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

DOLBY LABORATORIES
INSTRUCTION MANUAL

Dolby Laboratories Incorporated

U.S.A.: 731 Sansome Street, San Francisco, CA 94111
Tel: (415) 392-0300; telex 34409; cables: Dolbylabs

U.K.: 346 Clapham Road, London SW9 9AP
Tel: 01 720-1111; telex 919109; cables: Dolbylabs London

S78/677

List of Contents

Some sections in this manual are taken from other Dolby Laboratories manuals, retaining their original section numbers, which are therefore not consecutive.

SECTION 1

INTRODUCTION

1.1 Introduction

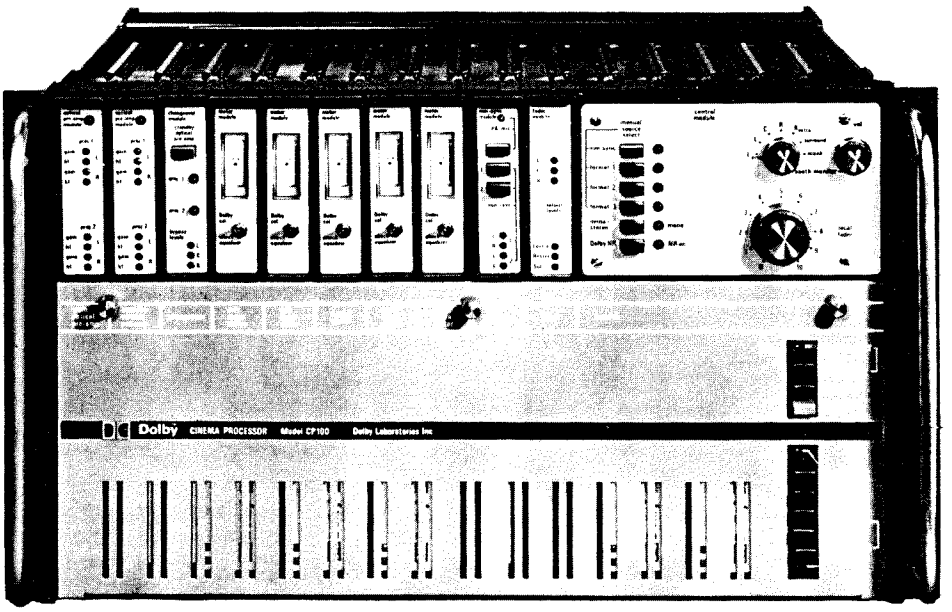
The CP100 is a complete cinema control centre allowing reproduction of all sound formats. In addition it contains all the equipment necessary for playback of Dolby Stereo Optical soundtracks. Modular construction is used to allow extra plug-in (optional) modules for playback of magnetic tracks or any other existing or future format through easy connection to outboard equipment.

Inputs are provided for optical solar cells, for up to 6-track magnetic films, for two stereo non-sync sources, and for a PA microphone.

Full remote facilities are provided, allowing control from each projector (two remote control units Cat. No. 88 supplied with CP100) or from automatic programmers.

The manual includes a description of the Dolby System as applied to film, as well as full operating instructions for the CP100 (Section 8). In the instruction section there are brief operating instructions in addition to more complete versions; these brief instructions are collated together at the rear of the manual. We suggest that this rear section is taken out of the manual and put on the projection room wall near to the CP100.

Dolby CP100 Cinema Processor



Today it is possible to enjoy good quality stereo sound in most homes. It is thus reasonable that the moviegoer should be able to hear the same high quality of sound in the theatre, adding realism, immediacy and impact to the superb high definition picture on the screen.

During the last eighteen months, tests carried out by Dolby Laboratories on monaural optical sound-tracks have led to the development of new techniques which for the first time make possible optical sound-tracks in stereo high fidelity. These tracks are made with conventional black-and-white sound processing techniques, utilizing two tracks side by side on the film, in the same location as a conventional monaural track. To play back this track in stereo high fidelity requires Dolby noise reduction decoding of the two signal elements, circuitry to derive centre-channel information for three-loudspeaker systems, and third-octave equalization for accurate matching of the loudspeaker characteristics to the existing theatre acoustics. These facilities form the basis of the new Dolby CP100 Cinema Processor.

In addition to stereo optical playback capability, the CP100 also employs its equalization circuitry when other film formats are being played. The unit contains comprehensive provision for the playback of conventional optical tracks and, when required, magnetic stripe.

Additionally, the unit contains a non-sync capability, so that tapes and records can be played back in the auditorium in high fidelity while using the existing theatre loudspeaker units.

The unit represents a simple one-time cost if the theatre already has three suitable power amplifiers and loudspeakers.

The CP100 Cinema Processor consists of a 19-inch main frame, into which the modules listed below are plugged in two levels.

Upper Level
(1) **Stereo optical playback module,** incorporating amplifiers and changeover functions for two projectors.
(2) **Standby stereo optical playback module,** identical to (1), selected by the changeover module in the case of failure of the main module.
(3) **Changeover module,** which incorporates the projector changeover logic.
(4)-(8) **Meter modules,** to check and calibrate internal signal levels.
(9) **Non-sync module,** with inputs for two stereo sources and also for a p.a. microphone.
(10) **Six-channel ganged fader,** electronically controlled and remotable.
(11) **Local control module** for setting volume levels in the auditorium, selecting film format, and also providing a monitoring control for booth loudspeakers.

Lower level (beneath a swing panel)
(12) **Noise reduction modules.** These are the standard Dolby A-Type noise reduction modules (Cat. 22) of which over 20,000 are currently in service worldwide
(13) **Equalization modules** which have been specifically designed for theatre reproduction and consist of 27 filter bands together with upper and lower frequency tone controls.
(14) **Mono/Stereo optical format module** with logic circuit to ensure stable centre-screen dialogue.
(15) Space for two further **format modules,** allowing the acceptance of magnetic inputs, or for processing of any other cinema format.
(16) **Facilities module,** allowing for local or remote control of projector changeover, fader control, and format selection. This module incorporates a bypass key to remove the complete unit from the signal path in case of failure, giving immediate restoration of sound to the auditorium

75/207 Printed in England

SECTION 3

PRINCIPLES OF DOLBY SOUNDTRACKS

PRINCIPLES OF DOLBY SOUNDTRACKS

3.1 Introduction

Since the introduction of sound on film in the 1930's, the quality and entertainment potential of the image in the motion picture theatre has improved beyond recognition, but the sound-track itself has not made comparable progress. Despite the quality capabilities of magnetic sound-tracks, it now seems certain that most films will continue to be released with optical sound-tracks, primarily because of production cost savings and the reluctance of many theatre owners to convert projection room plant.

The conventional optical sound-track leaves much to be desired with respect to sound quality, although it is simple and economical from a production and exhibition standpoint. Sophisticated and affluent audiences which are accustomed to high fidelity sound reproduction in the home are increasingly likely to become conscious of these quality shortcomings. Much of the poor quality of the optical track can be shown to be due to the way in which it is used, rather than to any inherent defect in the optical recording principle itself.

The application of the Dolby Noise Reduction System to optical recording and reproduction results in a quality comparable to that of magnetic recording. This quality is available in the theatre with little modification of existing equipment, and the release print is compatible for use with an unconverted system. Of course, these advantages also apply to Dolby 70 mm magnetic prints, and several films have been released in this format. The advantages of 70 mm prints over 35 mm are in the picture quality; there are now few high quality 35 mm magnetic prints since 35 mm optical stereo films are superior in sound quality and the picture quality is of course the same.

To achieve the benefits which the application of Dolby noise reduction can provide, standards, production techniques, and equipment and practice in the projection room must be changed, but the change is in the direction of a simpler set of techniques which give results superior to any yet obtained with optical sound-tracks.

With the introduction of the Dolby encoded optical sound track, high fidelity reproduction in the theatre becomes possible. Such a track gives acceptable results in an unequipped theatre when played through a conventional 'Academy' filter, though when played through Dolby Cinema Noise Reduction equipment in a theatre with equalized acoustics, the results obtained from an optical track can be compared favorably with those of any other professional recording medium. Additionally, the benefits of noise reduction are sufficient to allow high fidelity reproduction from a stereo optical track. Dolby equipment is thus able to bring the quality of sound available from an optical track from low fidelity monaural reproduction to the highest quality of multi-channel stereo reproduction. Dolby Cinema equipment has been designed as a flexible but comprehensive package for the necessary electronic equipment.

3.2 Conventional Optical Techniques

In order to understand the reasons for the effective limitations on optical sound quality it is necessary to understand some of the traditional techniques used before and after the optical recorder/printer/soundhead chain. As is well known, a considerable amount of treble cut is applied when optical sound-tracks are played back in the theatre. This high frequency roll-off, referred to as the Academy characteristic, produces an attenuation of at least 20 dB at 9 kHz.

In October 1938, when the Standard Electrical Characteristics were first published, the aim was to achieve standardization of sound reproduction with the release product then current. "Each characteristic was arrived at by listening to a variety of studio release product in a number of theatres . . ." In other words, a standard already existed on the optical sound-track, and the requirement was to match the replay system to suit it. It would seem that this compromise had already been taken, at a time in the early and mid-thirties when equipment limitations such as amplifier and loudspeaker response largely affected the result, as indeed did the greater noise of optical tracks at that time. The films were made to match theatres, and the theatres were made to match the films. All the Academy did in 1938 was to codify a situation that already existed.

It is clear that if optical sound-tracks could be freed from the frequency response constraints of the Academy Characteristic, they would be competitive in performance with magnetic release prints. The optical track itself is able to reproduce signals which are flat out to 10 or 12 kHz, a frequency at which most listeners are unable to detect the difference between the two media, even under optimum reproduction conditions. However, the fact is that the combination of the electrical reproduction curve suggested by the Academy Characteristic, and the acoustical roll-off found in most theatres (caused by the combination of inefficient high frequency loudspeaker units, screen attenuation of high frequencies, etc.) results in an optical track roll-off which starts at as low a frequency as 1 or 2 kHz. The overall acoustical frequency responses heard in a typical cinema is shown in fig. 3.1 which also indicates how this poor result has built up.

The dubbing engineer applies whatever pre-emphasis he can, in order to compensate for the Academy roll-off. The quality and nature of this pre-emphasis varies from product to product and studio to studio. The high cost of dubbing theatre operation usually precludes the dubbing engineer from selecting the best compromise between clipping of the optical track and ideal tonal balance during playback.

As dubbing technique varies so much, it is difficult to generalize as to the amount or nature of the pre-emphasis applied; it is invariably there, however, and is applied at some point between the location or studio floor recording and the final magnetic master. The pre-emphasis regularly takes the optical track into clipping distortion; this distortion is more readily apparent when the track is played back on wide range equipment, or when it is analyzed optically.

The conclusion is that the Academy roll-off, as used in the magnetic generations preceeding the optical print, is indirectly responsible for a large part of the distortion heard on the optical sound-track. The distortions generated by the optical recording and printing processes themselves are comparatively minor. This has been subjectively verified in practice by copying and re-copying dialogue on magnetic stock, with and without typical pre-emphasis.

3.3 Use of Dolby System on Soundtracks

The main use of the system is obviously to reduce the annoying background noise which is always present in conventional films (see Sections 6 and 10 for a full description of its operation). However, it not only provides a method of reducing noise, but enables a flat recording and playback characteristic to be used. This recording method provides a significant noise advantage compared with the Academy characteristic, and it results in extended high frequency response, reduced distortion, and a more natural, coloration-free sound. For reasons discussed below, the release print proves to be compatible in a theatre which does not have a Dolby unit, and in which the existing roll-off is still applied.

Evolution of 'Academy' optical sound track from original recording to audience presentation in the cinema.

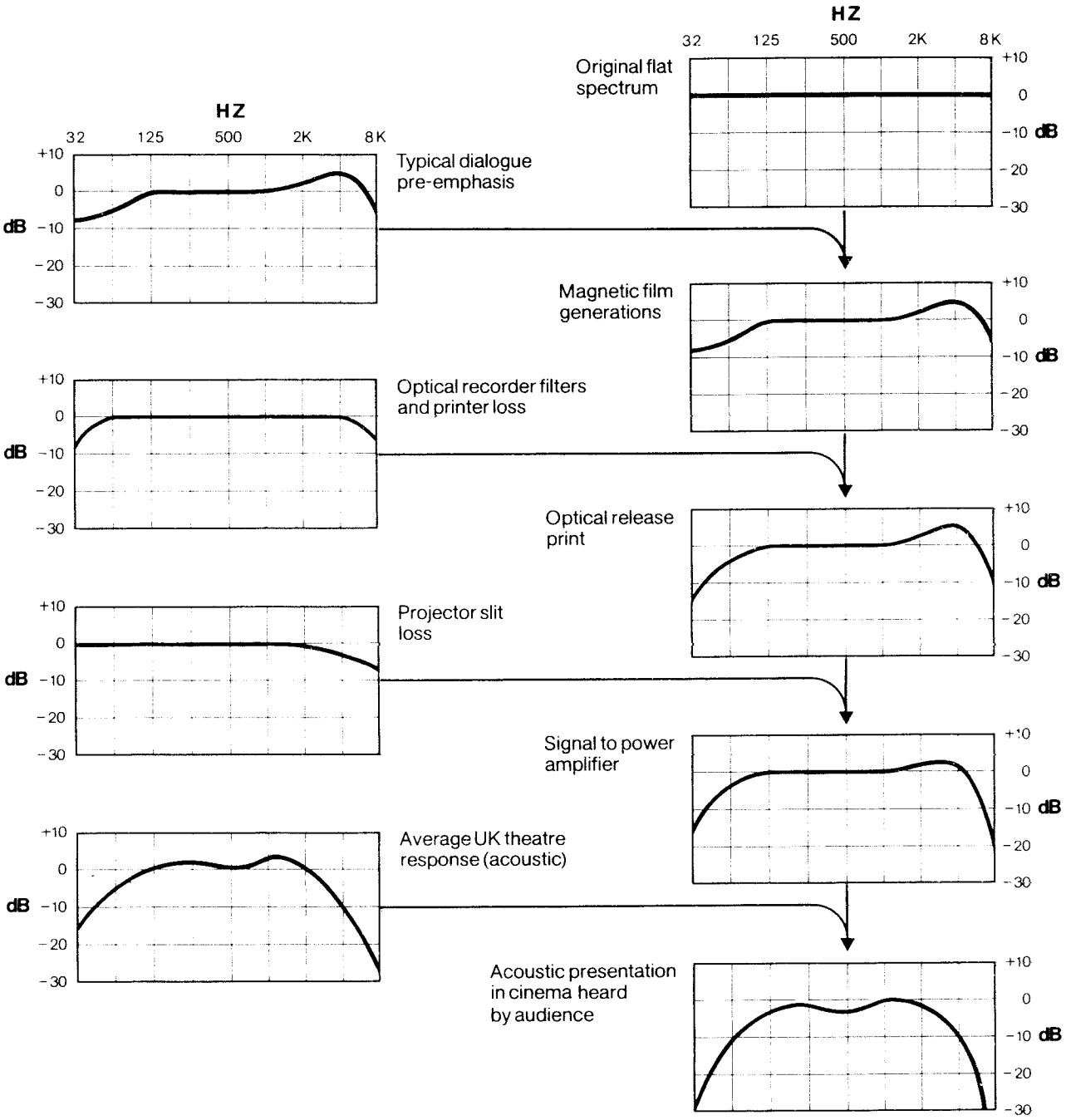


Fig. 3.1 Typical Cinema Response

In the Dolby System low-level signals at all frequencies are boosted in level by 10 dB by the encoding unit, and these components are attenuated by the same amount when decoded by the playback unit. If an encoded track is played back without a playback unit in the circuit these low-level signal components will remain in the boosted condition.

Subjectively, the roll-off provided by the Academy characteristic brings the tonal character of a Dolby processed flat-equalized track essentially back to normal. The low-level boosting of high frequency components in the encoding process adequately compensates for the high frequency Academy roll-off. Low frequency, low-level signals will be left in the boosted condition, but this effect is noticeable only when a track is switched directly from correct decoding to Academy replay. For normal operational purposes, the compromise of playing back a Dolby encoded track in a non-Dolby equipped theatre still applying the Academy roll-off can be considered completely acceptable from a commercial standpoint. Indeed, practical experience shows that the lower distortion on the flat-equalized track is still evident in the non-converted theatre, resulting in improved intelligibility.

Thus the practical consequence is that if a theatre has a flat playback frequency response, optical sound-tracks recorded and reproduced with the Dolby System will exhibit an improved frequency response, decreased distortion, and a lower noise level. The same sound-track is, however, compatible in a conventional theatre.

3.4 Cinema Auditorium Treatment

The stereo cells and optical pre-amplifier modules in the Dolby Cinema Equipment provide easily adjustable flat frequency response from the film to the output of the pre-amplifiers. However, conventional theatre speakers are not efficient at high frequencies, in large part because the high frequency roll-offs applied both for conventional optical tracks and magnetic stripe have made an extended high frequency response unnecessary in the past. In addition, differing acoustic environments, screen materials and other variables have led to the situation where few theatres sound alike. For these reasons, third octave equalization is employed to improve the acoustic response. The curve chosen on all speakers is flat to 2 kHz and then rolls off at 3 dB per octave; this apparent roll-off compensates for the difference between 'first arrival' sounds (normal listening) and the continuous pink noise used in the equalization calibration. This same characteristic is used in the re-recording theatre when units for stereo variable area soundtracks are being mixed, in this way ensuring a perfect match between sound in studio and sound in theatre. As previously described, one benefit of the technique is a substantial reduction in the distortion, commonly caused on both magnetic generations and the actual release print by overloads resulting from the equalization and pre-emphasis applied by the re-recording mixer to compensate for the Academy roll-off.

