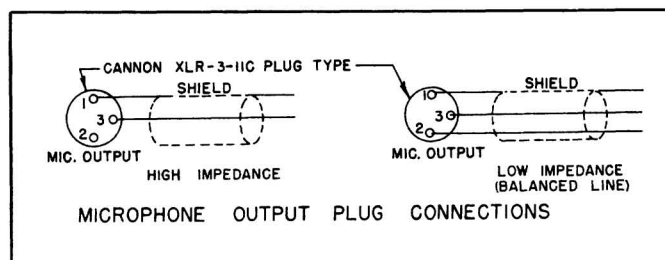


FIGURE 4. Microphone Output Plug Connections.

If the low impedance output is to be used with an unbalanced input, such as an input that uses a phone plug or other connector with only two connections, connect Pins 1 and 2 of the Console microphone output connector together. Use this as the "ground" and connect Pin 3 as the "hot."

It should be noted that the signal at this connector is "out-of-phase" with the Microphone Inputs. See page 6, *Input Connections*, for information on phasing.

## VA302 Series Vocal Master SPECIAL OPERATING INSTRUCTIONS

#### Echo:

Echo may be introduced into the Console by using an accessory echo device (such as an Echolette or Dynacord).

To use an external echo device in conjunction with the Console, interconnect the two units as follows: attach low capacitance, single conductor, shielded cable to the Console jack marked Echo "To Input." Connect the opposite end of this cable to the echo device jack marked "Input" (Aux. High Level). Connect a similar cable to the echo device jack marked "Output" (Aux. High Level) and connect the opposite end of this cable to the Console jack marked Echo "To Output."

Using the "Echo Gain" Control in conjunction with the level controls on the echo unit, the echo signal may be balanced with the gain of the Console so there is no change in level when the individual Reverb In-Out switches are operated.

When connected in the manner described, the individual channel Reverb In-Out switches will offer selective echo in addition to selective internal reverb. With the Master Reverb In-Out switch in the "Out" position, the individual

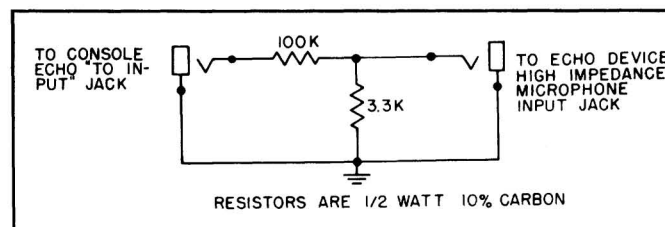


FIGURE 5.

channel Reverb switches will select "dry" (no echo) in the "In" position and "Echo" in the "Out" position.

Changing the Master Reverb In-Out switch to the "In" position will permit selection of echo (individual channel Reverb switch "Out") or reverb (individual channel Reverb switch "In").

The output signal of the Console at the jack marked Echo "To Output" is considered high level and is suitable for use with loads of 10 kilohms or greater. The jack marked Echo "To Input" presents a 40 kilohm load to the source and will accept high level signals. Some echo units employ inputs suitable only for very low level; in such cases, a

resistance pad (attenuator) will be required in the line from the Console to the echo device input. If the echo device input is suitable for only high impedance microphones a resistive pad consisting of a 100 kilohm and a 3.3 kilohm resistor is required. (See figure 5.) Almost all makes of echo units use different output levels; these may generally be compensated for by use of the gain controls on the echo unit and the "Echo Gain" control on the Console.

#### Tape Recording:

Tape recordings of the Vocal Master output can be made from either the "Microphone Level Output" or the "Auxiliary Hi-Level Output" on the Console. To use the "Microphone Level Output" connect a cable from the Console to the Microphone Input on the tape recorder. Set the Console "Lo Z-Hi Z" impedance selector switch to match the impedance of microphones normally used with the tape recorder. Use the "Lo Z" position for microphones up to 1000 ohms, and the "Hi Z" position for microphones 1000 ohms or greater impedance.

See the section on *Microphone Level Output* for wiring instructions.

To use the "Auxiliary Hi-Level Output" on the Console, connect a cable to the Auxiliary Hi-Level Input on the tape recorder. See the section on *Auxiliary Hi-Level Output*, page 10, for cable length and type. For stereo tape recordings see page 13, *Stereo Operation*.

#### Playing Tapes:

To play back tape recorded material through the Console, connect a cable from the tape recorder's High Level Output to the Echo "To Output" jack on the Console. Adjust the Echo "Gain" control, the "Master Volume" control, and the tape recorder playback level control for the desired volume. Note that those Input Channels on the Console that are switched to Individual Reverb "Out" are now turned off. See the section on *Microphone Cuing* on page 13.

Limit the cable length connected to this jack to 50 feet of low capacitance, single conductor, shielded cable (such as Belden #8401, #8410, #8411) to avoid loss of high frequency signal and to reduce the hum pickup.

An alternate method is to connect the high-level output of the tape recorder to a three-pin professional plug ("hot" lead to pin 3, shield to pin 1), and connect the plug to a Shure Model A15LA Line Input Attenuator. With the A15LA connected to a Console microphone input, 50 dB of attenuation is provided at that input.

Still another method is to use a Shure A95 Series Line Matching Transformer, with the auxiliary high-level tape recorder output attached to the high-impedance end and the low-impedance end attached to the Console microphone input. The Console Attenuator switch should be in the "In" position. NOTE: It may be necessary to add a Shure A15A Attenuator to provide an additional 15 dB of attenuation.

#### Musical Instruments:

Most electrified musical instruments may be amplified through the Vocal Master with great effectiveness. Place a microphone in front of acoustical, nonelectrified instruments, or in front of the instrument loudspeakers to "mike" an instrument. As an alternate direct connections may be used for instruments with a "pickup" or preamplifier output (such as a guitar or keyboard instrument). Connections are the same as for high impedance microphones, see page 11.

When the instruments play very loud, signals in excess of the Console preamplifier clipping level may be encountered, and produce distortion. Should this occur, switch the input attenuator on that channel to the "In" position

and adjust the channel volume control for the desired level. See *Input Attenuator Switches*, page 6.

#### High Impedance Microphones:

High impedance microphones may be used with the Console by adding accessory matching transformers (Shure A95 Series) to the Inputs.

The Shure Model A95U Line Matching Transformer is terminated at the low impedance end with a professional three-pin male audio connector for direct connection\* to the Console Inputs. The high impedance end of A95U Transformer is supplied with an adapter to accept phone plugs. Limit the high impedance cable length to 6m (20 ft) to avoid loss of high frequency signal. If a longer cable is required use approximately 3m (10 ft) of high impedance cable between the microphone and the matching transformer, and add as much cable as is required between the transformer and the Console Input.

#### Additional Inputs Using A Mixer:

If additional microphone inputs are required, a microphone mixer (such as a Shure M68 type) or a second Vocal Master Console may be used.

When using a microphone mixer for the additional inputs, connect the mixer Lo Impedance Mic. Output to one of the Input connectors on the Console. The individual input control on the channel, bass, treble, volume, and reverb, provide master control over the mixer inputs. See Figure 6.

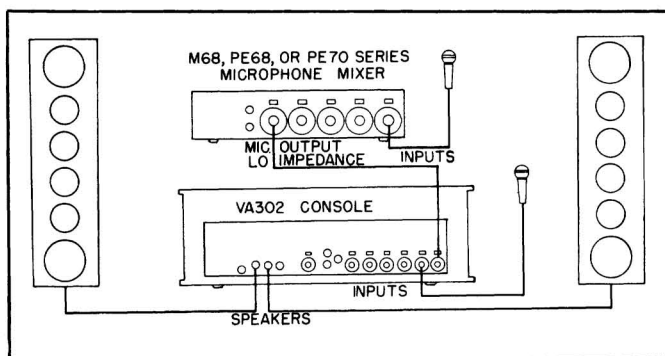


FIGURE 6.

When reverb and external echo are not required, the mixer may be connected to the Echo "To Output" jack. With this arrangement the mixer Aux. High Level Output is connected to the Console Echo "To Output" jack. See Figure 7.

