

Audimax

AUDIMAX[®] III
AUDIMAX[®] III S

Automatic level control
OPERATING AND MAINTENANCE INSTRUCTIONS

CBS LABORATORIES
A Division of Columbia Broadcasting System, Inc.

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AUDIMAX[®] III S

Automatic level control


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May, 1967

Transcribed July 2011
By Robert W. Meister WA1MIK

New Figures September 2011
Reorganized October 2011

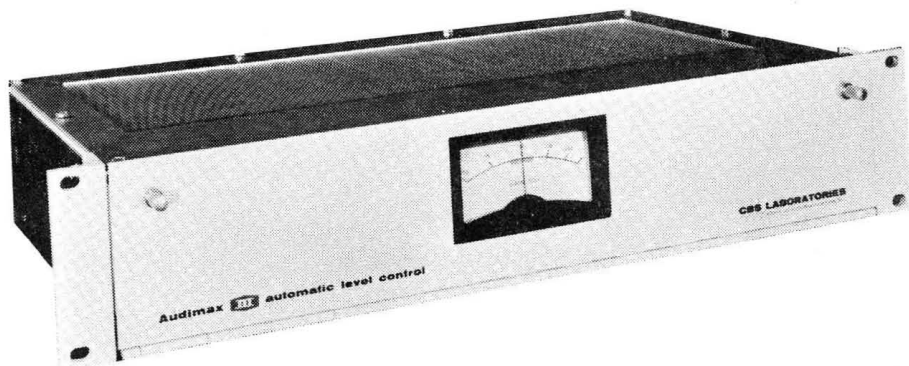
**PROFESSIONAL
PRODUCTS**



CBS LABORATORIES
Stamford, Connecticut
A Division of Columbia Broadcasting System, Inc.

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AUDIMAX III, MODEL 444



AUDIMAX III S, MODEL 445

SECTION I

INTRODUCTION

1-1 GENERAL

The new solid-state Audimax® III, Model 444, like its companion piece, Volumax™, is a tool to help the broadcaster achieve maximum program power within appropriate modulation limits. Incorporating all of the features of its famous predecessor, the Audimax III also provides additional gain and versatility. Designed for use wherever high quality automatic gain riding is required, Audimax III offers a unique method of audio control for AM, FM, and TV broadcasting, recording, motion pictures and public address use.

Audimax III is the latest development in the unique Audimax system of audio control developed by CBS Laboratories. Applicable to all audio media, the Audimax is totally different in concept from ordinary compressors, limiters or AGCs. The Audimax acts like a highly capable studio technician, but without many human limitations. Valuable in the studio, the Audimax is often more reliable outside, away from controlled studio conditions. The ability of the Audimax to act instantly and control audio levels intelligently frees engineers to cope with the many other problems of remote pick-ups.

The new solid-state Audimax III offers the ultimate in automated gain control combined with the extreme reliability of solid-state circuitry. The exclusive GAIN PLATFORM principle permits gain to remain on a stable plateau over a wide range of input levels rather than continuously allowing it to rise and fall with consequent distortion, thumping and pumping, and audio "holes". The unique GATED GAIN STABILIZER acts to bridge through program lapses and thus eliminates "swish-up" of background noise. A special RETURN-TO-ZERO function returns gain to normal during standby conditions.

1-2 WARRANTY

A warranty, with a return post card is included with your Audimax III. Fill out the post card and return it to CBS Laboratories as soon as possible to validate your warranty.

1-3 FACTORY SERVICE AND REPAIR

If you should experience difficulty in installing, operating, or repairing Audimax III, please contact CBS Laboratories, Professional Products, Stamford, Connecticut (Area Code 203) 327-2000. (In 1986, the CBS Technology Center in Stamford ceased operation; they stopped making these units long before then.)

1-4 SPECIFICATIONS

AUDIMAX III, Model 444

Frequency Response	Flat within 1 dB from 50 Hz to 15,000 Hz
Harmonic Distortion	Below 1% from 50 Hz to 15,000 Hz at +16 dBm output
Noise Level	Below -60 dBm output, with NORMAL gain
Control Characteristic	±10 dB of gain control
Gated Gain Stabilization	Threshold adjustable from -20 dB to normal input
Maximum Gain	50 dB (See Note below)
Input and Output Impedance	600 ohms, balanced or unbalanced (150 ohms on special order)
Minimum Input Level	-30 vu (See Note below)
Normal Output Level	+11 vu
Maximum Output	+25 dBm
Maximum Operating Temperature	55°C
Physical Dimensions	Standard 19" rack mounting, 3-1/2" high, 9-5/8" deep
Power Requirements	15 watts at 115/230 volts ac, 50-60 Hz

AUDIMAX IIIS, Model 445, (Stereo)

Physical Dimensions:	Standard 19" rack mounting, 7" high, 9-5/8" deep
Power Requirements	30 watts at 115/230 volts ac, 50-60 Hz

NOTE: As delivered, Audimax III contains a 20 dB fixed attenuator in the input circuit. Removal of this pad will permit user to realize specified maximum gain and minimum input level.

SECTION II

INSTALLATION PROCEDURES

2-1 UNPACKING

Carefully unpack your Audimax III and examine the unit for any evidence of physical damage that may have occurred during shipment. In the event of damage file a claim immediately with the carrier. If future transportation of the unit is anticipated, save the shipping carton for reuse.

2-2 PHYSICAL INSTALLATION

Audimax III is designed to be mounted in a standard 19-inch-wide rack. The unit requires 3-1/2-inch-high front panel space and is slightly less than 10 inches deep. Install the unit in a reasonably well-ventilated position making certain that there is no high heat producing equipment beneath it. The ambient temperature should not exceed 130°F.

2-3 ELECTRICAL INSTALLATION

The Audimax III power supply is equipped with a power transformer permitting the selection of either 115-volt or 230-volt operation. If 230-volt operation is required, remove the jumper on the power supply board from lugs 1 to 2 and 3 to 4. Reconnect a single jumper between lugs 2 and 3. Replace the fuse with a type 3AG-0.15 amp fuse.

For broadcast applications, it is recommended that the Audimax III be installed at a studio or console and its output fed directly into the main audio line. Satisfactory operation requires that the unit be presented with a constant 600/150-ohm impedance throughout the audio band.

A fast acting peak limiter is recommended for use at the transmitter (following Audimax III). However, this peak limiter should be set to show only occasional limiting of 2 or 3 dB. For best results, a CBS Laboratories' Volumax should be used instead of a conventional peak limiter.

NOTE

The master volume indicator should follow Audimax III.
This will discourage unnecessary gain riding which might
tend to defeat the automatic features of Audimax.

2-4 ELECTRICAL CONNECTIONS

Input and output leads should be connected to the five-terminal strip at the rear of the chassis. Terminals 1 and 2 are the input, and terminals 4 and 5 are the output connections. The unit may be connected for balanced or unbalanced operation. Terminal 3 is the chassis ground. The standard Audimax III is delivered for 600-ohm operation. For 150-ohm operation special input and output pads may be installed and transformers T2 and T3 strapped as shown on the schematic diagram (see Figure 4.4 and 4.5). The fixed attenuator at the input terminals must also be removed or converted for 150-ohm operation.

SECTION III

SETUP PROCEDURE

3-1 LEVEL ADJUSTMENT

Audimax III is supplied with a 20 dB fixed pad at its input to accommodate the levels usually present at the output of consoles. The minimum input for full automatic control is -10 vu under these conditions. However, removal of this pad permits normal operation with input levels as low as -30 vu.

With proper input levels, average program material should cause the front panel meter to indicate approximately 0 dB gain (this figure is relative and does not refer to actual gain of the amplifier). In this way, the advantage of ± 10 dB of level correction can be realized.

The INPUT LEVEL setting may be established by either of two methods:

- a. Use a recording or other program source and adjust the INPUT LEVEL control, as indicated above, until the average "0 dB" reading is achieved.
- b. An oscillator may be used in place of the usual program sources or connected directly to the Audimax III input. The oscillator output (at 1 kHz) should be adjusted so as to result in a level 4 dB higher than the normal vu level of the line in which Audimax III is connected. The INPUT LEVEL control is then adjusted for the "0 dB" reading. When an oscillator is connected directly to the Audimax III, it is important that proper impedance matching be observed and that no other loads are present on the line.

The OUTPUT LEVEL control is continuously variable over a 30 dB range to provide a maximum of 11 vu with normal program input.

