Dolby®

MODEL 372

INSTRUCTION MANUAL

INSTRUCTION MANUAL

ALIGNMENT AND OPERATION INSTRUCTIONS FOR MODEL 372

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WARRANTY INFORMATION: Equipment manufactured by Dolby Laboratories is warranted against defects in materials and workmanship for one year from the date of purchase. There are no other express or implied warranties and no warranty of merchantability or fitness for a particular purpose.

During the warranty period Dolby Laboratories will repair or, at its option, replace components which prove to be defective, provided the unit is shipped, prepaid, to the manufacturer directly or via an authorized distributor. Defects caused by modifications, misuse or accidents, and any further damage caused by inadequate packing for service return, are not covered by this warranty.

Dolby Laboratories' obligation is restricted to the repair or replacement of defective parts and under no circumstances will Dolby Laboratories be liable for any other damage, either direct or consequential.

All requests for repairs or information should include the unit serial number to ensure rapid service.

L90/101

TABLE OF CONTENTS

SECTION 1 INTRODUCTION

1.1 INTRODUCTION

The Model 372 is a portable noise reduction unit for applications requiring two independent channels of Dolby* professional A-type noise reduction in a compact, lightweight package.

Power may be supplied to the Model 372 by internal batteries or an external dc power supply, permitting use of noise reduction when conventional power sources are not available. 8 segment LED meters and an on-board Dolby Tone oscillator permit quick and accurate Dolby Level calibration. Two input level controls adjust either playback Dolby Level calibration or record level adjustment (internally selected), and may be "ganged" to permit single knob control of input levels. Electronically balanced inputs accomodate a wide range of signal levels. A stereo headphone monitor output is provided with an independent level control.

Portability, flexiblity and freedom from outboard power sources permit use of the Model 372 in a wide variety of applications, including mobile recording and radio and television location recording. The Model 372 may also be used with videotape recorders when noise reduction modules cannot be installed directly in machines, or portability is required.

Audio recordings encoded by the Model 372 are fully compatible with all Dolby A-type processors (approximately 75,000 are currently in use world-wide [April 1984]). Conversely, the Model 372 will properly decode any tape encoded using the Dolby A-type process.

The Model 372 is shipped with the following items:

(1) Model 372 Unit equipped with two Cat. No. 225 Noise Reduction Modules.

(1) Literature Packet consisting of:

- (1) Model 372 Manual
- (1) Reprint of paper entitled "An Audio Noise Reduction System" by Ray M. Dolby
- (1) Warranty Card and Envelope
- (1) Alignment tool
- (1) Hirose Connector
- (1) Female Tuchel/Binder Connector
- (1) Male Tuchel/Binder Connector
- (1) 2.5mm jack plug
- (2) 1A slow blow fuses

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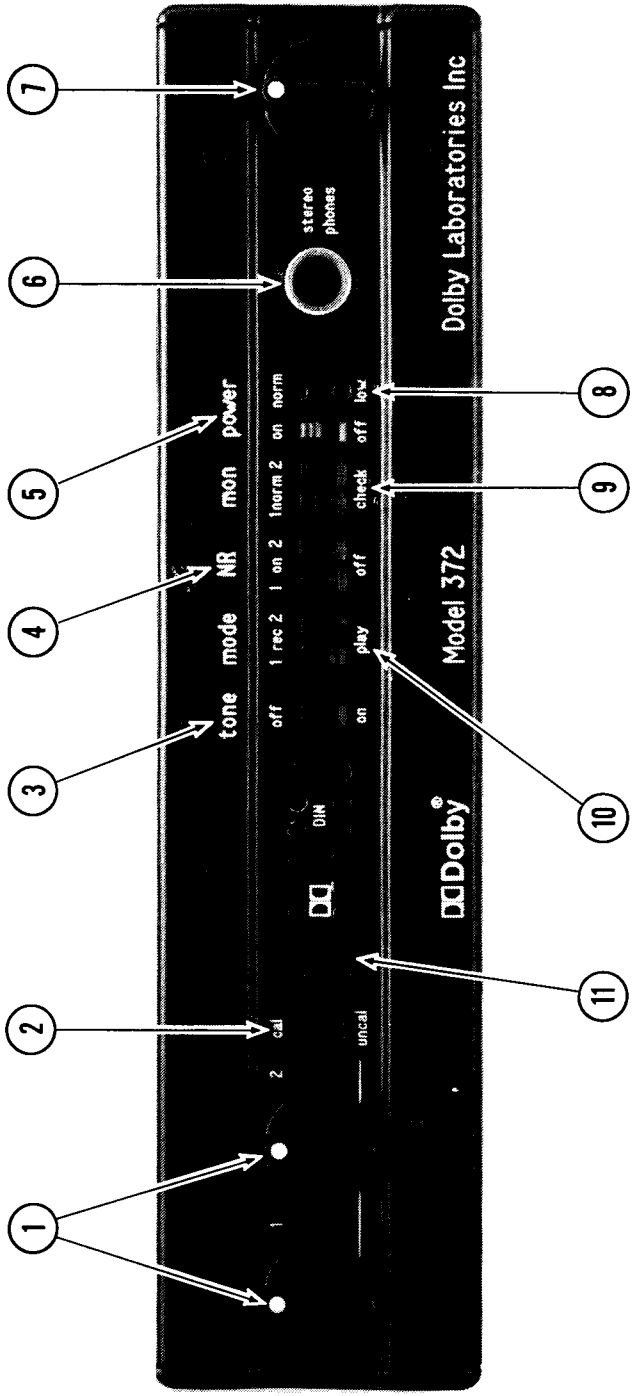

FIGURE 1.1
Front panel Controls and Connectors

1.2 EXTERNAL CONTROLS

(1) Variable Input Level Controls

The VARIABLE INPUT LEVEL controls adjust either the LINE INPUT level or the FROM RECORD level (selected by internal switches S1 and S2). The VARIABLE INPUT LEVEL controls are active when the CAL/UNCAL INPUT SELECTOR SWITCH (2) is in the UNCAL position. To "gang" the VARIABLE INPUT LEVEL controls, pull out control 1 and use control 2 to adjust the level of both channels. NOTE: The recessed LINE INPUT and FROM RECORD trimpots remain active when the Model 372 is in the VARIABLE INPUT LEVEL mode.

(2) CAL/UNCAL Input Selector Switch

In the CALibrated position, input level is controlled by the recessed LINE INPUT (19) and FROM RECORD (21) trimpots.
In the UNCALibrated position, input level is controlled by the VARIABLE INPUT LEVEL controls (1).

(3) Dolby Tone Switch

The DOLBY TONE SWITCH activates the internal Dolby Tone oscillator and the DOLBY LEVEL CALIBRATION METER (11) for aligning the Model 372 and recording Dolby Tone on tapes (for identification and future calibration). This switch should be OFF during normal operation.

(4) NR ON/OFF Switch

The NR ON/OFF SWITCH permits recording or replaying tapes with or without noise reduction. The NR ON/OFF function may be remotely controlled.

(5) Power ON/OFF Switch

(6) Stereo Headphone Output

The headphone output will power any high impedance stereo headphones. The output signal is the same as the TO MONITOR output signal and is selected by the MONITOR switch (9).

(7) Headphone level control

The headphone level control adjusts the headphone output level, but does not affect the TO MONITOR level.

(8) Power Status Indicator

NORMal LED flashing - batteries in good condition.
NORMal and LOW LED flashing - batteries are low.
LOW LED flashing - replace or recharge batteries immediately.

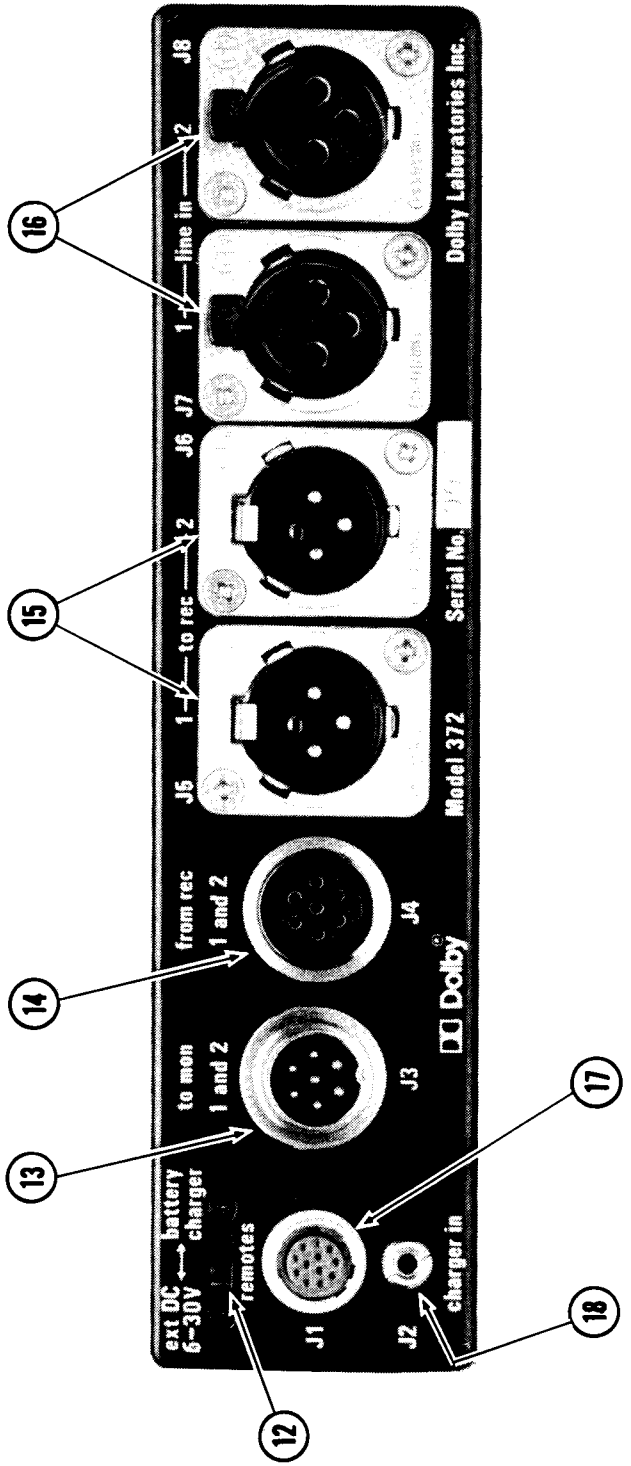

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FIGURE 1.2
Rear panel Controls and Connectors

(9) **Monitor Switch**
The MONITOR switch selects the signal present at the TO MONITOR and HEADPHONE outputs. In the NORMal position, the output is automatically switched between the LINE INPUT signal when recording, and a decoded signal during playback. In the CHECK position, the FROM RECORD signal is monitored (typically an un-decoded signal).

