Film-Tech

The information contained in this Adobe Acrobat pdf file is provided at your own risk and good judgment.

These manuals are designed to facilitate the exchange of information related to cinema projection and film handling, with no warranties nor obligations from the authors, for qualified field service engineers.

If you are not a qualified technician, please make no adjustments to anything you may read about in these Adobe manual downloads.

www.film-tech.com

TECHNICAL MANUAL

INSTALLATION, OPERATION, MAINTENANCE AND REPAIR INSTRUCTIONS WITH PARTS LIST

FOR

CHRISTIE SOUND-A-ROUND SOUND SYSTEM

CHRISTIE ELECTRIC CORPORATION
20665 Manhattan Place
Torrance, CA 90501
(213) 320-0808 : TWX 910-349-6260

TD-423
05-20-83

CHAPTER 1

GENERAL INFORMATION

1.1 INTRODUCTION

This Technical Manual presents technical specifications, installation, operating and maintenance procedures, plus parts lists, for the CHRISTIE Sound-A-Round Sound System, manufactured by CHRISTIE Electric Corporation, 20665 Manhattan Place, Torrance CA 90501, Telephone (213) 320-0808: TWX 910-349-6260.

NOTE
BEFORE INSTALLATION, CAREFULLY REVIEW THE INSTALLATION INSTRUCTIONS IN CHAPTER 8 OF THIS MANUAL.

Chapter 1 contains general specifications of the CHRISTIE Sound-A-Round Sound System. Normal and Emergency operating procedures are described in Chapter 2. Theory of Operation is discussed in Chapter 3 and preventive maintenance required to keep the system functioning in an optimum manner is covered in Chapter 4. Procedures for quickly isolating a fault are described in Chapter 5, while Disassembly/Assembly procedures are covered in Chapter 6. Complete parts lists are in Chapter 7. Chapter 8 contains information for the initial installation and setup of the CHRISTIE Sound-A-Round Sound System.

1.2 STANDARD FEATURES

The CHRISTIE Sound-A-Round stereo system, depicted in Figure 1-1, processes both *Dolby® Optical Prints as well as standard, monaural prints and 4-track magnetic prints. Features provided when using Dolby Optical Prints are:

- Use of Dolby Noise Reduction circuitry.
- 4 Amplifiers for the four sound channels.
- 4 Channel equalization.
- Automatic switching from mono to stereo.
- Backup circuitry is automatically switched in the unlikely event of a malfunction.

When using monaural prints, Christie's Panorama Sound enhances monaural sound so that it sounds like stereo. This unique feature is provided under exclusive licensing utilizing the patented process which has been used for many years by broadcasters and record companies to reprocess monaural records for stereo. With a push of the switch, Panorama Sound provides the output signals to drive the Left, Center, and Right speakers with audio which sounds like true stereo.

The Christie proprietary Integrated Circuit Decoder, the heart of the Christie Stereo System, provides enhanced Center and Surround decoding. The Surround Channel also uses a digital time delay to provide corrected arrival time in theaters varying from 30 to 160 feet in depth.

*Dolby is a registered trademark of Dolby Laboratories.

All four channels (Right, Left, Center, Surround) use a nine-band, 0 to 16 db cut equalizer for total compensation of the theater auditorium.

The Mono and Stereo Preamps are on separate, isolated printed circuit cards. Both the stereo Preamps, with Slit-Loss Equalization and the Mono Preamps have Dual Projector electronic switching for changeover.

An internal, high quality Monitor, permits monitoring of both the input and output of all audio channels of the System.

Solid state, 10 segment Bar Graph Meters provide a quick system check as well as Dolby level calibration.

Dual, redundant Power Supplies for the Decoder incorporate automatic switchover in the unlikely event of a malfunction. An LED fault indicator indicates this condition. The Emergency Preamp bypasses the entire Processor in the BYPASS position and drives the Center channel amplifier and speaker.

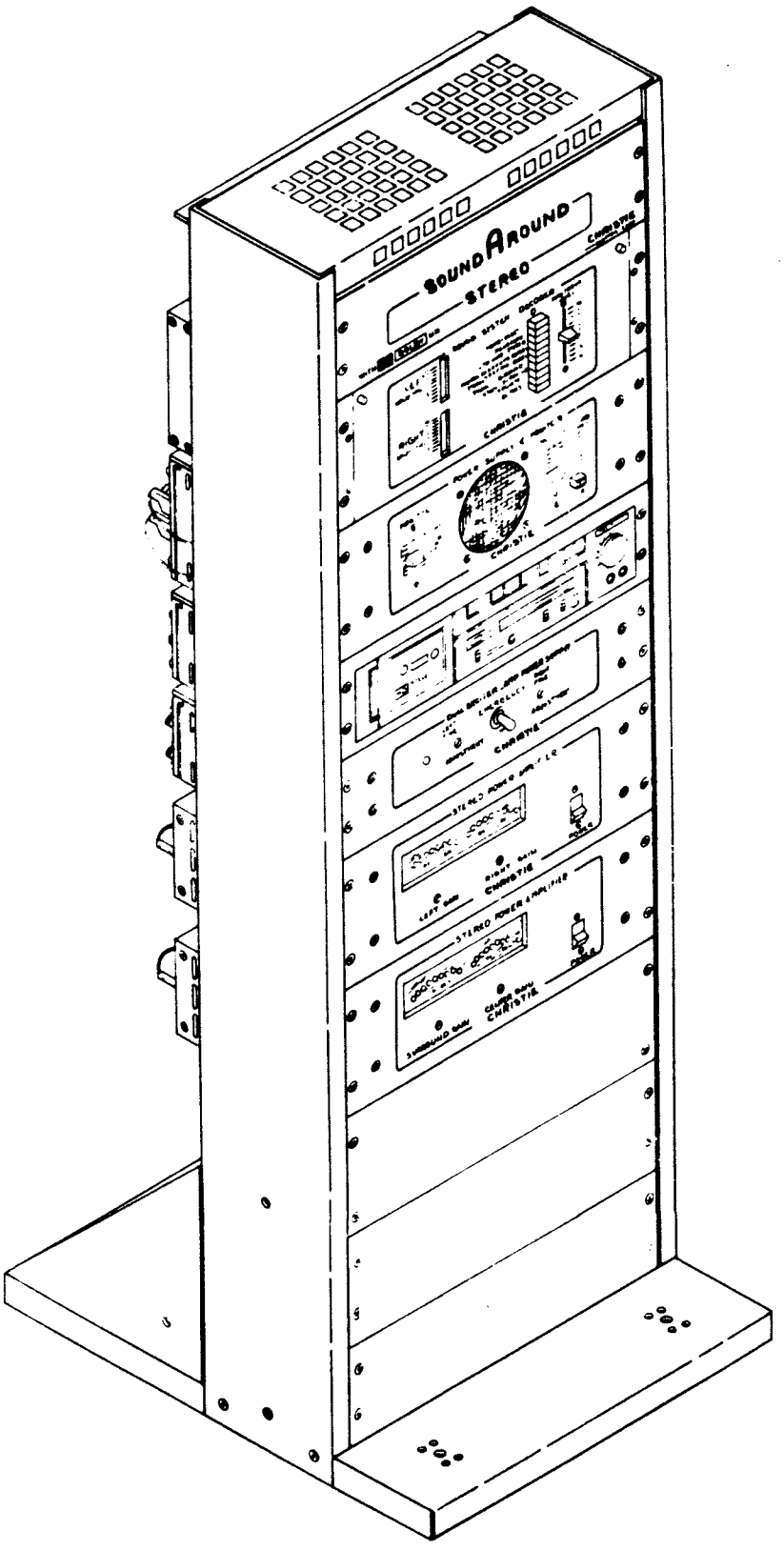


Figure 1-1 CHRISTIE Sound-A-Round Sound System

The Dual Exciter Lamp Supply provides to play intermission music.
Thus, the Christie Sound-A-Round is a complete system.
Other standard features are:

- Intermission music fade-in and fade-out controls
- Remote volume control
- Electronic control for perfect volume tracking on all four channels
- Extra card space in rack to accomodate future developments in Theater Sound.

1.3 OPTIONS

Options available, simply by plugging boards into the Decoder card rack, are:

- Mini Boom
- Limiter

The Mini Boom option is a bass frequency expender which enhances low frequency output. Mini Room should be used with a separate Sub-Woofer Speaker System and Power Amplifier.

The Limiter option is recommended for small, multi-theater applications to reduce the sound penetrating adjoining walls between theaters. The Limiter reduces the dynamic range of program material and controls "bleed-thru" to an adjacent auditorium of a multiplex installation.

1.4 BASIC SYSTEM COMPONENTS

The basic system subassemblies comprising the CHRISTIE Sound-A-Round Sound System are diagrammed in Figure 1-2.

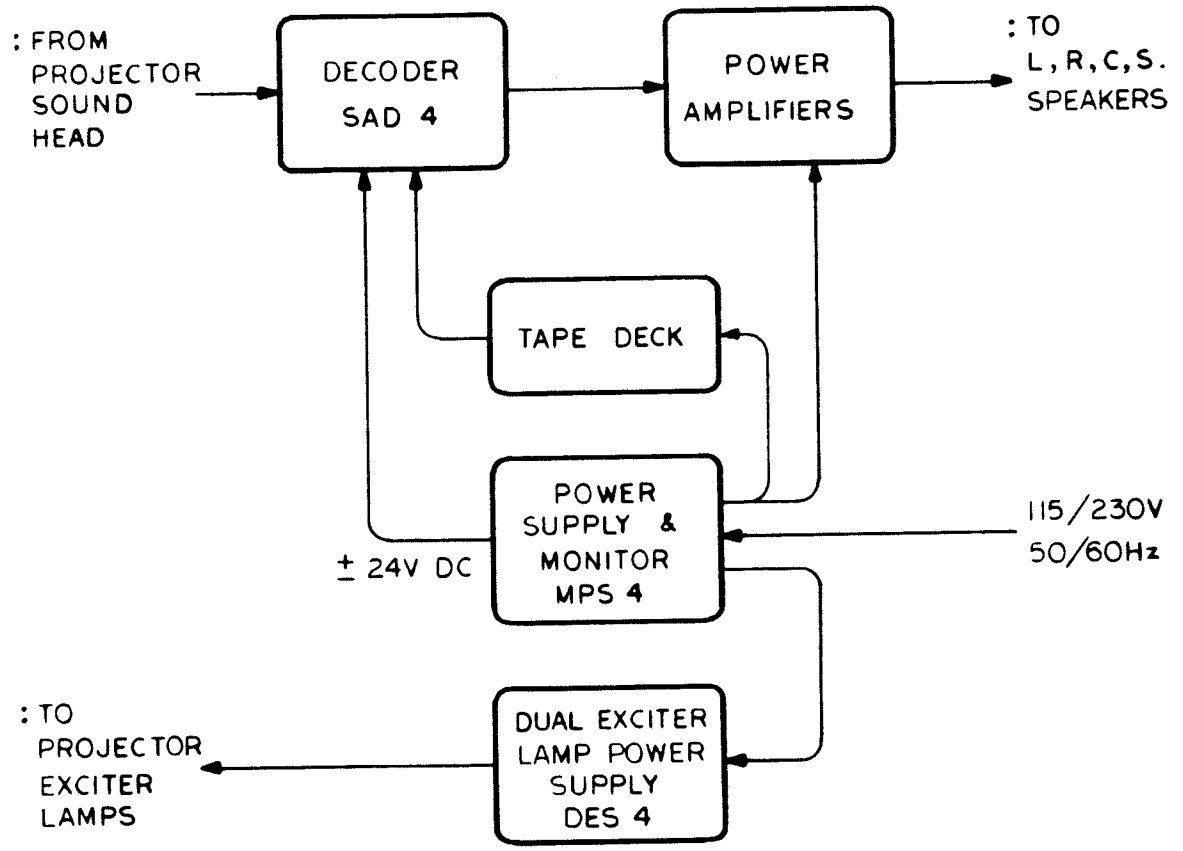


Figure 1-2 Basic System Subassemblies

1.5 System Specifications

System specifications, test and accessory equipment required are listed in Tables 1-1 through 1-4.

Table 1-1 Input/Output Specifications

Signal Inputs
Dual projector with Stereo Solar Cell Unbalanced Line Drive Outputs:

Mono Soundtracks
Dolby Stereo Soundtracks

Intermission Music
External 4-Track Magnetic Preamp

Input Power Requirements
Voltage: 110-130 Volts or 220-260 Volts, Single Phase
Current: 20 Amperes @ 115V., 10 Amperes @ 230V.
Frequency: 50/60 Hertz

POWER AMPLIFIER SPECIFICATIONS
Intermodulation Distortions: Less than 0.03% from 250 milliwatts to rated output (60 Hz and 6 kHz, 4:1)
Small Signal Frequency Response: +0, -3dB, 1Hz to 100 kHz; +0, -0.25dB, 20 Hz to 20 kHz
Hum and Noise Level: Better than 106 dB below rated output into 8-ohms (unweighted, 20 Hz to 20kHz)
Damping Factor: Greater than 230 to 1, referenced to 8-ohms at 1kHz
Output Impedance: Any load impedance equal to or greater than 4 ohms.

Options Connectors
Miniboom bass expander card
Four channel limiter card
Plus future developments

Table 1-2 Environmental Specifications

Ambient Temperature -20 to +50 °C (-5 to +122 °F)
Relative Humidity 0 to 90 percent
Altitude Up to 15,000 feet (to 4,500 Meters)

Table 1-3 Equipment/Accessories Supplied

Item	Part Number	Manufacturer
Extender Card		Christie Electric
Buzz Track Loop	SMPTE Type P35BT/PH22.68	
Left/Right Separation Film Loop	CAT 97	Dolby
Dolby Reference Loop & Pink Noise Loop	CAT 69	Dolby

CHAPTER 2
OPERATION

2.1 INTRODUCTION

This chapter covers the operation of the CHRISTIE Sound-A-Round Sound System after the initial installation and setup have been completed. For the initial installation and setup of the System, see Chapter 8.

Operating procedures are included in this chapter for the following modes:

BEFORE TURN-ON
TURN-ON
NORMAL OPERATION
BYPASS (EMERGENCY) OPERATION
TURN OFF — SECURING THE EQUIPMENT

Operation has been simplified with a minimum number of panel controls. The master fader has a volume range of 30 dB. In the fully lowered position, the sound can never turn fully off. This design allows a volume setting for any size audience and soundtrack recording level, but will not allow the volume to be accidentally turned off.

The Mode Selector switch allows the operator to manually set the mode of operation. This manual control locks the system in the desired mode. Only in the automatic mode does the System have a choice between Mono and Stereo. The Stereo Indicator informs the operator that the System has been manually or automatically triggered into optical Stereo.

The LED Left and Right channel meters inform the operator when there is a signal present on both incoming channels. Optical stereo can be selected without Surround speakers when playing optical stereo recordings that contain no surround information. The Surround speakers are automatically off when "Mono", "Intermission" music or Emergency "Bypass" is selected.

Two controls are provided on the Power Supply & Monitor. The Left control sets the booth Monitor audio level and the Right control selects the channel to be monitored. The Monitor Channel Selector switch should be left in the Center Amplifier out position so that center stage sound will be heard by the operator. Both inputs and outputs of the amplifiers can be monitored to aid in checking the System's performance.

2.2 BEFORE TURNON

The primary power switch for the complete System is located on the rear of the Monitor chassis. In most theatre installations, this switch will be left in the ON position and the power controlled from the Booth Circuit Breaker where the remaining projection equipment is controlled. The remaining power switches on the amplifiers and tape deck should normally stay in the ON position.

The start of the show, the selection of the projector (if it is a dual-projector booth), and the start of the intermission will be controlled by the booth automation or remote switches located for the convenience of the operator.

Before the start of the show, the operator must select the mode that is to be used, depending on the type of film or films to be shown, the type of audio output desired and the sequence in which the films are to be shown (e.g. Panorama to Stereo).

If the type of film to be shown is not known, refer to Section 2.10 of this chapter for assistance in differentiating between a mono print and a Dolby print.

The operating mode is selected by depressing the proper pushbutton on the front of the Decoder Panel. A drawing of the Decoder Panel in included as Figure 2-1. The functions of the ten pushbuttons are included in Table 2-1.

Note that all of the Decoder Automatic functions are unidirectional, that is, automatic switching always occurs in the Left-to-Right sequence indicated (e.g. PANORAMA TO STEREO) and that the automatic switching is always from one of the other modes to a Stereo mode. To function in an Automatic mode, the System must first be reset by depressing the RESET pushbutton, then the desired mode may be re-selected by depressing the appropriate Mode Pushbutton on the Decoder Panel.

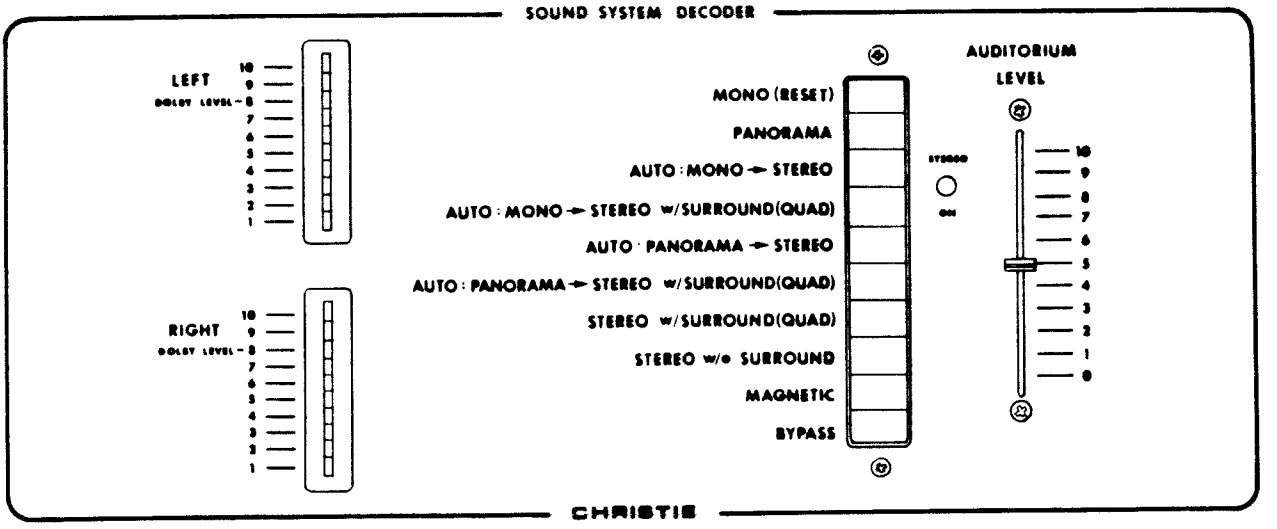


Figure 2-1 Decoder Panel Controls and Indicators

In the above figure, the functions of the Volume Control and the LED Indicator are:

AUDITORIUM LEVEL - Slide volume control adjusts the audio level of all four channels in the auditorium.

STEREO ON Red LED Indicator - Lights whenever the System operates in a Stereo mode.

Table 2-1 Mode Selection on Decoder Panel

Pushbutton Designation	Film Type(s)	Function(s)	Speaker(s) Activated
MONO (RESET)	1	Provides monaural sound. Also resets System so Automatic mode can be activated.	C
PANORAMA	1	Selects Christie's exclusive 3 channels of audio	L, R, C
AUTO:MONO→ STEREO	1 to 2	Automatic switching from monaural to Dolby (no Surround	C to L, R, C
AUTO: MONO→ STEREO W/ SURROUND	1 to 3	Automatic switching from monaural to Dolby w/Surround	C to L, R, C, S
AUTO: PANORAMA→ STEREO	1 to 2	Automatic switching from Christie's Panorama to to Dolby Stereo no Surround	L, R, C to L, R, C
AUTO:PANORAMA→ STEREO W/ SURROUND	1 to 3	Automatic switching from Panorama to Dolby w/Surround	L, R, C to L, R, C, S
STEREO W/ SURROUND	3	Use for Dolby Sound w/Surround	L, R, C, S
STEREO W/O SURROUND	2	Use with Dolby sound without Surround	L, R, C
BYPASS	All	Use in Emergency mode to bypass most of the decoder circuitry and to connect Mono Preamp output audio directly to Center channel and power amplifier.	C

*Types of Film Recordings:
1 - Mono Optic
2 - Dolby Optic - 3 channel (no surround)
3 - Dolby Optic - 4 channel (with surround)
4 - 4 Track Magnetic (with surround) - also has a half track Mono Optic

2.3 NORMAL OPERATION

The System is self-starting and self-adjusting, once it is turned ON, and will normally operate without any adjustments required while the System is functioning properly. The audio output levels should have been preset and should require no further adjustments while a film is being run.

the Monitor and Speaker are provided so that the sound being delivered by the four channels of the Decoder can be monitored as they are fed into the amplifiers to check on the Decoder operation and again as they come out of the amplifiers and are fed to the speakers to check the operation of the amplifiers.

When a System is operating and a film is being shown, a quick check should be made of the quality and presence of the audio in the various channels by selecting each channel in turn with the Monitor switch on the front panel of the Dual Power Supply and Monitor unit, MPS-4 (See Figure 2-2).

2.4 BYPASS OPEATION

In case of a malfunction in the Decoder System, a Bypass mode is provided. Depressing the Bypass button on the front panel of the Decoder reroutes the audio so it bypasses most of the Decoder circuitry and outputs a single audio channel to the Center Power Amplifier and the Center Speaker, providing a monaural output, regardless of the type of film being shown.

2.5 TURN OFF/ SECURING THE SYSTEM

To turn OFF the System, turn OFF either or both the ON/OFF switch on the rear of the Power Supply and Monitor Chassis, or the main Circuit Breaker supplying power to the Christie System. The System will automotically shut down and be ready to be turned ON again whenever necessary.

NOTE
DO NOT TURN OFF ANY OF THE OTHER SWITCHES. THESE SWITCHES MUST BE LEFT ON AT ALL TIMES AND ARE ONLY PROVIDED AS A CONVENIENCE IN TROUBLESHOOTING TO HELP ISOLATE FAULTS

2.6 DUAL POWER SUPPLY AND MONITOR

The front panel controls of the Dual Power Supply and Monitor are shown in Figure 2-2.

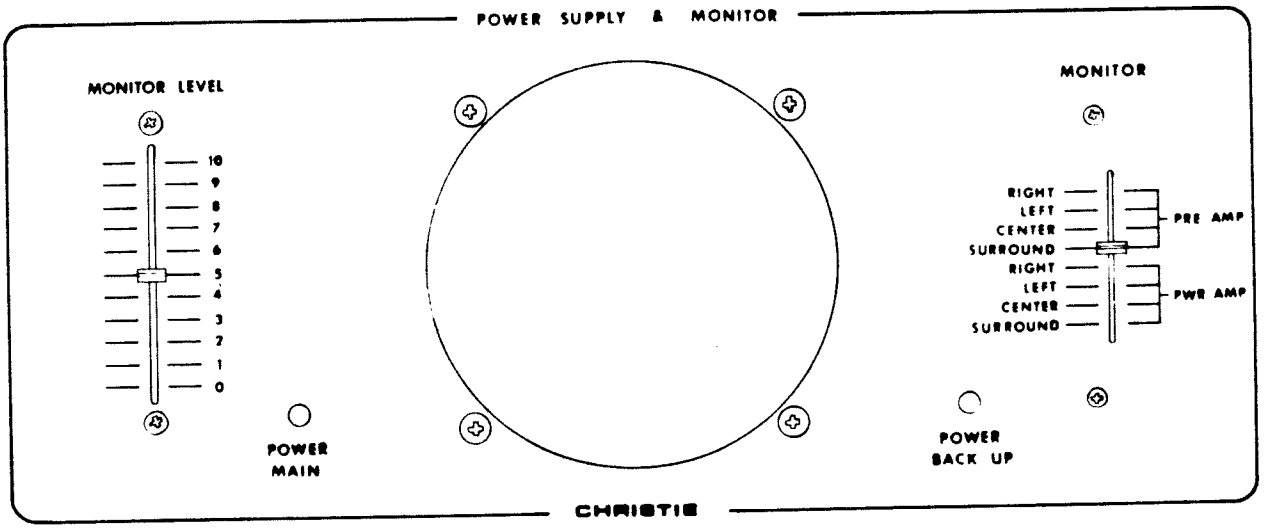


Figure 2-2 Dual Power Supply and Monitor Front Panel

For normal operation, power is applied to the Dual Power Supply and Monitor whenever ac power is supplied to the Christie System.

The Monitor Switch, S1, selects the audio channel to be monitored on the speaker.

The volume of that audio is controlled by the slide potentiometer, R1.

The POWER LEDs light when AC power is supplied to the unit. If these lights are not ON, make sure the ON/OFF switch, S2, on the rear of the unit has not inadvertently been turned OFF and that the fuses, F1 and F2, on the rear of the unit are also good.

The Dual Power Supply and Monitor has dual + 24 volt and – 24 volt DC outputs. Each of the internal DC supplies has adequate power to supply the entire system in an emergency.

When only one of the POWER LEDs lights, this indicates that one of the dual redundant + 24 volt and – 24 volt supplies has malfunctioned. The Christie System will continue to operate after this has happened, however the fault should be located and the Power Supply repaired or replaced as soon as practical to reinstate this important backup capability.

2.7 DUAL EXCITER LAMP POWER SUPPLY

The Dual Exciter Lamp Power Supply, the front panel of which is shown in Figure 2-4, has dual supplies. Each supply is capable of outputting 5-10 volts DC at a load current of up to 5 Amperes. In a single projector booth, only one supply will be in use and the second will be held in stand-by to be selected if needed, using the NORMAL-EMERGENCY switch.

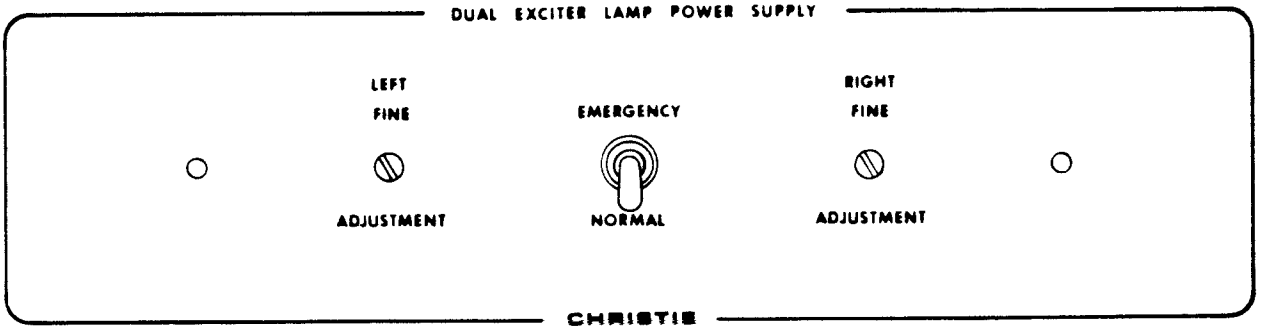


Figure 2-3 Dual Exciter Lamp Power Supply Front Panel

In a dual projector booth, one supply will be used for each projector. In case of a malfunction, normal operation can be maintained by switching the NORMAL-EMERGENCY switch at the end of the reel.

For normal operation, the unit is switched ON and OFF as ac line power is applied. The proper output voltage will be set up during the original installation and the EMERGENCY/NORMAL switch should be kept in the NORMAL position. For normal 9 volt-5amp exciter lamps, the voltage should be adjusted by placing a D.C. voltmeter on the exciter lamp terminals in the projector and adjusting the FINE ADJUSTMENT on the Exciter Power Supply for 8 volts for best operation.

The LEFT FINE ADJUSTMENT and RIGHT FINE ADJUSTMENT should not need to be adjusted while a film in being run. These adjustments should only be made when the periodic checks described in Chapter 4 are conducted and during Installation. Whenever this adjustment is made, both supplies should be adjusted to output the same voltage so that the Exciter Lamp will see the same voltage when switching from one supply to another.

