Leader

LT4670

SYNC GENERATOR

LT4670-SER01	GNSS
LT4670-SER02	SDI
LT4670-SER03	PTP
LT4670-SER04	25G-IP/12G-SDI TSG
LT4670-SER11	POWER UNIT
LT4670-SER21	4K 3G-Quad Link

Specification

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1 GENERAL

The LT4670 is a 1U full-rack size sync signal generator that outputs analog video sync signals and audio word-clock signals. The genlock function allows operation synchronized with input signals.

The genlock function has a stay-in-sync function that maintains the phase when an error occurs in the input analog video sync signal. Adding the power option provides redundant operation. The power supply unit and fan can be replaced without turning off the power of the LT4670 main unit. These features make it possible to configure a highly reliable system.

The LT4670 has six independent standard outputs of the analog sync signal output, digital audio output, word-clock output, and LTC I/O. Also, options are available for GNSS and PTP synchronization, arbitrary pattern output using 12G-SDI, 3G-SDI (4K Quad), HD-SDI, SD-SDI, and 25G-IP etc. These options are designed to enable the management of the optimal synchronization system for your application.

2 FEATURES

2.1 LT4670

Genlock Function

Various output signals can be synchronized by applying NTSC/PAL black burst signals, which are analog video sync signals, and HDTV tri-level sync signals.
NTSC/PAL black burst signal with field reference pulse and NTSC black burst signal with 10 field IDs are also supported.
The 10 MHz CW lock is also supported as a standard feature.

Stay-in-Sync and Slow Lock Functions

A stay-in-sync function is available in case errors occur at the genlock input. In addition, a slow lock function is available to reduce the shock that occurs when genlock is performed again based on stay-in-sync. This makes it possible to construct an extremely reliable synchronization system.

Analog Video Sync Signal Output

Six analog video sync signals can be output. The phase of each output can be adjusted independently.
NTSC/PAL black burst signal with field reference pulse and NTSC black burst signal with 10 field IDs are also supported.

Word-Clock Signal Output

The LT4670 can output a 48 kHz word-clock signal synchronized with video signals.

AES/EBU Signal Output

This option can output a 48 kHz AES/EBU signal synchronized with video signals. (AES/EBU connector)
It is also equipped with a AES/EBU signal output compatible with DARS. (SILENCE connector)

CW/1PPS Output

The CW/1PPS output can output 10 MHz CW or 1PPS, whichever is selected.

Time Code I/O

The time code generator can run in free run mode based on internal time information. Based on the NTP server, LTC, VITC, GNSS (SER01), or PTP (SER03) time information, it can embed the LTC3 system output and analog video sync signal output in VITC, as well as the SDI (SER02/SER04) output in ATC (LTC/VITC).

LTC I/O

The LTC has three independent outputs for an input. An offset time can be set for each output with respect to the frame rate and reference time.

Remote Connector

The remote connector can be used to load presets and transmit two alarm outputs.

Inter-instrument Synchronization Control (L-SYNC)

In a redundant system, the time can be synchronized by connecting the main and backup devices that are synchronized with the same analog video sync signal via L-SYNC.

Real Time Clock

The real time clock is backed up by a battery. There is no need to reset the clock even when the power is turned off and then back on.

Ethernet

Control is exerted based on the SNMP. When an error is detected, a TRAP is issued. Also, this instrument can be controlled using the HTTPS (future support), HTTP, and REST-API (future support).
When connected to an NTP server as an NTP client, the instrument can be used for internal clock synchronization or as an NTP server.

Preset Memory Function

Up to 10 presets can be saved. Convenient registered presets can be recalled during operation. The LT4670 can be started with the same settings every time.

External Memory Support

The log can be saved and preset data can be written and saved from the panel using USB memory devices.

Logging Function

The operation status can be logged to internal memory or external memory.

Last Memory Function

When the power is turned on, it starts up with the settings when the power was turned off last time.

2.2 LT4670-SER01 (GNSS)

GNSS Sync

A GNSS antenna can be connected to generate and output signals by locking to the frequency and clock obtained from the GPS, GLONASS, GALILEO, BDS, and QZSS.
It also features a stay in sync function, which retains the phase and frequency of the output signal when GNSS signals are lost.

2.3 LT4670-SER02 (SDI)

Triple-rate SDI Ready

The SDI signal output supports 3G-SDI (level A and level B), HD-SDI, and SD-SDI. There are two independent SDI signal output connectors, and different patterns and phases can be set for each.
Also, two SER02 units can be mounted, and up to four independent SDI signals can be output.
Moreover, adding a 4K option (SER21) supports the 4K 3G-Quad Link.

User Pattern Generation

In addition to internal patterns such as the color bar, SD and HD (2K) user patterns can be output.

ID Character Overlay

ID characters can be overlaid at any position on the display. In addition, ID characters can be scrolled horizontally or displayed in a blinking state for checking whether the display has frozen.

Logo Mark Overlay

24-bit full-color bitmap data can be overlaid as a logo mark at any position on the display at a 640 (dots) × 480 (lines) VGA size.

Safety Area Markers

90% and 80% safety area markers can be overlaid on the display. For 3G-SDI and HD-SDI, a 4:3 aspect marker can be overlaid.

