WVR7100
Waveform Rasterizer
Quick Start User Manual

www.tektronix.com
071-1588-00

Tektronix

Tektronix, Inc., P.O. Box 500, Beaverton, OR 97077

WARRANTY

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

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

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

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Table of Contents

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.

Connect and Disconnect Properly. Connect the probe output to the measurement instrument before connecting the probe to the circuit under test. Disconnect the probe input and the probe ground from the circuit under test before disconnecting the probe from the measurement instrument.

Ground the Product. This product is grounded through the grounding conductor of the 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 Note Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

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 Productc. 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:

CAUTION
Refer to Manual

WARNING
High Voltage

Protective Ground
(Earth) Terminal

Preface

This manual describes installation and operation of the WVR7100 Waveform Rasterizer. This instrument rasterizes serial digital video and composite video signals (depending on installed options) for an XGA display, providing a new standard of display quality and flexibility. Basic operations and concepts are presented in this manual. For more detailed information, see the online help on your rasterizer.

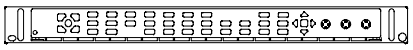
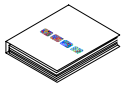
Key Features

The WVR7100 uses digital processing to ensure accurate, stable, and repeatable measurements, and provide a powerful monitoring solution for broadcasting, production, and post-production environments. The base instrument monitors HD component inputs, and can be ordered with options that add monitoring of SD component inputs, of analog composite inputs, and of multiple-channel audio. See *Options* on page 2 for information on options.

Key WVR7100 features include:

- FlexVu, a four-tiled display enabling you to quickly check the integrity of the signal, can present four views of the signal simultaneously to monitor several aspects of the signal at the same time.
- A high-resolution XGA output for crisp, high-quality, easy-to-read display that well supports the needs of production and post-production applications. Such applications include camera shading and alignment, color balancing, film-to-tape and format conversion, and special-effects work.
- A friendly menu-driven user interface that requires fewer keystrokes for the most common operations, and five instrument Presets for save and quick recall of commonly used configurations
- Support for digital applications, with high definition (and with Option SD, standard definition) Serial Digital Interface (SDI) inputs.
- Support for Analog applications when equipped with optional analog composite monitoring
- Fully Digital Processing for accurate, repeatable, drift-free operation that surpasses traditional analog designs.
- Measurements and displays that help check performance and solve problems faster, such as:
  - Traditional waveform displays, both overlay and parade
  - Vector display, both traditional and Lightning
  - Gamut monitoring, including Arrowhead, Diamond, and Split Diamond
  - Support for AES, analog, and embedded audio, both level and phase relationship
  - Gain, sweep, and magnification controls
  - Configurable alarms and error logging
  - Exclusive Session screens for content status at a glance
- Full remote control for complete installation flexibility
- Audio Option for digital AES/EBU monitoring or for both digital and analog monitoring

Documentation

Item	Purpose	Location
WVR7100 Waveform Rasterizer Quick Start User Manual	Installation and high-level operational overview. (This manual.)	
WVR7100 Online Help	In depth operation and UI help	
WVR7100 Waveform Rasterizer Performance Verification and Specifications	Procedure for checking performance and list of specifications	 WWW.Tektronix.com
WVR & WFM Series Programmer Manual	Programmers command reference for controlling the instrument	 WWW.Tektronix.com
WVR7100 Waveform Rasterizer Service Manual	Optional manual supporting module-level servicing of the instrument	

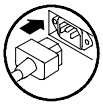
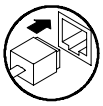
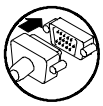
Contacting Tektronix

Phone	1-800-833-9200 [1]
Address	Tektronix, Inc. Department or name (if known) 14200 SW Karl Braun Drive P.O. Box 500 Beaverton, OR 97077 USA
Web site	www.tektronix.com
Sales support	1-800-833-9200, select option 1 [1]
Service support	1-800-833-9200, select option 2 [1]
Technical support	www.tektronix.com/support 1-800-833-9200, select option 3 [1] 6:00 a.m. - 5:00 p.m. Pacific Standard Time

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

Conventions Used in this Manual

The following icons are used throughout this manual.

Sequence Step	Connect power	Network	SVGA
1			

Before Installation

Check Package Contents

Unpack the instrument, and check that you received all items listed as *Standard Accessories*. Recommended accessories, instrument options, and upgrades are also listed in this section. Check the Tektronix website (www.tektronix.com) for the most current information.

Standard Accessories

Documents

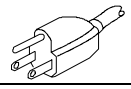
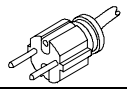
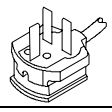
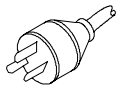
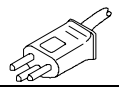
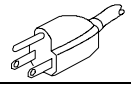
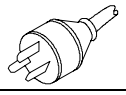
The following documents are standard accessories:

- *WVR7100 Waveform Rasterizer Quick Start User Manual*, Tektronix part number 071-1588-XX.
- *WVR7100 Waveform Rasterizer Release Notes*, Tektronix part number 061-4295-XX.
- *WVR7100 Waveform Rasterizer Documents CD*, Tektronix part number 020-2612-00.

Power Cords

The WVR7100 Waveform Rasterizer is shipped with one of the following power cord options. Power cords for use in North America are UL listed and CSA certified. Cords for use in areas other than North America are approved by at least one authority acceptable in the country to which the product is shipped.

Power cord identification

Plug configuration	Normal usage	Option number
	North America 120 V	Standard
	Universal Euro	A1
	United Kingdom	A2
	Australia	A3
	Switzerland	A5
	Japan	A6
	China	AC

Optional Accessories

- *WVR7100 Waveform Rasterizer Service Manual*, Tektronix part number 071-1589-XX.
- Analog/Audio Breakout Cable Assembly, Tektronix part number 012-1658-01.

Options

The WVR7100 ships with support for monitoring high definition (HD) serial digital signals. You can add any or all of the following options:

- Option SD – adds support for monitoring standard definition (SD) serial digital signals
- Option CPS – adds support for monitoring composite analog signals
- Option DG – adds Digital audio support
- Option DA – Adds Digital/Analog audio support
- Option RFP – configures instrument with a remote panel

Installation

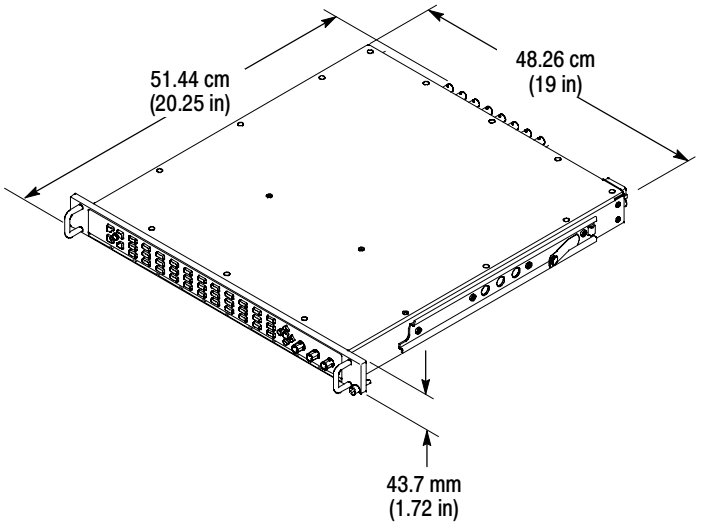
This section provides instructions for installing the waveform rasterizer into a standard instrumentation rack for both the standard configuration and when configured with the remote front panel option. At installation time, save the shipping carton and packing materials (including the anti-static bag) in case you need to ship the instrument.

Rackmount Installation

The waveform rasterizer ships with hardware for rackmounting and fits in a standard 19-inch rack. Requirements of the rack follow:

- Spacing between the front rails must be at least 17-¾ inches.
- Front-to-rear rail spacing must be between 15-½ and 28 inches.
- Six inches of clearance between the instrument rear panel and any rear cabinet panel for connector space and to provide adequate air circulation.

Instrument dimensions are shown at right.

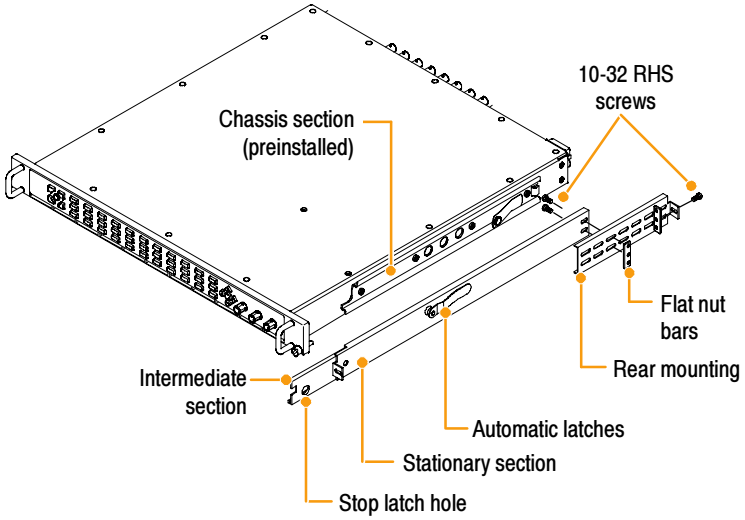


Mounting the Slide Tracks

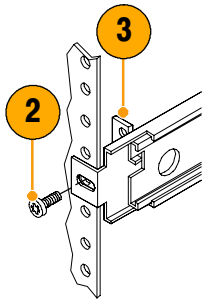
The procedure covers rear rail mounting details for both deep and shallow racks.

1. Mount the rails using the enclosed hardware as shown at right.

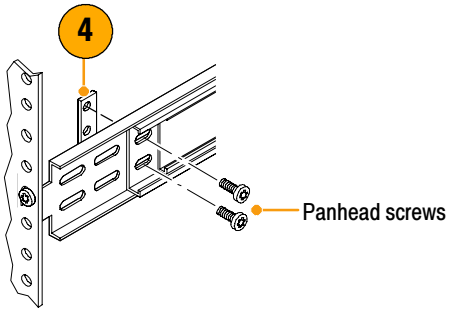
   ***NOTE**: Right hand and left hand stationary section is designated by the RH and the LH marked on the rails. Stop latch holes should be towards the bottom when slides are in place. (The right hand rail is shown.)*



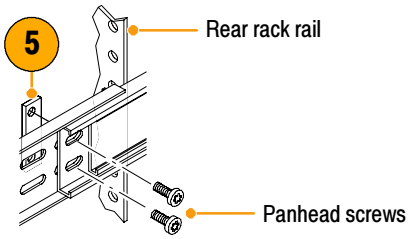
2. Screw-mount to the front rail as shown.
3. Install Bar nut if the front rail mounting hole is not tapped.



4. For a deep configuration, rear mount as shown. Make sure that the stationary sections are horizontally aligned, level, and parallel.



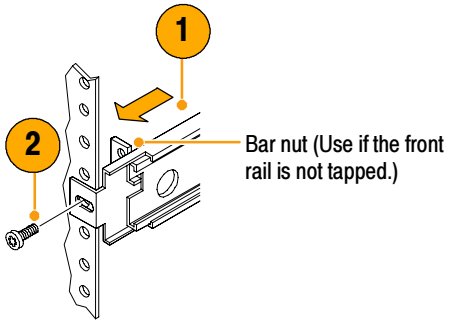
5. Alternately, for a shallow configuration, rear mount as shown. Make sure that the stationary sections are horizontally aligned, level, and parallel.



Rack Adjustments

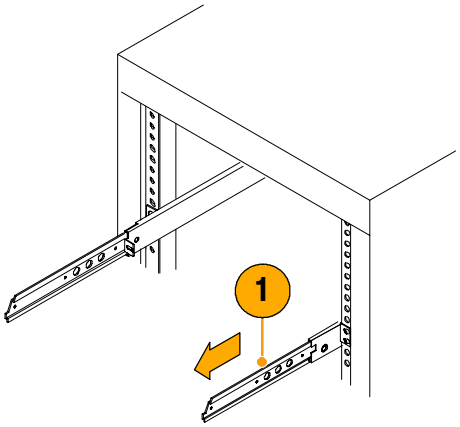
If, after installation, the slide tracks bind, adjust the tracks as follows.

1. Slide the instrument out about 10 inches, slightly loosen the screws holding the tracks to the front rails, and allow the tracks to seek an unbound position.
2. Retighten the screws and check the tracks for smooth operation by sliding the instrument in and out of the rack several times.

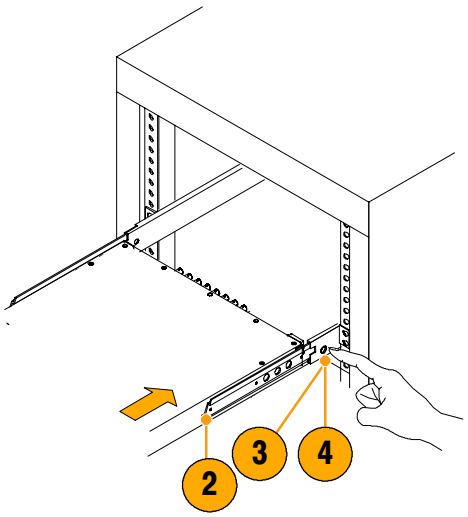


Installing the Instrument

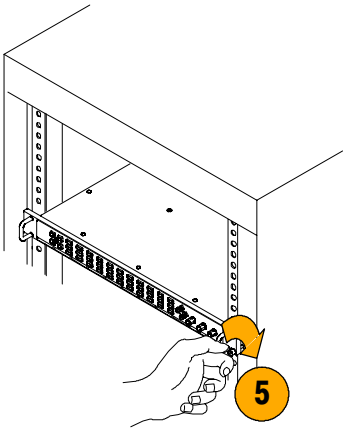
1. Pull the slide-out track section to the fully extended position.



2. Insert the instrument chassis sections into the slide-out sections.
3. Press the stop latches, and push the instrument toward the rack until the latches snap into their holes.
4. Press the stop latches again, and push the instrument fully into the rack.



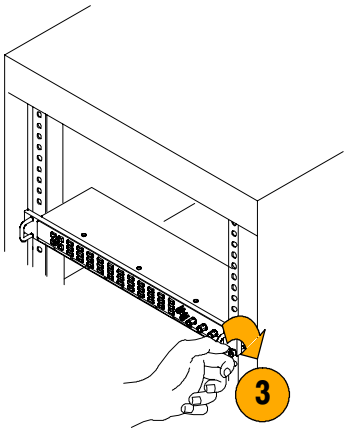
5. Tighten the front-panel retaining screws.



Installing the Instrument when Option RFP-Equipped (Remote Front Panel)

1. Install the main instrument using the procedures on page 3.
2. Choose a suitable remote location, which must be reachable by the connecting cable. (Option RFP equipped instruments come with a 25 ft. cable; maximum length allowed is 100 ft.)
3. Mount the RFP module by inserting in the rack and tightening the front-panel retaining screws.

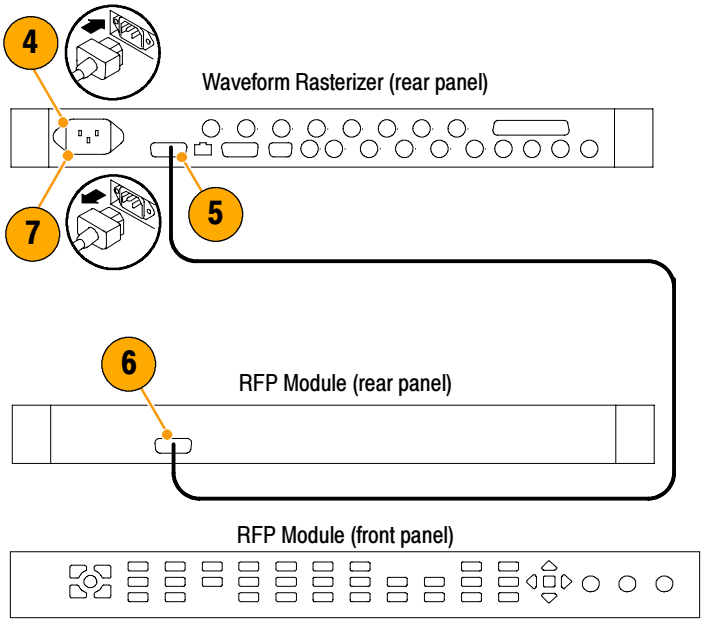
   NOTE. *The RFP module mounts using the front-panel retaining screws only. There are no rackmount rails present or required.*



4. If the instrument is powered on, disconnect its power cord.
5. Connect one end of the cable to the connector labeled Front Panel on the rear of the instrument.
6. Route the cable to the location chosen in step 2. Connect the cable to the connector at the rear of the RFP module.
7. Plug the instrument in to restore power and initialize the RFP module.

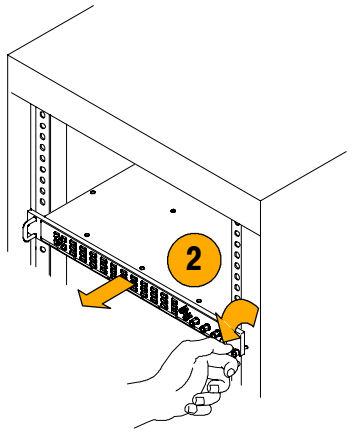
   NOTE. *All front-panel operations in this manual apply to the RFP module as well.*

   NOTE. *For additional information, see* Using the Remote Front Panel *on page 78.*

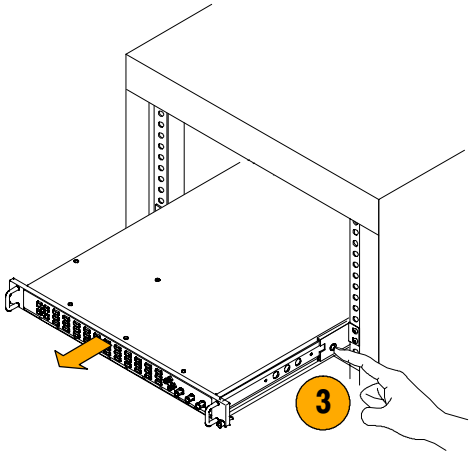


Removing the Instrument

1. Before removing the instrument, be sure to disconnect all cabling.
2. Loosen retaining screw and pull instrument outward until the stop latches snap into the holes.



3. Press stop latches (visible in the stop-latch holes) and carefully slide the instrument free from the tracks.



Rack Slide Maintenance

The slide-out tracks do not require lubrication. The dark gray finish on the tracks is a permanent, lubricated coating.

Connecting a Display

First, loosen the front-panel knurled retaining screw. See step 2 on page 7. Grasp the front handles, and pull the instrument out until all three slide sections latch. The instrument is firmly held in this position.

You are now ready to connect power and signal cables to the instrument.

The WVR7100 supports standard analog PC monitors, either CRT or LCD. The display resolution is 1024 X 768 (XGA). Connect the external display to the rear-panel XGA OUTPUT connector. The XGA OUTPUT connector is a standard 15-pin D-type connector with socket contacts. To select the display type, display the CONFIG menu, select Display Setting, and then Picture Refresh Mode. Select CRT or Interlaced for Monitors and LCD for LCD displays. Push the HELP button after selecting Picture Refresh Mode for information about these settings.

Connecting Power and Powering On/Off

The waveform rasterizer operates from a single-phase power source with the neutral conductor at or near earth ground. The line conductor is fused for over-current protection. A protective ground connection through the grounding conductor in the power cord is essential for safe operation.

AC Power Requirements

The waveform rasterizer operates from an AC line frequency of 50 or 60 Hz, over the range of 100-240 Volts, without the need for configuration, except the power cord. Refer to page 1 for the power cord options.

The typical power draw is 50 W. Refer to the *Specifications and Performance Verification* on the *Documents CD* for additional information on power and environmental requirements.

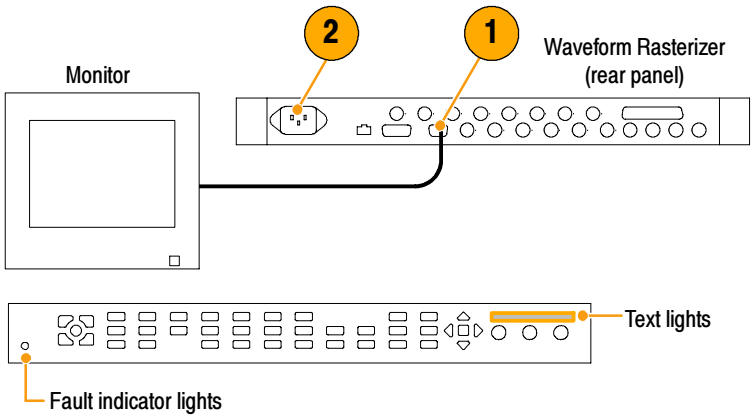
Connect the supplied power cord to the rear-panel power connector. There is no power switch on the waveform rasterizer, so the instrument will turn on as soon as you apply power.

Incoming Inspection

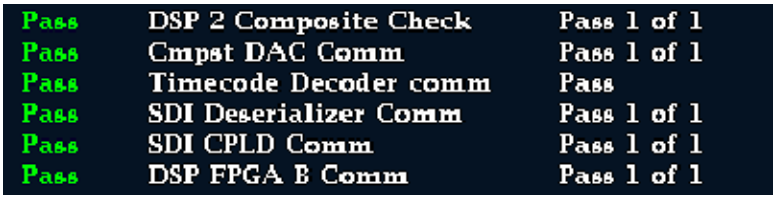
At your option, you can complete the following incoming inspection procedures. These procedures require no equipment aside from a display, to check functionality. They are are not a performance verification; that is included in the document Performance Verification and Specification Technical Reference found on the CD that shipped with this instrument.

Basic Turn On and Self Test

1. Connect a XGA monitor to the waveform rasterizer.
2. Connect the AC line cord to the rear of the instrument and to a 100 to 240 VAC source. There is no power switch on the waveform rasterizer, so the instrument will turn on as soon as you apply power.
3. Look at the front panel immediately after you apply power. All the buttons, the text over the three knobs, and the the **Fault** indicator should all light up.
4. After a couple of seconds, the lights in the buttons and text will turn off.
5. After about 15 seconds the fault light should turn off.
6. Also after about 15 seconds, the Power on diagnostic page should appear on the monitor.



7. Verify that all self tests pass. Any failures will be shown in Red. The results of the Power on diagnostics are erased from the screen, but you can view them by selecting **CONFIG** > **Utilities** > **View Diagnostics Log**. Part of the log is shown right.

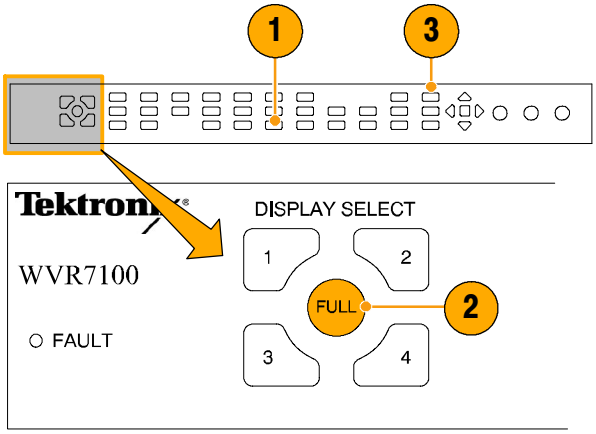


8. After the diagnostics are finished, the instrument state will be restored. When the progress indicator in the lower-right part of the screen is finished, the instrument has finished initializing.

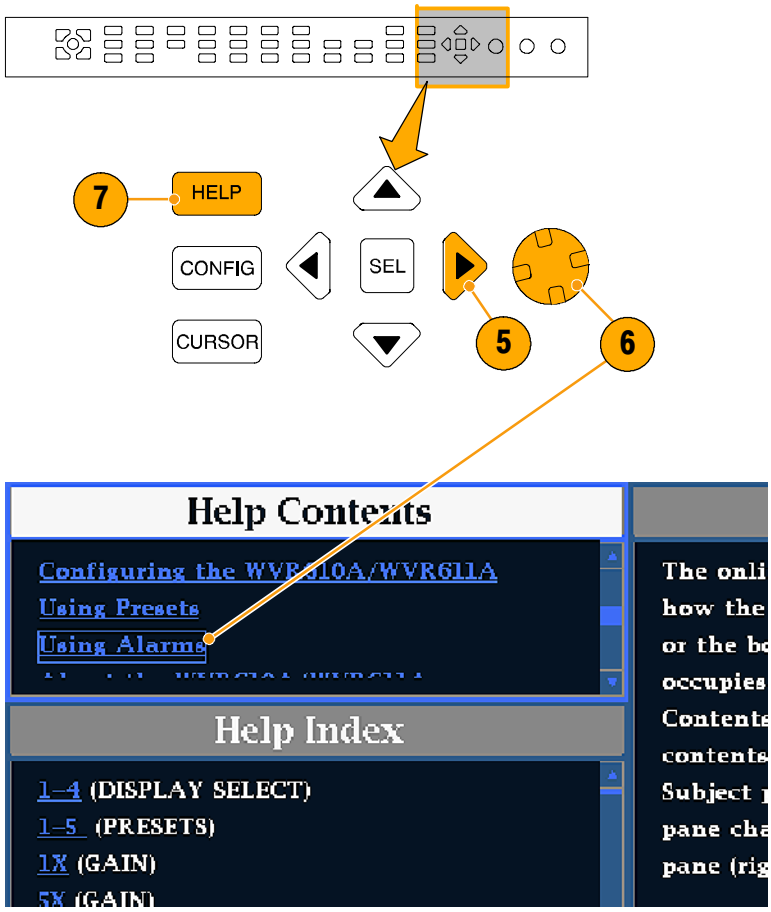
Front Panel Test

1. Press **FACTORY** to restore the factory preset. Wait for the process to complete as indicated by the progress indicator.
2. Press **FULL** to make the active tile be full screen.
3. Press **HELP** to display the help screens.
4. Press all the other buttons.

   Each one should flash as you press it. Most buttons bring up help text for that button in the help screen. (Some buttons, such as the presets, bring up the same information.) The HELP and the four arrow and the SEL keys do not bring up help text since they traverse the help panes and content.

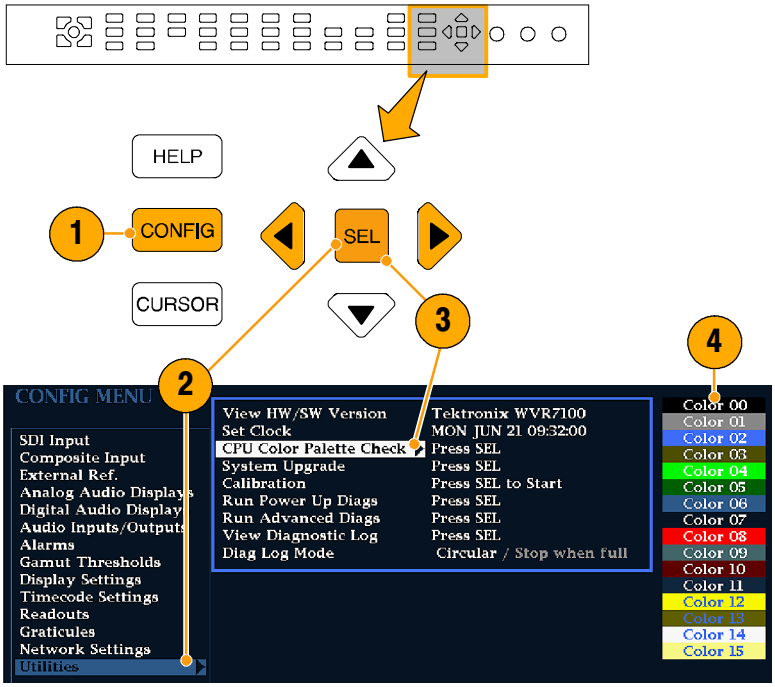


5. Press the right arrow key until the **Help Contents** pane in the upper-left corner is highlighted.
6. Turn the **GENERAL** knob and verify the selector box moves up and down the list.
7. Press **HELP** to exit help.