2.8 POWER AMPLIFIERS

The front panel of one of the two indentical Power Amplifiers as shown in Figure 2-5.

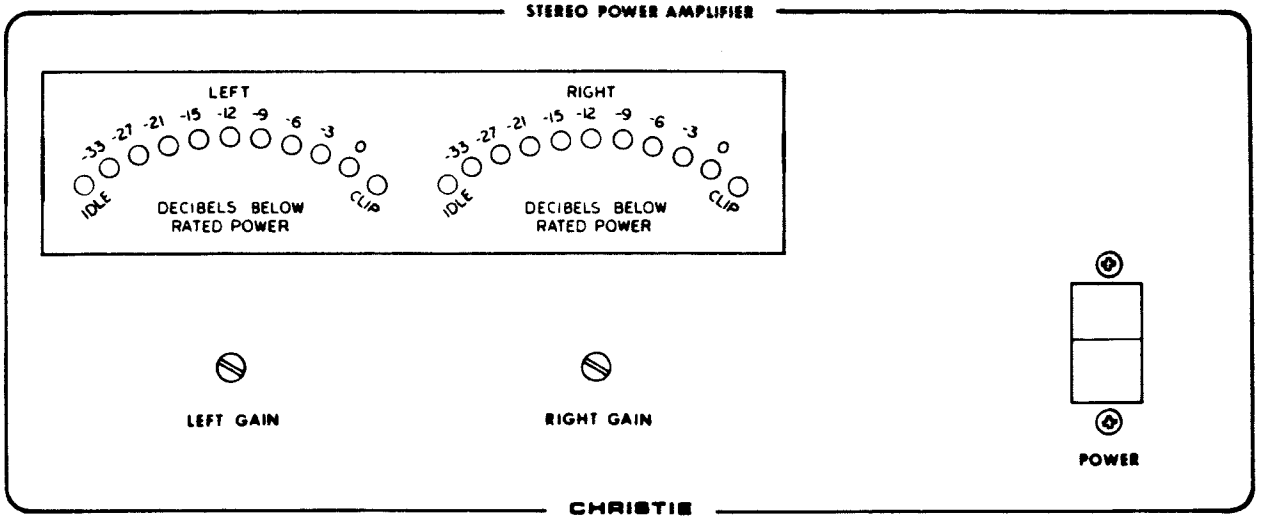


Figure 2-4 Power Amplifier-Front Panel

The POWER switch should be left ON and the far left LED indicator in each arc of LED indicators lights when AC power is supplied and the unit is ON.

The LED display consists of 10 LED's arranged in an arc. These 10 LED's indicate the magnitude of the output power of each amplifier, with the second LED indicating -33dB and the LED on the far right lighting when clipping occurs.

Normally the Power Amplifiers function unattended and require no adjustments. The operator need only observe that the LED indicators are lit, showing that a proper audio output is being supplied by the amplifiers.

Any adjustments (LEFT GAIN, RIGHT GAIN) which are made to compensate for aging of system components, or other changes in the System, should only be made when the periodic maintenance procedures listed in Chapter 4 are performed.

2.10 HOW TO TELL A STEREO PRINT FROM A MONO PRINT

A Dolby print should be identified as such on both the film can and the leader. However, with time the identification may be removed. If you are not sure whether or not you have a stereo print, play a reel and locate a stetch of music without dialogue or narration (on the latter, a stereo print looks much like a mono print). Examine the sound tracks closely, the two tracks on a stereo print will appear different from each other, as illustrated in Figure 2-5 whereas on a mono print they apear identical.

STEREO
On music and effects, the two stereo tracks look different

MONO
Mono tracks are identical on all material

Figure 2-5 Dolby vs. Standard Print

NOTE - It is impossible to tell from examining the film if the stereo tracks have been recorded with Surround information. It is also difficult to tell by listening, because some films which should be played without Surround will have out-of-phase information which will be decoded incorrectly if the Surround channel decoder is left ON. Check with the film exchange, or distributor, or directly with Dolby Laboratories if you are not sure whether a particular film should be played with or without Surround. If in doubt, switch Surround OFF until the correct format can be determined.

A comparison of conventional compandor performance as outlined above with the requirements for studio and broadcast applications shows that the normal compression and expansion approach is inadequate. Prior to the introduction of the Dolby type of compandor in 1966, compandors were generally found to be useable without qualification only in relatively low-grade, narrow-band applications such as telephone circuits.

In normal compression or limiting, a primary object is to modify high-level signal dynamics. It is thus unfortunately necessary to subject the signal as a whole to the hazards of passage through a variable-gain system. In applying compression techniques to the noise reduction problem, in which the objective does not include modification of signal dynamics, it is unnecessary and undesirable to operate upon high-level signal components; noise amplitude in a high-quality channel is only of the order of 0.1% of maximum signal amplitude. It is clearly preferable to generate a small correction or differential component which can be appropriately subtracted from the signal, thereby cancelling or reducing noise, while leaving the larger aspects of the signal untouched.

The differential treatment of the signal in the Dolby noise reduction system is illustrated in Figure 3-2 below. Incoming signals to the unit are split into two paths. The main path treats the

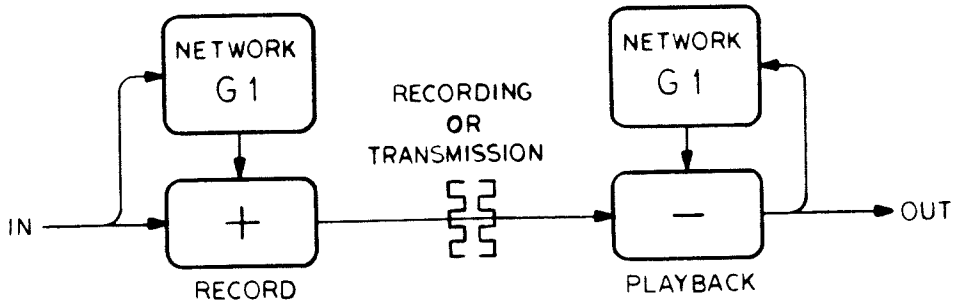


Figure 3-2 Noise Reduction System-Basic Layout

signal linearly. The signal in the secondary path passes through a variable attention network, G1, the output of which is combined additively with the main signal.

The basic input/output characteristic of the attenuators is given in Figure 3-3, which also shows the encoding and decoding characteristics obtained by addition and subtraction. It is

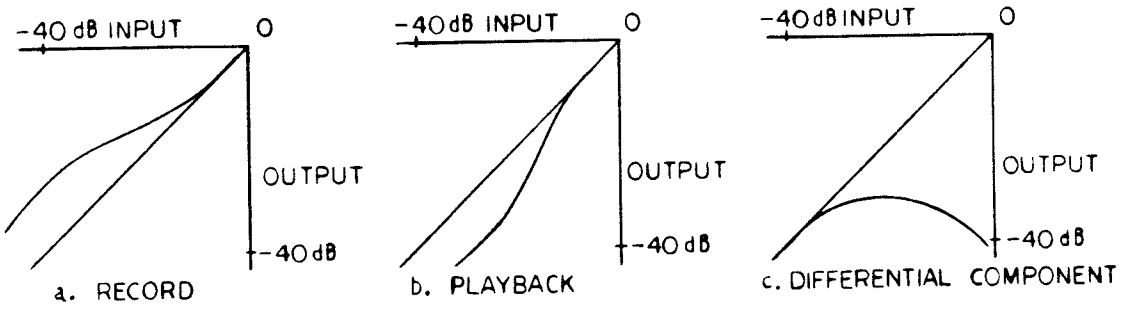


Figure 3-3 Attenuator Input/Output Characteristic

evident that the signal is modified only at low levels; by analogy with calculus, the correction signal is known as the differential component of the signal.

In practical embodiments, the Dolby method satisfies all of the requirements for high-quality transmission. Overshoots are minimal (less than 1½ dB), since the contribution of the

CHAPTER 3

THEORY OF OPERATION

3.1 INTRODUCTION

This chapter covers the theory of operation of the CHRISTIE Sound-A-Round Sound Sytems, starting with a discussion of the basic priciples of Dolby Sound. Next an overall block diagram of the entire system is provided, along with a brief description of the functions of the major components and subassemblies. The functioning of the individual circuit boards and subassemblies follows. Schematics of the various circuit boards and subassemblies are also included in this chapter, along with the corresponding block diagrams.

GENERAL PRINCIPLES OF DOLBY SOUND

In sound recording or transmission systems, the high and low audio frequencies are often pre-emphasized during recording and de-emphasized during reproduction to improve the signal-to-noise ratio. However, the equalization characteristic must be chosen such that even in the worst cases there are no detrimental effects; organ pedal notes or cymbal crashes must not cause distortion. Therefore, the allowable boost with fixed equalization is not as great as it might be for optimum utilization of the recording medium. For example, recording an instrument such as a piano or violin does not usefully load the channel over the whole audio spectrum, thus low and high frequency noises are particularly noticeable during reproduction.

It is clear that the situation could be improved with a more flexible equalization method. The Dolby A-type system provides a characteristic, controlled by the incoming signal, which achieves optimum loading of the recording medium under all signal conditions. During playback, a complementary characteristic is applied to the signal which restores all frequency components to their correct amplitudes and phases and, in the process, attenuates any noise introduced during recording.

Systems which improve signal-to-noise ratios by compression in the encoding mode, followed by expansion in subsequent decoding, are known generally as compandors. Such devices have a long histroy, and it is therefore important to discuss these conventional techniques to appreciate the significant differences between them and the Dolby system.

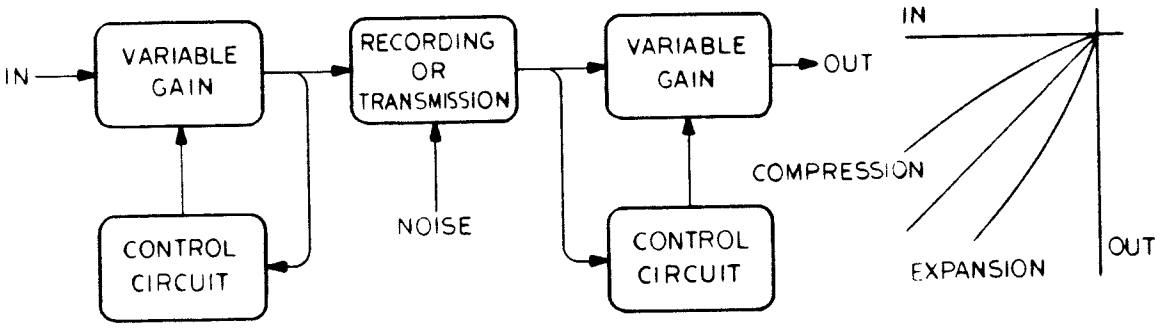


Figure 3-1 Conventional Compandor System

In the block diagram above, the conventional compandor system is shown, along with its transfer characteristic. Well known compandor difficulties-which by now are regarded as classical - include: poor tracking between recording and reproducing, both statically and dynamically; high sensitivity to gain errors in recording or transmission; inadequate dynamic range (high noise level vs. high distortion); production of overshoots with transient inputs; audible modulation-product generation under dynamic conditions; distortion of low frequencies by control-signal ripple modulation; and generation of noticeable signal-modulated noise effects.

side chain is always low, even under dynamic conditions. Mis -tracking between units is a function of the attenuators, which can be designed and built to follow a standard curve to within 0.5 dB. Signal level errors between the encoding and decoding units appear at the output only as linear level changes at high and low levels, since the input/output characteristics of the playback unit are linear in these regions. Even at the level of maximum compression slope (2:1), at around -30 dB, moderate errors (about2dB) in recording or transmission channel gain are not noticeable on program material.

With moderate signal level changes, the differential approach allows relatively long time constants to be used for control signal attack and decay times, therefore modulation products are minimal. For larger signal level changes, the attack time is decreased. This is achieved by non-linear control signal smoothing circuits which also keep low-frequency distortion to a figure of less than 0.2% at 40 Hz and peak level.

To obtain effective noise reduction under all signal conditions, the Dolby system utilizes the psychoacoustic phenomenon of masking, which is a kind of naturally occurring noise reduction. This is combined with electronic noise reduction (compression/expansion) to provide complete overall coverage. The masking effect, extending on both sides of the signal frequency, is dependent on both the absolute and relative amplitudes of the signal and noise. Taking these facts into account, the network G1 of Figure 3-2 is, in fact, four band-splitting filters, followed by four limiter circuits as illustrated in the basic block diagram of Figure 3-4. In this method, the masking

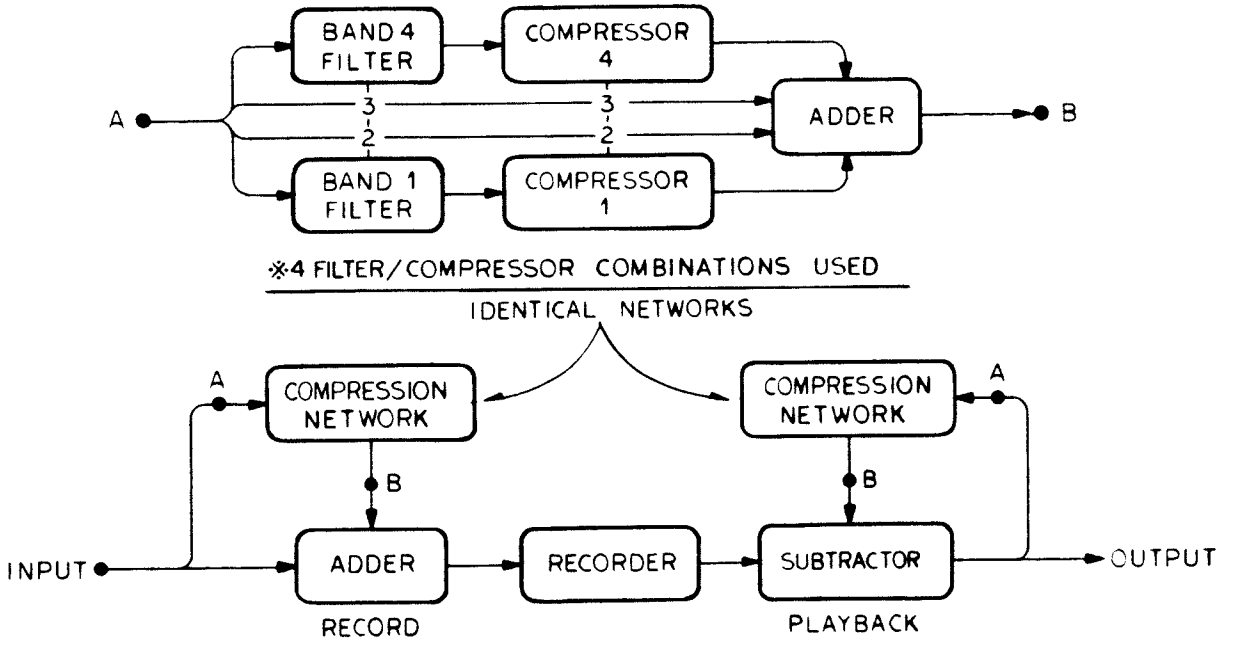


Figure 3-4 Noise Reduction System

effect is combined with compression and expansion in such a way that there are no audible noise modulation effects. The frequency bands are chosen with regard to the probable frequency distribution of a high-quality signal and to the types of noises likely to be encountered.

The differential approach, together with the band-splitting technique, results in a noise reduction system which is suitable for high-quality sound-transmission with excellent static and dynamic noise reduction and signal handling characteristics.

3.3 DECODER

In this section, a brief overview of the operation of the Decoder, with its major interconnections, will be presented. In the sections which follow, more detailed block diagrams and detailed explanations of the individual cards will be presented.

In the functional block diagram of Figure 3-6, the outputs of the projectors are amplified by the four Stereo Preamps to a voltage level adequate for processing by the Dolby Noise Reduction circuitry. This module also contains Changeover Logic to accomplish the switchover from one projector to the other.

The Mono Preamp card performs three basic functions. When operating in the Panorama mode, it generates Pseudo Left and Right signals from a Mono Optic signal to create a stereo-like sound. In the Bypass Mode, the Mono Preamp amplifies the solar cell output, delivering it to the Bypass Amp for driving the Center Channel power amplifier.

The Dolby Noise Reduction Module utilizes dynamic filters and adders to reduce the noise which is prevalent in audio channels by decoding the audio channel exactly the way Dolby encoded the audio for maximum fidelity and maximum noise reduction. The two modules are identical, each outputs one channel of audio.

The Meter Card contains two identical LED metering circuits. Each receives one channel of Dolby enchanced audio and provides a calibrated, accurate visual display of magnitude of that signal, both for calibration and for a quick visual check to see that the System is functioning properly.

The Matrix Decoder and Time Delay decodes the Left and Right audio channels received from the Dolby modules, and outputs Left, Center, Right and Surround channels. In addition, this module generates the required time delay for the Surround channel.

The Mono Stereo Sense module performes the basic electronic switching of the audio channels, as well as sensing when Stereo sound is present to activiate the proper automatic switching sequence.

WARNING: For the system to operate, Limiter (option) or Jumper Card must be installed.

Four identical Equalizers are used, one for each of the channels. Each Equalizer contains dynamic filters which are adjusted to compensate for the types of speakers used and for the acoustics of the theatre.

The Line Output and Music Fade Logic card contains line drivers which output to the four channels into the Power Amplifiers. This card has the inputs from the tape deck or other stereo intermission music as well as the logic circuitry to fade out intermission music and control it when activated by a remote control. The Monitor Amp is located on this card as well as the Surround activate circuit.

The four Power Amplifiers are identical, one is used for each channel of audio to boost the signals to a power level adequate to drive the theatre speaker system. Each Power Amplifier also contains a solid state meter for a visual indication of power output.

3.3.1 Stereo Preamps

The basic, functional components comprising the Stereo Preamp board are illustrated in Figure 3-7

Four identical channels amplify the Left and Right signal outputs of both projectors to a level adequate for switching and further processing. Each channel utilized a quad, linear op amp, providing four stages of operational amplification, with voltage and frequency feedback for gain and frequency stabilization over a wide band of audio signals. In addition, a pot in each channel (R2, R4, R6, and R8 on the schematic of Figure 3-8), provides high frequency compensation for sound lens loss which is adjusted during the initial installation.

The Changeover Logic, activated by an external signal, utilizes a Flip Flop to energize the Analog Switch, simultaneously switching both Left and Right stereo input channels from one projector to the other. This also contains 2 LEDs which indicate the preamp is activated.

An on-board regulator reduces the + 24 and – 24 volt input voltages to the $+V_{CC}$ and $-V_{CC}$ required by the amplifier and logic circuitry.

3.2 OVERALL OPERATION

Figure 3-5 illustrates the functional interconnection of the basic units supplied with the Christie Sound-A-Round System.

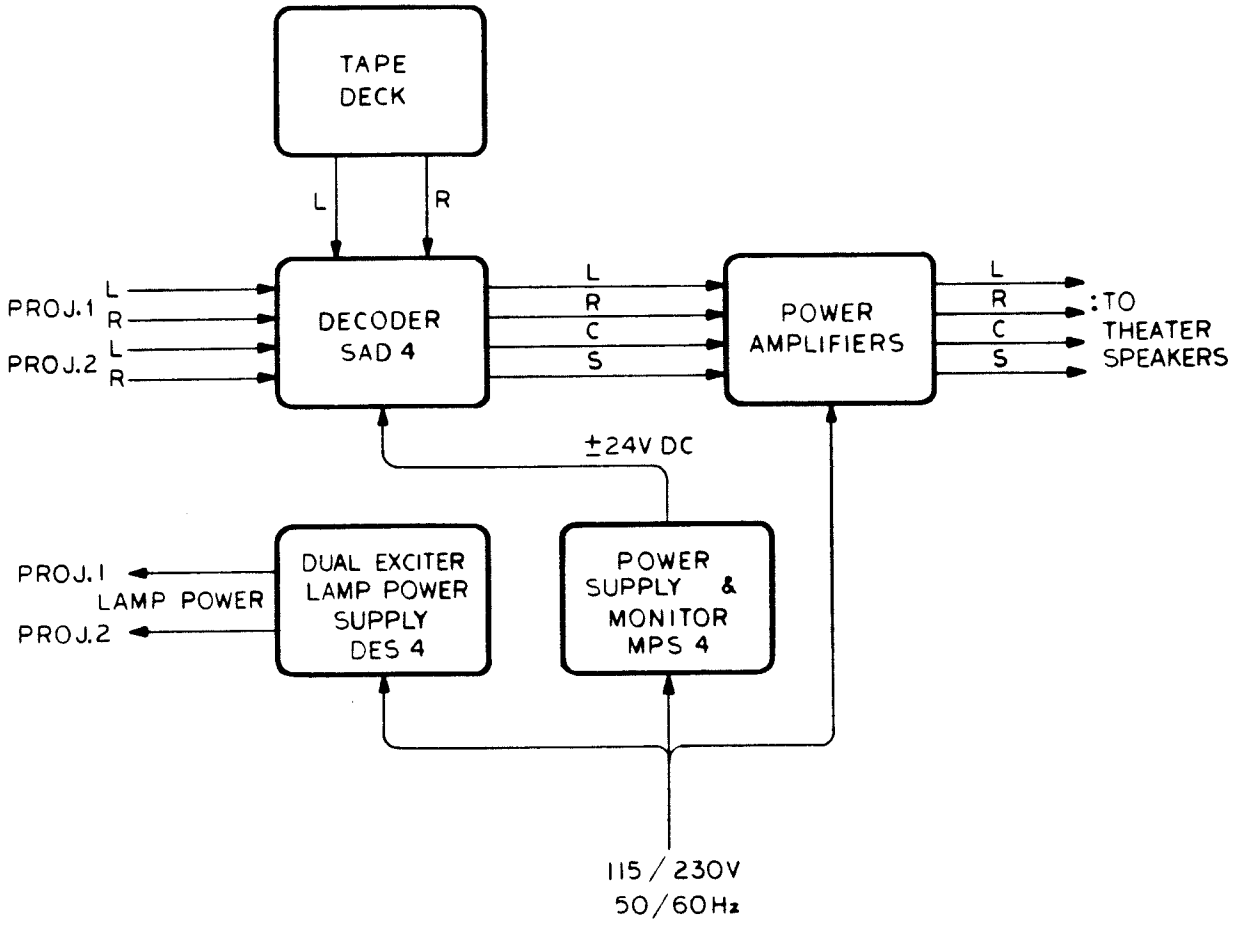


Figure 3-5 Overall System

The Decoder, the heart of the System, receives stereo or monaural signal inputs from the projector (or from the tape deck for intermission music). After preamplification of the projector signals, Dolby Noise Reduction circuitry, Decoding, Delay and Equalization circuitry process these signals to develop the Left, Right, Center, and Surround signals which are then input to the Power Amplifiers.

Two identical Power Amplifier chassis, with two power amplifiers mounted on each chassis, amplify and deliver the output power required to drive the remotely located Left, Right, Center and Surround speakers.

The Tape Deck provides Left/Right stereo signals which are input to the final stage of the Decoder for subsequent amplification by the Left, Center and Right Power Amplifiers.

The Dual Exciter Lamp Power Supply provides a regulated 5-10 volts dc to power the projector 02exciter lamps.

The Power Supply and Monitor Chassis rectifies the input ac and supplies a ± 24 volts DC to the Decoder circuitry. All of the individual Decoder circuit cards contain regulation circuitry for further step down and fine regulation of the specific voltages required on the circuit cards.