3-2 VARIATIONS FROM STANDARD OPERATING PROCEDURES

Three variations from standard operating procedures should be observed when Audimax III is used:

- a. If the master volume indicator is properly installed at the Audimax III output, there will be little tendency for manual gain control at this point. In fact, the rule here should be "DON'T TOUCH!"
- b. At individual stations, however, where an Audimax III is in control, it may be desirable at times to readjust levels slightly. This should be done slowly, whether the program level is too low or too high.
- c. A third change of procedure concerns "fades". Since Audimax III will defeat any slow deliberate reduction of level, all fades must be made more quickly than by usual methods. A little practice will easily result in the required skill. The most convenient way to insure proper procedures at all locations is to connect all cue lines to some point beyond the Audimax III output.

3-3 GATED GAIN STABILIZER

The function of the Gated Gain Stabilizer (GGS) is to make the following decisions: Should the gain be increased when a lapse occurs in the audio? This is especially important for television and motion pictures where these lapses occur quite often. To prevent level increases of system

noise or audio signals, which are clearly background effects, the GGS inhibits gain "recovery" during those intervals when the input level drops below a preset threshold.

The GGS threshold has been factory set to inhibit gain increase when the incoming signal has dropped approximately 14 dB below the normal line level. This figure has been established after extensive field experience, and represents a satisfactory value for typical broadcast use. For special applications the GGS threshold may be move upwards towards normal program level by decreasing the value of R45A or lowered by increasing the value of this resistor. The following table gives suggested values:

GGs Threshold	R45A
-4 dB	120 ohms
-8 dB	220 ohms
-11 dB	430 ohms
-14 dB	680 ohms
-17 dB	2.4 k
-20 dB	open

Sine wave verification of the GGS threshold level may be accomplished by the following procedure:

- a. Feed a sine wave input to cause the front panel meter to read 0 dB gain reduction.
- b. Remove the signal and wait at least 15 seconds for full stabilization to occur.
- c. Reapply the input signal at a level below the required threshold and slowly increase the signal until the front panel meter just begins to deflect towards the right. The input level at this time should be approximately 5 dB less than that indicated by the above table. (This 5 dB difference is a special factor and must be considered when sine-wave calibration of the GGS threshold is performed.)

3-4 FUNCTION SWITCH

Audimax III is in operation performing automatic level control when the FUNCTION switch is at NORMAL position. Turning the switch to the TEST position causes the gain to hold constant at the same level as for normal operation. The function of the TEST position is to provide for overall system performance measurements.

3-5 LIMITED DYNAMIC RANGE APPLICATIONS

The gain control action of the Audimax has been designed to provide a precise degree of control with a minimum of noticeable change in the original dynamic range. As a tool for the broadcaster, it provides maximum modulation consistent with artistically acceptable performance for a wide variety of program material. In some applications, however, it is practical and desirable to further limit program dynamic range. This is commonly done for the purpose of achieving higher average modulation, or a more uniform sound as in the case of public address systems. This effect may be achieved by decreasing the Audimax recovery time.

Although the total gain-reduction action of the Audimax is a complex function of many variables, one phase of the recovery characteristic may be modified by changing R76. This normally is a 10 megohm resistor mounted on lugs on the Logic Board. By decreasing its value, the speed of recovery is increased. Typically, the resistance may be decreased to 5 megohms, although values as low as 1 megohm can be used in special applications.

3-6 STEREOPHONIC OPERATION

For two-channel stereophonic operation, two Audimax III units are coupled together by means of a stereophonic adapter board mounted in the upper chassis. The adapter employs resistive mixing of the left and right Audimax III output signals and controls each of the two Audimax IIIS with a signal proportional to the sum of left plus right. In this way, gain changes in both channels are identical, thus preserving the stereophonic perspective, as well as making the system responsive to the true volume level.

NOTE

The Monaural Audimax III units cannot be modified for stereophonic operation in the field. If you anticipate going to stereo operation in the future, CBS Laboratories recommends the use of the Audimax IIIS, which can be operated in a monaural mode until the changeover.

In the event that the incoming left and right channels are improperly phased with respect to each other, the coupling circuitry in the stereophonic adapter would provide a difference signal instead of a sum signal for control purposes. Since this difference signal is generally lower in level than the sum signal, Audimax gain would be unnecessarily high. To correct for this out-of-phase condition, a STEREO REVERSE switch is provided. The upper chassis in the stereophonic pair contains a MODE switch to select either MONAURAL, STEREO or STEREO REVERSE operation. STEREO REVERSE operation corrects for an inadvertent phase reversal in the input line. MONAURAL operation permits independent usage of the two Audimax units. The FUNCTION switch works as previously described except that both left and right channel units are controlled by a single switch (S2) mounted on the lower chassis.

The INPUT LEVEL controls of the stereophonic Audimax units may be most conveniently adjusted by working with the MODE switch in the MONAURAL position. As previously indicated, a common 1 kHz sine wave input should be applied to both channels so as to result in a level 4 dB higher than the normal vu level of the lines in which the Audimax is inserted. When stereo operation is intended, adjust the INPUT LEVEL controls to produce front panel meter readings of approximately +6 dB. When the MODE switch is returned to the STEREO position, the gain in each unit should change to approximately 0 dB for normal operation.

In addition, because normal input levels are 6 dB lower in Stereo mode than in Monaural mode, R45A, for the Gated Gain Stabilization threshold control has been removed thereby providing the additional 6 dB of GGS sensitivity required. For that reason, when switching to Monaural mode, the GGS threshold will be -20 dB rather than -14 dB relative to normal input level.

SECTION IV

THEORY OF OPERATION

4-1 GENERAL

Observe Audimax III block and schematic diagrams (Figures 4.1, 4.4, and 4.5). Transistors Q2 through Q9, together with input and output attenuators, R8 and R43, and input and output transformers T2 and T3, constitute a high-quality audio amplifier. All stages are operated in push-pull. A variolossor network, including CR7 and CR8, obtains control voltage from the Audimax III Memory Unit. The signal attenuation of the variolossor is a function of the voltage applied to it. Thus, the overall system gain becomes a function of the output level, as determined by rectifier 1 and 2, and the input level determined by rectifier 3. Each rectifier is appropriately weighted with respect to charge and discharge speed to handle speech and music most effectively. For example, rectifier 2 is weighted to permit a more rapid discharge following a short impulsive signal, excessive with respect to the average, than would be true if there were merely a change in average level.

The attack time of Audimax III, i.e., the time required to effect a gain reduction when the signal level rises suddenly, is approximately 12 milliseconds and is dictated by the charge-up time of the rectifier 1 capacitor. The recovery time, i.e., the time required to effect a gain increase when the signal level drops, is a function of several variables. Audimax utilizes the "Platform" concept. Thus, instead of having a recovery action such that the control voltage tends to follow the amplitude contour of the audio signal, audible peaks in the signal cause the gain to be set at a proper level, and a reduction of signal from these peaks over a suitable range will be accommodated without gain changes unless it becomes apparent that the average value has shifted. When an increase of gain is required to maintain constant output level, this change is effected within one or two seconds. The Gated Gain Stabilization feature of Audimax III allows discharge of the storage capacitor through R76, thus providing a slow upward drift towards "Platforms" of higher gain, only during that time when program is present.

The Input Reference, driven by rectifier 3, feeds a third input to the Recovery "AND" circuit. As long as this input is positive, the additional slow recovery mode is in effect. However, during a lapse of audio, this input is at -2 volts. Under these conditions, the Recovery "AND" circuit is inhibited and R76 is electrically disconnected from the storage capacitor. Thus, the system gain is held constant during pauses until the Input Reference returns to a positive voltage condition. The gentle action provided by R76 is especially useful for improving average modulation levels. This action is completely separate from the normal gain riding activities of Audimax III and will not be objectionable under normal circumstances. If for special applications, it is deemed desirable to speed up this phase of the recovery characteristic, R76 may be decreased in value. (See Limited Dynamic Range Applications, page 5.)

The Input Reference also feeds a 10 second time delay which is coupled to the control voltage bus via an "OR" circuit. If audio should lapse for a period longer than 10 seconds, and if the system gain is greater than 0 dB, the gain will automatically return to 0 dB. This places the system in a proper standby condition to await the resumption of audio.

