

Dolby[®]

UFX/650 Upgrade Kit

Cat. No. 790

For CP650 Cinema Processor

Installation Instructions

Issue 2

Part No. 91841

Dolby Laboratories, Inc.

Corporate Headquarters

Dolby Laboratories, Inc.
100 Potrero Avenue
San Francisco, CA 94103-4813
Telephone 415-558-0200
Fax 415-863-1373
www.dolby.com

European Headquarters

Dolby Laboratories, Inc.
Wootton Bassett
Wiltshire, SN4 8QJ, England
Telephone (44) 1793-842100
Fax (44) 1793-842101

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UEX/650 Upgrade Kit

1 Introduction

The UEX/650 Upgrade Kit converts a Dolby® Model CP650D Digital Cinema Processor into a CP650 with Dolby Digital Surround EX™ film soundtrack playback capability. For a detailed description of the format, please see Section 7.

The kit also adds four S/PDIF digital signal inputs. These inputs accommodate PCM audio at sample rates of 48 and 44.1 kHz, plus Dolby Digital (consumer) bitstreams.

The signal input/output 25-pin D-connector is located on the rear panel of the CP650, labeled “Option Card I/O.”



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

The UEX/650 kit consists of:

- A Cat. No. 790 Dolby Digital Surround EX Decoder/Digital Input Board
- Mounting hardware and connector

Check CP650 Software Version

Perform this step before you install the Cat. No. 790 board. The CP650 operating system software must be version 2.1 or higher. With the CP650 operating normally, follow these steps:

	<p>Press the left menu button multiple times to step through the menus to About this CP650.</p> <p>Note: You can also press and hold the left menu button while rotating the front-panel fader knob clockwise to step through the menu items.</p>
<div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>About this CP650: System v. 2. 1. x. x Cat. No. xyz installed Cat. No. xyz installed</p> </div>	<p>About this CP650 has three menu screens.</p> <p>The first screen displays the version number of the installed operating system software. If the version reads “2.0.x.x”(x = any number) or earlier, you must update the operating system software to version 2.1.x.x or higher.</p>
	<p>Press the illuminated format button to return to the top menu screen.</p>

2 Handling PC Boards

This upgrade involves handling printed circuit boards. Many components are very sensitive to static electricity and can be destroyed if static charge on your body discharges through the component. You do not even have to touch the component to damage it. Before touching the components on the PC boards, ground yourself by rubbing the frame of the unit with each hand or wearing an earthing strap.

3 Installation Steps

1. Remove mains power from the CP650 by unplugging the rear-panel power cord.
2. Open the setup control panel access door.

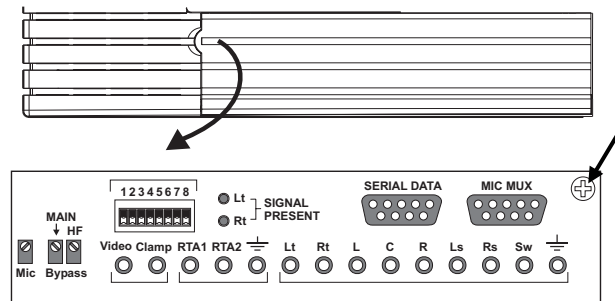


Figure 1 CP650 Control Panel

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.

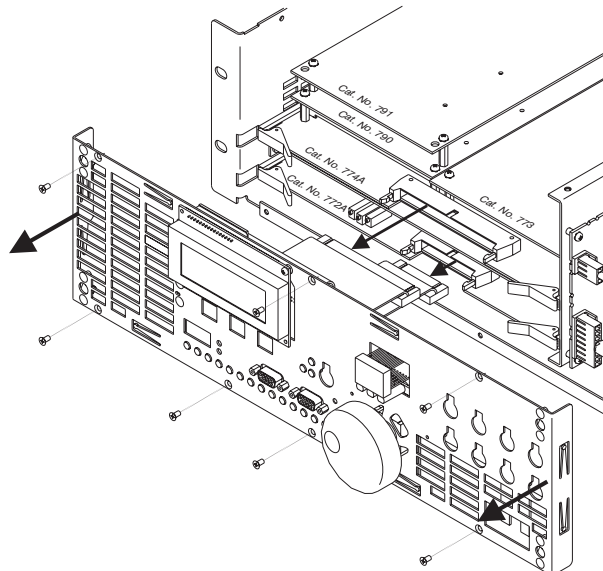


Figure 2 Remove Control Panel

4. Remove the seven subpanel mounting screws and carefully pull the subpanel toward you to remove it. Be sure to support the panel while you perform the next step.

