Dolby® CP650
Digital Cinema Processor

Installation Manual

Issue 6 Part Number 91569

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Issue 6
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Regulatory Notices

FCC

NOTE: 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.

Important Safety Instructions

1. Read these instructions.
2. Keep these instructions.
3. Heed all warnings.
4. Follow all instructions.
5. Do not use this apparatus near water.
6. WARNING: To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture.
7. Clean only with dry cloth.
8. Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
9. No naked flame sources, such as lighted candles, should be placed on the apparatus.
10. Protect the power cord from being walked on or pinched, particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
11. Only use attachments/accessories specified by the manufacturer.
12. Unplug this apparatus when unused for long periods of time.
13. Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as the power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.

14. Do not expose the apparatus to dripping or splashing and no objects filled with liquids, such as vases, shall be placed on the apparatus.

15. CAUTION: Troubleshooting must be performed by a trained technician. To reduce the risk of electric shock, do not attempt to service this equipment unless you are qualified to do so.

16. Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong is provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.

17. This apparatus must be earthed (grounded) by connecting to a correctly wired and earthed power outlet.

18. Ensure that your mains supply is in the correct range for the input power requirement of the unit.

19. In order to reduce the risk of electrical shock, the power cord must be disconnected when the power supply assembly is removed.

20. The mains power disconnect device for this unit is the plug-in mains cord rather than a power switch. The mains cord must remain readily accessible for disconnecting mains power.

21. This equipment is designed to mount in a suitably ventilated 19” rack. Ensure that any ventilation slots in the unit are not blocked or covered.

22. To avoid exposure to dangerous voltages and to avoid damage to the unit, do not connect the or rear-panel Ethernet port to telephone circuits.

23. 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 or green and yellow must be connected to the terminal in the plug identified by the letter **E** or by the earth symbol ⏚ or coloured green.
    - 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.

    This apparatus must be earthed.

Canada

This Class A digital apparatus complies with Canadian ICES-003.

This equipment complies with the EMC requirements of EN55103-1 and EN55103-2 when operated in an E2 environment in accordance with this manual.

IMPORTANT SAFETY NOTICE

This unit complies with the safety standard EN60065. The unit shall not be exposed to dripping or splashing and no objects filled with liquids, such as coffee cups, shall be placed on the equipment. To ensure safe operation and to guard against potential shock hazard or risk of fire, the following **must** be observed:

GB

- Ensure that your mains supply is in the correct range for the input power requirement of the unit.
- Ensure **fuses** fitted are the **correct rating and type** as marked on the unit.
- The unit **must be earthed** by connecting to a correctly wired and **earthed** power outlet.
- 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 EN60065. Ne pas exposer cet appareil aux éclaboussures ou aux gouttes de liquide. Ne pas poser d'objets remplis de liquide, tels que des tasses de café, sur l'appareil. 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

- Le selecteur de tension doit être placé sur la valeur correspondante à votre alimentation réseau.
- Les fusibles doivent correspondre à la valeur indiquée sur le materiel.
- Le materiel doit être correctement relié à la terre.
- 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 EN60065. Das Gerät darf nicht mit Flüssigkeiten (Spritzwasser usw.) in Berührung kommen; stellen Sie keine Gefäße, z.B. Kaffeetassen, auf das Gerät. Für das sichere Funktionieren des Gerätes und zur Unfallverhütung (elektrischer Schlag, Feuer) sind die folgenden Regeln unbedingt einzuhalten:

D

- Der Spannungswähler muß auf Ihre Netzspannung eingestellt sein.
- Die Sicherungen müssen in Typ und Stromwert mit den Angaben auf dem Gerät übereinstimmen.
- Die Erdung des Gerätes muß über eine geerdete Steckdose gewährleistet sein.
- 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 EN60065. Il prodotto non deve essere sottoposto a schizzi, spruzzi e gocciolamenti, e nessun tipo di oggetto riempito con liquidi, come ad esempio tazze di caffè, deve essere appoggiato sul dispositivo. 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

- Assicurarsi che il selettore di cambio tensione sia posizionato sul valore corretto.
- Assicurarsi che la portata ed il tipo di fusibili siano quelli prescritti dalla casa costruttrice.
- L'apparecchiatura deve avere un collegamento di messa a terra ben eseguito; anche la connessione rete deve avere un collegamento a terra.
- 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 EN60065. La unidad no debe ser expuesta a goteos o salpicaduras y no deben colocarse sobre el equipo recipientes con liquidos, como tazas de cafe. Para asegurarse un funcionamiento seguro y prevenir cualquier posible peligro de descarga o riesgo de incendio, se han de observar las siguientes precauciones:

E

- Asegúrese que el selector de tensión esté ajustado a la tensión correcta para su alimentación.
- Asegúrese que los fusibles colocados son del tipo y valor correctos, tal como se marca en la unidad.
- La unidad debe ser puesta a tierra, conectándola a un conector de red correctamente cableado y puesto a tierra.
- 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 EN60065. Enheten får ej utsättas för yttre åverkan samt föremål innehållande vätska, såsom kaffemuggar, får ej placeras på utrustningen." För att garantera säkerheten och gardera mot eventuell elchock eller brandrisk, måste följande observeras:

S

- Kontrollera att spänningsväljaren är inställd på korrekt nätspänning.
- Konrollera att säkringarna är av rätt typ och för rätt strömstyrka så som anvisningarna på enheten föreskriver.
- Enheten måste vara jordad genom anslutning till ett korrekt kopplat och jordat el-uttag.
- 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 EN60065 veiligheids-standaards. Dit apparaat mag niet worden blootgesteld aan vocht. Vanwege het risico dat er druppels in het apparaat vallen, dient u er geen vloeistoffen in bekers op te plaatsen. 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

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

Fase—Bruin Nul—Blauw Aarde—Groen/Geel

PRODUCT END-OF-LIFE INFORMATION

This product has been designed and built by Dolby Laboratories to give many years of service, and is backed by our commitment to provide high-quality support. When it eventually reaches the end of its serviceable life, it should be disposed of in accordance with local or national legislation.

For current information, please visit our website: *www.dolby.com/environment.*

CP650 Operating System Software History

V.1.0.4.4

- First product shipments.
- Covered in installation manual, Issue 1.

V.1.1.3.0

- Added support for Cat. No. 790 or 794 card: Dolby® Digital Surround EX™ decoder and AES3 input for stereo pulse-code modulated (PCM) or Dolby Digital bitstreams from consumer products.
- Covered in installation manual addendum, Part No. 91743.

V.1.1.5.0

- Added support for Cat. No. 779 remote control unit and Cat. No. 771 remote fader unit. Covered in *Remotes Installation Manual*, Part No. 91733.

V.1.1.7.0

- Added support for formats 92 and 93, Dolby SR input selections.

V.1.2.x.y (where x and y may be any numbers)

- Added support for auto Dolby Digital Surround EX switching, external control via the RS-232 serial data port, and the rotating pink-noise feature.
- The EQ Assist™ feature description was added to the installation manual.
- These features, along with all of the above updates, are covered in installation manual Issue 2.

V.2.0.x.y (where x and y may be any numbers)

- Added the Auditorium Assist™ feature, which measures and stores a characterization of the audio environment in a theatre, and allows periodic checks and comparisons to qualify the sound system.
- Added support for the Cat. No. 778 Eight-Channel Digital I/O Card.
- Added a noise floor optimization feature, which provides automatic gain adjustments in the equalizers for improved noise performance.
- These features, plus all of the above updates, are covered in installation manual Issue 3.

V2.1.x.y (where x and y may be any numbers)

- Added support for the Cat. No. 790 Dolby Digital Surround EX Decoder Card with four S/PDIF digital inputs. This card replaces the Cat. No. 794, adding three additional S/PDIF digital inputs.
- Added support for the Cat. No. 791 Digital Crossover Card. This card plugs into the Cat. No. 790, providing two- and three-way screen channel crossover capability along with support for Left Extra/Right Extra screen channels.

V2.2.x.y (where x and y may be any numbers)

- Digital film reader output levels can now be checked using the CP650 front-panel screen or setup software.
- The noise floor optimization setup step is now called headroom configuration.
- The default format assigned to the front-panel User 1 button (**U1**) is now format 75, Nonsync 1 Dolby Pro Logic® with Subwoofer.
- The test point signal that feeds an external real-time analyzer has been enabled to assist in setting the bypass output.
- Support for Ethernet-based ASCII control and network support has been added.
- Support for subtitling has been added.
- Expanded support for the Cat. No. 778 Digital Input/Ouput Card is incorporated including unity-gain functionality.

V2.3.4.x (where x may be any number)

- Formats for front-panel buttons **01**, **04**, and **11** are now user-assignable along with buttons **U1**, **U2**, and **NS**.
- Added format 76, Nonsync 2 Pro Logic with Subwoofer.
- Added global audio delay setting for use in Dolby Digital Cinema systems.
- Improved the communications interface to the Cat. No. 771 Remote Fader and 779 Remote Control Unit.
- Improved response to digital audio input streams.

V2.3.5.x (where x may be any number)

- Assigned default network address to be compatible with Dolby Digital Cinema.

V2.3.6.x (where x may be any number)

- All front-panel format buttons are user-assignable on CP650DC models
- Film-related functions are not active on CP650DC models

Chapter 1 Introduction

The Dolby® CP650 Digital Cinema Processor is a self-contained, all-digital cinema processor capable of supporting Dolby Digital Cinema systems, as well as Dolby Digital, Dolby Digital Surround EX™, Dolby SR, Dolby A-type, and Academy mono film sound playback.

For digital cinema installations that do not require film soundtrack playback, the CP650DC versions provide digital audio inputs for connection to a digital cinema server, while removing the additional cost of 35 mm film sound support.

The CP650 provides inputs for two projector soundheads (both analog and digital), an external six-channel processor, two nonsync sources, and a PA microphone. Its audio outputs are balanced, with a multipin connector configured to the THX standard. A built-in Ethernet and a serial interface accommodate PC control and cinema network connectivity.

Installation is simplified by built-in test instrumentation that includes a real-time analyzer. Third-octave equalization, plus bass and treble trim controls, are provided for up to seven channels (Left, Center, Right, Left Surround, Right Surround, Back Surround Left, and Back Surround Right). A digital parametric equalizer is provided for subwoofer equalization.

Easily programmed internal software manages most existing or likely future formats. While an external PC is not required for setup, a full-featured software package is available in several languages to facilitate the setup process. A serial connector for a PC, an input for a calibration microphone multiplexer, and a variety of test points are all accessible behind an access door on the front panel. Built-in diagnostic software runs automatically whenever the CP650 is turned on.

Calibration settings for a given theatre can be stored on a PC, and, if desired, transferred directly to another CP650, minimizing the need for additional calibration after repairs. As improvements to the CP650 digital control and processing software are developed, the latest revisions are transferable from a PC to the CP650.

Options available for the CP650 include a remote fader (Cat. No. 771), a remote unit (Cat. No. 779) that duplicates many of the CP650's front-panel controls, and a ten-channel digital I/O card (Cat. No. 778).

1.1 Dolby Catalog Number Listing

Cat. No. 771	Remote Fader
Cat. No. 772B	Analog I/O and Bypass Circuit Board
Cat. No. 773	Dolby Digital Film Decoder Circuit Board
Cat. No. 774A	System Controller Circuit Board
Cat. No. 775	Backplane Board
Cat. No. 775DC	Backplane Board (used on CP650DC models)
Cat. No. 776	Power Supply Assembly
Cat. No. 776DC	Power Supply Assembly (used on CP650DC models)
Cat. No. 777	Front-Panel Circuit Board
Cat. No. 778	Digital I/O Board provides up to ten channels of digital I/O
Cat. No. 779	Remote Control Unit
Cat. No. 790	Digital Input/Dolby Digital Surround EX Decoder Card (replaces the earlier Cat. No. 794)
Cat. No. 791	Crossover Card (Cat. Nos. 790, 772A or B, and 774A required)
Cat. No. 795	Power Supply Snubber Board
Cat. No. 792	Bypass Power Regulator Circuit Board (not used on CP650DC models)
Cat. No. 794	Dolby Digital Surround EX Decoder Card (with digital AES3 input; used in earlier CP650s and replaced by the Cat. No. 790)
Cat. No. 797	Flash Memory Module (part of the Cat. No. 774A board)

1.2 List of Formats Available

The formats supported by each CP650 model are listed in Table 1-1. See Appendix C for a complete definition of each format.

Table 1-1 Formats Supported by the Various CP650 Models

Format	Description	CP650SR	CP650D Cat. No. 773	CP650 Cat. No.790	CP650XO Cat. No. 790 Cat. No. 791	CP650DC Cat. No. 790	CP650DCXO Cat. No. 790 Cat. No. 791	CP650DCD Cat. No. 778
01	Academy mono optical film	X	X	X	X			
04	Dolby A-type optical film	X	X	X	X			
05	Dolby SR optical film	X	X	X	X			
10	Dolby Digital film		X	X	X			
11	External six-channel analog in	X	X	X	X	X	X	X
13	Dolby Digital Surround EX film		X	X	X			
20	35 mm magnetic film, L, C, R three-channel	X	X	X	X	X	X	X
22	35 mm magnetic film, four-channel	X	X	X	X	X	X	X
42	70 mm Dolby A-type mag film	X	X	X	X	X	X	X
60	Nonsync 1, L, R, Surrounds	X	X	X	X	X	X	X
61	Nonsync 2, L, R, Surrounds	X	X	X	X	X	X	X
64	Public Address Center channel	X	X	X	X	X	X	X
65	Public Address Ls, Rs Surrounds	X	X	X	X	X	X	X
66	Test Tone 320 Hz All Channels	X	X	X	X	X	X	X
70	Nonsync 1 Mono Center, Surrounds	X	X	X	X	X	X	X
71	Nonsync 1 Mono Center	X	X	X	X	X	X	X
73	Nonsync 1 Pro Logic® Left-Center-Right	X	X	X	X	X	X	X
74	Nonsync 1 Pro Logic No Subwoofer	X	X	X	X	X	X	X
75	Nonsync 1 Pro Logic With Subwoofer	X	X	X	X	X	X	X
76	Nonsync 2 Pro Logic With Subwoofer	X	X	X	X	X	X	X
80	Bitstream Master Digital In			X	X	X	X	X
81	Bitstream Master Digital In w/Surround EX			X	X	X	X	X

Format	Description	CP650SR	CP650D Cat. No. 773	CP650 Cat. No.790	CP650XO Cat. No. 790 Cat. No. 791	CP650DC Cat. No. 790	CP650DCXO Cat. No. 790 Cat. No. 791	CP650DCD Cat. No. 778
85	Bitstream PCM Eight-Channel Input, Ten-Channel Output (Le/Re Support)				X		X	X
86	Bitstream PCM Eight-Channel Input, Ten-Channel Output w/Surround EX (Le/Re Support)				X		X	X
87	External Six-Channel analog in w/Surround EX			X	X	X	X	X
88	Six-Channel PCM, L/R, C/SW, Ls/Rs			X	X	X	X	X
89	Six-Channel PCM w/Surround EX on Ls/Rs			X	X	X	X	X
90	Seven-Channel PCM, L/R, C/LFE, Ls/Rs, Bs			X	X	X	X	X
92	Dolby SR, input from Six-Channel L/R pair	X	X	X	X	X	X	X
93	Dolby SR, input from NS1 L/R	X	X	X	X	X	X	X

1.3 About Dolby Digital Surround EX

Dolby Digital Surround EX adds a third surround channel to digital film sound, a concept first envisioned by sound designers at Lucasfilm's Skywalker Sound postproduction facility. It gives sound mixers a new level of creative freedom.

Dolby Digital Surround EX is fully compatible with all current 5.1 digital sound formats and theatre systems. Prints that use it play normally with current systems, and provide the extra surround channel when played using a CP650 cinema processor equipped with a Cat. No. 790 or 794 board.

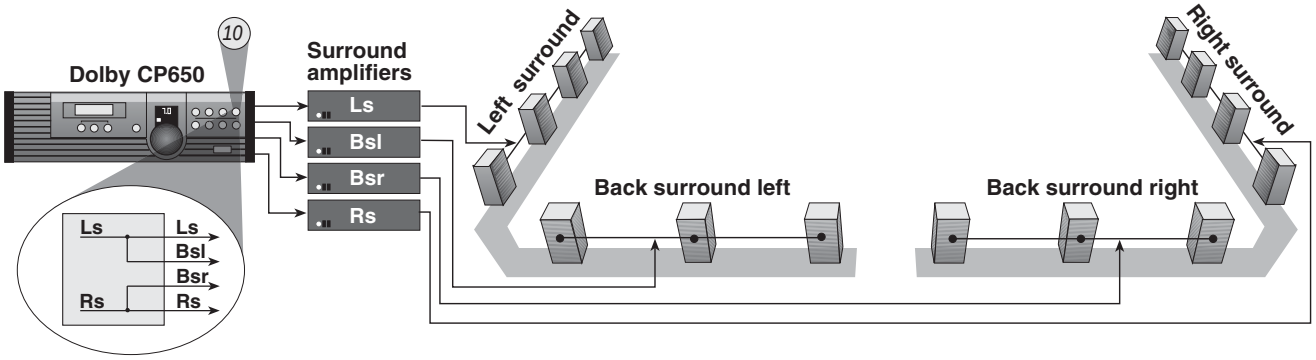
A Center screen channel is necessary to ensure the precise localization of front sounds for all viewers, including those seated off to the sides. Dolby Digital Surround EX brings similar benefits to the surround sound field. With Surround EX, a Back Surround channel is reproduced by the speaker array at the back of the theatre, while Left Surround and Right Surround channels are reproduced by the side arrays. This means that sounds can now be positioned behind the audience, allowing for exciting new effects, such as true 360-degree pans.

The Back Surround channel also makes front-to-back and back-to-front transitions more realistic. Flyovers really seem to pass overhead, rather than down the sides of the theatre. Even ambient sound reproduction is improved, being less affected by the width of the theatre. Equally important, the new Back Surround channel ensures that even viewers seated close to the left or right of the theatre experience the total surround ambience intended by the filmmaker.

The UEX650 kit upgrades the CP650D 5.1-channel processor to include three surround channels that can play digital prints prepared with the Dolby Digital Surround EX process. The installation requires wiring the surround speakers into left, back (split into two groups), and right. Two power amplifier channels are required for powering the two groups of Back Surround channel speakers. Figure 1-1 shows the surround signal distribution for conventional 5.1-channel surround. Distribution for the Dolby Digital Surround EX format is shown in Figure 1-2.

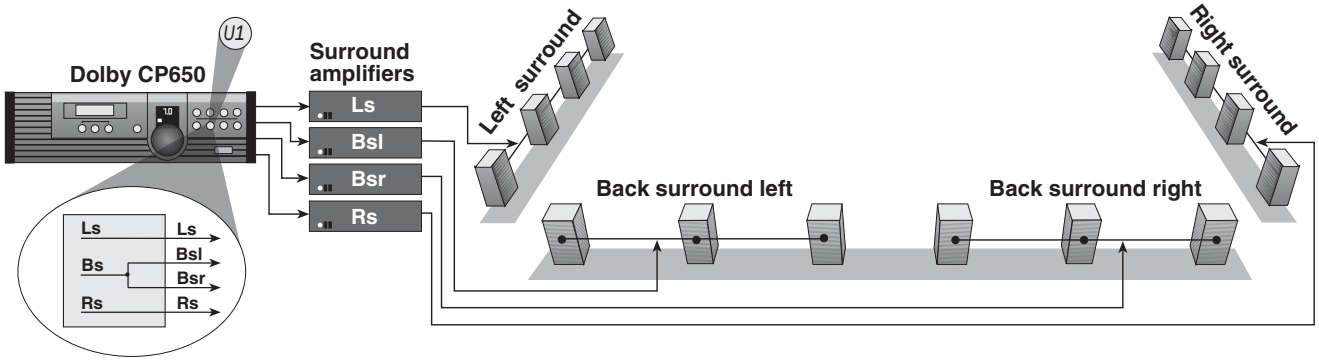
Auto Surround EX

Dolby Digital bitstreams that contain a data bit signifying Surround EX encoding cause the CP650 to automatically switch to Dolby Digital Surround EX decoding.



Dolby Digital 5.1 mode

Figure 1-1 Surround Speaker/Amplifier Switching for 5.1-Channel Use



Dolby Digital Surround EX mode

Figure 1-2 Surround Speaker/Amplifier Switching for Dolby Digital Surround EX Mode

1.4 Specifications

For digital cinema installations that do not require film soundtrack playback, the CP650DC versions provide digital audio inputs only.

Signal Inputs

Optical: Balanced inputs for two projectors with stereo solar cells or analog LED readers, digitally controlled gain and digital slit-loss EQ, power available for external cell preamp circuits; 9-pin D-connectors

Digital film reader: Inputs for two Dolby digital soundheads; 25-pin D-connectors

Nonsync: Two stereo inputs, 21 kΩ, sensitivity: 0.2–4 V (NS 1),
0.06–1.5 V (NS 2); RCA-type phono connectors

Six-channel analog input: For external digital processor, 10 kΩ (L, R),
27 kΩ (C, Ls, Rs, SW), 300 mV operating level; 25-pin D-connector

Microphone: Balanced input for Auditorium Assist™ microphone, PA mic, or B-chain alignment mic (or multiplexer), 15 V phantom power switchable via front-panel DIP switch; rear-panel XLR and front-panel 9-pin D-connector

AES/EBU digital inputs: Accommodate stereo PCM audio at 48, 44.1, or 32 kHz, also accept Dolby Digital bitstreams; input via 25-pin D-connector with optional adapter boards (Cat. No. 790 or 778)
110Ω ±20%, balanced (equipped with Cat. No. 778, four inputs), or
75Ω ±20%, single-ended (equipped with Cat. No. 790, four inputs)

Signal Outputs

Balanced, output impedance: 100Ω (load >600Ω)
Max level: +26 dBu (15.5 V), balanced loads; +20 dBu (7.75 V), unbalanced loads
Dolby level output adjust range: –31 to 0 dBu (20–780 mV)

Other Connections

Cat. No. 779 remote control unit and Cat. No. 771 remote fader connector (terminals for stripped wires)

Connectors (front and rear) for external PC control and setup, RS-232C (9-pin D-connector)

Hearing-impaired output: Center-weighted sum of L, R, and C; output impedance 100Ω, output level 200 mV fixed; unbalanced (RCA-type phono connector)

Automation connector for controlling and indicating format, fader select, and mute; interface similar to Model CP65

Connector for Ethernet link, RJ-45

Dolby Decoding

5.1 channels: Dolby Digital and Dolby Digital Surround EX
Four channels: Dolby A-type
Two channels: Dolby SR
Dolby Pro Logic

Chapter 2 Installation

The CP650 uses a universal switching power supply that can accommodate mains voltages from 100–120 VAC, and 200–240 VAC, at frequencies from 50 to 60 Hz.

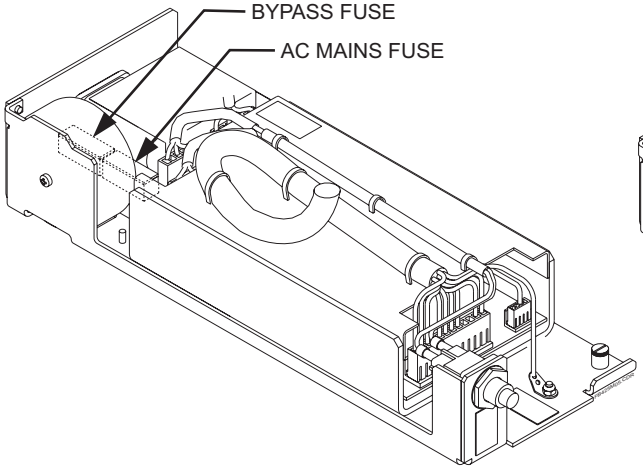


Figure 2-1 Fuse Locations on Units with Internal Fuses

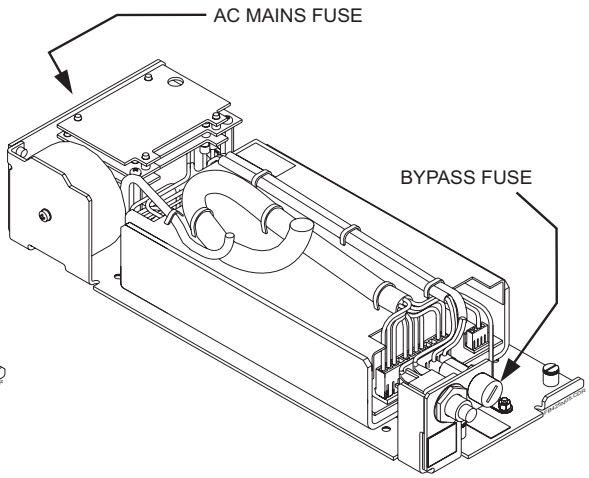


Figure 2-2 Fuse Locations on Earlier Units with External Fuses

The CP650DC models do not include a bypass fuse.

2.1 Check Main Fuse

WARNING: Do not connect the CP650 to mains power until all other connections have been made. Check that the correct main fuse has been installed. To reduce the risk of fire, replace only with fuses of the same type and rating.

The main power supply fuse is a 5 A (6.3 A on earlier units with external fuses), 250 V, 20 mm, time-lag, low-breaking capacity fuse.

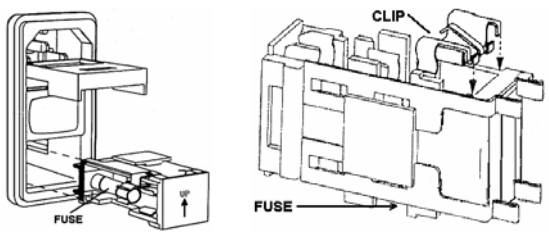


Figure 2-3 Main Fuse Assembly—Earlier Units with External 6.3 A Fuses

Check that the fuse is of the correct rating. The fuse carrier must be inserted into the compartment with the fuse oriented to the left. Do not force the carrier into the

compartment. Damage will result. The polarizing clip must be attached on the right side of the carrier at the rear. Snap the fuse compartment door closed.

2.2 Check Bypass Supply Mains Voltage Setting

Note: Skip this section if you are installing any of the CP650DC models (no bypass power supply.)

The bypass power supply mains voltage selector switch is accessible through a hole in the top cover of the CP650. Use a screwdriver to set the switch to either 120 or 220 VAC. Figure 2-11 shows the switch location.

Caution: *Be sure to check this setting. If the bypass voltage selector is set to 120 V but the unit is connected to 220 V mains voltage, the bypass power supply fuse will blow.*

Bypass Power Supply Fuse

- For 100–120 VAC mains—T 200 mA L (time-lag, 200 mA, 20 mm, low-breaking capacity, 250 V)
- For 200–240 VAC mains—T 100 mA L (time-lag, 100 mA, 20 mm, low-breaking capacity, 250 V)

Internal Fuse

The switching DC power supply contains a separate internal fuse, not accessible to the installation engineer or user. Do not remove the power supply cover. The CP650 main fuse will protect most fault conditions. If this fuse blows, the power supply has certainly failed.

2.3 Mount the CP650

To avoid heat or hum pickup problems, do not mount the CP650 immediately above or below power amplifiers. Locate power amplifiers away from the CP650 to avoid hum pickup problems. Always leave a 1-U space (43 mm, or 1.75 inches) above and below the CP650 to provide adequate ventilation. Install an air guide or baffle to deflect hot air from equipment below the CP650.

To ensure good ground contact, install a star washer on at least one (and preferably all) rack-mounting screws per piece of equipment (see Figure 2-4). This will also aid in the prevention of electrical noise problems.

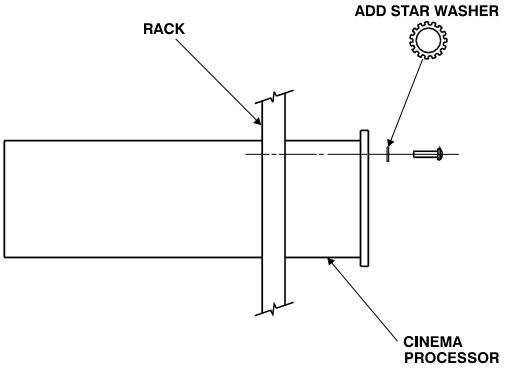
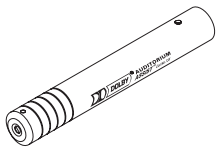


Figure 2-4 Star Washers and Rack-Mounting Screws

Proper shielding and termination of cables and cable assemblies are also very important. Follow the methods shown in the wiring diagrams.

If you are installing a Dolby® Digital soundtrack reader, refer to its installation manual for mounting and alignment.

2.4 Mount the Auditorium Assist Microphone



Auditorium Assist™ operation requires the use of the Cat. No. 735 microphone. Mount the microphone permanently in the auditorium, at a convenient location away from sound sources. If the rear wall is used, the microphone should be centered between surround speakers. Wall plates with an integrated XLR connector are available. Examples include:

- Switchcraft J3FS (stainless steel)
- Whirlwind WP1B/1FND (black)

Connect the microphone to the mic input located on the rear panel of the CP650 cinema processor. If the microphone input in your installation is currently dedicated to other uses, such as an emergency public address, install the necessary hardware to switch between microphones.

2.5 Connect the CP650

Refer to the appropriate wiring diagrams, located at the end of this chapter, showing connections to the CP650 or CP650DC models. Shields must be connected as shown in the diagrams to avoid radio frequency interference. Connector shells have been included in your installation kit for use in countries that are governed by the EMC directives. The shells must be connected as noted on the diagrams.

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

2.5.1 Motor-Start Relays (Except CP650DC Models)

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. Projector motor-start contact closures provide this signal to the CP650. Isolated contact closures from mechanical or opto-isolated relays wired across projector motors must be used. Refer to the installation wiring inputs and control diagram located at the end of this chapter.

Signal Levels

- Motor start—Less than 1 VDC with respect to signal ground
- Motor off—Greater than 3.5 VDC, less than 18 VDC

If the CP650 is to be used in a platter operation (single projector), a jumper must be installed. A prewired connector is installed at the factory for this purpose.

2.5.2 Remote Controls

Three types of remote controls can be used with the CP650. A maximum of three remote units (in any combination) can be used.

- The Cat. No. 779 Remote Control Unit duplicates the front-panel format selection, fader, and mute functions of the CP650.
- The Cat. No. 771 Remote Fader duplicates the front-panel main fader knob and level display of the CP650.
- A customer-supplied 100 kΩ linear pot, wired as a variable resistor, can also be used. Minimum pot resistance corresponds to a front-panel fader setting of maximum (10).

Details on how to connect any of these remote controls to the CP650 are shown in Chapter 8 and in the installation wiring inputs and control drawing located on page 2-13.

2.5.3 Solar Cell Reader Boards (Except CP650DC Models)

Most new projectors sold around the world incorporate a reverse-scan LED analog soundhead reader. In addition, many existing projectors are being upgraded to include this superior method of playing back stereo variable area (SVA) soundtracks. The Dolby Cat. No. 655 solar cell preamp board is an example of this kind of upgrade. The output of the solar cell in this system is at a lower level than a normal incandescent exciter lamp solar cell. In order to provide the correct signal level for the cinema processor, this small preamp board is mounted in the soundhead. Some care needs to be given to the wiring between the board and the CP650 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 0 V point (audio ground) must be connected from the inboard reader board to the CP650 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 show two connectors on the Cat. No. 655 circuit board. The three-pin connector, J1, is used for the power connections. The signal output connector, J2, provides six output pins: two each for the balanced left and right outputs, and two 0 V audio ground connections.

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 pin 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.

Table 2-1 Solar Cell Preamp Board Connectors

J2 Pin Number	Signal
1	Right (or Left) +
2	Signal Ground
3	Right (or Left) –
4	Left (or Right) +
5	Signal Ground
6	Left (or Right) –
J1 Pin Number	**Power from CP650**
7	+15 V
8	–15 V
9	Signal Ground

There must be a connection between the ground pins at the Cat. No. 655 solar cell circuit board and the audio common in the CP650. This connection must not use the shield of the optical input cable, because doing so may impose RF energy on the CP650 ground system.

Pin numbers 6 and 9 of each 9-pin D-connector (“Projector”) on the CP650 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.

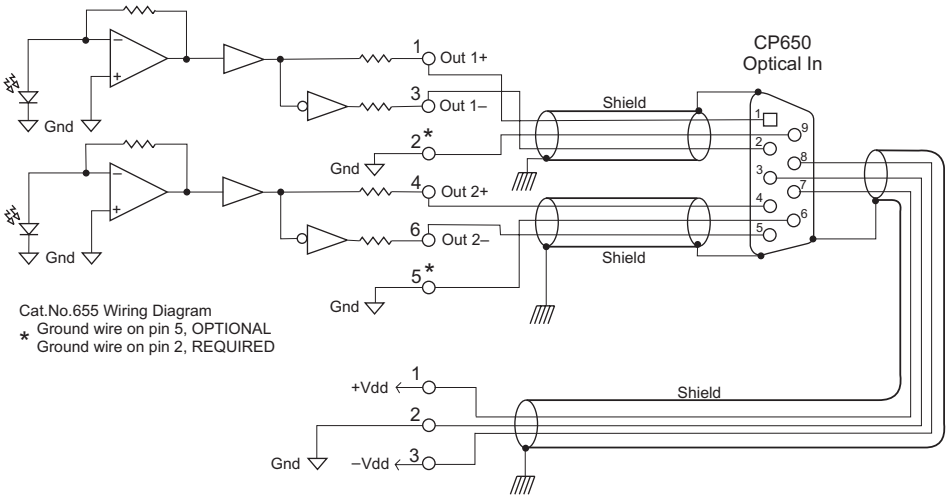


Figure 2-5 Cell Preamp Wiring Using Two Three-Conductor Shielded (Screened) Cables

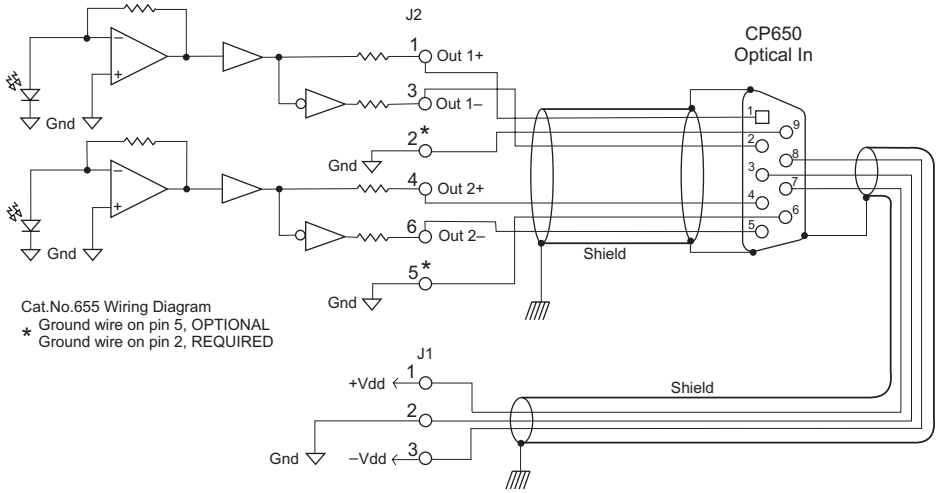


Figure 2-6 Cell Preamp Wiring Using One Five- or Six-Conductor Shielded (Screened) Cable

For Non-EU Countries Only

If it is necessary to use two- or four-conductor shielded cables, refer to the following wiring diagrams.

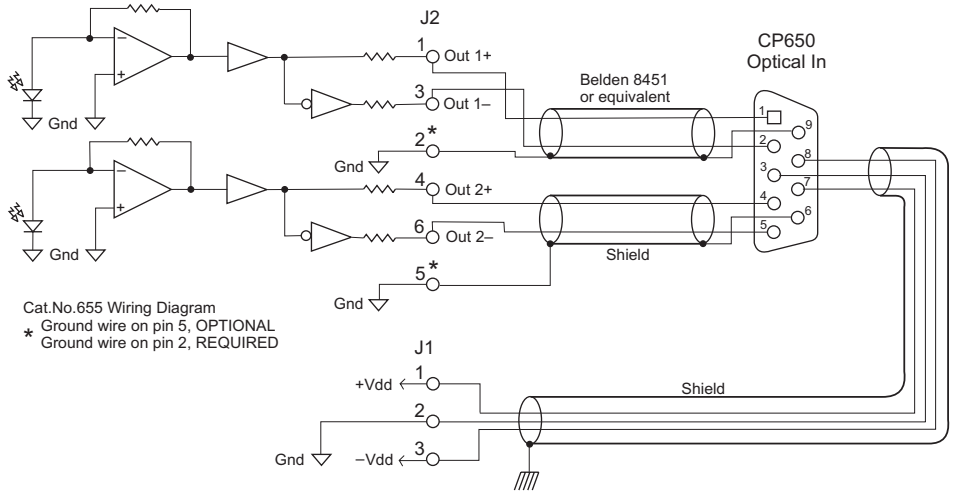


Figure 2-7 Cell Preamp Wiring Using Two Two-Conductor Shielded (Screened) Cable

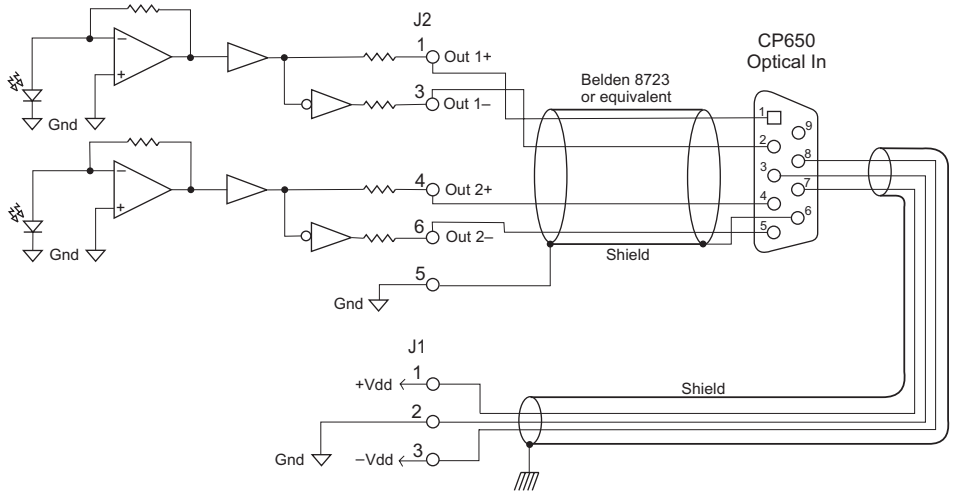


Figure 2-8 Cell Preamp Wiring Using One Four-Conductor Shielded (Screened) Cable

2.5.4 Analog Nonsync Sources

The CP650 has two sets of analog nonsync inputs, designated **Nonsync In 1** (format 60), and **Nonsync In 2** (format 61). The input impedance is 21 kΩ. They both have a wide range of input level adjustment, but to further extend the possible range of input levels, the two sets of inputs have different gain adjustment ranges:

- The **Nonsync In 1** input will accommodate input levels between approximately 0.2 and 4 V.
- The **Nonsync In 2** input will accommodate input levels between approximately 0.06 and 1.5 V.

2.5.5 Digital Audio Sources

The CP650 can accept AES3 or S/PDIF digital audio bitstreams, generated by digital audio sources including Dolby Digital Cinema systems, CD players, DAT recorders, DVD players, satellite television receivers, HDTV receivers, or HD video players.

With the Cat. No. 790 board (included with the standard Model CP650) installed, the CP650 accepts up to four two-channel PCM (pulse code modulated) bitstreams. Each bitstream contains the data for two channels of PCM audio. The AES1 digital audio channel pair can accept either PCM or Dolby Digital bitstreams. Sampling rates of up to 48 kHz—with up to 24-bit resolution—are accommodated. This bitstream format can be found on the digital output connector of a CD player, DAT recorder, DVD player, or any basic piece of digital audio equipment. The inputs are S/PDIF single-ended signals. To use these inputs, a digital input format (format 80, 81, 88, 89, or 90) may be assigned to one of the user-assignable format buttons.

With the Cat. No. 794 board (included with earlier CP650s) installed, the CP650 accepts a digital audio bitstream. The Cat. No. 794 can accept either AES3 differential signals or S/PDIF single-ended signals, depending on jumper settings on the board itself (see Figure 2-10). To use this input, format 80 (Master Digital In) or format 81 (format 80 with Dolby Digital Surround EX™) must be assigned to one of the user-assignable format buttons.

