

2.1 Dolby Audio Processing Systems

The two Dolby professional signal processing systems, Dolby A-type noise reduction and Dolby spectral recording (SR), are designed to use the recording medium with optimum efficiency using complementary, or two-part, processes. The sound signal is processed before it is recorded onto the tape; after playback it is again processed but in an equal-and-opposite way, restoring the original sound and reducing any audible effects from the intermediate recording process, such as noise and distortion.

Dolby A-type noise reduction (introduced in 1966) has been established over many years as the most widely used noise reduction system for professional music recording and broadcast video tape. Operating independently in four frequency bands it provides an improvement in audio noise performance of 10 dB at all frequencies up to 3 kHz, rising to 15 dB at 15 kHz.

Dolby SR, introduced in 1986, is a high-performance system that operates flexibly to discriminate accurately between the signal and unwanted noise and distortion. In addition, it uses anti-saturation techniques to improve the recording headroom and restore accurate transient performance. In overall performance, the system reduces noise selectively to match the sensitivity of the ear, giving a weighted noise improvement of 24 dB, as well as increasing the tape headroom by up to 10 dB at extreme high and low audio frequencies.

These systems operate selectively within the audio dynamic range, treating low level and high level signals independently to achieve best results with the minimum of signal processing. This requires that the levels in the playback (decode) processor should be the same as in the record (encode) processor, within normal operational tolerances. This relationship is calibrated during the installation procedure and is confirmed by routine operational checks. Special reference signals are provided to help this calibration. (See Section 2.3 Calibration Signals.)

2.2 Interchanging processing modules between SP, XP and SRP frames

As supplied by Dolby Laboratories, XP frames may contain Cat. No. 331 A-type or Cat. No. 431 SR modules. SRP frames are supplied with Cat. No. 531 SR modules. However, 331, 431 and 531 modules will all work correctly in both XP and SRP frames.

Cat. No. 431 SR modules may also be used in Dolby Laboratories' earlier SP frames (with the addition of a Cat. No. 342 Dolby noise generator). However 331s and 531s will not work in SP frames, and the Cat. No. 230/Cat. No. 22 combinations supplied with the SP frames will not work in XP and SRP frames.

Recordings made with any module can be decoded accurately using any other module containing the same processing system.

2.3 Calibration Signals—Dolby Tone and Dolby Noise

Both Dolby A-type noise reduction and Dolby SR require the signal to return to the playback processor at the same level as it left the record processor; in other words the record/play path should be unity gain. To help with this calibration, special alignment signals are provided: Dolby tone for A-type noise reduction and Dolby noise for Dolby SR. A calibrated LED display is also provided on each processing module to check the level of these signals.

Dolby tone is an audibly modulated 850 Hz tone at Dolby level. A short section of Dolby tone should be recorded at the beginning of each new A-type encoded tape; when replayed it should read at Dolby level on the LED displays to confirm correct calibration.

Dolby SR uses Dolby noise for similar purposes. It is a pink noise signal that is interrupted briefly at 2-second intervals. It is used for various functions:

- a. The interruptions, or 'nicks', provide an audible identification for the SR recording.
- b. The level of the signal, while not at Dolby level, is fixed in relation to Dolby level and is used for calibration checks. In 'Set-up' mode, replayed Dolby noise will read at Dolby level on the indicators.
- c. The Dolby noise may be displayed using a real-time analyzer to show any variation of the overall frequency response.
- d. Selecting 'Set-up' mode on the PS3, the power supply and control unit, enables a special 'Auto Compare' function. This alternates 4 seconds of Dolby noise from the tape with 4 seconds of noise directly from the generator. Variations in recorder level and response can be heard as differences between the two noise sources. (See Section 4.7.)

CAUTION

Check the voltage selector and fuse before applying power to the unit.

3.1 Installation

- STEP 1** Unpack the XP Series and PS3 units and check for damage. Check the packing material for the power cable and accessories.
- STEP 2** Mount the units appropriately in a rack or in a tape recorder. The PS3 Power Supply should be located directly above the XP Series frame. Check that the air flow at the bottom of the main frame and at the rear of PS3 is not blocked and that the incoming air is not heated by other equipment situated below it.
- STEP 3** Check the selected AC mains voltage at the rear panel of the PS3. If necessary, lever open the voltage selector/fuse compartment door in the power supply input connector. Rotate the voltage selector drum until it reads the correct voltage for the installation. (The drum may also be removed and replaced with the correct voltage displayed; it will only fit one way around.)

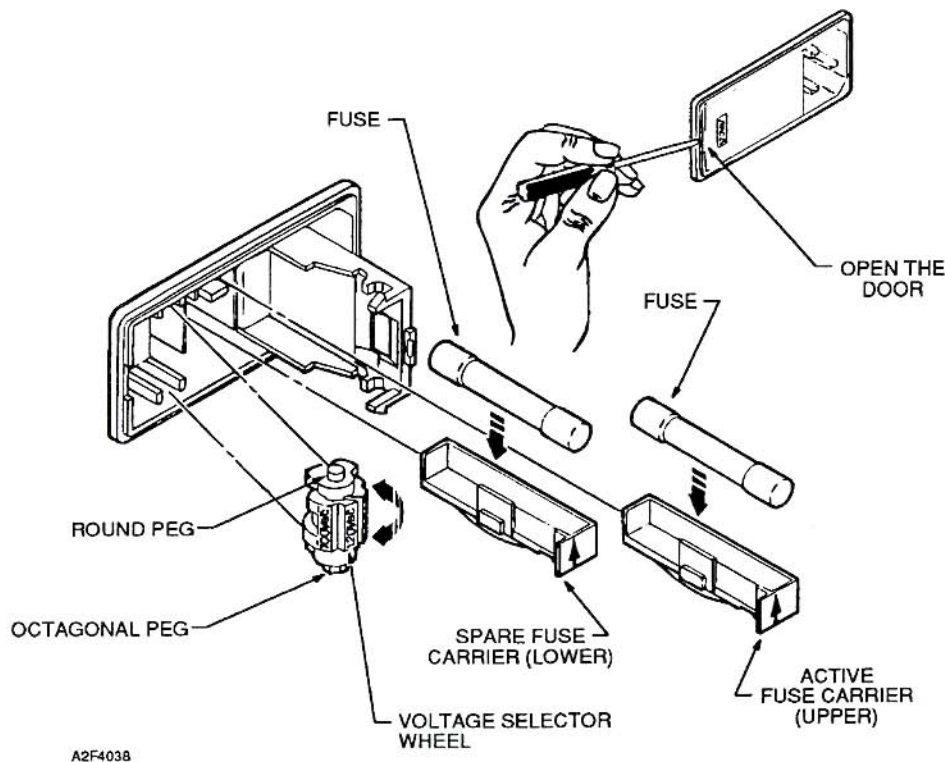
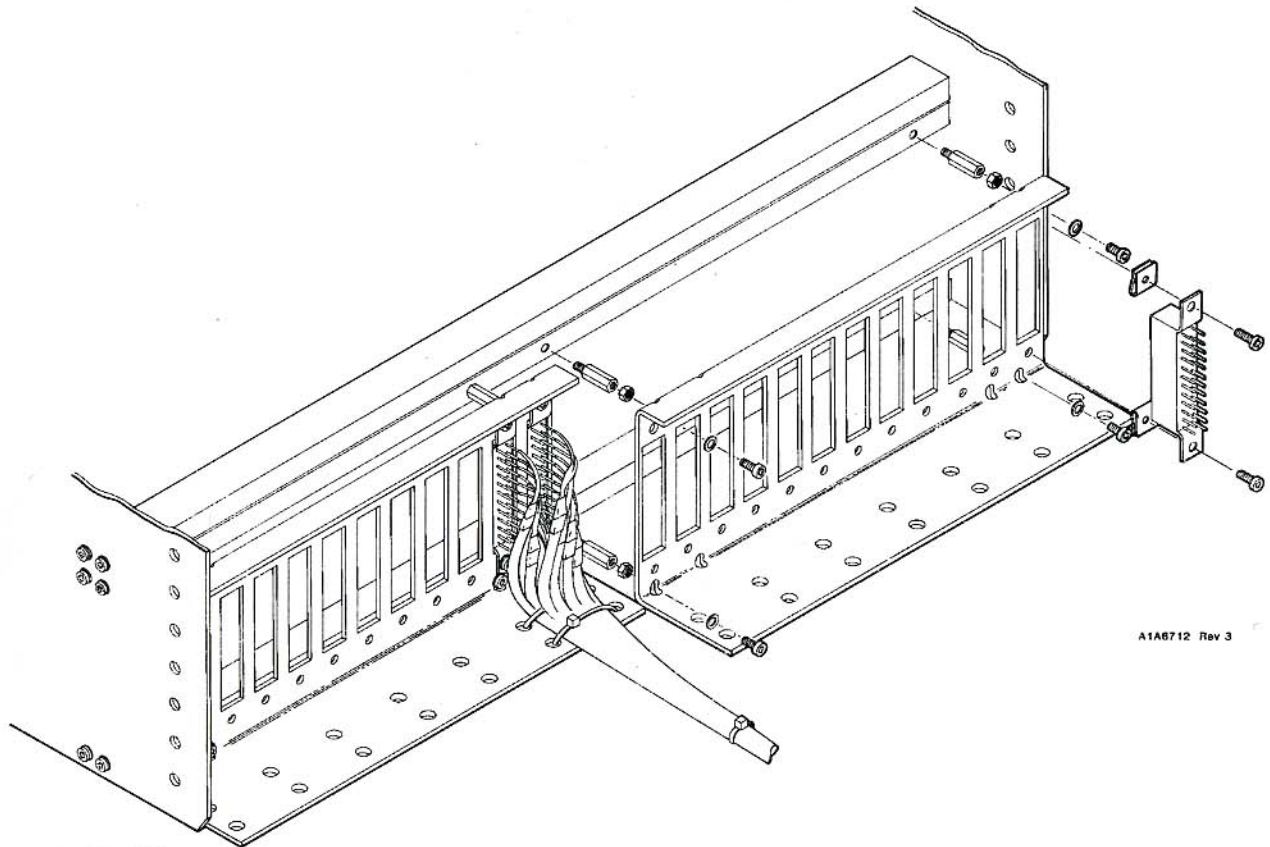


Figure 3-1 Fuse Location and Selection of Operating Voltage

3.2 Connections

- STEP 1** Connect the DC power cable between J2 on the PS3 power supply and JM2 on the main frame.
- STEP 2** Connect the control functions ribbon cable provided between J1 on the PS3 power supply and JM1 on the main frame.
- STEP 3** Examine Figure 3-2 which shows the method of making input and output connections.



