

# Master Sync / Master Clock Reference Generator

## SPG8000A datasheet

The SPG8000A is a precision multiformat video signal generator, suitable for master synchronization and reference applications. It provides multiple video reference signals, such as black burst, HD tri-level sync, and serial digital and composite analog test patterns, and it provides time reference signals such as time code, NTP (Network Time Protocol), and IEEE 1588 PTP (Precision Time Protocol).

### Key features

- Multiple independent black burst and HD tri-level sync outputs provide all the video reference signals required in a video broadcast or production facility
- Four LTC outputs, VITC on black burst outputs, and NTP server provide time reference signals in a variety of formats
- PTP (IEEE 1588) support, including SMPTE ST 2059-2 and AES67 profiles
- GPS/GLONASS-based synchronization gives an accurate time-of-day reference and deterministic video phase reference across multiple independent systems
- Stay GenLock® and Holdover Recovery prevent synchronization shock when the external reference input, PTP, or GPS/GLONASS signal is temporarily lost
- Wide selection of video test patterns in serial digital formats (SD, HD and 3G-SDI) and composite analog formats (NTSC and PAL)
- 4K/UHD formats support with full frame 100% and 75% color bars (Quad Link Square Division)

- Dual hot-swappable power supplies ensure continuous availability of reference signals
- Easy to manage with Web-based interface for remote configuration and SNMP for status and alert information

### Applications

- Sync generator and time reference generator for broadcast, studio, mobile, and post-production facilities
- Master or slave (genlock) operation for distributed system architectures
- Video equipment verification, facility link testing, and display calibration

### Master video synchronization and time reference generator

The base configuration includes three sync outputs that can be configured with independent output formats and independently adjustable timing offsets. With Option BG, four more analog outputs can be added. A high-accuracy, oven-controlled crystal oscillator provides a stable frequency reference for the system, or the pass-through genlock input can be used to lock to an external video reference or 10 MHz continuous wave signal.

The SPG8000A's Stay GenLock® feature avoids “synchronization shock” if the external reference suffers a temporary disturbance, by maintaining the frequency and phase of each output signal. When the external reference is restored, Stay GenLock® ensures that any accumulated clock drift is removed by slowly adjusting the system clock within standard limits instead of “jamming” back to the correct phase.



Time reference outputs are available in multiple formats. Three independent linear time code (LTC) outputs are available, and a fourth LTC connection can be used as input or output. Each LTC output has independent frame rate selection, time source (time-of-day or program time) and time zone offset. Vertical interval time code (VITC) is available on each NTSC or PAL black output, also with independent time sources and offsets. The SPG8000A can also serve as a Network Time Protocol (NTP) server or as a Precision Time Protocol (PTP) grandmaster clock, providing the time-of-day reference to network-attached devices.

### Optional GPS / GLONASS receiver

Option GPS adds an integrated receiver to the SPG8000A that is capable of receiving both GPS and GLONASS signals. When connected to an external antenna that supplies the standard GPS and/or GLONASS RF signal (for example, SPG8000ANT), the SPG8000A can use the GPS/GLONASS system's stable frequency reference.

The GPS/GLONASS signal also includes a precise time-of-day reference that can be used for all time code outputs. Similar to the Stay GenLock® feature, the SPG8000A can maintain the video frequency and phase when the GPS/GLONASS signal is interrupted, and the Holdover Recovery mode will ensure a shock-free realignment of frequency and phase when the GPS/GLONASS signal is restored.

### Optional PTP support

Option PTP adds two Precision Time Protocol (PTP) engines to the SPG system. The primary PTP engine has the capability to be a master PTP source or lock the SPG to the PTP as a slave. The secondary PTP engine can only be a master. The secondary engine allows implementing two masters when in Internal mode or locked to GPS, and simultaneous Master and Slave operation.

The black outputs support a 1pps mode. This is useful for measuring timing between systems.

### Test signal outputs

The SPG8000A can be optionally configured with a variety of test signal outputs. Option BG includes two composite analog outputs (NTSC or PAL) that can be used to generate test patterns such as color bars, or serve as additional black burst outputs.

Option SDI adds two fully independent serial digital video generator channels of two outputs each. Each channel can be configured to any standard 3G/HD/SD-SDI format and frame rate. The selected test pattern can be generated on both outputs per channel, or one output can generate digital black.

A wide variety of standard test patterns are included, such as color bars, convergence grid, step scales, ramps, multiburst, SDI pathological test matrix and a real-time programmable zone plate generator. Bitmap images can be downloaded to the SPG8000A's flash memory for arbitrary user-defined test patterns. ID text, burn-in time code, circle, and color logo overlays can be added to any test pattern, and several ancillary data packet types, including ancillary time code and user-defined packets, can be inserted into the SDI output signal.

