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Product documentation

Covered products The following Tektronix products are covered by this document:

- WFM8200 and WFM8300 Waveform Monitors
- WVR8200 and WVR8300 Waveform Rasterizers

**Product documentation
version**

Your instrument was shipped with firmware version 3.4.X installed, which is newer than the firmware version described by the product documentation that was shipped with your instrument. This document provides a brief description of the new features included with firmware version 3.4.X.

You can download the latest versions of the documentation for your product at the Tektronix Web site (www.tek.com).

New features in firmware version 3.4.X

Firmware version 3.4.X introduces a new HDR (High Dynamic Range) tool set for assisting camera operators and editors to adjust their content to the correct levels. The new HDR features and functions are described on the following pages.

NOTE. *Option PROD is required to access HDR features.*



Waveform display

Dynamic Range setting. The pop-up menu for the Waveform display now contains a selection for setting the Dynamic Range as shown below.

NOTE. When HDR or HDR Full is selected, you can use the Left / Right arrow keys to toggle the vertical scale of the graticule between NITS, STOPS, REFLECTANCE and CODE VALUE. The selected scale is shown at the bottom of the display. (See Figure 5.)

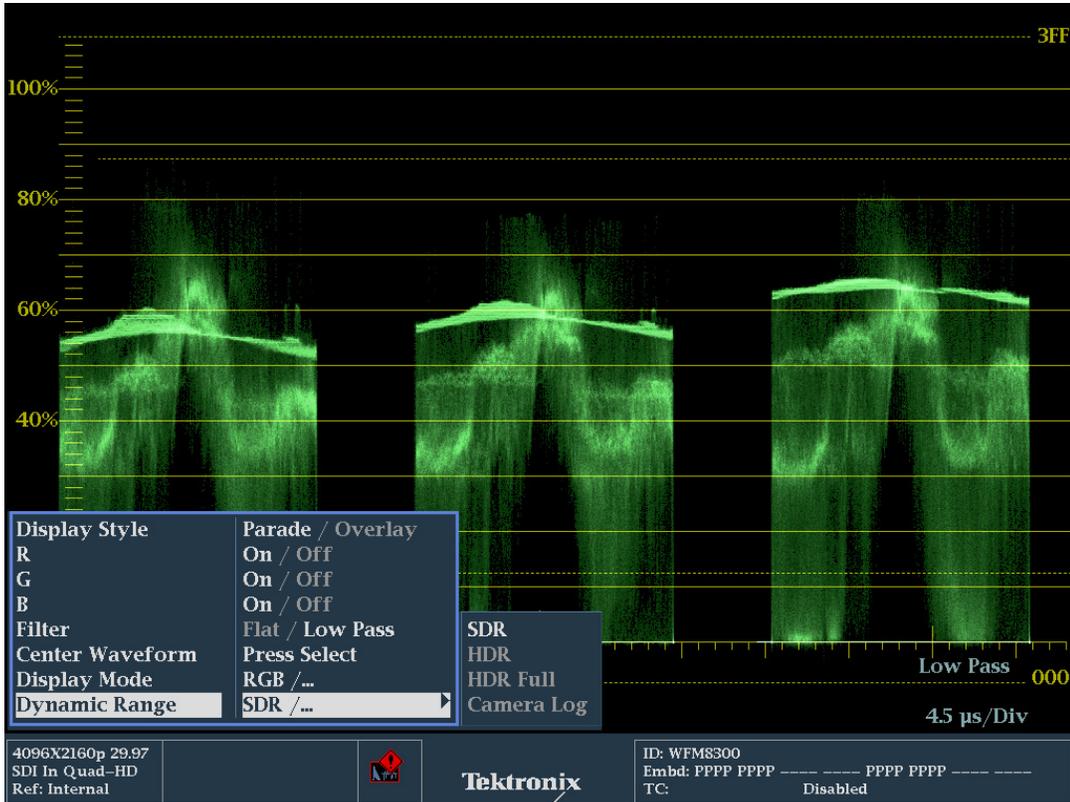


Figure 1: Waveform display pop-up menu showing the Dynamic Range selection

The following settings are available:

- **SDR (Standard Dynamic Range)**. Use this setting for conventional SD, HD and 3G signals using ITU-R BT.709/2020 with OETF (Optical to Electrical Transfer Function) gamma of 0.45 and with a display gamma EOTF (Electrical to Optical Transfer Function) of 2.4 as defined in ITU-R BT.1886.