5. Unplug the two ribbon cables connected to the internal circuit boards.
6. Remove the upper circuit board (Cat. No. 774A) using the left and right board ejectors. Place the board on a flat surface (such as a platter disk). The board should be oriented with the ejectors closest to you.
7. Remove the Cat. No. 790 board from its anti-static bag, and plug it into the **left-hand** side of the main board by aligning the two connectors as shown in Figure 3. Press down firmly on each side, making sure the connectors are fully seated. The board can be oriented only one way for the connectors to match.

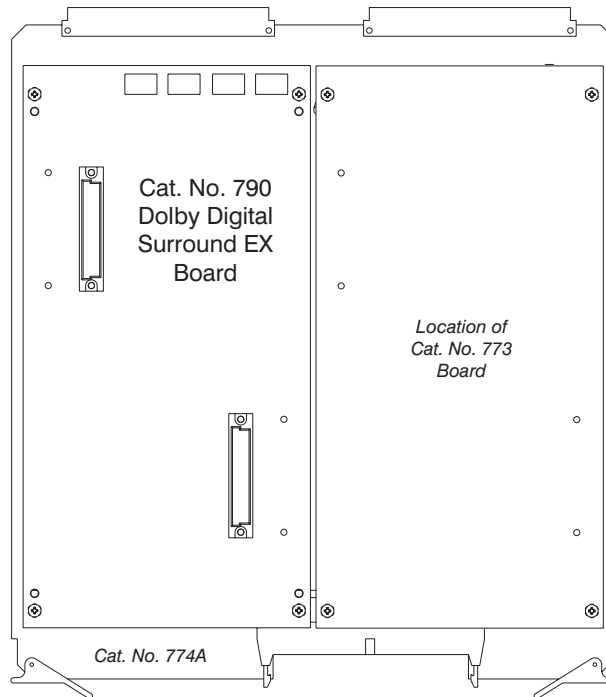


Figure 3 Mount the Cat. No. 790 Board

Note: The Cat. No. 790 will not function if it is installed in the right-hand location.

8. Turn over the board combination, and install screws through the Cat. No. 774A board and into standoffs at each corner of the Cat. No. 790 board.
9. Reinstall the assembly into the CP650. Push the board in firmly until it is fully seated.
10. Reinstall the two ribbon cables, inner panel, and front panel.

4 Connections

With the Cat. No. 790 board installed, all surround channels appear at the **Option Card I/O** connector on the rear panel of the CP650. You must move the Left Surround (Ls) and Right Surround (Rs) channel output wiring from the **Main Audio Output** connector to this connector. Do **not** use the Ls and Rs outputs on the main audio output connector. Additionally, install the wiring for the new Back Surround channel amplifiers.

The digital audio inputs on the Cat. No. 790 can accept up to four two-channel PCM (pulse-code modulated) bitstreams. Each bitstream contains the data for two channels of PCM audio. 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.

Make connections by soldering the appropriate wires to the male solder-cup connector shipped with the upgrade kit.

Note: When wiring to the digital inputs, be sure to ground all unused inputs. Failure to do so will cause unused channels to show signal, due to crosstalk between the used digital inputs and the unused digital inputs.