The four SDI outputs can be configured to support 4K/UHD full frame, 100% and 75% color bars for quad link square division mode. This allows simple verification of your 4K/UHD workflow within the production studio or mobile truck. Note: VPIDs are compliant only to HD and 3G formats in 4K/UHD formats.

Also included is an audio/video delay test sequence, which in conjunction with a Tektronix waveform monitor, can be used to ensure A/V delay compliance.

### Audio reference signals

Several audio reference signals are available on the SPG8000A. The base configuration includes a 48 kHz word clock output, and Option AG adds five AES/EBU output pairs. One pair is dedicated to a Digital Audio Reference Signal (DARS) output, and the other four pairs are used for test tone generation, with independent tone frequency and amplitude settings for each of the 8 channels.

Audio tone generation, including Dolby E format, is provided with Option SDI as embedded audio on each of the SDI outputs. Various Dolby E audio frame start locations can be set to test the error handling ability of the signal processing equipment in the signal path. Embedded Dolby E metadata are also included in the Dolby E test stream. Supported Dolby E program configurations include mono, stereo, 5.1 and 7.1 surround sound audio.

### Remote access

The SPG8000A includes a 10/100/1000BASE-T Ethernet interface for remote access to the instrument. A web-based user interface can be used for all configuration settings and for monitoring system status.

Alarm and key status information is also available using Simple Network Management Protocol (SNMP) messaging, enabling easy integration with network management systems. Remote control and alarm reporting is also available using a general purpose interface (GPI). The SPG8000A has a front-panel USB port that can be used to backup and restore presets and other user data, and to perform system firmware upgrades.

## Optional backup power supply

For mission-critical applications, the SPG8000A can be configured with a second power supply module. Under normal operation, the designated backup supply is seldom used, ensuring that it has maximum remaining life should the primary supply fail. The backup supply is load-tested once each day to verify that it can serve as the primary supply if necessary.

The usage time of each supply is logged as “temperature-weighted hours”, a metric that best estimates the calculated life of the supply. A front-panel LED will indicate when the supply is nearing its end-of-life.

If the primary supply is interrupted for any reason, the system will switch to the backup without any disruption to system operation. Power supply modules are hot-swappable for easy replacement, and feature a locking mechanism to prevent the power cable from accidental disconnection.

## Input specifications

All specifications apply to all SPG8000A configurations unless noted otherwise.

### Reference input

Connector	BNC ×2, passive loop-through
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Input impedance	75 Ω
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#### Input signal

##### NTSC/PAL black burst

##### HD tri-level sync

1080/60/59.94/50I
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1080/30/29.97/25/24/23.98P
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1080/24/23.98PsF
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720/60/59.94/50P
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##### 10 MHz continuous wave

Amplitude range	-8 dB to +6 dB
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S/N ratio	>40 dB
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SCH phase	0 ±40°
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Return loss	≥30 dB at 300 kHz to 10 MHz
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#### Lock stability

±3 dB amplitude change	<1 ns
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Jitter with burst lock	<0.5°
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Jitter with sync lock	<1 ns
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Jitter with CW lock	<1 ns (typ. 1°)
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### Genlock

Timing adjustment range	Anywhere in the color frame
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Timing adjustment resolution	<0.5° of NTSC/PAL subcarrier, 1 ns with tri-level sync input
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Color framing	Keeps accuracy even with ±45° SCH error of input reference signal
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Genlock tune range	±7.5 × 10 <sup>-6</sup>
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**GPS / GLONASS receiver (Option GPS)**

Type	L1 frequency (GPS - 1575.42 MHz, GLONASS - 1602.00 MHz), C/A Code, 32 channels
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Time accuracy	Within 150 ns to GPS/GLONASS/UTC
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Acquisition time	2 minutes on boot up with warm oven, good satellite signal, and known position
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**GPS / GLONASS antenna input (Option GPS)**

Connector	BNC
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Input impedance	50 $\Omega$ , internally terminated
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DC antenna power output voltage	3.3 V or 5 V at 55 mA
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Fault protection	Short-circuit/open detection and protection
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Return loss	8 dB at 1575 MHz
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**Time reference**

Source	GPS or GLONASS signal, PTP input, LTC input, VITC read from NTSC/PAL genlock input, or can enter manually
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Time zone offset	-23:59 to +23:59
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Daylight saving adjustment	Start/end from recurring calendar or manually scheduled, with adjustable offset
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Leap second adjustment	Inserted at 00:00 UTC on the scheduled date, or deferred up to 24 hours
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**LTC input**