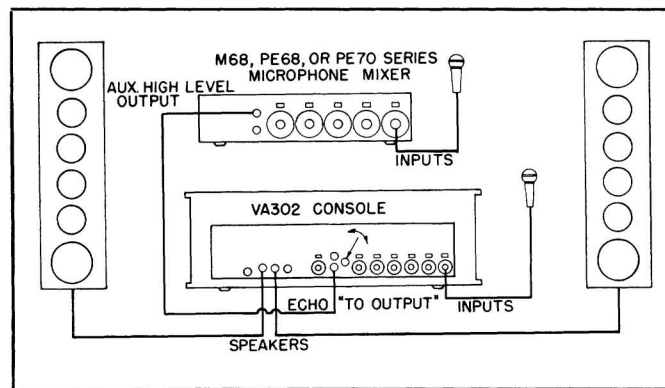


FIGURE 7.

\*Current A95 Line Matching Transformers have a smaller diameter low impedance end for direct plug-in connections to the "Inputs." When using older A95A Line Matching Transformers connect a cable between the transformer and the Console "Input."

Adjust the Echo Gain control and the mixer volume controls to match the gain of the Console inputs. With the mixer connected in this configuration the individual Reverb In-Out switches on the Console should be set to the "In" position. When these switches are set to the "Out" position, that individual channel will be muted, or "cued." See the description on "*cuing*." Still more inputs may be added by stacking additional mixers onto the first mixer. See the Mixer Operation Instructions.

#### Additional Inputs Using a Second Console:

A second Console may be used as a mixer to provide additional inputs.

Connect an accessory line matching transformer, Shure Model A95U, to the Echo "To Input" jack on the second Console. Connect a cable from the low impedance end of the transformer to an Input on the original Console and set the Input Attenuator on that input to the "In" position. See Figure 8.

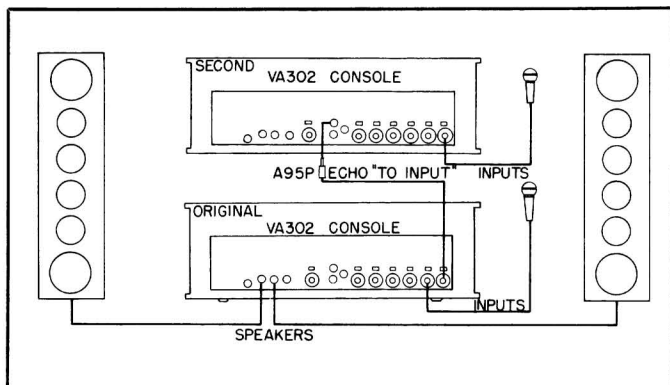


FIGURE 8.

At this point it should be noted that the microphones on the original Console are out of phase with those on the second Console. If the microphone pickups for the two Consoles are different sources, for instance the original Console is a vocal pickup and the second an instrumental pickup, this is not a problem.

For further information on Phasing see the section on *Input Attenuator Switches* on page 6.

With this arrangement, the power amplifier section on the second Console is not being used. If additional power and coverage are required, this power amplifier section may also be used. See the section on additional power using a second Console, Figure 10.

If it is necessary to use two Consoles on a permanent basis a factory authorized COMMON MIX. BUS MODIFICATION is available. Contact your Shure Dealer or the Shure Factory for further information on this.

#### Additional Power or Area Coverage:

In those applications which require more power than one Vocal Master system is able to deliver, such as very large auditoriums and stadiums, and in those installations where the audience is so widespread, such as Theatre-in-the-Round and for coverage in adjoining rooms or when more than three speaker columns are required, it is advisable to

use a PM300 Series Power Master amplifier and additional Speaker Columns. Generally two Speaker Columns should be connected to each amplifier. See Figure 9.

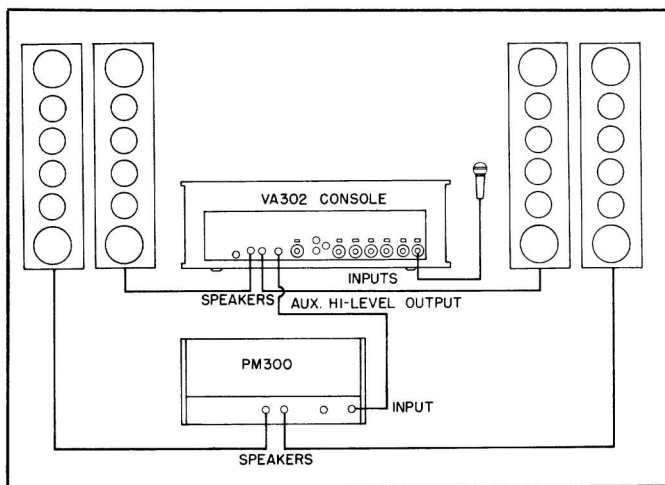


FIGURE 9.

To use the Power Master Amplifier, connect a cable from the Console jack marked "Aux. Hi-Level Output" to an input on the Power Master Amplifier. The cable used should be limited to 15m (50 ft) of low capacitance, single conductor, shielded type (such as Belden #8401, #8410, #8411).

Set the Volume Control on the Power Master to "7" to obtain the same amplification level from both the Console and the Power Master when identical speaker loads are employed on each amplifier. The output of the Power Master will "follow" all control settings of the Console. Additional Power Master Amplifiers may be added to the system by connecting a cable from the unused input jack on the last Power Master to one of the input jacks on the next Power Master. See Figure 9. NOTE: The unused input jack on the last Power Master in the "chain" can then be used for tape recording. See the Special Operating Instructions on *Tape Recording*.

To use a second Console in place of a Power Master to obtain additional power, connect a cable from the original Console jack marked "Aux. Hi-Level Output" to the jack marked Echo "To Output" on the second Console. See Figure 10.

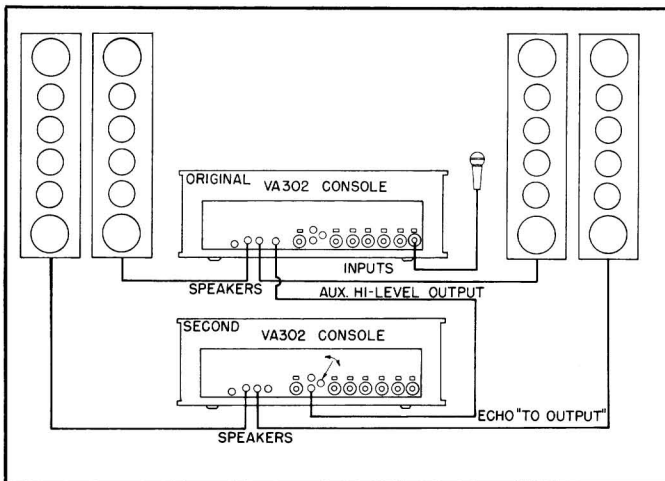


FIGURE 10.

Set the controls on the second Console as follows: Anti Feedback Switches to "Out," Master Reverb Switch "Out," Individual Volume Controls to "O," and the Master Volume to "5." Adjust the Echo "Gain" Control to approximately 1/3 rotation from the c.c.w. off position, and use this control as a volume control to obtain the same amplification level from both of the Consoles. Once the Echo "Gain" Control is preset, the output of the second Console will "follow" all control settings of the original Console. Small changes in amplification level on the second Console can be made by adjusting its Master Volume Control.

An additional Console, PM300 or tape recorder can be connected to the "Aux. Hi-Level Output" jack on the second Console.

#### **Microphone Cuing:**

Microphone "cuing" may be preset by using the individual Reverb "In-Out" switches to reduce the volume of, or turn off an unused individual microphone channel. This is useful when it is desired to preset the individual volume controls but only have one or two microphones "live" at a time. This allows tighter control of feedback, or additional control to avoid pickup from off-stage microphones.

Insert an unwired phone plug into the Echo "To Output" Jack. With the individual Reverb switch in the "In" position, the channel will operate normally. In the "Out" position, the channel level is reduced or turned off. The level of the "Out" or "Cued" channel is controlled by the "Echo Gain" control; turning this control fully counterclockwise turns off the "Cued" channel. Returning the individual Reverb "In-Out" switches to "In" restores the channel to the normal level.

For remote "Cuing" on and off, plug a foot switch into the Echo "To Output" Jack on the Console. Turn the "Echo Gain" control fully clockwise. With the foot switch in the "On" position, the channels will operate normally. With the foot switch "Off" those channels switched to individual Reverb "Out" are turned completely off. This is useful for remotely turning on and off preselected channels (Microphones). The cable used with the foot switch should be limited to 15m (50 ft) of low capacitance, single conductor,

shielded type (such as Belden #8401, #8410, #8411) to avoid high frequency signal loss and to reduce the possibility of hum pickup in the cables.