When SDR is selected as the dynamic range, the CONFIG > Graticules and Readouts menu contains the following graticule settings:

- **STD**. The Standard graticule is available in either millivolts (Normal) or Percent and can be configured within CONFIG > Graticules and Readouts > SDI Waveform Graticules.
- **NARROW**. The Narrow graticule uses a NITs graticule scale and code values, which is the traditional signal representation. This setting provides a signal representation using a code value of 64 decimal (10-bit) equal to 0 mV or 0%, and a code value of 940 decimal (10-bit) equal to 700 mV or 100%.
- **FULL**. The Full graticule uses a NITs graticule scale and code values that provides signal representation with a code value of 4d decimal (10-bit) equal to 0%, and a code value of 1019 decimal (10-bit) equal to 100%.

NOTE. In SDI signals, the code words 0-3d and 1020-1023 are excluded and clipped from a file that uses 0-1023 as the full range as defined in ITU-R BT2100.

- **HDR (High Dynamic Range)**. Use this setting if you need the bit depth to more efficiently produce smoother blacks and brighter specular highlights. When HDR is selected as the dynamic range, the CONFIG > Graticules and Readouts menu contains the following graticule settings:
 - **HLG(1200)**. The Hybrid Log Gamma (HLG) graticule is defined in standard ARIB STD B-67 and was developed by the BBC and NHK. SMPTE standard ST 2084 defines High Dynamic Range Electro-Optical Transfer Function of Mastering Reference Displays also known as Perceptual Quantization (PQ).
 - **ST2084(1K)**. This graticule uses the ST 2084 curve with a maximum value of 1000 Nits using the narrow range.
 - **ST2084(2K)**. This graticule uses the ST 2084 curve with a maximum value of 2000 Nits using narrow range.
 - **ST2084(4K)**. This graticule uses the ST 2084 curve with a maximum value of 4000 Nits using narrow range.

- **ST2084(5K)**. This graticule uses the ST 2084 curve with a maximum value of 5000 Nits using narrow range.
- **ST2084(10K)**. This graticule uses the ST 2084 curve with a maximum value of 10000 Nits using narrow range.

NOTE. *Narrow range is defined by ITU-R BT.2100 as signal representation with code value 64 decimal (10-bit) equal to 0 mV or 0%, and code value 940 decimal (10-bit) equal to 700 mV or 100%.*

- **HDR Full (High Dynamic Range Full)**. Use this setting if you need the High Dynamic Full Range defined by ITU-R BT.2100, which provides signal representation with code value 4d decimal (10-bit) equal to 0%, and code value 1019 decimal (10-bit) equal to 100%.

NOTE. *In SDI signals, the code words 0-3d and 1020-1023 are excluded and clipped from a file that uses 0-1023 as the full range as defined in ITU-R BT2100.*

When HDR Full is selected as the dynamic range, the CONFIG > Graticules and Readouts menu contains the following graticule settings:

- **ST2084(1K) Full**. This graticule uses the ST 2084 curve with a maximum value of 1000 Nits using full range.
- **ST2084(10K) Full**. This graticule uses the ST 2084 curve with a maximum value of 10000 Nits using full range.
- **Camera Log**. Use this setting to use a graticule with a curve based on the camera manufacturers specification. When Camera Log is selected as the dynamic range, the CONFIG > Graticules and Readouts menu contains the following graticule settings:
 - **S Log**. This graticule uses the Sony S Log curve.
 - **S Log2**. This graticule uses the Sony S Log2 curve.
 - **S Log3**. This graticule uses the Sony S Log3 curve.
 - **C Log**. This graticule uses the Canon C Log curve.
 - **Log C**. This graticule uses the ARRI Log C curve at (ISO) EI 800.
 - **BT.709**. This graticule uses the traditional ITU-R BT.709 representation.

HDR graticule selection. The CONFIG > Graticules and Readouts menu now contains a setting for selecting the HDR graticule to be used by the Waveform display: HLG(1200), ST2084 (1K), ST2084 (2K), ST2084 (5K), or ST2084 (10K).

