

Master Sync / Master Clock Reference Generator

SPG8000 Datasheet

Features & Benefits

- 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
- GPS-based synchronization gives an accurate time-of-day reference and deterministic video phase reference, and locks remote SPG8000 systems to each other
- Stay GenLock® and GPS Holdover Recovery prevent synchronization shock when the external reference input or GPS 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)
- 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

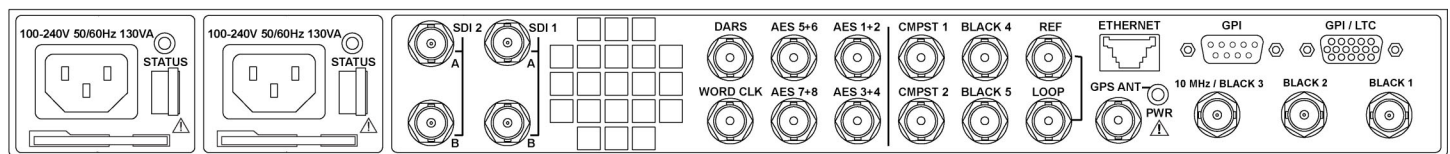
- Sync pulse generator and time reference generator for broadcast, studio, mobile, and post-production facilities
- Master or slave (genlock) operation for distributed system architectures
- Video equipment verification, facility link testing, and display calibration

Master Video Synchronization and Time Reference Generator

The SPG8000 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 and NTP (Network Time Protocol).

The base configuration includes three sync outputs that can be configured with independent output formats (NTSC/PAL black burst and/or HD tri-level sync) and independently adjustable timing offsets. With the BG option, 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 SPG8000'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 SPG8000 can also serve as a Network Time Protocol (NTP) server, providing the time-of-day reference to network-attached devices.



SPG8000 Master Sync / Clock Reference Generator front panel and back panel.

Optional GPS Receiver

The GPS option adds an internal GPS receiver to the SPG8000. When connected to an external antenna that supplies the standard GPS RF signal, the SPG8000 can utilize the GPS system's stable frequency reference. The GPS 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 SPG8000 can maintain the video frequency and phase when the GPS signal is interrupted, and the Holdover Recovery mode will ensure a shock-free re-alignment of frequency and phase when the GPS signal is restored.

Test Signal Outputs

The SPG8000 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 SD or HD-SDI format and frame rate. The selected test pattern can be generated on both outputs per channel, or one output can generate digital black. Option 3G extends the functionality of the SDI test signal outputs by adding 3 Gb/s SDI formats. 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 SPG8000'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.

Audio Reference Signals

Several audio reference signals are available on the SPG8000. 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 is also included with the SDI option, as embedded audio on each of the SDI outputs.

Remote Access

The SPG8000 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 via Simple Network Management Protocol (SNMP) messaging, enabling easy integration with network management systems. Remote control and alarm reporting is also available via a general purpose interface (GPI). The SPG8000 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 SPG8000 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.

Characteristics

Inputs

Reference Input

Characteristic	Description
Connector	BNC ×2, passive loop-through
Input Impedance	75 Ω
Input Signal	NTSC/PAL black burst HD tri-level sync 1080/60/59.94/50I 1080/30/29.97/25/24/23.98P 1080/24/23.98PsF 720/60/59.94/50P 10 MHz continuous wave
Amplitude Range	-8 dB to +6 dB
S/N Ratio	>40 dB
SCH Phase	0 ±40°
Return Loss	≥30 dB at 300 kHz to 10 MHz
Lock Stability	±3 dB amplitude change: <1 ns Jitter with burst lock: <0.5° Jitter with sync lock: <1 ns Jitter with CW lock: <1 ns (typ. 1°)

Genlock

Characteristic	Description
Timing Adjustment Range	Anywhere in the color frame
Timing Adjustment Resolution	<0.5° of NTSC/PAL subcarrier, 1 ns with tri-level sync input
Color Framing	Keeps accuracy even with ±45° SCH error of input reference signal
Genlock Range	±7.5 × 10 ⁻⁶

GPS Receiver (Option GPS)

Characteristic	Description
Type	L1 frequency (1575.42 MHz), C/A Code, 12 channels
Time Accuracy	Within 150 ns to GPS/UTC
Acquisition Time	From cold start, <46 sec (50%), <50 sec (90%)

GPS Antenna Input (Option GPS)

Characteristic	Description
Connector	BNC
Input Impedance	50 Ω, internally terminated
DC Antenna Power Output Voltage	3.3 V or 5 V at 55 mA
Fault Protection	Short-circuit/open detection and protection
Return Loss	8 dB at 1575 MHz