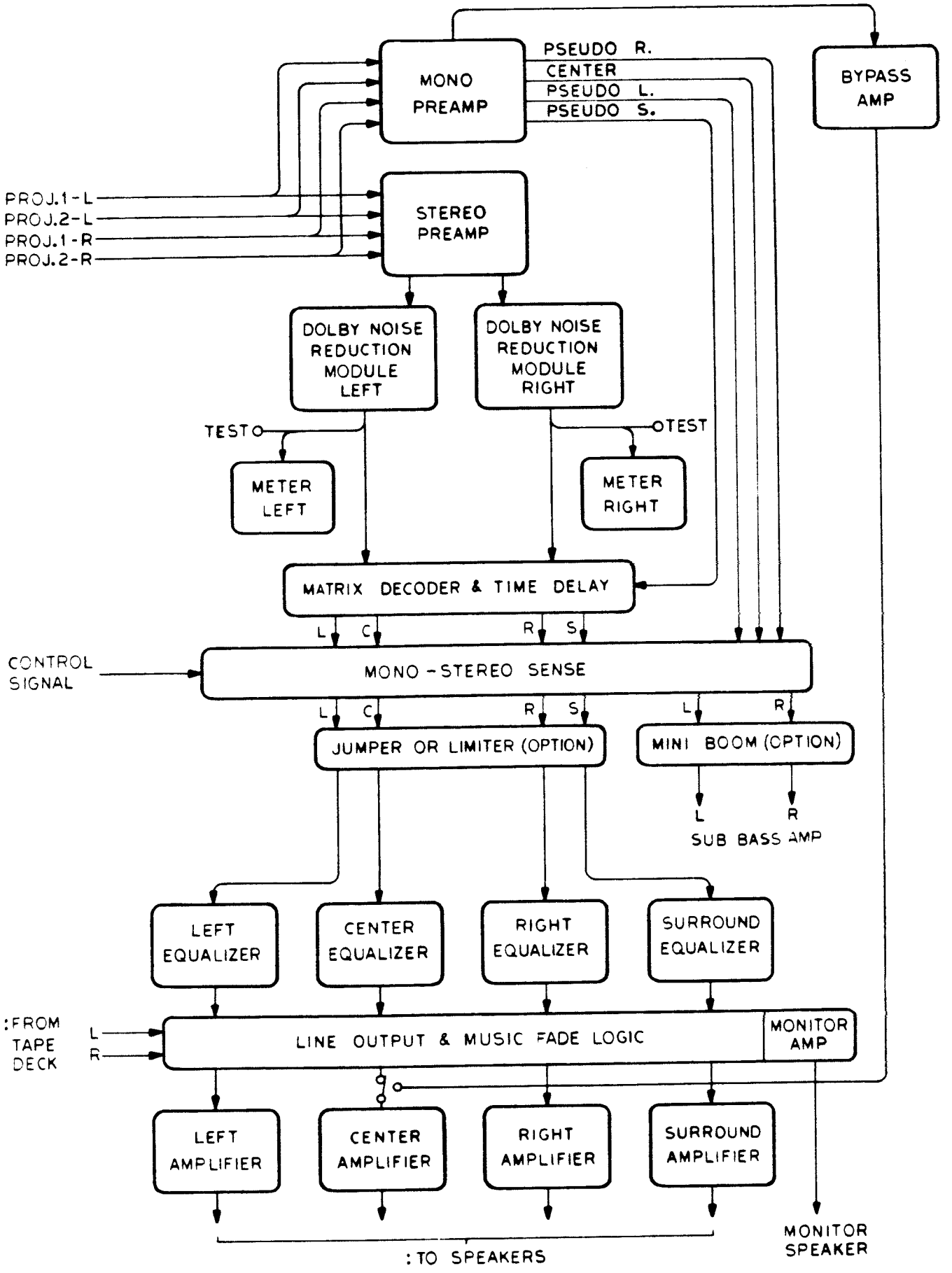


Figure 3-6 Decoder

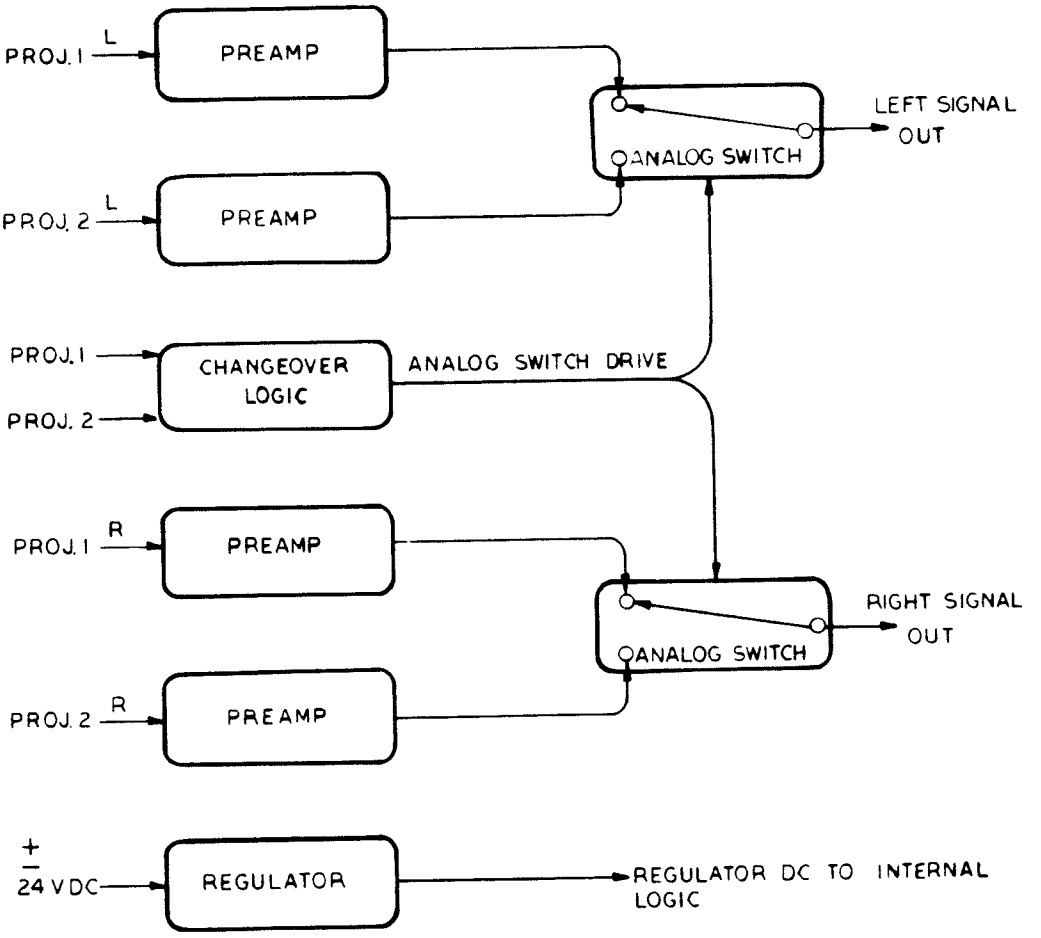


Figure 3-7 Stereo Preamps

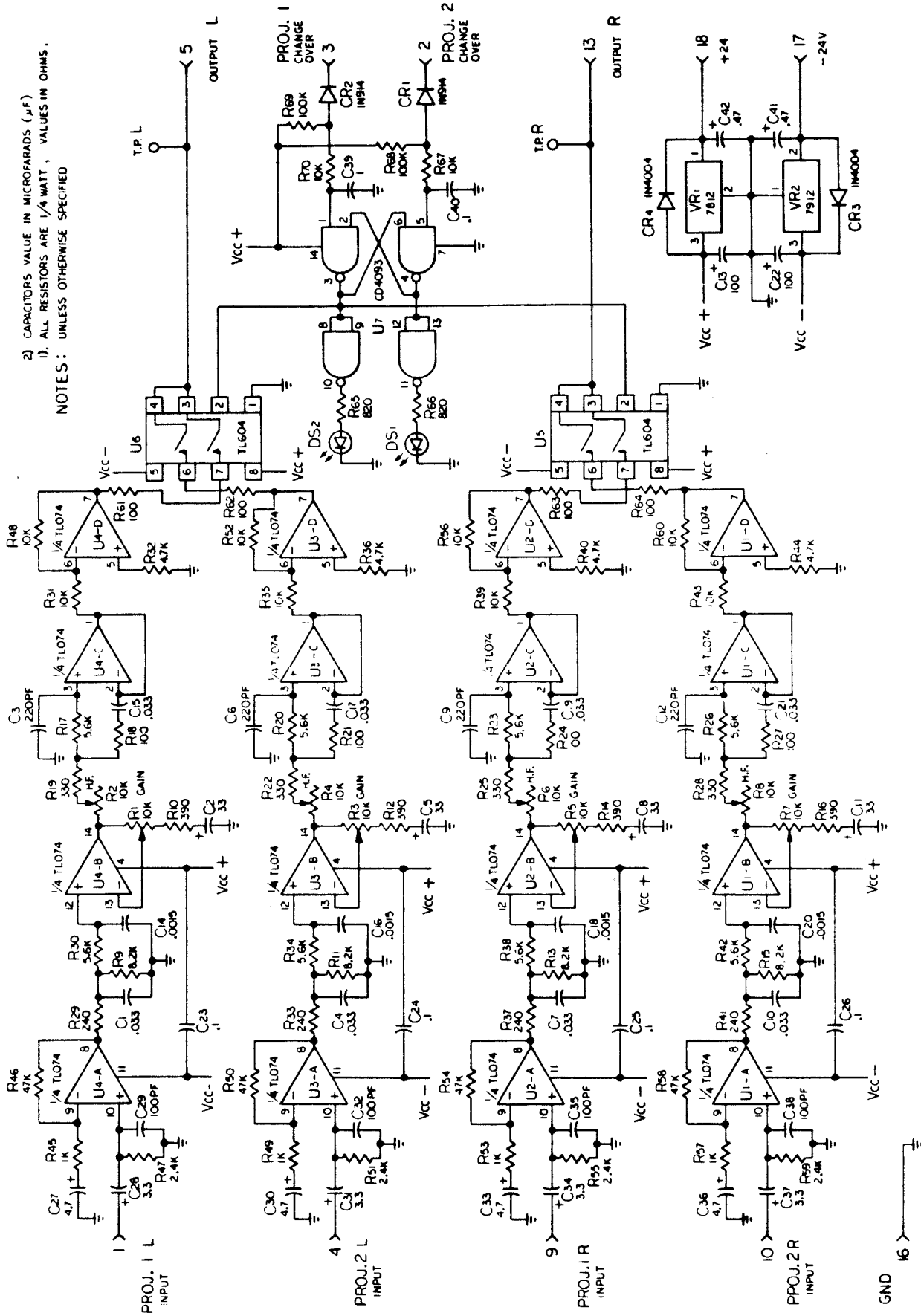


Figure 3-8 Stereo Preamps Schematic
Dwg. No. 503040 - Revision A

Figure 3-8 Stereo Preamps Schematic
Dwg. No. 503040 - Revision A

3.3.2 Mono Preamp Card

The Mono Preamp Card of Figure 3-9 functions in three basic modes:

1. Mono - The Left and Right sides of the solar cells are summed by the Preamps and switched by the analog switch to the Center output.

2. Panorama - When operating in this mode, the Mono Preamp Card receives signals from the projector solar cells, generates Pseudo Left and Pseudo Right signals and outputs three channel, stereo-like signals to the Left and Right channels, as well as the Center channel.

3. Bypass - In this mode, the Mono Preamp Card directly amplifies the projector solar cell output, bypasses all of the Decoder circuitry, and drives the Center Power Amplifier.

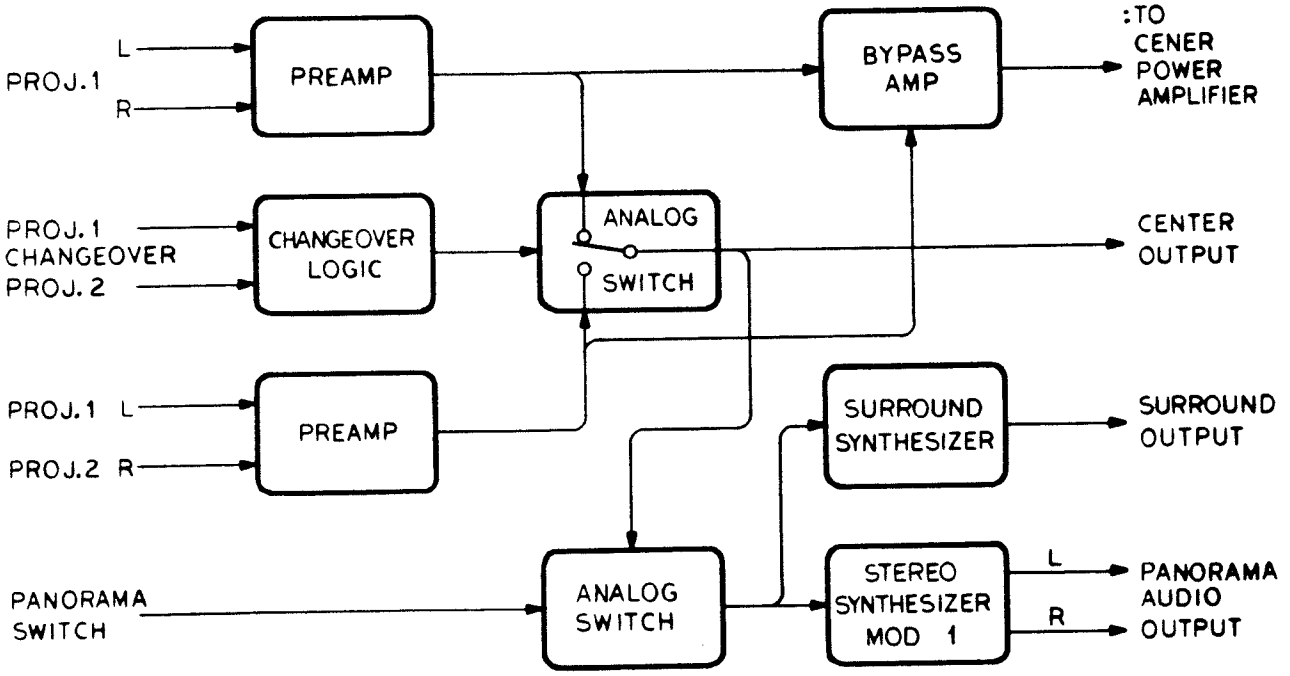


Figure 3-9 Mono Preamp

When operating in all modes, the input from both Left and Right channels of the projector solar cells are summed by the input stage, amplified by a two stage linear op amp, then output directly through the Analog Switch to the center channel as the Main Audio Output (See Figure 3-10). A slightly modified Academy frequency response curve is provided by these two-stage preamps.

At the same time, when activated by the Analog Switch, the Center channel of audio is fed into the Mod 1 module, Christie's proprietary circuitry, which generates Pseudo-Left and Pseudo-Right signals outputs these Panorama signals to the Output Line Driver, and Left and Right Power Amplifiers.

When operating in the Bypass Mode, the outputs of the Mono Preamps are switched by the Analog Switch directly to a two-stage, linear Op Amp which is then fed directly into the Center Power Amplifier, bypassing all of the Decoder circuitry.

Changeover Logic, consisting of a pair of flip-flops, controls the Analog Switch so that the audio from the correct projector is delivered to the output. This also contains 2 LEDs which indicate which Preamp is activated. The Changeover Logic is controlled from a remote location.

An on-board voltage regulator receives +24 and −24 Volts from the Power Supply and performs a fine regulation, supplying the $+V_{CC}$ *and* $-V_{CC}$ required by the logic circuitry.

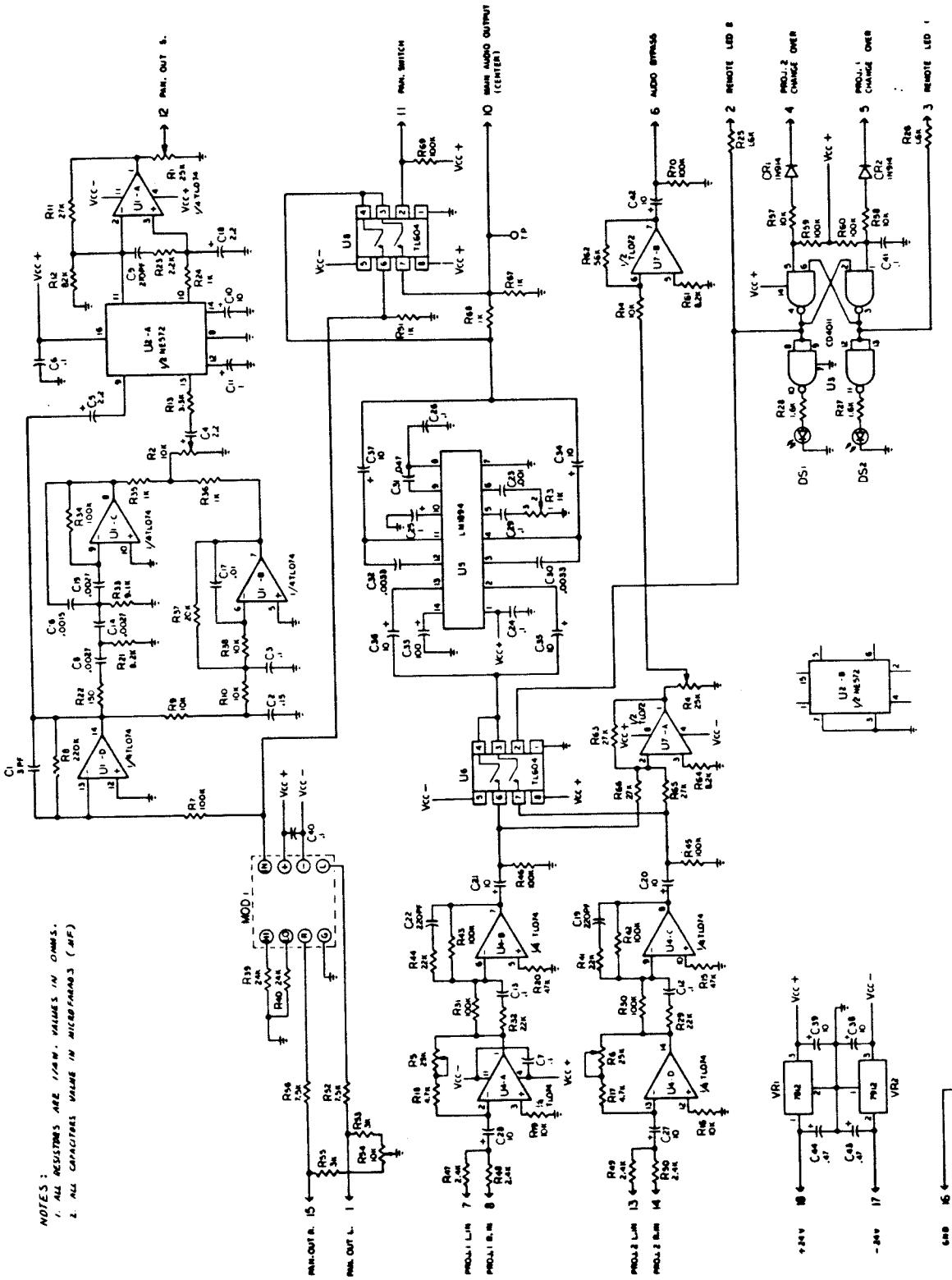


Figure 3-10 Mono Preamp Schematic
Dwg. No. 503041 - Revision C

Figure 3-10 Mono Preamp Schematic
Dwg. No. 503041 - Revision C

3.3.3 Dolby Noise Reduction

Two identical Dolby Noise Reduction Cards are used, one for each of the Left and Right channels. A block diagram of a single channel is included as Figure 3-11.

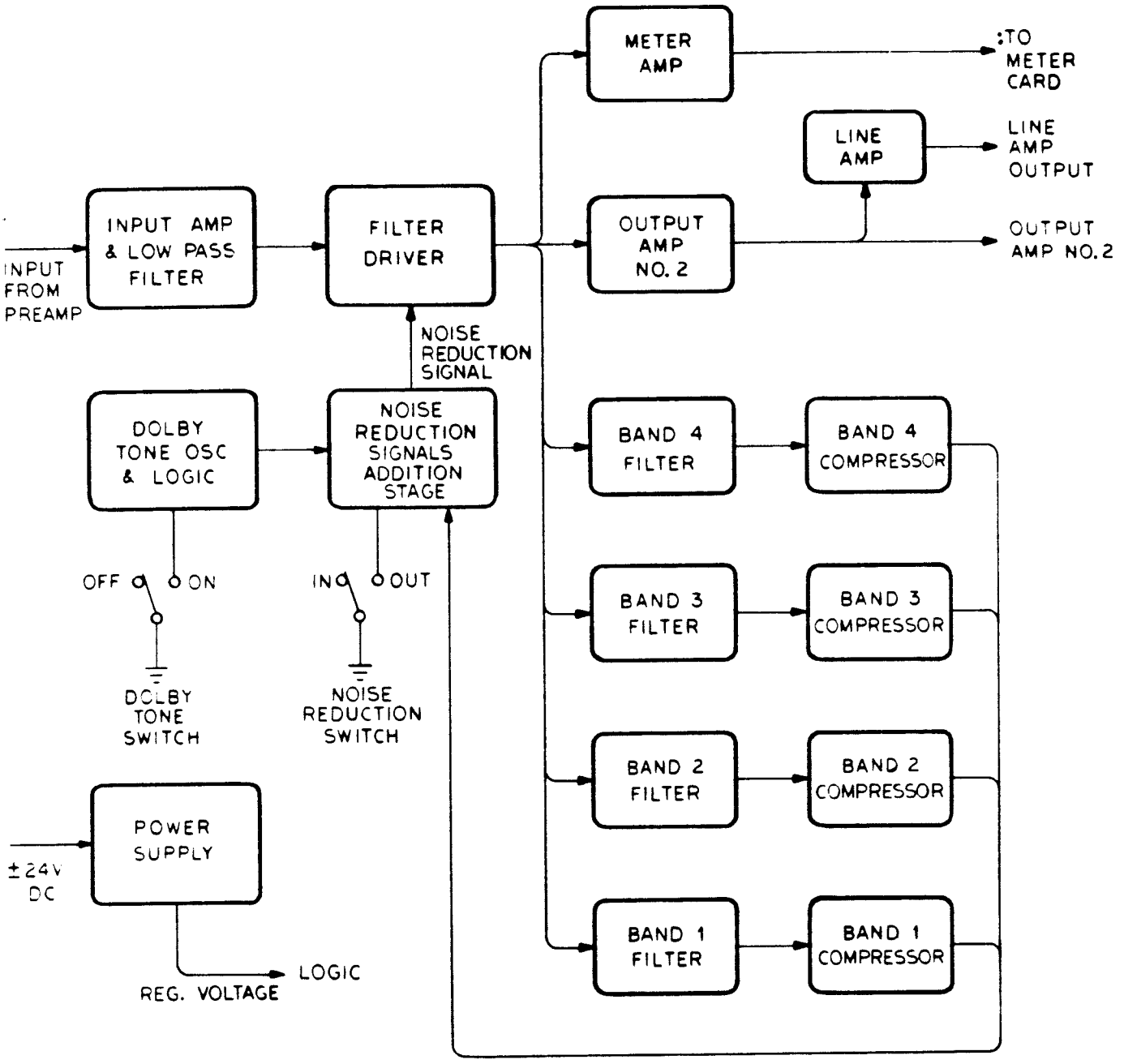


Figure 3-11 Dolby Noise Reduction

Input signals are applied to the Input Amplifier via an RF filter. The input amplifier is a high input impedance, unity-gain amplifier with a maximum sensitivity of 300 mV for Dolby Level. The output is a two-stage, active, 34 kHz low pass filter which prevents high frequency interference from entering the module and affecting the noise reduction circuitry.

The Filter Driver is a high input impedance, unity-gain amplifier, designed to feed the Filter Amplifiers. The Noise Reduciton signal, fed in from the Noise Reduction Signals Addition Stage, subtracts from the main signal, reducing the gain at low signal levels.

The Output 2 Amplifier is a feedback amplifier which raises the input 300 mV to a 500 mV signal which is output to the Matrix Decoder.

The Output 2 Amplifier also outputs a signal to the Line Amplifier. The Line Amplifier is designed to feed a 1:2 transformer to provide floating or balanced outputs. The normal input level is 90 mV for a 600 mV output.

The Meter Amplifier has a low output impedance for driving the Meter Card. The amplifier is driven from the Filter Driver Output which is called the reference point. All compressor characteristics are related in a fixed manner to the voltage at this point. Level calibration of the unit is thus obtained when the input voltage is adjusted to read the correct level at this point. This reference level, called the Dolby Level, can be related to the operating standards of the System which uses the Noise Reduction Circuitry.

The Dolby Tone Oscillator injects a signal into the circuit at a level corresponding to the Dolby Level. A multivibrator outputs a signal which is filtered to produce a sine wave of approximately 2% total harmonic distortion, providing a signal to the Noise Reduction Signals Addition Stage for calibrating the system, and for periodic checks.

The Filter Driver drives the four Filters, which split the audio signal into four frequency bands. The output from each of these bands passes through an independent low-level compressor before being combined to form the Noise Reduction Signal, which is then re-introduced to the main signal path. Bands 3 and 4 are both high-pass filters of identical circuit configuration with different component values.

The Band 4 Filter, for example, is an active high-pass filter, chosen for a cutoff frequency of 9 kHz. The Band 3 Filter forms a 3 kHz high-pass filter. The Band 1 Filter forms an 80 Hz low-pass filter.

The Band 2 Filter provides for a band-pass characteristic from 80 Hz to 3kHz, with an amplitude and phase response which is complementary to that of Bands 1 and 3. This is achieved by subtracting the outputs from Band 1 (80 Hz, low-pass) and Band 3 (3kHz, high pass) from the wideband input signal.

The Compressors in all four bands are essentially identical. The signal from each Filter enters the Compressor, and under low level signal conditions, is passed unattenuated, then is input to a low output impedance stage which then drives the Noise Reduction Signals Addition Stage. The overall gain of the Compressor is precisely set during manufacture. Dynamic smoothing circuitry within the Compressors processes the signal changes to provide both fast recovery and low signal distortion. At high signal levels, the Compressor output is reduced still further so that the Noise Reduction Signal represents a negligible portion of the main signal.

The output from the four Compressors are fed to the Noise Reduction Signals Addition Stage which "adds" the four signals and provides transient protection. The noise reduction action signal is cancelled when the Dolby Tone Oscillator is used during calibration or periodic checks.

The Power Supply receives a roughly smoothed + 24 V dc and stabilized this to a voltage of + 17.7 to + 18.3 Volts. The circuit also provides foldback-current-limiting to limit the current under short circuit conditions. The Power Supply also produces a secondary supply of 10 V, a zener diode 9.1 V supply and two voltages (3.2 V and 3.8 V) whose difference is temperature related and which is used to compensate for variations in the limiter circuits

A schematic of the Dolby Noise Reduction Card is included as Figure 3-12.

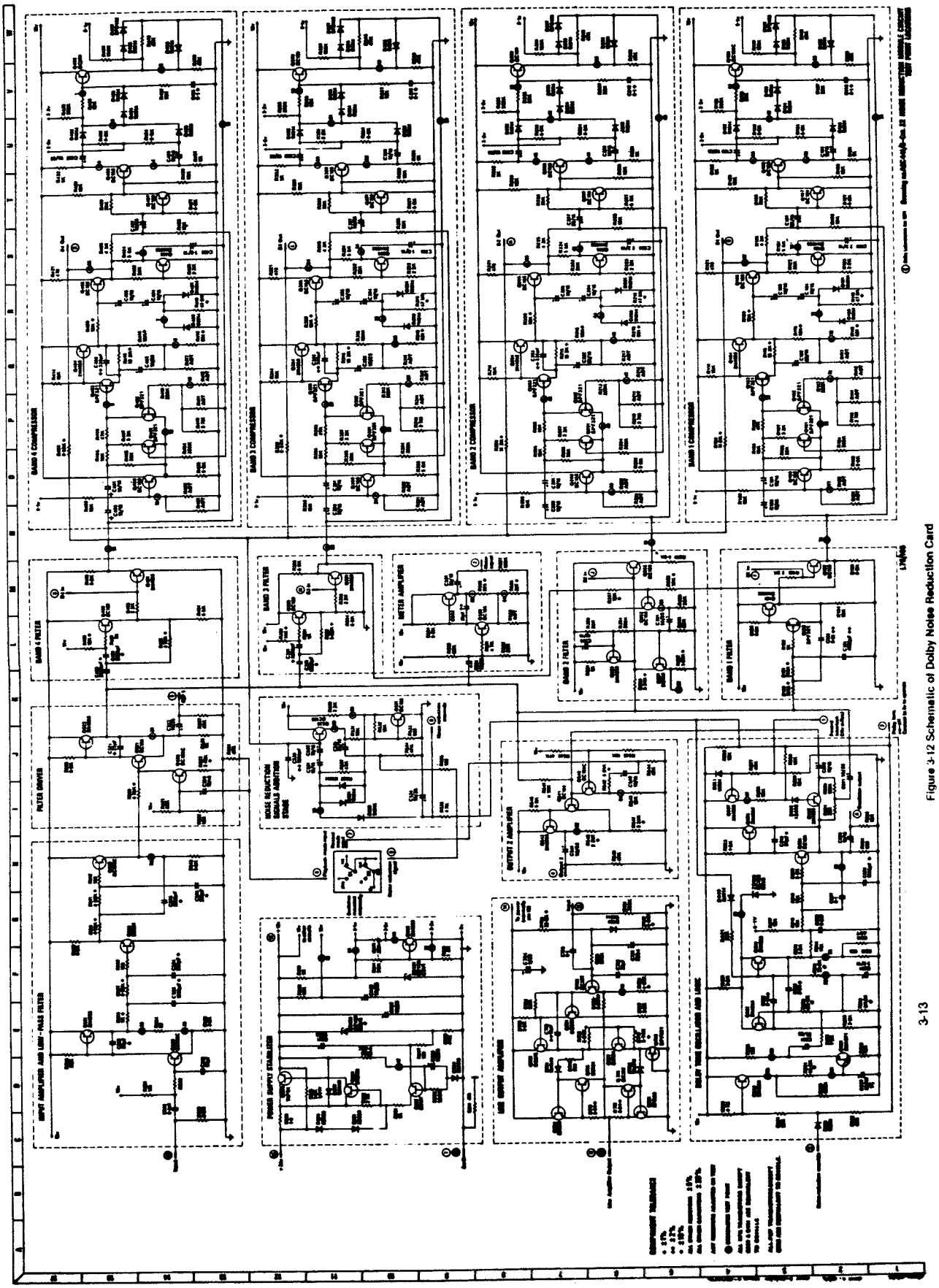


Figure 3-12 Schematic of Dolby Noise Reduction Card

3.3.4 Meter Card

The Meter Card of Figure 3-13 contains two identical LED arrays, one for each of the Left and Right stereo channels.

The input to the Meter Card, a dc voltage proportional to the signal level, is received from the Dolby Noise Reduction Circuits. This voltage is applied to the Dot Bar Display Driver which converts this analog voltage to digital voltages for the driving the LED display in the Bar mode.