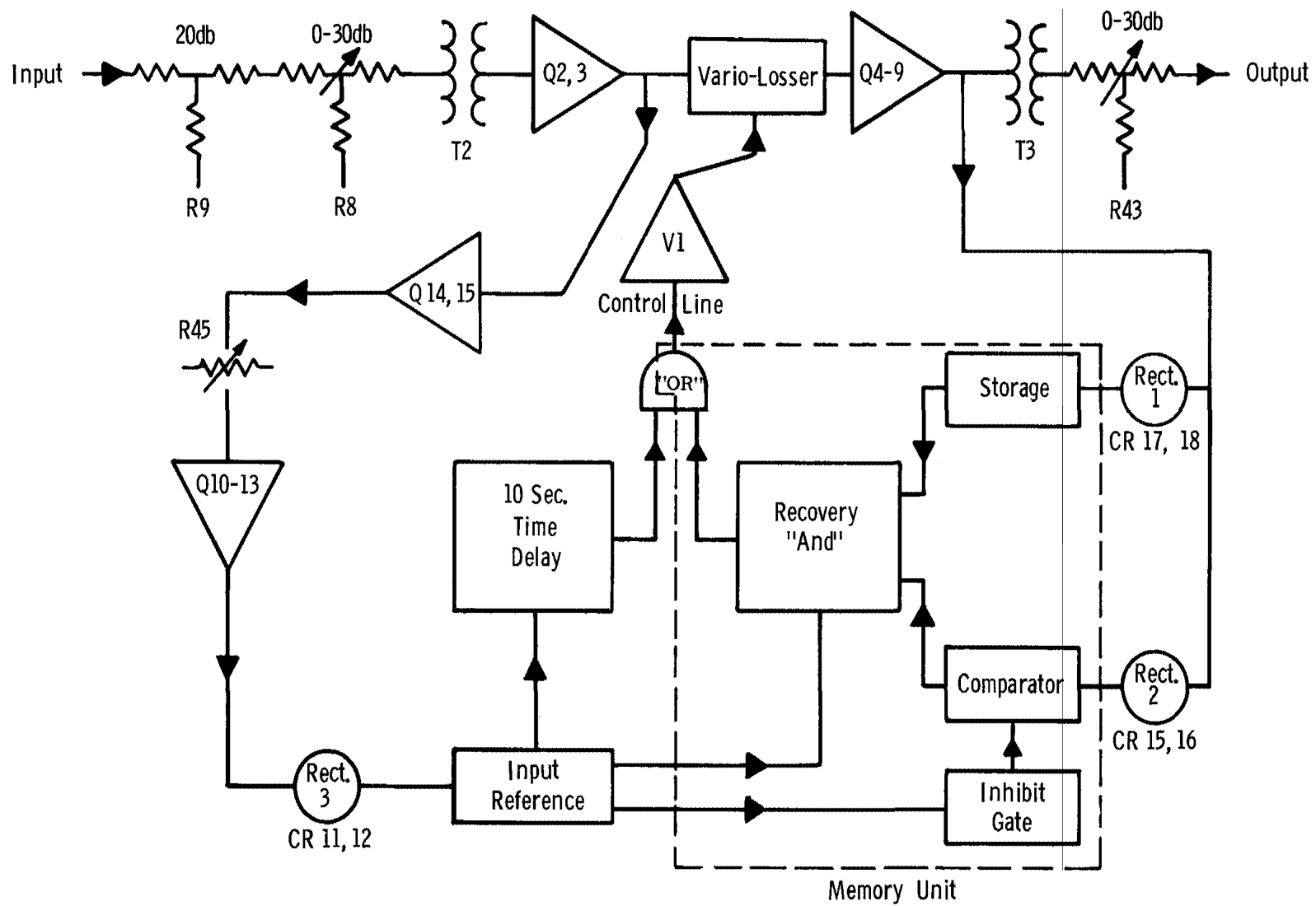


FIGURE 4.1 AUDIMAX III, MODEL 444, BLOCK DIAGRAM

4-2 CIRCUIT OPERATION

The input signal is applied through the input attenuators R8 and R9, and input transformer T2. The signal at the secondary winding of T2 is amplified by the push-pull class A amplifier stages Q2-Q3 and Q4-Q5. The coupling circuit between these stages contains the variollosser elements CR7 and CR8. These matched diodes present an attenuating path whose impedance is determined by the control voltage applied through R24. Control voltage, taken from potentiometer R68, controls the variollosser and therefore the amplifier gain.

To minimize distortion, the output transformer T3 is fed by a class A push-pull amplifier Q8-Q9, driven by push-pull emitter-followers Q6-Q7. Output is then fed through the 600-ohm T-pad, R43, to the output terminals.

Step up winding 1-5 of T3 is capacity coupled to diodes CR17 and CR18 whose cathodes are biased at +16 V. Program signal is rectified by them and the storage capacitor located within the Memory Unit is negatively charged through R79. The control line is connected to the grid of the cathode follower V1, which presents negligible loading of the storage capacitor and provides a low impedance voltage source to the variollosser.

Figure 4.2 is a composite functional diagram illustrating the steady-state inter-relationships among the several elements of the Audimax III system. The upper left quadrant indicates the relative gain of the variollosser (in decibels) as a function of control voltage. The lower left quadrant indicates the outputs of rectifiers 1 and 2 (see Figure 4.2) as a function of the Audimax III output level. The voltage across the storage capacitor developed by biased rectifier 1 (CR17, CR18) is shown by curve OJGH. The voltage developed by rectifier 2 (CR15, CR16) and fed to the comparator is shown by curve OJKQ. Rectifier 2 is biased with +7.5 volts.

Control voltage to V1 is obtained either from rectifier 1 or rectifier 2 depending upon which is less negative. This is determined by the comparator.

Referring now to the lower right quadrant of Figure 4.2, below an input of -24 dBm (with R8 fully clockwise) Audimax III has a constant gain of 30 dB. This is represented by section OA of the input-output curve. As the input is increased from -24 dBm to -16 dBm, the gain is maintained constant because, although rectifier 2 has developed about -8 volts, rectifier 1 output is zero, and being less negative than rectifier 2, therefore controls the gain. Thus, examining the upper right quadrant of Figure 4.2, Audimax III gain vs. input, the gain remains constant along FLM. As the input is further increased, rectifier 1 begins to develop negative dc along line GH, and since rectifier 2 output JKQ is more negative, control remains with rectifier 1. Audimax III gain follows line MN, and the output is determined by line BC.

When the input has reached +4 dBm, the output is +16.5 dBm and the normalized gain reduction is 17.5 dB. If the input is now reduced, rectifier 1 output will not become less negative because charge is retained by the Recovery "AND" circuit. Rectifier 2 output, however, will be reduced quickly. Thus, as the input drops from +4 dBm to -1 dBm, the gain remains constant (line NP), output follows line CD, control voltage to V1 remains constant along HK while rectifier 2 output drops along QK.

