Advanced 3G/HD/SD-SDI Waveform Monitors

WFM8300 • WFM8200 Data Sheet

Features & Benefits

- Video/Audio/Data Monitor and Analyzer – All in One Platform
  - WFM8300 and WFM8200 come standard with auto-detection of HD/SD-SDI and multiple Dual Link video formats
  - Optional capabilities include 3G-SDI (Level A and Level B) formats support (Opt. 3G), composite analog video support (Opt. CPS), as well as analog and digital audio (Opt. AD) and Dolby E, Dolby Digital Plus, and Dolby Digital audio (Opt. DPE) decoding and monitoring
  - WFM8300 also comes standard with Simultaneous Input Monitoring capability, ANC Data Inspector, and numerical/graphical display of A/V delay for analog, digital audio (Opt. AD), and Dolby (Opt. DPE)
  - Multiple Input Mode allows monitoring of 2 to 4 SDI inputs simultaneously (4-input mode requires Opt. 2SDI)
- Superior Physical Layer Signal Integrity Analyzer
  - Most accurate 3G-SDI jitter waveform display and eye pattern display in the waveform series and patented cable length measurement (WFM8300 Opt. PHY with Opt. 3G or WFM8200 Opt. PHY3 with Opt. 3G)
  - Most comprehensive eye pattern measurements including eye amplitude, rise/fall time, and overshoot/undershoot measurements as well as Tektronix jitter waveform display (WFM8300 Opt. PHY or WFM8200 Opt. PHY3)
  - Field-upgradeable HD/SD-SDI eye pattern input module to full 3G-SDI and HD/SD-SDI support with the purchase of an upgrade key (WFM830UP Opt. 3G or WFM820UP Opt. 3G)
- Black Picture and Tektronix-patented Frozen Picture Detection
- Tektronix-patented Timing and Lightning Displays
- New Tektronix-patented Spearhead Display and Luma Qualified Vector (LQV™) Display Facilitate Precise Color Adjustment for Post Production Applications (Opt. PROD)
- Tektronix patented Diamond and Arrowhead Displays for Gamut Monitoring
- Most Comprehensive Audio Monitoring (Opt. AD or Opt. DPE)
  - Multichannel Surround Sound*[1] display and flexible Lissajous display
  - Audio Loudness monitoring to ITU-R BS.1770-2 (Opt. AD or DPE)
  - Comprehensive Dolby metadata decode and display (Opt. DPE)
  - Dolby E Guard Band meter with user-defined limits (Opt. DPE)
- Most Comprehensive ANC Data Monitoring
  - Simultaneous CEA708/608 Closed Caption monitoring; Teletext and OP47 subtitle monitoring
  - Detect and decode ANC data including AFD, WSS, Video Index, TSID, V-Chip, Broadcast Flag/CGMS-A, VITC, LTC, and ANC TC ARIB STD-B35/B37/B39, TR-B22, and TR-B23 support
- Most In-depth Digital Data Analysis Helps Quickly Resolve Difficult Content Quality and Reliability Issues (standard WFM8300 or WFM8200 with Opt. DAT)
- Unmatched Display Versatility
  - FlexVu™, the most flexible four-tile display, tailors to various application needs to increase productivity
  - Standard and user-definable Safe Area Graticules facilitate editing and format conversions tasks, reducing the need for reworks
  - Active Format Description (AFD) detect, decode, and automatically adjusted graticule on picture display enable easy identification of aspect-ratio related issues
- Unmatched Usability
  - CaptureVu® advanced video frame data capture simplifies troubleshooting and equipment setup
  - 32 instrument presets for quick recall of commonly used configurations tailored to engineers or operators
  - Front-panel USB port enables easy transfer of presets, captured video frame data, screenshots, and error log
  - Front-panel headphone port enables quick verification of selected audio pair
  - Intuitive menu structure and context-sensitive help
  - Extensive alarms, status reporting, and error logging
  - Bright, crisp, high-resolution LED backlight display
  - SNMP and Ethernet remote interface capabilities and GPI control facilitate centralized monitoring and control

Tektronix®

Multiformat support grows with your needs.

Applications

- Monitoring and Compliance Checking in Content Distribution and Broadcast
- Quality Control in Content Production and Post Production
- Equipment/System Qualification and Troubleshooting for Installation and Maintenance of Content Creation and Distribution Facilities
- Research and Development of Professional Video Equipment

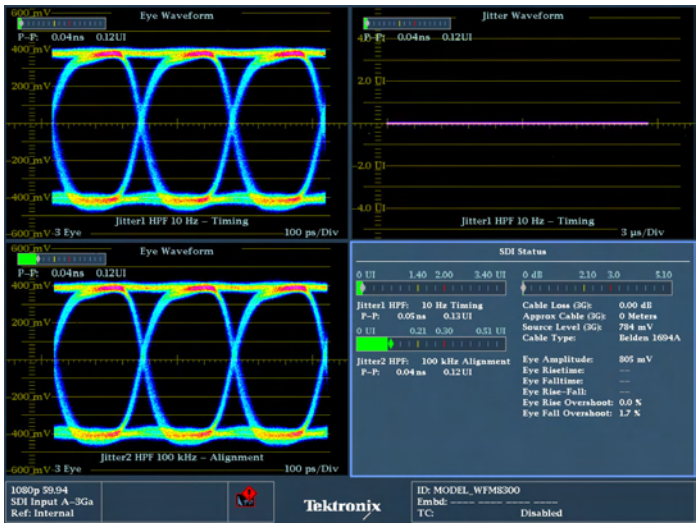
*1 Audio Surround Sound Display licensed from Radio Technische Werksütten GmbH and Co. KG (RTW).

WFM8300

The measurement and monitoring capabilities of the WFM8300 provide precision capabilities such as Physical Layer Measurements, Digital Data Analysis (including ANC Data Inspector), A/V Delay Measurement, and in-depth Simultaneous Input Monitoring which makes Tektronix the brand of choice for applications that require deep signal and content analysis with unquestionable accuracy.

The WFM8300 features the complete range of options of the product family and comes standard with HD/SD-SDI and Dual Link video formats support. It provides high-performance monitoring and measurement for applications for a wide range of formats from Composite Analog to SD-SDI, HD-SDI, Dual Link video formats, and 3G-SDI video signals. The WFM8300 offers support for a variety of audio formats for analog, digital AES/EBU, digital embedded, Dolby Digital, Dolby Digital Plus, and Dolby E.

- Video Monitoring Standards and Formats
  - 3G-SDI (Level A and Level B) – Option 3G
  - High Definition SDI – Standard
  - Standard Definition SDI – Standard
  - Dual Link (4:2:2, 4:4:4, alpha channel, 10 bit, 12 bit) – Standard
  - Composite Analog Video – Option CPS
  - Multiple Input Mode 2 SDI inputs – Standard
  - Multiple Input Mode 4 SDI inputs – Option 2SDI
- Color Gamut Monitoring
  - Arrowhead Display – Standard
  - Diamond and Split Diamond Displays – Standard
  - Spearhead Display – Option PROD
  - Luma Qualified Vector (LQV™) – Option PROD
- Audio Monitoring Standards and Formats
  - Analog, Digital AES/EBU, Digital Embedded – Option AD
  - Analog and Digital including Dolby Digital, Dolby Digital Plus, and Dolby E – Option DPE
- Measurement and Analysis
  - Automated Eye Pattern and Jitter Measurements – Option PHY
  - Color Bar and Pathological Signal Generation – Option PHY
  - Digital Data Analysis – Standard
  - ANC Data Inspector – Standard
  - Simultaneous Input Monitoring – Standard
  - 3D Video Monitoring – Standard
  - Audio/Video Delay Measurement – Standard



3G-SDI monitoring, jitter measurement, and test generator.

