

# SDI/HDMI Multiformat Compact Waveform Monitor

## WFM5250 Datasheet



### Features & Benefits

- Two Serial Digital Inputs (SDI) and two High Definition Multimedia Interface (HDMI) inputs with High-bandwidth Digital Content Protection (HDCP)
  - WFM5250 comes standard with auto-detection of 3G/HD/SD-SDI, Dual Link and HDMI video formats (3G-SDI requires Option 3G)
  - HDCP support on HDMI input and HDMI output for connectivity with consumer electronics products such as Set Top Box, DVD/Blu-ray disk player
  - Two-channel Simultaneous Monitoring (Option SIM)
  - 16-channel embedded AES/EBU audio simultaneous monitoring support with Multichannel Surround Sound <sup>1</sup> display and flexible Lissajous display (Option AUD)
  - Audio Loudness monitoring to ITU-R BS.1770-3/1771, EBU R 128, and ATSC A/85 recommendations (Option LOUD and AUD)
- Patented Diamond and Arrowhead Displays for Color Gamut Compliance Monitoring
- Patented Spearhead Display and Luma Qualified Vector (LQV™) Display facilitate precise color adjustment for post production applications (Option PROD)
- Stereoscopic 3D Video Displays for Camera Alignment and Production/Post-production Applications (Option S3D)
- Comprehensive Data Monitoring helps to quickly resolve difficult content quality and reliability issues (Option DATA)
  - Simultaneous CEA708/608 Closed Caption monitoring; Teletext and OP47 subtitle monitoring (Option DATA)
- 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
- ANC Data Inspector and SDI Data Analysis display helps troubleshoot ANC data and SDI data problems (Option DATA)
- HDMI / HDCP status with Extended Display Identification Data (EDID), which is information that helps users troubleshoot connectivity problems
- Simple 3G/HD/SD Color Bar and Pathological Signal Generator (Option GEN) for Troubleshooting Signal Paths and Equipment (Option 3G required for 3G-SDI test signal generation)
- Variety of Monitoring Displays
  - Patented Timing and Lightning displays makes facility and interchannel timing easy
  - Waveform display of external reference (Black Burst or Tri-Level Sync)
  - Black Picture and patented Frozen Picture Detection Extensive alarms, status reporting, and error logging for 10,000 events simplifies error correction tasks
  - User-definable Safe Area Graticules and AFD Graticule facilitate editing and format conversion tasks
- Unmatched Display Versatility
  - Flexible Quad Tile Display tailored to various applications needs to increase productivity
  - TandemVu® Display for efficient camera adjustments of luma and chroma
  - Full Screen mode that maximizes display size for precise adjustments
- Unmatched Usability
  - 3 RU height, Half-rack Width, Short-depth (5.5 in. or 14 cm) Instrument, Ideal for Space-constrained Environments
  - 4-pin XLR DC Power Input with AC Power Adapter for both AC/DC Operation
  - 32 instrument presets for quick recall of commonly used configurations tailored to colorists, editors, or operators
  - Front-panel USB port enables easy transfer of presets, screenshots, and error log
  - Front-panel headphone port for easy monitoring of audio channels
  - High-brightness display with crisp, high-resolution LED backlight, ideal for indoor and outdoor usage
  - SNMP and Ethernet remote interface capabilities and GPI control facilitate centralized monitoring and control
  - DVI-I external display output for easy connection to digital or analog XGA display

<sup>1</sup> Audio Surround Sound Display licensed from Radio Technische Werksütten GmbH and Co. KG (RTW).



WFM5250 portable monitoring instrument ideal for field applications.



WFM5250 camera monitoring at production.

## Applications

- Content Acquisition with DSLR camera
- Quality Control (QC) at DVD / Blu-ray master disk authoring in Post Production
- CALM and Picture quality monitoring in distribution with STB output
- Color Correction and Manipulation
- Content Editing and Special Effects
- Content Quality Control (QC) in Production and Post Production
- Field Production Setup and Troubleshooting

## WFM5250

The WFM5250 Compact Video Waveform Monitor provides an ideal solution for basic video and audio (with Option AUD) monitoring needs with an integrated high-brightness, low-power consumption LED backlit display in a convenient 3RU, half-rack, short-depth form factor, suitable for space-constrained environments. This versatile instrument can accept power from a 12 V DC source, a battery, or a 100-240 V AC converter.

SDI input provides multiformat support for HD-SDI (SMPTE 292), SD-SDI (ITU-R BT.601) and Dual Link (SMPTE 372) signal formats. The instrument provides automatic format detection for 3G/HD/SD-SDI on each input. Option 3G is required for support of Level A and Level B SMPTE 425/424 formats. The WFM5250 has HDMI inputs with HDCP support that can be connected to encrypted (HDCP) consumer devices for monitoring the video and audio signals.

Optional audio monitoring support for 16 channels of Embedded AES/EBU Audio (Option AUD) provides a variety of audio level bar monitoring, multichannel surround sound display <sup>1</sup> and flexible Lissajous display. A front-panel headphone port can be used for easy compliance verification of digital audio without the need for an additional piece of equipment.

This instrument provides the reliability of the Telestream waveform monitors family in a portable, basic monitoring product. The WFM5250 offers uncompromised monitoring quality with sharp CRT-like traces, patented Gamut displays, picture thumbnail, display freeze, and an error log for 10,000 events for efficient content compliance verification.

