# Film-Tech

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

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

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

www.film-tech.com

DOLBY LABORATORIES
INSTRUCTION MANUAL

Dolby Laboratories Incorporated

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

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

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

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

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

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

S80/677/2789

## TABLE OF CONTENTS

## LIST OF ILLUSTRATIONS

# SECTION 1

# INTRODUCTION AND SPECIFICATIONS

## 1.1 Introduction

The Dolby CP200 provides the processing circuitry required to reproduce Dolby Stereo 70 mm magnetic and Dolby Stereo 35 mm optical film soundtracks, as well as all existing conventional and non-sync formats. The CP200 may be easily adapted to accommodate any likely future formats. The sophisticated electronic switching system with memory used in the CP200 allows the projectionist to select formats with unprecedented ease. The theatre sound system may be pre-programmed for automatic, instantaneous selection of up to four different formats and four projectors from memory during a performance. A wide variety of accessories are available to tailor the CP200 to a theatre's particular needs.

The basic CP200 consists of three interconnected 19" wide chassis, which together occupy 15 3/4" of rack space. The 7" high control/output unit houses the switching system and contains all operating controls. A 7" high processor unit contains processing circuit modules and a third 1 3/4" high chassis contains the power supply. Standby power supplies are available, as is an optional 7" high accessory unit for additional circuit modules as required.

Full remote facilities are provided, allowing control from each projector or from automatic programmers. Various remote control units are available as optional accessories.

This manual includes installation and adjustment procedures, specifications, and circuit diagrams, and is intended for use by installation and service personnel.

Operation instructions for projectionists are included in a separate manual. Additional copies of the operation manual are available from Dolby Laboratories.

## 1.2 Specifications

Signal Inputs

a) Optical: balanced inputs for two projectors, each with two-channel solar cells (available mounted on brackets for most projector types from Dolby Laboratories).

b) Magnetic: inputs for two 4- or 6- track magnetic projectors and preamplifiers, 50 k ohms input impedance, requiring 100 mV or 1 V (internally selected) for Dolby Level.

c) Non-sync: three switchable stereo input pairs, 7 k ohms input impedance, 100 mV maximum sensitivity.

d) PA microphone: mono input suitable for microphones with minimum impedance of 600 ohms.

Signal Outputs

a) Eight main output channels (five for the screen channels, one for mono surround and two for stereo surround); 60 ohms output impedance, will drive any load of 200 ohms and upwards. Maximum output level is +20 dBm before clipping. Typical operating level is 0 dBm (0.775 V) with rear switch in high position, -20 dBm (77 mV) in low position.

b) Subwoofer output feeds optical and magnetic bass extension signals to additional amplifier/subwoofer combinations if

installed; low output impedance, will drive any load of 1k ohms and upwards. Output levels are the same as for main channels. Internal trimming potentiometer for adjusting subwoofer level relative to main channels.

| | |
|---|---|
| Noise Reduction | Four Cat. No. 22 noise reduction modules for both tracks of 35 mm Dolby Stereo optical prints and tracks 1,3,5, and 6 on 70 mm Dolby Stereo magnetic prints. Professional Dolby A-type characteristic providing 10 dB of noise reduction from 30 Hz to 5 kHz, rising to 15 dB at 15 kHz and above. |
| Noise Level | With fader set at 7 (approximately 10 dB below maximum), output level of 0 dBm (0.775 V), equalizers set to flat position, and NR switched off, output noise in optical mode is typically -55 dB (20-20 kHz) or -60 dB CCIR/ARM weighted, referenced to Dolby Level (50% modulation). |
| Stability | System is highly stable and does not require alignment after installation. |
| Ambient Operating Temperature | Up to 40 degrees C. |
| Dimensions | Control, Processor, and Accessory Units; each 178 x 483 mm rack mounting (7 x 19 in.). Maximum projection behind mounting surface 280 mm (11 in.). Maximum projection in front of mounting surface (Control Unit), 32 mm (1.25 in.).<br><br>PS-1 Power Supply: 44 x 483 mm rack mounting (1 3/4 x 19 in.). Maximum projection behind mounting surface, 229 mm (9 in.). Maximum projection in front of mounting surface, 13 mm (1/2 in.). |
| Weight | Control Unit, 6.4 kg (14 lbs.); Processor Unit, 6.8 kg (15 lbs.). Accessory Unit, nominally 6.4 kg (14 lbs.); actual weight depends on modules supplied. |
| Mounting | Units can be installed in standard 19 in. (483 mm) racks or cabinets. |
| Power Requirements | Four selectable nominal operating voltages (+5, -10%): 100 V, 120 V, 220 V, 240 V. 50-60 Hz, single phase 200 VA. |
| Fuse Requirements | 6.3 x 32 mm (North American 3AG), 2 A slow-blow for 100/120 V, 1 A slow-blow for 220/40 V. |

## 1.3 General Description

| | |
|---|---|
| Construction | Chassis frame construction with plug-in modules accessible behind hinged front panels. Fiberglass printed circuits, solid-state devices throughout. |
| Signal Connections | Standard screw-type terminal blocks for signals and connections for projector changeover, Remote Units, etc. Solder-tag fanning strip supplied for each terminal block. Multi-pin Molex connectors on rear panel provided for automation interface. Prewired cables for interconnecting CP200 units supplied. |

| | |
|---|---|
| Optical Preamplifier | Cat. No. 108 stereo preamplifier for two projectors equipped with stereo solar cells. Adjustable slit-loss equalization circuitry for flat response with virtually any type of optical sound-head. |
| Magnetic Input Amplifier | Cat. No. 201 for two 4- or 6-track magnetic projectors and associated preamplifiers. Optional use of two Dolby MPU preamplifiers increases system capability to four magnetic projectors. |
| Center Channel Surround Decoder | Cat. No. 150 decoder complements special Dolby encoder used in the preparation of 35 mm Dolby Stereo optical releases to accommodate left, center, right, and surround channels on the two tracks of the film. The decoder incorporates a delay line to minimize front-to-surround crosstalk. |
| Theatre Loudspeaker Equalization | Three Cat. No. 64 modules provide wide, smooth response from the left, center, and right screen speakers, and match them to the acoustical characteristics of the auditorium. Each module has separate ±10 dB high and low frequency controls to adjust speaker response at the ends of the audible spectrum, and for smooth response in between, 27 independently-adjustable ±6 dB level controls for narrowband filters at 1/3-octave ISO center frequencies from 40 Hz to 16 kHz. Proper adjustment by Dolby trained installers provides the standard system response for all Dolby Stereo exhibition and dubbing theatres (ISO 2969). |
| Optical And Magnetic Bass Extension | Cat. No. 160 and Cat. No. 142 modules process low bass information from 35 mm Dolby Stereo optical tracks and tracks 2 and 4 on 70 mm Dolby stereo magnetic prints for bass extension utilizing screen speakers 2 and 4. Bass extension signals may also be fed to subwoofers if installed. |
| Remote Facilities | Facilities provided for remote control of format changeover, projector changeover, sound mute, fader, and format preselection (depending on type of optional Remote Units selected). Automation facilities built-in (some programmers may require a simple relay interface). |
| MPU Magnetic Preamplifier Unit | The optional MPU-1 Magnetic Preamplifier Unit provides preamplifiers for two 35 mm 4-track magnetic projectors (8 preamplifiers) and/or two 70 mm 6-track magnetic projectors (12 preamplifiers). Plug-in modules (Cat. No. 92) contain two preamplifiers, each of which has four screwdriver adjustable controls: gain, low frequency, mid frequency, and high frequency (gap loss). The MPU-1 is for use with all standard low-impedance heads, and higher impedance heads can be accommodated by moving solder links on the rear plane of the unit.<br><br>An optional surrround switch module, Cat. No. 93, is available for 35 mm 4-track magnetic films whose surround tracks contain a 12 kHz switching tone; an internal switch on the module selects either automatic (12 kHz) switching or manual operation (surround on).<br><br>A front panel switch selects 35 mm or -70 mm projector outputs, or provides for automatic selection. Projector changeover is normally performed by the CP200, which also provides power for the MPU-1. |

The panel measures 133 x 483 mm (5 1/2" x 19"), and the unit is designed for standard rack mounting along with the other CP200 units. Weight is 5.5 kg (12 lbs.).

Options

Cat. No. 202 Remote Unit (installs at projector for remote control of projector and/or format changeover and muting sound).

Cat. No. 204 Remote Unit (same as above plus fader and format preselect controls).

Accessory Unit (houses optional circuitry such as additional equalization and noise reduction modules).

Standby PS-1 Power Supply (allows instant continuation of show in event of failure of PS-1 supplied as standard).

Additional optical preamp, Cat. No. 108 (for two additional optical projectors or to back up optical preamp supplied as standard).

Dolby MPU magnetic preamplifier (for new magnetic installations or for updating existing ones). CP200 switching logic controls up to two MPU preamps for use with up to four 4- or 6-track magnetic projectors.

Interface module for adapting CP200 to monitoring requirements of dubbing theatres.

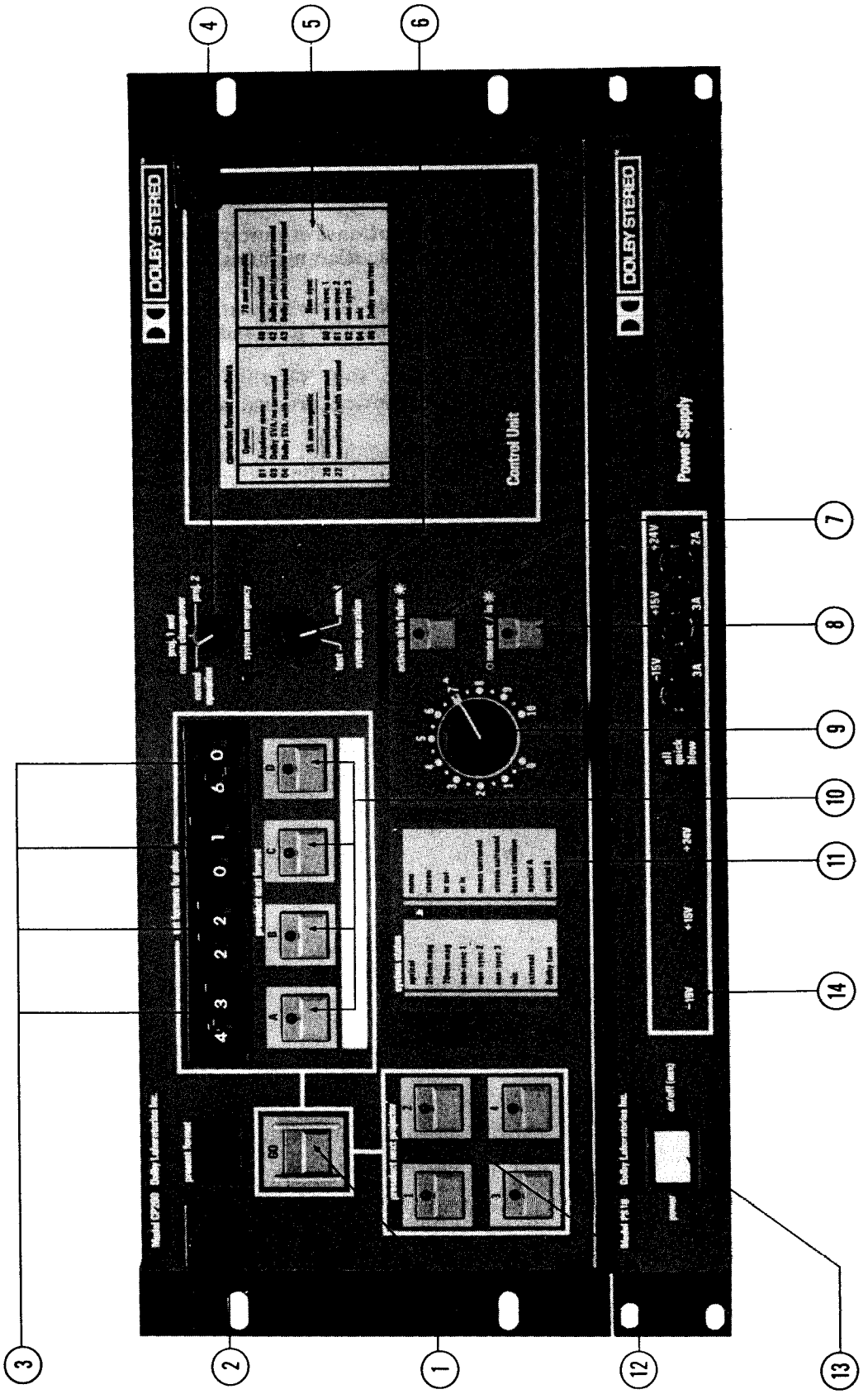



Fig. 1.1 Front View of CP200

## 1.4 Front Panel Controls

(1) 'GO' button changes mode of CP200 into format and projector preselected by buttons (10) and (12) .

(2) Numeric LED readout display shows actual format in use. Display flashes if format selected by (3) has not been programmed into CP200.

(3) 4 pairs of numerical switches for pre-setting formats used in the show.

(4) System Emergency switch bypasses signal processing in case of failure.

(5) List of common formats to aid setting of switches (3) .

(6) Normal/Test Switch.

(7) Button selects the control panel fader (9) .

(8) Mute button automatically fades signal over 3-second period; a second press (or pressing 'GO' button (1) ) cancels this fade, returning to level set by fader controls.

(9) Fader (eight channel ganged).

(10) Buttons to pre-select next format to be used.

(11) Tally lights show which functions (mono, surround, noise reduction, etc.) are being used in format in use.

(12) Buttons to preselect next projector to be used.

(13) Power ON/OFF (Aux) switch. In OFF position switches power to (optional) second power supply unit.

(14) Tally lights to show status of power supply.

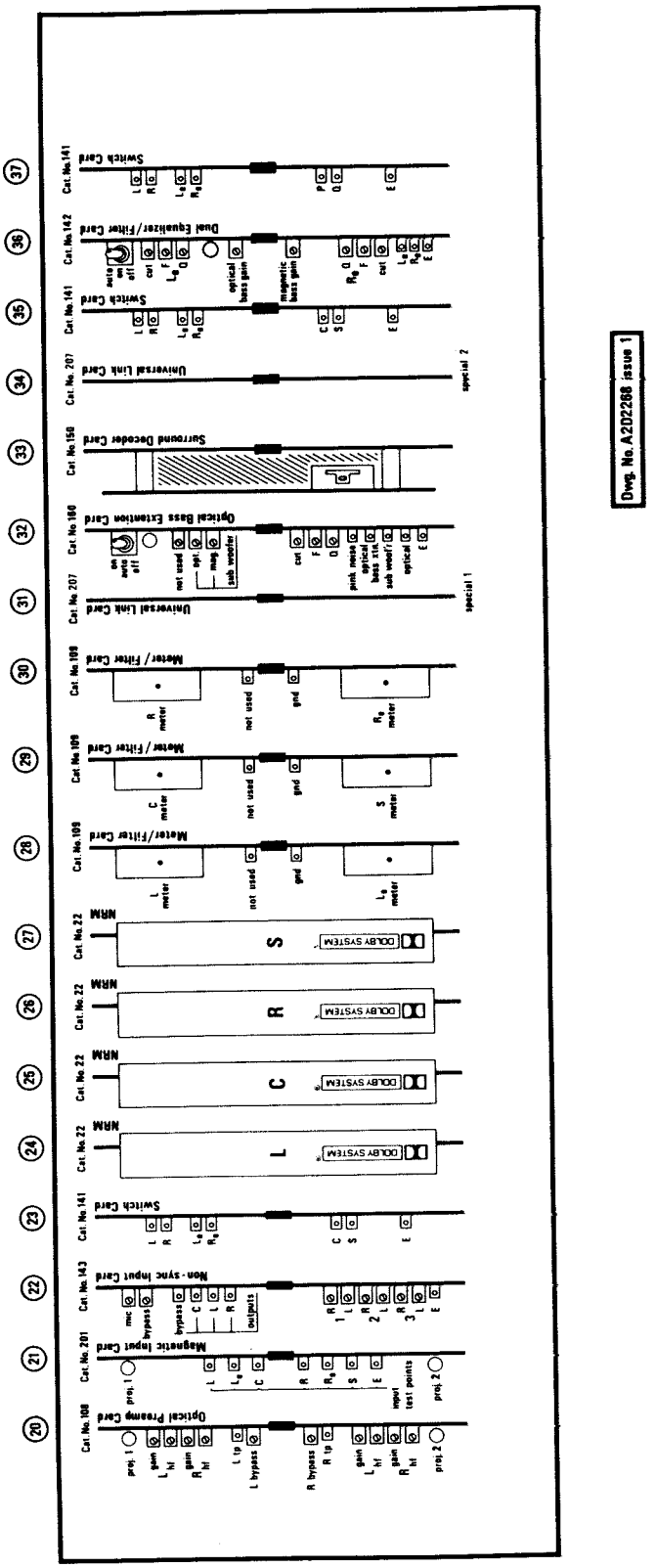



Fig. 1.2 Processor Unit

## 1.5 Processor Unit Modules

| | |
|---|---|
| (20) 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 of two projectors, each with front-accessed adjustment of gain and high frequency. |
| (21) Magnetic Input Card Cat. No. 201 | Contains inputs and switching for two projector/6 or 4 track magnetic systems. |
| (22) Non-sync Input Card Cat. No. 143 | Has amplifiers and switching for three stereo inputs and a mono mic input. Also contains bypass amplifier used in emergency situations. |
| (23), (35) & (37) Switch Card Cat. No. 141 | Contains three pairs of electronic two-pole, four-way switches to select and route signals in CP200. |
| (24), (25), (26), & (27) Noise Reduction Module Cat. No. 22 | Four noise reduction modules (NRM) Cat. No. 22 which are used to decode the sound tracks. |
| (28), (29) & (30) Meter/Filter Card Cat. No. 109C | Meters which indicate the signal level in all channels, and are used for setting up Dolby Level using special Dolby Tone film loops. Card also includes precision Academy filter which is switched in automatically when non-Dolby film is selected. |
| (31) & (34) Link Card | These spaces are provided for future developments; the link card ensures signal continuity. |
| (32) Optical Bass Extension Card Cat. No. 160 | This card extracts low frequency signals from optical film for use with the normally-unused $L_e$ and $R_e$ amplifier and speakers. The card also contains separate controlled outputs for a sub-woofer system if one is installed in the theatre. |
| (33) Decoder Card Cat. No. 150 (stereo with surround) | 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 Dolby optical tracks into left, center, right and surround channels. |
| (36) Equalizer/Filter Card Cat. No. 142 | Two-channel low pass filter to extract low frequency signals from Dolby magnetic 70mm soundtracks. Special circuits remove the usual low frequency resonances of the speaker/auditorium combination. |