#### **Stereo Operation:\***

Stereo operation may obviously be obtained by using two Vocal Master systems without any interconnections. If it is desired to have one of the microphones connected to both systems, simply use a "Y" connector on that microphone and feed its signal to one Input on each Console. For making stereo tapes, the "Aux. Hi-Level Output" jacks, one on each Console, may now be connected to the left and right Auxiliary Inputs, respectively, on a stereo tape recorder.

Alternatively, stereo may be accomplished by using one system and one Power Master with additional speakers. A connection is made from the Console jack marked Echo "To Input" to an input of the Power Master. Those input channels of the Console which are to be reproduced through the Console speakers will require that the individual channel Reverb "In-Out" switches be in the "In" position. The channels on which the switches are in the "Out" position will be heard at the speakers connected to the Power Master. This may be used for a special echo effect, like "throwing" a voice from the rear of the room.

Stereo recordings may also be made using one Vocal Master Console and one Power Master. One channel of the stereo tape recorder would be fed from the Console jack marked "Aux. Hi-Level Output," the other channel would be fed from the open input jack of the Power Master. NOTE: Reverberation can be added to only those channels that are being reproduced by the speakers connected to the Vocal Master Console.

A very convenient way of recording with a stereo tape recorder is to record the vocals on one tape channel and the instruments on the other tape channel. Connect the Console "Microphone Level Output" or the "Aux. Hi-Level Output" to the right channel of the tape recorder; see page 11 *Tape Recording*. A separate microphone is connected to the left channel microphone input of the tape recorder; an omni-directional microphone suspended from the ceiling is recommended.

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\*As a general rule stereo sound reinforcement of this type is quite distracting to listen to and is recommended only for special effects.



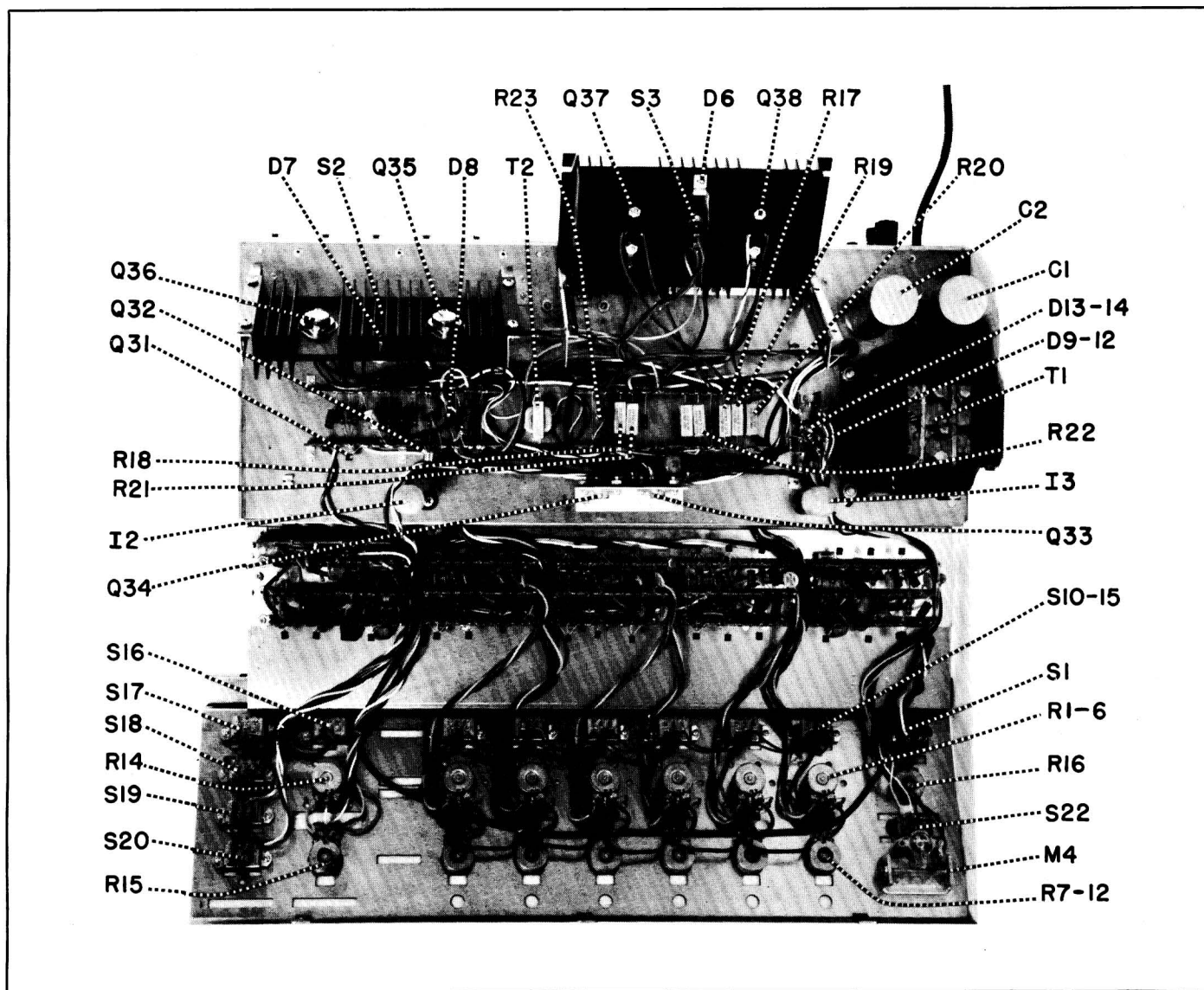


FIGURE 12.

#### Driver Transistors:

The driver transistors Q33 and Q34, Figure 12, Page 15, are located on the amplifier chassis. Before removing these transistors, write down the lead color and location at each transistor solder junction. If replacing transistors, apply type 120 Wakefield thermal joint compound to each side of the insulation wafer to provide good thermal transfer from transistor to chassis. After replacement and before connecting transistor leads, check transistors with an ohmmeter between case and chassis; there should be no continuity. Be sure that these transistors are not inverted in the circuit; they are not identical devices. Q33 is an NPN transistor, while Q34 is PNP transistor. Refer to the lower right corner of the circuit diagram, Figure 17, Page 21 for terminal code. NOTE: when replacing driver transistors, perform the following modification (if not already performed): solder a 3.3k, ½W resistor across the terminals to which the white and black leads of transformer T2 are connected. Add a second ground wire from the terminal

nearest the front of the unit to which resistor R21 is connected, through the chassis grommet, to the ground on the Speaker Output jacks (same path as existing wire).

#### Output Transistors:

The output transistors Q35 through Q38, Figure 12, Page 15, are located on the black finned heat sinks. Replacement procedure is the same for the driver transistors, Q33 and Q34.

NOTE: The output transistors, Q35 through Q38, must be matched for *current gain* and part number. When replacing output transistors be sure to replace with devices which have the same gain code as the original transistors. Shure transistors are coded either by the last letter in the part number or a color-dot on the top of the transistor.

|                |                |
|----------------|----------------|
| Blue Dot = A   | Brown Dot = F  |
| Red Dot = B    | Pink Dot = G   |
| Orange Dot = C | Violet Dot = H |
| Yellow Dot = D | Black Dot = J  |
| Green Dot = E  | White Dot = K  |

