User Manual

Tektronix
/

764
Digital Audio Monitor
(Serial Number B020000 and Above)

070-8811-08

This document supports firmware version 2.1 and
above.

www.tektronix.com

Warranty

Tektronix warrants that the 764 Digital Audio Monitor will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non-Tektronix supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

This warranty is given by Tektronix with respect to this product in lieu of any other warranties, expressed or implied. Tektronix and its vendors disclaim any implied warranties of merchantability or fitness for a particular purpose. Tektronix' responsibility to repair or replace defective products is the sole and exclusive remedy provided to the customer for breach of this warranty. Tektronix and its vendors will not be liable for any indirect, special, incidental, or consequential damages irrespective of whether Tektronix or the vendor has advance notice of the possibility of such damages.

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

To Avoid Fire or Personal Injury

Use Proper Power Cord

Use only the power cord set provided with this product, or some other properly rated and approved cord set configured for the local mains supply outlets.

Use Proper Power Source

This product is designed to operate from a power source that will apply no more than 250 V_{RMS} between the supply conductors, or between either supply conductor and ground.

Ground the Product

Before connecting the product's input or output terminals, plug the power cord into a properly wired receptacle. A protective ground connection, through the grounding conductor in the power cord, is essential for safe operation.

Use Proper Fuse

Use only the fuse type and rating specified for this product.

Operate Only Within a Suitable Enclosure

Operate this product only within an enclosure that prevents contact with interior electrical components.

Provide Proper Ventilation

Refer to the manual's installation instructions for details on installing the product so that it has adequate cooling ventilation.

Use in a Proper Environment

Do not operate this product in wet/damp locations/conditions or in explosive atmospheres.

Observe All Terminal Ratings

To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Safety Terms and Symbols

Terms in this Manual

These terms may appear in this manual:

⚠ *WARNING. Warning statements identify conditions or practices that could result in injury or loss of life.*

⚠ *CAUTION. Caution statements identify conditions or practices that could result in damage to this product or other property.*

Terms on the Product

These terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

Symbols on the Product

The following symbols may appear on the product:

DANGER High Voltage	Protective Ground (Earth) Terminal	ATTENTION Refer to Manual	Double Insulated

764 Digital Audio Monitor User Manual

Preface

The Tektronix 764 Digital Audio Monitor shown in Figure 1 is a tool for monitoring the signal levels and stereo phase of digitally-encoded (AES/EBU *and* IEC 958 "consumer use") audio in a production environment. The instrument can simultaneously display the levels of two two-channel inputs, and the stereo phase relationship of any two of the four input channels. It can also display numerical data about the audio program material as well as "Channel Status" and "User Data" information encoded in the digital audio signal.
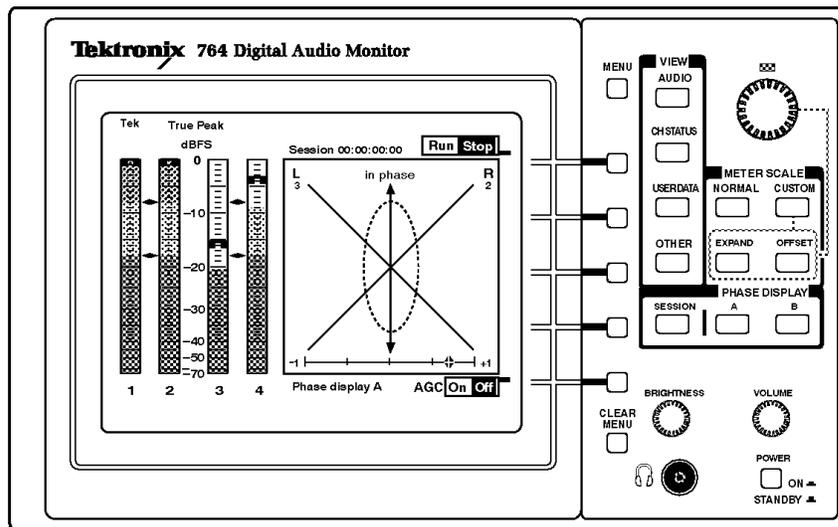
Figure 1: The Tektronix 764 Digital Audio Monitor

Through on-screen menus and front-panel controls, the user may configure the response dynamics (ballistics), reference levels, offset, and scale of the meters to suit the monitoring needs of the particular installation or situation. The user may also choose among several types of stereo phase display.

This Manual

This User Manual is divided into the following sections:

- **Getting Started** — All the information you'll need to put your new instrument in service. Begins on page 13.

- **Operating Basics** — What you'll need to know for day-to-day operation of the 764. Begins on page 13.

- **Reference** — Begins on page 43.

- **Appendices** — Instrument characteristics; Options/Accessories; User Service. Begin on page 75.

- **Glossary** — Begins on page 101.

- **Index** — Begins on page 103.

Contacting Tektronix

Phone	1-800-833-9200*
Address	Tektronix, Inc. Department or name (if known) 14200 SW Karl Braun Drive P.O. Box 500 Beaverton, OR 97077 USA
Web site	www.tektronix.com
Sales support	1-800-833-9200, select option 1*
Service support	1-800-833-9200, select option 2*
Technical support	Email: techsupport@tektronix.com 1-800-833-9200, select option 3* 1-503-627-2400 6:00 a.m. – 5:00 p.m. Pacific time

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* **This phone number is toll free in North America. After office hours, please leave a voice mail message.**
Outside North America, contact a Tektronix sales office or distributor; see the Tektronix web site for a list of offices.

Getting Started

This section contains information you'll need to put your 764 Digital Audio Monitor into service. For a detailed description of instrument capabilities, and instructions for its use, refer to the *Operating Basics* section of this manual.

Unpacking

Please save the packaging material in case you must later ship the instrument for calibration or service.

The following accessory items are included with the 764 Digital Audio Monitor:

■ This user manual

■ A power cord

Any cabinet ordered with the instrument is shipped in a separate carton.

Mechanical Installation

To accommodate the installation needs of users worldwide, Tektronix provides the 764 without an enclosure (cabinet). To ensure proper cooling, electromagnetic shielding, and protection against accidental electrical shock, install the instrument in the Tektronix enclosure that best suits your application.

NOTE. The Tektronix 764 meets EMI/EMC standards when shielded interconnect cables are used, and when installed in one of the following Tektronix enclosures:

■ *1700F00, Plain cabinet for 1/2 rack width*

■ *1700F02, Portable cabinet including feet and handle*

■ *1700F05, Dual side-by-side rackmount adapter*

Order the appropriate enclosure through your nearest Tektronix field office or representative.

⚠️ *WARNING. Do not carry an instrument in one of the optional enclosures without first installing the cabinet mounting screws as shown in Figure 2. Without the mounting screws, an instrument can slip out of its cabinet if tipped forward. Property damage or injury may result.*
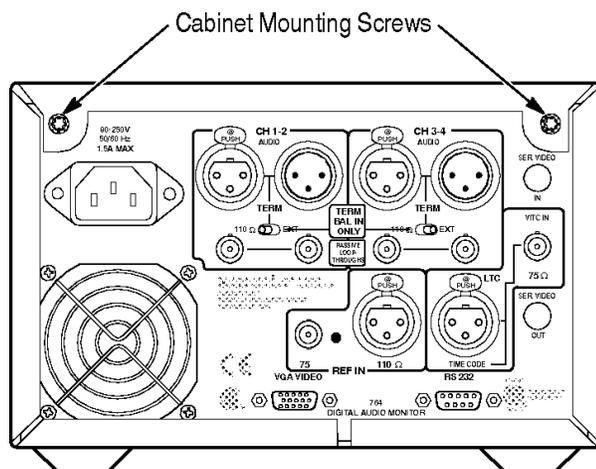
Figure 2: Rear view of the 764 in a Tektronix enclosure

Connecting the 764 to Your System

Except for the headphone jack, all connectors are on the rear panel of the 764, shown in Figure 3. The connections you make will depend on your particular installation and operating environment. See the following paragraphs for explanations of the connectors and their functions.
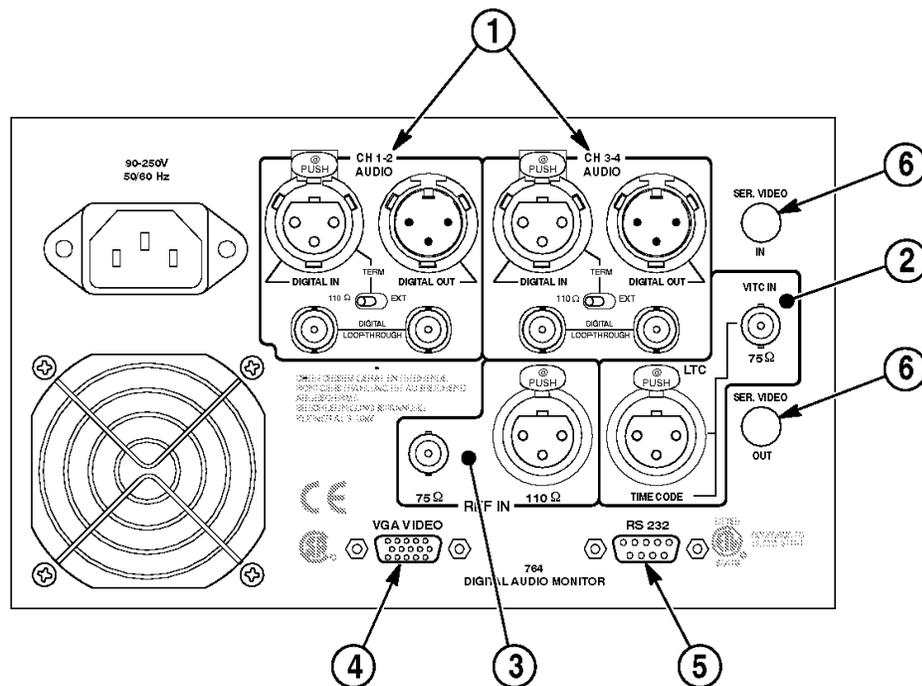
Figure 3: The 764 rear panel and connectors

(1) Digital Audio Inputs and Loop-Throughs

The 764 has two, two-channel digital audio inputs, one labeled CH 1–2, and the other labeled CH 3–4. Each input in the standard instrument has two passive loop-throughs that allow you to switch the instrument off with no effect on the through signal:

■ Balanced XLR connectors for signals conforming to the AES/EBU (AES3-1992) standard. Set the TERM switches immediately below these connectors to EXT when the 764 is installed in-line; select 110 Ω (internal termination) when the instrument is at the end of the signal path.

NOTE. The male XLR connectors of instruments equipped with Option 02 (Analog Line Output) are labeled ANALOG OUT; these instruments do not *have provision for loop-through on the balanced XLR connectors.*

The balanced XLR inputs of Option 02 instruments are unterminated when the associated TERM switches are set to EXT. To avoid signal degradation, always leave the TERM switches of Option 02 instruments set to 110 Ω.

Refer to Appendix C: Options *for more information about Option 02.*

- 75 Ω BNC connectors that accept unbalanced, digital audio signals in both professional (AES/EBU) and consumer (IEC958) formats. These inputs have no provision for internal termination; if the 764 is placed at the end of a signal path, install a 75 Ω end-line termination (Tektronix part number 011-0102-00) on the unused loop-through connector.

  An RCA phono plug-to-BNC male cable or adapter may be required to input consumer digital audio. Plug is available in North America through Markertek Video Supply, telephone: 800-522-2025.
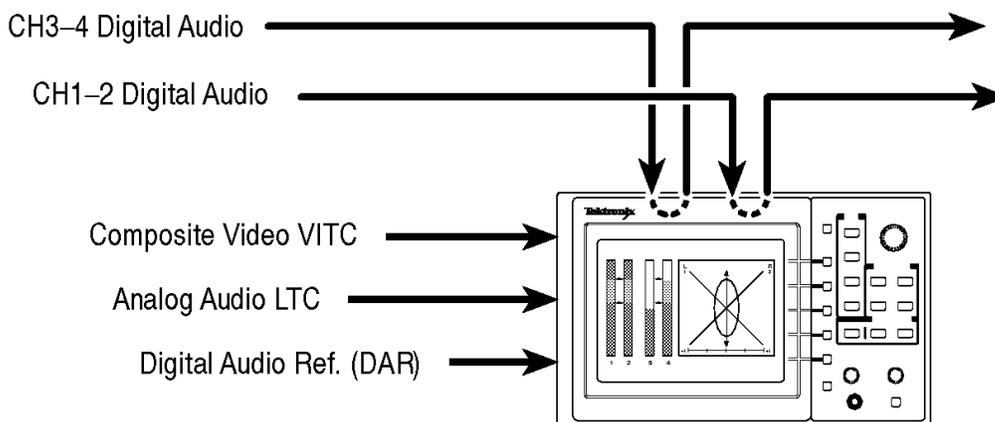
Figure 4: Connecting the standard 764 to your system

> **NOTE**. *The balanced (XLR) loop-throughs are the default 764 inputs. To receive a signal through the unbalanced (BNC) loop-throughs or the optional serial video loop-through (Option 01), you must first reconfigure the instrument through the on-screen menus. Refer to* Initial Power Up and Configuration *on page 9 for instructions.*

(2) Time Code Inputs

VITC — Reads vertical interval time code from NTSC or PAL analog video per IEC publication 461 specifications. The time code can be shown on the SESSION display, and stamped on each error on a printed Session Report. The format of the Session View time display is Hours:Minutes:Seconds.

LTC — Reads linear time code that also conforms to IEC specifications. The time code can be shown on the Session display, and stamped on each error on a printed Session Report. The format of the time display is Hours:Minutes:Seconds:Frames.

(3) Reference Inputs

Connect your "house" digital audio reference (DAR) signal to one of the REF IN connectors. These connectors (one BNC, one XLR) accept the same formats as the Digital Audio Inputs. They are internally terminated. As with the audio inputs, the default connector is XLR; use the on-screen menus to select the BNC connector. The 764 can use any AES signal as a DAR; it will use the reference input to detect and measure frame synchronization of AES signals.

If you do not connect a house DAR to one of the reference inputs, the 764 will monitor synchronization of the CH 3–4 input signal with the CH 1–2 input signal. For more information, refer to the explanation of the Frame Synchronization Error session statistic on page 32.

(4) VGA Video Output

To see a larger, color image of the 764 display (as illustrated in Figure 5), connect a VGA-compatible monitor to this standard 15-pin output. Table 25 on page 77 lists the characteristics of the Video Output signal.
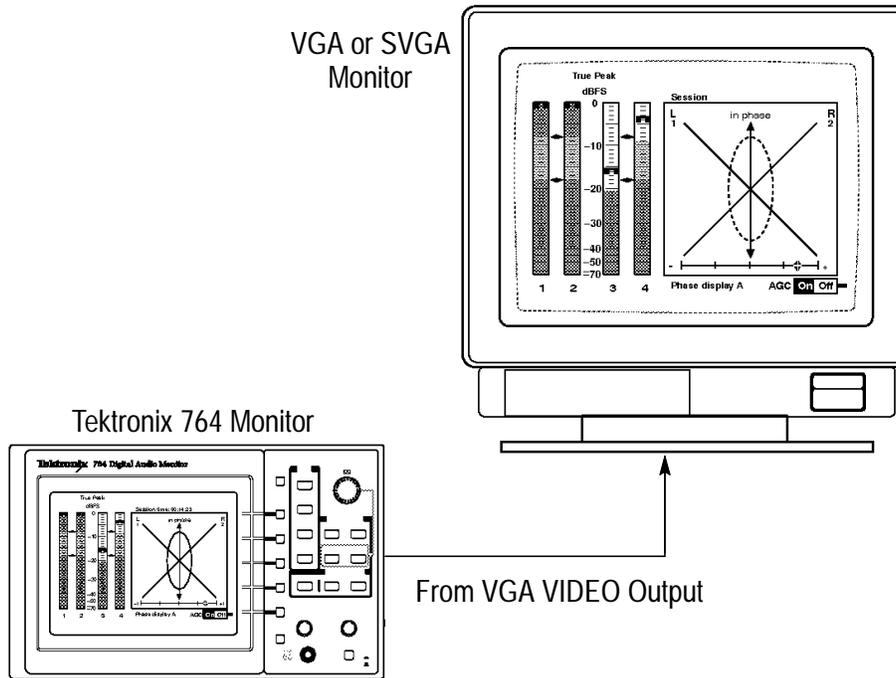
Figure 5: Using an external color monitor

(5) RS-232 Communications Port

Through the RS-232 port, you can:

- Output a record of the input signal and program, either to an ASCII printer or a personal computer (see Figure 6) running a communications application, such as PROCOMM or the Terminal accessory of Microsoft Windows. Refer to *Session Reports* beginning on page 34.

- Operate the instrument (serial number B020000 and later) by remote control. Refer to *Remote Control Commands*, beginning on page 66, for more information.

- Download future 764 software upgrades through a personal computer. Please contact your Tektronix representative, or the nearest Tektronix office, for information about software upgrades. Installation instructions are provided with each upgrade kit.

Figure 6: Outputting a session report

(6) Optional Serial Video Loop-Through

Instruments equipped with Option 01 (Embedded Audio Input) have two additional 75 Ω BNC connectors, SER. VIDEO IN and SER. VIDEO OUT. These connectors make up a loop-through that accepts digital video with embedded digital audio.

Refer to *Appendix C: Options,* beginning on page 89, for more information about Option 01.

Headphones

The front-panel headphone output lets you listen to the audio programs contained in the digital input signals. The connector accepts a standard $^1/_4$ inch (6.35 mm) stereo plug and is wired as shown in Figure 7. Adjust the output level with the **VOLUME** knob.

Figure 7: The headphone output (schematic)

By factory default, the headphone output automatically follows the phase display; that is, it contains the audio programs decoded from the two channels that you are monitoring with the Lissajous pattern and correlation meter. You may also choose to listen to any two of the input channels, independent of the phase display choices; for instructions, refer to *Selecting Headphone Channels* on page 48.

Supplying Power

You can operate the 764 on any AC power supply that provides 90 to 250 V at 50 to 60 Hz. If the power cord supplied with your instrument is incorrect for your local AC supply, please contact your nearest Tektronix representative or field office.

⚠ *WARNING. Line voltage will be present in the instrument whenever power is supplied even if the POWER switch is set to STANDBY. Always disconnect the power cord before removing the instrument from its cabinet.*

Initial Power Up and Configuration

Once you have connected a signal source to at least one of the 764 DIGITAL AUDIO inputs, switch the instrument On. When the start-up diagnostics are completed, the instrument will begin operation in the Audio View/Session display.

