User Manual

Tektronix

**VM700T Video Measurement Set
Option 1S
Serial Digital Measurements**

071-0074-01

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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 specified for this product and certified for the country of use.

Use Proper Voltage Setting. Before applying power, ensure that the line selector is in the proper position for the power source being used.

Ground the Product. This product is indirectly grounded through the grounding conductor of the mainframe power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

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.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

Do Not Operate Without Covers. Do not operate this product with covers or panels removed.

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

Avoid Exposed Circuitry. Do not touch exposed connections and components when power is present.

Do Not Operate With Suspected Failures. If you suspect there is damage to this product, have it inspected by qualified service personnel.

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Provide Proper Ventilation. Refer to the manual's installation instructions for details on installing the product so it has proper ventilation.

Symbols and Terms

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:

WARNING High Voltage	Protective Ground (Earth) Terminal	CAUTION Refer to Manual	Double Insulated

Preface

This manual provides instructions for operating Option 1S of the VM700T Video Measurement Set. As with other VM700T options, this manual is designed to fit into the back of the binder holding the user manuals for the rest of the measurement set.

About This Manual

This manual is composed of the following sections:

■ *Getting Started* provides a product description, a list of standard and optional accessories, installation and configuration instructions, and a functional check procedure for verifying basic instrument operation.

■ *Operating Basics* describes how the option affects the operation of the measurement set, describes measurement concepts that span the many applications within the option, and provides a description of the Option 1S rear panel.

■ *Reference* describes the measurement applications in detail including soft key definitions and signal measurement considerations.

■ *Appendices* provide a list of specifications, information about the remote control interface (including Get/Set keywords and remote soft key names), and examples of the measurement results files for each SDI application.

Contacting Tektronix

Product Support	For questions about using Tektronix measurement products, call toll free in North America: 1-800-TEK-WIDE (1-800-835-9433 ext. 2400) 6:00 a.m. – 5:00 p.m. Pacific time
	Or contact us by e-mail: tm_app_supp@tek.com
	For product support outside of North America, contact your local Tektronix distributor or sales office.
Service Support	Tektronix offers extended warranty and calibration programs as options on many products. Contact your local Tektronix distributor or sales office.
	For a listing of worldwide service centers, visit our web site.
For other information	In North America: 1-800-TEK-WIDE (1-800-835-9433) An operator will direct your call.
To write us	Tektronix, Inc. P.O. Box 1000 Wilsonville, OR 97070-1000 USA
Website	Tektronix.com

Getting Started

Getting Started

This section contains a product description, a list of standard and optional accessories, installation and configuration instructions, and a functional check procedure to verify basic instrument operation.

Option 1S is designed for installation in the VM700A and VM700T Video Measurement Sets. Option 1S is not available for the VM700 Video Measurement Set. Further references to the VM700T in this manual apply equally to both the VM700A and the VM700T measurement sets, but not to the VM700 measurement set.

Product Description

Historically, the baseband analog-video signal has been analyzed with oscilloscopes, waveform monitors, vectorscopes, and by automatic computerized analyzers such as the VM700T measurement set. The techniques used to measure the analog-video test signal have been proven to verify the signal quality. Due to the nature of the serial digital signal and the higher signal frequencies involved, equipment designed for the analog-video signal frequencies of 6 MHz (8 MHz for PAL) do not have adequate bandwidth for acquisition and analysis of the serial digital signal.

A suitable bandwidth oscilloscope (1 GHz) can view the physical signal but will provide few details about actual picture information or the quality of the digital-video signal. The digital-video signal may include errors due to A/D, D/A, and parallel-to-serial conversions, as well as bit errors, format errors, jitter, and loss-of-frame synchronization.

Option 1S provides the capability to display, capture, and analyze 270 Mbit, 525-line and 625-line serial component, 143 Mbit serial composite, and 360 Mbit, 525-line and 625-line serial component digital video signals. The Option 1S hardware consists of an SDI circuit board installed in the right-side card cage, a two-board input assembly mounted on the measurement set rear panel, updated instrument firmware, and some interconnecting cables.

The Option 1S rear panel connectors include two SDI inputs (one loopthrough and one internally terminated in 75 Ω), a buffered SDI output of one of the SDI input channels, an AES/EBU digital audio input, a Longitudinal Time Code input for time stamping logged error files, and an analog loopthrough input to be used for a timing reference signal.

The Option 1S measurement applications can be selected using the instrument front panel/touch panel interface, or by using the RS–232C or GPIB remote control drivers. Measurement functions can be enabled manually or automatically using the measurement set's internal clock. Option 1S measurement functions can be created and shared to additional VM700T measurement sets using the measurement set's FTP file transfer capability.

You can program the VM700T for remote operation. Refer to *Appendix B* for specific Option 1S remote commands, keywords, and soft key names. Refer to the *VM700T RS-232 Interface Programmer Manual* for general information on remote programming and operation of the VM700T measurement set.

Applications

Option 1S uses several different applications sharing an acquisition buffer to allow multiple measurements of a captured signal. The applications can be conceptually grouped by their measurement functions into four groups as shown in Table 1–1. All Option 1S application names start with "SDI" to distinguish them from any similar analog counterpart applications. Refer to the *Reference* section of this manual for detailed information about the applications.

Table 1–1: SDI applications listed by measurement functional group

Measurement group type	Application names
Electrical	SDI Eye Diagram
	SDI Jitter
	SDI Wander
Video format and content	SDI Format Monitor
	SDI Ancillary Data Analyzer
	SDI Ancillary Data Distribution Analyzer
	SDI Waveform
	SDI Lightning
	SDI Picture
Audio format and content	SDI Audio Format Analyzer
	SDI Audio Measurements
Timing	SDI Interchannel Timing
	SDI Audio/Video Timing

Key Features   Option 1S utilizes the following key features:

■   Automatic analysis of 270 Mbit component, 143 Mbit composite, and 360 Mbit component serial digital video signals

■   Continuous real-time format analyzer with event logging and frame capture (captured frames can be downloaded to a PC)

■   Longitudinal Time Code input for time stamping error events

■   Parade, stacked, and overlay displays with interpolated waveforms

■   Eye diagram display with automatic limit violation detection

■   External and embedded digital audio measurements

■   Conformance testing to SMPTE 259M

■   SMPTE RP–165 digital error detection and reporting

■   Conformance testing of SDTI signals to SMPTE 305M

■   Jitter measurements with wide-band spectral analysis

■   Ancillary data analysis with data distribution display

■   Relative to reference modes allow signal comparisons

■   Picture mode with large and small picture display sizes

■   Audio to video timing measurements

■   Digital video wander measurements

Accessories

The following accessories are offered with Option 1S:

Standard accessory: *VM700T Video Measurement Set Option 1S User Manual* (Tektronix part number: 071-0074-XX)

Optional accessory: *VM700T Video Measurement Set Service Manual* (Tektronix part number: 070-9630-XX)

Installation

Refer to the *VM700T Video Measurement Set Service Manual* for instructions on how to install or remove the hardware for Option 1S. This section describes installing the VM700T with Option 1S into a serial digital system and presents information about signal line termination.

Installing Option 1S into a Serial Video System

When you install Option 1S into your digital distribution system, consider the following characteristics of the rear-panel inputs (see Figure 1–1):

- The SDI Ch. A input is a noninterfering loopthrough BNC input for serial digital video signals. You must use the SDI Ch. A input to perform electrical signal measurements in the following applications: SDI Eye Diagram, SDI Jitter, and SDI Wander. The remaining loopthrough connector must be precision terminated in 75 Ω when not used in a loopthrough mode. The primary function intended for this input is to measure a signal under test.

- The SDI Ch. B input is an internally precision-terminated (75 Ω) BNC input for serial digital video signals. The SDI Ch. B input cannot perform the electrical measurements in the following applications: SDI Eye Diagram, SDI Jitter, and SDI Wander. Although you can use this input to measure a signal under test, the primary function of this input is to enable you to use a digital reference signal to make comparative timing measurements with the signal under test on the SDI Ch. A input.

- The Analog Ref input is a loopthrough BNC input for an analog timing reference signal (black burst). The remaining loopthrough connector must be terminated in 75 Ω when not used in a loopthrough mode. The only function of this input is to enable you to compare your analog timing reference signal with a digital timing reference and/or a signal under test. The timing comparison between an analog reference signal and a serial digital signal will never be a perfect match; however, you will be able to see resolution to within 1 μs.

- The SDI Output is a buffered BNC monitor output that can be set to output one of the following signal sources: SDI channel A input, SDI channel B input, currently selected SDI input channel (indicated by front-panel LED), or none (no output). You set the signal source to output in the Source Selection Digital configuration file. Refer to *Source Selection Digital Configuration File* on page 1–9.

NOTE. You may not be able to use the SDI Output signal effectively as a signal repeater when it is set to output the signal on the SDI channel A input. The output of the SDI channel A signal can be interrupted when you access one of the following applications: SDI Eye Diagram, SDI Jitter, and SDI Wander.
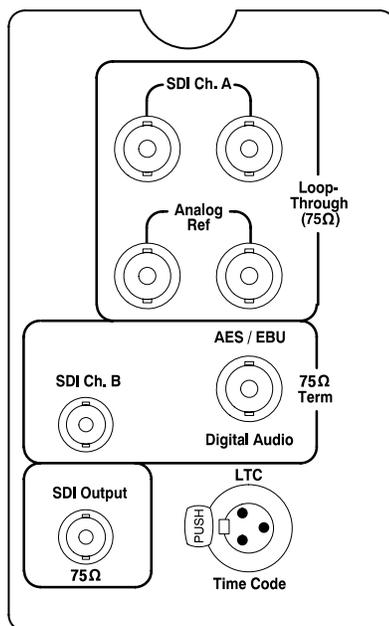
Figure 1–1: Option 1S rear panel

■ The AES/EBU Digital Audio input is used to measure external digital-audio signals. This BNC input is internally terminated in 75 Ω.

■ The LTC Time Code input is a standard Longitudinal Time Code interface input used for time stamping measurement log reports.

Line Termination

The Option 1S SDI Ch. A input uses passive loopthrough connectors, similar in concept to those used in baseband video equipment. Accordingly, the loop-through must be terminated externally. It is important that this external termination meet accuracy and return loss requirements. It is recommended that the external termination should have a return-loss specification at least 6 dB better than the specification for the SDI Ch. A input as listed in the *Specifications* section of this manual.

If Option 1S is installed to monitor an operating link, the destination receiver and the connecting cable serve as the termination. This monitoring connection is best because it checks the performance of the entire serial path. The return loss of Option 1S is sufficiently high that, in most cases, the destination receiver sets the system return loss. In cases where Option 1S is placed at the end of a link, a BNC termination must be installed on one side of the loopthrough connector.

You can inspect a terminator for return loss problems using Option 1S and a serial source with low aberrations, such as the Tektronix TG 2000 mainframe with a DVG1 Generator module. Connect the generator serial output to one side of the SDI Ch. A loopthrough connector and install the terminator under test on the other side. Select the SDI Eye Diagram application and observe the Eye Diagram, paying particular attention to leading edge aberrations.

Figure 1–2 shows the normal Eye Diagram display. Figure 1–3 shows an example of a distorted Eye Diagram caused by using a terminator having only 13 dB return loss (capacitive) at 100 MHz. Terminations with aberrations under 10% are acceptable. Depending on the termination problem, the signal distortion shown in Figure 1–3 could have been overshoot instead of undershoot on the transitioning edge of the signal.
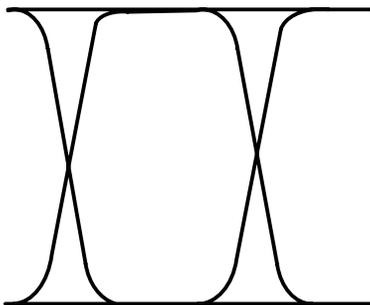
Figure 1–2: Example of a normal Eye Diagram display
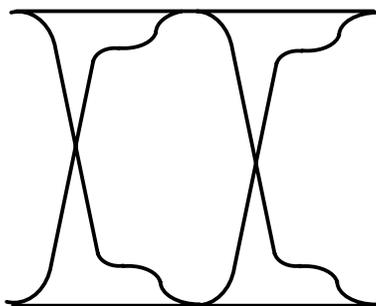
Figure 1–3: Example of a distorted Eye Diagram caused by a signal termination with poor return loss

Configuration

The VM700T (without Option 1S installed) has an analog configuration file hierarchy. Option 1S adds a digital configuration file hierarchy that operates in parallel with the analog hierarchy. To accommodate the parallel hierarchies, Option 1S adds a new soft key to allow you to switch between analog and digital operation. You must set the VM700T to the desired mode, analog or digital, before you can access the configuration file structure for that mode. A setting in the Source Selection Digital configuration file allows you to set the mode, analog or digital, that the VM700T starts up in after being powered down.

Option 1S comes from the factory already configured to perform SDI measurements. You can reconfigure Option 1S to perform measurements using custom measurement limits. The approach to configuring Option 1S is similar to that used for other VM700T video functions. Refer to the *VM700T Option 01 (NTSC) & Option 11 (PAL) User Manual* for additional information about configuring the measurement set.

A hierarchy of files and directories provide default parameters that the VM700T uses to measure video signals. At the highest level, the configuration files contain pointers (file names) to other configuration files. At the lowest level, the configuration files contain the actual measurement parameters to be used for specific measurements.

Accessing the Configuration Files

If your measurement application requires parameters other than the defaults supplied with the VM700T, you can configure Option 1S according to your preferences. To access the Option 1S configuration files, perform the following steps:

1. Press the front-panel **Configure** button to open the main Configure menu (see Figure 1–4).

2. Option 1S provides a new Mode soft key to toggle between analog and digital operation. Set the VM700T to Digital Mode using the **Mode** soft key if it is not already selected.

NOTE. The VM700T measurement set must be set to Digital Mode before you can access the Option 1S configuration files.

---

3. Touch the **Configure Files** soft key to access the digital configuration file structure. The screen now displays in a window a series of soft keys that represent directories of Option 1S configuration files (see Figure 1–5). Rotate the front-panel knob to scroll the window to view all of the configuration files.

In Figure 1–5, some of the soft keys have a shadow box behind them to indicate that these soft keys open directories containing other configuration files.

```
        Non volatile memory: used 52416 bytes, free 995904 bytes

used   ┌──┬────────────────────────────────────────────────────┐   free
5%     │▓▓│                                                    │   95%
       └──┴────────────────────────────────────────────────────┘

              VM700T Video Measurement Set xxxxxx-xxxx
       ┌──────────────────────────────────────────────────────┐
       │         Option 01 NTSC     Version  2.10              │
       │         Option 11 PAL      Version   2.10             │
       │         Option 1S Serial Digital  Version  1.00       │
       │         Option 40 Audio    Version  1.05              │
       │         Option 30 Component   Version  1.01           │
       │         Option 20 Teletext    Version  1.01           │
       │         Option 1G Echo/Rounding Version  1.00         │
       └──────────────────────────────────────────────────────┘

  ┌─────────┐  ┌───────────┐  ┌───────────┐  ┌──────────┐  ┌──────────┐
  │         │  │ Configure │  │ Function  │  │ Mode:    │  │ Option   │
  │  Time   │  │ Files     │  │ Keys      │  │ Digital  │  │ Key      │
  └─────────┘  └───────────┘  └───────────┘  └──────────┘  └──────────┘
```

Figure 1–4: Typical Configure menu with Option 1S firmware

```
  ┌───────────┐      ┌───────────┐      ┌───────────┐
  │ 143Mb     │      │ 270Mb     │      │ 270Mb     │
  │ NTSC      │      │ 525-Line  │      │ 625-Line  │
  └───────────┘      └───────────┘      └───────────┘

  ┌───────────┐      ┌───────────┐      ┌───────────────┐
  │ 360Mb     │      │ 360Mb     │      │ Communication │
  │ 525-Line  │      │ 625-Line  │      │ Setup         │
  └───────────┘      └───────────┘      └───────────────┘

  ┌───────────┐      ┌───────────────┐  ┌───────────────┐
  │ Diagnostics│     │ Digital_Audio │  │ Measurement   │
  │ Selection │      │ Setup         │  │ Results       │
  └───────────┘      └───────────────┘  └───────────────┘

  ┌───────────────┐
  │ Source_Selection│
  │ Digital       │
  └───────────────┘

  In /nvram0/ConfigFiles

           ┌──────────┐        ┌─────────┐ ┌───────────┐
           │ Mode:    │        │ Print   │ │ Leave     │
           │ Digital  │        │ File    │ │ Directory │
           └──────────┘        └─────────┘ └───────────┘
```
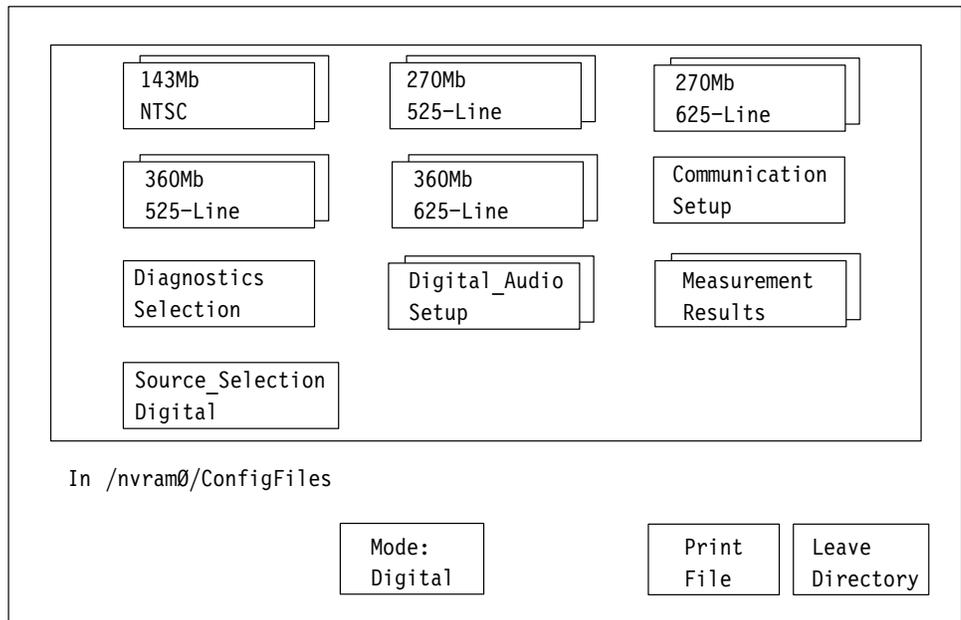
Figure 1–5: Option 1S ConfigFiles directory

Editing the Configuration Files

Option 1S provides factory-supplied measurement limit files to use as templates for your custom limit files. All of these template files are named System Default and their contents are not editable. When you want to create a new configuration file, you are prompted to select an existing file to use as a template. You can directly edit any configuration file not named System Default. Refer to *Configuration Tutorial* on page 1–25 for more information.

Source Selection Digital Configuration File. Touch the Source_Selection Digital soft key to open the highest level digital configuration file. The Source Selection Digital configuration file contains the following editable parameters (see Figure 1–6):

1. The measurement set uses the video standard set in this parameter to select the Digital Source File (set in parameters 2 through 6 in Figure 1–6) to use to make signal measurements on the SDI Ch. A Input. You can set this parameter to one of the following values: Auto detect, 270Mb 525-line, 270Mb 625-line, 360Mb 525-line, 360Mb 625-line, and 143Mb NTSC. If you select Auto detect, the measurement set will determine the video standard of the input signal.

2. This parameter selects the name of the Digital Source File to be used for measurements by the 143 Mb NTSC video standard on the SDI Ch. A Input. You can set this parameter to one of the following values: System Default (file name supplied with Option 1S) or the name of an existing custom Digital Source File. This file must be in the following directory path: *nvram0/ConfigFiles/143Mb~NTSC/Digital_Source~Files*

3. This parameter selects the name of the Digital Source File to be used for measurements by the 270 Mb 525-line video standard on the SDI Ch. A Input. You can set this parameter to one of the following values: System Default (file name supplied with Option 1S) or the name of an existing custom Digital Source File. This file must be in the following directory path: *nvram0/ConfigFiles/270Mb~525–line/Digital_Source~Files*

4. This parameter selects the name of the Digital Source File to be used for measurements by the 270 Mb 625-line video standard on the SDI Ch. A Input. You can set this parameter to one of the following values: System Default (file name supplied with Option 1S) or the name of an existing custom Digital Source File. This file must be in the following directory path: *nvram0/ConfigFiles/270Mb~625–line/Digital_Source~Files*

5. This parameter selects the name of the Digital Source File to be used for measurements by the 360 Mb 525-line video standard on the SDI Ch. A Input. You can set this parameter to one of the following values: System Default (file name supplied with Option 1S) or the name of an existing custom Digital Source File. This file must be in the following directory path: *nvram0/ConfigFiles/360Mb~525–line/Digital_Source~Files*

```
Source_Selection~Digital
┌──────────────────────────────────────────────────────────────────────┐
│                 Digital Video Standard                                 │
│      - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - │
```
1 → `Digital A:  Auto detect`
```
                                Video Source File
      - - - - - - - - - - - - - - - - - - - - - -
```
2 → `143Mb NTSC:    System~Default`
3 → `270Mb 525-line: System~Default`
4 → `270Mb 625-line: System~Default`
5 → `360Mb 525-line: System~Default`
6 → `360Mb 625-line: System~Default`

7 → `Audio Limits:   System~Default`

8 → `Digital B:  Auto detect`
```
                                Video Source File
      - - - - - - - - - - - - - - - - - - - - - -
```
9 → `143Mb NTSC:    System~Default`
10 → `270Mb 525-line: System~Default`
11 → `270Mb 625-line: System~Default`
12 → `360Mb 525-line: System~Default`
13 → `360Mb 625-line: System~Default`

14 → `Audio Limits:   System~Default`
```
      - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - 
```
15 → `SDI Output: Selected Channel`

16 → `Startup In: Digital Mode`
17 → `Hex Format: SMPTE`

Figure 1–6: Source Selection Digital configuration file

6. This parameter selects the name of the Digital Source File to be used for measurements by the 360 Mb 625-line video standard on the SDI Ch. A Input. You can set this parameter to one of the following values: System Default (file name supplied with Option 1S) or the name of an existing custom Digital Source File. This file must be in the following directory path: *nvram0/ConfigFiles/360Mb~625–line/Digital_Source~Files*

7. This parameter selects the name of the Digital Audio Setup file to be used for measurements on the SDI Ch. A input's signal. You can set this parameter to one of the following values: System Default (file name supplied with Option 1S), or the name of an existing custom Digital Audio Setup file. This file must be in the following directory path: *nvram0/ConfigFiles/Digital_Audio~Setup*

NOTE. *For external-audio signals, the Digital Audio Setup file set by this Audio Limits parameter will be used for measurements when the front-panel Source selection is set to channel A.*

---

8. The measurement set uses the video standard set in this parameter to select the Digital Source File (set in parameters 9 through 13 in Figure 1–6) to use to make signal measurements on the SDI Ch. B Input. You can set this parameter to one of the following values: Auto detect, 270Mb 525-line, 270Mb 625-line, 360Mb 525-line, 360Mb 625-line, and 143Mb NTSC. If you select Auto detect, the measurement set will determine the video standard of the input signal.

9. This parameter selects the name of the Digital Source File to be used for measurements by the 143 Mb NTSC video standard on the SDI Ch. B Input. You can set this parameter to one of the following values: System Default (file name supplied with Option 1S) or the name of an existing custom Digital Source File. This file must be in the following directory path: *nvram0/ConfigFiles/143Mb~NTSC/Digital_Source~Files*

10. This parameter selects the name of the Digital Source File to be used for measurements by the 270 Mb 525-line video standard on the SDI Ch. B Input. You can set this parameter to one of the following values: System Default (file name supplied with Option 1S) or the name of an existing custom Digital Source File. This file must be in the following directory path: *nvram0/ConfigFiles/270Mb~525–line/Digital_Source~Files*

11. This parameter selects the name of the Digital Source File to be used for measurements by the 270 Mb 625-line video standard on the SDI Ch. B Input. You can set this parameter to one of the following values: System Default (file name supplied with Option 1S) or the name of an existing custom Digital Source File. This file must be in the following directory path: *nvram0/ConfigFiles/270Mb~625–line/Digital_Source~Files*

12. This parameter selects the name of the Digital Source File to be used for measurements by the 360 Mb 525-line video standard on the SDI Ch. B Input. You can set this parameter to one of the following values: System Default (file name supplied with Option 1S) or the name of an existing custom Digital Source File. This file must be in the following directory path: *nvram0/ConfigFiles/360Mb~525–line/Digital_Source~Files*

13. This parameter selects the name of the Digital Source File to be used for measurements by the 360 Mb 625-line video standard on the SDI Ch. B Input. You can set this parameter to one of the following values: System Default (file name supplied with Option 1S) or the name of an existing custom Digital Source File. This file must be in the following directory path: *nvram0/ConfigFiles/360Mb~625–line/Digital_Source~Files*

14. This parameter selects the name of the Digital Audio Setup file to be used for measurements on the SDI Ch. B input signal. You can set this parameter to one of the following values: System Default (file name supplied with Option 1S), or the name of an existing custom Digital Audio Setup file. This file must be in the following directory path: *nvram0/ConfigFiles/Digital_Audio~Setup*

NOTE. For external-audio signals, the Digital Audio Setup file set by this Audio Limits parameter will be used for measurements when the front-panel Source selection is set to channel B.

15. This parameter selects which of the two SDI input signals is output to the SDI Output connector. You can set this parameter to one of the following values: Channel A, Channel B, Selected Channel, and None.

16. This parameter selects which mode, Analog or Digital, the measurement set starts up in after a power down.

17. This parameter selects which of the two hex formats, SMPTE or EBU, will be used to display hexadecimal numbers. Refer to *Hex Formats* on page 2–5 for more information.

Digital Source Files Configuration File. Each of the digital video formats has a subdirectory of Digital Source Files configuration files. The digital source files for the different video formats have identical parameters.

The following example uses the 270Mb 525-line format Digital Source Files configuration file.

To access the System Default Digital Source Files configuration file for 270Mb 525-line signal format measurements, touch the 270Mb 525-line soft key. See Figure 1–5 on page 1–8. Touch the Digital_Source Files soft key to open the 270Mb 525-line video source files directory. Touch the System Default soft key to open the Digital Source Files configuration file.

NOTE. Figure 1–7 shows the lines containing editable parameters in a Digital Source Files configuration file named Custom. You cannot edit the parameters of the System Default file. You can create a custom file using the Create File soft key or you can edit the contents of an existing custom configuration file.

```
        270Mb~525-line/Digital_Source~Files/Custom
1 ────────────────────► Digital Channel Configuration 270Mb 525-Line System Defaults File
   - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
2 ──► Eye   Limits:          System~Default                          (Channel A only)
3 ──► Wander Limits:         System~Default                          (Channel A only)
4 ──► Format Setup:          System~Default

5 ──► Source Name:           System Default
6 ──► Video Printout Title:  Video Measurement Set
```
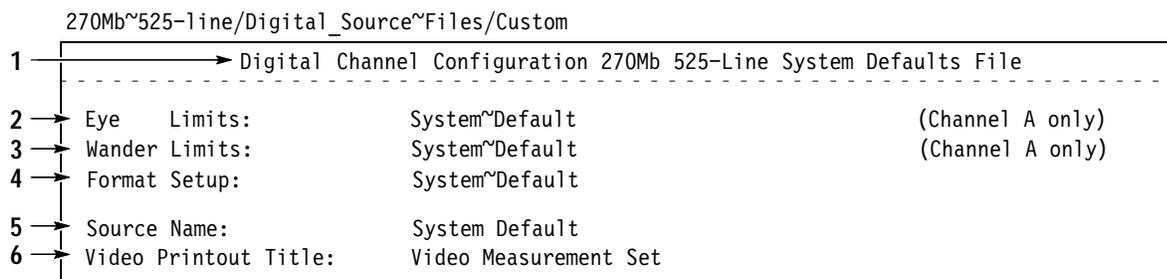
Figure 1–7: 270Mb 525-line format Digital Source Files configuration file

The Digital Source Files configuration file contains the following editable parameters:

1. You can edit this parameter to give the configuration file a custom title. When you select this parameter to edit, a keyboard appears on the screen to allow you to enter a custom title.

2. This parameter selects the name of the Eye Limits configuration file to be used for measurements on a 270 Mb 525-line video signal. You can set this parameter to one of the following values: System Default (file name supplied with Option 1S) or the name of a custom Eye Limits configuration file. This file must be in the following directory path: *nvram0/ConfigFiles/270Mb~525–line/Eye~Limits*

3. This parameter selects the name of the Wander Limits configuration file to be used for measurements on a 270 Mb 525-line video signal. You can set this parameter to one of the following values: System Default (file name supplied with Option 1S) or the name of a custom Wander Limits configuration file. This file must be in the following directory path: *nvram0/ConfigFiles/270Mb~525–line/Wander~Limits*

4. This parameter only appears in the Digital Source Files for the two 270 Mb video formats. This parameter selects the name of the Format Setup configuration file to be used for measurements on a 270 Mb 525-line video signal. You can set this parameter to one of the following values: System Default (file name supplied with Option 1S) or the name of a custom Format Setup configuration file. This file must be in the following directory path: *nvram0/ConfigFiles/270Mb~525–line/Format~Setup*

5. This parameter sets the Source Name for the measurement log report. When you select this parameter to edit, a keyboard appears on the screen to allow you to enter a custom Source Name.

6. This parameter sets the Video Printout Title for the measurement log report. When you select this parameter to edit, a keyboard appears on the screen to allow you to enter a custom Video Printout Title.

Eye Limits Configuration File. The Eye Limits configuration file sets the measurement limits for the SDI Eye Diagram application. Each of the digital video formats has a subdirectory of Eye Limits configuration files. The Eye Limits configuration files for the different video formats have identical parameters. The following example uses the 270Mb 525-line format Eye Limits configuration file.

To access the System Default Eye Limits configuration file for 270Mb 525-line signal format measurements, touch the 270Mb 525-line soft key. See Figure 1–5 on page 1–8. Touch the Eye Limits soft key to open the 270Mb 525-line video Eye Limits directory. Touch the System Default soft key to open the Eye Limits configuration file.

NOTE. Figure 1–8 shows the lines containing editable parameters in a Eye Limits configuration file named Custom. You cannot edit the parameters of the System Default file. You can create a custom file using the Create File soft key or you can edit the contents of an existing custom configuration file.

The Eye Limits configuration file lets you set the following four parameters for the Eye Diagram measurements: Log, Highlight, and the Low and High measurement limits. Measurement events that exceed the user-defined low or high limits can be logged or highlighted. Logged events are entered in the SDI Eye Diagram's log report. Refer to *Report Logging* on page 2–4 for more information. The Highlight parameter lets you highlight the measurement cell in the Measurement & Limits display (see Figure 3–6 on page 3–13) when the measurement exceeds the user-defined low or high limits.

```
     270Mb~525-line/Eye~Limits/Custom
 1 ─────────────────────►   Digital Eye Limits 270Mb 525-line System Default File

                                                         Limits
                           Log?         Highlight?     Low          High
                         - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 2 ──► Amplitude:          yes            yes           720           880    mV
 3 ──► Rise-Time:          yes            yes           400          1500    pS
 4 ──► Fall-Time:          yes            yes           400          1500    pS
 5 ──► Rise/Fall Diff:     yes            yes          -----          500    pS
 6 ──► Rise Overshoot:     yes            yes          -----           10    %
 7 ──► Fall Overshoot:     yes            yes          -----           10    %
 8 ──► DC Offset:          yes            yes          -500           500    mV

 9 ──► Jitter (10Hz):      yes            yes             0           250    pS
10 ──► Jitter (1KHz):      yes            yes             0           250    pS

11 ──► Consecutive error(s) before logging:  2
12 ──► Activate Relay:     Never
```

Figure 1–8: 270Mb 525-line format Eye Limits configuration file

The Eye Limits configuration file contains the following editable parameters:

1. You can edit this parameter to give the configuration file a custom title. When you select this parameter to edit, a keyboard appears on the screen to allow you to enter a custom title.

2. This line has four editable parameters to set the Amplitude signal limits to use for eye diagram measurements. The parameters are Log (yes/no), Highlight (yes/no), Low Limit (mV), and High Limit (mV). The possible values for the Low and High Limits are 0 mV through 2000 mV in increments of 1 mV, and Undefined.

3. This line has four editable parameters to set the Rise-Time signal limits to use for eye diagram measurements. The parameters are Log (yes/no), Highlight (yes/no), Low Limit (ps), and High Limit (ps). The possible values for the Low and High Limits are 0 ps through 2000 ps in increments of 1 ps, and Undefined.

4. This line has four editable parameters to set the Fall-Time signal limits to use for eye diagram measurements. The parameters are Log (yes/no), Highlight (yes/no), Low Limit (ps), and High Limit (ps). The possible values for the Low and High Limits are 0 ps through 2000 ps in increments of 1 ps, and Undefined.

5. This line has four editable parameters to set the Rise/Fall Difference signal limits to use for eye diagram measurements. The parameters are Log (yes/no), Highlight (yes/no), Low Limit (ps), and High Limit (ps). The possible values for the Low and High Limits are 0 ps through 2000 ps in increments of 1 ps, and Undefined.

6. This line has four editable parameters to set the Rise Overshoot signal limits to use for eye diagram measurements. The parameters are Log (yes/no), Highlight (yes/no), Low Limit (%), and High Limit (%). The possible values for the Low and High Limits are 0% through 10% in increments of 1%, and Undefined.

7. This line has four editable parameters to set the Fall Overshoot signal limits to use for eye diagram measurements. The parameters are Log (yes/no), Highlight (yes/no), Low Limit (%), and High Limit (%). The possible values for the Low and High Limits are 0% through 10% in increments of 1%, and Undefined.

8. This line has four editable parameters to set the DC Offset signal limits to use for eye diagram measurements. The parameters are Log (yes/no), Highlight (yes/no), Low Limit (mV), and High Limit (mV). The possible values for the Low and High Limits are –1000 mV through 1000 mV in increments of 1 mV, and Undefined.

9. This line has four editable parameters to set the Jitter (10 Hz) signal limits to use for eye diagram measurements. The parameters are Log (yes/no), Highlight (yes/no), Low Limit (ps), and High Limit (ps). The possible values for the Low and High Limits are 0 ps through 1000 ps in increments of 1 ps, and Undefined.

10. This line has four editable parameters to set the Jitter (1 kHz) signal limits to use for eye diagram measurements. The parameters are Log (yes/no), Highlight (yes/no), Low Limit (ps), and High Limit (ps). The possible values for the Low and High Limits are 0 ps through 1000 ps in increments of 1 ps, and Undefined.

11. This parameter sets the number of consecutive errors to be measured before an entry is made in the log report. Refer to *Report Logging* on page 2–4 for more information. The possible values are from 1 error to 9 errors in steps of 1 error.

12. This parameter sets the state of the Activate Relay which allows you to signal outside the measurement set that a measurement limit was violated. You can set this parameter to one of the following values: Never, On Highlight, and On Log.

Wander Limits Configuration File. The Wander Limits configuration file sets the measurement limits for the SDI Wander application. Each of the four digital video formats has a subdirectory of Wander Limits configuration files. The Wander Limits configuration files for the different video formats have identical parameters. The following example uses the 270Mb 525-line format Wander Limits configuration file.

To access the System Default Wander Limits configuration file for 270Mb 525-line signal format measurements, touch the 270Mb 525-line soft key. See Figure 1–5 on page 1–8. Touch the Wander Limits soft key to open the 270Mb 525-line Wander Limits files directory. Touch the System Default soft key to open the Wander Limits configuration file. See Figure 1–9.

NOTE. Figure 1–9 shows the lines containing editable parameters in a Wander Limits configuration file named Custom. You cannot edit the parameters of the System Default file. You can create a custom file using the Create File soft key or you can edit the contents of an existing custom configuration file.

270Mb~525-line/Wander~Limits/Custom

```
1 ─────────────────► Digital Wander Limits 270Mb 525-Line System Default File
                                                  Limits
                                           Low           High
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
2 ─► Drift Rate (peak):                    -28.0          28.0   ppb/sec
3 ─► Frequency Offset:                     -2800          2800   ppb


4 ─► Consecutive error(s) before logging:  2
5 ─► Activate Relay:      Never
```

Figure 1–9: 270Mb 525-line format Wander Limits configuration file

The Wander Limits configuration file contains the following editable parameters:

1. You can edit this parameter to give the configuration file a custom title. When you select this parameter to edit, a keyboard appears on the screen to allow you to enter a custom title.

2. This line has two editable parameters to set the Drift Rate (peak) signal limits for wander measurements. The parameters are Low Limit (ppb/sec), and High Limit (ppb/sec). The possible values for the Low Limit is –999.0 ppb/sec through 0 ppb/sec in increments of 0.1 ppb/sec, and Undefined. The possible values for the High Limit is 0 ppb/sec through 999.0 ppb/sec in increments of 0.1 ppb/sec, and Undefined.

3. This line has two editable parameters to set the Frequency Offset signal limits to use for wander measurements. The parameters are Low Limit (ppb), and High Limit (ppb). The possible values for the Low Limit is –99990 ppb through 0 ppb in increments of 10 ppb, and Undefined. The possible values for the High Limit is 0 ppb through 99990 ppb in increments of 10 ppb, and Undefined.

4. This parameter sets the number of consecutive errors to be measured before an entry is made in the log report. Refer to *Report Logging* on page 2–4 for more information. The range of values is from 1 error to 9 errors in steps of 1 error.

5. This parameter sets the state of the Activate Relay which allows you to signal outside the measurement set that a measurement limit was violated. The following parameters can be used: Never, On Highlight, and On Log.

Format Setup Configuration File. The Format Setup configuration files for the different video formats have identical parameters, although not all parameters apply to all video formats. The following example uses the 270Mb 525-line format Format Setup configuration file.

To access the System Default Format Setup file for 270Mb 525-line signal format measurements, touch the 270Mb 525-line soft key. See Figure 1–5 on page 1–8. Touch the Format Setup soft key to open the 270Mb 525-line Format Setup directory. Touch the System Default soft key to open the Format Setup configuration file. See Figure 1–11 and Figure 1–12.

Many of the error parameters in the Format Setup configuration file have the following three selections: Log (yes/no), Highlight (yes/no), and Capture (yes/no). The Log setting lets you automatically record a measured error in the Measurement Results Log files for the SDI applications. Refer to *Report Logging* page 2–4 for more information. The Highlight setting lets you highlight the measured error in SDI applications. The Capture setting lets you automatically capture the video frame containing a measured error.

NOTE. Figures 1–11 and 1–12 show the lines containing editable parameters in a Format Setup configuration file named Custom. You cannot edit the parameters of the System Default file. You can create a custom file using the Create File soft key or you can edit the contents of an existing custom configuration file.

When a parameter in the Format Setup configuration file does not apply to the selected video standard, Not Implemented appears by the parameter in the Format Setup file.

The Format Setup configuration file contains the following editable parameters:

1. You can edit this parameter to give the configuration file a custom title. When you select this parameter to edit, a keyboard appears on the screen to allow you to enter a custom title.

2. This line contains two editable parameters: High Luminance Warning and High Chrominance Warning limits. The warning limits are displayed in hex units. The possible values for the High Luminance Warning and High Chrominance Warning limits are 000 through 3ff in increments of 1 hex unit. The High Luminance Warning limit must be less than or equal to the High Chrominance Warning limit as shown in Figure 1–10.

3. This line contains two editable parameters: Low Luminance Warning and Low Chrominance Warning limits. The warning limits are displayed in hex units. The possible values for the Low Luminance Warning and Low Chrominance Warning limits are 000 through 3ff in increments of 1 hex unit. The Low Luminance Warning limit must be greater than or equal to the Low Chrominance Warning limit as shown in Figure 1–10.

8/10-Bit Validation

Hex values → 000   003 | 004   <low> | | <high>   3fb | 3fc   3ff

Luminance measurement ranges →

| Error Low | Warning Low | Valid Video | Warning High | Error High |

Valid luminance range must be within valid Chrominance range[1]

Chrominance measurement ranges →

| Error Low | Warning Low | Valid Video | Warning High | Error High |

Hex values → 000   003 | 004   <low> | | <high>   3fb | 3fc   3ff

User defined values set in the Format Setup configuration file

10-Bit Validation

Hex values → 000   000 | 001   <low> | | <high>   3fe | 3ff   3ff

Luminance measurement ranges →

| Error Low | Warning Low | Valid Video | Warning High | Error High |

Valid luminance range must be within valid Chrominance range[1]

Chrominance measurement ranges →

| Error Low | Warning Low | Valid Video | Warning High | Error High |

Hex values → 000   000 | 001   <low> | | <high>   3fe | 3ff   3ff

[1] **The requirement that the valid luminance value range be within the valid chrominance value range is an application limitation, and not a SMPTE specification.**

Figure 1–10: Relationship between the video-warning and video-error limit parameters

4. This parameter sets the number of active video lines to skip before starting the luminance and chrominance limit checks during measurements. The possible values for the number of video lines to skip is 0 video lines through 14 video lines, in increments of 1 video line.

SMPTE 259M defines active video to start when the V bit in the TRS XY(Z) word transitions from 1 to 0 (normally on video line 20). However, many operators are now embedding nonvideo information, such as closed captioning, within the first few lines of what is defined to be active video. This nonvideo data may not need to operationally conform to the Luminance and Chrominance limits. Therefore, this parameter allows the SDI Format Monitor and SDI Ancillary Data Analyzer applications to skip the specified number of video lines after the V-bit transition before starting to perform the Luminance and Chrominance limits checks.

270Mb~525-line/Format~Setup/Custom

```
1 ─────────────────────────► Digital Format Setup 270Mb 525-Line System Default File

                          │  8/10-Bit Validation Rules │  10-Bit Only Validation Rules
                          │  Luminance    Chrominance   │  Luminance    Chrominance
      Error    High       │     3ff          3ff        │     3ff          3ff
                          │     3fc          3fc        │     3ff          3ff
                          │
      Warning  High       │     3fb          3fb        │     3fe          3fe
2 ──────────────────────► 3ad     < =       3cl        │     <same as for 8/10 bit>

      Valid    Video      │                             │
      - - - - - - - - - - │- - - - - - - - - - - - - - -│- - - - - - - - - - - - - - - -
3 ──► Warning  Low         │     03f     > =   03f       │     <same as for 8/10 bit>
                          │     004          004        │     001          001
                          │
      Error    Low        │     003          003        │     000          000
                          │     000          000        │     000          000
              Luminance warning range must enclose chrominance warning range
                          (as shown by the '<=' and '>=')

4 ──►Skip  0 active video lines before starting Luma/Chroma warning limits checking.

      ============================================================================

      General Errors              Log?       Highlight?      Capture?
      - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
      Loss of
    ─► Signal                     yes          yes            no
    ─► TRS Align                  yes          yes            yes

      Length Errors
    ─► Line                       yes          yes            no
    ─► Blanking                   yes          yes            no
    ─► Vertical Interval          yes          yes            no
    ─►Field                       yes          yes            no

      Ancillary Data Errors
    ─► Header                     yes          yes            yes
5 ─► Data                        yes          yes            yes
    ─► Checksum                   yes          yes            yes
    ─► Placement                  yes          yes            yes

      Ancillary Audio Errors
    ─► Block out of Sequence      yes          yes            yes
    ─► Broken Block               yes          yes            yes
    ─► Samples / Frame            yes          yes            yes
    ─► 5 / 5 Pattern Broken       yes          yes            yes

      Misc. Errors
    ─► XY(Z)                      yes          no             no
    ─► Unused Space               yes          no             no
```

Figure 1–11: 270Mb 525-line format Format Setup configuration file

Video Errors	Log?	Highlight?	Capture?
Luminance			
Low	yes	yes	no
High	yes	yes	no
Chrominance			
Low	yes	yes	no
High	yes	yes	no

Video Warnings	Log?	Highlight?	Capture?
Luminance			
Low	yes	yes	no
High	yes	yes	no
Chrominance			
Low	yes	yes	no
High	yes	yes	no

EDH Errors	Log?	Highlight?	Capture?
EDH			
Full Field	yes	yes	no
Active Picture	yes	yes	no
Anc. Data	yes	yes	no
EDA			
Full Field	yes	yes	no
Active Picture	yes	yes	no
Anc. Data	yes	yes	no
IDH			
Full Field	yes	yes	no
Active Picture	yes	yes	no
Anc. Data	yes	yes	no
IDA			
Full Field	yes	yes	no
Active Picture	yes	yes	no
Anc. Data	yes	yes	no
UES	yes	yes	no
EDH Misplaced	yes	yes	yes
EDH Missing	yes	yes	no

6

7

8 → FIFO Overflow	yes	yes	no

9 → Consecutive error(s) before logging: 2
10 → Activate Relay: On Capture

Figure 1–12: 270Mb~525-line format Format Setup configuration file (Cont.)

