DOLBY LABORATORIES
INSTRUCTION MANUAL

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SECTION 1
MODEL 365 NOISE REDUCTION SYSTEM – INTRODUCTION

Model 365 – Introduction

The Dolby A-Type Noise Reduction System has been designed to reduce noises commonly encountered in audio signal recording and transmission systems. These noises may take the form of rumble, hum, crosstalk, clicks, pops, buzzing, and hiss, as well as discrete frequency interference such as television synchronizing pulse crosstalk. All of these noises are reduced by the system without affecting the overall frequency response or dynamics of the signal itself.

In the particular field of magnetic tape recording, the system will reduce tape hiss and also alleviate other problems such as print-through and high-frequency modulation noise. The print-through reduction is of special significance, as it allows the long-term storage of high-quality master tapes with minimal degradation.

The system is suitable for use in any situation in which the signal is available for processing at both ends of the recording or transmission chain. The processing operations can be separated by any distance or any time duration, since once correctly adjusted, the system parameters are extremely accurate and stable. Furthermore, the system is tolerant of gain-errors in the recording or transmission channel. An incorrect level to the playback unit of ±2 dB does not result in any perceptible alteration of the restored signal.

It should be appreciated that when recording or transmission noise is reduced, other noises masked by it naturally become more apparent. Full use of the increased dynamic range provided by the noise reduction system may therefore sometimes require a tightening of standards in the rest of the chain – i.e. in connection with noise from microphone amplifiers, mixers, and monitor amplifiers, as well as noise from wholly acoustic sources such as buzzing fluorescent lights, creaking chairs, and the movement of persons in the studio. (On the other hand, it can be argued that acoustic noises, having purely natural origins, contribute to a feeling of realism and immediacy.)

The Model 365 is a two-channel noise reduction processor unit. The unit can be used for either recording or playback (encoding or decoding), the operating mode being preset by pushbutton switches on the front panel. This model is designed for monitoring, editing, and disc cutting, as well as for applications in which simultaneous record-playback monitoring facilities are required. (One channel in record, the other in play).

The circuits used are highly stable and do not require any adjustments, apart from input and output levels, which are set during installation. The noise reduction circuitry is factory-set to precise limits and contains no adjustable controls. All components are mounted in a single module which can be purchased separately. Should failure ever occur, plug-in substitution will rapidly restore operation of the system with no adjustments necessary.

An internal Dolby Tone oscillator is provided for each channel to establish correct operating levels. The characteristic modulation of this tone also serves as identification for Dolby-processed tapes. All oscillators in a multichannel installation can be controlled by a single switch.

Dolby Spectral Recording

Dolby spectral recording, or Dolby SR, has been developed to answer the needs of modern professional recording. The Cat. No. 280 SR module is the first implementation of this new recording process. It can be used in existing interface frames manufactured by Dolby Laboratories and will, therefore, allow a widespread introduction of this new high-quality recording format.

Dolby SR Compatibility

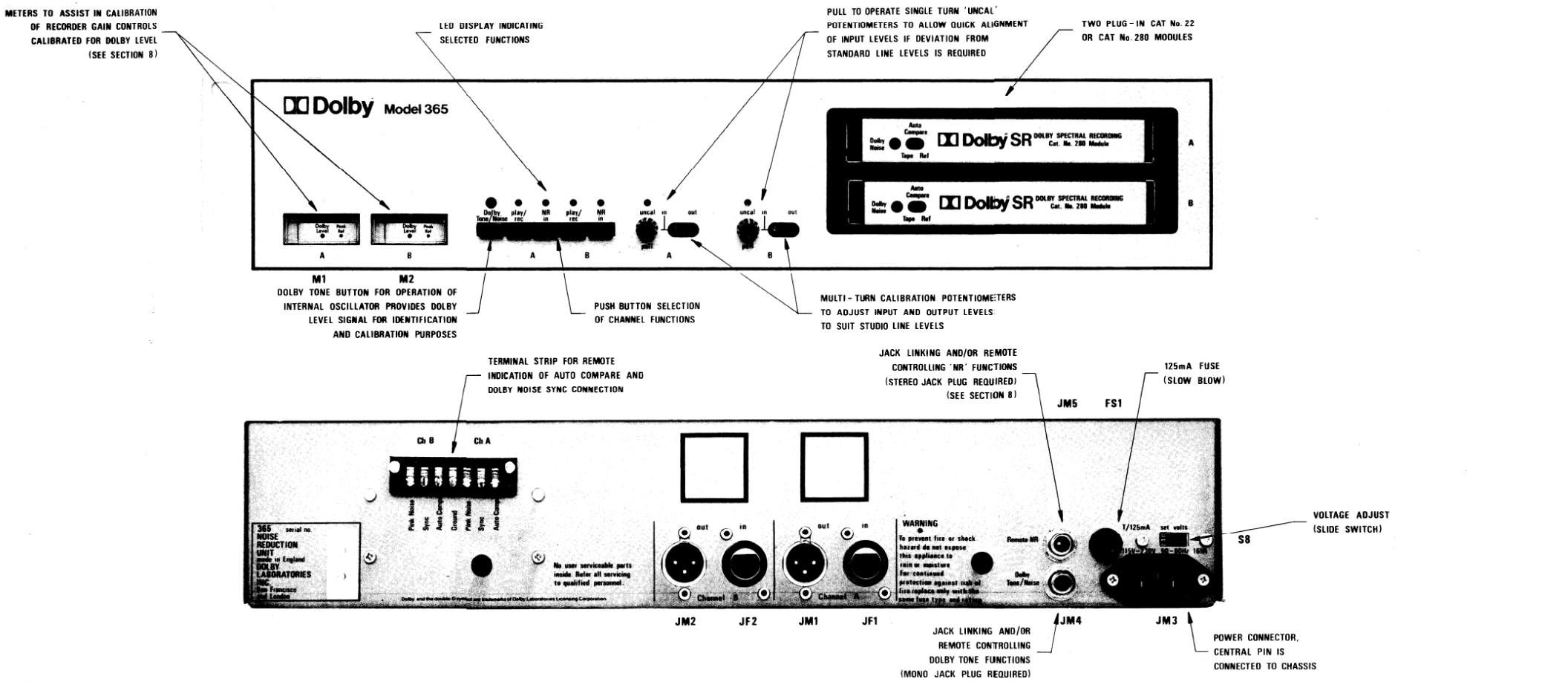
Electrically, the Dolby SR process is very different from A–type noise reduction. Both Dolby A–type NR and Dolby SR are complementary processes that, when decoded properly, give excellent results. Dolby SR, however, goes far beyond any other noise reduction system in its ability to improve the overall quality of a recording or transmission channel. Dolby A–type and Dolby SR are not considered cross-compatible – Dolby SR encoded tapes should not be decoded with Dolby A–type cards and vice versa.

Dolby SR Calibration

As with A–type noise reduction, Dolby SR requires the decode module to be correctly set in level with respect to the encode module. With A–type, this is accomplished using Dolby Tone; with the Dolby SR process, it is achieved using a new, easily identifiable alignment signal: Dolby Noise. Dolby Noise, abbreviated DN, is always used to establish correct decode level.

In addition to the Dolby spectral recording circuits and the Dolby Noise generator, the Cat. No. 280 contains an important new feature – Auto Compare. The Auto Compare circuit, using Dolby Noise as a signal, gives the user valuable gain and frequency response information about the recording channel. The Auto Compare mode allows an automatic aural comparison of the recorded Dolby Noise signal and the internally generated pink noise. The user can quickly, by ear, verify the performance of the recording system by comparing the reference pink noise with the Dolby Noise from the tape. The Auto Compare feature is discussed fully in the Cat. No. 280 manual Section 3 – Calibration.

SECTION 2
CONTROLS AND CONNECTORS



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MODEL 365 CONTROLS AND CONNECTORS

SECTION 3
SPECIFICATIONS

Specifications – Model 365

Layout:	Two independent signal processors per unit.
Signal Connections:	XLR inputs and outputs.
Input Circuit:	Bridging transformer, 10k Ohm balanced and floating.
Output Circuit:	Transformer, 20 Ohms output impedance, balanced and floating. Will drive any load impedance from 200 Ohms upwards.
Signal Levels:	Input levels adjusted either by single turn "Uncal " or multi-turn "Cal" potentiometers accessible from front of unit. Minimum input of 350 mV for Dolby Level on both calibrated and uncalibrated inputs. Maximum output level of +22 dBm into bridging load; +21 dBm into 600 Ohms; +20 dBm into 200 Ohms.
Meters:	Level setting meter for recorder gain calibration. Calibration marks for Dolby Level and Peak Reference Level.
Panel Controls:	Pushbutton for selection of:– a. Record/Play b. NR in/out or remote c. Set-up and a pull to operate uncalibrated input option.
Remote Control:	Mono jack socket for linking and/or remoting Set-up Stereo jack socket for independent NR remote operation. Control is effected by grounding the terminals for SR/NR in and Set-up on. Maximum grounding resistance 25 Ohm.
Overall Frequency Response:	±1 dB from 30 Hz to 20 kHz (encode–decode).