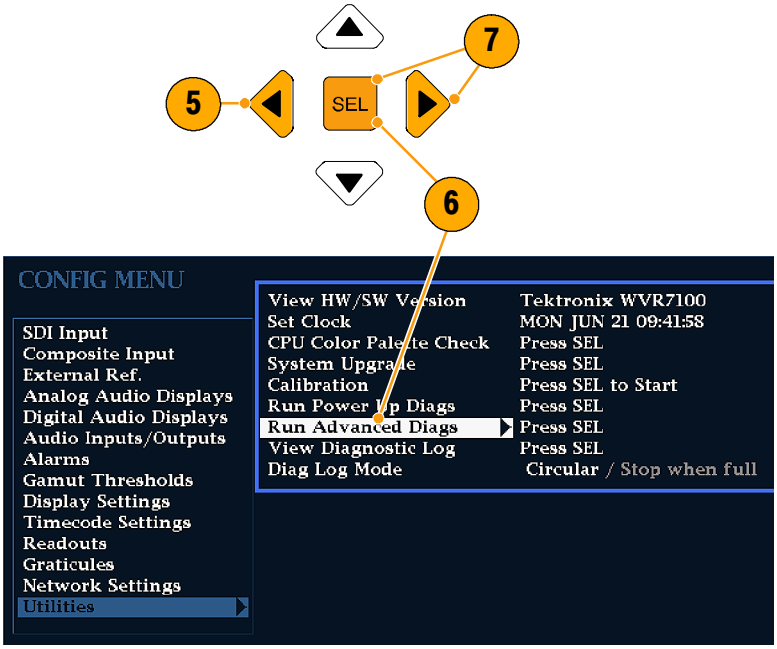


XGA and Extended Diagnostics Test

1. Press **CONFIG** to display the CONFIG menu.
2. Select **Utilities**, and then press **SEL**.
3. Select **CPU Color Palette Check**, and then press **SEL**.
4. Verify that 16 distinct colors are displayed. This tests the XGA data path from the CPU.



5. Press the left arrow key to change the menu focus back to the **Utilities** submenu.
6. Select **Run Advanced Diags** and then press **SEL**.
7. Use the right-arrow key to highlight the **Continue** box and then press **SEL** to run the test.
8. Verify the XGA DAC is working by looking at the White and Red steps at the top of the screen, and at the Green and Blue ramps at the bottom of the screen. They should not have steps but should instead have a smooth transition from dark to light.



9. Verify the frequencies shown are within 10 kHz, and that rates shown are within 0.1 μs, of the nominal values listed at right.
10. Verify that all the tests in the middle section of the screen have a green **Pass** status.
11. Verify that the bus bit activity tests (labeled Channel A:, Processor Video:, and Composite Video:, and appearing at the bottom of the screen) are as follows:
    - All three tests show both a red and a green bar in each bit location.
    - The Processors Video test shows 8 bits from the CPU, a space, then Hsync, a space, Vsync, a space and then the blank line. It is normal for the V sync bit to blink occasionally.
12. Press **SEL** or cycle the power to reboot the unit for normal operation.

- QDR Clock = 25.175 MHz
- VGA clock = 64.000 MHz
- Audio PLL1 = 12.288 MHz
- Audio PLL2 = 12.288 MHz
- Hsync rate : Width = 2.2 μs
- Vsync rate : Width = 63 μs

Fan Test

If the fault light in the lower left corner of the front panel is not on (Red), then the fans are running. You should also be able to hear them and feel air coming out the back of the instrument. At low temperatures the fans will turn slowly and be very quiet. Record Pass or Fail for Fan Test in the test record.

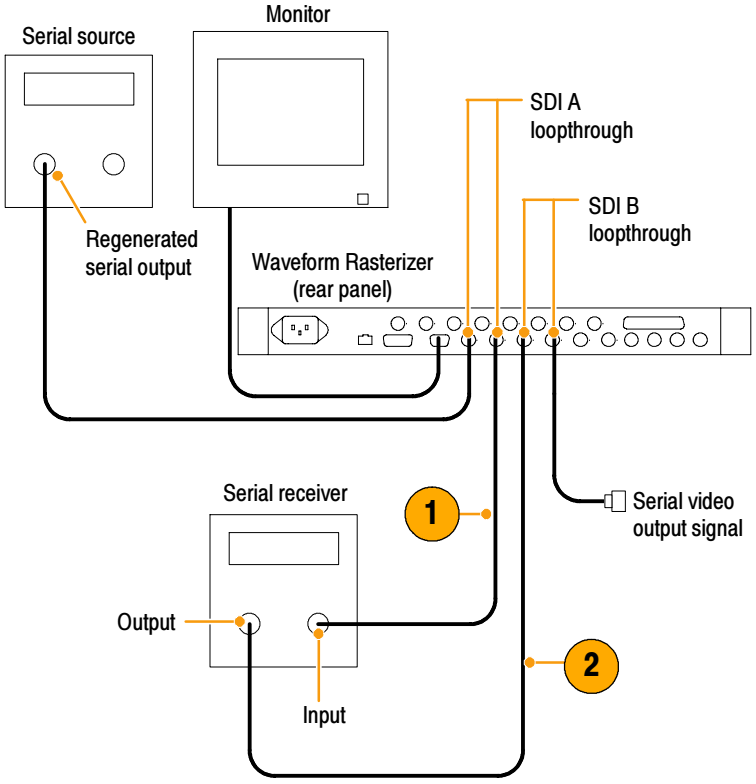
Installing in a Video System

The waveform rasterizer can operate almost anywhere in the distribution system due to its high impedance, bridging, and loop-through inputs. This section describes two types of connections and presents information on line termination. The following diagrams are for serial digital systems, but similar connections are common for the analog composite inputs on the WVR7100.

To install for monitoring the video bit stream of a serial receiver

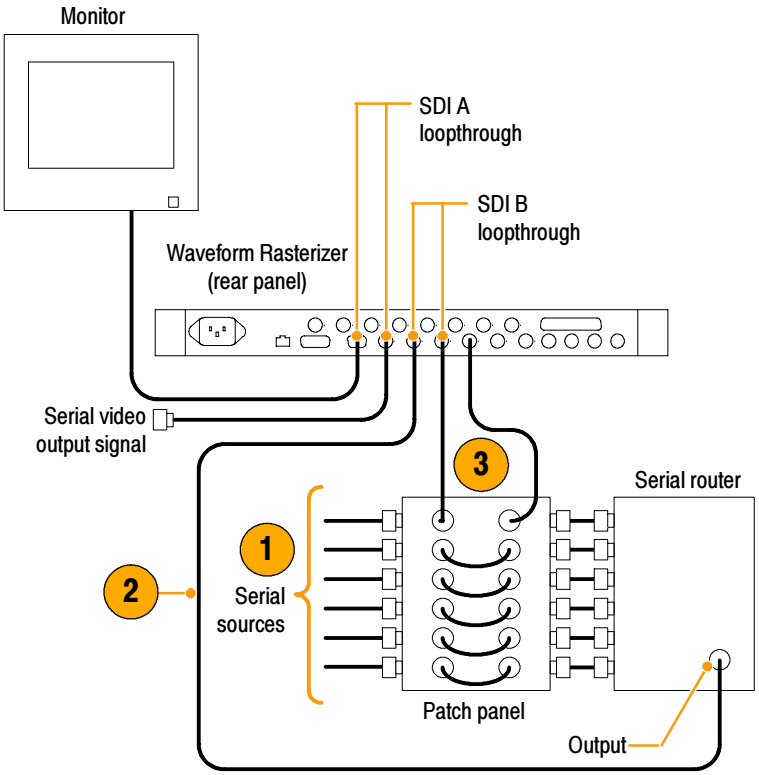
1. Route the incoming serial signal through one of the waveform rasterizer loop-though inputs.
2. Connect the output of the serial receiver to the other loop-through input, so you can compare the incoming signal and the regenerated output signal.

   NOTE. *See the Specifications on the* WVR7100 Documents CD *for maximum cable lengths allowed.*



To install monitoring serial digital signals around a routing switcher

1. Connect your serial sources through a patch panel to a serial router.
2. Connect the output of the serial router to a SDI loop through input for comparison.
3. Connect the other SDI loop-through input to the patch panel to jumper the signal that you want to compare to signal connected in step 2.



Line Termination

The waveform rasterizer uses passive loop-through serial and analog inputs. Accordingly, the loop-through must be terminated externally. It is important that this external termination meet accuracy and return loss requirements.

If the waveform rasterizer 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 the waveform rasterizer is sufficiently high that, in most cases, the destination receiver sets the system return loss.

In cases where the waveform monitor is placed at the end of a link, a BNC termination must be installed on one side of the loop-through connector. The termination must be 75 Ω and DC coupled (good return loss extends to DC). Return loss should exceed 25 dB from 10 kHz to 270 MHz for SDI. Return loss should exceed 40 dB from DC to 6 MHz for composite. An appropriate terminator would be Canare part number BCP-TA. It is a 75 Ohm 1%, BNC, 26 dB return loss to 2 GHz, End of Line termination.

Compatibility of BNC Center Pins

Most video equipment BNC connectors, whether 50 or 75 Ω, use a 50 Ω standard center pin. Some laboratory 75 Ω BNC connectors use a smaller diameter center pin. The BNC connectors on the waveform rasterizer are designed to work with the 50 Ω standard (large diameter) center pins.

Do not use connectors or terminators with the smaller center pins. They could cause intermittent connections.

Connecting to Monitors and Projectors Issues

Some monitors or projectors may have trouble adapting to the XGA output from the waveform rasterizer. This is because there may not be any significant signal in all four corners of the raster, so the monitor cannot find the edges of the active area. To overcome this, select Status in all four tiles of the waveform rasterizer display, and then cycle the power on the monitor to force it to reconfigure. If necessary, adjust the horizontal and vertical position and size to optimize the image, and set the Picture Refresh Rate to match the monitor (see *Connecting a Display* on page 7).

How to Operate Your Instrument

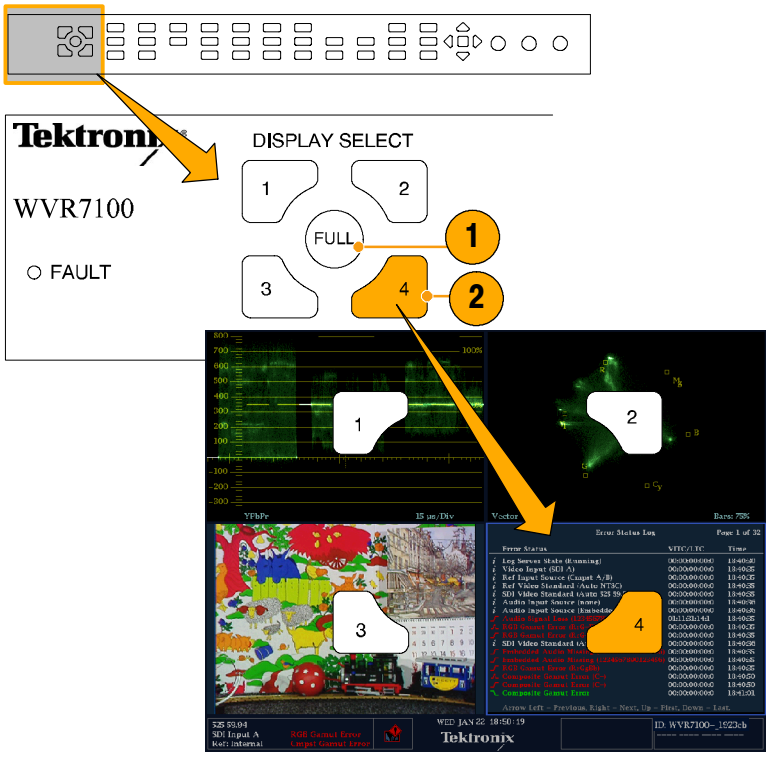
Getting Acquainted

The WVR7100 uses a flexible, tiled display. The waveform rasterizer can display four tiles at one time. Each tile can display a different measurement, effectively creating four independent instruments. To enable the tiles to function independently, most of the controls only affect one tile at a time.

To Control the Display:

1. To switch to tiled mode, toggle the FULL button until it is unlit and there are four displays shown.
2. To select a tile to control, push one of the numbered tile buttons.

   Note that the button you select lights and that a light-blue outline surrounds the tile. Both the lit button and the light-blue outline indicate the active, selected tile. Tile 4 is shown selected here.

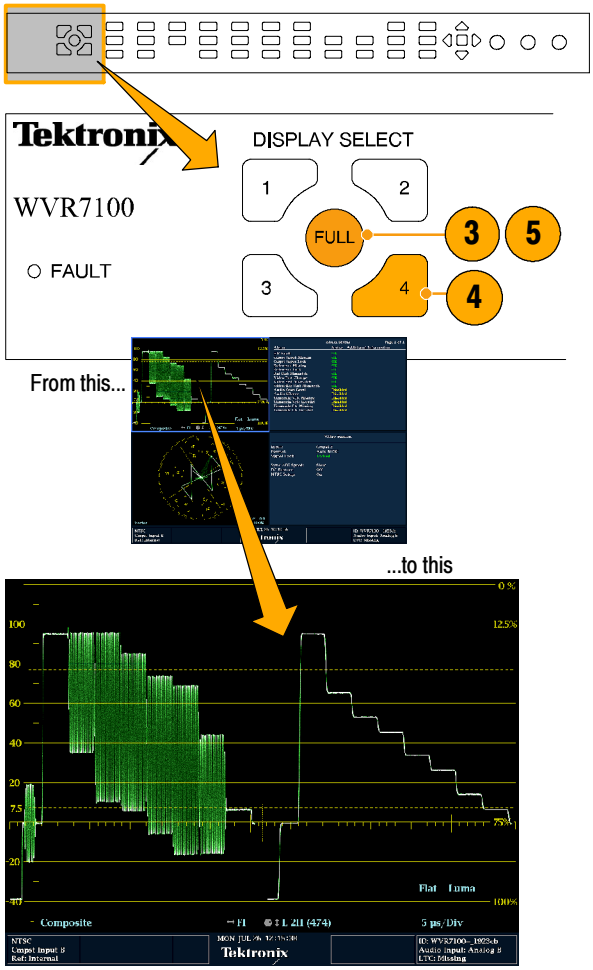


3. To display the selected tile full screen, toggle the FULL button until it is lit and the selected tile fills the screen.

   In a full display, the displayed tile is always selected.

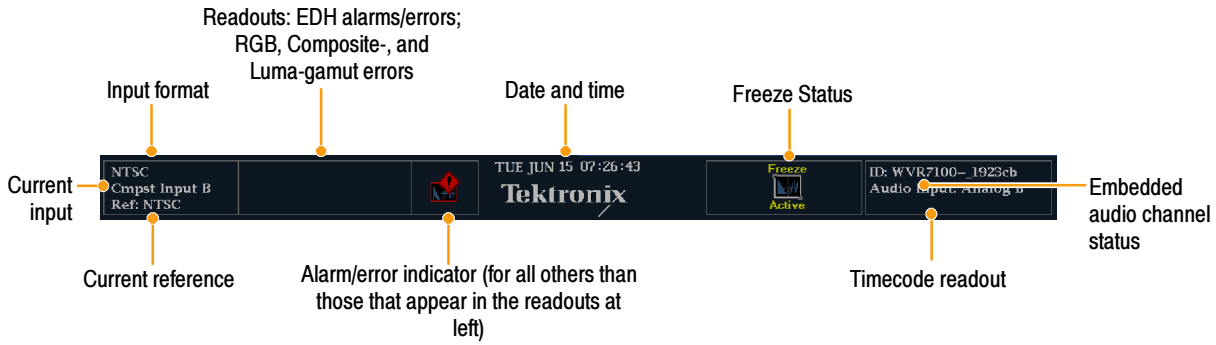
4. To select another tile, just push its button. The tile you select will replace the previously selected tile, displaying full screen.

5. Push the FULL button again to toggle to the four-tile display.



To Determine Status At-a-Glance

The Status Bar, located at at the bottom of the waveform rasterizer display, shows information on the status of instrument and of the monitored signal. The various elements detailed below describe the conditions that you can see at a glance in the Status Bar.



Display element	Description
Input Format	Text indicating the format of the signal on the selected input or whether signal is missing or unlocked.
EDH Error	A one-line area that is visible if EDH errors are present.
RGB Gamut Error[1]	A one-line area that is visible if RGB gamut errors are present.
Composite Gamut Error[1]	A one-line area that is visible if Composite gamut (Arrowhead) errors are present.
Luma Gamut Errors	A one-line area that is visible if Luma errors are present.
Alarm/Error Indicator	An icon visible when alarms of types other than those in the four readouts just listed occur.
Date and Time	Readout of the date and time (set in CONFIG > Utilities).
Instrument Name	Name assigned to the waveform rasterizer in the CONFIG > Utilities menu.
Audio Channel Status	A 16-character string indicating embedded audio channel status. Each character shows the status of a specific channel: **-** for not present and **P** for present.
Timecode readout	A readout showing the selected time format.
Current Reference	Text indicating the source of the current reference. Possible references are: Ext., Internal. Also indicates format and whether the reference is missing or unlocked.
Current Input	Text indicating the selected input. Possible inputs are: SDI A, SDI B, Cmpst A, Cmpst B (depending on installed options). Also indicates if the current input is not in Auto mode and is unlocked.

1 Because RGB and Composite Gamut messages appear on the same line in the display, if both RGB and Composite Gamut errors are present at the same time, the message “RGB and Cmpst Gamut” will appear.

Status Bar Icons

Display Icons	Description
	Warning - Appears when an alarm or error triggers.
	Alarms Muted - Appears when the alarms are muted from the STATUS pop-up menu.
	Remote Access - Appears when the waveform rasterizer is accessed from the network. For example, when the sending commands to the waveform rasterizer from the remote interface.
	Alarms Disabled - This text appears in the Status Bar when Alarms are disabled from the Configuration menu.
	Freeze Active - Appears when the tiles are frozen.

Front-Panel Controls

***NOTE**. This section flags controls that depend on which options are installed on the Waveform Rasterizer. Refer to the procedure* Using a Web Browser *and step 9 (page 73) of that procedure to determined which options are installed on your rasterizer.*

Three Levels of Control

You control the waveform rasterizer on three levels:

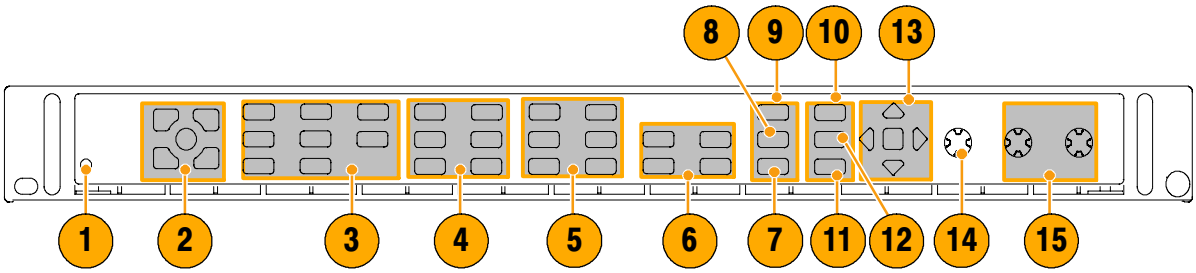
- **Frequently changed settings.** The front-panel buttons control the most commonly changed parameters, such as which measurement appears in each tile. The knobs are used to adjust levels and make selections.
- **Tile-specific settings.** Pop-up menus control parameters that are specific to the tile in which they are displayed. The pop-up menus control less frequently changed parameters such as the waveform display mode (for example, changing the waveform display mode from RGB to YPbPr). To display a pop-up menu, press and hold the desired MEASURE SELECT or DISPLAY SELECT button for about a second.
- **Instrument-wide settings.** The parameters in the Configuration menu are instrument-wide settings. The configuration menu controls settings that are changed only occasionally, such as changing waveform color or setting the network address.

Scope of Controls

Some controls are global and affect all tiles, while other controls only affect the active tile. Generally speaking, if a control is configured by front-panel buttons or by a pop-up menu, it is tile specific. (Exceptions are the Input buttons, and all audio features, both of which are global.) If control is configured by the Config menu, selections are usually global.

Layout and Usage

The front panel elements are shown below, referenced to the usage procedures that explain their operation.

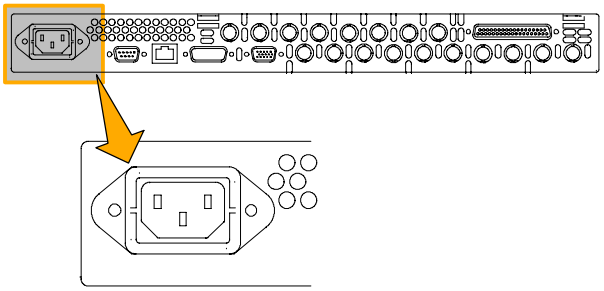


Index	Control Element or Group	Usage Procedures
1	FAULT (alarm) light	None. Indicates a hardware problem requiring servicing
2	Tile-selector and tile buttons	*To control the display* on page 16
3	Measurement buttons	*To select a measurement* on page 26 *To Set Measurement Parameters* on page 26
4	Gain and Sweep Buttons	*To Set Gain and/or Sweep* on page 29
5	Preset Buttons	*To Use Presets* on page 30
6	Input Selection Buttons[1]	*To Select Among Inputs* on page 28
7	Line Select button	*To Set Line Select Mode* on page 35
8	Ext REF	*To Use the Traditional Method* on page 53
9	Freeze button	*To Freeze the Display* on page 32
10	Help button	*To Use Online Help* on page 37
11	Cursors button	*To Measure Waveforms with Cursors* on page 31
12	Configuration menu button	*To Configure Your Instrument* on page 36
13	Up/Down/Left/Right Arrow keys and Sel Button	Demonstrated in *To Set Measurement Parameters* on page 26
14	General Knob	Demonstrated in *To Select/Adjust a Parameter* on page 36
15	Vertical and Horizontal Knobs	None. Use to position waveforms when displayed in tiles or full screen.

[1] Composite buttons present for Option CPS-equipped instruments only.

Rear-Panel Controls

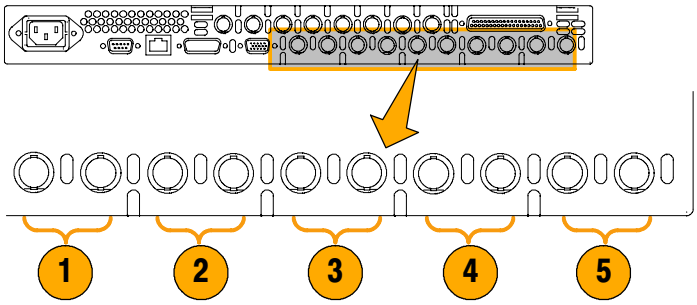
Power Requirements



- A single-phase power source with one current-carrying conductor at or near earth-ground (the neutral conductor).
- A power source frequency is 50 or 60 Hz, and a operating voltage range is from 100 to 240 VAC, continuous.
- Systems with both current-carrying conductors live with respect to ground (such as phase-to-phase in multiphase systems) are not recommended as power sources.

NOTE. *Only the line conductor is fused for over-current protection. The fuse is internal.*

Video Input Connectors



All are passive, loop-through inputs, compensated for 75 Ω

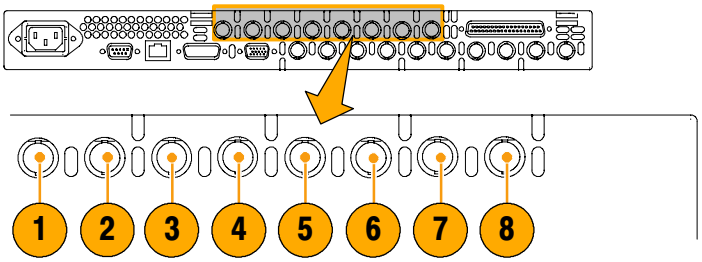
1. **SDI A Loop-through**. The A component serial digital input[1]
2. **SDI B Loop-through.** The B component serial digital input[1]
3. **Ref Loop-through.** Asynchronization input. The input signal can be analog black burst or analog composite video.
4. **Composite A Loop-through.** The A composite analog input[2]
5. **Composite B Loop-through.** The B composite analog input[2]

1 Accept HD inputs only unless Option SD-equipped. Option SD-equipped instruments accept and automatically detect both HD and SD signals.

2 Input not present unless instrument Option CPS-equipped.

AES A/B Connectors

These BNC connectors support AES audio inputs based on the audio options installed.



Connector Label

1. AES A 1-2 In
2. AES A 3-4 In
3. AES A 5-6 In
4. AES A 7-8 In
5. AES B 1-2 I/O[1]
6. AES B 3-4 I/O[1]
7. AES B 5-6 I/O[1]
8. AES B 7-8 I/O[1]

Connector Label Key:

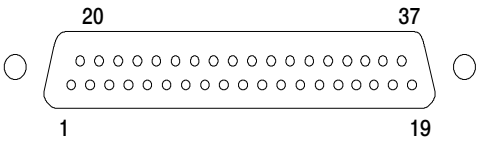
AES A AES B	1-2 3-4 5-6 7-8	In I/0
A or B	Channels supported	Input or Input/Output

[1] The AES B connectors can output embedded audio channels when configured from the Configuration menu.

Analog Input/Output Connector

The Analog I/O connector is used to input and output analog signals. The Analog I/O connector is a 37-pin, D-subminiature connector. Pin out and pin names follow.