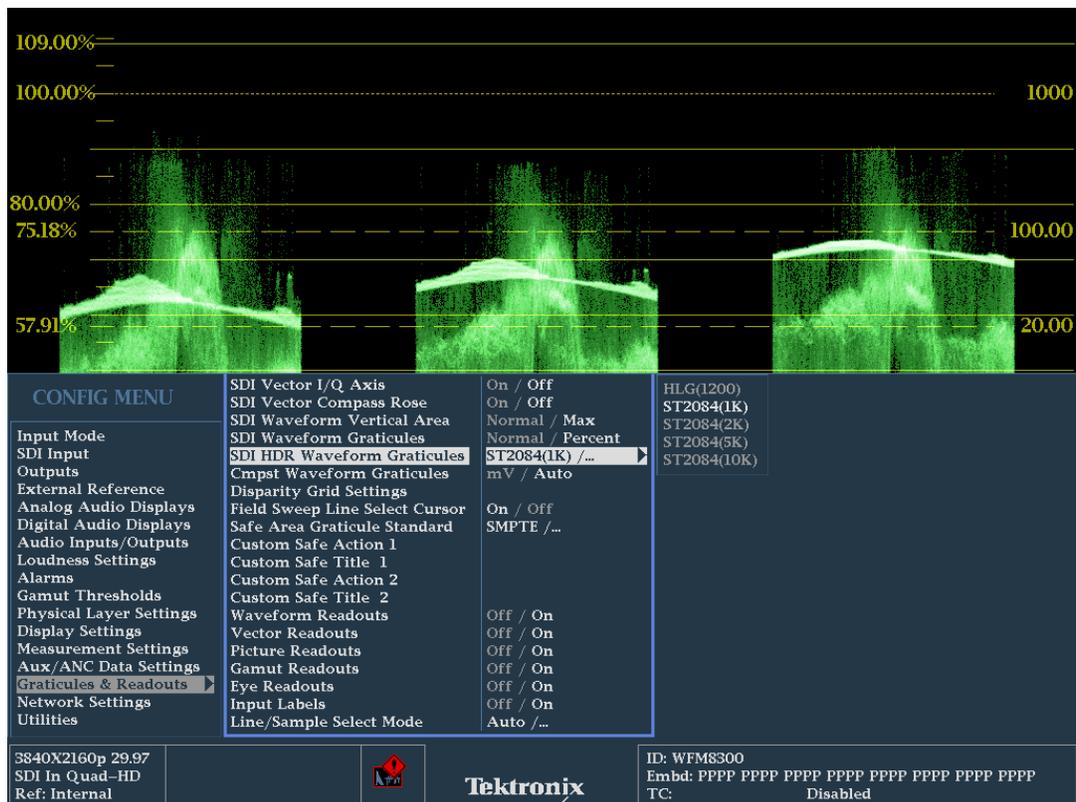


Figure 2: CONFIG menu showing the SDI HDR Waveform graticule selection

HDR graticule vertical scale setting. When an HDR graticule is selected for the Waveform display, you can use the Left / Right arrow keys to toggle the vertical scale units between NITS, STOPS, or REFLECTANCE. Camera operators can use the graticule lines at 2%, 18% or 90% Reflectance to properly setup camera exposure with a camera test chart of 2% black, 18% gray and 90% white.

