PROTECH®

1/03

MODEL 2000-C
DUGAN - COURTROOM AUTOMATIC MIXER WITH MIX-MINUS & LOGGING OUTPUTS.
INSTALLATION & OPERATION MANUAL

www.protechaudio.com

The Protech Audio Model 2000-C Courtroom Automatic Mixer is designed to be the best sounding, most transparent auto-mixer, for courtroom installations. From the properly implemented Dugan Speech System for transparent gain-sharing, to the logging recorder outputs, to the mix-minus outputs for maximum sound reinforcement, to the card frame mechanical packaging, the Model 2000-C is constructed to provide the designer and installer with every feature needed for perfect courtroom auto-mixer installations.

Before proceeding further, please make note that the Model 2000-C is shipped from the factory with all preliminary adjustments made. Each input channel is set to microphone input, 50dB of gain. The tone controls on each input are set to flat, and the master output level is set to unity. The unit should be installed, turned on and listened to, before any additional adjustments are made. In many installations, no further adjustments will be required. If line level inputs are to be used, the mic/line slide switch on that input should be reset to the line position.

The first feature to make note of is the patented Dugan Speech System for proper gain sharing in automatic mixing applications. This operating system, when properly implemented, results in the best, most transparent automatic mixing to be found anywhere. A short listening demonstration has impressed even the most critical audio system designers.

The second feature to be discussed is the logging recorder outputs. Each Model 2000-C chassis assembly will allow up to 4 logging recorder outputs. Each output contains the sum of two input channels (logging recorder output #1 contains input signals from channels 1 & 2).

The third feature to consider is the mix-minus outputs. Each Model 2000-C chassis assembly provides four mix-minus outputs, to allow custom mixes, with signals levels independently adjusted, to be sent to different areas of the sound reinforcement system. This approach allows much more gain before feedback. Other systems require any number of additional pieces of equipment, like wiring matrixes, to achieve mix-minus. In the Model 2000-C, the mix-minus feature is inherent in the design.

In addition to the logging recorder and mix-minus outputs, each input section incorporates a number of features, to allow installations to be done quickly, with a minimum of wiring and set-up time. High-Pass filters, Bass and Treble Controls, Logic Outputs, Phantom Power, and Mute functions are built into each input channel.

The output card has provision for two balanced line outputs, Auxillary Input, switch selectable Master/Slave operation, Gain Trim, Remote Volume Control, Group Mute, Pink Noise Generator, and optional Automatic Level Control.

The optional Automatic Level Control works in a very unique manner. Instead of adjusting levels at the output only, the ALC reaches back into each input channel and readjusts the gain at each input. This feature allows the mix-minus to remain properly adjusted.

The card frame assemblies are linkable, to create systems with up to 100 microphone inputs. The linking is accomplished by using standard DB15 cables.

INDEX

The Model 2000-C Courtroom Automatic Mixer is shipped from the factory with all cards plugged into their proper slots. The mechanical drawings on the facing page show the position of individual types of cards. If your system required less than 8 inputs, the system is shipped with the higher number card slots empty. If your systems required more than 8 inputs, additional frames have been shipped, along with the necessary link cables.

CAUTION: The Model 2000-C has been assembled and aligned at the factory. With the exception of line level inputs, the unit should be wired, turned on, and listened to, before any field adjustments are made.

UNPACKING-

1- Remove chassis assembly from carton.
2- Open card frame front panel by loosening two thumbscrews, remove anti-static shipping insert and discard.
3- Count input cards, output(s) card, power supply card(s), link cables, power supply transformers, to insure correct quantities.

MOUNTING

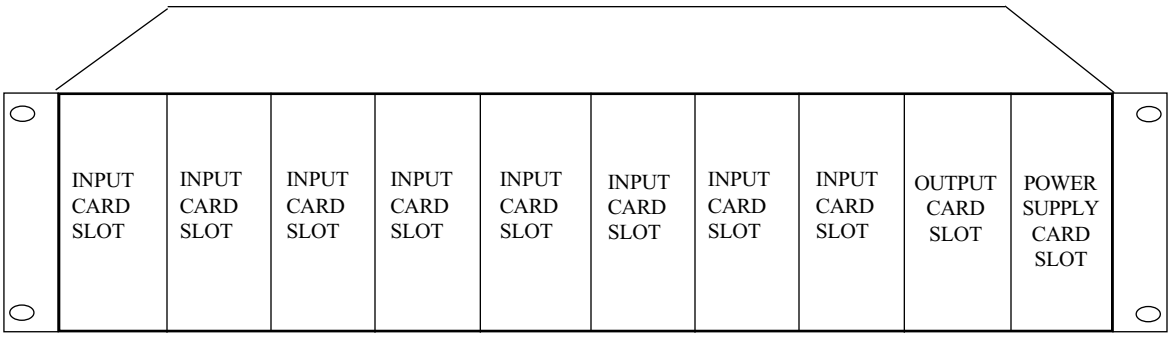
The Model 2000-C Courtroom Automatic Mixer is designed to be mounted in an industry standard 19" EIA rack. Care should be taken not to mount the unit next to power supplies, power amplifiers, or other equipment which generate strong AC fields.

WIRING-

All audio inputs and output(s) should be wired using double conductor shielded cable. Logic circuits may be wired using unshielded cable.