5. These lines represent the general errors that are tested. General errors include ancillary data and audio errors, length errors, and other miscellaneous errors. Refer to *Format Monitor Error Messages* on page 3–34 for more information. Each line lists the three parameters that set the error detection response during measurements. The parameters are Log (yes/no), Highlight (yes/no), and Capture (yes/no).

6. These lines represent the video errors that are tested. Video errors include warnings and errors for luminance and chrominance low and high levels. Each line lists the three parameters that set the error detection response during measurements. The parameters are Log (yes/no), Highlight (yes/no), and Capture (yes/no).

7. These lines represent the EDH errors that are tested. EDH errors include full field, active picture, and ancillary data errors for EDH, EDA, IDH, and IDA data. Each line lists the three parameters that set the error detection response during measurements. The parameters are Log (yes/no), Highlight (yes/no), and Capture (yes/no).

8. This line has three parameters to set the error detection response to a FIFO overflow error during measurements. The parameters are Log (yes/no), Highlight (yes/no), and Capture (yes/no).

9. This parameter sets the number of consecutive errors to be measured before an entry is made in the log report. Refer to *Report Logging* on page 2–4 for more information. The range of values is from 1 error to 9 errors in steps of 1 error.

10. This parameter sets the state of the Activate Relay which allows you to signal outside the measurement set that a measurement limit was violated. The following parameters can be used: Never, On Capture, On Highlight, and On Log.

Digital Audio Setup Configuration File. Touch the Digital_Audio Setup soft key (see Figure 1–5 on page 1–8) to open the Digital Audio Setup directory. Touch the System Default soft key to open the Digital Audio Setup configuration file.

The Digital Audio Setup configuration file lets you set the following four parameters for the audio measurements: Log, Highlight, and the Low and High measurement limits. Measurement events that exceed the user-defined low or high limits can be logged or highlighted. Logged events are entered in the SDI Eye Diagram's log report. Refer to *Report Logging* on page 2–4 for more information. The Highlight parameter lets you highlight the measurement cell in the Measurement & Limits display (see Figure 3–6 on page 3–13) when the measurement exceeds the user-defined low or high limits.

The Level measurement in the Digital Audio Setup configuration file is measured in dBr (dB reference) units. That means the audio level is measured in dB from a selected reference level. The dBr Reference parameter in the configuration file sets the audio level reference. The dBr reference is set to some level below dBFS (dB full-scale). The dB full-scale value represents the zero-reference point for the audio level measurement set at the highest signal-amplitude that the AES stream can represent. When you set the dBr Reference parameter, you are setting the zero-reference point at the highest signal-amplitude that you would normally want the AES stream to carry. Typically, the dBr reference is set about –20 dB below dBFS to prevent clipping on unusually loud sounds.

NOTE. Figure 1–13 shows the lines containing editable parameters in a Digital Audio Setup configuration file named Custom. You cannot edit the parameters of the System Default file. You can create a custom file using the Create File soft key or you can edit the contents of an existing custom configuration file.

The Digital Audio Setup configuration file contains the following editable parameters (see Figure 1–13):

1. You can edit this parameter to give the configuration file a custom title. When you select this parameter to edit, a keyboard appears on the screen to allow you to enter a custom title.

2. This line has four editable parameters to set the audio level signal limits to use for measurements. The parameters are Log (yes/no), Highlight (yes/no), Low Limit (dBr), and High Limit (dBr). The possible values for the Low Level and High Level limits are –99 dBr through 99 dBr in increments of 1 dBr, and Undefined.

```
     Digital_Audio~Setup/Custom
1 ────────────────────────► Digital Audio Limits System Default File

                                                        Limits
                            Log?        Highlight?      Low         High
2 ──► Level:                yes         yes             -----       -----    dBr
3 ──► Frequency:            yes         yes             -----       -----    Hz
4 ──► THD + N:              yes         yes             -----       -----    %

5 ──► Level Diff (L-R):     yes         yes             -----       -----    dB
6 ──► Phase      (L-R):     yes         yes             -----       -----    degrees

7 ──► dBr Reference:        -20 dBFS

8 ──► Consecutive error(s) before logging:  2
9 ──► Activate Relay:     Never
```

Figure 1–13: Digital Audio Setup configuration file

3. This line has four editable parameters to set the audio frequency signal limits to use for measurements. The parameters are Log (yes/no), Highlight (yes/no), Low Limit (Hz), and High Limit (Hz). The possible values for the Low Frequency and High Frequency limits are 20 Hz through 20000 Hz in increments of 1 Hz, and Undefined.

4. This line has four editable parameters to set the THD + N signal limits to use for measurements. The parameters are Log (yes/no), Highlight (yes/no), Low Limit (%), and High Limit (%). The possible values for the Low THD + N and High THD + N limits are 0% through 100% in increments of 0.01%, and Undefined.

5. This line has four editable parameters to set the audio level difference signal limits to use for measurements. The parameters are Log (yes/no), Highlight (yes/no), Low Limit (dB), and High Limit (dB). The possible values for the Low Level Diff and High Level Diff limits are –99 dB through 99 dB in increments of 1 dB, and Undefined.

6. This line has four editable parameters to set the audio phase signal limits for measurements. The parameters are Log (yes/no), Highlight (yes/no), Low Limit (degrees), and High Limit (degrees). The possible values for the Low Phase and High Phase limits are –180 degrees through 180 degrees in increments of 1 degree, and Undefined.

7. This line sets the dBr reference for measurements. The possible values for the dBr reference are –99 dBFS through 0 dBFS in increments of 1 dBFS.

8. This parameter sets the number of consecutive errors to be measured before an entry is made in the log report. Refer to *Report Logging* on page 2–4 for more information. The possible values are from 1 error to 9 errors in steps of 1 error.

9. This parameter sets the state of the Activate Relay, which allows you to signal outside the measurement set that a measurement limit was violated. The following parameters can be used: Never, On Highlight, and On Log.

Diagnostics Selection Configuration File. This configuration file allows you to select the diagnostics to perform when the measurement set powers up. Touch the Diagnostics Selection soft key (see Figure 1–5 on page 1–8) to open the Diagnostics Selection configuration file. Option 1S adds the following line to the configuration file:

```
SDI~Diagnostic
```

To select or deselect a diagnostic, use the front-panel knob to highlight the desired diagnostic. Touch the column (Selected or Not Selected) to move the highlighted diagnostic to the desired column.

Configuration Tutorial   Although Option 1S comes from the factory already configured to make measurements, you may want to use your own signal limits to perform specific measurements. The following procedure will step you through the process of creating a custom signal limit file and configuring Option 1S to use it for measurements. This tutorial example demonstrates how to customize a signal limit file for the 270 Mb 525-line video format.

1. Press the front-panel **Configure** button to enter the Configure Files directory.

2. Set the instrument to Digital Mode using the **Mode** soft key, and then touch the **Configure Files** soft key.

3. Touch the **270Mb 525-line** soft key to enter the directory of configuration files for this video format.

4. Touch the **Eye Limits** soft key to open the directory of Eye Limits files for the 270 Mb 525-line video format.

5. The System Default limits file is supplied by the factory and its contents cannot be edited. To create a new custom limits file, touch the **Create File** soft key. The measurement set prompts you by displaying "Please select a file as template" at the top of the display.

6. Touch the icon corresponding to the file you want to copy (normally **System Default**). This copies the contents of the selected file. To allow you to name the new copy, a box appears in the center of the directory window and a keyboard appears below it as shown in Figure 1–14. The characters you select (touch) appear in this box.

7. Type the new file name, observing the following rules and noting the special uses of some characters and keys:

   ■ Spaces are not allowed in file or directory names; use an _ (underscore) or . (dot) character to separate words in a name. Forward slash (/) and reverse slash (\) characters are not permitted in file names.

   ■ When neither Set1 nor Set2 is selected (highlighted), you can type lowercase and uppercase English alphabet characters. Touch the Set1 and Set2 soft keys to toggle them on or off. The lowercase Set1 character set allows you to enter numerals and punctuation characters. The uppercase Set1 and the Set2 character sets allow you to enter various special characters for use in non-English language file names.

   Both the Set1 and Set2 character keys and the Shift soft key "lock" when selected. Set1 and Set2 are unlocked by touching the same key again or touching the unselected key of the pair. Shift is unlocked by touching Shift again.

   ■ A maximum of 31 characters are allowed in a file or directory name.

■ Use only uppercase and lowercase letters, numbers, and the following punctuation characters: _ (underscore), . (dot), – (minus sign), + (plus sign), : (colon), and ~ (tilde) in names. Avoid using punctuation characters other than those mentioned above in a directory or file name.

■ Two-line directories and file names can be entered using the RETURN key. Touch RETURN on the keyboard to get to the second line.

■ When the measurement set is in remote mode, the return character becomes a tilde character (~) for purposes of file name reference. Thus, a directory whose name is displayed as:

```
JOHN
SMITH
```

in the directory display becomes JOHN~SMITH when referred to in a remote operation.

```
Please enter file name (max 31 characters)
```

```
Test_Set1█
```

```
q  w  e  r  t  y  u  i  o  p

 a  s  d  f  g  h  j  k  l  Back
                              Space

  z  x  c  v  b  n  m  Return

Cancel  Set1  Set2     Space      Shift  Done
```
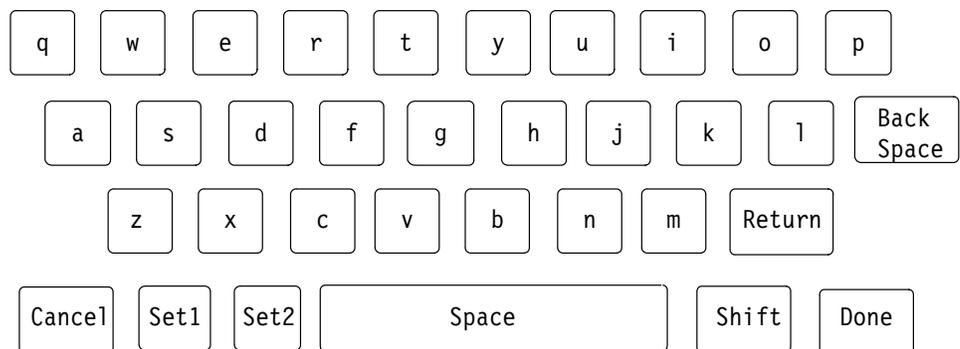
Figure 1–14: File naming keyboard

8. After typing the file name, touch **Done** to complete the creation of the file, or press **Cancel** to quit the process without creating the file. After you enter a file name and touch Done, the new signal limits file opens and is ready for editing.

9. To edit a signal limit parameter, rotate the front-panel knob to highlight the line that contains the parameter you want to change. After the line is highlighted, touch the parameter you want to change. There are four possible responses to this touch:

NOTE. The first line of a configuration file is often a title line. You may edit this line to provide a descriptive identifier about the content or purpose of the custom file. Editing the title line of a configuration file does not change the file name.

- If the item that you touch is not editable, the measurement set produces a clicking sound, but the screen is not changed.

- If the item that you touch can be edited alphabetically, a keyboard appears on the lower half of the display screen (see Figure 1–14).

- If you are to choose a new value for the item that you touch from a limited number of choices, a box appears around the item to be edited. Rotate the front-panel knob to cycle through the available choices.

- If the limit parameter is numerical, you can enter Undefined as its value by touching the Enter Undefined soft key. The parameter value of Undefined is shown by five dashes in the configuration field.

NOTE. Entering a configuration file parameter value as undefined causes the affected applications to not perform limit testing for that signal parameter.

10. After you change the value of a parameter, touch the **Accept Input** soft key or touch the screen anywhere inside the directory window to accept the new selection.

11. After you have changed all of the limits values that you want to, touch the **Update & Exit** soft key to write the file with the changes.

12. Now that you have a custom Eye Limits file, you must tell the measurement set to use it. Touch the **Leave Directory** soft key, and then touch the **Digital_Source Files** soft key.

13. Create a custom Digital Source File using the same method shown in steps 5 through 8. Once you have named the custom Digital Source File, it is open and ready to edit.

14. Rotate the front-panel knob to highlight the Eye Limits line. Touch the file name on the line (the file name should be highlighted in a box).

15. Rotate the front-panel knob to select the name of the custom Eye Limits file that you previously created.

16. Touch the **Accept Input** soft key, and then touch the **Update & Exit** soft key to create the custom Digital Source File.

17. Now that you have a custom Digital Source File, you must tell the measurement set to use it. Touch the **Leave Directory** soft key, and then touch the **Leave Directory** soft key again to return to the upper directory level.

18. Touch the **Source_Selection Digital** soft key to open that file.

19. Rotate the front-panel knob to highlight the line containing Digital A: 270Mb 525-line in the file. Touch the file name on that line.

20. Rotate the front-panel knob to select the name of the custom Digital Source File you created in steps 13 through 16.

21. Touch the **Accept Input** soft key, and then touch the **Update & Exit** soft key to update the Source Selection Digital file.

22. The measurement set is now configured to use your custom Eye Limits file for SDI Eye Diagram measurements on the SDI Ch. A input when a 270 Mb signal is present.

Functional Check

The following procedure provides a functional check to verify basic instrument operation. The procedure does not verify any specifications; it just provides a high level of confidence that the instrument is working properly. To verify instrument operation to published specifications, refer to the *Performance Verification* section in the *VM700T Video Measurement Set Service Manual*.

1. Connect signals to all of the Option 1S rear-panel connectors as shown in Figure 1–15.

NOTE. The internal power-up diagnostics for Option 1S provide the greatest degree of testing for instrument functionality when all rear-panel connectors have proper signals connected to them. When these signals are not present, the diagnostic tests that require input signals will report "N/A" (not applicable).

---

2. Press the front-panel **Measure** button, and then touch the **Diag** soft key.

3. Rotate the front-panel knob until you locate the SDI Diagnostic soft key.

4. Touch the **SDI Diagnostic** soft key to access the SDI diagnostic routine.

5. Touch the appropriate soft key to select the diagnostics run-mode type (Power-Up or Interactive).

Diagnostics performed from the Measure menu offer two modes: Power-Up and Interactive. In Power-Up mode, the diagnostics display a one-line header for each test being run. Should the diagnostics encounter an error, the measurement set waits for user acknowledgement. In Interactive Mode, the diagnostics display more detail about each test being performed. Before starting the next test in the list, the measurement set waits for user acknowledgement.

6. Observe the displayed diagnostic test results as they are performed. Diagnostic tests that do not pass display a highlighted Fail message.
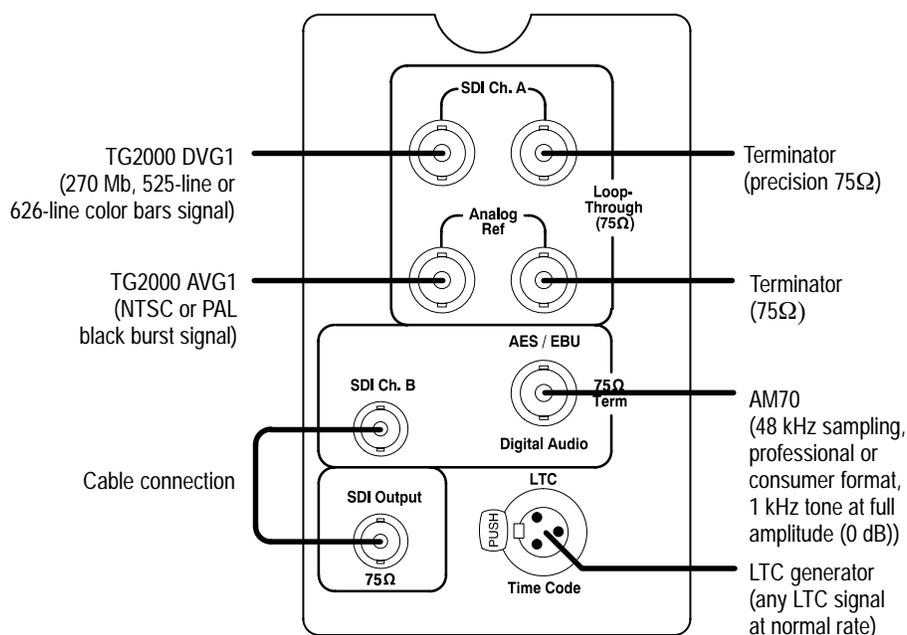
Figure 1–15: Signal connections for performing Option 1S diagnostic tests

7. The Rerun Test soft key lets you rerun diagnostic tests.

8. If Option 1S fails any diagnostic test, refer to the *VM700T Video Measurement Set Service Manual* for troubleshooting information or contact your local Tektronix representative for assistance.

Operating Basics

Operating Basics

This section contains a functional overview of instrument operation with Option 1S installed and a description of the function and usage of the rear-panel connectors included with Option 1S. The functional overview covers the operational topics that span across many applications in Option 1S. Refer to the *Reference* section of this manual for specific information about each application.

Functional Overview

The appearance and operation of the VM700T front panel does not change with Option 1S installed. The blank panel on the VM700T rear panel is replaced with the Option 1S rear panel. The position of the preexisting signal and power connectors of the VM700T does not change.

With Option 1S installed, the VM700T resembles two separate instruments in one package: one analog and one digital. You can switch between the analog and digital functions by selecting Digital Mode or Analog Mode from one of these locations: the Configuration menu (two locations), the Measure menu, or through remote control.

NOTE. *To access any of the functions of Option 1S, you must set the VM700T to Digital Mode.*

When you switch between Digital Mode and Analog Mode, the operation of the front-panel buttons does not change except for the following five buttons: Waveform, Vector, Picture, Measure, and Auto. The Waveform and Picture buttons access the SDI Waveform and the SDI Picture applications respectively. The Vector button accesses the SDI Lightning application. The Measure mode button operation changes such that the measurement choices shown in the Measure menu will be only those relevant to the selected signal source type (analog or digital). When the VM700T is set to Digital Mode, the Auto mode button provides direct access to the SDI Format Monitor application.

Option 1S adds a new soft key to the Measure mode screen and changes the name of one of the existing soft keys. The new SDI soft key changes the measurement set to Digital Mode and displays the SDI applications. The original Video soft key is renamed to Analog Video. The Analog Video soft key changes the measurement set to Analog Mode and displays the analog measurement applications.

Selecting an SDI Measurement Application

Press the front-panel Measure button to open the Measure mode display. The screen displays the available measurement groups for the selected instrument mode (analog or digital). Touch either the SDI or the Analog Video soft keys to set the measurement set to Digital or Analog modes respectively.

Once the instrument is set to Digital Mode, the Measure mode screen displays the available SDI measurement applications. Turn the front-panel knob as necessary to scroll through the complete list of SDI measurement applications. Touch the name of a measurement application in the Measure mode display to execute that measurement.

You can directly access some SDI applications using the following front-panel mode buttons: Waveform (SDI Waveform application), Vector (SDI Lightning application), Picture (SDI Picture application), and Auto (SDI Format Monitor).

Option 1S provides many applications, each pertaining to a different aspect of the digital signal. The applications are in one the following four measurement groups: electrical, video format and content, audio format and content, and timing. Refer to the *Reference* section of this manual for specific operating instructions describing the signal measurements available within each of the SDI measurement applications.

Video Frame Capture and Download to a PC

Option 1S introduces a new concept to the VM700T: the shared acquisition buffer. You can use this acquisition buffer to capture a video frame and then use multiple measurement applications to make different measurements on the same video frame. You can use the SDI Format Monitor application to capture a specific video frame or you can use the front-panel Freeze button to capture the active video frame. You can then use any of the following applications to make measurements on the captured frame: SDI Ancillary Data Analyzer, SDI Ancillary Data Distribution Analyzer, SDI Waveform, SDI Lightning, and SDI Picture.

You can download the captured frame to a PC using remote control. To download a captured frame to a PC, perform the following procedure:

1. Using remote control (either RS–232 or GPIB), activate the SDI Waveform application.

2. Change the selected line to F1 L1.

3. Type `getresults verbose`.

4. Download the resulting Measurement Results file. The Measurement Results file contains all the samples for the selected line and is located in the following directory path:
   nvram0/ConfigFiles/Measurement~Results.

5. Repeat steps 2 through 4 for each line in both fields of the video signal to download the entire frame.

Measurement Cell Display States   Several of the Option 1S applications use cells to display measurement results. These measurement cells can have several display states. Figure 2–1 shows the different display states you may encounter. The following example shows a group of cells from the SDI Format Monitor application.

(Default state) Measurement enabled in Format Setup configuration file (Highlight On, Capture Off): bright cell outline and shaded cell text

```
           Loss of
 Signal       TRS Align
 0            0
```

Measurement disabled in Format Setup configuration file (Highlight and Capture Off): shaded cell outline and shaded cell text

```
           Loss of
 Signal       TRS Align
 0            0
```

Measurement enabled in Format Setup configuration file (Highlight and Capture On): bright cell outline and bright cell text

Result of a past measurement-limit violation: bright cell outline and shaded cell interior

```
           Loss of
 Signal       TRS Align
 26           26
```

Result of a current measurement-limit violation: bright cell outline and bright cell interior (will blink if a frame has been captured)

Figure 2–1: Example showing the Format Monitor measurement-cell display states

Free Run Mode   In the normal display mode, the measurement set scans the video signal while correlating the signal to video field and line numbers. To accomplish this, the measurement set references the frame-start TRS marks in the video stream. In video streams where the frame-start TRS mark is unrecognizable (due to bad formatting, stuck bits, or excessive jitter in the sending hardware), you can use the Free Run mode to allow the SDI applications to display the video signal without correlating video field and line numbers. The Free Run mode is shared between Option 1S applications.

NOTE. When the Free Run mode is on, the SDI applications do not detect a signal format or rate change. If a signal format or rate change occurs while the Free Run mode is on, the measurement displays are erroneous.

Select Line Mode   The Select Line mode is shared among the SDI applications that use this mode. This means that when you select a video line for measurement in one application and then go to another application, that same video line is automatically selected for measurement (if the newly selected application uses the Select Line mode).

When the Select Line mode is active, the front-panel knob scrolls through the video lines in the current video field and wraps to the next field. The currently selected line is displayed in the application display readout.

When you press the front-panel Select Line button, the Select Line menu appears on the screen. The Select Line soft keys have the following functions:

■ Next Field. Touch this soft key to toggle the display to show the same video line number in the next video field.

■ Field *<number>* Line *<number>*. Touch these two soft keys to display the signal of the field and line number shown on them. These two soft keys serve as presets to provide you with a means to quickly jump to a desired field and line number. To change the preset field and line numbers, touch and hold the soft key as you turn the front-panel knob. The field and line numbers for the presets are reset to the factory default values when the measurement set is powered down.

The 525-line video formats (143 Mb NTSC, 270 Mb 525-line, and 360 Mb 525-line) share one set of line-select presets, and the 625-line video formats (270 Mb 625-line and 360 Mb 626-line) share another set of presets.

Report Logging   The SDI applications that perform measurements using limit files provide you with a means to select how the measurement results are reported (SDI Eye Diagram, SDI Wander, SDI Format Monitor, and SDI Audio Measurements). The Logging menus in each of these applications are identical. However, the log settings in one application do not affect the log settings in the other applications.

The Logging menu provides the following soft keys:

■ Log. Touch this soft key to toggle the logging function on and off. The logging function is on when this soft key is highlighted. The logging function must be off before you can use the Log Port, File Append, and File Overwrite soft keys to make changes to the logging output parameters.

■ Log Port. This soft key only appears when the logging function is turned off using the Log soft key. Touch this soft key to send the log report to the measurement set communication port selected in the Communication Setup configuration file.

■   File Append. This soft key only appears when the logging function is turned off using the Log soft key. Touch this soft key to append new logging information to the end of the Measurement Results Log file in the following directory path: *nvram0/ConfigFiles/Measurement~Results*.

■   File Overwrite. This soft key only appears when the logging function is turned off using the Log soft key. Touch this soft key to overwrite previous logging information in the Measurement Results Log file with new logging information in the following directory path: *nvram0/ConfigFiles/Measurement~Results*.

Hex Formats   The television industry has adopted two standards for representing the hexadecimal value of binary words (samples): SMPTE and EBU. SMPTE specifications convert binary words to whole hexadecimal numbers while EBU specifications split the binary word into whole and fractional parts. Option 1S allows you to select between these two hex formats when displaying measurement results.

Figure 2–2 shows an example of the partitioning difference between the two hex formats of the 10-bit binary word. In a partitioned word, each of the three groups of bits are called nibbles. The SMPTE hex representation of the binary word 1111111111 is 3ff and the EBU hex representation is ff.c.
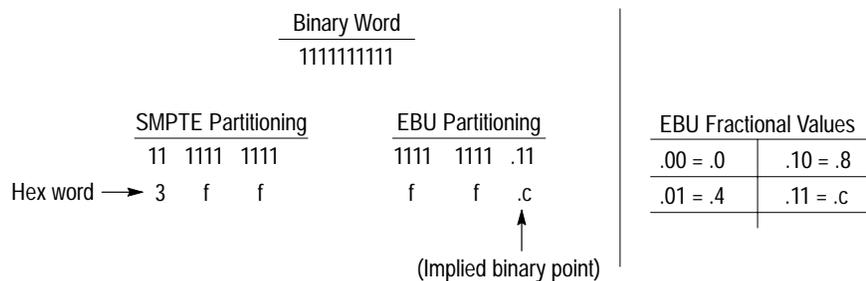
Figure 2–2: SMPTE and EBU hex format partitioning of the binary word

Timed Events   Every VM700T has the ability to execute user-configurable timed events. Timed events include analog Auto mode reports and user-configurable analog and/or digital test functions. The VM700T must be set to Analog mode before you can access the Timed Events directory. Refer to the *VM700T Video Measurement Set Option 01 (NTSC) and Option 11 (PAL) User Manual* for more information.

You can configure timed events for analog and SDI applications in the Timed Events directory located in the following directory path: *nvram0/Configfiles/Timed_Events*.

Functions referenced by the Timed Events directory must be in the following directory path: *nvram0/FunctionKeys/Timed~Functions*.

Rear Panel Connectors

Figure 2–3 shows the VM700T rear panel with Option 1S installed. Figure 2–4 shows a close-up of the Option 1S rear panel.

The Option 1S rear-panel connectors provide the following functions:

- The SDI Ch. A input is a noninterfering loopthrough BNC input for serial digital video signals. You must use the SDI Ch. A input to perform electrical signal measurements in the following applications: SDI Eye Diagram, SDI Jitter, and SDI Wander. The remaining loopthrough connector must be precision terminated in 75 Ω when not used in a loopthrough mode. The primary function intended for this input is to measure a signal under test.

- The SDI Ch. B input is an internally precision-terminated (75 Ω) BNC input for serial digital video signals. The SDI Ch. B input cannot perform the electrical measurements in the following applications: SDI Eye Diagram, SDI Jitter, and SDI Wander. Although you can use this input to measure a signal under test, the primary function intended for this input is to enable you to use a digital reference signal to make comparative timing measurements with the signal under test on the SDI Ch. A input.

- The Analog Ref input is a loopthrough BNC input for an analog timing reference signal (black burst). The remaining loopthrough connector must be terminated in 75 Ω when not used in a loopthrough mode. The only function intended for this input is to enable you to compare your analog timing reference signal with a digital timing reference and/or a signal under test. The timing comparison between an analog reference signal and a serial digital signal will never be a perfect match; however, you will be able to see resolution to within 1 μs.

- The SDI Output is a buffered BNC monitor output that can be set to output one of the following signal sources: SDI channel A input, SDI channel B input, currently selected SDI input channel (indicated by front-panel LED), or none (no output). You select the signal source in the Source Selection Digital configuration file. Refer to *Source Selection Digital Configuration File* on page 1–9.

NOTE. *You may not be able to use the SDI Output signal effectively as a signal repeater when it is set to output the signal on the SDI channel A input. The output of the SDI channel A signal can be interrupted when you access one of the following applications: SDI Eye Diagram, SDI Jitter, and SDI Wander.*

- The AES/EBU Digital Audio input is used to measure external digital-audio signals. This BNC input is internally terminated in 75 Ω.

- The LTC Time Code input is a standard Longitudinal Time Code interface input used for time stamping measurement log reports.
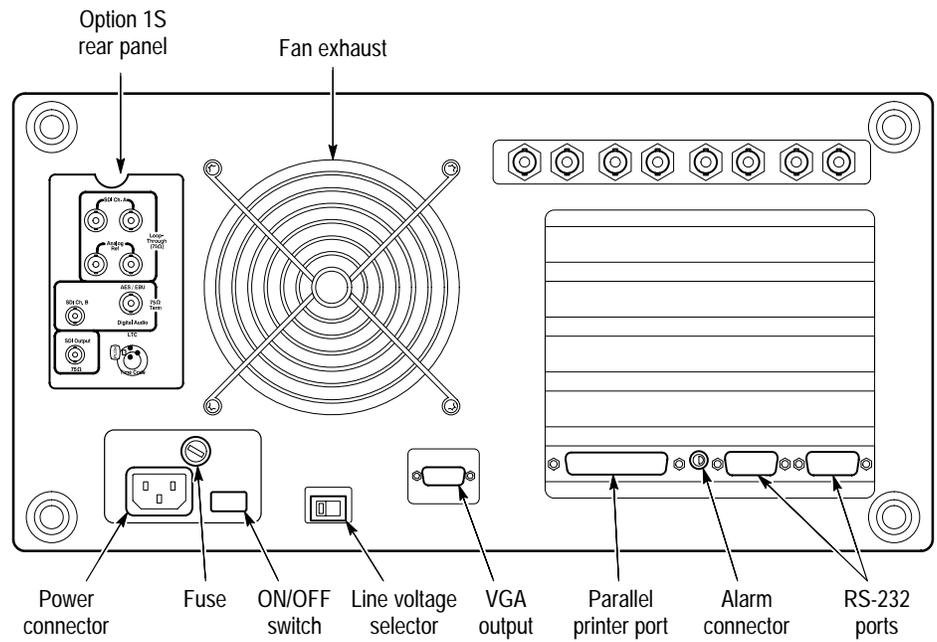
Figure 2–3: VM700T rear panel with Option 1S installed
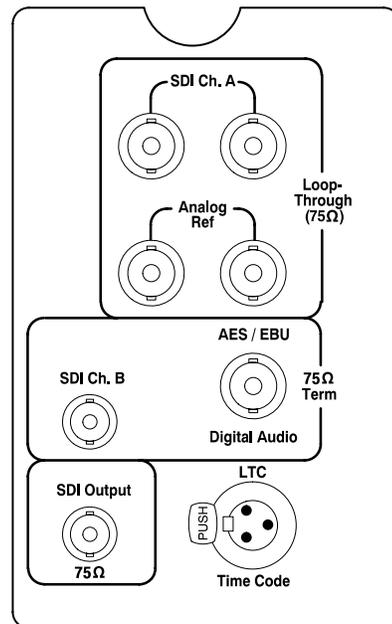
Figure 2–4: Option 1S rear panel

Reference

Reference

This section describes the functions and features of the SDI applications. Each application description contains general information about the application, descriptions of the measurement displays and the functions available through menu selections, and discussions about the practical use of the application.

The purpose of testing a digital-video signal is to provide details about the actual picture information or the quality of the digital-video signal. The digital-video signal may include errors due to A/D, D/A, and parallel-to-serial conversions, bit errors, format errors, jitter, and loss-of-frame synchronization. Option 1S provides the means to test for these types of errors by using different applications to measure specific characteristics of the digital-video signal.

Each of the Option 1S applications is a member of one of the following four measurement groups: electrical, video format and content, audio format and content, and timing. Table 3–1 lists the SDI applications under their associated measurement groups and the starting page number where you can find specific information about each application.

Table 3–1: SDI applications listed by measurement functional group

Measurement group type	Application names	Page number
Electrical	SDI Eye Diagram	Page 3–3
	SDI Jitter	Page 3–15
	SDI Wander	Page 3–22
Video format and content	SDI Format Monitor	Page 3–27
	SDI Ancillary Data Analyzer	Page 3–42
	SDI Ancillary Data Distribution Analyzer	Page 3–50
	SDI Waveform	Page 3–54
	SDI Lightning	Page 3–61
	SDI Picture	Page 3–64
Audio format and content	SDI Audio Format Analyzer	Page 3–66
	SDI Audio Measurements	Page 3–71
Timing	SDI Interchannel Timing	Page 3–75
	SDI Audio/Video Timing	Page 3–77

Electrical Measurement Applications. These applications measure the SDI physical layer for properties such as peak-to-peak voltage, DC offset, jitter, and conformance to valid analog-signal levels. Problems with the electrical properties of the SDI signal can be caused by the excessive length of cable runs, transmission sources that are noisy, signal conversion from one video format to another, and from the equipment that operates on the digital-video signal.

NOTE. The electrical-measurement applications (SDI Eye Diagram, SDI Jitter, and SDI Wander) only measure signals connected to the SDI Ch. A input.

Video Format and Content Measurement Applications. These applications check for data errors such as bit errors and protocol errors (i.e. TRS, EAV, SAV) and verify the content of the SDI signal using a traditional analog-looking display. These applications can locate problems such as incompatibility between SDI equipment as well as encoding and decoding artifacts remaining in the signal.

Audio Format and Content Measurement Applications. These applications display and verify the decoded audio signal in a traditional analog-looking display to ensure compliance to AES/EBU formatting specifications. These applications can locate problems such as incompatibility between SDI equipment, encoding and decoding artifacts remaining in the signal, and embedding and de-embedding conversion errors.

Timing Measurement Applications. These applications allow you to test the relative timing of SDI signals to a reference standard or to another SDI signal. The applications also provide the means to verify that the audio-to-video delay is within acceptable limits. These applications can locate problems such as signal re-timing, encoding and decoding artifacts remaining in the signal, excessive length and/or unmatched cable runs, and embedding and de-embedding conversion errors.

SDI Eye Diagram Application

As one of the electrical measurement applications, the SDI Eye Diagram application verifies the electrical characteristics of the SDI transport layer. The physical serial data stream consists of binary data transmitted over a single coaxial cable at data rates of 143 Mbit/sec up to 360 Mbit/sec. Serial digital receivers that operate at these rates need to have robust characteristics in order to operate correctly in the presence of signal jitter and noise. Measurements of this serial data stream include signal amplitude, rise and fall times, DC level, and jitter as defined by SMPTE 259M.

The SDI Eye Diagram application provides the following two display modes: Eye Diagram and Measurement & Limits. The Eye Diagram display mode allows you to observe and verify the analog characteristics of the digital-video signal. The Measurement & Limits display mode provides a display of the current and past Eye Diagram measurements and their user-defined limits.

Signal parameters such as amplitude level, rise and fall times, rise and fall overshoot, jitter, and DC offset are measured and plotted using equivalent-time sampling (refer to *Equivalent Time Sampling* on page 3–4). All signal-parameter measurements are compared against user-programmable limits to provide notification of out-of-tolerance conditions. The Measurement and Limits display mode provides visual indication of all out-of-limit errors as well as access to the logging function for signal-measurement error reports.

Measurement functions such as voltage and timing cursors allow direct manual measurements of the signal display. The 10 Hz and 1 kHz filters are provided for separate timing-jitter and alignment-jitter measurements. Also provided are an automatic cable length meter and the ability to select or deselect portions of the signal's eye-pattern waveform for measurement and display.

The SDI Eye Diagram application progressively scans through all lines of both fields of the tested signal. The field and line number of the displayed waveform is shown on the screen. To select a specific field and line number to take Eye Diagram samples from, press the front-panel Select Line button and turn the knob until the desired line is displayed. The selected line shown on the Eye Diagram display indicates the first line from which eye samples are taken. In 270 Mb and 360 Mb modes, samples are taken from the indicated line and the next two lines. In 143 Mb mode, samples are taken from the indicated line and the next five lines.

The Touch and Zoom function of the measurement set is locked in the vertical mode for this application. You cannot change the horizontal zoom or offset of the signal display.

The SDI Eye Diagram application can access the Select Line Mode. Refer to *Select Line Mode* on page 2–4 for more information.

Eye Diagram Display Mode

The SDI Eye Diagram application provides two display modes: Eye Diagram and Measurement & Limits. Use the Mode soft key to toggle between the two display modes.

The Eye Diagram display mode shows the analog characteristics of the digital-video signal on a high-resolution two-axis display (see Figure 3–1). The X axis represents time measured in unit intervals or in nanoseconds. The Y axis represents the DC offset of the input signal. The zero value for the DC offset is computed from the DC offset of the input signal.

The Eye Diagram display graphs multiple bits of the serial data stream to a single picture called an eye diagram or eye pattern. The behavior of each data bit contributes to the appearance of the display and indicates how easily a serial receiver can correctly decode the video signal.

Since the serial receiver determines if the signal is in a high or low state in the center of each eye pattern, a large clear eye opening is a useful means for evaluating the overall quality of the physical layer of the SDI signal. As noise and jitter in the signal increase through the transmission channel, the eye pattern becomes less distinct and can close completely. Any transmission effect which closes the eye pattern may reduce the ability to recover the received video signal.

An advantage of an SDI video system over analog video is the ability to operate in a noisy signal environment without noticeable degradation in the decoded signal quality. Unlike an analog system, the SDI receiver bit error rate is exponential. This means an SDI system may continue to function in a noisy environment but can suddenly fail when a few more meters of coaxial cable are added to the system. This effect is referred to as the digital cliff and can be tested with the Eye Diagram application precision cable-length meter. You can test for the length of cable that will cause the serial receiver system to fail and then design routing systems with less coaxial cable than would cause the digital cliff effect to occur.

Jitter Measurements. The Eye Diagram is an equivalent-time sampled display. Equivalent-time sampling refers to the fact that the sample rate of the SDI signal is below the Nyquist rate. The VM700T samples SDI signals at 1/19th the rate of the input SDI clock. The equivalent-time derived eye-pattern display is built up over time from thousands of individual periodic samples. Figure 3–2 shows how the eye-pattern waveform is built from samples of the video signal.

Due to this sampling pattern, line-correlated jitter anomalies may not be apparent using the SDI Eye Diagram application. The SDI Eye Diagram application can only show about 0.8 UI of jitter before the eye closes. At 270 Mb, this corresponds to about 3 ns of jitter. Therefore, you should use the SDI Jitter application to view line-correlated jitter anomalies or large jitter amplitudes.
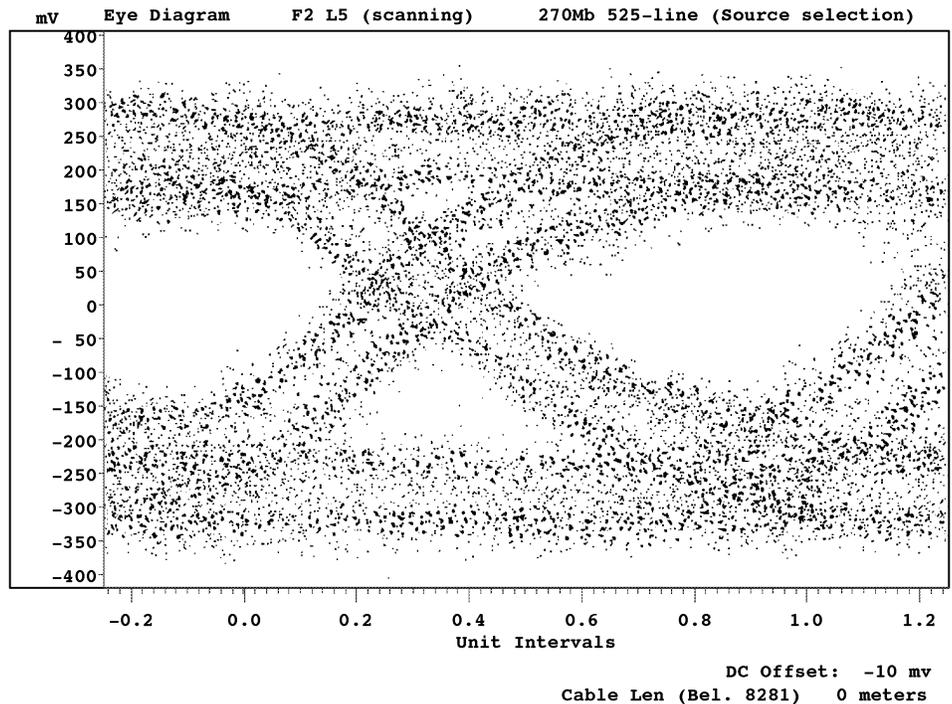
Figure 3–1: Example of jitter starting to close the eye opening

The eye-pattern waveform can be conceptualized as an oscilloscope display of the SDI signal that is triggered by a regenerated clock. The horizontal displacement of each waveform (jitter) represents the difference between its transition and the average transition that defines the regenerated clock.

The SDI Eye Diagram application measures the jitter at the eye crossing position in the display. As the jitter becomes larger, the empty space (the eye opening) between the rising and falling edges of the waveform diminishes. Figure 3–1 shows an example of jitter starting to diminish the space between the rising and falling edges of the waveform.

When the eye opening disappears, the automatic measurements become incomputable (except for amplitude) and the display looks like no meaningful data could be obtained from the signal. However, because of the agility of the digital receiver, the signal content may still be recoverable. The jitter slew rate ultimately determines whether the receiver can lock to the incoming signal. Figure 3–3 shows the region where the receiver can recover the signal in terms of jitter amplitude versus jitter frequency.
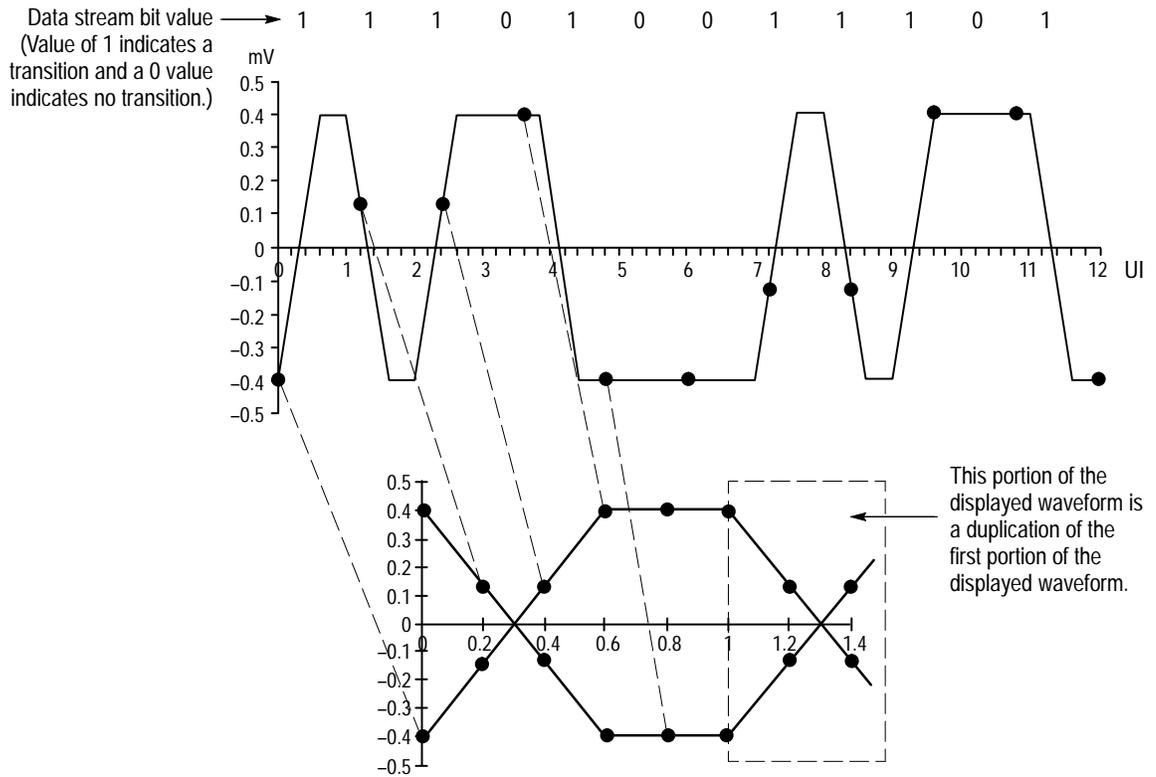
Figure 3–2: How equivalent-time sampling creates the eye-pattern waveform
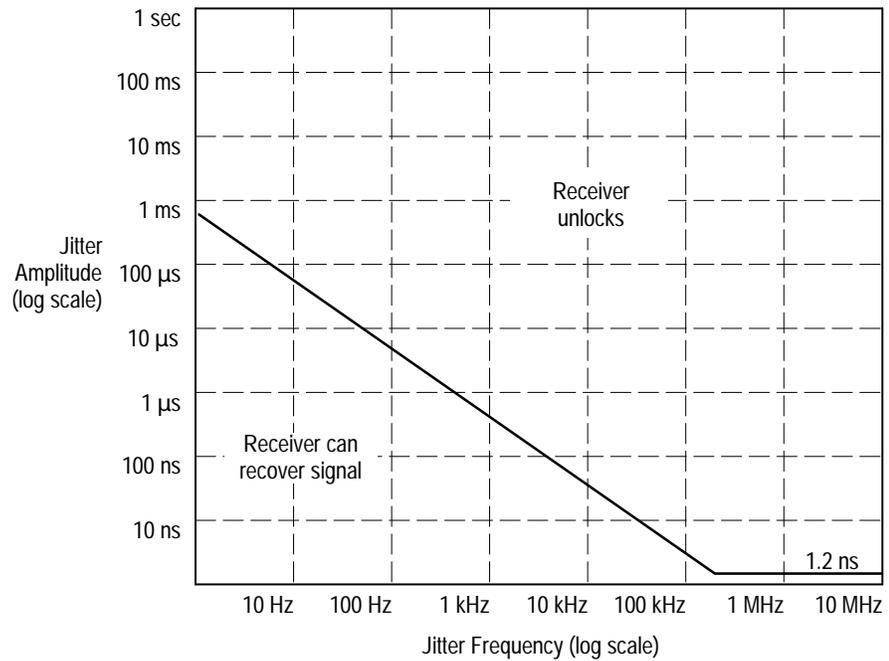
Figure 3–3: Plot of log jitter amplitude versus log jitter frequency

Eye Persistence. The Eye Persistence function controls the number of acquisitions-worth of data points displayed on the eye diagram. The front-panel Average button turns the Eye Persistence function on and off, and the Average soft key controls the persistence value. The possible persistence values are 1 through 10 and Infinity.