- Video Monitoring Standards and Formats
  - HDMI input with HDCP - Standard
  - 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
  - Two-channel Simultaneous Monitoring – Option SIM
- Color Gamut Monitoring
  - Arrowhead Display – Standard
  - Diamond and Split Diamond Displays – Standard
  - Spearhead Display – Option PROD
  - Luma Qualified Vector (LQV™) – Option PROD
- Audio Monitoring
  - 16-channel Digital AES/EBU (Embedded) – Option AUD
  - Audio Loudness Monitoring to ITU-R BS.1770-3 – Option LOUD
- Measurement and Analysis
  - Simultaneous CEA708/608 Closed Caption monitoring; Teletext and OP47 Subtitle Monitoring – Option DATA
  - SDI Digital Data Analysis – Option DATA
  - SDI ANC Data Inspector – Option DATA
  - SDI Stereoscopic 3D Monitoring – Option S3D
  - Color Bar and Pathological Signal Generation – Option GEN

## Ease of Use

The intuitive user interface provides backlit buttons and online help. 32 user-configurable presets allow users to recall commonly used configurations tailored to your personal work practices. These presets can be transferred to and from other units (same model) using the front-panel USB port. An Ethernet port allows for easy download of screenshots and the Error Log.

**Alarm Status** Page 1 of 5

Alarm	Status	Additional Information
HW Fault	OK	
SDI Input Missing	OK	
SDI Input Signal Lock	OK	
Reference Missing	OK	No Signal
Ref Lock	OK	No Signal
Ref Fmt Mismatch	OK	
RGB Gamut Error	OK	
Composite Gamut Error	OK	C-
Luma Gamut Error	OK	
Video Fmt Change	OK	
Video Fmt Mismatch	OK	
Y/Ref Mismatch	OK	
Video Not HD	OK	
Dual Link Format Mismatch	OK	
Line Length Error	OK	
Field Length Error	OK	
EAV Place Error	OK	
SAV Place Error	OK	
Line Number Error	OK	

**Video Session**

Input: SDI Input 1A Signal: **1080i**  
 Effective: Auto 1080i 59.94 - HD SDI 422 - 292M 1.485/M Gbps  
 Selected: Auto Format - Auto Structure - Auto Transport  
 SSM Payload: **OK** Y Stuck Bits: **---**  
 SAV Place Err: **OK** C Stuck Bits: **---**  
 Field Length Err: **OK**  
 Line Length Err: **OK**  
 Line Number Err: **OK**  
 Ancillary Data: Y Present

Statistics	Status	Err Secs	Err Fields	% Err Fields
RGB Gamut Error	OK	1	1	0.0031 %
Compst Gamut Error	OK	406	23798	72.8012 %
Luma Gamut Error	OK	1	1	0.0031 %
Y Cha. CRC Error	OK	9	18	0.0469 %
C Cha. CRC Error	OK	9	18	0.0469 %
Y Anc Checksum Error	OK	0	0	0.0000 %
C Anc Checksum Error	OK	2	2	0.0052 %

**Audio Session**

Audio Input Channel	Embedded A	Signal Loss
Clip	0	0
Over	0	0
Loud	0	0
Mute	0	0
Silence	0	0
Peak (dBFS)	-17.9	-6.2
High (dBFS)	-18.2	-7.9
Active bits	24	24

1080i 59.94  
SDI Input 1A  
Ref: Internal

**Tektronix** ID: WFM5250 TEK1  
Embd: PFFF PFFF PFFF PFFF  
Anc LTC: 09-04:1520 30 fps DF

Quad Tile display of Alarm Status, Error Log, Video, and Audio Sessions.

## See and Solve Displays

The “See and Solve” displays simplify video monitoring tasks such as calibration, error detection, and content correction allowing the user to detect errors at a glance and troubleshoot them efficiently.

Teletream displays offer the sharpest CRT-like trace quality for clear waveform monitoring with the look and feel of an analog display. The familiar video waveform display can show SD/HD/3G-SDI signals in RGB, YPbPr, YRGB, or pseudo composite. Signal components can be displayed in either Parade or Overlay mode.

With several sweep rates and easy control of vertical gain and horizontal magnification, you can efficiently monitor and measure video waveform parameters.

Specialized displays provide summarized, yet comprehensive reports of alarms, session, and status of content. Powerful displays such as Video Status show a condensed view of error statistics, signal format, presence of ancillary data, and more. These exclusive displays simplify monitoring tasks by providing important content information at a glance.

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.

## Alarms, Quality Statistics, and Logging – Thorough and Fast Content Verification

The WFM5250 offers a variety of displays designed to show status at a glance, in addition to the status bar continually displayed at the bottom of the screen.

A comprehensive overview of the video content status is presented in the Video Session display for both SDI and HDMI interfaces. Offering a time-based compilation of information, this screen is ideal for presenting evidence of compliance after content screening. Information on input format and session time is presented, along with statistics on Error Detection and

AFD: 169.15 - 1111 - 4x3 Safe

1080i 59.94  
SDI Input 1A  
Ref: Internal

**Tektronix** ID: WFM5250 TEK1  
Embd: PFFF PFFF PFFF PFFF  
Anc LTC: 09-05:58:03 30 fps DF

Picture display with Safe Area Graticule and AFD information.

Handling (EDH) / Cyclic Redundancy Check (CRC), gamut errors, and Black / Freeze frame detection. For an HDMI source, the HDMI formats (Colorimetry, Color space, Color depth, TMDS clock, HDMI/DVI ID, Pixel repetition rate, Quantization range), as well as HDCP status, are also presented. An EDID information display helps to diagnose connectivity issues when they occur.

The Alarm Status display provides continuous information on the state of each condition currently being monitored by the instrument.

To support unattended monitoring and QC applications, as well as provide documentation for service-level agreements, these instruments maintain an error log of 10,000 events, which facilitates the detection and correction of problems. Log entries are recorded with date, time of day, and time code (VITC, LTC, ANC). The error log can be downloaded to a USB memory stick or through a network connection to .TXT or .HTM formats for easy record keeping and processing on spreadsheets or database software.

