Film-Tech

DOLBY LABORATORIES

INSTRUCTION MANUAL

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

S80/677/2789

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 CP50 is a complete cinema optical sound control center allowing reproduction of all stereophonic optical soundtracks. Modular construction is used to allow extra plug-in (optional) modules for decoding of optical surround information, or for adaptors for any future format through easy connection to outboard equipment.

Inputs are provided for optical solar cells and for external non-sync or magnetic signals.

Full optional remote facilities are provided, allowing control from each projector 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 CP50 (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 the CP50.

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.

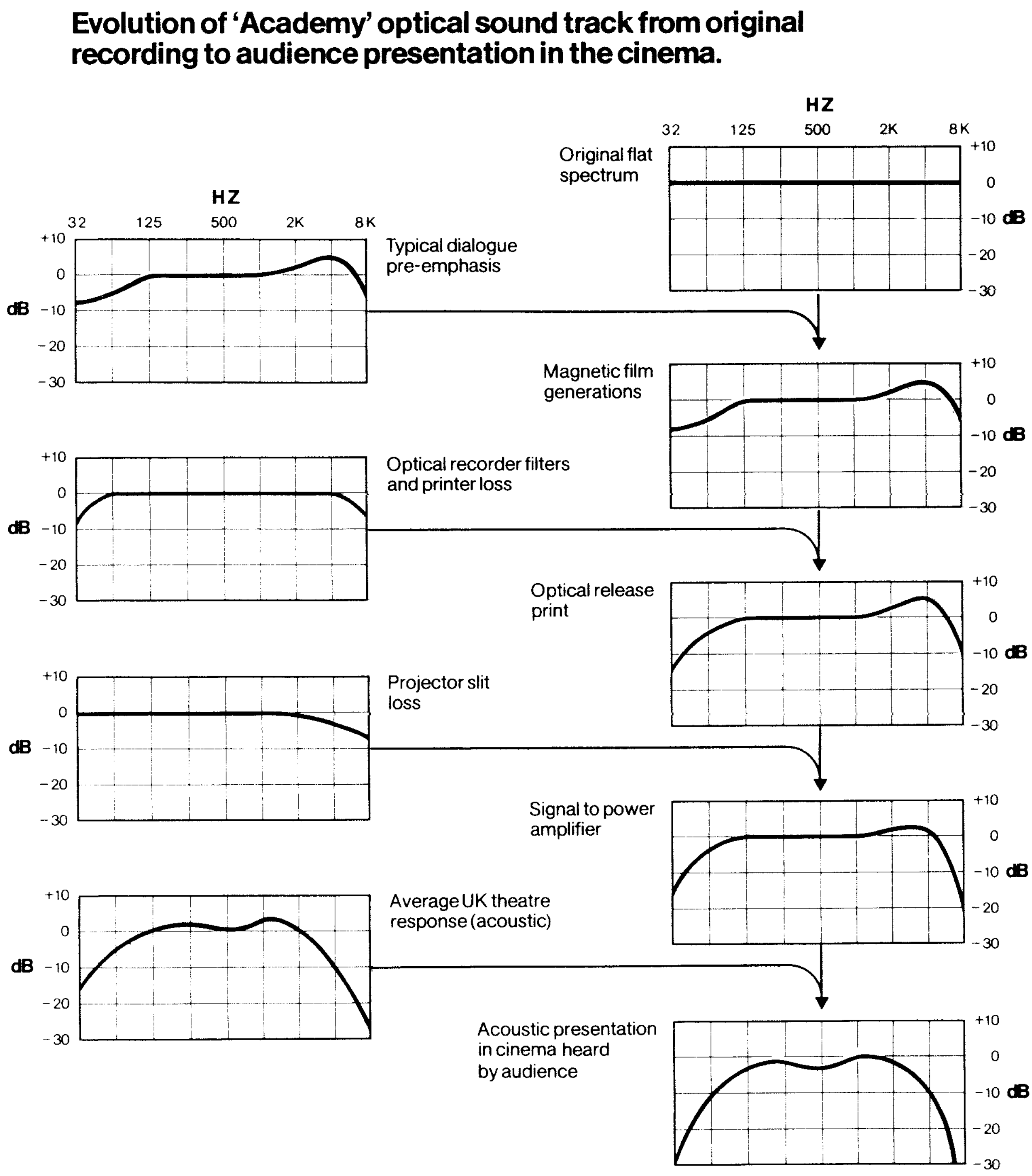

Fig. 3.1 Typical Cinema Response

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.

DOLBY LABORATORIES INC

FIELD BULLETIN NO. 88

DOLBY STEREO FILMS AND SURROUND

All 70 mm magnetic stereo releases and the vast majority of 35 mm Dolby stereo optical films contain surround information. It is becoming apparent that the different types and numbers of surround speakers in theatres, and incorrect setting of surround track levels, are becoming significant problems in playing back accurately the surround information in the way that the original mix intended. This bulletin is intended to clarify some of the issues involved.

Nature of Surround Material

Since the 1950's, when surround effects were first used on motion picture sound-tracks, the kind of material and usage of the surround capability has changed dramatically. The first releases had the surround track frequently referred to as the "effects" track, and the loudspeakers were commonly referred to as "effects" loudspeaker. This terminology accurately described the usage of the surround track at that time; occasional use was made of the effects track, more often than not for sudden, loud effects. The fourth track of 35 mm magnetic release prints is very narrow, and consequently has a very high noise (hiss) level; a trigger tone was used to gate the effects signal on and off, and this technique meant that it was very difficult to put a low level, continuous ambient sound on the effects track. This kind of ambient sound, such as rustling leaves, low level wind, or the faint reverberation from music which is predominantly being played on the main loudspeaker horns behind the screen, is however the kind of usage that the contemporary director likes to take advantage of. This kind of effect is much better described as "surround" rather than "effects".

Location and Type of Surround Loudspeakers

There are many technical difficulties relating to the optimum choice of surround loudspeakers, and surround loudspeaker placement. Obviously, the primary aim is to achieve the best possible distribution of the surround channel sound; wherever a member of the audience is sitting, the surround level should be substantially the same as at any other seat. Additionally, throughout the theatre the surround information should be diffuse, predominantly coming from behind and around the audience; if the surround sounds appear to be coming from the screen, then obviously the effect is wasted.

It is relatively easy to point out examples of bad surround loudspeaker placement. Ceiling speakers, for example, do not work satisfactorily, primarily because it is impossible to achieve a compromise between the person sitting directly under a loudspeaker, who hears too much surround, and the person not sitting directly under a speaker, who will not hear enough surround. Little better than ceiling speakers is the practice of having two large surround speakers in the left and right rear corners of the theatre--here, the problem is that people in the back corners of the theatre will be deafened by surround information if people in the middle of the house are to hear a reasonable surround balance. The best solution seems to be a large number of relatively small loudspeakers mounted on the side and rear walls of the theatre, sufficiently high up that the sound from adjacent speakers passes over the heads of those members of

S79/2006

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the audience seated directly under the speakers. The loudspeakers should be mounted no farther forward than half way from the back wall to the screen; in this way, surround sounds will not "fold" into the screen for audience members sitting half way down the house. Six or eight inch diameter loudspeakers mounted every two to three feet around the auditorium work the best; purchased in groups of four (several manufacturers now make them available in this way) the cost is no more than that of two large speakers in the back of the theatre, and the resultant distribution immeasurably more effective. It may be necessary to have a low frequency cross-over and add one or two bass units with this configuration, but the location of the bass units is not as critical in terms of distribution of the sound, as the ear is not conscious of directionality of the low frequency information.

Power Handling Necessary for Surround Channels

Even though much of the time the surround channel on modern film may only be carrying low level information, occasionally there may be a very loud sudden effect--at those moments it is essential that sufficient power is available to drive the surround loudspeakers without any audible distortion. Good medium sized theatres today will have a minimum of 100 watts for each of the behind screen loudspeakers, and certainly as much power should be available to drive the surrounds. The power needed to drive a large "string" of surround speakers as described above is no greater than that needed to drive a couple of large loudspeakers, as obviously the overall sound-pressure level required is the same, only the distribution has been improved.

Level Setting of Surround Loudspeakers

The level at which the surround channel is replayed is extremely critical, especially when the director has set up an ambience effect; a typical example would be low level wind and crop rustling noises in a country sequence, intentionally recorded on front and surround channels so as to give the audience the feeling of being within the middle of a field. Too much or too little surround level in these circumstances can totally destroy the intended effect. Many theatres have the surround channels too high, probably because an attempt has been made to make the surround channel seem obviously "on" to the audience. Not only will the balance get destroyed when ambience material is being played with too high a surround level, but also excessive noise from the track may become apparent from the surround speakers.

New Dolby Stereo Surround Test Film

The dubbing theatres in Hollywood and overseas have a calibrated level for the screen and surround speakers when the films are mixed. This means that the surround information recorded onto the film is at a calibrated level. If one film has more or less surround information than another, it is because the director has chosen louder or quieter surround sounds to suit the content of the movie. If surround channels are continually set too high in the theatres, then it seems possible that some directors will cease recording surround information altogether, rather than run the risk of varying playback levels.

To help check and set up surround loudspeaker playback levels, we have introduced recently a new Dolby stereo optical test film, which is intended for quick and accurate setting of surround speaker levels. No test equipment is required. Once surround levels have been set using this film, no further adjustment should be needed--any further variation between surround levels on different films will be intentionally selected by the director of the film. A free sample of the test film is being sent to all Dolby Stereo theatres in the United States, together with instructions for its use.

SECTION 4

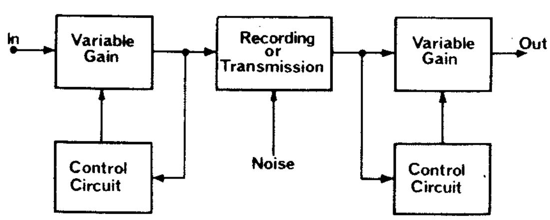
GENERAL PRINCIPLES

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.



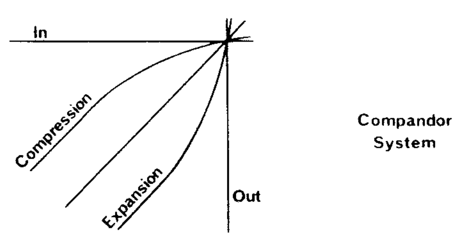
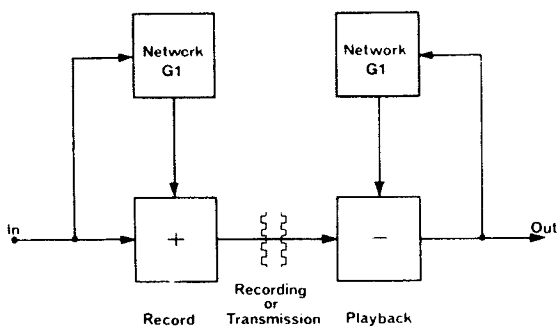


Fig. 4 1

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

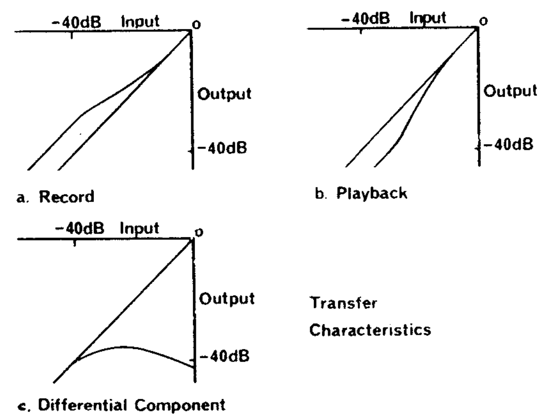
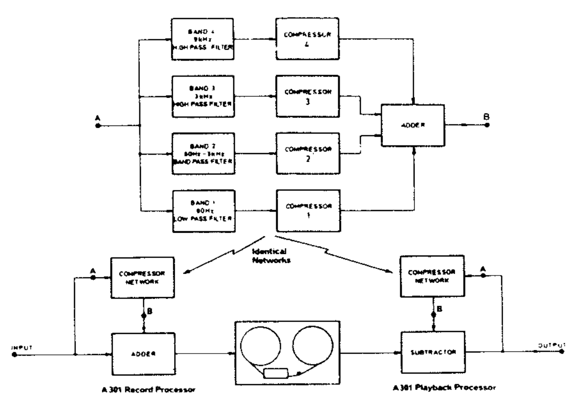


Fig. 4.3



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 Gl, the output of which is combined additively with the main signal. In playback the situation is similar, but the variable attenuation network Gl 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 Gl (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 [illegible] or room damping material.

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

List of Contents

NOTE: Sections 7.7 and 7.8 refer to superceded options (Models SA2, Cat. No. 116, Cat. No. 116A) and have been removed from this edition of the CP50 manual.