WFM8200

The WFM8200 provides an ideal solution for advanced monitoring of analog, digital, high frame-rate digital video, and multiple audio formats. This flexible solution comes standard with HD/SD-SDI and Dual Link video monitoring and can be equipped with options and upgrades to monitor 3G-SDI and/or composite analog video. The WFM8200 is an intelligent choice that prepares you for format transitions and growing monitoring needs. Available audio options include support for analog, digital AES/EBU, digital embedded, Dolby Digital, Dolby Digital Plus, and Dolby E formats.

- Video Monitoring Standards and Formats
  - 3G-SDI (Level A and Level B) – Option 3G
  - High Definition SDI – Standard
  - Standard Definition SDI – Standard
  - Dual Link (4:2:2, 4:4:4, alpha channel, 10 bit, 12 bit) – Standard
  - Composite Analog Video – Option CPS
  - Multiple Input Mode 2 SDI inputs – Standard
  - Multiple Input Mode 4 SDI inputs – Option 2SDI
- Color Gamut Monitoring
  - Arrowhead Display – Standard
  - Diamond and Split Diamond Displays – Standard
  - Spearhead Display – Option PROD
  - Luma Qualified Vector (LQV™) – Option PROD
- Audio Monitoring Standards and Formats
  - Analog, Digital AES/EBU, Digital Embedded – Option AD
  - Analog and Digital including Dolby Digital, Dolby Digital Plus, and Dolby E – Option DPE
- Measurement and Analysis
  - Automated Eye Pattern and Jitter Measurements – Option PHY3
  - Eye Pattern Display and Jitter Readouts – Option EYE or PHY3
  - Color Bar and Pathological Signal Generation – Option GEN
  - Digital Data Analysis – Option DAT
  - ANC Data Inspector – Option DAT
  - Simultaneous Input Monitoring – Option SIM
  - 3D Video Monitoring – Option 3D
  - Audio/Video Delay Measurement – Option AVD

Both WFM8300 and WFM8200 support flexible combinations of options and field upgrades, providing an excellent solution for multiformat environments while protecting your investment. For complete details regarding option and feature availability by model please refer to the section of this document on ordering information.

From Composite Analog to 3G-SDI Advanced Digital Video – All in One Platform

Ideal for multiformat environments, the WFM8300 and WFM8200 advanced waveform monitors provide flexible options and field-installable upgrade kits to monitor diverse video types including 3G-SDI, Dual Link, HD/SD-SDI, and composite analog video.

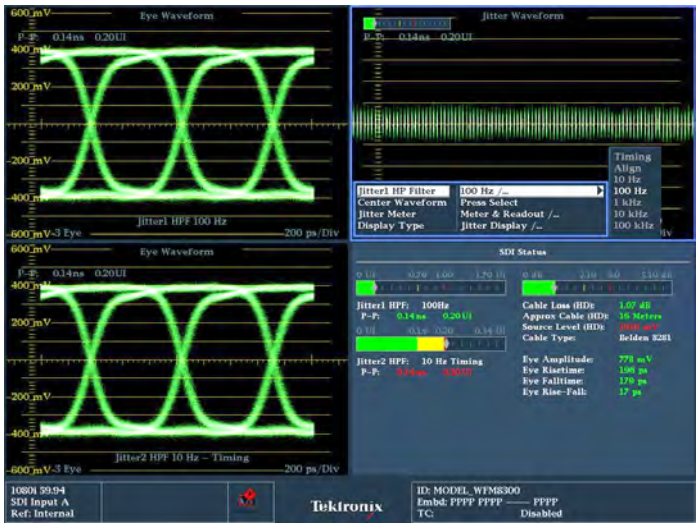
Both WFM8300 and WFM8200 come standard with Dual Link SMPTE 372M compliant monitoring, SMPTE 352M automatic format detection, and selectable display of Alpha Channel as well as 2K Dual Link monitoring with XYZ Color Space.

These instruments allow for monitoring of Link A, Link B, or the combined Dual Link input with a comprehensive set of displays and status reporting tools. The Tektronix-patented Timing display, which measures timing between Link A and Link B of the Dual Link signal, proves a valuable ally to maintain correct timing between the two links.

To support the latest production trends for high-definition 1080p 50/59.94/60 content, the WFM8300 and WFM8200 provide optional capabilities to monitor the 3G-SDI format. Option 3G for the WFM8300 and WFM8200 enables monitoring of SMPTE 425M Level A (directly mapped) and Level B (mapped from Dual Link) signals. Level B support for 2×HD (1920×1080 or 1280×720) is ideally suited for 3D distribution of Left and Right Eye signals within a 3G-SDI multiplex.

Monitoring display modes such as Waveform, Vector, Gamut, Timing, Status, Picture, and Audio, as well as automated physical-layer measurements and in-depth data analysis are available for 3G-SDI and other input formats.

Both WFM8300 and WFM8200 support any combination of video and audio format options, so these instruments excel in multiformat environments and evolve with your needs to protect your investment.



Physical-layer options provide precise measurements for video signals.

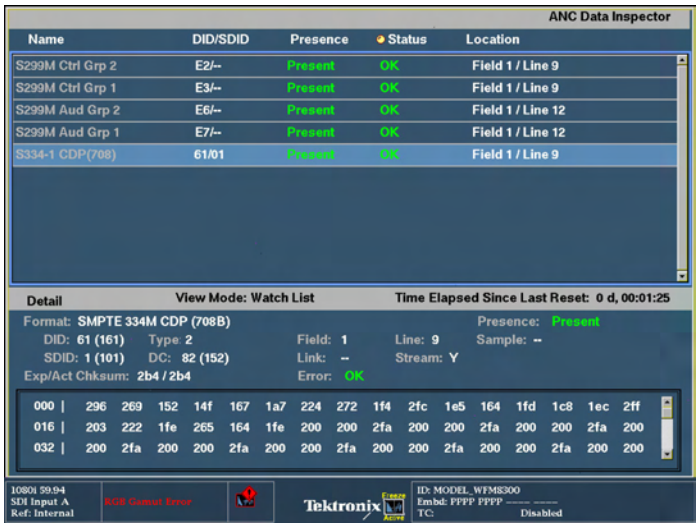
Unmatched Measurement and Monitoring Performance for Content Creation and Content Distribution

Most Advanced Physical Layer Measurement Solutions

The WFM8300 and WFM8200 high-performance waveform monitors offer the most comprehensive physical-layer signal measurements for engineers. When equipped with Option 3G and relevant physical-layer options for each model, the WFM8300 and WFM8200 can perform 3G-SDI eye pattern display, jitter measurements, and cable length measurements (Option PHY for WFM8300 or Option EYE or PHY3 for WFM8200). Options PHY and EYE provide unique capabilities such as reporting jitter levels above 1 UI and providing various jitter filters from 10 Hz to 100 kHz for SD/HD/3G-SDI signals. An easy-to-interpret gauge provides direct readout for jitter measurements. Users can configure timing jitter and alignment jitter readouts to be displayed simultaneously to effectively isolate the sources of jitter. The SDI Status display summarizes key signal parameters such as signal strength, cable loss, and estimated cable length measurements.

With FlexVu™, users can simultaneously display timing jitter and alignment jitter values, cable parameter measurements, and display different eye patterns to help quickly diagnose and resolve problems related to SDI timing jitter or cable attenuation. The infinite persistence mode of the waveform monitor can also be used to more easily view the eye opening of the physical-layer signal.

In addition, the WFM8300 (with Option PHY) and WFM8200 (with Option PHY3) can also perform automated eye amplitude, automated rise/fall time, automated overshoot/undershoot measurements, and provide jitter waveform display to view jitter related to line and field rates. All these capabilities help broadcasters and network operators detect and diagnose signal quality problems quickly and efficiently. WFM8300 (with Option PHY) and WFM8200 (with Option GEN) also include multirate HD/SD-SDI and 3G-SDI (with Option 3G) color bar and pathological signal generation capabilities to provide engineers with a simple signal source for quick signal path verification during system and/or equipment setup and troubleshooting.



