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

Model CP55

CINEMA PROCESSOR

Installation and Alignment Instructions

DOLBY

INSTALLATION INSTRUCTIONS

FOR

MODEL CP55
CINEMA PROCESSOR

Dolby Laboratories Incorporated

U.S.A.: 100 Potrero Avenue, San Francisco, CA 94103
Tel: 415-558-0200; telex 34409

U.K.: 346 Clapham Road, London SW9 9AP
Tel: 071-720-1111; telex 919109

ISSUE 4
Part No. 91012
S90/7166/8893
WW

CAUTION

This Installation Manual is for use by qualified personnel only. To avoid electric shock do not perform any servicing other than that contained in the Operator's Guide unless you are qualified to do so.

TABLE OF CONTENTS

*Some CP55 processors do not contain these features.

INTRODUCTION TO THE INSTALLATION AND ALIGNMENT MANUAL

This manual contains essential information on the installation and alignment of the Model CP55 Cinema Sound Processor. It is intended to be used by individuals who are qualified in the area of cinema sound service. The basic day-to-day operation of the CP55 is covered in the Operator's Guide.

This installation and alignment manual covers the procedures necessary to ensure that the theatre sound system is accurately aligned to standards that have been established by Dolby Laboratories. Following these procedures will ensure that the theatre sound system will accurately reproduce the soundtrack as the director and sound mixers intended.

The Dolby Cinema Processor is the central element of the theatre sound system. The projector, the Dolby Processor, the power amplifiers, the loudspeakers, as well as the auditorium itself must be considered when aligning the system for optimum performance.

The system alignment procedure is divided into two parts--the **A-chain** alignment which covers the projector, optical preamplifier, and Dolby noise reduction adjustments--and the **B-chain** alignment which covers the portions of the system from the room equalization circuits to the CP55 fader through to the loudspeakers.

The alignment instructions in this Manual are presented in three columns. The first column, **Action**, contains a drawing of the item to be adjusted and a caption containing a brief description of the action to be taken. The second column, **Indication**, contains a visual indication of the desired results, where applicable. The third column, **Notes**, contains information which amplifies and supplements the other two columns.

If you are familiar with alignment of other Dolby Cinema Sound Processors you need to follow only the information in the first two columns. If you are unfamiliar with the equipment or face special situations that require complete information you should consult the **Notes** column.

SECTION 1
EQUIPMENT REQUIRED

a. Dual-trace oscilloscope with X-Y facilities.

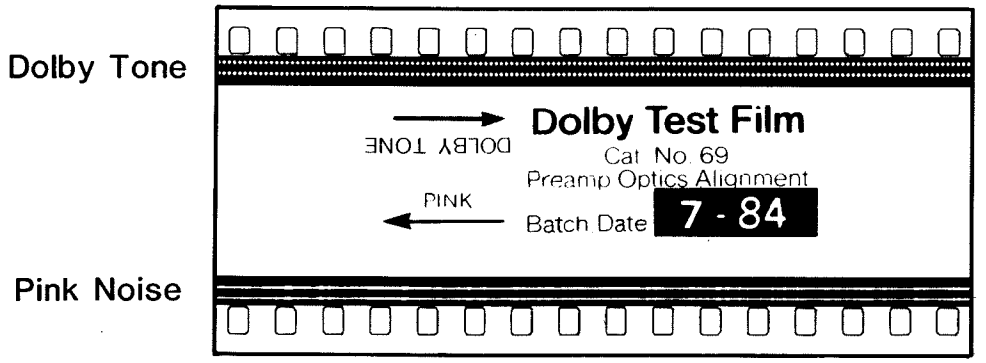
b. Real Time Spectrum Analyzer (RTA) with calibrated microphone

c. Sound Pressure Level Meter (with slow time constant and C weighting scale)

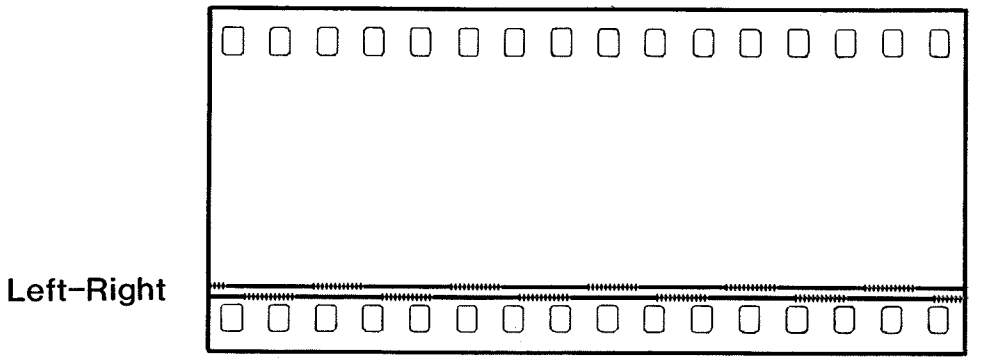
d. Cat. No. 85 pink noise generator.

e. Cat. No. 67 extender for the equalizer modules.

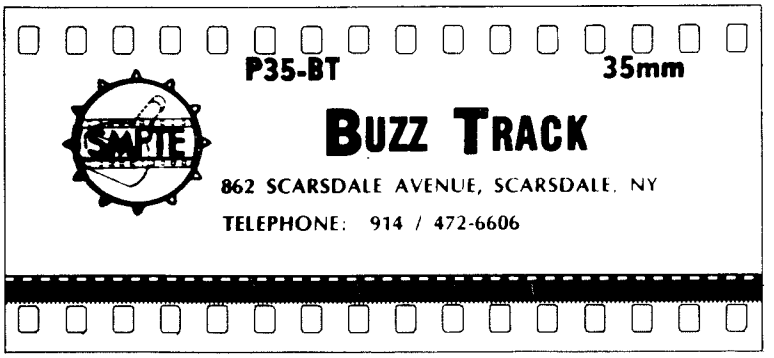
f. Test Films (available from Dolby Laboratories or equipment dealers). We recommend that you make loops of these test films, sufficiently long to go through the entire projector film path so that azimuth and lateral film position adjustments can be made accurately.



(1) Dolby Tone and Pink Noise -- Cat. No. 69

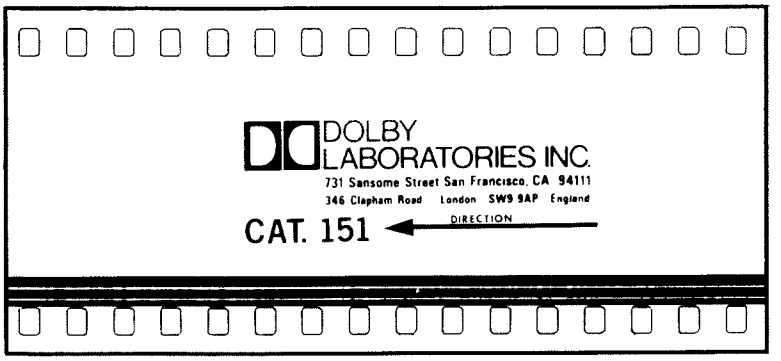


(2) 1kHz, 100% Modulation, Left/Right -- Cat. No. 97



(3) SMPTE Buzz Track

Center-Surround



(4) Stereo Optical Surround Level -- Cat. No. 151

g The following films can be purchased from Dolby Laboratories or a cinema equipment dealer. The films are optional items that are used in final system sound verification:

(1) "**Jiffy**" Test Film -- Cat. No. 251

(2) "***Listen . . .***" Film -- Cat. No. 351.

SECTION 2
INITIAL SET-UP AND INSTALLATION

CAUTIONS

1. Before you remove or replace the Cat. No. 240 Optical Pre-Amp or the Cat. No.249 Power Supply Card, first disconnect AC power from the CP55 to protect the speakers and the CP55 from damage. For all other modules in the CP55, first switch to **BYPASS**; you can then safely remove or replace the desired card without disconnecting power from the CP55.

2. Do **NOT** connect the CP55 to mains power until all connections have been made and all jumpers have been installed (see Pages 2.3, 2.4 and 2.5 following).

STEP 1 If air-conditioning noise is audible in the theatre, arrange for lubrication of the motor, fan bearings and adjustment of belts and drives to reduce the ambient noise to a minimum.

If the CP55 replaces an existing cinema sound system, put up a typical film before you remove the old system so you will have a benchmark for comparison to the new system and as a check of the positioning of the exciter lamp, the focusing of the sound track lens, and the condition of the solar cell.

Before you run the film:

- Verify that the existing power amplifiers are in good working order.
- Verify that the existing speakers are in good working order, and that there is no loose or missing hardware or structural members in the enclosures.
- Verify that all wiring is present and properly connected and that crossovers are operating.
- Check the phasing of the speaker connections (see Appendix A).
- Verify that there are adequate earth (ground) connections.
- Verify that radio interference problems are adequately resolved.

STEP 2 While you are running the film, listen carefully in various parts of the theatre for audio system problems:

- Hum.
- Noise, clicks, pops.
- Distortion.
- Poor tonal balance (lack of high-frequency or bass content).

These problems **must** be resolved before you can proceed to the next step in the installation.

STEP 3 To avoid heat problems, do not locate the CP55 immediately above or below the power amplifiers. Locate the power amplifiers away from the Cat. No. 240 optical preamplifier to avoid hum pickup problems.

STEP 4 Disconnect power from the existing cinema sound equipment.

STEP 5 Disconnect all cabling from the existing cinema sound processing system, but do not disconnect the wiring from power amplifiers, etc.

STEP 6 Check that the CP55 voltage selector switch is set correctly for your mains voltage and that the correct fuses are installed. (The selector switch is located on the rear of the Cat. 250 Power Supply and can be seen through the backplane.) **DISCONNECT THE CP55 FROM POWER BEFORE YOU TURN THE SELECTOR SWITCH FROM ONE POSITION TO ANOTHER**. The CP55 accepts both 50 Hz and 60 Hz power. The mains voltages must fall within the following limits:

Voltage Setting	Acceptable Voltage Range	Fuse	Type
100 VAC	85-110 VAC	600mA	1/4" x 1-1/4" slow-blow
120 VAC	102-132 VAC	600mA	1/4" x 1-1/4" slow-blow
140 VAC	119-154 VAC	600mA	1/4" x 1-1/4" slow-blow
200 VAC	170-220 VAC	T 250mA	5 x 20mm time lag
220 VAC	187-242 VAC	T 250mA	5 x 20mm time lag
240 VAC	204-265 VAC	T 250mA	5 x 20mm time lag

NOTE

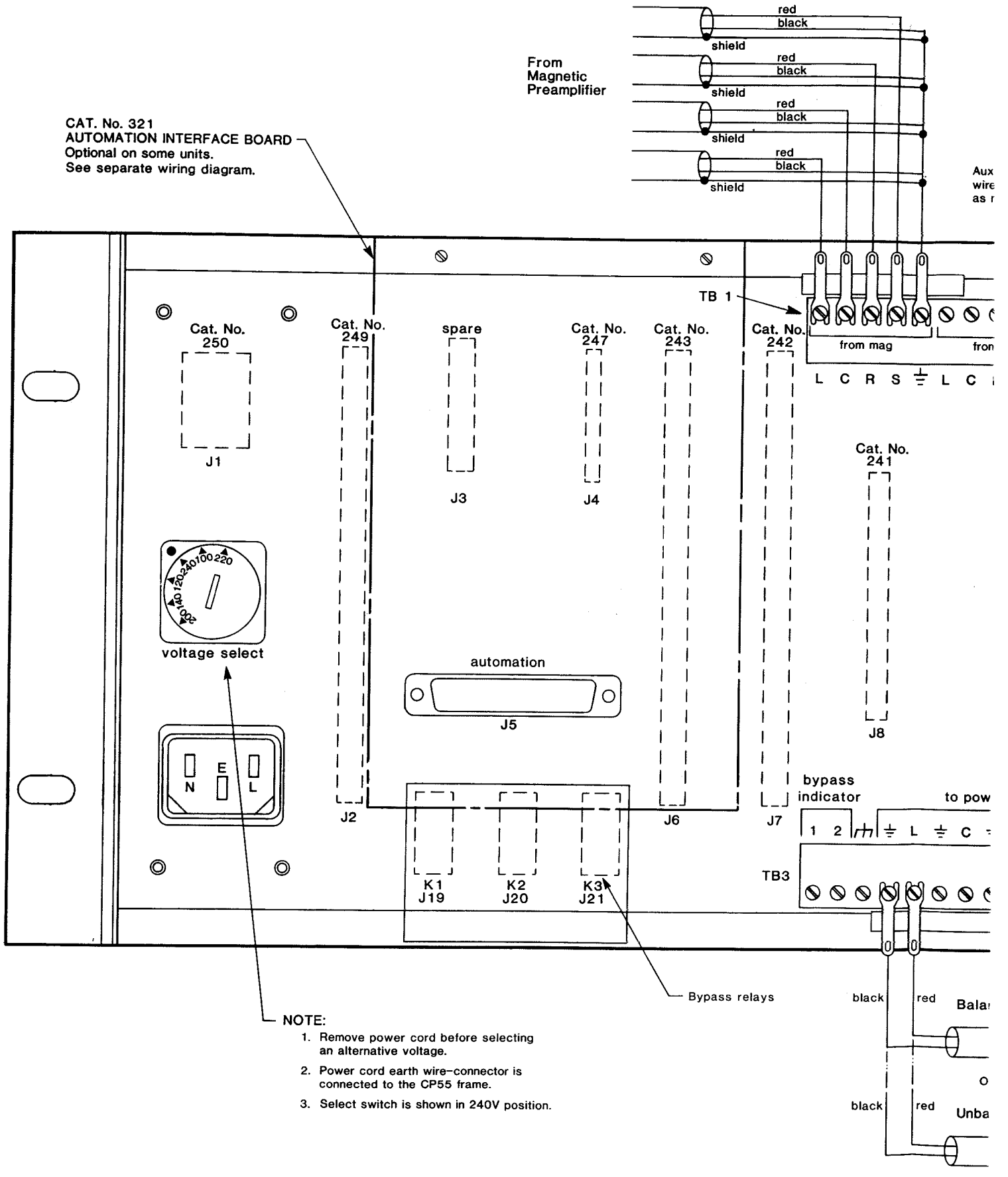
Follow all local codes and regulations covering electrical wiring. It is recommended that conduit be used for wiring runs.

