

SPG8000
Master Sync / Clock Reference Generator
Quick Start User Manual



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This document supports firmware version 1.2 and above.

www.tektronix.com

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General safety summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of a larger system. Read the safety sections of the other component manuals for warnings and cautions related to operating the system.

To avoid fire or personal injury

Use proper power cord. Use only the power cord specified for this product and certified for the country of use.

Ground the product. This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Observe all terminal ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

Power disconnect. The power cord disconnects the product from the power source. Do not block the power cord; it must remain accessible to the user at all times.

Do not operate without covers. Do not operate this product with covers or panels removed.

Do not operate with suspected failures. If you suspect that there is damage to this product, have it inspected by qualified service personnel.

Avoid exposed circuitry. Do not touch exposed connections and components when power is present.

Do not operate in wet/damp conditions.

Do not operate in an explosive atmosphere.

Keep product surfaces clean and dry.

Provide proper ventilation. Refer to the manual's installation instructions for details on installing the product so it has proper ventilation.

Terms in this manual

These terms may appear in this manual:



WARNING. *Warning statements identify conditions or practices that could result in injury or loss of life.*



CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Symbols and terms on the product

These terms may appear on the product:

- DANGER indicates an injury hazard immediately accessible as you read the marking.
- WARNING indicates an injury hazard not immediately accessible as you read the marking.
- CAUTION indicates a hazard to property including the product.

The following symbol(s) may appear on the product:



CAUTION
Refer to Manual



Protective Ground
(Earth) Terminal

Compliance information

This section lists the EMC (electromagnetic compliance), safety, and environmental standards with which the instrument complies.

EMC compliance

EC declaration of conformity – EMC

Meets intent of Directive 2004/108/EC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:

EN 55103-1:2009. Product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use.^{1 2}

- Environment E2 – commercial and light industrial
- Part 1 Emission
 - EN 55022:2006. Class B radiated and conducted emissions
 - EN 55103-1:2009 Annex A. Radiated magnetic field emissions
- Part 2 Immunity
 - IEC 61000-4-2:2000. Electrostatic discharge immunity
 - IEC 61000-4-3:2007. RF electromagnetic field immunity
 - IEC 61000-4-4:2004. Electrical fast transient / burst immunity
 - IEC 61000-4-5:2005. Power line surge immunity
 - IEC 61000-4-6:2006. Conducted RF Immunity
 - IEC 61000-4-11:2004. Voltage dips and interruptions immunity
 - EN 55103-2:2009 Annex A. Radiated magnetic field immunity

EN 61000-3-2:2006. AC power line harmonic emissions

EN 61000-3-3:1995. Voltage changes, fluctuations, and flicker

European contact.

Tektronix UK, Ltd.
Western Peninsula
Western Road
Bracknell, RG12 1RF
United Kingdom

EMC compliance

Meets the intent of Directive 2004/108/EC for Electromagnetic Compatibility when it is used with the product(s) stated in the specifications table. Refer to the EMC specification published for the stated products. May not meet the intent of the directive if used with other products.

European contact.

Tektronix UK, Ltd.
Western Peninsula
Western Road
Bracknell, RG12 1RF
United Kingdom

- 1 To ensure compliance with the EMC standards listed here, high quality shielded interface cables should be used.
- 2 Average half-cycle r.m.s. inrush current at initial switch-on: 1.8 A; average half-cycle r.m.s. after 5 second power interruption: 1.6 A.

Australia / New Zealand declaration of conformity – EMC

Complies with the EMC provision of the Radiocommunications Act per the following standard, in accordance with ACMA:

- EN 55022:2006. Radiated and conducted emissions, Class B, in accordance with EN 55103-1:2009.

Safety compliance

EC declaration of conformity – low voltage

Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities:

Low Voltage Directive 2006/95/EC.

- EN 61010-1: 2001. Safety requirements for electrical equipment for measurement control and laboratory use.

U.S. nationally recognized testing laboratory listing

- UL 61010-1:2004, 2nd Edition. Standard for electrical measuring and test equipment.

Canadian certification

- CAN/CSA-C22.2 No. 61010-1:2004. Safety requirements for electrical equipment for measurement, control, and laboratory use. Part 1.

Additional compliances

- IEC 61010-1: 2001. Safety requirements for electrical equipment for measurement, control, and laboratory use.

Equipment type

Test and measuring equipment.

Safety class

Class 1 – grounded product.

Pollution degree description

A measure of the contaminants that could occur in the environment around and within a product. Typically the internal environment inside a product is considered to be the same as the external. Products should be used only in the environment for which they are rated.

- Pollution Degree 1. No pollution or only dry, nonconductive pollution occurs. Products in this category are generally encapsulated, hermetically sealed, or located in clean rooms.
- Pollution Degree 2. Normally only dry, nonconductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.
- Pollution Degree 3. Conductive pollution, or dry, nonconductive pollution that becomes conductive due to condensation. These are sheltered locations where neither temperature nor humidity is controlled. The area is protected from direct sunshine, rain, or direct wind.
- Pollution Degree 4. Pollution that generates persistent conductivity through conductive dust, rain, or snow. Typical outdoor locations.

Pollution degree

Pollution Degree 2 (as defined in IEC 61010-1). Note: Rated for indoor use only.

Installation (overvoltage) category descriptions

Terminals on this product may have different installation (overvoltage) category designations. The installation categories are:

- Measurement Category IV. For measurements performed at the source of low-voltage installation.
- Measurement Category III. For measurements performed in the building installation.
- Measurement Category II. For measurements performed on circuits directly connected to the low-voltage installation.
- Measurement Category I. For measurements performed on circuits not directly connected to MAINS.

Overvoltage category

Overvoltage Category II (as defined in IEC 61010-1)

Environmental considerations

This section provides information about the environmental impact of the product.

Product end-of-life handling

Observe the following guidelines when recycling an instrument or component:

Equipment recycling. Production of this equipment required the extraction and use of natural resources. The equipment may contain substances that could be harmful to the environment or human health if improperly handled at the product's end of life. In order to avoid release of such substances into the environment and to reduce the use of natural resources, we encourage you to recycle this product in an appropriate system that will ensure that most of the materials are reused or recycled appropriately.



This symbol indicates that this product complies with the applicable European Union requirements according to Directives 2002/96/EC and 2006/66/EC on waste electrical and electronic equipment (WEEE) and batteries. For information about recycling options, check the Support/Service section of the Tektronix Web site (www.tektronix.com).

Perchlorate materials. This product contains one or more type CR lithium batteries. According to the state of California, CR lithium batteries are classified as perchlorate materials and require special handling. See www.dtsc.ca.gov/hazardouswaste/perchlorate for additional information.

Restriction of hazardous substances

This product is classified as an industrial monitoring and control instrument and is not required to comply with the substance restrictions of the recast RoHS Directive 2011/65/EU until July 22, 2017.

Preface

This manual describes how to install the SPG8000 Master Sync / Clock Reference Generator and provides basic operating information.

Product documentation

Table i: Product documentation

Document	Tektronix Part Number	Description	Availability		
			Print	Web	CD
Quick Start User Manual	071-3080-xx (English)	Describes how to install the instrument and provides basic operating information	✓	✓	✓
	077-0745-xx (Japanese)			✓	✓
	077-0746-xx (Russian)			✓	✓
Technical Reference	077-0747-xx	Provides detailed operating information		✓	✓
Specifications and Performance Verification	077-0748-xx	Lists the product specifications and provides procedures for verifying the performance of the instrument		✓	✓
Service Manual	077-0749-xx	Describes how to service the instrument to the module level (such as circuit boards and fuses)		✓	
Declassification and Security Instructions	077-0750-xx	Describes how to clear or sanitize the data storage (memory) devices in the product for customers with data security concerns.		✓	
Release Notes	077-0751-xx	Describes the new features, improvements, and limitations of the instrument firmware		✓	
Video Sync Pulse Generator and Electronic Changeover Unit System Integration Technical Reference	077-0563-xx	Provides information for system integrators who are designing systems for high-definition (HD) and standard-definition (SD) digital video content where Tektronix electronic changeover units and video sync pulse generators are to be deployed.		✓	✓

Conventions Used in This Manual

The following icons are used throughout this manual.

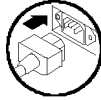
Sequence
Step



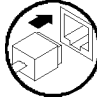
Front panel
power



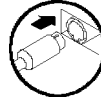
Connect
power



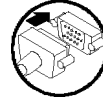
Network



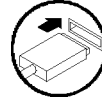
PS2



SVGA



USB



Installation

Product description

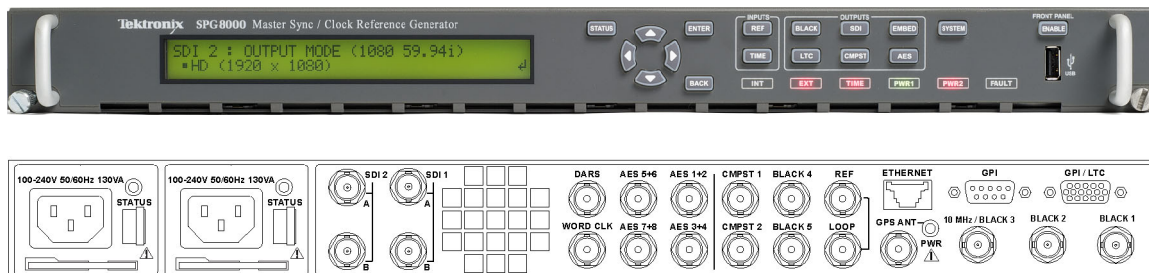


Figure 1: SPG8000 Master Sync / Clock Reference Generator front and back panels

The SPG8000 is a precision multi-format 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 loop-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.

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 adds two additional black outputs and adds 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 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.

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; the NTP server requires Option GPS
- 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); 3G-SDI test patterns require Option 3G
- 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

Accessories

The following table lists the standard and optional accessories provided with the SPG8000 generator.

Table 1: Standard and optional accessories

Accessory	Std.	Opt.	Tektronix part number
SPG8000 Quick Start User Manual (English)	•		071-3080-xx
Note: Japanese and Russian language versions of this document are available in PDF format on the Product Documentation CD			
SPG8000 Product Documentation CD	•		063-4474-xx
Rackmounting hardware	•		351-1137-00
Rackmount installation instructions	•		071-2746-xx
Power cord (See page 4, <i>International power cord options</i> .)	•		Varies by option
D-sub to XLR/BNC adapter cable (Option XLR only) ¹		•	NA ²
GPS rooftop antenna (Option ANT only)		•	NA ³

¹ This 6 foot adapter cable connects from the 15-pin D-sub GPI/LTC connector on the SPG8000 to four XLR male connectors (for LTC input/outputs) and three BNC male connectors (for General Purpose Interface (GPI) input/outputs).

² For a replacement cable, order SPG8UP Option XLR.

³ For a replacement antenna, order SPG8UP Option ANT.

International power cord options

All of the available power cord options listed below include a lock mechanism to keep the power cord attached to the instrument.

- Opt. A0 – North America power (standard)
- Opt. A1 – Universal EURO power
- Opt. A2 – United Kingdom power
- Opt. A3 – Australia power
- Opt. A5 – Switzerland power
- Opt. A6 – Japan power
- Opt. A10 – China power
- Opt. A11 – India power
- Opt. A12 – Brazil power
- Opt. A99 – No power cord

Initial product inspection

Perform the following product inspection procedure when you receive your instrument:

1. Inspect the shipping carton for external damage, which may indicate damage to the instrument.
2. Remove the SPG8000 generator from the shipping carton, and then check that the instrument has not been damaged in transit. Prior to shipment the instrument is thoroughly inspected for mechanical defects. The exterior should not have any scratches or impact marks.

NOTE. *Save the shipping carton and packaging materials for instrument repackaging in case shipment becomes necessary.*

3. Verify that the shipping carton contains the instrument, the standard accessories, and any optional accessories that you ordered. (See Table 1.)
4. Verify that all of the product options that you ordered are installed:
 - Before installation, you can verify the hardware options by viewing the rear panel. (See Figure 4 on page 38.) After installation, use the **SYSTEM : OPTIONS** menu selection to view which options are installed.
 - If you ordered Option 3G when you purchased the instrument, the software option should already be enabled and you should have received a document showing the option key. After the instrument is installed, use the **SYSTEM : OPTIONS** menu selection to verify that the option is enabled. If you need to enter the option key, see *How to enter the option key (Option 3G only)*. (See page 80.)

SYSTEM : OPTIONS GPS BG AG SDI 3G

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Contact your local Tektronix Field Office or representative if there is a problem with your instrument or if your shipment is incomplete.

Product installation

This section provides installation information for the SPG8000 generator.

Rackmount installation



WARNING. *Personal injury or damage to the instrument can occur if the instrument is not properly secured in the equipment rack.*

The SPG8000 is configured at shipment for use in an equipment rack. Refer to the *Rackmount Slides and Rails Kit Instructions*, Tektronix part number 071-2746-XX, that was supplied with the instrument for instructions on how to install the rackmounting hardware.

To install the instrument into an equipment rack. After you have installed the rackmounting hardware, perform the following steps to install the instrument into an equipment rack:



WARNING. *To prevent injury during product installation, use care not to pinch hands or fingers in the rails and slides.*

1. Insert the instrument left and right slides into the ends of the rack rails while tilting the long handle part of each lever upward. (See Figure 2.)

NOTE. *Make sure to insert the instrument slides inside the inner rack rails. You may also need to tilt the rear of the instrument up or down at a slight angle to fit the slides into the rails.*

2. Push the instrument into the rack until it stops.



CAUTION. *To prevent damage to the instrument and rackmount, do not force the instrument into the rack if it does not slide smoothly. The rails assembly may need to be adjusted to resolve the problem.*

3. Retighten any loose screws and push the instrument all the way into the rack. If the tracks do not slide smoothly, readjust the rail assemblies.
4. When adjusting is completed, tighten all rail assembly 10-32 screws using 28 inch-lbs of torque.
5. If the instrument has knob screws on the front corners, tighten them so that they are secured in the rack.
6. To remove the instrument from the rack, loosen the knob screws.

