

# 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

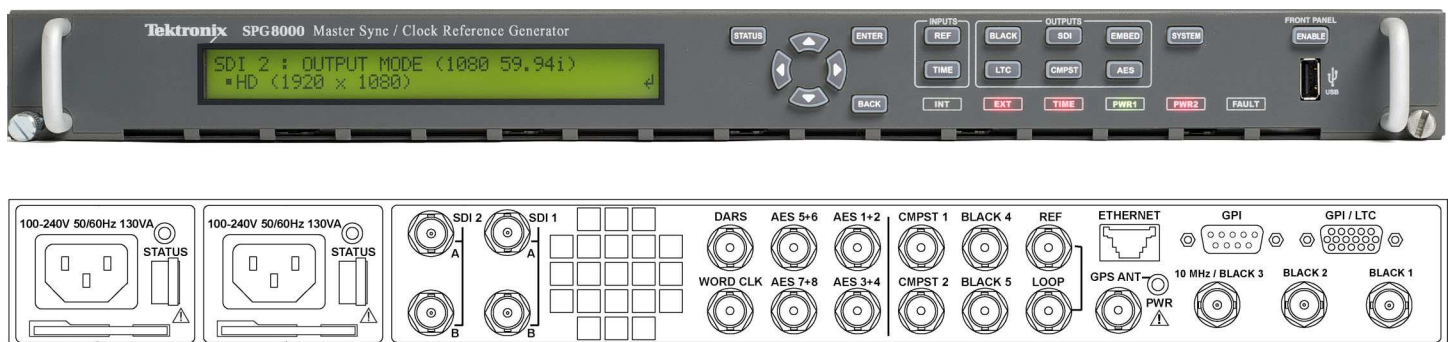
- Sync pulse generator and time reference generator for broadcast, studio, mobile, and post-production facilities
- Master or slave (genlock) operation for distributed system architectures
- Video equipment verification, facility link testing, and display calibration

### 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<br>HD tri-level sync<br>1080/60/59.94/50I<br>1080/30/29.97/25/24/23.98P<br>1080/24/23.98PsF<br>720/60/59.94/50P<br>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<br>Jitter with burst lock: <0.5°<br>Jitter with sync lock: <1 ns<br>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 <sup>-6</sup>                                           |

#### 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 <sub>p-p</sub> differential, 1 to 5 V <sub>p-p</sub> 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 $\Omega$ differential, 300 $\Omega$ 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 $\Omega$                                                                                                                                                                                                                                                                                |
| Return Loss          | $\geq 30$ 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 | $\pm 2\%$                                                                  |
| SCH Phase          | $< \pm 5^\circ$                                                            |
| Timing Adjustment  | Independent per output                                                     |
| Range              | Anywhere in the color frame                                                |
| Resolution         | Clock resolution 18.5 ns (1/54 MHz)<br>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<br>1080/30/29.97/25/24/23.98P<br>1080/24/23.98PsF<br>720/60/59.94/50P |
| Amplitude Accuracy | $\pm 2\%$                                                                               |
| Timing Adjustment  | Independent per output                                                                  |
| Range              | Anywhere in the color frame                                                             |
| Resolution         | Clock resolution 13.5 ns (1/74.25 MHz)<br>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 $\pm 10\%$ , 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 $\Omega$ (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 ×4                                                                                            |
| Output Impedance  | 75 Ω                                                                                              |
| Output Amplitude  | 800 mV <sub>p-p</sub> ±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)<br>≤80 ps (typical) (timing)                                         |
| SD                | ≤200 ps (typical) (alignment)<br>≤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)<br>≥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/I (525 lines)<br>720×576/50/I (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<br>1920×1080/60/59.94/50I<br>1920×1080/30/29.97/25/24/23.98P<br>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<br>4:4:4 R'G'B'(+A)/10-bit | 60/59.94/50/30/29.97/<br>25/24/23.98P                            |
| 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<br>4:4:4 R'G'B'(+A)/10-bit | 60/59.94/50I<br>30/29.97/25/24/23.98P<br>30/29.97/25/24/23.98PsF |
|                     | 4:4:4 Y'C'B'C'R/12-bit<br>4:4:4 R'G'B'/12-bit         | 60/59.94/50I<br>30/29.97/25/24/23.98P                            |
|                     | 4:2:2 Y'C'B'C'R/12-bit                                | 60/59.94/50I<br>30/29.97/25/24/23.98P<br>30/29.97/25/24/23.98PsF |
| 2048×1080           | 4:4:4 R'G'B'/12-bit<br>4:4:4 X'Y'Z'/12-bit            | 30/29.97/25/24/23.98P<br>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<br>4:4:4 R'G'B'(+A)/10-bit | 60/59.94/50I<br>30/29.97/25/24/23.98P<br>30/29.97/25/24/23.98PsF |
|                     | 4:4:4 Y'C'B'C'R/12-bit<br>4:4:4 R'G'B'/12-bit         | 60/59.94/50I<br>30/29.97/25/24/23.98P<br>30/29.97/25/24/23.98PsF |
|                     | 4:2:2 Y'C'B'C'R(+A)/12-bit                            | 60/59.94/50I<br>30/29.97/25/24/23.98P<br>30/29.97/25/24/23.98PsF |
| 2048×1080           | 4:4:4 R'G'B'/12-bit<br>4:4:4 X'Y'Z'/12-bit            | 30/29.97/25/24/23.98P<br>30/29.97/25/24/23.98PsF                 |
| Level B Dual-Stream |                                                       |                                                                  |
| 2× 1920×1080        | 4:2:2 Y'C'B'C'R/10-bit                                | 60/59.94/50I<br>30/29.97/25/24/23.98P<br>30/29.97/25/24/23.98PsF |
| 2× 1280×720         | 4:2:2 Y'C'B'C'R/10-bit                                | 60/59.94/50/<br>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                    | Optional VITC insertion                                                                                                                   |
| 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            | Independent per output                                                                                                                    |
| 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 $\Omega$ , unbalanced                                                                                                                                                    |
| Connector                   | BNC $\times$ 4                                                                                                                                                              |
| Output Amplitude            | 1 V $\pm$ 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           | $\pm$ 160 ms in 1 ms steps                                                                                                                                                  |

## DARS Output

| Characteristic     | Description                             |
|--------------------|-----------------------------------------|
| Outputs            | 2 channels (1 AES/EBU pair)             |
| Output Impedance   | 75 $\Omega$ , unbalanced                |
| Connector          | BNC $\times$ 1                          |
| Output Amplitude   | 1 $\pm$ 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          | $\pm$ 135 $\times$ 10 <sup>-9</sup> over 1-year calibration interval.<br>Typically $\pm$ 10 $\times$ 10 <sup>-9</sup> just after adjustment |
| Frequency Accuracy over Temperature          | $\pm$ 2 $\times$ 10 <sup>-9</sup> for $\pm$ 5 $^{\circ}$ C variation<br>$\pm$ 10 $\times$ 10 <sup>-9</sup> for 0 to 50 $^{\circ}$ C         |
| Frequency Variation from Vibration and Shock | $\pm$ 25 $\times$ 10 <sup>-9</sup> from 6 ms half-sine shocks over 20g                                                                      |
| Frequency Drift                              | < $\pm$ 100 $\times$ 10 <sup>-9</sup> 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<br>60 W on backup supply input during 5 s daily load test |
| Temperature       | 0 to +50 $^{\circ}$ 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 5 Years                                                               |
| 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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**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.tektronix.com](http://www.tektronix.com)



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