CAUTION. *Use care when connecting the Analog Audio Output. Refer to the instrument Specifications, to ensure Audio Load and Output Power meet specifications. Exceeding Analog Audio Output Power may result in damage to the instrument.*



Key:

ANALOG_INPUT ANA_OUT	_L _R	N P	0 1 2	_A _B
Balanced differential analog audio input or output	Left Right	N=Negative P=Positive	Pair 0 Pair 1 Pair 2	Input A Input B

Pin	Pin name	Pin	Pin name
1	ANALOG_INPUT_LP0_A	2	ANALOG_INPUT_LP0_B
3	ANALOG_INPUT_RP0_A	4	ANALOG_INPUT_RP0_B
5	ANALOG_INPUT_LP1_A	6	ANALOG_INPUT_LP1_B
7	ANALOG_INPUT_RP1_A	8	ANALOG_INPUT_RP1_B
9	ANALOG_INPUT_LP2_A	10	ANALOG_INPUT_LP2_B

Pin	Pin name	Pin	Pin name
11	ANALOG_INPUT_RP2_A	12	ANALOG_INPUT_RP2_B
13	GND (Ground)		
14	ANA_OUT_LN0	15	ANA_OUT_RN0
16	ANA_OUT_LN1	17	ANA_OUT_RN1
18	ANA_OUT_LN2	19	ANA_OUT_RN2
20	ANALOG_INPUT_LN0_A	21	ANALOG_INPUT_LN0_B
22	ANALOG_INPUT_RN0_A	23	ANALOG_INPUT_RN0_B
24	ANALOG_INPUT_LN1_A	25	ANALOG_INPUT_LN1_B
26	ANALOG_INPUT_RN1_A	27	ANALOG_INPUT_RN1_B
28	ANALOG_INPUT_LN2_A	29	ANALOG_INPUT_LN2_B
30	ANALOG_INPUT_RN2_A	31	ANALOG_INPUT_RN2_B
32	ANA_OUT_LP0	33	ANA_OUT_RP0
34	ANA_OUT_LP1	35	ANA_OUT_RP1
36	ANA_OUT_LP2	37	ANA_OUT_RP2

Pair to instrument inputs mapping

Pair Label	Analog Input[2]
L0	1
R0	2
L1	3
R1	4
L2	5
R2	6

[2] The left/right pair labels their mapped to inputs apply both the instrument inputs and, when used, the optional breakout cable inputs.

Connecting Signals. When connecting audio signals to the Analog Input connectors, you can use either balanced or unbalanced signals. If you connect unbalanced signals to the inputs, you do not have to ground the unused lead (grounding the unused lead can reduce noise).

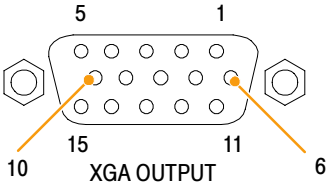
When connecting the Analog Output connectors, you can connect them as balanced or unbalanced. However, if you connect the balanced outputs to an unbalanced input, you must ground the unused lead. You can ground either lead.

***NOTE**. Note that grounding the unused lead does not attenuate the output but it does halve the clipping level. Therefore, you must attenuate the output by at least 6 dB to avoid clipping. The output signal level in unbalanced mode is double the signal level in balanced mode.*

Units that have both analog and digital capability can have AES or embedded inputs converted to analog and then routed to the six balanced outputs.

XGA Connector and Pin Out

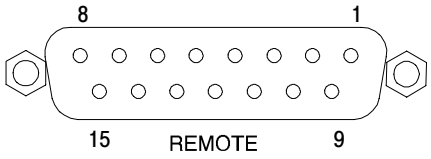
This is the display output. The display resolution is 1024 x 768, in 16 colors. The output is compatible with standard analog PC monitors, either CRT or LCD-based. The REMOTE connector is a 15-pin D-type connector with socket contacts.



Pin	Pin name
1	Red Video
2	Green Video
3	Blue Video
4	Not connected
5	Ground
6	Red Ground
7	Green Ground
8	Blue Ground
9	+5 V (For monitor EEPROM)
10	Not Connected
11	Not Connected
12	ID Bit (Supports I^2C polling)
13	Horizontal Sync
14	Vertical Sync
15	ID Clock

Remote Connector and Pin Out

The REMOTE connector interface uses ground closures for remote control and indicating to external equipment when alarms have occurred. The input of LTC is through the REMOTE connector. The REMOTE connector is a 15-pin D-type connector with socket contacts.



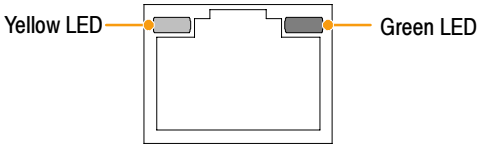
Pin	Pin name
1	Reserved for future use
2	GRD
3	Reserved for future use
4	Reserved for future use
5	Recall Preset 1
6	GRD
7	+Time Code (IN) (Logitudinal Time Code inputs)
8	-Time Code (IN) (Logitudinal Time Code inputs)
9	Output (Goes to GRD if alarm asserted and if enabled)

10	Reserved for future use
11	Reserved for future use
12	Reserved for future use
13	Recall Preset 2 (IN)[1]
14	Recall Preset 3 (IN)[1]
15	Recall Preset 4 (IN)[1]

[1] Asserting one of the Preset signals causes the associated front-panel preset to be applied to the waveform rasterizer. Assert a pin by connecting it to ground.

Ethernet Connector

The waveform rasterizer provides a 10/100 BaseT Ethernet interface. The Ethernet connector is a standard RJ-45 connector.



- Lit Green LED indicates connection is active
- Lit Yellow LED indicates a 100 MB transmission rate
- Unlit Yellow LED indicates a 10 MB transmission rate

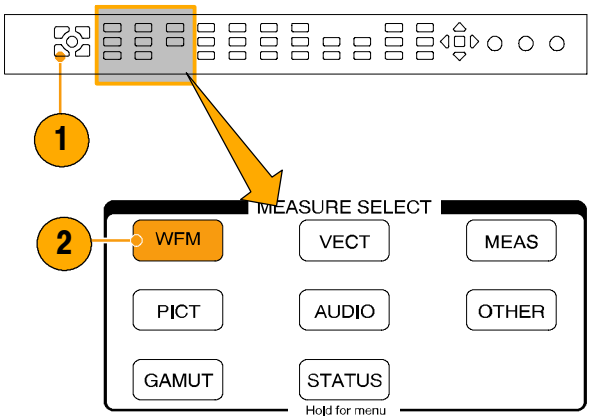
To Select a Measurement

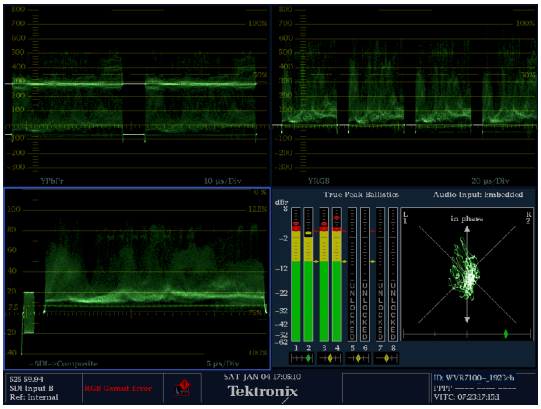
After you have selected a tile, you can choose what to display in it. Measurement/Display type is independent for each tile.

1. Select a tile as instructed in *To Control the Display* on page 16.
2. Push a button corresponding to the measurement that you want to display in the selected tile:
   - WFM - described on page 41
   - PICT - described on page 46
   - GAMUT - described on page 51
   - VECT - described on page 42
   - AUDIO - described on page 47
   - STATUS - described on page 52
   - MEAS - described on page 44
   - OTHER - (LTC display) described on page 49
3. Repeat steps 1 and 2 until you have selected measurement displays for all tiles that you wish to define.
4. To display the same measurements in more than one tile, select each tile in sequence, and then choose the same measurement for each one.

   The display at right shows the display with WFM selected for three tiles.

   NOTE. *Audio is the only measurement that can be displayed in only one tile at a time.*



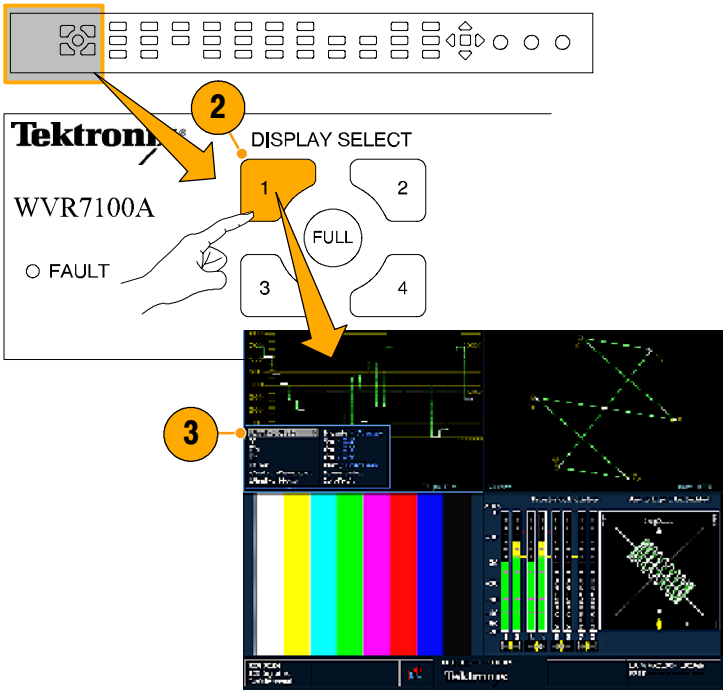


To Set Measurement Parameters

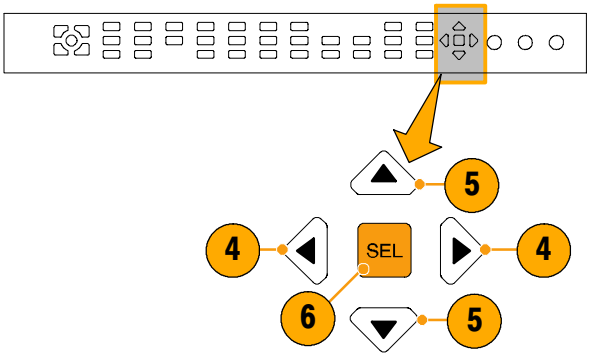
You can set up the measurements that you display using pop-up menus. Pop-up menus appear in the active tile. In general, they control only settings specific to the active tile. For example, the pop-up menu for the Waveform display enables you to specify the Display Mode.

The pop-up menu will appear when called (see procedure that follows), unless it is not appropriate for the current setting of the waveform rasterizer (for example, trying to display the Gamut menu when viewing a composite input signal).

1. Display the measurement in one of the four tiles as explained in *To Select a Measurement* on page 26.
2. Push and hold the tile button for the measurement that you displayed in step 1.

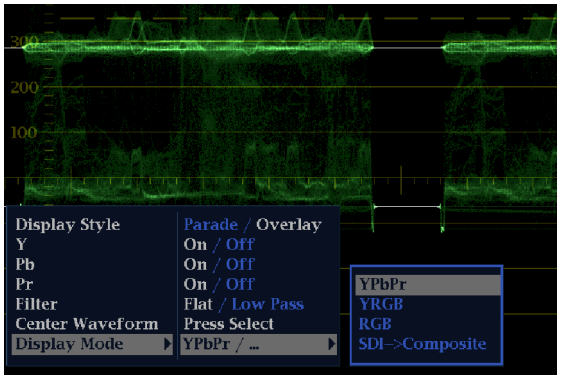


3. When the menu pops up, navigate it and make your selections as described in the steps that follow.
4. Use the right and left keys to traverse between menu panels. The instrument surrounds the panel selected with a blue border .
5. Use the up and down arrow keys to select parameters in a menu.
6. Press **SEL** to set the selected parameter.



The WFM pop-up menu with display mode set to YPbPr is shown.

NOTE. *The selections in a pop-up menu can change depending on settings.*



To Select Among Inputs

You can connect high-definition component signals and select them for display in a tile. Depending on the options that you ordered with your instrument, you can also connect standard-definition component signals and analog composite signals.

To select a component input

1. Connect any digital component video signals to the A and B SDI inputs at the rear panel.

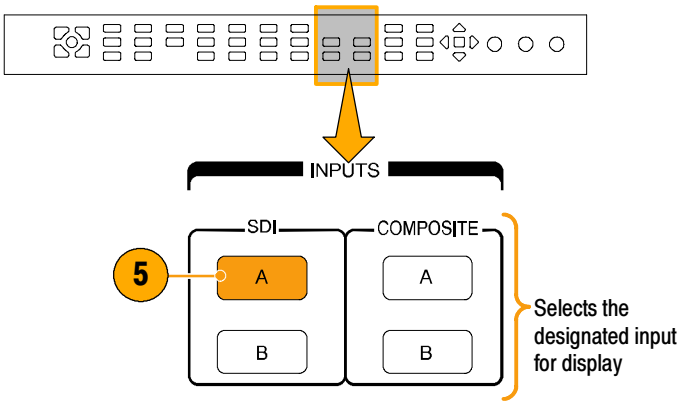
   If Option SD is installed, the instrument automatically detects whether input is HD or SD; otherwise connect HD signals only.

2. Connect any analog composite signals to the A or B Composite inputs at the rear panel. (On Option CPS equipped instruments only.)

3. Terminate the loop through input properly at the rear panel for any inputs that you connected.

4. Select a tile and measurement in which to display the input.

5. Press the button corresponding to the input selected in step 4 (SDI Input A shown in example).

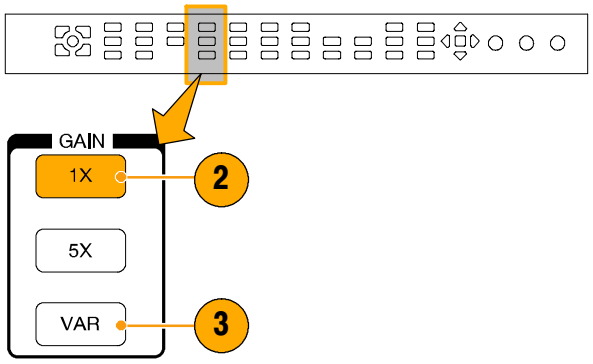


To Set Gain and/or Sweep

Each tile maintains its own settings independent of the other tiles. These settings include GAIN and SWEEP, and Display Type (among others). For instance, when you switch a tile to a different measurement, the GAIN and SWEEP settings will be changed to what they were the last time the selected measurement was displayed in the tile. As the procedure below indicates, GAIN and SWEEP do not apply to all display types.

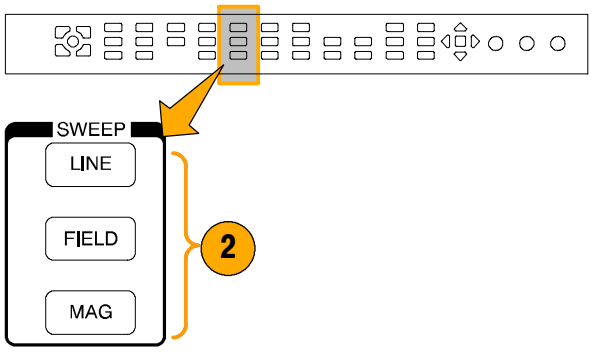
To set Gain:

1. Select a tile and a measurement (see *To Select a Measurement* on page 26 if you need help).
2. If GAIN is selectable, one of the GAIN buttons will be lit; otherwise select a measurement that supports GAIN selection, such as WFM. Push the button for the GAIN setting that you want.
3. If you push VAR(ible), set the gain that you want using the GENERAL knob.



To set Sweep:

1. If SWEEP is selectable, one of the SWEEP buttons will be lit; otherwise select another measurement that supports SWEEP selection, such as WFM.
2. Push the button for the SWEEP setting that you want.
   - LINE—Sets the active tile to the current Line rate sweep or 2 Line sweep
   - FIELD—Sets the active tile to the current Field rate sweep or 2 Field sweep
   - MAG—Sets the active tile to Variable Gain. Gain is set using the GENERAL knob.
3. Repeat steps 1 and 2 until you've selected measurement displays for all tiles that you wish to define.



To Use Presets

Presets let you save up to five custom setups for later recall. You can also recall a factory predefined setup.

To recall the factory preset

1. Push the FACTORY button.

   The front panel setup will revert to default factory settings.

To save as setup to a preset

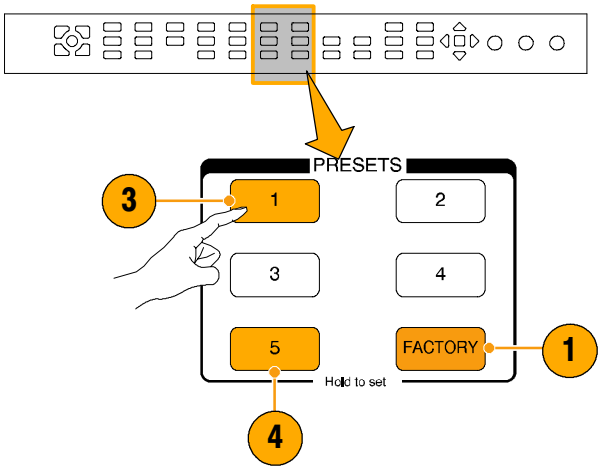
2. Set up the instrument as you want it.
3. Push and hold the button of the numbered preset in which to store the current instrument setup. (Preset 1 shown.)

   The setup will be stored for later recall.

To recall an existing preset

4. Push the numbered button for the preset you wish to recall.

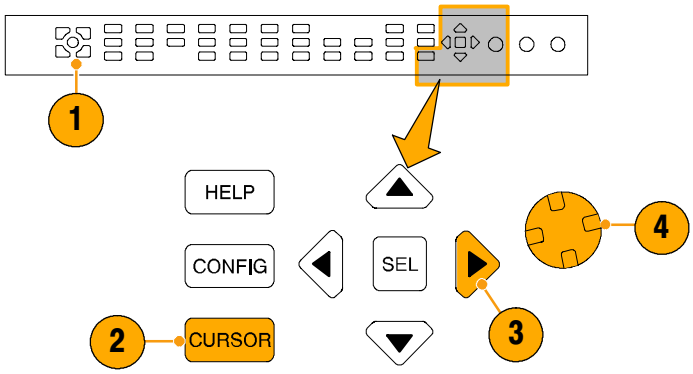
   The front panel setup will switch to the saved preset corresponding to the button pressed.



To Measure Waveforms with Cursors

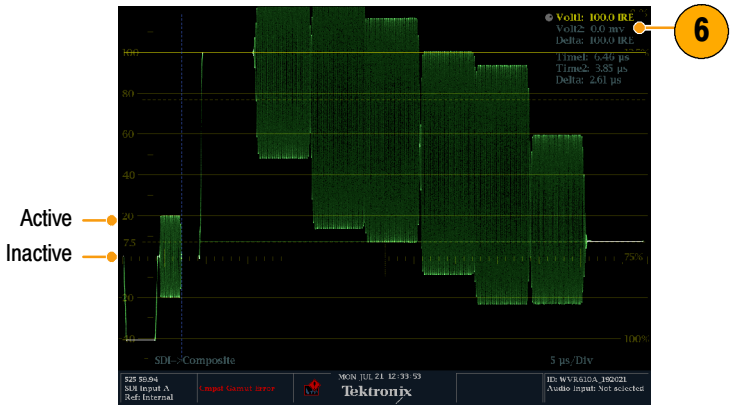
Cursors enable you to measure time or voltage on a waveform. Cursors appear only in a tile set to Waveform mode. If the active tile is not in Waveform mode, then an error message is displayed.

To display and adjust cursors



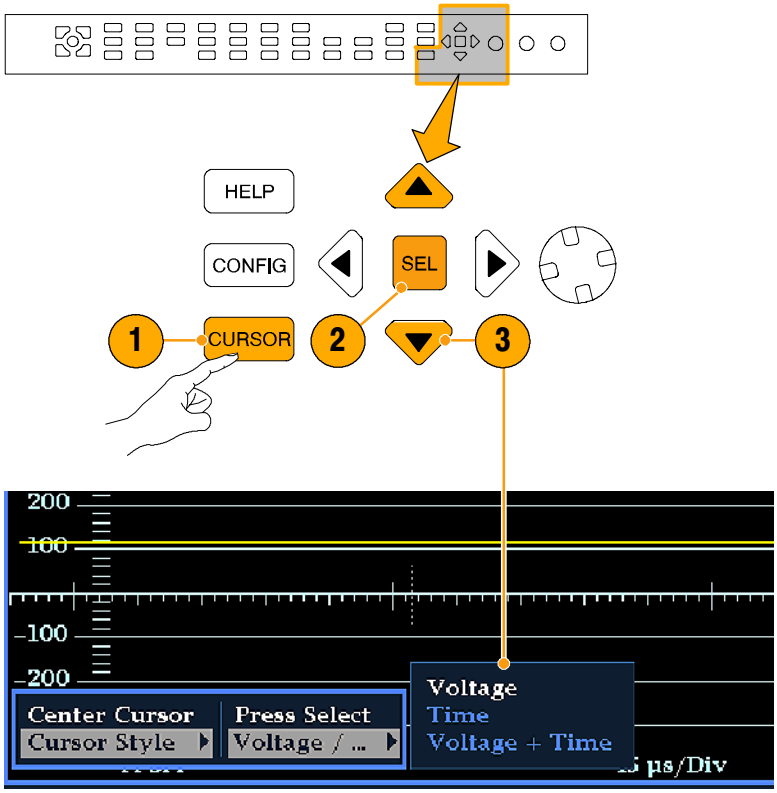
1. Choose a tile that is currently displaying a waveform.
2. Push the CURSOR button to display the cursors on the selected tile. (Pushing CURSOR again turns cursors off.)
3. Push the arrow keys to select the active cursor:
   - If Voltage OR Time cursors are displayed, press any arrow key to select active cursor.
   - If Voltage AND Time cursors are displayed for the voltage cursors, press either the up or down arrow key, and for time cursors, press either the left or right arrow key to change the active cursor.
4. Turn the general knob to adjust the selected cursor on the waveform. Active cursor readout appears in yellow with knob icon

   Tip. To quickly center the active cursor on screen, press and hold the SEL button.
5. Repeat steps 3 and 4 to adjust the other cursor.
6. Read the cursor measurement in the Cursors readout.



To switch among cursor types

1. Press and hold **CURSOR** to display the Cursor pop-up menu.
2. Select **Cursor Style,** and press **SEL** to change the focus to the submenu.



3. Select the desired cursor type using the up/down arrow keys. The three styles of cursors available are:
   - **Voltage** - display the voltage level at each cursor and the voltage difference between the two cursors.
   - **Time** - display the position of each cursor relative to the start of the sweep and the difference between the two cursors.
   - **Voltage + Time** - displays both the Voltage and Time cursors.

Other Usage Tips

If you use other functions, such as Line Select, while cursors are active, the knob will be assigned to those other functions. Press **CURSOR** to transfer the knob control back to cursors.

You can display independent cursors in all four tiles at the same time, although you will only be able to change the cursors in the active tile.

Cursors track the live trace, so they may not be correctly registered on a frozen trace.

To Freeze the Display

Pushing the **FREEZE** button captures the current image for traces (waveform, gamut, and vector), picture, status, and audio measurements, if selected. Freeze is useful for comparing sources or for capturing transient events. Press **FREEZE** to capture a display you wish to keep or show to someone else. In this application, the **Frozen Only** display mode may be best. For comparing sources, the **Frozen + Live** display mode is useful. To use this feature, select one source, press FREEZE to capture an image, then select the second source and compare.

Not all displays react identically to freeze. WFM displays capture a trace. For text displays, such as Status, pressing FREEZE halts updates to the display. This allows you to view the different status displays without numbers or status readouts changing. The waveform rasterizer continues to log error status in the background while the display is frozen.

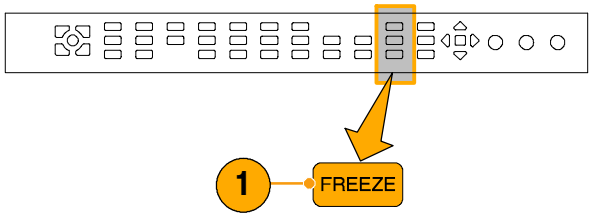
FREEZE works in both tile and full-screen modes, but frozen images do not change from tile to full or full to tile. That is, if you freeze a trace in tile mode, the frozen image will not be shown if you go to full-screen mode. The frozen image will still

be available if you go back to tile mode. Likewise, if you freeze a Waveform image in a tile and then switch the tile to another measurement such as Vector, the frozen waveform image will be hidden. If you then change the tile back to Waveform, the frozen image will reappear.

For waveform displays, the frozen image is shown in a different color to distinguish it from the live image.

To halt display update:

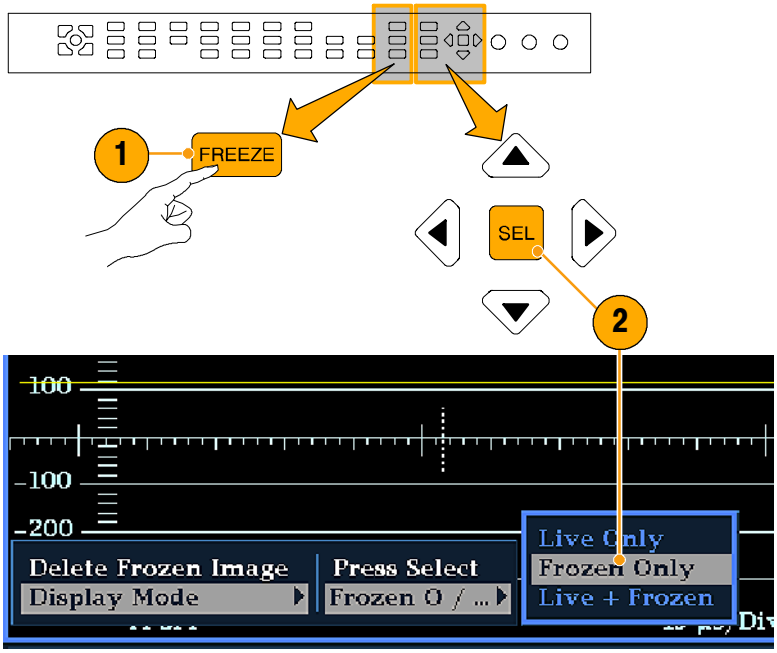
1. Push the FREEZE button. For most displays, updates stop.



To select the FREEZE display mode:

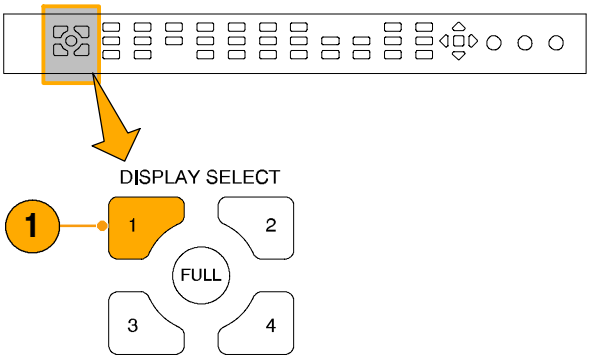
1. Push and hold **FREEZE** to display the pop-up menu.
2. Use the navigation keys to select the desired mode, and then press **SEL** to set the FREEZE display mode:
   - **Live Only** allows you to keep a frozen image, but not display it.
   - **Frozen Only** allows you to see artifacts in the frozen trace more easily
   - **Live + Frozen** allows comparisons and matching. (STATUS and AUDIO displays do not support this mode.)