Time Reference

Characteristic	Description
Source	GPS signal, LTC input, or VITC read from NTSC/PAL genlock input
Time Zone Offset	-23:59 to +23:59
Daylight Saving Adjustment	Start/end from recurring calendar or manually scheduled, with adjustable offset
Leap Second Adjustment	Inserted at 00:00 UTC on the scheduled date, or deferred up to 24 hours

LTC Input

Characteristic	Description
Connector	Available through D-sub 15-pin connector. Optional break-out cable to XLR connector available
Formats	24 fps (24 Hz or 23.98 Hz), 25 fps, 30 fps, 30 fps drop-frame (29.97 Hz) per SMPTE 12M
Timing to Video	Compliant with SMPTE 12M and continues to operate over at least 90% of possible timing range
Signal Voltage Range	0.5 to 10 V _{p-p} differential, 1 to 5 V _{p-p} single ended
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
Hum Tolerance	0 dB hum-to-signal ratio
Error Immunity	100 consecutive frames with consistent time code must be detected for time to be considered valid
Input Impedance	Nominal 600 Ω differential, 300 Ω single ended

Outputs**Reference Outputs**

Characteristic	Description
Number of Outputs	3 analog sync outputs in base configuration, up to 7 with Option BG
Connector	BNC x3-7
Formats	NTSC/PAL black burst, HD tri-level sync, or 10 MHz continuous wave
Format Combinations	
NTSC/PAL black burst	Available on all outputs (BLACK 1-5 and CMPST 1-2)
HD tri-level sync	Black outputs 1-3 can independently produce any of the formats from the integer rate group (24,25,30,50,60 Hz) or the non-integer rate group. (23.98, 29.97, 59.94 Hz). Blacks outputs 4-5 can also independently produce any of the formats from either the same or the other rate group.
10 MHz CW	BLACK 3 output only
Output Impedance	75 Ω
Return Loss	≥30 dB to 30 MHz

Black Burst Outputs

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

HD Tri-Level Sync Outputs

Characteristic	Description
Standards	SMPTE 240M, 274M, 296M, RP211
Formats	1080/60/59.94/50I 1080/30/29.97/25/24/23.98P 1080/24/23.98PsF 720/60/59.94/50P
Amplitude Accuracy	±2%
Timing Adjustment	Independent per output
Range	Anywhere in the color frame
Resolution	Clock resolution 13.5 ns (1/74.25 MHz) Fine resolution 0.2 ns for BLACK 1-3

LTC Outputs

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

Word Clock Output

Characteristic	Description
Connector	BNC x1
Output Level	5 V DC (CMOS compatible) or 1 V AC into 75 Ω (AES level)
Frequency	48 kHz

Serial Digital Test Signal Outputs (Option SDI)

Characteristic	Description
Number of Outputs	2 independent test pattern generators with 2 outputs each
Video Signal	Test pattern on both outputs or test pattern on one output and digital black on the second output
Connector	BNC x4
Output Impedance	75 Ω
Output Amplitude	800 mV _{p-p} ±3%
Overshoot	≤1% (typical)
Rise/Fall Time	
HD, 3G	≤70 ps (typical) (20-80%)
SD	≤700 ps (typical) (20-80%)
Jitter	
HD, 3G	≤40 ps (typical) (alignment) ≤80 ps (typical) (timing)
SD	≤200 ps (typical) (alignment) ≤200 ps (typical) (timing)
Timing Adjustment	Independent per generator channel
Range	Anywhere in the frame
Resolution	One clock cycle at the Y, G, or X pixel rate
Return Loss	≥15 dB from 5 MHz to 2.5 GHz (typical) ≥10 dB from 2.5 GHz to 3 GHz (typical)

Standard Definition (SD) Formats

Characteristic	Description
Standards	SMPTE 259M, 272M, 291M
Bit Rate	270 Mb/s
Formats	720×486/59.94/1 (525 lines) 720×576/50/1 (625 lines)

High Definition (HD) Formats

Characteristic	Description
Standards	SMPTE 274M, 291M, 292M, 296M
Bit Rate	1.485 Gb/s and 1.485/1.001 Gb/s
Formats	1280×720/60/59.94/50/30/29.97/25/24/23.98P 1920×1080/60/59.94/50/1 1920×1080/30/29.97/25/24/23.98P 1920×1080/30/29.97/25/24/23.98PsF