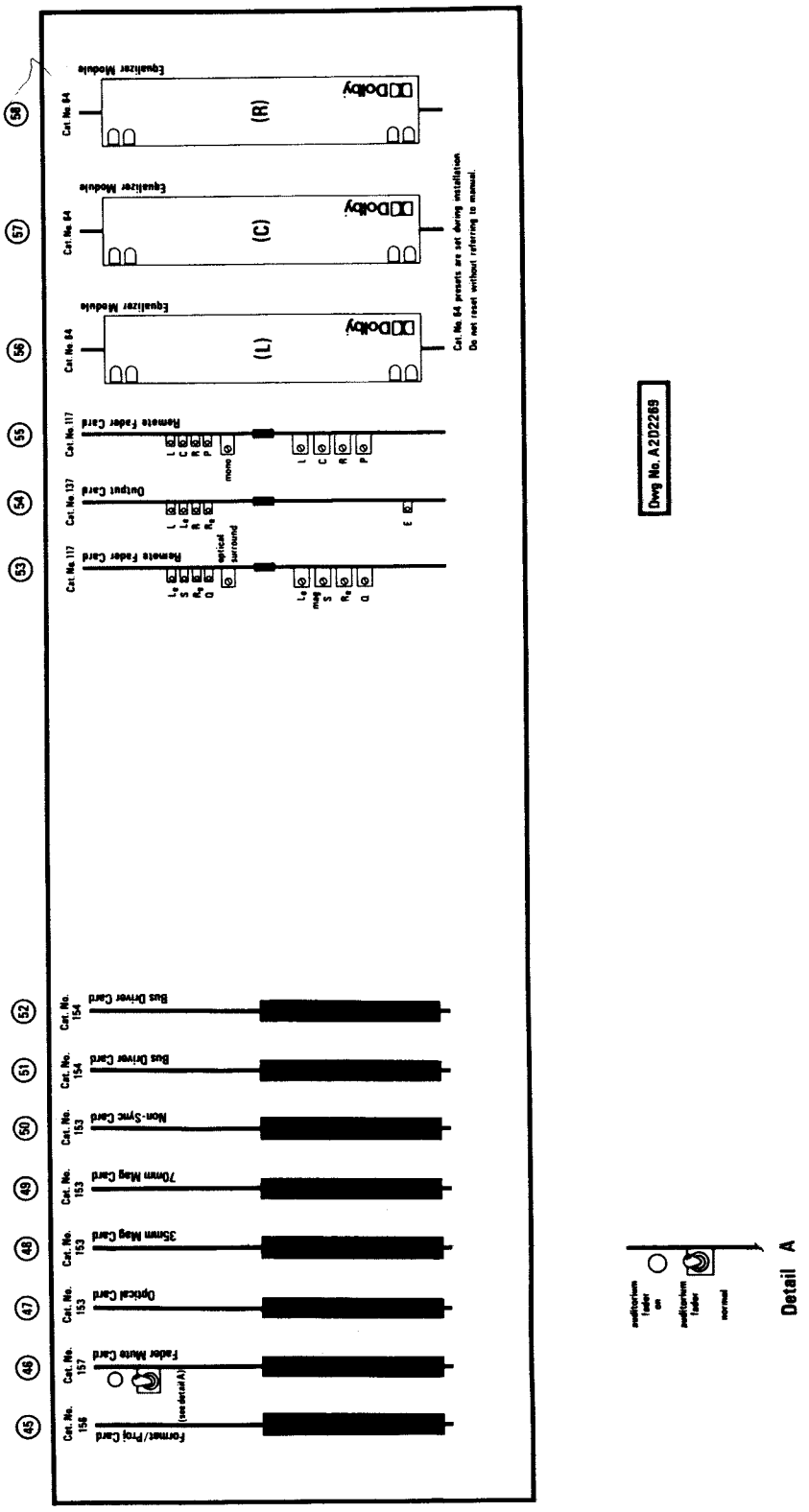



Fig. 1.3 Control Unit

## 1.6 Control Unit Modules

| | |
|---|---|
| (45) Format/Projector Logic Card Cat. No. 156 | Logic circuits which interpret position of front panel controls. |
| (46) Fader/Mute Logic Card Cat. No. 157 | Circuitry for local and remote fader selection, and for mute feature. |
| (47), (48), (49) (50) Format Decoder Cards Cat. No. 153 | Cards decode selected front panel format switches; supplied pre-wired and identified for optical, 35mm mag, 70mm mag and non-sync. Each card contains switches to allow special formats to be set up. |
| (51) & (52) Bus Driver Card Cat. No. 154 | Power drivers which transmit information from decoder cards (47) - (50) to drive the various control lines in the CP200. |
| (53) & (55) Remote Fader Card Cat. No. 117 | Fader card containing remotely controlled four-channel fader. Fader action is by a single dc control (local or remote) 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. Module contains two output amplifiers. |
| (54) Output Card Cat. No. 137 | This card contains four output amplifiers. The complete package of two Cat. No. 117 cards and one Cat. No. 137 provides eight channels of faders and output amplifiers. |
| (56), (57), (58) House Equalizer Modules Cat. No. 64 | Three cards containing 1/3 octave filters to provide optimum frequency response in the auditorium. |

# SECTION 2

# INSTALLATION

## 2.1 Introduction

(a) Installation of the CP 200 is not difficult, but requires specialized knowledge and equipment. Once installed, the CP200 is very stable and under normal circumstances will only need a simple periodic adjustment to compensate for a new or aging exciter lamp or wear in the magnetic head clusters.

Before starting the installation, take a few minutes to look at the block diagrams at the end of section 4. 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 CP200 and the rest of the existing system.

Numbers in the text ie. (3) , identify controls, modules and cards, as indicated in the drawings Fig. 1.1 to 1.3 at the beginning of this section.

(b) 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. By doing this you will get a good idea of the state of the system and any problems that may already be present. This will enable you to distinguish between existing problem areas and any generated or revealed by the CP200 installation.

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

## 2.2 Equipment needed to install and align the Dolby Cinema Package

Equipment and materials needed are listed below. If the installation wiring has been prepared and placed in position prior to the alignment, the wiring materials will not be required, and references in the text to making wiring harnesses should be ignored.

**TYPICAL INSTALLATION EQUIPMENT**

(a) 2-conductor shielded (screened) cable, such as Belden 8451, to connect CP200 to power amplifiers and to connect existing magnetic pre-amplifiers to the CP200. 4-conductor shielded cable, such as Belden 8404, to connect the optical cells to inputs of CP200 (If 4-conductor cable is not available, two runs of 2-conductor cable can be used).

(b) A standard tool kit, including a small-bladed screwdriver or alignment tool for the front panel preset controls.

(c) A set of Dolby Test Film loops (Dolby Cat. No. 69, 97, 151); see Fig. 2.2 on page 20. Standard Magnetic Test Films also required.

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

(e) A real-time analyzer (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 its frequency response.

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

(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 (Tandy) Cat. No. 42-3019.

(l) A.C. millivoltmeter.

## 2.3 Brief Description of Cat. No. 85C Pink Noise Generator

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.

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

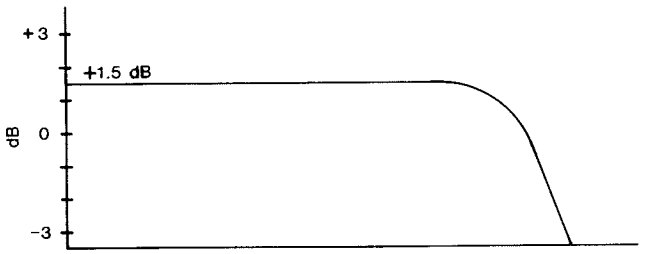



Figure 1
Center & Left channel, both in phase.

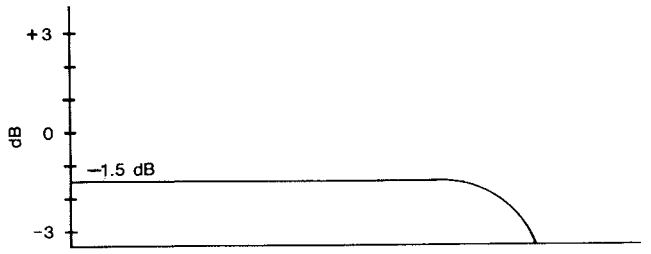
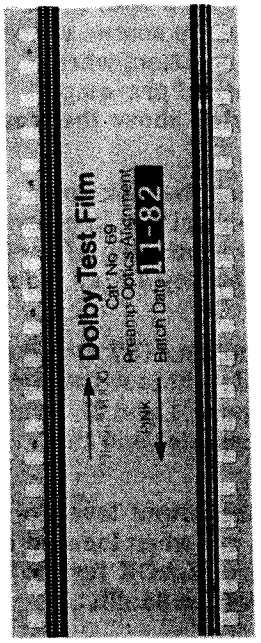
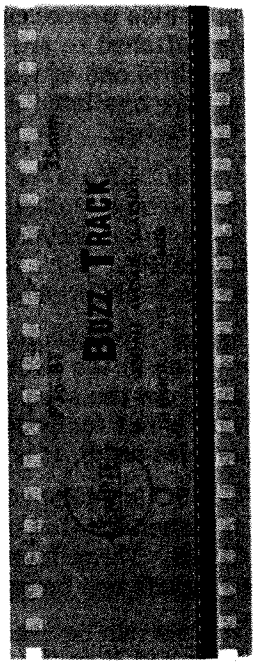



Figure 2
Center & Left channel, one reverse phase from the other.

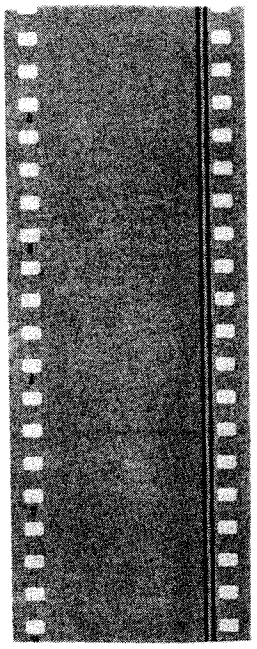



Dolby Tone Pink Noise

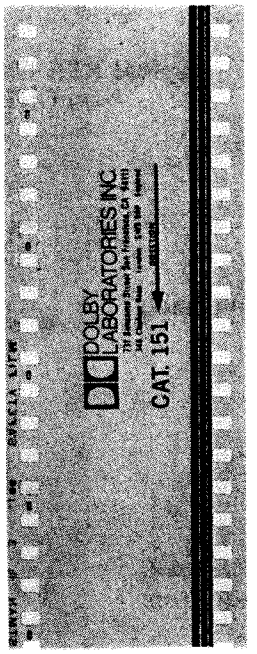
Dolby Cat. No. 69




SMPTE Buzz Track

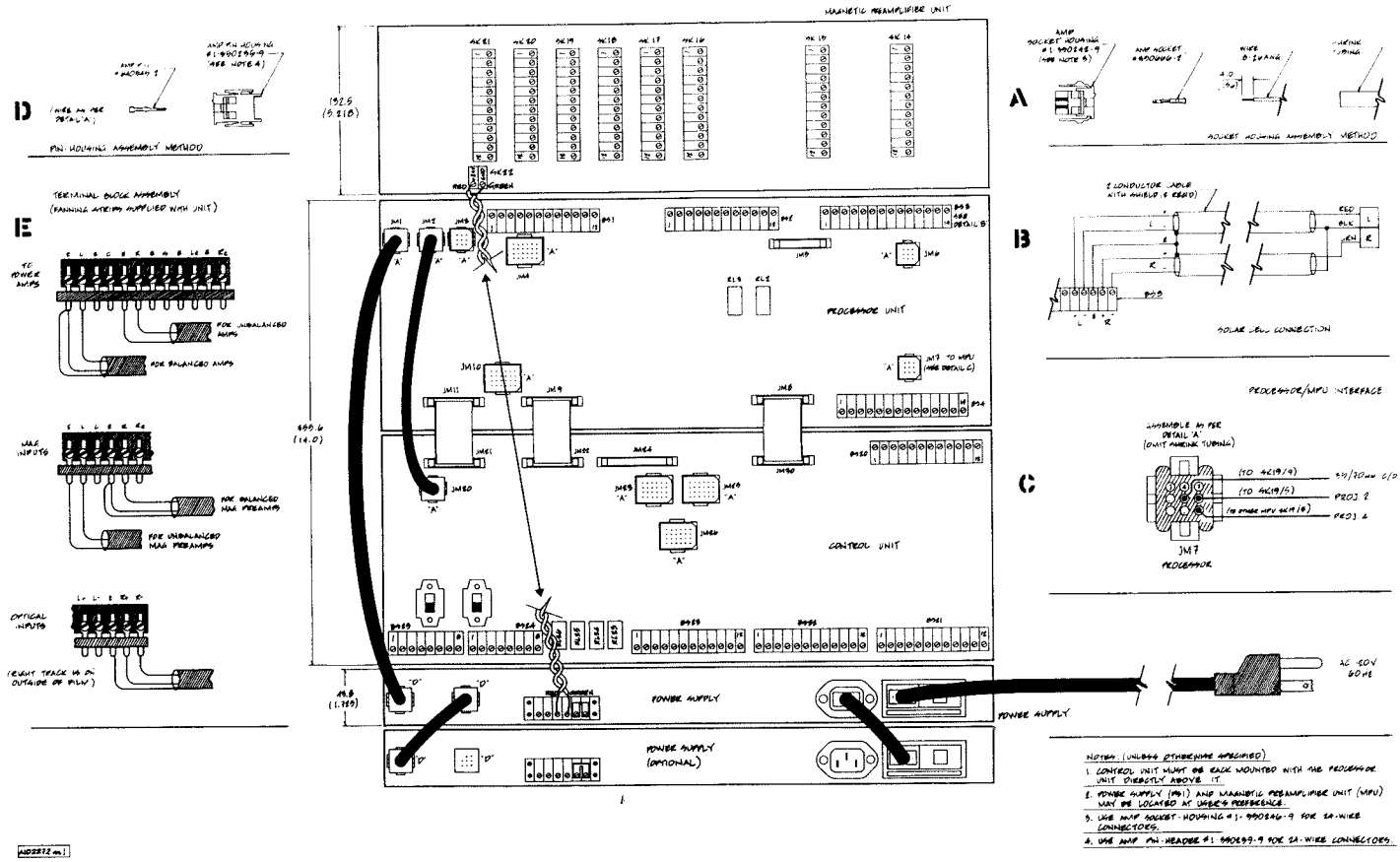


Left-Right
Dolby Cat. No. 97




Center-Surround
Dolby Cat. No. 151

Fig. 2.2 Test Films




S83/2491/5090

Figure 2.3 CP200 Interconnection Diagram

## 2.4 Basic Installation Procedure

**INITIAL EXISTING SYSTEM CHECK**

(a) The installation is divided into the B-chain first (auditorium equalization) followed by the A-chain (sources and signal processing).

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

(c) Install the units in a standard 19" rack assembly. The preferred order is (from top to bottom): Magnetic Preamplifier Unit - MPU (if purchased), Accessory Unit (if purchased), Processor Unit, Control Unit, Power Supplies. Other arrangements are acceptable and special connecting cords are available on application. However, power line transformers such as in power supply units must not be placed close to sensitive input areas such as the Processor Unit or Magnetic Preamplifier Unit. If the Accessory Unit is being installed, do not connect it to the main units at this time.
**NOTE: The reliability of electronic equipment depends critically on the temperature of the equipment. While the CP200 is designed to be self-ventilating, do not place it above hot power amplifiers. Always install heat deflectors between the CP200 and other equipment or use forced ventilation when mounted in the same cabinet as other heat-producing units.**

(d) Check the line voltage at the point of installation.