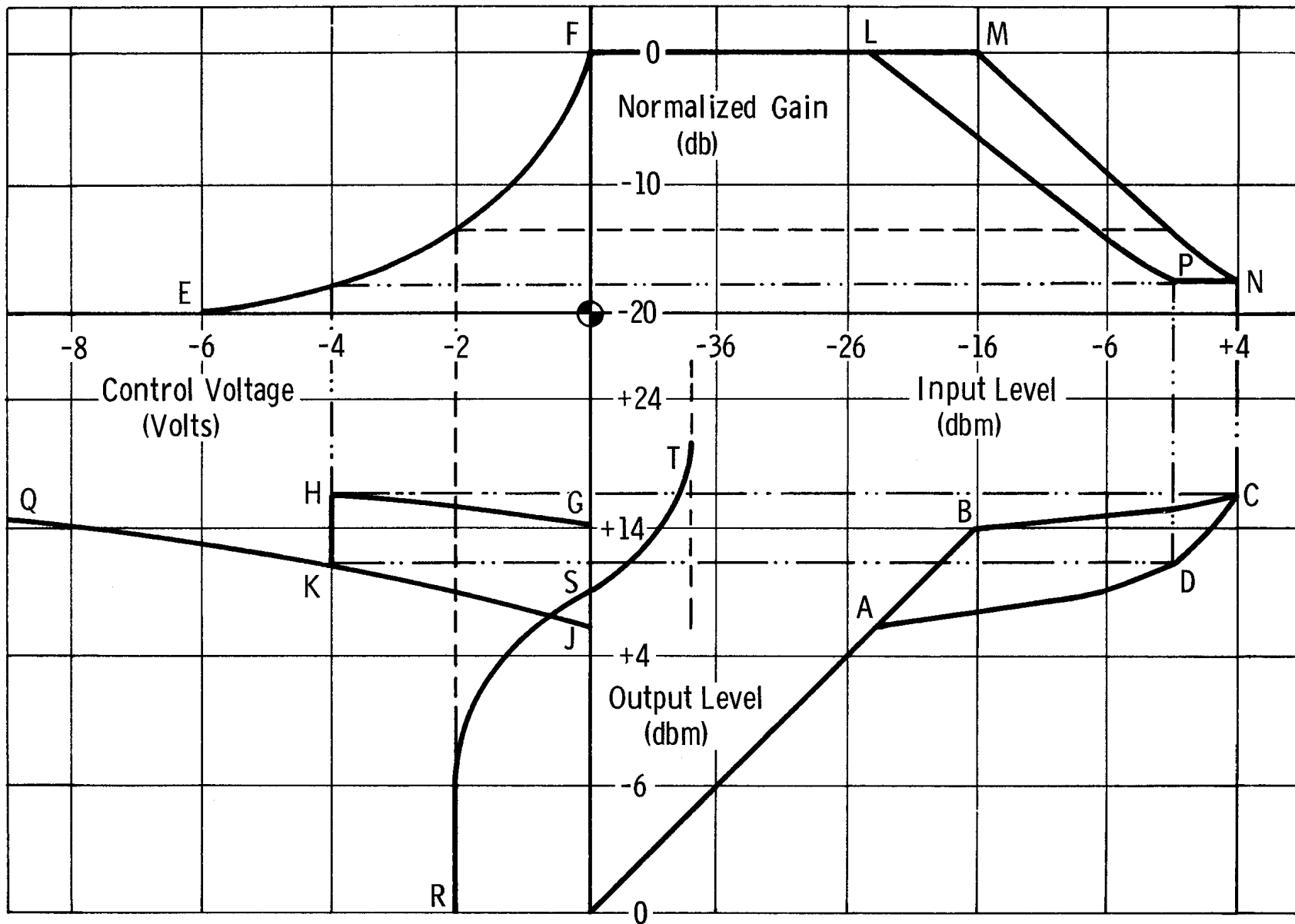


FIGURE 4.2 FUNCTIONAL DIAGRAM

As the input is reduced below -1 dBm, however, rectifier 2 output becomes less negative than rectifier 1 output, and gain control reverts to rectifier 2. Thus, the gain increases following line PL and the output follows line DA because both rectifiers 1 and 2 move along KJ. When the input is reduced below -24 dBm, Audimax becomes a constant gain amplifier.

Figure 4.2 may be used to determine Audimax III behavior for both ascending or descending input signals by the method of projection along the four sets of curves utilizing the rule of precedence indicated above, i.e., control is vested in either rectifier 1 or rectifier 2 depending upon which has a less negative output.

Bear in mind that the description given above pertains only to the steady-state performance of Audimax III. The transient behavior of the system modifies this performance to produce artistically acceptable automatic control.

4-3 GATED GAIN STABILIZATION

To prevent Audimax III from seeking its maximum gain due to a lapse of audio greater than two seconds, such as occurs in TV and motion pictures, Gated Gain Stabilization is employed. In the discussion to follow, the term "lapse of audio" refers to a condition where the input signal is below that determined by the GGS threshold control, R45A.

Referring to Figure 4.4 or 4.5, the signal from the collectors of Q2 and Q3 is fed to emitter-followers Q14 and Q15, and then to an amplifier consisting of Q10-Q13. R45, in the base circuit of Q10-Q11, forms a voltage divider with R44 and R46 thereby serving as the Gated Gain Stabilizer threshold control.

The push-pull output of Q12-Q13 drives rectifier 3 whose dc voltage (at terminal F of the GGS printed circuit board) is applied to the Input Reference. Figure 4.2 indicates the output of rectifier 3 (with R45A 680-ohms) as curve RST covering both lower quadrants. Values of rectifier 3 output shown in the lower right quadrant are positive and those in the lower left quadrant are negative. For example, if rectifier 1 output were -1 volt and rectifier 2 output were -10 volts, rectifier 3 output would be about +1.5 volts. Rectifier 3 determines the voltage at the output of rectifier 2 whenever rectifier 2 is less negative than rectifier 3. If the input signal were suddenly removed without rectifier 3 in the circuit, the control voltage would soon return to zero. However, with rectifier 3 output at -2 volts, rectifier 2 will rise from -9 volts to -2 volts and then relinquish control to rectifier 3. Since rectifier 3 remains at -2 volts, rectifier 1 output must remain at -2 volts, and the amplifier gain is held constant until a signal returns to cause rectifier 3 output to become positive with respect to rectifier 1. Since the speed with which rectifier 3 output is changed is very rapid in comparison with the operating speed of the other rectifiers, it assumes rapid control when signal changes occur requiring such action. Its behavior may be likened to an electronic "gate" which either inhibits or permits gain increases, depending upon the input signal level.

4-4 FUNCTION SWITCH AND METER

In the NORMAL position of the FUNCTION switch, Audimax III is in operation and the GAIN meter monitors the cathode voltage of V1. Since negative control voltage to V1 reduces the cathode voltage and increases attenuation of the variollosser, the meter is calibrated to indicate the relative gain of the amplifier.

In TEST position, the FUNCTION switch connects the control line to a potential providing a constant grid-cathode voltage at V1 and therefore constant gain to the amplifier. This voltage has been selected to duplicate the normal gain of Audimax III.

4-5 STEREOPHONIC ADAPTER

Figure 4.3 is a schematic diagram of the Audimax III Stereophonic Adapter circuitry. This board is mounted, together with the MODE switch, in the left (upper) channel unit of two essentially identical Audimax IIIS for use in stereophonic operation.

In STEREO position, output signals from the two units are coupled via capacitor pairs C10 and C11 to the Stereo Adapter printed circuit board where resistive mixing is employed to produce a push-pull Left-plus-Right signal. This sum is then fed to T91 by the class A push-pull amplifier Q91-Q92. Step-up winding 1-5 provides a parallel feed to the control circuitry of each Audimax via capacitors C91-C94. Since the control for the Left and Right Channel Audimax IIIS is being obtained from a sum signal, it must be realized that, when both channels are fed identical signals, gain control will occur at an input 6 dB below that indicated in Figure 4.2, thereby producing an output 6 dB below the normal output of a monaural Audimax III.

The STEREO REV position reverses the phase of the signal from the left (upper) Audimax to correct for improper phasing of the incoming left and right channel signals.

In MONO position of the MODE switch, both units are restored, except for the TEST function, which is controlled by the FUNCTION switch in the lower Audimax, to normal independent operation.