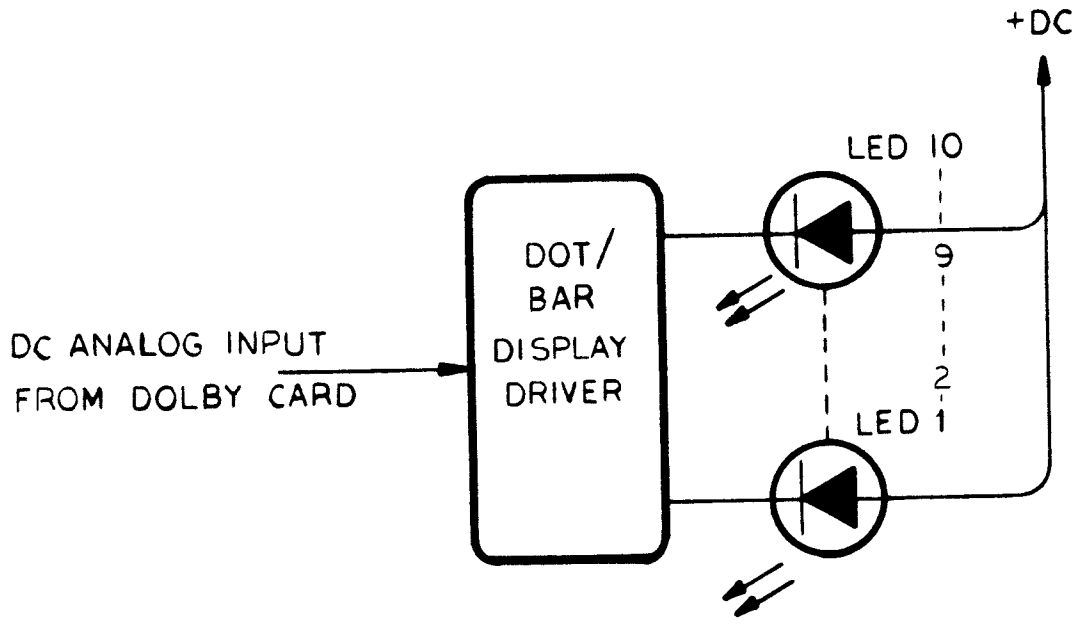


Figure 3-13 Meter Card

The Dot Bar Display IC converts the input analog voltage into a digital voltage, illuminating a number of LED's proportionately to the dc voltage being output by the Dolby Noise Reduction Circuits.

The bottom LED indicates that a minimum signal level is present, the top LED indicates that the signal is at a maximum, the eighth LED indicates Dolby Level.

A schematic of the Meter Card is included in Figure 3-14.

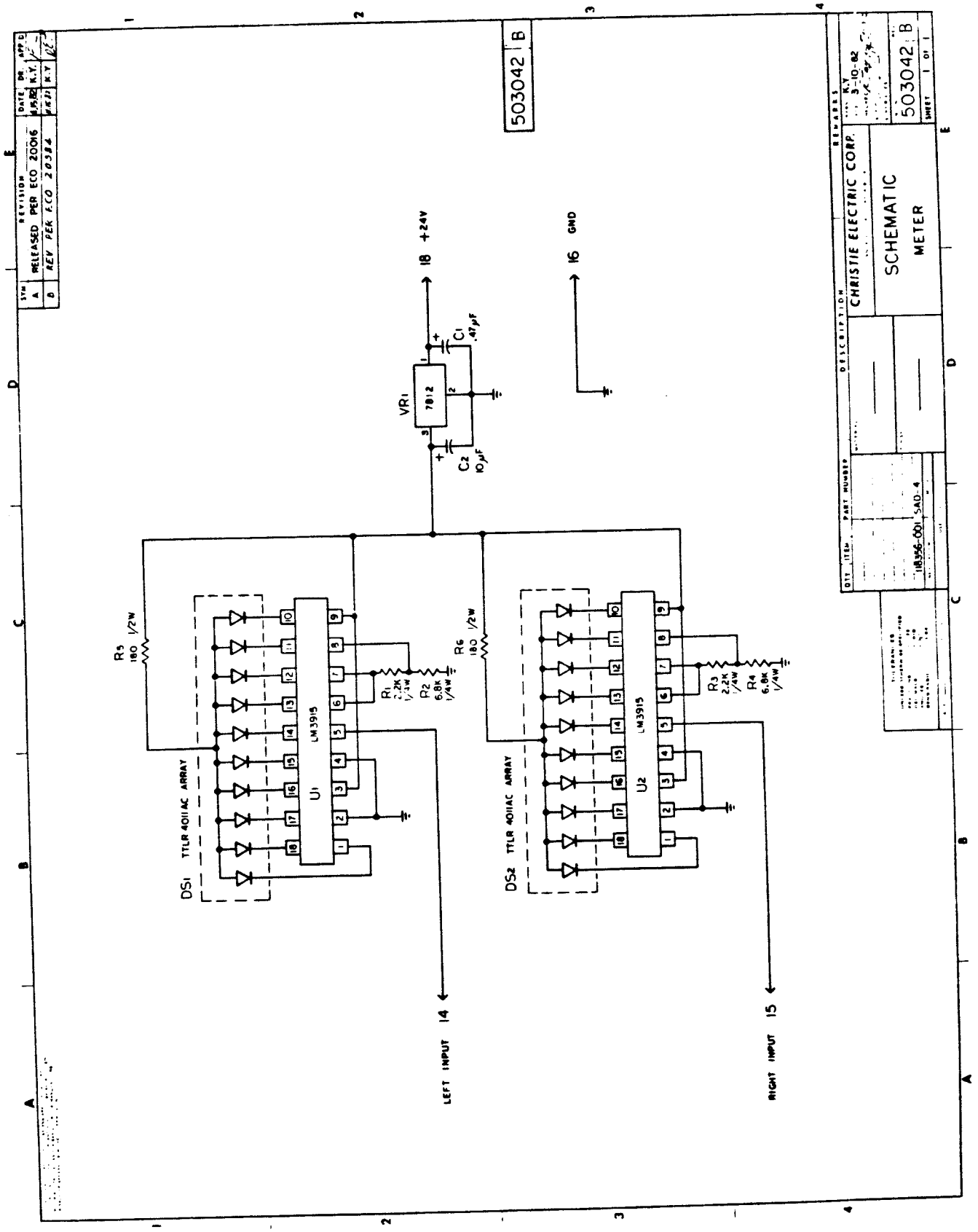


Figure 3-14 Meter Card Schematic

3.3.5 Matrix Decoder and Time Delay

In the diagram of Figure 3-15, the Left and Right Dolby signals are decoded by the Matrix Decoder which consists of three Integrated Circuits, developing Center and Surround channel information, in addition to the Left and Right channels of audio.

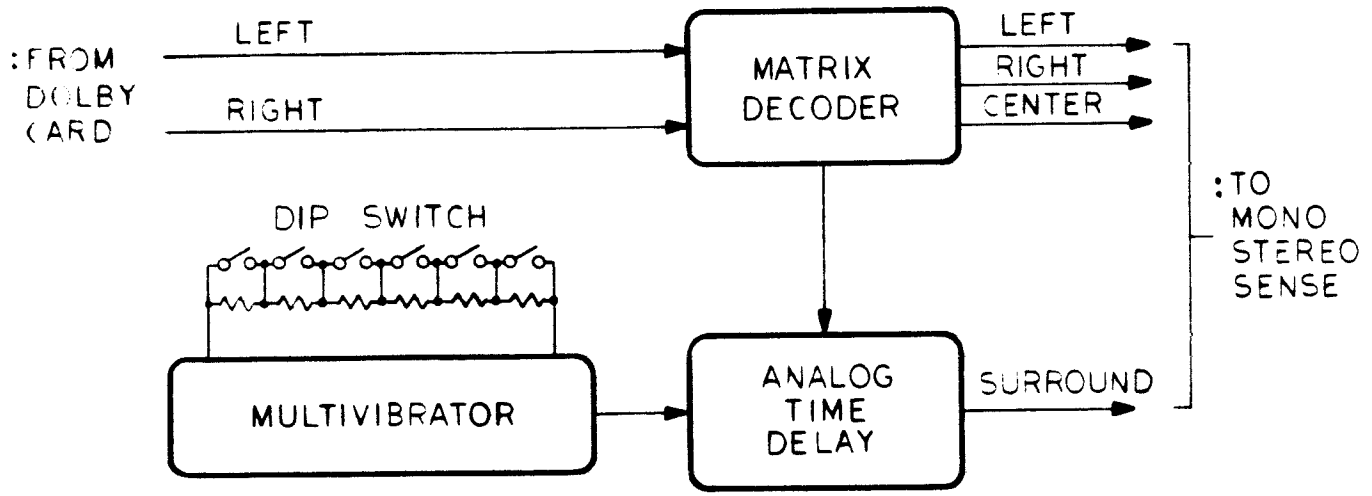


Figure 3-15 Matrix Decoder and Time Delay

An Analog Time Delay Circuit delays the Surround channel to minimize crosstalk from the front and to avoid an echo in the theatre. Working in conjuction with this Delay Circuit is a multivibrator. A DIP switch, with a series of resistors paralleling its contacts, sets the frequency of the multivibrator. And the frequency of the multivibrator determines the amount of time which the Analog Time Delay circuit delays the Surround information.

This time delay is established at installation and should be readjusted only if different speakers are used, or if the acoustics or funishings of the theatre are changed.

A schematic of the Matrix Decoder and Time Delay is included in Figure 3-16.

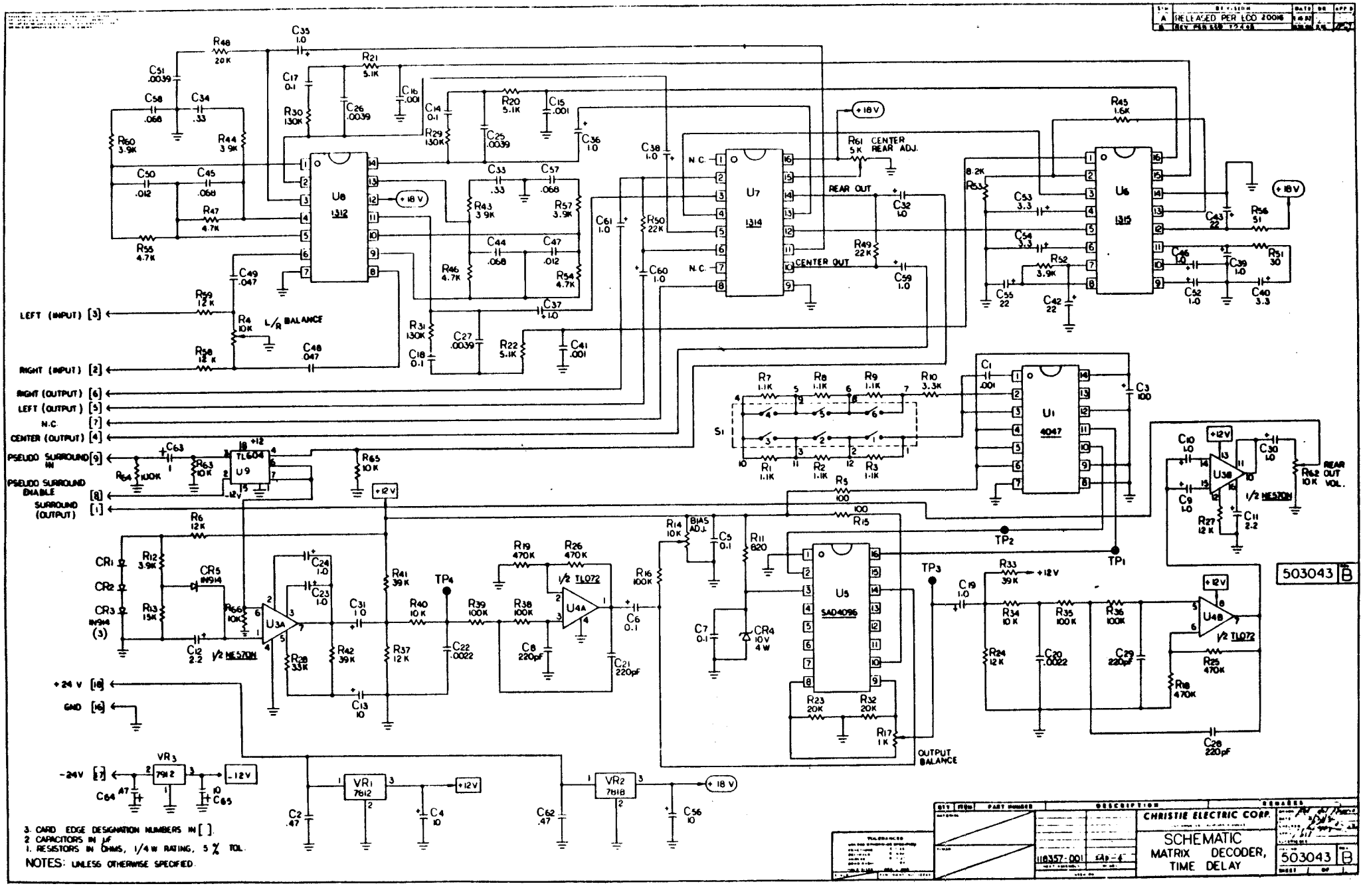


Figure 3-16 Schematic of Matrix Decoder and Time Delay

3.3.6 Mono Stereo Switch (Electronic Switch)

The Mono Stereo Switch Sense Card of Figure 3-17 performs the basic audio switching for the System as controlled by the Mode Switch on the Front panel, selecting either Mono, Pseudo Stereo, Optic Stereo, or Magnetic Four Track.

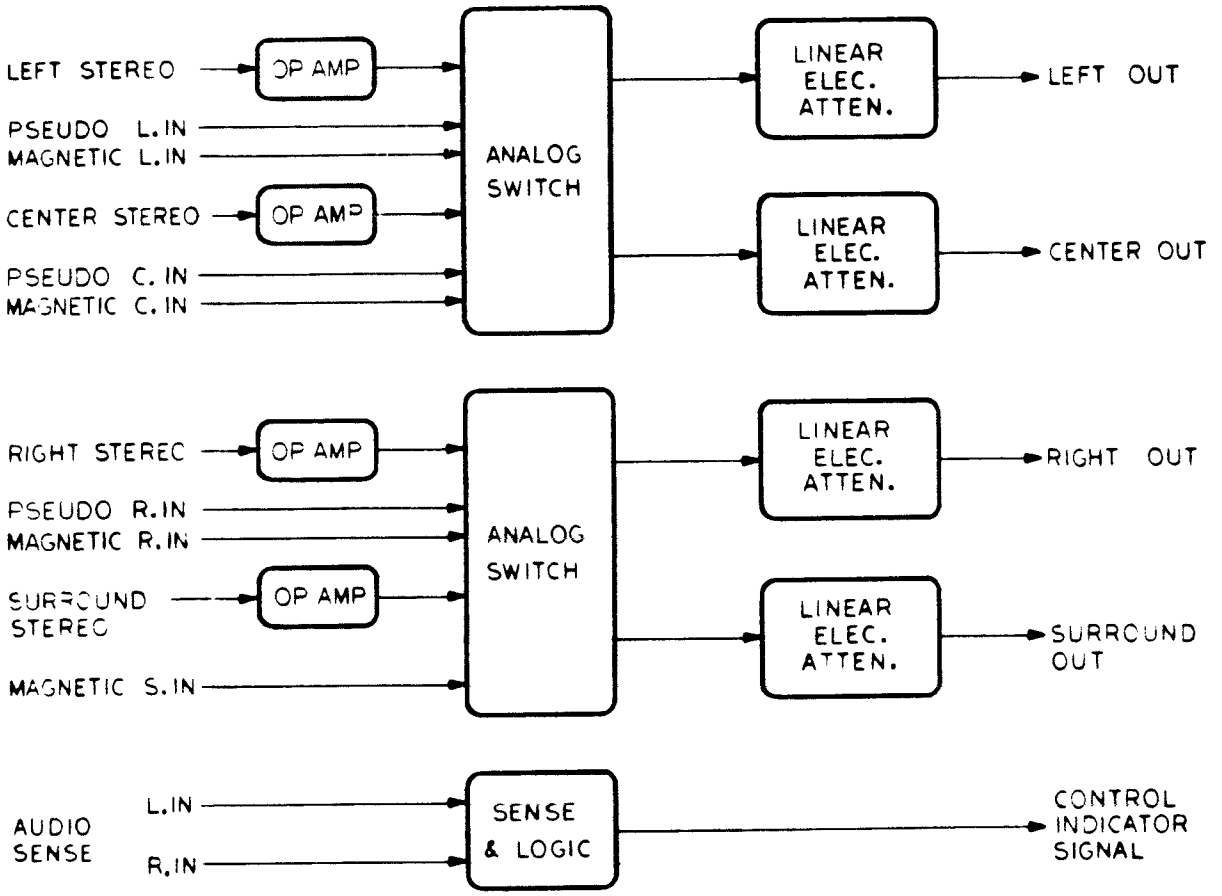
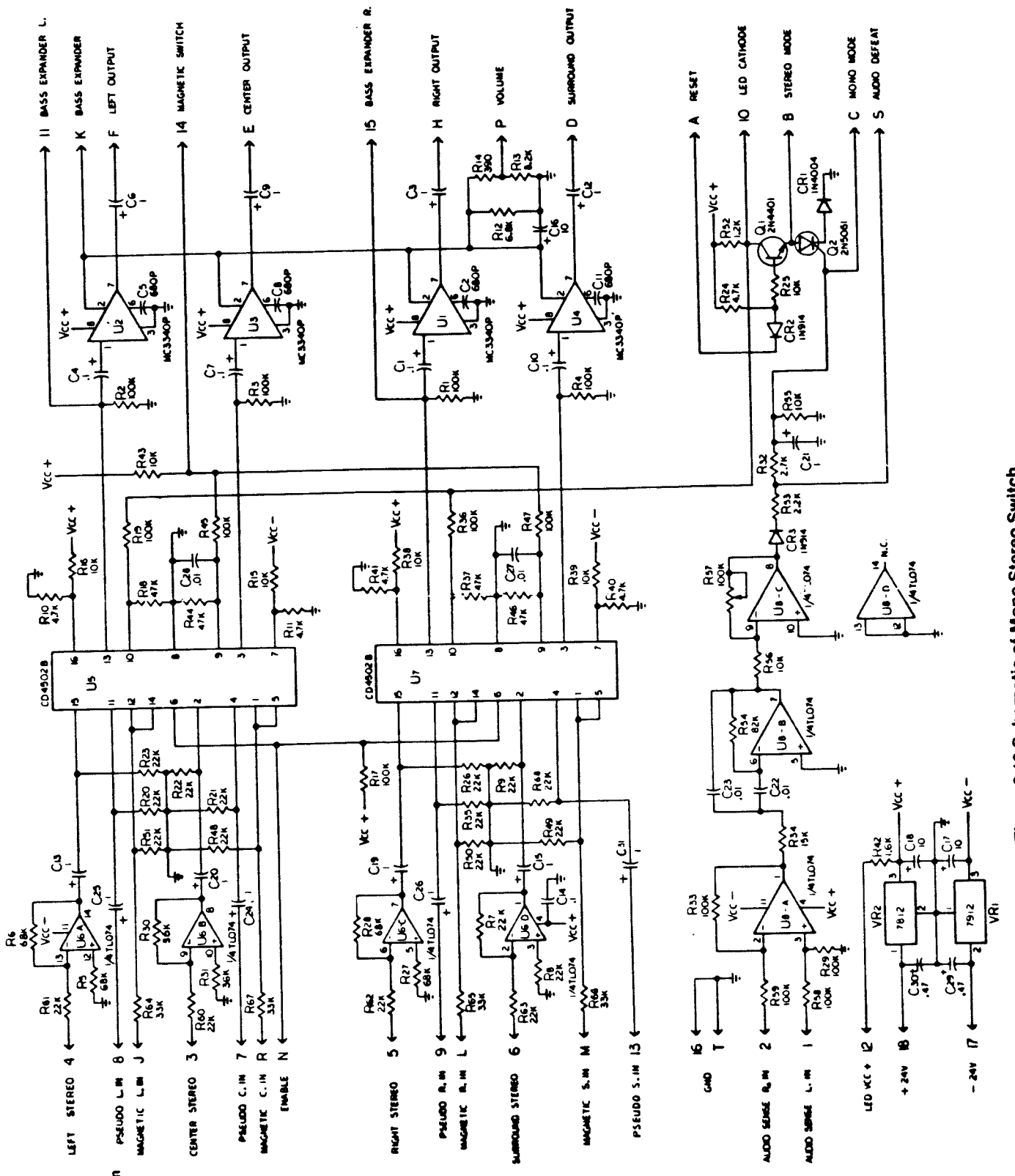


Figure 3-17 Mono Stereo Sense Card

The Sense Amplifier and Logic monitors the outputs of the Left and Right channels. When Stereo is applied, this Sense circuit detects that the signals are different and activates external logic circuitry and indicators to signal this change.

The Mono Stereo Switch schematic is in Figure 3-18.



NOTES: Unless otherwise specified
1 All resistors are ¼ W, 5%, in OHMS
2 All capacitors are in microfarads

Figure 3-18 Schematic of Mono Stereo Switch
Dwg. No. 503046 - Revision C

Figure 3-18 Schematic of Mono Stereo Switch
Dwg. No. 503046 - Revision C

3.3.7 Equalizer

Two Equalizers are included on each of the two cards, providing a total of four, or one Equalizer for each channel. The Equalizer circuits are identical, but are individually tuned to suit the characteristics of each specific channel.

In the block diagram of Figure 3-19, input audio is buffered by the Input Op Amp which then drives a series of 9 Dynamic filters, each filter being tuned to a specific center frequency, ranging from 31.5 Hz to 8 kHz for a full audio range of 15 Hz to 12 kHz. A pot is included in each of the Dynamic filters to adjust the attenuation of each individual response curve.

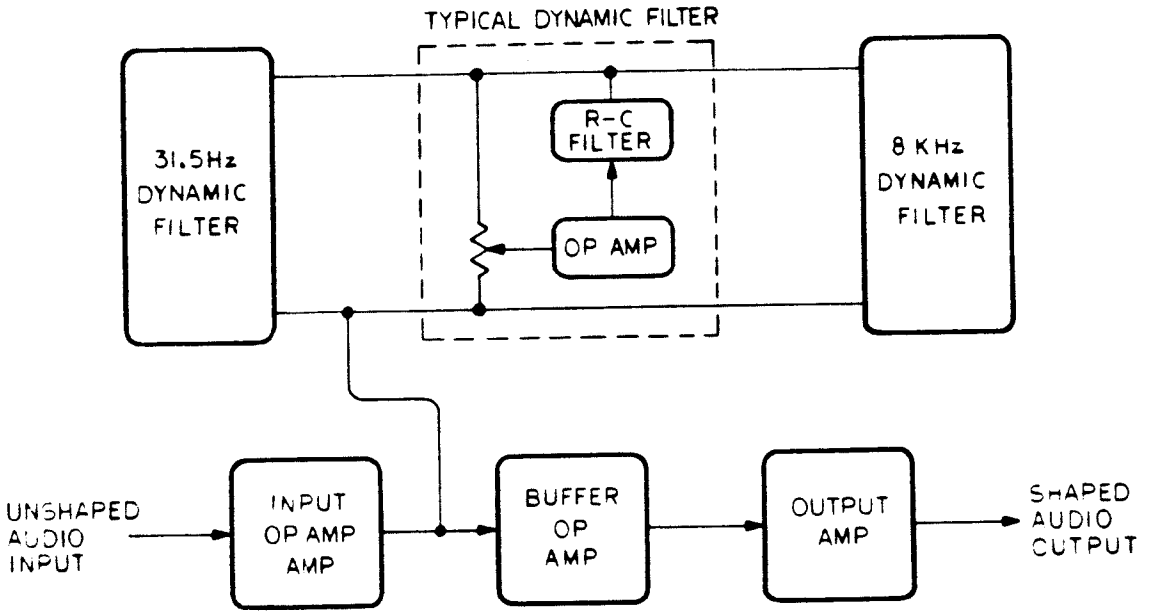


Figure 3-19 Equalizer

Each Dynamic Filter consists of an operational amplifier, and resistive and capacitive elements. Each filter is tuned to a specific center frequency by the fixed time constants in the circuit. The attenutation of each individual response curve superimposed on the input audio signal is set by the potentiometer. The Output Amp contains both a Bass and Treble tone control with a fall of 12 dB of level boost or attenuation.

All nine Dynamic Filters operate in parallel with the audio signal combining to shape the overall response curve of the channel. This permits a wide variation in possible response characteristics so that the Left, Right, Center, and Surround channels may be adjusted to suit a wide variety of speakers and theatre acoustics.

Adjustment of these Dynamic Filters is only required during installation and need only be altered if different speakers are used, or if the acoustics or furnishings of the theatre are changed.

A schematic of the Equalizer is included as Figure 3-20

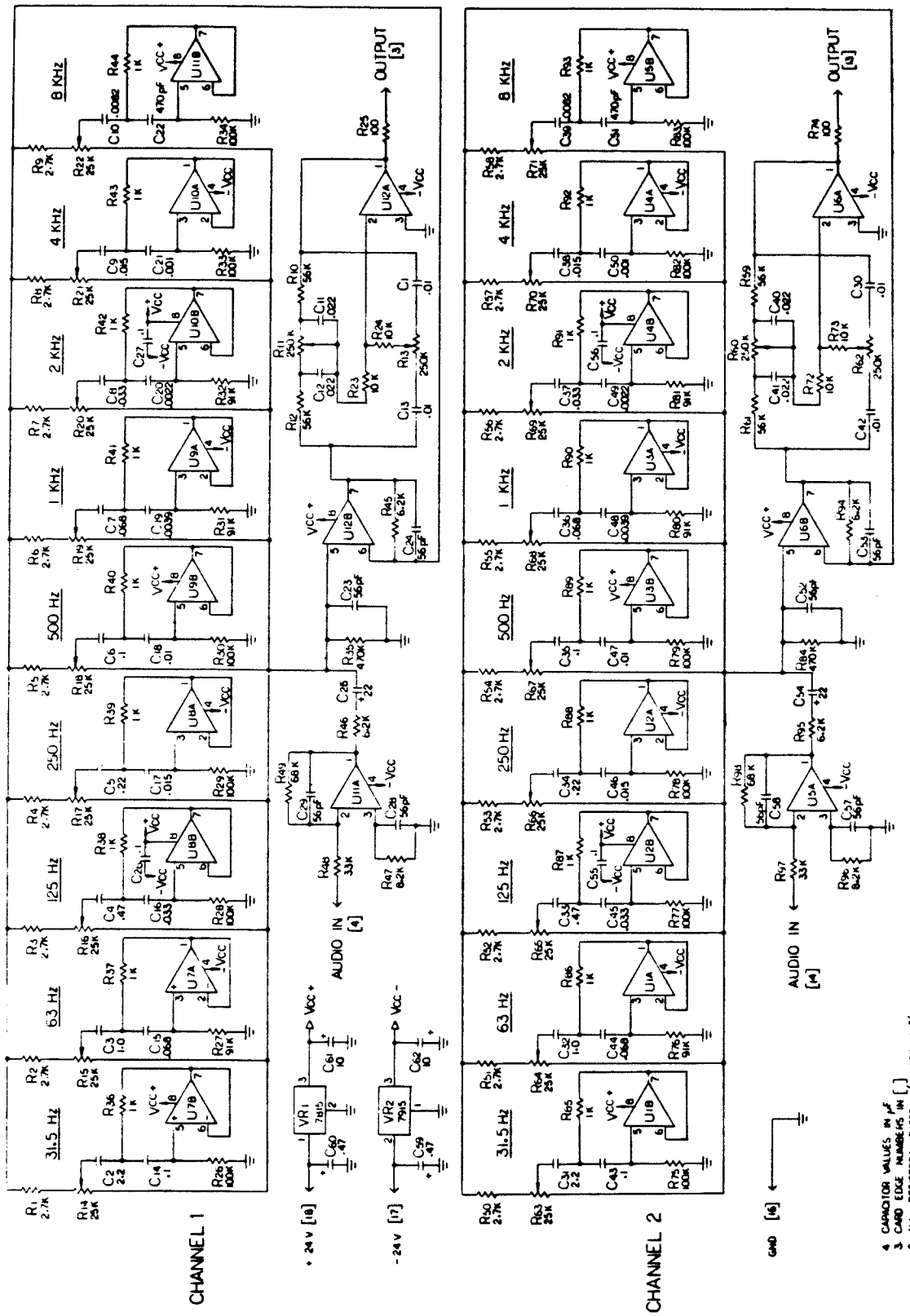


Figure 3-20 Schematic of Equalizer
Dwg. No. 50344 - Revision A

Figure 3-20 Schematic of Equalizer
Dwg. No. 50344 - Revision A

3.3.8 Line Output Card & Music Fade Logic

The Line Output and Music Fade Logic card of Figure 3-21 contains four Analog Switches and four Buffer Output Amps, one for each of the audio channels and outputs directly to the Power Amplifiers.