(10) **Mode Switch**
The MODE switch selects the mode of the noise reduction circuitry. In the RECord mode, NR encoding occurs. In the PLAY mode, NR decoding occurs. Mode switching may be remotely controlled.

(11) **Dolby Level Calibration Meter**
The DOLBY LEVEL CALIBRATION METER indicates the level at the input to the Model 372 noise reduction processors. The meter is used in the initial playback alignment of the Model 372 and to adjust the playback level of Dolby Tone on previously encoded tapes. The DOLBY TONE SWITCH (3) must be in the ON position to activate the meter. Proper Dolby Level calibration is indicated by equal brightness of the two green center LEDs. See Figure 3.1.

(12) **DC Source Switch**
The DC SOURCE switch selects between internal and external powering of the Model 372. In the BATTTERY position, power is derived from the internal batteries (the batteries may be charged during operation via the CHARGER IN jack (18)). In the EXT DC 6-30V position power is derived from an external supply. See Page 10.

(13) **To Monitor Connector and External DC Input** — Male 7 conductor Tuchel/Binder.

(14) **From Record Connector** — Female 7 conductor Tuchel/Binder.

(15) **To Record Connectors** — Male 3 conductor XLR.

(16) **Line Input Connectors** — Female 3 conductor XLR.

(17) **Remote Connector**
The REMOTE CONNECTOR permits remote control of record/play and NR ON/OFF. See Pages 11 and 18.

(18) **Charger In Jack** 2.5mm, 2 conductor jack.
The CHARGER IN jack permits rechargeable batteries to be recharged inside the Model 372. See Page 10.

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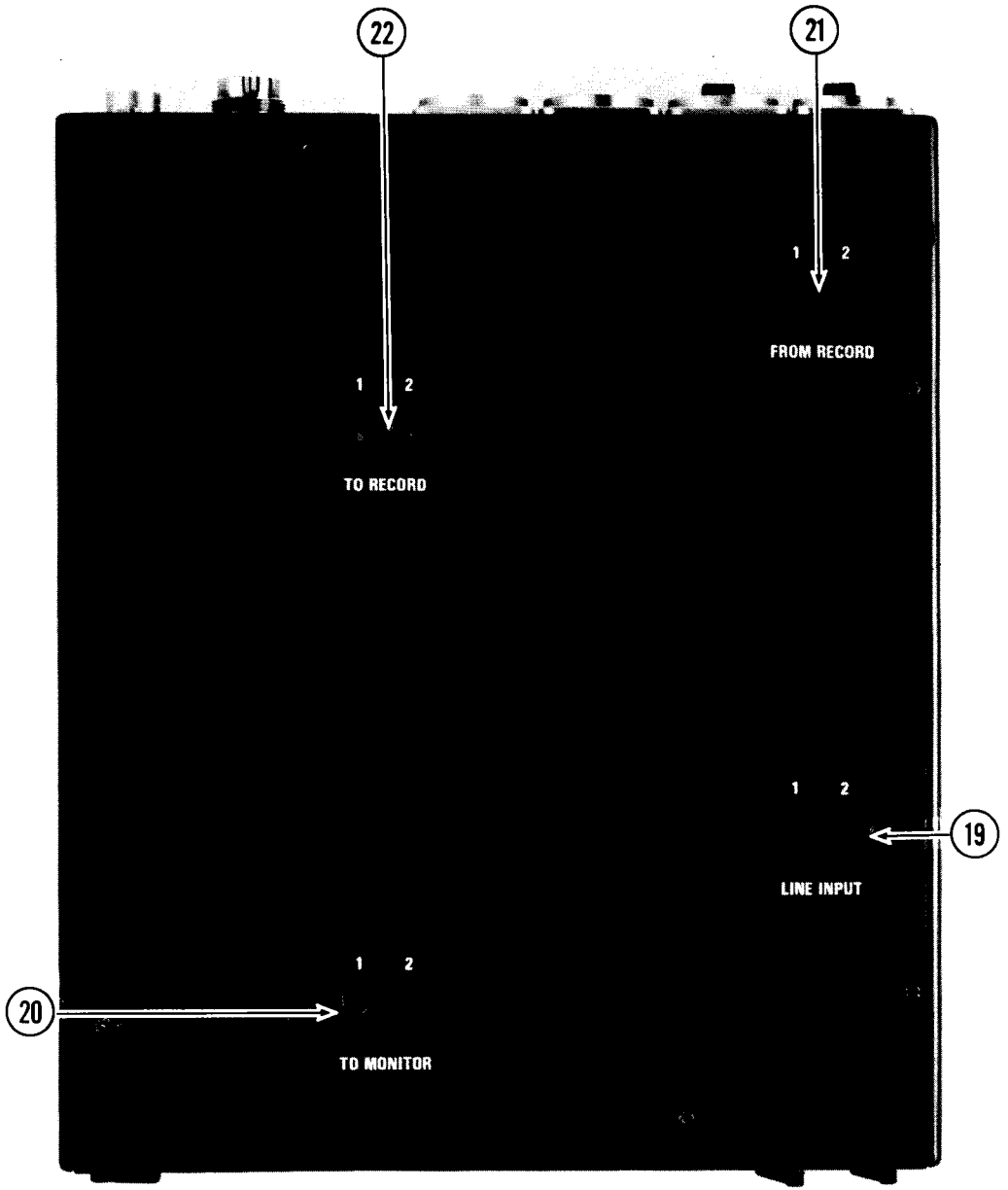

FIGURE 1.3
Bottom Plate Controls

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(19) Line Input Level Controls

(20) To Monitor Level Controls

(21) From Record Level Controls

(22) To Record Level Controls

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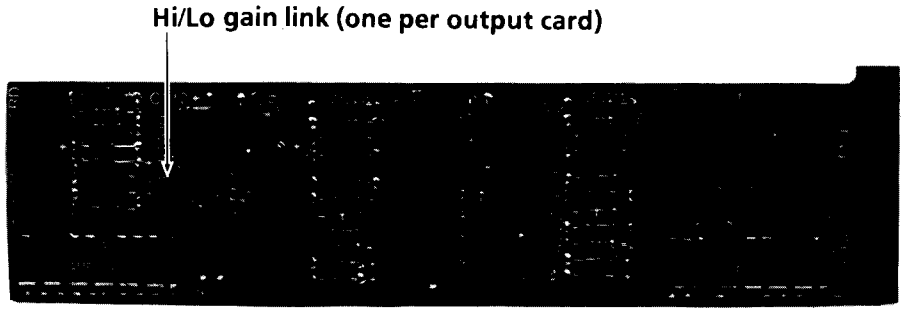


FIGURE 2.1
Output Card, showing location of Hi/Lo gain links

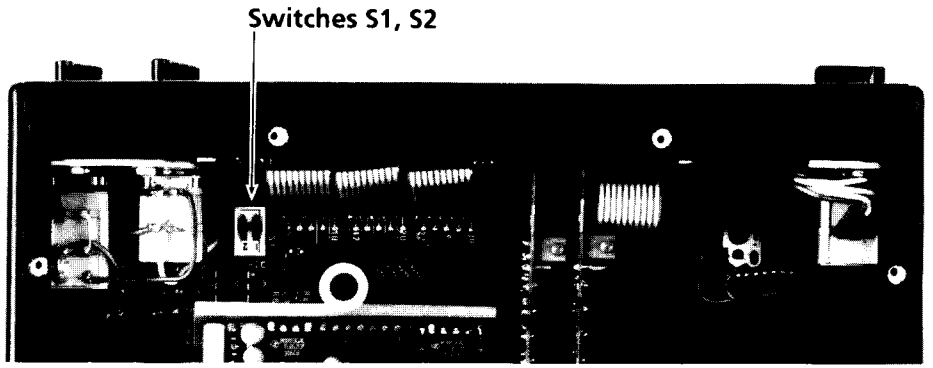


FIGURE 2.2
Location of internal switches
(bottom plate removed)

SECTION 2 INSTALLATION

2.1 INTERNAL LINKS AND SWITCHES

OUTPUT LEVEL LINKS

The TO RECORD output level of the Model 372 is nominally 0 dBm (0.775V). If a lower output level is required, the internal HI/LO gain links (located on the output cards) should be placed in the LO position, reducing the TO RECORD output level by 20dB. See Fig. 2.1.

INPUT LEVEL CONTROLS

The Model 372 front panel VARIABLE INPUT LEVEL potentiometers may be assigned control of either the LINE INPUT level or the FROM RECORD level. The VARIABLE INPUT LEVEL controls are active when the front panel CAL/UNCAL INPUT SELECTOR SWITCH is in the UNCAL position.

In the LINE INPUT mode, the VARIABLE INPUT LEVEL controls may be used to adjust record level without affecting Dolby Level calibration. In field applications where record level is not controlled by an external mixer or microphone preamplifier, selecting the LINE INPUT mode allows record levels to be optimized without adjusting recessed trimpots.

In the FROM RECORD mode, the VARIABLE INPUT LEVEL controls may be used to adjust playback Dolby Level calibration. In installations requiring frequent recalibration of Dolby Level (non-standard tapes), the FROM RECORD mode permits rapid Dolby Level calibration without accessing recessed trimpots.

To select the mode of the VARIABLE INPUT LEVEL controls, remove the bottom plate of the Model 372 and locate switches S1 and S2 (see Fig. 2.2). To assign control of LINE INPUT levels to the VARIABLE INPUT LEVEL controls, switch S1 and S2 to the position labeled "line in" (towards the front of the unit). To assign control of FROM RECORD levels to the VARIABLE INPUT LEVEL controls, switch S1 and S2 to the position labeled "rec" (towards the rear of the unit).

NOTE: The recessed LINE INPUT and FROM RECORD trimpots located on the Model 372 base plate remain active when the unit is in the VARIABLE INPUT LEVEL mode. Initial calibration of the Model 372 should be performed using the recessed trimpots. The VARIABLE INPUT LEVEL controls may then be used to further adjust levels when necessary.

2.2 POWER REQUIREMENTS

Internal Power Supply (Batteries)

Place the rear panel DC SOURCE switch in the BATTERY position. Open the battery compartment and install 4 "C" size batteries. If Nicad cells are used, they may be charged by a 9 - 15V dc supply connected to the rear panel CHARGER IN jack. The supply should provide 200 mA (minimum) with less than 200 mV peak-to-peak ripple. The charging current is internally limited to 200 mA ± 20 mA.