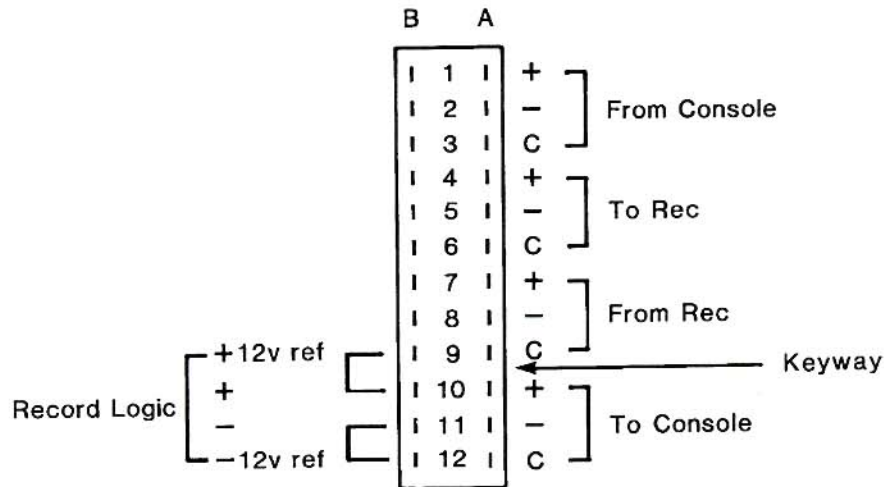
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Figure 3-2 Rear Connector Plate, Mounting Details

The connector plate is fully assembled at the factory with all connectors in place. The plate can be removed for ease of making connections by loosening the four captive screws used to mount the plate in place. Note that the connectors in the plate have been so assembled that there is approximately 1.5mm of play in the vertical axis. This float assists in correct seating of the module edge-connectors.

STEP 4 Connect the record logic remote control circuit of each module to the recorder electronics. See the application notes in Section 3.3.

- A voltage difference of 4V to 25V between pins B10(+) and B11(-) of the input/output connector for each channel (see Figure 3-3) will operate the floating switch and change the mode from playback to record. The current drain is approximately 5 mA (independent of voltage).
- Connect pins B10 (+) and B11(-) of the input/output connector for each channel via two-conductor cables to the record relay coil of the corresponding channel of the tape recorder. Observe the polarity, because it is important.



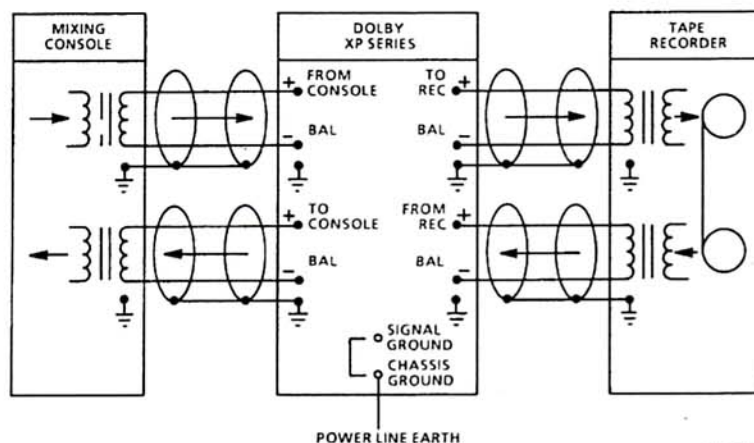
A3D3819 REV A

Figure 3-3 I/O Connector Wiring (rear view, as seen at cable entry)

- Alternatively, make connections to a suitable record-only voltage that is often supplied for this purpose with newer multi-track tape recorders or is available at the remote operation connector of a recorder (the application notes at the end of this section describe the remote control arrangements of many popular multi-track recorders).
- Reference voltages on pins B9 (+12V) and B12 (-12V) of the I/O connector are provided to simplify the interface (when needed). In order to avoid possible problems with ground returns, it is recommended that both terminals of the floating switch be powered only from the recorder. If either of the reference voltages is used and there is not a spare set of record relay contacts, a common ground must be provided between the XP/SRP Series unit and the tape recorder chassis.

STEP 5 Connect signal cables to the XP/SRP Series I/O connectors using appropriate two-conductor shielded cable. The best practice is to connect the shield (screen) at only one end of the cable. The convention in this manual is that the shield is to be connected to the ground of the sending unit only. The opposite convention may be used as well, but be sure to follow a consistent rule in all of your signal connections.

BALANCED CIRCUITS:



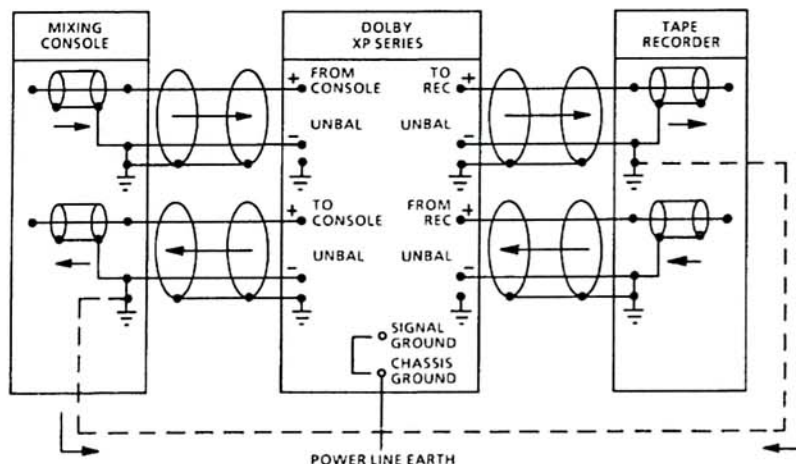
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Figure 3-4a Wiring of XP/SRP Series Unit To/From Balanced Circuits

Inputs Driven from Balanced Source: Connect the signal **high** side to '+' and the **low** side to '-'. Do not connect the shield at this end.

Outputs Driving Balanced Inputs: Connect the signal **high** side to '+'. Connect the **low** side to '-' and the shield to 'C'.

UNBALANCED CIRCUITS:

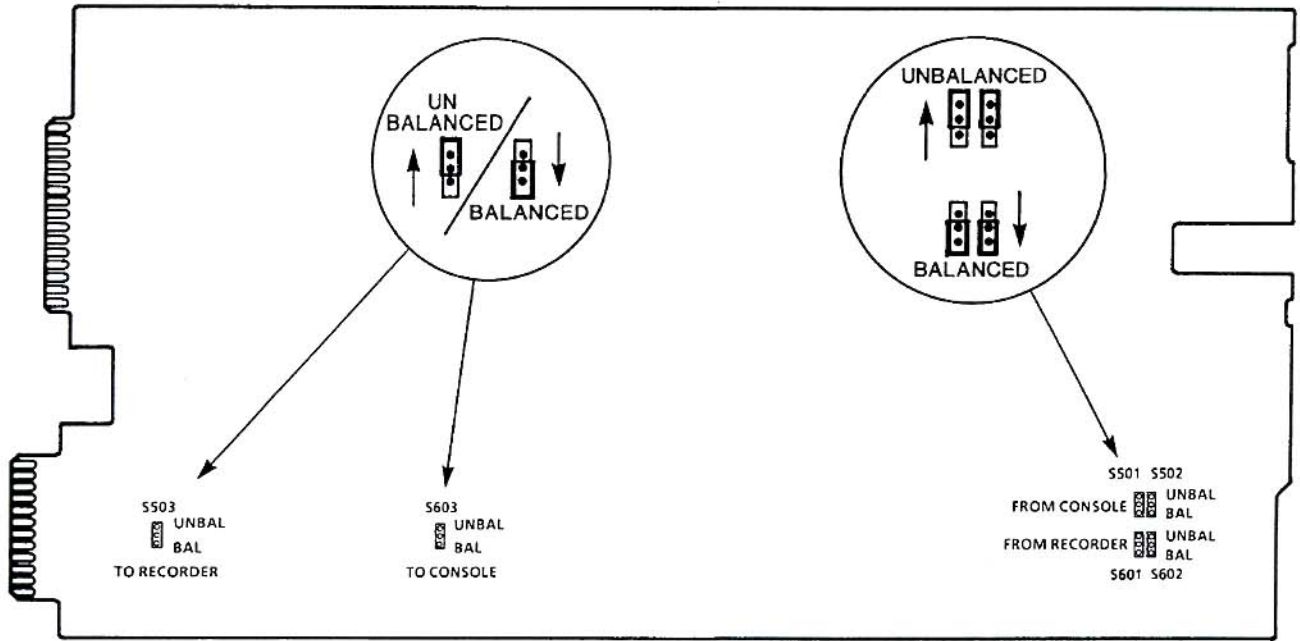


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Figure 3-4b Wiring of XP/SRP Series Unit To/From Unbalanced Circuits

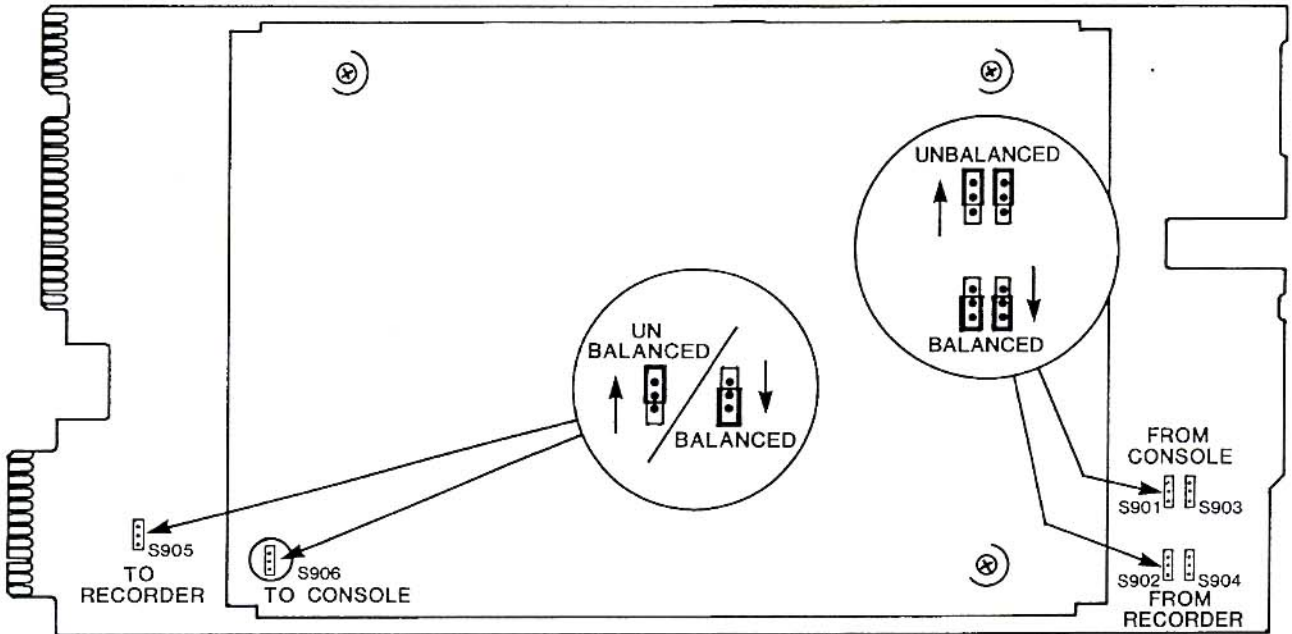
Inputs Driven from Unbalanced Source: Connect the signal to '+' and the ground of the sending unit to '-'. Do not connect the shield at this end.