With an optional Cat. No. 778 board installed, the CP650 gains the capability to accept up to four two-channel digital audio bitstreams, and provides up to five digital two-channel audio bitstream outputs. The CP650 can accept either PCM or Dolby Digital bitstreams on its AES1 digital audio input. Additionally, the Cat. No. 778 allows the CP650 to accept up to four PCM-formatted AES/EBU inputs, giving a total of eight discrete audio channels. The board provides five AES/EBU outputs to support up to ten discrete audio channels. All inputs and outputs comply with AES/EBU standards.

Connecting to the Digital Audio Input

The external electrical connections to the optional boards in the CP650 are available on the 25-pin D-connector marked **Option Card I/O** on the rear panel of the CP650. Because the boards have different functionality, each pin on this connector changes its function depending on which optional card is installed. Refer to Table B-2 for the signal definitions. Make external connections by soldering the appropriate wires to the male solder-cup connector shipped with the CP650, then plug this connector into the **Option Card I/O** connector on the CP650.

Note: When wiring to the digital inputs on the Cat. No. 790 or Cat. No. 778, be sure to ground all unused digital inputs. Failure to do so will cause unused channels to show signal level due to crosstalk between the used digital inputs and the unused digital inputs.

In a CP650 equipped with a Cat. No. 790 board, the input type is S/PDIF. See Figure 2-9 for **Option Card I/O** connector hookup details. Refer to Table B-2 for signal definitions.

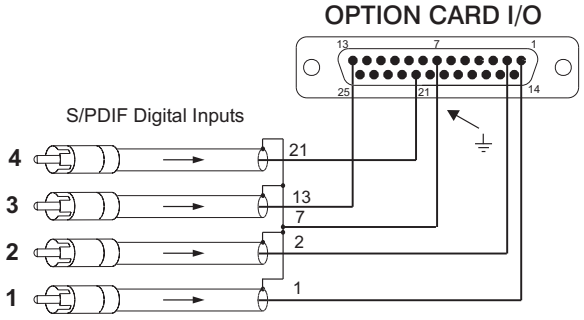


Figure 2-9 Cat. No. 790 S/PDIF Connections

In a CP650 equipped with the earlier Cat. No. 794 board, the input type (AES/EBU or S/PDIF) must be selected using jumpers on the board. The default factory setting is AES3. Refer to Table B-2 for signal definitions. When a Cat. No. 778 board is installed, the input type is always AES/EBU.

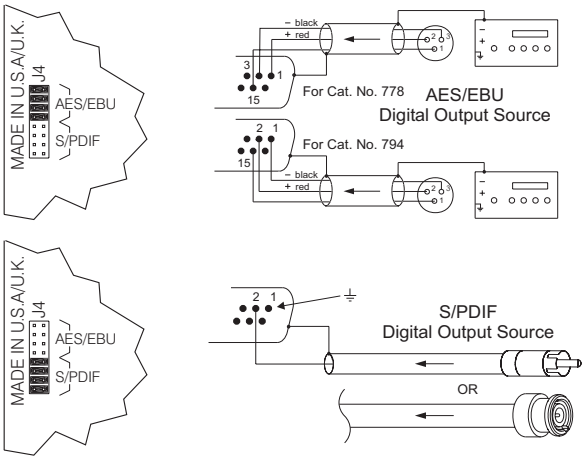


Figure 2-10 Cat. No. 794 AES/EBU and S/PDIF Jumper Selections and Connections

2.5.6 Digital Audio Inputs—General Information

There are two professional interface formats used for digital audio: AES/EBU (also known as AES3) and AES-3id. These stream the same digital data and professional audio header information over copper conductor links, but use different types of conductors and connectors.

AES/EBU uses a balanced connection (two conductors plus shield) with a characteristic input impedance of 110Ω, nominal peak-to-peak signal level of 5 V, and, most commonly, XLR connectors. The typical maximum transmission distance is 100 meters (328 feet).

AES-3id uses an unbalanced connection (one signal conductor plus shield) with a characteristic input impedance of 75Ω, peak-to-peak signal level of 1 V, and BNC connectors. The typical maximum transmission distance is 1,000 meters (3,280 feet).

Professional digital audio equipment usually uses the AES/EBU format because balanced operation yields superior noise immunity, as it does with analog audio signals, and because XLR connectors are widely used on professional analog audio equipment.

Professional video equipment usually uses the AES-3id variation of this interface, with BNC connectors. As with the use of XLR connectors on pro audio equipment, the adoption of BNC connectors for the audio on professional video equipment stems from their existing use for the video signal. Also, the unbalanced AES-3id signal can connect to more than one piece of equipment by using the loop-through connectors available on some devices, and is robust for long cable runs.

Consumer Interface Standards for Digital Audio

The consumer interface standard for digital audio is S/PDIF (IEC 61937). S/PDIF is found using either coaxial unbalanced connections (one signal conductor plus shield) with a characteristic input impedance of 75Ω with RCA (phono) connectors, or a fiber-optic cable with Toslink™ connectors. The unbalanced coaxial connection has a peak-to-peak signal level of 0.5 V. The typical maximum transmission distance is 10 meters (33 feet). Although S/PDIF-specific cables with suitable connectors can be purchased, you can also obtain good results using high-quality 75Ω video cable with the appropriate connectors and/or adapters.

Cable Issues

Even in digital audio, noise-free signals are still very important. The cable used for digital signals is specifically designed for digital audio use, even though it appears to be the same as that used for analog audio or video signals. Any professional audio equipment or broadcast supply company can provide 110Ω cable with connectors (or without, if you wish to terminate them yourself) for AES/EBU connections, and high-quality 75Ω video cables with BNC connectors for AES-3id connections. Use of cables or connectors not designed for digital transmission or with incorrect

impedance compromises the integrity of the bitstream and may create an unreliable link between pieces of equipment, particularly with long cable runs.

Multiple Sources—Conversion Between Interface Standards

Although some details of the bitstreams used in the AES and S/PDIF standards are different, the audio information is exactly the same. As a consequence, most audio equipment accepts either standard with no need to convert the bitstream itself; this is the case with the CP650. However, if you intend to connect sources across different types of digital audio inputs, do not attempt to convert a digital interface type by, for example, directly wiring an XLR connector to a BNC or RCA plug. This causes an impedance mismatch and signal reflections, resulting in degradation of the digital waveform. It may seem to work, but the results are unreliable and dropouts occur.

For conversion between the AES-3id and S/PDIF formats, you can use high-quality RCA-to-BNC adapters because the cable and impedance are both the same (75Ω).

For conversion between the AES/EBU and AES-3id or AES/EBU and S/PDIF formats, a simple and economical method is to use inline transformers. These devices perform the necessary impedance and balanced/unbalanced conversion. Table 2-2 shows some examples of suitable adapters. The unbalanced connector in these examples is a BNC. BNC-to-RCA adapters can be added to connect to consumer S/PDIF connections. The units listed use passive circuitry.

Table 2-2 Examples of Available Balanced ↔ Unbalanced Adapters

Adapter Type	Neutrik®	Canare™
XLR female 110Ω in to BNC female 75Ω out	NA-BF	BCJ-XJ-TRA
BNC female 75Ω in to male XLR 110Ω out	NA-BM	BCJ-XP-TRA

Higher-priced units incorporating active circuitry are also available. These offer additional features such as multiple inputs, inputs for Toslink digital connections, and multiple outputs.

2.5.7 Exploded View and Board Locations

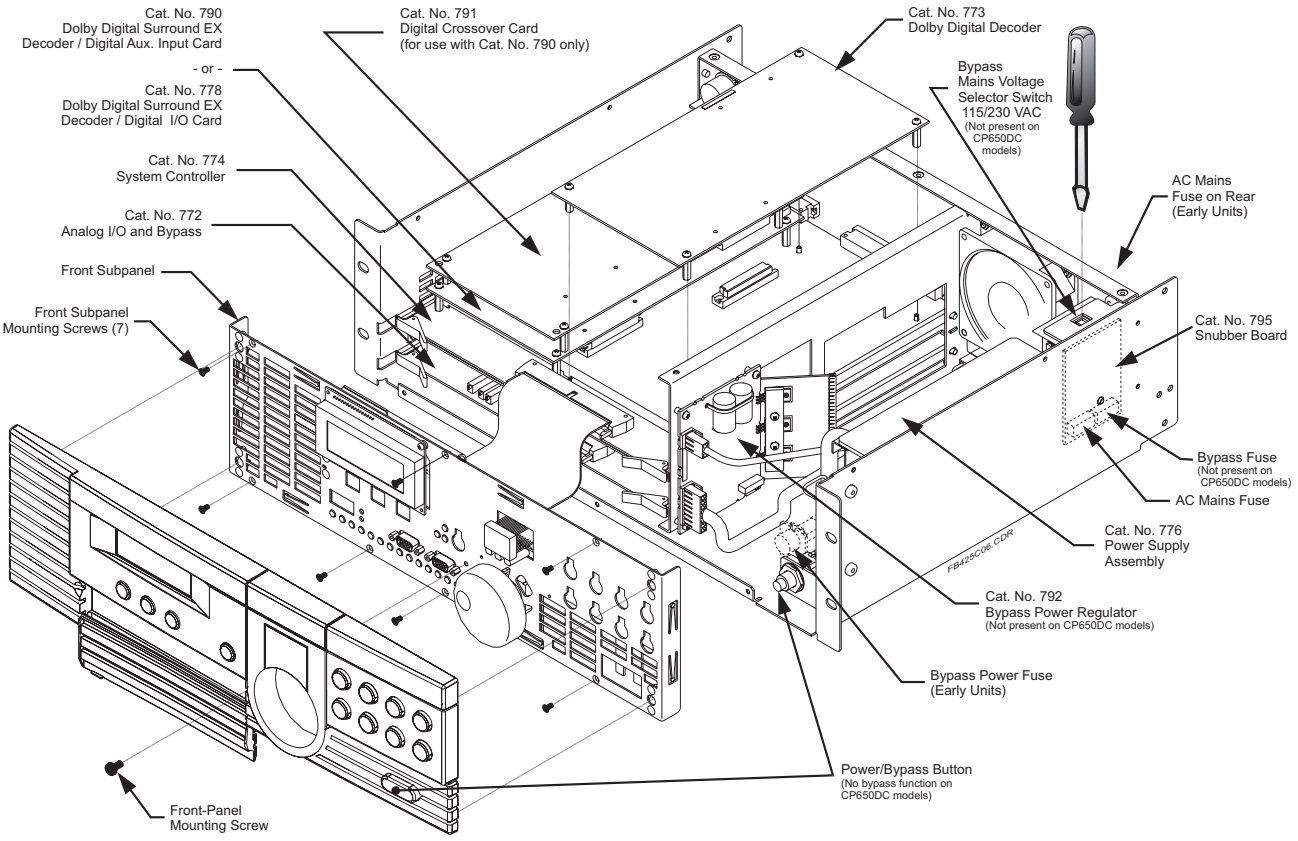
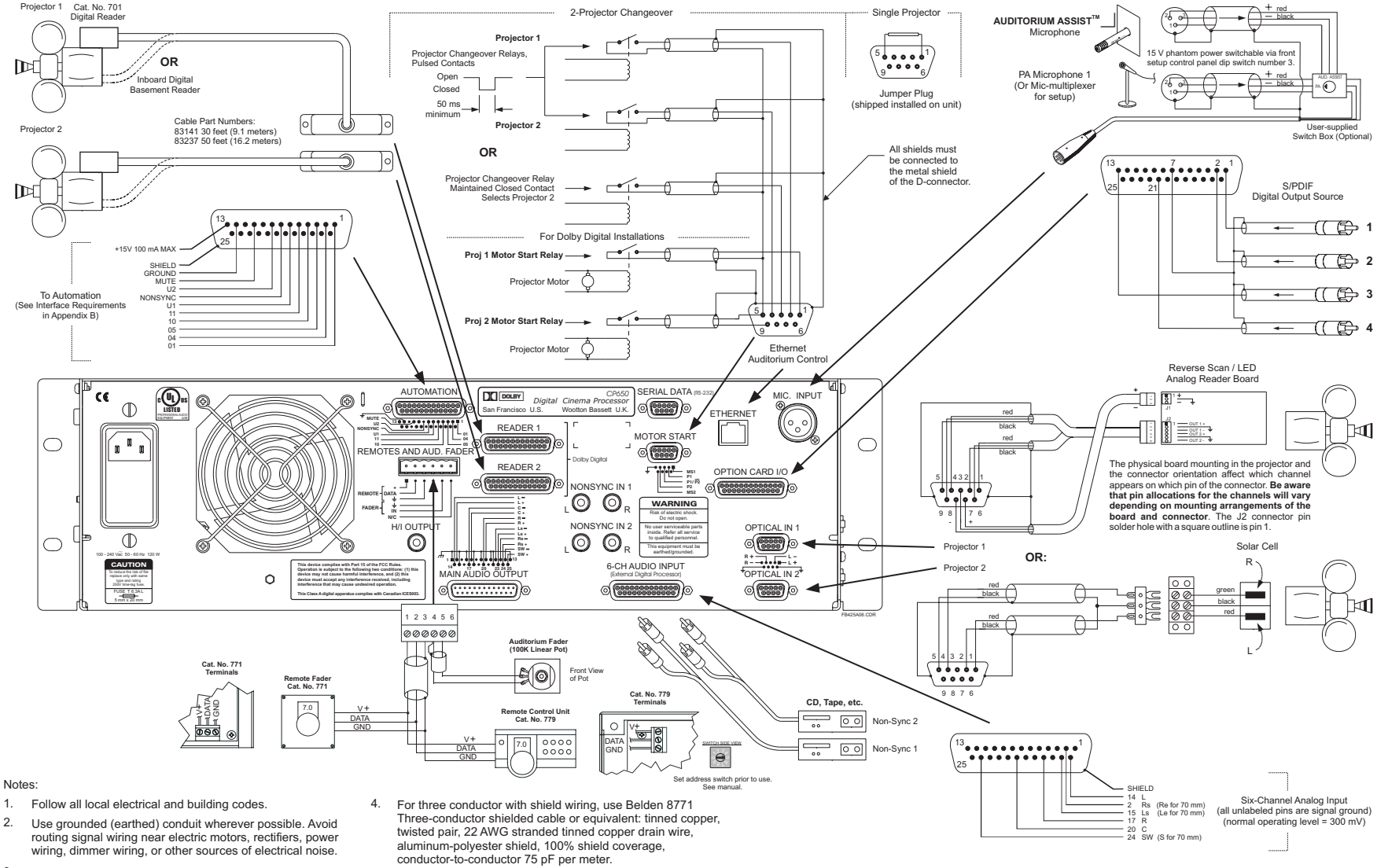


Figure 2-11 Model CP650 Exploded View

Disassembly steps can be found in the troubleshooting section of this manual. (See Section 9.3.2.)

2.5.8 Installation Wiring Diagrams

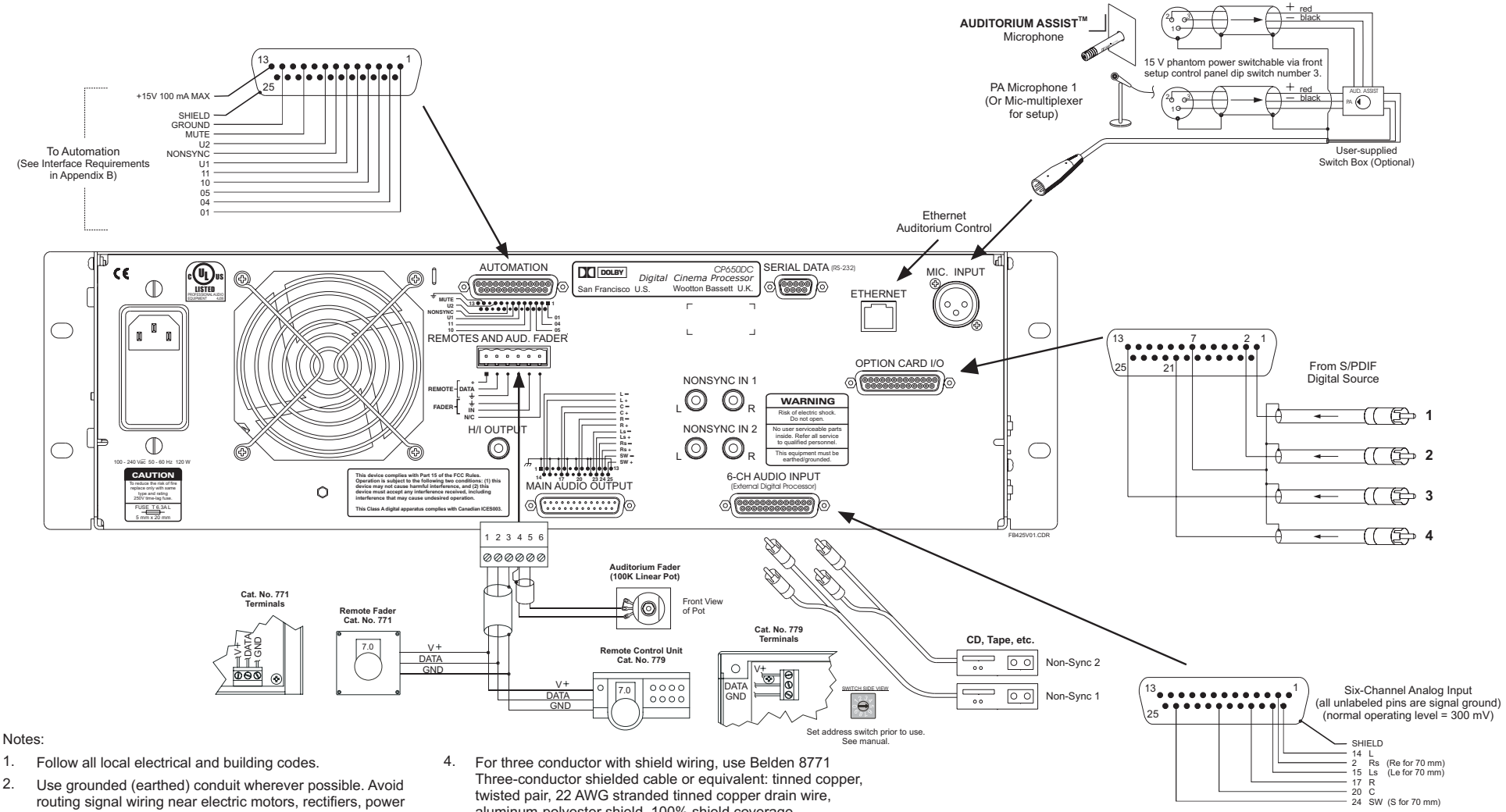
See the following pages for CP650 connection diagrams.



Notes:

1. Follow all local electrical and building codes.
2. Use grounded (earthed) conduit wherever possible. Avoid routing signal wiring near electric motors, rectifiers, power wiring, dimmer wiring, or other sources of electrical noise.
3. For two conductor with shield wiring, use Belden 8451 Two-conductor shielded cable or equivalent: tinned copper, twisted pair, 22 AWG stranded tinned copper drain wire, aluminum-polyester shield, 100% shield coverage, conductor-to-conductor 111 pF per meter.
4. For three conductor with shield wiring, use Belden 8771 Three-conductor shielded cable or equivalent: tinned copper, twisted pair, 22 AWG stranded tinned copper drain wire, aluminum-polyester shield, 100% shield coverage, conductor-to-conductor 75 pF per meter.
5. All shields must be connected to the CHASSIS of the CP650. This achieves the required RF interference immunity. A metal housing must be used for all D-connectors and the shields must be connected to the housing. Chassis ground and circuit (audio) ground are internally connected.

CP650 INSTALLATION WIRING
INPUT AND CONTROL CONNECTIONS



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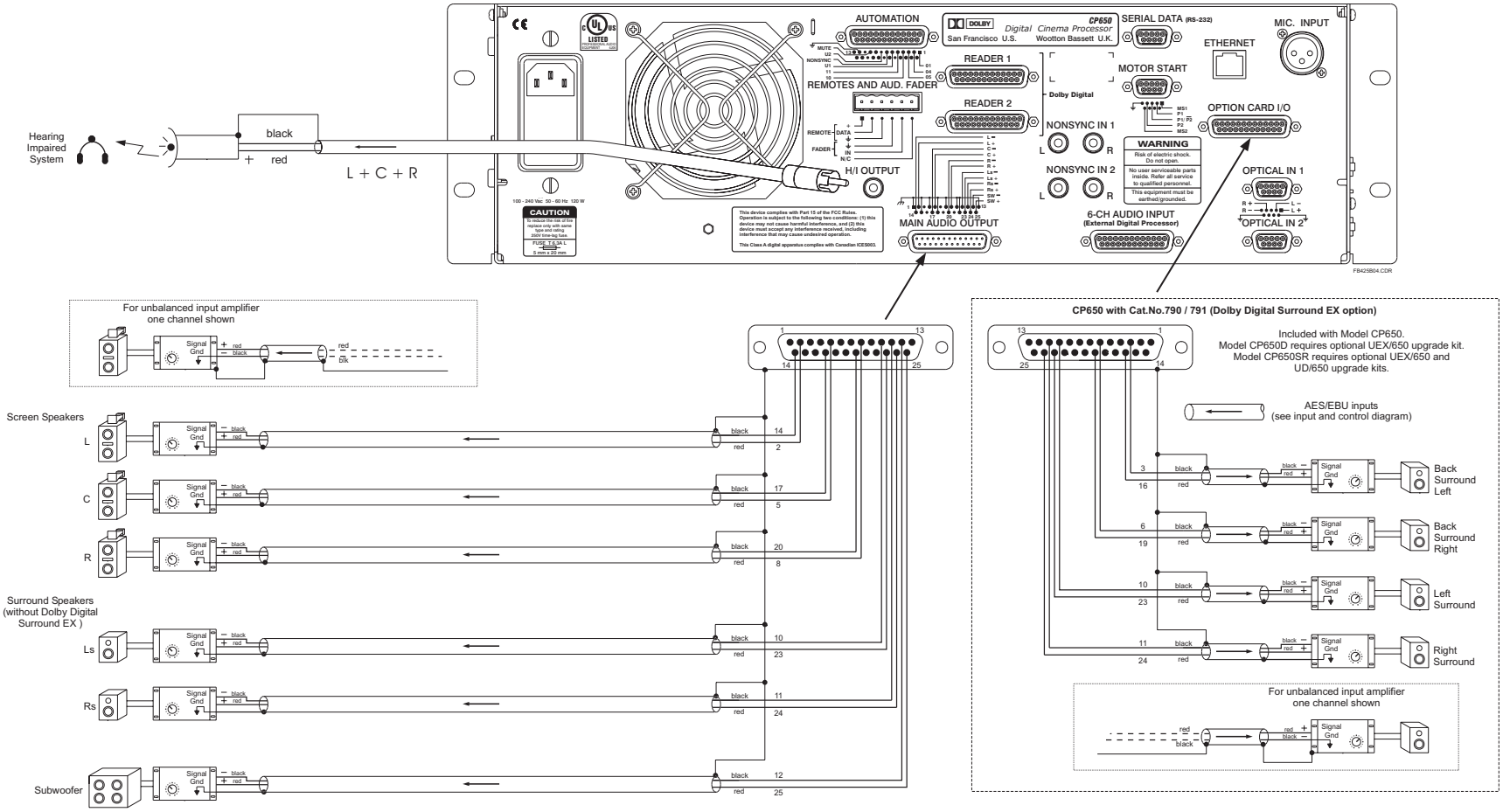
3. For two conductor with shield wiring, use Belden 8451 Two-conductor shielded cable or equivalent: tinned copper, twisted pair, 22 AWG stranded tinned copper drain wire, aluminum-polyester shield, 100% shield coverage, conductor-to-conductor 111 pF per meter.
4. For three conductor with shield wiring, use Belden 8771 Three-conductor shielded cable or equivalent: tinned copper, twisted pair, 22 AWG stranded tinned copper drain wire, aluminum-polyester shield, 100% shield coverage, conductor-to-conductor 75 pF per meter.
5. All shields must be connected to the CHASSIS of the CP650. This achieves the required RF interference immunity. A metal housing must be used for all D-connectors and the shields must be connected to the housing. Chassis ground and circuit (audio) ground are internally connected.

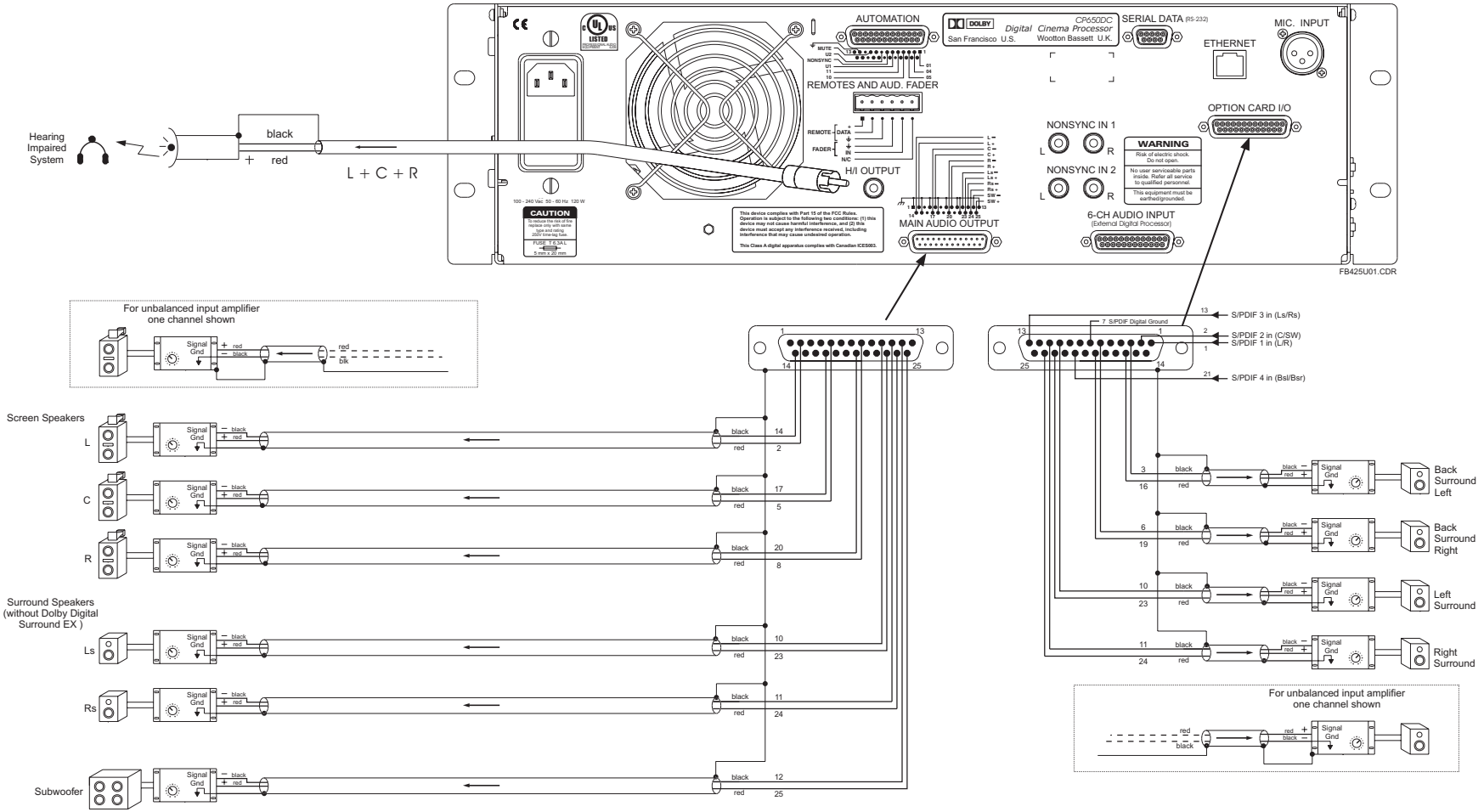
CP650DC MODELS INSTALLATION WIRING INPUT AND CONTROL CONNECTIONS



Notes:

1. Follow all local electrical and building codes.
2. Use grounded (earthed) conduit wherever possible. Avoid routing signal wiring near electric motors, rectifiers, power wiring, dimmer wiring, or other sources of electrical noise.
3. For two conductor with shield wiring, use Belden 8451 2-conductor shielded cable or equivalent: tinned copper, twisted pair, 22 AWG stranded tinned copper drain wire, aluminum-polyester shield, 100% shield coverage, conductor-to-conductor 111pF per meter.
4. All shields must be connected to the CHASSIS of the CP650. This achieves the required RF interference immunity. A metal housing must be used for all D-connectors and the shields must be connected to the housing. Chassis ground and circuit (audio) ground are internally connected.

CP650 INSTALLATION WIRING
AUDIO OUTPUT CONNECTIONS



Notes:

1. Follow all local electrical and building codes.
2. Use grounded (earthed) conduit wherever possible. Avoid routing signal wiring near electric motors, rectifiers, power wiring, dimmer wiring, or other sources of electrical noise.
3. For two conductor with shield wiring, use Belden 8451 2-conductor shielded cable or equivalent: tinned copper, twisted pair, 22 AWG stranded tinned copper drain wire, aluminum-polyester shield, 100% shield coverage, conductor-to-conductor 111pF per meter.
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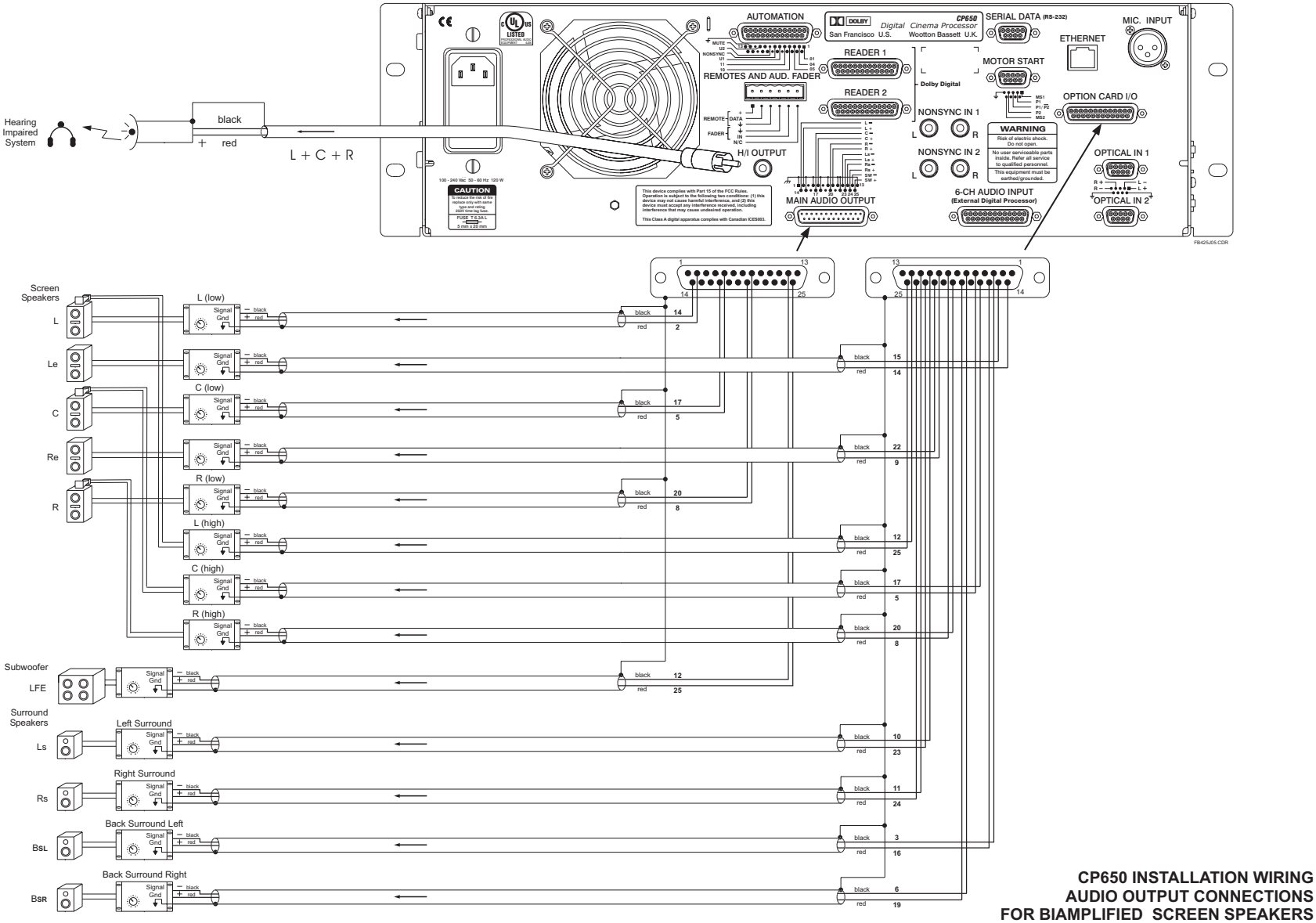
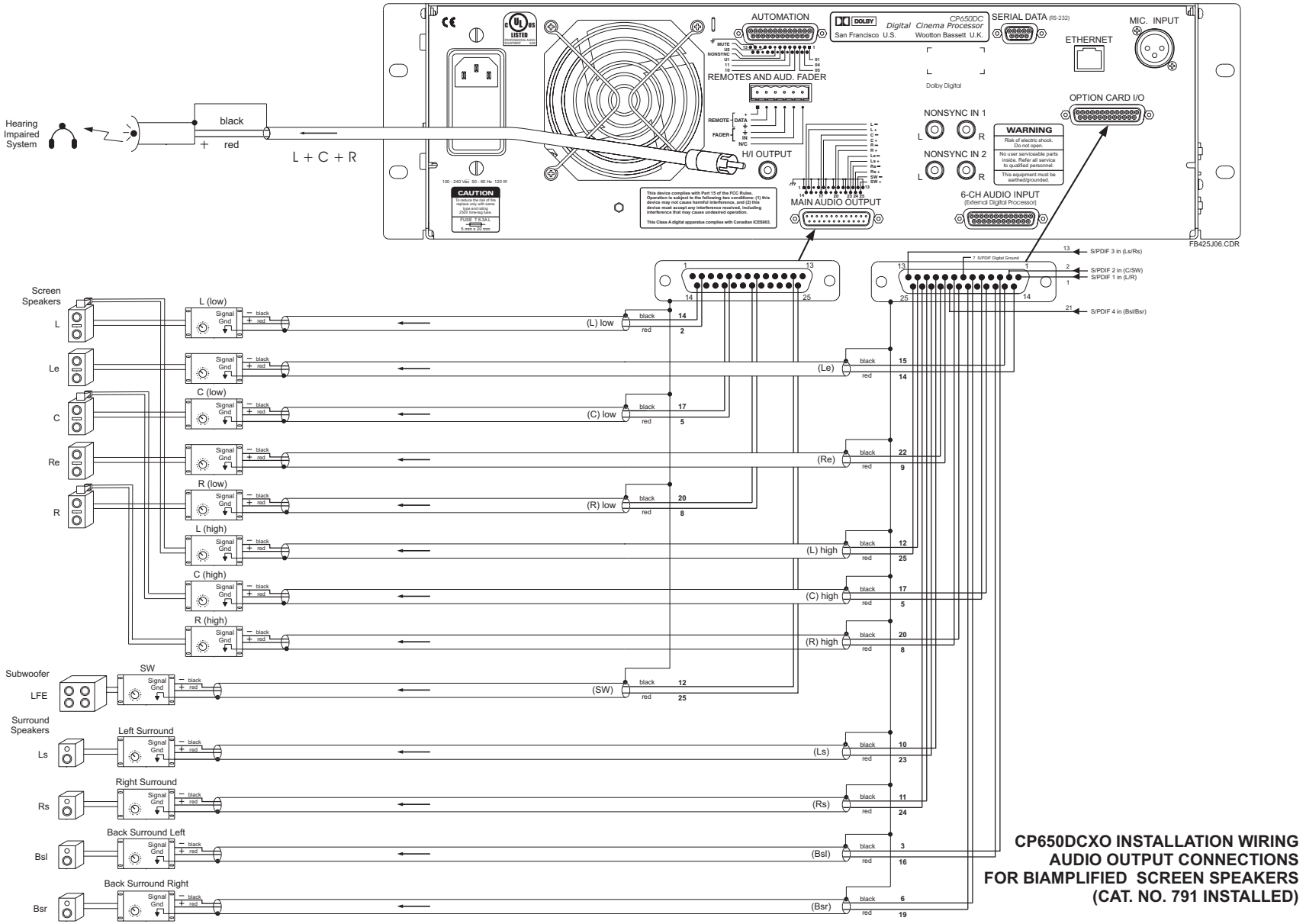
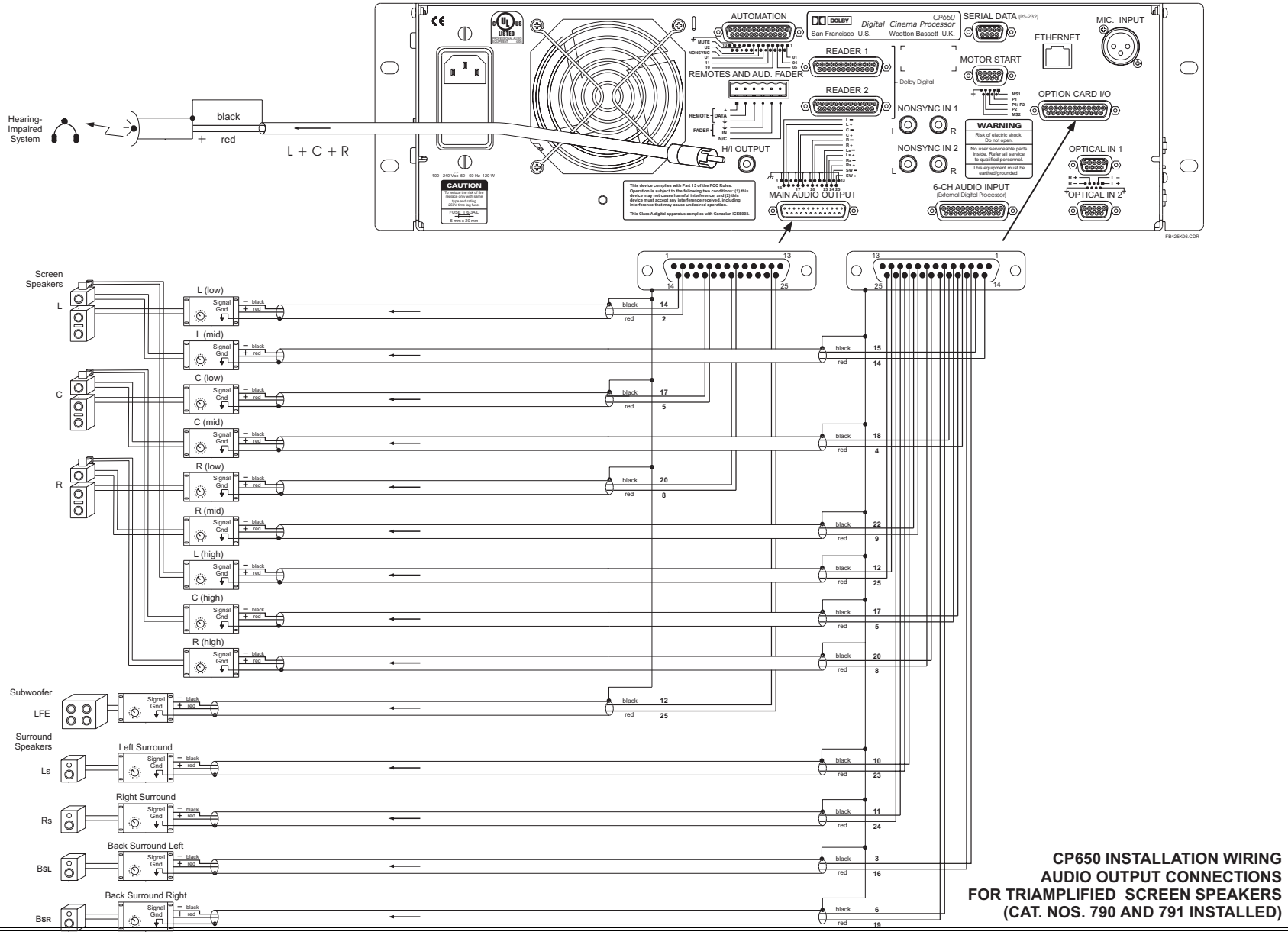
CP650DC MODELS INSTALLATION WIRING
AUDIO OUTPUT CONNECTIONS



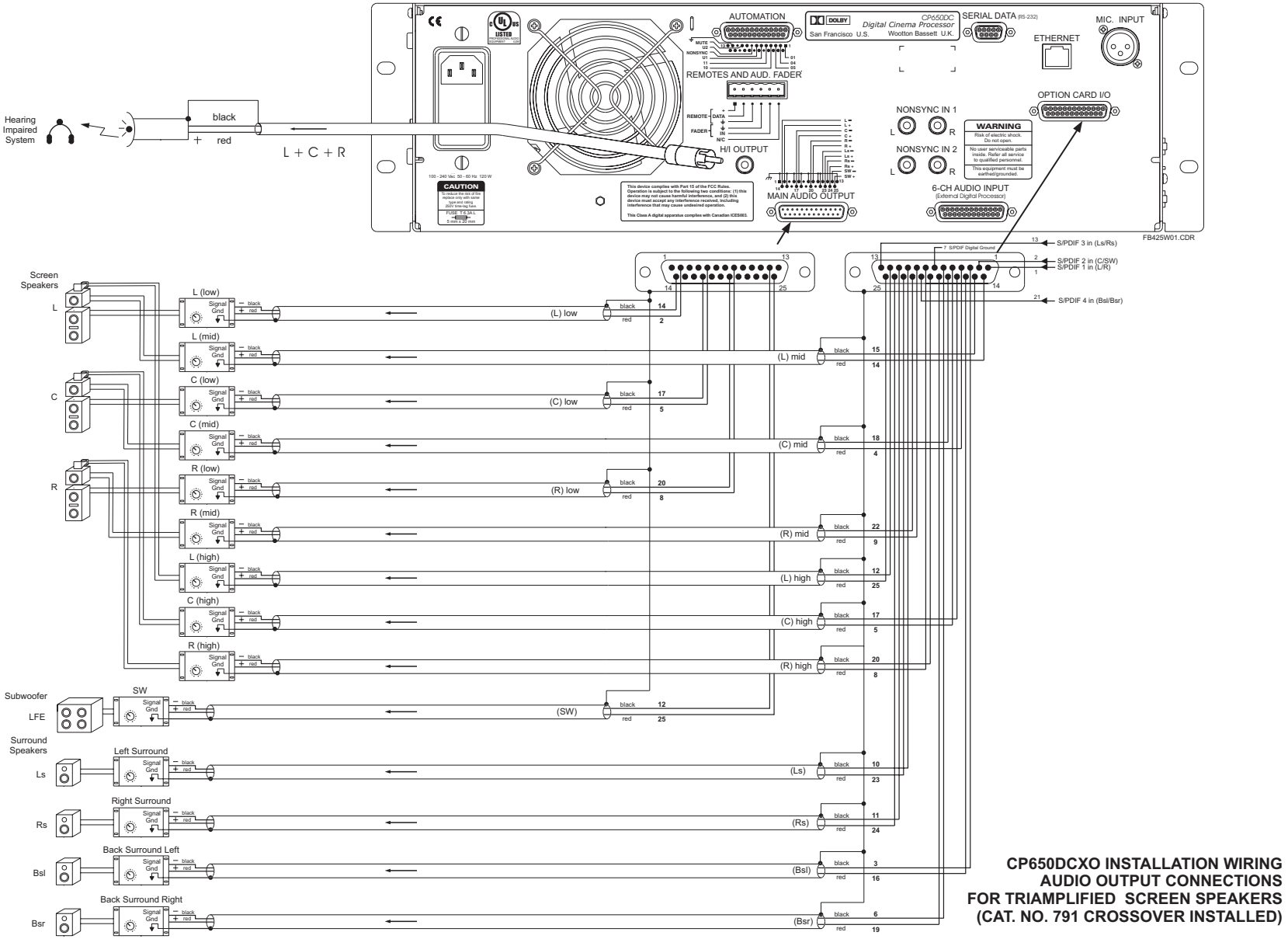
CP650 INSTALLATION WIRING
AUDIO OUTPUT CONNECTIONS
FOR BIAMPLIFIED SCREEN SPEAKERS
(CAT. NO'S. 790 AND 791 INSTALLED)



CP650DCXO INSTALLATION WIRING
AUDIO OUTPUT CONNECTIONS
FOR BIAMPLIFIED SCREEN SPEAKERS
(CAT. NO. 791 INSTALLED)



CP650 INSTALLATION WIRING
AUDIO OUTPUT CONNECTIONS
FOR TRIAMPLIFIED SCREEN SPEAKERS
(CAT. NOS. 790 AND 791 INSTALLED)



CP650DCXO INSTALLATION WIRING
AUDIO OUTPUT CONNECTIONS
FOR TRIAMPLIFIED SCREEN SPEAKERS
(CAT. NO. 791 CROSSOVER INSTALLED)

Chapter 3
Front-Panel and Alignment Overview

This chapter describes the features on the CP650 front panel, along with an overview of the general principles involved in the alignment of Dolby® cinema equipment. It is useful to develop an understanding of why the CP650 is aligned as described in this manual. If the installer is already familiar with the CP650 and these principles, or is in a hurry to complete the installation, this chapter may be read later. Continue the setup procedure beginning with the next chapter.