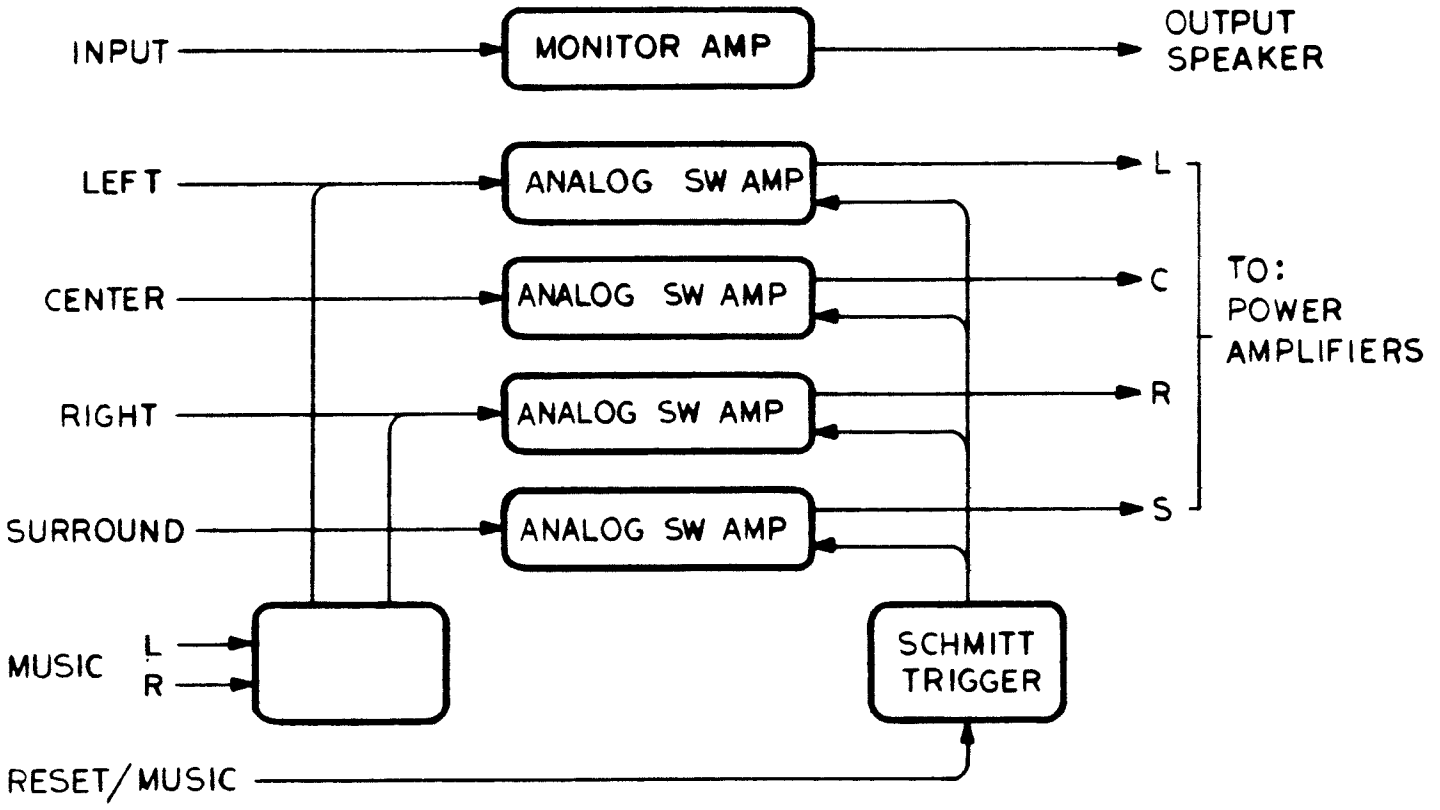


Figure 3-21 Line Output Card and Music Fade Logic

Left and Right channels of intermission music, such as obtained from the Tape Deck, are buffered by the two op amps and output to the Analog Switches for the Left, Center and Right channels.

When the intermission music is to be turned off, the Reset/Music line is activated by an external switch. This causes the Schmitt Trigger to output a pulse which gradually fades the intermission music out and triggers the Analog Switch to output the audio channels from the film.

A schematic of the Line Output Card and Music Fade Logic is included in Figure 3-22.

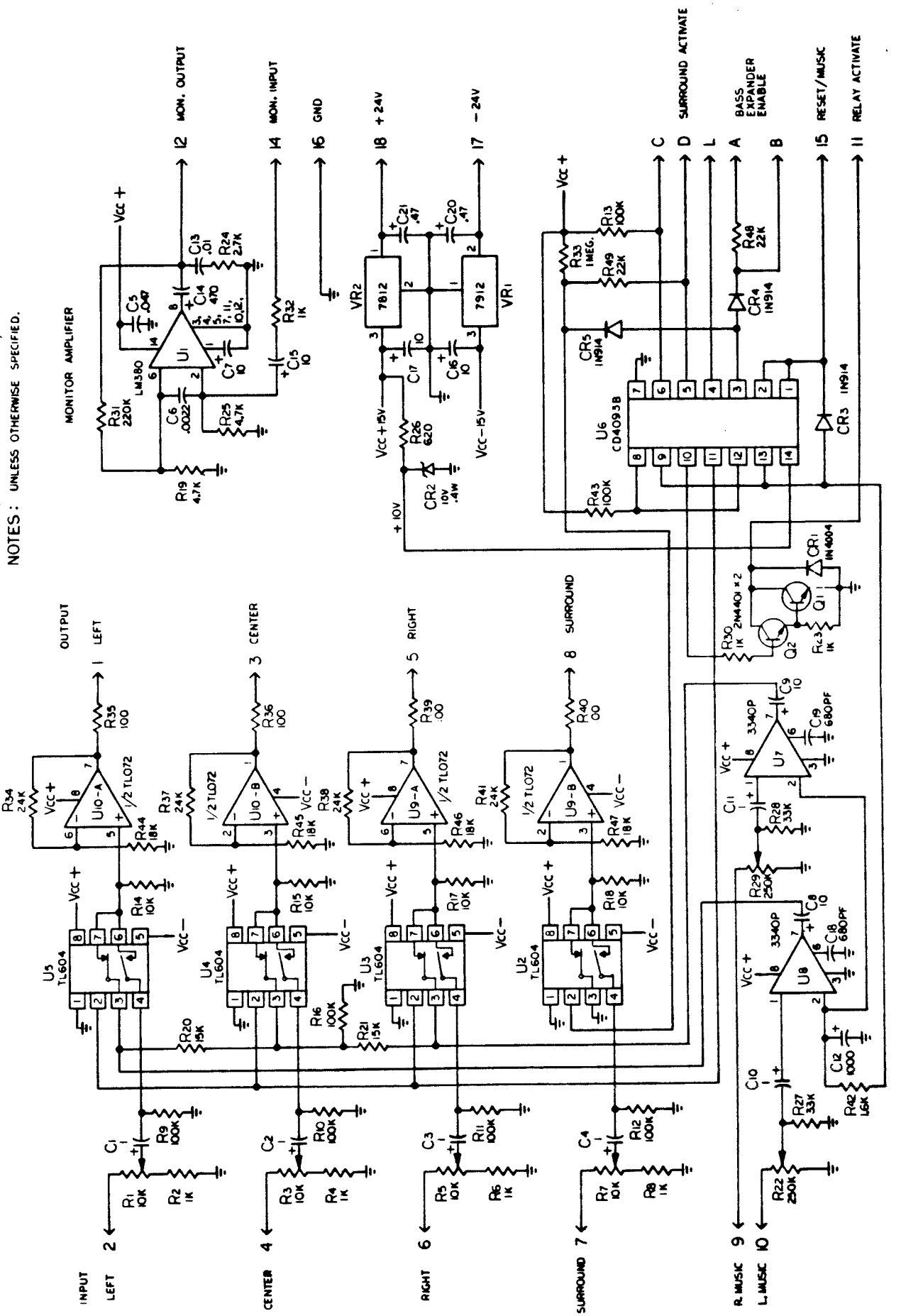


Figure 3-22 Schematic of Line Output Card and Music Fade Logic
Dwg. No. 50345 - Revision B

Figure 3-22 Schematic of Line Output Card and Music Fade Logic
Dwg. No. 50345 - Revision B

3.4 POWER AMPLIFIERS

The Power Amplifiers are professional, stereo power amplifiers. Two identical Power Amplifiers are on each chassis for a total of four, one for each channel. All active audio circuit components are contained in two modules, one for each channel. These modules consist of a glass epoxy circuit board, mechanically coupled to a large aluminum heat sink. Vertical fin arrangement and grill work on all radiating sides allow natural convection currents to flow upward and away from the amplifiers. A 16 gauge aluminum chassis is used, along with teflon insulated wiring, two massive heat sinks and modular construction.

An ON/OFF circuit breaker switch, gain controls, and the LED indicators are located on the front panel; all other external features are mounted on the rear.

General features (see Figures 3-24 thru 3-27) include an error-sensing op-amp input stage to stabilize performance, a heat sink mounted bias circuit to provide precise temperature compensation, and a full complementary output stage, featuring six 150 watt transistors in each channel (1800 watt total dissipation capability). Extensive circuitry is used to protect the amplifiers and any components or units connected to them.

In the block diagram of Figure 3-23, ten LED's arranged in an arc, form a solid state V.U. Meter. The first LED position is a "power ON" or "IDLE" indicator. The remaining nine LED's are calibrated in decibels below rated power, with the far right LED indicating 0 dB, or full power, and the balance ranging downward to – 33dB.

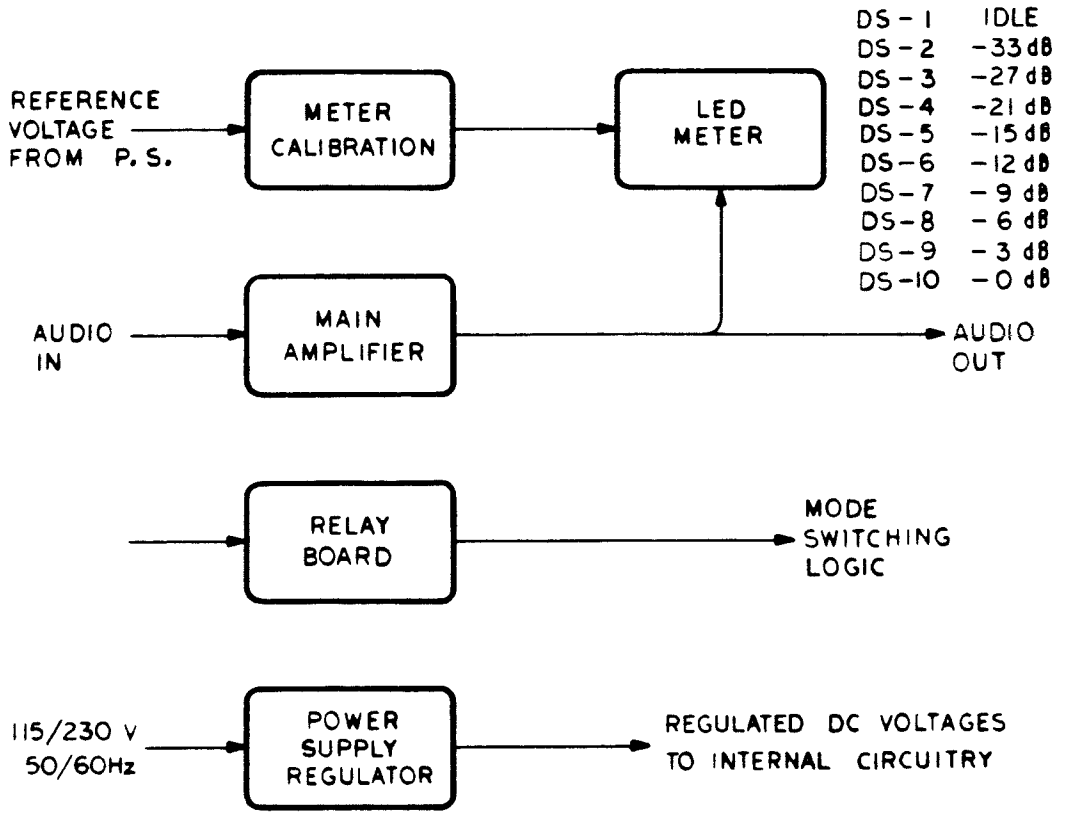


Figure 3-23 Power Amplifier

A switch on the rear panel calibrates the meter for four or eight ohm loads. This display, accurate to plus and minus 1 dB, has a response many times faster than a D'Arsonval meter and is also more precise. The meter is protected by a high impact, Lexan window that resists scratching and color degradation.

PROTECTION CIRCUITS

Both the primary power overload protection and the ON/OFF switch have been combined into a rocker-actuated, magnetic circuit breaker, whose operation, unlike fuses is predictable and independent of temperature. Returning the switch to the ON position resets the system.

Speaker protection is provided by relay circuitry that disconnects the load whenever a short circuit or harmful D.C. current is present across the output terminals. Transients created when removing extremely large signals from the load are suppressed by magnetic-field arc-interrupters mounted on the relay case.

The relay circuit includes a time delay that allows the amplifier to stabilize before the speakers are connected. It also disconnects the speakers the instant the circuit breaker is shut off, eliminating annoying pops and clicks.

Protection is further provided by the thermal-sensing switches mounted directly on each heat sink. Should the temperature in either output circuit rise beyond a safe level, a switch will shut the amplifier off and disconnect the speakers.

Power Amplifier schematics are included as Figures 3-24 thru 3-27

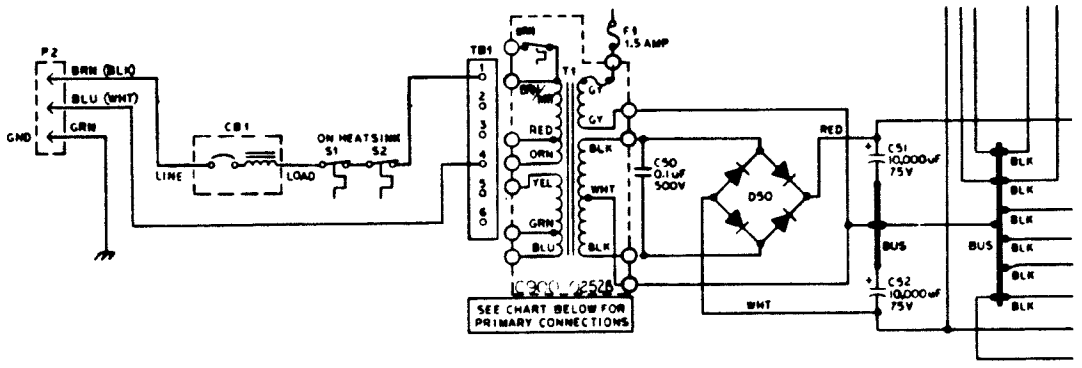


Figure 3-24 Schematic Chassis Wiring, Power Amplifier

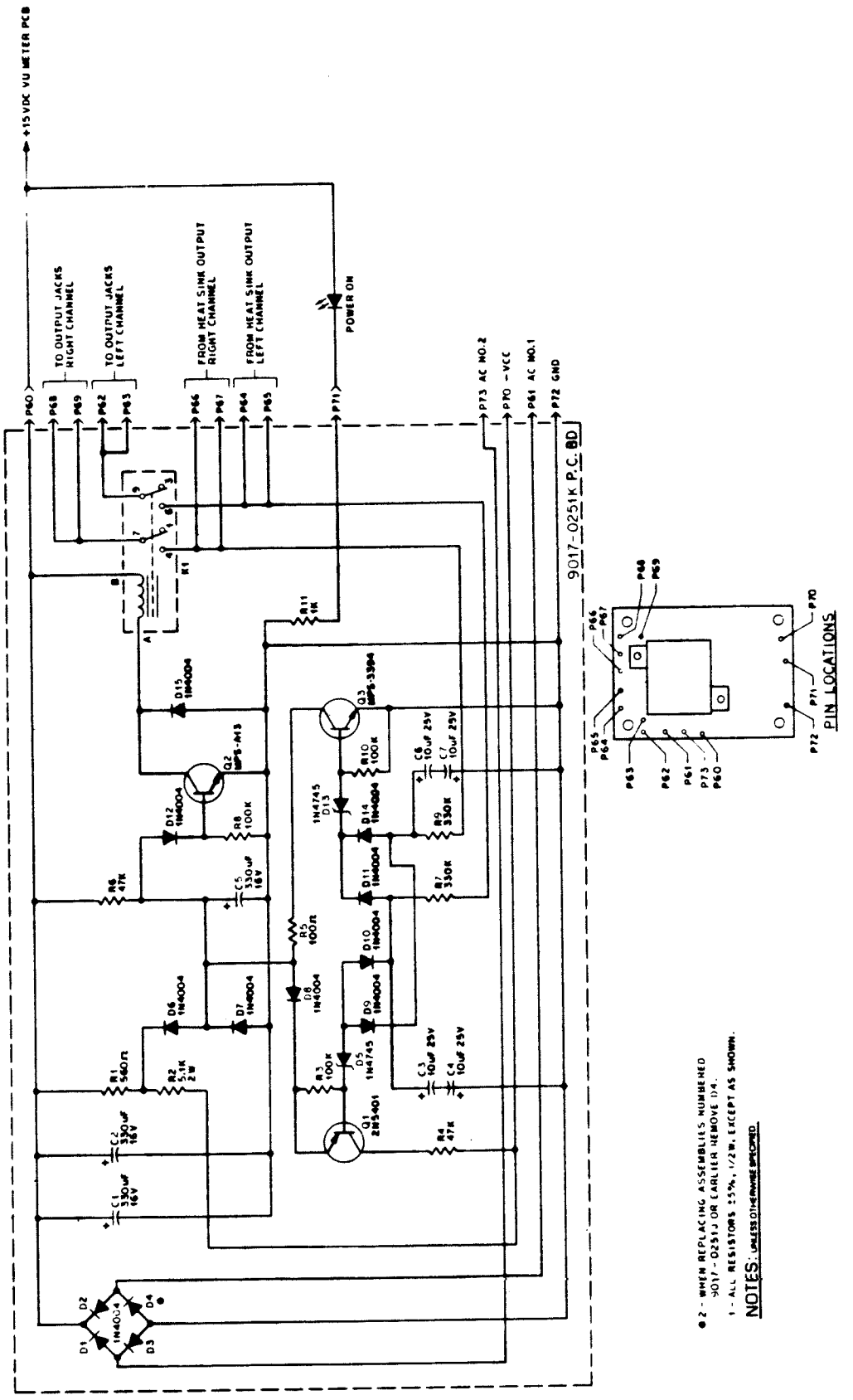


Figure 3-25 Schematic Relay Board, Power Amplifier
Dwg. No. MFRM-08304

Figure 3-25 Schematic Relay Board, Power Amplifier
Dwg. No. MFRM-08304

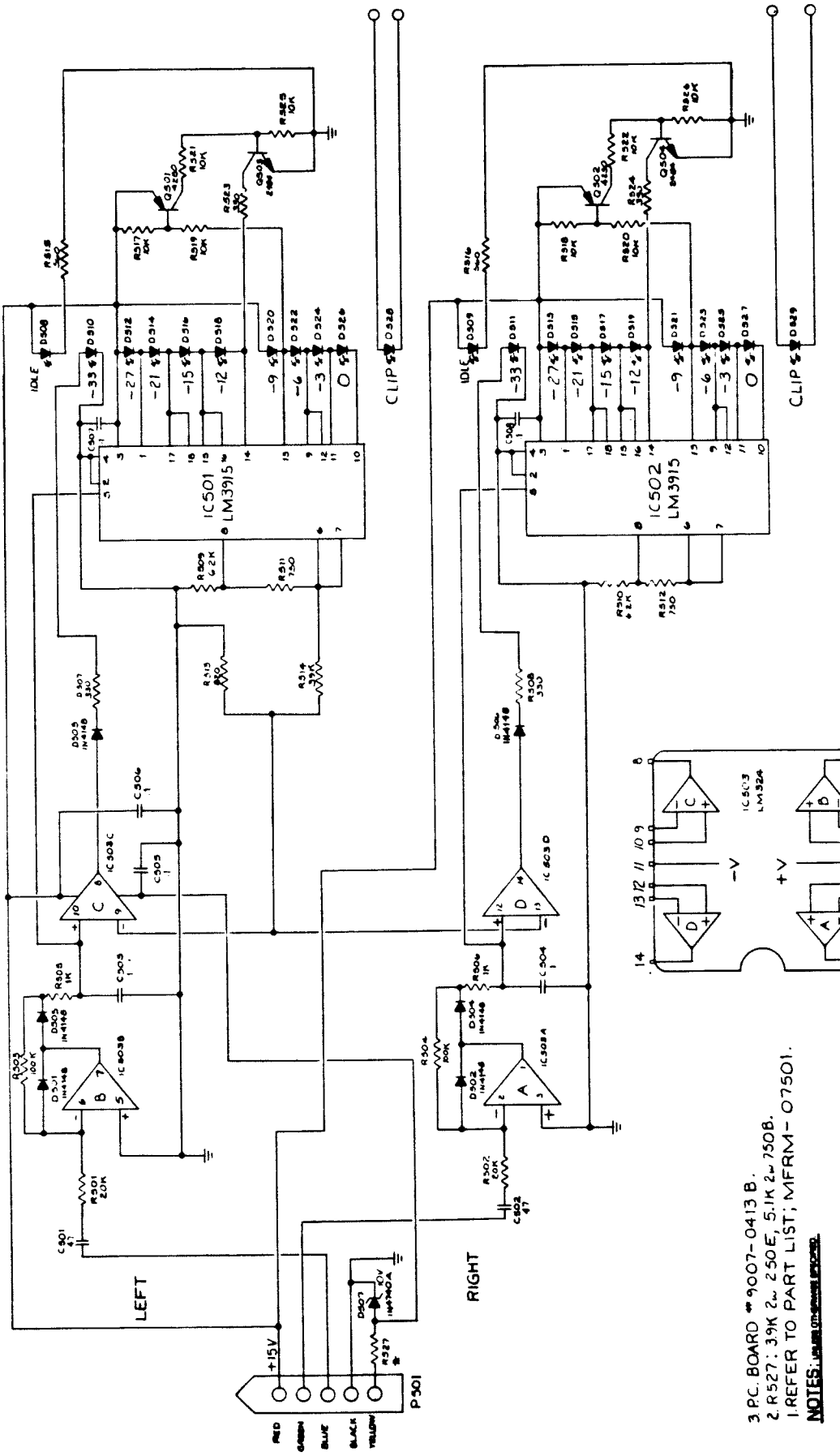


Figure 3-26 Schematic L.E.D. VU Meter, One Channel, PWR Amplifier
Dwg. No. MFRM-07104

Figure 3-26 Schematic L.E.D. VU Meter, One Channel, PWR Amplifier
Dwg. No. MFRM-07104

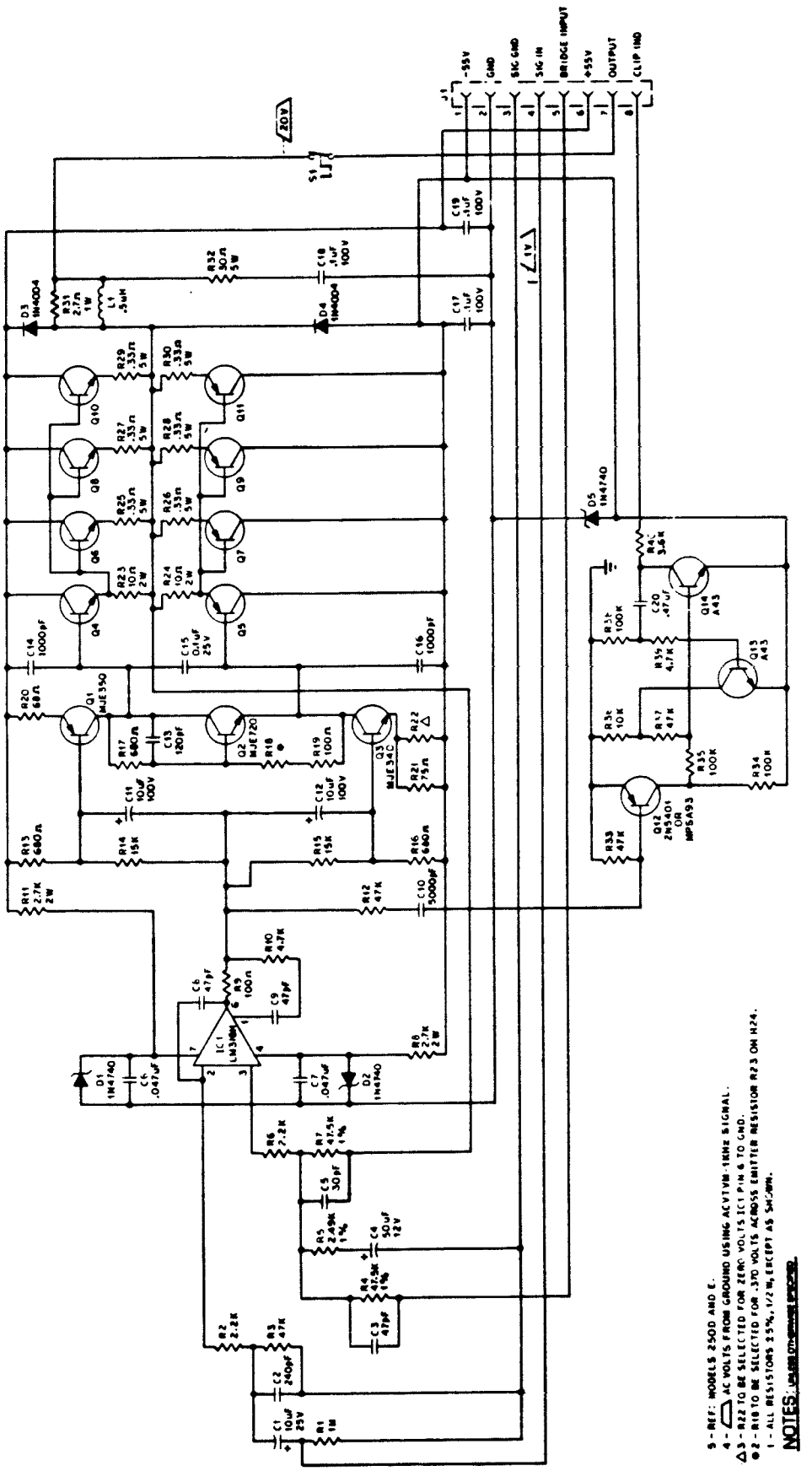


Figure 3-27 Schematic Heat Sink Module, Power Amplifier
Dwg. No. MFRM-09201

Figure 3-27 Schematic Heat Sink Module, Power Amplifier
Dwg. No. MFRM-09201

3.5 POWER SUPPLY AND MONITOR

The Power Supply and Monitor chassis of Figure 3-28 supplies an unregulated +24 volts and −24 volts to all of the circuitry in the Decoder and houses the Monitor Speaker and associated controls.