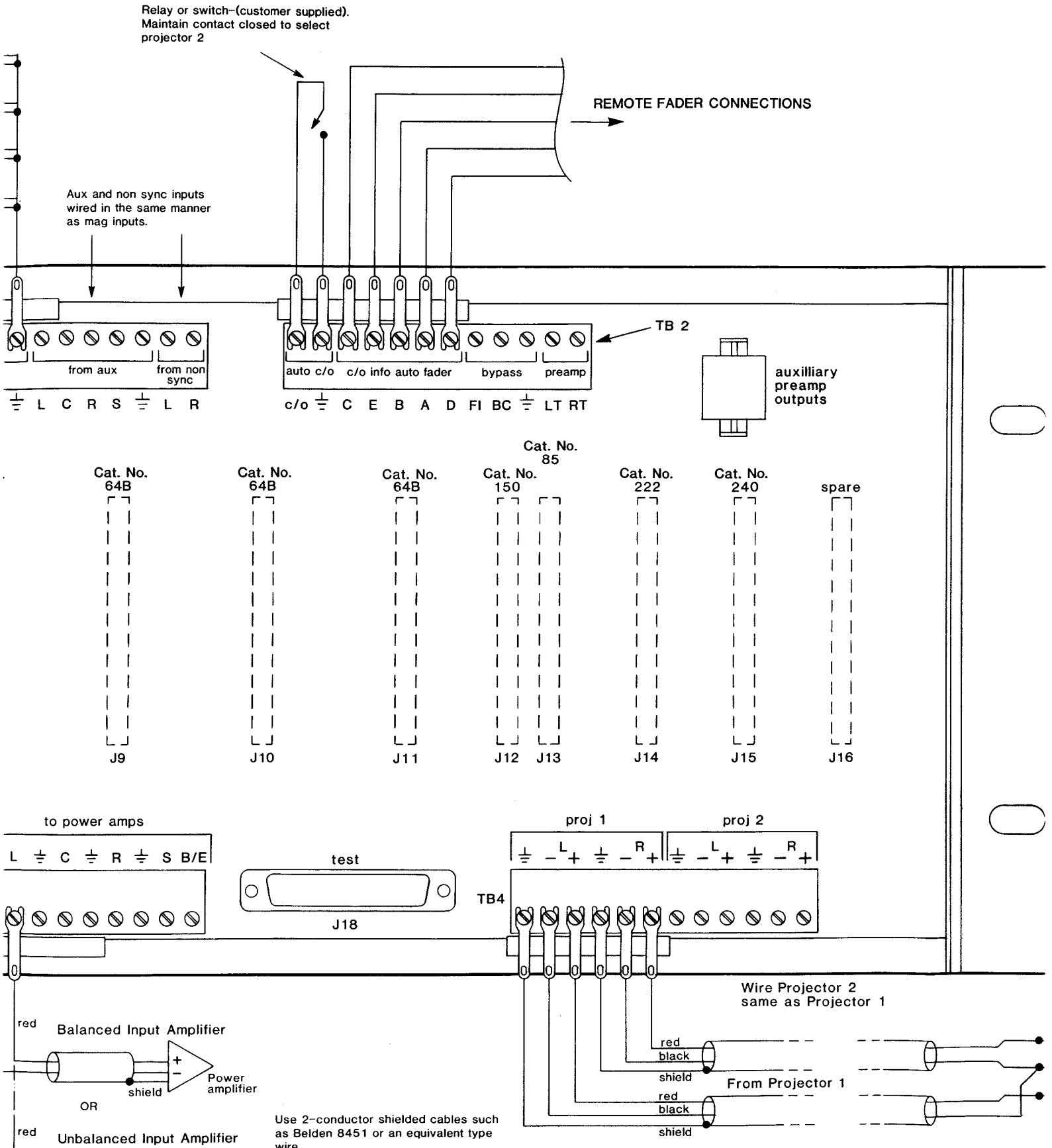
STEP 7 All signal connections (except those to automation connector **J5** -- see the following step) -- are made by soldering the leads to terminal strips (solder tags) that are furnished with the CP55. The strips with the soldered wiring are fastened in place at the terminal strips shown on the wiring diagram. If you will be installing new stereo solar cells on the projector or if the existing stereo solar cell is not soldered to a compatible terminal strip, solder the wiring to a terminal strip furnished with the CP55.

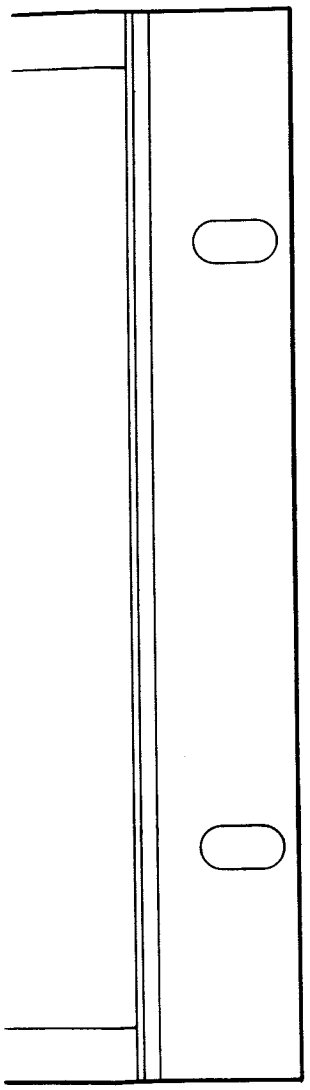
STEP 8 If you plan to make use of the automation interface in the CP55, there are two methods you can follow.

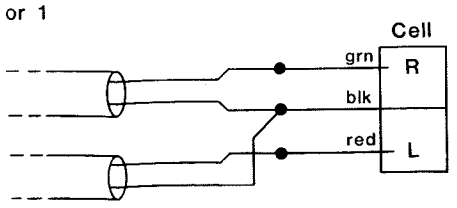
If your CP55 includes a Cat. No. 321 Automation Interface Card, the card must first be connected to customer-furnished wiring and parts as shown in Section 6. The Cat. No. 321 permits the connection of remote switches and indicators for format, mute, and local/remote fader control. (You do not have to make the connections for the automation until they are needed.) Plug connector P1 on the Automation Interface Card into **Automation** connector **J5** on the rear panel of the CP55.

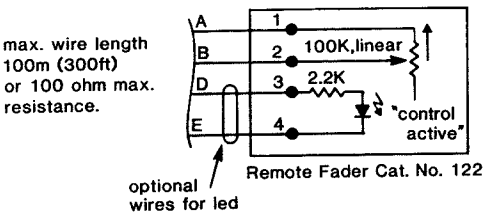
If you choose not to use the Cat. No. 321 card, you can wire remote switches directly to connector **J5** through a 25 way male D-connector **(DB-25S)**, following the pin identifications on the wiring table. However,there is no circuitry in the CP55 to drive remote indicators (this circuitry is part of the Cat. No. 321 card), so wire only the switches to the connector.


From Magnetic Preamplifier
red
black
shield
red
black
shield
red
black
shield
red
black
shield
CAT. No. 321
AUTOMATION INTERFACE BOARD
Optional on some units.
See separate wiring diagram.
TB 1
from mag
L C R S L C
Cat. No. 250
J1
Cat. No. 249
J2
spare
J3
Cat. No. 247
J4
Cat. No. 243
J6
Cat. No. 242
J7
Cat. No. 241
J8
voltage select
automation
J5
N E L
K1 J19
K2 J20
K3 J21
bypass indicator
1 2
TB3
to pow
Bypass relays
black
red
Bala
black
red
Unba
NOTE:
1. Remove power cord before selecting an alternative voltage.
2. Power cord earth wire–connector is connected to the CP55 frame.
3. Select switch is shown in 240V position.

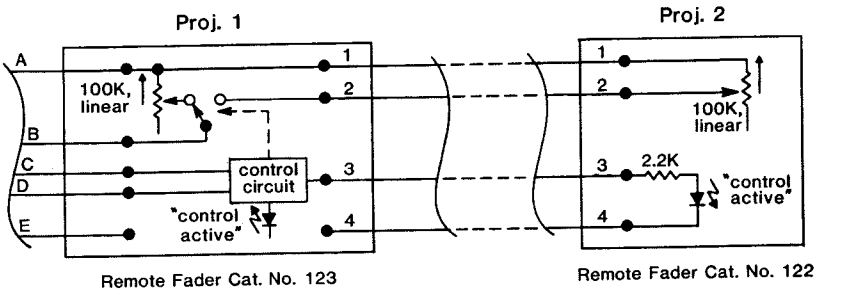

Relay or switch–(customer supplied). Maintain contact closed to select projector 2
REMOTE FADER CONNECTIONS
Aux and non sync inputs wired in the same manner as mag inputs.
from aux
from non sync
L C R S L R
auto c/o
c/o info auto fader
bypass
preamp
c/o C E B A D FI BC LT RT
TB 2
auxilliary preamp outputs
Cat. No. 64B
Cat. No. 64B
Cat. No. 64B
Cat. No. 150
Cat. No. 85
Cat. No. 222
Cat. No. 240
spare
J9
J10
J11
J12
J13
J14
J15
J16
to power amps
L C R S B/E
test
J18
TB4
proj 1
proj 2
L R
Wire Projector 2 same as Projector 1
red
black
shield
From Projector 1
red
Balanced Input Amplifier
shield
Power amplifier
OR
red
Unbalanced Input Amplifier
shield
Power amplifier
Use 2-conductor shielded cables such as Belden 8451 or an equivalent type wire.
For balanced input power amplifiers, ensure that amplifier commons are connected to CP55 ground, either through the rack or via a wire installed for that purpose.