When the persistence value is set above one, each dot on the display can assume two values: bright and dim. Bright dots represent where a large number of data points have occurred while dim dots represent where a lesser number of data points have occurred. The dividing line between bright and dim dots is dynamically computed to be 50% of the dot that has the highest number of data points.

Persistence values greater than one are used to qualitatively identify where a jittered waveform is spending most of its time and to average the automatic measurements. For example, in Figure 3–1, the waveform is spending most of its time in the predominate traces that appear brighter in the display. When the persistence value is set to Infinity, all data dots are shown no matter how infrequently they occur (within the limits of the sampling system) intensifying the predominate-trace effect on the waveform.

NOTE. High persistence settings will decrease the update rate of the SDI Eye Diagram application.

Rise Time Adjustment Mode. The SDI Eye Diagram display has a bandwidth of 750 MHz which equates to a 20 – 80% rise time of 300 ps. This finite rise time, inherent to the VM700T, affects the measured rise time of fast-transitioning signals. The SDI Eye Diagram application includes a Rise Time Adjusted mode to allow you to compensate for the bandwidth of the VM700T. The Rise Time Adjusted mode calculates an actual rise time of the source being measured using the following formula:

$$T_{R(source)} = \sqrt{(T_{R(measured)})^2 - (0.3ns)^2}$$

$T_{R(source)}$ = the actual 20 – 80% rise time of the source (in ns);

$T_{R(measured)}$ = the 20 – 80% rise time measured on the VM700T (in ns)

Table 3–2 compares a number of normally measured rise/fall times with the actual rise/fall times derived using the Rise Time Adjusted mode.

NOTE. You should perform rise/fall time measurements with the Rise Time Adjusted mode on to ensure accurate measurement results.

Table 3–2: Eye Diagram measured rise/fall times versus adjusted rise/fall times

Measured 20–80% rise/fall times with Rise Time Adjusted mode off	Actual 20–80% rise/fall times with Rise Time Adjusted mode on
500 ps	400 ps
583 ps	500 ps
671 ps	600 ps
762 ps	700 ps
854 ps	800 ps
949 ps	900 ps
1.04 ns	1.00 ns
1.14 ns	1.10 ns
1.24 ns	1.20 ns
1.33 ns	1.30 ns
1.43 ns	1.40 ns
1.53 ns	1.50 ns
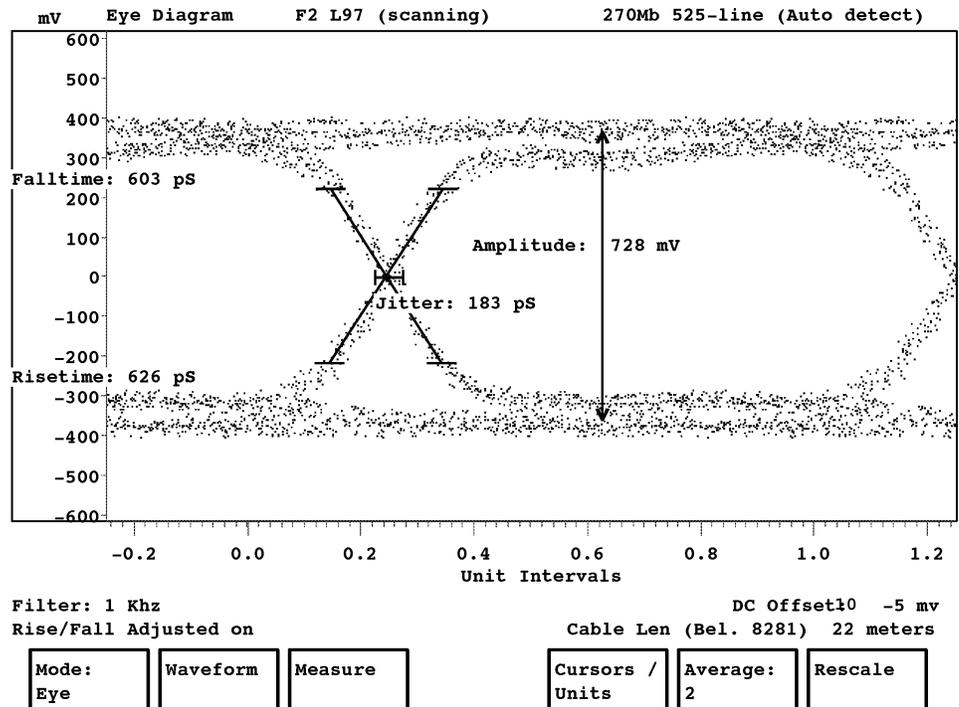
Figure 3–4: Eye Diagram display

Main Menu. Figure 3–4 shows the Eye Diagram display with the Main menu showing, and Figure 3–5 shows the menu tree for the SDI Eye Diagram application. The following Main menu soft keys appear at the bottom of the Eye Diagram display:

■   Mode: *<display mode>*. Touch this soft key to toggle the application between the Eye Diagram display mode and the Measurement and Limits display mode.

■   Waveform. Touch this soft key to open the Waveform submenu where you set the appearance of the displayed waveform.

■   Measure. Touch this soft key to open the Measure submenu where you select which measurements to perform.

■   Cursors/Units. Touch this soft key to open the Cursors/Units submenu where you access and control the measurement cursors and measurement units.

■   Average: *<number>*. Touch this soft key to set the value for Eye Persistence using the front-panel knob. The possible persistence values are 1 through 10 and Infinity. Refer to *Eye Persistence* on page 3–7 for more information.

■   Rescale. Touch this soft key to set the scale and offset of the display back to the default settings if you have used the Touch and Zoom function.

Waveform Submenu. The Waveform submenu sets the appearance of the displayed eye-pattern waveform. The following soft keys appear at the bottom of the display:

■   Rising Edge. Touch this soft key to toggle the rising edge portion of the eye-pattern waveform on and off.

■   Falling Edge. Touch this soft key to toggle the falling edge portion of the eye-pattern waveform on and off.

■   Non-Transitn. Touch this soft key to toggle the nontransitioning portion of the eye-pattern waveform on and off.

■   Full Signal. Touch this soft key to display the full eye-pattern waveform (turns on the Rising Edge, Falling Edge, and Non-Transitn soft keys).

■   Free Run. Touch this soft key to toggle the Free Run mode on and off. Refer to *Free Run Mode* on page 2–3 for more information.

■   Filter: *<frequency>*. Touch this soft key to toggle the jitter-filter frequency between 10 Hz and 1 kHz. Refer to *Jitter Filter* on page 3–17 for more information.

Eye Diagram display mode

Main menu

Mode: Eye	Waveform	Measure	Cursors/ Units	Average: 0	Rescale

Waveform submenu

Rising Edge	Falling Edge	Non- Transition	Full Signal	Free Run	Filter: 10 Hz

Measure submenu

Meas. Box	Eye Amplitude	Rise\Fall Times	Rise\Fall Overshoot	Jitter	Rise Time Adjusted	Cable: None

Cursors/Units submenu

Volt Cursor 1	Volt Cursor 2	Time Cursor 1	Time Cursor 2	Cursor to Center	Jitter Units: UI

- -

Measurement & Limits display mode

Main menu

Mode: Limits	Filter: 10 Hz	Logging	Clear

Logging submenu

Log	Log Port	File Append	File Overwrite

Figure 3–5: SDI Eye Diagram application menu tree

The Waveform and Measure submenus interact with each other to enable or disable the Eye Diagram measurements. Table 3–3 shows the soft key settings that must be set in both submenus to enable the Eye Diagram measurements.

Table 3–3: Measurement interactions between Waveform and Measure submenu selections

Measurement parameter	Waveform portion that must be turned on (Waveform submenu)	Measurement that must be turned on (Measure submenu)
Amplitude	Non Transition	Eye Amplitude
DC Offset	Non Transition	Eye Amplitude
Rise Time	Rising Edge	Rise/Fall Times
Fall Time	Falling Edge	Rise/Fall Times
Rise Time/Fall Time Difference	Rising Edge and Falling Edge	Rise/Fall Times
Rise Overshoot	Rising Edge	Rise/Fall Overshoot
Fall Overshoot	Falling Edge	Rise/Fall Overshoot
Jitter	Rising Edge and Falling Edge	Jitter

Measure Submenu. The Measure submenu selects the measurements to perform and sets other measurement-related parameters. The following soft keys appear at the bottom of the display:

- Meas Box. Touch this soft key to toggle the position of the displayed measurement values between the waveform and a measurement box in the corner of the display. At least one of the Eye Diagram measurements must be turned on before the measurement box appears. If a measurement readout-position is off-screen, the measurement readout appears in the measurement box regardless of the setting of this soft key.

- Eye Amplitude. Touch this soft key to toggle the Eye Amplitude measurement display on and off.

- Rise\Fall Times. Touch this soft key to toggle the Rise Time and Fall Time measurement display on and off.

- Rise\Fall Overshoot. Touch this soft key to toggle the Rise Overshoot and Fall Overshoot measurement display on and off.

- Jitter. Touch this soft key to toggle the Jitter measurement display on and off.

- Rise Time Adjusted. Touch this soft key to toggle the Rise Time Adjustment mode on and off. Refer to *Rise Time Adjustment Mode* on page 3–7 for more information.

- Cable: *<type>*. Touch this soft key to specify the type of cable used to supply the tested signal. Turn the front-panel knob to select from the following: None, Bel. 8281, Bel. 1694, Bel. 1505, PSF1/2, PSF1/3, 5C-2V, and 5C-FB. (Cable type abbreviations: Bel. = Belden; Nok. = Nokia.)

Cursors/Units Submenu. The Cursors/Units submenu lets you access and control the measurement cursors and units. The cursors are controlled through the soft keys. The selected cursor's position is controlled by the front-panel knob. The soft key of the selected cursor is highlighted.

The voltage cursors can be scrolled off screen as necessary (the readout value will continue to change) but the timing cursors cannot. The cursors reappear in their previous positions when you reenter the Cursors/Units submenu.

The Cursors/Units submenu provides the following soft keys:

■ Volt Cursor 1. Touch this soft key to select voltage cursor 1.

■ Volt Cursor 2. Touch this soft key to select voltage cursor 2.

■ Time Cursor 1. Touch this soft key to select timing cursor 1.

■ Time Cursor 2. Touch this soft key to select timing cursor 2.

■ Cursor To Center. Touch this soft key to move the selected cursor to the center of the screen.

■ Jitter Units: *<measurement units>*. Touch this soft key to toggle the X-axis graticule and readouts between UI (unit intervals) and seconds (nanoseconds or picoseconds). The Jitter Units soft key is shared between the SDI Eye Diagram and the SDI Jitter applications.

Measurement & Limits Display Mode

The SDI Eye Diagram application provides two display modes: Eye Diagram and Measurement & Limits. Use the Mode soft key to toggle between the two display modes.

The Measurement & Limits display mode provides a display of the Eye Diagram measurements that shows the current values of each measurement, the minimum and maximum values of each measurement since the last clear function, and the user defined values of the measurement limits (see Figure 3–6). You define the limits by entering them in the Eye Limits configuration file (see Figure 1–8 on page 1–14).

When a monitored error occurs, the Min/Max Since Last Clear box that contains the violation is highlighted. After the error has passed, the box continues to be highlighted in background intensity until you press the Clear soft key.

Main Menu. Figure 3–5 shows the menu tree for the SDI Eye Diagram application, and Figure 3–6 shows the Measurement & Limits display with the Main menu showing. The Main menu soft keys at the bottom of the Eye Diagram display have the following functions:

- Mode: *<display mode>*. Touch this soft key to toggle the application between the Eye Diagram display mode and the Measurement and Limits display mode.

- Filter: *<frequency>*. Touch this soft key to toggle the jitter-filter frequency between 10 Hz and 1 kHz. The Filter soft key is shared between the SDI Eye Diagram and the SDI Jitter applications. Refer to *Jitter Filter* on page 3–17 for more information.

- Logging. Touch this soft key to display the Logging submenu where you turn the Logging function on and off and select the log report destination for the SDI Eye Diagram application.

- Clear. Touch this soft key to clear the display of error highlighting and to clear the minimum and maximum display values.

```
Eye Diagram                                      270Mb 525-line (Source selection)
Measurements & Limits
                                    Since Last Clear           Limits
                          Current     Min       Max        Min        Max

         Amplitude          734       730       738        720.0      880.0     mv

         Rise-Time          704       654       780        400.0      1500.0    ps

         Fall-Time          706       650       756        400.0      1500.0    ps

     Rise/Fall Diff.         68        0        212         ---       500.0     ps

     Rise Overshoot         0.0       0.0       0.2         ---        10.0      %

     Fall Overshoot         0.0       0.0       0.2         ---        10.0      %

         DC Offset          -9.8      -11.4     -7.2       -500.0     500.0     mv

    Alignment (1kHz)        752       646       993         ---       250.0     ps
            Jitter

Filter: 1 kHz
Rise/Fall Adjusted off
```

Mode: Limits		Filter: 1 kHz		Logging	Clear

Figure 3–6: Measurements & Limits display

Logging Submenu. Refer to *Report Logging* on page 2–4 for more information about the logging function. The Logging submenu provides the following soft keys at the bottom of the display:

- Log. Touch this soft key to toggle the logging function on and off.

- Log Port. Touch this soft key to send the log report to the measurement set communication port selected in the Communication Setup configuration file.

- File Append. Touch this soft key to append new logging information to the end of the Measurement Results log file.

- File Overwrite. Touch this soft key to overwrite previous logging information in the Measurement Results file with new logging information.

SDI Jitter Application

The physical serial data stream consists of binary data transmitted over a single coaxial cable at data rates of 143 Mbit/sec up to 360 Mbit/sec. Serial digital receivers that operate at these rates must have robust characteristics in order to operate correctly in the presence of signal jitter and noise. Jitter in the serial digital signal can occur as it is processed by distribution amplifiers, routing switchers, and other digital processing equipment.

As one of the electrical measurement applications, the SDI Jitter application verifies the electrical characteristics of the SDI transport layer by measuring the peak-to-peak timing and alignment jitter of the signal. Timing jitter is defined as any jitter above 10 Hz, and alignment jitter is defined as jitter between the frequencies of 10 Hz and 1 kHz.

The SDI Jitter application is composed of two displays: a demodulated-jitter waveform display and a jitter-spectrum display. The demodulated-jitter waveform display is used for correlating jitter to line-rate and frame-rate components. The jitter-spectrum display provides an a means to identify the frequency spectrum of the jitter components using an FFT-generated spectrum display.

The demodulated-jitter waveform display and the jitter-spectrum display both use a two-axis display (see Figure 3–7) with two time-bases: Line Rate and Frame Rate. In the demodulated-jitter display, the Y axis shows the jitter amplitude in UI or picoseconds. The X axis represents time in microseconds (Line Rate) or in video line numbers relative to the start of the frame (Frame Rate). In the jitter-spectrum display, the Y axis shows the jitter amplitude in dBUI and the X axis shows the jitter frequency in hertz. The X axis scales to 20 kHz in Line Rate and to 10 MHz in Frame Rate. The zero reference for the jitter-spectrum display dB scale is 1 UI.

The demodulated-jitter and jitter-spectrum waveforms are asynchronous because the demodulated-jitter display updates about 10 times per second versus one time per second for the jitter-spectrum display. You must freeze the waveform buffer to view waveforms in both displays that are correlated with each other using the measurement set Freeze function. When you use the Freeze function, there may be a pause while the jitter spectrum being computed is canceled and the new jitter spectrum is computed.

The waveform and spectrum displays have independent touch-and-zoom capability. The waveform cannot be shrunk smaller than the FFT window and cannot be panned past the FFT window when the front-panel Freeze button is pressed. The frame-rate jitter display cannot be manipulated using touch-and-zoom to display anything outside the FFT window.
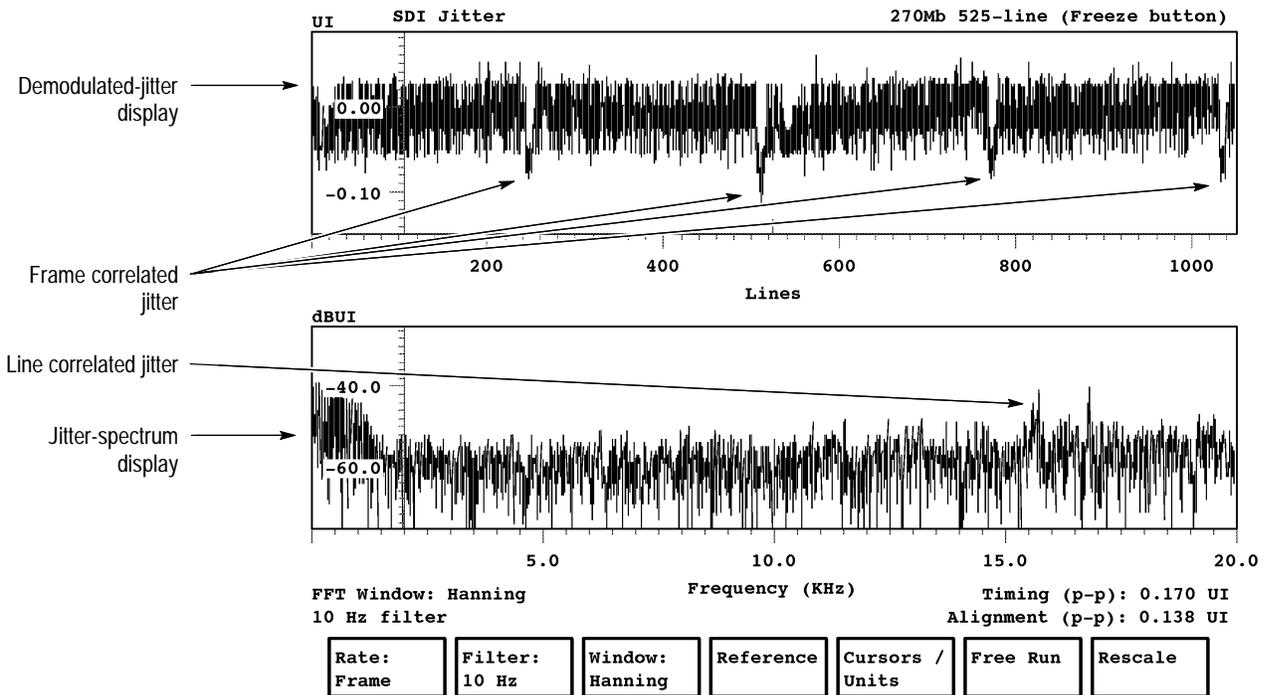
Figure 3–7: Rate: Frame display in the Jitter application
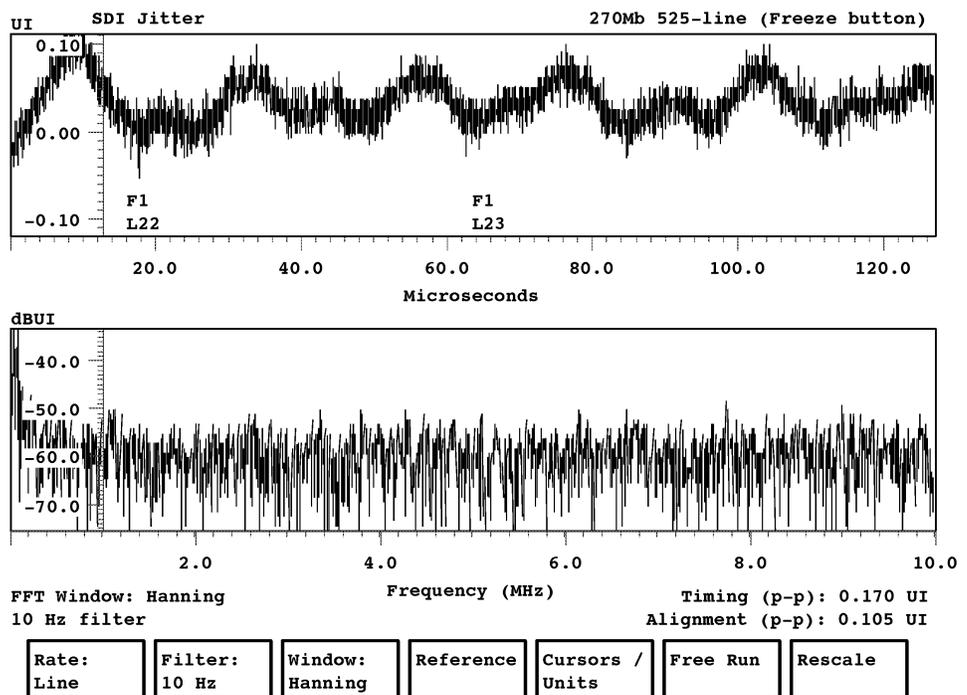
Figure 3–8: Rate: Line display in the Jitter application

Cursors provide measurement of jitter events in both the frequency and time domains. A relative-to-reference mode allows two jitter measurement references to be stored internally and used for difference measurements with a signal on the SDI Ch. A input.

The SDI Jitter application can access the Select Line Mode. Refer to *Select Line Mode* on page 2–4 for more information.

Measurement Considerations

This section contains information about measurement topics such as selecting the jitter filter, jitter amplitude attenuation, and FFT functionality.

Jitter Filter. The SDI Eye Diagram and SDI Jitter applications use a high-pass filter (as recommended by SMPTE RP–184) to facilitate the timing jitter and alignment jitter measurements. The jitter-filter frequency setting is shared between the SDI Eye Diagram and SDI Jitter applications and the Filter soft key appears within both applications. The 10 Hz filter is designed for use in timing-jitter measurements and the 1 kHz filter is designed for alignment-jitter measurements.

Jitter Amplitude Attenuation. The demodulated-jitter signal can contain a wide range of spectral components. To allow you to view most of the relevant spectral components, the jitter application is divided into two modes: Frame Rate and Line Rate. Frame Rate mode is used to view frame-rate to line-rate spectral components (15 Hz to 25 kHz). Line Rate mode is used to view line-rate and higher jitter components (8 kHz to 10 MHz).

The antialiasing filter for the Frame Rate mode has a fairly low cutoff to prevent high-energy, high-frequency components from causing ringing in the jitter waveform display. The jitter-spectrum display is compensated for this filter, but as a result the jitter amplitude displayed by the demodulated-jitter display may not exactly correspond to the amplitude reported by the jitter-spectrum display. The jitter amplitude discrepancy is most apparent towards the top of the jitter-spectrum range. Table 3–4 shows the jitter amplitude-attenuation in the Frame Rate mode as related to jitter frequency.

Table 3–4: Jitter amplitude attenuation in Frame Rate mode

Filter frequency	Attenuation dB	%
10 kHz	0	0
15 kHz	3	30
20 kHz	6	50
30 kHz	12	75
42 kHz	30	97

FFT Windowing. A 4096-point FFT computes the jitter spectrum from the data points (samples) that it receives. The FFT is a mathematical algorithm for converting time and amplitude information into frequency and magnitude information. For many measurement applications, it is appropriate to adjust the data before the FFT computation to see specific characteristics of the jitter spectrum. Different data adjustments are called FFT windows. Option 1S provides two FFT windows that affect the way the application displays the jitter spectrum: a Hanning window and a rectangular window.

The Hanning window merges close jitter frequencies, but the lower amplitude harmonics are easier to see in the display than with the rectangular window. The rectangular window provides better resolution in frequency, but masks lower amplitude components of the spectrum. Use the Hanning window to initially identify the main frequency of the jitter spectrum and the smaller harmonics. Then use the rectangular window to isolate and provide more detail for jitter frequencies that are close to each other.

Figures 3–9 illustrates the spectral characteristics of both FFT windows. Note that the rectangular window has a narrower mainlobe but that the amplitude of the sidelobes decreases slowly. The Hanning window has a wider mainlobe, but the amplitude of the sidelobes decreases quickly. The width of the mainlobe affects frequency resolution while the sidelobe amplitude affects the visibility of smaller amplitude spectral components.
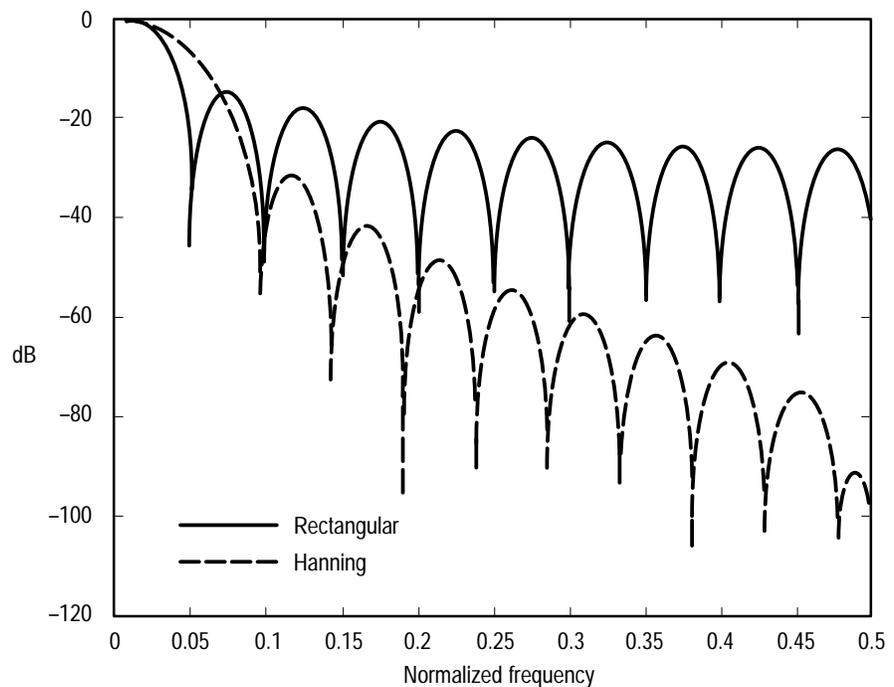
Figure 3–9: Spectral characteristics of the two FFT windows

Missing FFT Data. The jitter sampling rate does not exactly correspond to 4096 samples per two frames (frame-rate) or per two lines (line-rate). Therefore, the spectrum generated by the 4 K FFT excludes a small portion at the end of the second frame or line. In Table 3–5, the excluded portions of the signal are shown in percentage and in length of time. These numbers refer to the amount of signal excluded from the end of the two-frame or two-line sample sequences during the FFT computation.

Table 3–5: Portion of jitter waveform missing in FFT computations

Video Format	Rate: Frame (0 to 20 kHz) Sample frequency	Signal portion missing at end of second field		Rate: Line (0 to 10 MHz) Sample frequency	Signal portion missing at end of second line	
		%	Time		%	Time
143 Mb NTSC	62.3 kHz	1%	0.95 ms	35.8 MHz	10%	12.70 ns
270 Mb 525-line	61.9 kHz	1%	0.59 ms	33.8 MHz	5%	5.75 ns
270 Mb 625-line	61.9 kHz	17%	13.86 ms	33.8 MHz	5%	6.64 ns
360 Mb 525-line	62.1 kHz	1%	0.74 ms	36.0 MHz	10%	13.33 ns
360 Mb 625-line	62.1 kHz	18%	14.01 ms	36.0 MHz	11%	14.22 ns

SDI Jitter Application Menus

The SDI Eye Diagram application provides two display modes: Frame Rate and Line Rate. Use the Rate soft key to toggle between the two display modes. Figure 3–7 and Figure 3–8 show the display modes.

Main Menu. Figure 3–10 shows the SDI Jitter application menu tree. The descriptions of the measurement functions and settings available using the soft keys appear on the following pages. The Main menu soft keys at the bottom of the SDI Jitter application display have the following functions:

■ Rate:<*display frequency*>. Touch this soft key to toggle between Frame Rate and Line Rate display modes.

■ Filter: <*frequency*>. Touch this soft key to toggle the jitter-filter frequency between 10 Hz and 1 kHz. Refer to *Jitter Filter* on page 3–17 for more information.

■ Window: <*type*>. Touch this soft key to toggle the FFT window between Hanning and Rect. (rectangular). Refer to *FFT Windowing* on page 3–18 for more information.

Main menu

| Rate: Frame | Filter: 10 Hz | Window: Hanning | Reference | Cursors/ Units | Free Run | Rescale |

Reference submenu

| Save Act. as Ref. | Display Active | Display Reference | Display Diff |

Cursors/Units submenu

| Waveform Cursor 1 | Waveform Cursor 2 | Spectrum Cursor 1 | Spectrum Cursor 2 | Cursor to Center | Jitter Units: UI |
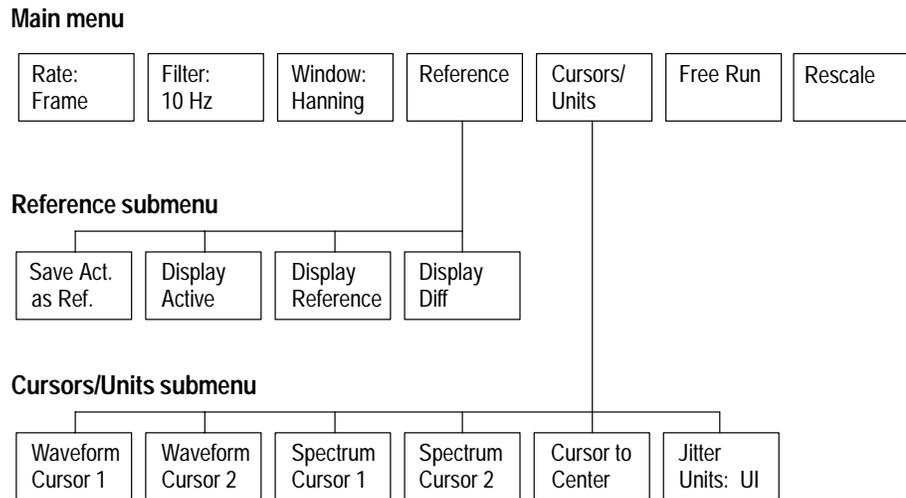
Figure 3–10: SDI Jitter application menu tree

■ Reference. Touch this soft key to open the Reference submenu where you can save and compare jitter-spectrum displays.

■ Cursors/Units. Touch this soft key to open the Cursors/Units submenu where you access and control the measurement cursors and measurement units.

■ Free Run. Touch this soft key to toggle the Free Run mode on and off. Refer to *Free Run Mode* on page 2–3 for more information.

■ Rescale. Touch this soft key to set the scale and the offset of the display back to the default settings if you have used the Touch and Zoom function.

Reference Submenu. The Reference submenu lets you save a jitter spectrum as a reference and then compare it to another jitter spectrum from a signal on the SDI Ch. A input. When the Display Reference or Display Diff soft key is active, the demodulated-jitter waveform display is blank.

NOTE. For the Display Difference mode to operate, the format standards of the compared jitter spectrums must match and the signal being compared must be on the SDI Ch. A input.

The Reference submenu provides the following soft keys:

■ Save Act. As Ref. Touch this soft key to copy the current jitter spectrum to the reference buffer and save it in NVRAM.

■ Display Active. Touch this soft key to display the spectrum of the current signal (default setting).

■ Display Reference. Touch this soft key to display the jitter spectrum stored as a reference in NVRAM.

■ Display Diff. Touch this soft key to display the difference between the jitter spectrum of the signal on the SDI Ch. A input and the reference jitter spectrum stored in NVRAM.

Cursors/Units Submenu. The Cursors/Units submenu lets you access and control the measurement cursors and units. The cursors are controlled through the soft keys. The position of the selected cursor is controlled by the front-panel knob. The soft key of the selected cursor is highlighted. The cursors reappear in their previous positions when you reenter the Cursors/Units submenu.

The Cursors/Units submenu provides the following soft keys:

■ Waveform Cursor 1. Touch this soft key to select waveform cursor 1.

■ Waveform Cursor 2. Touch this soft key to select waveform cursor 2.

■ Spectrum Cursor 1. Touch this soft key to select spectrum cursor 1.

■ Spectrum Cursor 2. Touch this soft key to select spectrum cursor 2.

■ Cursor to Center. Touch this soft key to move the selected cursor to the center of the screen.

■ Jitter Units: <*measurement units*>. Touch this soft key to toggle the Y-axis graticule of the demodulated-jitter display between UI (unit intervals) and seconds (nanoseconds or picoseconds). The jitter units setting is shared between the SDI Eye Diagram and the SDI Jitter applications and this soft key appears within both applications.

SDI Wander Application

As one of the electrical measurement applications, the SDI Wander application verifies the electrical characteristics of the SDI transport layer. The SDI Wander application provides a method for the verification of SDI frequency timing stability for studio, contribution, and distribution quality video applications without the use of any special test signals.

Digital distribution networks, which are synchronized to an external timing source, buffer their data and use pointers to indicate the start of the next part of the payload. At each step where data is multiplexed, the network may add or drop a few bytes of buffered data (pointer adjustments) in order to maintain the average payload bit rate. However, pointer adjustments cause a phase variation in the network.

A portion of this phase variation (horizontal-sync wander) is usually transferred to the video signal that is recovered at the output of the codec. If this happens, a video signal can exhibit subtle shifts in color hue or variations in sync phase when viewed on a waveform or vector monitor. Excessive pointer adjustments in the network can cause levels of video wander to accumulate, causing more severe problems including loss of synchronizing lock-up.

Since video-signal paths are usually self synchronized by phase tracking the input video signal, it is not advantageous to limit the very low-frequency spectral components to a fixed peak value. Therefore, the SDI Wander application uses two display modes to process these slow-phase variations in terms of Drift Rate and Frequency Offset, which are more directly related to a video-system's phase tracking ability.

Drift Rate and Frequency Offset Display Modes

The real-time Drift Rate display mode (see Figure 3–12) calculates the rate of frequency drift of the horizontal-synchronizing pulse frequency. The rate of horizontal-sync frequency drift has the greatest effect on studio-quality recording and post-processing equipment.

The Frequency Offset display mode (see Figure 3–13) is a frequency-accuracy measurement of the absolute frequency error of a video signal as compared to an internal, precision frequency reference. You can make accurate measurements of the input video-signal frequency to within 100 ppb.

In both display modes, indicators near the Y-axis graticule show the peak timing variations for the portion of the waveform displayed on screen. The Peak Hold mode allows you to track peak timing variations for as long as the application is active. The dotted lines on the display represent the measurement limits (before an error condition is reported) as set in the Wander Limits configuration file (see Figure 1–9 page 1–17).

LP Corner Selection. The plot of the time error versus frequency accommodation in Figure 3–11 illustrates the effect of the LP (low pass) Corner menu selections of 0.25 Hz, 0.50 Hz, and 1.00 Hz. These LP Corner drift-rate bandwidth values select the upper-frequency limit of the Drift Rate measurement. For example, if a 10 ns peak jitter is considered acceptable, you do not need to restrict the peak drift-rate to 28 ppb/s above 0.25 Hz since, as long as the peak jitter is below 10 ns, the drift-rate value is of no concern and can have any value.

To better understand this concept, consider the typical contribution-quality video signal. These signals typically have broad-band jitter and wander that is composed of many spectral components, but may have large low-frequency jitter or wander due to digital buffering and reclocking.

Contribution-quality video is not well defined, but a jitter limit of 2.5 ns peak (since no other limit currently exists) and a drift-rate limit of 28 ppb/s would be only slightly worse than a studio black-burst reference signal such as SMPTE RP-154-1994.

Therefore, you only need to measure the jitter spectral components below 0.5 Hz in terms of drift rate, and measure jitter above 0.5 Hz in terms of peak or peak-to-peak time value. For final distribution-quality video, 10 ns peak jitter may be acceptable. In this case, the drift rate should be measured only below 0.2 Hz. The general concept is that large acceptable jitter floors imply using a low LP Corner value.
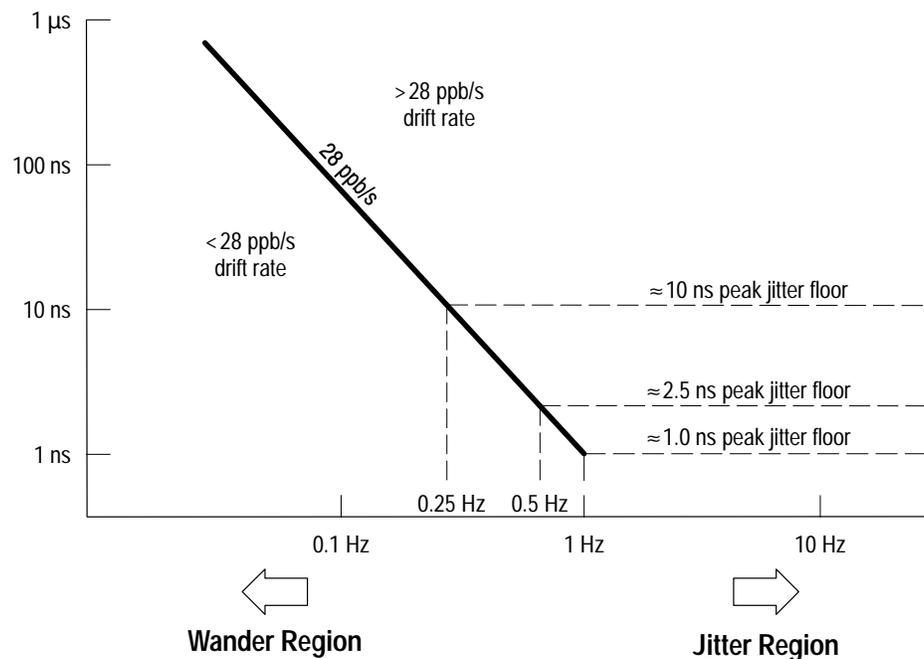
Figure 3–11: Plot of time error versus frequency accommodation

```
SDI Wander                          270Mb 525-line (Source selection)
Drift Rate
                                    Peak Hold  -1.94 ppm/sec *
ppm/sec                             Peak Hold  -6.94 Hz/sec @ Fsc *
```

Signal peak indicator

Measurement limit indicator

Measurement cursor

```
                    2.0
                    1.5
                    1.0
                    0.5
                    0
                   -0.5
                   -1.0
                   -1.5
                   -2.0
                   -2.5
                        Cursor: 1937.9 ppb/sec
                          2.0   4.0   6.0   8.0   10.0  12.0  14.0  16.0
```

| Drift Rate | Frequency Offset | LP Corner 0.50 Hz | Cursor | Peak Hold | Logging | Rescale |
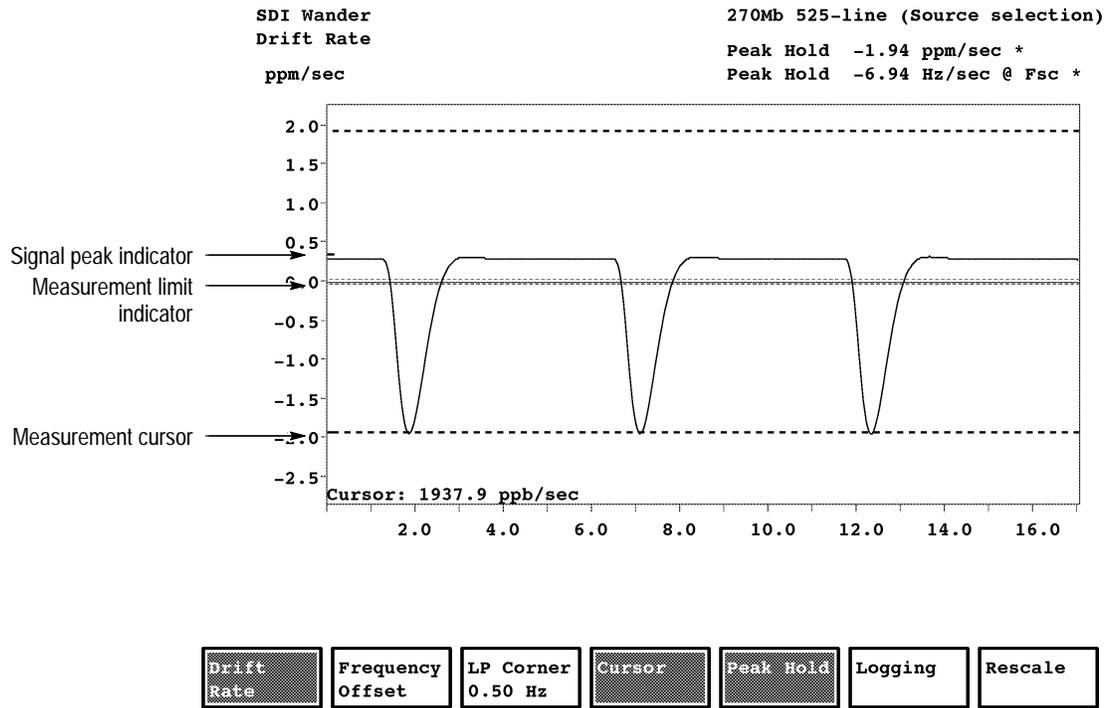
Figure 3–12: SDI Wander application Drift Rate display

```
SDI Wander                          270Mb 525-line (Source selection)
Frequency Offset
                                    Peak Hold  -1.66 ppm
ppm                                 Peak Hold  -5.95 Hz @ Fsc
```

Measurement limit indicator

Signal peak indicators

Measurement cursor

```
                    3.5
                    3.0
                    2.5
                    2.0
                    1.5
                    1.0
                    0.5
                    0.0
                   -0.5
                   -1.0
                   -1.5
                   -2.0
                   -2.5
                   -3.0
                   -3.5
                   -4.0
                        Cursor: 1772.8 ppb
                          2.0   4.0   6.0   8.0   10.0  12.0  14.0  16.0
```

| Drift Rate | Frequency Offset | LP Corner 0.50 Hz | Cursor | Peak Hold | Logging | Rescale |
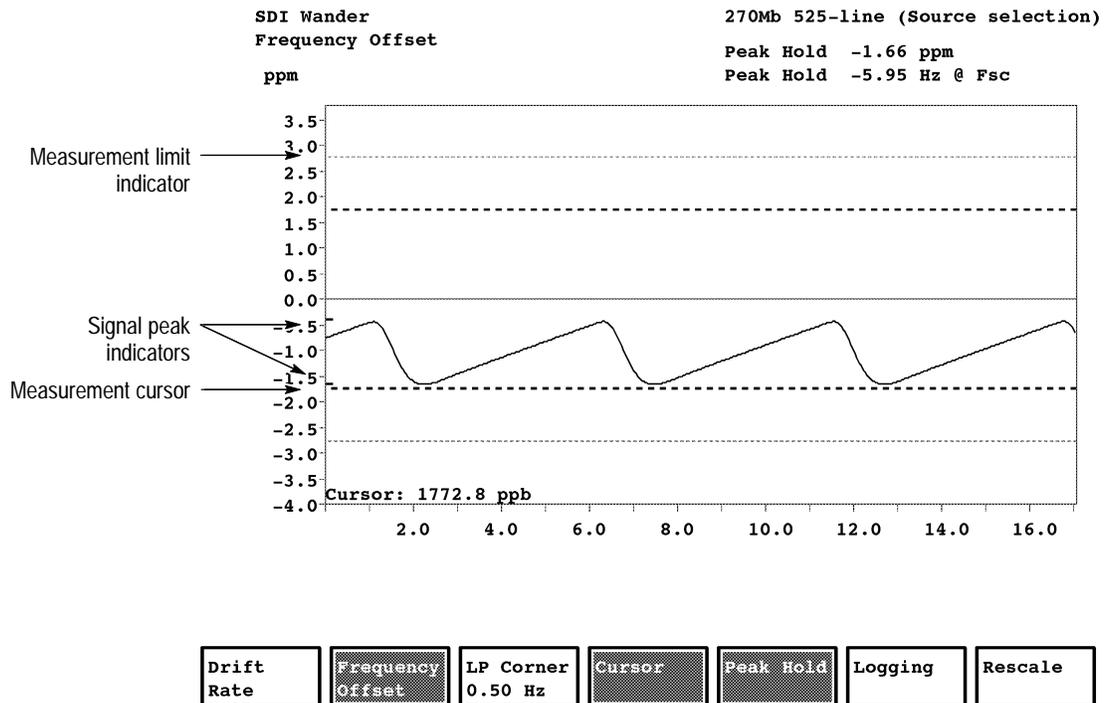
Figure 3–13: SDI Wander application Frequency Offset display

Main Menu. The menu tree for the SDI Wander application is shown in Figure 3–14. The following soft keys are provided at the bottom of the SDI Wander display:

■ Drift Rate. Touch this soft key to select the Drift Rate display mode.