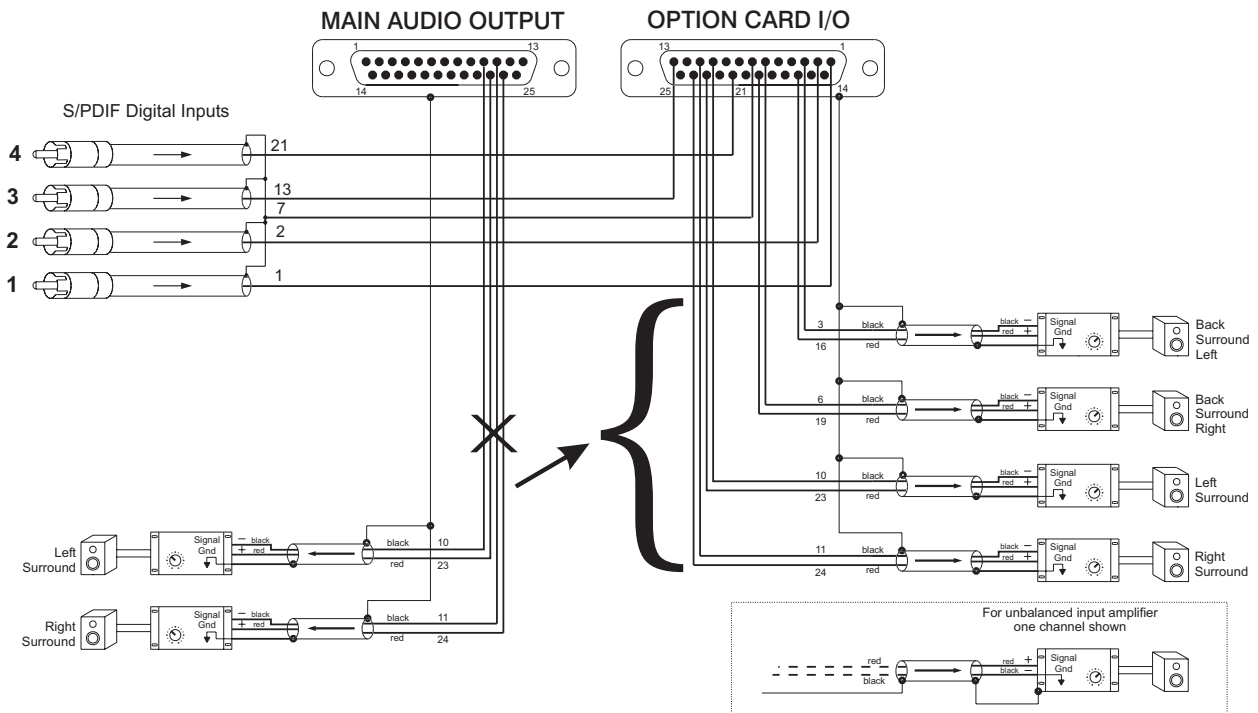


Figure 4 CP650 Outputs to Power Amplifiers

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Table 1 Option Card I/O Connector Pinout with Cat. No. 790 (or earlier Cat. No. 794) Installed

Pin	Signal with Cat. No. 790 Installed	Signal with Earlier Cat. No. 794 Installed
1	S/PDIF 1 (L/R) Input +	AES/EBU Input – S/PDIF Gnd
2	S/PDIF 2 (C/SW) Input +	AES/EBU Input + S/PDIF Input +
3	Back Surround Left –	Back Surround Left –
4	n.c.*	n.c.
5	n.c.	n.c.
6	Back Surround Right –	Back Surround Right –
7	Gnd – Digital Inputs See Note	n.c.
8	n.c.	n.c.
9	n.c.	Chassis Gnd
10	Left Surround –	Left Surround –
11	Right Surround –	Right Surround –
12	n.c.	n.c.
13	S/PDIF 3 (Ls/Rs) Input +	n.c.
14	n.c.	n.c.
15	n.c.	Chassis Gnd
16	Back Surround Left +	Back Surround Left +
17	n.c.	n.c.
18	n.c.	Chassis Gnd
19	Back Surround Right +	Back Surround Right +
20	n.c.	n.c.
21	S/PDIF 4 (Bsl/Bsr) Input +	n.c.
22	n.c.	Chassis Gnd
23	Left Surround +	Left Surround +
24	Right Surround +	Right Surround +
25	n.c.	n.c.