(e) Refer to Figure 2.4 and orient the voltage selector board within the "AC IN" power receptacle for the line voltage to be used (100 V, 120 V, 220 V, or 240 V).

**POWER VOLTAGE SELECTION**

(f) Verify that the proper fuse is installed in the fuse holder:

| LINE SETTING | FUSE TYPE |
|---|---|
| 100 V or 120 V | 2A, 250 V, slow blow |
| 220 V or 240 V | 1A, 250 V, slow blow |

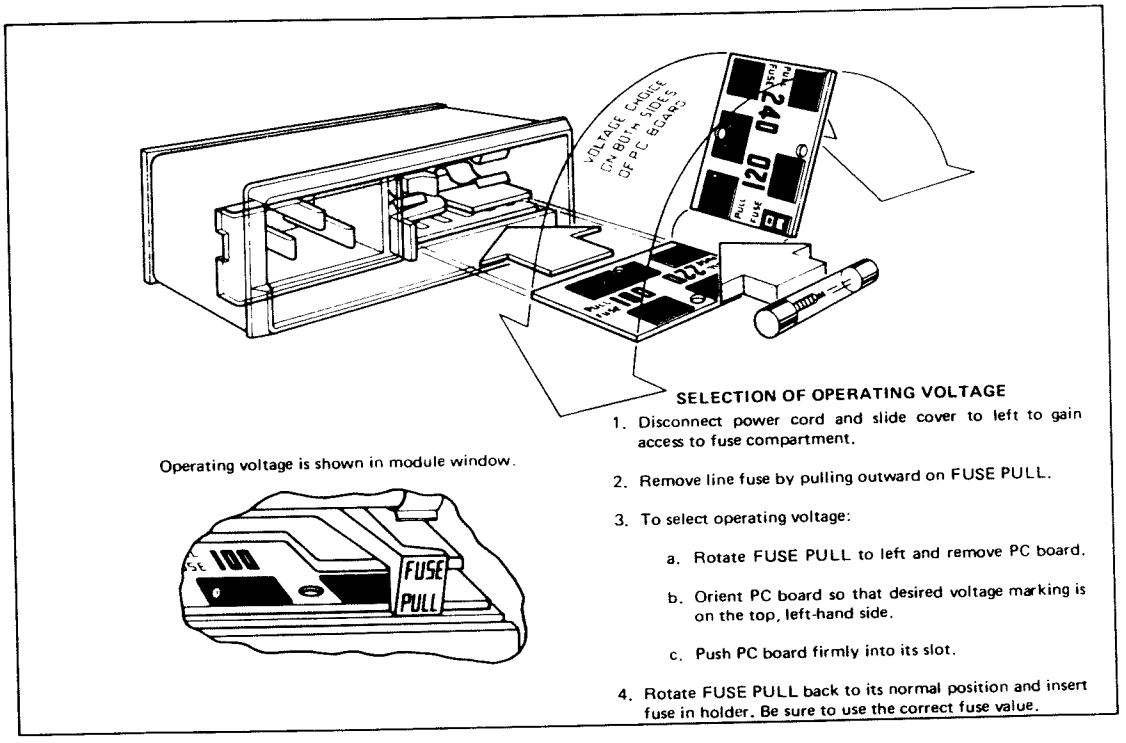



Fig. 2.4 Power Line Voltage Selection (shown for 100 V)

(g) If you require a power line connector other than the type moulded on the cable supplied, attach the appropriate plug to the power cable and connect
cable. The following wiring convention should be observed (for cables supplied with units):

| | |
|---|---|
| US-style wiring code: | Hot or Live = black; |
| | Neutral = white; |
| | Ground = green. |
| IEC/Continental-style wiring code: | Live or Hot = brown; |
| | Neutral = blue; |
| | Earth = yellow/green. |

(h) Connect the power line cable to the PS-1 AC IN connector, and connect the various pre-made interconnecting cables between the units. For connection details, see Fig. 2.1. If a second power supply is used, verify that the voltage selector on this second unit is correctly set as above, and connect the special power cable between the main and secondary power supplies.
**NOTE: If the secondary unit is switched on, power is switched to it automatically when the main unit is switched off. Check that the rear link on the barrier strip connects chassis to DC ground. Occasionally groundloop hum may be reduced by disconnecting this link.**

(i) Check that the miniature plug-in relays on the rear panels are securely pushed into their sockets (two on the Processor Unit and four on the Control Unit).

**OUTPUT CONNECTIONS**

(j) Connect the CP200 outputs directly to the inputs of the associated power amplifiers. For the moment leave the power amplifier gain settings at normal positions (see Fig. 2.5 for correct designation of tracks and speakers).

(k) Connect a high quality (preferably stereo) source to the Non-sync 1 input.

(l) Do not connect optical or magnetic inputs or remote control units at this time.

## 2.5 Initial Set-up Of CP200

**INITIAL ADJUSTMENTS ON CP200**

(a) Adjust controls in following order:

(i) Turn 'Fader' (9) to '0' (minimum).

(ii) Set 'System Emergency' (4) to normal.

(iii) Turn all the Cat. No. 64 House Equalizer (56), (57), (58) input controls to minimum (fully counterclockwise).

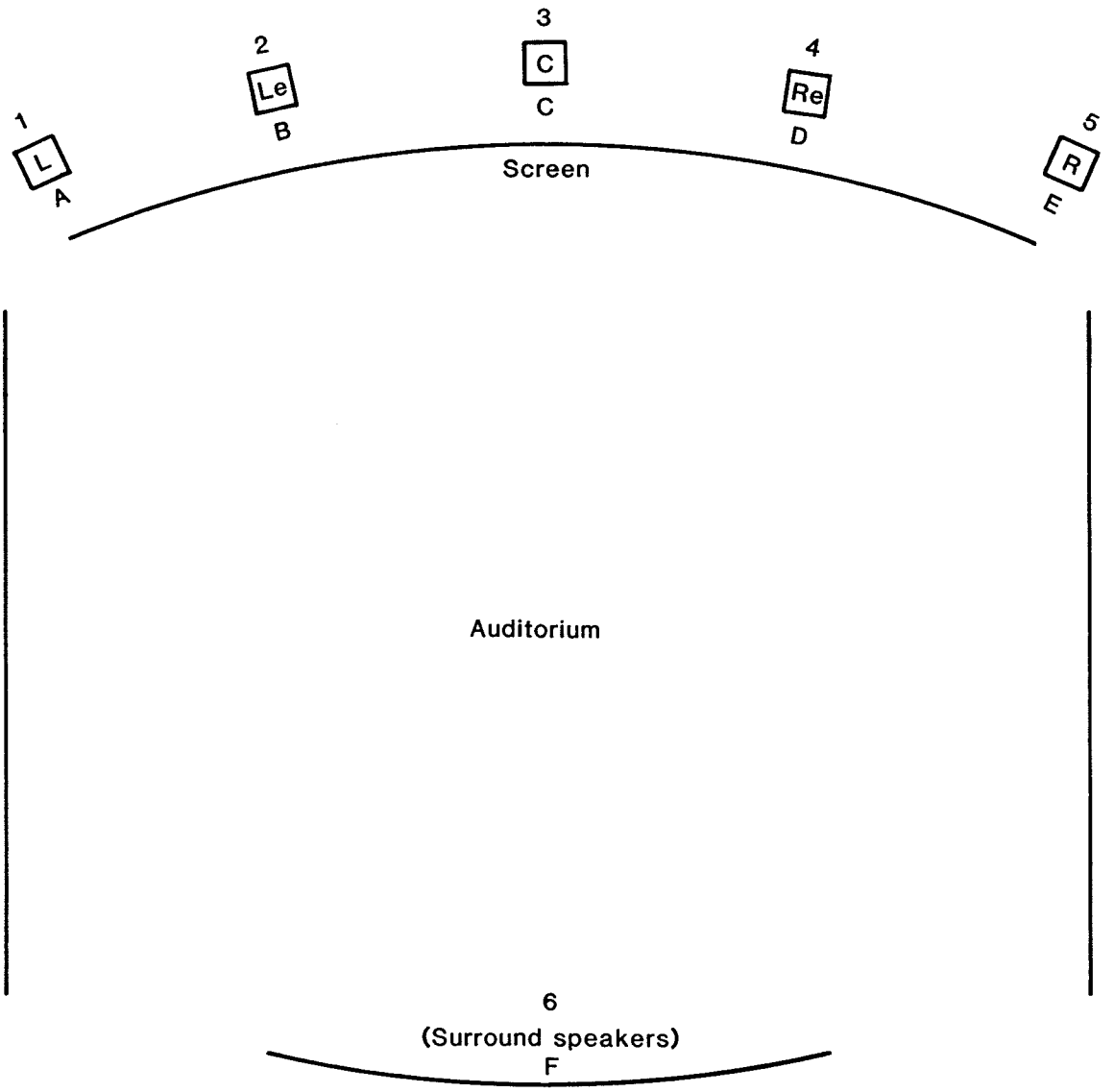



Fig. 2.5 Designation of Speakers and Tracks

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

The only exception to this arrangement occurs if the extreme Left and Right positions are situated behind thick drapes or equivalent masking. Then the positions of $L_e$ and L, and $R_e$ and R should be reversed with the CP200 L output going to the amplifier/loudspeaker marked B and the $L_e$ output to amplifier speaker A the R and $R_e$ speakers in a similar fashion. Alternatively, the CP200 may be programmed to interchange speakers A and B automatically depending on the position of the drapes (i.e. if they cover A for some formats). In this situation, the Accessory unit with full equalizers for speaker B and D must be purchased.

**NOTE: In certain countries (notably Japan) the 70 mm tracks are numbered with L = 5, $L_e$ = 1, C = 2, $R_e$ = 3, R = 6 and S = 4. 35 mm tracks are numbered L = 1, C = 2, R = 3 and S = 4.**

(b) Turn on power to the CP200 and power amplifiers. If possible, do not turn on power to the projector at this time. Switch ON the power supply (13). The +15 V and -15 V indicator lights (14) should come on immediately. The +24 V light should come on after a few seconds time delay.

(c) Set up for playback of a non-sync source on CP200 as follows:

i) Switch 'Set Formats for Show' D (3) to '60' (Non-sync 1).

ii) Press 'Preselect Next Format' D (10) (internal lamp should flash).

iii) Press 'Go' button (1). Light inside format preselector (10) should stop flashing and come on continuously; numeric readout (2) should change to '60'.

(iv) Advance trimpots on fader modules (53) and (55) by 5 turns; cards are initially supplied with these controls at minimum setting.

(v) Play a non-sync source and advance the fader (9). Sound should be heard in the auditorium. Return fader to zero. If no sound results, verify that 'Mute' button (8) is not operative (light not flashing) and 'Activate this Fader' (7) is on. The actual level is unimportant at this time.

2.6 Adjustment of House Equalization (Main Channels) and Auditorium Level

(a) Set format 66 on one of the four numeric lever switches (for example C) and press corresponding 'Preselect Next Format' button. Press 'GO' button. The Dolby calibration tone will now be generated internally. The L, C, R, and S meters (28), (29), (30) will indicate Dolby level.

(b) Connect a millivoltmeter in turn to L, C, and R testpoints on the Remote Fader card (55) set input controls on all Cat. No. 64 House Equalizer at minimum, and then adjust the corresponding Cat. No. 64 House Equalizer output level control (56), (57), (58) for a reading of 150 mV (-14.3 dBm).

(c) Verify that the voltage at the S test point on the Remote Fader card (53) is about 300 mV.

(d) Preselect format D and press the 'Go' button to remove Dolby calibration tone.

(e) Place rear switches S20 and S21 in the position corresponding to power amplifier sensitivity. In the low position, output level is approximately 100 mV (-18 dB); in the high position, approximately 1 volt (+2 dB). If in doubt, initially place these switches in the low position.

(f) Press the mute button (8) to protect the auditorium loudspeakers. Remove the switch card Cat. No. 141 from position (35). Do not remove the nearby switch card (37) at this time. Plug in its place a Cat. No. 85C Pink Noise Generator. Set the generator card switches to PN and left channel. Other channels should remain off.

**(NOTE: Switches are down for 'On', and up for 'Off'.)**

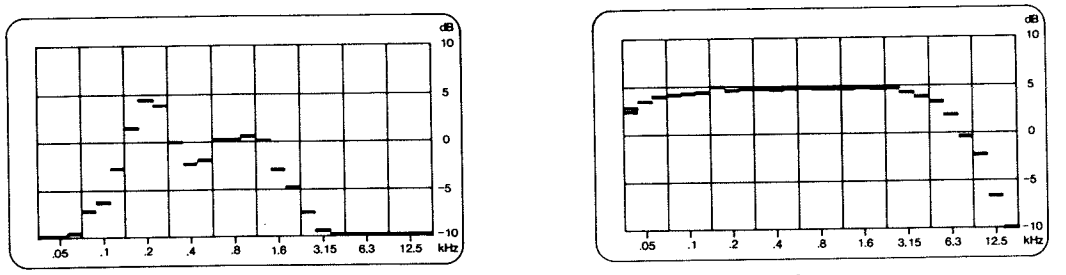
**NOTE: Cat. No. 85 pink noise generators prior to Serial No. 85-2-253 require field modification to work in CP200 units. Modified units are identified by a yellow sticker on the cover. All Cat. No. 85B units work correctly in the CP200; these do not carry the sticker.**

**The reason for this change is that the signal levels in a CP50 or CP100 are 600 mV at the insertion point of the Cat. No. 85, but 360 mV in the CP200. Therefore the Cat. No. 85 was designed to put out 600 mV. Modified units automatically switch between 600 mV and 360 mV depending on which unit they are plugged into. Thus, in an emergency situation, an unmodified (600 mV) unit will give approximately correct results if the main fader in the CP200 is moved from the normal calibrated position of "7" to "6". Remember to reset the fader to "7" when the auditorium levels have been set and the generator has been removed from the CP200 frame.**

(g) Connect the calibrated microphone to the real-time analyzer and place it in an average position about 2/3 of the way back in the reverberant field (not on the center line of the theatre and not directly on the speaker axis). The microphone should be about 5 feet (1.5 m) above floor level, and angled at about 45 degrees upward towards the screen.

(h) Remove L Cat. No. 64 Equalizer module (56) , remove the cover over the controls, and replace it with the special Equalizer Extender module Cat. No. 67. Plug the removed Cat. No. 64 into the extender. Set Local Fader (9) to position 7 and set the power amplifier gain controls for typical levels. Press the mute switch again to activate the auditorium speakers (flashing light in mute switch should go out). Check that the local fader is selected (indicator light in 'activate this fader' remote fader push-button (7) should be illuminated). If it is, press button once. Adjust the L Trimpot on the Remote Fader card (55) . Advance the trimpot and check that pink noise can be heard in the auditorium. Continue to advance the trimpot and analyzer gain until a trace is visible on the screen. Turn off the pink noise source momentarily to verify that the pink noise level is well above (about 20 dB) ambient noise. If the microphone and analyzer have been calibrated against a sound pressure meter, set the level at about 85 dBc. If there is insufficient signal level, return the fader control to zero, move rear switch S2 to the high position and return the fader to its previous position.

**NOTE: The CP200 is designed for use as the main control unit in the theatre. Thus its fader should be used in preference to the theatre's existing fader. If the existing fader is retained, and it has a large attenuation at its nominal setting, there may be insufficient signal available at the inputs to the power amplifiers. For example, if the fader has 14 dB of attenuation at its usual setting, the normal maximum output of the CP200 (with its fader set at 7) of 1 volt is attenuated to 200 mV. In this case, the preset controls on the CP200 Remote Fader card should be set at maximum, the existing fader should be turned up to a new 'normal' setting which does drive the power amplifiers correctly, and the CP200 fader used for normal use. In the rare case when the house fader must be retained at its established nominal position, then it should be increased temporarily (as above) for the installation. When the installation is completed, the house fader can be returned to its usual position and the CP200 fader increased from its standard 7 position to bring the sound to the correct level. However, this is strongly discouraged, since if much equalization is required for the speakers, high frequency clipping can easily occur.**




before after

Fig. 2.6 Auditorium Equalization

(i) Commence equalization by turning the 40 Hz band fully down. Adjust the bass and treble controls on the Cat. No. 64 module to obtain a response in the 8 kHz band about 6 dB below the mid band frequencies. Adjust the 27 third-octave bands to achieve a flat frequency response up to 2 kHz, descending at 3 dB per octave to 8 kHz (-3 dB at 4 kHz, - 6 dB at 8 kHz).

NOTE: The auditorium response is not rolled off as indicated by the analyzer trace. Because pink noise is a steady-state signal, the 'sound' heard or measured in the auditorium is the sum of the direct signal and all the reflections. Measurements show that if pink noise is calibrated with the apparent roll-off beginning at 2 kHz, then in an average-sized auditorium the response is flat with normal program material.

Above 8 kHz, allow the speaker to determine roll-off. CAUTION: Do not try to adjust 1/3 octave controls 8 kHz and above. Double-check the results if adjacent potentiometers show great differences between settings. If adjacent potentiometers have alternately counter-clockwise and clockwise settings, the result will be fairly flat frequency response 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. 2.6 above.