■ Frequency Offset. Touch this soft key to select the Frequency Offset display mode.

■ LP Corner. Touch this soft key to select from the following measurement bandwidths:

   1.00 Hz   1 ns maximum peak jitter (studio quality)

   0.50 Hz   2.5 ns maximum peak jitter (contribution quality)

   0.25 Hz   10 ns maximum peak jitter (distribution quality)

■ Cursor. Touch this soft key to toggle the measurement cursor on and off. You can use this cursor to measure the amplitude of a specific portion of the displayed waveform.

■ Peak Hold. Touch this soft key to toggle the Peak Hold mode on and off. The Peak Hold mode lets you track peak timing variations while the application is active (shown by indicators on the Y-axis graticule). See Figure 3–12.

■ Logging. Touch this soft key to display the Logging submenu where you turn the Logging function on and off and select the log report destination for the SDI Eye Diagram application.

■ Rescale. Touch this soft key to rescale the display for optimum viewing.

Main menu

| Drift Rate | Frequency Offset | LP Corner 0.25 Hz | Cursor | Logging | Peak Hold | Rescale |

Logging submenu

| Log | Log Port | File Append | File Overwrite |
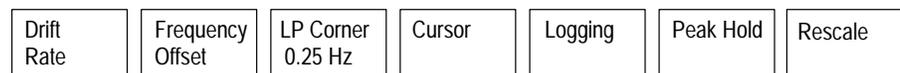
Figure 3–14: SDI Wander application menu tree

Logging Submenu. Refer to *Report Logging* on page 2–4 for more information about the logging function. The Logging submenu provides the following soft keys at the bottom of the display:

■ Log. Touch this soft key to toggle the logging function on and off.

■ Log Port. Touch this soft key to send the log report to the measurement set communication port selected in the Communication Setup configuration file.

■ File Append. Touch this soft key to append new logging information to the end of the Measurement Results log file.

■ File Overwrite. Touch this soft key to overwrite previous logging information in the Measurement Results file with new logging information.

SDI Format Monitor Application

Digital video standards were introduced to allow different manufacturers to build serial digital video products that could easily be connected together allowing the exchanging of signals between them. Data errors such as random timing errors in signal placement during encoding or decoding, or errors due to rate conversion from serial composite to serial component can mean trouble in a data recovery circuit. Therefore, monitoring and verification of the format of the serial digital signal is an important requirement for ensuring trouble-free communication between serial digital equipment.

As one of the video format and content applications, the SDI Format Monitor application provides continuous real-time format monitoring of the serial digital signal. The application provides two display modes: Format Monitor and Error Map. The Format Monitor display mode uses cells to display measurement results and errors. These measurement cells can have several display states. Refer to *Measurement Cell Display States* on page 2–3 for more information. The Error Map display mode shows the physical location of the selected error from the Format Monitor display in a two-field display. Refer to *Error Map Display Mode* on page 3–33 for more information.

The application provides a total validation of the SDI signal format by including the following checks and functions: loss of signal, video line, blanking, and field length errors, EAV/SAV misplacement, ancillary data errors, audio ancillary data errors, illegal luminance and chrominance values with selectable search areas, 8/10-bit validation, and RP–165 validation. Error events can be counted, time referenced, and logged. Error counts are reset when you exit the application or when you touch the Clear Counters soft key. You can capture frames from user-definable error events or data patterns. Captured video frames can then be shared with other SDI applications for further measurement analysis.

Measurement Considerations

This section contains information about measurement topics such as selecting the validation settings, FIFO overflow errors, and audio signal checks.

Video Limit Violation Reporting. The SDI Format Monitor application reports only one chrominance limit violation (error or warning) and one luminance limit violation per video line. If two or more chrominance violations occur on the same video line, the violation that is reported is the one that ranks highest in the following hierarchy: 1. Error High, 2. Error Low, 3. Warning High, and 4. Warning Low. The same reporting hierarchy applies for luminance limit violations. See Figure 1–10 on page 1–19.

Validation Settings. The Validate setting is used and shared by the SDI Format Monitor and SDI Ancillary Data Analyzer applications. SMPTE 259M contains a number of provisions to accommodate equipment that conforms to earlier versions of the specification. When Validate is set to 8/10-Bit, the two

applications validate the video stream in accordance with these exceptions. When Validate is set to 10-Bit, these accommodations are ignored and the stream is validated strictly according to the current specification. Table 3–6 shows the validation differences between these two modes.

Table 3–6: Differences between 8/10-bit validation and 10-bit validation

Signal parameter	8/10-bit validation	10-bit validation
TRS marks and ancillary data headers	000 through 003 treated as 000 (considered valid) 3fc through 3ff treated as 3ff (considered valid)	Only 000 is valid Only 3ff is valid
V-bit transition	Considered valid on video lines 10 through 20	Considered valid on video line 20 only
Ancillary data (user data) and luminance and chrominance error ranges	000 through 003 treated as 000 (considered invalid) 3fc through 3ff treated as 3ff (considered invalid)	Only 000 is invalid Only 3ff is invalid

FIFO Overflow Errors. The SDI Format Monitor application detects errors using both hardware and software. For video streams with many ancillary data packets and/or a large number of errors, the application software may lag behind the hardware sufficiently that an error condition might be missed. When this lagging occurs, the FIFO (First In First Out) Overflow error is reported.

NOTE. The FIFO Overflow error does not represent an error in the video stream. The error represents a video stream that cannot be adequately processed by the SDI Format Monitor application.

FIFO Overflow errors may be prevented on heavily loaded video streams by disabling the BrokenBlk Ch soft key to release some system resources or by disabling the Audio Check soft key to release more system resources. However, some extremely loaded video streams may still cause the SDI Format Monitor application to report this error.

Audio Broken Block Channel. When the Check Audio soft key is enabled, the BrokenBlk Ch soft key enables and selects the logical group and physical channel on which audio Z bit checking is performed (see Table 3–8). Audio Z bit checking verifies that the audio Z bit occurs every 192 audio samples for the specified audio group.

Table 3–7: Examples of physical arrangements of logical audio-channel data within ancillary audio packets

Arrangement type	Physical arrangement of logical channels
1	1, 2, 1, 2
2	5, 6, 7, 8, 5, 6, 7, 8
3	11, 12, 9, 10, 11, 12, 9, 10
4	13, 14, 13, 14, 15, 16, 15, 16

Table 3–8: Examples of logical channels selected by the BrokenBlk Ch soft key

BrokenBlk Ch soft key setting	Logical group selected	Physical channel selected	Logical channel selected from Table 3–7
Off	None	None	None
1	1	1	1
2	1	2	2
3	1	3	1[1]
4	1	4	2[1]
5	2	1	5
6	2	2	6
7	2	3	7
8	2	4	8
9	3	1	11[2]
10	3	2	12[2]
11	3	3	9[2]
12	3	4	10[2]
13	4	1	[3]
14	4	2	[3]
15	4	3	[3]
16	4	4	[3]

[1] Wraps around when only two channels are physically present.

[2] Example where the logical channel does not equal the physical channel.

[3] Confuses BrokenBlk Ch function (this pattern, while legal, is almost never used).

Format Monitor Display Mode

The Format Monitor display mode (see Figure 3–15) uses cells to display measurement results and errors. The measurement cells can have several display states. Refer to *Measurement Cell Display States* on page 2–3.

Figure 3–15 shows the Format Monitor display for 270 Mb 525-line signals. For 270 Mb 625-line signals, the display is identical except that the 5/5 pattern measurement cell does not appear.

For 360 Mb and 143 Mb signals (see Figure 3–16), the only measurement tests that are performed are loss of signal, TRS alignment, and EDH checking. With these two video formats, captured buffers cannot be viewed using other applications and the Error Map function is not supported.

The Format Monitor includes two measurement cells that keep track of time. The Err Secs (error seconds) cell counts the number of seconds when at least one error was detected. The Elapsed (elapsed seconds) cell counts the number of seconds since the Format Monitor's counters were last reset.

Main Menu. Figure 3–17 shows the menu tree for the SDI Format Monitor application. The following soft keys are at the bottom of the Format Monitor display mode:

- Validate: *<bit count>*. Touch this soft key to toggle the validation setting between 8/10-bit and 10-bit. Refer to *Validation Settings* on page 3–27 for more information.

- Check Audio. Touch this soft key to enable or disable the ancillary audio sequence, samples per frame, and 5/5 pattern checks, as well as the BrokenBlk Ch soft key. The Check Audio soft key should normally be on. However, on heavily loaded or unusually loaded data streams, you can disable this soft key to provide the maximum update rate for the SDI Format Monitor. Refer to *FIFO Overflow Errors* on page 3–28 for more information.

- BrokenBlk Ch: *<channel number>*. This soft key only appears when the Check Audio soft key is enabled. When Check Audio is enabled, the BrokenBlk Ch soft key enables and selects the logical group and physical channel on which audio Z bit checking is performed. Refer to *Audio Broken Block Channel* on page 3–28 for more information. Touch this soft key to select the audio channel to check for broken audio blocks (Z bit). Use the front-panel knob to select from Off and audio channels 1 through 16. However, on heavily loaded or unusually loaded data streams, you can disable the audio check functions to provide the maximum update rate for the SDI Format Monitor. Refer to *FIFO Overflow Errors* on page 3–28.

- Error Map. Touch this soft key to open the Error Map display mode. Refer to *Error Map Display Mode* on page 3–33 for more information.

SDI Format Monitor   270Mb 525-line (Auto detect)

Loss of	
Signal 0	TRS Align 0

Miscellaneous

XY(Z) 16	UnusedSpc 0

Length			
Line 16	Hblank 0	Vblank 0	Field 0

	Full Field	Active Picture	Anc Data
EDH	0	0	0
EDA	0	0	0
IDH	0	0	0
IDA	0	0	0

Ancillary Data

Header 0	Data 0	Checksum 0	Placement 16

Ancillary Audio

5/5 Patrn measurement cell visible for 270 Mb 525-line signals only

Sequence 0	BrokenBlk 0	Smpls/Frm 0	5/5 Patrn 0

Missing 0	Placement 0	UES 0

Luminance

Video limit violation measurement cells

Low 0	Low 0	High 0	High 0

Err Secs 16	Elapsed 16	FIFO 0

Error	Warning		Error
Low 0	Low 0	High 0	High 0

Chrominance

Skip lines: 0

These parameters are set in the Format Setup configuration file

Activate relay: On Capture

Validate: 8/10-bit	Check Audio	BrokenBlk Ch: Off

Error Map	Logging	Clear Counters

Figure 3–15: SDI Format Monitor display for 270 Mb signals

SDI Format Monitor   360Mb 525-line (Auto detect)

Loss of	
Signal 0	TRS Align 0

	Full Field	Active Picture	Anc Data
EDH	0	0	0
EDA	0	0	0
IDH	0	0	0
IDA	0	0	0

		UES 0

Err Secs 0	Elapsed 7	FIFO 0

Activate relay: On Capture

Logging	Clear Counters
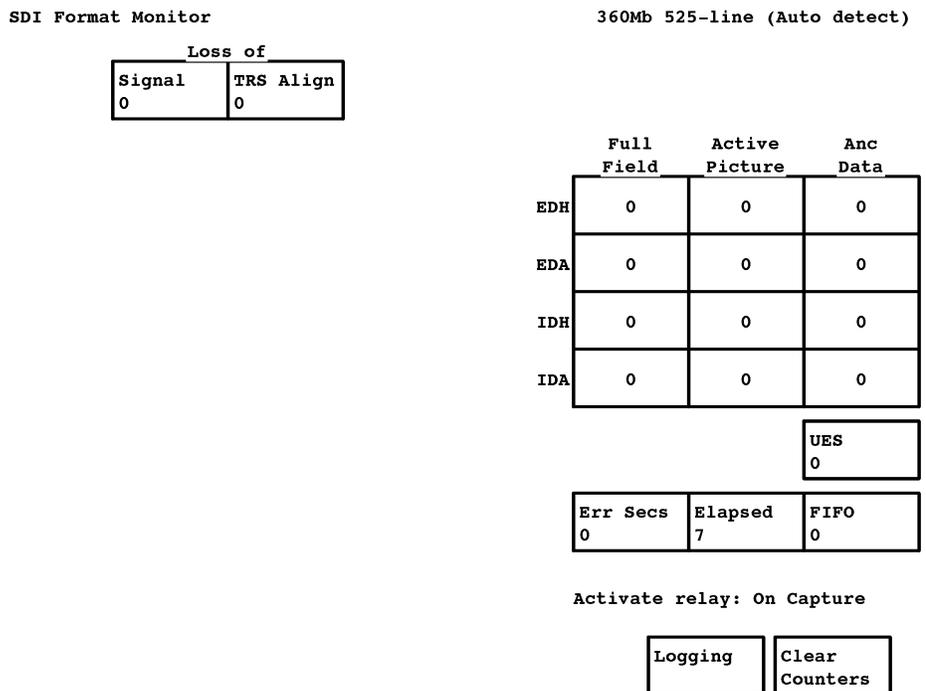
Figure 3–16: SDI Format Monitor display for 143 Mb and 360 Mb signals
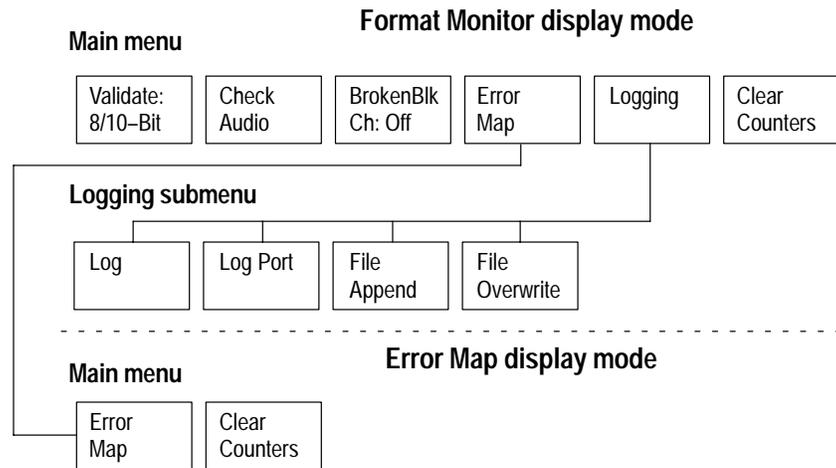
Figure 3–17: SDI Format Monitor application menu tree

- Logging. Touch this soft key to display the Logging submenu where you turn the Logging function on and off and select the log report destination for the SDI Eye Diagram application.

- Clear Counters. Touch this soft key to reset the counter display or to restart the Format Monitor if it is stopped by a trigger error.

Logging Submenu. Refer to *Report Logging* on page 2–4 for more information about the logging function. The Logging submenu provides the following soft keys at the bottom of the display:

- Log. Touch this soft key to toggle the logging function on and off.

- Log Port. Touch this soft key to send the log report to the measurement set communication port selected in the Communication Setup configuration file.

- File Append. Touch this soft key to append new logging information to the end of the Measurement Results log file.

- File Overwrite. Touch this soft key to overwrite previous logging information in the Measurement Results file with new logging information.

**Error Map
Display Mode**

Use the Error Map display to show the location of the errors from a selected type of format error. To select a specific format error from the Format Monitor display, touch the measurement cell of the desired error, and then touch the Error Map soft key. The Error Map display shows the physical location of format errors in a two field display. See Figure 3–18.

NOTE. Only one error type can be viewed at a time in the Error Map display.

The following soft keys are at the bottom of the Error Map display mode:

■ Error Map. Touch this soft key to return to the Format Monitor display mode.

■ Clear Counters. Touch this soft key to reset the counter display or to restart the monitor if it is stopped by a trigger error.
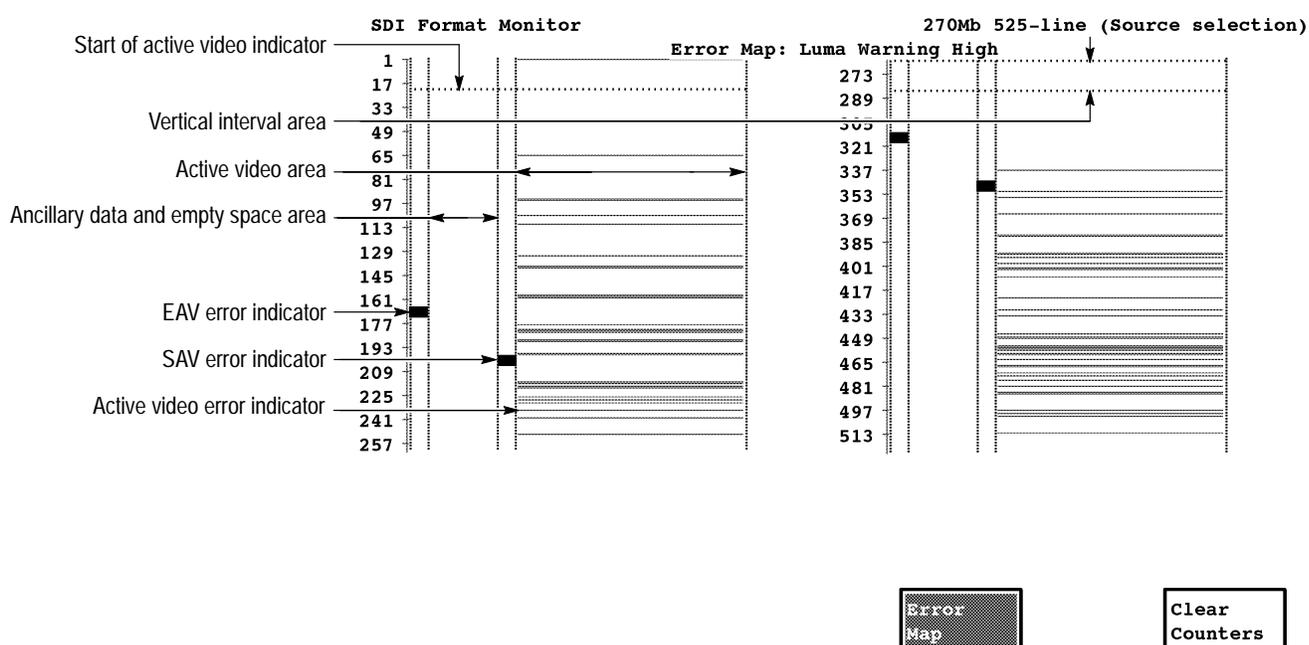
Figure 3–18: SDI Format Monitor application Error Map display

Format Error Messages   Table 3–9 lists the format error messages that you may encounter when you use the SDI Format Monitor or the SDI Ancillary Data Analyzer applications. Not all of the following error messages will appear in both applications because some of the listed errors can only be detected by one of the two applications.

Table 3–9: Format Monitor and Ancillary Data Analyzer error messages

Format Monitor cell name	Ancillary Data Analyzer error title	Error message or description
Loss of Signal	Loss of Signal	Cannot detect a valid SDI signal.
Loss of TRS Alignment	(This error is not detected by the SDI Ancillary Data Analyzer application.)	TRS marks in the signal are missing or out of place.
Length Line	Active Video Line Length	The number of samples in the active video portion of this line indicates that the EAV is misplaced.
	TRS Flag Invalid (SDI_Format reports as 'Length Line' if EAV invalid or 'Length Hblank' if SAV invalid)	TRSs are identified by a three word header: 3ff 000 000 (ff.c 00.0 00.0). In Validate 8/10-Bit mode, the values 3fc–3ff (ff.0–ff.c) are all recognized as 3ff (ff.c) and 000–003 (00.0–00.c) are recognized as 000 (00.0). In Validate 10-Bit Only mode, only 3ff and 000 (ff.c and 00.0) are acceptable. This header word is valid under 8/10-Bit mode but not under 10-Bit Only mode.
Length Hblank	Horizontal Blanking Interval Length	The number of samples in the horizontal blanking portion of this line indicates that the SAV is misplaced.
	TRS Flag Invalid (SDI_Format reports as 'Length Line' if EAV invalid or 'Length Hblank' if SAV invalid)	TRSs are identified by a three word header: 3ff 000 000 (ff.c 00.0 00.0). In Validate 8/10-Bit mode, the values 3fc–3ff (ff.0–ff.c) are all recognized as 3ff (ff.c) and 000–003 (00.0–00.c) are recognized as 000 (00.0). In Validate 10-Bit Only mode, only 3ff and 000 (ff.c and 00.0) are acceptable. This header word is valid under 8/10-Bit mode but not under 10-Bit Only mode.
Length Vblank	(This error is not detected by the SDI Ancillary Data Analyzer application.)	The V bits in the TRS XY(Z) word of both EAV and SAV have the wrong value for this location in the field. (Also causes a Misc XY(Z) error.)
Length Field	Field length	The number of lines in this field is invalid.

Table 3–9: Format Monitor and Ancillary Data Analyzer error messages (Cont.)

Format Monitor cell name	Ancillary Data Analyzer error title	Error message or description
Ancillary Data Header	Ancillary Data Packet Header Flag Invalid	Anc. data packets are identified by a three word header: 000 3ff 3ff (00.0 ff.c ff.c). In Validate 8/10-Bit mode, the values 000–003 (00.0–00.c) are all recognized as 000 (00.0) and 3fc–3ff (ff.0–ff.c) are recognized as 3ff (ff.c). In Validate 10-Bit Only mode, only 3ff and 000 (ff.c and 00.0) are acceptable. This header word is valid under 8/10-Bit mode but not under 10-Bit Only mode.
	Ancillary Data Packet Header Safety Bit (S-bit) Invalid	All non-data words in an ancillary packet should have their most-significant bit (bit 9) be the opposite of their next-most-significant bit (bit 8). Bit 9 of this ancillary packet's header word is the same as bit 8.
	Ancillary Data Packet Header Parity Bit (P-bit) Invalid	The ancillary data packet header word's next-to-most-significant bit (bit 8) is a parity bit for the lower-order 8 bits. The number of one bits in the low-order 8 bits plus the parity bit itself should be an even number (even parity). This word had odd parity, which indicates that there is a possible bit error within this word.
	Ancillary Data Packet Block Number Out Of Order	For ancillary data packets that contain block numbers, the block numbers must be numbered as follows: 1) A block numbered 0 must be followed either by another block numbered 0 or a block numbered 1. 2) A block numbered 255 must be followed by a block numbered 0 or a block numbered 1. 3) A block numbered with any other number must be followed by a block numbered one-higher or by a block numbered 0.
Ancillary Data Data	Ancillary Data Packet Illegal Data Word	In Validate 8/10-Bit mode, the data words in an ancillary data packet must exclude the protected ranges 000–003 and ffc–fff (00.0–00.c and ff.0–ff.c). In Validate 10-Bit Only mode, the data words must exclude only the protected values 000 and 3ff (00.0 and ff.c). This data word falls within one of these protected ranges.
Ancillary Data Checksum	Ancillary Data Packet Checksum Invalid	The last word of an ancillary data packet is a checksum computed over the nine least-significant bits of the packet starting at the DID. The checksum of this packet does not match the data contained within the packet.
	Ancillary Data Packet Checksum Safety-Bit Invalid	All non-data words in an ancillary packet should have their most-significant bit (bit 9) be the opposite of their next-most-significant bit (bit 8). Bit 9 of this ancillary packet's checksum is the same as bit 8.
Ancillary Data Placement	Ancillary Data Packet Placement Invalid	Ancillary data packets are required to be contiguous with the preceding packet or with the EAV mark. (The EDH ancillary data packet is an exception, as are packets that appear in the active portion of the vertical interval (VANC), which instead must be contiguous with the SAV mark. SDI_Format does not validate misplaced packets; SDI_Format and SDI_AncData do not validate VANC.)

Table 3–9: Format Monitor and Ancillary Data Analyzer error messages (Cont.)

Format Monitor cell name	Ancillary Data Analyzer error title	Error message or description
Ancillary Audio Sequence	Ancillary Data Packet Block Number Out Of Order	For ancillary data packets that contain block numbers, the block numbers must be numbered as follows: 1) A block numbered 0 must be followed either by another block numbered 0 or a block numbered 1. 2) A block numbered 255 must be followed by a block numbered 0 or a block numbered 1. 3) A block numbered with any other number must be followed by a block numbered one-higher or by a block numbered 0.
Ancillary Audio Broken Block	(This error is not detected by the SDI Ancillary Data Analyzer application.)	Embedded Audio Block Broken Each channel of AES audio is structured into blocks of 192 audio samples. The beginning of these blocks is marked by an audio Z-bit whose value is 1. This audio sample's Z-bit marks the beginning of a new block at a point other than 192 audio samples from the beginning of the preceding block.
	(This error is not detected by the SDI Ancillary Data Analyzer application.)	Embedded Audio Block Structure Missing Each channel of AES audio is structured into blocks of 192 audio samples. The beginning of these blocks is marked by an audio Z-bit whose value is 1. This audio channel's block structure is missing because it does not contain any Z-bits whose value is 1.
Ancillary Audio Samples/ Frame	(This error is not detected by the SDI Ancillary Data Analyzer application.)	For 525-line video, the number of audio samples per frame must be either 1601 or 1602. For 625-line video, the number of audio samples per frame must be exactly 1920. This frame contains some other number of samples per frame. (May be erroneously reported for ancillary packets with unusual audio channel arrangements.)
Ancillary Audio 5/5 Pattern	(This error is not detected by the SDI Ancillary Data Analyzer application.)	For 525-line video, the number of audio samples per frame must follow a repeating five-frame pattern: 1602, 1601, 1602, 1601, 1602. The most recent five-frames all had either 1601 or 1602 samples, but they did not follow the required pattern.
	(This error is not detected by the SDI Ancillary Data Analyzer application.)	Embedded Audio Channel Pairing Invalid Each embedded AES audio sample contains a channel number. Samples from channels 1 and 2 must be adjacent with the channel 1 sample appearing first. Channels 3 and 4 must appear similarly (though they may appear before sample pair 1–2). The audio channel for this sample violates these rules. (SDI_Format detects this error as an Audio Samples Per Frame error.)
(This error is not detected by the SDI Format Monitor application.)	Embedded Audio Validity-Bit (V-bit) Set	Each sample of embedded AES audio contains a bit to indicate whether it was detected as invalid by upstream equipment and so should be ignored when the audio stream is reconverted to analog. This audio sample's V-bit is set. (SDI_Format does not detect this error.)

Table 3–9: Format Monitor and Ancillary Data Analyzer error messages (Cont.)

Format Monitor cell name	Ancillary Data Analyzer error title	Error message or description
Luminance and Chrominance Warning and Error cells	Active Video Warning Value	This active video sample falls within the active video warning range specified by the current Format~Limits file. (Note: the start of active video is determined by the transition of the V-bit in the TRS XY(Z) word and the setting of the skip-lines value in the Format~Limits file.)
	Active Video Error Value	This active video sample falls within a protected range. In Validate 8/10-Bit mode, the protected ranges are 000–003 and 3fc–3ff (00.0–00.c and ff.0–ff.c). In Validate 10-Bit mode, the protected values are 000 and 3ff (00.0 and ff.c). (Note: the first line of active video is determined by the first XY(Z) word with a 0 V-bit and the setting of 'skip-lines' in the Format~Limits file.)
Miscellaneous XY(Z)	EAV / SAV Bit-9 Invalid	Bit-9 in this XY(Z) word is 0; it should be 1. XY(Z) word bits: <MSB> 1 F V H P3 P2 P1 P0 x x <LSB> (1=always 1; x=don't care)
	EAV / SAV Field-Bit (F-bit) Invalid	The Field-Bit in this XY(Z) word has the wrong value for this field. XY(Z) word bits: <MSB> 1 F V H P3 P2 P1 P0 x x <LSB> (1=always 1; x=don't care)
	EAV / SAV Vertical-Interval-Bit (V-bit) Invalid	The Vertical-Interval-Bit in this XY(Z) word has the wrong value for this location in the field. The V-bit must be 1 for lines 1–9 and 0 for lines 20+. In Validate 8/10-Bit mode, the V-bit may transition from 1 to 0 exactly once between lines 10 and 20. In Validate 10-Bit mode, the V-bit must be 1 for lines 1–19. XY(Z) word bits: <MSB> 1 F V H P3 P2 P1 P0 x x <LSB> (1=always 1; x=don't care)
	EAV / SAV Horizontal-Interval-Bit (H-bit) Invalid	The Horizontal-Interval-Bit in this XY(Z) word has the wrong value for this location in the line. For EAV, the H-bit should be 1; for SAV the H-bit should be 0. XY(Z) word bits: <MSB> 1 F V H P3 P2 P1 P0 x x <LSB> (1=always 1; x=don't care)
	EAV / SAV Protection Bits Indicate That A Bit-Error Has Occurred	The XY(Z) word contains four protection bits that allow the detection of many bit errors in the XY(Z) word. In this XY(Z) word, these bits indicate that at least one bit in the word has the wrong value. XY(Z) word bits: <MSB> 1 F V H P3 P2 P1 P0 x x <LSB> (1=always 1; x=don't care)
	EAV / SAV LSBs Invalid	In Validate 8/10-Bit mode, the two LSBs in the XY(Z) word can be anything. In Validate 10-Bit mode, they must be 0. At least one of these two bits is not 0. XY(Z) word bits: <MSB> 1 F V H P3 P2 P1 P0 x x <LSB> (1=always 1; x=don't care)

Table 3–9: Format Monitor and Ancillary Data Analyzer error messages (Cont.)

Format Monitor cell name	Ancillary Data Analyzer error title	Error message or description
Miscellaneous Unused Space	Empty Space Invalid	The vertical and horizontal blanking periods must either contain ancillary data packets or have its chrominance samples set to 040 (10.0) and its luminance samples set to 200 (80.0). This sample violates this rule.
EDH Full Field	(This error is not detected by the SDI Ancillary Data Analyzer application.)	EDH (Error Detected Here) Full Field An EDH full-field CRC showed an error occurred between where the EDH was last processed and the measurement set. Note: EDH packets with EDH bits set are reported as EDA because the error was detected upstream from the measurement set.
EDH Active Picture	(This error is not detected by the SDI Ancillary Data Analyzer application.)	EDH (Error Detected Here) Active Picture An EDH active-picture CRC showed an error occurred between where the EDH was last processed and the measurement set. Note: EDH packets with EDH bits set are reported as EDA because the error was detected upstream from the measurement set.
EDH Ancillary Data	(This error is not detected by the SDI Ancillary Data Analyzer application.)	EDH (Error Detected Here) Anc. Data An anc. data checksum showed an error occurred between where the checksum was last computed and the measurement set. (This box only active when EDH present. Error also reported as 'Anc. DataChecksum'.) Note: EDH packets with EDH bits set are reported as EDA because the error was detected upstream from the measurement set.
EDA Full Field	(This error is not detected by the SDI Ancillary Data Analyzer application.)	EDA (Error Detected Ahead) Full Field Some EDH-checking device upstream of the measurement set detected an EDH full-field CRC error, corrected the EDH CRC to reflect the error, and marked in the EDH packet that the error occurred. Note: EDH packets with EDH bits set are reported as EDA because the error was detected upstream from the measurement set.
EDA Active Picture	(This error is not detected by the SDI Ancillary Data Analyzer application.)	EDA (Error Detected Ahead) Active Picture Some EDH-checking device upstream of the measurement set detected an EDH active-picture CRC error, corrected the EDH CRC to reflect the error, and marked in the EDH packet that the error occurred. Note: EDH packets with EDH bits set are reported as EDA because the error was detected upstream from the measurement set.

Table 3–9: Format Monitor and Ancillary Data Analyzer error messages (Cont.)

Format Monitor cell name	Ancillary Data Analyzer error title	Error message or description
EDA Ancillary Data	(This error is not detected by the SDI Ancillary Data Analyzer application.)	EDA (Error Detected Ahead) Anc. Data Some EDH-checking device upstream of the measurement set detected an ancillary data checksum error, corrected the checksum to reflect the error, and marked in the EDH packet that the error occurred. Note: EDH packets with EDH bits set are reported as EDA because the error was detected upstream from the measurement set.
IDH Full Field	(This error is not detected by the SDI Ancillary Data Analyzer application.)	IDH (Internal (Error) Detected Here) Full Field This measurement cell is not used.
IDH Active Picture	(This error is not detected by the SDI Ancillary Data Analyzer application.)	IDH (Internal (Error) Detected Here) Active Picture This measurement cell is not used.
IDH Ancillary Data	(This error is not detected by the SDI Ancillary Data Analyzer application.)	IDH (Internal (Error) Detected Here) Anc. Data This measurement cell is not used.
IDA Full Field	(This error is not detected by the SDI Ancillary Data Analyzer application.)	IDA (Internal (Error) Detected Ahead) Full Field An error unrelated to EDH processing was detected upstream from the measurement set and was recorded in the EDH packet. Note: EDH packets with IDH bits set are reported as IDA because the error was detected upstream from the measurement set.
IDA Active Picture	(This error is not detected by the SDI Ancillary Data Analyzer application.)	IDA (Internal (Error) Detected Ahead) Active Picture An error unrelated to EDH processing was detected upstream from the measurement set and was recorded in the EDH packet. Note: EDH packets with IDH bits set are reported as IDA because the error was detected upstream from the measurement set.
IDA Ancillary Data	(This error is not detected by the SDI Ancillary Data Analyzer application.)	IDA (Internal (Error) Detected Ahead) Anc. Data An error unrelated to EDH processing was detected upstream from the measurement set and was recorded in the EDH packet. Note: EDH packets with IDH bits set are reported as IDA because the error was detected upstream from the measurement set.
EDH Missing	(This error is not detected by the SDI Ancillary Data Analyzer application.)	The Format~Limits file indicates that an EDH packet is expected in the video stream ('EDH Missing' Highlight setting is 'yes') but it is not present in this field.
EDH Placement	EDH Ancillary Data Packet Misplaced	In 270Mb 525-line component, the EDH ancillary data packet must be placed starting at sample 1689 on lines 9 or 272 (field 2, line 9). In 270Mb 625-line component, the EDH ancillary data packet must be placed starting at sample 1700 on lines 5 or 318 (field 2, line 5). This packet is misplaced.

Table 3–9: Format Monitor and Ancillary Data Analyzer error messages (Cont.)

Format Monitor cell name	Ancillary Data Analyzer error title	Error message or description
EDH UES	(This error is not detected by the SDI Ancillary Data Analyzer application.)	Unknown Error Status At least one of the UES status bits was set by equipment upstream of the measurement set. Indicates that the video stream originated from equipment that did not support EDH.
FIFO Overflow	(This error is not detected by the SDI Ancillary Data Analyzer application.)	The video stream being monitored contained so many anc. data packets and/or so many errors that SDI_Format could not keep up. Set either or both 'BrokenBlk Ch' and 'Check Audio' to off to reduce the frequency of this error. Note: This error does not itself indicate a video stream error.
(This error is not detected by the SDI Format Monitor application.)	SID For 305M DID Is Invalid	The SDTI Data ID [140h] requires a Secondary ID of 101h. Extended data packet SIDs are not currently defined.
(This error is not detected by the SDI Format Monitor application.)	DC For 305M Header Is Invalid	The SDTI Data ID [140] requires a Data Count of 22Eh. This value is incorrect.
(This error is not detected by the SDI Format Monitor application.)	Invalid Line Number For 305M Header	The encoded line number does not match the acquisition line number. The data is contained in two contiguous samples. The first sample is highlighted although the problem may be with the second.
(This error is not detected by the SDI Format Monitor application.)	Line Number For 305M Header Is Out Of Range	The encoded line number falls outside of the 1-525 or 1-625 range. The data is contained in two contiguous samples. The first sample is highlighted although the problem may be with the second.
(This error is not detected by the SDI Format Monitor application.)	Reserved Bits Non Zero In 305M Header	The reserved bits in the second line number sample are not set to zero[0].
(This error is not detected by the SDI Format Monitor application.)	Invalid 305M Payload Length	The payload length indicated by the Code is currently unsupported. The value identifies a length of 1920 words indicating a sample rate of 360Mbit/s.
(This error is not detected by the SDI Format Monitor application.)	Invalid 305M Destination & Source Address Format	The AAI indicates an unspecified destination / source format, but the corresponding 16 bytes contain non zero [0] entries.
(This error is not detected by the SDI Format Monitor application.)	Conflicting 305M Block Type Prefix	The Block Type prefix [B7, B6] value (1, 1) can only be used with the variable block size whose value is [01h].
(This error is not detected by the SDI Format Monitor application.)	Invalid 305M Header Expansion Reserved Data	The Header Expansion reserved data shall be positioned after the data extension flag. The default value for the reserved data is [200h].
(This error is not detected by the SDI Format Monitor application.)	Invalid 305M Separator	The value of the separator should be [309h]. This sample is in the separator position but has the wrong value.

Table 3–9: Format Monitor and Ancillary Data Analyzer error messages (Cont.)

Format Monitor cell name	Ancillary Data Analyzer error title	Error message or description
(This error is not detected by the SDI Format Monitor application.)	Invalid 305M Endcode	The value of the endcode should be [30Ah]. This sample is in the endcode position but has the wrong value.
(This error is not detected by the SDI Format Monitor application.)	Incorrect 305M Line CRC	The line CRC is generated using the DID through the second line sample inclusive and conforms to ITU-T X25. The generated value does not match this sample pair.
(This error is not detected by the SDI Format Monitor application.)	Incorrect 305M Header CRC	The header CRC is generated using the Code/AAI through the fourth reserved sample inclusive and conforms to ITU-T X25. The generated value does not match this sample pair.

SDI Ancillary Data Analyzer Application

One of the advantages of the serial-digital signal is the ability to embed data into an area of the signal. This embedded data is called ancillary data. One of the most common uses of the ancillary data area is to embed several channels of digital audio data into the digital signal. Embedding audio data with the digital video signal has many advantages, especially in very large facilities where running separate audio paths is costly and a technical disadvantage. Embedding audio data with the video data also helps to reduce synchronizing errors between the audio and video program material as it is routed throughout the facility.

As one of the video format and content applications, the SDI Ancillary Data Analyzer application interprets the ancillary data. All sample data are shown including field, line, and sample numbers, data types (for example EAV, SAV), as well as data values and their interpretations providing a precise byte-by-byte verification of all ancillary data (see Figure 3–21). You can optimize the display to only show specific data types, such as AES Audio packets or SDTI data, eliminating data displays you do not need.

The SDI Ancillary Data Analyzer application provides Find Error and Find Pattern display modes to search for data errors and patterns. These display modes can be accessed only after a video frame has been captured. You can capture a video frame by using one of the following two methods: press the front-panel Freeze button to capture the active video frame, or use the SDI Format Analyzer application to capture a specific video frame. The Find Error display mode scans through the display buffer for ancillary data that is noncompliant with SMPTE specifications. The Find Pattern display mode lets you search through the display buffer to locate user-specific data patterns.

The SDI Ancillary Data Analyzer application can use the Select Line Mode. Refer to *Select Line Mode* on page 2–4 for more information.

The SDI Ancillary Data Analyzer and the SDI Format Monitor applications report error messages for ancillary data errors. Table 3–9 starting on page 3–34 lists the error messages you may encounter in both applications.

Analyzing SDTI Signals　SMPTE standard 305M, known as SDTI for Serial Data Transport Interface, specifies a data stream for the purpose of transporting packetized data within a studio or production center environment. Option 1S supports automatic recognition and analysis of SDTI signals to SMPTE 305M specifications.

NOTE. *The SDTI analysis capabilities of Option 1S are limited to the SDTI transport layer. Option 1S does not decode or verify the packetized data payload.*

The SDTI data stream is intended to transport any packetized data signal over active video lines that have a maximum data rate of up to ≈ 200 Mb/s for 270 Mb/s systems or up to ≈ 270 Mb/s for 360 Mb/s systems. The data packets and synchronizing signals associated with SDTI are compatible with ANSI/SMPTE 259M. This allows routing of the SDTI signal, including the compressed data packets (see Figure 3–19), through a standard plant infrastructure. The SDTI header data packet contains provisions for addressing several destination devices on the SDTI connection, which allows a single SDTI source device to address several SDTI destination devices. While SDTI can be used to transport any packetized data, Panasonic's DVCPRO compressed digital format is the format most often associated with SDTI.
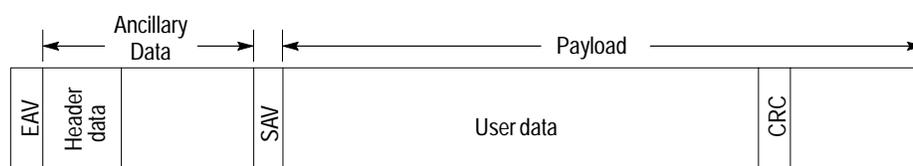
Figure 3–19: SMPTE 305M packet structure

An issue concerning manufacturers of professional video equipment with SDTI interfaces is the lack of standardized chip sets. Because of the lack of available chip sets, manufacturers have been forced to design their own discrete SDTI formatter and receiver circuits. The proliferation of various SDTI designs increases the possibility of interoperability problems occurring during data transfer between different manufacturer's devices. Many of these interoperability problems can be solved by analysis of the SMPTE 305M transport layer.

SDTI Header Data Structure. The SDTI header data as defined by SMPTE 305M is made up of 53 words as shown in Figure 3–20. Option 1S decodes the elements of the SDTI header and verifies them for compliance to SMPTE 305M.
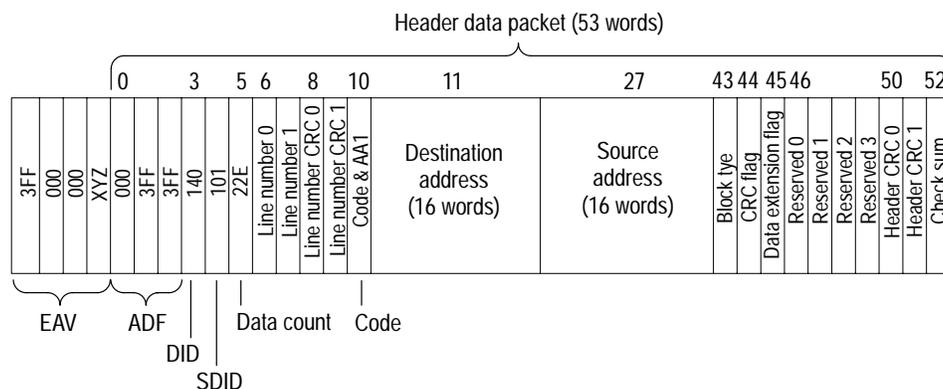
Figure 3–20: SMPTE 305M SDTI header data structure

Ancillary Data Analyzer Display Mode

Figure 3–21 shows the SDI Ancillary Data Analyzer application display. In the interpretation column of the display, the application uses the bit codes defined in Table 3–10 to display the AES audio data packets.

