

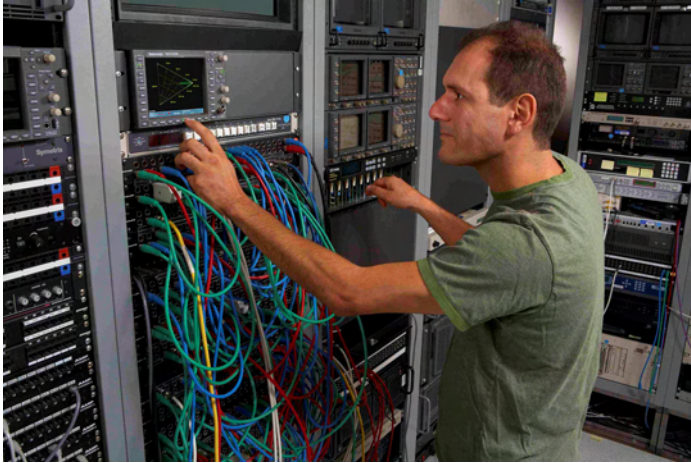
# Multiformat, Multistandard Waveform Monitor

## WFM7200 Data Sheet



### Features & Benefits

- Multiformat, Multistandard Video Monitoring
  - WFM7200 includes standard auto-detection of HD/SD-SDI and multiple Dual Link video formats
  - Composite analog (PAL/NTSC) video support (Opt. CPS)
  - Simultaneous monitoring (Opt. SIM) allows monitoring of 2 HD/SD-SDI inputs or 1 HD/SD-SDI input and 1 CPS input. Option 3G is required for 3G-SDI format support
  - Multiple Input Mode allows monitoring of 2 to 4 SDI inputs simultaneously (4-input mode requires Opt. 2SDI)
  - Upgradeable to 3G-SDI (Level A and Level B) format support (Opt. 3G)
- Comprehensive Audio Monitoring (Opt. AD or DPE)
  - Up to 16-channel audio monitoring for embedded audio
  - Multichannel Surround Sound\*1 display and flexible Lissajous display
  - Audio Loudness monitoring to ITU-R BS.1770-2 (Opt. AD or DPE)
  - Support for analog, digital, and embedded audio (Opt. AD)
  - Dolby Digital (AC-3), Dolby Digital Plus, and Dolby E (Opt. DPE)
  - Comprehensive Dolby metadata decode and display (Opt. DPE)
  - Dolby E Guard Band meter with user-defined limits (Opt. DPE)
- Unmatched Display Versatility
  - FlexVu™, the most flexible four-tile display, suited for various application needs to increase productivity
  - Tektronix-patented Diamond and Arrowhead displays for gamut monitoring
- 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)
- Stereoscopic 3D Video Displays for Camera Alignment and Production/Post-production Applications (Opt. S3D)
- Black Picture and Tektronix-patented Frozen Picture Detection
- Advanced 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
- In-depth Digital Data Analysis Helps Quickly Resolve Difficult Content Quality and Reliability Issues (Opt. DAT)
- Standard and User-definable Safe Area Graticules Facilitate Editing and Format Conversion Tasks, Reducing the Need for Reworks
- Active Format Description (AFD) Detection, Decode, and Automatically Adjusted Graticule in Picture Display enable Easy Identification of Aspect-ratio Related Issues
- Superior Physical Layer Signal Measurement
  - High-performance real-time eye pattern display, jitter measurements, and patented cable length measurement (Opt. PHY3)
  - Most comprehensive eye pattern measurements including eye amplitude, rise/fall time, and overshoot/undershoot measurements as well as Tektronix jitter waveform display (Opt. PHY3)
- 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



Multiformat support grows with your needs.

## Applications

- Monitoring and Compliance Checking in Content Distribution and Broadcast transmission
- Quality Control in Content Production and Post-production
- Equipment/System Qualification and Troubleshooting for Installation and Maintenance of Content Creation and Distribution Facilities
- Post-production Edit Suite and Color Correction Monitoring

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

## WFM7200

The monitoring and measurement capabilities of the WFM7200 provide a comprehensive suite of options and configurations to suit a variety of applications. For monitoring applications Tektronix-patented gamut displays simplify color adjustments for camera balancing and color correction applications. Get information about the signal at a glance from the audio session and video session displays that assist in ensuring quality control of the image.

Tektronix provides an extensive audio toolset for monitoring analog, digital AES/EBU, and digital embedded within Option AD. Up to 16 channels of embedded audio can be monitored for bar levels, which allows the operator to quickly check audio signal levels. Lissajous, Surround Sound\*<sup>1</sup>, and correlation meters show the interaction of the audio channels. For Dolby Digital (AC-3), Dolby Digital Plus, and Dolby E, Option DPE adds the additional functionality to decode the Dolby stream with a comprehensive Dolby metadata decode and status display. To ensure Dolby E synchronization the guard band meter easily shows the start of the Dolby frame in relation to the video signal with user-defined limits.