Battery charge condition is displayed by the front panel POWER STATUS INDICATOR LED's. If the NORMal (green) LED is flashing, the batteries are in good condition. If both the NORMal (green) and LOW (red) LED's are flashing, the batteries are getting low and should be recharged as soon as possible. When only the LOW (red) LED is flashing, the batteries must be recharged or replaced immediately. The Model 372 may produce gross distortion if operated on extremely low batteries.

The batteries may be fully recharged only if the Model 372 is switched OFF. The batteries will become fully charged after approximately 14 hours. If the Model 372 is connected to the charger during normal operation, the batteries will maintain a charge/discharge equilibrium (depending on the exact usage). Batteries must be installed in the unit to operate from the battery charger.

External Power Supply

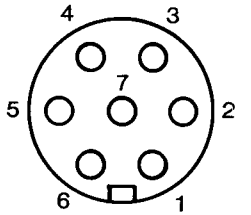
Place the rear panel DC SOURCE switch in the EXT DC 6-30V position. An external 6-30V dc power supply may now be connected to the Model 372 via the TO MONITOR connector (see Fig.2.3, "Connector Descriptions" for pin assignments). An external power supply must be capable of providing 2A for a short period of time to accommodate the Model 372 turn-on surge. Current requirements are dependent upon voltage supplied and Model 372 operating mode/conditions. Under no signal conditions input current typically 200 mA at 6V decreasing to 100 mA at 30V.

2.3 CONNECTOR DESCRIPTIONS

Cable end connectors, viewed from the solder side.

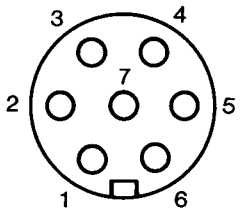
FROM RECORDER (7 pin Tuchel /Binder)

1	Screen	
2	–	CHANNEL 1
3	+	
4	+	CHANNEL 2
5	–	
6	Screen	
7	not used	



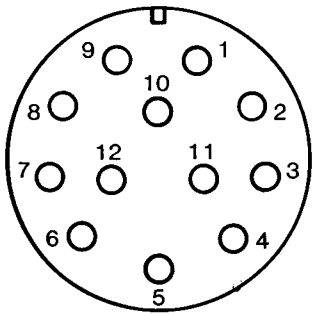
TO MONITOR (7 pin Tuchel/Binder)

1	External DC –	
2	–	CHANNEL 1
3	+	
4	+	CHANNEL 2
5	–	
6	External DC +	
7	not used	



REMOTE (12 pin Hirose)

1	not used
2	NR 1 On/Off
3	Rec/Play 1 +
4	Rec/Play 1 –
5	+ 9 V
6	Rec/Play 2 –
7	Rec/Play 2 +
8	NR 2 On/Off
9	not used
10	Logic Ground
11	not used
12	not used



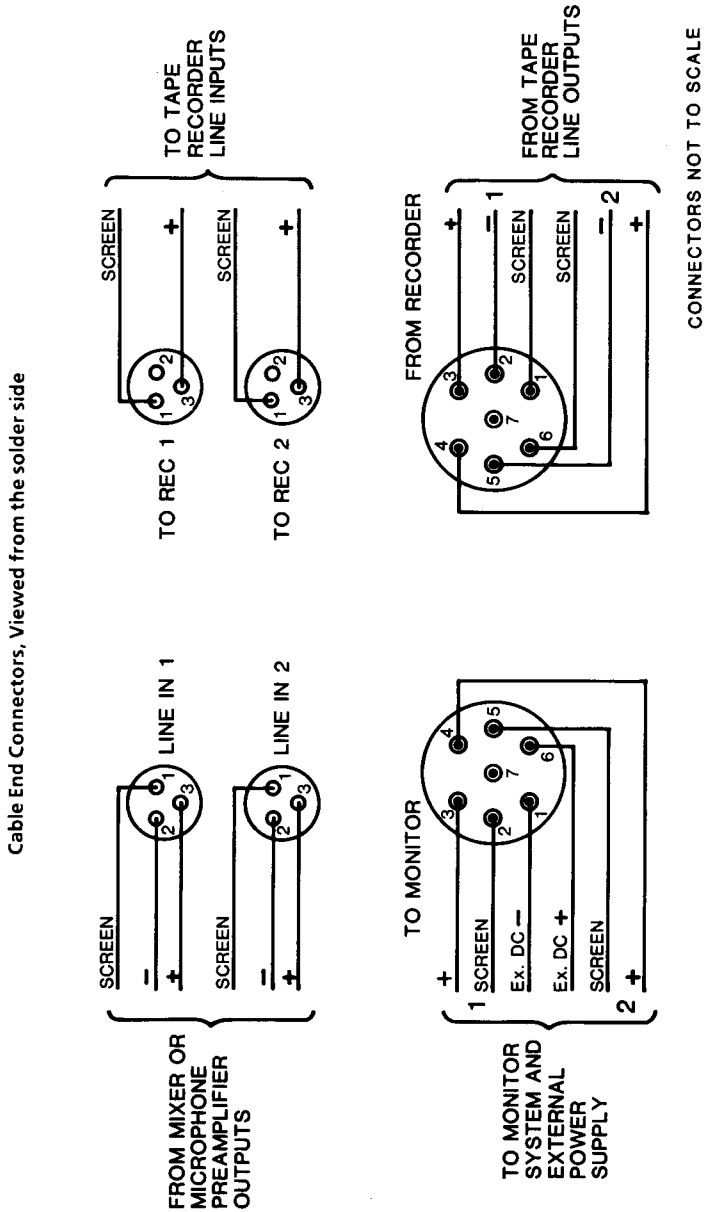


FIGURE 2.4
Interface Diagram

SECTION 3 ALIGNMENT

3.1 DOLBY LEVEL CALIBRATION METER

The Model 372 front panel Dolby Level Calibration Meter permits record and playback alignment without additional test equipment. The meter consists of two identical 8 LED displays (one display per audio channel). The levels indicated by each LED are given in Figure 3.1. As signal level increases, each LED is lit when the corresponding signal level is reached. The LED will then remain lit until the signal level reaches the next "LED on" signal level. Some LEDs crossfade as the level changes. "Dolby level" is indicated by equal brightness of the two green LEDs labeled DD. "DIN" level is indicated by equal brightness of the two yellow LEDs labeled DIN.

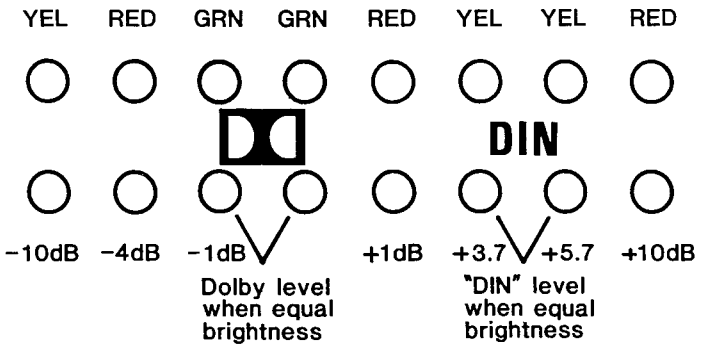


FIGURE 3.1
Dolby Level Calibration Meter

3.2 ALIGNMENT FOR USE WITH AUDIO TAPE RECORDERS

Refer to Figures 1.1 through 1.3 for locations of controls and connectors. Before connecting the Model 372, align the tape recorder to obtain unity record/replay response using a standard alignment tape (typically 185 or 320 nWb/m).

- Switch MODE (10) to Play, switch Dolby Tone (3) ON and switch the CAL/UNCAL INPUT SELECTOR SWITCH (2) to CAL.
- Play the reference level section of the standard alignment tape and adjust the FROM RECORD trimpots (21) to obtain equal illumination of the two green LED's marked DIN if using a 185 nWb/m alignment tape or equal illumination of the two LED's marked DIN if using a 320 nWb/m test tape.
- Continue playing the test tape and adjust the TO MONITOR trimpots (20) to obtain the standard line level in use at your facility at the Model 372 line outputs.
- Switch NR ON and Dolby Tone ON. Switch MODE to record.
- Begin recording Dolby Tone. If the tape recorder has three heads, monitor the tape playback output by switching MONITOR (9) to check, and adjust the TO RECORD trimpots (22) to obtain equal brightness of the two green LED's marked DIN. If the tape recorder is not capable of simultaneous record/replay (two head tape recorders), record and playback short segments of Dolby Tone, adjusting the TO RECORD trimpots each time until the playback results in equal illumination of the DIN LED's. Note the level on the tape recorder meter for use when adjusting the LINE INPUT trimpots.
- Switch NR OUT and Dolby Tone OFF. Switch MONITOR (9) to normal and MODE (10) to play.
- Apply a 1 kHz tone to the Model 372 LINE INPUTS (16) at standard line level and adjust the LINE INPUT trimpots (19) to obtain the tape recorder meter reading noted above.

The Model 372 and tape recorder are now calibrated. Any adjustments in record level must be made at the mixer or using the Model 372 front panel VARIABLE INPUT LEVEL controls (1).

IMPORTANT: Do not adjust the tape recorder record level controls once the Model 372 is aligned.

3.3 ALIGNMENT FOR USE WITH VIDEOTAPE RECORDERS

Refer to Figures 1.1 through 1.3 for locations of controls and connectors. Before connecting the Model 372, align the videotape recorder to obtain unity record/replay response using a standard alignment tape (typical reference level is 100 nWb/m). If a 100 nWb/m alignment tape (or other standard alignment tape) is not available, substitute a tape with tones recorded at a "standard" reference level (8 dB below peak level).

- Switch MODE (10) to Play, switch Dolby Tone (3) ON and switch the CAL/UNCAL INPUT SELECTOR SWITCH (2) to CAL.
- Play the reference level section of the alignment tape and adjust the FROM RECORD trimpots (21) to obtain equal illumination of the two green LED's marked DIN.
- Continue playing the test tape and adjust the TO MONITOR trimpots (20) to obtain the standard line level in use at your facility at the Model 372 line outputs.
- Switch NR ON and Dolby Tone ON. Switch MODE to record.
- Begin recording Dolby Tone. If the videotape recorder has an audio confidence head, monitor the tape playback output by switching MONITOR (9) to check, and adjust the TO RECORD trimpots to obtain equal brightness of the two green LED's marked DIN. NOTE: If using a videotape recorder with a confidence head, be sure the confidence playback level is properly aligned. If the videotape recorder is not capable of simultaneous record/replay, record and playback short segments of Dolby Tone, adjusting the TO RECORD trimpots each time until the playback results in equal illumination of the DIN LED's. Note the level on the videotape recorder audio meter for use when adjusting the LINE INPUT trimpots.
- Switch NR OUT and Dolby Tone OFF. Switch MONITOR (9) to normal and MODE (10) to play.
- Apply a 1 kHz tone to the Model 372 LINE INPUTS (16) at standard line level and adjust the LINE INPUT trimpots (19) to obtain the videotape recorder audio meter reading noted above.

