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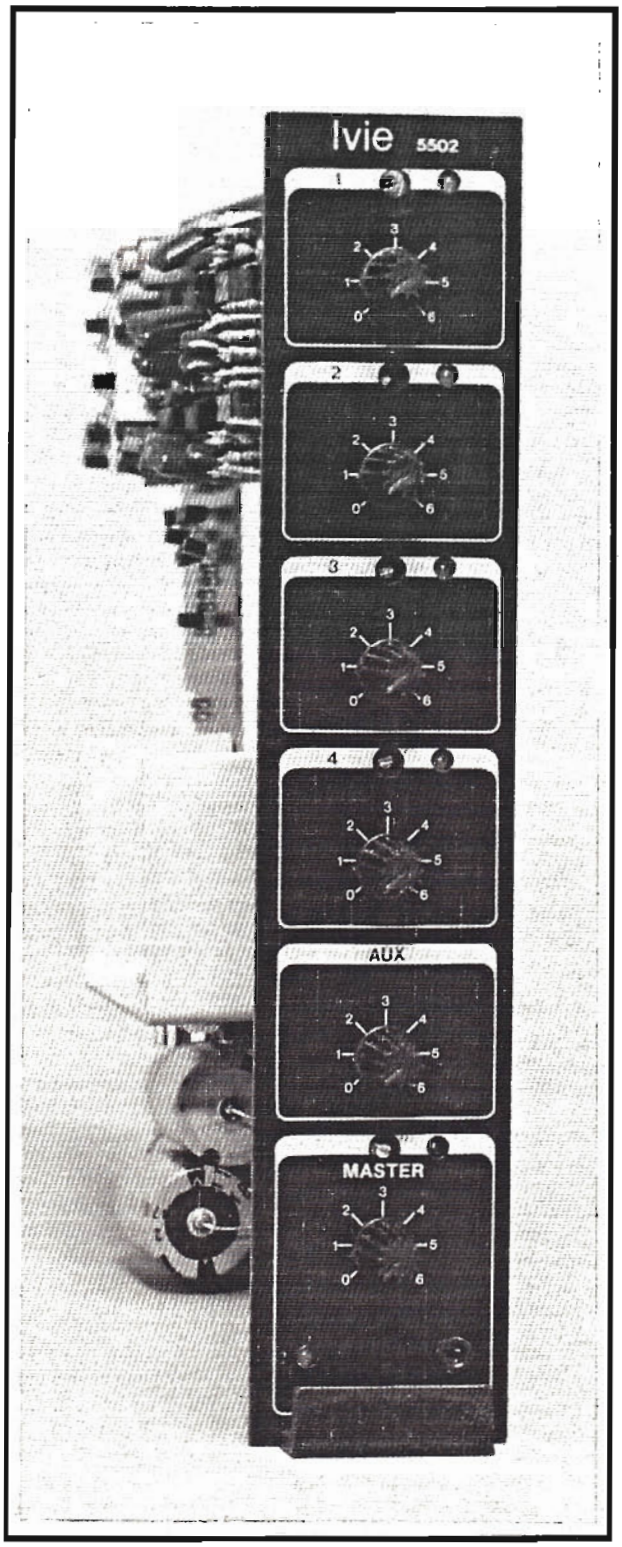
5502 & 5503 MANUAL



Operation and Owners Manual for the 5502 & 5503 Automixers

5000 Modular Sound System

Printed in U.S.A.

INTRODUCTION

For complete mixer setup instructions, see Appendix II of this manual.

The 5502 and 5503 Automatic Microphone Mixers are identical, except for one feature: While both mixers have a VCA on the Master Volume Control so it can be remoted, the 5503 has VCA's (hence, remote control capability) on its microphone inputs as well, but the 5502 does not. In all other respects, the mixers are identical and interchangeable, and will be treated as such in this manual. In the sections dealing with remote control, this difference in the mixers will be pointed out in more detail from an applications standpoint.

The 5502 and 5503 automatic mixers are designed to fulfill a number of applications, such as meeting rooms, churches, and auditoriums. They provide all the standard automatic mixer functions such as automatic microphone gating, NOM (number of open microphones) attenuation, channel active indication , etc. Additionally, they go far beyond standard automatic mixers by offering features that greatly multiply their power. These features include room combining, special paging input, special background music input and remote control capability.

The 5502 or 5503 may be used independently, as four input, one output mixers, or may be combined with other 5502's or 5503's to create an automixer with more inputs: 8, 12, 20, 100 or more. In addition, they contain features specifically designed for room combining applications. As an example, a 5001 Mainframe can house nine automixers. They could be configured so that the nine separate mixers were feeding nine separate rooms, or they could be configured as one 36 input, automatic mixer. As a further option, the nine separate mixers could be wired so they could be combined together via remote switches. These switches could be mounted in a convenient remote control panel and could then determine which mixers/rooms would be combined. This would allow for various mixer/room combinations and configurations.

FOUR AUTOMATIC MIC/LINE INPUTS

The 5502 and 5503 Automatic Microphone Mixers have four automatic, electronically balanced, microphone/line inputs. These four inputs contribute to a threshold comparison circuit to determine which input should be gated on. Also, each input contributes to, and is affected by the NOM (number of open microphone) attenuator. When an input is used as a line input, the contribution to the NOM for that channel may be disabled. In addition to the automatic, mic/line inputs, there are three, non-automatic, line level inputs.

NON-AUTOMATIC LINE INPUTS

Input number five is an unbalanced, line input with front panel volume control. This input can provide mixing from an auxiliary line level source such as a projector or tape

recorder. Neither this input, nor the other two line inputs (paging and background music inputs), affect the NOM attenuator or threshold circuits.

The paging and music inputs are also line level and unbalanced, but have no front panel volume control. They are designed specifically and exclusively for background music and paging applications. Both inputs have a 50k Ω input impedance to allow the paralleling of inputs with other mixers. Over 80 mixers may be driven from a single 600 Ω source. These inputs may be individually muted, using remote DC control lines. This means that from a remote location, background music may be turned on or off, with its level controlled by a remote Master Volume Control.

The paging input is designed for normal paging over the program material. The program material may be completely muted during the page, or, with the addition of an external 10k, linear potentiometer, the program material may be simply "ducked" during the page. The paging features of the 5502 and 5503 greatly simplify the design and installation of systems using paging and background music. This is especially true with life safety kinds of applications.

REMOTE CONTROLS

The 5502 and 5503 have many standard, remote control features. These control features provide several benefits in solving design applications. All remote control lines are low voltage, DC lines. The Master Volume Control may be remoted to a standard, 10k Ω, linear taper potentiometer. Additionally, the four mic/line channels and the three line level inputs of both mixers may be remotely turned on and off. The microphone input lines and the Aux input on the 5503 have the same remote control capability as the Master Volume Control, but the 5502 does not have this remote level control feature on its inputs.

FRONT PANEL CONTROLS

INPUT LEVEL CONTROL

There are five input level controls on the 5502 and 5503. The first four control the input level from the four mic/line channels and are labeled "1," "2," "3" and "4." The fifth control is for the Aux (auxiliary) input and is labeled "AUX." These five controls provide the normal function associated with an input level or volume control.

GT (GAIN TRIM)

There are four Gain Trim Controls located on the front panel. These are screwdriver adjustable shafts located just above their associated Volume Controls. Rotating a Gain Trim Control in a clock-wise direction increases the gain through the preamplifier.

The Gain Trim Control sets the maximum gain through the individual mic/line channel. It

also maximizes the signal to noise ratio and the input overload characteristics of the preamplifier. When properly adjusted, this control can help prevent feedback due to operator error. This is accomplished by adjusting the Gain Trim Control to a level that is just below feedback when the Volume Control is set at maximum.

The Gain Trim Control is used in conjunction with the 20dB pad in the preamplifier. The Gain Trim Control should always be adjusted first, before the 20dB pad is used. If a high level signal must be attenuated, the Gain Trim Control should first be used, with the 20dB pad used only when necessary. Of course, if line level signals are being fed into the preamplifier, the Mic/Line Switch should be set to the line position.

CHANNEL ACTIVE LED

In any automatic mixer, it is desirable to provide a front panel indication of channel gating status. This shows which microphones are currently on and which microphones are currently off. This type of indication is also of great benefit when installing and setting up the mixer. It helps with determining the proper placement of microphones relative to the desired source. Additionally, tests may be run using microphones of various polar patterns, while monitoring the gating status, to help determine which microphone is best for a particular application and environment. Monitoring the gating status is also beneficial while setting the Threshold level.

The 5502 and 5503 have four LED's that provide gating status. There is one yellow LED for each of the four automatic, mic/line inputs. This LED is located just to the right of each gain trim control, and is illuminated whenever the channel is gated on by the automixer.

The Channel Active, or Logic Output, for each channel is activated whenever the LED channel status indicator is illuminated (See the "CHANNEL ACTIVE OUTPUT" section of this manual on page 18 for more details).

THRESHOLD

The heart of an automatic mixer is the circuit that determines which microphones should be gated on and which microphones should remain off. The 5502 and 5503 accomplish 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 threshold sense bus by a certain number of dB. The Threshold Control sets the number of dB that the individual channel must exceed the dynamic threshold bus 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 can be seen, the Threshold Control determines how easily the microphones will gate on. If this control is set too low, then 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, the individual microphones may fail to gate on when spoken to by soft-spoken people. This control is best set during actual operating conditions. Turning the Threshold Control in a clock-wise direction increases the threshold level requiring a greater level at the microphone to gate it on.

The Threshold Control affects all four channels equally. When used in master/slave combinations, each automixer is affected only by it's own Threshold Control, although all of the Threshold buses are mixed together. 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 automixers are used in a master/slave configuration, there are two options available in remote master control. With option number one only the Master Level Control on the master mixer is active, and it controls the level for all slaves as well. In this configuration, the Master Level Controls of all slaves are disabled.

With option number two, all mixers retain their own independent Master Level Control - even those mixers in the SLAVE mode. The option selection is made at the time of installation, and is effected on the 55ACC Active Combining Card. For more detail, refer to the instructions that come with combining cards.