Connector	Available through D-sub 15-pin connector; Optional break-out cable to XLR connector available
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Formats	24 fps (24 Hz or 23.98 Hz), 25 fps, 30 fps, 30 fps drop-frame (29.97 Hz) per SMPTE 12M
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Timing to video	Compliant with SMPTE 12M and continues to operate over at least 90% of possible timing range
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Signal voltage range	0.5 to 10 $V_{p-p}$ differential, 1 to 5 $V_{p-p}$ single ended
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Noise tolerance	-30 dB SNR RMS white noise with 10 kHz BW to the p-p signal level, or -10 dB SNR for 5 MHz white noise
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Hum tolerance	0 dB hum-to-signal ratio
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Error immunity	100 consecutive frames with consistent time code must be detected for time to be considered valid
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Input impedance	Nominal 600 $\Omega$ differential, 300 $\Omega$ single ended
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## Output specifications

All specifications apply to all SPG8000A configurations unless noted otherwise.

### Reference outputs

<b>Number of outputs</b>	3 analog sync outputs in base configuration, up to 7 with Option BG
<b>Connector</b>	BNC ×3-7
<b>Formats</b>	NTSC/PAL black burst, HD tri-level sync, 10 MHz continuous wave, or 1 pps
<b>Format Combinations</b>	
<b>NTSC/PAL black burst</b>	Available on all outputs (BLACK 1-5 and CMPST 1-2)
<b>HD tri-level sync</b>	Black outputs 1-3 can independently produce any of the formats from the following rate groups: <ul style="list-style-type: none"> <li>- Integer: 720 (50p, 60p), 1080 (24sF, 24p, 25p, 30p, 48p, 50i, 50p, 60i, 60p)</li> <li>- Non-integer: 720 (59.94p), 1080 (23.98sF, 23.98p, 29.97p, 47.95p, 59.94i, 59.94p)</li> </ul> Black outputs 4-5 can independently produce any of the formats from the following rate groups: <ul style="list-style-type: none"> <li>- Integer: 720 (50p, 60p), 1080 (24sF, 24p, 25p, 30p, 50i, 60i)</li> <li>- Non-integer: 720 (59.94p), 1080 (23.98sF, 23.98p, 29.97p, 59.94i)</li> </ul>
<b>10 MHz CW</b>	BLACK 3 output only
<b>1 pps</b>	Black outputs 1-3 only
<b>Output impedance</b>	75 Ω
<b>Return loss</b>	≥40 dB from 300 kHz to 5 MHz ≥25 dB from 5 MHz to 30 MHz

### Black burst mode for reference sync outputs

<b>Standards</b>	SMPTE 170M, ITU-R BT.1700-1, EBU N14, SMPTE RP154, RP318M-B
<b>Formats</b>	NTSC-M (7.5 IRE black), NTSC-J (0 IRE black), PAL-B
<b>Time Code</b>	Optional VITC insertion
<b>Line</b>	One or two lines, user selectable
<b>Source</b>	Time-of-day with adjustable offset, or program (elapsed) time counter
<b>Amplitude accuracy</b>	±2%
<b>SCH phase</b>	< ±5°
<b>Timing adjustment</b>	Independent per output
<b>Range</b>	Anywhere in the color frame
<b>Resolution</b>	Clock resolution 18.5 ns (1/54 MHz) Fine resolution 0.1 ns on BLACK 1-3

**HD tri-level mode for reference sync outputs**

<b>Standards</b>	SMPTE 240M, 274M, 296M, RP211
<b>Formats</b>	1080/60/59.94/50I Black 1-3 outputs: 1080/60/59.94/50/48/47.95/30/29.97/25/24/23.98P Black 4-5 outputs: 1080/30/29.97/25/24/23.98P 1080/24/23.98PsF 720/60/59.94/50P
<b>Amplitude accuracy</b>	±2%
<b>Timing adjustment</b>	Independent per output
<b>Range</b>	Anywhere in the color frame
<b>Resolution</b>	Clock resolution 13.5 ns (1/74.25 MHz) Fine resolution 0.2 ns for BLACK 1-3

**LTC outputs**

<b>Number of outputs</b>	3 or 4 (LTC1 is selectable as input or output)
<b>Connector</b>	Available through D-sub 15-pin connector; Optional break-out cable to XLR connectors available
<b>Formats</b>	24 fps (24 Hz or 23.98 Hz), 25 fps, 30 fps, 30 fps drop-frame (29.97 Hz) per SMPTE 12M
<b>Source</b>	Time-of-day with adjustable offset, or program (elapsed) time counter
<b>Output amplitude</b>	5 V ±10%, adjustable from 0.5 V to 5 V in 0.5 V steps

**Word clock output**

<b>Connector</b>	BNC ×1
<b>Output level</b>	5 V DC (CMOS compatible) or 1 V AC into 75 Ω (AES level)
<b>Frequency</b>	48 kHz