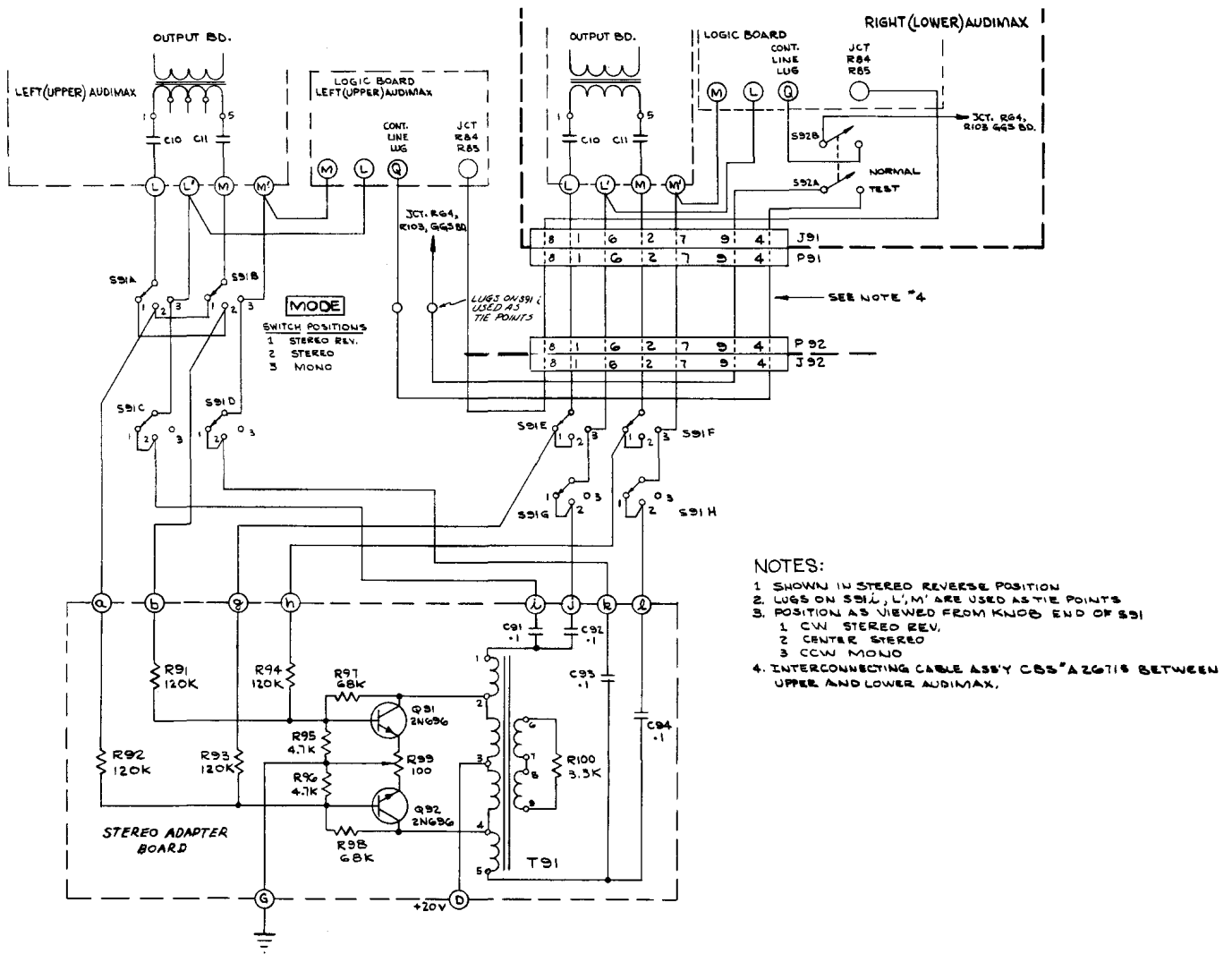
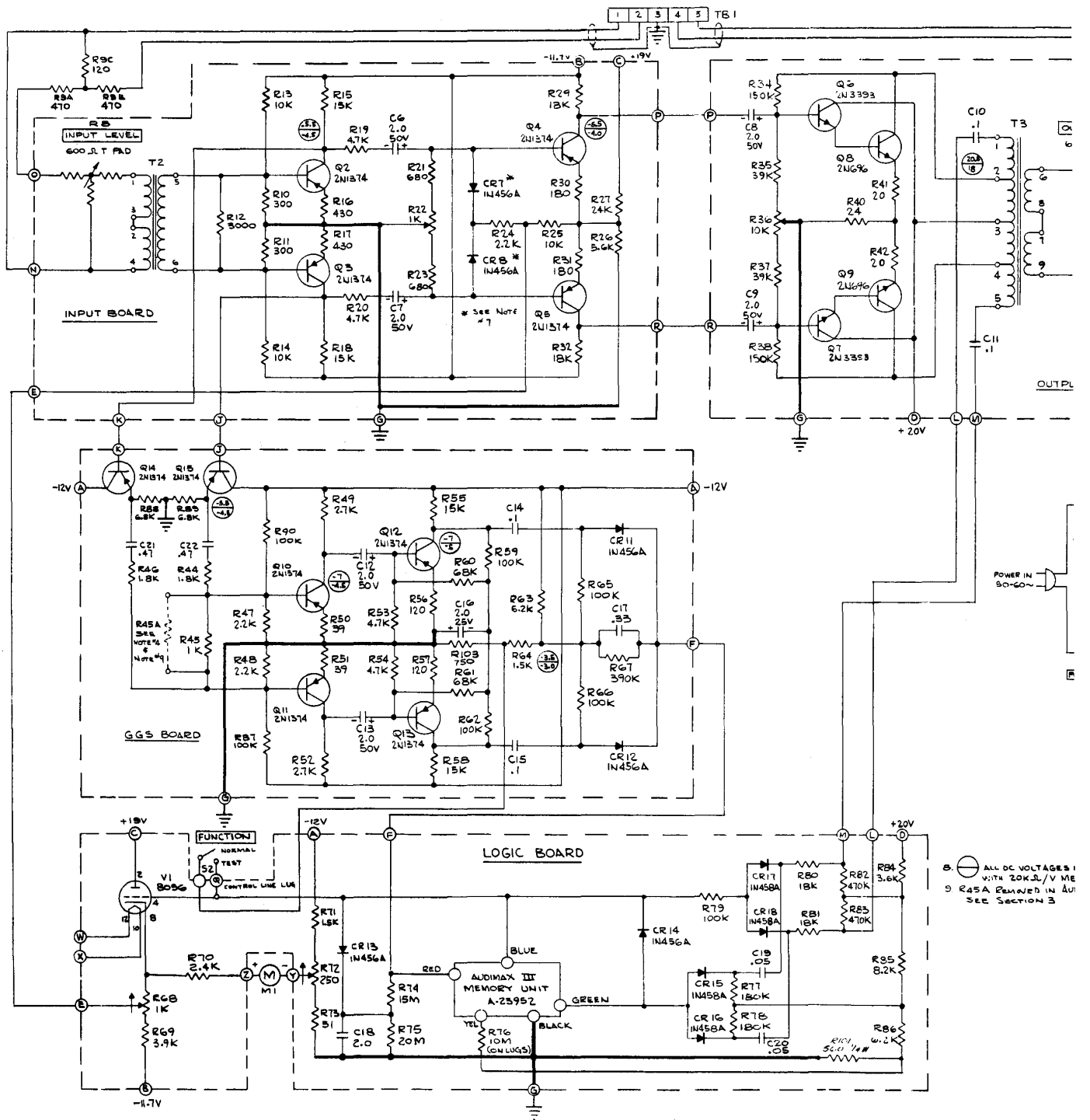