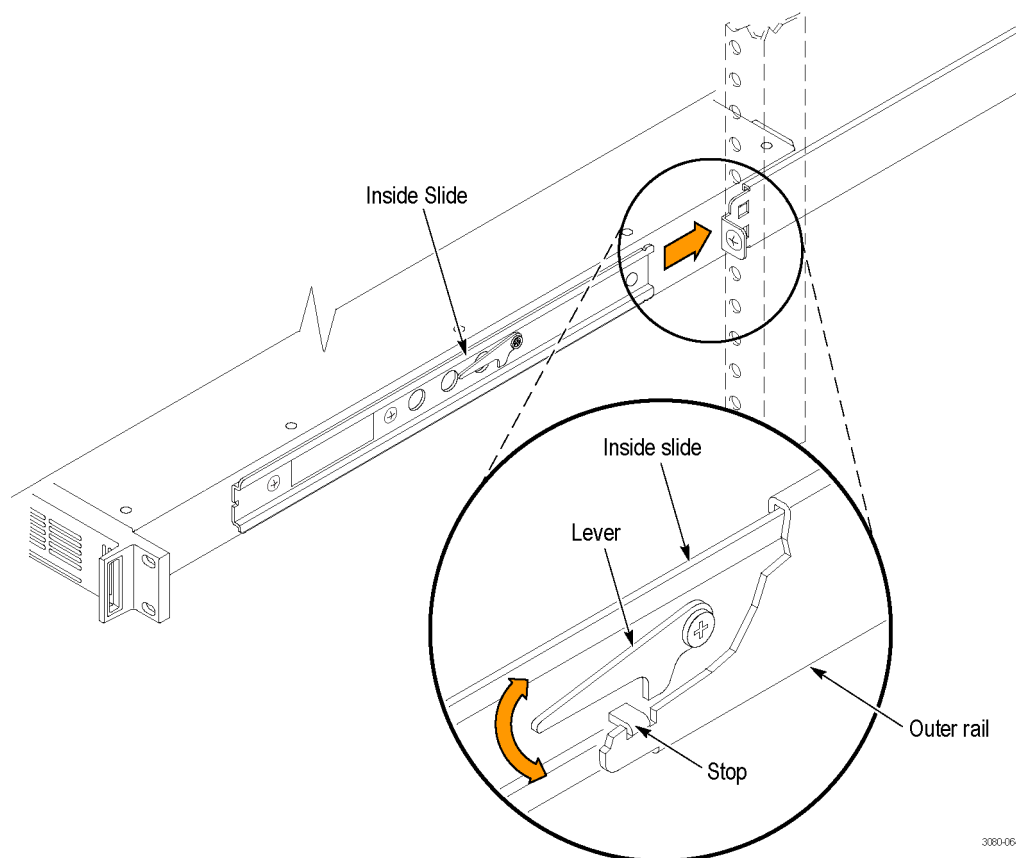


Figure 2: Installing or removing the instrument into or from the rack

To remove the instrument from an equipment rack. Perform the following steps to remove an instrument that is installed in an equipment rack:



WARNING. To prevent injury when removing the product from the rack, do not forcefully and abruptly pull the product from the rack. Pull with the minimum force required to move the instrument with a consistent, even motion.

1. Loosen the knob screws, if present, that attach the front of the instrument to the rack.
2. Gently pull the instrument toward you until you can reach the levers at the rear of the instrument.
3. Tilt both lever handles upward simultaneously to allow them to clear the stops. (See Figure 2.)
4. Pull the instrument past the stops and out of the rack.

Environmental operating requirements

Check that the location of your installation has the proper operating environment as listed in the following table. (See Table 2.)



CAUTION. Damage to the instrument can occur if this instrument is powered on at temperatures outside the specified temperature range.

Table 2: SPG8000 environmental requirements

Parameter		Description
Temperature	Operating	0 °C to +50 °C
	Nonoperating	-20 °C to +60 °C
Relative Humidity	Operating	20% to 80% (No condensation); Maximum wet-bulb temperature 29.4 °C
	Nonoperating	5% to 90% (No condensation); Maximum wet-bulb temperature 40.0 °C
Altitude	Operating	To 3,000 m (9,842 feet) Maximum operating temperature decreases 1 °C each 300 m above 1.5 km.
	Nonoperating	To 15,000 m (49,212 feet)

Leave space for cooling by ensuring standard side clearance for rack mounting or 2 inches (5.1 cm) of side clearance for benchtop use. Also, ensure sufficient rear clearance (approximately 2 inches) so that cables are not damaged by sharp bends.

For complete specifications for the instrument, refer to the *SPG8000 Specifications and Performance Verification Technical Reference* manual.

Firmware upgrades

Tektronix releases product updates to add new features and to fix problems with the product firmware. During installation, it is recommended that you verify your instrument has the latest firmware version installed. You can find the latest firmware for your product at the Tektronix Web site (www.tektronix.com/downloads). (See page 63, *How to upgrade the instrument firmware*.)

Power connection

The SPG8000 operates from a single-phase power source with the neutral conductor at or near earth ground. The line conductor is fused for over-current protection. A protective ground connection through the grounding conductor in the locking power cord is essential for safe operation.

The standard instrument has one Power Supply module installed. With Option DPW, a second hot-swappable redundant (backup) Power Supply module is installed. When two Power Supply modules are installed in the instrument, one is configured to be the primary supply and the other is configured to be the backup supply. In the event that the primary supply fails, the backup supply will automatically provide power to maintain instrument operation. (See page 76, *How to operate an instrument with two power supplies (Option DPW only)*.)



CAUTION. *The instrument does not have a power switch. When you connect the power cable to the AC line connector, the instrument powers on.*

Do not install or remove a Power Supply module when a power cord is attached to that module.

AC power requirements

Check that your location provides the proper electrical power requirements as listed in the following table. (See Table 3.)

Table 3: AC line power requirements

Parameter	Description
Line Voltage Range	100 - 240 VAC
	WARNING. <i>To reduce the risk of fire and shock, ensure that the mains supply voltage fluctuations do not exceed 10% of the operating voltage range.</i>
Line frequency	50/60 Hz
Maximum power	130 VA

To connect the power cable(s)

Connect the power cable to the instrument first, and then connect it to the AC power source. Connecting the power cable causes the instrument to power on.

After the instrument boots up and initializes, make sure that the FAULT indicator is not illuminated and that no faults are reported on the instrument display. If the FAULT indicator is illuminated, perform the appropriate user action. (See Table 7 on page 36.)

Backup supply (Option DPW). If the instrument has two Power Supply modules installed (Option DPW), connect a power cable to each of the supplies. After the instrument powers on, configure the instrument for the preferred (active) supply. (See page 76, *How to operate an instrument with two power supplies (Option DPW only)*.)

Network installation

The SPG8000 has a 10/100/1000 BASE-T Ethernet port on the rear panel that allows you to use a PC to remotely control the instrument and to upload and download user files such as signal or logo files.

This section provides instructions for connecting the SPG8000 to a single PC or to a network and for setting the network parameters on the Ethernet port.

See *How to transfer user files* for instructions on how to upload and download user files using the Ethernet port. (See page 71.)

Connecting the SPG8000 to your PC(s)

You can use one of the following two methods to connect the SPG8000 to your PC(s):

- If you are connecting the SPG8000 directly to a single PC, use an Ethernet cable to connect between the Ethernet port on the SPG8000 and the Ethernet port on the PC.
- If you are connecting the SPG8000 to your local Ethernet network, use an Ethernet cable to connect between the Ethernet port on the SPG8000 and the Ethernet hub port of your local network. By connecting to an Ethernet network, you can access the SPG8000 using any PC on the network.

To configure the network parameters

The following two procedures describe how to configure the SPG8000 network parameters. Use the first procedure if your network supports DHCP; use the second procedure if your network does not support DHCP.

To configure parameters for a network with a DHCP server. If your network has a DHCP server, perform the following steps to configure the instrument to function as a DHCP client. When the SPG8000 is connected to the network and DHCP service is enabled, the SPG8000 obtains the necessary network addresses automatically from the DHCP server.

NOTE. Under some network environments, the SPG8000 may not be able to get the IP address automatically from a DHCP server. In this case, you need to enter the appropriate address value in each submenu item.

Refer to your network administrator or to the user documentation supplied with your network server operating system (OS) for detailed information about DHCP server functions.

1. Press the front-panel **SYSTEM** button to access the SYSTEM menu.
2. Press the up (▲) or down (▼) arrow button to select **SYSTEM : NETWORK**.
3. Press the left (◀) or right (▶) arrow button to select **Setup**, and then press the **ENTER** button. This accesses the NETWORK SETUP submenu. The top line of the display should read **SYSTEM : NET SETUP : DHCP**.
4. Press the left (◀) or right (▶) arrow button to select **Enable**, and then press the **ENTER** button.
5. Press the **BACK** button to exit the NETWORK SETUP submenu.

To configure parameters for a network without a DHCP server. If your network does not have a DHCP server, perform the following procedure to set the network parameters:

1. Press the front-panel **SYSTEM** button to access the SYSTEM menu.
2. Press the up (▲) or down (▼) arrow button to select **SYSTEM : NETWORK**.
3. Press the left (◀) or right (▶) arrow button to select **Setup**, and then press the **ENTER** button. This accesses the NETWORK SETUP submenu. The top line of the display should read **SYSTEM : NET SETUP : DHCP**.
4. Press the left (◀) or right (▶) arrow button to select **Disable**, and then press the **ENTER** button.
5. If you connected the SPG8000 directly to a single PC:
 - a. Press the up (▲) or down (▼) arrow button to select **SYSTEM : NET SETUP : IP ADDRESS**, and then press the **ENTER** button to enter the edit mode.
 - b. Use the arrow buttons to set the IP address to be the same IP address as the PC's address except for the last number, and then press the **ENTER** button. The last number in the address must be different than the last number in the PC's IP address.
 - c. Press the up (▲) or down (▼) arrow button to select **SYSTEM : NET SETUP : SUBNET MASK**, and then press the **ENTER** button to enter the edit mode.
 - d. Use the arrow buttons to set the subnet mask to be the same net mask (subnet mask) used by the PC, and then press the **ENTER** button. Do not enter a number if the PC does not have a net mask.
 - e. You do not need to enter a **GATEWAY** address if you are directly connected to a single PC.
 - f. Press the **BACK** button to exit the NETWORK SETUP submenu.
6. If you connect the SPG8000 to your local Ethernet network, see the *Caution* note below.



CAUTION. To prevent communication conflicts on your Ethernet network, ask your local network administrator for the correct numbers to enter in the NETWORK PARAMETERS submenu if you connect the SPG8000 to your local Ethernet network.

7. Verify the Ethernet connection by using a ping command from the PC.

GPS antenna installation (Option GPS only)

If your instrument has Option GPS installed, you need to connect a GPS antenna and check the main oscillator calibration before you put the instrument into service.

If you ordered Option ANT, you received a GPS rooftop antenna (5.0 VDC, 1575 MHz range signals, F connector) that works with the integrated internal GPS receiver of a SPG8000 with Option GPS installed.

GPS antenna requirements

The SPG8000 generator requires an external antenna to receive signals from satellites. You must set up an antenna system to provide the GPS signal as an input to the SPG8000 generator. You can configure the instrument to provide 3.3 V or 5 V DC power for the antenna.



WARNING. Prevent risk of shock or fire by ensuring that the GPS antenna is protected from lightning strikes when it is mounted outside a building or facility. The SPG8000 generator does not have isolation protection from lightning, so the facility installation must provide suitable protection for the GPS antenna external to the instrument. Failure to use appropriate precautions can result in injury or death.



CAUTION. To avoid antenna damage, do not turn on the DC antenna power until you know that the antenna is designed to handle the selected voltage. Antenna damage can occur if the antenna is not designed to handle the voltage you select.

When a GPS feed is first connected to the antenna input on the SPG8000 generator, it can take several minutes for the signal quality to reach its nominal potential. How long that takes depends on such things as antenna site, cable plant design, and available satellites. Excluding those variables, the typical time to acquire satellites and achieve specified stability with a good satellite signal, known position, and a warmed up instrument, is two minutes.

GPS antenna system

Antenna systems vary depending on the operating environment and on safety and regulatory requirements. A simplified typical system is shown in the following figure to help you with planning and understanding the trade-offs of one set up versus another. (See Figure 3.)

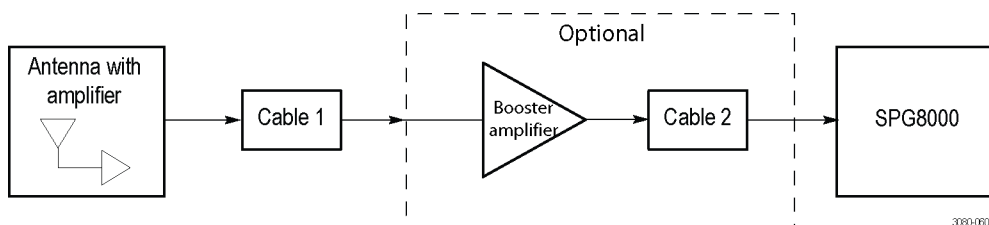


Figure 3: Simplified GPS antenna system

A GPS specific antenna with amplifier provides sufficient gain to drive a reasonable length of cable, and provides filtering to reject signals at other frequencies. A typical example of this is the Trimble Bullet III, 35 dB, 5 V, antenna.

In a simple system without the optional booster, Cable 1 connects the antenna to the SPG8000 generator. The length of this cable is limited by its attenuation at the GPS carrier frequency of 1575 MHz. The SPG8000 generator should have a signal that is 18 dB or greater above the ambient level. For example, for a 35 dB antenna, the allowed cable loss is $35 - 18 = 17$ dB. (See Figure 3.)

Cables. Attenuation varies significantly depending on cable type. Cable loss is about 13 dB/100 ft for a miniature coaxial cable like the Belden 1855, while for a RG11 style like the Belden 7731, the loss is only 5.5 dB/100 ft. This correlates to an allowable length of 130 ft for the small cable, to over 300 ft for the larger cable.

A booster amplifier can be added if more length is needed, as shown in the optional block in the signal path system. (See Figure 3.)

If a 20 dB amplifier is added, then 20 dB more cable loss can be accommodated. This equates to another 150 ft of small coax, or 360 ft of large coax.

Although the GPS input and most of the other components are 50 Ω , either 50 Ω or 75 Ω cables can be used in most installations. The reflections from the impedance mismatch will not cause significant changes in the system because the signal is narrow band and the cable loss is usually many dBs. However, you should not mix short cable lengths of different impedances, as this might create reflections with the potential to cause signal degradation.

Amplification. The SPG8000 generator provides either 3.3 V or 5 V DC power to drive the amplified antenna and booster amplifier. The power is carried on the same coax as the GPS signal, and can be turned off if the antenna is powered by a separate supply. When you are designing the antenna system, check the voltage and current requirements of the components to insure compatibility.

