Leader

LV5900A

WAVEFORM MONITOR

Specification

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1. GENERAL

The LV5900A WAVEFORM MONITOR handles 8K video signals. The LV5900A not only supports 8K video (multilink) but also four simultaneous input display of 4K and HD video signals. This allows you to use the LV5900A with high-end systems as well as other systems when necessary.

The LV5900A integrates waveform display technologies, measurement technologies, and monitoring technologies that Leader has accumulated over the years to provide both high functionality and superb operability.

For 8K video signals, 12G-SDI quad link is supported. In addition, for 4K and HD video signals, various SDI signals from HD-SDI to 12G-SDI are supported. The video signal waveform display, vector display, picture display, and eye pattern display enable measurements and quality control of various video signals. The status display allows you to view various error statuses and system stability in the form of event logs and long-term charts.

For audio signals, the LV5900A supports audio signals embedded in SDI signals and MADI audio signals received from external sources. Level display, Lissajous display, status display, and so on are available.

For controlling the instrument, you can use the keys and knobs as in previous instruments as well as a USB mouse or the touch panel monitor (*1). Moreover, eye pattern display, HDR, signal generation function, focus assist, custom layout, tally/camera ID display, and English/Japanese closed caption display are available as standard functions.

With these powerful functions and controls, the LV5900A can be used in the measurement, monitoring, and evaluation of video and audio signals in a wide variety of applications including (1) broadcast station master monitoring applications for the integrated monitoring of video and audio signals, (2) monitoring applications for monitoring the quality of transmission signals, (3) studio sub and post production applications for controlling the video signal levels, and (4) broadcast equipment compliance applications for determining whether video and audio signals comply with appropriate standards.

*1　The LV5900A requires a touch-panel type external monitor to be connected to the main unit. The touch panel interface on the external monitor is connected to the LV5900A’s USB port. The video interface on the external monitor is connected to the LV5900A’s monitor output connector. LEADER does not guarantee that all touch panel type monitors will work with the LV5900A.

2. FEATURES

- Superb Operability

  Operability was prioritized in the design of these instruments. You can use the best control interface according to your liking or situation. In addition to the conventional keys and knobs on the front panel, you can control the instrument remotely using a USB mouse. Further, the LV5900A is equipped with a 9-inch LCD with excellent viewing angle and color reproducibility. It can also be used as a high-quality high definition picture monitor.
  In addition, you can control and configure the instrument intuitively through touch control by connecting a USB touch panel interface of the touch panel monitor.
  These instruments can also be controlled remotely by connecting a dedicated remote controller (sold separately), controlled remotely from a Web browser on a PC over an Ethernet connection, and used to perform automatic measurements using TELNET or FTP.

- 2K/4K/8K Video Format

  In addition to HD-SDI and 3G-SDI single links, 12G-SDI single link, 6G-SDI single link, 3G-SDI dual link and quad link, and HD-SDI quad link are supported. These cover SDI signals from HD video format to 4K video format and even 8K video format through the 12G-SDI quad link, and 12G-SDI Dual link.
  For the 4K video format, in the case of 12G-SDI and 6G-SDI single link inputs, up to four inputs can be displayed through switching. In the case of 3G-SDI dual link input, up to two inputs can be displayed through switching. Further, in the case of 12G-SDI, two inputs can be displayed simultaneously.
  For the 2K video format, in the case of 3G-SDI and HD-SDI single link inputs, up to four input signals can be displayed and monitored simultaneously.

- Supports the 8K square division system

  It also supports a video systems which 8K is divided into 4K size squares.
  The 8K square division system is not included in the signal standard, but it is a system used on the market when 4K equipment is diverted to partially process the video signal in each area.

- Transmission Quality Analysis Function

  Signal analysis functions have been enhanced based on the SDI signal measurement technology that Leader has cultivated over the years. Other enhancements have been made to various transmission error monitoring, external sync phase difference display, lip sync measurement (4K 2-screen display is not supported), SDI signal frequency deviation measurement function, equivalent cable length meter function, and the ancillary data analysis function, which has become more important with the introduction of 4K video signals.

- Video Analysis Functions

  Numerous types of displays are available for the various video signals such as the video signal waveform display, vector display, picture display, 5-bar display (4K 2-screen display is not supported), and CIE chromaticity diagram display (4K 2-screen display is not supported). In addition, quality control (QoE) functions for video signals are available including freeze error, black error, and gamut error detection functions (4K 2-screen display is not supported). Detected errors can be recorded in event logs.

- Audio Analysis Functions

  For audio signals embedded in SDI signals and externally input MADI audio signals, level meter display, Lissajous display, surround display (8K is not supported.), loudness display (4K 2-screen display is not supported), mute, clip error detection, and so on are possible.
  Detected errors can be recorded in event logs.

- Eye Pattern Display (*1)

  Eye pattern display and jitter display, which are physical layer measurements of SDI signals from HD-SDI to 12G-SDI, are possible. These physical layer measurements can be performed using cursors or performed automatically.
  Measurements can be exported via a network.
  A histogram can be superimposed on the eye pattern display.

- Closed Caption Decode Display Function (4K 2-screen display or 8K is not supported)

  Japanese closed captions embedded in SDI signals, CEA-608 and CEA-708 closed captions, teletext, and OP47 subtitles can be decoded and displayed.

- External Sync Signal Input with Waveform Display Function

  The phase difference and synchronization states of SDI video signals can be shown graphically based on an external reference sync signal (black burst, tri-level sync). Further, the waveform of the applied external reference sync signal can be displayed, allowing early discovery of problems related to the sync signal (4K 2-screen display is not supported).

- Customizable Layout

  Video signal waveforms, vector waveforms, picture, and other items of input video signals can be laid out freely in the sizes of your choice. It is possible to display up to four input signals simultaneously or display a single input signal in several displays. You can create other display layouts such as displaying a normal picture display of a single input signal next to an HDR CINEZONE display (4K 2-screen display is not supported) or display the waveforms of all lines simultaneously with a line selection waveform.

- SDI Signal Generation Function

  The SDI signal reclock output connector also functions as a simple SDI signal generator. It supports HD-SDI to 12G-SDI as well as the 4K video format of 3G-SDI quad link and 8K video format of 12G-SDI quad link and 12G-SDI Dual link. For the pattern, you can select the HD multiformat color bar, the 4K multiformat color bar, or the color raster pattern, which allows you to select any level. You can also overlay a moving box or insert embedded audio. In addition, HDR color bars can be output.

- External Monitor Output

  The measurement screen can be output in SDI or TMDS from the monitor output connector. The output signal can be displayed on an external SDI or HDMI monitor (*2) in full high definition resolution.

- Capture Feature

  A screen capture feature, which captures the entire display as still-image data, is available. Not only can captured data be displayed on the instrument, but it can also be compared with an input signal or saved to a USB memory device as bitmap data for viewing on a PC.
  A frame capture feature (4K 2-screen display is not supported; only FRM format is supported for 8K) is also available. Frames, including the blanking interval, can be captured. You can set the frame capture function mode to manual or auto, which captures frames when errors occur. The frame capture data can be viewed and searched through on a PC using a frame capture viewer.

- Time Code Display

  The timecodes embedded in SDI signals can be displayed. The timecode can also be used as the timestamp in the event log.

- External Remote Connector

  A contact terminal can be used to load presets, switch the input signal, and transmit alarms.

- Ethernet Port

  The following features become available when you connect the instrument to a PC: remote control through TELNET, file transfer through FTP, remote control and alarm generation through SNMP, remote control from a Web browser through HTTP, and internal clock synchronization through SNTP. Using the LV7290 REMOTE CONTROLLER (sold separately) allows up to eight LV5900As to be remote controlled.

- HDR

  Level monitoring is possible on HLG and PQ defined in ITU-R BT.2100 as well as S-Log3, C-LOG, and Log-C compatible HDR signals. Level control is possible based on the estimated brightness (Nits) of a display taking the OOTF into consideration. Video signal waveform display supports IRE scale as well as HDR scale. On CINEZONE display (4K 2-screen display is not supported), the SDR area is displayed in monochrome, while the HDR area is displayed using colors corresponding to the brightness. This makes it easy to view the brightness distribution in the HDR area.
  Furthermore, you can display the MAX FALL and MAX CLL compliant with CEA-861.

- Focus Assist (4K 2-screen display is not supported)

  A new focusing algorithm based on nonlinear super-resolution technology has been developed, allowing highly sensitive focusing even on low-contrast images that were difficult to be focused in on in the past. You can select the sensitivity according to the image scene.

- RS-422/485 Connector

  For serial communication, you can select the Leader’s standard protocol or TSL protocol.
  When using the Leader’s standard protocol, you can remotely recall presets, switch the display channel, and display the camera ID, iris, and tally by using serial communication.
  When using the TSL protocol, you can control the camera ID (LABEL-1) and tally (TALLY-1, TALLY-2) displays.

*1　Select any of the input connectors from SDI INPUT 1 to 4 to show the eye pattern.
*2　LEADER does not guarantee the operation on all HDMI monitors.

3. SPECIFICATIONS

3.1 SDI Video Formats and Standards

Table 3-1 HD video signal formats and standards

Color System	Quantization	Image	Frame (Field) Frequency/Scanning	Supported Standard
YC_BC_R 4:2:2	10 bit	1280×720	60/59.94/50/30/29.97/25/24/23.98 /P	SMPTE ST 292-1 SMPTE ST 296
		1920×1080	60/59.94/50 /I	SMPTE ST 274 SMPTE ST 292-1
			30/29.97/25/24/23.98 /P	
			30/29.97/25/24/23.98 /PsF	