Outputs Driving Unbalanced Inputs: Connect the signal **high** side to '+', the **low** side (-) to the ground of the receiving unit, and the shield to 'C'.



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Figure 3-5 Cat. No. 331 Configuration Links



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Figure 3-6 Cat. No. 431/531 Configuration Links

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NOTE

In the unbalanced cases, shields and **low** sides must **NOT** be commoned but must be connected individually as shown in Figure 3-4b. If the shield connection at the mixing console or tape recorder is via a plug and socket, make certain that the appropriate pins really are connected to ground inside the console. **Connect a single signal ground wire between units making one connection on each unit.**

It is usually unnecessary to terminate the **FROM CONSOLE** and **FROM REC** inputs to the XP/SRP Series unit. It is also unnecessary to terminate the **TO CONSOLE** or **TO REC** outputs. They will drive any load above 200 ohms.

- STEP 6** Set the configuration links on each module for the proper interface with balanced or unbalanced inputs and outputs. See Figures 3-5 and 3-6 for the jumper locations.
- STEP 7** In order to reinstall the connector plates to the frame, perform the following steps:
- STEP 7A** Slide all of the modules away from the backplane an inch or two.
 - STEP 7B** Refasten the connector plates to the frame.
 - STEP 7C** Plug in the rightmost and leftmost modules of each connector plate (channels 1 and 12, 13 and 24) and check the alignment of the plates. If necessary, loosen the mounting screws and adjust the plates.
- STEP 8** Make certain that you have installed strain relief for each of the signal cables as shown in Figure 3-2.

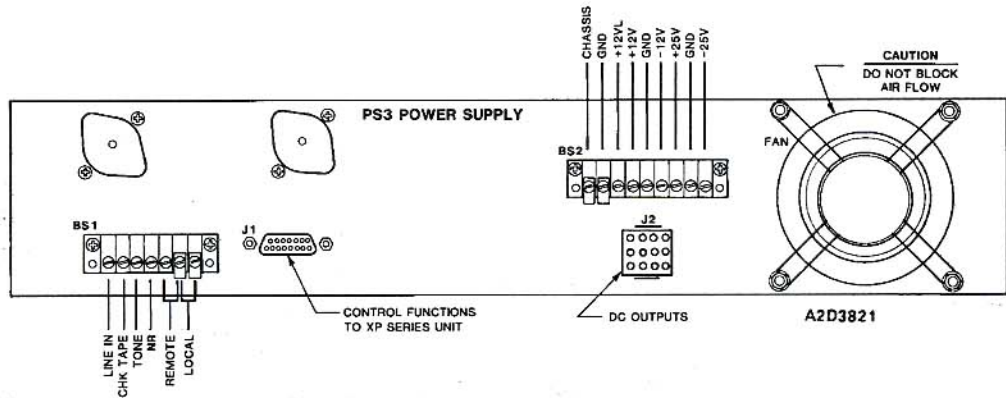
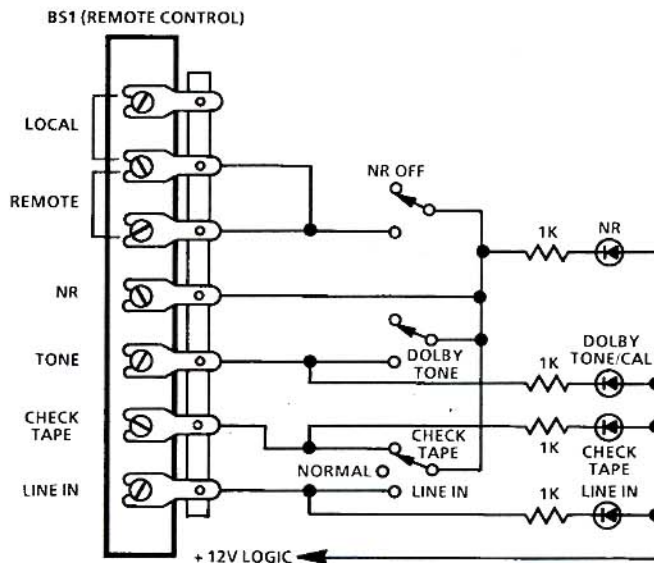


Figure 3-7 Location of Terminal Blocks on Rear of PS3 Power Supply

- STEP 9** The PS3 master control functions can be operated remotely by means of terminal block BS1 (**REMOTE CONTROL**) on the rear of the PS3 and a suitable mechanical switch circuit built by the user (see Figure 3-8). Connections to BS1 are made via a seven-terminal fanning strip that is packed with the unit. To permit remote switching, remove the link that connects terminals 6 and 7 (**LOCAL**) and connect it instead between terminals 5 and 6 (**REMOTE**); an orange LED on the front of the PS3 lights to indicate that the unit is under remote control.



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Rev 2

Figure 3-8 Remote Control Circuitry

- STEP 10** Fittings on the PS3 permit the unit to be supported from the rear in the rack. It is recommended that a rear support be installed in mobile installations or in other installations where the unit may be subjected to mechanical vibration.
- STEP 11** Read the safety information in Section 1.3. When you are confident that you have observed its provisions, connect the power cable between the PS3 power supply and a power outlet.
- STEP 12** Signal ground can be isolated from the chassis by removing an externally accessible link located on terminal block BS2 on the rear panel of the PS3 (see Figure 3-7 below). The chassis is always connected to ground via the power cable; for safety reasons this ground should never be disconnected.

MCI/SONY JH-16 AND JH-24

XP/SRP SERIES UNIT

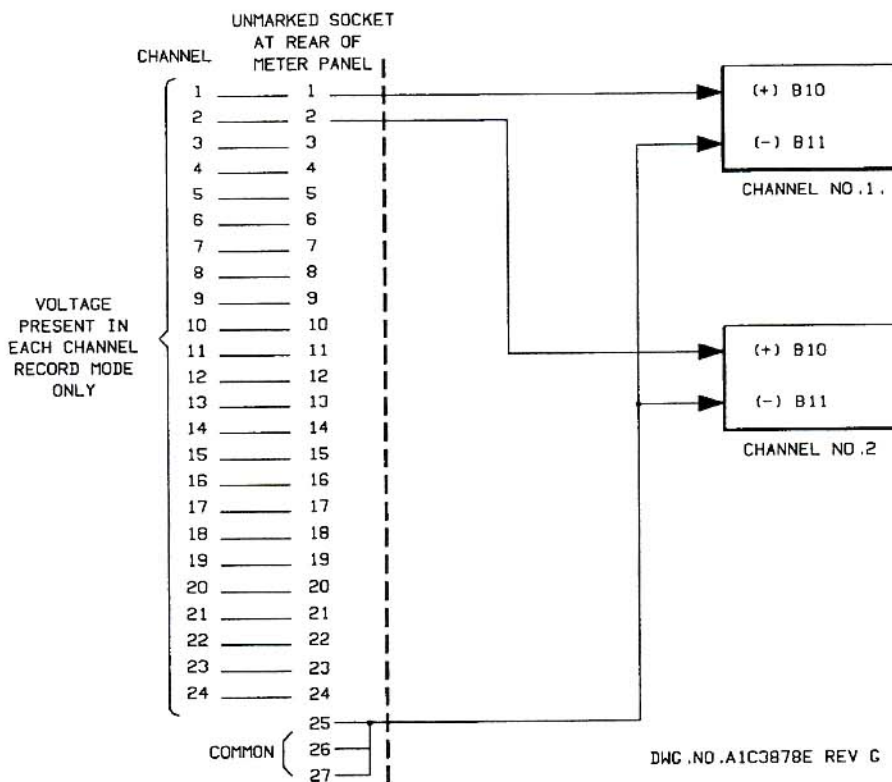
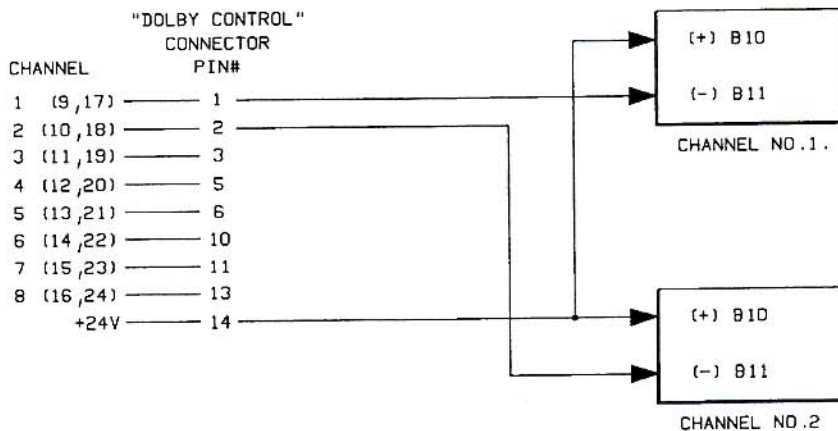


Figure 3-11 Remote Connection of XP/SRP Series Unit to MCI/Sony JH-16 and JH-24 Recorders

STUDER A80 (WITH AUDIO REMOTE)/A800/A820/A827

XP/SRP SERIES UNIT



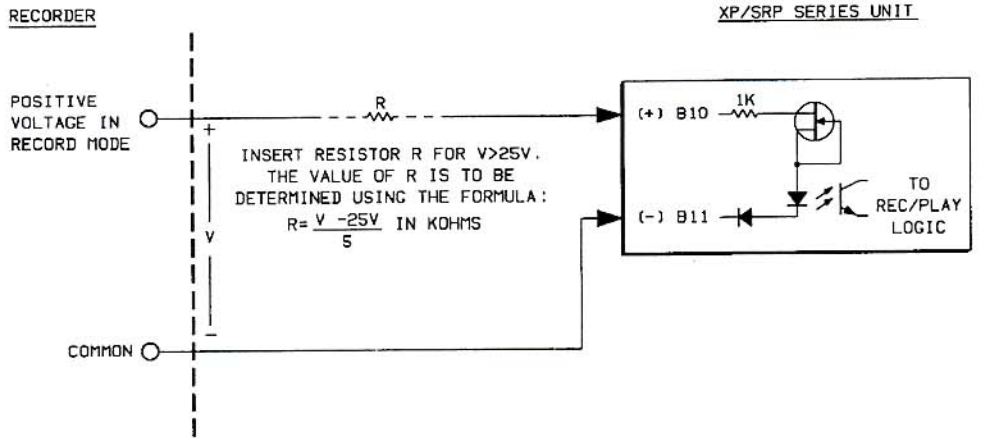
NOTES

1. MODEL A820 MUST BE FITTED WITH EXTERNAL NR CONTROLLER BOARD-STUDER PART NO.1.820.816.00
2. "DOLBY CONTROL" CONNECTORS ARE ELO2 (04,06) ON MODEL A80 AND ELOS ON MODELS A800/A820