Loudness is a critical audio measurement to make for each produced program and throughout the distribution chain. The WFM7200 includes a Loudness meter as part of Option AD or DPE, with short and infinite audio loudness measurements to ITU-R BS.1770-2 standard. Preset configurations are defined to meet ATSC A/85, EBU R128, and ARIB TR-B32 to suit the specific requirements of these standards. For detailed analysis of loudness a graphical plot provides a Loudness Session that can store up to 30 hours of data and can be downloaded for inclusion in documentation using a network connection or USB device.

A variety of ancillary data is now carried within the SDI signal, and the ANC data toolset of the WFM7200 can help monitor and troubleshoot problems within the signal chain. The Aux Data Status display provides a summary of critical ANC data such as closed captioning / subtitling, AFD, and time code. The ANC Data Inspector allows the user to quickly verify the presence of ANC data within the signal and the Datalist display allows inspection of the data line by line, sample by sample.

For measurement of the physical layer the WFM7200 includes high-precision eye and jitter displays that provide automated measurements of amplitude, rise/fall times, overshoot/undershoot, and timing or alignment jitter. The measurement functions of the WFM7200 also include options for AV Delay and Stereoscopic 3D Monitoring, making the WFM7200 an ideal choice for monitoring and measurement applications.

- Video Monitoring Standards and Formats
  - Standard Definition SDI – Standard
  - High Definition SDI – Standard
  - Dual Link (4:2:2, 4:4:4, alpha channel, 10 bit, 12 bit) – Standard
  - Composite Analog Video – Option CPS
  - 3G-SDI (Level A and Level B) – Option 3G
  - 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
  - Color Bar and Pathological Signal Generation – Option GEN
  - Digital Data Analysis – Option DAT
  - ANC Data Inspector – Option DAT
  - Simultaneous Input Monitoring – Option SIM
  - Stereoscopic 3D Monitoring – Option S3D
  - Audio/Video Delay Measurement – Option AVD

The screenshot displays the Tektronix WFM7200 interface. At the top, it shows 'Active Log' with columns for Source, Error Status, Timecode, and Alarm. Below this is an 'Alarm Status' section with a table of error events. The main area is divided into 'Audio Session' and 'Video Session' summary information, including input details, statistics, and error counts. At the bottom, there are control buttons for 'Run Time' and 'Stopped'.

Source	Error Status	Timecode	Alarm	Status	Additional Information
SDI 1A	Detected Dolby Format (Dolby E 20-101006-4211	11:25:56	HW Fault	OK	
SDI 1A	SDI Input Missing	11:25:56	SDI Input Missing	OK	
SDI 1A	SDI Input Signal Lock	11:25:57	SDI Input Signal Lock	OK	
SDI 1A	Reference Missing	11:25:57	Reference Missing	OK	
SDI 1A	Ref Lost	11:25:57	Ref Lost	OK	
SDI 1A	Ref Frame Mismatch	11:25:57	Ref Frame Mismatch	OK	
SDI 1A	RGB Gamut Error	11:25:57	RGB Gamut Error	OK	
SDI 1A	Composite Gamut Error	11:25:57	Composite Gamut Error	OK	
SDI 1A	Luma Gamut Error	11:25:58	Luma Gamut Error	OK	
SDI 1A	Video Fast Change	11:25:58	Video Fast Change	OK	
SDI 1A	Video Fast Mismatch	11:25:58	Video Fast Mismatch	OK	
SDI 1A	Vid/Ref Mismatch	11:25:58	Vid/Ref Mismatch	OK	
SDI 1A	Video Not HD	11:25:58	Video Not HD	OK	
SDI 1A	Dual Link Format Mismatch	11:25:58	Dual Link Format Mismatch	OK	
SDI 1A	Line Length Error	11:25:58	Line Length Error	OK	
SDI 1A	Field Length Error	11:25:58	Field Length Error	OK	
SDI 1A	EAV Place Error	11:25:58	EAV Place Error	OK	
SDI 1A	SAV Place Error	11:25:58	SAV Place Error	OK	
SDI 1A	Line Number Error	11:25:58	Line Number Error	OK	

A variety of Session and Status displays can be viewed at a glance with FlexVu™.

### 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 powerful Error Log is configurable by a variety of alarm conditions such as black and frozen frame detection 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 and allowing the operator to be alerted to problems within the transmission chain.

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 multi-view 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, or 3G-SDI (with Opt. 3G) 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 screenshot shows four distinct gamut displays on the WFM7200. Top-left: 'Picture Bright-up' showing a color bar. Top-right: 'Diamond' gamut display with a diamond-shaped graticule and color targets. Bottom-left: 'Arrowhead' gamut display with an arrowhead-shaped graticule. Bottom-right: 'Spearhead' gamut display with a spearhead-shaped graticule. Each display includes numerical data such as 'High: 735 mV', 'Low: -35 mV', and 'Area: 1 %'.

Tektronix-patented Diamond, Spearhead, and Arrowhead gamut displays, along with the Picture Bright-up display.

The Vector display offers user-selectable graticules, color targets (75% or 100%), and color axis.