Table 3-2 3G-A video signal formats and standards

Color System	Quantization	Image	Frame (Field) Frequency/Scanning	Supported Standard
YC_BC_R 4:2:2	10 bit	1920×1080	60/59.94/50 /P	SMPTE ST 274 SMPTE ST 425-1
			48/47.95 /P	-
		2048×1080	60/59.94/50/48/47.95 /P	SMPTE ST 425-1 SMPTE ST 2048-2
	12 bit	1920×1080	60/59.94/50 /I	SMPTE ST 274 SMPTE ST 425-1
			30/29.97/25/24/23.98 /P	
			30/29.97/25/24/23.98 /PsF	
		2048×1080	30/29.97/25/24/23.98 /P	SMPTE ST 425-1 SMPTE ST 2048-2
			30/29.97/25/24/23.98 /PsF	
YC_BC_R 4:4:4	10 bit	1280×720	60/59.94/50/30/29.97/25/24/23.98 /P	SMPTE ST 296 SMPTE ST 425-1
		1920×1080	60/59.94/50 /I	SMPTE ST 274 SMPTE ST 425-1
			30/29.97/25/24/23.98 /P	
			30/29.97/25/24/23.98 /PsF	
		2048×1080	30/29.97/25/24/23.98 /P	SMPTE ST 425-1 SMPTE ST 2048-2
			30/29.97/25/24/23.98 /PsF	
	12 bit	1920×1080	60/59.94/50 /I	SMPTE ST 274 SMPTE ST 425-1
			30/29.97/25/24/23.98 /P	
		2048×1080	30/29.97/25/24/23.98 /P	SMPTE ST 425-1 SMPTE ST 2048-2
			30/29.97/25/24/23.98 /PsF	
RGB 4:4:4	10 bit	1280×720	60/59.94/50/30/29.97/25/24/23.98 /P	SMPTE ST 296 SMPTE ST 425-1
		1920×1080	60/59.94/50 /I	SMPTE ST 274 SMPTE ST 425-1
			30/29.97/25/24/23.98 /P	
			30/29.97/25/24/23.98 /PsF	
		2048×1080	30/29.97/25/24/23.98 /P	SMPTE ST 425-1 SMPTE ST 2048-2
			30/29.97/25/24/23.98 /PsF	
	12 bit	1920×1080	60/59.94/50 /I	SMPTE ST 274 SMPTE ST 425-1
			30/29.97/25/24/23.98 /P	
		2048×1080	30/29.97/25/24/23.98 /P	SMPTE ST 425-1 SMPTE ST 2048-2
			30/29.97/25/24/23.98 /PsF	
			30/25/24 /PsF	

Color System	Quantization	Image	Frame (Field) Frequency/Scanning	Supported Standard
XYZ 4:4:4	12bit	2048×1080	30/25/24 /P	SMPTE ST 425-1
			30/25/24 /PsF	SMPTE ST 428

Table 3-3 3G-B-DL, HD(DL) Video Signal Formats and Standards

Color System	Quantization	Image	Frame (Field) Frequency/Scanning	Supported Standard
YC_BC_R 4:2:2	10 bit	1920×1080	60/59.94/50 /P	SMPTE ST 274 SMPTE ST 372 SMPTE ST 425-1
			48/47.95 /P	-
		2048×1080	60/59.94/50/48/47.95 /P	SMPTE ST 372 SMPTE ST 425-1 SMPTE ST 2048-2
	12 bit	1920×1080	60/59.94/50 /I	SMPTE ST 274 SMPTE ST 372 SMPTE ST 425-1
			30/29.97/25/24/23.98 /P	
			30/29.97/25/24/23.98 /PsF	
		2048×1080	30/29.97/25/24/23.98 /P	SMPTE ST 372 SMPTE ST 425-1 SMPTE ST 2048-2
			30/29.97/25/24/23.98 /PsF	
YC_BC_R 4:4:4	10 bit	1920×1080	60/59.94/50 /I	SMPTE ST 274 SMPTE ST 372 SMPTE ST 425-1
			30/29.97/25/24/23.98 /P	
			30/29.97/25/24/23.98 /PsF	
		2048×1080	30/29.97/25/24/23.98 /P	SMPTE ST 372 SMPTE ST 425-1 SMPTE ST 2048-2
			30/29.97/25/24/23.98 /PsF	
	12 bit	1920×1080	60/59.94/50 /I	SMPTE ST 274 SMPTE ST 372 SMPTE ST 425-1
			30/29.97/25/24/23.98 /P	
			30/29.97/25/24/23.98 /PsF	
		2048×1080	30/29.97/25/24/23.98 /P	SMPTE ST 372 SMPTE ST 425-1 SMPTE ST 2048-2
			30/29.97/25/24/23.98 /PsF	

Color System	Quantization	Image	Frame (Field) Frequency/Scanning	Supported Standard
RGB 4:4:4	10 bit	1920×1080	60/59.94/50 /I	SMPTE ST 274
			30/29.97/25/24/23.98 /P	SMPTE ST 372
			30/29.97/25/24/23.98 /PsF	SMPTE ST 425-1
		2048×1080	30/29.97/25/24/23.98 /P	SMPTE ST 372
			30/29.97/25/24/23.98 /PsF	SMPTE ST 425-1
				SMPTE ST 2048-2
	12 bit	1920×1080	60/59.94/50 /I	SMPTE ST 274
			30/29.97/25/24/23.98 /P	SMPTE ST 372
			30/29.97/25/24/23.98 /PsF	SMPTE ST 425-1
		2048×1080	30/29.97/25/24/23.98 /P	SMPTE ST 372
			30/29.97/25/24/23.98 /PsF	SMPTE ST 425-1
				SMPTE ST 2048-2
XYZ 4:4:4	12bit	2048×1080	30/25/24 /P	SMPTE ST 372
			30/25/24 /PsF	SMPTE ST 425-1
				SMPTE ST 428

*　When these signals are displayed, phase differences of up to 100 clocks (approx. 1.34 μs) between HD(DL) links are automatically corrected.

Table 3-4　3G-B-DS video signal formats and standards

Color System	Quantization	Image	Frame (Field) Frequency/Scanning	Supported Standard
YC_BC_R 4:2:2	10 bit	1920×1080	60/59.94/50 /I	SMPTE ST 274
			30/29.97/25/24/23.98 /P	SMPTE ST 425-1
			30/29.97/25/24/23.98 /PsF	
		1280×720	60/59.94/50/30/29.97/25/24/23.98 /P	SMPTE ST 296
				SMPTE ST 425-1

Table 3-5　3G(DL)-2K Video Signal Formats and Standards

Color System	Quantization	Image	Frame (Field) Frequency/Scanning	Supported Standard
YC_BC_R 4:2:2	12 bit	1920×1080	60/59.94/50 /P	SMPTE ST 274
				SMPTE ST 425-3
			48/47.95 /P	-
		2048×1080	60/59.94/50/48/47.95 /P	SMPTE ST 2048-2
				SMPTE ST 425-3
YC_BC_R 4:4:4	10 bit	1920×1080	60/59.94/50 /P	SMPTE ST 274
				SMPTE ST 425-3
		2048×1080	60/59.94/50/48/47.95 /P	SMPTE ST 2048-2
				SMPTE ST 425-3
	12 bit	1920×1080	60/59.94/50 /P	SMPTE ST 274
				SMPTE ST 425-3
		2048×1080	60/59.94/50/48/47.95 /P	SMPTE ST 2048-2
				SMPTE ST 425-3

Color System	Quantization	Image	Frame (Field) Frequency/Scanning	Supported Standard
RGB 4:4:4	10 bit	1920×1080	60/59.94/50 /P	SMPTE ST 274 SMPTE ST 425-3
		2048×1080	60/59.94/50/48/47.95 /P	SMPTE ST 2048-2 SMPTE ST 425-3
	12 bit	1920×1080	60/59.94/50 /P	SMPTE ST 274 SMPTE ST 425-3
		2048×1080	60/59.94/50/48/47.95 /P	SMPTE ST 2048-2 SMPTE ST 425-3

* When these signals are displayed, phase differences of up to 100 clocks (approx. 0.67 μs) between links are automatically corrected.

* 3G-A and 3G-B-DL links are supported.

Table 3-6 3G(DL)-4K Video Signal Formats and Standards

Division Transmission System	Color System	Quantization	Image	Frame Frequency/Scanning	Supported Standard
Square	YC_BC_R 4:2:2	10 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-3 SMPTE ST 2036-1
				30/29.97/25/24/23.98 /PsF	-
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-3 SMPTE ST 2048-1
				30/29.97/25/24/23.98 /PsF	-
2 sample interleave	YC_BC_R 4:2:2	10 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-3 SMPTE ST 2036-1
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-3 SMPTE ST 2048-1

* When these signals are displayed, phase differences of up to 100 clocks (approx. 0.67 μs) between links are automatically corrected.

* 3G-B-DS links are supported.

Table 3-7 HD(QL) video signal formats and standards

Division Transmission System	Color System	Quantization	Image	Frame Frequency/Scanning	Supported Standard
Square	YC_BC_R 4:2:2	10 bit	3840×2160	30/29.97/25/24/23.98 /P	-
				30/29.97/25/24/23.98 /PsF	-
			4096×2160	30/29.97/25/24/23.98 /P	-
				30/29.97/25/24/23.98 /PsF	-

* When these signals are displayed, phase differences of up to 100 clocks (approx. 0.67 μs) between links are automatically corrected.

Table 3-8 3G(QL) video signal formats and standards

Division Transmission System	Color System	Quantization	Image	Frame Frequency/Scanning	Supported Standard
Square	YC_BC_R 4:2:2	10 bit	3840×2160	60/59.94/50 /P	SMPTE ST 425-5 SMPTE ST 2036-1
				48/47.95 /P	-
			4096×2160	60/59.94/50/48/47.95 /P	SMPTE ST 425-5 SMPTE ST 2048-1
		12 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2036-1
				30/29.97/25/24/23.98 /PsF	-
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2048-1
				30/29.97/25/24/23.98 /PsF	-
	YC_BC_R 4:4:4	10 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2036-1
				30/29.97/25/24/23.98 /PsF	-
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2048-1
				30/29.97/25/24/23.98 /PsF	-
		12 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2036-1
				30/29.97/25/24/23.98 /PsF	-
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2048-1
				30/29.97/25/24/23.98 /PsF	-
	RGB 4:4:4	10 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2036-1
				30/29.97/25/24/23.98 /PsF	-
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2048-1
				30/29.97/25/24/23.98 /PsF	-
		12 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2036-1
				30/29.97/25/24/23.98 /PsF	-
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2048-1
				30/29.97/25/24/23.98 /PsF	-
	XYZ 4:4:4	12bit	4096×2160	30/25/24 /P	SMPTE ST 425-5 SMPTE ST 428
				30/25/24 /PsF	-

Division Transmission System	Color System	Quantization	Image	Frame Frequency/Scanning	Supported Standard
2 sample interleave	YC_BC_R 4:2:2	10 bit	3840×2160	60/59.94/50 /P	SMPTE ST 425-5 SMPTE ST 2036-1
				48/47.95 /P	-
			4096×2160	60/59.94/50/48/47.95 /P	SMPTE ST 425-5 SMPTE ST 2048-1
		12 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2036-1
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2048-1
	YC_BC_R 4:4:4	10 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2036-1
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2048-1
		12 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2036-1
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2048-1
	RGB 4:4:4	10 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2036-1
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2048-1
		12 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2036-1
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2048-1
	XYZ 4:4:4	12bit	4096×2160	30/25/24 /P	SMPTE ST 425-5 SMPTE ST 428

* When these signals are displayed, phase differences of up to 100 clocks (approx. 0.67 μs) between links are automatically corrected.

* 3G-A and 3G-B-DL links are supported.