The SDI Ancillary Data Analyzer display uses abbreviations to describe the data types encountered in the Type column of the display. Table 3–11 lists the definitions of these data-type abbreviations.

```
Ancillary Data Analyzer                              270Mb 525-line (Freeze button)
                                                                          F1 L20

F  Ln  Smpl Type    Data                      Interpretation
1  20  1712 SAV     3ff 000 000 200           <F1 L20><F=0,V=0,H=0>
1  20    0 VIDEO    -----------------------------
1  21 1440 EAV      3ff 000 000 274           <F1 L21><F=0,V=0,H=1>
1  21 1444 AES3     000 3ff 3ff 1fb 200 224   DID=1fb,DBN=200,DC=024
1  21 1450 DATA     210 2b3 110      21a 26f 10f   01 82cc2 0001 | 02 79bc3 0001
1  21 1456 DATA     204 200 100      206 200 200   03 00000 0001 | 04 00000 0000
1  21 1462 DATA     2d8 29d 210      2d2 190 20e   01 8275b 0000 | 02 7641a 0000
1  21 1468 DATA     204 200 100      206 200 200   03 00000 0001 | 04 00000 0000
1  21 1474 DATA     260 289 210      23a 283 20e   01 8224c 0000 | 02 720c7 0000
1  21 1480 DATA     204 200 100      206 200 200   03 00000 0001 | 04 00000 0000
1  21 1486 CHKSUM   261                        z# audio vucp   z# audio vucp
1  21 1487 EMPTY    -------------------------------
1  21 1712 SAV      3ff 000 000 200           <F1 L21><F=0,V=0,H=0>
1  21    0 VIDEO    -----------------------------
1  22 1440 EAV      3ff 000 000 274           <F1 L22><F=0,V=0,H=1>
1  22 1444 AES3     000 3ff 3ff 1fb 200 224   DID=1fb,DBN=200,DC=024
1  22 1450 DATA     2b0 276 290      1a2 148 18d   01 81d96 0010 | 02 6d234 0011
1  22 1456 DATA     204 200 280      206 200 180   03 00000 0010 | 04 00000 0011
1  22 1462 DATA     1c0 264 110      2ea 1e3 10c   01 81938 0001 | 02 678dd 0001
```

XY(Z) word decodes

Group of three 10-bit video samples containing one audio sample (decoded in the right column)

Decoded audio sample from the left column's video-sample group (shows bit values and 20-bit audio data)

Decoded bits are shown in Table 3–10

```
Validate:        Find       Find        Show Anc:              ShowVideo
8/10-Bit         Error      Pattern     All                   & Empty
```

Figure 3–21: SDI Ancillary Data Analyzer display

Table 3–10: AES audio data bit code definitions

Bit code	Definition	Possible values
#	Audio channel bit	0, 1, 2, or 3
c	Channel status bit	0 or 1
p	Subframe parity bit	0 or 1
u	User data bit	0 or 1
v	Audio validity bit	0 or 1
z	Z bit	0 or 1

Table 3–11: SDI Ancillary Data Analyzer data-type abbreviations

Abbreviation	Definition	Comment
AES<u>n</u>	AES audio	Audio group <u>n</u> (n = audio channel 1, 2, 3, or 4)
AES-X<u>n</u>	AES audio extended block	Audio group <u>n</u> (n = audio channel 1, 2, 3, or 4)
AES-C<u>n</u>	AES audio control block	Audio group <u>n</u> (n = audio channel 1, 2, 3, or 4)
ANCTIM	Ancillary time code	
CHKSUM		Ancillary data checksum
DATA		Ancillary data packet itself
DATA8		Ancillary data packet itself (8-bit data)
DELETD	Deleted block	Block marked as deleted
EAV	End of active video	
EDH	Error detection and handling	
EMPTY		Empty ancillary data space (data not shown)
END	End mark	Last block in this ancillary space (optional)
RS08	Reserved ID	8-bit data
RS10	Reserved ID	10-bit data
SAV	Start of active video	
TIMCOD	Time code	
UNDEF	Undefined format	ID code 200 only
UR08	User data	8-bit data
UR10	User data	10-bit data
VIDEO		Video space (data not shown)
305M	SDTI header data	SDTI header packet length: 53 words
FC	SMPTE 305M ID: 2d1h	
SXA	SMPTE 305M ID: 282h	
SXC	SMPTE 305M ID: 2c3h	
SXV	SMPTE 305M ID: 102h	
MPG2PS	SMPTE 305M ID: 152h	MPEG-2 P/S
MPG2TS	SMPTE 305M ID: 253h	MPEG-2 T/S
DVCPR1	SMPTE 305M ID: 221h	DVCPRO1/Digital S
DVCPR2	SMPTE 305M ID: 222h	DVCPRO2
DVCAM1	SMPTE 305M ID: 241h	DVCAM-1
SDTI	SDTI user data	SDTI is displayed if the SDTI data type does not match any of the recognized data types

Figure 3–22 shows the bit relationship to the XY(Z) word.

MSB									LSB
1	F	V	H	P3	P2	P1	P0	0	0

F - Field parity;   0=Field 1, 1=Field 2
V - Vertical;   0=Active video, 1=Vertical blanking
H - Horizontal;   0=SAV, 1=EAV
P3,P2,P1,P0= Hamming code

Figure 3–22: Definition of the bits in the TRS XY(Z) word

Main Menu. The menu tree for the application is shown in Figure 3–23. The following soft keys appear at the bottom of the Ancillary Data Analyzer display:

- Validate: *<bit count>*. Touch this soft key to toggle the validation setting between 8/10-bit and 10-bit. Refer to *Validation Settings* on page 3–27 for more information.

- Find Error. This soft key appears only if a video frame has been captured. Touch this soft key to access the Find Error display mode. Refer to *Find Error Display Mode* on page 3–47 for more information.

- Find Pattern. This soft key appears only if a video frame has been captured. Touch this soft key to access the Find Pattern display mode. Refer to *Find Pattern Display Mode* on page 3–48 for more information.

- Show Anc: *<data type>*. Touch this soft key to select the type of ancillary data to display. Touch the soft key to toggle through the selections of All, Audio, Non Audio, and None. The Audio Group soft key appears when this soft key is set to Audio. The Show Anc soft key setting is shared with the SDI Ancillary Data Distribution Analyzer application and the soft key appears in both applications.

- Audio Group: *<group number>*. This soft key only appears when the Show Anc soft key is set to Audio. Touch this soft key to select the audio group from which to display data. Once this soft key is highlighted, use the front-panel knob to select the audio group. The selections include audio groups 1 through 4. The Audio Group soft key setting is shared with the SDI Ancillary Data Distribution Analyzer application and the soft key appears in both applications.

- ShowVideo & Empty. Touch this soft key to toggle between showing and suppressing samples containing video and empty data.

Main menu

```
┌──────────┐ ┌──────────┐ ┌──────────┐ ┌──────────┐ ┌──────────┐ ┌──────────┐
│ Validate:│ │ Find     │ │ Find     │ │ Show Anc:│ │ Audio    │ │ ShowVideo│
│ 8/10–Bit │ │ Error    │ │ Pattern  │ │ All      │ │ Group: All│ │ & Empty  │
└──────────┘ └──────────┘ └──────────┘ └──────────┘ └──────────┘ └──────────┘
```

Find Error submenu

```
┌──────────┐ ┌──────────┐ ┌──────────┐
│ Find Next│ │ Close    │ │ Find Next│
│ Backwards│ │ Error Box│ │ Forwards │
└──────────┘ └──────────┘ └──────────┘
```

Find Pattern submenu

```
┌──────────┐ ┌──────────┐ ┌──────────┐
│ Find Next│ │ Close    │ │ Find Next│
│ Backwards│ │ PattrnBox│ │ Forwards │
└──────────┘ └──────────┘ └──────────┘
```
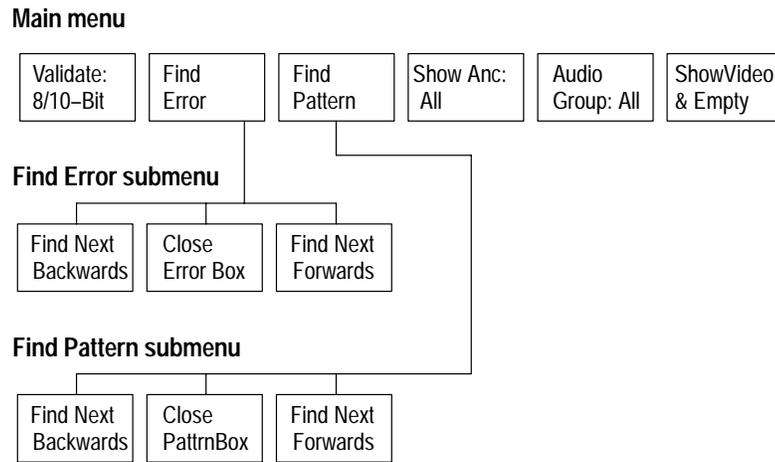
Figure 3–23: SDI Ancillary Data Analyzer application menu tree

Find Error Display Mode

This mode can be accessed only after a video frame has been captured. The Find Error display mode (see Figure 3–24) scans through the display buffer for ancillary data that is noncompliant with SMPTE specifications. The selected noncompliant data is indicated in inverse video on the display along with a detailed text interpretation of each data error. The Find Pattern display mode lets you search through the display buffer to locate user-specific data patterns.

```
Ancillary Data Analyzer                          270Mb 525-line (Freeze button)
                                                                     F1 L30

 F  Ln  Smpl  Type    Data                        Interpretation
 1  30  1712  SAV     3ff 000 000  000            <F1 L30><F=0,V=0,H=0>
 1  30     0  VIDEO   ------------------------------
 1  31  1440  EAV     3ff 000 000 374             <F1 L31><F=1,V=0,H=1>
 1  31  1444  AES1    000 3ff 3ff 2ff 200 224     DID=2ff,DBN=200,DC=024
 1  31  1450  DATA    200 200 200     202 200 100 01 00000 0000 | 02 00000 0001
 1  31  1456  DATA    204 200 100     206 200 200 03 00000 0001 | 04 00000 0000
 1  31  1462  DATA    1a0 2cc 11e     1ea 2fc 11f 01 f3334 0001 | 02 fbf3d 0001
 1  31  1468  DATA    1ec 2fc 11f     1ee 2fc 21f 03 fbf3d 0001 | 04 fbf3d 0000
 1  31  1474  DATA    200 200 200     202 200 100 01 00000 0000 | 02 00000 0001
 1  31  1480  DATA    204 200 100     206 200 200 03 00000 0001 | 04 00000 0000
 1  31  1486  CHKSUM  1da                         z# audio vucp   z# audio vucp
 1  31  1487  EMPTY   ------------------------------
 1  31  1712  SAV     3ff 000 000 000             <F1 L31><F=0,V=0,H=0>
 1  31     0  VIDEO   ------------------------------
 1  32  1440  EAV     3ff 000 000 274             <F1 L32><F=0,V=0,H=1>
                              Find Error
                         EAV / SAV Bit-9 Invalid

        Bit-9 in this XY(Z) word is 0; it should be 1. XY(Z) word bits:
           <MSB> 1 F V H P3 P2 P1 P0 x x <LSB> (1=always 1; x=don't care)


        ┌──────────┐              ┌──────────┐              ┌──────────┐
        │Find Next │              │Close     │              │Find Next │
        │Backwards │              │Error Box │              │Forwards  │
        └──────────┘              └──────────┘              └──────────┘
```

Highlighted error → (points to first data row: 1 30 1712 SAV 3ff 000 000 [000])

Error message for highlighted error → (points to Find Error text)

Figure 3–24: SDI Ancillary Data Analyzer application Find Error display mode

Use the front-panel knob to scroll through the data display. Press the front-panel Select Line button to cause the knob to scroll through the data by video line. Messages describing the highlighted error appear at the bottom of the display.

Find Error Submenu. The following soft keys appear at the bottom of the Find Error display mode:

■   Find Next Backwards. Touch this soft key to search the display buffer backwards for the next data error.

■   Close Error Box. Touch this soft key to exit the Find Error display mode and return to the main Ancillary Data Analyzer display.

■   Find Next Forwards. Touch this soft key to search the display buffer forwards for the next data error.

Find Pattern Display Mode

This mode can be accessed only after a video frame has been captured. When diagnosing serial-digital system problems, it is often necessary to locate and verify unique digital word patterns within the video signal. For example, a misplaced TRS (Timing Reference Signal) in the active video portion of the signal can cause equipment to create a false sync trigger. The Find Pattern display mode (see Figure 3–25) allows you to input and search for up to three successive digital words throughout the entire captured video frame.

Touch the Next Pattern soft key to begin a sample-by-sample forward search through the video frame starting at the current line for the desired digital word or words pattern. The display stops and highlights the first occurrence of the word pattern once a match is found. Touch the Next Pattern soft key again to continue the search through the video frame for the next data-word pattern match. Touch the Previous Pattern soft key to search backwards through the video frame for a digital-word pattern starting at the current line.

Entering Search-Word Patterns. Search-word patterns are based on the Hex format of the sampled data (SMPTE or EBU). Refer to *Hex Formats* on page 2–5 for more information. Search-word patterns are entered using the touch-screen keypad. To enter a search-word pattern, touch one of the three Find Pattern search-words on the display (see Figure 3–25). This will highlight the 10-bit binary search-word within a lined border and activate the touch-panel keypad. Use the keypad to set the value of the selected search word while using the front-panel knob to move the cursor between the bits in the word. The hex value for each nibble of the binary word is shown to the right of the search word. Each of the three groups of bits in the binary word are called nibbles.

Found pattern matching the search words

```
Ancillary Data Analyzer                           270Mb 525-line (Freeze button)
                                                                         F1 L59

F  Ln  Smpl  Type    Data                              Interpretation
1  59  1444  ADS1    000 3ff ▓▓▓ ▓▓▓ ▓▓▓ 224           DID=2ff,DBN=200,DC=024
1  59  1450  DATA    260 133 201      21a 103 200      01 0cccc 0000 | 02 040c3 0000
1  59  1456  DATA    21c 103 200      21e 103 100      03 040c3 0000 | 04 040c3 0001
1  59  1462  DATA    200 200 200      202 200 100      01 00000 0000 | 02 00000 0001
1  59  1468  DATA    204 200 100      206 200 200      03 00000 0001 | 04 00000 0000
1  59  1474  DATA    1a0 2cc 29e      1ea 2fc 29f      01 f3334 0010 | 02 fbf3d 0010
1  59  1480  DATA    1ec 2fc 29f      1ee 2fc 19f      03 fbf3d 0010 | 04 fbf3d 0011
1  59  1486  CHKSUM  1bf                               z# audio vucp   z# audio vucp
1  59  1487  EMPTY   ------------------------------
1  59  1712  SAV     3ff 000 000 200                   <F1 L59><F=0,V=0,H=0>
1  59     0  VIDEO   ------------------------------
```

Search words

Keypad for entering search words

```
              Find Pattern
                                                    ┌────────┬────────┬────────┬────────┐
First Word:  11 1111 1111   3ff                     │   C    │   D    │   E    │   F    │
                                                    ├────────┼────────┼────────┼────────┤
Second Word: 10 1111 1111   2ff                     │   8    │   9    │   A    │   B    │
                                                    ├────────┼────────┼────────┼────────┤
Third Word:  10 0000 0000   200                     │   4    │   5    │   6    │   7    │
                                                    ├────────┼────────┼────────┼────────┤
                                                    │   0    │   1    │   2    │   3    │
  ┌──────────┬──────────┬──────────┐                ├────────┼────────┼────────┼────────┤
  │Find Next │Close     │Find Next │                │ Binary │ Binary │ Binary │Match Any│
  │Backwards │PattrnBox │Forwards  │                │   0    │   1    │  (x)   │  (x)   │
  └──────────┴──────────┴──────────┘                └────────┴────────┴────────┴────────┘
```

Figure 3–25: SDI Ancillary Data Analyzer application Find Pattern display mode

The touch-screen keypad is divided into two sections: the hexadecimal keys and the binary keys. The hexadecimal keys enter the selected value as the value for the current nibble of the partitioned binary word where the cursor is located. The hexadecimal keys include the top four rows of the keypad plus the Match Any (x) key. The binary keys enter the selected value for only the bit of the binary word that is highlighted by the cursor. The binary keys are the three keys on the left of bottom row on the keypad. The two (x) keys let you match any value for that bit or nibble of the binary word.

Find Pattern Submenu. The following soft keys appear at the bottom of the Find Pattern display mode:

■ Find Next Backwards. Touch this soft key to search the display buffer backwards for the next data word pattern.

■ Close PattrnBox. Touch this soft key to exit the Find Pattern display mode and return to the main Ancillary Data Analyzer display.

■ Find Next Forwards. Touch this soft key to search the display buffer forwards for the next data word pattern.

SDI Ancillary Data Distribution Analyzer Application

One of the advantages of the serial-digital signal is the ability to embed data into an area of the signal. This embedded data is called ancillary data. One of the most common uses of the ancillary data area is to embed several channels of digital audio data into the digital signal. Embedding audio data with the digital video signal has many advantages, especially in very large facilities where running separate audio paths is costly and a technical disadvantage. Embedding audio data with the video data also helps to reduce synchronizing errors between the audio and video program material as it is routed throughout the facility.

As one of the video format and content applications, the SDI Ancillary Data Distribution Analyzer application scans ancillary data to help debug buffer overflow problems of the ancillary data distribution pattern within a video frame.

Although it would be preferable for ancillary data to be distributed evenly throughout the video field, it is not practical to do so. Since some video lines are excluded in the distribution of ancillary data (for example lines in the vertical interval where frame switches occur), a data buffer is required in serial receivers to accommodate the uneven ancillary data distribution. In some cases, the ancillary data distribution is such that serial receiver buffers will overflow or run empty causing disruptions in the decoded ancillary data stream.

The SDI Ancillary Data Distribution Analyzer application can access the Select Line Mode. Refer to *Select Line Mode* on page 2–4 for more information.

SDI Ancillary Data Distribution Analyzer Display Modes

The SDI Ancillary Distribution Analyzer application provides three display modes to display the distribution pattern of the ancillary data throughout the video frame: Words, Deltas, and Packets. Use the front-panel knob to select a specific video line with the measurement cursor.

Words Display Mode. The Words display mode (see Figure 3–26) shows the number of ancillary-data samples distributed throughout the video frame using one of the following two modes: Words or Audio Units. In the Words mode (default mode), the graticule and cursor function is calibrated for a 10-bit video sample. The Words readout value on the display indicates the total number of 10-bit video samples detected in the data portion of each ancillary-data block for each video line (volume of User Data Words in each line per SMPTE 291M). The Video Frame Total readout value indicates the total number of 10-bit video samples detected in the ancillary data for each video frame.

In the Audio Units mode, the graticule and cursor function is calibrated to display only the number of audio samples in a single channel of the selected audio group. SMPTE 272M-1994 defines the audio-data structure as being mapped into three contiguous data words (a composite consisting of control bits, channel information, and 20 bits of audio data). There are either two or four audio channels per audio group.
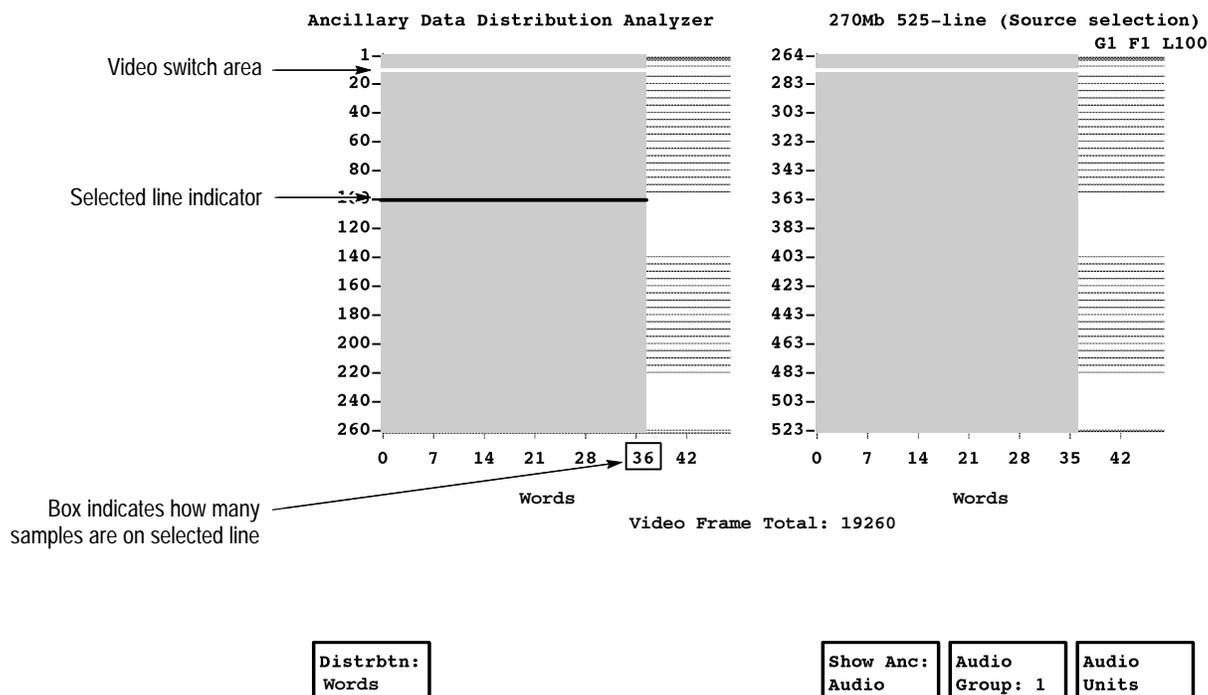
Figure 3–26: Ancillary Data Distribution Analyzer distribution Samples display

To access the Audio Units mode, set the Show Anc soft key to Audio (displaying the Audio Group and Audio Units soft keys). Use the Audio Group soft key to select one of the audio groups (1, 2, 3, or 4) for display. Touch the Audio Units soft key to turn the Audio Units mode on.

Deltas Display Mode. The Deltas display mode (see Figure 3–27) predicts buffer requirements for the receiver device based on the distribution of the ancillary-data samples. The display represents a buffer's occupancy when filled with the ancillary data stream and drained at a constant (average) rate. The occupancy value for each line is computed by summing the number of words received up to and including the line, subtracting the average number of words in the frame, and normalizing the results so that no difference is less than zero. You can use the Deltas display mode for debugging buffer overflow problems in serial receiver devices.
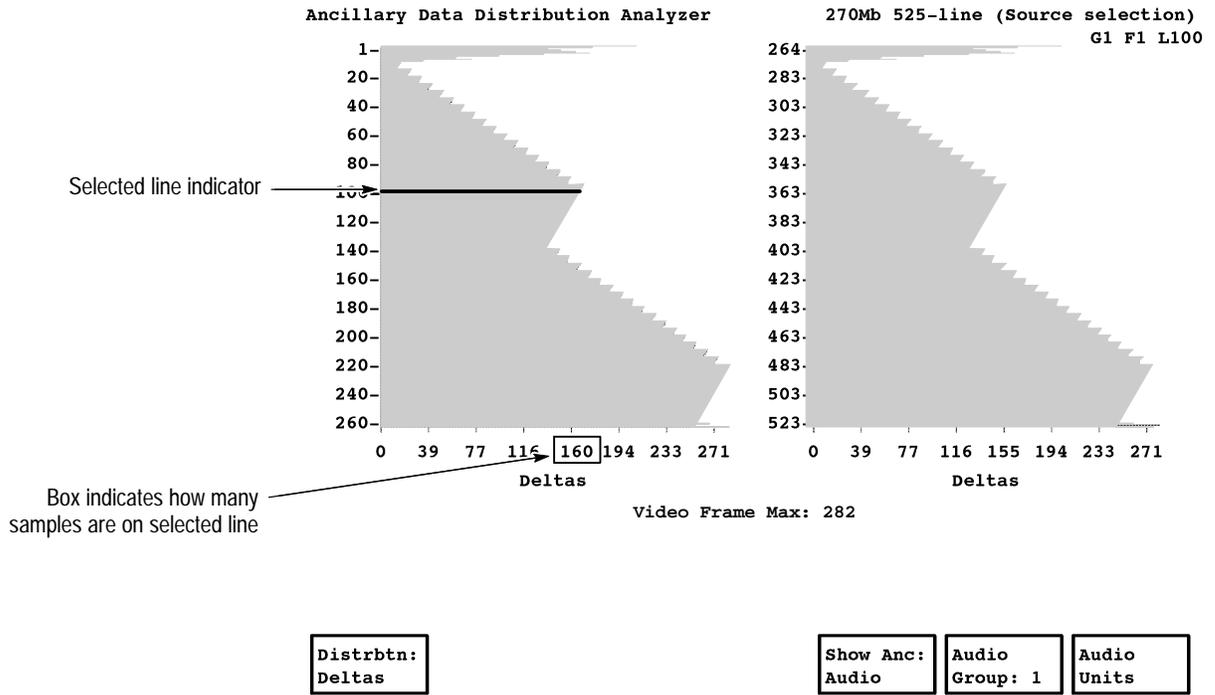
Figure 3–27: Ancillary Data Distribution Analyzer distribution Deltas display
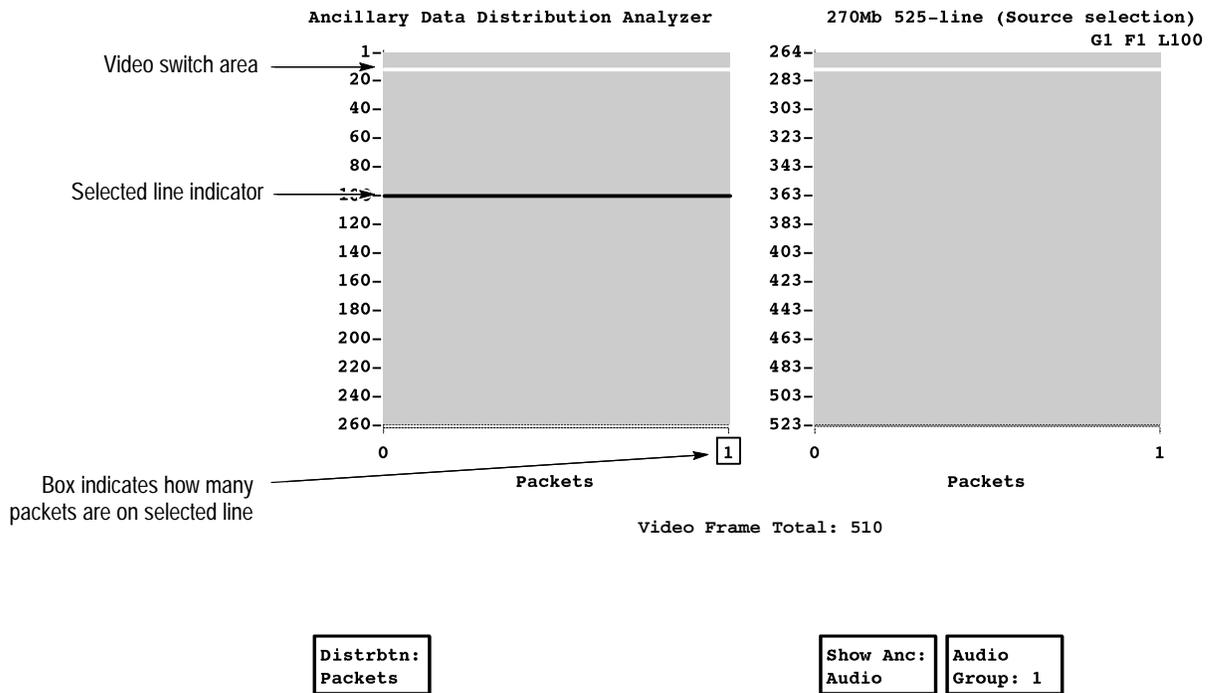
Figure 3–28: Ancillary Data Distribution Analyzer distribution Packets display

Packets Display Mode. The Packets display mode (see Figure 3–28) shows the number of ancillary-data packets distributed throughout the video frame. The Packets readout value on the display indicates the total number of packets detected in the ancillary-data space for each video line (volume of Ancillary Data Packets in each line per SMPTE 291M). There can be as many packets as there is ancillary-data space to put them. For example, an ancillary-data space with an AES1 and EDH block contains two packets. However, the ancillary-data space with only an AES1 block contains only one packet. The number of packets is shown on the X axis. The Packets display mode is useful for heavily loaded or unusually loaded ancillary-data streams.

Main Menu. Figure 3–29 shows the menu tree for the application. The following soft keys appear at the bottom of the display:

- Distrbtn: *<type>*. Touch this soft key to toggle the distribution display mode between Words, Deltas, and Packets.

- Show Anc: *<data type>*. Touch this soft key to select the type of ancillary data to display. Touch the soft key to toggle through the selections of All, Audio, Non Audio, and None. When this soft key is set to Audio, the Audio Group soft key appears. The Show Anc soft key setting is shared with the SDI Ancillary Data Distribution Analyzer application.

- Audio Group: *<group number>*. This soft key appears only when the Show Anc soft key is set to Audio. Touch this soft key to select the audio group from which to display data. Once this soft key is highlighted, use the front-panel knob to select through the selections of All, and audio groups 1, 2, 3, and 4. The Audio Group soft key setting is shared with the SDI Ancillary Data Distribution Analyzer application. When this soft key is not set to All and the Distrbtn soft key is set to Words or Deltas, the Audio Units soft key appears.

- Audio Units. This soft key only appears when the Audio Group soft key setting is not set to All and the Distrbtn soft key is set to Words or Deltas. The Words and Deltas displays count the number of AES/EBU data words per video line. When Audio Units is set to off, the graticule X axis counts the total number of video samples. When Audio Units is on, the video-sample count is divided by six for two-channel audio, or the video-sample count is divided by twelve for four-channel audio.

Main menu

Distribtn: Words	Show Anc: Audio	Audio Group: All	Audio Units

Figure 3–29: SDI Ancillary Data Distribution Analyzer application menu tree

SDI Waveform Application

By design, the serial digital video signal is robust. Error detection and correction techniques used in all-digital facilities allow for a reduced reliance on traditional signal-monitoring equipment as compared to analog facilities. However, most digital video still begins as an analog signal that has gone through an analog-to-digital conversion process and serial encoding. In the studio and post-production environments, the serial-digital signal is often reclocked, encoded, decoded, compressed, decompressed, or even transcoded from one format standard to another. After processing, the digital signal is converted back to analog form before final distribution.

The effect of multiple-layered signal processing steps in the digital form can lead to distortions of the final analog product during the digital-to-analog conversion process. These distortions are apparent in the form of pulse and group-delay distortions, edge ringing, amplitude errors, and high-frequency detail loss. Therefore, even in an all-digital facility, it is still a recommended practice to monitor the analog-equivalent content of the serial-digital signal.

As one of the video format and content applications, the SDI Waveform application displays the content of the component and composite serial-digital signal in a traditional waveform display. A special smoothing technique interpolates between digital samples to create an analog-looking waveform. You can directly evaluate the analog-type distortions of the decoded serial-digital signal as they would appear in analog form.

Measurement cursors are provided for specific amplitude and timing measurements. The measurement data is shown as individual sample values in hex, decimal, or binary format. A relative-to-reference mode allows video references to be stored internally and used for difference measurements with a signal on the SDI Ch. A input.

The SDI Waveform application can access the Select Line Mode. Refer to *Select Line Mode* on page 2–4 for more information.

SDI Waveform Display and Menus

You can access the SDI Waveform application directly by pressing the front-panel Waveform button. The Waveform application includes three display modes set by the Mode soft key: Stacked, Overlay, and Parade. The Stacked display mode (see Figure 3–30) shows the waveforms of the three channels (Y, Cr, and Cb) stacked vertically in the display. The Overlay display mode shows the three waveforms overlaid on each other to produce a single waveform. The Parade display mode shows the three waveforms paraded horizontally across the display.

Main Menu. The menu tree for the application is shown in Figure 3–31. The following soft keys appear at the bottom of the Waveform display:

■ Mode: *<type>*. Touch this soft key to toggle the display mode between Stacked, Overlay, and Parade.

■ Style: *<type>*. Touch this soft key to toggle the signal display between Bar and Smooth. The Bar setting shows the signal as individual sample data. The Smooth setting uses a smoothing algorithm to show the signal in a more analog-type display.

■ Display. Touch this soft key to open the Display submenu.

■ Cursors/Units. Touch this soft key to open the Cursors/Units submenu.

■ Reference. Touch this soft key to open the Reference submenu where you can save and compare waveform displays.

■ Free Run. Touch this soft key to toggle the Free Run mode on and off. The Free Run function is shared by the Option 1S applications. This soft key appears in menus within different applications for your convenience. Refer to *Free Run Mode* on page 2–3 for more information.

■ Rescale. Touch this soft key to reset the touch and zoom parameters to bring the waveform on screen at the default magnification.

Display Submenu. The Display submenu provides the following soft keys:

■ Y. Touch this soft key to turn the Y channel display on and off.

■ Cb. Touch this soft key to turn the Cb channel display on and off.

■ Cr. Touch this soft key to turn the Cr channel display on and off.

■ Units: *<type>*. Touch this soft key to toggle the Y axis through the unit settings of mVolts, IRE, and Sample. The Units soft key setting is shared with the Cursors/Units submenu.

■ Base: *<unit type>*. Touch this soft key to toggle the displayed sample values through the base units of Binary, Hex, and Decimal. The Base soft key setting is shared with the Cursors/Units submenu.

Figure 3–30: SDI Waveform application display in Stacked mode

Figure 3–31: SDI Waveform application menu tree

Cursors/Units Submenu. The SDI Waveform mode includes two types of measurement cursors, Pixel and Sample, to provide a direct readout of digital values of the SDI signal. The cursors select a location within the selected line, not within a frame. This means that when the selected line changes, the locations of the cursors change to the corresponding locations on the newly selected line.

There are two Pixel Cursors in SDI Waveform application. Pixel cursors provide direct readouts of individual luminance and chrominance sample values, but do so pixel-by-pixel as opposed to sample-by-sample. The Pixel Cursors sample the signal by alternating between a luminance sample plus two chrominance samples as shown in Figure 3–32. The total number of available measurement pixels is one half the number of available samples.

Each sample value can be displayed in binary, decimal, or hexadecimal format. Figure 3–32 illustrates the Sample Cursor sampling method. Each sample includes a separate luminance (Y) and chrominance (Cr or Cb) word. The Sample Cursor increments in steps of four samples corresponding to the start of each word group (Y, Cr, Y′, and Cb).
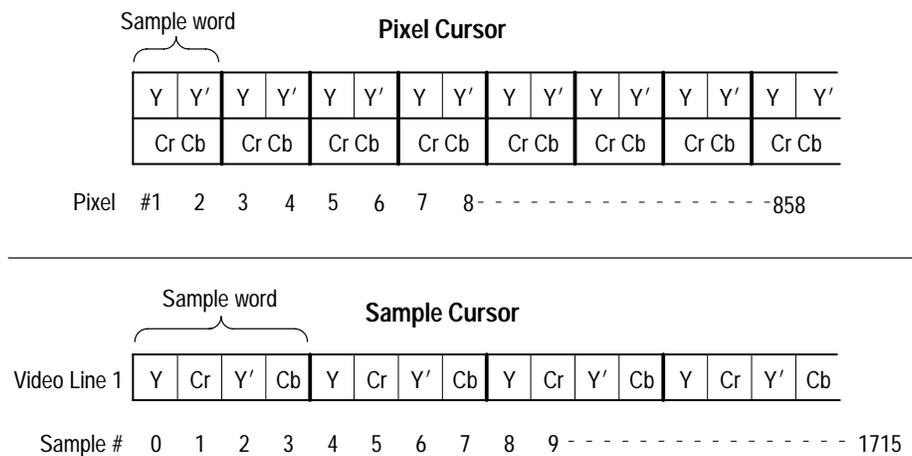
Figure 3–32: Example of Pixel Cursor and Sample Cursor sampling methods
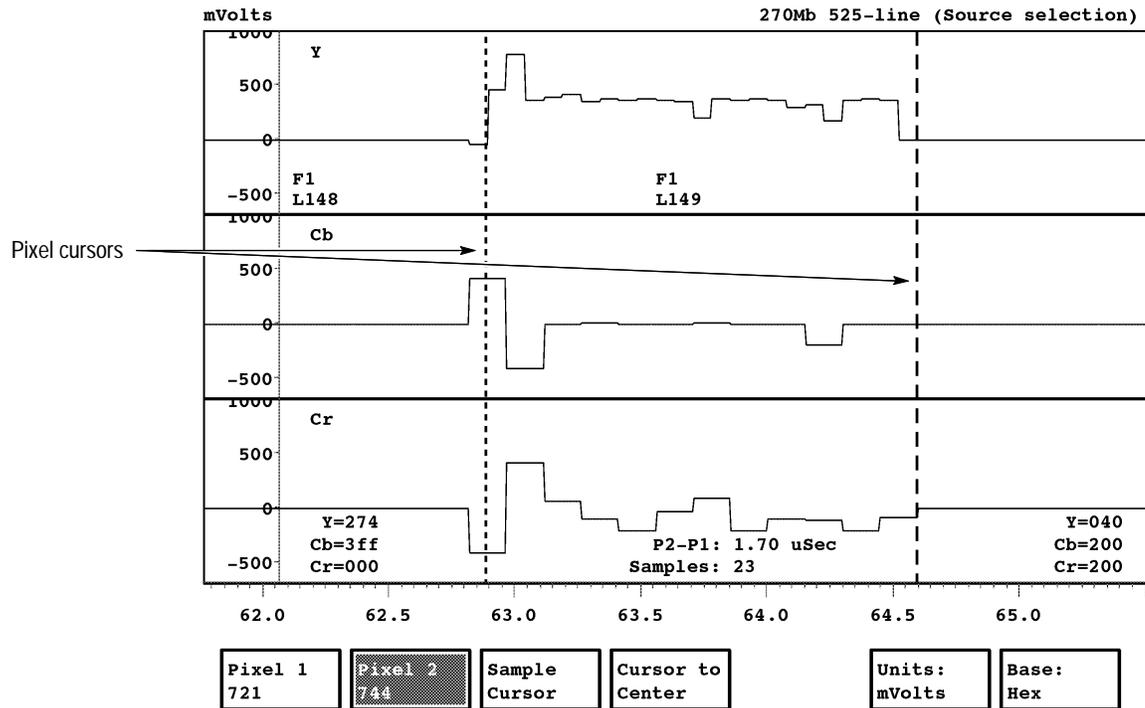
Figure 3–33: SDI Waveform application Pixel Cursors display

The Cursors/Units submenu provides the following soft keys:

■ Pixel 1 *<number>*. Touch this soft key to assign control of the Pixel 1 cursor to the front-panel knob. Turn the knob to select the desired pixel. The pixel number appears in the soft key readout and the sample values at the cursor position are listed in the on-screen readout (see Figure 3–33). Use the Base soft key to set the base units for the displayed sample values. The number of selectable pixels is dependent on the video format of the input signal.

■ Pixel 2 *<number>*. Touch this soft key to assign control of the Pixel 2 cursor to the front-panel knob. Turn the knob to select the desired pixel. The pixel number appears in the soft key readout and the sample values at the cursor position are listed in the on-screen readout (see Figure 3–33). Use the Base soft key to set the base units for the displayed sample values. The number of selectable pixels is dependent on the video format of the input signal.

■ Sample Cursor. Touch this soft key to assign control of the Sample Cursor to the front-panel knob. Turn the knob to select the desired sample. The Sample Cursor changes the right side of the display (see Figure 3–34) to show the actual sample values at the cursor position. Use the Base soft key to set the base units for the displayed sample values.

```
mVolts                                      270Mb 525-line (Freeze button)
 1000                              Smpl   Cb   Y0    Cr    Y1
       Y                          1128   960  164   438   164
  500                             1132   960  164   438   164
                                  1136   960  164   438   164
    0                             1140   960  164   438   164
                                  1144   960  164   438   164
 -500   F1              F1        1148   960  164   438   164
        L58             L59       1152   960  164   438   164
 1000   Cb                        1156   960  164   438   164
                                  1160   960  164   438   164
  500                             1164   960  164   438   164
                                  1168   960  164   438   164
    0                             Dec>   960  164   438   164
                                  1176   960  164   438   164
 -500                             1180   960  164   438   164
                                  1184   960  164   438   164
 1000   Cr                        1188   960  164   438   164
                                  1192   960  164   438   164
  500                             1196   960  164   438   164
                                  1200   960  164   438   164
    0                             1204   960  164   438   164
                                  1208   960  164   438   164
 -500                             1212   960  164   438   164

   30.0    40.0    50.0    60.0    70.0    80.0    90.0    100.0
```

Sample cursor

This highlighted row shows the sample values at the cursor position

| Pixel 1 720 | Pixel 2 780 | Sample Cursor | Cursor to Center | | Units: mVolts | Base: Decimal |

Figure 3–34: SDI Waveform application Sample Cursor display

- ■ Cursor To Center. Touch this soft key to move the selected cursor to the center of the screen.

- ■ Units: *<type>*. Touch this soft key to toggle the Y axis through the unit settings of mVolts, IRE, and Sample. The Units soft key setting is shared with the Display submenu.

- ■ Base: *<unit type>*. Touch this soft key to toggle the displayed sample values through the base units of Binary, Hex, and Decimal. The Base soft key setting is shared with the Display submenu.

Reference Submenu. The Reference submenu lets you save a waveform as a reference and then compare it to another waveform from another signal.

NOTE. For the Display Difference mode to operate, the format standards of the compared waveforms must match.

The Reference submenu provides the following soft keys:

■ Save Act. As Ref. Touch this soft key to copy the waveform of the selected frame to the reference buffer and save it in NVRAM.

■ Display Active. Touch this soft key to display the waveform of the selected signal (default setting).

■ Display Reference. Touch this soft key to display the waveform stored as a reference in NVRAM.

■ Display Diff. Touch this soft key to display the difference between the selected signal's waveform and the reference waveform stored in NVRAM.

SDI Lightning Application

Even though the CCIR 601 serial component signal is robust, compression, format conversion, and other digital processing systems will impact the resultant analog characteristics of the component digital signal. Component gain-balance errors and interchannel timing errors are a common problem occurring in component systems. (Interchannel in this case refers to component channels, for example Y, Pb and Pr as opposed to separate SDI source channels.) If any of the components has an amplitude error relative to the others, hue and or saturation problems will occur in the picture.

As one of the video format and content applications, the SDI Lightning application provides an accurate method for the evaluation of component gain and timing errors. The SDI Lightning application is a three-dimensional display that shows all three component signals at once (Y, Cr, and Cb), using a standard color bars signal. The SDI Lightning display is generated by plotting luminance (channel 1) versus B–Y (channel 2) in the upper half of the display, and inverted luminance versus R–Y (Channel 3) in the lower half.

Luminance amplitude changes are indicated by vertical gain changes in the Lightning display. Chrominance amplitude changes are indicated by horizontal gain changes. Additionally, interchannel-component delay errors are indicated by a bowing of the line connecting the component dots. Numerical readouts on the display for each component dot provide accurate measurements of any component gain and timing errors.

The SDI Lightning application can access the Select Line Mode. Refer to *Select Line Mode* on page 2–4 for more information.

SDI Lightning Display and Menus

You can access the SDI Lightning mode directly by pressing the front-panel Vector button. The Lightning display can be thought of as two XY displays that share the same screen. Figure 3–35 shows a typical Lightning display. It consists of a single graph, divided into two halves. The upper half plots the B-Y component along the X axis and the Y (luminance) component along the Y axis. The lower half plots the R-Y component along the X axis and the inverted Y (luminance) component along the Y axis.