The location of the booster amplifier is important. It needs to be before the second length of cable shown in the simplified antenna system diagram. If the booster amplifier is placed just *before* the SPG8000 generator, then the signal will have been attenuated too far and the output may be noisy. If you cannot put the optional booster amplifier in the middle of a long run of cable, then put it near the antenna rather than near the SPG8000 generator end.

For more complex systems, a variety of booster amplifiers, powered and passive splitters, DC blocks, and filters are available from a number of vendors.

Antenna location. It is important that the GPS antenna location has a clear view of a large part of the sky. Since GPS satellites are constantly orbiting the earth, they may be in any direction at a given time. If part of the sky is blocked by buildings, trees, mountains, etc., then fewer satellites will be visible. It is also possible to get reflected signals that will have come by a longer path than expected and thus may degrade timing accuracy and stability. When evaluating a site, it is important to monitor it over several days and with a variety of weather conditions present.

This antenna information is not intended to cover all aspects of the antenna system design. Important topics that were not covered include items like lightening protection and drip loops. For information about the cable plant design in your system, contact the appropriate person or group in your organization, or contract with a qualified installer.

Check the oven oscillator calibration

You should not need to adjust the oven oscillator frequency immediately after the initial installation since the oscillator frequency was adjusted accurately at the factory. However, you can adjust the oscillator frequency at any time to improve the accuracy of the internal frequency. When Option GPS is installed, you may be able to improve the accuracy slightly after installation since the instrument will be at the normal temperature for your specific installation site. The steps for checking the oscillator accuracy are included in the oven calibration procedure. (See page 14, *Oven oscillator calibration.*)

Oven oscillator calibration

You can calibrate the internal oscillator frequency at any time after you install the instrument in its operating environment and allow it to reach a stable operating condition. You can perform this calibration while the instrument is in service.

You can calibrate the oscillator using GPS or reference signals such as NTSC Burst or CW. However, if you are not using GPS, be careful to insure the reference signal is at the correct frequency.

The following procedure describes how to adjust the oven oscillator using GPS. See the *SPG8000 Technical Reference* manual for instructions on how to calibrate the oven oscillator when a GPS signal is not available.

NOTE. Perform the internal oscillator frequency calibration at least once a year to compensate for oscillator drift.

To calibrate the internal oven oscillator frequency using GPS

Perform the following procedure to set the internal frequency of the instrument internal oscillator. This adjustment stores the current frequency of the oscillator for use when the instrument is set to **Internal** mode. This procedure can be done without any disruption to operation and is best performed in the operating environment of the instrument.



CAUTION. To prevent inaccurate calibration, be sure the instrument is warmed up for at least 20 minutes before you perform this procedure. If Option GPS is installed, be sure a GPS antenna is connected to the instrument. (See Figure 4 on page 38.)

1. Press the **STATUS** button to access the STATUS menu.
2. Use the up (▲) or down (▼) arrow button to check that there are no faults or alerts reported.
3. Press the **REF** button to access the REFERENCE menu.
4. Press the left (◀) or right (▶) arrow button to select **GPS Signal** as the reference source.
5. Press the **ENTER** button to confirm the selection. A bullet appears in front of the readout to indicate the current selection.
6. Press the **STATUS** button to access the STATUS menu.
7. Press the up (▲) arrow button to select **STATUS : REFERENCE : GPS**
8. Check that the status readout shows **Locked**.
9. Check the signal lock indicator and check the tune setting:
 - a. Press the **SYSTEM** button to access the SYSTEM menu.
 - b. Press the up (▲) arrow button to select **SYSTEM : DIAGNOSTICS**.
 - c. Press the **ENTER** button to access the DIAGNOSTICS menu.
 - d. Check that **Fine** is showing on the right side of the TUNE readout on the LCD display.
 - e. Check the Tune readout value. If the value is greater than $\pm 0.10e-6$, then you need to calibrate the oven oscillator. If the value is less than $\pm 0.10e-6$, then no calibration is required.
 - f. Press the **BACK** button to exit the DIAGNOSTICS menu.

10. If you need to calibrate the oscillator, press the up (▲) arrow button to select **SYSTEM : CALIBRATE OVEN**.
11. Press the **ENTER** button to access the **Internal Frequency Calibration** submenu.
12. In the **Execute Calibration?** confirmation display, press the **ENTER** button to start the calibration. The instrument will display the stored calibration value.
13. Press the **ENTER** button.
14. Press the **BACK** button to exit the calibration menu when the calibration is complete.

Functional checks

Use the following procedures to check that the hardware options installed in your SPG8000 generator are functional. Some of the procedures depend on which options are installed in your instrument.

Preparation

Perform the following steps before you perform the functional check procedures:

1. Power on the SPG8000 generator by connecting it to the power source. The initialization process for all of the installed hardware options is executed.
2. Check that no error messages appear on the LCD display.
3. Warm up the instrument for 20 minutes.



CAUTION. To prevent inaccurate results, be sure to warm up the instrument for 20 minutes before you perform any of the functional check procedures.

Diagnostics check

Use the following procedure to check that the BLACK signal outputs are functional:

1. Press the **SYSTEM** button to access the SYSTEM menu.
2. Press the up (▲) or down (▼) arrow button to select **SYSTEM : DIAGNOSTICS**.
3. Press the **ENTER** button to access the DIAGNOSTICS menu.
4. Use the arrow buttons to navigate through the diagnostic displays. The up (▲) and down (▼) arrow buttons select different diagnostic categories. The left (◀) and right (▶) arrow buttons select additional pages of information for many diagnostic categories.
5. **Option SDI only:** Check that the status for each of the DDS and PLL displays read **Lock** or **Lk**.

NOTE. There are additional SDI diagnostics for checking the DDR2 and SRAM memory that can be accessed only in factory mode. See the SPG8000 Service Manual for information on using the factory mode.

6. Check that all of the temperature readouts are within range or report a status of **OK**.
7. Check that the status of all voltage readouts are **OK**.
8. Check that the status of the fan speed readouts are **OK**.
9. **Option GPS only:** Check that the status of the GPS phase ramp readouts are **OK**.
10. If any of the diagnostics report a problem, service the instrument before proceeding with the functional checks.

BLACK output formats and frame pulse functional check

Use the following procedure to check that the BLACK signal formats are functional:

Required equipment.

- Television signal generator with black burst and HD SDI outputs
- NTSC/PAL/SDI waveform monitor
- 75 Ω BNC cable

Procedure.

1. Connect an HD SDI signal, like one from an HDVG7 or SDI7 module in a TG700 or TG8000 generator, to the SDI A input of a WFM8300, and select that input as the active input on the waveform monitor. You can use any HD SDI signal (for example, 1080i 59, 1080i 50, or 1080p 24).
2. Connect a cable from the BLACK 1 output on the SPG8000 generator to the reference input of the WFM8300. Terminate the loopthrough connector on the monitor with a 75 Ω terminator.
3. Press the **EXT REF** button on the WFM8300.
4. Set the format of the BLACK 1 output to PAL:
 - a. Press the **BLACK** button on the SPG8000 generator to select **BLACK 1 : FORMAT**.
 - b. Use the left (◀) or right (▶) arrow button to select **PAL**.
 - c. Press the **ENTER** button. A bullet will appear in front of the PAL readout to indicate the current format selection.
5. Check that the WFM8300 shows PAL as the reference input.
6. Set the HD tri-level sync rate to Non-Integer for the BLACK 1–3 outputs:
 - a. Press the **BLACK** button repeatedly to select **BLACK 1-3 : HD TRI-LEVEL SYNC RATE**.
 - b. Press the right (▶) arrow button to select **Non-Integer (59.94, 29.97, 23.98)**.
 - c. Press the **ENTER** button. A bullet will appear in front of the Non-Integer readout to indicate the current rate selection.

BLACK 1-3 : HD TRI-LEVEL SYNC RATE

■ Non-Integer (59.94, 29.97, 23.98) ◀

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7. Set the format of the BLACK 1 output to 1080 59.94i:
 - a. Press the **BLACK** button to select **BLACK 1 : FORMAT**.
 - b. Use the left (◀) or right (▶) arrow button to select **1080 59.94i** as the format of the BLACK 1 output.
 - c. Press the **ENTER** button. A bullet will appear in front of the 1080 59.94i readout to indicate the current format selection.
8. Check that the WFM8300 shows a 1080 59.94i signal on the reference input.

9. Set the HD tri-level sync rate to Integer for the BLACK 1–3 outputs:
 - a. Press the **BLACK** button repeatedly to select **BLACK 1-3 : HD TRI-LEVEL SYNC RATE**.
 - b. Press the right (▶) arrow button to select **Integer (60, 50, 30, 25, 24)**.
 - c. Press the **ENTER** button. A bullet will appear in front of the Integer readout to indicate the current rate selection.
10. Set the format of the BLACK 1 output to 1080 60i:
 - a. Press the **BLACK** button to select **BLACK 1 : FORMAT**.
 - b. Use the left (◀) or right (▶) arrow button to select **1080 60i** as the format of the BLACK 1 output.
 - c. Press the **ENTER** button. A bullet will appear in front of the 1080 60i readout to indicate the current format selection.
11. Check that the WFM8300 shows a 1080 60i signal on the reference input.
12. Check the BLACK 2 output:
 - a. On the SPG8000 generator, move the signal cable from the BLACK 1 output to the BLACK 2 output.
 - b. Repeat steps 4 through 11 for the BLACK 2 output.
13. Check the BLACK 3 output:
 - a. On the SPG8000 generator, move the signal cable from the BLACK 2 output to the BLACK 3 output.
 - b. Repeat steps 4 through 11 for the BLACK 3 output.
14. **Option BG only:** Check the BLACK 4 output:
 - a. On the SPG8000 generator, move the signal cable from the BLACK 3 output to the BLACK 4 output.
 - b. Repeat steps 4 through 11 for the BLACK 4 output. Be sure to select BLACK 4–5 when you set the HD tri-level sync rates.
15. **Option BG only:** Check the BLACK 5 output:
 - a. On the SPG8000 generator, move the signal cable from the BLACK 4 output to the BLACK 5 output.
 - b. Repeat steps 4 through 11 for the BLACK 5 output. Be sure to select BLACK 4–5 when you set the HD tri-level sync rates.

Composite outputs functional check (Option BG only)

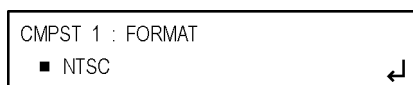
Use the following procedure to check that the composite video outputs (Option BG only) are functional:

Required equipment.

- NTSC/PAL waveform monitor
- 75 Ω BNC cable

Procedure.

1. Press the **CMPST** button repeatedly until the **CMPST 1** output is selected as shown below.



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2. Press the left (◀) or right (▶) arrow button to select desired signal format: **NTSC** or **PAL**.
3. Press the **ENTER** button to confirm the format selection. A bullet appears in front of the selected format name as shown above.
4. Press the up (▲) or down (▼) arrow button to select **CMPST 1 : TEST SIGNAL**.
5. Press the left (◀) or right (▶) arrow button to select **100% Color Bar**.



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6. Press the **ENTER** button to confirm the test signal selection. A bullet appears in front of the selected signal name as shown above.
7. Connect the **CMPST 1** connector to the NTSC/PAL waveform monitor using the 75 Ω BNC cable.
8. Set the waveform monitor to view the signal.
9. Check that the appropriate color bar signal is displayed.
10. Press the **CMPST** button to select the **CMPST 2** output.
11. Repeat steps 1 through 9 for the **CMPST 2** output.

SDI outputs functional check (Options SDI and 3G only)

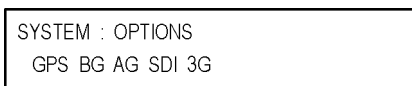
Use the following procedure to check that the SDI outputs (Option SDI only) are functional.

Required equipment.

- 3 Gb/s waveform monitor
- One 1 m (3 ft) BNC to BNC high-bandwidth cable

Procedure.

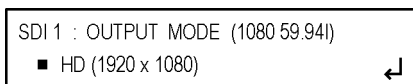
1. Check the SPG8000 diagnostics. (See page 16, *Diagnostics check*.) The diagnostics affecting the SDI outputs are the PLL and DDS status readouts and the SDI Board temperature readouts.
2. Determine if Option 3G is enabled. Some of the steps in this procedure depend on whether the option is enabled or not.
 - a. Press the **SYSTEM** button to access the SYSTEM menu.
 - b. Press the up (▲) or down (▼) arrow button to select **SYSTEM : OPTIONS**.
 - c. If 3G appears in the second line of the display as shown below, then Option 3G is installed.



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NOTE. If Option 3G is not enabled and you have the option key, you can enter the option key to enable the option. (See page 80, *How to enter the option key (Option 3G only)*.)

3. Press the **SDI** button until the SDI 1 output is selected as shown below.



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4. Press the left (◀) or right (▶) arrow button to select the appropriate output mode as listed below. When the desired output mode is displayed, press the **ENTER** button to confirm the selection.
 - Option 3G enabled: select the **3G-Level A (1920 × 1080)** output mode.
 - Option 3G not enabled: select the **HD (1920 × 1080)** output mode.
5. Press the up (▲) or down (▼) arrow button to select **SDI 1 : FORMAT**. The selected Output Mode will be listed on the top line of the display.
6. Press the left (◀) or right (▶) arrow button to select the appropriate format as listed below. When the desired format is displayed, press the **ENTER** button to confirm the selection.
 - Option 3G enabled: select the **1080 50p** format.
 - Option 3G not enabled: select the **1080 50i** format.

7. Press the up (▲) or down (▼) arrow button to select **SDI 1 : TEST SIGNAL**, and then press the **ENTER** button to enter the SDI TEST SIGNAL submenu.
8. Press the up (▲) or down (▼) arrow button to select the test signal type (such as Color Bar), and then press the left (◀) or right (▶) arrow button to select a specific test signal to output (such as 100% Color Bars). Press the **ENTER** button to confirm the signal selection.
9. Press the **BACK** button to exit the SDI TEST SIGNAL submenu.
10. Connect the **SDI 1A** connector to the HDTV waveform monitor using the 75 Ω BNC cable.
11. Set the waveform monitor to view the signal.
12. Check that the signal appears as expected. Check for errors on the video session screen of the waveform monitor.
13. Disconnect the BNC cable from the **SDI 1A** connector, and then connect the BNC cable to the **SDI 1B** connector.
14. Press the up (▲) or down (▼) arrow button to select **SDI 1 : FORMAT**.
15. Press the left (◀) or right (▶) arrow button to select the appropriate format as listed below. When the desired format is displayed, press the **ENTER** button to confirm the selection.
 - Option 3G enabled: select the **1080 59.94p** format.
 - Option 3G not enabled: select the **1080 59.94i** format.
16. Check that the signal appears as expected on the waveform monitor and check for errors on the video session screen.
17. Repeat steps 3 through 16 for the SDI 2 outputs. To test the SDI 2 outputs, connect the SDI 2A and SDI 2B outputs to the waveform monitor.