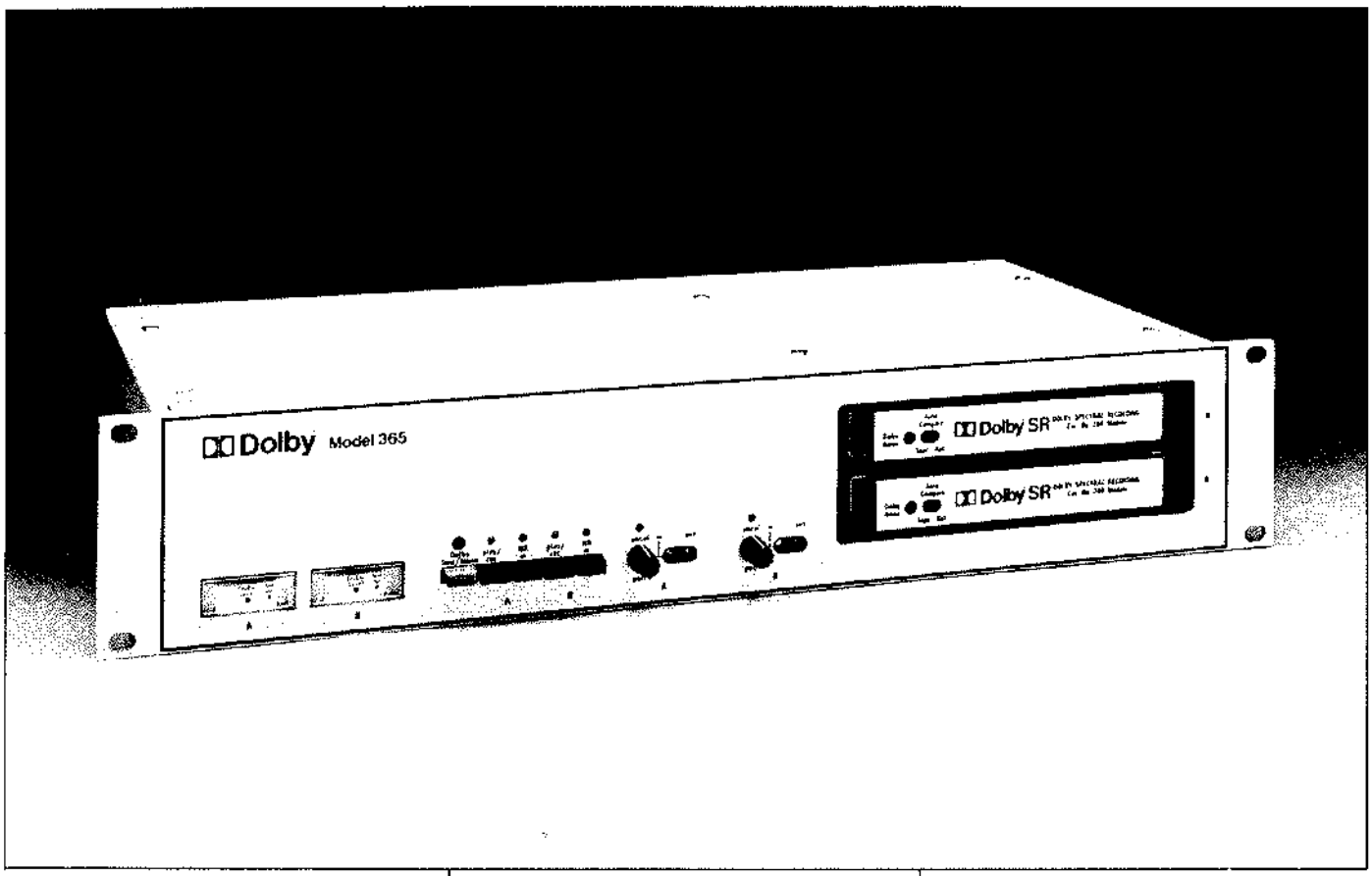
Dolby A–Type Noise Reduction

Total Harmonic Distortion:	At +4 dBm, less than 0.1% at 1 kHz: less than 0.2% from 40 Hz to 20 kHz.
Encoding Characteristics:	Dolby A-type professional characteristic providing 10 dB of noise reduction from 30 Hz to 5 kHz, rising to 15 dB at 15 kHz. With noise reduction action switched off, the unit becomes a fixed, unity gain line amplifier.
Overall Noise Level:	Record-playback (NR off), 80 dB below Dolby Level over a 20 Hz to 20 kHz bandwidth.
Matching Between Units:	±1 dB at any level and any frequency, 30 Hz to 20 kHz.
Signal Delay:	Constant with frequency, 24 μsec per channel. Overall encode/decode process 48 μsec.
Phase Error:	Less than 5°, 20 Hz to 20 kHz overall encode/decode.
Crosstalk:	Better than 70 dB over 20 Hz to 20 kHz.

Dolby SR Spectral Recording

Overall Total Harmonic Distortion:	2nd and 3rd harmonic each 0.3% at 3 dB below peak level, 20 Hz–20 kHz. Negligible high order distortion components at any level.
Overall Dynamic Range of SR System: (1)	105 dB – clipping level to CCIR/ARM noise level. 93 dB – clipping level to CCIR Rec. 468–2 weighted noise level. 105 dB – clipping level to NAB A-weighted noise level (2). 95 dB – clipping level to unweighted noise level, 20 Hz–20 kHz (3). (1) Processor alone; in interfaces, may depend on line levels used. (2) Weighting filter supplemented by 25 kHz 4-pole low-pass filter to ensure that only audible noise is measured. (3) RMS or average responding meter, 4-pole filters.
Typical Obtainable Dynamic Range, 15ips:	90–95 dB.
Matching Between Units:	1 dB at any level and any frequency, 20 Hz–20 kHz.
Signal Delay:	14 μs overall, encode/decode.
Phase Difference SR in/SR out:	Less than 2 degrees, 20 Hz–20 kHz overall, encode/decode.
Calibration Facilities:	Dolby Noise generator for establishing correct levels and frequency response, via built-in meter-amplifier and interface frame meter. Output signal can also be fed to external analysis facilities. Automatic audible Auto-Compare function, allowing comparison of Dolby Noise from tape with internally generated reference pink noise.
Status Indicators:	Yellow LED on front of module indicates Dolby Noise mode. Auto-Compare Tape/Reference function status indicated by green and red LEDs on front of module. (LED control signal available for remotely situated LEDs or lamps.)
Stability:	The system is highly stable and does not need routine alignment.
Operating Temperature:	Up to 45°C.
Construction:	Plug-in noise reduction modules (Cat. 22 or Cat. 280). Level setting potentiometers immediately accessible through front panel. Fibre-glass printed circuit board and solid-state devices throughout.
Finish:	Steel case, zinc passivated finish; front panel clear anodised aluminium with black characters.
Size:	3.5″ x 19″ rack mounting (88 x 482mm). Maximum projection behind mounting surface: 8 15/16″ (228mm). Maximum projection in front of mounting surface: 7/8″ (22mm).
Weight:	18lbs (8Kg).
Power Requirements:	Units are designed for operation from a centrally switched power source. Power cable provided. 104–130 V and 208–260 V, single phase, 16 VA.

Dolby Model 365
Two-channel Interface



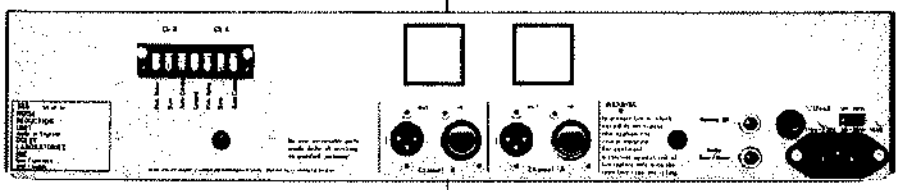
The Dolby Model 365 is ideal for applications requiring two channels of dedicated recording or playback. Front panel switches operate encode/decode functions for each channel.

The Model 365's processing circuitry is contained in a pair of modules which are easily accessible from the front panel. Push-buttons on the front panel control the process in/out function. Dual meters and built-in reference generators simplify Dolby Level set-up. The process in/out and Dolby Level set-up functions may be operated remotely.

Each channel of the Model 365 has a Play Uncal control which permits temporary recalibration to match a tape recorded at a different level while retaining the unit's preset Dolby Level.

The Model 365 may be ordered either as a 365 A with two Cat. No. 22 Dolby A-type noise reduction modules, or as a 365 SR with two Cat. No 280 Dolby SR spectral recording modules.

Dolby Model 365 Specifications



Layout:

Two processors per unit, on common power supply.

Signal Connections:

XLR inputs and outputs.

Input Circuit:

Bridging transformer, 10 k ohms balanced and floating.

Output Circuit:

Transformer, 20 ohms output impedance, balanced and floating. Will drive any load impedance from 200 ohms upwards.

Signal Level Adjustments:

Input levels adjusted either by single-turn "uncal" or multi-turn "cal" potentiometers accessible from front of unit.

Minimum input of 350 mV for Dolby Level on both calibrated and uncalibrated inputs.

Maximum output level of +22 dBr into bridging load; +21 dBr into 600 ohms; +20 dBr into 200 ohms. (0 dBr = 0.775 V)

Meters:

Level setting meter for recorder gain calibration. Calibration marks for Dolby Level and Peak Ref (+5 dB above Dolby Level.)

Panel Controls:

1. Push-buttons for selecting:
   a. RECORD/PLAY
   b. IN/OUT or REMOTE
   c. SET-UP — engages Dolby Tone oscillators or Dolby Noise generators
2. PLAY UNCAL control — push preset/pull variable

Remote Control:

Jack sockets for linking and/or remoting Dolby Level set-up operation.

Stereo jack socket for independent In/Out remote operation, achieved by grounding the terminals for In/Out and Dolby Level set-up. Maximum grounding resistance 25 ohms.