If a signal source is connected through one of the XLR inputs, the program level should be shown in the corresponding meters. If the input is through a BNC connector, you must reconfigure the input with the following procedure before you can monitor the signal. In either case, please take this opportunity to familiarize yourself with the 764 front panel controls (Figure 8), menu structure, and techniques.
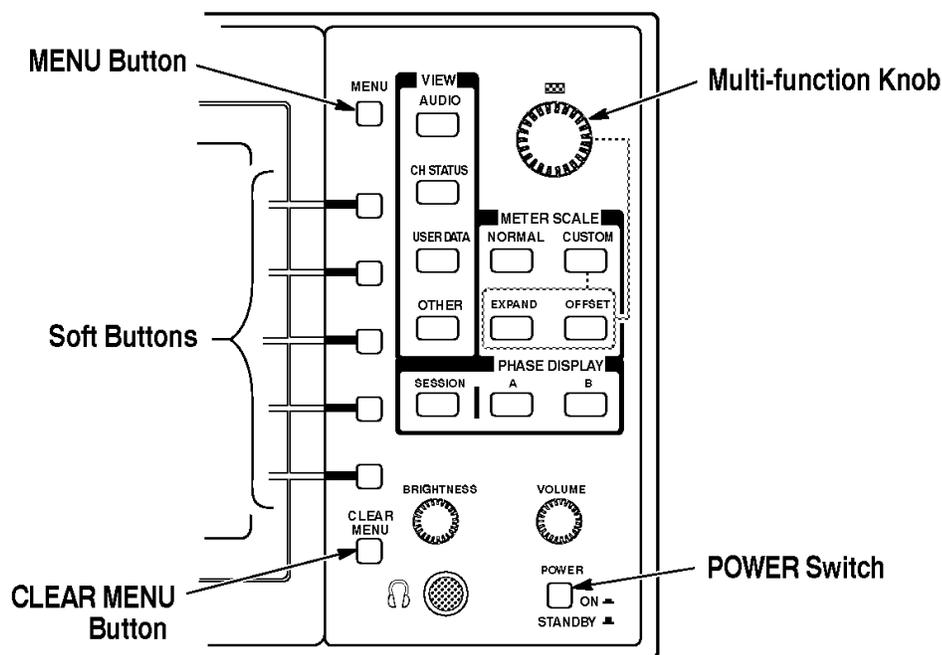
Figure 8: Controls for initial power up and configuration

Perform the following steps to select the input types and familiarize yourself with the 764 menu structure:

1. Press the **MENU** button to enter the TOP MENU.

2. When the 764 is in menu mode, **MENU** provides access to context-sensitive HELP messages. Press **MENU** now to see the TOP MENU help message; the display resembles Figure 9. Press the button again to clear the message.
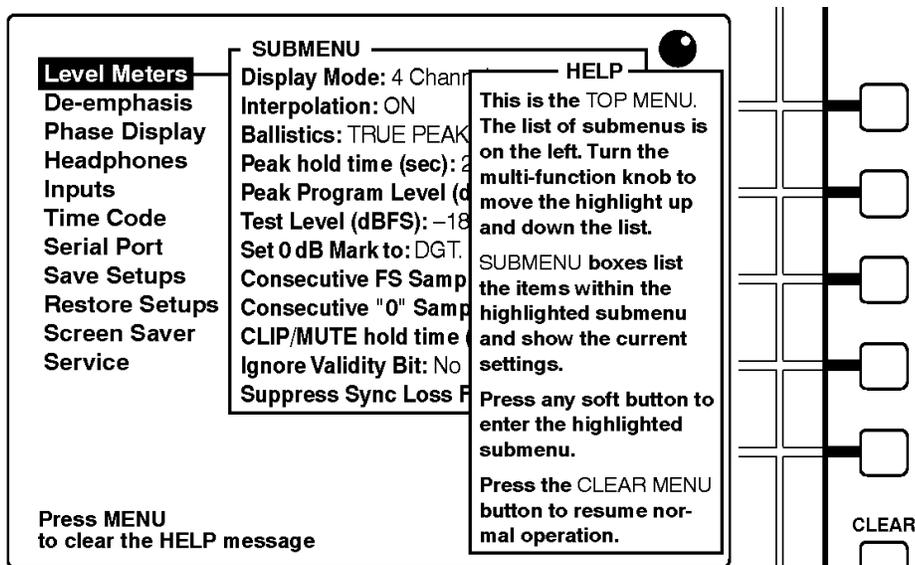
Figure 9: The top menu HELP message

3. The knob icon appears in the upper-right corner of the display when the multi-function knob is active. Here, you may turn the knob to scroll among the TOP MENU choices. Turn the knob now to scroll the menu highlight to the "Inputs" entry, as shown in Figure 10.
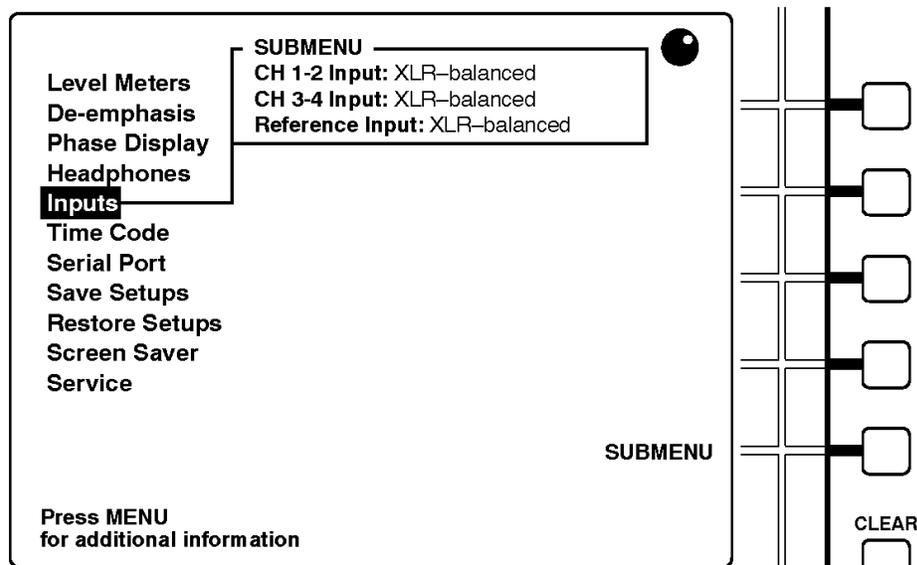
Figure 10: Selecting from the top menu

4. The five buttons immediately to the right of the display are called soft buttons. The printed/molded lines to the left of these buttons serve to associate the buttons with on-screen menu choices or functions. In Figure 10, the bottom soft button is associated with the SUBMENU function, but you can press *any* soft button to enter the Inputs submenu.[1] After you do, the display resembles Figure 11.

5. To change the channel 1–2 input to the BNC connector, press the soft button to the right of the "BNC-unbalanced" choice. The change is in effect when you exit the menu and return to normal operation.

[1] Because there are no other soft button assignments in the top menu level, the 764 is configured so that pressing any one of the five soft buttons will select the highlighted submenu.
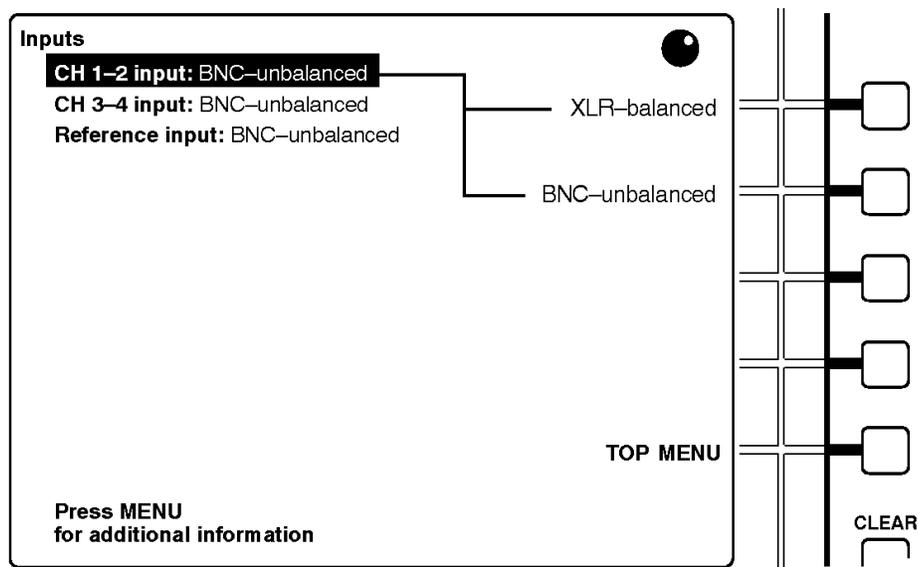
Figure 11: The inputs submenu

6. Turn the multi-function knob to move the menu highlight to the "CH 3–4 input:" line.

7. If desired, change the channel 3–4 input to the BNC connector by pressing the associated soft button.

8. Press the **CLEAR MENU** button to exit the menus and resume normal operation. If you have selected the appropriate input type, the corresponding level meters should now respond to the input audio program.

Operating Basics

This section contains the basic information needed to use your 764. The subsections are: Overview, Front Panel Controls, The Level Meters, The Phase Display, The Session Display, Session Reports, The Channel Status View, The User Data View, and Other Features.

Please take a few minutes to familiarize yourself with this section and the information contained in it. Consult the text whenever you have a question regarding instrument operation. Because the Tektronix 764 Digital Audio Monitor is intended as a tool for use in a production environment, every effort has been made to keep operation as simple and intuitive as possible. An attempt has also been made to keep this section of the manual brief and easy to use. You will find detailed information about the more technical aspects of 764 operation in the Reference section of this manual.

Overview

The 764 permits in-line monitoring of the audio program contained in a digital audio signal without first converting it to analog form. In addition, it can report and interpret the ancillary data that is transmitted through the Channel Status and User Data bits of the digital data stream.

The 764 uses three display views to perform those functions—the Audio view, the Channel Status view, and the User Data view—as described in the following paragraphs. (To locate buttons mentioned in the text, refer to *Front Panel Controls* beginning on page 16.)

Monitoring an Audio Program with the Audio View

The Audio view (with the Session Statistics displayed, as shown in Figure 12) is the power-up default configuration of the 764. Otherwise, the Audio View is never more than two button presses away:

1. Press the **CLEAR MENU** button to exit any on-screen menu.

2. Press the **VIEW:AUDIO** button.

The left portion of the Audio view display always contains four "bar graph" level meters. The right portion contains either a numerical display of session statistics (see Figure 12), or the Phase display (shown in Figure 13). Configure the right side of the Audio view display with the three PHASE DISPLAY buttons: **A**, **B**, and **SESSION**.

Tek
True Peak
clip dBFS Session : 00:00:00:00 Run Stop
0

SESSION STATISTICS

Channel	1	2	3	4	
Highest true pk	0	0	nil	nil	dBFS
Highest bar rdg	0	0	nil	nil	dBFS
No. of clips No.	117	23	0	0	
of mutes Invalid	0	11	0	0	
samples	0	0	0	0	
Parity Errors	0	0	0	0	
Code violations	0	0	0	0	dBFS
Active Bits	24	24	0	0	kHz
DC offset	−90	−90	nil	nil	%
Sample rate		48.00	00.00		
Frame Sync Err		0.0	0.0		

−10 INPUT UNLOCKED INPUT UNLOCKED −20 −30 −40 −50 −70

1 2 3 4

CLEAR MENU

Figure 12: The 764 AUDIO/SESSION view

The 764 has many options that affect the appearance and behavior of the Audio view features. For more information, refer to *The Level Meters* beginning on page 18; *Sum and Difference Bars* on page 25; *The Phase Display* on page 26; and *The Session Display* on page 29.

Session Reports

The 764 can also output session reports, which are permanent records of session activity, through the rear-panel RS-232 port. The reports can either be sent directly to a printer, or captured on a PC and saved to disk.

This feature adds important utility to the 764 because it permits screening of digital audio programs for errors and peak levels

without requiring constant operator attention. When errors and peaks are encountered, they are time-stamped with the active session time code, which makes it easy to return to the part of the program that contains the event of interest. See page 34 for more information.
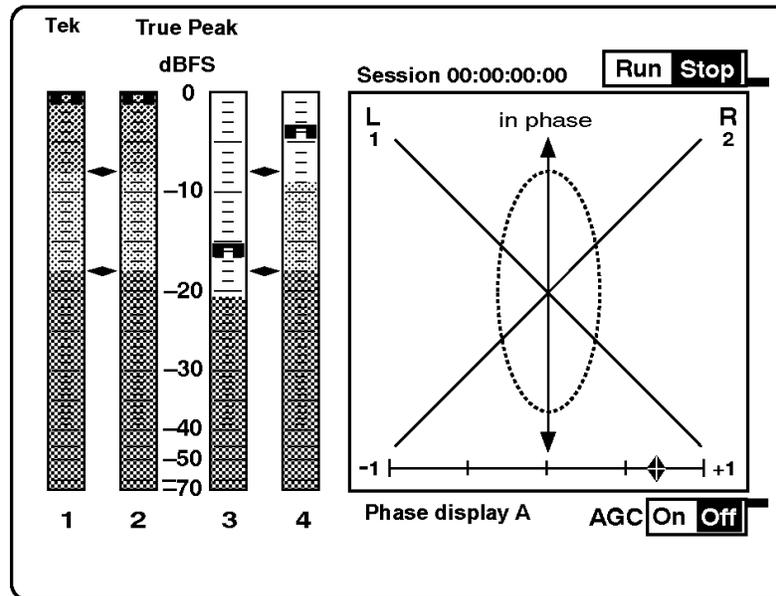
Figure 13: The 764 AUDIO/PHASE view

Monitoring the Ancillary Data

You can monitor ancillary data contained in the digital audio signal through two additional 764 view options.

Channel Status View. The Channel Status view reports the information embedded in the channel status bytes of the incoming serial digital signal. Select the Channel Status view by pressing **CLEAR MENU** (if necessary, to exit the on-screen menus), then the **VIEW:CH. STATUS** button. You may select a number of Channel Status view options with the Soft buttons to the right of the display. Refer to *The Channel Status View* beginning on page 37 for more information.

User Data View. The User Data view reports the information embedded in the User bytes of the incoming signal. Select the User data view by pressing **CLEAR MENU** (if necessary, to exit the on-screen

menus), then the **VIEW:USER DATA** button. You may select a number of User Data view options with the Soft buttons. Refer to *The User Data View* beginning on page 39 for more information.

Other Features

With the 764, you can also save up to three instrument configurations (setups) for later recall. Refer to page 40.

Front-panel Controls

Figure 14 shows the 764 front panel controls.

(1) POWER switch. Press the POWER switch to toggle between ON and STANDBY. A portion of the instrument power supply remains active when the switch is in the Standby position. Unplug the 764 if it is necessary to isolate it completely from the main power supply; instrument settings are preserved with internal battery back up.

(2) VIEW Selection buttons. Use the VIEW buttons to select among the **AUDIO**, **CH**(annel) **STATUS**, and **USER DATA** views. These buttons are inactive when a menu is present on the 764 display. The **OTHER** button is not used in this version of the instrument.

(3) PHASE DISPLAY and SESSION buttons. Use the PHASE DISPLAY buttons to configure the right portion of the Audio view.

The **A** and **B PHASE DISPLAY** buttons select a Lissajous Phase display with correlation meter, as illustrated in Figure 13. The A and B phase pairings are, by default:

- Pair A, left = input channel 1; Pair A, right = input channel 2.

- Pair B, left = input channel 3; Pair B, right = input channel 4.

You can change the orientation of the Lissajous display (from soundstage to X–Y) and the phase channel pairings through on-screen menus. Refer to *The Phase Display Submenu* beginning on page 54 for more information.

The **SESSION** button selects a Session Statistics panel,
illustrated in Figure 12. Refer to *The Session Display* beginning
on page 29 for more information.
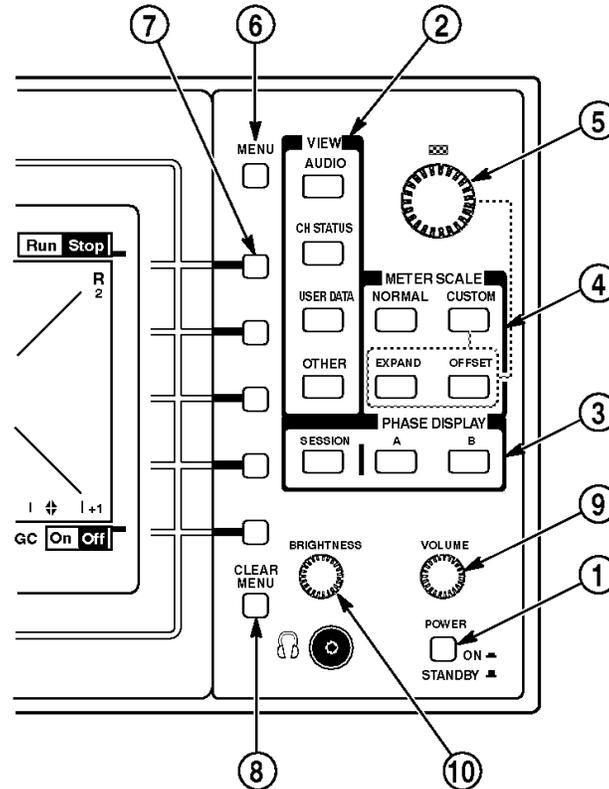
Figure 14: 764 front-panel controls

(4) METER SCALE buttons. Use the METER SCALE buttons to change
the Audio view level meter scale. The default scale, selected with
NORMAL, is illustrated in Figure 12. Use **EXPAND** and **OFF-
SET**—with the multi-function knob—to configure the range and
offset of the custom scale. Refer to *The Level Meters* beginning
on page 18 for more information.

(5) Multi-function knob. Turn the multi-function knob to expand and
offset the meter scale, and to scroll various on-screen menus. The

LED immediately above the knob will light and a knob icon will appear in the upper-right of the display when the knob is active.

(6) **MENU button.** Press MENU to invoke the display menu and call up context-sensitive help text when a menu is on screen.

(7) **Soft buttons.** The five white soft buttons are used to select choices or toggle settings that are indicated on the CRT display. In Figure 12, for example, the top soft button is used to toggle the Session between Run and Stop.

(8) **CLEAR MENU button.** Press CLEAR MENU to exit the on-screen menu and return to the most recent view (Audio, Channel Status, or User Data).

(9) **Headphone VOLUME control.** The VOLUME knob controls the analog headphone output gain; on instruments equipped with Option 02, it also controls the gain of the rear-panel analog audio outputs.

(10) **Display BRIGHTNESS control.** Turn the BRIGHTNESS knob to adjust the brightness of the 764 display. Does not affect the output of the rear-panel VGA VIDEO connector.

The Level Meters

The 764 level meters are vertical bar graphs in which the height of each bar indicates the amplitude of the audio program contained on the corresponding input channel. The levels of all four input channels are shown in the default meter configuration, illustrated in Figure 15. You can also select—through on-screen menus—"two channel plus sum and difference" mode, shown in Figure 16.

Indeed, almost every feature of the 764 level meters may be customized to suite your particular needs. The features and your options are explained briefly in the following numbered paragraphs. Choose the options that are appropriate to your particular application through the on-screen menus; refer to *Configuring the Level Meters* beginning on page 22 for more information.
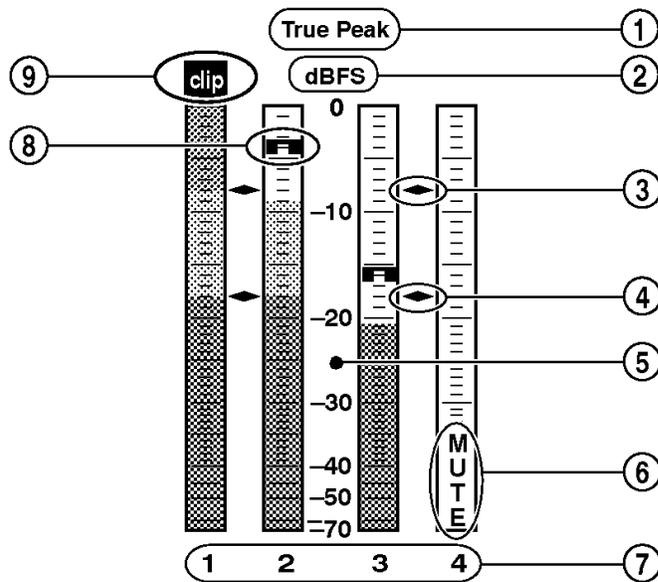
Figure 15: The 764 Level Meters

(1) Meter Ballistics (i.e., dynamic response, or attack/decay character-
istics of the meters). The meters can emulate the dynamic re-
sponse of three common types of analog audio level meter.
Choices are VU with the scale extended to permit display of true
peaks on the same bar; PPM, a quasi-peak meter with 10 ms in-
tegration time and slow decay; and True Peak, with instantaneous
response and slow decay.