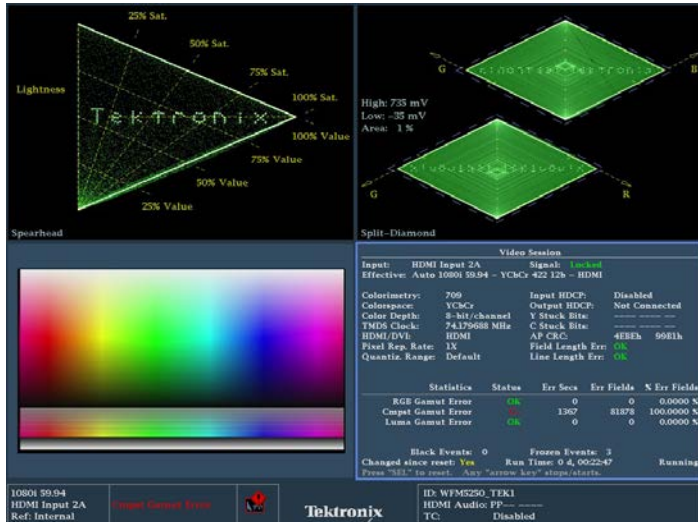
## Picture Display – Quick Visual Confirmation and Precision Content Adjustment

For a qualitative view of the content, a full-color Picture display is offered, which can be displayed as a full-screen presentation. This display is compatible with all input formats and features automatic adjustment for aspect ratio and number of active lines.

You can select bright-up conditions that show the location of RGB or composite gamut errors on the Picture display. The Line Select mode shows the location of the line currently selected within the Picture display.

Users can choose from several Safe Action and Safe Title graticules on the Picture display which help editors and operators easily identify incorrectly positioned video content such as graphics, titles, or logos.

Graticule choices include the Safe Action and Safe Title graticules defined in SMPTE RP218, ITU, and ARIB standards, plus two sets of completely flexible, user-definable graticules. These graticules facilitate editing tasks and reduce the need for format conversions.



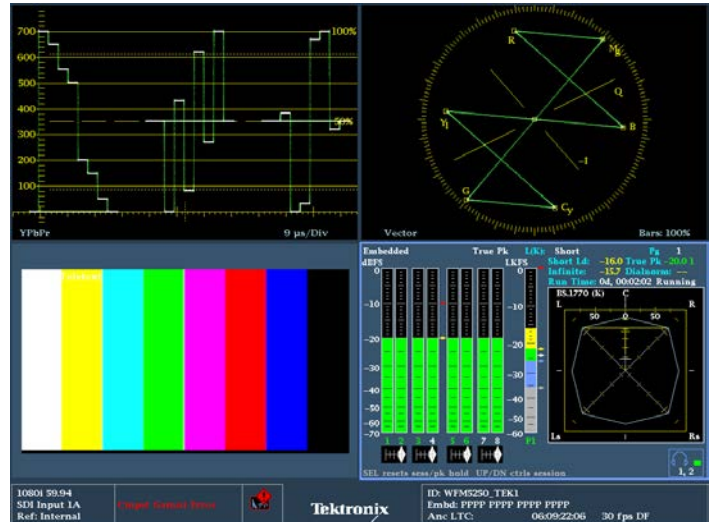
Spearhead and Diamond gamut displays.

**Patented Gamut Displays – Efficiently Detect and Allow Correction of Gamut Problems**

The patented Diamond, Split Diamond, and Arrowhead displays simplify the process of verifying gamut compliance and are ideal for colorists, editors, and operators to visualize whether the content is RGB or Composite Gamut compliant with a single glance. Plus, they are designed to help isolate the Out-of-Gamut component just as easily. For SDI component content that is destined for broadcast in composite systems, the unique Arrowhead display can be used to monitor Composite Gamut compliance without the need for a separate encoder. Within this display, a separate upper and lower luma-only gamut limit can be applied.

Each of these displays offers user-selectable gamut thresholds so operators can set monitoring limits appropriate to their specific operation and include a preset for EBU-R103. You can also select bright-up conditions to see the location of gamut errors on the Picture display. In addition, gamut monitoring is fully integrated with the powerful alarm logging and reporting capabilities of the WFM5250.

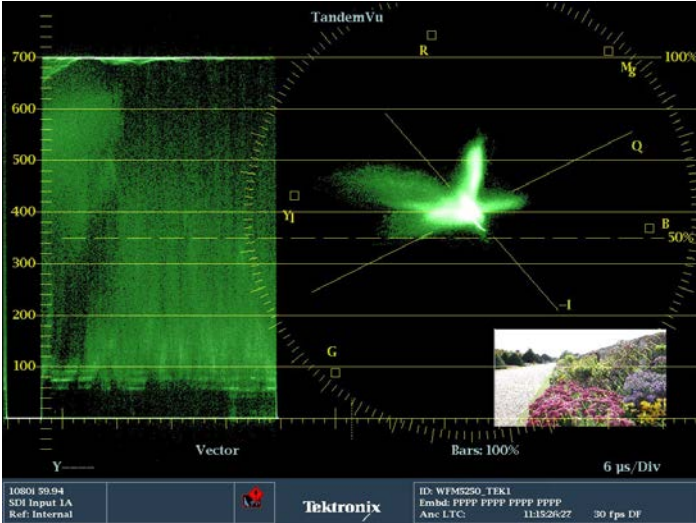
The WFM5250 also features new optional advanced color gamut monitoring capabilities (Option PROD) including the patented Luma Qualified Vector (LQV™) display and Spearhead display that, when used in conjunction with proprietary Diamond and Split Diamond gamut displays, provide the most comprehensive color gamut monitoring tools available for precise color gamut adjustments.



Quad Tile display allows for displays to be viewed simultaneously.