MASTER LED

The LED located above, and just to the right of the word "MASTER" on the 5502 and 5503 front panel, is the Master/Slave indicator. This green LED will be lit when a mixer is being used independently as a master. When an automixer is being used as a slave, this LED will not be illuminated. When a 5502 or 5503 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 5502 and 5503 is an output indicator. It is connected to the output of the mixer and turns on when an output signal is present. It is modulated by the amplitude of the output signal - the higher the output signal amplitude, the brighter the LED. It is very useful in visually following the signal flow through the system.

TEST POINT

As with all other modules in the 5000 system, the 5502 and 5503 automixers have a test

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

INTERNAL CONTROLS and CONNECTIONS

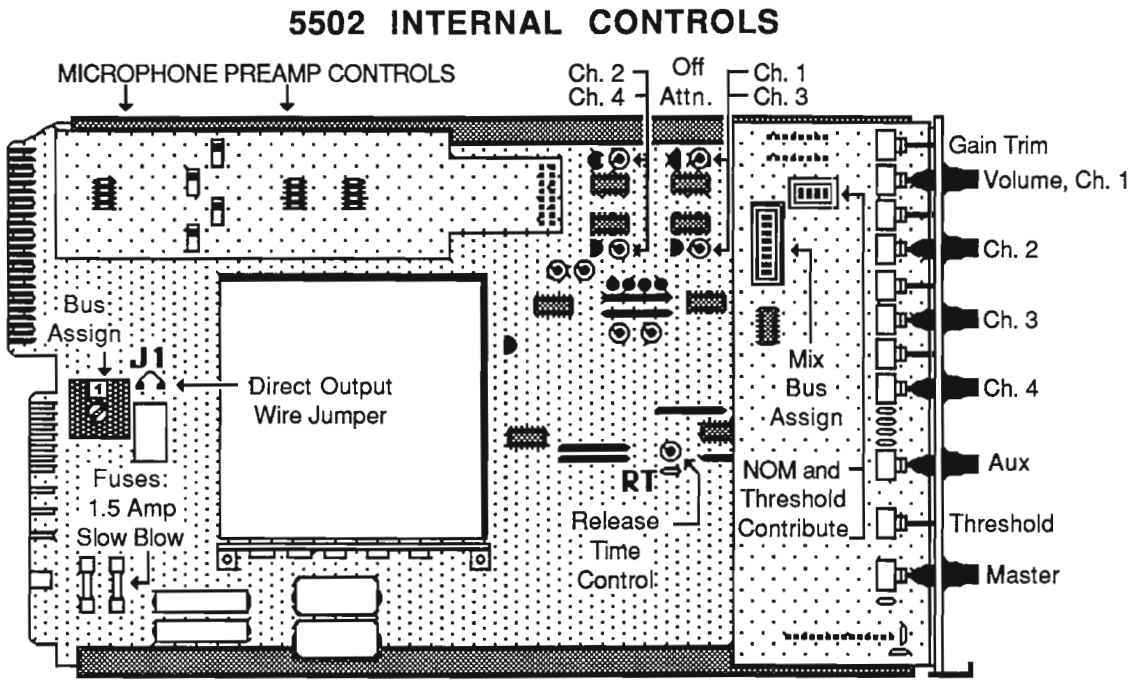


Figure 1

MIX BUS ASSIGN

There are eight channels on the Mix Bus Assign Switch - one each for inputs 1 through 6, and two for input 7 (See Figure 1). When a switch for an individual channel is set to the ON position, that channel contributes audio to the output of the mixer. If the switch is set to the OFF position, the audio from that channel is isolated from the output of the mixer. Any channel may be isolated from the Mix Bus by setting the individual switch for that channel to the OFF position. This is useful when a channel is to be used as an independent preamp.

Channel number 7 has two assign switches to provide several options when the paging feature is used. Please refer to the "PAGING INPUT" section of this manual on page 9 for information on these options.

NOM and THRESHOLD CONTRIBUTE

Channels 1 - 4 all contribute to NOM (number of open microphones) attenuator and to the Threshold Bus for gating comparisons. There are some types of input signals that should not affect the NOM and Threshold buses. When a line level input is fed into one of the input channels, that input should be switched off the NOM and Threshold contribute bus using the NOM and Threshold Contribute Switch (See Figure 1). If this is not done, the line level input will drive up the threshold level and make it more difficult for microphones to gate on. The line input will also affect the NOM and cause attenuation that is not necessary to maintain a level below feedback. In normal microphone operation, channels 1 - 4 all contribute to the NOM and the Threshold bus.

LAST ON

Ivie automixers have a unique circuit that enhances many automatic mixer applications. When the "Last On" feature of the automixer is activated, there is at least one microphone gated on at all times. The last microphone gated on remains on until another microphone is gated on to take its place. There is always at least one open microphone. The Last On feature allows more than one microphone to be on at a time, and is in no way restrictive of normal automixer operation.

The release timer for the individual channels continues to work in the Last On mode. When a mic is already on, and a second mic gates on, the first mic will gate off after the RT timer elapses. If desired, the RT timer could be set to a very short time duration, thus allowing the first mic to gate off as soon as the second mic gates on.

The Last On feature is not "on" when an automixer is shipped from the factory, and if this feature is desired, it must be enabled by connecting terminal #11 to Gnd on the TB-52. *Mixer setup is done without the Last On feature enabled.*

RT (RELEASE TIME)

The purpose of a Release Time Control on an automixer is to provide smoother operation of the automatic mixing function. If a channel immediately gated off whenever its input level fell below the threshold level, it would be very distracting. It could gate off between syllables, and in some cases, even during a syllable.

The addition of a release timer keeps the channel gated on for a period of time after the threshold circuit tells the channel to gate off. In other words, when a channel receives a 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. This is true for both normal and Last On automatic operation.

The RT is set for 1-2 seconds at the factory, but may be set in the field to suit a particular application. The factory setting is proper for almost all applications. The release time is

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

The RT control is a screwdriver adjustable potentiometer located on the main printed circuit board (See Figure 1). It is labeled "RT" and controls all four channels. *When automixers are combined, the RT controls remain independent, and the RT circuit remains active when the Last On feature is used.*

OFF ATTN (OFF ATTENUATION)

When the automixer gates a channel off, the output of that channel will be attenuated by a maximum of 90dB. When the mixer's output is used to drive ancillary areas, such as foyers, it is highly desirable to *reduce* the level of the program material only, 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 discontinuance of the room noise that is objectionable.

The Off Attenuation 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. Off Attenuation is adjustable for each gated channel (See Figure 1 for location of the Off Attenuation potentiometers), and the range is from 0 to 90dB. Off attenuation is preset at the factory at around -18dB, which works for most applications.

MASTER AUDIO OUTPUT

The master audio output may be accessed in three places: the front panel test point, the Output Bus Assign Switch, and terminal #20 on the TB-52 terminal block. The master output signal appears at all three places simultaneously.

In most applications, the output of the mixer will be assigned to the 5001 Mainframe motherboard buses via the Output Bus Assign Switch. If this is not to be the case, the Output Bus Assign Switch should be assigned to an unused bus. If it is desirable to completely isolate the output of the mixer from the motherboard, the direct output wire jumper should be cut (See Figure 1, page 5, for J1 jumper location).

The output of the 5502 or 5503 will always appear at terminal #20 of the TB-52, even if the direct output wire jumper, J1, is cut. Terminal #20 is the Direct Output. Terminals #7 or #10 can be used as the ground connection for the Direct Output.

INPUTS AND OUTPUTS

MIC/LINE INPUTS (CHANNELS 1-4)

Inputs one through four are electronically balanced. In the "Mic" setting, the input

impedance is approximately 1200 Ω and is designed to work with low impedance microphones (150-600 Ω). The mixer has in excess of 80dB of gain, and will accommodate the least sensitive microphone. A switchable, 20dB pad allows the input to work with the hotter output levels of condenser microphones.

Each input channel has three outputs - a pre-gate output, a post-gate output, and an output to the mix bus of the mixer. The first two outputs will be discussed elsewhere in this manual. The output of each channel is routed to the mix bus through a switch on the printed circuit board. Normally, this switch would be closed to route the signal to the mix bus. In some applications, it is necessary to have a mic preamp whose output is not routed to the mix bus. The pre or post-gate output would then be used, and the Mix Bus Switch would be opened to isolate that channel from the mixer mix bus. Please see the "CHANNEL OUTPUTS" section of this manual on page 11 for more information.

Phantom power is available for condenser microphones and more information on this subject is available in the section of this manual titled "PHANTOM POWER" on page 13.

In the "Line" setting, a 40dB resistive pad is inserted in the preamp circuit . The input impedance of the Line input is 33k Ω, and it can accept input levels in excess of +28 dBm.

All four inputs can be remotely turned on and off. The manual section titled "REMOTE ON/OFF CONTROLS, CHANNELS 1 - 4" on page 13 contains detailed information on this feature.

AUX INPUT(AUXILIARY, CHANNEL 5)

The Aux input is an unbalanced, line level input controllable from the front panel. The input impedance is 10k Ω. A 0.5 volt rms signal will drive mixer output to +18dBm. The input can accept a level of +18dBm before distortion. The input terminals on the TB-52 for the Aux input are #6 (Hot), and #7 (Gnd).

The Aux audio input may be remotely turned on and off. It is normally off and can be turned on by connecting terminal #36 of the TB-52 to +10 volts (terminal #37). When shipped from the factory, the TB-52 comes with a jumper between terminals #36 and #37 to turn the Aux input on.

BACKGROUND MUSIC INPUT(CHANNEL 6)

The 5502 and 5503 have a special input for background music. Of course, use of this input is not restricted to background music. This channel can be isolated from the mix bus by opening its Mix Bus Switch. The Background Music input is different from inputs 1-4 in that it has neither a front panel nor internal volume control. It is normally off unless specifically turned on by connecting terminal #38 on the TB-52 to +10 volts (terminal #37). This input is fixed in gain with a sensitivity of 0.5 volts RMS in for 0.775 volts (0dBm) out. The maximum input level is +18dBm.