Pattern Scrolling

This option is equipped with a function for scrolling patterns in eight directions. The moving speed can be varied.

Moving Box

A moving box can be overlaid on the display. Its color, size, and moving speed can be varied.

Circle

90%, 80%, and 70% circles can be overlaid on the display. Their brightness can be changed, and they can be displayed in a blinking state.

Time Code

A time code can be overlaid at any position on the display. Its character size and brightness can be changed.

Audio Embedding

Embedded audio of 16 channels (four channel × four groups) can be embedded. The frequency, level, and the like can be set for each channel.

Lip Sync Pattern

Lip sync patterns in which the video and audio are synchronized can be output. By using a waveform monitor that features a lip sync measurement function, such as the Leader's LV5600, it is possible to measure the offset between the video and audio in SDI signal transmissions.

2.4 LT4670-SER03 (PTP)

PTP Leader Function

This option supports the Precision Time Protocol defined in IEEE1588-2008 and operates as a PTP grand master. SMPTE2059, AES67, and General profiles are supported. The PTP time source is obtained from the internal clock, NTP server, GNSS, VITC, or LTC.

PTP Follower Function

When a host PTP grand master is present in the system, this option operates as a PTP follower and can operate as a PTP leader for lower devices.

Two Independent PTP Ports

Since two PTP engines are mounted, a PTP system can be constructed for each of them as an independent grand master.
The two engines can be used as followers. (The leader can be selected automatically or arbitrarily by the user.)
It is also possible to use one engine as a follower and the other as the leader.

10GbE Support

A 10GbE SFP+ module, sold separately, can be used.

Local PTP Function

When genlocked to the analog video sync signal or HDTV tri-level sync signal, this function obtains time information from an external time source, such as a GNSS or NTP server. It can adjust the time according to the phase information of the genlocked sync signal and redistribute the PTP time.

2.5 LT4670-SER04 (25G-IP)

This section describes the IP functions of the LT4670-SER04 (25G-IP/12G-SDI TSG).

IP Signal Generation

IP test pattern signals can be generated.
The IP transmission standard is SMPTE ST 2110-20/30/31/40. This function can generate 2K and 4K video signal test patterns. ST-2022-6 is also supported.
For IP signals, up to four streams can be output per port within the band.
(IP test patterns specified with SDI outputs are output.)

Network Synchronization

Video and audio test signals can be generated in sync with the PTP (Precision Time Protocol) of SMPTE ST 2059.

Packet Errors (future support)

Packet loss and packet error test signals can be generated.

Packet Jitter (future support)

Packet jitter can be added to test signals.

2.6 LT4670-SER04 (12G-SDI)

This section describes the SDI functions of the LT4670-SER04 (25G-IP/12G-SDI TSG).

12G-SDI Ready

The SDI signal output supports 12G-SDI, 3G-SDI (level A and level B), HD-SDI, and SD-SDI. There are four independent SDI signal output connectors, and different patterns and phases can be set for each.

4K Internal Pattern Generation (future support)

In addition to the internal patterns of LT4670-SER04, the following patterns can be output.

・UHD Color Bar ARIB STD-B66
・HLG CB ITU-R BT.2111 HLG narrow range
・S-LOG3(Live HDR) Ver1.11 narrow range scale

User Pattern Generation

In addition to internal patterns such as the color bar, SD, HD (2K), and 4K user patterns can be output.

ID Character Overlay

ID characters can be overlaid at any position on the display. In addition, ID characters can be scrolled horizontally or displayed in a blinking state for checking whether the display has frozen.

Logo Mark Overlay

24-bit full-color bitmap data can be overlaid as a logo mark at any position on the display at a 640 (dots) × 480 (lines) VGA size.

Safety Area Markers

90% and 80% safety area markers can be overlaid on the display. For 12G-SDI, 3G-SDI, and HD-SDI, a 4:3 aspect marker can be overlaid.

Pattern Scrolling

This option is equipped with a function for scrolling patterns in eight directions. The moving speed can be varied.

Moving Box

A moving box can be overlaid on the display. Its color, size, and moving speed can be varied.

Circle

90%, 80%, and 70% circles can be overlaid on the display. Their brightness can be changed, and they can be displayed in a blinking state.

Time Code

A time code can be overlaid at any position on the display. Its character size and brightness can be changed.

Audio Embedding

Embedded audio of 16 channels (four channel × four groups) can be embedded. The frequency, level, and the like can be set for each channel.

Lip Sync Pattern

Lip sync patterns in which the video and audio are synchronized can be output. By using a waveform monitor that features a lip sync measurement function, such as the Leader’s LV5600, it is possible to measure the offset between the video and audio in SDI signal transmissions.

2.7 LT4670-SER11 (POWER UNIT)

Redundant Power Supply

You can make the power supply redundant.
When errors occur in power supply units, alarms are indicated on the instrument panel. Errors can also be output as alarms using SNMP.

2.8 LT4670-SER21 (4K 3G-Quad Link)

4K 3G-Quad Link Output

Two LT4670-SER02 (SDI) options are featured. When this option is enabled, the 4K 3G-Quad Link can be output.

4K Internal Pattern Generation (future support)

In addition to the internal patterns of LT4670-SER02, the following patterns can be output.