(2) Scale Units (dBFS or dBr). By default, the zero dB mark is at digital
full scale, and units are in dB relative to full scale (dBFS). You
may also set the 0 dB mark to either the Peak Program level or
the Test level—see items (3) and (4) below. In either case, the
scale units are dB relative to the specified zero point (dBr).
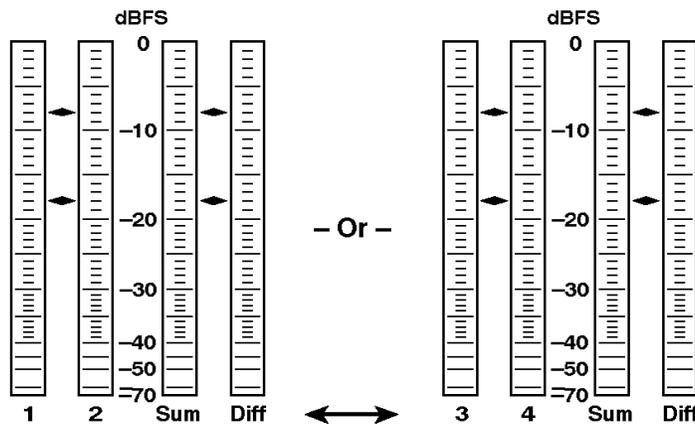
Figure 16: The sum and difference display modes

(3) Peak Program level. The Peak Program level is usually the maximum permissible level for audio program material. The default Peak Program level is –8 dBFS; you may set it to the integer value between 0 (FS) and –30 dBFS that is appropriate to your particular needs. The diamond-shaped Peak Program level scale markers will be red on an (optional) external color display; if the audio program exceeds this level, the portion of the meter bar above the level will also be red.

(4) Test Level. Test level is also known as Reference level or Line-up level. The diamond-shaped Test level marker will be yellow on an external color display, and the part of the meter bar between this level and Peak Program level will also be yellow. The default test level is –18 dBFS; it may be set to any integer between 0 and –30 dBFS.

(5) Variable scale. The scale range and offset may be adjusted through the **METER SCALE:EXPAND** and **:OFFSET** buttons. This feature lets you more closely monitor program levels in a selected portion of the meter, such as immediately above and below the Test level. To adjust either the range or offset, press the appropriate button, then turn the multi-function knob. Press **METER SCALE:NORMAL** to restore the default meter scale.

■ The normal range is 70 dB (0 dBFS to –70 dBFS); custom range may be as little as 10 dB or as great as 90 dB.

- Shape: The upper 20 dB of the scale is linear in dB; the scale is progressively compressed below –20 dBFS.

- The upper limit of the meter scale is the anchor for expansion and compression; that is, the top scale number remains the same when you expand or compress the scale.

- The lower limit (bottom) of the scale cannot be adjusted below –90 dBFS; the upper limit (top) cannot be higher than 0 dBFS, or lower than –20 dBFS.

(6) **Mute indicator (and other messages).** The MUTE indicator is one of seven messages that can appear in the lower half of each meter bar. The remaining messages are intended to alert you to possible errors in the input signal; they are explained in *In-Bar Warning Messages* beginning on page 44.

You can specify the number of consecutive all-zero samples required for a MUTE indication. The default is 10 samples; the range is 0 to 100. The Mute indicator always reacts to unprocessed input data, regardless of Interpolation or de-emphasis settings (refer to *Interpolation* on page 50 or *The De-emphasis Submenu* on page 53).

You may also specify the persistence (hold time) for the in-bar indicators between 1 and 30 seconds; the default is 2 seconds.

(7) **Meter bar labels.** The meter bar labels depend on the display mode. The channel numbers (1, 2, 3, and 4) correspond to the rear-panel input labels; "Sum" indicates (L+R)/2, and "Diff" indicates (L–R)/2.

(8) **True peak indicators.** The true peak indicators always show true peak values, regardless of the selected meter ballistics. These indicators are particularly useful when you have selected PPM or VU ballistics, which have rise times that may prevent you from seeing peaks in program material containing steep transients. By default, the peak indicators persist at the most recent program peak for 2 seconds; you can set this "peak hold time" (through the level meters submenu) between 0 and 10, in one-second increments.

Please be aware that although the peak indicators may reveal higher peaks than VU or PPM ballistics, the indicators *do* act on the same, processed data as the meters. If interpolation is ON, the peak indicators show peaks in the oversampled data, and these peaks may be higher than those in the raw input data (see "Interpolation," on page 50). If de-emphasis (AUTO, CCITT J.17, or 50/15) is selected, the peaks—particularly at higher frequencies—may be lower than in the raw data (refer to *The De-emphasis Submenu* on page 53).

(9) Clipping flag. The clipping flag appears when the 764 detects clipping and persists for the same hold time as chosen for the Mute indicator. The user can specify the number of consecutive full scale samples that constitute clipping. The range is from 1 to 100 samples. Like the Mute indicator, the clipping flag always reacts to unprocessed input data, regardless of Interpolation or de-emphasis settings.

Configuring the Level Meters

You can configure the level meter scale with front-panel controls. Other meter characteristics—such as ballistics, scale units, and program/test levels—are configured through the on-screen Level Meter submenu.

Variable scale. To adjust either the range or offset of the level meters, press **METER SCALE:EXPAND** or **METER SCALE:OFFSET**, then turn the multi-function knob. For best results (and least confusion), expand the scale to the desired range first, then adjust the offset to view the meter region of interest. For example, to change normal scale to a custom scale showing only the –10 to –30 dBFS range (see Figure 17):

1. Press **METER SCALE:EXPAND**, then turn the multi-function knob clockwise [↻] to expand the scale range to 20 dB, top to bottom.

2. Press **METER SCALE:OFFSET**, and turn the multi-function knob counterclockwise [↺] to shift the scale upwards by 10 dB.

Press **METER SCALE:NORMAL** to restore the default meter scale; to later restore the "custom" scale and offset, press **METER SCALE:CUSTOM**.
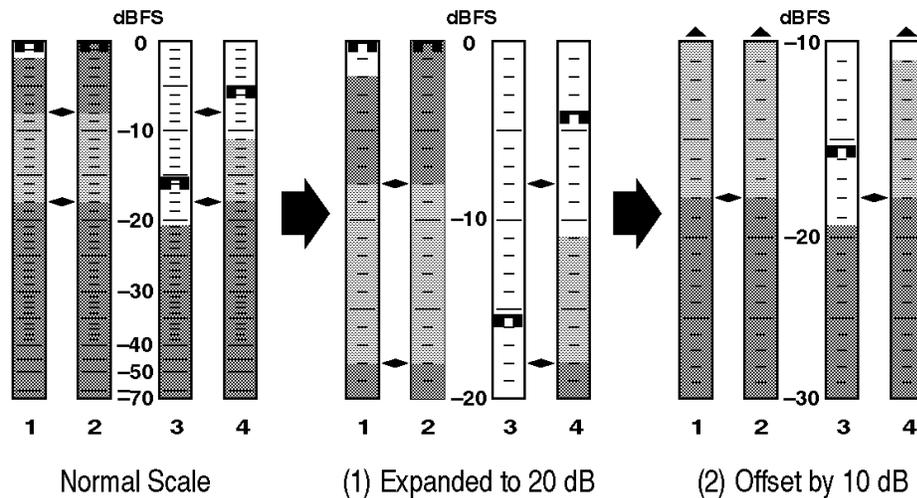
Figure 17: Creating a custom meter scale

Level Meter Submenu selections. All remaining level meter configuration selections are made through the Level Meter submenu. Follow the steps below to make menu selections. As with meter scale, all selections apply to all four input channels, and all four meter bars.

1. Press **CLEAR MENU**, if necessary, to exit any menu and resume normal operation.

2. Press **MENU** to enter the root menu (the TOP MENU).

3. Turn the multi-function knob to scroll the menu highlight to the Level meters entry.

4. Press any soft button to enter the level meters submenu. The display will resemble Figure 18.
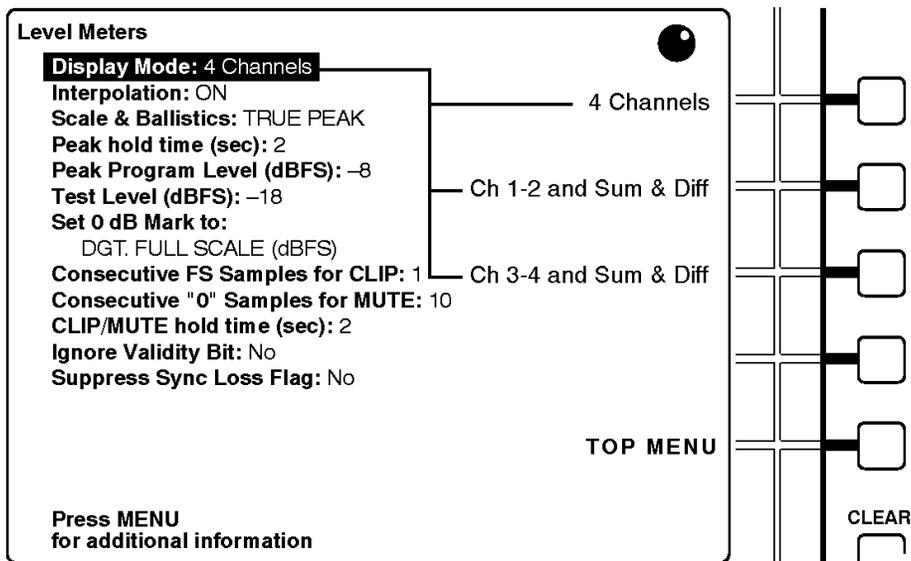
Figure 18: The Level Meters submenu

5. Again, use the multi-function knob to scroll the menu highlight to the parameter you wish to configure. The soft button assignments will change to reflect your choice of settings. For menu items that have numeric settings, the top two soft buttons become increment/decrement controls designated with up and down arrow icons, as represented in Figure 19.
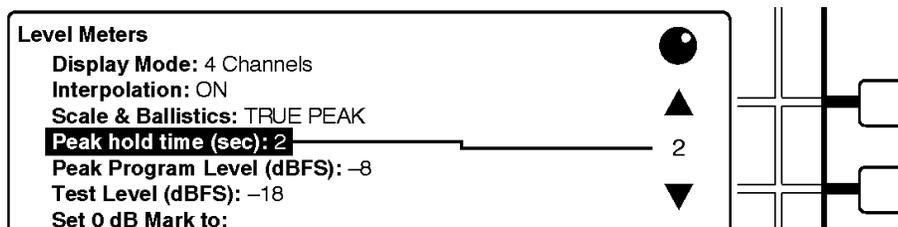
Figure 19: Soft buttons and numeric settings

6. Press the soft button that corresponds to the desired setting, or that increments or decrements the numeric value. (A numeric value will continue to increase or decrease as long as you hold

the button down—or until you reach an adjustment limit.) Changes are confirmed by changed text after the parameter name in the submenu column on the left side of the screen.

7. Repeat steps (5) and (6) until you have configured the meters to suit your needs.

8. Press the TOP MENU soft button to return to the top menu, or press **CLEAR MENU** to exit the menus and resume normal operation.

Sum and Difference Bars

When Sum and Difference bars are selected, the two left-hand bars show the levels of one input pair (either channels 1 and 2, or channels 3 and 4), and the right-hand bars emulate the sum and difference bars of an analog audio monitor, such the Tektronix 760. Note that the "sum" is actually *one-half* of the sum of the left- and right-channel data, while the "difference" is *one-half* of the difference between the channels. That is:

$$Sum = \frac{L + R}{2} \qquad\qquad Diff = \frac{L - R}{2}$$

The Sum and Difference bars use the same scale and ballistics, and all other settings, as the channel level meters. Session statistics—other than sum and difference peaks—are *not* accumulated for the Sum and Difference bars, because they would be either meaningless or redundant. See Figure 20 and *The Session Display* beginning on page 29 for more information.
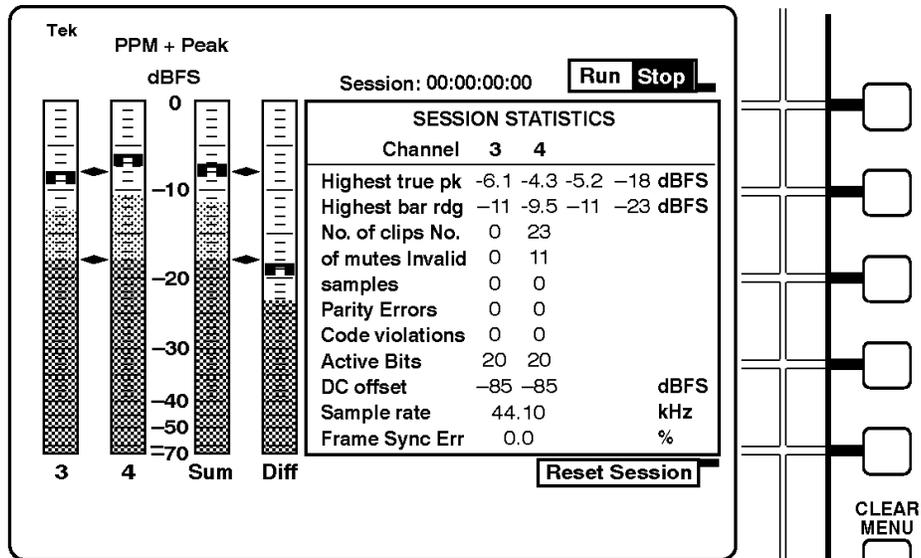
Figure 20: Sum and difference bars and the session display

The Phase Display

The 764 Phase display is a Lissajous pattern display augmented with a (phase) Correlation meter. It is designed for convenient, qualitative monitoring of the phase relationship between any two input channels. The Phase display always uses interpolated (4X "oversampled") data, even if interpolation is turned off in the level meters submenu. You can set the instrument for either Soundstage or X–Y orientation of the Lissajous pattern, as illustrated in Figure 21.

NOTE. The orientation of the Lissajous pattern, phase channel pairings, and Correlation meter speed (see below) are selected through the Phase Display submenu. Please see page 54, in the Reference section of this manual, for details.

Soundstage Orientation   X–Y Orientation
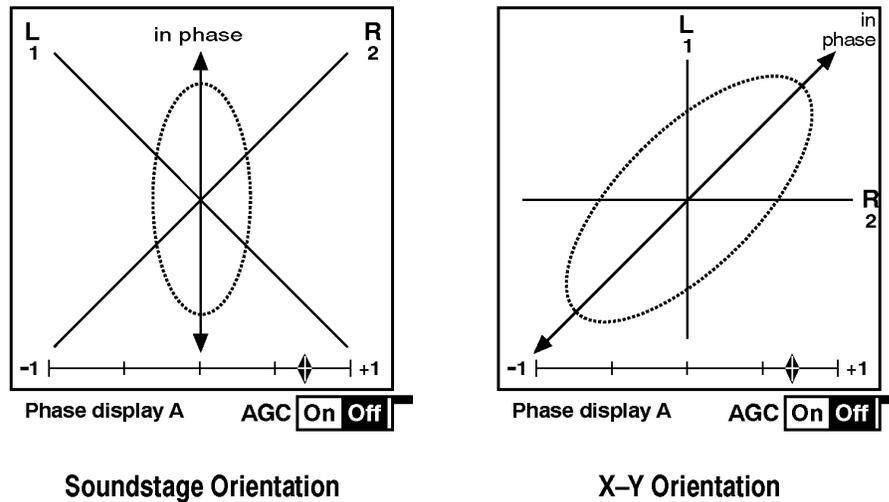
Figure 21: The 764 phase display

The Lissajous Pattern

The Lissajous portion of the phase display is a plot of one channel against another on an orthogonal pair of axes. The X–Y orientation—shown on the right in Figure 21—plots left channel data along the vertical axis and right channel data on the horizontal axis, emulating the conventional X–Y display of an oscilloscope. The default "Soundstage" orientation, shown on the left in Figure 21, rotates the X–Y pattern 45 degrees counterclockwise so that the channel data are plotted along diagonal axes, and mono (or in-phase) audio appears along the vertical ("straight ahead") axis.

If you are unfamiliar with Lissajous phase patterns and their interpretation, see Tektronix application note 21W-6244-2, "Stereo Audio Measurements Using the 760A Audio Monitor." The concepts discussed apply to the Lissajous display of the 764 as well.

The Correlation Meter

The Correlation meter, illustrated in Figure 22, displays a true mathematical phase correlation (mono compatibility) between the two channels of the phase pair, independent of signal amplitude. You may find it easier to interpret the correlation meter than the Lissajous pattern. The position of the diamond-shaped pointer indicates the correlation between the two selected channels. The meter will read

+1 when the channels contain identical signals (frequency and phase); it will measure –1 when the signals have the same frequency (or frequencies), but are 180 degrees out of phase. A center-scale (0) reading indicates uncorrelated—or random—signals.
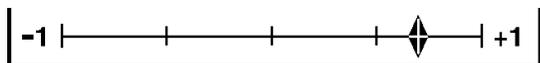
Figure 22: The phase correlation meter

When you monitor audio programs (as opposed to simple test tones) with the 764, the pointer will usually read between +0.5 and +1, and will move as the correlation between the two channels changes. Choose the time constant of the meter—and thus the speed of meter response—through the Phase Display submenu.

AGC

AGC (automatic gain control) keeps the Lissajous pattern visible and within the bounds of the phase display for signal levels between 0 dBFS and approximately –40 dBFS. When the AGC is Off, full scale is equivalent to the Peak Program level (refer to page 20). AGC does not affect the correlation meter Press the bottom soft button (immediately above **CLEAR MENU**) to toggle AGC On/Off.

The Session Display

The session display is a dynamic readout of session history; it is illustrated in Figure 23. When the 764 is in Audio view, press the **PHASE DISPLAY:SESSION** button to toggle between the Phase display and the Session display.
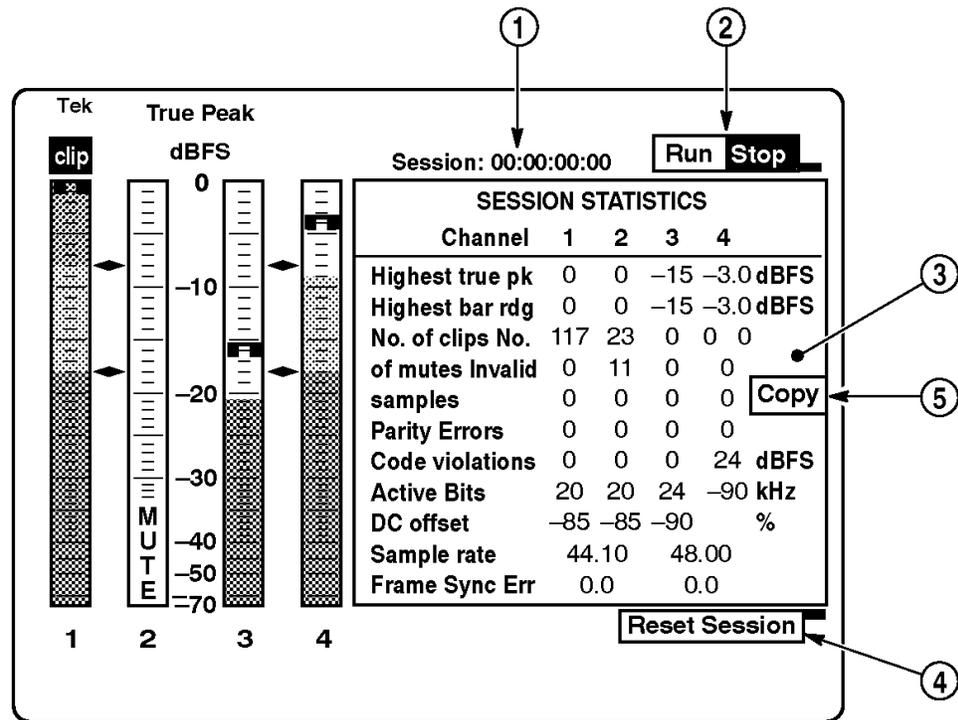
Figure 23: The 764 AUDIO/SESSION view

Features of the Session Display

The following numbered paragraphs correspond to the numbered features visible in Figure 23.