DWG.NO.A1C3878D REV G

3.3 Record/Play Switching — Application Notes

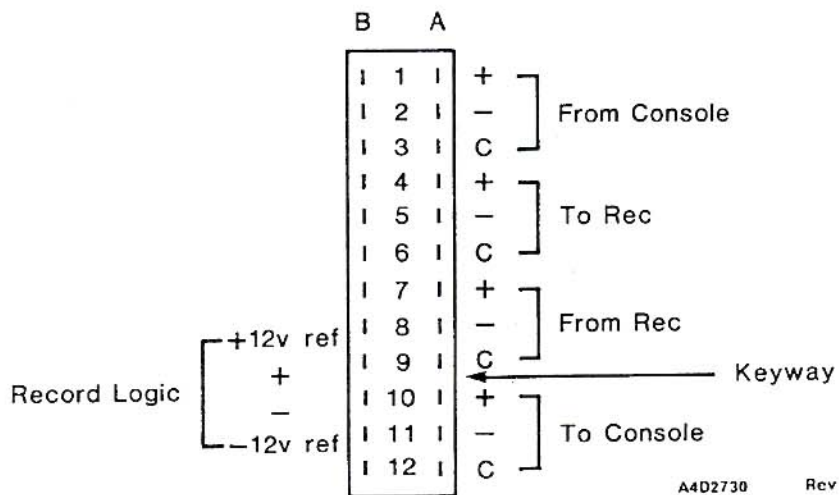
The XP and SRP Series have been designed for record-play changeover operation of each channel. Solid-state switches place the Dolby processing electronics in either the input (Record) signal paths or the output (Play) signal paths. The circuits are typically switched under control from the recorder. Each channel can be switched from playback mode to record mode by applying a voltage in the range 4-25 Vdc between pins B10 and B11 of each channel. Many tape recorders have suitable switching voltages available. The switching input uses an opto-isolator to provide a floating input. The input current is roughly 5mA, essentially independent of voltage up to 25V. Switching voltages higher than 25 V can be accommodated by adding an appropriate external resistor. The following notes show the interconnections between the record/play logic and popular tape recorders. Figure 3-9 shows the general case; the remaining Figures apply to specific models of recording equipment.



NOTE: REVERSE B10/B11 CONNECTION FOR NEGATIVE VOLTAGE IN RECORD MODE

DWG. NO. A1C3878A REV G

Figure 3-9 Remote Connection of XP/SRP Series Unit Record/Play Logic to Tape Recorder (General Case)



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Figure 3-10 I/O Connector Wiring (rear view, as seen at cable entry)

3.4 Dedicated Encode or Decode Operation

It is possible to use XP or SRP Series channels for dedicated encode or decode only operation.

On the channels dedicated to encode, the console should be connected through to the tape recorder using the 'FROM CONSOLE' and 'TO REC' connections on the record channels and the record logic switching linked so that the channel is locked into encode (record) operation (see Figure 3-25). The From Console and the To Rec potentiometers are used to set record path input and output levels.

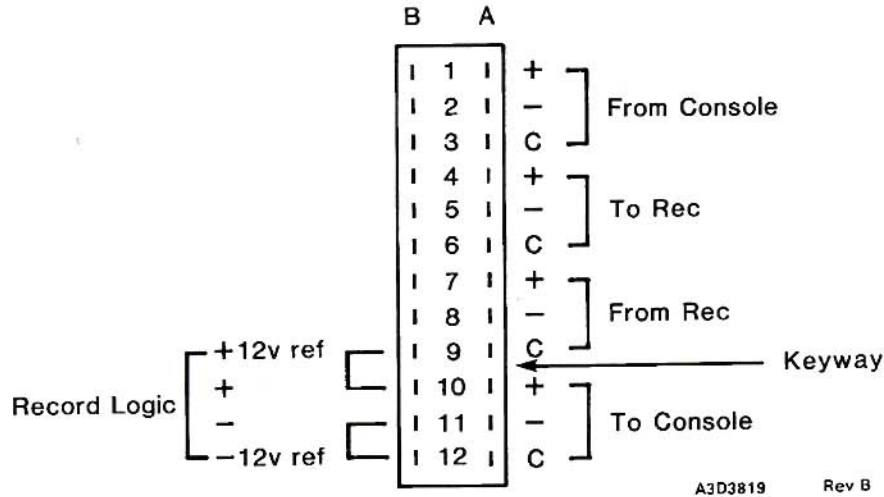


Figure 3-25 Cat. No. 331/431 Input Output Connector Wired for Record (Encode) Only Operation

On the channels dedicated to decode, the playback machine is connected through the 'FROM RECORDER' and 'TO CONSOLE' connections. Links are not necessary. The FROM RECORDER and TO CONSOLE potentiometers (See Figures 4-1, 4-2, 4-3) are used to set playback path input and output levels.

4.1 PS3 Monitor Controls

When the **normal** monitor push button is pressed, the monitor output of the XP/SRP Series (the **TO CONSOLE** output) is: (1) the signal from the output of the console during the record mode and (2) the decoded tape signal during the play mode. A normal (non-encoded) signal is thus heard at all times.

To monitor the console output while the recorder is in either the rest or play modes, press the **line in** monitor push button on the PS3 or use the line in monitor switch on the recorder if equipped.

It is sometimes useful to monitor the signal from the tape during recording rather than the console output as discussed above. Press the **check tape** monitor push button on the PS3. The signal heard will be in the encoded form. This function is intended to be used as a quick means to verify that the signal is being recorded. When using Cat. No. 431 or 531 SR modules, do not press **check tape** if any channel is in the playback mode during a recording session (ping-pong or sync operations). Incorrect operation of the decoding process will result. When using Cat. No. 331 A-type modules the check tape switching is internally blocked on any channel which is in playback mode.

4.2 Set-up Push Button (Dolby Tone/Cal On Early Units)

Pressing the **Set-up** push button (with the recorder in the record mode) at the start of each reel of tape automatically records the appropriate calibration signal—Dolby noise for tracks with SR selected, Dolby tone for tracks with A-type selected. The use of Dolby tone/noise provides a simple accurate alignment check for correct decoding, overdubbing and "punch-in" on existing tracks for any studio at any time. It will also identify those tracks with Dolby processing. The appropriate calibration signal should always be recorded even if other normal studio tones are recorded as well.

When the **Set-up** push button is pressed the Dolby calibration signal is sent to the recorder on all channels with Dolby NR or SR switched IN, and the XP/SRP Series displays are automatically switched to read the playback signal from the recorder. The complete recorder and XP/SRP Series combination is thus easily checked both for signal continuity and for level calibration.

With Cat. No. 431 or 531 Dolby SR modules installed, verification of the complete recording system is carried further to include the frequency response of each recording channel using the Auto Compare facility. (See Sections 4.7 and 4.7.1.) Pressing the **Set-up** push button initiates the Auto Compare facility and alters the LED display calibration to enable a Dolby noise signal to indicate Dolby level on all channels with SR selected.

When the calibration is correct, the XP/SRP Series indicators should always indicate equal brightness of the green display LEDs in the '**Set-up**' mode, independent of the alignment procedure used.

Note that pressing the **Set-up** push button inhibits the Dolby processing on all channels in both play and record modes; this fact is indicated by the off status of the **SR** or **NR** LED on each channel. Keep in mind, however, that the Dolby tone or noise is recorded only on channels on which processing is active (master switch on PS3 **IN** and, for Cat. Nos. 331 and 431 only, individual processing toggle switches up).

4.3 The PS3 IN/OUT Switch (NR OFF Switch On Early Units)

The user has the option of selecting the function of the PS3 **in/out** (or **nr off**) push button by the use of switch SW1 on the rear of main frame (see Figure 5-2). In the "NR out" position, the PS3 **in/out** push button disables the noise reduction/spectral recording function (standby/out mode) leaving the input and output line amps still in circuit, whereas in the "bypass" position the PS3 **in/out** push button places the XP/SRP Series in hard-wired bypass.

4.4 Cat. No. 331, 431 and 531 Front Panel Controls

The front panel controls of the Cat. No. 331 A-type and the Cat. No. 431 and 531 SR modules are very similar.

Each module has a calibration display for accurate measurement of Dolby tone or Dolby noise, LEDs to indicate processing on, record mode and "meter reads tape", an individual bypass switch, and multi-turn potentiometers for the input and output levels.

SR modules (Cat. Nos. 431 and 531) have three additional LEDs associated with the AutoCompare function. All three are off if Auto Compare is not activated. See paragraph 4.7 below.

Cat. Nos. 331 (A-type) and 431 (SR) have more elaborate level displays. In addition to the basic 4-LED display for Dolby level (red-green-green-red), they have an orange presence-of-signal indicator, a pair of orange LEDs which glow equally brightly when a tone is present at +4.7 dB relative to Dolby level ("DIN level"), and a red LED indicating overload ("clip").