3.1 The CP650 Front Panel

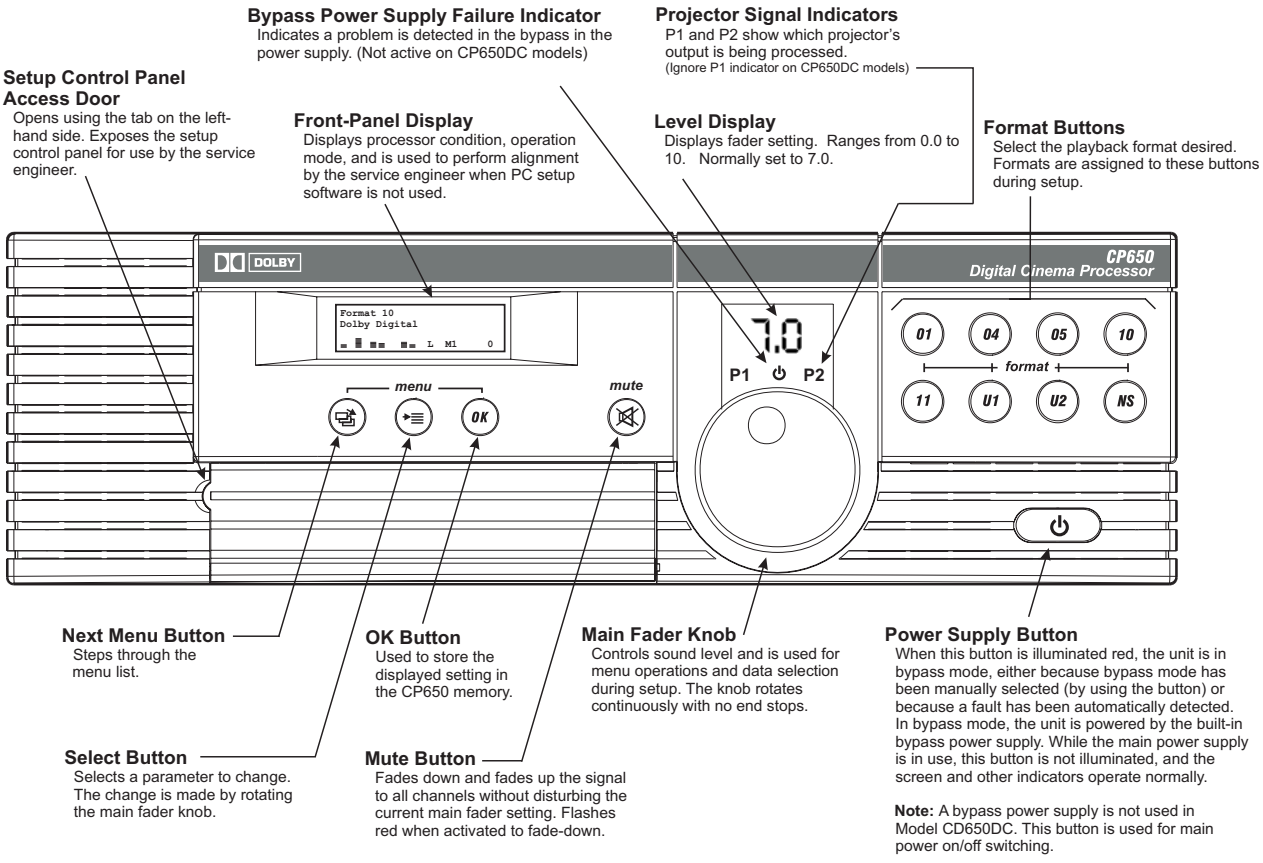


Figure 3-1 Front-Panel Controls

Front-Panel Display

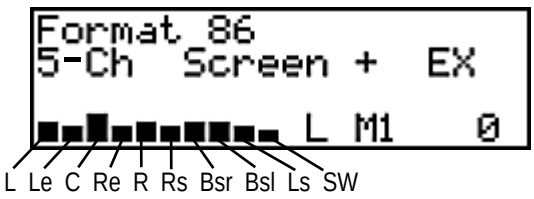


Figure 3-2 Front-Panel Display Showing All Possible Channels Active

Day-to-day operation of the CP650 is performed through interaction with this display. The 20-character, four-line LCD provides a readout of processor condition and operation mode. It can be used by the service engineer to align the CP650 if PC setup software is not used.

Figure 3-2 shows the display that is active when the CP650 is processing and playing a digital signal connected to the CP650 input with all channels active. The top two lines display the current format, which in this case is Dolby Digital Surround EX™ with five screen channels active. The bottom left area contains an active bar graph display of the sound signals present on each channel. The bars move, confirming that sound is passing through the CP650.

The bars are displayed starting with the Left screen channel, and moving clockwise around the auditorium:

- Left
- Left Extra
- Center
- Right Extra
- Right
- Right Surround
- Back Surround Right
- Back Surround Left
- Left Surround
- Subwoofer

The `L` on the display indicates that fader control is set to local, meaning that the fader knob on the front panel of the CP650 (and any Dolby remote box fader knob) controls the sound level in the auditorium. If the display shows an `A`, an external auditorium fader knob (not made by Dolby) controls the sound level.

The `M1` on the display (not active on CP650DC models) indicates that the projector 1 motor contact is closed or jumpered (the **Motor Start** connector on the back panel). The motor running signals are used in the timing of changeovers while running Dolby Digital films in a two-projector system.

The 0 shown on the bottom right is the Dolby Digital film error rate. The first indication of satisfactory digital film playback is the detection of a low error rate. The error rate is a number between 0 and 8. With a correctly aligned digital film reader, most films will play at an error rate of 6 or lower. If the digital error rate exceeds 8, or if the display shows F (data not readable) or "–"(no digital soundtrack), the CP650 automatically switches to playing the film's analog soundtrack until usable data appears.

Other Possible Front-Panel Sound Format Displays

Figure 3-3 shows the display when the CP650 is playing a Dolby Digital soundtrack with no Dolby Digital Surround EX decoder board installed. Because there are no Le, Re, Bsr, or Bsl channels present in this configuration, no signal bars are indicated for those channels.

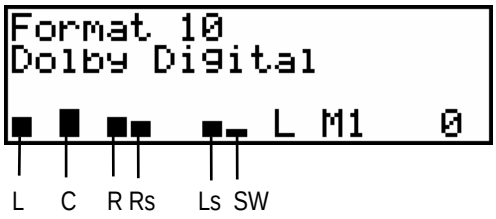


Figure 3-3 Front-Panel Display Showing a Dolby Digital Film Playing

Figure 3-4 shows the display when the CP650 is equipped with a Dolby Digital Surround EX decoder board, and is playing a Dolby Digital Surround EX soundtrack. The additional Back Surround Left and Back Surround Right channels are present in this configuration.

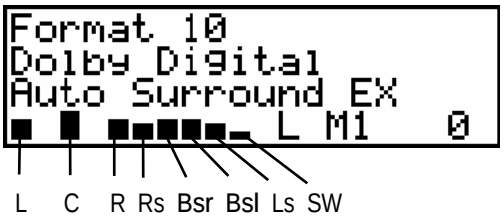


Figure 3-4 Front-Panel Display Showing Dolby Digital Surround EX Film Playing

The digital sound data from current films produced with the Dolby Digital Surround EX process contains auto-switching bits (Surround EX flags). A CP650 equipped with the Cat. No. 790 Dolby Digital Surround EX Decoder detects these bits and automatically switches the CP650 to Surround EX decoding. If the flags indicate that the film is not a Surround EX film, or if the flag bits are not present, Surround EX mode is switched off. The Bsr and Bsl channels are automatically configured for either 5.1 mode or Surround EX mode.

Note: If an N appears in the top right corner of the display, Noise Floor Optimization mode has been enabled. If a U appears, Unity Gain has been enabled. See Section 7.16.4.

Front-Panel Sound Format Display on Units with Earlier Software

The bar graph display on CP650s running software earlier than version 2.1 is slightly different.

Figure 3-5 Front-Panel Display when Running Earlier Software

Level Display

The main fader level is displayed as a two-digit number. Starting from a display of `0.0`, the level increases from –90 to –10 dB (display `4.0`) as the fader knob is turned clockwise. The level then increases in smaller steps from –10 to +10 dB (display `10`). As with previous generations of Dolby cinema processors, a fader setting of `7.0` (0 dB) is the nominal correct operating level. This setting matches the level used during production of the film.

Main Fader Knob

Use this knob to adjust the sound level. A fader reading of `7.0` is the nominal correct operating level. The main fader knob rotates continuously with no end stops. The knob is also used for data selection during setup operations.

When the fader knob is rotated between readings `0` and `4.0`, the output level changes in 20 dB steps between –90 and –10 dB. When the fader knob is rotated between readings `4.0` and `10`, the output level changes in 3 1/3 dB steps between –10 and +10 dB.

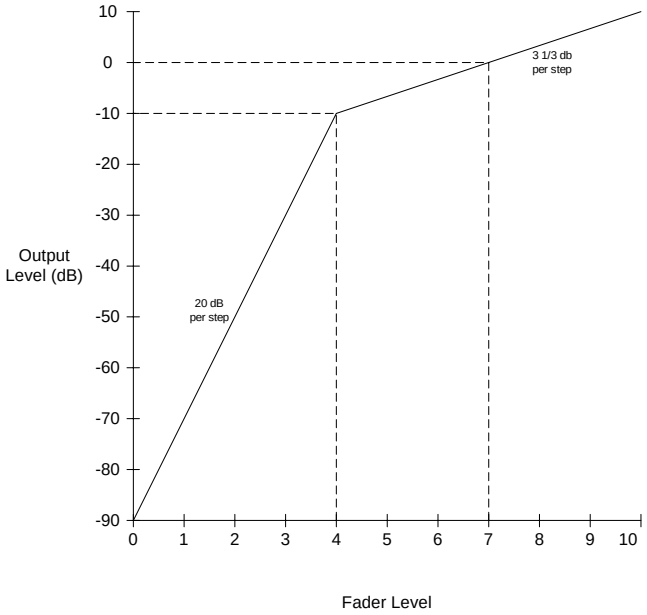


Figure 3-6 Fader Characteristic

Projector Signal Indicators

On the display, `P1` and `P2` show which projector optical input has been selected (not active on CP650DC models—`P1` remains illuminated).

Bypass Power Supply Failure Indicator

This indicator lights if a problem is detected in the bypass power supply circuitry (not active on CP650DC models).

Power Supply Button

This button operates the main power supply for the CP650. As with other Dolby cinema processors, the CP650 (except CP650DC models) incorporates a separate backup (bypass) power supply to power a basic film playback path. A red LED built into the switch is activated when the unit is powered from the bypass supply. While the main power supply is in use, this button is not illuminated, and the screen and other indicators operate normally. When this button is illuminated red, the unit is in Bypass mode, either because Bypass mode has been manually selected (by using the button) or because a fault has been automatically detected. In Bypass mode, the unit is powered by the built-in bypass power supply. On CP650DC models, the red LED built into the switch is not activated (no bypass power supply).

Format Buttons

These buttons select the desired format. Pressing a format button during menu operations will return the display to the top-level menu.

Setup Control-Panel Access Door

For use by the service engineer, the access door is opened to expose the setup control panel.

Mute Button

Pressing the **mute** button fades the audio output to all channels without disturbing the current main fader setting. The speed of fade-in and fade-out is separately adjustable from 0.2 to 5 seconds, using either the front-panel menu buttons or PC setup software. The **mute** button flashes red when mute is activated.

Operation and Setup Menu Control Buttons

The menu control buttons are used by both the operator and the service engineer to navigate front-panel screen menus, select various menu options, and store setup data.

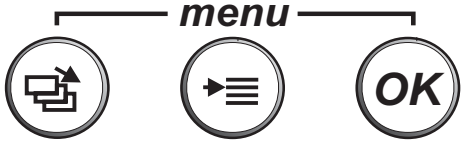


Figure 3-7 CP650 Operation and Setup Menu Control Buttons

The left-hand next menu button is used to step through the menu list. Pressing and releasing the button once will change the display to the next menu item. Pressing and holding the button while rotating the main fader knob will step the display through all menu items.

The center adjust parameter button is used to select a parameter to adjust when there are multiple items available on the display. Pressing and releasing the button will select among them. The adjustment is then made by rotating the main fader knob.

The right-hand **OK** button is used to accept the setting displayed on the front-panel screen and store it in CP650 memory. Any changes to settings will occur immediately, but will not be saved until this button is pressed. Leaving the current menu before pressing the button will cause the change to be discarded.

Note: For convenience, pressing the illuminated format button once, or any other format button twice, causes the CP650 to immediately return to the menu top-level screen display. This feature is handy for making a quick change, then returning to normal operation. This feature is not active in Setup mode (described below).

3.2 The Setup Control Panel

The setup control panel is located behind the front-panel access door.

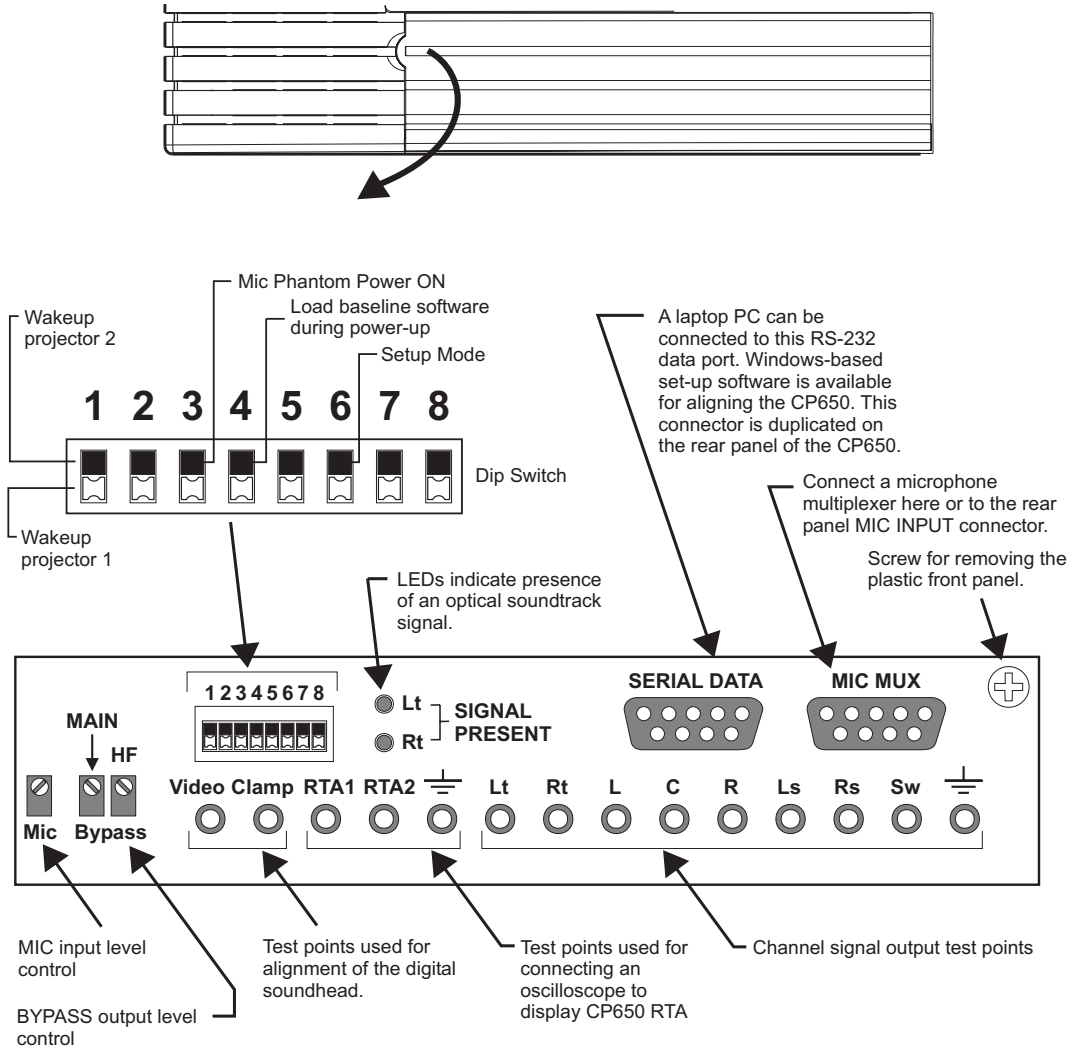


Figure 3-8 Setup Control Panel

Mic Input Level Control

This ten-turn potentiometer has an end-to-end range of 46 dB. It is shipped from the factory set to minimum.

Bypass Output Level Controls (not active on CP650DC models)

These two potentiometers, located on the Cat. No. 772B card, set the CP650 output level when the unit switches to bypass operation. The HF control is used if the CP650 is equipped with a Cat. No. 791 Crossover Card. Earlier units used the Cat. No. 772 card with a single potentiometer.

Setup DIP Switch

The eight-position DIP switch is used to set the functions shown. All switches are factory-set to down. Switches 2, 5, 7, and 8 are not used. DIP switch 6 is used to enter CP650 Setup mode.

Lt/Rt Signal Presence LEDs

These LEDs indicate that signals exist on the Lt and Rt channels from the film's analog soundtrack. They flash during film playback in both normal and bypass operation.

Serial Communications Port (RS-232)

A laptop PC can be connected to this port using a straight-through (pin 1 to pin 1, pin 2 to pin 2, and so on) cable. A cable with receive and transmit lines swapped (null modem cable) will not work. Setup software is available for aligning the CP650. This connector is duplicated on the rear panel of the CP650.

Caution: *The front- and rear-panel connectors are wired in parallel and should not be used simultaneously. Do not plug anything into the rear-panel connector if the front-panel connector is being used.*

Mic Mux Connector

When setting up a CP650, a microphone multiplexer can be plugged into this connector (or to the XLR connector on the rear panel for some types of units).

Test Points

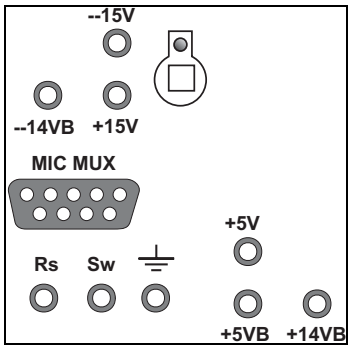
These test points are provided to allow rapid access to the required signals used during CP650 setup. Each test point is a 2 mm diameter female socket that accepts a 2 mm male test pin. Test point pins can be obtained in the USA from Pomona Electronics. The Pomona® Type 3221 is a useful, stacking, pin-to-BNC female adapter.

3.3 Power Supply Voltage Test Points

Six test points are located behind the front panel for measuring power supply voltages. They can be accessed by removing the front panel. See Section 9.3.1 for the voltage test ranges. Figure 3-9 shows the locations of the test points. A portion of the front subpanel, with the front panel removed, is also shown in this figure.

- Main power supply DC test points: +15 V, –15 V, +5 V
- Bypass power supply DC test points: +14 V, –14 V, +5 V

Note: On CP650DC models, voltage appears on the bypass supply test points, however, no bypass supply is incorporated. The readings result from the use of diodes feeding these test points from the main power supply.



(A portion of the front subpanel, with front panel removed)

Figure 3-9 Power Supply Voltage Test Points

Chapter 4
B-Chain Alignment

4.1 Check Theatre Equipment

Thoroughly check the loudspeakers and power amplifiers for any sources of poor performance, using the suggested checklists below as a guide.

Speakers

- Loudspeaker cables—Check cable condition and confirm they are the correct gauge for the impedance of the speakers and the length of the run.
- Speaker wiring—Check that the speakers are connected to the correct power amp channel.
- Rattles—A leak in the low-frequency driver cabinet may sound like a rattle.
- Also check for loose bolts or other hardware.
- Open drivers—In systems with pairs of drivers, 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.
- Check for missing drivers or other components.
- Crossover settings matching the type of drivers in use and the acoustics of the theatre—The high-frequency driver level control must be set for the best possible frequency response before you attempt any equalization. This is especially true if the system uses active crossovers with biamp equipment. If your CP650 is equipped with a Cat. No. 791 Crossover Card, please refer to Section 4.4 for information on settings.
- Check for proper polarity between the low- and high-frequency drivers, and between the channels.
- Aiming of speakers—Ensure that the speakers are correctly aimed into the auditorium, and that they are not obstructed by the screen frame, struts, or other obstructions.

Amplifiers

- Check for 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.

- Check for blown fuses.
- Ensure that there is good air movement through power amplifiers.

Air Conditioning

If air-conditioning noise is audible in the theatre, 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.

4.2 Microphone Placement

Position a microphone multiplexer in the center of the listening area. Place each microphone in the auditorium so that each is substantially in the reverberant field rather than in an area that receives the most direct energy from the speakers. In addition, avoid perfect symmetry. Arrange the microphones so that they are not arranged in a perfect square or rectangle parallel to the sides of the room. Take care not to place any of the microphones (except mic number 1) on the central axis of the room. Standing waves and nodes at these positions can cause measurement errors. Microphone number 1 should be placed two-thirds of the distance from the front speakers to the rear, at the exact side-to-side center of the room, approximately five feet above the floor level, and rotated 45 degrees upward toward the screen. Placement of this microphone is important for output level adjustments.

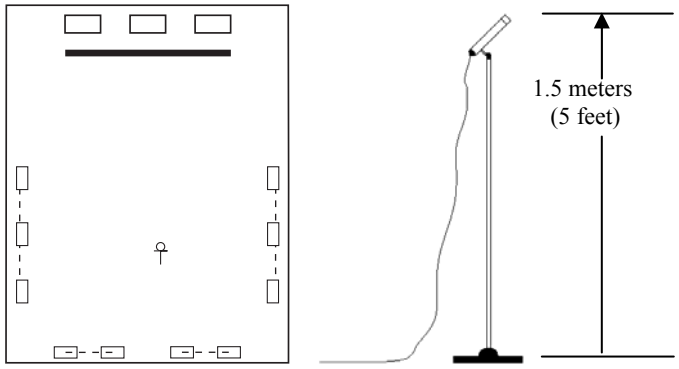


Figure 4-1 EQ Microphone Placement

If a single microphone is used (which is not advised), the recommended position would be two-thirds of the way from the front speakers to the rear, off the axis of the center speaker, five feet above the floor level, and rotated 45 degrees upward toward the screen.

Route the output cable to the CP650 and connect it to the microphone connector on the rear panel or front setup panel (XLR on the rear panel or nine-pin D-connector **Mic Mux** input on the front setup panel). The mic input connectors are wired in parallel. Phantom power is optionally provided to both mic connectors by moving DIP switch 3 to the up position.

4.3 Initial Setup

1. 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.

Caution: *The following steps will cause the CP650 to output pink noise to the power amplifiers. The CP650 output levels may be set too high. If you are unsure of the settings on your unit, turn off the power amplifiers before selecting the* `Calibrate SPL` *menu item shown in Section 4.4. Then, select and observe the present output level adjustment settings. (Press* ↵ *two times while the unit is in Setup mode.)*

2. Connect an oscilloscope to the test points located on the setup panel:
   - RTA1 to scope channel 1
   - RTA2 to scope channel 2

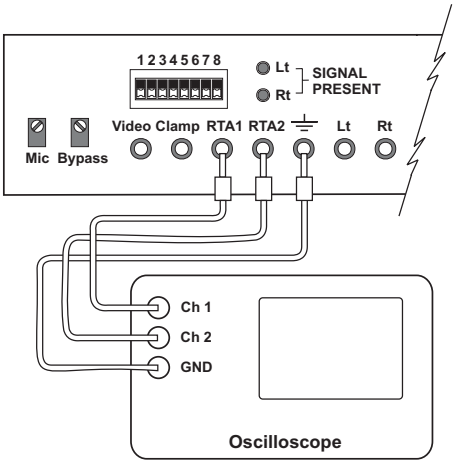


Figure 4-2 Oscilloscope Hookup

3. Set the oscilloscope to display both channels. Use the "chop" mode instead of "alt" mode for the best display results.

4. Apply power to the CP650.

5. Slide DIP switch 6 to the up position. This switches the CP650 into Setup mode. `(Install)` appears on the display screen. If a microphone multiplexer is being used, select microphone 1.

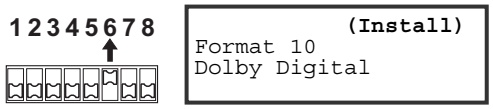


Figure 4-3 Switch to Setup Mode

4.4 Sound Pressure Level Calibration

If your CP650 is equipped with a Cat. No. 791 Crossover Card, an initial setup is required before you begin the SPL calibration. If you do not have a Cat. No. 791 installed, skip to Section 4.4.2.

4.4.1 Initial Setup with Cat. No. 791 Crossover Installed

Sound pressure level (SPL) calibration of a CP650 equipped with a Cat. No. 791 Crossover Card is performed with the crossover set to Full Range mode. Pink noise is applied only to the CP650 low-frequency main outputs, and these outputs are switched to full-frequency operation for calibrating the CP650 to the room sound pressure level.

1. Press ⇆ four times to display the `Crossover Mode` screen. One of three crossover configuration choices is displayed on the second line: `Full Range`, `2-Way`, or `3-Way`. Rotate the front-panel knob until `Full Range` is displayed.

```
Crossover Mode
Full Range
Crossover Disabled
```

2. Press **OK** to save this setting.

4.4.2 Calibration Procedure—All CP650s

1. Press ⇆ twice to move the display to the Calibrate SPL menu item. Pink noise is sent to the Center channel speaker.

```
Calibrate SPL
 Enter Room Reading:
> xx.x dB
 Press OK to continue
```

Note: If pink noise is not being generated, this indicates that the status of the digital input has changed. If you are using the digital input on the CP650, either disconnect or power down the device attached to the digital input during calibration. A change in the digital input bitstream will cause the CP650 to mute the pink noise.

2. The scope should now be receiving sync signals from the CP650. Set the scope vertical inputs to 100 mV/division.

3. Set the horizontal sweep rate to 1 ms/division.

4. Temporarily switch the inputs to ground, and move the vertical position of each trace to line up with the bottom screen graticule line. Do not move the vertical positions after completing this step.

5. Switch the inputs to DC and adjust the sync to trigger on the waveform. Adjust the scope horizontal position offset such that each displayed burst appears on the left- and right-hand sides of the screen.

6. The CP650 is shipped from the factory with the mic input-level control set to minimum. If necessary, adjust the mic input-level pot until the center area of the displayed pink noise moves to the middle of the scope screen. The trimpot is accessible through an opening in the setup panel.

7. With a sound pressure level meter, measure the noise level in the room. Hold the sound pressure level meter near the location of mic 1.

8. Rotate the CP650 front-panel knob until the room reading is shown on the front-panel screen. The adjustment range is from 45 to 108.5 dB, in 0.5 dB steps. Press **OK**.

9. Wait while the system automatically calibrates to the room reading. The calibration is retained in CP650 memory and can be used in future alignments. However, it is advisable to recalibrate the system when rearranging microphones because the sound pressure level will vary slightly with microphone placement.

Note: The spectrum analyzer built into the CP650 has automatic level control covering a range of mic input levels. If, however, you see an error message reporting mic level too low or too high, the microphones may require phantom power.

```
Mic Level Too Low
or Too High
Proceeding
Uncalibrated
```

If the microphone requires phantom power, move DIP switch 3 up (to turn on phantom power), then press and hold , and rotate the main fader counterclockwise one step back to the `Calibrate SPL` menu. Repeat steps 1–9. Or, while watching the oscilloscope RTA display, adjust the mic gain control to place the flat part of the signal in the approximate center of the screen. Then press and hold while rotating the main fader counterclockwise one step back to the `Calibrate SPL` menu, then repeat steps 1–9.

4.5 Initial Output-Level Calibration

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 because the levels will change slightly during equalization of the room. Exact output level adjustment will be performed after equalization.

Note: If pink noise is not being generated, this indicates that the status of the digital input has changed. If you are using the digital input on the CP650, either disconnect or power down the device attached to the digital input during calibration. A change in the digital input bitstream will cause the CP650 to mute the pink noise.

4.5.1 Main Channels

1. After auto-calibration, the Output Levels adjust screen appears with Center channel active.

```
Output Levels
>Channel: Center
 Level: xx
 Room Level xx.x dB
```

Note: The RTA oscilloscope display is not active on this menu.

2. Press →☰, moving the cursor down one line to Level. The Level: line on the display shows a relative number. The number has no units.

```
Output Levels
 Channel: Center
>Level: xx
 Room Level xx.x dB
```

3. Rotate the main fader knob to change the CP650 pink-noise output signal level into the auditorium while watching the measured Room Level shown on the bottom line of the display. Set it to read 85.0 dB.

```
Adjust Output Level
 Channel: Center
> Level: xx
 Room Level 85.0 dB
```

Note: If the room level does not appear, the calibration step may have failed or was not performed. Repeat Section 4.4.

4. Press →☰ once to move the cursor back up to the `Channel` selection. Rotate the main fader knob counterclockwise to change the `Channel` selection to `Channel: Left`.

```
Adjust Output Level
>Channel: Left
 Level: xx
 Room Level xx.x dB
```

5. Press →☰, moving the cursor down one line to `Level`, and rotate the main fader knob to set the room level to read `85.0 dB`.

```
Adjust Output Level
 Channel: Left
>Level: xx
 Room Level 85.0 dB
```

6. Repeat this process for the Right screen channel, setting the room level to `85.0 dB`.

7. Repeat this process, setting the Ls and Rs channels (or Ls, Bsl, Bsr, and Rs channels, if your unit is equipped with Dolby® Digital Surround EX™) to read `82.0 dB`.

8. When all channels have been adjusted, press **OK**. Saving Changes appears on the front-panel screen.

Note: If is pressed before **OK**, all of the level settings will be lost.

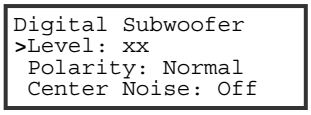
4.5.2 Subwoofer Channel

The initial subwoofer level adjustment uses a displayed RTA reference line, established from the Center channel pink-noise level. The subwoofer level is adjusted to match the displayed reference line. Final subwoofer level adjustments for both digital and optical signal paths are carried out later, after the room is equalized.

Note: When the Digital SW level is changed, the Optical SW level tracks proportionally with it, with a typical offset of –10 dB. The Optical SW level can be adjusted independently from the Digital SW level (see page 4-19), but remember to recheck it if the Digital SW level is changed.

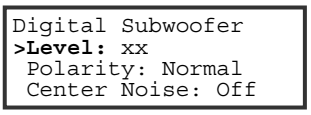
1. Switch the microphone multiplexer to cycle.

2. Press once to move the display one menu step. The Digital Subwoofer channel adjust menu appears next. Scope channel 2 displays a reference line.

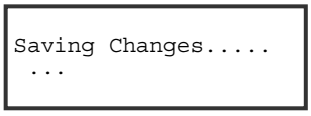


Note: The RTA oscilloscope display is active on this menu.

3. Pink noise is now present on the Subwoofer channel only (140 Hz bandwidth for EQ and level setting screens). Using the front-panel knob, adjust the Subwoofer channel level by moving the average subwoofer RTA display to the reference line displayed on the scope.



4. Press OK to save the level setting.



4.6 Crossover Setup—CP650 with Cat. No. 791

If your CP650 is not equipped with a Cat. No. 791 Crossover Card, please skip to the next section.

Two jumpers, located on the Cat. No. 772B board, must be set to their enabled position when a Cat. No. 791 Crossover Board is installed. CP650s shipped with a Cat. No. 791 board have the correct jumper setting. See Section 9.3.2 for instructions on gaining access to the jumpers.

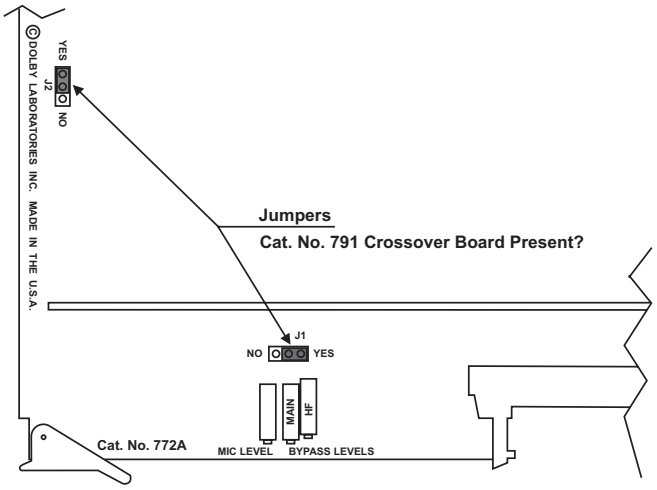


Figure 4-4 Cat. No. 772B Board Jumpers for Cat. No. 791 Crossover

The Cat. No. 791 Crossover Board contains a circuit in each high-frequency output channel (Left high, Right high, and Center high) to boost high frequencies. This allows the outputs to overcome the loss caused by placing the high-frequency drivers behind a perforated theatre screen. The circuit adds a maximum of 8 dB boost starting at approximately 6 kHz. This boost, combined with the bulk treble and equalization adjustments, provides enough high-frequency gain to suit most applications.

Because not all applications require this boost, jumpers are provided on the card to enable or disable it. The jumpers are set to the disabled position at the factory. See Section 9.3.2 for instructions on gaining access to the jumpers.

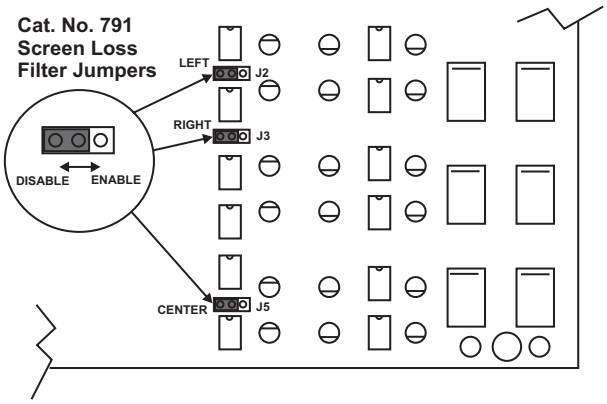
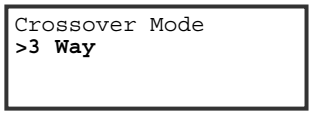


Figure 4-5 Cat. No. 791 Board Jumpers for Screen Loss HF Boost

The following parameters must be set before adjusting the room equalization in your auditorium:

- Crossover mode (2-Way or 3-Way)
- Left Extra (Le) and Right Extra (Re) screen channel support (available only in 2-Way and Full Range crossover modes)
- Filter type used at each crossover point (Linkwitz-Riley or Butterworth)
- Filter corner frequency at each crossover point
- Filter slope (Butterworth filter type only)
- Delay
- Polarity inversion to check for speaker wiring connections

Crossover Mode



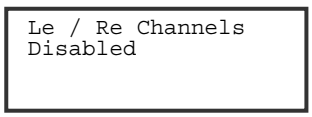
1. Press  multiple times to move to the Crossover Mode menu.
2. Rotate the front-panel knob to select the crossover mode desired: 2-Way or 3-Way.