(1) Time readout in hours:minutes:seconds:frames. By default, this is "Session time." Session time is the time elapsed since the session was started, or since the most recent session reset. You can set the 764—through the Time Code submenu—to display VITC (Vertical Interval Time Code) or LTC (Linear Time Code) in place of

Session time. The instrument time-stamps any errors encountered during the Session with the chosen time code; the information is saved in NVRAM for use when you output a Session report (refer to page 34).

(2) Run(ning)/Stop(ped) indicator and soft button assignment. This indicator is associated with the top soft button, immediately below the **MENU** button. The current state is highlighted. Run means that the Session is running, and statistics are accumulating. Stop means that the Session has been suspended, or stopped. Press the soft button to toggle the Session between Run(ning) and Stop(ped).

(3) Session Statistics, explained below.

(4) RESET Session indicator and soft button assignment. This indicator is visible only when the Session is stopped. Press the associated soft button (immediately above **CLEAR MENU**) to reset all Session statistics to 0 or blank (unknown). Note that a Session reset erases all Session statistics from memory; if you plan to output a Session report, do so *before* you reset the Session.

(5) Copy soft button — is present when SHORT REPORT or LONG REPORT has been selected through the Serial Port submenu and the session has been stopped but not reset. Press the soft button to output a session report to an attached printer or personal computer. Refer to *Session Reports* beginning on page 34 for more information.

Session Statistics

The session display reports these values for the four input channels:

- Highest true peak in the session. It is equal to the highest peak indicator reading on the corresponding level meter, and does not depend on the meter Scale & Ballistics selected through the Level Meters submenu.

- Highest meter bar reading ("bar rdg") of the session. This corresponds to the highest reading of the meter bar, which—for a given audio program—may depend on the meter Scale & Ballistics selected through the Level Meters submenu.

■ Number of CLIPs detected during the session. This is directly affected by the "Consecutive FS Samples for CLIP" setting in the Level Meters submenu.

■ Number of MUTEs detected during the session. Affected by the "Consecutive '0' Samples for Mute" setting in the Level Meters submenu.

■ Number of invalid samples encountered during the session. The 764 counts a sample as invalid when its validity bit is set high. All these fields will read "off" when the "Ignore Validity Bit" item in the Level Meters submenu is set to YES.

■ Number of parity errors detected during the session. This will increment if the 764 detects incorrect parity in a received digital audio word. Parity errors suggest problems with the digital signal source or signal path.

■ Code Violations — the number of "raw" serial data subframes containing biphase coding errors that are encountered during the session. Code Violations indicate an incorrect or unreliable serial digital signal or transmission path.

■ The digital audio word length, detected by monitoring bit activity in the part of the digital signal reserved for audio sample data. Although it is not likely, this number *can* differ from the sample length information indicated in the Channel Status bits of the digital input signal.

■ DC Offset — reported in dBFS (dB relative the the full scale amplitude of the input signal). Note that an offset of –60 dBFS is only 0.001 of the full scale amplitude, while an offset of –90 dBFS is approximately 3.16×10^{-5} of full scale.

■ The measured sample rate. This number is independent of the sample rate indicated in the Channel Status bits of the digital input data, but should be the same. Non-standard sample rates can cause constantly changing frame synchronization errors and

SYNC ERR flags as shown in Figure 24. Please see the following paragraphs for more information.
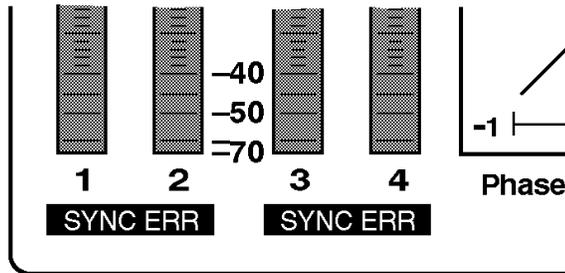
Figure 24: The SYNC ERR Flags

- Frame Synchronization Error — for each input with respect to the Digital Audio Reference (DAR), when one is present at the REFERENCE input. Otherwise—when both inputs are active but no DAR is present—the error of input 3–4 relative to input 1–2, as depicted in Figure 25. Errors are expressed as the percentage of a complete digital audio frame.

  Notice the "No Reference Signal" message in Figure 25. It will appear whenever a DAR is absent from the REFERENCE input.
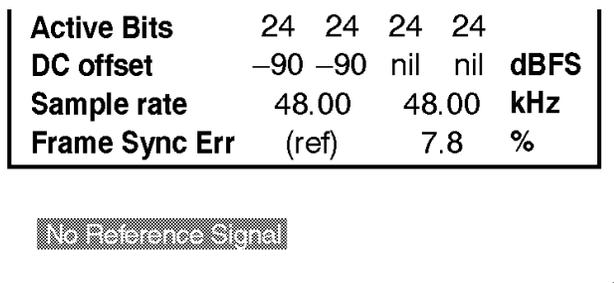
Figure 25: Sync Error Reporting in the Absence of a DAR

The AES11 standard specifies that synchronization errors should be no greater than 25% of the audio sample frame. When the synchronization error exceeds this limit, a SYNC ERR flag

displays under the meter bars of the unsynchronized input. Figure 24 shows the flags as they would appear if each input signal preceded or followed the DAR signal by more than 25% of a frame.

The SYNC ERR flags also appear when the input signal sample frequency varies from the reference frequency by 0.01 kHz or more. Any such frequency mismatch will cause the input signal to "slide" relative to the reference with constantly changing sync error; the 764 detects this and displays the appropriate SYNC ERR flag(s) at all times—not just when the error exceeds 25%.

Both the "No Reference Signal" message and the SYNC ERR flags may be suppressed through the Level Meters submenu; refer to page 52 for details.

Session Reports

The 764 can output the data collected during a session—in the form of ASCII text session Reports, through the rear-panel RS-232 connector. You can print reports on a serial printer, or save them to files on an IBM-compatible Personal Computer (PC). The 764 can generate two types of session report, short (Figure 26) and long (Figure 27).

```
Tektronix 764 Session Screen Report                        (short report)
-------------------------------------------------------------------------
Title_____Date_____
Time Code used: Session HH:MM:SS
          Starting time 00:00:00
          Ending   time 00:00:41
          Elapsed  time 00:00:41
-------------------------------------------------------------------------
Settings:
      Display Mode:                          4 Channels
      Interpolation:                              ON
      Ballistics:                            TRUE PEAK
      Peak Program Level (dBFS):                 -8
      Test Level (dBFS):                        -18
      Consecutive full-scale samples for clip:    1
      Consecutive zero samples for mute:         10
      De-emphasis used on channel 1:            NONE
      De-emphasis used on channel 2:            NONE
      De-emphasis used on channel 3:            NONE
      De-emphasis used on channel 4:            NONE
-------------------------------------------------------------------------
                        | Channel 1| Channel 2| Channel 3| Channel 4|
------------------------+----------+----------+----------+----------+-----
Highest True Peak Reading|   -0.7  |    0     |    0     |    0     | dBFS
------------------------+----------+----------+----------+----------+-----
Highest Bar Reading     |   -0.7   |    0     |    0     |    0     | dBFS
------------------------+----------+----------+----------+----------+-----
Clips Found             |    0     |    0     |   234    |   234    |
------------------------+----------+----------+----------+----------+-----
Mutes Found             |    15    |    17    |    0     |    0     |
------------------------+----------+----------+----------+----------+-----
Invalid Samples Found   |    0     |    0     |    0     |    0     |
------------------------+----------+----------+----------+----------+-----
Parity Errors Found     |    0     |    0     |    0     |    0     |
------------------------+----------+----------+----------+----------+-----
Code Violations Found   |    11    |    12    |    27    |    33    |
------------------------+----------+----------+----------+----------+-----
Number of Active Bits   |    24    |    24    |    24    |    24    |
------------------------+----------+----------+----------+----------+-----
DC Offset               |  -58.9   |  -70.3   |  -52.2   |  -62.0   | dBFS
------------------------+----------+----------+----------+----------+-----
Starting Sample Rate    |      44.10          |      48.00          | kHZ
Ending   Sample Rate    |      48.00          |      48.00          | kHZ
Number of changes       |        3            |        3            |
------------------------+----------+----------+----------+----------+-----
Frame Sync Error        |        3            |        0            | %
------------------------+----------+----------+----------+----------+-----
```

Figure 26: A short session report

The short report, shown in Figure 26, is a record of what happened during the session. It contains a print-out of the statistics tabulated on the 764 Session display, and lists several instrument settings that can affect meter behavior.

In addition to all the information in the short report, the long report contains time-stamped peak and error data and gives more detail about active bits, DC offset, and sample rates. Figure 27 is an example of the additional information contained in a long report.

```
--------------------------------------------------------------------------
Time Stamped Information Follows:
--------------------------------------------------------------------------
Highest True Peak Reading - within each 20 second interval
   Channel 1          Channel 2          Channel 3          Channel 4
Session   dBFS     Session   dBFS     Session   dBFS     Session   dBFS
00:00:09 -10.8     00:00:09 -8.1      00:00:11 -8.1      00:00:12 -8.1
00:00:31 -4.9      00:00:31  0        00:00:31  0        00:00:31  0
--------------------------------------------------------------------------
Highest Bar Reading - within each 20 second interval
   Channel 1          Channel 2          Channel 3          Channel 4
Session   dBFS     Session   dBFS     Session   dBFS     Session   dBFS
00:00:10 -13.6     00:00:10 -12.1     00:00:12 -12.1     00:00:12 -12.1
00:00:31 -4.9      00:00:31  0        00:00:30  0        00:00:30  0
--------------------------------------------------------------------------
Clips Found - NONE
--------------------------------------------------------------------------
Mutes Found
   Channel 1          Channel 2          Channel 3          Channel 4
Session            Session            Session            Session
                                      00:00:32           00:00:32
00:00:37           00:00:37
--------------------------------------------------------------------------
Invalid Samples Found - NONE
--------------------------------------------------------------------------
Parity Errors Found - NONE
--------------------------------------------------------------------------
Code Violations Found
   Channel 1          Channel 2          Channel 3          Channel 4
Session            Session            Session            Session
00:00:17           00:00:17
                                      00:00:36           00:00:36
--------------------------------------------------------------------------
Number of Active Bits
   Channel 1          Channel 2          Channel 3          Channel 4
Minimum   Bits     Minimum   Bits     Minimum   Bits     Minimum   Bits
00:00:13   0       00:00:13   0       00:00:13   0       00:00:13   0
Maximum   Bits     Maximum   Bits     Maximum   Bits     Maximum   Bits
00:00:00  24       00:00:00  24       00:00:00  24       00:00:00  24
--------------------------------------------------------------------------
DC Offset
   Channel 1          Channel 2          Channel 3          Channel 4
Minimum   dBFS     Minimum   dBFS     Minimum   dBFS     Minimum   dBFS
00:00:00   nil     00:00:00   nil     00:00:00   nil     00:00:00   nil
Maximum   dBFS     Maximum   dBFS     Maximum   dBFS     Maximum   dBFS
00:00:00   nil     00:00:00   nil     00:00:00   nil     00:00:00   nil
Average   dBFS     Average   dBFS     Average   dBFS     Average   dBFS
          nil                nil                nil                nil
--------------------------------------------------------------------------
   Sample Rate
                Channels 1-2                   Channels 3-4
                Session  kHZ                   Session  kHz
                                               00:00:12  48.00
                   00:00:26  00.00
--------------------------------------------------------------------------
```

Figure 27: Additional data on the long report

There are two types of time-stamped information, peak readings and error events. Peak readings are the highest true peak and the highest meter reading encountered during each consecutive peak reading interval in the session. An error event is a clip, mute, invalid sample, parity error, or code violation episode, consisting of at least one such error.

The time stamp is the hour:minute:second:frame when the peak or error occurred, in the time format—Session, VITC, or LTC—selected through the Time Code submenu.

Use the following procedure to output a session report:

1. Connect the 764 to the printer or PC. Cable requirements are explained under *Using the RS-232 Port* beginning on page 62.

2. Select the appropriate communications and report options (flow control, baud rate, type of report, and peak reading interval) through the Serial Port submenu; for more information, refer to *Serial Port Submenu* beginning on page 58. Be sure to set the Copy selection to either SHORT REPORT or LONG REPORT.

3. Run a session.

4. Stop the session, but *do not* reset it. Press the Copy soft button (feature ⑤ in Figure 23 on page 29). The 764 will send the report to the printer or PC, indicating the remaining number of lines on the bottom of the display. Press the soft button a second time to cancel the report.

The Channel Status View

The 764 Channel Status view displays the channel status information that is embedded in AES3-1992 (professional) or IEC-958 (consumer) digital audio signals. Press **CLEAR MENU** (if necessary to exit a menu), then the **VIEW:CH. STATUS** button to select the Channel Status view.

You can choose to display the Channel Status in one of four formats: fully decoded text (the default, illustrated in Figure 28), binary (Figure 29), transmission-order binary, or hexidecimal. To change display formats, press the soft button assigned to the desired format, as listed on the right side of the Channel Status View.

- In Text mode, the Channel Status data is spelled out in "plain English," as shown in Figure 28. The 764 will decode embedded channel status data per AES3-1992 or IEC-958 depending on the state of the first-transmitted channel status bit (bit 0 of byte 0). Press the top (**CHAN**) soft button to toggle between the two input channel pairs (1&2 and 3&4).

CHANNEL STATUS	Channel 1	Channel 2
Channel use	professional	professional
Data use	audio	audio
Emphasis	no emphasis	no emphasis
Locking of source	locked	locked
Sample frequency	48 kHz	48 kHz
Channel mode	2–channel	2–channel
User bits mode	not indicated	not indicated
AUX bits use	main audio	main audio
Audio word length	not indicated	not indicated
Reference signal	not a ref.	not a ref.
Origin	AM70	AM70
Destination	ABCD	EFGH
Sample number	0	0
Time of day	00:00:00	00:00:00
Block CRC	is valid	is valid

CHAN
1 2 3 4

FORMAT
Text

Binary

Xmsn
Order
Binary

Hex

CLEAR

Figure 28: The Channel Status view, text mode

- In binary display mode (illustrated in Figure 29), you may turn the multi-function knob to highlight various bits or blocks of bits for same-screen "plain English" decoding. For example, bits 3 through 5 of byte 0 indicate the (pre)emphasis, if any, that has been applied to the audio program; when you move the screen highlight to those bits, the type of emphasis will be displayed in decoded text near the bottom of the screen. Only one channel at a time is shown in binary mode; the selected channel is indicated on the top line of the display. Press the CHAN soft button repeatedly to cycle among the four input channels.

- The "Xmsn Order Binary" display reverses the bit order to correspond to transmission order (LSB first) of the Channel Status bits. Use the knob as in the binary display to highlight bits or bit-blocks for decoding. Press the **CHAN** soft button repeatedly to cycle among the four input channels.

- Hex format is included for compatibility with other instrumentation. All four input channels are shown on one display.
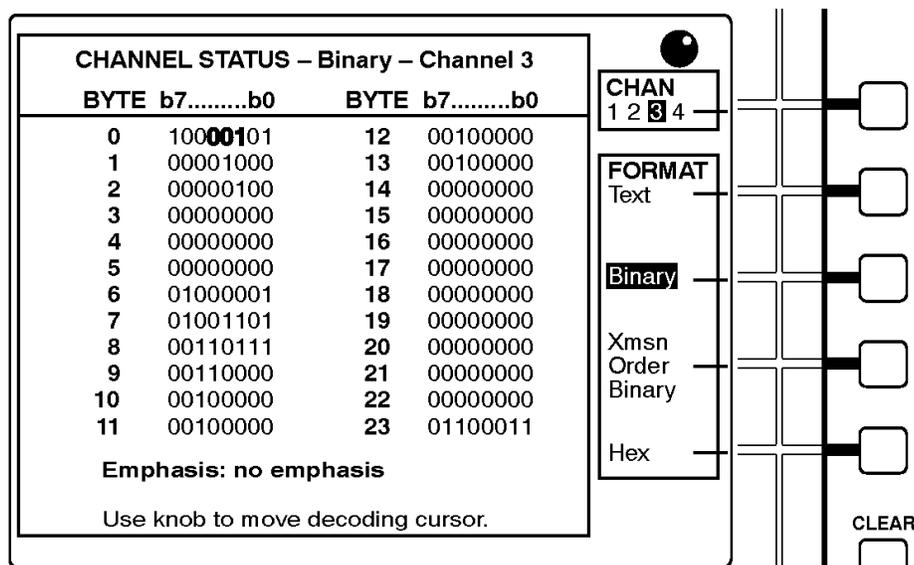
Figure 29: The Channel Status view, binary mode

The User Data View

The 764 User Data view is intended to display optional user information that may be embedded in the "user bits" of digital audio signals. As this is written, the 764 can only interpret and display data that is block-aligned with the Channel status data; the 764 cannot interpret IEC-908 (Compact Disk) user data. Press **CLEAR MENU** (if necessary to exit a menu), then the **VIEW:USER DATA** button to select the User Data view.

User data may be displayed either in Hexidecimal form or as the equivalent ASCII text. The Text mode is shown in Figure 30. Select the desired format by pressing the appropriate soft key. The Hexidecimal display format has room for data from all four input channels; the Text display shows two channels at a time. In the Text display, press the top (**CHAN**) soft button to toggle between the two input channel pairs (1&2 and 3&4).
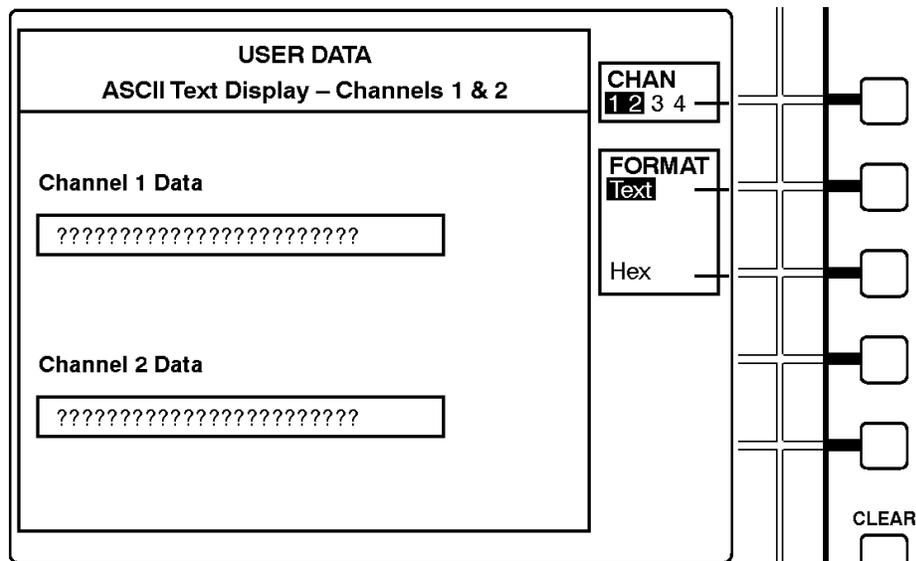
Figure 30: The User Data view, text mode

Saving and Restoring Setups

The 764 automatically stores current front panel and menu settings in non-volatile RAM. The instrument restarts every time in the Audio View/Session Display, with the session stopped and session time (if it is the current Time Code selection) reset to zero. All other settings will be as when the 764 was switched off.