NOTE. *The display mode chosen is specific to the tile selected, and can be set independently.*

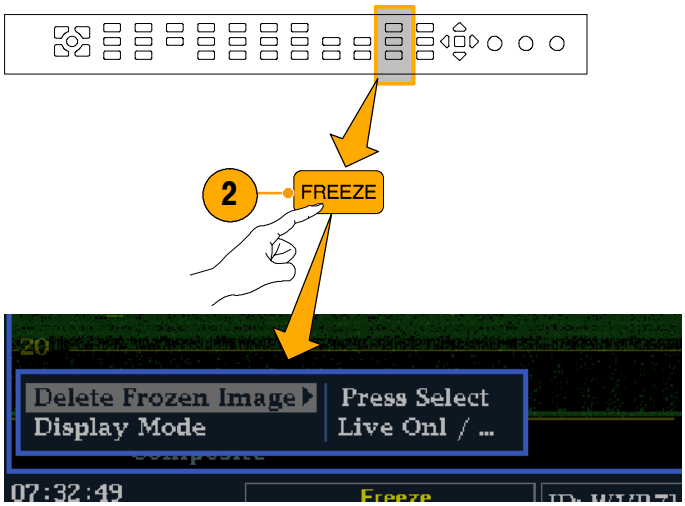


To delete the FREEZE display:

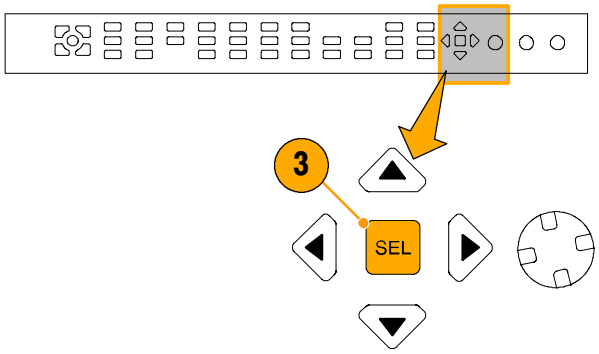
1. Select the display tile for the frozen display that you want to delete.



2. Push and hold **FREEZE** to display the pop-up menu. **Delete Frozen Image** will be already selected.



3. Press **SEL** to delete the frozen image. The pop-up menu is automatically removed from the display when the frozen image is deleted.



Usage Tips

FREEZE can be configured to act on only the active tile or on all tiles. To change the FREEZE from Active Tile to All Tiles, you must go to the *Display Settings* Configuration menu.

Cursors track the live trace, so they may not be correctly registered on a frozen trace. If you change parameters such as position, sweep rate, or gain, then the cursors may not be accurate relative to a frozen trace.

To Set Line Select Mode

To Toggle Line Select Mode

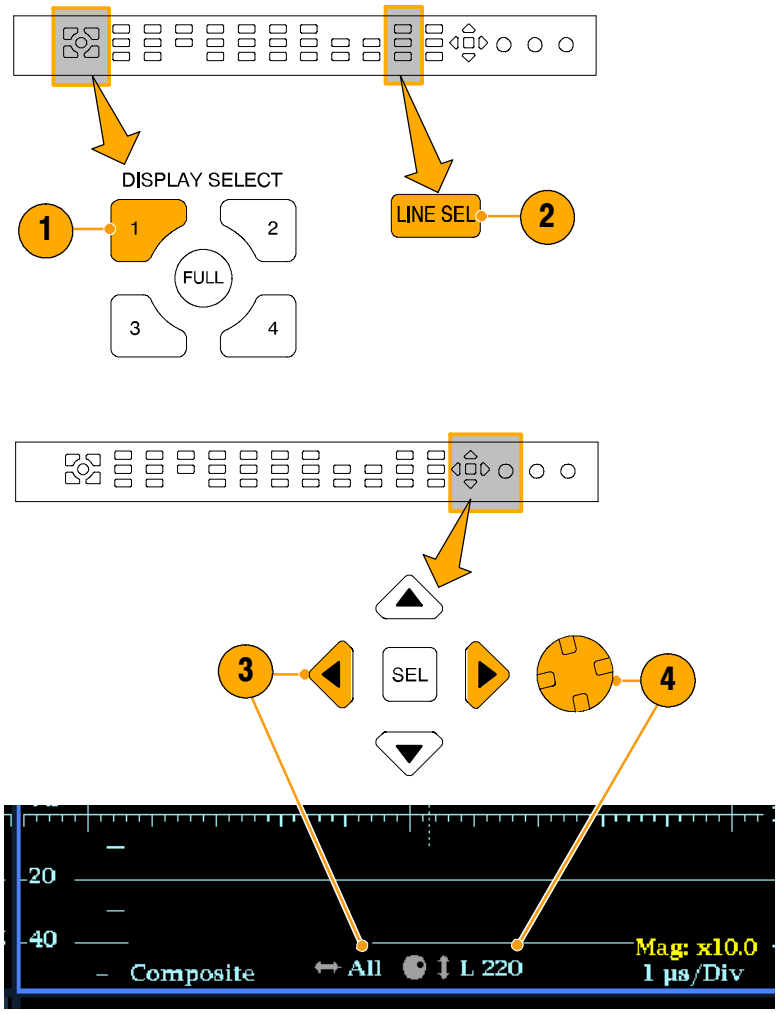
1. Select the tile containing the display for which you want to set Line Select Mode.

   NOTE. *Line Select Mode can only be active on one tile at a time.*

2. Push **LINE SEL** to toggle Line Select Mode on or off. When on, the tile displays the selected line information only. The Line selection menu appears at the bottom of the selected tile.

3. Press the left or right arrow key to select F1 (field 1), F2 (field 2), F3 (field 3), F4 (field 4),or All

4. Turn the GENERAL knob to select the line you want to view.



To Configure Your Instrument

The Configuration menu is used to change the settings of the waveform rasterizer that are changed only occasionally or settings that are not specific to a tile, such as printer settings. To change a setting, you must highlight the desired setting:

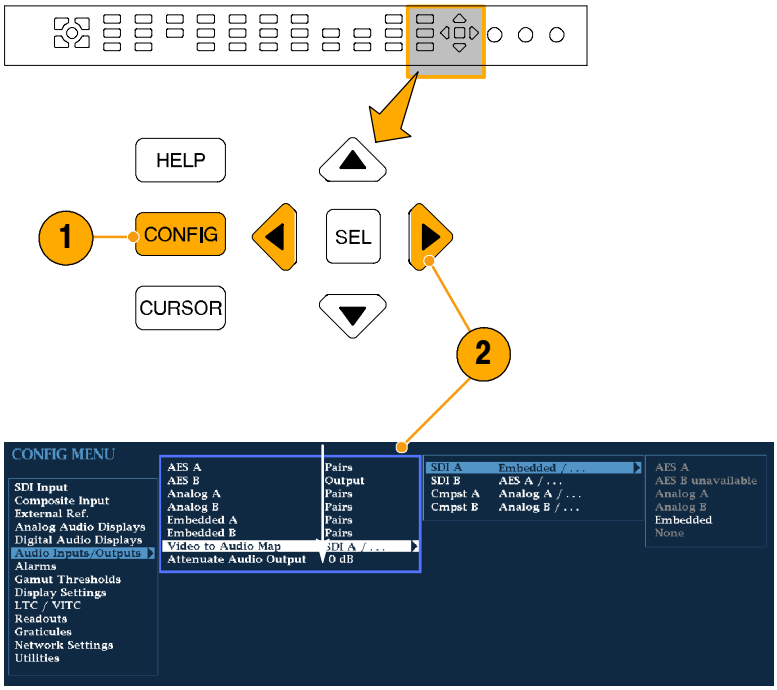
To Transverse Menu Panes:

1. Press the CONFIG button to display the Configuration menu.

   The Configuration menu is displayed on the top or bottom half of the screen opposite the active tile.

2. Use the left/right arrow keys to move the selection back and forth among panels.

   The selected, active pane is boxed by a blue line.



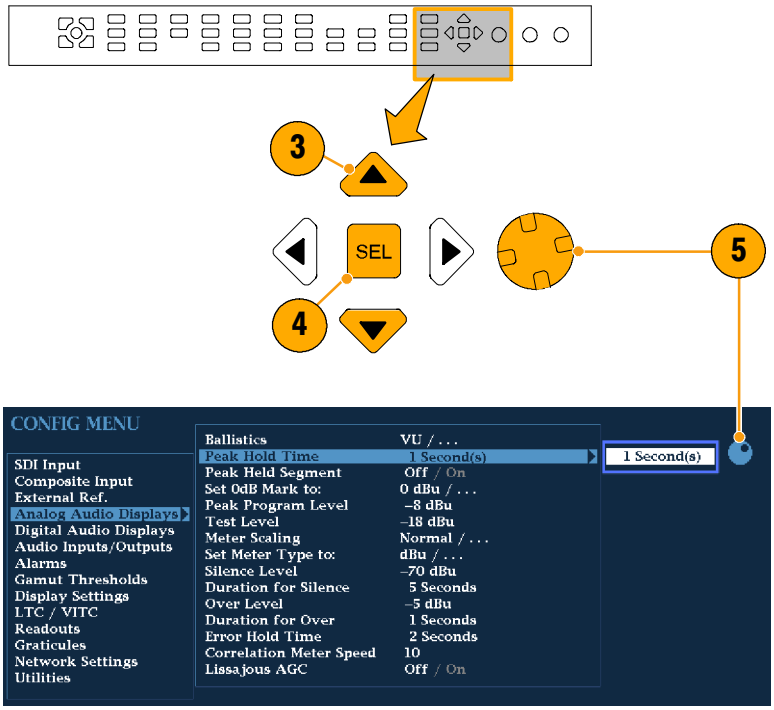
To Select/Adjust a Parameter:

3. Use the up/down arrow keys (or the General knob) to move the selection up and down the menu entries in the selected pane.

   The selected, active menu item is highlighted by a white menu bar; the selected item in unselected menus highlighted by a blue menu bar.

4. Push the SEL key (or right-arrow key) to toggle between parameter settings. For example, if Peak Held Segment was highlighted at right, pushing SEL toggles between On and Off settings.

5. If the menu item selected results in the knob icon appearing in the menu, use the General knob to adjust the selected parameter.



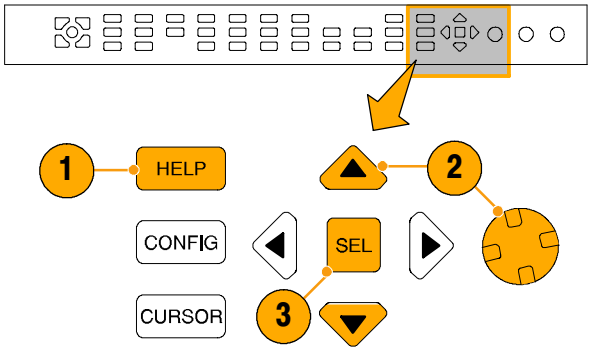
To Use Online Help

The WVR7100 online help is both a quick reference to instrument operation, and the exclusive reference for the details of instrument operation. The online help is both:

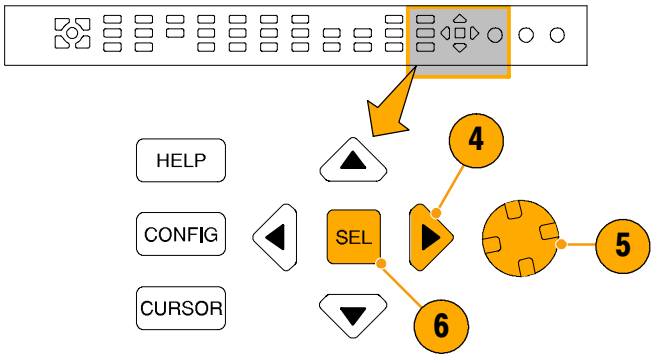
- context-sensitive, where the topic displayed depends on what is displayed in the active tile when the online help is selected, or what control is operated after help is selected, and ...
- navigatable, with the Contents and Topic Selector panes, along with Links within the topics, providing access to topics.

To display and navigate online help:

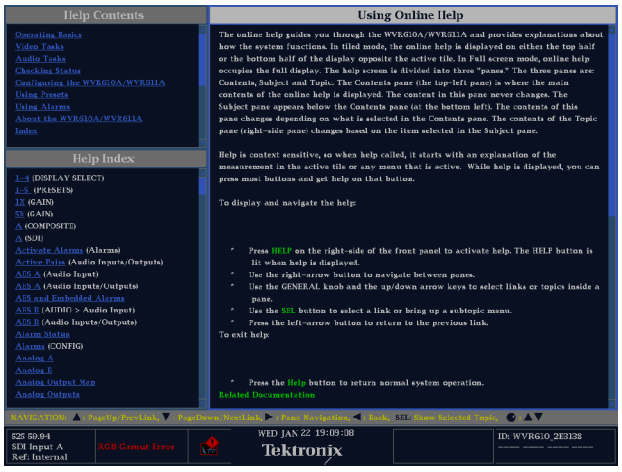
1. Press **HELP**.
2. Use the **GENERAL** knob or the up / down arrow keys to highlight a entry in the Contents (entries never change).
3. Press **SEL** to select the the highlighted category.



4. Press the right-arrow key to move selection to the Topic Selector pane (entries change with the selection made in steps 2 and 3).
5. Use the **GENERAL** knob and the up / down arrow keys to select among the topics listed for the heading selected in step 2.

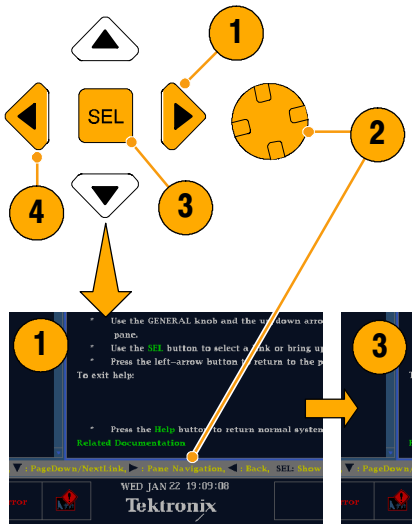


6. Press **SEL** to display the selected topic.



To follow a link within a help topic

1. Press the right-arrow key to move selection to the Topic pane
2. Highlight a link using the GENERAL knob or the up / down arrow key.
3. Press **SEL** to jump to the linked-to topic.
4. Press the left-arrow key to go back to the previous topic.

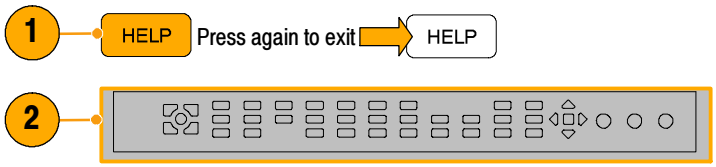


To get context sensitive help:

1. When you want help on the control or setting you are using now, press **HELP**.

   If you displayed a menu in the active tile, and select a menu setting, help on that setting displays.

2. Now operate (press, select, turn) a control that you need help with. The help topic pane displays help on the control you used.



To exit the online help:

- Press **HELP** to extinguish the button.

To Connect to a Network

The following topics cover configuring the IP settings, so that you can use the waveform rasterizer over a network, and configuring SNMP, which is required if you are using commands to control the waveform rasterizer.

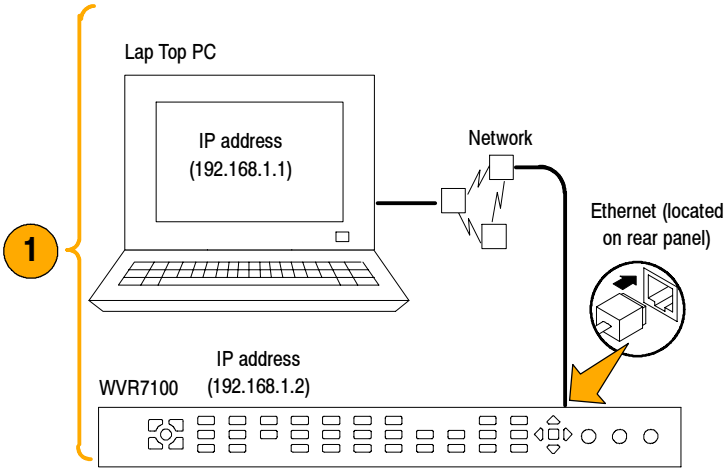
Connection and IP Settings

To allow network access to the instrument, you need set the IP address. Network addresses can be assigned either automatically or manually. If your network does not use DHCP, you will have to manually enter the address for the instrument. To get an address, talk to your LAN administrator.

1. Connect your waveform rasterizer to a network and access it with a remote PC.

   Set up the rasterizer as described in the steps that follow.

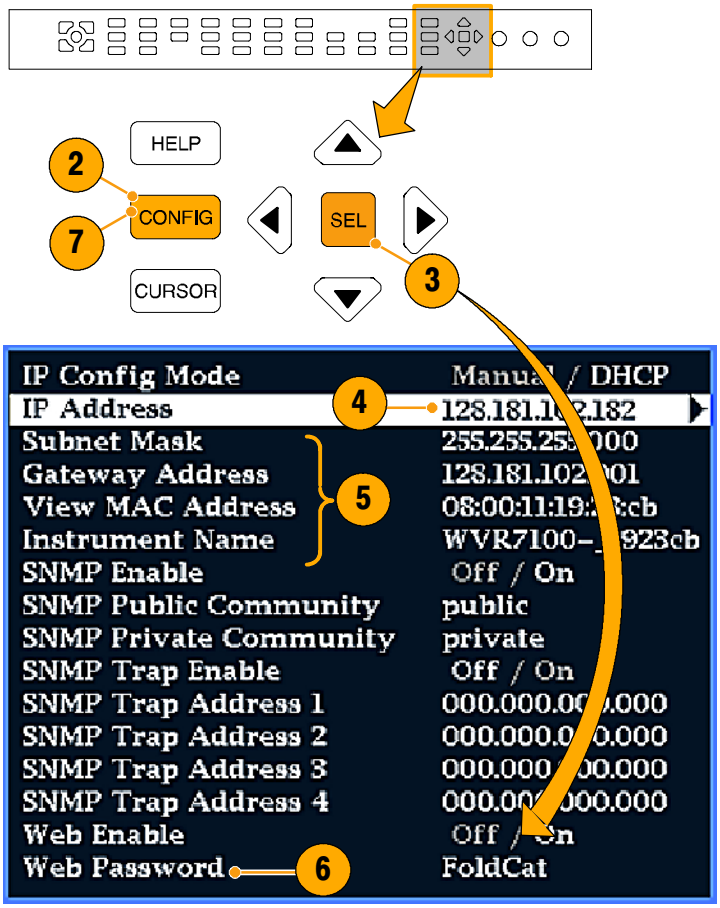
   NOTE. *You may want to connect directly between your PC and the WVR7100. See* To Connect Directly to a PC *on page 40.*



2. Press **CONFIG** to display the Configuration menu.
3. Select **Network Settings** > **Web Enable**. Press **SEL** to select **On**.
4. Set the IPConfig Mode to Manual or DHCP, depending on your network setup.
5. If you can't use DHCP, you will have to set the subnet mask and gateway address network parameters in this menu; see your LAN administrator for required values. (Be sure to use compatible addresses between the PC and the rasterizer.) You may also set the instrument name and view the MAC Address.
6. If the password is set, note it. You will be prompted for it when you connect to the rasterizer.

   NOTE. *For help with entering or changing the password, select Web Password, and press the HELP button.*

7. Press **CONFIG** to close the Configuration menu.



SNMP Setup

If you intend to use SNMP commands to control the instrument (SNMP control is primarily intended for access via automation systems), you need to setup SNMP parameters.

NOTE. *The* WFM Series Waveform Monitors wfm_mon.mib & WVR7100.mib *can be downloaded from the instrument web page. See step 16 on page 73, of* Using the Web Browser *in this manual.*

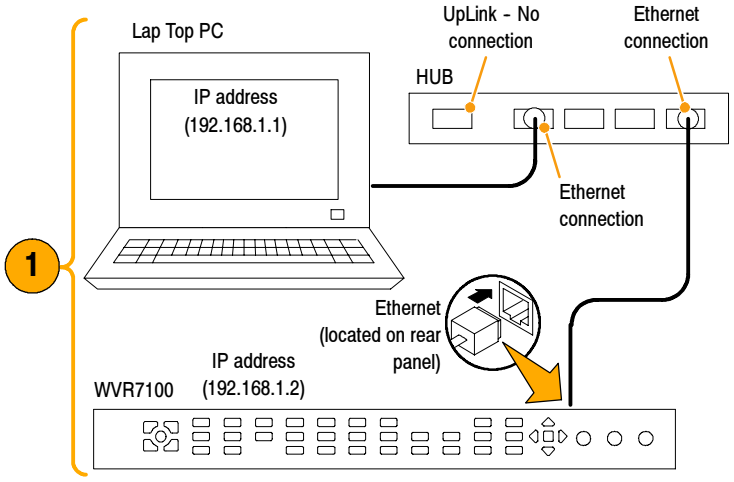
The procedure to set SNMP settings is similar to that shown above for IP settings; the parameters that can be set follow:

SNMP Enable	This entry in the Network Settings portion of the Configuration menu allows you to turn on or off the remote access via SNMP.
SNMP Trap Enable	This menu entry allows you to turn on or off the traps that are sent out via SNMP.
SNMP Trap Address	This menu entry allows you to set IP addresses to which SNMP traps are sent. SNMP Traps can be sent to up to four addresses when error conditions are detected. ***NOTE.*** *A value of all zeroes for the address will disable that trap output.*
Private Community String	This menu entry allows you to set the Private Community string. This string is effectively a password. Without this string SNMP commands cannot change values in the instrument. ***NOTE.*** *The Private String is necessary for SNMP access to write changes into the instrument, the Public string can be used for accesses to read information from the instrument.*
Public Community String	This menu entry allows you to set the Public Community string. This string is effectively a password. Without this string SNMP commands read values from the instrument. ***NOTE.*** *The Public String is necessary for SNMP access to read values from the instrument. The Private string must be used for SNMP access to write information to the instrument.*

To Connect Directly to a PC

A common configuration is to connect the rasterizer directly to a PC.

1. Connect your waveform rasterizer to a PC through HUB as shown. A standard Cross-Over cable can be substituted for the HUB.
2. Set up the rasterizer as described in steps 2 through 7 on page 39, choosing Manual IP mode and setting the IP address manually. Be sure to set an address that is compatible with the setting of your PC.
3. SNMP setup, if used, is the same as described under *SNMP Setup* on page 39.



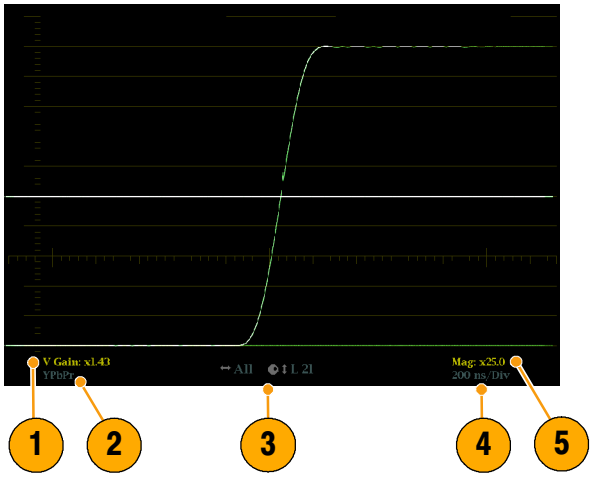
List of Measurements and their Pop-up Menus

Waveform Display

The WFM button displays the Waveform (WFM) display, which is the familiar voltage versus time display used to view a waveform. You can view the input signal in line or field sweep. You can choose which SDI signal elements are displayed (RGB, YRGB, or YPbPr), and you can apply filters to the signal. You can also display an SDI input as though it were a composite signal. You can also control whether EAV, SAV, and ANC data is included in the display in the CONFIG menu.

Waveform Display Elements:

1. Is blank when vertical gain is X1; otherwise indicates V Gain is x5 or variable.
2. Lists the currently displayed waveform color-space. Dashes (--) indicate components not displayed.
3. Lists the currently selected field and line (when in Line Select mode).
4. List the current sweep rate for tile.
5. List the Mag rate if MAG is on.



Waveform Pop-up menu and settings

The Waveform pop-up menu enables you to choose the display style and display mode used in the active tile (SDI inputs only), select a filter to apply to the input signal, or center the waveform in the display.

To display the Waveform pop-up menu:

- Press and hold **WFM** to display the pop-up menu

To choose a display mode use the menu to select among the following the choices (only available while displaying SDI inputs) :

- **YPbPr** - Displays the input as Luminance (Y) and color difference (Pb, Pr) components.
- **YRGB** - Displays the input as Luminance (Y), Red (R), Green (G), and Blue (B) components.
- **RGB** - Displays the input as Red (R), Green (G), and Blue (B) components.
- **SDI -> Composite** - Displays the SDI input as if it has been encoded into composite. The sync and burst in this mode are synthetic and convey no information about signal quality.

When viewing 525-line SDI input as a composite waveform while using line select mode, both burst phases may appear when you would expect to see only one. This is because the line selection in SDI Mode is an odd/even selection, while composite signals are normally viewed with a one-of-four or one-of-eight line selection.

To choose how the signal components are displayed in the active tile, use the :The Display Style menu setting (SDI inputs only) to select:

- **Parade** style - has all the components shown one beside the other like cars in a parade.
- **Overlay** style - has all the components drawn at the same location so that they appear one on top of the other.

The Waveform pop-up menu **Filter** selection allows you to select filters to be applied to the video. This is useful to isolate a specific characteristic of the input. For example, to measure amplitude you may want to use a Luma or Low pass filter to remove the high frequency components.

To choose a filter (filters available depend on display type, SDI or Composite), select one of the following filters from the Waveform menu:

- **Flat**[1,2] - Display with the full available bandwidth.
- **Luma**[2] or **Low Pass**[1] - Display only the low-frequency portion of the signal.
- **Chroma**[2] - Display only the portion of the signal with frequencies near the color sub-carrier. For Composite inputs only.
- **Flat + Luma**[2] - A combination of a Flat and a Luma waveform from a Composite input; it shows two waveforms in parade configuration.

[1] Available for SDI displays, such as RGB mode.

[2] Available for Composite displays.

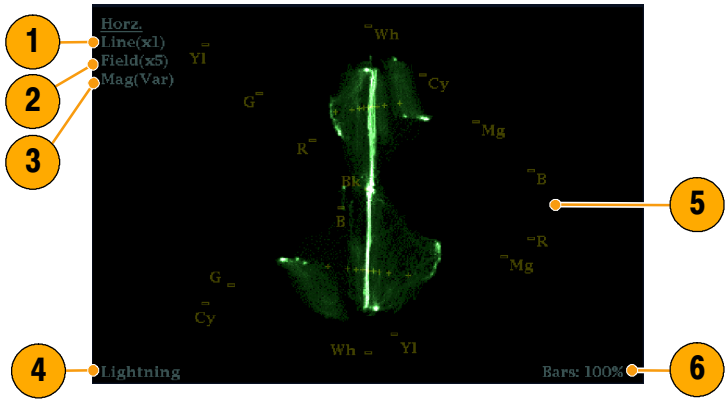
To cancel any horizontal or vertical position adjustments and restore the trace to the default position, select **Center Waveform** and press **SEL.** For a tile in WFM mode, this puts the baseline at the zero graticule.

Vector Display

The VECT button calls up the Vector display, which provides two plots of the R-Y and B-Y color signals, Vector and Lightening.

Display Elements:

1. **Line.** Pressing the LINE button sets the horizontal gain to 1X.
2. **Field.** Pressing the FIELD button sets the horizontal gain to 5X.
3. **Mag.** Pressing the MAG button enables you to adjust the horizontal gain using the GENERAL knob.
4. **Display Type.** The selected display, either Lightning or Vector.
5. **Bar Target Setting.** The bar target setting, either 75% or 100%.
6. **Phase.** Appears in Composite Vector display only.