GPS functional check (Option GPS only)

Use the following procedure to check that the GPS synchronization and timecode functions are operational.

Required equipment.

- GPS antenna feed with good signal level
- Voltmeter
- BNC-to-banana-plug adapter
- (2) 75 Ω coaxial terminators (Tektronix part number 011-0163-XX)
- (2) BNC T connectors
- 1 meter BNC cable

Procedure.

1. Check the SPG8000 diagnostics. (See page 16, *Diagnostics check*.) The diagnostics affecting the GPS system are the REF Board temperature and the readouts for the GPS up and down phase ramps.
2. Load the factory preset:
 - a. From the SYSTEM menu, press the up (\blacktriangle) or down (\blacktriangledown) arrow button to select **SYSTEM : PRESET**.
 - b. Press the **ENTER** button to access the PRESET menu.
 - c. Press the left (\blacktriangleleft) arrow button to select **Factory Default**.
 - d. Press the **ENTER** button to load the Factory Default preset.
 - e. When the preset loading is complete, press the **BACK** button to exit the PRESET menu.

NOTE. When Option GPS is installed, the Factory Default preset sets the reference source to GPS Signal in the REFERENCE menu. The following procedures assume the Reference Source setting is configured to GPS Signal.

Check the DC antenna output power voltage.

1. Connect the BNC-to-Banana-plug adapter to the voltmeter.
2. Connect the BNC T to the adapter.
3. Connect a 75 Ω BNC cable to the other end of the BNC T connector.
4. Connect the other end of the cable to the GPS antenna input on the rear of the instrument. (See Figure 4 on page 38.)
5. Set the GPS antenna power to 3.3 V:
 - a. Press the **REF** button to access the REFERENCE menu.
 - b. Use the up (**▲**) or down (**▼**) arrow button to select **REFERENCE : GPS ANTENNA POWER**.
 - c. Use the left (**◀**) or right (**▶**) arrow button to select **3.3 Volt**.
 - d. Press the **ENTER** button. A bullet will appear in front of the 3.3 Volt readout to indicate the current power selection.
6. Check that the voltmeter shows between 3.3 V and 4 V.
7. Use the left (**◀**) arrow to set the GPS antenna voltage to **5 Volt**.
8. Press the **ENTER** button. A bullet will appear in front of the 5 Volt readout to indicate the current power selection.
9. Check that the voltmeter shows between 5 V and 6 V.

Check the antenna current and fault thresholds.

1. Connect the BNC-to-Banana-plug adapter to the voltmeter.
2. Connect the BNC T to the adapter.
3. If necessary, set the GPS antenna power to 5 V:
 - a. Press the **REF** button to access the REFERENCE menu.
 - b. Use the up (**▲**) or down (**▼**) arrow button to select **REFERENCE : GPS ANTENNA POWER**.
 - c. Use the left (**◀**) or right (**▶**) arrow button to select **5 Volt**.
 - d. Press the **ENTER** button. A bullet will appear in front of the 5 Volt readout to indicate the current power selection.
4. Connect a 75 Ω BNC cable to the other end of the BNC T connector.
5. Connect the other end of the cable to the GPS antenna input on the rear of the instrument. (See Figure 4 on page 38.)
6. Check that the GPS power LED (located next to the GPS antenna connector on the rear panel) is flashing green. Green indicates an open circuit.
7. Apply a 75 Ω terminator to the BNC T and check that the voltage is between 4.5 V and 5 V.
8. Check that the GPS power LED is a steady green. This indicates a nominal load.
9. Connect the second BNC T and 75 Ω terminator to the antenna system to exceed the allowed antenna current.
10. Check that the GPS power LED is a steady red. This indicates a short circuit.
11. Remove the terminators and the connection to the voltmeter.

Check the lock to GPS through antenna function.



CAUTION. To avoid antenna damage, do not turn on the DC antenna power until you know that the antenna is designed to handle the selected voltage. Antenna damage can occur if the antenna is not designed to handle the voltage you select.

1. Set the antenna voltage as needed by the antenna in the test system (3.3 Volt or 5 Volt).
2. Navigate to the GPS signal quality menu:
 - a. Press the **STATUS** button to access the STATUS menu.
 - b. Use the up (▲) or down (▼) arrow button to select **STATUS : GPS**. As shown below, the signal quality will read 0.0 and the number of satellites used will read 0/0 because there is no GPS signal connected to the instrument.

STATUS : GPS
GPS Signal Quality : 0.0 Sats : 0/0

3080-056

- c. Use the up (▲) or down (▼) arrow button to select **STATUS : REFERENCE : GPS**. The status will read No Signal because there is no GPS signal connected to the instrument.
3. Connect the GPS input signal feed to the GPS antenna input on the rear of the instrument.
 4. Check that the GPS reference status readout changes from *No Signal* to *Low Signal* to *Acquiring satellites* to *Adjusting phase* to *Locked*.

NOTE. It is okay if some steps are skipped. Depending on the signal level, it may take from a few seconds to several minutes to leave the "No Signal" state.

5. Use the up (▲) or down (▼) arrow button to select **STATUS : GPS**. When the GPS reference status is Locked, the signal quality will read at least 30 and the number of satellites used will read at least 4/4 depending on the number of satellites being used.
6. Make sure that the instrument has been running for at least 20 minutes before performing the next step.
7. Enter the Diagnostics menu and check for "fine" tune status. This indicates the GPS is operating at the maximum stability:
 - a. Press the **SYSTEM** button to access the SYSTEM menu.
 - b. Use the up (▲) or down (▼) arrow button to select **SYSTEM : DIAGNOSTICS**.
 - c. Press the **ENTER** button to access the DIAGNOSTICS menu.
 - d. Use the up (▲) or down (▼) arrow button to select **TUNE** and check that the instrument shows **Fine** on the right side of the display.
8. Press the **BACK** button to exit the DIAGNOSTICS menu.

LTC outputs functional check

Use the following procedure to check that the LTC outputs are operational.

Required equipment.

- WFM8300 or equivalent with Option CPS
- LTC/GPIO breakout adapter cable (Tektronix part number 012-1717-XX)
- Female XLR connector, three wires, and one 15-pin, high-density DSUB male header with solder cups, assembled as described in the LTC Output test

Procedure.

1. Connect the LTC/GPIO breakout adapter cable to the GPI/LTC connector on the back of the SPG8000 generator.
2. Construct an adapter by soldering wires between a female XLR and a 15-pin DSUB male header with solder cups, with this pin out:
 - a. XLR pin 1 to DSUB pin 6.
 - b. XLR pin 2 to DSUB pin 7.
 - c. XLR pin 3 to DSUB pin 8.
3. Connect the LTC 1 output on the breakout cable to the XLR adapter you just made.
4. Connect the DSUB end of the adapter you just made to the remote connector on the WFM8300.
5. Configure the WFM8300 to use LTC as the Timecode source.
6. Configure the LTC 1 output for 30 fps drop frame:
 - a. Press the **LTC** button to select **LTC 1 : INPUT-OUTPUT**.
 - b. Use the left (◀) or right (▶) arrow button to select **Output (if allowed)**.
 - c. Press the **ENTER** button. A bullet will appear in front of the Output (if allowed) readout to indicate the current selection.
 - d. Use the up (▲) or down (▼) arrow button to select **LTC 1 : FORMAT**.
 - e. Use the left (◀) or right (▶) arrow button to select **30fps drop-frame**.
 - f. Press the **ENTER** button. A bullet will appear in front of the 30fps drop-frame readout to indicate the current selection.
 - g. Use the up (▲) or down (▼) arrow button to select **LTC 1 : SOURCE**.
 - h. Use the left (◀) or right (▶) arrow button to select **Time of Day**.
 - i. Press the **ENTER** button. A bullet will appear in front of the Time of Day readout to indicate the current selection.
7. Check that the time of day is correctly updating on the WFM8300 timecode display.
8. Repeat steps 3 through 7 for LTC 2 at 30 fps.
9. Repeat steps 3 through 7 for LTC 3 at 25 fps.
10. Repeat steps 3 through 7 for LTC 4 at 24 fps.

GPI output functional check

Use the following procedure to check that the GPI outputs are operational.

Required equipment.

- Television signal generator with an NTSC black burst output
- Voltmeter
- LTC/GPIO breakout adapter cable (Tektronix part number 012-1717-XX)
- 9-pin DSUB male header with a wire connected to pin 6
- BNC-to-banana-plug adapter

Procedure.

1. Connect an NTSC black burst signal from a television signal generator to one of the REF loopthrough connectors on the SPG8000.
2. Terminate the other REF loopthrough connector in 75 Ω .
3. Set the reference source to NTSC Burst as follows:
 - a. Press the **REF** button on the SPG8000.
 - b. Press the up (**▲**) arrow button to select **REFERENCE : SOURCE**.
 - c. Use the left (**◀**) or right (**▶**) arrow button to select **NTSC Burst**.
 - d. Press the **ENTER** button.
 - e. Check that the **EXT** indicator light on the front panel is green and stable.
4. Connect the GPI 1 output to the voltmeter:
 - a. Connect the BNC-to-Banana-plug adapter to the voltmeter.
 - b. Connect the LTC/GPIO breakout adapter cable to the GPI/LTC connector on the back of the instrument.
 - c. Connect the GPI 1 connector on the breakout cable to the BNC-to-Banana-plug adapter.
5. Configure the GPI 1 output to be asserted on unlock:
 - a. Press the **SYSTEM** button to access the SYSTEM menu.
 - b. Use the up (**▲**) or down (**▼**) arrow button to select **SYSTEM : GPI**.
 - c. Press the **ENTER** button to access the GPI submenu.
 - d. Use the up (**▲**) or down (**▼**) arrow button to select **SYSTEM : GPI : OUTPUT 1**.
 - e. Press the **ENTER** button to access the GPI OUTPUT 1 submenu.
 - f. Use the up (**▲**) or down (**▼**) arrow button to select **Lock Error**.
 - g. Use the left (**◀**) or right (**▶**) arrow button to select **Lock Error: Enable**.
 - h. Press the **ENTER** button. A bullet will appear in front of the Lock Error readout to indicate the current selection.
 - i. Press the **BACK** button twice to exit the GPI submenu.
6. Check that the voltage on the GPI 1 output measures between 4.5 V and 5.5 V.

7. Disconnect the antenna input from the SPG8000 generator. After 15 seconds, check that the GPI 1 output is below 0.5 V.
8. Repeat steps 4 through 7 for the GPI 2 output.
9. To test the GPI 3 output, connect the 9-pin DSUB header to the GPI port on the instrument. Connect the pin 6 wire to a voltmeter and connect the ground lead of the voltmeter to the chassis of the SPG8000 generator.
10. Repeat steps 5 through 7 for the GPI 3 output.

GPI input functional check

Use the following procedure to check that the GPI input is operational.

Required equipment.

- LTC/GPIO breakout adapter cable (Tektronix part number 012-1717-XX)
- 75 Ω terminator

Procedure.

1. Configure the GPI input to reset the program time:
 - a. Press the **SYSTEM** button to access the SYSTEM menu.
 - b. Use the up (**▲**) or down (**▼**) arrow button to select **SYSTEM : GPI**.
 - c. Press the **ENTER** button to access the GPI submenu.
 - d. Use the up (**▲**) or down (**▼**) arrow button to select **SYSTEM : GPI : INPUT TRIGGER**.
 - e. Use the left (**◀**) or right (**▶**) arrow button to select **Reset Program Time**.
 - f. Press the **ENTER** button. A bullet will appear in front of the Reset Program Time readout to indicate the current selection.
 - g. Press the **BACK** button to exit the GPI submenu.
2. Press the **STATUS** button to access the STATUS menu.
3. Use the up (**▲**) or down (**▼**) arrow button to select **SYSTEM : TIME : GPS**.
4. Use the left (**◀**) or right (**▶**) arrow button to display **Program Time**.
5. Write down the program time.
6. Connect the LTC/GPIO breakout adapter cable to the GPI/LTC connector on the back of the instrument.
7. Attach a 75 Ω terminator to the GPI input for 2 seconds, and then remove it.
8. Look at the program time readout and compare it to the program time you wrote down before. The time on the display should have reset to the default start time of 00:00:00.00 and now be counting again.

REF loopthrough input functional check

Use the following procedure to check that the Genlock function is operational.

Required equipment.

- NTSC black source (can be a second SPG8000 generator, or a TG8000/TG700 mainframe with Option GPS installed)
- 1 meter BNC cable
- 75 Ω terminator

Procedure.

1. Set the Reference Source to Internal.
 - a. Press the **REF** button to access the REFERENCE menu.
 - b. Use the left (◀) or right (▶) arrow button to select **Internal**.
 - c. Press the **ENTER** button. A bullet will appear in front of the Internal readout to indicate the current reference source selection.
2. Check that the **INT** indicator on the front panel lights solid green. This shows that the instrument is using the internal reference signal.
3. Use the left (◀) or right (▶) arrow button to select **NTSC Burst** as the reference source.
4. Press the **ENTER** button. A bullet will appear in front of the NTSC Burst readout to indicate the current reference source selection.
5. Check that the **INT** indicator lights solid green and the **EXT** indicator is solid red. This shows that the is not locked to any reference signal.
6. Connect the NTSC signal generator output to one of the **REF** loopthrough connectors using a 75 Ω BNC cable.
7. Connect a 75 Ω terminator to the other REF loopthrough connector.
8. Set the NTSC signal generator to output an NTSC signal.
9. Check that the **EXT** indicator lights. This shows that the instrument is now using the external reference signal.
10. Disconnect the test setup.

WORD CLOCK output functional check

Use the following procedure to check that the Word Clock output is functional:

Required equipment.

- Oscilloscope
- 75 Ω BNC cable
- 75 Ω Termination

Procedure.