・UHD Color Bar ARIB STD-B66
・HLG CB ITU-R BT.2111 HLG narrow range
・S-LOG3(Live HDR) Ver1.11 narrow range scale

User Pattern Generation

In addition to internal patterns such as the color bar, 4K user patterns can be output.

ID Character Overlay

ID characters can be overlaid at any position on the display. In addition, ID characters can be scrolled horizontally or displayed in a blinking state for checking whether the display has frozen.

Logo Mark Overlay

24-bit full-color bitmap data can be overlaid as a logo mark at any position on the display at a 640 (dots) × 480 (lines) VGA size.

Safety Area Markers

90% and 80% safety area markers can be overlaid on the display. A 4:3 aspect marker can also be overlaid.

Pattern Scrolling

This option is equipped with a function for scrolling patterns in eight directions. The moving speed can be varied.

Moving Box

A moving box can be overlaid on the display. Its color, size, and moving speed can be varied.

Circle

90%, 80%, and 70% circles can be overlaid on the display. Their brightness can be changed, and they can be displayed in a blinking state.

Time Code

A time code can be overlaid at any position on the display. Its character size and brightness can be changed.

Audio Embedding

Embedded audio of 16 channels (four channel × four groups) can be embedded. The frequency, level, and the like can be set for each channel.

Lip Sync Pattern

Lip sync patterns in which the video and audio are synchronized can be output. By using a waveform monitor that features a lip sync measurement function, such as the Leader's LV5600, it is possible to measure the offset between the video and audio in SDI signal transmissions.

3 STANDARDS

3.1 LT4670

General Specifications

Model Number	LT4670
Model Name	SYNC GENERATOR
Use	1U full-rack size sync signal generator that outputs analog video sync signal and audio word-clock signals
Environmental Conditions	
Operating Temperature	0 – 40°C
Operating Humidity Range	85% RH or less (no condensation)
Optimal Temperature	10 – 35°C
Operating Environment	Indoors
Operating Altitude	Up to 2,000 m
Overvoltage Category	II
Pollution Degree	2
Power Supply	
Voltage	100 – 240 VAC
Voltage Variation	±10%
Power Consumption	150 W max. (when all options are used)
Dimensions	482 (W) × 44 (H) × 400 (D) mm (excluding protrusions)
Weight	4.2 kg (excluding options) 5.4 kg (when SER01, SER02×2, SER03, and SER11 are installed) 5.4 kg (when SER01, SER03, SER04, and SER11 are installed)
Accessories	Power cord AC cord clamp General safety summary
Sold Separately	SFP transceiver (LC2141 / LC2142 / LC2148 / LC2149 / LC2151 / LC2152) GNSS antenna Fan unit (LP2184) LTC cable (LC2185)(for connecting with LT4448) L-SYNC cable (LC2186)

Power Supply Unit

Number of Units in Main Unit	
Standard	1
Maximum	2 (when LT4670-SER11 is installed)
Power Supply Redundancy	When LT4670-SER11 is installed
Replacement Method	The installed LT4670-SER11 can be replaced without turning off the power of the main unit.
Alarm	A power supply alarm is indicated on the LED and LCD and notified by an SNMP trap.

Fan Unit

Number of Fans	2 (one on front, one on rear)
Replacement Method	The fan can be stopped using the panel and replaced without turning off the power of the main unit.
Alarm	A fan alarm is indicated on the LED and LCD and notified by an SNMP trap.

Corresponding Standard

Analog Video Sync Signal	
NTSC Black Burst Signal	SMPTE ST 170, SMPTE ST 318, SMPTE RP 154
PAL Black Burst Signal	ITU-R BT 1700, EBU N14
HD Tri-level Sync Signal	SMPTE ST 240, SMPTE ST 274, SMPTE ST 296
AES/EBU Signal	ANSI S4.40, AES3-2009, AES11-2009, SMPTE ST 276
LTC Signal	SMPTE 12M-1
Phase Management	SMPTE ST 2059-1

I/O Connectors

Genlock Input Connector	
Connector	2 BNC connectors
Input Signal	Analog composite sync signal
HD Tri-level Sync Signal	Analog composite sync signal
Format	Loop-through
Input Impedance	47 kΩ
Maximum Input Voltage	±5 V (DC + peak AC)
Operating Input Level Range	±6 dB
External Lock Range	±5 ppm
Jitter	1 ns (when genlock is in use)
10 MHz CW Input Connector	
Connector	1 BNC connector (used in combination with the genlock input connector)
Input Impedance	47 kΩ (used with 50 Ω terminated to the loop-through)
Input Signal Level	0.5 - 1 Vrms (50 Ω termination)
Input Signal Frequency	10 MHz
Locking Frequency Range	±5 ppm
10 MHz CW/1PPS Output Connectors	
Connector	1 BNC connector (used in combination with 10 MHz CW and 1PPS)
Output Amplitude Signal Level	
10 MHz CW	2 Vp-p ± 20% (1 Vrms) for square waves; 50 Ω termination
1PPS	4.8 ± 0.5 V (no termination, high level) 2.4 ± 0.25 V (50 Ω termination, high level)
Output Impedance	50 Ω unbalanced
Output Signal Frequency	10 MHz/1PPS

