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Model CP500
Digital Cinema Sound Processor

Installation and Alignment

Issue 5 Part No. 91371

Installation and Alignment Manual

For

Model CP500

Digital Cinema Sound Processor

Dolby Laboratories Incorporated

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1.1 About the Dolby CP500

Dolby Laboratories has continuously established new benchmarks for motion picture sound. The CP500 Digital Cinema Processor maintains that tradition, setting new standards for performance, value, flexibility, and convenience. Entirely self-contained, the CP500 provides both Dolby Digital and Dolby analog processing built in. An easy-to-read LCD screen and uncomplicated front panel soft keys makes it easy to install, operate, and maintain. Software that can be readily programmed, controls any existing or future format. Built-in test instrumentation that includes a real time analyzer make the CP500 easier to align and calibrate than conventional processors. No external PC is required for setup. Once aligned, calibration settings can be password protected to prevent mis-adjustment.

Built-in diagnostic software enables theater staff to verify performance of the complete theater sound system. Calibration settings for a given theater can be stored on a PC, and should the need ever arise, they can be transferred directly to another CP500 or other modules, thereby reducing or eliminating the need for further calibration after repairs. As improvements to the CP500 digital control and processing software are developed, the latest revisions can be downloaded from a PC to the CP500 hardware. Moreover, updates to the audio coding used for Dolby Digital soundtracks, which are included from time to time on Dolby Digital release prints, download automatically into the CP500 the first time such a print is played in the cinema.

Options available for the CP500 include internal Linkwitz-Riley crossover networks (Cat. No. 683) for bi-amplified screen speakers, and 6 channel A/D converter (Cat. No. 685) for use with Dolby models DA10 or DA20 processors, 70mm magnetic systems, or other cinema sound systems.

1.2 Hardware Configurations Available

The CP500 is available in four versions:

CP500-D

- Dolby Digital decoding capability
- Dolby A-type and SR analog soundtrack decoding capability

CP500-D/300

- Primarily used in preview theaters and studios
- Dolby A-type and SR analog soundtrack decoding capability
- Dolby Digital decoding capability

CP500-SR

- Dolby A-type and SR analog soundtrack decoding capability
- Upgradable to Dolby Digital decoding by means of plug-in circuit cards

CP500-70

- Dolby Digital decoding capability
- Dolby A-type and SR analog soundtrack decoding capability
- 70mm magnetic soundtrack capability (includes a 6 channel A/D module and 4 additional channels of Dolby A-Type noise reduction for use with an external magnetic pre-amp); can play Formats 42 and 43

Any CP500 configuration also interfaces readily with other film sound equipment.

1.3 About This Manual

This manual is intended to be used by individuals who are qualified in the area of cinema sound equipment installation and service. The basic day-to-day operation of the CP500 is covered in the **CP500 Users' Manual**, Dolby part number 91372.

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

The Dolby CP500 is the central element of the theater sound system. The projector, the Dolby Processor, the power amplifiers and the loudspeakers, as well as the auditorium itself, must all be considered when aligning the system for optimum performance.

The system alignment procedure is divided into two parts. The B-chain alignment includes the equalization, loudspeaker crossover, and output level adjustments, in addition to the regulation of miscellaneous functions, such as fade-out time adjustment. The A-chain alignment involves adjustments made to the projector soundhead optics, solar cell, and optical preamplifier card.

1.4 Specifications

Construction
Rack-mount chassis frame construction with plug-in modules accessible behind hinged front panel.

Signal Connections
a. Standard 9 pin D-type connectors for Mic., Optical 1, Optical 2, Serial Data, and Motor Start signals.

b. Standard 25 pin female D-type connectors for Digital Readers 1 and 2, Accessory Unit, Automation connections, and 6 Channel Analog Inputs.

c. RCA type phono jacks for Non-sync 1 and 2.

d. Phoenix screw terminal connectors for processor outputs, bypass power, and remote control connections.

Signal Inputs
a. 6 Channel: Six analog inputs for use with external magnetic preamplifier or external processor, 300 mV operating level. (Requires optional Cat. No. 685.)

b. Optical: Two pairs of balanced inputs for two projectors with stereo solar cells (available from Dolby Laboratories mounted on brackets for most projector types). Inputs compatible with LED illuminated reverse-scan analog readers.

c. Non-sync: Two stereo inputs for non-sync sources. 50 kOhm input impedance, 50 mV to 2.5 V sensitivity. 2:4 decoder may be used to decode Dolby Surround program sources.

d. Microphone: One balanced input for B-chain equalization P.A. mic. or multiplexer and one unbalanced input for house announcement mic.

e. Dolby Digital Film Reader (CP500-D): Two inputs for connection to penthouse or inboard readers.

Signal Outputs
47 ohms output impedance will drive any load greater than 600 ohms. Maximum output level, +20 dBu. Typical operating level, -10 dBu.
Operating levels from 25 mV to 0.7 V may be accommodated.

Output For Hearing-impaired System
Center-weighted sum of L, R, C for connection to auxiliary system for the hearing impaired. Output impedance is 47 ohms with a fixed output level of 200 mV.

Optical Preamplifier
A Cat. No. 661 Optical Preamplifier accepts signals from two projectors with stereo solar cells. Gain and slit loss adjustments are digitally controlled.

Noise Reduction
Two channels of Dolby A-type noise reduction and two channels of Dolby SR are provided as standard. Up to six channels of A-type (CP500-70) and two additional channels of studio SR (CP500-300) can be accommodated.

Four Channel Decoder
Cat. No. 675A DSP Module decodes left, center, right, and surround channels from the two optical tracks on Dolby analog optical prints. Adjustable delay to optimize front to surround separation.

Loudspeaker Equalization
L,C,R: 27 band digital 1/3 octave EQ; digitally controlled bass and treble

L_SR_S: digital 9-band, full octave EQ

SW: Digital parametric EQ with 12dB cut capability

Remote Connections
Connections for up to two Dolby Cat. No. 689 remote fader, format selectors and/or Cat. No. 734 fader-only remotes are provided. A provision is also made for a temporary auditorium fader consisting of a 100k potentiometer.

Automation
Direct mode allows eight contact closures to ground for selecting formats.
Sequential mode allows a single contact closure to ground for sequencing pre-programmed formats.

Distortion
Typically 0.05% in Dolby SR mode (Format 05, with output operating level set to -10 dBu and input 10dB over Dolby level).

Dynamic Range
Typically 92 dB with fader set to 7.0.

Dimensions
Four units high rack mount chassis. Standard 178 mm high by 493 mm wide faceplate (7 x 9"). Maximum projection behind mounting surface is 360 mm (14.17"). Maximum projection in front of mounting plate is 32 mm (1.23").

Weight
11.7 kgs (26 lb.) Max.

Power Requirements
100 - 240 VAC, 50-60 Hz Auto Sensing. 2 A max. input current. Single phase. 120 Watts max.

Fuse Requirements
Single 1 1/4" or 5 X 20 mm slow blow fuse according to local safety requirements.

Operating Conditions
0 - 40 ^{O}C, 20-80 % humidity, non-condensing.

1.5 Regulatory Notices

FCC

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with this instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his or her own expense.

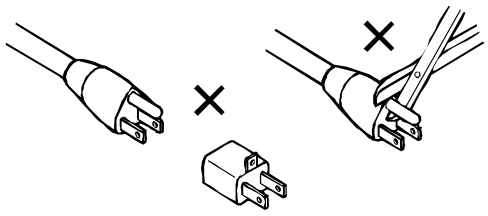
UL

The CP500 is UL listed. This installation manual is for use by qualified personnel only. To avoid electric shock do not open the unit or perform any servicing unless you are qualified to do so.

WARNING: Check that the correct fuse has been installed. To reduce the risk of fire, replace the fuse only with the same type and rating.

FUSE - 2 Amp, time-lag (T2A), 20 mm long, 250 Volt
Dolby part no. 56027

The ground terminal of the power plug is connected directly to the chassis of the unit. For continued protection against electric shock, a three-pin, correctly wired and earthed power outlet must be used. Do not use a ground-lifting adapter and never cut the ground pin on the three-prong plug.



UK

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

IEC

This unit complies with the EMC requirements of EN50081-1 and EN 50082-1 when installed in an E2 environment in accordance with this manual.

IMPORTANT SAFETY NOTICE

This unit complies with the safety standard IEC65. To ensure safe operation and to guard against potential shock hazard or risk of fire, the following **must** be observed:

GB

- o If the unit has a **voltage selector**, ensure that it is set to the correct mains voltage for your **supply**. If there is no voltage selector, ensure that your supply is in the correct range for the input requirement of the unit
- o Ensure **fuses** fitted are the **correct rating and type** as marked on the unit.
- o The unit **must be earthed** by connecting to a correctly wired and **earthed** power outlet.
- o The **power cord** supplied with this unit must be wired as follows:

Live—Brown Neutral—Blue Earth—Green/Yellow

IMPORTANT – NOTE DE SECURITE

Ce materiel est conforme à la norme IEC65. Pour vous assurer d'un fonctionnement sans danger et de prévenir tout choc électrique ou tout risque d'incendie, veillez à observer les recommandations suivantes.

F

- o Le selecteur de tension doit être placé sur la valeur correspondante à votre alimentation réseau.
- o Les fusibles doivent correspondre à la valeur indiquée sur le materiel.
- o Le materiel doit être correctement relié à la terre.
- o Le cordon secteur livré avec le materiel doit être cablé de la manière suivante:

Phase—Brun Neutre—Bleu Terre—Vert/Jaune

WICHTIGER SICHERHEITSHINWEIS

Dieses Gerät entspricht der Sicherheitsnorm IEC65. Für das sichere Funktionieren des Gerätes und zur Unfallverhütung (elektrischer Schlag, Feuer) sind die folgenden Regeln unbedingt einzuhalten:

D

- o Der Spannungswähler muß auf Ihre Netzspannung eingestellt sein.
- o Die Sicherungen müssen in Typ und Stromwert mit den Angaben auf dem Gerät übereinstimmen.
- o Die Erdung des Gerätes muß über eine geerdete Steckdose gewährleistet sein.
- o Das mitgelieferte Netzkabel muß wie folgt verdrahtet werden:

Phase—braun Nulleiter—blau Erde—grün/gelb

NORME DI SICUREZZA – IMPORTANTE

Questa apparecchiatura è stata costruita in accordo alle norme di sicurezza IEC 65. Per una perfetta sicurezza ed al fine di evitare eventuali rischi di scossa êlettrica o d'incendio vanno osservate le seguenti misure di sicurezza:

I

- o Assicurarsi che il selettore di cambio tensione sia posizionato sul valore corretto.
- o Assicurarsi che la portata ed il tipo di fusibili siano quelli prescritti dalla casa costruttrice.
- o L'apparecchiatura deve avere un collegamento di messa a terra ben eseguito; anche la connessione rete deve avere un collegamento a terra.
- o Il cavo di alimentazione a corredo dell'apparecchiatura deve essere collegato come segue:

Filo tensione—Marrone Neutro—Blu Massa—Verde/Giallo

AVISO IMPORTANTE DE SEGURIDAD

Esta unidad cumple con la norma de seguridad IEC65. Para asegurarse un funcionamiento seguro y prevenir cualquier posible peligro de descarga o riesgo de incendio, se han de observar las siguientes precauciones:

E

- o Asegúrese que el selector de tensión esté ajustado a la tensión correcta para su alimentación.
- o Asegúrese que los fusibles colocados son del tipo y valor correctos, tal como se marca en la unidad.
- o La unidad debe ser puesta a tierra, conectándola a un conector de red correctamente cableado y puesto a tierra.
- o El cable de red suministrado con esta unidad, debe ser cableado como sigue:

Vivo—Marrón Neutro—Azul Tierra—Verde/Amarillo

VIKTIGA SÄKERHETSÅTGÄRDER!

Denna enhet uppfyller säkerhetsstandard IEC65. För att garantera säkerheten och gardera mot eventuell elchock eller brandrisk, måste följande observeras:

S

- o Kontrollera att spänningsväljaren är inställd på korrekt nätspänning.
- o Konrollera att säkringarna är av rätt typ och för rätt strömstyrka så som anvisningarna på enheten föreskriver.
- o Enheten måste vara jordad genom anslutning till ett korrekt kopplat och jordat el-uttag.
- o El-sladden som medföljer denna enhet måste kopplas enligt foljande:

Fas—Brun Neutral—Blå Jord—Grön/Gul

BELANGRIJK VEILIGHEIDS-VOORSCHRIFT:

Deze unit voldoet aan de IEC65 veiligheids-standaards. Voor een veilig gebruik en om het gevaar van electrische schokken en het risico van brand te vermijden, dienen de volgende regels in acht te worden genomen:

NL

- o Controleer of de spanningscaroussel op het juiste Voltage staat.
- o Gebruik alleen zekeringen van de aangegeven typen en waarden.
- o Aansluiting van de unit alleen aan een geaarde wandcontactdoos.
- o De netkabel die met de unit wordt geleverd, moet als volgt worden aangesloten:

Fase—Bruin Nul—Blauw Aarde—Groen/Geel

SECTION 2
EQUIPMENT REQUIRED

The following equipment is required for proper installation and alignment of the CP500 Digital Cinema Processor.

- Dual-trace oscilloscope with X-Y facilities (minimum bandwidth 20 MHz, 50 MHz recommended).
- Calibrated microphone (preferably multiple microphones and a multiplexer).
- Sound pressure level meter with slow time-constant and C weighting scale.
- Voltmeter for measuring the exciter lamp power supply.
- Test Films, available from Dolby Laboratories or equipment dealers (*Figures 2-1 through 2-7*). We recommend that you make loops of these test films, long enough to go through the entire projector film path so that azimuth and lateral film position adjustments can be made accurately.

Figure 2 - 1. Dolby Tone – Cat. No. 69T.

Figure 2 - 2. Pink Noise – Cat. No. 69P.

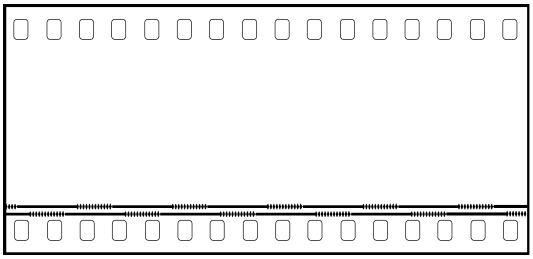


Figure 2 - 3. 1kHz, Crosstalk/Cell Alignment – Cat. No. 97.

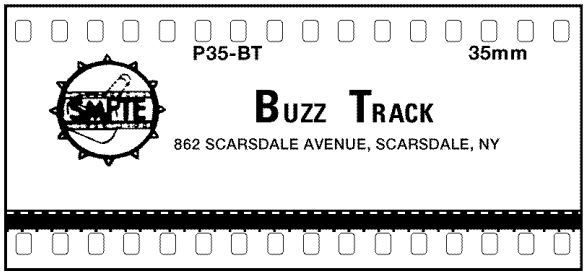


Figure 2 - 4. SMPTE Buzz Track.

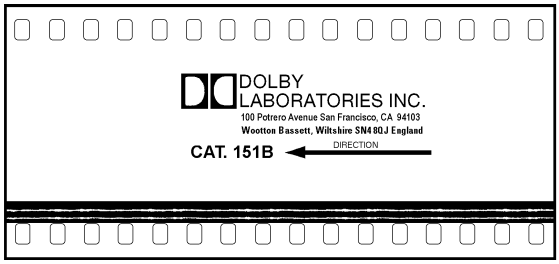


Figure 2 - 5. Stereo Optical Surround Level – Cat. No. 151B.

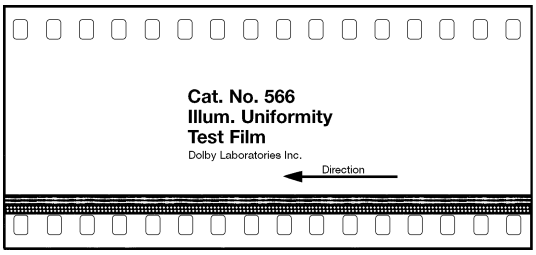


Figure 2 - 6. Illumination Uniformity – Cat. No. 566.

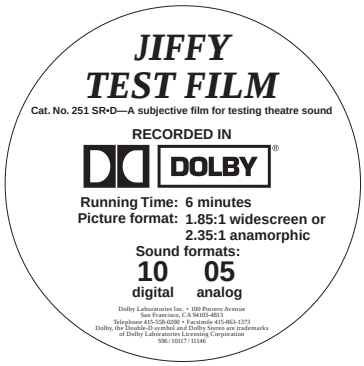


Figure 2 - 7. "Jiffy" Test Film – Cat. No. 251 SR/Digital.

Additional test films used during Dolby Digital system installation:

- **Cat. No. 1010 Sync Test**
- **Cat. No. 1011 Channel ID**
- **Cat. No. 1012 Dolby Level**

Do **NOT** connect the CP500 to mains power until all connections have been made and all jumpers have been checked or set.

If air-conditioning noise is audible in the theater, arrange for lubrication of the motor, fan bearings, adjustment of belts and drives, and cleaning of filters to reduce the ambient noise to a minimum. If the air-conditioning cannot be repaired switch it off while the CP500 is being aligned.

3.1 Replacing an Existing Sound System

If the CP500 replaces an existing cinema sound system, play a typical film before you remove the old system so you will have a benchmark for comparison to the new system. It can also serve as a check of the positioning of the exciter lamp, the focusing of the soundtrack lens, and the condition of the solar cell.

3.1.1 Before playing 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, structural parts, or damaged drivers in the enclosures.
- Verify that all wiring is present and properly connected and that crossovers are operating and are correctly adjusted.
- Check the polarity of the speaker connections.
- Verify that there are adequate earth (ground) connections.
- Verify that radio interference problems are adequately resolved.

3.1.2 While playing the film:

While you run the film, listen carefully in various parts of the theater for audio system problems:

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

These problems must be resolved before you can proceed with the new installation.

3.1.3 Disconnect the old system

- Disconnect power from the existing cinema sound equipment.

- Disconnect all cabling from the existing sound processor. Leave the cables connected to the power amplifiers, booth monitor, etc.

3.2 Mount the CP500

To avoid heat problems, do not mount the Dolby CP500 immediately above or below the power amplifiers. Locate the power amplifiers away from the CP500 to avoid hum pickup problems. Always leave a 1U (43 mm, 1.75") space above and below the CP500 to provide adequate ventilation. Install an air guide or baffle to deflect hot air from equipment below the CP500.

To ensure good ground contact, install star washers on all or at least one rack mounting screw per piece of equipment (*Figure 3-1*). This will also aid in the prevention of electrical noise problems.

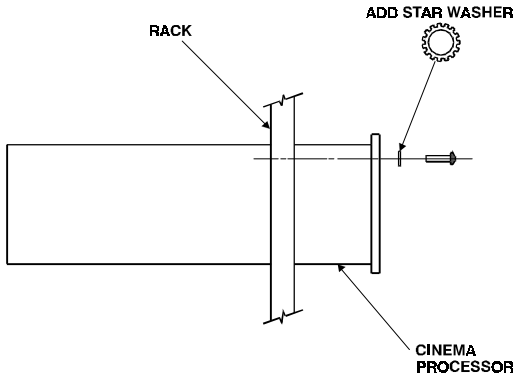


Figure 3 - 1. Install star washers to rack mounting screws.

Proper shielding and termination of cables and cable assemblies are also very important. Be sure to follow the methods shown in the wiring diagrams.

If you are installing a Dolby Cat. No. 700 Digital Soundtrack Reader, refer to its installation manual for mounting and alignment.

3.3 Connect the CP500

Refer to the appropriate fold-out page (*at the end of this section*) showing connections to the various CP500 model configurations.

Make output signal connections by inserting stripped and tinned leads into the supplied cable connectors and tightening each lead in place by means of the integral set screw. The cable connectors are then plugged into place at the corresponding locations shown on the fold-out wiring diagram. Shields must be connected as shown in the fold out page to avoid radio frequency interference.

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

Green plastic connector shells have been included in your installation kit for use in countries which are governed by the EMC directives. The shells **must** be used as noted on the fold-out pages.

3.3.1 Connect Motor Start Relays (Models CP500-D, and -70)

For two-projector installations, motor start relays are required for projector changeover. Digital data on the soundtrack is read in advance of the picture, therefore an advanced changeover signal is required (s*ee **Appendix C***). Projector motor start contact closures provide this signal to the CP500. **Isolated** contact closures from mechanical or opto-isolated relays wired across projector motors must be used. Refer to the ***Installation Wiring Power and Control*** diagram at the end of this section.

Signal levels:

Motor Start	Less than 1 Vdc with respect to signal ground.
Motor Off:	Greater than 3.5Vdc, less than 18Vdc.

Refer to the unit connections fold-out diagram for details (*located at the end of this manual*). For single projector installations, a prewire connector is supplied.

3.3.2 Connect Remote Controls

The CP500 is equipped for use with three types of remote controls: the Cat. No. 689, and Cat. No. 734, which are offered by Dolby Laboratories, and an auditorium fader, which can be made from parts purchased at an any electronics store.

The **Cat. No. 689 CP500 Remote Control** duplicates the front panel format selection, fader, and mute controls of the CP500.

The **Cat. No. 734 CP500 Remote Fader** consists of a shaft encoder with LEDs to indicate the fader setting.

The **auditorium fader** is a 100k linear pot wired as a variable resistor, with minimum resistance corresponding to fader 10.

Details on how to connect any of these remotes to the CP500 are shown in the ***Installation Wiring Power and Control*** drawing located at the end of this section.

3.3.3 Connection of Solar Cell Boards

In contrast to traditional solar cells, the Cat. No. 655 and other solar cell circuit boards used by several projector manufacturers are active devices with their own power supply. Some care needs to be given to the wiring between the board and the CP500 in order to avoid grounding problems and to provide immunity to RF interference. In principle, this means separating the audio ground connections and the RF shielding screen connections.

The 0V point (audio ground) must be connected from the basement reader card to the CP500 by a separate wire (or wires) along with the audio signal wires. The cable shield (screen) must be kept separate from the audio ground connections. It must be connected only to the chassis or enclosure of the equipment at each end.

The following diagrams (*Figures 3-2 and 3-3*) show two connectors on the board. The three pin connector, J1 is used for the power supply. The signal output connector J2 provides six output pins; two each for the "balanced" left and right cell outputs, and two 0V audio ground connections.

NOTE: The following tables show the Right channel appearing on pins 1, 2, and 3 of the 6-pin connector J2. The physical orientation of the board mounting in the projector and the orientation of the connector body mounting on the board affect which channel appears on which pins of the connector. **Be aware that pin allocations for the channels will vary depending on mounting arrangements of the board and connector**. The J2 connector pin solder hole with a square outline is pin 1.

J2 Pin Number	Signal
1	**Right** +
2	Signal Ground
3	**Right –**
4	**Left** +
5	Signal Ground
6	**Left** –

OR:

J2 Pin Number	Signal
1	**Left** -
2	Signal Ground
3	**Left** +
4	**Right** -
5	Signal Ground
6	**Right** +

There must be a connection between the ground pins at the Cat. No. 655 solar cell circuit board and the audio common in the CP500. This connection must **not** use the shield of the optical input cable, otherwise RF energy can be imposed on the CP500 ground system.

Pin numbers 6 and 9 of each 9-pin D connector ("Projector") on the CP500 allow these connections to be made. The wire that connects either of these pins to the Cat. No. 655 audio ground should pass inside the same shield as the optical input cables and not connect with the shield at any point.

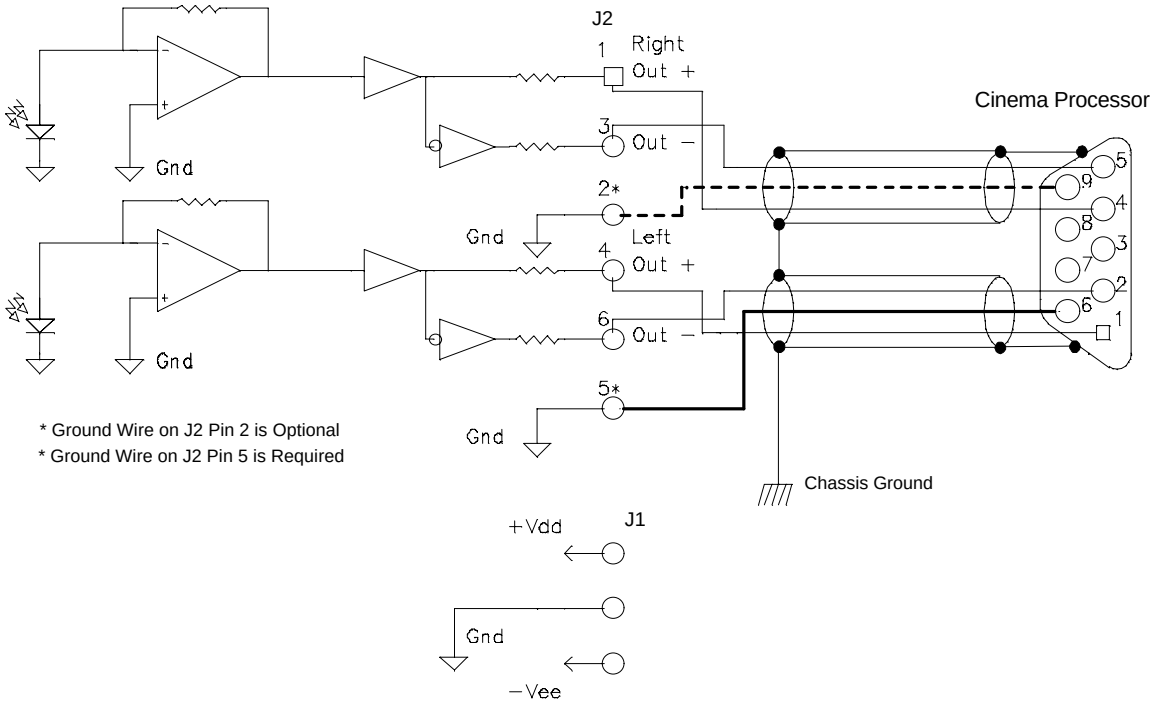


Figure 3 - 2. Wiring using two 3-wire shielded (screened) cables.

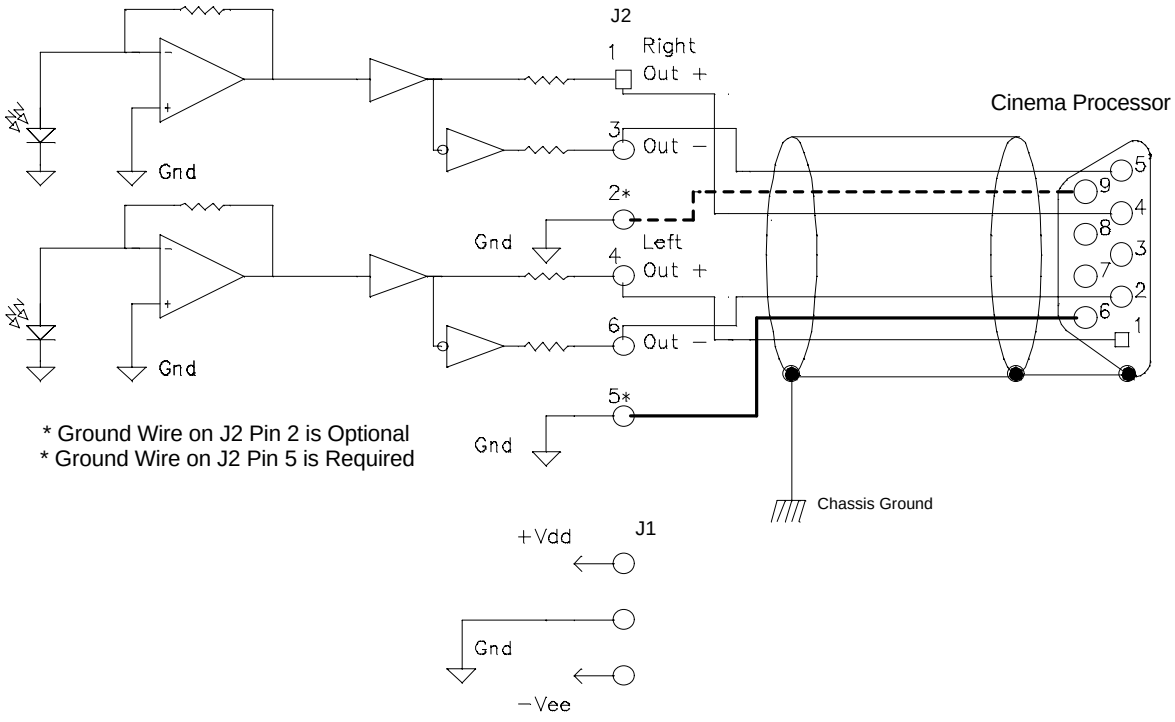


Figure 3 - 3. Wiring using one 5 or 6-wire shielded (screened) cable.

3.4 Check and Set Jumpers

Next, check the following jumpers located on each circuit card. The factory settings for each jumper are shown in [brackets].

Cat. No. 661 Optical Pre-amplifier Card (Analog Soundtracks)

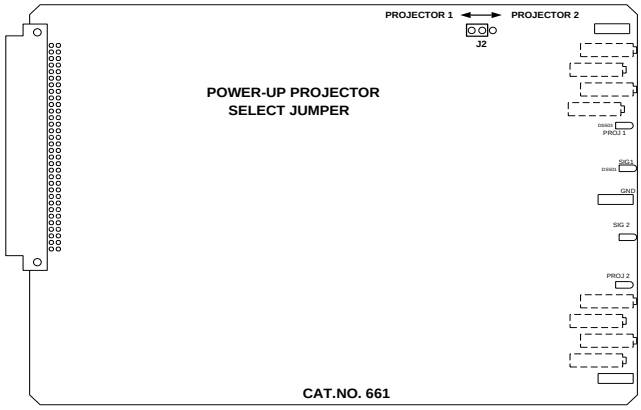


Figure 3 - 4. Cat. No. 661.

J2 **Power-up Projector Select** (Wake-up state) [P1]
This jumper determines which projector is selected when power is first applied to the CP500. When J2 is set to “P1”, Projector 1 is selected at power up. When J2 is set to “P2”, Projector 2 is selected at power up. The jumper is set to "P1" at the factory.

Cat. No. 681 Analog Switch Card

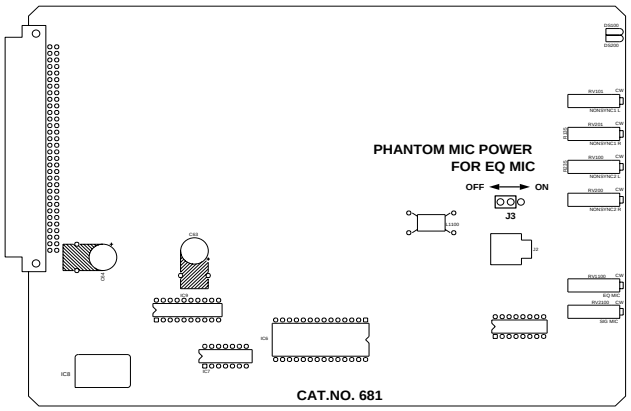


Figure 3 - 5. Cat. No. 681.

J3 **Equalization Microphone Phantom Power** [OFF]
This jumper enables a phantom power source for theater equalization microphones which require phantom power to operate. When the jumper is set to the “ON” position, phantom power (15V) is supplied to the EQ microphone jack and the rear panel microphone connector.

Cat. No. 682 Analog Output Card

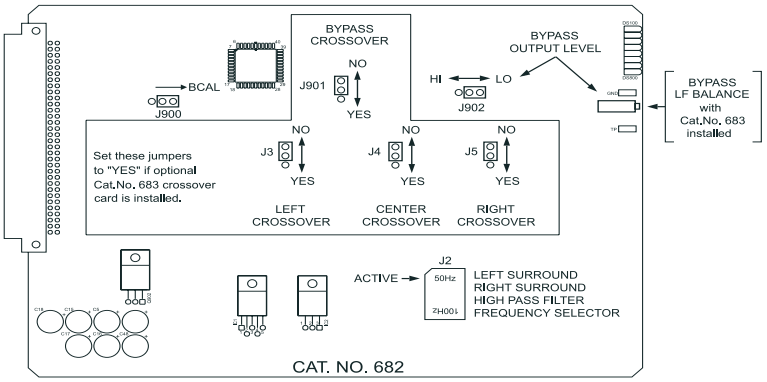


Figure 3 - 6. Cat. No. 682.

Crossover Select Jumpers [NO]

J3 Left Channel

J4 Center Channel

J5 Right Channel

J901 Bypass Audio Channel

These jumpers route the designated signals through an optional Cat. No. 683 crossover card. If the Cat. No. 683 card is installed, these jumpers should be set to the "YES" position. If the optional Cat. No. 683 is not present, these jumpers should be set to the "NO" position. The jumpers are set to the "NO" position at the factory.

NOTE: If bypass audio is routed to the optional Cat. No. 683 crossover card, the bypass portion of the crossover circuitry must be functioning in order to produce a bypass audio output.

J900 Bypass Calibration

This jumper inserts a calibrated pink noise signal into the bypass system for level and (optional) crossover adjustments. The calibration signal is enabled when the jumper is in the "BCAL" position and is disabled otherwise.

NOTE: It is important to move the jumper to the disabled position after calibration is complete so that the bypass signal path remains completely isolated from any possible erroneous signals in the signal path.

J902 Bypass Channel Output Level Select [LO]

This jumper, along with the bypass gain adjustment potentiometer (RV901), adjusts the level of the bypass channel. The jumper provides a "coarse" gain setting and the potentiometer provides a "fine" gain adjustment. The "HI" jumper position can be used to produce a higher output level range on the bypass channel. This jumper is factory set to the "LO" position.

NOTE: If Cat. No. 683 Crossover card is installed, the preferred setting for this jumper is HI.

J2 L and R Surround High-Pass Filter Frequency Select [50Hz]

This header sets filter circuits to the indicated high-pass frequency. Signals below this frequency are attenuated in order to prevent distortion or damage to surround speakers that are unable to handle extreme low frequency energy.

NOTE: The function of the Bypass Output Level control changes to Bypass Low Frequency Balance Control if a Cat No. 683 Crossover Card is installed.

Cat. No. 683 Crossover Card (Optional)

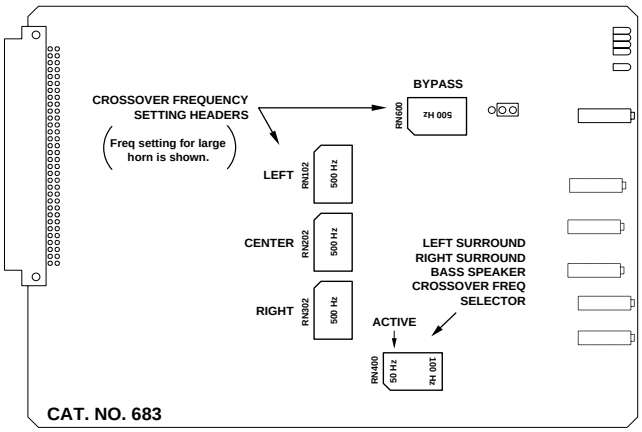


Figure 3 - 7. Cat. No. 683 – Crossover Frequency Setting Headers.

Crossover Frequency Setting Headers- Screen Channels

RN102 Left Channel
RN202 Center Channel
RN302 Right Channel
RN600 Bypass

These headers select the desired crossover frequency. For large horns, the correct setting is usually 500 Hz. For small horns, 800 Hz is usually correct. Check the loudspeaker manufacturer's specifications for details. Be sure to select the same Bypass crossover frequency header as the screen channels use. The headers are shipped with each card.

NOTE: Custom settings are possible. See *Appendix B, Cat. No. 683*.

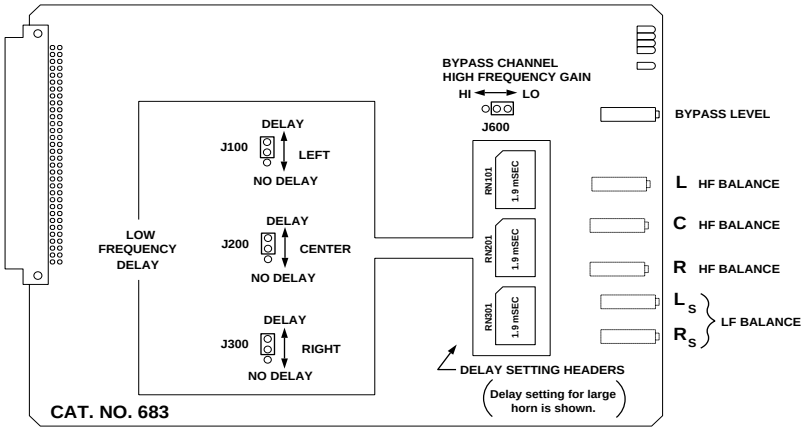


Figure 3 - 8. Cat. No. 683 – Low Frequency Time Delay Enable Jumpers

Low Frequency Time Delay Enable Jumpers [DELAY]

J100 Left Channel

J200 Center Channel

J300 Right Channel

These jumpers allow the low frequency portion of the designated channels to be delayed when the jumper is placed in the “DELAY” position. This compensates for the time offset caused by high frequency drivers being behind the low frequency drivers in contemporary stage speakers. With the jumper in the "DELAY" position, sound produced by the low frequency speakers is delayed to cause the low and high frequency energy to reach the listener at the same time. There is no low frequency delay when the jumper is set to “NO DELAY”. The factory setting is “DELAY”.