(j) If necessary, the coarse bass and treble controls may be adjusted to minimize adjustment of the one-third octave band potentiometers. The House Equalizer output level control may be adjusted to compensate for small 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 analyzer trace decreases at high frequencies, and often increases at low frequencies.

(k) Move the microphone to other positions in the auditorium and check that a good average equalization has been achieved. Compromises may be required in extreme seating positions. Make a note of the settings on the white card supplied inside each Cat. No. 64. This information may be invaluable if settings are accidentally changed. Finally, add the appropriate identifying sticker to the front of the Cat. No. 64 cover to indicate its position, replace all covers on the module and replace the module in the CP200.

(l) Check that the main fader has not been moved since step (h). Adjust the L trimpot on the right hand Remote Fader card (55) for a sound pressure level of 85 dBc near the center of the auditorium.

(m) Switch pink noise off on the left channel, and repeat the equalization process (steps h-l) for the C and R channels, checking that the sound pressure levels produced by each of three front speakers match at 85 dBc. If the power amplifiers will not produce this level with adequate overload margin, they should be replaced.

2.7 Equalization of Remaining Channels

(a) This section will discuss the equalization of the $L_e$, $R_e$, Surround and Stereo surround channels (the stereo surround channels are designated P for left back surround and Q for right back surround). The P and Q channels are used when the accessory unit and appropriate modules have been installed. If this option has not been installed, ignore the P and Q calibrations described below.

**HOUSE EQUALIZATION of $R_e$, $L_e$ AND S CHANNELS**

(b) Move the toggle switch on the Cat. No. 142 Equalizer Filter card to the 'Off' position (down). Select $L_e$ on the Pink Noise Generator and adjust the $L_e$ trimpot on the left Remote Fader card (53) for a sound pressure level of 85 dBc, or to the level set in 2.6 (m) above if different. The shape of the response will depend on the auditorium and speaker characteristics. The accessory unit has provision for adding equalizers in the $L_e$, $R_e$, S, P and Q channels. These equalizers are aligned following the Accessory Unit instructions.

(c) Repeat for $R_e$ and S channels.

(d) Select $L_e$ again on the Pink Noise Generator, and move the toggle switch on the Equalizer Filter card Cat. No. 142 (36) to the center or 'On' position. Observe the real time analyzer display of the signal in the auditorium. The frequency response should roll off sharply above about 200 Hz. Switch the filter in and out by toggle switch to check filter operation, and note auditorium level with the filter out. If low frequency response rolls off, remove the Equalizer filter card and check that the two soldered links are in place. These links are removed if a separate sub-woofer channel is used. See Section 2.12.

(e) Set format 04 on an unused preselector, and press 'GO' to switch the Cat. No. 142 into the optical mode.

(f) Adjust the Optical gain control on the Equalizer filter card to obtain a level (with the filter in) which is 4-6 dB above the level with the filter out. This is a rough adjustment and will be trimmed after the other controls are adjusted (Step (n)).

(g) Set format 42 on same preselector, and press 'GO' to switch the Cat. No. 142 into the magnetic mode.

(h) Adjust the Magnetic gain control on the Equalizer filter card to give a level 4 to 6 dB above the level with the filter switched out. This is a rough adjustment and will be trimmed after the other controls are adjusted (Step (m)).

(i) Three controls affecting the setting of a variable dip filter are also on the Equalizer filter card. This filter is intended to remove the effect of even the largest room on speaker resonance in the low frequency range, typically between 80 Hz and 150 Hz (depending, of course, on the particular room and speaker combination).

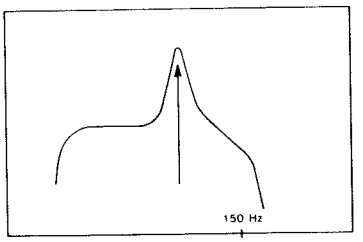



Fig. 2.7
Initial Response

Figure 2.7 shows a typical response of the output of the low frequency card, measured with pink noise in the auditorium, without the variable dip circuit in use.

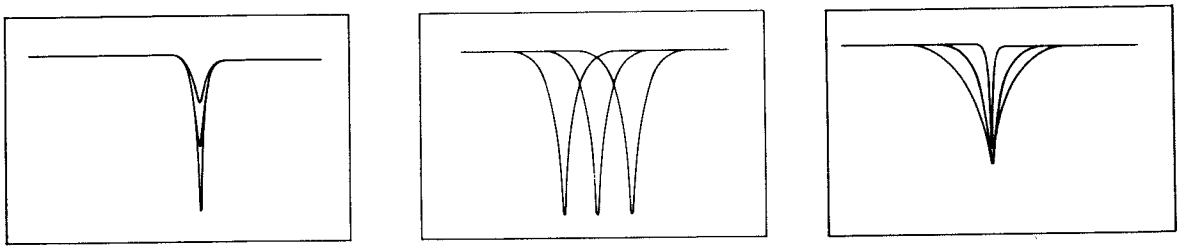
The controls adjust:

(i) The depth (cut) of the dip filter

(ii) The frequency of the dip filter

(iii) The Q (or steepness) of the dip filter.

Figure 2.8 shows the effect of adjusting these controls.



'Cut' 'Frequency' 'Q'

Fig. 2.8 Effect of the three dip filter controls

(j) Adjust controls as follows. First set 'cut' control to minimum and note the peak resonance frequency (Fig. 2.9).

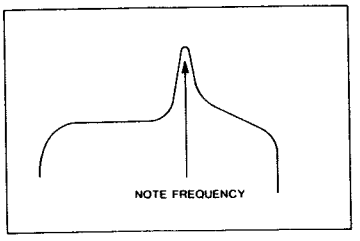



Fig. 2.9 Depth Control

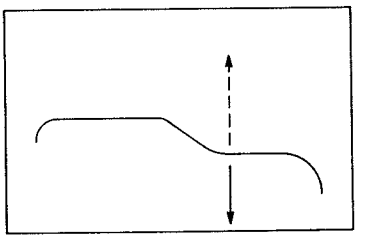


Fig. 2.10 Frequency Control

(k) Set 'Q' control to approximate middle position (5 turns from fully clockwise) and 'depth' to maximum. Adjust 'frequency' control until the dip filter is set to the same frequency as the peak resonance (Fig. 2.10).

(l) Adjust 'cut' and 'Q' controls alternately until a smooth characteristic has been achieved (Fig. 2.11).

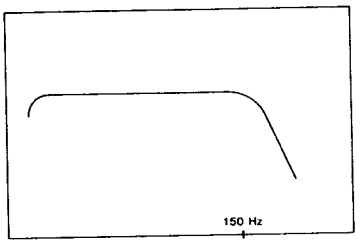



Fig. 2.11
Desired Response

(m) Switch the filter in and out, and adjust the Magnetic Gain control until the level (with the filter in) is 4 to 6 dB above the level with the filter out.

(n) Switch back to format 04. Switch the filter in and out, and adjust the Optical Gain control until the level with the filter in is 4 to 6 dB above the level with the filter out.

(o) Repeat steps (d) - (l) for the Right channel. Note however, optical and magnetic gain controls should NOT be readjusted since a single control is used for both channels. If there is a difference in levels between $L_e$ and $R_e$ after both the dip filters are adjusted, SMALL changes can be made to the $L_e$ and $R_e$ Output controls.

(p) Move the toggle switch on the Cat. No. 142 Equalizer filter card to the up or 'Auto' position. Leave the toggle switch in this (normal) position.

(q) Remove the Pink Noise Generator and replace the switch card Cat. No. 141. Use the mute control to avoid thumps in the auditorium speakers. If P and Q channels are provided in the auditorium, remove the switch card (37) and plug it in place of the Pink Noise Generator.

(r) To align the P channel, select Center (C) channel on the generator, and adjust the P channel trimpot on the left Remote Fader card (55) for a level of 85 dBc in the auditorium.

(s) To align the Q channel, select Surround (S) channel on the generator and adjust the Q channel trimpot on the left Remote Fader card (53) for a level of 85 dBc in the auditorium.

(t) Replace the Pink Noise Generator with the switch card Cat. No. 141. Use the mute control to avoid thumps in the auditorium speakers. The auditorium equalization is now complete.

## 2.8 Optical Installation

(a) Install the stereo solar cell assemblies on the projectors. Accurate alignment of the cells 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. 2.12).

OPTICAL CELL CONNECTION

**NOTE: for reverse scan situations separate large cells are used for each channel with identical red (hot) and black (common) wires. Connect cells to inputs; a check will be made later to verify correct connection (see Section 2.9 (g)).**

(b) Connect the cells to the appropriate CP200 input terminals (BS3 and 4) using 4-conductor shielded cable (or two 2-conductor shielded cables). See Fig. 2.1 for numbering of rear connectors. Connect the inner conductors to the projector input + and - terminals, maintaining correct phase relationships. Connect the shield at the CP200 end only to terminals marked E (ground or earth) adjacent to the projector input terminals.

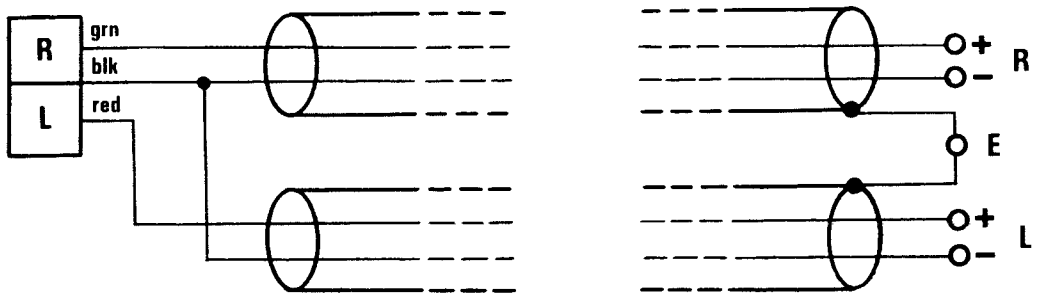



Fig. 2.12 Connection of cell using 2 x 2 - conductor cable

(c) Set up for playback of a stereo optical film on the CP200 as follows:

i) Switch 'Set Formats for Show' A (3) to 03 (Dolby SVA print).

ii) Press 'Preselect Next Format' A (10) (internal lamp should flash).

iii) Decide which projector will be aligned first, and press the appropriate 'Preselect Next Projector' button (12) (Internal lamp should flash).

iv) Press 'Go' button (1) . Lights inside the projector and format preselectors should stop flashing and illuminate continuously; numeric readout (2) should change to '03'.

## 2.9 Alignment of Projector Optics and Optical Preamplifier

(a) On the Optical Preamp card (20) (inside the Processor unit) turn all output and bypass controls fully clockwise, and all high frequency contols fully counterclockwise.

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

**OPTICAL CELL MECHANICAL ADJUSTMENT**

(c) On the projector to be aligned first, switch on the exciter lamp supply 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 (about 0.05 in) from cell to film. Image of slit should be near the top of the cell (Fig. 2.13). Avoid the top edge insulation on the cell. Brackets are factory designed to suit most projectors. However, it may be necessary to adapt the nearest standard bracket to suit a particular projector.

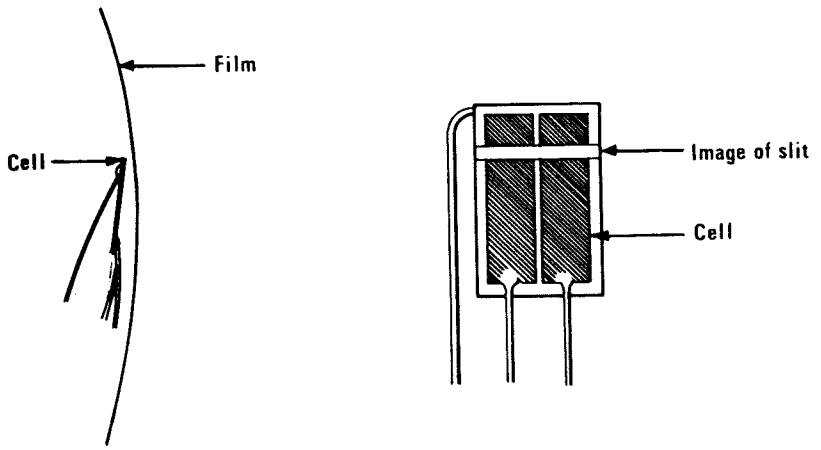



Fig. 2.13 Positioning of Slit Image

(d) Connect the two inputs of a dual trace oscilloscope to the left (red) and right (green) test points on the Optical Preamp card (20) . A ground (black) test point may be found on any of the meter modules.

**CROSSTALK ADJUSTMENT**

(e) Thread and play the stereo cell alignment film Cat. No. 97. Move the cell laterally across the film plane until there is minimum crosstalk Left to Right and Right to Left (it should be possible to achieve better than 20 dB separation each way). 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 the triggering and timebase of the dual-beam oscilloscope to give traces similar to Fig. 2.14. When satisfactory results are obtained, lock the settings. If any misaligned feature films are encountered after last adjustment has been locked, the guide roller should be moved, not the cell alignment.

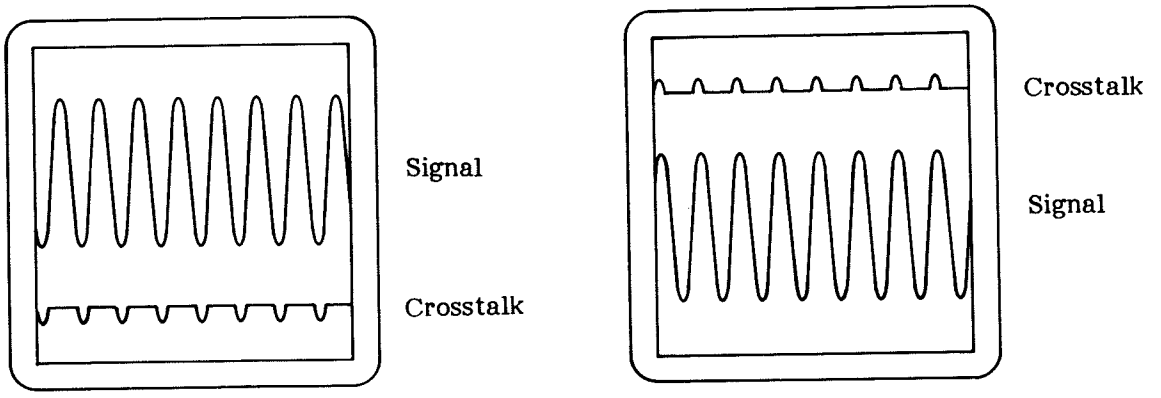



Fig. 2.14

Oscilloscope traces of optical 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). Adjust the appropriate Proj. left and right Optical Pre-amplifier gain controls (20) so the L and R meters (28) , (30) read approximately Dolby Level (see Fig. 2.15). 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, increase the exciter lamp voltage.

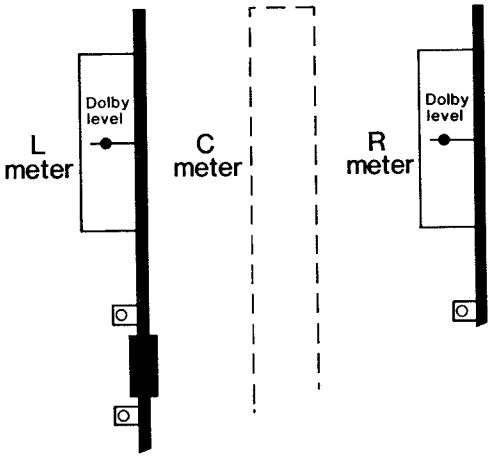



Fig. 2.15 Meter Indication of Dolby Level

(g) Check that the right track is connected to the right amplifier by placing a business card into the light path from the outside edge of the film and observing 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 in 2.9(d), switch the oscilloscope to X/Y mode. With a real-time analyzer alternately connected to the left and right channels (use the test response points on the optical preamplifier), adjust the focus for maximum h.f. on the real-time analyzer (Fig. 2.16) and rotate the slit for best azimuth as seen on the oscilloscope (Fig. 2.17). 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.