FIGURE 4.3 STEREOPHONIC ADAPTER SCHEMATIC DIAGRAM



FIGURE

Figure 4.4-a. Audimax III Schematic Diagram s/n 101-200

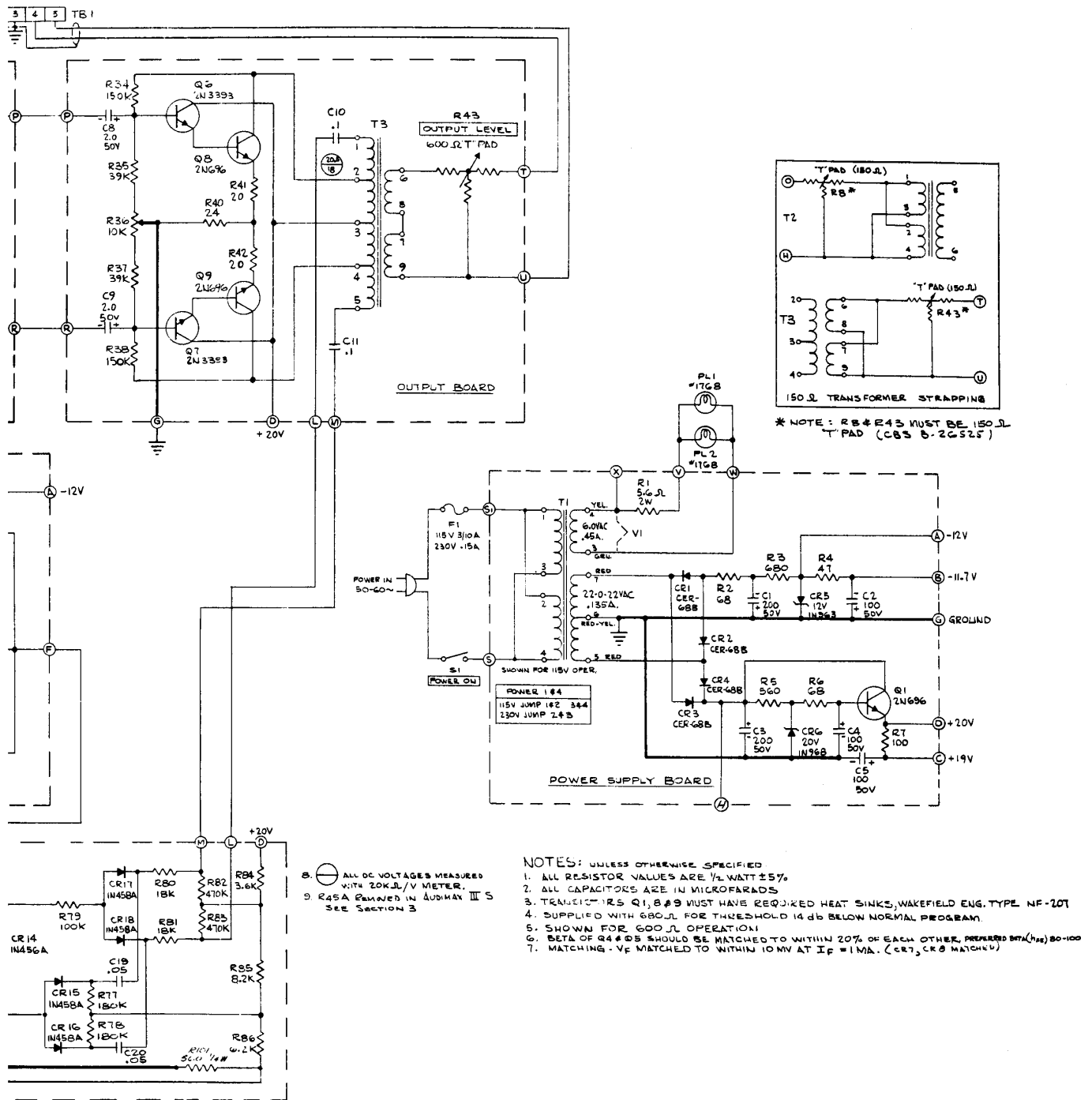
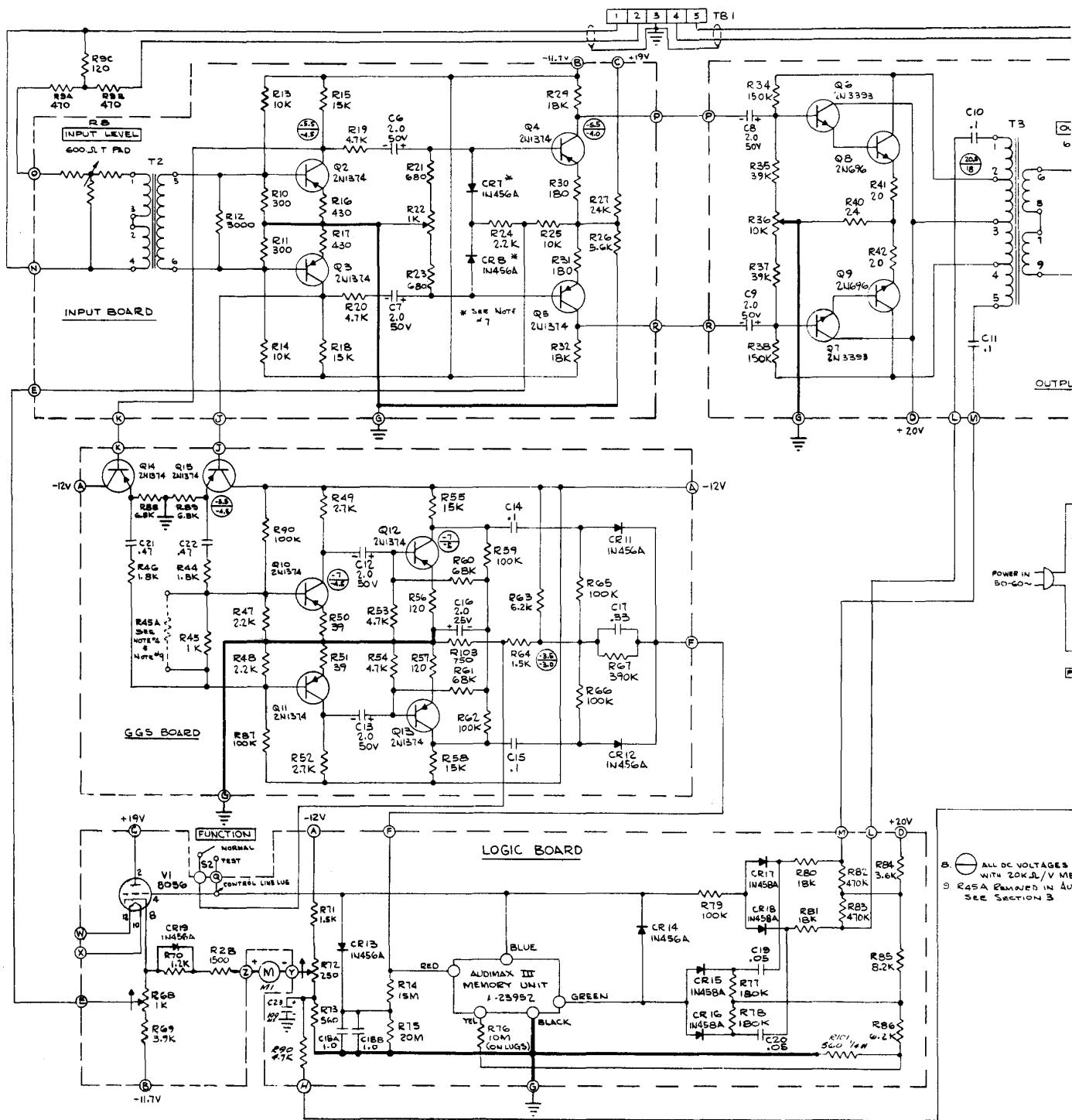


FIGURE 4.4 AUDIMAX III, MODEL 444, SERIAL NUMBERS 101 THROUGH 200, SCHEMATIC DIAGRAM

Figure 4.4-b. Audimax III Schematic Diagram s/n 101-200



ALL DC VOLTAGES + WITH 20K Ω /V ME
 R45A SHOWN IN AUI
 SEE SECTION 3

FIGURE 4.5-a

Figure 4.5-a. Audimax III Schematic Diagram s/n 201 and up

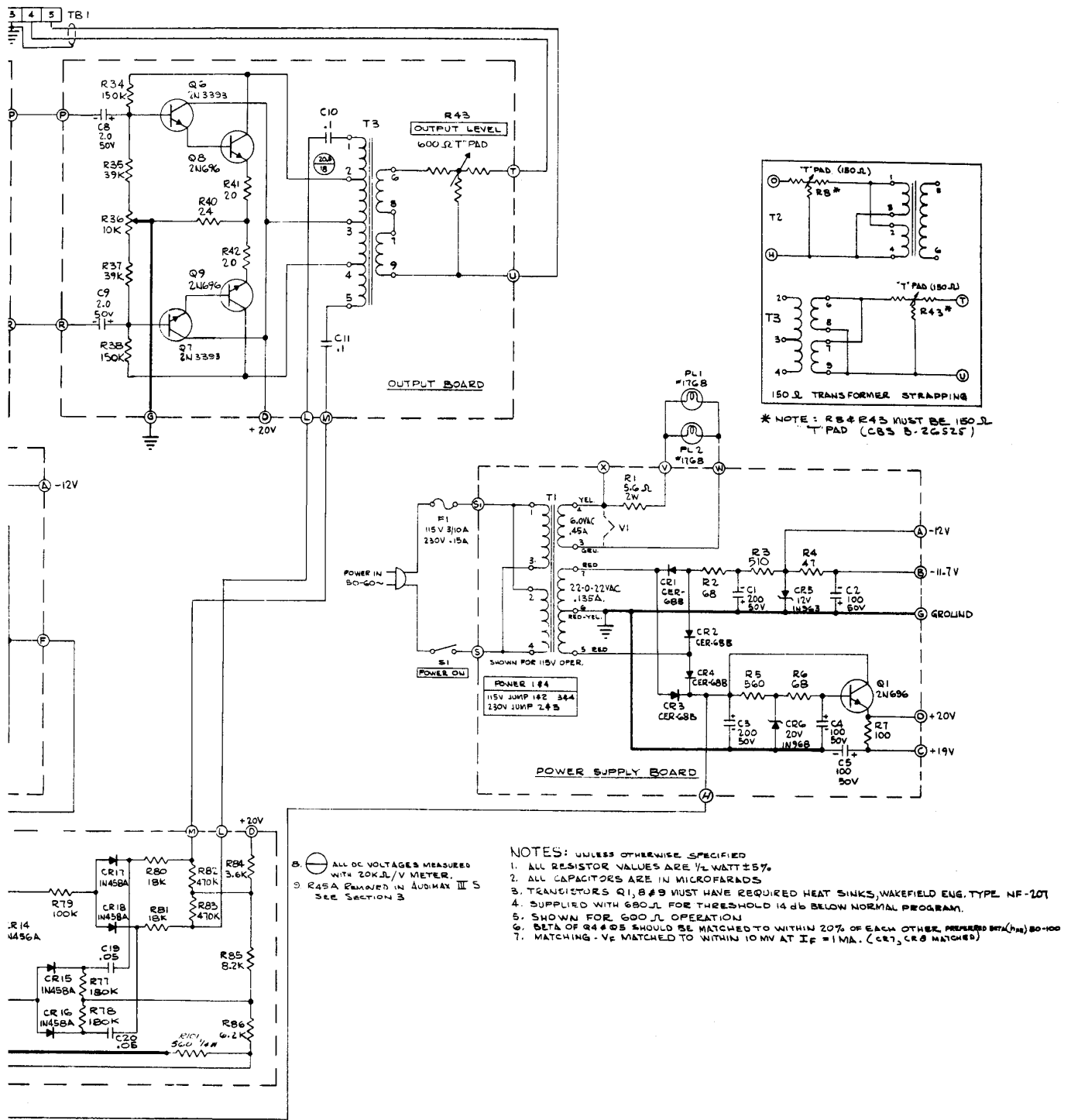


FIGURE 4.5 AUDIMAX III, MODEL 444, SERIAL NUMBERS 201 AND ABOVE, SCHEMATIC DIAGRAM

Figure 4.5-b. Audimax III Schematic Diagram s/n 201 and up

SECTION V

MAINTENANCE

5-1 GENERAL

Troubleshooting for any apparent malfunction of the Audimax III should begin with a check of the power supply. The Audimax III is designed for operation with a 600-ohm load. A standard 620-ohm resistor may be used during bench check. DC voltages, as measured with a multi-meter rated at 20,000 ohms per volt or greater, should fall between the upper and lower limits as shown on the schematic diagram. Accidental shorting of the +20 V supply could cause Q1 to develop a collector-emitter short thereby impressing an unregulated 28 V at point D. If this transistor is replaced, do not neglect to install the heat sink on the new transistor. Check for open decoupling capacitors in the event of excessive 120 Hz hum. If the power supply functions properly, proceed with the following recommended checks for possible troubles.