### Color Correction Toolset for Editors and Colorists

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

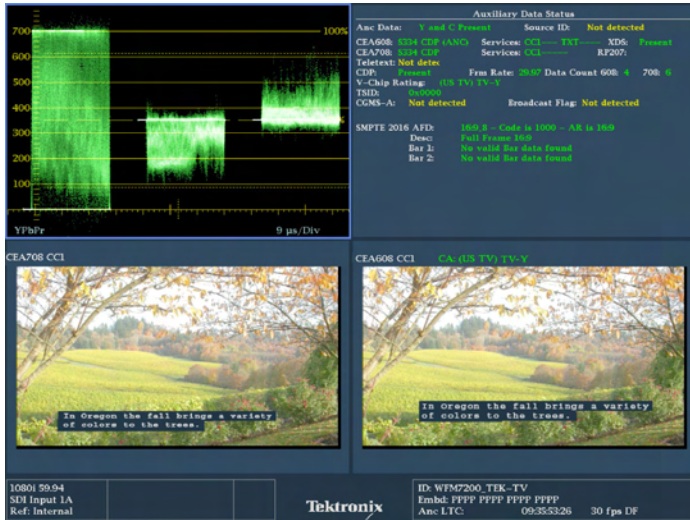
The Diamond and Split Diamond displays help easily identify and correct RGB gamut errors in digital video signals. The Arrowhead display saves time in verifying composite gamut compliance for digital video signals.

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 easily see the location of gamut errors in the picture display. Flexible Safe Area Graticules within the picture display allow for quick placement of graphics, titles, or logos. Using FlexVu™, users can see two or more pictures with different graticules.

The WFM7200 also features optional advanced color gamut monitoring capabilities including the Tektronix-patented Luma Qualified Vector (LQV™) display and Spearhead display (Opt. PROD) 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.

The combination of FlexVu™ and variety of gamut displays allow the instrument to be customized for your individual application to meet your needs. Additionally, simple presets can be set up and quickly recalled allowing the user to rapidly switch from one configuration to another.



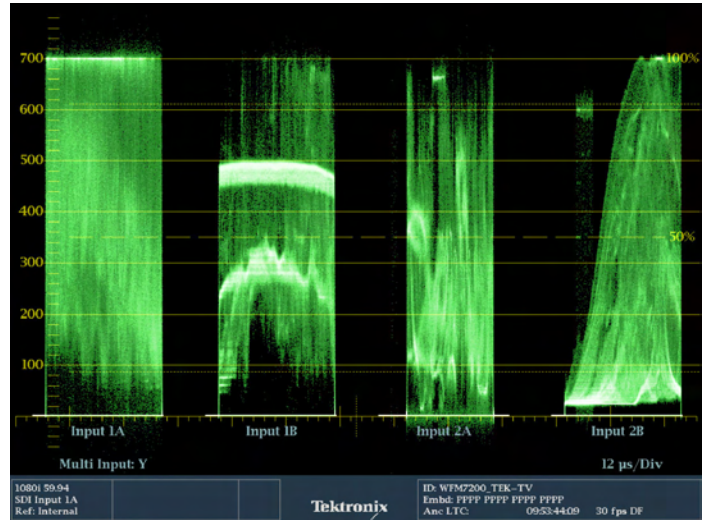


Simultaneous decode of CEA708 and CEA608 captions within multiple picture displays.

### Content QA and Distribution Chain

The WFM7200 can be configured to alarm on a variety of errors within the video and audio signal. Errors that occur within the program material can be logged against time code, allowing an operator to quickly investigate problems within the material. This can save time in evaluating quality assurance issues within content and provide documentation of the list of errors within the material that can be downloaded from the instrument using a network connection or USB device.

The picture display provides detection and decode of CEA708/608 Closed Caption. Using multiple picture displays, the instrument can decode CEA708 and CEA608 simultaneously, allowing verification of the presence and decoding of this critical metadata within one pass of the material. 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.



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

Black and frozen frame detection can provide indication when the signal is lost during transmission and provide an alert of the alarm visually within the video session or error log displays. Alternatively, a ground closure or SNMP trigger can also be used to alert the operator to a problem.

### Camera Balance Application

Within a studio or on-location within a truck it is important that all the cameras are matched to ensure the look of the production from camera to camera, scene to scene. With the Multiple Input mode of the WFM7200 the instrument can be used to monitor up to four SDI inputs simultaneously when in Full Screen mode (4-input mode requires Opt. 2SDI). This type of display is ideal for camera balance applications where the user wishes to check the video level across multiple inputs to ensure consistency of the cameras' output. This Multiple Input mode is available within Waveform, Vector, Lightning, Diamond, Arrowhead, and Spearhead (with Opt. PROD) display modes, allowing for the comparison of video inputs across a wide variety of these displays.



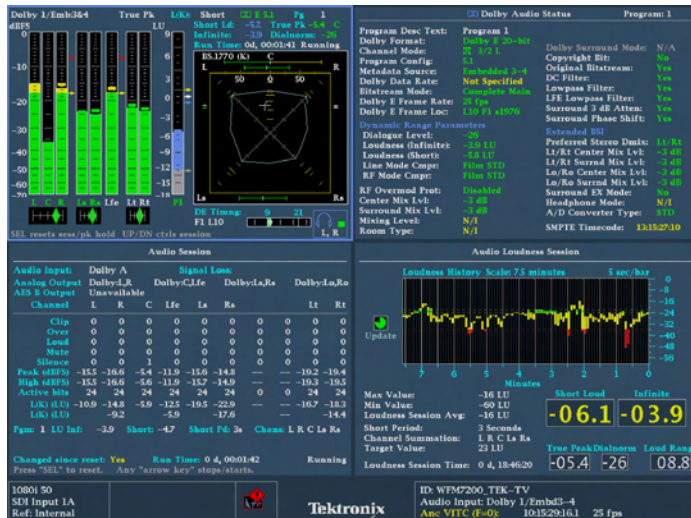
Audio Monitoring with Lissajous display, Channel Status information, Loudness Session, and Audio Session.