ANC Data Inspector and CaptureVu provide detailed content analysis.

Datalist display provides detailed pixel-by-pixel information.

Monitoring of Ancillary data (Closed Caption, Time Code, and AFD) using Aux Data Status.

Superior Data Analysis Capabilities for Engineers and Operators

The new ANC Data Inspector (standard on WFM8300 and available on WFM8200 with Option DAT) provides an industry-leading solution to help broadcasters easily and accurately ensure that all required VANC data is present and correctly configured through an intuitive ANC data display.

In contrast to other solutions, the ANC Data Inspector enables operators to easily and quickly ensure that the VANC data is present and free of errors. When errors are detected, engineers are quickly guided to a more detailed view of the data packet content for further analysis.

With FlexVu™, each picture display tile can display different CEA708/608 Closed Caption and individual Teletext subtitles. Teletext subtitle pages can be decoded in either WST or OP47 format.

The Auxiliary Data Status display (standard on both the WFM8300 and WFM8200) provides summary information on Active Format Description (AFD) per SMPTE 2016, Video Index Aspect Ratio, Wide Screen Signaling (WSS), V-Chip, TSID, CGMS-A, Broadcast Flag, CEA708/608 Closed Caption, Teletext, and Time Code information.

Today there is a wide array of metadata that provides information to a variety of equipment through the processing chain. Monitoring of this metadata is critical to ensure that the processing equipment correctly handles the signal. For instance, correct format of the AFD ensures that the aspect ratio on the display is correctly formatted and the automated AFD graticule is available for the picture display of the WFM8300 and WFM8200 along with the binary data and text description for easy monitoring.

The WFM8300 and WFM8200 can also monitor Dolby metadata embedded in the Vertical Ancillary (VANC) data space per SMPTE 2020.

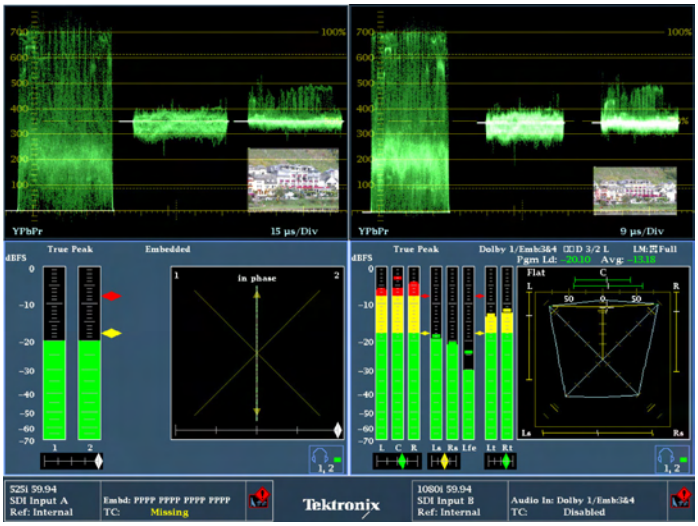
The Datalist display, available as standard on the WFM8300 and available as part of Option DAT on the WFM8200, provides detailed information on the actual data values in HD/SD-SDI and 3G-SDI (with Option 3G) input signals. Users can easily use this display to locate protocol errors in the input signals.

The right side of the display shows the data values in hexadecimal, decimal, or binary format and uses the following color coding for easy identification of data types and errors:

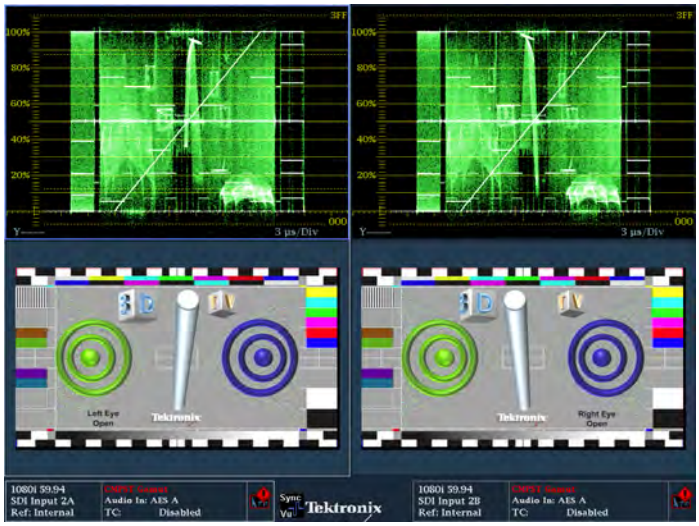
- Green – Active video data
- Blue – Data in horizontal or vertical blanking intervals
- White – EAV, SAV, and other reserved words
- Yellow – Data outside nominally allowed values
- Red – Data with illegal values

The left side of display shows un-interpolated digital values plotted against sample numbers as a digital waveform. You can configure this unique display in either Video mode or Data mode.

In Video mode, the display shows the Y, Cb, Cr values aligned temporally, but offset vertically. Like the waveform display, you can configure the display to show 1, 2, or all 3 components.



Simultaneous display, virtually two instruments in one.



Simultaneous 3D display of Left Eye and Right Eye signals.

Full-featured Simultaneous Input Monitoring Boost Versatility

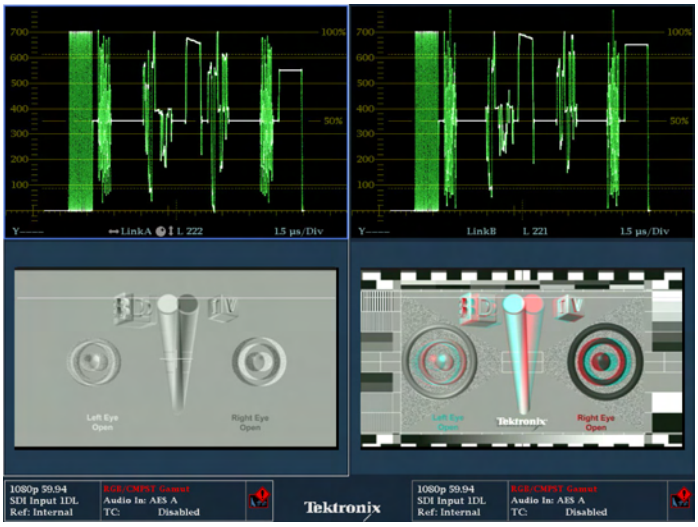
The Simultaneous Input Monitoring (SIM) capability standard on the WFM8300 and available with Option SIM on the WFM8200 takes multiformat monitoring to a new level. This capability helps operational staff quickly determine if a video quality problem existed in the input signal or arose in their facility. It enables engineering staff to quickly detect, diagnose, and resolve technical problems introduced in a piece of video equipment by comparing the input and output signals at each point in the chain. This feature is also especially helpful when checking for transparency during format conversion.

FlexVu™ enables flexible and intuitive configuration of displays from two monitored inputs. User can display simultaneous fault detection, status reporting, alarm generation, and error logging. SIM is ideal for transmission monitoring of simultaneous HD and SD programs. It is also ideal for monitoring stereoscopic 3D content in production and post production applications by simultaneously monitoring the Left Eye signal and the Right Eye signal.