LTC I/O Connector

Connector	D-sub 26-pin (female)
LTC	
Number of Inputs	1
Input Impedance	1 kΩ (balanced) 500 Ω (unbalanced)
Input Signal Level	0.5 - 4 Vp-p
Number of Outputs	3
Output Impedance	24 Ω balanced
Output Signal Level	2 Vp-p ± 10%

Analog Video Sync Signal Output Connector

Connector	6 BNC connectors, 6 outputs
Output Signal	NTSC black burst signal, PAL black burst signal, HD tri-level sync signal
Output Impedance	75 Ω
Sync Level	
NTSC	40±1IRE
PAL	-300±6mV
HD	±300±6mV
Blanking	0 ± 15 mV

AES/EBU Digital Audio Output Connector

Connector	1 DIN 1.0/2.3 connector
Output Amplitude	1 Vp-p ± 0.1 V
Output Impedance	75 Ω unbalanced

AES/EBU Silence Output Connector

Connector	1 DIN 1.0/2.3 connector
Output Amplitude	1 Vp-p ± 0.1 V
Output Impedance	75 Ω unbalanced

Word-Clock Output Connector

Connector	1 DIN 1.0/2.3 connector
Output Frequency	48 kHz
Output Amplitude	4.8 V or more (no termination, high level) 2.4 V or more (75 Ω termination, high level)

Control Connectors

Ethernet Port	
Standard	IEEE 802.3
Protocol	
SNMP v2c/v3	
	Command control, status query, trap transmission
REST-API (future support)	Command control, status query
HTTP/HTTPS (HTTPS to be supported in the future)	
	Monitoring and operation using a browser
NTP	Internal clock synchronization, time distribution
Connector	RJ-45
Type	10BASE-T, 100BASE-TX, 1000BASE-T (auto switching)
USB Port	
Standard	USB 2.0
Supported Media	USB memory device
Supported Format	FAT32
Functions	Preset, logo, ID character, and user pattern loading; preset and log saving; MIB file retrieval; HTTP authentication key retrieval (future support); firmware update
Connector	USB Type A
Remote Connector	
Connector Shape	D-sub 26-pin (female)
Locking Screw	Inch screw (No.4-40UNC)
Number of Ports	1
Control Signal	
Preset Recall	LV-TTL level (low active)
Alarm Output	HC-CMOS level
Input Voltage Range (Preset Recall)	0 - 5 VDC All inputs are pulled up to +3.3 V (control is also possible using +5 V).
Output Voltage Range (Alarm Output)	
	0 - 5 VDC
Functions	Preset recall Alarm output (when an error occurs, when the fan malfunctions, or when the power supply malfunctions)

Inter-instrument Synchronization Connector (L-SYNC)

Connector Shape	D-sub 15-pin (female)
Number of Ports	1
Control Signal	LV-CMOS 6 main-side outputs 6 backup-side inputs
Input Voltage Range	0 - 3.3 VDC
Function	The time of the two instruments is synchronized in a redundant configuration.

* It is not supported when the reference signal format is 23.98 Hz.

LCD

Number of Characters	24 characters × 2 lines
Backlight	On/off

Genlock Function

Signal Format	NTSC BB, NTSC BB+REF, NTSC BB+ID, NTSC BB+REF+ID, PAL BB, PAL BB+REF, 525/59.94I, 525/59.94P, 625/50I, 625/50P, 1125/60P, 1125/59.94P, 1125/50P, 1125/60I, 1125/59.94I, 1125/50I, 1125/30P, 1125/29.97P, 1125/25P, 1125/24P, 1125/23.98P, 1125/24PsF, 1125/23.98PsF, 750/60P, 750/59.94P, 750/50P, 750/30P, 750/29.97P, 750/25P, 750/24P, 750/23.98P
Timing Adjustment	
Adjustment Range	
FINE	±100 (in units of 0.5 ns)
Reference Source	
Internal Reference Signal	INTERNAL
External Reference Signal	GENLOCK FMT-AUTO / GENLOCK FMT-MANUAL / 10MHz CW / GNSS (SER01) / PTP (SER03)
Recovery Mode	
AUTO	Resynchronizes according to the auto setting when the external reference signal recovers.
MANUAL	Retains the STAY IN SYNC state when the external sync signal recovers.
Auto Setting	
IMMEDIATE	Resets the lock when the external sync signal recovers.
FAST	Quickly resynchronizes when the external sync signal recovers.
SLOW	Slowly resynchronizes when the external sync signal recovers.

Manual Setting	
IMMEDIATE	Resets the lock when the external sync signal recovers and REFERENCE READJUST operation is performed.
FAST	Quickly resynchronizes when the external sync signal recovers and REFERENCE READJUST operation is performed.
SLOW	Slowly resynchronizes when the external sync signal recovers and REFERENCE READJUST operation is performed.
REFERENCE READJUST	Resynchronizes immediately.
Stay in Sync Function	Retains the frequency (video phase) immediately before error occurrence when an error occurs in the external reference signal. Retains the previous frequency if the 10 MHz CW signal is interrupted when 10 MHz CW is input.