The Model 372 and videotape recorder are now calibrated. Any adjustments in record level must be made at the mixer or using the Model 372 front panel INPUT LEVEL controls.

IMPORTANT: Do not adjust the videotape recorder record level controls once the Model 372 is aligned.

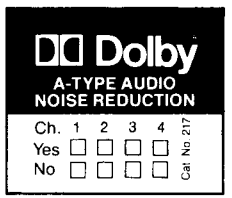
SECTION 4 OPERATION

4.1 OPERATION

Whenever a recording is made with noise reduction, it is good practice to record approximately 15 seconds of Dolby Tone at the beginning of the tape. The characteristic warble of the tone is an indication to other users that the recording was encoded with Dolby noise reduction, and thus helps ensure that playback decoding is employed. In addition, Dolby Tone permits the proper level calibration to be confirmed. Dolby Tone should always be included with the test tones recorded at the begining of each tape reel.

An identification label should also be applied to the tape reel to indicate that the tape is encoded using Dolby A-type noise reduction. Two types of labels (shown below) are provided with the Model 372. The Cat. No. 217 VTR Identification labels should be used with videotapes to identify the specific audio tracks (1,2,3 or 4) that are encoded. The yellow Cat. No. 100 "Dolby A" labels should be used for general purpose identification. Additional labels may be ordered from Dolby Laboratories or its distributors.

VTR Identification Labels, Cat. No. 217



Dolby A Identification Labels, Cat. No. 100

A tape encoded with Dolby noise reduction can be checked for calibration error by playing the Dolby Tone recorded on it and observing the Dolby Level Calibration Meter. Adjusting the FROM RECORD trimpots on the

Model 372 to obtain equal brightness of the green LEDs marked DD will achieve ideal decoding of the tape. If the Model 372 is frequently used to decode non standard tapes, control of the FROM RECORD level may be assigned to the front panel VARIABLE INPUT LEVEL controls. The Model 372 may then be recalibrated for non-standard tapes in the variable mode without disturbing the standard calibration level.

Typically, your standard studio recording practices will not be affected at all by the use of noise reduction. However, the 10 dB increase in signal-to-noise ratio obtained by using Dolby A-type noise reduction creates additional flexibilty in the recording process. Recording levels can be reduced, thus increasing recording headroom while sacrificing only a few decibels of the recorder's improved signal-to-noise ratio. Distortion on peak levels will be audibly reduced, and less compression and limiting is usually required.

SECTION 5 REMOTE CONTROL

5.1 REMOTE CONTROL

The Record/Play (Encode/Decode) and NR On/Off functions of the Model 372 may be controlled from a remote switching source via the rear panel remote connector (J1). Each channel may be switched independently.

For remote control of MODE switching the front panel MODE switch must be in the REC (up) position. The Model 372 will enter the PLAY mode when a DC voltage (4 - 30V) is applied across pins 3 (+) and 4 (–) (channel 1), or pins 7 (+) and 6 (–) (channel 2) of the remote connector. A convenient (unswitched) DC source is provided on pins 5 (+ 9V) and 10 (0V) of the remote connector.

For remote control of NR switching the Model 372 front panel NR switch must be in the NR ON position. To switch NR OFF for channel 1, connect pin 2 of the remote connector to logic ground (pin 10). To switch channel 2 NR OFF, connect pin 8 of the remote connector to logic ground.

See section 2.3, "Connector Descriptions", for a diagram illustrating the remote connector pin assignments.

SECTION 6 SERVICE AND REPAIR

6.1 ISOLATION OF THE PROBLEM

If the Model 372 malfunctions, isolate the problem by interchanging each circuit board (Cat. No. 225, input and output boards) with the same circuit board from the other channel. Once the faulty circuit board has been identified, it may be repaired (refer to the circuit diagrams on pages 27 - 34) or a replacement may be obtained from your local Dolby representative, or directly from Dolby Laboratories. Do not attempt to repair faulty Cat. No. 225 modules. The Cat. No. 225 is not user-serviceable.

6.2 CAT. NO. 225 REPAIR

The Cat. No. 225 module has been designed for accuracy, reliability, and long life. The individual circuits operate well below their dissipation limits, and close tolerance high stability components ensure consistency and accuracy of system parameters. There is no need for adjustment of the printed circuit card; the critical parts of the circuit are pre-adjusted during manufacture with fixed-value selected components, using custom-designed test equipment and procedures. These selected components determine the Dolby A-type noise reduction characteristic, and attempted user-repair of the Cat. No. 225 may result in degraded performance. All Cat. No. 225 failures should be returned to Dolby Laboratories or one of its distributors for exchange.

6.3 FACTORY SERVICE

Defective Cat. No. 225 modules returned to Dolby Laboratories for repair or exchange are subject to the following conditions:

Modules must be shipped pre-paid. Customers will be charged for return freight charges.

There will be additional charges for the repair of defects caused by modifications, misuse or accident, and by any damage caused by inadequate packing for service return.

If a faulty module must be replaced immediately, Dolby Laboratories will send advance replacements when available. The faulty module must be returned to Dolby Laboratories within two weeks of exchange module shipment. If the faulty module is not received within two weeks the replacements will be billed at the current list price.

SECTION 7 PRINCIPLES OF NOISE REDUCTION

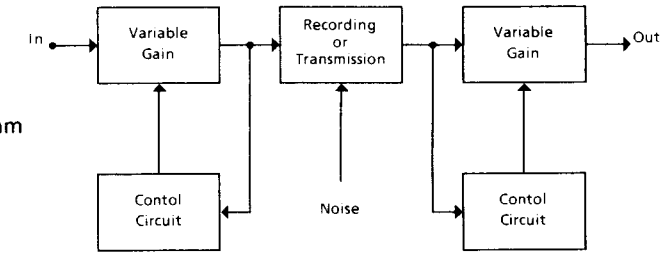
7.1 GENERAL PRINCIPLES

In sound recording or transmission systems the high and low audio frequencies are often pre-emphasized during recording and de-emphasized during reproduction in order 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, and thus low and high frequency noises are particularly noticeable during reproduction.

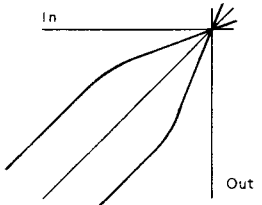
It is clear that the situation could be improved with a more flexible equalization method. The Dolby A-type system provides a characteristic, controlled by the incoming signal, which achieves a more optimum loading of the recording medium under all signal conditions. During playback a complementary characteristic is applied 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 history, and it is therefore important to discuss these conventional techniques to appreciate the significant differences between them and the Dolby system.

(a) Block diagram



(b) Transfer characteristic

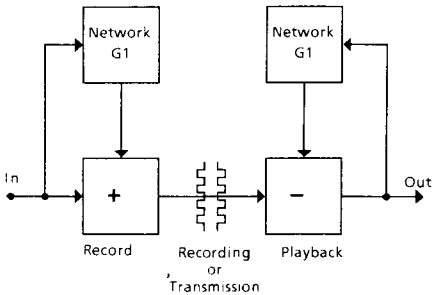


Compandor System
FIGURE 7.1

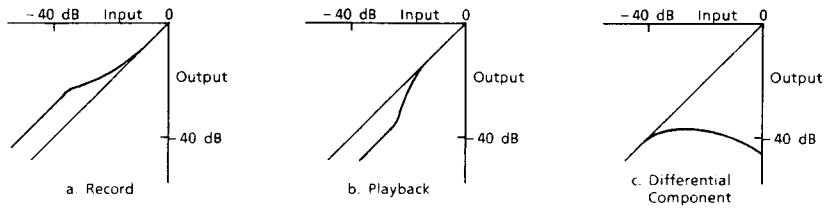
Fig. 7.1 is a block diagram of a conventional compandor, together with its transfer characteristics. Well-known compandor difficulties - which by now are regarded as classical - include poor tracking between recording and reproducing, both statically and dynamically; high sensitivity to gain errors in 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.

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 usable 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.



Noise Reduction System - Basic Layout
FIGURE 7.2



Transfer Characteristics

FIGURE 7.3

The differential treatment of the signal in the Dolby noise reduction system is illustrated in Fig. 7.2. Incoming signals to the record unit are split into two paths. The main path treats the signal linearly. The signal in the secondary path passes through a variable attenuation network G1, the output of which is combined additively with the main signal. In playback the situation is similar, but the variable attenuation network G1 is connected in a feedback loop and its output is combined subtractively with the main signal. The basic input/output characteristic of the attenuators is given in Fig. 7.3, which also shows the encoding and decoding characteristics obtained by addition and subtraction. It is 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.

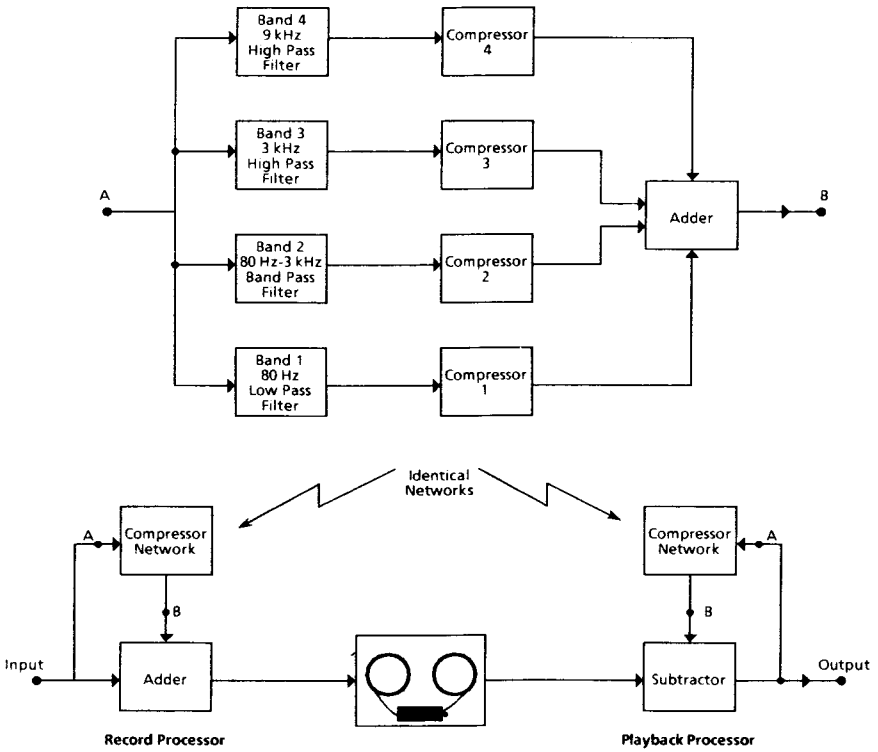
In practical embodiments, the Dolby method satisfies all the requirements for high-quality transmission. Overshoots are minimal (less than 1.5 dB), since the contribution of the side chain is always low even under dynamic conditions. Mistracking between units is a function of the attenuators, which can 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 (about 2 dB) 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, and 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 40Hz and peak level.