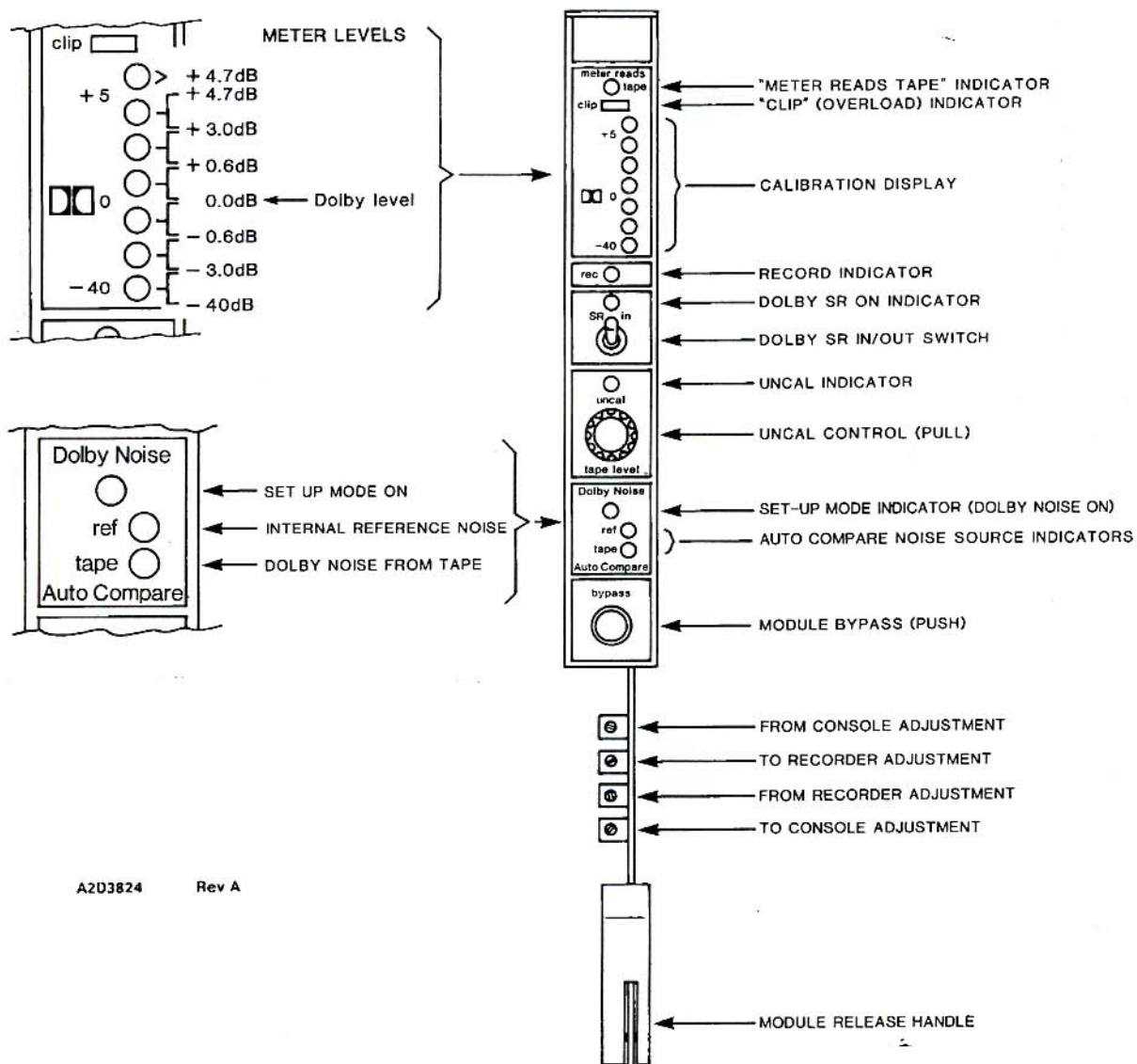
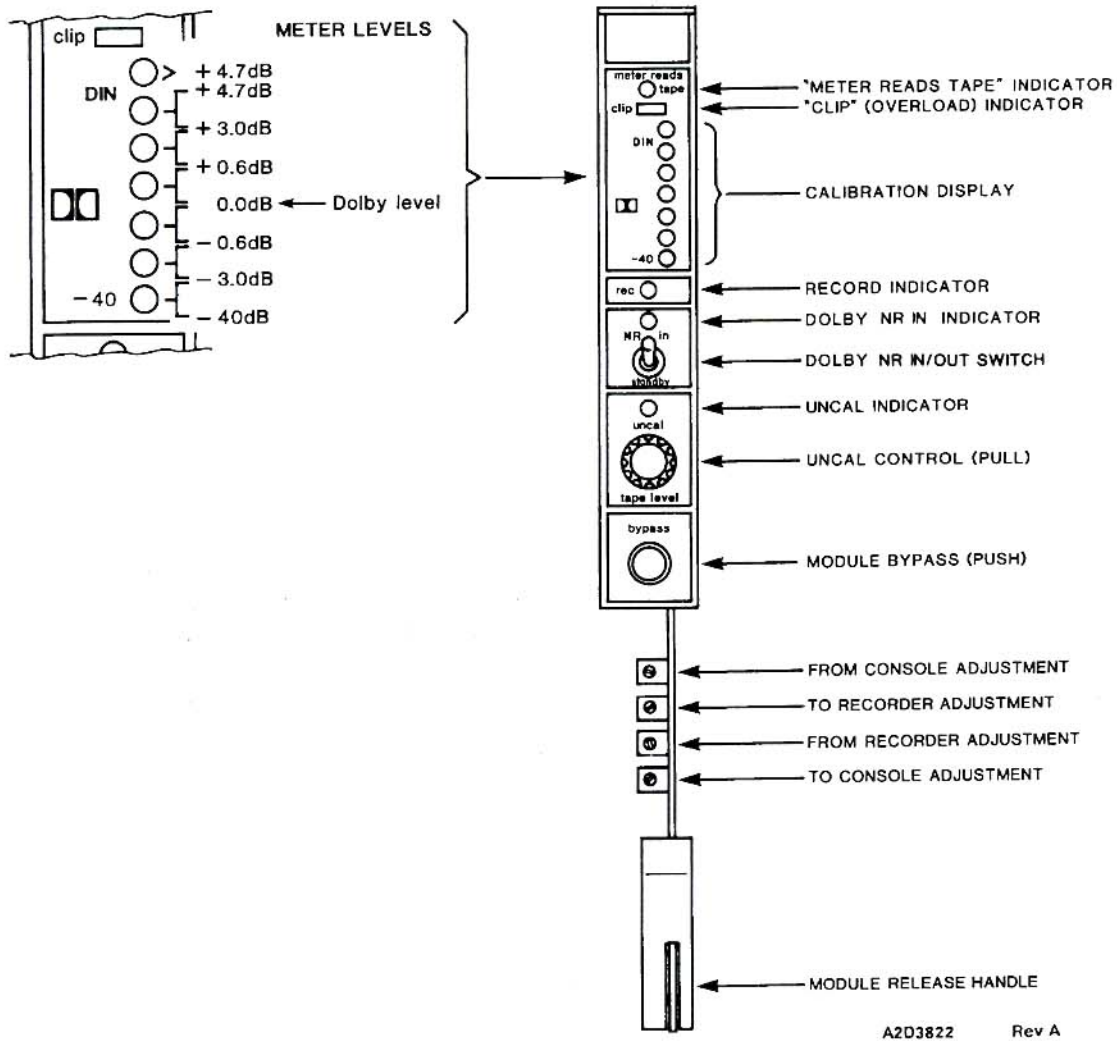
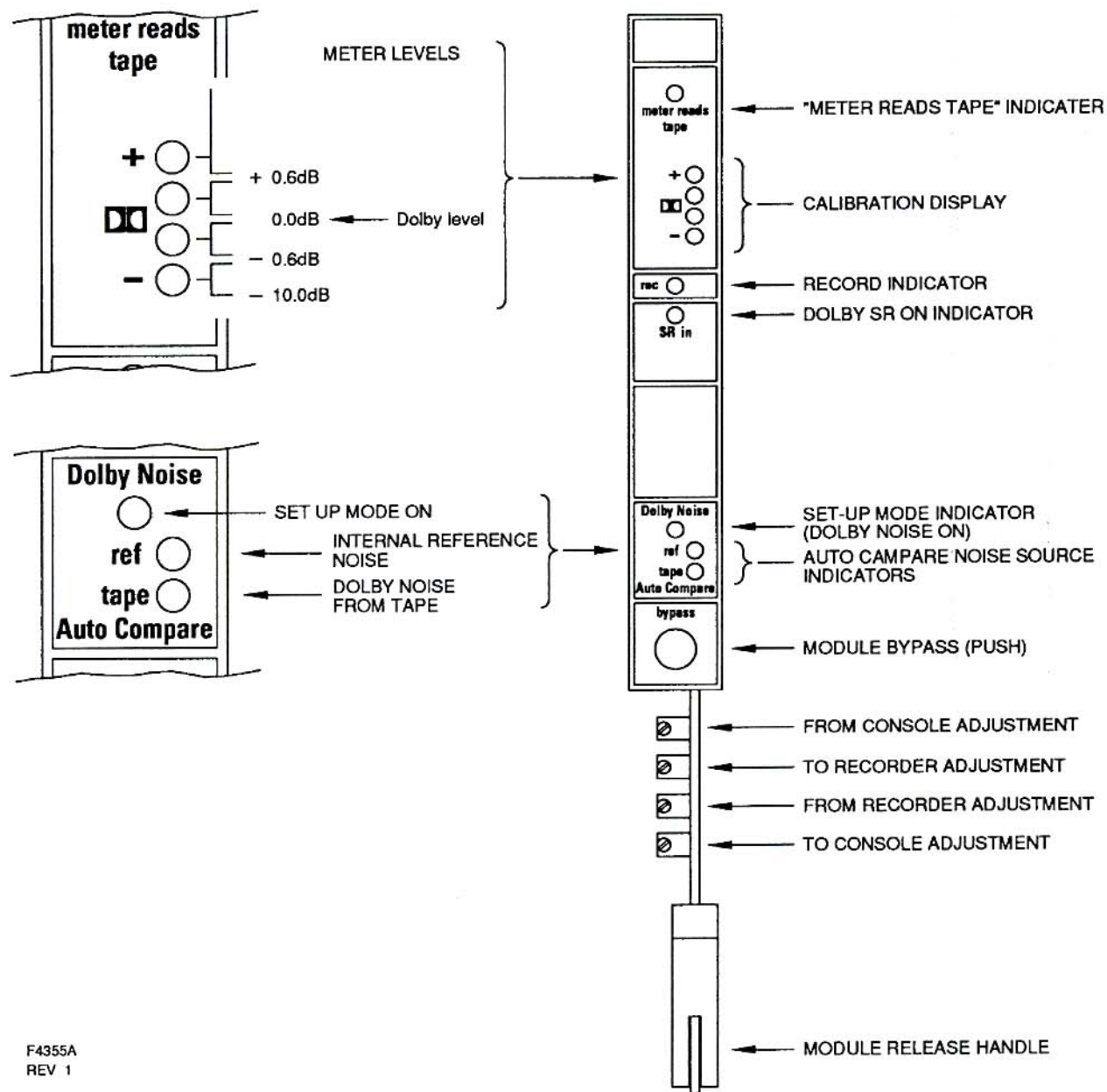


Figure 4-1 Cat. No. 431 Front Panel Controls



A203822 Rev A

Figure 4-2 Cat. No. 331 Front Panel Controls



F4355A
REV 1

Figure 4-3 Cat. No. 531 Front Panel Controls

4.5 Calibration with the LED Display

Accurate indication of Dolby level (repeatable within ± 0.1 dB) is obtained by matching the intensity of the two green LEDs. Dolby tone, or Dolby noise as appropriate, must always be aligned to Dolby level in the 'Set-up' mode.

The DIN or +5 mark on the LED displays of the Cat. Nos. 331 and 431 should never be used for Dolby tone. It was originally intended for studios using a 320 nWb/m DIN level set tape as a peak flux reference. When this peak reference was adjusted to light the two orange LEDs, Dolby level would then be at 185 nWb/m ANSI (4.7 dB lower).