**Quad Tile Display – Flexible Monitoring Configuration Customized to Suit Your Application**

Telestream offers multiple display options to suit a variety of applications that can be customized to the user's needs. The Quad Tile display provides flexibility to increase your productivity. The user can configure four different displays within the one instrument. A maximum of two traces can be displayed, along with picture, status, and audio bars to create flexible monitoring configurations that can be saved as presets for quick and easy recall. For instance, a waveform parade, vector, picture, and audio bar display can be configured to monitor the audio and video signal simultaneously within the Quad Tile display. Unlike instruments with predetermined view combinations, Quad Tile lets you create a tiled 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.



TandemVu® allows camera alignment of luma and chroma within Full Screen display.

### TandemVu® Display – Customized Waveform and Vector View

TandemVu® provides the ability to visualize waveform and vector or lightning displays simultaneously. Each trace can be positioned and magnified individually based on the user's preferences.

TandemVu® provides operators with an efficient way to adjust and balance camera in production studios or outside broadcast (OB Vans) applications.

The Line Select provides a line marker in full-screen and thumbnail picture modes.

The vector display is offered with selectable 75% and 100% targets.

Each display automatically selects the appropriate graticule based on the input format.

### Two-channel Simultaneous Monitoring (Option SIM)

Two-channel Simultaneous Monitoring (Option SIM) is ideal for monitoring multiple camera inputs or comparison of incoming and outgoing transmission chains. In mobile truck (OB van) applications this allows the operator to compare two different camera inputs with picture and waveform displays. This capability can also help 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.



Two-channel simultaneous monitoring of waveform and picture input, ideal for monitoring multiple camera inputs.

Video Session				Auxiliary Data Status			
Input: HDMI Input 2A	Signal: HDMI	Effective: Auto 1080i 59.94 - YCbCr 422 12b	Output HDCP: Disabled	Source Prod Desc: Aspect Ratio: 16:9			
Colorimetry: 709	Input HDCP: Not Connected	Colorspace: YCbCr	Output HDCP: Not Connected	ACP Packet: Missing			
Color Depth: 8-bit/channel	V Stuck Bits: ---	FMBS Clock: 74.175680 Mhz	G Stuck Bits: ---	ISRC Packet: Missing			
HDMI/DVI: HDMI	AP CRC: 4EBEh 99B1h	Pixel Rep. Rate: 1X	Field Length Err: ---	Gamut Packet: Missing			
Quantiz. Range: Default	Line Length Err: ---	Statistics		Vendor Specific Info: Missing			
		Err Secs	Err Fields	AVI Info: Source Prod Desc Info: Missing			
		0	0	Audio Info: MPEG Source Info: Missing			
		0	0	0.0000 %			
		164	5812	96.9593 %			
		0	0	0.0000 %			
Black Events: 0				Finest Events: 2			
Changed since reset: Yes				Run Time: 0 d, 00:02:45			
Press "SEL" to reset. Any "arrow key" stops/starts.				Running			
Auxiliary Data Status Page 2 of 3				Auxiliary Data Status Page 3 of 3			
EDID Received on HDMI OUT:				EDID Transmitted on HDMI IN:			
0x0 0x1 0x2 0x3 0x4 0x5 0x6 0x7 0x8 0x9 0xa 0xb 0xc 0xd 0xe 0xf				0x0 0x1 0x2 0x3 0x4 0x5 0x6 0x7 0x8 0x9 0xa 0xb 0xc 0xd 0xe 0xf			
0x0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00				0x0 00 ff ff ff ff ff ff 00 50 ab 07 11 01 00 00 00			
0x1 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00				0x1 23 16 01 03 80 0c 09 78 0a 1e ac 98 59 56 25 28			
0x2 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00				0x2 29 52 57 20 00 00 00 41 c0 01 01 01 01 01 01 01			
0x3 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00				0x3 01 01 01 01 01 01 02 3a 80 18 71 38 24 40 58 2c			
0x4 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00				0x4 45 00 44 0c 11 00 0e 01 14 80 18 71 1c 16 20			
0x5 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00				0x5 38 2c 25 00 51 49 00 00 0e 00 00 00 00 00 00			
0x6 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00				0x6 45 4b 24 35 32 35 30 0a 20 20 20 00 00 00 fd			
0x7 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00				0x7 00 17 34 04 2e 11 00 0a 20 20 20 20 01 1f			
0x8 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00				0x8 02 03 26 71 44 90 05 02 04 01 11 14 13 1f 06 15			
0x9 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00				0x9 03 12 23 0f 04 01 83 4f 00 00 6b 03 0c 00 10 00			
0xa 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00				0xa 59 24 20 00 02 14 01 14 00 72 00 40 1e 00 5c 29			
0xb 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00				0xb 00 00 81 49 00 00 00 18 46 09 80 a0 00 e0 24 00			
0xc 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00				0xc 10 60 00 00 81 60 00 08 18 8c 0a 40 90 40 40			
0xd 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00				0xd 21 00 0c 40 90 00 81 60 00 00 18 00 00 00 00			
0xe 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00				0xe 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00			
0xf 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00				0xf 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00			
Arrow Left, Up - Previous page, Right, Down - Next page.				Arrow Left, Up - Previous page, Right, Down - Next page.			
1080i 59.94 SDI Input 2A Ref: Internal				ID: WFM5250_TEK1 HDMI Audio: PFFF PFFF PFFF PFFF Anc: LTC Disabled			

HDMI input, including EDID information, available in multiple displays.

### HDMI Input with HDCP

HDMI is used in a wide variety of applications, from cameras to Blu-ray players and set-top box devices. The HDMI signal can have HDCP enabled, which prevents illegal distribution of copyrighted content. HDCP is typically enabled for consumer type devices such as Blu-ray players and set-top boxes. For other applications, such as cameras or other professional devices, HDCP will not be enabled, allowing copying and distribution of the copyrighted content. Information on HDCP is found in the Video Session display, along with information on the video format. The HDMI interface also contains metadata, and a summary of this information is found on the Aux Data Status display. When HDCP content is present, the SDI output and picture display on the DVI-I output will be disabled and an HDCP compliant monitor will be required to view the picture display on the switched HDMI output. The Video Session display provides summary information related to the HDMI metadata for an HDMI input. Additional metadata presence can be found in the Aux Data Status display that provides data values of the input and output EDID information.