Note: Selecting `Full Range` mode disables the crossover outputs and switches the main channel outputs to full bandwidth for calibrating the SPL in the auditorium (see Section 4.4.1).

3. Press OK to save your selection.

Le/Re Screen Channel Support

1. If your application calls for Le and Re support, the crossover must be operated in 2-Way or Full Range mode. In this case, the Le and Re outputs are full bandwidth. If these channels also require a crossover, you must use external units.
2. Press  once to display the `Le/Re Channels` screen.
3. Rotate the front-panel knob to enable or disable Le/Re support.



Note: Le/Re screen channel support is available in 2-Way and Full Range mode only.

Setting Butterworth Filter Characteristics

The crossover filters designed into the Cat. No. 791 are adjustable to allow tailoring of the response to your particular system. For most applications, the default crossover filter, Linkwitz-Riley, should be used. The slopes in this filter are not adjustable. The filter has two cascaded two-pole Butterworth filters for the lowpass side, and a three-pole filter for the highpass side at the crossover point. The corner frequency for each crossover point is adjustable.

To customize the filter slopes, change the crossover filter type to Butterworth by following these steps:

1. Move the display to the `Crossover Config` menu by pressing multiple times, or by pressing and holding the button while rotating the front-panel knob.

2. Rotate the front-panel knob to select the channel that you wish to set up (in this case, Left).

```
Crossover Config:
>Channel: Left
 Param    : F Type Low
 Value    : Lkwz.-Rly.
```

3. Press to move the selection arrow to `Param`. This allows you to select which filter parameter you wish to set.

4. Rotate the front-panel knob to select the filter type (`F Type`.) If you wish to change the crossover filter slope to customize your application, the type must be changed to Butterworth by following the next steps:

```
Crossover Config:
 Channel: Left
>Param    : F Type Low
 Value    : Lkwz.-Rly.
```

2-Way Crossover

If you configured the crossover mode as `2-Way`, there is one crossover point for setting the filter type. Press to move the arrow to `Value`.

```
Crossover Config:
 Channel: Left
 Param    : F Type Low
>Value    : Butterwth.
```

Rotate the front-panel knob to select the Butterworth filter type.

3-Way Crossover

If you configured the crossover mode as `3-Way`, set the filter type for the high-frequency crossover point by pressing to move the arrow to the `Param` selection, then rotate the front-panel knob to select `F Type High` for setting the mid-to-high crossover filter type.

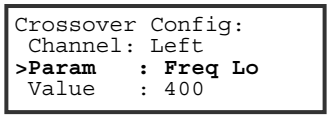
```
Crossover Config:
 Channel: Left
>Param    : F Type High
 Value    : Lkwz.-Rly.
```

Select the type of filter that you wish to use for the high-frequency crossover by pressing to select `Value`, then rotate the front-panel knob to select the Butterworth filter type.

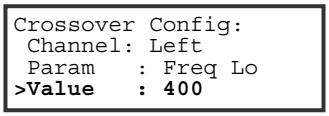
```
Crossover Config:
 Channel: Left
 Param    : F Type High
>Value    : Butterwth.
```

Setting Crossover Corner Frequency

1. Press ▶☰ to move the arrow to the parameter (Param) selection, then rotate the front-panel knob to select the lowpass filter corner frequency parameter (Freq Lo).



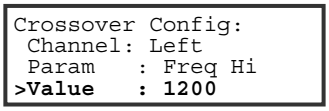
2. Press ▶☰ to move the arrow to the Value selection, then rotate the front-panel knob to select the desired corner frequency.



3. Press ▶☰ to move the arrow back to the crossover parameter selection.

2-Way Crossover

If you configured the crossover mode as `2-Way`, repeat steps 1–3 to set the highpass corner frequency (`Freq Hi`)**.**

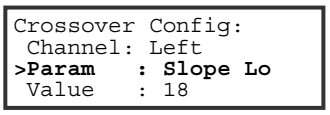


3-Way Crossover

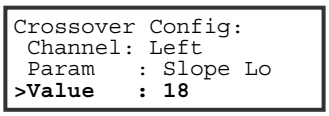
If you configured the crossover mode as `3-Way`, repeat steps 1–3 to set the mid-to-low (`Freq M Lo`), mid-to-high **(**`Freq M Hi`), and highpass frequencies (`Freq Hi`).

Setting Butterworth Filter Slope

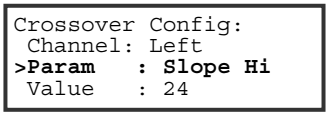
1. If you selected Butterwrth for the crossover filter type, press ▶☰ to move the arrow to the parameter selection, then rotate the front-panel knob to select the low-frequency slope (Slope Lo).



2. Press ▶☰ to move the arrow to the value selection, then rotate the front-panel knob to set the desired slope value.



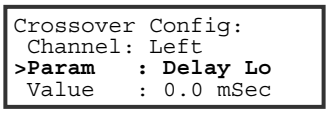
3. Repeat steps 1 and 2 to adjust the high-frequency slope (2-Way), or the mid-to-low, mid-to-high, and high-frequency slopes (3-Way).



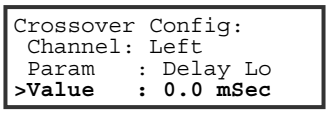
Setting Output Delay

The delay settings must be adjusted to compensate for different physical mounting positions of the speaker drivers.

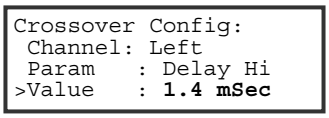
1. Press ▶☰ to move the arrow to the parameter (`Param`) selection, then rotate the front-panel knob to select the low-frequency output delay (`Delay Lo`).



2. Press ▶☰ to move the arrow to the value selection, then rotate the front-panel knob to adjust the output delay, in milliseconds, for the low-frequency output.

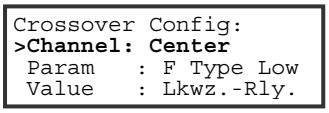


3. Repeat steps 1 and 2 to adjust the high-frequency delay (`2-Way`), or mid-frequency and high-frequency delay (`3-Way`).



Move to Next Channel

1. After all parameters have been set for this channel, press ▶☰ to move the arrow to the channel selection, and rotate the front-panel knob to select the next screen channel to be adjusted. This example shows the `Center` channel selected.



2. Set the crossover parameters for the selected channel.

Save

When all crossover parameters have been set, press **OK** to save all settings.

4.7 Room Equalization

Room equalization is performed using the real-time analyzer (RTA) circuit built into the CP650 along with an oscilloscope for RTA display. The adjustments for all output channels involves two steps: the coarse, or bulk, adjustment, using bass and treble controls, and the fine adjustment, using a 27-band equalizer. Subwoofer channel equalization involves setting the frequency, Q (center width), and level of cut, using a single-band parametric equalizer circuit.

If your CP650 is equipped with an optional Cat. No. 791 Crossover Card, there are additional steps to perform before setting room equalization. See Section 4.7.1.

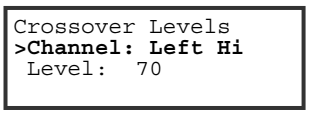
The RTA screen on the scope displays a standard (ISO 2969) response curve. The ideal setting is reached when the room response readings fall on (or very close to) this standard curve.

Note: If pink noise is not being generated, this indicates that the status of the digital input has changed. If you are using the digital input on the CP650, either disconnect or power down the device attached to the digital input during equalization. A change in the digital input bitstream will cause the CP650 to mute the pink noise.

4.7.1 Crossover Level Adjustment with Cat. No. 791 Crossover

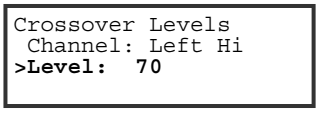
If your CP650 is equipped with a Cat. No. 791 Crossover Card, perform the steps below before adjusting the bulk treble and bass settings in the next section. In order to properly set the levels of the various bands (low and high for 2-Way, or low, mid, and high for 3-Way systems), you must first adjust the levels of all bands to be approximately equal. By performing this adjustment first, the final amount of equalization required to match the standard response curve will be less.

1. From the main format screen, press multiple times to display the Crossover Levels screen, then rotate the front-panel knob to select the Left channel high-frequency output (Left Hi).

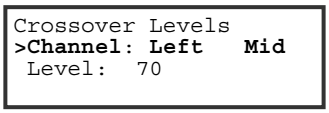


Note: With the crossover mode set to 2-Way or 3-Way, each output (low, mid, and high) will affect the RTA display in the band set by the crossover corner frequency settings. Each crossover output level (mid and high) should be adjusted separately from the main level control in order to match the low-frequency output level.

2. Press to move the arrow to the Level selection. While observing the RTA display on the oscilloscope, rotate the front-panel knob until the high-frequency bands are at the same approximate level as the low-frequency bands.



3. If you configured the crossover mode as 3-Way, press to move the arrow to the Channel selection, then rotate the front-panel knob to select the Left channel Mid frequency output.



4. While observing the RTA display on the oscilloscope, rotate the front-panel knob until the mid-frequency bands are at the same approximate level as the low-frequency bands.

```
Crossover Levels
 Channel: Left   Mid
>Level:  70
```

5. Press ▶≡ to move the arrow to the Channel selection, and repeat the procedure for the remaining channels.

```
Crossover Levels
>Channel: Center Hi
 Level:  70
```

6. When all of the crossover level adjustments have been set, press **OK** to save your settings.

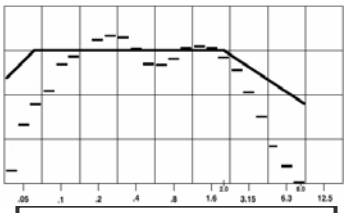
```
Saving Changes.....
 ...
```

4.7.2 Setting Coarse EQ

1. Press ⇆. The Bulk EQ Ch. menu appears with the Center channel selected. Pink noise will appear at the Center channel speaker.

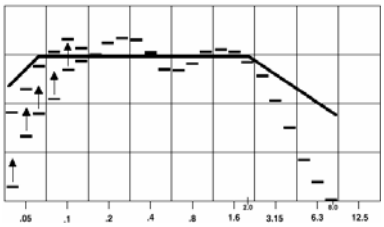
```
>Bulk EQ Ch.: Center
 Bass Adjust:±x.x dB
 Treble  Adj: ±x.x dB
 Corner Freq: x kHz
```

   The standard response curve should appear over the average of the displayed mid-frequency peaks. If this is not the case, the scope setup step may have been performed incorrectly. See Section 4.3, step 1.



2. Press ▶≡ to move the cursor down to Bass Adjust, then slowly move the front-panel knob to adjust the low-frequency response as close as possible to the reference line displayed on the RTA.

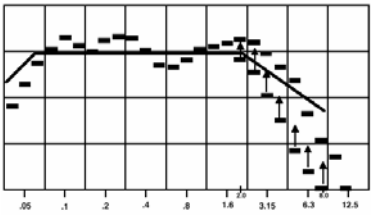
```
Bulk EQ Ch.: Center
>Bass Adjust:±x.x dB
 Treble  Adj: ±x.x dB
 Corner Freq: x kHz
```



3. Press ▶≡ to move the cursor down to Treble Adjust, then slowly move the front-panel knob to adjust the high-frequency response as close as possible to the reference line displayed on the RTA.

```
Bulk EQ Ch.: Center
 Bass Adjust:±x.x dB
>Treble  Adj: ±x.x dB
 Corner Freq: x kHz
```

   If a satisfactory response is not obtained, try changing the corner frequency. Pressing ▶≡ again moves the cursor to Corner Freq. The frequency selections are 1, 2, 3, or 4 kHz, and are set by rotating the front-panel knob.



4. Adjust each of the remaining full-range channels, using ▶≡ to move the cursor to Bulk EQ Ch., and the front-panel knob to select the desired channel. Bulk equalization facilities for the surround channels are slightly different than for the

screen channels. The corner frequency is fixed at 2 kHz, and there is a 3 dB level shift to the standard response curve displayed on the scope.

Caution: *Do not press the button. All settings would be lost!*

5. Press **OK** to save all bulk EQ settings.

```
Saving Changes.....
 ...
```

4.7.3 Setting Fine EQ

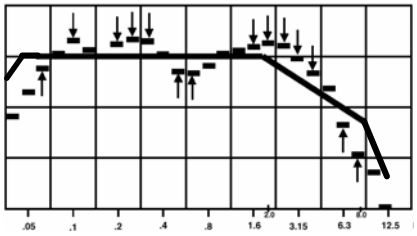
1. Press once to move to the `B-Chain EQ` menu. The software enters this menu with Center channel selected. Press **OK** to begin the final EQ adjustments on this channel.

```
B-Chain EQ
 Channel Select
>Center
 Press OK to continue
```

The 27-band RTA now displays on the oscilloscope. The default start frequency band selected is 1 kHz. A small marker on the scope trace shows the frequency band selected. Turn the front-panel knob (with no button pressed) to select the active band. The CP650 LCD screen cursor (line) blinks to indicate which band is active. When the front-panel knob is rotated to select frequencies at the far left or right side of the LCD screen, the displayed bands will scroll left or right to show the low- or high-frequency bands.

```
1.0kHz  C  ±x.x dB
```

2. Press and hold while moving the front-panel knob to adjust the level of the selected band. Perform fine adjustment of each band, adjusting the response to be as close as possible to the standard curve displayed on the scope.



All of the equalizer bands interact with each other. You should not start at the low-frequency end of the response curve and merely work your way to the high-frequency end. As each band is adjusted, the response of adjacent bands is affected. Start at the center frequencies. The desired curve is a flat frequency response up to 2 kHz, falling at 3 dB per octave to 8 kHz (1 dB per third-octave band). If modern woofer systems (vented-box direct radiator enclosures) are installed in the theatre, moderate bass equalization may be used down to 40 Hz. Once an adjustment seems OK, work on the frequencies on either side of it. You may find that a cut at one frequency is followed by a slight boost at adjacent frequencies.

Caution: *Do not press the button unless you wish to reset your changes. All settings would be lost!*

Shortcuts:


= **Flat**

- Spin the front-panel knob counterclockwise (more than 100 steps) to set the equalization to flat (no boost, no cut).
- Spin the front-panel knob clockwise (more than 100 steps) to activate the EQ Assist™ feature. See Section 4.7.4.


= **EQ Assist**

3. When the desired response for this channel has been achieved, press **OK** to save your settings.

```
Saving Changes.....
 ...
```

4. Press ▶☰ once, then move the front-panel knob to select the next channel to be equalized. Repeat the above procedure for the remaining full-range channels.

4.7.4 The EQ Assist Feature

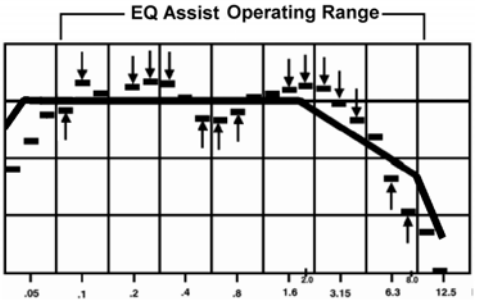


Figure 4-6 EQ Assist Operating Range

The EQ Assist function automatically adjusts the B-chain EQ levels in 22 bands, attempting to bring the spectrum of the audio in the auditorium in alignment with the standard response curve. Course (bulk) EQ must be performed before activating EQ Assist. (See Section 4.7.2.)

Activate EQ Assist by rotating the front-panel knob clockwise to move the blinking cursor up to the 16 kHz band. Keep spinning the knob clockwise. When the cursor stops blinking, EQ Assist is active and no further changes are allowed while it operates. You will see the levels moving, and hear the audio in the auditorium changing as EQ Assist operates. When the cursor begins blinking again (after approximately eight seconds), EQ Assist has finished.

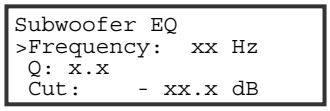
It is important to note that the lowest three bands of the graphic equalizer (40, 50, and 63 Hz) and the uppermost two bands (12.5 and 16 kHz) will not be adjusted. This is to protect the speakers against undesirable level boosts in those bands. Set these bands manually, then verify that the overall equalization is satisfactory.

Note: Accurate sound pressure level calibration for each channel must be performed before using this feature. See Section 4.4 if necessary.

4.7.5 Setting Subwoofer Channel EQ

Equalization facilities for the Subwoofer channel are different than for the other channels. This process is designed to correct the principal room resonance in the operating range of the subwoofer. The subwoofer equalizer is a cut-only filter, with adjustable frequency (25 to 125 Hz), Q (center width, selectable between four values), and amount of cut (0 to 12 dB). There is no standard curve displayed for this function.

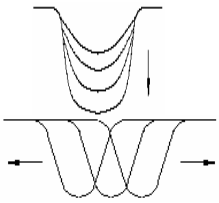
1. Press multiple times to move to the Subwoofer EQ screen. The button is used to select Frequency, Q, or Cut, and the main fader knob changes the settings.



2. Press to move the cursor to Q, then rotate the front-panel knob to set Q to 2.0. This will produce a moderately wide notch.

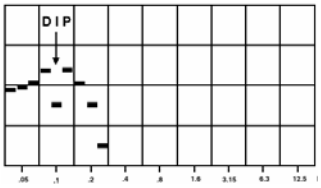
3. Press , moving the cursor to Cut, then rotate the front-panel knob setting cut to 0.0 dB (minimum cut). This will disable the EQ so that you can determine the low-frequency resonant peak to be equalized. The factory setting is 0.0 dB.

4. Rotate the front-panel knob counterclockwise to set `Cut` to maximum, `12 dB`.

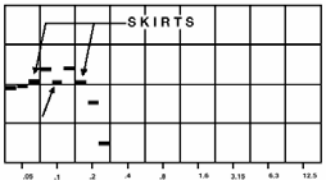


5. Press to move the cursor to `Frequency`, then rotate the front-panel knob. A dip in the frequency response will move along the frequency axis of the scope RTA display.

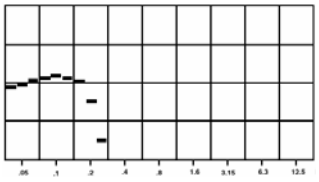
6. Adjust the frequency until the center of the dip is in the same band as the peak displayed in the previous unequalized frequency response.



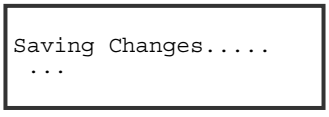
7. Press to move the cursor to `Cut`, then slowly reduce the amount of cut to flatten the dip. The center of the dip should be at the same level as the skirts.



8. Press to move the cursor to `Q`, and adjust `Q` for the flattest possible frequency response.



9. When the desired response has been achieved, press **OK** to save the settings. After saving the settings, the display returns the `Subwoofer EQ` screen.



4.7.6 Final Output-Level Calibration

Once room equalization is complete, the sound pressure level in the theatre can be set accurately.

Main Channels

1. If a microphone multiplexer is being used, select Mic 1.

2. Press  to display the Output Levels screen, then repeat the output level setting steps given in Section 4.5.1, starting with step 2.

   Make the following settings: L, C, R = 85 dB, Ls and Rs = 82 dB (or Ls, Bsl, Bsr, Rs = 82 dB).

Note: Because the sound pressure level calibration was performed earlier, a recalibration is not required unless the microphone placement has changed. Repeat the steps in Section 4.4 if necessary.

Digital Subwoofer Channel Level

Switch the microphone multiplexer to cycle.

1. Press  once to move the display one menu step to Digital Subwoofer Level. The RTA oscilloscope display is active on this menu. If the reference line does not appear, the calibration step may have failed or was not performed. Repeat the SPL setting steps in Section 4.4.

```
Digital Subwoofer
>Level: xx
 Polarity: Normal
 Center Noise: Off
```

   Pink noise is now present on the Subwoofer channel only (100 Hz bandwidth). Using the front-panel knob, adjust the digital subwoofer channel level by moving the average subwoofer RTA display to the reference line shown on the scope.

Note: When the Digital SW level is changed, the Optical SW level tracks proportionally with it, with a typical offset of –10 dB. The Optical SW level can be adjusted independently from the Digital SW level (see page 4-19), but remember to recheck it if the Digital SW level is changed.

   If pink noise is not being generated, this indicates that the status of the digital input has changed. If you are using the digital input on the CP650, either disconnect or power down the device attached to the digital input during level setting. A change in the digital input bitstream will cause the CP650 to mute the pink noise during level setting.

2. Press **OK** to save the final level setting.

Optical Subwoofer Bandwidth

This menu item sets the upper frequency limit of the Subwoofer channel to either 50 or 100 Hz. The recommended setting depends on the type of screen speakers in your cinema. If you have direct radiator type screen speakers, set the bandwidth to 50 Hz. If you have older, horn-loaded screen speakers (such as Altec A-4s), set the bandwidth to 100 Hz.

1. Press to move the display one menu step to `Optical Subwoofer Bandwidth`, then rotate the front-panel knob to select 50 or 100 Hz.

```
Optical Subwoofer
 Bandwidth
> 50 Hz
```

2. Press **OK** to save the selection.

Optical Subwoofer Channel Level

1. Press to move the display one menu step to the Optical Subwoofer Level setup menu. Pink noise is now present on the subwoofer channel only.

```
 Optical Subwoofer
>Level: xx
 Polarity: Normal
 Center Noise: Off
```

Note: The RTA oscilloscope level reference line displays 10 dB lower for this adjustment and the pink noise generator bandwidth is set to 50 Hz. If the reference line does not appear, the calibration step may have failed or was not performed. Repeat the steps in Section 4.4.

2. Rotate the front-panel knob to move the average level of the displayed pink noise up or down to the meet the reference line.

Subwoofer Speaker Polarity Check

1. Using , move the cursor to Center Noise, then rotate the front-panel knob to On.

```
 Optical Subwoofer
 Level: xx
 Polarity: Normal
>Center Noise: On
```

2. Press to move the cursor to `Polarity`, then use the front-panel knob to alternate between `Normal` and `Inverse` polarity.

```
 Optical Subwoofer
 Level: xx
>Polarity: Inverse
 Center Noise: On
```

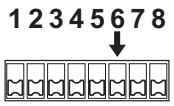
Note the change in the average level of the RTA bands between 20 and 80 Hz. There should be a level decrease when the polarity is `Inverse`. The polarity of the subwoofer wiring is incorrect if you do not see a decrease. In this case, reverse the subwoofer speaker wiring connections. If the subwoofer wiring polarity is correct, you will see a level increase between 20 and 80 Hz on the RTA display when the front-panel knob is rotated to `Normal`.

The subwoofer polarity will always be reset to the `Normal` setting after completing this check. `Inverse` is a temporary setting for this test only.

3. Press **OK** to save the final level and polarity settings.

4.8 Final Sound Check—Rotating Pink Noise

1. Slide DIP switch 6 down to the normal position. The CP650 will switch to normal operation with the user menu choices available.



2. Press ⇆ multiple times to move the display to the `Rotating Noise` screen.

```
 Rotating Noise
Press OK to
Start or Stop
```

3. Press **OK** to start the pink noise.

***Caution**: Pressing* **OK** *will play pink noise in the auditorium!*

Pink noise is sent to each channel in turn, holding for five seconds at each channel. The channel currently running pink noise is shown on the bottom right-hand side of the display.

```
 Rotating Noise
Press OK to
Start or Stop
Running                L
```

Unlike the different levels used during alignment, the rotating pink noise is set to 85 dB for all channels during this test. Pressing the **OK** button stops the pink noise from moving to the next channel. Pressing the **OK** button again resumes pink-noise rotation.

4. Go to the auditorium and sit two-thirds of the distance from the front speakers to the rear, and at the center from side to side. All channels should sound equally loud and have similar frequency response as the noise rotates. An SPL meter can be used to confirm accurate and equal level settings.

5. Press the illuminated front-panel **format** button to return the CP650 to normal operation.

Chapter 5
A-Chain Alignment

Note: CP650DC models for digital cinemas do not incorporate 35 mm film sound support. Skip this chapter if you are installing any of these models.

The A-chain alignment involves adjustments made to the projector soundhead optics, solar cell, and optical preamplifier board. 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 A-chain optical level is calibrated with the Cat. No. 69T Dolby Tone test film. This film is used to establish the correct Dolby operating level within the CP650.

A Cat. No. 69P 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 CP650.

The slit image must be correctly focused on the film and must be set at precisely a right angle 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 CP650 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 to 16 kHz can be achieved.

5.1 Projector Checkup

Clean the optical surfaces with a cotton swab moistened with glass cleaner. Inspect the film guides for evidence of cuts, cracks, surface defects, or any foreign materials that could impair smooth film guiding.

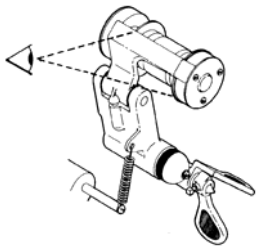
5.2 Projector Analog Optical Alignment

If a stereo solar cell is already installed on projector 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. 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 it and look through the lens at a light. Repeated 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. Install a new lens assembly if necessary.

Inspect the lateral film guides for evidence of cuts, cracks, surface defects, or any foreign materials that could impair the film guiding. Clean or replace the guides as necessary. The guide roller must rotate freely; if it is spring-mounted, make sure that lateral movement and return are not obstructed. If the roller has a felt or rubber insert, check for a flat spot and replace the roller if necessary.

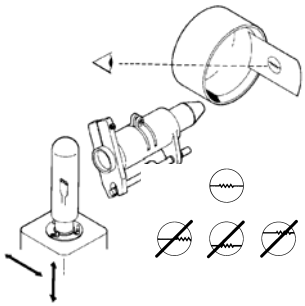


Remove the existing exciter lamp and replace with a new lamp. Adjust the exciter lamp DC voltage to between 70 and 85 percent of the rated voltage. Using an AC millivolt meter or oscilloscope, verify that there is no more than 3 percent ripple present with the lamp on.

LAMP VOLTAGE	DC ADJUSTMENT
6 V	4–5 V
9 V	6.5–8 V

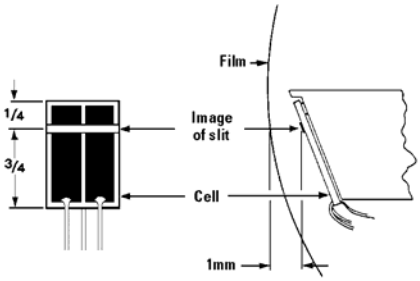
If the projector uses a plastic light pipe or tube, verify that the light output is not appreciably affected by dirt, cracks, flaws, yellowing, or foreign matter. Replace if necessary.

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



If you have difficulty obtaining an image of the filament, place a piece of tissue paper over the lens to assist in seeing the image. 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. If this distance is exceeded, there will be crosstalk between the two optical stereo tracks. Check the image of the slit on the cell: It should be a thin sharp line. The slit image should be the width of the cell, and positioned three-quarters of the way up the cell. Try to get the best compromise among all of these conditions, then tighten the cell bracket mounting screws.

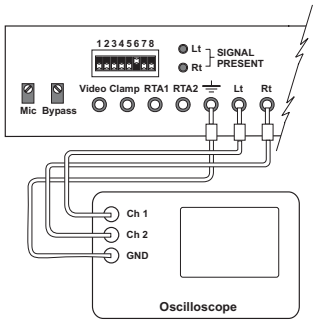


Confirm that the cell wiring and connections are correct. Shielded cables must be used. The inner conductors must be wired to the CP650 optical input connectors exactly as shown on the wiring diagram. See the wiring diagram on page 2-13.

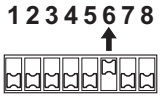
Note: The solar cell associated with the Right channel is closest to the edge of the film.

5.3 Dolby Level Set

1. Connect the oscilloscope to the Lt and Rt test points.



2. Slide DIP switch 6 to the up position. This switches the CP650 into Setup mode.



5.3.1 Automatic

1. Press ⇆ multiple times to move the display to Automatic Optical Level Adjust Projector 1.

```
Automatic
Optical Level Adjust
Projector 1
 Press OK When Ready.
```

2. Thread and play a Dolby test film, Cat. No. 69T, on projector 1. The film emulsion should face away from the screen.

3. Verify that the signal presence LEDs on the CP650 setup panel are illuminated. The Dolby tone signal should be visible on the oscilloscope.

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

5. Press **OK** to begin the automatic level calibration for projector 1. The four vertical circles display the Left channel signal level.

```
                L O O R
Please Wait.    ..O O
                  O O
                  O O
```

6. Perform automatic calibration for projector 2 if the theatre is so equipped.

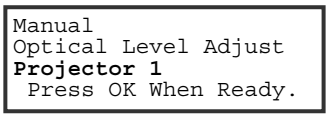
```
Automatic
Optical Level Adjust
Projector 2
 Press OK When Ready.
```

7. If there is a problem with automatic calibration, perform manual adjustment by pressing **OK**.

```
Unable to complete
Level adjustment.
Press OK to continue
```

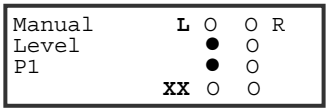
5.3.2 Manual

1. To set Dolby level manually, press **OK** to return to the `Automatic Optical Level Adjust` screen, then press twice to move to `Manual Optical Level Adjust` for projector 1.

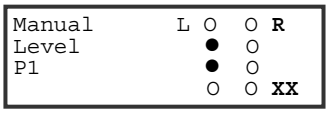


2. Press **OK** to begin manual adjustment.

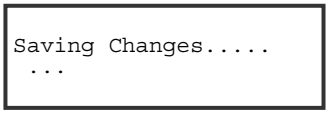
3. The number displayed on the bottom line represents the level setting for the Left channel. The left four vertical circles display the Left channel signal level, similar to an LED meter. Rotate the front-panel knob until the two center circles fill black. The adjustment range is 0–63 dB in 0.3 dB steps.



4. Press to select the Right channel and adjust in the same manner. The number displayed on the bottom line will move the Right channel column.



5. Press **OK** to save your level settings for projector 1.

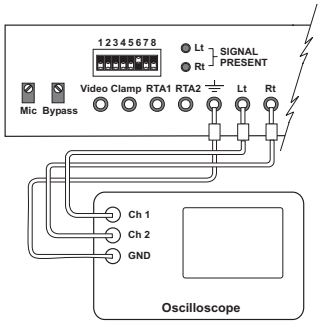


6. Stop the projector, and load and run the Cat. No. 69T test film on projector 2 (if so equipped).

7. Press to move the menu to `Manual Optical Level Adjust` for projector 2, and repeat the above procedure for the Left and Right channels.

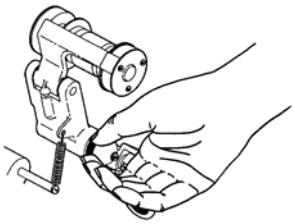
8. Press **OK** to save your level settings for projector 2.

5.4 Film-Path Alignment Check

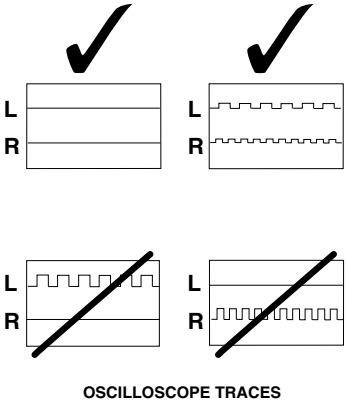


1. Connect the oscilloscope to the Lt and Rt test points.

2. Thread and play a SMPTE buzz track test film. This film has modulation just beyond the normally scanned areas of the optical soundtracks. The objective of this test is to ensure that the slit illuminates only the soundtracks.



3. The method of positioning the slit relative to the optical tracks varies with the design of projector installed. In many cases, the film guide is adjusted laterally for a null if the lens and exciter lamp are fixed in position. If the film guide cannot be moved, then adjust the lens and LED or exciter lamp assembly laterally.

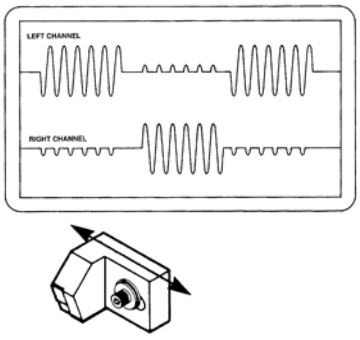


4. The adjustment is correct when there is no signal output while the film is running. It may not be possible to adjust for a null with some older slits; in such instances, adjust for a minimum and equal signal on left and right.

   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.

OSCILLOSCOPE TRACES

5.5 Cell Alignment Check



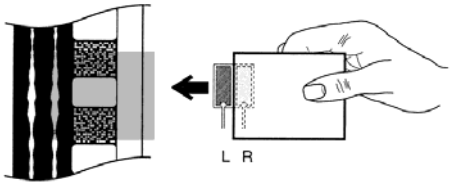
1. Remove the SMPTE buzz track test film, and thread and play the Cat. No. 97 stereo cell alignment film.

2. If a large amount of crosstalk is present on the scope display, loosen the stereo solar cell head and move it from side to side until the crosstalk is minimum and equal. 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.

3. Lock the cell bracket into position after completing this adjustment. Check that the crosstalk does not change as the bracket is tightened.

5.6 Cell Wiring Check

1. Verify that the outputs of the right and left solar cells are properly connected by placing a white card over the right soundtrack (nearer the outside of the projector) and verifying that the level of the Right channel drops, as indicated by the **Rt Signal Present** LED on the CP650 setup panel.

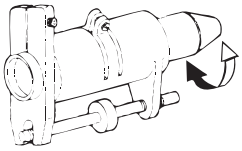


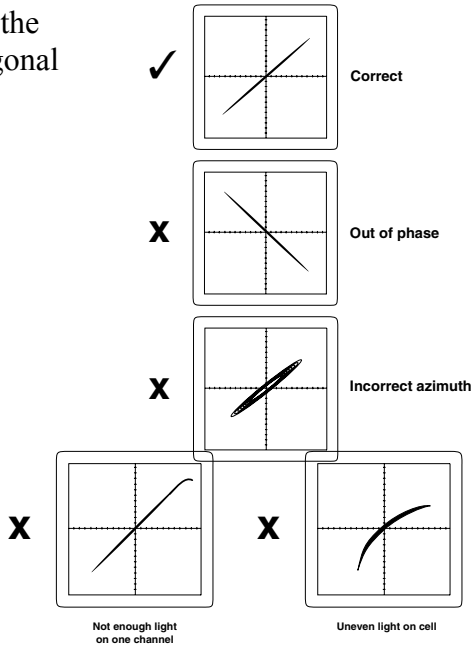
2. If the film path, optics, or LED/exciter lamp were adjusted, repeat the previous film-path alignment and cell alignment steps. The optimum setting is attained when no further adjustments are required using the two test films.

5.7 Azimuth Check

1. Thread and play the Cat. No. 69P pink-noise test film.

2. Switch the oscilloscope to the X/Y mode, and adjust the azimuth of the soundtrack lens for the narrowest diagonal trace.



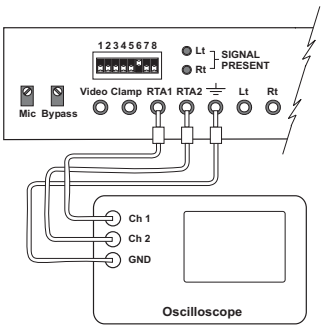


3. If the ends of the trace display thicker than the center area, then improper lighting of the edges of the optical tracks should be corrected.

4. If necessary, repeat the buzz track and cell alignment steps or LED/exciter lamp position steps to reduce such blooming to a minimum.

5.8 Focus Check

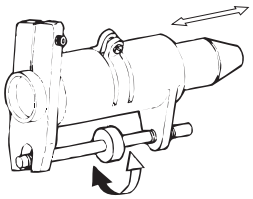
1. Connect the scope to **RTA1** and **RTA2** test points.



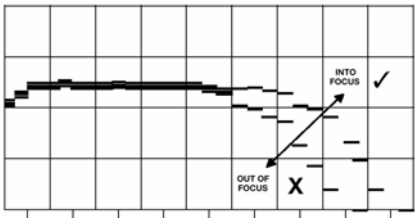
2. Press to move to the `Optical Focus` adjust menu. The scope RTA will display the frequency response of the Left channel optical preamp output for projector 1. Pressing selects the projector or channel. The front-panel knob selects P1/P2 or Left/Right channel to view. Select projector 1.

```
Optical Focus
>Projector: P1
 Channel: Left
Press OK when ready.
```

3. With the pink-noise test film running, observe the high-frequency response displayed on the scope and adjust the focus of the soundtrack lens for the best high-frequency response on both the Left and Right channels.



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. Do not proceed to the next step until both the left and right results are similar.



4. Repeat the focus adjustment for projector 2, if installed.

5.9 Optical HF Equalization (Slit-Loss EQ)

This step adjusts the high-frequency response of the optical preamplifier circuit. The CP650 provides both automatic and manual facilities for optical, or slit-loss, high-frequency equalization. The `Auto` menu appears first.

5.9.1 Auto Slit-Loss EQ

1. Play the Cat. No. 69P pink noise test film.
2. Press ⇆ to move the CP650 menu to `Auto Slit-loss EQ` for projector 1.

```
Auto Slit-loss EQ
Projector P1

Press OK when ready.
```

3. Press **OK** to begin automatic equalization. The high-frequency response on both the Left and Right channels is automatically equalized.
4. You can observe the action on the scope RTA display. Dots shown on the front-panel display show progress. When the dots reach the end of the line, the Right channel is automatically equalized. When EQ is completed, as shown on the display, press **OK** to save the settings.

```
Auto Slit-loss EQ
Level Adjust done.
Press OK to save the
current settings.
```

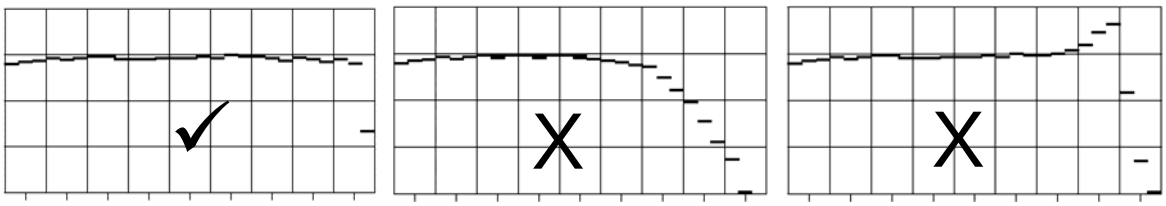
5. If a second projector is installed, press ⇆ to move to the projector 2 menu and repeat this procedure.

5.9.2 Manual Slit-Loss EQ

1. While playing the Cat. No. 69P pink noise test film, press ⇆ to move the CP650 menu to `Manual Slit-loss EQ` for projector 1.
2. Pressing ▸≡ selects the projector choice or EQ value set for each channel. The front-panel knob selects P1/P2, or adjusts the value (`1–127`). Select `Projector 1`.

```
Manual Slit-loss EQ
Projector 1
>Channel: Left
Value: xx
```

3. Rotate the front-panel knob for the most extended high-frequency response without peaking.



If this procedure does not improve the response, the problem may be a degraded slit or lens damage.

5. When the desired response has been achieved, press **OK** to save the settings.
6. After saving the settings, the display returns the `Manual Slit-loss EQ Projector 1` menu. If a second projector is installed, press  to move to the `Manual Slit-loss EQ Projector 2` menu, and repeat the procedure.

Chapter 6
Digital Soundheads

Note: CP650DC models for digital cinemas do not incorporate 35 mm film sound support. Skip this chapter if you are installing any of these models.

6.1 Mechanical Alignment

Mechanical alignment of the digital soundhead consists of confirming that the film path through the digital soundhead is aligned with the path through the projector. For built-in reverse-scan (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 continue 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. Make any needed adjustments by loosening the soundhead mounting bolts or reel arm.

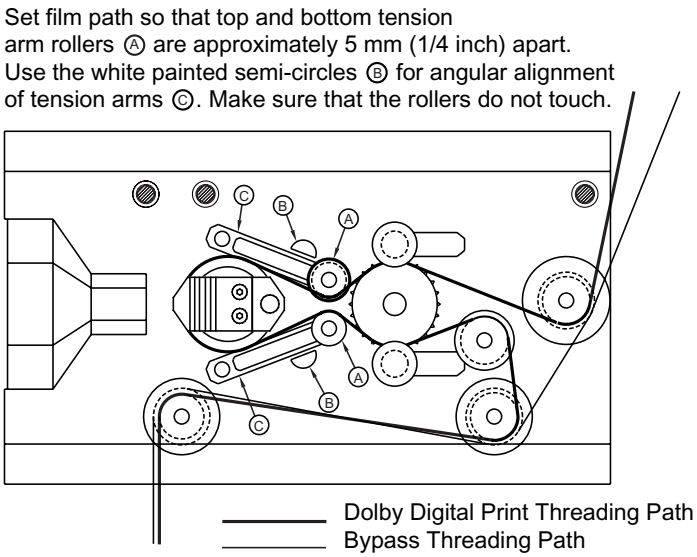


Figure 6-1 Digital Soundhead Adjustments

6.2 Adjustment with Oscilloscope

Dolby® Digital soundheads are optically aligned at the factory and should not require adjustment unless the CCD circuit board has been disturbed. The following test setup will enable adjustment of focus and confirmation or adjustment of light level and optical alignment.