Low Frequency Time Delay Setting Headers

RN101 Left Channel

RN201 Center Channel

RN301 Right Channel

For large horns, the correct delay setting is usually 1.9 ms. For small horns, 0.8 ms is usually correct. The headers are shipped with each card.

NOTE: Custom settings are possible. See *Appendix B, Cat. No. 683.*

RN400 L and R Surround Low-Pass Filter Frequency Select [50Hz]

This header sets filter circuits to the indicated low-pass frequency. Signals below this frequency are sent to the surround channel low frequency drivers. Both the Cat. No. 682 Output card and the Cat. No. 683 have reversible filter headers for the surround channels. Ensure that the headers on both cards are set to the same frequency, chosen to suit the low frequency handling capability of the surround speakers in use. If you have surround bass drivers, it is probably best to set both headers to 100 Hz in order to improve the low frequency power handling ability of the surround channel. The factory setting is 50Hz.

J600 Bypass Channel HF Output Level Range [LO]

This jumper selects between two gain ranges for the bypass channel high frequency output. The “HI” setting has approximately 12 dB higher output level than the “LO” setting. The factory setting is “LO”.

3.5 Install Circuit Cards - Card Descriptions

If they are not already installed in the CP500 unit, install all of the cards for your system as shown below for each CP500 version. Note that the noise reduction modules (Cat. No. 222SR-A) are shipped uninstalled. This is to prevent damage during shipment due to their weight. Should it ever be necessary to ship the CP500 again, be sure to remove these from the unit and pack them separately.

NOTE: Cat. No. 222SR-A modules are primarily intended for playback of 35mm photographic soundtracks, and have headroom capabilities based on that medium. As a result, use of Cat. No. 222SR-A modules are not recommended for playback of 35 mm magnetic print-masters or SR encoded 70mm magnetic film. Contact Dolby Laboratories for further information.

Model CP500-D

Cat. No. 222SR/A Module

Provides two channels of Dolby A-type noise reduction and Dolby SR processing.

Cat. No. 661 Optical Preamplifier Card *Must be functioning for bypass operation*

Amplifies the outputs of the analog soundtrack solar cells in the selected projector.
Projector select logic.
Provides slit loss equalization.

Cat. No. 681 Input Switch Card

Stereo analog multiplexer for selecting signal to be fed to noise reduction cards.
Audio sample rate clock.

Cat. No. 675A Digital Signal Processing Cards (2)

Matrix decoder for Dolby Pro-Logic.
Non-sync processing.
Signal generation and signal analysis functions.
Twenty-seven band 1/3 octave equalization for L, C, R channels.
Nine band octave equalization for L and R surround channels.
Equalization for subwoofer channel.

Cat. No. 685 6-Channel Analog to Digital Converter Card

Used for external 6-channel analog inputs (optional).

Cat. No. 662 6-Channel Digital to Analog Converter and Voltage Controlled Amplifier Card

Converts digital data to analog audio and includes the main fader voltage controlled amplifier.

Cat. No. 682 Analog Output Card *Must be functioning for bypass operation*

Switches and routes output channels.
Contains treble and bass control circuits.
Generates hearing impaired output and mid-surround output.
Contains bypass power regulator and output amplifier.

Cat. No. 684 System Controller Card

Must be present for level control in bypass mode. Bypass will function at a fixed level if this card is not present or operational.

Contains Microprocessor.
Controls front panel display and controls.
Contains interface for remotes and automation equipment.

Cat. No. 683 Crossover Card (Optional)

Provides active high- and low-pass filters on L, C, and R signals for bi-amplified installations.
Provides low frequency surround channel outputs.
Provides low frequency delay for time alignment of L, C, and R low frequency drivers.
Contains bypass crossover and must be present for bypass operation in bi-amplified systems.

Dolby Digital Soundtrack Processing System

Cat. No. 670 Video Front-end Card

Digitizes the video data received from the film soundtrack reader.

Cat. No. 671 DSP Cards (2)

Processes the digitized video data and extracts the AC-3 bitstream.

Cat. No. 673 System Services Card

Contains the operating software.

Cat. No. 675A Digital Signal Processing Card

This additional Cat. No. 675A provides Dolby AC3 decoding.

Cat. No. 680 Bit Rate Converter Card

Converts PCM audio from the variable projector rate clock to a stable PCM audio sample rate.

Model CP500-D/300

Contains the same boards as the CP500-D above, except Cat. No. 300 modules are used in place of the Cat. No. 222SR/A modules. A Cat. No. 668 Adapter Card is required. Used primarily in preview theaters and studios.

Model CP500-SR

Contains the same boards as the CP500-D above except without the Dolby Digital soundtrack processing system cards.

Model CP500-70

Contains the same boards as the CP500-D, and additionally:

Cat. No. 222A Modules (2)

Provides four additional channels of Dolby A-type noise reduction bringing the total number of noise reduced channels to six.

Cat. No. 669 Adapter Card

Used for installing the two Cat. No. 222A cards above.

Cat. No. 685 6-Channel Analog to Digital Converter Card

Used for external 6-channel analog inputs.

3.6 Bypass Power Wiring

For emergency operation, the CP500 comes equipped with an independent external mains power module. If the main power supply or processor circuitry fails, the unit will automatically switch to bypass operation, allowing the show to continue with limited sound processing functions. The unit can also be switched manually to bypass operation by pushing a button located inside the front panel and labeled POWER/BYPASS.

In some countries the primary cable for the module may not have a mains plug fitted. These unterminated leads must be as follows:

Brown wire -- Live or hot Blue wire -- Neutral

NOTE: If you are uncertain about the wiring of your mains outlet do not use it. Consult a qualified electrician.

For safety reasons, the bypass power module contains an internal fuse. **DO NOT** connect the module to AC mains power until the output wires have been connected to the CP500. Otherwise, shorted secondary wires will blow the fuse.

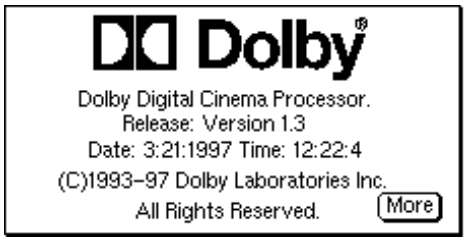
Install the ferrite clamp on the bypass power supply cable where it connects to the back of the CP500. Open the clip and wrap the bypass power supply wire around one side of the ferrite three times so that the loops lie inside the ferrite channel. Close the clip until it snaps firmly closed. Make sure that the bypass power supply cable is not pinched between the halves of the ferrite clamp.

3.7 Power On

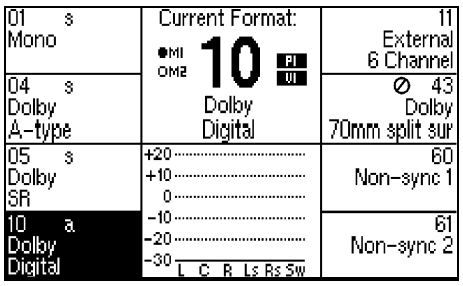
Connect the bypass power module to the CP500 and plug it into AC mains. The unit is shipped with the POWER/BYPASS switch set to BYPASS. The front panel BYPASS LED should light.

Open the front panel and confirm that one of the Projector Select LEDs is on. Projector 1 or Projector 2 is selected by Jumper J2 on the Cat. No. 661 (*See manual section 3.4*).

Connect the main power cable. Then, push the Bypass/Power button to turn on the CP500.



When power is first applied, the first screen that appears displays the revision level of the software. Next, a brief "Loading System" message is displayed.



In a few seconds, the *Current Format* screen appears. This is the normal screen that the projectionist or any other operator would see and the only screen they will need to see for ordinary purposes.

Run quick checks to confirm that:

- Rotating the front panel knob changes the numbers displayed next to it.
- Pushing the MUTE button causes the MUTE LED to flash.
- Pushing any of the buttons on each side of the display causes the mute LED to go off and the LED next to the button pushed to go on (except buttons next to "⊘" on the display).

3.7.1 Hum and Other Noise Problems

If you hear undesirable hum from the speakers when you apply power to the CP500 and other projection room equipment, check the following list for possible causes.

1. **Equipment grounding**. All equipment including the CP500 is grounded to the rack. To ensure good ground contact, install a starwasher to one mounting screw per piece of equipment. Installation of star washers is strongly recommended because electrical contact may not be achieved since modern powder coat paints can be very tough.

2. **Ground loops** caused by audio signal wiring, especially to power amplifiers. Be sure to check the booth monitor installation.

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

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

5. **Power amplifiers**. Disconnect from the CP500 and ground the inputs to determine if the power amplifiers are causing hum problems.

6. **Solar cell wiring**. (Analog film sound format selected). Check the shield connections. Cell wiring should be placed away from mains and other wiring. Cell wires must not be connected to the frame of the projector.

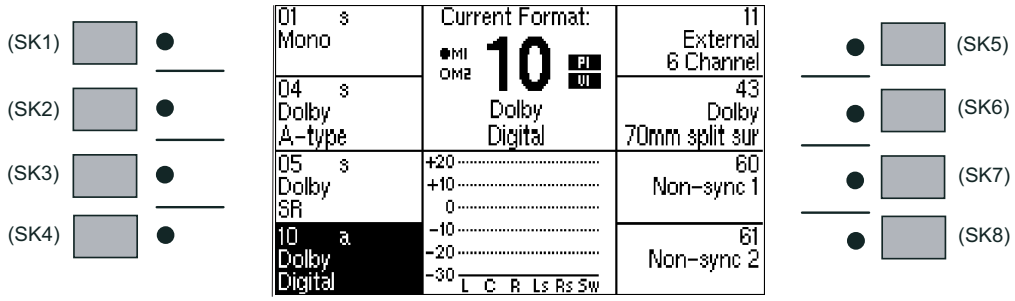
7. **Exciter lamp power supply**. Check for ripple on the DC power supply outputs. Some old exciter lamp power supplies and emergency supplies provide AC to the lamp. The resulting hum makes them totally unsuitable for a Dolby film sound system. Such exciter supplies must be replaced.

8. **Projection room lighting/solar cells**. Ambient lighting, especially florescent tubes, can leak into the solar cell area and cause hum.

This section describes the CP500 LCD display and operation of the front panel controls, along with of an overview of the general principles involved in the alignment of Dolby cinema equipment. It is useful to develop an understanding of why the CP500 is aligned as described in this manual. If the installer is already familiar with the CP500 and these principles, or is in a hurry to complete the installation, this section may be read later. Continue the installation procedure beginning with ***Section 5***.

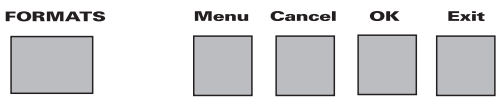
4.1 The CP500 Front Panel

4.1.2 Soft Keys: SK1 to SK8



The buttons located on each side of the LCD display are sometimes called "**soft keys**"(SK). That is, they do not have a single fixed function but rather their function is software controlled and changes based on the current screen displayed. The purpose of each button is shown on the display and can change with each different displayed screen.

4.1.3 Hard Keys

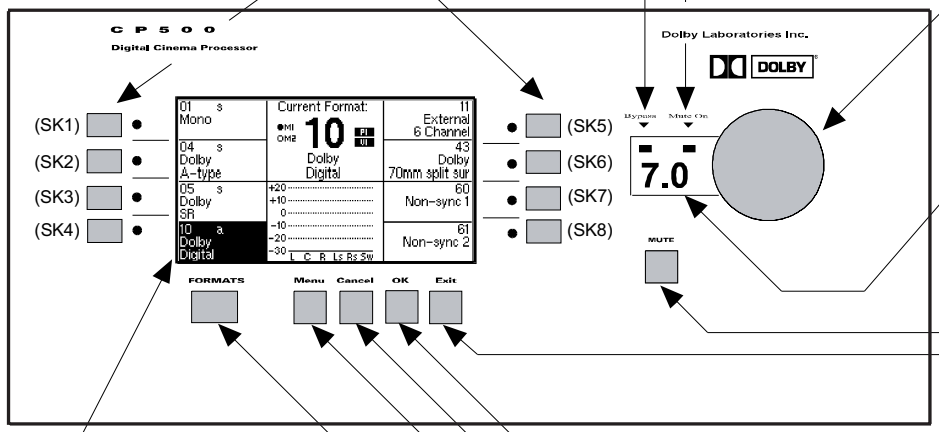


FORMATS

The single large and four small keys along the bottom of the display are the "**hard keys**". Their function is labeled on the panel. The large key on the left, **FORMATS,** is used to return to the *Format Selection* (*Current Formats*) screen from any other menu screen. This screen is displayed during normal day-to-day operation of the CP500. If any other screen or menu is displayed, this button returns the display immediately to this "top" of the menu tree.

MENU

The **MENU** key is used as the first step in selecting all software functions and menus except format selection. It selects or returns the unit to the top menu.



SOFT KEYS 1 - 8

Used to select the function shown next to the switch in the front panel display.

BYPASS INDICATOR

Indicates continuous red when unit is in bypass mode.

MUTE ON INDICATOR

Flashes when mute is activated.

MAIN FADER/MULTI-FUNCTION CONTROL

Controls sound level and also is used for data selection in menu operations.

FADER LEVEL DISPLAY

Displays fader setting. Ranges from 0 to 10. Normally set to 7.0 This display shows '- -' when in data entry mode.

MUTE KEY

Mutes output to all channels when activated.

EXIT KEY

Used to select the previous menu.

OK KEY

Used during pop-up menu operations. Selects option currently in pop-up window selection box. Also stores currently displayed data.

CANCEL KEY

Used during pop-up menu operations. Cancels pop-up menu operation and restores the previous menu or data.

MENU KEY

Used to return to the top of the menu tree.

FRONT PANEL DISPLAY

Displays format and menu screens.

FORMATS KEY

Used to switch to format selection screen.

CANCEL

Many of the screens used during set-up, alignment, or diagnostics contain a "Pop-Up" screen within the main screen. The **CANCEL** key is used to cancel the current pop-up operation being performed and restore any data that was changed during the pop-up screen operation.

OK

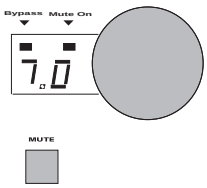
This key is used to accept and store the current setting in a pop-up screen.

EXIT

This key is used to signal completion of an adjustment procedure or select the previous screen.

4.1.3 Other Controls and Indicators

To the right of the display is another window showing the selected fader level. As with previous generations of Dolby cinema processors, a fader setting of "***7.0***" is the nominal correct operating level. This setting matches the level used during the film's production. As the **main fader** (or front panel knob) is turned, the numbers on the display will move from zero to ten. The **main fader** rotates continuously with no end stops. The number displayed will always indicate the current level setting.



The **MUTE** button is used to fade the sound down without disturbing the current fader setting. A green LED, **MUTE ON**, located above the fader level display will flash, indicating that the CP500 outputs are muted.

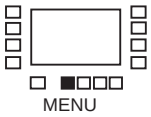
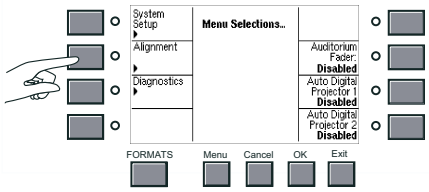
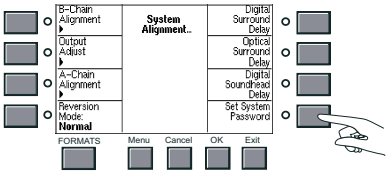
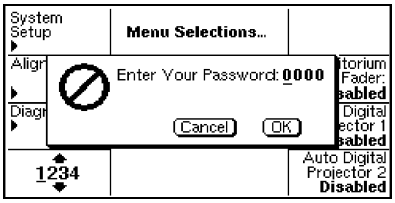
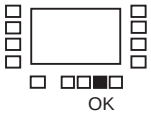
A **BYPASS** LED is located to the left of the **MUTE ON** LED. As with other Dolby cinema processors, the CP500 utilizes a separate back-up power supply which is used during emergency operation. If the CP500 is operating in bypass mode, this red LED will come on (not flashing). If there should be a failure, the system can switch into bypass mode either temporarily or permanently. The minimum electronics required for a bypass output signal from the CP500 is:

- Functioning bypass power transformer (external module)
- Cat. No. 661 Optical Preamplifier card
- Cat. No. 682 Analog Output card
- Cat. No. 683 (optional) Crossover card, if used in a bi-amplified installation.

A manual bypass push-button is located inside the front panel on the right hand side of the unit.

4.2 System Password

Many of the CP500 alignment functions can be protected from unauthorized access be using a system password (any four numbers). A password can be stored after the system is aligned in order to block any changes to the B-chain alignment, level settings, or time delays. Knowledge of this password would be required to enter these CP500 menus. The CP500 is shipped with no system password. The number stored in CP500 memory is "0000". This allows access to all alignment functions. The following procedure should be used to set or change the system password.

	Press the **MENU** key.
	The *Menu Selections* screen will be displayed. Press **Alignment** (SK2).
	The *System Alignment* screen will appear. Press **Set System Password** (SK8). **NOTE:** If a system password has already been stored in memory, then the screen below will appear.
	Rotate the front panel knob to select the digit you wish to set, then press and hold soft-key SK4, "**1234**", while rotating the front panel knob to set the desired number. Repeat this process for any of the four password digits you wish to set.
	Press the **OK** key to store the new password.

4.3 Aligning the B-Chain

The B-chain is defined as those system components from the fader through the loudspeakers. In the CP500, available adjustments include equalization, level control, and digital soundhead, analog, and digital surround delay settings. Adjustable mute fade-out time is also provided.

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 theaters 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 theaters) 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 or a multi-microphone setup with multiplexer is placed in the auditorium to receive the pink noise reproduced by the loudspeaker. The output of the selected microphone is fed to a real time analyzer (RTA) circuit built into the CP500 cinema processor, and equalization can be performed using the CP500 front panel display to show the audio spectrum received by the microphone(s). 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, placed in front of a perfectly flat microphone, producing perfectly flat response to sounds arriving from all directions, will display a perfectly flat response on the RTA from pink noise. In an enclosed space such as a theater, 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. Then 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. Since high and mid frequency energy is absorbed when sound is reflected, 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 theater.

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 theater 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 theaters in which films with Dolby soundtracks are mixed and for all Dolby processor-equipped cinemas.

The size of the theater 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 theaters. The ***Treble Control*** can be used to reduce the output on the response curve by approximately 1 dB at 8 kHz for very large theaters; an increase of 1 dB at 8 kHz may be in order for a very small theater. Any such adjustment should be based on an evaluation by ear of actual known films rather than as a rule of thumb.

Some loudspeakers used in theaters 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 EQ circuitry.

The final factor is masking of the screen. Most 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 theaters have installed acoustically transparent masking cloth, and others leave the masking open whenever they are showing a 1.85:1 film with a stereo soundtrack. Moving the speakers towards the center of the screen so as to clear heavy masking is not a good solution, since the stereo separation would be degraded.

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

5.1 Check Theater Equipment

Thoroughly check the loudspeakers and power amplifiers for sources of poor performance:

- Check that the loudspeaker cables are in good condition and that they of a suitable gauge for the impedance of the speakers and the length of the run.

- Rattles (a leak in the low frequency driver cabinet may appear to be a rattle).

- Loose bolts or other hardware.

- Open drivers.

  In systems with pairs of drivers – low frequency or high frequency – one voice coil of the pair may be open but the system will still function. Check the speakers with an ohmmeter. If one channel requires markedly more equalization than the other or if one speaker overloads at lower levels than the other speakers, an open driver circuit could be the cause.

- Missing drivers or other components.

- The settings of the crossovers to match the type of drivers in use and the acoustics of the theater.

  The high frequency driver level control must be set for the best possible frequency response before you attempt any equalization. This is also true if the system uses active crossovers with bi-amp equipment.

- Phasing between the low frequency and high frequency drivers, and between the channels.

- Aiming of speakers.

  Check that the speakers are correctly aimed into the auditorium, and that they are not obstructed by the screen frame, struts or other obstructions.

- Check that speakers are correctly connected; that the speaker on the left is connected to the left power amplifier.

Amplifiers

- Distortion.

- Gross gain differences among amplifiers.

  If one amplifier differs in performance from the others, it should be checked and repaired, if necessary, before proceeding further. Input gain controls should all be at the same setting.

- Blown fuses.
- Good air movement through power amplifiers.

Air-conditioning

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

5.2 Preparing for Room Equalization

Using a Microphone Multiplexer with the CP500

If you are using a Dolby Cat. No. 580 Microphone Multiplexer system and need instructions on its use, turn to ***Section 9.2***.

5.2.1 Configure the Cat. No. 682 for use with the Optional Cat. No. 683 Electronic Crossover Card

Verify that the Cat. No. 682 jumpers J901, J3, J4, and J5 are set to the "YES" position to enable the crossover features of the Cat. No. 683.

5.2.2 Screen Channels

The factory setting for the Cat. No. 683 card has the Low Frequency Time Delay Enable Jumpers set to DELAY. This indicates that jumpers J100, J200, and J300 of the Cat. No. 683 card allow the low frequency portion of the designated channels to be delayed by 1.9 ms or 0.8 ms. The “DELAY” setting compensates for the time offset caused by high frequency drivers being behind the low frequency drivers in contemporary stage speakers. Sound produced by the low frequency speakers is delayed to cause the low and high frequency energy to reach the listener at the same time. There is no low frequency delay when the jumper is set to “NO DELAY”.

Board locations RN102, RN202, RN302, and RN600 select the desired crossover frequency and locations RN101, RN201, and RN301 select the time delay. For large horns, the correct setting is usually 500 Hz and 1.9 ms. For small horns, 800 Hz and 0.8 ms is usually correct. Check the loudspeaker manufacturer’s specifications for details.

Before you set out to equalize the room, make sure you do the following:

1. Be sure to use the same Bypass crossover frequency setting header as the screen channels use.
2. Carefully install the correct headers in the appropriate socket locations, making sure to set the header correctly.
3. Set all power amplifier gain pots to the maximum. Carefully ensure that only HF outputs are routed to the HF horns to avoid damage from excessive low frequency excursion of HF horn diaphragms.
4. Place microphones in the auditorium and connect the mikes and multiplexer (if available) to the CP500.
5. Set the fader level display to read "***0***".
6. Enter the CP500 B-chain EQ screen and select Left channel.
7. Gradually turn the fader by moving the pointer to the fader slider on the EQ screen. Verify by ear or spectrum analyzer or both that the low frequency driver and HF horn are each producing only their appropriate halves of the spectrum.
8. Turn the fader up until a satisfactory level is achieved in the auditorium.
9. Set all EQ controls to flat.
10. Using the Left trimpot on the edge of the CN683, adjust the relative HF horn output level so that the low frequency driver and HF horn output levels match in the octaves just above and just below the crossover frequency. For example, if the crossover frequency is set to 500 Hz, then the level from 250-500 Hz should match that from 500-1,000 Hz.
11. Adjust the Right and Center channels, then proceed to room equalization as described in *Section 5.3*.

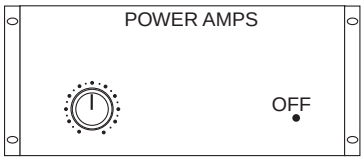
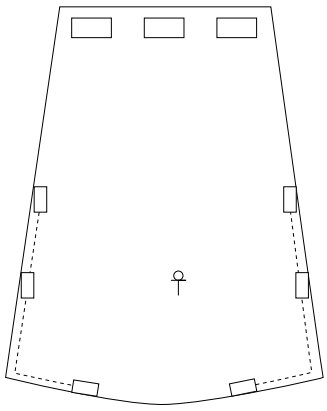
5.2.3 Surround Channel Bass Drivers (Optional)

Both the Cat. No. 682 Output card and the Cat. No. 683 card have reversible filter headers labeled 50/100 Hz for the surround channels. Ensure that the headers on both cards are set to the same frequency (usually to suit the low frequency handling capability of the surround speakers in use). If you have separate surround bass drivers, it is probably best to set both headers to 100 Hz in order to improve the low frequency power handling ability of the surround channel.

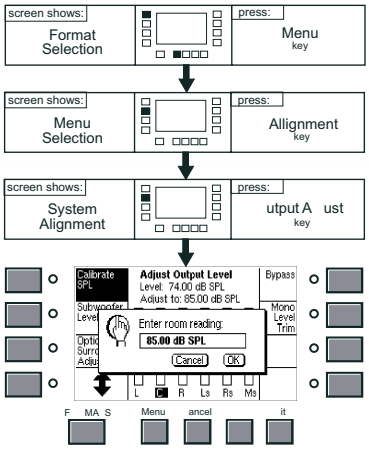
Enter the B-chain EQ screen and select Left Surround. Set the EQ to flat. Adjust the Ls trimpot on the Cat. No. 683 so that the level in the room is reasonably equal in the 40-100 Hz and 100-200 Hz regions on average. Now adjust the EQ controls as usual.

5.3 Room Equalization

Equalization is performed using a real-time analyzer built into the CP500. The adjustment for the five full range channels involves two steps - coarse adjustment and fine adjustment, using a 27-band equalizer for each of the screen channels (left, center, and right), and a 9-band equalizer for the two surround channels (left surround and right surround). Subwoofer channel equalization involves setting the frequency, "Q", and level of "cut". The real-time analyzer screen displays a standard response curve. The ideal setting is reached when the room response readings fall on or very close to this standard curve.

	Set all the gain controls on all power amplifiers to a known repeatable setting. **The preferred setting for most amplifier gain controls is maximum.** If a different setting is required in order to optimize the noise performance of the system, the controls should be locked in position or marked clearly.
	Position calibrated microphones in the theater. Whenever possible, use multiple microphones and a multiplexer. (Suggested microphone positions for use with a multiplexer are shown in *Section 9.2.*) For a single microphone, the recommended position is shown in the diagram – 2/3 of the way from the front speakers to the rear – but off the axis of the center speaker – 5 feet off the floor level – and angled 45 degrees upward toward the screen.

WARNING: The following steps will cause the CP500 to output pink noise to the power amplifiers. The CP500 is shipped with the output levels set to a minimum. If you are unsure of the settings on your unit, turn off the power amplifiers before pressing the **Output Adjust** key. Then, press the key and observe the front panel display; it will show the present output level adjustment settings. With the settings at minimum, excessive loudness will usually not be a problem.

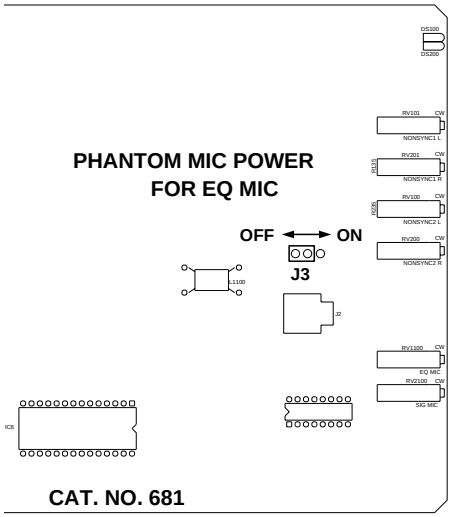


To perform a preliminary adjustment of the output level:

Press the **MENU** key,

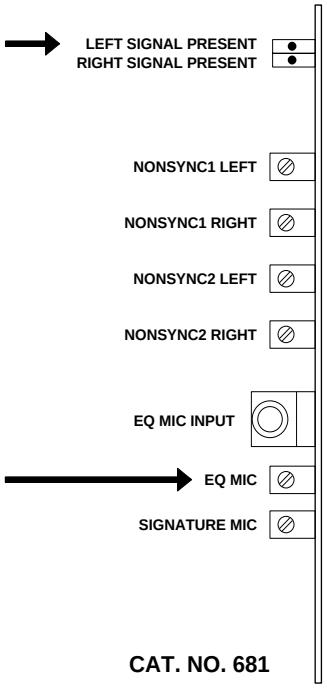
Press **Alignment** (SK2),
(A system password may be required at this point.)

Choose **Output Adjust** (SK2).



Phantom power is optionally provided to both connectors via a jumper on the Cat. No. 681.

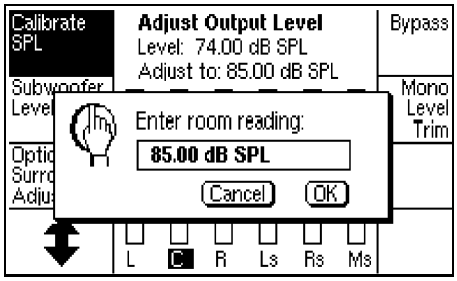
The spectrum analyzer, built into the CP500, has automatic level control covering a range of input levels. However, if you get an error message that reads that the input level is too low or too high, the EQ mic trimpot on the Cat. No. 681 should be adjusted to have the level meter on the Cat. No. 222 show approximately Dolby level for **85 dBC** pink noise in the auditorium. This will place the signal in the middle of the analyzer's acceptable level range.

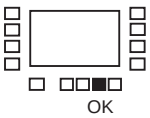


Connect Cat. No. 580 Microphone Multiplexer to the microphone input connector on the rear panel, or if using another type of multiplexer or single microphone, open the front door of the CP500 and plug it into the "EQ MIC INPUT" connector on the Cat. No. 681 card. This is a balanced input connection which is wired in parallel with the rear panel connector. The rear panel connector can also be used with a single microphone if a suitable cable or adaptor is provided.

The left signal presence LED indicator on the top card edge should illuminate indicating that signal is present. **If it is not illuminated or is very dim, adjust the "EQ Mic" control to obtain sufficient signal.**

NOTE: If your microphone requires phantom power, move jumper J3 on the Cat. No. 681 board to the ON position.

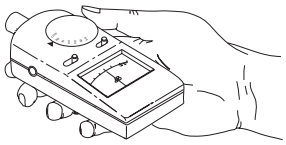




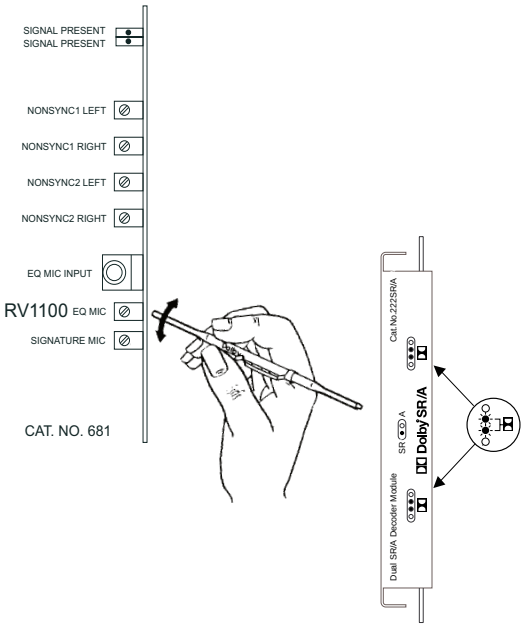
Pink noise will now be routed to the **center** channel output.

With a hand-held sound pressure level meter, measure the noise level in the room. Enter this reading in the box displayed by rotating the front panel knob, then press the **OK** key.

The calibration is retained in CP500 memory and can be used in future adjustments, however it is advisable to recalibrate the system when re-arranging microphones because the sound pressure level will vary slightly with microphone placement.



"85 dBC"



CAT. NO. 222

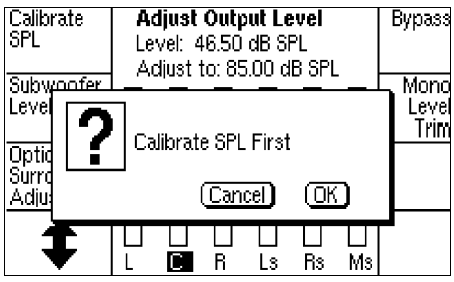
If the sound pressure level in the theater is too low, a dialog box will appear on the CP500 screen.

Adjust the level in the room to about **85 dBC**, using the EQ mic control as mentioned above. Verify the level by using your hand-held sound level meter.

Now open the front door of the CP500 and locate RV1100, the second trimpot from the bottom on the Cat. No. 681.

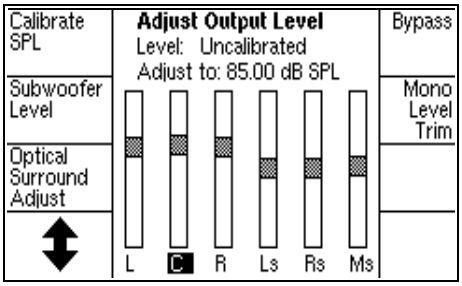
Adjust the trimpot so that the 4-LED Dolby level meter on the Cat. No. 222 (standard or -300 versions) or right-hand Cat. No. 222 (70 mm versions) indicates approximately equal greens.

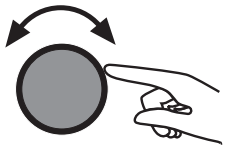
NOTE: Some CP500-300 versions may not have a Cat. No. 222 installed. On these units, adjust the trimpot so that the signal-present LED at the top of the Cat. No. 681 flickers and is reasonably close to full brightness. Its action should be similar to that of the selected channel's signal-present LED on the Cat. No. 682.



If the CP500 has previously been calibrated, it will display a dialog box asking if calibration is to be performed or if the old calibration data is to be used. Press **OK** to recalibrate, or **CANCEL** to use the old calibration data.

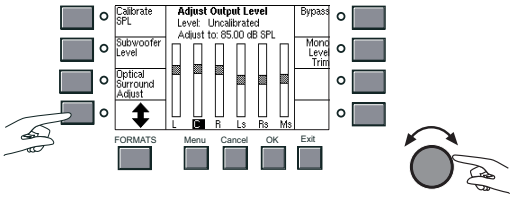
NOTE: While in the output level adjust menu, pressing the **Calibrate SPL** key (SK1) will allow recalibration of the system.



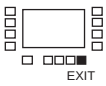


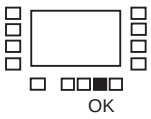
Each of the channels should now be adjusted to give a reasonable sound pressure level in the room. It is not necessary to get exact readings at this point since the levels will change slightly during equalization of the room. Exact output level adjustment must be performed after equalization.

To select the channel to be adjusted, rotate the front panel knob. Pink noise is routed to the channel indicated by the video highlight along the bottom of the screen.



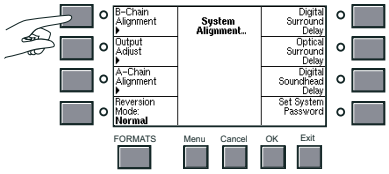
Adjust the output level of the selected channel by pressing and holding the **Up/Down Arrow** key (SK4) and rotating the front panel knob.





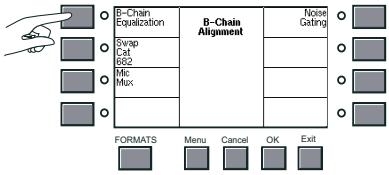
When all the channel output levels are adjusted, press the **EXIT** key. The system will display a box prompting you to save or discard the changes.

Press **OK** to save the settings.

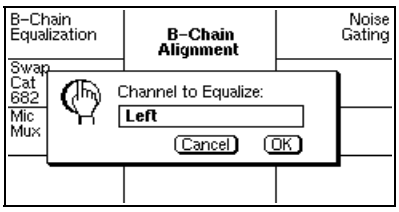


To perform equalization of the room,

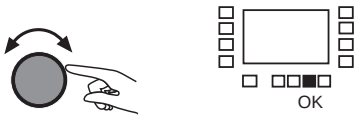
Press **B-Chain Alignment** (SK1).



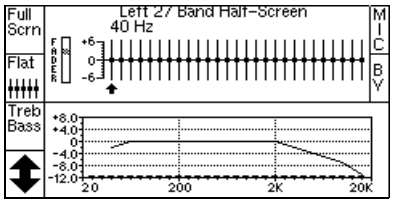
Then, press **B-Chain Equalization** (SK1).

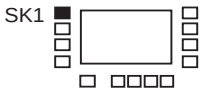


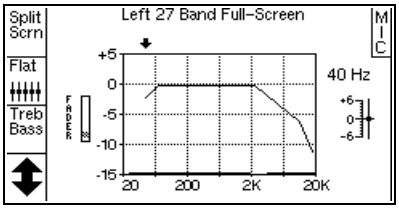
The system now displays a dialog box allowing you to select the channel to equalize.