In order 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 (Fig 7.2) is in fact four band-splitting filters, followed by four limiter circuits. In this scheme the masking 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 noise likely to be encountered (Fig. 7.4).

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.



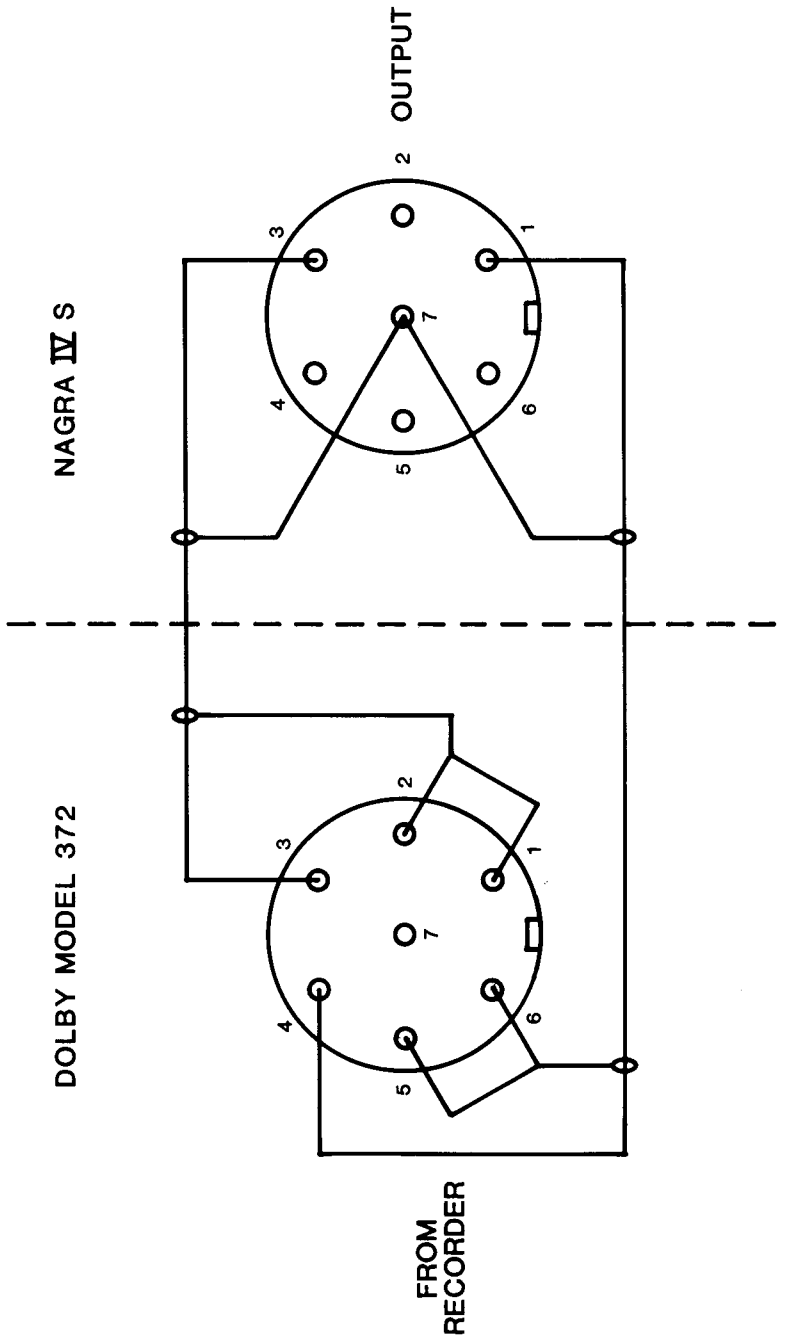
Noise Reduction System - Basic Block Diagram

FIGURE 7.4

SECTION 8 SPECIFICATIONS

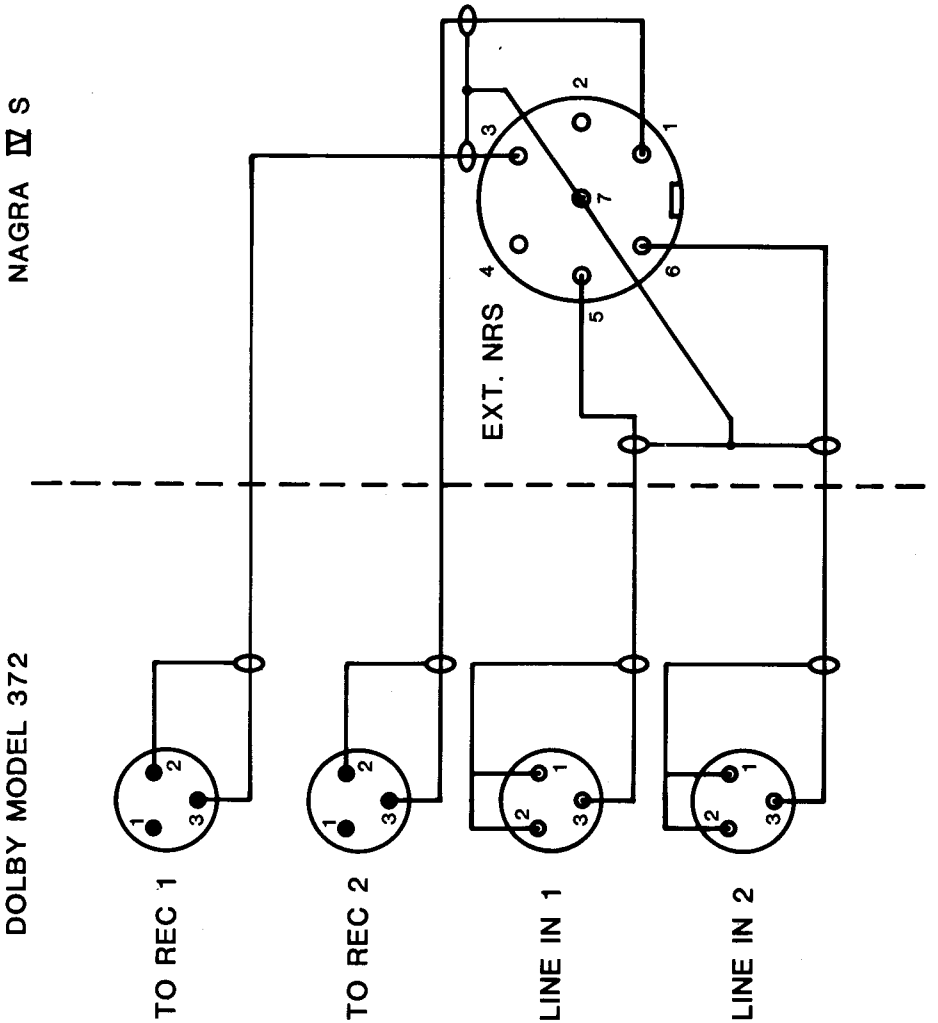
NOISE REDUCTION	Standard Dolby A-type characteristic, providing 10 dB of noise reduction from 30 Hz to 5 kHz, rising to 15 dB at 15 kHz.
OVERALL NOISE LEVEL (record-playback)	75 dB below Dolby level (20Hz to 20 kHz, unweighted).
HARMONIC DISTORTION	Maximum 0.1%, 1 kHz to 20 kHz, at + 4 dBr (0 dBr = 0.775V).
OVERALL FREQUENCY RESPONSE	30 Hz - 20 kHz ± 1 dB, encode - decode.
MATCHING BETWEEN UNITS	± 1 dB at any level and frequency 30 Hz - 20 kHz, between any Dolby A-type units.
SIGNAL LEVELS	Minimum input level - 10 dBr for Dolby Level, all inputs. Maximum *Line Output* level + 21 dBr into 600Ω or above. Maximum *To Record* output level + 16 dBr into 600Ω or above (0 dBr = 0.775V).
SIGNAL DELAY	15 μs, overall encode - decode process. Constant with frequency.
PHASE ERROR	Less than 5 degrees, 20 Hz to 20 kHz, overall encode - decode.
POWER REQUIREMENTS	Rear panel switch selects between: a) Internal Batteries - 4 "C" size cells or equivalent Nicad cells which are charged via a rear panel connector. Charger requirements: 9 - 15V dc at 200 mA minimum, (less than 2V peak-to-peak ripple). b) 6 - 30V dc input via a rear panel connector. Current varies depending on input voltage and Model 372 operating mode/conditions. Under no signal conditions input current typically 200 mA at 6V decreasing to 100 mA at 30V.
BATTERY LIFE	Typically 6 - 10 hours depending on Model 372 usage. (Based on fully charged 2.2 Ah "C" size Nicad batteries).

CHARGE TIME	14 hours to full charge (Model 372 switched off). With Model 372 turned on, batteries maintain charge equilibrium.
AMBIENT OPERATING CONDITIONS	Temperature range, -10° to + 50° C. Humidity, 0 to 90% non-condensing.
SIZE	220mm (8.5") long. 184mm (7.25") wide. 44mm (1.75") high.
WEIGHT	1.5 kg (3.3 lb) without batteries.