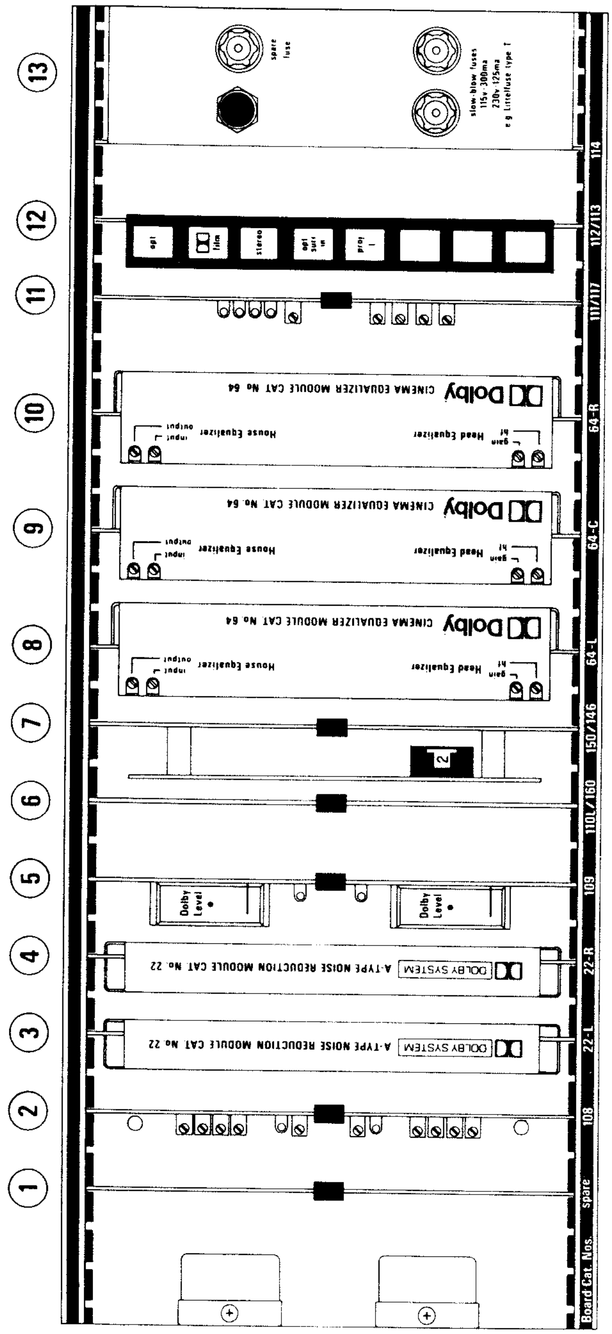


Fig. 7.1.1 Front view of CP50

7.1 Description of CP50 Modules

(1) Spare	Parking slot for (optional) spare optical Pre-amplifier card.
(2) Optical Pre-amp card Cat. No. 108	Optical Pre-amplifier card 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.
(3) and (4) Noise Reduction Module Cat. No. 22	Two noise reduction modules (NRM) Cat. No. 22 which are used to decode the two stereo optical tracks.
(5) Meter/Filter card Cat. No. 109	Meters to indicate the signal level in left and right channels and for setting up Dolby Level using special Dolby Tone loop. Card also includes precision Academy filter which is switched in automatically when non-Dolby film is selected.
(6) Link card Cat. No. 110L	This card passes the left and right signals from the meter card to the decoder card. This card slot allows for future expansion.
(7) Decoder card Cat. No. 150 (stereo with surround) OR, Cat. No. 146 (stereo only)	The Cat. No. 146 decoder decodes the left and right signals into left, center and right signals. This is necessary to harden the center channel and still maintain full stereo width. The Cat. No. 150 decoder consists of a Cat. No. 146 decoder and a delay line sub-assembly on the same card. The Cat. No. 150 decodes the surround channel in addition to left, center and right channels. Note: Early CP50's used a Cat. No. 110 (or Cat. No. 82) in slot (6) to provide left, center, right decoding. Slot (7) contained a link card (Cat. No. 115) for non-surround installations, and a surround decoder (Cat. No. 116A) for installations with surround. This arrangement was superseded in April, 1979 by the Cat. No. 110L/150 system.
(8), (9) and (10) Equalizer modules Cat. No. 64	Three 27-band third-octave equalizers for the left, center and right channels.

(11) Output card Cat. No. 111	Output card containing two output amplifiers for center and surround tracks (left and right output amplifiers are in the respective Noise Reduction Modules), with preset level controls for all four channels.
OR	
(11) Remote Fader card Cat. No. 117	Optional fader card containing remotely controlled four-channel fader in addition to normal output module circuitry. Fader action is by a single d. c. control (remotely situated) feeding all four electronic faders which track to ±1 dB in their working range. Four preset controls allow individual setting of the output levels to suit the power amplifiers in use.
(12) Switch card Cat. No. 112	Module contains legended push buttons to select the operational mode for optical or non-sync/mag inputs, Dolby or non-Dolby film, mono or stereo, optical surround, and projector change over. Also two emergency push buttons to bypass the signal processing sections of the CP50, and to select an emergency external power supply. (Cat. No. 114A optional extra).
OR	
(12) Automation Switch card Cat.No. 113	Optional card allows the normal operating modes to be selected by an external automation controller. LED indicators show status of unit. Buttons for bypass and emergency power supply are also located on this card.
(13) Power Supply Module Cat. No. 114	Module takes in power line supply (115/60 or 230/50) and produces +21 volts, and ±12 volts for circuits in CP50. Also available as self-contained unit for use as emergency external power supply.

7.2 Installation Instructions

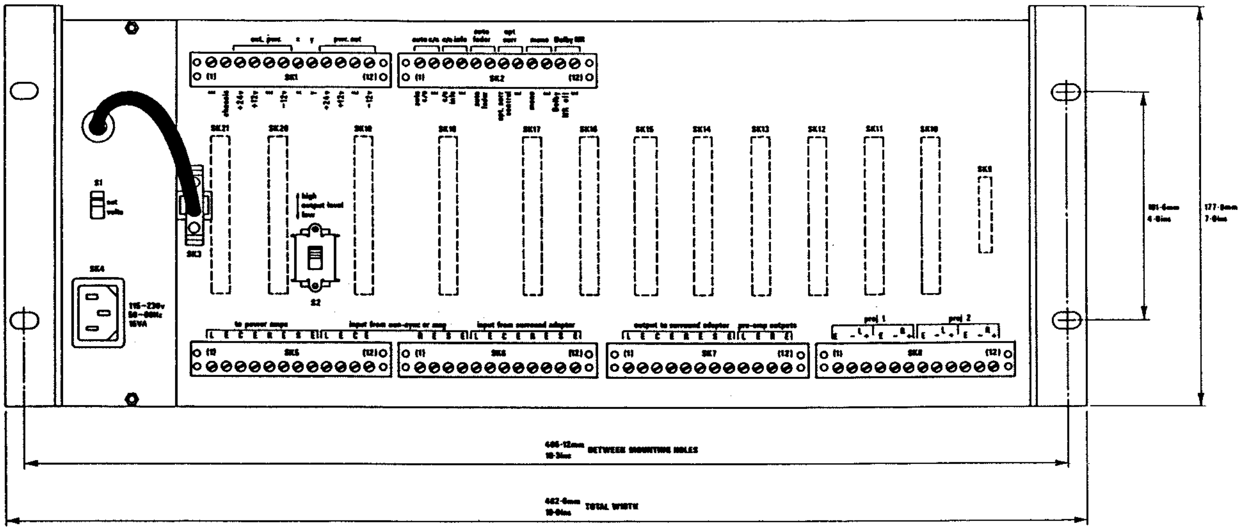
7.2.1 Introduction

The Dolby CP50 Optical Sound Processor contains all amplifiers, equalizers and signal processors necessary to play back correctly, Dolby stereo optical soundtracks, together with the switching required to integrate it into an existing cinema installation, containing power amplifiers and speakers.

The installation is not difficult, but requires specialized knowledge and equipment. Once installed, it is very stable and under normal circumstances will only need a simple adjustment if the exciter lamp is changed or ages significantly.

Before starting the installation, take a few minutes to look at the block diagrams at the end of this section. Familiarize yourself with these diagrams so that you can best adapt the standard installation procedure to the particular installation you are doing at the moment. Each theatre is different from the last and may need individual interfacing arrangements between the CP50 and the rest of the system.

Numbers, in the text ie. (3), identify the modules and cards, as indicated in the drawing Fig. 7.1.1 at the beginning of this section.



CP50 REAR VIEW and Installation Details
© Dolby Laboratories Inc. 1977 Drawing No. A1D1631

Fig. 7.2.1
Connector Designation - Rear View of CP50

Brief Description of CN85C, Pink Noise Generator

This note explains the CN85 Pink Noise Generator and should be read in conjunction with the unit alignment procedures outlined later in this manual.

The CN85C is an update of the CN85 and is designed to be used with all of the Dolby cinema processors as a calibrated wide-range pink noise source which can be switched to any or all of the B-chain channels. In addition, when inserted into one of the format slots of the CP100, the optical pre-amp outputs are available at the red and green test points located above the front cover switches.

The CN85C differs from the previous CN85 versions in that the pink noise source can be switched to any or all of the B-chain channels either **in phase** (switches up), or **reverse phase** (switches down). The center position of each switch is **OFF.** The addition of the reverse phase signal facility allows a quick check for B-chain phasing.

The use of this module in conjunction with a real-time analyzer (RTA) and a microphone in the auditorium can provide a quick check on whether the signals coming from the speakers are in correct phase or not (figures 1 and 2). While this test is not foolproof (since it depends on the room acoustics and the frequencies used), it is in most cases a valid test.

The CN85C is equipped with automatic logic to control the output level to 600 mV when located in the CP50 and CP100, and to 360 mV when located in the CP200. These levels can be checked at the **WHITE** and **BLACK** test points. These signals can be used to calibrate the auditorium level for 85 dBC.

The module can be used as a pink noise source in other applications by supplying +15 V to the **RED** test point, -15 V to the **BLUE** test point, and 0 V to the **BLACK** test point. The supply should be regulated and able to supply 50 mA. The pink noise output is at the **WHITE** test point and the common **BLACK** test point.

For applications of the CN85C in specific Dolby cinema equipment refer to section 7, Controls, Connectors and Installation, in the manual for that unit.

Typical RTA displays showing effect of phase reversals on CN85C with in phase loudspeakers.

Figure 1
Center & Left channel, both in phase.

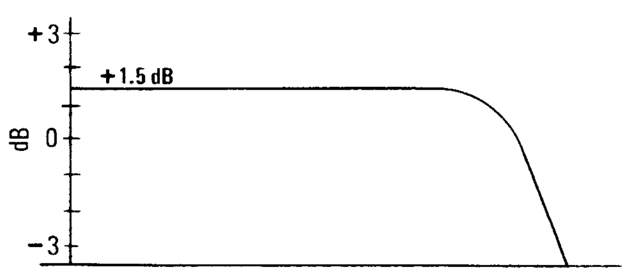
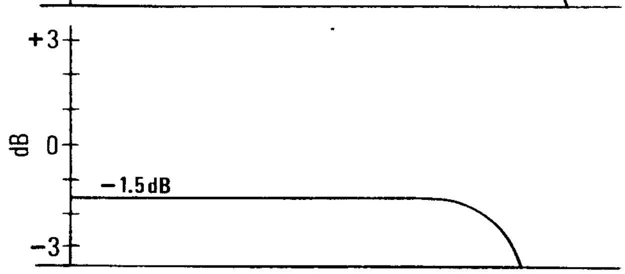
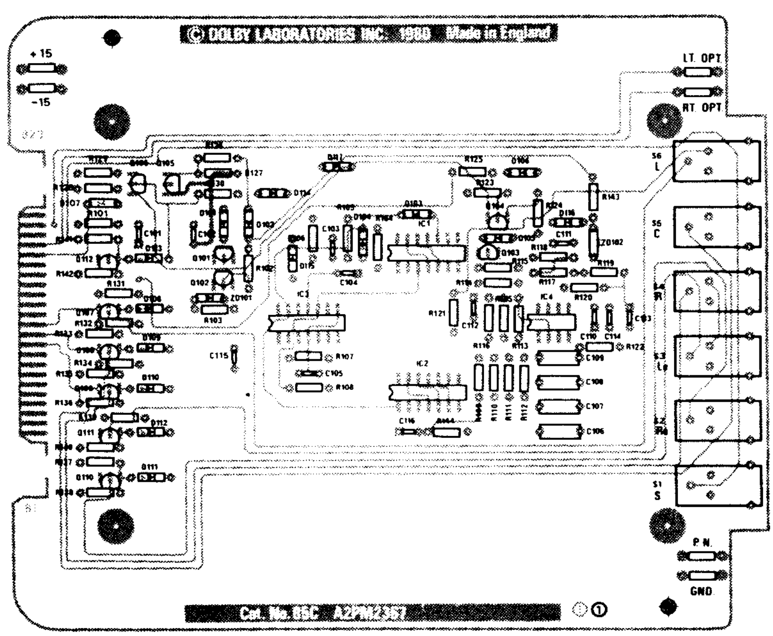


Figure 2
Center & Left channel, one reverse phase from the other.



Ref.	Description	Ref.	Description	Ref.	Description
C101	10 µf at 16 V tant.	Q102	Std. NPN	R122	220K 5%
C102	.1 µf ceramic	Q103	Std. FET	R123	75K 5%
C103	.1 µf ceramic	Q104	Std. PNP	R124	100K 5%
C104	1.0 µf at 35 V tant.	Q105	Std. NPN	R125	75K 5%
C105	82 pf ceramic	Q106	Std. PNP	R126	100K 5%
C106	.056 µf at 63 V 1%	Q107	Std. FET	R127	100K 5%
C107	.033 µf at 400 V 2%	Q108	Std. FET	R128	75K 5%
C108	.015 at 40 V 2%	Q109	Std. FET	R129	100K 5%
C109	.0082 at 63 V 2.5%	Q110	Std. FET	R130	75K 5%
C110	10 µf at 35 V tant.	Q111	Std. FET	R131	2M2 5%
C111	.1 µf ceramic	Q112	Std. FET	R132	220K 5%
C112	10 µf at 35 V tant.	IC101	4006	R133	2M2 5%
C113	10 µf at 35 V tant.	IC102	4006	R134	220K 5%
C114	.1 µf ceramic	IC103	4030	R135	2M2 5%
C115	.1 µf ceramic	IC104	TL072	R136	220K 5%
C116	22 µf at 25 V tant.	R101	100 5%	R137	2M2 5%
D101	1N4148	R102	100 5%	R138	220K 5%
D102	1N4148	R103	100K 5%	R139	2M2 5%
D103	1N4148	R104	100K 5%	R140	220K 5%
D104	1N4148	R105	100K 5%	R141	2M2 5%
D105	1N4148	R106	1M 5%	R142	220K 5%
D106	1N4148	R107	33K 5%	R143	470 5%
D107	1N4148	R108	10K 5%	R144	100K 5%
D108	1N4148	R109	30K1 1%	R145	AOT 1%
D109	1N4148	R110	30K1 1%	S1	switch toggle 3 pos.
D110	1N4148	R111	10K 1%	S2	same
D111	1N4148	R112	3K01 1%	S3	same
D112	1N4148	R113	15K 5%	S4	same
D113	1N4148	R114	4K2 1%	S5	same
D114	1N4148	R115	AOT 1%	S6	same
D115	SFD 108 diode	R116	100 5%	PN	test point WHITE
D116	1N4148	R117	10K 5%	Gnd	test point BLACK
D117	1N4148	R118	2M2 5%	Lt. Opt.	test point RED
ZD101	9V1 Zener	R119	10K 5%	Rt. Opt.	test point GREEN
ZD102	15 V Zener	R120	100 5%	+15 V	test point RED
Q101	Std. FET	R121	220K 5%	-15 V	test point BLUE



7.2.2 Equipment needed to install the Dolby Cinema Package

You will need the following:

(a) 2-conductor shielded (screened) cable, such as Belden 8451, to connect CP50 to power amplifiers and to connect existing magnetic pre-amplifiers to CP50. 4-conductor shielded cable, such as Belden 8404, to connect optical cell to input of CP50 (note: if 4-conductor cable is not available, two runs of 2-conductor cable can be used).

(b) A standard toolkit, including a small-bladed screwdriver or tuning wand for the front panel preset controls.

(c) A set of Dolby Test Film loops, Dolby Cat. No. 69, 97, 151; see Fig. 7.2.8 on page 7.17.

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

(e) A real-time analyser (such as an Abacus ARTA 8000, Altec 8050A, Crown RTA-2, Inovonics 500, Ivie IE-30A) together with a suitable microphone, (such as a Bruel and Kjaer type 2619 with 4133 1/2" free field capsule or any omnidirectional microphone, such as an AKG C451 with a CK-2 capsule) having adequate sensitivity and frequency response. If a microphone other than a laboratory standard microphone is used, a comparison between it and a standard microphone should be done in order to calibrate frequency response.