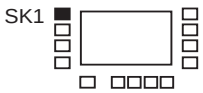


Rotate the front panel knob until the desired channel is displayed, then press the **OK** key to select the channel.



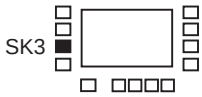




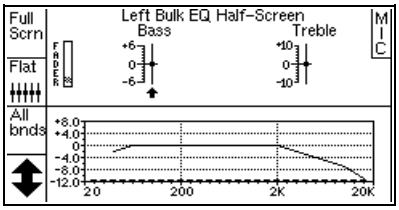


The display will switch to the *27 Band Half-Screen* mode. This screen is split into two parts which display equalizer band settings, or “sliders” at the top, and a frequency versus level analyzer at the bottom.

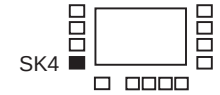
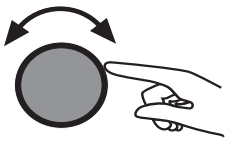
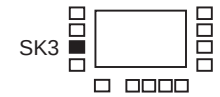
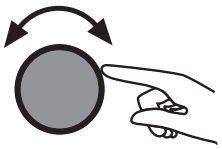
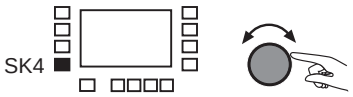
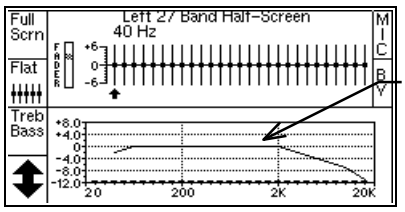
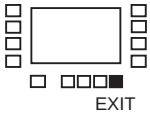
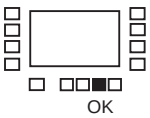
NOTE: For enhanced resolution, the Real-Time Analyzer has a second display mode, called "Full-Screen". To change to full screen display mode, press the **Full Scrn** key (SK1). This larger display allows closer scrutiny of the analyzer's results. Only one graphic equalizer control is displayed at a time. Once again, rotating the front panel knob will select the band to adjust, and holding the "Up/Down arrow" key (SK4) while rotating the front panel knob will adjust the selected band's EQ.
To return to the "Half Screen" mode of display, press the “Split Scrn” key (SK1).

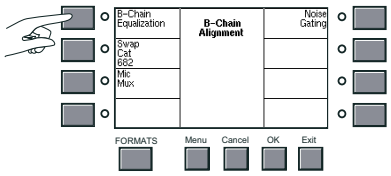


Set the coarse equalization by pressing **Treb / Bass** (SK3).



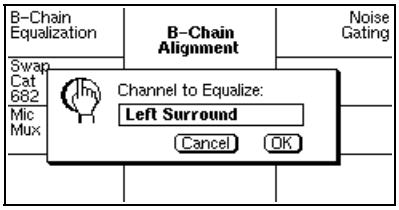
The screen will change to the *Bulk EQ* screen. The lower half will continue to show the frequency versus level analyzer and the top will switch to Bass and Treble controls. (The "full-screen" display mode is available here also.)

 	Adjust the Bass and Treble controls to move the room levels close to the reference line. This is accomplished by rotating the front panel knob until the arrow is under the desired control to be adjusted. Then, press and hold the **Up/Down arrow** key (SK4), and rotate the front panel knob until the desired response is displayed.
	Press **All Bands** (SK3) to return to the *27 Band Half-Screen* screen.
	Rotate the knob until the arrow is under the desired band shown in the top section of the screen.
  **Reference Response Line**	Perform fine adjustment of each band by pressing and holding the **SK4** key while rotating the front panel knob. Adjust the room response to match the reference line as closely as possible.
  	When the adjustments for this channel have been completed, press the **EXIT** key. If changes have been made, a box will appear asking if the changes should be saved. Press **OK** to save, or **CANCEL** to discard the new changes.

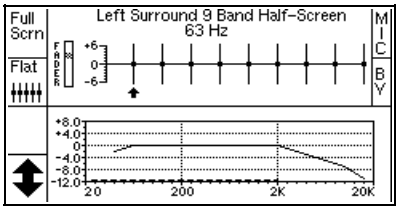


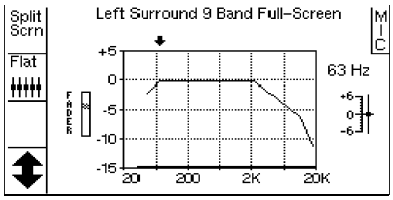
Select the next channel to adjust by again pressing **B-Chain Equalization** (SK1).

Repeat the above procedure for the remaining front screen channels.



Equalization facilities for the surround channels are slightly different than for the screen channels.

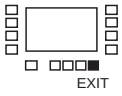


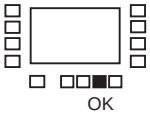


The equalizers for the surround channels are 9-band octave equalizers.

Adjustment of the room response is performed by using the front panel knob and the "Up/down arrow" key just as it was done for the screen channels.

NOTE: As with the front screen channel equalizers, the Full-Screen display mode is available by pressing the **Full Scrn** key (SK1).

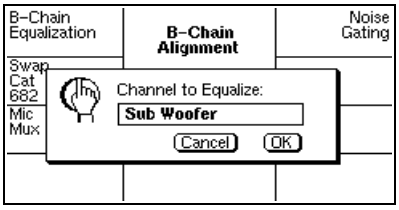


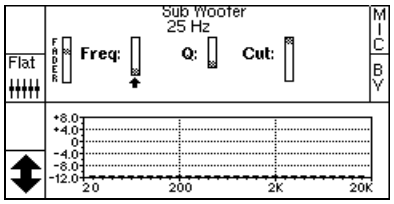


When the desired response has been achieved, press the **EXIT** key to return to the **B-Chain Alignment** screen. If changes have been made, a box will appear asking if the changes should be saved.

Press **OK** to save, or **CANCEL** to discard the new changes.

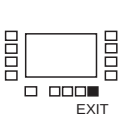
Repeat the above procedure for the other surround channel.



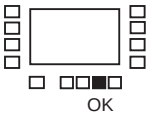


Equalization facilities for the subwoofer channel are also different than for the other channels.

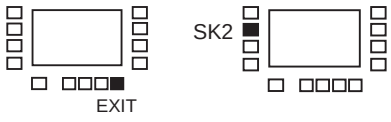
The subwoofer equalizer is a digital cut-only filter, with adjustable frequency, Q (or sharpness), and amount of cut. From the analyzer display, determine the primary low-frequency resonant peak of the room and adjust the **Frequency**, **Q**, and **Cut** controls to cancel this resonance. The front panel knob and "Up/down arrow" key (SK4) are once again used to select and move the controls.



When the desired response has been achieved, press the **EXIT** key to return to the *B-Chain Alignment* window. If changes have been made, a box will appear asking if the changes should be saved.

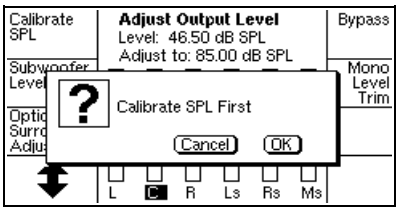


Press **OK** to save, **CANCEL** to discard the new changes.

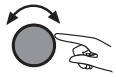


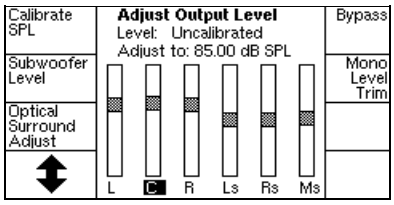
To perform SPL Adjustment

Now that the equalization is complete, the sound pressure level in the room can be set exactly. Return to the output level adjust window by pressing **EXIT** and then the **Output Adjust** key (SK2).



Since the system was calibrated earlier, it is not required to perform the calibration again, however it is prudent to recalibrate if microphone placement has changed. Press **OK** to recalibrate, or **CANCEL** to use the earlier calibration data.

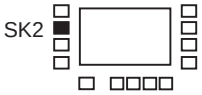




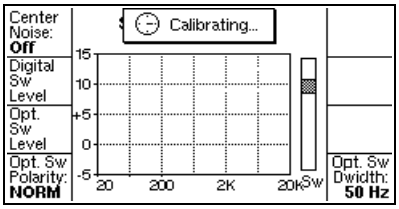
Using the front panel knob and the "Up/down arrow" key:

Set the SPL to **85 dB** for the screen channels.

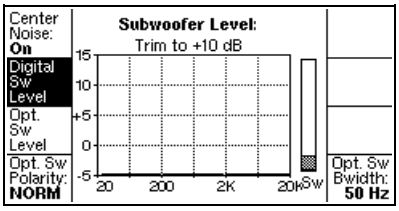
Set the SPL to **82 dB** for the surround channels.



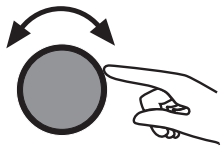
When the proper levels have been achieved, the subwoofer level may be set by pressing the **Subwoofer Level** key (SK2).



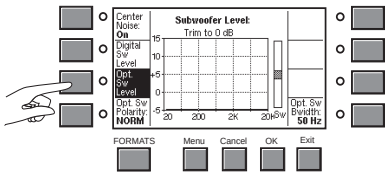
The subwoofer adjustment begins with a calibration cycle which uses center channel pink noise to establish the zero reference line of the RTA display.



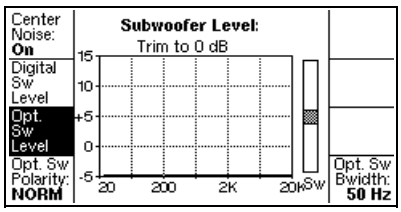
When the reference level has been established, center channel noise is removed and noise is routed to the subwoofer in digital mode (+10 dB, 180 Hz bandwidth.

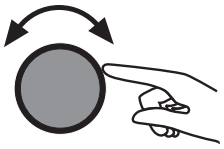


Use the front panel knob to set the average of the bands below 180 Hz to **+10 dB** on the RTA display.



When the correct level has been achieved, the optical subwoofer level may be adjusted by pressing the **Opt. Sw Level key** (SK3).

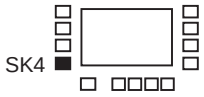


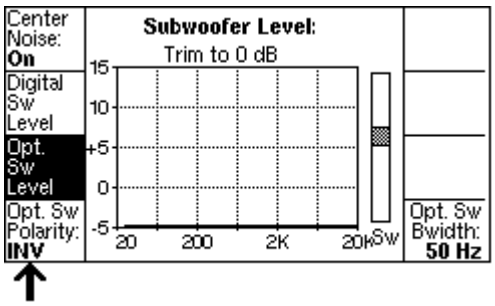


Noise is now routed to the subwoofer in optical mode (0 dB, 50 Hz bandwidth).

Use the front panel knob to set the average of the bands below **50 Hz** to **0 dB** on the RTA display.

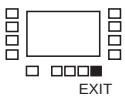
Center noise can be turned on and off at any time by pressing the **Center Noise** key (SK1), allowing observation of the bass extension of the center speaker contributed by the subwoofer.

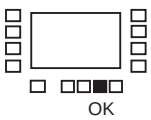




Check the polarity of the signal being sent to the subwoofer channel by using the **Opt. Sw Polarity** key (SK4). Center noise must be **On** for this test.

Note the change in the average level of the bands from 20 Hz to 100 Hz when SK4 is pressed. There should be a level DECREASE when the polarity key is switched to **INV**erted. The subwoofer is out of phase with the front channels if you do not see this level decrease. Reverse the subwoofer(s) speaker connections to correct the polarity.



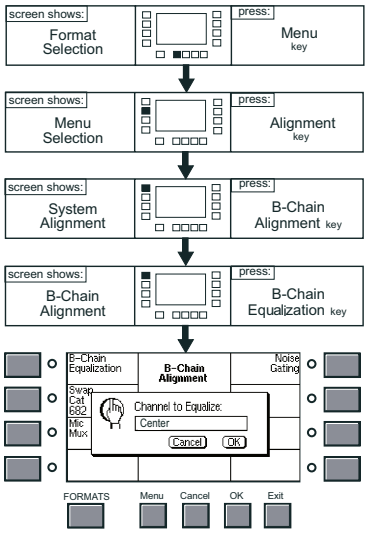
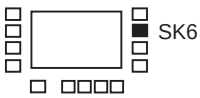
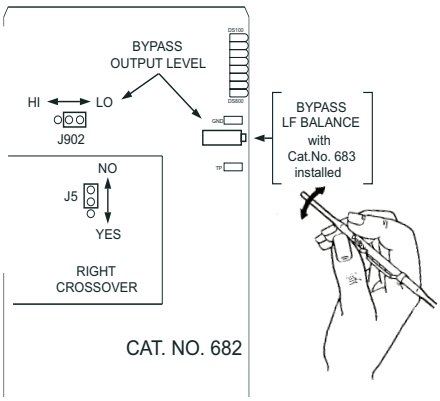


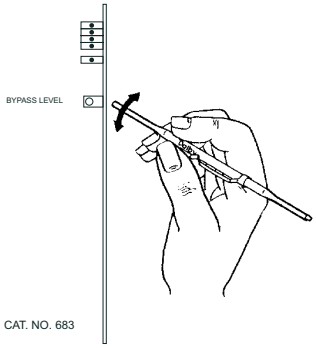
When the desired level has been achieved, press **EXIT** to return to the main output level adjust window. If changes have been made, press **OK** to save the settings in CP500 memory, or **CANCEL** to discard them.

5.4 Bypass Crossover Adjustment

NOTE: In a bi-amplified system, the bypass subsystem must have its own electronic crossover as well, to avoid damage to the HF horns from low frequency signals.

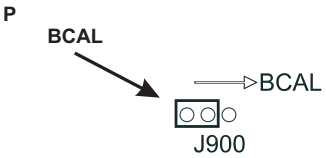
In order to perform these adjustments, first turn off the CP500 and remove the Cat. No. 682. Move jumper J900 to the BCAL position. Re-insert the card and turn on the CP500. Also, set the bypass adjust level jumpers on the Cat. No. 682 to HI and the Cat. No. 683 to LO. Then, perform the following steps.

	Press the **MENU** key**,** choose **Alignment** (SK2), and **B-Chain Alignment** (SK1). Select **B-chain Equalization** (SK1), Choose the ***Center*** channel and half screen mode.
	Press **Bypass** (SK6) to select the bypass mode.
	Set the **Bypass LF Balance** trimpot on the **Cat. No. 682** for equal average levels in octaves just below and just above the crossover frequency (usually 500 Hz).



"85 dBC"

Adjust the **Bypass Level** trimpot on the **Cat. No. 683** for **85 dBC** in the room.



Cat. No. 682 card

Next, turn off the CP500 and reset jumper J900 to disable BCAL to preserve correct bypass operation. If the jumper is left in BCAL, Bypass mode will not isolate the CP500 output from faulty sounds in the main signal path.

Bear in mind that when the unit first switches into Bypass mode, (when power is first applied, for example) the fader level in Bypass will be set to "***7.0***". When in Bypass mode, the fader setting can be adjusted and will be remembered until Bypass power is interrupted. Adjustments made to the fader level while not in Bypass do not affect the setting of the fader for Bypass mode.

SECTION 6
A-CHAIN ALIGNMENT

The A-chain alignment involves adjustments made to the projector soundhead optics, solar cell, and optical preamplifier card. It is the part of the sound system that covers the film path, analog soundtrack solar cell, optical preamplifier, slit loss equalizer, digital soundtrack reader, associated digital signal processing and decoding circuitry, and Dolby processing circuits.

The CP500 does not contain a magnetic A-chain but has facilities for switching external magnetic preamplifiers into the B-chain.

6.1 Aligning the A-Chain

The A-Chain optics is first cleaned and mechanically adjusted, then calibrated by use of the Cat. No. 69T Dolby Tone test film. This film is used to establish the correct Dolby operating level within the CP500.

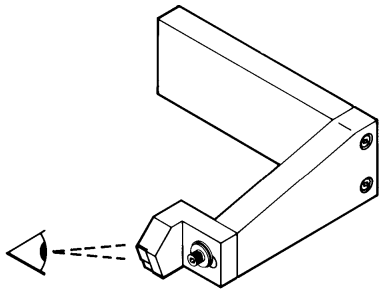
A pink noise test film is used for A-chain frequency response and soundhead alignment. Pink noise has a constant amount of energy per 1/3-octave band, creating a flat response on a real-time analyzer display.

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 focused on the optical soundtracks on the film. The light that passes through the soundtracks falls on the stereo solar cell which generates an electrical signal proportional to the audio signal recorded on the optical soundtracks. The slit introduces high frequency loss which must be compensated by circuitry in the Cat. No. 661 optical preamplifier card.

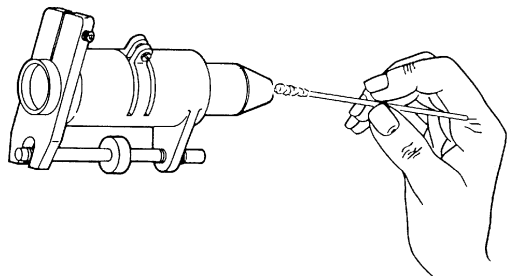
The slit image must be correctly focused on the film and must be precisely at right angles to the direction of film movement in order to maintain the correct phase relationships between the two optical tracks. Any azimuth error will show as a loss of high frequency in the front channels and potentially excessive crosstalk in the surround channels.

Each channel in the Cat. No. 661 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 flat response up to a minimum of 12 kHz can be achieved.

6.2 Analog Optical Alignment - Projector

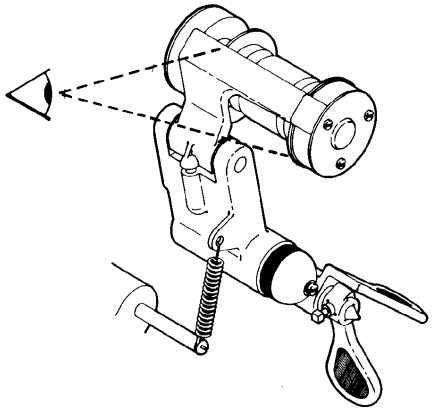


If a stereo solar cell is already installed on Projector No. 1, inspect the surface of the cell for cracks, chipping, or other damage. If the cell appears to require replacement, remove the mounting bracket from the projector and replace the cell and mounting block assembly.

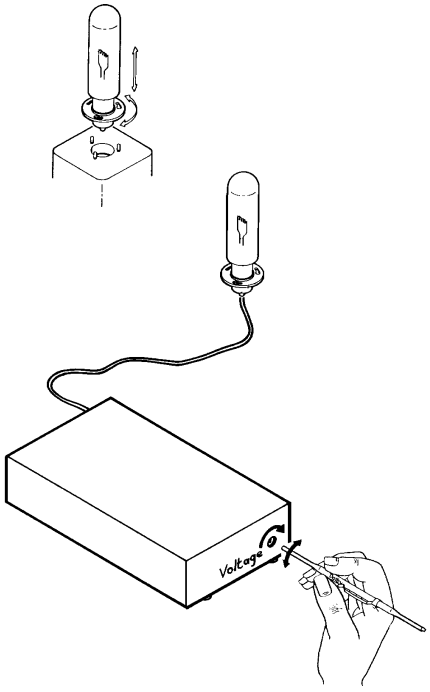


Clean the lens surfaces with a cotton swab moistened with glass cleaner. But keep in mind that you may find, during optical preamp adjustment, that it will be necessary to remove and inspect the lens if the high-frequency response is not correct.

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. If the roller has a felt or rubber insert, check for a flat spot, replace the roller if need be.

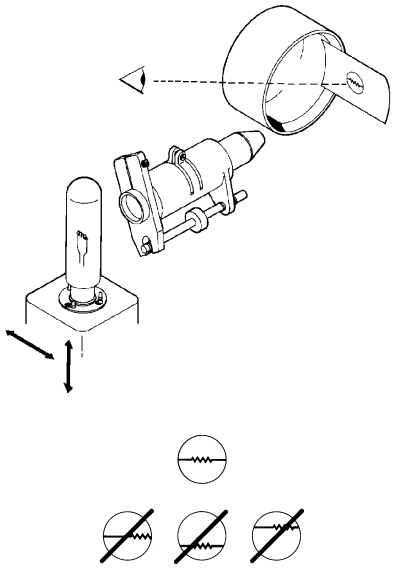


Remove the existing exciter lamp and replace with a new lamp.

Adjust the exciter lamp DC voltage to 70% to 85% of the rated voltage and verify that there is no more than 3% ripple present with the lamp on, using an AC millivolt meter or oscilloscope.

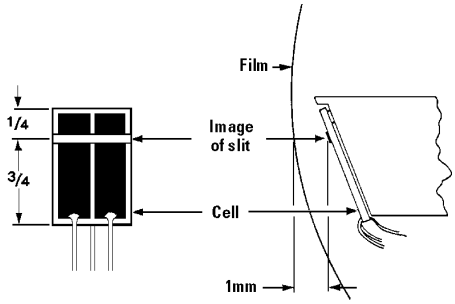
LAMP VOLTAGE	DC ADJUSTMENT
6 V	4-5 Volts
9 V	6.5-8 Volts

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.

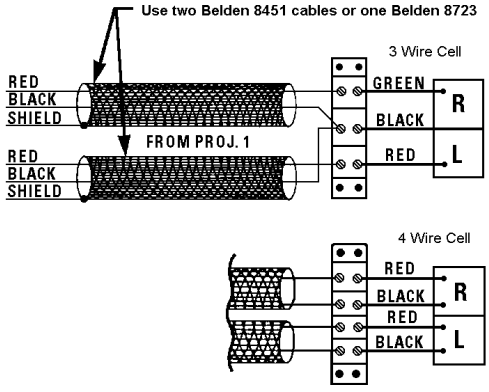


Place a white card at the front of the lens close to the position of the film sound track. Adjust the position of the exciter lamp until the image of the filament is centered both vertically and horizontally as shown.

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.

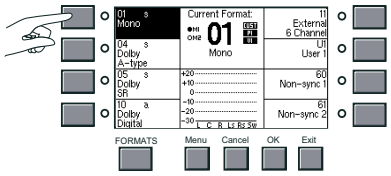


Loosely install the stereo solar cell bracket on the projector. Position the bracket carefully until the surface of the cell is 1 mm from the film plane surface. Note that if this distance is exceeded, there will be crosstalk between the two optical stereo tracks. Check the image of the slit on the cell.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



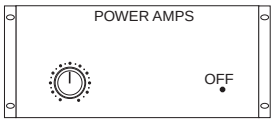
Confirm that the cell wiring and connections are correct. Shielded cables must be used. The inner conductors must be wired to the CP500 OPTICAL input connectors exactly as shown on the wiring diagram fold-out.

NOTE: The solar cell associated with the right channel is closest to the edge of the film.

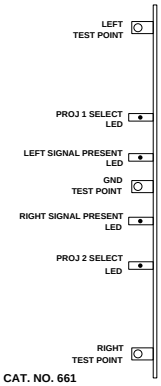


On the CP500, press the **FORMATS** key. The *Current Format* screen will be displayed.

Select **Format 01**, **Mono**.

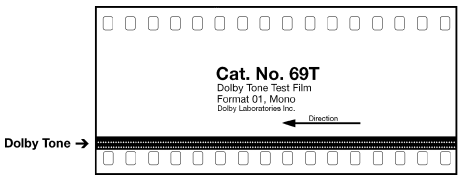


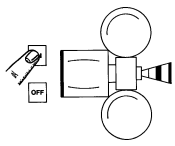
Verify that the theater power amplifiers are off.

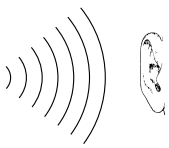


Open the CP500 front panel, and connect an oscilloscope to the test points **Left** and **Right** on the Cat. No. 661 Optical Pre-amplifier card. as shown. Ground the oscilloscope to the **GND** test point on the card.

Set the oscilloscope to dual trace mode and be sure that the vertical range is set the same on both channels.



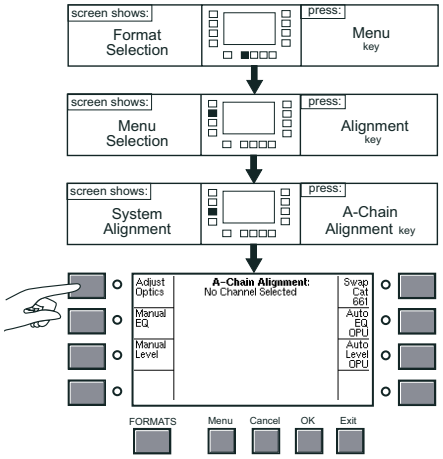




Thread and play the Dolby Tone test film Cat. No. 69T for an initial test of the signal path through the projector preamplifier. The film emulsion should face away from the screen.

Verify that the signal present LEDs on the Cat. No. 661 are lit. The Dolby tone signal should be visible on the oscilloscope.

Listen to the tone on the booth monitor to identify any problems with distortion or unwanted film playing speed variations.



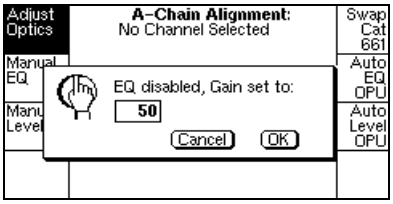
Begin the optical alignment program by pressing the following keys:

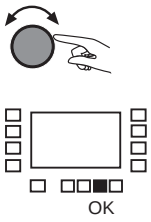
MENU,

Alignment (SK2)
(A password may be required to continue),

A-chain Alignment (SK3),

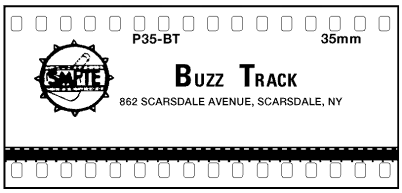
Adjust Optics (SK1).

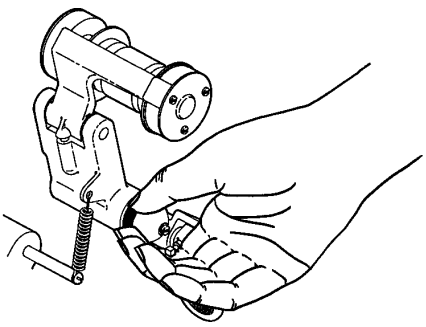




This step disables the optical preamp equalization and allows you to set the preamp gain (both left and right channels) to a known standard setting between 0 and 100.

Set the gain to "***50***", then press **OK.**

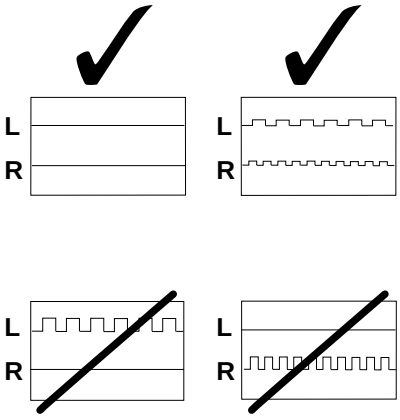




Remove the Cat. No. 69 test film and thread the SMPTE Buzz Track Film. This film has modulation just beyond the normally scanned areas of the optical sound tracks. The objective of this test is to ensure that the slit illuminates only the sound-tracks.

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.

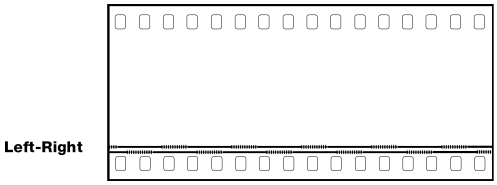


OSCILLOSCOPE TRACES

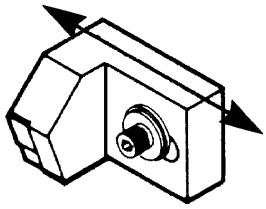
The lens and exciter lamp assembly are adjusted laterally for a null if the film cannot be moved laterally.

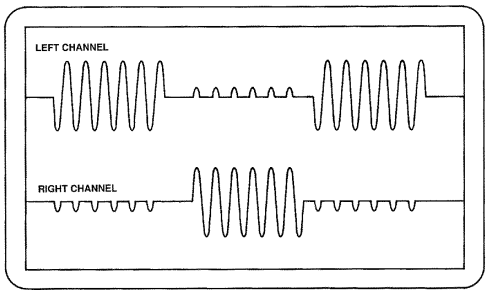
The adjustment is correct when there is no signal output while the film is played. It may not be possible to adjust for a null with some older slits; in such instances, adjust for a minimum and equal signal on L and R.

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.



Remove the SMPTE Buzz Track test film and thread and play the Cat. No. 97 Stereo Cell Alignment Film.

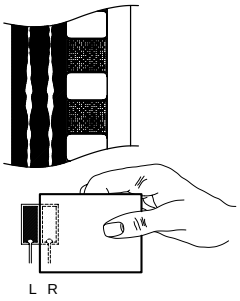


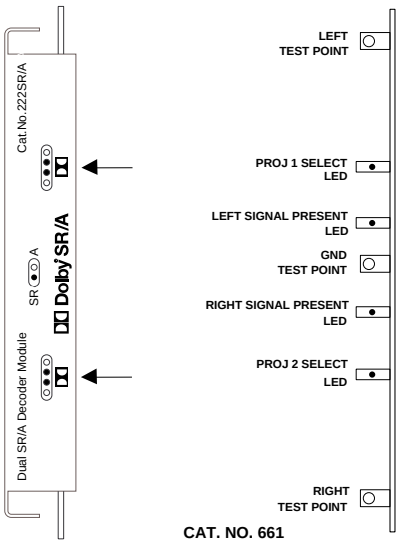


While the film is playing, look at the oscilloscope. If a large amount of crosstalk is present, loosen the stereo solar cell head and move the head from side to side until the crosstalk is minimum and equal.

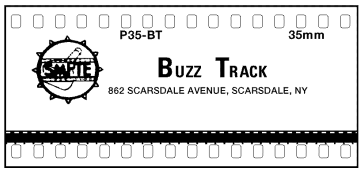
NOTE: The right channel is the track toward the outside of the projector. On some projectors, it may be necessary to stop the film to adjust the position of the cell.

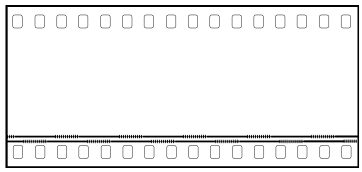
Lock the cell bracket into position after completing this adjustment. Check that the crosstalk has not changed as the bracket was tightened.





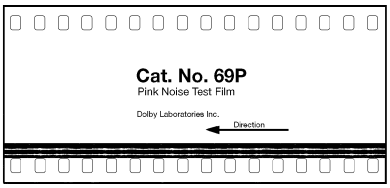
Verify that the outputs of the right and left solar cells are properly connected by placing a white card over the right solar cell (nearer the outside of the projector) and verifying that the level of the right channel drops, as indicated by the bottom group of LEDs on the Cat. No. 222SR/A card, and the **Right Signal Present** LED on the Cat. No. 661 card.





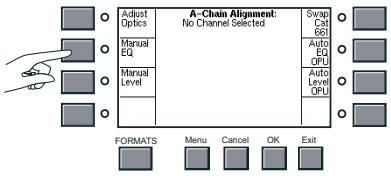
Left-Right

Repeat the previous SPMTE Buzz Track alignment. If the film, optics, or exciter lamp position must be adjusted, repeat the cell alignment step using the Cat. No. 97 test film. The optimum setting is attained when no further adjustments are required using the two test films.

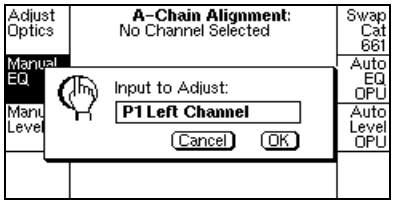


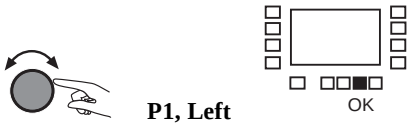
Pink Noise

Thread and play the pink noise on the Cat. No. 69 P film.

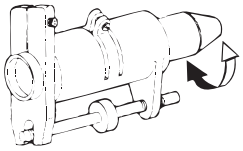


Press **Manual EQ** (SK2).

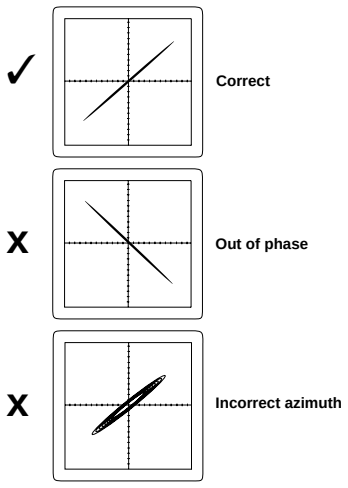


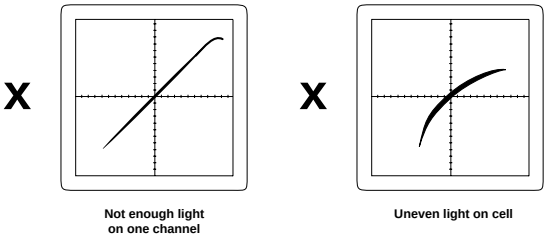


Select **Projector 1, Left Channel** by rotating the front panel knob and pressing OK. The OPU Alignment RTA screen will appear.



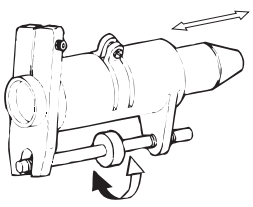
Switch the oscilloscope to the X/Y mode and adjust the azimuth of the projector optics for the narrowest diagonal trace.



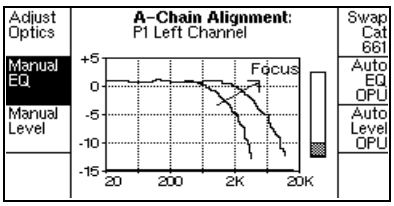


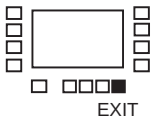
Blooming at the ends of the trace may be caused by improper lighting of the edges of the optical tracks.

NOTE: If necessary, repeat the buzz track and cell alignment steps or exciter position step above to reduce such blooming to a minimum.



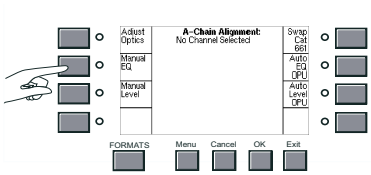
While observing the RTA screen, adjust the focus of the sound track lens for the best high frequency response.





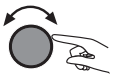
The RTA trace shown may not be typical of your results. Merely attempt to obtain the best response. The azimuth and focus adjustments interact so you must repeat the azimuth and focus adjustments until no further improvement is obtained.

Press **EXIT**.

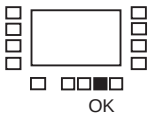


Now check the Right channel:

Press **Manual EQ** (SK2)

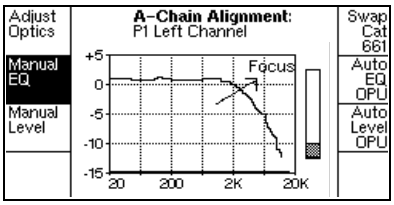


P1, Right



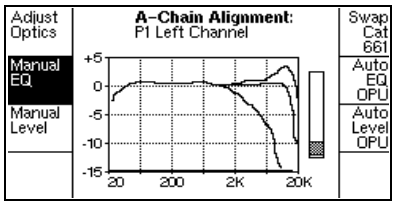
Select **Projector 1, Right channel** by rotating the front panel knob and pressing **OK.**

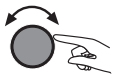
Right Channel:



The high frequency response must be the same on both the left and right channels. 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 both the left and right results are similar**

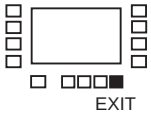
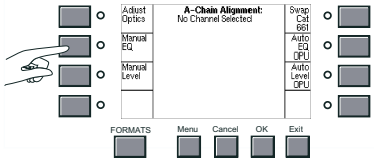
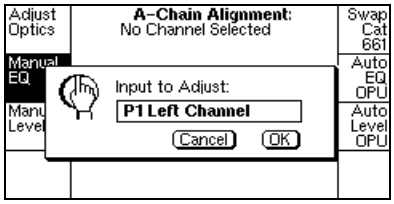
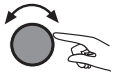
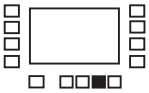
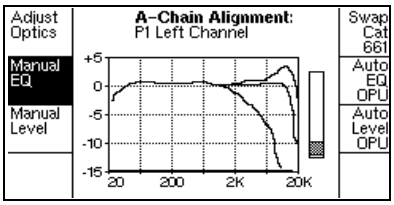
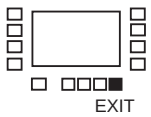
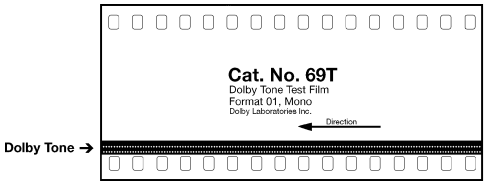
Right Channel:

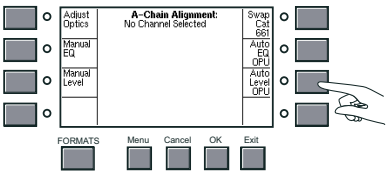
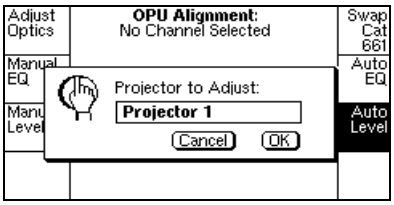
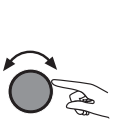
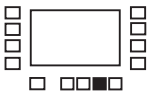
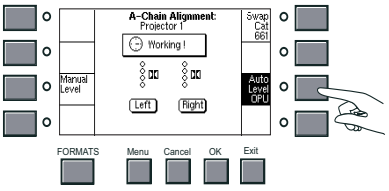
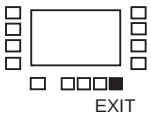
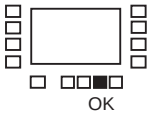




This step adjusts the high frequency response of the optical preamplifier circuit (slit loss).