The input impedance is 50k Ω. This high input impedance facilitates the paralleling of background music inputs to a large number of mixers. For example, over 80 separate mixers can be driven from a single 600 Ω source. Figure 2 below shows a typical background music application:

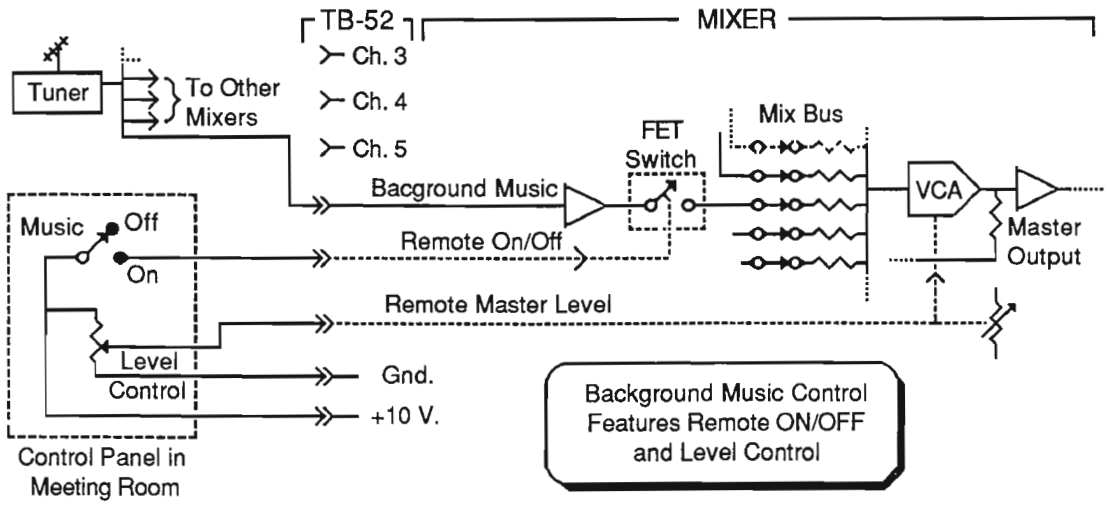


Figure 2

Note: The fixed gain requires that the background music source have a variable gain stage to set the level. Setting the maximum permissible level for one mixer in a group sets it for all mixers in that group. The level out of the mixer may be controlled from a remote location using a remote Master Volume Control, and the background music feed may be muted entirely via the remote on/off feature on this input.

Figure 2 also shows the FET switch, in series with the Background Music input, which allows the input signal to be turned on or off from a remote location. This switch is normally off, thus muting the background music. Also shown is the use of a remote Master Volume Control.

PAGING INPUT (CHANNEL 7)

The Paging input is identical to the Background Music input, but with one addition: The Paging input has two Mix Bus Switches. Mix Bus Switch 7 connects the Page audio to the same audio summing point as all the other inputs. This is the standard mix bus whose output is fed to the VCA. *The VCA will affect the page audio. This means that its level will be affected by the Master Volume Control and the VCA override.*

Figure 3 on the following page is a block diagram showing the paging input and how it can be affected:

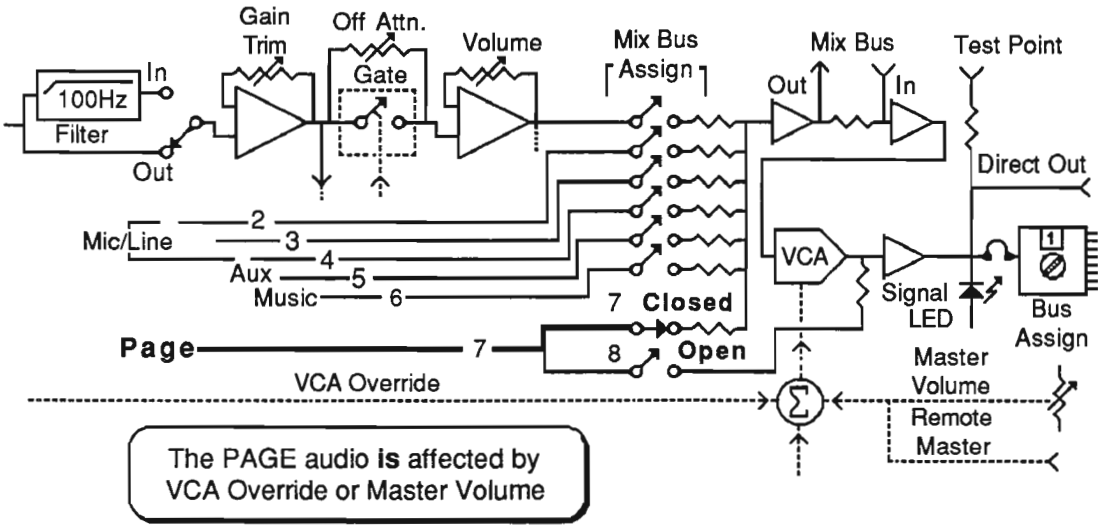


Figure 3

Mix Bus Switch 8 connects the Page audio to a summing point that is *after* the VCA and just before output of the mixer. There are two audio signals fed to this summing, or mixing point. One is from the Page input via 8, and the other is the composite audio from the mix bus via the VCA. The audio from the Page input is *not* affected by the Master Volume control or the VCA override. *This means that a page would go through the mixer to its output despite the Master Volume Control being turned all the way down, or the VCA override being activated.*

This is ideal for emergency page applications. The illustration below shows the connections to the TB-52 for this type of application:

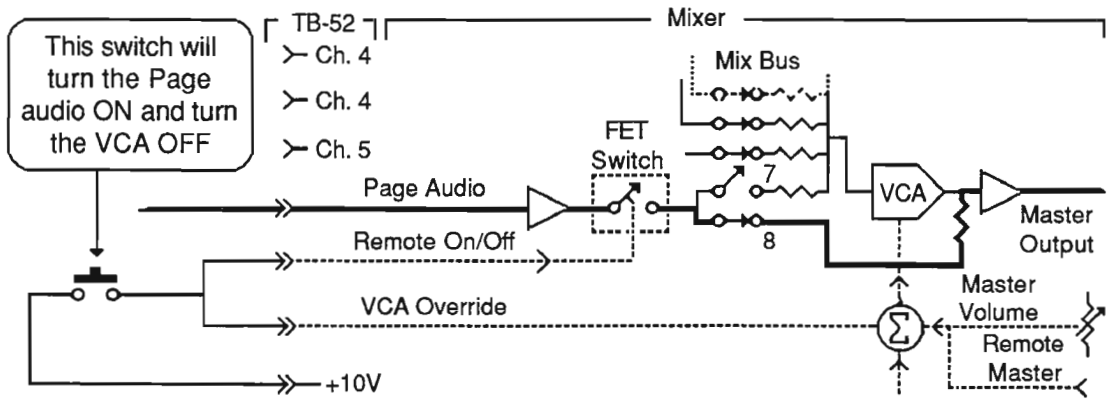


Figure 4

Program material may be "ducked" during a page as well as muted. For further data on that subject, refer to the "VCA OVERRIDE" section of this manual on page 16.

CHANNEL OUTPUTS

PRE-GATE and PRE-GATE MIX OUTPUTS

The pre-gate output is a direct output from each channel before it goes through the FET gate circuitry. This output has a maximum gain of 53dB as referenced to the input level. The actual gain is determined by the settings of the 20dB pad and the gain trim control.

The pre-gate outputs are not affected by the gating action of the mixer, the NOM, the channel level control, or the master level control. It is an ideal feed, for example, to a logging recorder when used in a courtroom system. The output is fed through a built-in 604 Ω resistor which allows several pre-gate outputs to be tied together at the terminal block. This would mix the outputs together and cause a 6dB drop in overall output level of the combined pre-gate outputs. This is common when two outputs of equal impedance are combined. An additional 6dB drop will occur every time the number of outputs tied together is doubled.

If the pre-gate outputs of all four channels are to be tied together, it is preferable to use the pre-gate mix output (TB-52 terminal #34). This output does not suffer from the reduction in level due to combining because the channels are actively combined. The pre-gate mix output can also serve as a tape output, as Figure 5 below illustrates:

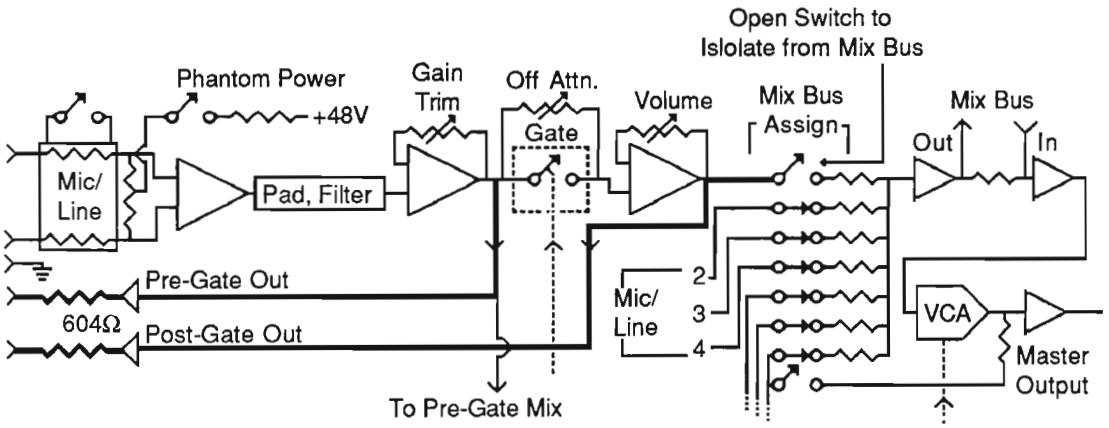


Figure 5

In the pre-gate mix output, the four channels are mixed together internally and then buffered through an output amplifier. When mixers are combined, the pre-gate mix outputs of the individual mixers are *not* automatically combined. If several mixers are being ganged together to create one large, multiple input mixer, it may be desirable to tie

the pre-gate mix outputs together. This is accomplished by directly connecting the mix outputs together from terminal #34 of one TB-52 to terminal #34 of the next TB-52, and so on. Shields can be looped together as well using terminal #10. A 6dB drop in overall level will occur when the two mix outputs are connected together, and an additional 6dB drop will occur every time the number of mix outputs connected together is doubled (1-2-4-8.....).