1. Make sure power to the digital soundhead is provided. Power to the CP650 should also be on.
2. Open the CP650 front-panel setup access door.
3. Connect a probe from channel 1 of an oscilloscope (with 20 MHz or greater bandwidth) to the video test point, with the ground lead attached to the ground test point.
4. Connect a second probe from the scope's channel 2 to the clamp signal test point to trigger the scope. Connect the second probe's ground wire to the ground test point.
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 after triggering has been established.
7. Adjust the scope for one horizontal trace across the screen, and adequate vertical gain (approximately 2 µs/division horizontal, 1 V/division vertical).
8. With digital film threaded and running in the projector, observe the video waveform. (See Figure 6-2.)

6.3 Focus Adjustment

Dolby Digital soundheads are factory adjusted and should not require adjustment during installation. If the soundhead has become misadjusted, it may be necessary to refocus. To do so, adjust the objective lens/CCD assembly in the reader head by loosening the 2 mm hex socket set screw (located below the lens bore), which holds the lens/CCD assembly in place, then moving the assembly back and forth. There are two methods for moving the assembly. A flat-blade screwdriver inserted in the oval slot above the lens can be twisted to slide the assembly. Alternatively, if the CCD circuit board cover is removed, the assembly can be moved back and forth with your thumb and forefinger. The best focus is achieved when the scope pattern has minimum brightness in the center of the trace. (See Figure 6-2.) Look for the most in-focus display possible, while maintaining minimum brightness inside the envelope. Setting the best focus will help minimize the digital error rate.

Retighten the lens-holding screw.

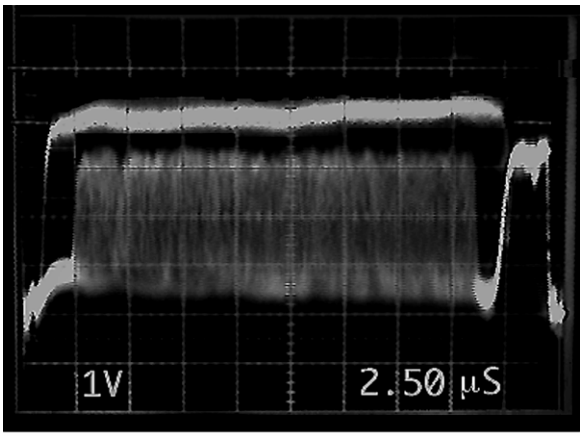


Figure 6-2 Digital Video Oscilloscope Image—Focus Adjustment

6.4 LED Brightness Confirmation and Adjustment

The optimum peak video signal voltage (unobstructed light through the perf hole) is 4 V, measured from the 0 V reference baseline to the upper trace.

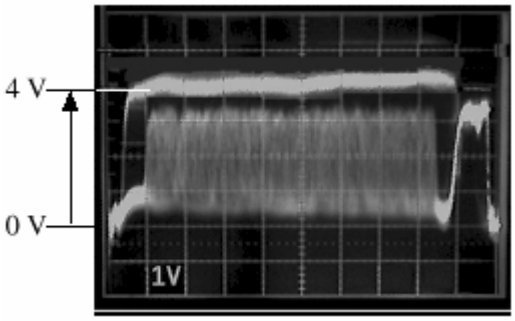


Figure 6-3 Measuring Peak Video Signal Voltage

6.4.1 Cat. No. 702 Reader

The Cat. No. 702 incorporates a video level measuring circuit and indicator along with a trimpot for adjusting the video level (LED brightness).

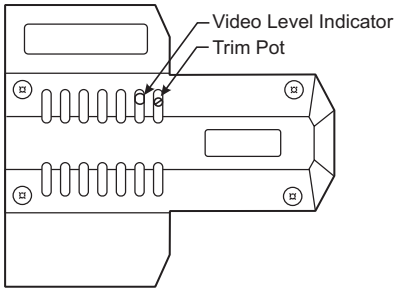


Figure 6-4 Cat. No. 702 LED Brightness Adjustment

The video level indicator colors and video levels are:

Red	Signal too low	<1.5 V
Green	Optimum signal	1.5–4.5 V
Orange	Signal too high	>4.5 V

With proper LED light output, the indicator is green. To adjust the light level for the optimum signal range, run film containing a Dolby Digital soundtrack and turn the pot clockwise until the indicator turns orange, then turn the indicator counterclockwise until it turns green.

6.4.2 Cat. No. 701 Reader

If necessary, adjust the Cat. No. 701 power supply output to achieve the correct video voltage. See Figure 6-5 for adjustment location (VR1). The back cover of the digital soundhead must be removed to gain access to the output adjustment.

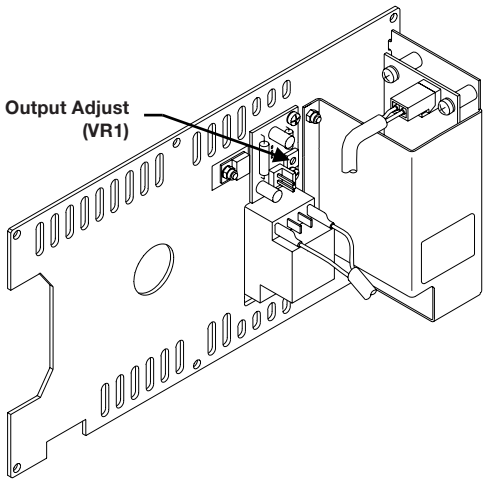


Figure 6-5 Cat. No. 701 LED Brightness Adjustment

6.4.3 Inboard Digital Readers

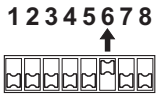
There are several varieties of basement readers; some use lamps as the illumination source, others use LEDs. Refer to the instructions for the built-in reader for details on adjusting lamp/LED current. In any case, the proper video level is 4 V. If the top of the video waveform is not reasonably flat (±1 division), check for dirt, dust, or other obstruction to the light path, and clean.

Chapter 7
Final Adjustments

Note: If you are installing CP650DC models for digital cinema, skip to Section 7.2.

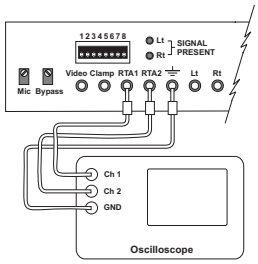
7.1 Setting Bypass Level

With a Cat. No. 791 Crossover Card installed, two jumpers located on the Cat. No. 772B card must be set to their enabled position. This enables the Cat. No. 791 card bypass output and sends a full-range signal to the hearing-impaired output. CP650s shipped with a Cat. No. 791 card have the correct jumper settings. See Figure 4-4.



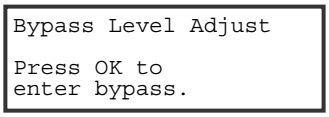
1. Ensure that DIP switch 6 is in the up position.

2. On CP650s running software version 2.2 and later, the test point signal that feeds an external RTA has been enabled to assist in setting the bypass output.



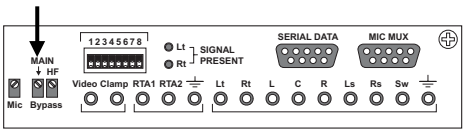
3. Press ⇆ to move the Bypass Level Adjust menu (or press and hold while rotating the front-panel knob).

4. Press **OK**, switching the CP650 to bypass operation. The main power button will illuminate, confirming that the unit is in bypass.



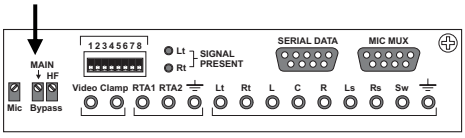
5. Thread and play a loop of Cat. No. 69P pink-noise test film.

6. Using the **OK** button, toggle back and forth between normal and bypass operation, while setting the **Main** bypass level trimpot (located through the access hole on the setup panel). Adjust the pot until the audio level in the auditorium sounds similar when operating in Normal and Bypass modes.



7. If your CP650 is equipped with a Cat. No. 791 Crossover Board, both the **Main** and **HF** bypass trimpots must be adjusted. The real-time analyzer hookup should be used for accurate setting.

   Play the pink noise test loop, adjust the Main bypass level trimpot for correct low-frequency level matching, and adjust the HF trimpot for correct low-to-high frequency balance.



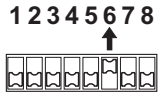
8. Verify that the audio level in the auditorium sounds the same in both Normal and Bypass modes by using the OK button to toggle back and forth between Normal and Bypass.

9. When finished, leave the CP650 in normal operating mode (power button not glowing red).

7.2 Optical Surround Level Trim

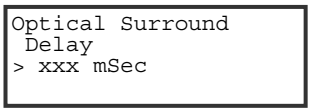
This adjustment applies when using any Dolby® Pro Logic® format, from either film or digital sources. Use this procedure to subjectively balance front and surround loudspeaker levels using the Cat. No. 151B test film. The film contains band-limited noise, restricted to the range 500 Hz to 2 kHz. The noise is cycled between the front center speaker and rear surround speakers. The surround level should have already been set using the final output level calibration procedure in Section 4.7.6.

1. Slide DIP switch 6 to the up position. This switches the CP650 into Setup mode.



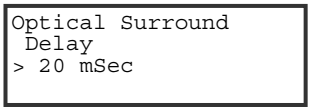
2. Temporarily set the optical surround delay to minimum (20 ms). This step eliminates any confusion while the test film noise cycles between front and rear speakers.

3. Press  multiple times (or press and hold the left menu button while rotating the front-panel fader knob) to move to the `Optical Surround Delay` menu item.

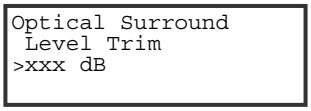


Note: If the optical surround delay has been set during a previous CP650 system setup, write down the current delay setting displayed.

4. Rotate the front-panel knob counterclockwise to set the delay to 20 ms, then press **OK** to save the setting.



5. Press and hold  while rotating the front-panel fader knob to move to the `Optical Surround Level Trim` menu item.



6. Thread and play a loop of the Cat. No. 151B test film.

7. Walk around the auditorium, and make an overall judgment of the surround level compared to the screen level. Because of the "diffuse" nature of the surround sound, it will commonly require a slight increase in surround level to get it to match the screen level. The tonal balance and acoustic level should subjectively match.

8. Rotate the fader knob to set the surround level trim desired. The range is –3 to +6 dB.

9. Press **OK** to save the setting.

10. If a previous CP650 setup has been performed, restore the original optical surround delay setting noted in the step 3 above.

7.3 Setting Optical Surround Delay

Note: If you are installing a CP650DC model (for digital cinemas), formats that require Dolby Pro Logic decoding (for example, 60, 61, 75, 76, or 80) require this setting.

In analog optical formats, the CP650 incorporates a delay line in the Surround channel to ensure that sound from the rear of the theatre arrives at the listeners' ears approximately 20 ms after the arrival of sound from the front speakers. The delay is adjustable from 20 to 150 ms, in 1 ms steps. The setting is stored to CP650 memory using the procedure outlined below. 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, multiply the meters by three to convert to feet.

2. Estimate the distance from this seat to the front loudspeakers (again, in feet). If the metric system is used, multiply the distance by three 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 nearest surround speaker.
   - The selected seat is 80 feet (26.7 meters) from the front speakers.
   - The delay is set for (80–10) + 20 = 90 ms.

4. Press  to move to the Optical Surround Delay menu.

```
Optical Surround
 Delay
> xxx mSec
```

5. Rotate the front-panel knob to show the desired delay, then press **OK**.

   Verify that the delay setting is acceptable by listening to familiar Dolby Pro Logic content that ideally contains both Center-channel dialogue and some discernible surround sound. For film verification, the Dolby Cat. No. 251 Dolby SR/Dolby Digital film *Jiffy* serves this purpose well.

   During playback, walk around the theatre and listen carefully to the surround speakers during Center-channel dialogue. The dialogue should appear to be coming primarily from the screen, and not from the surround speakers.

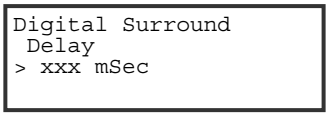
If you hear discernible dialogue from the surround speakers, the delay time was probably set too long.

If you hear an objectionable amount of dialogue from the surround speakers that persists regardless of the delay time setting, there is probably a severe gain or azimuth error in the system. Recheck 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 thwarted.

7.4 Setting Digital Surround Delay

The CP650 automatically calculates a typical digital surround delay based on the optical surround delay setting performed in the previous section. Actual theatre geometry affects the amount of surround delay required; you may, therefore, wish to set the delay manually.



1. Press to move to the `Digital Surround Delay` menu.
2. Rotate the front-panel knob to show the desired delay, then press **OK**.

Table 7-1 and Table 7-2 show approximate delay values (in milliseconds) based on theatre width and length. Setting of surround delay should be verified by listening at various locations in the theatre.

Table 7-1 Surround Delays Based on Theatre Dimensions (in Feet)

Length (feet) \ Width (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

Table 7-2 Surround Delays Based on Theatre Dimensions (in Meters)

Length (meters) \ Width (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

7.5 Setting Dolby Digital Reader Delay

(Not active on CP650DC models)

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, a delay is necessary to synchronize the digital soundtrack with the analog track and the picture. In the CP650, this delay is set by entering the number of film perforations within the range from 12 perfs (approximately 160 ms delay) to 512 perfs (approximately five seconds).

Soundhead delay can be determined in either of two ways, static or dynamic, as described below.

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 film threaded through the digital soundhead, read the number of perforations present in the light path of the digital soundhead. Enter this number by pressing to move to the `Dolby Digital Reader Delay` menu.

```
Dolby Digital
 Reader Delay
> xxx Perforations
```

3. Rotate the front-panel knob to show the number of perforations obtained in step 1, then press **OK**.
4. Verify the accuracy of the setting by running a loop of Cat. No. 1010 test film and checking that the flash on the screen coincides with a pip in the sound.

Dynamic

1. Thread a loop of Cat. No. 1010 test film through the projector, analog soundhead, and digital soundhead, and run the projector.
2. Press to move to the `Dolby Digital Reader Delay` menu. Both optical and digital audio are present while the CP650 is set to this menu item.

```
Dolby Digital
 Reader Delay
> xxx Perforations
```

3. The audio contains equal digital and optical sound simultaneously. Rotate the front-panel knob to set the number of perfs that produce a minimum delay between the analog and digital track, then press **OK**.

   Table 7-3 and Table 7-4 show representative delay settings for a variety of common projectors in use.

Table 7-3 Typical Delay Settings for Penthouse Digital Film Readers

Model	Delay (Perfs)
Dolby Cat. Nos. 699/700/701/702	250
Ballantyne 35 mm	247
BACP DSTR-20	250
Century 35 mm (SA)	245
Century 35/70 (JJ)	309
Cinemeccanica V5	252

Model	Delay (Perfs)
Cinemeccanica V8	260
Christie	250
Norelco/Kinoton AAII (DP70)	283
Simplex 35 mm (XL)	242
Simplex 35/70	298

Table 7-4 Typical Delay Settings for Other Digital Film Readers

Model	Delay (Perfs)
Century with Component Engineering or Kelmar	20
China Film (Zhuhai) ZRS-05 on DongFeng FG35VI projector	22
Christie	26
Cinemeccanica V5	28
Ernemann 15	30
Kinoton FP 30 D	26

Model	Delay (Perfs)
Meopta Meo 5 XB1	20
Meopta Meo 5 XB3	20
Proyecson PX-35 basement	23
Shanghai Paradise	28
Simplex 5 Star with Component Engineering or Kelmar	26

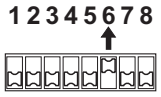
7.6 Dolby Digital Video Level Check

(Not active on CP650DC models)

On CP650s running software v.2.2 and later, the digital film reader output levels can be checked.

Note: Your CP650 must be capable of decoding Dolby Digital film soundtracks to use this feature. If your cinema processor is a Model CP650SR, you must first install a Cat. No. 773 Dolby Digital Film Decoder Circuit Board. The UD/650 Upgrade Kit is available for this purpose.

1. Slide DIP switch 6 to the up position. This switches the CP650 into Setup mode.



2. Run film containing a Dolby Digital soundtrack

3. Press ⇆ multiple times (or press and hold the button while rotating the front-panel fader knob) to move to the `Dolby Digital Video Level` menu. The video output level of the digital film reader is displayed. If necessary, follow the level adjustment procedure described in Section 6.4.

```
Dolby Digital
Video Level
>Reader 1
x.x V
```

4. (If your CP650 is not equipped with a Cat. No. 773 board, a `Not Installed` message is displayed.)

```
Dolby Digital
Video Level
Cat. No. 773
Not Installed
```

5. Switch the measurement to the second film reader, if installed, by rotating the front-panel knob.

Note: The video level displayed is a close approximation to the actual level measured with an oscilloscope. Setup and calibration should be performed using the traditional method outlined in Chapter 6.

7.7 Nonsync Level Adjustment

1. Press ⇆ to move to the `Nonsync 1 Level` (or `Nonsync 2 Level`) menu.

```
Nonsync 1 Level
> xx
```

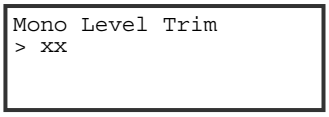
2. Play a CD or other audio source on your nonsync device and adjust the front-panel knob for the desired level in the theatre. If possible, select a recording that has a natural ambience, such as an orchestral work.

Note: During nonsync level setting, the main fader level is fixed at 7.0. This makes special front-panel fader settings for nonsync unnecessary.

3. Press **OK** to save the desired level setting.

7.8 Mono Level Trim

(Not used on CP650DC models)



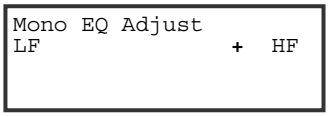
1. Press to move to the Mono Level Trim menu.
2. Thread and play a mono film familiar to you.
3. While the film is running, adjust the front-panel knob to the desired loudness level.

Note: During mono level setting, the main fader level is fixed at 7.0. This makes special front-panel fader settings for mono films unnecessary.

4. Press **OK** to save the desired level setting.

7.9 Mono EQ Adjustment

(Not active on CP650DC models)



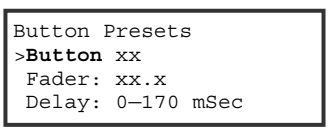
1. Press to move to the Mono EQ Adjust menu.
2. While a mono film is playing, adjust the front-panel knob to change the equalization for a more pleasing sound, if desired.

Note: With the plus symbol (+) moved to the far-right position (high-frequency setting) of the display, the CP650 applies the Academy filter.

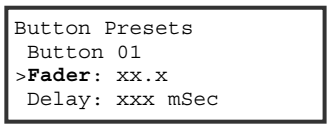
3. Press **OK** to save the desired EQ setting.

7.10 Assigning Default Level and Global Delay to Front-Panel Buttons

Preset fader levels and system delay can be assigned to each CP650 format button. Global audio delay allows you to set additional delay, adding to the built-in CP650 processing latency, for synchronization of the audio with the picture in digital cinema systems. Cinema-grade DLP projectors introduce an additional video processing delay. If you also use an external video scaler, it may introduce additional decoding delay.

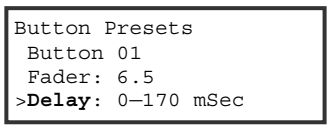


1. Press to move to the Button Presets menu, then rotate the front-panel knob to select the front-panel button you wish to preset (**01, 04, 05, 10, 11, U1, U2**, or **NS**).



2. Press to move the selection to Fader, then rotate the front-panel knob to the desired level setting for this button (01–10).

3. Press to move the selection to `Delay`, then rotate the front-panel knob to the desired delay setting for this button (`0–170 mSec`).



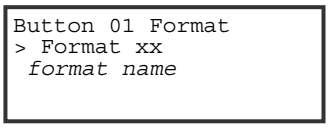
4. Press **OK** to save the presets for this button.

5. Press to return to `Button` and rotate the front-panel knob to select the next front-panel button you wish to preset. Repeat these steps to set the preset fader level and delay for any of the buttons (**01**, **04**, **05**, **10**, **11**, **U1**, **U2**, or **NS**).

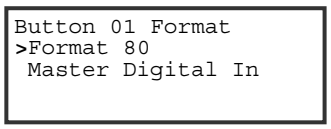
7.11 Assigning Front-Panel Buttons to Formats

If a Cat. No. 773 Dolby Digital film decoder board is installed, format buttons `05` and `10` are fixed to format 05 (Dolby SR film) and 10 (Dolby Digital film). Otherwise any available format can be assigned to the front-panel buttons. When the button is pressed, that format is selected.

1. Pressing steps through the button selections: `01, 04, 05, 10, 11, U1, U2, and NS.`

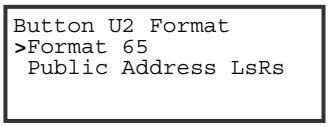


2. Rotate the fader knob to select one of the many format choices available. This example shows `Format 80, Master Digital In` assigned to button **01**.



3. Press **OK** to save the assignment to this button.

4. Press to step to the other button choices, then rotate the fader knob again to select the desired format.



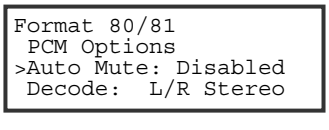
5. Press **OK** to save the assignment to each button.

7.12 Format 80/81 PCM Options

Use this menu to change the settings for processing a PCM digital input to the Cat. No. 794 card, or the first digital input of the Cat. No. 790 or Cat. No. 778 card (**Option Card I/O** connector). Dolby Pro Logic decoding can be applied to the signal if desired.

Auto mute causes the CP650 outputs to mute automatically if a Dolby Digital bitstream input is not present. When a PCM input bitstream is detected, the CP650 outputs will mute. Use this option with caution.

1. Press , or press and hold the button while rotating the front-panel knob, to move to the Format `80/81 PCM Options` menu.



2. Press ▶☰ to choose between setting PCM Auto Mute (Disabled or Enabled) and PCM Dolby Pro Logic Decode (L/R Stereo or Pro Logic).

Note: Be aware that enabling PCM auto mute will not allow the CP650 to play back any PCM content.

3. Rotate the front-panel knob to make the selections.
4. Press **OK** to save the settings.

7.13 Reversion Mode

(Not active on CP650DC models)

This function is used mainly by film labs. Be aware that leaving Reversion Mode set to None (Permanent) prevents automatic switching to analog optical sound if there is a loss or failure of the Dolby Digital soundtrack.

1. Press ⮆ to move to the Reversion Mode menu.

```
Dolby Digital
Reversion Mode
>Enabled
```

2. Rotate the front-panel knob to select Enabled, None (Temporary), or None (Permanent). None (Temporary) resets to Enabled after switching the power on.
3. Press **OK** to save the setting.

7.14 Auto Surround EX Disable

1. The Auto Surround EX™ feature can be disabled for testing purposes. Be aware that leaving this setting to Disabled prevents automatic switching to Dolby Digital Surround EX when these films are played.

2. Press ⮆ to move to the Auto Surround EX screen, then rotate the front-panel knob to switch between Enabled and Disabled.

```
Auto Surround EX
> Enabled
```

3. Press **OK** to save the setting.

7.15 Noise Gating

This menu item is for special applications. It is used with specialized test equipment to make RT-60 measurements. See Table B-12 in Appendix B for signal connection details. Connecting certain automation port terminals to ground will cause pink noise to be sent to individual or all channels.

1. Press ⮆ to move to the Noise Gating Active menu.

```
Noise Gating Active
```

2. Press **OK** to save the setting.

7.16 Running Auditorium Assist

The Auditorium Assist™ feature, included in CP650 operating system software v.2.0 and later, provides an indication of the stability and characteristics of your theatre's speakers, crossovers, amplifiers, and auditorium acoustics. The first time it is used, the frequency response and sound level of each speaker are checked and stored in the CP650 memory. Whenever Auditorium Assist is subsequently selected, all channels are measured and compared to these reference settings. Auditorium Assist also checks and compares the level of the ambient noise floor in the auditorium to the reference level originally stored.

Activate the Auditorium Assist reference measurement function after the first B-chain alignment is finished, and again after any subsequent changes in the EQ settings or sound equipment have been made.

The initial measurements should be performed after the CP650 theatre installation is complete, with seats, carpet, screen, and room treatment all installed. Auditorium conditions should include the following:

- Curtains and masking fully open
- Auditorium unoccupied
- Doors closed
- Heating and air conditioning system switched to a known and repeatable condition

7.16.1 Establish Reference Measurements

1. To move the display to the `Auditorium Assist` menu, press multiple times, or press and hold the button while rotating the front-panel knob.

   A `No Reference` display means there are no reference measurements stored in CP650 memory.

   ```
   Auditorium Assist
    No Reference
   >Set Reference
   ```

   An `Invalid Reference` display means the CP650 room equalization settings were changed after the previous reference measurements were stored.

   ```
   Auditorium Assist
    Check Auditorium
   >Set Reference
    (Invalid Reference)
   ```

2. Use to choose `Set Reference`, then press **OK** to begin the process. The CP650 will output pink noise to the Center channel speaker for initial microphone input level calibration.

3. If reference measurements have not been previously stored, a meter appears allowing you to trim the microphone input level. Adjust the input level by turning the mic input level pot, located directly next to the bypass output level pot on the setup control panel. The display shows an asterisk midway between the `L` (low) and `H` (high) indicators when the ideal mic level is reached.

   ```
   Auditorium Assist
     Calibrate mic...
   L        *          H
   Press OK to continue
   ```

4. Press **OK** to accept the mic level setting, and do not make any further changes to the mic level pot.

5. Auditorium Assist automatically begins the reference calibration sequence. First, an auditorium noise floor measurement is performed, then Auditorium Assist cycles through all channels. The channel being measured is displayed. The CP650 outputs pink noise at 85 dBC for the L, C, and R channels; 82 dBC for each of the surround channels; and +10 dBr for the subwoofer.

   ```
   Auditorium Assist
   Setting Reference:
     Left
   Press OK to cancel
   ```

6. When finished, the reference measurements are automatically saved in the CP650 memory for comparison against future checks, and the display returns to the initial `Auditorium Assist` menu.

7.16.2 Auditorium Sound Check

The Auditorium Assist sound-check function can be performed at any time.

1. To move the display to the `Auditorium Assist` menu, press multiple times, or press and hold the button while rotating the front-panel knob.
2. Use to choose `Check Auditorium`, then press **OK** to begin the process.

```
Auditorium Assist
>Check Auditorium
.Set Reference
```

Note: The display shows `Invalid Reference` if the CP650 room equalization settings were changed after reference measurements were stored. A new set of reference measurements must be stored.

3. Auditorium Assist automatically begins the measurement sequence. First, an auditorium noise floor measurement is performed, then Auditorium Assist cycles through all channels. The channel being measured is displayed. The CP650 outputs pink noise at 85 dBC for the L, C, and R channels; 82 dBC for each of the surround channels; and +10 dBr for the subwoofer.

```
Auditorium Assist
Checking Auditorium:
  Left
Press OK to cancel
```

4. Upon completion, channels are listed with `OK` for pass, or `X` for fail. Any `X` (failure) indication is logged into the event log. (See Section 9.3.3.)

```
Auditorium Assist
  L:OK   C:OK   R:OK
 Ls: X  SW:OK  Rs:OK
Bsl:OK Amb:OK Bsr:OK
```

7.16.3 Fail Parameters

Noise Floor

A failure is indicated if a new auditorium noise floor measurement differs from the saved reference measurement by more than ±10 dB. The measurement is taken at a bandwidth between 20 Hz and 16 kHz.

The noise level in the auditorium is an important part of any theatre environment. This test is designed to measure the room noise, and to determine if it has changed significantly. The CP650 mutes, and a comparison is made between the noise received by the microphone and the stored reference reading. If this comparison fails, the message `Aud Noise xx dBr` is inserted into the event log, where `xx` is the number of decibels over or under the stored reference noise reading. If the auditorium noise is more than ±10 dB from the reference level, then the frequency tests do not occur.

Level and Frequency Response

A failure is indicated if a new frequency response measurement of any channel (L, C, R, Ls, Rs, Bsl, or Bsr) differs from the saved reference measurements by more than ±3 dB. The measurement is taken in the region between 200 Hz and 5 kHz.

A failure is indicated in the Subwoofer channel if the frequency response deviates by more than ±5 dB from the reference reading, in the region between 60 and 100 Hz. A change in the sound level from a speaker can be caused by many factors, including:

- Power amplifier gain has been changed, or the amplifier has failed
- Crossover has been changed or has failed
- Speaker has been changed, has failed, has an element with an open circuit, or is otherwise nonoperational

If the comparison fails any of the frequency response or level tests, a message is inserted into the event log. For example, in the message `R FAIL MH`, the `R` indicates the Right channel. An `L`, `M`, or `H` represents low-, mid-, and high-frequency regions. Here, low frequencies are considered to be below 315 Hz, mid frequencies are between 315 Hz and 2 kHz, and high frequencies are above 2 kHz. If more than one channel failed the test, multiple events are added to the event log.

7.16.4 Headroom Configuration

Headroom is the difference (in dB) between the highest peaks of the signal and the highest peak that can be passed through the system without distorting. Use the `Headroom Config` setup menu item to specify how this additional capacity is to be used. The settings available are `Typical`, `Noise Floor Optimization`, and `Unity Gain`.

Typical (default)

This is the recommended setting. All headroom is available for use by the output level fader or equalization boost. This setting should not be changed without a thorough understanding of the consequences.

Noise Floor Optimization

Noise Floor Optimization calculates and utilizes any available leftover capacity in each channel to improve the overall noise floor of the CP650. It operates by measuring the extent to which the unit uses the available headroom in the B-chain, then boosts the overall gain in the digital domain to use all available headroom. The analog output level trims are then reduced by the amount of that boost, resulting in an optimally reduced noise floor. This adjustment also factors in the headroom available to the fader. Changes to the output trim values are transparent to the user, and no changes will be seen in the fader values in the setup software. Clipping may occur on high level signals if the fader is set above 7.0.

Noise Floor Optimization mode is indicated by an `N` in the top right corner of the front-panel display.

Unity Gain (available with Cat. No. 778 digital I/O card installed)

Unity Gain allows a digital signal to pass through the CP650 while maintaining its original level. In this condition, the CP650 will pass digital signal inputs up to full scale on all channels without clipping, provided that the graphic EQ, subwoofer EQ, treble bulk EQ, bass bulk EQ, optical surround level trim, subwoofer level trim, and fader provide no boost in level. (When the Cat. No. 778 card is initially installed, these settings are automatically set to flat, but may have been changed subsequently.)

The CP650 is designed to process a 0 dB signal as a full-scale digital signal (0 dBFS). Normal operation produces a –12 dB insertion loss in the B-chain. This allows for +6 dB boost in the EQ, and up to +6 dB additional boost by the fader (above nominal 7.0) without causing numerical overflows (digital clipping) within the internal digital signal processing. The fader algorithm produces a soft clip when it encounters an overflow condition, minimizing the objectionable effects of unmodified digital clipping. While the Unity Gain feature is enabled, the CP650 can, at most, deliver a 0 dBFS signal output from a 0 dBFS input. Any desired additional boost must occur outside the unit.

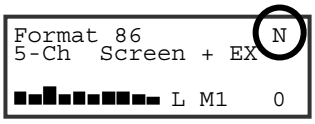
If a Cat. No. 778 Digital Input/Output card is installed, Unity Gain mode is indicated by a `U` in the top right corner of the front-panel display.

Noise Floor Optimization and Unity Gain cannot be selected simultaneously.

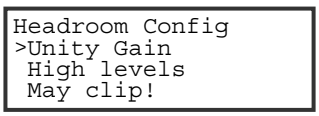
Set headroom configuration by following these steps:

1. Press  multiple times (or press and hold the button while rotating the front-panel fader knob) to move to the `Headroom Config` menu.
2. Rotate the front-panel knob to select the desired setting.
3. Press **OK** to save this setting.

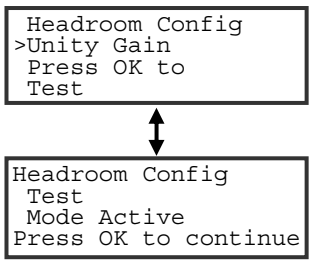
Noise Floor Optimization mode is indicated by an `N` in the top right corner of the front-panel display. Unity Gain mode is indicated by a `U`.



The Unity Gain (with Cat. No. 778 card) choice shows a warning screen before you press **OK** to select it.



With Unity Gain selected, pressing **OK** toggles the unit between the Unity Gain select screen and test mode. With test mode active, EQ and output level trims are forced to their default unity gain settings to ensure true unity gain for a temporary confidence check.

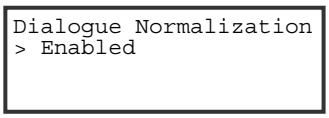


7.17 Dialogue Normalization

This feature is normally set to Disabled, and affects Dolby Digital bitstreams from consumer devices such as DVD and terrestrial/satellite broadcast sources.

With dialogue normalization enabled, the overall playback level is set in relation to the Center channel dialogue information. This level is determined and set during the encoding process, and is carried by metadata embedded in the Dolby Digital bitstream.

1. Press to move to the `Dialogue Normalization` screen, then rotate the front-panel knob to switch between `Enabled` and `Disabled`.



2. Press **OK** to save the setting.

7.18 Network Configuration

A CP650 can be controlled via an Ethernet-based network using a PC connected to the CP650 through a hub or switch, or directly, using a network crossover cable. See Appendix D.1, Control via Serial Port for further information.

Default network settings:
software version 2.3.5.2 and later

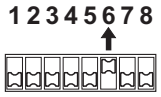
IP address—192.168.x.132
(x=auditorium number)
Address mask—255.255.255.128
Gateway address—192.168.x.129

Default network settings:
software version 2.3.4.4 and earlier

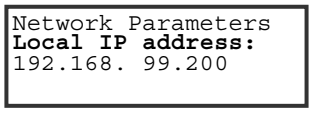
IP address—192.168.99.200
Address mask—255.255.255.0
Gateway address—192.168.99.1
System name—Dolby_cp650

Use the `Network Parameters` menu item to set up the CP650 for network control:

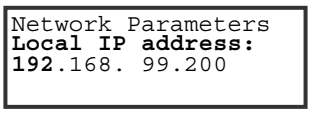
1. Switch the CP650 into Setup mode by sliding DIP switch 6 to the up position.



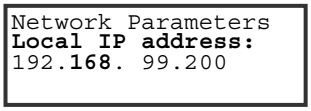
2. Press multiple times (or press and hold the button while rotating the front-panel fader knob) to move to the `Network Parameters` menu.



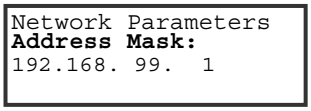
3. The default local IP address is shown in this example. To change the first octet (`0 to 255`), rotate the front-panel knob.



4. Move the cursor to the next octet by pressing and holding while rotating the front-panel fader knob. Rotate the front-panel knob to set the number and continue to the next octet.



5. Press to move to the next network parameter, and set the values using the same procedure as above.



6. Press **OK** to save your settings.

7.19 Clock Set

The clock is used only to time stamp event log messages to aid in troubleshooting. The CP650 will operate normally without setting the clock.

1. Press , or press and hold the button while rotating the front-panel knob, to move to the `Clock Set` menu.

```
Clock Set

>Hour:xx
 Min:  xx
```

2. Press to choose between setting the hour and minutes, then rotate the front-panel knob to set the times.
3. Press **OK** to save your settings.

7.20 Date Set

1. Press , or press and hold the button while rotating the front-panel knob, to move to the `Date Set` menu.

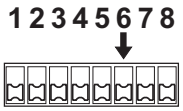
```
Date Set
>Day:   xx
 Month: xx
 Year  : xx
```

2. Press to choose `Day`, `Month`, or `Year`, then rotate the front-panel knob to adjust the settings.
3. Press **OK** to save your settings.

7.21 Mute Fade Time Adjustment

The mute speed is the length of time it takes for the sound to fade from the normal setting to muted after the **mute** button is pressed, and the time it takes to fade back to normal after the **mute** button is pressed again. Both times are independently adjustable.

1. Slide DIP switch 6 to the normal (down) position. The CP650 will switch to normal operation with the user's menu choices available.



2. Press , or press and hold the button while rotating the front-panel knob, to move to the `Mute Fade-in Time` menu.

```
Mute Fade-in Time
>x.x Seconds
```

3. Set the desired fade-in time using the front-panel knob.
4. Press **OK** to save your settings.
5. Press to set the `Mute Fade-out Time` using the same procedure.

7.22 Auto Dolby Digital Function

(Not active on CP650DC models)

One of the items found in the user's menus (DIP switch 6 set to down) is Auto Dolby Digital Enable/Disable. Dolby Digital film soundtracks can be automatically sensed to enable format 10 (Dolby Digital). The sensing can be thought of as source sensing. More specifically, Auto Dolby Digital can only be sensed from an analog film source format. The format 10 button location can be thought of as the target for Auto Dolby Digital.

Note: There may be more than one format 10 button location. In addition to button 10, format 10 may also be assigned to any of the front-panel buttons.

More than one button can be assigned as format 10 in order to use the fader preset feature available for each button. Some users assign one button as format 10 for trailers and another format 10 button for the feature film, with each button preset to the desired fader level.

If an analog soundtrack film is playing on a button that is assigned to either format 01 (Mono), format 04 (Dolby A-type), or format 05 (Dolby SR), and a Dolby Digital soundtrack is sensed, the CP650 will switch to the format 10 (Dolby Digital) target button. The format 10 target button is assigned in the user's setup menu area.

The Auto Dolby Digital feature is disabled whenever a front-panel button is pressed or an automation cue is received after Auto Dolby Digital has operated. This action is useful, for example, if you wish to quickly select an analog film format during the show.

The **NS** button reenables the Auto Dolby Digital feature. It is recommended that the **NS** button be assigned to your intermission format (typically format 60, 75, or 80) because at the end of the film, when the **NS** format button is typically used, the Auto Dolby Digital feature is then reenabled (provided that the feature was originally set to "Enable").

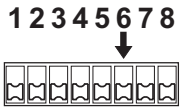
Chapter 8
Accessories

This chapter covers installation of the Cat. No. 779 Remote Control Unit and the Cat. No. 771 Remote Fader. Before installing remote units, read these general points:

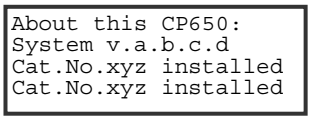
- No more than three remote units (in any combination) may be used with a CP650. A customer-supplied auditorium fader can be connected in addition to the remotes, but it cannot be operated at the same time as any remote.
- The combined length of connecting cable to all the remote units should not exceed 100 m (300 ft).
- When you connect one or more remote units to the CP650, all units are live and communicate with each other. Any fader level adjustment changes the display on all of the connected units.

Before installing any remote units, check the software version running in your CP650:

1. Slide DIP switch 6 to the normal (down) position. The CP650 will switch to normal operation with the user's menu choices available.



2. Press  multiple times, or press and hold the button while rotating the front-panel knob, to move to the `About this CP650` screen.



3. This menu is made up of four menu screens. The first information screen displays the version number of the installed system control software, and lists any optional circuit boards installed in your unit. The version number must be 1.1.5.0 or later. If it is not, obtain a software upgrade before proceeding with installation.