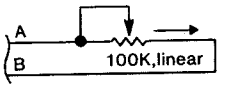




SINGLE-STATION INSTALLATION OF REMOTE FADER

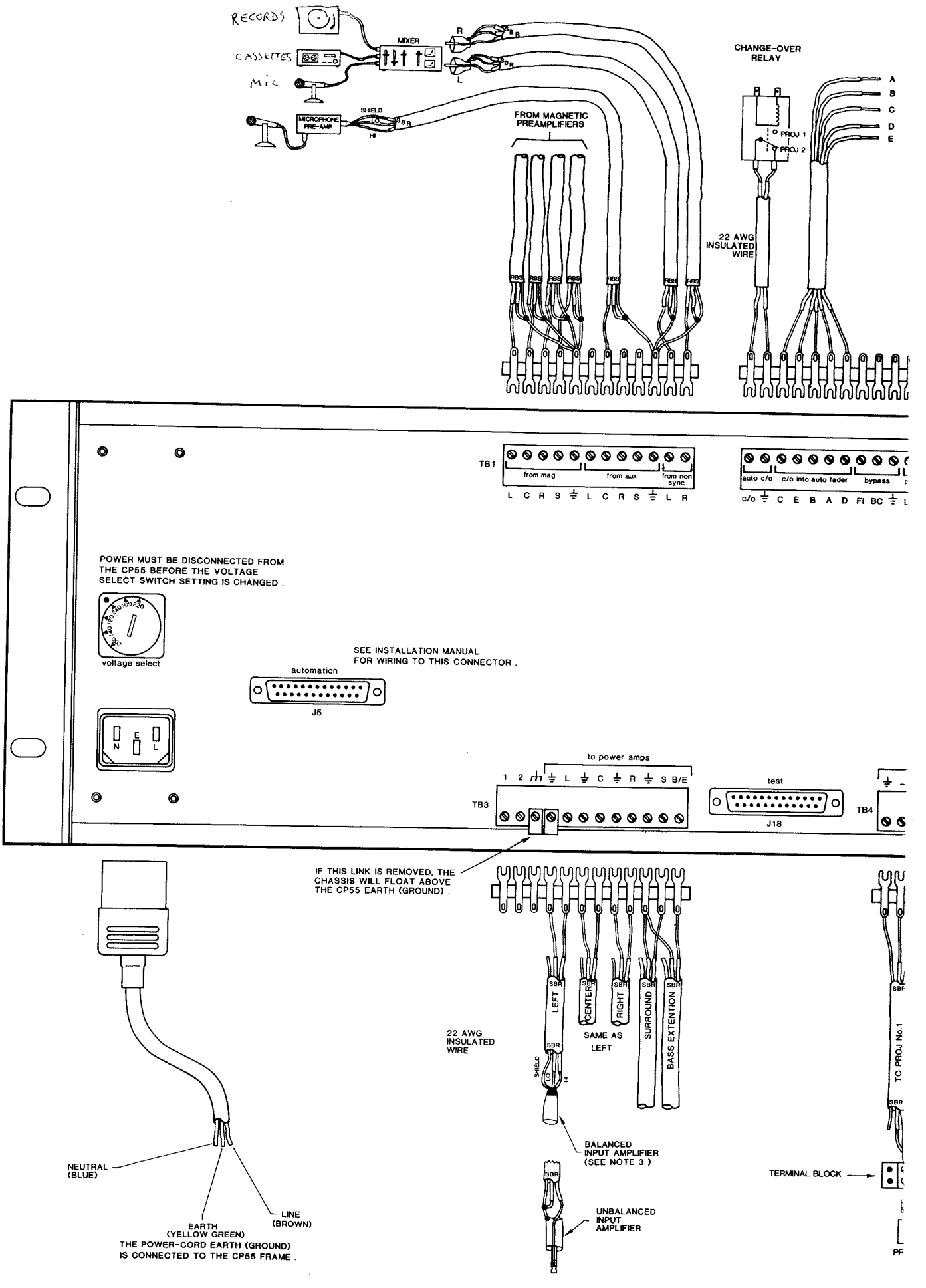


TWO-STATION INSTALLATION OF REMOTE FADER
(EXPANDABLE TO ANY NUMBER)

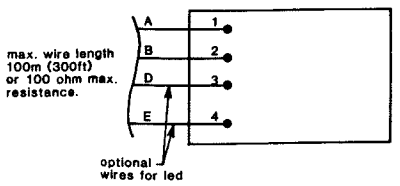


CUSTOMER SUPPLIED REMOTE FADER POTENTIOMETER

CP55 WIRING DIAGRAM
AOW3041, REV 3
S85/5956/6039

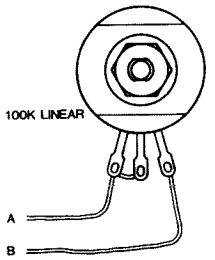

RECORDS
CASSETTES
MIC
MIXER
MICROPHONE PRE-AMP
SHIELD
LO
HI
R
L
FROM MAGNETIC PREAMPLIFIERS
CHANGE-OVER RELAY
PROJ 1
PROJ 2
A
B
C
D
E
22 AWG INSULATED WIRE
TB1
from mag
from aux
from non sync
L C R S ⏚ L C R S ⏚ L R
auto c/o
c/o info auto fader
bypass
c/o ⏚ C E B A D FI BC ⏚
POWER MUST BE DISCONNECTED FROM THE CP55 BEFORE THE VOLTAGE SELECT SWITCH SETTING IS CHANGED .
voltage select
SEE INSTALLATION MANUAL FOR WIRING TO THIS CONNECTOR .
automation
J5
N
E
L
to power amps
1 2 ⏚ L ⏚ C ⏚ R ⏚ S B/E
TB3
test
J18
TB4
IF THIS LINK IS REMOVED, THE CHASSIS WILL FLOAT ABOVE THE CP55 EARTH (GROUND) .
22 AWG INSULATED WIRE
SBR
LEFT
CENTER
RIGHT
SURROUND
BASS EXTENTION
SAME AS LEFT
SHIELD
LO
HI
BALANCED INPUT AMPLIFIER (SEE NOTE 3)
UNBALANCED INPUT AMPLIFIER
TO PROJ No.1
TERMINAL BLOCK
NEUTRAL (BLUE)
LINE (BROWN)
EARTH (YELLOW GREEN)
THE POWER-CORD EARTH (GROUND) IS CONNECTED TO THE CP55 FRAME .

EXAMPLE
A

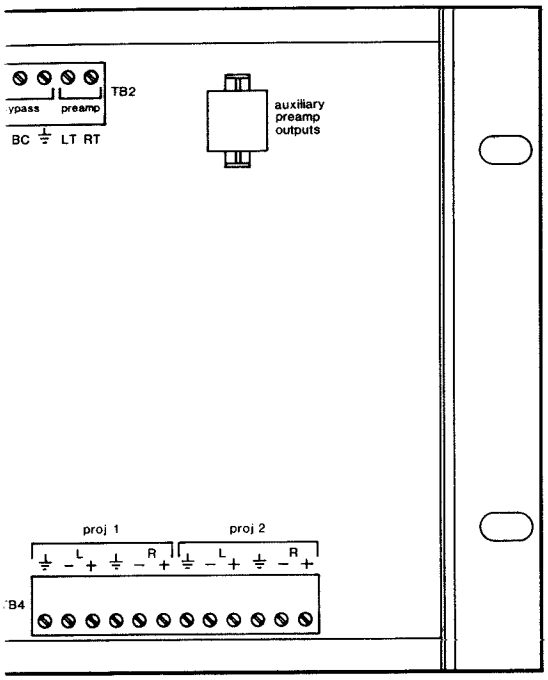


SINGLE-STATION
INSTALLATION
OF REMOTE FADER
Cat. No. 122

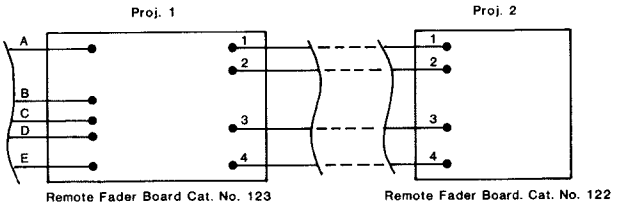
EXAMPLE
B



CUSTOMER SUPPLIED REMOTE
FADER POTENTIOMETER



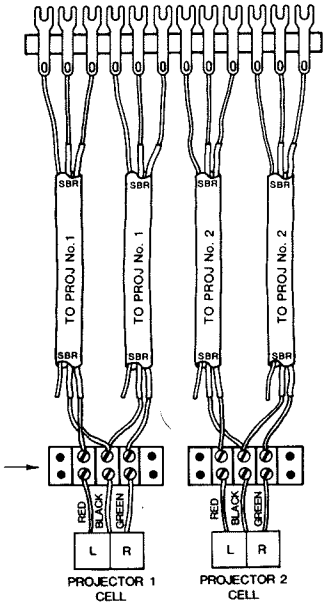
EXAMPLE
C



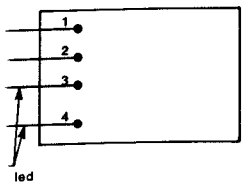
Remote Fader Board Cat. No. 123

Remote Fader Board. Cat. No. 122

TWO-STATION INSTALLATION OF REMOTE FADER
(EXPANDABLE TO ANY NUMBER)

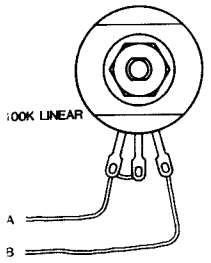


EXAMPLE
A



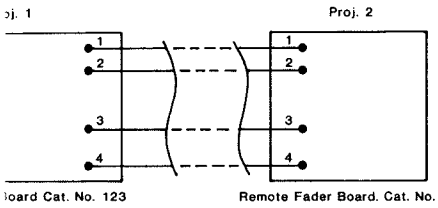
SINGLE-STATION
INSTALLATION
OF REMOTE FADER
Cat. No. 122

EXAMPLE
B



STOMER SUPPLIED REMOTE
FADER POTENTIOMETER

EXAMPLE
C



oard Cat. No. 123 Remote Fader Board. Cat. No. 122

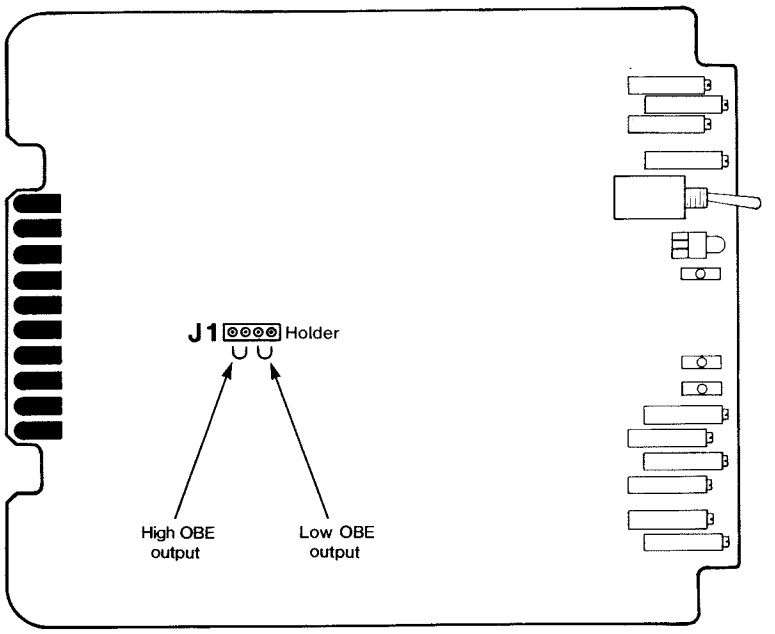
VO-STATION INSTALLATION OF REMOTE FADER
(EXPANDABLE TO ANY NUMBER)

NOTES:

1. FOLLOW ALL LOCAL ELECTRICAL AND BUILDING CODES .
2. USE EARTHED (GROUNDED) CONDUIT WHEREVER POSSIBLE . AVOID ROUTING SIGNAL WIRING NEAR ELECTRIC MOTORS, RECTIFIERS, POWER WIRING, DIMMER WIRING OR OTHER SOURCES OF ELECTRICAL NOISE .
3. CHECK EARTHING (GROUNDING) OF POWER AMPLIFIERS. FOR BALANCED INPUT POWER AMPLIFIERS, CONNECT THE AMPLIFIER COMMONS TO THE CP55 CHASSIS EARTH (GROUND) EITHER THROUGH THE RACK OR VIA A DIRECT WIRE CONNECTION THAT IS INSTALLED FOR THIS PURPOSE .
4. USE BELDEN 8451 2-CONDUCTOR SHIELDED WIRING FOR ALL SIGNAL WIRING (TWO 22AWG 7x30 STRANDED CONDUCTORS, TINNED COPPER, POLYPROPYLENE INSULATED, TWISTED PAIR, 22AWG STRANDED TINNED COPPER DRAIN WIRE, BELDFOIL ALUMINUM-POLYESTER SHIELD, PAPER WRAP, 100% SHIELD COVERAGE, NOMINAL OD 0.135in. (3.43 mm), 34pf PER FOOT CONDUCTOR TO CONDUCTOR (111 pf PER METER)).
5. USE 22AWG WIRING FOR FADER AND OTHER CONTROL WIRING (ONE 22AWG 7x30 STRANDED CONDUCTORS, TINNED COPPER, PVC OR EQUIVALENT INSULATED, PVC OR EQUIVALENT JACKET). IF DESIRED, EQUIVALENT RIBBON CABLE MAY BE USED FOR MULTICONDUCTOR CONNECTIONS .
6. IF A CHANGEOVER RELAY IS USED, CONNECT A REVERSE-BIASED DIODE ACROSS THE RELAY COIL TERMINALS (1N4004 FOR 110 VOLT RELAY, 1N4008 FOR 220 VOLT RELAY) .
7. S = SHIELD (DRAIN) WIRE, B = BLACK, R = RED .