Vector Pop-up Menu

The Vector pop-up menu enables you to specify the display type (SDI inputs only), to set the bar targets, and to center the waveform in the display.

To display the Vector pop-up menu:

- Press and hold **VECT** to display the pop-up menu.

To choose the display type (SDI inputs only), use the pop-up menu to choose either:

- Vector - The Vector display shows a plot of the R-Y signal on one axis and the B-Y signal on the other. This display is useful for looking at hue and saturation of the colors, but does not show luminance information.
- Lightning - The Lightning display shows the same color signals as in vector, but they are plotted versus luminance. One color difference signal in the top half and the other in the bottom. Lightning is useful for checking chroma and luma gain, and for checking chroma to luma delay via the timing marks that show errors in the green to magenta transition on a color bar signal. This is a Tektronix proprietary display and is for SDI signals only.

To select which scaling should be used in the active tile for either the Vector or Lighting display, use the menu to select 75% or 100% scaling.

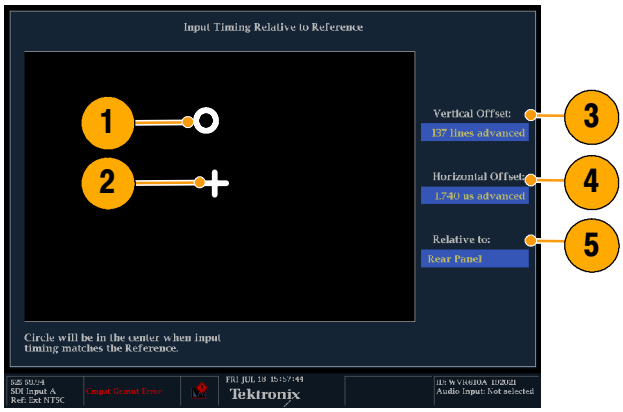
To cancel any horizontal or vertical position adjustments and restore the trace to the default position, use the up/down arrow keys to select **Center Waveform** in the menu. Then:

- For a Lightning display, press **SEL** to center the waveform. The trace is set back to the center of the tile.
- For a Vector display, press the right-arrow key to select the color you want to locate at the center of the display.

Timing Display

Pressing the MEAS button displays a Tektronix proprietary display that simplifies measuring the timing difference between two signals as the timing is corrected. Using the Tektronix Timing display enables you to easily compare and correct the timing between two digital signals.

Display Elements:



1. **Input Signal Indicator:** A single[1] circle representing timing of input signal relative to the reference.
2. **Reference Indicator:** A cross-hair indictor centered in the display represents the reference signal.
3. **Vertical Offset**: The timing difference between the reference and input signal.
4. **Horizontal Offset:** The timing difference between the reference and input signal.
5. **Relative to:** Indicates the chosen zero point for the timing display.[2]

1 More complex timing relationships display multiple circles. See *Timing Displays for Simple Versus Complex Timing* on page 45.

2 Rear Panel is the default setting, where offset is shown as zero when the input and reference are at the same timing at the rear panel of the waveform rasterizer. If you select *Saved Offset*, you can save the timing from one signal, and then display the timing relative to that saved offset..

Measure Pop-up Menu

The Measure pop-up menu enables you to save a timing setting for comparison with another signal and specify the zero point of the timing display.

To display the Measure pop-up menu:

- Press and hold **MEAS** to display the pop-up menu.

To save the timing of the current input as an offset to the timing display, use the **Save Offset** menu entry. The current timing becomes the zero point for the saved offset mode of the timing display. This applies to both the cross-hair target in the middle of the display and the numeric readouts.

***NOTE**. You cannot save the timing offset if either the input or reference is missing or unlocked. You also cannot save a reference when in internal mode. Saving an offset in these conditions would lead to misleading results so it is not allowed by the instrument. A warning message will appear on the screen if you attempt to save the offset when it is not allowed.*

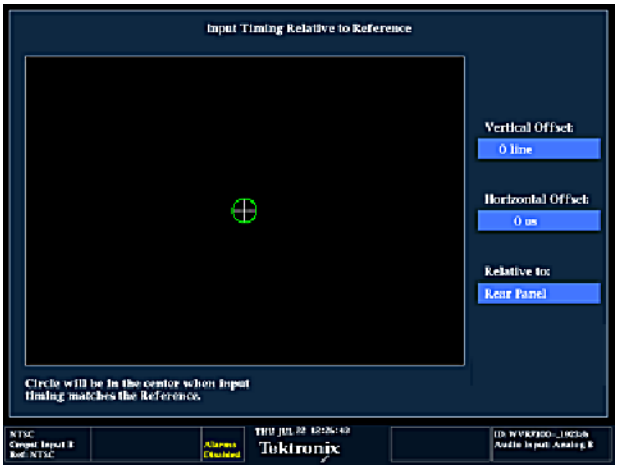
Save Offset allows you to measure the timing between inputs or to match multiple signals. To select the definition for the zero timing offset, use the **Relative To:** menu entry to select one of the following:

- **Rear Panel** which means the timing offset will be shown as zero when the two signals are timed down at the rear of the waveform rasterizer
- **Saved Offset** which means that the timing will be shown as zero offset when the input signal matches the timing of the signal that was present when the offset was saved using the Save Offset menu entry.

This selection changes both the numeric readouts and the target in the middle of the timing display.

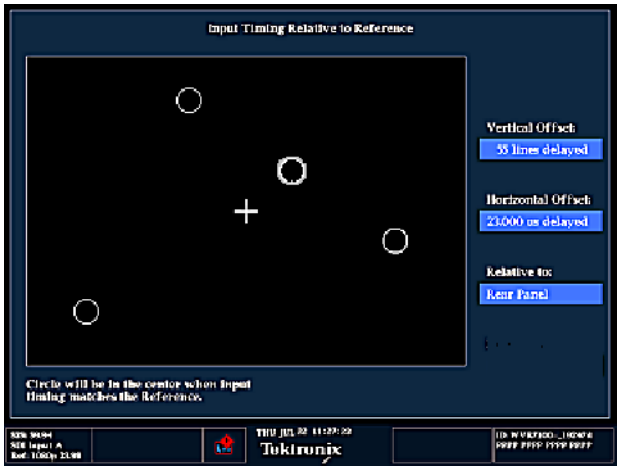
Timing Displays for Simple Versus Complex Timing

The number of circles, with each representing a time offset, varies with the complexity of the timing between the reference and input signals. If you are timing input signals with rates that are integer multiples of the reference rates, the instrument can measure the timing deterministically and displays the relationship as one circle (offset) relative cross-hair (reference as is shown.



Such cases include timing an NTSC input (multiplier of 1) or a 525 SDI input whose frame time is 33.36ms (multiplier of 2), against an NTSC reference, which has a frame time of 66.73 ms.

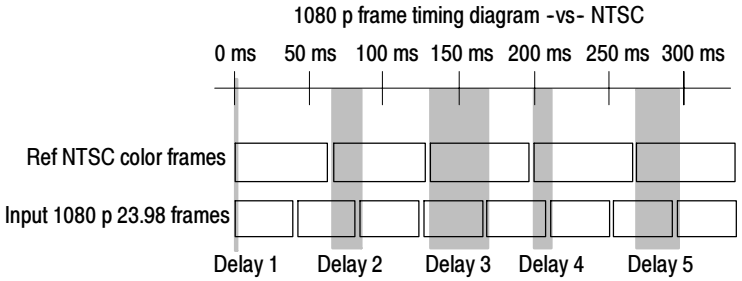
If you time input rates that are *not* integer multiples of the reference rates, the instrument cannot measure the timing deterministically, so it displays the relationships as several circles. Each circle represents a possible timing offset measurement relative to the reference cross-hair. Display emphasis is given the circle that times closest to zero offset and the numerical readouts track this pair.



Nondeterministic cases include timing of slow rate inputs against fast frame-rate references or when timing video against film rates.

For a case where multiple relationships would display, consider an input of 1080p/23.98 Hz with a reference of NTSC/59.94 Hz:

- The different rates result in timing relationships between the signals that repeat once for every four fields of the input and five frames of the reference (shown right).
- Because this allows for five possible ways to measure timing between these two signals, the timing display shows four circles, with emphasis and readouts as previously described (shown above).

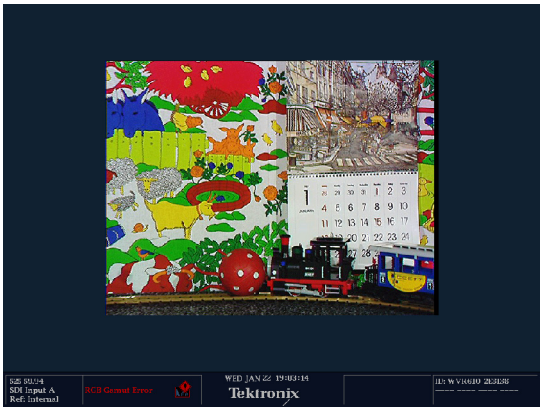


Picture Display

Pressing the PICT button calls up the Picture display, which lets you see the picture generated by the video signal. You can choose to display the picture with or without a Picture Frame.

Display Characteristics:

- In full-screen mode (shown), there is no cropping.
- Pictures are decimated horizontally or vertically to achieve the correct aspect ratio. This decimation may cause some artifacts. This behavior may be evident on a sweep signal.
- Also see the online help for the Picture Aspect Ratio for related information.



Picture Pop-up Menu

The Picture pop-up menu enables you to display or hide elements of the video signal outside the active video. With Picture Frame switched On, only the active video portion of the signal is displayed. With Picture Frame switched Off, elements of the signal outside the active video are visible. When the picture frame is off, you can see user data, embedded audio, and elements in the vertical interval.

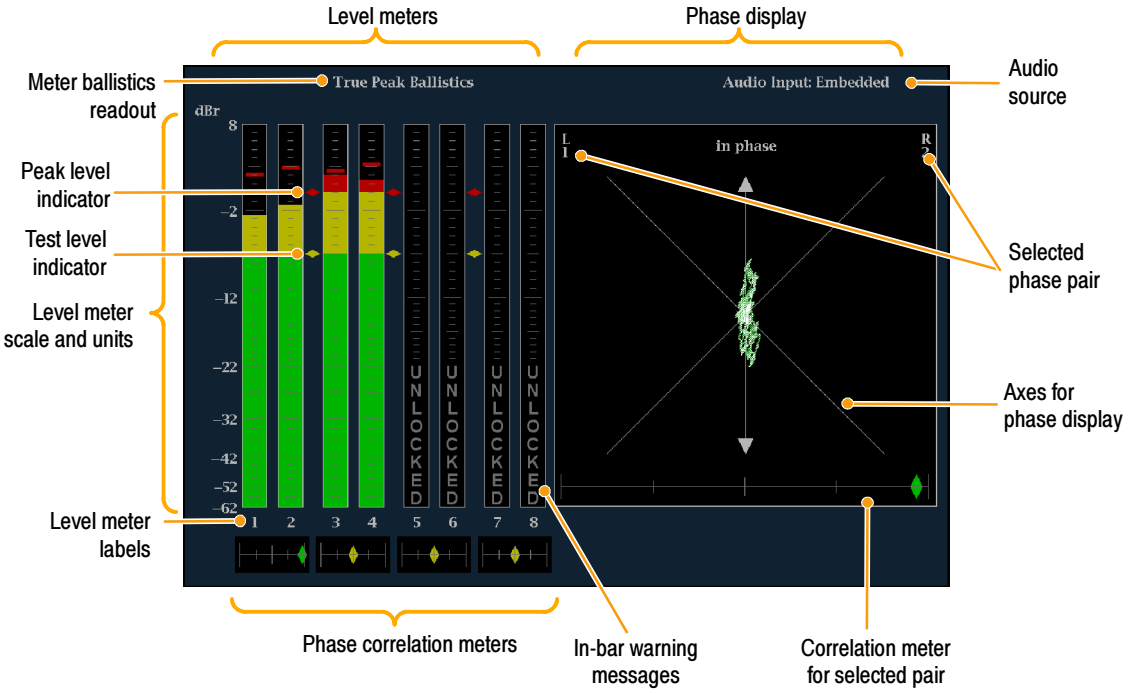
To display the Picture pop-up menu, press and hold PICT. Use the SEL key to switch the **Picture Frame** On or Off.

***NOTE**. You can see signal elements outside the active video only when the PICT display is set to FULL. You will not be able to see sync signal elements on Composite signals.*

Audio Display

Pressing the AUDIO button brings up the Audio Display. The Audio display provides level meters and a phase display for monitoring audio signals. The Audio display always shows the level meters and correlation meters. When you choose to display the phase plot (also known as Lissajous), the left portion of the Audio tile displays the level meters and the right portion the Phase display. See the figure that follows.

Display Elements



Element Descriptions

Element	Description
Level meters	Indicate the amplitude of selected audio channels.
Phase display	Plot of one channel versus the other in a pair.
Audio source	The selected audio input.
Level meter labels	Identifies the signal in each meter bar.
Level meter ballistics read-outs	Displays the selected dynamic response characteristic.
Axes for phase display	Shows the orientation of the two audio signals.
Phase correlation meters	Displays phase correlation between the two channels of each appropriate pair. Located under the bars for the same channels. Duplicated under the Phase display. Has configuration response time.

Element	Description
Test level and Peak program level indicators	Diamond-shaped markers between the level bars that indicate the configurable limits set up for the display. Above the Test level the bar displays in a yellow color. Above the Peak level the bar displays in a Red color. Test level is also known as Reference level or Line-up level.
Level meter scale and units	By default, the zero dB mark is at digital full scale, and units are in dB relative to full scale (dBFS). You may also set the 0 dB mark to either the Peak Program level or the Test level.

Above-bar Warning Messages

The WVR7100 displays warning messages above the level meter bars. The warning messages that can appear above the bars are shown below.

CLIP. The number of consecutive samples is at or exceeds the # Samples for Clip setting.

OVER. The signal has been at or above the specified Over Level for a time exceeding the Duration for Over setting.

In-bar Warning Messages

The WVR7100 display warning messages within the level meter bars. The warning messages that can appear are shown below in order of priority.

UNLOCKED. The instrument is not locked to an incoming signal on the indicated input channel. Data cannot be decoded and all data and other errors are ignored. This means that if an AES input is selected, nothing recognizable is present on the input, or if embedded audio is selected, the VIDEO input is unrecognizable.

AES PARITY. The incoming subframe does not have even parity as specified by the digital audio standards. The data sample is unreliable and is ignored. The level meters and Lissajous display treat the sample as a zero sample.

AES CRC ERROR. The CRC code in the AES channel status packet is incorrect. Sometimes the CRC code is set to zero, indicating that the signal is missing; when this is the case, this message is not displayed.

MUTE. The number of consecutive all-zero samples is at or exceed the # Samples for Mute setting.

SILENCE. The signal has been at or below the specified Silence Level for a time exceeding the Duration for Silence setting.

DISABLED. Disabled can appear for three reasons:

- Analog audio is selected as the bar source, this causes bars 7 and 8 to say DISABLED since there are only 6 analog inputs.
- Embedded audio is selected as the bar source when Composite video is selected as the video input. Since there is no embedded audio in composite, all of the bars will say DISABLED.
- If the currently selected audio source's Bar to Input Map does not have all of the bars mapped to inputs, any bars that are unmapped will say DISABLED.

AES V BIT. Indicates that the Validity bit is set high for one or more data samples. In the AES/EBU standard, a set validity bit indicates that the sample is not suitable for conversion to audio. By default, the level meter bars and Lissajous display treat the affected samples as zero samples.

Audio Pop-up Menu

The Audio pop-up menu enables you to select the audio input source and specify whether or not the signal phase is displayed. If the signal phase is displayed, you can also specify the style of the phase display and which pair of inputs is shown in the phase display.

To display the Audio pop-up menu:

- Press and hold **AUDIO** to display the pop-up menu.

To select the source for the Audio display, select **Audio Input** in the menu and set a source. The number of available sources depends on which audio option is installed. Choosing any given input will make that audio the monitored signal regardless of which video input is active. Alternatively, you can choose **Follows video** to enable the mapping that allows changing the audio source as the video input selection is changed.

***NOTE**. Use the CONFIG menu to select the mapping of input to bar, the meter type, and the Follows video mapping of audio to video.*

To add a 2-channel phase display to the audio tile, toggle **Phase Display** on in the audio pop-up menu. A phase display is also called a “Lissajous” display.

To choose the plot style of the Phase Display, select between the following two entries in the pop-up menu:

- **Lissajous Snd** (Sound) **Stage** has axes rotated at a 45 degrees.
- **X-Y** has axes that are horizontal and vertical.

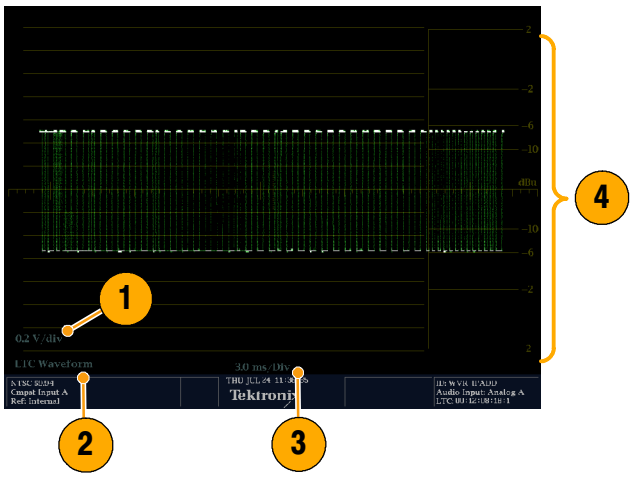
To choose the pair of inputs that is displayed in the phase display, select **Phase Pair** and set a value. You can not select channels from separate pairs since the relative timing cannot be ensured.

LTC Waveform Display

Pressing the OTHER button brings up a display of an LTC waveform when one is present. This enables you to check the LTC amplitude and noise, and verify LTC is locked to the video. The display has two vertical scales, one in Volts and the other in dBu.

Display Elements:

1. **Vertical Scale (V):** The vertical display scale in volts.
2. **Time Code:** when displayed, indicates that the LTC itime code that is locked to the video.
3. **Horizontal Scale:** The horizontal display scale.
4. **Vertical Scale (dBu):** The vertical display scale in dBu.



OTHER Pop-up Menu

The Other pop-up menu provides access to the Center Waveform function. The Center Waveform function is used to cancel any horizontal or vertical position adjustments and restore the trace to the default position.

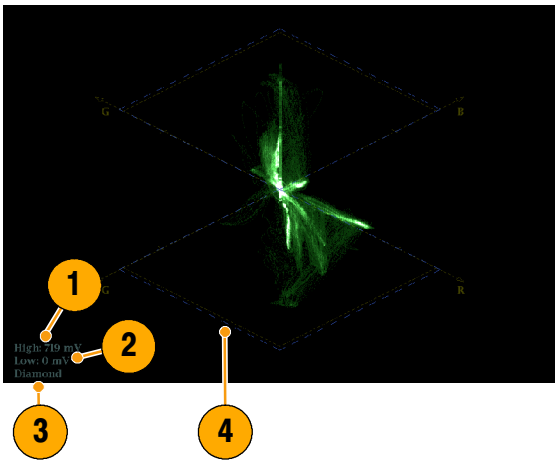
To display the Other pop-up menu, press and hold the OTHER button; press SEL to center the waveform.

Gamut Display

Pressing the GAMUT button calls up the Gamut Display. The Gamut display provides three proprietary Tektronix display types to enable you to easily and quickly check the gamut of an SDI signal. You can choose from the Arrowhead, Diamond, and Split Diamond displays. The Arrowhead display provides NTSC and PAL composite gamut information directly from the SDI signal. The Diamond and Split Diamond display provide a reliable method of detecting invalid colors.

Display Elements:

1. **High threshold:** shows the currently specified high threshold (Diamond High or Arrowhead Max).
2. **Low threshold:** shows the currently specified low threshold (Diamond Low).
3. **Gamut display type:** shows the selected Gamut display type - Diamond, Split Diamond, or Arrowhead.
4. **Threshold indicators:** indicates the the threshold settings using blue dashed lines.



GAMUT Pop-up Menu

The GAMUT pop-up menu allows you to select the type of gamut display shown in the active tile.

To display the Gamut pop-up menu:

- Press and hold **GAMUT**.

To change the display type in the GAMUT display, use the pop-up menu to select from the following displays:

- **Diamond** shows Gamut violations of the SDI input if translated to RGB color space.
- **Split Diamond** offsets the two halves of the Diamond to allow you to better see negative RGB Gamut errors.
- **Arrowhead** shows Gamut violations of the SDI input if it were translated to the Composite domain.

Status Display

Pressing the STATUS button calls up the Status display, which provides several views of signal status. Status displays are text displays that show signal status. You can view current alarms and errors (those occurring now and within the last few seconds), a history of errors and alarms (up to 10,000 entries), video error statistics or audio error statistics. You can display a different Status display type in all four tiles at once.

Status display types available:

1. **Error Log** - When Error Log is selected, the pop-up menu enables you to control the error logging settings.
2. **Alarm Status** - When Alarm Status is selected, the only other selection available is Mute Alarms.
3. **Video/Audio Session** - When either Video Session or Audio Session is selected, you can also control the session settings.

   NOTE. *Press the HELP button and then press the STATUS button to explore help topics on these status types.*

STATUS Pop-up Menu

The STATUS pop-up menu enables you to mute alarms, to select the type of display that appears in the status screen, and to set options related to the selected display type.

To display the STATUS menu, press and hold the STATUS button.

Timing a Studio

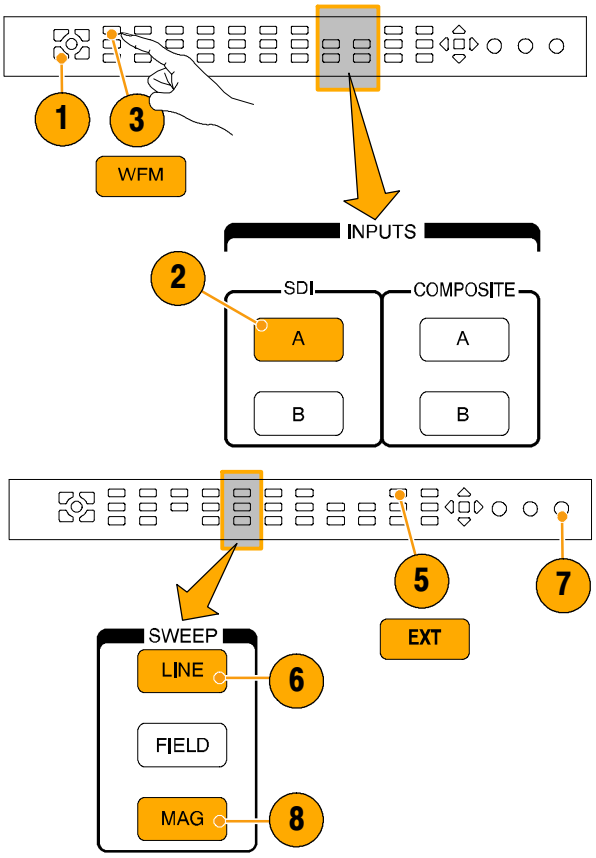
Timing a studio involves adjusting the references going to different sources so that their output feeds have the same timing when they arrive a common point, such as a production switcher. For digital systems, the timing typically only needs to be close, because most switchers have some tolerance to timing errors. For analog composite systems, the timing may need to be matched within a small part of a subcarrier cycle to prevent hue shifts when switching between sources.

The WVR7100 supports multiple methods and techniques of timing a studio. All of these methods require an external reference to the waveform rasterizers. The methods and techniques follow.

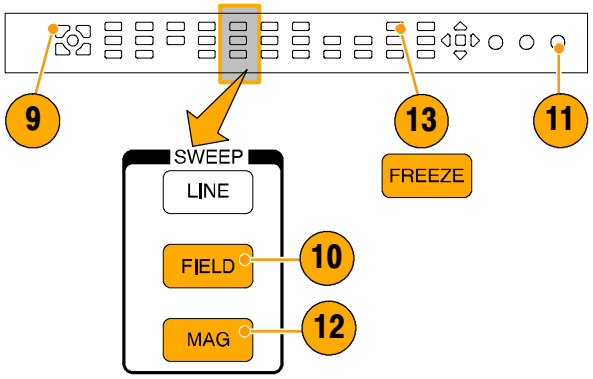
To Use the Traditional Method

This instrument makes the traditional method of comparing Horizontal and Vertical timing easier by providing flexible tiles and the FREEZE function. To time a studio using the traditional method, you store an input as a baseline and compare signals that you time against the baseline.

1. Select a tile in which to time the active input. Select WFM
2. Apply the first input signal to the appropriate input, terminate it properly, and select it. (See *Line Termination* on page 14 for termination information.)
3. Push and hold WFM. Select a display mode from the Pop up menu that is appropriate to the signal that you input.
4. Apply the house reference signal to the external reference input, terminating it properly.
5. Press **EXT** to select External Reference mode. (Connected to the house reference.)
6. Put the selected tile in line mode.
7. Use the **HORIZONTAL** knob to center the sync edge or the SAV pulse. (If using the SAV pulse, turn off Stripping EAV/SAV/ANC in the SDI Input settings of the CONFIG Menu.)
8. Press **MAG** to increase the timing resolution.



9. Select a second tile.
10. Press **FIELD** to put a second tile in field mode, choose an appropriate waveform mode.
11. Use the **HORIZONTAL** knob to center the vertical interval.
12. Press **MAG** to increase the timing resolution.
13. Press **FREEZE** save the waveform as a baseline.
14. Apply an input that needs to match timing of the first input.
15. Adjust the timing offset of the signal being timed to match the timing to the saved baseline.
16. Repeat steps 14 and 15 for any other required signals.



***NOTE**. Use the Cursors as markers or to measure timing differences between sources.*

In this procedure, other tiles can be used to set fine timing and check color frame alignment on composite signals. Alternatively, the other two tiles could be used for line and field rate displays without Mag active to show the location of significantly mis-timed signals.