### Complete Monitoring Tool Set for Optimum Sound Quality

The WFM7200 provides 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 Audio display provides a variety of display configurations for audio level and phase monitoring. Up to 16 channels of embedded audio levels can be monitored with a variety of scales and ballistics configured by the user. For AES and embedded audio, eight audio channels can be monitored for audio level with phase correlation meters. The Bars display provides indicators for faults, audio levels, and Dolby format information. A Lissajous display can be enabled for a selected channel pair and provides an X-Y plot of the audio signals. The flexible Lissajous display allows the selection of any two audio channels. The Surround Sound\*1 display provides intuitive graphical representation of channel interaction in a system.

Loudness monitoring is becoming a critical part of audio monitoring of the program to ensure consistent audio loudness levels between programs and commercials. 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. Within the configuration menu there are simple Loudness presets for the various standards such as ATSC A/85, EBU R128, and ARIB TR-B32. The Loudness session display graphically



Dolby Audio Monitoring with Surround Sound display, Dolby Status, Audio Session, and Loudness Session displays.

plots Loudness measurements 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 WFM7200 instrument the most comprehensive waveform and audio monitor 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.

### Dolby Audio Monitoring

Option DPE of the WFM7200 supports decoding of Dolby Digital (AC-3), Dolby Digital Plus, and Dolby E, providing decoding of up to 10 audio bar level meters along with correlation meters of the Dolby data stream. The decoded Dolby stream can be flexibly mapped to the analog or digital audio outputs.

The Dolby Status display (Opt. DPE) gives an in-depth view of integrated or VANC metadata and comparisons of the Dialnorm value to Loudness measurements. Dolby E requires frame synchronization to the video signal and the guard band measurement provides a direct readout in terms of field and line location of the Dolby frame sequence. User-configurable thresholds for the Dolby E guard band timing measurement (Opt. 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).



Simultaneous Input mode of WFM7200 comparing incoming and outgoing signals.

### Full-featured Simultaneous Input Monitoring Boost Versatility

The Simultaneous Input Monitoring (Opt. SIM) capability of the WFM7200 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. The 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 image and the Right Eye image.

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. When SyncVu™ is enabled, the Left and Right Tile displays are synchronized, so that if a picture tile is selected for Tile 1, Tile 2 automatically 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.

The CaptureVu® feature on the WFM7200 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.



Simultaneous 3D display of Left Eye and Right Eye signals with Difference Map and Overlay picture displays.

### 3D Stereoscopic Monitoring

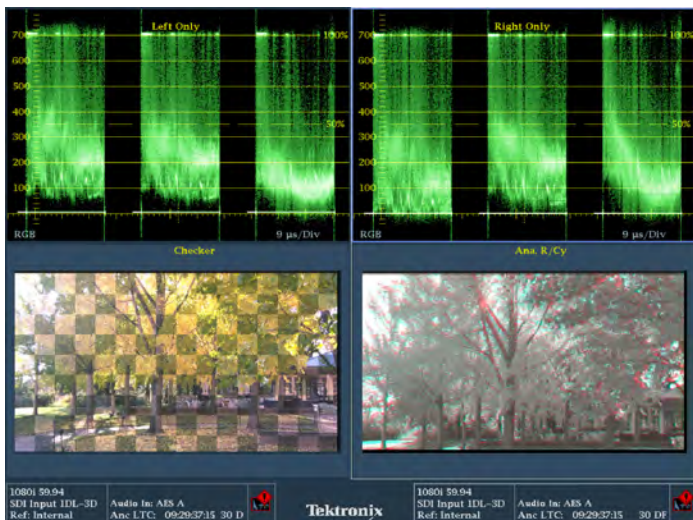
The 3D stereoscopic monitoring and displays are available on WFM7200 with Option S3D. A 3D image is comprised of a Left Eye and Right Eye image to be fed as two separate HD-SDI signals or combined within a 3G Level B format. Alternatively, the 3D signal can be carried in a single HD-SDI signal as a Side by Side or Top/Bottom image for the left and right images. A variety of different 3D monitoring modes are available within the instrument 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 and see the difference between the 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
- 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.



