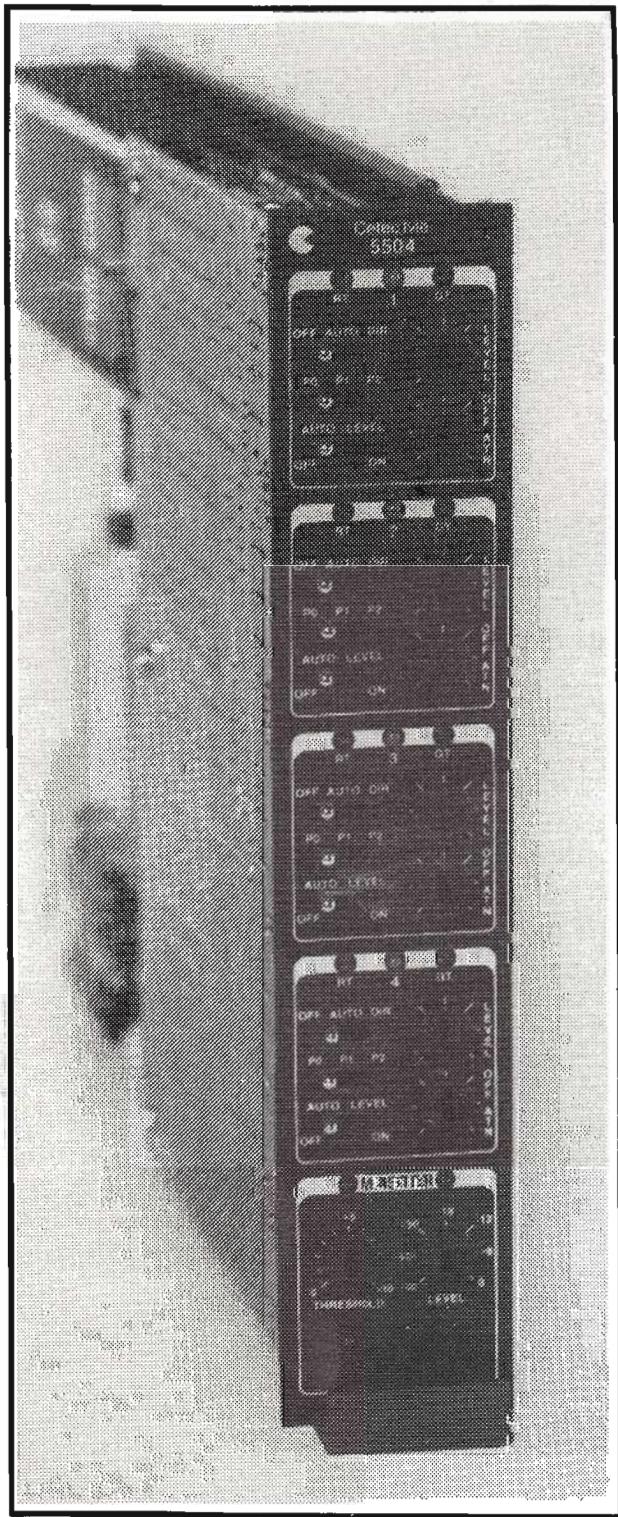




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## 5504 MANUAL



**Operation and  
Owners Manual  
for the**

**5504 Automatic Mixer  
5000 Modular Sound System**

## INTRODUCTION

The 5504 automixer is a very versatile mixer. It can function as a simple manual mixer or as a very sophisticated, fully automatic mixer or anywhere in between.

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**Because of the complex and sophisticated nature of this mixer it is imperative that you read this instruction manual in its entirety.**

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This manual does not attempt to cover all facets of design, installation and operation of the 5504 automatic mixer in detail. However, it does attempt to provide all the basic information required for the proper utilization of the 5504.

It is assumed that the user possesses a fundamental understanding of the operation of automatic microphone mixers and their applications. A familiarity with basic sound system design, installation and operation is also assumed.

A great deal of information contained in this manual can be found in the "5504 Block Diagram", "5504 Internal Options and Controls" page and the "5504 Input/Output Connections" page. You should frequently refer to these pages as you read the text of this manual. You will also find that these diagrams contain additional specialized information not necessarily found in the text.

## HOW TO USE THIS MANUAL

First of all invest some time right up front and read the manual. This could be a cursory reading to get a feel for the features and functions of the mixer. You will find that there are bits of theory of operation and applications information salted throughout the manual. If you just read selected sections on an "as needed" basis you will miss out on much of the meat of the manual.

After reading the manual you can use it as a reference source when detailed information is required on a specific subject.

## Front Panel Controls

### OFF-AUTO-DIR

**OFF** - In this position the microphone channel is essentially turned off (-100 dB). The attenuator (OFF ATN) does not affect the off level of the channel.

**AUTO** - In the auto position the microphone channel is placed in the automatic gating mode. The microphone is gated on and off as determined by the levels sensed by each individual microphone. When the channel is gated on, it contributes to the NOM. The OFF ATN control is active in this mode when the channel is gated off.

NOTE: The AUTO function operates independently from the AUTO LEVEL function. The auto level function determines when a channel should be gated (turned) on. The auto level function will maintain the proper level once the channel has been gated on.

**DIR** - (DIRECT) In this position the microphone channel is on all the time. The microphone contributes to the NOM and may be controlled by the auto level. It cannot be turned off by a higher priority channel. It will turn off a lower priority channel ONLY when the input signal level would cause that channel to gate on if it were in the AUTO mode.

### RT (RELEASE TIME)

RT control pertains only to the AUTO mode. When a channel in the AUTO mode receives a signal command to gate off, it does not gate off immediately, but is held on for a period of time determined by the RT control setting.

The RT is adjustable over a range from .1 seconds (full ccw) to 10 seconds (full cw). The release time should be set for each individual application. As a rule of thumb, the RT should be set so that the channel remains on during pauses in normal speech.

### GT (GAIN TRIM)

The gain trim control sets the maximum gain through the individual channel. This control must be properly adjusted in order to avoid the possibility of feedback. Refer to the section "5504 Set Up Procedure" for more information.

### CHANNEL ACTIVE LED

This LED is located between the RT and GT controls of each channel. It provides three indications: channel on (active), signal modulation or presence, and input clipping. The LED will come on when the channel is turned on in the DIR mode or gated on in the AUTO mode. When a signal appears at the input, it will modulate the brightness of the LED causing it to flicker. Should a strong signal cause the input to clip, the LED will turn from green to red.

### **P0-P1-P2 (PRIORITY LEVEL 0-1-2)**

The 5504 has an automatic priority feature that allows the microphone channels to have three different levels of priority or precedence over one another. P2 is the highest level of priority and will override P1 and P0. Likewise, P1 will override P0. When a channel set to P2 gates on, it will turn all lower priority (P1&P0) channels off. These lower priority channels will be attenuated by the amount set on their individual OFF ATN controls. The priority override does not wait for the release time to "time out" on the channel being overridden. More than one channel may be assigned the same priority level. If **NO PRIORITY** is desired, then set all channels to P0.

Refer to the section on OFF ATN (OFF ATTENUATION) for an example of how to use the priority settings.

### **AUTO LEVEL**

The AUTO LEVEL function is unique to the 5504. It may be used in either the AUTO or DIR mode. It will automatically adjust for differences in level from speaker to speaker. Refer to the section "Set Up Procedure for the 5504", step #7B.

### **LEVEL CONTROL**

The LEVEL control sets the level for the microphone channel. This control functions the same whether or not the AUTO LEVEL function is used. The LEVEL control is adjusted for the desired level and mix while program material is played over that channel. When using the AUTO LEVEL function, the program material should be allowed to play for 5 seconds before any adjustment is made. This provides the AUTO LEVEL time to make it's adjustment and stabilize.

### **OFF ATN (OFF ATTENUATION)**

When a channel is gated off while in the AUTO mode, it's output will be attenuated by the amount set by the OFF ATN control. Thus when a channel is gated off it may not be completely off, but only attenuated. When the output of the 5504 is used to drive ancillary areas, such as foyers, it is highly desirable to only reduce the level of the program material and not to turn it completely off. The audio feed to these ancillary areas contains the program material plus the noise of the meeting room. It is the total and abrupt discontinuence of the room noise that is objectionable.

The OFF ATN feature allows the output level from the microphone to be reduced, thus maintaining the gain before feedback margin without totally interrupting the feed to the ancillary areas.

The OFF ATN control can be put to great benefit when used in conjunction with the priority controls. For example: Background music is fed to channel 1 - its priority is set to P0 and its OFF ATN is set to "-18dB". Channel 2 is the paging channel. Its priority is set P1 and its OFF ATN is set to  $-\infty$ . The level controls of the two channels are set as desired. When a page comes over channel 2, it's higher priority (P1) causes channel 1 (P0) to attenuate by 18dB. This has the effect of "ducking" the background music during the page. The background music will resume its preset level as soon as the RT of channel 2 times out after completion of the page. When the paging channel is off, it is attenuated by 100dB.

## THRESHOLD

The heart of any automatic mixer is the circuit that determines which microphones should be gated on and which microphones should remain off. The 5504 accomplishes this task by comparing the input of each individual microphone to the sum of all the microphone inputs. A portion of the sum of all the inputs creates the dynamic threshold sense bus. In order for a microphone to be gated on, it must exceed the level of this bus by a certain number of dB. The THRESHOLD control sets the number of dB that the individual channel must exceed the dynamic threshold sense in order to be gated on. If the THRESHOLD control is set for +8dB, then the signal level from a microphone must exceed the dynamic threshold bus by 8dB before it will be gated on.

As you can see, the THRESHOLD control determines how easily the microphones will gate on. If this control is set too low, then the ambient noise in the room may cause the microphones to gate on and off in a random manner. If the control is set too high, then they may fail to gate on when spoken to by a soft-spoken person. This control is best set during actual operating conditions.

The THRESHOLD control affects all four channels equally. When used in master/slave combinations, each 5504 is effected only by its own THRESHOLD control. This provides independent zone control for each mixer.