POST-GATE OUTPUT

This output will contain information from an individual channel only. It will, however, be affected by the 20dB pad, filter, gain trim, and all normal functions associated with that channel, such as auto gating, remote channel on/off, off attenuation, and manual level. The impedance of this output is 600 Ω. This allows it to be mixed with other outputs if desired. The post-gate outputs appear on TB-52 terminals #12, #13, #14, #15.

In addition, the audio of any channel may by isolated from the rest of the mixer by setting the Mix Bus Assign Switch to "Off" position. The post-gate output from that channel would then be the main output for the channel. When the audio of any channel is isolated from the mix bus, it is normally desirable to isolate the logic functions of that channel. This is accomplished by setting the NOM and Threshold Contribute Switch to the "Off" position for that channel.

PREAMP CONTROLS

MICROPHONE/LINE INPUT SWITCH

Inputs 1 - 4 may be switched to accept either mic or line levels. *If a line input, or a mic input outside the closed loop of the sound system is being used, it would be best to switch that particular input off the NOM and Threshold contribute bus.* A detailed description of how this is done can be found on page 6 of this manual under the heading "NOM and THRESHOLD CONTRIBUTE."

20dB PAD

The 20 dB pad may be used to normalize microphone inputs when both dynamics and condensers are used. *The 20dB pad should be switched in only after the Gain Trim Control has been turned fully counter-clockwise, and more attenuation is still required.* Figure 6 on the following page details the switching of the 20dB pad, as well as phantom power, high pass filter, and mic/line switching:

5502 - 5503 Preamp Controls

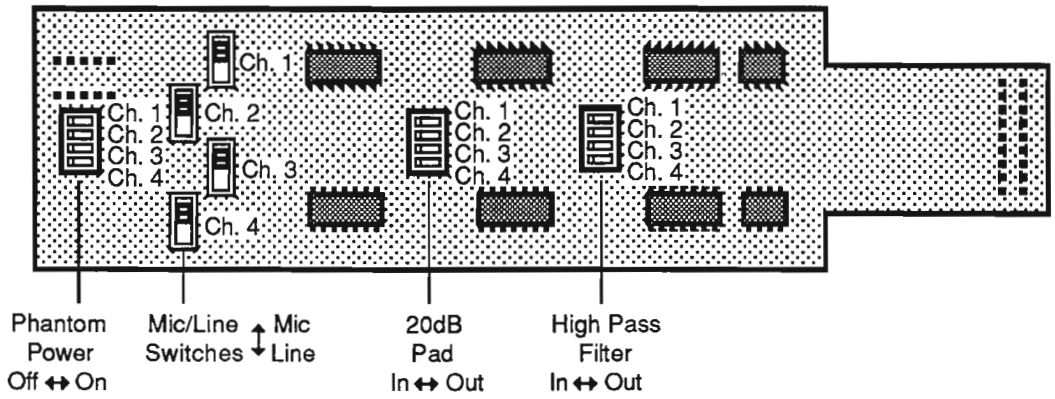


Figure 6

HIGH PASS FILTER

The high pass filter in the 5502 and 5503 is unique. Unlike the majority of other mixers that provide a high pass filter with a 6dB/octave rolloff that starts at 250Hz, the 5502 and 5503 high pass filter has a rolloff slope of 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 noise that is typically generated when handling a microphone.

PHANTOM POWER

Phantom power for condenser microphones is available on each of the four mic/line inputs. The internal power supply provides 48 VDC current limited through a 3.3k Ω resistor and connected to the primary center-tap of the input transformer. This supply will also work with condenser microphones requiring lower voltage and higher current, provided the microphone contains its own internal voltage regulator. The phantom power for each input is turned on by setting the appropriate dip switch to the "On" position (See Figure 6). Phantom power should, of course, be off if condenser microphones are not being used.

REMOTE CONTROLS

REMOTE ON/OFF CONTROL: CHANNELS 1-4

Channels 1-4 have three modes of operation: 1) automatic gating on and off, 3) manual on, and 3) manual off. The automatic gating mode should be considered the normal

mode of operation. Automatic gating of the microphones is dictated by microphone usage. This automatic mode of operation may be overridden by the use of remote on/off controls.

The capability of remotely turning a channel on or off is a provided feature on both the 5502 and 5503 mixers. The remote function will override the automatic gating function of the mixer: If a channel is gated on, it can be turned off remotely. Likewise, if it is off, it can be turned on remotely. *The remote on/off function has precedence over the automatic gating function.*

The remote control line is accessed on the TB-52. The terminal assignments for the four channels are: Ch. 1 - #40, Ch. 2 - #41, Ch. 3 - #42, and Ch. 4 - #43. Connecting a remote terminal to ground will turn that channel off. Connecting the terminal to +10 VDC on the mixer will turn the channel on. The +10 VDC is available either at terminal #37 on the TB-52, or at the positive side of the amplifier terminal block, located on the rear of the Mainframe, right below the mixer (See the inside, rear cover of this manual for a diagram of the TB-52 and associated amplifier terminal block).

The illustrations following provide some ideas on remote on/off control:

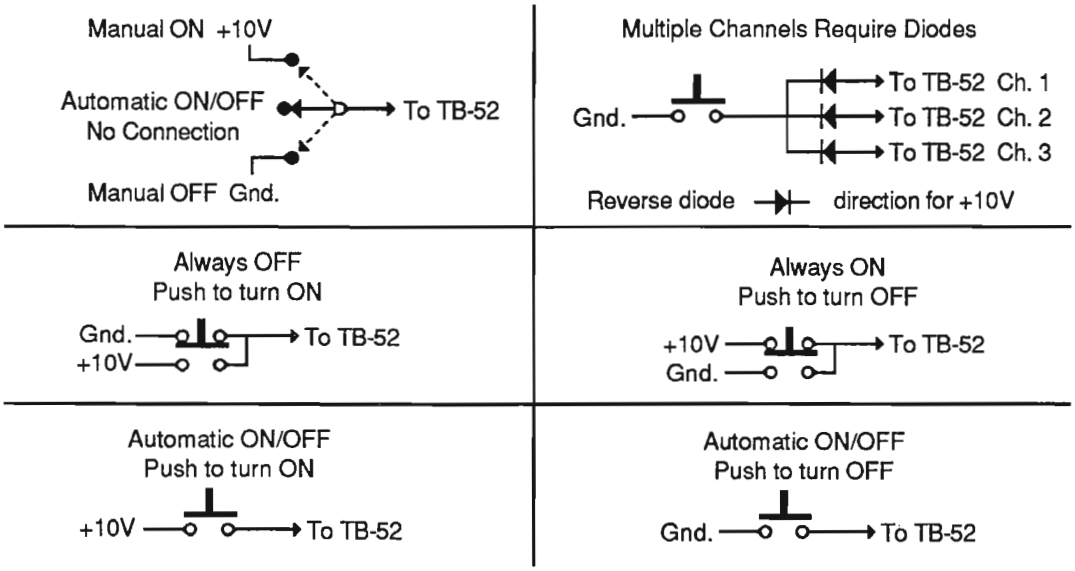


Figure 7

REMOTE ON/OFF CONTROL: CHANNELS 5-7

The remote control of channels 5-7 differ from channels 1-4 in that there is no automatic mode to override. Channels 5-7 are normally turned off and must be connected to +10 VDC to be turned on. This may seem a bit odd until it is realized that it is in keeping with the logic applied to the other channels. The TB-52 connections are as follows: Ch. 5

(AUX) - #36, Ch. 6 (MUSIC) - #38, and Ch. 7 (PAGE) - #39. *Channels 5-7 are normally off and must be turned on via the remote control connections. <u>However, the mixers are shipped from the factory with the jumper installed in the remote control line of Channel 5 to activate it.</u>* The illustration below provide some further ideas on remote on/off control:

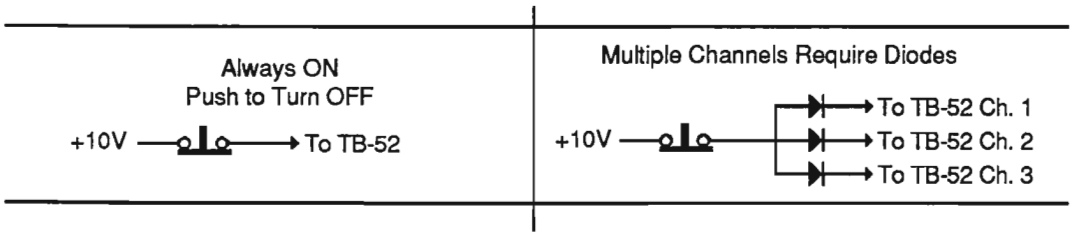


Figure 8

REMOTE LEVEL CONTROL

While the 5502 has remote control capability on the Master Level Control only, the 5503 has remote control capability on the input channels as well. All remote control lines are low voltage DC. Remote control has been designed with simplicity in mind so that custom remote controls can easily be designed and constructed by the installer. Of course, remote controls for the 5503 can be purchased directly from the factory as well. The control has a 90dB range, when 0 to +10 VDC is applied to the control line. The +10 VDC is taken directly from the mixer, and with 0 VDC applied to the control line, the channel is at full output (0dB attenuation). With the full +10 VDC applied to the control line, maximum attenuation (90dB) occurs.

An added feature of the 5502 and 5503 is the automatic switching between local (front panel control) and remote control. 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 is again determined by the front panel control.

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

Figure 9 on the following page shows the simplicity of the remote circuitry. Note that only two components are required - a 10k Ω linear taper pot and a 2.2k Ω, 1/4 watt or larger resistor. It is important to note that the switch from remote to local is made *only* 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.

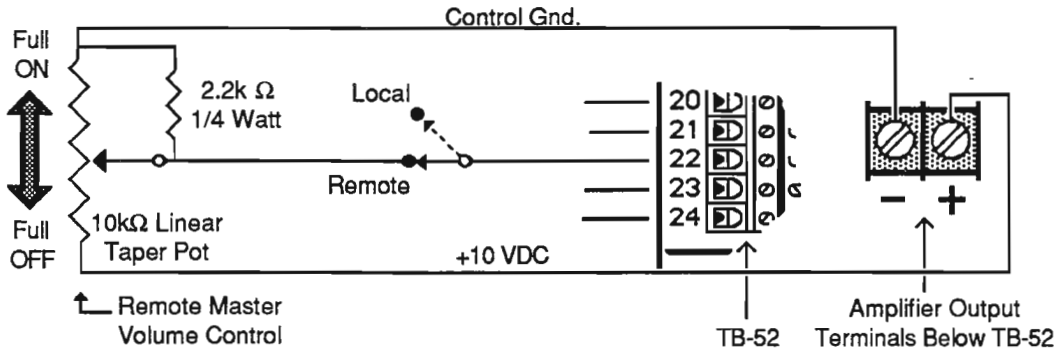


Figure 9

Important Caution on Remote Control Connections:

Do not connect the +10 volt terminals of two mixers together. This will damage the voltage regulators inside the mixers. Each mixer +10 v. supply must remain independent.