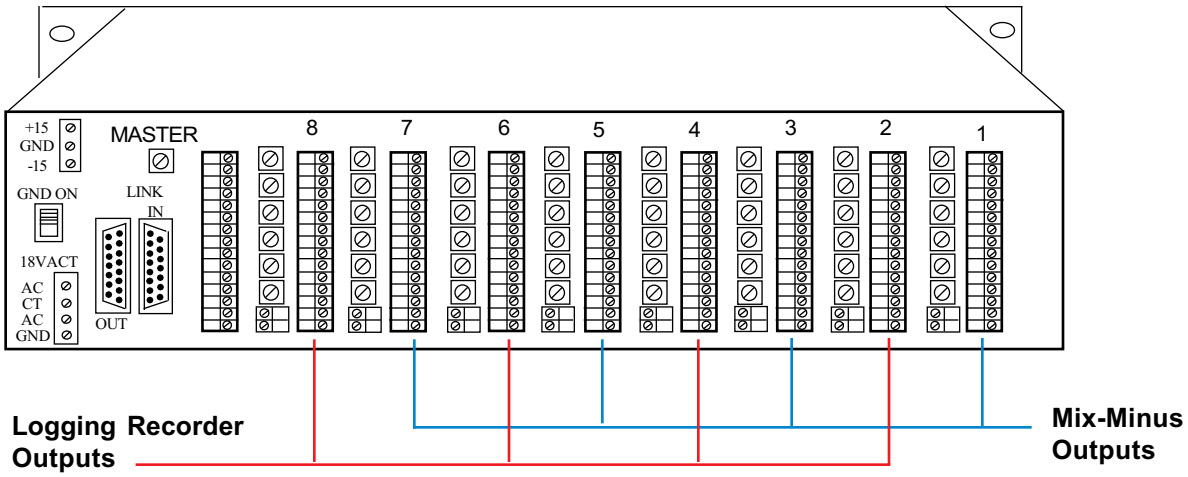
PRODUCT COMPONENTS

FRONT VIEW

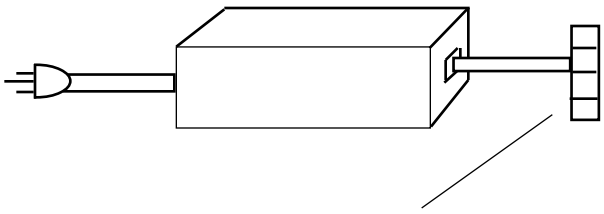


1 TO 8 INPUT CHANNELS,
SLOTS 1 THRU 8 MAY BE USED FOR OTHER INTEGRA III SYSTEM MODULES

REAR VIEW



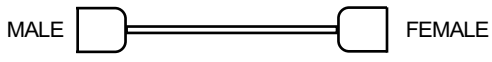
POWER SUPPLY, 1 PER CHASSIS



Connector Plugs Into
Mating Connector On Chassis
(18VACT)

LINK CABLE

DB15



LINK IN

LINK OUT

QUICK START SET-UP, STANDARD AUTOMIXER INSTALLS

Unpacking and Mounting -
Unpack each Model 2000-C Card Frame Assembly, loosen thumbscrews and open door. Remove anti-static bubblepack and discard.
Identify which card slots will have microphone level input signals, and which will have line level input signals. For line level signals, slide the input card out of the frame, and set the mic/line switch to the line position. Plug the card back into the frame.
Close door and mount frame in rack. Wire all inputs and outputs with double conductor shielded cable (See connection points on pages 7 & 9.)

Inputs -
Each input card is set to microphone position, with gain preset for 50dB. If condenser microphones are to be used, set the gain slide switch to the low position on the corresponding input card. The input cards are jumpered for 15 volt phantom power. The phantom power is automatically disconnected when the card is set to line position. (See page 6 for details.)
The input cards, when set to line position, are designed to be used with devices such as telco hybrids, compact discs, and tape players. The mode switch on each input is factory preset to "Auto". Depending on the installation, it may be desirable to set it to "Manual". In manual mode, the automix gain function will not effect the line input gain.

Tone Controls -
Each input card has a switch selectable high-pass filter, and Bass and Treble controls. The inputs are shipped with the high-pass filter switched out, and the tone controls set for "Flat".

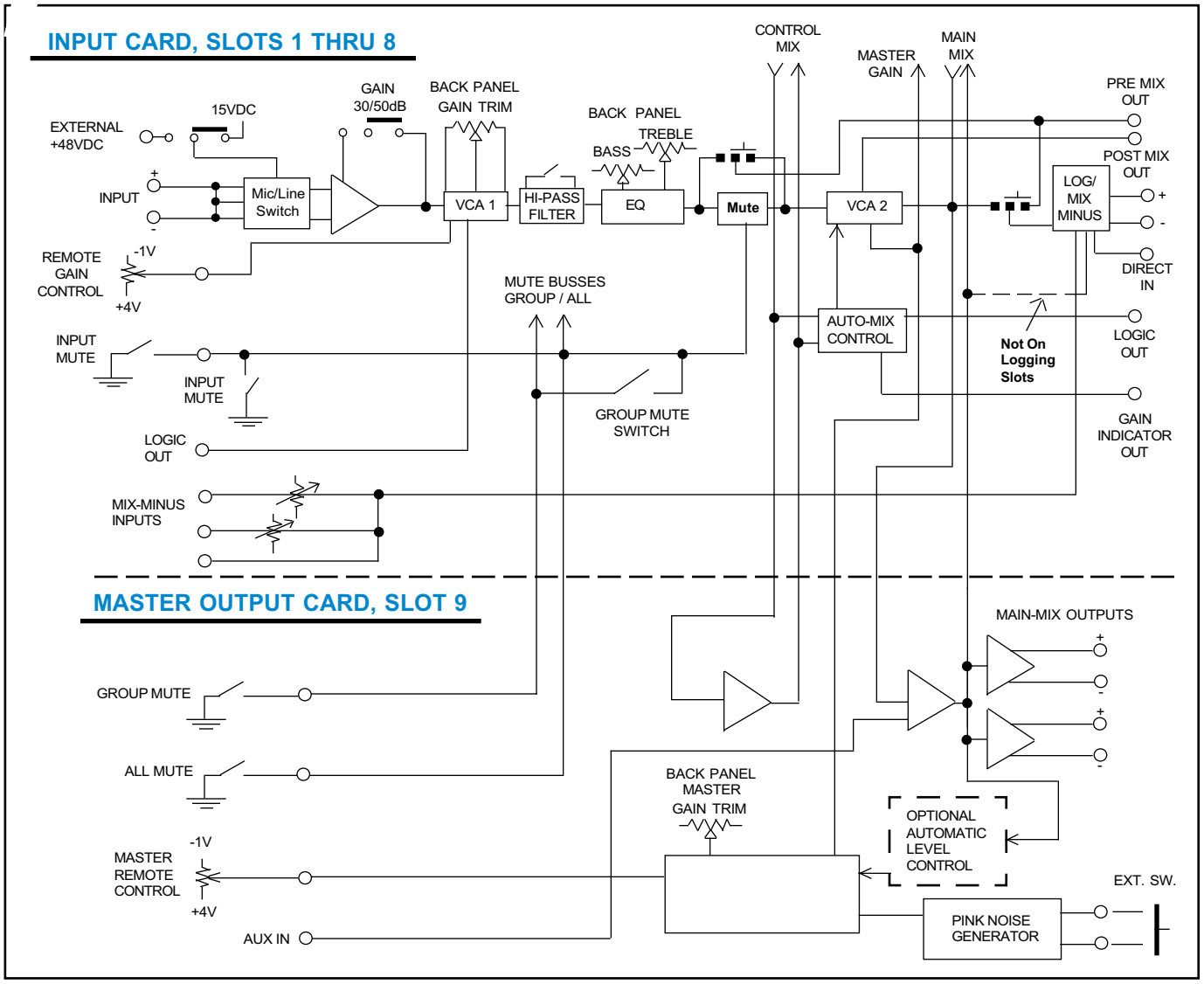
Output Cards -
The output card has only one slide switch, designed to set the output to Master or Slave operation. If only one chassis is to be used, no adjustment of the Master/Slave switch, is necessary.
If more than one chassis is to be used, consult page 11.