(f) Pink noise generator, Dolby Cat. No. 85.

(g) Reel of conventional mono Academy film.

(h) Reel of Dolby encoded stereo optical film.

(i) Dual trace oscilloscope.

(j) Dolby Cat. No. 67, (Extender for Cat. No. 64 House Equalizer).

(k) Sound level meter capable of 'C' weighting (flat response) such as Radio Shack Cat. No. 42-3019.

7.2.3 Basic Installation Procedure

(a) Before starting any installation, play a typical film on the existing installation to form an idea of the quality before you start. Pay particular attention to the hum levels, apparent frequency response, projector change-over clicks and similar points.

(b) Thread up and play the SMPTE Buzz Track film. Depending on the projector mechanical design, the normal buzz track alignment is carried out by moving the film position (lateral guide) or by moving the slit.

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

(d) Check voltage selector on rear of Model CP50; set to correct voltage (115 or 230 volts).
IMPORTANT: Check correct fuses are fitted; 300 mA for 115 V, 125 mA for 230 V.

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

US style power: Hot or Live = black; Neutral = white; Ground = green.

Continental style power: Hot or Live = brown; Neutral = blue; Earth = yellow/green.

(f) Install stereo solar cell assemblies on projectors. Accurate alignment of cell is not important at this point. The cell wires are color coded, red for the left channel, green for the right and black for the common (see Fig. 7.2.1.1).

Note: for reverse scan situations separate large cells are used for each channel with identical red (hot) and black (common) wires. Connect up arbitrarily; a check will be made later to determine correct connection (7.2.5 (3)).

(g) Connect the cells to the appropriate CP50 input terminals (SK8) using 4-conductor shielded cable (or two 2-conductor shielded cables). See Fig. 7.2.1.1 for numbering of rear connectors. Connect the inner conductors to the projector input + and - terminals, maintaining correct phase relationships. Connect the shield at CP50 end only to terminals marked E (ground or earth) adjacent to projector input terminals.

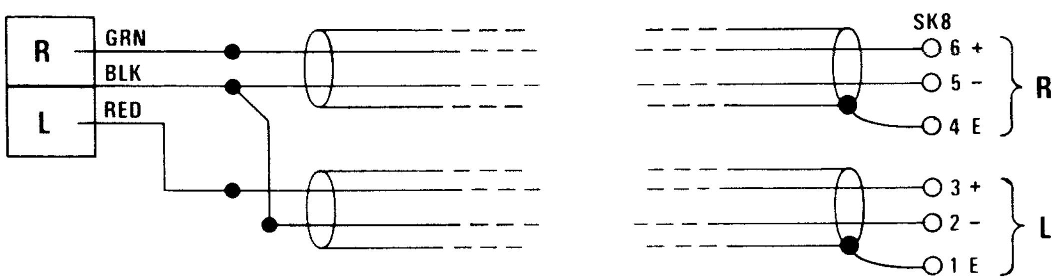


Fig. 7.2.1.1 Connection of cell using 2 x 2 - conductor cable

(h) The following steps in this sub-section assume installation in the type of theatre shown in Fig. 7.6.1 at the rear of these installation instructions. Small variations may have to be made depending on exact situation.

(i) Disconnect the signal leads going from the existing pre-amplifier and switching system to the house fader, and re-route or extend them to the non-sync or mag. inputs on the rear of the CP50 (SK5/9-12, SK6/1-4). If new cables have to be run in, use 2-conductor cables. Connect one of the inner wires (hot) for signal from the pre-amplifier to signal terminal on CP50 and the other inner (cold or common) to E (ground). Connect shield at existing equipment end only, leaving it unconnected at CP50 end.

(j) In a similar manner, connect the CP50 outputs directly to the inputs of the house fader. Connect the shield at the fader end only, leaving the shield unconnected at the CP50 end.

(k) Remove each Cat. No. 64 Equalizer card and check that the rotary single-turn potentiometers are at mid position (12 o'clock). Even if the installation will be controlled by some form of automation, make sure the manual Switch card (12) is initially in the CP50.

(l) Remove or turn off existing optical pre-amplifiers to prevent any unwanted injection of signals or noise into normal chain.

7.2.4 Projector optics and optical pre-amplifier alignment

(a) On Optical Pre amp card (2) turn output controls full clockwise, high frequency contols full counter-clockwise and bypass L and R full clockwise. Turn house fader to minimum. Turn on power in projection booth to projector and CP50, but if possible not yet to power amplifiers.

(b) Clean sound head optics of both projectors. Make test loops to suit projectors from Dolby test films Cat. No. 69 (Dolby Tone and pink noise), and Cat. No. 97 (1 kHz 100% left/right film) and from SMPTE Buzz Track film.

(c) On projector 1 switch on exciter lamp and move the cell towards the film until it almost touches the film plane. If the cell is too far from the film, crosstalk will result. If too near, film and cell damage can occur. An optimum separation is 1 mm from cell to film. Image of slit should be near top of cell (Fig. 7.2.2). Avoid the top edge insulation on the cell. Brackets are factory designed to suit most projectors.

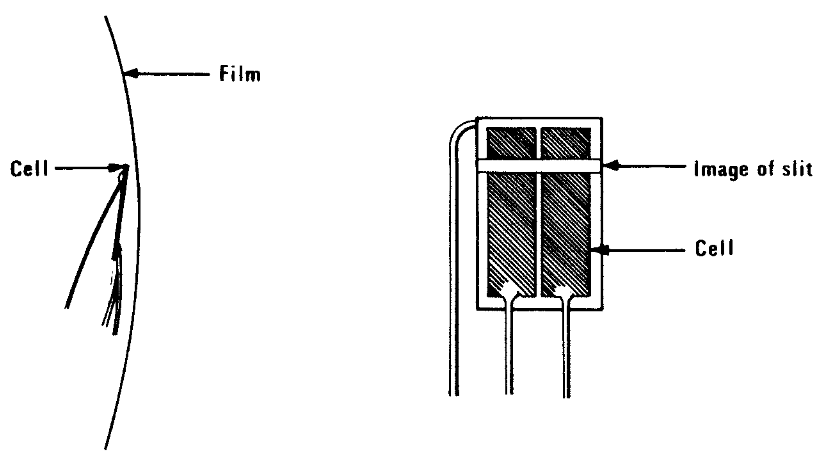


Fig. 7.2.2

(d) Connect the two inputs of the dual trace oscilloscope to the left (red) and right (green) test points on the Optical Pre-amp card ② ; a ground (black) test point may be found on the meter module ⑤ .

(e) Thread and play the stereo cell alignment film Cat. No. 97. Move cell laterally across the film plane until there is a minimum and equal crosstalk Left to Right and Right to Left (it should be possible to achieve better than 20 dB separation each way.) Note that it may be necessary to stop the projector to make these adjustments. The Cat. No. 97 has Left and Right signals alternating at about 15 millisecond intervals; adjust triggering of dual-beam oscilloscope to give traces similar to Fig. 7.2.3. When satisfactory results are obtained, lock the settings. If any misaligned films are encountered, the guide roller should be moved, not the cell alignment.

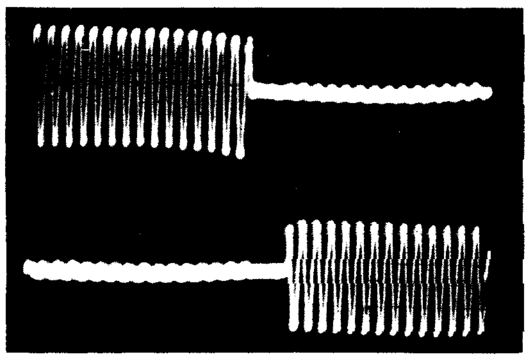


Fig. 7.2.3

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

(f) Thread up and play the Dolby tone side of the Dolby test film Cat. No. 69 (the side with the symmetrical waveform as opposed to the random noise side). Select non-Dolby film and Proj. 1 on the Switch card ⑫ , and adjust Proj. 1 left and right Optical Pre-amplifier gain controls ② so the meters ⑤ read approximately Dolby Level. (This is an approximate setting only, and will be repeated with greater accuracy later; if the tone cannot be made to reach the Dolby Level marks, raise exciter lamp voltage.)

(g) Check that the right track is connected to the right amplifer by placing a business card into the light path and observe which meter drops first. The right track is the track nearer the edge of the film.

(h) Thread up and play the pink noise side of Dolby test film Cat. No. 69. With 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. 7.2.4) and rotate the slit for best azimuth as seen on the oscilloscope (Fig. 7.2.5). (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). Since the focus and azimuth settings are somewhat interdependent, repeat the adjustments once again to check for optimum settings.

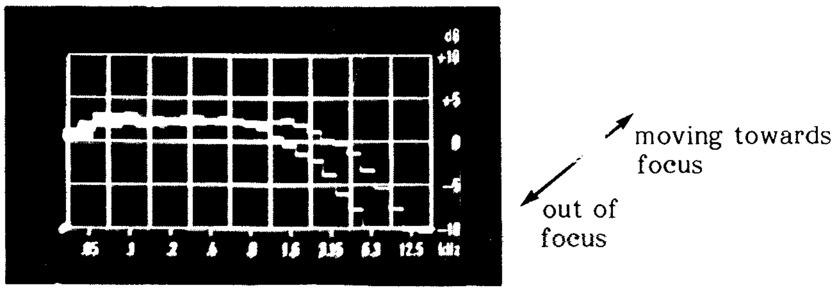
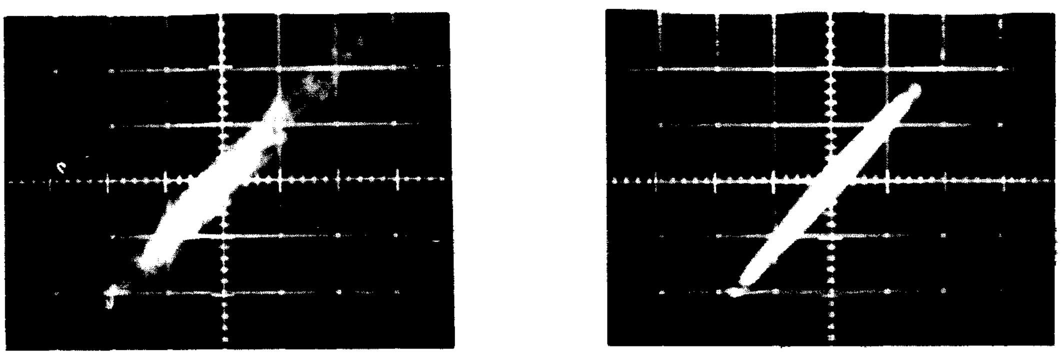


Fig. 7.2.4
Effect of focus adjustment

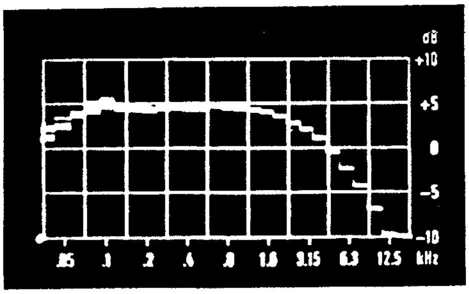


(i) incorrect azimuth

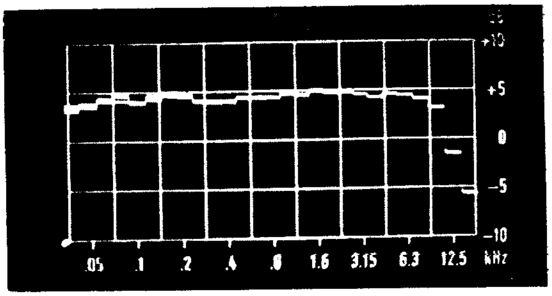
(ii) improved relative to (i)

Fig. 7.2.5
Effect of aximuth adjustment; final trace should be as thin as possible

(i) When azimuth and h.f. have been optimised in (h) obtain flat h.f. response in left and right channels using the Optical Pre-amplifier (2) h.f. controls (Fig. 7.2.6). The response should be flat up to a limit determined by the slit size, with a rapid fall above a certain frequency. Attempt to achieve a flat frequency response without any peaks rather than an extended response which may have a small high frequency peak which may introduce audible coloration. Different results will be obtained from projector to projector, but in all cases a response flat to 10 kHz should be obtained. In cases of a poor high frequency response, inspect slit.



before



after

Fig. 7.2.6
Adjustment of Optical Pre-amplifier h.f. controls

(j) Re-thread Dolby Tone side of Cat. No. 69 loop and adjust pre-amplifier gain controls left and right so that the meters (5) indicate Dolby Level.

(k) Switch CP50 to projector 2 and repeat sections (c) to (j) for the other projector.

7.2.5 Adjustment of House Equalization and Auditorium Level.

(a) Select 'optical' and 'stereo' on Switch card (12).

(b) Set house fader control to minimum position; if Dolby remote fader accessory is fitted, set to '0'.

(c) Check that output level controls on output card (11) are at minimum (fully counter-clockwise).

(d) Turn all the Cat. No. 64 House Equalizer (8), (9), (10) input controls to minimum (fully counterclockwise).

(e) Thread up and play Dolby tone from Cat. No. 69 test film (check meters on Meter card (5) indicate Dolby Level).

(f) Connect a millivoltmeter to C test points on Output card (11) and adjust center Cat. No. 64 (9) House Equalizer output contol for a reading of 210 mV (-11.3 dBm).

(g) Unplug the right Cat. No. 22 (4) module to produce a left only signal. Move the millivoltmeter to the L test point on the Output card (11) and adjust the left Cat. No. 64 (10) output control for a reading of 150 mV (-14.3 dBm).

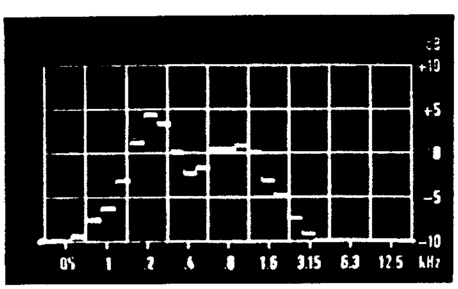
(h) Plug in the right Cat. No. 22 module and unplug the left Cat. No. 22 module to produce a right only signal. Move the millivoltmeter to the R test point on the Output card and adjust the right Cat. No. 64 output control for a reading of 150 mV (-14.3 dBm).

(i) Place rear switch S2 in position corresponding with power amplifier sensitivity. In low position, output level is in region of 100 mV (-18 dB); in high position, about 1 volt (+2 dB). (If in doubt, place in low position initially.)