LED status indicators are also remotable.

Stability:

The system is highly stable with either Cat. No. 280 or Cat. No. 22 modules, and does not need routine alignment.

Crosstalk:

Better than 70 dB (encode-decode) over 20 Hz-20 kHz.

Operating Temperature:

Up to 45° C.

Construction:

Plug-in processing module (Cat. No. 280 or Cat. No. 22).

Level setting potentiometers immediately accessible through front panel.

Fiberglass printed circuit board and solid-state devices throughout.

Finish:

Steel case, zinc passivated finish; front panel clear anodized aluminum with black characters.

Dimensions:

3.5" x 19" rack mounting (88 x 483 mm). Maximum projection behind mounting surface, 8-15/16" (228 mm). Maximum projection in front of mounting surface, 7/8" (22 mm).

Weight:

18 lbs. (8 kg).

Power Requirements:

Units are designed for operation from a centrally switched power source. Power cable provided.

104-130 V and 208-260 V, single phase, 16 VA.

The following specifications describe the Model 365's performance with the Cat. No. 22 Dolby A-type noise reduction module. The Model 365 may also be purchased with Dolby spectral recording modules; for these performance specifications, see the Cat. No. 280 information sheet.

Overall Frequency Response:

±1 dB, 30 Hz-20 kHz, encode/decode.

Total Harmonic Distortion:

At +4 dBr, less than 0.1% at 1 kHz; less than 0.2% from 40 Hz-20 kHz.

Noise Reduction:

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 (NR out), better than 80 dB below Dolby level, unweighted 30 Hz to 20 kHz bandwidth, or weighted CCIR/ARM.

Matching Between Units:

±1 dB at any level and any frequency, 30 Hz-20 kHz.

Signal Delay:

Constant with frequency, 19 μsec per channel, 38 μsec overall encode/decode, including delay of Model 360 Series interfaces.

Set-up:

Dolby tone oscillator for establishing correct levels via built-in meter amplifier and interface meter.

Dolby

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SECTION 5
LEVEL STANDARDIZATION

5.1 Basic Standardization Requirements

Correct operation of the Dolby A-type Noise Reduction System is dependent on only one basic requirement – that the signal voltage in the playback processor should be the same (within 2 dB) as that in the recording processor. In other words, the recording system should have an effective overall record-playback gain of unity. However, the requirement for signal interchangeability imposes a further requirement – that the signal levels in the noise reduction system should be related to the levels of internationally recognized standards, such as magnetic test tapes (of which the most widely used are the Ampex NAB and DIN tapes).

In order to correlate the various voltage levels and flux levels used in the complete recording or transmission chain, the concept of "Dolby Level" is employed. Dolby Level bears a fixed amplitude relationship to the noise reduction compression and expansion parameters. In 360 Series units, this level correlation is achieved in practice by a meter with a Dolby Level mark and by a special built-in Dolby Tone oscillator which generates a signal at Dolby Level. For maximum effectiveness, the Dolby Tone has been designed to be easily recognizable in order to avoid possible confusion with the multiplicity of tone signals at present in use for equalization or testing purposes. Its level has been chosen to be readily measurable on normal programme level meters in studios or broadcast stations, as well as on the meters of 360 Series units (on A301 units Dolby Level corresponds to the NAB meter mark). Since Dolby Level bears a fixed relationship to the noise reduction transfer curves, it can be further linked to the recording or transmission system parameters – i.e. line levels, flux levels, etc.

The Dolby Tone is generated by a constant-amplitude oscillator which is periodically frequency-modulated upwards with a 10% frequency change. The modulation occurs for a period in the low tens of milliseconds, which the ear interprets not as frequency modulation but more as amplitude modulation. However, since the amplitude is in fact constant, level setting meters maintain constant indications (regardless of their time constants). The A-type oscillator runs at 850 Hz and is modulated to approximately 930 Hz for 30 milliseconds every 750 milliseconds. The resulting periodic chirp-like sound is highly characteristic.

5.2 Magnetic Tape Recording

Dolby Level is linked to the magnetic flux level on the tape and was originally defined as 185nWb/m (this corresponds to Ampex operating level which is approximately 4.8dB below the I.E.C. reference level of 320nWb/m). As tape types have improved operational levels have increased and 185nWb/m may not be appropriate. If you use VU meters then use a Dolby Level equal to the flux level which corresponds to 0 VU. If you use peak reading meters then use a Dolby Level equal to the flux level corresponding to 5dB below your 100% level. For other types of magnetic media Dolby Level is defined as follows:

Magnetic film; 185nWb/m
Video tape (B and C format); 100nWb/m (EBU/SMPTE reference level).

5 3 Transmission Applications

Dolby Level is linked to the transmission level by the following relationships:

1. If VU meters are used, Dolby Level corresponds to 0 VU on a steady-state basis.

2. If fast risetime peak programme meters are used, Dolby Level corresponds to a level of 4 dB below the nominal nominal 100% or peak operating level on a steady-state basis (i.e. PPM 5 for UK peak meters, +4 on the EBU meter scale, or –4 on light-beam instruments).

5 4 Optical Sound Tracks

Dolby Level is defined as 6 dB below clash (clipping) level, or 50% of full track width modulation.

5 5 Other Systems

Dolby Level can be defined by reference to the overload properties of the transmission system following the guidelines provided by the above definitions.

5 6 Adjustment of Input and Output Levels

The adjustment of signal levels is covered in detail in Section 8, Operation. A generalized description is given here to illustrate the part played by the Dolby Level calibration.

Decode or playback units are calibrated first. A tone, from a test tape or oscillator, at either 0 VU (or Ampex Operating Level – Dolby Level) or DIN (PEAK) level, is fed into the unit and the input level potentiometer is adjusted to give an appropriate reading on the front-panel meter on the unit (i.e. Dolby Level or PEAK REF). The output level potentiometer is then adjusted to give unity gain through the unit.

Following correct calibration of the decoder unit, the encoder or record unit is set up. The record gain controls on the recorder or the line sending controls on the line amplifier are adjusted to suit the usual line levels. The Dolby Tone button is pressed, and the output level control on the 360 Series unit is adjusted such that the recorder or received tone, as indicated by the previously calibrated decoder unit, is at the Dolby Level mark. The input potentiometer of the encoder unit is then adjusted to suit the incoming signal level.

After this calibration is completed, the A-type encoder and decoder units, together with the recorder or transmission line coupling them, should be treated as a fixed, unity-gain system. The decoded output is at studio or line level; for encoding, studio or line level should be fed in.

In operation, do not compensate for different types of programme material (e.g. piano) or different types of tape (e.g. high-output) by altering any of the previously adjusted record and playback gain controls in the chain; set the level actually recorded on the tape or sent to the line by adjusting the level of the programme source (mixer output). The calibration procedure ensures that the internal characteristics of the A-type units are directly related to the transmission or recording parameters (e.g. tape flux density), and altering the gain settings to suit programme material would destroy this relationship. These precautions

are essential for tape and transmission standardization. To assist in maintaining standardization in tape exchanges and inter-studio transmissions, always record or send a section of Dolby Tone at the beginning of each programme using the internal Dolby Tone oscillator.

It should be emphasized that the requirement for level standarization in using the Dolby system in no sense puts a constraint on the actual programme levels used. The programme levels.themselves should be the same as those used in the absence of the Dolby system. However, with the system it may be found advantageous to devote some of the 10 dB increase in usable dynamic range to a reduction of distortion produced by the recording or transmission channel; a reduction of programme level would then be called for.

SECTION 6
APPLICATIONS

6.1 Applicability of Dolby system

Dolby A-type audio noise reduction units can be applied to any noise-introducing recording or transmission channel in which the signal is available before and after the noisy channel and in which the gain and frequency response characteristics of the channel are fixed and known. These basic considerations are discussed in Sections 1 and 4. In addition to the handling of normal music and other audio signals, the Dolby system can in principle be used for the recording or transmission of any type of analogue signal in which the ultimate method of presentation of the information is aural.

6.2 Magnetic Sound Recording

6.2.1. Mono and Stereo Tape Recording. The A-type system has applications in mono or stereo recording at all tape speeds. The system will reduce tape noise, modulation noise, and crosstalk. Multi-generation copying is an application in which these noise reductions are particularly valuable.

6.2.2. Multi-track Tape Recording. Multi-track tapes (usually 16 and 24 tracks on 2 inch tape, 8 tracks on 1 inch) are considerably improved by the Dolby system. The mixing of tracks to a two or four track master inevitably results in an accumulation of noise on the master, following basic physical laws. For example, if ten tracks are mixed at equal level to form one new track, the signal-to-noise ratio is degraded by 10 dB. The A-type system reduces the noise level of the ten-track mix to that of a single track recorded without noise reduction; an improvement of this magnitude could otherwise be achieved only by running the tape at ten times the speed or by increasing the track widths by a factor of ten (for example, resulting in a tape width of 20 inches).

6.2.3. Disc Cutting. To take full advantage of the noise reduction used in the production of the master tape, Dolby-encoded tapes should be sent for disc mastering. Each channel of the disc cutter is then decoded via Dolby A-type noise reduction units. Similarly, where copies of master tapes are sent abroad for processing by licensees, A-type encoding should preferably be used in order to maintain optimum quality (see Dolby international user list)

6.2.4. Tape Duplication. The benefits of noise reduction can be applied to all stages of a duplicating chain. With Dolby B-type (consumer) encoding on open reel, cassette, or cartridge, the noise from a single non-encoded master tape generation is audible on the resultant duplicate. It is therefore preferable that all master tapes used in the duplicating process should use A-type noise reduction.