NAGRA 4S INTERFACING DIAGRAM
(Cable #1)

S84/5510



NAGRA 4S INTERFACING DIAGRAM
(Cable #2)

S84/5509/5883

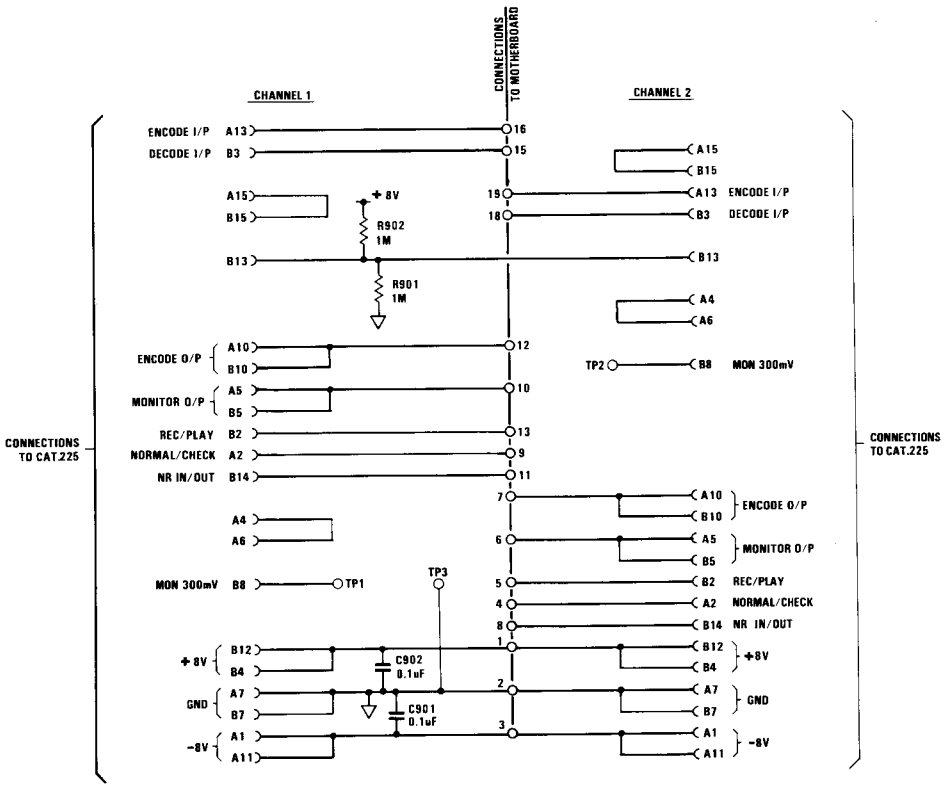


FIGURE 9.1
Interface Card Circuit Diagram

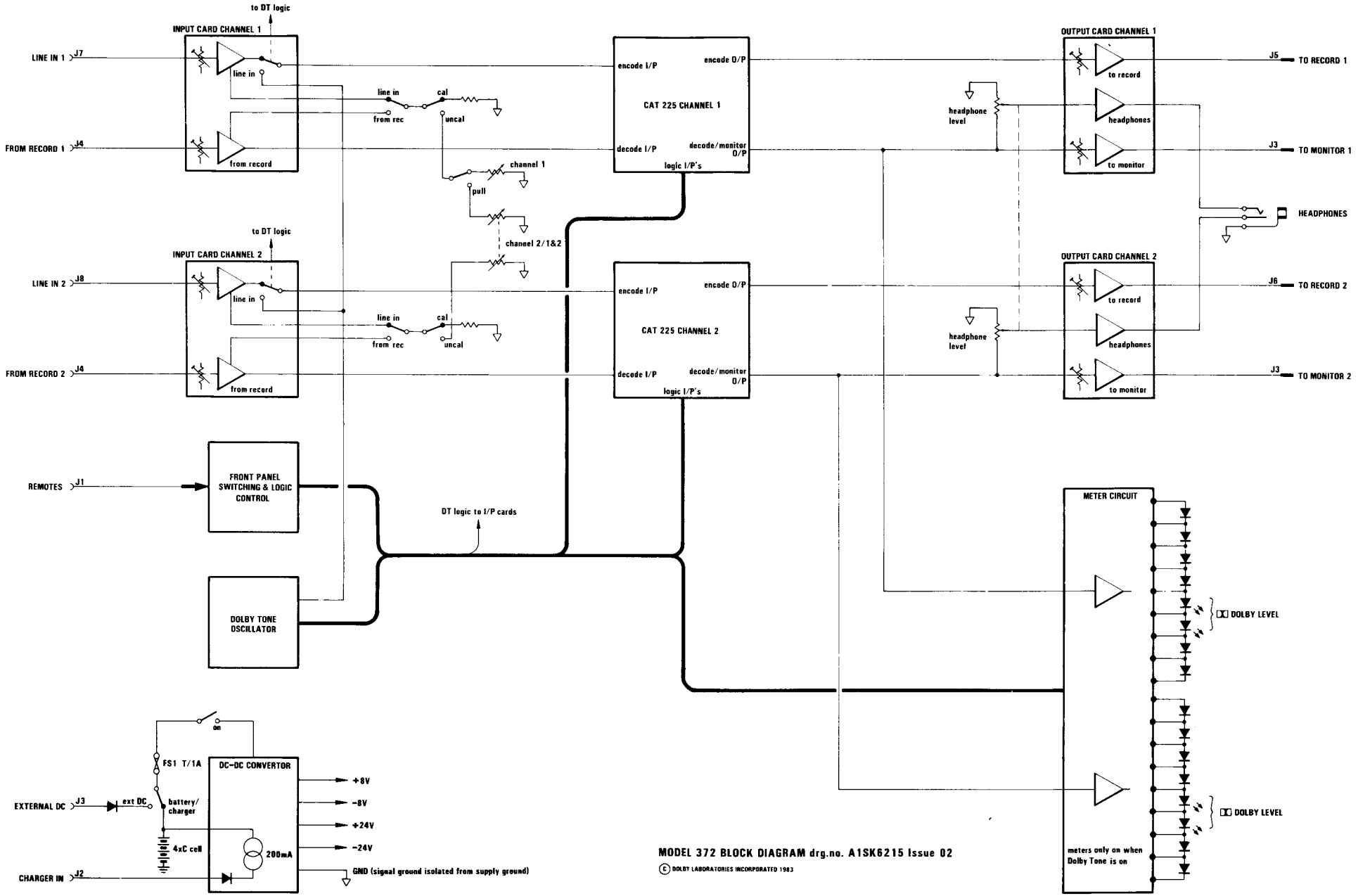


FIGURE 9.2
Block Diagram

S84/5512

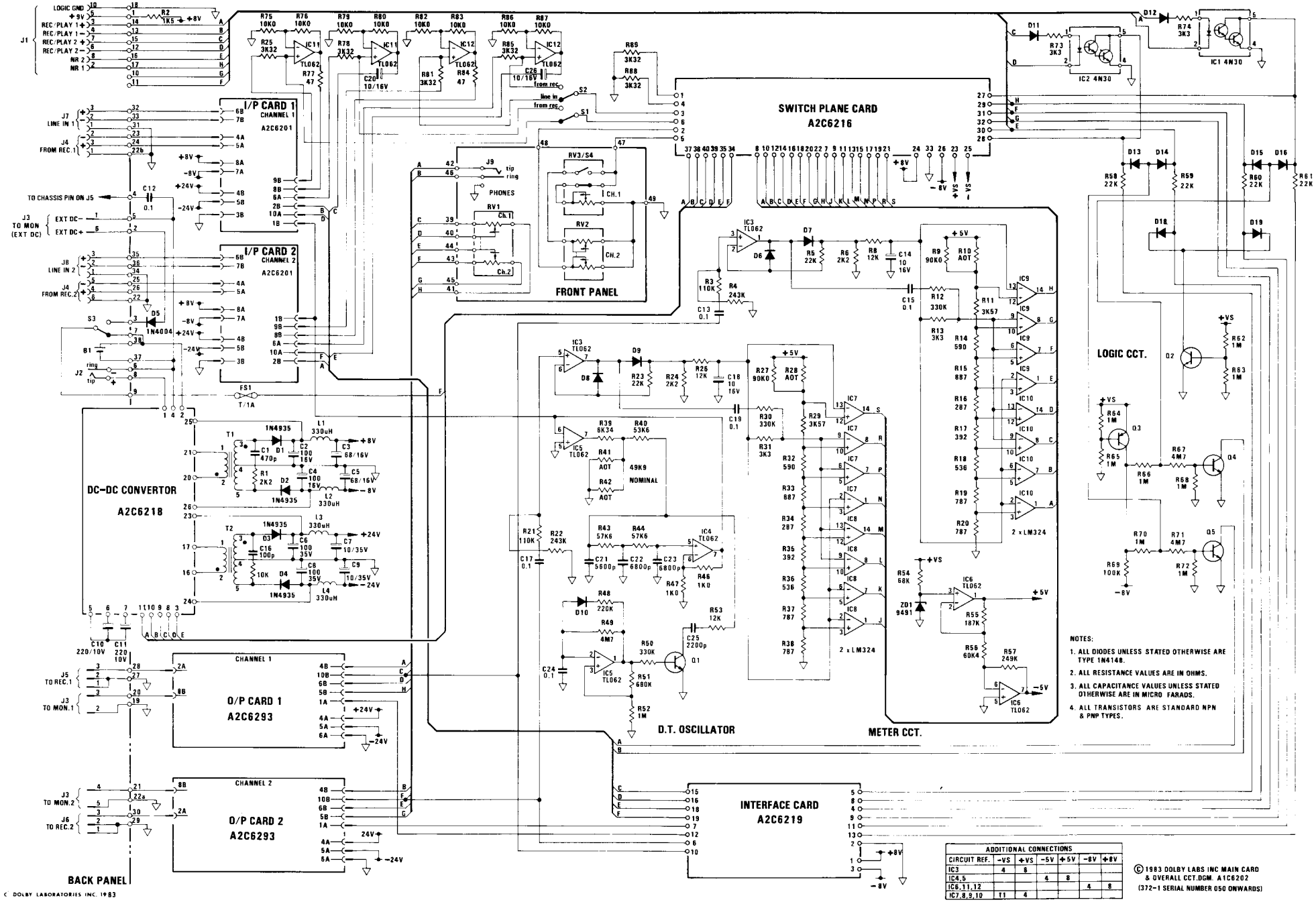


FIGURE 9.3
Main Card Circuit Diagram

S84/5513

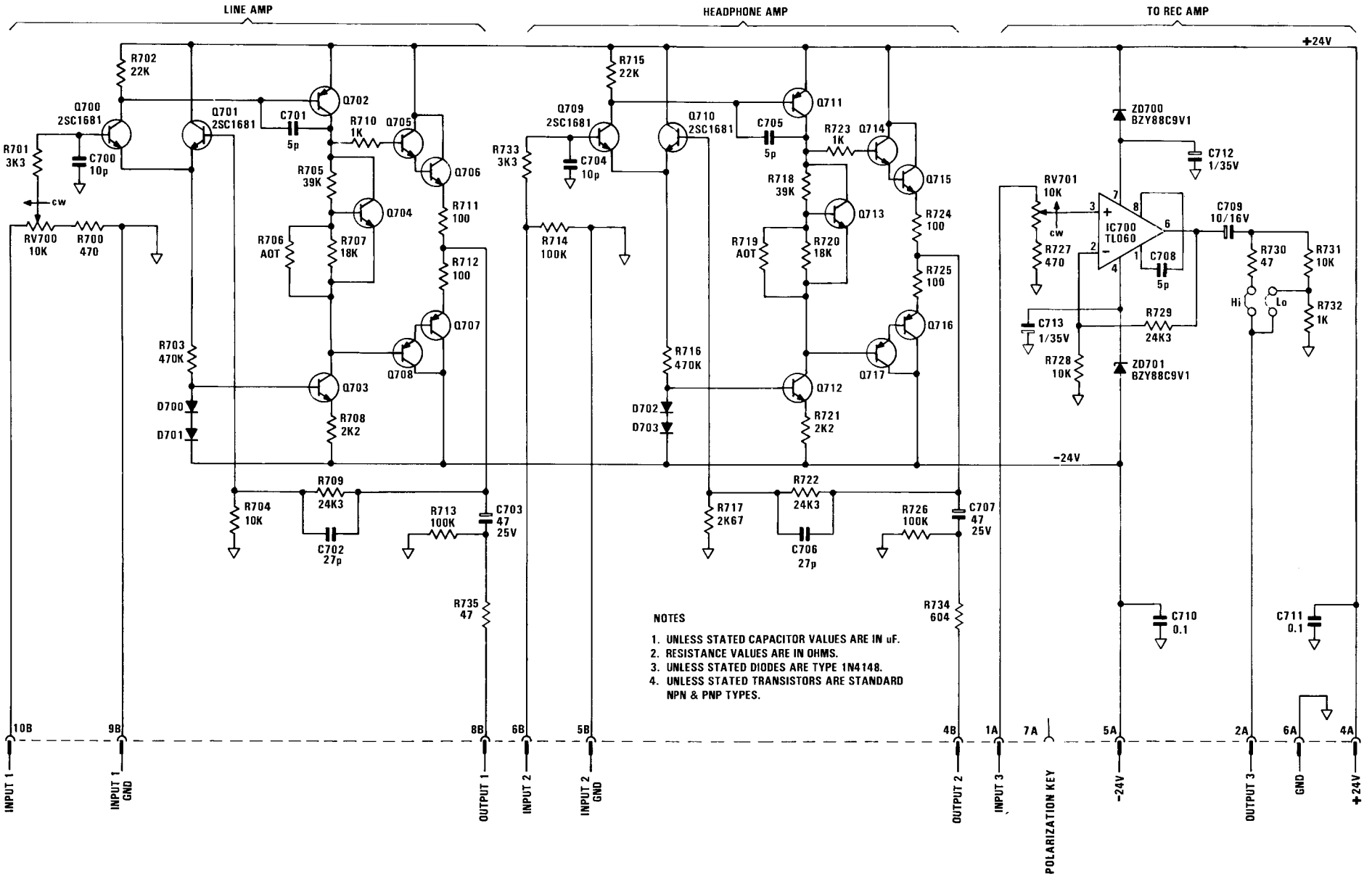


FIGURE 9.4
Output Card Circuit Diagram

S84/5514

NOTES.

1. UNLESS STATED CAPACITOR VALUES ARE IN uF.
2. RESISTANCE VALUES ARE IN OHMS.
3. UNLESS STATED DIODES ARE TYPE 1N4148.
4. UNLESS STATED TRANSISTORS ARE STANDARD NPN & PNP TYPES.