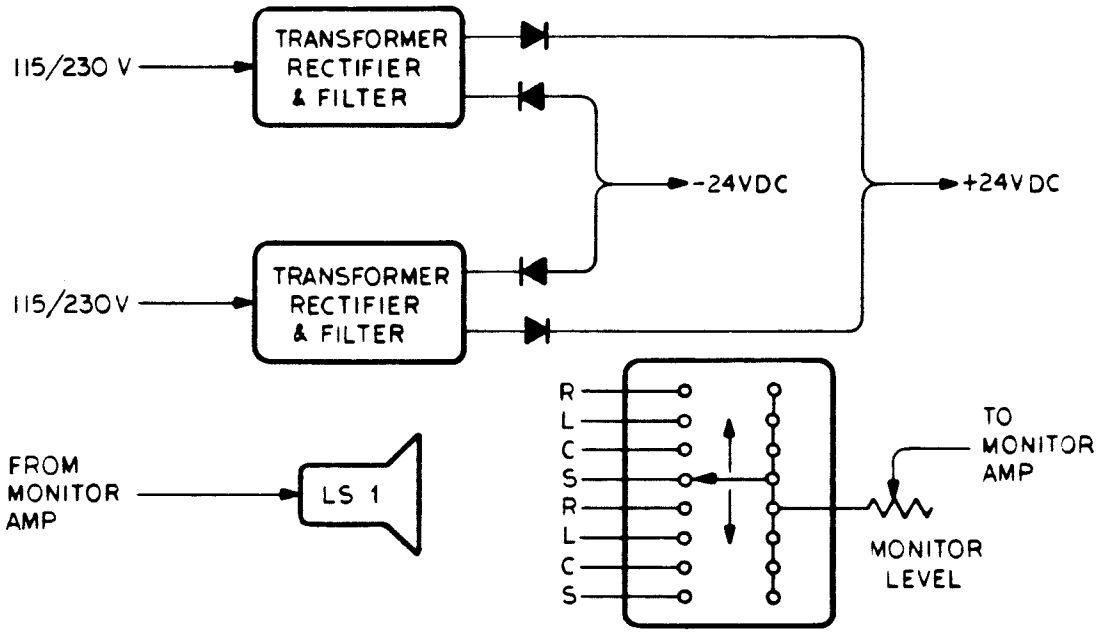


Figure 3-28 Power Supply and Monitor

After the input ac voltage is stepped down to 36 volts, the full wave, bridge rectifier rectifies it, capacitively filters the dc and outputs the voltage to the external circuitry. Two identical supplies are used and they are interconnected so that they each supply roughly half of the current load. The supplies are designed, however, that in case of an emergency, one supply can provide the entire load requirements of the system. A zener diode and rectifier combination (CR5 and CR6) monitors the difference in the two supplies. If one supply fails, the other supply automatically takes over. The LED on the defective power supply extinguishes to inform the operator of the situation.

The Power Supply and Monitor chassis also provides a mounting for the Monitor loudspeaker and the related controls. One control selects monitoring of either the input or output of all four amplifiers. The MONITOR LEVEL control adjusts the volume of only the local monitor and has no effect on the volume of the audio in the theatre.

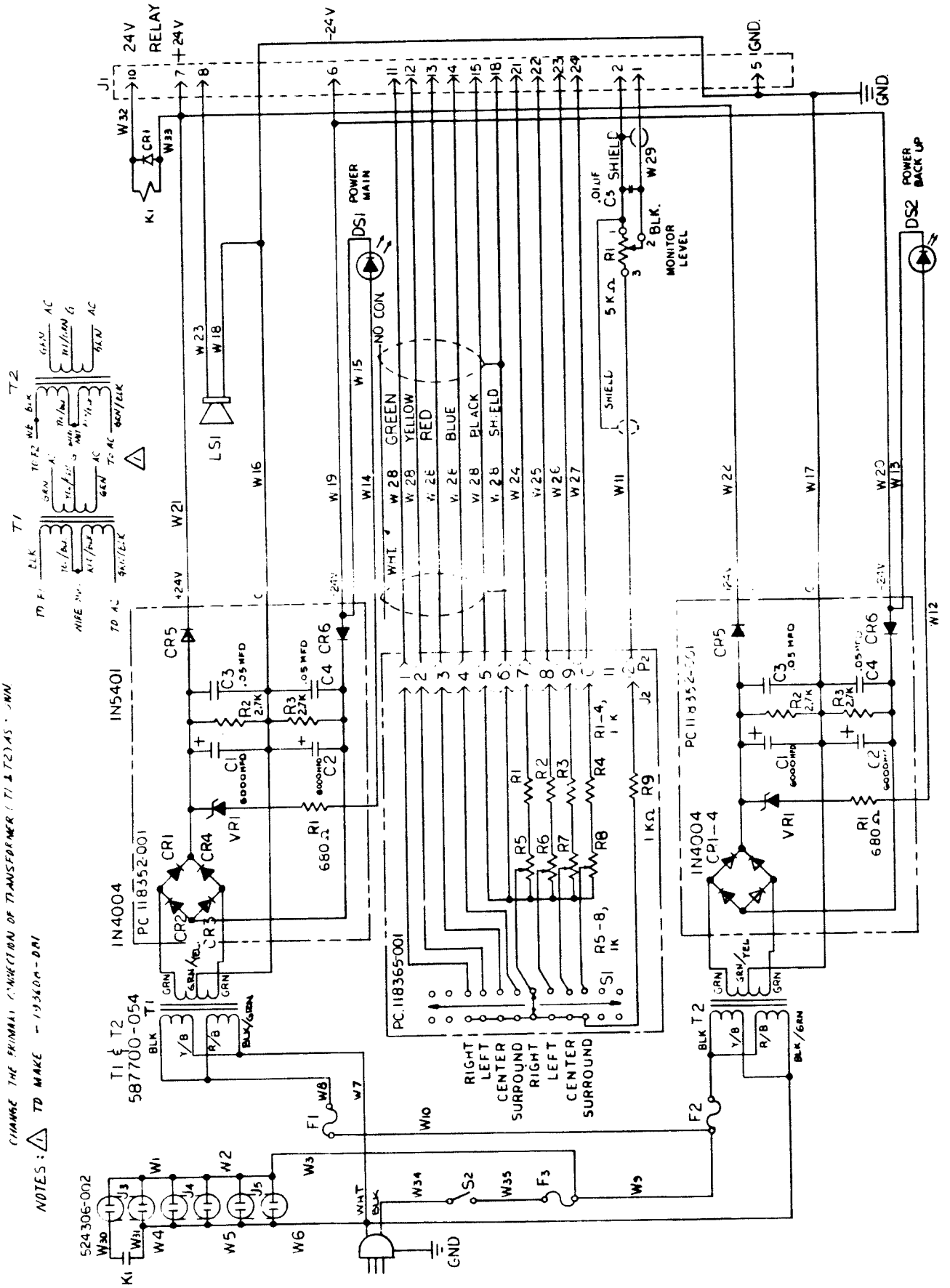


Figure 3-29 Schematic of Power Supply and Monitor
Dwg. No. 503047 · Revision D

Figure 3-29 Schematic of Power Supply and Monitor
Dwg. No. 503047 · Revision D

3.6 DUAL EXCITER LAMP POWER SUPPLY

The Dual Exciter Lamp Power Supply of Figure 3-30 provides a regulated 5-10 volts for powering the Exciter Lamps in the Projectors. The supplies are identical and one supply can back up the other, if one should malfunction.

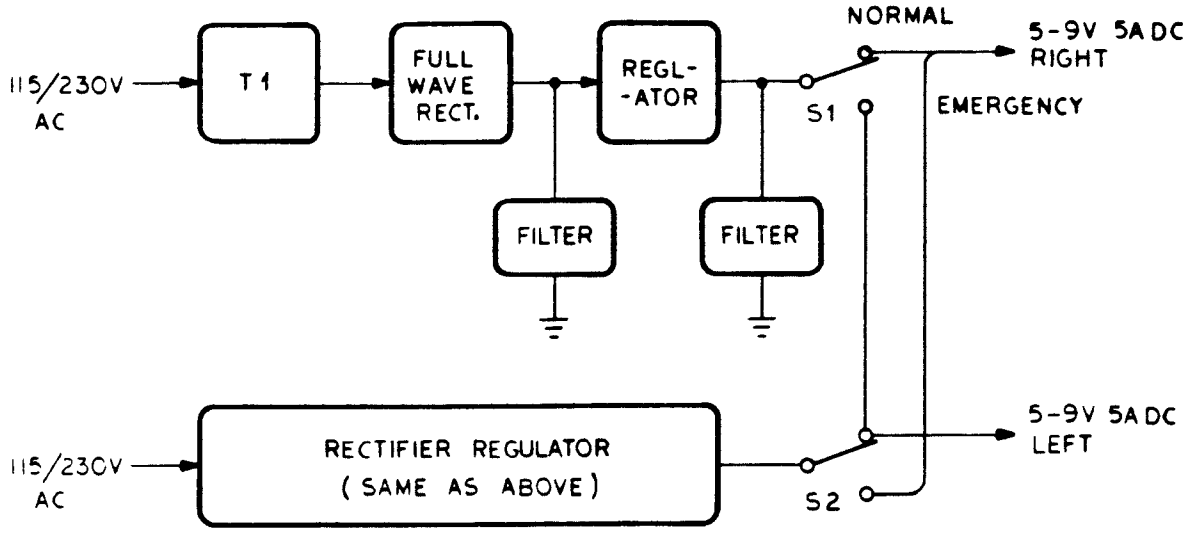


Figure 3-30 Dual Exciter Lamp Power Supply

The input transformer steps the input ac voltage down to ——volts. This voltage is then rectified by a pair of diodes, then regulated by an Integrated Circuit Regulator. After additional filtering, the dc voltage is output to the exciter lamps. An internal pot provides the capability of adjusting the output voltage between 5 and 10 volts. Each supply can supply up to 5 amperes of regulated current.

A switch is provided to switch in the other supply in case one fails. A front panel indicator lights to inform the operator of this situation.

A schematic of the Exciter Lamp Power Supply is included in Figure 3-31.

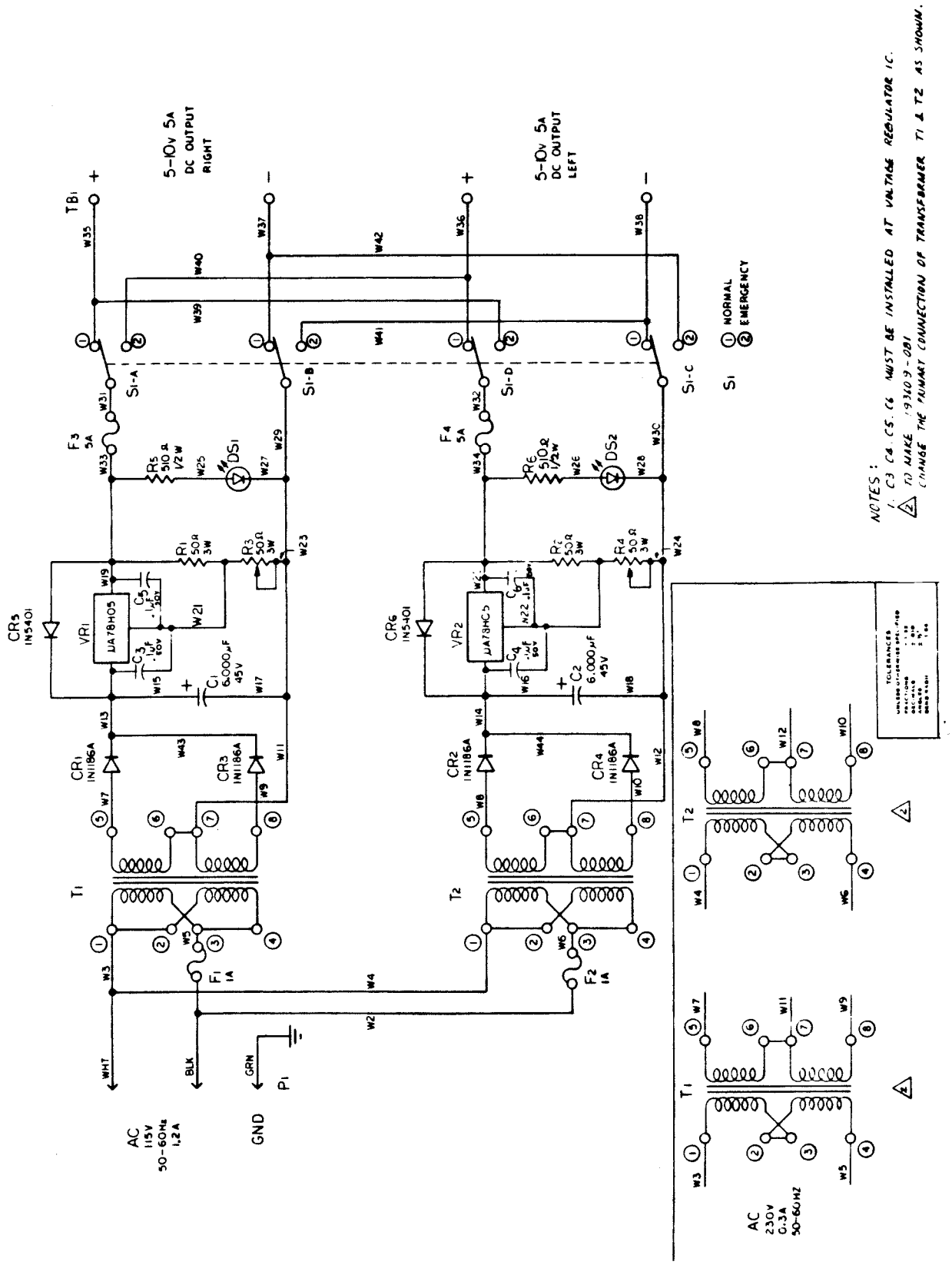
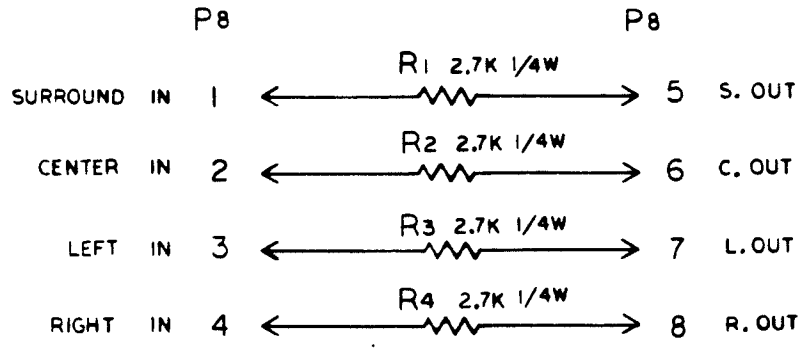


Figure 3-31 Schematic of Dual Power Supply
Dwg. No. 503048 - Revision D

Figure 3-31 Schematic of Dual Power Supply
Dwg. No. 503048 - Revision D

REV	REVISION	DATE	DR	CHK	APPD
A	RELEASED PER ECO 20371	10.29.82	K Y	[illegible]	[illegible]

503073 REV A



8364-001	
NEXT ASSEMBLY	MODEL
USED ON	

TOLERANCES UNLESS NOTED
DECIMAL XXX ±
DECIMAL XX ±
FRACTION ±
ANGULAR ±
HOLE SIZES — 003 + 006
MAT'L SPEC
SCALE — FED IDENT NO 02294

CHRISTIE ELECTRIC CORP.
TORRANCE, CALIFORNIA 90501

ADDITIVE FINISH

SCHEMATIC
JUMPER

DRAWN K Y
DATE 10-29-82
CHECKED [illegible]
APP'D
SUPERSEDES
DWG NO 503073 REV A
SHEET 1 OF 1

Figure 3-32 Schematic of Jumper

CHAPTER 4

PREVENTIVE MAINTENANCE

4.1 INTRODUCTION

This chapter describes the scheduled calibration and maintenance procedures necessary to keep the CHRISTIE Sound-A-Round System functioning in an optimum manner. Because of the reliable nature of this equipment, preventive maintenance is minimal. When the scheduled maintenance and calibration procedures described in this chapter are followed, the CHRISTIE Sound-A-Round Sound System will provide reliable, long-life, trouble-free operation.

4.2 CALIBRATION/ADJUSTMENTS

The Christie Stereo System requires a minimum of adjustments. Properly performed, these adjustments will keep the System functioning at its peak at all times.

An excellent overall check of operation is to run a Dolby Level Loop using a CAT 69 Type Dolby film loop. Check the readings on the Meter Card and on the Power Amplifiers, and compare these with the readings obtained when the System was initially installed. Note these readings in a log so you can compare performance over a period of time.

If the performance deteriorates beyond certain limits, the System gain can be increased by increasing the gain of the PreAmps or Power Amplifiers until the desired sound level is achieved.

If the performance has drastically changed, it may be necessary to replace the Exciter Lamps in the projectors. Follow the manufacturer's directions if this is necessary and perform the System calibration procedure described in Paragraph 4.7.

The mechanical cell assembly in the projectors should not need any adjustment. If a misalignment or movement is suspected, follow the procedures outlined in Chapter 8, INSTALLATION.

No other controls should need adjustment since they are installation adjustments which require special test equipment. (See Chapter 8 of this manual).

4.3 PERIODIC INSPECTION AND MAINTENANCE

The Periodic Maintenance and Inspection listed in Table 4-1 establishes the procedures and frequency interval for performing the basic inspection and preventive maintenance listed.

Table 4-1 Periodic Inspection and Maintenance

Item	Inspection Period	Procedure
Cabinets	6 months	Inspect cabinets, knobs, controls, switches. Look for loose or missing screws, broken or burned components, peeled insulation, etc.

4.4 CLEANING

It is important to keep the sound head optics clean so that the signals delivered to the stereo system are also clean. Clean the projector's soundhead optics, and use only the cleaning materials specified by the manufacturer. Be very careful not to touch the solar cells because a finger print or dirt can seriously affect the performance of these elements.

Avoid accumulation of dirt, dust, moisture and other foreign matter on or within the cabinets. Clean the cabinets monthly, wiping away any accumulated moisture, or dirt with a cloth. Remove any heavy dirt deposits with a cleaning solvent.

4.5 LUBRICATION

The only item requiring lubrication in the Christie System is the Tape Deck. Follow the manufacturer's instructions for lubricating the Tape Deck and be careful to not spill any of the lubricant on any of the components in the Christie System.

4.6 LOGS/RECORDS

Keep a log of the measurements made during the monthly checks with the Dolby Test Loop. Note the date and the readings taken each time. This will help you spot any sudden change in performance and to circumvent a possible failure. Also, the log will tell you when to make changes in the System gain.

4.7 CHANGING AN EXCITER LAMP

Changing an Exciter Lamp requires a simple calibration procedure of the Christie System to ensure proper performance. A Dolby Cat. No. 69 test film is required.

1. After changing the lamp, thread the Dolby Cat. No. 69 test film loop on the projector to play the Dolby tone tracks. The emulsion side of the film must be away from the screen.
2. Turn on the Christie System and the projector. With the test film running, adjust the left and right gain controls on the Preamp card (for the projector under test), until the meters located on the Meter Card read on the Dolby level dot (Eighth LED).
3. The procedure should be repeated for the other projector to be sure it is calibrated properly.

CHAPTER 5

TROUBLESHOOTING

5.1 INTRODUCTION

This chapter contains general Troubleshooting guidelines, plus a Protective Device Index which lists all of the circuit breakers and fuses which monitor and protect the CHRISTIE Sound-A-Round Sound System from damage during operation.

In addition, Troubleshooting Procedures provide detailed fault symptoms and procedures to isolate faults to a specific component(s) or subassembly. If the system does not operate properly, turn it OFF and refer to the Troubleshooting procedures covered in this chapter.

When troubleshooting, observe the following general guidelines:

a. Keep complete notes of all steps and an accurate log of adjustments made so that a corrective procedure may be reversed. Comprehensive notes and a log make it possible to relate progress to others and facilitate communications regarding repair procedures.

b. When detaching wires from components, always mark wires with a piece of tape, a tag, or other suitable identification device, showing the terminal from which wire was removed. Tag each wire to insure correct rewiring.

c. When replacing defective components, make secure solder joints and tight connections because a poor solder joint or loose connection are two of the most difficult faults to locate.

d. For voltage and current measurements, use a digital voltmeter if possible, alternatively use a transistorized meter.

CAUTION
HIGH VOLTAGE IS USED IN THIS EQUIPMENT. USE CARE WHEN SERVICING THE COMPONENTS TO PREVENT INJURY BY ACCIDENTAL CONTACT WITH POWER POINTS.

5.2 PROTECTIVE DEVICE INDEX

A list of the protective devices provided is included in Table 5-1.

Table 5-1 Protective Device Index

Location	Circuit Desig.	Rating		Part Designation
		Voltage	Current	
Exciter Lamp P.S.	F1, F2	250V	1 Amp	
Exciter Lamp	F3, F4		5 Amp	
P.S. & Monitor	F1, F2		1 Amp	
			25 Amp	Circuit Breaker
Power Amplifier	S1, S2			Thermal switch
Power Amplifier	CB1			Circuit Breaker
Power Amplifier	F1		1.5 Amp	Fuse, 3AG

5.3 TROUBLESHOOTING GUIDELINES

Troubleshooting, as covered in this chapter, deals with faults which still allow the System to operate in the Emergency Bypass mode, or which have caused the System to not function properly.

The following items are considered as replaceable items and are not to be repaired, except for obvious, visible faults such as broken wires.

These assemblies are to be returned to Christie for repair/replacement if they malfunction:

1. All printed circuit boards
2. Dual Power Amplifier Chassis
3. Power Supply Monitor Chassis
4. Dual Exciter Lamp Power Supply

5.4 GENERAL TROUBLESHOOTING

Troubleshooting is broken down into three levels:

LEVEL ONE — OBSERVE
LEVEL TWO — MEASURE

Level One troubleshooting is a quick-fix type which consists of merely observing the status of indicators and switches. Level Two consists of simple voltage and resistance measurements.

Because of the serial nature of the System and the built-in meters, faults can be located quickly if certain fundamental procedures are observed.

The block diagram of Figure 5-1 illustrates the serial nature of the signal path and indicates some of the key visual.

5.5 LEVEL ONE TROUBLESHOOTING

CAUTION
BEFORE STARTING ANY TROUBLESHOOTING PROCEDURES, MAKE SURE POWER IS APPLIED TO THE UNIT, THAT ALL SWITCHES ARE ON, AND THAT ALL FUSES ARE GOOD.

Step 1 — For Level One troubleshooting, turn the System ON but do not run a film for the first few tests. Observe that at least one LED indicator is lit on the Power Supply and Monitor Chassis. On the Dual Exciter Power Supply, the switch should be in the NORMAL position. Both switches should be ON on the Power Amplifier chassis as indicated by the first light on the LED meters being lit.

Step 2 — First, install the Dolby Test Loop in the projector.

a. Check the Left Meter Card, the first eight LEDs should be lit. If not, the fault is to the left of the Meter Card.

b. Check the Power Amplifier LED Indicators for the Left Channel. They should present a normal indication.

c. With the Monitor Speaker, check to see that the Left and Right channels are carrying the Dolby frequency at both the input and output of the Amplifier.

d. Verify that the Left Speaker is outputting the Dolby sound, a frequency of around 400 Hertz.

e. Turn the Left Dolby oscillator OFF and turn ON the Right Dolby oscillator and repeat Steps a thru d above.

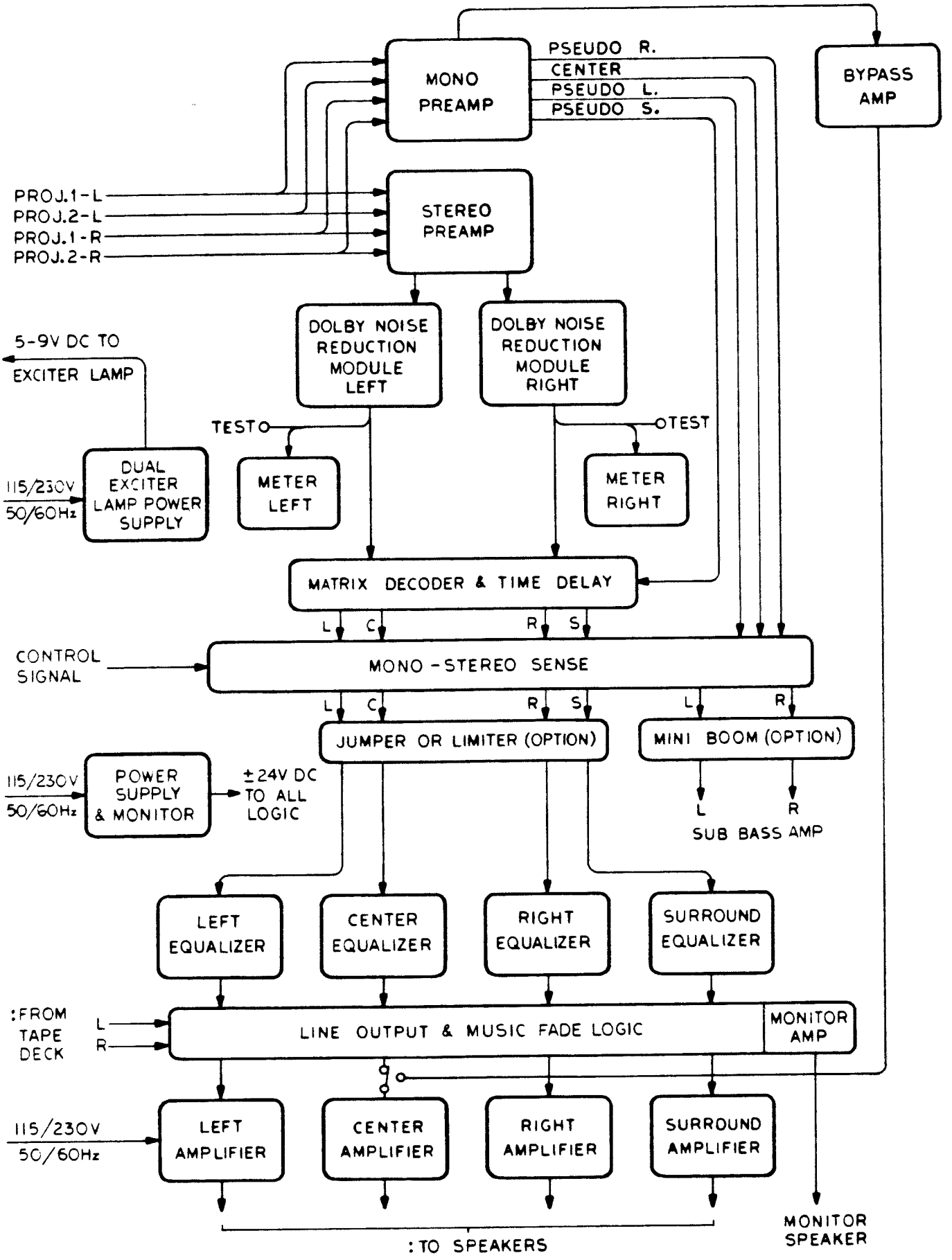


Figure 5-1 Key Test Points

Step 3. Thread a Dolby Test Loop into the projector, turn the projector ON, then repeat Steps 1 and 2 above for all four channels, observing the indications on all four meters on the Power Amplifiers.

Level One Troubleshooting is a technique for isolating a fault to a subassembly, or a general area. Proceed to Level Two Troubleshooting to further isolate a fault if required.

5.6 LEVEL TWO TROUBLESHOOTING

For Level Two Troubleshooting, voltage and resistance measurements are to be made. For all voltage measurements, make sure power is ON to the unit under test. For all resistance measurements, make sure the power is OFF.

With the Dolby Test loop running, measure the voltages indicated in Table 5-2. Generally, if the voltage is correct, the fault will lie to the right (See Figure 5-1) of the point of measurement. If the fault is outside of the specified limits, the fault lies to the left of the measurement point.

Table 5-2 Key Measurements

Chassis/ Subassembly	Point of Measurement	Voltage Range

(Key test points to be listed along with keys in Figure 5-1 to show the location of these test points.)

By using this measurement technique, you should eventually reach a component or printed circuit board or a subassembly where the input voltage is correct, but the output voltage is incorrect. At this point, you should have located the fault.

Normally you can test your solution by replacing the fault component, circuit board or subassembly by substituting a good item in its place.

If your troubleshooting isolates the fault down to a single suspect component, refer to the component troubleshooting procedures of Paragraph 5.7.

5.7 COMPONENT TESTING PROCEDURES

When a fault has been narrowed down to one or more components, or subassemblies, use the procedures described below. For these procedures, when making resistance measurements, it is usually necessary to remove one or more of the connecting leads to make sure the resistance of alternate paths is not being measured.

a. Switches, fuses, connections, soldered joints

Ohmmeter check — A closed switch, a good connection or a good fuse has a resistance of less than one ohm. If faulty, their resistance is very high, probably greater than one megohm.