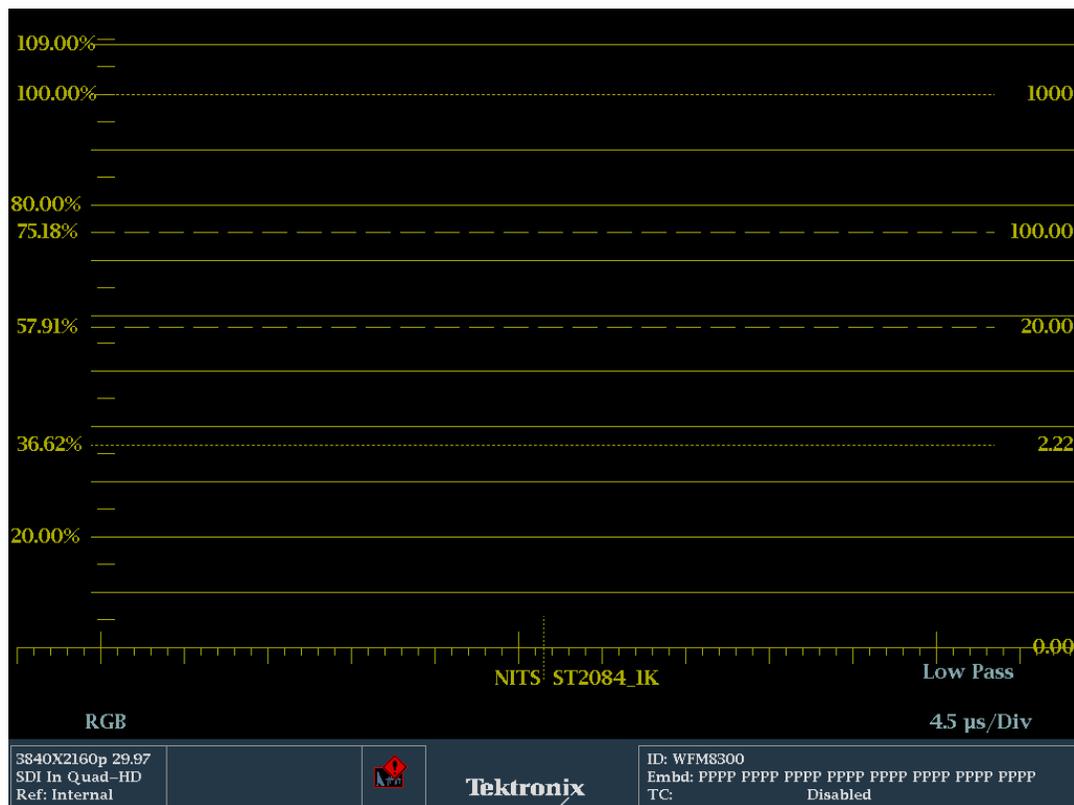


Figure 3: Waveform display showing the HDR graticule with NITS selected as the vertical scale

Gain adjustment. When the ST.2084 (1K) or ST.2084 (10K) HDR graticules are selected, a fixed zoom mode from 100 Nits to maximum scale is available by using the Up arrow key to enable Zoom Mode and the Down arrow key to disable Zoom Mode. When Zoom Mode is enabled, the Gain function and the Vertical Position controls are locked in a fixed configuration. When in HDR modes, Variable Gain will be enabled by default to facilitate the Zoom mode function.

Voltage cursors. When HDR or HDR Full mode is selected as the Dynamic Range setting, the mV voltage measurement cursors are replaced by a set of Nits measurement cursors.

New features in firmware version 3.3.X

Firmware version 3.3.X introduces the new features and functions described on the following pages.

Datalist display

ANC Data highlighting. The following new ANC Data highlighting has been added to the Datalist display (See Figure 6.):

- Blue background highlighting indicates Ancillary Data
- Cyan highlighting in an ANC Data packet indicates the checksum data
- White text in an ANC Data packet indicates the packet header data
- Green text in an ANC Data packet indicates user-defined data words
- Red text in an ANC Data packet indicates a data word error



Figure 6: Datalist display showing ANC Data packet highlighting

Switch line highlighting. New gold highlighting indicates a switch line. (See Figure 7.)



3406-04

Figure 7: Datalist display with switch line highlighting

Sample value readout. In full-screen mode, a new readout near the top right of the Datalist display (See Figure 6.) provides a description of the selected sample. The readout value depends on the type of the selected sample:

- SAV/EAV Header: Values 0, 1, 2 (3FF, 000, 000)
- SAV/EAV XYZ: F (Field: 0 = Field 1, 1 = Field 2) V (Vertical: 0 = Not Blanking, 1 = Field Blanking) H (Horizontal: 0 = SAV, 1 = EAV)
- ANC Data Header: Values 1, 2, 3 (000, 3FF, 3FF) (See Figure 1.)
- ANC Data (DID) Data Identifier
- ANC Data (SDID/DBN) Secondary Data Identifier / Data Block Number
- ANC Data (DC) Data Count
- ANC Data (UDW[x]) User Data Word Number
- ANC Data (CS) Checksum
- Sample value shown in millivolts and (%) (See Figure 7.)