3 Gb/s Formats (Option 3G) test

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

Formats	Sample Structure	Frame/Field Rates
Level A		
1280×720	4:4:4 Y'C _B C _R (+A)/10-bit	60/59.94/50/30/29.97/ 25/24/23.98P
	4:4:4 R'G'B(+A)/10-bit	
1920×1080	4:2:2 Y'C _B C _R /10-bit	60/59.94/50P
	4:4:4 Y'C _B C _R (+A)/10-bit	60/59.94/50/1
	4:4:4 R'G'B(+A)/10-bit	30/29.97/25/24/23.98P 30/29.97/25/24/23.98PsF
	4:4:4 Y'C _B C _R /12-bit	60/59.94/50/1
2048×1080	4:4:4 R'G'B/12-bit	30/29.97/25/24/23.98P
	4:4:4 X'Y'Z'/12-bit	30/29.97/25/24/23.98PsF
	4:2:2 Y'C _B C _R /12-bit	60/59.94/50/1
		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 _B C _R /10-bit	60/59.94/50P
	4:4:4 Y'C _B C _R (+A)/10-bit	60/59.94/50/1
	4:4:4 R'G'B(+A)/10-bit	30/29.97/25/24/23.98P 30/29.97/25/24/23.98PsF
	4:4:4 Y'C _B C _R /12-bit	60/59.94/50/1
2048×1080	4:4:4 R'G'B/12-bit	30/29.97/25/24/23.98P
	4:4:4 X'Y'Z'/12-bit	30/29.97/25/24/23.98PsF
	4:2:2 Y'C _B C _R (+A)/12-bit	60/59.94/50/1
		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 _B C _R /10-bit	60/59.94/50/1
		30/29.97/25/24/23.98P 30/29.97/25/24/23.98PsF
2× 1280×720	4:2:2 Y'C _B C _R /10-bit	60/59.94/50/ 30/29.97/25/24/23.98P

Test Patterns

Characteristic	Description
Color Bars	100%, 75%, SMPTE EG1, SMPTE RP219, SMPTE EG432-1
Flat Field	Full field 0% (Black), 50%, 100% (White), Red, Green, Blue, Cyan, Magenta, Yellow
Linearity Test	Ramp, Limit Ramp, Valid Ramp, Shallow Ramp Matrix, 5/10 Step Staircase
Monitor	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
SDI Pathological	Equalizer Test, PLL Test, SDI Matrix per SMPTE RP178/RP198
Frequency Response	Multiburst, Real-time parametric moving zone plate
Pulses	2T Pulse and Bar, Color Pulses, Co-siting Pulse
Full-frame Picture	User-defined bitmap files (BMP format) can be downloaded to flash memory and displayed in any format

Video Overlays

Characteristic	Description
Logo	24-bit color bitmap file (BMP format) or 32-bit with transparency, up to 1920×1080 pixel size. Adjustable on-screen position.
ID Text	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).
Burnt-in Time Code	On-screen display of the current time code value (HH:MM:SS:FF) for the output, updated every field. Character size is 10% APH.
Circle	Adjustable diameter (%APH).
Border	Text and circle overlays are rendered as near-white objects, with a selectable enclosing near-black bounding area.
Blink	Text and circle overlays can blink on and off for dynamic on-screen activity.
Position	All overlay objects have adjustable on-screen position.

Embedded Audio

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

Ancillary Data

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

Composite Analog Test Signal Outputs (Option BG)

Characteristic	Description
Number of Outputs	2 independent test pattern generators
Connector	BNC ×2
Standards	SMPTE 170M, ITU-R BT.1700-1, EBU N14, SMPTE RP154, RP318
Formats	NTSC-M (7.5 IRE black), NTSC-J (0 IRE black), and PAL-B
Test Patterns	
NTSC	100% Color Bars, 75% Color Bars, SMPTE EG1 Color Bars, 40% Flat Field, Convergence, Pluge and Luma Reference, Black with 10 Field ID
PAL	100% Color Bars, 75% Color Bars, 100% Color Bars over Red, 75% Color Bars over Red, 40% Flat Field, Convergence, Pluge and Luma Reference
Time Code	
Line	One or two lines, user selectable
Source	Time-of-day with adjustable offset, or program (elapsed) time counter
Luminance Amplitude Accuracy	±1% (video at 100%)
Chroma Amplitude Accuracy	±2%
Timing Adjustment	
Range	Anywhere in the color frame
Resolution	Clock resolution 18.5 ns (1/54 MHz)
Output Impedance	75 Ω
Return Loss	≥30 dB to 30 MHz

Audio Test Signal Outputs (Option AG)