3D monitoring of left and right eye.

### 3D Stereoscopic Monitoring

3D stereoscopic monitoring and displays are available for SDI signals on the WFM5250 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 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.

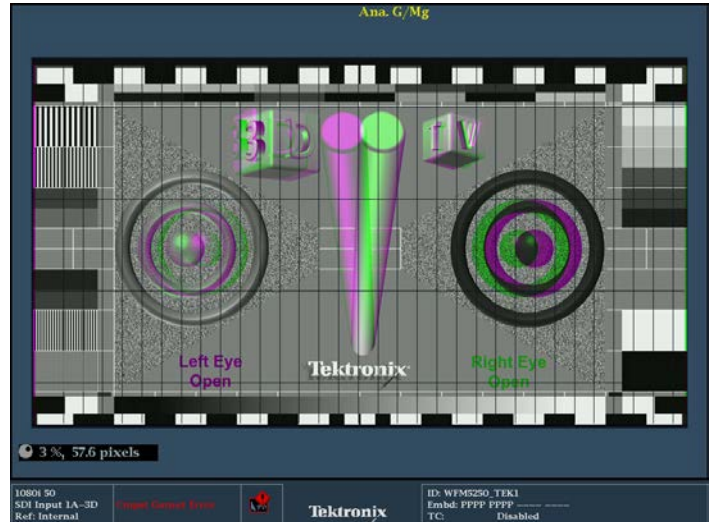
**Green/Magenta Anaglyph Display** – The left image is shown in green and the right image is shown in magenta, with identical left and right objects shown in monochrome.

**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 16x9 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 Stereoscopic Measurement

For measurement of the depth of an object within the image (Option 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

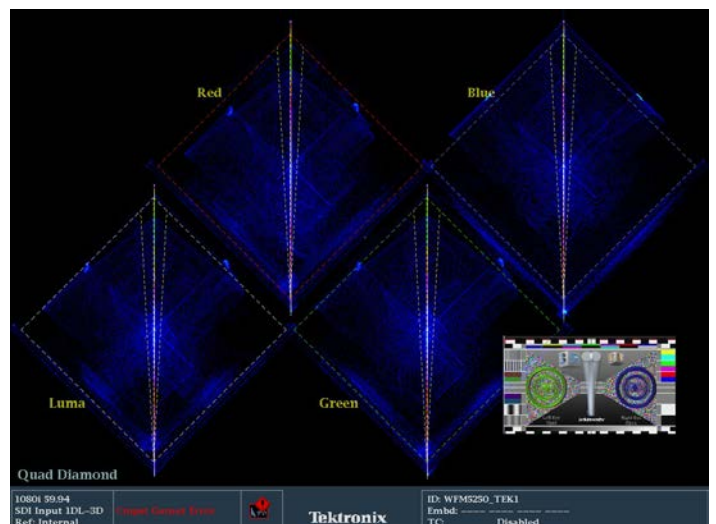


3D monitoring using a disparity grid.

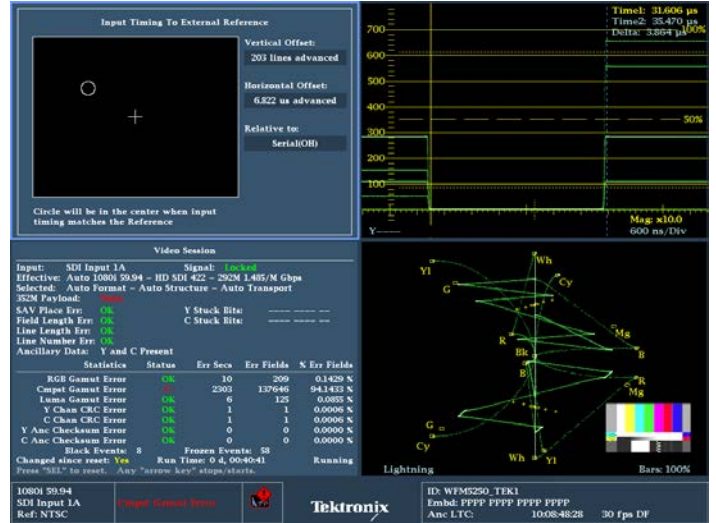
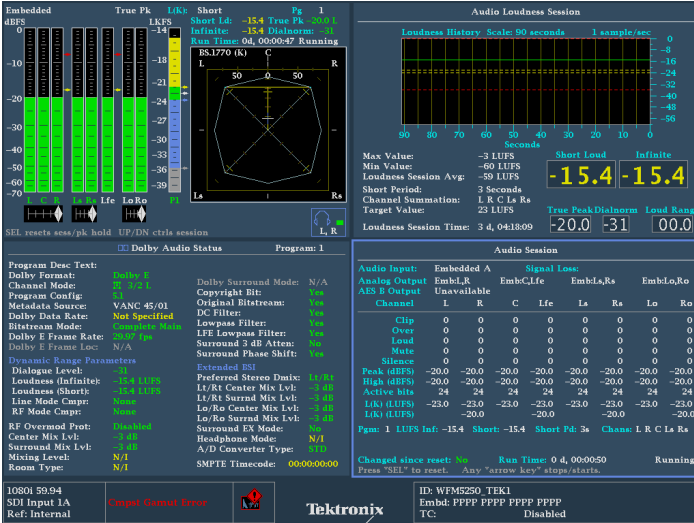
controls allow the Disparity Grid to be moved around within the picture display to gauge the depth of objects within the image. A set of Disparity Cursors are also available for precise measurement of horizontal disparity of an object between the Left and Right Eye images. Readout is given of the pixel difference between the cursors and the percentage of disparity of an object.