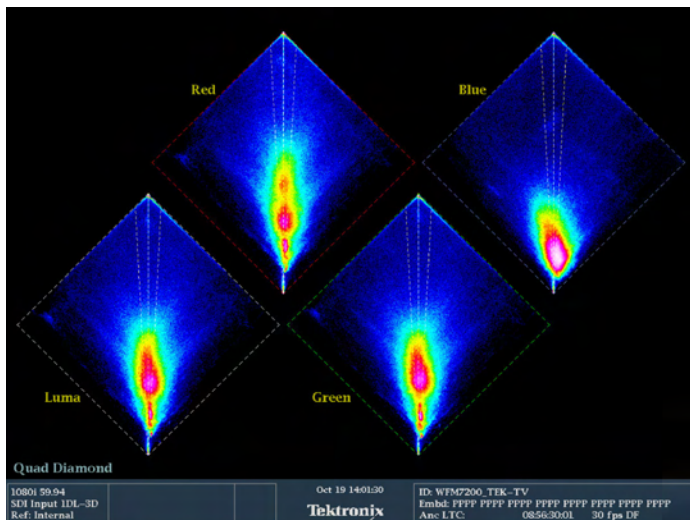


3D Left and Right Eye RGB waveform displays with a Checkerboard, and Red/Cyan Anaglyph picture displays.

### 3D Stereoscopic Measurement

For measurement of the depth of an object within the image (Opt. S3D) 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.

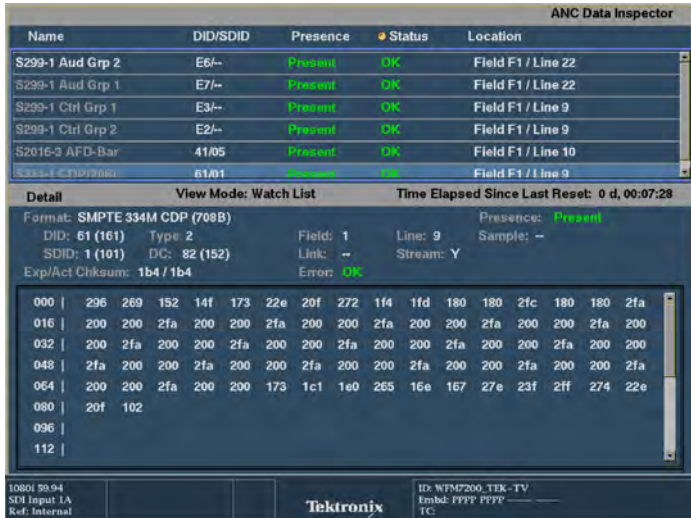
A set of Disparity Cursors are also available for precise measurement of horizontal disparity of an object between the Left and Right Eye images. Readout is given of the pixel difference between the cursors and the percentage of disparity of an object.



Quad Diamond display of Left and Right Eye Disparity for Luma, Red, Green, and Blue components.

### Quad Diamond Display for 3D Alignment

The new Tektronix-patented Quad Diamond display (Opt. S3D) simplifies stereoscopic camera alignment by viewing a disparity histogram of the left and right signal from a signal level of 0 to 100% vertically for each of the components: Luma, Red, Green, and Blue. If the two cameras are well balanced the trace will form a vertical trace for each of the diamonds. A deviation in the trace indicates an imbalance between the left and right eye images that should be corrected using the various camera controls until the trace becomes vertical. This display can also be used in post-production for aiding the editor and perform color correction on the left and right images.



ANC Data Inspector and CaptureVu provide detailed content analysis.



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

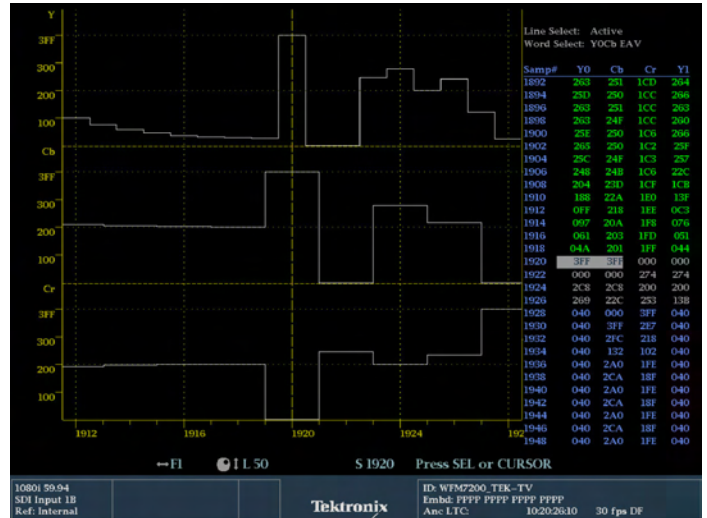
## Superior Data Analysis Capabilities for Engineers and Operators

The ANC Data Inspector (Opt. 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 the WFM7200) provides summary information on Active Format Description (AFD) per SMPTE 2016,



Datalist display provides detailed pixel-by-pixel information.

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 WFM7200 along with the binary data and text description for easy monitoring.

The WFM7200 can also monitor Dolby metadata embedded in the Vertical Ancillary (VANC) data space per SMPTE 2020.

The Datalist display (Opt. DAT) provides detailed information on the actual data values in HD/SD-SDI and 3G-SDI (with Opt. 3G) input signals. Users can easily use this display to locate protocol errors in the input signals.