To Use the Timing-Display Method

The Tektronix proprietary Timing Display (patent pending) provides a quicker, easier to use measure of the timing of an input relative to the external reference:

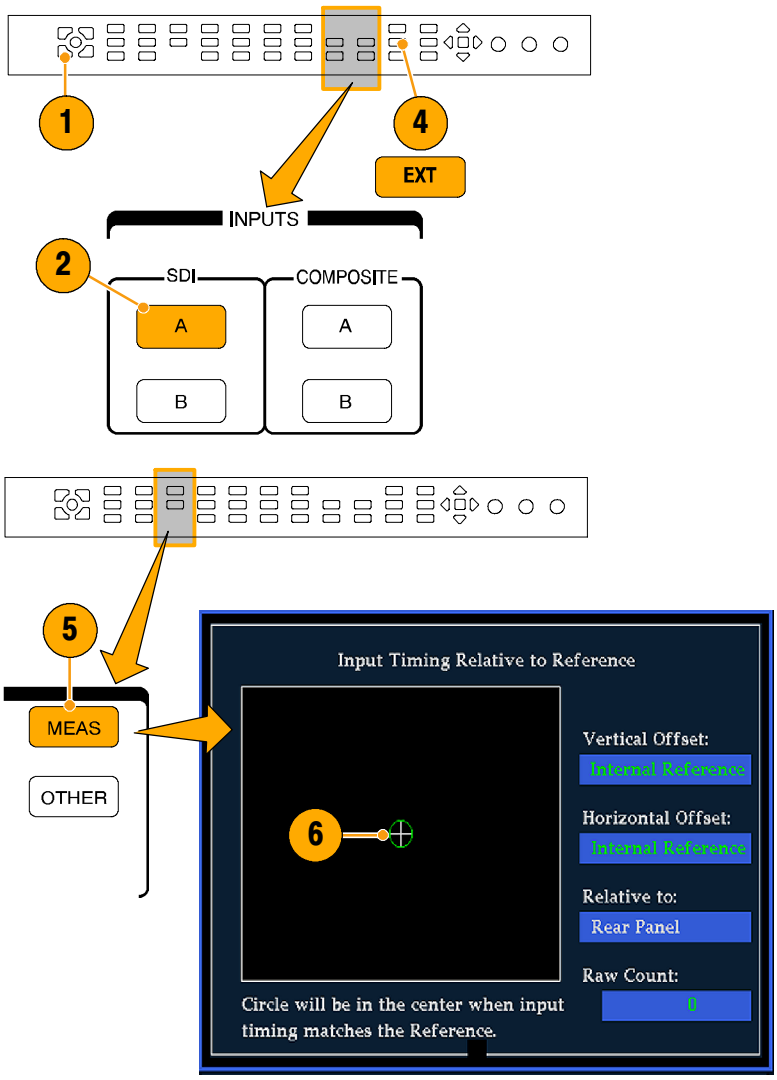
- The rectangular display automatically scales to match the input signal. For progressive signals the display represents one field, for interlace signals the display represents one frame, and for composite inputs the display represents one color frame.
- The cross-hair in the center represents zero offset, and the circle represents the timing of the input signal. Lines of advance or delay are shown as vertical displacement, while timing errors of less than one line are shown as horizontal displacement. If the input is at the same time as the reference, then the circle will be centered on the cross-hair.
- The timing offset is also shown numerically as lines and micro-seconds of advance or delay in the boxes at the right side of the display.
- For input and reference signals with closely related frame rates, there is only one timing relationship, so a single circle is shown on the display to indicate the timing offset of the input signal.
- For input and reference combinations with more complex relationships, multiple circles are displayed to indicate all the possible interpretations of the timing offset, with the one that is closest to zero shown with emphasis. The numerical readouts will correspond to the timing indicator circle with the emphasis.

- The Relative to: box indicates the chosen zero point for the timing display. The default is Rear Panel. In this mode, the offset is zero when the input and reference are at the same timing at the rear panel of the waveform rasterizer. The other choice is Saved Offset. In this mode, you can save the timing from one signal and then display the timing relative to that saved offset.

To use the Timing display to time a signal to a reference:

1. Select a tile in which to time the active input.
2. Apply the input signal to be timed to the appropriate input, terminate it properly, and select it. (See *Line Termination* on page 14 for termination information.)
3. Apply the house reference signal to the external reference input, terminating it properly.
4. Press **EXT** to select External Reference mode.
5. Press **MEAS** to select the Timing display for the tile selected in step 1.
6. If only one circle is displayed, adjust the timing offset of the black generator to match the timing to the external reference. Adjust for a perfect coincidence of the circle around the reference target (circle turns green at coincidence) and null values of the vertical and horizontal timing readouts.
7. If multiple circles are displayed, the timing is complex, and you must choose the one you want. The measurement that is closest to zero offset is displayed with emphasis and appears in the readouts.

   NOTE. *For discussion on complex timing displays, see* Timing Displays for Simple Versus Complex Timing *on page 45 for more information on this display and its elements.*
8. Repeat step 6 or 7 for any other signals.



***NOTE**. As you adjust timing, the circle representing the input timing may jump occasionally. This is because the color frame detection circuit can be temporarily disrupted as the signal shifts. The jump is often a multiple of the field time. The circle will settle back to the correct location in a second or so.*

Usage Notes

- The resolution of the timing display for Composite and SD signals is one 27 MHz clock cycle or 37 ns. For HD signals, it is one clock at 74.25 MHz, which equates to about 13.5 ns. To get the greater accuracy needed for a composite signal, first use the timing display to get close, then use a vector display for the final burst phase alignment. Since the waveform rasterizer can display both the timing display and a vector display simultaneously (each in its own tile), this process can still be easy and quick.
- For composite signals the definition of time aligned is obvious but for an SDI input relative to a analog reference the situation is more complex. For the timing display, the definition of zero offset on an SDI input uses the methodology described in SMPTE RP168. This method specifies the SDI signal will be converted to analog. The converted analog signal is then compared to the analog reference. For the conversion a D/A converter with delay of about three microseconds is used.
- In the relative to rear panel mode, this three microsecond conversion delay is accounted for in the displayed offset. In the Relative to Saved Offset mode, it has no effect.

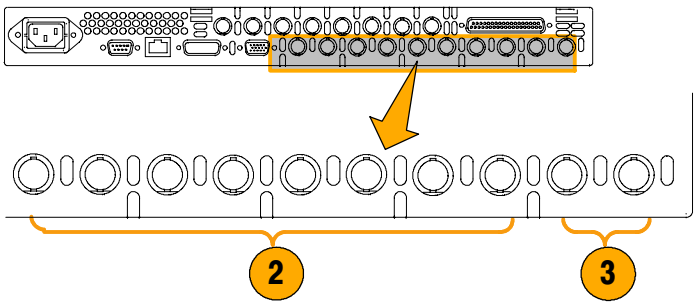
To Time Multiple Inputs to a Router

You can also use the Relative to: function to set the offset between a master and a reference signals as the zero-point reference for time-down applications. The **Relative to**: box indicates the chosen zero point for the timing display:

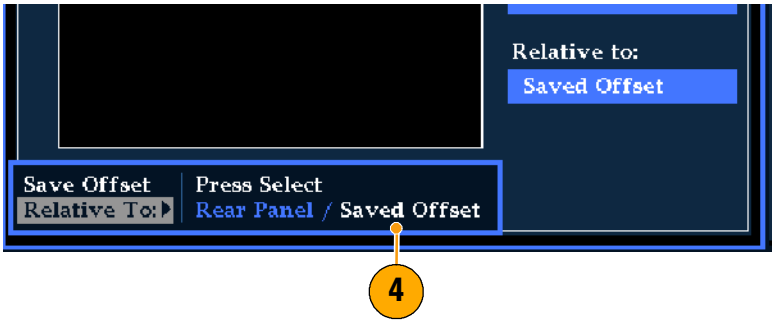
- **Rear Panel**. In this mode (default), the offset is zero when the measured signal input and reference are at the same timing at the reference at the instrument rear panel. This setting was used in the Timing Display Method procedure.
- **Saved Offset**. In this mode, you can save the timing from a master signal relative to the reference as the zero point offset. Then route other inputs and measure relative to this saved offset.

To time the inputs to a router:

1. Perform steps 1 through 5 of the procedure starting on page 55, with the qualifications described in steps 2 and 3 that follow.
2. Route the signal you want as the master to the appropriate input, SDI or Composite, and terminate properly.
3. Route the reference signal to the reference input and terminate appropriately.



4. Save[1] the timing offset for the master input (**MEAS** > **Save Offset** > **Press Select**) and select **Relative to: Saved Offset** mode from the pop-up menu.
5. Now select other inputs to the router to be connected to the waveform rasterizer. For each input the relative timing will be displayed.
6. Adjust the timing offset at the master sync source to time down the inputs to the router to match the master.



1 *You cannot save the timing offset if either the input or reference is missing or unlocked. You also cannot save a reference when in internal mode. Saving an offset in these conditions would lead to misleading results so it is not allowed by the instrument. A warning message will appear on the screen if you attempt to save the offset when it is not allowed.*

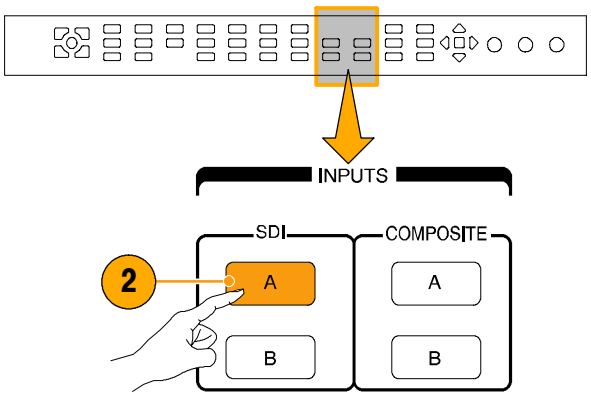
Usage Notes

- The resolution of the timing display is one 27 MHz clock cycle or 37 ns. To get the greater accuracy needed for a composite signal, first use the timing display to get close, and then use a vector display for the final burst phase alignment. Since these two displays can be present simultaneously in separate tiles, this process is still easy and quick.
- For composite signals, the definition of time aligned is straight forward, but for an SDI input relative to an analog reference, the situation is more complex. For the timing display, the definition of zero offset on an SDI input assumes the SDI signal will be converted to composite. The converted composite signal is then compared to the analog reference. For the conversion, a half-band filter with a 33 clock-cycle delay and an analog reconstruction filter are assumed. This conversion introduces a delay of about 3 μs.
- In the **Relative to: Rear Panel** mode, this 3 μs conversion delay is removed from the measured offset before the display is generated. In the **Relative to: Saved Offset** mode, it has no effect.
- This timing relationship between input and reference is also compatible with waveform mode. That is, if you have zero timing on the Timing display and change from internal to external reference, the displayed waveform will not shift position.
- When timing analog composite signals, adjust system phase with the Vector display. The Vector display is described on page 42.
- Note: If you have an input and reference combination that requires multiple timing indicator circles, then it can be misleading to compare timing offsets between multiple inputs. Because the timing display chooses the smallest of the possible timing offsets, if a large timing difference exists between two inputs, then they may not be matched. This problem will also occur using traditional timing methods unless one uses something similar to the SMPTE318 10 field flag to identify a specific sub-multiple of the reference.

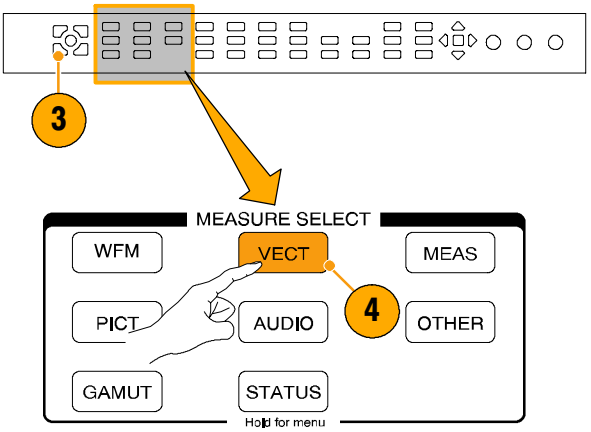
Checking Chroma/Luma Delay (Lightning Display)

The Lightning display can be used for interchannel timing measurement. If the color-difference signal is not coincident with luma, the transitions between the color dots will deviate from the center mark of a delay scale. The amount deviated represents the relative signal delay between luma and color-difference signal.

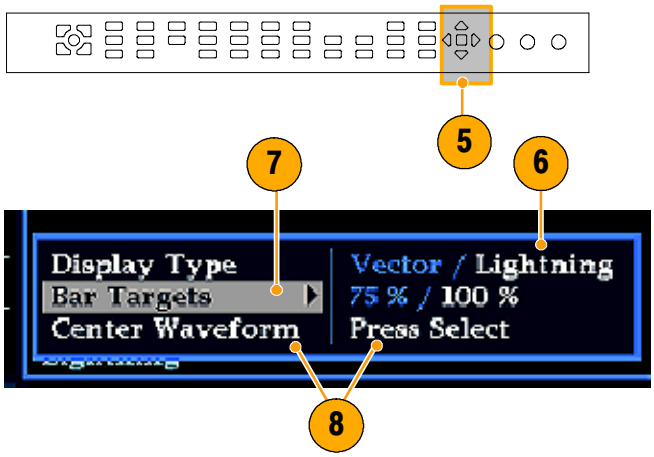
1. Connect a signal containing color bar information, terminating the signal properly (see *Line Termination* on page 14 for termination information).
2. Select the input corresponding to the signal connected.



3. Select a tile.
4. Press and hold the VECT button to display the signal in a tile and pop up the Vector menu.



5. Use the Selection Keys and Button to set the menu in the steps that follow.
6. If Display Type is Vector, select Lightning in the menu.
7. Set Bar Targets to match your input signal.
8. Select Center Waveform, and press SEL if you want center your waveform.
9. Press the VECT button to close the menu.



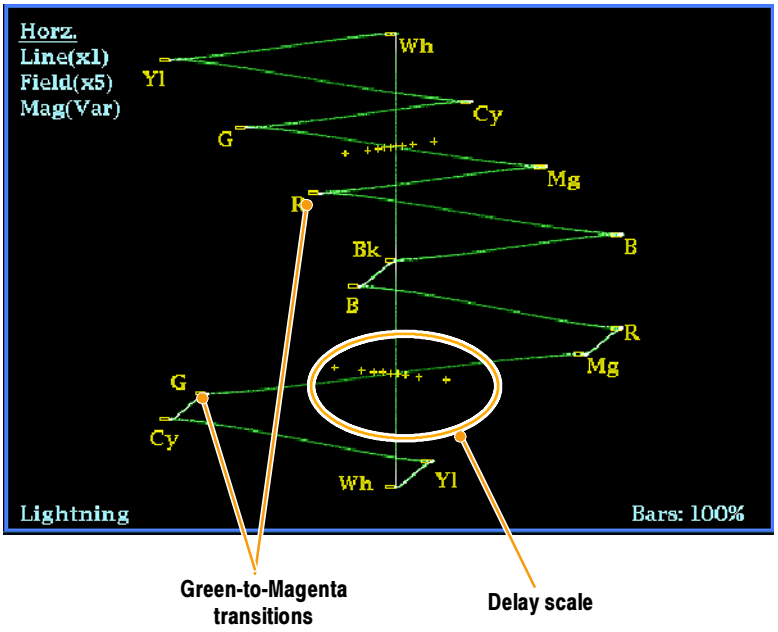
10. Determine where transitions intersect the delay scales and derive the timing error in nanoseconds, as deflected from center mark:

Deflection	SD	HD
0 marks	0 ns	0ns
+/-1 mark	20 ns	2 ns
+/-2 marks	40 ns	5 ns
+/-3 marks[1]	74 ns	13.5 ns
+/-4 marks[2]	148 ns	27 ns

[1] **1 Luma sample**

[2] **1 Chroma sample**

- The center mark of the nine marks spanning at each green-magenta transition is the zero error point.
- Alignment to a mark towards black means the color-difference signal lags with respect to luma.
- Alignment to a mark towards white means the color-difference signal leads the luma signal.
- The upper half of the display measures the Pb to Y timing; the bottom half measures the Pr to Y timing.



Checking Gamut

Signals that are legal and valid in one signal representation may not be legal in another representation. Specifically, signals which are legal in the Digital YCbCr representation may not be legal if transcoded to RGB or encoded to NTSC / PAL. Any signal that fails this test is considered out of gamut.

The WVR7100 supports multiple displays and alarms to allow detecting out of gamut signals. The flexible tile display allows you to simultaneously view several of the gamut measurements to learn which is most appropriate for a given application. The displays are:

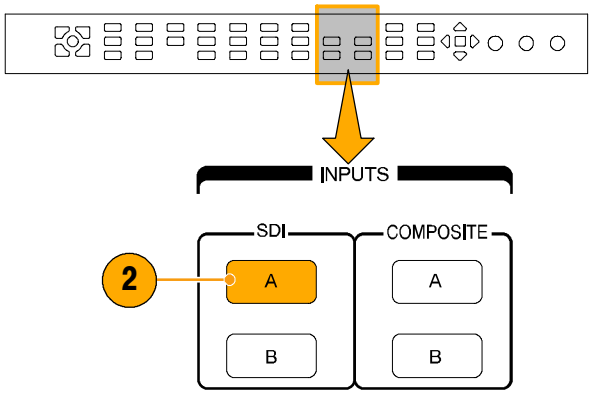
- Diamond for checking that SDI signals conform to legal RGB gamut space
- Split Diamond separates the upper and lower diamonds to show excursions below black, otherwise it is identical to the Diamond display
- Arrowhead for checking if an SDI signal is legal for composite color space
- Composite Waveform modes for checking both SDI and composite signals for legality in composite color space

Diamond, Split Diamond, and Arrowhead have adjustable thresholds. If the signal goes outside the area defined by the thresholds, the signal is out of gamut. If these limits are exceeded then the waveform rasterizer can generate alarms if configured to do so. For composite waveforms, the legal limit is simply the maximum level allowed for the combination of luma and chroma. This limit depends on application. For example, a recording on a tape may be able to handle a larger signal than if driving into a transmitter.

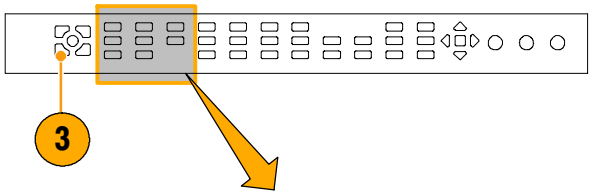
Setting up for Gamut Checks

1. Connect a video signal and terminate it properly.

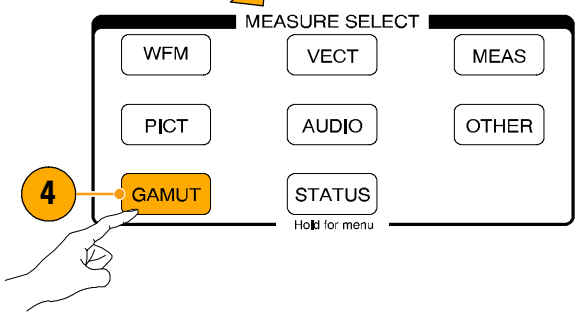
2. Select the input corresponding to the signal connected.



3. Select a tile.

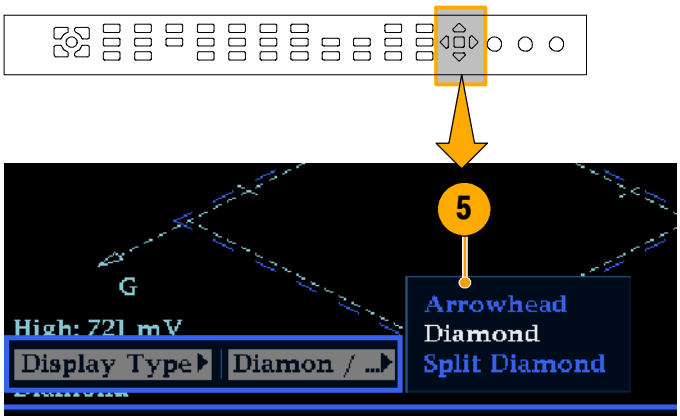


4. Press and hold the GAMUT button to display the signal in a tile and pop up the GAMUT menu.

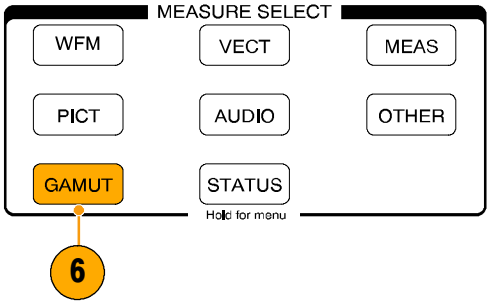


5. Use the Arrow Keys and SEL Button to set the menu to one of these three gamut displays:

   - Diamond- use to detect, isolate, and correct RGB component gamut errors
   - Split Diamond- use to reveal hard-to-find black gamut errors
   - Arrowhead - use to detect and correct composite gamut errors, without employing a composite encoder.



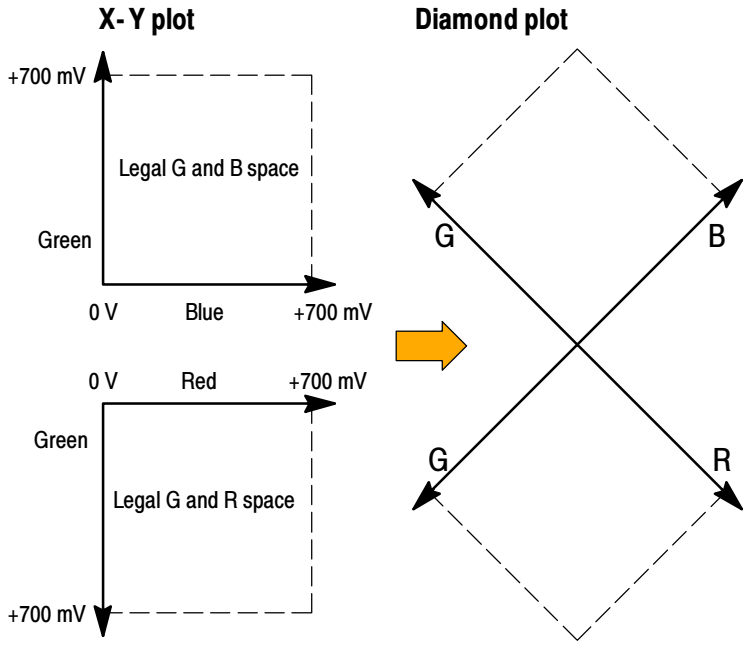
6. Press the GAMUT button to close the menu.



Checking RGB Gamut

The Diamond display effectively shows how the R, G, and B signal video signals relate, making it a good tool for detecting gamut errors.. The waveform rasterizer converts the Y, P_b, and P_r components recovered from the serial signal to R, G, and B to form the Diamond display. To predictably display all three components, they must lie between peak white, 700 mV, and black, 0 V.

For a signal to be in gamut, all signal vectors must lie within the G-B and G-R diamonds. Conversely, if a signal vector extends outside the diamond, it is out of gamut. The direction of an excursion out of gamut indicates which signal is excessive. Errors in green amplitude affect both diamonds equally, while blue amplitude errors affect only the top diamond and red errors affect only the bottom diamond.

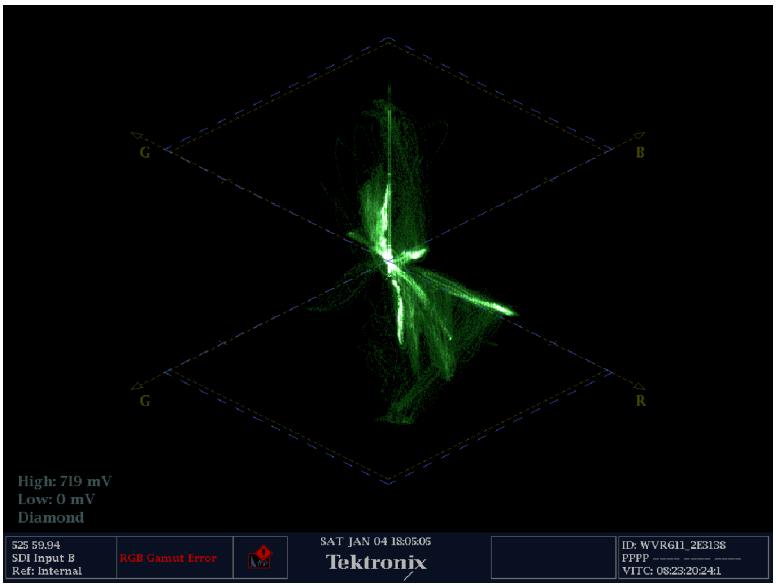


1. Perform the Checking Gamut procedure on page 60, selecting Diamond in step 5.

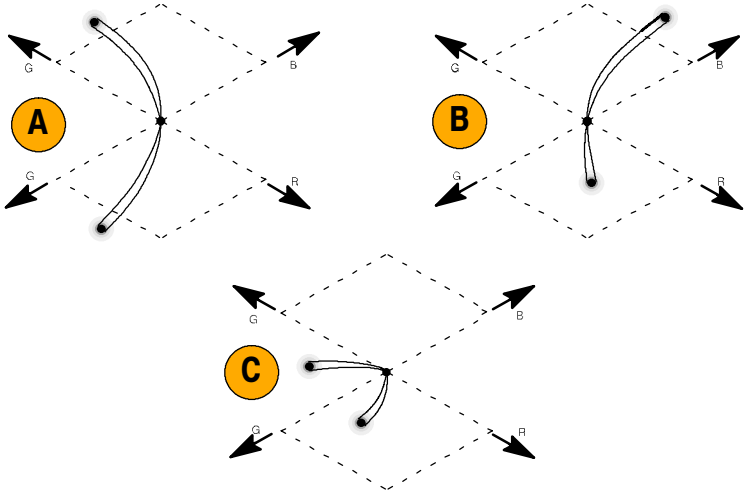
2. Compare the signal to the display to determine out of gamut components, noting the following:

   - The intensity of a vector indicates its duration.
   - A momentary out-of-gamut condition appears as a faint trace. Long duration violations show as a bright trace.

   See the following step for some sample out-of-gamut signals.



3. Consider the following examples when evaluating for out of gamut components:



A Example A:
R - Ok
G > 700 mV
B - Ok

B Example B:
R - Ok
G - Ok
B > 700 mV

C Example C:
R - Ok
G - Ok, 350 mV
B < 0 mV

Usage Notes

As with the lightning display, bending of the transitions indicates timing delays. When a color bar signal is applied, the vertical axis becomes an indicator of delay errors.

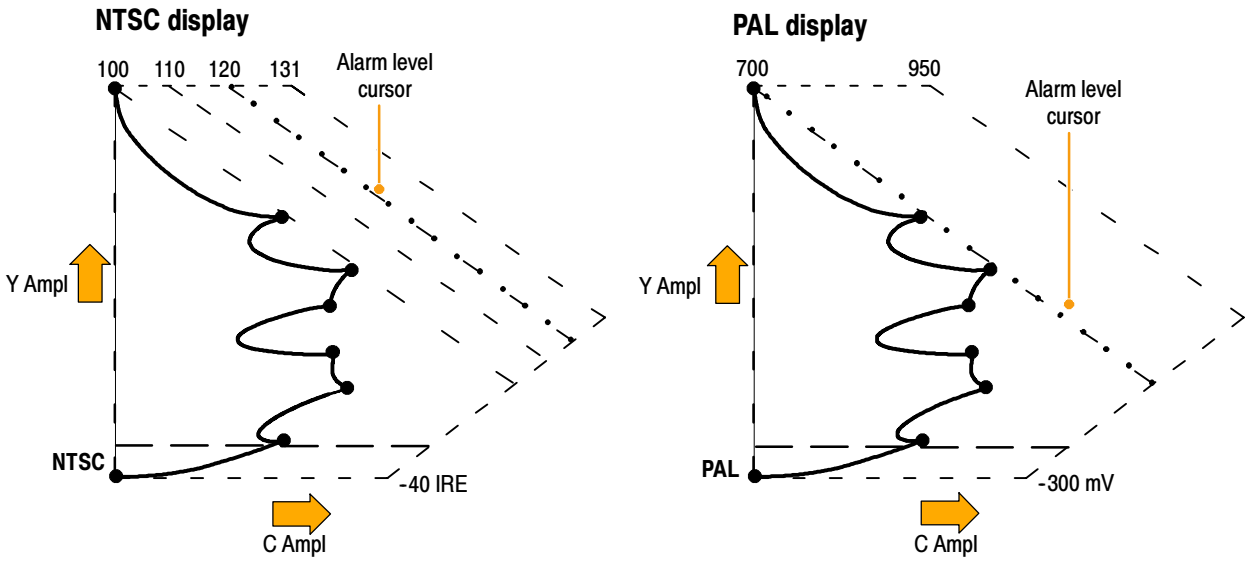
On the Diamond Display, monochrome signals appear as vertical lines. Nonlinear component processing, such as from a gamma corrector that alters white balance, can cause deviations along the vertical axis.