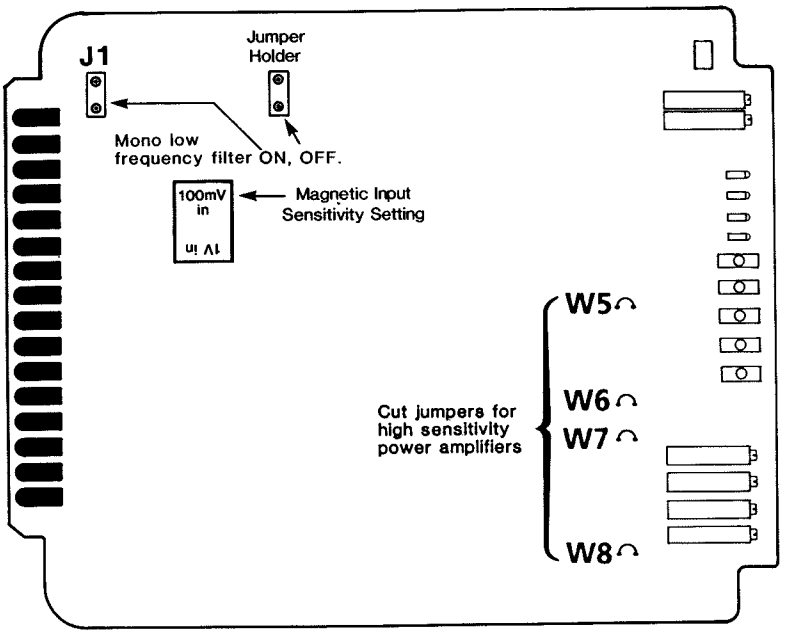
INSTALLATION DIAGRAM: CP55
A0W3058 REV A

STEP 9 Next, check the jumpers on the following cards:



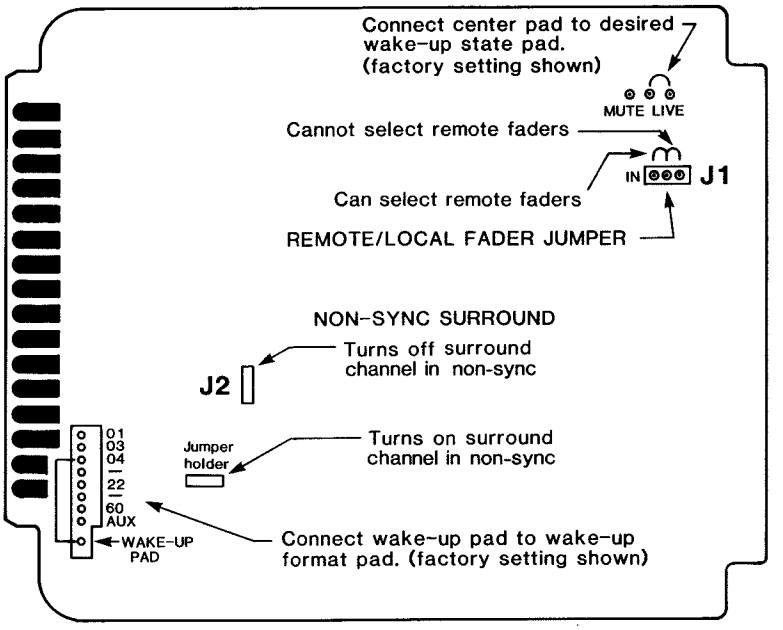
Cat. No. 241, Surround Equalization and Optical Bass Extension Card

Jumper J1 should be in the **Low** OBE (Optical Bass Extension) output position If high OBE output is required, the need will be determined during the OBE alignment (see Page 5.25).



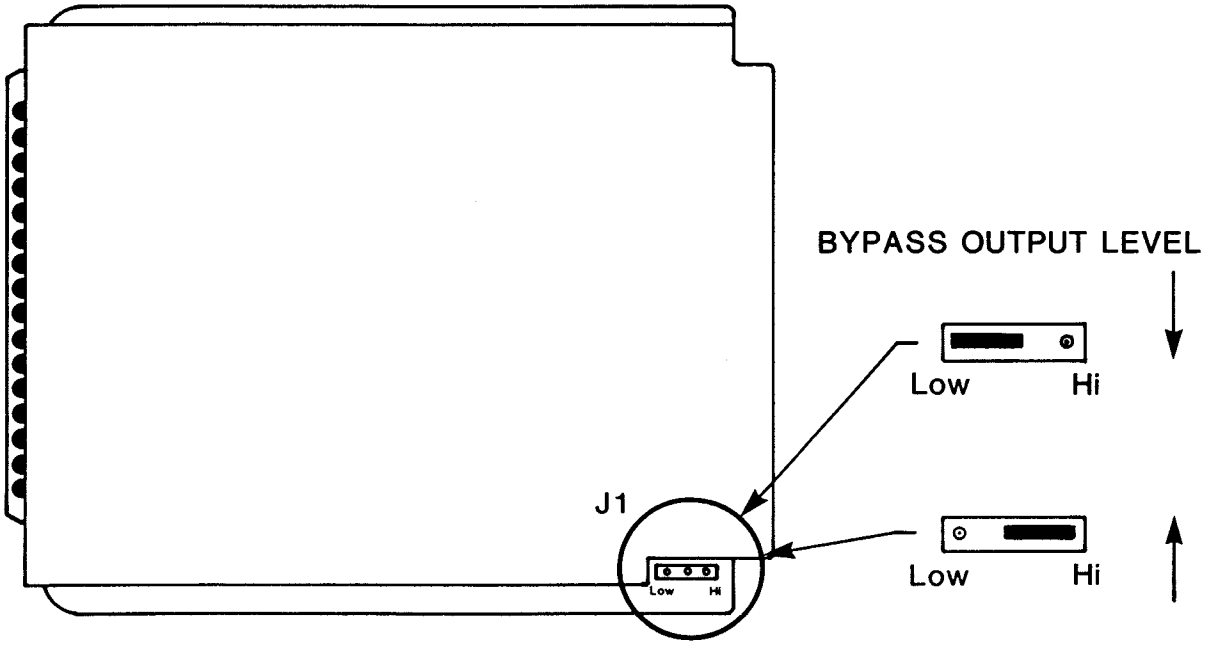
Cat. No. 242, B-Chain Card

Jumper J1 should be in the jumper holder unless the low-frequency mono sound must be filtered because adjustment of the mono equalization potentiometer is insufficient for pleasing sound (see Page 5.53). Jumpers W5, W6, W7, and W8 are set at the factory for a power amplifier input sensitivity of between 90 mV and 1.23 V. If the power amplifiers used in the installation are very



Cat. No. 243, Control Logic Card

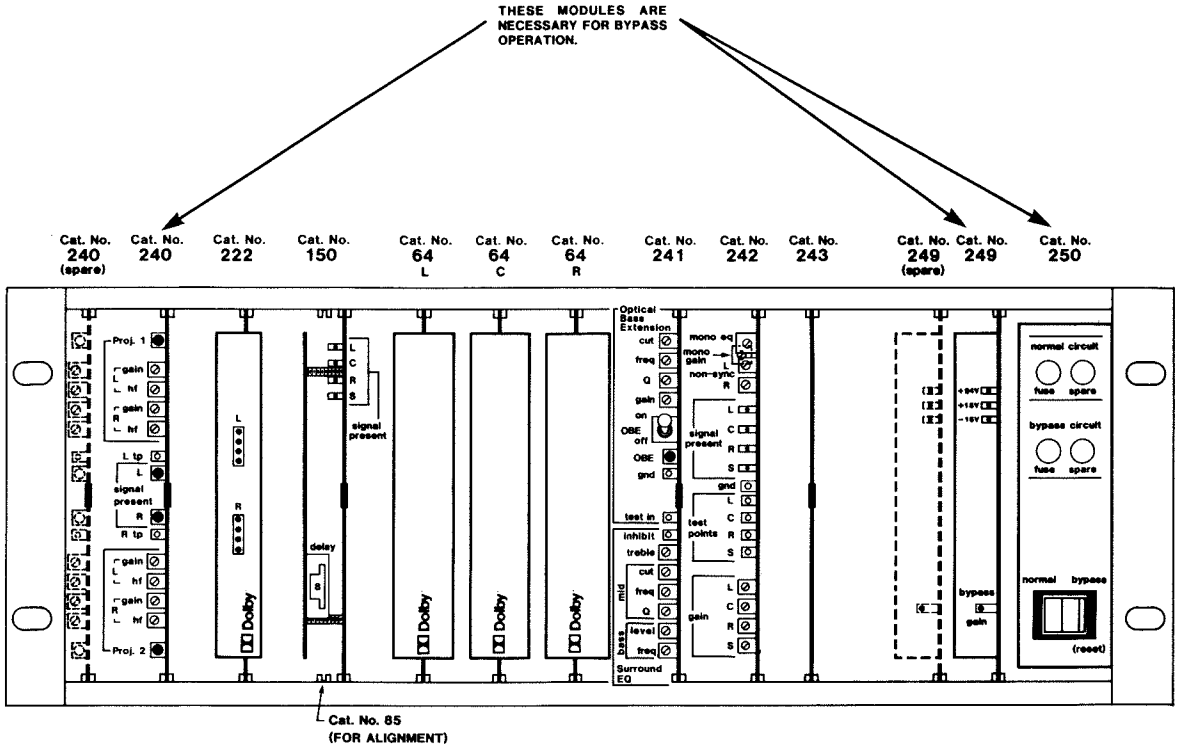
Set jumper J1 either to enable or disable selection of remote faders as shown above. The jumper in the lower left corner is used to set the "wake-up" condition (the format to which the CP55 is set whenever power is applied). The CP55 is shipped with a jumper soldered between the **wake up** and format **04** terminals (Dolby Stereo optical with surround). If the installation requires a different wake-up condition, cut the jumper and resolder a new jumper between **wake up** and the desired format number (the markings are the same as the front panel format buttons). The upper right soldered jumper enables you to select sound on **(LIVE)** as shown above or sound off (MUTE), when power is applied. The non-sync surround jumper is shipped in the jumper holder (non-sync surround sound on). If non-sync surround sound is to be off, move the jumper to J2.



Cat. No. 249, Power Supply Module

Set jumper J1 in the **Low** bypass output range initially. If increased bypass output gain is required,

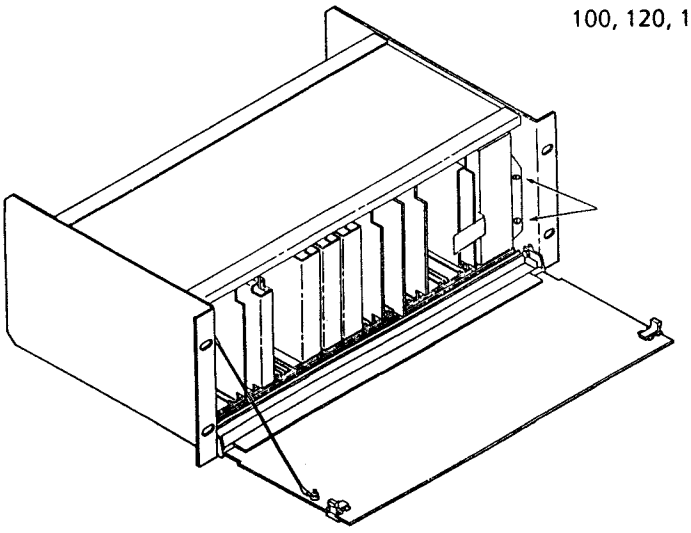
STEP 10 If they are not already installed in the CP55 card cage, install all of the cards for your system as shown.



Card Descriptions

Slot No.	Card	Function
1	Slot for spare Cat. No. 240 Card	
2	**Cat. No. 240** **Optical Preamplifier Card**	Amplifies the outputs of the solar cell in the selected projector. Electronic switches select projector No. 1 or 2.
3	**Cat. No. 222** **Dual Noise Reduction Module**	Contains two channels of Dolby A-type noise reduction circuitry with LED indicators to set Dolby Level.
4	**Cat. No. 150** **2:4 Channel Decoder Card**	Derives left, right, center, and surround information from the two optical tracks on the film.
5, 6, 7	**Cat. No. 64B** **Equalizer Module**	Contains treble and bass controls and 27 third-octave equalizer controls. One card is used for each front channel: left, center, right.