For added flexibility, you can also save up to three instrument configurations, recall them later, or restore the factory default settings with the techniques described next.

Saving a Setup

You can save up to three additional instrument configurations in NVRAM for convenient later recall through the "Save Setups" submenu. To do so:

1. Configure the instrument as desired with the front-panel controls and through the various submenus.

2. Enter the top menu. (Press **CLEAR MENU**, then **MENU** to enter the top menu anytime the 764 is operating.)

3. Use the multi-function knob to scroll the menu highlight to "Save Setups." Press any soft button to enter the submenu.

4. Press one of the three available soft buttons to save the instrument settings. A highlighted message—"SETUP #*N* has been saved"—will appear on screen when the operation is complete.

5. Press **CLEAR MENU** to resume normal instrument operation.

Restoring a Setup

To recall a setup or restore factory default settings:

1. Enter the top menu.

2. Use the multi-function knob to scroll the menu highlight to "Restore Setups." Press any soft button to enter the submenu. It will resemble the display illustrated in Figure 31.

3. Press one of the four soft buttons to recall/restore the associated instrument settings. A highlighted message—"SETUP #*N* has

been restored"—will appear on screen to signal that the operation is complete.

4. Press **CLEAR MENU** to resume normal instrument operation with the newly-recalled settings.
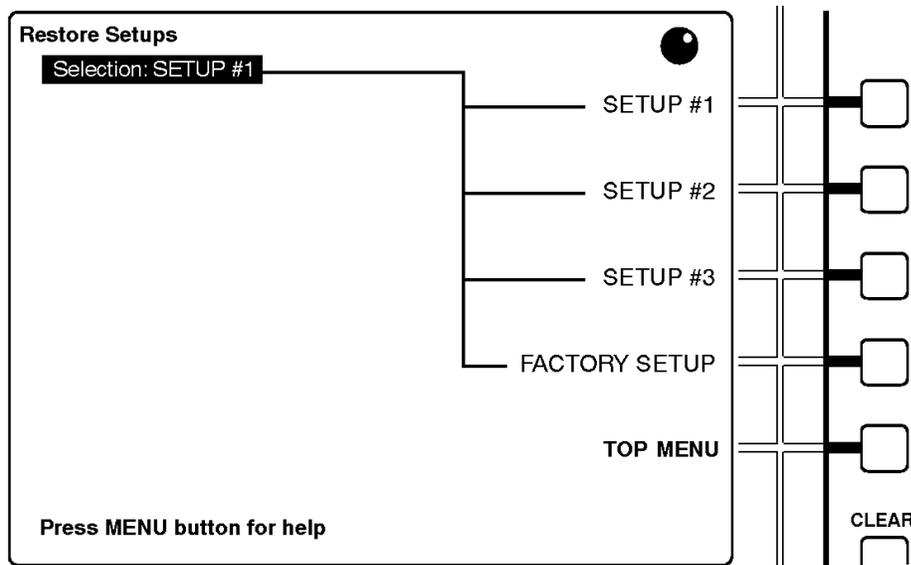
Figure 31: The Restore Setups submenu

Editing a Setup

To edit an existing, saved setup:

1. Recall the Setup through the Recall Setups submenu.

2. Change the instrument settings as desired.

3. Save the Setup as the same setup number through the Save Setups submenu.

Reference

This section contains detailed information about the more technical aspects of 764 operation. The subsections are: *Level Meters*, *Correlation Meter Algorithm*, *Selecting Headphone Channels*, *Submenus*, and *Using the RS-232 Port*.

Level Meters

Also refer to *The Level Meters Submenu* beginning on page 48.

Meter Ballistics and Alignment Levels

The many level meter options in the 764 may leave the user wondering which settings to use for a given installation or application. The short answer is to choose settings to emulate the meters that you are accustomed to. However, you may not find the translation between the analog and digital worlds completely straightforward. Or, you may wish to modify your practice and adopt certain standards to ease inter-platform and international program exchange. In either case, the next few paragraphs may help you decide on the Ballistics, Peak Program Level, Test Level, and "0 dB Mark" settings for your 764.

To ease signal exchange between equipment, EBU Recommendation R68–1992 suggests that the alignment level be set at 18 dB below maximum digital coding level (that is, –18 dBFS). This level corresponds to the CCIR 645 [renamed ITU–R BS.645–2] analog alignment level, and allows adequate headroom above the permitted maximum level for (PPM) metering and meter-reading errors. The permitted maximum level, as defined in CCIR 645, is 9 dB (or 8 dB, in some organizations) above the alignment level.

A practical way of configuring the 764 to implement the above recommendation with PPM ballistics is to set the Test Level to the EBU-recommended alignment level of–18dBFS, and set the Peak Program Level to the permitted maximum level of –9 dBFS (or –10 dBFS). You may choose to set the 0 dB mark to either the Peak Program Level or Digital Full Scale. With the 764**,** the true peaks are

always indicated by the peak segment, so actual headroom is always visible.

With VU ballistics, the Test Level should correspond to the same level as above (–18 dBFS) if program exchange is important. In accordance with standard practice, the Test Level ("line–up level") corresponds to 0 VU, so you may set the 0 dB mark to the Test Level. If program material is then peaked at 0 dB, you can expect actual peaks to be 8 to 14 dB higher (which can be easily seen with the true peak indicators of the 764). A good setting for the Peak Program Level would be in the range of –8 to –10 dBFS. IEEE 152–1991 recommends that the VU meter readings of program material be 8 dB below those of a PPM meter to get the same actual program level. The above setup accomplishes that.

All of the above is for standardizing digital recordings or digital transmissions for international program exchange. Individual organizations may have their own internal standards. Some experienced recording engineers prefer a higher alignment level than –18dBFS to make fuller use of the available coding range for a better S/N ratio. Others are more conservative. For example, SMPTE (in RP 155–90) recommends a "reference" level of –20 dBFS.

And, of course, digital purists may always select True Peak ballistics.

In-Bar Warning Messages

The in-bar warning messages (for example, INPUT UNLOCKED, in the Channel 3 and 4 meter bars in Figure 32) are listed below in order of error condition priority. Higher priority errors preempt lower priority ones. Messages—or "Flags"— are displayed for as long as the error condition lasts plus n seconds, where n is the CLIP/MUTE hold time set through the Level Meters submenu (see page 52). The INPUT UNLOCKED and LOW CONFidence flags will always appear in both bars of the affected input; all other messages can appear in one or both bars, depending on channel content.

INPUT UNLOCKED —The 764 is not locked to an incoming signal on the indicated input channel. Data cannot be decoded; all data and all other errors are ignored. This message will appear when no input signal is present.

CODE ERR — A bi-phase coding violation (ERRor) has occurred in the digital data stream. All affected data samples are unreliable, and are therefore ignored. The instrument treats affected samples as "zero samples" for use by the meter bars and phase display. When Session is running, the instrument counts code violations and displays the total on the Session view.
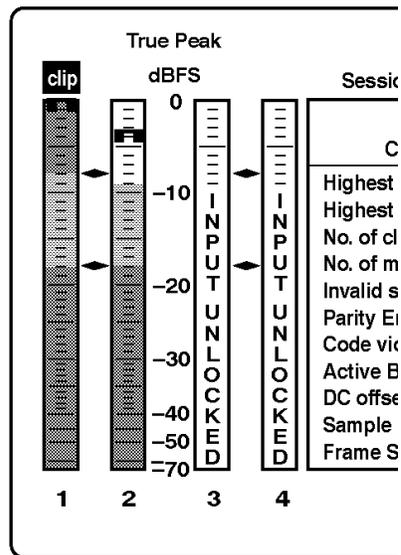
Figure 32: An "in-bar" warning message

PARITY — The incoming subframe does not have even parity as specified by the applicable digital audio standards. The data sample is unreliable and is ignored. The meter bars and phase pattern treat the sample as a zero sample. When Session is running, the instrument counts parity errors and displays the total on the Session view.

LOW CONF — (Low Confidence.) This warning message indicates a marginal signal on the serial digital interface. Problems that can trigger this message — such as significant jitter or low signal amplitude — will usually result in a poor "eye" pattern when the serial digital signal is displayed on appropriate equipment.

V BIT — Indicates that the Validity bit is set high for one or more data samples. In the AES/EBU standard, a set validity bit indicates that the sample is not suitable for conversion to audio. By default, The meter bars and phase display treat the affected samples as a zero samples. When Session is running, the instrument counts "invalid samples" and displays the total on the Session view.

You can suppress the V BIT message by setting the "Ignore Validity Bit" item in the Level Meters submenu to YES. If you do so, the 764 will treat all samples as valid, and the word "off" will appear in the Invalid samples fields of the Session view. This feature is included because the use of the Validity bit varies despite its official meaning as specified in the AES/EBU standard, and you may find it desirable to monitor audio from "invalid" samples.

Correlation Meter Algorithm

The correlation meter reading is calculated 60 times each second from $\frac{1}{60}$-second-long blocks of interpolated ("4x oversampled") input data. The formula used to drive the correlation meter is:

$$C = (sign) \times \sqrt{\frac{\left[\displaystyle\sum_{n=0}^{4fs/60}(L_nR_n)\right]^2}{\left[\displaystyle\sum_{n=0}^{4fs/60}(L_n)^2\right]\left[\displaystyle\sum_{n=0}^{4fs/60}(R_n)^2\right]}}$$

Where

f_s = the sampling frequency, in Hz (for example, 48000);
L_n = the value of the nth left-channel sample; and
R_n = the value of the nth right-channel sample

and

$$(sign) = (+1) \text{ if } \sum_{n=0}^{4fs/60} (L_n R_n) \text{ is } > 0$$

or

$$(sign) = (-1) \text{ if } \sum_{n=0}^{4fs/60} (L_n R_n) \text{ is } < 0$$

The actual correlation meter reading is the "rolling average" of the last i sample blocks:

$$M = \frac{C_1 + C_2 +,\dots, + C_i}{i}$$

where i is determined by the Correlation Meter Speed setting in the Phase Display submenu. Table 1 lists i—and the corresponding averaging interval—for each meter speed selection.

Table 1: Correlation meter speed averaging intervals

Speed setting	i	Equivalent interval (s)	Speed setting	i	Equivalent interval (s)
1	1	0.0167	11	180	3.0
2	2	0.0333	12	210	3.5
3	4	0.0667	13	240	4.0
4	8	0.1333	14	270	4.5
5	16	0.2667	15	300	5.0
6	32	0.5333	16	330	5.5
7	60	1.0	17	360	6.0
8	90	1.5	18	390	6.5
9	120	2.0	19	420	7.0
10	150	2.5	20	450	7.5

Selecting Headphone Channels

By factory default, the headphone output follows the phase display. That is, you can listen to the audio programs that are currently driving the Lissajous pattern and Correlation meter (refer to *The Phase Display* beginning on page 26). When you change the phase display channels—either by selecting the other display pair (A or B), or through the phase display menu—the headphone output will contain the audio on the newly-selected input channels.

You can also configure the headphone output to listen to any two input channels you wish, independent of the phase display selections. Follow these steps to make "manual" headphone selections:

1. Enter the top menu (either by pressing **MENU** or the TOP MENU soft button, if already in a submenu).

2. With the multi-function knob, move the menu item highlight to Headphones. Then press a soft button to enter the submenu.

3. Set the Audio Source to MANUAL.

4. Select the appropriate "Manual Left Channel" and "Manual Right Channel."

5. Press **CLEAR MENU** to exit the on-screen menus and resume normal operation.

Submenus

The various 764 submenus are summarized below. See the *Getting Started* section of this manual, starting on page 1, for an explanation of general menu techniques.

The Level Meters Submenu

Use this Submenu to configure the appearance and behavior of the Audio View level meters.

Table 2: Level Meters submenu

Item	Choices	Factory setting
Display Mode	4 Channels Ch 1–2 and Sum & Diff Ch 3–4 and Sum & Diff	4 Channels
Interpolation	OFF; ON	ON
Ballistics	PPM True Peak Extended VU	True Peak
Peak Hold Time	0 to 10 seconds	2
Peak Program Level (dBFS)	0 to –30 dBFS (cannot be set below Test level)	–8 dBFS
Test Level (dBFS)	0 to –30 dBFS (cannot be set above Peak Program level)	–18 dBFS
Set 0 dB Mark to	DIGITAL FULL SCALE PEAK PROGRAM TEST LEVEL	DIGITAL FULL SCALE
Consecutive FS Samples for CLIP	1 to 100	1
Consecutive "0" Samples for MUTE	0 to 100	10
CLIP/MUTE Hold Time (sec)	1 to 30	2
Ignore Validity Bit	NO; YES	NO
Suppress Sync Loss Flags	NO; YES	NO

Display Mode. Use the Display Mode setting to configure the audio view to contain four level meters (as shown in Figures 15 and 17 on pages 19 and 23 respectively) or two level meters plus Sum and Difference bars. When Sum and Difference bars are selected, the two left-hand bars show the levels of one input pair (either channels 1–2

or channels 3–4); the right-hand bars show (L+R)/2 (Sum) and (L–R)/2 (Diff) data derived from the two left-hand bars. The Sum and Difference bars use the same scale and ballistics, and all other settings, as the channel level meters.

Interpolation. When interpolation is OFF, the 764 level meters measure the digital input data only. When interpolation is ON, the instrument also measures interpolated data generated by a 4X oversampling filter. Select OFF to see the levels encountered by the digital equipment (such as recorders, processors, and transmitters) in your system. Choose ON to see a more accurate representation of the levels in the reconstructed analog audio program.

A display message—immediately below the level meters—reminds you when Interpolation is set to OFF; see Figure 33.
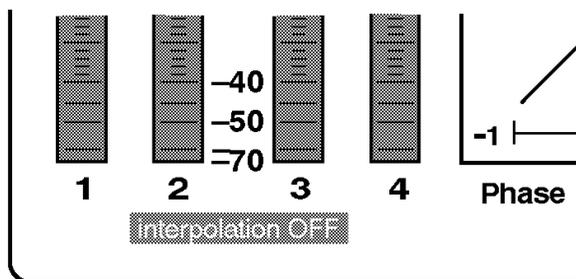
Figure 33: The "interpolation OFF" message

Ballistics. Use the Ballistics item to configure the dynamic response of the level meters to conform to one of three "standards":

■ PPM (peak program meter), which shows "quasi-peak" levels as defined in IEEE Std. 152–1991 and IEC 268–10a. When PPM ballistics are selected, the meters also contain true peak indicators, and the display designation is "PPM + Peak."

■ True Peak, which shows actual signal peaks regardless of their duration. Rise and Fall times are essentially instantaneous, although the in-bar peak indicator will persist at program peaks for the "peak hold time," described below.

■ Extended VU, a VU meter as defined in IEEE 152–1991, but with an extended dB-linear scale. The 764 meter bars will also contain true peak indicators when Extended VU is selected, and the display designation of this setting is "vu + Peak."

Note that this setting only affects meter performance when the input is "live," changing audio. A constant 1000 Hz, –10 dBFS tone, for example, will drive the meters to a constant –10 dBFS reading regardless of which Ballistics setting is selected.

Peak Hold Time. Peak Hold time is the number of seconds that the true peak indicator (see Figure 15, item 8 on page 19) remains at the most recent peak. Set the hold time to 0 to turn the peak indicator Off.

Peak Program Level (dBFS). Peak Program level is the level—relative to digital full scale—that you choose as the maximum desired level for monitored programs. The meter bars change to maximum brightness (on the 764 display) or red (on an external VGA monitor) above Peak Program level.

Test Level (dBFS). Test level is the level—relative to digital full scale—that you choose as the test or "line up" level for your system. The meter bars change to medium brightness (on the 764 display) or yellow (on an external VGA monitor) between the Test and Peak Program levels.

Set 0 dB Mark to. Use this item to number the meter scale relative to Digital Full scale or to one of the two user-adjustable levels. When the zero mark is set to either Peak Program or Test level, the scale units are dBr, relative to the 0 dB level; units above the selected 0 dB mark are positive, while units below it are negative.

Consecutive FS Samples for CLIP. Select the number of successive full-scale samples that constitute a "Clip." This setting determines when a clip flag (see Figure 15, item 9 on page 19) appears above a level meter, and it also affects the number of clips detected during a Session and included in a session report (refer to *The Session Display* beginning on page 29). The range for this setting is 1 to 100; the factory default is 1.

Consecutive "0" Samples for MUTE. Use this item to select the number of successive full-scale samples that constitute a "Mute." This setting determines when a MUTE indicator (see Figure 15, item 6 on

page 19) appears in a level meter, and it also affects the number of clips detected during a Session and included in a session report (refer to *The Session Display* beginning on page 29). The range for this setting is 0 to 100; a setting of 0 turns mute detection Off, in which case no mutes will be reported on the session display or in a session report. The factory default is 10.

CLIP/MUTE Hold Time (sec). CLIP/MUTE hold time is the number of seconds that the Clip indicator and various In-bar warning messages will persist after the end of the Clip, Mute, or error condition. For more information, refer to *In-Bar Warning Messages* beginning on page 44.

Ignore Validity Bit. Ignore Validity Bit determines how the instrument will react to a high (value 1) validity bit in the input data. In AES3-1992 digital audio, a high validity bit indicates that the sample word is not suitable for conversion to audio. When this item is set to the factory default of "No," the 764 will ignore any sample accompanied by a high validity bit, display a "V BIT" flag in the level meter, and report invalid samples on the session display and report. When set to Yes, invalid sample reporting will be turned Off, and the instrument will treat all samples as valid.

Suppress Sync Loss Flags. Use this setting to suppress the SYNC ERR flags and "No Reference Signal" message when no DAR (digital audio reference) is connected to the REFERENCE input, or to prevent "nuisance flashing" of the SYNC ERR message when the input signals have differing sample rates.

The De-emphasis Submenu

The De-emphasis submenu, shown in Table 3, lets you select the appropriate de-emphasis for each of the four input channels. Enter the De-emphasis submenu from the TOP menu level by scrolling the highlight to the De-emphasis item and pressing a soft button. Then scroll the highlight to the desired channel. The four submenu items are identical, except for the affected channel.

Table 3: De-emphasis submenu

Item	Choices	Factory setting
Channel # (Where # = 1, 2, 3, or 4)	NONE AUTO CCITT J.17 50/15	NONE

Selecting either CCITT J.17 or 50/15 will force that type of de-emphasis. When AUTO is selected, the 764 will apply the appropriate de-emphasis if either CCITT J.17 or 50/15 emphasis is indicated in the channel status data of the digital input signal.

If you choose de-emphasis, please be aware that—although the 764 will continue to use raw input data when reporting MUTEs and CLIPs— the level meters and session statistics will measure and report levels in the *de-emphasized* signal. Because de-emphasis attenuates the higher frequencies of a signal, selecting de-emphasis may result in meter readings and true peak statistics that understate the actual signal levels.