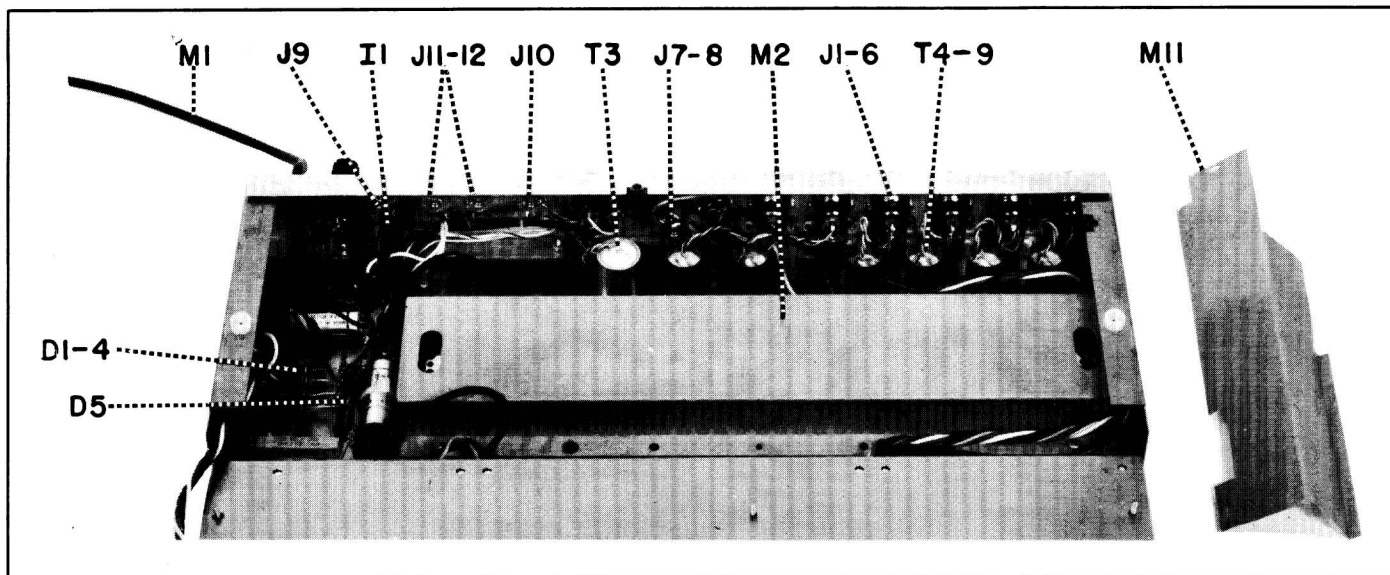


FIGURE 13.

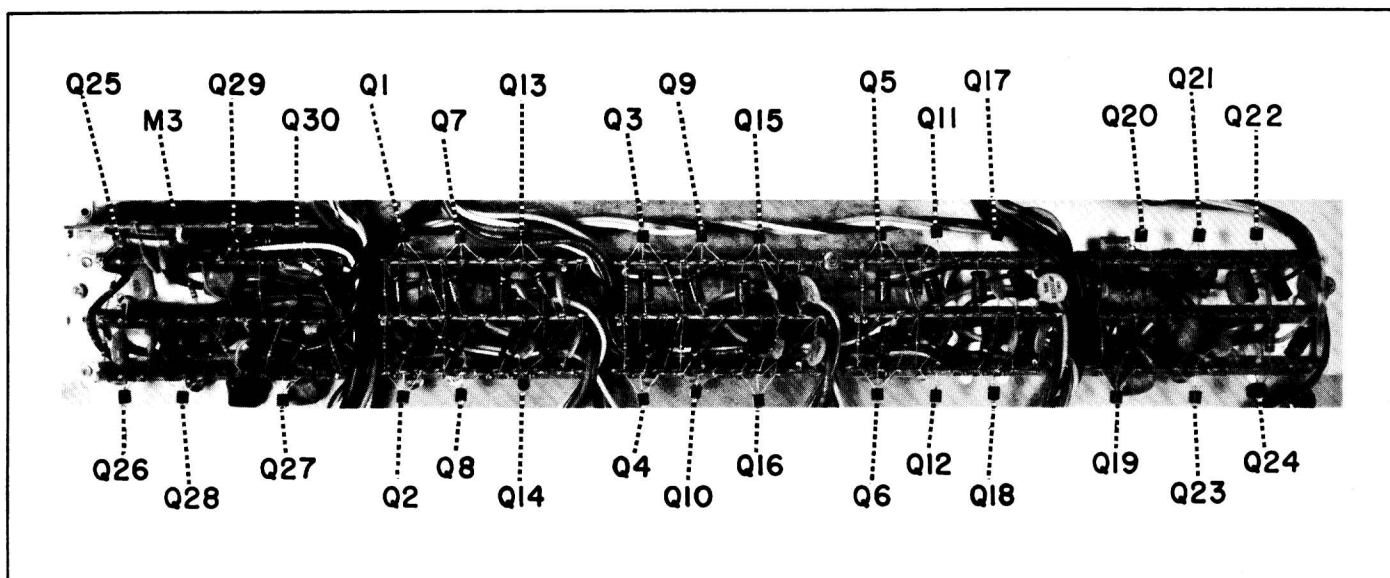


FIGURE 14.

#### Small Signal and Predriver Transistors:

Transistors Q1 through Q30, Figure 14, Page 16, and Q31 and Q32, Figure 12, Page 15, are mechanically supported by their leads. When replacing these transistors, it is imperative that proper lead configuration be followed. A minimum of soldering heat should be used to avoid damage to the transistor. Refer to the lower right corner of the circuit diagram, Figure 17, Page 21, for lead code.

#### Diodes:

Diodes D6 and D7, see Figure 12, Page 15, are located on the black finned heat sink with the output transistors. Special care is required to insulate these diodes from the heat sink while providing good thermal transfer from sink to diode. Heat shrinkable tubing or "spaghetti" should be placed over the diode and connecting leads; the diode should be securely clamped to the heat sink with the clamp provided.

#### Check Transistors and Diodes:

Defective transistors and diodes may be located by use of an ohmmeter. Polarity of the ohmmeter must be verified before these checks are made.

With a known diode orientation, measure the diode resistance in the forward and reverse directions. The lowest meter reading will establish the probe at the cathode end (schematic symbol arrow points to cathode) as the "minus" probe while the other probe will be "plus." Some ohmmeters are not polarized in this manner with relation to "volts plus probe" and "volts minus probe."

To check transistors, the ohmmeter should be set to the 100 ohm or 1,000 ohm scale. Small signal transistors (Q1 through Q32) must be removed from the circuit before testing. Transistors mounted with screws (Q33 through Q38) may be tested in place; however, the leads to these transistors must be removed.

If all conditions in the following table are met, the transistor may be considered free of any gross defect; if any of the following conditions are not met, the transistor should be replaced. See lower right corner of circuit diagram, Figure 17, Page 21, for transistor terminal code.

| OHMMETER CONNECTIONS |                 | OHMMETER READING     |                      |
|----------------------|-----------------|----------------------|----------------------|
| "Plus"<br>Lead       | "Minus"<br>Lead | N.P.N.<br>Transistor | P.N.P.<br>Transistor |
| Collector            | Emitter         | High                 | High                 |
| Emitter              | Collector       | High                 | High                 |
| Collector            | Base            | High                 | Low                  |
| Emitter              | Base            | —                    | Low                  |
| Base                 | Collector       | Low                  | High                 |
| Base                 | Emitter         | Low                  | —                    |

With the ohmmeter "plus" probe on the anode end of a diode, and the "minus" probe on the cathode end, the ohmmeter should read approximately 2000 ohms or less. With the meter probes reversed, a reading of about 10,000 ohms or more should occur. If either of these conditions is not met, the diode should be replaced.

#### Power Drain Resistor ( $R_{SEL}$ ):

The following condition may occur after replacement of driver transistors Q33 and Q34, output transistors Q35 through Q38, or diodes D6 and D7. If the unit appears to operate at an excessively high temperature or thermally recycles after about 10 minutes with no signal input, the "cold" standby power drain may be excessive (up to 20 watts higher than normal; a higher power drain indicates further circuitry problems). The nominal power drain under these conditions should be 60 watts; if the measured figure exceeds 75 watts, insert a resistor ( $R_{SEL}$ ) in parallel with the 56-ohm resistor between the base of transistor Q33 and the junction of diodes D6 and D8 (figure 17, page 21).  $R_{SEL}$  (1/2 W, 10%) should be either 180 ohms to decrease the power consumption by 20 watts, or 82 ohms to decrease the power consumption by 30 watts.

#### Lamp Replacement:

The two lamps I2 and I3, Figure 12, Page 15, which provide illumination of the front panel controls are 115 to 125 volt, 15 watt incandescent bulbs. These bulbs are soldered and epoxied into the molded plastic sockets in order to meet Underwriters' Laboratories requirements. The assembly may be removed by unsoldering the lamp leads at the terminal strips and removing the screw that holds the socket to the chassis.

#### Reverberation Assembly:

The Reverberation Assembly M2, Figure 13, Page 16, may be removed and returned to the factory Service Department for repair if a malfunction should occur. The amplifier can be operated without this assembly. To eliminate possible damage, or shock hazard, the plug-in cables should be temporarily inserted in the nylon inserts normally used to mount this sub-assembly. If extensive damage has occurred, a replacement Reverberation Assembly may be ordered through the dealer or from the factory Service Department.

#### Replacement Parts:

Parts that are readily available through local electronic parts distributors are not shown on the accompanying Parts List. Their values are shown on the circuit diagram. The special custom made parts are shown on the Parts List.