VCA OVERRIDE

The VCA Override has the highest priority level of all VCA control lines. This an external control line that appears on the TB-52 at terminal #44. When terminal #44 is connected to +10 VDC (supplied by the mixer), all signals through the VCA will be muted, regardless of the front panel and remote master control settings, as shown in Figure 10 below.

This control is often used in emergency page applications. For emergency page application information refer to the "PAGING INPUT" section of this manual on page 9.

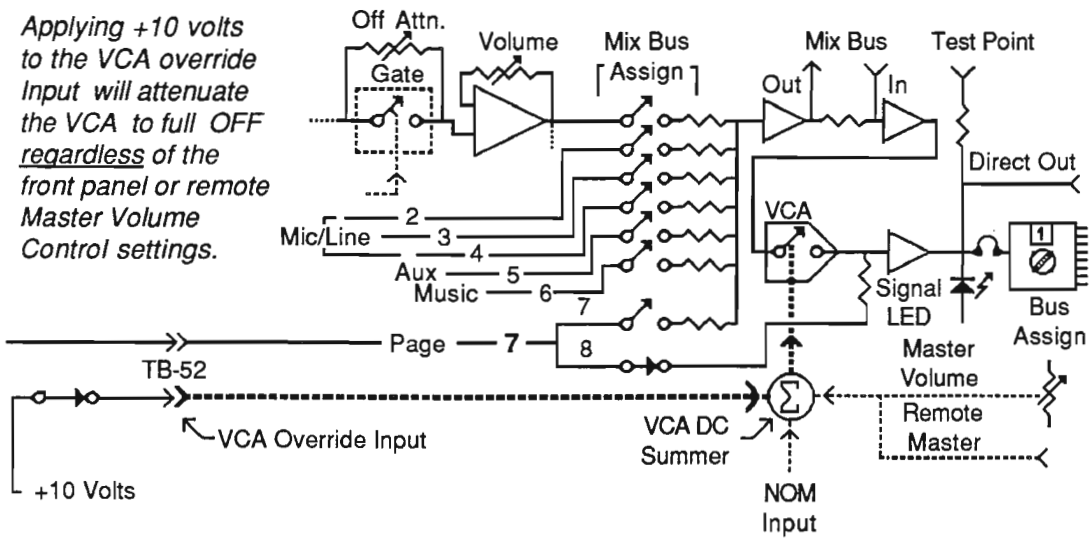


Figure 10

The VCA override may also be used to "duck" the signal level through the VCA while paging through the mix bus 7 page input (for a detailed discussion of paging mix bus 7, and mix bus 8, see the "PAGING INPUT" section of this manual on page 9). This is accomplished by connecting terminal #44 to a voltage *less than* 10 volts. This will cause the VCA to attenuate in proportion to the amount of voltage applied to terminal #44. The paging signal that is mixed in after the VCA will remain at a constant level during the page.

The simple circuit illustrated below shows how to obtain a variable voltage for "ducking."

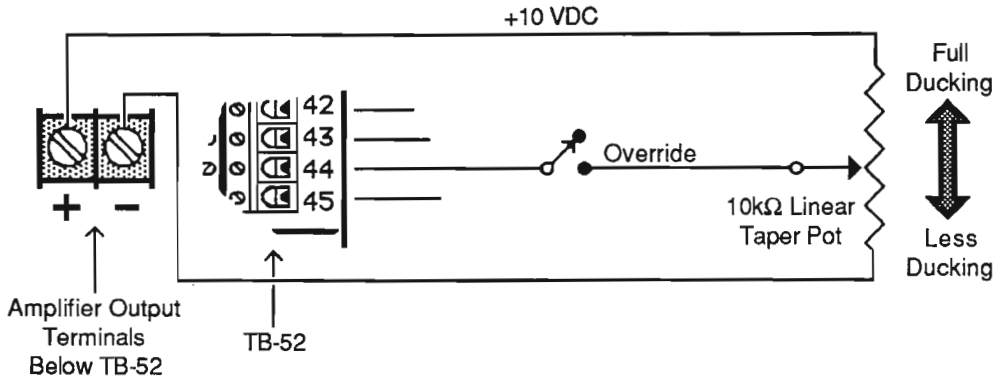


Figure 11

CHANNEL ACTIVE OUTPUTS (LOGIC OUTPUT)

Each of the four Mic/Line channels on the mixers 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, as shown in Figure 12 below:

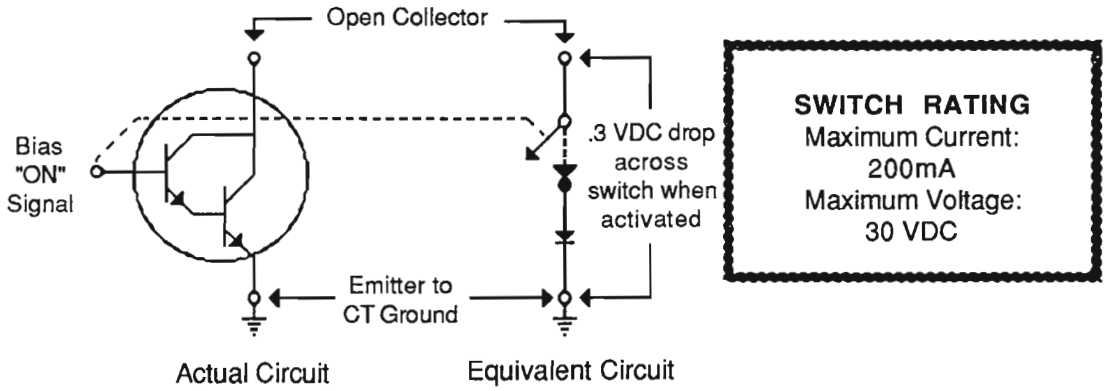


Figure 12

The collector of the transistor is connected to the TB-52. 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 VDC.

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 TB-52 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, 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.

In Figure 13 below is an example of external devices connected to the channel active outputs. As can be seen, 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

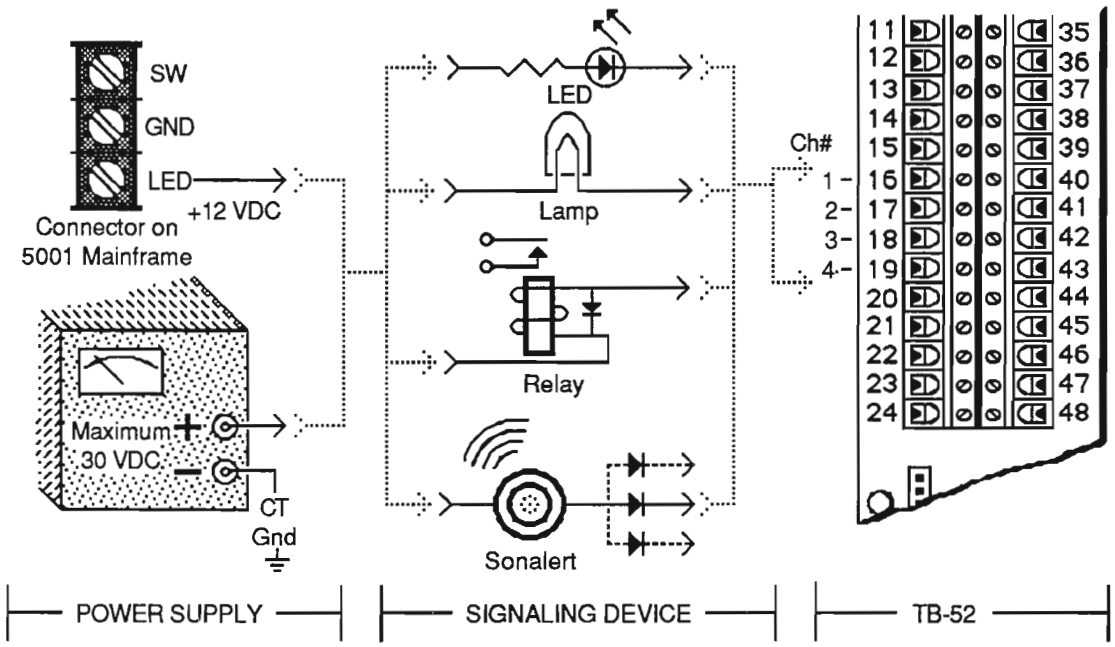


Figure 13

MULTIPLE MIXER OPERATION

GANGING MULTIPLE MIXERS (MAKING ONE BIG MIXER)

Multiple mixers may be ganged together to provide an automatic mixer with more than four automatic inputs. This is done by connecting the desired number of mixers together in a master/slave configuration. One mixer is placed in the master mode while all other mixers are placed into the slave mode. The mixers are bused together on the TB-52's using optional accessory combining cards and plugging them between TB-52's.

There are two different accessory combining cards, the 55ACC Active Combining Card, and the 55PCC Passive Combining Card. Whenever two or more mixers are to be combined, at least one active combining card (55ACC) is required. After an active card is used, additional mixers may be combined with the first two mixers using passive combining cards (55PCC's). However, when mixers need to be switched between the "Master" and "Slave" mode to provide a room combining function, an active card is required for each one of these switching points.