When any type of de-emphasis has been selected, it is indicated by a "flag" on the display above the meter pair, as shown in Figure 34. In the configuration pictured, de-emphasis has been selected for input channels 1, 2, and 3—but not for channel 4. (If de-emphasis was also not selected for channel 3, the "De-emp" flag would not appear above the right-hand meter pair.)
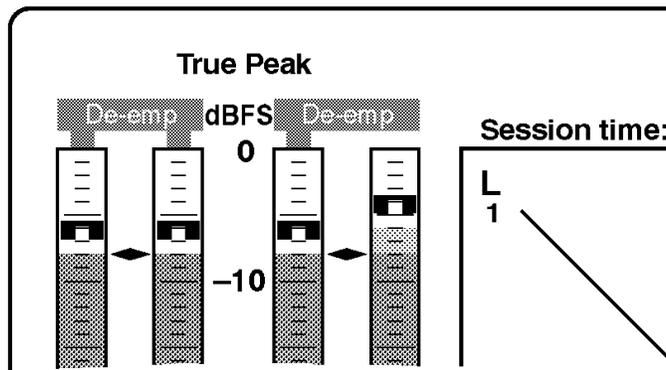
Figure 34: The De-emphasis flags

The Phase Display Submenu

Use the Phase Displaly submenu (Table 4) to configure the appearance and behavior of the Audio View Phase display.

Table 4: Phase Display submenu

Item	Choices	Factory setting
Format	LISSAJOUS-SOUND-STAGE LISSAJOUS-X–Y	LISSAJOUS-SOUND-STAGE
Correlation Meter Speed	1 to 20	8
Pair A Left channel assignment	1; 2; 3; 4	1
Pair A Right channel assignment	1; 2; 3; 4	2
Pair B Left channel assignment	1; 2; 3; 4	3
Pair B Right channel assignment	1; 2; 3; 4	4

Format. To change the phase display format, scroll to this menu choice and then press the soft button that corresponds to the desired

display orientation. Refer to page 26 for details on the phase display formats.

Correlation Meter Speed. The Correlation Meter Speed setting determines how quickly the meter reacts to changes in phase relationship. The meter reading is actually an average of correlation over time, and this setting determines how many samples are used to calculate the average. The 764 uses the fewest samples when this setting is 1, and the meter reacts almost instantaneously. The instrument uses the most samples when the setting is 20, and the meter reacts much more slowly. Experiment to find the setting that best fits your application. For more information about this setting, refer to *Correlation Meter Algorithm* on page 46.

Pair A [B] Left [Right] channel assignment. These four choices let you pair any two of the four input channels on the phase display. By default, channels 1 and 2 are phase pair A, and channels 3 and 4 are pair B. You can, however, designate channels 1 and 3 or 1 and 4—or channels 2 and 3 or 2 and 4—as either pair A or pair B.

Change the channels of the phase pairs using the following steps:

1. Press the MENU button.

2. Turn the multifunction knob until PHASE DISPLAY is highlighted.

3. Push any of the inner group white soft key buttons to the right of the display screen to bring up the Phase Display screen.

4. Rotate the multifunction knob to highlight Pair A left or right, or Pair B left or right..

5. Push the appropriate white soft key buttons to set any channel 1 through 4 to left and right of either Pair A or Pair B.

6. Push CLEAR MENU button to return to the screen that was displayed before you pushed the MENU button.

Note that if you pair channels from different inputs, the two data streams must be synchronized. If data slippage is 1/2 frame or greater, the 764 will not be able to unambiguously identify left-right sample pairs and the phase display will not be reliable. If that happens, a warning message appears on the display.

Headphones Submenu

Use the Headphone submenu (Table 5) to determine the input channels to be decoded and output through the headphone jack.

Table 5: Headphones submenu

Item	Choices	Factory setting
Audio Source	AUTO (follows phase); MANUAL	AUTO (follows phase)
Manual Left Channel	1; 2; 3; 4	1
Manual Right Channel	1; 2; 3; 4	2

Input Submenu

Select the active connectors for the digital audio and reference inputs through this submenu.

Table 6: Input submenu items (standard instrument)

Item	Choices	Factory setting
CH 1–2 input	XLR-balanced BNC-unbalanced	XLR-balanced
CH 3–4 input	XLR-balanced BNC-unbalanced	XLR-balanced
Reference input	XLR-balanced BNC-unbalanced	XLR-balanced

In instruments equipped with Option 01 (embedded audio input), the Input submenu is changed to accommodate the additional input choice; the submenu also changes depending on the chosen input. Table 7 describes the input submenu in Option 01 instruments when the audio source selection is digital audio inputs. Table 8 describes the submenu when digital video input is selected.

Please refer to *Appendix C: Options,* beginning on page 89, for more information about Option 01.

Table 7: Option 01 input submenu, audio inputs selected

Item	Choices	Factory setting
Audio Source	Digital Audio Inputs Digital Video Input	Digital Audio Inputs
CH 1–2 input	XLR-balanced BNC-unbalanced	XLR-balanced
CH 3–4 input	XLR-balanced BNC-unbalanced	XLR-balanced
Reference input	XLR-balanced BNC-unbalanced	XLR-balanced

Table 8: Option 01 input submenu, video inputs selected

Item	Choices	Factory setting
Audio Source	Digital Audio Inputs Digital Video Input	(see Table 7)
Channels	1 through 4 5 through 8 9 through 12 13 through 16	1 through 4

Time Code Submenu

Select the time code to be displayed on the Session Display and used to time-stamp errors on Session reports.

Table 9: Time Code submenu

Item	Choices	Factory setting
Time code in use	SESSION VITC LTC	SESSION

Serial Port Submenu

The Serial Port submenu contains items used for setting the serial port parameters and controlling the content of the session report. The items and choices are listed in Table 10 and explained in the subsequent paragraphs.

Table 10: Serial Port submenu items

Item	Choices	Factory setting
Flow Control	SOFTWARE; HARD-WARE; BOTH; NONE	SOFTWARE
Baud Rate	38400; 19200; 9600; 2400	38400
Copy	NO REPORT; SHORT REPORT; LONG RE-PORT	NO REPORT
Peak Reading Interval (sec)	0, 1, 2, ..., 300 (seconds)	60

Flow Control. Scroll to the "Flow Control:" menu choice (by turning the multi-function know) and then press the soft button that corresponds to the appropriate type of flow control. If you do not know which flow control is correct for your application, first try HARDWARE when outputting a report to a printer, and SOFTWARE when downloading a report to a personal computer.

Baud Rate. Scroll to the "Baud Rate:" menu choice and press the soft button that corresponds to rate that is used by the receiving printer or PC. For fastest data transfer when outputting a session report to a PC, select the highest baud rate available in both the 764 and the PC; then, if you experience difficulty with flow control between the 764 and the PC, set both to the next lower baud rate available and try again.

Copy. The Copy submenu item determines the type of report that is output when you press the Copy soft button (see Figure 23). When NO REPORT is selected, the "Copy" function is removed from the third soft button, and you cannot output a Session Report.

Peak Reading Interval (sec). Use this item to choose the duration of the peak reading intervals. When a session is running, the 764 stores the time and value of the highest true peak and meter bar readings encountered during each interval. The time-stamped peaks are included in a long report; see Figure 27 (on page 35).

■ This setting does *not* apply to error events (clips, mutes, Invalid samples, Parity Errors, and Code Violations).

■ Program peaks are *not* stored when the setting is 0 (zero).

■ Peaks are time-stamped with the time (Session, VITC, or LTC) that has been selected through the Time Code submenu.

The length of time you may accumulate session statistics depends on this setting and the number of error events that occur. Assuming few clips, mutes, or other errors, the 764 has enough memory for at least 30 minutes of records when the interval is set to 1 second, and over 30 *hours* when the factory setting (60 seconds) is used. Choose an interval that is appropriate to your situation; be aware that the 764 can store enough peak data to fill over 70 pages of text.

NOTE. To prevent unexpected results, change this setting immediately after a session reset only, and not *during a session.*

Save Setups Submenu

Save the current instrument configuration through the Save Setups submenu (Table 11). The current settings will overwrite any configuration previously saved in the Setup.

Table 11: Save Setups submenu

Item	Choices	Factory setting
Selection	SETUP #1 SETUP #2 SETUP #3	(not applicable)

Restore Setups Submenu

Restore a previously saved instrument configuration through the Restore Setups submenu (Table 12). The current instrument settings will be replaced by those in the saved Setup.

Table 12: Restore Setups submenu

Item	Choices	Factory setting
Selection	SETUP #1 SETUP #2 SETUP #3 FACTORY SETUP	(not applicable)

Screen Saver Submenu

Select a suitable delay in the Screen Saver submenu (Table 13) to help prevent display "burn in." Choose an interval long enough to prevent activation during program monitoring. When the screen saver is active, press any button to restore the normal display.

Table 13: Screen Saver submenu

Item	Choices	Factory setting
Delay in Hours	OFF, 1, 2, ..., 23 (hours)	OFF

Service Submenu

Use the Service submenu (Table 14) to select patterns for use in adjusting the display; find the version of software installed in the instrument and the instrument's firmware identification number; and superimpose a numeric readout of signal levels on the Session display. Refer to the 764 service manual for more information.

Table 14: Service submenu

Item	Choices	Factory setting
Adjustment	MONITOR CROSS-HATCH	(not applicable)
Information	SOFTWARE VERSION IDENTIFICATION NUM.	(not applicable)
Numeric Level Readout	OFF; ON	OFF

Adjustment. Once you choose this item, you can cycle through the four available test patterns by repeatedly pressing the top soft button. Patterns are used in adjusting the display during manufacture.

Information. Press the appropriate soft button to access the corresponding information.

Numeric Level Readout. This readout is intended for use in manufacture only; it obscures a large part of the Session display.

Using the RS-232 Port

The primary use of the 764 RS-232 port is to output session reports. The reports can be sent directly to any ASCII printer with serial input, or captured on a PC and saved to disk.

The RS-232 port also supports remote control of 764 Digital Audio Monitors with serial number B020000 and higher. To control the instrument from a personal computer or ASCII terminal, connect it as discussed under *Cable Requirements* and confirm the connection by downloading a session report to the computer or terminal. Then refer to the *Remote Control Commands* section, which begins on page 66.

Cable Requirements

The 764 is an RS-232 DCE device. Table 15 lists the pin assignments of the connector. When communicating with a DTE device that has a male 9-pin (DB9) connector, use a cable that connects pins 2, 3, 5, 7, and 8 straight-through (example: Tektronix part number 012-1445-00). To communicate with another DCE device, use a null modem cable (which swaps the lines between pins 2 and 3 and pins 7 and 8). Figure 35 and Figure 36 illustrate cable wiring for communicating with a device that has a 25-pin serial connector.

Table 15: RS-232 pin assignments

764 DB9 pin	Signal name	Signal direction
1	(optional)	—
2	RXD (Received Data)	From 764
3	TXD (Transmitted Data)	To 764
4	(optional)	—
5	Signal Ground	—
6	(optional)	—
7	RTS (Request to Send)	To 764
8	CTS (Clear to Send)	From 764
9	(optional)	—

NOTE. RS-232 signals are named from the perspective of the DTE device. Since the 764 is a DCE device, pin 2 (Received Data) is an output from the instrument; that is, the data is received by the connected DTE device.

The 764 supports both hardware (RTS/CTS) and software (Xon/Xoff) handshaking; choose the appropriate handshaking protocol through the Serial Port submenu. Set the serial communication parameters of the connected device to 8 bits, 1 stop bit, and no parity. Be sure that the same Baud rate is selected at the 764 and the connected device.
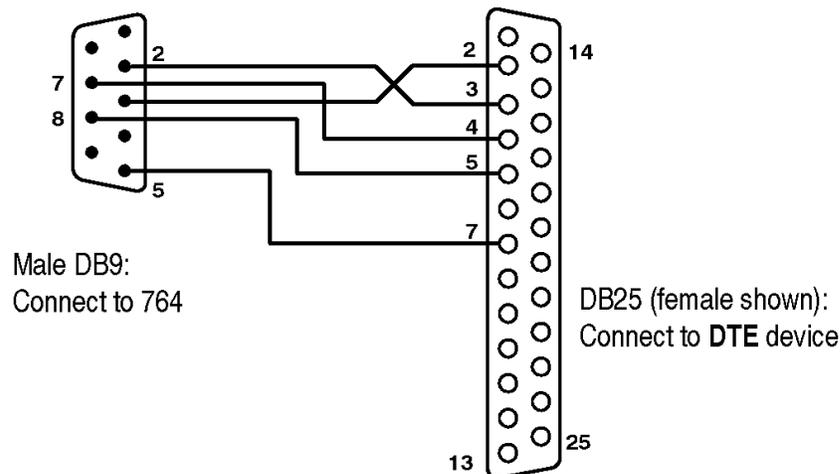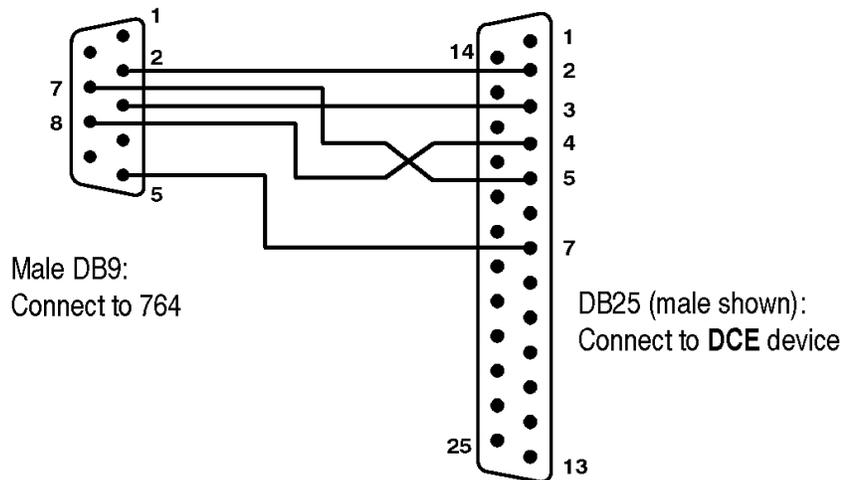

Figure 35: Connecting to a DTE device with a DB25 serial port

Figure 36: Connecting to a DCE device with a DB25 serial port

NOTE. Most Personal Computers are DTE devices; however, printers may be either DTE or DCE, and the type may not be obvious from the printer documentation or the gender of the RS-232 connector. If you have trouble outputting a 764 Session report, first verify that communication parameter and Baud rate settings are correct, then try reversing the conductors at pins 2 and 3 and 7and 8 at the cable end that is connected to the 764.

Communication Examples

The following hardware/software and 764 settings have been verified effective for either printing a session report to a printer or download-ing the report to a PC running Microsoft Windows 3.1. You may find the examples helpful; please note, however, that mention of third-party software or equipment does *not* constitute endorsement or recommendation by Tektronix, Inc. The settings required for your particular printer, PC, and communications software may vary.

Printing. You can use the hardware and software settings described below to print a session report.

■ Printer/port: QMS-PS 410/serial (DB25)

- Printer Communications Settings:

  ESP (automatic protocol sensing)
  9600 (baud)
  8 (bits)
  1 (stop bit)
  DTR/DSR (flow control)

- 764 Serial Port settings:

  Flow Control = HARDWARE
  Baud Rate = 9600

Communicating with a PC. You can use the software and settings below to establish communications with a personal computer.

- PC Software: Microsoft Windows 95 Hyperterminal Accessory application. Many other communications or terminal applications also work.

- Hyperterminal application File menu, **Properties** command, **Connect To** tab settings:

  Connect Using = COMx (depends on computer configuration; often COM2 when a serial mouse is installed)

  Configure...

      Baud Rate = 19200 (or 38400)
      Bits = 8
      Stop Bits = 1
      Parity = none
      Flow Control = Xon/Xoff

- 764 Serial Port settings:

  Flow Control = SOFTWARE
  Baud Rate = 19200 (or 38400)

Be sure to set compatible baud rates before attempting to establish communications. At power-on of the 764, a command prompt (764>) and product identification message will be displayed on the PC or terminal screen when connected.

Outputting a Session Report

You can test your RS-232 connection by outputting a short session report.

1. Confirm that the Copy selection of the 764 Serial Port submenu is set to either SHORT REPORT or LONG REPORT.

2. Clear the on-screen menu and display the Audio Session view.

3. Run a session.

4. Stop the session, but *do not* reset it.

5. Press the on-screen Copy soft button (feature ⑤ in Figure 23 on page 29). The 764 will send the report to the printer or PC. As it sends the report, the monitor indicates the number of remaining lines on the bottom of the display. Press the soft button a second time to cancel the report.

Remote Control Commands

Once you have established communications between the 764 and a personal computer or ASCII terminal, you may use the remote control commands to operate the audio monitor from the computer or terminal.

Command Syntax. Use the colon (:) as the command argument separator as in the following examples:

```
PRESS:SKEY4  (the command to press soft key number 4)
```

```
MENU:DISMODE:1  (the command to display the sum and
difference of Channel 1 and Channel 2)
```

You can string the remote commands together on a single command line. Use a semicolon (;) to separate commands on the line as in the following example:

```
PRESS:APH;GET:CURTP:2;GET:SHIGH:2; ...
```

The commands are not case-sensitive although this section shows them in all uppercase for clarity. You can also abbreviate the commands. Only enough letters to make the command unique need be used in a command as shown in the following example:

```
G:T;G:SA:1;P:AU
```

The example command gets the time, gets the sample rate from the Channel 3 – Channel 4 input, and presses the View Audio button. When you abbreviate a command, you cannot leave out letters in the middle of a command argument. If the complete argument is needed to make a command unique, all the argument alphanumerics must all be used. For example:

> PRESS:SKEY5 can be abbreviated as p:skey5, but the complete argument is necessary. The unique letter or number is the last one of the argument.

If you send an abbreviated argument that is not unique, the first command in the list that is recognized is done. If you send a command with unrecognized syntax, an error message is displayed showing the incorrect command. If you are in doubt about an abbreviation, use the entire argument.

General Commands. Table 16 lists and explains the general or miscellaneous 764 remote control commands.

Table 16: General remote control commands

Command	Effect
HELP	Displays the list of remote commands
KNOB:UP:<1–10>	Scrolls up a menu or data list by the specified number of positions or turns the knob one increment "up."
KNOB:DOWN:<1–10>	Scrolls down a menu or data list by the specified number of positions or turns the knob one increment "down."
KNOB:?	Displays the syntax for the KNOB command
ECHO:ON	Turns command echo on; echo on is the default.
ECHO:OFF	Turns command echo off; your command entry will not appear on the computer or terminal display.
ECHO	Displays the current state of ECHO, on or off.
ECHO:?	Displays the syntax of the ECHO:ON/OFF command
RESET	Resets the instrument to a power-up state.

Table 16: General remote control commands (Cont.)

Command	Effect
MSGON:<text>	Displays a temporary message up to 58 characters on the top line of the 764 display. Excess text does not wrap; it is truncated.
MSGOFF	Removes the temporary message.
SYSTEM:ERROR	Returns the last command error.
SYSTEM:ERROR:CLEAR	Clears the last command error.

GET Commands. GET commands retrieve information from the 764; Table 17 lists and explains the GET commands.

```
SYNTAX:        GET:mnemonic:<number> (no number or
invalid number returns all selections for the mnemonic).
```

Table 17: Remote control GET commands

Command	Value = selection	Retrieves
GET:?	*none*	Lists all the GET commands
GET:mnemonic	*none*	All the values for the command mnemonic
GET:TIME	*none*	Current (Session, LTC, or VITC) time
GET:FRAME:<0–1>	0=Ch 1–2 input 1=Ch 3–4 input	Frame Sync Errors
GET:SAMPR:<0–1>	0=Ch 1–2 input 1=Ch 3–4 input	Sample rate
GET:RAWSR:<0–1>	0=Ch 1–2 input 1=Ch 3–4 input	Raw sample rate
GET:ERRFLAG:<0–1>	0=Ch 1–2 input 1=Ch 3–4 input	Error flags
GET:BARFLAG:<0–3>	0=Meter bar #1 1=Meter bar #2 2=Meter bar #3 3=Meter bar #4	Bar flags

Table 17: Remote control GET commands (Cont.)