Rotate the **main fader** (front panel knob) for the most extended high frequency response without "peaking". If this does not improve the response, the problem may be a degraded slit or lens damage.

	Press **EXIT**.
	Press **Manual EQ** (SK2) and repeat the high frequency adjustment for the left channel.
  **P1, Left** 	Select **Projector 1, Left channel** by rotating the front panel knob and pressing **OK.**
 	Again, rotate the **main fader** for the most extended high frequency response without "peaking". The frequency response (both channels) must be within 1dB to at least 12kHz.
	Press **EXIT**.
	The final step is to adjust the output level of the optical preamplifier for Projector 1. Thread and run the Cat. No. 69T Dolby Tone test film.

	Press **Auto Level** (SK7)
  **Projector 1** 	A pop-up screen appears which allows you to select Projector 1 or 2 as the optical input source. Turn the front panel knob to select **Projector 1**, then press **OK.**
 	Be certain that the Dolby Tone test film is still running. The CP500 automatically calibrates the right and left channel optical preamp gain, setting it to Dolby level. This operation takes approximately 30 seconds. Press **EXIT** when the screen reports the calibration finished.
	Press **OK** to save these gain settings.

Repeat all of the above steps for Projector 2, if present.

7.1 Mechanical Alignment

Mechanical alignment of the Cat. No. 700 Digital Soundhead consists of making sure the film path through the Digital Soundhead is aligned with the path through the rest of the projector. For built-in (basement) digital soundheads, see the manufacturer's instructions.

1. Thread a length of film from a supply reel through the Digital Soundhead (refer to the threading diagram located on the soundhead), and on through the projector as you would any film.

2. Apply tension to the film and inspect for equal tension on both edges of the film.

3. Check for uneven forces on the rollers, or twisting of the film.

4. When the path is aligned, tighten the soundhead mounting bolts and reel arm.

7.2 Adjustment Setup with Oscilloscope

NOTE: The Dolby Cat. No. 700 Soundhead is optically aligned at manufacturer and should not require adjustment unless the CCD Circuit Board has been disturbed.

The following test setup will enable adjustment of focus and confirmation and adjustment of lamp level and optical alignment.

1. Make sure power to Cat. No. 700 Digital Soundhead is provided. Power to the CP500 should also be on.

2. Open the CP500 front panel.

3. Connect a probe from Channel 1 of a 20MHz or greater bandwidth oscilloscope to the VIDEO Test Point (TP1) on the Cat. No. 670 Video Acquisition Card with the ground lead attached to VGND (TP2, just below TP1). See the fold-out drawing located at the end of Section 3 for the card location.

4. Connect a second probe from the scope’s Channel 2 to the CLAMP signal test point (TP3) to trigger the scope. Connect the second probe’s ground wire to DGND (TP7).

5. Set the trigger source on the scope to Channel 2.

6. Adjust the Channel 2 vertical trace position to move the trace off the screen. It is not necessary to view this signal once triggering has been established.

Cat. No. 670 Video Board Test Points:

VIDEO	TP1 (white)	The CCD video signal
VGND	TP2 (black)	Ground reference for Video signal
CLAMP	TP3 (green)	Horizontal Sync. to view Video scan.
TRACK	TP4 (brown)	Perforation rate - check for 96Hz
+15	TP5 (yellow)	+15V power supply rail
+5	TP6 (red)	+5V power supply rail
DGND	TP7 (black)	Digital ground reference
–15	TP8 (blue)	—15V power supply rail

Adjust the scope for one horizontal trace across the screen, and adequate vertical gain (approximately 2 µ sec/div. horizontal, 1 V/div. vertical). With digital film threaded and running in the projector, observe the video waveform. (See figure below).

7.3 Focus Adjustment

Cat. No. 700 Digital Soundheads are factory adjusted and should not require adjustment during installation. If the soundhead has become misadjusted, focusing may be performed. Using the setup as above, adjust the objective lens/CCD assembly in the reader head by loosening the 2mm hex socket set screw (located below the lens bore) which holds the lens/CCD assembly in place, and moving the assembly back and forth. There are two methods for moving the assembly. A flat blade screw driver inserted in the oval slot above the lens can be twisted to slide the assembly. Alternately, if the CCD circuit board cover is removed, the assembly can be moved back and forth with the thumb and forefinger. The best focus is achieved when the scope pattern has minimum brightness in the center of the trace. There will always be some light here; one is looking for the most “focused looking” display, with minimum brightness inside the envelope. This should correlate with minimum error rate. Re-tighten the lens holding screw.

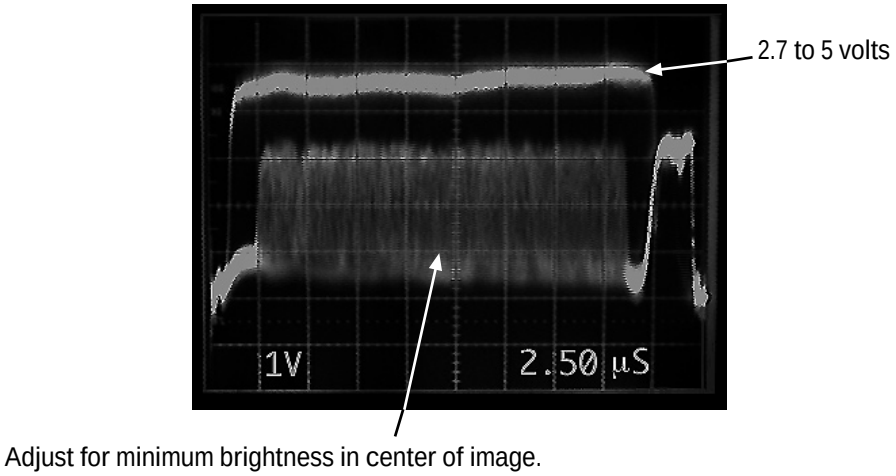


Figure 7- 1. The best focus is achieved when the scope has minimum brightness.

7.4 Exciter Lamp Level Confirmation and Adjustment

The output voltage of the lamp power supply is factory-set to be between 9.5 and 10 volts (See scope set up in Section 7.2). Lamp intensity has a direct relationship to the video signal voltage. The acceptable range for the peak video signal voltage (of unobstructed light through the perf hole) is between 2.7 and 5 volts (see figure above). Under normal circumstances, the lamp power supply voltage will never need adjustment to achieve the acceptable video voltage range. However, some combinations of individual lamp intensity and projector speed may result in a video signal outside the 2.7 to 5 volt range. In that case, it may be necessary to adjust the lamp power supply. See the figure below (*7-2*) for the adjustment location (VR1). Do not adjust the power supply output voltage above 10 volts.

If the top of the video waveform is not reasonably flat (±1 division), check for dirt, dust, or other obstruction to the light path, and clean (*see **Section 7.8***).

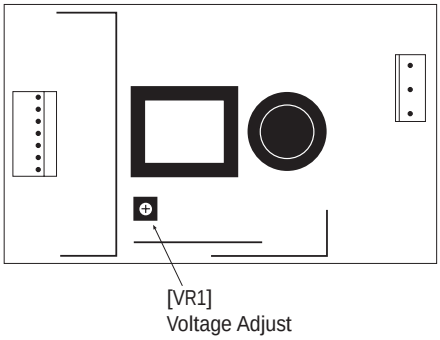


Figure 7- 2. Adjustment location for lamp power supply.

7.5 Film Path Alignment

The film path is aligned during manufacture and should not require adjustment during installation. The procedure for confirming or adjusting the film path follows.

The flanged guide roller on the top tension arm (the spring loaded roller between the sprocket and drum) is the only film guide with provision for lateral adjustment. The specification for its position is based on nominal film position. The film should be guided so that the inner edge of the film is 25.4mm (+0.1-0.1mm) from a machined reference surface on the soundhead housing (unpainted area between the sprocket boss and the light pipe). The outer edge of the flange on the guide roller therefore should measure 61.9mm from the reference surface. To adjust the position of the guide, the rear panel of the soundhead, the flywheel, and the tension arm spring must be removed. See *Figure 7-3* for the location of the two screws that control the position of the roller. Before loosening the clamp screw, note the angular position of the spring arm with respect to the tension arm on the front of the soundhead (return the arm to the same angular relationship prior to tightening). The lateral adjustment screw can be turned after the clamp screw is loosened. A quarter turn of the adjusting screw will move the lateral guide roller approximately 0.1mm.

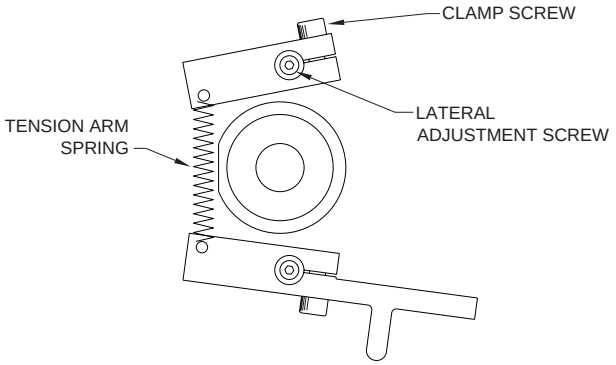


Figure 7- 3. Locations of clamp screw and lateral adjustment screw.

7.6 Optical Alignment

The soundhead is optically aligned at manufacture and should not require adjustment unless the CCD circuit board has been moved or replaced (the CCD sensor is located on the CCD circuit board. Optical alignment of the sensor depends on the position of the circuit board). Two adjustments of CCD board position are possible: lateral and rotational (azimuth). The procedure for confirming or adjusting the position of the CCD board follows.

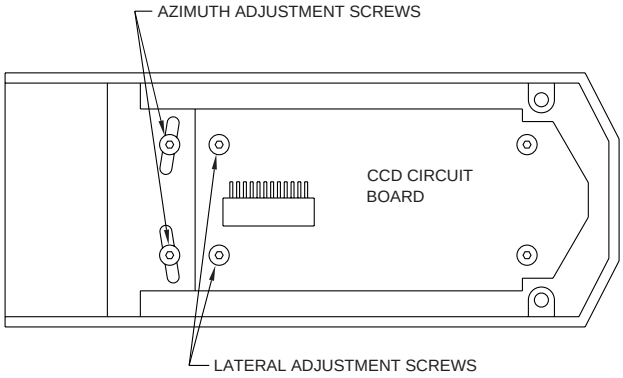


Figure 7- 4. CCD Circuit Board.

Lateral
Lateral position can be confirmed if the video signal (of unobstructed light through the perf hole) on the oscilloscope falls in the center of the total CCD video signal. To center the video signal on the scope do the following:

1. Use the scope setup described in 7.2 above, observe both channels 1 and 2.

2. Run the Cat. No. 530 digital test film through the soundhead.

3. The scope image should be adjusted to look like the diagram below.

4. If the CCD circuit board is aligned, the video signal of light through the perf hole will be centered between the falling edge of clamp (trigger) trace and the rising edge of clamp trace. As in the diagram, distance “X” will be equal on each side of the video signal.

5. To re-align the CCD board, first loosen the two lateral adjustment screws shown in the diagram of the circuit board. Move the board laterally while observing the image on the scope. When the video trace appears as shown in Figure 7-5, with respect to the clamp trace, tighten the screws.

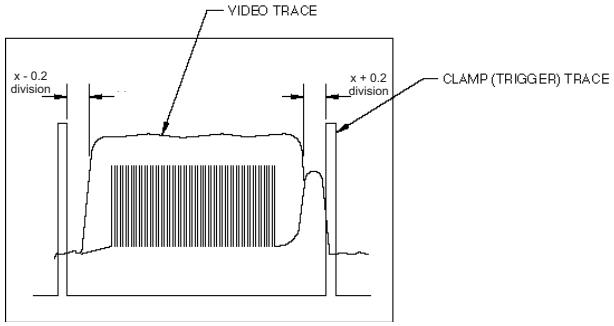


Figure 7- 5. Video trace in relation to clamp trace.

Azimuth

The azimuth adjustment controls the angular position of the CCD board with respect to the film. To adjust the azimuth of the CCD:

1. Loosen the two azimuth adjustment screws shown in the diagram. The focus adjustment screw will also need loosening slightly

2. Rotate the CCD circuit board assembly clockwise and counterclockwise and observe the LEDs on the Cat. No. 671 boards in the CP500.

3. Center the rotation of the CCD circuit board assembly between the angles at which synchronization pattern finding begins to fail. See discussion below.

4. Tighten azimuth adjustment screws and then refocus the soundhead.

Verification of synchronization pattern finding

The Cat. No. 671 cards in the CP500 are responsible processing the digital data. These cards display **sync found** on their LEDs. The 8 LEDs from top to bottom display sync found as follows:

- Upper Left found first pass
- Upper Right found first pass
- Lower Left found first pass
- Lower Right found first pass
- Upper Left found at all
- Upper Right found at all
- Lower Left found at all
- Lower Right found at all

If any of these LEDs are constantly off, this may indicate improper positioning of the film or CCD circuit board.

Proper adjustment of position, intensity and focus will be verified by observing no error light flashing and minimum error rate (1 to 8) displayed on the Cat. No. 673 board in the CP500.

7.7 How to Identify Types of Soundtracks

A Dolby Digital print, or stereo optical (A-type or SR),or mono optical print should be identified as such both on the film can and the leader. However, with handling the identification may be lost. If neither are available, close inspection of the film will help distinguish the various types. Digital data blocks are printed between the perforations on the side of the film next to the analog (Dolby SR) track.

Figure 7- 6. Soundtracks

Dolby Digital Print
The digital data is clearly visible between perforations next to the analog track. The analog track is Dolby SR.

Analog Dolby SR or A-type Print
Clear differences between the stereo channels will be seen in some places along the track.

Mono Print
Both tracks are the same.

7.8 Film Threading

The Cat. No. 700 Digital Soundhead is similar in many ways to a conventional analog soundhead, having a lightweight flywheel, toothed sprocket, two pad rollers, and two dashpot-damped tension arms. The pad rollers on the toothed sprocket are coupled to allow easy film threading. A spring loaded roller arm damps variations in input film tension. Bypass rollers are provided to bypass the soundhead with either 35 or 70 mm film. The figure below shows Digital Soundhead film path threading. Care must be taken to thread the film the same way every time, so that the distance from the optical pickup point to the film gate is constant from show to show. Circuitry in the CP500 processor delays the signal read at the optical pickup by an amount set during installation. The threading must match this delay, or improper synchronization will result.

NOTE: Film tension is important. A proper loop is set when the tension arms match the white half circles. The arms must not touch, or be too far apart (approximately 5mm is correct).

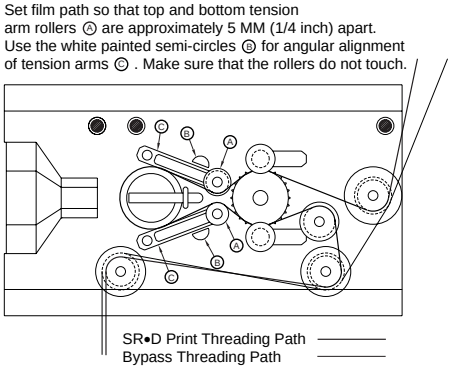


Figure 7- 7. Digital Film Path Threading.

7.9 Cat. No. 673

Error Rate Display
Following powerup, with no film running, the seven-segment display on the Cat. No. 673 will display a "-" indicating no data on which to display error rate. With film running, the display will show the error rate of the film on a scale of 0-8 with intermediate values indicated by the right hand decimal point (0,0.,1,1.,2,2.,3,3.,4,4.5,5.,6,6.,7,7.,8,) where 0 is the lowest and 8 is the highest. The display shows "***F***." when an uncorrectable block of data is being processed. See ***Section 8.2*** for further details.

Rotary Switch
This switch should always be set to position 0 for normal operation. It is used to determine internal software revision levels when servicing the digital sub-system.

7.10 Projector Changeover / Motor Run Indicators

The **V1** and **V2** indications on the CP500 front panel screen indicate the status of the video inputs from the Cat. No. 700 Digital Soundhead. Two LEDs on the Cat. No. 670 card also indicate this status. The **M1** and **M2** indications show which projector motor(s) are running. The motor running signals are used in the timing of changeovers in a two projector system.

The CP500 "changes over" between Cat. No. 700 Digital Soundheads by switching between digital data signals at a time in advance of the actual picture changeover. The data on the film is read by the Digital Soundhead ahead of the picture gate by typically 1-1/2 seconds. A delay circuit in the CP500, set during installation, compensates for this "early" reading of data. In order for a changeover to be seamless, the switchover to the incoming digital data must happen "early" as well. The Motor Start signal (a contact which closes when power is applied to the projector) is used to initiate the digital changeover. Digital changeover occurs at eight seconds minus the amount of delay set at installation. Eight seconds is the time between the motor start cue at the end of a reel and the last picture frame on that reel. If the Digital Soundhead were located at the analog soundhead position, no fixed delay would be required, and the digital changeover would happen simultaneously with the picture changeover. Any amount of delay added to the digital signal to compensate for "early reading" (ahead of the analog soundhead) must be subtracted from the eight seconds to get the time that the digital signal must be switched after the motor start.

7.11 Format Control

When Format 10 Dolby Digital is selected, the audio output terminals of the CP500 will carry decoded digital audio when valid digital data is being read by the soundhead. When this is not possible (for example, playing an analog only print) the output of the CP500 will be analog audio in Format 05 (Dolby SR).

The CP500 uses very sophisticated error correction techniques to allow the data to be read perfectly, even in the presence of heavy scratching and dirt. As with any

digital system, the performance is perfect up to the limits of error correction, and then degrades very rapidly. Should the digital data become corrupted beyond correction through perforation damage, concealment techniques are applied for up to 4 perforations (40 ms), after which time the CP500 switches to passing analog audio. Corrected digital data must remain valid for a period of time before switching back to the digital track.

7.12 Automatic Selection of the Dolby Digital Format

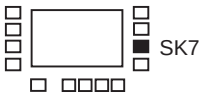
CP500s equipped with versions 1.30 or later software can be set up to sense the presence of Dolby Digital data on the film and automatically switch to Dolby Digital from any other format. The section begins with a basic look at how to use this feature with the standard setup. The latter part of this gives a full explanation of the auto-digital operation and shows how to modify the operation when using a custom set-up.

7.12.1 A Quick Look at Operation With Standard Set-up

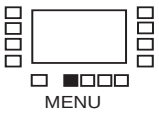
The Standard format control screen on the CP500 comes with Formats 01 (Mono), 04 (A-Type), and 05 (Dolby SR) set up so that auto-digital will occur from them. These formats are marked by an "***s***" for *sources* on the screen.

Format 10 is the format that the auto-digital system will switch to when good Dolby Digital data is detected. It is marked with an "***a***" (for *automatic*) on the screen. In this case, Format 10 is defined as the "target" format. For more information on target formats, see ***Section 7.12.2***.

To enable the auto-digital feature:

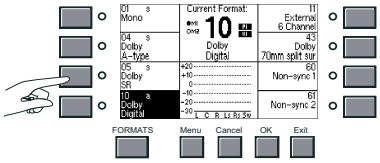
	Press **Menu**.
	Then, press **SK7**. Pressing SK7 alternately enables and disables the auto-digital feature.

To disable the auto-digital feature:

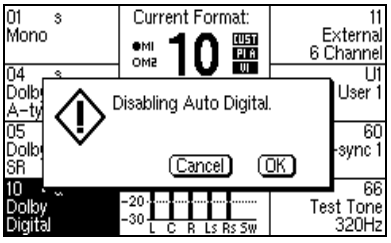


You may disable auto-digital operation by pressing the **MENU** key and **SK7**.

Pressing SK7 alternately enables and disables the auto-digital feature.



Alternately, if the unit is currently playing digital audio in Format 10, select **Format 05** (SK3).



A dialog box will ask you if you want to disable auto-digital operation.

NOTE : The dialog box will not appear and auto-digital will not be disabled unless the CP500 is currently playing in Format 10.

- Press the **OK** key and it will *disable* auto-digital.
- Press the **CANCEL** key and it will leave the CP500 as it was.

7.12.2 Operation with Custom Set-up

When a CP500 is configured for auto-digital operation, certain formats are designated "**sources**," that is -- formats from which automatic switching to Dolby Digital is permitted, while other formats are considered "**targets**" that the system will switch to if the auto-digital feature is operational and if good Dolby Digital data is detected. Any format that is designated as a source will display an "***s***" and any target format will show an "***a***" (abbreviation for "automatic") in its softkey window.

The Standard Control screen comes configured with Formats 01, 04, and 05 as source formats and Format 10 as the target format. Even if you use a Custom screen, complying to this set of source and target formats is probably the best choice.

Allowable Source Formats

Any format can be designated as a ***source*** format. Non-film formats, however, should not be chosen as source formats. If, for example, you choose non-sync as a source format, film motion during projector cueing could result in accidental selection of Dolby Digital during intermission.

Allowable Target Formats

Any format can be a ***target*** format. Of course, the target format should be the format in which you play Dolby Digital. Format 10 (internal Dolby Digital system), Format 11 (external DA20), or formats derived from them are the two most appropriate target formats.

How It Works

When the auto-digital feature is enabled and valid source and target formats have both been assigned, the system will automatically select the target format when:

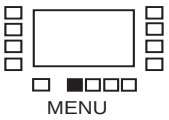
- a source format is selected, and
- valid digital data is available.

So, if you select a source format when valid Dolby Digital data is available, the CP500 will immediately change to the target format. It is important that all operations personnel understand that this is normal operation and does not indicate a malfunction.

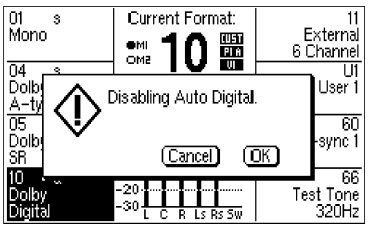
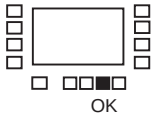
Disabling the Auto-Digital Feature

Occasionally you may need to disable automatic selection of the Dolby Digital film format. This should only be done if a print is faulty or damaged so that it frequently reverts to analog. Three methods are provided.

Method 1

	Auto-digital can be disabled by pressing the **MENU** key, then
 **Projector 1** **Projector 2**	Press **SK7** or **SK8** (depending on which projector you are using) . Pressing SK7 or SK8 alternately enables and disables the auto-digital feature.

Method 2

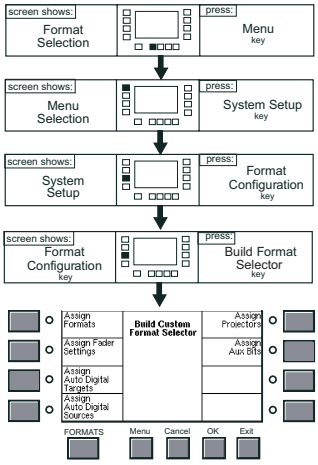
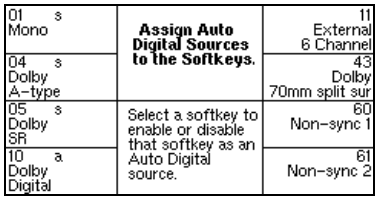
	Press **Format 05** while playing digital data. A dialog box will appear on the screen, asking if you want to disable the auto-digital format.
	Press the **OK** key to disable auto-digital. **NOTE** : The dialog box will not appear and auto-digital will not be disabled unless the CP500 is currently playing in Format 10.

Method 3

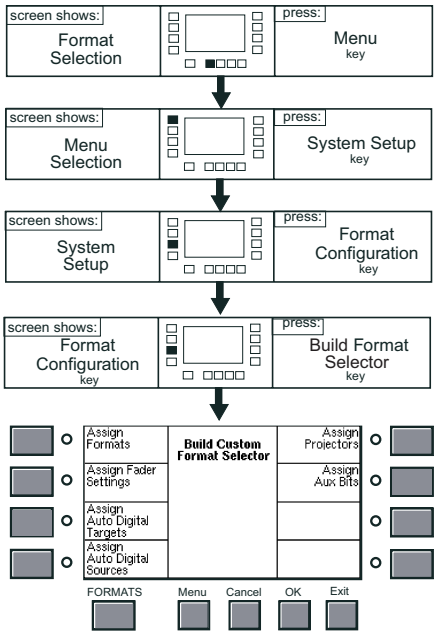
Turn off the light source in the digital reader. Note that in some projectors with the digital and analog readers built-in, both light sources turn on and off together. In these installations, it will not be possible to turn off the digital reader without also disabling the analog track and causing complete failure of sound in the theater.

7.12.3 Setting Up the Auto-Digital System

Assigning Source Formats

	Press the **MENU** key **System Setup** (SK1) **Format Configuration** (SK3) **Build Format Selector** (SK3)
	Choose **Assign Auto-Digital Sources** (SK4)**.** Press any softkey to toggle that format into and out of being a ***source*** format for auto-digital operation.

Assigning Target Formats

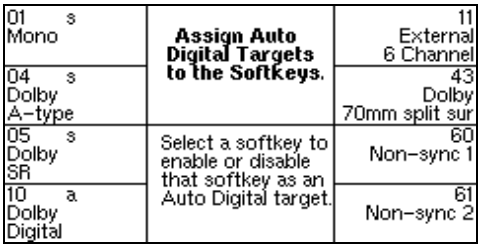


Press the **MENU** key

System Setup (SK1)

Format Configuration (SK3)

Build Format Selector (SK3).



Choose **Assign Auto-Digital Targets** (SK3). Press any softkey to toggle that format into and out of being a ***target*** format for auto-digital operation.

7.13 Maintenance and Adjustments

The Cat. No. 700 Digital Soundhead should be kept clean and free of dust and dirt for best performance, just like the analog soundhead. Wiping the external surfaces with a clean cloth on a regular basis will keep the head looking new. The optical path should be inspected regularly and kept clean with a photographer's lens cleaning kit (available from most camera stores). Use care not to scratch the lens. The film path (rollers and drum) should be cleaned regularly, as you would on the projector. Acetone, carbon tetrachloride, or other dangerous cleaners **should not** be used.

7.13.1 Replacing the Exciter Lamp

The exciter lamp in the Cat. No. 700 Digital Soundhead has been designed for long life and should provide over 8000 hours of reliable use under normal circumstances. Routine replacement will depend on your theater's hours of operation. To replace the exciter lamp, carefully remove the six screws holding the rear cover/power supply of the Digital Soundhead. Allow the lamp to cool if necessary. With the rear cover removed, the lamp will be visible but still attached to the rear cover assembly by its two supply wires. Slide the lamp out of its base. Carefully remove a new lamp from the protective box, and using gloves or a clean, lint-free cloth, replace the lamp in the socket. Be careful not to touch the bulb or inner surface of the reflector in the lamp. If either is accidentally touched, carefully clean the area with isopropyl alcohol when the bulb is cool. Slide the lamp back into its base in the soundhead, replace the rear cover assembly and tighten the six screws.

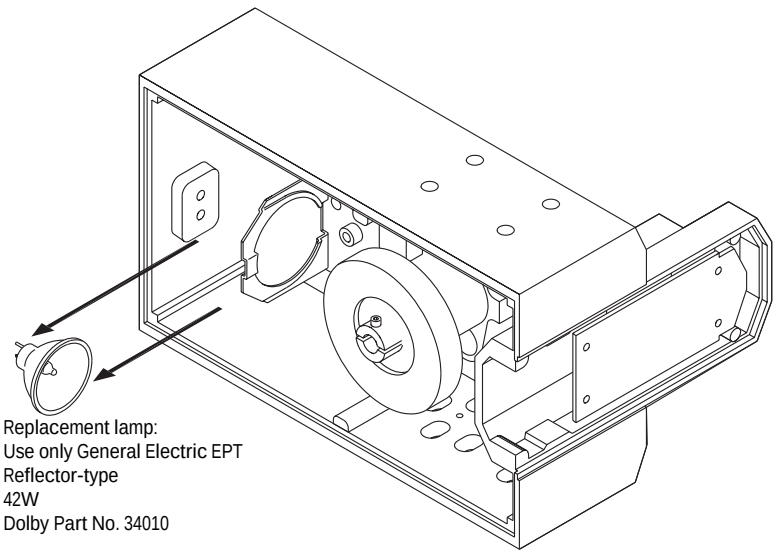


Figure 7- 8. Digital Soundhead Exciter Lamp Replacement.

7.13.2 Print Cleanliness

As with any soundtrack, keeping the film print clean will give best performance. The Dolby Digital print format has robust error correction information encoded along with the audio data, and the CP500 uses a powerful digital error correction technique, allowing the data to be read perfectly even if scratches and dirt are present. However, best performance will be obtained if the print is kept clean. Standard film cleaners will provide good results.

The sound quality of the digital track has properties unlike those of an analog track with regard to print wear. With any analog track, print wear will degrade quality in a more or less linear fashion; the more wear, the lower the quality of the sound. With a digital soundtrack, wear will have no audible effect until the picture quality is degraded beyond use. At this point, wear may exceed the error correction capabilities of the decoder, and switching to the analog Dolby SR track will occur.

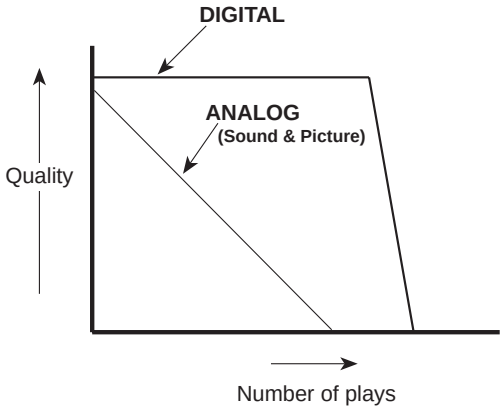


Figure 7- 9. Digital/Analog Track.

7.13.3 Adjustments

Routine adjustments are not required on the digital sub-system under normal use. Adjustments for soundhead delay, surround delay, focus, and film path alignment are made during installation, and should not be attempted by the operator. Small adjustments may not affect the sound under most circumstances, and no changes will be heard, but improper adjustment may reduce the safe operating area within which all errors can be corrected. Proper test equipment is required.

CAUTION: The Cat. No. 700 contains no user serviceable parts. Do not attempt any repairs, as attempts to do so may cause electric shock. If you feel your Cat. No. 700 is in need of service, contact your local service engineer.

8.1 Setting Optical Surround Delay

The CP500 incorporates a delay line in the surround channel to ensure that sound from the rear of the theater arrives at the listeners' ears approximately 20 milliseconds after the arrival of sound from the front speakers. The delay is set into CP500 memory using the front panel knob. Use the following formula to calculate the correct delay setting:

1. Estimate the distance between a rear seat and the nearest surround loudspeaker, in feet. If the metric system is used, convert the distance from meters to feet by multiplying by three (3).

2. Estimate the distance from this seat to the front loudspeakers, in feet. If the metric system is used, multiply the distance by three (3) to convert distance from meters to feet.

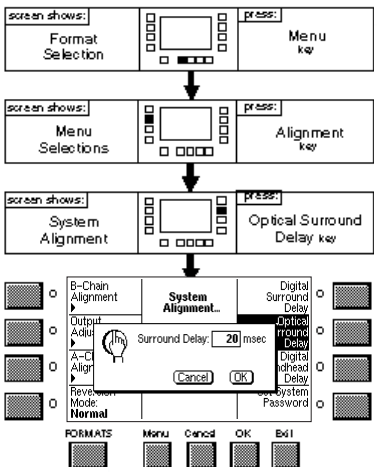
3. Subtract the distance measured in step 1 above from the distance measured in step 2, then add 20. The result is the delay time, in milliseconds.

For example:

The selected seat is 10 feet (3.3 meters) from the surround speakers.

The selected seat is 80 feet (26.7 meters) from the front speakers.

The delay is set for (80-10) + 20 = 90 milliseconds.

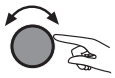
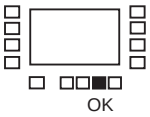


Next, enter the desired delay time into CP500 memory:

Press the **MENU** key.

Choose **Alignment** (SK2).
(A system password may be required at this point.)

Then, press **Optical Surround Delay** (SK6).

	Rotate the front panel knob until the desired delay reading is displayed.
	Then press the **OK** key.

You can verify that the delay setting is acceptable by listening to a familiar Dolby Stereo film which ideally contains both center channel dialogue and some discernible surround sound. The Dolby Cat. No. 251 SR/Digital "*Jiffy*" film serves very well for this purpose. If a stereo film is not available, the delay time can be checked with a mono film if the film is played in Format 04 Dolby stereo optical with surround. Make certain all speakers are ON for this test.

While the film is playing, walk around the theater and carefully listen to the surround speakers when there is center channel dialogue. The dialogue should appear to be coming from the screen with no significant dialogue coming from the surround speakers.

If you hear discernible dialogue from the surround speakers, the delay time was probably set too long.

If you hear an objectionable amount of dialogue from the surround speakers, which persists regardless of the delay time setting, there is probably severe gain or azimuth error in the system. Re-check both the Dolby level and the A-chain alignment of the optical system.

In many films, the surround information is intended for subtle effects and may provide only a low-level ambience. If the surround level and delay time have been adjusted as previously described, the surround information will be at the level desired by the film director. Do not be tempted to increase the surround level because the effect desired by the film production team may be impaired or destroyed.

8.2 Setting Digital Soundhead Delay

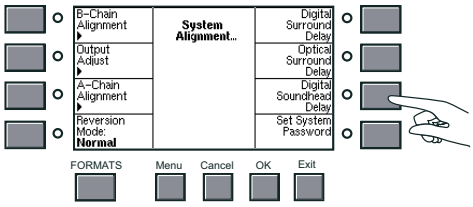
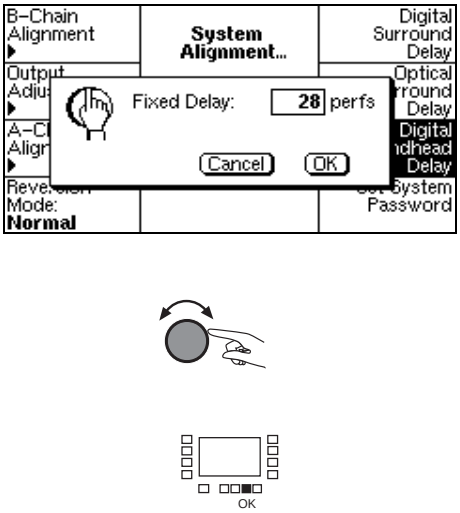
On a Dolby Digital print, the digital sound data is located 6 frames in advance of the analog soundtrack, and 26 frames in advance of the picture. When the Digital Soundhead is mounted above the analog soundhead (as with the Cat. No. 700) a delay is necessary in order to synchronize the digital soundtrack with the analog track and the picture. In the CP500, this delay is set by entering the number of film perforations, within the range from 016 perfs (approximately 170 ms delay) to 528 perfs (approximately 5.33 seconds). The minimum is set by signal propagation delays within the CP500 decoding process.

Soundhead delay may be determined in either of two ways: static and dynamic.

8.2.1 Static

1. Thread a length of Cat. No. 1010 Digital Soundhead alignment test film such that the "bullet" frame (perf 106) is located in the picture gate, and perf number 26 is located at the analog soundhead.