Analog Video Sync Signal Output

Signal Format	Each of the 6 outputs can be configured independently. NTSC BB, NTSC BB+REF, NTSC BB+ID, NTSC BB+REF+ID, NTSC BB+SETUP, NTSC BB+S+REF, NTSC BB+S+ID, NTSC BB＋S+R+ID, PAL BB, PAL BB+REF, 525/59.94I, 525/59.94P, 625/50I, 625/50P, 1125/60P, 1125/59.94P, 1125/50P, 1125/60I, 1125/59.94I, 1125/50I, 1125/30P, 1125/29.97P, 1125/25P, 1125/24P, 1125/23.98P, 1125/24PsF, 1125/23.98PsF, 750/60P, 750/59.94P, 750/50P, 750/30P, 750/29.97P, 750/25P, 750/24P, 750/23.98P
Timing Adjustment	Each of the 6 outputs can be configured independently.
Adjustment Range	
NTSC Black Burst Signal	±5 frames
PAL Black Burst Signal	±2 frames
HD Tri-Level Sync Signal	1 frame (entire frame)
Adjustment Unit	
NTSC/PAL Black Burst Signal	In units of 0.0185 µs (54 MHz clock)
HD Tri-Level Sync Signal	In units of 0.0135 µs (74.25/1.001 MHz clock unit or 74.25 MHz clock unit)

AES/EBU Digital Audio Output

Timing Adjustment	
Adjustment Range	±1 AES/EBU frame (±511)
Adjustment Unit	In units of 512 fs (24.576 MHz)
Sampling Frequency	48 kHz sampling (synced with the video signal)
Resolution	20 bits, 24 bits
Pre-emphasis	OFF, 50/15, CCITT (only the CS bit is switched)
Frequency	SILENCE, 400 Hz, 800 Hz, 1 kHz
Level	-60 – 0 dBFS (in units of 1 dBFS)
Audio Click	OFF, 1, 2, 4 sec
Lip Sync	Synchronization with SDI-1
Sampling Clock Accuracy	Grade 2 (±10 ppm)

* The frequency, level, and audio click can be set for each channel.

AES/EBU Silence Output

Timing Adjustment	
Adjustment Range	±1 AES/EBU frame (±511)
Adjustment Unit	In units of 512 fs (24.576 MHz)
Sampling Frequency	48 kHz sampling (synced with the video signal)
Resolution	20 bits, 24 bits
Pre-emphasis	OFF
Frequency	SILENCE
Level	MUTE
Sampling Clock Accuracy	Grade 2 (±10 ppm)

* Supports DARS.
* When EQUAL TO AES/EBU is set to on, the same signal as the AES/EBU digital audio signal is output.

Word-Clock Output

Timing Adjustment	
Adjustment Range	±1 AES/EBU frame (±511)
Adjustment Unit	In units of 512 fs (24.576 MHz)

Time Code Function

Reference Time	Internal / NTP / LTC / VITC / GNSS (SER01) / PTP (SER03)
Frame Rate	30 / 29.97 / 25 / 24 / 23.98 Hz
Dropped Frame Mode	On/Off
JAM SYNC	
Application Setting	Set the application time with a timer.
ATC Setting	
LTC Insertion Setting	On/Off
VITC Insertion Setting	On/Off

Black Setting	
VITC Insertion Setting	On/Off
Superimposed Line	
NTSC	10 - 20 (*1)
PAL	6 - 22 (*2)
AES/EBU Setting	
Insertion Setting	On/Off
LTC Setting	
Output Setting	On/Off
Leap Second	
Application Setting	Set the application date/time with a timer. (The PTP (SER03) does not support timer setting.)
Daylight Savings Time	
Application Setting	Set the application date and time with a timer.

*1 When REF is included in the black format, it cannot be superimposed on the 10th line.
When ID is included in the black format, it cannot be superimposed on the 15th line.
*2 When the black format is PAL BB+REF, it cannot be superimposed on the 7th line.

Preset Function

Preset	Saves the panel settings.
Number of Presets	10
Recall Method	Panel, remote connector, SNMP, REST-API (future support), browser
Copy Method	Copy from this instrument to a USB memory device or copy from the USB memory device to this instrument.

* Logo data and device-specific information (IP address, time, etc.) cannot be saved.

Logging Feature

Saved Items	Genlock status change, instrument operation, alarm information, attention information
Number of Logs	Up to 1000
Copy Method	Copy from this instrument to a USB memory device.
Display	Panel, browser

3.2 LT4670-SER01 (GNSS)

I/O Connectors

GNSS Input Connectors	
Connector	1 BNC connectors
Input Impedance	50 Ω
Antenna, Pre-amp Power Supply	
Voltage	5 V / 3.3 V / OFF
Current	50 mA max. (built-in overcurrent protection circuit)

GNSS Lock

GNSS Receiver	
Receive Frequency	
GPS	1575.42MHz (L1)
GLONASS	1602 MHz + k×562.5kHz (L1OF) (k = -7,⋯,5,6)
GALILEO	1575.42MHz (E1-B/C)
BDS	1561.098MHz (B1)
GPS+QZSS	1575.42MHz (L1)
Status	GNSS No Fix, ADJUST FREQ TO GNSS, ADJUST PHASE TO GNSS, TRACKING, LOCK, STAY, RECOVERY
Stay in Sync Function	Retains the previous frequency and phase when the GPS, GLONASS, GALILEO, BDS, or GPS+QZSS signal is interrupted.