4. Press the illuminated format button to return the CP650 to normal operation.

8.1 Cat. No. 779 Remote Control Unit Installation

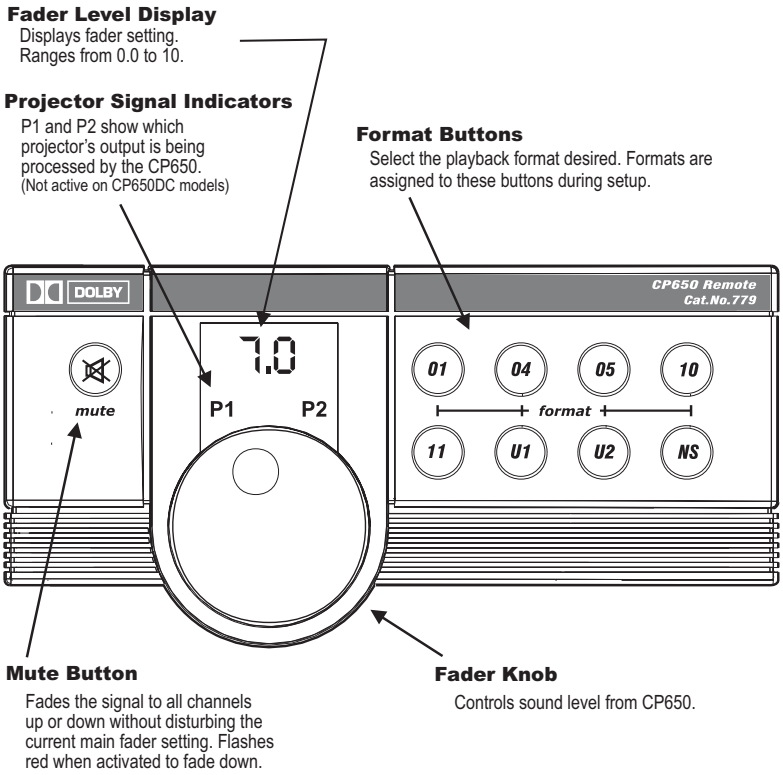


Figure 8-1 Cat. No. 779 Remote Control Unit Functions

8.1.1 Remove the Housing

1. Hold the plastic front panel firmly with both hands on either side of the unit, and pull one side. The front panel snaps away from the circuit board and housing.
2. Remove the four screws that fasten the circuit board to the housing, and store them nearby.
3. Remove the housing from the circuit board.

Caution: *Do not touch circuit-board components. Static electricity can damage components.*

8.1.2 Make a Hole for the Interface Cable

Use a two-conductor shielded cable (Belden 8451 or equivalent) to connect the remote to the CP650. To prevent wear on the cable from the metal edge of the hole you create, use a rubber or neoprene grommet on the cable. The diameter of the hole you make should be the same as the diameter of the cable grommet or conduit bushing.

The wire to the CP650 must run from the connection point on the circuit board without touching any circuit-board components.

- If the remote control will be mounted in a console or on a wall, we recommend placing the hole in the bottom of the housing.
- If the remote control will stand alone, we recommend placing the hole in the side of the housing.
- If you must put the hole in the top of the housing, place the hole in either of the locations shown in Figure 8-2 to ensure that the wire has sufficient clearance.

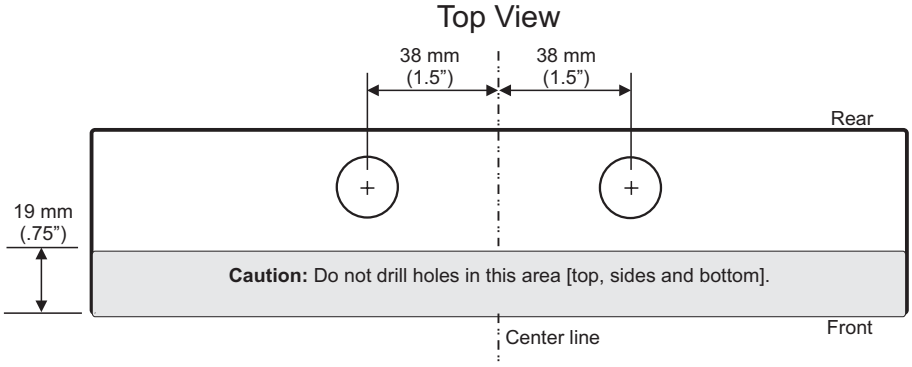


Figure 8-2 Location to Drill Wiring Hole

Note: Do not drill in the front one-third of the housing (the shaded area in the figure) on any side, or the circuit board will obstruct the opening.

8.1.3 Connect to the Circuit Board

Thread the interface wire through the hole you made. The J1 interface connector is in the upper left-hand corner of the circuit board. Connect the wire to the J1 interface connector as shown below.

Cat. No. 779
J1 interface connection to CP650

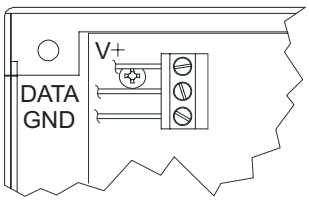


Figure 8-3 Remote Control Unit Circuit-Board Connector

8.1.4 Set the Address Switch

For the CP650 to communicate with all the remote units, each unit must be set to a unique address number using switch SW1.

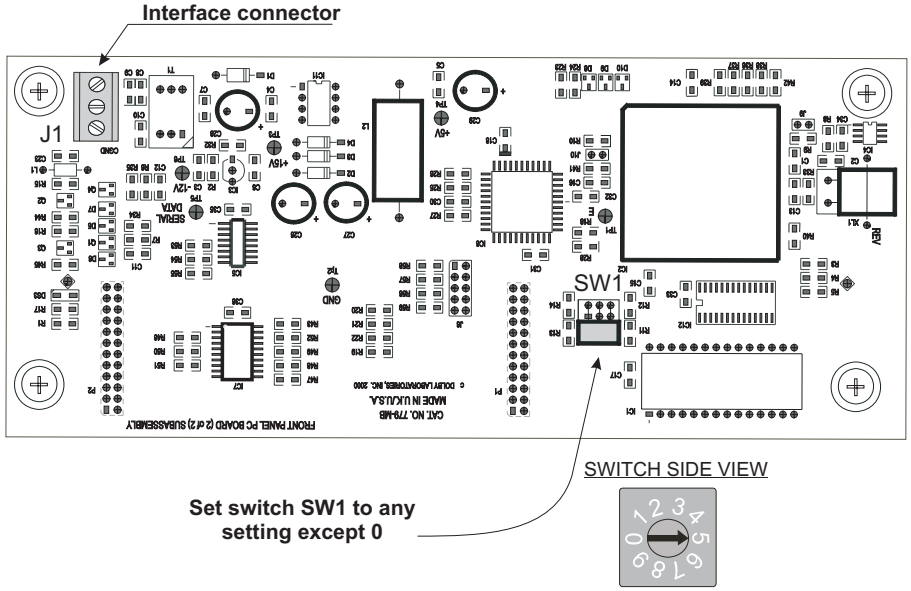


Figure 8-4 SW1 Address Switch Location

Use a small flat-blade screwdriver to set switch SW1. Do not set the arrow to the 0 position, because that setting generates an error message and disables the unit. It is not important what address number any single unit is set to, but no two remote units can be set to the same number, so record what number you assign for each unit. If your installation has only one remote unit right now, it is still a good idea to record the setting in case you add another remote later. The CP650 will display the address number assigned to each remote control via the `Remote Addresses` user menu.

8.1.5 Assemble the Unit

If the remote control is to be mounted on a wall or in a console, mount it before reattaching the circuit board to the housing. The housing has precut holes in the back panel for easy mounting.

1. Carefully pull the interface cable through the hole you drilled in the housing as you bring the circuit board into position.

   Note: Keep the cable clear of all circuit-board components as you pull.

2. Secure the four circuit-board screws you removed earlier.

3. Snap the front panel back into place. The remote control will be ready to use as soon as you connect the interface cable to the CP650, as described in Section 8.1.6.

8.1.6 Connect to the CP650

1. Connect the interface wires to the six-way connector shown in the figure below. If you cannot locate the connector, you can order one (Part No. 70206) from Dolby Laboratories.

Note: All remote units attach to the same terminals on the connector. Do not connect wires from any Dolby® remote unit to terminals 4, 5, or 6.

2. Plug the connector into the **Remotes and Aud. Fader** input on the CP650 rear panel.

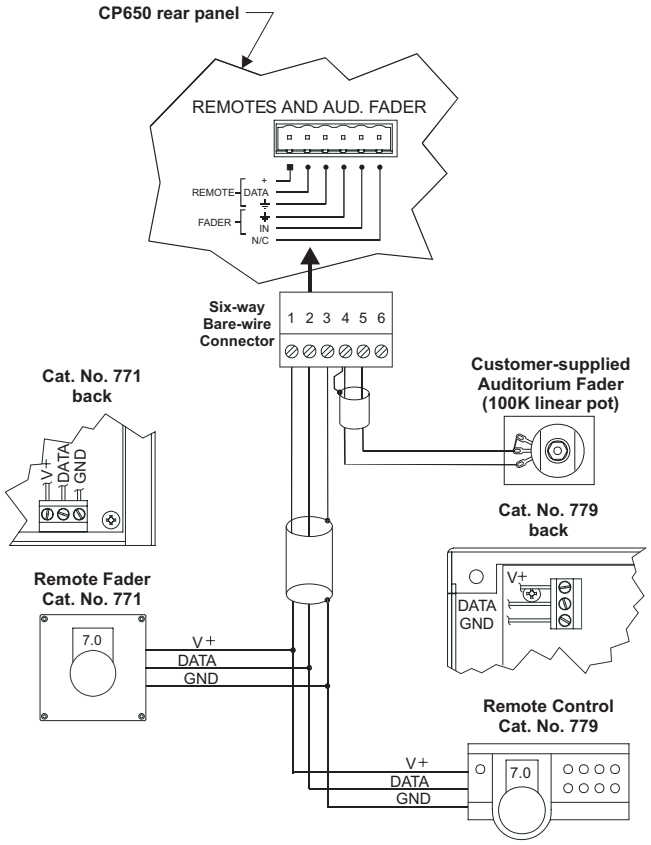


Figure 8-5 Connection of Remotes to the CP650

You can confirm that remote units are connected and communicating with the CP650 by selecting the `Remote Addresses` menu on the CP650:

Press multiple times, or press and hold the button while rotating the front-panel knob, to move to the `Remote Addresses` menu. The single-digit address of each connected remote unit is displayed.

8.2 Cat. No. 771 Remote Fader Installation

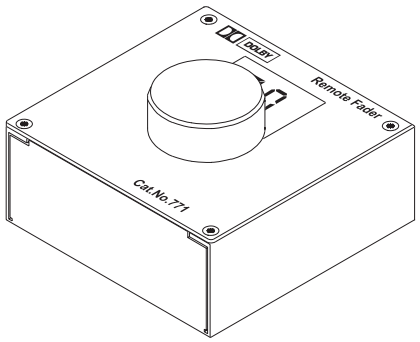


Figure 8-6 Cat. No. 771 Remote Fader

The Cat. No. 771 Remote Fader can be mounted on a wall or in a console, or it can stand alone. To install the remote fader:

1. Remove the four screws from the corners of the front panel. Store the screws nearby and remove the rear housing.

Caution: *Do not touch circuit-board components. Static electricity can damage components.*

2. Make a hole in the housing for the interface wire. We recommend you place the hole on the bottom if the remote fader will be mounted, or on a side if the fader will stand alone.

3. Use a two-conductor shielded cable (Belden 8451 or equivalent) to connect the remote to the CP650. To prevent wear on the cable from the metal edge of the hole you create, use a rubber or neoprene grommet on the cable. The diameter of the hole you make should be the same as the diameter of the cable grommet or conduit bushing.

4. Thread the interface wire and attach the +voltage, data, and ground wires to the interface connector as shown in Figure 8-3.

5. Use a small flat-blade screwdriver to set address switch SW2. Do not set the arrow to the 0 position, because that setting generates an error message and disables the unit. It is not important what number any single unit is set to, but no two remote units can be set to the same number, so record what address you set for each unit. If your installation includes only one remote unit right now, it is still a good idea to record the setting in case you add another remote later.

6. Replace the housing, pulling the interface cable tight enough to keep it from touching any components on the circuit board.

7. Secure the front panel to the housing with the screws you removed in step 1.

8. Connect the interface cable to the CP650 as shown in Figure 8-5.

Chapter 9
Maintenance and Troubleshooting

If you are installing a CP650DC model, skip to Section 9.3.

9.1 Print Cleanliness

As with any soundtrack, keeping the film print clean will give the best performance. The Dolby® Digital print format has robust error correction information encoded along with the audio data, and the CP650 uses a powerful digital error correction technique, allowing the data to be read perfectly even if scratches and dirt are present. However, the 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 Dolby Digital decoder, and the CP650 will automatically switch to the analog Dolby SR track.

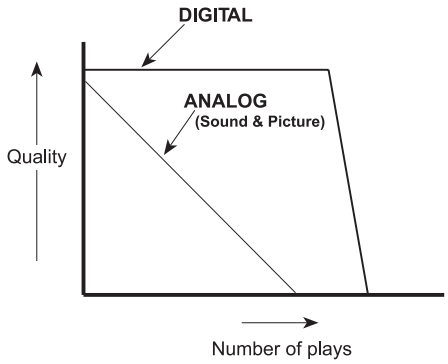


Figure 9-1 Digital/Analog Track Wear

9.2 Digital Soundhead Maintenance

The 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, and other dangerous cleaners should not be used.

The tension arm rollers on earlier Dolby Digital film readers Cat. Nos. 701, 700, and 699 may begin to show wear and need replacement. A replacement rollers kit is available for upgrading your unit.

9.3 CP650 Troubleshooting

The following sections cover power supply information, the event log, and troubleshooting tips.

9.3.1 Power Supply Voltage Ranges

Six test points are located on the front subpanel for measuring power supply voltages. They can be accessed by removing the front panel.

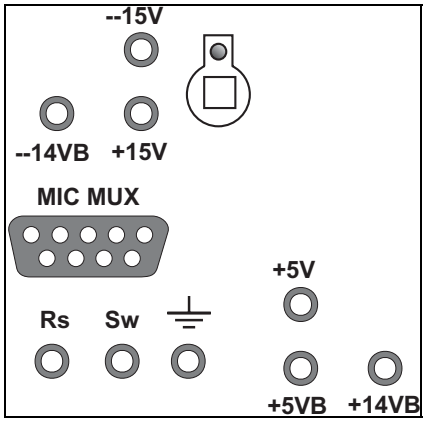


Figure 9-2 Power Supply Voltage Test Points
(Ignore test points "VB" on CP650DC models)

Table 9-1 Main Power Supply Voltage Ranges

Test Point	Voltage Range
+15 V	14.5 to 15.8
–15 V	–14.5 to –15.8
+5 V	4.85 to 5.15

Table 9-2 Bypass Power Supply Voltage Ranges
(Ignore these test points on CP650DC models)

Test Point	Voltage Range (Main and Bypass Supplies On)	Voltage Range (Bypass Supply Only On)
+14 V	13.9 to 15.2	11.0 to 12.5
–14 V	–13.9 to –15.2	–11.0 to –12.5
+5 V	4.6 to 5	4.6 to 5

9.3.2 Exploded View and Board Locations

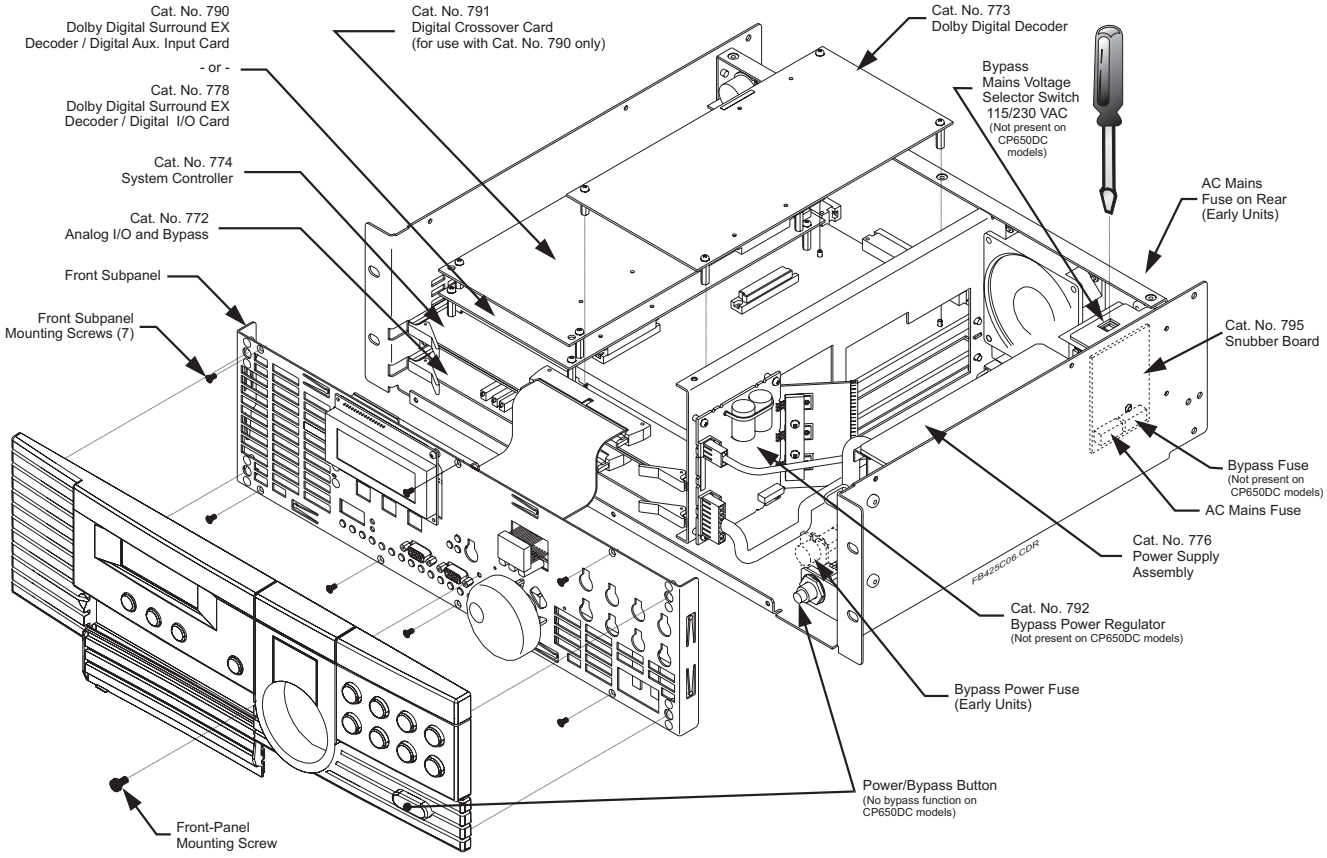


Figure 9-3 Model CP650 Exploded View

Caution: *Many components used on the circuit boards are sensitive to electrostatic damage. It is essential to wear a grounding strap while handling or changing CP650 circuit boards.*

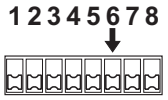
To gain access to the CP650 circuit boards:

1. Remove the AC mains power cable.
2. Open the setup control-panel access door.
3. Remove the front-panel mounting screw located in the upper right-hand corner of the setup control panel, and carefully pull the front panel toward you to remove it.
4. Remove the seven front subpanel mounting screws, and carefully pull the subpanel toward you to remove it.
5. Unplug the two ribbon cables connected to the internal circuit boards.

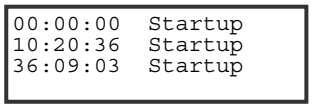
The power supply assembly can be removed by loosening the two finger screws on the front edge of the assembly and the two rear-panel screws above and below the AC mains connector. From the front of the unit, carefully remove the connector at the backplane along with the two front connectors, then slide the assembly out.

9.3.3 The Event Log

The event log stores entries on the operation of the CP650. It can be useful in troubleshooting or tracking subtle system failures. Also, Auditorium Assist™ fail parameters are stored in the event log. (See Section 7.16.3.) Normally, a single log entry occurs every time the CP650 powers on. When viewing the event log display, the newest entries appear at the top; turn the front-panel knob to scroll through the list.



1. The event log is a user's menu item. Ensure that DIP switch 6 is in the normal (down) position.
2. Press  multiple times, or press and hold the button while rotating the front-panel knob, to move to the event log.
3. Scroll through the event log using the front-panel knob.



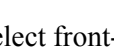
Note: If film is running during CP650 power-up, you may see erroneous information entered into the event log. The power-up self-test software applies test signals to the optical input circuits. If film is playing, the test signals are mixed with film sound, producing unpredictable test results.

9.3.4 Troubleshooting Chart

The following chart may assist you in solving problems.

Symptom	Probable Cause	Recommended Action
NO SOUND AT ALL		
No sound, front panel dark, power button not glowing.	No power to either main or bypass systems.	See if AC mains panel circuit breaker feeding the CP650 is tripped. Verify that all power connectors are fully inserted into their sockets. Press main power button. If CP650 still does not come on, check fuse behind plastic door in AC mains power inlet module located on the rear of the unit.
No sound, and switching to Bypass doesn't restore sound. or No sound, front panel dark, power button is illuminated, and system is already in bypass mode.	Defective analog reader LED, exciter lamp, or LED/lamp power supply.	Check that the LED or exciter lamp is on. If not, fade up background music, transfer the reel to the alternative projector, and continue the show until the LED/lamp or its power supply can be replaced. Call service engineer.
	Projector selection wire/switch is faulty.	If the front-panel indication (P1, P2) for the currently active projector is not correct, check the projector selector switch wiring. In addition, check that the switch or relay is operating properly.
	No signals coming from stereo solar cells.	Check that the signal-presence LEDs inside the setup panel access door are flashing while film is running. If not, there is no signal from the solar cells, or the Cat. No. 772B analog board has failed. Substitute a known, working Cat. No. 772B board.
	Power amplifiers switched off.	Check power feed to power amplifiers for blown circuit breaker or fuse or accidental disconnection.
No sound, front panel normal.	Check the causes listed above, plus wrong format selected, system muted, or fader turned down.	Check same components as mentioned above. Then verify selected format, mute status, and fader setting. If no formats produce sound, there may be a CP650 internal problem. Call your local service engineer.

Symptom	Probable Cause	Recommended Action
NO SOUND IN SOME FORMATS		
No analog film sound (formats 01, 04, or 05). Front panel normal, Dolby Digital sound OK, and nonsync OK.	The analog LED or exciter lamp or power supply may have failed or the wrong projector may be selected. Solar cell connections may be loose or damaged. The remote solar cell preamp board used with LED analog readers may have failed.	If the signal-presence LEDs inside the access door are not flashing, verify exciter operation and solar cell connections as described above. Substitute known working Cat. No. 772B board.
No Dolby Digital sound (format 10). Front panel normal, analog sound OK.	Digital reader LED not working, Dolby Digital decoder board Cat. No. 773 not installed or not working, Dolby Digital print not being played, film not threaded correctly in reader, reader failure.	Verify that the LED (or exciter lamp) in the digital film reader is on. Verify that the print you are playing is correctly threaded through the digital reader and that it includes Dolby Digital information. If the CP650 accepts a format 10 command, the digital subsystem is probably still working.
No sound on external six-track input (format 11, 70 mm, external Dolby Model DA20, or other multichannel sound sources), front panel normal.	Cat No. 772B board defective. Wrong format, external device not receiving good data. Six-channel input connector not fully plugged in.	Check external device for audio output. Reseat the six-channel connector.
No sound in nonsync.	Nonsync source not working, nonsync level set too far down, faulty Cat. No. 772B board. If nonsync is a user format, is the input from Nonsync 1 or Nonsync 2? Which channels are the signals being sent to? Are those power amplifiers working?	Verify output of nonsync source. Determine from front-panel display which channels the output is directed to and verify that power amplifiers and speakers for those channels are working. After checking the above, adjust nonsync level in setup, changing both Left and Right channels by equal amounts.
Power button illuminated. Front panel dark. There is sound.	System is in Bypass mode.	Turn on the CP650 with the front-panel power button. Call service engineer if the system is still not operating correctly.

Symptom	Probable Cause	Recommended Action
FADER PROBLEMS		
Front-panel fader knob has no effect.	External analog remote fader pot selected.	Select front-panel (local) fader by pressing  to show the `Fader Setting` menu, then turn the front-panel knob to display `Local`. Press **OK**. This will restore control to the main front-panel fader and any digital remotes that are connected.
Fader level display changes when no change of CP650 front-panel fader has been made.	A remote digital fader is being operated. A format with a different fader setting was selected. Analog remote fader is selected and being changed.	**Note:** Digital remote faders are always active. Disconnect the remote to disable it.
CONTROL PROBLEMS		
CP650 won't accept a format selection, and displays a `Format Unavailable` message.	CP650 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 Dolby Digital Cat. No. 773 board. Formats 13, 80, or 81 require the Cat. No. 790 or 794 Dolby Digital Surround EX™ board, or Cat. No. 778 Digital I/O board. Digital reader LED not working, not a Dolby Digital print being played, film not threaded correctly in reader, reader failure.	Obtain and install the necessary circuit boards. If they are already present, ensure that they are firmly seated in their connectors. Verify that the LED (or exciter lamp) in the digital film reader is on. Verify that the print you are playing is correctly threaded through the digital reader and that it includes Dolby Digital information. If the CP650 accepts a format 10 command, the digital subsystem is probably still working.
Front-panel display reads `Reverted!` when format 10 is selected and stays in optical Dolby SR.	No Dolby Digital data available, not a Dolby Digital print, projector not running, or data blocks badly damaged.	Review each possible cause.

Symptom	Probable Cause	Recommended Action
RUMBLES, WHISTLES, HUM 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 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 CP650. Call your service engineer.

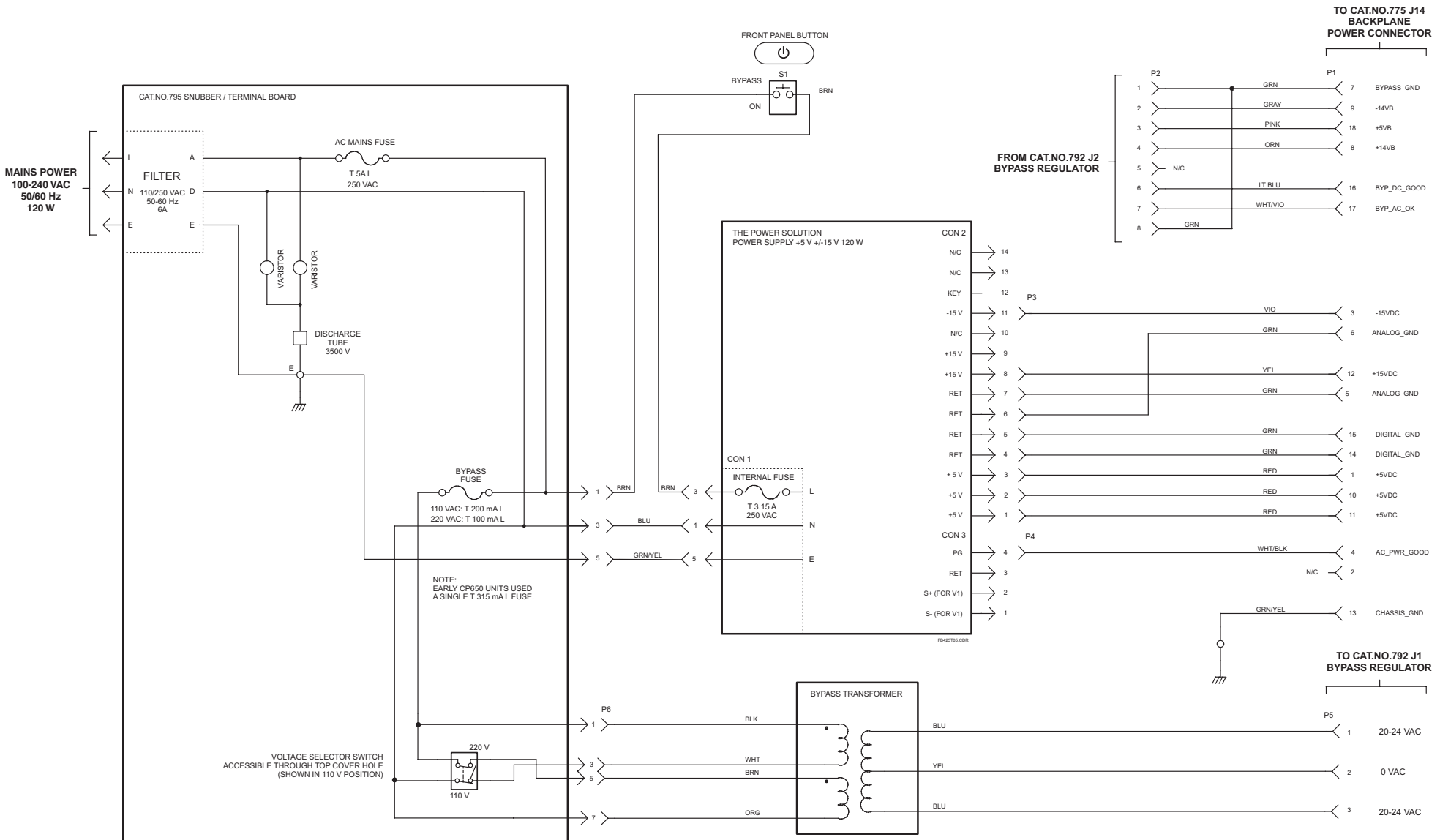
Symptom	Probable Cause	Recommended Action
TROUBLE IN ONE OR MORE CHANNELS		
One channel fails.	Defective power amplifier, external crossover, or wiring for that channel.	Place the CP650 in Bypass mode. All three screen speakers should become active. If not, there is a fault in the power amplifier, external crossover, or wiring for the missing channel.
		Check whether the amplifier is on and check for blown fuses.
	Power amplifier input level setting turned down.	Check that the power amplifier volume control setting has not been changed.
		Check that the wiring from the CP650 to the amplifier or the loudspeaker wiring has not been broken or disconnected.
	Malfunctioning board in CP650.	If the power amplifier and the wiring are satisfactory, the problem may be a malfunctioning circuit in the CP650. Switch to Bypass mode and call service engineer.
The sound from **one** channel is distorted and you can hear the distortion through the booth monitor at normal listening level.	Defective power amplifier for that channel.	Check that the amplifier is on and the fuses are OK.
	Defective speaker for that channel. (The booth sound is OK but sound in the auditorium is bad).	Check speaker.
	Malfunctioning Cat. No. 772B board in CP650.	Call service engineer.
	Wiring from the stereo solar cell to the CP650.	Check that the wiring from the stereo solar cell to the CP650 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 CP650. Call service engineer if wiring problems are found.

Symptom	Probable Cause	Recommended Action
The sound from **two or more** channels is distorted and you can hear the distortion through the booth monitor at normal listening level.	Malfunctioning two-channel power amplifier.	If two distorted channels are served by the same two-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 theatre.	Surround sound delay set improperly.	Call service engineer.
The sound level in Bypass mode is higher or lower than the normal sound level.	Adjust with the front-panel knob, because other parts of the system may be malfunctioning.	Call service engineer.

Symptom	Probable Cause	Recommended Action
There is distortion when you play nonsync sound, but sound from the film is not distorted.	The nonsync source is introducing distortion. Excessive output level from nonsync source. Defective Cat. No. 772B board.	Change the nonsync selection (in case the track being played is distorted). If you have control of the output level of the nonsync device (cassette deck, CD player, and so on), turn down its output level, especially if you have to operate the nonsync with the fader set far below 7. If this does not help, try a different device. If changing both the device and the selection does not eliminate the distortion, the problem is in the CP650, probably on the Cat. No. 772B board. Call service engineer.
Nonsync sound is heard in other formats.	The nonsync source output level is set far too high or there is a balanced/unbalanced wiring problem.	Turn down nonsync source level if possible and call service engineer. If turning the nonsync source down doesn't correct the problem, turn it off 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.

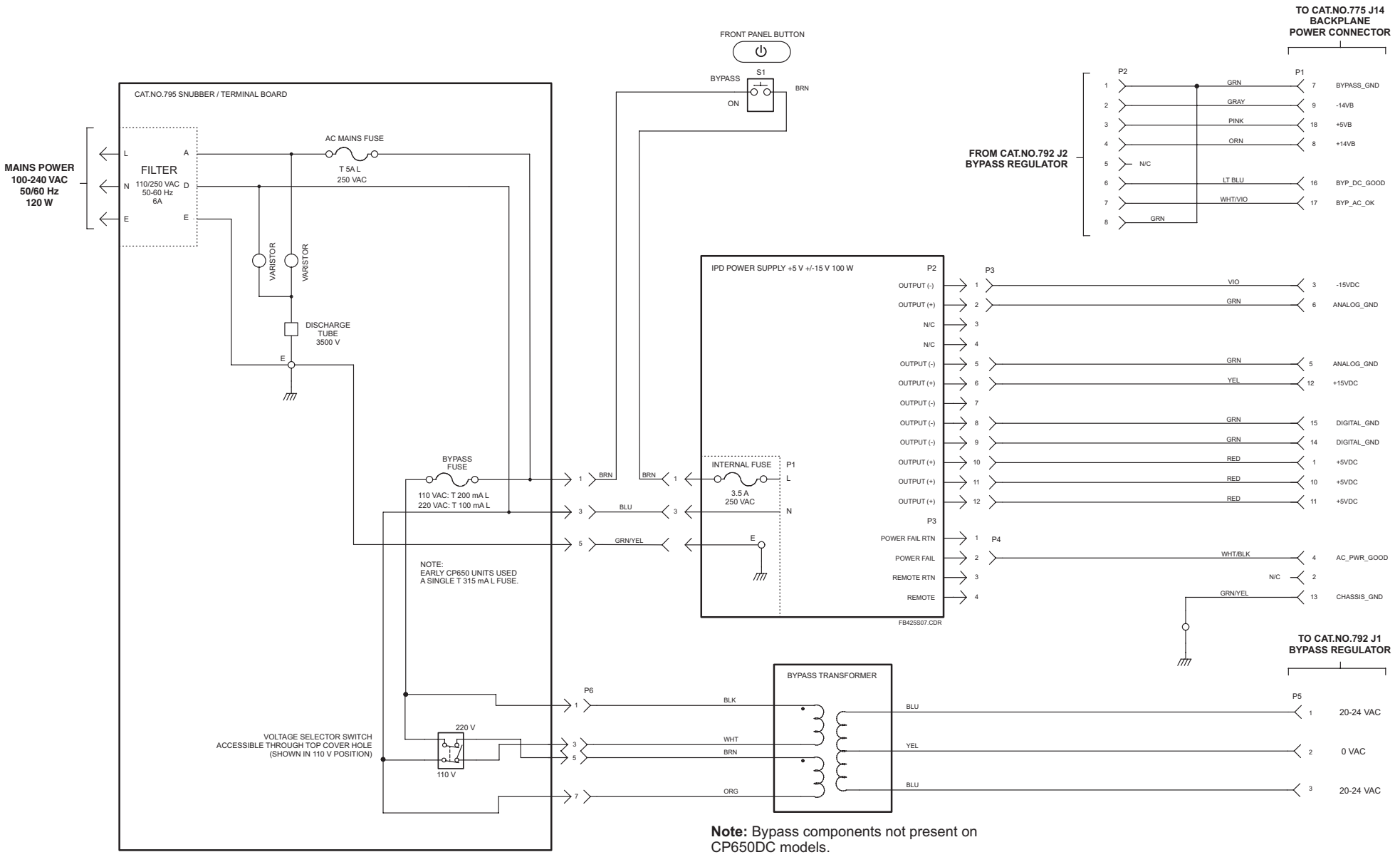
Symptom	Probable Cause	Recommended Action
CHANGEOVER AND CONTROL TROUBLES		
Projector changeover command does not change the sound to the output of the selected projector and the front-panel indicators P1 or P2 do not light according to the projector selected.	Defective changeover relay or switch. Defective wiring from relay or switch to terminals on rear of the CP650. Defective Cat. No. 772B board.	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 an automation system connected to the CP650: The CP650 freezes into one format and does not accept any other selected format when you press the front-panel buttons.	Incorrect wiring to D-connector plugged into CP650; defective or incorrectly programmed automation equipment.	Unplug the D-connector from the back of the CP650. If you can exercise local control over the CP650, the problem is either the wiring to the automation equipment or the automation equipment itself. Call service engineer. If you cannot exercise local control over the CP650 even with the automation equipment disconnected, switch to Bypass mode by pressing the front-panel power button, and call service engineer.

Symptom	Probable Cause	Recommended Action
You can hear pops or thumps during projector changeover.	If the projector changeover relay power is DC, a diode should be soldered across the winding of the relay to prevent switching noise 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 defective. If the diode is not present or if it appears to be open, 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 positive terminal. The diode should be a 1N4004 (1A, 400 V), or 1N4008 (1A, 800 V), or equivalent.
	If the projector changeover relay is AC powered, a capacitor soldered to the relay coil terminals may be defective.	Install a 0.01 µF 600 V capacitor across the relay coil terminals.
	Malfunctioning Cat. No. 772B board.	Call service engineer to correct the malfunction.



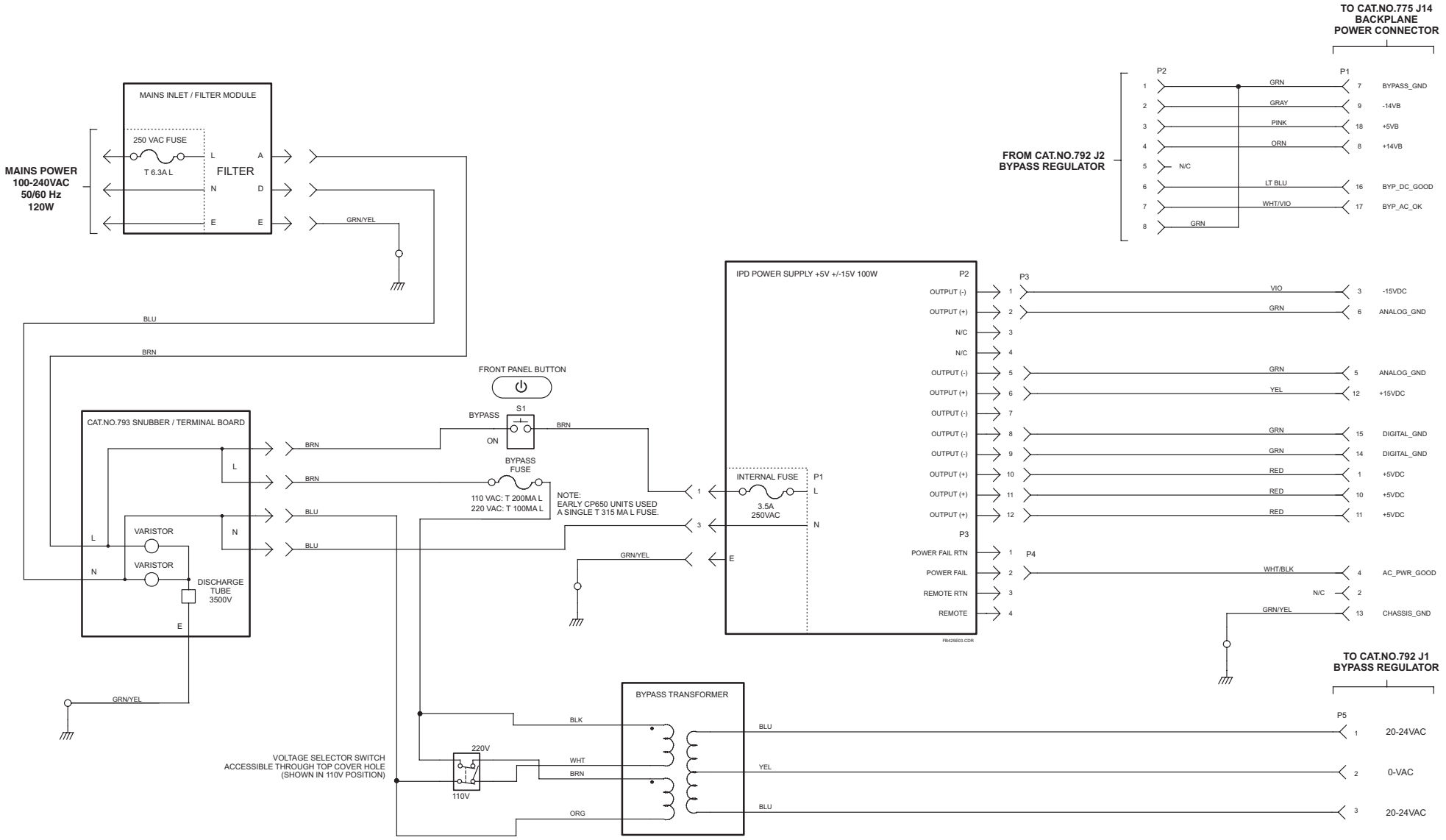
Note: Bypass components not present on CP650DC models.