UHD/4K support. The Datalist display now supports UHD/4K signals. The user can use the MEAS button menu to display all four links at once or to select an individual link for display (Link A, Link B, Link C, or Link D) (See Figure 1.).

NOTE. For UHD/4K signals, the Datalist display only operates in Data mode. The Trace Type > Video menu selection is not available for UHD/4K signals.

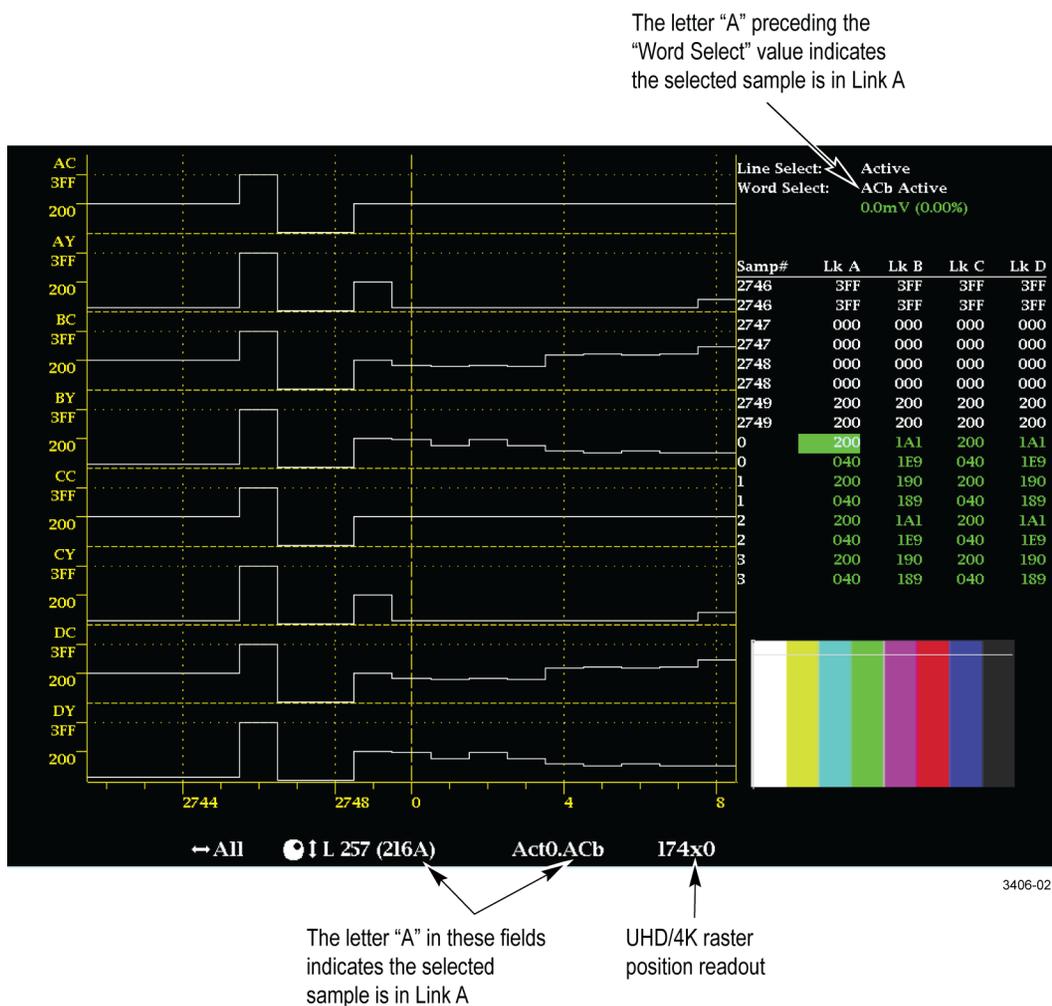


Figure 8: Datalist display showing UHD/4K signal readouts

Audio Loudness Session reset using the GPI interface

There is a new Loudness Session Logging setting in the CONFIG > Utilities > Ground Closure Mode menu that allows you to configure the GPI interface (REMOTE connector) to reset the Audio Loudness Session and to note the reset in the Loudness Trigger Log.