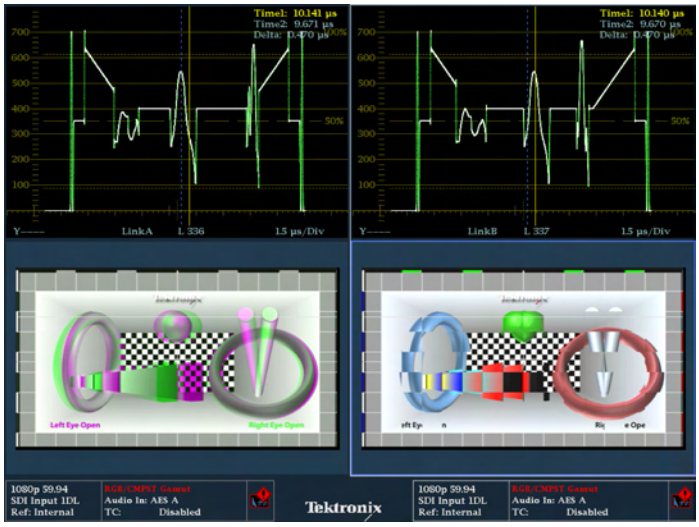
SyncVu™ is used in conjunction with SIM mode for 3D applications when input A is used for the Left Eye and input B is used for the Right Eye (**Note**: SIM is included as part of Option 3D on WFM8200). When SyncVu is enabled, the Left and Right Tile displays are synchronized, so that if a Picture Tile is selected for Tile 1, automatically Tile 2 displays a Picture Tile in exactly the same mode as Tile 1. This enables the user to quickly configure the instrument identically for Left and Right Eye 3D monitoring.

Multiple Input mode display of 4 SDI inputs with input labels for each signal.

Multiple Input mode can be used to monitor up to 4 SDI inputs simultaneously when in Full Screen mode (4-input mode requires Option 2SDI). This type of display is ideal for camera balance applications where the user wishes to check the video level across multiple inputs. This Multiple Input mode is available within Waveform, Vector, Lightning, Diamond, Arrowhead, and Spearhead (with Option PROD) display modes, allowing for the comparison of video inputs across a wide variety of these displays.



3D Left and Right Eye images showing a Difference Map and Red/Cyan Anaglyph using SIM mode.



3D Left and Right Eye images showing Green/Magenta Anaglyph and Checkerboard display using SIM mode.

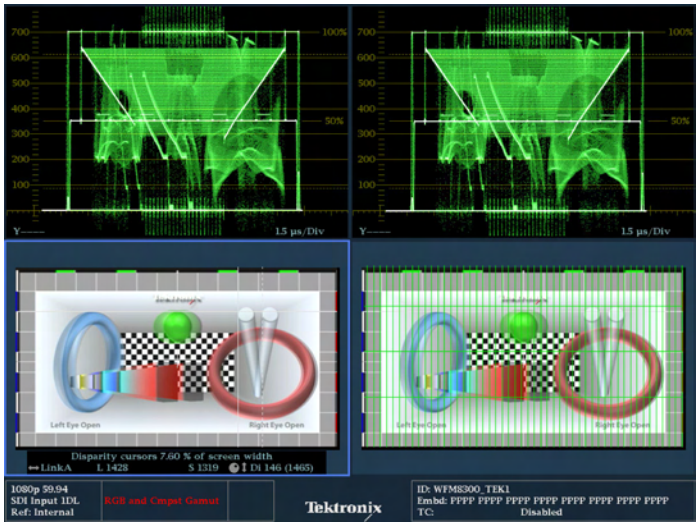
3D Measurement and Monitoring

The 3D measurements and displays are standard on the WFM8300 and available as Option 3D on the WFM8200. A 3D image is comprised of a Left Eye and Right Eye view feed as two separate HD-SDI signals or combined within a 3G Level B format. Additionally, a 3D signal can be carried within a single SDI signal as a left and right image Side by Side, Top/Bottom, or Field Interlace. Within the instrument a variety of different 3D monitoring modes are available to assist the user in determining the difference between the Left Eye and Right Eye views. From this disparity difference between the two left and right images the depth of an object within the image can be determined.

For monitoring purposes a variety of displays can be set up within the Picture mode:

- Difference Map Display – A subtraction of the two luma video signals L-R or R-L to produce a grayscale difference map image to see the difference between left and right images.
- Red/Cyan Anaglyph Display – The left image is shown in red and the right image is shown in cyan, with identical left and right objects shown in monochrome. This allows the user to isolate differences between objects and gauge the depth of the object within the image.
- Green/Magenta Anaglyph Display – The left image is shown in green and the right image is shown in magenta, with identical left and right objects shown in monochrome. If an object appears in magenta and then green this indicates that the object is coming out from the screen plane. Similarly if the object appears in green and then magenta the object is behind the screen plane.
- Checkerboard Display – This picture display shows a block of the image from the left eye and then the next block shows the image from the right eye in a 16×9 checkerboard pattern. This helps the user compare the levels and color of the signal between the left and right images.

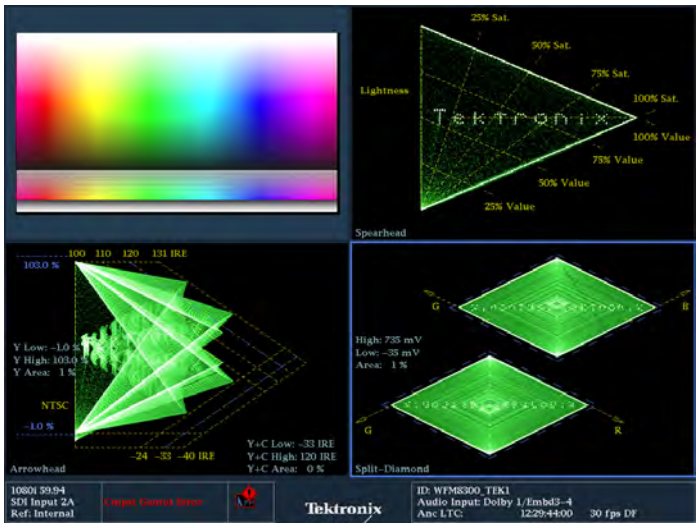
These modes help the user compare the disparity between the left and right images and can assist in interpreting the depth of the objects within the image.



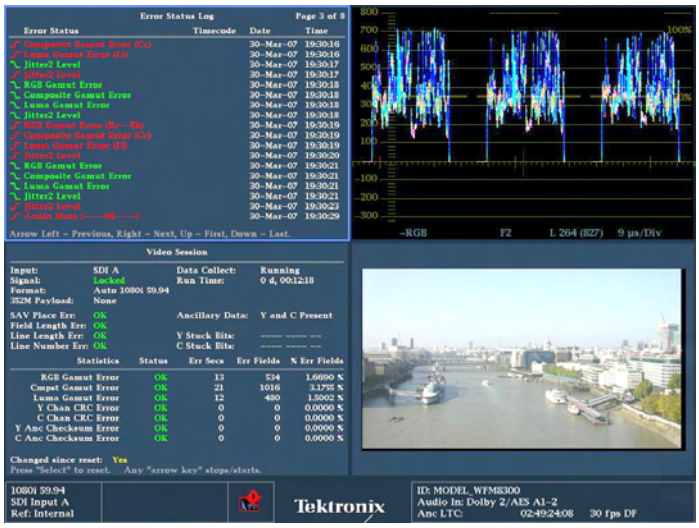
3D Left and Right Eye images showing Disparity Grid and Disparity Cursor measurement using SIM mode.

For measurement of the depth of an object within the image a Disparity Grid can be overlaid over the picture with a horizontal disparity between 1 to 15% of screen width and a vertical disparity of 50%, 25%, or 10% that can be selected by the user. The horizontal and vertical position controls allow the Disparity Grid to be moved around within the picture display to gauge the depth of objects within the image.

A set of Disparity Cursors are also available for precise measurement of horizontal disparity of an object between the Left and Right Eye images. Readout is given of the pixel difference between the cursors and the percentage of disparity of an object.



See and Solve™ displays detect and address problems quickly and efficiently.



FlexVu – The display that adapts to your work practices.

See and Solve™ with Tektronix Displays

Tektronix See and Solve™ displays simplify video monitoring tasks such as calibration, error detection, and content correction allowing users to detect errors at a glance and troubleshoot them efficiently.

Specialized Session and Status displays provide summarized yet comprehensive reports of conditions and measurements of content parameters.