Command	Value = selection	Retrieves
GET:WARFLAG:<0–3>	0=Meter bar #1 1=Meter bar #2 2=Meter bar #3 3=Meter bar #4	Warning flags
GET:CURTP:<0–3>	0=Meter bar #1 1=Meter bar #2 2=Meter bar #3 3=Meter bar #4	Current true peak
GET:SPEAK:<0–3>	0=Meter bar #1 1=Meter bar #2 2=Meter bar #3 3=Meter bar #4	Session true peak
GET:RAWTP:<0–3>	0=Meter bar #1 1=Meter bar #2 2=Meter bar #3 3=Meter bar #4	Raw true peak
GET:CURHP:<0–3>	0=Meter bar #1 1=Meter bar #2 2=Meter bar #3 3=Meter bar #4	Current high peak
GET:SHIGH:<0–3>	0=Meter bar #1 1=Meter bar #2 2=Meter bar #3 3=Meter bar #4	Session high peak
GET:RAWHP:<0–3>	0=Meter bar #1 1=Meter bar #2 2=Meter bar #3 3=Meter bar #4	Raw high peak
GET:FILESPACE	*none*	File space free
GET:LREPORT	*none*	Long session report
GET:SREPORT	*none*	Short session report

PRESS Commands. Each front-panel button (except the power switch) has an equivalent PRESS:<button> command. Send the command to perform the same action as pressing the button.

Table 18: Remote control PRESS commands

Command	Equivalent button
PRESS:?	Lists all the PRESS commands
PRESS:APH	PHASE DISPLAY:A
PRESS:AUDIO	VIEW:AUDIO
PRESS:BPH	PHASE DISPLAY:B
PRESS:CHSTAT	VIEW:CH STATUS
PRESS:CLEAR	CLEAR MENU
PRESS:CUSTOM	METER SCALE:CUSTOM
PRESS:EXPAND	METER SCALE:EXPAND
PRESS:NORMAL	METER SCALE:NORMAL
PRESS:MENU	MENU
PRESS:OFFSET	METER SCALE:OFFSET
PRESS:OTHER	VIEW:OTHER
PRESS:SESSION	PHASE DISPLAY: SESSION
PRESS:SKEY1	Soft Button #1 (top)
PRESS:SKEY2	Soft Button #2
PRESS:SKEY3	Soft Button #3
PRESS:SKEY4	Soft Button #4
PRESS:SKEY5	Soft Button #5 (bottom)
PRESS:USER	VIEW:USER DATA

MENU Commands. Use the MENU commands listed in Table 19 to make selections from the 764 on-screen menus. The menus need not be visible on the display to change a setting with a MENU command.

```
SYNTAX:        MENU:mnemonic:<number> (unrecognized
number returns "Out Of Range Error")
```

Table 19: Remote control MENU commands

Command	Value = setting	Submenu, item
MENU:?		Lists the Menu commands
MENU:mnemonic:?		Lists the command syntax for the queried mnemonic and gives the current setting
MENU:DISMODE:<0–2>	0=4 Channels 1=Ch 1–2 + Sum & Diff 2=Ch 3–4 + Sum & Diff	Level Meters, Display Mode
MENU:INTERP:<0–1>	0=ON 1=OFF	Level Meters, Interpolation
MENU:BALLIST:<0–2>	0=True Peak 1=PPM 2=Extended VU	Level Meters, Ballistics
MENU:PHTIME:<0–10>	0 to 10 seconds	Level Meters, Peak Hold Time
MENU:PPGMLVL:<−30–0>	−30 to 0 dBFS	Level Meters, Peak Program Level
MENU:TESTLVL:<−30–0>	−30 to 0 dBFS	Level Meters, Test Level
MENU:ZERODB:<0–2>	0=Dgt. Full Scale (dBFS) 1=Peak Program (dBr) 2=Test Level (dBr)	Level Meters, Set 0 dB Mark to
MENU:CLIP:<1–100>	1 to 100 samples	Level Meters, Consecutive FS Samples for CLIP
MENU:MUTE:<0–100>	0 to 100 samples	Level Meters, Consecutive "0" Samples for MUTE
MENU:CMTIME:<1–30>	1 to 30 seconds	Level Meters, CLIP/MUTE Hold Time(sec)
MENU:IGVBIT:<0–1>	0=NO 1=YES	Level Meters, Ignore Validity Bit

Table 19: Remote control MENU commands (Cont.)

Command	Value = setting	Submenu, item
MENU:SYNCF:<0–1>	0=NO 1=YES	Level Meters, Suppress Sync Loss Flags
MENU:DEEMP1:<0–3>	0=None 1=Auto 2=CCITT J.17 3=50/15	De-emphasis, Channel 1
MENU:DEEMP2:<0–3>	0=None 1=Auto 2=CCITT J.17 3=50/15	De-emphasis, Channel 2
MENU:DEEMP3:<0–3>	0=None 1=Auto 2=CCITT J.17 3=50/15	De-emphasis, Channel 3
MENU:DEEMP4:<0–3>	0=None 1=Auto 2=CCITT J.17 3=50/15	De-emphasis, Channel 4
MENU:PDISP:<0–1>	0=Lissajous–Soundstage 1=Lissajous–XY	Phase Display, Format
MENU:CORR:<1–20>	1 to 20 (see page 46)	Phase Display, Correlation Meter Speed
MENU:PALEFT:<0–3>	0=channel #1 1=channel #2 2=channel #3 3=channel #4	Phase Display, Pair A: Left Channel Assignment
MENU:PARIGHT:<0–3>	0=channel #1 1=channel #2 2=channel #3 3=channel #4	Phase Display, Pair A: Right Channel Assignment
MENU:PBLEFT:<0–3>	0=channel #1 1=channel #2 2=channel #3 3=channel #4	Phase Display, Pair B: Left Channel Assignment

Table 19: Remote control MENU commands (Cont.)

Command	Value = setting	Submenu, item
MENU:PBRIGHT:<0–3>	0=channel #1 1=channel #2 2=channel #3 3=channel #4	Phase Display, Pair B: Right Channel Assignment
MENU:AUDSRC:<0–1>	0=Manual 1=Auto (follows phase)	Headphones, Audio Source *(also applies to Option 02)*
MENU:MLEFT:<0–3>	0=channel #1 1=channel #2 2=channel #3 3=channel #4	Headphones, Manual Left Channel *(also applies to Option 02)*
MENU:MRIGHT:<0–3>	0=channel #1 1=channel #2 2=channel #3 3=channel #4	Headphones, Manual Right Channel *(also applies to Option 02)*
MENU:SOURCE:<0–1> *(Option 01 only)*	0=Digital Audio Inputs 1=Digital Video Input	Input, Audio source
MENU:CH1–2IN:<0–1>	0=XLR–balanced 1=BNC–unbalanced	Input, CH 1–2 Input
MENU:CH3–4IN:<0–1>	0=XLR–balanced 1=BNC–unbalanced	Input, CH 3–4 Input
MENU:REFINP:<0–1>	0=XLR–balanced 1=BNC–unbalanced	Input, Reference Input
MENU:SD_GROUP:<0–3> *(Option 01 only)*	0=1 through 4 1=5 through 8 2=9 through 12 3=13 through 16	Input, Channels
MENU:TIME:<0–2>	0=SESSION 1=VITC 2=LTC	Time Code, in use
MENU:FLOW:<0–3>	0=Software 1=Hardware 2=Both	Serial Port, Flow Control

Table 19: Remote control MENU commands (Cont.)

Command	Value = setting	Submenu, item
MENU:BAUD:<0–3>	0=38400 1=19200 2=9600 3=2400	Serial Port, Baud Rate (Changing the Baud rate interrupts the remote connection)
MENU:COPY:<0–2>	0=No Report 1=Short Report 2=Long Report	Serial Port, Copy
MENU:PR–INT:<0–300>	0 to 300 seconds	Serial Port, Peak Reading Interval
MENU:SAVE:<0–2>	0=Setup #1 1=Setup #2 2=Setup #3	Save Setups, Last Saved (saves the current setup as setup #*n*)
MENU:RESTORE:<0–3>	0=Setup #1 1=Setup #2 2=Setup #3 3=Factory Setup	Save Setups, Last Restored (restores setup #*n*)
MENU:SCRSVR:<0–23>		Screen Saver, Delay in Hours
MENU:INFO:<0–1>	0=Software Version 1=Identification Num.	Service, Information
MENU:NUMERIC:<0–1>	0=OFF 1=ON	Service, Numeric Level Readout
MENU:HOME		Selects (highlights) the first item of the current menu or submenu

Appendix A: Specifications

Table 20: Digital audio inputs

Characteristic	Performance requirements	Supplemental information
Impedance		
Balanced inputs (XLR)		
Term switched in	$110\,\Omega \pm 5\%$	0.1 MHz to 6 MHz
Term switched out	Return loss >30dB	0.1 MHz to 6 MHz. Relative to $110\,\Omega$ load at loop-through connector.
Unbalanced inputs	Return loss > 30dB	Relative to $75\,\Omega$ load at loop-through connector.
Input level		
Balanced inputs	0.2 to 10 V_{p-p}	
Unbalanced inputs	50 mV_{p-p} to 2 V_{p-p}	
Reference input		
Balanced input		
Connector type		XLR, terminated, no loop-through
Input impedance	$110\,\Omega \pm 10\%$	0.1 to 6 MHz
Input level	0.6 to 10 V_{p-p}	
Unbalanced input		
Connector type		BNC, terminated, no loop-through
Input impedance	$75\,\Omega \pm 10\%$	0.1 to 6 MHz
Input level	0.2 V_{p-p} to 2 V_{p-p}	
Sample rate locking range, all audio inputs	27 kHz to 52 kHz	

Table 21: Level Meters and Phase Display

Characteristic	Performance requirements	Supplemental information
Attack and Decay Characteristics:		Ballistics only: normal *scale* does not comply with standards.
True Peak	PPM decay characteristics	No attack delay
PPM	per IEC 268-10A and IEEE std. 152-1991	
VU	per IEEE std. 152-1991	
Level Meter accuracy	$\pm$0.05 dB	Steady 1 kHz tone, Full Scale to –20 dBFS, no de-emphasis.
AGC Control Range	0 dBFS to –40 dBFS	Lissajous pattern

Table 22: SMPTE Time Code inputs

Characteristic	Information
VITC (Vertical Interval Time Code)	Reads NTSC and PAL VITC conforming to IEC publication 461; indicates time as Hours:Minutes:Seconds.
Input connector	BNC, 75Ω termination, no loop-through
Input signal	Video with VITC, 1 volt nominal
LTC (Longitudinal Time Code)	LTC conforming to IEC publication 461; indicates time as Hours:Minutes:Seconds.
Input connector	XLR balanced, 600Ω termination, no loop-through
Input signal	Range: 250 mV$_{p-p}$ to 10 V$_{p-p}$.

Table 23: Interface parameter measurements

Characteristic	Performance requirements	Supplemental information
Sample rate		
Range	27 kHz to 52 kHz	
Resolution	0.01 kHz	

Table 23: Interface parameter measurements (Cont.)

Characteristic	Performance requirements	Supplemental information
Accuracy	Within .01 kHz	
Synchronization		
Range	$\pm$40% of dig. audio frame	
Accuracy	$\pm$2% of digital audio frame	
Indication		"Frame Sync Err" (session view)

Table 24: Headphone output

Characteristic	Performance requirements	Supplemental information
Output voltage	$> 10\ V_{p\text{-}p}$	into 150 Ω load, 0 dBFS input
Frequency response	20 Hz to 20 kHz $\pm$2 dB	
Balance	$\pm$0.5 dB	
Distortion	THD+N $<$ 0.05%	20 kHz measurement bandwidth

Table 25: VGA output

Characteristic	Information
Resolution	640 X 480 VGA
Signal Level Voltage	
White	0.7 V
Black	0 V
Blanking	0 V
Horizontal Sync	TTL, low true
Vertical Sync	TTL, low true

Table 25: VGA output (Cont.)

Characteristic	Information
Load Impedance	
Red	75 ohms
Green	75 ohms
Blue	75 ohms
Horizontal Sync	TTL compatible
Vertical Sync	TTL compatible
Timing/Frequency	
Dot Clock	25.175 MHz
Horizontal Rate	31.469 kHz
Vertical Rate	59.940 Hz
Pin Assignments	
pin: 1	Red
2	Green
3	Blue
4	NC
5	Ground
6	Red Ground
7	Green Ground
8	Blue Ground
9	NC
10	Ground
11	NC
12	NC
13	Horizontal Sync
14	Vertical Sync
15	NC

Table 26: Physical characteristics

Characteristic	Information
Height	$5^{1}/_{4}$ inches (13.3 cm)
Width	$8^{1}/_{2}$ inches (21.6 cm)

Table 26: Physical characteristics (Cont.)

Characteristic	Information
Depth	17 inches (43.2 cm)

Weight
  Net
  Shipping
	
	10 lbs (4.54 kg)
	17 lbs 5 oz (7.85 kg)

Table 27: Power requirements

Characteristic	Information
Input voltage	90–250 VAC
Input frequency	50 or 60 Hz
Current rating	1.5 A Maximum
Power consumption	56 Watts typical

Table 28: Environmental characteristics

Characteristic	Information

Temperature
  Operating
  Storage
	[NOTE: Safety certification compliance to +40 °C]
	0 °C to +50 °C (32 to 122 °F)
	–55 °C to +75 °C (–67 to +167 °F)

Humidity	Will operate at 93% relative humidity for up to five days Meets requirements of the five-day humidity cycling test described in Tektronix standard 062-2847-00

Altitude
  Operating
  Storage
	[NOTE: Safety certification compliance to 2000 m]
	to 15,000 feet (4572 m)
	to 50,000 feet (15420 m)

Vibration (Operating)	15 minutes each axis at 0.013 inch, frequency varied from 7 to 55 to 7 Hz in five-minute cycles with the instrument attached to a vibration platform Dwell for 10 minutes each axis at any resonant frequency, or 33 Hz if no resonant frequency is found (Tektronix std. 062-2858-00).
Shock (non-operating)c	30 Gs, $\frac{1}{2}$ sine, 11 ms duration; 3 shocks per surface

Table 28: Environmental characteristics (Cont.)

Characteristic	Information
Transportation	Meets the requirements of NTSB Test Procedure 1A, category II (24 inch drop)
Equipment Type	Measurement
Equipment Class	Class I (grounded product) (As defined in IEC 1010-1, Annex H.)
Installation Category	Installation Category II (as defined in IEC 1010-1, Annex J)
Pollution Degree	Pollution Degree 2 (as defined in IEC 1010-1; indoor use only)
Emissions	47 CFR, Part 15, Subpart B,Class A

Table 29: Certifications and compliances

EC Declaration of Conformity – EMC	Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities: EN 50081-1 Emissions: EN 55022 Class B Radiated and Conducted Emissions EN 50082-1 Immunity: IEC 801-2 Electrostatic Discharge Immunity IEC 801-3 RF Electromagnetic Field Immunity IEC 801-4 Electrical Fast Transient/Burst Immunity
EMC Compliance	Meets the intent of Directive 89/336/EEC for Electromagnetic Compatibility when it is used with the product(s) stated in the specifications table. Refer to the EMC specification published for the stated products. May not meet the intent of the Directive if used with other products.
FCC Compliance	Emissions comply with FCC Code of Federal Regulations 47, Part 15, Subpart B, Class A Limits

Table 29: Certifications and compliances (Cont.)

Australia/New Zealand Declaration of Conformity – EMC	Complies with EMC provision of Radiocommunications Act per the following standard(s): AN/NZS 2064.1/2 Industrial, Scientific, and Medical Equipment: 1992
EC Declaration of Conformity – Low Voltage	Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities: Low Voltage Directive 73/23/EEC, Amended by 93/68/EEC: EN 61010-1:1993 Safety requirements for electrical equipment for measurement, control, and laboratory use
Approvals	UL3111-1 – Standard for electrical measuring and test equipment CAN/CSA C22.2 No. 1010.1 – Safety requirements for electrical equipment for measurement, control and laboratory use
Installation Category Descriptions	Terminals on this product may have different installation category designations. The installation categories are: CAT III Distribution-level mains (usually permanently connected). Equipment at this level is typically in a fixed industrial location CAT II Local-level mains (wall sockets). Equipment at this level includes appliances, portable tools, and similar products. Equipment is usually cord-connected CAT I Secondary (signal level) or battery operated circuits of electronic equipment

Appendix B: Error/Warning Messages

This appendix lists and explains the various error and warning messages that can appear on the 764 display. Figure 32 on page 45 shows the In-bar message location.

Channels not synchronized

Location: Audio View, phase display.

The left and right samples are not synchronized well enough to be reliably paired. Only possible when left and right channels are chosen from different inputs (for example, channel 1 paired with channel 4).

CLIP

Location: Audio View, above the meter bar of the affected channel.

The CLIP indicator flashes when the digital audio data on the input channel remains at full scale for n or more consecutive samples. The factory default value of n is one (1); it may be changed through the Level Meters submenu. "Full scale" means maximum coding level, either positive or negative. Maximum coding level is determined by the number of active bits detected in the digital input signal.

This indicator persists for the "CLIP/MUTE Hold Time," also set through the Level Meters submenu. When a Session is running, the instrument counts CLIPs and displays the current total on the Session display.

CODE ERR

Location: In-bar.

(Code error.) A bi-phase coding violation has occurred in the digital data stream. All affected data samples are unreliable, and are therefore ignored. The instrument treats affected samples as "zero samples" for use by the meter bars and phase display.

The CODE ERRor indicator persists for the "CLIP/MUTE Hold Time," set through the Level Meters submenu. During a Session, the instrument counts code violations and displays the current total on the Session display.

CRC Error

Location: Channel Status View (lower-left corner).

The Cyclic Redundancy Code calculated by the 764 does not agree with that calculated by the originating equipment and transmitted in Channel Status byte 23 of the digital input signal. This discrepancy usually results from errors in digital signal transmission.

De-emp

Location: Audio View, above meter bar of affected channel.

De-emphasis is in effect on the indicated channel. Will appear above the affected meter bar when CCITT J.17 or 50/15 ms de-emphasis is selected through the De-emphasis submenu, or when AUTO is selected *and* pre-emphasis is indicated in the channel status bits of the input signal.

This message persists as long as the instrument is applying de-emphasis to the input channel.

INPUT UNLOCKED

Location: In-bar.

The 764 is not locked to an incoming signal on the indicated input channel. Data cannot be decoded; all data and all other errors are ignored. Likely causes of this message include: missing input signal; incorrect setting(s) in the Inputs submenu; or inadequate or defective input signal(s).

The INPUT UNLOCKED indicator persists for the "CLIP/MUTE Hold Time," set through the Level Meters submenu.

Interpolation OFF

Location: Audio View, below meter bars (may be obscured by other error messages).

Interpolation has been turned OFF through the Level Meters submenu. This message will persist until Interpolation is returned to the factory default setting of ON.

LOW CONF

Location: In-bar.

(Low Confidence.) This warning message Indicates a marginal signal on the serial digital interface. Problems that can trigger this message—such as significant jitter or low signal amplitude—will usually result in a poor "eye" pattern when the serial digital signal is displayed on appropriate equipment.

The LOW CONFidence indicator persists for the "CLIP/MUTE Hold Time," set through the Level Meters submenu.

MUTE

Location: In-bar.

The MUTE indicator flashes when the digital audio data on the input channel remains at zero-value for *n* or more consecutive samples. The factory default value of *n* is ten (10); it may be changed through the Level Meters submenu. A setting of zero (0) disables this indicator.

The MUTE indicator persists for the "CLIP/MUTE Hold Time," set through the Level Meters submenu. When a Session is running, the instrument counts MUTEs and displays the current total on the Session display.