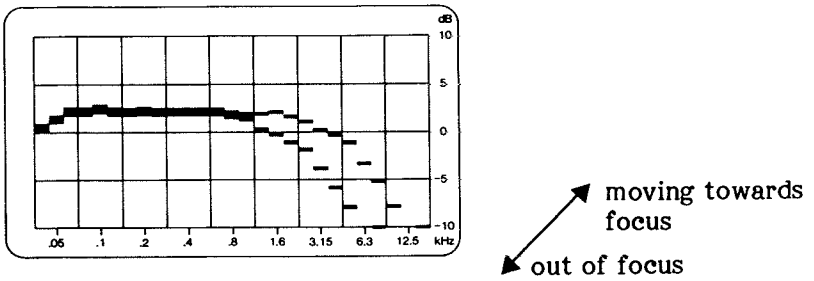
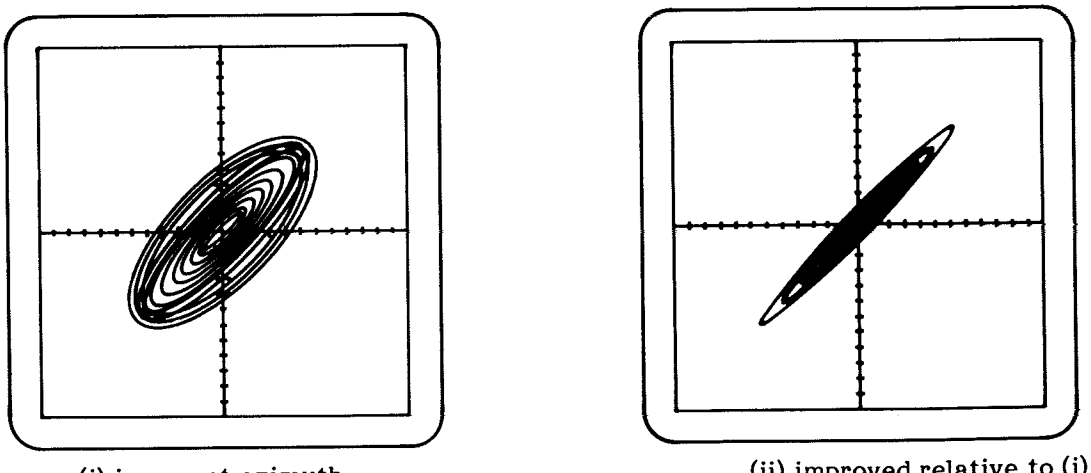



Fig. 2.16

Effect of Focus Adjustment



(i) incorrect azimuth

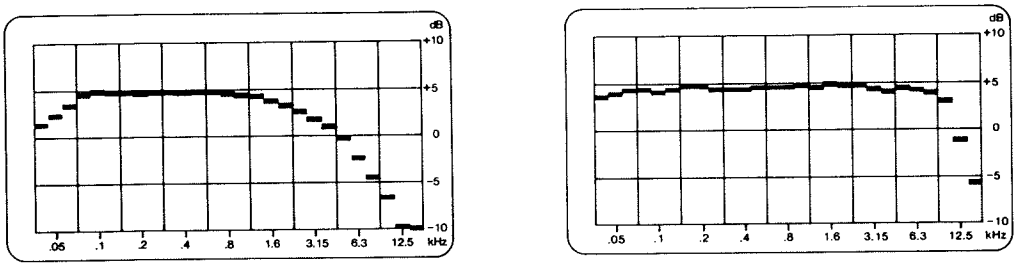
(ii) improved relative to (i)

Fig. 2.17

Effect of azimuth adjustment. Final trace should be as thin as possible.

**OPTICAL PREAMPLIFIER HF CONTROL**

(i) After azimuth and h.f. have been optimised in (h), obtain flat h.f. response in left and right channels using the Optical Pre-amplifier (20) h.f. controls (Fig. 2.18). The response should be flat up to a limit determined by the slit size, with a rapid roll off above this frequency. Attempt to achieve a flat frequency response without any peaks, rather than an extended response with 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 poor high frequency response, inspect the exciter lamp and slit lens assembly.




before after

Fig. 2.18

Adjustment of Optical Preamplifier h.f. controls

**OPTICAL PREAMPLIFIER GAIN CONTROL**

(j) Re-thread the Dolby Tone side of the Cat. No. 69 loop and adjust the left and right pre-amplifier gain controls so that the L and R meters (28) , (30) indicate Dolby Level (see Fig. 2.15).

(k) Stop first projector; preselect next projector (internal light flashes), then press 'Go' button (1) . The light inside the first projector button should go out, and the light inside the second projector button should be on continuously. Repeat sections (c) to (j) for the other projectors.

2.10 Optical Surround Adjustments.

(a) Levels should be close to optimum if the above procedures have been followed. It is important that the surround channels not be too loud, since their use is normally for subtle audience sound where the director intends the level to be low. Please read Dolby Laboratories Field Bulletin No. 88, "Principles of Dolby Encoded Soundtracks" for a complete discussion of surround systems and levels. The levels can be checked using the special test film, Cat. No. 151.

(b) Change 'Set Formats for Show' B to 04; preselect 'Next Format' B; preselect projectors to be used. Press 'Go', lace up and play the Cat. No. 151 Test Film.

(c) Set the delay switch on the Cat. No. 150 Decoder card (33) to '1'.

(d) Set the switch on the Cat. No. 160 Bass Extension card (32) to the 'Off' position (switch down).

**OPTICAL SURROUND LEVEL CHECK**

(e) Stand (or have an assistant stand) in the middle of the auditorium. Determine by ear whether the level coming from the surround speakers is the same as the level coming from the front horns. If it is not the same, reduce or raise the level of the surround channel using the surround trimpot on the Remote Fader card (53) until the screen and surround levels sound the same.
**NOTE: If a large change is required, a system problem exists which must be diagnosed and cured before further adjustments are made.**

(f) The remaining adjustment for optical surround concerns the setting of the delay time, which is adjusted by a thumbwheel switch on the Cat. No. 150 card (33) . With the switch indicating '1', the delay is set at 30 milliseconds. Each succeeding switch position adds 10 ms of delay, up to a maximum of 150 ms with the switch indicating '13'. The object of the delay line is to insure that front signals not intended for the surround loudspeakers, but 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.

Thus switch position:

1 = 30 msec delay
2 = 40 msec delay
3 = 50 msec delay
4 = 60 msec delay
5 = 70 msec delay
6 = 80 msec delay
7 = 90 msec delay
8 = 100 msec delay
9 = 110 msec delay
10 = 120 msec delay
11 = 130 msec delay
12 = 140 msec delay
13 = 150 msec delay

The delay is set by estimating the distance in feet from a rear seat (close to a surround loudspeaker) to the front loudspeakers and 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.

(g) 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.

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

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 seat nearest 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.

(h) **NOTE: In many films the surround information is intended 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 speaker will produce the level the film director wanted. Do not increase the surround volume as this might destroy the effect that the film production team desired.**

(i) Play a good quality Dolby Stereo print which has surround information using Format 04. Check the sound quality in the auditorium.

(j) The steady-state equalization set up in Section 2.6 gives the correct flat program response for a middle-sized auditorium. For small auditoriums a slightly brighter steady-state (analyzer) response is required, and for larger halls slightly less high frequency is required. These adjustments should be made by playing a familiar reel of Dolby-encoded film and making small adjustments to the treble control on the Cat. No. 64 and not under any circumstances to the one-third octave controls.

(k) Continue to play the print. Move the switch on the Cat. No. 160 Bass Extension card to the 'Auto' position (switch in center position). This allows low frequency material on the film to be played back in the $L_e$ and $R_e$ speakers present in a 70 mm house. The sound quality in the auditorium should remain balanced, but with extended bass (if present on the film). If the sound is boomy or bass heavy, adjust the 'optical' gain control on the Cat. No. 142 Equalizer Filter card (36) . Leave switch in 'Auto' position. **NOTE: The control on the Cat. No. 160 marked "Optical Bass" is inoperative in the CP200, and is provided for use in the CP50 only.**

(l) Turn "System Emergency" switch (4) to proj 1 or proj 2, depending on which projector is playing, and check that the L and R bypass controls on the optical pre-amplifier (20) are set to the maximum clockwise position. Then adjust the bypass level control on the non-sync card (22) to give approximately the same volume in the auditorium when the System Emergency switch is switched between proj 1/2 and normal positions. Return the switch to the Normal position.

(m) Stop the film. The basic optical installation and alignment is now complete.

2.11 Magnetic Alignment.

**INITIAL MAGNETIC PENTHOUSE ADJUSTMENTS**

(a) Connect the outputs of the magnetic pre-amplifier to the inputs on the CP200. (See diagram 2.1 for details). The preamplifiers may be those already in use at the cinema, or alternatively a Dolby Model MPU may be used. If existing amplifiers are used, make sure they are suitable for the CP200, paying particular attention to the signal levels, frequency response and terminations. The CP200 will accept signals of 100 mV or 1 volt for Dolby level (about 1% distortion level on the film), and presents a high impedance. Some preamplifiers may require a termination resistor (usually 600 ohm) for correct response and calibrated output levels. Such terminations can be added at the input barrier strips on the rear of the CP200.
NOTE: If the magnetic heads are a long way from the magnetic preamplifier inputs, it is strongly recommended that a high quality screened cable such as National Wire Company types 691006, 7, 8 and 9 be used to avoid hum problems. If the Dolby MPU is used, a stabilizer card Cat. No. 206 must be used in the MPU. See the appropriate section in the MPU manual. Inspect the Cat. No. 206 card to make sure pin 5 is joined to pins 3 and 4. Early cards did not have this link which must be present or be added for correct operation.

(b) Inspect the magnetic cluster (heads) for wear. If worn, a satisfactory frequency response will not be obtained. Degauss the heads before lacing any film. If an Annis gauss monitor (or equivalent) is available, check the complete film path for magnetized parts. Inspect the penthouse, and make the mechanical adjustments according to the manufacturer's recommendations. Check that the bearings, gears and guide rollers are in good condition.

(c) If only two projectors are used, connect Projector 1 to Mag Input A (BS3) and Projector 2 to Mag Input B (BS4). The link on the rear panel PJ1 must be placed in the '2 mag proj' position.

(d) If three or four projectors are used, some form of changeover facility must be provided externally unless the MPU is used (which has a built-in changeover facility.) Connect the externally switched inputs from Projector 1/2 to Mag Input A, and from Projector 3/4 to Mag Input B. If using an MPU, see the MPU instruction manual. The rear link PJ1 must be placed in the '4 mag proj' position.

**ADJUSTING FREQUENCY RESPONSE**

(e) Set format 40 on a suitable preselect position (for example, C). Preselect the appropriate projector and press 'Go'. Lace up and play the 70 mm pink noise test film. Adjust the preamplifiers for flat frequency response (the real-time analyzer can be attached to the test points on the magnetic input card (21) for this measurement). If the response is more than ±2 dB, 50 Hz to 10 KHz, change heads. If this makes no difference, the pre-amplifier may not be satisfactory and should be changed or checked.

**ADJUSTING DOLBY LEVEL**

(f) Lace up and play the Dolby level test film. Adjust the preamplifer outputs to read Dolby level on all meters in the CP200 Processor unit (28) , (29) , (30) . In some preamplifiers which normally produce a high level output signal, the preamplifier controls may have to be set at the very low end of their travel, making adjustment difficult. If so, remove the Cat. No. 201 Magnetic input card (21) and unplug the three attenuators blocks on the card (which should be in the 100 mv position) and reverse them to the 1 volt position. Replace the magnetic input card in the CP200 and re-adjust the magnetic preamplifier level controls).

(g) Repeat the above procedure for all projectors and all tracks. Switch to format 21 and repeat for 35 mm magnetic tracks.

(h) This concludes the basic magnetic installation.

2.12 Sub-woofer Alignment.

(a) The CP200 has provision for a separate controlled output to sub-woofer channels which may be necessary if the existing speakers are deficient in the extreme bass. The output on the rear of the CP200 should be wired to a suitable amplifier and speaker combination.

(b) Remove the Cat. No. 142 (36) Equalizer Filter card, then remove the two links to restrict the low frequency response in the $L_e$ and $R_e$ channels (the sub-woofer channel will reproduce these low frequencies). Switch this card to the Auto position.

(c) Press the "mute" switch, remove the Cat. No. 160 Bass Extension card and check that:

1) Switch on front edge of card is set to 'Auto'.

2) VCA gain link is connected to 'In' position.

3) Q circuit link is connected to 'Out' position. This circuit is used in CP50 only. In the CP200 the circuit is duplicated in the Equalizer Filter card Cat. No. 142 (36) .

4) Ignore the OBE link (used only in CP50 installations).

**OPTICAL SUB-WOOFER LEVEL ADJUSTMENT**

(d) Replace the Cat. No. 160 card, press "Go" and select format 04. Play the optical sub-woofer test film, which contains alternate sections of mid-frequency and very low frequency pink noise. Stand in the auditorium and have an assistant adjust the 'Opt. Sub-woofer Level' trimpot control on the Cat. No. 160 until the level of each of these tones sounds approximately the same.

**MAGNETIC SUB-WOOFER LEVEL ADJUSTMENT**

(e) Select Format 42 and play the magnetic sub-woofer test film, adjusting the 'Mag Sub-woofer Level' trimpot control on the Cat. No. 160 to achieve equal sound levels.

(f) If neither test film is available, sub-woofer may be adjusted following this procedure:

1) Switch off L, $L_e$, R and $R_e$ power amplifiers.

2) Select format 42.

3) Press the "mute" switch and remove the Cat. No. 141 module from slot 23.

4) Insert the Cat. No. 85 Pink Noise Generator in slot 23.

5) Switch off the sub-woofer power amplifiers. Switch on the $L_e$ and $R_e$ power amplifiers.

6) Switch on the $L_e$ and $R_e$ channels on the Cat. No. 85.

7) Note the level on a one-third octave real-time analyzer.

8) Turn off the $L_e$ and $R_e$ power amplifiers. Turn the mag sub-woofer control to its minimum setting.

9) Switch on the sub-woofer power amplifiers.

10) Adjust the Mag sub-woofer level control to obtain the same level as in step (7).

11) Repeat steps 8-10 to adjust the optical sub-woofer level. Be sure to adjust the Optical sub-woofer level control. Do not readjust the Mag sub-woofer level control.

Note: If a one-third octave real-time analyzer is not available, adjust the sub-woofer level controls to obtain a 91 dB sound pressure level. Check the overall frequency balance by listening to music and speech.

## 2.13 Connection of Non-sync Sources

(a) Connect up to two additional stereo non-sync sources and one P. A. microphone to rear connector BS2 on the CP200 Processor unit.

**NOTE: Non-sync 1 is the primary (main) input, and should be used for the usual intermission music source. Only non-sync 1 is passed through the unit in the System Emergency mode.**

(b) Non-sync sources are selected by Formats 60, 61, 62 for non-sync 1, 2 and 3, and by Format 64 for microphone.

(c) Play program material from the various sources, selected via the Format switches. Adjust the trimpots in front of the Cat. No. 143 non-sync card (22) to produce the correct levels in the auditorium.

**NON-SYNC SIGNAL ROUTING**

**MIC SIGNAL ROUTING**

**NOTE: Non-sync sources are stereo, and are sent to L and R speakers with a derived center channel for the C speaker. By means of a rear link PJ4, this derived center or mono signal can be sent to the surround speakers. The microphone signal can be sent to either the center or the surround channels or both, by means of rear links PJ2 and 3. If neither of these links is in place, no microphone signal will be heard.**

## 2.14 User Options/Other Features

### (a) Initial Switch-on Conditions

The CP200 is factory-wired so that when power is supplied initially, Format D and Local fader are selected. The intention is that Format D can be left programmed for a non-sync source (for example, Format 66 - non-sync 1) so that the unit is ready to play the intermission music on switch-on. However, links inside the Format/Projector logic card (45) can be changed to allow any desired Format to be selected on switch-on, as well as any projector (thus allowing, for example, Format B and projector 2 to be selected automatically on initial switch-on). See the Cat. No. 156 Projector/Format Logic Card circuit diagram (Fig. 4.14) for details on this modification.

The Fader/Mute logic card (46) ensures that the fader on the control unit is always activated on switch-on. The only exception to this occurs if the board-mounted toggle switch on the card is switched to "auditorium fader", in which case a fader in the auditorium is always activated, and local or other remote control of the fader is inhibited. A red warning indicator light on the card reminds the operator that operation of the fader is locked to a single auditorium fader.

### (b) Special Format Selection

Each Format Decoder card contains four 8-way dual-in-line miniature switches (a total of 32 switches). Each switch corresponds to a particular control line in the CP200, which in turn controls a particular function - e.g., NR on, stereo, optical surround, etc. Thus, by presetting the switches any special format can be set up. The switches themselves are inoperative until selected by the front panel numeric switches (3) . Each group of formats has been assigned the next-to-last number in its group to activate the switches. Thus, Format number 18 activates the switches in the optical format decoder card, 38 those in the 35 mm magnetic decoder card, 58 the 70 mm, and finally 78 the non-sync switches.

The intention of these switches is two-fold. First, unusual combinations of functions can be set up for special features or for test purposes. Second, if a new format is developed, a theatre can quickly program their CP200 to play that format correctly. If this format is commercially successful a new permanent format number will be assigned, and diodes added on the matrix in each Format Decoding card to release the switches for the first purpose described above.

Full format card modification instructions will be given with each permanent new allocation of format numbers. Alternatively, decoder cards may be exchanged for modified versions.

### (c) External Inputs

Format 68 (external inputs) connects the CP200 into the dubbing theatre mode. Details of this special application of the unit are given in a special Dubbing Theatre manual.

## 2.15 Remote Control Units

(a) Three types of remote control boxes are available as options, two of which are shown in Figure 2.19. The Cat. No. 202 has a mute in-out push button (which duplicates the similar button on the control unit (8)) and a 'GO' push button which activates the particular box and projector and, (if a format pre-selection has been made on the main control unit), a format change simultaneously. A remote box is placed by each projector.

(b) The Cat. No. 204 Remote Unit has, in addition to the above facilities, the ability to pre-select a format change. It also contains a fader control which is always activated when the 'GO' button is pressed.

(c) In addition, the Cat. No. 204 contains another push button labelled 'Activate this Fader'. Pressing this always moves control to the fader on that remote box, regardless of which fader was previously in operation. Thus the fader in the Remote Unit is activated when either the 'GO' button is pressed (which also changes the status of the CP200) or when the 'Activate this Fader' button is pressed.