1. Connect the **WORD CLOCK** connector to the oscilloscope CH1 input using the 75 Ω BNC cable and 75 Ω termination.
2. Check that the appropriate clock signal is displayed on the screen. The signal will be either 1 V (AC) or 5 V (DC) depending on the setting in the AES button menu.

NOTE. The 5 V (DC) mode will only provide 2.5 V into a 75 Ω terminator. If you want 5 V, you must remove the 75 Ω terminator and input the signal into the oscilloscope with the oscilloscope input set to 1 M Ω mode.

AES audio and DARS output functional check (Option AG only)

Use the following procedure to check that the AES audio outputs are functional:

Required equipment.

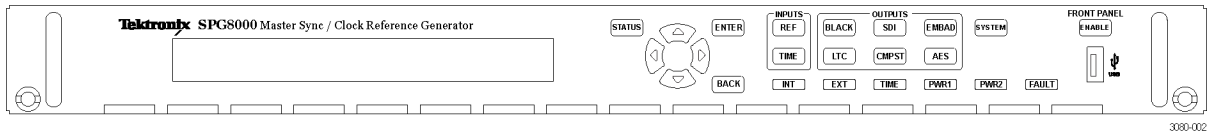
- Digital audio monitor
- 75 Ω BNC cable
- 75 Ω Termination

Procedure.

1. Press the front-panel **AES** button to access the AES menu.
2. Connect the **AES 1+2** connector to the digital audio monitor using the 75 Ω BNC cable.
3. Set the digital audio monitor to display the status for the audio data.
4. Check that no CRC errors appears on the monitor and that the signal levels match the settings in the AES button menu. The default signal amplitude is -20 dBFS.
5. Move the BNC cable from the **AES 1+2** connector to the **AES 3+4** connector, and then repeat step 4.
6. Move the BNC cable from the **AES 3+4** connector to the **AES 5+6** connector, and then repeat step 4.
7. Move the BNC cable from the **AES 5+6** connector to the **AES 7+8** connector, and then repeat step 4.
8. Move the BNC cable from the **AES 7+8** connector to the **DARS** connector, and check that no CRC errors appear on the monitor. The signal levels on the DARS connector should be at the bottom of the graph (less than -70 dBFS) and should indicate mute on the bars.

Operation

Front panel controls



LCD display

The LCD display is a two-line, 40-character-per-line display. Almost all menus have two lines of text, where the first line shows the current position in the current menu, and the second line shows the current selection (if there is not a submenu). If nothing is on the second line, press the ENTER button to access the corresponding submenu.

You can adjust the contrast of the LCD display using the SYSTEM menu. (See page 47, *SYSTEM button menu diagram*.)

STATUS button

Use the STATUS button to view the status of instrument settings such as the GPS parameters, the format of the black outputs, the format of the composite outputs, the format of the SDI outputs, and the status of the LTC signals. You can also view messages explaining the cause of any red or orange fault LEDs on the front panel.

The STATUS button menu allows you to only view information about the settings and state of the instrument. Since no changes to the instrument operation can be made from this menu, it is always safe to navigate this menu while the instrument is in operation.

Menu control buttons

Use these buttons to control the menu display. (See page 44, *Menu diagrams*.)

Arrow (▲), (▼), (◀), and (▶) Buttons. Use these arrow buttons to scroll through the available menu items.

ENTER button. Use the ENTER button to enable the selected menu item or to enter a submenu.

BACK button. Use the BACK button to return to the previous menu item.

INPUTS

Use these buttons to access menus for controlling the Reference and Time settings in the instrument.

REF button. Use the REF button to access the Reference menu where you can configure the reference source, genlock timing, and GPS reference settings.

TIME button. Use the TIME button to access the Time menu where you can configure timing settings such as the time of day, time zone offset, DST schedule, and alarm time and delay.

OUTPUTS

Use these buttons to access menus for configuring the signal outputs.

BLACK button. Use the BLACK button to configure the format, timing, timecode, and tri-level sync rate of the Black outputs. Three Black outputs are standard; there are five Black outputs when Option BG is installed.

SDI button. Option SDI is required for this button to operate. Use the SDI button to configure the output mode and format of the selected test signal on the optional SDI outputs. You can also enable the moving picture mode, enable and configure an overlay on the test signal outputs.

EMBED button. Option SDI is required for this button to operate. Use the EMBED button to configure the embedded audio on the optional SDI outputs.

LTC button. Use the LTC button to configure the LTC input and outputs on the GPI / LTC connector.

CMPST button. Option BG is required for this button to operate. Use the CMPST button to configure the composite outputs.

AES button. Option AG is required for this button to operate. Use the AES button to configure the AES audio outputs.

SYSTEM button

Use the SYSTEM button to access the System menu where you configure and view various system settings. You can save and recall presets, configure the network settings, enable the Web user interface and the SNMP interface, backup and restore instrument settings, view alarms, configure the GPI interface, run and view instrument diagnostics, and upgrade the instrument firmware.

FRONT PANEL ENABLE button

Use this button to enable or disable the front-panel buttons. When pressing this button for about one second while the front-panel buttons are enabled, all of the front-panel buttons are disabled. If you have selected a timeout period in the FRONT PANEL DISABLE item in the UTILITY submenu, and that period passes without a button push, all of the front-panel buttons are also disabled.

Press and hold this button for about three second to enable the front-panel buttons. The timeout counter is restarted (if the timeout period is already set) and the indicator next to the button lights to show that the front-panel is enabled.

Refer to *SYSTEM menu* for more information about the settings the period until the front panel times out. (See page 47, *SYSTEM button menu diagram*.)

USB port

Use the USB port to upgrade the instrument firmware and to copy files such as presets and test signal files between instruments.

(See page 63, *How to upgrade the instrument firmware*.)

(See page 71, *How to transfer or install user files*.)

Indicators

The front panel includes the following indicators:

INT and EXT reference indicators. The INT (internal) and EXT (external) LEDs indicate the status of the reference signal used to time signals. The states of the INT and EXT indicators depend on whether Option GPS is installed in the instrument. The following table shows the states of the LEDs for the different reference signal configurations.

Table 4: States of the INT and EXT reference indicators

Reference source	Option GPS installed			Base instrument		
	Status	EXT LED state	INT LED state	Status	EXT LED state	INT LED state
Internal	Good	Off	Solid green	Good	Off	Solid green
Internal	Warming up	Off	Blink green	Warming up	Off	Blink green
GPS	Good	Solid green	Off	NA	Off	Off
GPS	FOM is less than the GPS signal warning threshold ¹	Solid amber	Off	NA	Off	Off
GPS	"GPS not locked"	Solid red	Solid green	NA	Off	Off
Genlock	Good	Solid green	Off	Good	Solid green	Off
Genlock	"Near Loss of Genlock"	Solid amber	Off	"Near Loss of Genlock"	Solid amber	Off
Genlock	"Genlock not locked"	Solid red	Solid green	"Loss of Lock"	Solid red	Solid green

¹ The FOM warning level is set using the REFERENCE : GPS SIGNAL WARNING selection in the REF button menu. This status occurs when GPS is locked but the FOM falls below the configured warning threshold level.

TIME indicator. The TIME indicator shows the status of the selected time input. The following table shows the states of the TIME indicator for the different time source configurations.

Table 5: States of the TIME indicator

Selected time source	Time status	TIME LED state
Internal	“Program Time” selected	Off
External (GPS, VITC, or LTC)	“Time of Day” selected	Solid green
External (LTC only)	OK The timing of LTC and genlock video are the same frame rate and the relative timing is inside the SMPTE 12M specification, or LTC is a different rate than the genlock input.	Solid green
External (LTC only)	Warning The timing of LTC and genlock video are the same frame rate but the relative timing is outside the SMPTE 12M specification.	Solid yellow
External (GPS, VITC, or LTC)	Error Missing, discontinuous, or for LTC only, badly timed relative to the genlock input.	Solid red

PWR1 and PWR2 indicators. The PWR1 and PWR2 indicators illuminate using various colors to show the status of the Power Supply modules. The following table describes the different states of the indicators.

NOTE. When viewed from the front of the instrument, Power Supply 1 is the left Power Supply module and Power Supply 2 is the right Power Supply module. This matches the orientation of the PWR1 and PWR2 indicators on the front panel.

In addition to the PWR1 and PWR2 indicators, the rear panel of each Power Supply module has a STATUS LED that matches the status shown on the PWR1 and PWR2 indicators.

Table 6: States of the PWR1 and PWR2 indicators

PWR1 / PWR2 indicator state	Power Supply module condition	Example(s)	User actions
Off	Not installed	When only one Power Supply module is installed, the PWR indicator for the uninstalled supply is turned off.	None; this state indicates normal operation.
Dim green	No faults; backup supply	When two Power Supply modules are installed and connected to a power source, the indicator for the backup supply is dim green.	None; this state indicates normal operation.
Bright green	No faults; active supply	When a single Power Supply module is installed and connected to a power source, the indicator for that supply is bright green. When two Power Supply modules are installed and connected to a power source, the indicator for the active (primary) supply is bright green.	None; this state indicates normal operation.
Dim orange ¹	Warning; backup supply	When two Power Supply modules are installed and connected to a power source, the indicator for the backup supply is dim orange when a marginally low or high power supply voltage is detected, or when the supply has exceeded the specified temperature weighted hours. (See page 76, <i>Temperature weighted hours (TWH)</i> .)	Use the STATUS button menu to view information about the warning. Remove the associated Power Supply module for repair.

Table 6: States of the PWR1 and PWR2 indicators (cont.)

PWR1 / PWR2 indicator state	Power Supply module condition	Example(s)	User actions
Bright orange ¹	Warning or fault; active supply	<p>When two Power Supply modules are installed and connected to a power source, the indicator for the active (primary) supply is bright orange when a marginally low or high power supply voltage is detected, or when the supply has exceeded the specified temperature weighted hours.</p> <p>When the power supply fan has failed (active supply).</p>	<ol style="list-style-type: none"> 1. If two Power Supply modules are installed and the status of the inactive supply is also faulted (red), replace the inactive supply or install the power cable. The system will automatically switch to use the good supply, which will turn the indicator to red from bright orange. Proceed to step 4. 2. If only one Power Supply module is installed, install a second supply so that you can repair the first supply. 3. If two Power Supply modules are installed and the status of the inactive supply is no faults (dim green), use the System menu to configure the other Power Supply module to be the active (primary) supply. (See page 77, <i>To configure the preferred (active) supply.</i>) 4. Remove the associated Power Supply module for repair.
Red ²	Fault (including being installed but unplugged)	<p>When the 12 V power from a supply is too high or too low (includes if the supply has failed).</p> <p>When two Power Supply modules are installed and one of the supplies has no AC power applied.</p> <p>When the power supply fan has failed (inactive supply).</p> <p>NOTE. <i>In the case of a failed fan on both supplies, the instrument will keep running as long as the voltage is adequate.</i></p>	<ol style="list-style-type: none"> 1. Verify that the power cable is connected to the Power Supply module and that the power cable is connected to the power source. 2. Remove the associated Power Supply module for repair.

¹ The dim and bright orange warning states clear immediately if the marginal voltage condition is corrected.

² The red fault state is maintained for approximately 30 seconds after the fault is cleared to allow you more time to observe the fault condition.

FAULT indicator. The FAULT illuminates when there is a problem with the instrument hardware. The following table shows the states of the FAULT indicator for hardware failures.

NOTE. You can view descriptions of the active alerts and faults using the STATUS menu. (See page 44, Alert and fault error messages.)

Table 7: States of the FAULT indicator

Instrument condition	Example(s)	FAULT LED state	User actions
A fault condition exists that has the potential to damage the instrument hardware	<ul style="list-style-type: none"> ▪ The main fan has stopped turning ▪ The internal temperature of the instrument is too high 	Blinking red	<ol style="list-style-type: none"> 1. Press the STATUS button to view a message describing the fault. 2. Navigate to the SYSTEM > DIAGNOSTICS menu. 3. Scroll through the diagnostic readouts and look for fan or voltage “Warn” messages. 4. The FAULT indicator will continue to blink red unless the fan restarts or the internal temperature falls to normal levels. 5. If the fault does not clear, unplug the instrument from the power source and contact Tektronix customer support.
A fault condition exists that renders the instrument unusable	<ul style="list-style-type: none"> ▪ The fan speed is out of range ▪ An internal power supply voltage is out of range 	Solid red	<ol style="list-style-type: none"> 1. If the instrument is still on, navigate to the STATUS > FAULT menu to view the fault message. 2. If the fault message is for voltage issues, navigate to the SYSTEM > DIAGNOSTICS menu. 3. Scroll through the diagnostic readouts and look for voltage “Warn” messages. 4. Unplug the instrument from the power source and contact Tektronix customer support.

Table 7: States of the FAULT indicator (cont.)

Instrument condition	Example(s)	FAULT LED state	User actions
A fault condition exists, but the instrument is still usable	<ul style="list-style-type: none"> ▪ The main or SDI PLL is unlocked ▪ There is an SDI DDS phase error ▪ A Power Supply module has reached the temperature weighted hour limit 	Solid amber	<ol style="list-style-type: none"> 1. Navigate to the STATUS > FAULT menu to view the fault message. 2. Navigate to the SYSTEM > DIAGNOSTICS menu. 3. Scroll through the diagnostic readouts and look for a "PLL UL" (unlocked) message. 4. When you are ready to have the instrument serviced, unplug the instrument from the power source and contact Tektronix customer support.
Normal	<ul style="list-style-type: none"> ▪ The instrument is operating properly ▪ The instrument is turned off 	Off	None

Rear panel connectors

The following figure shows the locations of the SPG8000 connectors on the rear panel. A brief discussion of each connector follows the illustration.

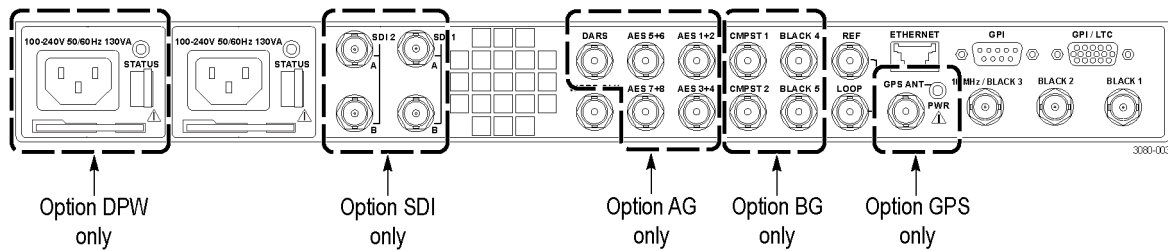


Figure 4: SPG8000 rear panel

Power connector(s)

The SPG8000 is designed to operate from a single-phase power source with the neutral conductor at or near earth ground. Only the line conductor is fused for over-current protection. A protective ground connection through the grounding conductor in the power cord is essential for safe operation.