Characteristic	Description
Standard	ANSI S4.40 (AES3), AES3-ID
Outputs	8 channels (4 AES/EBU pairs)
Output Impedance	75 Ω, unbalanced
Connector	BNC ×4
Output Amplitude	1 V ±0.2 V
Frequency (Hz)	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
Level	-60 to 0 dBFS, 1 dB step
Sampling Frequency	48 kHz (lock on video signal)
Quantization	Linear PCM, 20 or 24 bits (2's complement)
Transfer Coding	Bi-phase mark
Audio/Video Synchronization	Free run or synchronized with video framing
Timing Adjustment	±160 ms in 1 ms steps

DARS Output

Characteristic	Description
Outputs	2 channels (1 AES/EBU pair)
Output Impedance	75 Ω, unbalanced
Connector	BNC ×1
Output Amplitude	1 ±0.2 V
Frequency, Level	No signal
Sampling Frequency	48 kHz (lock on video signal)
Quantization	Linear PCM, 20 or 24 s (2's complement)
Transfer Coding	Bi-phase mark

General

Internal Oscillator

Characteristic	Description
Frequency Accuracy in Internal Mode	±135 × 10 ⁻⁹ over 1-year calibration interval. Typically ±10 × 10 ⁻⁹ just after adjustment
Frequency Accuracy over Temperature	±2 × 10 ⁻⁹ for ±5 °C variation ±10 × 10 ⁻⁹ for 0 to 50 °C
Frequency Variation from Vibration and Shock	±25 × 10 ⁻⁹ from 6 ms half-sine shocks over 20g
Frequency Drift	< ±100 × 10 ⁻⁹ per year for internal and Stay GenLock® modes at constant temperature

Remote Access

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

General Purpose Interface

Characteristic	Description
Connector	9-pin D-sub connector for all input/output lines. 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	Three, user-selectable to assert on specific events
1,2	Assert on one of: GPS signal warning, loss of lock, near loss of lock, loss of input signal, or timer expiry
3	Assert on logical OR of any of: fan fault, loss of lock, near loss of lock, loss of genlock input
Output Level	0.5-5 V
Inputs	Two (using 4 pins on connector)
1	User-selectable to signal GPS reacquisition, jam sync, or restart timer
2	Three pins on connector to recall preset 1-7
Input Level	0.8-2.4 V

Physical Characteristics

Dimensions	mm	in.
Height	44	1.7
Width	483	19
Depth	559	21.5
Weight	kg	lb.
Net	4.85	10.7

Environmental

Characteristic	Description
Power Consumption	60 W (max) on active power supply input 60 W on backup supply input during 5 s daily load test
Temperature	0 to +50 °C
Altitude	3,000 m (9,842 ft.)
Source Voltage	100 to 240 V, 50/60 Hz

Ordering Information

SPG8000

Master Sync / Master Clock Reference Generator base unit

Includes: Genlock input with loop-through output, three 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 NTP server and SNMP.

Options

Option	Description
GPS	Add GPS master clock synchronization capability, including internal GPS receiver
BG	Add 2 channels of composite NTSC/PAL black or HD tri-level outputs plus 2 channels of composite NTSC/PAL test signal outputs
SDI	Add 2 channels of SD/HD SDI test signal generation on 2 outputs each. Each channel can generate a test pattern on both outputs or a selected test pattern on one output and digital black on the other output.
3G	Add 3G SDI format support (Opt. SDI required)
AG	Add DARS output (2 AES/EBU channels. plus 4 audio tone outputs (8 AES/EBU channels)
DPW	Add a second hot-swappable redundant (backup) power supply (a second power cord option is required)

Power Cord Options

All power cords include a locking mechanism except as otherwise noted.

Option	Description
A0	North American power
A1	Universal European power
A2	United Kingdom power
A3	Australia power
A5	Switzerland power
A6	Japan power
A10	China power
A11	India power (no locking cable)
A12	Brazil power (no locking cable)
A99	No power cord

Service Options

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

Recommended Accessories

Accessory	Description	Order
D-sub to XLR/BNC Cable	Adapter cable from 15-pin D-sub connector on the SPG8000 to 4 XLR connectors (for LTC input/outputs) and 3 BNC connectors (for General Purpose Interface input/outputs)	012-1717-xx

Field Upgrade Kit — SPG8UP

Option	Description
DPW	Add a second hot-swappable redundant (backup) power supply. A power cord option must also be specified. (See <i>Power Cord Options</i> .)
3G	Add 3G SDI format support (software option key upgrade). Option SDI must already have been installed in the base SPG8000 unit.
IF	Upgrade installation service.
IFC	Service installation and calibration.



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

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