6.2.5. Archive Recording. Storage of magnetic tapes for archival purposes often results in magnetic printing from layer to layer in the reel, producing pre- and post-echoes. If the original tape has been encoded by Dolby A-type noise reduction units a long term 10 dB reduction in print-through is achieved. While a reduction of print-through cannot be obtained on existing conventionally recorded tapes, further print can effectively be arrested by re-recording of the material through A-type units.

6.2.6. Sprocketed Magnetic Film. The Dolby system can be of significant assistance in the motion picture and television industries for sound recording on 35 mm or 16 mm sprocketed magnetic film. The use of noise reduction is especially valuable wherever the final sound track may be built up from several sychronized recordings or where multiple generation dubbing techniques may be used.

6.2.7. Videotape Recorders. Audio on videotape has long suffered from the problems associated with trying to record sound on magnetic tape designed for recording video signals. On quadruplex machines the effects of the basic oxide formulation were compounded by the fact that the magnetic particles needed to be aligned perpendicularly to the direction of tape travel in order to make the recording of the video signal easier. This resulted in a fairly high basic noise level. The addition of Dolby A-type noise reduction to this format greatly assisted in improving the audio performance of the system.

The more recent 1 inch formats have in themselves offered significant audio improvements over quadruplex machines and with the addition of Dolby A-type noise reduction can now give results much closer to the performance people have come to expect from standard audio recorders.

Because of the need for easy tape interchange between national and international broadcast organizations, Dolby Level has been rigidly defined for 1" broadcast applications. Again, in order to make things simpler and avoid using a variety of different levels, Dolby Level has been defined for C–format tapes as being the same as EBU/SMPTE reference level, that is Dolby level = 100nWb/m flux level on tape.

6.3 Transmission Applications

6.3.1. Landlines. Lines between studios and transmitters, or between distribution centres, are still often coaxial or twisted pairs. Such lines are subject to a variety of interferences ranging from cross-talk and telephone dialling pulses to low frequency noise which can be either hum or noises introduced by earth or sea movements. Adjacent circuits carrying video signals may contribute television line-frequency interference. Landlines often suffer from considerable high frequency attenuation, and the degree of high frequency equalization which then has to be applied may result in unacceptable high frequency noise. The Dolby system is of great value in alleviating these line noise problems.

6.3.2. Microwave Links. Broadcast signals are often sent from station to station through some form of microwave system. This may take the form of a number of probably adjacent 3 kHz bandwidth channels multiplexed onto a carrier. At the receiving end of the chain the 3 kHz channels are demodulated and re-assembled. Any over-modulation of the channels can cause distortion products to be generated in adjacent channels; hence signal overshoots must be minimal. The Dolby A-type noise reduction technique allows transmission of all types of programme. The noise reduction action also removes low-level carrier interference signals which may occur in this type of transmission.

6.3.3. Other Transmission Methods. The A-type system is generally suitable for use with any communication link with fixed gain and frequency response characteristics. However, for correct operation the signal entering the decode processor should be identical (within normal operating tolerances) to that leaving the encode processor. The signals should also be in unequalized (flat) form.

6.4 Motion Picture Industry

6.4.1. Location Recording. Since Dolby A-type noise reduction units have application throughout the motion picture industry, from the location recording to the final print in the cinema, it is preferable if a sound recording is A-type encoded from the beginning. On location, camera noise and other naturally occurring sounds will often dominate the tape noise. But there are many instances when this is not so, and the use of noise reduction at this early stage increases the flexibility in subsequent signal processing without the hazard of noise build-up.

6.4.2. Transfer and Dubbing. The motion picture industry has traditionally used the technique of multiple dubbing to assemble the final master (full-coat, triple or M.E.D.) recording from a variety of sources (dubbing units), rather than the music recording industry's method of parallel recording on multi-track machines. Clearly noise build-up is a problem which can be alleviated by use of the Dolby technique.

6.4.3. Release prints. Historically, the sound quality of the cinema itself – the final link in the chain – has lagged behind the rest of the entertainment industry. To reduce the audibility of wideband and impulse noise a high frequency filter, known as the Academy roll-off, is used in traditional mono optical reproduction systems.

Dolby A-type noise reduction, incorporated into the Dolby Stereo System, is now widely used in cinemas as a means of improving not only the dynamic range but – more importantly – the overall bandwidth of the reproduction system.

This improvement in cinema sound quality has made the use of noise reduction even more important in the early stages of a production if they are not to limit the final product.

6.5 Sound Delay and Echo Systems

6.5.1. Tape Delay. Popular tape delays use either an endless tape loop or a magnetic disc; both systems use a master recording head and several playback heads. Delay units are used to increase intelligibility in large reverberant buildings, to equalize time-differences between vision channels transmitted via satellite and their associated audio channels transmitted via cable, or to create special sound effects. Since magnetic tape is usually the recording medium, noise is a problem which can be alleviated through the use of the A-type noise reduction system.

6.5.2. Electronic Delay. Various methods are being used to produce electronic delays, including shift registers and sample, storage and read circuits. For economic reasons the noise performance is often inadequate for the most demanding applications, and in general the noise spectra is obtrusive since it is not white. In such instances the signal can be noise reduction encoded prior to the delay unit and decoded at the output, yielding a significant improvement in signal-to-noise ratio.

6.5.3. Reverberation systems. Echo chambers or reverberant plates are often noise limited. Dolby A-type noise reduction units can be placed around the echo chain, resulting in a significant improvement in signal-to-noise ratio. Unfortunately, such applications are not as straightforward as they might appear, since due to dispersion the signal at the decoder is not identical to that leaving the encoder. Thus a comparison of the signal with and without noise reduction will reveal differences. The apparent reverberation time will be decreased, but this can be compensated by readjustment of the plate time or room damping materials.

6.6 Digital Applications

Digital techniques are becoming more common as the size and cost of complex semi-conductor logic arrays are reduced. Digital techniques for delay purposes have already been discussed (Subsection 6.5.2.). Another digital application is the use of pulse code modulation (PCM) for signal transmission. To describe an audio signal in digital form needs a given number of bits (level samples) occurring at a given sampling rate, producing a serial data rate in the order of 700 kilobits per second. To transmit this information requires a wide bandwidth; or in recording terms either a multiplicity of tracks or a high head-to-tape speed. The data rate can be reduced if one of the required performance parameters is relaxed, such as signal to noise ratio; incorporation of the analogue A-type noise reduction system into existing or new digital designs can save two bits to give a useful reduction in bit rate for a given ratio. The economic saving of two bits can sometimes be greater than the cost of the A-type processors. The processors should be used before the input to the digital encoder and after the output of the digital decoder.

6.7 Electronic Music

It is not necessary that the programme being encoded consist of naturally occurring sounds. The A-system is equally effective when processing the signals which are often found in electronic music composition. Furthermore, because of the specialized techniques (such as multiple dubbing and the mixing of many pre-recorded sources) employed in these compositions, noise reduction is of particular value in preventing excessive noise build-up.

SECTION 7
INSTALLATION

Installation Instructions

MODEL 365

Two channel record or playback (no automatic changeover)

NOTE: CHECK VOLTAGE SELECTOR BEFORE APPLYING POWER

1. Unpack Model 365 unit and check for damage.

2. Set voltage selector switches (115–230V) appropriately.

3. Mount unit in rack.

4. Connect power cables. If power plugs on cables are changed for another type, the following wiring convention should be observed (for cables supplied with units).

U.S. style	Power: L,black;N,white	Earth:green
Continental style	Power:L,brown;N,blue	Earth:yellow/green

5. Connect signal cables to Model 365 units using three-pin XLR cable connectors. For use in recording, prepare cables from mixing console and cables to recorder. For use in playback, prepare cables from recorder and cables to monitor facilities. In all of the three-pin XLR signal connectors, pin 1 is earth and pins 2 and 3 are the balanced-floating winding of the input or output transformer, with pin 2 as the "low" side and pin 3 as the "high" side for standardized phasing. For unbalanced operation, pin 2 should be connected to earth; pin 3 is signal.

6. Input impedance of Model 365 is 10k Ohms; output impedance is 20 Ohms. The unit will drive any load impedance from 200 Ohms upwards; therefore it is unnecessary to provide an output termination resistor when feeding a bridging load. However, if the tape-recorder has an output termination switch, the switch should be "on" when driving Model 365 (playback mode).

7. Set-up may be linked to other units and/or remotely controlled via a mono jack plug inserted into the appropriate socket on the rear of the unit.

   The Set-up oscillators within a single Model 365 have common control via this socket and are activated by connecting the centre pin of the jack plug to earth.

   Pressing the Set-up button on any linked units connects this pin to earth.

   The Set-up functions may be activated remotely (at the mixing console for example) simply by extending the jack plug links; connect a single pole, normally open switch to the end of the remote link.

   NR may also be linked and/or remotely controlled in a similar way to Set-up, the significant difference being that a stereo jack plug is required.

   The tip controls channel A and the ring controls channel B.

8. Remote indication of Auto Compare is provided at a terminal strip on the rear panel. The Cat. No. 280 Manual Appendix B provides connection details.

   A connection is also provided to enable Dolby Noise to be synchronised. Connect the two "sync" terminals together on the rear of the Model 365 and to other Dolby units providing this facility.