The Black and Frozen frame detection can be used to alert the operator to a problem in the transmission chain. These and other errors can automatically be logged in the Error Log and provided as a report.

The powerful Error Log is configurable and provides detailed reports for up to 10,000 events that can be downloaded using a web browser or saved through a front panel connection to a USB flash drive. Alarms can also activate ground closures and SNMP traps simplifying centralized monitoring of multiple programs.

The FlexVu™ four-tile display provides maximum flexibility to increase your productivity. Unlike instruments with predetermined view combinations or limited choices, FlexVu™ lets you create a multiview display tailored to your specific needs and work practices. Each tile can be configured to enable easy signal analysis such as multiple alarm and status screens, different Safe Area Graticules and cursors on each tile, and more.

Tektronix displays offer the sharpest CRT-like trace quality for clear waveform and vector monitoring without pixelation distortions. The familiar video waveform display can show SD/HD/3G-SDI signals in RGB, YPbPr, YRGB, or composite formats. Signal components can be displayed in either Parade or Overlay mode. For composite analog video, NTSC and PAL signals can be displayed with luma, chroma, and luma+chroma filtering. The vector display offers user-selectable graticules, color targets (75% or 100%), and color axis.

The Tektronix-patented Diamond, Split Diamond, and Arrowhead gamut displays simplify the process of verifying gamut compliance.

The Diamond and Split Diamond displays help easily identify and correct RGB gamut errors in digital video signals. The Arrowhead display saves time in verifying composite gamut compliance for digital video signals.

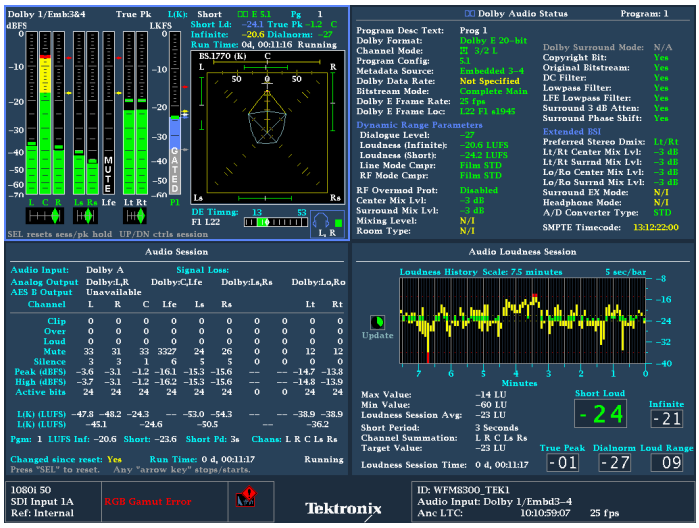
User-selectable gamut thresholds let you tailor these displays and the associated gamut alarms to your particular compliance standards.

You can also select bright-up conditions to see the location of gamut errors on the picture display.

The WFM8300 and WFM8200 also feature new optional advanced color gamut monitoring capabilities including the Tektronix-patented Luma Qualified Vector (LQV™) display and Spearhead display which, when used in conjunction with Tektronix proprietary Diamond and Split Diamond gamut displays, provide the most comprehensive color gamut monitoring tools available for precise color gamut adjustments (Option PROD).

The picture display can simultaneously detect and decode CEA708/608 Closed Caption. Teletext subtitle pages can also be decoded in either 625 formats or using OP47 Ancillary data. Flexible Safe Area Graticules allow for quick placement of graphics, titles, or logos. Using FlexVu™, users can see two or more pictures with different graticules.

The CaptureVu® feature on the WFM8300 and WFM8200 allows users to capture, store, and download the data of a video frame to recreate displays and compare the live signal to captured data for easy troubleshooting of intermittent errors or for analyzing fault conditions at remote sites.



Surround Sound, Dolby Metadata, Audio Session, and Loudness Session.

Complete Monitoring Tool Set for Optimum Sound Quality

The WFM8300 and WFM8200 provide high-quality digital filtering and oversampling to insure precise, reliable, and repeatable audio measurements. For easy monitoring, the WFM audio options provide format auto-detection and flexible mapping of audio inputs to analog or digital audio outputs for connection to external devices.

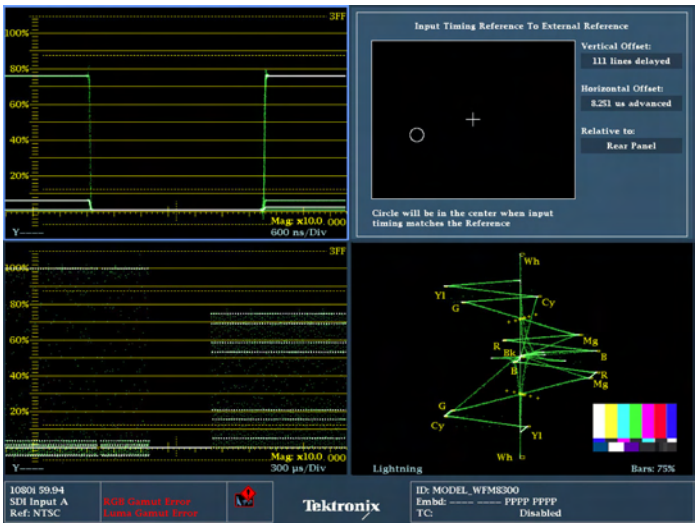
The Surround Sound*1 display provides intuitive graphical representation of channel interaction in a system. The Bars display provides indicators for faults, audio levels, and Dolby format information. The flexible Lissajous display allows the selection of any two audio channels. Loudness measurements are made to ITU-R BS.1770-2. A Loudness meter is available within the Audio display that provides Short and Infinite Loudness measurements. The Loudness session display graphically plots Loudness measurement over time, from 90 seconds to 30 hours. The Loudness measurements can be downloaded through the network or saved to USB for further analysis.

Specialized audio displays provide deeper inspection of the signal and make the WFM8000 Series instruments the most comprehensive waveform and audio monitors available. The audio session displays summarize levels, faults, and number of active bits for each channel. These instruments also feature Audio Control Packet Data and Channel Status displays.

The Dolby Status display (in Option DPE) gives an in-depth view of integrated or VANC metadata and Dolby E Guard Band timing and synchronization.

User-configurable thresholds for the Dolby E Guard Band timing measurement (in Option DPE) are available as well as Dolby E Guard Band timing and trigger alarms based on their specific guard band parameters.

*1 Audio Surround Sound Display licensed from Radio Technische Werksütten GmbH and Co. KG (RTW).



Timing and Lightning displays simplify timing tasks.

Facility Timing Made Easy

Audio/Video synchronization is an important challenge in the processing of video signals. The WFM8300 or WFM8200 with Option AVD displays the A/V delay on a graphical bar indicator. The measurement readout gives facility engineers the necessary tools to ensure system integrity and facilitate A/V delay compliance. This feature provides out-of-service measurement of A/V delay for analog or digital audio and video formats. A TG700 is required to generate the SDI signal which contains the audio and video sequence that can be distributed through the system and measured by the WFM8300 or WFM8200 with Option AVD.

The Tektronix-patented SMPTE RP168 compliant Timing display makes facility timing easy through a simple graphical representation which shows the relative timing of the input signal and the reference signal (or a saved offset reference) on an X-Y axis.

The Lightning display shows luma and chroma amplitudes and helps users verify component timing using a color bar signal. The Tektronix-patented Bowtie display (standard on both the WFM8300 and WFM8200) complements the timing measurement capability of the Lightning display. Using a special Bowtie test signal in component format, this display helps make precise and accurate measurements of interchannel amplitude and timing. The SCH Phase display helps quickly verify this critical timing parameter of composite analog video signals.

Video Input and External Reference Formats Supported

Automatic Detection of a Wide Range of Signal Formats

The WFM8300 and WFM8200 waveform monitors accept a wide variety of input signal formats and external references. The monitor will automatically detect the signal format and establish the appropriate settings for the various displays.