Table 3-9 6G video signal formats and standards

Division Transmission System	Color System	Quantization	Image	Frame Frequency/Scanning	Supported Standard
2 sample interleave	YC_BC_R 4:2:2	10bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 2036-1 SMPTE ST 2081-10
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 2048-1 SMPTE ST 2081-10

Table 3-10 12G video signal formats and standards

Division Transmission System	Color System	Quantization	Image	Frame Frequency/Scanning	Supported Standard
2 sample interleave	YC_BC_R 4:2:2	10 bit	3840×2160	60/59.94/50 /P	SMPTE ST 2036-1 SMPTE ST 2082-10
				48/47.95/P	-
			4096×2160	60/59.94/50/48/47.95 /P	SMPTE ST 2048-1 SMPTE ST 2082-10
		12 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 2036-1 SMPTE ST 2082-10
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 2048-1 SMPTE ST 2082-10
	YC_BC_R 4:4:4	10 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 2036-1 SMPTE ST 2082-10
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 2048-1 SMPTE ST 2082-10
		12 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 2036-1 SMPTE ST 2082-10
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 2048-1 SMPTE ST 2082-10
	RGB 4:4:4	10 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 2036-1 SMPTE ST 2082-10
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 2048-1 SMPTE ST 2082-10
		12 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 2036-1 SMPTE ST 2082-10
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 2048-1 SMPTE ST 2082-10

* For 4K 2-Screen Display Off, if you input 12G-SDI signal without the Sync Bit Insertion, the instrument displays "NO SIGNAL" and cannot receive the signal.

Table 3-11 12G(QL) video signal formats and standards

Division Transmission System	Color System	Quantization	Image	Frame Frequency/Scanning	Supported Standard
Square (*1)	YC_BC_R 4:2:2	10bit	7680×4320	60/59.94/50/48/47.95/P	-
			8192×4320	60/59.94/50/48/47.95 /P	-
	YC_BC_R 4:4:4	10bit	7680×4320	30/29.97/25/24/23.98 /P	-
			8192×4320	30/29.97/25/24/23.98 /P	-
		12bit	7680×4320	30/29.97/25/24/23.98 /P	-
			8192×4320	30/29.97/25/24/23.98 /P	-
	RGB 4:4:4	10bit	7680×4320	30/29.97/25/24/23.98 /P	-
			8192×4320	30/29.97/25/24/23.98 /P	-
		12bit	7680×4320	30/29.97/25/24/23.98 /P	-
			8192×4320	30/29.97/25/24/23.98 /P	-
2 sample interleave	YC_BC_R 4:2:2	10 bit	7680×4320	60/59.94/50/48/47.95/P	SMPTE ST 2082-12
			8192×4320	60/59.94/50/48/47.95 /P	-
	YC_BC_R 4:4:4	10 bit	7680×4320	30/29.97/25/24/23.98 /P	SMPTE ST 2082-12
			8192×4320	30/29.97/25/24/23.98 /P	-
		12 bit	7680×4320	30/29.97/25/24/23.98 /P	SMPTE ST 2082-12
			8192×4320	30/29.97/25/24/23.98 /P	-
	RGB 4:4:4	10 bit	7680×4320	30/29.97/25/24/23.98 /P	SMPTE ST 2082-12
			8192×4320	30/29.97/25/24/23.98 /P	-
		12 bit	7680×4320	30/29.97/25/24/23.98 /P	SMPTE ST 2082-12
			8192×4320	30/29.97/25/24/23.98 /P	-

*1 8K video is divided into four parts of 4K size, up, down, left and right, and the 4K size is divided by 2 sample interleave system.
Upper left: LINK1, upper right: LINK2, lower left: LINK3, lower right: LINK4.

Table 3-12 12G(DL) video signal formats and standards

Division Transmission System	Color System	Quantization	Image	Frame Frequency/Scanning	Supported Standard
2 sample interleave	YC_BC_R 4:2:2	10 bit	7680×4320	30/29.97/25/24/23.98 /P	SMPTE ST 2082-11
			8192×4320	30/29.97/25/24/23.98 /P	-

3.2 SDI Audio Formats and Standards

Supported Standard	SMPTE ST 299
Sampling Frequency	48 kHz
Quantization	24 bit
Format	L-PCM
Clock Generation	Generated from the video clock
Synchronization	Synchronized to the video signal All video and audio streams must be synchronized during Simul Display.
SDI Audio Channel Separation	
2K, 4K	Separates up to 16 channels into groups G1 to G4 from the specified SDI input
8K(QL)	Separates up to 32 channels into groups G1 to G8 from LINK1 (SUB1), LINK2 (SUB5), LINK3 (SUB9), and LINK4 (SUB13) of the SDI input
8K(DL)	Separates up to 32 channels into groups G1 to G4 from LINK1 (SUB1, SUB2) and LINK2 (SUB9, SUB10) of the SDI input

3.3 MADI Input Audio Formats and Standards

Supported Standard	AES-10
Sampling Frequency	48 kHz
Quantization	24 bit
Format	L-PCM
Clock Generation	Generated from the MADI input signal
MADI Audio Channel (*1)	
2K, 4K	Fix to 8ch or fix to 16ch
8K	Fix to 16ch or fix to 32ch

*1 MADI does not have the concept of audio groups, but groups of four channels are divided into G1 to G8 to provide operability similar to that of SDI embedded audio.

3.4 SDI Input Connector

Connector Type	BNC
Number of Input Connectors	4 (SDI INPUT 1, 2, 3, 4)
Input Impedance	75 Ω
Input Return Loss	
5 MHz to 1.485 GHz	-15 dB or more
1.485 to 2.970 GHz	-10 dB or more
2.970 to 5.940 GHz	-7 dB or more
5.940 to 11.880 GHz	-4 dB or more
Maximum Input Voltage	±1 V (DC + peak AC)
Eye Pattern Display	Select any of the input connectors from SDI INPUT 1 to 4 to show the eye pattern.

3.5 SDI Output Connector

Connector Type	BNC
Number of Output Connectors	4 (SDI OUTPUT 1, 2, 3, 4)
Output Impedance	75 Ω
Output Return Loss	
5 MHz to 1.485 GHz	-15 dB or more
1.485 to 2.970 GHz	-10 dB or more
2.970 to 5.940 GHz	-7 dB or more
5.940 to 11.880 GHz	-4 dB or more
Output Voltage	800 mVp-p ± 10 % (into 75 Ω)
Output Signal	Reclocked signal of SDI input (*1), TSG output
Reclocked Signal	Reclocks the SDI signals of SDI INPUT 1 to 4 and outputs them through SDI OUTPUT 1 to 4
Select Reclocked Signal	SDI OUTPUT 1 can reclock and output a signal from SDI INPUT 1 to 4 by switching. (*2)
Signal Generation Function	SDI OUTPUT 1 to 4 output SDI signals as a TSG

*1 When SDI system setting is 2K HD/3G-B-DL/3G-A and input signal is 6G-SDI, reclock output is not possible.

*2 Valid when the display assignment mode is set to off.

3.6 External Reference Input

Connector Type	BNC
Number of Input Connectors	1 pair
Input Impedance	15 kΩ passive loop-through
Input Return Loss	≥ 30 dB for 50 kHz to 30 MHz into 75 Ω
Maximum Input Voltage	±5 V (DC + peak AC)
Input Signal	Tri-level sync or NTSC/PAL black burst signal 10 field IDs are supported.
Function	Video signal waveform display (*1) and phase difference (*2) display based on the phase of an external sync signal Waveform display of external sync signal (*3)

* The display position of the video signal waveform display and the measured phase of the phase difference display based on the phase of the external sync signal may vary by ±1 clock depending on the timing when the external sync signal or SDI signal is connected or disconnected or when the device is restarted.

*1 Video signal waveform display based on the phase of an external sync signal is not possible for the following formats.
- 3G's 720/30P, 720/29.97P, 720/25P, 720/24P, 720/23.98P
- HD(DL)'s 1080/60P, 1080/59.94P, 1080/50P
- 3G(DL), 3G(QL), HD(QL), 6G, 12G, 12G(QL), 12G(DL)
- Frame frequency 48P, 47.95P

*2 Phase difference display based on the phase of an external sync signal is not possible for the following formats.
- 3G's 720/30P, 720/29.97P, 720/25P, 720/24P, 720/23.98P
- 12G(DL)

*3 Waveform display using an external sync signal is not possible for the following formats.
- HD(DL), 3G(DL)-2K, 3G-B-DS, 12G(For 4K 2-screen display)

3.7 MADI Input/Output Connectors

MADI Input Connector

Connector Type	BNC
Number of Input Connectors	1
Input Impedance	75 Ω
Maximum Input Voltage	±1 V (DC + peak AC)

MADI Output Connector

Connector Type	BNC
Number of Output Connectors	1
Output Impedance	75 Ω
Output Signal	Reclocks the MADI signals of MADI INPUT
Output Voltage	450 mVp-p ± 10 % (into 75 Ω)

3.8 Monitor Output Connector

SDI Output Connector

Function	Output the displayed screen to an SDI monitor
Output Connector	BNC
Number of Output Connectors	1
Output Impedance	75 Ω
Output Return Loss	
5 MHz to 1.485 GHz	15 dB or more
1.485 to 2.97 GHz	10 dB or more
Output Voltage	800 mVp-p ± 10 % (into 75 Ω)
Output Signal	Outputs the LCD screen in HD, 3G-A, or 3G-B-DL.
Output Format	

Color System	Quantization	Image	Frame (Field) Frequency/Scanning	Supported Standard
YC_BC_R 4:2:2	10 bit	1920×1080	60/59.94/50 /I	SMPTE ST 274
			60/59.94/50 /P	

Synchronization	Synchronized with the LCD refresh rate (free run or frequency synchronization with the external reference signal(*1))

TMDS Output Connector

Function	Output the displayed screen to an HDMI monitor (*2)
Output Connector	HDMI
Number of Output Connectors	1
Signal Format	Single Link T.M.D.S
DDC	Not supported
HOT PLUG Detection	Not supported
Output Signal	Outputs the LCD screen
Image	1920×1080
Frame Frequency	60P, 59.94P, 50P
Synchronization	Synchronized with the LCD refresh rate (free run or frequency synchronization with the external reference signal(*1))
Touch Control	Touch control possible by connecting the USB touch panel interface of a touch panel monitor to the LV5900A (*3)

*1 Frame (field) frequencies 24 Hz and 23.98 Hz are not supported.
*2 LEADER does not guarantee the operation on all HDMI monitors.
*3 LEADER does not guarantee that all touch panel type monitors will work with the LV5900A.