9. Refer to Model 365 Operating Instructions for calibration and operating procedures.

SECTION 8
OPERATION

Operating Instructions

MODEL 365

Dual channel record or playback (no automatic changeover)

NOTE: CALIBRATION TRIMPOTS ON UNITS ARE TURNED DOWN BEFORE SHIPMENT. CALIBRATION PROCEDURE BELOW MUST BE CARRIED OUT BEFORE UNITS ARE USED.

Calibration can be effected with either Cat. No. 22 or Cat. No. 280 modules installed. If Cat. No. 22 modules are used the characteristic Dolby Tone will be sent to the recorder. If Cat. No. 280 modules are installed then Dolby Noise will be sent to the recorder. The additional benefits of Dolby Noise are outlined in the Cat. No. 280 Manual which is supplied when Model 365 is shipped with Cat. No. 280 installed.

Dolby Noise is recorded at 15dB below Dolby Level. Dolby Noise will only indicate Dolby Level on the Dolby Indicator when the 'Set-up' button is depressed.

The unit type selector switch on Cat. No. 280 should be set at 360. Refer to Cat. No. 280 Manual for further information.

365 ALIGNMENT

Ensure that installation has been carried out according to "Model 365" Installation Instructions".

A-Type Calibration

Record Use
Select RECORD mode and noise reduction OUT in all required channels.

1. Align recorder channels.
2. Send 1kHz tone at Dolby level to the input of the 365. (See below – Dolby Level)
3. Adjust input level control on the Model 365 to give Dolby level on the Model 365 indicator.
4. Adjust output level control on the Model 365 to give unity gain through the unit.
5. Select noise reduction IN to restore A-type processing to the recording chain.

Always record a section of Dolby Tone at the head of each recording by pressing the SETUP button.

Playback Use
Select PLAY mode and noise reduction OUT in all required channels.

1. Align playback side of recorder channels.
2. Playback Dolby Tone or tone from tape at Dolby level. (See below – Dolby Level).
3. Adjust input level control on the Model 365 to give Dolby level on the Model 365 indicator.
4. Adjust output level control on the Model 365 to give unity gain through the unit.
5. Select noise reduction IN to restore A-type processing to the playback chain.

Dolby Level

Dolby level may be related directly to other studio reference levels and their associated meter indications. Within any facility there will be a fixed relationship between Dolby level, line level and magnetic flux level. Different applications of A-type will dictate differences in defining Dolby level; these are broadly detailed in Section 5, Level Standardisation. The most frequently adopted are:–

Recording/broadcast studios using an operating level reference typically using vu meters or BBC type PPMs – Dolby level = operating level eg"O"vu, PPM5.
Recording/broadcast studios using a peak level reference with peak meters – Dolby level has historically been 4.7dB below OdB below OPB peak reference.
Film studios and cinemas – Dolby level = 185nWb/m magnetic, 50% optical.
Audio on "C" format 1" video tape – Dolby level = 100nWb/m (or equivalent line level).

It may be useful to record a section of Dolby tone at Dolby level for use as an "in-house" reference.

SR Calibration

Record Use

Select RECORD mode and Special Recording OUT in all required channels.

1. Align recorder channels.
2. Send 1kHz tone at Dolby level to the input of the 365. (See below – Dolby Level).
3. Adjust input level control on the Model 365 to give Dolby level on the Model 365 indicator.
4. Adjust output level control of the Model 365 to give unity gain through the unit.
5. Select Spectral Recording IN to restore SR processing to the recording chain.

Always record a section of Dolby Noise at the head of each recording by pressing the SETUP button.

Playback Use

EITHER – using Dolby Noise from tape.
Select PLAY mode and Spectral Recording OUT in all required channels.

1. Align playback side of recorder channels.
2. Press SETUP and playback Dolby Noise from tape.
3. Adjust input level control on the Model 365 to give Dolby level on the Model 365 indicator.
4. Release SETUP.
5. Playback a 1kHz tone from tape and adjust output level control on the Model 365 to give unity through the unit.
6. Select Spectral Recording IN to restore SR processing to the playback chain.

OR – using tone on tape at Dolby level.
Select PLAY mode and Spectral Recording OUT in all required channels.

1. Align playback side of recorder channels.
2. Playback tone from tape at Dolby level. (See below – Dolby Level).
3. Adjust input level control on the Model 365 to give Dolby level on the Model 365 indicator.
4. Adjust output level control on the Model 365 to give unity gain through the unit.
5. Select Spectral Recording IN to restore SR processing to the playback chain.

Dolby Level

To get the most from Dolby SR, Dolby level should be optimised so that the noise floor of the SR system electronics alone is below that of the recording medium with SR processing. With magnetic tape, this means Dolby level will lie between 100 and 320 nWb/m. For example:–

In vu meter studios, if you have a flux level for "0"vu at 320 nWb/m or less, Dolby level can correspond to "0"vu. If your magnetic flux for "0"vu is greater than 320, eg400nWb/m, Dolby level should be set to a convenient point on the meter 4 to 6 dB below "0".

In peak meter studios, optimal Dolby level will be 8 to 12 dB below the actual programme peaks as read on the meter. Consequently, Dolby level should be set at a convenient point on the meter 8 to 12 dB below the maximum signal peak reading.

It may be useful to record a section of 1kHz tone at Dolby level for use as an "in-house" reference.

After above calibration has been carried out, Model 365 record channels, recorder, and Model 365 playback channels should be treated as fixed, unity gain recording system operating at your normal line levels.

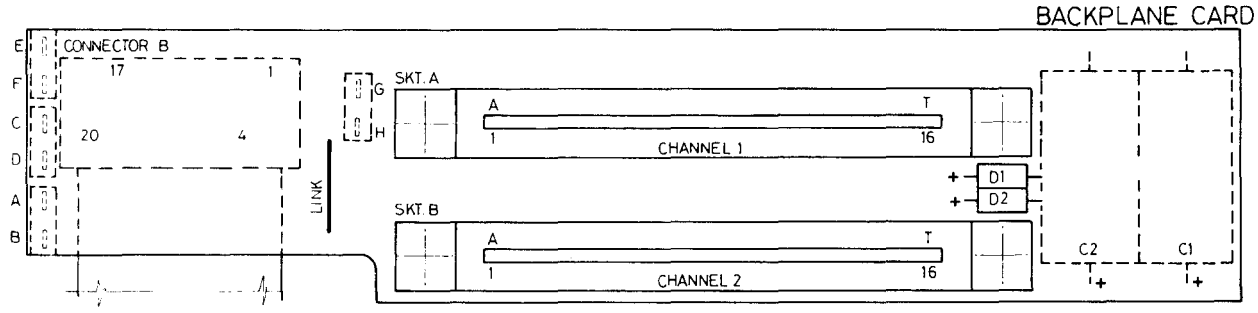
Use of Uncal

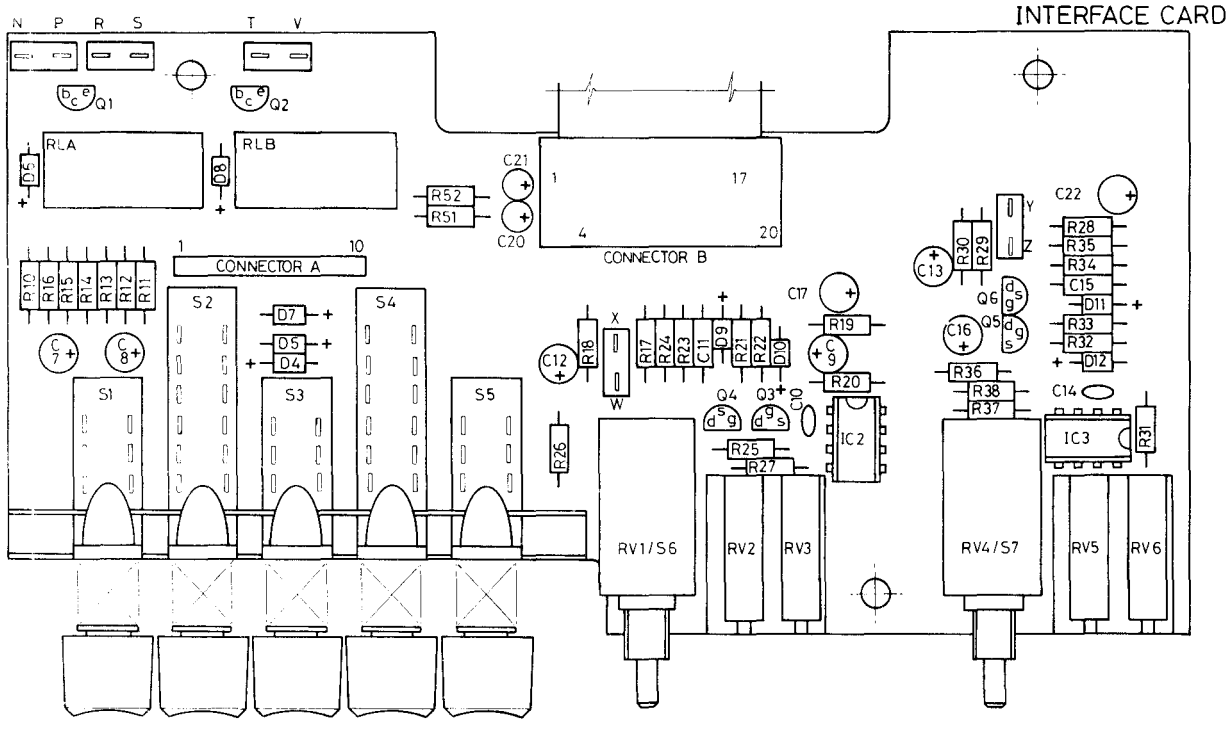
Model 365 input levels can be adjusted via the pull to operate 'uncal knob' should playback of the tape recorded at a non-standard level be necessary.