				External Reference Inputs												
				Bi-level Sync		Tri-level 720p			Tri-level 1080p		Tri-level 1080i			1080 SF	
Setting	Opt. CPS	STD SD	STD HD	NTSC	PAL	50 Hz	59.94 Hz	60 Hz	23.98 Hz	24 Hz	50 Hz	59.94 Hz	60 Hz	23.98 Hz	24 Hz
NTSC 59.94 Hz	X			X											
PAL 50 Hz	X				X										
BT601 483i, 59.94 Hz (525)		X		X			X					X			
BT601 576i, 50 Hz (625)		X			X	X					X				
296M 720p, 23.98 Hz			X	X			X		X			X		X	
296M 720p, 24 Hz			X					X		X			X		X
296M 720p, 25 Hz			X		X	X					X				
296M 720p, 29.97 Hz			X	X			X					X			
296M 720p, 30 Hz			X					X					X		
296M 720p, 50.00 Hz			X		X	X					X				
296M 720p, 59.94 Hz			X	X			X					X		X	
296M 720p, 60.00 Hz			X					X		X			X		X
240M 1035i, 59.94 Hz			X	X			X					X			
240M 1035i, 60 Hz			X					X		X			X		X
274M 1080i, 50 Hz			X		X	X					X				
274M 1080i, 59.94 Hz			X	X			X					X			
274M 1080i, 60 Hz			X					X		X			X		X
274M 1080p, 23.98 Hz			X	X			X		X			X		X	
274M 1080p, 24 Hz			X					X		X			X		X
274M 1080p, 25 Hz			X		X	X					X				

				External Reference Inputs												
				Bi-level Sync		Tri-level 720p			Tri-level 1080p		Tri-level 1080i			1080 SF	
Setting	Opt. CPS	STD SD	STD HD	NTSC	PAL	50 Hz	59.94 Hz	60 Hz	23.98 Hz	24 Hz	50 Hz	59.94 Hz	60 Hz	23.98 Hz	24 Hz
274M 1080p, 29.9 Hz			X	X			X					X			
274M 1080p, 30 Hz			X					X					X		
274M 1080sf, 23.9 Hz			X	X			X		X			X		X	
274M 1080sf, 24 Hz			X					X		X			X		X
274M 1080sf, 25 Hz			X		X	X					X				
274M 1080sf, 29.9 Hz			X	X			X					X			
274M 1080sf, 30 Hz			X					X					X		

Supported Dual Link Formats

Format	Sample Structure	Frame/Field Rates
Dual Link		
1920 × 1080	4:2:2 YCbCr 10 bit	60, 60/1.001, and 50 progressive
	4:4:4 RGB 4:4:4:4 RGB +A 10 bit	30, 30/1.001, 25, 24 and 24/1.001 progressive, PsF 60, 60/1.001, and 50 fields interlaced
	4:4:4 RGB 12 bit	
	4:4:4 YCbCr 10 bit 4:4:4:4 YCbCr +A 10 bit	
	4:4:4 YCbCr 12 bit	
	4:2:2 YCbCr 12 bit 4:2:2:4 YCbCr +A 12 bit	
2048 × 1080	4:4:4 RGB 4:4:4:4 RGB +A 10 bit	30, 30/1.001, 25, 24, and 24/1.001 progressive, PsF
	4:4:4 RGB 12 bit	
	4:4:4 YCbCr 10 bit 4:4:4:4 YCbCr +A 10 bit	
	4:4:4 YCbCr 12 bit	
	4:2:2 YCbCr 12 bit 4:2:2:4 YCbCr +A 12 bit	
	4:4:4 XYZ 12 bit	

Supported 3G Single Link Formats

Format	Sample Structure	Frame/Field Rates
3G-SDI Formats		
Single Link		
1920 × 1080	4:2:2 YCbCr 10 bit Level A and Level B	50, 59.94, 60 progressive
	4:2:2 YCbCr 10 bit Level B	23.98, 23.98sF, 24, 24sF, 25, 25sF 29.97, 29.97sF, 30, 30sF progressive 50, 59.94, 60 interlaced
	4:4:4 YCbCr 10 bit 4:4:4:4 YCbCrA 10 bit Level B	
	4:4:4 RGB 10 bit 4:4:4:4 RGB +A 10 bit Level B	
	4:4:4 RGB 12 bit Level B	
	4:2:2 YCbCr 12 bit 4:2:2:4 YCbCrA 12 bit Level B	
	4:4:4 YCbCr 12 bit Level B	
2048 × 1080	4:4:4 RGB 12 bit Level B	23.98, 23.98sF, 24, 24sF, 25, 25sF, 29.97, 29.97sF, 30, 30sF progressive
	4:4:4 XYZ 12 bit Level B	
2 × HD 1920 × 1080	4:2:2 YCbCr 10 bit Level B	23.98, 23.98sF, 24, 24sF, 25, 25sF, 29.97, 29.97sF, 30, 30sF progressive 50, 59.94, 60 interlaced
2 × HD 1280 × 720	4:2:2 YCbCr 10 bit Level B	23.98, 24, 25, 29.97, 30, 50, 59.94, 60 progressive

Characteristics

Composite Video Interface (Option CPS)

Characteristic	Description
Formats Supported	NTSC, NTSC no setup, PAL
Inputs	Two, only one active at a time
Input Type	Passive loopthrough BNC, 75 Ω compensated
Input Dynamic Range	±6 dB (typical)
Maximum Operating Amplitude	–1.8 V to +2.2 V, DC + peak AC (typical)
Absolute Maximum Input Voltage	–6.0 V to +6.0 V, DC + peak AC
DC Input Impedance	20 kΩ, nominal
Return Loss	>40 dB to 6 MHz, power on (typical) >40 dB to 10 MHz (typical) >46 dB to 6 MHz (typical) 35 dB, power off (standard amplitude video)
Crosstalk between Channels	>60 dB to 6 MHz (typical)
Loopthrough Isolation	>70 dB to 6 MHz (typical)
DC Offset with Restore Off	<20 mV (typical)
DC Restore	50 Hz and 60 Hz
Attenuation	Fast mode >95% attenuation, Slow mode <10% attenuation, <10% peaking
Slow Mode	Typical peaking 8% at 50 Hz and 60 Hz
Lock Range	±50 ppm remains locked

External Reference

Characteristic	Description
Input Type	Passive loopthrough BNC, 75 Ω compensated
DC Input Impedance	15 kΩ, typical
Return Loss	>40 dB to 6 MHz, >35 dB to 30 MHz (typical)

User Interface

1024 (H) × 768 (V) pixels LCD.

Serial Digital Waveform Vertical Characteristics

Characteristic	Description
Vertical Measurement Accuracy	At 1X, ±0.5%; at 5X, ±0.2% of 700 mV full-scale mode
Gain	X1, X2, X5, and X10

Frequency Response

Characteristic	Description
HD	
Luminance Channel (Y)	50 kHz to 30 MHz ±0.5%
Chrominance Channels (Pb, Pr)	50 kHz to 15 MHz ±0.5%
SD	
Luminance Channel (Y)	50 kHz to 5.75 MHz ±0.5%
Chrominance Channels	50 kHz to 2.75 MHz ±0.5%

Analog Composite Waveform Vertical Characteristics (Option CPS)

Characteristic	Description
Vertical Measurement Accuracy	±1% all gain settings
Gain	X1, X2, X5, and X10
Frequency Response	Flat to 5.75 MHz, ±1%

Waveform Horizontal Sweep Characteristics

Characteristic	Description
Sweep Timing Accuracy	±0.5%, all rates, fully digital system
Sweep Linearity	0.2% of time displayed on screen, fully digital system

Vector Characteristics

Characteristic	Description
Vector Amplitude Accuracy	±2%
Vector Phase Accuracy	±2°