Slot No.	Card	Function
8	**Cat No. 241 Surround Equalizer and Optical Bass Extension Card (Optional in some countries)**	(1) Provides equalization for the surround channel; (2) Extracts low frequency information from the left and right signals and sends these signals to a subwoofer output through an equalizer and a fader circuit.
9	**Cat. No. 242 B-Chain Card**	Contains the signal processing circuitry for the B-Chain except for the equalizers. Has input buffers and filters for non-sync, aux and magnetic sources, electronic switches to select input sources, a 4-channel fader circuit, and output level potentiometers for all channels.
10	**Cat. No. 243 Control Logic Card**	Configures the CP55 for the selected format. Also contains fader mute and fader local/remote status circuits. Generates control logic signals for other cards in the CP55. Its inputs are the Cat. No. 247 front panel controls, external remote boxes, or automation inputs to the CP55. It also contains a jumper block to enable the wake-up condition to be preselected.
11	**Slot for spare Cat. No. 249 card.**	
12	**Cat. No. 249 Power Supply Module**	Contains a semi-regulated power supply with nominal outputs of + 15V, -15V, and 24V. Also contains the bypass amplifier, gain trimmer, and a + 12V bypass power supply.
13	**Cat. No. 250 Transformer Module**	Contains two power transformers (main and bypass) that convert mains voltage AC to low-voltage AC. The selector switch for main voltages is accessible through the backplane. It permits a choice of the following nominal mains voltages: 100, 120, 140, 200, 220, and 240V.



As a safety feature in many countries, the Cat. No. 249 module is held in place by a retainer bracket mounted to the Cat. No. 250 module. To withdraw the Cat. No. 249 it is first necessary to remove the Cat. No. 250. Do this by disconnecting the power cord from the Cat. No. 250 and then undoing the two screws indicated by arrows. Remove the Cat. No. 250 followed by the Cat. No. 249.

ADDITIONAL INFORMATION FOR THE SAFE OPERATION OF THE CP55

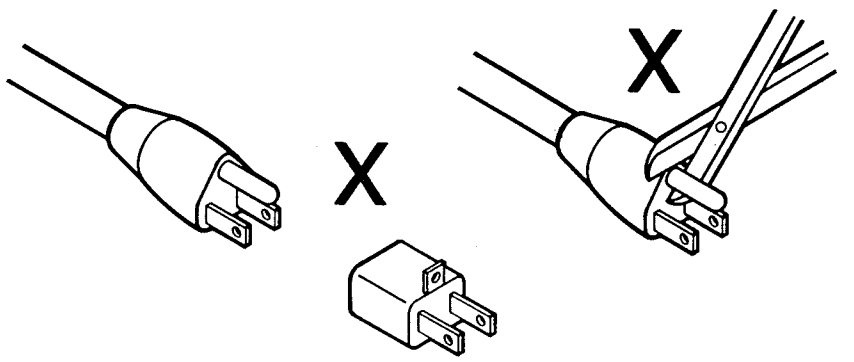
To ensure proper operation and guard against potential shock hazard, the CP55 must be connected only to a properly wired, grounded (earthed) mains receptacle. If you are uncertain about the wiring of your mains outlet do not use it. Consult a qualified electrician. The power cord is furnished with either a standard U.S.A. three-prong plug or with unterminated leads for use in other countries. The wires are colored in accordance with the following international code:

	International	U.S.
live or hot	brown	black
neutral	blue	white
earth	green/yellow	green/yellow

Before the power cord is connected to the CP55, ensure that a qualified electrician has wired the cord following the code.

U.S. Style Plugs

Never cut the ground pin on the standard U.S.A. three-prong plug and do not use a ground-lifting adaptor.



Connections for United Kingdom

WARNING: THIS APPARATUS MUST BE EARTHED.

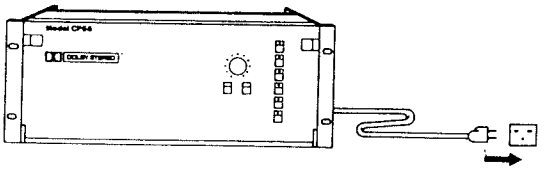
As the colours of the cores in the mains lead may not correspond with the coloured markings identifying the terminals in your plug, proceed as follows:

- the core which is coloured green and yellow must be connected to the terminal in the plug which is marked with the letter E or by the earth symbol ⏚, or coloured green or green and yellow.
- the core which is coloured blue must be connected to the terminal which is marked with the letter N or coloured black.
- the core which is coloured brown must be connected to the terminal which is marked with the letter L or coloured red.

WARNING--Before you connect the unit to mains power, check that it has been set to the correct mains voltage and that the correct fuse is installed. To reduce the risk of fire, replace the fuse only with the same type and 250V rating:

Voltage Setting	Fuse	Type

STEP 11 Turn the front panel FADER fully down, then connect the CP55 to mains power.



STEP 12 With the **NORMAL/BYPASS** switch (accessible with the front door open) in the **NORMAL** position, verify that all three LEDs on the Cat. No. 249 Power Supply Module are lit. Close the front door and verify that format 04 **Dolby stereo optical with surround, local active**, and **proj 1** or **proj 2** LEDs are on (unless a different wake-up format was selected on the Cat. No. 243).

STEP 13 Select each format in turn, using the buttons on the front panel and check that the associated LED lights.

STEP 14 Press the **MUTE** pushbutton switch; the LED on the switch should blink. Press the **MUTE** pushbutton switch again; the LED on the switch should be off.

STEP 15 Place the **NORMAL/BYPASS** switch to the **BYPASS** position. The **bypass** LED on the front panel should blink and all other LEDs should be off.

STEP 16 Place the **NORMAL BYPASS** switch back to the **NORMAL** position and apply power to the other projection room equipment.

HUM PROBLEMS

If you hear undesirable hum from the speakers when you apply power to the CP55 and other projection room equipment, check the following list for possible causes:

1. **Ground loops caused by audio signal wiring, especially to power amplifiers.** Only one end of an audio shield wire should be connected. See Page 2.3. Be sure to check the booth monitor installation.

2. **Projector power wiring.** All mains wiring should be properly grounded.

3. **Room lighting dimmer controls** (SCR-TYPE).

4. **Power amplifiers.** Disconnect from the CP55 and ground the inputs to determine if the power amplifiers are causing hum problems.

With CP55 fader turned up and format 04 selected:

5. **Solar cell wiring**. Check the shield connections. Cell wiring should be placed away from mains and other wiring.

6. **Exciter lamp power supply.** Check for ripple on the DC power supply outputs. Some old exciter lamp power supplies and emergency supplies provide AC to the lamp. The resulting hum makes them totally unsuitable for a stereo playback system.

7. **Room lighting/solar cells.** Ambient lighting can leak into the solar cell area and cause hum.

The CP55 backplane contains a link which connects frame ground to signal/power ground (TB3 terminals 3 and 4). If you have checked items 1 through 7 above and hum is still present, removing this link may fix the problem.

SECTION 3
AN OVERVIEW OF THE ALIGNMENT PROCEDURE

This section is an overview of the general principles involved in the alignment of Dolby cinema equipment. It is useful to develop an understanding of why the CP55 is aligned as described in this manual. If the installer is already familiar with these principles, or is in a hurry to complete the installation, this section may be read later. Continue the installation procedure beginning with Section 4.

1. Aligning the A-Chain

The A-Chain is first calibrated by use of the Dolby Tone test film to establish the correct Dolby operating level within the CP55 and to ensure correct tracking of the Dolby noise reduction circuit.

Pink noise is used for equalization of the A-chain. (Pink noise is similar to white noise but provides equal energy per octave of bandwidth.) Pink noise for A-chain alignment is recorded on the Cat. No. 69 test film. The output should be displayed on an Real Time Analyzer (RTA) so adjustments can be made quickly.

The optical slit is the key element in the A-chain because it imposes the initial limitation on the high-frequency response of the system. Light from the exciter lamp passes through the optical slit and is focussed on the optical sound tracks on the film. The light that passes through the sound tracks falls on the stereo solar cell which generates an electrical signal that is proportional to the audio signal recorded on the optical sound tracks. The slit introduces high frequency loss which must be compensated by circuitry in the Cat. No. 240 optical preamplifier (see Appendix B).

The slit image must be correctly focussed on the film and must be precisely at right angles to the direction of film movement in order to maintain the correct phase relationships between the two optical tracks.

Each channel in the Cat. No. 240 optical preamplifier is equipped with a slit loss equalizer control. Adjustment of this control shifts a fixed amount of boost upward or downward in frequency, but the shape of the curve remains constant. A perfectly flat response up to a minimum of 12 kHz can be achieved; flat responses up to and slightly beyond 14 kHz are often possible. See Appendix B for further details.

2. Aligning the B-Chain

In an average theatre playback system, the acoustical qualities of the theatre are relatively fixed. Therefore, the primary area of improvement is correcting loudspeaker response changes caused by the theatre acoustic environment.

The conventional theatre loudspeaker response in an unequalized installation shows (1) a falling response at both the low and high frequencies, (2) two bumps in the bass and treble areas, and (3) a dip at the crossover frequency. While this characteristic shape is normally present, it will vary somewhat depending on the make of loudspeaker and the acoustic environment. A wider and smoother frequency response is essential for high fidelity theatre sound. In addition, there should be consistency between the sound that is heard in the dubbing theatre and that heard in any given cinema.

It is not practical for the entire cinema industry to standardize on a single make and model of loudspeaker. In any event, the different acoustical characteristics of individual theatres would, to some extent, negate any such standardized speakers. Electronic equalization of each loudspeaker system achieves consistent results in a broad spectrum of environments, and with a broad range of speakers. Accurate equalization requires the use of standardized acoustic measurement procedures.

A pink noise generator provides a continuous random noise signal that covers the total bandwidth and is used to measure and adjust the response of the loudspeakers. The use of random noise eliminates the problems inherent with tones (standing wave patterns in the theatres) and enables the frequency response of the entire system to be observed. Each channel can be measured and adjusted independently of the other channels.

A calibrated microphone is placed in the auditorium to receive the pink noise reproduced by the

curve. Pure pink noise would yield a "flat" horizontal line on the RTA. Thus, the effect of adjustments to the equalizers is quickly and easily seen.

One of the problems inherent in equalization is the nature of the environment. In an open space, a perfect loudspeaker -- radiating a perfectly flat response in all directions -- that is placed in front of a perfectly flat microphone -- producing perfectly flat response to sounds arriving from all directions -- will produce a perfectly flat response on the RTA from pink noise. In an enclosed space such as a theatre, the results are different. When the pink noise generator is first turned on, all of the sound that initially reaches the microphone comes directly from the loudspeaker; the response is flat -- for a few milliseconds. At that time, reflected sound from the walls, ceiling, floor, seats, etc starts to arrive at the microphone together with the direct sound from the loudspeaker. This indirect or reflected sound reinforces the direct sound. The system soon settles into an equilibrium condition. As much energy is being absorbed at the walls, ceiling, etc. as is fed into the room. The displayed response appears to have a rising bass and a falling treble characteristic. At first glance, rolling off the bass and boosting the high frequencies may appear to be the logical approach for a flat steady-state response, but such an arrangement works only on sustained sounds. Dialogue contains short, impulsive sounds and will yield a much-too-bright result because there is no time for reverberation to build and add to the original sound. What is required is a curve that favors such impulsive "first arrival" sound and implies the same gently falling response that is observed when the output of an ideal loudspeaker is measured with a perfect microphone in the theatre.

The amount of reverberation varies with frequency and the higher the frequency the more the treble will be absorbed rather than being reflected. A typical reverberation curve in a theatre rolls off at about 3 dB per octave above 2 kHz. This characteristic is used to define the standard steady-state response curve for all dubbing theatres in which Dolby stereo films are mixed and for all Dolby stereo-equipped cinemas.

The size of the theatre affects the reverberation time and, therefore, the measurement of frequency response. After alignment to this standard curve, some slight adjustment of high frequency slope may be found necessary for extremely large or small theatres. The treble control on the Cat. No. 64 Equalizer card can be adjusted to reduce the output on the response curve by approximately 1 dB at 8 kHz for very large theatres; an increase of 1 dB at 8 kHz may be in order for a very small theatre. Any such adjustment should be based on an evaluation by ear of actual known films rather than as a rule of thumb.

Many loudspeakers used in theatres are far from ideal and require boosting of the low- and high-frequency extremes in order to produce an approximation of the standard reference response curve. Bass and treble controls -- centered on the turnover points of typical loudspeakers -- lift the ends of the spectrum without the need for large amounts of narrow-band boost from the third-octave controls in the Cat. No. 64 cards. The third-octave controls are used for minor adjustments that are required to smooth the frequency response curve.

The final factor is masking of the screen. Most stereo films today are shown in a wide-screen format. The masking curtains of the screen must be drawn back sufficiently to clear the left and right speakers before any adjustments or measurements are made. The treble horns should clear the screen frame and be mounted as close as possible to the screen. Conventional black felt side masking can severely curtail high frequency response. Consequently, there would be severe losses if the left and right loudspeakers were equalized with the masking open as for a 2.35:1 film, and then the masking were brought in for a 1.85:1 film, thus obscuring the outer speakers. To avoid this problem, some theatres have installed acoustically transparent masking cloth, and others leave the masking open whenever they are showing a 1.85:1 film with a stereo sound-track. Moving the speakers towards the center of the screen so as to clear heavy masking is not a good solution, since the stereo sound width would be degraded.