3.9 Headphone Output

Output Connector	One 3.5 mm mini jack (stereo)
Output Signal	2 channels from the audio signals that are being displayed on the screen (downmixed Lt and Rt are also possible)
Sampling Frequency	48 kHz
Volume Adjustment	Using the menu
Power Output	100 mW maximum (into 8 Ω load)

3.10 Control Connectors

USB Port

Port Type	Standard A
Number of Ports	2
Specifications	USB 2.0
Compatible Devices	USB memory, USB mouse, touch panel monitor
USB Memory Feature	Saves capture data, preset data, event log data, data dumps, and loudness log data
USB Mouse Feature	Used to control on the screen
Touch panel monitor	Touch control of the displayed screen (*1, *2)

Ethernet Port	
Supported Standard	IEEE802.3
Supported Protocol	
TELNET (*3)	
	Command control, status query
FTP	
	File transfer
SNMP	
	Command control, alarm query
HTTP	Remote monitoring and control from a Web browser
SNTP	Internal clock synchronization
Connector Type	RJ-45
Type	10Base-T, 100Base-TX, 1000Base-T
Function	Remote control from an external PC, file transfer, status information query
Remote Connector	
Port Type	15-pin D-sub (female)
Locking Screws	Inch screws (No.4-40UNC)
Number of Ports	1
Control Signal	LV-TTL level (low active)
Input Voltage Range	0 to 5 V DC
	All inputs are pulled up to +3.3 V (control is also possible using +5 V)
Function	Load preset settings, switch input signals, transmit alarm signals activate tally, and start, stop, and clear the loudness measurement
Alarm Output	Outputs alarms signals when a format alarm occurs, when various errors occur, when the fan malfunctions, or when the internal temperature is abnormal
RS-422/485 Connector	
Supported Protocols	
Leader	Receives tally, camera ID, and camera iris signals and displays them
TSL UMD Protocol	Tally (TALLY-1, TALLY-2), camera ID (LABEL-1) reception display
Supported Versions	UMD 3.1, UMD 4.0
Port Type	RJ-45
Number of Ports	2

*1 Pinch out and swipe operations are not supported.
*2 LEADER does not guarantee that all touch panel type monitors will work with the LV5900A.
*3 You cannot use TELNET and the LV7290 at the same time.

3.11 Front Panel

Display

LCD Type	9-inch color TFT
Resolution	1920×1080P
Refresh Rate	60 Hz, 59.94 Hz, 50 Hz (free run or frequency synchronization with the external reference signal(*1))
Key LEDs	All the keys are dimly back-lit. The selected key is lit more brightly.
Power Switch	Electronic switch (which remembers whether the instrument is on or off)
Last Memory	Backs up the panel settings to memory
Key Lock	Lock by holding down the SYS key. Prevents unintentional operations on the instrument.

*1 The LCD refresh rate changes automatically depending on the frame rate of the external reference signal.

Frame Rate of the External Reference Signal	LCD Refresh Rate
23.98Hz	Free run
24Hz	Free run
25Hz	50Hz
29.97Hz	59.94Hz
30Hz	60Hz

3.12 Capturing

Screen Capture

Function	Captures the screen
Display	Displays only the captured image or overlays the captured image over the input signal
Media	Internal memory (RAM) and USB memory You can only save one screen capture to the internal memory.
Data Output	Saved to bitmap format to a USB memory device or to a file format that the instrument can load (BSG).
Data Input	Data saved to a USB memory device can be loaded and displayed on the instrument.

Frame Capture (4K 2-screen display is not supported)

Function	Captures frame data
Input Signal	SDI signal
Display	Displays only the captured frame data or superimposes the captured frame data over the input signal
Media	Internal memory (RAM) and USB memory Stores 1 frame or 16 consecutive frames (4 frames for 8K, 32 frames for some formats) in the internal memory
Data Output	Saved to DPX or TIFF format to a USB memory device or to a file format that the instrument can load (FRM). (*1)
Data Input	Data saved to a USB memory device can be loaded and displayed on the instrument. (*2)
Capture Timing	Manual and automatic (error capture)
Error Capturing	Automatically captures frame data when an error occurs
Error Location Search	Can be searched on Frame Capture Viewer

*1 Only FRM format is supported for 8K.

*2 An input signal in the same format as the frame data is required.

3.13 TSG

Table 3-13 HD video signal formats and standards

Color System	Quantization	Image	Frame (Field) Frequency/Scanning	Supported Standard
YC_BC_R 4:2:2	10 bit	1280x720	60/59.94/50 /P	SMPTE ST 292-1
			30/29.97/25/24/23.98 /P	SMPTE ST 296
		1920×1080	60/59.94/50 /I	SMPTE ST 274
			30/29.97/25/24/23.98 /P	SMPTE ST 292-1
			30/29.97/25/24/23.98 /PsF	

Table 3-14 3G-A, 3G-B-DL video signal formats and standards

Color System	Quantization	Image	Frame (Field) Frequency/Scanning	Supported Standard
YC_BC_R 4:2:2	10 bit	1920×1080	60/59.94/50/48/47.95 /P	SMPTE ST 274 SMPTE ST 425-1
			48/47.95 /P	-
		2048×1080	60/59.94/50/48/47.95 /P	SMPTE ST 425-1 SMPTE ST 2048-2
YC_BC_R 4:4:4	10 bit	1920×1080	60/59.94/50 /I	SMPTE ST 274 SMPTE ST 425-1
			30/29.97/25/24/23.98 /P	
			30/29.97/25/24/23.98 /PsF	
		2048×1080	30/29.97/25/24/23.98 /P	SMPTE ST 425-1 SMPTE ST 2048-2
			30/29.97/25/24/23.98 /PsF	
RGB 4:4:4	10 bit	1920×1080	60/59.94/50 /I	SMPTE ST 274 SMPTE ST 425-1
			30/29.97/25/24/23.98 /P	
			30/29.97/25/24/23.98 /PsF	
		2048×1080	30/29.97/25/24/23.98 /P	SMPTE ST 425-1 SMPTE ST 2048-2
			30/29.97/25/24/23.98 /PsF	

Table 3-15 3G(DL)-4K Video Signal Formats and Standards

Division Transmission System	Color System	Quantization	Image	Frame Frequency/Scanning	Supported Standard
Square	YC_BC_R 4:2:2	10 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-3 SMPTE ST 2036-1
				30/29.97/25/24/23.98 /PsF	-
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-3 SMPTE ST 2048-1
				30/29.97/25/24/23.98 /PsF	-
2 sample interleave	YC_BC_R 4:2:2	10 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-3 SMPTE ST 2036-1
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-3 SMPTE ST 2048-1

Table 3-16 3G(QL) video signal formats and standards

Division Transmission System	Color System	Quantization	Image	Frame Frequency/Scanning	Supported Standard
Square	YC_BC_R 4:2:2	10 bit	3840×2160	60/59.94/50 /P	SMPTE ST 425-5 SMPTE ST 2036-1
				48/47.95 /P	-
			4096×2160	60/59.94/50/48/47.95 /P	SMPTE ST 425-5 SMPTE ST 2048-1
	YC_BC_R 4:4:4	10 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2036-1
				30/29.97/25/24/23.98 /PsF	-
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2048-1
				30/29.97/25/24/23.98 /PsF	-
	RGB 4:4:4	10 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2036-1
				30/29.97/25/24/23.98 /PsF	-
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2048-1
				30/29.97/25/24/23.98 /PsF	-
2 sample interleave	YC_BC_R 4:2:2	10 bit	3840×2160	60/59.94/50 /P	SMPTE ST 425-5 SMPTE ST 2036-1
				48/47.95 /P	-
			4096×2160	60/59.94/50/48/47.95 /P	SMPTE ST 425-5 SMPTE ST 2048-1
	YC_BC_R 4:4:4	10 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2036-1
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2048-1
	RGB 4:4:4	10 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2036-1
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 425-5 SMPTE ST 2048-1

* 3G-A and 3G-B-DL links are supported.

Table 3-17 6G video signal formats and standards

Division Transmission System	Color System	Quantization	Image	Frame Frequency/Scanning	Supported Standard
2 sample interleave	YC_BC_R 4:2:2	10bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 2036-1 SMPTE ST 2081-10
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 2048-1 SMPTE ST 2081-10

Table 3-18 12G video signal formats and standards

Division Transmission System	Color System	Quantization	Image	Frame Frequency/Scanning	Supported Standard
2 sample interleave	YC_BC_R 4:2:2	10 bit	3840×2160	60/59.94/50 /P	SMPTE ST 2036-1 SMPTE ST 2082-10
				48/47.95/P	-
			4096×2160	60/59.94/50/48/47.95 /P	SMPTE ST 2048-1 SMPTE ST 2082-10
	YC_BC_R 4:4:4	10 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 2036-1 SMPTE ST 2082-10
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 2048-1 SMPTE ST 2082-10
	RGB 4:4:4	10 bit	3840×2160	30/29.97/25/24/23.98 /P	SMPTE ST 2036-1 SMPTE ST 2082-10
			4096×2160	30/29.97/25/24/23.98 /P	SMPTE ST 2048-1 SMPTE ST 2082-10

Table 3-19 12G(QL) video signal formats and standards

Division Transmission System	Color System	Quantization	Image	Frame Frequency/Scanning	Supported Standard
2 sample interleave	YC_BC_R 4:2:2	10 bit	7680×4320	60/59.94/50/48/47.95/P	SMPTE ST 2082-12
			8192×4320	60/59.94/50/48/47.95 /P	-
	YC_BC_R 4:4:4	10 bit	7680×4320	30/29.97/25/24/23.98 /P	SMPTE ST 2082-12
			8192×4320	30/29.97/25/24/23.98 /P	-
	RGB 4:4:4	10 bit	7680×4320	30/29.97/25/24/23.98 /P	SMPTE ST 2082-12
			8192×4320	30/29.97/25/24/23.98 /P	-

Table 3-20 12G(DL) video signal formats and standards

Division Transmission System	Color System	Quantization	Image	Frame Frequency/Scanning	Supported Standard
2 sample interleave	YC_BC_R 4:2:2	10bit	7680×4320	30/29.97/25/24/23.98 /P	SMPTE ST 2082-11
			8192×4320	30/29.97/25/24/23.98 /P	-

Output Pattern

The following table shows the patterns that are output for each video signal format.

Pattern	HD	3G-A, 3G-B-DL	3G(DL)-4K	3G(QL)	6G	12G	12G(QL)	12G(DL)
100% color bar	Yes	Yes	Yes	Yes	Yes	Yes		
75% color bar	Yes	Yes	Yes	Yes	Yes	Yes		
HD multiformat color bar (*1)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4K multiformat color bar (*1)			Yes	Yes	Yes	Yes	Yes	Yes
Color raster	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Gamma	Yes	Yes	Yes	Yes	Yes	Yes		
Cross hatch	Yes	Yes	Yes	Yes	Yes	Yes		
10 step	Yes	Yes	Yes	Yes	Yes	Yes		
Limit lamp	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Check field	Yes	Yes	Yes	Yes	Yes	Yes		
Lip sync pattern	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HDR color bar (*1)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

YCbCr/RGB on/off, Level Adjustment

When the following patterns are selected, you can turn on and off YCbCr or RGB separately.