## MASTER LEVEL CONTROL

The MASTER LEVEL CONTROL affects the level of all channels at the same time. The mix of all the channels is maintained as the master level is varied. When multiple 5504's are used in a master/slave configuration, only the MASTER LEVEL CONTROL on the master 5504 is active. The master level controls of all slaves are disabled.

## MASTER LEDs

There are two LEDs in the master section of the 5504. The LED located just to the left of the word MASTER is the output clip LED. This LED will flash red when the master output signal goes into clipping.

The LED located to the right of the word MASTER is the master/slave indicator. This LED will be green when the 5504 is being used independently or as a master. When used as a slave, this LED will not be lit. When the 5504 is remotely switched between master and slave, this LED provides front panel master/slave status indication.

## SIGNAL PRESENCE LED

The yellow LED located in the lower left corner of the 5504 is the output signal presence LED. It is connected to the output of the 5504 and flashes on and off when an output signal is present.

## TEST POINT

The test point is located in the lower right corner of the front panel. The test point is connected to the output of the 5504 via a 600 ohm resistor. This test point allows the use of oscilloscopes, real time analyzers, voltmeters, etc., for system documentation and trouble shooting. The 600 ohm isolation resistor will not affect the accuracy of the measurement when the test instrument input impedance is greater than 50,000 ohms.

## \*\*\*\*\* INTERNAL CONTROLS and CONNECTIONS \*\*\*\*\*

### MASTER AUDIO OUTPUT

The master audio output of the 5504 may be accessed in three places: the front panel test point, the output buss assign switch, and terminal #24 on the TB51 terminal block. The master output signal appears at all three places simultaneously.

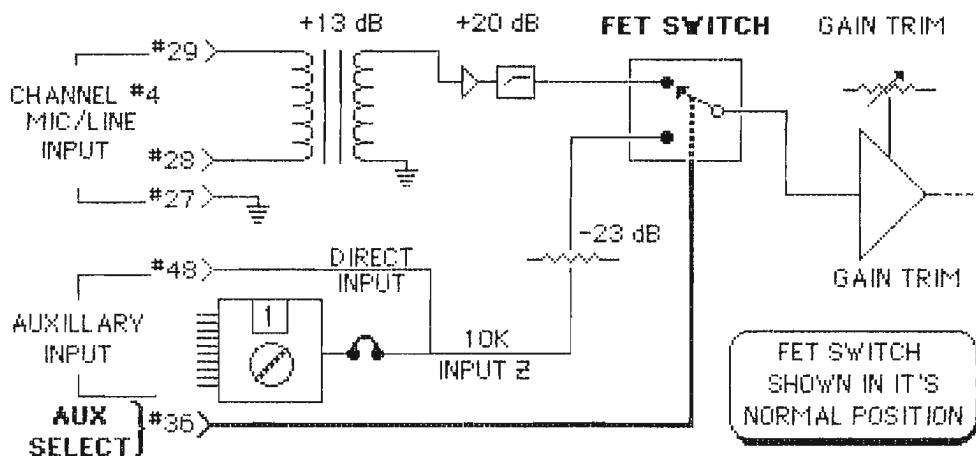
In most applications, the output of the 5504 will be assigned to the 5001 motherboard busses via the master output buss assign switch. If this is not to be the case, the master output buss assign switch should be assigned to an unused buss. If it is desirable to completely isolate the output from the motherboard, then cut the wire jumper located just to the right of the master output buss assign switch.

The output of the 5504 will always appear on terminal #24 of the TB51 even when the wire jumper adjacent to the output buss assign switch is cut. This is the direct output. Terminal #50 should be used as the ground connection for the direct output.

### CHANNEL #4 AUX IN

Channel #4 has two inputs, the regular microphone/line input and the auxillary input. The input to channel #4 can be remotely switched between two sources. This allows input #4 to serve as a regular microphone input for the majority of the time, and to be switched over to an auxillary line level input on special occasions.

The auxillary input may receive its signal from the motherboard busses via the CHANNEL #4 AUX IN buss select switch, or from terminal #48 on the TB51. Channel #4 always receives its signal from terminals #27, #28, and #29 on the TB51 unless the auxillary input is selected by shorting terminal #36 to terminal #50. This function may be remotely controlled using an unshielded pair of wires.



CHANNEL NUMBER FOUR MIC-LINE/AUXILLARY INPUT

## \*\*\*\*\* PREAMP CONTROLS \*\*\*\*\*

TO GAIN ACCESS TO THE FOLLOWING CONTROLS, REMOVE THE **PREAMP CONTROLS** COVER.

### **20dB PAD**

The 20dB pad should be switched in only after the GAIN TRIM control has been turned fully counter-clockwise and more attenuation is required.

### **MICROPHONE/LINE INPUT SWITCH**

Each input may be switched to accept either mic or line levels. Note: When using mic or line level signals from outside of the closed loop of the sound system, you may wish to consider disabling the NOM receive, NOM contribute, and THRESHOLD contribute of the involved channel.

### **HIGH PASS FILTER**

The high pass filters in the 5504 are unique. Unlike the majority of other mixers that provide a high pass filter with a 6dB/octave rolloff that starts at 250Hz, the 5504 HP filter is 30dB/octave and is 6dB down at 125Hz.

This provides several advantages. The 6dB down point of 125Hz does not affect the quality of human speech. This filter characteristic eliminates the most annoying part of P-Pops and other plosive sounds generated when speaking into a microphone. It also minimizes low frequency sound generated by microphone handling.

### **PHANTOM POWER**

Phantom power for condenser microphones is available on each input. The internal power supply provides 48Vdc through a 3,300 ohm resistor. The phantom power is turned on to each input by setting the appropriate dip switch to the on position.

### **PRE-VCA OUTPUT**

The PRE-VCA (voltage controlled attenuator) OUTPUT is a direct output from each channel before it goes through the VCA. This output has a maximum gain of 53dB when referenced to the input level. The actual amount of gain is determined by the settings of the pad and the gain trim control.

The PRE-VCA outputs are not affected by the gating action of the mixer, the priority switching, the auto level, the manual level, or the master level controls. It is an ideal feed for a logging recorder when used in a courtroom system. The output is fed through a 604 ohm resistor which allows several PRE-VCA outputs to be tied together at the TB51 terminal block. This would mix the outputs together and cause a 6dB drop in overall output level of the combined PRE-VCA outputs. An additional 6dB drop will occur every time the number of outputs tied together is doubled. If the PRE-VCA outputs of all four channels are to be tied together, then it is preferable to use the PRE-VCA mix output of the 5504 (TB51 terminal #10).

## **PRE-VCA MIX OUTPUT**

The PRE-VCA mix output is a mix of all four channel's PRE-VCA outputs. The four channels are mixed together internally and then buffered through an output amplifier. The mix output appears on terminal #10 of the TB51. This output is typically used to feed tape recorders.

When 5504s are combined in a master/slave configuration, the PRE-VCA mix outputs of the individual mixers are NOT automatically combined. This is desirable in those applications where the master/slave function is being used as a room combiner. If several mixers are being ganged together to create one large multiple input mixer, then you may wish to tie the PRE-VCA mixer together. This is accomplished by directly connecting the mix outputs together from terminal #10 of one TB51 to terminal #10 of the next TB51, and so on. A 6dB drop in overall level will occur when the two mix outputs are connected together, and an additional 6dB drop will occur everytime the number of mix outputs connected together is doubled (1-2-4-8.....).

## **POST VCA OUTPUT or LINK IN**

Terminals #30, #31, #32, and #33 on the TB51 serve double duty. They can provide an output from individual channel after (post) the VCA, or they can act as a link input just prior to the VCA. A link circuit allows the normal signal flow to be interrupted and re-routed through an external signal processor. The status of these terminals, post out or link in, is determined by the LINK/NORMAL switch for each channel. These switches are located on the side of the 5504 printed circuit board. Refer to the fold-out page in this manual titled "5504 Internal Options and Controls" for the exact location of these controls.

With the switch in the NORMAL position, the signal at the terminal will be an output coming from the output of the VCA. This signal will contain only information from that channel. It will, however, be affected by the pad, filter, gain trim, and all functions associated with the VCA such as AUTO GATING, NOM, OFF ATN, AUTO, MANUAL LEVEL, PRIORITY, and MASTER LEVEL.

With the LINK/NORMAL switch in the LINK position, the terminal is now an input to the VCA. The normal connection from the GAIN TRIM stage to the VCA is broken. The PRE-VCA output is now used in conjunction with the LINK IN to provide a link circuit. The signal path between the gain trim and the VCA has been broken and brought out to the TB51. The signal path may be re-established by connecting the PRE-VCA output to the link input, or special signal conditioning may now be inserted at this point. This might include equalization, compression, limiting, special switching, etc.

In addition, the audio of any channel may be isolated from the rest of the mixer by setting the switch to LINK. The output from that channel would then be the PRE-VCA OUT. To isolate the logic functions of that channel, certain other jumpers or switches may need to be cut or set. See the sections on NOM RECEIVE, NOM CONTRIBUTE, and THRESHOLD SENSE.