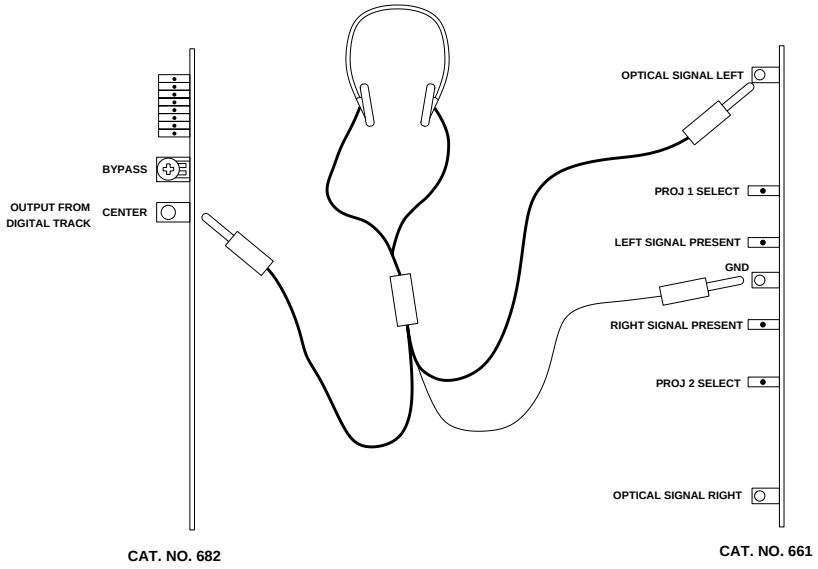
2. With the length threaded through the Cat. No. 700 Digital Soundhead, read the number of the perforation present in the light path of the Digital Soundhead. Enter this number using the procedure shown below:

	From the *System Alignment* menu, press the **Digital Soundhead Delay** key (SK7).
	Using the front panel knob, dial in the desired number of perfs obtained from either of the methods described. Press **OK**.

3. Verify the accuracy of the setting by running a loop of Cat. No. 1010 test film and observing that the flash on the screen coincides with the pip in the sound.

8.2.2 Dynamic

1. Thread a loop of Cat. No. 1010 Digital Soundhead alignment test film through the projector, analog soundhead, and digital soundhead. Run the projector.
2. From the *Current Format* menu, select **Format 10**, Dolby Digital.
3. Press **MENU**, **Alignment** (SK1), **Reversion Mode** (SK4), then rotate the front panel knob to display **Digital Only**. Press **OK**. This forces the CP500 to read the digital track on the Cat. No. 1010 continuously. Press **MENU,** then **Alignment** (SK2) to place the CP500 into the *System Alignment* screen.
4. Monitor audio from the center channel output of the CP500 (digital track) while simultaneously monitoring audio from the analog track. Headphones may be connected to the test points as shown below for monitoring both signals.



5. Set the CP500 screen to *Digital Soundhead Delay* as described above and adjust the number of perfs for minimum delay between the analog and digital track.
6. RESET THE *REVERSION MODE* TO **NORMAL**.

8.2.3 Typical Settings

The table below shows representative settings for a variety of common projectors in use:

Dolby Digital Readers:

Projector	Delay
Ballantyne 35mm	247
Century 35mm (SA)	245
Century 35/70 (JJ)	309
Cinemaccanica V5	252
Cinemaccanica V8	260

Projector	Delay
Christie	250
Norelco/ Kinoton AAII (DP70)	283
Simplex 35mm (XL)	242
Simplex 35/70	298

Built-in Digital Readers:

Projector	Delay
Century w/ Component Engineering or Kelmar	20
Christie	26

Projector	Delay
Cinemaccanica V5	28
Simplex w/ Component Engineering or Kelmar	26

8.3 Setting Digital Surround Delay

The CP500 automatically calculates a typical digital surround delay based on the optical surround delay setting performed in ***Section 8.1***. Actual theater geometry affects the amount of surround delay required, therefore you may wish to set the delay manually.

From the **System Alignment** menu, press the **Digital Surround Delay** key (SK5). Rotate the front panel knob until the desired delay reading is displayed, then press **OK.**

The following tables show approximate delay values (in milliseconds) based on theater width and length. Setting of surround delay should be verified by listening at various locations in the theater.

Width (feet)

Length (feet)	20	30	40	50	60	70	80	90	100	110	120	130	140
20	10	10	10	10	10	10	10	10	10	10	10	10	10
30	10	10	10	10	10	10	10	10	10	10	10	10	10
40	20	20	20	20	20	20	20	20	20	20	20	20	20
50	30	20	20	20	20	20	20	20	20	20	20	20	20
60	30	30	30	30	30	30	30	30	30	30	30	30	30
70	40	30	30	30	30	30	30	30	30	30	30	30	30
80	50	40	40	40	40	40	40	40	40	40	40	40	40
90	50	50	40	40	40	40	40	40	40	40	40	40	40
100	60	50	50	50	50	50	50	50	50	50	50	50	50
110	70	60	60	50	50	50	50	50	50	50	50	50	50
120	70	70	60	60	50	50	50	50	50	50	50	50	50
130	80	80	70	70	60	60	60	60	60	60	60	60	60
140	90	80	80	70	70	60	60	60	60	60	60	60	60
150	90	90	80	80	80	70	70	70	70	70	70	70	70
160	100	100	90	90	80	80	70	70	70	70	70	70	70
170	110	100	100	90	90	80	80	80	80	80	80	80	80
180	110	110	100	100	100	90	90	80	80	80	80	80	80
190	120	120	110	110	100	100	90	90	90	90	90	90	90
200	130	120	120	110	110	100	100	100	90	90	90	90	90

Width (meters)

Length (meters)	10	15	20	25	30	35	40	45	50
10	20	20	20	20	20	20	20	20	20
15	20	20	20	20	20	20	20	20	20
20	30	30	30	30	30	30	30	30	30
25	40	40	40	40	40	40	40	40	40
30	50	50	50	50	50	50	50	50	50
35	60	60	50	50	50	50	50	50	50
40	80	70	60	60	60	60	60	60	60
45	90	80	70	70	70	70	70	70	70
50	100	90	80	80	80	80	80	80	80
55	110	100	90	90	80	80	80	80	80
60	120	110	110	100	90	90	90	90	90
65	130	120	120	110	100	100	100	100	100
70	140	140	130	120	110	110	110	110	110
75	150	150	140	130	120	120	110	110	110

8.4 Bypass Adjustments

The Bypass system has two adjustments: output level (all systems) and low frequency and high frequency driver balance (for systems only equipped with the optional Cat. No. 683 Electronic Crossover).

8.4.1 Before you Adjust

First, turn off the power to the CP500. Remove the Cat. No. 682 card, located in position J2 (see ***Model CP500-SR Card Locations*** in ***Section 3***). Set jumper J900 to the **BCAL** position.

Set jumper to BCAL position.

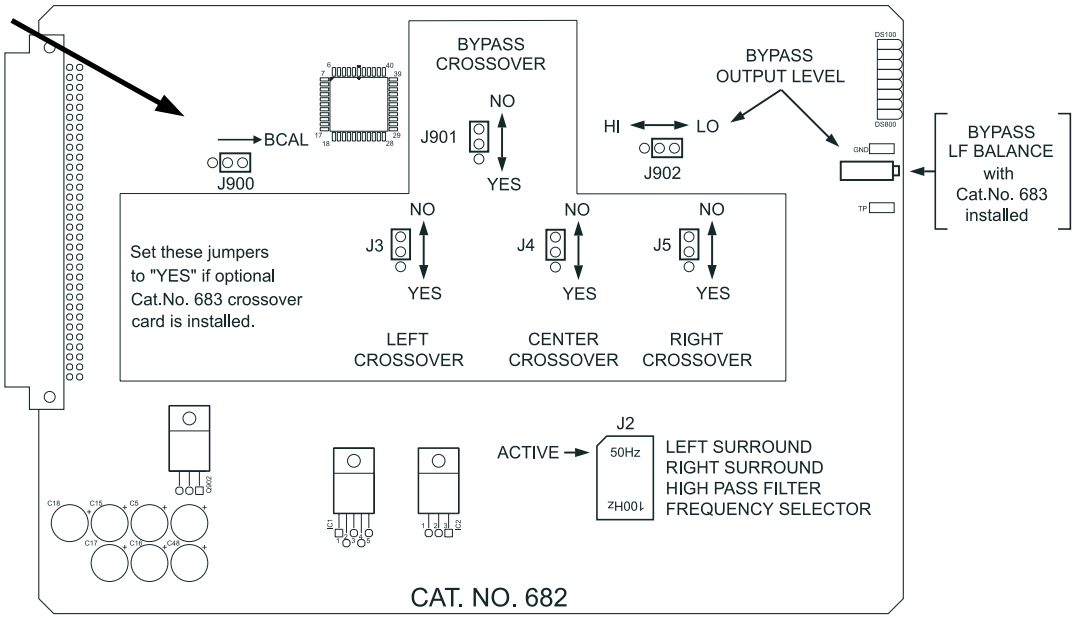


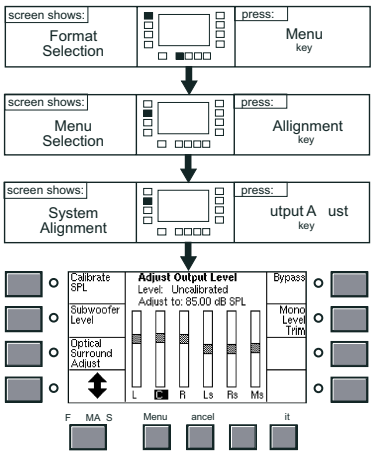
Figure 8-1. Cat. No. 682 - Set jumper J900 to the BCAL position.

NOTE: Cat. No. 682 cards with revision numbers earlier than Revision 3 do not have this jumper. To adjust level and low and high frequency driver balance with these older cards, see special instructions below.

Then, re-install the Cat. No. 682 card and turn on the CP500.

If you have a Cat. No. 683 Electronic Crossover card in your CP500, skip the following sub-section and proceed to the section titled ***8.4.3 Output HF/LF Balance and Level Adjustments (Systems with Cat. No. 683 Electronic Crossover Card)***. Special instructions for adjusting Cat. No. 682 cards with revisions earlier than Revision 3 can be found in sections ***8.4.4*** and ***8.4.5***. (Revisions 2 and earlier Cat. No. 682 cards do not have the jumper J900 to feed the pink noise calibration signal into the bypass system.)

8.4.2 Bypass Level Adjustment
(No Cat. No. 683 Electronic Crossover Card Installed)



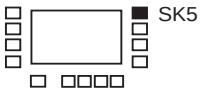
Press the **MENU** key,

Alignment (SK2),

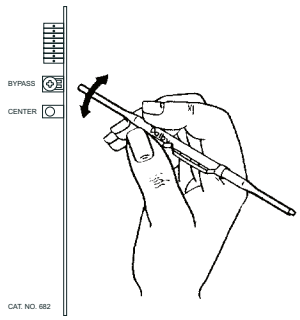
Output Adjust (SK2), and select the ***Center*** channel.

If necessary, calibrate the SPL level of the CP500 analyzer.

Select **Half Screen**.



Press **Bypass** (SK5). This connects the Left, Center, and Right outputs of the CP500 to the Bypass subsystem output.



“85 dBC”

Adjust the Bypass Level trimpot on the **Cat. No. 682** card for **85 dBC** in the theater.

(If the desired level cannot be achieved, turn the CP500 off and remove the Cat. No. 682 card. Move the Bypass Gain HI/LO jumper J902 to the alternative HI or LO gain position, as desired.

Replace the Cat. No 682 in the CP500, turn the power on, and repeat the first two steps.)

Cat. No. 682 card

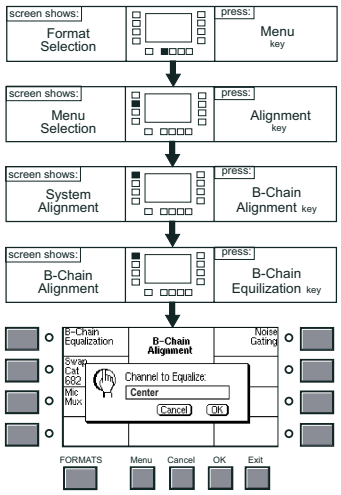
Turn off the power to the CP500.

Remove the **Cat. No. 682** card and switch jumper J900 to the **non-BCAL** position.

Re-install the card.

8.4.3 Output HF/LF Balance and Level Adjustments (With Cat. No. 683 Electronic Crossover Card)

REMEMBER: Adjust the trimpot on the **Cat. No. 682** Output Card for ***LF/HF Balance*** and adjust the trimpot on the **Cat. No. 683** Electronic Crossover Card for ***Bypass Level***.



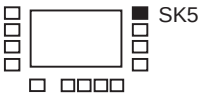
Press the **MENU** key

Alignment (SK2)

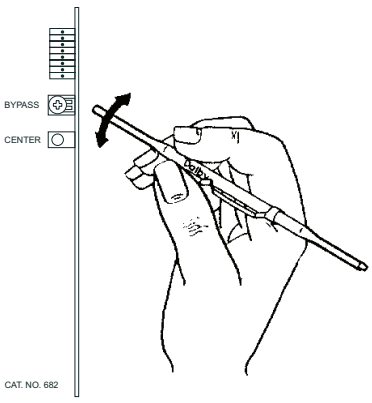
B-chain Alignment (SK1)

B-chain EQ (SK1) and select the ***Center*** channel.

Select **Half Screen**.

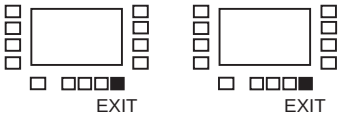


Press **Bypass** (SK5). This connects the Left, Center, and Right outputs of the CP500 to the Bypass subsystem output.

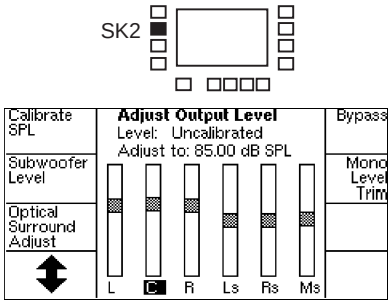


Adjust the Bypass trimpot on the Cat. No.682 (be sure not to adjust the Cat. No. 683 at this time) so that the average level displayed on the spectrum analyzer from 200 to 500 Hz is equal to that from 630 Hz to 3 kHz.

This trimpot adjusts the low frequency driver level relative to the high frequency driver. In general, the Bypass Gain Range jumper (J907) on the Cat. No. 682 card should be set to HI and the jumper (J600) on the Cat. No. 683 card should be set to LO. If you cannot get the desired result, change the setting of the appropriate jumper.



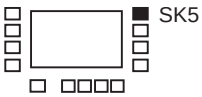
Press **EXIT** twice to get to the *System Alignment* menu.



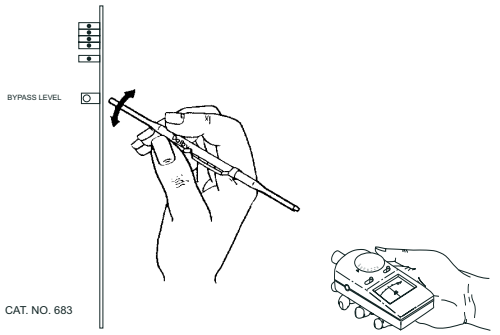
Press **Output Adjust** (SK2).

Select the ***Center*** channel. If necessary, calibrate the SPL level of the CP500 analyzer.

Select **Half Screen**.

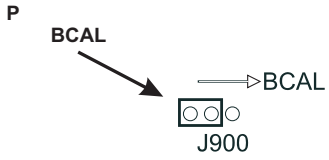


Press **Bypass** (SK5). This connects the Left, Center, and Right outputs of the CP500 to the Bypass subsystem output.



"85 dBC"

Adjust the Bypass Level trimpot on the **Cat. No. 683** (do not adjust the 682 at this time) Electronic Crossover Card to **85 dBC** in the theater.



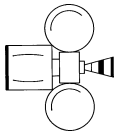
Cat. No. 682 card

Turn off the power to the CP500.

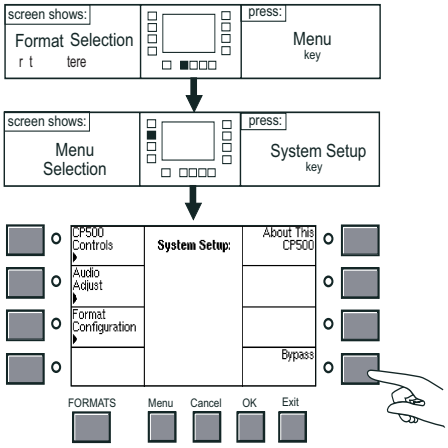
Remove the **Cat. No. 682** card and switch jumper J900 to the **non-BCAL** position.

Re-install the card.

8.4.4 Bypass Level Adjustment for Early Cat. No. 682 (No Cat. No. 683 Electronic Crossover Card Installed)



Thread the projector, and run a loop of Cat. No. 69P pink noise test film, or the pink noise side of Cat. No. 69 test film.



Select **Format 04** (Dolby Stereo).

Press **MENU**. Then, **System Setup**.

Using the **Bypass** key (SK8), toggle back and forth between regular and bypass operation, setting the Bypass level trimpot so that the sound pressure level matches between Bypass and non-Bypass operation

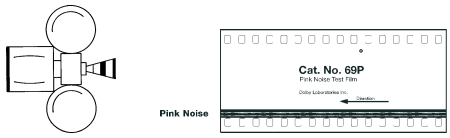
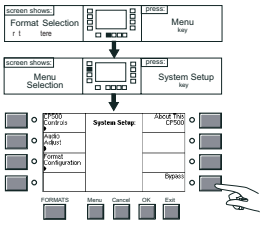
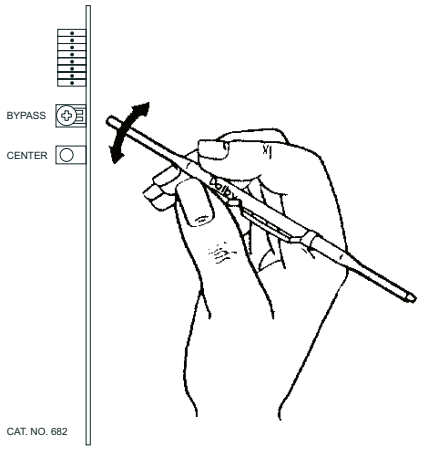
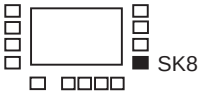
(If the desired level cannot be achieved, turn the CP500 off and remove the Cat. No. 682 card. Move the Bypass Gain HI/LO jumper J902 to the alternative HI or LO gain position, as desired.

Replace the Cat. No 682 card in the CP500, turn the power on, and repeat step the above steps.)

Turn the off the Bypass feature. Press **FORMATS** to return to the *Format* screen.

8.4.5 Early Cat. No. 682 Output HF/LF Balance and Level Adjustments (With Cat. No. 683 Electronic Crossover Card)

REMEMBER: Adjust the trimpot on the **Cat. No. 682** Output Card for ***LF/HF Balance*** and the adjust the trimpot on the **Cat. No**. **683** for ***Bypass Level***.

	Thread the projector, and run a loop of Cat. No. 69P pink noise test film, or the pink noise side of Cat. No. 69 test film.
	Select **Format 04** (Dolby Stereo). Press **MENU**. Then, **System Setup**. Press **Bypass** (SK8). This connects the Left, Center, and Right outputs of the CP500 to the Bypass subsystem output.
	Adjust the Bypass trimpot on the **Cat. No. 682** (be sure not to adjust the Cat. No. 683 at this time) so that the average level displayed on the external spectrum analyzer (you cannot use the CP500's internal analyzer for this adjustment) from 200 to 500 Hz is equal to that from 630 Hz to 3 kHz. This trimpot adjusts the low frequency driver level relative to the high frequency driver. In general, the Bypass Gain Range jumper on the Cat. No. 682 card should be set to HI and the Cat. No. 683 card should be set to LO. If you cannot get the desired result, change the setting of the appropriate jumper.
	Using the **Bypass** key (SK8), toggle back and forth between regular and bypass operation, setting the Bypass level trimpot on the **Cat. No. 683** so that the sound pressure level matches between Bypass and non-Bypass operation.
	Turn the bypass feature off. Press **FORMATS** to return to the *Format* screen.

8.5 About Non-sync

The CP500 has two sets of Non-sync inputs, designated Non-sync 1 and 2. They both have a wide range of input level adjustment, but to further extend the possible range of input signals, the two sets of inputs have different gain adjustment ranges.

- **Non-sync 1** will accommodate input Dolby levels between approximately 0.13 and 6.3 volts.
- **Non-sync 2** will accommodate input Dolby levels between approximately 0.05 and 2.5 volts.

Dolby level represents about 85 dBC in the auditorium.

The adjustment trimpots for these inputs are on the Cat. No. 681 card. Non-sync 1 L and R input gains are adjusted by the top two pots; Non-sync 2 L and R are adjusted by the next two pots down.

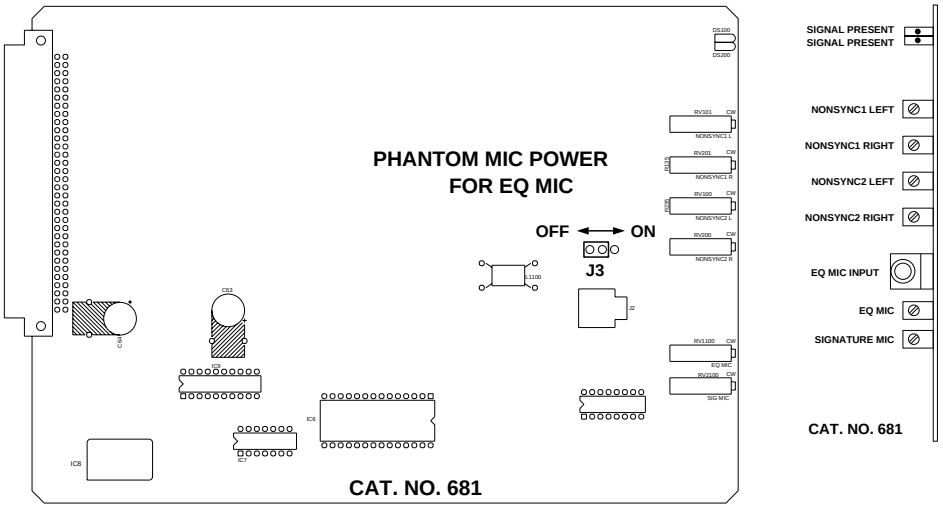


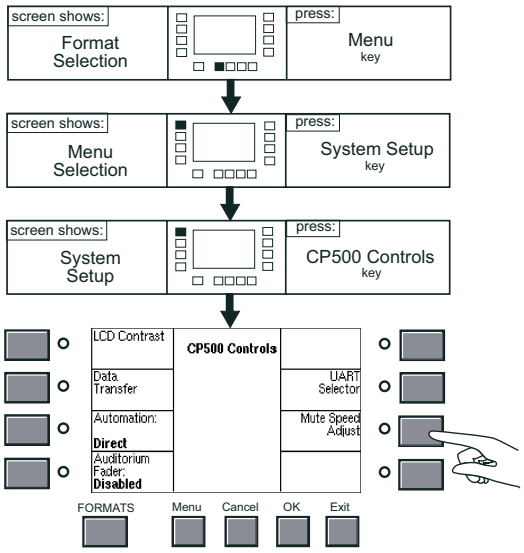
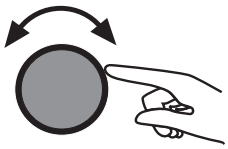
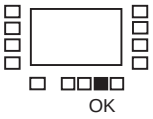
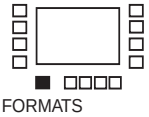
Figure 8-2. Cat. No. 681 card – Front View and Side View

The Non-sync gain should be adjusted with the fader at its usual setting, generally 7.0, to obtain the desired output level. This makes special fader settings for Non-sync unnecessary.

Format 60 selects Non-sync 1; Format 61 selects Non-sync 2. These formats are decoded in the same manner that is used in the Dolby CP55 and CP65 Cinema Processors: Left and Right channels are sent straight through to the Left and Right stage speakers; Center is muted, and the difference between the Left and Right inputs is sent to the surround channels. A user format is easy to create with full Dolby Pro-logic decoding of the Non-sync inputs. This can be done by using the Build Custom Format menu and starting with a copy of Format 60 or 61. Note that many two channel stereo music mixes will sound monaural when Pro-logic decoded; you will have to experiment on a case-by-case basis to see what works best.

8.6 Mute Speed Adjustment

The length of time it takes for the sound to fade from normal setting to muted (when the **MUTE** key is pressed) is adjustable. To make this adjustment,

	Press the **MENU** key, **System Setup** (SK1), **CP500 Controls** (SK1), **Mute Speed Adjustment** (SK7).
	Use the main fader to select the fade-out time you prefer. The time displayed is the approximate time to silence. You can test the mute function while in this window to see whether you are satisfied with the setting chosen.
	Press **OK** when you are satisfied with the setting or press **CANCEL** if you wish to retain the original setting.
	Press **FORMATS** to return to the normal format control screen.

NOTE: When the Mute function is being executed, any other control actions will be delayed for approximately 1.2 times the selected mute time.

9.1 CP500 Operation with Remote Controls

The CP500 is equipped for use with three types of remote controls: Cat. No. 689, Cat. No. 734, and an auditorium fader.

9.1.1 Cat. No. 689 CP500 Remote Control

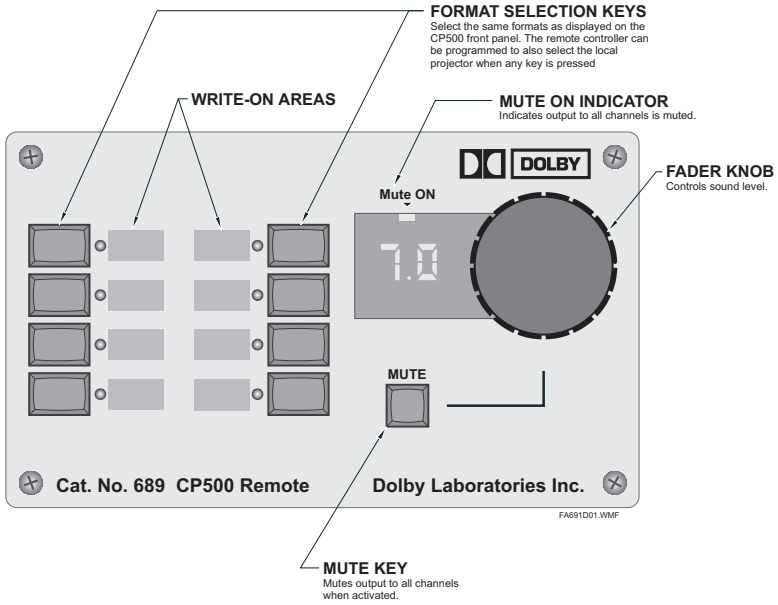


Figure 9 - 1. Cat. No. 689 CP500 Remote Control.

NOTE: Operation of the remote is disabled when the front panel display shows a screen other than a format screen.

The features of the Cat. No. 689 Remote Control duplicate the front panel format selection, fader , and mute controls of the CP500.

The function of the remote fader duplicates the CP500 **main fader**. Both are active at all times and both fader setting indicators display the most current adjustment, regardless of which fader was last modified.

Operation of the remote fader is disabled when the front panel display of the CP500 shows a screen other than a format screen. In such cases, the Fader Level Display of the CP500 will read ***0.0***, ***1.0***, or ***2.0***, showing which projector is associated with the remote. The association between a projector and the remote is set by means of DIP switches inside the Cat. No. 689. Either ***0*** (no projector), ***1*** (Projector 1), or ***2*** (Projector 2) can be selected. If the remote control is programmed with a projector, any format selection from it will execute a changeover to that projector. Fader or mute operations will not cause changeovers.

The format selection softkeys and **MUTE** key of the remote control box function just like those on the CP500 front panel, as long as the CP500 is in a format screen. White painted areas are provided next to each softkey so that the assigned formats can be written on them.

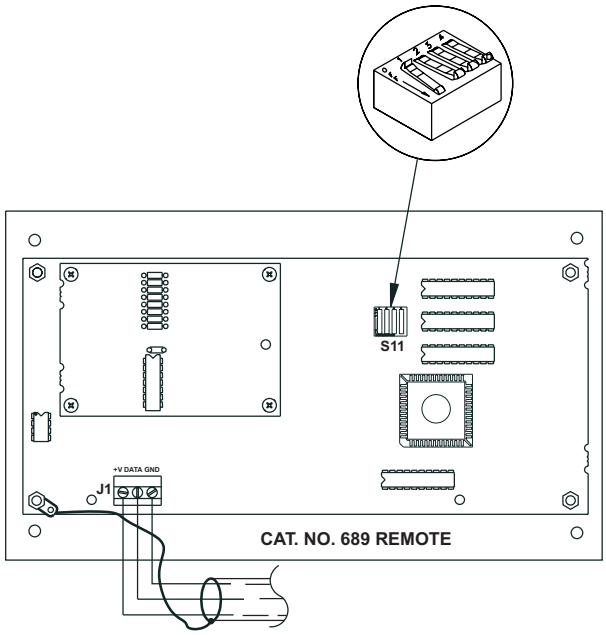


Figure 9 - 2. Dip switch location for Cat. No. 689 – set to Projector 1.

The remote is set at the factory with all switches UP (ON), which causes the Cat. No. 689 not to be associated with any projector. To program the Cat. No. 689 to be associated with Projector 1, set DIP Switch 1 OFF (DOWN), and leave the other switches ON (UP). To program the Cat. No. 689 to be associated with Projector 2, set DIP Switch 2 OFF (DOWN), and leave the other switches ON (UP).

When a Cat. No. 689 is programmed to be associated with a projector, any format selection from that remote will cause the CP500 to switch to that projector.

NOTE: Mute and fader changes from any remote controller will not affect the projector selection.

9.1.2 Cat. No. 734 CP500 Remote Fader

The Cat. No. 734 CP500 Remote Fader consists of a shaft encoder with LEDs to indicate the fader setting. It functions just like the CP500 **main fader**. Both are active at all times, and both fader setting indicators display the most current adjustment, regardless of which fader was last adjusted.

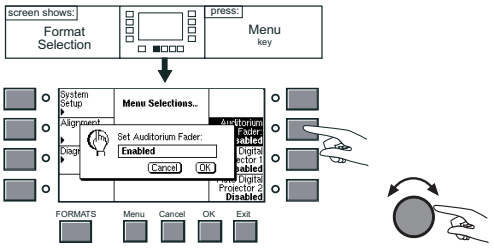
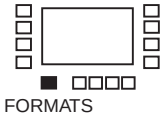
The Cat. No. 734 is identical in function to the **main fader** on the CP500 front panel. The system will accommodate two Cat. No. 734s.

NOTE: Operation of the remote fader is disabled when the front panel display shows a screen other than a format screen.

9.1.3 Auditorium Fader

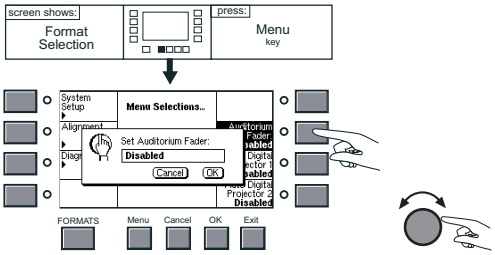
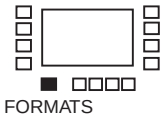
This is a user-furnished 100k linear pot wired as a variable resistor, with minimum resistance corresponding to Fader 10.

To select the Auditorium Fader:

	Press the **MENU** key. Press **Auditorium Fader**. Turn the front panel knob to the "***Enabled***" position
	Press the **FORMATS** key to return to the format control screen. The fader level display will show "***AU***."

NOTE: When the auditorium fader is selected, the CP500 **main fader** and any Cat. Nos. 706 or 689 faders installed in your system will be disabled. Only the auditorium fader will be active.

To return to the Main Fader:

	Press the **MENU** key. Press **Auditorium Fader**. Turn the front panel knob to the "***Disabled***" position.
	Press the **FORMATS** key to return to the format control screen. The fader level display will show the current fader setting once again.

9.2 Operation with Cat. No. 580 Microphone Multiplexer

The Cat. No. 580 Microphone Multiplexer has been designed to work with, as well as be controlled from the CP500. The multiplexer ensures more accurate theater speaker equalization by enabling the simultaneous use of as many as four microphones (supplied) placed throughout the auditorium. Although the unit is normally furnished with Dolby recommended miniature measurement microphones, it will accommodate 12V phantom powered professional microphones as well.

The multiplexer rapidly switches between the four microphones and sends their outputs to the CP500 over the special 31-meter (100-ft.) Dolby Cat. No. 582 input/output cable (supplied). Then, the digital circuitry within the CP500 averages the microphone outputs for display on its built-in real time analyzer and subsequent EQ adjustments. This eliminates the time-consuming process of moving a single microphone to different locations and manually averaging the results.

Four high-quality electret microphones are supplied with the Cat. No. 580, in addition to six meter (20-ft.) connecting cables that adapt the microphones' standard XLR connectors to the “mini-XLR” style input connectors on the Cat. No. 580. The Cat. No. 582 input/output cable used to connect the Cat. No. 530 to the CP500 contains two individually shielded pairs: one for distribution of bi-directional RS-232 control signals and the other for the multiplexed microphone signal.

A built-in microcontroller chip is programmed to control microphone selection, switching rate between microphones, and the Cat. No. 530 LED display. There are no user adjustments on the Cat. No. 530 itself.

9.2.1 Operation

Position the Cat. No. 580 Multiplexer in the center of the listening area and connect the four microphones to the multiplexer using Cat. No. 581 adapter cables. Place each microphone in the room so that they are substantially in the reverberant field rather than in an area that receives the most direct energy from the speakers. In addition, avoid perfect symmetry -- that is, arrange the microphones so that they are not, for example, arranged in a perfect square or rectangle parallel to the sides of the room. Take care not to place any of the microphones on the central axes of the room, as standing waves and nodes at these positions can cause measurement errors.

The microphones should normally be mounted at the listener's head height. However, if the seats have high backs, the microphones should be raised to have at least 23 cm (9 inches) above the top of the seat to avoid unwanted effects.

The figure shown below provides an example of good microphone placement.

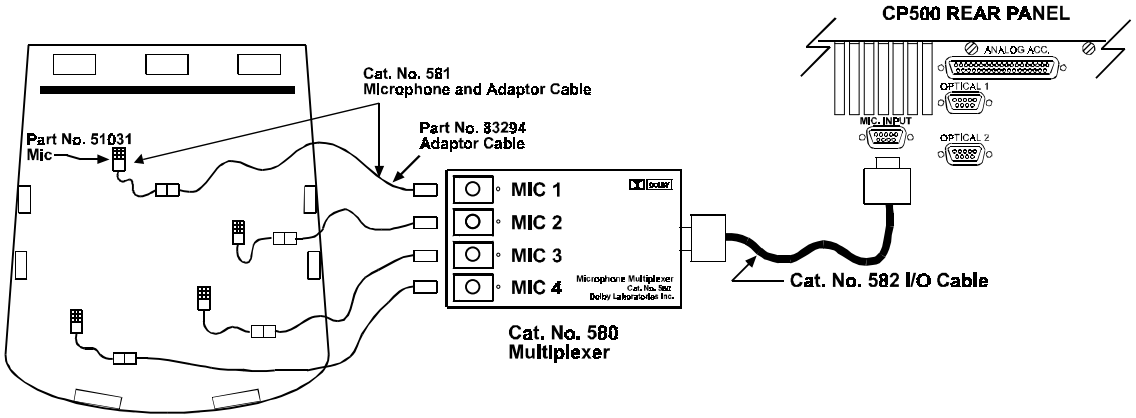
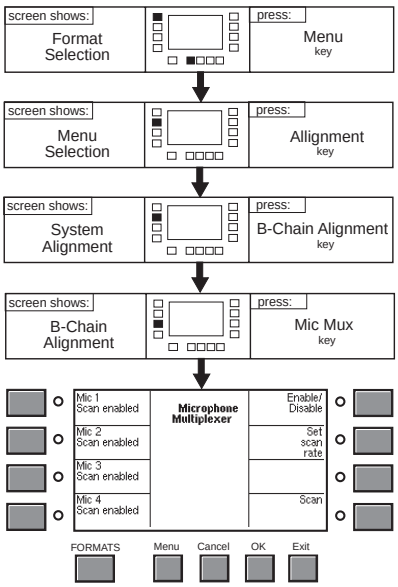


Figure 9 - 3. Microphone placement with Cat. No. 580 Multiplexer.

Connect the Cat. No. 582 input/output cable to the Cat. No. 580 Multiplexer and secure the hold down screws so that the cable cannot work loose. Route the cable to the location of the CP500 and connect it to the microphone connector on the back panel of the CP500.