**Serial digital test signal outputs (Option SDI)**

<b>Number of outputs</b>	2 independent test pattern generators with 2 outputs each
<b>Video signal</b>	Test pattern on both outputs or test pattern on one output and digital black on the second output
<b>Connector</b>	BNC ×4
<b>Output impedance</b>	75 Ω
<b>Output amplitude</b>	800 mV <sub>p-p</sub> ±3%
<b>Overshoot</b>	≤1% (typical)

**Serial digital test signal outputs (Option SDI)**

<b>Rise/Fall time</b>	
HD, 3G	≤70 ps (typical) (20-80%)
SD	≤700 ps (typical) (20-80%)
<b>Jitter</b>	
HD, 3G	≤40 ps (typical) (alignment)
	≤80 ps (typical) (timing)
SD	≤200 ps (typical) (alignment)
	≤200 ps (typical) (timing)
<b>Timing adjustment</b>	Independent per generator channel
Range	Anywhere in the frame
Resolution	One clock cycle at the Y, G, or X pixel rate
<b>Return loss</b>	≥15 dB from 5 MHz to 2.5 GHz (typical)
	≥10 dB from 2.5 GHz to 3 GHz (typical)

**Standard Definition (SD) formats (Option SDI)**

<b>Standards</b>	SMPTE 259M, 272M, 291M
<b>Bit rate</b>	270 Mb/s
<b>Formats</b>	720×486/59.94/I (525 lines)
	720×576/50/I (625 lines)

**High Definition (HD) formats (Option SDI)**

<b>Standards</b>	SMPTE 274M, 291M, 292M, 296M
<b>Bit rate</b>	1.485 Gb/s and 1.485/1.001 Gb/s
<b>Formats</b>	1280×720/60/59.94/50/30/29.97/25/24/23.98P
	1920×1080/60/59.94/50I
	1920×1080/30/29.97/25/24/23.98P
	1920×1080/30/29.97/25/24/23.98PsF

**3 Gb/s formats (Option SDI)**

<b>Standards</b>	SMPTE 291M, 424M, 425-1
<b>Bit rate</b>	2.97 Gb/s and 2.97/1.001 Gb/s
<b>Alpha channel</b>	Same as Y/G channel or flat field (0% to 100% in 10% steps)

## 3 Gb/s formats (Option SDI)

Formats		Sample structure	Frame/Field rates
Level A			
	1280×720	4:4:4 Y'C <sub>B</sub> C <sub>R</sub> (+A)/10-bit 4:4:4 R'G'B'+(+A)/10-bit	60/59.94/50/30/29.97/25/24/23.98P
	1920×1080	4:2:2 Y'C <sub>B</sub> C <sub>R</sub> /10-bit	60/59.94/50P
		4:4:4 Y'C <sub>B</sub> C <sub>R</sub> (+A)/10-bit 4:4:4 R'G'B'+(+A)/10-bit	60/59.94/50I 30/29.97/25/24/23.98P 30/29.97/25/24/23.98PsF
		4:4:4 Y'C <sub>B</sub> C <sub>R</sub> /12-bit 4:4:4 R'G'B'/12-bit	60/59.94/50I 30/29.97/25/24/23.98P
	4:2:2 Y'C <sub>B</sub> C <sub>R</sub> /12-bit	60/59.94/50I 30/29.97/25/24/23.98P 30/29.97/25/24/23.98PsF	
2048×1080	4:4:4 R'G'B'/12-bit 4:4:4 X'Y'Z'/12-bit	30/29.97/25/24/23.98P 30/29.97/25/24/23.98PsF	
Level B Dual-Link			
	1920×1080	4:2:2 Y'C <sub>B</sub> C <sub>R</sub> /10-bit	60/59.94/50P
		4:4:4 Y'C <sub>B</sub> C <sub>R</sub> (+A)/10-bit 4:4:4 R'G'B'+(+A)/10-bit	60/59.94/50I 30/29.97/25/24/23.98P 30/29.97/25/24/23.98PsF
		4:4:4 Y'C <sub>B</sub> C <sub>R</sub> /12-bit 4:4:4 R'G'B'/12-bit	60/59.94/50I 30/29.97/25/24/23.98P 30/29.97/25/24/23.98PsF
	4:2:2 Y'C <sub>B</sub> C <sub>R</sub> (+A)/12-bit	60/59.94/50I 30/29.97/25/24/23.98P 30/29.97/25/24/23.98PsF	
2048×1080	4:4:4 R'G'B'/12-bit 4:4:4 X'Y'Z'/12-bit	30/29.97/25/24/23.98P 30/29.97/25/24/23.98PsF	
Level B Dual-Stream			
	2× 1920×1080	4:2:2 Y'C <sub>B</sub> C <sub>R</sub> (+A)/10-bit	60/59.94/50I 30/29.97/25/24/23.98P 30/29.97/25/24/23.98PsF
	2× 1280×720	4:2:2 Y'C <sub>B</sub> C <sub>R</sub> (+A)/10-bit	60/59.94/50/30/29.97/25/24/23.98P