## **REMOTE LEVEL CONTROLS**

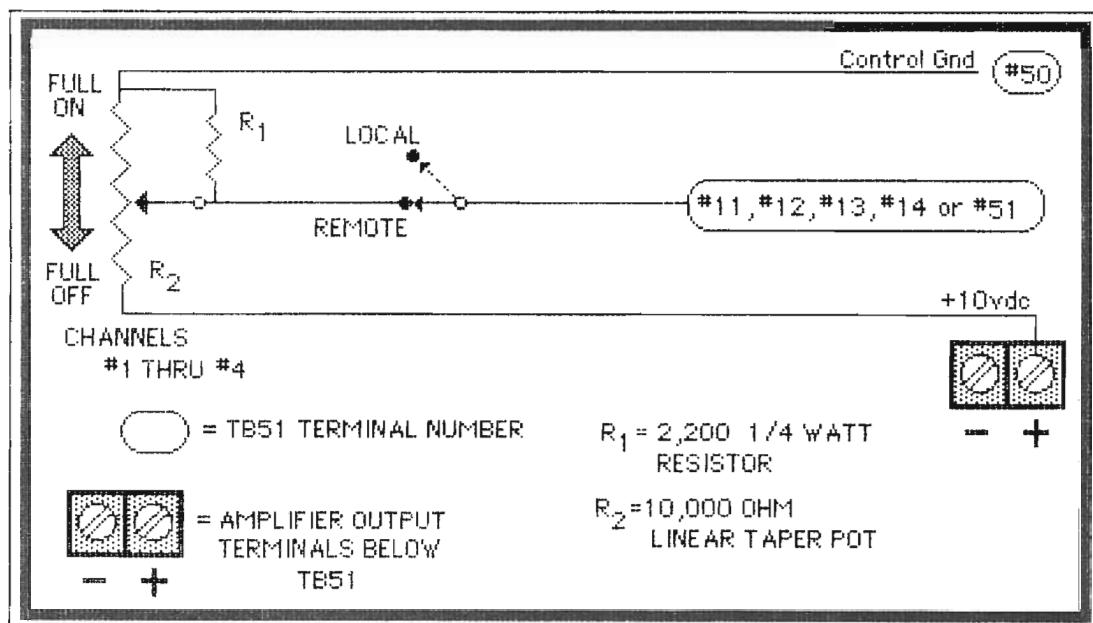
The four channel LEVEL controls and the MASTER LEVEL control may be remotely controlled. All remote controls are activated by safe, low-level dc voltages. The remote controls have been designed with simplicity in mind. Custom remote controls can easily be designed and constructed by the installer. The volume controls have a 100dB range. The control voltage varies from 0 to +10 vdc and is supplied by the 5504. With 0 vdc at the remote terminal, the channel is at full output (0 attenuation). The channel is at maximum attenuation (-100dB) when +10 volts is applied to its terminal.

An added feature of the 5504 is the automatic switching between local (front panel controls) and remote controls. When a remote control is connected to the mixer, the corresponding front panel control is disabled and relinquishes control to the remote. When the remote control is unplugged or disconnected, the level of that input is again determined by the front panel control. The maximum level of either the remote or local control is determined by the GAIN TRIM control associated with that channel.

It is evident that the level controls may be preset for certain predetermined operating conditions. These presets may then be overridden from a remote location simply by connecting a remote control to the mixer. This provides manual control for special events. When the remote is disconnected, the mixer resumes the preset levels.

The figure below shows the simplicity of the remote circuitry. Note that only two components are required; a 10,000 ohm linear taper pot and a 2,200 ohm 1/4 watt or larger resistor. It is important to note that the change from remote to local is ONLY made when the connection between the pot wiper and the remote terminal is broken. The remote/local switching CANNOT be accomplished by disconnecting the +10 volts or control ground.

\*\*\*\*\* CAUTION \*\*\*\*\*  
**Do NOT connect the +10 volt terminals of two 5504 mixers together, as this will damage the voltage regulators inside the mixers. The +10 supplies must remain independent of one another. You have been warned.**  
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## 5504 REMOTE VOLUME CONTROLS

## REMOTE MODE CONTROL

The three operating modes of the 5504, OFF-AUTO-DIR, may be remotely controlled. The remote mode switch is in essence paralleled with the front panel OFF-AUTO-DIR switch. It is recommended that the REMOTE MODE ENABLE, terminal #37, be connected to control ground, terminal #50, whenever the remote mode controls are to be utilized.

The REMOTE MODE ENABLE function enables remote mode control of all four channels simultaneously. By recommending that the REMOTE MODE ENABLE always be used, we assure consistent remote mode operation. The REMOTE MODE controls will operate without the REMOTE MODE ENABLE being set, if and only if the front panel OFF-AUTO-DIR switch is placed and left in the AUTO position. If the front panel switch is set to OFF or DIR, it will override the remote mode setting (unless the remote mode is enabled). If the front panel switch is set to AUTO, the remote mode switch will override the front panel switch.

It is possible to preset two different modes of operation and then remotely switch between them using the REMOTE MODE ENABLE switch.

## REMOTE LEDs

The four CHANNEL ACTIVE LEDs on the 5504 front panel may be duplicated at a remote location. The remote LEDs are connected to the TB51 (see the 5504 Input/Output drawing). The remote LED output is designed to drive a bi-directional, two color LED. A standard bi-directional, two color LED should be used (Opcoa part #OPL-743). If unavailable, then two LEDs connected in parallel and back to back may be substituted.

The common lead of the LEDs must be connected to the LED GND terminal which is the minus (-) amplifier terminal located just below the TB51. **Do not connect the common lead of the LEDs to any other ground.** The remote LEDs will provide the same indications as the front panel LEDs (see the "Channel Active LED" section).

## AUTO LEVEL DISABLE

The AUTO LEVEL function of all channels may be remotely disabled by connecting terminal #38 to terminal #50 on the TB51. This will affect any or all of the four channels utilizing AUTO LEVEL. The remote AUTO LEVEL disable is confined to one 5504 module and will not disable the AUTO LEVEL function in any slave 5504s unless externally connected together. The slaves may be left independent or tied together with one another and the master. To tie the auto level disable function of all modules together, terminal #38 of each module would be connected to a common point through a blocking diode. The anode of the diode should be connected to terminal #38 and the cathode should be connected to the common point. When this common point is connected to control ground (#50), all 5504s will have their AUTO LEVEL functions disabled.

## \*\*\*\*\* SPECIAL INTERNAL CONTROLS \*\*\*\*\*

Refer to the fold out page in this manual titled  
"5504 Internal Options and Controls"

### AUTO LEVEL ADJUSTMENT

The AUTO LEVEL ADJUSTMENT is located on the inside of the 5504 at the top edge of the printed circuit boards. This control is preset at the factory for the majority of applications; however there may be applications where adjusting this control may prove to be advantageous.

This control affects the "apparent" amount of AUTO LEVEL control. As the pot is rotated clock-wise, the response time or rate of level adjustment will appear to be faster. The AUTO LEVEL function has two rates of response: a fast rate and a slow rate. When the channel first gates on, the AUTO LEVEL response rate is in the fast mode. This means that the mixer will respond to and correct quickly any changes in level. After a period of time, the AUTO LEVEL will switch over to a slower rate of response.

Once the level has been adjusted by the fast rate, the slow rate takes over so that the dynamics of the person talking are not affected too quickly by the AUTO LEVEL. This provides for more natural sounding speech. The AUTO LEVEL adjustment actually determines how long the 5504 stays in the fast mode before it switches over into the slow mode.

### AUTO LEVEL SLOW RATE

The response time of the slow rate may be adjusted by the AUTO LEVEL SLOW RATE control. This control is factory preset to effect changes in level at a rate of approximately 3 dB per second. The slow rate may be adjusted to match the fast rate or slowed down so much that it appears not to function at all.

### THRESHOLD SENSE

Each channel contributes to the DYNAMIC THRESHOLD SENSE BUSS. The sound sensed at each microphone is converted to a dc signal and then summed onto the DYNAMIC THRESHOLD SENSE BUSS. This buss is dynamic (always changing in level) because the sound level at each microphone is always changing. As the ambient noise level in the room increases, the level of the DYNAMIC THRESHOLD SENSE BUSS also increases.

Whether a microphone should be gated on is determined by the sound level at each microphone as compared to the level of the DYNAMIC THRESHOLD SENSE BUSS. In order for a microphone to be gated on as the noise level in the room increases, the level at the microphone must exceed the room noise level by the number of dB set by the THRESHOLD control. In other words, the zone of sensitivity (to gate on) around a microphone is controlled by the level of the DYNAMIC THRESHOLD SENSE BUSS and the THRESHOLD control. The higher the level of the buss, the smaller the turn-on zone around the microphone. The lower the level of the buss, the larger, or more sensitive the turn-on zone.

The DYNAMIC THRESHOLD SENSE BUSS is affected by any signal entering the channel, including line

level signal. Therefore, a line level signal will cause the DYNAMIC THRESHOLD SENSE BUSS to increase in level and reduce the zone of sensitivity around the microphones. The contribution of the line input to the DYNAMIC THRESHOLD SENSE BUSS is of no advantage; in fact, it is a disadvantage.

It is recommended that inputs permanently assigned as a line level input have their contribution to the DYNAMIC THRESHOLD SENSE BUSS disabled by cutting a trace on the 5504s printed circuit board. See the fold out page in this manual titled "5504 Internal Options and Controls".

### **THRESHOLD LIMIT**

There are certain applications when it becomes desirable to gate on all microphones at the same time. Such an application might be a musical play or church choir. When several performers are on stage, it is desired to have individual microphones gate on and off selectively, thus providing maximum signal to noise and gain before feedback. When a large number of performers are on stage at the same time, such as a chorus, it might be desirable to gate on all of the microphones at the same time. When the chorus is on stage, the sound is generally distributed uniformly and at the same time louder in overall level. All of the mics may fail to gate on because the chorus is interpreted to be ambient noise.

The internal THRESHOLD LIMIT control may be set so that after the DYNAMIC THRESHOLD SENSE BUSS reaches a certain level, all of the microphones would then be gated on. Thus all of the mics would be on for the chorus, but would gate on and off selectively during the rest of the play. The adjustment of this control, as well as all related controls, should be done during actual operating conditions. It should be noted that these controls are only part of the entire operating system. The type of microphones used and their placement will greatly affect the systems performance.

### **CHANNEL #4 MASTER SOURCE SELECT**

This special feature has been added to channel #4, and is intended to be used in conjunction with the 55ACM and 55ASM ambient control system. The 55ACM and 55ASM are used to monitor the ambient noise level in a given environment and to turn up the output level of the 5504 as the ambient noise increases.

The 55ACM controls the output of the 5504 by injecting a dc control signal at the output of the master level control which in turn sends control signals to the VCAs of all four channels.