(d) For a single-station remote fader such as an auditorium fader or (in the case of a dubbing studio) a fader on the console, a Cat. No. 122 can be used. This fader consists solely of a fader control and a 'fader active' indicator. For operation, the switch on the Fader/Logic card (46) must be in the 'auditorium fader' position.

(e) The units are connected to the CP200 as indicated in diagrams 2.20, 2.21 and 2.22. Use 16-way cable (2 x 8-way cable) for the Cat. No. 202 and 2 x 16-way cable for the Cat. No. 204. Use 4-way cable for the Cat. No. 122. Unshielded low-current cable is suitable in this application. The units are designed for "daisy-chain" wiring. One cable from the CP200 to the nearest Remote Unit, and then from that unit directly to the next Remote Unit, and so on.

(f) Each unit has two header sockets into which a pre-wired projector selector can be plugged in two positions for each socket. It is usual practice to place a remote control unit by each projector. The pre-wired selector should be plugged in the position corresponding to the number of the projector which is controlled by the remote control unit.

(g) Operation of the remote control units is straight forward. Note that the controls are in parallel with those in the main Control unit.

**Note: Initial units are shipped with a two diode assembly wired between rear barrier strip BS23 pins 1 and 2 and BS21/11. This is required for emergency changeover only when Remote Units Cat. Nos. 202 and 204 are not being used. When installing these remote units, this assembly should be removed and discarded. Later units have a programmed jumper (PJ25) on the rear of the Control Unit which should be moved to the appropriate position for 'no remotes' or 'remotes installed'.**

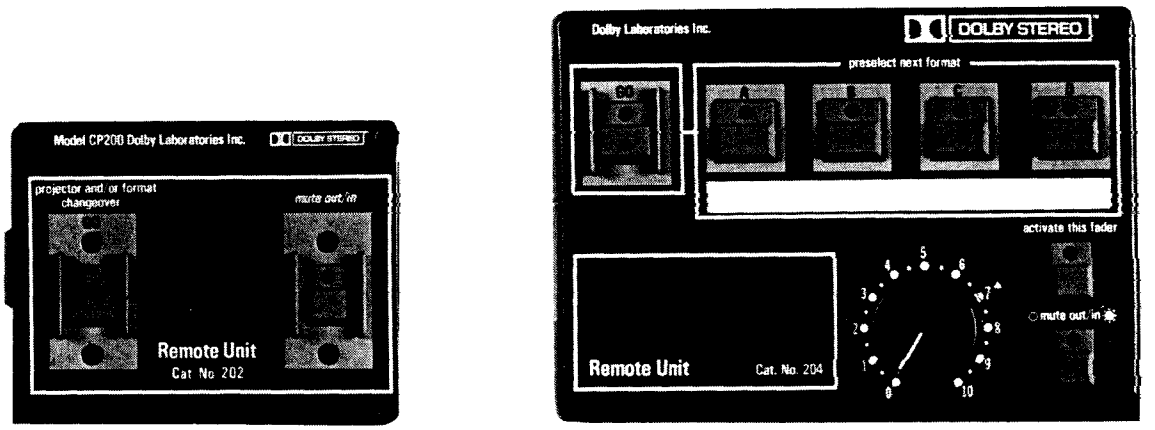
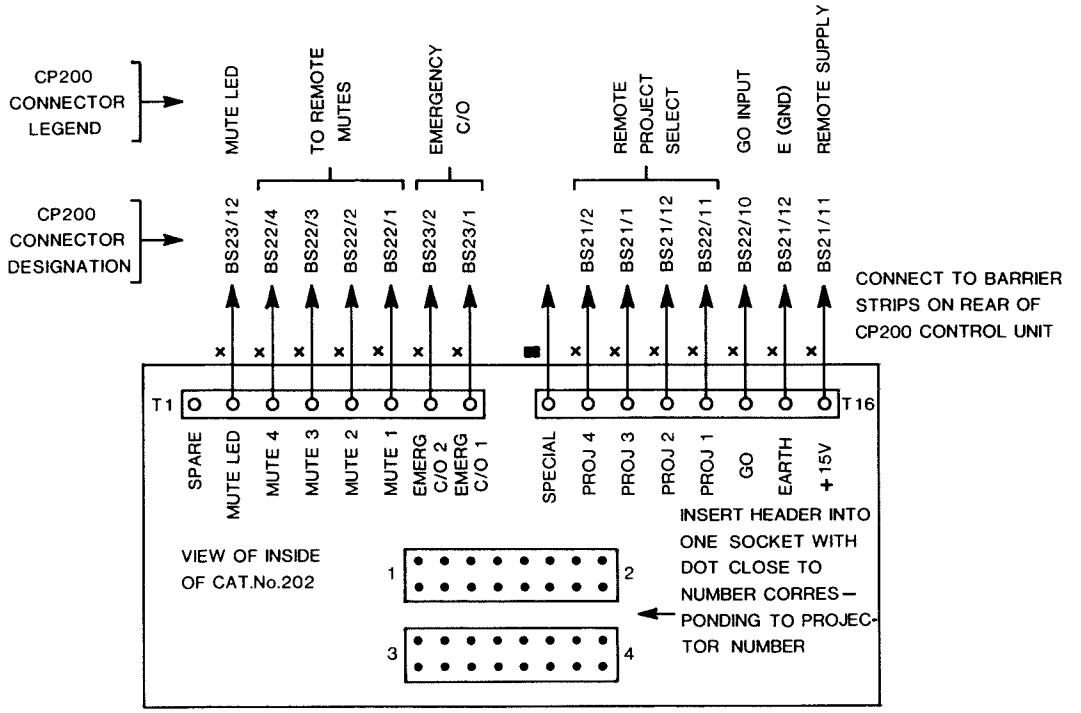



Fig. 2.19 Cat. Nos. 202 and 204 Remote Control Units




NOTES:

× 2nd WIRE CONNECT TO OTHER REMOTE UNITS TO SAME TERMINAL NUMBERS

■ A LIT "GO" SWITCH ON THE REMOTE UNIT CAN BE ENABLED TO INDICATE WHICH PROJECTOR IS ACTIVE BY TAKING THE "SPECIAL" TERMINAL TO "EARTH" VIA THE APPROPRIATE PROJECTOR CONTROL RELAY ON THE CP200 BS23 CONNECTOR BLOCK

Fig. 2.20 Connection of Cat. No. 202 to CP200

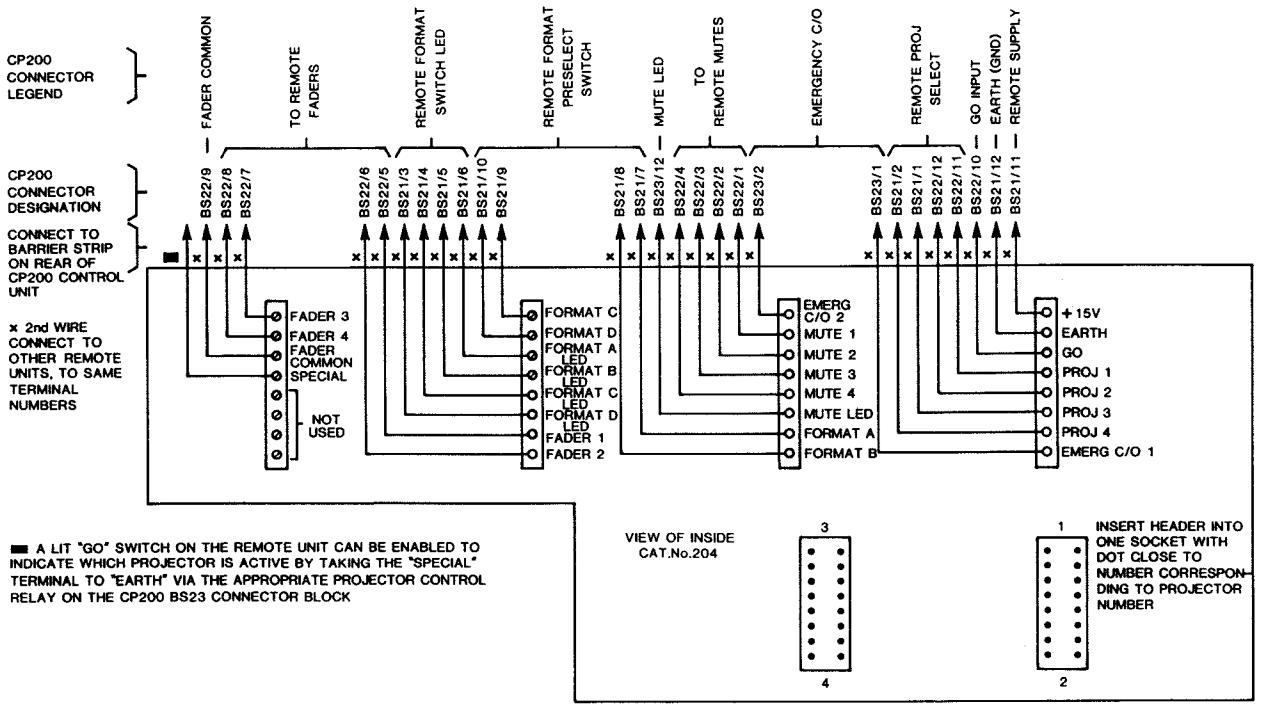



Fig. 2.21 Connection of Cat. No. 204 to CP200

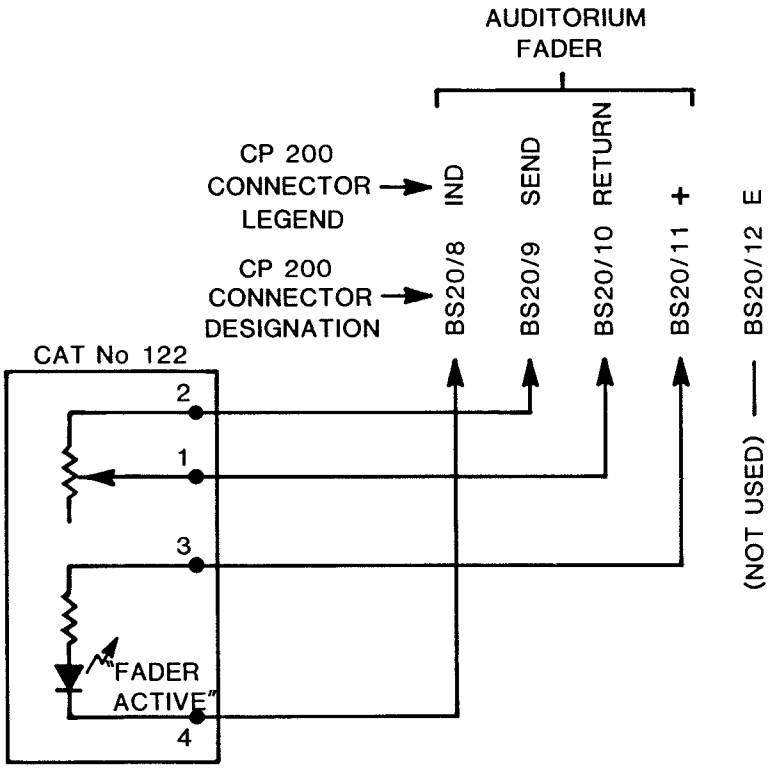



Fig. 2.22 Connection of Cat. No. 122 to CP200

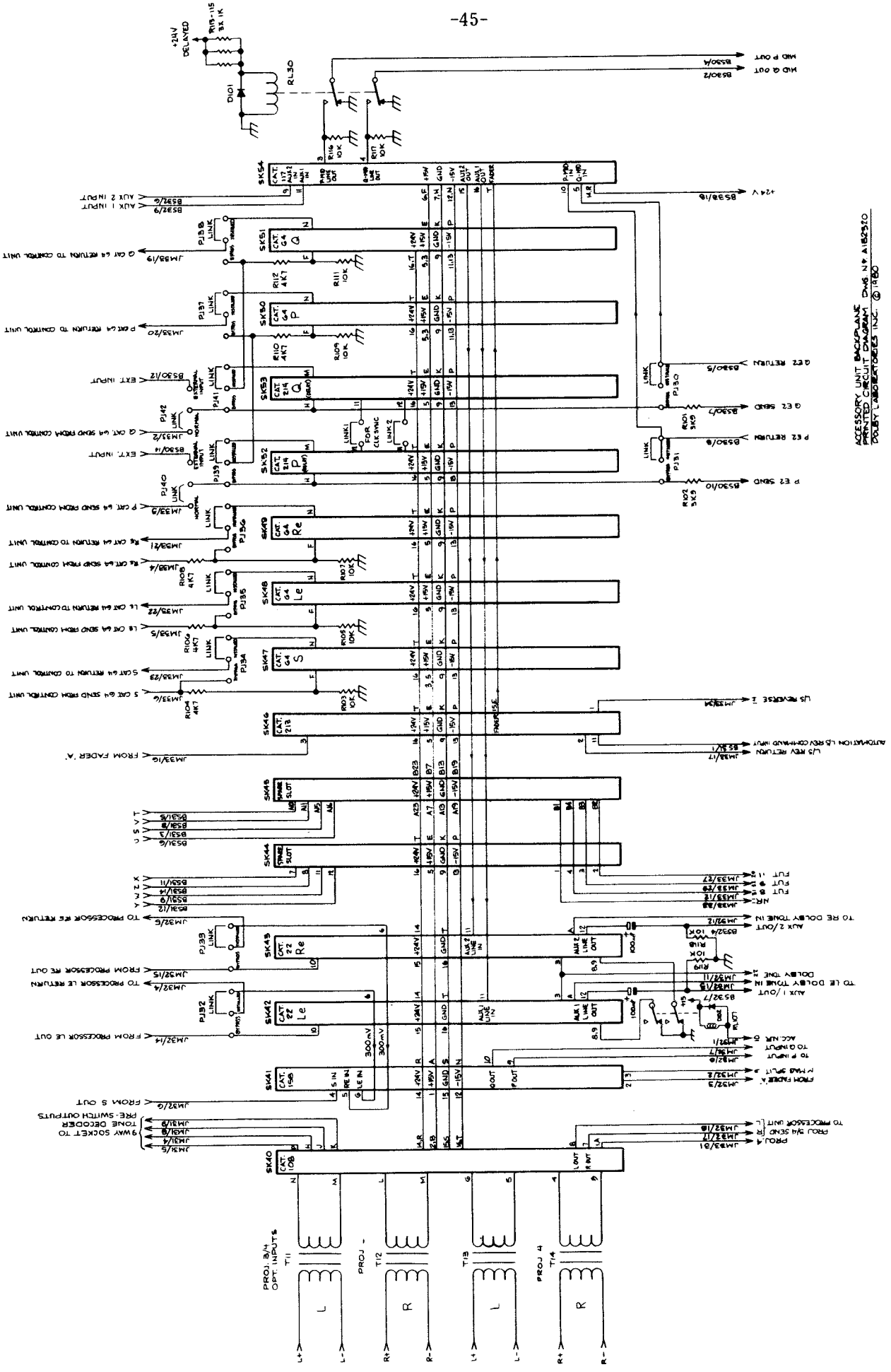



Figure 2-25 Block and Signal Routing Diagram

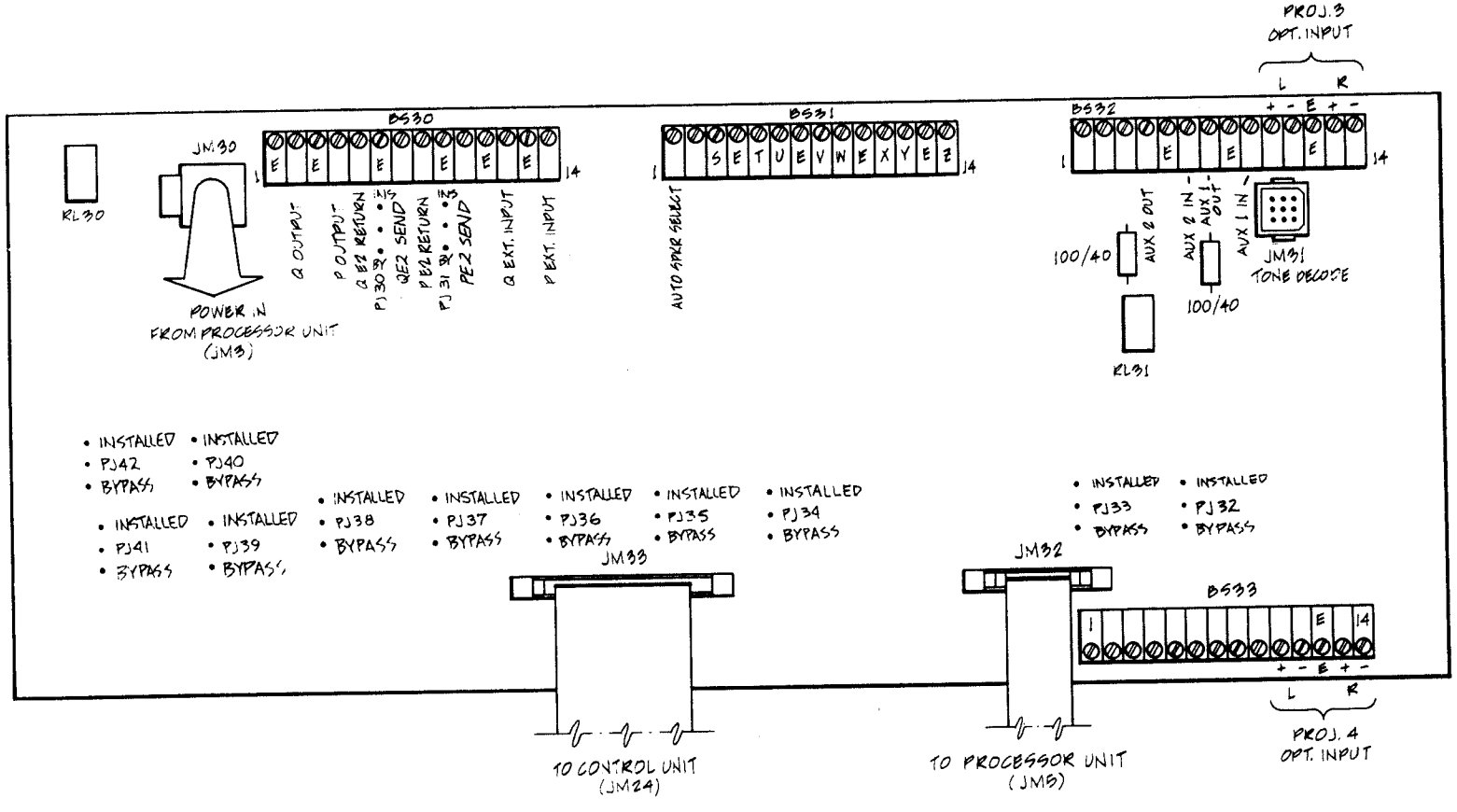



Figure 2.23 Connection of Accessory Unit to CP200

REAR VIEW AND INSTALLATIONS DWG.NO A2D237E



NOTE: ACCESSORY UNIT IS NORMALLY INSTALLED ABOVE PROCESSOR UNIT.