## 4K/UHD outputs (Option SDI)

Output mode	Quad Link Square Division
Standards	All supported 3G/HD-SDI standards
Formats	All supported 2048×1080 and 1920×1080 3G/HD-SDI formats
Test signals	Full frame 75% and 100% color bars only

**Test patterns (SD/HD/3G-SDI)**

<b>Color bars</b>	100%, 75%, SMPTE EG1, SMPTE RP219, SMPTE EG432-1
<b>Flat field</b>	Full field 0% (Black), 50%, 100% (White), Red, Green, Blue, Cyan, Magenta, Yellow
<b>Linearity test</b>	Ramp, Limit Ramp, Valid Ramp, Shallow Ramp Matrix, 5/10 Step Staircase
<b>Monitor</b>	Checkerboard, Clean Aperture, Convergence, Black-White Step Scale, Black-Dark Gray Step Scale, Pluge and Luma Reference, Production Aperture, Window, SMPTE 303M Color Reference, ChromaDuMonde
<b>SDI pathological</b>	Equalizer Test, PLL Test, SDI Matrix per SMPTE RP178/RP198
<b>Frequency response</b>	Multiburst, Real-time parametric moving zone plate
<b>Pulses</b>	2T Pulse and Bar, Color Pulses, Co-siting Pulse
<b>Full-frame picture</b>	User-defined bitmap files (BMP format) can be downloaded to flash memory and displayed in any format

**Video overlays**

<b>Logo</b>	24-bit color bitmap file (BMP format) or 32-bit with transparency, up to 1920×1080 pixel size. Adjustable on-screen position.
<b>ID text</b>	Programmable string from front-panel entry (printable ASCII characters) or downloaded text file (UTF-8 encoding) for any Unicode characters. A preinstalled TrueType font is provided for Latin, Greek, and Cyrillic characters; an alternate TrueType font file may be downloaded to support other character sets. Character size is adjustable (%APH, 0.1% resolution).
<b>Burnt-in time code</b>	On-screen display of the current time code value (HH:MM:SS:FF) for the output, updated every field. Character size is 10% APH.
<b>Circle</b>	Adjustable diameter (%APH).
<b>Border</b>	Text and circle overlays are rendered as near-white objects, with a selectable enclosing near-black bounding area.
<b>Blink</b>	Text and circle overlays can blink on and off for dynamic on-screen activity.
<b>Position</b>	All overlay objects have adjustable on-screen position.

**Embedded audio**

<b>Standards</b>	SMPTE 272M (SD), 299 (HD/3G)
<b>Active channels</b>	16 channels (SD, HD, 3G-A), 32 channels (3G-B)
<b>Sample frequency</b>	48 kHz
<b>Digital coding</b>	24 bits (HD, 3G), 20 bits (SD)
<b>Signal alignment</b>	Async. and Sync. (no frame #), Synchronous (frame #)
<b>Tone frequency</b>	10.0 Hz to 20000.0 Hz, 0.5 Hz resolution
<b>Level</b>	-60 to 0 dBFS, 1 dB steps
<b>Channel identification</b>	Audible click, AES channel origin bytes

**Ancillary data**

<b>Error detection and handling</b>	EDH packet inserted in SD-SDI signals per SMPTE RP165
<b>Video payload identifier</b>	Optional VPID insertion per SMPTE 352M
<b>Ancillary time code</b>	Optional ATC insertion per SMPTE 12M-2
<b>Format</b>	ATC-LTC and/or ATC-VITC
<b>Source</b>	Time-of-day with adjustable offset, or program (elapsed) time counter
<b>User-programmable ANC packet</b>	
<b>Content</b>	DID, SDID, DC, UDW (255), CS; Automatically calculate checksum and/or parity, or manual override
<b>Location</b>	Line number, sample offset, luma/chroma channel, virtual link (3G)
<b>Mode</b>	Continuous insertion or single packet