### Quad Diamond Display for 3D Alignment

The patented Quad Diamond display (Option S3D) simplifies stereoscopic camera alignment by showing 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, then 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.



Quad Diamond display for stereoscopic alignment.



Audio display with Surround Sound and Loudness monitoring.

Timing and Lightning displays simplify timing tasks.

### Digital Audio and Video Monitoring in One Instrument (Option AUD)

The WFM5250 (with Option AUD) provides high-quality digital filtering and oversampling to insure precise, reliable, and repeatable audio measurements. The instrument provides 16-channel embedded digital audio monitoring with Audio Bars, Lissajous Displays, Surround Display\* 1, and a front-panel headphone port for easy compliance verification of digital audio without the need for an additional piece of equipment. Flexible mapping of the embedded audio inputs to the audio bar displays allows for a variety of audio mixes to be supported from multiple stereo signals to surround and stereo support.

The Surround Sound<sup>1</sup> display provides intuitive graphical representation of channel interaction in a surround sound system. The Bars display provides indication for faults, audio levels, and provides indication of the presence of a Dolby format. The flexible Lissajous display allows the selection of any two audio channels.

Loudness measurements are made to ITU-R BS.1770-3/1771, EBU R 128, and ATSC A/85 recommendations. A Loudness meter (with Option LOUD) is available within the Audio display that provides Short and Infinite Loudness measurements. The Loudness session display graphically 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 WFM5250 instrument a comprehensive compact waveform and audio monitor. 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 metadata can be monitored within the instrument using the Dolby Status display that gives an in-depth view of VANC Dolby metadata that complies with the SMPTE 2020 standard. The user can also choose to monitor Dolby E guardband timing information from one of the embedded audio channels.

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

### Facility Timing Made Easy

Synchronization is one of the most fundamental and critical procedures in a video facility. Every device in a system must be synchronized in order to successfully create, transmit, and recover video pictures and audio information. The intuitive Timing display clearly shows the timing offsets between HD and SD signals relative to the reference. (Timing display is not available for HDMI inputs.)

This 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. Simply adjust the timing of the equipment until the circle is within the center of the display for precise, direct measurements of vertical offset in number of lines and horizontal offset in  $\mu$ s.

The Lightning display shows luma and chroma amplitudes and helps users verify component timing using a color-bar signal. The patented Bowtie display complements the timing measurement capability of the Lightning display. Using a special Bowtie test signal in component format, this display helps make precise, accurate measurements of interchannel amplitude and timing.

### Troubleshoot Signal Paths

A simple test signal (Option GEN) can be generated from the SDI output that produces 100% or 75% color bars along with pathological test signals. This can be useful for troubleshooting a signal path or piece of equipment without the need to carry an additional generator.

ANC Data Inspector				
Name	DID/SDID	Presence	Status	Location
S299-1 Ctrl Grp 4	E0/-	Present	OK	Field 1 / Line 9
S299-1 Ctrl Grp 3	E1/-	Present	OK	Field 1 / Line 9
S299-1 Ctrl Grp 2	E2/-	Present	OK	Field 1 / Line 9
S299-1 Ctrl Grp 1	E3/-	Present	OK	Field 1 / Line 9
S299-1 Aud Grp 4	E4/-	Present	OK	Field 2 / Line 111
S299-1 Aud Grp 3	E5/-	Present	OK	Field 1 / Line 131
S299-1 Aud Grp 2	E6/-	Present	OK	Field 1 / Line 16
S299-1 Aud Grp 1	E7/-	Present	OK	Field 1 / Line 16
S2016-3 AFD-Bar	41/05	Present	OK	Field 1 / Line 21
S2020 Aud	45/01	Present	OK	Field 2 / Line 22

Detail		View Mode: Watch List		Time Elapsed Since Last Reset: 0 d, 00:43:26	
Format: SMPTE2016.3 AFD and Bar Data					
DID: 41 (241)	Type: 2	Field: 1	Line: 21	Sample: --	Presence: Present
SDID: 5 (205)	DC: 8 (108)	Link: --	Stream: Y		
Exp/Act Chksum: 2ca / 2ca		Error: OK			

000	17c	200	200	200	200	200	200
016							
032							

1080i 59.94	SDI Input 1A	Output Format Error	ANC	Tektronix	ID: WFM5250_TEK1	Embds: PFFF PFFF PFFF PFFF	Anc LTC: 10:11:34:28	30 fps DF
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ANC Data Inspector provides detailed content analysis.

Auxiliary Data Status			
Anc Data: Y and C Present			
CEA608:	5334 CDP (ANC)	Services: CC --- TXT ---	XDS: Not detected
CEA708:	5334 CDP	Services: CC ---	RP207:
Teletext:	Not detected		
CDP:	Present	Frm Rate: 29.97	Data Count 608: 4    708: 0
V-Chip Rating:	Not detected		
TSID:	Not detected		
CGMS-A:	Not detected	Broadcast Flag:	Not detected

SMPTE 2016 AFD: 16:9 8 - Code is 1000 - AR is 16:9			
Desc: Full Frame 16:9			
Bar 1: No valid Bar data found			
Bar 2: No valid Bar data found			

1080i 59.94	SDI Input 1A	Output Format Error	ANC	Tektronix	ID: WFM5250_TEK1	Embds: PFFF PFFF	T.C: Missing	
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Monitoring of Ancillary data (Closed Caption, Time Code, and AFD) using Aux Data Status.

### Superior Data Analysis Capabilities for Operators and Engineers (Option DATA)

The ANC Data Inspector 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 quickly and easily 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.