In the extreme case - no output at all - check you input and output connections thoroughly. Inspect the harness connection to the printed circuit boards for a possible open lead. If this visual inspection does not uncover any defects, stage by stage checking of the unit is necessary. The collector dc voltages of each stage should be checked before any signal tracing is attempted.

In this section, the various adjustment procedures have been double-underlined.

5-2 SERVICING THE MAIN AMPLIFIER

An input signal of -18 dBm (0.1v) at 1 kHz may be used for signal tracing the main amplifier channel. Since this level is below the threshold of gain reduction, the amplifier should provide 30 dB of gain from input to output terminals, with the GAIN meter reading +10. To insure maximum gain, short the "control line lug" to ground.

NOTE

Care should be taken to have the FUNCTION switch in NORMAL position whenever the control line is grounded to prevent possible damage to the GAIN meter.

This lug is located at the top of the logic board adjacent to the Memory Unit. Frequency response is also most conveniently measured at this level, although response is flat at all levels.

The signal at points P and R on the input board should be about 0.15 volts RMS measured with a VTVM to ground. If this voltage appears to be incorrect, localize the trouble by removing the harness leads from points P and R. The voltage at these points should now measure 0.45 volts. Obtaining the correct reading in this unloaded condition would indicate proper functioning of the Input board and, therefore, a malfunction of the Output board. However, if this measurement does not check, then further checking of the Input board is required.

With the input maintained at 100 millivolts, the following approximate signal voltages to ground should be present: Q2 and Q3 collectors: 35 millivolts; the bases of Q4 and Q5: 7 millivolts. With

correct voltages at Q2 and Q3, but incorrect at Q4 and Q5, remove the harness lead from point E and observe that the level at Q4 and Q5 bases does not increase by more than 1 dB. Excessive level increase would indicate a malfunction or improper calibration of the logic board. If transistors Q4 and Q5 are defective, replace them with beta matched within 20% of each other. If it is not practical to match betas, select a replacement transistor such that the collector voltages of Q4 and Q5 differ by less than 1 V dc.

Diodes CR7 and CR8 are matched. To match a replacement diode, feed 1 milliampere from a regulated power supply through a high resistance in series with the diode. Forward voltage drop across the diode under test must be within 10 millivolts of the other diode under the same condition.

If any of the semiconductor devices on the Input board are replaced, it will be necessary to readjust R22 and R68 as follows: turn the INPUT and OUTPUT LEVEL controls and R68 fully clockwise. Feed a 5 kHz signal at -6 dBm and adjust R68 to produce a 0 dB reading on the GAIN meter. The output should be +15 dBm. Connect a distortion analyzer across the output and adjust R22 for minimum distortion.

Replacing Q6, Q7, Q8 or Q9 will necessitate the readjustment of R36. Feed a 50 Hz signal to deflect the GAIN meter to the green region and adjust R36 for minimum output distortion.

5-3 SERVICING THE GATED GAIN STABILIZER

Troubleshooting of the Gated Gain Stabilizer (GGS) and the Logic board can be facilitated by the use of Figure 4.2. It is very important, however, that all dc measurements be performed with a VTVM of 10 megohms or greater input impedance.

With no input signal applied to Audimax III, -2 volts dc should be present at point F of the GGS printed circuit board. Monitor this point and feed a 1 kHz signal at -28 dBm with the INPUT LEVEL control R8, fully clockwise. Increase the input slowly and observe that point F becomes positive at approximately -20 dBm. With this input, 0.025 volts RMS should be present at the emitters of Q14, Q15 producing approximately 0.060 volts at Q10, Q11 collectors.

5-4 SERVICING THE LOGIC BOARD AND MEMORY UNIT

NOTE

Be careful when making these tests. The Memory Unit can be permanently damaged if the voltmeter probe shorts these points to other voltages.

The solid state Memory Unit has been encapsulated in epoxy for maximum stability and protection. No attempt should be made to open it; all test measurements can be made at appropriate connection points. Before undertaking any tests of the Memory Unit, first be sure that the main amplifier and Gated Gain Stabilizer are functioning properly.

To test the steady-state performance of the Logic board and Memory Unit, turn the INPUT LEVEL control R8 fully clockwise. An input of -6 dBm at 1 kHz should produce -1 volt at the control line (BLUE connection to the Memory Unit) and -9 volts at the GREEN connection. This voltage will rise from -9 volts towards 0 but should then begin to increase negatively, at

approximately -20 dBm, when rectifier 3 becomes more negative than rectifier 2. It is important that the above measurements be made with a vacuum tube voltmeter with an input impedance of at least 10 megohms.

The steady-state voltage relationships are graphically shown in Figure 4.2. If, for some reason, it is necessary to replace V1, then R72 and R68 will require recalibration. To set R72 short to ground the "control line lug", located at the top of the Logic board adjacent to the Memory Unit, and adjust for a +10 dB reading of the GAIN meter. Remove short. R68 can then be set by feeding -6 dBm at 1 kHz to Audimax III, with the INPUT LEVEL control R8 fully clockwise, and adjusting for a 0 dB reading on the GAIN meter. If meter will not go full scale with R72, replace 8056 nuvistor.

5-5 TRANSIENT PERFORMANCE

To check transient performance, turn R43 fully clockwise and feed a 1 kHz signal so as to produce a GAIN meter reading between -5 and -10 dB. This should result in an output level of +16 dBm.

Rapidly reduce the input signal exactly 20 dB. Recovery to maximum gain should occur in two steps: after an initial delay, quickly to a reading of approximately +5 dB, then slowly to +10 dB. This fast mode of recovery is typical of the speed at which gain is increased when program levels exceed the lower boundaries of the "platform". The slower recovery mode is equivalent to that speed at which a drift towards "platforms" of higher gain occurs. This latter time-constant is controlled by R76, and the above description only applies when R76 is unchanged from its original value of 10 megohms.

After the gain has stabilized at maximum, short out the input signal and watch the GAIN meter. Gain should remain constant for at least 10 seconds and then slowly return to the normal region. If the gain immediately begins to fall slowly, the sealed memory unit may be defective. Less than optimum performance results but AGC still occurs.

Next, restore the previous full input signal level, resulting in a gain reading between -5 and -10 dB. Short out the input signal and observe that the gain will recover to -5 dB with no further change. If the meter sweeps past +10, the nuvistor is bad.

To verify correct operation of Gated Gain Stabilizer, feed a 1 kHz signal to produce a reading of 0 dB on the GAIN meter. Quickly reduce the input 20 dB. The meter should not move out of the green region towards maximum gain.

This check is only valid for R45A = 680 ohms as factory supplied. If this value has been changed to alter the Gated Gain threshold, the performance check must be changed accordingly.

5-6 BULB REPLACEMENT

Meter lamps PL1 and PL2 are rated at 6 volts, but are operated at only 4 volts to provide extremely long life. If, however, replacement becomes necessary, removal of the lamp holders is facilitated by the access holes located directly behind the sockets in the card holder.

5-7 CIRCUIT BOARD INTERCONNECTIONS

This table was NOT in the original manual; the transcriber added it by examining the schematic diagrams.

The modules are probably arranged left to right, looking in from the front.