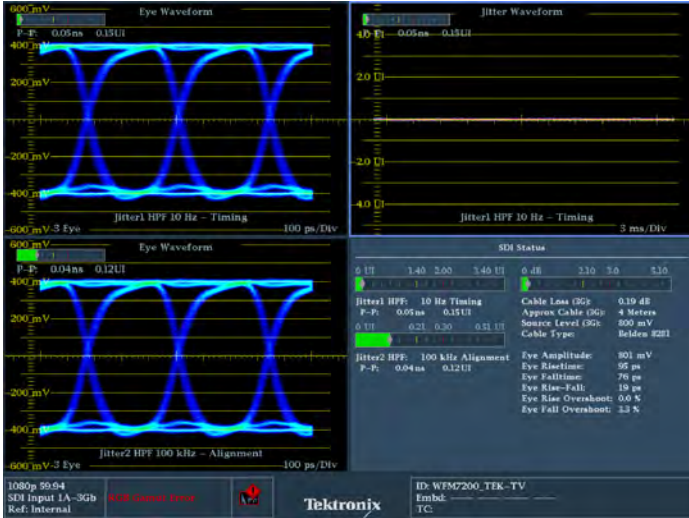
The right side of the display shows the data values in hexadecimal, decimal, or binary format and uses the following color coding for easy identification of data types and errors:

- 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 the 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 one, two, or all three components.





Eye and Jitter display along with automated measurements of physical layer parameters.

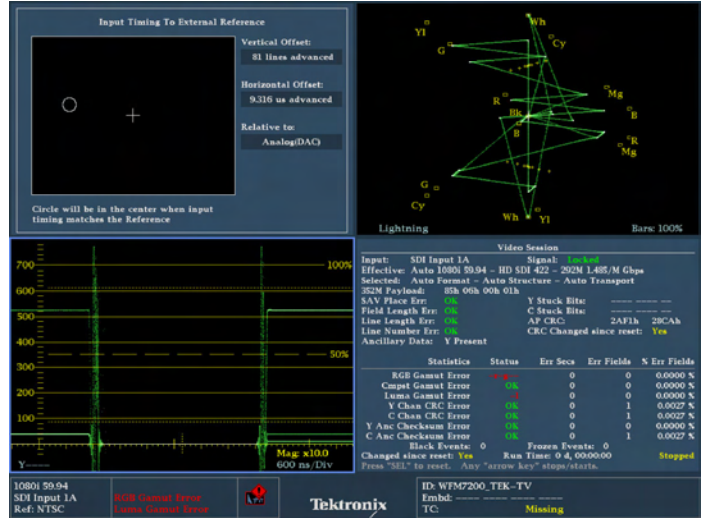
### Physical Layer Measurements

The WFM7200 waveform monitor offers comprehensive physical-layer signal measurements for engineers when Option PHY3 is installed.

The HD/SD-SDI eye pattern display, jitter measurements, and cable length measurements provide essential analysis of the physical layer. An easy-to-interpret gauge provides direct readout of jitter measurements for timing or alignment jitter with various user-selectable jitter filters from 10 Hz to 100 kHz within the eye display. 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 Tektronix-patented estimated cable length measurements. With Option 3G the WFM7200 is also capable of displaying 3G physical layer measurements, allowing the instrument to support your future requirements.

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 WFM7200 (with Opt. PHY3) can also perform automated eye amplitude, automated rise/fall time, automated overshoot/undershoot measurements, and provide a jitter waveform display to view jitter related to line and field rates. All these capabilities help broadcasters and



Timing and Lightning displays simplify timing tasks.

network operators detect and diagnose signal quality problems quickly and efficiently.

Option GEN on the WFM7200 provides a simple test signal generator output that creates 100% Color Bars, 75% Color Bars, and Pathological Test signals for a variety of video formats that can be used to verify signal path.

### Facility Timing Made Easy

Audio/Video synchronization is an important challenge in the processing of video signals. The WFM7200 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 WFM7200.

The Tektronix-patented 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 the WFM7200) 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 inter-channel 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 WFM7200 waveform monitor accepts 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.

Setting	Opt. CPS	STD SD	STD HD	External Reference Inputs																
				Bi-level Sync		Tri-level 720p			Tri-level 1080p		Tri-level 1080i			1080 SF						
				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 Hz			X		X	X						X								
296M 720p, 59.94 Hz			X	X			X						X				X			
296M 720p, 60 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								

Setting	Opt. CPS	STD SD	STD HD	External Reference Inputs											
				Bi-level Sync		Tri-level 720p			Tri-level 1080p		Tri-level 1080i			1080 SF	
				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
<b>Dual Link</b>		
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	
	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	
2048 × 1080	4:2:2 YCbCr 12 bit	30, 30/1.001, 25, 24, and 24/1.001 progressive, PsF
	4:2:2:4 YCbCr +A 12 bit	
	4:4:4 RGB	
	4:4:4:4 RGB +A 10 bit	
	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		
2 × HD	4:2:2 YCbCr 12 bit	30, 30sF progressive 50, 59.94, 60 interlaced
	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
<b>3G-SDI Formats</b>		
<b>Single Link</b>		
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	
2048 × 1080	4:4:4:4 RGB +A 10 bit Level B	23.98, 23.98sF, 24, 24sF, 25, 25sF, 29.97, 29.97sF, 30, 30sF progressive
	4:4:4 RGB 12 bit Level B	
	4:2:2 YCbCr 12 bit	
2 × HD	4:2:2:4 YCbCrA 12 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 12 bit Level B	
2 × HD	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	2, only 1 active at a time
Input Type	Passive loopthrough BNC, 75 $\Omega$ compensated
Input Dynamic Range	$\pm 6$ 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 k $\Omega$ , 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	$\pm 50$ ppm remains locked