**Composite analog test signal outputs (Option BG)**

<b>Number of outputs</b>	2 independent test pattern generators
<b>Connector</b>	BNC ×2
<b>Standards</b>	SMPTE 170M, ITU-R BT.1700-1, EBU N14, SMPTE RP154, RP318
<b>Formats</b>	NTSC-M (7.5 IRE black), NTSC-J (0 IRE black), and PAL-B
<b>Test patterns</b>	
<b>NTSC</b>	100% Color Bars, 75% Color Bars, SMPTE EG1 Color Bars, 40% Flat Field, Convergence, Pluge and Luma Reference, Black with 10 Field ID
<b>PAL</b>	100% Color Bars, 75% Color Bars, 100% Color Bars over Red, 75% Color Bars over Red, 40% Flat Field, Convergence, Pluge and Luma Reference
<b>Time code</b>	Optional VITC insertion
<b>Line</b>	One or two lines, user selectable
<b>Source</b>	Time-of-day with adjustable offset, or program (elapsed) time counter
<b>Luminance amplitude accuracy</b>	±1% (video at 100%)
<b>Chroma amplitude accuracy</b>	±2%
<b>Timing adjustment</b>	Independent per output
<b>Range</b>	Anywhere in the color frame
<b>Resolution</b>	Clock resolution 18.5 ns (1/54 MHz)
<b>Output impedance</b>	75 Ω
<b>Return loss</b>	≥30 dB to 30 MHz

**Audio test signal outputs (Option AG)**

<b>Standards</b>	ANSI S4.40 (AES3), AES3-ID
<b>Outputs</b>	8 channels (4 AES/EBU pairs)
<b>Output impedance</b>	75 $\Omega$ , unbalanced
<b>Connector</b>	BNC $\times$ 4
<b>Output amplitude</b>	1 V $\pm$ 0.2 V
<b>Frequency (Hz)</b>	50, 100, 150, 200, 250, 300, 400, 500, 600, 750, 800, 1000, 1200, 1500, 1600, 2000, 2400, 3000, 3200, 4000, 4800, 5000, 6000, 8000, 9600, 10000, 12000, 15000, 16000, 20000
<b>Level</b>	-60 to 0 dBFS, 1 dB step
<b>Sampling frequency</b>	48 kHz (lock on video signal)
<b>Quantization</b>	Linear PCM, 20 or 24 bits (2's complement)
<b>Transfer coding</b>	Bi-phase mark
<b>Audio/Video synchronization</b>	Free run or synchronized with video framing
<b>Timing adjustment</b>	$\pm$ 160 ms in 1 ms steps

**DARS output**

<b>Outputs</b>	2 channels (1 AES/EBU pair)
<b>Output impedance</b>	75 $\Omega$ , unbalanced
<b>Connector</b>	BNC $\times$ 1
<b>Output amplitude</b>	1 $\pm$ 0.2 V
<b>Frequency, level</b>	No signal
<b>Sampling frequency</b>	48 kHz (lock on video signal)
<b>Quantization</b>	Linear PCM, 20 or 24 s (2's complement)
<b>Transfer coding</b>	Bi-phase mark

## Option PTP specifications

All specifications apply to all SPG8000A configurations which have Option PTP installed.

### Connectors

<b>Ethernet connection 1</b>	RJ45 8P8C connector supporting 10/100/1000 Base T
<b>Ethernet connection 2</b>	SFP cage accepting 1 Gigabit Ethernet modules, MSA standard (orderable as Option LX and Option SX)

**Internet protocol version** IPv4

**Profiles supported** ST 2059-2, AES67, General, AVB

**Operating modes** In Internal, GPS or Genlock reference modes, user may select one or two PTP masters. If locked to PTP input, then user may enable one PTP master.

### Communication mode support

<b>General AVB and AES67 profiles</b>	Supports both Multicast and Unicast
<b>ST2059-2 profile master mode</b>	Supports Multicast, Mixed, Mixed without grant negotiation, and Unicast
<b>ST2059-2 profile slave mode</b>	Supports Multicast, Mixed with negotiation, Mixed without negotiation and Unicast with negotiation

**Maximum message rates** Total maximum message rate for the two masters is 512 per second on the Announce message and 8192 per second on the Sync and Delay Response messages

At 8 messages per second, this accommodates approximately 500 end points in Unicast and 1000 end points in Multicast; higher message rates will reduce the number of end points that may be supported

**Master mode ST 2059-2 Synchronization Metadata TLV support** Master outputs Multicast SM TLV when active

**Slave mode lock time at 8 messages per second** Typically three minutes if not previously locked

**Slave mode lock range**  $\pm 7.5$  ppm

**Timing offset** Typically less than 1  $\mu$ s for up to 7 hops of PTP compliant switches and less than 500 ns of uncompensated asymmetric network delay

**Asymmetric delay correction** Slave supports manual entry or a delay compensation value up to  $\pm 20$   $\mu$ s

## General specifications

All specifications apply to all SPG8000A configurations unless noted otherwise.