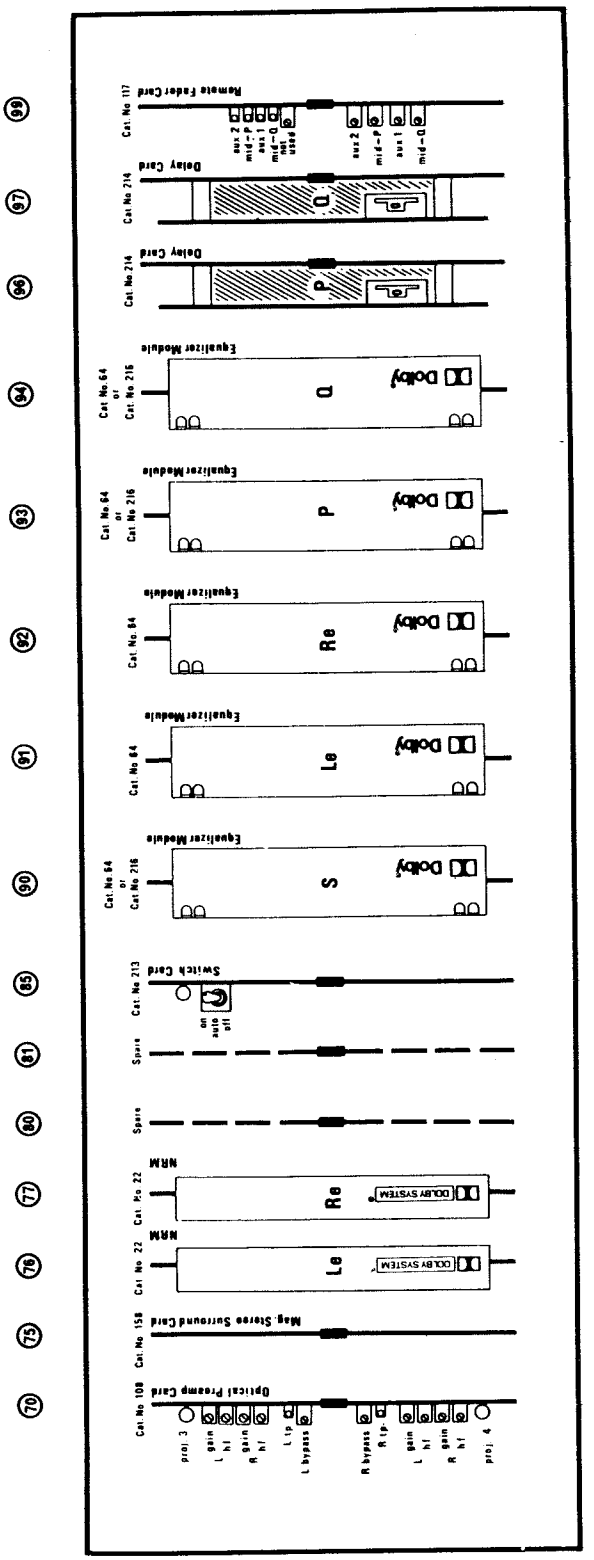
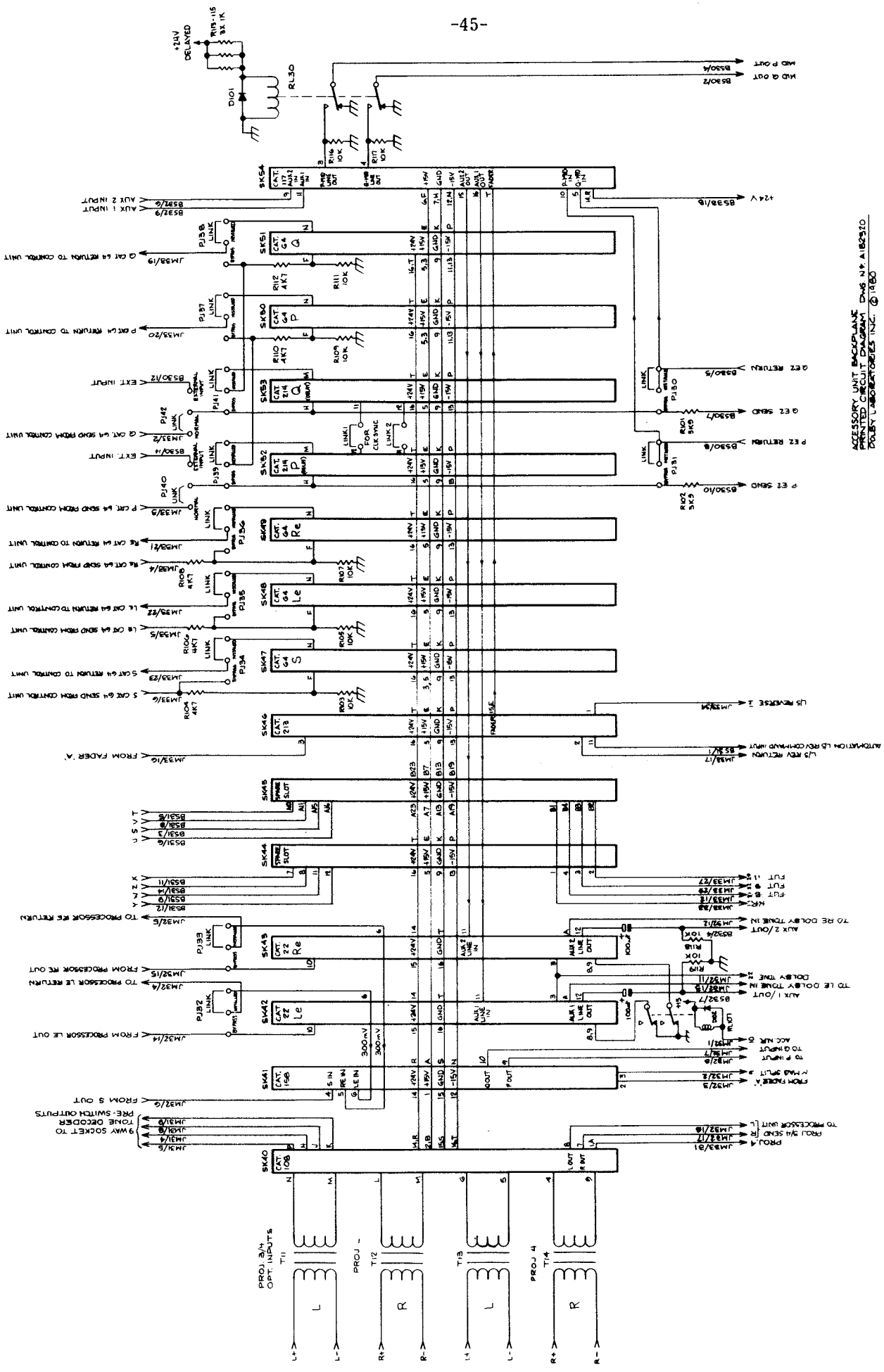



Figure 2.24 Inside View of Accessory Unit




L84/34

Figure 2.25 Block and Signal Routing Diagram

## 2.16 Accessory Unit

(a) The frame of the Accessory Unit mounts above the Processor Unit and is connected to the main CP200 chassis using three cable assemblies supplied with the Accessory Unit. Power is supplied to the unit from the Processor unit (JM3 to JM30). The logic control and audio are carried on two flat cables (JM5 to JM32 and JM24 to JM33). However, do not connect the unit either to power or to the main CP200 chassis until the standard CP200 installation and alignment procedures have been completed. See Fig. 2.23 for cable details and Fig. 2.24 for module location.

(b) The Accessory Unit will be supplied with modules installed for the option ordered with the unit. Options not ordered with the unit may be added at any time in the future by installing the proper modules and carrying out the installation and alignment procedures listed below.

(c) Each option is connected into the signal path by rear-mounted programmed jumper links (for example, PJ32 and PJ33). These links can be seen in Fig. 2.23. The links must be in the 'Bypass' position when the options are not installed to allow correct signal flow. Fig. 2.25 is the block and signal routing diagram for the Accessory Unit, which is useful for understanding the operation and connection of the various options.

## 2.17 3/4 Optical Projectors Option (Kit E)

(a) This option consists of a second optical preamplifier Cat. No. 108 (70) . Connect the projector 3 and 4 cells to the appropriate terminals on the rear of the Accessory Unit (BS 32/10-15 and BS 33/10-15, see Fig. 2.23). See Section 2.8 (a) and (b) for installation procedures.

(b) Check that links W103 and W104 are fitted to the format/projector logic card Cat. No. 156 (45) .

(c) Using the normal projector selection buttons (12) on the control unit, select the appropriate projector (3 or 4), and follow the calibration procedure given in Section 2.8 (c) to (k).

## 2.18 Magnetic Stereo Surround (70 mm) (Kit B & C)

(a) In this Dolby format, the $L_e$ and $R_e$ magnetic tracks contain the usual bass enhancement signals as well as higher frequency information (above 500 Hz) which provides discrete Left back and Right back information (Lb and Rb). The low frequency component of the normal surround track is added to these signals, thus providing balanced full range rear channel information.

(b) The option consists of two Cat. No. 22 noise reduction modules (76) and (77) to provide noise reduction on the $L_e$ and $R_e$ signals, a Cat. No. 158 Magnetic Stereo Surround card (75) , and two Cat. No. 64 Equalizer cards (93) and (94) for the Lb and Rb channels, designated P and Q for convenience. An alternative equalizer to the third-octave Cat. No. 64 is the simple Cat. No. 216 which is better suited for the average surround system. This card has bass, middle and treble controls only, but is aligned following the same principles used in the alignment of the Cat. No. 64.

(c) Connect the P and Q outputs of the control unit to suitable power amplifiers (BS24/6-8). Make sure that the programmed links PJ40 and PJ42 are in the 'Normal' position, PJ39 and PJ41 are in the 'Bypass' position, and PJ32, 33, 37 and 38 are in the 'Installed' position.

(d) There are no operational controls to adjust in the Accessory Unit. However, the equalizer controls must be adjusted during installation.

(e) Set format 66 on one of the four numeric switches (for example C) and press the corresponding 'Preselect Next Format' button. Press the 'GO' button. The Dolby calibration tone will now be generated internally. The L, C, R, and S meters (28) , (29) , (30) will indicate Dolby level. Press the Mute button and remove the P & Q Cat. No. 64 modules. Remove the covers, reinstall the Cat. No. 64 cards and press the Mute button again.

(f) Connect a millivoltmeter alternately to the P and Q testpoints on the Remote Fader cards (55) and (53). Check that the input controls on the Cat. No. 64 House Equalizers P and Q (93) and (94) are at minimum, and then adjust the corresponding Cat. No. 64 House Equalizer output level control for a reading of 150 mV (-14.3 dBm).

(g) Press the mute button (8) to protect the auditorium loudspeakers. Remove the switch card Cat. No. 141 in position (37) . Plug in its place a Cat. No. 85C Pink Noise Generator. Put the generator card switches to PN and center (C) channel, leaving the other channels off.

**(NOTE: Switches on the Cat. No. 85 are down for 'On', and up for 'Off'. Cat. No. 85A center position is 'Off'.)**

(h) Connect the calibrated microphone to the real-time analyzer and place it in an average position about 2/3 of the way back in the reverberant field (not on center line of theatre and not directly on the speaker axis). The microphone should be about 5 feet (1.5 m) above the floor level and angled at about 45 degrees upward towards the screen.

(i) Remove the P Cat. No. 64 Equalizer module (93) and replace it with the special Equalizer Extender module Cat. No. 67. Plug the removed Cat. No. 64 into the extender. Set Local Fader (9) to position 7 (normal position) and set any gain controls on the power amplifiers to their normal positions. Press mute switch again to de-mute the auditorium speakers (the flashing light in the mute switch should go out). Check that the local fader is selected (indicator light in 'activate this fader' remote fader push-button (7) should be illuminated). If it is not, press button once. Adjust the P trimpot of the Remote Fader card (55) . Advance the trimpot and check that pink noise can be heard in the auditorium. Continue to advance the trimpot and analyzer gain until a trace is visible on the screen. Turn off the pink noise source momentarily to check that the pink noise level is well above (about 20 dB) ambient noise. If the microphone and analyzer have been calibrated against a sound pressure meter, set the level at about 85 dBc.

(j) Continue with the equalization following the procedure described in subsection 2.6 (i) to (m).

(k) Repeat the above procedure using the Surround (S) channel on the Pink Noise Generator for the Rb (Q) channel. Note that the Q-channel gain control is on the Remote Fader card (53) , not on the same card as the P-channel control (55) .

2.19 Installation and Calibration of Cat. No. 216 (3 band Surround Equalizer)

**NOTE: Numbers in the text, such as (90), identify controls, modules and cards as indicated in the CP200 manual in drawings 1.1 to 1.3 at the beginning of Section 1 and fig. 2.24 on page 45.**

(a) Verify that the three rotary pots are at mid position (arrow should point forward, away from the edge connector).

(b) Plug a Cat. No. 216 module into Accessory Unit slots number (90), (93) and (94) for Surround, P and Q channels respectively.

Alignment Procedure for Standard Mono Surround

(c) Verify that jumper link PJ34 (located on the back of the unit) is in the 'INSTALLED' position and the Surround gain trimpot on the remote fader card in position (53) is turned down (counterclockwise).

(d) Connect the calibrated microphone to the real-time analyzer and place it in an average position about 2/3 of the way back from the screen (not on center line of theatre). The microphone should be about 5 feet (1.5 m) above the floor level and adjusted so that it is pointing toward the screen at 45°.

(e) Press the mute button (8) to protect the auditorium loudspeakers. Remove the switch card, Cat. No. 141, from position (35). Plug in its place a Cat. No. 85C Pink Noise Generator. If a Cat. No. 85 is used, switch the OPT/P.N. switch to P.N. Switch on the (C) channel, leaving all other channels off. Observe the response to confirm that the proper equalization of the Center channel is present (flat to 2 kHz and descending at 3 dB per octave). Now move the microphone so it points straight up. Observe the response on the real time analyzer. This is the characteristic that the surround should be adjusted to match, as closely as possible. Switch off the (C) channel and switch the (S) channel on, leaving the other channels off.

**(NOTE: Switches on the Cat. No. 85C are up for 'In Phase' and center for 'Off'. Switches on the Cat. No. 85 are down for 'On' and up for 'Off'.**

(f) Set Local Fader (9) to normal house setting "7" and check that local fader is selected (indicator light in 'ACTIVATE THIS FADER' push-button (7) should be illuminated). If it is not, press button once. Set the gain controls on the power amplifiers to their normal positions. Press mute switch again to de-mute the auditorium speakers (flashing light in mute switch should go out).

(g) Adjust the S trimpot of the Remote Fader card (53) until a trace is visible on the real-time analyzer screen. Turn off pink noise source momentarily to check that the pink noise level is well above (at least 10 dB) ambient noise. If the microphone and analyzer have been calibrated against a sound pressure meter, set the level at about 85 dBc.

(h) Adjust the three pots (Bass, Mid, Hi) to achieve a frequency response on the real-time analyzer as close as possible to the response observed in (e). The frequency response obtainable will depend on the quality of the Surround loudspeakers, which often are significantly inferior to the main speakers.

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

(j) Verify that the main fader has not been moved. Adjust the S trimpot on the Remote Fader card (53) to obtain a sound pressure level of 85 dBc near the center of the auditorium.