Let's take the example of a single, 16 input mixer. This requires that four automixers be ganged together to provide the 16 inputs. There is no requirement for the 16 input mixer to be combined with additional mixers, or to be separated into 4 individual mixers. This configuration would require the purchase and installation of one (1) 55ACC and two (2) 55PCC combining cards. The 55ACC would be installed between the first and second mixers, and the two 55PCC cards would be installed between the second and third, and third and fourth mixers. Mixer combining is accomplished when terminals #23 and #24 on the TB-52 of the "Master" mixer (the first mixer) are connected together, as shown below:

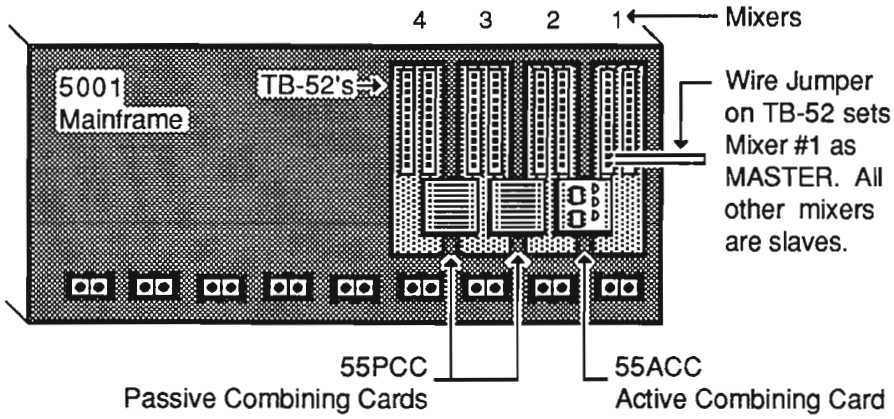


Figure 14

As you face the front of the Mainframe, the "Master" mixer should be located to the left of the "Slave" mixers. All mixers must be placed in adjacent slots in the Mainframe. This approach to combining allows the cost of the additional circuitry to be borne only when the circuitry will be used. The 55ACC is more expensive than the 55PCC.

Let's continue with an example of four mixers again, but in a different configuration. In this

example, we have two meeting rooms. Each room requires eight inputs. There is a movable wall that separates the two rooms. At times, this wall is opened, making one big room, and the sound systems of the two rooms need to be combined. The Master/Slave function of the mixers allows this to be accomplished.

Three (3) 55ACC cards are required. They are used as illustrated in Figure 15 below. Notice that the Master/Slave switch wired to the second mixer's TB-52 provides the room combining function. This switch line carries only low level DC and can be remoted to a convenient location. Additional mixers could be ganged with mixers 2 and 4 using 55PCC cards *as long as a 55ACC is used between the two groups of ganged mixers.*

COMBINING TWO PAIRS OF GANGED MIXERS

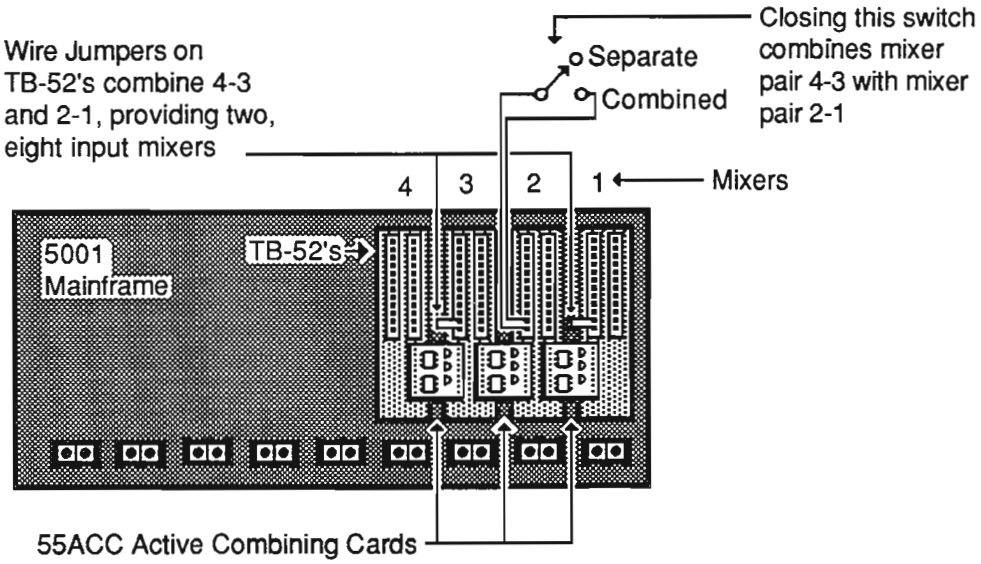


Figure 15

The master audio output of the combined mixers will appear at the Output Bus Assign Switches of *all* mixers, both masters and slaves. The output of each mixer is active and can drive up to 15 other inputs. *The Output Bus Assign Switches of all combined mixers must be set to different buses so that the outputs don't try to drive one another.* If all of the motherboard buses are in use, the direct output wire jumper, adjacent to the Bus Assign Switch, may be cut to isolate the unneeded mixer outputs from the motherboard buses. Even when mixers are combined in a Master/Slave configuration, they still retain some independent operating functions. These include: Pre-gate Mix, Remote Control and Threshold Control.

55ACC & 55PCC INSTALLATION

The 55ACC Active Combining Card and the 55PCC Passive Combining Card are optional accessories to the 5502 and 5503 automixers. They are required if mixers are to be combined in any configuration. These cards are plugged on to adjacent TB-52 terminal blocks located on the rear of the 5001 Mainframe .

The illustration below depicts proper orientation and alignment of the 55ACC & 55PCC relative to the TB-52's.

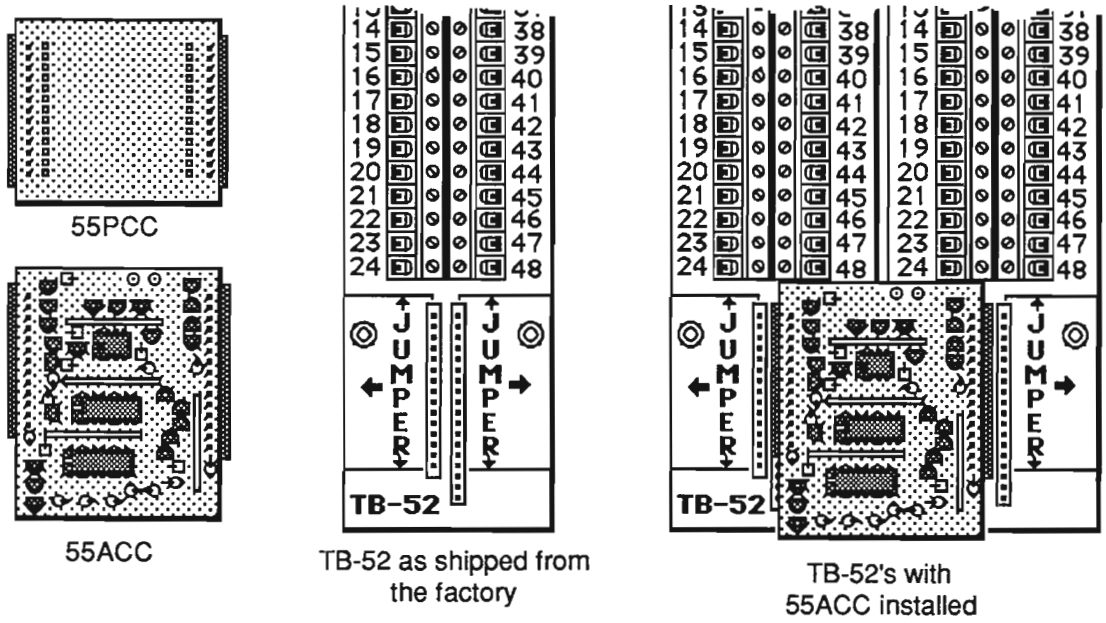


Figure 16

The jumper boards must be properly aligned with the terminal blocks. The top edge of the 55ACC and 55PCC must touch the bottom edge of the terminal blocks. *If a gap is left between the card and the terminal block, pins are not aligned and the system will not function properly.*

MASTER VOLUME CONTROL OF COMBINED MIXERS

What happens to the Master Volume Control of individual mixers when they are combined? Actually, there are two possibilities. The first possibility is that nothing happens - all mixers retain their own independent Master Volume Control, the same as before they were combined. The other possibility is that when the mixers are combined, the "Master" mixer has the only active Master Volume Control.

The first option allows for independent zone control even when mixers are combined. The second option allows for only one Master Volume Control per combined set of mixers to be in operation at a time. In other words, the Master Volume Control on the "Master"

mixer is the only operational control.

Both options can be used with the remote Master Volume Control as well as the front panel Master Volume Control. As with all remotes, the front panel control is operational unless the remote is connected. A connected remote control will have precedence.

The desired option is selected at the time of 55ACC card installation. A wire jumper on this card determines which option will be in use. *If the jumper is in place, only the Master Volume Control on the "Master" mixer will be operational. If the jumper is cut, then all Master Volume Controls will remain operational when the mixers are combined.*

Figure 17 below shows the location of the jumper that determines the configuration of the Master Volume Controls when mixers are combined:

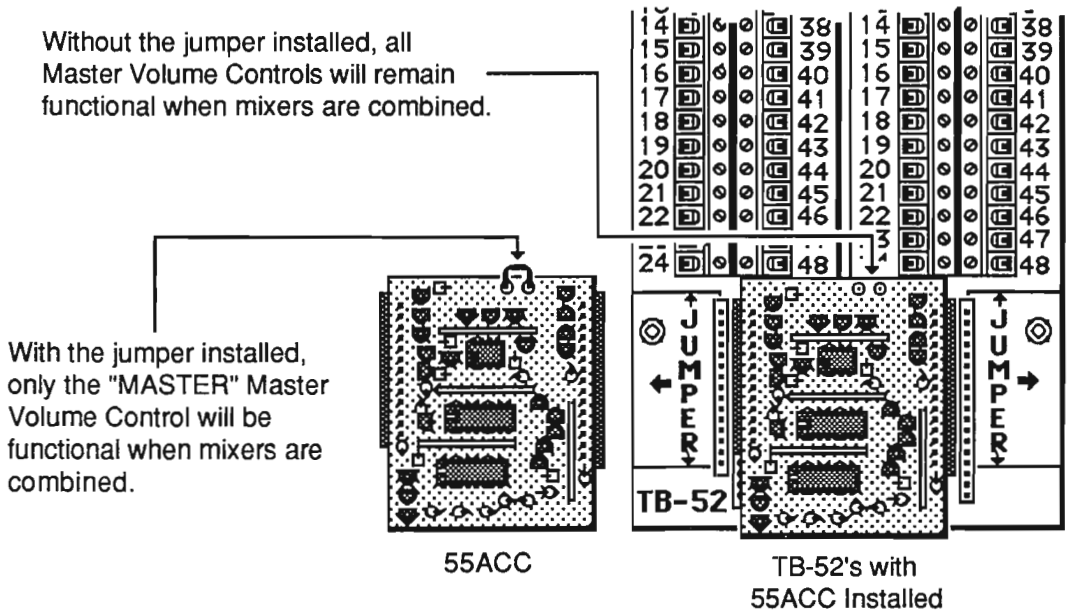


Figure 17

SPECIFICATIONS: 5502 & 5503

Power Consumption ---------- 11 Watts

Frequency Response ---------- ± .5dB 20Hz to 20kHz

Distortion (THD) ---------- .01%

Equivalent Input Noise ---------- -127 dBm Per Channel, A Weighted

Maximum Gain ---------- 85dB

Microphone Input Impedance ---------- Actual: 1300 Ω, Recommended: 150 to 600Ω

Line Input Impedance ---------- Actual: 20k Ω

Phantom Power ---------- +48 VDC Through 3.3k Ω Resistor

Output Load Impedance ---------- 604 Ω

Maximum Output Level ---------- +18 dBm

Pre-VCA Output Impedance ---------- 604Ω

Pre-VCA Output Level ---------- +3 to +60dB Relative to Input Level
≈18dB Below Master Output Level

Pre-VCA Mix Output Impedance ---------- 604Ω

Pre-VCA Mix Output Level ---------- ≈6dB Below Master Output at Zero Attenuation

Post-VCA Output Impedance ---------- 604Ω

Channel Off Attenuation ---------- 0 to 90dB

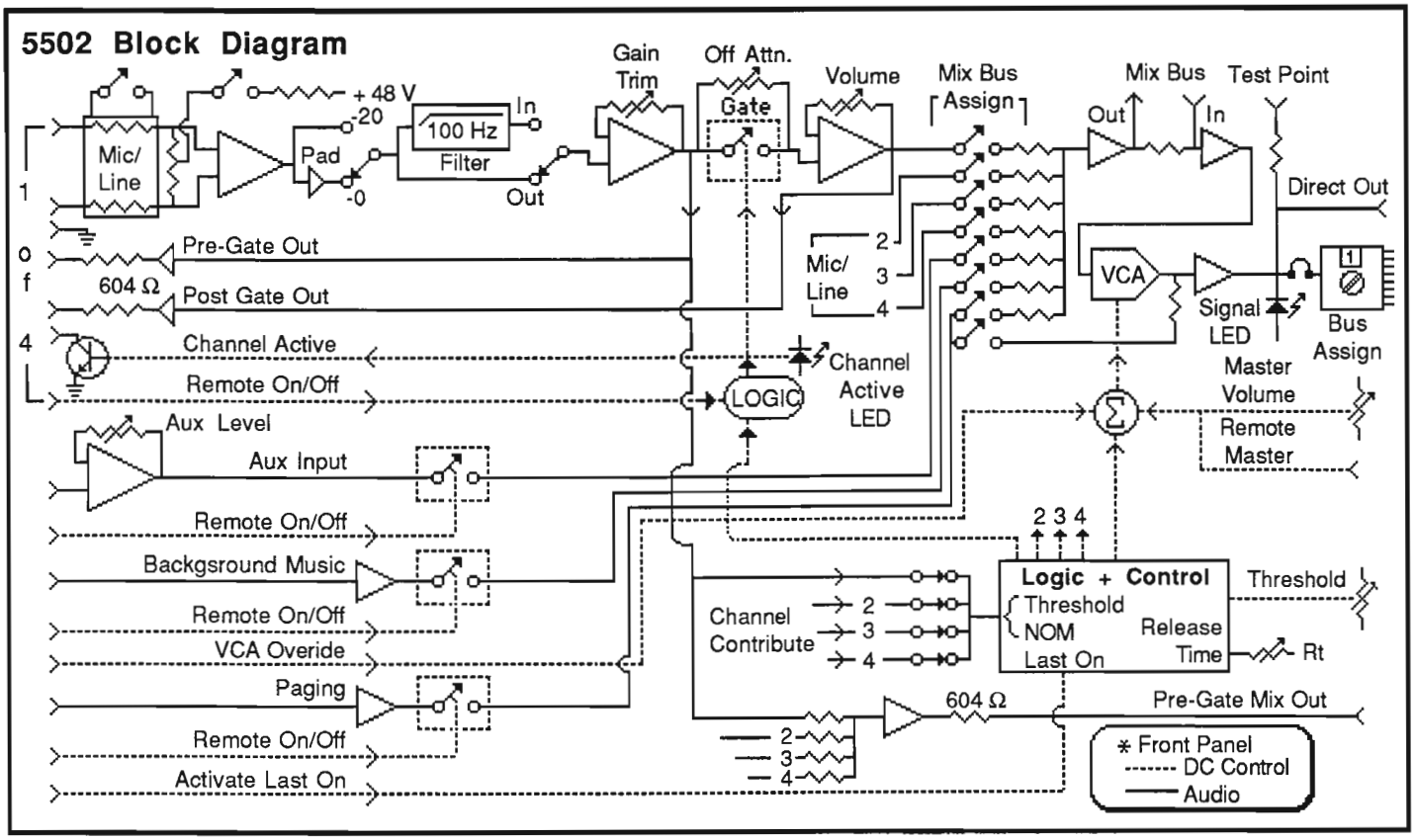
Channel Release Time ---------- 0.1 to 10 Seconds

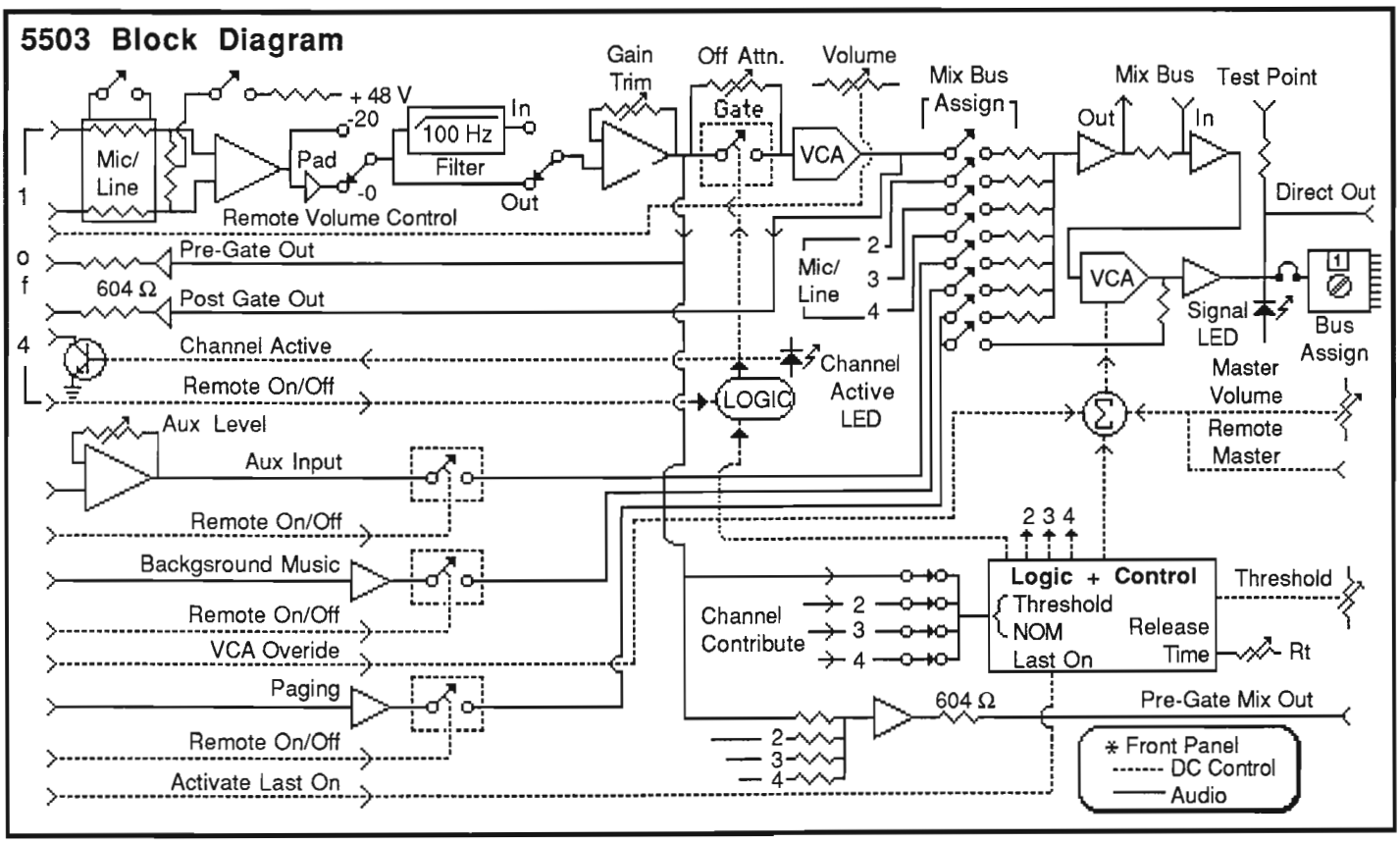
Channel Active Output --- Open Collector Type Capable of Sinking 200 ma @ 30 VDC

High Pass Filter ---------- -6dB @ 125Hz; -30dB @ 32 Hz

INDEX

BLOCK DIAGRAMS: 5502 and 5503





APPENDIX I

A FEW THOUGHTS ON MICROPHONE SELECTION

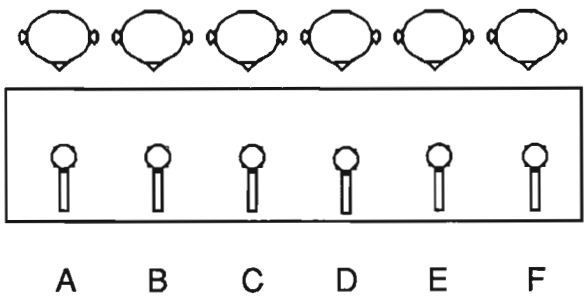
All microphones used with the 5502 and 5503 automixers are an integral part of the automatic mixer "system." Therefore, the selection and placement of these microphones should be given careful consideration.