To operate the Cat. No. 580 Microphone Multiplexer through the CP500:



Begin by entering the microphone multiplexer control screen on the CP500:

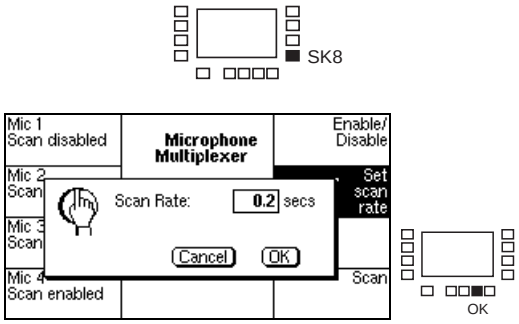
Press the **MENU** key.

Press **Alignment** (SK2).
(A system password may be required at this point)

Press **B-chain Alignment** (SK1).

Choose **Mic Mux** (SK3).

NOTE: While performing equalization, this multiplexer control screen may be entered directly by pressing **SK5**.



To scan through the microphones, press **Scan** (SK8).

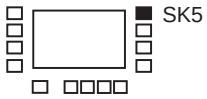
The scan rate may be set by choosing **Set Scan Rate** (SK6). Rotate the front panel knob until the desired rate is displayed then press **OK**. The number displayed is the time spent connected to each microphone.

To **select one** mic:

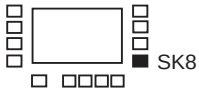
SK1 - SK4

To **remove** one mic:

SK1 - SK4 ⇒



To **resume scan**:



Pressing any soft key, SK1 through SK4, will halt scanning and enable the corresponding microphone.

To remove a microphone from the scan sequence, select the microphone by pressing the corresponding softkey, then press the **Enable/Disable** key (SK5).

Resume scanning by pressing **Scan** (SK8).

NOTE: This feature can be used to find out if one microphone has accidentally been placed in an acoustically unusual location that might adversely affect the overall equalization. It can also be used to identify failed microphones.

Calibration of the CP500's measurement system for absolute level is done in the same way as it is with no multiplexer.(*See page 5-7.*) Sound pressure levels can be adjusted either with the multiplexer scanning or with a single microphone selected, although equalization should always be done with the multiplexer in scanning mode.

The Real-Time Analyzer in the CP500 has been designed to always set the 800 Hz 1/3-octave band at the "***0***" line. Therefore, any variations in microphone sensitivity or level in the room are automatically removed from the display, and only equalization differences remain. This feature makes using a multiplexer for equalization much easier since only frequency response differences are shown on the display. Furthermore, the CP500 analyzer has slower display time constants -- graded according to frequency, than many commercial analyzers. This results in a display that is more stable at low frequencies but still responsive at mid- and high frequencies.

9.2.2 Components

Use the listed numbers for ordering replacement parts:

Cat. No. 580	Microphone Multiplexer Unit
Cat. No. 581	One Microphone with Adapter Cable (Part Nos. 51031 and 83294)
Part No. 51031	Microphone
Part No. 83294	Microphone-to-MPX500 Adapter Cable, 6 meter (20')
Cat. No. 582	MPX500-To-CP500 I/O Cable, 31 meter (100')

Your theater sound system consists of a number of critical audio components in addition to the Dolby CP500. Thus, the first step when something goes wrong with the sound is to find the source of the problem. The troubleshooting chart, starting on page 7, can be helpful.

If the troubleshooting chart is not sufficient for finding and solving the problem right away, the procedures in the following manual sections should be helpful.

If you are unable to solve the problem using the information which follows, call your local authorized service engineer. ***Section 3*** of this manual contains fold-out drawings of the circuit card locations, which will help if a phone discussion with your service engineer is necessary.

10.1 During the Show

10.1.1 If Film Sound Is Lost

1. First, check that the correct format and projector are still selected.
2. Verify that the exciter lamp(s) in both the analog and digital (if so equipped) film readers are on.
3. Check that the system is not in Mute, the fader is set to "***4.0***" or above, and that the front panel still responds to the controls.
4. If your installation uses an auditorium fader (fader display shows "***AU***"), check the setting of this fader.
5. Open the front door of the CP500 and switch to Bypass using the pushbutton switch in the lower right corner. If sound is restored, it will be playing in mono, but you can continue the show while you try to find the source of the trouble.
6. If sound is not restored, check that bypass power is connected to the CP500. A red LED located above the front panel knob will be on if bypass power is present. An external bypass transformer must be connected to the CP500 and plugged into an operational power source for Bypass to work.
7. If these methods do not restore film sound, press the bypass power switch in the lower right hand corner behind the door again. When the *Current Format* screen appears, switch the CP500 to non-sync and play your source of intermission music. If the system operates properly in this format, there is no problem with the equipment following the CP500 (such as power amplifiers and loudspeakers). The problem may be in the projector(s). Double-check both projectors, and if possible continue the show using the other projector.

10.1.2 If One Channel Fails or is Distorted

1. Open the front door of the CP500 and switch to Bypass using the pushbutton switch in the lower right corner. A mono signal is then fed to all three screen channels. If the problem in one channel persists, the power amplifier or speaker for that channel is probably at fault. If the problem is **not** in the Center channel, switch the faulty amplifier off, being sure that it is not shared with the Center channel, and finish the show in that condition. If the Right or Left channel has failed, it may be preferable to switch off both Right and Left power amplifiers.

2. If you are showing a mono film and the Center channel has failed or is distorted, switch the CP500 to Bypass so that the mono signal is fed to the still-functioning Left and Right channels. Turn off the power amplifier for the Center channel.

10.1.3 If Switching to Bypass Does Not Restore Sound

1. First, check the exciter lamps, the fader setting and the mute button. Make certain that all components including power amplifiers are receiving AC mains power.

2. With the unit switched to Bypass, verify that the red LED near the front panel fader knob is illuminated. If it is not, bypass power may be the problem. Check that a bypass power transformer is connected to the CP500 and plugged in to an operating AC mains power outlet.

3. If the bypass power appears to be working properly, check if the signal present lights on the Cat. No. 661 optical preamp card (third slot from the left side of the unit) are flashing. If they are and sound is still not available, check that AC power to the power amplifiers has not been lost.

4. If the signal present lights on the Cat. No .661 are not flashing, the circuit card may be defective, or the bypass power section of the Cat. No 682 (second slot from the left side of the unit) may have failed. Substitute other known good cards as a temporary measure. If you substitute another Cat. No. 682, both the bypass level potentiometer located on the edge of the card and jumper J902 may need to be adjusted.

10.1.4 If You Hear Extraneous Noises When Playing a Digital Film

1. Switch the Format to analog (Format 05). If the noises persist, open the front door of the CP500 and switch to Bypass using the pushbutton switch in the lower right corner. If the noises still persist, check the power amplifiers as it is unlikely that both the digital and analog parts of the system have failed.

10.1.5 Excessive or Inappropriate Sound From Surround Speakers

1. As an emergency measure to continue the show, switch off the surround channel power amplifier(s). At your next opportunity, find out if the problem is related to the film itself or the theater sound system.

   The problem is most likely to be in:

   - Power amplifier gain settings;
   - Damaged loudspeakers rattling, etc.;
   - Solar cell alignment in the projector (if the problem is analog sound);
   - Cat. No. 661 optical preamplifier card (if the problem is analog sound);
   - Cat. No. 222 SR/A or Cat. No. 300 (if so equipped) Noise Reduction cards (if the problem is analog sound).

10.1.6 On CP500s Equipped with Cat. No. 683 Electronic Crossover:

This optional board is located in the first slot on the left hand side of the unit.

No High Frequency Or Low Frequency Output

Possible causes are

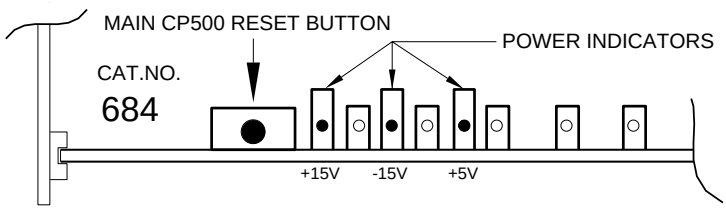
- A high frequency driver speaker driver has failed.
- A low frequency speaker has failed.
- A power amplifier has failed.
- A power amplifier fuse has failed.
- The Cat. No. 683 card may have failed.

High frequency driver failures are the most common cause of this problem.

If it appears that the Cat. No. 683 card is the cause of the problem, open the front door of the CP500 and switch to Bypass using the pushbutton switch in the lower right corner. A separate speaker crossover system is provided for Bypass operation; however, the sound will be in mono only.

10.2 Between Shows

Open the door and look at the three LEDs at the left edge of the Cat. No. 684 system controller board. This is the horizontal board located at the bottom of the CP500. If all three are lit, then the power supply is acceptable.



NOTE: There is no LED indicating +24V power. If the fan is running then +24V power is working.

Next, turn off the power amplifiers to avoid disturbing the audience.

The CP500 is equipped with several sets of LEDs which indicate the presence of signals. These LEDs can assist in fault diagnosis. If you have only a small amount of time between shows, then you may wish to perform this procedure after the theater has closed.

NOTE: The signals **do not** flow straight across the unit from left to right.

10.2.1 Analog Film Sound Signal Path LEDs

(Be certain that Format 04 is selected)

For playing analog films, the first LEDs in the signal path are located on the Cat. No. 661 Optical Preamp card. This card is located on the third slot from the left in the CP500 chassis (J3). Two LEDs near the center of the card indicate that signals exist for the Lt and Rt sound channels from the film. The other two LEDs above and below these indicate which projector is selected. If the center LEDs are not flashing for normal film dialog level passages, then the problem may be one of the following:

- The wrong projector is selected.
- The exciter lamp has failed.
- The solar cell is not in the correct position on the projector.
- This card has failed.

The second set of two LEDs for Lt and Rt are at the top of the Cat. No. 681 card, which is the right-most full height card (J7). If the LEDs on the Cat. No. 661 (discussed above) are flashing and these LEDs are not, then either the Cat. No. 661 or Cat. No. 681 is faulty.

Next in the analog signal path are the LEDs on the Cat. No. 222 SR/A module, located next to the Cat. No. 681 card (J4). The bottom LED of the set of four LEDs located next to the Dolby symbol is a signal present indicator. The other

three LEDs function as a signal meter. If the Cat. No. 681 LEDs are flashing but these are not, then the Cat. No. 681 is defective, or the Cat. No. 222 SR/A is defective.

EXCEPTION: If you have a Cat. No. 668 Studio NR daughter board, the Lt and Rt signals are routed through the Cat. No. 300 modules rather than the Cat. No. 222 SR/A module. The Cat. No. 300s have no level meters so no signal presence indicators are available in this configuration.

Next in the signal path are the LEDs on the Cat. No. 675A card located nine slots from the right hand side of the unit (J12). This card functions as the surround decoder. The top two LEDs indicate level in the Lt and Rt channels; the bottom two indicate analog-to-digital converter overload in the same two channels. If LEDs are flashing on the Cat. No. 222 SR/A but not here, then the Cat. No. 681 card, or this Cat. No. 675 is faulty.

Next in the signal path for **all formats** are the LEDs on the Cat. No. 675A card, located seven slots from the right hand side of the unit (J14). The top six LEDs indicate signals are present in the respective channels. This card functions as the equalizer card. The Cat. No. 675A, as mentioned earlier shows lights, but if this card does not, one of the two Cat. No. 675A cards discussed is defective.

The last point in the signal processing chain for **all formats** is the Cat. No. 682 Output card located in the second slot from the left hand side of the unit (J2). If all other LEDs mentioned above are flashing but LEDs on the card are not, then the **main fader** is turned down too far, the system is muted, or the Cat. No. 662 Digital-to-analog converter card or this card is faulty.

10.2.2 Digital Film Sound Signal Path LEDs

All the LEDs in the analog section described above should be on as described above, since the print also contains an analog soundtrack.

The first LEDs in the digital signal path are the 16 **green** LEDs on each of the two Cat. No. 671 cards located in the 4th and 5th slots from the right hand side of the unit (J16,17). These should all be on nearly all the time when playing a good quality film print with digital sound track.

Note that a steady **red** light showing on either of these cards indicates that the card is **not** working. Pushing the digital sub-system reset button located at the bottom of the Cat. No. 673 card (third slot from the right hand side of the unit, J18) will frequently cure this problem.

WARNING: Pushing digital reset will cause the CP500 to revert to analog sound until the reset process is complete. This will produce a sound change depending on the actual program. For the least disturbance to the audience, digital reset can be performed once or twice during a show

If this does not correct the problem, you can reset the entire CP500 by pressing the button located on the left hand end of the horizontal Cat. No. 684 board on the bottom of card rack (J8,9).

WARNING: Resetting the system will cause the CP500 to switch to Bypass until the system reset process is complete. This will produce a considerable change in sound quality and you may not wish to do this during a show.

The Cat. No. 673 contains a one-character alphanumeric display. This display normally operates as an error rate indicator. Good Dolby Digital films should play with error rates of **"5"** or below. If the error rate exceeds **"*8*"**, then the display will indicate "***F***" and the system will revert to analog playback until the data quality improves. This card also contains two LEDs. The lower one flashes whenever an uncorrectable block of digital data is processed; the upper one indicates a fault condition on the Cat. No. 673 card. In normal operation, the lower LED should rarely if ever flash, and the upper one will remain off.

The next LEDs in the digital sound path are on the Cat. No. 675A AC-3 Decoder card, located two2 slots from the right hand side of the unit (J19). This card has three columns of eight LEDs. The top four LEDs in each column indicate signals present in the L, Ls, and C channels respectively. The bottom four LEDs in each row indicate signals present in the R, Rs, and SW channels. In each group, the bottom one is illuminated for signals of 40 dB below Dolby level or louder, the middle two for signals very close to Dolby level, and the top one for signals 10 dB above Dolby level and louder.

The next LEDs in the digital sound path are on the Cat. No. 675A Equalizer card, located seven slots from the right hand side of the unit (J14). This card has eight LEDs. The top six LEDs indicate signals present in the L, C, R, Ls, Rs, SW channels (from the top LED). If the Cat. No. 671 discussed above shows lights but this card does not, then the Cat. Nos. 673, 675, or 680 may be faulty, or this Cat. No. 675A card is defective. **These LEDs are also illuminated when playing analog formats**

The last card containing LEDs in the signal processing chain **for all formats** is the Cat. No. 682 Output card located in the second slot from the left hand side of the unit (J2). If all other LEDs mentioned above are flashing but LEDs on the card are not, then the fader is turned down too far, or the system is muted, or the Cat. No. 662 Digital-to-Analog Converter card or this card is faulty. **These LEDs are also illuminated when playing analog formats.**

10.2.3 Bypass Signal Path LEDs

When the CP500 is operating in Bypass, the only LEDs that are active are the Cat. No. 661 optical preamp card located three slots from the left hand side of the unit (J3). They are the Projector Selected LEDs and the Lt and Rt Signal Present LEDs. If the Signal Present LEDs are flashing, you should have sound unless the fader is turned down or the Cat. No. 661, 682, or 683 (optional card) has failed.

10.3 Troubleshooting Chart

The following pages may assist you in finding problems with your CP500 Cinema Processor.

Symptom	Probable Cause	Recommended Action
NO SOUND AT ALL		
No sound, front panel dark, no bypass LED	No power to either main or bypass systems.	See if mains panel fuse or circuit breaker feeding the CP500 is blown. Verify all power connectors are fully inserted into their sockets. If power is present, see if CP500 bypass transformer is installed correctly. Verify that Cat. No. 682 card is fully seated in its connector. Press main power switch (behind front door of CP500). If CP500 still doesn't come on, check fuse behind plastic door in power inlet module on power supply housing.
No sound, and switching to Bypass doesn't restore sound.	Defective exciter lamp or lamp power supply.	Check that the exciter lamp is on and that the lamp power supply is operating. If not, fade up background music and transfer the reel to the alternative projector and continue the show until the exciter lamp can be replaced. Call service engineer.
No sound, front panel dark, red Bypass LED is on and system is already in Bypass	Projector selection wire/switch is faulty.	If the front panel indication (P1, P2) for the currently active projector is not correct, check that the projector selector switch wiring is held firmly under the screw terminals on the Phoenix connector on the back panel of the processor. In addition, check that the switch is operating properly.
	No signals coming from stereo solar cells.	Check that the signal present LEDs on the Cat. No. 661 optical preamp are flashing while film is projected. If not, there is no signal from the solar cells or the Cat. No. 661 has failed.
	Power amplifiers switched off.	Check power feed to power amplifiers for blown circuit breaker or fuse or accidental disconnection.
	Malfunction in the CP500.	Substitute Cat. Nos. 661, 682, 683 (if so equipped). *See block diagram and earlier parts of the troubleshooting section.*
No sound, front panel normal.	Above problems plus wrong format, system muted, fader turned down. If fader display reads "**Au**," check where the auditorium fader is set.	Check same components as mentioned above. Then verify selected format, mute status, and fader setting. If no formats produce sound, a number of cards may be at fault. *See block diagram and LED fault tracing instructions.*

Symptom	Probable Cause	Recommended Action
NO SOUND IN SOME FORMATS		
No analog film sound (Formats 01,04, 05)**.** Front panel normal, but Dolby Digital sound OK and non-sync OK.	The analog exciter lamp or power supply may have failed or the wrong projector may be selected. Solar cell connections may be loose or damaged. The Cat. No. 661 optical preamp may have failed.	If signal present LEDs on the Cat. No. 661 (J3) are not flashing, verify exciter operation and solar cell connections as described above. Substitute known good Cat. No. 661.
No Dolby Digital sound (Format 10)**.** Front panel normal, analog sound OK**.**	Digital exciter lamp/LED not working, Digital subsystem, non-Dolby Digital print being played, film not threaded correctly in reader, reader failure	Verify that the exciter lamp or LED in the digital reader is on and that the print you are playing has Dolby Digital information on it and is correctly threaded through the digital reader. If the CP500 will still accept a Format 10 command, the DA20 subsystem is probably still working.
No sound on external 6 track input (Format 11, 70mm, external DA20, or other multi-channel sound sources) Front panel normal.	Cat No 685 card defective. Wrong format, external device not receiving good data.	Check external device for audio output. Substitute known good Cat. No. 685.
No sound in non-sync	Non-sync source not working, non-sync level pots too far down (on Cat. No. 681 card), faulty Cat. No. 681. If non-sync is a user format, is the input from Non-sync 1 or Non-sync 2? Which channels are the signals being sent to? Are those power amplifiers working?	Verify output of non-sync source. Determine from front panel meters which channels the output is directed to and verify that power amplifiers and speakers for those channels are working. After checking the above, adjust non-sync level pots on Cat. No. 681, turning both left and right channels by equal amounts.
Red Bypass LED lit. Front panel dark. There is sound.	System is in Bypass operation.	Turn on the CP500 with the push switch at the lower right hand corner behind the front door. Check that the power cord to CP500 is securely plugged in to a working power source. Check fuse behind plastic door on AC mains power inlet module of CP500. Call service engineer if none of these steps fixes the problem.

Symptom	Probable Cause	Recommended Action
FADER PROBLEMS		
Fader level display indicates "**Au**" and front panel fader has no effect	Auditorium analog fader selected. Select front panel fader.	In the screen menu structure, go to MENU/System Setup/CP500 Controls and disable the auditorium fader. This will restore control to the **main fader** and any digital remotes that are connected.
Fader level display changes when no change in CP500 front panel fader has been made	Remote fader is being operated; If in *Custom* screen, new format with different fader setting selected	**NOTE**: CP500 remote faders are always active. Disconnect remote to disable it.
CONTROL PROBLEMS		
CP500 won't accept a format, gives circle/slash symbol	CP500 doesn't have the optional modules needed for that format, or that part of the system is not working . For example: Format 10 requires the digital subsystem modules. Format 43 requires six channel A-type NR. Format 11 requires Cat. No. 685 6 CH ADC.	Obtain and install the necessary modules. If they are already present, ensure that they are firmly seated in their connectors. Digital modules: Cat. Nos. 670,671 (two),673,675A,860.
CP500 gives "Not Available" when Format 10 is selected and stays in format 05, marked with exclamation point.	No Dolby Digital data available-non Dolby Digital print, projector not running, data blocks badly damaged.	
CP500 refuses any format selection	Format selection switch for format you are using is stuck down.	Gently pry button up.

Symptom	Probable Cause	Recommended Action
RUMBLES, WHISTLES, HUM etc. IN SOUND		
Rumble in sound, regardless of format	Audio grounding scheme may need changing.	Call service engineer.
Whistles in sound	Audio grounding scheme may need changing.	Call service engineer.
Hum (power line frequency) in sound	Malfunctioning exciter lamp or lamp power supply.	Cover the solar cells with a business card or other opaque object. **Do NOT touch the cells and do NOT disturb the position of the cell bracket!** • If the hum disappears, the problem is in the exciter lamp.
	Stray light striking the stereo solar cells.	• If hum still persists, turn out all lights in the booth to check if stray light is striking the cells. If the hum disappears, turn on booth lights that are usually on during projection, one at a time, until you detect hum again. Redirect the light from the offending source or keep it off during a showing. If the hum still is present, the problem is either in the grounding or wiring or in the CP500. Call a service engineer.

Symptom	Probable Cause	Recommended Action
TROUBLE IN ONE OR MORE CHANNELS		
One channel fails.	Defective power amplifier, external crossover, or wiring for that channel.	Place the CP500 in bypass. All three screen speakers should become active. If not, there is a fault in the power amplifier, external crossover, or wiring for the missing channel. Check if the amplifier concerned is on and check for blown fuses. Check that the wiring from the CP500 to the amplifier or the loudspeaker wiring have not been broken or disconnected; check that the screws connecting the wiring on the back panel are properly tightened..
	Malfunctioning module in CP500.	If the power amplifier and the wiring are satisfactory, the problem is a malfunctioning module in the CP500; switch to bypass and call service engineer.
The sound from **one** channel is distorted (you can detect the distortion at the booth monitor at normal listening level).	Defective power amplifier for that channel.	Check if amplifier is on and if its fuse(s) is OK.
	Defective speaker for that channel. (Booth sound is OK but sound in the auditorium is bad).	Check speaker.
	Malfunctioning card in CP500.	Check that the cards are all properly seated in their connectors.
	Wiring from the stereo solar cell to the CP500.	Check that the wiring from the stereo solar cell to the CP500 has not become damaged and that the solder connections to the fanning strip are secure. Check that the D connector for the solar cell is firmly plugged into the CP500. Call service engineer if wiring problems are found.

Symptom	Probable Cause	Recommended Action
The sound from **two** or more channels is distorted (you can detect the distortion at the booth monitor at normal listening level).	Malfunctioning 2-channel power amplifier.	If two distorted channels are served by the same 2-channel amplifier, the problem may be in the amplifier. See the manufacturer's instructions. Call service engineer.
When a stereo film is projected, the sound appears to be coming from the wrong speakers.	The A-chain has become misaligned.	Check Dolby level calibration. Call service engineer.
Sound from the front (screen) channels is leaking into the surround channel.	The A-chain has become misaligned. Surround sound delay set improperly. Surround sound level set too high.	Call service engineer. Call service engineer. Call service engineer.
You hear an echo in a small theater.	Surround sound delay set improperly.	Call service engineer.
The sound level in bypass is higher or lower than the normal sound level.	Adjust with the front panel fader since other parts of the system may be malfunctioning.	Call service engineer.

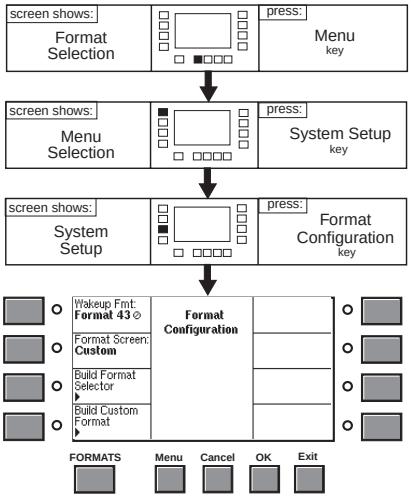
Symptom	Probable Cause	Recommended Action
There is distortion when you play non-sync sound, but sound from the film is not distorted.	The non-sync source is introducing distortion. Defective Cat. No. 681 board	Change the non-sync selection in case the track being played is distorted. If you have control of the output level of the device (cassette deck, CD player, etc.), it will be useful to turn down its volume especially if you have to operate the non-sync with the fader a long way below 7. If this does not help, try a different device. If the distortion goes away, you have found the problem. If changing both the device and the selection does not eliminate the distortion, the problem is in the CP500, probably on the Cat. No. 681. Call service engineer.
Non-sync sound is heard in other formats	The non-sync source is set for too high an output level or there is a balanced / unbalanced wiring problem.	Turn down non-sync source level if possible and call service engineer. If turning the non-sync source down doesn't correct the problem, turn it off if possible during the show.
Sound from a mono film is distorted as is sound from the center channel of a stereo film.	Malfunctioning power amplifier. Malfunctioning loudspeaker.	Interchange power amplifiers to determine if distortion is still present. Interchange speakers to determine if distortion is still present.

Symptom	Probable Cause	Recommended Action
CHANGEOVER AND CONTROL TROUBLES		
Projector changeover command does not change to sound output of the selected projector and the front panel LEDs do not light according to the projector selected.	Defective changeover relay or switch. Defective wiring from relay or switch to terminals on rear of the CP500. Defective Cat. No. 661 optical preamplifier.	If possible, check that the relay or switch contacts actually open and close as the changeover command is issued several times. Check that the wiring has not been damaged and that connections are firmly made at both ends. Call service engineer.
With optional automation connected to the CP500: The CP500 freezes into one format and does not accept any other selected format when you press the front panel switches.	Incorrect wiring to D-connector plugged into CP500 or defective or incorrectly programmed automation equipment.	Unplug the D-connector from the back of the CP500. If you can exercise local control over the CP500, the problem is in either the wiring to the automation equipment or the automation equipment itself. Call service engineer. If you cannot exercise local control over the CP500 even with the automation equipment disconnected from the CP500, switch to bypass and call service engineer.
With optional remote control unit Cat. No. 689 connected to the CP500: The CP500 freezes into one format and does not accept any other selected format when you press the front panel switches.	Incorrect wiring to remote box connector plugged into CP500 or defective Cat. No. 689.	Disconnect the Cat. No. 689 cable from the CP500. If you can exercise local control over the CP500, the problem is in either the wiring to the remote unit or the remote unit itself. Call service engineer. If you cannot exercise local control over the CP500, even with the remote unit disconnected from the CP500, switch to bypass and call service engineer.

You can hear pops and thumps during projector changeover.	If your projector changeover relay power is DC, a diode should be soldered across the winding of the relay to prevent noise from the relay winding from leaking into the audio wiring. This diode may be missing or defective.	If possible, check that the diode is installed across the relay winding. If you are familiar with such electronic components, check to see that it is not blown. If the diode is not present or if it appears to be blown, install a good diode. Activate the changeover and use a multimeter to find the polarity of DC that appears on the relay coil. Install the diode with the band end soldered to the terminal that is positive when measured with the meter. The diode should be a 1N4004 (1 Amp, 400 V), or a 1N4008 (1 amp, 800 V diode) or equivalent.
	If your projector changeover relay is AC, a capacitor soldered to the relay coil terminals may be defective.	Install a .01µF 600V capacitor to the relay coil terminals.
	Malfunctioning Cat. No. 661 optical preamplifier card.	Call service engineer to correct the malfunction.

A.1 Customizing the Format Display Screen

There are two types of Format Selection display screens. The unit is shipped in "Standard Mode", which allows selection of eight commonly used formats. There also exists a "Custom Mode" which allows the user to program the softkeys to show formats of his own choosing, along with changes to the fader setting and projector selection for each of these softkeys.

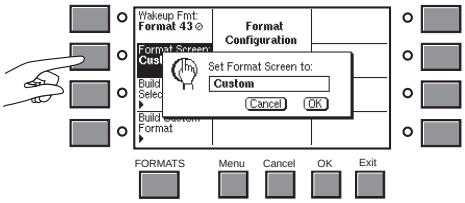


Begin the procedure by pressing the **MENU** key.

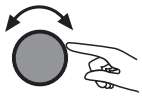
Press **System Setup** (SK1)

Press **Format Configuration** (SK3)

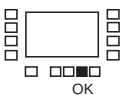
Switching the Format screen display between Standard and Custom is next.



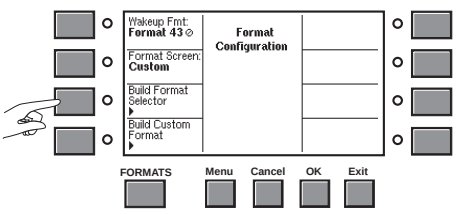
Press **Format Screen** (SK2).
A pop-up box appears.



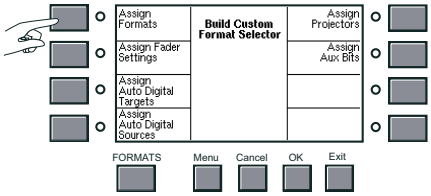
Rotating the front panel knob selects between ***Standard*** and ***Custom*** modes. Select ***Custom***.



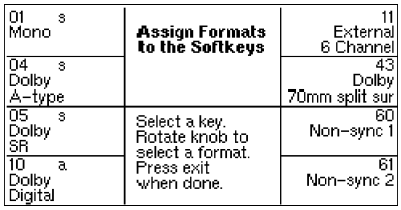
Then press the **OK** key to complete the action.



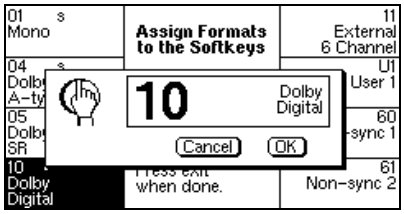
To program the softkeys, press the **Build Format Selector** key (SK3).



To assign formats to the softkeys press the **Assign Formats** key (SK1).



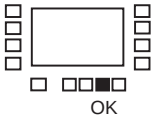
A copy of the existing format selection screen is displayed. Pressing any softkey causes a pop-up box to appear, allowing any format to be assigned to that softkey.



This example shows the display after SK4 has been pressed for assignment.

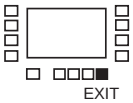
Rotating the front panel knob will move the display through the formats available.

When the desired format is shown, select it by pressing the **OK** key.

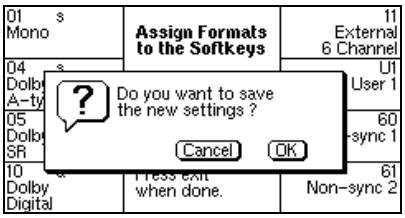


NOTE: Pressing the **CANCEL** key, removes the pop-up box and restores the previous format assigned to that softkey.

Continue in this fashion until all of the desired formats are assigned to the soft keys of your choice.

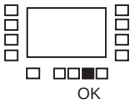


Press the **EXIT** key to return to the Build Custom Format menu.

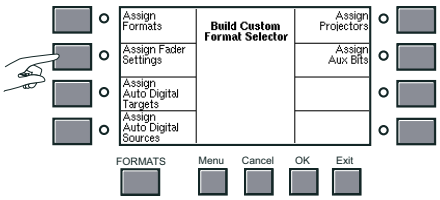


If changes have been made, a box will appear prompting you to save or discard the changes.

Press **OK** to save the new settings.

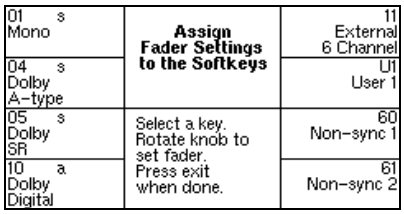


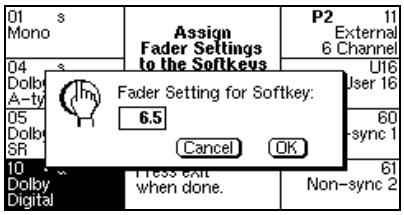
NOTE: Pressing the **CANCEL** key discards the new settings and restores the old settings.

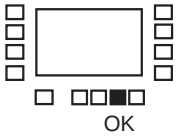


Assigning fader settings to the softkeys is done in a similar fashion.

To assign fader settings, press the **Assign Fader Settings**, key (SK2).







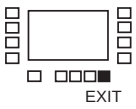
Once again a copy of the format selection screen is displayed. Pressing any softkey causes a pop-up box to appear allowing a fader setting to be entered for that softkey.

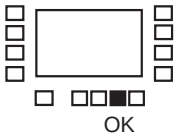
This example shows the display after SK4 has been pressed to set a fader value for SK4, "Format 10".
Rotate the front panel knob to set the fader value to be associated with the softkey.

When the desired fader setting is shown, select it by pressing the **OK** key.

NOTE: Pressing the **CANCEL** key, removes the pop-up box and restores the previous fader setting assigned to that softkey.

Continue in this fashion until all the desired fader settings have been assigned to the soft keys of your choice.

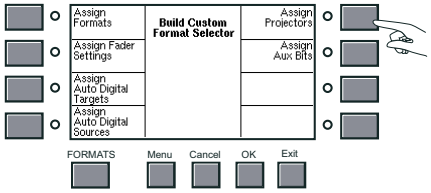




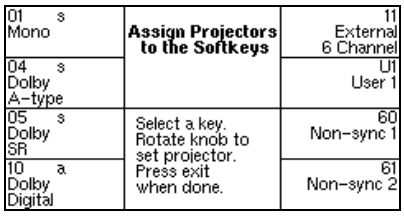
Press the **EXIT** key to return to the Build Custom Format menu. If changes have been made, a box will appear prompting you to save or discard the changes.
Press **OK** to save the new settings.

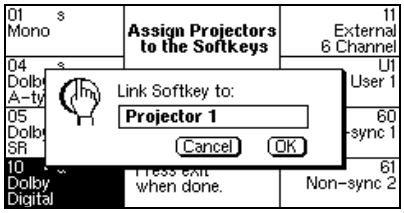
NOTE: Pressing the **CANCEL** key discards the new settings and restores the old settings.

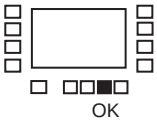
NOTE: When the CP500 switches to a format that has no fader setting programmed, the current front panel fader setting will remain unchanged.



Assigning , or "linking", a projector selection to the softkeys is done in a similar fashion. To assign projector selection, press the **Assign Projectors** key (SK5).







Once again a copy of the format selection screen is displayed. Pressing any softkey causes a pop-up box to appear allowing a projector selection to be entered for that softkey.

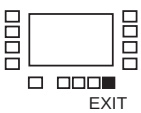
This example shows the display after SK4 has been pressed to link a projector to SK4, "Format 10".

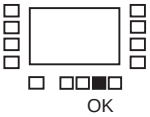
Rotate the front panel knob to display the projector you wish to link to the softkey.

When the desired projector is shown, select it by pressing the **OK** key.

NOTE: Pressing the **CANCEL** key, removes the pop-up box and restores the old projector number assigned to that softkey.

Continue in this fashion until all the desired projector selections have been assigned to the soft keys of your choice. The projector selection for each softkey that has been assigned will appear in bold text in the softkey box.

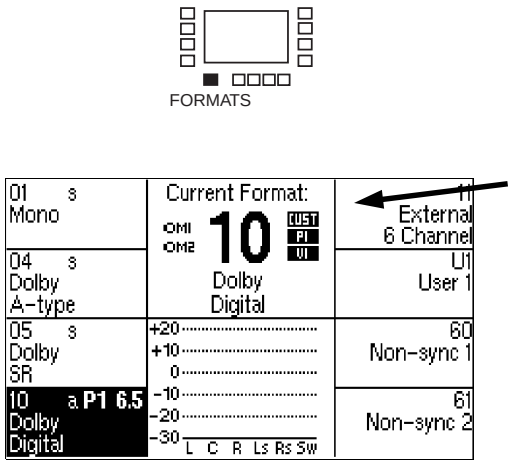




Press the **EXIT** key to return to the Build Custom Format menu. If changes have been made, a box will appear prompting you to save or discard the changes.

Press **OK** to save the new settings.

NOTE: Pressing the **CANCEL** key discards the new settings and restores the old settings.



Press the **FORMATS** key to return to the format selection screen.

Notice that a small indicator (**CUST**) now appears next to the Current Format area, indicating that "***Custom***" screen mode is active.

Any fader settings and projector selections are also displayed. In this example, the screen tells you that the fader setting has been adjusted to ***6.5*** and ***Projector 1*** has been selected.

A.2 Saving System Settings

It is possible to send the CP500 system parameters into a computer before replacing or moving the unit, or installing a repaired Cat. No. 684 board. Also, software upgrades for the Model CP500 are sometimes accomplished by distribution of new FLASH EPROMs. In order to avoid having to re-equalize the theater after any of these operations, the existing CP500 system parameters can be saved on a computer, then sent back to the new EPROMS or replacement unit. **We strongly suggest that the current CP500 system settings be saved to a disk after each installation.**

Saving the CP500 system settings can be accomplished by using the terminal program in Windows® or by using Dolby Laboratories' **Load500** software.