When COLOR RASTER pattern is selected, you can set the YCbCr or RGB levels separately. Moreover, if Structure is set to RGB, You can set R, G, and B level in interlocking.

Pattern	YCbCr/RGB on/off separately	YCbCr/RGB level adjustment separately	RGB level adjustment interlocking
100% color bar	Yes		
75% color bar	Yes		
HD multiformat color bar (*1)	Yes		
4K multiformat color bar (*1)	Yes		
Color raster	Yes	Yes	Yes
Gamma	Yes		
Cross hatch	Yes		
10 step	Yes		
Limit lamp	Yes		
Check field			
Lip sync pattern			
HDR color bar (*1)	Yes		

Scrolling (*2)	
Direction	Eight directions (up, down, left, right, and their combinations)
Speed Range and Unit	Per frame (field) 4 to 124 dots, in 4 dot steps
Moving Box	ON, OFF (*2)
Colors	WHITE, YELLOW, CYAN, GREEN, MAGENTA, RED, BLUE, BLACK
Speed	1 to 3
Frequency Phase Adjustment (8K is not supported.) (*2, *3)	
Quad link	Vary the phases of SDI OUTPUT 2 to 4 independently relative to SDI OUTPUT 1
Dual link	Vary the phase of SDI OUTPUT 2 relative to SDI OUTPUT 1 and the phase of SDI OUTPUT 4 relative to SDI OUTPUT 3
Adjustment Range	±0.5 lines (in unit of video clocks) ±1/2 frames (in unit of lines)
Embedded Audio	
Number of Embedded Channels	
	16 channels max. (*4)
Embedding On/Off	On/off at the audio group level
Audio Level	-20d BFS, -18 dBFS, 0 dBFS, Mute
Audio Frequency	1 kHz
CRC Error Addition	An incorrect CRC is inserted into the Y component of the first line.

*1 It cannot be set in horizontal 8192, 4096, 2048 and 1280 pixel format.
*2 Either scrolling, moving box, or frequency phase adjustment can be turned on.
*3 The output phase may be off by ±2 clock from the specified value as a result of switching the format or turning on and off the power.
*4 For horizontal 8192/4096/2048 pixel format at frame rates 60, 59.94, 30, 29.97 Hz, only 8 channels are embedded.

3.14 Presets

Preset	Saves panel settings (with a few exceptions)
Number of Presets	60
Preset Loading Method	Front panel or remote connector(*1)
Copying	All preset data can be copied from the instrument to a USB memory device or from a USB memory device to the instrument.

*1 The number of presets loaded from the remote connector can be 8 or 60.

3.15 Display

Number of simultaneously displayed SDI input signals

HD, 3G-A, 3G-B-DL	4
HD(DL)	2
3G-B-DS	1
3G(DL)-2K	2
3G(DL)-4K	1
HD(QL)	1
3G(QL)	1
6G	1
12G	
4K 2-Screen Display On	2
4K 2-Screen Display Off	1
12G(QL)	1
12G(DL)	1

Display Mode

Single display	Displays a single input signal
Simul Display	Displays two or more input signals simultaneously
4K 2-Screen Display	For 4K 12G, displays two channels of 4K input signals simultaneously (*1)
Display Assignment Mode (Only HD, 3G-A, and 3G-B-DL are supported)	Maps the input video signal of a channel to multiple areas (*2)

Alarm Indications

System Alarm Indication	Displays an alarm when the fan malfunctions or when the internal temperature is abnormal
Error Indication	Displays an error when an receive signal error occurs

Display Layout

Multi Display	Control the WFM/PIC and other display functions in multiple areas from a single screen

Customized Layout	
Function	Freely arrange the windows shown with the WFM, VECT, PIC, AUDIO, STATUS, and EYE keys (one of each), and a window consisting of six displays shown with MULTI
Display Format	Displays up to four single link input signals in tiled, mixed, V aligned, or H aligned mode.
Normal Mode	Each display area is divided evenly.
Tiled Display	The windows are divided into four quadrants.
Mixed Display	The windows are cascaded.
V Aligned Display	The windows are arranged top to bottom.
H Aligned Display	The windows are arranged side by side.
Tile Mode	The display contents arranged in the display are shown in four quadrants per screen.
V Aligned Mode	The display contents arranged in the display are shown in four vertical divided windows per screen.
H Aligned Mode	The display contents arranged in the display are shown in four horizontally divided windows per screen.
Enhanced Layout	
Function	When multiple channels of single link are displayed, the selected channel is automatically shown in a specific area. You can make the specific area larger than the other areas to show the selected channel enlarged.
3G-B-DS Display Format	
Aligned Display	The screen is divided into windows.
Time Display	
Displayed Contents	Current time, time code
Current Time Display	The time based on the internal clock
Time Code Display	LTC, VITC
Supported Standard	
LTC, VITC	SMPTE ST 12-2
Tally Display	
Remote Connector	Turn on and off the tally display by controlling through the remote connector
RS-485 Control	Shows tallies through RS-485 control
Camera ID Display	
Instrument Setting	Shows the camera ID set with the instrument's menu
RS-485 Control	Shows the camera ID through RS-485 control
Iris Display	
RS-485 Control	Shows the iris through RS-485 control

*1 The signals that can be displayed simultaneously are the 4K input signals of SDI INPUT 1 and 2 or the 4K input signals of SDI INPUT 3 and 4.
Apply signals with the same format to both channels.

*2 Simultaneous display of HDR and normal picture or CINEZONE and normal picture is possible. However, there is a limit to the number of channels that can be displayed. This can be set only for HD/3G-A/3G-B-DL single link. It cannot be set for 4K signals or SDI system that transmits multiple lines.

3.16 Video Signal Waveform Display

Waveform Control

Display Mode	
Overlay	Overlays component signals
Parade	Displays component signals side by side
Blanking Interval	H and V blanking periods can be masked.
RGB Conversion	Converts a YC_BC_R signal into an RGB signal and displays the result
Channel Assignment	GBR or RGB order
Pseudo-Composite Display	Artificially converts component signals into composite signals and displays the result
Line Select	Displays the selected line
Sweep Modes	H, V
Color	7 colors to choose from

Vertical Axis

Gain	×1, ×5, ×10
Variable Gain	
Gain x1	×0.2 to ×2.0
Gain x5	×1.0 to ×10.0
Gain x10	×2.0 to ×10.0
Amplitude Accuracy	±0.5% (single default display)
3G, HD(DL) (1080/60P, 1080/59.94P, 1080/50P)	
Y Signal	±0.5 % (1 to 60 MHz)
C_BC_R Signal	±0.5 % (0.5 to 30 MHz)
Low-Pass Attenuation	≥ 20 dB (at 40 MHz)
3G, HD, HD(DL) (1080/60P, 1080/59.94P, 1080/50P)	
Y Signal	±0.5 % (1 to 30 MHz)
C_BC_R Signal	±0.5 % (0.5 to 15 MHz)
Low-Pass Attenuation	≥ 20 dB (at 20 MHz)

Horizontal Axis

Line Display	
Display Format	Overlay (1H, 2H) (*1) Parade (1H, 2H, 3H) 4Y parade (4H)
Magnification	×1, ×10, ×20, ACTIVE, BLANK
Field Display	
Display Format	Overlay (1V, 2V) (*2) Parade (1V, 2V, 3V)
Magnification	×1, ×20, ×40
Time Accuracy	±0.5% (single default display)

Cursor Measurement

Composition	
Horizontal Cursors	2 (REF and DELTA)
Vertical Cursors	2 (REF and DELTA)
Simultaneous Display	Displays the horizontal cursors and vertical cursors simultaneously
Amplitude Measurement	mV, %, R%, DEC, HEX
Time Measurement	Second display
Frequency Display	Computes and displays the frequency with the length of one period set to the time between two cursors
Cursor Value Display	Displays measured values at the cursors

Scale

Type	%, V, decimal, hexadecimal
Display Colors	7 colors to choose from

HDR Scale Adds an HDR scale to each scale for HDR

External Sync Signal Waveform Display

Compatible SDI Systems	Can be displayed for HD, 3G-A, 3G-B-DL, 12G(1-screen display), 6G, 3G(QL), 3G(DL)-4K, HD(QL), 12G(DL), and 12G(QL)
Features	Waveform display of external sync signal
Vertical Axis	
Gain	×1
Variable Gain	CAL
Horizontal Axis	
Line Display	
Display Format	1H, 2H
Magnification	×1
Field Display	
Display Format	1V, 2V
Magnification	×1
Scale	
Type	%
Display Colors	7 colors to choose from

*1 2H display is not possible when the input signal is 4K.
*2 2V display is not possible when the input signal is progressive.

3.17 Vector Display

Display Colors	7 colors to choose from
Blanking Interval	H and V blanking periods can be masked (according to the video signal waveform display settings).
Pseudo-Composite Display	Artificially converts component signals into composite signals and displays the result
Line Select	Displays the selected line
Gain	×1, ×5, IQ-MAG
Variable Gain	
Gain x1	×0.2 to ×2.0
Gain x5	×1.0 to ×10.0
Gain IQ-MAG	
Component display	0.620 to 6.240
Pseudo-composite display	0.570 to 5.700
Amplitude Accuracy	±0.5 %
Scale	
Type	AUTO, ITU-R BT.709, DCI, ITU-R BT.2020
Color Bar Saturation	75%, 100%
IQ Axis	Show or hide
Display Colors	7 colors to choose from
Variable Scale	ON, OFF
ARIB Check Marker	OFF, STD-B66, STD-B72
Vector Marker Display	Displays a marker and numeric value at the specified location on the vector display
Number of Markers	1
Numeric Display	Displays the marker position numerically
Cb	Displays the C_B position as a percentage
Cr	Displays the C_R position as a percentage
deg	Displays the hue in degrees.
d	Displays the distance from the center as a percentage
Variable Marker	Marker and frame resizing
Histogram Display (4K 2-screen display is not supported)	Displays the Y, R, G, and B histograms
5-Bar Display (4K 2-screen display is not supported)	
Function	Converts an SDI signal into Y, R, G, B, and composite values, and then displays the five peak levels.
Channel Assignment	RGB, GBR
Scale	%, mV, HEX, DEC
Error Level	Based on the gamut error, composite gamut error, and luminance error thresholds
Line Select (8K is not supported.)	Displays the selected line
Low-Pass Filter	The same as for gamut errors

3.18　Picture Screen

Quantization	8 bit (internal signal processing is performed with signed 12 bit or higher)
Level Mapping	Maps the black level to 0 (8bit), SDI code value 1024 to 255 (8 bit)
Display Sizes	Reduced, 1/4 8K (8K only), actual size (4K 2-screen display or 8K is not supported), ×2 (4K and 8K are not supported.), full frame (4K and 8K are not supported.)
Quality Adjustment and Color Selection	Brightness, contrast, RGB gain, RGB bias, chroma gain, monochrome display (RGB gain, RGB bias, chroma gain not valid)
Frame Rate	Converts the frame rate based on the LCD frame rate (60P, 59.94P, 50P)
Aspect Marker Display	
17:9 aspect ratio	16:9, 14:9, 13:9, 4:3, 2.39:1
16:9 aspect ratio	17:9, 14:9, 13:9, 4:3, 2.39:1, AFD (*1)
Aspect Marker Format	Line, shadow (99 levels), or black
Safety Marker Size	ARIB TR-B4, SMPTE RP-218, or user-defined
AFD Display (*1)	Displays abbreviations for SMPTE ST 2016-1-2007 standard AFD codes
Line Select	Marks the selected line
Error Indication (*2)	Displays markers in the gamut error and level error areas

*1　AFD Supports only HD-SDI.
*2　Errors are not displayed for the 4K 2-screen display.
*　8K signals are down converted internally to 4K and then displayed.
*　For the 4K 2-screen display, signals are down converted internally to 2K and then displayed.