The mixer 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. An individual microphone will be gated on only when the signal level 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, so 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 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: *Whenever feasible, use the same type of microphone throughout the system.*

Now that we have explored how the automixer microphone gating works, let's consider the application below. This is a discussion panel, or boardroom application where there is one microphone per person.

TOP VIEW



The reason for using an automixer is to maximize the gain before feedback potential in the room. By keeping unused microphones gated off, there is more gain available for the microphones in use. It makes sense that we should design the system so that any unnecessary gating, or false triggering, of microphones is minimized. In the example on the preceding page, when the person at microphone "C" speaks, we want microphone "C" only 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 person speaking, and as far away from other sound sources as possible. That's nothing new. It gives us a signal to noise ratio advantage at the microphone - the signal being the person speaking, and all other sound sources being the noise. Suggestion number two: *Place the microphone as close to the person speaking 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 that an omnidirectional microphone would at 1 foot.

Suggestion number three: *Use a directional microphone.* It will provide 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 hemispheric 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, but 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.

APPENDIX II

AUTOMIXER SET UP PROCEDURE

For proper operation, the automixer requires on-site adjustments, preferably under actual operating conditions.

Step 1: (Initial control settings). Please set the following controls as described.

All channel volume controls - full clockwise (full on).
All channel Gain Trim Controls - full counter clockwise (full off).
Master Volume Control - full clockwise (full on).
Threshold sensitivity control - full counter clockwise (maximum sensitivity).
Turn off or disconnect (unplug) all microphones from the system.

Step 2: (Setting the channel gain trims on all microphone inputs). Activation of the "Last On" feature to facilitate the setting of the Gain Trim Controls is suggested.

The following procedure suggests that both the Master and the input channel volume controls be set to maximum gain. This is a suggestion and not a requirement. By setting these controls to the maximum and properly setting the channel gain trim controls, the system can be made less susceptible to feedback due to user gain adjustments. With the volume controls set to maximum, the user cannot add any more gain to the system, so he cannot get the system into feedback. If operation of the system by unskilled or unauthorized personnel is not anticipated, the volume controls may be set to less than maximum gain.

What is important, however, is that the volume controls not be set low with the Gain Trims set high to make up the gain. This can overdrive the automixer logic and cause the mixer to perform below its potential. The volume controls should be operated in their upper quarter, with required reductions in gain made with the Gain Trim Controls.

It is very important that *as gain trim adjustments are made, one and only one channel is gated on at a time.* The NOM will cause a reduction in gain of 3dB when a second channel is gated on. If a channel is adjusted to just below feedback when two channels are gated on, when the

second channel gates off, the system will be 3dB into feedback.

With one, and only one, microphone gated on, and with its volume control set to maximum, (or at least in the upper quarter of available gain), adjust the Gain Trim Control to a comfortable level below feedback. This, of course, is best accomplished with someone speaking into the mic.

Step 3: (Set the rest of the microphone inputs). Simply repeat Step 2 for the rest of the microphone inputs. Remember to have only one microphone on at a time. This is easily accomplished by plugging in only one mic at once.

Step 4: (Adjust the Threshold Control). Deactivate the "Last On" feature to facilitate setting the Threshold Control.

Set up the sound system the way it will be used most of the time. With the Threshold Control set fully counter clockwise (maximum sensitivity), the individual microphones will gate on with any noise in the room. Typically, any room noise will cause random gating. The Threshold Control will have to be turned clockwise (less sensitivity) until the random gating stops and the desire gating is achieved.

Setting the threshold level is a balancing act. It requires give and take. If the threshold is set too low, the microphones will gate on and off with any room noise. If the threshold is set too high, microphones will be difficult to gate on with normal voice levels.

Imagine a balloon with a microphone inside it. The balloon represents the "pick up" area of the microphone. With the Threshold Control set to maximum sensitivity, the balloon is very large and any sound in the room will cause the channel to gate on. As the Threshold Control is turned up (clockwise), the size of the balloon decreases. This means that someone trying to gate on the channel will have to speak louder, or move closer to the microphone.

The Threshold Control is best set under actual operating conditions. Most times this is not possible, so we do the best we can to simulate these conditions. Then, if possible, we return to do a final tweak during the actual operating conditions. Please understand that perfection may be

unobtainable. Setting this control is a compromise. In order to have enough sensitivity for people who speak softly, some random gating may have to be accepted.

Role playing as a system user is often helpful in setting the Threshold Control. If the application is a church, someone will want to play the part of the minister speaking into microphone. Better yet, get the minister himself to help adjust the system. Don't forget to play the organ to see the effect it might have on gating the microphones.

Set the Threshold Control as desired by turning it clockwise. Do this slowly because the release timer will continue to hold a channel on for a brief period of time as the control is advanced. This could cause the threshold level to be set artificially high. Monitoring the "Channel Active" LED's on the front panel will help indicate channel gating. It will be necessary to have someone talk into the individual microphones to accomplish this.

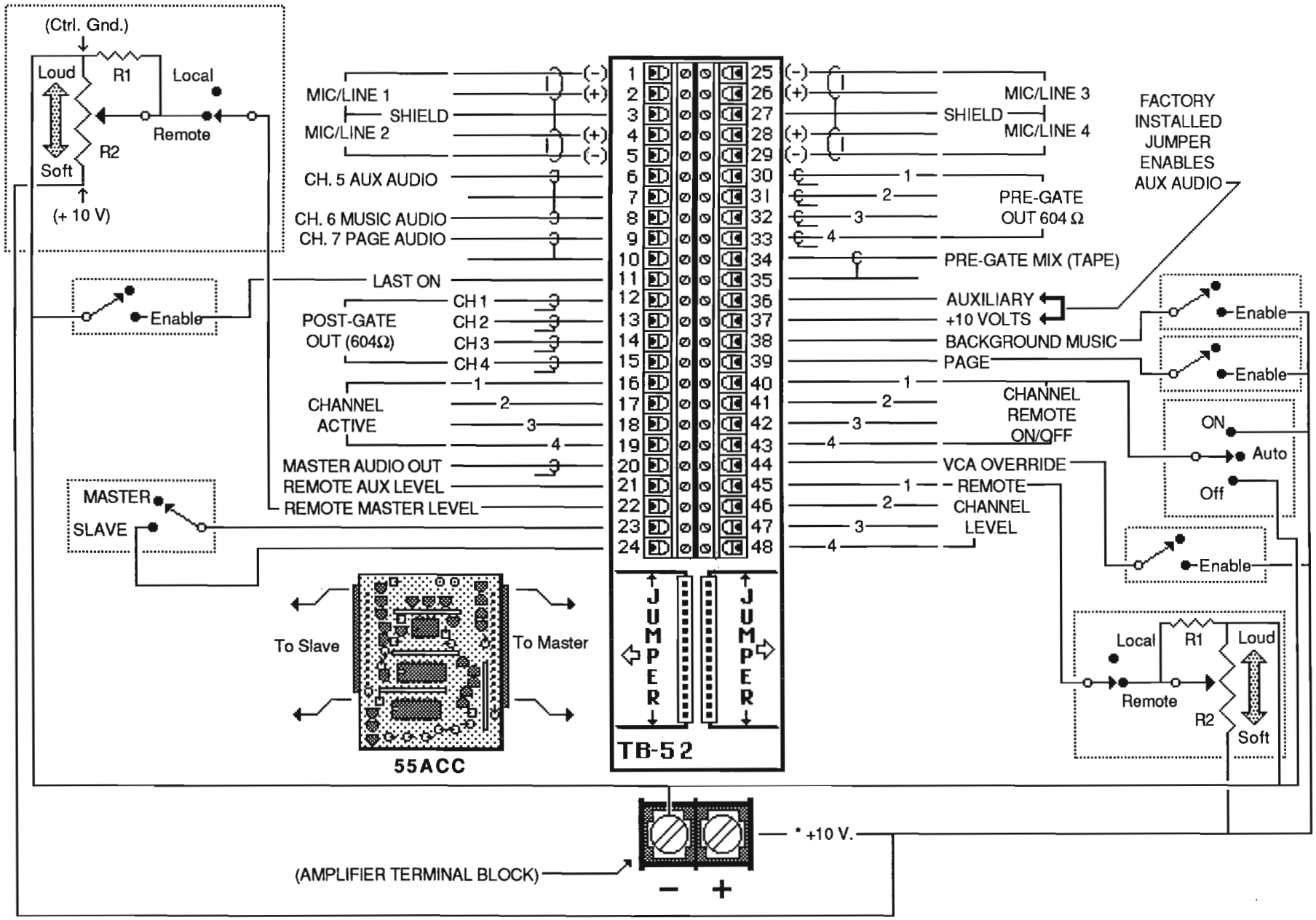
After the Threshold Control is set, have someone talk into the mics. Do they gate on with appropriate sound levels? If not, some minor Threshold Control adjustment may be necessary.

Remember, as room noise increases, the microphones will require a higher signal lever to gate on. It may be helpful to generate some typical room noise while checking the gating sensitivity of each channel. If one channel seems to gate on far easier than the other channels, turning down the Gain Trim Control for that channel may be necessary. The volume control for that channel would then have to be turned up to compensate for the gain reduction at the gain trim.

Step 5: (Finalizing input levels). After the Threshold Control has been set, and any Gain Trim Controls adjusted, "tweak" the input level controls as needed for normal operation. The Master Volume Control may be "tweaked" as well, if needed. Subsequent level adjustments would normally be made at the audio amplifier stage.

Activate "Last On," if desired.

The automixer should now be ready for operation.



NOTES:
R1 = 2.2kΩ
R2 = 10kΩ Linear Taper

* +10 V is current limited and only to be used for 5502 and 5503 remote acessories. ***DO NOT*** connect the +10 terminal of one mixer to another.

5502 & 5503
TB-52 Connections

NOTES:
Terminals 45, 46, 47, and 48 (Remote Level Control) apply to the 5503 only. +10 Volts is available at both terminal 37 and the positive amplifier terminal.