Measurements on the B-chain response involve the use of one-third octave pink noise at one-third octave intervals. The pink noise is produced in a special generator and injected immediately before the power amplifiers. Acoustic responses are then measured with a calibrated microphone and real-time analyser at various auditorium positions. The variations in the performance of theatre sound systems result in requirements for flattening the B-chain which vary greatly from site to site. Even the removal of the Academy roll-off requires a different treatment in different theatres, since the equalization may be acquired from any combination of slit width, equalization in pre-amplifiers, an actual filter unit, equalization in the power amplifiers, a high frequency loudspeaker pad, and, finally, the treble attenuation which the screen provides.

Having measured the acoustic response, one-third octave filters in the Dolby cinema equipment are adjusted to achieve the desired smooth response. Once set, there is no need for further adjustment unless new loudspeakers are installed, or the furnishings in the auditorium are changed.

Dolby cinema equipment includes precision academy filters which are automatically switched into circuit when a conventional film is played (Dolby NR out). The results will usually still be an improvement since any peculiarities in the cinema response will have been fully equalized, so that the response (with the filter) will be an accurate Academy curve, to which the film was carefully dubbed, rather than an approximation to the curve.

3.5 Further Reading

Following this section is Section 4 which gives a technical description of how the Dolby system works. Section 6 discusses some of the varied applications.

For further reading on the application to film, we recommend the following papers.

1. R. Uhlig JSMPTE 82: 292 - 295, April 1973
2. R. Uhlig JSMPTE 83: 729 - 732, September 1974
3. I. Allen JSMPTE 84: 720 - 729, September 1975
4. I. Allen Paper presented at SMPTE 117th Conference, Los Angeles, September 1975.

SECTION 4

GENERAL PRINCIPLES

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 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.

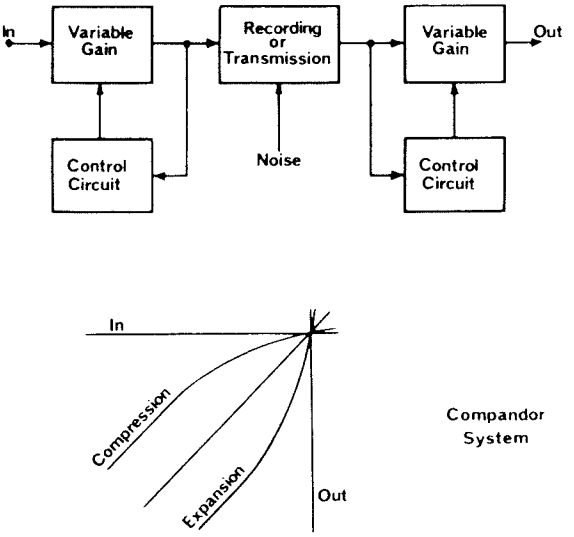
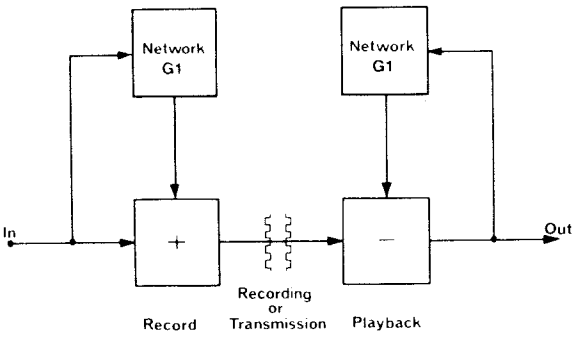


Fig. 4 1

Fig. 4.1 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

Fig. 4.2

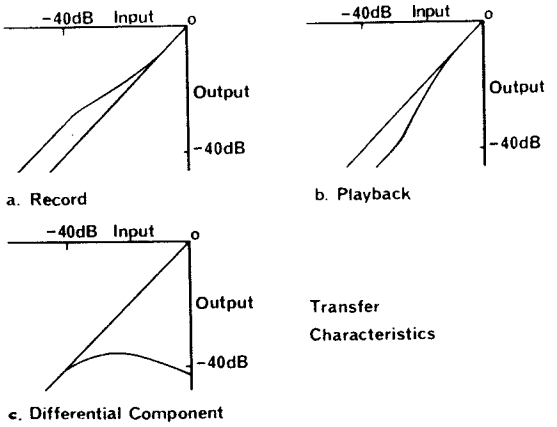
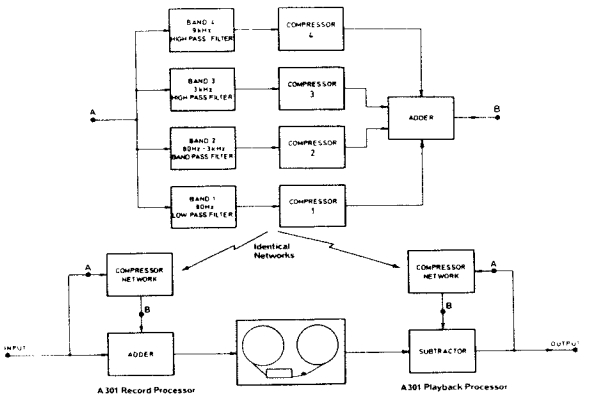


Fig. 4.3



Noise Reduction System–Basic Block Diagram

Fig. 4.4

The differential treatment of the signal in the Dolby noise reduction system is illustrated in Fig. 4.2. 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. 4.3, 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 $1\frac{1}{2}$ dB), since the contribution of the 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 (about 2 dB) in recording or transmission channel gain are not noticeable on programme 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 40 Hz 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. 4.2) 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 noises likely to be encountered (Fig. 4.4).

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.

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-system has applications in mono or stereo recording at all tape speeds. The system will reduce tape noise, modulation noise, and crosstalk; it also reduces amplifier noise such as hum, hiss or flicker noise. 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 during reduction 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-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 in 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 tapes used in the duplicating process should be noise-reduced.

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 synchronized recordings or where multiple generation dubbing techniques may be used.

6.2.7. Video Tape Recorders. The quality of the audio track on both quadruplex and helical scan video tape recorders is usually inferior to that of professional audio recorders. The poor quality is due to a combination of narrow tracks, thin oxides, a disadvantageous magnetic orientation of oxide particles (which for quadruplex recorders are aligned in the direction of the transverse video tracks rather than that of the audio tracks), and various crosstalk and spurious signal problems, such as from the control track, video tracks, and capstan drive motor. The A-system can improve the main audio track nearly to studio quality; this provides not only recording of superior sound quality but in addition the capability of utilizing electronic editing and transfer or dubbing techniques without excessive noise build-up.

The quality of the cue tracks (in particular on quadruplex machines) is significantly inferior to the main audio track, since the track is even narrower. In the case of quadruplex machines, break-through of control track pulses and tone occurs. There are occasions when it is desirable to raise the quality of the cue track to allow a second audio channel to be recorded - for example in countries where two languages exist. The Dolby A-system is capable of upgrading the cue track to a satisfactory standard for full broadcast use.

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 proplems.

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 avoids overshoot problems and 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 audio entertainment industry. Early methods of recording and reproduction were limited, and cinemas were designed to use a high frequency roll-off, known as the Academy roll-off, to reduce the effects of wideband and impulsive noise. The loss is severe - about 15 dB at 8 kHz which, when added to the high frequency attenuation in the speaker-screen combination, causes dialogue and music to be dull and indistinct. To improve intelligibility it has become common studio practice to boost middle and high frequencies during dubbing, causing further distortion due to the limited modulation capabilities of the film. The Dolby A-type system provides the way out of the dilemma, making it possible to produce wide-range optical sound, since the system reduces background noise without impairing high frequency response. Special A-type units are available for installation in cinemas, enabling the new Dolby encoded optical or magnetic tracks to be replayed, yet retaining the switched option of standard Academy responses for non-encoded material. The units can be used with combined or separate optical or magnetic tracks.

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 semiconductor 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 500 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

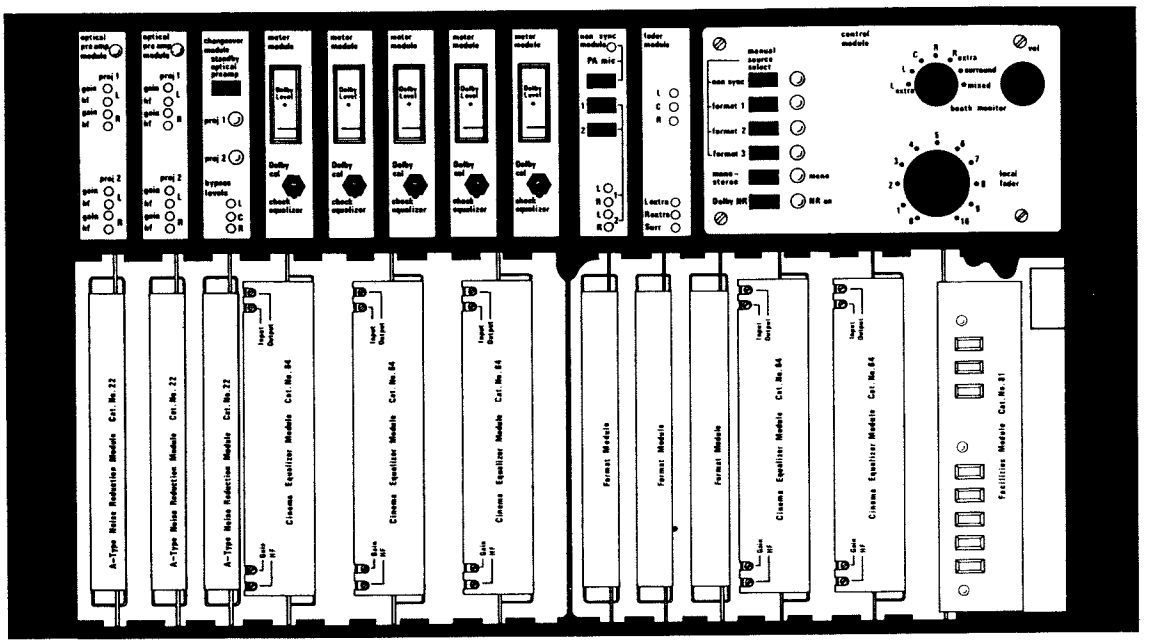
CONTROLS, CONNECTORS, AND INSTALLATION

SECTION 7

List of Contents

Drawings

7.1 Description of CP100 Modules



(1) Optical Pre-amp Module	Optical pre-amplifier with inputs for two projectors, for use in playback of mono or stereo optical films using suitable stereo cells. Contains four pre-amplifiers for the two channels and two projectors, each with front panel adjustment of gain and high frequency.
(2) Optical Pre-amp Module (Standby)	Identical with the optical pre-amplifier (1) for emergency use, switched into circuit by the red push button on the changeover module (3). A red indicator lamp in the module shows which pre-amplifier is in use.
(3) Changeover Module	Contains the circuitry necessary to switch between projectors, with front panel indication. Also includes a push button to switch between main and standby optical pre-amplifiers (1) and (2).
(4) Meter modules and (8)	Only used for six-track magnetic, surround or special systems. Normally CP100 is supplied with blank units in these positions.

(5) Meter modules (6) and (7)	Meters to indicate the signal level in left, centre and right channels and for setting up Dolby Level using special Dolby Tone loop supplied with each CP100
(9) Non-sync module	Module has inputs for three sources: two stereo inputs and a monophonic public address microphone. Levels are preset by front panel potentiometers. A push button on the control module (11) selects the non-sync module.
(10) Fader module	The module contains six channels. Fader action is by a single d. c. control (on the control module (11) or remotely situated) feeding all six electronic faders which track to ± 1 dB in their working range. Six present controls allow individual setting of the output levels to suit the power amplifiers in use.
(11) Control module	This control module selects the source and its mode. Push buttons and red led indicators allow the choice of non-sync sources, or one of the three 'formats' (optical sound, magnetic tracks, etc.). The format in use is determined by the selected format module itself, contained in one of three positions (18) - (20) behind the front swing panel. Two further push buttons select mono - stereo and noise reduction in-out (Dolby NR). The red led indicators for these two modes will only be illuminated if the 'command' sent to the module by the switch is compatible with the module - for example, if 'mono' is selected as well as magnetic tracks (which are usually at least three track), the command will be ignored by the magnetic tracks module and the indicator will not be illuminated. The module contains the local fader control and the selector and volume control for the booth monitor.
(12) NRM and (14)	Two noise reduction reduction modules (NRM) Cat. No. 22 are used to decode two inputs (normally the two stereo optical tracks).
(13) NRM	Position for a third noise reduction module to decode a third track (used for 4-track magnetic prints). For six-track Dolby-encoded magnetic prints external noise reduction units can be used for decoding.
(15) Equalizer modules (16) and (17)	Three 27-band third-octave equalizers (Cat. No. 64) for the left, centre and right channels.

(18) (19) Format modules and (20)

Position for three format modules; the operating module is selected by the control module (11). The format module makes the correct connections between sources and outputs as well as providing any necessary signal processing electronics.

The unit is normally supplied with only the mono-stereo format module installed. The mono-stereo optical format module Cat. No. 82 derives a centre channel from the left and right channels. The level of the centre channel is not fixed, but is automatically varied by some 4 dB relative to the left and right channels. The level and phase of the left and right channels are compared in the module, and if they are identical, the source effectively must be monophonic. In this case the centre channel is raised by 2 dB and the left and right reduced by 2 dB. If the channels are not identical, then the reverse occurs. This technique hardens centre channel information, necessary to maintain image location in the wide speaker separation situation found in most cinemas.

Also available are a Magnetic Tracks module (Cat. No. 84) which caters for up to six-track systems and an External Format module (Cat. No. 83) which transfers appropriate points in the signal path to rear terminals, allowing external connection of equipment to process any existing or future format.

(21) (22) Equalizer modules

Position for two further equalization modules (Cat. No. 64). These are not normally supplied for stereo optical use, but are required for four and five channel magnetic use. (If equalization is required on the sixth magnetic track, the surround track, provision is made to connect an outboard equalizer Model E2 to rear terminals).

(23) Facilities module

This module controls the method of operating the CP100. It contains switches to select remote or automatic operation of the source selection switches and mode switches on the control module (11), by, for example, an automatic programmer, or by Remote Control Units Cat. No. 88 (two supplied with the CP100) which are mounted one near each projector.

Remote control of the fader control and of projector changeover are also selected in the facilities module.

Facilities module (continued)

A Processing Bypass switch bypasses all signal processing with the exception of the optical pre-amplifier modules, allowing quick restoration of the programme in the event of a failure.

In the event of a major power supply failure, the facilities module (23) can be replaced by an optional Emergency Power Supply module (Cat. No. 91), which allows connection to external power sources, such as batteries.

7.2 Installation Instructions

7.2.1 Introduction

The Dolby CP100 Cinema Processor comprises a complete cinema audio control centre, enabling all forms of sound reproduction to be selected in the cinema. In addition, equalizers are incorporated to make the necessary frequency response corrections in 27 bands spread across the audio spectrum, so that the imperfections in the overall theatre frequency response are removed. By using plug-in Format modules, provision is made to accommodate all known signal processing systems while allowing new modules to be designed for any future system.

The installation procedure will cover all sound sources in logical steps. Not all the steps may be applicable to every installation, as not all installations will be using the full capabilities of the CP100.

The numbers (3) identify the modules; see drawing at beginning of this section.

7.2.2 Items needed to install the Dolby Cinema Package

You will need the following:-

(a) Two conductor screened cables.

(b) A wire-stripping tool, a soldering iron, and various screwdrivers, including one with a small trimming blade for the front panel preset controls.

(c) A Dolby Test Film loop, Cat. No. 69 (Dolby Tone on one side, pink noise on the other.)

(d) A real-time analyser, together with a suitable microphone.

(e) Pink noise generator, Cat. No. 85.

(f) Stereo cell alignment (crosstalk) film, Cat. No. 97.

(g) Buzz Track Film, SMPTE type P35BT/PH22.68.

(h) Reel of conventional Academy film.

(i) Reel of Dolby encoded film.

(j) Dual beam oscilloscope.

7.2.3 Basic Installation Procedure

(a) Turn off all equipment power in projection booth.

(b) Check voltage selector on rear of Model CP100; set to correct voltage (115 or 230 volts). Check correct fuse is fitted.

(c) Attach correct plugs to power cables and connect cables. The following wiring convention should be observed (for cables supplied with units):

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

(d) Install stereo solar cells on projectors according to instructions supplied with each cell. Accurate alignment of cell is not important at this point.

(e) Connect the cells to the CP100 using two two-conductor screened cables (or a single 4-core screened cable). Connect the inner conductors to the projector input + and - terminals, maintaining correct phase relationships. Connect the screen at CP100 end only to terminals marked earth adjacent to projector input terminals. (See drawing at rear of this section for details of rear connectors).

(f) Connect the CP100 outputs directly to the inputs of the associated power amplifiers. For use with unbalanced amplifiers, the - terminal should be connected to the earth at the amplifier, not CP100, end; the + terminal is the signal. Leave power amplifier gain settings at normal positions. Connect the booth monitor output to a suitable amplifier and speaker in the control booth.

(g) Do not connect magnetic inputs, non-sync inputs or remote control units at this stage.

7.2.4. House Equalization

(a) Switch Facilities module (23) to Manual source select, Local Fader and Local c/o key.