Pin	Input	Output	Logic	GGS	PS	Signal Name/Function
A			Y	Y	Y\$	-12VDC
B	Y		Y		Y\$	-11.7VDC
C	Y		Y		Y\$	+19VDC
D		Y	Y		Y\$	+20VDC
E	Y		Y\$			GR Control
F			Y	Y\$		GGG Output
G	Y	Y	Y	Y	Y\$	Ground (3)
H			Y		Y\$	+30VDC Unregulated
I						NOT USED
J	Y\$			Y		GGG Feed
K	Y\$			Y		GGG Feed
L		Y\$	Y			Audio Feed
M		Y\$	Y			Audio Feed
N	Y					Audio Input (1)
O	Y					Audio Input (2)
P	Y\$	Y				Inter-stage Audio
Q			Y			Test Switch
R	Y\$	Y				Inter-stage Audio
S					Y	AC Input (switch)
S1					Y	AC Input (fuse)
T		Y\$				Audio Output (4)
U		Y\$				Audio Output (5)
V					Y\$	Meter Bulbs
W			Y		Y\$	Filament, Bulbs
X			Y		Y\$	Filament
Y			Y\$			GR Meter -
Z			Y\$			GR Meter +

NOTES:

- 1: Point Q is referred to as the "Control Line Lug".
- 2: Board/terminals marked with "\$" are the source of the particular signal.
- 3: The other side of the TEST switch goes to an unmarked point on the GGS board.
- 4: Numbers in parentheses are the input/output terminal strip (TB1) lug number.

SECTION VI

PARTS LISTS

NOTE: Resistors are 1/2 watt, 5% unless otherwise indicated. Manufacturer's part numbers and all CBS-specific part and assembly numbers have been omitted from these lists, although they are present in the original 1967 manual.

6-1 AUDIMAX III

Reference Symbol	Component Description	Revision Notes
C1	Electrolytic 200uF 50V	
C2	Electrolytic 100uF 50V	
C3	Electrolytic 200uF 50V	
C4	Electrolytic 100uF 50V	
C5	Electrolytic 100uF 50V	
C6	Electrolytic 2uF 50V	
C7	Electrolytic 2uF 50V	
C8	Electrolytic 2uF 50V	
C9	Electrolytic 2uF 50V	
C10	Dipped Mylar 0.1uF 100V 10%	
C11	Dipped Mylar 0.1uF 100V 10%	
C12	Electrolytic 2uF 50V	
C13	Electrolytic 2uF 50V	
C14	Dipped Mylar 0.1uF 100V 10%	
C15	Dipped Mylar 0.1uF 100V 10%	
C16	Electrolytic 2uF 50V	
C17	Dipped Mylar 0.33uF 100V 10%	
C18	Dipped Mylar 2.0uF 100V 10%	s/n > 200: omitted
C18A	Dipped Mylar 1.0uF 100V 10%	s/n < 201 only
C18B	Dipped Mylar 1.0uF 100V 10%	s/n < 201 only
C19	Dipped Mylar 0.05uF 100V 10%	
C20	Dipped Mylar 0.05uF 100V 10%	
C21	Dipped Mylar 0.47uF 100V 10%	
C22	Dipped Mylar 0.47uF 100V 10%	
C23	Electrolytic 100uF 50V	s/n < 201: omitted
CR1	Silicon Rectifier 250mA 100PIV	
CR2	Silicon Rectifier 250mA 100PIV	

Reference Symbol	Component Description	Revision Notes
CR3	Silicon Rectifier 250mA 100PIV	
CR4	Silicon Rectifier 250mA 100PIV	
CR5	Silicon Zener 1N963B 12V 0.4W 5%	
CR6	Silicon Zener 1N968B, 20V 0.4W 5%	
CR7	Silicon Diode 1N456A	Matched to within 20%
CR8	Silicon Diode 1N456A	Matched to within 20%
CR11	Silicon Diode 1N456A	
CR12	Silicon Diode 1N456A	
CR13	Silicon Diode 1N456A	
CR14	Silicon Diode 1N456A	
CR15	Silicon Diode 1N458A	
CR16	Silicon Diode 1N458A	
CR17	Silicon Diode 1N458A	
CR18	Silicon Diode 1N458A	
CR19	Silicon Diode 1N456A	s/n < 201: omitted
F1	Fuse 3AG 3/10A (115V), 0.15A (230V)	
Fuse Holder	Littlefuse 342012	
Heat Sinks	Wakefield Eng NF-207	
Lamp Holders	Lee Craft 16-26	
M-1	Meter "GAIN"	
PL1	Lamp #1768	
PL2	Lamp #1768	
Q1	2N696 Transistor	
Q2	2N1374 Transistor	
Q3	2N1374 Transistor	
Q4	2N1374 Transistor	Beta matched to 20%
Q5	2N1374 Transistor	Beta matched to 20%
Q6	2N3396 Transistor	
Q7	2N3396 Transistor	

Reference Symbol	Component Description	Revision Notes
Q8	2N696 Transistor	
Q9	2N696 Transistor	
Q10	2N1374 Transistor	
Q11	2N1374 Transistor	
Q12	2N1374 Transistor	
Q13	2N1374 Transistor	
Q14	2N1374 Transistor	
Q15	2N1374 Transistor	
R1	5.6 ohm 2w wire-wound	
R2	68 ohm	
R3	680 ohm	s/n > 200: 510 ohms
R4	47 ohm	
R5	560 ohm	
R6	68 ohm	
R7	100 ohm	
R8	600 ohm T-pad (150 ohm T-pad optional)	
R9A	470 ohm	
R9B	470 ohm	
R9C	120 ohm	
R10	300 ohm	
R11	300 ohm	
R12	3 K	
R13	10 K	
R14	10 K	
R15	15 K	
R16	430 ohm	
R17	430 ohm	
R18	15 K	
R19	4.7 K	
R20	4.7 K	
R21	680 ohm	
R22	Pot 1 K 1/6W 20%	
R23	680 ohm	
R24	2.2 K	

Reference Symbol	Component Description	Revision Notes
R25	10 K	
R26	5.6 K	
R27	24 K	
R28	1.5 K	s/n < 201: omitted
R29	18 K	
R30	180 ohm	
R31	180 ohm	
R32	18 K	
R34	150 K	
R35	39 K	
R36	Pot 10 K 1/6W 20%	
R37	39 K	
R38	150 K	
R40	24 ohm	
R41	20 ohm	
R42	20 ohm	
R43	600 ohm T-pad (150 ohm T-pad optional)	
R44	1.8 K	
R45	1K	
R45A	680 ohm	Omitted on IIS
R46	1.8 K	
R47	2.2 K	
R48	2.2 K	
R49	2.7 K	
R50	39 ohm	
R51	39 ohm	
R52	2.7 K	
R53	4.7 K	
R54	4.7 K	
R55	15 K	
R56	120 ohm	
R57	120 ohm	
R58	15 K	
R59	100 K	
R60	68 K	

Reference Symbol	Component Description	Revision Notes
R61	68 K	
R62	100 K	
R63	6.2 K	
R64	1.5 K	
R65	100 K	
R66	100 K	
R67	390 K	
R68	Pot 1 K 1/6W 20%	
R69	3.9 K	
R70	1.2 K	s/n < 201: 2.4 K
R71	1.5 K	
R72	Pot 250 ohm 1/6W 20%	
R73	560 ohm	s/n < 201: 51 ohm
R74	15 M	
R75	20 M	
R76	10 M	
R77	180 K	
R78	180 K	
R79	100 K	
R80	18 K	
R81	18 K	
R82	470 K	
R83	470 K	
R84	3.6 K	
R85	8.2 K	
R86	6.2 K	
R87	100 K	
R88	6.8 K	
R89	6.8 K	
R90	100 K	
R101	560 ohm 1/4w 5%	
R102	4.7 K	s/n < 201: omitted
R103	750 ohm	
S1	Switch SPST (Power)	

Reference Symbol	Component Description	Revision Notes
S2	Switch SPST (Test)	
T1	Power Transformer	
T2	Input Transformer	
T3	Output Transformer	
TB-1	Barrier Strip (5 Term)	
V1	8056 Nuvistor tube	

6-2 STEREOPHONIC ADAPTER

Reference Symbol	Component Description
C91	Mylar 0.1uF 100V 10%
C92	Mylar 0.1uF 100V 10%
C93	Mylar 0.1uF 100V 10%
C94	Mylar 0.1uF 100V 10%
J91	DB9P male chassis-mount
J92	DB9P male chassis-mount
Q91	2N696 Transistor
Q92	2N696 Transistor
R91	120 K
R92	120 K
R93	120 K
R94	120 K
R95	4.7 K
R96	4.7 K
R97	68 K
R98	68 K
R99	Potentiometer 100 ohm 1/6w 20%
R100	3.3 K
S91	Switch, Rotary "MODE"
S92	Switch, "FUNCTION"
T91	Transformer (output driver)