Repainted screens cannot be used for quality sound playback, since the perforations which allow the high frequencies through the screen become clogged with paint.

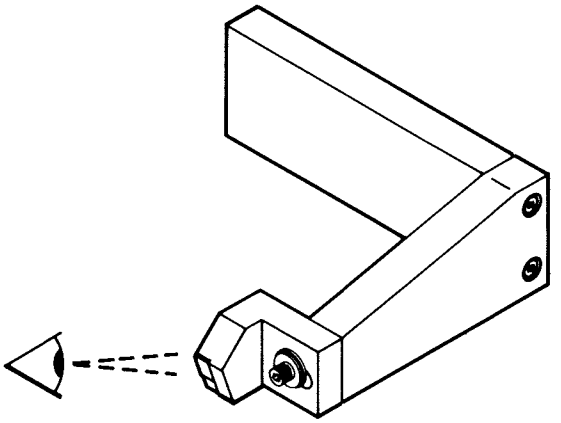
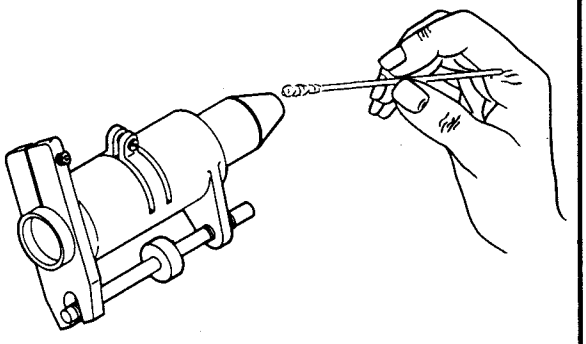
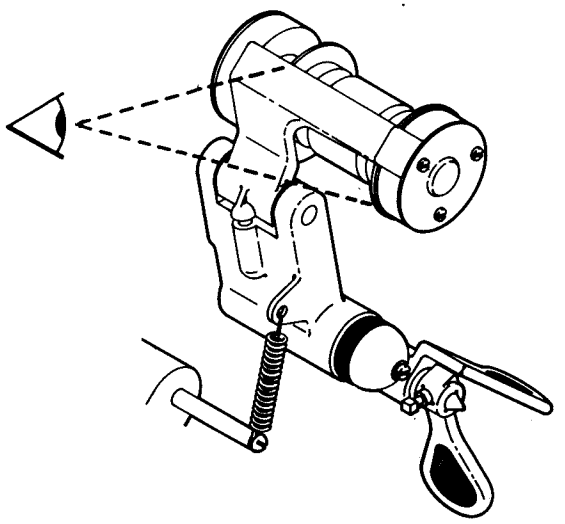
SECTION 4
A-CHAIN ALIGNMENT

The A-chain is the part of the sound system that covers the film path, solar cell, optical preamplifier, slit loss equalizer and Dolby noise reduction circuit.

The CP55 does not contain a magnetic A-chain but has facilities for switching external magnetic preamplifiers into the B-chain. An overview of external magnetic A-chain adjustments is given at the end of this section.

a. Preliminary Procedures

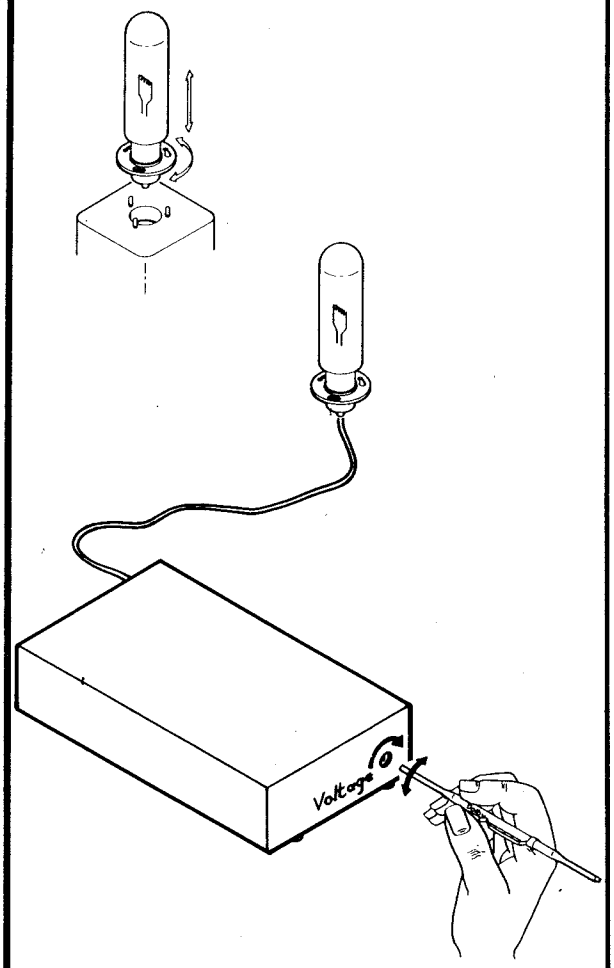
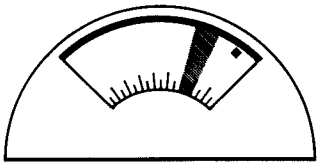
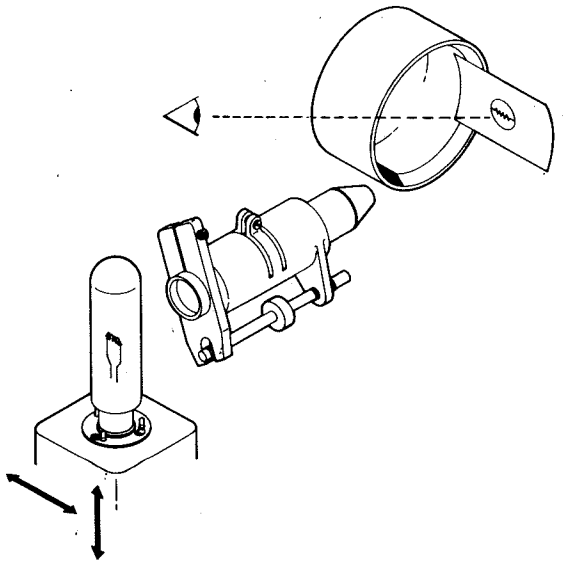
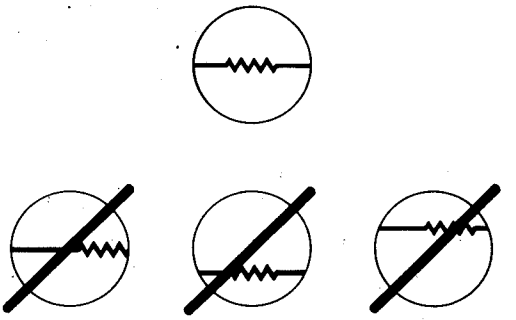
A-Chain Alignment Procedures

Step No.	Action	Indication
1		
2		
3		

Notes
If a stereo solar cell is already installed on Projector No. 1, inspect the surface of the cell for cracks, chipping, or other damage. If the cell appears to require replacement, remove the mounting bracket from the projector and replace the cell and bracket assembly. If the cell appears to be usable, either loosen the cell mounting bracket and swing the cell out of the light path or, if this cannot be done, remove the mounting bracket and cell assembly from the projector and set the assembly aside.
Clean the lens surfaces with a cotton swab moistened with lens cleaner. But keep in mind that you may find in Step 14 under **"b. Optical Preamplifier Adjustment"** that it will be necessary to remove and inspect the lens if the high-frequency response is not correct. If the lens is removed, clean the lens as indicated above and look through the lens at a bright light. Repeated alternate heating and cooling of the lens can cause oil or other contaminants to enter the lens barrel. Verify that there is a clear, unobstructed light path through the lens and that the edges of the slit are sharp without cracks or corrosion. Fit a new lens assembly if you are unable to clear the optical path through the slit.
Inspect the lateral film guides for evidence of cuts, cracks, surface defects, and any foreign materials that could impair the film guiding. Clean as required or replace the guides, as necessary. Make sure the guide roller rotates freely and, if it is spring mounted, make sure that lateral movement and return is not obstructed.

a. Preliminary Procedures

A-Chain Alignment Procedures

Step No.	Action	Indication
4		70 TO 80% OF RATED VOLTAGE 
5		

Notes

Remove the existing exciter lamp and replace with a new lamp.

Adjust the exciter lamp DC voltage to 70% to 80% of the rated voltage and verify that there is no more than 5% ripple present with the lamp on, using an AC millivolt meter or oscilloscope. Do NOT attempt to extend the exciter lamp life by running at too low a voltage; the center of the slit may receive higher illumination than the edges, causing signal distortion.

LAMP VOLTAGE	DC ADJUSTMENT
6V	4-5 volts
10V	7-8 volts

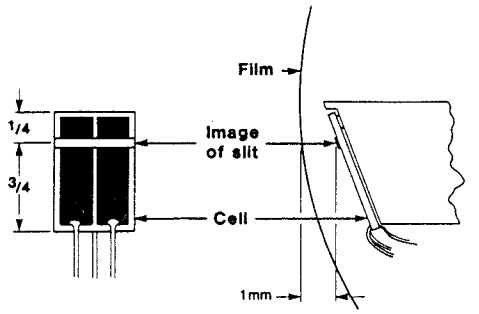
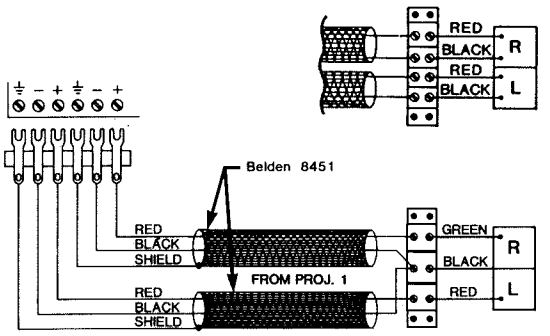
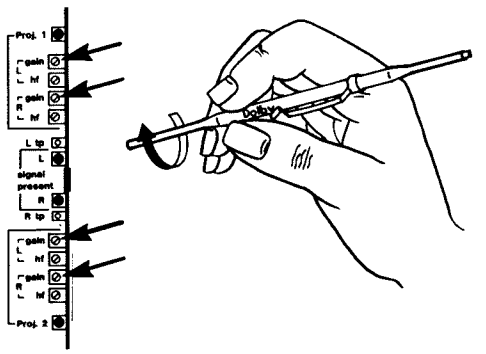
If the projector uses a plastic light pipe or tube, verify that the light output is not appreciably affected by dirt, cracks or flaws, yellowing, or foreign matter. Replace if necessary.

Place a white card at a point behind the film plane. Then adjust the position of the exciter lamp until the image of the filament is centered both vertically and horizontally as shown.

You may find that obtaining an image of the filament is difficult in some projectors. Place a piece of tissue paper over the lens to assist in seeing the image of the filament. Some projectors do not use adjusting screws to change the position of the lamp; shims are sometimes used for positioning.

b. Optical Preamplifier Adjustments

A-Chain Alignment Procedures

Step No.	Action	Indication
1		
2		
3		

Notes

Loosely install the stereo solar cell bracket on the projector. Position the bracket carefully until the surface of the cell is 1 mm from the film plane surface. Note that if this distance is exceeded, there will be crosstalk between the two optical stereo tracks. Check the image of the slit on the cell. The image should be a thin sharp line. The slit image should be as long as the cell, and positioned at three-quarters of the height of the cell. Try to get the best compromise among all of these conditions and then tighten the cell bracket mounting screws.

Connect the cells to the correct CP55 input terminals via the barrier strip, using a single shielded (screened) 4-conductor cable or two shielded 2-conductor cables. Connect the inner conductors to the projector input + and – terminals exactly as shown. Connect the shields only at the CP55 end. Note that the cell associated with the right channel is closest to the edge of the film.