(b) Set Local Fader on CP100 Control Module (11) to '7'. Turn the Cat. No. 64 House Equalizer output controls to minimum (fully anti-clockwise).

(c) Plug in the External Format Module (Cat. No. 85) into the two vacant Format slots (19) and (20) (one is already occupied by the mono-stereo Optical Format Module).

(d) Switch on power to CP100 only.

(e) Select Format corresponding to position of External Format and depress Test Tone button on Facilities Module (23).

(f) Switch all meter modules (4) to (8) to 'check equalizer' position.

(g) Connect a temporary link between rear terminals 'To Ext. Format left output' and 'From Ext. Format left input'.

(h) Adjust left Cat. No. 64 House Equalizer (15) input control to give a reading of Dolby Level on associated meter module (5).

(j) Keeping one end of the link on the 'To Ext. Format left output' terminal, transfer the other end of the link to 'From Ext. Format centre input'. Adjust Centre Cat. No. 64 to give a reading of Dolby Level on associated meter module (6).

(k) Continue for all Cat. No. 64 modules fitted.

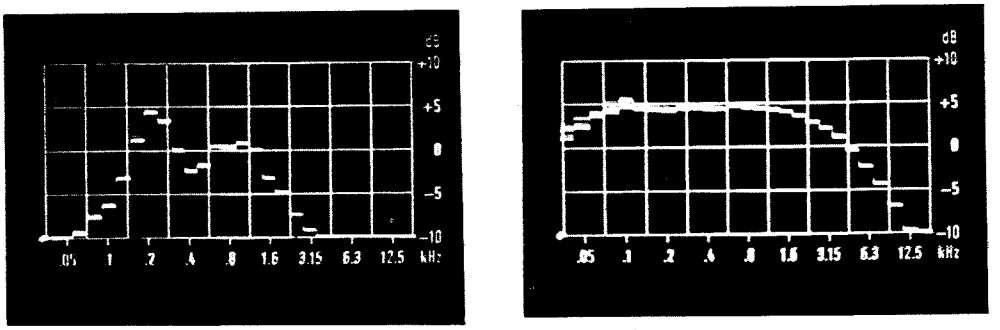
(l) Remove the left channel Cat. No. 64 (15), and plug in the test extender Cat. No. 67 in its place. Plug the Cat. No. 64 into the extender.

(m) Switch on power amplifiers.

(n) Switch Manual Source Select button to select Format corresponding to position of Pink Noise Generator. On generator, switch pink noise to left track only.

(o) Connect the calibrated microphone in an average position about 2/3 way back in the reverberant field (not on centre line of cinema and not directly on the speaker axis) to the real-time analyser. With normal volume settings on the power amplifier, adjust L Trimpot on Fader Module (10). Advance trimpot and analyser gain until trace is visible on screen and pink noise is heard in auditorium. Turn off pink noise source momentarily to check pink noise level is well above (20 dB) ambient noise.

(p) Make a rough equalization using the bass and treble controls on the Cat. No. 64 module. Then move to the 27 third octave bands, adjusting them to achieve flat frequency response up to about 2 kHz, with a 3 dB/octave roll-off above this frequency (-3 dB at 4 kHz, -6 dB at 8 kHz). Double-check the results if it is noticed that adjacent trimmers shows great differences between settings. The final result is shown in fig. 7.1 below.



before after

Fig 7.1 Auditorium Equalization

(q) As the equalization progresses, it is sometimes a advantageous to alter the coarse bass and treble controls to make a basic correction, and occasionally a small change can be made to House Equalizer input control to correct for equalization gains or losses. When equalization is complete, the average of the 27 band potentiometer settings should be about 12 o'clock (i.e. not mostly up or mostly down).

(r) Move the microphone to other positions in the auditorium, and check that a good average equalization has been achieved, considering that compromises may have to be made in extreme seating positions.

(s) Switch pink noise off on left channel, and proceed to equalize remaining channels in similar manner (steps n-r).

(t) When all channels have been equalized, leave microphone in auditorium as it will be required for setting the listening levels (Section 7.2.6).

7.2.5 Projector optics and optical pre-amplifier alignment

(a) Clean sound head optics of both projectors. Make test loops to suit projectors from Dolby test film Cat. No. 69 and from 1 kHz 100% left/right film. Switch meters on CP100 to Dolby Cal. position.

(b) On projector 1, switch on exciter lamp and move the cell towards the film until it almost touches the film plane. Image of slit should be near top of cell (Fig. 7.2).

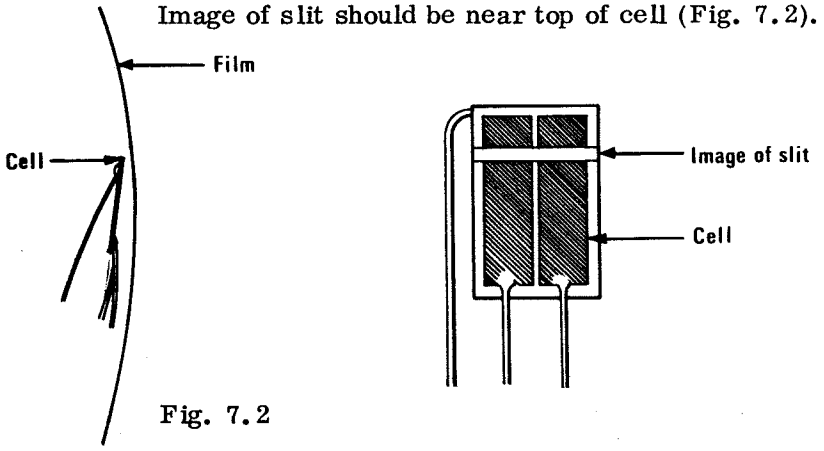


Fig. 7.2

(c) Lace up and play the Dolby tone side of the Dolby test film Cat. No. 69. Select Proj. 1 on the Facilities Module (23), and adjust left and right optical pre-amplifier gain controls (1) so the meters (5) and (7) read approximately Dolby Level. (Ignore centre channel meter (4)). Operate change-over module (3) red switch to select standby optical pre-amplifier (2) and repeat gain adjustments. This is an approximate setting only, and will be repeated later.

(d) Connect the two inputs of the dual beam oscilloscope to the left and right outputs on the CP100. Press the Processing Bypass red button on the Facilities module (23) to connect the optical pre-amplifier outputs directly to the output terminals. (Note: the levels at the output terminals may change significantly as the Bypass red button is pressed). Lace and play the stereo cell alignment film Cat. No. 97. Move cell to and fro across film plane until there is a minimum crosstalk Left to Right and Right to Left (it should be possible to achieve better than 20 dB separation each way). The oscilloscope traces will be similar to Fig. 7.3. It may be necessary to stop the projector to make these adjustments.

(e) Lace up and play the SMPTE Buzz Track film. If it is not convenient to listen, use the Dual beam oscilloscope connected as above. Depending on the projector mechanical design, the normal buzz track alignment is carried out by moving the film position or by moving the slit.

If slit moved: Proceed to step (f) directly.

If film moved: Re-Run the stereo cell alignment film Cat. No. 97 to trim cell position, and then re-run the SMPTE Buzz Track film to trim film position. If there are considerable adjustments required, it may be necessary to perform a third run of each film since the steps (d) and (e) are inter-dependent. Then proceed to step (f).

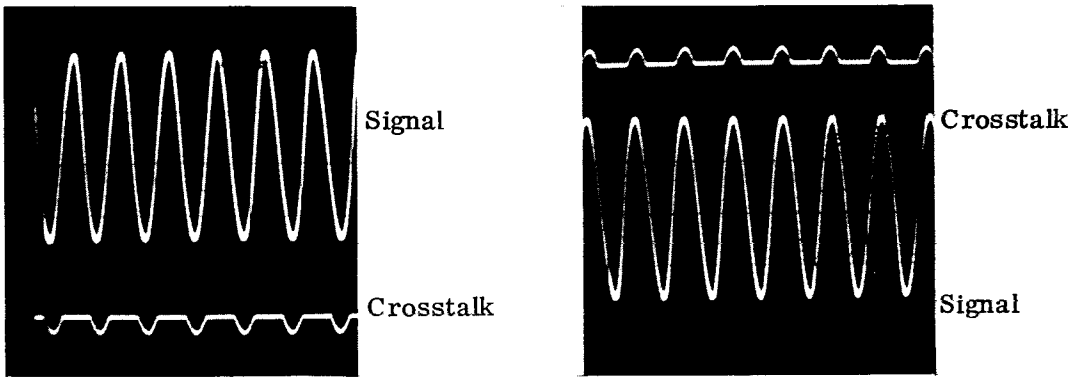
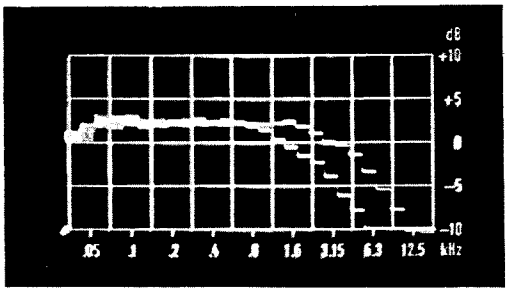


Fig. 7.3 Oscilloscope traces of crosstalk. Upper trace, left channel; lower trace, right channel.

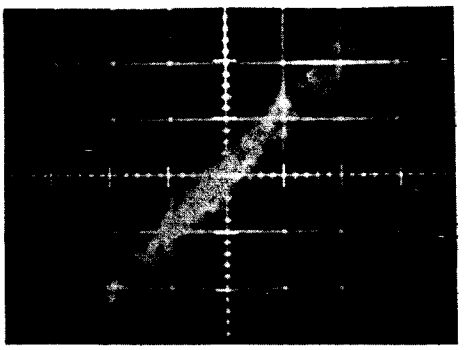
(f) Lace up and play the pink noise side of Dolby test film Cat. No. 69. With the CP100 still in bypass and the oscilloscope connected as above, switch the oscilloscope to X/Y mode. With the real-time analyser connected to left and right channels in turn, adjust focus for maximum h.f. on the real-time analyser (Fig. 7.4) and rotate the slit for best azimuth as seen on the oscilloscope (Fig. 7.5). (Check that the X and Y gains of the oscilloscope are identical by applying the same input to each trace in turn or simultaneously to both inputs).



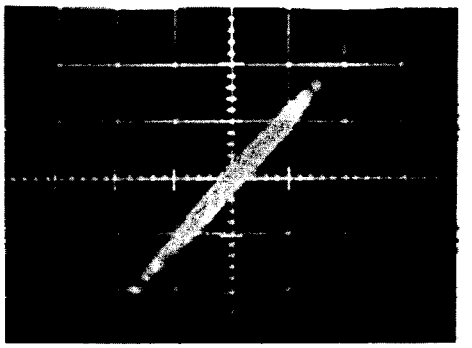
moving towards focus

out of focus

Fig 7.4 Effect of focus adjustment



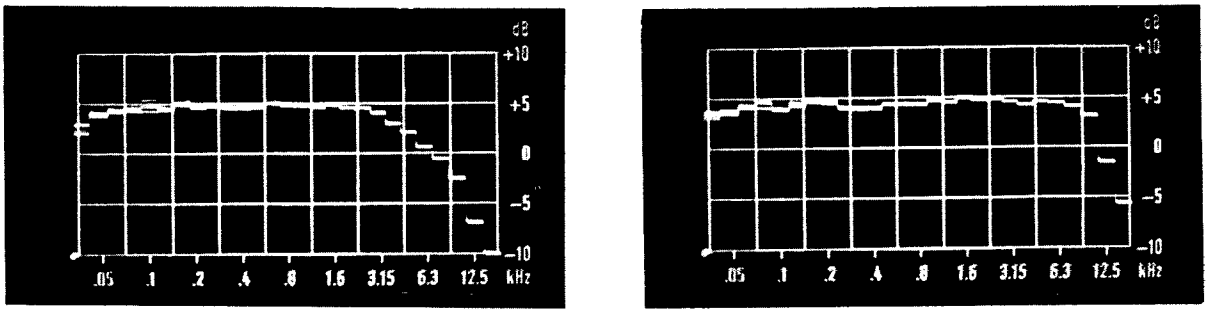
incorrect azimuth



trace shows direction of adjustment

Fig 7.5 Effect of azimuth adjustment; final trace should be as thin as possible

(g) When azimuth and h.f. have been optimised in (f) obtain flat h.f. response to left and right using the pre-amplifier h.f. controls (Fig. 7.6). Take into account any h.f. calibration information included with the test film. Switch to standby optical pre-amplifiers and repeat.



before after

Fig. 7.6 Adjustment of Optical Pre-amplifier h.f. controls

(h) Release Processing Bypass red button on the Facilities module (23) to restore normal signal conditions.

(i) Re-thread Dolby Tone side of Cat. No. 69 loop and adjust pre-amplifier gain controls left and right so that the meters (5) and (7) indicate Dolby Level. Switch back to main optical pre-amplifier and repeat.

(j) Switch CP100 to projector 2 and repeat sections (b) to (h) for the other projector.

7.2.6 Adjustment of Auditorium Levels

(a) Select Mono-Stereo Optical Format module. Push Dolby NR button in. Play Dolby encoded film and check sound quality and level in auditorium, making rough trimming adjustments to the level by means of the trimpots on the Fader module (10). (In the case of very sensitive power amplifiers as sometimes encountered on Philips projectors an external attenuating L-pad must be added at the power amplifier input to reduce the CP100 output level of 1 volt to that required by the power amplifier. The condition is shown by high noise levels and by the CP100 fader module presets being very close to their lowest setting).

(b) Select Format corresponding to position of Cat. No. 85 Pink Noise Generator. Reconnect microphone to analyser input, and selecting each channel in turn on Cat. No. 85 make final adjustments to Fader Module trimpots to give same sound pressure level responses as seen on trace.

(c) Select Mono-Stereo Optical Format and continue to play Dolby film to check level and balance in auditorium. The Local Fader control can be used over its working range of 10 dB about position 7 to cater for different films; it should not be necessary to adjust the Fader Module trimpots except in cases of gross imbalance in the film soundtracks.

(d) Lace an Academy film. Turn off Dolby noise reduction by releasing Dolby NR button, and play film.

(e) Press Processing Bypass button on Facilities module (23) and adjust the left and right trimpots on the Changeover module (3) to give a balanced sound in the auditorium. (It may not be possible to match previous sound levels exactly since this depends on the sensitivity of the following main power amplifiers). Release the Processing Bypass pushbutton.

7.2.7 Non-sync sources

(a) Connect stereo non-sync sources. Select non-sync mode. Play suitable material; adjust the input trimpots to give correct sound levels in the auditorium. (If only mono non-sync sources available, strap together left and right inputs of tagstrip for each source).

7.2.8 Magnetic tracks

(a) Using two-conductor screened wire, connect the outputs of the magnetic pre-amplifier already associated with the two projectors into the rear of the CP100. Maintain phasing.

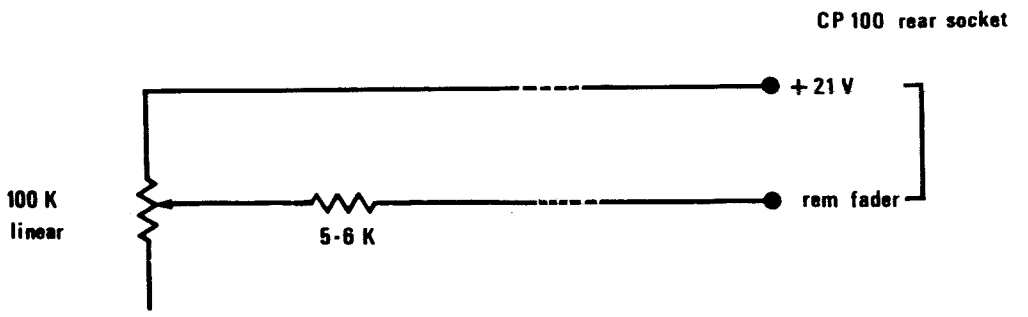
(b) Switch NR off, select Magnetic Track Format module. Switch meter modules to Dolby Cal. Selecting each projector in turn, play suitable test film to ensure flat frequency response. Adjust the level controls on the magnetic pre-amplifier to give a reading of about 13mm ($\frac{1}{2}$") above the Dolby Level mark. (Any Dolby encoded magnetic track film will have a short section of Dolby Level at the beginning which can be used for more accurate calibration).

7.2.9 Remote control installation

Several of the CP100 functions may be controlled remotely, either by using easily-available components or by using Dolby Laboratories accessories.

(a) Remote fader

Remote fader capability is selected by the appropriate push-button on the Facilities Module. A100k linear potentiometer connected to the remote terminals is required to control all six channels.