No Reference Signal

Location: Audio View, below the Session or Phase display.

The 764 is not locked to an incoming signal on the REFERENCE input. Likely causes of this message include: missing reference signal; incorrect "Reference Input" setting in the Inputs submenu; or an inadequate or defective DAR signal.

The flag will persist until a valid reference signal is detected, or until "Suppress Sync Loss Flags" is selected through the Level Meters submenu.

No Video Input (Option 01 only)

Location: Audio View, below the Session or Phase display.

Video input is selected, but there is no video signal present at the input. The in-bar INPUT UNLOCKED flag also appears in all four level meter bars whenever this message is displayed.

The flag persists until a valid digital video signal is detected at the SER. VIDEO IN connector, or until another input is selected.

NOT PRESENT (Option 01 only)

Location: In-bar.

The NOT PRESENT flag indicates that, although video input is detected, there is no active audio on the corresponding channel (no channel ID is detected).

PARITY

Location: In-bar.

The incoming subframe does not have even parity as specified by the applicable digital audio standards. The data sample is unreliable and is ignored. The meter bars and phase pattern treat the sample as a zero sample.

The PARITY indicator persists for the "CLIP/MUTE Hold Time," set through the Level Meters submenu. When a Session is running, the instrument counts parity errors and displays the current total on the Session display.

SYNC ERR

Location: Audio View, below the affected meter pair (1–2 or 3–4).

Either the input is out of synchronization with the REFERENCE input signal by at least 25% of the digital audio sample frame, or the input-to-reference timing is constantly changing due to mismatched sampling frequencies.

When the 764 is not locked to an incoming signal on the REF-ERENCE input, the presence of this flag below the channel 3–4 meter bars indicates that the two inputs (CH 1–2 and CH 3–4) are out of sync with each other. Again, the signals can be mistimed by a quarter-frame or more, or be "sliding" relative to one another due to a sample frequency mismatch.

To determine the exact cause of a SYNC ERR flag, select the 764 Session display and check the Sample Rate and Frame Sync Err fields in the SESSION STATISTICS panel. See *The Session Display* on page 29 for more information. The flag will persist until synchronization is achieved, or until "Suppress Sync Loss Flags" is set in the Level Meters submenu.

V BIT

Location: In-bar.

Indicates that the Validity bit is set high for one or more data samples. In the AES/EBU standard, a set validity bit indicates that the sample is not suitable for conversion to audio. By default, The meter bars and phase display treat the affected samples as a zero samples. When Session is running, the instrument counts "invalid samples" and displays the current total on the Session display.

You can suppress the V BIT message by setting the "Ignore Validity Bit" item in the Level Meters submenu to YES. If you do so, the 764 will treat all samples as valid, and the word "off" will appear in the Invalid samples fields of the Session display. (This feature is included because the use of the Validity bit varies despite its official meaning as specified in the AES/EBU standard, and you may find it desirable to monitor audio from "invalid" samples.)

Appendix C: Options

This section describes the following options available with the 764 Digital Audio Monitor:

- Option 01, Embedded Audio Input

- Option 02, Analog Line Output (see page 93)

- Power cord options (see page 99)

Embedded Audio Input (Option 01)

Option 01 provides the ability to monitor AES/EBU digital audio that is embedded in serial digital video.

The option, available both factory-installed and as a field-upgrade kit, may be installed in any instrument with serial number B020000 and above. It consists of an active digital video loop-through and the circuitry required to extract digital audio from (625- and 525-line) Component and NTSC Composite serial digital video.

Option 01 instruments retain all features of the standard 764 Digital Audio Monitor. Table 30 lists and describes important Option 01 characteristics.

Table 30: Option 01 characteristics

Characteristic	Description
Input video formats	270 Mbit/s component (625- and 525-line) complying with SMPTE 259M and CCIR 656-1 143 Mbit/s NTSC composite complying with SMPTE 259M
Audio format	SMPTE 272M level B: 20-bit; 48 kHz sampling rate; synchronized with video
Input level	800 mV$_{p-p}$ ± 10%

Table 30: Option 01 characteristics (Cont.)

Characteristic	Description
Equalization range	Proper operation with up to 19.0 dB loss at 135 MHz using coaxial cable having $1/f^{1/2}$ loss characteristics with a launch amplitude of 800 mV
Return loss (input and output)	$\geq$ 15 dB relative to 75 ohms, 1–270 MHz, power on
Output level	800 mV$_{p\text{-}p}$ $\pm$ 10%

Operating Information

The following paragraphs explain how to monitor embedded audio with a 764 Digital Audio Monitor equipped with Option 01. Most procedures are the same as those used for monitoring digital audio with a standard instrument; this section emphasizes the few differences from standard operation as discussed in the rest of this manual.

Connect the Instrument. Connect the 764 to the digital video signal path with appropriate 75 Ω coaxial cable, such as Belden 8281. Notice that the SER. VIDEO IN and SER. VIDEO OUT connectors make up an *active* loop-through, in which the output is an equalized and regenerated copy of the input. A termination is not required on the serial video output when the instrument is installed at the end of the signal path.

Select the Digital Video Input and Audio Channel Group. Configure the 764 to monitor the serial video input with the following steps:

1. Switch instrument power on.

2. Press the **MENU** button to enter the on-screen menu hierarchy.

3. Turn the multi-function knob to highlight the Input menu selection; then press the **SUBMENU** soft button (or any white button) to enter the Input submenu.

4. Press the soft button that corresponds to the Digital Video Input choice. Notice that the Input submenu changes to include only Audio Source and Channels selections.

5. Turn the multi-function knob to highlight the **Channels** menu item; then press the soft button that corresponds to the channel group (channels 1–4; 5–8; 9–12; or 13–16) that you want to monitor. If you do not know which audio channels are active on the input video, ignore the channel setting and proceed to the next step.

6. Press the **CLEAR MENU** button to exit the menu hierarchy; then press **VIEW:AUDIO**, if necessary, to select the audio Phase or Session display. Notice that sixteen diamonds, arranged in four groups of four, now occupy the top of the display as shown in Figure 37. The diamonds represent the four groups of four audio channels defined in SMPTE 272M. Bright diamonds indicate active channels; a white underline indicates the channel group that you have selected through the Input submenu. The numbers of the selected channels appear under the meter bars.
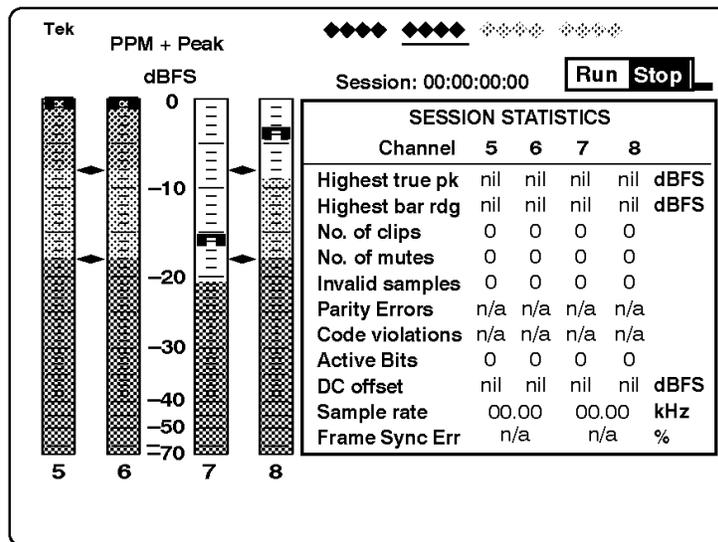
Figure 37: The Audio view with digital video input selected

7. If there is no audio on one or more of the channels in the selected group, the message NOT PRESENT now occupies the meter bars of the inactive channels. If necessary, repeat steps 2, 3, and 5

above to select a group with active audio channels; then press **CLEAR MENU** to return to the audio view.

Configure the Meters. Once you have selected the correct channel group, you can configure the level meter scale and offset by following the instructions under *Configuring the Level Meters* on page 22. You can also select appropriate meter response characteristics (ballistics) and alignment levels; refer to *Level Meters*, on page 43, for more information.

Configure the Phase Display. The phase display can show the phase relationship of any two channels in the selected channel group. By default, phase pair A is the first two channels in the group and phase pair B is the last two channels. For example, when the second channel group (channels 5 through 8) is selected, phase pair A is channel 5 left and channel 6 right, and phase pair B is channel 7 left and channel 8 right. You can specify any pairing of the four channels through the Phase Display submenu.

Refer to *The Phase Display Submenu* beginning on page 54 for information about specifying phase pairings, setting the phase display orientation, and setting the correlation meter speed.

Changes to the Session Statistics Display

Because Parity errors, code violations, and frame sync errors have no meaning in embedded audio, the corresponding fields of the Session display always contain "n/a" to signify that the parameters are not applicable.

Additional Error/Warning Messages

There are two on-screen error/warning messages unique to Option 01. For more information about other error and warning messages, refer to *Appendix B: Error/Warning Messages*.

No Video Input. A "No Video Input" message is displayed at the bottom of the Audio view if Video Input is selected but there is no video signal present. The in-bar INPUT UNLOCKED flag also appears in all four meter bars whenever the No Video Input message is displayed.

NOT PRESENT. The in-bar NOT PRESENT flag indicates that, although video input is detected, there is no active audio on the corresponding channel (no channel ID is detected).

Analog Line Output (Option 02)

Option 02 replaces the balanced XLR digital audio outputs with analog audio line outputs; it is available only as a factory option to the 764 and cannot be installed in existing instruments. Option 02 has the following features and characteristics:

- The option provides two channels (typically, left and right) of balanced analog output.

- The audio channels present on the left and right analog line outputs are those selected by the user for headphone monitoring.
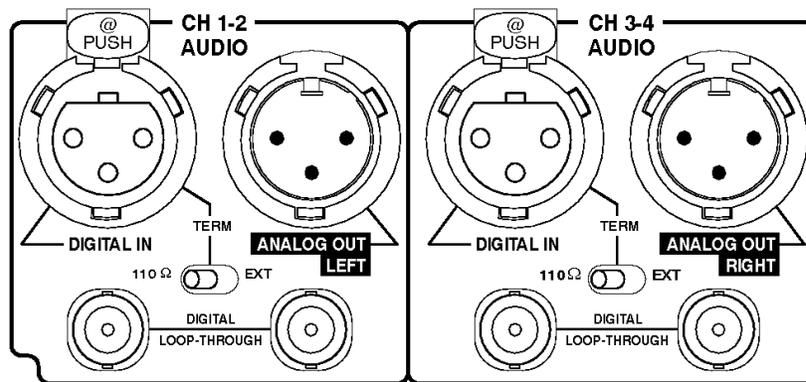
Figure 38: Option 02 connectors

- The analog output can be configured one of three ways: fixed at +24 dBm into a balanced 600 ohm load; variable up to +24 dBm, also for a balanced 600 ohm load; or variable up to 2.0 V_{RMS} into an unbalanced, 10 kΩ (or greater) load. When the instrument is set for variable output, the front-panel VOLUME knob controls output gain.

Option 02 instruments are set during manufacture for fixed output; refer to *Configuring the Output* on page 95 for information about changing the setting.

When outputting to an unbalanced load (0 to 2.0 V_{RMS} variable output only), you must connect one of the lines to ground; refer to *Connecting the Instrument* on page 97 for more information.

■ The analog outputs supercede the digital XLR loop-throughs; always leave the TERM switches of Option 02 instruments set to 110 Ω for proper XLR input termination.

Table 31 lists and describes important Option 02 characteristics.

Table 31: Option 02 characteristics

Characteristic	Description
Output Level	With 0 dBFS 1 kHz sine wave applied to the input
Fixed gain	+24 dBm +1.6/–0.0 dBm into 600 Ω balanced
Variable gain, high output	+24 dBm (volume control fully clockwise) into 600 Ω balanced
Variable gain, low output	2.0 V_{RMS} (volume control fully clockwise) into ≥10 kΩ
Output impedance, typical	50 Ω
Frequency Response	±2 dB, 20 Hz to 20 kHz
Distortion, THD+N	<0.05% (22 kHz THD+N bandwidth)
Distortion, typical, THD+N, variable gain, high output	<0.005% at 1 kHz (control fully clockwise, load ≥10 kΩ, 22 kHz THD+N bandwidth)

Configuring the Output

Qualified service personnel can change the output configuration with the following procedure:

⚠ **CAUTION.** *The 764 contains static-sensitive components. The following procedure should be performed by qualified technicians only.*

---

1. Disconnect power and all other connections from the 764 rear panel and then remove the instrument from its enclosure. The Analog Line Output circuit board assembly is mounted horizontally above the audio XLR connectors at the rear of the chassis. The configuration jumper pins are readily accessible on the top surface of the board.

2. Identify the jumper configuration in Table 32 that corresponds to the desired output; add and remove jumpers to/from the jumper pin pairs to achieve that configuration. Pin pairs J20, J21, J22, and J23 are provided as a convenient place to "park" unused jumpers. If you need additional jumpers for the new configuration, take them from J20–J23; if you have extra jumpers after reconfiguration, put them onto J20–J23.

Table 32: Output configuration jumper locations

Output	Jumper configuration	AES connector*
Fixed, +24 dBm	J4 J7 J8 J6 J5 J15 J16 J18 J17 J14	J914
Variable, to +24 dBm	J4 J7 J8 J6 J5 J15 J16 J18 J17 J14	J913
Variable, to 2.0 V_{RMS}	J4 J7 J8 J6 J5 J15 J16 J18 J17 J14	J913

  * See **configuration procedure** step 3.

---

3. Locate J913 and J914, the two rows of six connector pins on the AES circuit board assembly. The AES board is on the right side of the 764 when you view the instrument from the rear panel; J913 and J914 are near the end of the AES board that is closest to the front of the instrument. The AES–XLR cable must be connected to either J913 or J914; use J914 for *fixed* analog audio output and use J913 for *variable* output.

If you move the AES–XLR cable, be sure to connect pin one of the cable connector to pin one on J913 or J914. Pin one is indicated by a triangular symbol on the circuit board and a triangular symbol and white dot on the cable connector.

4. Reinstall the 764 in its enclosure and reconnect it to your system. The appropriate analog audio cable connections depend on the analog output configuration. Refer to *Connecting the Instrument* on page 97 for analog audio cable requirements.

5. The audio input channels routed through the left and right analog line outputs are the same as on the front-panel headphone output. During manufacture, the headphone output is set to follow the phase display. You may manually select the headphone and analog line output channels through the Headphones submenu; refer to *Selecting Headphone Channels* on page 48 for more information.

Connecting the Instrument

The appropriate method of connecting the Option 02 analog outputs to your system depends on the configured output level and the requirements of your particular installation.

High-level, Balanced Output. When using high-level fixed or variable balanced output, connect the 764 to your system with standard shielded XLR cables. The analog line output polarity matches Figure 39 when the instrument is configured for variable high-level output. If you are using fixed output, and output phase *must* match input phase, reverse the connections to pins 2 and 3.

Male XLR

Pin 1 (shield) — Pin 2 (+)
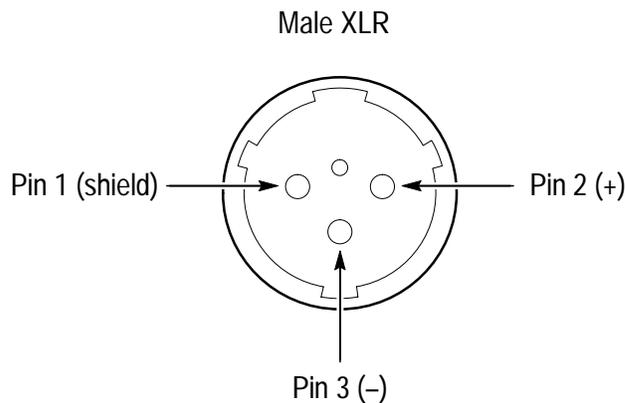
Pin 3 (–)

Figure 39: Standard balanced-output pin assignments

Low-level, Unbalanced Output. When using low-level output to drive an unbalanced load such as a consumer amplifier, you must use cables that short either pin 2 or pin 3 to pin 1, the shield/ground. The output will not meet the distortion specification if you do not ground one of the output lines.

Connecting an unbalanced load as shown in either the top or bottom of Figure 40 ensures that the phase of the signal at the unbalanced input matches the phase of the 764 input.
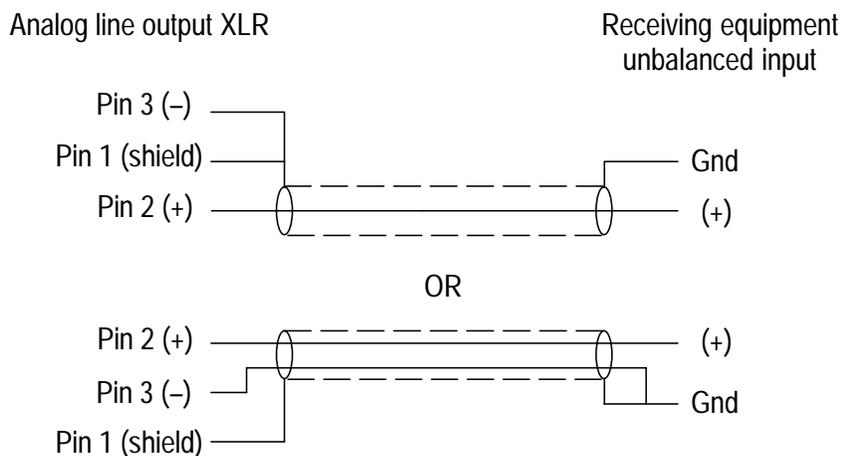
Figure 40: Connecting to an unbalanced input

NOTE. Connecting a line to ground as shown in Figure 40 forces the analog outputs into unbalanced mode. The outputs will clip above approximately +20 dBu in unbalanced mode. Do not *use unbalanced mode when you have configured the instrument for either fixed high level output or variable high level output.*

Power Cords

Table 33 lists and describes the available power cord options. Please contact your Tektronix representative if the power cord supplied with your instrument is not correct for the local power supply.

Table 33: Power cord identification

Plug configuration	Normal usage	Option number
	North America 125V/15A Plug NEMA 5-15P	Standard
	Europe 230 V	A1
	United Kingdom 230 V	A2
	Australia 230 V	A3
	North America 230 V	A4
	Switzerland 230 V	A5
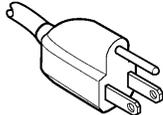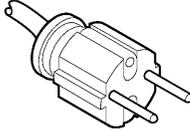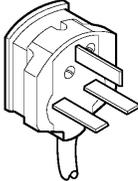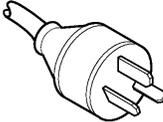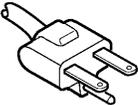
Glossary

CLIP

One or more consecutive positive or negative full scale samples. The actual number of consecutive samples that constitute a CLIP may be adjusted through the Level Meters submenu; the factory setting is one (1).

Copy

Output a session report via the rear-panel RS-232 port.

Frame Sync Err

Frame synchronization error between the input pair and the reference, as a percentage of the digital audio frame.

MUTE

One or more consecutive "zero" samples. The actual number of consecutive samples that constitute a MUTE may be adjusted through the Level Meters submenu; the factory setting is ten (10).

nil

The measured signal level is lower than –90 dBFS

Session

A mode of instrument operation during which the digital audio input signals are monitored, and signal data are collected.

Session Time

The time elapsed since the beginning of the current Session.

True Peak

The actual highest positive or negative audio sample value. True Peaks will often be greater than the highest meter reading when Extended VU or PPM ballistics are used.

Test Level

Also called "alignment" or "reference" level. Usually, the signal level used for system alignment. In the 764, this setting determines the placement of level meter markers and a meter bar intensity/color threshold.

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