The SPG8000 operates from an AC line frequency of 50/60 Hz, over the range of 100 - 240 VAC ($\pm 10\%$), without the need for configuration. (See Table 3 on page 9.)



WARNING. Injury or death can occur as the result of electrical shock. To avoid electrical shock, do not connect power to the SPG8000 when the top cover is off. There are dangerous potentials present on the Power Supply circuit boards when the power cord is connected.

Disconnect the power cord from a Power Supply module before you remove the module from the instrument. Also, do not connect a power cord to a Power Supply module while the module is not installed in the instrument. There are dangerous high voltages on the module when the power cord is connected.

Backup power supply (Option DPW only). The standard instrument includes one Power Supply module. With Option DPW, a second hot-swappable redundant (backup) Power Supply module is installed. (See page 76, *How to operate an instrument with two power supplies (Option DPW only).*)

SDI 1/2 output connectors (Option SDI only)

With Option SDI, the following SDI signal BNC connectors are installed.

NOTE. When the *SECONDARY OUTPUT* selection is set to *Test Pattern* for channel 1, the *SIGNAL 1A* and *SIGNAL 1B* connectors will output the same test signal. The same is true for the channel 2 connectors when *Test Pattern* is set as the *SECONDARY OUTPUT* selection for channel 2.

- **SIGNAL 1A:** Outputs the selected SDI serial digital video test signal for channel 1.
- **SIGNAL 1B:** This output can be configured to output a test pattern, where it produces the same output as the Signal 1A output, or to output a Black signal in the same format as the Signal 1A output. Use the SDI button menu to configure the secondary output. (See page 56, *SDI button menu diagram (Option SDI only)*.)

You can also configure the audio to be the same as Signal 1A, or to have no audio or muted audio. Use the *EMBED* button menu to configure the audio on the secondary output. (See page 58, *EMBED button menu diagram (Option SDI only)*.)

- **SIGNAL 2A:** Outputs the selected SDI serial digital video test signal for channel 2.
- **SIGNAL 2B:** This output can be configured to output a test pattern, where it produces the same output as the Signal 2A output, or to output a Black signal in the same format as the Signal 2A output. Use the SDI button menu to configure the secondary output. (See page 56, *SDI button menu diagram (Option SDI only)*.)

You can also configure the audio to be the same as Signal 2A, or to have no audio or muted audio. Use the *EMBED* button menu to configure the audio on the secondary output. (See page 58, *EMBED button menu diagram (Option SDI only)*.)

Word Clock output connector

Outputs a 48 kHz word clock signal. You can set the output amplitude to 1 V (AC) or 5 V (DC). The word clock output and the optional AES audio outputs can be synchronized to any of the three frame pulses, and the phase can adjusted relative to the frame pulse. Use the AES button menu to configure the word clock output. (See page 59, *AES button menu diagram*.)

DARS and AES audio output connectors (Option AG only)

With Option AG, the following audio connectors are installed.

- **AES 1+2:** Outputs channels 1 and 2 of the selected AES/EBU serial digital audio signal.
- **AES 3+4:** Outputs channels 3 and 4 of the selected AES/EBU serial digital audio signal.
- **AES 5+6:** Outputs channels 5 and 6 of the selected AES/EBU serial digital audio signal.
- **AES 7+8:** Outputs channels 7 and 8 of the selected AES/EBU serial digital audio signal.
- **DARS:** Outputs a DARS (muted audio) signal.

The word clock output and the AES audio outputs can be synchronized to any of the three internal frame pulses, and the phase can adjusted relative to the frame pulse. Use the AES button menu to configure the word clock output. (See page 59, *AES button menu diagram*.)

Composite outputs and Black 4/5 output connectors (Option BG only)

With Option BG, the following composite and additional Black outputs are installed.

- **CMPST 1:** Outputs the selected composite video signal.
- **CMPST 2:** Outputs the selected composite video signal.
- **BLACK 4:** Outputs the selected black burst or HDTV trilevel sync signal.
- **BLACK 5:** Outputs the selected black burst or HDTV trilevel sync signal.

REF loopthrough input connectors

Use the REF input loopthrough connectors for an external reference signal, which can be NTSC/PAL black burst or HDTV trilevel sync signals. The reference input requires proper external termination. The signal may connect on to other devices via the loop connection. However, the signal must be terminated eventually, either on the instrument or at the other device.

10 MHz and BLACK 1/2/3 output connectors

- **BLACK 1:** Outputs the selected black burst or HDTV trilevel sync signal.
- **BLACK 2:** Outputs the selected black burst or HDTV trilevel sync signal. You can configure this output connector to turn off if certain errors are detected. The output will remain off as long as the error occurs. Use this function to trigger a downstream ECO to switch to backup.
- **10 MHz / BLACK 3** Outputs the selected black burst or HDTV trilevel sync signal. You can also configure this connector to output a 10 MHz sine wave.

NOTE. You can use the *BLACK* button menu to independently set the format and timing of the three black outputs and to enable *VITC* to be applied to the output signal. For tri-level signals, the *BLACK 1, 2, and 3* outputs are a group that must all output either integer or non-integer rates. (See page 43, *Management of tri-level sync output rates.*)

GPS antenna connector (Option GPS only)

With Option GPS, you can reference the instrument timing to the GPS satellite system. You must connect a GPS antenna to the instrument in order to use this functionality. The GPS antenna input must meet specific requirements. (See page 12, *GPS antenna requirements.*)

You can use the Reference menu to enable this connector to provide 3.3 V or 5 V DC power to the antenna. When the connector is configured to provide power to the antenna, the rear-panel GPS ANT indicator lights as follows:

- Blinks green to indicate an open circuit. This occurs if no antenna is connected or if the current load is less than expected because a splitter or DC block is being used.
- Displays solid red if the connected antenna is shorted. A shorted antenna will not damage the SPG8000 generator. If a splitter is used on the antenna, it may appear as a short at DC but will still pass through the RF signal, which will allow the GPS to function.
- Displays solid green if the current load of the antenna is within the nominal range.

Ethernet port

Use this port to connect to your local Ethernet network. You can control the SPG8000 generator remotely through the port. Also, you can upload and download various files such as signal files, logo files, and preset files through the port.

GPI port

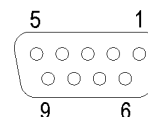
You can use the dedicated General Purpose Interface (GPI) port to perform the following tasks: (See page 61, *General Purpose Interface (GPI and GPI/LTC) ports.*)

- Recall preset 1 through 7 of the available 13 user-defined presets
- Output up to three alarm signals
- Trigger the instrument to reset the program time, reacquire the GPS position (Option GPS only), or to force a jam sync

The GPI port is a 9 pin, D-sub connector that includes one ground closure input, three ground closure outputs, and three preset selection inputs. You can use the SYSTEM : GPI menu to configure the function of the ground closure input and outputs. The GPI alarm configuration applies to both the GPI port and the GPI/LTC port.

Table 8: GPI port – connector pin assignments

Pin #	Function
1	Ground
2	GPI out 1
3	GPI out 2
4	GPI input
5	+5 V (1 k source resistance, so very limited current)
6	GPI out 3
7	GPI preset select 3
8	GPI preset select 2
9	GPI preset select 1



NOTE. Several of the signals in the 9-pin GPI port and the 15-pin GPI/LTC port are shared between the two connectors. For example, when an alarm is configured to be output on the GPI 1 signal, the alarm appears on both the GPI and GPI/LTC ports.

GPI/LTC port

You can use the General Purpose Interface (GPI/LTC) port to perform the following tasks:. (See page 61, *General Purpose Interface (GPI and GPI/LTC) ports.*)

- Input (LTC 1 only) an LTC signal or output up to four LTC differential signals
- Output up to two alarm signals
- Trigger the instrument to reset the program time, reacquire the GPS position (Option GPS only), or to force a jam sync

This is a 15 pin, D-sub connector that carries four differential LTC signals, one ground closure input, and two ground closure outputs. You can use the LTC button menu to independently set the format and timing of the four LTC signals. You can use the SYSTEM : GPI menu to configure the function of the ground closure input and outputs. The GPI alarm configuration applies to both the GPI port and the GPI/LTC port.

You can configure LTC1 to be an LTC input instead of an output. The supported LTC input signal formats include 23.98, 24, 25, 29.97 drop frame, and 30 Hz, as per SMPTE 12M.

The GPI/LTC connector provides full functionality when you use the LTC DSUB-to-XLR breakout cable that is available as an optional accessory. The GPI/LTC connector provides partial functionality when you use a standard RGBHV (VGA-to-BNC) breakout cable. (See Table 9.)

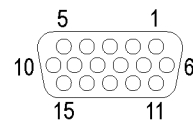
NOTE. You do not need the optional LTC and GPI breakout cable if you are using only VITC and/or ATC as a timecode signal.

For correct operation if you use a VGA-to-BNC breakout cable, pins 6, 7, 8, and 10 must be internally grounded together in the cable and to the connector shell.

Several of the signals in the 9-pin GPI port and the 15-pin GPI/LTC port are shared between the two connectors. For example, when an alarm is configured to be output on the GPI 1 signal, the alarm appears on both the GPI and GPI/LTC ports.

Table 9: GPI/LTC port – connector pin assignments

Pin #	Function	VGA cable
1	GPI out 1	Red BNC
2	GPI out 2	Green BNC
3	GPI input	Blue BNC
4	No connection	
5	LTC 4 negative	
6	Ground	Ground
7	LTC 3 negative	Ground
8	LTC 2 negative	Ground
9	Ground	
10	LTC 1 negative	Ground
11	+5 V (1 k source resistance, so very limited current)	
12	LTC 3 positive	
13	LTC 2 positive	H BNC
14	LTC 1 positive	V BNC
15	LTC 4 positive	



Management of tri-level sync output rates

For tri-level sync signals, the BLACK 1, 2, and 3 outputs comprise a group that must all output either integer or non-integer rate signals. When Option BG is installed, the BLACK 4 and 5 outputs comprise a separate group, which also must output either integer or non-integer rates. That means that Option BG must be installed in order for the instrument to simultaneously generate tri-level sync signals in both integer and non-integer rates.

Perform the following steps to set the rate for tri-level sync signals for each of the BLACK output groups:

1. Press the BLACK button repeatedly to select **BLACK 1–3 : HD TRI-LEVEL SYNC RATE**.
2. Press the left (◀) or right (▶) arrow button to select the desired HD tri-level sync rate for the BLACK 1, 2, and 3 outputs: **INTEGER (60, 50, 30, 25, 24)** or **NON-INTEGER (59.94, 29.97, 23.98)**.
3. Press the **ENTER** button to select the displayed rate. A bullet will appear in front of the selected rate to indicate the current selection.
4. **Option BG only:** Press the BLACK button repeatedly to select **BLACK 4–5 : HD TRI-LEVEL SYNC RATE**.
5. Repeat steps and to set the desired HD tri-level sync rate for the BLACK 4 and 5 outputs.

LCD display readouts

The readouts on the LCD display vary depending on the instrument setting and which menu is being accessed. The following figure shows some example display readouts.

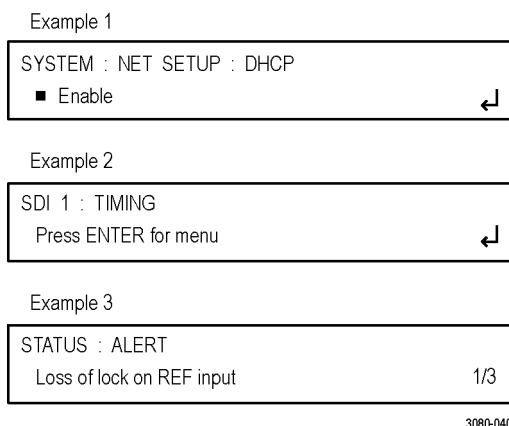


Figure 5: Example display readouts

The format of the readouts usually follow these guidelines:

- The top line of the display lists the current menu selection. The first word is usually the name of the selected button menu, followed by the name of a parameter or category.
- The second line of the display shows the setting of the selected menu setting. As shown in example 1 above, a bullet in front of a setting indicates that setting is the currently selected setting.

- As shown in examples 1 and 2 above, if a carriage return character is displayed at the far right of the second line, this indicates one of both of the following two situations:
 - There are additional settings that can be accessed by pressing the left (◀) or right (▶) arrow button. When the desired setting is displayed, press the ENTER button to select that setting.
 - There is a submenu available for the menu selection that can be accessed by pressing the ENTER button. When you enter a submenu, press the BACK button to return to the top menu.
- As shown in example 2 above, if the second line of the display reads “Press ENTER for menu,” this indicates that you need to press the ENTER button to access the submenu for that menu selection.
- As shown in example 3 above, if there are multiple alerts or faults reported in the STATUS menu, the far right of the second line will display the currently viewed alert or fault number followed by the total number of alerts or faults. In example 3, the display shows “1/3,” indicating that the currently displayed alert is number one of three reported alerts. In this situation, press the left (◀) or right (▶) arrow button to view the other alerts or faults.

Alert and fault error messages

When error conditions occur, you can view descriptions of the alert and fault messages using the STATUS menu as described below.

1. Press the **STATUS** button to access the STATUS menu.
2. Press the up (▲) or down (▼) arrow button to select **STATUS : FAULT** or **STATUS : ALERT**.
3. Press the left (◀) or right (▶) arrow button to view all of the reported faults or alerts. The possible messages are listed in the following table.