### Internal oscillator

Frequency accuracy in Internal mode	$\pm 135 \times 10^{-9}$ over 1-year calibration interval. Typically $\pm 10 \times 10^{-9}$ just after adjustment.
Frequency accuracy over temperature	$\pm 2 \times 10^{-9}$ for $\pm 5$ °C variation $\pm 10 \times 10^{-9}$ for 0 to 50 °C
Frequency variation from vibration and shock	$\pm 25 \times 10^{-9}$ from 6 ms half-sine shocks over 20g
Frequency drift	$< \pm 100 \times 10^{-9}$ per year for internal and Stay GenLock® modes at constant temperature

### Remote access

Network interface	10/100/1000 BASE-T
Configuration	Web-based user interface, HTML with JavaScript
Management	SNMPv2

### General Purpose Interface (GPI)

Connector	Two outputs and one input also available on the same 15-pin D-sub connector as the LTC signals. Optional breakout cable makes these available on BNC connectors.
Outputs 1, 2	Two, user-selectable to assert on specific events Assert on one or more of: GPS/GLONASS signal warning, loss of lock, near loss of lock, loss of input signal, or timer expiration
Output level	0.5-5 V
Inputs 1 2	Two (using 3 pins on connector) Pin 3 is programmable to be either a user-selectable input to signal GPS/GLONASS reacquisition, jam sync, or restart timer, or is the MSB of the preset input group When pin 3 is programmed to be part of the preset input group, then three pins on the connector can be used to recall presets 1-7. When pin 3 is programmed to be a user-selectable input, then two pins on the connector can be used to recall presets 1-3.
Input level	0.8-2.4 V

## Physical

### Dimensions

Height	44 mm (1.7 in.)
Width	483 mm (19 in.)
Depth	559 mm (21.5 in.)

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Weight (net)	4.85 kg (10.7 lb.)
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## Environmental

Power consumption	130 VA (max) on active power supply input 130 VA on backup supply input during 5 s daily load test
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Temperature	0 to +50 °C
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Altitude	3,000 m (9,842 ft.)
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Source voltage	100 to 240 VAC $\pm$ 10%, 50/60 Hz
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## Ordering information

### Models

SPG8000A	Master Sync / Master Clock Reference Generator base unit  <b>Includes:</b> Genlock input with loop-through output, 3 analog composite black or HD tri-level sync outputs, LTC input/outputs (4 out or 1 in/3 out), 48 kHz word clock output; general purpose interface, 10/100/1000 Ethernet interface with Web UI support, SNMP support.
SPG8000ANT	GPS/GLONASS rooftop antenna (5.0 VDC, 1588 MHz range signals, F connector) for receiving GPS and/or GLONASS satellite signals. The antenna works with the integrated internal GPS/GLONASS receiver of a SPG8000A with Option GPS.

### Instrument options

#### Product options

AG	Add a DARS output plus four AES/EBU test signal outputs (eight audio channels)
BG	Add two analog black burst or tri-level sync outputs plus two additional analog black burst or composite analog test signal outputs
GPS	Add GPS/GLONASS master clock synchronization capability (including integrated GPS/GLONASS receiver) plus NTP server support
PTP	Add PTP (IEEE 1588) support, including SMPTE ST 2059-2 and AES67 profiles
SDI	Add two independent sets of 3G/HD/SD-SDI test and test/black signal generation outputs (including embedded Dolby E audio test signal)

#### Accessory options

DPW	Add a second, hot-swappable, redundant (backup) power supply and a second power cord
LX	Add a Gigabit Ethernet optical SFP module, 1310 nm, single-mode, LC connector
RACK	Add rackmount slides and rails kit for SPG8000A (1 RU height, standard full depth)
SX	Add a Gigabit Ethernet optical SFP module, 850 nm, multimode, LC connector
XLR	Add an adapter cable (six feet long) from 15-pin D-sub GPI/LTC connector on the SPG8000A to four XLR male connectors (for LTC input/outputs) and three BNC male connectors (for GPI input/outputs)

#### Power plug options

Opt. A0	North America power plug (115 V, 60 Hz)
Opt. A1	Universal Euro power plug (220 V, 50 Hz)
Opt. A2	United Kingdom power plug (240 V, 50 Hz)
Opt. A3	Australia power plug (240 V, 50 Hz)
Opt. A5	Switzerland power plug (220 V, 50 Hz)
Opt. A6	Japan power plug (100 V, 50/60 Hz)
Opt. A10	China power plug (50 Hz)
Opt. A11	India power plug (50 Hz)
Opt. A12	Brazil power plug (60 Hz)
Opt. A99	No power cord