### External Reference

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

### Monitor Display Output

Characteristic	Description
Signal Format (XGA DVI-I Output)	1024 $\times$ 768, 60 Hz vertical rate

### Serial Digital Waveform Vertical Characteristics

Characteristic	Description
Vertical Measurement Accuracy	At 1X, $\pm 0.5\%$ At 5X, $\pm 0.2\%$ 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 $\pm 0.5\%$
Chrominance Channels (Pb, Pr)	50 kHz to 15 MHz $\pm 0.5\%$
SD	
Luminance Channel (Y)	50 kHz to 5.75 MHz $\pm 0.5\%$
Chrominance Channels (Pb, Pr)	50 kHz to 2.75 MHz $\pm 0.5\%$

### Analog Composite Waveform Vertical Characteristics (Option CPS)

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

### Waveform Horizontal Sweep Characteristics

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

### Vector Characteristics

Characteristic	Description
Vector Amplitude Accuracy	$\pm 2\%$
Vector Phase Accuracy	$\pm 2^\circ$

### 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 $\Omega$ terminated, unbalanced, 0.2 $V_{p-p}$ to 2 $V_{p-p}$
Input Return Loss	>25 dB relative to 75 $\Omega$ from 0.1 MHz 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 loophrough, 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 4 Luminance Channel 50 kHz to 30 MHz $\pm 0.5\%$ pairs
Output Characteristics	BNC, 75 $\Omega$ terminated, unbalanced, 0.9 $V_{p-p}$ to 1.1 $V_{p-p}$ Chrominance 50 kHz to 15 MHz $\pm 0.5\%$ into 75 $\Omega$
Output Return Loss	>25 dB relative to 75 $\Omega$ from 0.1 MHz to 6 MHz (typical)
Output Jitter	3.5 ns, peak, typical, with 700 Hz high-pass filter per Luminance Channel 50 kHz to 5.75 MHz $\pm 0.5\%$ AES specification (typical)
Level Meter Accuracy over Frequency	+0.1 dB from 20 Hz to 20 kHz, 0 dBFS 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	2 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 $\pm 0.5$ dB
Digital Input to Analog Output Gain Accuracy over Frequency	$\pm 0.5$ dB, 20 Hz to 20 kHz, -40 dBFS, 20 bit 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 $\Omega$ nominal

**Power**

Characteristic	Description
Power Consumption	110 W maximum
Voltage Range	100 to 240 V AC $\pm 10\%$ ; 50/60 Hz

**Physical Characteristics**

Dimension	mm	in.
Height	133	5.3
Width	213	8.4
Depth	464	18.3
Weight	kg	lb.
Net	3.9	8.5

**Capabilities by Optional Configuration**

Capability	WFM7200
<b>Video Formats and Inputs</b>	
HD-SDI / Dual Link / SD-SDI	Standard
3G-SDI (Level A and Level B)	Option 3G
4 SDI Input Monitoring	Option 2SDI
Composite PAL/NTSC	Option CPS

**Audio Formats and Inputs**

Embedded and AES Digital Audio	Option AD or DPE
Analog Audio	Option AD or DPE
Dolby E / Dolby Digital Plus / Dolby Digital	Option DPE

**Physical Layer Measurement**

Jitter Measurements	Option PHY3
Eye Pattern Display	Option PHY3
Eye Pattern Auto Measurements	Option PHY3
Pathological Signal Generation	Option GEN

**Other Advanced Capabilities**

Advanced Color Gamut (Spearhead / LQV)	Option PROD
Simultaneous Input Monitoring (SIM)	Option SIM
3D Video Monitoring	Option S3D
ANC Data Inspector	Option DAT
Digital Data Analysis	Option DAT
Out-of-Service AV Delay Measurement	Option AVD

## Ordering Information

**Note:** Please specify power plug when ordering.

### Product Nomenclature and Descriptions

Model	Option	Description
WFM7200		SDI Waveform Monitor, 2 SDI inputs (Auto-detection of SDI format)  Base unit includes HD-SDI, SD-SDI, Dual Link signal formats  Option 3G required for 3G-SDI support
	CPS* <sup>2</sup>	Add support for composite analog video monitoring; 2 composite analog inputs; passive loopthrough
	3G	Add support for 3G-SDI signal formats
	SIM	Add simultaneous monitoring of 2 HD/SD-SDI inputs or 1 HD/SD-SDI input and 1 CPS input  Option 3G required for 3G-SDI formats support
	2SDI* <sup>2</sup>	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
	PROD	Advanced Gamut Monitoring Package (Spearhead gamut display and Luma Qualified Vector display)
	DAT	Add Advanced HD/SD-SDI Data Analyzer and Ancillary Data Analyzer  Option 3G required for 3G-SDI formats support
	PHY3	Physical Layer Measurement Package (includes HD-SDI, and SD-SDI eye pattern and jitter waveform displays; automated measurements of eye pattern parameters, jitter, and cable parameters)  Option 3G required for 3G-SDI support
	GEN	Add HD/SD-SDI Color Bar and Pathological Signal generation capability  Option 3G required for 3G-SDI signal generation capability
	AVD	Add support for out-of-service A/V delay measurements; An audio option must also be ordered
	S3D	Add Monitoring Support for Stereoscopic 3D Video (including Simultaneous Input Monitoring Capability)
	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) including loudness monitoring
	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 including loudness monitoring
	62	Analog Audio Breakout Cable, 6 feet, male 62-pin connectors to 8 XLR male output connectors and 12 XLR female input connectors