The channel #4 MASTER SOURCE SELECT allows channel #4 to select whether it will be affected by just the MASTER LEVEL control or by the MASTER LEVEL control and the 55ACM. If, for example, background music is played over channel #4, you would have two choices. The first choice, with the source select switch set to FROM 55ACM, would cause the level of the background music to be increased as the ambient noise in the room increases (as controlled by the 55ACM/55ASM). The second choice, with the switch in the FROM FRONT PANEL MASTER LEVEL position, would be to allow the background music to remain at a constant level as the 55ACM/55ASM increases the level of the other channels used for paging. This means that as the noise in the room increases, the background music level remains the same.

In a restaurant system, where background music is used for masking, it may not be desirable to turn up the music as the restaurant fills up with patrons and the noise level increases.

## **VCA STATUS**

The status, or amount of attenuation, provided by the VCA is determined by the system gain sense buss (SGS). This is an internal housekeeping buss that takes into account the number of open microphones, the manual level setting of the channels, the auto level setting (if engaged), the master level, input from the 55ACM, and the gain of all other microphone channels. The status, or amount of attenuation, on each VCA may be monitored on the TB51 (terminals #39 through #42).

The amount of VCA attenuation is represented by a dc voltage. If the VCA is at 0 attenuation then the dc voltage at the TB51 terminal will be 0 volts. If the VCA is attenuated 100dB (full off), then the voltage at the terminal will be a minus (-) 10 volts. This is 10 dB of attenuation per volt. This voltage may be used to control an external VCA (installer supplied). This external VCA may be used to control the level of a speaker associated with that particular microphone channel. This might be a conference table application with a microphone and speaker at each chair. The level to the speaker would be reduced as the gain to the microphone is increased and vice-versa.

## **NOM RECEIVE**

Whenever the NOM contribution of a channel is disabled (see below section), the NOM receive of that channel should also be disabled. When the NOM receive is disabled, that channel is no longer affected by the NOM attenuator. Channel #4 has a slide switch that allows it to place the NOM receive switch in the "no" position. Channels #1, #2, and #3 may have their NOM receive disabled by cutting the appropriate wire jumper. (See the fold out sheet in this manual titled "5504 Internal Options and Controls").

## **NOM CONTRIBUTION**

When a microphone is turned on and its level is set just below feedback, it will remain stable until another microphone is turned on, at which time the system will go into feedback. One of the functions of an automatic mixer is to provide system gain attenuation whenever more than one microphone is turned on at a time. This is accomplished by attenuating the output of the mixer by 3dB every time the number of open microphones is doubled.

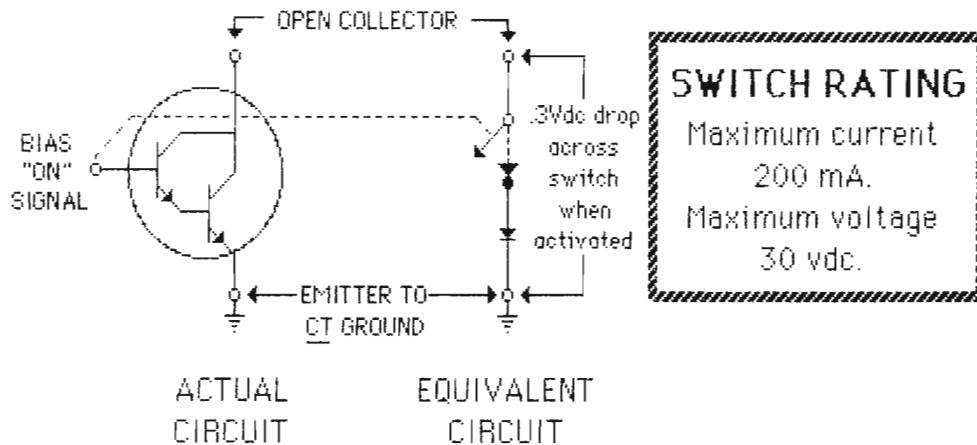
However, this simplistic approach assumes that all microphones that are on are set just below feedback. This may not be the case. Depending upon the location and application of the microphone, its gain may be significantly below feedback.

Enter the system gain sense buss. The SGS buss monitors the gain in each channel so that when it receives notification from the NOM buss that another channel has been gated on, it can provide the proper amount of attenuation. It may calculate that only 1dB or less of attenuation is required depending upon the gain of other channels. Whenever a channel is gated on in the AUTO mode, or turned on in the DIR mode, it contributes to the Number of Open Microphones buss. The NOM buss keeps track of the number of microphones that are open or turned on at any given time.

Under certain operating conditions, it may be desirable to defeat the contribution to the NOM by a particular channel.

## CHANNEL ACTIVE OUTPUTS (Logic Output)

Each of the four channels on the 5504 has a CHANNEL ACTIVE output, sometimes referred to as a logic output. This output is designed to interface with external devices, and is of the transistor (MPSA13) open collector type.



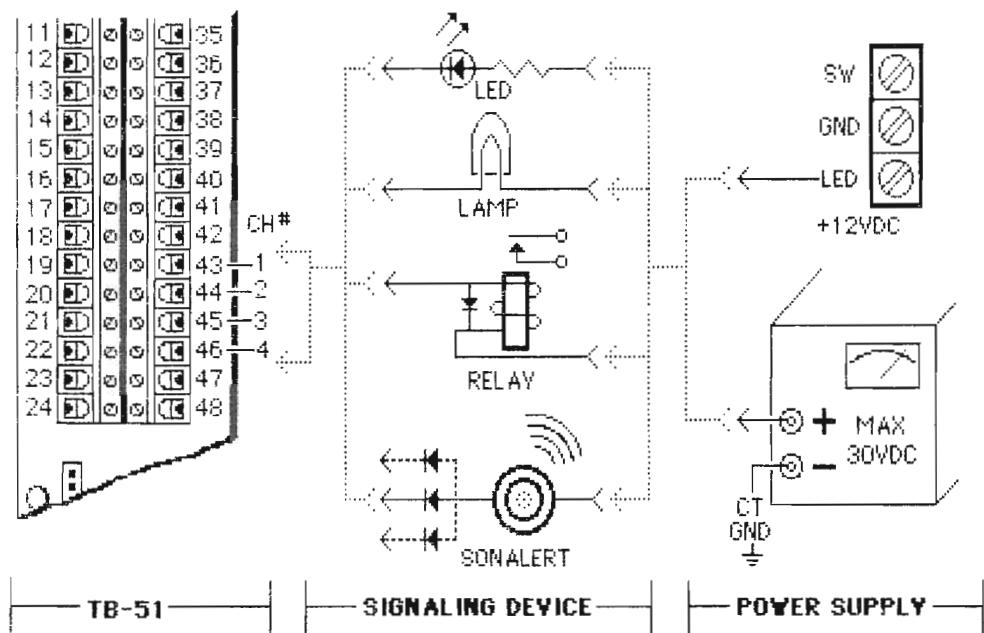
The collector of the transistor is connected to the TB51. The transistor's emitter is connected to center tap (CT) or power ground. Whenever the channel becomes active as indicated by the CHANNEL ACTIVE LED on the front panel, the transistor is turned on and the collector is shorted to the emitter, and thus to CT ground.

Think of the transistor as a normally open switch that closes to CT ground when the channel becomes active. As with all switches, there are voltage and current limitations on the contacts. The current through the CHANNEL ACTIVE transistor should be limited to 200 milliamps (.2 amps). The voltage across the transistor should not exceed 30 volts dc.

Power to drive the external device must be supplied by the installer. The device to be powered is connected between the positive side of the external supply and the TB51 channel active output. The negative side of the external power supply is connected to LED (CT) ground. Do NOT connect the negative side of the power supply to any other ground.

If a relay is used as the external device, then a diode should be connected across the coil of the relay with the cathode (the end with the band around it) connected to the external power supply side of the coil.

Below is an example of external devices connected to the channel active outputs. As you can see, there are several different methods of remote monitoring. The sonalert is connected via several diodes to different channels. Diodes may be used with other indicators as well.



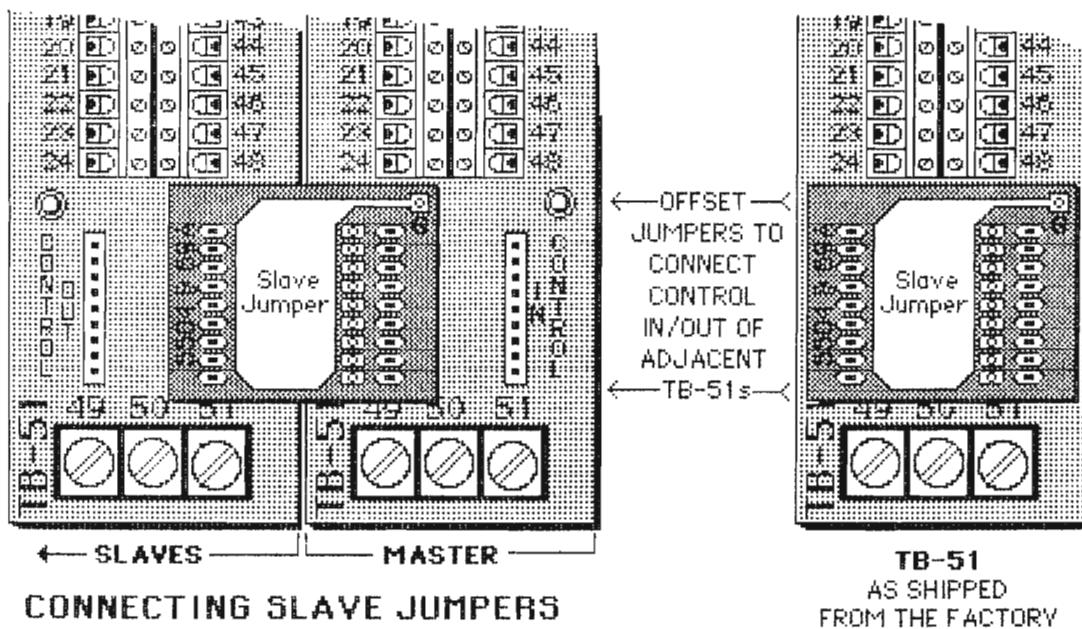
## REMOTE INDICATORS FOR CHANNEL ACTIVE OUTPUTS

## \*\*\*\*\*MASTER/SLAVE OPERATION\*\*\*\*\*

### GANDING MULTIPLE 5504s (or Making One Big Mixer)

Multiple 5504s may be ganged together to provide an automatic mixer with more than four inputs. This is done by connecting the desired number of mixers together in a master/slave configuration. One mixer is left in the master mode while all other mixers are placed into the slave mode. The mixers are bussed together on the TB51s (labeled 5504 X 68B) using the supplied slave jumper printed circuit board and plugging onto each TB51.