When recorded Dolby tone or Dolby noise is played back in the 'Set-up' mode, the lighting of one or both of the green LEDs indicates that the unit is satisfactorily aligned. The lighting of only a red LED indicates that audible effects caused by misalignment may be occurring; the unit should be recalibrated to the tape being played (see Section 4.3). When both the red and green LEDs are lit, the calibration is not exact but audible effects are unlikely to occur.

4.6 Uncal (Cat. Nos. 331 and 431 only)

A simple and fast way to align a unit with tapes from other studios is to use the **uncal** feature. Pull the **uncal** knobs and play the recorded Dolby tone/noise section on the tape. Press the PS3 **Set-up** push button. While the recorded Dolby tone/noise on the tape is playing, adjust the **uncal** knobs for equal brightness of the green display LEDs. This adjustment trims the **FROM REC** calibration and simultaneously trims the **TO REC** calibration for proper over-dub and punch-in levels. To disable the uncal feature, merely push the **uncal** knobs "in" to return to your pre-set calibration.

4.7 Auto Compare (Cat. No. 431 and 531 Modules)

"Auto Compare" is an exclusive function of Dolby SR. When the **Set-up** button on the PS3 is pressed, Cat. No. 431 and 531 SR modules initiate Auto Compare. Auto Compare provides a simple and convenient way of quickly verifying the performance of the recording channel. During the Auto Compare mode, the internal reference pink noise and the recorded Dolby noise are alternately switched to the monitor output at four-second intervals. The Dolby noise recorded on the tape has interruptions every two seconds. The internal reference noise, on the other hand, is continuous and does not have the interruptions. This leads to an easily identifiable pattern of four seconds of continuous reference noise followed by four seconds of the interrupted or "nicked" Dolby noise. By listening to this continuous A/B comparison, quick identification of errors in level and frequency response may be carried out by ear if you listen to one track at a time.

The orange LED on the front of the Cat. No. 431 and 531 indicates when the unit is ready to perform Auto Compare. When Dolby noise is received from the tape, the red and green LEDs on the front of the module indicate whether the monitor is receiving the internal reference noise (red) or the Dolby noise from the tape recorder (green).

4.7.1 Auto Compare Control and Metering

Auto Compare is controlled by the **Set-up** button on the power supply and by the status of the tape recorder. An Auto Compare sequence will automatically begin IF the tape recorder is playing Dolby noise AND **Set-up** is pressed.

The Auto Compare circuitry may deliver spurious and unexpected noises if it receives signals other than Dolby noise (including silence); this is normal and harmless. To avoid such anomalies it is good operating practice when playing Dolby noise to find the appropriate point on the tape **before** you press the **Set-up** button, and to release the button as soon as you have finished with the Auto Compare sequence.

The Dolby noise signal is sent to the tape recorder at 15 dB below the established Dolby level. This level is compensated for by gain in the calibration display whenever the **Set-up** button is pressed. Therefore, the Dolby noise should read Dolby level (equal greens) when, and only when, the **Set-up** button is pressed.

In order for Dolby noise to produce an accurate and reliable display reading, the Dolby noise signal returning from the tape is band-limited. The signal is then amplified so that Dolby noise reads Dolby level—the center green LEDs—on the calibration display. The calibration display will always indicate the Dolby noise signal from the tape and not the alternating Tape/Reference sequence sent to the monitor. When the **Set-up** button is not pressed, the band limiting and amplification are not in circuit, and the display functions normally.

5.1 Alignment—General Rules

There is one very simple rule in aligning Dolby equipment:

Dolby tone or noise from the record processor should always indicate Dolby level on the calibration display on playback (with the **set-up** button depressed when using Dolby SR).

This means that whenever a recording is made, a short section of Dolby tone or noise should be recorded on the tape as a Dolby level reference. When this is played back, whether immediately or in another studio some time later, the Dolby unit should be adjusted so that the two green LEDs on the LED display glow with equal brightness. Alignment will then be correct: any other alignment will be for level interfacing which, while operationally convenient, will not affect the Dolby processing.

When carrying out regular in-house alignment, it is simplest to send a tone at Dolby level (e.g., 0 VU) from the console and align for the same unity gain structure as there is when the unit is bypassed. When aligning to a tape from another studio, it may be necessary to take the Dolby level recorded on the tape as the starting point and set up the unity gain structure from there. For this reason there are two alignment procedures set out here:

“Dolby level Taken from the Console” uses a 1 kHz console tone to indicate Dolby level. This is the simplest way of calibrating or checking regular in-house alignment.

“Dolby level Taken from Tape” takes Dolby level from the Dolby tone or noise recorded on tape. Typically this will have been recorded in another studio.

Many parts of the audio industry have standardized their Dolby level to ease interchange of material. The list below gives some examples:

| <u>Application</u> | <u>Dolby level</u> | |
|--------------------------|----------------------|--------------|
| | <u>Meter Reading</u> | <u>Level</u> |
| Recording studio, Europe | 0 VU | 320 nWb/m |
| Recording studio, USA | 0 VU | 250 nWb/m |
| C-format 1" video | -- | 100 nWb/m |
| 35mm Magnetic film | -- | 185 nWb/m |
| 35mm Optical film | -- | 50% |

If there is no standard for a particular application, the user should choose a level that is easy to read on the meters normally used, or check with other users in this same field to make interchange convenient.

5.2 Dolby level Taken From The Console Routine "In-House" Alignment

RECORDER ALIGNMENT

The recorder must be aligned before calibrating the XP/SRP Series unit.

STEP 1 Switch the unit to hard **bypass**.

The **in/out** (nr off in earlier units) push button on the PS3 may be programmed via switch SW1 on the rear of the main frame to select either "hard-wired bypass" or "NR/SR out-soft bypass" (which means the signal is still routed through the input and output circuitry). To switch the unit to hard bypass:

| SW1 Switch Position | Hard Bypass Method |
|---------------------|---|
| "Hard bypass" | Operate the PS3 front panel in/out (or nr off) push button. All channels will switch to hard bypass. |
| "Soft bypass" | Operate the individual channel bypass push buttons. |

See also: 5.7b "Using the XP/SRP Series units as a gain stage between recorder and console"

STEP 2 Adjust both the play and record aspects of the recorder, including the line level interfacing with the console. Adjust sync level controls (if available) to match the play level.

The recorder and console meters should match or have a known relationship during record and play. Correct the meter calibrations if necessary.

XP/SRP SERIES ALIGNMENT

The following alignment steps involve sending a 1 kHz tone from the console at Dolby level. In many studios this will be the normal studio line level, e.g., 0 VU. Further information on Dolby level can be found in Sections 5.5 and 5.6. See Figures 4-1, 4-2 and 4-3 for locating the front panel controls.

STEP 3 Restore the unit to normal operation by operating the **in/out** (or nr off) push button on the PS3 or releasing the individual **bypass** push buttons.

STEP 4 Check that all **uncal** knobs are pushed in fully and the **uncal** LEDs are off (Cat. Nos. 331 and 431 only).

STEP 5 Press the **line in** push button on the PS3. If you have Cat. Nos. 331 or 431, set the individual processing switches **OUT** (down position).

RECORD SIDE

STEP 6 Send a 1 kHz test tone at Dolby level (e.g., 0 VU) from the console to the XP/SRP Series unit.

STEP 7 Adjust the FROM CONSOLE control on the processing modules for Dolby level, equal brightness of the green LEDs.

STEP 8 Place the recorder in line-in, EE or record using blank tape. Adjust the TO RECORDER control on the processing module for unity gain by observing each recorder meter while depressing and releasing **bypass** on each channel. The recorder indications should be identical with individual **bypass** switches in and out.

PLAYBACK SIDE

- STEP 9** Switch console meters to read from tape.
- STEP 10** Adjust the **TO CONSOLE** controls on the processing modules for Dolby level (e.g., 0 VU) on the console meters.
- STEP 11** Press the **normal** button on the PS3.
- STEP 12** If you have Cat. Nos. 331 or 431, set the individual NR/SR switches **IN** (up position).
- STEP 13** Press the **Set-up** push button on the PS3.
- STEP 14** Adjust **FROM REC** on the processing modules for Dolby level, (equal brightness of the green LEDs).
- STEP 15** Release the **Set-up** push button on the PS3.

Alignment is now complete.

Record a section of Dolby tone or noise on fresh tape as a reference for new recordings by pressing **Set-up** on the PS3. (Note that Dolby noise is recorded on tape 15 dB below Dolby level. This level difference is automatically compensated in the LED display when **Set-up** is selected.) Under these conditions, when using Dolby SR, the module will go into the **Auto Compare** mode. **Auto Compare provides the user with an accurate audible verification that both the tape recorder frequency response and the calibration levels are set properly regardless of the indications shown on the tape recorder meters and Dolby calibration displays.** Listen for level differences between the pink noise signal coming from the output of the tape and internal Dolby noise generator in the **Auto Compare** mode. The two LEDs on the front of the modules indicate whether the monitors are receiving the internal reference signal (red LED) or the Dolby noise from the tape recorder (green LED). The alignment procedure is correct when the levels between the tape and reference levels audibly match.

Note: Dolby level on tape will now have a fixed flux level that may be referred to in relation to the magnetic reference tape used in recorder alignment, e.g., "Dolby level is +4 dB above 185 nWb/m."

It may be useful to write the alignment details in the space provided on the insert card in the unit door.

5.3 Dolby level Taken from Tape Aligning to Dolby Tone/Noise on a Previously Recorded Tape

RECORDER ALIGNMENT

The recorder must be aligned before calibrating the XP/SRP Series unit.

STEP 1 Switch the unit to hard **bypass**.

The **in/out** (nr off in earlier units) push button on the PS3 may be programmed via the switch SW1 on the rear of the main frame to select either "hard-wired bypass" or "NR/SR out-soft bypass" (which means the signal is still routed through the input and output circuitry). To switch the XP/SRP Series to hard bypass:

| SW1 Switch Position | Hard Bypass Method |
|---------------------|---|
| "Hard bypass" | Operate the PS3 front panel in/out (or nr off) push button. All channels will switch to hard bypass. |
| "Soft bypass" | Operate the individual channel bypass push buttons. |

See also: 5.7b "Using the XP/SRP Series unit as a gain stage between recorder and console"

STEP 2 Align the recorder using the tones on the incoming tape as playback reference, and check that recorder and console meters agree, or bear a known fixed relationship.

XP/SRP SERIES ALIGNMENT

STEP 3 Restore the unit to normal operation by operating the **in/out** (or nr off) push button on the PS3 or releasing the individual **bypass** push buttons.

STEP 4 Check that all **uncal** knobs are pushed in fully and the **uncal** LEDs are off (Cat. Nos. 331 and 431 only).

STEP 5 Press the **normal** push button on the PS3. If you have Cat. Nos. 331 or 431, set the individual processing switches to **IN** (up position).