Closed Caption (CEA708/608) and individual Teletext subtitles can be simultaneously decoded and displayed within the Picture display. Teletext subtitle pages can be decoded in either WST or OP47 format.



Datalist display provides detailed pixel-by-pixel information.

The Auxiliary Data Status display 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 graphic is available for the Picture display of the WFM5250 along with the binary data and text description for easy monitoring.

The Datalist display 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. (Datalist and ANC Data Inspector are not available for HDMI inputs.)

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.



**Video Input and External Reference Formats Supported****Automatic Detection of a Wide Range of Signal Formats**

The WFM5250 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	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				
BT601 483i, 59.94 Hz (525)	X				X		X						X							
BT601 576i, 50 Hz (625)	X					X							X							
296M 720p, 23.98 Hz			X		X						X							X		
296M 720p, 24 Hz			X						X			X						X		X
296M 720p, 25 Hz			X			X						X								
296M 720p, 29.97 Hz			X		X								X							
296M 720p, 30 Hz			X						X									X		
296M 720p, 50 Hz			X			X							X							
296M 720p, 59.94 Hz			X		X								X					X		
296M 720p, 60 Hz			X						X			X						X		X
240M 1035i, 59.94 Hz			X		X								X							
240M 1035i, 60 Hz			X						X			X						X		X
274M 1080i, 50 Hz			X			X							X							
274M 1080i, 59.94 Hz			X		X								X							
274M 1080i, 60 Hz			X						X			X						X		X
274M 1080p, 23.98 Hz			X		X								X					X		
274M 1080p, 24 Hz			X						X			X						X		X
274M 1080p, 25 Hz			X			X							X							
274M 1080p, 29.9 Hz			X		X								X							

Setting	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, 30 Hz			X					X					X			
274M 1080sf, 23.9 Hz			X			X			X				X			
274M 1080sf, 24 Hz			X					X		X				X	X	
274M 1080sf, 25 Hz			X		X						X					
274M 1080sf, 29.9 Hz			X			X						X				
274M 1080sf, 30 Hz			X					X					X			

**Supported Dual Link Formats**

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

**Supported HDMI Formats**

CEA format number	Video format	Color depth supported
1*	640 x 480p, 59.94/60Hz, 4:3	24/30/36 bit
2	720 x 480p, 59.94/60Hz, 4:3	24/30/36 bit
17	720 x 576p, 50 Hz, 4:3	24/30/36 bit
4	1280 x 720p, 59.94/60 Hz, 16:9	24/30/36 bit
19	1280 x 720p, 50 Hz, 16:9	24/30/36 bit
5	1920 x 1080i, 59.94/60 Hz, 16:9	24/30/36 bit
20	1920 x 1080i, 50 Hz, 16:9	24/30/36 bit
16	1920 x 1080p, 59.94/60 Hz, 16:9	24/30 bit
31	1920 x 1080p, 50 Hz, 16:9	24/30 bit
32	1920 x 1080p, 23.98/24 Hz, 16:9	24/30/36 bit
33	1920 x 1080p, 25 Hz, 16:9	24/30/36 bit
34	1920 x 1080p, 29.97/30 Hz, 16:9	24/30/36 bit
	Limited range support: 4:2:2 YCbCr, 4:4:4 YCbCr	
	Limited and full quantization range support: 4:4:4 RGB	

\* Only RGB is supported.

**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	
	4:4:4:4 RGB +A 10 bit Level B	
4:4:4 RGB 12 bit Level B		
2048 × 1080	4:2:2 YCbCr 12 bit	23.98, 23.98sF, 24, 24sF, 25, 25sF, 29.97, 29.97sF, 30, 30sF progressive
	4:2:2:4 YCbCrA 12 bit Level B	
2048 × 1080	4:4:4 YCbCr 12 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	
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
	4:4:4 XYZ 12 bit Level B	
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

### Serial Digital Video Interface

Characteristic	Description
Inputs	2 inputs Auto-detection between 3G, Dual Link, HD, and SD signals (Option 3G required for 3G formats)
Input Type	BNC, internally terminated 75 $\Omega$
Input Level	800 mV <sub>P-P</sub> , $\pm 10\%$
Input Equalization	270 Mb/s: Up to 215 m of type 1694A cable 1.5 Gb/s: Up to 200 m of type 1694A cable 3 Gb/s: Up to 130 m of type 1694A cable
Output	SDI Switched Output. Selectable, active input, or test signal
Return Loss (Inputs and Outputs)	>15 dB from 1 MHz to 1.5 GHz, power on or off >10 dB from 1.5 GHz to 3 GHz, power on or off
Monitor Output	Signal Format (DVI-I Output) – 1024x768, 60 Hz vertical rate Picture display will be disabled while monitoring the HDCP encrypted video signal through an HDMI input

### External Reference

Characteristic	Description
Sync Formats	NTSC and PAL and tri-level sync
Input Type	Passive loop through BNC, 75 $\Omega$ compensated
DC Input Impedance	20 k $\Omega$ , nominal
Return Loss	>40 dB to 6 MHz >35 dB to 30 MHz
Lock Range	$\pm 50$ ppm

### High Definition Multimedia Interface (HDMI)

Characteristic	Description
Inputs	2 inputs Auto-format-detection
Output	HDMI switched output with HDCP
Connector type	Type A receptacle
HDCP	HDMI output is encrypted while receiving the HDCP encrypted content on a selected input. The picture display and the thumb nail display on the DVI output will be disabled while receiving the HDCP encrypted content on a selected input.