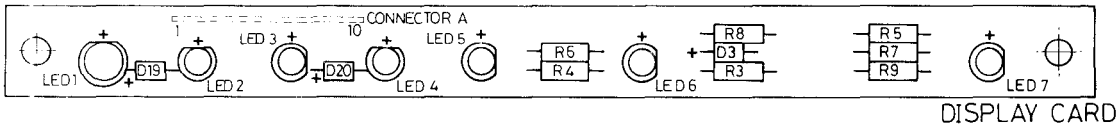
When the uncal knob is returned to the 'cal' position, the system returns to standard levels.

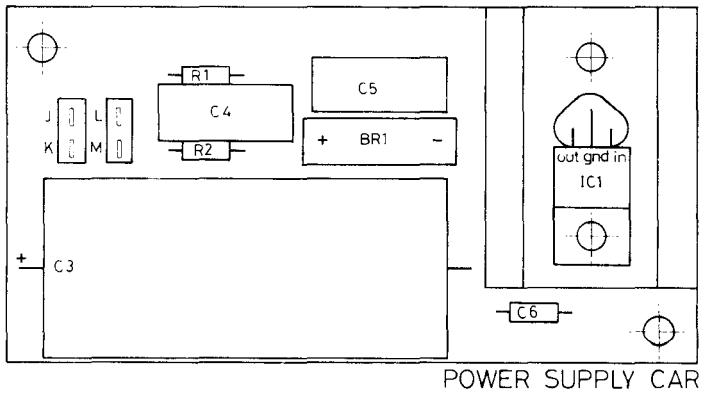
To record or replay tapes without the Dolby A-Type/SR characteristic, press IN-OUT buttons appropriately.

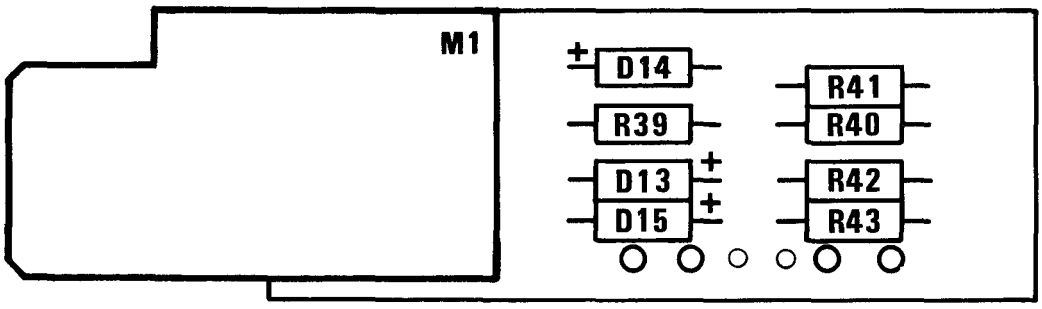
SECTION 9
INTERFACE SERVICING


BACKPLANE CARD
CONNECTOR B
17
1
20
4
LINK
SKT. A
SKT. B
CHANNEL 1
CHANNEL 2
D1
D2
C2
C1

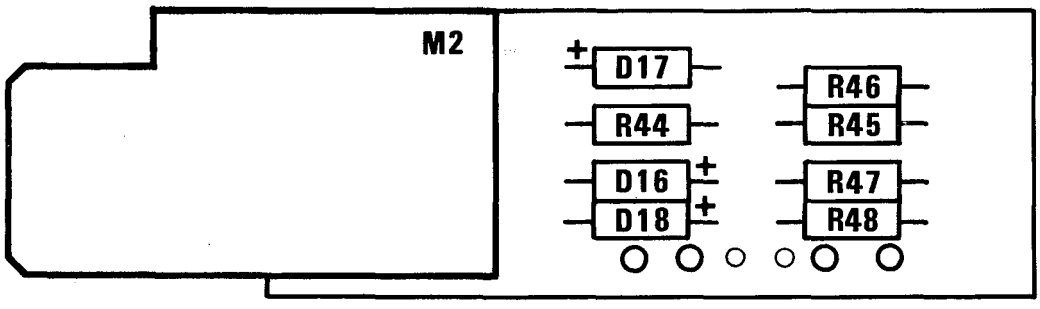

INTERFACE CARD
CONNECTOR A
CONNECTOR B
RLA
RLB
S1
S2
S3
S4
S5
RV1/S6
RV2
RV3
RV4/S7
RV5
RV6
IC2
IC3


CONNECTOR A
LED1
LED 2
LED 3
LED 4
LED 5
LED 6
LED 7
DISPLAY CARD

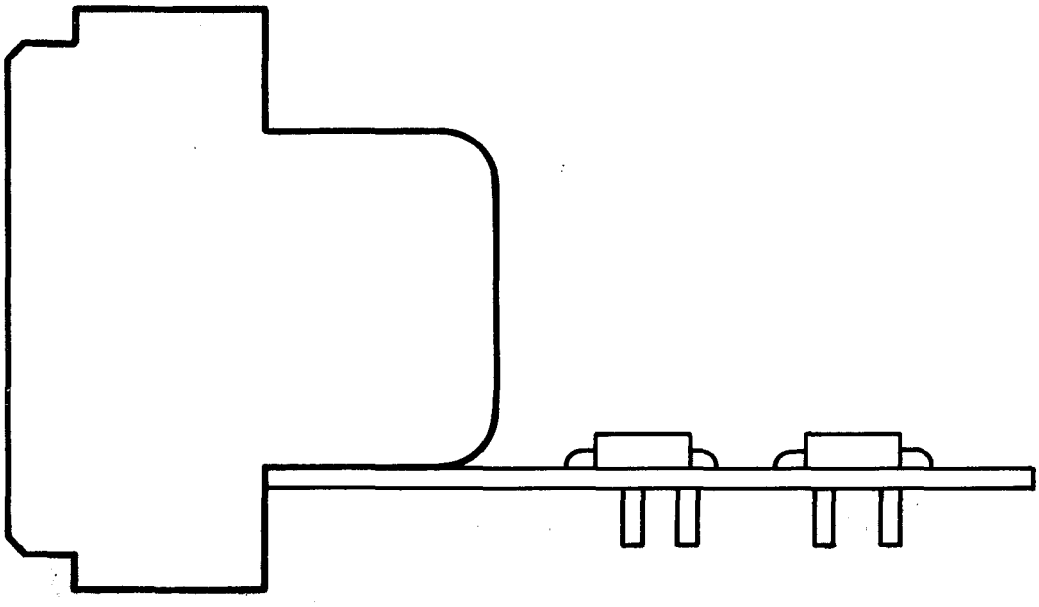

C5
C4
R1
R2
BR1
C3
C6
IC1
out gnd in
POWER SUPPLY CARD



CHANNEL A



CHANNEL B



ISSUE No.	DATE	CHANGE No.	CHANGED BY	DESCRIPTION OF CHANGE
1				FIRST ISSUE
2	4-2-87	3029	C.Hanley	D19 and Note 'g' added.
3	27-8-87	3230	C.Hanley	VARIOUS MODS.

NOTES :

a. ⊗ = PCB PIN

UNLESS OTHERWISE STATED

b. ALL RESISTORS ARE 0.25W 5%

c. ALL CAPACITOR VALUES ARE IN uF

d. POTENTIOMETERS ARE LINEAR

e. ALL DIODES ARE IN 4148

f ○= RIBBON CABLE

g. IF IC4 IS 78L18 D19 MUST BE REPLACED WITH WIRE LINK
IF IC4 IS 78L15 D19 MUST BE 2V7 ZENER DIODE TYPE BZY88 OR EQUIVALENT

365 CIRCUIT DIAGRAM
AOC 9105 ISSUE 3

DRAWN	SJC	25.3.88
CHECKED		
APPROVED		
OTHER		

MATERIAL & SPECIFICATION — FINISH

ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED | THIS DRAWING COMPLIES WITH BS308 & BS3939 | THIRD ANGLE PROJECTION | SCALE ——

REMOVE ALL BURRS & SHARP EDGES UNLESS OTHERWISE STATED

ALL DIMENSIONS APPLY AFTER PLATING

TOLERANCES UNLESS OTHERWISE STATED
DIMS TO 2 DEC PLACES ± 0.1mm
DIMS TO 1 DEC PLACE ± 0.2mm
DIMS WITHOUT DEC PLACE ± 0.4mm
HOLE DIAMETERS + 0.15mm − 0.05mm
ANGULAR ± 0° 30'

SCREW THREADS
B.A. TO BS 93 NORMAL
B.S.F. & B.S.W. TO BS 84 NORMAL
B.S.P. TO BS 2779 MEDIUM
UNIFIED TO BS1580
ISO METRIC TO BS 3643
PARTS 1,2 or 3