**Service options**

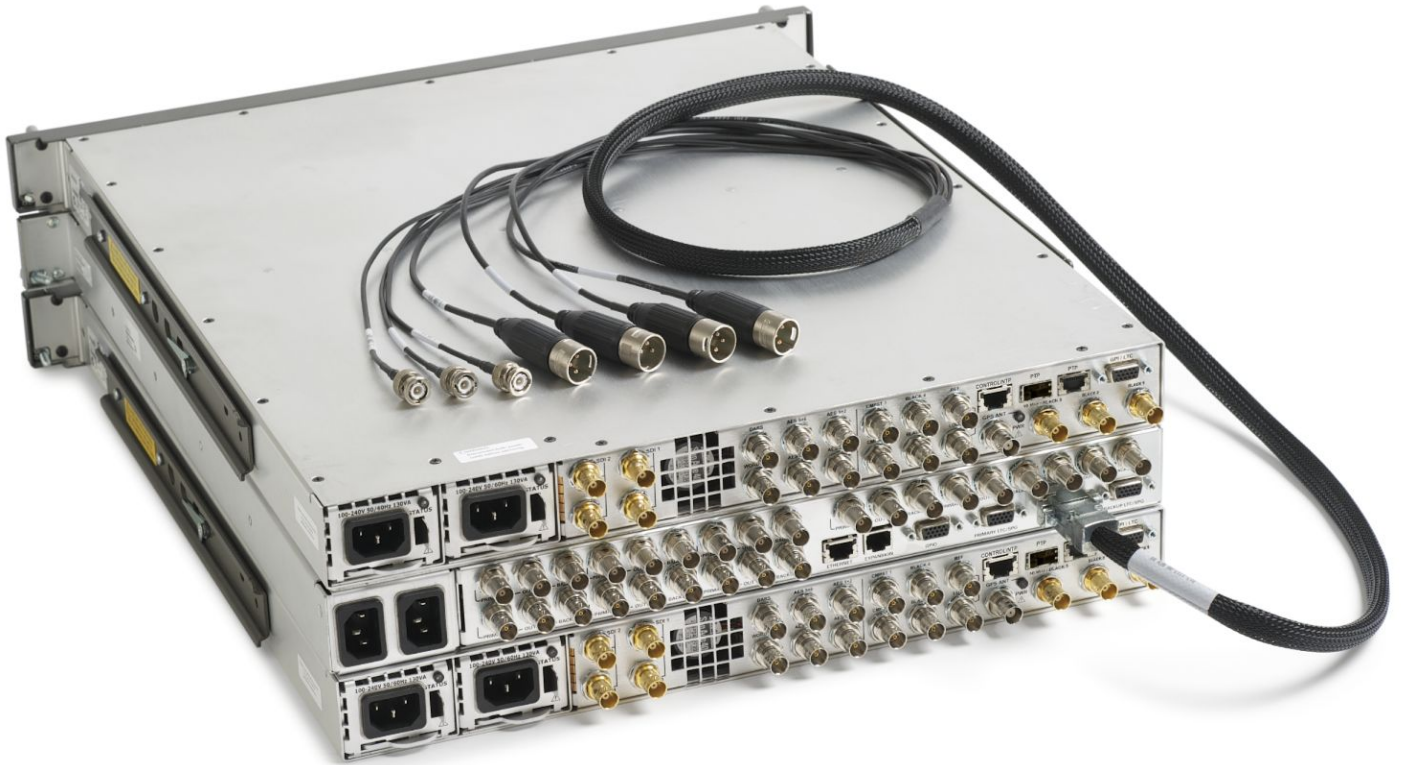
Opt. C3	Calibration Service 3 Years
Opt. C5	Calibration Service 5 Years
Opt. D1	Calibration Data Report
Opt. D3	Calibration Data Report 3 Years (with Opt. C3)
Opt. D5	Calibration Data Report 5 Years (with Opt. C5)
Opt. G3	Complete Care 3 Years (includes loaner, scheduled calibration, and more)
Opt. G5	Complete Care 5 Years (includes loaner, scheduled calibration, and more)
Opt. R3	Repair Service 3 Years (including warranty)
Opt. R5	Repair Service 5 Years (including warranty)

**Repair service options**

Opt. R3DW	Repair Service Coverage 3 Years (includes product warranty period). 3-year period starts at time of instrument purchase.
Opt. R5DW	Repair Service Coverage 5 Years (includes product warranty period). 5-year period starts at time of instrument purchase.

**SPG800AUP field upgrades**

DPW	Add a replacement or a second, hot-swappable, redundant (backup) power supply. A power plug option must be specified. See <a href="#">Power plug options</a> .
LX	Add a Gigabit Ethernet optical SFP module, 1310 nm, single-mode, LC connector
PTP	Add PTP (IEEE 1588) support, including SMPTE ST 2059-2 and AES67 profiles
RACK	Add rackmount slides and rails kit for SPG8000A (1 RU height, standard full depth)
SX	Add a Gigabit Ethernet optical SFP module, 850 nm, multimode, LC connector
XLR	Add an adapter cable (six feet long) from 15-pin D-sub GPI/LTC connector on the SPG8000A to four XLR male connectors (for LTC input/outputs) and three BNC male connectors (for GPI input/outputs)



Option XLR adapter cable



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



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**For Further Information.** Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit [www.tek.com](http://www.tek.com).

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