CAUTION: The Model 2000-C has been assembled and aligned at the factory. With the exception of line inputs, which only require the mic/line switch to be reset to the line input position, the unit should be wired, turned on, and listened to, before any field adjustments are made.

Mute Functions -
The mute function on each input card is factory set to post-vca. This means that when the mute function is activated, the input signal will not appear on any output. In some courtroom applications, the judge may want the sidebar microphone input signal to continue to be sent to the logging recorder. A push-on jumper on each input card allows this to be field set. See input card section for further details.

Special Features -
The Model 2000-C Automatic Mixing system contains many special features, which allow the unit to perform many special tasks, without the need for additional equipment.
Each special feature and how to use it, is described in detail, on the following pages. Please see page 2, for a page index of special features.

QUICK START SET-UP, BLOCK DIAGRAM & CONNECTIONS



Input Connections

Logging Outputs = Slots 2,4,6,8
Mix-Minus Outputs = Slots 1,3,5,7

1	Remote Control Voltage for Remote Gain Control.
2	Input Mute, Grounding Pin Mutes Channel Input.
3	Ground.
4	Input Hi.
5	Input Lo.
6	48V Phantom From External Source.
7	Pre Mix Out, after Remote Volume, Mute, & Tone Controls.
8	Ground
9	Direct MIx Minus Input (Resistor Isolate)
10	Gain Ind. Out
11	Logic Out, Open collector grounded when active.
12	Post Mix Out, Used for Mix-Minus or Console Insert.
13	Ground
14	Mix-Minus Out Hi/Logging Out Hi
15	Mix-Minus Out Lo/Logging Out Lo

Output Connections

1	Remote Master In.
2	All Mute
3	Ground.
4	Group Mute.
5	Pink Noise Option Activation
6	Do Not Use!
7	Aux Input Hi
8	Aux Input Lo (Ground)
9	Do Not Use!
10	Do Not Use!
11	Mix 1 Out Hi.
12	Mix 1 Out Lo.
13	Ground.
14	Mix 2 Out Hi.
15	Mix 2 Out Lo.

AUDIO INPUTS

GAIN -
Each input card has individually adjustable gain, and a MIC/LINE switch. The MIC/LINE switch is factory set for microphone inputs, and the gain is preset at 50dB. With the exception of line level inputs, it is strongly recommended that the unit be installed, wired, turned on, and listened to, before any additional adjustments are made. If additional gain adjustments are necessary, they may be made in one of two ways. (NOTE: If ALC option is used, switch ALC to "OFF" position, before adjusting gain trimpots.)
First, if any line level signals are to be used, unplug the corresponding card, and set the MIC/LINE switch to the line position.
Second, there is a gain setting slide switch on the input card assembly. This switch allows the preamplifier gain to be set to either 30dB or 50dB in MIC position, and 0dB or 20dB in LINE position. This switch is set to 50dB at the factory. Many microphone applications will require the 50dB setting. The 30dB setting is recommended for condenser type microphones.
Third, each input card slot has a VCA 1 gain adjustment trimpot mounted on the backplane assembly. The trimpot is set at the factory for 0dB (unity gain after the preamplifier). The gain settings correspond to "clock" positions with 12:00 being straight up. Additional settings are as follows:

7:00 = -35dB
8:00 = -33dB
9:00 = -27dB
10:00 = -20dB
11:00 = -15dB
12:00 = -6dB
1:00 = 0dB - Recommended
2:00 = +6dB
3:00 = +11dB
4:00 = +17dB
5:00 = +18dB

HIGH PASS FILTER & TONE CONTROLS -
Each input card has a slide switch selectable high-pass filter. Each input card slot has individual Treble and Bass controls. The Model 2000-C is shipped from the factory with the high-pass filter in the "OUT" position. The BASS and TREBLE tone controls are set to the "FLAT" position. Counter-clockwise rotation "CUTS" frequencies, while clockwise rotation "BOOSTS" frequencies.
The corner frequency of the BASS control is 315Hz, with a peak at 50Hz. The corner frequency of the TREBLE control is 1150Hz, with a peak at 10KHz.

PHANTOM POWER -
Each input card has a 3 pin terminal strip to allow jumpering for phantom power. A red push-on jumper is supplied for each input card. By placing the jumper on the #2 and #3 terminals, the card will supply 15VDC phantom power to the microphone. By placing the jumper on the #1 and #2 terminals, the card will allow 48 volt phantom power to be supplied from an external source. Each input card is individually configured. The unit is shipped with the jumper in the external 15 volt position.