3.3 LT4670-SER02/SER04/SER21 (SDI)

This section describes the following options:

・LT4670-SER02 (SDI)
・SDI functions of the LT4670-SER04 (25G-IP/12G-SDI TSG)
・LT4670-SER21 (4K 3G-Quad Link)

Depending on the option added to the instrument, the supported SDI format differs as follows. See the items appropriate to the respective options.

Table 3-1 | SDI format

Option	2K			4K	
	SD-SDI	HD-SDI	3G-SDI	3G-Quad Link	12G-SDI
SER02	●	●	●	-	-
SER02×2 + SER21	●	●	●	●	-
SER04	●	●	●	●	●

Corresponding Standard

SDI Embedded Audio
12G, 3G, HD SMPTE ST 299
SD SMPTE ST 272
SDI Payload ID SMPTE ST 352

SDI Formats and Standards

Table 3-2| HD and SD video signal formats and standards

Color System	Quantization	Image	Frame (Field) Frequency/Scanning	Corresponding Standard
YC_BC_R 4:2:2	10bit	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 292-1 SMPTE ST 274
			30/29.97/25/24/23.98/P	
			30/29.97/25/24/23.98/PsF	SMPTE ST 292-1 SMPTE RP 211
		720×487	59.94/I	SMPTE ST 259
		720×576	50/I	

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

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

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

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

Table 3-5 | 3G-Quad Link video signal formats and standards

Division Transmission System	Color System	Quantization	Image	Frame Frequency/ Scanning	Corresponding Standard
2 sample interleave	YC_BC_R 4:2:2	10bit	3840×2160	60/59.94/50/P	SMPTE ST 425-5 SMPTE ST 2036-1
			4096×2160	60/59.94/50/48/47.95/P	SMPTE ST 425-5 SMPTE ST 2048-1
		12bit	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	10bit	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
		12bit	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

Table 3-6 | 12G video signal formats and standards

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

I/O Connectors

SDI Output Connector	
SER02	2 BNC connectors
SER04	4 Micro-BNC connectors
Output Impedance	75 Ω
Output Amplitude	800 mVp-p ± 10%
Output Return Loss	
5 MHz – 1.485 GHz	15 dB or more
1.485 GHz – 2.97 GHz	10 dB or more
2.97GHz - 6GHz	7 dB or more
6GHz - 12GHz	4 dB or more
Overshoot	Less than 10%
Rise and Fall Times	
12G	45 ps or less (20 – 80%)
3G	135 ps or less (20 – 80%)
HD	270 ps or less (20 – 80%)
SD	0.4 ns or more, 1.5 ns or less (20 – 80%)
DC Offset	0 ± 0.5 V

* For SER04, the value when the following Micro-BNC-BNC conversion cable is used is indicated.

Product Name:	Micro BNC Cable
Model:	DM2.5HWSC002EA-BJ
Length:	200 mm
Manufacturer:	Canare Electric Co., Ltd.

SDI Video Output

SDI Signal	
Bit Rate	
12G	11.880Gbps, 11.880/1.001Gbps
3G	2.970Gbps, 2.970/1.001Gbps
HD	1.485Gbps, 1.485/1.001Gbps
SD	270Mbps
Timing Adjustment	
Adjustment Range	Entire frame
Adjustment Unit	
V	Lines
H	Clocks (148.5 MHz, 148.5/1.001 MHz, 74.25 MHz, 74.25/1.001 MHz, 27 MHz)
Selecting the Timing Reference	SD and HD only; SERIAL only for 12G and 3G
SERIAL	Signals are output at the timing defined in the signal standard.
LEGACY	Signals are output at the same timing as Leader's conventional signal generators.

Test Patterns	
12G, 3G, HD	100% color bar, 75% color bar, multiformat color bar (ARIB STD-B28, pattern 2 area can be set to 100% white, 75% white, or +I), check field, flat field white 100%, white 50%, black 0%, red 100%, green 100%, blue 100%
SD	
525/ 59.94I	100% color bar, 75% color bar, SMPTE color bar, check field, flat field white 100%, white 50%, black 0%, red 100%, green 100%, blue 100%
625/50I	EBU color bar, BBC color bar, check field, flat field white 100%, white 50%, black 0%, red 100%, green 100%, blue 100%
4K Additional Test Patterns (future support)	
UHDColorBar	ARIB STD-B66 UHDTV MULTIFORMAT COLOR BAR
HLGCB	ARIB STD-B72 Color Bar Test Pattern for HLG HDR-TV System Recommendation ITU-R BT.2111 HLG
Slog3_LiveHDR_narrow_V11	S-Log3 (Live HDR) Ver.1.11 narrow range scale
User Pattern Display	Select one from INT1 to INT4 for SD, HD, and 4K, respectively.
File Format	24-bit full color bitmap format (.bmp) 24/48-bit TIFF format (.tif) uncompressed only
Automatic Switching	Automatically switches between selectable color bar patterns.
Switch Time	1 – 255 sec
Pattern Scrolling	
Direction	Eight directions (up, down, left, right, and their combinations)
Speed Range and Unit	
Interlace	In unit of fields
V	±256 lines (in 1-line steps)
H	±256 dots (in 2-dot steps)
Progressive	In unit of frames
V	±256 lines (in 1- or 2-line steps)
H	±256 dots (in 2- or 4-dot steps)

* Not available when the check field pattern is selected.