\*<sup>2</sup> Option 2SDI and Option CPS cannot be installed on 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
WFM RACK-NN	Dual Rack Cabinet New-New
WFM RACK-ON	Dual Rack Cabinet Old-New
WFM50F06	Filler Blank Panel for WFM RACK



## Post Sale Upgrade Options

Model	Option	Description
WFM720UP	CPS*2	Add support for composite analog video monitoring; 2 composite analog inputs; passive loopthrough
	3G	Add support for 3G-SDI signal formats
	SIM	Add simultaneous monitoring of 2 HD/SD-SDI inputs or 1 HD/SD-SDI input and 1 CPS input Option 3G required for 3G-SDI formats support
	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
	PROD	Advanced Gamut Monitoring Package (Spearhead gamut display and Luma Qualified Vector display)
	DAT	Add Advanced HD/SD-SDI Data Analyzer and Ancillary Data Analyzer Option 3G required for 3G-SDI formats support
	PHY3	Physical Layer Measurement Package (includes HD-SDI, and SD-SDI eye pattern and jitter waveform displays; automated measurements of eye pattern parameters, jitter, and cable parameters) Option 3G required for 3G-SDI support
	GEN	Add HD/SD-SDI Color Bar and Pathological Signal generation capability Option 3G required for 3G-SDI signal generation capability
	AVD	Add support for out-of-service A/V delay measurements; An audio option must also be ordered
	S3D	Add Monitoring Support for Stereoscopic 3D Video (including Simultaneous Input Monitoring Capability)
	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) including loudness monitoring
	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 including loudness monitoring
	62	Analog Audio Breakout Cable, 6 feet, male 62-pin connectors to 8 XLR male output connectors and 12 XLR female input connectors

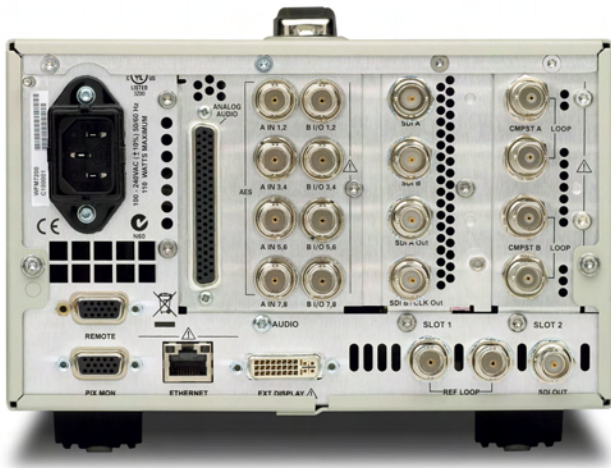
\*2 Option 2SDI and Option CPS cannot be installed on the same instrument.

## Service Options

Option	Description
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 5 Years (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



WFM7200 Front Panel.



WFM7200 Rear Panel.



Tektronix is registered to ISO 9001 and ISO 14001 by SRI Quality System Registrar.

www.tektronix.com

**Contact Tektronix:**

- ASEAN / Australasia (65) 6356 3900
- Austria 00800 2255 4835\*
- Balkans, Israel, South Africa and other ISE Countries +41 52 675 3777
- Belgium 00800 2255 4835\*
- Brazil +55 (11) 3759 7627
- Canada 1 800 833 9200
- Central East Europe and the Baltics +41 52 675 3777
- Central Europe & Greece +41 52 675 3777
- Denmark +45 80 88 1401
- Finland +41 52 675 3777
- France 00800 2255 4835\*
- Germany 00800 2255 4835\*
- Hong Kong 400 820 5835
- India 000 800 650 1835
- Italy 00800 2255 4835\*
- Japan 81 (3) 6714 3010
- Luxembourg +41 52 675 3777
- Mexico, Central/South America & Caribbean 52 (55) 56 04 50 90
- Middle East, Asia, and North Africa +41 52 675 3777
- The Netherlands 00800 2255 4835\*
- Norway 800 16098
- People's Republic of China 400 820 5835
- Poland +41 52 675 3777
- Portugal 80 08 12370
- Republic of Korea 001 800 8255 2835
- Russia & CIS +7 (495) 7484900
- South Africa +41 52 675 3777
- Spain 00800 2255 4835\*
- Sweden 00800 2255 4835\*
- Switzerland 00800 2255 4835\*
- Taiwan 886 (2) 2722 9622
- United Kingdom & Ireland 00800 2255 4835\*
- USA 1 800 833 9200

\* European toll-free number. If not accessible, call: +41 52 675 3777

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