3.19 Superimpose Display (4K 2-screen display or 8K is not supported)

Displays English closed captions, European closed captions, and Japanese closed captions over the picture

English Closed Caption

Supported Standards (Mapping Standards)	
EIA-708	SMPTE ST 334
EIA/CEA-608-B (EIA-708-B)	SMPTE ST 334
EIA/CEA-608-B (EIA/CEA-608-B)	SMPTE ST 334
Supported Video Formats	HD, 3G-A, 3G-B-DL, HD(DL) (close caption decoding only for link A), 3G(DL)-2K (3G-B not supported, close caption decoding only for link 1), 3G(DL)-4K (close caption decoding only for link 1), HD(QL) (close caption decoding only for link 1), 3G(QL) (close caption decoding only for link 1), 6G (close caption decoding only for sub 1) 12G (close caption decoding only for sub 1)

European Closed Caption

Supported Standards	
Teletext	OP47

Simple Japanese Closed Caption Display

	Displays a simple Japanese closed caption on the picture display. (Select HD, SD, analog, or portable closed caption to display. Select language 1 or 2.)
Supported Standard	ARIB STD-B37 short form data
Supported Video Formats	HD, 3G-A, HD(DL) (close caption decoding only for link A), HD(QL) (close caption decoding only for link 1), 3G(QL) (3G-B not supported, close caption decoding only for link 1), 6G (close caption decoding only for sub 1) 12G (close caption decoding only for sub 1)
Display	Display position control is supported only for HD and SD closed captions.
Characters	Only Kanji, roman numerals, katakana, hiragana, additional characters (ARIB STD-B24), additional kanji (ARIB STD-B24), and 1-byte DRCS are displayed.
Character Sizes	Supports only standard, medium, small, and specified size codes
Logging	
Logged Events	Clear screen command, text closed caption display event, time code, TV commercial material check result
Data Format	Text

TV Commercial Material Checking

Function	Checks whether closed caption displays are present during the closed caption prohibited time
Check Period	The material start time and end time can be specified using timecodes.
Log Display Color	
Closed Caption during Prohibited Time	Red
Closed Caption Not during Prohibited Time	Green
Check Result Display	Displays OK or NG when measurements are complete
Loudness Synchronization	Simultaneous measurement with loudness measurement

3.20 CINELITE Display (4K 2-screen display is not supported)

Function	Video levels are displayed numerically.
f Stop Display	Displays f Stop values relative to a reference point Set in reference to an object with an 18% reflectance f Stop gamma correction (not supported on the HDR)
Fundamental Gamma	ITU-R BT.709, hybrid log gamma (HLG), PQ, S-Log3
User Correction Table	3 types (data acquired with a real device)
% Display (SDR)	Displays the luminance level or RGB level as a percentage with the SDI code value 64 assumed to be 0% and the SDI code value 940 assumed to be 100%
Gradation Display	Displays the luminance or RGB value with the SDI code value 64 assumed to be 0 and the SDI code value 940 assumed to be 255
CV Display	Decimal, hexadecimal Displays the SDI signal code value as YCBCR or RGB according to the input signal (only for measurement size 1×1)
HDR Display	
HLG	
System Gamma OFF	
Narrow Range	Displays the relative HLG luminance with the SDI code value 64 assumed to 0% and 940 assumed to be 1200% or 100%
Full Range	Displays the relative HLG luminance with the SDI code value 0 assumed to 0% and 1023 assumed to be 1200% or 100%
System Gamma ON	
Narrow Range	Displays the relative HLG luminance with the SDI code value 64 assumed to 0 Nits and 940 assumed to be 1000 Nits
Full Range	Displays the relative HLG luminance with the SDI code value 0 assumed to 0 Nits and 1023 assumed to be 1000 Nits

PQ	Converts the luminance level to the display's Nits and displays the result
Narrow Range	SDI code value 64 to 940 are assumed to be 0 Nits to 10000 Nits
Full Range	SDI code value 0 to 1023 are assumed to be 0 Nits to 10000 Nits
S-Log3	Converts the reflectance to IRE with SDI code value 95 assumed to be 0% and 589 assumed to be 100% and displays it as a percentage
C-Log	Displays the percentage with the SDI code value 128 assumed to 0% and 614 assumed to be 100%
Log-C	
EI200	Displays the percentage with the SDI code value 95 assumed to 0.39% and 853 assumed to be 83%
EI400	Displays the percentage with the SDI code value 95 assumed to 0.39% and 917 assumed to be 90%
EI800	Displays the percentage with the SDI code value 95 assumed to 0.39% and 976 assumed to be 95%
EI1600	Displays the percentage with the SDI code value 95 assumed to 0.39% and 1022 assumed to be 94%
Measured Points	3
Measurement Sizes	1 × 1 pixel, 3 × 3 pixels, and 9 × 9 pixels

3.21 CINELITE Advanced Display (4K 2-screen display is not supported)

Function	Synchronizes the markers on the waveform display, vector display, and chromaticity diagram display to the points selected with CINELITE
Waveform Display Link Markers	
	Synchronizes the markers on the waveform display to the points selected with CINELITE
Number of Link Markers	Up to 16 (for YRGB, YGBR display) (including the 4 reference points)
Vector Link Markers	Synchronizes the markers on the vector display to the points selected with CINELITE
Number of Link Markers	Up to 4 (including the 1 reference point)
Vector Numeric Display	Displays numerically the active marker position
Cb	Displays the CB position as a percentage
Cr	Displays the CR position as a percentage
deg	Displays the hue as an angle (°).
d	Displays the distance from the center as a percentage
CIE Chromaticity Diagram Display Link Markers	
	Synchronizes the markers on the CIE chromaticity diagram display to the points selected with CINELITE
Number of Link Markers	Up to 4 (including the 1 reference point)

3.22 CINEZONE Display (4K 2-screen display is not supported)

CINEZONE Display (SDR)

Function	Adds colors to the display in accordance with luminance levels
Display Colors	Linear (1024 colors), step (12 colors)
Upper Limit	-6.3 to 109.4 % (values equal to or greater than the upper limit are displayed in white)
Lower Limit	-7.3 to 108.4 % (values less than the lower limit are displayed in black)

CINEZONE display (HDR)

Function	Adds colors to the display in accordance with luminance levels
HDR Area Setting	Displays color according to the brightness
SDR Area Setting	Monochrome display
Upper Limit	Displays magenta for values exceeding the limit Ref.LEVEL to 100% (code values 64 to 940 or 0 to 1023 assumed to be 100%)
Lower Limit	Displays black for values less than the limit 0% to Ref.LEVEL% (code values 64 to 940 or 0 to 1023 assumed to be 100%)

* 8K signals are down converted internally to 4K and then displayed.

3.23 Focus Assist (4K 2-screen display is not supported)

Detection Sensitivity	LOW, MIDDLE, HIGH
Highlight Display Color	WHITE, GREEN, BLUE, RED
Picture Luminance Level	OFF, EMBOSS, 25%, 50%, 75%, 100%

* 8K signals are down converted internally to 4K and then displayed.

3.24 CIE Chromaticity Diagram Display (4K 2-screen display is not supported)

Display Standard	CIE1931 (xy display), CIE1976 (u'v' display)
Display Type	Chromaticity diagram display, color temperature display
Display Mode	
Chromaticity Diagram Display	Luminance display, color display
Color Temperature Display	Luminance display
Colorimetry	BT.709, DCI, ITU-R BT.2020
Clipping	
ON	Clips negative values of the input signal to zero
OFF	Displays negative values of the input signal according to ITU-R BT.1361
Smoothing	Displays by averaging data every two pixels
Accuracy	±0.005 (relative to the measurement coordinate value)

Chromaticity Diagram Display Scale	
Triangle	Select two from ITU-R BT.709, DCI, and ITU-R BT.2020
User-defined Triangle	Set a single user-defined triangle
Background	Color sample, white background, black background
Sub scale	Color temperature curve, grid (0.1 steps), white point (D65), triangle name (each can be turned on or off)
Cursor	Displays the cursor position in coordinates
Gamma	ITU-R BT.709, user (1.5 to 3.0), HLG, PQ, S-Log3, C-Log, Log-C
Line Select	Displays the selected line

3.25 HDR Display

Supported Standard	ITU-R BT.2100 (HLG: Hybrid Log Gamma, Full range / Narrow range), ITU-R BT.2100 (PQ: Perceptual Quantization, Full range / Narrow range), S-Log3, C-Log, Log-C
Supported Formats	All formats
Function	
Video Waveform Display	Scale, cursor
Vector Display (4K 2-screen display is not supported)	
	Histogram
Picture Screen (4K 2-screen display is not supported)	
HDR CINEZONE (*1)	
HDR CINELITE	
MAX CLL, MAX FALL (CEA861 compliant)	
START	MAX CLL, MAX FALL computation start
STOP	MAX CLL, MAX FALL computation stop

* 8K signals are down converted internally to 4K and then displayed.

3.26 Audio Display

Input Signal	SDI embedded audio, MADI
Format	L-PCM
Sampling Frequency	48 kHz
Quantization	24 bit
SDI Embedded Audio	
Supported Standard	
3G, HD, HD(DL)	SMPTE ST 299
Clock Generation	Generated from the video clock
Synchronization	Must be synchronized to the video clock. All SDI signals must be synchronized.