DOLBY LEVEL MATCHING

STEP 6 Replay the Dolby tone or noise from tape and then press **Set-up** on the PS3. When using Dolby SR, Cat. No. 431 or 531 modules will go into the **Auto Compare** mode. **Auto Compare provides the user with an accurate audible verification that both the tape recorder frequency response and the calibration levels are set properly regardless of the indications shown on the tape recorder meters and Dolby calibration displays.** Listen for level differences between the pink noise signal coming from the tape and the internal Dolby noise generator in the **Auto Compare** mode. The two LEDs on the front of the Cat. No. 431/531 module indicate whether the monitors are receiving the internal reference signal (red LED) or the Dolby noise from the tape recorder (green LED).

STEP 7 Adjust the **FROM RECORDER** control on each channel until the tape and reference levels audibly match in the **Auto Compare** mode or for equal brightness of the green LEDs.

STEP 8 Place the recorder in Line In, EE, or record using blank tape.

STEP 9 Adjust the **TO RECORDER** control on the processing modules for Dolby level (equal brightness of the green LEDs).

CONSOLE LEVEL MATCHING

- STEP 10** Release the **Set-up** button. If you have Cat. Nos. 331 or 431, select **STANDBY** or **OUT** (down position) on the individual processing switches.
- STEP 11** Send a 1 kHz test tone at a convenient level (e.g., 0 VU) from the console to the unit.
- STEP 12** Observe the recorder meters with the **bypass** buttons depressed on the processing modules.
- STEP 13** Release the **bypass** buttons and adjust the **FROM CONSOLE** controls for identical recorder indications with individual channel **bypass** buttons in and out.
- STEP 14** Switch the console meters to read from Tape.
- STEP 15** Adjust the **TO CONSOLE** controls to return the tone to the console meters at the same level (e.g., 0 VU).
- STEP 16** If you have Cat. Nos. 331 or 431, set the individual Cat. No. 331/431 NR/SR switches **IN** (up position).

Alignment is now complete.

Dolby level is now adjusted to match the Dolby level on the incoming tape; the normal console/recorder level relationship remains the same. (Note that Dolby noise is recorded on tape 15 dB below Dolby level. This level difference is automatically compensated in the LED display when **Set-up** is selected).

5.4 Further Information on Alignment

For correct operation of all Dolby processing the signal level in the playback (decode) processor should be the same as in the record (encode) processor. Dolby units therefore require level calibration—lining up.

To make this calibration simple, all Dolby units provide a reference tone at a level fixed in relation to the internal processing, together with a display on which this level can be checked. This reference level is known as "Dolby level." With Dolby A-type noise reduction, Dolby level is indicated by Dolby tone, a tone with momentary modulations in pitch. With Dolby SR spectral recording, Dolby level is indicated by Dolby noise, a pink noise signal with a periodic nick every 2 seconds. These reference signals are intentionally different both from each other and from other alignment signals to distinguish between A-type, SR and other recordings, in addition to indicating Dolby level.

Dolby level is a high level reference: it is helpful to relate it directly to existing studio reference levels and metering principles: e.g., "0 VU", "ppm 5", "-6 dB". Dolby level may also be defined in terms of magnetic flux on tape since there is a fixed correlation between magnetic flux and console or recorder meter readings in any given studio. For further information on Dolby level for specific applications, please see Section 5.1.

For operational convenience the Dolby unit should be aligned to match the existing studio gain structure, in other words the combination of the recorder and Dolby unit are aligned for unity gain. When carrying out regular in-house alignment, it is simplest to send a tone at Dolby level from the console and align for the same unity gain structure as there is when the unit is bypassed. When aligning to a tape from another studio, it may be necessary to take the Dolby level recorded on the tape as the starting point, and set up the unity gain structure from there. For this reason there are two alignment procedures set out here; the first (Section 5.2) sets Dolby level to a tone from the console (Console Level Reference), the second (Section 5.3) to a different Dolby level recorded on a tape from another studio (Tape Level Reference).

5.5 Dolby level with Dolby A-type Noise Reduction

Historically, the existence of two different metering practices has led to two distinct approaches to equipment alignment. These in turn affect the approach to the alignment of Dolby noise reduction. To simplify A-type alignment, reference to the more common operating level standards of 'NAB' and 'DIN' was made in earlier A-type calibration procedures.

'NAB' and 'DIN' date back to when the NAB reference of 185 nWb/m (Ampex operating level) was always read on a VU meter as 0 VU, and the DIN (German) standard of 320 nWb/m (a peak reference level) was read as 100% modulation, ppm 6, or 0 dB on a peak reading meter. The actual difference between the two is between 4 and 5 dB.

The introduction of high output tapes led to actual flux levels on tape being elevated above these standard references, and to the use of higher level reference tapes, e.g., 250 nWb/m. At the time some studios elevated Dolby level along with the reference level while others kept Dolby level at 185 nWb/m. This situation became further complicated by some studios assuming all other studios to be using the same operating procedures and failing to record a section of Dolby tone with the flux level reference tones. Confusion and incorrect operating procedures sometimes resulted.

Dolby tone is also a positive indication of tape recorder tracks that have been Dolby A-type encoded.

Today most music studios using VU meters conveniently use a Dolby level equal to the flux level that corresponds to 0 VU.

Broadcasting studios and others using peak reading meters with a Peak Level reference often use a Dolby level equal to the flux level corresponding to 4.7 dB below 100% level.

Film studios will use a 320 nWb/m reference for 0 VU but Dolby level will always be at 185 nWb/m.

Video facilities use a Dolby level reference of 100 nWb/m.

Whichever test tape is used, and whether the level is elevated above that reference or not, a short recording of Dolby tone will always permit correct decoding or overdubbing at any time by any studio, regardless of the flux level used for Dolby level. Dolby tone, easily recognized by its characteristic warble, must always be aligned to the two green LEDs.

5.6 Dolby level with Dolby SR

In general, the principles governing Dolby A-type alignment and Dolby level can be applied directly to Dolby SR alignment. In certain cases, however, a direct application of A-type alignment principles could compromise the dynamic range obtainable with Dolby SR on magnetic tape.

To get the most from Dolby SR, Dolby level should be optimized so that the noise floor of the SR system electronics is below that of the recording medium with SR processing. In this way headroom of the SR circuitry is not wasted. With magnetic tape, this means that Dolby level will lie between 100 nWb/m and 320 nWb/m.

For example:

In VU meter studios, using a flux level for 0 VU at 320 nWb/m or less, Dolby level on steady state tone (e.g., 1 kHz) can conveniently correspond to 0 VU.

(If the magnetic flux level for 0 VU is greater than 320, e.g., 400 nWb/m, Dolby level should be set to a convenient point on the meter 4 to 6 dB below 0 VU. See 5.6.1, Dynamic Range with Dolby SR.)

In peak meter studios, optimal Dolby level on steady state tone (e.g., 1 kHz) will be 8 to 12 dB below the actual program peaks as read on the meter. Consequently, Dolby level should be set at a convenient point on the meter to 8 to 12 dB below the maximum signal peak reading.

(If for example your "0" dB peak corresponds to 514 nWb/m magnetic flux and program peaks reach "+3 dB," set Dolby level to ?6 dB on steady state tone.)

It may be useful to record a section of 1 kHz tone at Dolby level for use as an "in-house" reference tape.

Dolby level is indicated by equal brightness in the two green LEDs on the Cat. No. 431/531 SR modules. Dolby noise should read Dolby level when, and only when, the **Set-up** button is pressed.

5.6.1 Dynamic Range with Dolby SR

Strictly speaking, when studios use 320 nWb/m for "0" VU the dynamic range may be a 1 or 2 dB greater with Dolby level set to 200 nWb/m ("–4" VU) rather than "0" VU.

A consideration of the relationship between "operating level" (e.g., 0 VU) and Dolby level shows why setting Dolby level at 185/200 nWb/m offers slightly greater dynamic range than at 320 or 400. To obtain the greatest improvement from SR, the electronic noise of the SR processor should be substantially lower than the tape noise, that is, when the two are added together the tape noise should be dominant.

Figure 5-1 shows that the tape noise is dominant if Dolby level is set at 185/200 nWb/m. However if Dolby level is at 320 nWb/m the noise of the electronics and the tape noise are comparable, and therefore the total noise is 2 to 3 dB higher than it would have been if the contribution of the electronics had been negligible.

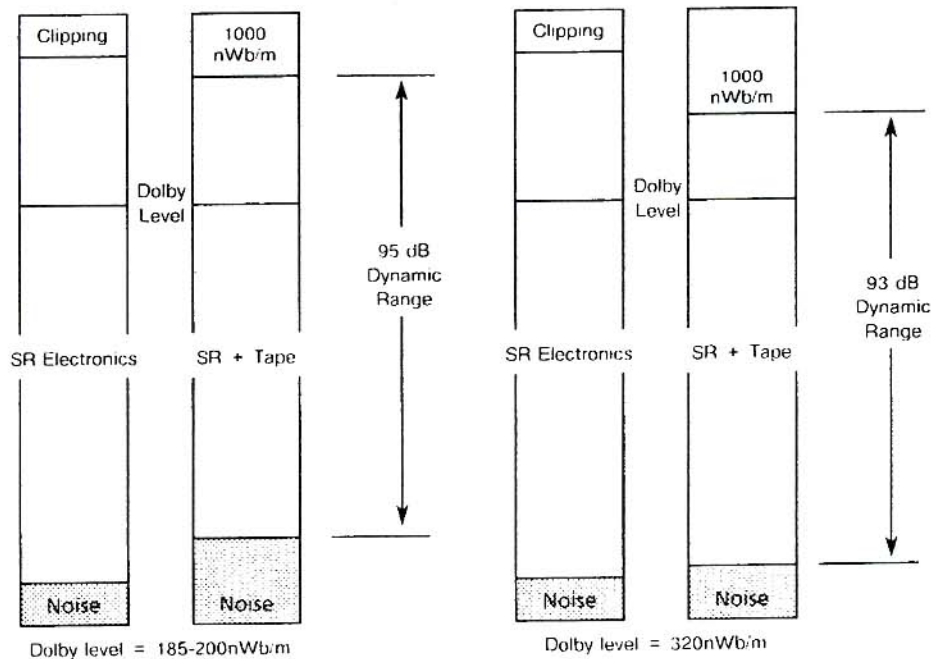


Figure 5-1 Typical Noise and Overload Levels

With a recorder running at 15 ips (38 cm/s) typical results are as follows (all noise levels CCIR/ARM weighted):

Relative to Dolby level at 185 nWb/m

| | |
|-----------------------------|--------|
| tape noise plus electronics | -80 dB |
| audible tape distortion | +15 dB |
| effective dynamic range | 95 dB |

Relative to Dolby level at 320 nWb/m

| | |
|-----------------------------|--------|
| tape noise plus electronics | -83 dB |
| audible tape distortion | +10 dB |
| effective dynamic range | 93 dB |

Changing Dolby level from 320 to 185 nWb/m increases the dynamic range by about 2 dB. This order of improvement would be measured rather than heard. In most real recording situations with Dolby SR, the overall performance of the recording system is limited by noise from microphone pre-amplifiers, other electronic processing equipment such as delay lines, or frequently the ambient noise level at the recording location.