Safety Area Markers

12G, 3G, HD	Action safe area (90%) Title safe area (80%) 4:3 aspect ratio (can be turned on and off separately)
SD	Action safe area (90%) Title safe area (80%) (can be turned on and off separately)

* Not available when the check field pattern is selected.

ID Characters

Number of Characters	Up to 20 characters
Size	32 × 32, 64 × 64, 128 × 128, 256 × 256 dots
Brightness	100%, 75% (black only for the background)
Display Position	Anywhere on the display
Display Position Adjustment Range	
V	0 - 100% (in units of 1%)
H	0 - 100% (in units of 1%)
Blinking Display (*1)	On/Off
On Time	1 - 9 sec (in units of 1 sec)
Off Time	1 - 9 sec (in units of 1 sec)
Scrolling (*1)	
Function	Scroll including the ID character background
Direction	Two directions (left and right)
Speed Range and Unit	
Interlace	In unit of fields ±256 dots (in 2-dot steps)
Progressive	In unit of frames ±256 dots (in 2- or 4-dot steps)

* Not available when the check field pattern is selected.

*1 The blinking display and scrolling can be set simultaneously.

Logo Mark

Logo Mark Data	24-bit full-color data
Maximum Size	640 (dots) × 480 (lines) (VGA size)
Number of Logo Marks That Can Be Saved in the Instrument	Up to 4 types
Display Position	Anywhere on the display
Display Position Adjustment Range	
V	0 - 100% (in units of 1%)
H	0 - 100% (in units of 1%)
File Format	24-bit full color bitmap format (.bmp)
Logo Mark Data Transfer	The data is transfer from a USB memory device to the instrument.

* Not available when the check field pattern is selected.

Component On/Off

Function	Each of the Y/G, Cb/B, and Cr/R components can be turned on and off independently.

* Not available when the check field pattern is selected.

Moving Box

Box Color	White, yellow, cyan, green, blue, red, magenta, black
Speed Setting V/H	LOW / MIDDLE / HIGH
Size Setting V/H	SIZE 1 - 5

* Not available when the check field pattern is selected.

Circle

Display Position	90%, 80%, or 70% of the resolution
Brightness	100% / 75%
Blinking Display	On/Off
On Time	1 - 9 sec (in units of 1 sec)
Off Time	1 - 9 sec (in units of 1 sec)

* Not available when the check field pattern is selected.

Time Code

Size	32 × 32, 64 × 64, 128 × 128, 256 × 256 dots
Brightness	100%, 75% (black only for the background)
Display Position	Anywhere on the display
Display Position Adjustment Range	
V	0 - 100% (in units of 1%)
H	0 - 100% (in units of 1%)

* Not available when the check field pattern is selected.

Image Overlay

Display Priority	Test pattern < Circle < Moving box < Safety area marker < Logo mark < ID character < Time code (The display order cannot be changed.)
Simultaneous Display	The test pattern, circle, moving box, safety area marker, logo mark, ID character, and time code can be displayed simultaneously.

Embedded Audio

Embedded Channels	Can be turned on and off at the group level. 16 channels (4 channels × 4 groups)
Sampling Frequency	48 kHz sampling (synced with the video signal)
Resolution	20 bits, 24 bits
Pre-emphasis	OFF, 50/15, CCITT (only the CS bit is switched)
Frequency	SILENCE, 400 Hz, 800 Hz, 1 kHz
Level	-60 – 0 dBFS (in units of 1 dBFS)
Audio Click	OFF, 1 sec, 2 sec, 4 sec

* Audio (including packets) cannot be embedded when the check field pattern is selected.
* The frequency, level, and audio click can be set for each channel.
* The audio click and digital audio are asynchronous.
* Not available when lip sync is enabled.
* The following limitations apply for SD (525/59.94I).
  • For 16 channel output, the resolution is set to 20 bits.
  • Up to three groups (12 channels) can be output at 24-bit resolution.

Lip Sync Pattern

Setting	On/Off

* AES/EBU is synchronized with SDI1.
* Not available when the check field pattern is selected.
* Safety area markers, ID characters, logo marks, moving boxes, circles, and time codes cannot be overlaid.
* The audio click of embedded audio is disabled, and audio synchronized to the lip sync pattern is output.

3.4 LT4670-SER03 (PTP)

Corresponding Standard

Internet Protocol Version	IPv4
PTP Standard	IEEE 1588 – 2008
Supported Profile	SMPTE ST 2059 / AES67 / General

I/O Connectors

SFP/SPF+ connector	
Number of Ports	2
Port Type	SFP gauge
Compliant Standard	MSA
Supported Modules and Types	
SFP Transceiver RJ-45	1000Base-T
SFP + Optical Transceiver	10GBase-SR and 10GBase-SW

* The SFP/SFP+ module is optional.