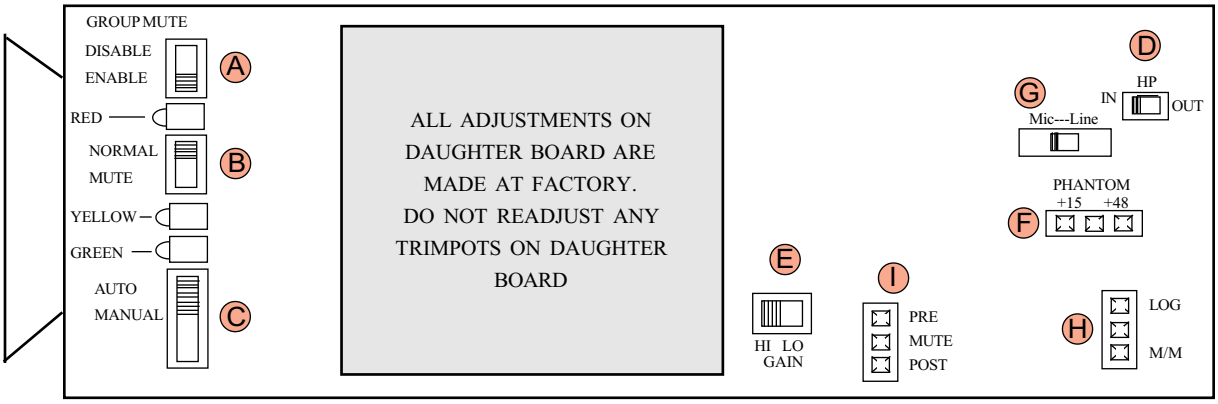
MUTE, INPUT MUTE & GROUP MUTE -
Each input card has a 3 pin terminal strip that is used to program the PRE-MIX and LOGGING recorder outputs, for PRE or POST Mute operation. Placing the Red push-on jumper in the PRE position, will allow the PRE-MIX and LOGGING recorder outputs to remain active, while the main mix and mix-minus outputs are muted. This feature is useful in sidebar applications.
Each input card also has a MUTE slide switch, used for troubleshooting. Sliding this switch to the "MUTE" position mute the input signal to the various outputs, as described above.
Each input card has a separate mute control pin connection on the rear 15 pin connector. Grounding this pin will mute the input. Grounds are on pins 3, 8, and 15, of all card slots.
Each input card has a slide switch that enables the card to be attached to a group mute function. Grounding the Group Mute pin on the Master card slot will mute all inputs attached to the Group Mute function. The input cards are shipped with the GROUP MUTE enabled.

LOGGING RECORDER OUTPUTS
Slots 2, 4, 6, and 8, are designed for logging recorder outputs. These outputs have a slide switch that programs the output for either mic or line level output. The logging recorder output on slot #2 contains the input signals from inputs 1 & 2. The logging recorder output on slot #4 contains the input signals from inputs 3 & 4. The logging recorder output on slot #6 contains the input signals from inputs 5 & 6. The logging recorder output on slot #8 contains the input signals from inputs 7 & 8.
Additional input signals may be introduced to each logging recorder output, by wiring pin #12 from the desired channel to the 2 pin barrier on the logging channel. A rear panel slide switch sets the logging output to mic or line level.

AUTOMATIC/MANUAL OPERATION
Each input card has a slide switch that allows the individual card to operate automatic or manual.

MIX-MINUS - see page 12 mix-minus section.

INPUT CARD ASSEMBLY



Ⓐ= Switch allows individual channels to be connected to Group Mute. (Shipped "Enabled")

Ⓑ= Switch allows individual channels to be muted for troubleshooting. (Shipped "Normal")

Ⓒ= Switch allows either automatic or manual operation of individual input channels.(Shipped "Auto")

Ⓓ= High-Pass filter (Rumble). (Shipped "Out")

Ⓔ= HI-LO gain switch, 50 or 30 dB, for use with different microphone types. (Shipped "HI")

Ⓕ= Placing RED push-on shunt on pins +48 and middle, allows external 48 volt phantom to be used. (Shipped "15V")

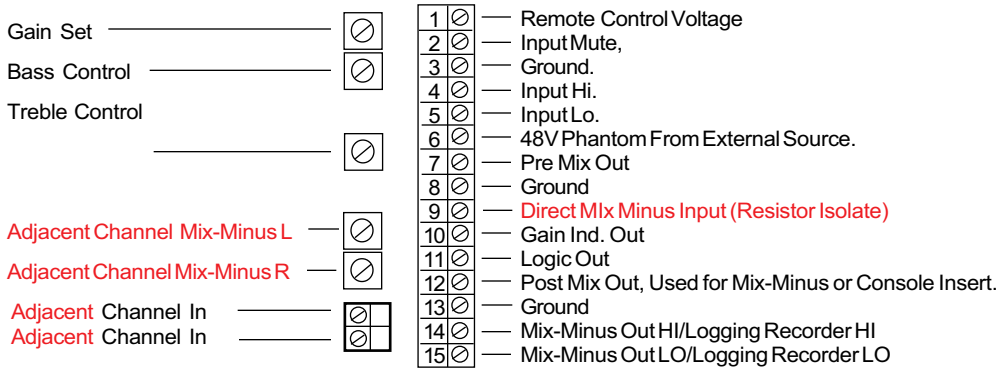
Ⓖ= Mic/Line switch, for determining input impedance and gain structure. (Shipped as MIC input)

Ⓗ= Factory set, to allow pins 14 & 15 to be either mix-minus output or logging recorder output. (Shipped with slots 1, 3, 5, 7 set as mix-minus, slots 2, 4, 6, 8 set as logging recorder outputs. Not user definable.)

Ⓘ= Placing RED push-on jumper determines whether logging recorder and pre-mix outputs are pre or post mute. Used for sidebar microphones. (Shipped "Post" mute.)

LED's = Red indicates Mute Function.
Yellow indicates Logic function.
Green indicates gain function.

TYPICAL INPUT CONNECTION, 1 OF 8



RED = Not ON Logging Recorder Channels

OUTPUT SET-UP

GAIN -

Each output card slot has a Master VCA 2 gain adjustment trimpot mounted on the backplane assembly. The master gain trimpot adjusts all VCA 2's together. The trimpot is set at the factory for -5dB. The gain settings correspond to "clock" positions with 12:00 being straight up. Additional settings are as follows:

7:00 = -33dB
8:00 = -33dB
9:00 = -27dB
10:00 = -23dB
11:00 = -18dB
12:00 = -13dB Recommended
1:00 = -10dB
2:00 = -5dB Recommended
3:00 = 0dB
4:00 = +4.5dB
5:00 = +5dB

AUXILLARY INPUT -

The Auxillary Input is an unbalanced input, designed to allow insertion of audio signals from devices such as cassette players, computers, tape machines, and CD players.

MASTER/SLAVE OPERATION-

Each output card has a slide switch, which determines whether the frame assembly is used as a master or slave. The slave position is used only when two or more frames are linked together.

In the "MASTER" position, the frame controls the auto-mixing function for the cards within the frame, and any frames, to which it may be linked.