ADDITIONAL CONNECTIONS		
CCT. REF.	+8V	-8V
IC100	PIN 8	PIN 4

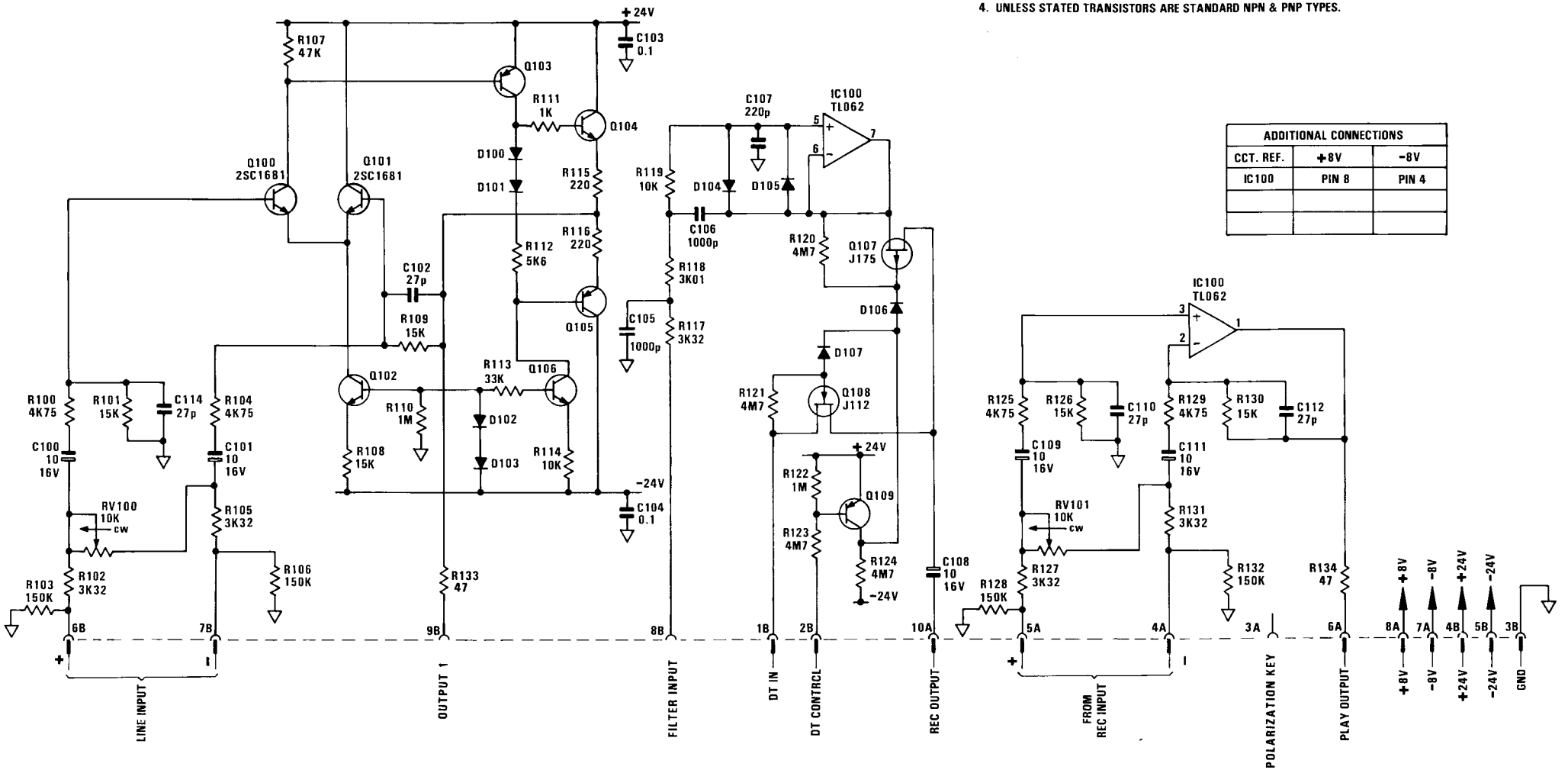


FIGURE 9.5
Line Input/Play Amp Circuit Diagram

S84/5515

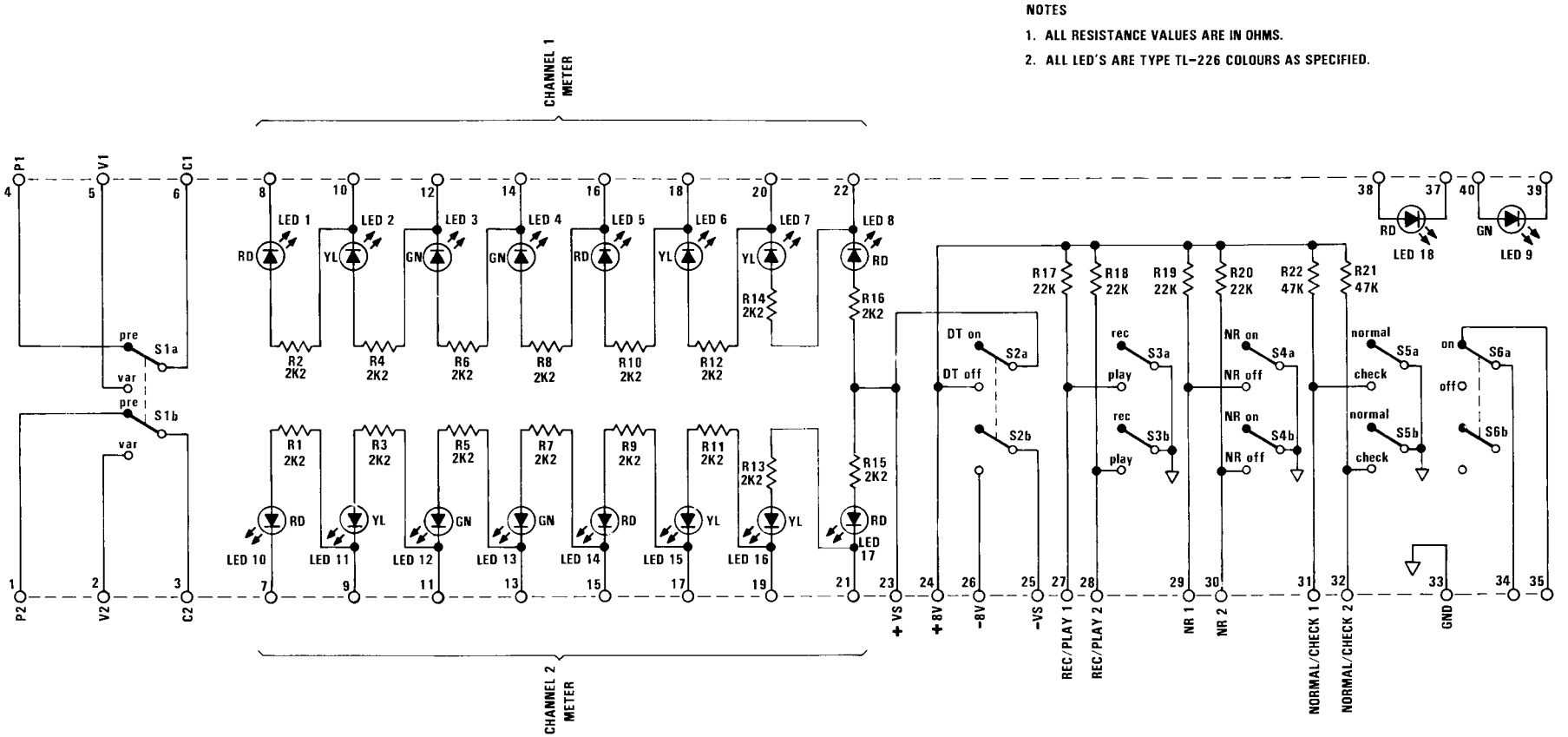
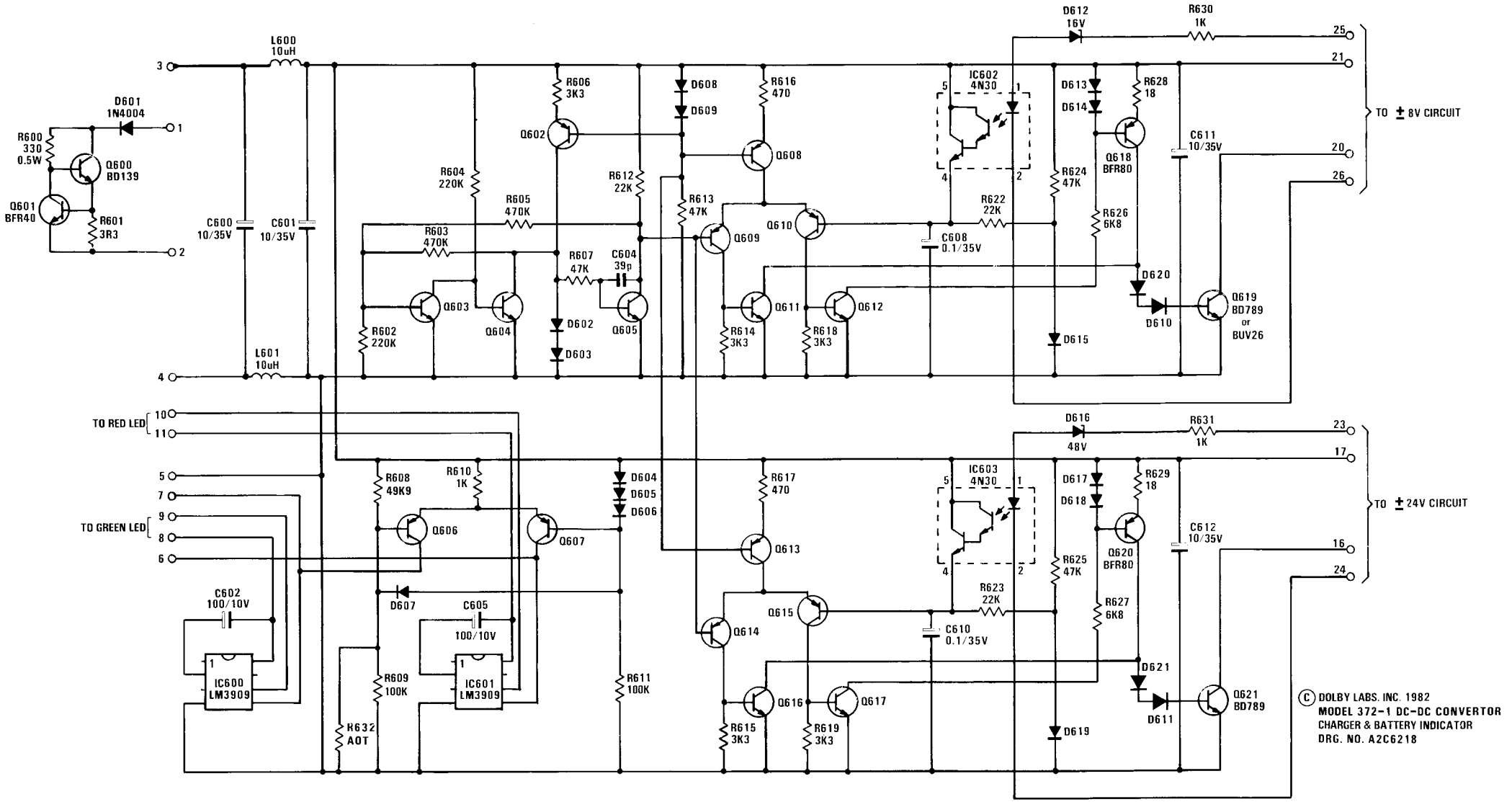


FIGURE 9.6
Switch Plane Circuit Diagram

NOTES

1. UNLESS STATED CAPACITOR VALUES ARE IN uF.
2. RESISTANCE VALUES ARE IN OHMS.
3. UNLESS STATED DIODES ARE TYPE 1N4148.
4. UNLESS STATED TRANSISTORS ARE STANDARD NPN & PNP TYPES.

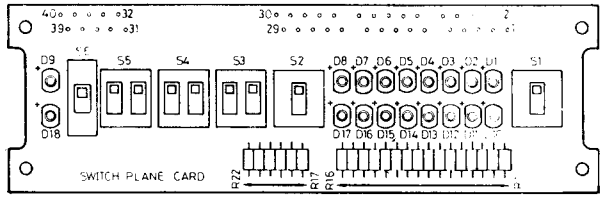