Audio Characteristics (Optional Capability)

Characteristic	Description
Level Meter Resolution	0.056 dB steps at 30 dB scale, from full scale to –20 dBFS
User-selectable Scales	
Analog	dBu, Din, Nordic, VU, IEEE PPM, BBC Scale, and user definable
Digital	dBFS, Din, Nordic, VU, IEEE PPM, BBC Scale, and user definable
Meter Ballistics	Selectable from true peak, PPM type 1, PPM Type 2, and Extended VU
Defined/Programmable Level Detection	Mute, clip, user-programmable silence, over

Digital Audio (Option DPE and AD)

Characteristic	Description
Inputs	Two sets with 8 channels each, 32-192 kHz, 24 bit. Meets requirements of AES 3-ID and SMPTE 276M-1995
Input Characteristics	BNC, 75 Ω terminated, unbalanced, 0.2 V_{p-p} to 2 V_{p-p}
Input Return Loss	>25 dB relative to 75 Ω from 0.1 to 6 MHz (typical)
Outputs	Up to 8 channels, AES 3-ID output, 48 kHz 20 bit for SD embedded, 48 kHz 24 bit for HD embedded, 48 kHz 24 bit for analog to AES. For AES to AES loopthrough, output format equals input format. Meets requirements of SMPTE 276M-1995 (AES 3-ID). For decoded Dolby Digital, output is 24 bits at a rate of 32, 44.1, or 48 kHz for any one decoded pair. For decoded Dolby E, the output is 24 bits at 48 kHz or 47.952 kHz for up to four pairs
Output Characteristics	BNC, 75 Ω terminated, unbalanced, 0.9 V_{p-p} to 1.1 V_{p-p} into 75 Ω
Output Return Loss	>25 dB relative to 75 Ω from 0.1 to 6 MHz (typical)
Output Jitter	3.5 ns, peak, typical, with 700 Hz high-pass filter per AES specification (typical)
Level Meter Accuracy over Frequency	+0.1 dB from 20 Hz to 20 kHz, 0 to –40 dBFS, sine wave, Peak Ballistic mode (except for within 5 Hz of some submultiples of the sampling frequency)

Analog Audio (Option DPE and AD)

Characteristic	Description
Analog Inputs	Two sets of 6 channels each
Analog Input Characteristics	Balanced, unterminated through the rear-panel connector
Crosstalk	<90 dB
Input Impedance	24 k, typical
Analog Outputs	8 channels
Analog Output Characteristics	
Balanced	Unterminated through the rear-panel connector
Maximum Output Level	
Balanced	+24 dBu ±0.5 dB
Digital Input to Analog Output Gain Accuracy over Frequency	±0.5 dB, 20 Hz to 20 kHz, –40 dBFS, 20 or 24 bit inputs
Analog Input to Analog Output Gain Accuracy over Frequency	+0.8 dB, 20 Hz to 20 kHz, 24 dBu to –16 dBu
Output Impedance	50 Ω nominal

Power

Characteristic	Description
Power Consumption	110 W maximum
Voltage Range	100 to 240 V_{AC} ±10%; 50/60 Hz

Physical Characteristics

Dimension	mm	in.
Height	133	5 1/4
Width	213	8 3/8
Depth	464	18 1/4
Weight	**kg**	**lb.**
Net	3.9	8.5

Capabilities by Model

Capability	WFM8300	WFM8200
Video Formats and Inputs		
HD-SDI / Dual Link / SD-SDI	Standard	Standard
3G-SDI (Level A and Level B)	Option 3G	Option 3G
4 SDI Input Monitoring	Option 2SDI	Option 2SDI
Composite PAL/NTSC	Option CPS	Option CPS
Audio Formats and Inputs		
Embedded and AES Digital Audio	Option AD or DPE	Option AD or DPE
Analog Audio	Option AD or DPE	Option AD or DPE
Dolby E / Dolby Digital Plus / Dolby Digital	Option DPE	Option DPE
Physical Layer Measurement		
Jitter Measurements	Option PHY	Option EYE or PHY3
Eye Pattern Display	Option PHY	Option EYE or PHY3
Eye Pattern Auto Measurements	Option PHY	Option PHY3
Pathological Signal Generation	Option PHY	Option GEN
Other Advanced Capabilities		
Advanced Color Gamut (Spearhead/LQV)	Option PROD	Option PROD
Simultaneous Input Monitoring (SIM)	Standard	Option SIM or 3D
3D Video Monitoring	Standard	Option 3D
ANC Data Inspector	Standard	Option DAT
Digital Data Analysis	Standard	Option DAT
Out-of-Service AV Delay Measurement	Standard	Option AVD

Ordering Information

Note: Please specify power plug when ordering.

Product Nomenclature and Descriptions

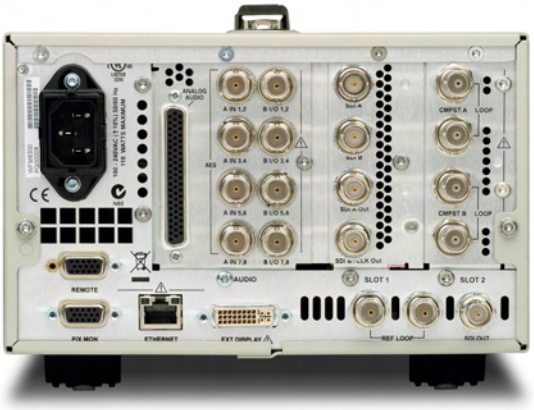
Model	Option	Description
WFM8300		Advanced 3G/HD/SD Waveform Monitor, 2 SDI inputs (3G-SDI, HD-SDI, and SD-SDI support on the same inputs – auto detect) Base unit includes HD-SDI, SD-SDI, Dual Link signal formats, Simultaneous Input Monitoring (SIM), advanced data analysis, 3D Video monitoring, and audio/video delay measurement (requires an audio option) Option 3G required for 3G-SDI support
	3G	Add support for 3G-SDI signal formats
	2SDI*2	Adds additional SDI module (in Slot 2) to support up to 4 SDI inputs within Multi-mode displays (3G-SDI, HD-SDI, and SD-SDI support on the same inputs – auto detect) Option 3G required for 3G-SDI support
	CPS*2	Add support for composite analog video monitoring; 2 composite analog inputs; passive loopthrough
	AD	Add analog audio monitoring (2 sets of 6-channel analog audio inputs and 8-channel analog audio outputs) plus 16 channels embedded or AES/EBU digital audio support (8 channels at a time)
	DPE	Add Option AD capabilities (analog and digital audio – embedded or external AES) plus support for decoding and monitoring Dolby E, Dolby D, and Dolby Digital Plus
	PHY	Physical Layer Measurement Package (includes 3G-SDI, HD-SDI, and SD-SDI eye pattern and jitter waveform displays; automated measurements of eye pattern parameters, jitter, and cable parameters; color bar and pathological signal generation) Option 3G required for 3G-SDI support
	PROD	Advanced Gamut Monitoring Package (Spearhead Gamut display and Luma Qualified Vector display)
	62	Analog Audio Breakout Cable, 6 feet, male 62-pin connectors to 8 XLR male output connectors and 12 XLR female input connectors
WFM8200		3G/HD/SD Waveform Monitor, 2 SDI inputs (3G-SDI, HD-SDI, and SD-SDI support on the same inputs – auto detect) Base unit includes HD-SDI, SD-SDI, and Dual Link signal formats support Option 3G required for 3G-SDI support
	3G	Add support for 3G-SDI signal formats
	2SDI*2	Adds additional SDI module (in Slot 2) to support up to 4 SDI inputs within Multi-mode displays (3G-SDI, HD-SDI, and SD-SDI support on the same inputs – auto detect) Option 3G required for 3G-SDI support
	CPS*2	Add support for composite analog video monitoring; 2 composite analog inputs; passive loopthrough
	AD	Add analog audio monitoring (2 sets of 6-channel analog audio inputs and 8-channel analog audio outputs) plus 16 channels embedded or AES/EBU digital audio support (8 channels at a time)
	DPE	Add Option AD capabilities (analog and digital audio – embedded or external AES) plus support for decoding and monitoring Dolby E, Dolby D, and Dolby Digital Plus
	EYE	Eye pattern display and Jitter Measurement Package (includes 3G-SDI, HD-SDI, and SD-SDI eye pattern display; automated measurements of jitter and cable parameters) Option 3G required for 3G-SDI support
	PHY3	Physical Layer Measurement Package (includes automated measurement of 3G/HD/SD eye pattern parameters, jitter, and cable parameters; jitter waveform display) Option 3G required for 3G-SDI physical layer measurements
	PROD	Advanced Gamut Monitoring Package (Spearhead Gamut display and Luma Qualified Vector display)
	3D	3D Video Monitoring (Left Eye/Right Eye Side by Side Simultaneous Monitoring with SyncVu™)
	DAT	Add Advanced 3G / Dual-Link / HD / SD-SDI Data Analyzer and Ancillary Data Analyzer (Datalist and ANC Data Inspector) Option 3G required for 3G-SDI support
	SIM	Add simultaneous monitoring of two 3G/HD/SD-SDI inputs or one 3G/HD/SD-SDI input and one CPS input Option 3G required for 3G-SDI format support
	AVD	Add support for out-of-service A/V delay measurement An audio option must also be ordered
	GEN	Add 3G/HD/SD-SDI color bar and pathological signal generation capability Option 3G required for 3G-SDI signal generation capability
	62	Analog Audio Breakout Cable, 6 feet, male 62-pin connectors to 8 XLR male output connectors and 12 XLR female input connectors