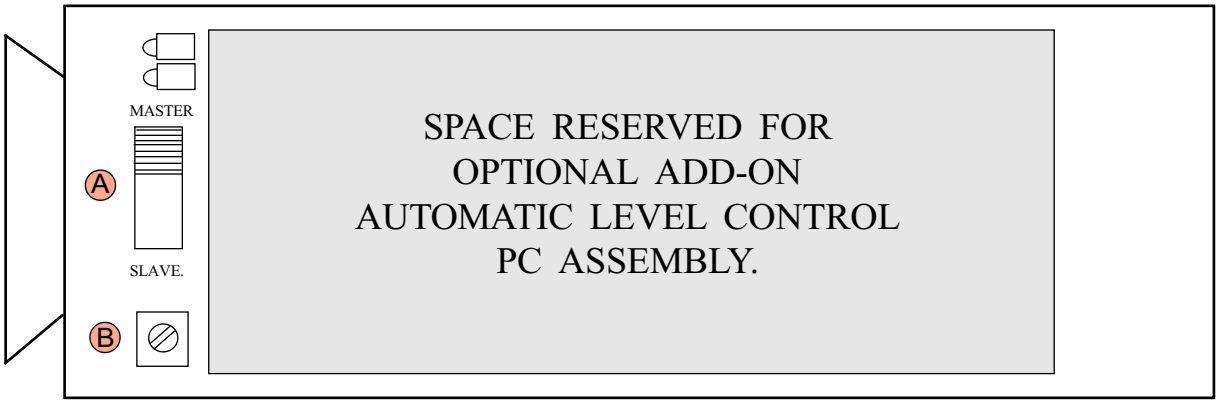
In the "SLAVE" position the frame allows control of the auto-mixing function from an external "MASTER" frame. All of the input card signals in the "SLAVE" frame will appear on the outputs of the "MASTER" frame.

The "SLAVE" frame main outputs will contain only the input signals originating within the frame.

PINK NOISE GENERATOR -

The pink noise generator provides a pink noise signal, that is activated by a ground closure, that appears on the main output, and all mix-minus outputs. It does not appear on the logging recorder outputs. This feature is designed to provide privacy, in courtroom sidebar applications.

OUTPUT CARD ASSEMBLY

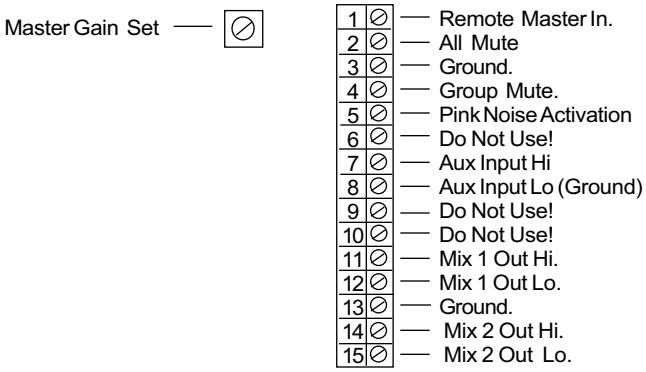


(A) Switch allows chassis to be linked, as master or slave unit.

(B) Trimpot Adjusts Pink Noise Level (Factory Set At 0dB Out)

LED's = Green indicates ±DC power.

TYPICAL OUTPUT CONNECTOR



OUTPUT CONNECTOR FUNCTIONS

1 - Remote Master In..... External DC voltage to control master output level.
2 - All Mute..... Grounding pin mutes all inputs.
3 - Ground..... Ground.
4 - Group Mute..... Grounding pin mutes all inputs with group mute switch in "ENABLE" position.
5 - PNG..... Pink Noise Activation
6 - N/A..... Do Not Use!
7 - AUX In HI..... Auxillary Input High
8 - Ground..... Auxillary Input Low
9 - N/A..... Ground
10 -N/A..... Do Not Use!
11 -Mix Out Hi..... Main Mix #1 Output High.
12 -Mix Out Lo..... Main Mix #1 Output Low.
13 -Ground..... Ground.
14 -Mix Out Hi..... Main Mix #2 Output High.
15 -Mix Out Lo..... Main Mix #2 Output Low.

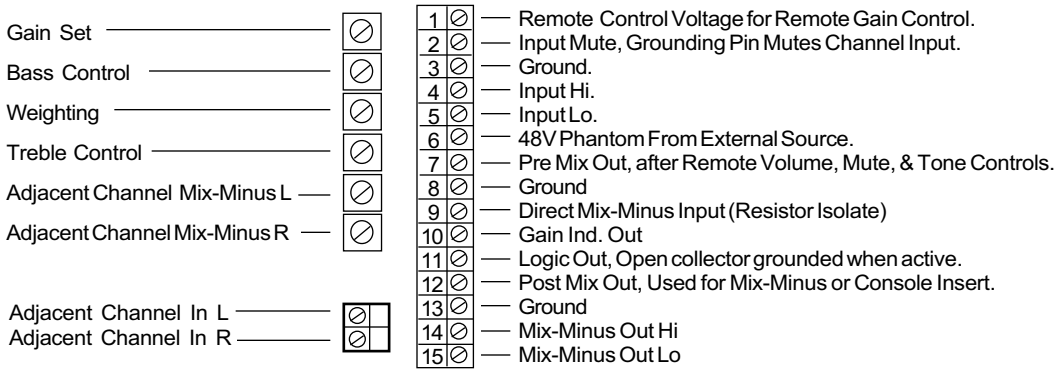
USING MIX-MINUS OUTPUTS

Inputs 1, 3, 5, and 7 have a discrete mix-minus output. The mix-minus output on these input cards, has all input signals received on the mixing buss except the signal received on that input (primary signal).

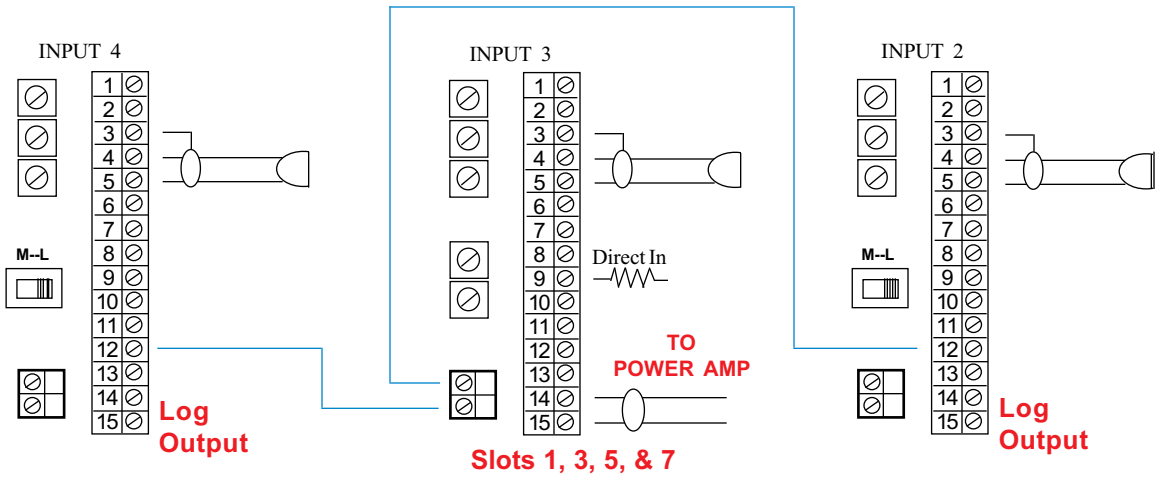
In addition to the primary signal being removed on the mix-minus output, each input card has several provisions for additional signals to be removed or attenuated on the mix-minus output. Two signals are referred to as adjacent channel left, and adjacent channel right. This description is intended to describe microphones located next to each other in a room, not card slot locations in the card frame. Additional signals may be removed using the direct input, or the Model 704 Modular Matrix Mixer cards.