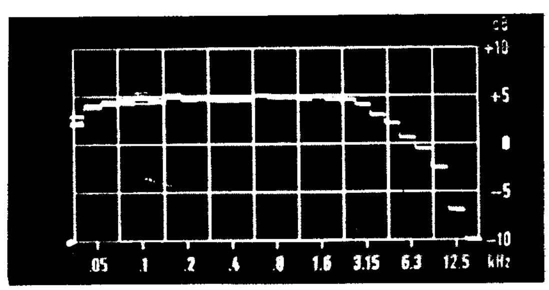
(j) Remove the decoder (Cat. No. 150 or Cat. No. 146) from (7) and remove the link card (Cat. No. 110L) from (6). The link card should be reversed and plugged into (7). This will provide a link for signals to pass through slot (7). Plug a Cat. No. 85 Pink Noise Generator into the 110/160 slot (6). On generator, switch to PN and switch pink noise on to left channel only. (NOTE: Switches are down for 'on', and up for 'off'.)

(k) Connect the calibrated microphone in an average position about 2/3 way back in the reverberant field (not on center line of cinema and not directly on the speaker axis) to the real-time analyser. The microphone should be about 5 feet (1.5 m) above the floor level, and angled at about 45 degrees upward towards the screen. Turn on power amplifiers. With normal volume settings on the house fader (if a remote fader Cat. No. 117 is being used the normal setting is '7' for a Dolby accessory control or about "2 o'clock" if it is a non-Dolby potentiometer) and power amplifier, adjust L Trimpot on Output card 11 . Advance trimpot and check that pink noise can be heard in auditorium. Continue to advance trimpot and analyser gain until trace is visible on screen. Turn off pink noise source momentarily to check pink noise level is well above (20 dB) ambient noise. If the microphone and analyser have been calibrated against a sound pressure meter, set up the level at about 85 dBc. (If there is insufficient signal level, return fader control to zero, and move rear switch S2 to high position.) Remove L Cat. No. 64 Equalizer module and place it in the special Equalizer extender Cat. No. 67. Plug the extender into the CP50.

(l) Commence equalization by turning 40 Hz band fully down. Make a rough equalization with the bass and treble controls on the Cat. No. 64 module, trying to obtain a response of about 6 dB below the mid band frequencies in the 8 kHz band. Then move to the 27 third octave bands, adjusting them to achieve a flat frequency response up to about 2 kHz, descending at 3 dB per octave to 8 kHz (-3 dB at 4 kHz, -6 dB at 8 kHz). Above 8 kHz, allow the speaker to set the drop-off. CAUTION: Do not try to adjust 1/3 octave controls 8 kHz and above. Double-check the results if it is noticed that adjacent potentiometers show great differences between settings. If adjacent potentiometers have alternately counter-clockwise and clockwise settings, the result will be fairly flat but with very poor phase response, and the potentiometers should be re-adjusted to show small variations from band to band. The final result is shown in Fig. 7.2.7 below.



before



after

Fig. 7.2.7
Auditorium Equalization

(m) As the equalization progresses, it is sometimes 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 output 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). Note: Check that the power amplifiers are not overloading; a common symptom of overloading is that as a high frequency control is increased, the analyser trace decreases at high frequencies, and often increases at low frequencies. Make a note of the settings on the white card supplied inside each Cat. No. 64. This would be invaluable in case of moving a control accidentally. Finally, add the appropriate L, C or R black sticker to the front of the Cat. No. 64 cover to identify its position.

(n) 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.

(o) Recheck that the main fader is set at the normal level. Adjust the L trimpot on Output card (11) for a sound pressure level of 85 dBc near the center of the auditorium. (Note: The Cat. No. 85 Pink Noise Generator must be set for a level of 600 mV measured at its meter output test points, with an average responding meter. If your Cat. No. 85 does not produce this output level, you should adjust the level trimpot which is located at the bottom of the card and is accessible from the front. Early Cat. No. 85 Pink Noise Generators were not factory adjusted for this level.)

(p) Switch pink noise off on left channel, and proceed to equalize the right and center channels in similar manner (steps l-o), checking that the sound pressure levels produced by each of three front speakers match at 85 dBc.

(q) If a surround system is being installed, switch pink noise on to the surround channel. Adjust the surround trimpot on the output module for a sound pressure level of 85 dBc.

(r) Select mono on switch module (12) . Select pink noise on center channel only and adjust mono output level control on output card for a sound pressure level of 85 dBc.

(s) Remove the Cat. No. 85 Pink Noise Generator and re-install the Cat. No. 110L link card and Cat. No. 150 (or Cat. No. 146) decoder card in their proper slots.

(t) The remaining adjustment (for surround installations only) 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.

(u) The delay setting may be checked by playing a stereo 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 the front channel sounds should appear to come from the screen. If sounds which should be at 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 very 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 CP50 switched for stereo and 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.

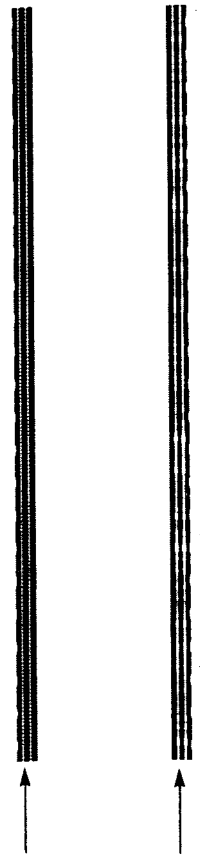
(v) In many films the surround information is meant to be a subtle effect and to provide a low level ambience. Provided that the surround level and delay time have been adjusted as described, the surround level will be what the film director wanted. Do not be tempted to increase the surround volume as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

(w) Push 'Stereo' and 'Dolby NR' buttons in. Set house fader to normal position. Play a Dolby encoded stereo optical film and check sound quality in the auditorium. (Note: If the film has been surround encoded, and a surround system has been installed in the theatre, press 'opt. surr. in'.)

(x) The equalization set up in paragraph 7.2.5 (l) is the correct response for a middle-sized auditorium; for small auditoriums a slightly brighter response is required, and for larger halls slightly less high frequency is required. These adjustments are best made by playing a known reel of Dolby-encoded film and making small adjustments to the treble control on the Cat. No. 64 and not in any circumstances to the third octave controls.

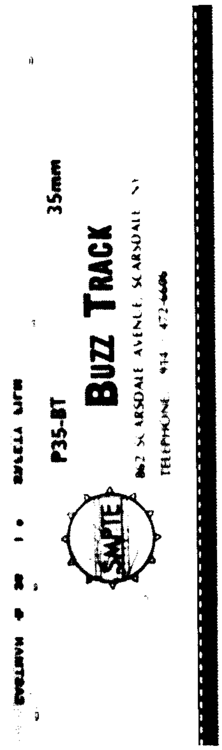
(y) Press Optical Fault push button on Switch card (12) and adjust the left and right bypass trimpots on the Optical Preamplifier (2) to give a balanced sound in the auditorium. (It may not be possible to match previous sound levels exactly since this depends on the sensitivity of the following main power amplifiers). Release the Optical Fault push button.

(z) The basic installation is now complete. In case of problems, refer to section 7.3.

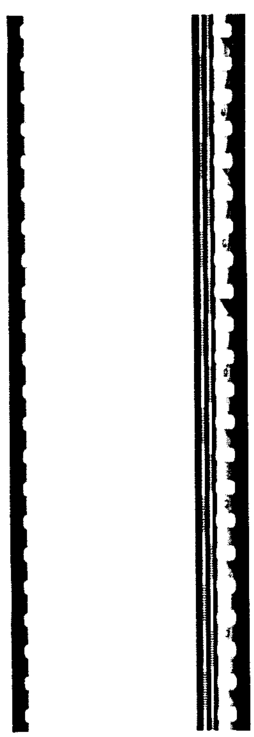


Dolby Tone   Pink Noise

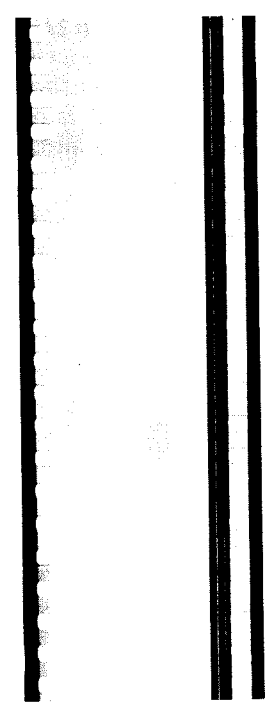
Dolby Cat. No. 69



SMPTE Buzz Track



Left-Right
Dolby Cat. No. 97



Center-Surround
Dolby Cat. No. 151

7.2.7 Connection to Existing Changeover System

(a) The CP50 projector changeover can be manually operated by the two pushbuttons on the switch card Cat. No. 112 (12) .

(b) These pushbuttons may be used to control any existing changeover system by utilizing the information on the rear connector SK2 pin 3 (c/o info). With projector 1 selected, this point is at a positive (undefined) potential (see pin 1, circuit diagram of optical preamplifier). With projector 2 selected, the point is connected to the CP50 0 V supply. If this signal is not suitable for connection to the existing system a simple interface can be made by connecting a 12 V relay from SK2/3 to the +12 V supply in the CP50 which is available on rear connector SK1/10. The relay will operate in projector 2 mode; the relay contacts can then control the existing changeover system.

(c) Alternatively, the existing changeover system may control the CP50. By lightly depressing the projector pushbutton switch not selected, both pushbuttons may be put into the released condition (no legends visible). In this mode, a ground connection to the rear connector SK2/1 (auto c/o) commands the CP50 to switch to projector 2.

If this ground connection is at a slightly different potential to the CP50 ground, this method may introduce hum. Therefore, it is better practice to use an isolated switch contact on the existing changeover system to connect SK2/1 to SK2/2 (E) for projector 2. Depending on the existing changeover, some relay interface may be required; as there are so many different systems in operation, it is impossible to give comprehensive instructions and a suitable method will have to be chosen at each installation.

7.3 Troubleshooting

7.3.1 There may be instances where the installation produces sound but of poor quality. Here is a list of some common installation problems with cures.

7.3.2 Hum comes and goes in optical mode.

(a) Check that the cell is shielded from any light souces in the booth. The light output from all light, and especially from fluorescent tubes, is strong in 120 Hz (or 100 Hz) components which can be picked up by the cell. The light from the Xenon can also cause problems.

(b) Check that the exciter lamp is not ac supplied. If dc check that it is ripple-free; try adding additional smoothing capacitors while listening to hum.

7.3.3 Hum comes and goes at random.

(a) Switch off CP50 and listen again. If hum is still present switch off booth completely. If hum still present, check for other sources in auditorium. These may be mechanical sources, for example a refrigerator behind screen or near auditorium. Do not overlook any air conditioning system.

(b) If hum goes when booth is switched off, check for any ground (earth) loops in installation. Listen to any hum level change as the CP50 is switched on and off, leaving the main amplifiers on. Switch between optical sound and Non-sync/Mag on the CP50 and listen to hum changes.

(c) CP50 units are sent out with a strap connecting the signal ground to the chassis (SK1/1 to SK 1/2). Under some circumstances this may cause hum, due to ground loops. Try removing this. NOTE: For safety, the chassis must at all times be connected to power line ground either through the 3-pin power line connector supplied or via the rack mounting system. Electric shock hazard may result if grounding is removed.

7.3.4 Clicks.

The CP50 provides an increased frequency response from cell to auditorium. Under some circumstances, this may mean that the installation shows up clicks in the system. Such clicks may be produced by changeover system relays, motors starting, or arcs striking. Xenon lamps, for example, are rarely suppressed. If they produce bad clicks, recommend to the projectionist that both lamps should be left on all the time; this will also extend the life of the Xenon as striking a Xenon is equivalent to running continuously for 1½ hours.

Another typical source of clicks or crackles is the motor drive system used for carbon arc light sources. Check the brushes on the motors and the state of the commutators, and refurbish and suppress where appropriate.

The equipment producing the click may not even be connected with the technical side of the system - it could for example be the ice cream freezer in the front-of-house area. The source of each click must be traced and appropriate measures taken; these may involve power line filters or contact suppression devices. (Typical suppression components are 0.1 uF in series with 100 ohms connected across the contacts; use either encapsulated proprietary combination devices or separate components, taking care to observe safety requirements for possible electric shock hazards. The capacitor voltage rating must be suitable for the ac power line used.)

Repetitive clicks when playing a magnetic print (via the non-sync or mag input) can be caused by magnetized sprockets which will permanently over-record a click on the print. Since the mass of the sprockets is so large, the only practical cure is to replace the offending sprocket completely and obtain a new print.

Finally, clicks can be introduced by grounding procedures; check the grounding arrangements for the various pieces of equipment in the booth are optimized.

7.3.5 In cases of incorrect audio signals, use the block diagram in Section 9 of the manual (unit circuits) to trace the signal path from input to output. If signals are injected from an oscillator into the input terminals from the projector, make sure a 100 k ohm resistor is used in series with the input to simulate the high impedance cell.

The fault-finding chart in Section 8.4 is also of use in tracing faults.

7.3.6 Due to the subtle nature of much surround information it is sometimes difficult to be sure that the surround decoder is properly functioning. A simple check is to play a loop of Cat. No. 151 surround test film. This film has a burst of pink noise which rapidly alternates between the center and surround channels at the same volume. It may be helpful to reduce the surround delay to minimum (30 ms) for this test.

7.4 Installation of Remote Fader option - Cat. No. 117

7.4.1 The Remote Fader Output card (Cat. No. 117) can be substituted for the normal Output card (Cat. No. 111). Control of gain is effected by a single 100 k ohm linear potentiometer which may be supplied locally or may be purchased from Dolby Laboratories mounted in a special box. For single-station remote operation, order Slave Remote Control Unit Cat. No. 122. For multiple-station operation (for example, one control by each projector) order one Cat. No. 122 and as many Master Control Units, Cat. No. 123 as necessary. (See diagram on next page)

7.4.2 Mount the control units where desired.

7.4.3 Connect the control units as shown in Figs. 7.4.1 or 7.4.2. The maximum voltage in the wires is 24 volts and maximum current is 20 mA, so that the choice of cable is not critical. Audio signals are not present in any of the wires so that shielded cables are not required.

7.4.4 If the Cat. No. 117 Remote Fader Output card is being installed in an existing CP50 which has already been aligned, it will be necessary to adjust the output level trimpots. Proceed as follows:

(a) Remove the existing output card (11) replace it with the Cat. No. 117.

(b) Remove the decoder card Cat. No. 150 or Cat. No. 146 (6).

(c) Remove the Cat. No. 110L link card (6). Reverse the link card and plug it into the 150/146 slot (7). This will provide a link for signals to pass through this position.

(d) Plug a Cat. No. 85 Pink Noise Generator into the 110/160 slot (6). On the generator, switch to PN and switch pink noise on to left channel only. (Note: Switches are down for 'on', and up for 'off'.)