When a selected pin on the REMOTE connector is grounded (See Table 1.), the Audio Loudness Session will save the values of the loudness measurement parameters in the Loudness Trigger Log. The loudness meter will then be reset and begin a new measurement when the GPI trigger is released.

Use the Tektronix WFM Remote Interface to view the Loudness Trigger Log.

Trigger events. There are three trigger events that can be used to reset the Audio Loudness Session:

- **Start Commercial 1:** Use this GPI trigger to reset the Audio Loudness Session when a commercial program is provided and to indicate the commercial program in the Loudness Trigger Log.
- **Start Program 1:** Use this GPI trigger to reset the Audio Loudness Session when a main program is provided and to indicate the main program in the Loudness Trigger Log.
- **Pause Monitoring Channel 1:** Use this GPI trigger to reset the Audio Loudness Session when monitoring is paused and to indicate the pause in the Loudness Trigger Log.

Use only the Channel 1 trigger events when the CONFIG > Input Mode is configured to Single or UHD/4K Video mode. When the CONFIG > Input Mode is configured to Simultaneous, you can also use the Channel 2 trigger events to reset the Audio Loudness Session for the secondary channel.

REMOTE connector pin functions. The following table shows the functions of the REMOTE connector pins when the Ground Closure Mode is set to Loudness Session Logging.

Table 1: REMOTE connector pin functions in Loudness Session Logging mode

REMOTE connector pin	Function
1	GND (In)
2	Reserved (I/O)
3	Reserved (I/O)
4	Reserved (In)
5	Reserved (In)
6	GND (In)
7	Time Code Positive (LTC In)
8	Time Code Negative (LTC In)
9	Ground Closure (Alarm Out)
10	Start Commercial Monitoring Channel 1
11	Start Program Monitoring Channel 1
12	Pause Monitoring Channel 1
13	Start Commercial Monitoring Channel 2
14	Start Program Monitoring Channel 2
15	Pause Monitoring Channel 2

Two Sample Interleave mode for UHD/4K monitoring

For UHD/4K format inputs, the instrument now supports both Square Division and Two Sample Interleave modes. Use the CONFIG > SDI Input > Quad SDI Mode menu to make the selection.

In AUTO mode, the instrument defaults to Two Sample Interleave mode if the Video Payload Identifier (VPID) complies with SMPTE 425.3 or SMPTE 425.5. The instrument defaults to Square Division mode if the VPID complies with SMPTE 292.1, SMPTE 372, SMPTE 425.1, or a quad-HD signal is present and VPID is missing.

ITU-R BT.2020 color space

There is a new ITU-R BT.2020 setting in the CONFIG > SDI Input > HD Colorimetry menu that allows you to monitor the BT.2020 color space for HD and UHD/4K formats. When the HD Colorimetry is set to ITU 2020, the targets on the Vector and Lightning displays shift slightly to conform to the BT.2020 color space and the gamut measurement limits also change.

If the colorspace is set to AUTO, the instrument will select BT.2020 if signalled in the VPID.

HD colorimetry readout

The Video Session display has a new readout to indicate the current HD colorimetry setting (CONFIG > SDI Input > HD Colorimetry).

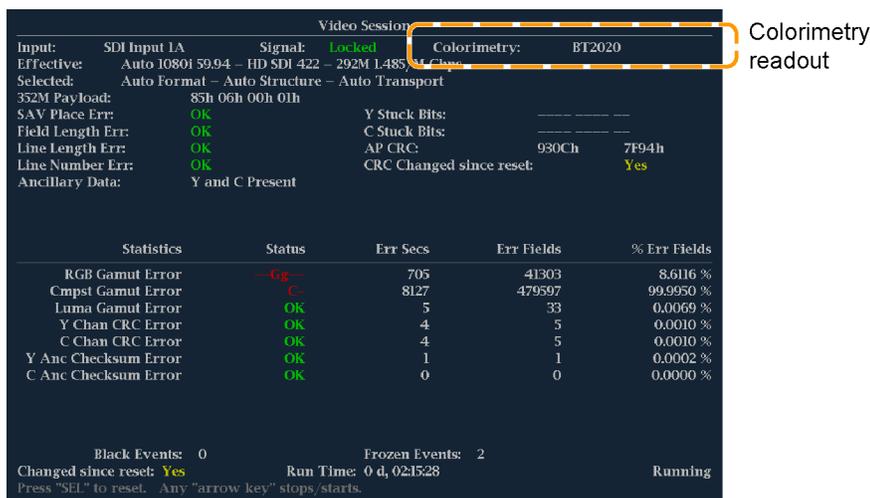


Figure 9: New colorimetry readout on the Video Session display

Audio level readouts

The audio levels for each of the audio channels (1–8) are now shown on the Audio Session display and the Audio Auxiliary Loudness display.