As you face the front of the mainframe, the "master" 5504 mixer should be located to the left of the "slave" mixers. All mixers must be placed in adjacent slots in the mainframe. The printed circuit boards labeled "slave jumper" should be removed from the TB51s. These jumpers are then plugged back onto the TB51s so that they are offset and interconnect or jump from one TB51 to another. The jumper board connects the CONTROL OUT terminals of the "master" TB51 to the CONTROL IN terminals of the "slave" TB51. You should end up with one extra slave jumper.



Even though the mixers are connected via the slave jumpers, they still operate independently of one another (as masters) until the mixers designated as "slaves" are placed into the slave mode. This is accomplished by connecting together terminals #49 and #50 on each individual "slave" TB51. When this is done, the green "master" LED on the front panel of the "slaves" will be out.

The master audio output of the combined mixers will appear at the output buss assign switches of **ALL** mixers, both masters and slaves. It is recommended that the output buss assign switches, of **ALL combined** mixers be **set to the SAME buss**. **This is contrary to normal set up procedure for 5000 series modules and should ONLY be applied to the 5504.**

When 5504 mixers are combined in a master/slave configuration, they still retain some independent operating functions. These functions are: PRE- VCA MIX, REMOTE MODE control, AUTO LEVEL DISABLE, and THRESHOLD control.

## **ROOM COMBINING WITH THE 5504**

This section of the manual is an application of the 5504 mixer used in master/slave combinations. It is therefore imperative that you first read and comprehend the preceding section of this manual titled "GANGING MULTIPLE 5504's"

There are many applications in meeting rooms and ballrooms where smaller adjoining rooms are opened up into a larger room or set of rooms. When this is the case, it is often required that the individual sound systems of the smaller rooms be combined into one overall system for the newly created large room.

The 5504 is specifically designed for this application. The master/slave feature is used to combine rooms. Each room has its own master 5504 mixer. Additional 5504s may be slaved with the master to create one multiple input mixer per room, as needed. When two rooms are to be combined, the master of one room is placed in the slave mode to slave to the other room. This is easily accomplished by shorting terminals #49 and #50 of the second master together. This may be done from a remote location using a SPST switch. All remote control signals of the 5504 are low voltage and low current.

When the rooms are separated, each group of mixers is independent, providing an output to its assigned room. When two rooms are combined via the master/slave buss system, the output of the master is fed to its assigned room and back through the slave's buss assign switch to its assigned room. The NOM, PRIORITY, and THRESHOLD BUSSES are combined so that the combined mixers function as one automatic mixer feeding two rooms. This application may be expanded to work with more than two rooms.

## **ROOM COMBINING EXAMPLE**

An example of room combining in block diagram form can be found in appendix B. This block diagram shows four 5504 mixers being used to feed four separate rooms. This example demonstrates the use of the slave jumpers, remote switching, master/master, master/slave and mainframe placement concepts.

## 5504 SET UP PROCEDURE

Before the 5504 is set up for any automatic functions, it should first be set up to function properly as a manual mixer. Steps #1 through #5 outline this procedure.

### STEP #1 Set all controls as follows:

OFF-AUTO-DIR . . . . .	OFF
PO-P1-P2 . . . . .	PO
AUTO LEVEL . . . . .	OFF
LEVEL . . . . .	0 (FULL CLOCKWISE)
OFF ATN . . . . .	-∞ (FULL COUNTER-CLOCKWISE)
RT . . . . .	FULL COUNTER-CLOCKWISE
GT . . . . .	FULL COUNTER-CLOCKWISE
THRESHOLD . . . . .	+8dB
MASTER LEVEL . . . . .	0 (FULL CLOCKWISE)

### INTERNAL CONTROLS

MIC/LINE . . . . .	AS REQUIRED
20dB PAD . . . . .	OFF (NO ATTENUATION)
PHANTOM POWER . . . . .	AS REQUIRED
FILTER . . . . .	AS REQUIRED
LINK NORMAL . . . . .	NORMAL
NOM JUMPERS & SWITCHES . . .	<u>NO</u> NOM JUMPERS SHOULD BE CUT, AND ALL SWITCHES SHOULD BE SET TO <u>YES</u> .
CHANNEL #4 MASTER	
SOURCE SELECT . . . . .	FRONT PANEL MASTER

### STEP #2 Set the power amplifier gain control to the mid (12 o'clock) position.

### STEP #3 Set one input channel to the DIR mode while keeping all other channels set to OFF.

### STEP #4 Turn the GT control clockwise until the level in the room is

just below feedback. Alternately adjust the GT control and the amplifier gain control until the input to the 5504 and amplifier clip at the same time and the level in the room is just below feedback and stable. Now turn the channel to the OFF position.

**NOTE:** Once the amplifier's gain has been set, any increase in gain through the system will cause it to go into feedback under certain operating conditions.

**STEP #5** Set the next channel to the DIR position and adjust it's GT control so the channel is just below feedback. Do NOT re-adjust the amplifier's gain control. Return the channel to the OFF position.

Repeat this procedure for all other channels.

---

---

The 5504 is set up for operation as a manual mixer. Just set all OFF-AUTO-DIR switches to the DIR position.

---

---

## AUTOMATIC MIXER FUNCTIONS

### **STEP #6** SETTING THE RT CONTROL

Set the OFF-AUTO-DIR switch of one channel to the AUTO position. Cause the channel to gate on by having someone talk into the microphone. Turn the RT control clockwise until the channel no longer gates off during pauses in normal program material. The RT range is adjustable from .1 second (ccw) to 10 seconds (cw).

Repeat the above procedure for all other channels.

### **STEP #7A** SETTING THE CHANNEL LEVEL CONTROL (NON AUTO LEVEL)

With the OFF-AUTO-DIR switch set to the AUTO or DIR position, have someone address the microphone while you adjust the level control for the desired level in the room.

## **•7B SETTING THE CHANNEL LEVEL CONTROL (WITH AUTO LEVEL)**

With the OFF-AUTO-DIR switch set to the AUTO or DIR position, have someone address the microphone in a loud voice, preferably with lips touching the microphone. This will cause the VCA to attenuate and allow you to adjust the level control for the desired level in the room.

The auto level may now be tested by having the person at the microphone be quiet and back away from the microphone, thus giving the auto level timer in that channel time to reset to the fast mode. After a pause of about 5 seconds, have the person at the microphone resume talking at a low level. You should be able to hear the auto level turn the gain up, trying to maintain the level in the room.

The level control may be adjusted at any time during auto level operation. Think of the level control as the reference point that the auto level tries to maintain.

The auto level will not increase the gain to a point so as to cause feedback if and only if steps 1 through 5 are properly followed. The maximum gain through any channel is controlled by the GT control and not the VCA. However, if the GT control is set while the VCA is attenuated for any reason, such as more than one channel being on at a time during set up, then it is possible for feedback to occur under certain conditions.

## **STEP #8 SETTING THE OFF ATN**

When four microphones are being used, it is recommended that a minimum OFF ATN per channel be -6dB, and that -12dB is preferable. If more than four microphones are used, then the minimum OFF ATN per channel may be calculated by following the NOM rule, which is: For every doubling of the number of open microphones, increase the off atn by a minimum of 3dB.

For example:	4 microphones	-6dB OFF ATN
	8 microphones	-9dB OFF ATN
	16 microphones	-12dB OFF ATN

===== THESE ARE ABSOLUTE MINIMUM VALUE ! =====

The OFF ATN is only active when the OFF-AUTO-DIR switch is set to the AUTO position and the channel is gated off. When the channel is gated off, it is off or attenuated by the amount set by the OFF ATN control. On the other hand, if the channel is turned off by the OFF-AUTO-DIR switch, then the channel is turned off completely and is not affected by the OFF ATN control.

**STEP #9** SETTING THE PRIORITY

Assign priority to the channels as desired. If no difference in priority is required, then set all priority switches to the same setting; i.e. all at P0.

**STEP #10** SETTING THE THRESHOLD

With the presence of normal ambient noise in the room, the THRESHOLD control should be advanced from 0 toward +10 until the individual channel active LED's cease to gate on and off in a random manner.

The "turn on" sensitivity of the microphone is determined by the setting of the THRESHOLD control. The lower the setting of the control, the more sensitive it is and the easier it will turn on. The higher it is set, the more insensitive it is to ambient noise and the harder it is to turn on.

## SPECIFICATIONS for the 5504 AUTOMIXER

Frequency response:  $\pm 5$  dB 20 Hz to 20 kHz

Equivalent input noise: -127 dBm per channel A weighted

Distortion (THD): .01%

Maximum gain: 83 dB

Microphone input impedance: Actual- 1300 ohms;  
transformer balanced      Recommended- 150 to 600 ohms

Line input impedance: Actual- 30,000 ohms  
transformer balanced

Channel #4 Aux input impedance: 10,000 ohms  
unbalanced

Channel Link input impedance: 20,000 ohms

Phantom power: +48 Vdc thru 3,300 resistor

Output load impedance: 600 ohms or greater

Maximum output level: +18 dBm

Pre-Vca output impedance: 604 ohms

Pre-Vca output level: +3 to +60 dB relative to input level  
 $\approx$  18 dB below master output level

Pre-Vca mix output impedance: 604 ohms

Pre-Vca mix output level:  $\approx$  6 dB below master output  
at zero attenuation

Post-Vca output impedance: 604 ohms

Channel off attenuation: 0 to -100 dB

Channel release time: .1 to 100 sec.