(e) Set the remote fader control knob at '7' if it is a Dolby accessory or at about "2 o'clock" if it is a non-Dolby potentiometer.

(f) Adjust the left output level control on the Cat. No. 117 Remote Fader Output card for a sound pressure level of 85 dBc measured near the center of the auditorium.

(NOTE: The Cat. No. 85 Pink Noise Generator must be set for a level of 600 mV measured at its meter output test points with an average responding meter. If your Cat. No. 85 does not produce this output level, you should adjust the level trimpot which is located at the bottom of the card and is accessible from the front. Early Cat. No. 85's were not factory adjusted for this level.

(g) Repeat step (f) for the center and right channels, and if surround is installed, for the surround channel.

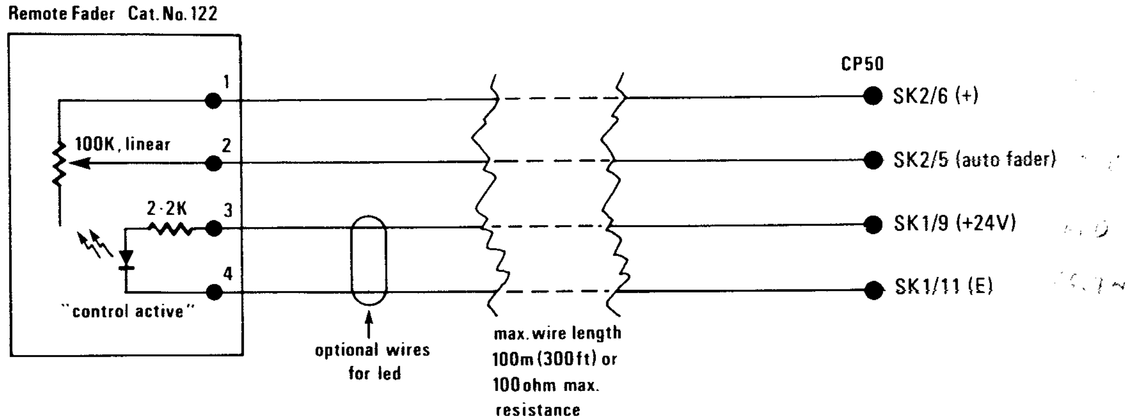


Fig. 7.4.1 Single-station installation of Remote Fader

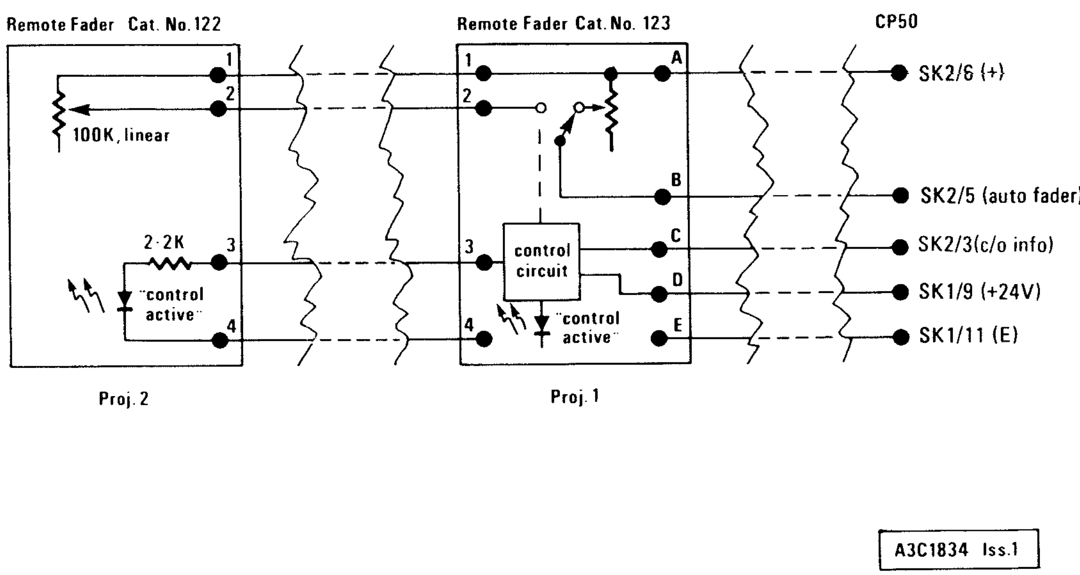


Fig. 7.4.2 Two-station installation of Remote Fader
(expandable to any number)

7.5 Installation of Automation Switch card option, Cat. No. 113

Carry out the normal installation procedures of Section 7.2. Connect the rear terminals SK1 and SK2 to the automation system switches following the table below. Each switch should be isolated from grounds (earth) other than the unit ground, marked E on the rear terminals. Maximum voltage on any control wire is 15 V, and maximum current is 10 mA. Shielded cable is not required.

Functions are selected by connecting each remote terminal via the switch to the unit ground (E). A permanent switch must be made rather than a pulse; in some situations an interface may be required between the automation unit and the CP50.

Function	Connect switch between	switch closed for	open for
system selection	SK1/7(x) and SK1/11*(E)	optical	non sync/mag
Dolby Noise Reduction	SK2/11 (NR off) and SK2/12(E)	non-Dolby Film	Dolby Film
mono/stereo	SK2/9 (mono) and SK2/10*(E)	mono	stereo
optical surround in-out	SK2/7 (opt surr cont) and SK2/8*(E)	surround in	surround out
projector changeover	SK2/1 (auto c/o) and SK2/2*(E)	projector 2	projector 1

*It is not necessary to run separate ground (E) wires to each switch if all functions are being operated. A single wire from SK2/12 to the automation programmer is sufficient.

Install the Automation Switch card Cat. No. 113 in place of the manual Switch card Cat. 112. Store the Cat. No. 112 somewhere safe since it is used for alignment and calibration, and also allows manual control in the event of a failure in the automation unit.

Run the automation unit and check that as the function switches operate, the appropriate led indicators on the front of the Automation Switch card illuminate.