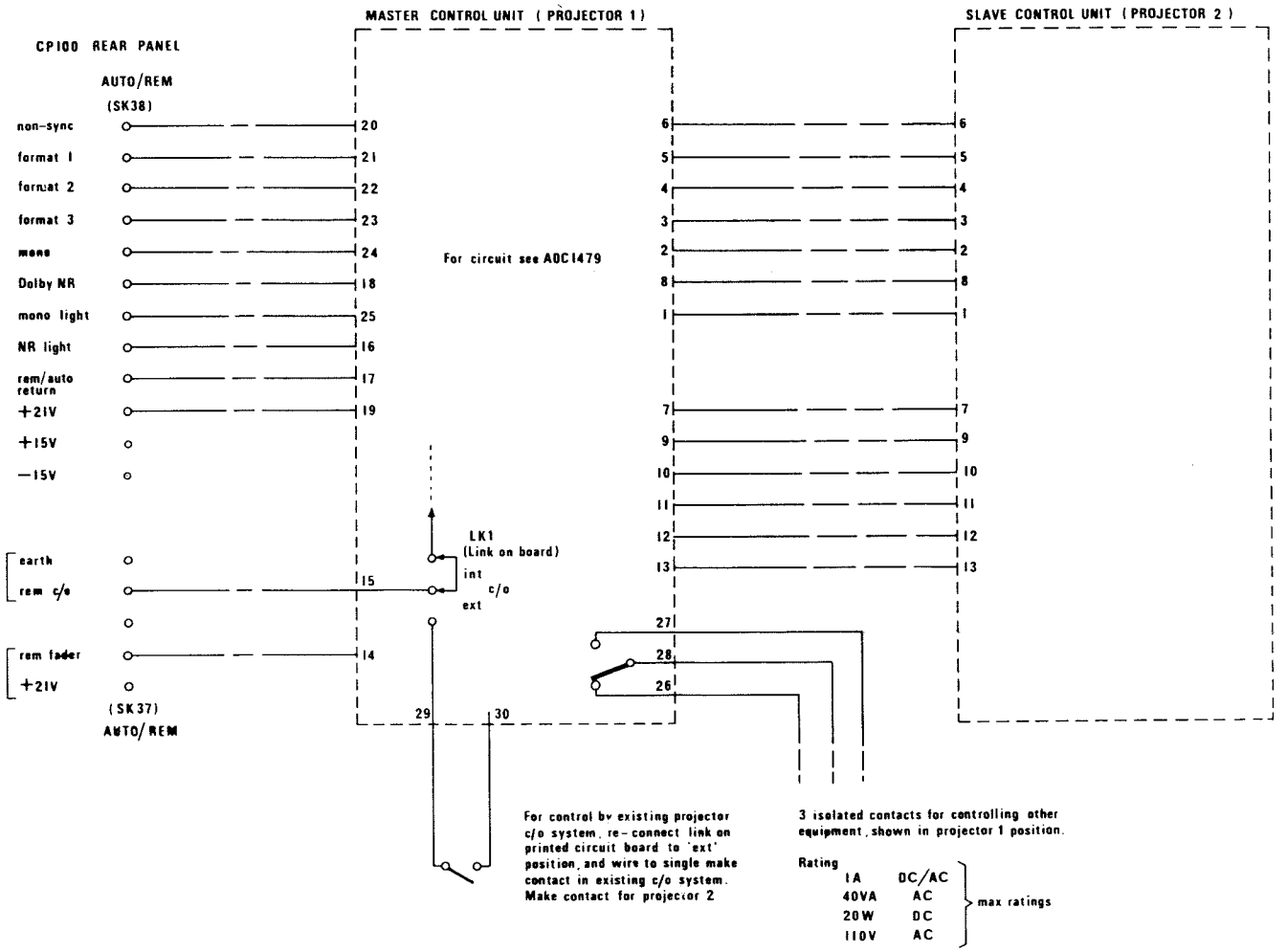


(b) Remote changeover

The changeover between projector 1 and 2 can be controlled by the CP100 Facilities Module or remotely by depressing the appropriate button on the module. A single-make contact across the two rear-mounted terminals causes the CP100 to change inputs from projector 1 to projector 2. The controls may be available already in the existing projector changeover system, or it may be necessary to add an interfacing switch or relay.

(c) Full remote/automation

With the projector c/o and fader remotely selected on the facilities module, selection of the Auto/Remote button transfers these facilities and the format and mode selection push buttons (manual source select) to rear mounted terminals. Dolby Laboratories Cat. No. 88 Remote Units may be used at each projector using either the existing projector changeover arrangement to control the switching or using the remote unit changeover buttons to control the existing changeover arrangement, whichever is more convenient (see Dwg. A2C1480). Alternatively, the CP100 may be connected to one of the many forms of sequence controllers in an automated cinema (simple relay interfacing may be required). Grounding the appropriate rear mounted terminal causes the function to be switched in or changed over (see Dwg. A3C1429 for details).

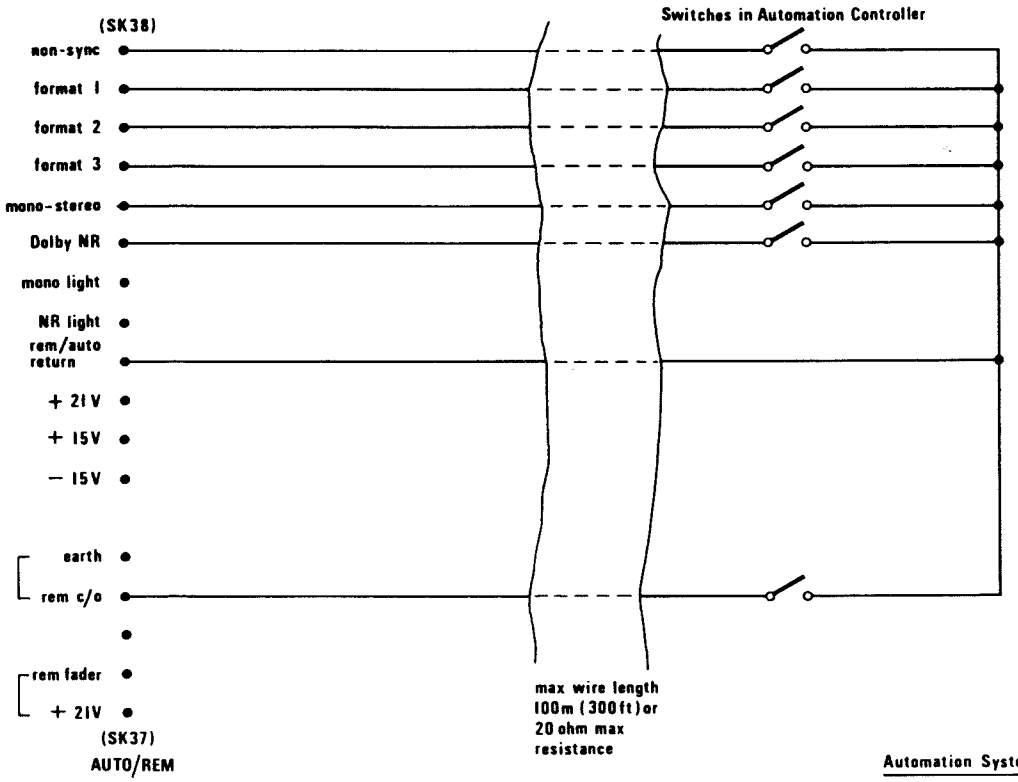


NOTES

1. Slave unit has no relay inside, visible when top cover is removed for installation.
2. Switch CP 100 to :
   a) Auto/Rem
   b) Remote Fader
   c) Remote c/o
3. Use multicore or single conductor cable; screened cable need not be used.
4. Fix units to wall or projector with screws through 4 holes in base.

A2C 1480 Issue 1

Installation of Remote Control Units
Drawing no. A2C1480



Connection of CP100 to an automatic programmer
Drawing number A3C1429

L76/343/38

7.2.10 Installation of Surround Decoder option (Model SA2 and Cat. No. 116 or 116A)

(a) Optical films requiring a surround track will have been made using a specially adapted version of the Sansui QS* matrix encoding technique during production. Correct decoding of this track is necessary to provide the separate surround information; however, such a film may be played back satisfactorily in normal stereo or mono.

The external Surround Decoder card Cat. No. 116 plugged into the Surround Adapter unit SA2, together with the Pentoptical Formal Module Cat. No. 94, provide the necessary decoding ability in the theatre.

Early SA2 units comprised a plug-in Surround Decoder card (Cat. No. 116) and a delay line built into the main SA2 chassis. Later technology allowed the delay line to be added into a revised Surround Decoder card, Cat. No. 116A, thus allowing all the circuitry to be mounted as a plug-in card. The 116A is designed so that it will operate with either new or old SA2 mainframes; however note that a new mainframe (distinguished by not having a screwdriver adjust switch under the front panel access plate) requires a Cat. No. 116A.

The alignment procedure falls into two parts. Firstly, the sound level is adjusted so that the surround volume is correctly matched to that of the front speakers. Secondly, the signal delay between front and surround speakers is adjusted so that the ear (which in the case of two almost coincidental sounds listens predominantly to the sound which arrives first at the ear) ignores any crosstalk leak of front signals in the rear and only is aware of surround signals when they differ markedly from those on the front speakers.

(b) Before installing the SA2, it is preferable to set the surround levels as described below. An alternative method for use after installation is given in sub-section (e) below.

Plug the Pink Noise Generator Cat. No. 85 into a format slot, and switch Manual Source Select button to select corresponding format.

Select left and right channels only on the Pink Noise Generator (switches are down for "on" and up for "off") and with normal fader settings measure the sound pressure level in the auditorium either with the analyser (see Section 7.2.4 (o)) or sound pressure level meter. Turn off the left and right channels, select surround on the generator and adjust the surround (surr) trimpot on the Fader module 10 and any gain control on the surround power amplifier until the same sound pressure level is reached. If no test instruments are available, you will have to rely on your ears to adjust for equal levels while switching between (L and R) and S on the Pink Noise Generator. (If no sound is heard in the auditorium, check that the surround equalizer in-out sockets (SK31) are connected on rear of CP100. Normal operation requires two resistors, 8K2 from SK31/3 to SK31/1, and 2K7 from SK31/1 to SK31/2.)

(c) Remove the Pink Noise Generator and install the Pentoptical Module Cat. No. 94 in its place. Selection of this card by the appropriate format button will activate the optical surround decoding system.

(d) Mount the SA2 unit close to the CP100. Connect the units together following the diagram A2D1707 on Page 7.22. Note the early SA2 requires 115/230v, 50/60HZ; select the correct voltage by the rear screw-driver operated switch, and check that the fuse has the correct rating. If both Optical and Magnetic surround systems are to be operated, add the extra circuitry shown on A4C1669 on Page 7.23; a special assembly (Surround Relay board) which mounts on the rear of the CP100 containing this circuitry is available from Dolby Laboratories, free of charge. Install as shown on page 7.22.

(e) An alternative approach is to switch to the format corresponding to the Cat. No. 94 position, and replay the special Dolby Tone test film, Cat. No. 125. This special film has the phase reversed on one channel. If this film is not available, the normal in-phase Dolby Tone test film, Cat. No. 69, can be used by reversing the phase on one input form one projector only (interchanging the wires on, say, Left Projector 1 input + and -). If this method of phase reversal is adopted, any monophonic film can be used. In the reverse phase condition, the output should be almost entirely from the surround speaker, and little from the front speakers. The same film on Projector 2 (or a loop of standard Cat. No. 69) will give output almost entirely from the front, and little from the surround. The surround gain controls can be adjusted to provide equal sound levels from front and surround speakers in the two conditions. (Note: this procedure is also useful to check if the Surround Adaptor is functioning correctly. The output of the surround channel can be measured at the CP100 output terminals; the level depends on the setting of the output trimpots, but the change between in and out-of-phase inputs should be easily seen.)

Remember to return the input connection to normal before moving to the next step.

(f) The remaining adjustment is to set the delay time on the SA2, which in early SA2 units is varied by a screwdriver-operated switch (under the front panel access plate). With the switch fully in the counter-clockwise position, the delay is 30 msec. Each switch position in the clockwise direction adds 10 msec up to a maximum of 100 msec. The object of the delay line is to insure that front signals not intended for the surround loudspeakers but which are present due to the normal crosstalk in the surround decoder arrive at the listener about 20 msec later than those from the front. The ear then interprets the signals as coming entirely from the front, and does not hear the surround speakers.

(f) con't The delay is set by estimating the distance from a rear seat (close to a surround loudspeaker) to the front loudspeakers in feet, subtracting the distance from this seat to the surround speaker. Add 20 to this number, and set the delay line to this delay. (Examples: the chosen seat is 80 feet from the front speakers, and 10 feet from the surround speakers. The delay is set for $(80-10)+20=90$ ms, or the 7th position of the switch, that is, six clicks off the fully counterclockwise position).

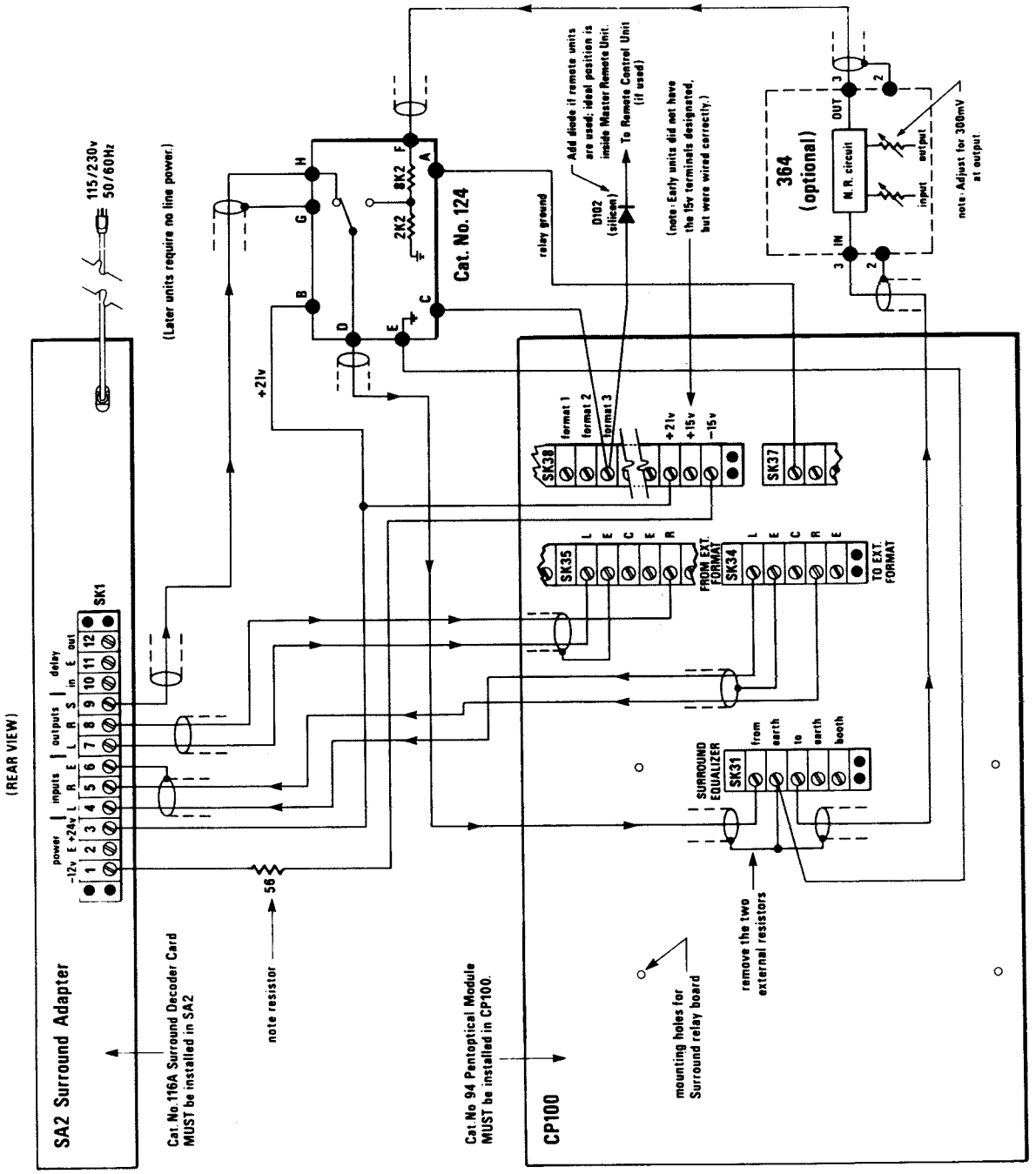
If you work in the metric system, convert the seat - loudspeaker distances to feet by multiplying by 3, before adding 20.

In the case of the Cat. No. 116A, the delay time is varied by a thumbwheel switch (if the Cat. No. 116A is plugged into an early SA2, the screwdriver switch is inoperative but should be set to the same value as the thumbwheel switch to allow Cat. No. 116 cards to be used in case of failure). With the switch indicating '1', the delay is set at 30 milliseconds. Each succeeding switch position adds 10 ms up to a maximum of 100 ms with the switch indicating '8'. Set the delay using the procedure outlined above.