Channel active output: Open collector type capable of sinking  
200 mA @ 30 Vdc

High pass filter: -6dB@ 125 Hz; -30 dB @-32 Hz

Power consumption: 11 watts

CETEC IVIE reserves the right to make changes in specifications without notice.

## APPENDIX A

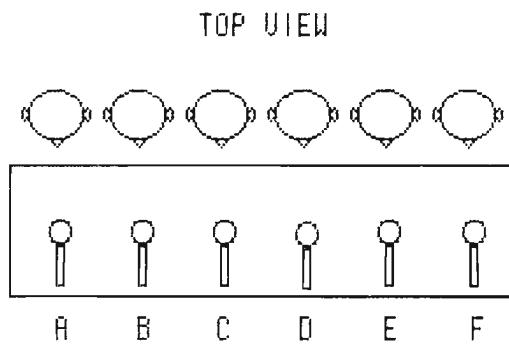
### A FEW THOUGHTS ON MICROPHONE SELECTION

All microphones used with the 5504 are an integral part of the automatic mixer "system". Therefore the selection and placement of these microphones should be given careful consideration.

The 5504 determines which microphone(s) if any, should be gated on by a comparison process. Each individual microphone signal is compared to all the microphone signals summed together. These summed signals are considered by the mixer to be the ambient noise. The signal at each individual microphone is considered to be the desired signal. The individual microphone will be gated on only when the signal at that microphone exceeds the ambient noise level (as sensed by all the microphones) by a certain amount. This amount is determined by the setting of the threshold control.

Let us consider the condition when there is no one talking to any of the microphones. There is only the ambient noise in the room. All microphones are sending the same signal to the mixer. Each individual microphone is constantly being compared to the summed and weighted signal of all the microphones. Since no one single microphone level is significantly greater than any other microphone level; no microphones are gated on. Because of this comparison process it is logical to assume that it can be aided or enhanced by using the same type of microphone throughout the system. **This brings us to the first suggestion: When feasible use the same type of microphone throughout the system.**

Now that we have an idea of how the automixer works, let us consider the application below. This is a discussion panel application in which there is one microphone per person.



The reason for using an automixer is to maximize the gain-before- feedback potential in the room. By keeping unused microphones gated off, the is more gain available for the microphones in use. It then makes sense that we should design the system so that any unnecessary or false triggering of the microphones is minimized. In the above example when the person at microphone "C" speaks, we only want microphone "C" to gate on. It is undesirable to gate on microphones "B" and "D".

This can be accomplished by proper microphone selection and placement. First of all the microphone should be located as close to the talker, and as far away from other sound sources as possible, nothing new here. This gives us a signal to noise ratio advantage at the microphone. The signal being the talker and all other sound sources being the noise. **Suggestion number two: place the microphone as close to the talker as possible.**

The signal to noise ratio of the microphones can further be enhanced by using directional microphones. Typically a cardioid, super-cardioid or hyper-cardioid polar pattern is desirable. These microphones could be either "Single-D" or "Variable-D" design. It has been proven that a directional cardioid microphone will provide an increased working distance of approximately 1.6 to 1. This means that a cardioid microphone will provide the rejection to room noise at 1.6 feet than an omnidirectional microphone would at 1 foot.

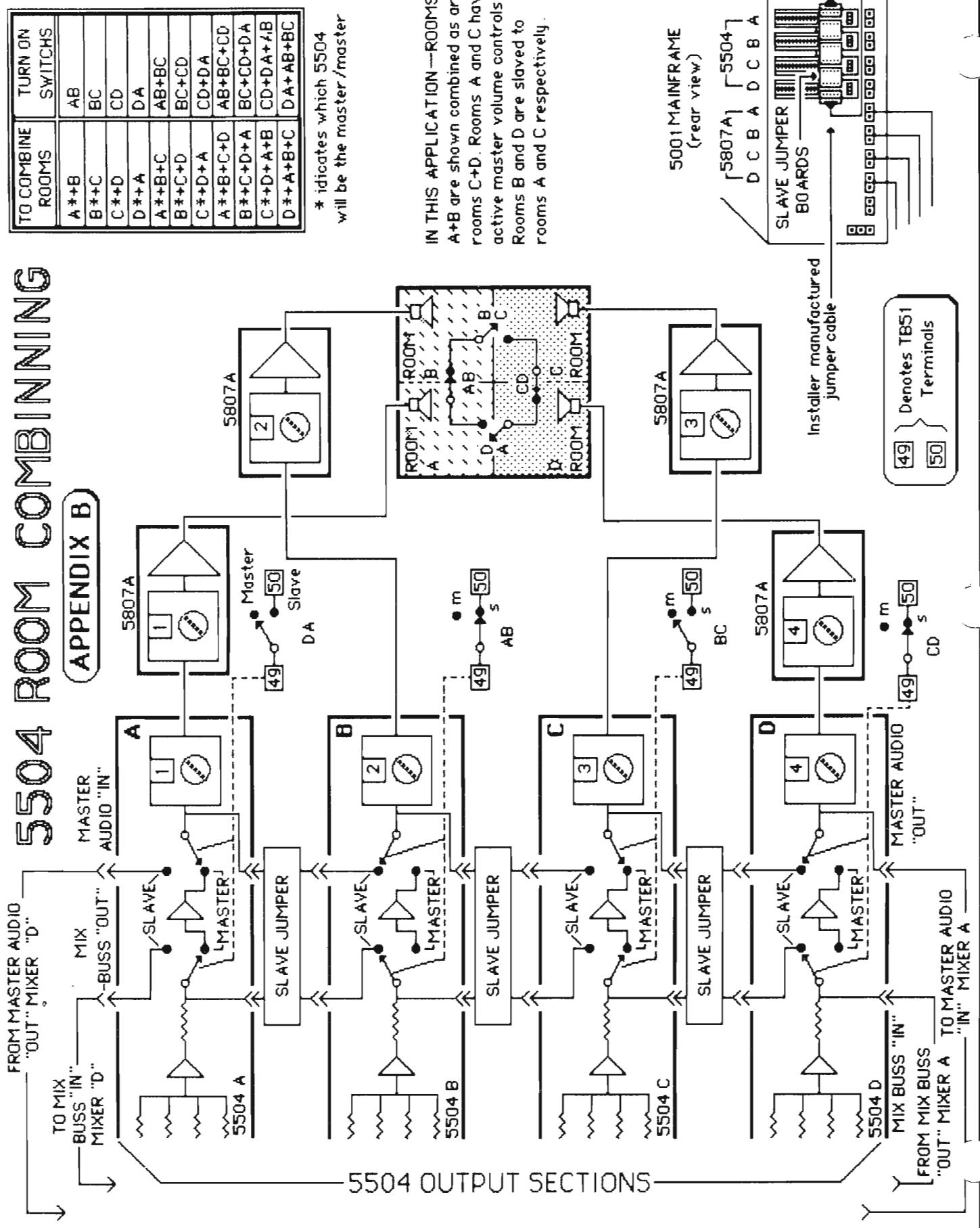
**Suggestion number three: use a directional microphone.** It will provide you with a system that is more immune to false gating than a system using omnidirectional microphones.

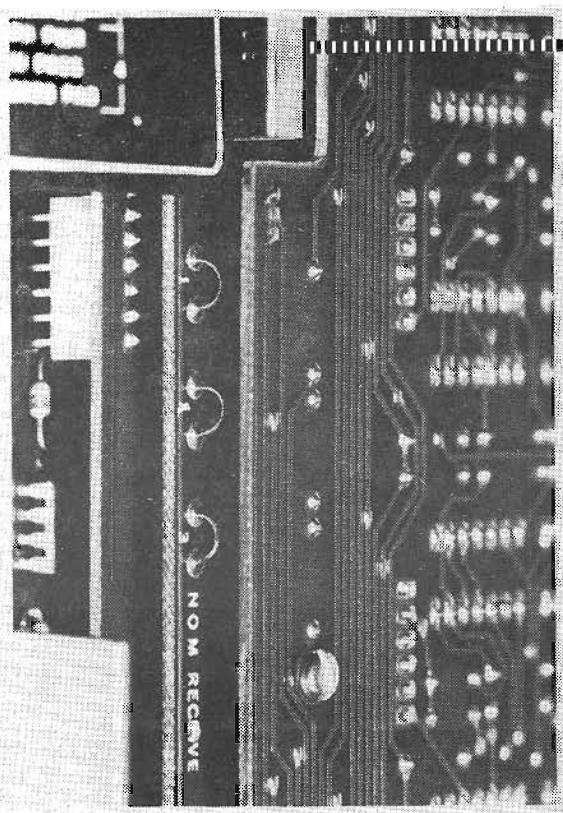
Pressure zone type microphones are not particularly recommended for use with the automixer. Although they have a hemispherical polar pattern they do not exhibit as high a directivity index as a typical directional mic. Shotgun or line type microphones are not recommended either. Their highly directional polar pattern is desirable, however their gain before feedback characteristic is not as good as a standard cardioid microphone. **Suggestion number four: shy away from pressure zone and shotgun type microphones.**

**Suggestion number five: there are exceptions to suggestions number one through four.**

# 5504 ROOM COMBINING

## APPENDIX B

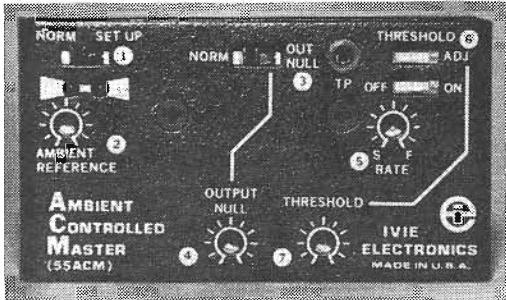




CUT JUMPERS TO DISABLE  
NOM RECEIVE FOR CHANNELS  
#1, #2 and #3.