Channel Separation	
2K, 4K	Separates up to 16 channels into groups G1 to G4 from the specified SDI input
8K(QL)	Separates up to 32 channels into groups G1 to G8 from LINK1 (SUB1), LINK2 (SUB5), LINK3 (SUB9), and LINK4 (SUB13) of the SDI input
8K(DL)	Separates up to 32 channels into groups G1 to G4 from LINK1 (SUB1, SUB2) and LINK2 (SUB9, SUB10) of the SDI input

MADI	
Supported Standard	AES-10
Sampling Frequency	48 kHz
Quantization	24 bit
Format	L-PCM
Clock Generation	Generated from the MADI input signal
MADI Audio Channel	
2K, 4K	Fix to 8ch or fix to 16ch
8K	Fix to 16ch or fix to 32ch

Number of Display Channels	
SDI embedded audio signal	
2K, 4K	16 channels max.
8K	32 channels max.
MADI Signal	
2K, 4K	Fix to 8ch or fix to 16ch
8K	Fix to 16ch or fix to 32ch

* MADI does not have the concept of audio groups, but groups of four channels are divided into G1 to G8 to provide operability similar to that of SDI embedded audio.

Display Types	Level meter, Lissajous, correlation meter, surround (8K is not supported.), status, loudness

Level meter	
Displayed Channels	
2K, 4K	8ch, 16ch
8K	16ch, 32ch
Dynamic Range	
SDI Embedded Audio	-60 dBFS, -90 dBFS, reference level±3 dB
MADI	-60 dBFS, -90 dBFS, reference level±3 dB
Meter Response Model	TRUE PEAK, PPM type Ⅰ, PPM type Ⅱ, VU
Peak Hold Time	0.0 to 5.0 s (in 0.5 s steps), HOLD
Level Setting	-40.0 to 0.0 dBFS (standard level, warning level, over level)
Level Numeric Display	Displays the levels numerically Numeric display in red when level-over is detected Displays a blue “M” when mute is detected (ON/OFF selectable. The displays changes to a blue ■ when the layout size is small.) Displays “U.L” when audio is not detected

Lissajous Display

Displayed Channels	
2K, 4K	2ch×1
	2ch×4
	2ch×8
8K	2ch×8
	2ch×16
Display Mode	X-Y, MATRIX
Correlation Meter	Displays the correlation between two channels as a value from -1 to 1
Channel Assignment	
SINGLE LISSAJOU	L, R
MULTI LISSAJOU	L1, R1 to L4, R4 to L8, R8

Surround Display (8K is not supported.)

Function	Displays a graphical representation of a sound field
Surround Format	5.1ch
Channel Mapping	L, R, C, LFE, Ls, Rs, Lt, Rt
Center Channel Format	NORMAL, PHANTOM CENTER
Gain	×1, AUTO

* Only CH Mode 8ch is supported.

Status Display

Level	Audio levels are displayed using numbers (dBFS).
Error Detection	Counts the number of errors that occur for each channel
Level Over	Counts the number of times that the level of the input signal exceeds the set value
Detection Setting	-40.0 to 0.0 dBFS
Clipping	Counts the number of times that a received signal exceeds the maximum signal value for the specified number of consecutive samples
Detection Setting	1 to 100 sample
Mute	Counts the number of times that the length of a received mute signal exceeds the specified period
Detection Setting	1 to 5000 ms
Parity Error (*1)	Counts the number of times that the input signal's parity bit and the parity bit recalculated by the instrument differ
Validity Error (*1)	Counts the number of times that the input signal's validity bit is 1
CRC Error (*1)	Counts the number of times that the CRC of the channel status bits and the calculated CRC are different
Code Violation (*1)	Counts the number of times that the state of the input signal's biphase modulation is abnormal
Elapsed Time	Displays the amount of time that has elapsed since the instrument was reset
Channel Status Bits	Dump display, text display
User Data Bits	Dump Display

*1 This feature is not supported during MADI input.

Loudness Display (4K 2-screen display is not supported)

Function	Loudness chart display, numeric display, log, level meter display, peak value display
Supported Standard	ITU-R BS.1770, ARIB TR-B32, EBU R128, ATSC A/85
Measurement Channel	Simultaneous measurement of two audio sources
2K, 4K	
Mode (Main)	Monaural, stereo, 5.1, user specified channel
Mode (Sub)	Off, monaural, stereo
Channel Selection	User-defined assignment of eight channels
LFE Gain	0 to 10 times
8K	
Mode (Main)	22.2, 5.1, stereo
Mode (Sub)	Off, 5.1, stereo
Channel	Fixed assignment
LFE Gain	0 to 10 times
Measurement Trigger	Manual (panel), remote, timecode, mute
Measurement Mode	BS1770, ARIB, EBU, ATSC, CUSTOM
Target Level	
BS1770	-24.0 LKFS
ARIB	-24.0 LKFS (±1 LK)
EBU	-23.0 LUFS (±1 LU)
ATSC	-24.0 LKFS (±2 LK)
CUSTOM	-25.0 to -23.0 LKFS
Average Time	
Momentary Loudness	200 to 10000 ms
Short-term Loudness	200 to 10000 ms
Chart Display	
1 During Audio Measurement	Graph display of integrated loudness and momentary or short-term loudness
2 During Audio Measurement	Graph display of integrated, momentary, or short-term loudness
Measurement Time	2min, 10min, 30min, 1hour, 2hour, 6hour, 12hour, 24hour
MAG	Zoomed display of the target level from -18 to +9 (LK/LU)
Numeric Display	Absolute value and relative value displays of integrated loudness and momentary or short-term loudness
Integrated Loudness	Displayed in red when the target level range is exceeded
Momentary, Short-term Loudness	Displayed in red when the target level is exceeded
Log	
Log Time	Up to 24 hours
File	
Log	Saves gating block loudness in CSV format
Summary	Saves settings and measurement results in text format

Level Meter Display	
2K, 4K	Displays level meters for eight channels
8K	Displays level meters for 32 channels
Peak Value Display	Displays peak values of a measurement channel numerically

* For 2K or 4K, loudness display is possible only when CH Mode is set to 8ch.
For 8K, loudness display is possible only when CH Mode is set to 32ch.

3.27 Status Display

Signal Detection	Detects the presence of an SDI signal
Format Display	Displays the video signal format
Frequency Deviation Display	
Function	Displays the sampling frequency deviation
	Displays an error if ±10 ppm is exceeded
Measurement Range	±100 ppm
Precision	±2 ppm
Equivalent Cable Length Display	
Function	Displays SDI signal attenuation in terms of cable length
	Displays an error if the specified cable length is exceeded
Supported Cables	
12G, 6G	L-5.5CUHD
3G, HD	LS-5CFB, 1694A
Display Range	
12G, 6G	< 10 m, 10 to 80 m, > 80 m
3G	< 10 m, 10 to 100 m, > 100 m
HD	< 10 m, 10 to 130 m, > 130 m
Precision	
12G, 6G, 3G, HD	±20 m
Resolution	10 m
Error Count Display	Up to 999999 errors for each error type
Count Period	1 second, 1 field (frame)
Embedded Audio Channel Display	
	Displays the embedded audio channel numbers

* If the input signal is 3G-B-DL, only stream 1 is supported.

SDI Signal Error Detection	
CRC Error	Detects 3G and HD signal transmission errors
TRS Position Error	Detects TRS embedding position errors
TRS Code Error	Detects TRS protection bit errors
Line Number Error	Detects errors with the line numbers embedded in 3G and HD signals
Illegal Code Error	Detects data within the range of 000 to 003h and 3FC to 3FFh in locations other than TRS and ADF

Ancillary Data Packet Error Detection

Checksum error	Detects ancillary data transmission errors
Parity Error	Detects ancillary data header parity errors
Embedded Audio Packet Error Detection (*1)	
BCH Error	Detects audio packet transmission errors
DBN Error	Detects audio packet continuity errors
Parity Error	Detects audio packet parity errors
Embedded Position Error	Detects the presence of audio in lines where it should not be embedded
Sample Counter Error	Detects asynchronous audio by measuring the number of audio samples

*1　If the input signal is 3G-B-DL, only stream 1 is supported.

Video Error Detection (4K 2-screen display is not supported)

	8K signals are down converted internally to 4K and then detected.
Freeze Error	Detects freezing of video within the specified time range
Detection Method	Video interval checksum
Time Specification	2 to 300 frames
Black Error	Detects video blackouts
Black Level Specification	0 to 100%
Area Specification	1 to 100%
Time Specification	1 to 300 frames
Level Error	Detects luminance level errors and chrominance level errors
Luminance Level Detection Range	
Upper limit	-51 to 766 mV
Lower Limit	-51 to 766 mV
Chrominance Level Detection Range	
Upper limit	-400 to 399 mV
Lower Limit	-400 to 399 mV
Black Line Error	Detects consecutive black-level lines as error lines and displays the start line number and end line number of the consecutive error lines
Black Level Specification	0 to 100 %

Gamut Error — Detects gamut errors

Detection Range

Upper limit — 90.8 to 109.4%

Lower Limit — -7.2 to 6.1%

Low-Pass Filter

Format	Low-Pass Filter	
	HD: 1 MHz	HD: 2.8 MHz
HD 1280×720	Approx. 1 MHz	Approx. 2.8 MHz
HD 1920×1080 (frame rate ≤ 30 Hz)	Approx. 1 MHz (IEEE STD 205)	Approx. 2.8 MHz
HD 1920×1080 (frame rate > 30 Hz)	Approx. 2 MHz	Approx. 5.5 MHz
HD 2048×1080 (frame rate ≤ 30 Hz)	Approx. 1 MHz (IEEE STD 205)	Approx. 2.8 MHz
HD 2048×1080 (frame rate > 30 Hz)	Approx. 2 MHz	Approx. 5.5 MHz
4K 3840×2160 (frame rate ≤ 30 Hz)	Approx. 4 MHz	Approx. 11 MHz
4K 3840×2160 (frame rate > 30 Hz)	Approx. 8 MHz	Approx. 22 MHz
4K 4096×2160 (frame rate ≤ 30 Hz)	Approx. 4 MHz	Approx. 11 MHz
4K 4096×2160 (frame rate > 30 Hz)	Approx. 8 MHz	Approx. 22 MHz

Area Specification — 0.0 to 5.0%

Time Specification — 1 to 60 frames

Composite Gamut Error — Detects level errors that occur when component signals are converted to composite signals

Detection Range

Upper limit — 90.0 to 135.0%

Lower Limit — -40.0 to 20.0%

Low-Pass Filter — The same as the gamut error

Area Specification — 0.0 to 5.0%

Time Specification — 1 to 60 frames

SDI Analysis Features

Event Log Display

Function — Records detected errors, events—such as the instrument switching between input signals, and timestamps.