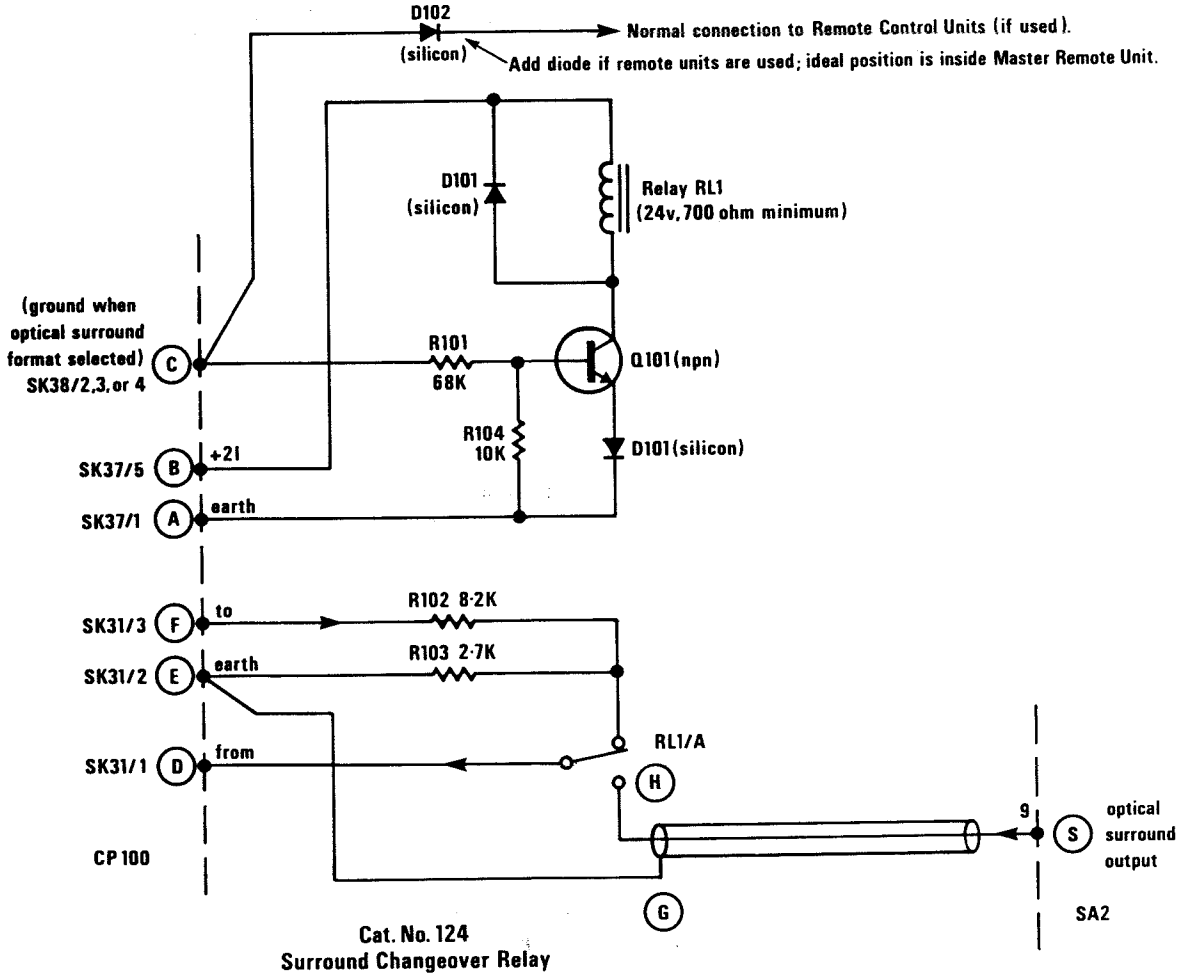
(g) Alternatively, play a monophonic film and adjust the delay so that no surround information is heard in a seat close to one of the surround loudspeakers.

(h) Check the format containing the Cat. No. 94 is still selected. Play a Dolby-encoded film which has surround information. Listen critically to the sound. If a definite rear echo is heard on sounds which should be coming from the front, the delay time is too long. If the front image is diffuse (not clearly behind the screen), the delay is too short. NOTE: In many films, the use of surround information is subtle; it may not be meant to be at a loud volume. Provided the setup detailed in sub-section 7.2.10(b) or 7.2.10(e) has been carried out, a low level surround means the director wanted it that way - do not be tempted to increase the surround volume which would destroy the effect the production team desired.

(i) If a magnetic surround system is also to be used, play a Dolby Level 70 mm film; select magnetic format. Adjust the input potentiometer of the Model 364 (see page 7.22) for a reading of Dolby Level on the 364 meter. Adjust 364 output control for 300 mV at output. If for any reason there are level differences between magnetic and optical surround levels when playing feature films, equalize levels by adjustment of 364 output potentiometer



Installation of SA2 Surround Adapter with CP100

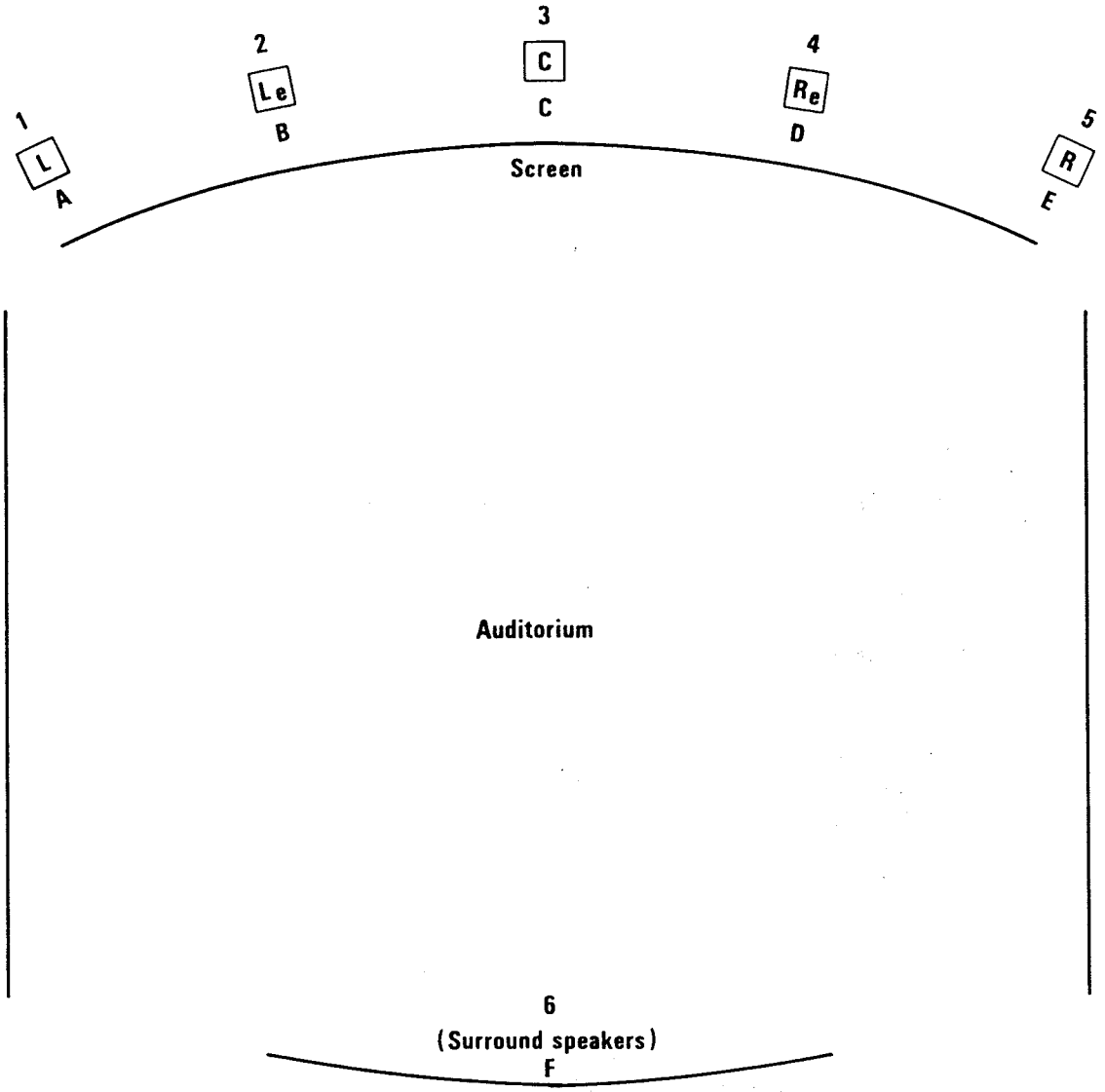


Cat. No. 124
Surround Changeover Relay

Notes: (Unless otherwise specified.)

1. Relay shown in energized position (magnetic surround).
2. Connect point (X) to format pin corresponding to format being used for surround (normally uses Cat. No. 94 or modified Cat. No. 82 in format position in CP100).
3. Connect 364 unit (if used) between CP100 SK31/3 and Cat. No. 124 pin (F)

A3SK1669 Issue 3



Designation of Tracks

For Optical and 35mm magnetic prints, the Left, Center and Right speakers are situated as shown above. For 70mm magnetic prints, the L extra, R extra and Surround channels are added in the positions above.

The only exception to this is if the extreme Left and Right positions are always behind thick drapes or equivalent. Then the positions of Le and L, and Re and R should be reversed with the CP100 L output going to the amplifier/loudspeaker marked B and the Le output to that marked A (and similarly for the R and Re speakers).

7.2.11 Installation of Surround Decoder option (Model SA3 and Cat. No. 116A)

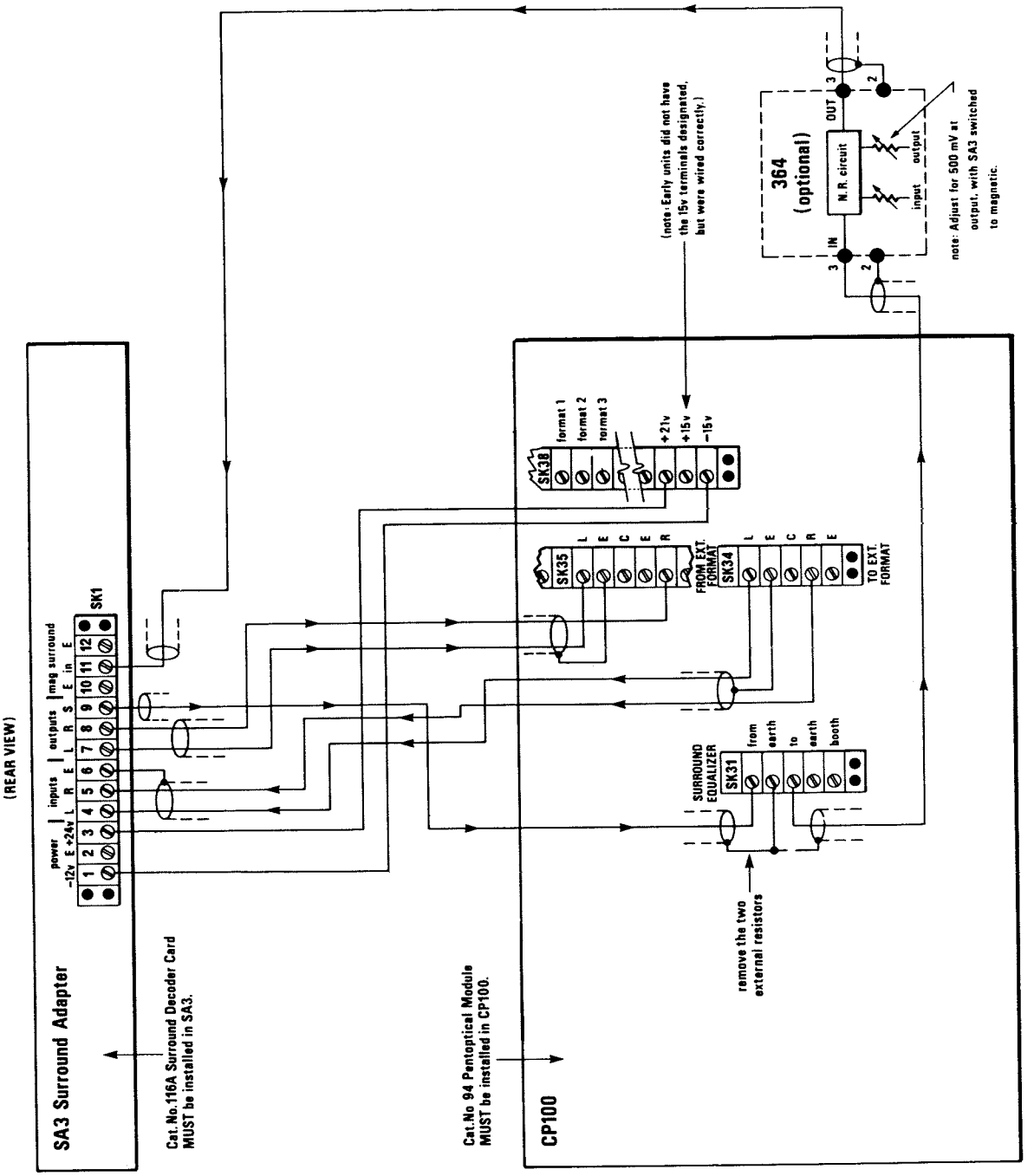
(a) The basic concept of the optical surround decoder is explained on page 7.19, paragraph (a). The Model SA3 differs from the SA2 only in that the optical/magnetic surround changeover is built inside the SA3; thus the Cat. No. 124 relay system is not required. The connection diagram is shown on the next page.

(b) The installation follows that given on page 7.19 for the SA2, except that the front panel selector switch on the SA3 must be placed initially in the "optical" position for steps (a) through (h), and to magnetic for step (i).

(c) In operation, the front panel selector switch should be moved to the position appropriate for the film being played, in addition to the operation of the correct format switch on the CP100. If there is no surround information, be sure to leave the switch in the center "off" position.

(d) NOTE: Early CP100 power supply stabilizers (Cat. No. 81, Facilities module) were set for safety reasons to limit the current provided by the supply as soon as the amount required by the CP100 was exceeded. The addition of the SA3 brings the current required very close to that set for the current limiting and in these conditions "lock-up" on switch-on can occur and the power supply will not turn on at all.

When installing the SA3, remove the Cat. No. 81 (see (23), page 7.3 and check the value of R203. This should be 680 ohm, $\frac{1}{4}$ watt; early units used 3k3 ohm, which should be changed.

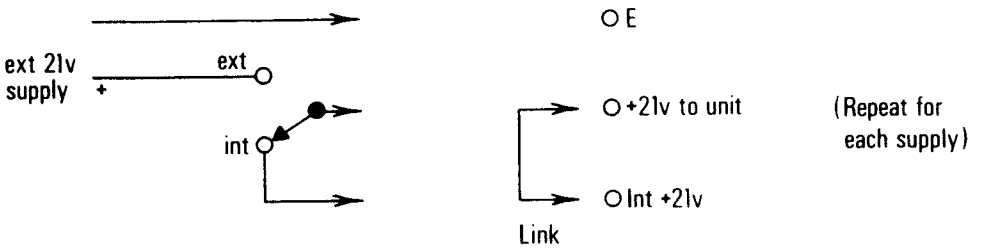


Installation of SA3 Surround Adapter

7.2.12 Connection of External Emergency Power Supplies

CP100 units from serial number 200 have connections for external power supplies brought out on rear terminal block SK41. Units with earlier serial numbers can be modified on site by following the instructions given in Engineering Field Bulletin 72.

The unit is normally supplied with links connecting the internal supplies to the power supply inputs. For external supplies, remove these links and connect supplies as shown below. In the case of power supply failures, these external supplies can be switched in. For safety's sake, then disconnect the power cord until repairs can be carried out.



a) External switched supplies

b) Normal connection

The precise values of the external voltages are not critical, except that they should be within the ranges ± 2 volts on the 15 volt supplies and -1, +3 volts on the 21 volt supply (the gain of the fader module is dependent on the absolute value of the 21 volt supply, and if a somewhat different value is used, it may be necessary to alter the fader settings slightly).

Ripple (hum) and noise should be less than 20 mV rms; current requirements are as follows:

+21 volt	1.5 amp
+15 volt	0.5 amp
-15 volt	0.5 amp

7.2.13 Installation and Alignment Instructions for Equalizer Bypass Card (Cat. No. 105D)

Most 70 mm Dolby encoded magnetic tracks have a special signal recorded on tracks 2 and 4 (Left extra and Right extra) for bass enhancement. When extra low frequency effects are demanded by the film, these tracks carry only the low frequency component of the other tracks. On replay, the output of these tracks is passed through a 200 Hz low pass filter in the Cat. No. 105D card, and thence to the output amplifiers in the normal manner.

For playback of older non-Dolby 70 mm prints, the filter is switched out of circuit. This switching can be done manually or, on CP100 units after serial number 185, controlled automatically by the action of the Dolby NR in-out button.

Installation:

(a) Insert the Cat. No. 105D into the CP100 unit in the two positions marked "Cat. No. 64 Equalizer Left Extra" and "Cat. No. 64 Equalizer Right Extra".

(b) Switch the small toggle switch mounted on the card to 'Auto' position (marked in copper on the circuit side of the board, corresponding to the switch in the down position).

(c) Switch CP100 to format corresponding with position of Magnetic Format module. Operate Dolby NR in-out button (check light next to button operates) and observe LED on Cat. No. 105D card. If it also goes on and off, the CP100 is wired for auto control of the Cat. No. 105D. Older CP100 did not have the necessary rear connector wiring. (To modify early units, connect wire from SK22/M to SK21/M to SK20/M to SK16/M to SK15/M and then to SK3/F, i.e., the NR information signal.)

(d) In existing installations, the channel gains will have been set previously. Move to step (f).

(e) In new installations, switch Dolby NR off (when auto control is wired) or switch out the Cat. No. 105D filter (switch in top position). Proceed to set equalization and levels as described in the CP100 manual, Sections 7.2.4 and 7.2.6.

(f) Using the pink noise generator (Cat. No. 85) select Le only, switch to Dolby NR in (with auto control) or filter in (switch in center position) and observe real time analyser display of signal in auditorium. The spectrum should roll off sharply after 200 Hz. Switch filter in and out by Dolby NR switch, or card switch as appropriate, to check filter operation.

(g) Note level in auditorium with NR out (or Cat. No. 105D card switched out).

(h) Switch NR in or Cat. No. 105D in, and set low frequency level in auditorium to 4-6 dB above that noted in (g) by adjustment of trimpot at front edge of card (this control is inoperative in filter out mode).