OPTIONAL 55ACM

PLUGS ONTO 5504 MOTHERBOARD



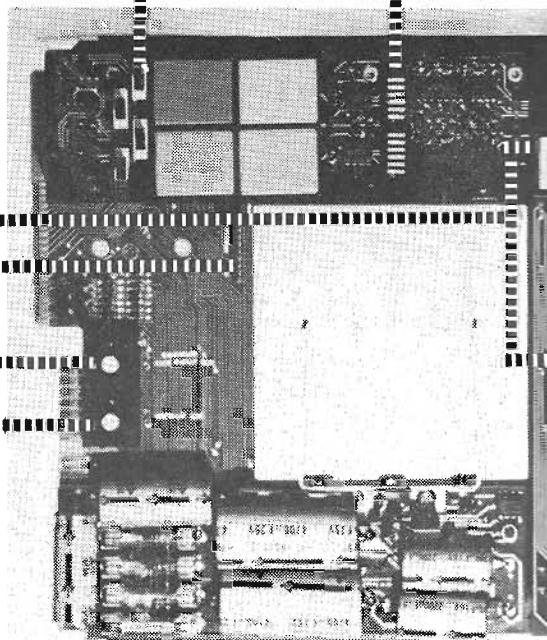
NOTE: ALL CONTROLS HAVE BEEN SET  
BY THE FACTORY FOR OPTIMUM PER-  
FORMANCE FOR THE MAJORITY OF AP-  
PLICATIONS. PLEASE USE DISCRETION  
WHEN MAKING ADJUSTMENTS IN THE  
FIELD.

#4 NOM

NO  
YES

PREAMP MODULE

CHANNEL #4  
AUX IN BUSS  
SELECT  
MASTER  
OUTPUT  
BUSS ASSIGN



POWER SUPPLY MODULE

NOM CONTRIBUTE (NC)  
TO DISABLE,  
CUT P.C. BOARD TRACE  
Located between  
arrows on channels  
1, 2 and 3

Link  
Channel #1  
Normal

#1

Link  
Channel #2  
Normal

#2

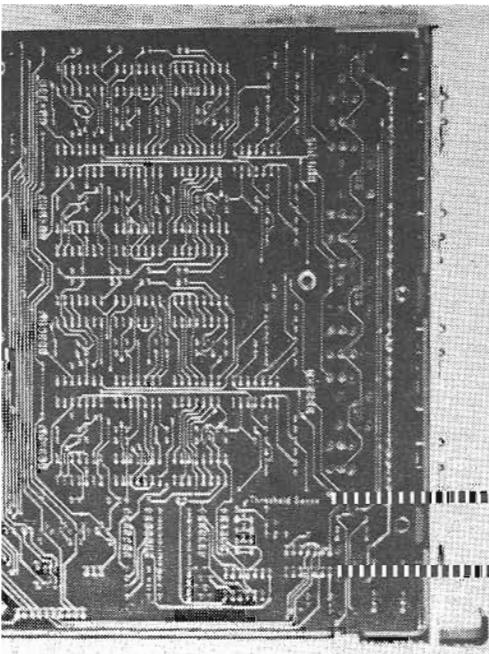
Link  
Channel #3  
Normal

#3

TO DISABLE CHANNEL  
#4 NOM CONTRIBUTION  
Place NOM Contribute  
slide switch "NO" - "YES"  
To the "NO" position.

NO  
YES

5504 INTERNAL OPTIC

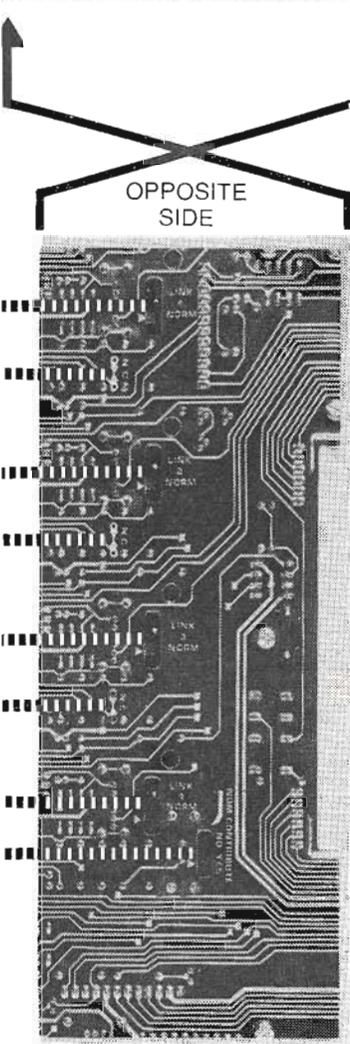
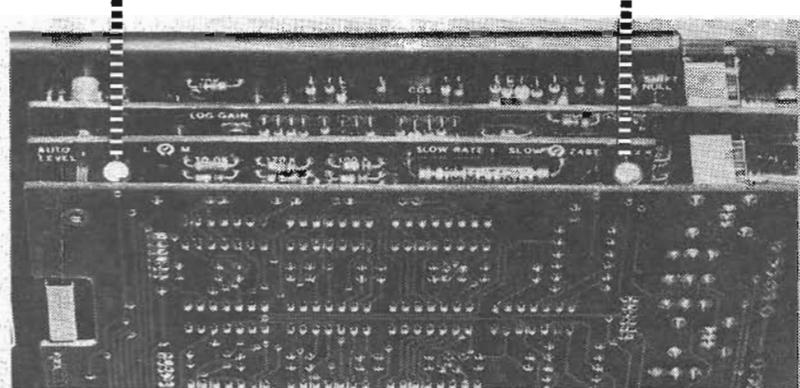