Table 10: Possible alert and fault error messages

Alert messages	Fault messages
Near loss of lock on REF input	No fault
Loss of lock on reference input	Main cooling fan fault
No GPS signal detected	Temperature out of range
VITC or LTC input missing	Internal diagnostic test failed
LTC out of SMPTE spec	PS1 fault error
No REF input signal detected	PS2 fault error
GPS Figure of Merit (FOM)	PS1 temp. wtd. hours exceed limit
Alarm time	PS2 temp. wtd. hours exceed limit

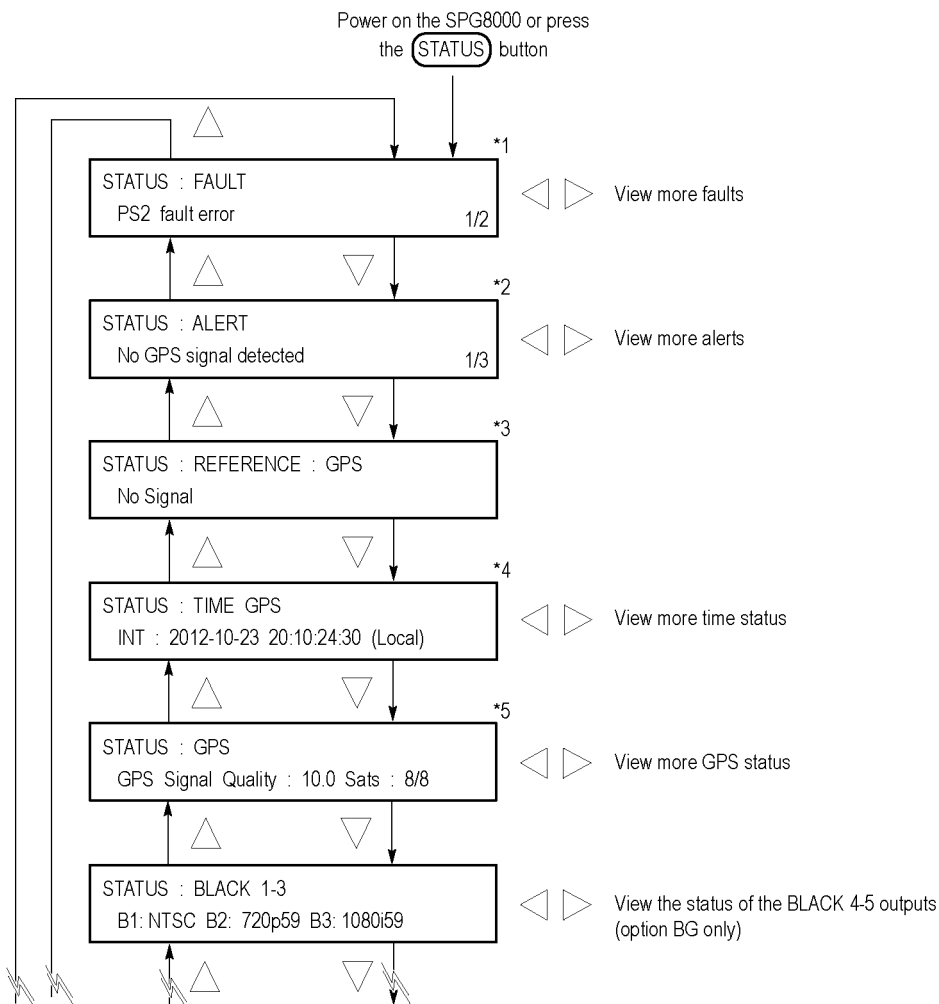
Menu diagrams

When you press the front-panel STATUS or SYSTEM buttons, or press the buttons in the INPUTS or OUTPUTS sections, you access menus that allow you to view or change instrument settings. Some of the buttons apply only to specific hardware options and will not operate unless the option is installed.

This section provides diagrams for the main levels of each button menu. Refer to the *SPG8000 Technical Reference* manual for diagrams of the submenus and detailed descriptions of each menu selection.

STATUS button menu diagram

Press the STATUS button to view the current status of instrument settings such as the signal reference source, the GPS time and antenna quality, the signals being output, and information about system faults and alerts. This menu is for viewing status only and no changes to the instrument settings can be made from this menu. The following figures show the menu diagram for the STATUS button.

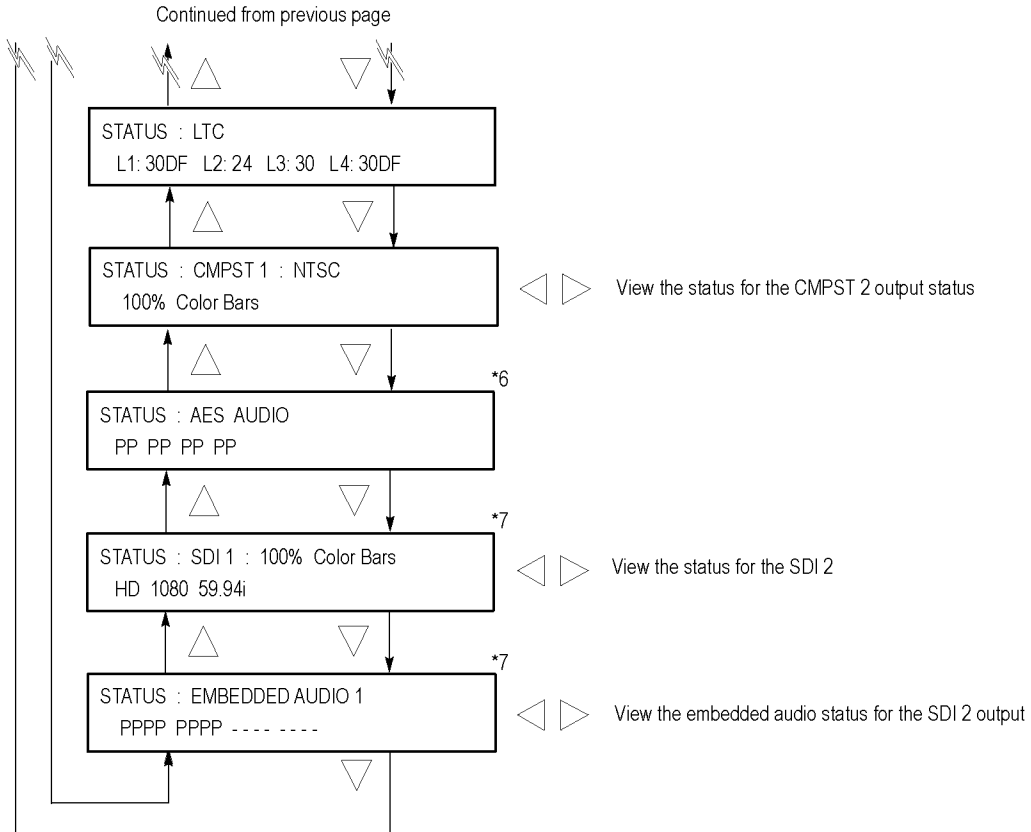


- *1 This menu item appears only when an instrument hardware issue has caused a status indicator to turn Orange or Red on the front panel status or web interface.
- *2 This menu item appears only when a problem with the reference or time inputs that has caused a status indicator to turn Orange or Red on the front panel status or web interface.
- *3 The readout for this menu item depends on the selected reference source (i.e. GPS, Internal, NTSC Burst, etc.).
- *4 The readout for this menu item depends on the selected time source (i.e. GPS, LTC, VITC, Internal, etc.).
- *5 This menu item appears only when Option GPS is installed.

Continued on next page

3080-046a

Figure 6: STATUS button menu diagram – part 1



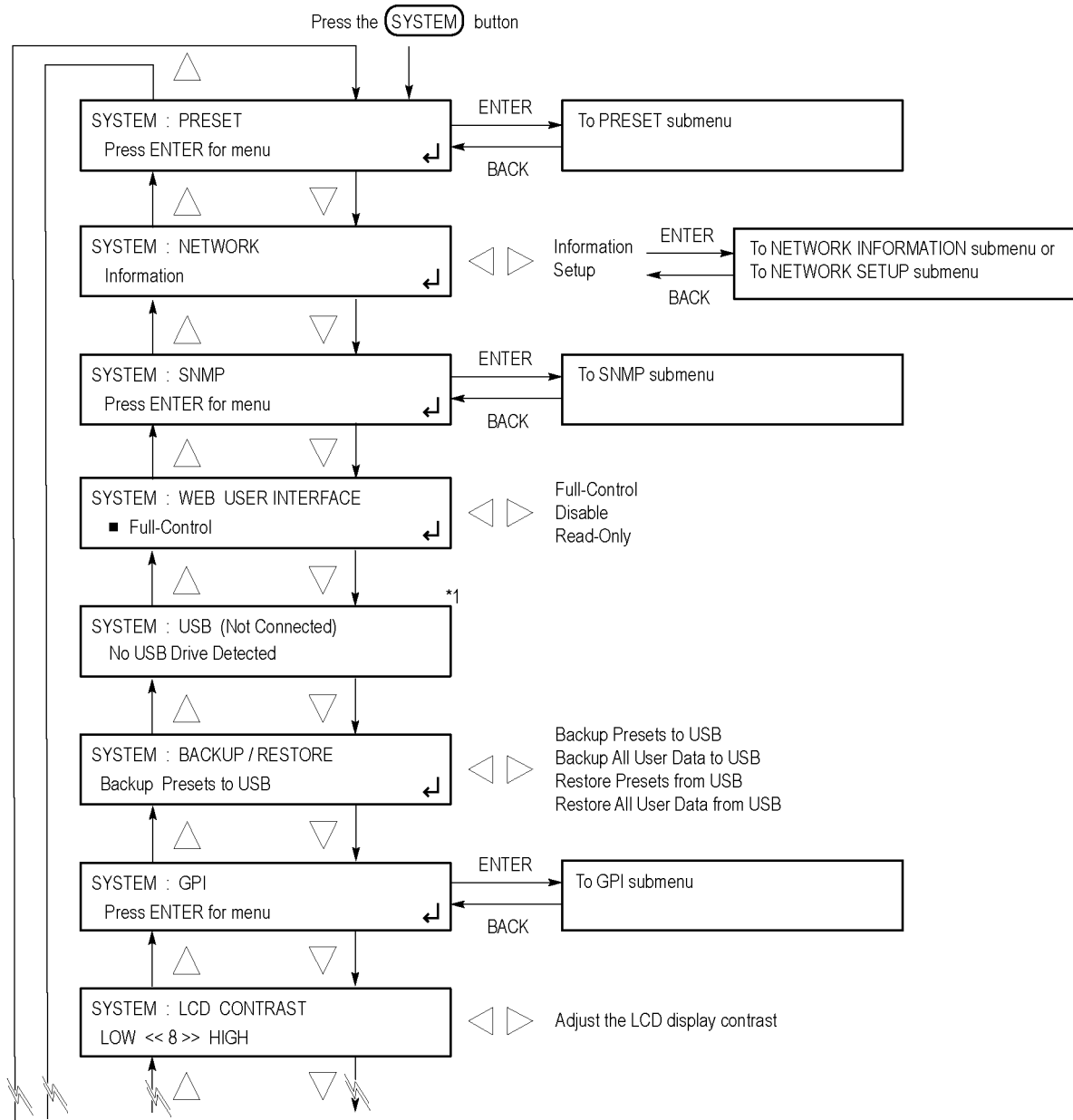
*6 This menu item appears only when Option AG is installed.
 *7 These menu items appear only when Option SDI is installed.

3080-046b

Figure 7: STATUS button menu diagram – part 2

SYSTEM button menu diagram

Press the SYSTEM button to view and configure instrument settings such as network parameters, SNMP traps, Web interface access, GPI alarms, installed options, display brightness, beeper control, front panel disable, and hardware/firmware versions. You can also use this menu to perform firmware upgrades, calibrate the oven oscillator, mount or unmount a USB device, save and recall presets, view diagnostic results, and perform a load test on the power supply. The following figures show the menu diagram for the SYSTEM button.



*1 The USB selection shows the USB status (mounted or unmounted) and allows for manual mounting or unmounting.