5.7 Level and Impedance Matching with the XP/SRP Series

If your console and recorder output impedances are low (<50 ohm) and input impedances are high impedance bridging (>10k ohm), as will be the majority of studio installations, you should not experience any level mismatch.

- a. Output trimming due to impedance mismatch.

Recorder output levels should not be affected when switching the unit from bypass to in-circuit. Trimming may be required with low-impedance (600 ohms) inputs. The unit has high impedance bridging inputs, but when it is bypassed the output of the recorder is loaded directly by the tape return input impedance of the console. If this impedance is low the output level of the recorder may fall slightly. Correct setting of the termination switches on the recorder is usually sufficient to eliminate discrepancies in level so that minimal trimming of the recorder output level is required.

- b. Using the XP/SRP Series unit as a gain stage between recorder and console.

Bypassing the unit may be impractical in installations where it doubles as a gain stage between the recorder and the console, or where the signal level changes when bypass is selected because of the input and output impedances of the console and the recorder. For this reason, the user has the option of selecting the function of the PS3 In/out (or nr off) push button by the use of switch SW1 on the rear of the main frame. In the "NR out" position, the PS3 In/out push button disables the noise reduction/spectral recording function (standby/out mode) leaving the input and output line amps still in circuit, whereas in the "bypass" position the PS3 In/out push button places the unit in hard-wired bypass.

If the installation requires use of the unit for signal gain, a meter must be used to set the proper levels at the inputs and outputs during initial calibration.

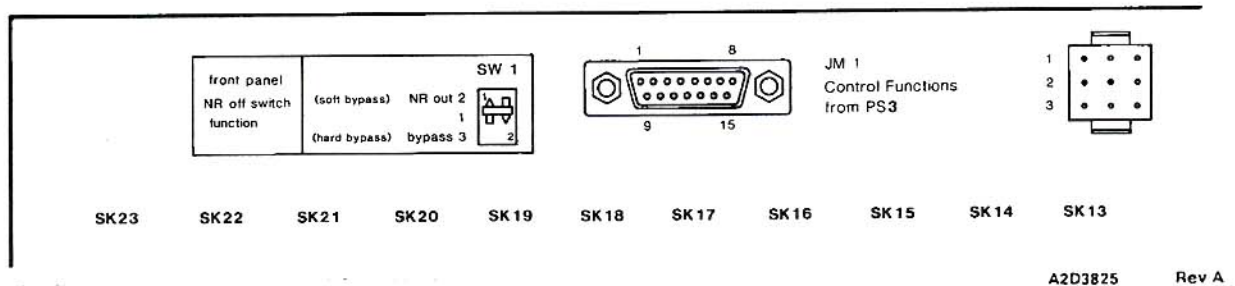


Figure 5-2 Switch on the Rear of the XP/SRP Series Frame

5.8 Maximum Output Level and Dolby Level

The maximum output level of the Cat. No. 331, 431 and 531 modules is +24 dBr into an impedance greater than 600 ohm giving 20 dB of headroom above Dolby level where Dolby level is set to +4 dBr, or 16 dB of headroom if Dolby level is set to +8 dBr. Note that the clip point of the processing circuit itself is approximately 21 dB above Dolby level.

The Cat. No. 331 and Cat. No. 431 modules have a **clip** indicator that warns that the peak level of the input signal has exceeded the output capability of the module. Should this LED occasionally flash, the peak program level through the module is too high. In a properly calibrated recording system, the maximum peak level of the program material will be determined by the tape overload characteristics and the interface electronics should never clip the audio. If, however, the reference flux level established for Dolby level is either too low or the output level of the interface is set too high, the peak level can exceed the established Dolby level enough to clip the internal electronics and the warning indicator will flash.

(0 dBr = 0.775 V)

The following instructions apply for normal operation of XP or SRP Series units, regardless of the conditions of operation or method of initial calibration (see Sections 4.2 and 4.3).

REMEMBER

For correct decoding: Whenever a recorded Dolby noise signal or Dolby tone on your own tape or on a tape from another studio is played back with the **Set-up** button depressed, the green calibration display LEDs should glow with equal brightness.

6.1 Initial Check

- STEP 1** Make certain the individual channel **bypass** push buttons on the processing modules are released.
- Step 2** Cat. Nos. 331 and 431:
Set all NR/SR switches on the modules to the **IN** position (up), unless Dolby processing is not required on a particular channel.
- Cat. No. 531:
Skip this step. It is not possible to turn off the processing of individual channels (except by means of the **bypass** push button).
- Step 3** Cat. Nos. 331 and 431:
Check if the **uncal** adjustments are in use by observing the **uncal** lights. If the normal calibration is to be used, push the **uncal** knobs in so that the **uncal** lights are off (see 6.3 below for use of the **uncal** adjustment).
- Cat. No. 531:
Skip this step. There are no **uncal** controls.
- STEP 4** Push in the **in/out** push button (or release the **NR off** button on early PS3's) and press the **NORMAL** monitor push button on the PS3. Check that the **Set-up** push button is released.
- If remote operation of the PS3 common facilities functions is in use, only the **Set-up** push button will continue to function locally.
- The unit is now ready for use. The tape recorder is used normally. The output of the recorder should be set to monitor off tape.

6.2 Tape Variations

The XP/SRP Series electronics are extremely stable. After the unit has been calibrated, any discrepancies in level are usually caused by variations in tape or possibly by changes in the characteristics of the recorder.

A convenient way to compensate for a small discrepancy in the recording level caused by a change in tape sensitivity is simply to record Dolby tone or noise on the blank tape and to adjust the input or record level controls on the recorder until the discrepancy is eliminated.

In any event, do not start adjusting the XP/SRP Series unit until after the recorder and tape have been checked thoroughly. During any tape recorder alignment, operate the PS3 **in/out** push button (if switch SW1 on the rear of the main frame is in **bypass**) or press the individual channel bypass buttons.

6.3 Tapes from Other Studios

If you receive a tape from another studio, the level of the Dolby tone/noise recorded on it must be matched to the Dolby level in your XP/SRP Series unit. For this purpose, disregard the levels of any tones on the tape other than the Dolby tone/noise. Note that a discrepancy in Dolby level does not necessarily mean that the other studio has aligned its recorder and/or Dolby units carelessly; there may be a difference in track width between your recorder and theirs (or, if the difference is as much as 2 or 3 dB, they are using a Dolby level standard that differs from yours).

If you have Cat. Nos. 331 or 431, a simple and fast way to align the unit for tapes from other studios is to use the "uncal" feature. Pull the **uncal** knobs and press the PS3 **Set-up** push button. While the recorded Dolby tone/noise on the tape is playing, adjust the **uncal** knobs for equal brightness of the green display LEDs. This adjustment trims the **FROM REC** calibration and simultaneously trims the **TO REC** calibration for proper over-dub and punch-in levels. To disable the **uncal** feature, merely push the **uncal** knobs "in" which returns to your pre-set calibration. The Cat. No. 531 SR processing module does not have this facility.

6.4 Good Operating Practice

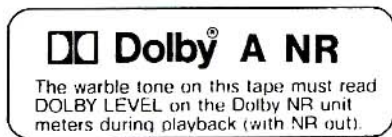
The following notes cover routine day-to-day alignment information and hints on good practice when using Dolby SR or A-type signal processing.

1. **Recording Dolby tone or Dolby noise:** At the start of each new tape, always record a section of Dolby tone (A-type NR), or Dolby noise (SR) (the type of calibration signal automatically follows the choice of SR or A-type signal processing). This will be important later for other operators to identify the tape processing used, and for them to calibrate to their own operation.
2. **Playback and check:** If you are playing a tape that uses A-type or SR, play back the Dolby tone or Dolby noise section. Select 'Set-up' mode and check that the LED display reads Dolby level (equal brightness of the green LEDs). Remember to release the **Set-up** button when you have finished.
3. **Auto Compare:** While playing Dolby noise in the 'Set-up' mode, you are able to listen to the 'Auto Compare' feature. The monitor output will switch between Dolby noise from tape, and pink noise direct from the reference generator. Any substantial audible variation between the two will indicate a difference between the performance of the recorder and the player. Make sure only one track at a time is feeding the loudspeakers. The LED calibration display, however, will continuously read from tape.
4. **Monitoring off-tape:** Normal monitoring will provide a 'Line-In' signal during the record process, or a decoded playback signal in all other modes. In some recorders, a 'check' or 'confidence' tape replay is provided while recording. Pressing the Check Tape button allows the operator to hear the tape signal in this situation, although it will be in the encoded form. The encoded sound is not intended for quality monitoring, but will be adequate to confirm that the recording is taking place, the presence of tape drop-outs, and the accuracy of edits. If full quality monitoring is needed while recording, a second set of Dolby processors can be connected to the recorder output for decoding.
5. **Tape copying:** In normal operations, all audio signals will be encoded before the recording, and decoded on playback. This keeps the processing as a part of the machine's recording characteristic and is an automatic process. If tapes need to be copied, and processing equipment is not available, this can be done simply by making a direct copy of the encoded tape, taking care to keep levels and frequency response constant. The encoding characteristic will be transferred accurately. Make sure you also transfer the original calibration tones, including Dolby tone or Dolby noise.

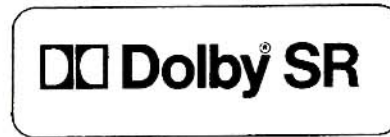
NOTE: When the signal is in an encoded form, dynamic and equalization changes to the signal will result in incorrect decoding. These changes, which include fades or mixes, equalization or limiting/compression, should be made on the decoded signal before re-encoding and re-recording the signal.

6. **Editing:** When editing a Dolby SR encoded tape, it may prove advantageous to monitor the encoded signal with decoding switched OUT. This will give less of a low frequency bias to the sound when rolling the tape slowly over the heads to finalize the edit point.
7. **Box labelling:** It is good practice to mark clearly on the tape box and/or recording report information describing the recording. In addition to the normal information, this should clearly indicate details of:

Processing system (A-type or SR)
Recording reference level
Dolby level
Details of the calibration signals recorded on tape
8. **Reel Labelling:** Use "Dolby A" stickers (Cat. No. 100) on your tapes to identify Dolby A-type encoded recordings or "Dolby SR" stickers (Cat. No. 400) on your tapes to identify Dolby SR encoded recordings.



Cat. No. 100



Cat. No. 400

9. **Remember**—to ensure correct calibration:
 - a. Always record Dolby noise or Dolby tone at the head of each track.
 - b. Always align Dolby noise and Dolby tone on playback in the 'Set-up' mode for Dolby level.