The commercial alternates shown on the Parts List are not necessarily equivalents, but may be used in the event that direct factory replacements are not immediately available. To maintain the highest possible performance and reliability, Shure factory replacement parts should be used. When ordering replacement parts, specify the Shure Replacement Kit Number, description, product model number and serial number.

### EQUIPMENT DESIGNED FOR USE WITH THE VOCAL MASTER VA302 CONSOLE SERIES

|            |                                     |
|------------|-------------------------------------|
| VA300-S    | Vocal Master Speaker Column         |
| VA301-S    | Vocal Master Monitor Speaker        |
| PM300      | Power Master Booster Amplifier      |
| PM300E     | Power Master Booster Amplifier      |
| PM300E6    | Power Master Booster Amplifier      |
| A3PC       | Soft Cover Set                      |
| A3PC-C     | Console Soft Cover                  |
| A3PC-S     | Speaker Column Soft Cover           |
| A31PC-S    | Monitor Speaker Soft Cover          |
| A3S-C      | Fold-Up Console Stand               |
| A3S-S      | Speaker Stand                       |
| A3S-T      | Speaker Stand                       |
| A50XC      | 15m (50 ft) Speaker Extension Cable |
| A95 Series | Line Matching Transformers          |

**GUARANTEE:** This Shure product is guaranteed in normal use to be free from electrical and mechanical defects for a period of one year from the date of purchase. Please retain proof of purchase date. This guarantee includes all parts and labor.

**SHIPPING INSTRUCTIONS:** Carefully repack the unit and return it prepaid to the factory. If outside the United States, return the unit to your authorized Shure Service Center for repair. The unit will be returned to you prepaid.

**SERVICE:** If information or service should be required, contact your local Shure Vocal Master dealer explaining your difficulty in detail. In addition, the Shure factory service department will be ready to assist you immediately upon request.

### VA300-S Speaker Servicing:

1. Unplug cables from speaker jacks.
2. Using an ohmmeter, measure the resistance of the speaker column. The resistance should be between 12 and 16 ohms. Readings outside of these limits indicate possible failure.
3. Remove back of cabinet.
4. Disconnect one end of the lead connected **between** the two 10 inch loudspeakers.
5. Using an ohmmeter, measure resistance of the voice-coil of each loudspeaker individually. Each 10 inch speaker should measure between 12 and 16 ohms. Each 8 inch speaker should measure between 5 and 8 ohms. Readings outside of these limits indicate possible failure.
6. Apply 60 Hz, 1 to 10 volts, to each of the six speakers individually. Any buzzes or rattles indicate possible failure. The speakers should all sound generally alike with a slight difference between the 8 inch and 10 inch loudspeakers.
7. Reconnect lead disconnected in Step 4. Install back of cabinet tightly.

### REPLACEMENT PARTS LIST FOR VA300-S SPEAKER COLUMN

| ITEM | REP. KIT NO. | REPLACEMENT KIT CONSISTS OF |          |                           |
|------|--------------|-----------------------------|----------|---------------------------|
|      |              | QTY.                        | PART NO. | DESCRIPTION               |
| M10  | RKC29        | 1                           | 80A207   | 8 Inch Loudspeaker        |
| M11  | RKC56        | 1                           | 80A208   | 10 Inch Loudspeaker       |
| M12  | RKC31        | 1                           | 90A1375  | Rear Panel Assembly       |
| M13  | RKC25        | 1                           | 94B462   | Column Cabinet            |
| M14  | RKC4         | 1                           | 90A1373  | Cable and Plug Assembly * |
| M15  | RKC32        | 1                           | 95A436   | Handle Assembly           |
| M16  | RKC39        | 4                           | 65A1001A | Bumper (Plastic Foot)     |
| M17  | —            | —                           | 39A279   | Name Plate                |
| M18  | —            | —                           | 48A20    | Side Rail                 |

\*Recommended replacement cable connectors (not available from factory; Switchcraft part numbers given.) Straight Locking Plug: #282; Right Angle Locking Plug: #228; Locking Extension Jack (for Extension Cable Assembly): #123.

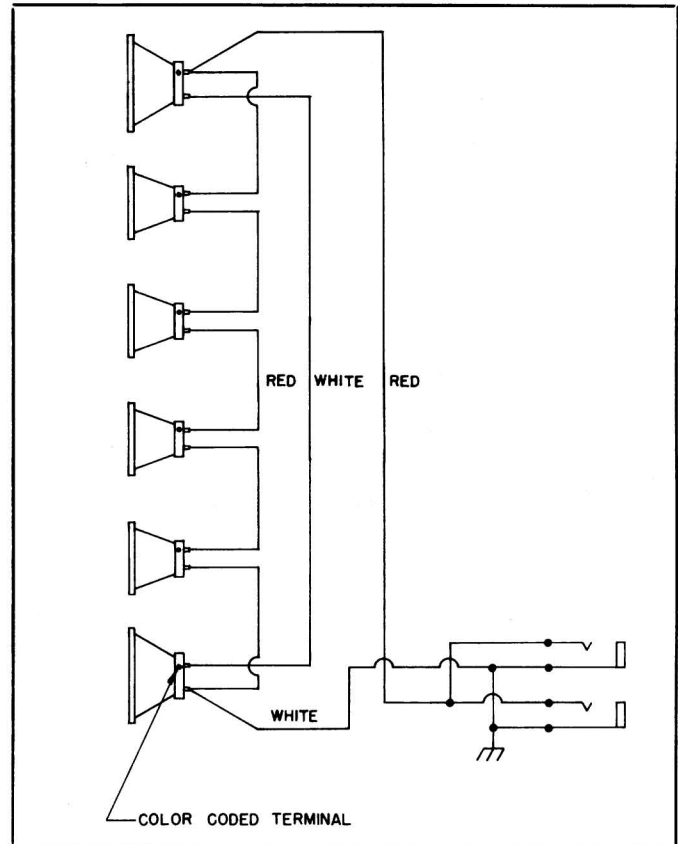


FIGURE 15.

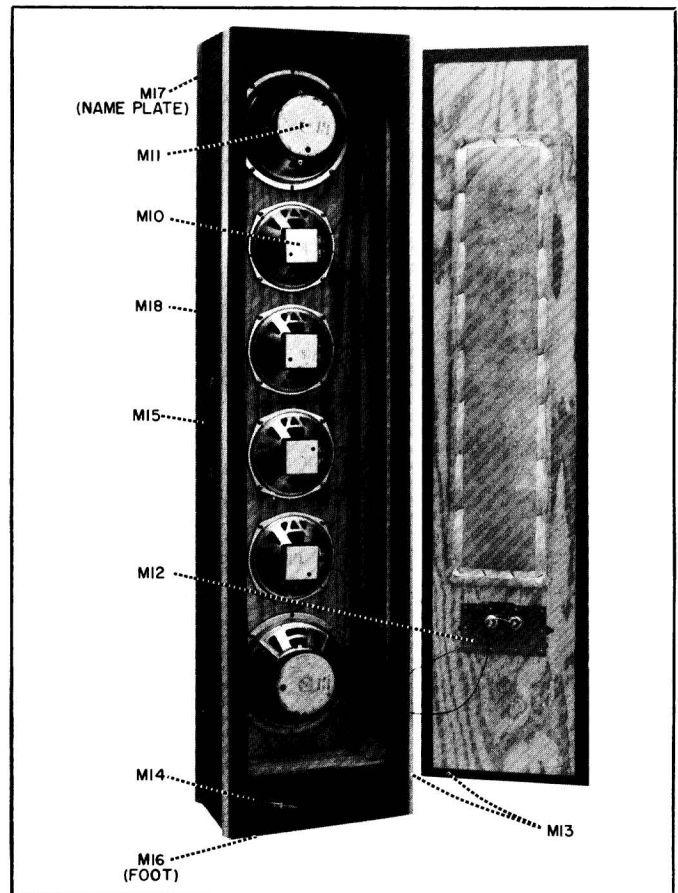


FIGURE 16.