### Serial Digital Waveform Vertical Characteristics

Characteristic	Description
Vertical Measurement Accuracy	At 1x gain, $\pm 0.5\%$ of 700 mV full scale; at 5x gain, $\pm 0.2\%$ of 700 mV full scale
Gain	1x, 5x, variable range 0.25x to >7.5x
Frequency Response	
SD	Luminance (Y) channel $\pm 0.5\%$ to 5.75 MHz Color Difference channels (Pb, Pr) $\pm 0.5\%$ to 2.75 MHz
HD	Luminance (Y) channel $\pm 0.5\%$ to 30 MHz Difference channels (Pb, Pr) $\pm 0.5\%$ to 15 MHz

### Waveform Horizontal Characteristics

Characteristic	Description
Sweep Timing Accuracy	$\pm 0.1\%$
Sweep Linearity	$\pm 0.1\%$

### Audio Characteristics

Characteristic	Description
Level Meter Resolution	0.056 dB steps at 30 dB scale from full scale to $-20$ dBFS 0.20 dB steps at 70 dB scale for signals above $-20$ dBFS
Meter Ballistics	True peak, PPM type 1, PPM type 2, BBC PPM, Loudness
Defined/Programmable Level Detection	Mute, clip, user-programmable silence, over
Level Meter Accuracy	$-0.5$ dB (for analog), $-0.2$ dB (for digital) from 20 Hz to 20 kHz, 0 to $-40$ dBFS sine wave, Peak Ballistic mode

### Power

- 12 V DC In
- Power adapter accepts 100 to 240 V AC  $\pm 10\%$  50/60 Hz

### Input Voltage

Characteristic	Description
Voltage Range	12 to 15 V DC nominal 10.75 to 18 V DC min-max operating
Supply Connection	XLR 4-pin male connector Pin 1 = V(-) Pin 4 = V(+) Pin 2, 3: NC
Power Consumption	27 W typical 35 W max
Surge	10 A at 12 V
Fuse Rating	4 A, internal self-resetting fuse
Transient, Over, and Reverse Voltage	Reverse- and over-voltage protected to $\pm 30$ V DC The unit may power itself down in the presence of high transient voltages. This prevents damage to the unit and is not a fault

### Physical Characteristics

Dimension	mm	in.
Height	133	5.3
Width	213	8.4
Depth	140	5.5
Weight	kg	lb.
Net	1.5	3.3

## Ordering Information

Model	Option	Description
WFM5250		SDI / HDMI Waveform Monitor, 2 SDI inputs and 2 HDMI inputs Option 3G required for 3G-SDI support
	3G	Add support for 3G-SDI signal formats (Level A and Level B)
	AUD	Add 16-channel Embedded AES Audio Monitoring (including Multichannel Surround Sound Display)
	SIM	Add simultaneous monitoring of 2 HD/SD-SDI inputs or one HD/SD-SDI input and one HDMI input; Option 3G required for 3G-SDI formats support
	DATA	Add Ancillary Data monitoring (including decoding of 708 and 608 Closed Captions, Teletext and OP47 Subtitles, AFD, and CGMS-A), ANC Data Inspector, and advanced Data Analysis capabilities
	GEN	Add 3G/HD/SD-SDI Color Bar and Pathological Signal Generation capability Option 3G required for 3G-SDI Signal Generation capability
	LOUD	Add Audio Loudness monitoring capabilities including Loudness Meter, Loudness Trend Chart, and Loudness Data Logging capabilities Must also order Option AUD
	PROD	Add Advanced Gamut Monitoring Package (including Spearhead display and Luma Qualified Vector display)
	S3D	Add monitoring support for SDI stereoscopic 3D video

Note: Please specify power plug when ordering.

## Post Sale Upgrade Options

Model	Option	Description
WFM525UP		Post Sale Upgrade for WFM5250 3G/HD/SD Waveform Monitor Option 3G required to be installed in the WFM5250 for 3G-SDI support
	3G	Add support for 3G-SDI signal formats (Level A and Level B)
	AUD	Add 16-channel Embedded AES Audio Monitoring (including Multichannel Surround Sound Display)
	SIM	Add simultaneous monitoring of 2 HD/SD-SDI inputs or one HD/SD-SDI input and one HDMI input; Option 3G required for 3G-SDI formats support
	DATA	Add Ancillary Data monitoring (including decoding of 708 and 608 Closed Captions, Teletext and OP47 Subtitles, AFD, and CGMS-A), ANC Data Inspector, and advanced Data Analysis capabilities
	GEN	Add 3G/HD/SD-SDI Color Bar and Pathological Signal Generation capability Option 3G required for 3G-SDI Signal Generation capability
	LOUD	Add Audio Loudness monitoring capabilities including Loudness Meter, Loudness Trend Chart, and Loudness Data Logging capabilities Option AUD must also be installed in the WFM5250 base unit
	PROD	Add Advanced Gamut Monitoring Package (including Spearhead display and Luma Qualified Vector display)
	S3D	Add monitoring support for SDI stereoscopic 3D video

**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
<b>Cabinet Accessories</b>	
WFM50F01	Portable Cabinet
WFM50FSC (WFM50F01 is required)	Soft Carrying Case to accompany the WFM5000 Series Portable Cabinet
WFM RACK-NN	Dual Rack Cabinet for a combination of any WFM5000, WFM6000, WFM7000, or WFM8000 Series
WFM RACK-ON	Dual Rack Cabinet Old-New for a combination of any WFM5000, WFM6000, WFM7000, or WFM8000 Series with older-style 1700 Series, WFM601, 764, or 760 products
WFM RACK-S2	Full rack, short depth, 3RU rackmount to fit one or two WFM5xxx or WFM4xxx
WFM50F06	Filler Panel for Dual Rack Cabinet
<b>Battery Accessories</b>	
WFM50FGM	Battery Adapter Plate (Anton Bauer Gold-Mount)
WFM50FVM	Battery Adapter Plate (Sony/IDX V-Mount)

**Service Options**

Option	Description
Opt. C3	Calibration Service 3 Years
Opt. C5	Calibration Service 5 Years
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



WFM5250 Front Panel.



WFM5250 Rear Panel.

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