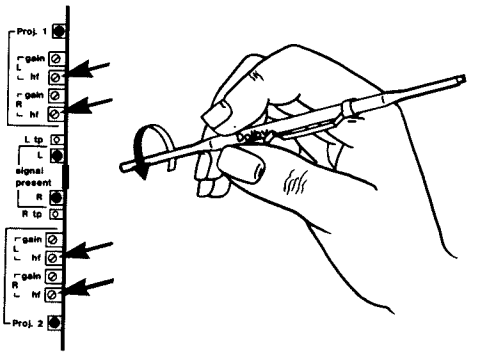
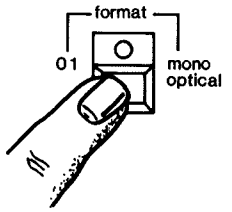
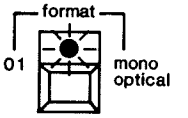
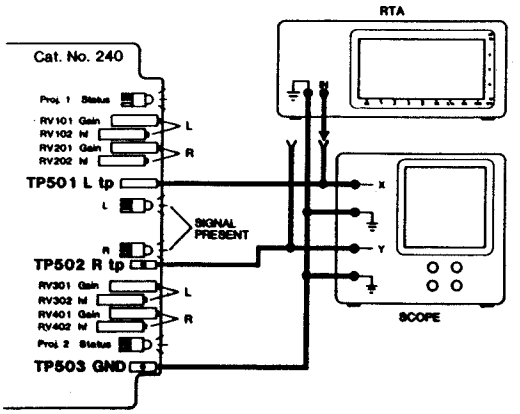
Separate cells are used for each channel in reverse scan projectors. Both use identical red (hot) and black (low) wires. A check will be made in Step 9 to determine the correct left and right placement.

On the Cat. No. 240 Optical Preamplifier Card

Turn all of the **Proj 1** and **Proj 2 gain** potentiometers fully clockwise (CW).

b. Optical Preamplifier Adjustments

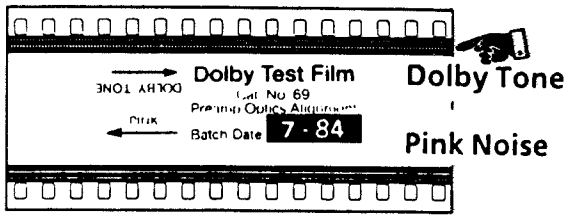
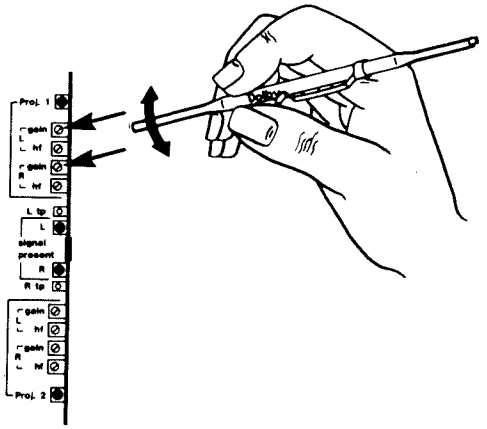
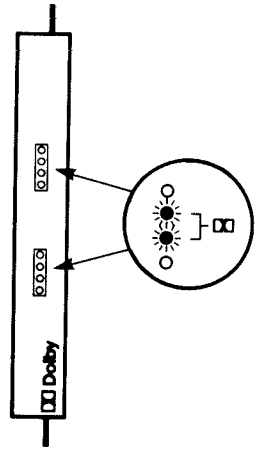
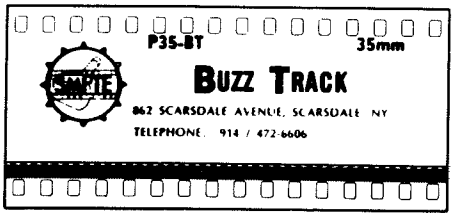
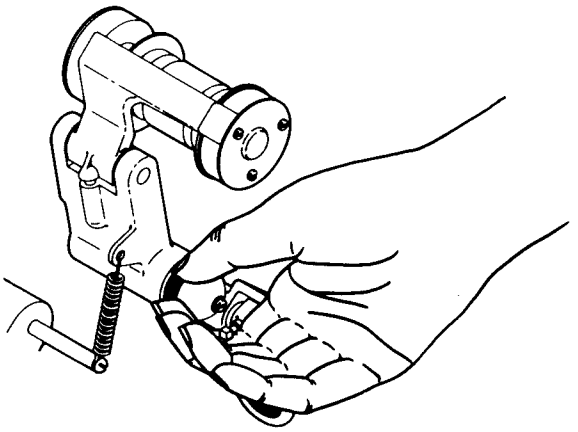
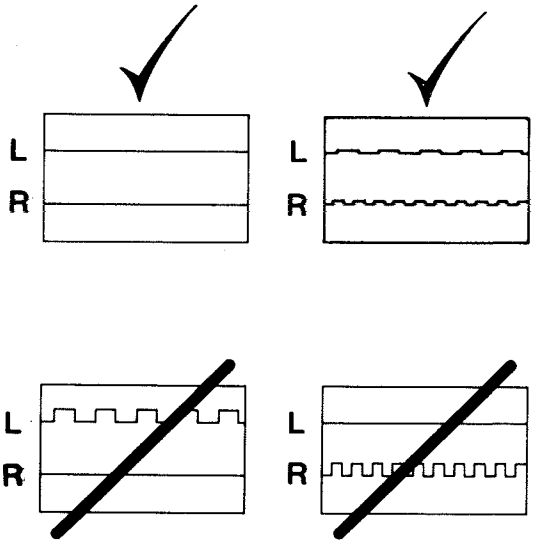
A-Chain Alignment Procedures

Step No.	Action	Indication
4		
5		
6		

Notes
On the Cat. No. 240 Optical Preampamplifier Card Turn all of the **Proj 1** and **Proj 2 hf** potentiometers fully counterclockwise (CCW). Verify that power to the power amplifiers is **OFF**.
Press the **mono optical 01 format** switch on the front panel; the LED in the switch should light.
Connect the RTA and the oscilloscope to the Cat. No. 240 **TP501 L** (left) and **TP502 R** (right) test points as shown in the interconnection diagram. Earth (ground) both instruments at **TP503 GND** on the card. The input to the RTA will be switched to the left channel or right channel in the following steps.

b. Optical Preamplifier Adjustments

A-Chain Alignment Procedures

Step No.	Action	Indication
7	  CAT. NO. 240	 CAT. NO. 222
8	 	 OSCILLOSCOPE TRACES

Notes

Thread and play the Dolby tone side of the Cat. No. 69 test film for an initial test of the signal path through the projector preamplifier. The film emulsion should face away from the screen. Adjust the Cat. No. 240 **Proj 1 L and R** gain potentiometers until the LEDs on the Cat. No. 222 Dual Noise Reduction Module indicate the Dolby level -- the center two green LEDs are lit. In addition, verify that the signal present LEDs on the Cat. No. 240 are lit. The Dolby tone signal should be visible on the oscilloscope.

Remove the Cat. No. 69 test film and thread the SMPTE Buzz Track Film. This film has modulation just beyond the normally scanned areas of the optical sound tracks. The objective of this test is to ensure that the slit illuminates only the sound-tracks. Depending on the design of the projector, the positioning of the slit relative to the optical tracks is adjusted as follows:

The film guide is adjusted laterally for a null if the lens and exciter lamp are fixed in position;

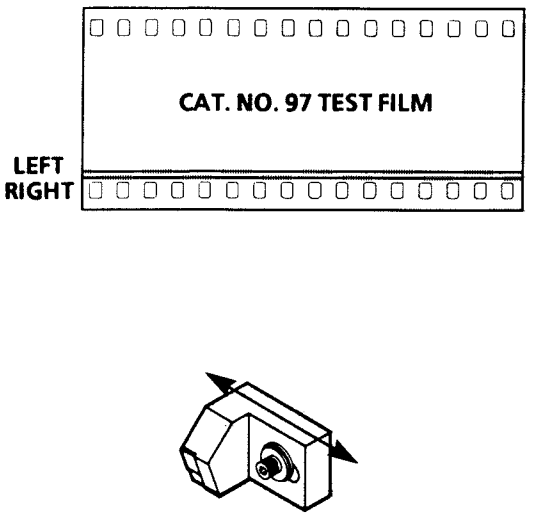
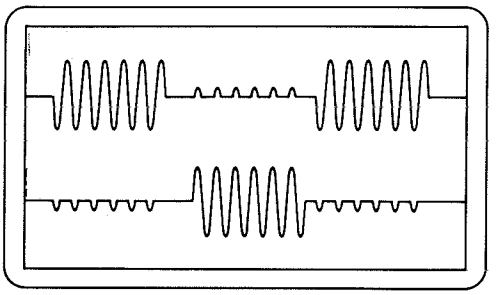
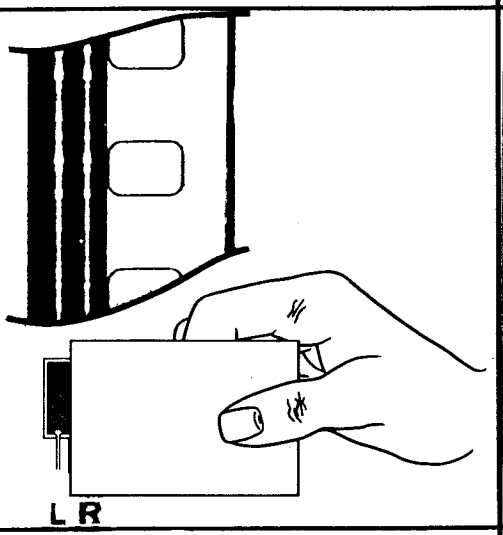
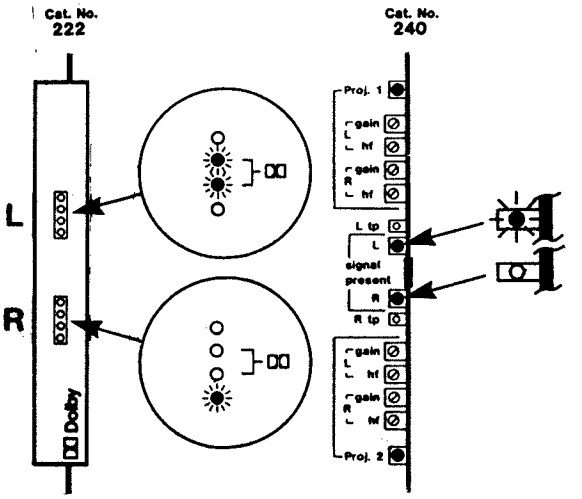
The lens and exciter lamp are adjusted laterally for a null if the film cannot be moved laterally.

The adjustment is correct when there is no signal output while the film is played. It may not be possible to adjust for a null with some older slits; in such instances, adjust for a minimum and equal signal on L and R.

Some projectors use a lens with an adjustable slit width. The adjustment is correct at the point when the left and right signals both disappear equally.

b. Optical Preamplifier Adjustments

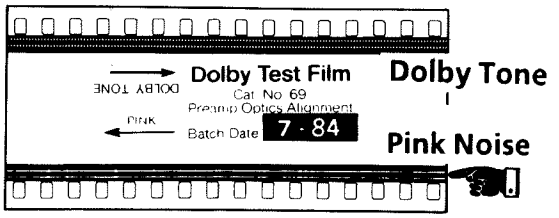
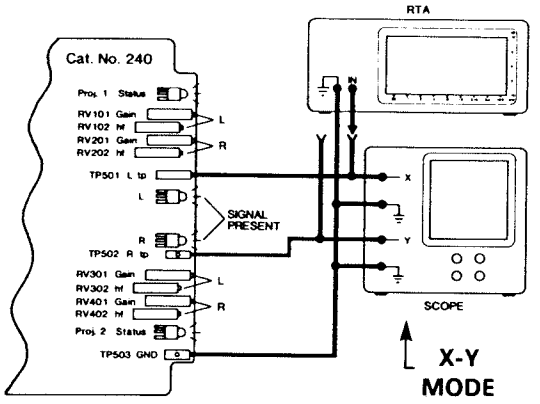
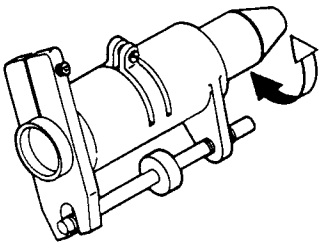
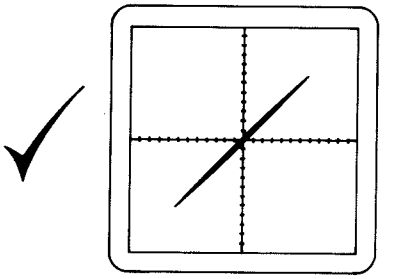
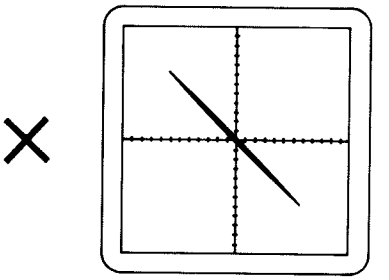
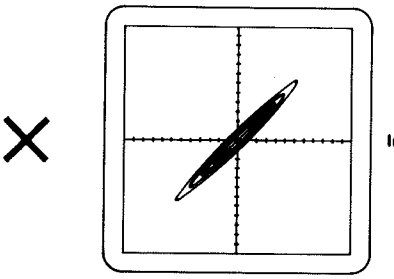
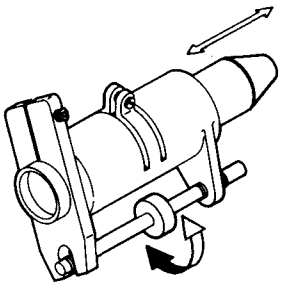
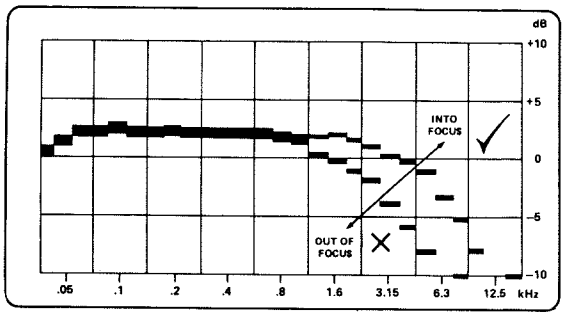
A-Chain Alignment Procedures