Log Capacity — Up to 1000 events

Operation — Logs all events from start to finish

Data Output — Overwrite mode, Stop after 1,000 events

Data Dump Display

Display Format — Displays serial data sequence or displays each color component separately

HD, 3G-A, 3G-B-DS — PICTURE, stream 1, stream 2

3G-B-DL — PICTURE, link A, link B

HD(DL) — PICTURE, link A, link B

3G(DL)-2K — PICTURE, link 1, link 2

3G(DL)-4K — PICTURE, link 1, link 2

3G(QL), HD(QL) — PICTURE, link 1, link 2, link 3, link 4

6G, 12G — PICTURE, sub1, sub2, sub3, sub4

12G(QL), 12G(DL) — PICTURE, sub1 to sub16

Display Format Details

PICTURE	Links or streams 1 and 2 are combined and displayed in a picture structure.
Stream 1/2	Displays each stream in a transmission structure
Link A, B, 1, 2, 3, 4	Displays the selected link
Sub 1 to 16	Displays the HD sub image in a transmission structure.
Line Select	Displays the selected line
Sample Select	Displays from the selected sample
Jump Feature	Jumps to an EAV or SAV
Data Output	Text output to USB memory

Phase Difference Display

Function	Displays the phase difference between a reference signal and an SDI signal numerically and graphically
Reference Signal	
HD, 3G-A, 3G-B-DL	external sync signal, Ach
3G-B-DS	External sync signal
HD(DL)	External sync signal, Ach, Cch
3G(DL)-2K	External sync signal, Ach, Cch
3G(DL)-4K	External sync signal, Ach, Cch
HD(QL), 3G(QL)	External sync signal, Ach
6G, 12G	External sync signal
12(DL)	Ach, Cch
12(QL)	External sync signal, Ach
Display Range	
Vertical	1 frame For 3G-B-DL 47.95P to 60P, ±1 frame measurement possible
Horizontal	±1 line

* If the reference signal is set to an external sync signal, the measured phase may vary by ±1 clock depending on the timing when the external sync signal or SDI signal is connected or disconnected or when the power is turned on and off.

SDI Ancillary Data List Display

List Display Details	Presence or absence of each ancillary data type, embedded line number, and number of packets per frame
Dump Display	The selected ancillary data is displayed in hexadecimal or binary.

Payload ID Display

Supported Standard	SMPTE ST 352
Displayed Contents	Analyzes and displays payload information
Display Format	Text and binary

Displaying Audio Control Packets

Supported Standard	SMPTE ST 299-1, SMPTE ST 272
Displayed Contents	Displays audio control packet analysis
Display Format	Text, hexadecimal, binary
Display Format	1 to 8

Japanese Closed Caption Display (*1)

Supported Standard	ARIB STD-B37
Displayed Contents	Analysis display of closed caption signals
Display Format	Text, hexadecimal, binary

English Closed Caption Display (4K 2-screen display or 8K is not supported)

Supported Video Formats	HD, 3G-A, 3G-B-DL, HD(DL) (close caption decoding only for link A), 3G(DL)-2K (3G-B not supported, close caption decoding only for link 1), 3G(DL)-4K (close caption decoding only for link 1), HD(QL) (close caption decoding only for link 1), 3G(QL) (close caption decoding only for link 1), 6G (close caption decoding only for sub 1), 12G (close caption decoding only for sub 1)

CDP Packet Display Details

CDP packet header information

Presence or absence of timecode packet,
Presence or absence of closed caption packet and validity of this packet,
Presence or absence of closed caption service packet and validity of this packet,
Presence or absence of the FUTURE data packet

Time Code	When time code packets are present
Closed Caption Data	When valid closed caption packets are present

Presence or absence of CC1 to 4, TEXT1 to 4, XDS packets

XDS Packet Display Details

Contents adviser information
Copy management information

Display content of Program Description packet

Stuffing Descriptor
AC3 Audio Descriptor
Caption Service Descriptor
Content Advisory Descriptor
Extended Channel Name Descriptor
Service Location Descriptor
Time-Shifted Service Descriptor
Component Name Descriptor
DCC Arriving Request Descriptor
DCC Arriving Request Descriptor
Redistribution Control Descriptor

Inter-Stationary Control Signal (NET-Q) Display (*1)
ARIB STD-B39
Analysis display of inter-stationary control signals
Text, hexadecimal, binary
Q signal logging
Analysis display of the format ID
Outputs Q signal logs in CSV format through a USB memory device

Data Broadcast Trigger Signal Display (*1)
ARIB STD-B35
Text, hexadecimal, binary

V-ANC User Data Display (*1)
ARIB TR-B23
Hexadecimal, binary

AFD Packet Display　SMPTE ST 2016-3
Text, hexadecimal, binary

User-Defined ANC Packet Display
DID, SDID
Y, C
Hexadecimal, binary

*1　Supported video formats are as follows:
HD, 3G-A, HD(DL) (close caption decoding only for link A),
HD(QL) (close caption decoding only for link 1), 3G(QL) (3G-B not supported, close caption decoding only for link 1),
6G (close caption decoding only for sub 1), 12G (close caption decoding only for sub 1)
12G(QL) (close caption decoding only for sub 1), 12G(DL) (close caption decoding only for sub 1)

Lip Sync Display (4K 2-screen display is not supported)

Displays the phase difference between the video and audio

Lip Sync Measurement

Function	Measures the time difference between the SDI signal and digital audio signal and displays the results numerically and graphically
Reference Signal	A Leader TSG that supports lip syncing (*1)
Measurement Method	Measures the time difference when the luminance level of the video signal exceeds the specified value and when the audio level signal exceeds the specified value
Luminance Level Setting	25 to 100%
Audio Signal Level Setting	-30 to 0 dBFS
Supported Audio Signals	Embedded audio signal, MADI signal
Measurement Range (Bar Display)	±50 ms, ±100 ms, ±500 ms, ±1.0 s, ±2.5 s
Measurement Range (Numeric Display)	±3999 ms
Measurement Resolution	1 ms

*1　TSG patterns not made by Leader may be supportable by specifying the video signal setting and audio signal setting.

3.28 Eye Pattern

SDI Input Connector	SDI INPUT 1 to 4 (select an input terminal to display)
Display	Displays the input SDI waveform before equalizing
Number of Displays	
1-Screen Display	Displays the eye pattern of the selected filter in a single screen
2-Screen Display	Displays the timing filter and eye pattern of the selected filter in two screens
Waveform Display Color	7 colors to choose from
Scale Display Color	7 colors to choose from
Method	Equivalent time sampling
Amplitude Accuracy	800 mV ± 5 % (for 800 mV input)
Time Axis	
2 UI Display	
12G	12.5 ps/div
6G	25ps/div
3G	50 ps/div
HD	100 ps/div
4 UI Display	
12G	25 ps/div
6G	50ps/div
3G	100 ps/div
HD	200 ps/div
16 UI Display	
12G	100 ps/div
6G	200ps/div
3G	400 ps/div
HD	800 ps/div
Time Axis Accuracy	±3 %
Jitter Filter	
10Hz	HPF 10Hz
100Hz	HPF 100Hz
1 kHz	HPF 1 kHz
100 kHz	HPF 100 kHz
TIMING	HPF 10Hz
ALIGNMENT	
12G, 6G	HPF 100 kHz
3G, HD	HPF 100 kHz
Cursor Measurement	Amplitude measurement using Y cursors Time measurement using X cursors Rise time and fall time measurement using the TrTf cursor

Automatic Measurement Items	
	Eye pattern's amplitude
	Rise time (the time for the signal to rise from 20 to 80 % of its amplitude)
	Fall time (the time for the signal to fall from 80 to 20 % of its amplitude)
	Timing jitter
	Jitter
	Rising edge overshoot
	Falling edge overshoot
Histogram Display	Displays the frequency distribution of the eye pattern waveform amplitudes

3.29 Jitter Display

SDI Input Connector	SDI INPUT 1 to 4 (select an input terminal to display)
Display	Displays the jitter component of an SDI signal
Number of Displays	
1-Screen Display	Displays the jitter waveform of the selected filter in a single screen
2-Screen Display	Displays the timing jitter and the jitter waveform of the selected filter in two screens
Waveform Display Color	7 colors to choose from
Scale Display Color	7 colors to choose from
Method	Phase detection method
Gain	×16, ×8, ×4, ×2, ×1
Measurement Range	
12G	
×16	0.00 to 1.20 UI
×4	1.20 to 4.80 UI
×2	4.80 to 9.60 UI
×1	9.60 to 19.20 UI
3G, HD, 6G	
×8	0.00 to 1.20 UI
×2	1.20 to 4.80 UI
×1	4.80 to 9.60 UI
Time Axis	1H, 2H, 1V, 2V (*1)
Time Axis Accuracy	±3 %

Jitter Filter	
10Hz	HPF 10Hz
100Hz	HPF 100Hz
1 kHz	HPF 1 kHz
100 kHz	HPF 100 kHz
TIMING	HPF 10Hz
ALIGNMENT	
12G, 6G	HPF 100 kHz
3G, HD	HPF 100 kHz
Cursor Measurement	Jitter value measurement through the use of cursors
Automatic Measurement Display Feature	
	Displays the jitter value in seconds (sec) and unit intervals (UI)
Automatic Measurement Items	
	Timing jitter, alignment jitter, jitter
Accuracy	Input jitter frequency: 1 kHz. Filter setting: 10 Hz, within measurement range
0 UI < automatic measured value ≤ 1 UI	
	±10 % + 0.07 UI
1 UI < automatic measured value ≤ 7 UI	
	±10 %

*1 2V display is not possible when the input signal is progressive except for 60/59.94/50P of HD(DL).

3.30 Tally Display

Number of Displays	3 (TALLY-1, TALLY-2, TALLY-EXT) (*1)
Display Colors	7 colors to choose from
Control Method	Remote connector, RS-422/485 connector

*1 The number of displays per channel. Arranged using the customized layout feature or the enhanced layout feature.

3.31 Camera ID Display

Number of Displays	2 (LABEL-1, LABEL-2) (*1)
Iris Display	1 (IRIS) (*1)
Control Method	Instrument, RS-422/485 connector

*1 The number of displays per channel. Arranged using the customized layout feature or the enhanced layout feature.

3.32 General Specifications

Environmental Conditions	
Operating Temperature	0 to 40 °C
Operating Humidity Range	85 %RH or less (no condensation)
Optimal Temperature	10 to 30 °C
Operating Environment	Indoors
Elevation	Up to 2,000 m
Overvoltage Category	Ⅱ
Pollution Degree	2
Power Requirements	
Voltage	90 to 250 VAC
Frequency	50/60Hz
Power Consumption	300 W max.
Dimensions	223 (W) × 172 (H) × 360 (D) mm (excluding protrusions)
Weight	6.5 kg max. (excluding accessories)
Accessories	Power cord 1
	Cover/Inlet stopper..... 1
	Instruction manual (CD-ROM) 1
Items Sold Separately	
LV7290	Ethernet connection remote controller