(i) Play Dolby encoded 70 mm film, such as STAR WARS reel 1 or CLOSE ENCOUNTERS reel 7 A/B. Listen critically to low frequency response and check that power amplifiers and speakers are not distorting, and that chandeliers, lighting fixtures, etc. in the auditorium have no loose rattling parts.

7.2.14 Installation of Surround Decoder (Model SA4, Cat. Nos. 148, 150)

(a) Films which have a surround track are encoded using a technique in which the surround information is recorded out-of-phase. Correct decoding of this track is necessary to provide the separate surround information; however, the film will play back in either stereo or mono satisfactorily.

The early surround adapter system consisted of an SA2 frame which housed the Cat. No. 116 surround decoder and a delay line. This worked in conjunction with a Cat. No. 94 pentoptical format module housed in the CP100 mainframe and, where magnetic surround was also installed, a Cat. No. 124 relay board.

Later technology allowed the delay line to be mounted on the decoder board and the combination was designated the Cat. No. 116A. The SA3 frame is designed to hold the Cat. No. 116A. The SA3 differs from the SA2 in that it does not contain a delay line, and it contains a switch for selection of magnetic or optical surround. The Cat. No. 124 relay is not required with the SA3. The Cat. No. 94 pentoptical module is still required.

The Cat. No. 150 represents a further advance in decoder technology and takes advantage of linear large scale integrated circuits which were designed for the Tate directional enhancement system (DES). The Cat. No. 150 assembly consists of a Cat. No. 146 decoder on which is mounted a delay line assembly. The Cat. No. 150 accepts left and right channel inputs and decodes all four channels: left, center, right, and surround. The Cat. No. 150 must be used in an SA4 frame which differs from an SA3 frame in that it has a terminal for the center channel output. Since the Cat. No. 150/SA4 package provides center channel decoding, there is no requirement for either the Cat. No. 82 Mono/Stereo Optical Module, or the Cat. No. 94 Pentoptical Module. (However, the Cat. No. 82 may be retained as an emergency replacement for the new optical system.) The Cat. Nos. 82 and 94 are together replaced with a single Cat. No. 148 Optical Format Module. The SA4/ Cat. No. 150 in conjunction with the Cat. No. 148 Optical Format Module decodes all optical formats: Academy mono, Dolby mono, Dolby Stereo, or Dolby Stereo with Surround.

The alignment procedure falls into two parts. First, the sound level is adjusted so that the surround volume is correctly matched to that of the front speakers. Second, the signal delay between front and surround speakers is adjusted so that the ear (which in the case of two almost coincidental sounds listens predominantly to the sound which arrives first at the ear) ignores any crosstalk leak of front signals in the rear and only is aware of surround signals when they differ markedly from those on the front speakers.

(b) Mount the SA4 near the CP100 (preferably above the CP100). Connect the units together following the diagram A2D1915 on page 7.34. Temporarily connect the SA4 "mag surround" input to the CP100 "to surround equalizer" output. This connection is required to set the surround level. Plug the Cat. No. 85 Pink Noise Generator into a format slot and press Manual Source Select to select that format. Switch the SA4 surround switch

to magnetic. The L, C, R, S switches on the Pink Noise Generator (switches are down for "on" and up for "off") should now control the pink noise fed to the left, center, right and surround speaker systems. Adjust the trimpots on the fader module so that equal sound pressure level is obtained out of each speaker system. (It is essential that equal sound pressure levels are set up, in contrast to the accepted procedure for the older 116A/94 system, whereby in certain types of halls the center channel was deliberately raised by a few dB to compensate for decoding deficiencies, thus improving the center lock.) If Le and Re speakers and amplifiers are installed, also check that they produce equal sound pressure levels.

(c) Remove the Cat. No. 85 Pink Noise Generator and install the Cat. No. 148 Optical Format Module. Connect the magnetic surround wiring as shown on the diagram A2D1915 on page 7.34.

(d) The remaining adjustment is to set the delay time, which is varied by a thumbwheel switch on the Cat. No. 150 card. With the switch indicating '1', the delay is set at 30 milliseconds. Each succeeding switch position adds 10 ms up to a maximum of 100 ms with the switch indicating '8'. The object of the delay line is to insure that front signals not intended for the surround loudspeakers but which are present due to the normal crosstalk in the surround decoder arrive at the listener about 20 ms later than those from the front. The ear then interprets these signals as coming entirely from the front, and does not hear them from the surround speakers.

The delay is set by estimating the distance from a rear seat (close to a surround loudspeaker) to the front loudspeakers in feet, subtracting the distance from this seat to the surround speaker. Add 20 to this number, and set the delay line to this delay. (Example: The chosen seat is 80 feet from the front speakers, and 10 feet from the surround speakers. The delay is set for (80 - 10) + 20 = 90 ms, or switch position '7'.)

If you work in the metric system, convert the seat-loudspeaker distances to feet by multiplying by 3, before adding 20.

(e) The delay setting may be checked by playing a film with the surround decoder on. The dissimilar left-right sounds on a stereo film will produce some crosstalk into the surround channel. When sitting in a seat near a surround speaker these sounds should appear to come from behind the screen. If sounds which should be behind the screen appear to be coming from the surround speakers, the delay is probably too short. If a definite rear echo is heard, the delay is too long.

Any mono film may also be used to check the delay setting. However, since mono or center channel information is almost entirely rejected by the surround channel it will be necessary to get close to a surround speaker to hear any crosstalk. Sit in the nearest seat to a surround speaker at the back of the auditorium, and play the mono film with the CP100 switched for optical surround. If program material appears to come from the surround speaker the delay is probably too short. If a definite echo is heard the delay is too long.

If a substantial amount of mono or center channel information appears out the surround channel then there is probably a severe gain or azimuth error. Dolby level and optical system alignment should both be checked.

(f) In many films the surround information is meant to be a subtle effect and to provide a low level ambience. Provided that the surround level and delay time have been adjusted as described, the surround level will be what the film director wanted. Do not be tempted to increase the surround volume as this might destroy the effect that the film production team desired.

(g) Select Magnetic Format. Play a Dolby level magnetic test film, and adjust the input potentiometer of the Model 364 (see diagram A2D1915 on page 7.34) for a reading of Dolby Level on the 364 meter. Adjust the 364 output level control for 500 mv at the 364 output. If for some reason there are level differences between magnetic and optical surround levels when playing feature films, the magnetic surround level should be trimmed to match the optical with the 364 output level control. The CP100 surround trimpot on the fader module can then trim both the magnetic and optical surround levels.

(h) Operating Instructions (Model SA4, Cat. Nos. 148, 150.)

1. Optical

Academy Mono: Select Cat. No. 148 format module, mono, N.R. off, and surround off.

Dolby Mono: Select Cat. No. 148 format module, mono, N.R. on, and surround off.

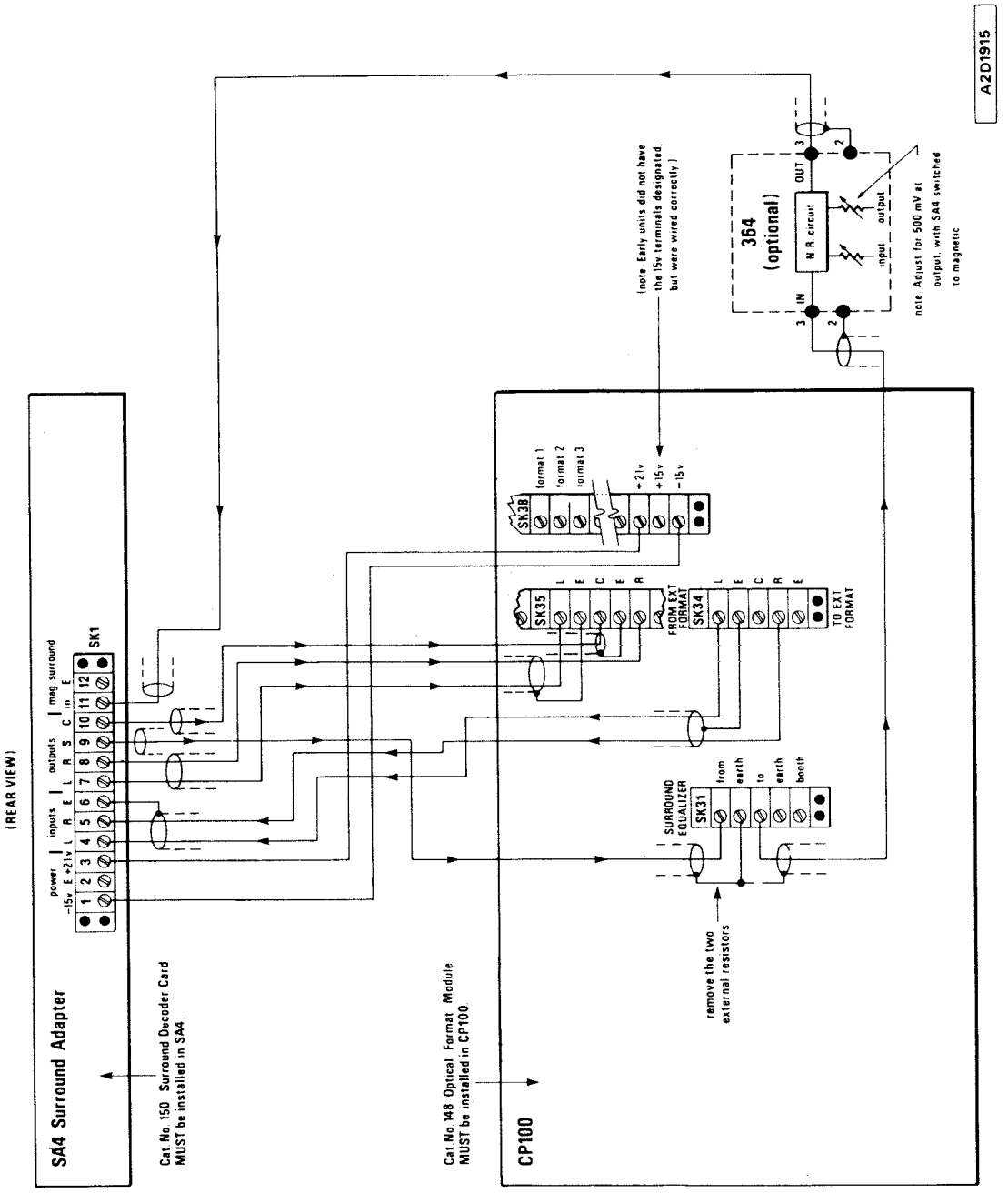
Dolby Stereo without Surround: Select Cat. No. 148 format module, stereo, N.R. on, and surround off.

Dolby Stereo with Surround: Select Cat. No. 148 format module, stereo, N.R. on, and switch surround to optical.

2. Magnetic

Conventional Magnetic: Select Cat. No. 84 format module, N.R. off, and switch surround to magnetic.

Dolby Magnetic: Select Cat. No. 84 format module, N.R. on, and switch surround to magnetic.



Connection of SA4 Surround Adapter to CP100

7.2.15 Operation of CP100 with External Power Supplies

a) Introduction

The CP100 unit may be operated from external power supplies, which allows standby or emergency power units to be connected in case of failure of the internal unit. Terminal strip SK41 (upper right hand corner viewed from back) is used for this purpose, and is factory-wired and labeled in all CP100 units after Serial No. 200. Previous to this, the unit must be field-modified following the instructions below.

b) Connector Designation

Viewed from the back, affix new label with designations as below. A suitable label is available on request from Dolby Laboratories.

1.
2.
3.
4. Int. +21 V
5. +21 V to unit
6. Earth
7. Int. +15 V
8. +15 V to unit
9. Earth
10. Int. -15 V
11. -15 V to unit
12. Earth

Note: In following wiring instructions, lengths of wire are approximate. It may be more convenient to lace in the extra wires before connecting them to the terminal strip on the back of the CP100. For location of connectors, wires, etc., refer to drawings 9.13 and 9.18 in the CP100 manual.

c) -15 V Connections

1. With rear panel removed, locate edge connector SK14 (Facilities Module).

2. Lift brown wire from pin 13, extend it (insulate joint) and connect it to pin 13 of SK15, next connector over. Alternatively replace this whole wire by a longer brown one.

3. Cut and remove the blue sleeved link between SK14, pin P, and SK15, pin 13. Do not remove link between pins 13 and P, SK14.

4. Connect a blue wire (900 mm or 35 ½ inches long) from pin 13 of SK14 to the newly labeled "Int. -15 V" terminal, SK14 pin 10, on the back of the CP100.

5. Connect a brown wire (850 mm or 33 ½ inches long) from pin 13 of SK15 to the "-15 V to unit" terminal, SK41 pin 11.

d) +15 V Connections

1. Go to edge connector SK14 (Facilities Module).

2. Lift white/red wire from pin 5, extend it (insulate joint) and connect it to pin 15 of SK15, next connector over. Alternatively replace this wire by a longer one.

3. Cut and remove the blue sleeved link between E, SK14, and pin 5, SK15; do not remove link between pins 5 and E, SK14.

4. Connect an orange wire (940 mm or 37 inches long) from pin 5 of SK14 to the newly labeled "Int. +15 V" terminal, SK41 pin 7 on the back of the CP100.

5. Connect a red wire (850 mm or 33½ inches long) from pin 5 of SK15 to the "+15 V to unit" terminal, SK41 pin 8.

e) +21 V Connections

1. Go to edge connector SK11 (Changeover Module).

2. Remove the red/gray wire from pin M.

3. Extend this red/gray wire with a 410 mm, or 16 inch, piece of violet wire (insulate joint) and connect it to the "Int. +21 V" terminal, SK41 pin 4 on the back of the CP100.

4. Connect a yellow wire (560 mm or 22 inches long) from pin M of SK11 to the "+21 V to unit" terminal, SK41 pin 5.

f) Earth (Ground) Connections

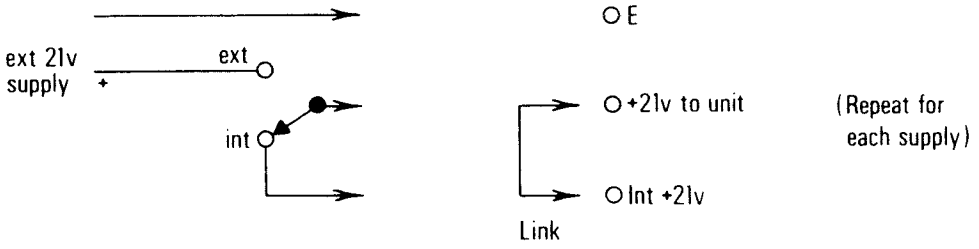
Connect a separate gray wire (1020 mm or 40 inches long) to each of the three earth terminals of the external power supply terminal strip (SK41, pins 6, 9, and 12). Run the wires over to the second pin (pin 2, to which several black wires are connected) of the 11-way terminal strip above the red power box. (Do not connect to pin 1, which also has a black wire.) It is important to use three separate wires to avoid interaction between the three separate power supplies.

g) Operation

1. For operation without external supplies, each of the adjacent "Internal" and "to unit" terminals on the external power supply terminal block (SK41, upper right hand corner of unit, viewed from back) are connected together. The connection may be made by three links.

2. In external power supply operation due to a fault, remove the power cord from the unit in order to de-energize the faulty power supply.

3. Connect (or switch in) the three external power supplies (-15 V, +15 V, +21 V) to the appropriate terminals on the externai power supply terminals block (see diagram below).



a) External switched supplies b) Normal connection

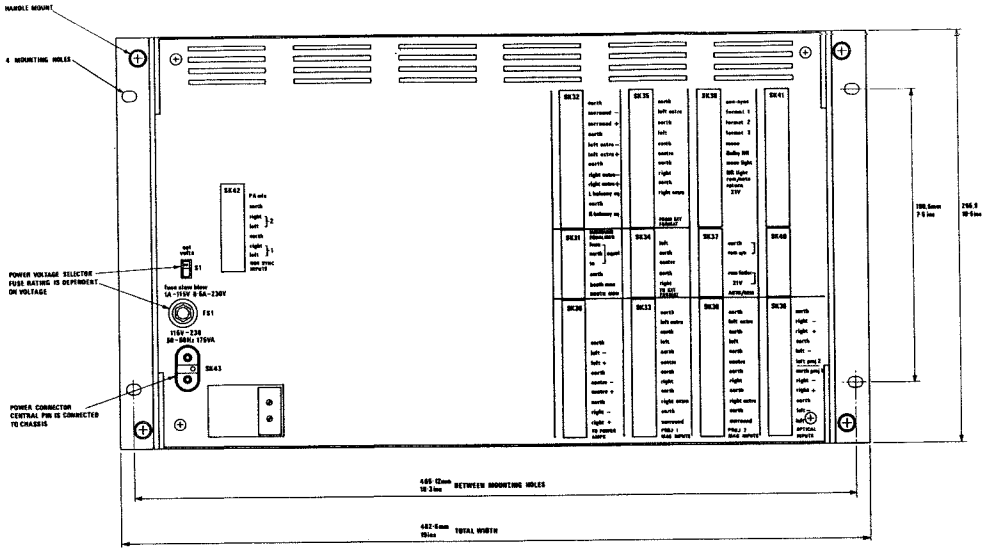
4. When the external power supplies are switched on, the unit should function normally. If not, check for possible damage to one or more of the modules due to power supply failure.

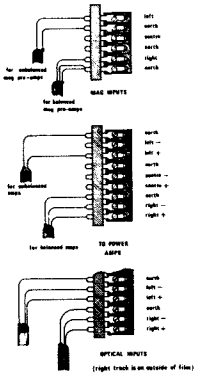
h) External Supply Requirements

The precise values of the external voltages are not critical, except that they should be within the ranges ±2 volts on the 15 volt supplies and -1, +3 volts on the 21 volt supply (the gain of the fader module is dependent on the absolute value of the 21 volt supply, and if a somewhat different value is used, it may be necessary to alter the fader settings slightly).