A small rectangle in the center of the screen represents the blanking level, or zero signal. The graticule boxes define the expected values for yellow, cyan, green, magenta, red, and blue color bars. The position of the boxes on the screen varies with the format standard of the color-bars signal.

The lightning waveform is normally shown as a series of dots to let you clearly see the target boxes for the color bars values. The Draw Lines mode lets you show the lightning waveform as a solid line so that you can clearly see the waveform transitions between the color bars values.

Color-bars signals, with correct Y, B-Y, and R-Y amplitude levels and with correct relative timing, display a series of dots that cluster in each of the graticule boxes. The line of dots forming the transition between the graticule boxes may be straight or may exhibit a curved "S" shape. The size of the curve shows the relative timing differences between the Y and the B-Y or R-Y signals. Regardless of the transition shape, it passes through the midpoint of an imaginary straight line between each pair of graticule boxes.

Amplitude errors result in a displacement of each cluster of dots outside the graticule boxes. Displacement along the vertical axis indicates a Y (luminance) amplitude error while displacement along the horizontal axis indicates a B-Y or R-Y amplitude error.

Additional information shown on the Lightning display includes the current field and line numbers being measured, the format standard of the signal, the chrominance-amplitude percentage (75% or 100%), and other information that defines the type of color bars signal. Figure 3–35 shows the Lightning display in the Draw Numbers display mode.

```
SDI Lightning    Colorbars:  75% SMPTE/EBU     270Mb 525-line (Source selection)
F1 L148          Pk-white (100%) 700.0 mV,   Color Pk-to-Pk 525.0 mV
    Yl              G              R              Cy             M              B
 -262.42         -174.94        -88.27          88.24         174.95         262.43
   -0.03%          0.59%         -0.36%         -0.39%          0.60%         -0.03%
                                               B-Y
    Yl                                                                         Cy
   465.01                                                                    368.34
    -0.03%                                                                     0.08%
     G                                                                        M
   308.40                                                                    216.53
     0.07%                                                                    -0.14%
     R                                                                        B
   156.59                                                                     59.92
    -0.24%                                                                     0.12%

                                               R-Y
    Cy              G              B              Yl             M              R
 -262.42         -219.47        -42.98          42.94         219.46         262.42
   -0.03%         -0.15%          0.68%          0.60%         -0.16%         -0.03%
 Color Pk-to-Pk:  B-Y 524.85 mV  -0.03%     R-Y 524.83 mV  -0.03%
 Pk-white: 699.92 mV (100%)  -0.01%      Delay:  B-Y -0.3 ns    R-Y -0.3 ns
```

Draw Numbers	Draw Lines	Amplitude	Rescale

Figure 3–35: SDI Lightning application display with Draw Numbers on

Main menu

Draw Numbers	Draw Lines	Amplitude	Rescale

Amplitude submenu

75% with 100% Flag	75%	100%
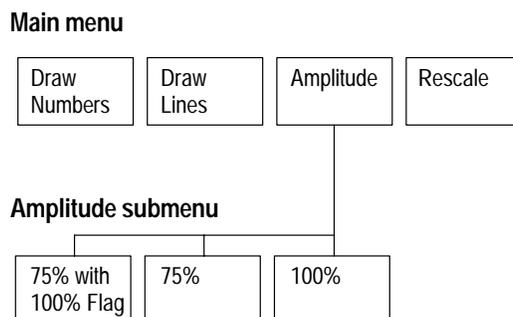
Figure 3–36: SDI Lightning application menu tree

Main Menu. The menu tree for the SDI Lightning application is shown in Figure 3–36. The following soft keys appear at the bottom of the display:

■ Draw Numbers. Touch this soft key to toggle the Draw Numbers display mode on and off. Use the Draw Numbers display mode to show the actual amplitude values (in millivolts) for each of the six color bars on each of the three channels, along with the percentage deviation from the reference value. The numbers are linked to the displayed waveform by lines that indicate the measurement location.

■ Draw Lines. Touch this soft key to toggle the Draw Lines display mode on and off. Use the Draw Lines display mode to show the lightning waveform as solid lines instead of as dots.

■ Amplitude. Touch this soft key to open the Amplitude submenu where you set the Lightning graticule to correctly measure a 75%, a 75% with 100% white flag, or a 100% color bars signal.

■ Rescale. Touch this soft key to set the touch and zoom setting to bring the waveform on screen at the default magnification.

Amplitude Submenu. Only one of the following Amplitude submenu soft keys can be selected at a time:

■ 75% with 100% Flag. Touch this soft key to set the Lightning graticule to correctly measure a 75% with 100% white flag color bars signal.

■ 75%. Touch this soft key to set the Lightning graticule to correctly measure a 75% color bars signal.

■ 100%. Touch this soft key to set the Lightning graticule to correctly measure a 100% color bars signal.

SDI Picture Application

Analysis of the serial digital component signal on a line-by-line basis presents only part of the overall signal quality. Many times it is necessary to view the test signal in a traditional rasterized picture format to provide visual identification of pixel defects across the full video frame.

As one of the video format and content applications, the SDI Picture mode uses a display algorithm with 64 gray scales to produce a sharp full-screen picture display. Video lines with pixel defects can be selected with the cursor using the front-panel knob for further analysis in other measurement applications.

The SDI Picture application can access the Select Line Mode. Refer to *Select Line Mode* on page 2–4 for more information.

SDI Picture Display and Menus

You can access the SDI Picture application directly by pressing the front-panel Picture button. The SDI Picture display is shown in Figure 3–37 and the menu tree is shown in Figure 3–38.

The following soft keys appear at the bottom of the Picture display:

- Default Bright. Touch this soft key to return the Picture display to the default brightness. You can adjust the picture brightness by pressing and holding the front-panel Display button, and then turning the front-panel knob.

- Default Contrast. Touch this soft key to return the Picture display to the default contrast. You can adjust the picture contrast by pressing and holding the front-panel Graticule button, and then turning the front-panel knob.

- Center Picture. Touch this soft key to vertically re-center the large-sized Picture display. When the picture size is set to large, the picture display pans to display a selected line if the selected line is off-screen. Use this soft key to re-center the picture display.

- Size: <*picture size*>. Touch this soft key to toggle the size of the picture display between Large and Small.

- Field: <*field number*>. Touch this soft key to toggle the picture display between Field 1 and Field 2.

- Readouts: <*state*>. Touch this soft key to toggle the readout display between On and Off. The readouts include the field and line numbers.
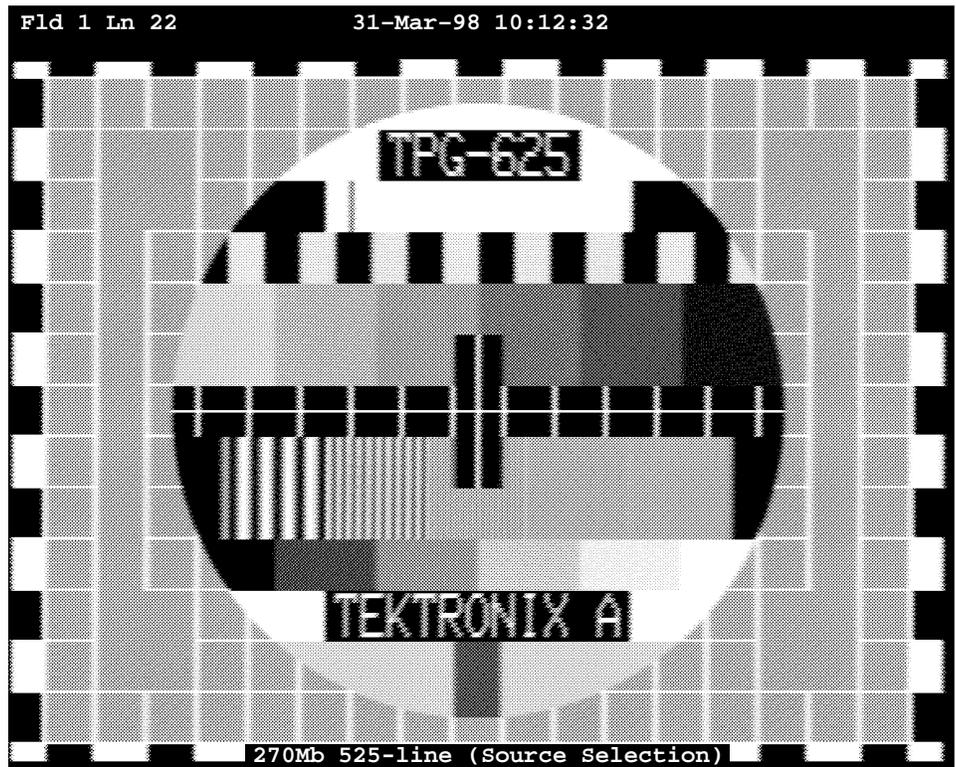
Figure 3–37: SDI Picture application display

Main menu

Default Bright	Default Contrast	Center Picture	Size: Large	Field: 1	Readouts: On

Figure 3–38: SDI Picture application menu tree

SDI Audio Format Analyzer Application

AES/EBU digital audio conforms to the specification AES3-1992 (ANSI S4.40-1992). The specification lets manufacturers design and build digital-audio products to a common standard, allowing easy exchange of audio programming. An AES/EBU digital-audio signal always consists of two audio channels. The two audio channels may be distinctly separate audio material or they may be stereophonic audio. There is also a provision for single channel operation (monophonic).

NOTE. *The SDI Audio Format Analyzer application does not make any measurements on the digital-audio signal, but instead serves as a visual aid for looking at the audio data. Use the SDI Audio Measurements application to make signal content measurements.*

As one of the audio format and content applications, the SDI Audio Format Analyzer application displays the user data and channel status blocks of the digital-audio data.

How the Channel Status & User Data Blocks are Constructed

The AES/EBU audio stream is composed of audio-sample pairs, one per audio channel, that are transmitted in blocks of 192 pairs of audio samples. Each sample is composed of 32 bits organized as shown as shown in Figure 3–39.

Each audio sample is carried by a subframe containing the following data: 20 bits of sample data, 4 bits of auxiliary data (which can be used to extend the sample to 24 bits), and 4 other bits of data and a preamble (see Figure 3–39). It takes two subframes to complete an AES/EBU audio frame. Each audio frame contains one sample from each of the two audio channels. Audio frames are further grouped into 192-frame blocks which define the limits of the user data and channel status blocks. Channel-status blocks contain verification of audio format compliance.

The Channel Status Block is constructed from the C bits (see Figure 3–39) of each sample within a block as shown in Figure 3–40. The User Data Block is constructed in the same manner using the U bit from each sample. The specification AES3-1992 (ANSI S4.40-1992) defines the interpretation of the bits in the Channel Status Block.

NOTE. *The AES/EBU audio-stream illustrations (Figures 3–39, 3–40, and 3–41) display the sample bits in their SDI transmission order: starting with the LSB and ending with the MSB.*
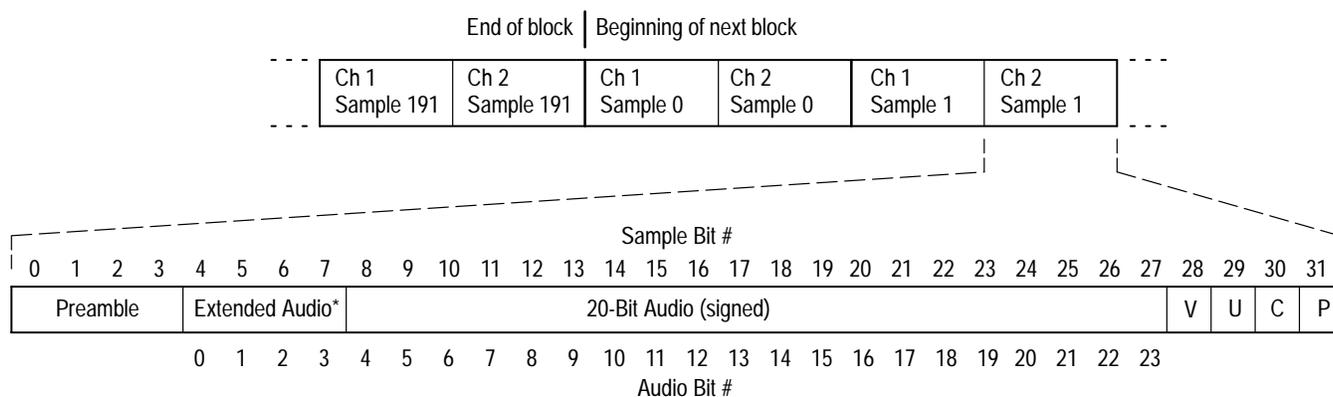
* Or auxiliary data

V = Validity bit
U = User data bit
C = Channel status bit
P = Parity bit

Figure 3–39: Example of the organization of an AES/EBU 32-bit audio sample
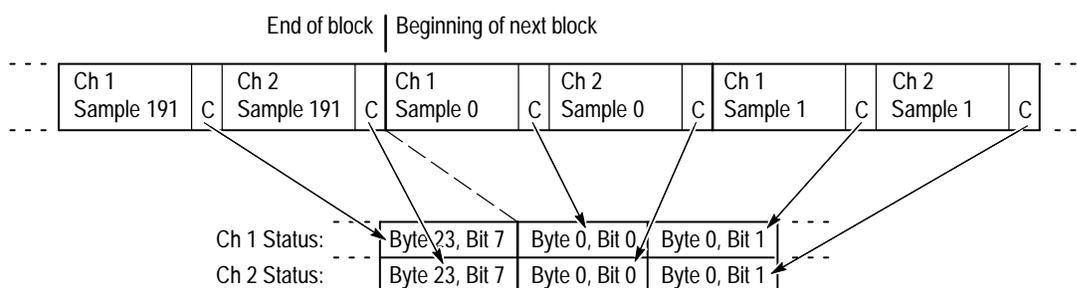
Figure 3–40: Example showing how the Channel Status Block is constructed

When AES/EBU audio is embedded into ancillary data, each audio sample is mapped into three video samples as shown in Figure 3–41.

NOTE. The specification SMPTE 272M-1994 numbers the audio bits from 0–19 and does not number the extended audio bits. The numbering shown in Figure 3–41 is used by the Audio applications to be consistent when displaying embedded and external audio information. The extended audio bits (0–3), if present, are placed in an Extended Data Packet.

	Video Sample 1													Video Sample 2									Video Sample 3							
9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0	9	8	7	6	5	4	3	2	1	0
*	Audio Bits 8-13						Ch #		Z	*	Audio Bits 14-22									*	V	U	C	P	Audio Bits 27-23				
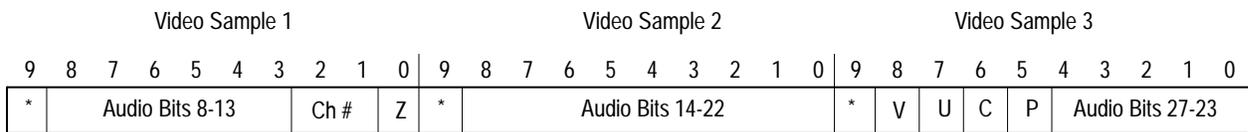
* Not bit 8

Z = Z bit marks the beginning of an audio block

Figure 3–41: Example of AES/EBU audio sample distribution in video samples

SDI Audio Format Analyzer Display and Menus

The Audio Format Analyzer has two different display modes set by the Screen soft key: Channel Status and User Data. The Channel Status display mode displays the status of the professional or consumer-audio signal data. The display is organized depending on whether the signal is professional or consumer audio. Figure 3–43 shows a professional-audio Channel Status display. The User Data display mode (see Figure 3–44) shows the user-data sample values and the decoded user data.

AES/EBU data is transmitted from LSB to MSB. The specification AES3-1992 (ANSI S4.40-1992) uses this order to define the interpretation of the bits in the Channel Status Block. However, the byte values are written MSB to LSB as shown in Figure 3–42. For example, in Figure 3–43, the sample value of channel 1 byte 0 is 85 hex. The binary representation of the number 85 hex is 1000 0101. As shown in Figure 3–43, bits 2–4 are shown in reverse order of the binary number representation.

Binary value of 85 hex as written:	Bit number:	7 6 5 4	3 2 1 0
	Value:	1 0 0 0	0 1 0 1
Binary value of 85 hex as transmitted and displayed: (reverse of written order)	Bit number:	0 1 2 3	4 5 6 7
	Value:	1 0 1 0	0 0 0 1

Figure 3–42: Example correlating hex values to bit values in the Audio Format Analyzer display

```
Audio Format Analyzer                          270Mb 525-line (Source selection)
Source: Embedded


Byte Bits  Chan. 9    Chan. 10  Channel Status        Channel 9        Channel 10
     0  0       1          1       Channel use:          professional     professional
     0  1       0          0       Data use:             audio            audio
     0  2-4     100        100     Emphasis:             no emphasis      no emphasis
     0  5       0          0       Locking of source:    locked           locked
     0  6-7     01         01      Sample frequency:     48 kHz           48 kHz
     1  0-3     0001       0001    Channel mode:         2-channel        2-channel
     1  4-7     0001       0001    User bits mode:       192-bit blocks   192-bit blocks
     2  0-2     000        000     AUX bits use:         not indicated    not indicated
     2  3-5     101        101     Audio word length:    20 bits          20 bits
     4  0-1     00         00      Reference signal:     not a ref.       not a ref.
     6  0-31    Table bytes 06-09  Origin:               ch1              ch2
     10 0-31    Table bytes 10-13  Destination:          not indicated    not indicated
     14 0-31    Table bytes 14-17  Sample number:        0                0
     18 0-31    Table bytes 18-21  Time of day:          00:00:00         00:00:00
     23 0-7     Table byte  23     Block CRC:            is valid         is valid
```

Binary representation of hex sample values (bits in LSB to MSB order)

Interpretation of binary bit values

Highlighting indicates a difference in the status blocks of the two channels

```
              Hexadecimal Table of Channel Status Data
Byte  00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Ch  9 85 88 28 00 00 00 63 68 31 00 00 00 00 00 00 00 00 00 00 00 00 00 03 4f
Ch 10 85 88 28 00 00 00 63 68 32 00 00 00 00 00 00 00 00 00 00 00 00 00 00 1a
```

Channel status sample hex values

```
Source:    Group:   Channel:                        Screen:
Embedded   3        9 & 10                           Chan.Stat
```

Figure 3–43: Audio Format Analyzer showing the Channel Status display

```
Audio Format Analyzer                          270Mb 525-line (Source selection)
Source: Embedded


                          USER DATA
                      ASCII Text Display


                      Channel 9 Data



                      Channel 10 Data
```

Decoded user data

```
              Hexadecimal Table of User Data
Byte  00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23
Ch  9 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
Ch 10 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

User data sample values

```
Source:    Group:   Channel:                        Screen:
Embedded   3        9 & 10                           User Data
```

Figure 3–44: SDI Audio Format Analyzer showing the User Data display

Main Menu. Figure 3–45 shows the SDI Audio Format Analyzer application menu tree. The following soft keys appear at the bottom of both the Channel Status and User Data displays:

■ Source: *<source type>*. Touch this soft key to toggle the audio source between Embedded and External. The Source soft key setting is shared between the SDI Audio Format, the SDI Audio Measurements, and the SDI Audio/Video Timing applications.

NOTE. When the signal source is set to External, use the front-panel A and B Source buttons to select the measurement-limits file (Digital Audio Setup configuration file) to use for measurements (set in the Source Selection Digital configuration file). Refer to Configuration *on page 1–7 for more information.*

■ Group: *<number>*. This soft key appears only when the Source soft key has been set to Embedded. Touch this soft key to toggle through the four audio groups. When you change audio groups or channel pair, the displayed Min/Max values are reset. The Group soft key setting is shared among the SDI Audio Format, the SDI Audio Measurements, and the SDI Audio/Video Timing applications.

■ Channel: *<channel pair>*. This soft key appears only when the Source soft key has been set to Embedded. Touch this soft key to toggle between alternate channel pairs within the audio group selected by the Group soft key (for example Ch 5 & 6/Ch 7 & 8 for group 2, and so forth). When you change audio groups or channel pairs, the displayed Min/Max values are reset. The Channel soft key setting is shared among the SDI Audio Format, the SDI Audio Measurements, and the SDI Audio/Video Timing applications.

■ Screen: *<type>*. Touch this soft key to toggle the display between the Chan. Stat (Channel Status) and User Data display modes.

Main menu

| Source: Embedded | Group: 1 | Channel: 1 & 2 | Screen: Chan. Stat |

Figure 3–45: SDI Audio Format Analyzer application menu tree

SDI Audio Measurements Application

As one of the audio format and content applications, the SDI Audio Measurements application allows you to measure audio level, frequency, and total harmonic distortion and noise. You can also measure the interchannel phase and level of the decoded AES/EBU digital audio and embedded digital audio signal.

The SDI Audio Measurements application is designed to verify the audio functionality of a product or to provide a basic evaluation of the audio quality of a transmission link. To test a product, send one or more test tones of known values from the product under test to the VM700T, and then compare the results against the measurements made from a known-good product. To test a transmission link, transmit one or more tones of known values down the transmission path to the VM700T, and then evaluate the resulting measurements.

NOTE. When testing with multiple audio tones, the Frequency limit-values set in the Digital Audio Setup configuration file can be set to Unspec (unspecified) to avoid reporting unwarranted errors.

The decoded audio waveforms of the selected digital audio pair are also displayed for verification of audio content as well as a quick visual check for signal anomalies. For each measurement update, 1000 pairs (L+R) of audio samples are used.

SDI Audio Measurements Display and Menus

Figure 3–46 shows the SDI Audio Measurements application with the main menu displayed. When a monitored error occurs, the Min/Max cell that contains the violation is highlighted. After the error has passed, the cell highlighting is dimmed until you press the Clear soft key.

The application display is continuously updated while the application is open and is reset when you exit the application. The Current boxes contain the message "No signal" when there is no audio signal present, and they contain the message "Muted" when the audio signal is present but has no amplitude.

The application display includes two windows for showing the decoded audio waveforms for each audio channel. These waveform displays support panning and zooming, but they are too small to support zooming around a touch point. Instead, use the front-panel Expand function in conjunction with the Arrow button and the knob to manipulate the waveforms (there is no rescale).

First audio channel
waveform display

Stuck bits indicator

Second audio channel
waveform display

```
Audio Measurements                          270Mb 525-line (Source selection)
Source: Embedded (L=48000 R=48000)
                Current
        Ch 9        Ch 10                            Stuck Bits
                                -20      Ch  9: ---- ---- ---- ---- ---- 0000
Level   20.0        20.0        dBr      Ch 10: ---- ---- ---- ---- ---- 0000
                                               23   19   15   11   7    3
Frequency 100.0     600.0       Hz

THD + N  0.0002     0.0001      %
            Ch 9                    Ch 10                   Limits
        Min      Max          Min      Max          Min      Max

Level   20.0     20.0         20.0     20.0         ---      ---      dBr

Frequency 100.0  100.0        600.0    600.0        ---      ---      Hz

THD + N  0.0001  0.0003       0.0001   0.0001       ---      ---      %
        Current   Min    Max        Min      Max

Level Diff.  0.0    0.0    0.0        ---      ---      dB

Phase        0.0    0.0    0.0        ---      ---      deg

Source:     Group:   Channel:                 Logging   Clear
Embedded    3        9 & 10
```

Figure 3–46: SDI Audio Measurements application display

Main menu

| Source: Embedded | Group: 1 | Channel: 1 & 2 | Logging | Clear |

**Logging submenu**

| Log | Log Port | File Append | File Overwrite |
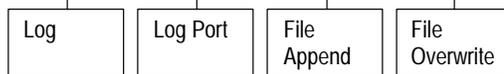
Figure 3–47: SDI Audio Measurements application menu tree

The stuck-bits indicator shows which bits do not change values within the application's 1000-sample audio acquisition. If stuck bits are shown, at least one of the following is occurring:

■   The signal is composed of audio tones that are submultiples of the audio sampling rate and have a large enough amplitude that the low-order bits do not change.

■   The signal source is less than 24-bit audio (the AES/EBU format supports as few as 16 audio bits).

■   The signal source has stuck bits.

Main Menu. Figure 3–47 shows the application menu tree. The following soft keys appear at the bottom of the display:

■   Source: *<source type>*. Touch this soft key to toggle the audio source between Embedded and External. The Source soft key setting is shared among the SDI Audio Format, the SDI Audio Measurements, and the SDI Audio/Video Timing applications.

NOTE. When the signal source is set to External, use the front-panel A and B Source buttons to select the measurement-limits file (Digital Audio Setup configuration file) to use for measurements (set in the Source Selection Digital configuration file). Refer to Configuration *on page 1–7 for more information.*

■   Group: *<number>*. This soft key appears only when the Source soft key has been set to Embedded. Touch this soft key to toggle through the four audio groups. When you change audio groups or channel pair, the displayed Min/Max values are reset. The Group soft key setting is shared among the SDI Audio Format, the SDI Audio Measurements, and the SDI Audio/Video Timing applications.

■   Channel: *<channel pair>*. This soft key only appears when the Source soft key has been set to Embedded. Touch this soft key to toggle between alternate channel pairs within the audio group selected by the Group soft key (for example Ch 5 & 6/Ch 7 & 8 for group 2, and so forth). When you change audio groups or channel pairs, the displayed Min/Max values are reset. The Channel soft key setting is shared between the SDI Audio Format, the SDI Audio Measurements, and the SDI Audio/Video Timing applications.

■   Logging. Touch this soft key to display the Logging submenu.

■   Clear. Touch this soft key to clear the display of error highlighting and to clear the minimum and maximum display values.

Logging Submenu. Refer to *Report Logging* on page 2–4 for more information about the logging function. The Logging submenu provides the following soft keys at the bottom of the display:

■   Log. Touch this soft key to toggle the logging function on and off.

■   Log Port. Touch this soft key to send the log report to the measurement set communication port selected in the Communication Setup configuration file.

■   File Append. Touch this soft key to append new logging information to the end of the Measurement Results log file.

■   File Overwrite. Touch this soft key to overwrite previous logging information in the Measurement Results file with new logging information.

SDI Interchannel Timing Application

Relative-timing differences between SDI signals may vary from several nanoseconds to a few video lines and still remain within the operational range of in-studio equipment. The timing difference between the signal sources can be caused by routing the signal through various pieces of studio equipment or by unequal cable lengths. If the relative timing of the signal sources is left uncorrected, video-quality problems will occur when out-of-time sources are combined or when the buffering requirements of the resynchronizer are exceeded. Therefore, you must verify and control the relative timing of SDI signal sources to ensure post-production video quality.

As one of the timing applications, the SDI Interchannel Timing application allows you to measure time delay between two SDI signal sources or between one SDI signal source and an analog-signal source (black burst). Timing references are made in-service without special test signals. The application can measure up to a video field of timing error using an auto-scaling display to indicate time delay in either time or in video frame units.

SDI Interchannel Timing Display and Menus

Figure 3–48 shows the SDI Interchannel Timing application display.
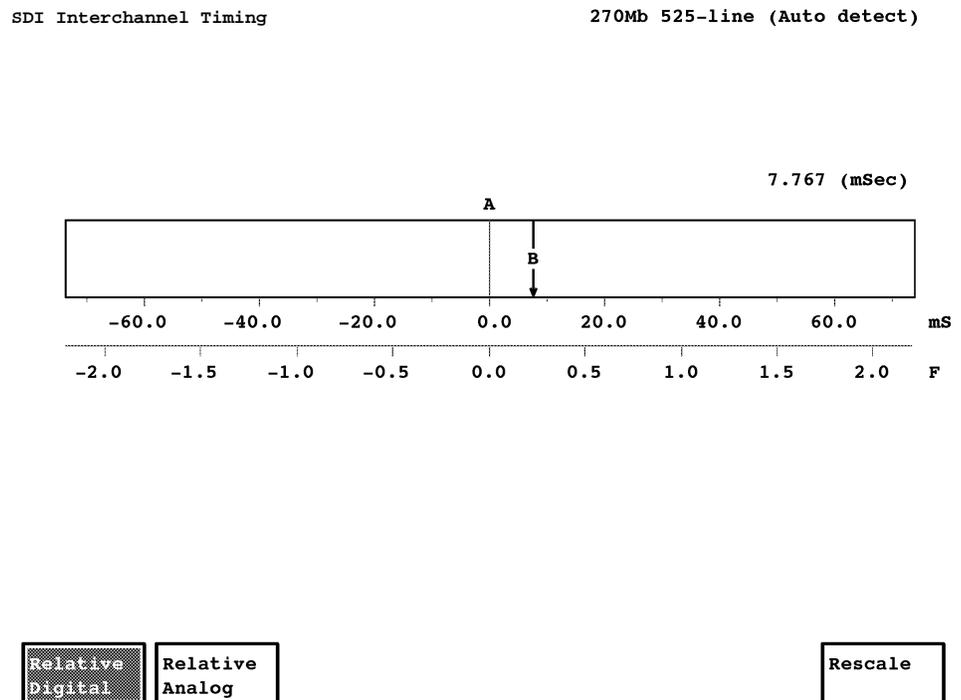
Figure 3–48: SDI Interchannel Timing display

Figure 3–49 shows the application menu tree. The following soft keys are at the bottom of the display:

■ Relative Digital. Touch this soft key to perform measurements using the SDI signal sources on the SDI Ch. A and the SDI Ch. B inputs. The application uses the timing of the selected SDI input channel (use the front-panel Source buttons) as the measurement reference (0.0 ms). The timing of the unselected SDI input channel is measured relative to the selected channel.

■ Relative Analog. Touch this soft key to perform measurements using one SDI signal source and one analog black-burst reference signal. The application uses the timing of the selected SDI input channel (use the front-panel Source buttons) as the measurement reference (0.0 ms). The timing of the analog reference signal is measured relative to the selected SDI input channel.

■ Rescale. Touch this soft key to set the touch and zoom setting to bring the measurement on screen at the default magnification.

Main menu

Relative Digital	Relative Analog	Rescale
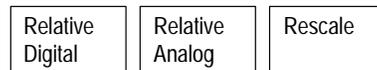
Figure 3–49: SDI Interchannel Timing application menu tree

SDI Audio/Video Timing Application

All television programs consist of audio and video elements. These elements are usually recorded simultaneously and synchronized during production. However, the audio and video elements are often transported and processed separately before final distribution and viewing. Because the audio and video are handled separately, a phase delay often occurs between them. If the phase delay is large enough, an annoying synchronizing error (referred to as lip sync error) can occur.

As one of the timing applications, the SDI Audio/Video Timing application measures the time delay that accumulates between the audio and video content of the television signal during signal transport or post-production processes. The application uses simultaneous audio and video test signals (available from the Tektronix *TG2000 Signal Generation Platform*) to measure time delay of up to ±2 seconds. Measurements are made on embedded or AES audio signals and time delay is indicated in units of video frames or in units of milliseconds. A relative-to-reference function allows you to normalize the application measurement to a specific delay.

NOTE. *The audio/video timing measurement must be performed when your system is out of service.*

The SDI Audio/Video Timing application requires special test signals to perform the measurements. Refer to *Signal Requirements for Measuring Audio/Video Timing* on page 3–80 for more information.

SDI Audio/Video Timing Display and Menus

Figure 3–50 shows the SDI Audio/Video Timing application. An error message area above the graph provides information regarding the state of the triggers needed to make a timing measurement. The message line may say that it is waiting for either or both triggers (audio and video) to arrive, or that one of the triggers has arrived and it is waiting for the other trigger. Upon receiving both triggers, the VM700T makes the measurement and provides a time-delay numerical readout and a graphical display.

```
SDI Audio Video Timing                              270Mb 525-line (Auto detect)
```

Error message area ⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⎯⟶

```
-20 mSec                                                 Audio Delay


         -60.0    -40.0    -20.0     0.0     20.0    40.0    60.0    mSec

       -2.0   -1.5   -1.0   -0.5    0.0    0.5    1.0    1.5    2.0   Frames
                           Video Source : TG2000
                           Audio Source : Embedded Audio
                            Audio Group : 1
                         Audio Channels : 1 and 2
```
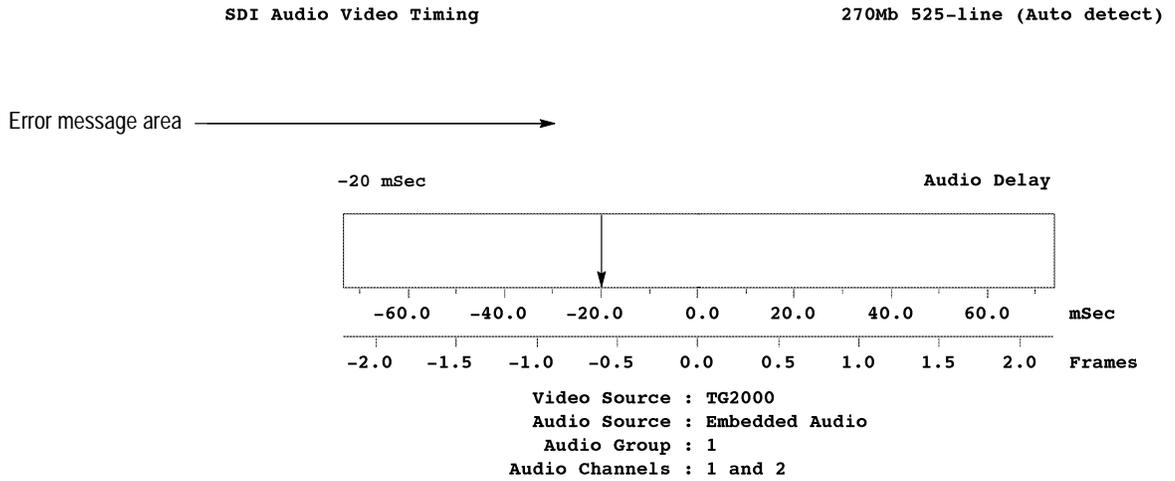
Source: Embedded	Group: 3	Channel: 9 & 10	Offset	Offset mS: 0	Signal Placement	Rescale

Figure 3–50: SDI Audio/Video Timing display

Main menu

Source: Embedded	Group: 1	Channel: 1 & 2	Offset	Offset mS: 0	Signal Placement	Rescale

Signal Placement submenu

| TG2000 Mode	Vertical Interval	Active Video

Figure 3–51: SDI Audio/Video Timing application menu tree

Main Menu. Figure 3–51 shows the application menu tree. The following soft keys appear at the bottom of the display:

■ Source: *<source type>*. Touch this soft key to toggle the audio source between Embedded and External. The Source soft key setting is shared among the SDI Audio Format, the SDI Audio Measurements, and the SDI Audio/Video Timing applications.

NOTE. When the signal source is set to External, use the front-panel A and B Source buttons to select the measurement-limits file (Digital Audio Setup configuration file) to use for measurements (set in the Source Selection Digital configuration file). Refer to Configuration *on page 1–7 for more information.*

■ Group: *<number>*. This soft key appears only when the Source soft key has been set to Embedded. Touch this soft key to toggle through the four audio groups. When you change audio groups or channel pair, the displayed Min/Max values are reset. The Group soft key setting is shared among the SDI Audio Format, the SDI Audio Measurements, and the SDI Audio/Video Timing applications.

■ Channel: *<channel pair>*. This soft key only appears when the Source soft key has been set to Embedded. Touch this soft key to toggle between alternate channel pairs within the audio group selected by the Group soft key (for example Ch 5 & 6/Ch 7 & 8 for group 2, and so forth). When you change audio groups or channel pairs, the displayed Min/Max values are reset. The Channel soft key setting is shared between the SDI Audio Format, the SDI Audio Measurements, and the SDI Audio/Video Timing applications.

■ Offset. Touch this soft key to toggle the Offset function on and off. The Offset function allows you to normalize the application. When you turn the Offset function on, the value of the timing offset (delay) set by the Offset mS soft key will be accepted as the zero value (no delay) for the measurement.

■ Offset mS: *<time>*. Touch this soft key to set the amount of timing offset for measurements. The Offset function allows you to normalize the application. When you turn the Offset function on, the value of the timing offset (delay) set by the Offset mS soft key will be accepted as the zero value (no delay) for the measurement.

■ Signal Placement. Touch this soft key to open the Signal Placement submenu.

■ Rescale. Touch this soft key to set the touch and zoom setting to bring the measurement on screen at the default magnification.

Signal Placement Submenu. The Signal Placement submenu lets you select which signal-placement format to use. Refer to *Signal Requirements for Measuring Audio/Video Timing* on the following pages for more information. The Signal Placement submenu provides the following soft keys at the bottom of the display:

■ TG2000 Mode. Touch this soft key to set the application to accept a signal source from the Tektronix *TG2000 Signal Generation Platform.*

■ Vertical Interval (tested on line 13). Touch this soft key if your video source is in the vertical interval portion of the signal.

■ Active Video (tested on line 45 for 525-line, line 38 for line 625). Touch this soft key if your video source is in the active video portion of the signal.

Signal Requirements for Measuring Audio/Video Timing

Option 1S provides three different signal-placement modes (soft key selectable) for measuring audio/video timing: TG2000, Vertical Interval, and Active Video. In the TG2000 mode, the video and audio test signals are generated using the Tektronix *TG2000 Signal Generation Platform.* Testing for the luminance or audio-sample transitions occurs on all lines. However, transitions that occur in the vertical or horizontal interval (for example the level below the trigger point going into the interval and above the trigger point coming out) are ignored.

NOTE. The TG2000 placement mode is the preferred mode for measuring digital audio/video timing. Use the 525AVDLY.SEQ or the 625AVDLY.SEQ sequences (available with the TG2000 Platform firmware version 2.0 and above) to perform the audio/video timing measurement. If your TG2000 Platform does not have these sequences, contact your local Tektronix representative to obtain a field-installable upgrade kit.

The Vertical Interval and Active Video placement modes are provided for those of you using the analog version of the audio/video timing measurement in the VM700T measurement set. In these two modes, the test signals are generated using the Tektronix VITS 200 NTSC Generator and Inserter *or the Tektronix* VITS 201 PAL Insertion Generator *for the video signal, and the Tektronix* ASG100 *or* ASG140 Audio Signal Generator *for the audio signal. You must send the signals from these generators through an analog-to-digital conversion before they are input to the Option 1S rear panel.*

The audio/video timing measurement feature on these generators permits you to synchronize the video and audio test signals at the sending end of the program. Check the operators manuals for these instruments to determine if they support the audio/video measurement (these instruments can be modified to support this measurement). See your local Tektronix representative for information either on obtaining modification kits or having your equipment modified.

In the Vertical Interval mode, the application tests for the luminance or audio-sample transitions on line 13 in the vertical interval portion of the video signal. In the Active Video mode, the application tests for the luminance or audio-sample transitions on line 45 for 270 Mb 525-line format (line 38 for 270 Mb 625-line format) in the active video portion of the video signal.

You can construct your own A/V Timing signal to use for measurements. The video trigger occurs when the luminance-sample hexadecimal value transitions from less than 100 hex to greater than 100 hex. The audio trigger occurs when the audio-sample decimal value transitions from less than 1000 to greater than 1000 (transitions in the opposite direction past the trigger values are ignored). The interval between these transitions, as seen by the VM700T, must be less than ±2 seconds (depending on how heavily loaded the the ancillary data stream is). The interval between the lagging transition, as seen by the VM700T, and the leading transition of the next transition pair must be at least 5 seconds.

VM700T Signal Hookup. The SDI Audio/Video Timing application requires both video and audio test signals. You can use one or both of the SDI video input channels. The selected channel (A or B) on the VM700T is the source for the video portion of the measurement. The audio-signal source is the embedded audio in the video signal or an external audio signal connected to the rear-panel AES/EBU Digital Audio connector.

Procedure for Using the VITS 200 & ASG 100/ASG 140. Perform the following procedure to use the VITS 200 and the ASG 100 or ASG 140 to make audio/video timing measurements:

NOTE. The following setup procedures apply only if you are using the Vertical Interval or Active Video placement modes for performing the audio/video timing measurement. This setup is not recommended for new installations.

---

1. Set the ASG 100 or the ASG 140 controls as follows:

   a. Select manual mode.

   b. Set frequency for 10 kHz.

   c. Set output level to –10 dB.

   d. Select On Line (Red LED is on).

   e. Ground pin 1 of the remote connector and check that the audio output turned off.

NOTE. The VITS 200 must be configured correctly to place the test signal in the vertical interval or active video portions of the video signal.

2. To place the signal in the vertical interval portion of the video signal, connect the instruments as shown in Figure 3–52 and set the VITS 200 controls as follows:

a. Connect an NTSC video source so that the VITS 200 is genlocked.

b. From the front panel, select:

```
Vertical Characters

VERT CHAR 2 ENABLE
```

c. Input the message you intend to use.

d. Check that when the VITS 200 is genlocked, the signal at pin 20 of the remote connector is a TTL HIGH voltage for 4.5 seconds, and then LOW for 0.5 seconds. The signal transitions from high to low at line 262, field 3. The audio output is turned ON at this time, but the text inserted by the VITS 200 does not appear until field 1 line 11. The SDI Audio/Video Timing application removes this time delay before presenting the measured time difference.

NOTE. The wiring diagram in Figure 3–52 selects message number 2 by grounding pin 2. You can select any of the 15 possible messages by grounding different selection lines (pin 2, 3, 4, or 5).
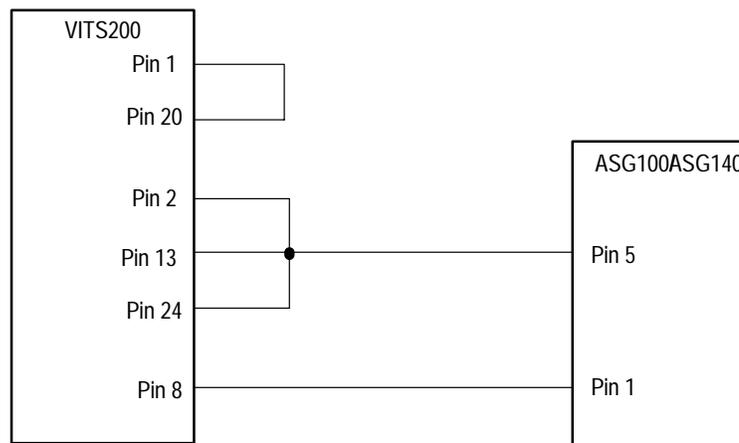
Figure 3–52: Cabling between the VITS 200 and the ASG 100/ASG 140 for vertical interval placement

3. To place the signal in the active video portion of the video signal, connect the instruments as shown in Figure 3–53 and set the VITS 200 controls as follows:

   a. Connect an NTSC video source so that the VITS 200 is genlocked.

   b. From the front panel, select:

      STANDBY MODE TO 0% BLACK

      ENABLE STANDBY MODE

   c. Input the standby message you intend to use (for example, AV TIME).

   d. Check that when the VITS 200 is genlocked, the signal at the remote connector pin 20 will be a TTL HIGH voltage for 4.5 seconds, and then LOW for 0.5 seconds. The signal transitions from high to low at line 1, field 1. The audio output is turned ON at this time, but the text inserted by the VITS 200 does not appear until the active video. This means that the audio leads the video change. The SDI Audio/Video Timing application removes this time delay before presenting the measured time difference.
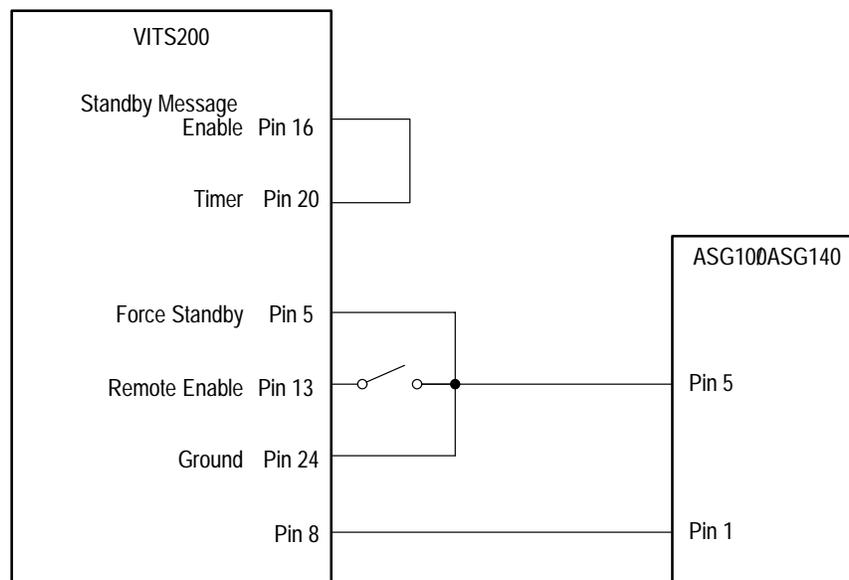
Figure 3–53: Cabling between the VITS 200 and the ASG 100/ASG 140 for active video placement

Procedure for Using the VITS 201 & ASG 100/ASG 140. Perform the following
procedure to use the VITS 201 and the ASG 100 or ASG 140 to make audio/vid-
eo timing measurements:

*NOTE. The following setup procedures apply only if you are using the Vertical
Interval or Active Video placement modes for performing the audio/video timing
measurement.*

1. Set the ASG 100 or the ASG 140 controls as follows:

    a. Select manual mode.

    b. Select 10 kHz frequency.

    c. Select –10 dB output level.

    d. Select On Line (red LED is on).

    e. Ground pin 1 of the remote connector and check that the audio output
        turns off.

*NOTE. The VITS 201 must be configured correctly to place the test signal in the
vertical interval or active video portions of the video signal.*

2. To place the signal in the vertical interval portion of the video signal,
    connect the instruments as shown in Figure 3–54 and set the VITS 201
    controls as follows:

    a. Connect a PAL video source so that the VITS 201 is genlocked.

    b. Open S11 switch 4 and switch 10.

    c. Press the Function button six times (until a C appears). Enter some text
        in the vertical interval such as "AV TIME." Only one character is
        needed.

NOTE. The output signal is HIGH during this function.
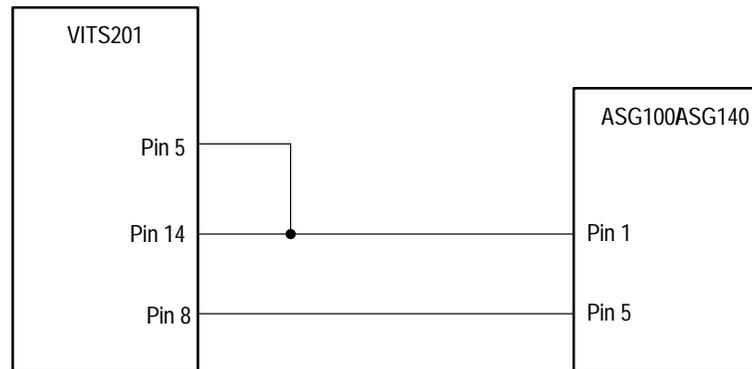
Figure 3–54: Connecting the VITS 201 and the ASG 100/ASG 140 for vertical interval placement

    d. Close switch 10.

    e. Check that when the VITS 201 is in the power-up Line Selection mode and is genlocked, the signal at pin 14 of the remote connector will be a TTL low voltage for 4.5 seconds, and then high for 0.5 seconds. The signal transitions from low to high at line 1 field 1. When the TTL signal is high, the audio output is ON, but the text inserted by the VITS 201 does not become visible until line 10. The SDI Audio/Video Timing application removes this time delay before presenting the measured time difference.

3. To place the signal in the active video portion of the video signal, connect the instruments as shown in Figure 3–55 and set the VITS 201 controls as follows:

    a. Connect a PAL video source so that the VITS 201 is genlocked.

    b. Ensure that J39 on the VITS 201 is set to 2-3.

    c. Open S11 switch 4 and switch 10.

    d. Press the Function button until a C appears. Enter some text such as "AV TIME." Only one character is needed.

NOTE. The output signal is HIGH during this function.

---

    e. Open S11-2. Press the Function button until an F appears. Set the Standby INTERNAL test signal, as described inside the front cover of the VITS 201, to 0% Black.

    f. Open S11 switch 3 and closed S11 switch 10.
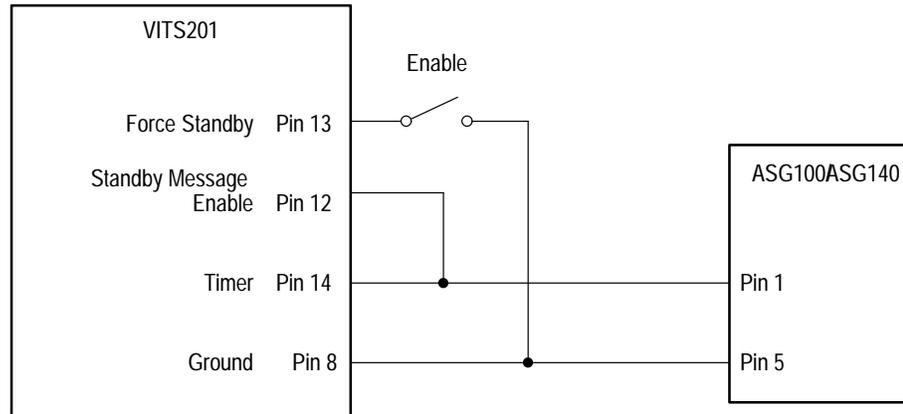
Figure 3–55: Cabling between the VITS 201 and the ASG 100/ASG 140 for active video placement

    g. Connect a special cable between the VITS 201 remote connector and the ASG 100/ASG 140 remote connector as shown in Figure 3–55. Insert a switch in line with pin 13 to use as an ENABLE. Connect the switch, as shown, between pin 13 and pin 8. Other standby pages of standby text can be used by grounding pins 4 and 11. See the *VITS 201 PAL Insertion Generator User Manual* for more details.

    h. Check that when the VITS 201 is in the power-up Line Selection mode and is genlocked, the signal at pin 14 of the remote connector will be a TTL low voltage for 4.5 seconds, and then high for 0.5 seconds. The signal transitions from low to high at line 1 field 1. When the TTL signal is high, the audio output is ON, but the text inserted by the VITS 201 does not become visible until active video. The SDI Audio/Video Timing application removes this time delay before presenting the measured time difference.

NOTE. This check forces the VITS 201 into Standby Mode. It can be used only when the VITS 201 is out of service.

Appendices

Appendix A: Specifications

This section contains the specifications for Option 1S. All guaranteed specifications are listed in the "Performance requirement" column in the tables. The data listed in the "Supplemental information" column is provided for your information, but is not guaranteed. The supplemental information can include data that further explains the guaranteed specifications, or data that lists typical by-design performance expectations that are not guaranteed.

The specifications for Option 1S are the same as those listed for the VM700T Video Measurement Set except where listed below. The following specifications are only valid when Option 1S is installed in a VM700T.

Table A–1: SDI Eye Diagram application

Characteristic	Performance requirement	Supplemental information
Eye Diagram Measurements		Measurements performed on SDI Ch. A input signals only
Amplitude Accuracy		
10° C to 35° C ambient	$\pm$ 5% for signals between 600 mV$_{p\text{-}p}$ and 1 V$_{p\text{-}p}$	
Full temperature range	$\pm$ 10% for signals between 600 mV$_{p\text{-}p}$ and 1 V$_{p\text{-}p}$	
20% to 80% Rise Time Accuracy	$\pm$ 100 ps for rise times between 400 ps and 1.5 ns	
Signal Aberrations	$<$ 5% for 800 mV$_{p\text{-}p}$ step with $\geq$ 400 ps rise time	
Noise Floor		
Amplitude		10 mV tangential noise
Timing		$<$ 100 ps tangential noise
DC Offset Accuracy		10 mV $\pm$ 2% of reading from –1 V to +1 V
Filter Performance		
10 Hz filter		–3 dB at 10 Hz
1 kHz filter		–3 dB at 1 kHz

Table A–2: SDI Jitter application

Characteristic	Performance requirement	Supplemental information
Jitter Measurements		Measurements performed on SDI Ch. A input signals only
Maximum Amplitude		
143 Mb/s		3 ns pk-to-pk for frequencies of 0.5 MHz and above Max jitter (ns) = 1500 ÷ jitter frequency (kHz) for frequencies below 0.5 MHz
270 Mb/s	1 ns pk-to-pk for frequencies of 1.5 MHz and above Max jitter (ns) = 1500 ÷ jitter frequency (kHz) for frequencies below 1.5 MHz	1.2 ns pk-to-pk for frequencies of 1.25 MHz and above typical Max jitter (ns) = 1500 ÷ jitter frequency (kHz) for frequencies below 1.25 MHz typical
360 Mb/s		0.9 ns pk-to-pk typical frequencies of 1.33 MHz and above Max jitter (ns) = 1200 ÷ jitter frequency (kHz) for frequencies below 1.33 MHz
Frequency Response of Jitter-Waveform and Spectrum displays		
143 Mb/s	± 3 dB to 0.5 MHz; +3 dB to –5 dB at 3 MHz	
270 Mb/s, 360 Mb/s	± 3 dB to 5 MHz; +3 dB to –6 dB at 10 MHz	–3 dB at 8 MHz typical
Timing & Alignment Jitter Readout Accuracy		
143 Mb/s	200 ps ± 20% of actual for components from 50 Hz to 1 MHz 200 ps +20%, –30% of actual for components from 1 MHz to 3 MHz	100 ps ± 5% of actual for components from 50 Hz to 1 MHz typical
270 Mb/s, 360 Mb/s	200 ps ± 20% of actual for components from 50 Hz to 1 MHz 200 ps +60%, –30% of actual for components from 1 MHz to 10 MHz	100 ps ± 5% of actual for components from 50 Hz to 1 MHz typical

Table A–3: SDI Wander application

Characteristic	Performance requirement	Supplemental information
Wander Measurements		Measurements performed on SDI Ch. A input signals only
Frequency Range		
143 Mb/s	$\pm$ 20 ppm	
270 Mb/s	$\pm$ 20 ppm	
360 Mb/s	$\pm$ 20 ppm	
Frequency Accuracy	$\pm$ 0.1 ppm	
Drift Rate Range	$\pm$ 40 ppm/s	
Drift Rate Accuracy	$\pm$ 5 ppb/s	

Table A–4: SDI Interchannel Timing application

Characteristic	Performance requirement	Supplemental information
Digital-to-Digital		
Accuracy	$\pm$ 1 sample	
Range	$\pm$ 0.5 frame	
Digital-to-Analog		
Accuracy	$\pm$ 400 ns	
Range	$\pm$ 0.5 frame	

Table A–5: SDI Audio/Video Timing application

Characteristic	Performance requirement	Supplemental information
Embedded Signal		
Accuracy	$\pm$ 200 µs	
Range		$\pm$ 2 seconds; less range on data streams heavily loaded with ancillary data
External Signal		
Accuracy	$\pm$ 200 µs	
Range		$\pm$ 2 seconds

Table A–6: SDI Ch. A Input

Characteristic	Performance requirement	Supplemental information
Electrical Characteristics		
Input type	BNC passive loopthrough; 75 Ω compensated	
Return Loss		
Power On	≥ 25 dB, 1 MHz to 360 MHz	Channel on or off
Power Off	≥ 15 dB, 1 MHz to 360 MHz	
Insertion Loss		
Power On	< 0.3 dB, 1 MHz to 360 MHz	
Power Off	< 1.0 dB, 1 MHz to 360 MHz	
Signal Characteristics		
Amplitude Range	800 mV; +15%, −25%	
Frequency Range		
143 Mb/s	± 20 ppm	
270 Mb/s	± 20 ppm	
360 Mb/s	± 20 ppm	
Jitter Maximum for No Bit Errors		
143 Mb/s		2 ns pk-to-pk for frequencies of 160 kHz and above Max jitter (ns) = 320 ÷ jitter frequency (kHz) for frequencies below 160 kHz
270 Mb/s		1 ns pk-to-pk for frequencies of 160 kHz and above Max jitter (ns) = 160 ÷ jitter frequency (kHz) for frequencies below 160 kHz
360 Mb/s		0.8 ns pk-to-pk for frequencies of 160 kHz and above Max jitter (ns) = 130 ÷ jitter frequency (kHz) for frequencies below 160 kHz
Cable Length Maximum for No Bit Errors	Equivalent to 200 meters of Belden 8281 cable	Equivalent to 250 meters of Belden 8281 cable typical

Table A–7: SDI Ch. B Input

Characteristic	Performance requirement	Supplemental information
Electrical Characteristics		
Input type	BNC; 75 Ω terminated	
Return Loss		
Power On	≥ 25 dB, 1 MHz to 360 MHz	Channel on or off
Power Off	≥ 15 dB, 1 MHz to 360 MHz	
Signal Characteristics		
Amplitude Range	800 mV; +15%, −25%	
Frequency Range		
143 Mb/s	± 20 ppm	
270 Mb/s	± 20 ppm	
360 Mb/s	± 20 ppm	
Jitter Maximum for No Bit Errors		
143 Mb/s		2 ns pk-to-pk for frequencies of 160 kHz and above Max jitter (ns) = 320 ÷ jitter frequency (kHz) for frequencies below 160 kHz
270 Mb/s		1 ns pk-to-pk for frequencies of 160 kHz and above Max jitter (ns) = 160 ÷ jitter frequency (kHz) for frequencies below 160 kHz
360 Mb/s		0.8 ns pk-to-pk typical for frequencies of 160 kHz and above Max jitter (ns) = 130 ÷ jitter frequency (kHz) for frequencies below 160 kHz
Cable Length Maximum for No Bit Errors	Equivalent to 200 meters of Belden 8281 cable	Equivalent to 250 meters of Belden 8281 cable typical

Table A–8: LTC Input

Characteristic	Performance requirement	Supplemental information
Electrical Characteristics		
Input type	Miniature XLR	
Input Impedance		> 10 kΩ
Signal Characteristics		
Format	Longitudinal Time Code per IEC pub. 461	

Table A–9: SDI Output

Characteristic	Performance requirement	Supplemental information
Electrical Characteristics		
Output type	BNC; 75 Ω compensated	
Return Loss		
Power On	≥ 25 dB, 1 MHz to 360 MHz	Channel on or off
Power Off	≥ 15 dB, 1 MHz to 360 MHz	
Signal Characteristics		
Amplitude	800 mV$_{p\text{-}p}$ ± 10%	
20% to 80% Rise/Fall Time	400 ps to 800 ps	

Table A–10: Analog Ref. Input

Characteristic	Performance requirement	Supplemental information
Electrical Characteristics		
Input type	BNC passive loopthrough; 75 Ω compensated	
Return Loss	≥ 30 dB, 50 kHz to 6 MHz	Power on or off
Signal Characteristics		
Amplitude Range	± 6 dB with respect to 1 V$_{p\text{-}p}$ video	

Table A–11: AES Audio Input

Characteristic	Performance requirement	Supplemental information
Electrical Characteristics		
Input type	BNC; 75 Ω	
Return Loss		> 15 dB, 0.1 MHz to 6 MHz
Signal Characteristics		
Amplitude Range		0.2 V$_{p\text{-}p}$ to 2 V$_{p\text{-}p}$
Format	AES/EBU digital-audio per AES3-1992 (ANSI S4.40-1992)	

Table A–12: Environmental specification

Characteristic	Performance requirement	Supplemental information
Maximum operating temperature	45° C	VM700T with Option 1S installed

Appendix B: Remote Control

This section contains general information on how to connect the VM700T Video Measurement Set for remote control and the specific remote commands and keywords required to operate the Option 1S functions via remote control. In addition, the remote names for Option 1S soft keys are listed.

Option 1S can be controlled remotely either through the standard RS-232C interface or through the optional GPIB remote interface. Control of the Option 1S application involves sending the appropriate *softkey*, *softpress*, or *softrelease* command followed by the desired soft key name in the application.

Remote Control Setup

The VM700T Video Measurement Set performs remote control of the Option 1S measurements via the serial (RS-232C) or GPIB (Option 48) ports on the measurement set rear panel. Capabilities available while operating the measurement set from a remote location include:

- Perform a specific manual measurement

- Execute and interrupt a function (front-panel Function button)

- Temporarily change the configuration of a channel

To use the RS-232C remote-control functions, you must connect a terminal or computer to the measurement set RS-232C serial port. If you use a computer, you must also have a suitable terminal program to operate the measurement set.

Tektronix offers a software package called *VMT Remote Control Software* for serial communication. This software package provides a choice of using either menu selection or command-line entry of VM700T Video Measurement Set remote commands.

To use the GPIB remote-control functions, you must have Option 48 (GPIB) installed in your measurement set. You will then connect a GPIB controller with appropriate controller programming to the measurement set remote connector.

More Information

For information about configuring the measurement set serial ports for remote operation and typical cable-wiring configurations, refer to the *VM700T RS-232 Interface Programmer Manual*. For information about using the GPIB (Option 48) remote port, refer to the *VM700T Option 48 GPIB Interface Programmer Manual*.

General Remote Commands

You can use the VM700T remote commands listed below with Option 1S.

NOTE. The remote commands and keywords are case sensitive. Option 1S introduces lower case keywords to the VM700T measurement set. Be sure to enter the commands and keywords exactly as they appear in this manual.

Throughout the descriptions in this section, **VM700T>** *is a prompt (which you can edit), not a required input.*

---

execute *application*

The `execute` command starts the specified VM700T application. An application is one of the executable files (with exceptions noted below) found in the Instrument~Operations, VM700~Diagnostics, Video~Measurements, or Audio~Measurements directories in the Executable~Files directory. Selecting an operational mode application, such as Vector, is equivalent to pressing the front panel button: the LED on the selected button is turned on. Selecting a measurement or diagnostic application is equivalent to touching the desired soft key. In the example below, the SDI Format Monitor application is started by touching the SDI_Format soft key.

```
VM700T> execute SDI_Format
```

NOTE. To execute an SDI application remotely, you do not need to switch the measurement set to Digital Mode; you just execute an application regardless of the current mode of the measurement set (Analog or Digital). Executing an SDI application does not switch the measurement set to Digital Mode if it is currently in Analog Mode.

---

get *keyword {channel}*

The `get` command returns the configuration file value(s) of the specified keyword for the specified input channel. The valid keywords are listed later in this section. The valid values for the input channel argument are A and B. In the example below (using the keyword "oamp"), the values returned are the limits that will be used for an SDI Eye Diagram application Amplitude measurement on a 270 Mb 525-line video format signal connected to the SDI Ch A input: Log (no), Highlight (yes), Low Limit in millivolts (720), and High Limit in millivolts (880).

```
VM700T> get oamp A
no yes 720 880
```

getresults The `getresults` command stores Measure or Auto mode measurement results in default files in the Measurement~Results directory. In Measure mode, entering `getresults` with no argument(s) stores measurement results for the current measurement. If the system is not taking a measurement, the message `"Request not supported"` displays. If the system is making a measurement, the message `"Results in file:` *filename*`"` displays. Use the `show` command to view the measurement results.

```
VM700T> getresults
Results in file: SDI_Format
```

hardkey *button_name* The `hardkey` command indicates the press and release of the specified front panel button, *button_name*. Using the `hardkey` command is equivalent to using `hardpress` and `hardrelease` commands. In general, use the `hardkey` command instead of the `hardpress` and `hardrelease` commands.

```
VM700T> hardkey Menu
```

The front panel button names are listed in Table B–1.

NOTE. The Configure, Function, and Measure front-panel buttons cannot be selected remotely.

Table B–1: Front panel button names

A	Display	Picture
Auto	Freeze	SelectLine
Average	Graticule	Vector
B	Help	Waveform
C	Menu	XY (Arrow selector)
Copy	MoveExpand	

set *keyword*
[*channel_letter***]** *value1*
[*value2 ...***]]**

The set command defines configuration values to use during the remote session. The keywords available for use with set are listed in Table B–2 through Table B–9. The channel letter can be A or B. The configuration values changed with the set command remain in effect until restored to their original values with the restoreconfig command, or until power to the instrument is switched off and back on. System line and other global variables can be changed with the set command but are not restored with the restoreconfig command.

```
VM700T> set oamp A yes yes 700 900
```

The above example sets the Amplitude signal-limit parameters to use for eye diagram measurements on a 270 Mb 525-line video signal connected to the SDI Ch. A input. The command sets the measurement parameters to the following: Log measurement violations, yes; Highlight measurement violations, yes; signal Low Limit, 700 mV; and the signal High Limit, 900 mV.

show *filename*

The show command returns the contents of the specified filename. The default path is the Measurement~Results directory, but other files can be specified with a full path name or a path relative to the Measurement~Results directory.

```
VM700T> show /nvram0/ConfigFiles/Source_Selection~Video
Video NTSC Video Source File Name      PAL Video Source File Name
-----------------------------------------------------------------
Source A: NTSC System~Default                  System~Default
Source B: PAL  System~Default                  System~Default
Source C: NTSC System~Default                  System~Default
Timed Events: System~Default
```

softkey *softkey_name*

The softkey command indicates the touch and release of a specified softkey. The softkey command is equivalent to entering the softpress and softrelease commands. In general, use the softkey command instead of the softpress and softrelease commands.

```
VM700T> softkey Rescale
```

The remote names of the Option 1S soft keys are listed in Table B–11 through Table B–26 starting on page B–30.

Get and Set Command Keywords

The VM700T Video Measurement Set remote commands use this form:

```
command [argument(s)]
```

Variable values in the command are shown in *italics*. Optional arguments are enclosed with [ ]. A description of command usage and arguments follows the command header.

Most of the Option 1S remote keywords are channel dependent. These commands must also include an argument specifying which input channel (A or B) is being controlled. The channel-dependent keywords use the following form:

```
command <channel letter> [argument(s)]
```

NOTE. The remote commands and keywords are case sensitive. Option 1S introduces lower case keywords to the VM700T measurement set. Be sure to enter the commands and keywords exactly as they appear in this manual.

Throughout the descriptions in this section, **VM700T>** *is a prompt (which you can edit), not a required input.*

---

query Command

You can use the query command to return information about the keyword used as its argument. Use the following syntax for the query command:

```
query keyword
```

In computer mode, the information returned includes the type and range of valid values for each field returned by the get command or used as an argument by the set command. If the field specifies a numeric value, the valid range of numbers is returned. If the field specifies a file name or other discrete values, the values that can be used as an argument are listed.

In terminal mode, the query command also tells you whether or not the keyword is channel-specific (that is, if it requires a channel-letter when used in a `get` or `set` command).

Terminal mode example:

```
VM700T> query VSCA
channel independent
field 1 is a file name. Possible names are:
System~Default
VM700T> query LZCL
channel specific
field 1 is an integer value with range 1 to 625
```

Computer mode example:

```
VM700T> query VSCA
F1: file list:
System~Default
VM700T> query LZCL
F1: integer 1 625
```

Entering Parameter Values as Undefined

Most of the numeric parameter values in the configuration files can also be entered as undefined. Entering a configuration file parameter value as undefined causes the affected applications to not perform limit testing for that signal parameter. To enter a parameter value as undefined, enter "undef" as its value.

```
set oamp A yes yes undef 900
```

"d" Group Keywords

You can use the "d" group keywords to set the digital source selection parameters. Figure B–1 shows the relationship between the Source Selection Digital configuration file and the "d" group keywords. Table B–2 lists the "d" group keywords and shows application examples using the get and set commands.

```
Source_Selection~Digital                                                    Remote
                                                                            Keywords
┌─────────────────────────────────────────────────────────────────────┐       ⇩
│             Digital Video Standard                                    │
│ - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - │
│ Digital A:  Auto detect                                               │    dsta
│                       Video Source File                               │
│                       - - - - - - - - - - - - - - -                   │
│          143Mb NTSC:     System~Default                               │    d1na
│          270Mb 525-line: System~Default                               │    d25a
│          270Mb 625-line: System~Default                               │    d26a
│          360Mb 525-line: System~Default                               │    d35a
│          360Mb 625-line: System~Default                               │    d36a
│                                                                       │
│          Audio Limits:   System~Default                               │    dada
│                                                                       │
│ Digital B:  Auto detect                                               │    dstb
│                       Video Source File                               │
│                       - - - - - - - - - - - - - - -                   │
│          143Mb NTSC:     System~Default                               │    d1nb
│          270Mb 525-line: System~Default                               │    d25b
│          270Mb 625-line: System~Default                               │    d26b
│          360Mb 525-line: System~Default                               │    d35b
│          360Mb 625-line: System~Default                               │    d36b
│                                                                       │
│          Audio Limits:   System~Default                               │
│ - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - │    dadb
│ SDI Output: Selected Channel                                          │    dout
│                                                                       │
│ Startup In: Digital Mode                                              │    dmod
│ Hex Format: SMPTE                                                     │    dhex
└─────────────────────────────────────────────────────────────────────┘
```

Figure B–1: Source Selection Digital configuration file relationship to remote commands

Table B–2: "d" Group keywords: Source Selection Digital configuration file

Keyword	Description and get/set command examples

dsta	dsta sets the video format of the signal the measurement set will assume is being input on the SDI Ch. A input. The Digital Source File set in the Source Selection Digital configuration file for that for video format will be used for measurements. You can use one of the following arguments with this command: Auto detect, 143Mb NTSC, 270Mb 525-line, 270Mb 625-line, and 360Mb Unspec (unspecified). If you have selected the Auto detect setting, the measurement set will determine the video format of the input signal.
	
	`VM700T> get dsta`
	`270Mb 525-line`
	`VM700T> set dsta Auto detect`

d1na	d1na sets the name of the Digital Source File to be used for measurements by the 143Mb NTSC video format on the SDI Ch. A input. You can use one of the following arguments with this command: System~Default (file name supplied with Option 1S), or the name of an existing Digital Source File. This file must be in the following directory path: *nvram0/ConfigFiles/143Mb~NTSC/Digital_Source~Files.*
	
	`VM700T> get d1na`
	`System~Default`
	`VM700T> set d1na Custom~File`

d25a	d25a sets the name of the Digital Source File to be used for measurements by the 270Mb 525-line video format on the SDI Ch. A input. You can use one of the following arguments with this command: System~Default (file name supplied with Option 1S), or the name of an existing Digital Source File. This file must be in the following directory path: *nvram0/ConfigFiles/270Mb~525-line/Digital_Source~Files.*
	
	`VM700T> get d25a`
	`System~Default`
	`VM700T> set d25a Custom~File`

d26a	d26a sets the name of the Digital Source File to be used for measurements by the 270Mb 625-line video format on the SDI Ch. A input. You can use one of the following arguments with this command: System~Default (file name supplied with Option 1S), or the name of an existing Digital Source File. This file must be in the following directory path: *nvram0/ConfigFiles/270Mb~625-line/Digital_Source~Files.*
	
	`VM700T> get d26a`
	`System~Default`
	`VM700T> set d26a Custom~File`

d35a	d35a sets the name of the Digital Source File to be used for measurements by the 360Mb 525-line video format on the SDI Ch. A input. You can use one of the following arguments with this command: System~Default (file name supplied with Option 1S), or the name of an existing Digital Source File. This file must be in the following directory path: *nvram0/ConfigFiles/360Mb~525-line/Digital_Source~Files.*
	
	`VM700T> get d35a`
	`System~Default`
	`VM700T> set d35a Custom~File`

d36a	d36a sets the name of the Digital Source File to be used for measurements by the 360Mb 626-line video format on the SDI Ch. A input. You can use one of the following arguments with this command: System~Default (file name supplied with Option 1S), or the name of an existing Digital Source File. This file must be in the following directory path: *nvram0/ConfigFiles/360Mb~625-line/Digital_Source~Files.*
	
	`VM700T> get d36a`
	`System~Default`
	`VM700T> set d36a Custom~File`

Table B–2: "d" Group keywords: Source Selection Digital configuration file (Cont.)

Keyword	Description and get/set command examples

dada	dada sets the name of the Digital Audio Setup file to be used for audio measurements on the SDI Ch. A input. You can use one of the following arguments with this command: System~Default (file name supplied with Option 1S), or the name of an existing Digital Audio Setup file. This file must be in the following directory path: *nvram0/ConfigFiles/Digital_Audio~Setup*.
	
	`VM700T> get dada`
	`System~Default`
	`VM700T> set dada Custom~File`

dstb	dstb sets the video format of the signal the measurement set will assume is being input on the SDI Ch. B input. The Digital Source File set in the Source Selection Digital configuration file for that for video format will be used for measurements. You can use one of the following arguments with this command: Auto detect, 143Mb NTSC, 270Mb 525-line, 270Mb 625-line, and 360Mb Unspec (unspecified). If you have selected the Auto detect setting, the measurement set will determine the video format of the input signal.
	
	`VM700T> get dstb`
	`270Mb 525-line`
	`VM700T> set dstb Auto detect`

d1nb	d1nb sets the name of the Digital Source File to be used for measurements by the 143Mb NTSC video format on the SDI Ch. B input. You can use one of the following arguments with this command: System~Default (file name supplied with Option 1S), or the name of an existing Digital Source File. This file must be in the following directory path: *nvram0/ConfigFiles/143Mb~NTSC/Digital_Source~Files*.
	
	`VM700T> get d1nb`
	`System~Default`
	`VM700T> set d1nb Custom~File`

d25b	d25b sets the name of the Digital Source File to be used for measurements by the 270Mb 525-line video format on the SDI Ch. B input. You can use one of the following arguments with this command: System~Default (file name supplied with Option 1S), or the name of an existing Digital Source File. This file must be in the following directory path: *nvram0/ConfigFiles/270Mb~525-line/Digital_Source~Files*.
	
	`VM700T> get d25b`
	`System~Default`
	`VM700T> set d25b Custom~File`

d26b	d26b sets the name of the Digital Source File to be used for measurements by the 270Mb 625-line video format on the SDI Ch. B input. You can use one of the following arguments with this command: System~Default (file name supplied with Option 1S), or the name of an existing Digital Source File. This file must be in the following directory path: *nvram0/ConfigFiles/270Mb~625-line/Digital_Source~Files*.
	
	`VM700T> get d26b`
	`System~Default`
	`VM700T> set d26b Custom~File`

d35b	d35b sets the name of the Digital Source File to be used for measurements by the 360Mb 525-line video format on the SDI Ch. B input. You can use one of the following arguments with this command: System~Default (file name supplied with Option 1S), or the name of an existing Digital Source File. This file must be in the following directory path: *nvram0/ConfigFiles/360Mb~525-line/Digital_Source~Files*.
	
	`VM700T> get d35b`
	`System~Default`
	`VM700T> set d35b Custom~File`

Table B–2: "d" Group keywords: Source Selection Digital configuration file (Cont.)

Keyword	Description and get/set command examples

d36b	d36b sets the name of the Digital Source File to be used for measurements by the 360Mb 625-line video format on the SDI Ch. B input. You can use one of the following arguments with this command: System~Default (file name supplied with Option 1S), or the name of an existing Digital Source File. This file must be in the following directory path: *nvram0/ConfigFiles/360Mb~625-line/Digital_Source~Files*.
	
	 `VM700T> get d36b`
	 `System~Default`
	 `VM700T> set d36b Custom~File`

dadb	dadb sets the name of the Digital Audio Setup file to be used for audio measurements on the SDI Ch. B input. You can use one of the following arguments with this command: System~Default (file name supplied with Option 1S), or the name of an existing Digital Audio Setup file. This file must be in the following directory path: *nvram0/ConfigFiles/Digital_Audio~Setup*.
	
	 `VM700T> get dadb`
	 `System~Default`
	 `VM700T> set dadb Custom~File`

dout	dout sets which one of the two SDI input signals will be output to the SDI Output connector. You can use one of the following arguments with this command: Channel A, Channel B, Selected Channel, and None.
	
	 `VM700T> get dout`
	 `Channel A`
	 `VM700T> set dout Channel B`

dmod	This command is not used for remote programming. The command is included here for completeness. dmod sets the mode (Analog or Digital) the measurement set starts up in. You can use one of the following arguments with this command: Analog or Digital.
	
	 `VM700T> get dmod`
	 `Analog`
	 `VM700T> set dmod Digital`

dhex	dhex sets the hex format (SMPTE or EBU) used to display hexadecimal numbers in the measurement displays. You can use one of the following arguments with this command: SMPTE or EBU. Refer to *Hex Formats* on page 2–5 for more information.
	
	 `VM700T> get dhex`
	 `SMPTE`
	 `VM700T> set dhex EBU`

"w," "m," "r," "h," and "b"
Group Keywords

These keyword groups are channel dependent. They are used to set the parameters of the Digital Source File for the video formats listed below:

- The "w" group is used for the 143Mb NTSC format.

- The "m" group is used for the 270Mb 525-line format.

- The "r" group is used for the 270Mb 625-line format.

- The "h" group is used for the 360Mb 525-line format.

- The "b" group is used for the 360Mb 625-line format.

Figure B–2 shows the relationship between the Digital Source Files configuration file and the group keywords. Table B–3 lists the "m" group keywords and shows application examples using the get and set commands.

The "w," "r," "h," and "b" group keywords use the same last three characters in the keywords to perform the same function for the other video formats. Replace the "m" character in the listed keywords with one of the "w," "r," "h," and "b" group characters to set the parameters for the video format you want to edit.

```
270Mb~525-line/Digital_Source~Files/System~Default          Remote
                                                            Keywords
    Digital Channel Configuration 270Mb 525-Line System Defaults File     ⇩

Eye Limits:            System~Default              (Channel A only)   -fel
Wander Limits:         System~Default              (Channel A only)   -fdl
Format Setup:          System~Default                                 -ffs

Source Name:           System Default                                 —src
Video Printout Title:  Video Measurement Set                          -prt
```

Figure B–2: Digital Source Files configuration file relationship to remote commands

Table B–3: "m" Group keywords: 270Mb 525-Line Digital Source Files configuration file

Keyword	Description and get/set command examples

mfel	mfsl sets the name of the Eye Limits configuration file to be used for measurements by the 270 Mb 525-line video format on the specified input channel. You can use the following arguments with this command: A or B (SDI input channel), System~Default (file name supplied with Option 1S), or the name of an existing Eye Limits configuration file. This file must be in the following directory path: *nvram0/ConfigFiles/270Mb~525-line/Eye~Limits*.
	
	 `VM700T> get mfsl A`
	`System~Default`
	`VM700T> set mfsl A Custom~File`

mfdl	mfdl sets the name of the Wander Limits configuration file to be used for measurements by the 270 Mb 525-line video format on the specified input channel. You can use the following arguments with this command: A or B (SDI input channel), System~Default (file name supplied with Option 1S), or the name of an existing Wander Limits configuration file. This file must be in the following directory path: *nvram0/ConfigFiles/270Mb~525-line/Wander~Limits*.
	
	 `VM700T> get mfdl A`
	`System~Default`
	`VM700T> set mfdl A Custom~File`

mffs	mffs sets the name of the Format Setup configuration file to be used for measurements by the 270 Mb 525-line video format on the specified input channel. You can use the following arguments with this command: A or B (SDI input channel), System~Default (file name supplied with Option 1S), or the name of an existing Format Setup configuration file. This file must be in the following directory path: *nvram0/ConfigFiles/270Mb~525-line/Format~Setup*.
	
	 `VM700T> get mffs A`
	`System~Default`
	`VM700T> set mffs A Custom~File`

msrc	msrc sets the Source Name for log report titles on the specified input channel. You can use the following arguments with this command: A or B (SDI input channel), System Default (name supplied with Option 1S), or a Source Name title of your choice.
	
	 `VM700T> get msrc A`
	`System Default`
	`VM700T> set msrc A Custom~Title`

mprt	mprt sets the Video Printout Title for log reports on the specified input channel. You can use the following arguments with this command: A or B (SDI input channel), Video Measurement Set (name supplied with Option 1S), or a Video Printout Title of your choice.
	
	 `VM700T> get mprt A`
	`Video Measurement Set`
	`VM700T> set mprt A Custom Title`

**"y," "o," "t," "j," and "e"
Group Keywords**

These keyword groups are channel dependent. They are used to set the parameters of the Eye Limits file for the video formats listed below:

- The "y" group is used for the 143Mb NTSC format.

- The "o" group is used for the 270Mb 525-line format.

- The "t" group is used for the 270Mb 625-line format.

- The "j" group is used for the 360Mb 525-line format.

- The "e" group is used for the 360Mb 625-line format.

Figure B–3 shows the relationship between the Eye Limits configuration file and the group keywords. Table B–4 lists the "o" group keywords and shows application examples using the get and set commands.

The "y," "t," "j," and "e" group keywords use the same last three characters in the keywords to perform the same function for the other video formats. Replace the "o" character in the listed keywords with one of the "y," "t," "j," and "e" group characters to set the signal limits in the SDI Eye Diagram application for the video format you want to edit.

```
270Mb~525-line/Eye~Limits/System~Default
```
```
                   Digital Eye Limits 270Mb 525-line System Default File          Remote
                                                                                  Keywords
                                                      Limits                         ⇩
                    Log?        Highlight?        Low           High
        ----------------------------------------------------------------------
        Amplitude:          yes          yes         720           880    mV       -amp
        Rise-Time:          yes          yes         400          1500    pS       -rst
        Fall-Time:          yes          yes         400          1500    pS       -flt
        Rise/Fall Diff:     yes          yes        -----          500    pS       -rfd
        Rise Overshoot:     yes          yes        -----           10    %        -rov
        Fall Overshoot:     yes          yes        -----           10    %        -fov
        DC Offset:          yes          yes        -500           500    mV       -dco

        Jitter (10Hz):      yes          yes           0           250    pS       -j10
        Jitter (1KHz):      yes          yes           0           250    pS       -j1k

        Consecutive error(s) before reporting:      2                              -cep
        Activate Relay:     Never                                                  -rly
```

Figure B–3: Eye Limits configuration file relationship to remote commands

Table B–4: "o" Group keywords: 270Mb 525-Line Eye Limits configuration file

Keyword	Description and Get/Set command examples

oamp	oamp sets the Amplitude signal-limit parameters to use for eye diagram measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–3. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), Low Limit (mV), and High Limit (mV). The possible values for the Low and High Limits are 0 mV through 2000 mV in increments of 1 mV, and Undefined.
	
	`VM700T> get oamp A`
	`no yes 720 880`
	`VM700T> set oamp A yes yes 700 900`

orst	orst sets the Rise-Time signal-limit parameters to use for eye diagram measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–3. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), Low Limit (ps), and High Limit (ps). The possible values for the Low and High Limits are 0 ps through 2000 ps in increments of 1 ps, and Undefined.
	
	`VM700T> get orst A`
	`no yes 400 1500`
	`VM700T> set orst A yes yes 300 1200`

oflt	oflt sets the Fall-Time signal-limit parameters to use for eye diagram measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–3. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), Low Limit (ps), and High Limit (ps). The possible values for the Low and High Limits are 0 ps through 2000 ps in increments of 1 ps, and Undefined.
	
	`VM700T> get oflt A`
	`no yes 400 1500`
	`VM700T> set oflt A yes yes 300 1200`

orfd	orfd sets the Rise/Fall-Diff signal-limit parameters to use for eye diagram measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–3. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), Low Limit (ps), and High Limit (ps). The possible values for the Low and High Limits are 0 ps through 2000 ps in increments of 1 ps, and Undefined.
	
	`VM700T> get orfd A`
	`no yes 0 500`
	`VM700T> set orfd A yes yes 100 800`

orov	orov sets the Rise Overshoot signal-limit parameters to use for eye diagram measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–3. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), Low Limit (%), and High Limit (%). The possible values for the Low and High Limits are 0% through 10% in increments of 1%, and Undefined.
	
	`VM700T> get orov A`
	`no yes 0 10`
	`VM700T> set orov A yes yes 1 8`

ofov	ofov sets the Fall Overshoot signal-limit parameters to use for eye diagram measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–3. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), Low Limit (%), and High Limit (%). The possible values for the Low and High Limits are 0% through 10% in increments of 1%, and Undefined.
	
	`VM700T> get ofov A`
	`no yes 0 10`
	`VM700T> set ofov A yes yes 1 8`

Table B–4: "o" Group keywords: 270Mb 525-Line Eye Limits configuration file (Cont.)

Keyword	Description and Get/Set command examples

odco	odco sets the DC Offset signal-limit parameters to use for eye diagram measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–3. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), Low Limit (mV), and High Limit (mV). The possible values for the Low and High Limits are –1000 mV through 1000 mV in increments of 1 mV, and Undefined.
	
	`VM700T> get odco A`
	`no yes -500 500`
	`VM700T> set odco A yes yes -100 100`

oj10	oj10 sets the 10 Hz Jitter signal-limit parameters to use for eye diagram measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–3. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), Low Limit (ps), and High Limit (ps). The possible values for the Low and High Limits are 0 ps through 1000 ps in increments of 1 ps, and Undefined.
	
	`VM700T> get oj10 A`
	`no yes 0 250`
	`VM700T> set oj10 A yes yes 10 500`

oj1k	oj1k sets the 1 kHz Jitter signal-limit parameters to use for eye diagram measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–3. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), Low Limit (ps), and High Limit (ps). The possible values for the Low and High Limits are 0 ps through 1000 ps in increments of 1 ps, and Undefined.
	
	`VM700T> get oj1k A`
	`no yes 0 250`
	`VM700T> set oj1k A yes yes 10 500`

ocep	ocep sets the number of consecutive errors before log reporting for the specified input channel. You can use the following arguments with this command: A or B (SDI input channel) and the number of errors. The range of values for the number of errors is from 1 error to 9 errors in steps of 1 error.
	
	`VM700T> get ocep A`
	`2`
	`VM700T> set ocep A 4`

orly	orly describes when the SDI Eye Diagram application sets the GRLY keyword (refer to page B–29), which allows you to signal outside the VM700T that a measurement limit was violated for the selected input channel. Measurements that are enabled to Highlight or Log when limits are exceeded cause the application to set the GRLY keyword when their measurement state matches the defined orly state. You can use the following arguments with this command: A or B (SDI input channel), Never, On Highlight, and On Log.
	
	`VM700T> get orly A`
	`Never`
	`VM700T> set orly A On Highlight`

"z," "p,""u," "k," and "f" Group Keywords

These keyword groups are channel dependent. They are used to set the parameters of the Wander Limits file for the video formats listed below:

- The "z" group is used for the 143Mb NTSC format.

- The "p" group is used for the 270Mb 525-line format.

- The "u" group is used for the 270Mb 625-line format.

- The "k" group is used for the 360Mb 525-line format.

- The "f" group is used for the 360Mb 525-line format.

Figure B–4 shows the relationship between the Wander Limits configuration file and the group keywords. Table B–4 lists the "p" group keywords and shows application examples using the get and set commands.

The "z," "u," "k," and "f" group keywords use the same last three characters in the keywords to perform the same function for the other video formats. Replace the "p" character in the listed keywords with one of the "z," "u," "k," and "f" group characters to set the signal limits for the video format you want to edit.