# REPLACEMENT PARTS LIST FOR VA302-C SERIES CONSOLES

| ITEM                  | REPL. KIT NO. | REPLACEMENT KIT CONSISTS OF: |          |                                                     | COMMERCIAL ALTERNATE                            |
|-----------------------|---------------|------------------------------|----------|-----------------------------------------------------|-------------------------------------------------|
|                       |               | QTY.                         | PART NO. | DESCRIPTION                                         |                                                 |
| C1                    | RKC26         | 1                            | 86A631   | Capacitor, 2500 x 100                               | NONE                                            |
| C2                    | RKC27         | 1                            | 86B631   | Capacitor, 4000 x 60                                | NONE                                            |
| D1-D4                 | RKC46         | 4                            | 86A406   | Silicon Rectifier, 3A., 200 V.                      | Motorola No. 1N4721                             |
| D5                    | RKC22         | 1                            | 86A408   | Zener Diode, 22V., 1 W., 5%                         | Motorola No. 1N4748A                            |
| D6, D7                | RKC50         | 2                            | 86A410   | Silicon Rectifier, 100 V., 1/2 A.                   | Motorola No. 1N4002                             |
| D8, D15               | RKC23         | 1                            | 86A409   | Zener Diode, 3.6 V., 1 W., 5%                       | Motorola No. 1N4729A                            |
| D9-D12                | RKC19         | 4                            | 86A405   | Germanium Diode                                     | Sylvania No. 1N48, 1N60                         |
| D13, D14              | RKC79         | 1                            | 86A403   | Silicon Diode, 50 V., 1/2 A.                        | Motorola No. 1N4001                             |
| F1                    | RKC62         | 5                            | 80A159   | A.C. Fuse (VA302 and VA302E)                        | Littelfuse 3AG/3A/SB (Slo-Blo)                  |
| F1                    | ----          | —                            | 80A258   | A.C. Fuse (VA302E6 only)<br>for 200-240 volts       | 5 x 20mm, 1.6 AT, 250 V.                        |
| F1                    | ----          | —                            | 80B258   | A.C. Fuse (VA302E6 only)<br>for 100-140 volts       | 5 x 20mm, 3.0 AT, 250 V.                        |
| F2                    | RKC62         | 5                            | 80A160   | D.C. Fuse (VA302 and VA302E)                        | Littelfuse 3AG/5A                               |
| F2                    | ----          | —                            | 80A259   | D.C. Fuse (VA302E6 only)                            | 5 x 20mm, 5.0 A, 250 V.                         |
| F3                    | ----          | —                            | 80A269   | Wired in A.C. Fuse (VA302 only)                     | Bussmann MDV/5A/SB (Slo-Blo)<br>Pig-tail        |
| I1                    | RKC45         | 1                            | 80A79    | Pilot Lamp (VA302 only)                             | Leecraft No. 36N1311-6                          |
| I1                    | RKC78         | 1                            | 80Z251   | Pilot Lamp (VA302E and VA302E6)                     | Leecraft No. 36HN-1311-7W                       |
| I2, I3                | RKC34         | 2                            | 90A1463  | Lamp Assembly                                       | NONE                                            |
| J1-J6                 | RKC83         | 2                            | 95A482   | Connector, Mic. Input                               | Switchcraft No. C3F                             |
| J7                    | RKC87         | 1                            | 95C446   | Phone Jack                                          | Switchcraft No. 12-A                            |
| J8                    | RKC86         | 1                            | 95A446   | Phone Jack                                          | Switchcraft No. 14-B                            |
| J9-J12                | RKC68         | 1                            | 95B446   | Phone Jack                                          | Switchcraft No. 11                              |
| J13                   | RK122P        | 1                            | 95A198   | Connector Mic. Output                               | Switchcraft No. C3M                             |
| M1                    | RKC82         | 1                            | 95A510   | 3 Wire A.C. Line Cord and Plug<br>(VA302 only)      | NONE                                            |
| M1                    | RKC88         | 1                            | 70A3071  | Line Cord (VA302E only)                             | NONE                                            |
| M1                    | ----          | —                            | 90A1888  | Line Cord and Connector<br>(VA302E6 only)           | NONE                                            |
| M2                    | RKC30         | 1                            | 95A430   | Reverberation Assembly                              | Gibbs No. 4L (Insulated Output)                 |
| M3                    | RKC36         | 1                            | 95A444   | Anti Feedback Inductor Assembly                     | NONE                                            |
| M4                    | RKC80         | 1                            | 95A499   | VU Meter                                            | NONE                                            |
| M5                    | RKC32         | 1                            | 90BD2600 | Handle Assembly                                     | NONE                                            |
| M6                    | RKC24         | 1                            | 90A1370  | Console Cabinet                                     | NONE                                            |
| M7                    | RKC49         | 3                            | 90B2285  | Volume Control Knob Assembly                        | NONE                                            |
| M8                    | RKC48         | 3                            | 90B1391  | Treble Control Knob Assembly                        | NONE                                            |
| M9                    |               | 3                            | 65A686A  | Bass Control Knob                                   | NONE                                            |
| M10                   | RKC70         | 1                            | 32A627   | Knob and Screw (Line Cord<br>Storage Spindle)       | NONE                                            |
| M11                   | ----          | —                            | 53A1587  | Shield                                              | NONE                                            |
| M12                   | RKC39         | 4                            | 65A685   | Bumper (Plastic Foot)                               | NONE                                            |
| M13, M14              | ----          | —                            | 95A429   | Fuse Holder (VA302 only)                            | Littelfuse No. 342014                           |
| M13, M14              | RKC72         | 1                            | 95A500   | Fuse Holder (Screw Slot,<br>VA302E only)            | Littelfuse No. 341001                           |
| M13, M14              | ----          | —                            | 95A604   | Fuse Holder (5 x 20mm VA302E6 only)                 | Schurter Type FEB                               |
| M15                   | ----          | —                            | 95A568   | A.C. Chassis Power Connector<br>(VA302E6 only)      | Switchcraft No. EAC-301                         |
| M16                   | ----          | —                            | 48A21    | Cabinet Upper Side Rail                             | NONE                                            |
| M17                   | ----          | —                            | 48A22    | Cabinet Lower Side Rail                             | NONE                                            |
| Q1-Q23,<br>Q25-Q31    | RKC9          | 4                            | 86A349   | Transistor (Replaces 86A327)                        | Motorola No. MPS-6521<br>Texas Inst. No. 2N3711 |
| Q24                   | RKC52         | 3                            | 86A324   | Transistor                                          | Motorola No. MPS-3392                           |
| Q32                   | RKC53         | 1                            | 86A333   | Transistor 110 V. BV <sub>CEO</sub> Min.            | RCA No. 40349                                   |
| Q33                   | RKC55         | 1                            | 86A338   | Transistor 110 V. BV <sub>CEO</sub> Min.            | RCA No. 2N3441                                  |
| Q34                   | RKC54         | 1                            | 86A339   | Transistor 105 V. BV <sub>CEO</sub> Min.            | Motorola No. 2N3741 Selected                    |
| Q35-Q38               | ----          | —                            | 86B332*  | (Mutually Interchangeable)                          | RCA No. 2N3773                                  |
|                       |               |                              | 86B332*  | Transistor 110 V. BV <sub>CEO</sub> Min.,<br>150 W. |                                                 |
| R1-R6, R14            | RKC58         | 1                            | 46A017   | Potentiometer, Dual 50K/50K                         | NONE                                            |
| R7-R12,<br>R16        | RKC59         | 1                            | 46A016   | Potentiometer, 50K.                                 | NONE                                            |
| R13                   | RKC57         | 1                            | 46A018   | Potentiometer, 50K.                                 | NONE                                            |
| R15                   | RKC60         | 1                            | 46A020   | Potentiometer, 2.5K.                                | NONE                                            |
| R17, R18,<br>R19, R21 | ----          | —                            | 45EC439B | Resistor, .43 ohms, 5 W.                            | NONE                                            |
| R20                   | ----          | —                            | 45EC209B | Resistor, .20 ohms, 5W.                             | NONE                                            |
| R22                   | ----          | —                            | 45EC129B | Resistor, .12 ohms, 5 W.                            | NONE                                            |
| R23                   | RKC47         | 1                            | 45A38    | Resistor                                            | Workman No. FRT-2                               |
| S1                    | RKC61         | 1                            | 55A72    | Toggle Switch (VA302 and VA302E)                    | Cutler-Hammer No. 7563K5                        |
| S1                    | ----          | —                            | 55A98    | Toggle Switch<br>(2 position VA302E6 only)          | Marquardt Type No. 0132                         |
| S2, S3                | RKC37         | 1                            | 95A551   | Thermostat                                          | NONE                                            |
| S4-S9, S21            | RKC10         | 4                            | 55A54    | Slide Switch (Screw Slot)                           | Continental-Wirt No. G-326                      |
| S10-S16               | RKC44†        | 1                            | 55A73A†  | Rocker Switch, Chrome                               | NONE                                            |
| S17                   | RKC43         | 1                            | 55A73E   | Rocker Switch, Red/Orange                           | NONE                                            |
| S18                   | RKC42         | 1                            | 55A73D   | Rocker Switch, Orange                               | NONE                                            |
| S19                   | RKC41         | 1                            | 55A73C   | Rocker Switch, Orange/Yellow                        | NONE                                            |
| S20                   | RKC40         | 1                            | 55A73B   | Rocker Switch, Yellow                               | NONE                                            |
| S22                   | ----          | —                            | 55A80    | Slide Switch, Black                                 | NONE                                            |
| S23                   | ----          | —                            | 55A99    | Voltage-Selector Switch<br>(VA302E6 only)           | NONE                                            |
| T1                    | RKC35         | 1                            | 51A215   | Power Transformer (VA302 only)                      | NONE                                            |
| T1                    | RKC147        | 1                            | 51A241   | Power Transformer (PM300E and<br>PM300E6)           | NONE                                            |
| T2                    | RKC28         | 1                            | 51A217   | Feedback Transformer                                | NONE                                            |
| T3-T9                 | RKC84         | 1                            | 90H2150  | Mic. Transformer Assy.                              | NONE                                            |