*2 Option 2SDI and Option CPS cannot be installed in the same instrument.

Post Sale Upgrade Options

Model	Option	Description
WFM830UP		Post sale upgrade for WFM8300 Advanced 3G-SDI / Dual Link / HD-SDI / SD-SDI Waveform Monitor Option 3G required to be installed in the WFM8300 for 3G-SDI support
	3G	Add support for 3G-SDI signal formats (software option key)
	2SDI*2	Adds additional SDI module (in Slot 2) to support up to 4 SDI inputs within Multi-mode displays (3G-SDI, HD-SDI, and SD-SDI support on the same inputs – auto detect) Option 3G required for 3G-SDI support
	CPS*2	Add support for composite analog video monitoring; 2 composite analog inputs; passive loopthrough
	AD	Add analog audio monitoring (2 sets of 6-channel analog audio inputs and 8-channel analog audio outputs) plus 16 channels embedded or AES/EBU digital audio support (8 channels at a time)
	DPE	Add Option AD capabilities (analog and digital audio – embedded or external AES) plus support for decoding and monitoring Dolby E, Dolby D, and Dolby Digital Plus
	PHY	Add Physical Layer Measurement Package (includes 3G-SDI, HD-SDI, and SD-SDI eye pattern and jitter waveform displays; automated measurements of eye pattern parameters, jitter, and cable parameters; color bar and pathological signal generation) Option 3G required to be installed in the WFM8300 for 3G-SDI support
	PROD	Add Advanced Gamut Monitoring Package (Spearhead Gamut display and Luma Qualified Vector display)
	62	Analog Audio Breakout Cable, 6 feet, male 62-pin connectors to 8 XLR male output connectors and 12 XLR female input connectors
WFM820UP		Post sale upgrade for WFM8200 3G-SDI / Dual Link / HD-SDI / SD-SDI Waveform Monitor Option 3G required to be installed in the WFM8200 for 3G-SDI support
	3G	Add support for 3G-SDI signal formats (software option key)
	2SDI*2	Adds additional SDI module (in Slot 2) to support up to 4 SDI inputs within Multi-mode displays (3G-SDI, HD-SDI, and SD-SDI support on the same inputs – auto detect) Option 3G required for 3G-SDI support
	CPS*2	Add support for composite analog video monitoring; 2 composite analog inputs; passive loopthrough
	AD	Add analog audio monitoring (2 sets of 6-channel analog audio inputs and 8-channel analog audio outputs) plus 16 channels embedded or AES/EBU digital audio support (8 channels at a time)
	DPE	Add Option AD capabilities (analog and digital audio – embedded or external AES) plus support for decoding and monitoring Dolby E, Dolby D, and Dolby Digital Plus
	EYE	Add eye pattern display and Jitter Measurement Package (includes 3G-SDI, HD-SDI, and SD-SDI eye pattern display; automated measurements of jitter and cable parameters) Option 3G required to be installed in the WFM8200 for 3G-SDI support
	PHY3	Physical Layer Measurement Package (includes automated measurement of 3G/HD/SD eye pattern parameters, jitter, and cable parameters; jitter waveform display) Option 3G required for 3G-SDI physical layer measurements
	PROD	Add Advanced Gamut Monitoring Package (Spearhead Gamut display and Luma Qualified Vector display)
	3D	3D Video Monitoring (Left Eye/Right Eye Side by Side Simultaneous Monitoring with SyncVu™)
	DAT	Add Advanced 3G / Dual-Link / HD / SD-SDI Data Analyzer and Ancillary Data Analyzer (Datalist and ANC Data Inspector) Option 3G required for 3G-SDI support
	SIM	Add simultaneous monitoring of two 3G/HD/SD-SDI inputs or one 3G/HD/SD-SDI input and one CPS input Option 3G required for 3G-SDI format support
	AVD	Add support for out-of-service A/V delay measurement An audio option must also be ordered
	GEN	Add 3G/HD/SD-SDI color bar and pathological signal generation capability Option 3G required for 3G-SDI signal generation capability
	62	Analog Audio Breakout Cable, 6 feet, male 62-pin connectors to 8 XLR male output connectors and 12 XLR female input connectors

*2 Option 2SDI and Option CPS cannot be installed in the same instrument.



International Power Plugs

Option	Description
Opt. A0	North America power
Opt. A1	Universal Euro power
Opt. A2	United Kingdom power
Opt. A3	Australia power
Opt. A5	Switzerland power
Opt. A6	Japan power
Opt. A10	China power
Opt. A11	India power
Opt. A12	Brazil power
Opt. A99	No power cord or AC adapter

Optional Accessories

Accessory	Description
WFM7F02	Portable cabinet includes handle, feet, tilt bail, and front-panel cover
WFMRACK-NN	Dual Rack Cabinet New-New
WFMRACK-ON	Dual Rack Cabinet Old-New
WFM50F06	Filler Blank Panel for WFMRACK

Service Offerings

Service	Description
WFM8300, WFM8200	
Opt. CA1	Provides single calibration event or coverage for the designated calibration interval whichever comes first
Opt. C3	Calibration Service 3 Years
Opt. C5	Calibration Service 5 Years
Opt. D1	Calibration Data Report
Opt. D3	Calibration Data Report 3 Years (with Opt. C3)
Opt. D5	Calibration Data Report 5 Years (with Opt. C5)
Opt. G3	Complete Care 3 Years (includes loaner, scheduled calibration and more)
Opt. G5	Complete Care 5 Years (includes loaner, scheduled calibration and more)
Opt. R3	Repair Service 3 Years (including warranty)
Opt. R5	Repair Service 5Years (including warranty)
Opt. R5DW	Repair Service Coverage 5 Years (includes product warranty period). 5-year period starts at time of customer instrument purchase. This option is available if the instrument is within product warranty. It is not available once instrument exits warranty period
Opt. R3DW	Repair Service Coverage 3 Years (includes product warranty period). 3-year period starts at time of customer instrument purchase. This option is available if the instrument is within product warranty. It is not available once instrument exits warranty period

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Updated 10 February 2011

For Further Information. Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit **www.tektronix.com**

13 Apr 2012 2PW-24416-8