A.2.1 Using the Terminal Program in Windows®

Equipment Needed

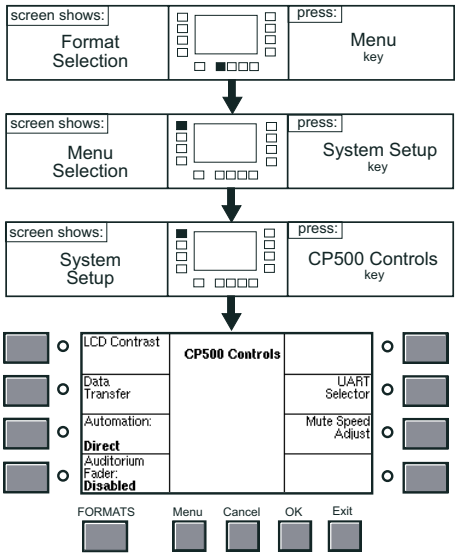
- IBM compatible computer with serial port and terminal emulator capable of 2400 baud, 8 data bits, 1 stop bit, no parity.
- Cable (RS232) with 9-way male and 9-way female D-connectors, pin l to pin 1, pin 2 to pin 2, etc. A cable with receive and transmit lines swapped (null modem cable) will not work.

Transferring Data From the CP500 to the Computer

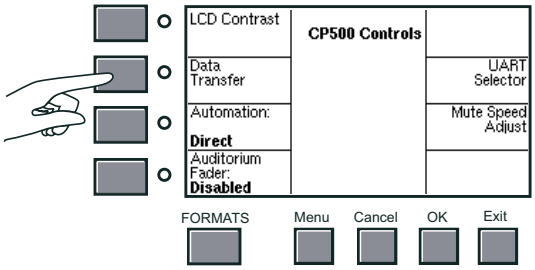
Connect the computer's serial port to the **Serial Data** connector on the rear panel of the CP500 located beneath the power supply.

1. Begin the data download function (send data to a computer) in the CP500 by pressing the key sequence:

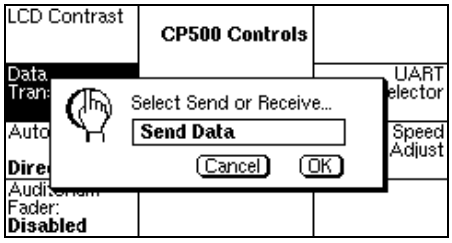
   MENU
   System Setup (SK1)
   CP500 Controls (SK1)



2. Next, press **Data Transfer** (SK2).



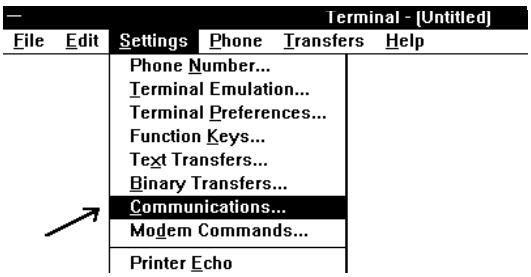
3. A pop-up box will appear prompting you to select various send or receive modes.



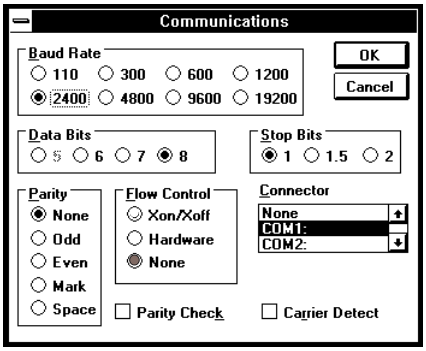
4. Before selecting the CP500 transfer mode, start the computer's terminal program and prepare to receive an ASCII file at **2400 baud, 8 data bits, 1 stop bit, no parity, and flow control off**.

   For example, if you are running Windows®, double click the '**Terminal**' icon, usually located in the **Accessories** program group.

5. Go to the **Settings** drop-down menu, and select **Communications**.



6. Click on the various options as shown in this figure. This sets the above communications parameters in the **Communications** dialog box.

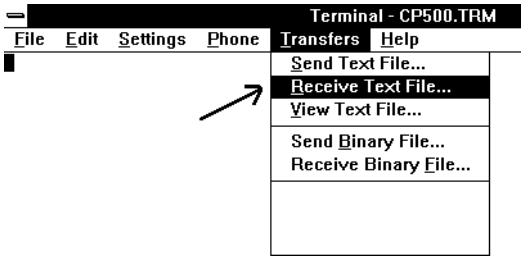


7. Click **OK** to return to the initial **Terminal - (Untitled)** window.

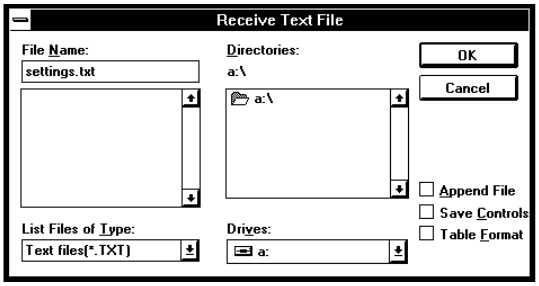
8. You can now save these communications settings for future use. Go to the **File** menu and **Save** these settings as CP500.trm in a convenient directory. The name of the window will now change to **Terminal - CP500.TRM**.

9. These saved settings can now be used for all subsequent uploading and downloading of data to or from a CP500. Clicking on **File** then **Open** will enable you to re-load the CP500.TRM communications settings.

10. Next prepare the computer to receive the CP500 information by selecting the **Transfers** then **Receive Text File**.



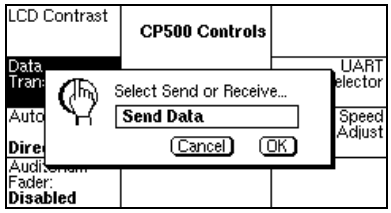
11. The CP500 settings will be saved in the computer in a file which must be named. Give the file a name relating to the installation you are saving. Use a directory which will contain all the CP500 installations files.

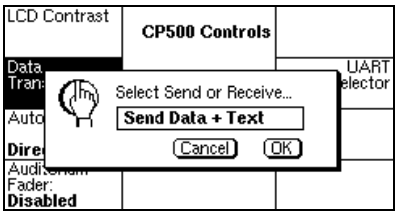


12. Then, click **OK**. The computer is now ready to receive the data from the CP500.

13. On the CP500, rotate the front panel knob on the CP500 front panel to select **Send Data + Text** (for saving the CP500 data plus a readable file of the system's settings),

    or select **Send Data** (for saving the CP500 data only).

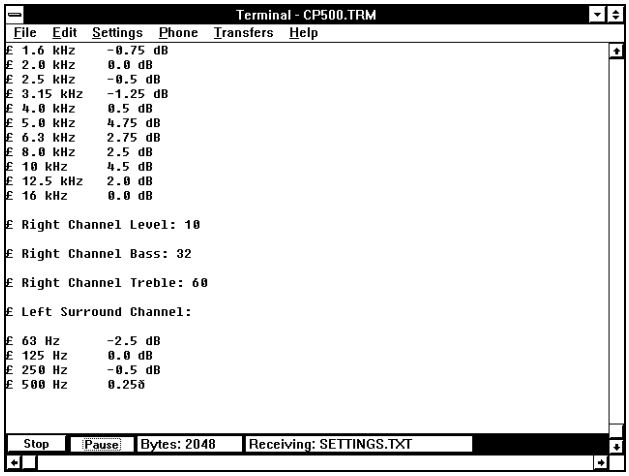




14. Press the front panel **OK** key when you have the correct setting in the list box.

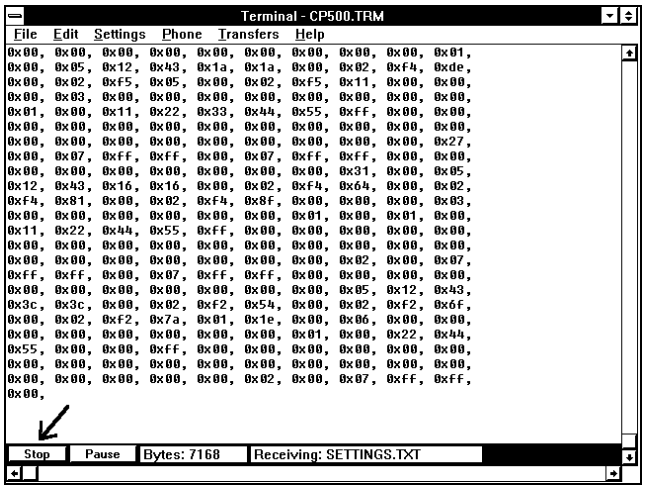
The file will then begin to transfer, and will be visible as it is received on the computer's terminal screen.

If the "***Send Data + Text***" option was used in the previous step, then the CP500 will indicate that text is being sent and text should begin to appear on the computer screen. This transfer will take approximately 20 seconds.



Next, the approximately 3k bytes CP500 settings data (in hex) will be transferred.

The total download time is about 1 minute 20 seconds (approximately 18k bytes).



15. When the CP500 has stopped sending all the data, click the **Stop** button located at the bottom left hand corner of the Terminal screen. This will save the data to the previously named file. It may be useful to clear the screen of data by selecting **Edit**, then **Clear Buffer**. The CP500 system settings are now saved on the computer.

16. It is a good idea to check the integrity of the file which has just been downloaded by immediately trying to load the file back into the CP500 as described in the following section. Any errors in the transfer process will become apparent because the data is automatically checked before any attempt is made to save the new received settings in the CP500.

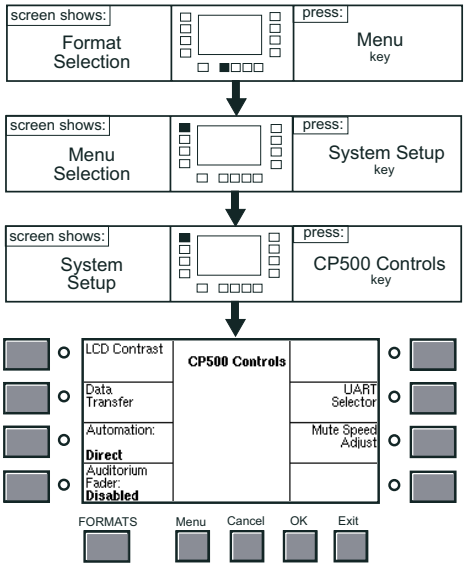
    To view the readable text portion of the file to look at settings, etc., open the file in a text editing program such as Notepad. It is not possible to edit the CP500 settings using a text editor.

Transferring Data From the Computer to the CP500

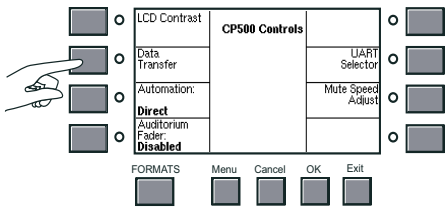
1. Connect the computer's serial port to the **Serial Data** connector on the rear panel of the CP500 located beneath the power supply.

2. To send the stored settings to a CP500 Cinema Processor, return to the data transfer menu by pressing:

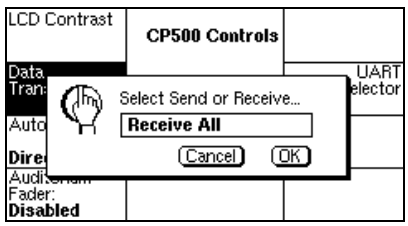
   MENU
   System Setup (SK1)
   CP500 Controls (SK1)



3. Next, press **Data Transfer** (SK2).

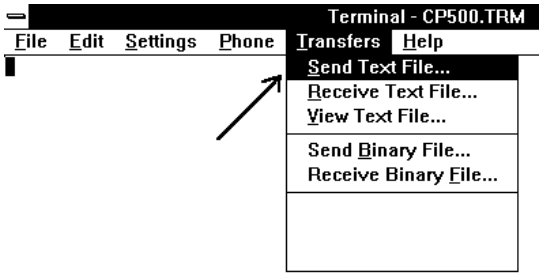


4. Rotate the front panel knob to Select the **Receive All** option from the pop-up box. Other receive modes such as "***Receive EQ***" or "***Receive Formats***" can be selected if only some of the information is required to be uploaded to the CP500.



5. Press the **OK** key and the receive data pop-up box should appear. The system is now waiting for data to be sent from the computer.

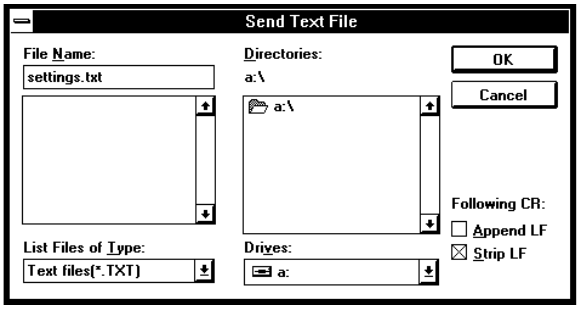
6. On the computer screen, go to **Transfers** and select **Send Text file**.



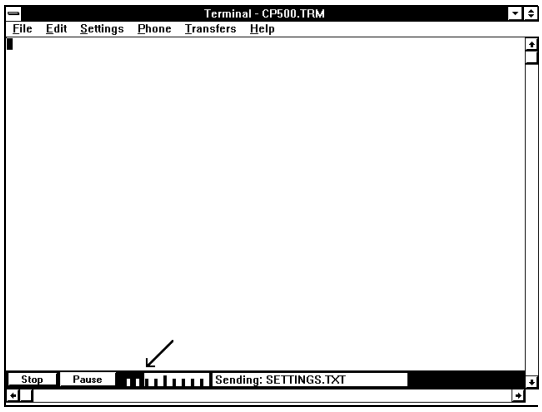
7. Provide the name of the file you wish to transfer to the CP500.

8. Click **OK** or press the **Return** key.

   The transfer of data will now begin.



Although the computer's progress bar will indicate that it is sending the file, the data itself will not be visible.



The CP500 will not respond until the beginning of the hex data file is reached (about 20 seconds if sending a text **and** data file) at which point the bar within the receive data pop-up box on the CP500 will begin moving, showing the progress of the data transfer.

At the end of the data file the computer's terminal program will automatically stop and if there have been no errors or lost bits in the transfer a dialog box will appear on the CP500 asking if you wish to save the new settings. If the CP500 indicates that there has been an error in the transfer then it may be necessary to download the CP500 data to disc again if possible.

9. Press the **OK** key on the CP500. (If only checking the integrity of the downloaded data, then press **CANCEL** on the CP500.)

A.2.2 Using Load500 Software

Load500 is a specific DOS based program which has been developed to make the task of transferring alignment and format information to and from a computer both simpler and quicker. The program includes a special option which allows CP500 operating software to be updated easily from new files supplied on disc. Please refer to the *Load500* software manual, for complete information on installation requirements and operation.

Equipment Needed

The following minimum computer system and CP500 requirements are necessary to successfully use Load500:

1. An IBM/PC-compatible computer with a free serial port running MS-DOS version 5.0 or greater.
2. A direct connection serial cable (not null modem) to connect the IBM/PC-compatible computer to the CP500.
3. The CP500 to be upgraded must have 2Mbit flash ROM's.

Transferring Data From the CP500 to the Computer

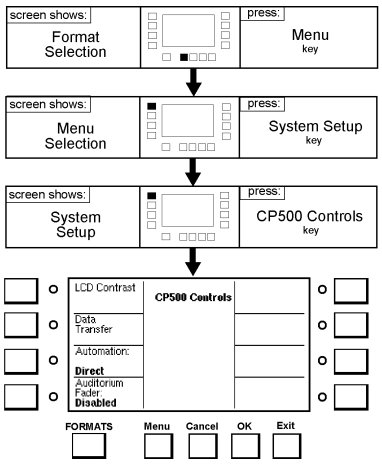
1. Connect the Serial Data port on the back of the CP500 to the computer's serial port using the cable described above.
2. On the CP500, press

   MENU

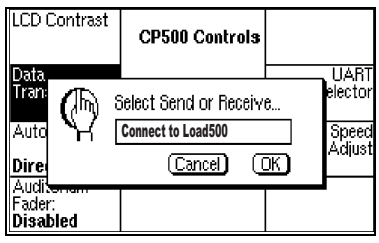
   System Setup

   CP500 Controls

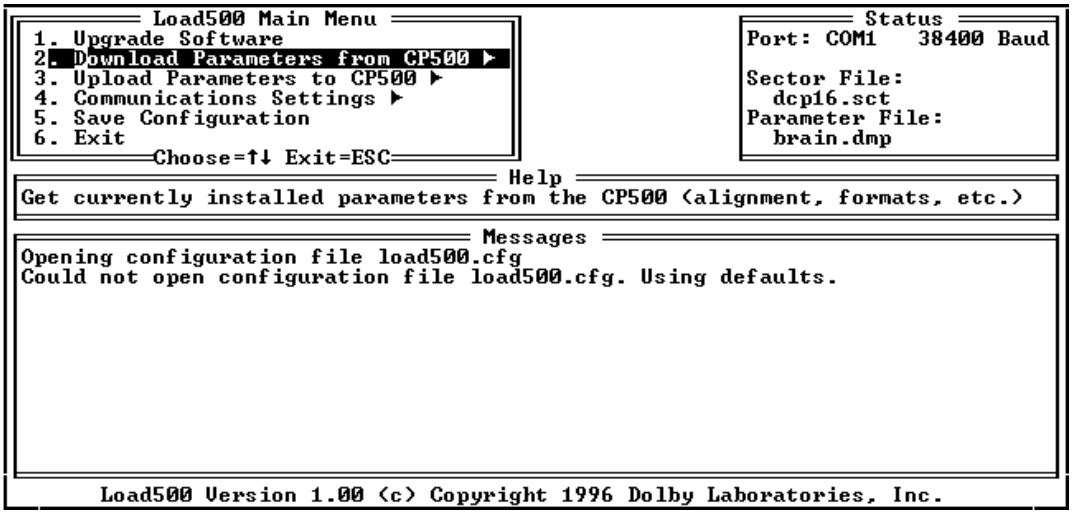
   Data Transfer



3. Once in the Data Transfer screen, select "***Connect to Load500***", then press **OK**. The CP500 will display the "***Waiting for connection***" box.



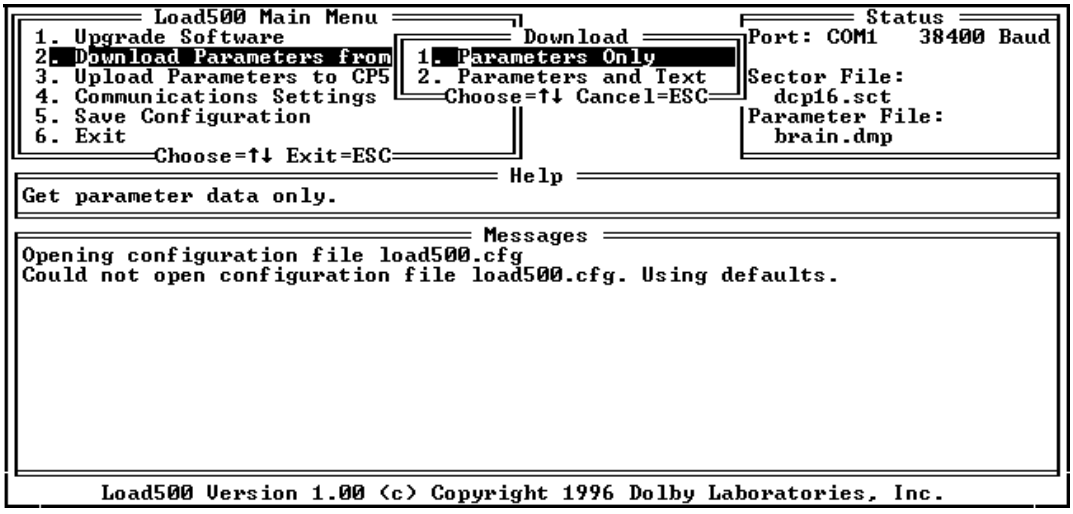
4. On the computer run **Load500**.



5. At the **Load500** screen, select
   `2. Download Parameters from CP500`.

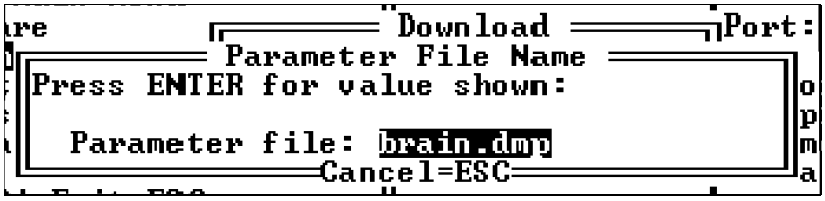
   Selection of menus in Load500 can be performed by (a) using the arrow keys and pressing RETURN, (b) pressing the associated number key, in this case, "2", or (c) pressing the highlighted letter key, in this case, "D".

6. Your next option is to download the CP500 with
   `1. Parameters Only` or
   `2. Parameters and Text`



7. After choosing your option, the screen prompts you for a file name. (Any file name within the normal DOS constraints may be used, e.g. *.dmp. Refer to the *Load500* software manual.).

   Type in the filename and press enter. **The ".dmp" extension is not automatically added by the Load500 program and should therefore normally be included in the typed file name.**



NOTE: The default file name *brain.dmp* should not be used. That name should be reserved for the temporary use of the Upgrade Software option as it is liable to be overwritten without warning.

8. The remaining operation will be automatic. **Load500** will display messages as it progresses with the download. When the transfer is complete the CP500 will reboot itself. If Load500 encounters any problems it will display instructions on the screen.

Transferring Data from the Computer the to the CP500

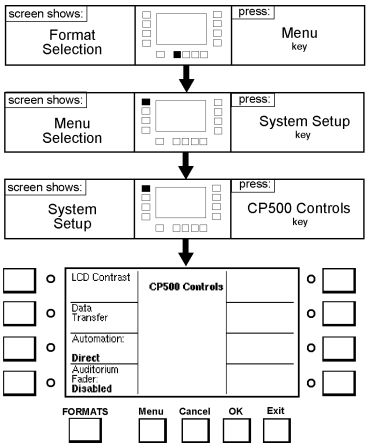
1. Connect the Serial Data port on the back of the CP500 to the IBM-compatible computer's serial port using the cable described above.
2. On the CP500, press

   MENU

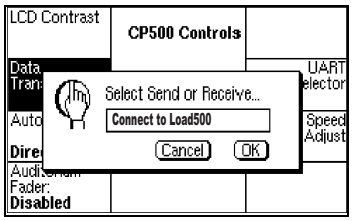
   System Setup

   CP500 Controls

   Data Transfer

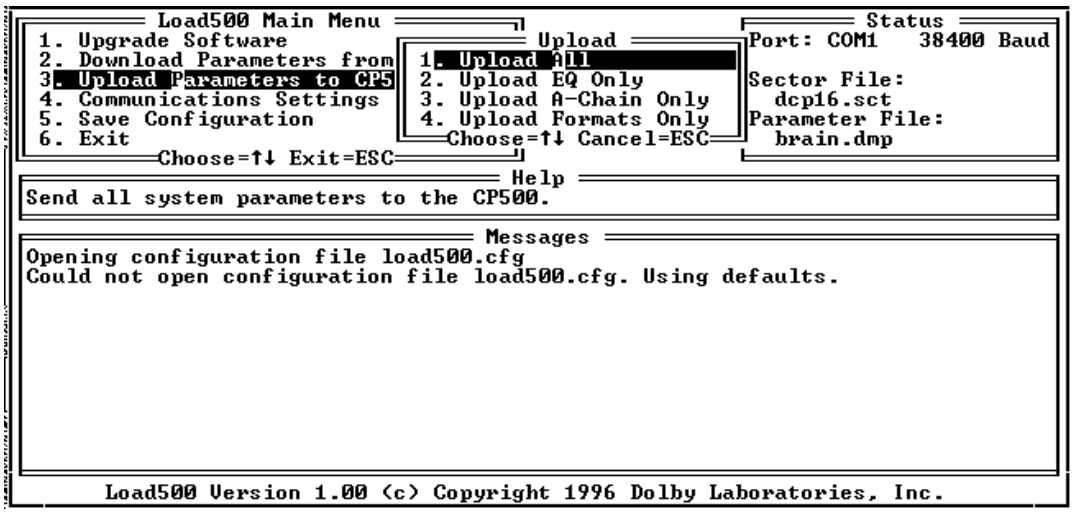


3. Once in the Data Transfer screen, select "***Connect to Load500***", then press **OK**. The CP500 will display the "***Waiting for connection***" box.



4. On the computer, run **Load500**.
5. From the Load500 screen, select
   `3. Upload Parameters to CP500`.
   Selection of menus in **Load500** can be performed by (a) using the arrow keys and pressing RETURN, (b) pressing the associated number key, in this case, "3", or (c) pressing the highlighted letter key, in this case, "P".
6. Your next option is to download the CP500 with one of the following:

   `1. Upload All`
   `2. Upload EQ only`
   `3. Upload A-chain only`
   `4. Upload Formats only`



7. After choosing your option, the screen prompts you for a file name. (Any file name within the normal DOS constraints may be used, e.g. **.dmp*. Refer to the *Load500* software manual.)

   Type in the filename and press enter. **The ".dmp" extension is not automatically added by the Load500 program and should therefore normally be included in the typed file name.**

NOTE: The default file name brain.dmp should not be used. That name should be reserved for the temporary use of the Upgrade Software option as it is liable to be overwritten without warning.

8. The remaining operation will be automatic. **Load500** will display messages as it progresses with the download. When the transfer is complete, the CP500 will reboot itself. If Load500 encounters any problems it will display instructions on the screen.

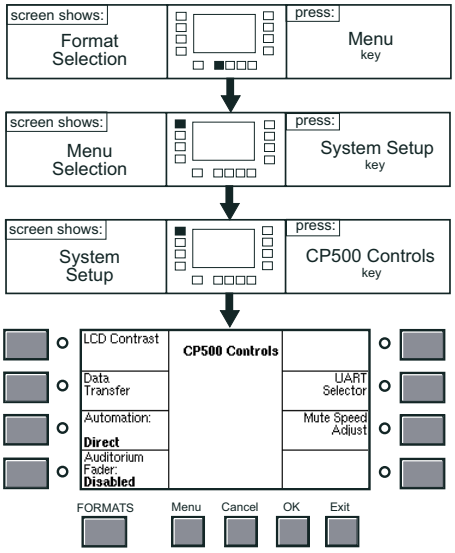
A.3 Transferring Data Between Two CP500s

It is possible to send CP500 system alignment and set-up parameters to another CP500 Cinema Processor before replacing or moving it. A Cinema Processor can therefore be swapped with another and the replacement will not require re-alignment. The original data is simply copied to the replacement processor. An RS232 data cable with 9-way male D-connectors at both ends, and with the receive and transmit lines (pins 2 and 3) swapped is required. This type of cable is sometimes termed a "null modem" cable.

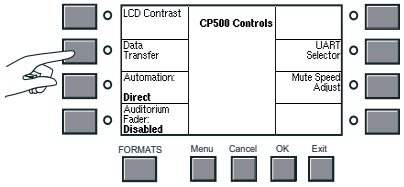
1. Connect both CP500s together with the serial cable plugged into the **Serial Data** connector located on the rear panel of each CP500 beneath the power supply.

2. On the replacement CP500 that will be **receiving** the data, go to the data transfer menu by pressing:

   MENU
   System Setup (SK1)
   CP500 Controls (SK1)

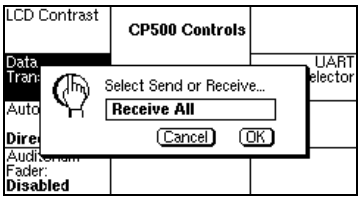


3. Next, press **Data Transfer** (SK2).



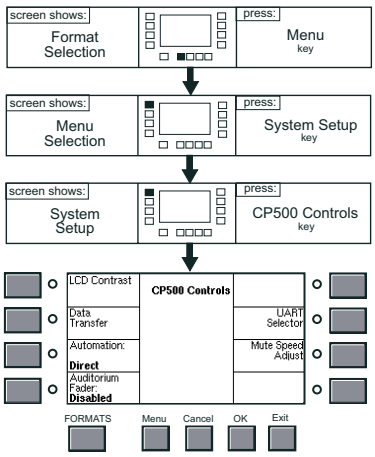
4. Rotate the front panel knob to select the **Receive All** option from the pop-up box. Other receive modes such as "***Receive EQ***" or "***Receive Formats***" can be selected if only some of the information is required to be transferred to this CP500.

5. Press the **OK** key and the ***Receive Data*** pop-up box should appear. The system is now waiting for data to be sent from the other CP500.

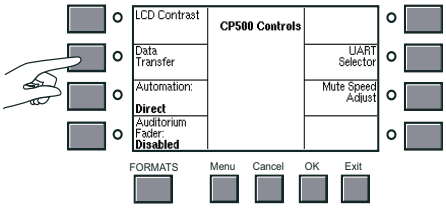


6. On the **sending** CP500, press the key sequence:

   MENU
   System Setup (SK1)
   CP500 Controls (SK1)

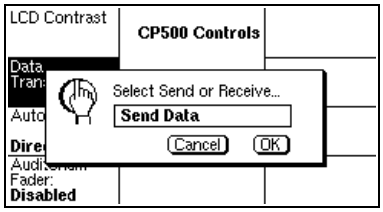


7. Next, press **Data Transfer** (SK2).



8. Rotate the front panel knob to select the **Send Data** option from the pop-up box.

   Press the **OK** key.



A progress bar will appear, showing the progress of the data transfer.

At the end of the data transfer the process will automatically stop. If there have been no errors or lost bits in the transfer, a dialog box will appear on the receiving CP500 asking if you wish to save the new settings. If the CP500 indicates that there has been an error in the transfer then it may be necessary to transfer the data between processors again if possible.

9. Press the **OK** key on the receiving CP500.

The transfer of data is now complete. Note that the **Non-sync levels** and the **Bypass level** trimpots must be adjusted in the replacement CP500 Processor. Refer to the appropriate sections of this manual if more information is needed on these adjustments. Also, if a Cat. No. 683 optional crossover board is installed, then the HF trimpots will need adjustment. Refer to the alignment instructions for this board.

B.1 Description and Features

The Cat. No. 683 Electronic Crossover Board is designed for use in the CP500 Digital Cinema Processor. When installed in a CP500, it provides the following features:

- **Electronic crossover filters for three bi-amplified channels** (L, C, R) are configured to create a 4 pole Linkwitz-Reilly crossover, taking into account common loudspeaker characteristics. The crossover frequencies are programmable by means of 16 pin DIP headers containing resistors. Standard factory values are presently 500 and 800 Hz, designed to accommodate most popular cinema loudspeakers. Other frequencies can be programmed by user-made headers.
- **Low frequency driver time delays to ensure correct time alignment of low frequency driver and HF horn signals**. The time delay value is programmable by means of 18 pin DIP headers containing resistors. Standard factory values are presently 1.9 ms and 0.8 ms, designed to accommodate most popular cinema loudspeakers. Other delays can be programmed by user-made headers.
- **Low-pass filters for use with two (Ls, Rs) surround bass bins**. Two pole filters are provided, programmable with a 16 pin DIP header. As delivered, this is the same header furnished on the Cat. No. 682 and is reversible to accommodate either 50 or 100 Hz Butterworth filter characteristics. These filters plus the high-pass filters on the Cat. No. 682 provide the ability to bi-amp the surround channels in order to improve the bass response and the power handling capabilities of these channels.
- **A secondary crossover system with manual adjustments for use when in Bypass**.
- **All adjustments necessary to permit correct alignment and equalization of a complete bi-amplified system.**

B.2 Installation

Remove Cat. No. 682 from the CP500 and move jumpers **J901, J3, J4, J5** to the "**YES**" position to enable the crossover features of the Cat. No. 683.

The Cat. No. 683 is installed in the left-most slot (J1) in the CP500 after jumpers and headers are configured. When the Cat. No. 683 is installed in a CP500, the **MAIN** screen channel connector on the rear panel becomes the **LF** output connector. The HF horn outputs are available at the additional rear panel connector, **XOVER OUT**, located to the right of the main output connector. The Left and Right Surround bass speaker outputs are also available at this connector. An ID pin on the card automatically tells the Cat. No. 684 System Controller card that a crossover card is present.

B.3 Alignment

B.3.1 Screen Channels

Jumpers J100, J200, and J300 allow the low frequency portion of the designated channels to be delayed by 1.9 ms or 0.8 ms when the jumper is placed in the “DELAY” position. This compensates for the time offset caused by high frequency drivers being behind the low frequency drivers in contemporary stage speakers. With the jumper in the "DELAY" position, sound produced by the low frequency speakers is delayed to cause the low and high frequency energy to reach the listener at the same time. There is no low frequency delay when the jumper is set to “NO DELAY”. The factory setting is “DELAY”.

Board locations RN102, RN202, RN302, and RN600 select the desired crossover frequency and locations RN101, RN201, and RN301 select the time delay. For large horns, the correct setting is usually 500 Hz and 1.9 ms. For small horns, 800 Hz and 0.8 ms is usually correct. Check the loudspeaker manufacturer’s specifications for details. Be sure to use the same Bypass crossover frequency setting header as the screen channels use. Carefully install the correct headers in the appropriate socket locations being sure to orient the header correctly.

Set all power amplifier gain pots to the maximum. Carefully ensure that only HF outputs are routed to the HF horns to avoid damage from excessive low frequency excursion of HF horn diaphragms.

Place microphones in the auditorium and connect the microphones and multiplexer (if available) to the CP500.

Set the fader to “0”. Enter the CP500 B-chain EQ screen and select Left channel. Gradually turn up the fader by moving the pointer to the fader slider on the EQ screen. Verify by ear or spectrum analyzer or both that the low frequency driver and HF horn are each producing their appropriate halves of the spectrum.

Turn the fader up until a satisfactory level is achieved in the auditorium. Set all EQ controls to flat. Using the Left trimpot on the edge of the CN683, adjust the relative HF horn output level so that the low frequency driver and HF horn output levels match in the octaves just above and just below the crossover frequency. For example, if the crossover frequency is set to 500 Hz, then the level from 250-500 Hz should match that from 500-1,000 Hz.

Now equalize the room in the usual fashion, adjusting treble and bass controls first and 1/3 octave controls next. The output level is set in exactly the same manner as in a non-biamplifed system.

Set up and equalize the Right and Center channels in the same manner.

B.3.2 Surround Channel Bass Drivers

Both the Cat. No. 682 Output card and the Cat. No. 683 have reversible filter headers labeled 50/100 Hz for the surround channels. Ensure that the headers on both cards are set to the same frequency, chosen to suit the low frequency handling capability of the surround speakers in use. If you have separate surround bass drivers, it is probably best to set both headers to 100 Hz in order to improve the low frequency power handling ability of the surround channel.

Enter the B-chain EQ screen and select Left Surround. Set the EQ to flat. Adjust the Ls trimpot on the Cat. No. 683 so that the level in the room is reasonably equal in the 40-100 Hz and 100-200 Hz regions on average. Now adjust the EQ controls as usual.

B.3.3 Bypass Crossover Subsystem

In a bi-amplified system, the bypass subsystem must have its own electronic crossover as well, to avoid damage to the HF horns from low frequency signals. This channel is set up differently than the normal screen channels in the following ways:

- Set up is accomplished with trimpots
- A trimpot on the **Cat. No. 683** now governs the **overall** Bypass Output Level
- The trimpot on the **Cat. No. 682** formerly used to set the Bypass Output Level now governs the bypass **low frequency driver output level (or "balance")** relative to the overall setting above.

In order to perform these adjustments, select the A-chain alignment screen (Menu/Alignment/A-chain alignment/Manual EQ). Turn the fader to select the EQ mic and press OK. This displays the real-time analyzer screen connected to the multiplexer (optional) and microphone(s) in the auditorium.

Play a loop of Cat. No. 69 pink noise test film. Press the Bypass switch (S8. lower right corner) to select bypass mode. Now set the **LF balance pot on the Cat. No. 682** for equal average levels in the octaves just below and just above the crossover frequency (usually 500 Hz).

Next, adjust the **bypass level pot (now on the Cat. No. 683)** by playing a typical reel of film and adjusting the pot to a suitable level. Note that the pink noise signal on the Cat. No. 69 test film is not at Dolby level, but approximately 15 dB below it. Therefore a preliminary setting can be achieved by setting the SPL to 70 dB while playing Cat. No. 69 pink noise. This is an approximate adjustment and must be confirmed with actual film program material to ensure that bypass works correctly should it be needed.