* No connection.

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

5 Alignment

The Dolby Digital Surround EX format may be assigned to any user-assignable format button. After you make your assignment, the CP650 front-panel bar graph display and the PC setup software show the additional Back Surround outputs (Bsr and Bsl):

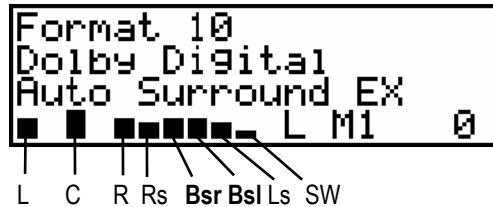


Figure 5 Front-Panel Display while running a Dolby Digital Surround EX Film





The Dolby Digital Surround EX format is defined as Format 13. 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 Surround EX Board detects these bits and automatically switches the CP650 to Surround EX decoding. There is no need to assign a button to Format 13. If the flags indicate that the film is not a Surround EX film, or if the flag bits are not present, Surround EX mode switches off automatically. The Bsr and Bsl channels are automatically configured for either 5.1 mode or Surround EX mode.

The alignment procedure for the new surround outputs follows the same steps used for the original Left Surround and Right Surround channels during the initial cinema setup. Using the *CP650 Installation Manual*, follow the procedure for microphone placement, RTA hookup, and SPL calibration; then perform level calibration and equalization for all speaker channels:

1. **Initial Output-Level Calibration**—Select and set each main output channel (C, L, and R) to 85 dB, and set each Surround output (Ls, Bsl, Bsr, Rs) to 82 dB.
2. **Coarse (Bulk) Equalization**—Adjust the EQ on all speakers.
3. **Fine (1/3-Octave) Equalization**—Adjust the EQ on all speakers.
4. **Final Output-Level Calibration**—Select and set each main output channel to 85 dB, and each Surround output to 82 dB.

6 Assign a Digital Input Format

After making the connections, you may assign a digital input format to one of the user-definable format buttons (U1, U2, or NS) if selection of digital inputs is desired. Using the PC setup software, select the desired format from the pull-down list for the format button to be assigned, or use the CP650 front-panel menu steps shown below.

 <div data-bbox="414 660 718 761" style="border: 1px solid black; padding: 5px;"> User Format 2 > Format xx format name </div>	<p>Press the left menu button multiple times (or press and hold the left menu button while rotating the front-panel fader knob) to move to the User Format 1, 2, or NS menu.</p> <p>This example shows the U2 button.</p>
 <div data-bbox="470 828 774 929" style="border: 1px solid black; padding: 5px;"> User Format 2 >Format 80 Di gi tal I nput </div>	<p>Rotate the fader knob to select the desired digital input format number from the displayed list.</p>
 <div data-bbox="478 1019 782 1120" style="border: 1px solid black; padding: 5px;"> Savi ng Changes. . . </div>	<p>Press the OK button to save the assignment to the Format button.</p>
	<p>Press the illuminated Format button to return to normal operation.</p>

7 The Dolby Digital Surround EX Format

The Dolby Digital Surround EX format 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 processing 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 the earlier Cat. No. 794 board).