```
270Mb~525-line/Wander~Limits/System~Default
```

```
                    Digital Wander Limits 270Mb 525-Line System Default File        Remote
                                                                                     Keywords
                                                       Limits                           ⇩
                                                  Low          High
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Drift Rate (peak):                                -28.0          28.0    ppb/sec      -drt
Frequency Offset:                                 -2800          2800    ppb          -fro


Consecutive error(s) before reporting:     2                                          -cep
Activate Relay:     Never                                                             -rly
```

Figure B–4: Wander Limits configuration file relationship to remote commands

Table B–5: "p" Group keywords: 270Mb 525-Line Wander Limits configuration file

Keyword	Description and get/set command examples

pdrt	pdrt sets the Drift Rate wander-limit parameters to use for measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–4. You can use the following arguments with this command: SDI input channel (A or B), Low Limit (ppb/sec), and High Limit (ppb/sec). The possible values for the Low Limits is –999.0 ppb/sec through 0 ppb/sec in increments of 0.1 ppb/sec, and Undefined. The possible values for the High Limits is 0 ppb/sec through 999.0 ppb/sec in increments of 0.1 ppb/sec, and Undefined.
	
	`VM700T> get pdrt A`
	`-28 28`
	`VM700T> set pdrt A -40 40`

pfro	pfro sets the Frequency Offset wander-limit parameters to use for measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–4. You can use the following arguments with this command: SDI input channel (A or B), Low Limit (ppb), and High Limit (ppb). The possible values for the Low Limits is –99990 ppb through 0 ppb in increments of 10 ppb, and Undefined. The possible values for the High Limits is 0 ppb through 99990 ppb in increments of 10 ppb, and Undefined.
	
	`VM700T> get pfro A`
	`-2800 2800`
	`VM700T> set pfro A -4000 4000`

pcep	pcep sets the number of consecutive errors before log reporting for the specified input channel. You can use the following arguments with this command: SDI input channel (A or B) and the number of errors. The range of values for the number of errors is from 1 error to 9 errors in steps of 1 error.
	
	`VM700T> get pcep A`
	`2`
	`VM700T> set pcep A 4`

prly	prly describes when the SDI Wander application sets the GRLY keyword (refer to page B–29), which allows you to signal outside the VM700T that a measurement limit was violated for the selected input channel. Measurements that are enabled to Highlight or Log when limits are exceeded cause the application to set the GRLY keyword when their measurement state matches the defined prly state. You can use the following arguments with this command: A or B (SDI input channel), Never, On Highlight, and On Log.
	
	`VM700T> get prly A`
	`Never`
	`VM700T> set prly A On Highlight`

"x," "n," "s," "i," and "c"
Group Keywords

These keyword groups are channel dependent. They are used to set the parameters of the Format Setup file for the video formats listed below:

- The "x" group is used for the 143Mb NTSC format.

- The "n" group is used for the 270Mb 525-line format.

- The "s" group is used for the 270Mb 625-line format.

- The "i" group is used for the 360Mb 525-line format.

- The "c" group is used for the 360Mb 625-line format.

Figure B–5 on page B–21 and Figure B–6 on page B–22 show the relationship between the Format Setup configuration file and the group keywords. Table B–6 lists the "n" group keywords and shows application examples using the `get` and `set` commands.

The "x," "s," "i," and "c" group keywords use the same last three characters in the keywords to perform the same function for the other video formats. Replace the "n" character in the listed keywords with one of the "x," "s," "i," and "c" group characters to set the Format Setup for the video format you want to edit.

NOTE. For 360 Mb and 143 Mb signals, the only SDI Format Monitor application tests that are performed are loss of signal, loss of TRS alignment, and EDH checking (see Figure 3–16 on page 3–31). The "x," "i," and "c" group keywords listed in Table B–6 have no effect for tests not performed on 360 Mb and 143 Mb signals.

Table B–6: "n" Group keywords: 270Mb 525-Line Format Setup configuration file, part 1

Keyword	Description and get/set command examples

nvwh	nvwh sets the High Luminance Warning and High Chrominance Warning limit parameters to use for measurements on a 270 Mb 525-line video signal on the specified input channel (A or B). See Figure B–5. Enter the warning limits in decimal units. The possible values for the High Luminance Warning and High Chrominance Warning limits are 0 through 1023 in increments of 1 decimal unit. The High Luminance Warning limit must be less than or equal to the High Chrominance Warning limit (shown in Figure 1–10 on page 1–19) due to an application limitation.
	
	`VM700T> get nvwh A`
	`961 986`
	`VM700T> set nvwh A 900 1000`

nvwl	nvwl sets the Low Luminance Warning and Low Chrominance Warning limit parameters to use for measurements on a 270 Mb 525-line video signal on the specified input channel (A or B). See Figure B–5. Enter the warning limits in decimal units. The possible values for the Low Luminance Warning and Low Chrominance Warning limits are 0 through 1023 in increments of 1 decimal unit. The Low Luminance Warning limit must be greater than or equal to the Low Chrominance Warning limit (shown in Figure 1–10 on page 1–19) due to an application limitation.
	
	`VM700T> get nvwl A`
	`63 63`
	`VM700T> set nvwl A 100 50`

nskp	nskp sets the number of active video lines to skip before starting the luminance and chrominance limit checks during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–5. You can use the following arguments with this command: A or B (SDI input channel) and the number of lines to skip. The possible values for the number of video lines to skip is 0 lines through 14 lines, in increments of 1 line.
	
	`VM700T> get nskp A`
	`2`
	`VM700T> set nskp A 5`

nlss	nlss sets the format for error detection response to a loss-of-signal error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–5. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nlss A`
	`yes yes no`
	`VM700T> set nlss A no yes yes`

nlsa	nlsa sets the format for error detection response to a loss-of-TRS-alignment error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–5. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nlsa A`
	`yes yes yes`
	`VM700T> set nlsa A no yes no`

nlnl	nlnl sets the format for error detection response to a line-length error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–5. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nlnl A`
	`yes yes no`
	`VM700T> set nlnl A no yes yes`

Table B–6: "n" Group keywords: 270Mb 525-Line Format Setup configuration file, part 1 (Cont.)

Keyword	Description and get/set command examples

nlnb	nlnb sets the format for error detection response to a blanking-length error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–5. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nlnb A`
	`yes yes no`
	`VM700T> set nlnb A no yes yes`

nlnv	nlnv sets the format for error detection response to a vertical-interval-length error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–5. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nlnv A`
	`yes yes no`
	`VM700T> set nlnv A no yes yes`

nlnf	nlnf sets the format for error detection response to a field-length error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–5. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nlnf A`
	`yes yes no`
	`VM700T> set nlnf A no yes yes`

nanh	nanh sets the format for error detection response to an ancillary-data-header error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–5. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nanh A`
	`yes yes yes`
	`VM700T> set nanh A no yes yes`

nand	nand sets the format for error detection response to an ancillary-data data error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–5. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nand A`
	`yes yes yes`
	`VM700T> set nand A no yes yes`

nanc	nanc sets the format for error detection response to an ancillary-data checksum error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–5. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nanc A`
	`yes yes yes`
	`VM700T> set nanc A no yes yes`

nanp	nanp sets the format for error detection response to an ancillary-data placement error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–5. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nanp A`
	`yes yes yes`
	`VM700T> set nanp A no yes yes`

Table B–6: "n" Group keywords: 270Mb 525-Line Format Setup configuration file, part 1 (Cont.)

Keyword	Description and get/set command examples
naus	naus sets the format for error detection response to a block-out-of-sequence ancillary-audio error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–5. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no). VM700T> get naus A yes yes yes VM700T> set naus A no yes yes
naui	naui sets the format for error detection response to a broken-block ancillary-audio error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–5. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no). VM700T> get naui A yes yes yes VM700T> set naui A no yes yes
naus	naus sets the format for error detection response to a samples-per-frame ancillary-audio error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–5. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no). VM700T> get naus A yes yes yes VM700T> set naus A no yes yes
nau5	nau5 sets the format for error detection response to a 5/5-pattern-broken ancillary-audio error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–5. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no). VM700T> get nau5 A yes yes yes VM700T> set nau5 A no yes yes
nmix	nmix sets the format for error detection response to an XY(Z) miscellaneous error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–5. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no). VM700T> get nmix A yes no no VM700T> set nmix A yes yes yes
nmiu	nmiu sets the format for error detection response to an unused-space miscellaneous error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–5. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no). VM700T> get nmiu A yes no no VM700T> set nmiu A yes yes yes

270Mb~525-line/Format~Setup/System~Default

```
                     Digital Format Setup 270Mb 525-Line System Default File          Remote
                                                                                      Keywords
                    | 8/10-Bit Validation Rules | 10-Bit Only Validation Rules           ⇩
                    | Luminance    Chrominance  | Luminance     Chrominance
Error     High      |   3ff           3ff       |   3ff            3ff
                    |   3fc           3fc       |   3ff            3ff
                    |                           |
Warning   High      |   3fb           3fb       |   3fe            3fe
                    |   3ad    < =    3cl       |   <same as for 8/10 bit>              -vwh
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Valid     Video     |                           |
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Warning   Low       |   03f    > =    03f       |   <same as for 8/10 bit>              -vwl
                    |   004           004       |   001            001
                    |                           |
Error     Low       |   003           003       |   000            000
                    |   000           000       |   000            000

              Luminance warning range must enclose chrominance warning range
                         (as shown by the '<=' and '>=')

    Skip  0 active video lines before starting Luma/Chroma warning limits checking.
                                                                                       -skp
= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =

General Errors                    Log?        Highlight?     Capture?
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
Loss of
  Signal                         yes          yes            no                        -lss
  TRS Align                      yes          yes            yes                       -lsa

Length Errors
  Line                           yes          yes            no                        -lnl
  Blanking                       yes          yes            no                        -lnb
  Vertical Interval              yes          yes            no                        -lnv
  Field                          yes          yes            no                        -lnf

Ancillary Data Errors
  Header                         yes          yes            yes                       -anh
  Data                           yes          yes            yes                       -and
  Checksum                       yes          yes            yes                       -anc
  Placement                      yes          yes            yes                       -anp

Ancillary Audio Errors
  Block out of Sequence          yes          yes            yes                       -aus
  Broken Block                   yes          yes            yes                       -aui
  Samples / Frame                yes          yes            yes                       -aus
  5 / 5 Pattern Broken           yes          yes            yes                       -au5

Misc. Errors
  XY(Z)                          yes          no             no                        -mix
  Unused Space                   yes          no             no                        -miu
```

Figure B–5: Format Setup configuration file relationship to remote commands, part 1

```
Video Errors                    Log?       Highlight?    Capture?
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Luminance
  Low                           yes         yes           no                    -yel
  High                          yes         yes           no                    -yeh

 Chrominance
  Low                           yes         yes           no                    -cel
  High                          yes         yes           no                    -ceh

Video Warnings                  Log?       Highlight?    Capture?
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 Luminance
  Low                           yes         yes           no                    -ywl
  High                          yes         yes           no                    -ywh

 Chrominance
  Low                           yes         yes           no                    -cwl
  High                          yes         yes           no                    -cwh

EDH Errors                      Log?       Highlight?    Capture?
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
 EDH
  Full Field                    yes         yes           no                    -ehf
  Active Picture                yes         yes           no                    -ehp
  Anc. Data                     yes         yes           no                    -ehd

 EDA
  Full Field                    yes         yes           no                    -eaf
  Active Picture                yes         yes           no                    -eap
  Anc. Data                     yes         yes           no                    -ead

 IDH
  Full Field                    yes         yes           no                    -ihf
  Active Picture                yes         yes           no                    -ihp
  Anc. Data                     yes         yes           no                    -ihd

 IDA
  Full Field                    yes         yes           no                    -iaf
  Active Picture                yes         yes           no                    -iap
  Anc. Data                     yes         yes           no                    -iad

 UES                            yes         yes           no                    -ues

 EDH Misplaced                  yes         yes           yes                   -ems
 EDH Missing                    yes         yes           no                    -epl

 FIFO Overflow                  yes         yes           no                    -ues

Consecutive error(s) before logging:  2                                        -lin
Activate Relay:                 On Capture                                      -rly
```

Figure B–6: Format Setup configuration file relationship to remote commands, part 2

Table B–7: "n" Group keywords: 270Mb 525-Line Format Setup configuration file, part 2

Keyword	Description and Get/Set command examples

nyel	nyel sets the format for error detection response to a video low-luminance error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–6. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nyel A`
	`yes yes no`
	`VM700T> set nyel A yes yes yes`

nyeh	nyeh sets the format for error detection response to a video high-luminance error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–6. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nyeh A`
	`yes yes no`
	`VM700T> set nyeh A yes yes yes`

ncel	ncel sets the format for error detection response to a video low-chrominance error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–6. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get ncel A`
	`yes yes no`
	`VM700T> set ncel A yes yes yes`

nceh	nceh sets the format for error detection response to a video high-chrominance error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–6. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nceh A`
	`yes yes no`
	`VM700T> set nceh A yes yes yes`

nywl	nywl sets the format for error detection response to a video low-luminance warning during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–6. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nywl A`
	`yes yes no`
	`VM700T> set nywl A yes yes yes`

nywh	nywh sets the format for error detection response to a video high-luminance warning during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–6. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nywh A`
	`yes yes no`
	`VM700T> set nywh A yes yes yes`

ncwl	ncwl sets the format for error detection response to a video low-chrominance warning during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–6. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get ncwl A`
	`yes yes no`
	`VM700T> set ncwl A yes yes yes`

Table B–7: "n" Group keywords: 270Mb 525-Line Format Setup configuration file, part 2 (Cont.)

Keyword	Description and Get/Set command examples

ncwh	ncwh sets the format for error detection response to a video high-chrominance warning during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–6. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get ncwh A`
	`yes yes no`
	`VM700T> set ncwh A yes yes yes`

nehf	nehf sets the format for error detection response to an EDH full-field error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–6. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nehf A`
	`yes yes no`
	`VM700T> set nehf A yes yes yes`

nehp	nehp sets the format for error detection response to an EDH active-picture error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–6. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nehp A`
	`yes yes no`
	`VM700T> set nehp A yes yes yes`

nehd	nehd sets the format for error detection response to an EDH ancillary-data error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–6. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nehd A`
	`yes yes no`
	`VM700T> set nehd A yes yes yes`

neaf	neaf sets the format for error detection response to an EDA full-field error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–6. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get neaf A`
	`yes yes no`
	`VM700T> set neaf A yes yes yes`

neap	neap sets the format for error detection response to an EDA active-picture error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–6. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get neap A`
	`yes yes no`
	`VM700T> set neap A yes yes yes`

nead	nead sets the format for error detection response to an EDA ancillary-data error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–6. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nead A`
	`yes yes no`
	`VM700T> set nead A yes yes yes`

Table B–7: "n" Group keywords: 270Mb 525-Line Format Setup configuration file, part 2 (Cont.)

Keyword	Description and Get/Set command examples

nihf	nihf sets the format for error detection response to an IDH full-field error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–6. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nihf A`
	`yes yes no`
	`VM700T> set nihf A yes yes yes`

nihp	nihp sets the format for error detection response to an IDH active-picture error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–6. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nihp A`
	`yes yes no`
	`VM700T> set nihp A yes yes yes`

nihd	nihd sets the format for error detection response to an IDH ancillary-data error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–6. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nihd A`
	`yes yes no`
	`VM700T> set nihd A yes yes yes`

niaf	niaf sets the format for error detection response to an IDA full-field error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–6. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get niaf A`
	`yes yes no`
	`VM700T> set niaf A yes yes yes`

niap	niap sets the format for error detection response to an IDA active-picture error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–6. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get niap A`
	`yes yes no`
	`VM700T> set niap A yes yes yes`

niad	niad sets the format for error detection response to an IDA ancillary-data error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–6. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get niad A`
	`yes yes no`
	`VM700T> set niad A yes yes yes`

nues	nues sets the format for error detection response to an UES EDH error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–6. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nues A`
	`yes yes no`
	`VM700T> set nues A yes yes yes`

Table B–7: "n" Group keywords: 270Mb 525-Line Format Setup configuration file, part 2 (Cont.)

Keyword	Description and Get/Set command examples

nems	nems sets the format for error detection response to an EDH misplaced error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–6. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nems A`
	`yes yes yes`
	`VM700T> set nems A yes yes no`

nepl	nepl sets the format for error detection response to an EDH missing error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–6. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nepl A`
	`yes yes no`
	`VM700T> set nepl A yes yes yes`

nffo	nffo sets the format for error detection response to a FIFO overflow error during measurements on a 270 Mb 525-line video signal on the specified input channel. See Figure B–6. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), and Capture (yes/no).
	
	`VM700T> get nlin A`
	`yes yes no`
	`VM700T> set nlin A yes yes yes`

ncep	ncep sets the number of consecutive errors before log reporting for the specified input channel. You can use the following arguments with this command: SDI input channel (A/B), and number of errors. The range of values for the number of errors is from 1 error to 9 errors in steps of 1 error.
	
	`VM700T> get ncep A`
	`2`
	`VM700T> set ncep A 4`

nrly	nrly describes when the SDI Format Monitor application sets the GRLY keyword (refer to page B–29), allowing you to signal outside the VM700T that a limit was violated for the selected input channel. Measurements that are enabled to Highlight or Log when limits are exceeded cause the application to set the GRLY keyword when their state matches the defined nrly state. You can use the following arguments: A or B (SDI input channel), Never, On Highlight, On Log, and On Capture.
	
	`VM700T> get nrly A`
	`Never`
	`VM700T> set nrly A On Highlight`

"a" Group Keywords

"a" group keywords are channel dependent. They are used to set the digital audio setup parameters. Figure B–7 shows the relationship between the Digital Audio Setup configuration file and the "a" group keywords. Table B–8 lists the "a" group keywords and shows application examples using the `get` and `set` commands.

```
Digital_Audio~Setup/System~Default
```

```
┌─────────────────────────────────────────────────────────────────────┐          Remote
│                  Digital Audio Limits System Default File             │        Keywords
│                                                                       │           ⇩
│                                              Limits                    │
│                   Log?        Highlight?     Low          High        │
│─────────────────────────────────────────────────────────────────────│
│ Level:            yes         yes            -----        -----   dBr │         alvl
│ Frequency:        yes         yes            -----        -----   Hz  │         afrq
│ THD + N:          yes         yes            -----        -----   %   │         athd
│                                                                       │
│ Level Diff (L-R): yes         yes            -----        -----   dB  │         alvd
│ Phase     (L-R):  yes         yes            -----        -----   degrees│       aphd
│                                                                       │
│ dBr Reference:    -20 dBFS                                            │         adrf
│                                                                       │
│ Consecutive error(s) before logging:  2                              │         acep
│ Activate Relay:    Never                                             │         arly
└─────────────────────────────────────────────────────────────────────┘
```

Figure B–7: Digital Audio Setup configuration file relationship to remote commands

Table B–8: "a" Group keywords: Digital Audio Setup configuration file

Keyword	Description and get/set command examples

alvl	alvl sets the audio level limits to be used for measurements on the specified input channel. See Figure B–7. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), Low Limit (dBr), and High Limit (dBr). The possible values for the Low Level and High Level limits are –99 dBr through 99 dBr in increments of 1 dBr, and Undefined.
	
	`VM700T> get alvl A`
	`no yes -50 ---`
	`VM700T> set alvl A yes yes undef 50`

afrq	afrq sets the audio frequency limits to be used for measurements on the specified input channel. See Figure B–7. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), Low Limit (Hz), and High Limit (Hz). The possible values for the Low Frequency and High Frequency limits are 20 Hz through 20000 Hz in increments of 1 Hz, and Undefined.
	
	`VM700T> get afrq A`
	`no yes 0 ---`
	`VM700T> set afrq A yes yes undef 1000`

Table B–8: "a" Group keywords: Digital Audio Setup configuration file (Cont.)

Keyword	Description and get/set command examples

athd	athd sets the audio THD + N limits to be used for measurements on the specified input channel. See Figure B–7. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), Low Limit (%), and High Limit (%). The possible values for the Low THD + N and High THD + N limits are 0% through 100% in increments of 0.01%, and Undefined. You need only enter a new value to the most significant decimal point of the percentage you want to enter. Returned values are to two decimal places.
	
	`VM700T> get athd A`
	`no yes 0.00  ---`
	`VM700T> set athd A yes yes undef 10.1`

alvd	alvd sets the audio level difference limits to be used for measurements on the specified input channel. See Figure B–7. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), Low Limit (dB), and High Limit (dB). The possible values for the Low Level and High Level limits are –99 dB through 99 dB in increments of 1 dB, and Undefined.
	
	`VM700T> get alvd A`
	`no yes –50 ---`
	`VM700T> set alvd A yes yes undef 50`

aphd	aphd sets the audio phase limits to be used for measurements on the specified input channel. See Figure B–7. You can use the following arguments with this command: SDI input channel (A/B), Log (yes/no), Highlight (yes/no), Low Limit (degrees), and High Limit (degrees). The possible values for the Low Phase and High Phase limits are –180 degrees through 180 degrees in increments of 1 degree, and Undefined.
	
	`VM700T> get aphd A`
	`no yes –50 ---`
	`VM700T> set aphd A yes yes undef 50`

adrf	adrf sets the audio dBr reference to be used for measurements on the specified input channel. See Figure B–7. You can use the following arguments with this command: SDI input channel (A/B), and dBr reference. The range for the dBr reference is –99 dBFS through 0 dBFS in increments of 1 dBFS.
	
	`VM700T> get adrf A`
	`–20`
	`VM700T> set adrf A –50`

acep	acep sets the number of consecutive errors before log reporting for the specified input channel. You can use the following arguments with this command: SDI input channel (A/B), and number of errors. The range of values for the number of errors is from 1 error to 9 errors in steps of 1 error.
	
	`VM700T> get acep A`
	`2`
	`VM700T> set acep A 4`

arly	arly describes when the SDI Audio applications set the GRLY keyword (refer to page B–29), which allows you to signal outside the VM700T that a measurement limit was violated on the selected input channel. Measurements that are enabled to Highlight or Log when limits are exceeded cause the application to set the GRLY keyword when their measurement state matches the defined arly state. You can use the following arguments with this command: A or B (SDI input channel), Never, On Highlight, and On Log.
	
	`VM700T> get arly A`
	`Never`
	`VM700T> set arly A On Highlight`

"G" Group Keywords   Option 1S adds two commands to the existing "G" group keywords of the VM700T measurement set. Table B–9 describes the function of the two new "G" group keywords.

Table B–9: Option 1S "G" Group keywords: Remote configuration

Keyword	Description and Get/Set command examples

GDSR	GDSR sets the active channel (A or B) for the measured digital video source. The argument is an integer value of 0 or 1. Entering a 0 sets the digital active video source to Channel A, and entering a 1 sets the digital active video source to Channel B.
	
	```VM700T> get GDSR```
	```0```
	```VM700T> set GDSR 1```

GMMO	GMMO sets major operation mode of the VM700T measurement set to either analog or digital. The argument is an integer value of 0 or 1. Entering a 0 sets the operation mode to Analog, and entering a 1 sets the operation mode to Digital.
	
	```VM700T> get GMMO```
	```0```
	```VM700T> set GMMO 1```

Table B–10 describes the function of two existing "G" group keywords (from the analog VM700T) that can be used with Option 1S. The Option 1S application *<group letter>*rly keywords signal the VM700T to activate the GRLY keyword.

Table B–10: Analog VM700T "G" Group keywords: Remote configuration

Keyword	Description and Get/Set command examples

GOOL	GOOL sets the value of the global out-of-limits flag. The set command takes one argument, 0 (false) or 1 (true). This parameter is set to 1 whenever a measurement application finds a value outside of its lower-to-upper limit range. You can test the status of the global out-of-limits flag with the ?GOOL command. You must reset the global out-of-limits flag to 0 explicitly within a function; it does not return to 0 when tested.
	
	```VM700T> get GOOL```
	```0```
	```VM700T> set GOOL 1```

GRLY	GRLY sets the state of the Activate Relay which allows you to signal outside the VM700T that a measurement limit was violated. You can use this command in conjunction with the GOOL command to activate the Alarm relay. You can use the following arguments with this command: 0 (open relay) or 1 (close relay).
	
	```VM700T> get GRLY```
	```0```
	```VM700T> set GRLY 1```

Remote Soft Key Names

The following tables list the Option 1S soft key names to be used for remote control. All remote soft key names are made up of one word with no spaces. In cases where the actual soft key name has two words separated by a space, such as `Rising Edge`, the remote soft key name uses an "_" character to represent the space (`Rising_Edge`). In cases where the actual soft key name includes a selected argument, such as `Average: 0`, the remote soft key name includes only the function name (`Average`). The applications appear here in the same order as they appear in the *Reference* section of this manual.

Table B–11: SDI Eye Diagram application remote soft key names

Main menu							
Soft key name	Mode: Eye	Waveform	Measure		Cursors / Units	Average: 0	Rescale
Remote soft key name	Mode	Waveform	Measure		Cursors_Units	Average	Rescale
Waveform submenu							
Soft key name	Rising Edge	Falling Edge	Non–Transitn	Full Signal		Free Run	Filter: 10 Hz
Remote soft key name	Rising_Edge	Falling_Edge	Non_Transitn	Full_Signal		Free_Run	Filter
Measure submenu							
Soft key name	Meas. Box	Eye Amplitude	Rise\Fall Times	Rise\Fall Overshoot	Jitter	Rise Time Adjusted	Cable: None
Remote soft key name	Meas_Box	Eye_Amplitude	Rise_Fall _Times	Rise_Fall _Overshoot	Jitter	Rise_Time _Adjusted	Cable
Cursors/Units submenu							
Soft key name	Volt Cursor 1	Volt Cursor 2	Time Cursor 1	Time Cursor 2	Cursor to Center		Jitter Units: UI
Remote soft key name	Volt_Cursor_1	Volt_Cursor_2	Time _Cursor_1	Time _Cursor_2	Cursor_to _Center		Jitter_Units
Measurement and Limits submenu							
Soft key name	Mode: Limits		Filter: 10 Hz			Logging	Clear
Remote soft key name	Mode		Filter			Logging	Clear
Logging submenu							
Soft key name	Log				Log Port	File Append	File Overwrite
Remote soft key name	Log				Log_Port	File_Append	File_Overwrite

Table B–12: SDI Jitter application remote soft key names

Main menu

Soft key name	Rate: Frame	Filter: 10 Hz	Window: Hanning	Reference	Cursors / Units	Free Run	Rescale
Remote soft key name	Rate	Filter	Window	Reference	Cursors_Units	Free_Run	Rescale

Reference submenu

Soft key name	Save Act. as Ref			Display Active	Display Reference	Display Diff	
Remote soft key name	Save_Act _as_Ref			Display_Active	Display _Reference	Display_Diff	

Cursors/Units submenu

Soft key name	Waveform Cursor 1	Waveform Cursor 2	Spectrum Cursor 1	Spectrum Cursor 2	Cursor to Center		Jitter Units: UI
Remote soft key name	Waveform _Cursor_1	Waveform _Cursor_2	Spectrum _Cursor_1	Spectrum _Cursor_2	Cursor_to _Center		Jitter_Units

Table B–13: SDI Wander application remote soft key names

Main menu

Soft key name	Drift Rate	Frequency Offset	LP Corner 0.25 Hz	Cursor	Logging	Peak Hold	Rescale
Remote soft key name	Drift_Rate	Frequency _Offset	LP_Corner	Cursor	Logging	Peak_Hold	Rescale

Logging submenu

Soft key name	Log				Log Port	File Append	File Overwrite
Remote soft key name	Log				Log_Port	File_Append	File_Overwrite

Table B–14: SDI Format Monitor application remote soft key names

Main menu

Soft key name	Validate: 8/10–Bit	Check Audio	BrokenBlk Ch:		Error Map	Logging	Clear Counters
Remote soft key name	Validate	Check_Audio	BrokenBlk_Ch		Error_Map	Logging	Clear _Counters

Logging submenu

Soft key name	Log				Log Port	File Append	File Overwrite
Remote soft key name	Log				Log_Port	File_Append	File_Overwrite

Table B–15: SDI Format Monitor application remote measurement cell names

Measurement cells

Meas. cell name		Loss of Signal	Loss of TRS Align	
Remote soft key name		Loss_of _Signal	Loss_of _TRS_Align	
Meas. cell name	Length Line	Length Hblank	Length Vblank	Length Field
Remote soft key name	Length_Line	Length_Hblank	Length_Vblank	Length_Field
Meas. cell name	Anc. Data Header	Anc. Data Data	Anc. Data Checksum	Anc. Data Placement
Remote soft key name	Anc_Data _Header	Anc_Data _Data	Anc_Data _Checksum	Anc_Data _Placement
Meas. cell name	Ancillary Audio Sequence	Ancillary Audio BrokenBlk	Ancillary Audio Smpls/Frm	Ancillary Audio 5/5Pattrn
Remote soft key name	Anc_Audio _Sequence	Anc_Audio _BrokenBlk	Anc_Audio _Smpls/Frm	Anc_Audio _5/5Pattrn
Meas. cell name	Luminance Error Low	Luminance Warning Low	Luminance Warning High	Luminance Error High
Remote soft key name	Luma _Error_Low	Luma _Warn_Low	Luma _Warn_High	Luma _Error_High
Meas. cell name	Chrominance Error Low	Chrominance Warning Low	Chrominance Warning High	Chrominance Error High
Remote soft key name	Chroma _Error_Low	Chroma _Warn_Low	Chroma _Warn_High	Chroma _Error_High

Measurement cells

Meas. cell name	Miscellaneous XY(Z)	Miscellaneous Empty Spc	

Table B–15: SDI Format Monitor application remote measurement cell names (Cont.)

Measurement cells

Remote soft key name	Misc_XY(Z)	Misc _Empty_Spc	
Meas. cell name	EDH Full Field	EDH Active Picture	EDH Anc Data
Remote soft key name	EDH_Full _Field	EDH_Active _Picture	EDH_Anc _Data
Meas. cell name	EDA Full Field	EDA Active Picture	EDA Anc Data
Remote soft key name	EDA_Full _Field	EDA_Active _Picture	EDA_Anc _Data
Meas. cell name	IDH Full Field	IDH Active Picture	IDH Anc Data
Remote soft key name	IDH_Full _Field	IDH_Active _Picture	IDH_Anc _Data
Meas. cell name	IDA Full Field	IDA Active Picture	IDA Anc Data
Remote soft key name	IDA_Full _Field	IDA_Active _Picture	IDA_Anc _Data
Meas. cell name	EDH Missing	EDH Placement	EDH UES
Remote soft key name	EDH_Missing	EDH _Placement	EDH_UES

Table B–16: SDI Ancillary Data Analyzer application remote soft key names

Main menu

Soft key name	Validate: 8/10–Bit		Find Error	Find Pattern	Show Anc: All	Audio Group: All	ShowVideo & Empty
Remote soft key name	Validate		Find_Error	Find_Pattern	Show_Anc	Audio_Group	ShowVideo _&_Empty
Find Error submenu							
Soft key name	Find Next Backwards			Close Error Box			Find Next Forwards
Remote soft key name	Find_Next _Backwards			Close_Error _Box			Find_Next _Forwards

Table B–17: SDI Ancillary Data Analyzer application Find Pattern mode remote soft key names

Find Pattern mode

Soft key name		First Word		C	D	E	F
Remote soft key name		First_Word		C	D	E	F
Soft key name		Second Word		8	9	A	B
Remote soft key name		Second_Word		8	9	A	B
Soft key name		Third Word		4	5	6	7
Remote soft key name		Third_Word		4	5	6	7
Soft key name				0	1	2	3
Remote soft key name				0	1	2	3
Soft key name	Find Next Backwards	Close PattrnBox	Find Next Forwards	Binary 0	Binary 1	Binary (X)	Match Any (X)
Remote soft key name	Find_Next _Backwards	Close _PattrnBox	Find_Next _Forwards	Binary_0	Binary_1	Binary_(X)	Match _Any_(X)

Table B–18: SDI Ancillary Data Distribution Analyzer application remote soft key names

Main menu

Soft key name	Distribtn: Samples				Show Anc: All	Audio Group: All	Audio Units
Remote soft key name	Distribtn				Show_Anc	Audio_Group	Audio_Units

Table B–19: SDI Waveform application remote soft key names

Main menu

Soft key name	Mode: Stacked	Style: Smooth	Display	Cursors / Units	Reference	Free Run	Rescale
Remote soft key name	Mode	Style	Display	Cursors_Units	Reference	Free_Run	Rescale

Display submenu

Soft key name	Y	Cb	Cr			Units: IRE	Base: Hex
Remote soft key name	Y	Cb	Cr			Units	Base

Cursors/Units submenu

Soft key name	Pixel 1	Pixel 2	Sample Cursor	Cursor to Center		Units: IRE	Base: Hex
Remote soft key name	Pixel_1	Pixel_2	Sample _Cursor	Cursor_to _Center		Units	Base

Reference submenu

Soft key name	Save Act. as Ref			Display Active	Display Reference	Display Diff	
Remote soft key name	Save_Act _as_Ref			Display_Active	Display _Reference	Display_Diff	

Table B–20: SDI Lightning application remote soft key names

Main menu

Soft key name				Draw Numbers	Draw Lines	Amplitude	Rescale
Remote soft key name				Draw _Numbers	Draw_Lines	Amplitude	Rescale

Amplitude submenu

Soft key name			75% with 100% Flag	75%	100%		
Remote soft key name			75_with _100_Flag	75	100		

Table B–21: SDI Picture application remote soft key names

Main menu							
Soft key name	Default Bright	Default Contrast	Center Picture	Size: Large	Field: 1	Readouts: On	
Remote soft key name	Default_Bright	Default _Contrast	Center_Picture	Size	Field	Readouts	

Table B–22: SDI Audio Format Analyzer application remote soft key names

Main menu							
Soft key name	Source: Embedded	Group: 1	Channel: 1 & 2				Screen: Chan.Stat
Remote soft key name	Source	Group	Channel				Screen

Table B–23: SDI Audio Measurements application remote soft key names

Main menu							
Soft key name	Source: Embedded	Group: 1	Channel: 1 & 2			Logging	Clear
Remote soft key name	Source	Group	Channel			Logging	Clear
Logging submenu							
Soft key name	Log				Log Port	File Append	File Overwrite
Remote soft key name	Log				Log_Port	File_Append	File_Overwrite

Table B–24: SDI Interchannel Timing application remote soft key names

Main menu							
Soft key name	Relative Digital	Relative Analog					Rescale
Remote soft key name	Relative _Digital	Relative _Analog					Rescale

Table B–25: SDI Audio/Video Timing application remote soft key names

Main menu

Soft key name	Source: Embedded	Group: 1	Channel: 1 & 2	Offset	Offset mS: 0	Signal Placement	Rescale
Remote soft key name	Source	Group	Channel	Offset	Offset_mS	Signal _Placement	Rescale

Signal Placement submenu

Soft key name	TG2000 Mode	Vertical Interval	Active Video				
Remote soft key name	TG2000_Mode	Vertical _Interval	Active_Video				

Table B–26: Option 1S Select Line mode remote soft key names

Main menu

Soft key name	Next Field		Field 1 Line 21	Field 2 Line 21			
Remote soft key name	Next_Field		Field_Line_1	Field_Line_2			

Appendix C: Measurement Results Files

This section illustrates examples of the measurement results files that are produced by the SDI applications. Option 1S automatically produces a measurement results file for an SDI application when you exit that application. The measurement results file is written to the following directory path:

nvram0/ConfigFiles/Measurement~Results/<application name>

You can also create and view the measurement results files remotely when you execute the following sequence of commands:

execute *<application name>*

get results

show *<application name>*

Table C–1 lists the Option 1S application names to use for remote control. The measurement set also uses these names for application-specific file names.

Table C–1: Application names for remote control and file names

SDI_AncData	SDI_EyeDiagram	SDI_Picture
SDI_AncDist	SDI_Format	SDI_Wander
SDI_AudioFormat	SDI_IC_Timing	SDI_Waveform
SDI_AudioMeas	SDI_Jitter	
SDI_AV_Timing	SDI_Lightning	

Starting below, example measurement results files for each SDI application are shown on the following pages. The applications are listed in alphabetical order.

SDI Ancillary Data Analyzer Application (SDI_AncData)

```
Measurement Results         Channel A          Tue Mar 24 13:02:30
SDI_AncData                                        270Mb 525-line
Validate 8/10-Bit
Luminance   Legal Range: 040-3ac
Chrominance Legal Range: 040-3c0
----------------------------------------------------------------------
Line                  17
----------------------------------------------------------------------
```

SDI Ancillary Data Distribution Analyzer Application (SDI_AncDist)

```
Measurement Results         Channel A            Tue Mar 24 13:03:48
SDI_AncDist                                          270Mb 525-line
Samples   Show All
------------------------------------------------------------------------
Frame Total          32
Maximum              16
Minimum              0
------------------------------------------------------------------------
```

SDI Audio Format Application (SDI_AudioFormat)

```
Measurement Results         Channel A            Tue Mar 24 13:11:54
SDI_AudioFormat                                      270Mb 525-line
Source Embedded, Group: 1, Channel: 1 & 2
        Channel Status        Data  Byte          Status
------------------------------------------------------------------------
Ch. 1  Channel use              1    0        professional
Ch. 1  Data use                 0    0               audio
Ch. 1  Emphasis               110    0            50/15 us
Ch. 1  Locking of source        0    0              locked
Ch. 1  Sample frequency        01    0              48 kHz
Ch. 1  Channel mode          0001    1           2-channel
Ch. 1  User bits mode        0001    1     192-bit blocks
Ch. 1  AUX bits use           000    2       not indicated
Ch. 1  Audio word length      101    2             20 bits
Ch. 1  Reference signal        00    4         not a ref.
Ch. 1  Origin            80808080    6
Ch. 1  Destination       80808080   10
Ch. 1  Sample number         0000   14                   0
Ch. 1  Time of day           0000   18            00:00:00
Ch. 1  Block CRC         01010101   23            is valid
Ch. 2  Channel use              1    0        professional
Ch. 2  Data use                 0    0               audio
Ch. 2  Emphasis               110    0            50/15 us
Ch. 2  Locking of source        0    0              locked
Ch. 2  Sample frequency        01    0              48 kHz
Ch. 2  Channel mode          0001    1           2-channel
Ch. 2  User bits mode        0001    1     192-bit blocks
Ch. 2  AUX bits use           000    2       not indicated
Ch. 2  Audio word length      101    2             20 bits
Ch. 2  Reference signal        00    4         not a ref.
Ch. 2  Origin            80808080    6
Ch. 2  Destination       80808080   10
Ch. 2  Sample number         0000   14                   0
Ch. 2  Time of day           0000   18            00:00:00
Ch. 2  Block CRC         01010101   23            is valid
------------------------------------------------------------------------
```

SDI Audio Measurements Application (SDI_AudioMeas)

```
Measurement Results         Channel A          Tue Mar 24 13:11:00
SDI_AudioMeas                                  270Mb 525-line
Source Embedded, Channel: 1 & 2, Group: 1, 0 dBr = -20 dBFS
Measurement                   Cur     Min     Max    MinL    MaxL  Units
----------------------------------------------------------------------
Left  Level                  -0.0    -0.0    -0.0     ---     ---   dBr
Right Level                 -10.0   -10.0   -10.0     ---     ---   dBr
Left  Frequency             800.0   800.0   800.0     ---     ---   Hz
Right Frequency            2000.0  2000.0  2000.0     ---     ---   Hz
Left  THD + N              0.0017  0.0017  0.0017     ---     ---   %
Right THD + N              0.0044  0.0044  0.0044     ---     ---   %
Level Difference             10.0    10.0    10.0     ---     ---   dB
Phase                       -72.0   -72.0   144.0     ---     ---   deg
Left  Stuckbits (23-20)     ----
Left  Stuckbits (19-16)     ----
Left  Stuckbits (15-12)     ----
Left  Stuckbits (11-08)     ----
Left  Stuckbits (07-04)     ----
Left  Stuckbits (03-00)     0000
Right Stuckbits (23-20)     ----
Right Stuckbits (19-16)     ----
Right Stuckbits (15-12)     ----
Right Stuckbits (11-08)     ----
Right Stuckbits (07-04)     ----
Right Stuckbits (03-00)     0000
----------------------------------------------------------------------
```

SDI Audio/Video Timing Application (SDI_AV_Timing)

```
Measurement Results         Channel A          Tue Mar 24 13:01:43
SDI_AV_Timing                                  270Mb 525-line
Source: Embedded, Group: 1, Channel: 1 & 2, TG2000 Mode
----------------------------------------------------------------------
Audio delay                 -------------- ms
----------------------------------------------------------------------
```

SDI Eye Diagram Application (SDI_EyeDiagram)

```
Measurement Results        Channel A        Tue Mar 24 13:04:53
SDI_EyeDiagram                                  270Mb 525-line
Measurement                Cur    Min    Max    MinL    MaxL  Units
-----------------------------------------------------------------------
Amplitude                  491    165    491   720.0   880.0  mv   *
Rise-Time                  965      0   1321   400.0  1500.0  ps   *
Fall-Time                 1013      0   1659   400.0  1500.0  ps   *
Rise/Fall Diff.             48      0    367     ---   500.0  ps
Rise Overshoot             1.9    0.0  361.1     ---    10.0  %    *
Fall Overshoot             1.6    0.0   19.1     ---    10.0  %    *
DC Offset               2093.0    9.8 2093.0  -500.0   500.0  mv   *
Alig. Jitter (1 kHz)       260     10   2971     ---   250.0  ps   *
Cable Len (Bel. 8281)        0                                meters
-----------------------------------------------------------------------
```

SDI Format Monitor Application (SDI_Format)

```
Measurement Results        Channel A        Tue Mar 24 13:15:29
SDI_Format                                      270Mb 525-line
Validate 8/10-Bit
Check Audio
BrokenBlk Ch: Off
Luminance   Legal Range: 040-3ac
Chrominance Legal Range: 040-3c0
Error Type              Count        Status
-----------------------------------------------------------------------
Loss of Signal          0            display,log
Loss of TRS Align       0            display,log
Line Length             0            display,log
Horz. Blanking Length   0            display,log
Vert. Blanking Length   0            display,log
Length of Field         0            display,log
Ancillary Header        0            display,log
Ancillary Data          0            display,log
Ancillary Checksum      0            display,log
Ancillary Placement     0            display,log
Anc. Audio Sequence     0            display,log
Anc. Audio Broken Block 0            display,log
Anc. Audio Smpls/Frame  0            display,log
Anc. Audio 5/5 Pattern  0            display,log
Luma Warning Low        0            display,log
Luma Warning High       0            display,log
Luma Error Low          0            display,log
Luma Error High         0            display,log
Chroma Warning Low      0            display,log
Chroma Warning High     0            display,log
Chroma Error Low        0            display,log
```

```
                      Chroma Error High      0                 display,log
                      XY(Z) Status Word      0                 display,log
                      Blanking Empty Space   0                 display,log
                      EDH FF                 0                 display,log
                      EDH AP                 0                 display,log
                      EDH AD                 0                 display,log
                      EDA FF                 0                 display,log
                      EDA AP                 0                 display,log
                      EDA AD                 0                 display,log
                      IDH FF                 0                 display,log
                      IDH AP                 0                 display,log
                      IDH AD                 0                 display,log
                      IDA FF                 0                 display,log
                      IDA AP                 0                 display,log
                      IDA AD                 0                 display,log
                      EDH Missing            0                 display,log
                      EDH Placement          0                 display,log
                      EDH UES                0                 display,log
                      FIFO Overflow          0                 display,log
                      Errored Seconds        0                 display
                      Elapsed Seconds        5                 display
                      ---------------------------------------------------------------
```

SDI Interchannel Timing Application (SDI_IC_Timing)

```
                      Measurement Results        Channel A          Tue Mar 24 12:59:47
                      SDI_IC_Timing                                 270Mb 525-line
                      Relative to digital
                      ---------------------------------------------------------------
                      Delta (from A)          --------------uSecs
                      ---------------------------------------------------------------
```

SDI Jitter Application (SDI_Jitter)

```
                      Measurement Results        Channel A          Tue Mar 24 13:04:23
                      SDI_Jitter                                    270Mb 525-line
                      ---------------------------------------------------------------
                      Display             Frame   Rate
                      Filter              10      Hz
                      Timing Jitter       0.028   UI
                      Alignment Jitter    0.020   UI
                      ---------------------------------------------------------------
```

SDI Lightning Application (SDI_Lightning)

```
Measurement Results          Channel A          Tue Mar 24 13:14:03
SDI_Lightning                                    270Mb 525-line
Field = 1  Line = 17
Reference
  Colorbars:  75% SMPTE/EBU
  Pk-white (100%) 700.0 mV,  Color Pk-to-Pk 525.0 mV
------------------------------------------------------------------
Color Pk-to-Pk B-Y      0.0           mV
Color Pk-to-Pk R-Y      0.0           mV
Pk-white                0.0           mV
Delay B-Y           -------------- ns
Delay R-Y           -------------- ns
------------------------------------------------------------------
```

SDI Picture Application (SDI_Picture)

```
Measurement Results          Channel A          Tue Mar 24 13:16:54
SDI_Picture                                      270Mb 525-line
------------------------------------------------------------------
 Fld 1  Ln  22              24-Mar-98 13:16:54          Peak   781 mV
 Black    0 mV       270Mb 525-line (Auto detect)    White  714 mV
------------------------------------------------------------------
```

SDI Wander Application (SDI_Wander)

```
Measurement Results          Channel A          Tue Mar 24 12:58:26
SDI_Wander                                       270Mb 525-line
Drift Rate, LP Corner = 0.5 Hz
------------------------------------------------------------------
Maximum                 15.45         ppb/sec
Minimum                 -7.79         ppb/sec
Peak                    0.06          Hz
------------------------------------------------------------------
```

SDI Waveform Application (SDI_Waveform)

```
Measurement Results          Channel A          Tue Mar 24 12:57:36
SDI_Waveform                                     270Mb 525-line
------------------------------------------------------------------
Line                    17
------------------------------------------------------------------
```

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