For Split Surround
P channel, proceed as follows:

(k) Make sure the jumper link PJ37 (located on the back of the unit) is in the 'INSTALLED' position and the P channel gain trimpot on the remote fader card in position (55) is turned down (counterclockwise).

(l) Connect the calibrated microphone to the real-time analyzer and stand it in an average position slightly off-center, about 2/3 of the way back from the screen . The microphone should be about 5 feet (1.5 m) above the floor level and adjusted so that it is pointing toward the screen at 45°.

(m) Switch on the (C) channel, leaving all other channels off. Observe the response to confirm that the proper equalization of the Center channel is present (flat to 2 kHz and descending at 3 dB per octave). Readjust the microphone so it points straight up. Observe the response on the real time analyzer. This is the characteristic that the surround should be adjusted to match, as closely as possible. Press mute button (8), remove the Cat. No. 85C and insert the Cat. No. 141 (35) which was originally in that position. Remove the second Cat. No. 141 (37) and replace it in turn with the Cat. No. 85C. Switch on the (C) channel, leaving off all other channels.

**(NOTE: Switches on the Cat. No. 85C are up for 'In Phase' and center for 'Off'. Switches on the Cat. No. 85 are down for 'On' and up for 'Off'.**

(n) Set the Local Fader (9) to normal house setting "7" and check that the local fader is selected (indicator light in 'ACTIVATE THIS FADER' push-button (7) should be illuminated). If it is not, press button once. Set all power amplifier gain controls to their normal positions. Press the mute switch again to activate the auditorium speakers (flashing light in the mute switch should go out).

(o) Adjust the P trimpot of the Remote Fader card (55) until the trace is visible on the real-time analyzer screen. Turn off the pink noise source momentarily to check that the pink noise level is well above (about 20 dB) ambient noise. If the microphone and analyzer have been calibrated against a sound pressure meter, set up the level at about 85 dBc.

(p) Repeat steps (h) and (i).

For Split Surround
Q channel, proceed as follows:

(q) Make sure the jumper link PJ38 (located on the back of the unit) is in the "installed" position and the Q channel gain trimpot on the remote fader card in position (53) is turned down (counterclockwise).

(r) Repeat step (m), but select Surround (S) channel instead of (C).

(s) Repeat (l), (o), (h), and (i).

(t) Verify that the main fader has not been moved. Adjust the P trimpot on the right hand Remote Fader card (55) and the Q trimpot on the left hand remote Fader card (53) for a sound pressure level of 82 dBc near the center of the auditorium, moving the Cat. No. 85C from (35) to (37). Since both P and Q channels are adjusted to this level, the overall sound pressure level from both will be 85 dBc (same as any one screen channel).

(u) Press the mute button (8) and remove the Pink Noise Generator, Cat. No. 85C, and replace it with the original switch card, Cat. No. 141.

2.20 Equalization of $L_e$ and $R_e$ Channels (Kit A)

(a) Two further Cat. No. 64 Equalizer modules (91) and (92) may be used to equalize the $L_e$ and $R_e$ speakers to improve the sound quality of conventional 70 mm prints. The Cat. No. 216 Equalizer is not suitable for this high quality channel and will not operate in these two positions.

(b) Make sure the two programmed jumper links PJ35 and PJ36 are in the 'Installed' position.

(c) Use the Pink Noise Generator in the switch card (37) position. Remove the $L_e$ equalizer and place it in the Equalizer extender. Set the input and output controls to minimum.

(d) Switch the Pink Noise Generator to $L_e$, and equalize the $L_e$ channel following the procedures of sections 2.6 and 2.7 (the Cat. No. 142 card will need re-adjusting after $L_e$ and $R_e$ equalization).

(e) Switch between L and $L_e$ on the Pink Noise Generator and adjust the output level control on the $L_e$ Equalizer Cat. No. 64 to give the same sound pressure level when either $L_e$ or L is selected on the generator.

(f) Repeat (c), (d) and (e) for the $R_e$ equalizer.

2.21 6-channel Dolby Encoded Films (Kit G)

(a) In early 70 mm films (about 1973-5), all tracks were encoded with the Dolby system and were thus wide-range. Certain new films for special applications also have this configuration. The option to be described allows correct playback. The option consists of two Cat. No. 22 noise reduction modules (76) and (77), and two Cat. No. 64 Equalizer modules (91) and (92). Correct operation occurs when Format 41 is selected on the control unit.

(b) Make sure programmed links PJ32, 33, 35 and 36 are in the 'Installed' positions.

(c) Follow the equalization procedures in section 2.20 above to align the $L_e$ and $R_e$ equalizers.

2.22 Interchange of L and $L_e$, R and $R_e$ Channels (Kit F)

(a) In many theatres, the screen width used for 1.85 (widescreen) films is substantially narrower than that used for 2.35 (Cinemascope) films, and the outer loudspeakers are outside the picture area. The loudspeakers in modern theatres (which tend to be long and thin) must be placed wide apart for stereo images to be apparent at the back of the house. Consequently, even in a 70 mm five-loudspeaker behind-the-screen house, it is desirable to send the stereo audio signals into channels 1, 3 and 5. The optimum method of doing this is to install acoustically transparent masking cloth, similar to that used on home loudspeaker systems. This makes it possible to achieve an adequate compromise loudspeaker equalization with the masking both open and closed (Dolby Laboratories can advise on availability of suitable materials). It is not possible to leave the existing thick masking in place for 1.85 films and to use speakers 1 and 5, as the high frequencies will be severely attenuated. If it is not possible to change the masking, and the outer loudspeakers are hidden during the screening of a 1.85 film,

then an alternative solution is to leave the masking open, but to ensure that the aperture plates are accurately cut and will give a sharp edge to the projected picture. If neither of these solutions are possible, then it is possible (though not at all desirable) to program the CP200 to interchange the signals between the $L_e$ and L speakers (and $R_e$ and R speakers) though this will result in a serious degradation of stereo width. Separate equalizers must be used for the $L_e$ and $R_e$ speakers to ensure correct reproduction of the tracks.

(b) For this option, the same two equalizers referred to in 2.20 (a) are used, (91) and (92), together with a Cat. No. 213 switch card (85), which is activated by the CP200 logic in the optical mode only. The switch is then operated manually to select track reversal for appropriate films. For the CP200 logic to activate the switch card, diodes must be installed in positions 275 and 307 in the Cat. No. 153 Optical Format Decoder card (47). Withdraw card and check that diodes are fitted.

(c) Alignment is carried out as in Step 2.20 (a) to (f).

2.23 Equalization of S Channels (Kit D)

(a) An additional Cat. No. 64 Equalizer module (90) (or simplified Equalizer Cat. No. 216) may be used to equalize the S speakers to improve the sound quality.

(b) Make sure the programmed jumper link PJ34 is in the 'Installed' position.

(c) Place the Pink Noise Generator in the switch card (35) position. Remove the S equalizer and place it in the Equalizer extender. Set the input and output controls to minimum.

(d) Switch the Pink Noise Generator to S, and equalize the S channel following the procedures of section 2.22.

(e) Switch between S and C on the Pink Noise Generator and adjust the output level control on the $L_e$ Equalizer Cat. No. 64 to give the same sound pressure level when either S or C is selected on the generator. Due to different surround loudspeaker dispersion characteristics, you should verify by ear (standing in the center of the auditorium) that the levels of the S and C channels appear to be the same.

2.24 Operation with Automation Equipment

(a) The design of the CP200 permits various levels of automation to be used, ranging from simple control of projector changeover to complex, fully automated programmers. Since each installation can differ significantly, it is not possible to provide comprehensive installation instructions, but only to give outlines of what can be achieved. An understanding of the control logic adopted in the CP200 will allow a competent installation technician to interface the CP200 with any system already installed in the theatre. Dolby Laboratories will be pleased to advise on specific questions, but cannot undertake to make any specialized adapters.

2.25 Control of Equipment by CP200

(a) Information is available on the rear connectors of the CP200 to enable the CP200 to control the changeover function existing in the theatre. Terminals on the barrier strip BS23 are connected to four isolated make or break relay

contacts. These are user-adjustable by programmable jumper links (PJ's) which change state as the appropriate projector is selected. The user-adjustable links are adjacent to the rear-mounted relays (see fig. 2.26). The relay contacts are rated 0.5 amp, 50 v ac/dc maximum. To control a power-line operated relay a further interface relay must be used. With the PJ links in the horizontal position, the terminals are open when a projector is selected, and closed when it is not. With the PJ links in the vertical position, the terminals are closed when a projector is selected, and open when it is not.

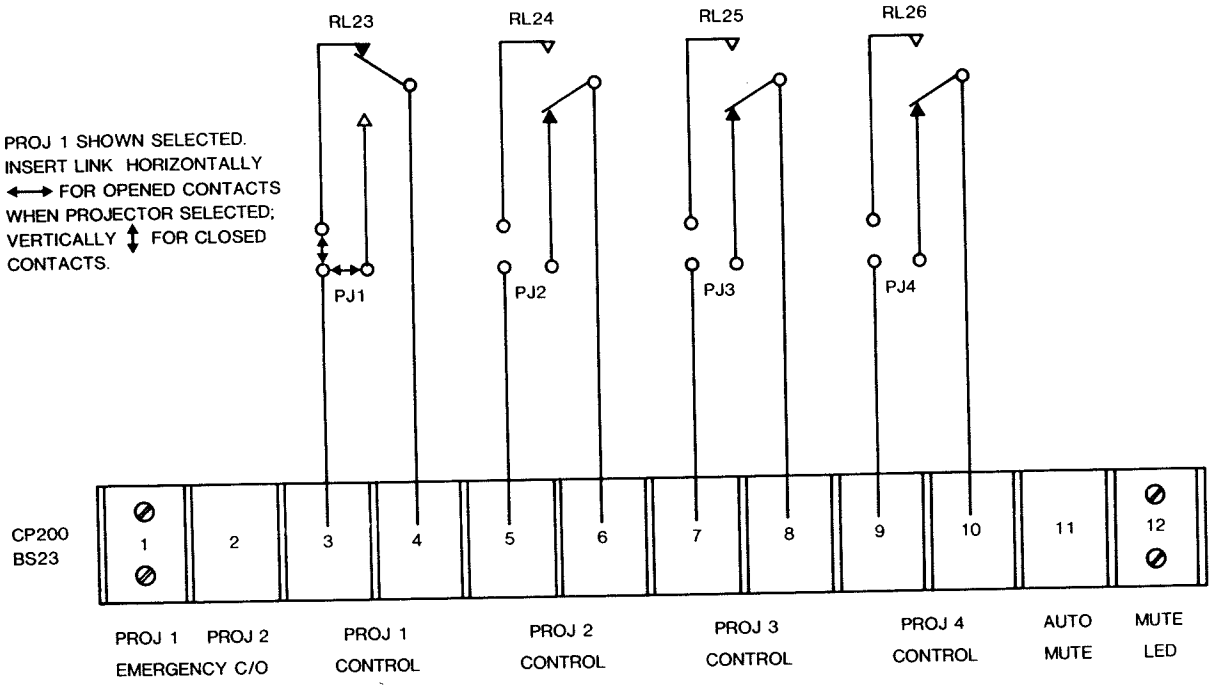



Fig. 2.26 Projector selection information out (for control of projector by CP200).

(b) Dual BCD (binary coded decimal) outputs are provided which are in effect a representation of the format number chosen. This information can be used to drive remote format indicators (useful in dubbing theatre situations) or to drive a decoder which can then select or control other equipment. Suitable decoder circuits can be obtained from Dolby Laboratories, allowing such a remote indicator to be built economically. Dolby Laboratories does not manufacture such a display themselves, but will make available a printed circuit card (Cat. No. 208) which can be built into other control equipment. For connector pin assignments, see section 3.

## 2.26 Control of CP200 by other equipment.

### Projector Changeover

(a) Simple changeover control can be achieved by applying a momentary signal (0.5 to 1 sec.) to the appropriate rear terminals of the CP200. Usually, a simple interface will be required (for isolation purposes) between the CP200 and the house system. Fig. 2.27 shows an example of one such system.

(b) The dual BCD information socket can also act in reverse, to accept inputs from external sources and to decode them to control the CP200. In this mode, all front panel indicators are operative.

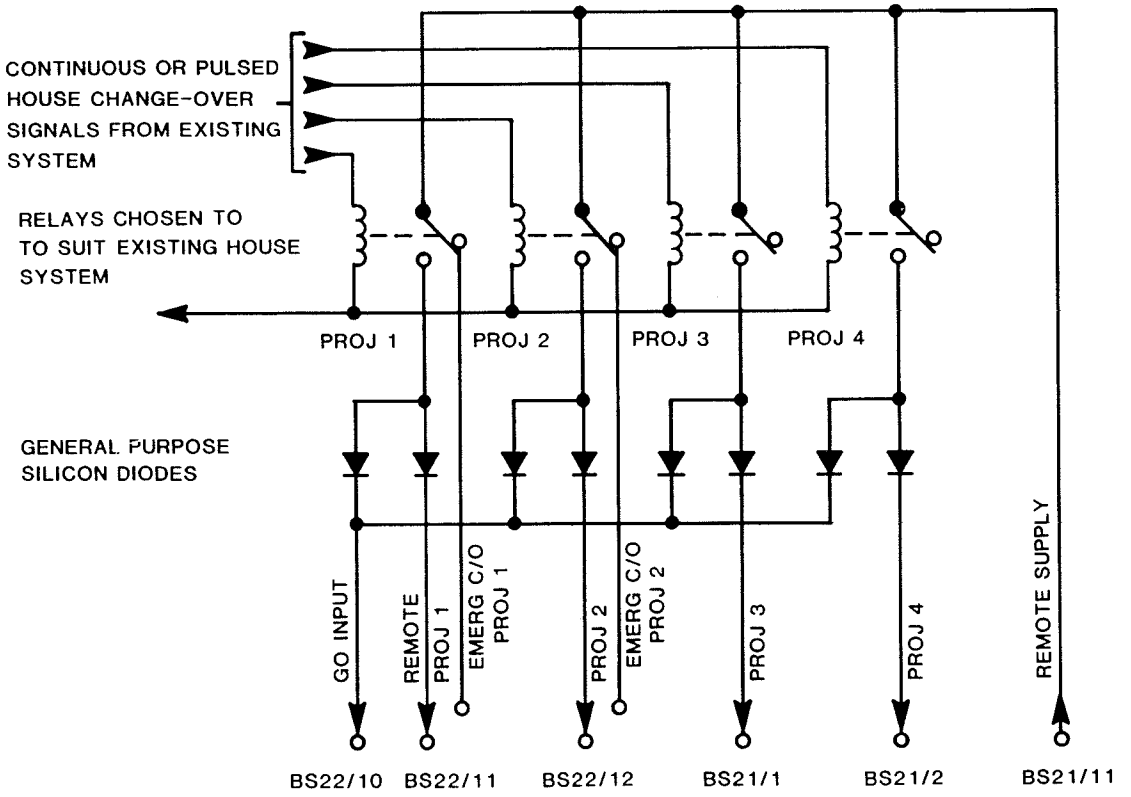



Fig. 2.27 Control of c/o by external equipment

## 2.27 Automation Adapter

(a) Information can also be fed back into the BCD connector JM26 to inhibit the normal CP200 front panel format selector. This inhibition automatically occurs when JM26 pin 6 is held high (positive). Signals can then be fed back into the CP200 for decoding, display and operation. This mode is designed for dubbing studios where it is sometimes convenient to be able to control the format of the CP200 from the mixing desk. It is also designed for automation, where a single pulse from a momentary contact (or a continuous ground connection) can be used to change the format, using a simple interface circuit. Contact Dolby Laboratories to obtain a circuit diagram or more information.

## 2.28 Troubleshooting

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

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.

Hum comes and goes at random

(a) Switch off the CP200 and listen again. If hum is still present, switch off the booth completely. If hum is still present, check for other sources in the auditorium. These may be mechanical sources, for example a refrigerator behind the screen or near the auditorium. Do not overlook any air conditioning system which may operate intermitently.

(b) If hum disappears when the booth is switched off, check for any ground (earth) loops in the installation. Listen to any hum level change as the CP200 is switched on and off (leaving the main amplifiers on). Switch between optical sound and Non-sync/Mag on the CP200 and listen to changes in hum level.

(c) CP200 units are supplied with a strap connecting the signal ground to the chassis. Under some circumstances this may cause hum due to ground loops. Try removing this ground strap. **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 may result if grounding is removed.**

Clicks

The CP200 provides increased frequency response from the cell or tape head to the auditorium. Under some circumstances, this may reveal clicks in the system. The 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 be left on at all times. This practice will also extend the life of the Xenon, as striking a Xenon is equivalent to running continuously for 1 1/2 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 related to the theatre system. For example, it could 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, it is not possible to de-gauss the sprocketed drum. 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.

In cases of incorrect audio signals, use the block diagram in Section 4 of the manual (unit circuits) to trace the signal path from input to output. If signals are injected from an oscillator into the optical input terminals from the projector, be sure a 100 k ohm resistor is used in series with the input to simulate the high impedance cell.

Due to the subtle nature of most surround information, it is sometimes difficult to verify that the surround decoder is functioning properly. 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.