The drawing at the bottom of this page shows the wiring connections needed to use the mix-minus output, with adjacent channels left and right. (Note: Depending on microphone to speaker spacing, it is not always necessary to attenuate adjacent channels.) The adjacent channels have trimpot controls that allow the amount of signal attenuation to be adjusted. As shown below, the channel two mix-minus output would have input two removed, and inputs 1 and 3 attenuated to whatever level the adjacent channel trimpots are set. The direct input allows other signals to be removed, should that become necessary. This wiring scheme would be duplicated wherever adjacent channels need attenuation.

CONNECTION AND CONTROL DRAWING



TYPICAL MIX-MINUS INPUT CONNECTION



MULTI-CHASSIS LINKING CONNECTIONS

1- On master chassis, set master/slave switch (see output section for location) to master.

On slave chassis(s), set master/slave switch to slave.

2-

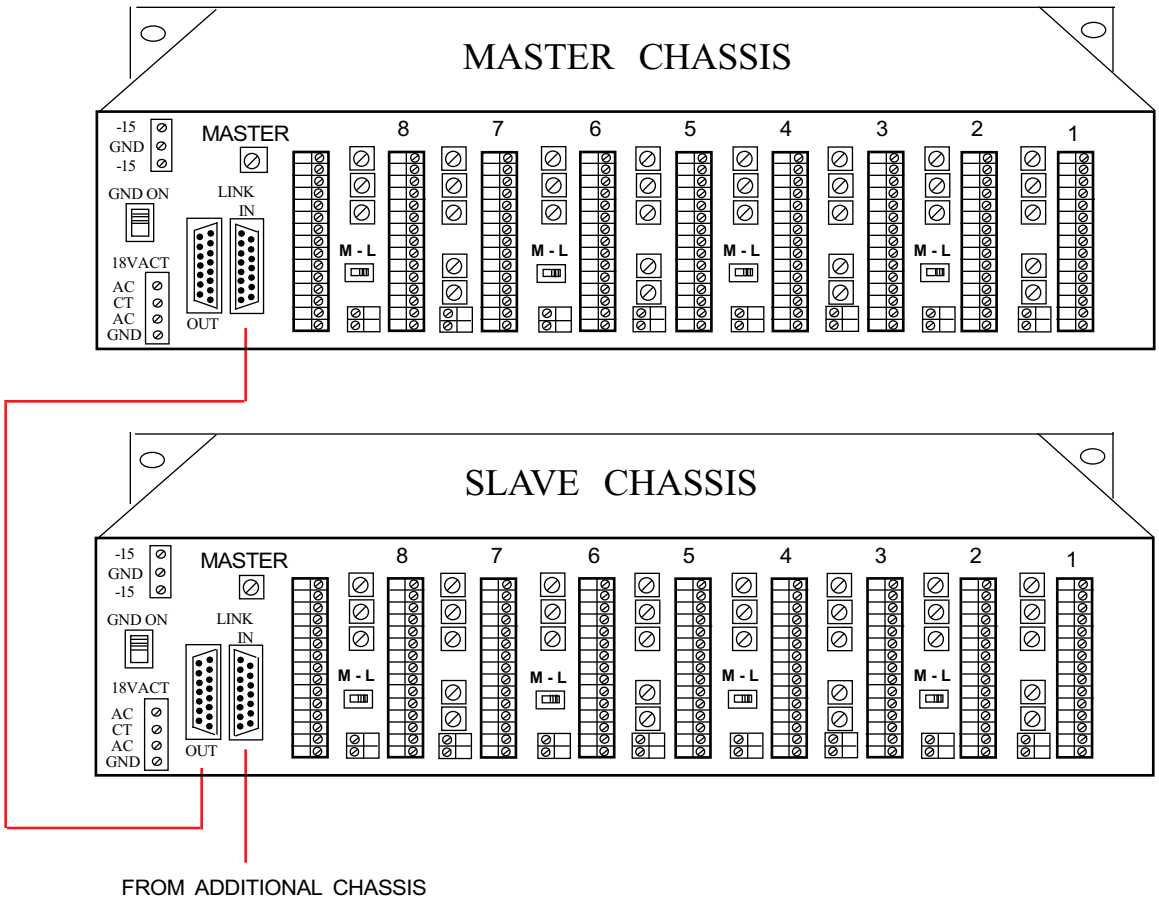
Use 2000-CA link cable to connect chassis(s).

3-

Use Master trimpot on master chassis to adjust all input levels simultaneously.

4-

Note: If ALC option is used, the ALC is placed on the output board of the master chassis.



REMOTE VOLUME CONTROL CONNECTIONS

Note: Models 2000-RVC-IN (Input Remote Control) & 2000-RVC-OP (Output Remote Control) are available to provide the remote control circuits described below. See next page.

1- Wire one resistor-potentiometer circuit for each output circuit requiring remote level control.