NOTE: The Commercial Alternates shown above are not necessarily equivalents but may be used in the event that direct factory replacements are not immediately available. To maintain the highest possible performance and reliability, Shure Factory Replacement Parts should be used.

\*When ordering 86A332 or 86B332, specify current gain code. See Page 15.

\*\*Parts listed as RKC Kits should be ordered by that kit number. Any orders received for piece parts where RKC Kit number is shown will be shipped in RKC quantities.

†For gray switch order Part No. 55A73F.

# Notes to Circuit Diagram

## D.C. Voltage Measurements:

Check the DC voltages first, because any deviation from the nominal voltages will affect the AC voltage. In the power amplifier, Q31 to Q38, the key DC voltages are +94 (collector of Q33, Q35, and Q37), +22 (collector of Q31), and the split voltage at the junction of R17, R19, R20, and R22. If these three key DC voltages are correct, then proceed with the AC voltage measurements.

The numbers within the symbols  $\bigcirc$  on the circuit diagram denote the D.C. voltage at that point with the following test conditions:

1. Voltages measured at points indicated with respect to chassis, unless otherwise indicated.
2. Line voltage — VA302-C: 120v. 60 Hz.  
VA302E-C: 120/240v. 50/60 Hz.  
VA302E6-C: 100, 120, 140, 200, 220, or 240v. 50/60 Hz.
3. No input signal applied.
4. D.C. voltage measurements may vary  $\pm 20\%$  from the values shown.
5. Measured with a VTVM of 11-megohms input impedance.
6. Q27 transistor voltages on the circuit diagram are with the master reverb switch in the "IN" position. With the master reverb switch in the "OUT" position, Q27 voltages are: emitter 4.0, base 0.0, and collector 22.0.

## A.C. Voltage Measurements:

The numbers within the symbols  $\square$  on the circuit diagram denote the A.C. voltage at that point with the following test conditions:

1. Voltages measured at points indicated with respect to chassis, unless otherwise specified.
2. Line voltage — as specified above.
3. 1,000 Hz. signal applied to input, in "IN" position, at 0.8 millivolts.
4. Measured with an A.C. VTVM of 1.0 megohms or greater input impedance.
5. Noninductive load of 8 ohms, 200 watts connected to speaker output jack for Q31 through Q38.
6. Echo input and output jacks to be open; echo gain control set to maximum.
7. All anti feedback switches set to "OUT" position.
8. Reverb intensity set to minimum.
9. All tone controls set to 12 o'clock position.
10. All volume controls set to maximum.
11. Master reverb switch set to "OUT" position except as noted.
12. Individual channel reverb switches set to "OUT" position except where noted.

13. Transistor voltage measurements for Q20 through Q27 must be made with master reverb switch and individual channel reverb switches in the "IN" position.
14. A.C. voltage measurements may vary  $\pm 50\%$  from the values shown.
15. For A.C. measurements on Q25, Q26, and Q27, the frequency may be varied  $\pm 100$  Hz. to obtain the A.C. measurements shown.
16. For VU Meter specifications, see page 9.

## Ohmmeter Measurements:

With the A.C. line cord unplugged and the power switch in the "OFF" position, the following ohmmeter measurements may be made:

1. Reverberation Assembly M2 input and output coils approximately 180 ohms.
2. Anti feedback Inductors M3 approximately 300 ohms.
3. B+ to ground approximately 50 ohms.
4. Ohmmeter plus probe to the junction of R17, R19, R20, and R22, ohmmeter minus probe to ground: greater than 100 ohms.
5. Ohmmeter plus probe to B+, ohmmeter minus probe to the junction of R17, R19, R20, and R22: greater than 100 ohms.
6. To test transistors and diodes, see page 16.

Shure part numbers are not shown in the parts list accompanying the circuit diagram if parts are readily available through local electronic parts supply distributors. In these instances, the circuit diagram will show the value of the standard parts.

All capacitor values are shown in microfarads. All non-electrolytic capacitors are to be 100 volts or more unless otherwise specified in the circuit diagram. Electrolytic capacitors are shown in microfarads and volts.

All resistor values are shown in ohms. Resistors are all to be 10% tolerance unless specifically noted on the circuit diagram.

Resistors shown in the upper two lines of circuitry on the diagram are  $\frac{1}{4}$  watt unless otherwise specified. Resistors shown in the lower line of circuitry are  $\frac{1}{2}$  watt unless otherwise specified.

The following ground symbols denote:

Chassis  
Ground



Preamplifier  
Ground



Reverb  
Driver Ground



# VA302-C CIRCUIT DIAGRAM

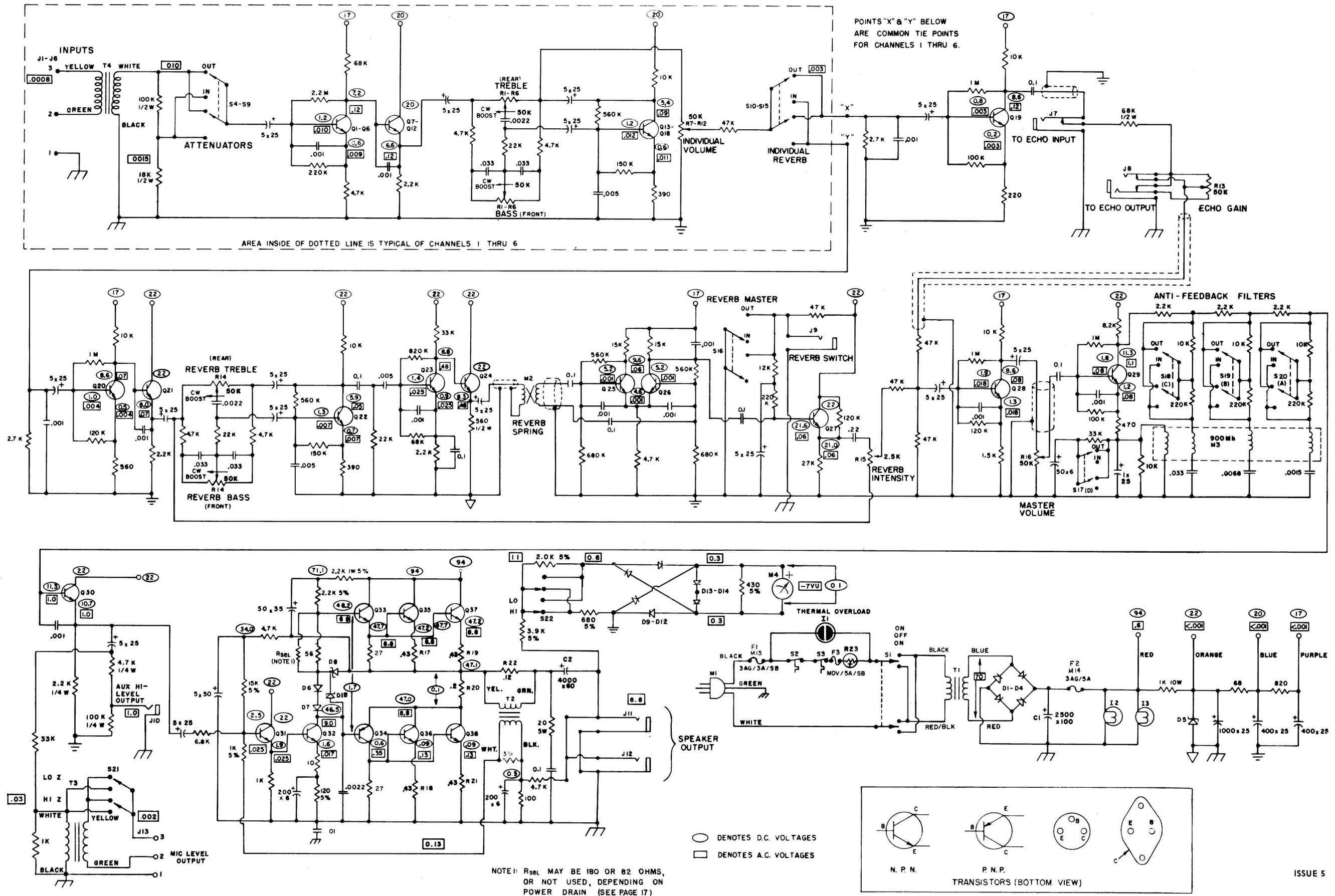


FIGURE 17.