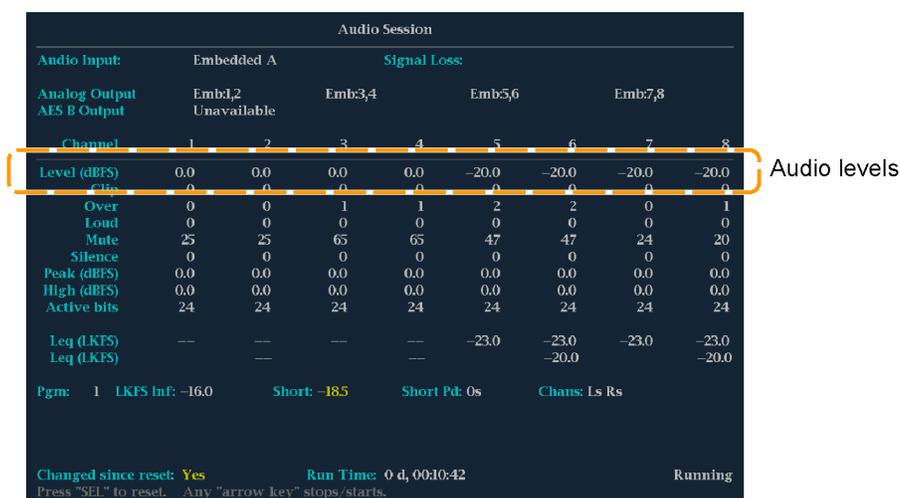


Figure 10: New audio level readouts on the Audio Session display

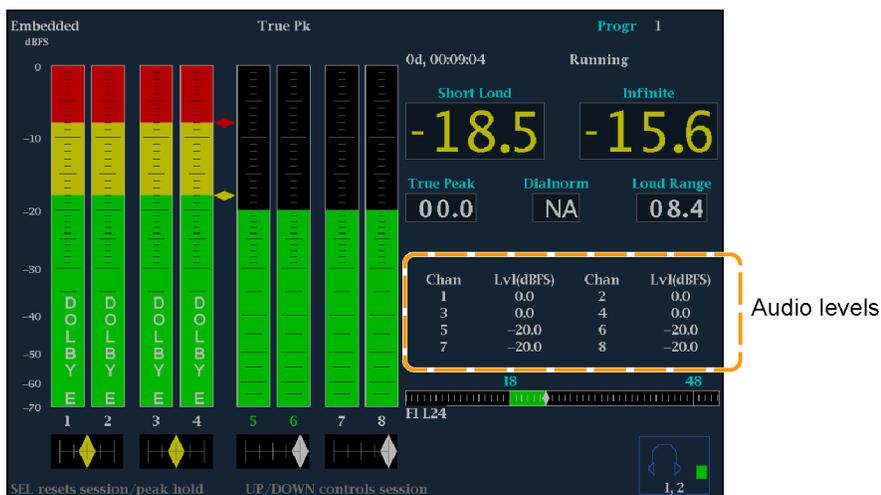


Figure 11: New audio level readouts on the Audio Auxiliary Loudness display

Additional SDI format support

The following table lists the additional SDI formats that are supported in firmware version 3.3.X. Included are Two Sample Interleave formats for UHD/4K, Dual Link formats for 3G-SDI UHD/4K, deep color formats for 3G-SDI Level A/B, and 48p frame rate support for HD and UHD/4K formats.