CP650 POWER SUPPLY WIRING
CAT.NO.776-5 (GOLD COVER)



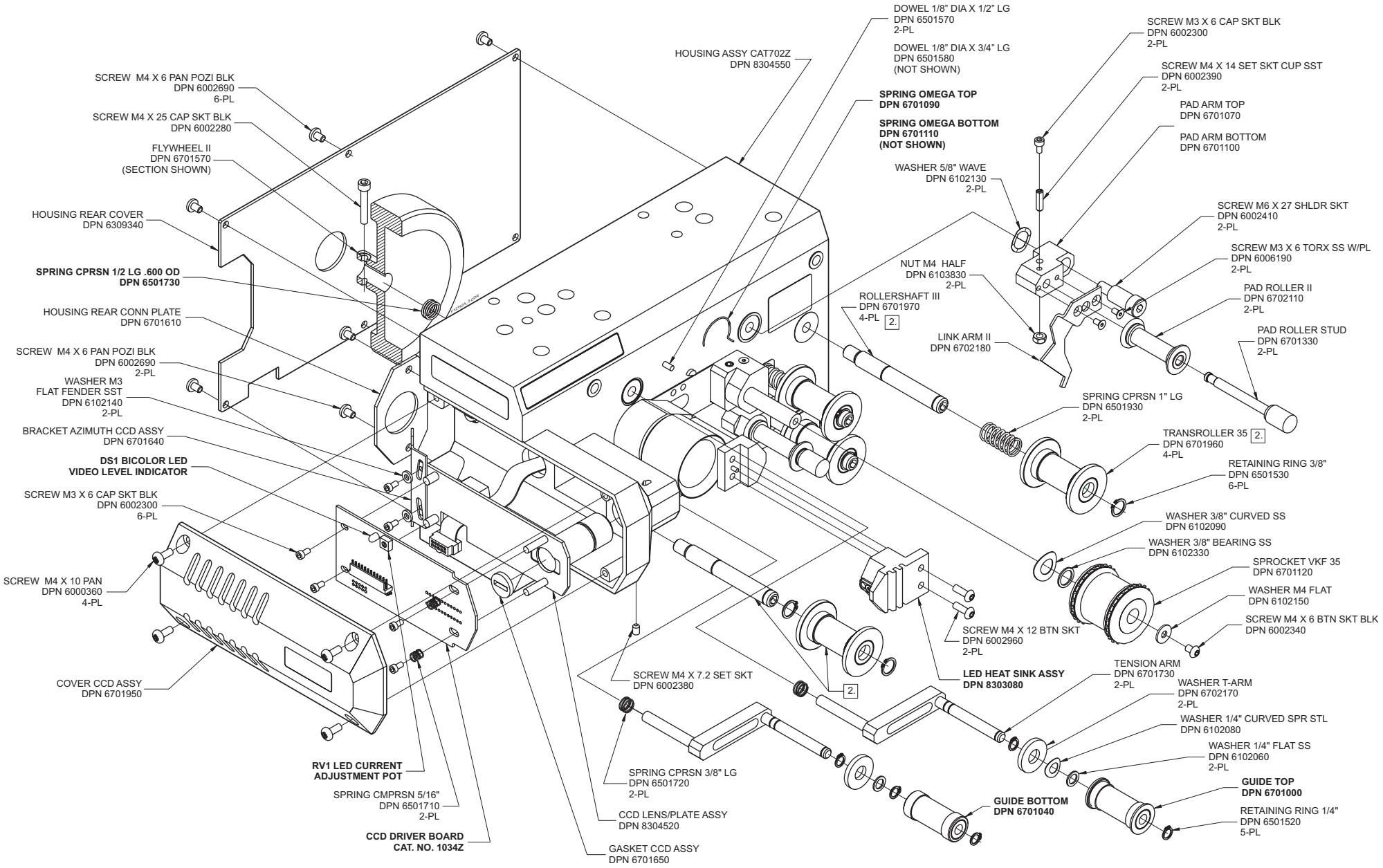
Note: Bypass components not present on CP650DC models.

CP650 POWER SUPPLY WIRING
CAT.NO.776-4 (GOLD OR SILVER COVER)

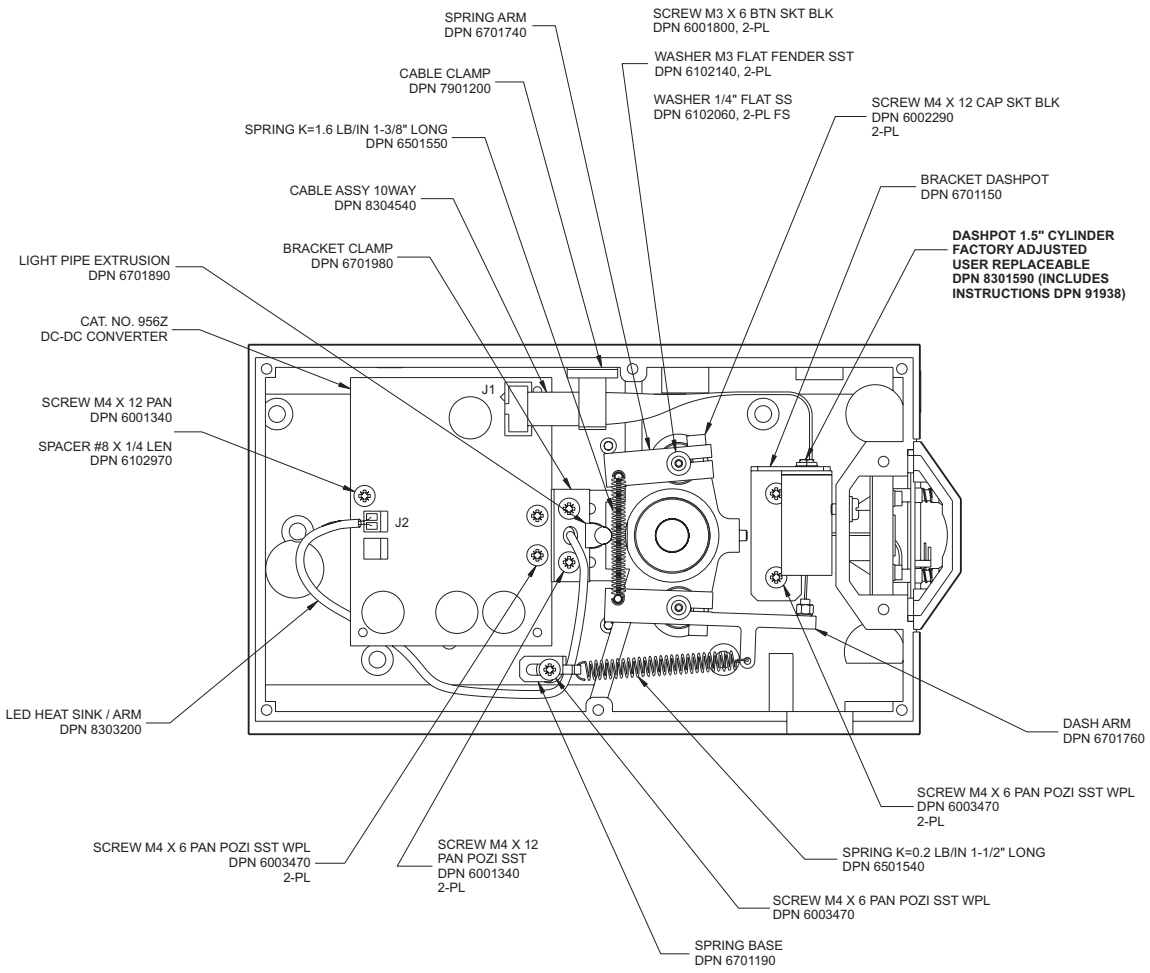


Note: Bypass components not present on CP650DC models.

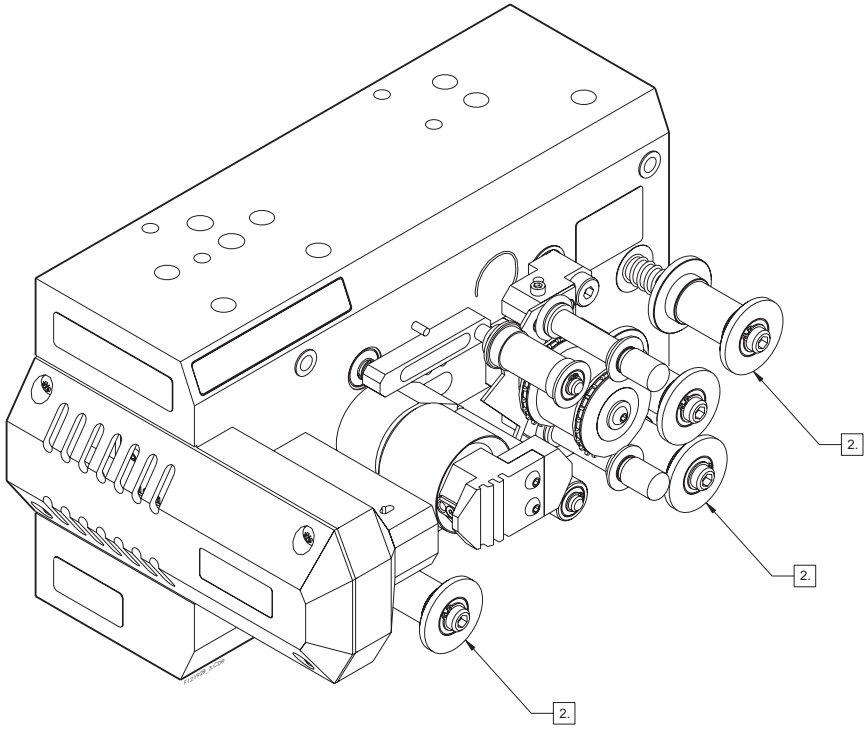
CP650 POWER SUPPLY WIRING
CAT.NO.776-2 (GOLD COVER)



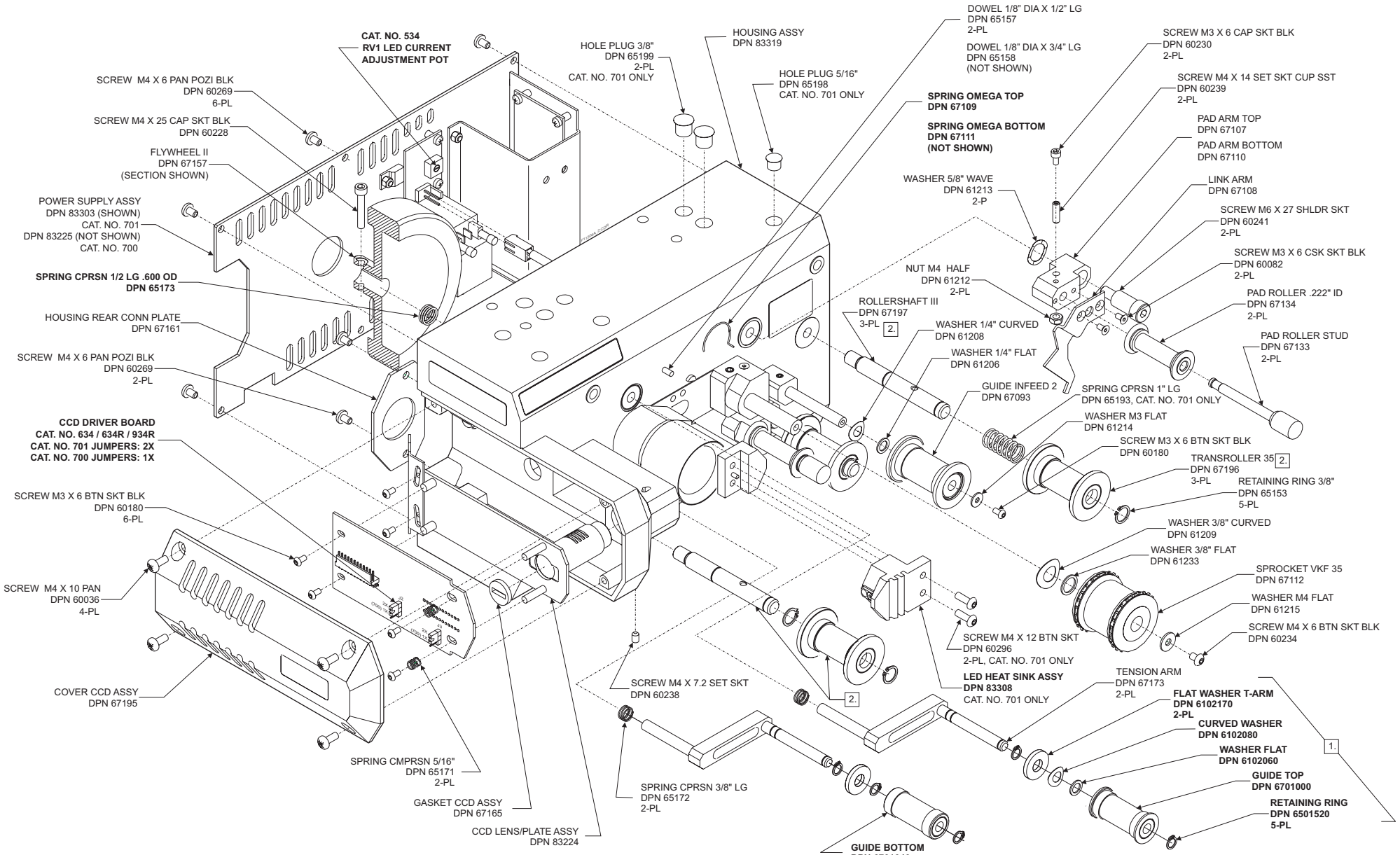
Cat. No. 702 Exploded View



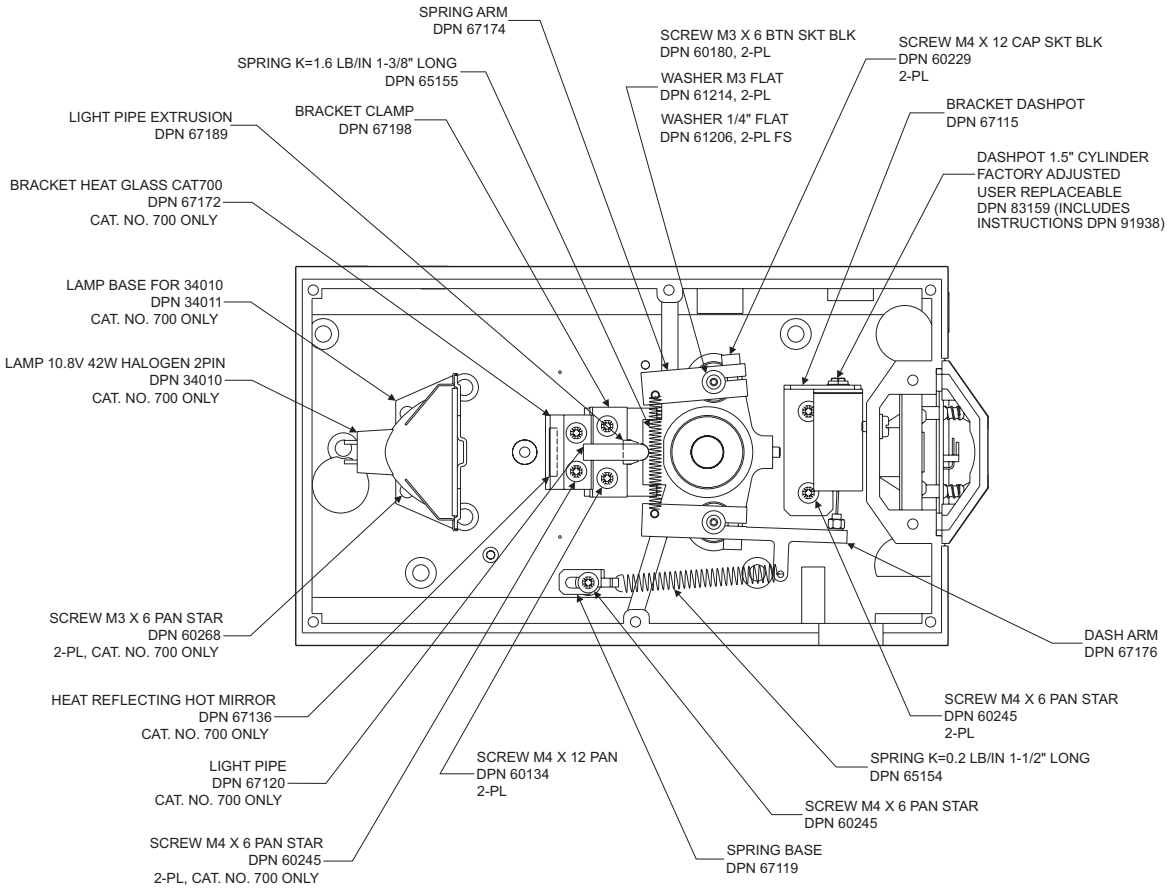
Cat. No. 702 REAR VIEW
(POWER SUPPLY ASSEMBLY NOT SHOWN)



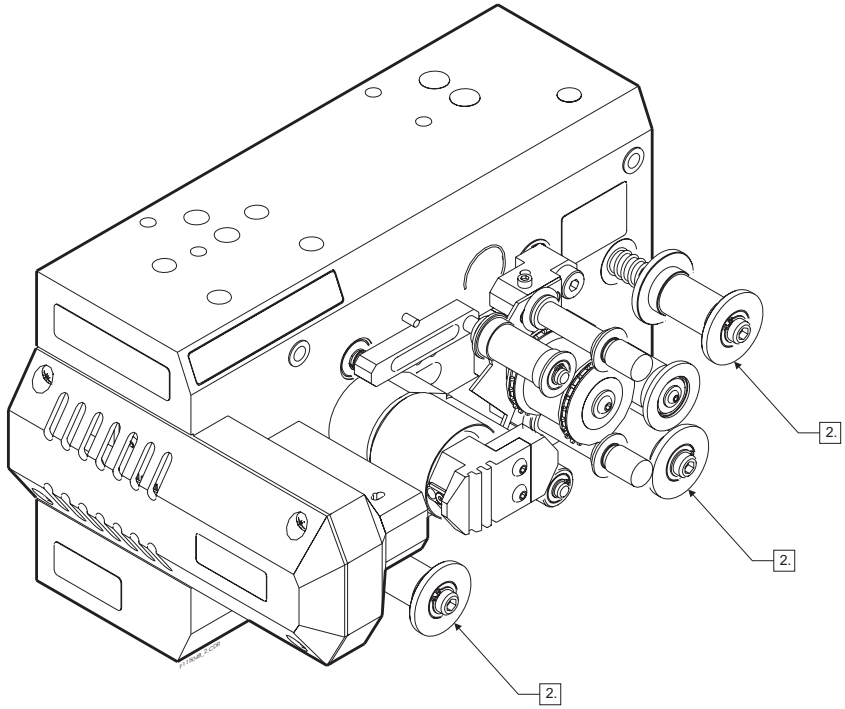
TRANSROLLER ASSEMBLY TABLE		
	STANDARD 35 MM [2.]	OPTIONAL 35/70 MM BYPASS (DPN 8302390)
DESCRIPTION	DOLBY PART NUMBER (DPN)	
TRANSROLLER	6701960	6700970
SHAFT	6701970	6701770
RETAINING CLIP (2)	6501530	6501530



Cat. No. 700 / 701 Exploded View



Cat. No. 700 / 701 REAR VIEW
(POWER SUPPLY ASSEMBLY NOT SHOWN)



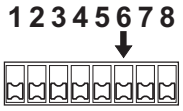
TRANSROLLER ASSEMBLY TABLE		
	STANDARD 35 MM 2.	OPTIONAL 35/70 MM BYPASS (DPN 83239)
DESCRIPTION	DOLBY PART NUMBER (DPN)	
TRANSROLLER	67196	67097
SHAFT	67197	67177
RETAINING CLIP (2)	65153	65153

Appendix A
Software Operations

A.1 Display Information About This CP650 Unit

This user's menu item provides information about the software and hardware installed in your CP650.

1. Confirm that DIP switch 6 is set to the normal (down) position to enable the user's menu choices.



2. Press  multiple times, or press and hold the button while rotating the front-panel knob, to move to the `About this CP650 screen`. This menu is made up of four menu screens.

3. The first information screen displays the version number of the installed system control software, and lists any optional circuit boards installed in your unit.

```
About this CP650:
System v.a.b.c.d
Cat.No.xyz installed
Cat.No.xyz installed
```

4. Pressing  cycles the menu display between the four screens. The second information screen displays the headroom configuration setting.

```
Headroom Config
  Typical
```

5. The third information screen displays the version numbers of the various software modules running in your unit. This screen is useful when discussing CP650 operational issues with Dolby engineers.

```
About this CP650:
Module Version
0503040001000020204010
20201010101
```

6. The fourth screen displays the network MAC address, unique to this CP650. The bottom line displays the version number of each circuit board installed in your unit. The version numbers are listed for each board in the following order:

```
About this CP650:
Hardware Information
Network:xxxxxxx
Boards:a3842
```

   Cat. No. 772B, Cat. No. 773, Cat. No. 774A, Cat. No. 777, Cat. No. 778, or Cat. No. 790 (or earlier Cat. No. 794) mounted in the option card location.

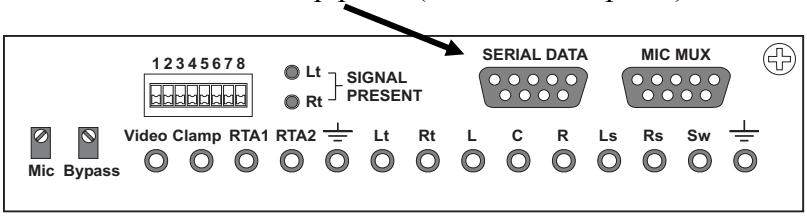
   If `X` is displayed, the corresponding board is not installed. In the example shown, the following board versions are installed:

Board	Version
Cat. No. 772B	A
Cat. No. 773	3
Cat. No. 774A	8
Cat. No. 777 (front-panel board)	4
Cat. No. 778, or 790, or 794	2

7. Press the illuminated **format** button or press  at the fourth screen to return the CP650 to normal operation.

A.2 Updating CP650 Software

1. Connect the PC to the CP650 using a serial cable to the CP650 serial data connector on the front setup panel (or on the rear panel).



2. Run the CP650 setup software on the PC.
3. From the **Action** menu, choose **Connect**, or click on the connect icon.
4. If prompted, choose to retrieve cinema processor settings.
5. From the **Action** menu, choose **Update Software**.
6. If desired, you may save the newly retrieved settings to disk.
7. Browse for and select the software update file (`.bin`) to be used for updating the CP650.
8. Select **Update Now**. This process should not be interrupted. If the connection is lost during the update process, the CP650 displays:

```
Update Failed!
Reconnect and update
software to proceed.
```

   If this occurs, you must reconnect the CP650 setup software and restart the software update process. If the software update is not completed successfully before the CP650 main power is turned off, the CP650 will become inoperable and the Cat. No. 797 flash memory module must be replaced.

9. When the update has finished, the CP650 will automatically restart.
10. Next, the CP650 setup software will automatically reconnect, send the cinema processor settings back, and remain connected.

The update process is now complete. The CP650 will contain updated software, while retaining your original alignment settings.

A.3 Transferring Settings Between Two CP650s

1. Connect the PC to the source CP650 using a serial cable.
2. Run the CP650 PC setup software on the PC.
3. From the **Action** menu, choose **Connect** or click on the connect icon.
4. If prompted, choose **Retrieve** to retrieve existing cinema processor settings.
5. After the settings have been retrieved, choose **Disconnect** from the **Action** menu, or click on the disconnect icon.

6. From the **File** menu, choose **Save** or click on the save icon.

7. Save the retrieved settings to disk. The file name should end with the `.dby` extension.

8. Unplug the serial cable from the source CP650 and plug it into the destination CP650.

Note: If you have closed the CP650 setup program or opened another settings parameter file (`.dby`), then before continuing, you must select **Open** from the **File** menu and open the file that was saved in step 6.

---

9. Repeat steps 1–3.

10. When prompted, select **Send Settings**.

11. The saved settings will be sent to the destination CP650.

12. You must select **Disconnect** from the **Action** menu (or click the disconnect icon) to allow the settings to be saved in the destination CP650.

Note: Only the settings that appear in the CP650 setup program are transferred during this process.

Appendix B
Rear-Panel Connectors

B.1 Output Connectors

Main Audio Output Connector

The **Main Audio Output** of the CP650 is sourced from balanced output circuits. The connector type and pin configuration conform to the THX® standard. With a Cat. No. 790 Dolby® Digital Surround EX™ decoder board installed (standard model CP650), the Left Surround and Right Surround outputs on this connector are disabled. All surround channel audio outputs appear on the **Option Card I/O** connector.

Table B-1 Main Audio Output Connector Pinout

Pin	Connection
1	Chassis
2	Left +
3	No connection
4	Chassis
5	Center +
6	No connection
7	Chassis
8	Right +
9	Chassis
10	*Left Surround – (models CP650D and CP650SR only)
11	*Right Surround – (models CP650D and CP650SR only)
12	Subwoofer –
13	Chassis
14	Left –
15	Chassis
16	No connection
17	Center –
18	Chassis
19	No connection
20	Right –
21	No connection
22	Chassis
23	*Left Surround + (models CP650D and CP650SR only)
24	*Right Surround + (models CP650D and CP650SR only)
25	Subwoofer +

* See Table B-3 for outputs on models containing a Cat. No. 778, and Table B-2 for surround outputs on all other models.

Option Card I/O Connector

The pinout of this connector is determined by the type of option board installed in the connectors of the Cat. No. 774A system controller board.

In CP650DC models, the Cat. No. 790 Dolby Digital Surround EX Decoder/Digital Input Card is shipped in this location. Output signals for the surround channels appear on this connector. The digital input pins can be connected to the bitstream audio output of the digital cinema server. The input impedance is 75Ω. Use an impedance matching transformer if necessary. See Section 2.5.6.

Table B-2 Option Card I/O Connector Pinout with Cat. Nos. 790, 791, or 794 Installed

Pin	Signal with Cat. No. 790 Installed	Additional Outputs with Cat. No. 791 Crossover Installed
1	S/PDIF 1 (L/R) Input +	
2	S/PDIF 2 (C/SW) Input +	
3	Back Surround Left –	
4	No connection	Center mid +
5	No connection	Center high +
6	Back Surround Right –	
7	Ground –digital inputs (See Note)	
8	No connection	Right high +
9	No connection	Right mid + [Right Extra +*]
10	Left Surround –	
11	Right Surround –	
12	No connection	Left high –
13	S/PDIF 3 (Ls/Rs) Input +	
14	No connection	Left mid + [Left Extra +*]
15	No connection	Left mid – [Left Extra –*]
16	Back Surround Left +	
17	No connection	Center high –
18	No connection	Center mid –
19	Back Surround Right +	
20	No connection	Right high –
21	S/PDIF 4 (Bsl/Bsr) Input + (Le/Re Input + Format 85 or 86) (Bs Input + Format 90)	
22	No connection	Right mid – [Right Extra –*]
23	Left Surround +	
24	Right Surround +	
25	No connection	Left high +

* Available only when system is configured as a two-way crossover and Le/Re mode is enabled.

Note: The screen (shield) of all analog output connections must be connected to the shell of the D-connector.

The optional Cat. No. 778 card has five pairs of AES inputs, the first of which provides a single digital bitstream input (Dolby Digital or PCM), or up to ten channels of digital PCM audio input. The card provides ten channels of digital audio outputs, while supporting the Dolby Digital Surround EX audio format. With this card installed, all output channel level trims default to a fixed level (127 on the `Output Levels Adjust` menu) to allow for the proper gain structure.

Table B-3 Option Card I/O Connector Pinout with Cat. No. 778 Installed

Pin	Digital Signal I/O with Cat. No. 778 Installed	
1	AES1 (L/R) in +	This digital input pair can receive either PCM or Dolby Digital bitstreams. The remaining AES pairs receive PCM only.
2	AES1 (L/R) in –	
3	AES3 (Ls/Rs) in +	
4	AES2 (C/SW) in +	
5	AES4 (Bsl/Bsr) in + (Le/Re in + Format 85) (Bs in + Format 90 or 86)	
6	AES5 (X1/2) ½ in +	
7	AES1 (L/R) out +	
8	AES3 (Ls/Rs) out +	
9	Chassis ground	
10	AES5 (Le/Re) out +	
11	Chassis ground	
12	AES2 (C/SW) in –	
13	AES3 (Ls/Rs) in –	
14	Chassis ground	
15	AES1 (L/R) out –	
16	AES3 (Ls/Rs) out –	
17	AES5 (Le/Re) out –	
18	Chassis ground	
19	AES5 (X1/2) in –	
20	AES4 (Bsl/Bsr) in – (Le/Re in – Format 85) (Bs in – Format 90 or 86)	
21	AES4 (Bsl/Bsr) out –	
22	AES4 (Bsl/Bsr) out +	
23	AES2 (C/SW) out –	
24	AES2 (C/SW) out +	
25	Chassis ground	

Hearing-Impaired Output Connector

The **Hearing-Impaired** output is an unbalanced signal output. The connector used is a female RCA connector.

B.2 Input Connectors

Dolby Digital Reader Connectors—Reader 1 and Reader 2 (Not Present on CP650DC Models)

These connectors are used for connecting up to two Dolby Digital film soundtrack readers to the CP650 or CP650D. These connections are inactive on Model CP650SR. The pinout and the signals on these connectors are identical to the Dolby DA20 Digital Film Sound Processor and CP500D Digital Cinema Processor.

Note: If only one projector input is required (platter operation), then the interconnecting cable must be plugged into **Reader 1**.

Table B-4 Dolby Digital Reader Input Connector Pinout

Pin Number	Signal Name	Signal Description
1 (No connection)		
2 (No connection)		
3 (No connection)		
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 (No connection)		
11 (No connection)		
12 (No connection)		
13 (No connection)		
14	VO	Differential video V0
15	VOGND	V0 common
16	+15VIDEO	+15 VDC
17	V1	Differential video V1
18	V1GND	V1 common
19	–15VIDEO	–15 VDC
20 (No connection)		
21 (No connection)		
22 (No connection)		
23 (No connection)		
24 (No connection)		
25 (No connection)		

Motor Start Connector (Not Present on CP650DC Models)

The **Motor Start** connector is used to interconnect the changeover control lines of the CP650 with the theatre control system. If the CP650 is to be used in a platter operation (single projector), a jumper must be installed on this connector between pins 1 and 5. This configuration is identical to the one used on the Dolby CP500.

- Motor start—Less than 1 VDC with respect to signal ground
- Motor off—Greater than 3.5 VDC, less than 18 VDC

Table B-5 Motor Start Connector Pinout

Pin	Connection
1	Motor start 1
2	P1 changeover select pulse to (ground)
3	P1/P2 changeover select (ground for P2)
4	P2 changeover select pulse to (ground)
5	Chassis ground
9	Motor start 2

Optical Input Connectors 1 and 2 (Not Present on CP650DC Models)

There are two connectors for analog solar cell inputs from analog soundheads. Up to two projectors can be connected to the CP650. The pinout for each connector is identical. In addition to providing for the input of the analog soundhead signals, the CP650 has bipolar DC outputs to supply power to optical preamplifiers (±14 VDC). This DC voltage is supplied from the CP650 bypass power supply to ensure that optical preamplifiers still function if the CP650 switches to bypass operation during a performance. The maximum supply current available is 20 mA per preamp.

Table B-6 Optical Input Connector Pinout

Pin	Connection
1	L+
2	L–
3	Ground
4	R+
5	R–
6	Ground
7	+14 V supply (through a 150Ω resistor), 20 mA max
8	–14 V supply (through a 150Ω resistor), 20 mA max
9	Ground

Mic Input Connector

The **Mic Input** connector is a balanced input using a three-pin XLR female connector. This connector is a duplicate of the **Mic Mux** input connector on the front setup panel.

Table B-7 Mic Input Connector Pinout

Pin	Connection
1	Shield
2	+ signal
3	– signal

Mic Mux Connector on Front Setup Control Panel

An EQ microphone or mic multiplexer can be connected at this location without the need for access to the CP650 rear panel. Pins 1, 2, and 5 are wired in parallel with the rear-panel microphone input XLR connector. If you wish to use a connector already wired for use with a Dolby CP500, add a jumper between pins 5 and 6.

Caution: *It is essential that nothing be connected to the rear-panel microphone input connector if this front-panel connector is used for performing equalization.*

Table B-8 Front-Panel Mic Multiplexer or EQ Mic Connector Pinout

Pin	Connection
1	+ mic signal
2	– mic signal
3	No connection
4	No connection
5	Mic cable ground
6	No connection
7	+15 V (through a PTC resistor), 100 mA max
8	Data ground
9	Digital control signals for multiplexer

Nonsync Input Connectors (1 and 2)

Both **Nonsync In** connectors are female RCA connectors, and the input circuit is unbalanced, 21 kΩ. Sensitivity: 0.2–4 V for NS 1, and 0.06–1.5 V for NS 2.

Remote Control Unit and Remote Fader Connector

Table B-9 Remote Control Unit and Remote Fader Connector Pinout

Pin	Connection
1	Power +
2	Remote data
3	Chassis ground
4	Chassis ground
5	Remote fader wiper
6	No connection

Six-Channel Analog Audio Input Connector

This input is an unbalanced analog audio input. The nominal reference level is approximately 300 mV. There are no input level trim controls within the CP650 for this input.

Table B-10 Six-Channel Analog Audio In Connector Pinout

Pin	Connection
1	Signal ground
2	Right Surround channel 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	Left channel input
15	Left Surround channel input
16	Signal ground
17	Right channel input
18	Signal ground
19	Signal ground
20	Center channel input
21	Signal ground
22	Signal ground
23	Signal ground
24	Subwoofer channel input
25	Signal ground

B.3 I/O Connectors

Automation I/O Connector

This connector is a 25-pin female D-connector, wired to closely match the configuration of the Dolby Model CP65.

Table B-11 Automation I/O Connector Pinout

Pin	Connection	Specification	
1	S0 (automation select) Button 01	Control signal low = Select Low = < 2.4 VDC for at least 20 ms If a solid-state switch is used, it must have a saturation (on) voltage of less than 2.4 V at a current of 2.5 mA, or a resistance of 950Ω or less, and 0 V offset.	
2	S1 (automation select) Button 04		
3	S2 (automation select) Button 05		
4	S3 (automation select) Button 10		
5	S4 (automation select) Button 11		
6	S5 (automation select) Button User1		
7	S6 (automation select) Button Nonsync		
8	S7 (automation select) Button User2		
9	(automation select) remote fader select		
10	(automation select) mute		
11	No connection (–15 V in Model CP65)		
12	Digital ground		
13	+15 V (through a PTC resistor)	100 mA maximum current available	
14	ID0 (automation indicator) Button 01	ID on = Internal 1.5 kΩ resistor to +15 V ID off = Open circuit	
15	ID1 (automation indicator) Button 04		
16	ID2 (automation indicator) Button 05		
17	ID3 (automation indicator) Button 10		
18	ID4 (automation indicator) Button 11		
19	ID5 (automation indicator) Button User1		
20	ID6 (automation indicator) Button Nonsync		
21	ID7 (automation indicator) Button User2		
22	Fader local/remote fader (automation indicator)	High = Local	Internal circuit: High = 10 kΩ to +15 V Low = 500Ω +1.2 V fixed drop to ground
23	Mute (automation indicator)	Low = Muted	
24	No connection		
25	Projector status (automation indicator)	Internal circuit: High = Projector 1: 1.5 kΩ to +13 VDC (1.5 kΩ to +10 VDC in bypass) Low = Projector 2: 1.5 kΩ to ground	

Note: To maintain CP65 compatibility, the order of the select/indicator lines does not correspond to the front-panel button order.

Automation I/O Connector—Pins Used for Noise Gating

The table below lists the pin numbers used for the noise gating function. See Section 7.15 for a description of this setup menu item. Grounding the listed pin will send pink noise to the listed channel when the setup menu is set to `Noise Gating`.

Table B-12 Automation I/O Connector Pins Used for Noise Gating

Grounding This Pin:	Sends Pink Noise To:	Level
1	Left	85 dB
2	Center	85 dB
3	Right	85 dB
4	Left Surround	82 dB
5	Right Surround	82 dB
6	Subwoofer	Digital SW level
7	All channels	
8	Back Surround (both Bsl and Bsr)	82 dB

Serial Data Connector—RS-232

This connector "mirrors" the RS-232 connector located on the front setup panel. A PC can be connected at either location for performing complete cinema processor alignment using Dolby CP650 setup software.

Caution: *Only one of the two RS-232 connectors can be used at any given time.*

Table B-13 Serial Data Connector Pinout

Pin	Connection
1	No connection
2	Data out
3	Data in
4	Connected to pin 6
5	Chassis
6	Connected to pin 4
7	Connected to pin 8
8	Connected to pin 7
9	No connection

Ethernet Connector

The CP650 can be controlled via an Ethernet-based network using a PC connected to the CP650 through a hub or switch, or directly, using a network crossover cable.

Appendix C
Format Descriptions

Each format supported by the CP650 is described in Section C2. More specifically, each listing describes the audio processing applied by each format for any Dolby® cinema processor. Table C-1 describes the channel designations.

C.1 Channel Definitions

Table C-1 Channel Definitions

L	Left screen channel
Le	Left Extra screen channel
C	Center screen channel
Re	Right Extra screen channel
R	Right screen channel
SW	Subwoofer
Lt, Rt	Left Total and Right Total signals, which contain the encoded signals to be matrix-decoded into a four-channel signal
S	Mono Surround
Ls	Left Surround
Rs	Right Surround
Bsl	Back Surround Left
Bsr	Back Surround Right
Bs	Back Surround; internal Dolby Digital Surround EX™ decoded signal sent to Bsl and Bsr outputs

Note: In Dolby Digital 5.1 mode, Ls refers to the combination of Bsl and Ls speakers; Rs refers to the combination of Bsr and Rs speakers. In Surround EX mode, Ls and Rs refer only to the left- and right-side speakers, respectively. (See the output switching in Figure 1-1.)

C.2 Format Definitions

The formats supported by the CP650 are described below. If a format name is too long for display on the CP650 front panel (limited to 19 characters), a shorter name is given.

Format 01
Academy Mono Optical
Short name: Mono

Audio Description—Optical mono audio comes in on either projector's optical input, has no noise reduction applied, and is intended to produce audio on the Center channel only. This format takes Lt + Rt and puts the result on the Center channel only. There is no derived subwoofer. The mono EQ and mono level trim settings are enabled.

In this format, processing is applied after the optical preamps and the slit-loss filter to obtain the desired response curve.

Format 04
Dolby A-type Optical
Short name: Dolby A-type

Audio Description—Either projector's optical input provides Lt/Rt inputs, and matrix decoding produces four output channels (L, C, R, S). Dolby A-type noise reduction is applied to Lt and Rt.

The subwoofer signal is derived by summing L + C + R (after matrix decoding). This audio is then filtered by applying a user-selectable 50 or 100 Hz subwoofer filter, applying the downward expander, the parametric equalizer, and finally a separate optical subtrim. The level is nominally set to match the passband level of the Center channel using an RTA.

Format 05
Dolby SR Optical
Short name: Dolby SR

Audio Description—Either projector's optical inputs provides Lt/Rt inputs, and matrix decoding produces four output channels (L, C, R, S). Dolby SR processing is applied to Lt and Rt.

The subwoofer signal is derived in the same way as in format 04.

Format 10
Dolby Digital Film (Cat. No. 773 required)
Short name: Dolby Digital

Audio Description—The input is from the Dolby Digital reader, which provides the signal to the Dolby Digital decoder and creates six discrete channels (L, C, R, Ls, Rs, SW). The optical soundtrack is processed as in format 05 at all times, to enable rapid reversions to analog film sound when needed.

On a reversion event, the following actions take place:

1. The subwoofer level is set back to 0 dB, relative to the Center channel passband.
2. The subwoofer lowpass filter is set to 50 or 100 Hz.
3. The downward expander is turned on.
4. The sound crossfades from the digital audio to the optical to minimize the audibility of the reversion.