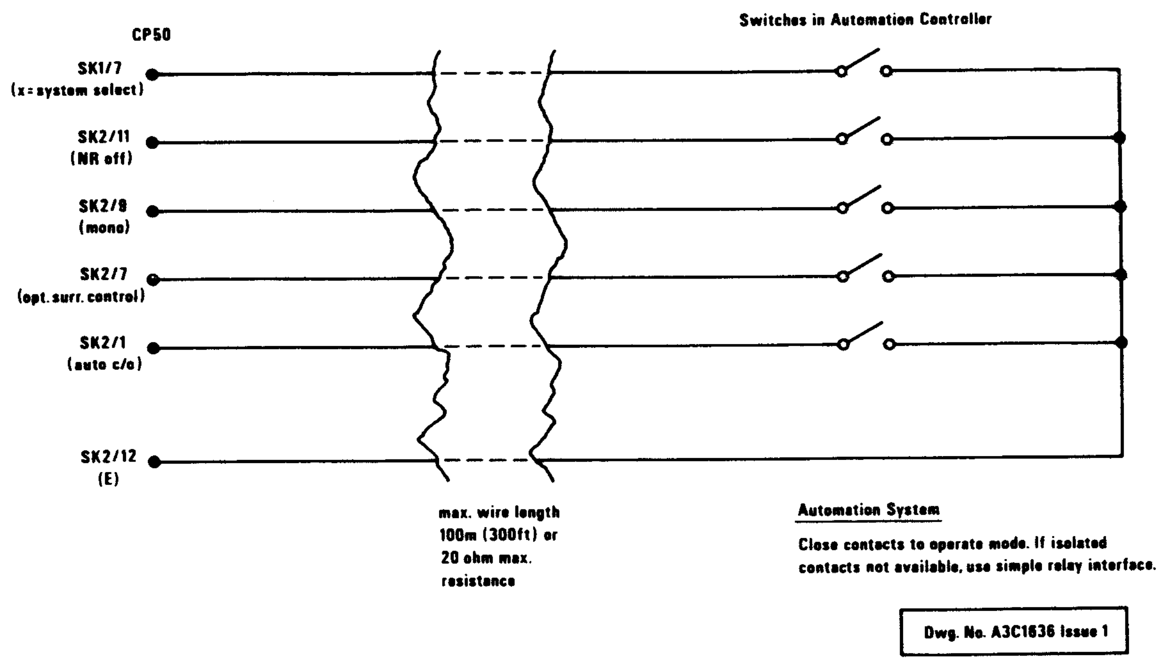


Fig. 7.5.1 Connection of CP50 to an automatic programmer

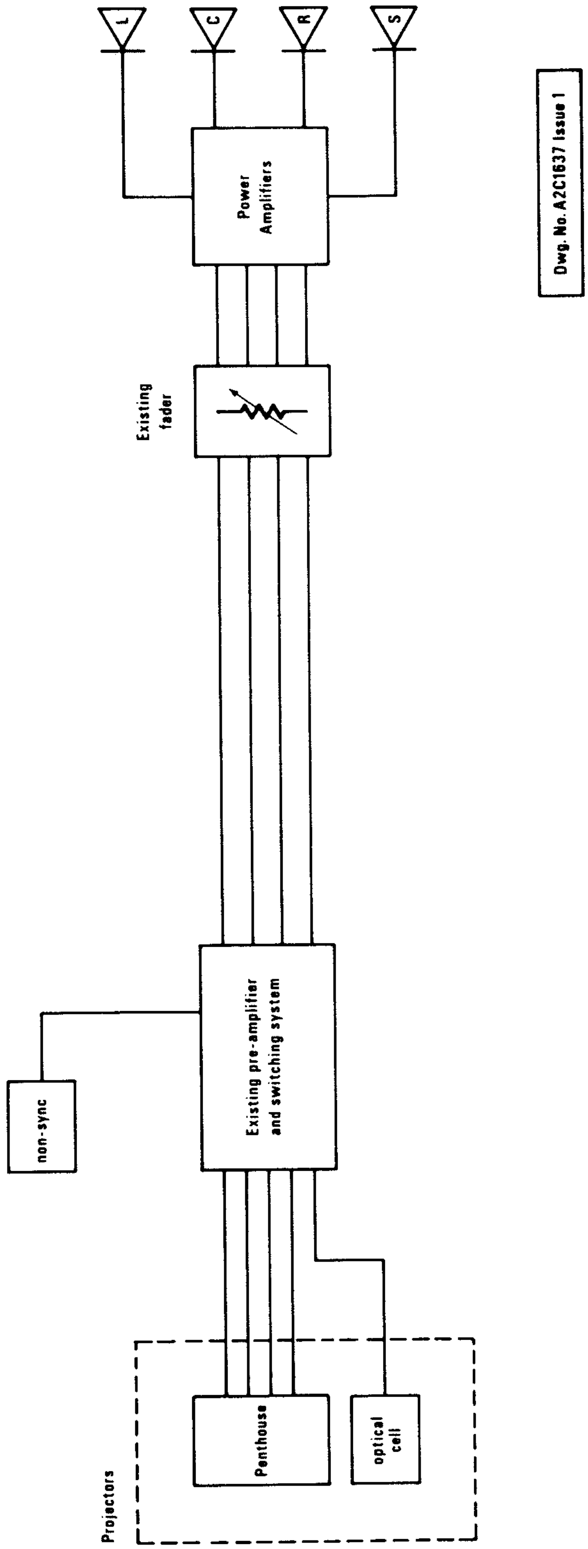


Fig. 7.6.1 Typical existing installation for optical and 4-track magnetic

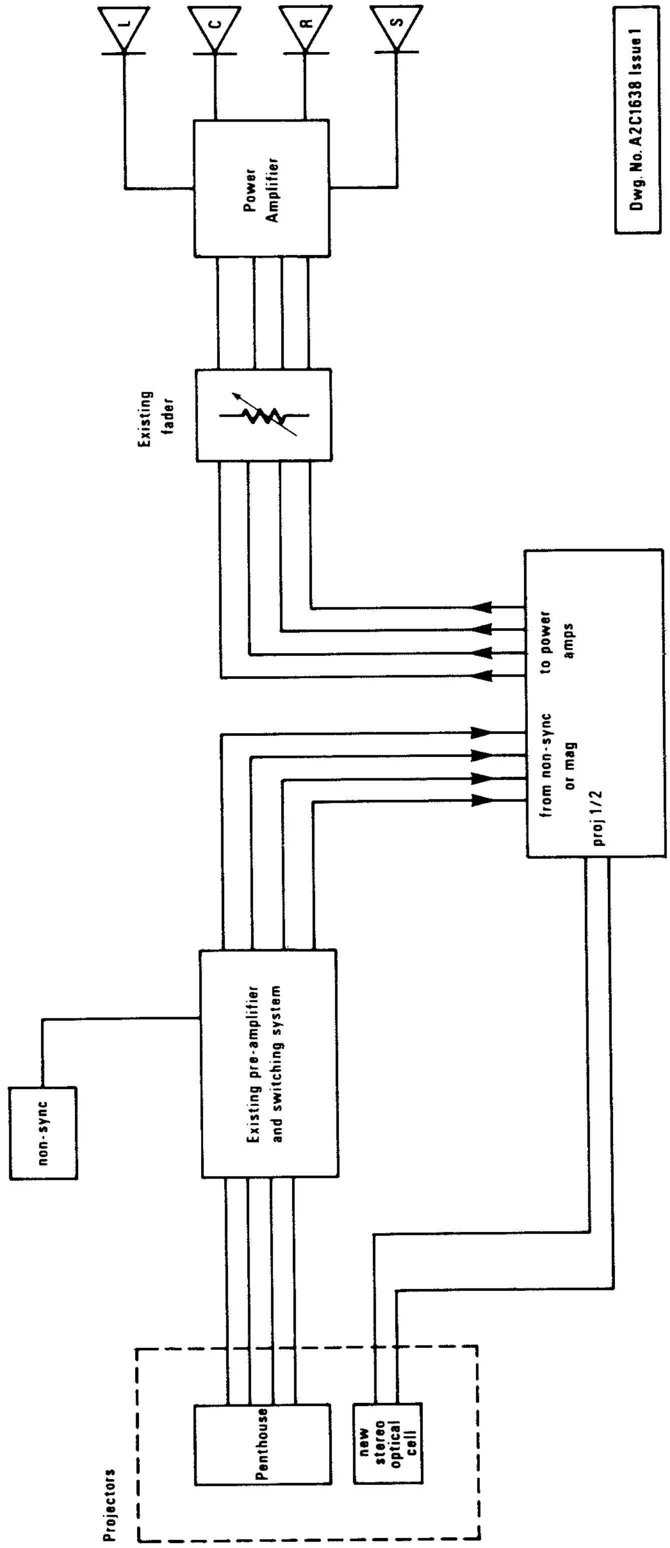


Fig. 7.6.2 Typical addition of CP50 to optical/4-track magnetic house

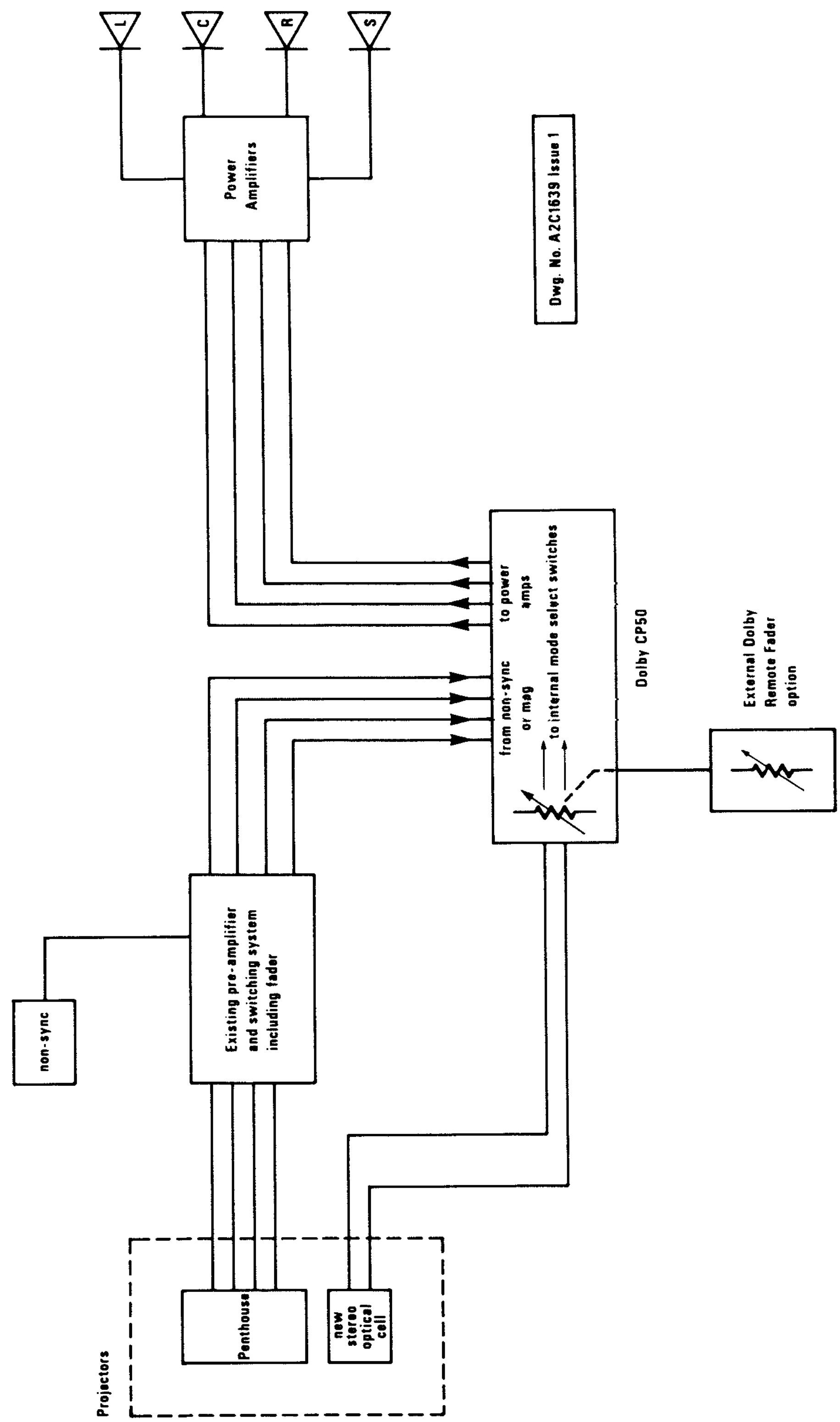


Fig. 7.6.3 Connection where is is not practical to use existing fader, or to add new external 4-gang fader

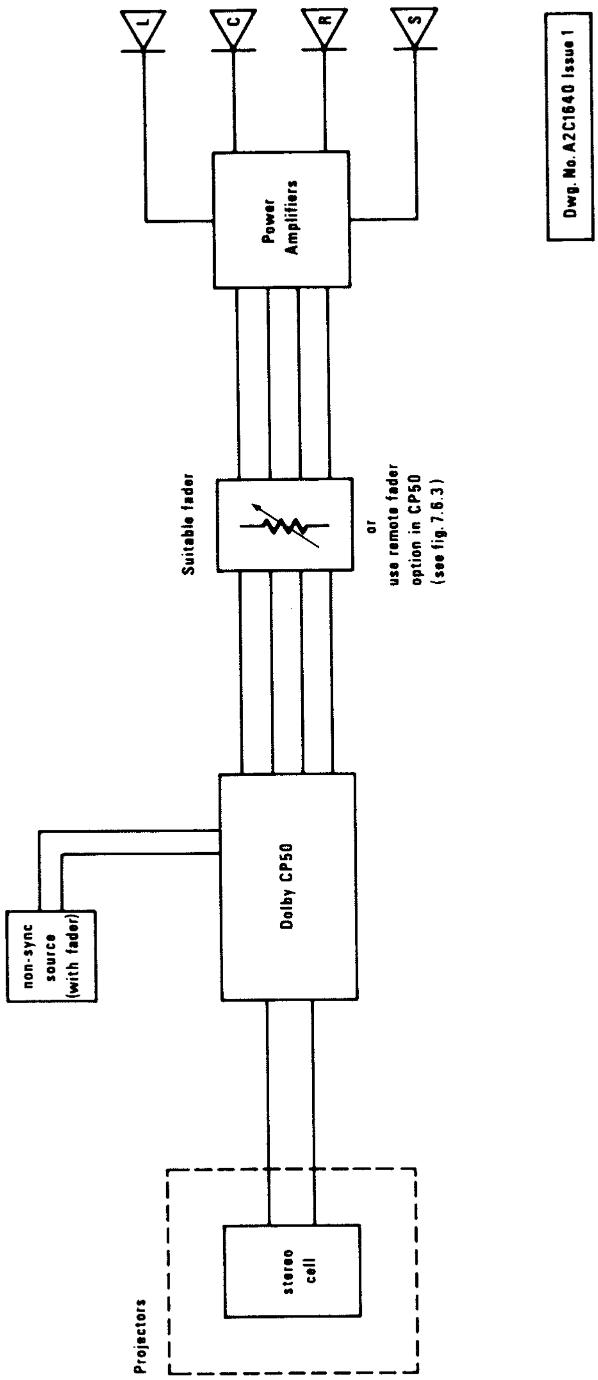


Fig. 7.6.4 New optical-only installation

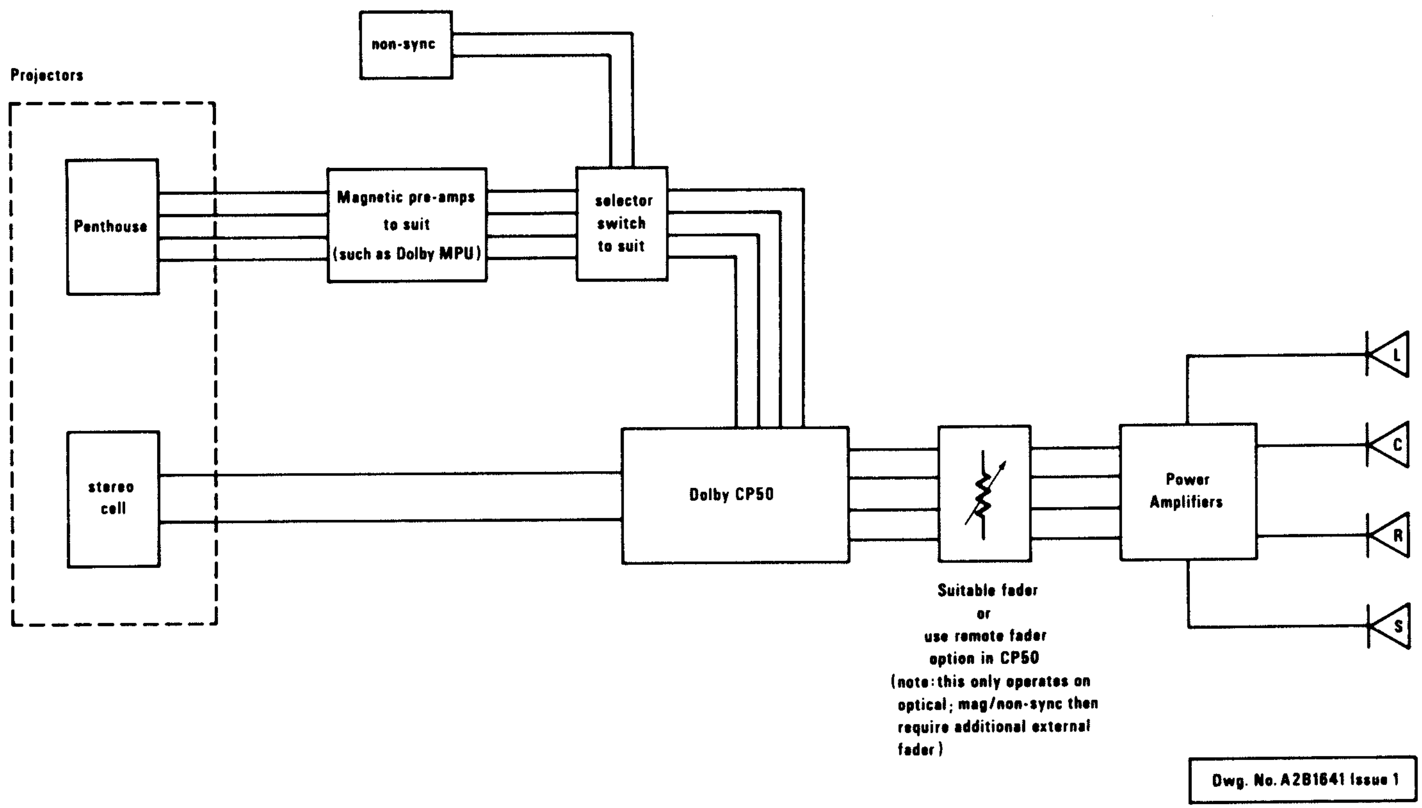


Fig. 7.6.5 New optical and magnetic installation

7.9 Installation Instructions for Spare Power Supply and Cord for the CP50 (Cat. No. 114)

7.9.1 Select correct power line voltage using slide switch on rear of power supply.

7.9.2 Check fuse ratings are correct for selected line voltage (300 mA slow blow for 115 V, 125 mA slow blow for 230 V).

7.9.3 Connect the 6 foot long cord to the matching 4-pin connector on the spare power supply.

7.9.4 Attach the fanning strip to the "Ext. Pwr." terminal block (SK 1) on the CP50, as indicated in Fig. 7.9.1, leaving E to Chassis link in place, if fitted.

7.9.5 Connect the power cord to the spare power supply.

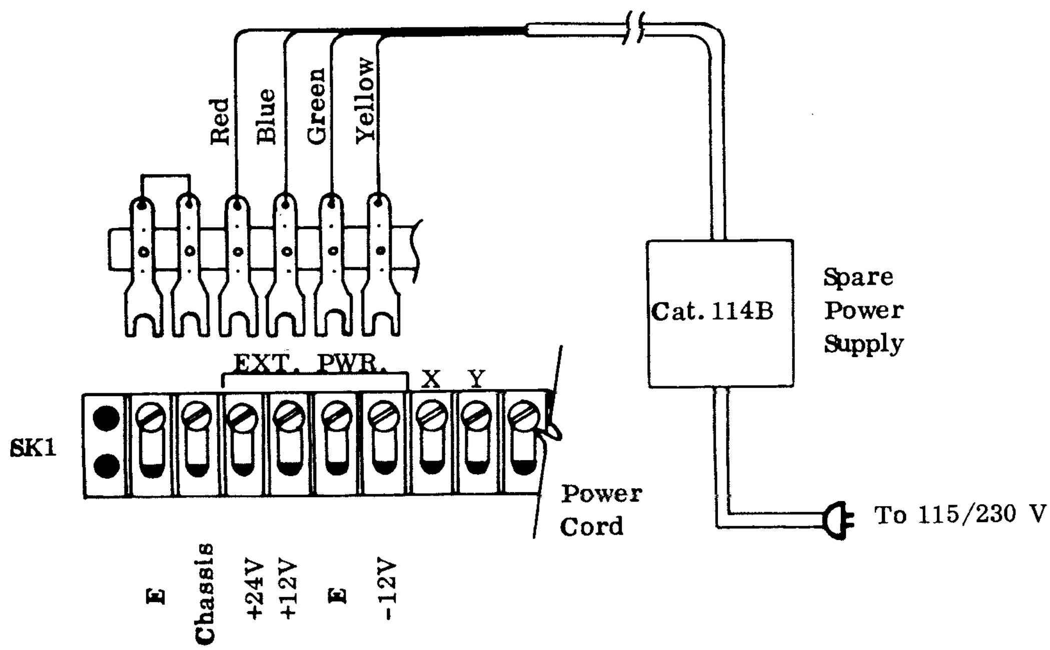


Fig. 7.9.1

7.9.6 Plug in the spare power supply to the power line, switch its power on, check light in switch operates.

7.9.7 Check the voltages at the terminal strip of the CP50 with an appropriate meter.

7.9.8 Push the bottom switch on the CP50 (marked "Int./Ext. Pwr.") to external power; the CP50 should function normally.

7.10 Cat. No. 160: Description and Location

The Cat. No. 160 was developed for use in 35 mm stereo optical projection to extend the low frequency response in the theatre. This is accomplished by supplying a controlled low frequency output to speaker systems separate from the three usual screen speakers, thus improving low bass response. The additional loudspeakers may be dedicated low frequency woofer units or speakers 2 (L_e) and 4 (R_e) in a 70 mm system (speaker numbering may be different in other countries, e.g., 1 and 5 in Japan).

The acoustics of the theatre influence the frequency response of the program material reproduced within that theatre; the lower the frequency, the higher the power needed and the larger the speaker system necessary to reproduce that frequency. As a result, the response from theatre to theatre varies, especially below 150 Hz.

The Cat. No. 160 replaces the Cat. No. 110L card in CP50 units; the Cat. No. 160 cannot be used in earlier CP50 units that are equipped with Cat. No. 110 (or 82) and Cat. No. 116A format cards. If a Cat. No. 160 is to be fitted to a CP50 already fitted with a Cat. No. 110/116A combination, these latter cards must be replaced with a Cat. No. 150 format card, leaving the Cat. No. 110L slot open for the Cat. No. 160. All CP50 units since Serial No. 1000 (approximately December 1978) have been supplied with the Cat. No. 150 card.