MODEL 372-1 DC-DC CONVERTOR
CHARGER & BATTERY INDICATOR
DRG. NO. A2C6218

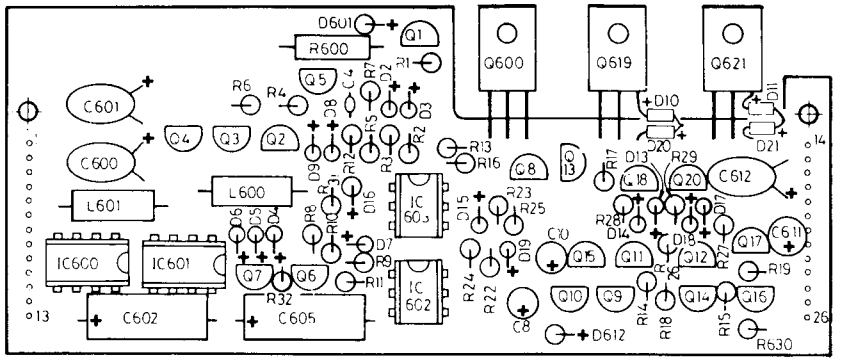
FIGURE 9.7
DC/DC Converter

S84/5535

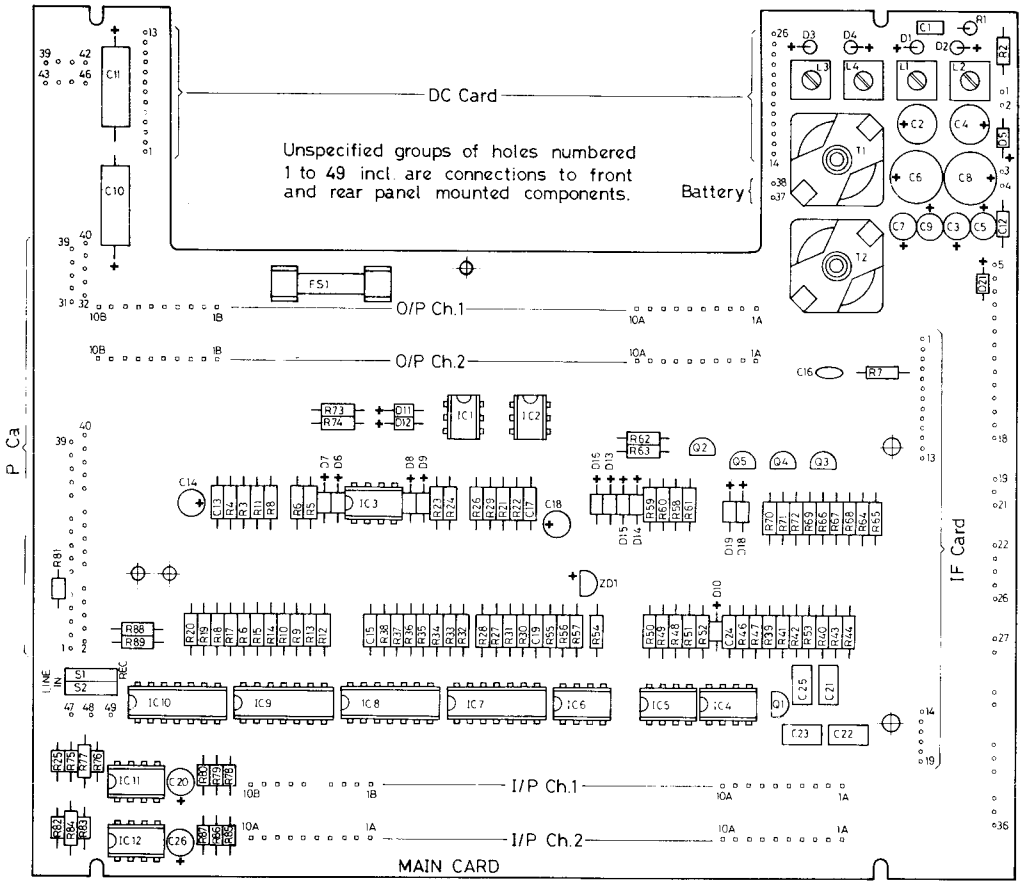
Switch Plane Component Layout



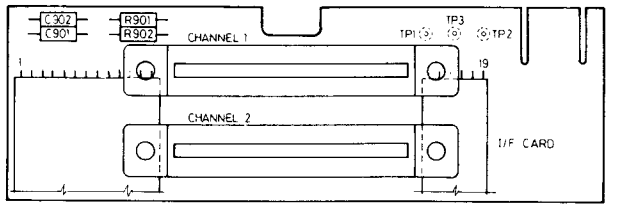
DC-DC Card Component Layout



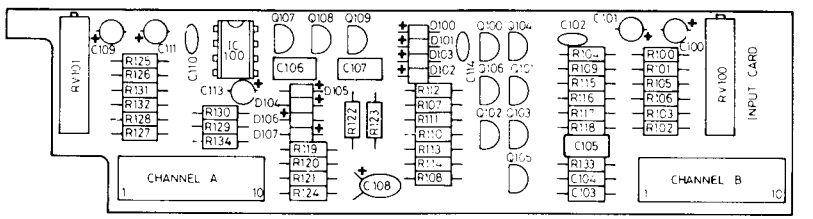
Main Card Component Layout



Interface Card Component Layout



Input Card Component Layout



Output Card Component Layout

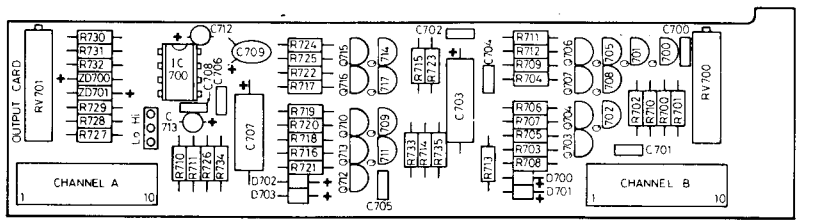


FIGURE 9.8 Component Layout Diagrams