Step No.	Action	Indication
9		 OSCILLOSCOPE TRACE
10		
11	REPEAT 9 AND 10	

Notes
Remove the SMPTE Buzz Track Film and thread and play the Cat. No. 97 Stereo Cell Alignment Film. While the film is playing, look at the oscilloscope. If a large amount of crosstalk is present, loosen the stereo solar cell head and move the head from side to side until the crosstalk both left-to-right and right-to-left are both at a minimum and are equal. (The right channel is the track toward the outside of the projector.) You should be able to adjust the position of the cell to obtain better than 20 dB of crosstalk rejection (10:1 voltage ratio) both left-to-right and right-to-left. **NOTE:** On some projectors, it may be necessary to stop the film to adjust the position of the cell. Lock the cell bracket into position after completing this adjustment. Check that the crosstalk has not changed as the bracket was tightened.
Verify that the outputs of the right and left solar cells are properly connected per the diagram in Step 2 on page 3-8. Then place a white card over the right solar cell (nearer the outside of the projector) and verify that the level of the right channel drops -- as indicated by the **R** LED on the Cat. No. 222 card, and the **R** LED on the Cat. No. 240 card.
Repeat the SMPTE Buzz Track alignment in Step 8. If the film or optics/exciter lamp position must be readjusted, repeat Step 9. The optimum setting is attained when no further adjustments are required in Steps 8 and 9.

b. Optical Preamplifier Adjustments

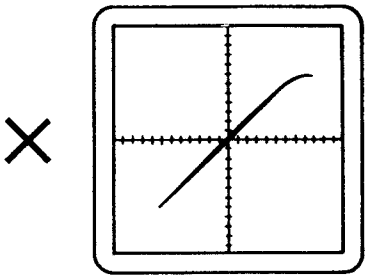
A-Chain Alignment Procedures

Step No.	Action	Indication
12	 Cat. No. 69  	OSCILLOSCOPE TRACES   
13		 RTA DISPLAY

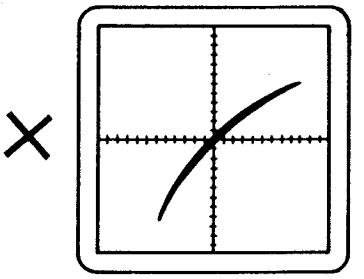
Notes

Remove the Cat. No. 97 film and thread and play the pink noise on the Cat. No. 69 film (emulsion away from screen). Connect the RTA to the left test point **TP501 L** on the Cat. No. 240.

Switch the oscilloscope to the X/Y mode and adjust the azimuth of the projector optics for the narrowest diagonal trace. (Blooming at the ends of the trace may be caused by improper lighting of the edges of the optical tracks. If necessary, repeat steps 8 and 9 to reduce such blooming to a minimum.)



Not enough light on one channel

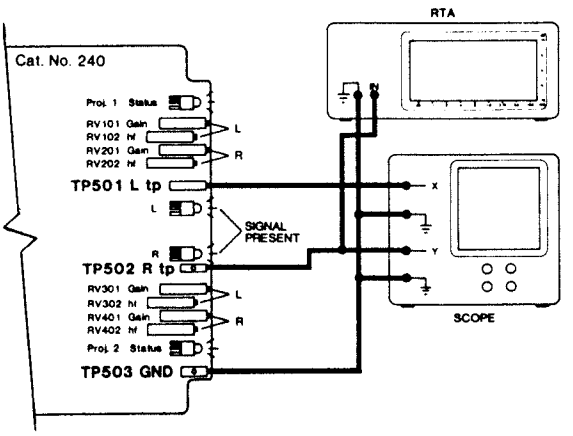
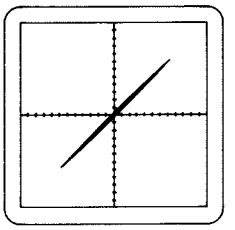
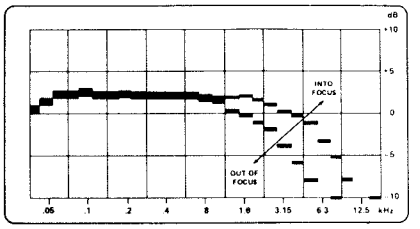
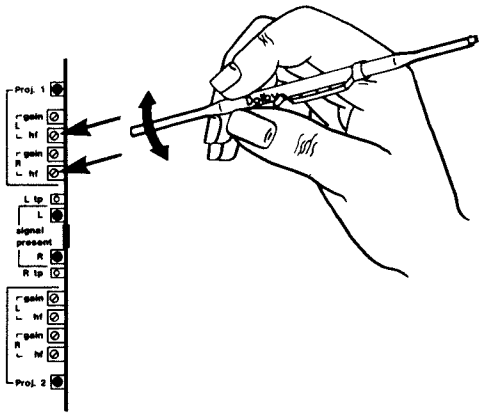
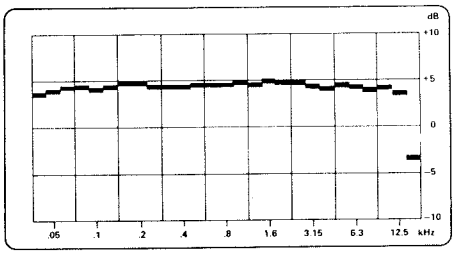
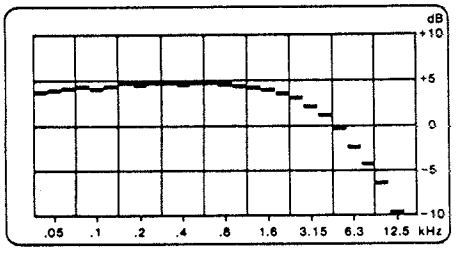
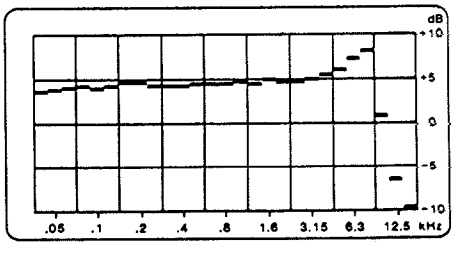


Uneven light on cell

Then, while observing the trace on the RTA, adjust the focus of the sound track lens for the best high frequency response. The trace shown in the example is ideal; merely attempt to obtain the **best** response. The azimuth and focus adjustments interact so you must repeat Steps 12 and 13 until no further adjustments are required.

b. Optical Preamplifier Adjustments

A-Chain Alignment Procedures

Step No.	Action	Indication
14	 REPEAT 12 AND 13	 
15		✓  A-chain response after equalization ✗  ✗ 

Notes

Disconnect the RTA from the left test point and connect it to the right test point **TP502 R**. Then repeat Steps 12 and 13. **NOTE:** The azimuth and high frequency response must be the same at both the left and right test points. If results are not similar, it may be necessary to remove the lens and check for oil or contamination or a degraded slit. Replace the lens, if necessary. **Do not proceed to the next step until the outputs at both the left and right test points are similar.**

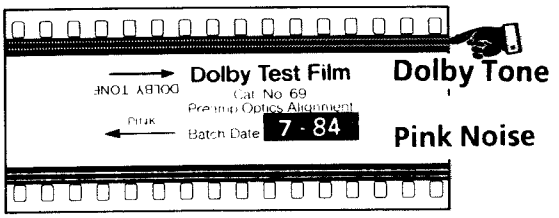
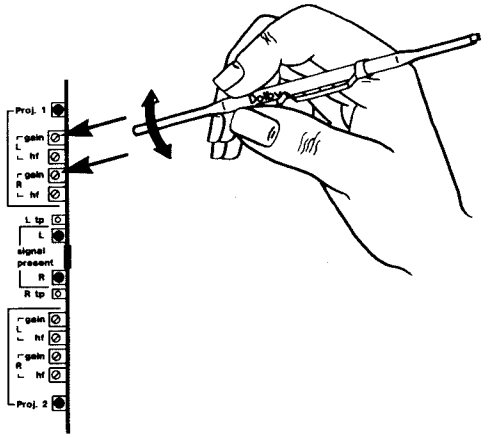
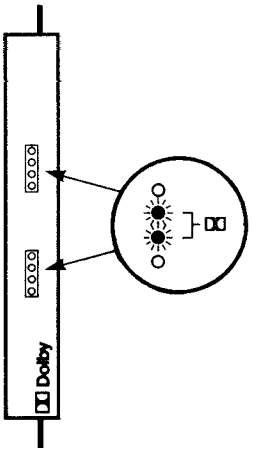
Appendix B shows the effects of slit geometry on frequency response.

The test in this step is performed both at the right and left channel test points of the Cat. No. 240 card.

The frequency response must be within 1 dB to at least 12 kHz. If necessary, adjust the **L hf** and **R hf** potentiometers on the Cat. No. 240 card. If these adjustments do not improve the frequency response, the problem may be a degraded slit or damage to the lens.

b. Optical Preamplifier Adjustments

A-Chain Alignment Procedures

Step No.	Action	Indication
16	 	
17	**Projector No. 2** **REPEAT** 1 → 16	

Notes
Reverse the Cat. No. 69 test film to play Dolby tone. Verify that the Dolby tone indication is shown on the Cat. No. 222 card (the center two green LEDs are lit for both the R and L channels). If necessary, re-adjust the **Proj 1** left and right **gain** controls on the Cat. No. 240 card. Do not re-adjust the hf controls.
Repeat all of the above steps for projector No. 2. If you purchased a spare Cat. No. 240 card, repeat steps 15 and 16 for the spare card so it will be ready for use immediately if the occasion arises.

Magnetic Alignment

The CP55 does not provide noise reduction for magnetic inputs.

Inspect the magnetic head for evidence of wear; wear can reduce the frequency response. De-magnetize the head and all elements in the film path, both metal and plastic (some plastic parts may have steel centers). If you have an Annis gauss meter or its equivalent, verify that no elements in the film path are magnetized. Repeat the degaussing, as required.

Inspect the penthouse and perform any mechanical adjustments in accordance with the manufacturer's instructions. Verify that all bearings, gears, and guide rollers are in good working order.

Install the magnetic preamplifier according to the manufacturer's information.

Connect the magnetic heads to the MPU input barrier strip with high-quality shielded cable, Belden 8451 or equivalent.

Connect the outputs of the magnetic preamplifier to the **from mag** inputs on the **TB1** barrier strip. **NOTE:** Magnetic preamplifiers already installed in the projector can be used or a Dolby Model MPU system can be installed in their place. **The MPU must be powered by an external power supply because the CP55 does not supply operating power to the MPU.**

If a Dolby MPU is used, the Cat. No. 242 B-chain card must be removed and a setting verified. Place the **NORMAL/BYPASS** switch in the **BYPASS** position. Then remove the Cat. No. 242 card and verify that the reversible plug-in **Magnetic Input Sensitivity Setting** header is in the **100 mV in** position (see page 2.4). Re-install the Cat. No. 242 card and restore the **NORMAL/BYPASS** switch to the **NORMAL** position. Skip the next step.

If the existing non-Dolby preamplifiers are used, their compatibility with the CP55 must be ensured.

The CP55 accepts a nominal operating input level of either 100 mV or 1V -- chosen by the position of the reversible plug-in Magnetic Input Sensitivity Setting header on the Cat. No. 242 B-chain card. The input impedance of the CP55 is 100K at both input levels. In addition, some preamplifiers may require a termination resistor (usually 600 Ohms). You can connect the termination resistors at the input barrier strip **TB1 from mag** terminals on the backplane. **Note that changeover between projector 1 and projector 2 must be accomplished in the magnetic preamplifier.**