Voltmeter check — The voltage drop across a closed switch, good connection or good fuse is near zero. This voltage will often be as high as the voltage applied to the circuit.

b. Capacitor check — For a rough check of a capacitor, place one probe of a Simpson 260 Type ohmmeter (use a medium resistance scale) on one terminal and momentarily touch the other terminal with the other. The meter should deflect momentarily to a low resistance, then deflect to a near full scale resistance and remain there once the capacitor is charged. For small capacitors, e.g., .01 mfd, the deflection is small and instantaneous. For large capacitors, e.g. 1 mfd and larger, the deflection is generally high and will take up to a few seconds to reach a high resistance on the scale as the capacitor is charged.

c. Resistor — Check the resistance with one lead disconnected from the resistor, on the appropriate resistance scale so the reading is about half scale.

d. Power Transformer — Power up the unit and check the primary and secondary voltage with a voltmeter. If the unit continues to blow fuses, a quick check of continuity can be made with an ohmmeter, with one terminal of each winding disconnected from the ciruit. The resistance reading should be low, less than 1 ohm.

e. Diode — Disconnect one lead and measure the forward and reverse resistance of the diode on the RX1 scale. The reverse resistance should be more than 100 times greater than the forward resistance.

f. Transistor — Disconnect the Base terminal and measure the Emitter-to-Base resistance with an ohmmeter, it should be low. Next, measure the Base-to-Collector resistance, it should be high.

5.8 WIRING DIAGRAM

To help troubleshoot, a wiring diagram of the Christie Sound-A-Round Sound System is included as Figure 5-2.

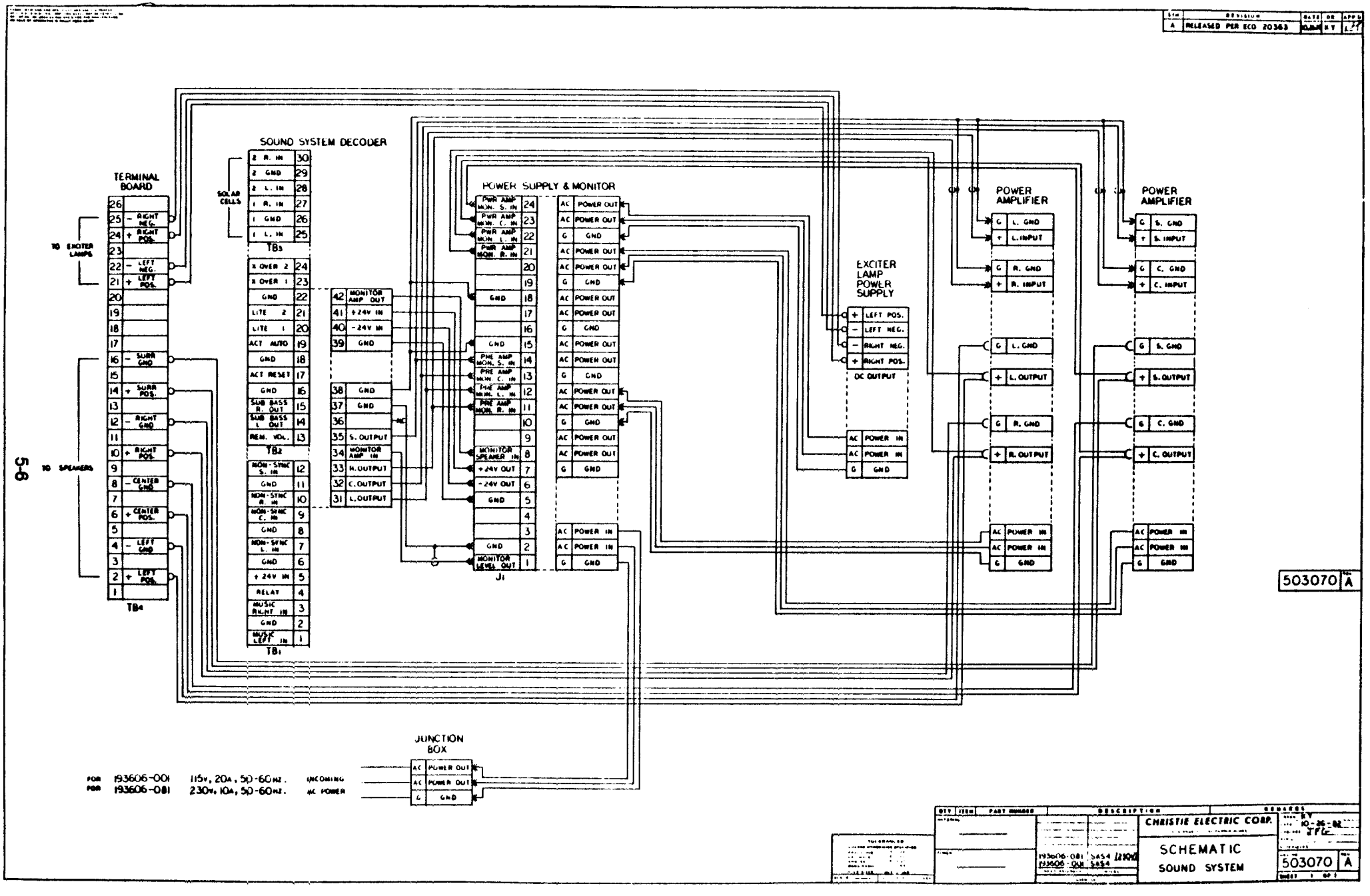


Figure 5-2 Wiring Diagram of Christie Sound-A-Round System
Dwg. No. 503070 - Revision A

CHAPTER 6

CORRECTIVE MAINTENANCE

6.1 INTRODUCTION

This chapter assumes that a fault has been isolated to one or more replacement components or subassemblies and describes general disassembly/assembly procedures required to obtain access to various subassemblies and components for troubleshooting and repair to return the Christie Sound-A-Round Sound System to full service.

These procedures are broken down into the following basic categories:

- Replacing Printed Circuit Boards in the Decoder
- Removing and replacing major subassemblies, such as the Power Amplifiers
- Replacing basic components such as switches, pots, transformers, capacitors, etc.
- Replacing transistors and diodes

6.2 REPLACING PRINTED CIRCUIT BOARDS

First, be sure power to the entire Christie System is OFF before removing or reinserting any of the printed circuit boards.

Then, remove the faulty printed circuit board carefully by firmly grasping the card edge with the fingers, and pulling out with a steady but gentle pull. Once the board is removed, inspect it for obvious damage, such as a burned or discolored component, broken leads, etc. Make a note of any obvious damage and also make a note of the symptoms which led you to suspect the board was faulty.

Then, replace the board with another of the same type in the empty slot. Make sure the board is firmly plugged into its connector, then resume operation. Return the faulty board to Christie for repair/replacement. Do not attempt to repair the board, such action will void Christie's warranty.

6.3 REMOVING/REPLACING MAJOR SUBASSEMBLIES

Removal and replacement of one of the subassemblies is a major operation, so be certain the unit is faulty before you start to remove it.

First of all, make sure ALL power is OFF to the rack. Prior to any removal or disconnecting, make a sketch of the cables leading to the subassembly, and mark the cables with tape, such as masking tape, recording on the tape, the pin, terminal board, connector, etc., the cables and wires were removed from.

Remove the screws holding the major subassembly to the rack or chassis, saving all of the mounting hardware in a small container. Then, double check to make sure that all of the wires and cables have been disconnected and carefully remove the unit from its mounting.

Next, place the spare known good unit back in the empty slot and reconnect the cables, connectors, etc. Doublecheck the connections by consulting the wiring diagram in Figure 5-2 before turning power on.

Turn the power back ON and check the operation of the unit with a film or a Dolby test loop.

Return the faulty unit to Christie for repair and/or replacement. Do not attempt to repair the unit or Christie's warranty will be voided.

CAUTION
WHEN MORE THAN ONE WIRE IS REMOVED FROM A COMPONENT TAG THE WIRES TO CLEARLY IDENTIFY THEIR TERMINATION POINT. WHEN A MAJOR COMPONENT IS TO BE REPLACED, MAKE A SKETCH OF THAT COMPONENT AS MOUNTED AND THE CONNECTIONS EXISTING BEFORE YOU DO ANY DISASSEMBLY, TO ENSURE PROPER REPLACEMENT.

6.4 REPLACING BASIC COMPONENTS

Before replacing any components such as a switch, pot, resistor, capacitor, etc., make sure the correct part is available for replacement.

For replacement of all soldered components, connections can be disconnected using a soldering iron of no more than 100 watts. Use a clean, hot iron on each connection for a minimum of time. However, make sure you obtain good soldered connections because a cold solder joint is one of the most difficult faults to locate.

After replacing a component, and before turning the unit back ON, double check all connections, mounting, etc., to make sure the parts are installed properly, then turn the unit back ON and resume operation.

6.5 REPLACING DIODES, TRANSISTORS

When replacing diodes and transistors, take special precautions to make sure the component is not damaged in handling or mounting. Make a sketch to follow in replacing the component and its leads.

Before unsoldering any diodes or transistors, attach a heatsink between the joint to be unsoldered and the component to be replaced, to conduct the heat away. A metal-clamp, long-nose pliers, an alligator clip or a similar type of metal contact can serve as a heatsink.

Use a clean, hot iron and unsolder quickly, pulling the connections loose from the flowing solder, using steady pull with a long-nose pliers. Then, move the heatsink to the next connection to be unsoldered and repeat the procedure.

Replace the component, trimming the leads if required. Again, use a heatsink and a hot, clean soldering iron to insure reliable, long-lasting repair. Check the components and its connections after the joints have cooled before turning the unit back ON. Clean flux deposit with flux remover or "Energene" cleaning fluid to prevent future corrosion.

CHAPTER 7

PARTS LISTS

7.1 INTRODUCTION

This chapter contains replacement parts lists for the CHRISTIE Sound-A-Round Sound System. Replacement parts may be ordered from CHRISTIE ELECTRIC using the information given in the Parts List of Table 7-1. When ordering parts, list the circuit designation given in the table, along with the full part number and description. Be sure to also include the model number and serial number of the unit.

To order parts, contact your local dealer, or, to find out the dealer nearest you, contact:

CHRISTIE ELECTRIC CORPORATION
20655 Manhattan Place
Torrance, CA 90501
(213) 320-0809 : TWX 910-349-6260

7.2 PARTS LISTS

The parts lists are divided and arranged by major units and their respective subassemblies, listed in numerical sequence.

The parts list contain the following:

a. Reference designators, where applicable, are listed as they appear on the schematics, wiring diagrams etc. (e.g. C1, R34, etc.)
b. Name and Description of item, plus descriptive data to identify part.
c. Part number
d. Assembly or Subassembly name

Table 7-1

Ref. Desig.	Name/Description	Part No.	Assembly/ Subassembly
	Power Amp 100 w/ch	193548-001	Power Amp.
	PC Assy-Back Plane	118351-001	Decoder
	Stereo Preamps	118353-001	Decoder
	Stereo Mono Preamp	118354-001	Decoder
	Meter Card Assy	118356-001	Decoder
	PC Assy, Dolby	599000-156	Decoder
	Matrix Time Delay	118357-001	Decoder
	Stereo Equalizer	118358-001	Decoder
	Output and Monitor	118361-001	Decoder
	Mono Stereo Switch	118363-001	Decoder
	PC Assy-Jumper	118364-001	Decoder
	PC Board Switch	118366-001	Decoder

Table 7-1 (cont'd)			
Ref. Desig.	**Name/Description**	**Part No.**	**Assembly/ Subassembly**
	Decoder Out Cable	193627-001	Decoder
	P/S Card Assy	118352-001	Power Supply/Monitor
S1	PC Assy, Slide Switch	118365-001	Power Supply/Monitor
	Grill-Speaker	1932621-001	Power Supply/Monitor
	LED Green	541140-015	Power Supply/Monitor
R1	Pot Slide 5K, 0.5W	565053-104	Power Supply/Monitor
S2	Switch, Toggle, SPST	578711-017	Power Supply/Monitor
T1, T2	Xfmr 35 VCT, 15 Amp	587700-054	Power Supply/Monitor
LS1	Speaker, 5"OD, 18W 4-8 Ohms	598900-104	Power Supply/Monitor
	Dual Exciter P.S.	193609-001	Dual Exc. P.S.
	Transistor	518600-023	Dual Exc. P.S.
C1, C2	Cap, 50V, 6000MF	530106-305	Dual Exc. P.S.
C3, C4	Cap 0.1 MF, 100V	530601-616	Dual Exc. P.S.
CR1-4	Diode 1N1186A	541103-017	Dual Exc. P.S.
DS1, 2	LED Green	541-140-015	Dual Exc. P.S.
CR5, 6	Diode, Silicon	541141-010	Dual Exc. P.S.
VR1, 2	Reg. 5V 5A MA78H05	541210-033	Dual Exc. P.S.
R1, R2	Res. 50 Ohm, 3W, 5%	555051-306	Dual Exc. P.S.
R3, R4	Pot. 50 Ohm, 3W	555051-302	Dual Exc. P.S.
S1	Switch, Toggle, 4PDT	578742-003	Dual Exc. P.S.
T1, T2	Xfmr-Pri, 115V, 230V	587700-055	Dual Exc. P.S.

7.3 RECOMMENDED SPARE PARTS

Spare parts recommended to be stocked for one year's operation are listed in Table 7-2. (Alternatively, recommended spare parts can be designated on the individual parts list by an asterisk.)

CHAPTER 8

INSTALLATION

1.1 INTRODUCTION

The CHRISTIE Sound-A-Round Sound System is shipped from the factory with all of the equipment mounted in the rack and all interconnections made. After being installed in its selected area, the system can be hooked up for initial checkout and calibration.

8.2 SITE REQUIREMENTS-PHYSICAL

The Christie System should be mounted in an area at least two feet (0.6 meters) away from a wall or corner. Access is required to the rear of the unit not only for initial cable inter-connections with the power, projector and speaker systems, but also to provide access to switches and fuses which are mounted on the rear of the unit.

The front of the unit should be near the projectors so that the operator can observe the front panels of the unit to check the projector operation.

8.3 SITE REQUIREMENTS-ELECTRICAL

Depending on the specific configuration ordered, the Christie System requires single phase, primary power of either 110-130 volts at 30 Amperes, 50/60 Hertz, or 220-260 Volts at 15 Amperes, 50/60 Hertz. Standard EIA or conduit box hookup can be used.

The unit comes from the factory wired either for a nominal 115 or 230 volts. If the unit must be reconnected for a voltage other than the hookup delivered, contact your Christie representative for assistance.

Output from the projector sound-head to the Christie unit should use twisted, shielded-pair wiring with a conduit termination to the terminal board.

Signal output to the speakers should be from the five way binding posts. Twin-lead or electrical conduit wire can be used to connect to the speakers. Selecting the size of the speaker cables is covered in Section 8-9. Use #12 or #14 wires twisted in pairs for each speaker.

8.4 TOOLS/MATERIALS REQUIRED FOR INSTALLATION

Listed in Table 8-1 are special tools/test equipment/materials recommended to be used in the initial installation of the Christie Sound-A-Round Sound System.

8.5 SPECIAL COOLING, VENTING REQUIREMENTS

The Christie Sound-A-Round System is cooled by natural convection currents flowing past the components, absorbing the heat and carrying it away. If the air flow is impeded, or if the ambient air temperature is too high, the resulting temperature rise will cause the equipment to malfunction.

Be sure that the rack of equipment is installed at least two feet away from a wall or corner and that air can flow freely from the bottom of the rack to the top.

8.6 EQUIPMENT INSTALLATION, MOUNTING

Refer to Figure 8-1 for a system wiring diagram and Figure 8-2 for a drawing of the mother board, or rear panel of the Decoder card rack to check the wiring and to locate the various test points and switches.

If you are using a single projector, run a short piece of bare wire from the Projector Changeover Number 1 terminal (TB2, Pin 23) to one of the ground terminals (see Figure 8-2). This will assure that the unit is always in the Projector Number 1 position and can never accidentally be triggered over to Projector Number 2.

If you are using two projectors, changeover boxes, with momentary contact switches must be provided. Also, two LEDs should be mounted in the boxes to indicate which projector has been selected. Figure 8-2 diagrams the proper connections for this.

When the Christie System is initially turned ON at the beginning of each day, the internal logic will automatically select Projector Number 1.

A single-pole, single-throw toggle switch must be remotely located to actuate the music-fade-in and kill the sound from the projector(s). Figure 8-2 diagrams the necessary connections. When the switch is closed, the music will fade in and the projector in use will fade out. This switch also resets the Decoder from the Stereo mode back to the Mono mode.

The Christie Decoder has remote level control capability with a "Remote-Local" Selector switch on the rear of the Decoder. For remote operation, a 5 Kohm linear-taper control has to be connected from TB-2, Pins 13 and 16. Regular 18 to 22 gauge intercom wire can be used and neither shielding or conduit is required.

If the Auto Sense feature is not desired, or is subject to false triggering, the AUTO SENSE DEFEAT switch on the rear of the Decoder (see Figure 8-2) should be moved to the DEFEAT position. Remote triggering of Mono to Stereo operation can be accomplished without the Auto Sense. A momentary switch is connected to TB2, between the Reset (Pin 17) terminal and the Auto terminal (Pin 19) on the rear barrier strip and the System will switch from Mono to Stereo, provided that the Automatic Mode has been selected on the front panel.

The Tape Deck outputs, or Phono outputs can be connected to the unit through the Left (Pin 1) and Right (Pin 3) Music Input terminals on TB1. This is an unbalanced input and the center terminal (Pin 3) is the ground for the shield.

If you wish to Start and Stop the tape machine, an early start and delayed turnoff circuit will close an external relay so that AC to the machine or remote start can be actuated. There is no relay in the Decoder. A 24 volt DC relay should be connected to the relay terminal (Pin 4 of TB1) and the 24 volt terminal (Pin 5 of TB1).

CAUTION
IT IS MANDATORY THAT THE 24 VOLT TERMINAL NOT BE SHORTED TO GROUND AT ANY TIME. IT CARRIES THE FULL POWER OF THE SUPPLY BUS.

The non-sync inputs permit external magnetic preamplifiers to be routed through the System to the auditorium speakers. This circuit passes through the room Equalizers and is selected by placing the Mode Selector switch on the Decoder Panel to the MAGNETIC position.

The Left and Right channel from each solar cell are brought into the solar cell input terminal strip (TB3) using shielded cable. It is important that the shield be grounded at the terminal input and nowhere else. With Kelmar solar cells, the green lead is the Right channel and the red lead is the Left channel.

Prior to applying line power to the Christie System, make sure that the proper voltage is applied to the system and that all of the individual ON/OFF switches on the individual chassis are in the ON position.

Visually check all cables and connections to make sure they are secure. Make certain that good fuses are in all of the fuse holders.

Check to make sure that all of the printed circuit boards are firmly seated in their connectors. A jumper card is mandatory in the four channel Limiter card position if the Limiter is not used. A jumper is not necessary in the Miniboom position but may be utilized for appearance. Jumper cards are the same for each position. Dolby Noise Reduction cards have been keyed so they cannot be inserted upside down. In early versions of the Christie System, the remaining cards may not have been keyed, so be sure they are inserted in the card rack with the components to the right, and the foil to the left.

Connect the auditorium speakers and Surround speakers to the proper amplifiers. Turn the Master Volume control on the Decoder Panel to the mid-position. Depress the Stereo button on the Decoder panel. Set the Monitor volume control at near minimum and the Monitor Selector switch to the Center Channel Decode position. Connect a dual channel oscilloscope to the meter test pins on the back of the mother board above the selector switches. Ground the oscilloscope at the ground terminals.

Table 8-1 Equipment/Tools/Materials Recommended for Initial Installation	
ITEM	**SUGGESTED TYPE(S)**
Standard tool kit, including a small bladed screwdriveer or tuning wand for the controls.	
1 Set of Dolby Test Film Loops	Dolby Cat. Nos. 69, 97, 151
Buzz Track Film	SMPTE Type P35BT/PH22.68
Real Time Analyzer	Abacus ARTA 8000, Altec 8050A, Crown RTA-2, Invonics 500, Ivie IE-30A
Microphone	Bruel and Kjaer Type 2619 with 4133 1/2 inch free field capsule or any on midirectional microphone, such as an AKG C451 with a CK-2 capsule
Pink Noise Generator Reel of Conventional Mono Academy Film Reel of Dolby Encoded Stereo Optical Film Dual Trace Oscilloscope	Dolby Cat. No. 85
Sound Level Meter, capable of 'C' weighting (flat response)	Radio Shack Cat. No. 42-3019