## VA302E-C POWER SUPPLY CIRCUIT DIAGRAM

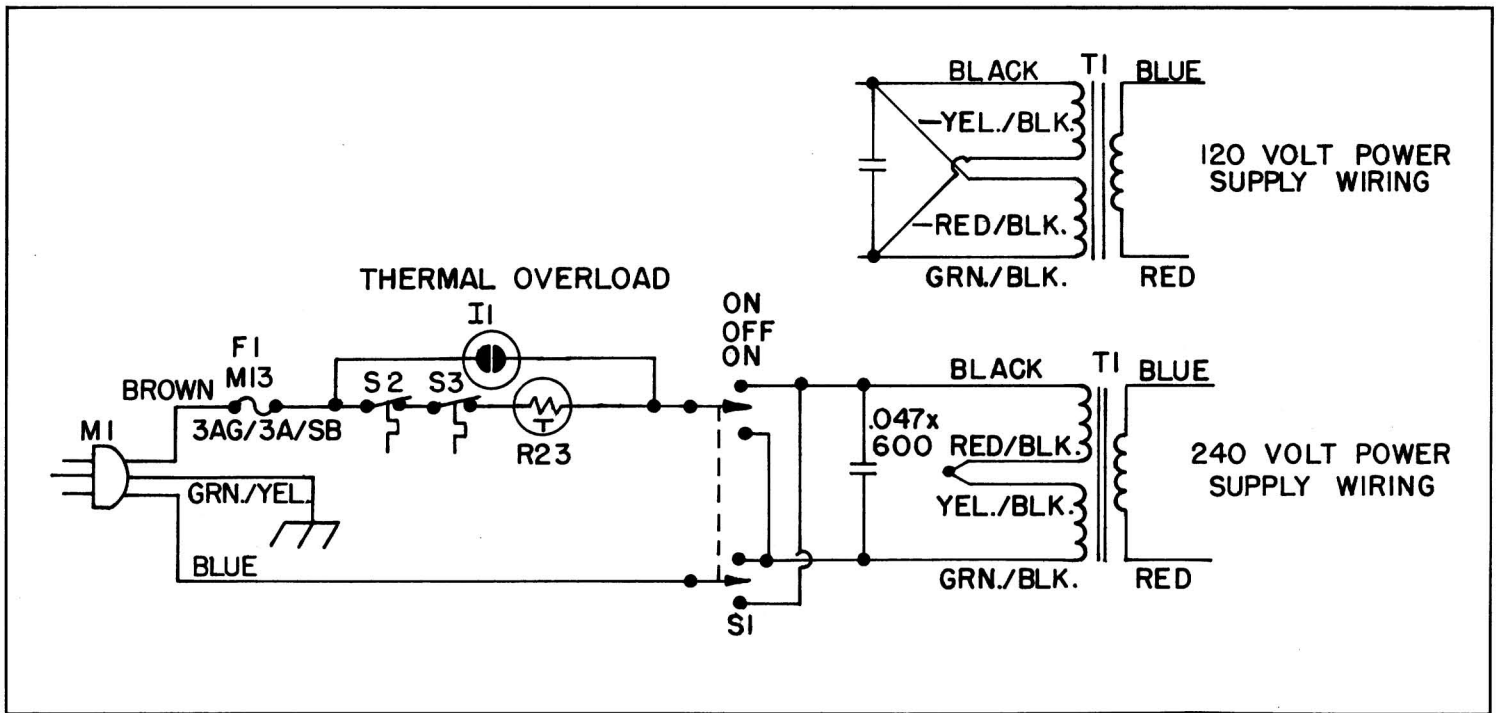


FIGURE 18.

## VA302E6-C POWER SUPPLY CIRCUIT DIAGRAM

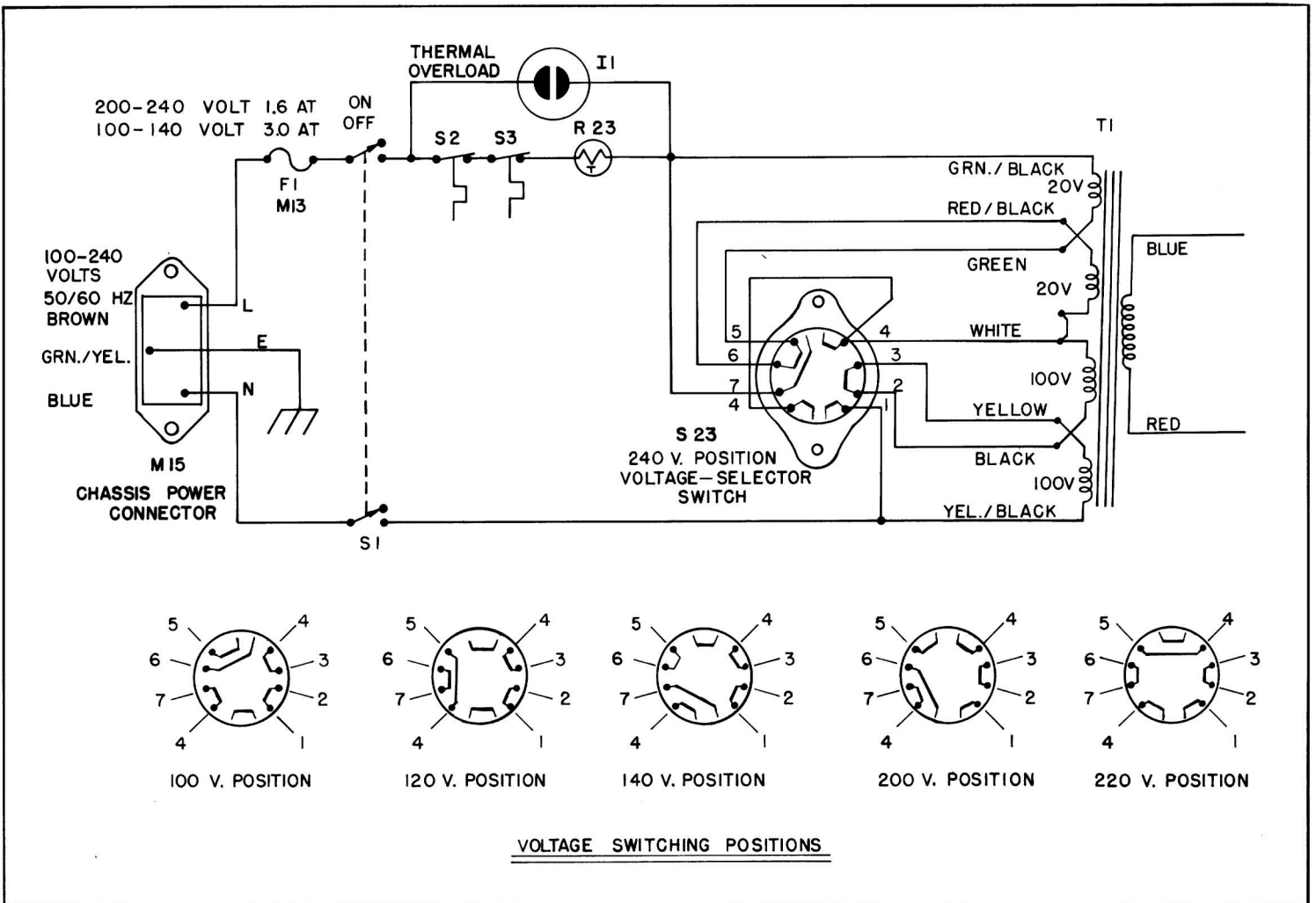


FIGURE 19.