Ripple (hum) and noise should be less than 20 mV rms; current requirements are as follows:

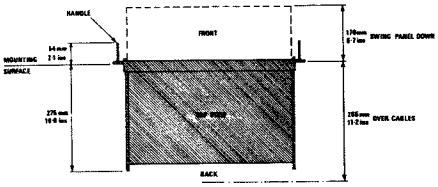
+21 volt	1.5 amp
+15 volt	0.5 amp
-15 volt	0.5 amp





TERMINAL BLOCK ASSEMBLY METHODS

(forming strips supplied with unit)



CP100 REAR VIEW and Installation Details

 Drawing No. A08152Z

CP100 Rear view and Installation details

SECTION 8

OPERATING INSTRUCTIONS

List of Contents

Note: All brief operating instructions are also on a fold-out chart at end of manual.

Operating Instructions - Optical Soundtracks

A. Normal Operation (refer to drawing on next page)

1. Select the format (24) which corresponds to the position of the Mono-Stereo Optical Module (Cat. No. 82), situated under the front cover. The module may be placed in any of the three format positions; after selection by the corresponding format button, the appropriate switching for the optical soundtrack is achieved in the module itself.

2. Check the label on the film. If it has a Dolby encoded soundtrack, it should carry a label similar to one of these:

THIS FILM HAS A DOLBY ENCODED STEREO HIGH FIDELITY OPTICAL SOUND-TRACK

A. In theatres which **are** Dolby equipped:
   1. With a Dolby 364 and E2 equalizer:
      Engage the **Dolby Film** and **Optical** pushbuttons on the Dolby 364.
   2. With a CP 100 Cinema Processor:
      Select **Mono/Stereo Optical** format.
      Engage **Dolby NR** pushbutton and disengage **Mono-Stereo** pushbutton.

B. In theatres which are **not** Dolby equipped:
   The sound-track will play as a conventional film with no adjustment. However, a wide spread of theatre characteristics exists around the world, and tone controls, if installed, can be adjusted for best results.

Dolby Laboratories Inc
346 Clapham Rd, London SW9. 01-720 1111
1133 Avenue of the Americas, New York City 10036. 212-489 6652

Dolby® DD

Dolby and the double-D symbol are trade marks of Dolby Laboratories Inc

THIS FILM HAS A DOLBY ENCODED MONO HIGH FIDELITY OPTICAL SOUND-TRACK

A. In theatres which **are** Dolby equipped:
   1. With a Dolby 364 and E2 equalizer:
      Engage the **Dolby Film** and **Optical** pushbuttons on the Dolby 364
   2. With a CP 100 Cinema Processor:
      Select **Mono/Stereo Optical** format.
      Engage **Mono-Stereo** and **Dolby NR** pushbuttons.

B. In theatres which are **not** Dolby equipped:
   The sound-track will play as a conventional film with no adjustment. However, a wide spread of theatre characteristics exists around the world, and tone controls, if installed, can be adjusted for best results.

Dolby Laboratories Inc
346 Clapham Rd, London SW9. 01-720 1111
1133 Avenue of the Americas, New York City 10036. 212-489 6652

Dolby® DD

Dolby and the double-D symbol are trade marks of Dolby Laboratories Inc

3.(a) For Dolby encoded films, push the button marked Dolby NR (25). The red light alongside will come on indicating that the noise reduction circuits are operating.

(b) If the film is monophonic, press the button marked mono-stereo (25). The mono red light will come on, showing that the mono command sent by the push button has been 'accepted' and 'acted upon' by the module. This is a safety feature (shared by the Dolby NR button) which only allows the correct mode to be selected. For example, if mono is selected for a magnetic format, which is usually multitrack, the command will be ignored by the magnetic module.

(c) If the film is stereo, check that the mono-stereo button is NOT pressed and that the mono red light is NOT illuminated.

4. If the optical soundtrack is not Dolby-encoded, it must be a conventional Academy mono print. Release the Dolby NR button (red light goes out) and push the Mono-Stereo button in. Fixed accurate Academy filters are automatically switched into the circuit. However, the house equalizers are retained to give accurate reproduction.

5. After the film has ended, select the next format or non-sync source by the controls (24) on the control module. If non-sync is chosen, the non-sync module (9) is selected, giving a choice of two stereo inputs or a P.A. microphone.

6. The volume in the cinema should be adjusted at all times by the CP100 fader control system and not by any other controls such as those on individual amplifiers. If the local fader has been selected (via the push button on the facilities module (26), then the local fader (21) is operative.

7. The sound level in the projection booth is controlled by the booth monitor control (28) (and is also dependent on the setting of the fader control). The selector switch switches to each channel or to a mixture of all channels.

B. Routine Checks

1. Dolby Level. From time to time (once a month for example) run a Dolby Level loop. Switch the left and right meter modules (5), (7) to Dolby cal. Adjust the left and right gain controls (take care not to alter accidentally the hf controls) on the optical preamp (1) and on the standy optical preamplifier (2) switching by means of the changeover module (3) red key. Repeat for projector 2.

2. The mechanical cell assembly should not need any adjustment. Should it be suspected that movement or misalignment has occurred, the procedures outlined in the Installation Instructions should be followed.

Brief Operating Instructions - Optical Soundtracks

1. Select source (24) by pressing format button which corresponds to position of Mono/Stereo Optical Module (18) - (20) behind swing panel.

2. Look at label on film.

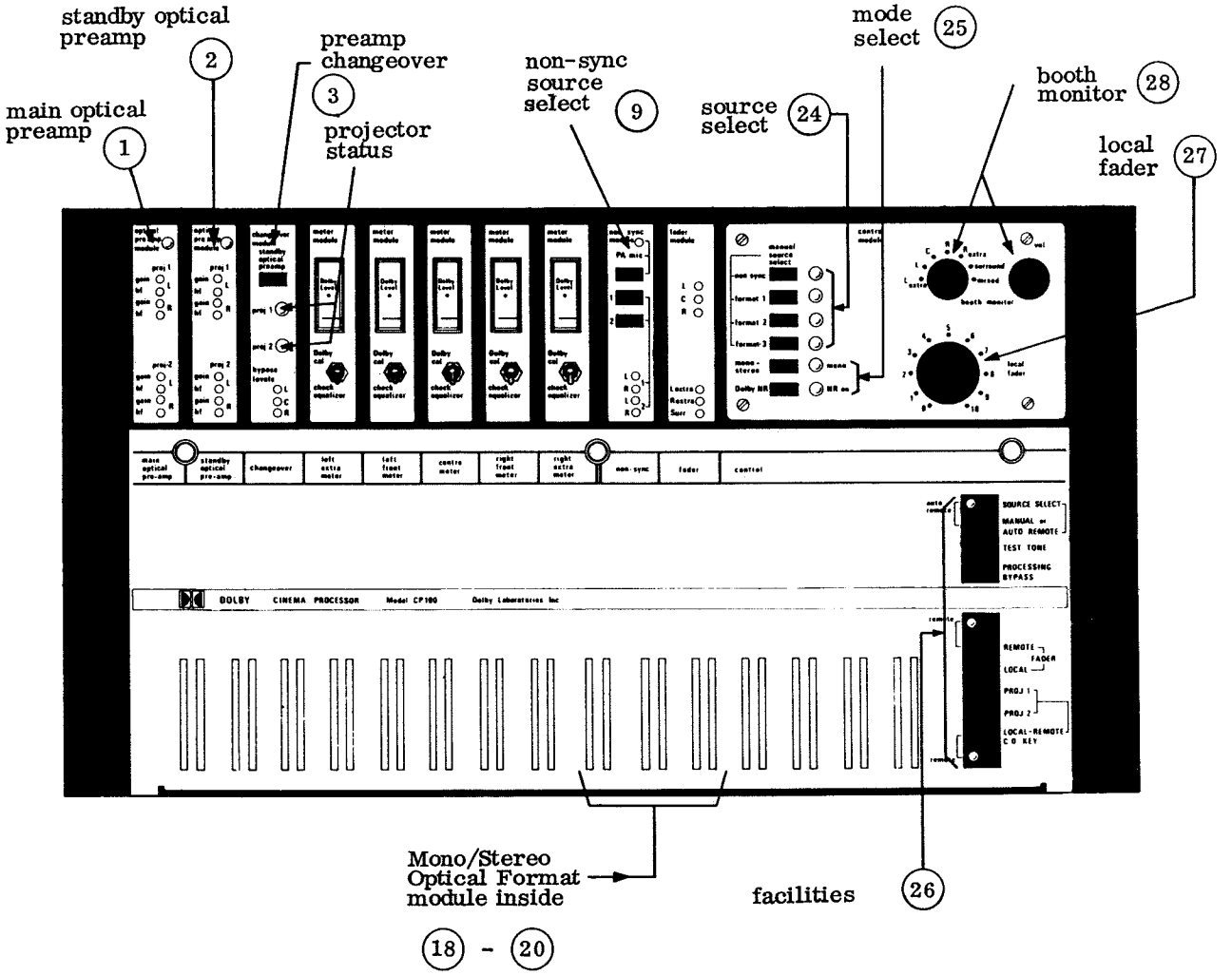
3. (a) If the film is Dolby encoded, select 'Dolby NR' (25); NR light will come on,

then (b) For stereo optical tracks, check that mono-stereo button (25) is released and mono light is not on,

or (c) For mono optical tracks, push in mono/stereo button (25).

4. For conventional Academy prints (non-Dolby) switch off Dolby NR and select mono.

5. At the end of the film, select source (24) appropriate for next programme. For example, select non-sync via pushbutton on source select (24) to activate non-sync module (9).



Operating Instructions - Magnetic Soundtracks

A. Normal Operation (refer to drawing on next page)

1. Select the format (24) which corresponds to the position of the Magnetic Tracks Module (Cat. No. 84), situated under the front cover. The module may be placed in any of the three format positions; after selection by the corresponding format button, the appropriate switching for the magnetic soundtrack is achieved in the module itself.

2. Check the label on the film. If it has Dolby encoded soundtracks, push the button marked Dolby NR (25). The red light alongside will come on indicating that the noise reduction circuits are operating.

3. Magnetic soundtracks are always multi-track. The logic circuitry in the Magnetic Tracks module recognizes this and will not respond to any command sent by the mono-stereo button (25). The mono lamp associated with the button will not light even if the mono-stereo button is pressed, indicating that the button has no effect when magnetic tracks are being played.

4. If the soundtrack is not Dolby-encoded, it must be a conventional Academy print. Release the Dolby NR button (red light goes out). Fixed accurate Academy magnetic filters are automatically switched into the circuit. However, the house equalizers are retained to give accurate reproduction.

5. After the film has ended, select the next format or non-sync source by the controls (24) on the control module. If non-sync is chosen, the non-sync module (9) is selected, giving a choice of two stereo inputs or a P.A. microphone.

6. The volume in the cinema should be adjusted at all times by the CP100 fader control system and not by any other controls such as those on individual amplifiers. If the local fader has been selected (via the push button on the facilities module (26), then the local fader (21) is operative.

7. The sound level in the projection booth is controlled by the booth monitor control (28) (and is also dependent on the setting of the fader control). The selector switch switches to each channel or to a mixture of all channels.

B. Routine checks

1. The modules in the CP100 are very stable and do not drift. However, the penthouse mechanical assembly may need recalibration fairly frequently.

2. From time to time run Dolby level and high frequency (azimuth) tape to check the penthouse. First adjust the mechanical azimuth and then the high frequency equalization controls in the magnetic preamplifiers in each projector.

3. Run a Dolby Level loop. Switch the CP100 meter modules (4) to (8) to Dolby Cal and adjust the magnetic preamplifier gain controls to read Dolby level on the meters.

Brief Operating Instructions - Magnetic Tracks

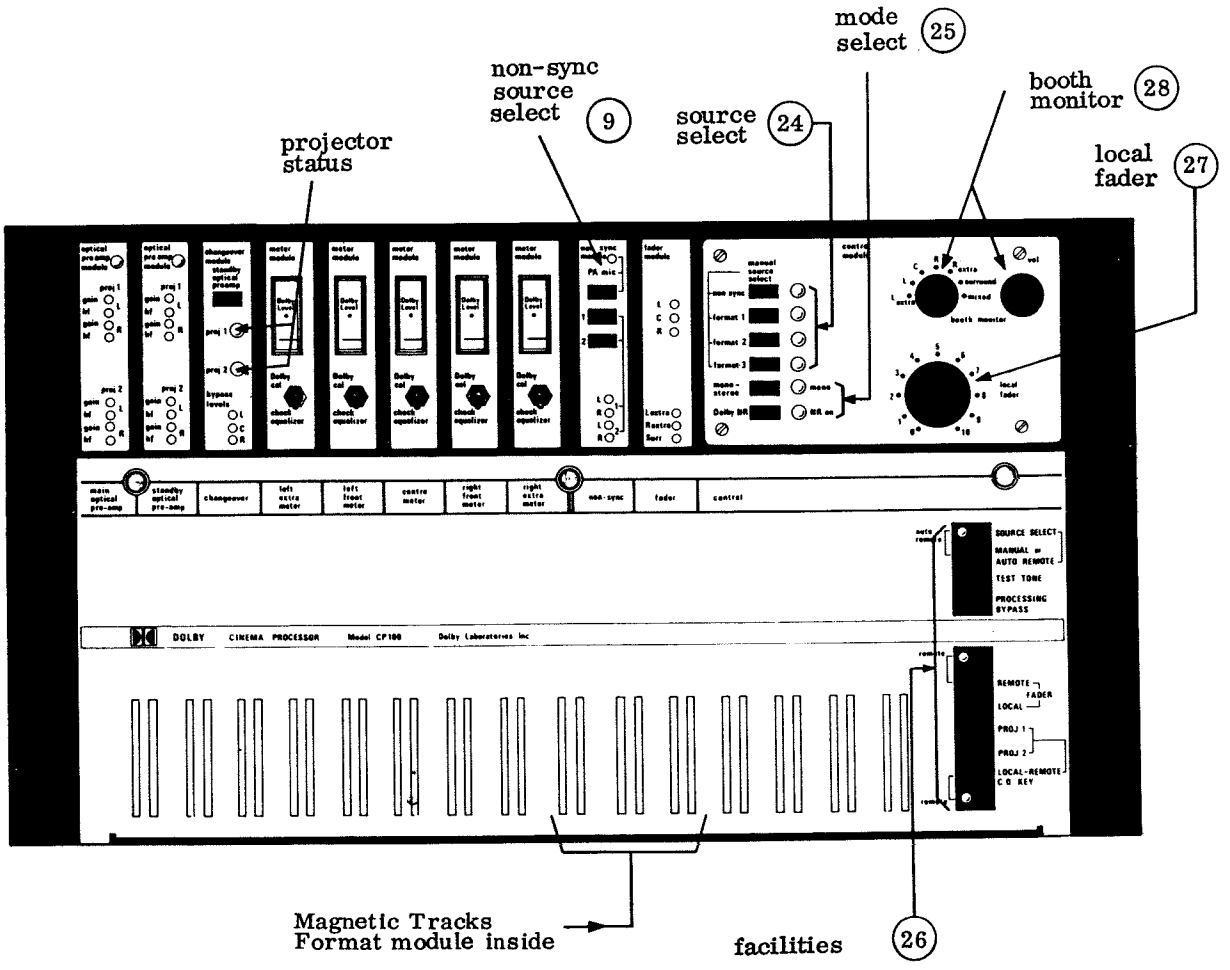
1. Select source (24) by pressing the format button which corresponds to position of Magnetic Tracks module (18) - (20) behind swing panel.

2. Look at label on film.

3. If the film is Dolby encoded, select 'Dolby NR' (25); NR light will come on.

4. For conventional (non-Dolby) prints, release 'Dolby NR' button (25).

5. At end of film, select source (24) appropriate for next programme. For example, select non-sync via 'non-sync source select' (24) to activate non-sync module (9).



Operating Instructions - External Formats

A. Normal Operation. (refer to drawing on next page)

1. The external format mode transfers to the rear panel of the CP100 several internal signal points allowing external equipment to be introduced simply to allow any special signal processing. An example is matrix-encoded quadrophonic tracks where external decoders are required to convert two-track encoded material into four or more tracks.

   By making suitable connections in the External Format module, the optical preamplifier in the CP100 can be used. Alternatively and more usually the signals are from magnetic tracks which enter the CP100 by the normal connectors before leaving the unit on the 'to external format' connector. After processing in the external equipment, the signals return to the CP100 to pass through the remainder of the control chain.

2. Select the format (24) which corresponds to the position of the External Format Module (Cat. No. 83), situated under the front cover. The module may be placed in any of the three format positions; after selection by the corresponding format button, the appropriate switching for the soundtrack is achieved in the module itself.

3. Check the label on the film. If it has Dolby encoded soundtracks, push the button marked Dolby NR (25). The red light alongside will come on indicating that the noise reduction circuits are operating. Specially encoded tracks will usually be multi-track. The circuitry in the External Format module recognizes this and will not respond to any command sent by the mono-stereo button (25). The mono lamp associated with the button will not light even if the mono-stereo button is pressed, indicating that the button has no effect when External Format is selected.

4. If the soundtrack is not Dolby-encoded, it must be a conventional Academy mono print. Release the Dolby NR button (red light goes out). Fixed accurate Academy filters are automatically switched into the circuit. However, the house equalizers are retained to give accurate reproduction.