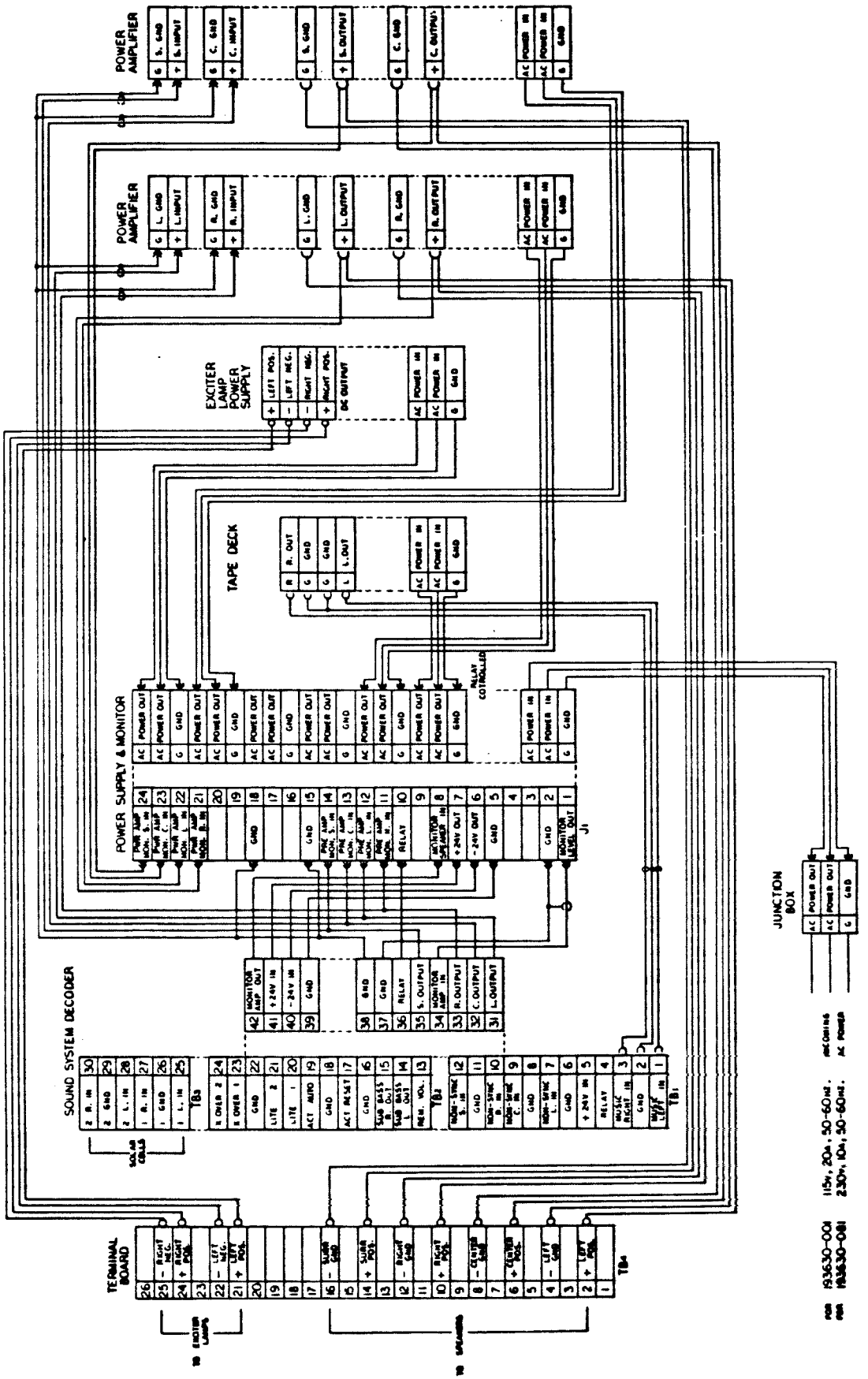


Figure 8-1 Wiring Diagram
Dwg. No. 503071 · Revision A

Figure 8-1 Wiring Diagram
Dwg. No. 503071 · Revision A

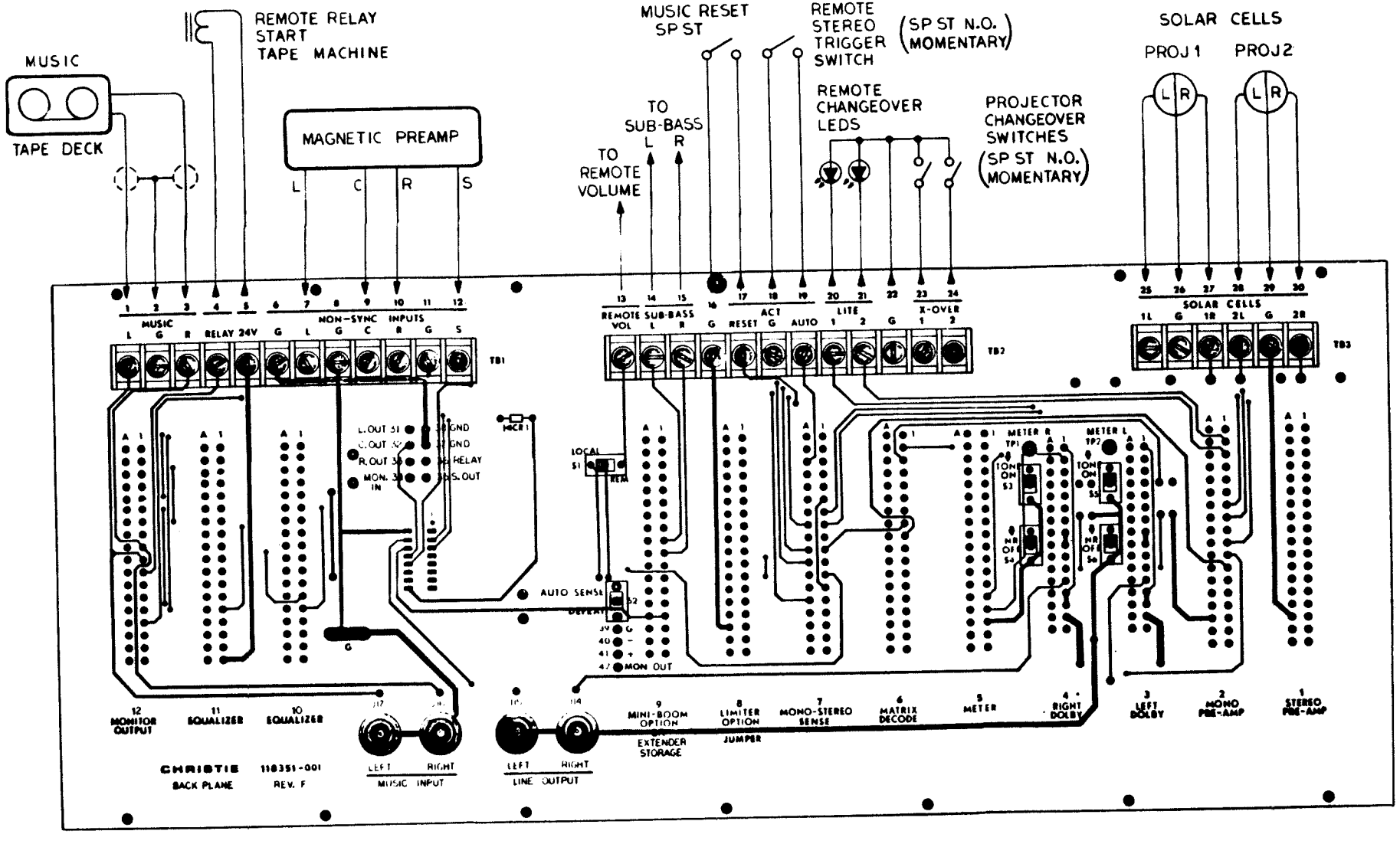


Figure 8-2 Mother Board — Rear View

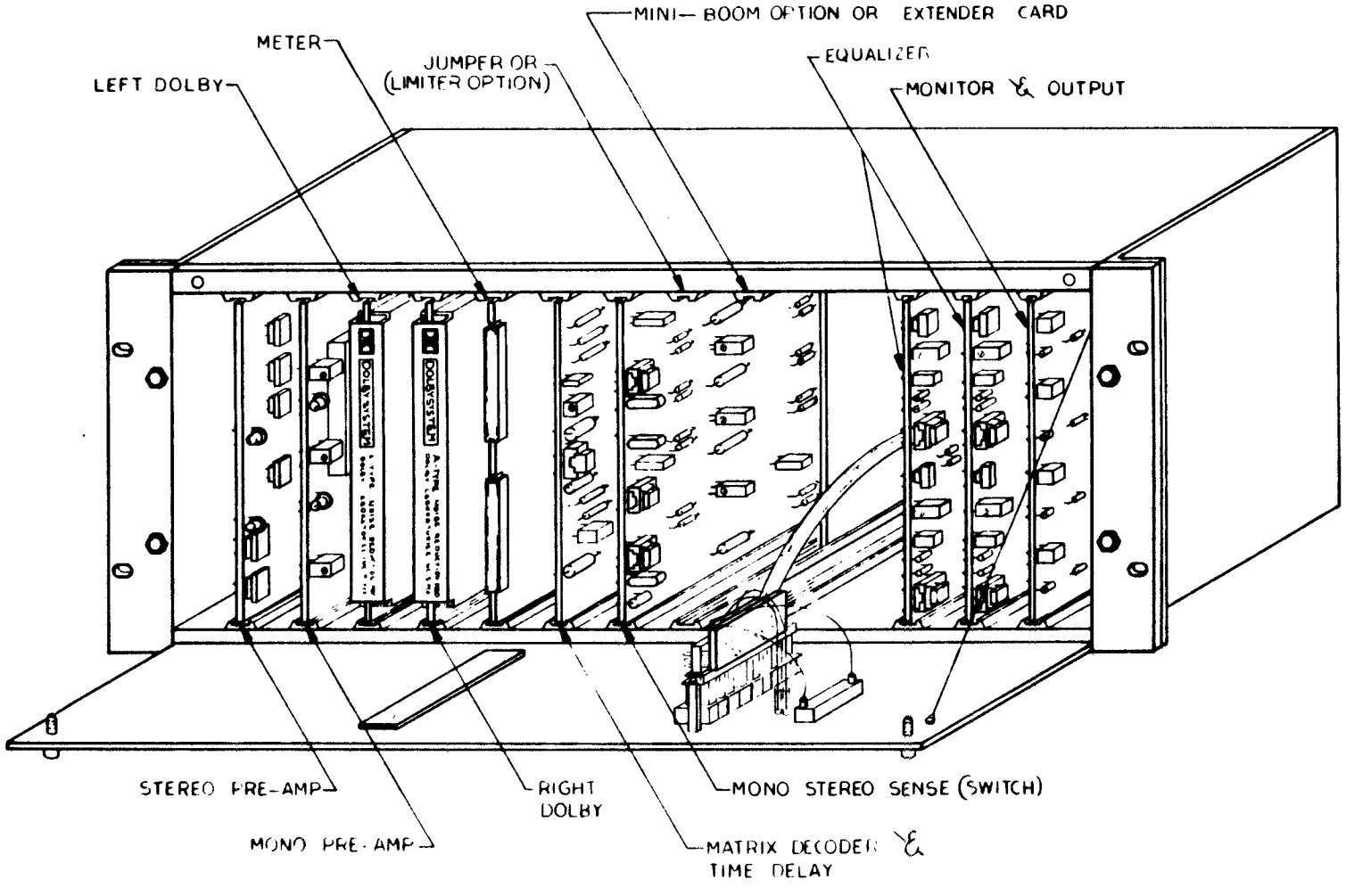


Figure 8-3 PC Cards and Their Location

8.7 SUMMARY OF ADJUSTMENTS REQUIRED

The basic adjustments required are summarized below. The detailed procedures for making these adjustments are included in Paragraph 8.8 below. Figure 8-3 illustrates the PC Cards used, and their location in the card cage.

STEREO PREAMPLIFIER - This card contains four channels, and there are two adjustments for each channel. The Level controls, R-1, 3, 5, & 7, raise the solar cell output of the four amplifiers to the proper amplification to cause the Dolby Noise Reduction cards to track within their proper range. The High Frequency controls, R-2, 4, 6 & 8, correct for slit loss through the optical sound lens and extend the solar cell responses for high fidelity reproduction. In a two projector booth, the Left and Right channel of each projector must be trimmed for proper operation.

MONO PREAMPLIFIER - This card sums the Left and Right channels from each solar cell to create a combined monaural signal, then preamplifies the signal independently of the Dolby card and outputs to the Electronic Switch and Auto Sense card. The Mono PreAmp card also contains the circuits necessary to generate the pseudo stereo sound from the Mono track and outputs to the Electronic Switch and Auto Sense card. Levels should be set with a film loop to correct for any difference in sensitivity between Projector One and Projector Two. The Emergency Bypass Amplifier is also on this card and its gain should be adjusted for a comfortable level in the auditorium when the Mode switch on the Decoder front panel is in the BYPASS position.

METER CARD - This indicator card has no controls but is used for initial calibration and periodic checks. It senses the level from the Left and Right Dolby cards and allows the operator to observe that signals are present in both channels. When a Mono film is being run, both indicators will show the same instantaneous level. Each LED which illuminates indicates a step of 1.5 dB change in signal magnitude. When the System is properly adjusted, a Dolby Reference film loop will cause the bottom eight LED's to illuminate.

MATRIX DECODER AND TIME DELAY - This card separates the Left, Center, Right, and Surround information from the two-channel recording. It also delays the sound on the rear channel to minimize crosstalk from the front and to avoid an echo in the auditorium. DO NOT CHANGE ANY SETTINGS ON THIS CARD, THEY ARE FACTORY SET FOR OPTIMUM OPERATION. The only adjustment required in this card is to set the amount of the Surround channel time delay desired with the mini DIP switches.

ELECTRONIC SWITCH AND AUTO SENSE - All audio switching is done automatically. The Mode switch on the front panel of the Decoder tells the card which source is desired. The card also carries the Mono to Stereo automatic switch logic. The small pot at the rear of the card sets the sensitivity of this function. Too much sensitivity will cause the circuit to trigger into Stereo on poorly recorded Monaural soundtracks. Too little sensitivity will cause the circuti to ignore the Stereo signal. It is highly recommended that a "snipe" be spliced before the feature film whenever the automatic mode operation is selected on the front panel. This loud passage of stereo program material will trigger the unit for positive identification of true stereo tracks. The Emergency Bypass Monaural signal does not go through the Electronic Switch card.

JUMPER - This card is mandatory in the Limiter option position. Without the Jumper card, no signals could pass beyond this point. Signals will continue through the connector to the next stage.

MINIBOOM OPTION - This is a bass expander and is used with a supplemental amplifier and separate woofers behind the screen. This two-channel card is effective only where additional equipment has been added. A pot for each channel selects the proper level in the auditorium of the sub-bass, and a switch is set for the amplifier rating being used.

ROOM EQUALIZER - Two cards are required in this System. Each card has two channels. Card #11 has the Surround and Center channel equalization. The cards are interchangeable. Bass and treble controls set the broad band general equalization and one octave cut filters allow the installer to smooth the response of each speaker in the auditorium.

LINE OUTPUT CARD AND MUSIC FADE LOGIC - Output levels from each channel are adjusted and buffered by this card. The ten turn pots at the front of the card are labeled for each channel. They have been preset at the factory for two volts output from the Decoder. Music level trim adjustments are set with the two minipots in the center of the card. Although there are only two channels coming from the tape deck, a third Center channel is created internally to fill in the

"hole in the middle" that can occur because of the width of a giant screen. This Line Output Card also contains a two watt Monitor Amplifier.

8.8 INITIAL TURNON AND ADJUSTMENTS

1. Turn the power ON to the System either by activating the ON/OFF toggle switch on the rear of the Power Supply and Monitor Chassis, or by closing the input circuit breaker supplying power to the System.
2. Before proceeding further, make sure that:
   a. The sound lenses are new and clean, free of scratches.
   b. Both azimuth and focus can be adjusted.
   c. Exciter lamp is new, adjusted and has the correct voltage applied (8 Volts D.C. for 9 Volt, 5 Amp lamps).
   d. Lateral guide roller is in good mechanical condition.

NOTE
THE PROCESS DESCRIBED IN STEPS 3 THRU 6 HAS TO BE REPEATED AT LEAST TWO OR MORE TIMES TO OBTAIN OPTIMUM RESULTS.

3. Set input level controls on stereo preamp to mid positon and set "High Frequency" controls to zero. Set noise reduction switches on back of Decoder to OFF.
4. Place the Buss Track Loop on the projector. Connect dual trace scope to TP1 and TP2 on back of Decoder and adjust lateral roller for minimum reading on both scope traces. At this point it can be determined if the right channel and left channel of the solar cell are connected correctly. TP1 is the right channel or outside sound track, and will have the high frequency test tone of the buzz track test film. TP2 will have the left channel with the low frequency test tone. If necessary, reverse the solar cell connections at TB3, 25-27 and 28-30, to obtain correct place.
5. Leave the scope connected and switch from dual trace to X-Y input. Connect the Real Time Analyzer to TP1, along with the scope. Use Pink Noise Test Loop 1, watch both instruments and adjust both focus and azimuth for maximum frequency response and thinnest X-Y trace. (The lens should have a frequency response of a minimum of 9 kHz.) Continue to watch the Analyzer on TP1 and adjust the right "High Frequency" control for a flat response to about 12 kHz with no hump on the high end.
6. With the scope connected to TP1 and TP2 on dual trace, use the Left-Right Separation Loop and adjust the split cell for minimum cross-talk between channels and for maximum output.
7. Place the Dolby Reference loop on the projector. Remove the oscilloscope from the meter test pins and place a good quality transistor voltmeter on either the Left and Right channel test point. With the Dolby loop running, adjust the level for that channel with the level control. Move the meter to the other channel and repeat the adjustment. The RMS voltage at the test pin for either channel should be trimmed to 1.85 VAC rms. The LED meter in the unit will indicate with the lower eight LED's on each channel illuminated. This adjustment is VERY IMPORTANT so the Dolby cards will track the encoded signal on the film.
8. Turn the Noise Reduction Switches on the rear of the mother board to ON for both channels.
9. Change the front panel Mode selector switch from Stereo to Mono. Adjust the volume control on the Mono card for each projector. While switching back and forth between the STEREO and MONO positions on the Mode Selector, the levels should appear to be about the same with the Dolby Reference loop running.
10. Speaker Phasing-When feeding pink noise to a speaker system and observing the results on a Real Time Analyzer, a severe dip at the crossover frequency indicates incorrect speaker phasing and is normally corrected by reversing the leads to the high frequency horn.

After the three stage speakers are checked separately, then the Left and the Right speaker should be compared to the Center speaker-phasing. To accomplish this, feed pink noise to both Center and Left speakers. While listening at a point between the two speakers, have someone reverse the Left speaker phase and select the phase which lets you hear the full sound. Repeat this process between the Center and Right speakers while reversing the Right speaker phase. The speakers should be correctly phased and positioned before starting auditorium equalization.

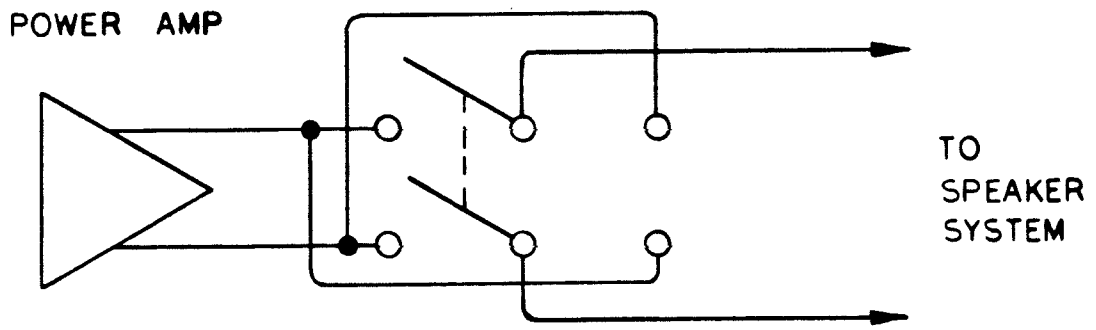


Figure 8-4 System for Reversing Phase of Speaker

11. To set the room equalization for each speaker, use the Extender card. The jack on the Extender card interrupts the flow of signal from the front end of the Decoder. It allows pink noise to be inserted from the Real Time Analyzer and to adjust each channel individually. Place the Sensing Microphone in the middle of the auditorium approximately half the distance from the screen. The front panel Mode switch should be in the STEREO position. Turn the Power Amplifier volume up to a suitable sound level and read the results on the Real Time Analyzer. Adjust the bass and treble control for smoothest response. Use one octave "cut" filters to correct for auditorium acoustic abnormalities. The range of each control is approximately 10 dB. The idealized room curve is flat to 1 kHz and down 3dB for each octave above 1kHz. If gross abnormalities are observed in the response, it is likely the problem is in loudspeaker phasing, placement, or horn orientation toward the Sensing Microphone. Do not try to correct speaker deficiences with the Equalizer controls. Correct the problem then equalize.

12. Move the pink noise jack to another channel and repeat this operation for all four channels.

13. Do not try to force the Surround channels into extended range. The purpose of the Surround Equalizer is to try to get the same coloration from these smaller speakers as the sound originating from the large stage speakers. Remove the Extender card and replace the Equalizers in the card cage.

14. The Line Output card is pre-adjusted at the factory for 2 volts output. The level pots should not be changed unless additional output is needed to drive the Power Amplifiers. With the Extender card in, adjust the Left and Right music channels from the Tape deck or Phono source. Check the fade-out operation by grounding the reset terminal through the remote Reset switch.

15. Adjust the Power Amplifier levels in the auditorium. It will probably be easier to adjust the Left and Right channels first, with the Center and Surround Amplifiers turned down. The tone switches on the back of the Mother Card will insert a tone that can be heard through the Left and Right speakers. These should be turned ON individually, and not together. After the Left and Right channels have been set, place a feature film on the projector. Turn up the Center channel to the level where it balances with the Left and Right channels.

16. Adjust the Surround channel to an appropriate level when Surround material appears. Make sure the MODE switch on the front panel of the Decoder is in the STEREO W/SURROUND position.

17. While the feature is running, select the BYPASS mode with the Mode selector switch on the Decoder. Set the Bypass volume control on the Mono Preamp at a comfortable auditorium level. This is a fixed setting and is not affected by the master volume control. It is used for emergency purposes only.

18. While the feature is running, select STEREO and set the time delay for minimum echo and crosstalk. The time delay setting should coincide with the distance the Surround speakers are from the main speakers. The minimum time delay has been set a 30 milliseconds. Each switch on the DIP switch adds an additional ten milliseconds of time delay to the Surround channel. If the rear seats of the auditorium are sixty feet from the screen, three time delay switches should be turned ON. The time delay starts with 30 milliseconds of delay, 10 more are added with each of the six switches, for a total of 90 milliseconds or 90 feet.

8.9 SPEAKER WIRE SIZE AND DAMPING FACTOR

The high damping factor of the power amplifiers results in a very clean bass response. Excessively long and small diameter speaker wires can lower the damping factor, distort the lower frequencies and result in high power loss. A damping factor of at least 50 should be maintained to insure good audio quality.

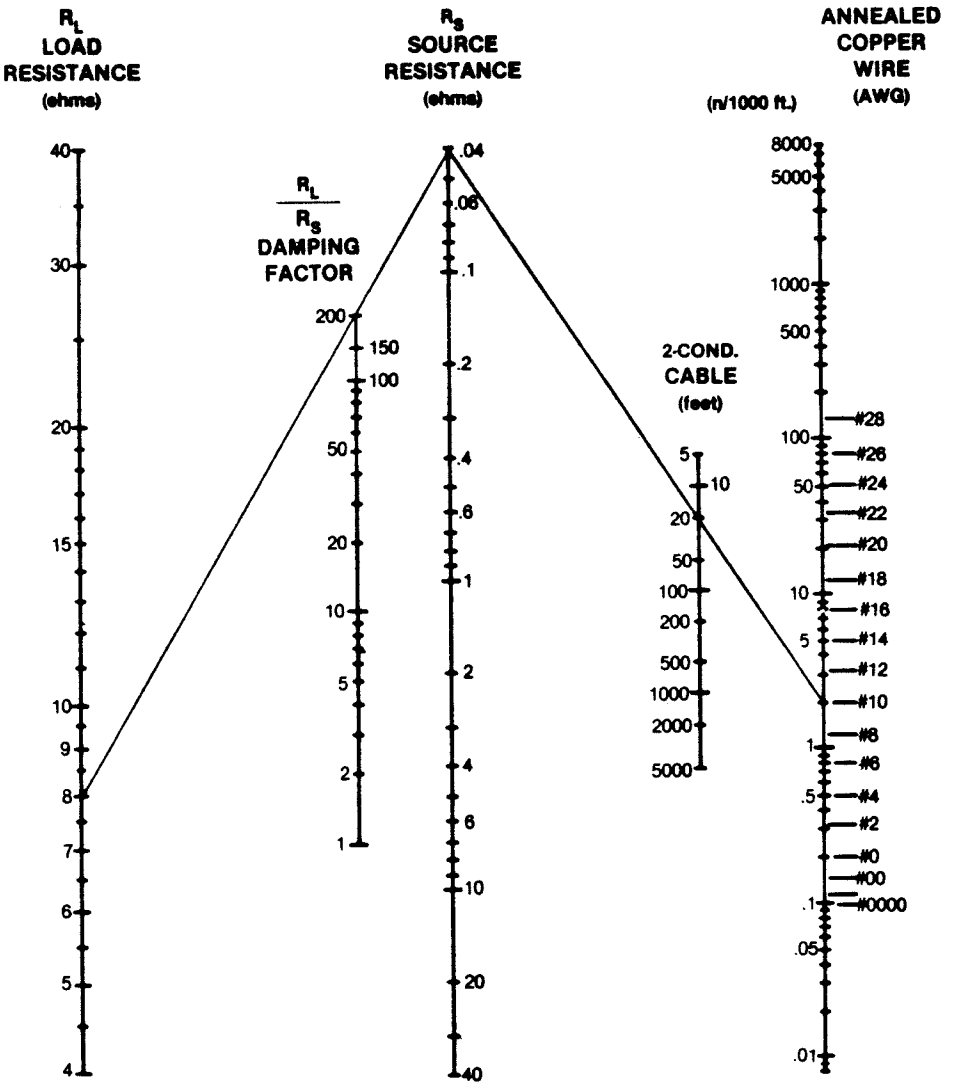
The relationship between speaker wire length and diameter and damping factor can be calculated using the nomograph of Figure 8-5. To use this chart:

1. With a straight-edge, line up the gauge of the speaker wire with its length. Mark off the resulting source impedance where this line crosses the center column.

2. Line up the source resistance, determined in Step 1, with the manufacturer's impedance of the speaker system. Read the damping factor.

NOTE: The impedance of a speaker system can be approximated by measuring the resistance across the speaker terminals, with the amplifier disconnected. Multiply this resistance by 1.33 to obtain the approxiamate impedance.

The Power Amplifier incorporates a time delay network and a relay which connects the speaker only after the amplifier has stablized, thus eliminating transients.



EXAMPLE: R_L = 8 , R_S .04 OR D.F. = 200

CABLE LENGTH OF 20 FT. ANSWER: #10 WIRE

SOURCE RESISTANCE AND DAMPING FACTOR VS. LENGTH AND SIZE OF OUTPUT LEADS

MFRM-03510

Figure 8-5 Speaker Nomograph

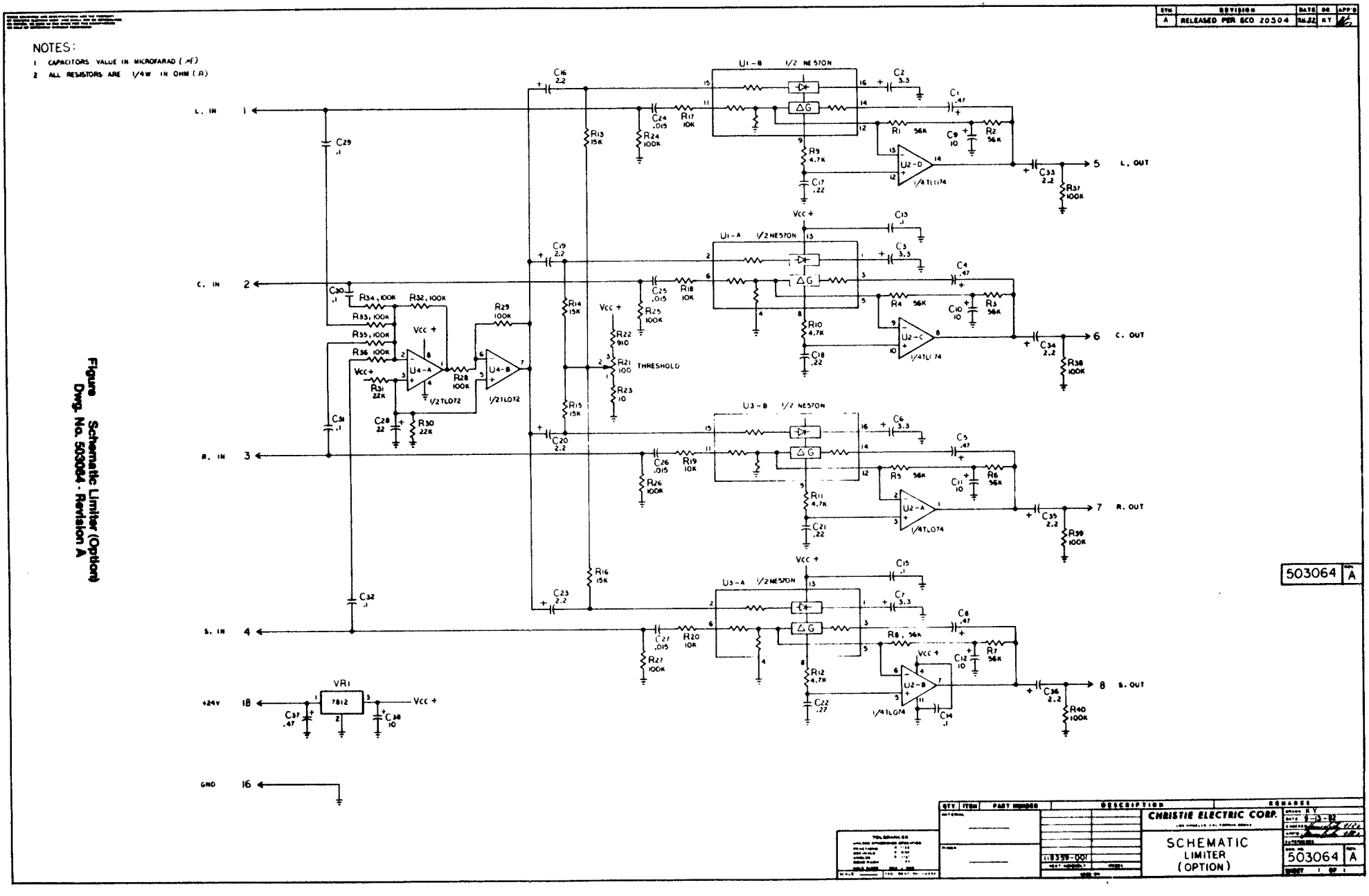


Figure Schematic Limiter (Option)
Dwg. No. 503064 - Revision A

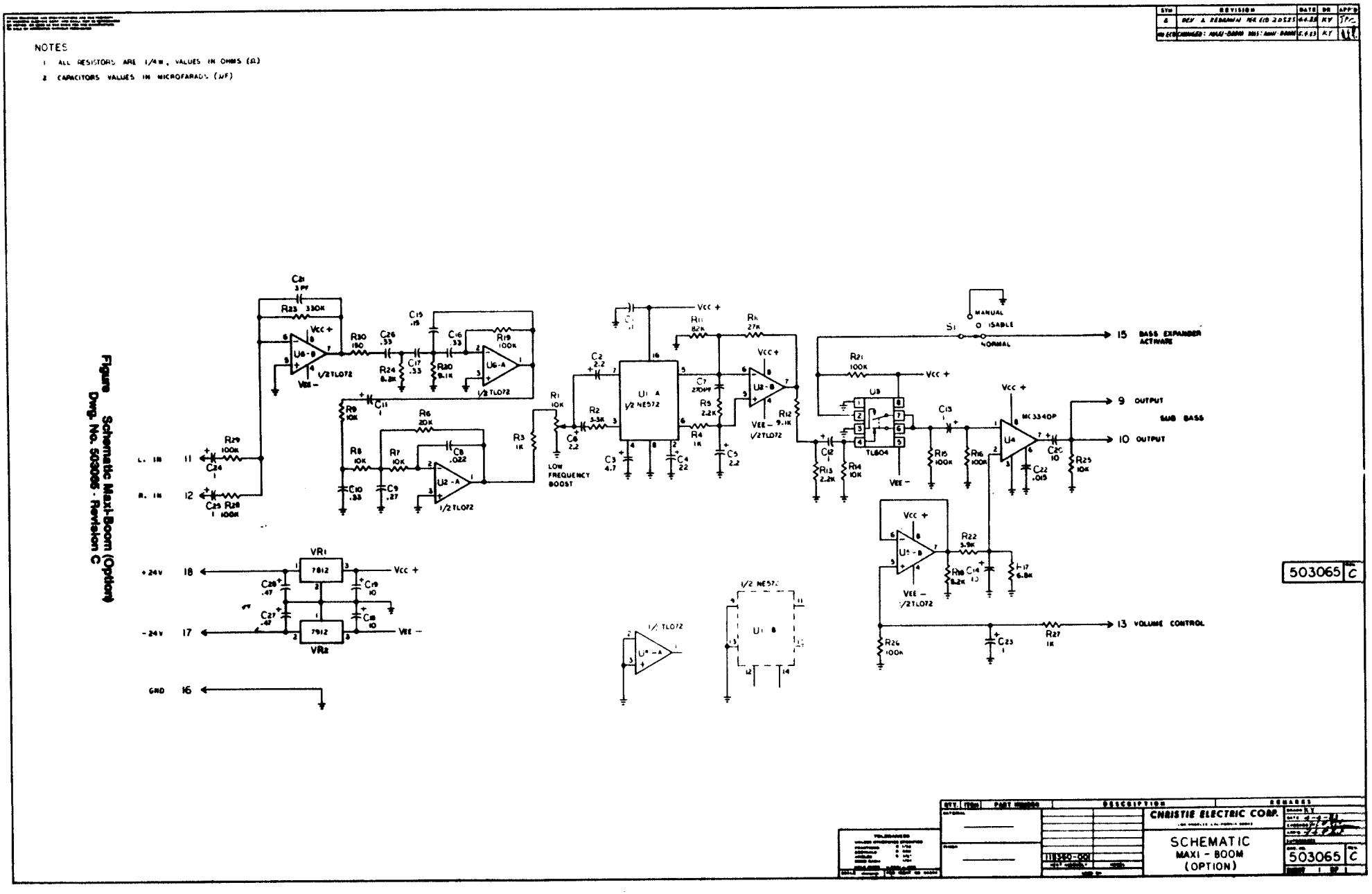


Figure Schematic Maxi-Boom (Option)
Dwg. No. 503065 - Revision C