Auto Level Adjustment

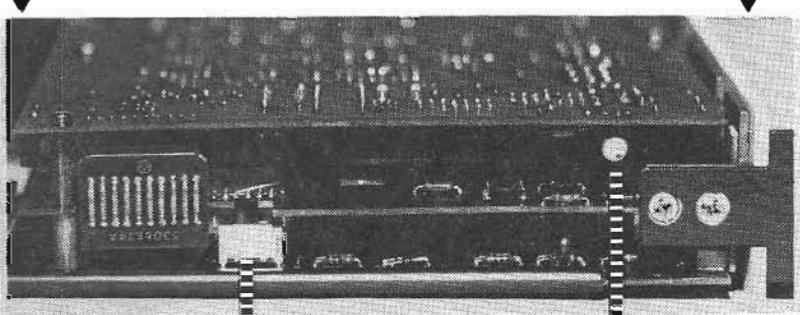
Less      More

Auto Level Slow Rate

Slower      Faster



air duct

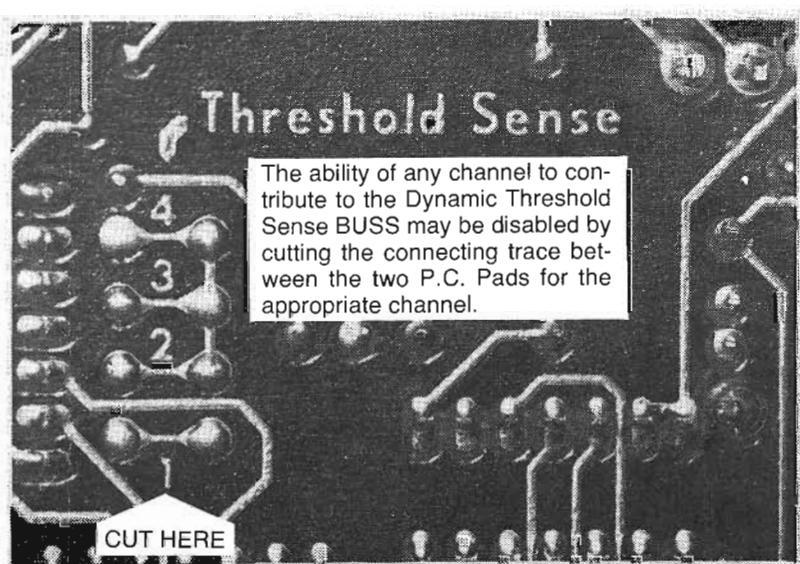


From Front Panel  
Master Level

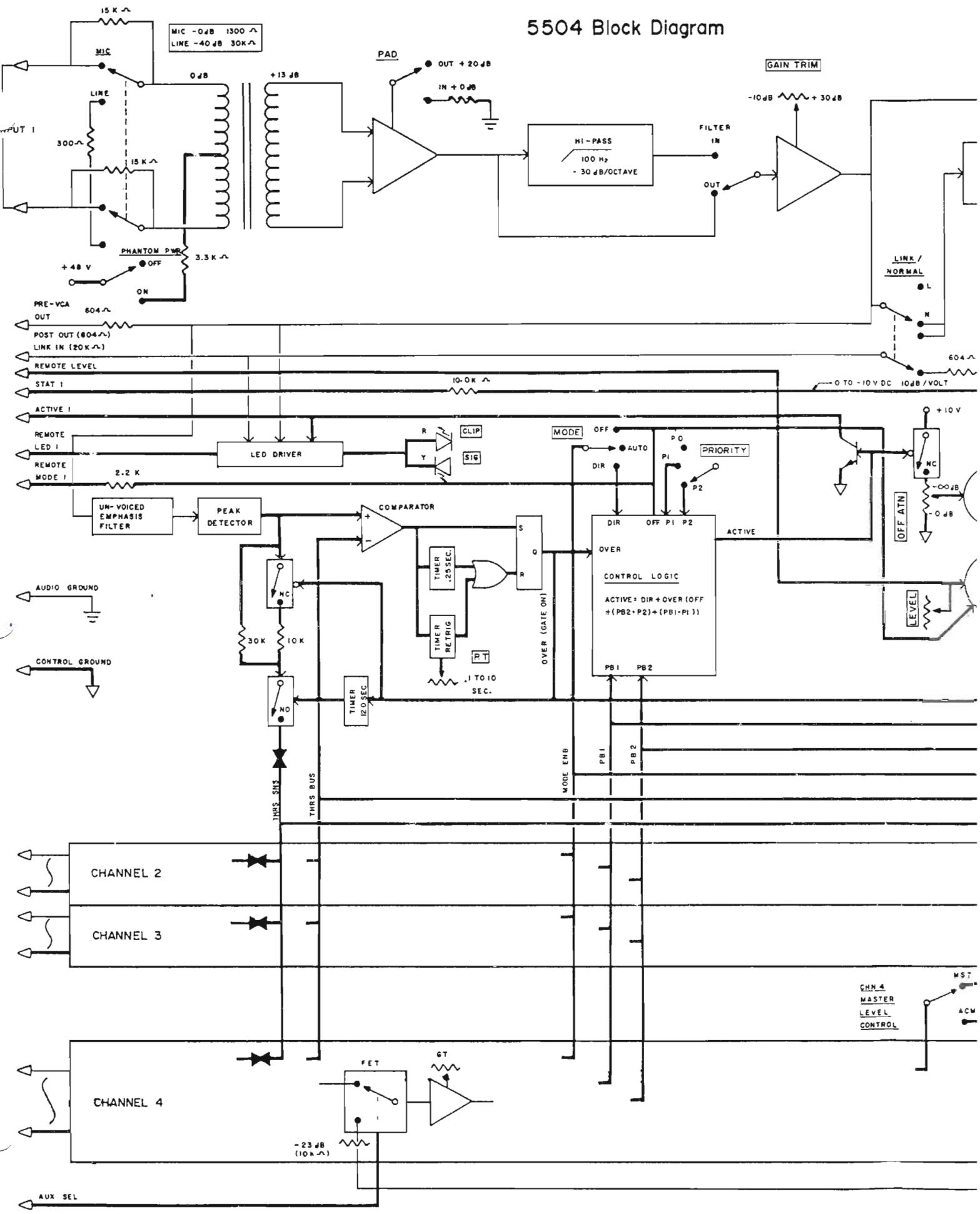
From  
55ACM

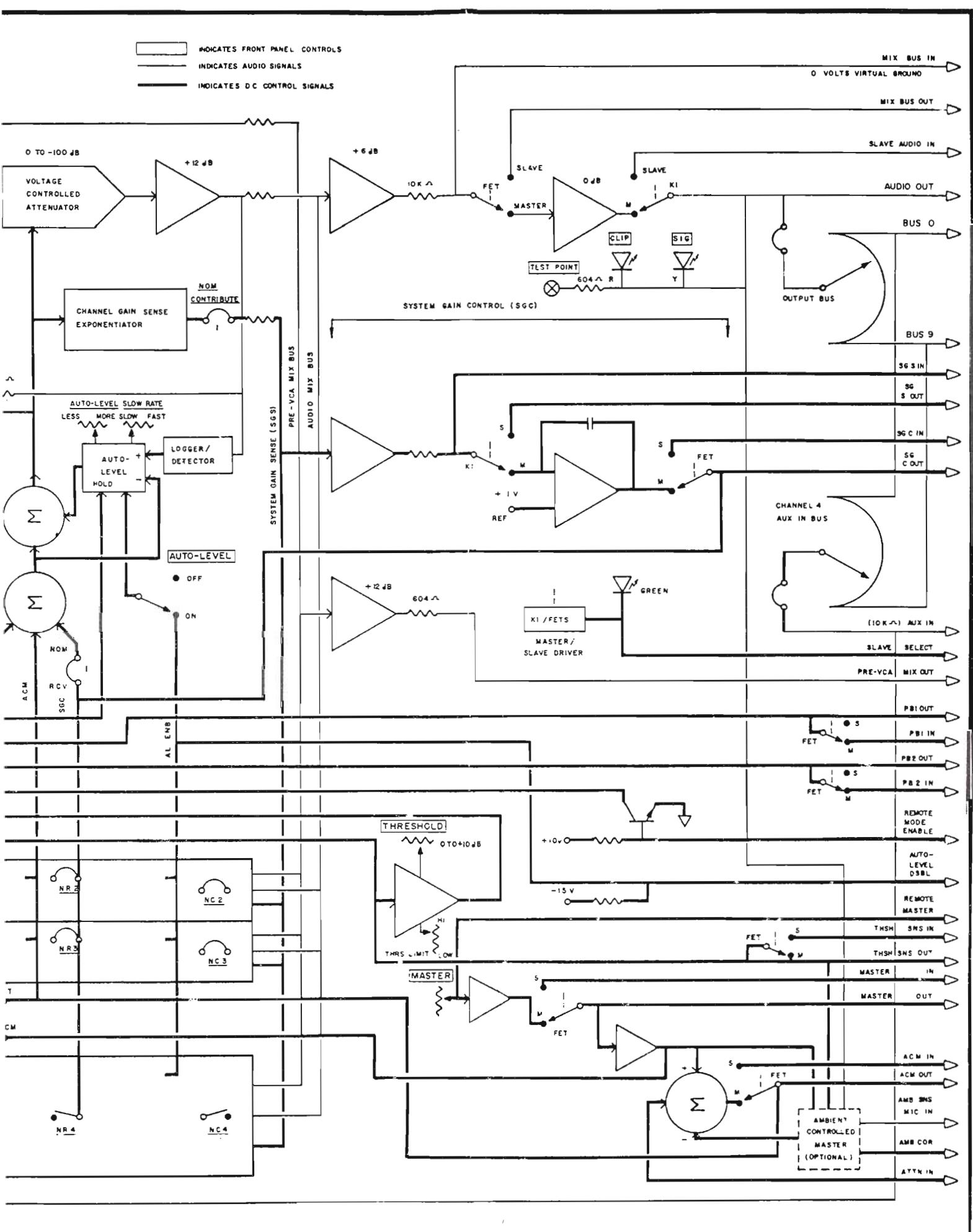
CHANNEL #4  
MASTER SOURCE  
SELECT.

Low      High  
Threshold  
Limit



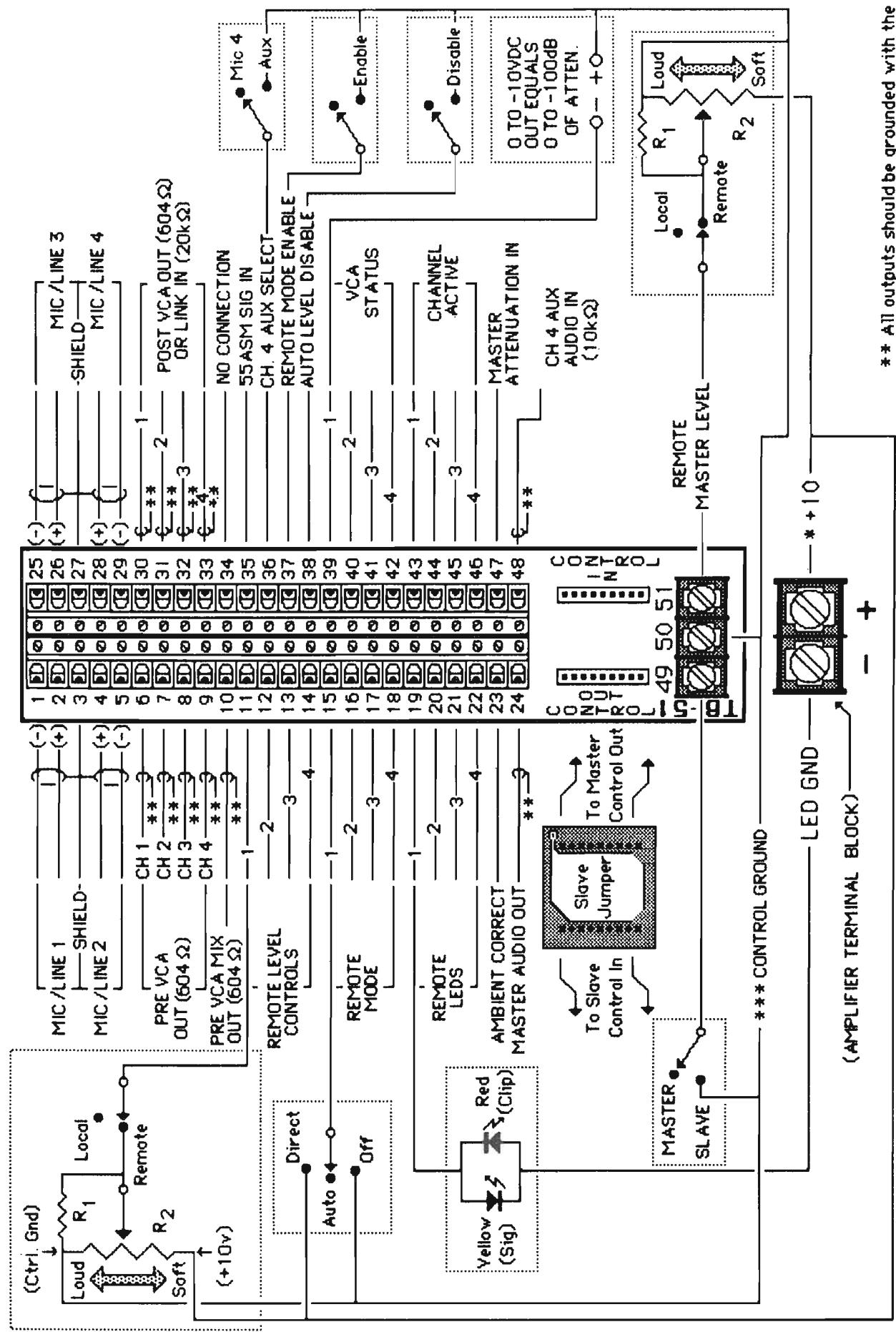
# 5504 Block Diagram





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NOTES:  
 $R_1 = 2.2K\Omega$  \* +10V is current limited and only to be used for 5504 remote accessories.  
 $R_2 = 10K\Omega$  DO NOT connect the +10 terminal of one 5504 to another 5504 Linear Taper

\*\* All outputs should be grounded with the shield wire connected at one place... typically at the next input. This avoids ground loop problems.  
\*\*\* Control ground may also be used as an audio ground.

## 5504 TB-51 INPUT/OUTPUT CONNECTIONS