Leader Function

Number of Controllable Leader Devices	2
Communication Mode	Multicast / Unicast / MIXED SMPTE / MIXED SMPTE without negotiation
Domain Number	0 – 127 (SMPTE ST 2059) 0 – 255 (AES67 / General)
Announce Message Rate (*1)	0.125s 8Hz / 0.25s 4Hz / 0.5s 2Hz / 1s 1Hz / 2s 0.5Hz / 4s 0.25Hz / 8s 0.125Hz / 16s 0.0625Hz
Sync Message Rate (*1)	0.0078s 128Hz / 0.015s 64Hz / 0.0312s 32Hz / 0.0625s 16Hz / 0.125s 8Hz / 0.25s 4Hz / 0.5s 2Hz / 1s 1Hz / 2s 0.5Hz / 4s 0.25Hz / 8s 0.125Hz / 16s 0.00625Hz
Priority 1	0 – 255
Priority 2	0 – 255
Number of Connectable Followers	1000 (theoretical value when the sync message is 8 Hz)

*1 The message rate setting range varies depending on the profile.

Follower Function

Number of Controllable Follower Devices	2
Communication Mode	Multicast / Unicast / MIXED SMPTE / MIXED SMPTE without negotiation
Domain Number	0 – 127 (SMPTE ST 2059) 0 – 255 (AES67 / General)
Delay Message Rate	0.0078s 128Hz / 0.015s 64Hz / 0.0312s 32Hz / 0.0625s 16Hz / 0.125s 8Hz / 0.25s 4Hz / 0.5s 2Hz / 1s 1Hz / 2s 0.5Hz / 4s 0.25Hz / 8s 0.125Hz / 16s 0.00625Hz
Announce Timeout Count	2 - 10

3.5 LT4670-SER04 (25G-IP)

This section describes the IP functions of the LT4670-SER04 (25G-IP/12G-SDI TSG).

IP Corresponding Standard

IP Format	SMPTE ST 2022-6
	SMPTE ST 2110-20/21/30/31/40
Synchronization Mode	PTP (SMPTE ST 2059)

IP Formats and Standards

Table 3-7| HD video signal formats and standards (*1)

Color System	Quantization	Image	Frame (Field) Frequency/Scanning	Corresponding Standard
YC_BC_R 4:2:2	10bit	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 292-1 SMPTE ST 274
			30/29.97/25/24/23.98/P	
			30/29.97/25/24/23.98/PsF	SMPTE ST 292-1 SMPTE RP 211

Table 3-8 | 3G-A video signal formats and standards (*1)

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

Table 3-9 | 12G video signal formats and standards (*1)

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

Test Patterns	100% color bar, 75% color bar, multiformat color bar (ARIB STD-B28, pattern 2 area can be set to 100% white, 75% white, or +I), check field, flat field white 100%, white 50%, black 0%, red 100%, green 100%, blue 100%
User Patterns	Select one from INT1 to INT4
Audio Signals	SMPTE ST 2110-30/31 SILENCE, 400Hz, 800Hz, 1kHz

*1 Can be set to formats not listed here, but the output is unstable.

Supported Protocols

Supported Protocols	IPv4 (Internet Protocol version 4) IGMPv2/v3 (Internet Group Management Protocol) NMOS (IS-04/05)

IP Output Connector

Connector Type	SFP+ / SFP28
Number of Ports	2 (*1)
Compliant Standards	10GBASE-SR / 10GBASE-LR / 25GBASE-SR / 25GBASE-LR
Fiber Type	Multi mode / Single mode

*1 The standard must be matched between the two output connectors.

IP Packet Emulation (future support)

Function	Adding jitter and checksum errors to the test signals of SMPTE ST 2110-20
Error	FCS ERROR / IP CS / UDP CS
Jitter	1 / 10 / 20 / 30 / 40 / 50 / 60 / 70 / 80 / 90 / 100 packet

* Errors and jitter will be reflected in the output from port 1.
* Jitter during 4K output will be up to 20 packets.
* The duration of jitter varies depending on the output signal format.
* There is a ±10% error margin in the duration of jitter.
* RTP timestamps cause a delay twice the packet transmission interval.

3.6 LT4670-SER11 (POWER UNIT)

Power Supply Redundancy	Supported
Replacement Method	Can be replaced without turning off the power of the main unit.
Alarm	A power supply alarm is indicated on the LED and LCD and notified by an SNMP trap.

3.7 SFP Transceiver (Sold Separately)

LC2148

Product Name	SFP+ MULTI-MODE
Classification	Class 1
Output Level	-1 dBm max.
Wavelength	850 nm
Manufacturer	GIGALIGHT TECHNOLOGY

LC2149

Product Name	SFP+ SINGLE-MODE
Classification	Class 1
Output Level	+0.5 dBm max.
Wavelength	1310 nm
Manufacturer	GIGALIGHT TECHNOLOGY

LC2151

Product Name	SFP28 MULTI-MODE
Classification	Class 1
Output Level	+2.4 dBm max.
Wavelength	850 nm
Manufacturer	GIGALIGHT TECHNOLOGY

LC2152

Product Name	SFP28 SINGLE-MODE
Classification	Class 1
Output Level	+2.0 dBm max.
Wavelength	1310 nm
Manufacturer	GIGALIGHT TECHNOLOGY