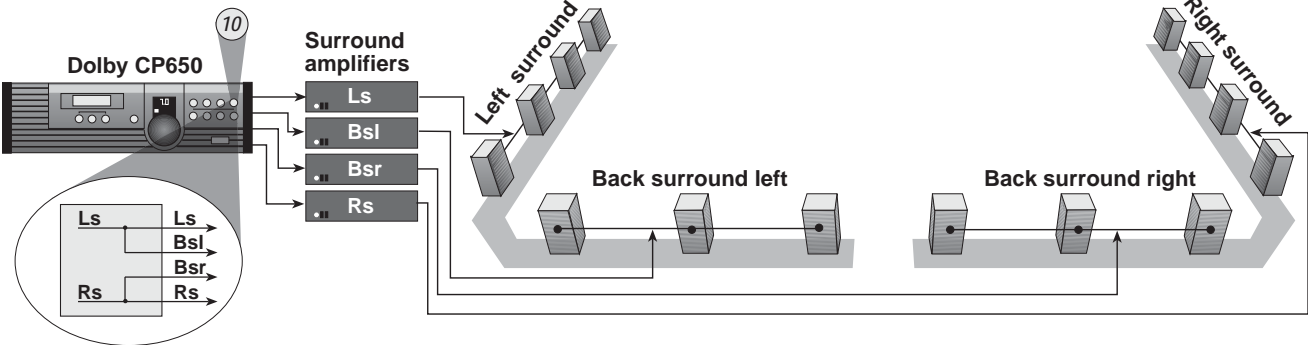
A center screen channel is necessary to ensure the precise localization of front sounds for all viewers, including those seated on the sides. Dolby Digital Surround EX audio brings similar benefits to the surround sound field. With the Surround EX process, a Back Surround channel is reproduced by the speaker array at the back of the theatre, while Left and Right Surround is reproduced by the side arrays. This means that sounds can now be positioned behind the audience, opening the door to exciting 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 side of the theatre experience the total surround ambience intended by the filmmaker.

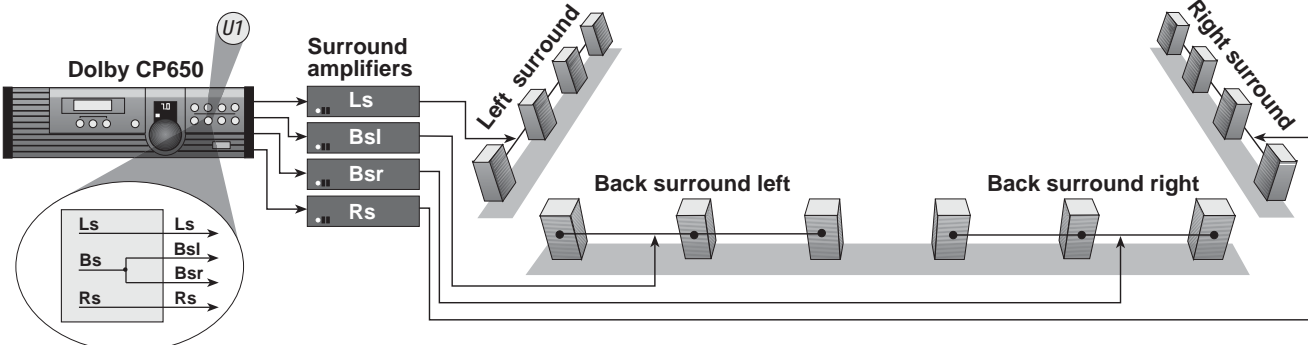
The UEX650 kit upgrades the CP650D 5.1-channel digital cinema sound processor to three surround channels that can play digital prints prepared with the Dolby Digital Surround EX process. The installation requires wiring the surround speakers into **Left**, **Back** (split into two groups), and **Right**. Two power amplifier channels are required for powering the two groups of Back Surround channel speakers. Figure 6 shows the surround signal distribution for conventional 5.1-channel surround format and for Dolby Digital Surround EX format.

Auto Surround EX

On Dolby Digital soundtracks that contain a data bit signifying Surround EX encoding, the CP650 automatically switches to Dolby Digital Surround EX decoding (when CP650 operating software is version 1.2 and above).



Dolby Digital 5.1 mode



Dolby Digital Surround EX mode

Figure 6 Surround Speaker/Amplifier Switching for 5.1 and Surround EX Modes

8 Digital Audio Inputs

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 1V, and BNC (“push and twist”) 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 have been standard on analog professional 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.

8.1 Consumer Interface Standards for Digital Audio

The consumer interface standard for digital audio is **S/PDIF** (IEC61937). 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 get good results using high-quality 75Ω video cable with the appropriate connectors and/or adapters.

8.2 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.

8.3 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 (phono plug)-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 3 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 3 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 like multiple inputs, inputs for Toslink digital connections, and multiple outputs.