5. After the film has ended, select the next format or non-sync source by the controls (24) on the control module. If non-sync is chosen, the non-sync module (9) is selected, giving a choice of two stereo inputs or a P.A. microphone.

6. The volume in the cinema should be adjusted at all times by the CP100 fader control system and not by any other controls such as those on individual amplifiers. If the local fader has been selected (via the push button on the facilities module (26), then the local fader (21) is operative.

7. The sound level in the projection booth is controlled by the booth monitor control (28) (and is also dependent on the setting of the fader control). The selector switch switches to each channel or to a mixture of all channels.

B Routine checks

1. Depending on whether the external format is optical or magnetic, follow the routine check notes on pages 8.4 and 8.7.

Brief Operating Instructions - External Format

1. Select source (24) by pressing format button which corresponds to position of External Tracks Module (18) - (20) behind swing panel.

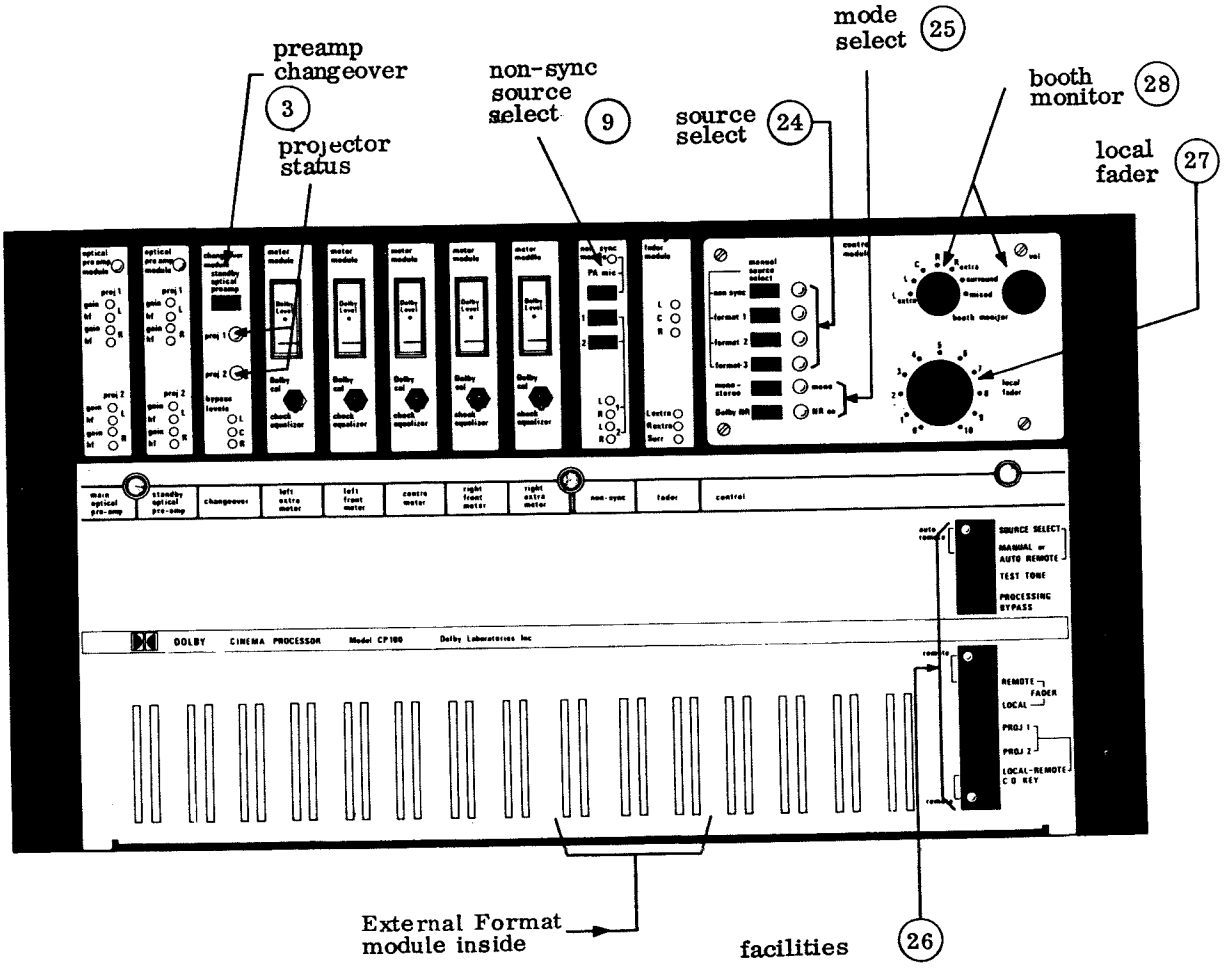
2. Look at label on film.

3. If the film is Dolby encoded, select 'Dolby NR' (25) ; NR light will come on.

4. For conventional (non-Dolby) prints, release 'Dolby NR' button (25).

5. Check controls associated with the external equipment required for the particular format are correctly set.

6. At end of film, select source (24) appropriate for next programme. For example, select non-sync via 'non-sync source select' (24) to activate non-sync module (9).



Operating Instructions - Remote Facilities

The CP100 has several facilities for remote operation, which may be used independently or together (refer drawing on next page). For further details, see installation instructions, Section 7.2.9.

1. Automatic Operation

Pressing the Auto/Rem button (29) transfers the source select (24) and mode select (25) function to terminals at rear. Grounding the appropriate terminal selects the function, making it easy to connect the CP100 to an automatic programmer. Depending on the design of programmer, a relay interface may be required. By changing links inside the control module (11) it is possible to retain local control of some functions while transferring the remainder.

2. Remote Fader (30)

Pressing this button transfers the fader from the Local fader (27) to a simple one gang variable resistor connected to the rear terminals. The dc control signal from the variable resistor controls the ganged six channel electronic fader (10) . The control may be mounted up to 500m from the CP100 using normal two conductor cable.

3. Remote Projector changeover (31)

Allows control of the CP100 projector changeover relays by an existing changeover system. Grounding the rear terminal changes from projector 1 to projector 2. Red led indicators in the changeover module (3) show the projector status. This control can be linked to an automatic programmer.

4. Remote Control Unit

The normal manner of operation of the CP100 is to use two Remote Control Units Cat. No. 88, one mounted next to each projector. These control all the functions of the CP100. All three buttons (Auto/Rem (29) , Remote Fader (30) , and Remote c/o (31)) should be pressed. The remote units can be wired to control the existing changeover system, or conversely the existing system can control the CP100. The remote unit not in use (ie. that on projector 2 while projector 1 is running) acts as a pre-selector allowing different formats and volume levels to be pre-set. Switching to projector 2 brings the box and its selected format and mode into operation.

Brief Operating Instructions - Remote Facilities

1. Remote changeover (31)

   Grounding rear terminal switches CP100 projector changeover relays. Indication given on changeovers module (3).

2. Remote Fader (30)

   Transfers control from 'Local Fader' (27) to an external potentiometer connected to terminals at rear.

3. Auto/Rem (29)

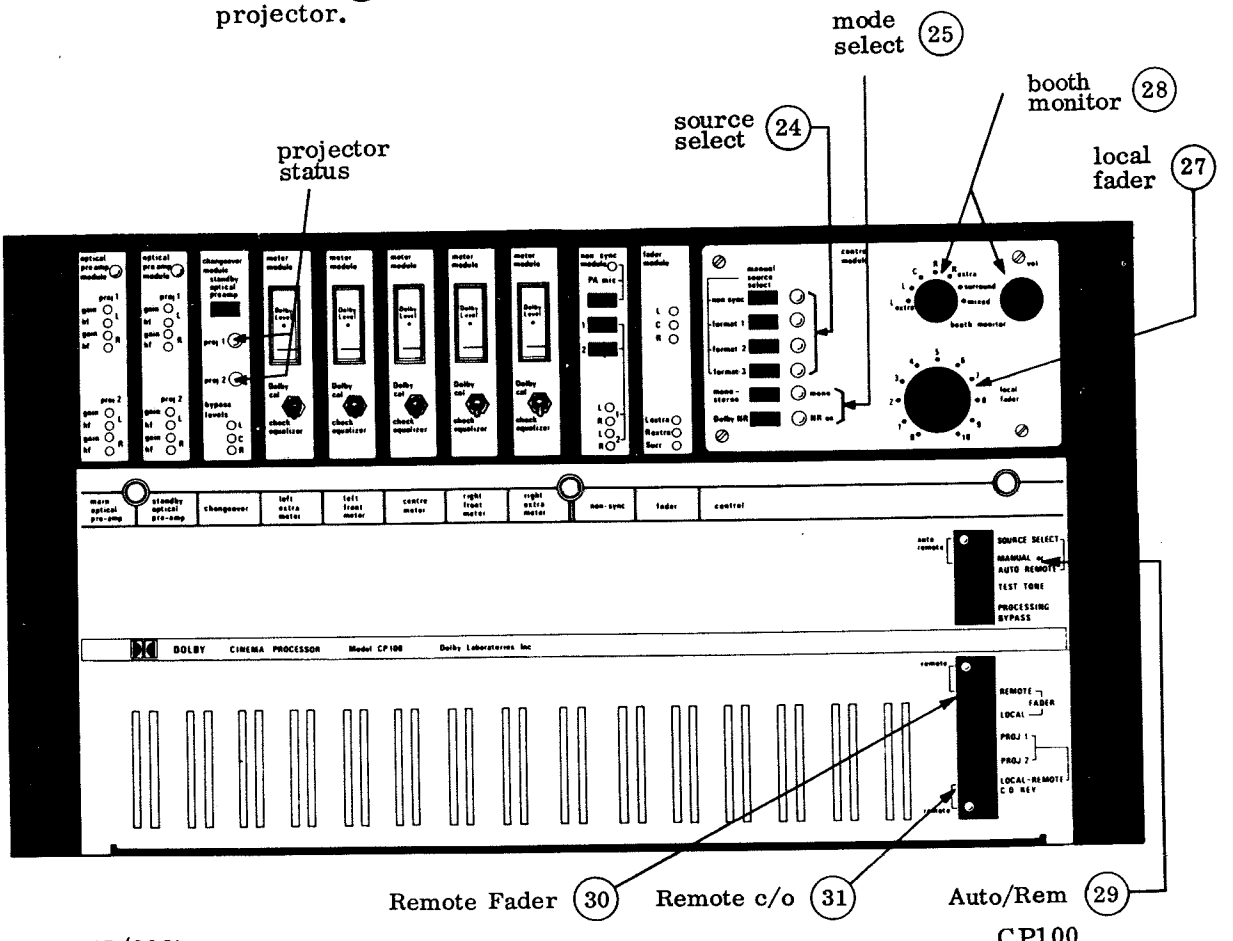
   Transfers source select (24) and Mode functions (25) to rear terminals.

4. Automation

   Press Rem c/o (31) and Auto/Rem (29) to transfer control to automatic programmer.

5. Remote Control Units

   Press all three buttons Auto/Rem (29), Remote Fader (30) and Rem c/o (31) and use remote control units mounted near each projector.



Operating Instructions - Emergency Operation

Several emergency-operation features are built into the Model CP100 allowing continued operation in the event of electronic failures. If external power supplies are available, continued operation is possible even in the event of a major power supply failure.

A. Diagnostic Procedure

1. If the sound disappears completely, look at the unit and check at least one red indicator lamp is on. If not, the probability is that the power line supply has failed or the rear mounted fuse has blown.

2. Assuming the power supplies are functioning correctly, the fault may be either complete loss of sound or some other problem such as distortion in one channel or crackling noises.

3. In the case of optical sound, the next step is to select the spare standby optical preamplifier (2) by pressing the red push button on the changeover module (3).

4. The next step for optical sound, and only step for magnetic sound, is to bypass the electronic processing entirely by pressing the Processing Bypass red button (32). This connects the inputs directly to the outputs via the projector changeover relays alone (but in addition through the optical preamps for optical sound).

5. It is unlikely the levels will be identical after the button is pressed, since this is dependent on the sensitivity of the following main amplifier. The gain control on these amplifiers may have to be adjusted to get satisfactory sound in the auditorium.

B. Power Supply Failures

There are three power supply regulators inside the CP100. Failure of any to the unregulated mode will not cause interuption to the CP100 operation as safety circuits will operate. However, the failure should be cured as soon as possible, and to draw attention to the fault condition which might otherwise not be noticed, a warbling warning tone is generated in the CP100. This tone is fed to a small loudspeaker in the unit and does not appear out the main programme outputs.

The Processing Bypass switch (32) also operates this warning tone.

If standby power supplies (batteries or power line operated) are available, the accessory Emergency Power Supply Cat. No. 91 may be used in place of the Facilities Module (23). A single supply of between 11 volts and 25 volts d. c. may be used to supply all the changeover relays in the CP100 and also the optical Preamplifiers

(1) and (2). With the Processing Bypass switch (32) operated, operation can be restored. If supplies of + 12v, + 24v and - 12v (ie. three batteries) are available, full operation of the CP100 is possible.

C. Repairs

Full circuit diagrams and a block diagram are given in Section 9, Unit circuits. The block diagram allows full diagnosis of the fault, and since several modules are duplicated, and several have up to six identical channels, signal re-routing and module interchange make fault-finding simple.

In most cases however, it is preferable to contact your local Dolby Laboratories office or agent, who keep a full stock of spare modules for immediate interchange.

Brief Operating Instructions - Emergency Operation

A. Loss of sound

1. Check red indicators show desired operation mode. If no lights on, check power line, fuses and power supplies. If available use Emergency Power Supply module Cat. No. 91.

2. Press 'Standby Optical Preamp' red button (3). Check indicator lights on optical pre-amplifier modules (1) and (2) change appropriately.

3. If sound still missing or intermittent, press 'Processing Bypass' red button (32).

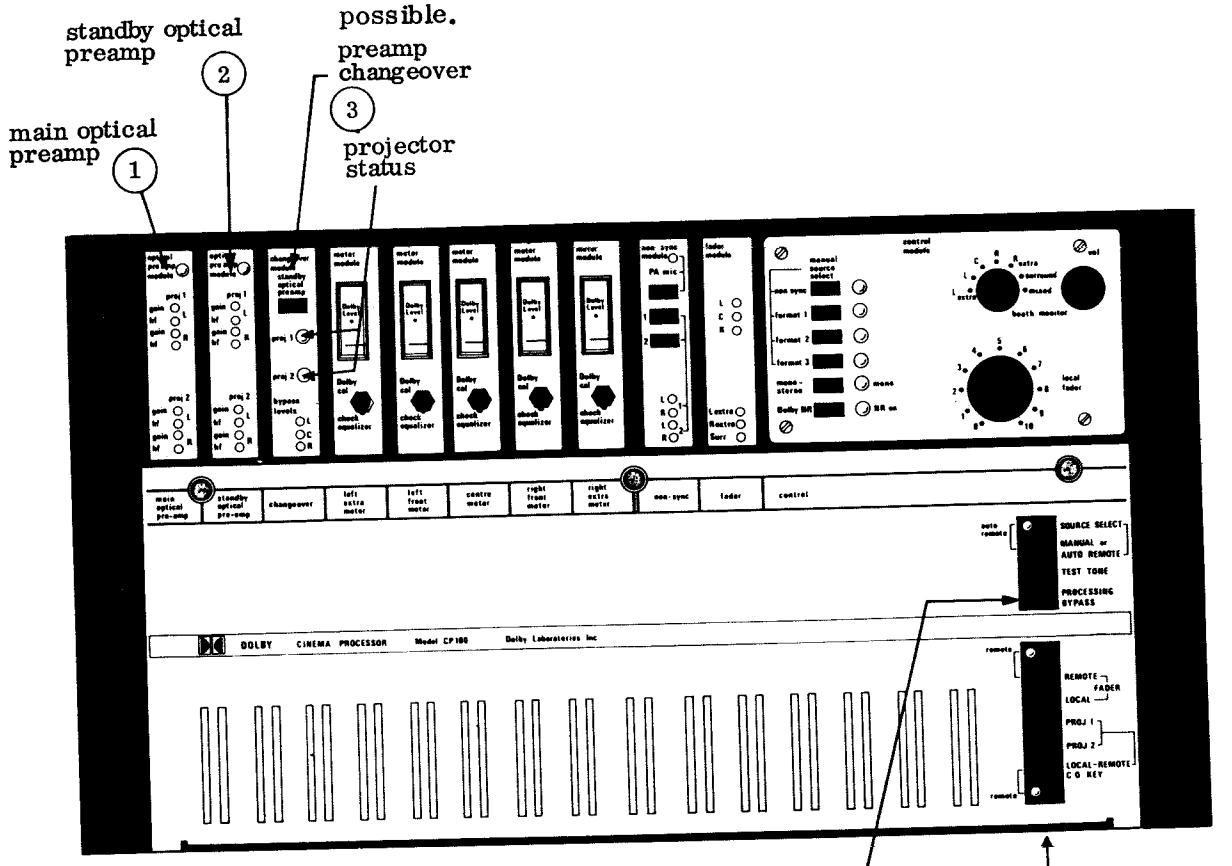
B. Distorted or intermittent sound

1. Follow steps 2 and 3 above.

C. Notes

(a) Switching functions of CP100 function in all cases except of power supply failure.

(b) Processing Bypass switch (32) turns on a modulated warning tone reminding operators of fault condition. If tone starts at any other time, it signifies power supply malfunction. The CP100 will continue to operate, but should be repaired as quickly as possible.



(L76/337/86)

Processing Bypass (32)

Position for Cat. No. 91 Emergency Power Supply