To isolate gamut bright-ups, try the following:

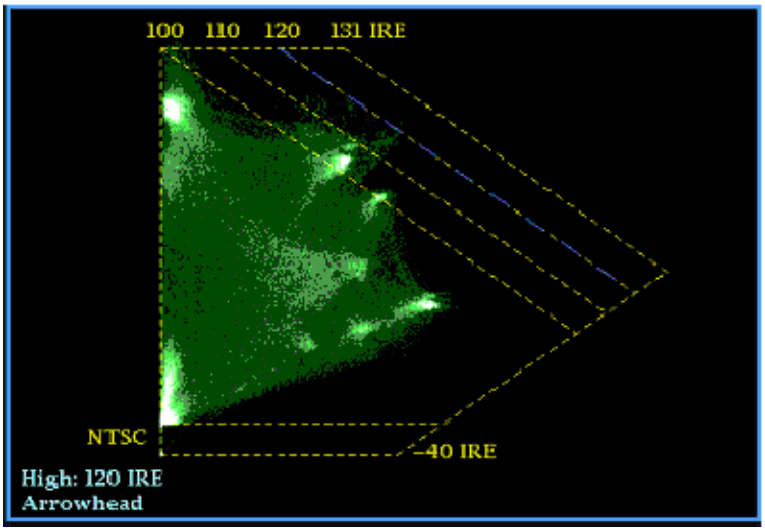
- Use LINE SEL to select individual lines
- Use PICT to examine the rasterizer signal
- Use Arrowhead % setting (CONFIG menu, Gamut Thresholds section) to specify a percentage of the screen for which to ignore for gamut violations.

Checking Composite Gamut

The Arrowhead gamut display plots luminance (Y) against chrominance (C) to check if the composite signal adheres to standard gamut. NTSC and PAL Arrowhead displays (75% Color bars) and indicates the values of the graticule lines. The arrow-head shape of the graticule results from overlaying the standard limits for luminance and luminance plus peak chrominance.



1. Perform the *Checking Gamut* procedure on page 60, selecting Arrowhead in step 5.
2. Compare the signal to the display to determine out of gamut composite components, noting the following:
   - Signals exceeding the luminance amplitude gamut extend above the top horizontal limit (top electronic graticule line).
   - Signals exceeding the luminance plus peak chrominance amplitude gamut extend beyond the upper and lower diagonal limits.
   - The bottom horizontal line shows the minimum allowed luminance level of 7.5 IRE for NTSC and 0 mV for PAL.



Usage Notes

- To adjust the IRE level limits, do the procedure *To Adjust Gamut Limits* on page 67.

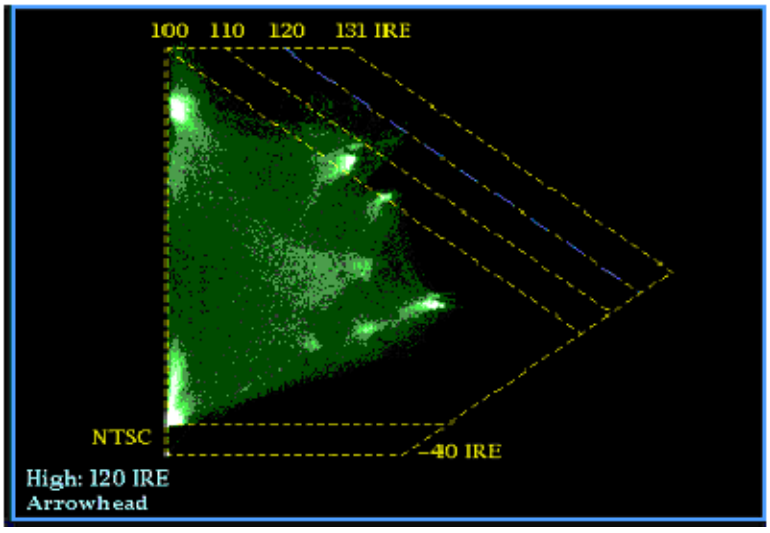
- To automate this check, do the procedure *To Automate Gamut Checks* on page 65.

Checking Luma Gamut

Luma limit thresholds can be configured for identifying luma exceeding threshold limits. They apply to both the incoming SDI and to the arrowhead representation of the SDI input as a composite signal. By defining these levels in percent, they automatically account for the presence or absence of setup.

The thresholds are affected by your choice of set-up or no set-up for the Arrowhead display.

1. Perform the *Checking Gamut* procedure on page 60, selecting Arrowhead in step 5.
2. Compare the signal to display to determine out of gamut luminance. Note the following:
   - The adjustable thresholds are indicated by the dark blue horizontal graticule lines
   - The thresholds are defined in terms of percent of full scale
   - The range for the Upper limit is 90% to 108%.
   - The range to the Lower Limit is -6% to +5%

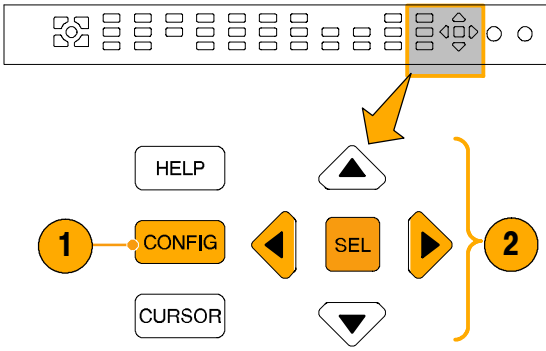


Another useful Arrowhead function is a measure of how well the active video signal is using the dynamic range of video channel. A properly adjusted signal should be centered in the arrowhead graticule and have transitions that approach all the limits.

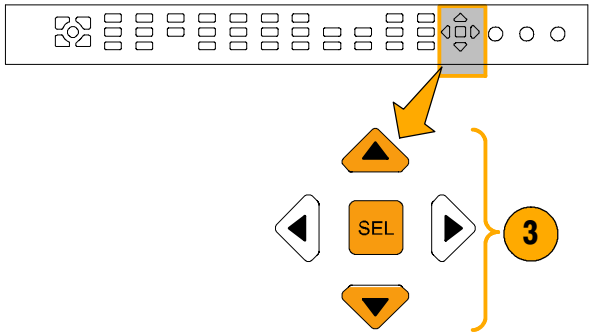
To Automate Gamut Checks

You can use alarms to automatically monitor for out of gamut conditions:

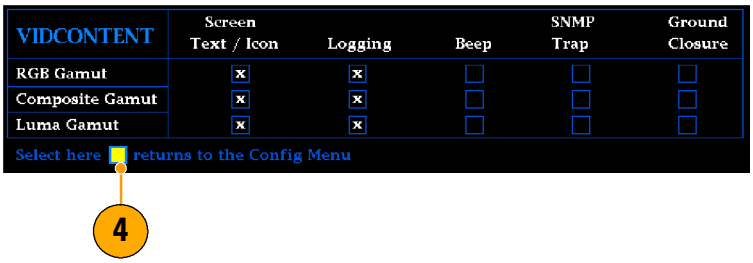
1. Press the CONFIG button to display the Configuration menu.
2. Use the left/right arrow keys and SEL button to select Alarms, and then Video Content.



3. Use the up/down arrow keys to move to each the alarm that you want to set. Press SEL button to toggle the alarm on (X) or off.

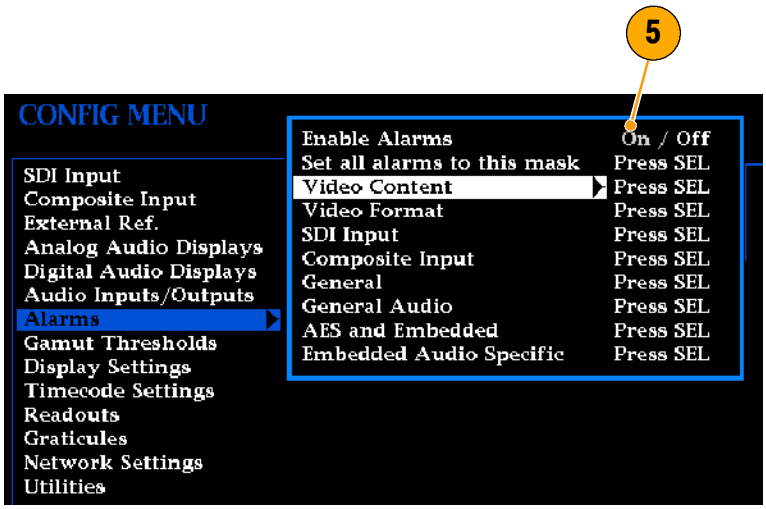


4. When you have configured the Alarms as you want them, move to the Select here... box and select it.

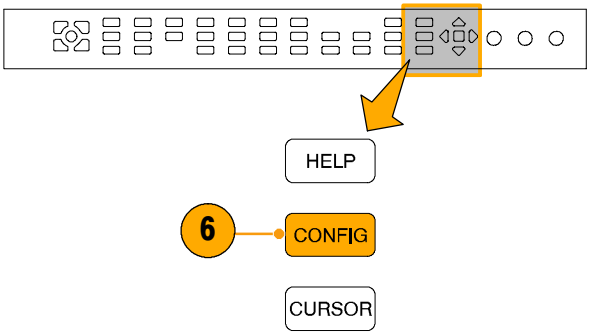


5. Check that Enable Alarms is set to On in the Alarms menu before leaving the Alarms menu.

   NOTe. *For information on Alarms, press the HELP button while Alarms is selected in the CONFIG menu.*



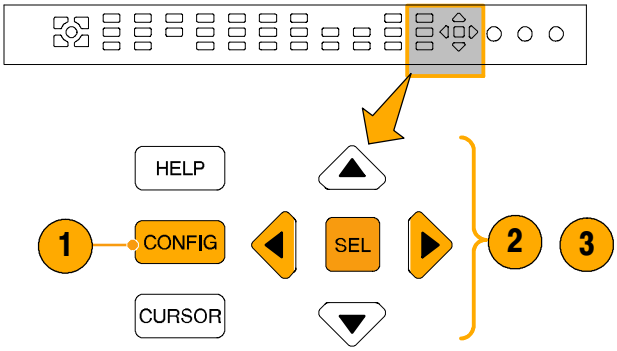
6. Press CONFIG to exit menu.



To Adjust Gamut Limits

1. Press the CONFIG button to display the Configuration menu.
2. Use the left/right arrow keys and SEL button to select Gamut Thresholds.
3. Press SEL button to enter the sub-menu, and use arrow keys and SEL button (and General knob, when indicated) to select and set the various thresholds as you want them.

   Note that you can also reset thresholds to defaults.



Selecting and Monitoring Audio

The WVR7100 provides several methods to monitor audio signals. You can measure levels, monitor phase, and display phase correlation. You can specify meter ballistics and scales, set the Test and Peak Program indicator levels, and specify how phase is displayed.

***NOTE**. With audio option DA, the waveform rasterizer can monitor AES, analog and Embedded audio; Option DG can only monitor AES and embedded audio.*

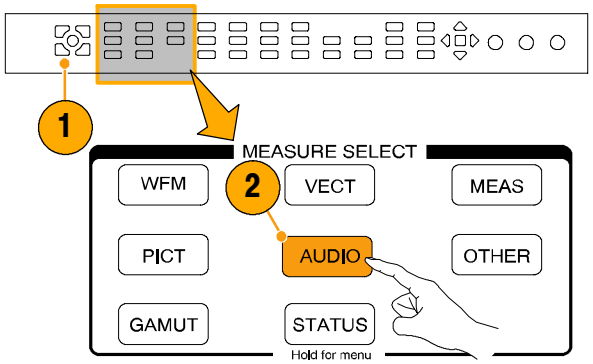
Selecting the Audio Input

You select the audio input to be monitored from the front-panel AUDIO button pop-up menu.

***NOTE**. The Audio display can appear in only one tile at a time.*

To select the audio input monitor:

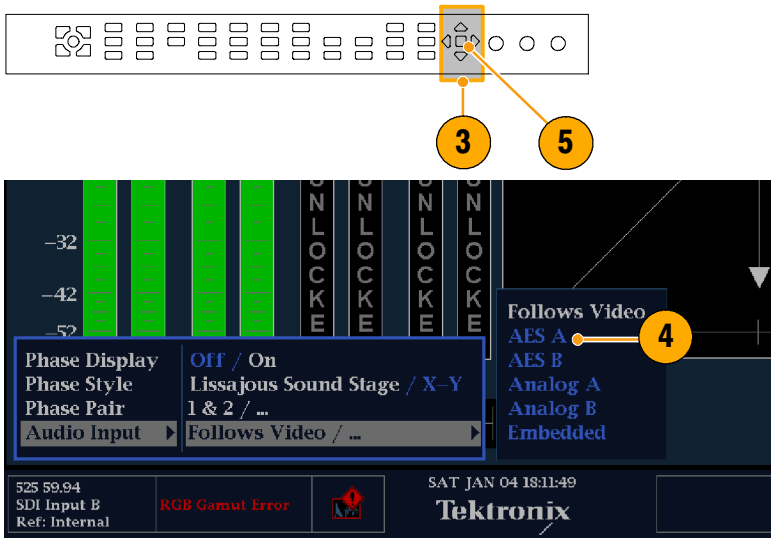
1. Select a tile.
2. Press and hold the Audio button to open the Audio display in a tile and pop up the Audio menu.



3. Use the Selection Keys and Button to set the menu in the steps that follow.
4. Select **Audio Input**, and then select one of the audio input options shown.

   ***NOTE.** The available selections depend on the installed audio option. Selecting Follows Video selects the audio to video mapping set in the Configuration menu.*

5. To activate the input selected, press **SEL**.



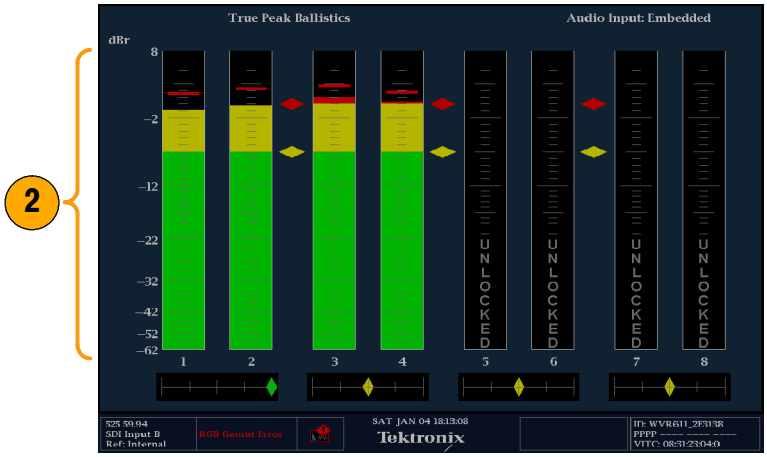
Checking Audio Level & Phase

The waveform rasterizer level meters are vertical bar graphs where the height of the bar indicates the amplitude of the audio program in the corresponding input channel. You can change the input and turn on and off the Phase display from the audio pop-up menu. Other meter characteristics such as ballistics, scale units, and program/test levels are configured through the Configuration menu.

The WVR7100, with optional audio, can display phase of one input pair with a Lissajous pattern display, and it can display relative phase on all four pairs of inputs with correlation meters.

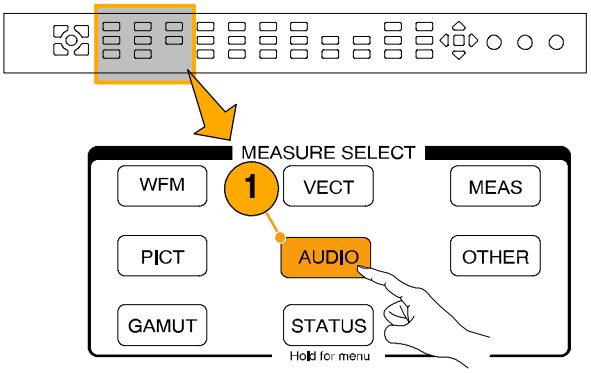
Check Level

1. Open the audio monitor in a tile as described in on page 68.
2. Check the level meter bars for current audio levels, which are displayed according to the selected meter ballistics. Each bar displays three colors:
   - Green- Indicates portions of the level meters below the test level.
   - Yellow- Indicates portions of the level meters between the test and peak program level.
   - Red- Indicates portions of the level meters above the peak program level.

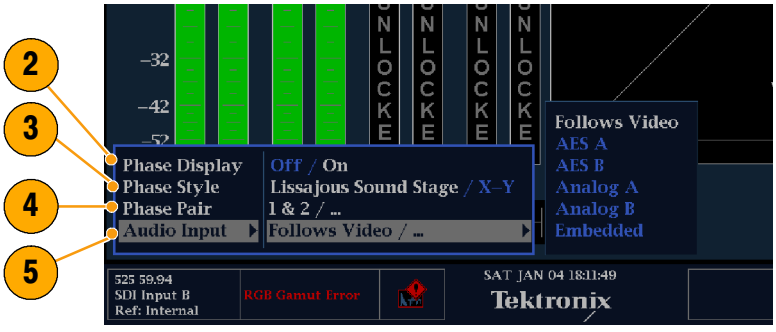


Check Phase

1. Press and hold the **AUDIO** button to display the pop-up menu.

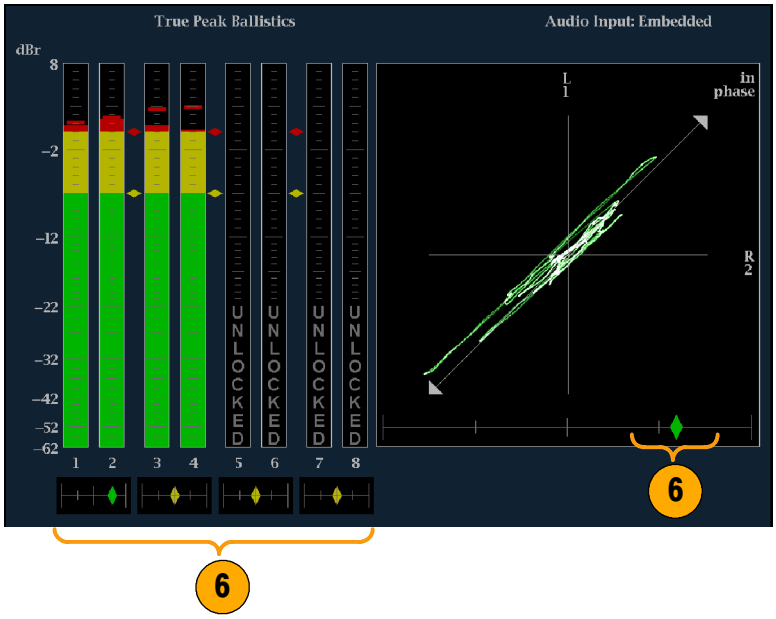


2. Select **Phase Display**. Press **SEL** or the right-arrow key to turn the phase display on.
3. Select the **Phase Style**. Choose either a **Soundstage** or **X-Y** orientation for the Lissajous signal. (See *Usage Notes* on page 70.)
4. Select the Phase Pair to be displayed.
5. Set the Audio Input to match the signal that you are checking.



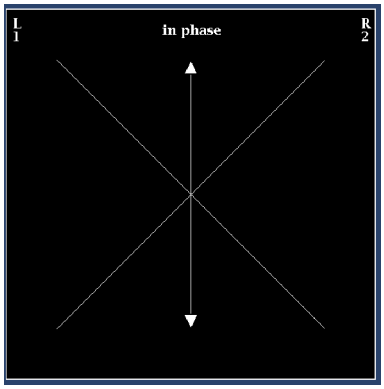
6. Check for Phase correlation of the signals, noting the following:

   - Phase correlation meters are located under the appropriate bars and one is duplicated under the phase display.
   - For correlated signals, the diamond will be green, and it will move to the right side.
   - For uncorrelated signals, the indicator will be yellow and tend to stay in the middle.
   - For anticorrelated signals (one goes up when the other goes down), the indicator will be red move to the left side.

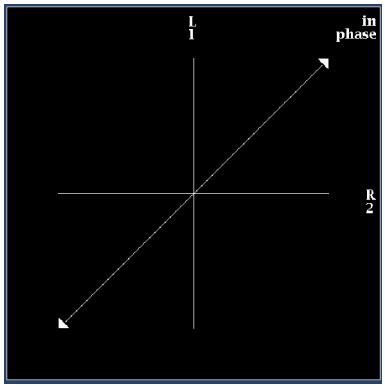


Usage Notes

- The Lissajous or phase display is a plot of one channel against another on an orthogonal pair of axes:
  - Soundstage plots the two channels at 45 degree angles, with the mono combination appearing on the vertical axis—more like a left-right image in a studio.
  - X-Y plots left-channel data on the vertical axis and right channel data on the horizontal axis, emulating the X-Y display of an oscilloscope.



Lissajous sound stage



X-Y orientation

- The response time of the correlation meters can be set from the CONFIG menu. The choices follow.

Speed setting	Response averaging time (s)
1	0.0167
2	0.0333
3	0.0667
4	0.1333
5	0.2667
6	0.5333

Speed setting	Response averaging time (s)
7	1.0
8 (default)	1.5
9	2.0
10	2.5
11	3.0
12	3.5
13	4.0
14	4.5
15	5.0
16	5.5
17	6.0
18	6.5
19	7.0
20	7.5

Remote Communications

Remote communications that are covered here include those that are:

- over an Ethernet network through a Web browser,...
- over an Ethernet network through a Java applet,...
- over a cable using the optional Remote Front Panel, and those...
- that download previously saved setups (Presets) and error logs (included is how to print those error logs)

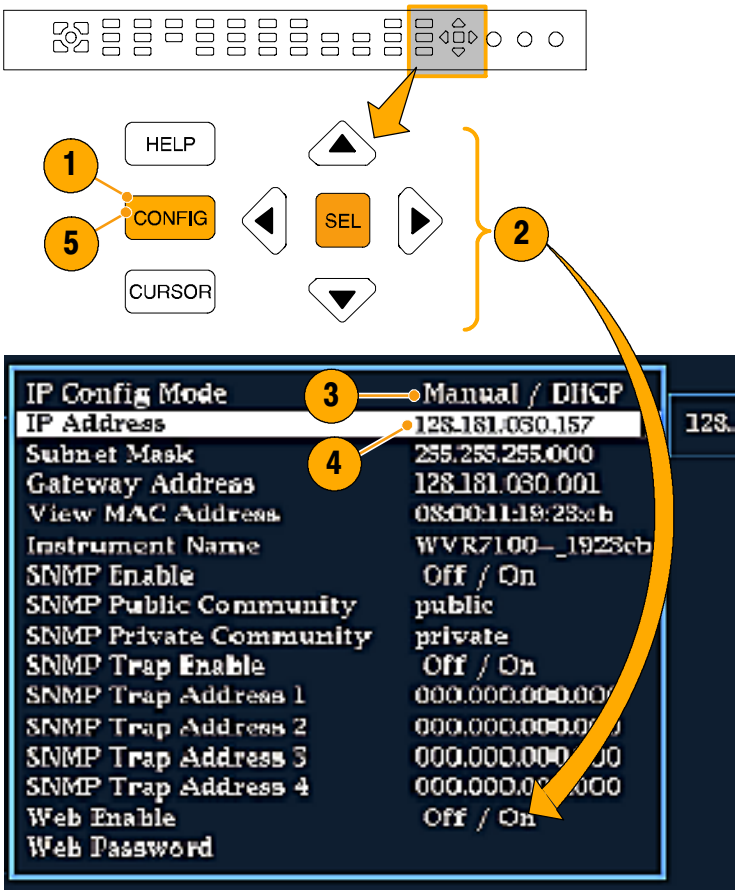
Using a Web Browser

You can connect to the waveform rasterizer and perform simple operations without installing any software and using just a Web browser. To use a Web browser to connect to a WVR7100, the waveform rasterizer must be connected to an IP network via Ethernet. You will need to set the IP Config Mode, IP Address, Subnet Mask, and possibly the Gateway Address depending on your network configuration.

Using only a Web browser, you can save screen captures, download presets, and download the error log. To connect to the waveform rasterizer using a Web browser:

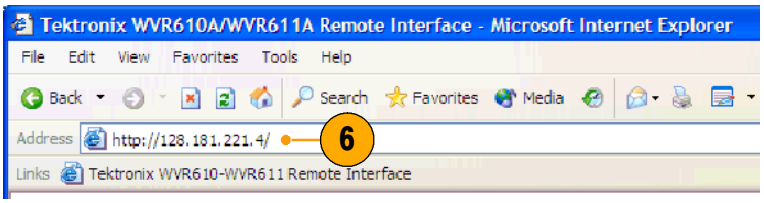
1. Press **CONFIG** to display the Configuration menu.
2. Select **Network Settings** > **Web Enable**. Press **SEL** to select **On**.
3. Set the IPConfig Mode to Manual or DHCP, depending in your network set-up.
4. Note the IP Address for use in step 6.

   NOTE. *You may have to set other network parameters in this menu; see your LAN administrator if required.*
5. Press **CONFIG** to close the Configuration menu.