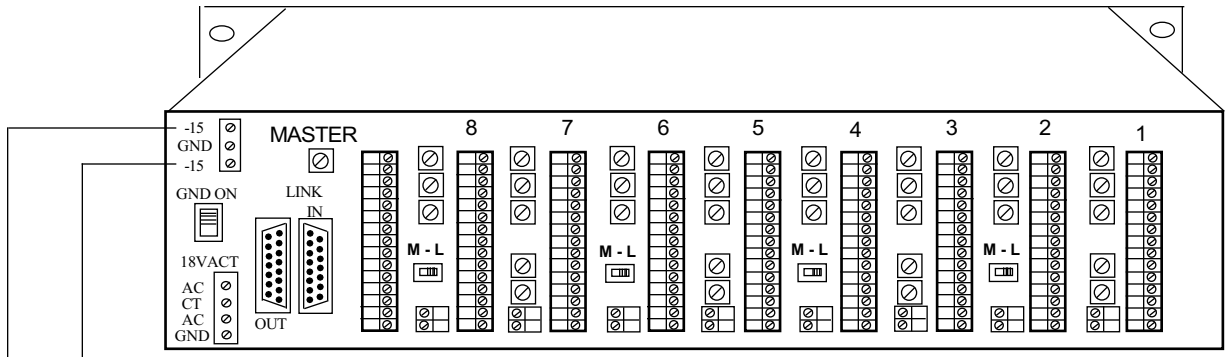
2- Turn gain trimpots on chassis full counterclockwise, on all channels having remote level.control circuits

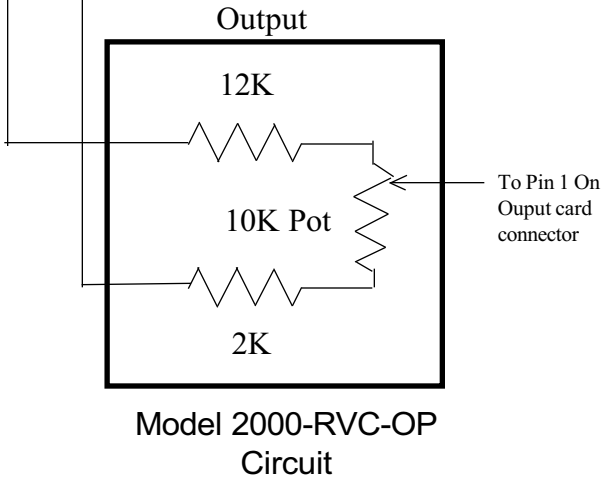
3- Set all remote potentiometers to full clockwise position.

4- Apply AC power to external power transformer.

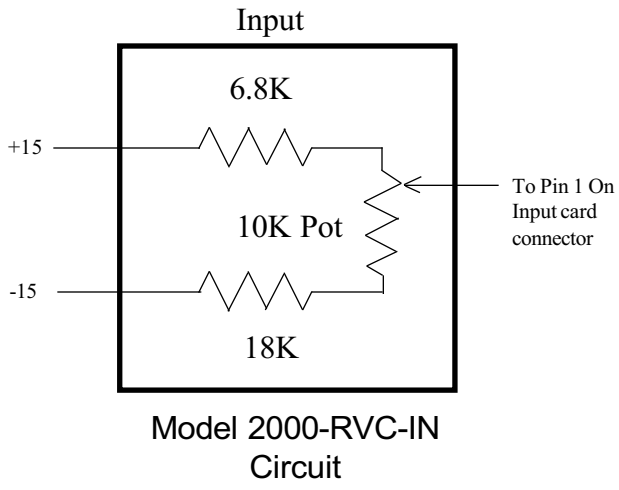
5- Adjust each input and output trimpot to required level by rotating trimpots clockwise. Suggested settings are 1:00 for input gain trimpots, and 12:00 for the master output trimpot.

This alignment procedure will allow the installer to limit the maximum gain available to the end user.





Model 2000-RVC-OP Circuit

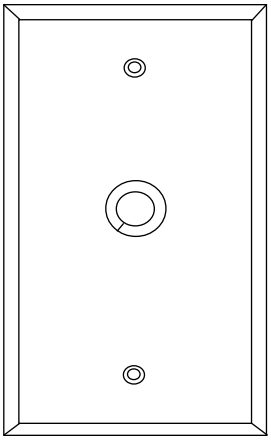


Model 2000-RVC-IN Circuit

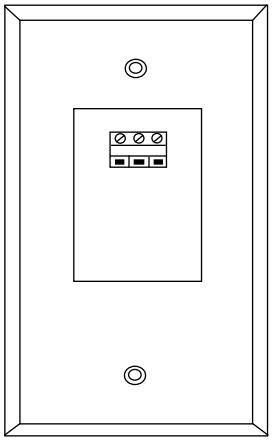
REMOTE VOLUME CONTROL OPTIONS

MODELS 2000-RVC-IN & 2000-RVC-OP
REMOTE VOLUME CONTROLS

FRONT VIEW



REAR VIEW



Single-Gang Wall Plate

MODEL 2000-CON REMOTE CONSOLETTE

Custom Labeling Available

AUTOMATIC LEVEL CONTROL OPTION

NOTE 1:
Always turn the ALC assembly off (switch down) when adjusting any system gain controls, including mixer inputs, master gain control, tone controls, system equalizers, and amplifiers.
If this procedure is not followed, the ALC may fade the gain back up when someone speaks softly, and the system may go into feedback.

NOTE :
The automatic level control card assembly has been aligned at the factory. Normally, no further adjustments are necessary.

How It Works -
The ALC's function is to fade the master gain down when the speaker is too loud, and hold it there during pauses. When a quieter speaker talks, the gain will be raised again. The ALC compares the level of the mixer's output, measured with a VU meter characteristic, with a threshold set by the TARGET trimpot control. When the output level is lower than the threshold, the ALC will fade up the master gain. When the output level is higher than the threshold, the ALC will fade the master gain down. The speed of the fade is set with the RATE trimpot control.
The gating action of the ALC freezes the master gain when no one is talking. Normally it is controlled by the logic outputs of the automatic mixing input channels. Whenever a yellow logic LED on any channel is on, the ALC action is allowed to adjust the output level. The yellow ALC ENABLE LED will come on when any input's logic LED is on, and indicates when the ALC is active.

Factory Settings- Recommended positions.