Bear in mind that when the unit first switches into Bypass mode, (when power is first applied, for example) the fader level in Bypass will be set to 7. When in Bypass mode, the fader setting can be adjusted and will be remembered until Bypass power is interrupted. Adjustments made to the fader level while not in Bypass do not affect the setting of the fader for Bypass mode.

B.4 Special Applications

The Cat. No. 683 was designed to be very flexible. The factory supplies standard programming headers to suit the usual types of speakers in service. Over time, other headers may become available. Contact your dealer.

It is also possible to make your own headers, using 1% resistors and DIP sockets. The information below describes how to do this. This process should not be undertaken without a complete understanding of your requirements. Consult the speaker manufacturer's information if you are unsure.

B.4.1 Time Delay

The values given in the table are for a 1.9 ms delay. The delay can be set by scaling ALL resistors in the same manner. Larger resistors give longer delays. The delay for a 1.9 ms header is constant within 10% up to about 800 Hz, and this upper frequency will scale with the delay. Shorter delays are constant to higher frequencies.

1.9 ms Header	
DIP Pins	**Resistance**
1-18	44.2K
2-17	1.43K
3-16	499
4-15	44.2K
5-14	1.43K
6-13	499
7-12	44.2K
8-11	1.43K
9-10	499

Example: Suppose you wish to create a 1.2 ms time delay. Multiply each resistor value above by 1.2/1.9. The table shows the resulting values rounded to the nearest standard 1% resistor value.

1.2 ms Header	
DIP Pins	**Resistance**
1-18	28.0K
2-17	909
3-16	316
4-15	28.0K
5-14	909
6-13	316
7-12	27.4K
8-11	909
9-10	316

B.4.2 Crossover Frequency

The values given in the table are for a 500 Hz crossover frequency. The frequency can be set by scaling ALL resistors in the same manner. Larger resistors give lower frequencies.

500 Hz header	
Pins	**Resistance**
1-16	10.0K
2-15	10.0K
3-14	6.98K
4-13	13.0K
5-12	8.45K
6-11	8.45K
7-10	16.9K
8-9	none

Example: Suppose you wish to create a 630 Hz crossover frequency. Multiply each resistor value above by 500/630. The table shows the resulting values rounded to the nearest standard 1% resistor value.

630 Hz header	
Pins	**Resistance**
1-16	7.87K
2-15	7.87K
3-14	5.49K
4-13	10.2K
5-12	6.65K
6-11	6.65K
7-10	13.3K
8-9	none

B.5 Headers Available

Factory-made headers currently shipped with the product are:

Channel	Function	Dolby Part no.
LCR and Bypass	500 Hz Crossover	74114
LCR and Bypass	800 Hz Crossover	74117
LCR	1.9 ms LF Delay	74115
LCR	0.8 ms LF Delay	74116

The Ls and Rs crossover frequency setting header is available only as the 50/100 Hz reversible header shipped with the product.

B.6 Jumpers and Headers

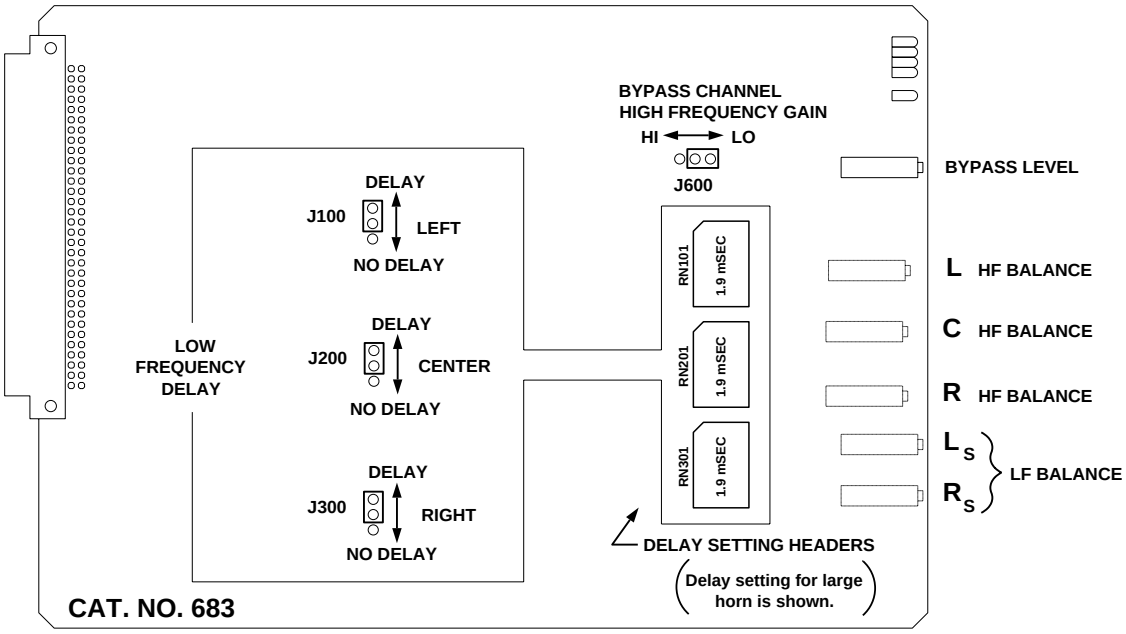


Figure B - 1. Cat. No. 683.

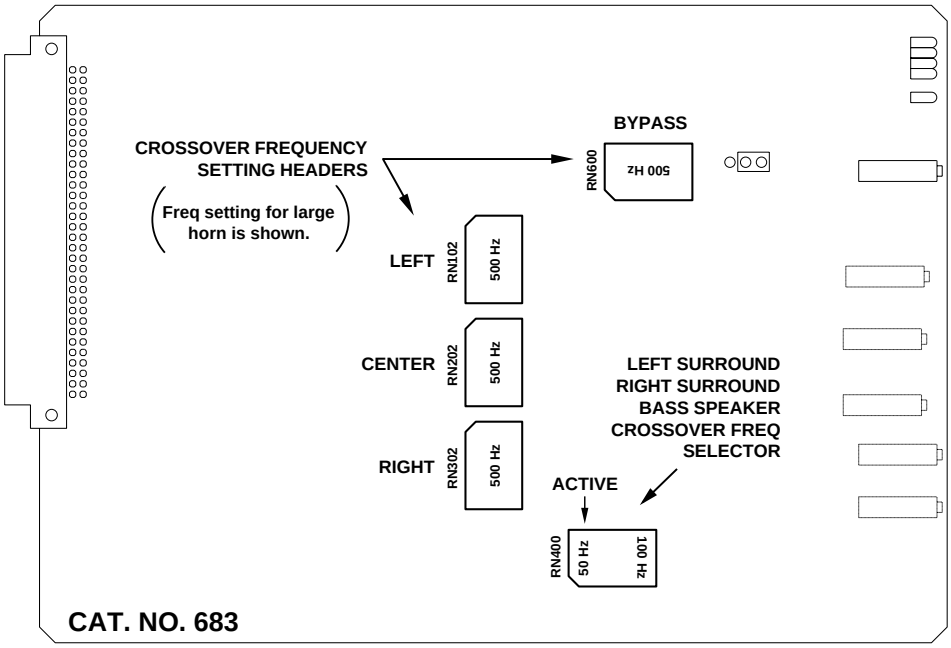


Figure B - 2. Cat. No. 683.

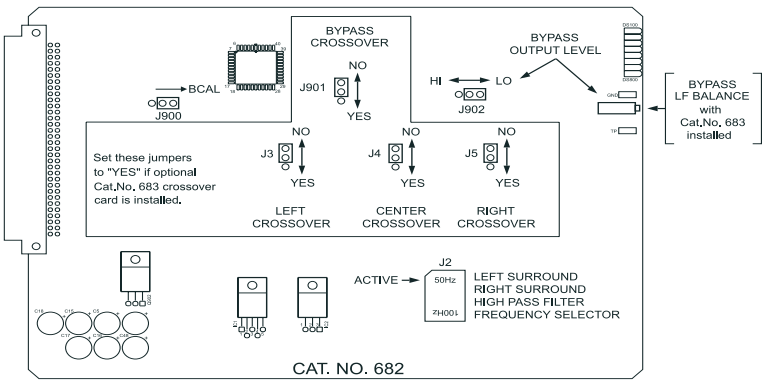


Figure 3 - 1. Cat. No. 682.

Crossover Select Jumpers [NO]

J3 Left Channel

J4 Center Channel

J5 Right Channel

J901 Bypass Audio Channel

These jumpers route the designated signals through an optional Cat. No. 683 crossover card. If the Cat. No. 683 card is installed, these jumpers should be set to the "YES" position. If the optional Cat. No. 683 is not present, these jumpers should be set to the "NO" position. The jumpers are set to the "NO" position at the factory.

NOTE: If bypass audio is routed to the optional Cat. No. 683 crossover card, the bypass portion of the crossover circuitry must be functioning in order to produce a bypass audio output.

J900 Bypass Calibration

This jumper inserts a calibrated pink noise signal into the bypass system for level and (optional) crossover adjustments. The calibration signal is enabled when the jumper is in the "BCAL" position and is disabled otherwise.

NOTE: It is important to move the jumper to the disabled position after calibration is complete so that the bypass signal path remains completely isolated from any possible erroneous signals in the signal path.

J902 Bypass Channel Output Level Select [LO]

This jumper, along with the bypass gain adjustment potentiometer (RV901), adjusts the level of the bypass channel. The jumper provides a "coarse" gain setting and the potentiometer provides a "fine" gain adjustment. The "HI" jumper position can be used to produce a higher output level range on the bypass channel. This jumper is factory set to the "LO" position.

NOTE: If Cat. No. 683 Crossover card is installed, the preferred setting for this jumper is HI.

J2 L and R Surround High-Pass Filter Frequency Select [50Hz]

This header sets filter circuits to the indicated high-pass frequency. Signals below this frequency are attenuated in order to prevent distortion or damage to surround speakers that are unable to handle extreme low frequency energy.

NOTE: The function of the Bypass Output Level control changes to Bypass Low Frequency Balance Control if a Cat No. 683 Crossover Card is installed.

CP500 Backplane Connector Pin Assignments

1. Automation Connector:

Pin Number	Function
1	SK1 Format Select Input
2	SK2 Format Select Input
3	SK3 Format Select Input
4	SK4 Format Select Input
5	SK5 Format Select Input
6	SK6 Format Select Input
7	SK7 Format Select Input
8	SK8 Format Select Input/or STEP (in Automation Sequential mode)
9	Mute On/Off Input
18	Format Status Bit 0
19	Format Status Bit 1
20	Format Status Bit 2
25	Projector Status Output
12	Signal Ground

2. Serial Data Connector:

Pin Number	Signal Name
1	N/C
2	Transmitted Data
3	Received Data
4	Looped back to pin 6
5	Signal Ground
6	Looped back to pin 4
7	Looped back to pin 8
8	Looped back to pin 7
9	N/C

3. Motor Start Connector:

Pin Number	Signal Name
1	Motor Start Relay, Proj 1
2	Proj 1 Changeover, pulsed contacts
3	Changeover relay, closed selects Proj 2
4	Proj 2 Changeover, pulsed contacts
5	Ground
6	N/C
7	N/C
8	N/C
9	Motor Start Relay, Proj 2

4. Bypass / Remote Connector:

Pin Number	Signal Name
1	Bypass Power Transformer Connection, 16-18 Vac
2	Bypass Power Transformer Connection, 16-18 Vac
3	Remote Control Unit V+
4	Remote Control Unit Data
5	Remote Control Unit Ground
6	Remote Auditorium Fader +
7	Remote Auditorium Fader Ground
8	N/C

5. Main / LF Output Connector:

Pin Number	Signal Name
1	Left Channel
2	Signal Ground
3	Right Channel
4	Signal Ground
5	Center Channel
6	Signal Ground
7	Left Surround Channel
8	Signal Ground
9	Right Surround Channel
10	Signal Ground
11	Sub Woofer Channel
12	Signal Ground
13	Hearing Impaired Channel
14	Signal Ground
15	Mono Surround Channel

6. Crossover Output Connector **(Used With Cat. No. 683 Installed):**

Pin Number	Signal Name
1	Left Channel HF
2	Signal Ground
3	Right Channel HF
4	Signal Ground
5	Center ChannelHF
6	Signal Ground
7	Left Surround Channel LF
8	Signal Ground
9	Right Surround Channel LF
10	Signal Ground

7. Optical 1 Input Connector:

Pin Number	Signal Name
1	Projector 1 Left Channel +
2	Projector 1 Left Channel -
3	Signal Ground
4	Projector 1 Right Channel +
5	Projector 1 Right Channel -
6	Signal Ground
7	N/C
8	N/C
9	Signal Ground

8. Optical 2 Input Connector:

Pin Number	Signal Name
1	Projector 2 Left Channel +
2	Projector 2 Left Channel -
3	Signal Ground
4	Projector 2 Right Channel +
5	Projector 2 Right Channel -
6	Signal Ground
7	N/C
8	N/C
9	Signal Ground

9. Mic. Input Connector:

Pin Number	Signal Name
1	Mic1+
2	Mic1-
3	Mic2 signal
4	Mic2 ground
5	N/C
6	Mic1 ground
7	Mic Multiplexer V+
8	Mic Multiplexer Gnd
9	Mic Multiplexer Data

10. Accessory Rack Analog Connector:

Pin Number	Signal Name	Signal Description
1	AccOptByp	Mono input to Cat 682 for Bypass Operation
2	X15	Direct Input to Cat 682
3	X14	Direct Input to Cat 682
4	X13	Direct Input to Cat 682
5	X12	Direct Input to Cat 682
6	X11	Direct Input to Cat 682
7	X10	Direct Input to Cat 682
8	AccSW	Ouput to Acc Rack from Cat 662
9	AccC	Ouput to Acc Rack from Cat 662
10	AccRS	Ouput to Acc Rack from Cat 662
11	AccLS	Ouput to Acc Rack from Cat 662
12	AccR	Ouput to Acc Rack from Cat 662
13	AccL	Ouput to Acc Rack from Cat 662
14	AccNRS	Input to noise reduction resources*
15	AccNRC	Input to noise reduction resources*
16	AccNRRe	Input to noise reduction resources*
17	AccNRLe	Input to noise reduction resources*
18	AccNRR	Input to noise reduction resources*
19	AccNRL	Input to noise reduction resources*
20	Ground	Signal Ground
21	Ground	Signal Ground
22	Ground	Signal Ground
23	Ground	Signal Ground
24	Ground	Signal Ground
25	Ground	Signal Ground
26	Ground	Signal Ground
27	Ground	Signal Ground
28	Ground	Signal Ground
29	Ground	Signal Ground
30	+13VDC	Power Supply
31	+13VDC	Power Supply
32	-12VDC	Power Supply
33	-12VDC	Power Supply
34	Ground	Signal Ground
35	OPTBUSSR	Optical Pre Amp Output Right Channel
36	Ground	Signal Ground
37	OPTBUSSL	Optical Pre Amp Output Left Channel

* Dolby Level is 388 mV.

11. Accessory Rack Digital Connector:

Pin Number	Signal Name	Signal Description
1	Signal Ground	Signal Ground
2	OPTLRCK	Left / Right Clock from Optical A/D
3	RETSD2	Serial Data 2 Return
4	RETSD1	Serial Data 1 Return
5	RETSD0	Serial Data 0 Return
6	RETWCK	Word Clock Return
7	RETBCK	Serial Bit Clock Return
8	ACCBAUD	Baud Rate Clock
9	ACCLINK	Accessory Rack Present
10	RET256FS	256 X Sample Rate Clock Return
11	ACCRXD	Accessory Rack Received Data
12	ACCTXD	Accessory Rack Trasmitted Data
13	Signal Ground	Signal Ground
14	OPTBCK	A/D Bit Clock form Optical A/D
15	OPTDAT	Serial Data from Optical A/D
16	RETOPTDAT1	Spare Data Line 1
17	RETOPTDAT2	Spare Data Line 2
18	!ACCEN	Enable Accessory Rack
19	ACCSD2	Accessory Rack Serial Data 2
20	ACCWCK	Accessory Rack Word Clock
21	ACCBCK	Accessory Rack Bit Clock
22	ACCSD1	Accessory Rack Serial Data 1
23	ACC256FS	Accessory Rack 256 X Sample Rate Clock
24	ACCSD0	Accessory Rack Serial Data 0
25	ACC512FS	Accessory Rack 512 X Sample Rate Clock

12. 6 Channel Input Connector* :

Pin Number	Signal Name	Signal Description
1	Signal Ground	
2	EXT3	Right Surround Channel External Input
3	Signal Ground	
4	Signal Ground	
5	Signal Ground	
6	Signal Ground	
7	Signal Ground	
8	Signal Ground	
9	Signal Ground	
10	Signal Ground	
11	Signal Ground	
12	Signal Ground	
13	Signal Ground	
14	EXT0	Left Channel External Input
15	EXT2	Left Surround Channel External Input
16	Signal Ground	
17	EXT1	Right Channel External Input
18	Signal Ground	
19	Signal Ground	
20	EXT4	Center Channel External Input
21	Signal Ground	
22	Signal Ground	
23	Signal Ground	
24	EXT5	Sub Woofer Channel External Input
25	Signal Ground	

* Dolby Level is 300 mV at these set of inputs.

13. Reader 1 and Reader 2 Input Connector:

Pin Number	Signal Name	Signal Description
1	N/C	
2	N/C	
3	N/C	
4	TTCO	Row Clock Return
5	TCOGND	Row Clock Common
6	FTCO	Row Clock Send
7	TSCO	Pixel Clock Return
8	SCOGND	Pixel Clock Common
9	FSCO	Pixel Clock Send
10	N/C	
11	N/C	
12	N/C	
13	N/C	
14	VO	Differential Video V0
15	VOGND	V0 Common
16	+15VIDEO	+15VDC
17	V1	Differential Video V1
18	V1GND	V1 Common
19	-15VIDEO	-15VDC
20	N/C	
21	N/C	
22	N/C	
23	N/C	
24	N/C	
25	N/C	

The following fold-out pages are for reference:

System Setup Menu Tree

Alignment and Diagnostics Menu Tree

Signal Block Diagram

Backplane Interconnections Schematic

Basic Functions

The basic functions of the Dolby Digital subsystem are:

- Video Acquisition
- Sync Finding
- Thresholding and Bit Packing
- Error Correction and De-interleaving
- FIFO Buffering and DAC Clock Generation
- Soundhead Delay
- AC-3 Transform Decoding
- Sample Rate Conversion

Dolby Digital data is printed in the “interperf” area, between sprocket holes, adjacent to the normal analog tracks of standard 35mm release print motion picture film. Blocks of 76 X 76 “fixels” or film elements contain the audio data, along with synchronization, error correction, and auxiliary data. The film is passed through a mechanical transport, generally mounted on top of the projector, where the motion of the film is stabilized, and the interperf area is illuminated with white light. A CCD (charge coupled device) optical line scanner produces an electrical signal representing a video image of each interperf area due to the horizontal scanning of the CCD and the vertical motion of the film with respect to the CCD. This signal contains the information necessary to reconstruct the 6 audio channels.

Extensive Digital Signal Processing (DSP) techniques are applied to the video signal described above, using a variety of specific hardware and general purpose DSP cards, connected in a pipeline architecture, with each card performing part of the overall task, and passing the results to the next card over a serial data path.

Video Acquisition
The analog video signal from the CCD is digitized by an A/D converter at a rate which tracks the film speed. The converted samples are written into a bank of RAM to form an image of the interperf area in RAM. Sequential interperf images are transferred to one of four DSPs on two dual DSP cards where the images may be processed and data extracted.

Sync Finding
Each block of RAM is searched by the associated DSP card for synchronization patterns in the four corners of the image. When sync. is found, the locations of the bits within the image are calculated, and the values at those locations are obtained. An array of these samples is then further processed.

Thresholding and Bit Packing
Each dual DSP card then accomplishes Thresholding on the block of 5776 8-bit values representing the center of each bit on the film, for each interperf area. Based on the statistics of light and dark bits, which are accessible via “mailbox memory”

from each DSP, a threshold value is derived, above which a fixel is determined to be clear, representing a digital “1”, and below which the fixel is determined to be a “0”. Having reduced each 8-bit sample value to a single bit, each DSP packs groups of 8 bits of data and 8 a bit of erasure information into a serial stream, and passes this block of 722 words to the next stage.

Error Correction and De-interleaving

The Cat. No. 673 Card accepts blocks of data alternately from each of the video processor DSPs, recombining the separately processed alternate perf data streams into a single AC-3 coded data stream. Reed-Solomon Error correction decoding is performed, using check bytes encoded during the film recording process to correct errors in the data due to dirt, scratches, misalignment, or illumination non-uniformity. The data, having been interleaved within a perf to reduce the effect of block errors (dirt, etc.) is now de interleaved, returning the data to the format used by the AC-3 decoder.

FIFO buffering and DAC Clock Generation

The data leaving the Error Correction process comes in bursts of 256 words approximately every 10 milliseconds, depending on film speed. The DSP of the Cat. No. 673 card implements a FIFO (First-In-First-Out) buffer to smooth out the bursts of data from the Error Correction process into a steady stream of data to the Transform Decoder section, while reconciling any difference in average data rates between the incoming data and the output sample rate of the audio. Using fullness of the buffer as the controlling parameter, the FIFO card slowly adjusts the frequency of the output sample clock until equilibrium is reached.

Soundhead Delay

A delay is required in the CP500 to compensate for the time between when the data is read (at the Digital Soundhead) and when the audio is to be reproduced in sync. with the picture. Dolby Digital data is recorded 6 frames in advance of the analog sound track, which is itself placed 20 frames in advance of the picture gate. If the SR•D data is read 40 frames above the picture gate, for instance, the data must be delayed by 40+20+6 = 66 frames, or 264 perforations, or about 2-1/2 seconds. This delay is accomplished by storing incoming data in RAM and sending it out at a later time, determined by the delay setting.

AC-3 Transform Decoding

The Delayed data is now passed to a Zoran Z38000 DSP card which performs Dolby AC-3 decoding. A full explanation of this process is beyond the scope of this manual, but it may briefly be described as a method of low bit rate perceptual coding of audio data using frequency-domain information as the transmitted data, rather than conventional time-domain PCM coding. The composite data stream is separated into three sets of two-channel data. Each of the channel pairs is then fully decoded into PCM audio, and sent serially to the DAC Card.

Sample Rate Conversion
The sample rate of the data comming from the film is determined ultimately by the projector speed. For correct operation of the CP500, all data must be at a fixed sample rate. The Cat. No. 680 Bit Rate Converter Card performs this function.

Discussion of Changeover Technique

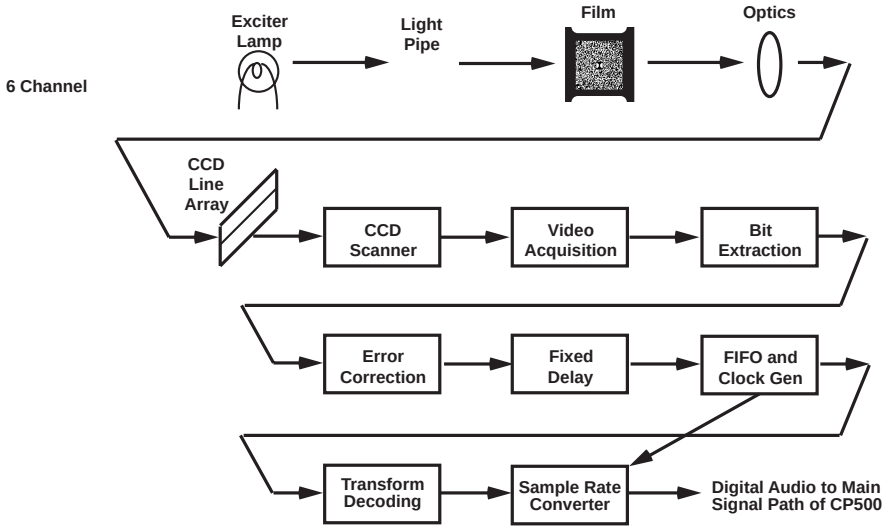
Projector changeover sensing is provided through the 9 pin female D-connector "**Motor Start**" on the CP500 rear panel. In single projector applications, all terminals may be left unconnected, and the CP500 will assume projector 1. If reversion to analog tracks is desired, the motor start signal must be provided, otherwise the CP500 will not revert to analog, as without a motor running, the CP500 assumes no analog track is playing. The motor start signals are used to signal the CP500 in advance of a changeover in order that the video front end can switch to video from the incoming reel prior to the actual picture changeover. The changeover to the incoming projector CCD signal will be made at a time after the Motor Start signal equal to (8 seconds minus the fixed delay value.) Removal of the Motor Start signal prior to video changeover resets the changeover timing, allowing the operator to “jockey” the placement of film in the projector for between 1.5 and 7 seconds, depending on delay setting, without initiating a changeover. Verification of changeover is confirmed by the Changeover signal at the actual instant of changeover. If no Motor Start signal is asserted, the video input follows the changeover signal.

Auxiliary Data Channel

The Auxiliary data channel may be monitored using an RS-232 compatible device. The data format is RS-232 standard 115,200 bits/second, 8 bit data, no parity, 1 start bit, 1 stop bit. Connection to the data channel is provided through the DB-9 female connector, "**Serial Data**", on the rear panel. The data channel supports RS-232C signal levels. The connector is wired as DCE (Data Common Equipment) with TXD (Transmit Data) on pin 2 and signal common on pin 5. Pins 4 and 6 are shorted, as are pins 7 and 8, to allow direct connection to a standard PC serial port. The connector case is wired to chassis ground.

Serial Data Connector Pin assignments	
1	n.c.
2	Serial Data Out
3	Serial Data In
4	Connected to pin 6
5	Signal Ground
6	Connected to pin 4
7	Connected to pin 8
8	Connected to pin 7
9	n.c.

Dolby Digital Decoder Block Diagram



Thanks to such developments as multichannel sound, the motion picture viewing experience today is more exciting and involving than ever before. And what the audience hears today is very much the result of a continuing effort to improve film sound originally undertaken by Dolby Laboratories more than twenty years ago. Indeed, the evolution of motion picture sound over the past two decades is, in great part, that of Dolby film sound technologies.

Optical Sound

The photographic or "optical" soundtrack was the first method of putting sound on film, and today it remains the most popular.

An opaque area adjacent to the picture contains narrow, clear tracks that vary in width with variations in the sound. As the film is played, a narrow beam of light from an exciter lamp in the projector's soundhead shines through the moving tracks. Variations in the width of the clear tracks cause a varying amount of light to fall on a solar cell, which converts the light to a similarly varying electrical signal. That signal is amplified and ultimately converted to sound by loudspeakers in the auditorium.

Several advantages of optical sound have contributed to its universal acceptance, the foremost being economy. For one thing, the soundtrack is printed photographically on the film at the same time as the picture. For another, the soundtrack can last as long as the picture, which—with care—can be a long time indeed. A further benefit is that the optical soundhead within the projector is itself economical and easily maintained.

Motion pictures with sound were first shown to significant numbers of movie-goers in the late 1920s. By the mid-1930s, the "talkies" were no longer a novelty, but a necessity, and many thousands of theaters were equipped in that short time to show films with optical soundtracks. This phenomenally rapid acceptance of a sophisticated new technology was not without drawbacks, however. Equipment was installed in theaters so rapidly that there was no time to take advantage of improvements which were occurring on an almost daily basis.

A good example is loudspeaker design. The first cinema loudspeakers had very poor high-frequency response. Speakers with superior high-frequency capability became available within just a few years. But there was no time to retrofit the original systems with new units, because engineers were too busy equipping other theaters with their first sound installations.

This caused a dilemma for soundtrack recordists. Should the tracks be recorded to take advantage of the improved speakers, or should they be prepared to sound best on the many older installations already in place? Given that it was impractical to release two versions of a given title, the only alternative was to tailor soundtracks

to the older speakers. The result was to ignore the improved high-frequency response of the newer, better units.

To forestall compatibility problems, in the late 1930s a *de facto* standardization set in, the theater playback response that today is called the "Academy" characteristic. Theater owners knew what to expect from the films, and therefore what equipment to install. Directors and sound recordists knew what to expect from theater sound systems, and thus what kind of soundtracks to prepare. The result was a system of sound recording and playback that made it possible for just about any film to sound acceptable in any theater in the world. It was also a system, however, without the flexibility to incorporate improvements beyond the limitations that existed in the 1930s.

Even with these limitations, for years optical film sound provided higher quality sound than home phonographs and radios. But by the late 1960s and early 1970s, superior hi-fi stereo systems had been installed in so many homes that a significant and influential proportion of the moviegoing public was used to better sound at home than could be heard in the theater.

Magnetic Sound

In the 1950s, a new method of putting sound on film was introduced as an alternative to the optical soundtrack. After the picture is printed, narrow stripes of iron oxide material similar to the coating on magnetic recording tape are applied to the film. The sound is then recorded on the magnetic stripes in real time. In the theater, the film is played back on projectors equipped with magnetic heads, similar to those on a tape recorder, mounted in a special soundhead assembly called a "penthouse."

Magnetic sound was a significant step forward, and at its best provided much improved fidelity over the conventional optical soundtrack. Magnetic sound also permitted the multiple tracks required by stereophonic sound. The voice of an actor appearing to the left, center, or right of the picture could be heard coming from speakers located at the left, center, or right of the new wide screens also being introduced at this time. Music took on a new dimension of realism, and special sound effects could emanate from the rear or sides of the theater. The two main magnetic systems adopted were Twentieth Century Fox's four-track 35 mm CinemaScope system introduced for *The Robe*, and the six-track Todd-AO system first used for such 70 mm films as *Oklahoma!* and *Around The World in 80 Days*.

Many theaters were equipped for magnetic sound in the 1950s, even though the playback equipment was expensive. Many films were issued with magnetic soundtracks, although magnetic prints were, and remain, much more expensive than optical sound prints (35 mm magnetic prints cost at least double their optical equivalents, and today's 70 mm magnetic prints cost up to fourteen times as much).

By the 1970s, however, the film industry declined overall, with fewer films and fewer theaters. The expense of magnetic release prints, their comparatively short life compared to optical prints, and the high cost of maintaining magnetic theater equipment led to a massive reduction in the number of magnetic releases and theaters capable of playing them. Magnetic sound came to be reserved for a only handful of first-run engagements of "big" releases each year. By the mid-1970s, movie-goers were again usually hearing low fidelity, mono optical releases again, with only an occasional multitrack stereo magnetic release.

Dolby Gets Involved

The situation that prevailed in the mid-1970s completely changed by the late 1980s. Thanks to new technology and a turnaround in the financial decline of the industry, almost all major titles today—accounting for 80% of the boxoffice—are released with wide-range multichannel stereo soundtracks.

The breakthrough was the development of by Dolby Laboratories of a highly practical 35 mm *stereo* optical release print format originally identified as Dolby Stereo. In the space allotted to the conventional mono optical soundtrack are two soundtracks that carry not only left and right information as in home stereo sound, but also information for a third center-screen channel and—most notably—a fourth surround channel for ambient sound and special effects.

This format not only enabled stereo sound from optical soundtracks, but higher quality sound as well. Various techniques are applied both when the soundtrack is recorded and when it is played back to improve fidelity. Foremost among these is Dolby noise reduction to lower the hissing and popping associated with optical soundtracks, and loudspeaker equalization to adjust the theater sound system to a standard response curve.

All this means that these prints can be reproduced in theaters with Dolby-manufactured cinema processors with far wider frequency response and much lower distortion than conventional soundtracks. In fact, the Dolby optical format has led to a new worldwide playback standard (ISO 2969) for wide-range stereo prints, just as the "Academy" characteristic applies for mono prints.

An important advantage of the Dolby optical format is that the soundtracks are printed simultaneously with the picture, just like mono prints. Thus a four-channel stereo release print costs no more to make than a mono print (although it is more expensive to record and mix in stereo than in mono). Conversion to Dolby optical is relatively simple—more than 28,000 theaters worldwide have done so—and, once the equipment has been installed, very little maintenance is required, particularly when compared to magnetic stereo playback systems. Moreover, print life is as long as that of conventional mono optical prints, unlike magnetic prints. The result is multichannel capability equaling that of four-track magnetic 35 mm

(made all but obsolete by the stereo optical format), consistently higher fidelity, and few of the drawbacks of magnetic formats.

Much of the new technology, including noise reduction and equalization, also is applied to 70 mm magnetic releases (also originally designated as Dolby Stereo). Although 70 mm release prints continue to be very expensive, Dolby improvements brought a resurgence of interest in this “big” format for road shows where the ultimate in picture and sound presentation is particularly likely to be reflected in box office figures. There are six magnetic tracks on 70 mm film, two of which carry low bass effects. Some 70 mm films also use a technique developed by Dolby Laboratories to provide two separate surround channels in addition to the left, center, right, and bass effects screen channels.

The Next Step: Dolby SR

In 1986, Dolby Laboratories introduced a new professional recording process called Dolby SR (spectral recording). Like Dolby noise reduction, it is a mirror-image, encode-decode system used both when a soundtrack is recorded and when it is played back. It provides more than twice the noise reduction of Dolby A-type, and, moreover, permits capturing loud sounds with wider frequency response and lower distortion.

35 mm optical soundtracks treated with Dolby SR instead of Dolby A-type not only sound superb in the more than 10,000 theaters equipped with special SR processors, they also play back satisfactorily in *any* theater. As a result, most Dolby SR titles are released single inventory. In fact, in theaters equipped with regular A-type processors, the moderate compression that results helps prevent the louder peaks on SR soundtracks from overloading the theater's sound system. This feature further obviates the need for separate mixes and releases.

And Now - Dolby Digital

The newest film sound development from Dolby Laboratories puts a six-channel *digital* optical soundtrack in addition to a four-channel SR analog track on the same 35 mm prints. This Dolby Digital format is yet another significant step forward in film sound, providing independent left, center, right, left surround, and right surround channels, plus a sixth channel for bass effects.

In addition to multiple channels, the Dolby Digital track provides extraordinary dynamic capability, wide frequency, range low distortion, and relative immunity to wear and tear. The format has already proved its unique combination of high quality, reliability, and practicality in theaters around the world. And because the digital track is right on the film, the format has none of the drawbacks of separate disc systems.

As with previous Dolby developments, Dolby Digital does not obsolete existing theater installations. The prints can be played conventionally in any theater, while the digital optical track can be reproduced by adding digital readers to the projectors and a digital decoder which interfaces with the theater's existing Dolby cinema sound processor.

About Dolby AC-3

Conventional digital audio is coded by a technique called pulse code modulation (PCM). As good as it sounds, however, PCM-coded audio coded takes up so much more space than analog audio that it was necessary to invent an entirely new medium, the Compact Disc, to bring digital sound into the home.

It would be very difficult to provide even *one* channel of conventional PCM digital audio on a movie print, let alone the 5.1 channels widely regarded as ideal for proper cinema stereo. Yet for compatibility, ease of distribution, economical release print manufacturing, and overall cost-effectiveness, nothing beats the classic, on-film optical soundtrack.

Therefore, to make it possible to put a *digital* optical soundtrack on release prints, Dolby Laboratories developed with a new, far more efficient way to code digital audio, a technique which provides 5.1 channels of sound in less space than just one channel on a CD. This new technique is called Dolby AC-3.

Just like the Dolby Surround technology developed originally for motion picture sound, Dolby AC-3 can be used in a wide variety of other applications, including consumer formats. For example, AC-3 will be used to provide 5.1 channel surround sound with the U.S. HDTV system and digital video discs. It is already being used on compatible Laser Discs of movies, including many originally released in the Dolby Digital format. Equipment for home Dolby AC-3 playback has come onto the market as well.

Making Films Sound Better

Dolby format release prints and the equipment which reproduces them are only links in a chain that extends from the original location, through the dubbing theater, to the laboratory, and finally into the theater. Developments like Dolby SR and Dolby Digital ensure that the soundtrack itself remains one of the strongest links. But just like high-quality CDs played on the best home stereo equipment, Dolby formats are capable of carrying a higher fidelity “message” than previously—and so can reveal the quality of each step in the recording, mixing, and dubbing processes. Taking advantage of the new formats has thus required new approaches to soundtrack production. Admittedly, the results can vary—the final reproduced soundtrack can be no better than the elements it comprises—but Dolby film sound at its best means not only better quality sound, but sound in the theater that consistently realizes the director’s original intentions.

While Dolby's involvement with film sound first achieved wide recognition with the spectacular audio effects of such films as *Star Wars*, it has long since come to mean more than just special or dramatic effects. The objective is high quality sound reproduction overall—dialogue and music, as well as effects. Dolby technology is a means, not an end. It can be likened to an artist's palette that provides the director with a full range of colors, where before there were but a few. Above all, Dolby formats have been developed to enhance that very special experience of going to the movies.