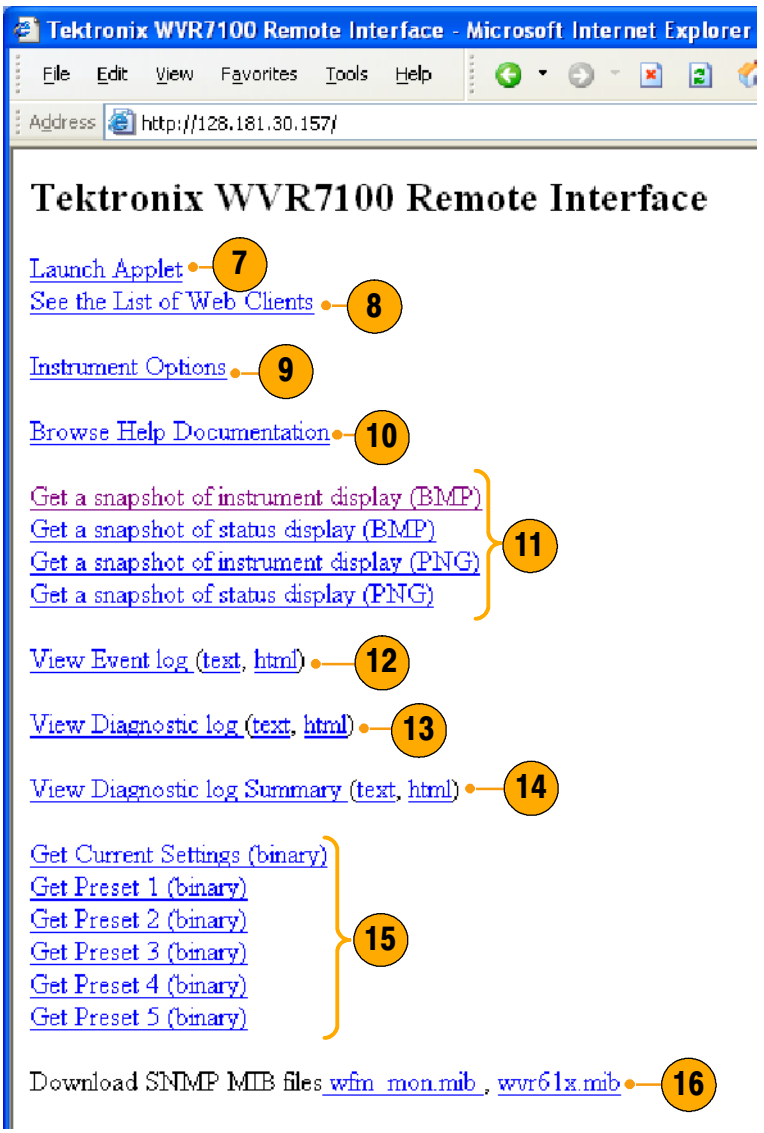
6. Start your Web browser and type the network address of the waveform rasterizer (from step 4) into the URL entry box like this:

   `http://123.123.123.123/`[1]



Do any of the following steps as desired:

7. Click to start the Java applet (see next procedure).
8. Click to display a list of web clients (by network address) currently logged into the waveform rasterizer.
9. Click to display which options this instrument is equipped with.
10. Display waveform rasterizer online help.
11. Capture the full or status bar displays in BMP or PNG formats. Retrieves the capture for saving to a file.
12. Download and display the Error Log as tab-delimited text or an HTML table.
13. Download and display the Diagnostic Log as tab-delimited text or an HTML table.
14. Download instrument settings to a file in binary format.
15. Download Preset <N> to a file in binary format, where <N> is any of 1 – 5.
16. Download each of the MIB files in ASCII format.



[1] *Many web browsers do not correctly interpret IP addresses with leading zeros. If the IP address shown in the Configuration menu contains leading zeros as in 124.161.038.151, remove the "0" when entering it into the address line of the browser. For example, 124.161.038.151 should be entered as 124.161.38.151.*

Using the Java Applet

To further extend your control from a remote PC, launch the Java applet from the Web browser to change the waveform rasterizer settings, display and refresh the waveform rasterizer screen, save screen captures, download and upload presets, and download the error log. The Java applet provides a menu bar and a virtual front panel that gives you complete remote control over instrument settings.

Note that the Web interface operation is optimized for screen resolutions of 1024 x 768 or higher. Operation on computers with lower resolution requires scroll-bar use to see the entire interface.

Java Applet Requirements

If you install Java on your PC, you can launch a Java applet to control the waveform rasterizer. The Java Applet requires:

- Version 1.41 (or later) of the Java Run-Time Environment (JRE) from Sun Microsystems installed on your PC. To download the JRE (Java Run-Time Environment) plug-in from Sun Microsystems, download the appropriate code from the URL: *http://java.sun.com/j2se/1.4/*

  Once you download the executable file, launch the installation software and follow the instructions.

- Microsoft Internet Explorer 5.0 or later running on a Windows PC.

- Netscape on Apple Linux or on UNIX machines.

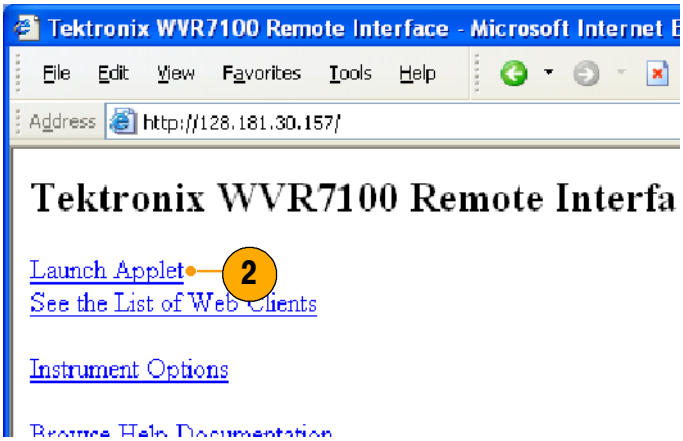
***NOTE**. If you need remote operation on other platforms, use the Java Application, which stands-alone and provides all of the features of the Java applet. The Java Application can be run on any platform that supports Java version 1.4.1 or later, including Windows NT/2000/XP, Linux, Unix, and Mac OS X. The Java application, unlike the Java applet, does not run within a web browser and, thus, is not subject to the various browser limitations. You can download the Java application package from the Tektronix web site. Look for* WVR Remote Software Package *in the download section of the Video Test Product pages.*

The Java Application can be used to download instruments Presets to a remote file and upload from the remote file to the instrument.

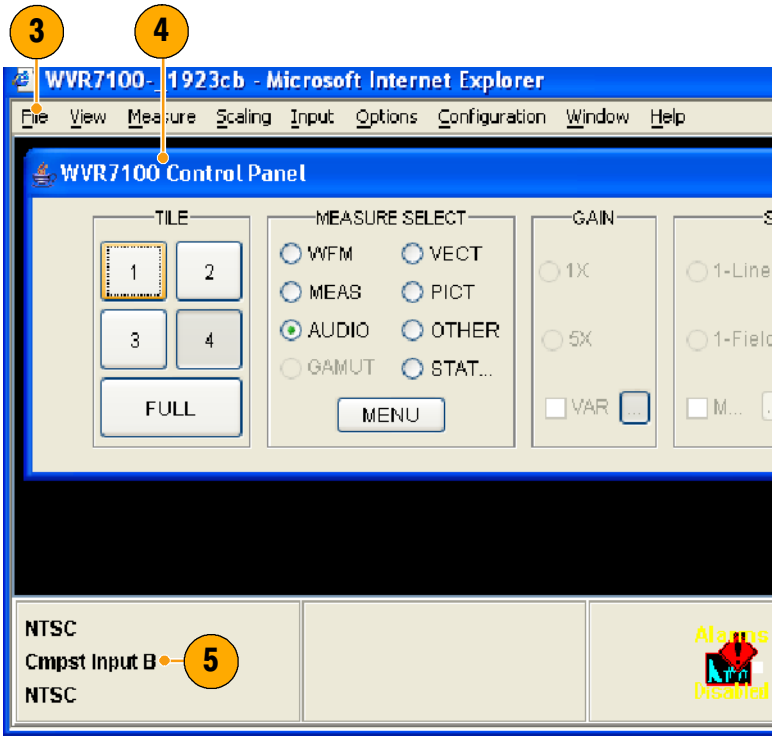
Launching the Applet

When you launch the Java applet, it is downloaded from the waveform rasterizer and launched. There is no software installation required to use the applet (other than the Java Run-Time Environment noted previously). The waveform rasterizer supports up to three remote clients (screen updates become slower with each client added).

1. Launch the Web browser as described under *Using a Web Browser*, starting on page 72.
2. Once the Remote Interface appears, select **Launch Applet**. The Java applet will be launched (shown below)



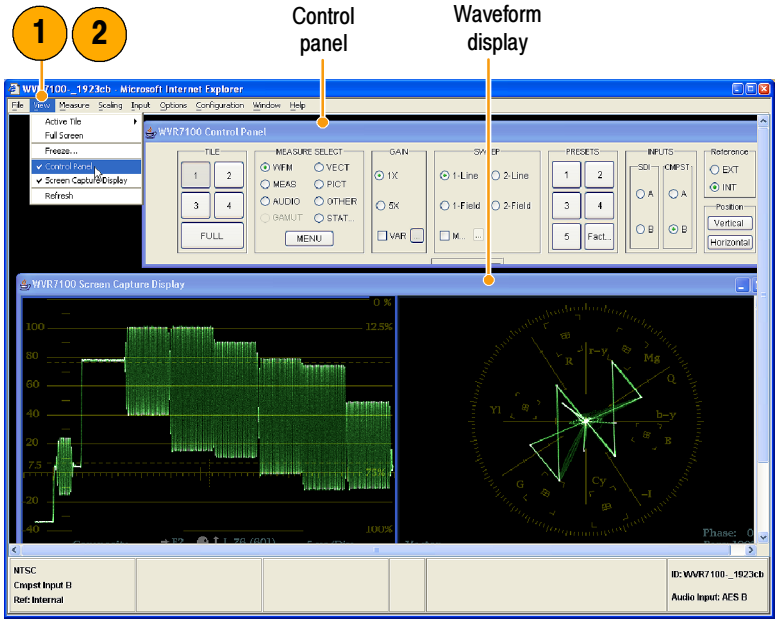
3. Use the menu bar of the Java applet window to quickly access functions that are not available from the front panel. Also, access the Configuration menu by using these menus rather than a front-panel button.
4. For front panel functions, click the virtual front-panel controls to remotely press most instrument front panel controls.
5. Read the status bar the same way as you would when it is displayed directly from the instrument display. (See *To Determine Status At-a-Glance* on page 18.



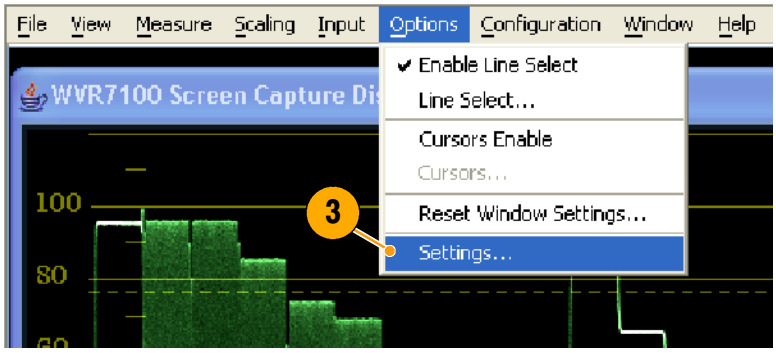
Selecting Displays

1. To turn the display of the virtual front panel on or off, click **View** > **Control Panel**.
2. To turn the display of the Waveform Display Window on or off, click **View** > **Waveform Display**.

   NOTE. *The displays can be turned on or off independently of each other. Here they are both shown displayed in the applet window.*



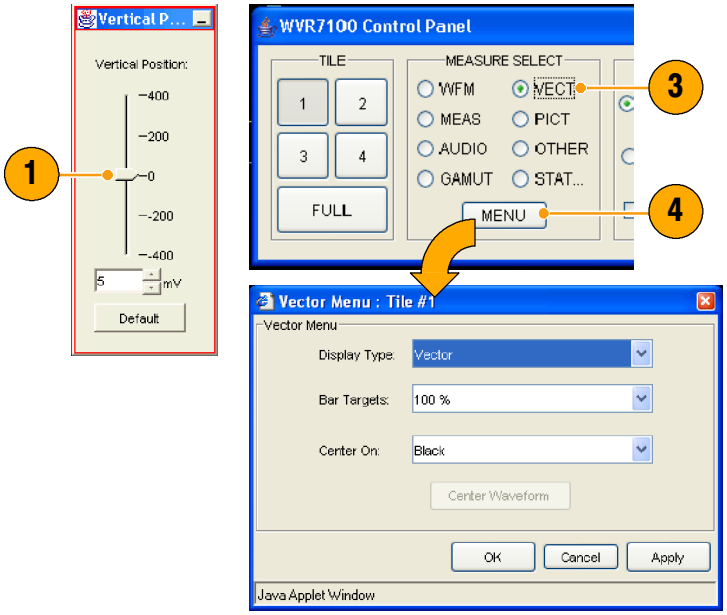
3. To change the refresh rates (defaults are every 10 seconds), do the following:
   - First select Options > Settings.
   - Adjust the refresh rates to the desired periods in the **Settings** pop up.
   - Click **OK** to save the new rates.



NOTE. *You can also display the waveform rasterizer online help from the Java Applet. Select* ***Help*** *>* ***Help...*** *to opens online help in a new browser window.*

Operating Notes

1. When adjusting variable settings, such as vertical and horizontal position or gain, the Remote Interface displays a small window with a slider that you use to adjust the value.
2. For example, to adjust the vertical position of a waveform: Select **Scaling** > **Vertical Position** and adjust as desired.
3. To allow for display of pop-up menus for each MEASURE SELECT button, the Remote Interface provides a menu button: select the measurement for which you want to display the pop-up menu.
4. Click the **MENU** button.



Usage Notes

The Remote Interface Control Panel differs from the instrument front panel in that it provides a menu. The menu provides many controls some of which duplicate functions directly available from the Control Panel. See the list that follows.

Menu	Commands	Description
File	Restore Settings	Restores instrument-stored setup that you select (one of Preset 1 through Preset 5 or Factory) to the waveform rasterizer
	Save as Preset	Saves the current waveform rasterizer settings as as setup in the instrument (select any one of Preset 1 through Preset 5)
	Load Presets From File	This selection is disabled in the Java Applet. In the Java Application (see NOTE on page 74), this selection restores the presets (1 through 5) to the waveform rasterizer from any previously saved presets file that you select
	Save Presets To File	This selection is disabled in the Java Applet. In the Java Application (see NOTE on page 74), this selection saves the waveform rasterizer presets 1 through 5 in a remote file.
	Exit	Closes the Java applet
View	Active Tile	Changes the active tile
	Full Screen	Changes display to Full screen mode
	Freeze...	Captures the current image for most of the possible displays in the waveform rasterizer.
	Control Panel	Toggles the display of the Control Panel window on and off
	Screen Capture Display	Toggles the Waveform Display window on and off
	Refresh	Updates the Waveform Display
Measure	Various control items	Contents of this menu varies with the selection in the WVR7100 Control Panel (WFM, MEAS, AUDIO, GAMUT, VECT, PICT, OTHER, or STATUS).
Scaling	Vertical Position	Displays a window to enable you to adjust the vertical position
	Horizontal Position	Displays a window to enable you to adjust the horizontal position
	Gain	Enables you to set the Gain to 1X, 5X, or set the variable gain
	Sweep	Enables you to set the sweep mode to One Line, Two Line, One Field, or Two Field
	Mag	Magnifies the Active Tile sweep rate
Input	Inputs and Reference	The settings displayed below **Input** correspond to the controls in the Inputs and Ref groupings on the control panel.
Options	Line Select & Cursors commands	These menu entries below **Options** duplicate operation of the Line Select and Cursors controls on the Control Panel.
	Refresh Rate	Specifies how often the Waveform Display should be automatically updated
Configuration	Various controls not available on the front panel	The menu entries below **Configuration** duplicate most of the setups available by display the Configuration menu using the CONFIG button on the instrument front panel.

Menu	Commands	Description
Window	Control Panel	Moves the Control Panel window to the front if it is covered by the Waveform Display
	Waveform Display	Moves the Waveform Display window to the front if it is covered by the Control Panel
Help	Help	Displays the waveform rasterizer online help
	About	Displays version information about the Java applet

Using the Remote Front Panel

This instrument is orderable with Option RFP, in which case it ships with a separate front-panel module. The front- panel area of the main instrument is blank, since all the front-panel controls are accessed from an RFP module that connects to the instrument through a cable. This cable may be up to 100 ft. long (a 25 ft. cable ships with the optioned instrument) to allow remote operation.

- To configure the Option RFP equipped instrument, follow the installation instructions in this manual (refer to *Installing the Instrument when Option RFP-Equipped* on page 6).
- To use the RFP module, use it in as you would the integral front panel of a instrument that is not Option RFP equipped. In other words, all operating procedures in this manual and the instrument online help apply to operation using the RFP module as well as the integral front panel to control the instrument.
- The RFP module is also orderable as an optional accessory—either at the time the main instrument is purchased or afterwards. Order the RFP module as an optional accessory when you wanted both the RFP module and the standard front panel on the instrument; order Option RFP when you want the main instrument to come with a blank front panel.

  Installation is the same; follow the installation instructions in this manual (refer to *Installing the Instrument when Option RFP-Equipped* on page 6). When the RFP module is installed, the instrument front panel becomes inactive when the RFP is connected. (The Fault LED may still operate on the instrument front panel, but you should rely on the Fault LED on the RFP module, not the instrument.)

***NOTE**. You must cycle power to initialize operation from the RFP module. In general, anytime you connect the RFP module to the instrument, power it down, connect the RFP module, and then power up the instrument.*

Cable Description

The requirements for cables that may be used with this WVRRFP module follow:

- Connectors (each end): 9-pin D-SUB, male, with jackscrews
- Cable: nine conductors, 26 gauge or heavier, shielded
- Construction: Pins 1-9 of each connector wired to corresponding pins of the alternate connector (connect pin 1 to pin 1, and so on). Shield or drain wire bonded to metal shell at each end.
- Maximum length: 100 ft.

To Upgrade the Waveform Rasterizer Firmware

System Upgrade (CONFIG> Utilities > System Upgrade) is used to upgrade the system software of the WVR7100. The upgrade is performed across an Ethernet network using a PC to transfer the new software to the WVR7100.

PC System Requirements

The data-transfer utility for upgrading the WVR7100 runs on these PC systems: Windows 98, Windows NT 4.0, Windows ME, Windows 2000, and Windows XP.

The data-transfer utility also requires Winsock 2.0, an ethernet interface, and 10 MB of free disk space be present on the PC system.

Before You Begin

Before performing *Installing the Firmware* on page 80, read about possible fault conditions and their remedies, and about how the waveform rasterizer uses button animation to signal upgrade progress and events.

FAULT Recovery and Cautions

- The boot monitor will assert a FAULT after an unsuccessful firmware update operation. The failure of the firmware update can be caused by a network communication error, time out or a corrupt firmware package. When it detects a firmware update error, the instrument returns to the ready state (tile buttons flashing).

  In this event, you can try to resend the firmware data to the instrument. In the case of repeated failures, check to make sure that you have the correct firmware release for the instrument.

- The boot monitor might also detect errors in the DHCP software which can result from repeatedly switching between factory and DHCP network settings. The FAULT light remains lit and the instrument fails to obtain an address from a DHCP server.

  In this event, reboot the instrument by pressing one of the MEASURE SELECT buttons or by removing power from the instrument. When the instrument reboots, hold down the **FULL** button to return the instrument to the firmware update mode.

- When using DHCP, there is a small possibility that the waveform rasterizer will be assigned a different address when the software update mode is activated. (If the unit is not off or disconnected from the network very long, then typically the waveform rasterizer will get the same address as it had previously.)

  In this event, you may need to abort the update (see CAUTION that follows), go the Config menu and get the current IP address, and use that address in the update process. If this does not work the first time you may need to try again or use the manual IP address mode. Or, alternatively, you can temporarily set the IP address to the default value (192.168.1.1) once it is in upgrade mode by pressing **SEL,** and use that address in the upgrade procedure. After the upgrade is completed, the original IP address will be restored.

CAUTION. *Once the instrument has started to erase internal flash (VECT button lit), DO NOT remove power from the instrument. If you do so, the instrument will only boot in the firmware update mode until new firmware has been loaded into the instrument flash. Therefore, use the MEASURE select buttons to abort a firmware update. Remove power from the instrument only as a last resort.*

- The instrument will automatically switch to factory default if DHCP discovery fails. Press the **SEL** button to restart DHCP discovery.

***NOTE**. FAULTS will not be logged into the diagnostic log because the boot monitor is running, not the main instrument software.*

Button Animation During Upgrade

Button indication	State	Description
■ Flashing DISPLAY SELECT buttons	Ready	Instrument is ready to receive firmware data and is waiting for a connection from the PC host
■ Flashing arrow buttons	DHCP discovery	Instrument is negotiating for an IP address from a DHCP server
■ SEL button lit	Factory IP configuration	Instrument is configured with factory default IP address of 192.168.1.1
■ Arrow and SEL not lit	Manual IP configuration	Instrument is configured with manual IP configuration
■ Arrow buttons lit, SEL not lit	DHCP configuration	Instrument has received an IP address from a DHCP server
■ WFM button lit	Receiving firmware	Instrument is receiving firmware data
■ VECT button lit	Erasing flash memory	Instrument is erasing internal flash memory
■ MEAS button lit	Programming flash memory	Instrument is programming internal flash memory
■ 1X button lit	Verifying flash memory	Instrument is verifying programming of internal flash memory

Installing the Firmware

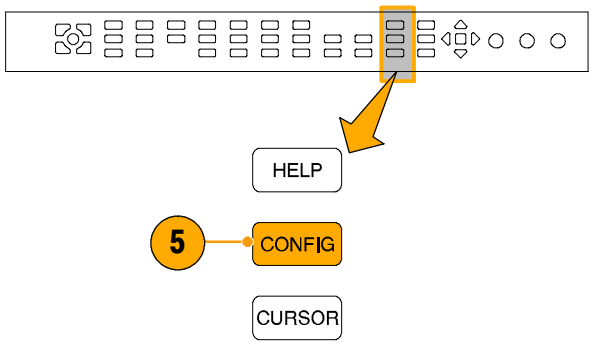
To install new firmware in a waveform rasterizer:

Download the Firmware Package

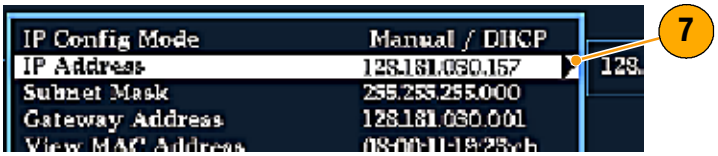
1. To download the latest version of the WVR7100 firmware, navigate to the Tektronix website at the http://www.tek.com/Measurement/video_audio.
2. From there, follow the links to *Software & Drivers*, and then to *Video Test* to locate the waveform rasterizer firmware-upgrade package and download it.
3. Click on the downloaded self-extracting archive to extract the following files into a directory of your choice.
4. Files extracted are: transfer.exe firmware.pkg, and readme.txt.

Check and Record the IP Address

5. Press **CONFIG** to display the Configuration menu.
6. Select **Network Settings** to display the Network Setting Menu.



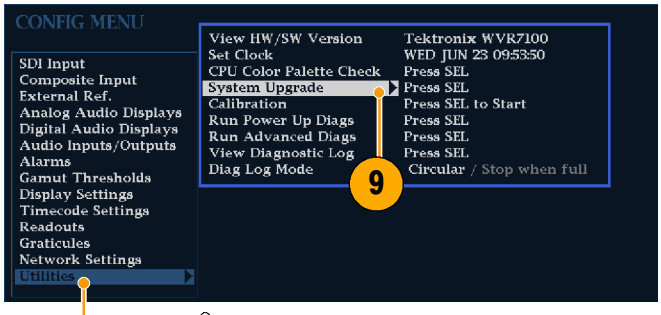
7. Write down the number listed for **IP Address** in the menu.



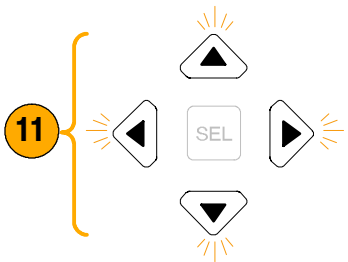
Enter System Upgrade Mode

8. On the waveform rasterizer, press the left-arrow key to return to the main CONFIG menu and select **Utilities**.
9. Highlight **System Upgrade,** and the press **SEL**. This displays the System Software Upgrade window.
10. To continue with the upgrade, press the right-arrow key to select **Continue** and press **SEL**.

    The monitor display goes to black and the DISPLAY SELECT keys flash in sequence.



11. If the arrow keys also flash, the waveform rasterizer is in DHCP mode. *Wait until the arrow keys stop flashing before proceeding.*



Run the Upgrade

12. On the PC, double-click the **transfer.exe** file to launch the transfer program. This displays the window shown in part at right.

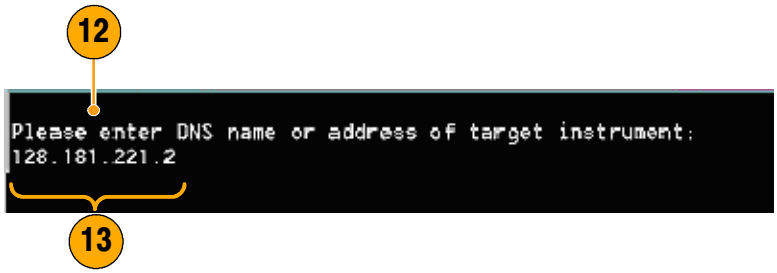
13. Type the network address (for example: 128.181.221.002) or DNS name of the waveform rasterizer you wish to update, and then press Enter. This starts the firmware upgrade process.

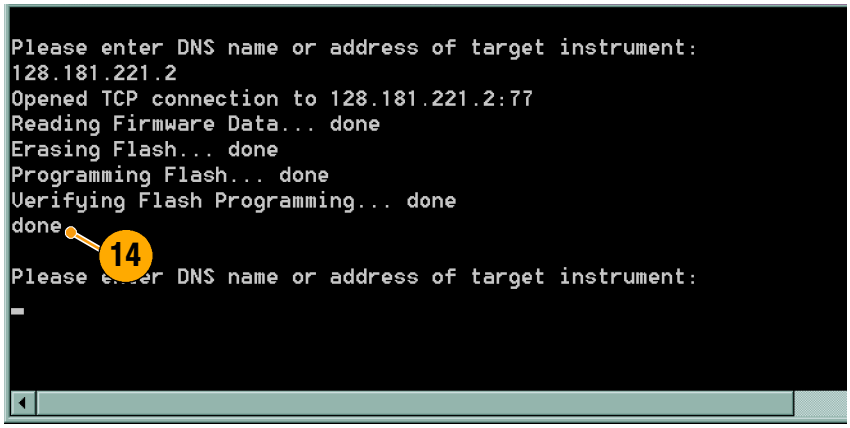
NOTE. *To stop the firmware update, you can press any MEASURE button on the front-panel of the waveform rasterizer before the words* ***Erasing Flash...*** *appear in the transfer utility window.*

14. The transfer utility displays **done** when the software upgrade completes.

When the software upgrade completes, the waveform rasterizer will reboot.

15. To update another waveform rasterizer, begin at step 5 and skip step 12. If you won't be updating another waveform rasterizer, press **Enter** to exit the transfer utility.





Upgrading Multiple Instruments

You can upgrade several instruments in in one session, one at a time, if you've determined their addresses. To upgrade, use the Windows Command Prompt. Enter the following line in a Command Prompt window (substituting the addresses of your machines):

```
transfer.exe 192.181.115.1 192.181.115.2 192.181.115.3
```

Separate the addresses with a space.

Alternatively, you can use file redirection to input the IP addresses to the transfer.exe utility. To do this, create a text file containing a carriage-return delimited list of IP addresses or DNS names for the instruments to be updated. If you created a text file named HOSTS.TXT, you would enter the following command to update a group of instruments:

```
transfer.exe < HOSTS.TXT
```

NOTE*. You can also place the waveform rasterizer into the upgrade mode by pressing the FULL button while applying power to the instrument.*

Verifying the Upgrade

After you have completed the firmware upgrade, the instrument will reboot and come up in an operational mode.

To verify the functional performance of your instrument, perform the Incoming Inspection procedures starting on page 8.

***NOTE**. See the Readme.txt file that is included with the firmware-upgrade package to determine whether all of the current Configuration menu and instrument-mode settings are preserved through upgrading.*

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