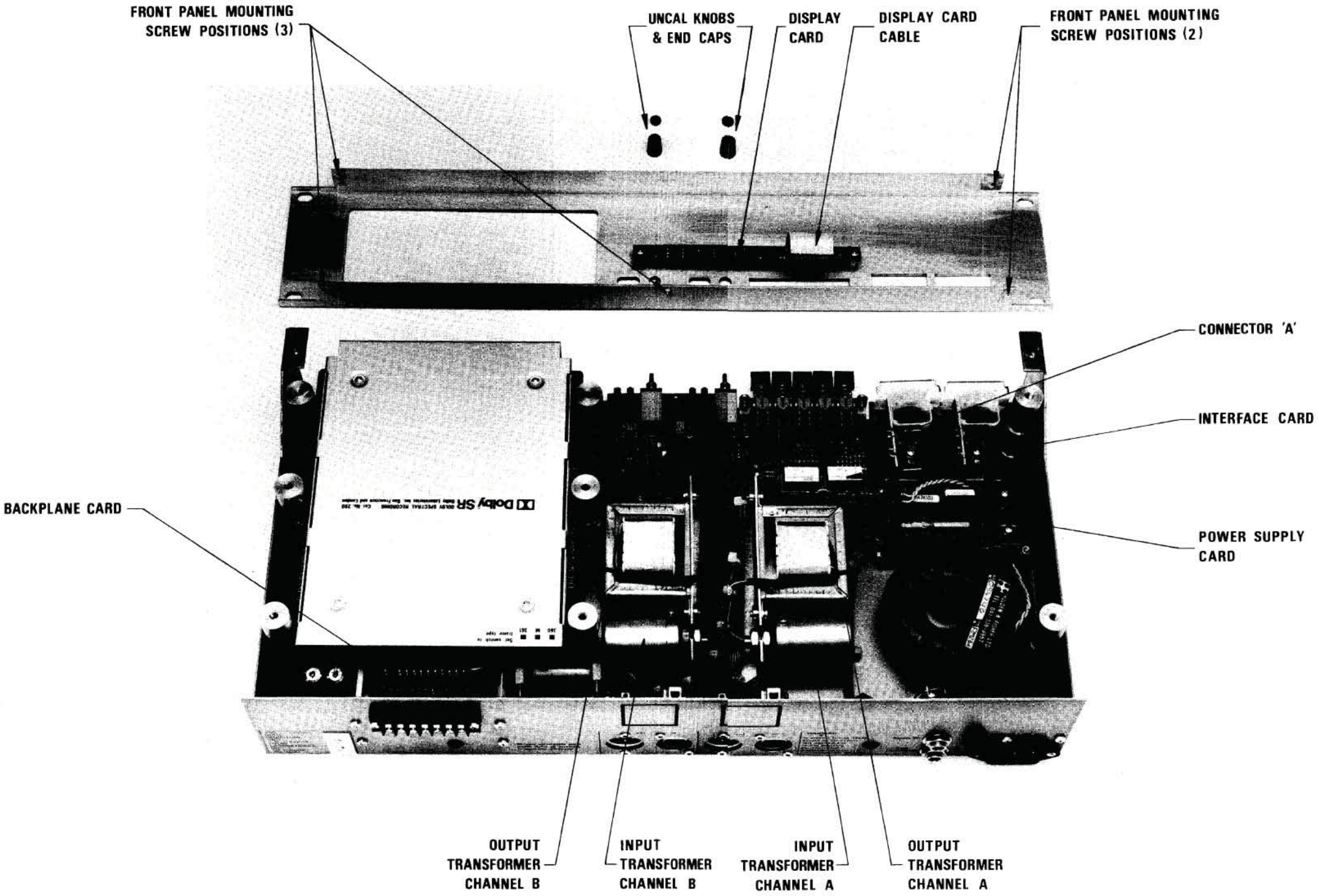
REDUCE TO 150.00 mm ± 0.5 mm

DOLBY LABORATORIES INC.
346 Clapham Road London SW9
U.S.A. 731 Sansome Street, San Francisco, CA 94111

title: 365 CIRCUIT DIAGRAM

sheet 1 of 1 AOC9105 | rev 3

Agfa-Gevaert D R 153


FRONT PANEL MOUNTING SCREW POSITIONS (3)
UNCAL KNOBS & END CAPS
DISPLAY CARD
DISPLAY CARD CABLE
FRONT PANEL MOUNTING SCREW POSITIONS (2)
CONNECTOR 'A'
INTERFACE CARD
BACKPLANE CARD
POWER SUPPLY CARD
OUTPUT TRANSFORMER CHANNEL B
INPUT TRANSFORMER CHANNEL B
INPUT TRANSFORMER CHANNEL A
OUTPUT TRANSFORMER CHANNEL A

L86/116

Dolby Laboratories Inc

Field Bulletin No. 156

Model 365 Modifications to allow the use of Cat. No. 280 Spectral Recording Modules

All Model 365 after Serial No. 444 were factory modified. In addition units serial no. 400, 415, 416, 417, 423, 425, 426, 430, 432, 434, 438, 440, 441 are known to have been modified.

- [x] Modification Urgent
- [ ] Modification Recommended
- [ ] Modification Required if Problem is Present
- [ ] Modification for Special Applications

Problem: Some Dolby Cat.No.280 SR modules used in Model 365 frames fail to switch Dolby SR "in" when in play mode.

Modification:

1) Remove the top cover of the Model 365.

2) Remove the end caps of the two "uncal" knobs. Release the screw by one turn and slide the knobs off the shaft.

3) Unplug the LED display card ribbon cable from the connector on the switch board (use caution, the cable is somewhat fragile).

4) Remove the 5 front-panel mounting screws (2 top, 3 bottom).

5) Slide the front panel forward, clear of the main chassis.

6) Cut the tracks on the top (component) side of the board in the three places indicated in fig. 1.

7) Remove the five screws securing the switch PCB to the main chassis. Turn the board over to gain access to the underside of the board.

8) Solder an insulated wire jumper to the underside (solder side) of the board between the relay pin and the ground plane, as shown in fig. 2.

9) The modification can be checked, as shown in fig.3, by measuring the resistance between 1) point 'A' and the grounded end of R19, and 2) between point 'B' and the grounded end of R30. Both resistance measurements should read "open circuit" with the noise reduction modules removed from the chassis.

10) Reassemble the unit, taking care not to damage the end of the LED display card ribbon cable.

11) Refit the knobs to the 'uncal' controls, ensuring that the white line on the knob is at "7 o'clock" when the control shaft is turned fully counterclockwise.

Dolby
Signal Processing and Noise Reduction Systems

100 Potrero Avenue
San Francisco, California 94103-4813
Telephone 415-558-0200
Telex 34409
Facsimile 415-863-1373

346 Clapham Road
London SW9 9AP
Telephone 01-720-1111
Telex 919109
Facsimile 01-720-4118

October 1987
S87/8042
SEF/WW

Operational checks:

If you are using DOLBY CAT. NO. 280 SR modules.

Install a Cat.No.280 SR module in the channel under test. Set the front panel noise reduction in/out switch to "out," and the record/play switch to "play." Connect a 10 kHz oscillator (at nominal line level) to the Model 365 input and adjust for a "Dolby level" indication on the front panel meter (meter reads on the center dot). Now set the noise reduction in/out switch to "in." The meter reading should increase; this is your verification of correct operation. Repeat for the other channel.

If you are using DOLBY CAT. NO. 22 A-type modules.

13) Install a Cat.No.22 A-type module in the channel under test. Set the front panel noise reduction in/out switch to "out," and the record/play switch to "play." Connect a 10 kHz oscillator (at nominal line level) to the Model 365 input and adjust for a "Dolby level" indication on the front panel meter (meter reads on the center dot). Connect an AC voltmeter to the output of the channel under test. Reduce the oscillator level by 20 dB and note the new AC voltmeter reading. Now set the noise reduction in/out switch to "in." The AC voltmeter reading should decrease; this is your verification of proper operation. Repeat for the other channel.

Technical Questions: **San Francisco -** 415-558-0200, Bob Cavanaugh or Bill Mead