The Optical Bass Extension (OBE) signal from the Cat. No. 160 is derived by summing the L_t and the R_t signals coming from the Cat. No. 109 meter card. The resultant mono signal is sent via a low-pass filter to a downward expander for noise reduction. This is followed by a variable dip filter to flatten the acoustic response of the speaker/room combination. Finally, the signal is sent through a voltage controlled attenuator/amplifier (VCA) and out to appropriate power amps and speaker systems. The block diagram Fig. 7.10.6 outlines the signal flow. Note the Cat. No. 160 card is also used in other Dolby Laboratories' units such as the CP200; some sections of the card are used in CP50 installations, others only in CP200 installations.

7.10.1 Controls and Jumper Description

The controls and jumpers on the Cat. No. 160 card are shown in Fig. 7.10.1; refer to this figure and to the block diagram Fig. 7.10.6.

JM1 This Jumper should be as shown to set the low end cut-off at 22 Hz (the 100 Hz position is for special applications).

JM2 This Jumper determines whether the VCA is in use (IN) or not (OUT); the 'OUT' position is used with an external fader.

JM3 This Jumper will enable the dip filter (IN) or disable it (OUT).

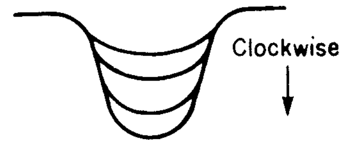
S1 This switch sets the operating mode of the card. ON turns OBE on at all times provided stereo is selected, and is used in the initial set-up procedure. In the AUTO position (the normal operating mode), OBE will follow the Dolby Film Switch; when Dolby Film and stereo are selected, OBE will be on. In the OFF position, OBE is turned off under all conditions.

IND 1 This indicates whether the OBE is switched in. (LED on = OBE on).

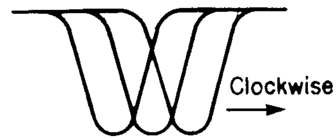
CONT 1 (OBE level) This control is the same as the line output controls on the line output card (Cat. No. 111 or 117).

CONT 2 and CONT 3 These controls are not used when Cat. No. 160 is installed in a CP50.

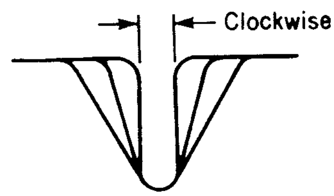
CONT 4 This controls the depth of the "cut" of the variable dip filter Initially it should be adjusted to the fully clockwise position.



CONT 5 This controls the "frequency" of the variable dip filter (initially it should be adjusted to the fully clockwise position.



CONT 6 This controls the "Q", or the width, of the variable dip filter Initially it should be adjusted to the fully clockwise position.



TP1 This is the input point for the pink noise test signal (600 mV).

TP2, TP3, and TP4 These test points are not used when the Cat. No. 160 is installed in a CP50.

TP5 This is at signal ground of the CP50.

7.10.2 VCA Interface in CP 50

The Cat. No. 160 has a separate Voltage Controlled Amplifier (VCA), similar to that used in the Cat. No. 117 Remote Fader Card, to control the OBE output. If the optional Cat. No. 117 is not used in the CP50, the VCA in the Cat. No. 160 must be removed from the circuit. This is accomplished by placing the VCA suitcase link into the "OUT" position; to control output levels, another gang must be added to the existing house fader.

If the optional Cat. No. 117 is used in the CP50, the remote gain control for that card is also used to control the Cat. No. 160 output. In this case, make sure that the VCA link on the Cat. No. 160 is in the "IN" position. In addition, on CP50 units prior to serial number 2260 (approximately October 1980), a modification must be made to the rear backplane (see Figure 7.10.2). A wire link must be added on the CP50 backplane from SK2 (5) (or the pc board trace just below this terminal) to pin A12 on the Cat. No. 160 edge connector SK15. A12 is the twelfth pin up from the bottom left on the connector when viewed from the rear. When this link is added, the OBE output will track with the other channels. Note that this link was added in manufacture on all CP50 units after serial number 2260.

The output from the Cat. No. 160 card is SK 7 terminals 3 and 4 (see Figure 7.10.2) labelled "output to surround adaptor C and E". Connect suitable cables from these points to the power amplifiers; the block diagram Fig. 7.10.6 shows connection details. **Note: When the Cat. No. 85 is installed in the Cat. No. 110L position (removing the Cat. No. 160) for House Equalization, the OBE power amp must be turned off or the center channel pink noise will be sent both to the center channel Cat. No. 64 and the OBE amp.**

7.10.3 Calibration of the Cat. No. 160 Card

a) You will need the following equipment for the alignment of the Cat. No. 160:

1. Real Time Analyzer with microphone
2. Sound pressure meter
3. Cat. No. 85 with connector adapter (Cat. No. 218) or pink noise source set at 600 mV (adapter is supplied with the Cat. No. 160)
4. Hand tools and soldering iron

b) The dip filter and output level on the Cat. No. 160 are aligned using pink noise. The pink noise is injected through TP1, the blue test point (see Figure 7.10.1). The pink noise sources used should be adjusted to 600 mV using a normal average reading meter (do not use an oscilloscope which measures peaks). If the Cat. No. 85 is used, the Cat. No. 218 connector adapter must be used in order to plug the Cat. No. 85 in place of the Cat. No. 108 (Optical Pre-amp). In addition, a jumper must be placed between the red test point on the Cat. No. 85 and the blue test point on the Cat. No. 160.

c) Turn controls 1, 2, and 3 fully counter-clockwise, and controls 4, 5, and 6 fully clockwise.

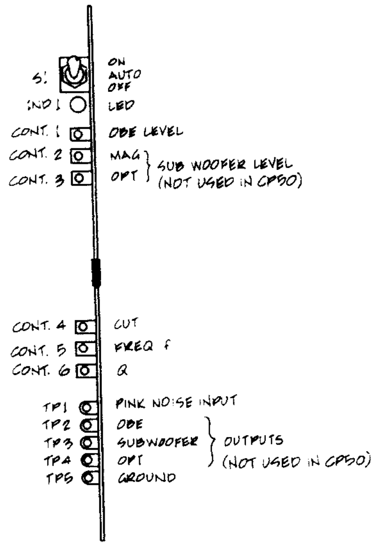
d) Set house fader and/or Dolby remote fader (if fitted) to normal settings. Switch CP50 to Stereo position.

e) Place S1 in "ON" position. Connect the pink noise source to TP1 (blue) on the Cat. No. 160. Adjust the OBE level control (control 1, see Figure 7.10.1) in conjunction with the power amp gain of the OBE channel to obtain a level of approximately 85 dBC in the theatre.

f) Observe the response on the RTA--it should look like Figure 7.10.3. Locate the primary peak in the response and with the controls set as above, adjust the frequency control (CONT. 5) so that the filter is over the peak. The response should then look similar to Figure 7.10.4. Adjust the "Q" and depth controls (CONT. 4 and 6) while observing the RTA, to obtain a response like Figure 7.10.5.

g) Trim the OBE level (Cont. 1) to 85 dBC with the house fader at its normal setting. This setting should be checked with stereo program material. Because different acoustic environments affect the propagation of low frequencies, an absolute level is difficult to define--a slight increase or decrease may be necessary. Turning the OBE channel on and off should never affect the quality of the speech in program material; if it does, the OBE level is too high and must be reduced.

h) Move S1 to AUTO. The OBE will now be activated when the CP50 is set to reproduce a Dolby SVA sound-track, but de-activated for standard mono sound-tracks, thus not upsetting the frequency response of standard mono prints.



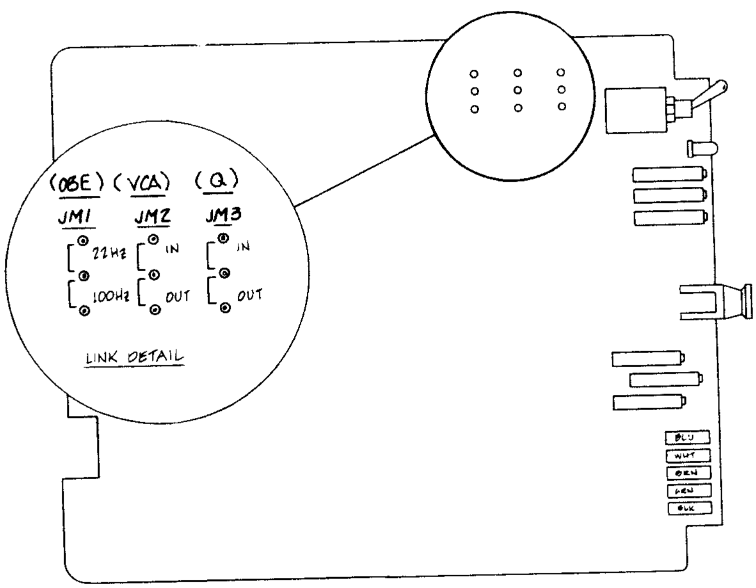


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Fig. 7.10.1 Controls and Jumpers

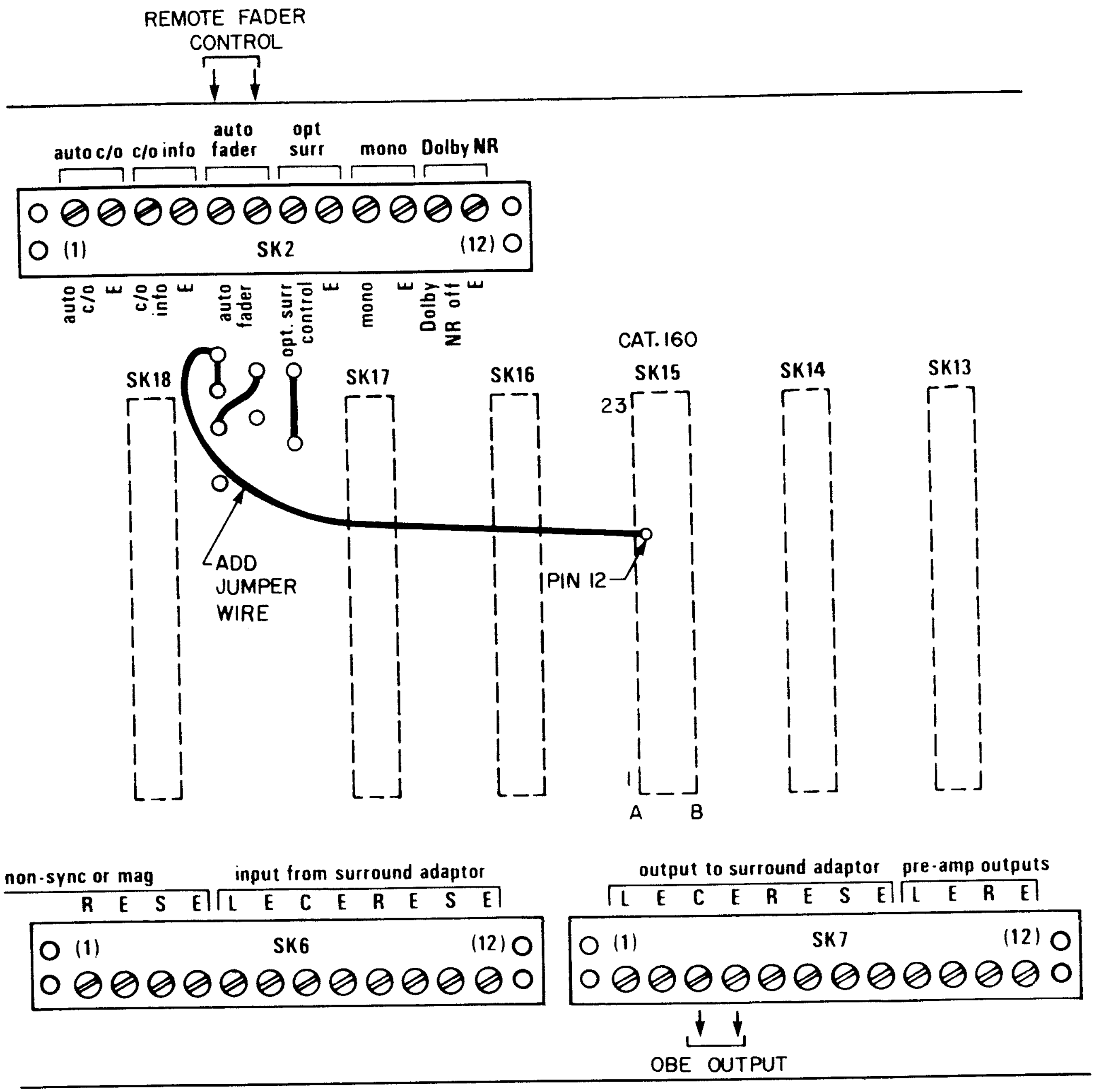


Fig. 7.10.2

Rear connections to CP50, and modification required to units prior to serial number 2260

Fig. 7.10.3 Before Adjustment

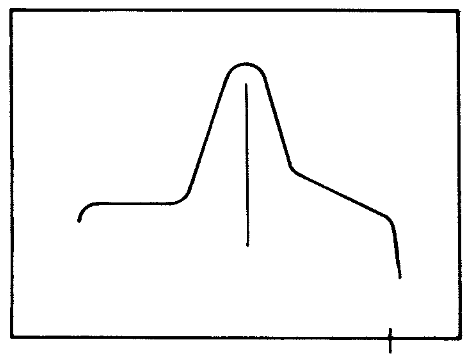


Fig. 7.10.4 Frequency Control

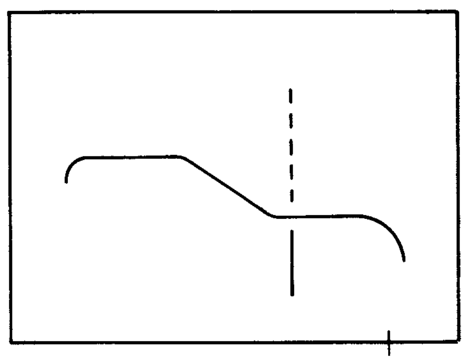
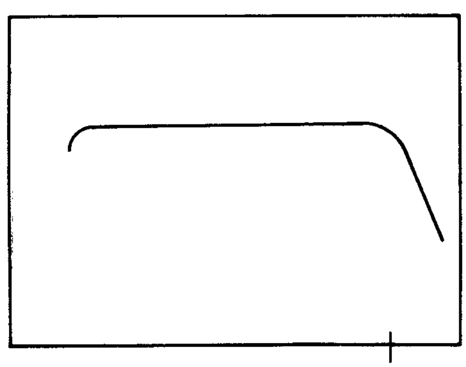