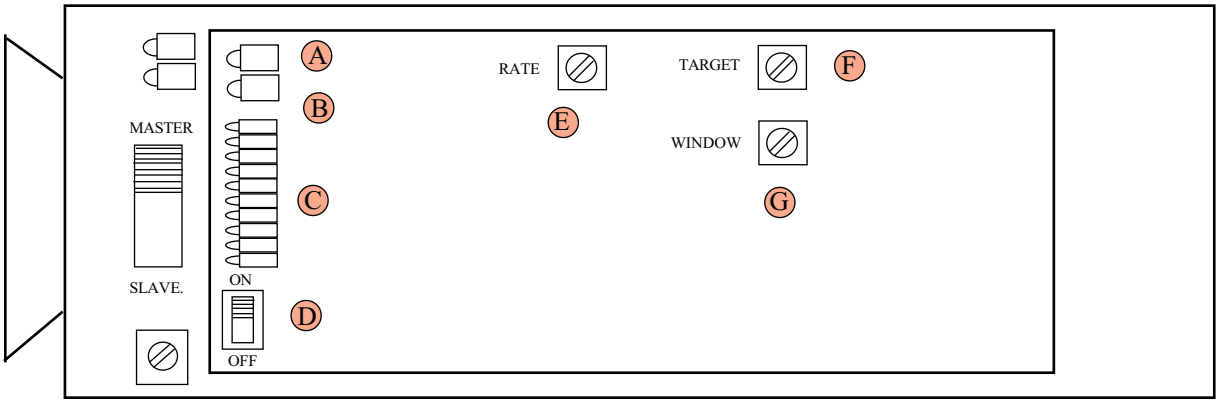
RATE Trimpot = 12:00, Counterclockwise = Slower
TARGET Trimpot = 9:00, Counterclockwise = Downward
WINDOW Trimpot = 12:00, Counterclockwise = More Dynamic range

Alignment Procedure -
Unplug the power supply card. Unplug and remove the master output card assembly (with ALC card assembly). Plug the extender card into the master output card slot. Plug the master output card assembly into the extender card. Plug in the power supply card
With the ALC switched to "OFF", adjust all input gains, master output gains, tone controls, and adjacent channel input controls, as well as any other equipment in the signal chain (equalizers, power amps, etc.). Be sure to test with speech at all microphones after any gain adjustment. Because of the automatic mixing action, a microphone that may be ready to feed back, will not have it's gain turned up until someone speaks into it.
Turn the ALC "ON". Have someone speak loudly at a microphone. Adjust the TARGET trimpot downward (counterclockwise) until the volume is reduced to a comfortable level. The middle green LED is illuminated to indicate where the target level should be. Now the ALC will fade the master gain down whenever the output level is higher than the TARGET level. When a quieter speaker talks, the gain will fade up again.
Next adjust the RATE trimpot to 12:00 or lower. This will increase the ALC fade time so that it doesn't "pump". 100% counterclockwise is the slowest setting.
If more dynamic range is desired, more difference between loud and soft speakers, turn the window control counterclockwise. This will create a "dead zone" below the threshold level, where the volume can vary naturally without ALC action. A WINDOW setting of 50% gives a dead zone of 5dB, and 0% (full counterclockwise), about 8dB.

Exempting Line Level Inputs From ALC -
Since the ALC works by varying the master gain when a logic indicator is active, removing R23 prevents the ALC from changing the gain on the line input, whenever any input becomes active. Setting the MODE switch to manual, also disables the ALC from changing the gain on a channel.

AUTOMATIC LEVEL CONTROL (ALC) CARD ASSEMBLY

(Mounted on Master Output Card Assembly)



Ⓐ -ALC Active.....Indicates active ALC function
Ⓑ -(Level Gate).....N/A
Ⓒ -ALC Gain Indicator.....Displays gain reduction.
Ⓓ -ALC ON-OFF Switch.....Used for set-up
Ⓔ -RATE Trimpot.....Controls speed of ALC action.
Ⓕ -TARGET Trimpot.....Controls desired output level.
Ⓖ -WINDOW Trimpot.....Controls "dead zone" for dynamic range function.

NOTES:

USING INTEGRA III CARDS WITH MODEL 2000-C

The Model 2000-C chassis will accomodate a number of different INTEGRA III cards. Each card has a part number that starts with"2K-", to denote that it was modified at the factory, to allow operation in the Model 2000-C chassis. All other features are identical. For instance, the Model 665 is a 1 input, 5 output audio distribution amplifier card. The Model 2K-665 is the same card, with a trace modification.

The INTEGRA III cards that are available for use with the Model 2000-C chassis are;

2K-662 Audio Distribution Amp, 1 x 2
2K-663 Audio Distribution Amp, 1 x 3
2K-664 Audio Distribution Amp, 1 x 4
2K-665 Audio Distribution Amp, 1 x 5

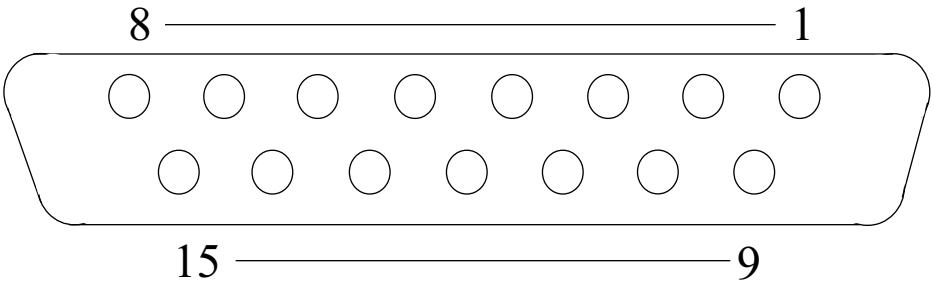
2K-674 Audio Line Mixer, 2 x 1
2K-675 Audio Line Mixer, 3 x 1
2K-676 Audio Line Mixer, 4 x 1
2K-677 Audio Line Mixer, 5 x 1

2K-588 Noise Gate Ducker, 2 x 1
2K-639 Line Amp/Compressor

Other modified INTEGRA III cards are available upon request.
The trimpot controls, and the 2 pin connector, on the rear of the Model 2000-C chassis, will not be functional when modified INTEGRA III cards are placed into that card slot. Only the 15 pin connector will remain functional, to allow termination of the inputs and outputs.
An extender card, Model 516, may be required, to allow adjustment of the gain on modified INTEGRA III cards.

NOTES:

Rear View Of Chassis



Pin 1 = Mic 1 Gain
Pin 2 = Mic 2 Gain
Pin 3 = Mic 3 Gain
Pin 4 = Mic 4 Gain
Pin 5 = Mic 5 Gain
Pin 6 = Mic 6 Gain
Pin 7 = Mic 7 Gain
Pin 8 = Mic 8 Gain

Pin 9 = +15VDC
Pin 10 = -15VDC
Pin 11 = System Mute
Pin 12 = Table Mute
Pin 13 = GND
Pin 14 = Master Gain