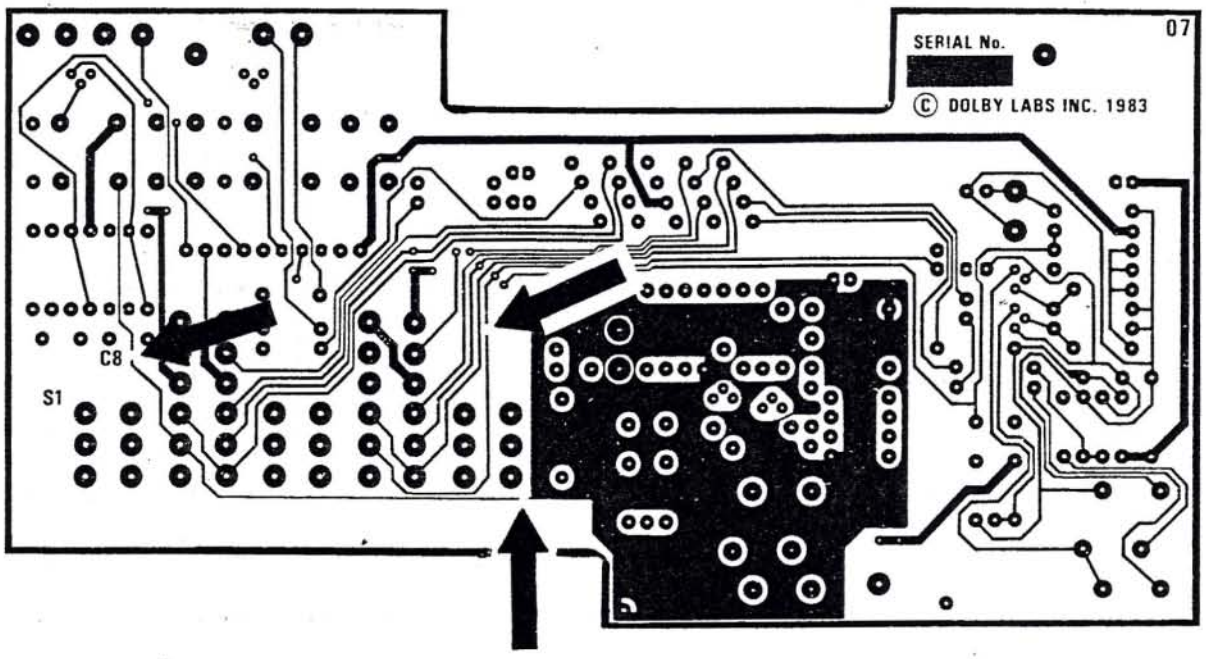


Fig. 1 Component Side - 3 cuts

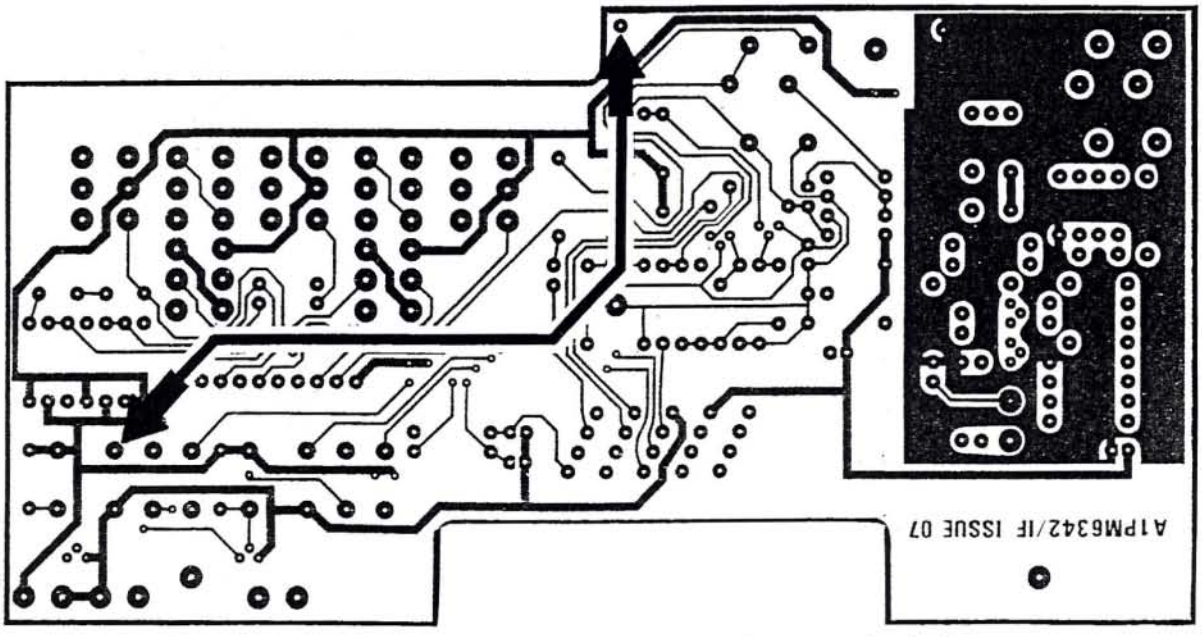


Fig. 2 Solder side - add jumperwire

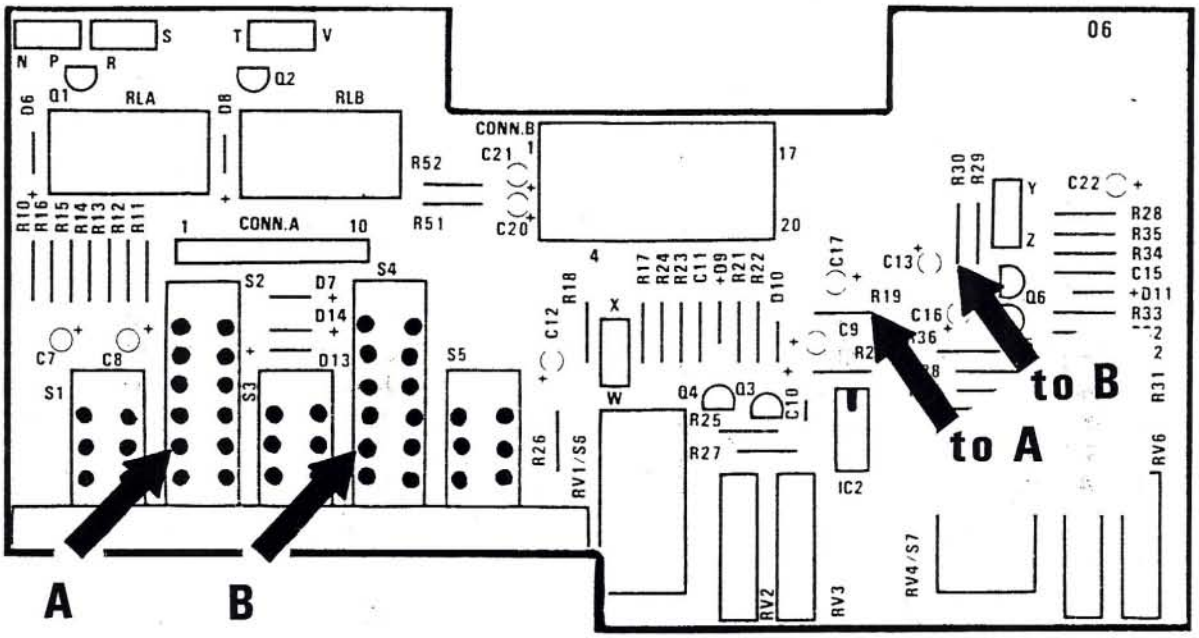


Fig. 3 - check points

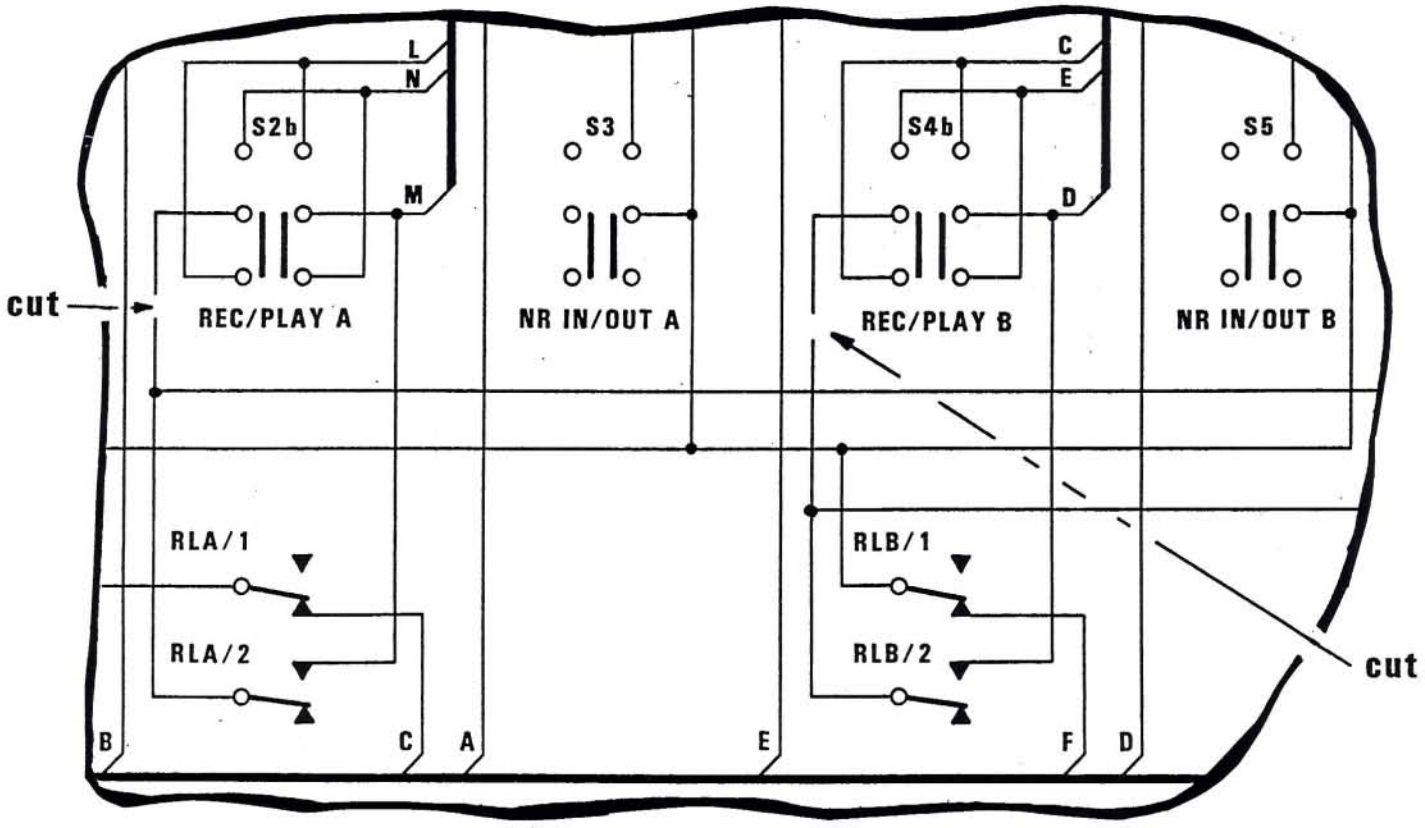


Fig. 4 - Schematic changes to Model 365 circuit diagram. A0C 9105 (issue 1 and 2)