Fig. 7.10.5 Desired Response



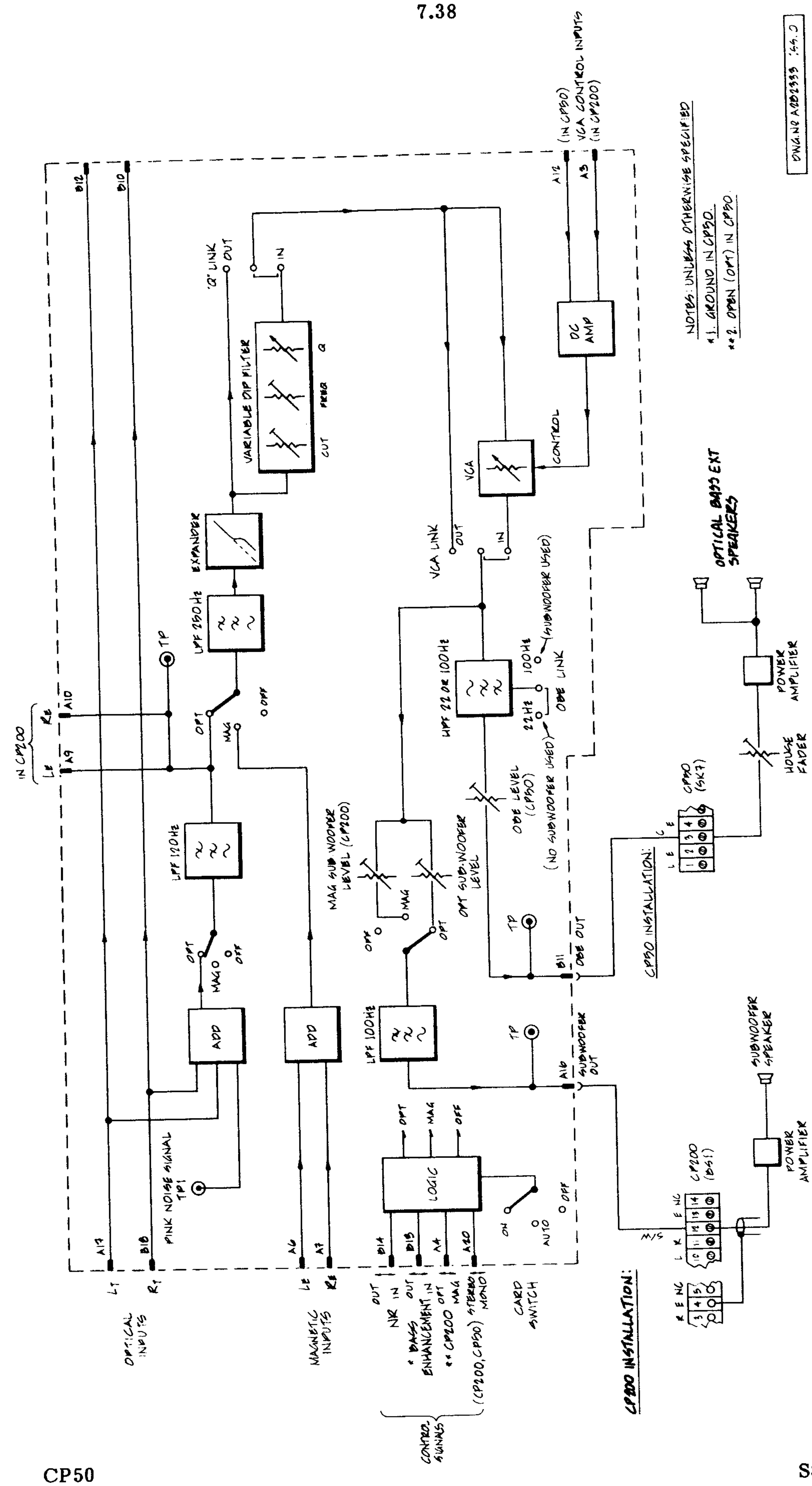


Fig. 7.10.6 Block Diagram

DOLBY LABORATORIES INC

FIELD BULLETIN NO. 89

DOLBY CAT No. 151 STEREO OPTICAL SURROUND LEVEL TEST FILM

This test film is intended for checking and adjusting surround loudspeaker auditorium levels, and does not require the use of any test equipment. Once correctly set as described below, no further adjustment of surround levels should be required. Variations in surround level between films thereafter will only be caused by differing selection of surround material by directors to suit the content of particular movies.

Description

The Cat No. 151 Test Film consists of pink noise at a calibrated level which switches at high speed between centre front and surround channels.

How to Use It

1. Make a loop from the film provided to suit the projector in use.

2. Set the theatre Dolby unit to Stereo mode, Surround in, Noise Reduction in. Check that all power amplifiers are on, and that the fader is at a normal setting. Make a note of the current setting of the delay thumb-wheel on the Cat No. 116 or Cat No. 150. While using the test film, the delay should temporarily be reduced to its minimum setting, marked "1" on the thumb-wheel. Now start the loop.

3. Next stand (or have an assistant stand) in the middle of the auditorium. By ear determine whether the level coming from the surrounds is the same as the level coming from the front horns. If it is not the same, reduce or raise the gain of the surround power amplifier or the Dolby output amplifier until the screen and surround levels sound the same.

4. Stop the projector and return the delay setting to its normal position, or check the delay calibration according to the technique described in the CP50 or CP100 manuals, or the notes provided with the Cat No. 150 module.

S79/2008

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San Francisco CA 94111
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SECTION 8

OPERATING INSTRUCTIONS

List of Contents

8.1 Operating Instructions - Optical Soundtracks

8.1.1 Select Optical position of top button of Switch card (12) (see drawing on next page). If Automation Switch is in use, refer to sub-section 8.3. Check the label on the film. If it has a Dolby encoded optical soundtrack, it should carry a label similar to this:

THIS FILM HAS A DOLBY ENCODED STEREO OPTICAL SOUND-TRACK

A. In theatres which have Dolby mono equipment (364 and E2 units): Select **Dolby Film** and **Optical**.

B. In theatres which have Dolby stereo equipment (CP100 or CP50 units): Select **Optical**, **Stereo** and **Dolby**.

C. In theatres which are not Dolby equipped: The sound-track will play as a conventional film with no adjustment. However, a wide range of characteristics exists in different theatres and tone controls, if installed, can be adjusted for best results.

Dolby Laboratories, Inc.
731 Sansome St., San Francisco, CA 94111 415-392-0300
346 Clapham Rd., London SW9. 01-720 1111

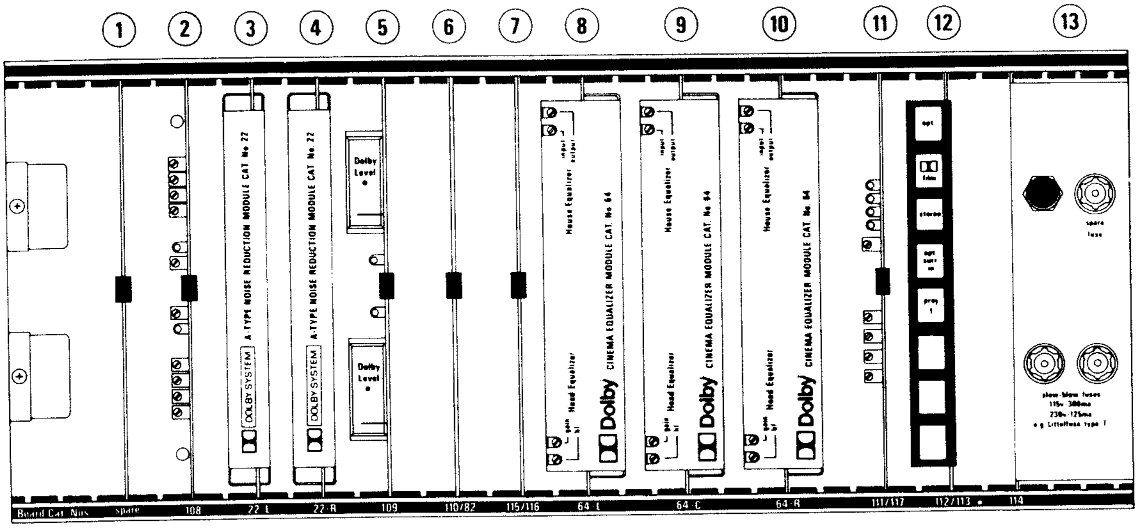
'Dolby' and the double-D symbol are trade marks of Dolby Laboratories Inc.

8.1.2 Occasionally the shipping cans may have been changed; if you are in doubt check with your local film exchange or examine the leader for any special messages.

8.1.3 For Dolby encoded films, select Dolby Film position of the second button from top of the Switch card (12) .

8.1.4 There are a few Dolby encoded monophonic films, so that very occasionally one may be encountered. Select mono position of the third button from the top of the switch card.

8.1.5 Most films however will be stereo, and the stereo position of the push button should be selected.



8.1.6 If the label indicates that the optical soundtrack also contains surround or other special information signals, make sure that there is the corresponding Dolby module in position (7) and select the Optical Surround In push button, (4th from the top). Films which contain surround information will play satisfactorily as normal stereo in cases where surround adaptors have not been installed.

8.1.7 If the optical soundtrack is not Dolby-encoded, it must be a conventional Academy mono print. Select non-Dolby film and the Mono by the appropriate switches. Fixed accurate Academy filters are automatically switched into the circuit. However, the house equalizers are retained to give accurate reproduction.

8.1.8 Set house fader to normal position and run film.

8.1.9 At the end of each reel, change projectors using the 5th and 6th push buttons. If an external changeover system is used, both these buttons must be in the released postion. (If one button is already depressed, slight pressure on the other will release both buttons.)

8.1.10 For playback of non-sync or magnetic sound tracks, release top push button.

8.1.11 <u>Routine Checks</u>

a) Dolby Level. From time to time (once a month for example) run a Dolby Level loop. Adjust the left and right gain controls (take care not to alter accidentally the hf contols) on the optical pre amp (2). Repeat for projector 2.

b) 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.

c) No other controls should need adjusting, since they are installation adjustments which require specialized test equipment (see installation section of manual). Should you feel for any reason that recalibration is necessary, please check with your local service organization before adjusting any controls.

8.2 Operating Instructions - Magnetic Tracks/Non-Sync inputs

8.2.1 Release top-most push button in switch card into the non-sync or mag position.

8.2.2 Output of CP50 is now from external non-sync source or magnetic soundtrack reproducer which should be connected to rear of CP50.

8.2.3 Set house fader to normal position, adjust non-sync playback level controls (if fitted) as normal, and start source.

8.3 Operating Instructions - Remote Facilities

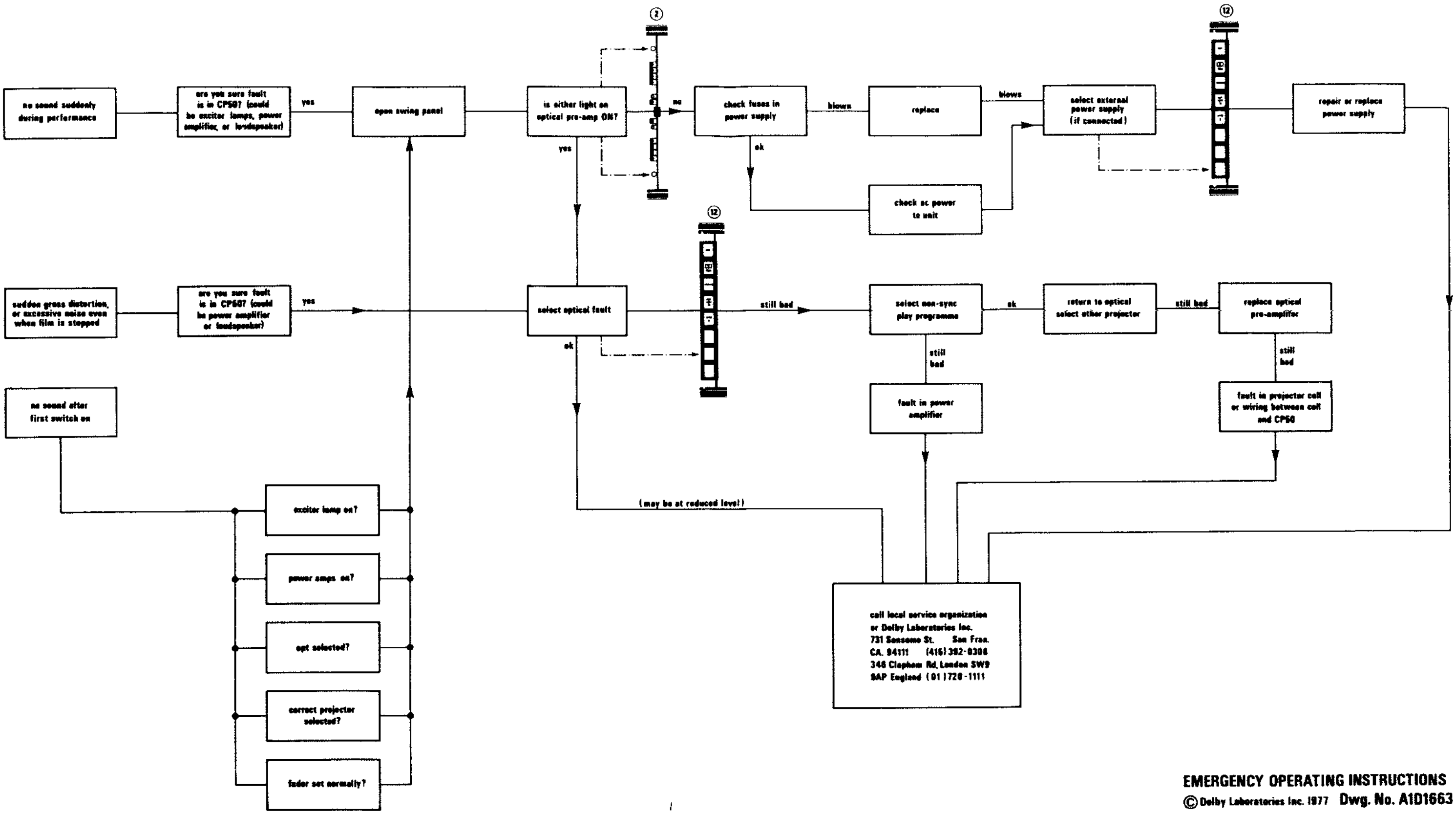
A. Remote Fader

1. If a Remote Fader output card (Cat. No. 117) is fitted in position (11) , the level from the CP50 can be controlled from a number of remote locations - such as by each projector.

2. If Dolby remote fader units (Cat 122/3) are used, the normal position is (7) . The memory dial can be set to allow the volume to be readjusted accurately after an intermission fade.

B. Automation Switch card

1. The automation switch card allows remote control of all CP50 normal operating modes. Switching is achieved by single-pole make contacts from an automatic programmer. Status of the unit is shown at all times by indicator lights.



EMERGENCY OPERATING INSTRUCTIONS

 Dwg. No. A1D1663