Table 2: New SDI formats supported in firmware version 3.3.X

Link	Format	Sample structure		Bits	Frame/field rates
HD-SDI	2048×1080	4:2:2	YCbCr	10b	23.98/24/25/29.97/30p and psF
Dual Link HD-SDI	2048×1080	4:2:2	YCbCr	10b	47.95/48/50/59.94/60p
	2048×1080	4:4:4	YCbCr	10b	23.98/24/25/29.97/30p and psF
	2048×1080	4:4:4	GBR	10b	23.98/24/25/29.97/30p and psF
	2048×1080	4:4:4	YCbCr	12b	23.98/24/25/29.97/30p and psF
	2048×1080	4:2:2	YCbCr	12b	23.98/24/25/29.97/30p and psF
3G-SDI Level A (Option 3G)	2048×1080	4:2:2	YCbCr	10b	47.95/48/50/59.94/60p
	1920×1080	4:4:4	GBR	10b	50/59.94/60i, 23.98/24/25/29.97/30p and psF
	2048×1080	4:4:4	GBR	10b	23.98/24/25/29.97/30p and psF
	1920×1080	4:4:4	GBR	12b	50/59.94/60i, 23.98/24/25/29.97/30p
	2048×1080	4:4:4	GBR	12b	23.98/24/25/29.97/30p and psF
	2048×1080	4:4:4	XYZ	12b	24/25/30p and psF
3G-SDI Level B (Option 3G)	2048×1080	4:2:2	YCbCr	10b	47.95/48/50/59.94/60p
	2048×1080	4:4:4	YCbCr	10b	23.98/24/25/29.97/30p and psF
	2048×1080	4:4:4	GBR	10b	23.98/24/25/29.97/30p and psF
	2048×1080	4:4:4	YCbCr	12b	23.98/24/25/29.97/30p and psF
	2048×1080	4:2:2	YCbCr	12b	23.98/24/25/29.97/30p and psF
Dual Link 3G-SDI Level B (Option 4K, 3G, 2SDI)	3840×2160	4:2:2	YCbCr	10b	23.98/24/25/29.97/30p and psF
	4096×2160	4:2:2	YCbCr	10b	23.98/24/25/29.97/30p and psF
Quad link 3G-SDI Level A, Square Division (Option 4K, 3G, 2SDI)	3840×2160	4:4:4	GBR	10b	23.98/24/25/29.97/30p and psF
	3840×2160	4:4:4	GBR	12b	23.98/24/25/29.97/30p and psF
	4096×2160	4:4:4	GBR	10b	23.98/24/25/29.97/30p and psF
	4096×2160	4:4:4	GBR	12b	23.98/24/25/29.97/30p and psF

Table 2: New SDI formats supported in firmware version 3.3.X, (cont.)

Link	Format	Sample structure		Bits	Frame/field rates
Quad link 3G-SDI Level B, Square Division (Option 4K, 3G, 2SDI)	3840×2160	4:4:4	YCbCr	10b	23.98/24/25/29.97/30p and psF
	3840×2160	4:4:4	GBR	10b	23.98/24/25/29.97/30p and psF
	3840×2160	4:4:4	YCbCr	12b	23.98/24/25/29.97/30p and psF
	3840×2160	4:4:4	GBR	12b	23.98/24/25/29.97/30p and psF
	3840×2160	4:2:2	YCbCr	12b	23.98/24/25/29.97/30p and psF
	4096×2160	4:4:4	YCbCr	10b	23.98/24/25/29.97/30p and psF
	4096×2160	4:4:4	GBR	10b	23.98/24/25/29.97/30p and psF
	4096×2160	4:4:4	YCbCr	12b	23.98/24/25/29.97/30p and psF
	4096×2160	4:4:4	GBR	12b	23.98/24/25/29.97/30p and psF
	4096×2160	4:2:2	YCbCr	12b	23.98/24/25/29.97/30p and psF
Quad link 3G-SDI Level A, Two sample Interleave (Option 4K, 3G, 2SDI)	3840×2160	4:2:2	YCbCr	10b	50/59.94/60p
	4096×2160	4:2:2	YCbCr	10b	50/59.94/60p
Quad link 3G-SDI Level B, Two sample Interleave (Option 4K, 3G, 2SDI)	3840×2160	4:2:2	YCbCr	10b	50/59.94/60p
	4096×2160	4:2:2	YCbCr	10b	50/59.94/60p