On an unreversion event, the following actions take place:

1. The subwoofer level is set back to +10 dB, relative to the optical subwoofer level.
2. The subwoofer lowpass filter is set to 180 Hz.
3. The downward expander is turned off.
4. The sound crossfades from the optical audio to the digital, to minimize the audibility of the unreversion.

Format 11
External 6-Channel

Audio Description—This external audio format has six discrete channels (L, C, R, Ls, Rs, SW), is input via the six-channel analog input D-connector, and can be used when an external digital processor is utilized. The Subwoofer channel level is +10 dB referenced to the optical, with no downward expander.

Format 13
Dolby Digital Surround EX Film (Cat. Nos. 773 and 790 required)
Short name: Surround EX

Audio Description—This format is very similar to format 10. Digital audio is processed normally. The Cat. No. 790 (or earlier Cat. No. 794) applies the Dolby Digital Surround EX™ matrix decoder to the unequalized Ls and Rs channels, which yields the channels Ls, Bs (which is copied into the Bsl and Bsr channels), and Rs. The out-of-phase information is discarded. The audio for the screen channels and subwoofer is output via the CP650's main audio outputs, and the audio for the four surround channels is output via the **Option Card I/O** D-connector. Note that reversions occur exactly the same as in format 10.

Format 20
35 mm Magnetic, L, C, R 3-Channel
Short name: 3-Channel Mag

Audio Description—This magnetic audio format has four discrete channels (L, C, R, S, though S is unused) and is input through the six-channel analog input. The magnetic preamplifier units (MPUs) are external, and the Academy mag filters (if required) are also external to the CP650. There is no derived subwoofer.

Format 22
35 mm Magnetic, 4-Channel
Short name: 4-Channel Mag

Audio Description—This format differs from format 20 only because the mono Surround channel (S) is not muted in format 22. This magnetic audio format has four discrete channels (L, C, R, S) and is input through the six-channel analog input. The MPUs are external, and the Academy mag filters (if required) are also external to the CP650. There is no derived subwoofer.

Format 42
70 mm Dolby A-type Mag. Mono Surround
Short name: 70 mm Dolby Stereo

Audio Description—This magnetic audio format has six discrete input channels (L, Le, C, Re, R, S) and is input through the six-channel analog input. The MPUs are external. Four channels of A-type noise reduction are applied to the L, C, R, and S tracks (tracks 1, 3, 5, and 6). The CP650 generates the outputs L, C, R, Ls, Rs, and SW. The Ls and Rs outputs are copies of the S mono surround input track. The subwoofer track is created by lowpass filtering the Le and Re tracks at 180 Hz and summing them. The subwoofer level is set to +10 dB (relative to the optical subwoofer level). The Le and Re tracks are used only to generate SW output, and do not pass on any screen or Surround channel audio.

Format 60
Nonsync 1

Audio Description—This external audio format has two discrete input channels (L, R) and is input through the **Nonsync In 1** connectors. The L and R channels are passed to the L and R outputs of the CP650. The L and R channels are also passed to the Dolby Pro Logic® decoder, with only the surround signal being utilized and sent to the surround outputs of the CP650.

Format 61
Nonsync 2

Audio Description—This external audio format has two discrete input channels (L, R) and is input through the **Nonsync In 2** connectors. The L and R channels are passed to the L and R outputs of the CP650. The L and R channels are also passed to the Dolby Pro Logic® decoder, with only the surround signal being utilized and sent to the surround outputs of the CP650. A subwoofer signal is derived from the screen channels.

Format 64
Public Address Center Channel
Short name: Public Address, C

Audio Description—A single channel is input through the microphone input connector. The audio output is sent to Center only.

Format 65
Public Address Surround Channels
Short name: Public Address LsRs

Audio Description—A single channel is input through the microphone input connector. The audio output is sent to Ls and Rs only.

Format 66
Test Tone 320 Hz

Audio Description—This internally generated audio format outputs a 320 Hz Dolby level tone on all channels.

Format 70
Nonsync 1 Mono Center-Surround
Short name: NS1 Mono CS

Audio Description—This external audio format has two discrete input channels (L, R) and is input through the **Nonsync In 1** connectors. The L and R channels are summed to mono, with the resulting audio sent to the C, Ls, and Rs channels. There is no derived Subwoofer channel.

Format 71
Nonsync 1 Mono Center
Short name: NS1 Mono C

Audio Description—This external audio format has two discrete input channels (L, R) and is input through the **Nonsync In 1** connectors. The L and R channels are summed to mono, with the resulting audio sent to the C channel only. There is no derived Subwoofer channel.

Format 73
Nonsync 1 Pro Logic Left-Center-Right
Short name: NS1 Pro Logic LCR

Audio Description—This external audio format has two discrete input channels (L, R) and is input through the **Nonsync In 1** connectors. The audio is processed with Dolby Pro Logic decoding with the surround output muted, and is output on channels L, C, and R (including the surround audio). There is no derived Subwoofer channel.

Format 74
Nonsync 1 Pro Logic No Subwoofer
Short name: NS1 Pro Logic No SW

Audio Description—This external audio format has two discrete input channels (L, R) and is input through the **Nonsync In 1** connectors. The audio is processed with Dolby Pro Logic decoding and output on channels L, C, R, with a mono signal to Ls and Rs. There is no derived subwoofer.

Format 75
Nonsync 1 Pro Logic With Subwoofer
Short name: NS1 Pro Logic w/SW

Audio Description—This external audio format has two discrete input channels (L, R) and is input through the **Nonsync In 1** connectors. The audio is processed with Dolby Pro Logic decoding and output on all channels. The subwoofer signal is derived by summing L + C + R (after matrix decoding). This audio is then sent to the user-selectable 50 or 100 Hz subwoofer filter, and the output level is controlled by the separate optical subtrim. As in optical formats, the level is nominally set to match the passband level of the Center channel using an RTA.

Format 76
Nonsync 2 Pro Logic With Subwoofer
Short name: NS2 Pro Logic w/SW

Audio Description—This external audio format has two discrete input channels (L, R) and is input through the **Nonsync In 2** connectors. The audio is processed with Dolby Pro Logic decoding and output on all channels. The subwoofer signal is derived by summing L + C + R (after matrix decoding). This audio is then sent to the user-selectable 50 or 100 Hz subwoofer filter, and the output level is controlled by the separate optical subtrim. As in optical formats, the level is nominally set to match the passband level of the Center channel using an RTA.

Format 80 (Cat. No. 790 or 778 required)
Bitstream Master Digital Input
Short name: Master Digital In

Audio Description—The input is a digital bitstream into the **Option Card I/O** connector, AES 1 (L/R) pins. This format automatically detects whether the bitstream is PCM or Dolby Digital (AC-3), and configures the decoder appropriately. For a PCM (two-channel) input signal, matrix decoding may be applied using the `Format 80/81 PCM Options` screen. This screen also contains a `PCM Auto Mute` option that causes the CP650 to mute automatically if it does not detect a Dolby Digital bitstream. This prevents noise when working only with encoded bitstream audio. For Dolby Digital bitstreams, the metadata contained in the bitstream specifies the channel format and surround processing to be applied.

This format does not support more than two channels of PCM. For multichannel PCM support, use formats 88, 89, or 90.

Format 81 (Cat. No. 790 required)
Bitstream Dolby Digital Surround EX
Short name: Fmt 80 w/Surr. EX

Audio Description—The input signal is a digital bitstream into the **Option Card I/O** input. The signal is Dolby Digital (consumer) decoded, and the resultant L, C, R, and SW signals are sent to the output. The Ls and Rs channels are sent to the Dolby Digital Surround EX matrix decoder to yield the channels Ls, Rs, and Bs (which is copied into the Bsl and Bsr channels). The out-of-phase information is discarded. The audio for all channels output via the **Option Card I/O** connector.

For PCM or bitstream material with fewer than two discrete surround channels, this format is identical to format 80.

Format 85 (Cat. Nos. 790 and 791 or Cat. No. 778 Required)
Bitstream PCM 8-Channel Input, 10-Channel Output
Short name: 5-Ch. Screen

Audio Description—The input signals are S/PDIF formatted bitstreams into the **Option Card I/O** input. S/PDIF input 1 carries L and R channel audio data and is output on the L and R channel analog outputs. S/PDIF input 2 carries C and SW channel audio data is output on the C and SW channel analog outputs. S/PDIF input 3 carries Ls and Rs channel audio data. Ls audio is output on the Ls and Bsl analog outputs. The Rs audio is output on the Rs and Bsr analog outputs (these are full-range signals). There are two additional output channels labeled Le and Re. These are input on S/PDIF input 4 and output on the L and R mid-frequency analog outputs. In order to use this format, the CP650 must be configured for 2-Way or full-range crossover operation, and Le/Re mode must be enabled.

Format 86 (Cat. Nos. 790 and 791 or Cat. No. 778 Required)
Bitstream PCM 8-Channel Input, 10-Channel Output
Short name: 5-Ch. Screen + EX

Audio Description—The input signals are S/PDIF formatted bitstreams into the **Option Card I/O** input. S/PDIF input 1 carries L and R channel audio data and is output on the L and R channel analog outputs. S/PDIF input 2 carries C and SW channel audio data and is output to the C and SW channel analog outputs. S/PDIF input 3 carries Ls and Rs channel audio data. These channels are Dolby Digital Surround EX decoded. The Ls audio is output on the Ls analog output. The Bsl audio is output on the Bsl analog outputs. Rs audio is output on the Rs analog output. The Bsr audio is output on the Bsr analog outputs. In this format, there are two extra channels, labeled Le and Re. These two channels are input on S/PDIF input 4 and output on L and R mid-frequency analog outputs. In order to use this format, the CP650 must first be configured for 2-Way or Full Range crossover operation, and Le/Re mode must be enabled.

Format 87 (Cat. No. 790 or earlier Cat. No. 794 required)
Analog 6-Channel with Surround EX
Short name: Fmt 11 w/Surr. EX

Audio Description—This analog audio format is a combination of formats 11 and 13, and can be used when the analog output of an external digital processor is connected. Signals of six discrete channels (L, C, R, Ls, Rs, SW) are connected to the six-channel analog input connector. The L, C, R, and SW channels are sent discrete to the outputs. The unequalized Ls and Rs channels are sent to the Dolby Digital Surround EX matrix decoder to yield the channels Ls, Bs (which is copied into the Bsl and Bsr channels), and Rs. The out-of-phase information is discarded. The audio for the screen channels and SW is output via the CP650's main audio outputs, and the audio for the four surround channels is output via the **Option Card I/O** connector. The SW channel level is +10 dB referenced to the optical, with no downward expansion.

Format 88 (Cat. No. 790 or 778 required)
6-Channel PCM

Audio Description—This format uses six discrete input channels (L/R, C/LFE, Ls/Rs) and processes them in the following manner:

1. The master audio clock source is the L/R input (first AES pair).
2. Dolby Digital bitstream decoding is disabled.
3. Digital subwoofer EQ and level processing is applied, but no lowpass filter is used.
4. The Ls input is duplicated on the Bsl output, and the Rs input is duplicated on the Bsr output.
5. The surround level adjustments are similar to those for 5.1 film formats, where Ls/Bsl together produce 82 dBC SPL, and Rs/Bsr together produce 82 dBC SPL.

Format 89 (Cat. No. 778 or 790 required)
6-Channel PCM + Surround EX
Short name: 6-Channel PCM + EX

Audio Description—This format is identical to format 88, with the exception that Dolby Digital Surround EX decoding is applied to Ls and Rs, producing additional (and identical) Bsl/Bsr outputs.

Format 90 (Cat. No. 778 or 790 required)
7-Channel PCM

Audio Description—This format is used to input seven discrete channels (L/R, C/LFE, Ls/Rs, and Bs) as would exist in a preencoded Dolby Digital Surround EX mix. Processing is identical to format 88, with the following exceptions:

1. The Back Surround (Bs) input (channel 1 of AES input 4) is copied to the Bsl and Bsr outputs.
2. No Dolby Digital Surround EX decoding is performed.

The output levels are adjusted to produce reference 85 dB SPL in Ls and Rs, and 82 dB SPL in Bsl and Bsr. (This produces a net 85 dB SPL from the combined Bs outputs.)

Format 92
Dolby SR 2-Track Printmaster
Short name: Dolby SR (6-Ch In)

Audio Description—This format is the equivalent of format 05, but takes the audio from the six-channel analog input L/R pair instead of the optical Lt/Rt input.

Format 93
Dolby SR 2-Track Printmaster
Short name: Dolby SR (NS1)

Audio Description—This format is the equivalent of format 05, but takes the audio from the NS1 input instead of the optical Lt/Rt input.

Table C-2 Format Characteristics Chart

Format Number	Format Name	Required Option 2 board	Input	Decode	Noise Reduction	Subwoofer	Subwoofer Lowpass	Sub Output Level Referenced to Center	Downward Expander	Surrounds	Optical Surround Level Offset
01	Academy Mono Optical		Optical in	Lt + Rt summed to center with Academy filter	None					None	
04	Dolby A-type Optical		Optical in	Dolby Pro Logic derived L, C, R, S	A-type	Derived from L, C, R	User defined: 50/100 Hz	0 dB	Yes	Mono Pro Logic derived	Yes
05	Dolby SR Optical		Optical in	Dolby Pro Logic derived L, C, R, S	SR	Derived from L, C, R	User defined: 50/100 Hz	0 dB	Yes	Mono Pro Logic derived	Yes
10	Dolby Digital Film		Digital reader	Dolby Digital (film)		Discrete	120 Hz, defined by recording	+10 dB		Discrete Ls, Rs	
11	External 6-Channel		Six-channel	Discrete		Discrete	20 Hz to 20 kHz	+10 dB		Discrete Ls, Rs	
13	Dolby Digital Surround EX Film	Cat. No. 790 or 794	Digital reader	Dolby Digital (film) with Surround EX		Discrete	120 Hz, defined by recording	+10 dB		EX derived Ls, Bs, Rs to Option I/O outputs	
20	35 mm Magnetic. L, C , R 3-channel		Six-channel	Discrete							
22	35 mm magnetic 4-channel		Six-channel	Discrete						Discrete mono	
42	70 mm Dolby Stereo		Six-channel	Discrete	A-type x 4	Summed from Le, Re	180 Hz	+10 dB	Yes	Discrete mono	
60	Nonsync 1		Nonsync 1	Discrete L/R, Dolby Pro Logic surround						Mono Pro Logic derived	Yes
61	Nonsync 2		Nonsync 2	Discrete L/R, Dolby Pro Logic surround		Derived from L, C, R				Mono Pro Logic derived	Yes
64	PA Center Channel		Mic Input	Input signal sent to Center							
65	PA Surround Channels		Mic input	Input signal sent to surrounds						Mono from input	
66	Test Tone			320 Hz tone		Tone				Tone	
70	Nonsync 1 Mono Center-Surround		Nonsync 1	L + R summed to C, Ls, Rs						L + R summed to Ls, Rs	
71	Nonsync 1 Mono Center		Nonsync 1	L + R summed to Center							
73	Nonsync 1 Pro Logic Left-Center Right		Nonsync 1	Dolby Pro Logic, no surrounds							N/A
74	Nonsync 1 Pro Logic, No Subwoofer		Nonsync 1	Dolby Pro Logic derived L, C, R, S						Mono Pro Logic derived	Yes
75	Nonsync 1 Pro Logic with Subwoofer		Nonsync 1	Dolby Pro Logic derived L, C, R, S		Derived from L, C, R	User defined: 50/100 Hz	0 dB		Mono Pro Logic derived	Yes
76	Nonsync 2 Pro Logic with Subwoofer		Nonsync 2	Dolby Pro Logic derived L, C, R, S		Derived from L, C, R	User defined: 50/100 Hz	0 dB		Mono Pro Logic derived	Yes

Format Number	Format Name	Required Option 2 Board	Input	Decode	Noise Reduction	Subwoofer	Subwoofer Lowpass	Sub Output Level Referenced to Center	Downward Expander	Surrounds	Optical Surround Level Offset
80	Bitstream Master Digital Input	Cat. No. 778 Cat. No. 790 Cat. No. 794	AES1 S/PDIF AES3, S/PDIF	Auto-detect/decode PCM, Dolby Digital (consumer)		In bitstream				Up to four discrete, dependent on format	
81	Bitstream Dolby Digital Surround EX	Cat. No. 778 Cat. No. 790 Cat. No. 794	AES1 S/PDIF AES/EBU, S/PDIF	Dolby Digital (consumer) with Surround EX		In bitstream				Surround EX derived Ls, Bs, Rs to Option I/O outputs	
85	5-Channel Screen	Cat. No. 778 Cat. Nos. 790 and 791	AES/EBU S/PDIF	Eight-channel discrete	None	Discrete bitstream input				Bsl = Ls, Bsr = Rs; Ls and Rs are discrete PCM streams	
86	5-Channel Screen + EX	Cat. No. 778 Cat. Nos. 790 and 791	AES/EBU S/PDIF	Eight-channel discrete, Surround EX decode of Ls and Rs inputs	None	Discrete bitstream input				Surround EX derived Ls, Bs, Rs to Option I/O outputs	
87	6-Channel with Surround EX	Cat. No. 790 Cat. No. 794	Six-channel	Discrete L, C, R, SW with EX decode of Ls, Rs		Discrete	20 Hz to 20 kHz	+10 dB		Surround EX derived Ls, Bs, Rs to Option I/O outputs	
88	6-Channel PCM	Cat. No. 778 Cat. No. 790	AES x 3	Discrete							
89	6-Channel PCM + Surround EX	Cat. No. 778 Cat. No. 790	AES x 3	Discrete							
90	7-Channel PCM	Cat. No. 778 Cat. No. 790	AES x 4	Discrete							
92	Dolby SR 2-Track Printmaster		Six-channel L, R input	Dolby Pro Logic derived L, C, R, S	SR	Derived from L, C, R	User defined: 50/100 Hz	0 dB	Yes	Mono Dolby Pro Logic derived	Yes
93	Dolby SR 2-Track Printmaster		Nonsync 1	Dolby Pro Logic derived L, C, R, S	SR	Derived from L, C, R	User defined: 50/100 Hz	0 dB	Yes	Mono Dolby Pro Logic derived	Yes

Appendix D
External Control

The CP650 can be controlled via the Ethernet port, by devices connected to the RS-232 serial data connector, or to the rear-panel Remotes and Auditorium Fader connector.

For control via the Ethernet port, see the configuration settings in Section 7.18.

D.1 Control via Serial Port

This appendix is for use by customers who are highly qualified to modify hardware and write software. Dolby Laboratories cannot be held liable for incidental, special, direct, indirect, or consequential damages; or loss of use, revenue, or profit by users attempting to interface the CP650 with other systems.

The **Serial Data** port supports standard 9-pin serial connections to PC serial ports and other RS-232 devices. Although this port is primarily used while running the CP650 setup software from a PC, the software interface described below allows the **Serial Data** port to be used with a simple ASCII character interface to set and get information regarding the current CP650 processor status.

The raw serial interface parser accepts ASCII commands as described below. Each command consists of a simple keyword, <key>, followed by an "=" sign and the <value> for that key. A command is terminated by an end-of-line character combination ("\r\n"). This is the typical "end of line" combination sent by PC terminal programs.

Current CP650 settings may be queried by substituting a question mark "?" for the "<value>" field. The complete set of known settings may be queried by using the special "all=?" command. See the examples in Table D-1.

Table D-1 Remote Commands

Key	Range of Values	Notes
exit	0 .. 1	Closes the current Ethernet control connection.
fader_level	0 .. 100 Corresponding to fader values 0.0 ... 10.0	Querying fader_level while the fader_setting is "auditorium" returns the level as determined by the auditorium fader.
fader_setting	"local" "auditorium" If "auditorium" is selected, the main shaft fader is disabled as are any attached remotes (Cat. No. 779, Cat. No. 771).	<see above> If changed via this serial interface, this setting is lost at the next CP650 restart.
format_button	0 .. 7 Indicates which button on the CP650 front panel should be applied: Data Button Applied 0 Format 01 1 Format 04 2 Format 05 3 Format 10 4 Format 11 5 User format 1 6 User format 2 7 Nonsync format Any preset fader level associated with the indicated button is also applied, and the LED for the selected button is illuminated.	
format_list		Lists all formats assigned to the eight front-panel buttons.
mute	0 .. 2 Indicating the desired mute setting: Data Mute Operation 0 Unmute 1 Mute 2 Toggle Any applicable fade in/out time is applied just as if the front-panel **mute** button were used.	
preset_fader_ level		This key can only be queried, not modified. Querying this key returns on one line a comma-separated list indicating the current value for all format buttons separated by commas. The buttons are listed in the following order: 01, 04, 05, 10, 11, U1, U2, NS Each level can be 0–100, or –1. A setting of –1 indicates no preset fader level for that button.
projector	1 .. 2	This key can only be queried, not modified.
user_formats		This key can only be queried, not modified. Querying this key returns on one line a comma-separated list indicating the user formats: <user 1>, <user 2>, <nonsync>.

Query

Querying an Individual Parameter

"<key>=?" returns a "<key>=<value>" output line for that key.

Querying All Available Parameters

"all= ?" results in a series of output lines representing every known key in the serial control system.

Query Errors

If a query cannot be parsed or does not match a known parameter, "error" will be output. External controllers must wait for the response to a query before proceeding.

Notes

1. The ASCII interface system operates at a baud rate of 9,600 bps (8 data bits, 1 stop bit, no parity, no flow control) and cannot be invoked while the **Serial Data** port is in use by the CP650 setup or reader alignment programs.
2. The interface operates in raw serial mode. Characters are not echoed back to the controller, and control characters are ignored.
3. Command parsing is not case sensitive.
4. White space (<space>, <tab>, and so on) is ignored on input lines.
5. No error correction (CRC), sync bytes, or protocol is applied to this interface. Customers must be aware of any stability or dropout issues with their own hardware.
6. If a command is parsed successfully but the value is out of range (or the same as the current setting), no error is issued and the command has no effect.

Table D-2 Remote Command Examples

Operation	Character String to Send	Output from the CP650
To set the CP650 fader level to 6.5	fader_level = 65\r\n	
To ensure the CP650 is not muted	mute = 0\r\n	
To apply the format 10 button	format_button = 3\r\n	
This example shows a query of the status of all keys. The results show a typical CP650 setup.	All = ?\r\n	fader_level=70 fader_setting=local format_button=4 format_list=64, 76, 5, 10, 11, 88, 80, 75 global_delays=0, 0, 0, 0, 0, 110, 0, 0 mute=0 preset_fader_level=-1, 45, 60, 70, -1, -1, -1, -1 projector=1 user_formats=88, 80, 75

D.2 Control via Remotes Connector

CP650 control using single-wire communications via the **Remotes and Aud. Fader** connector is available in CP650 system software version 1.1.5 and later. To do so, it is recommended that a Cat. No. 779 Remote Control Unit or Cat. No. 771 Remote Fader be used.

Dolby Laboratories occasionally receives requests to interface the CP650 to other types of computers, for the purposes of remote control. While this was never intended to be a feature of the remote port, it may be possible to command the CP650 to change the fader level, select any one of the eight front-panel formats, and to toggle the mute status.

The remote port interface consists of three wires. One provides 15 volts at low current to power the remote units. The other two lines of the remote port are ground (0 volts) and data. The ground line should be connected to the reference ground voltage of the serial port on the computer. This is usually found on pin 7 of a serial 25-pin D-connector, or pin 5 of a 9-pin D-connector.

The single data line presents the single biggest challenge of interfacing another computer to the CP650. All industry-standard RS-232 ports have two data lines: one to transmit, and one to receive. The CP650 data line works by placing the single data line in a high-impedance state while listening for transmitted data, and driving voltages onto this line when it needs to send information. In other words, the single data line is a receiving line for all devices, except when they need to send data, at which point it is a transmitting line.

Thus, when the CP650 needs to communicate, or a remote accessory needs to communicate with the CP650, it takes control of the single data line just long enough to send its message. It then must place the line back in a high-impedance state, and listen for a response.

Interfacing an external computer's serial port to the single data line can be tricky. The actual requirement, as stated above, is for the serial port to "tri-state" its transmitter when it is not sending.

If one cannot engineer this type of circuit for the computer's serial port, an alternate method can be tried, but it may damage the serial port. Pass the serial port's transmit line through a series-connected resistor, and tie that line to both the serial port receive line and the CP650's data line. It is possible that the serial port's transmitter (which does not tri-state) can be overridden by the CP650's transmitter, and yet still function as a transmitter when necessary (when the CP650 is in High Impedance mode). But the outcome cannot be guaranteed.

To do this, start with a high resistance (say, 100 kΩ), and reduce it until the computer's serial port is able to both send and receive data. The exact value required depends on the types of chips used in the serial port.

Digital Data Communications Message Protocol

Digital Data Communications Message Protocol (DDCMP) was developed by Digital Equipment Corporation as a serial link layer protocol.

All messages between the CP650 and the remote accessories take place within the context of the DDCMP protocol. An important reference document, `ddcmp.txt`, is published by Digital Equipment Corporation.

The network is a half-duplex multipoint network. The operating mode of the remote accessories is that of a half-duplex tributary station, with the control station being the CP650.

The CP650 supports remote accessory device addresses 1–9.

The CP650 has intentionally added one nonstandard modification to the DDCMP protocol. If the CP650 sends out the hex value `FF` 20 times in a row, all remote accessories should recycle themselves to their power-on state. This includes resetting themselves to the ISTRT state, and attempting to reestablish the link.

Disclaimer

An attempt has been made to implement the DDCMP protocol as defined in the `ddcmp.txt` reference document. If there is a difference between the reference document and the CP650 implementation, the CP650 method is defined to be correct, and will not be modified. Dolby Laboratories reserves the right to make changes to the remote port communication scheme or interface at any time, without notice.

DDCMP Timers

A real timer must exist in both the ISTRT and ASTRT states, of approximately one second, for sending STRT and STACK messages, respectively.

Establishing the DDCMP Link

On power-up, the remote accessories should be in the ISTRT state. As specified in the DDCMP document, the link to the CP650 is established by each remote accessory sending one (or more) STRT messages until the remote accessory receives the STACK message (indicating that the link has been established).

The delay between repeated STRT messages should be determined by each accessory's address (slightly different for each address) to prevent repeated transmission collisions.

Remote Accessories-to-CP650 Message

A periodic ACK from the CP650 will pass the select flag to each remote accessory (in turn). If no change in the state of the CP650 is required by the selected remote accessory, the remote simply returns the select flag via an ACK message.

If the remote has been given the select flag, and it intends to change the state of the CP650, it will send the 1 byte data message.

Note: All remotes must parse all messages. This requires looking at the length and cannot be ignored.

To command the CP650 to toggle the mute setting, the data message must have a value of zero. If the CP650 was unmuted before receiving this command, it will be in the Muted mode afterward, and if muted before, it will be unmuted after.

The CP650 front-panel buttons can be thought of as being numbered 1 through 8 (**format 01**, **04**, **05**, **10**, **11**, **U1**, **U2**, and **NS**, respectively). To command the CP650 to assert a format change, the data byte should be a number from 1 to 8.

To change the fader level, the data byte should be a value from 10 to 110. This corresponds to a fader setting between 0.0 and 10. (Subtract 10 from the value of the data byte, and then divide by 10 to obtain the resulting fader value.)

CP650-to-Remote Accessories Message

The message from the CP650 to any remote accessory will always contain 2 bytes of data. The CP650 will periodically transmit this message to all registered remote accessories to ensure that they have the proper data. This data message will also be sent immediately whenever there is a relevant change in the state of the CP650.

The least significant 7 bits of the first byte in the data packet (received from the CP650) contains the current fader level, between 0 and 100. Divide by 10 to obtain the correct fader level.

The most significant bit of the first byte in the data packet tells the remote accessory whether or not to blank its fader display (0 = display on, 1 = display off).

The least significant 3 bits of the second byte in the data packet contain the current format of the CP650. The value will be between 1 and 8, corresponding to the front-panel buttons as described above.

The next most significant bit tells whether the CP650 is muted (0 = not muted, 1 = muted).

The next most significant bit tells which projector is in use (0 = projector 1, 1 = projector 2).

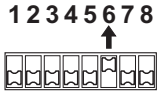
The next most significant bit tells whether the current CP650 format is valid (0 = normal, 1 = invalid format).

The next most significant bit tells whether the auditorium fader is active (0 = not active, 1 = active).

The most significant bit of the second data byte is not used.

Appendix E
Setup and User Menus

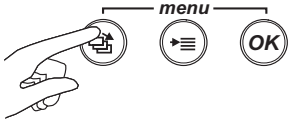
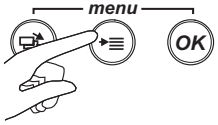
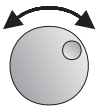
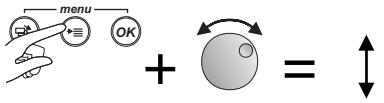
E.1 CP650 Setup Menu



DIP switch 6 UP

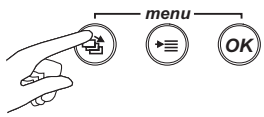
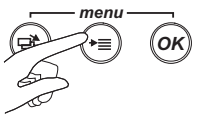
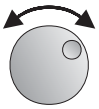
The Bsl and Bsr channels (shown in italics) are available only with Cat. No. 790 installed. The Le and Re channels (shown in italics) are available only with Cat. No. 791 installed.

B-Chain

					**Notes**
1	Le/Re Channels (with Cat No. 791 crossover installed)		Enable/Disable *Le/Re* channel support		Crossover mode. must be Full Range or 2-Way.
2	Calibrate SPL		Enter room readings: 45–108.5 dB		Calibrates CP650 internal SPL meter to agree with auditorium sound level meter reading.
3	Output Levels Adjust (Initial)	Channel: Level:	L, C, R, Ls, *Bsl, Bsr*,Rs 1–127 (0.3 dB steps)		Subwoofer level is set in separate menu items.
4	Crossover mode (with Cat No. 791 crossover installed)	Select: Select:	Full Range, 2-Way, 3-Way Enable/Disable		Must be Full Range or 2-Way in order to enable *Le/Re.*
5	Crossover Levels (with Cat No. 791 crossover installed)	Channel: Level	Select crossover output Select level		Available only with optional Cat. No. 791 Crossover Card installed.
6	Crossover Configuration (with Cat No. 791 crossover installed)	Channel: Parameter: Value:	Select L, C, or R Type, Freq, Slope, Delay Set value of the parameter selected above		Available only with optional Cat. No. 791 Crossover Card installed.
7	Digital Subwoofer Level Adjust (initial)	Level:	1–127 (0.3 dB steps)		This adjustment also affects Optical SW level.
8	Bulk EQ Adjust	Channel: Bass Adjust: Treble Adjust: Corner Frequency:	L, C, R, Ls, *Bsl, Bsr*, Rs ± 6 dB ± 10 dB 1, 2, 3, 4 kHz		Set these before adjusting B-Chain EQ. (Corner fixed at 2 kHz for Ls, *Bsl, Bsr*,Rs)
9	B-Chain EQ Adjust		Select channel: L, C, R, Ls, *Bsl, Bsr*, Rs		 Press **OK** to start.
			Select frequency band: 40 Hz to 16 kHz ↔		
		 Hold down middle button and turn the knob to adjust level: ±6 dB in the selected band.			 To exit, press **OK** to save, then press the left button to move back to the channel selection menu.

(Continued on next page)

CP650 Setup Menu, B-Chain (Continued)

				**Notes**
10	Subwoofer EQ Adjust	EQ center frequency: EQ filter width ("Q"): Level Cut:	25–125 Hz 0.5, 1, 2, 4 0 to –12 dB	
11	Output Levels Adjust (Final)	Channel: Level:	L, C, R, Ls, *Bsl*, *Bsr*, Rs 1–127 (0.3 dB steps)	Final level adjustment after EQ.
12	Digital Subwoofer Level Adjust (Final)	Level:	1–127 (0.3 dB steps)	This adjustment also affects Optical SW level.
13	Optical Subwoofer Bandwidth	50/100 Hz	50/100 Hz	Match SW to LF limit of main screen speakers.
14	Optical Subwoofer	Level: Polarity: Center Noise:	1–127 (0.3 dB steps) Normal/Inverse on/off	Perform final level adjustment and polarity check: Center noise LF output should decrease when polarity is inverse.

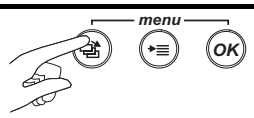
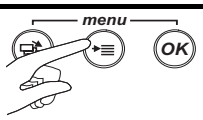
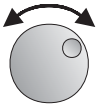
A-Chain (The shaded menu items do not apply to CP650DC models)

15	Automatic Optical Level Adjust, Projector 1			Run Cat. No. 69T test film and press **OK**.
16	Automatic Optical Level Adjust, Projector 2			
17	Manual Optical Level Adjust, Projector 1			Run Cat. No. 69T test film and press **OK**.
		Left channel/Right channel	Adjust level of selected cell: 0–63 (0.3 dB steps)	
18	Manual Optical Level Adjust, Projector 2			Run Cat. No. 69T test film and press **OK**.
		Left channel/Right channel	Adjust level of selected cell: 0–63 (0.3 dB steps)	
19	Optical Focus	Projector: Channel:	P1/P2 L/R	Adjust lens for max HF.
20	Automatic Slit-Loss Projector 1			Run Cat. No. 69P test film and press **OK**.
21	Automatic Slit-Loss Projector 2			
22	Manual Slit-Loss Projector 1	Channel: Value:	L/R 1–127	
23	Manual Slit-Loss Projector 2			

(Continued on next page)

CP650 Setup Menu, A-Chain (Continued)

(The shaded menu items do not apply to CP650DC models)

					Notes
24	Bypass Level Adjust				***OK*** = Bypass/Normal toggle Set bypass trimpots (RTA test points active).
25	Optical Surround Level Trim			–3 to +6 dB	Run Cat. No. 151B test film.
26	Optical Surround Delay Adjust			20–150 ms	
27	Digital Surround Delay Adjust			20–150 ms	
28	Dolby® Digital Reader Delay			16–512 perfs	
29	Dolby Digital Video Level Check			Reader 1/Reader 2	Confirm correct voltage.
30	Nonsync 1 Level Adjust			1–127	
31	Nonsync 2 Level Adjust			1–127	
32	Mono Level Trim			0 to –12 dB	
33	Mono EQ Adjust			LF ◄——► HF	
34	Front-Panel Button Preset Defaults		Button: Fader level set: Delay set:	**01**, **04**, **05**, **10**, **11**, **U1**, **U2**, **NS** 0–10 or None 0–170 ms	
35	Button **01** Format Assignment			Select format to assign to the **01** button	
36	Button **04** Format Assignment			Select format to assign to the **04** button	
37	Button **05** Format Assignment			Select format to assign to the **05** button	If a Cat. No. 773 is installed, format buttons **05** and **10** are fixed.
38	Button **10** Format Assignment			Select format to assign to the **10** button	
39	Button **11** Format Assignment			Select format to assign to the **11** button	
40	Button **U1** Format Assignment			Select format to assign to the **U1** button.	
41	Button **U2** Format Assignment			Select format to assign to the **U2** button.	
42	Button **NS** Format Assignment			Select format to assign to the **NS** button.	
43	Format 80/81 Options PCM Options		Auto Mute: Decode:	Disabled/Enabled L/R Stereo/Dolby Pro Logic®	Mutes CP650 if not detecting Dolby Digital input bitstreams.
44	Dolby Digital Reversion Mode		Normal/No Reversion	Enabled/ None(Temporary)/ None (Permanent)	Recommended for test use only. “Temporary” resets to Normal after powering on.
45	Auto Surround EX™		Enabled/Disabled	Enabled/Disabled	Press **OK** to save change.
46	Noise Gating Active				Special application. For use with RT-60.
47	Auditorium Assist™		No Reference or Check Auditorium Set Reference		"No Reference" is displayed when no room measurements have been stored.

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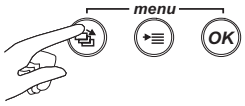
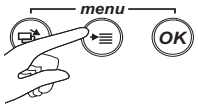
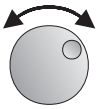
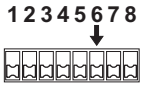
CP650 Setup Menu, A-Chain (Continued)

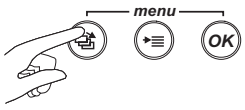
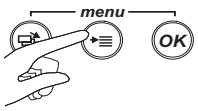
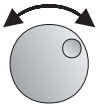
				**Notes**
48	Headroom Configuration	Typical Noise Floor Optimization Unity Gain (Cat. No. 778 only)		Press **OK** to test.
49	Dialogue Normalization	Disabled/Enabled	Disabled/Enabled	
50	Network Configuration	Local IP address: 192.168.99.200 Address Mask: 255.255.255.0 Gateway address: 192.168.99.1 System name:	Edit address octets Edit address octets Edit address octets Edit letters	Hold down middle button and turn the knob to move to next field. Press **OK** to save.
51	Clock Set	Hour: Minute:	Set Set	
52	Date Set	Day: Month: Year:	Set Set Set	

E.2 CP650 User Menu



DIP switch 6 Down

The options shown in bold are the default settings when the unit was shipped from the factory. The shaded menu items do not apply to CP650DC models.

				**Notes**
Top	Format and CP650 Status Display			This is the top-level menu display.
1	Fader Setting	**Local**/Auditorium	**Local**/Auditorium	
2	Front-Panel Button Preset Defaults	Button: Fader level set: Delay set:	**01**, **04**, **05**, **10**, **11**, **U1**, **U2**, **NS** 0–10 or None 0–170 ms	If a Cat. No. 773 is installed, format buttons 05 and 10 are fixed.
2	Preset Fader Levels	Format: Fader level set:	1, 4, 5, 10, 11, U1, U2, NS 0–10 or None	
3	Auto Dolby Digital	**Enabled**/Disabled	**Enabled**/Disabled	
4	Auto Digital Target		Select Target Format: **Format 10** or Format 13	Format 13 must be one of the user formats.
5	Rotating Pink Noise			Press **OK** to start/stop movement.
6	Auditorium Assist	Check Auditorium or **No Reference**		"No Reference" is displayed when no room measurements have been stored.
7	Automatic Optical Level Adjust **Projector 1**			Run Cat. No. 69T test film. Press **OK** to start. Press **OK** to save.
8	Automatic Optical Level Adjust **Projector 2**			Press **OK** to start. Press **OK** to save.
9	Manual Optical Level Adjust **Projector 1**		Set level	Press **OK** to start. Press **OK** to save.
10	Manual Optical Level Adjust **Projector 2**		Set level	Press **OK** to start. Press **OK** to save.
11	Button 01 Format Select		Select format to assign	
12	Button 04 Format Select		Select format to assign	
13	Button 05 Format Select		Select format to assign	
14	Button 10 Format Select		Select format to assign	
15	Button 11 Format Select		Select format to assign	
16	Button U1 Format Assignment		Select format to assign	Default is **Format 75.**
17	Button U2 Format Assignment		Select format to assign	Default is **Format 65.**
18	Button NS Format Assignment		Select format to assign	Default is **Format 60.**
19	Format 80/81 PCM Options	Auto Mute: Decode:	**Disabled**/Enabled **L/R Stereo**/Pro Logic	Mutes CP650 if not detecting Dolby Digital input bitstreams.
20	Mute Fade-In Time		0.2–5 Seconds	
21	Mute Fade-Out Time		0.2–5 Seconds	

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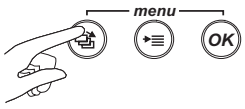
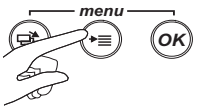
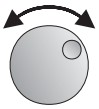
CP650 User Menu (Continued)

					**Notes**
22	Power-On Format Select	Select from Format list or select **Last Format** used.	Select from Format list or select **Last Format** used.		
22	Contrast Adjustment		Set the display contrast.		
23	Event Log		Scroll up and down the event listing.		Useful for telephone discussions.
24	About this CP650—**Screen 1** • Control software version number • Optional boards installed				
25	About this CP650—**Screen 2** • Headroom Configuration setting				
26	About this CP650—**Screen 3** • CP650 software modules version numbers				
27	About this CP650—**Screen 4** • CP650 network MAC address • Board version numbers				The version numbers are listed for each board in the following order: **Cat. No. 772B,** **Cat. No. 773,** **Cat. No. 774A,** **Cat. No. 777,** **Cat. No. 778, or 790 or 794** "x"= Board not installed
28	Remote Addresses				Displays the single-digit address of each attached remote unit (three remotes maximum).
29	Return to the Top-Level Menu Display				