Continued on next page

3080-039a

Figure 8: SYSTEM button menu diagram – part 1

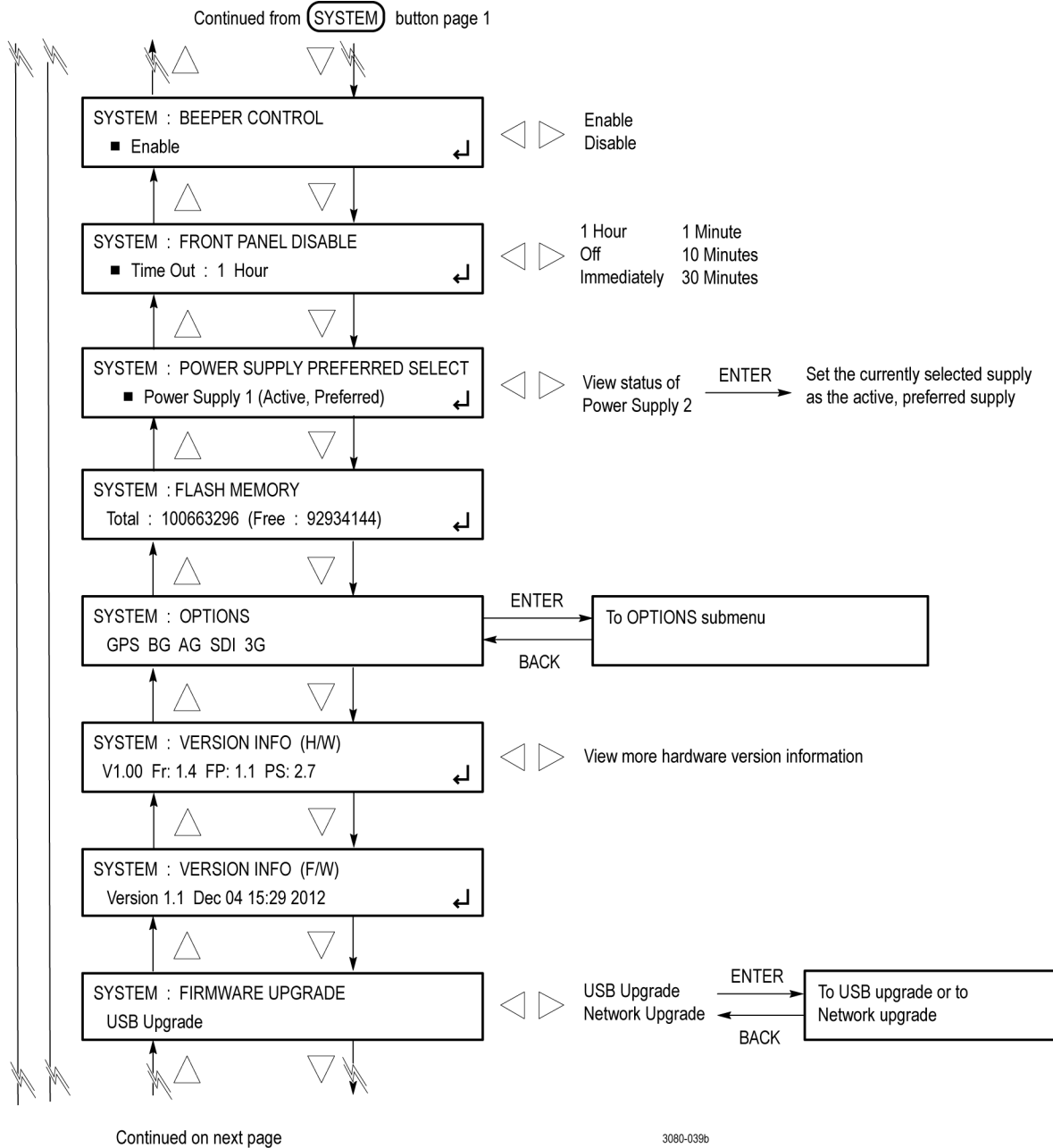


Figure 9: SYSTEM button menu diagram – part 2

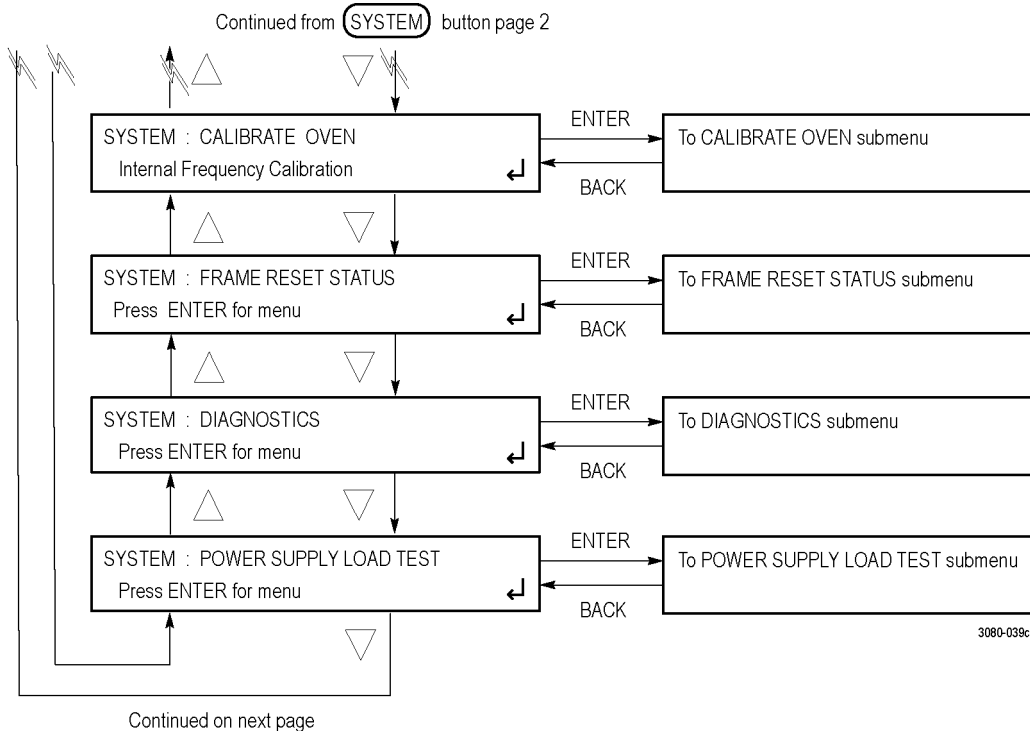
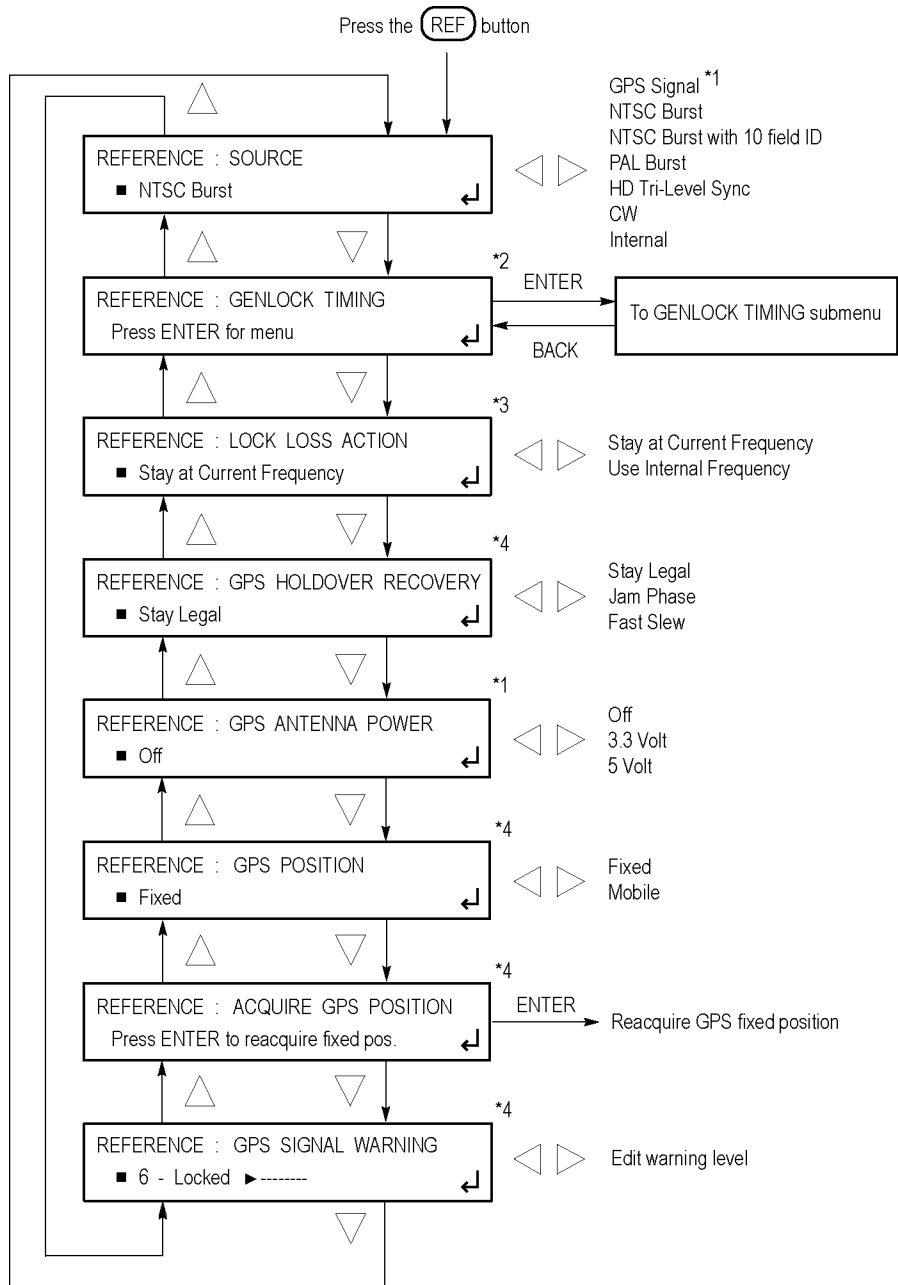


Figure 10: SYSTEM button menu diagram – part 3

REF button menu diagram

Press the REF button to view the current status of instrument settings such as the signal reference source, the GPS time and antenna quality, the signals being output, and information about system faults and alerts. The following figure shows the menu diagram for the REF button.



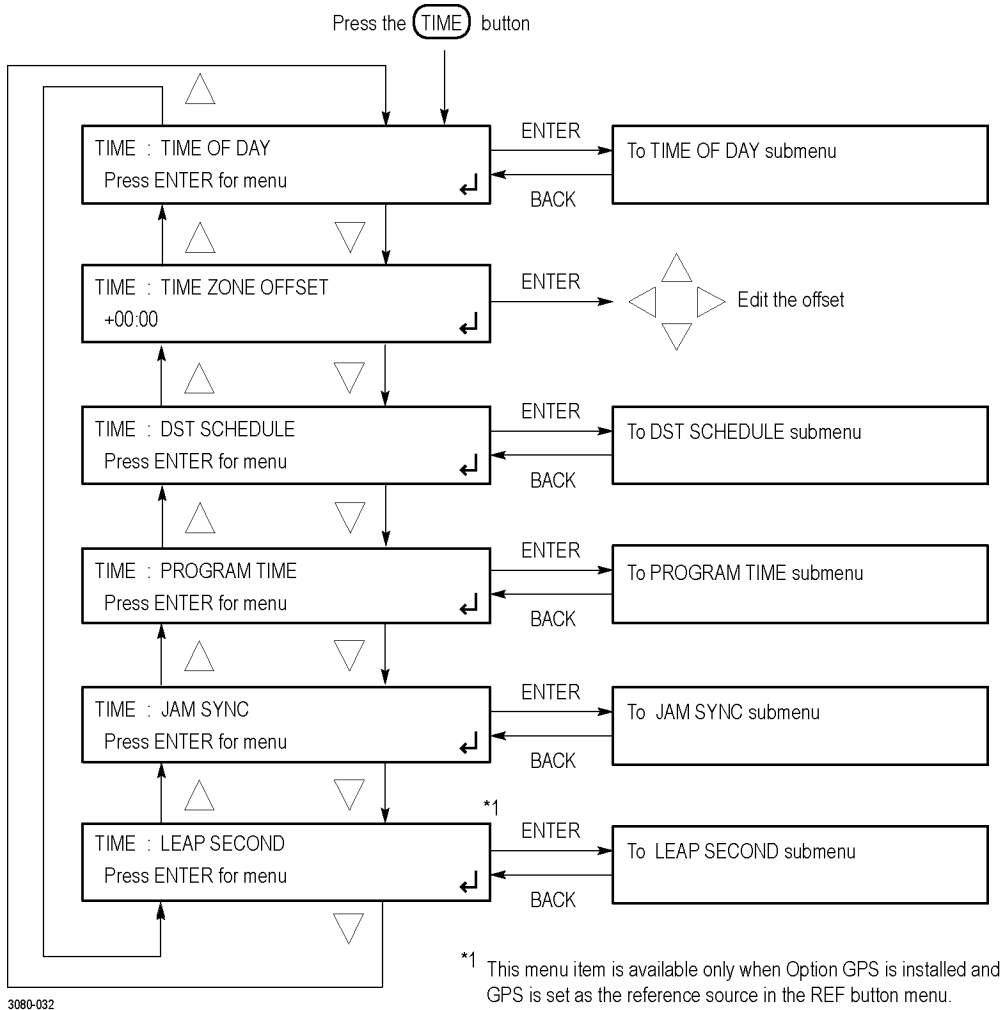
- *1 This menu item appears only when Option GPS is installed (appears for all reference sources).
- *2 This menu item appears only when Option GPS is not the reference source; this item does not appear when the reference source is set to internal.
- *3 This menu item does not appear when the reference source is set to internal.
- *4 These menu items appear only when Option GPS is installed and GPS is the reference source.

3080-016

Figure 11: REF button menu diagram

TIME button menu diagram

Press the TIME button to set instrument time parameters such as the time of day source, the time zone offset, the DST schedule, the leap second schedule, the program time, and the jam sync settings. The following figure shows the menu diagram for the TIME button.

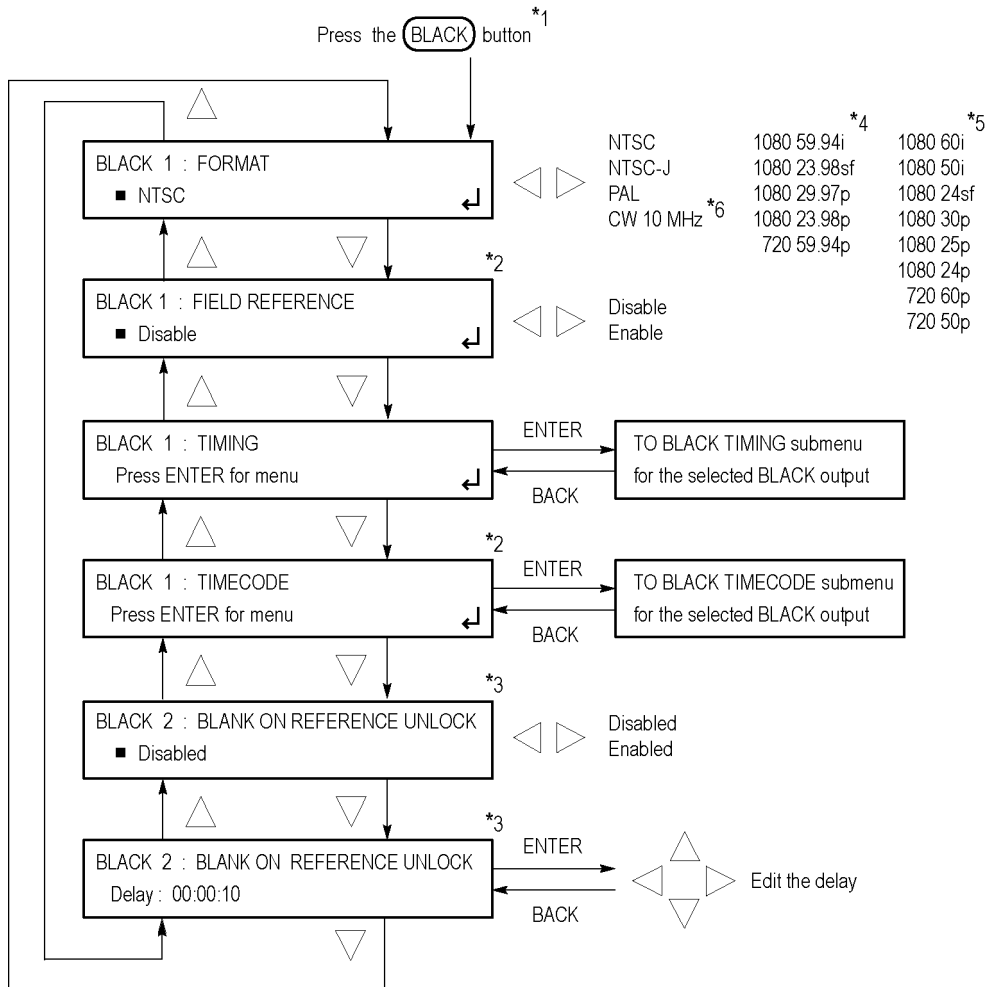


3090-032

Figure 12: TIME button menu diagram

BLACK button menu diagram

Press the BLACK button to view and configure the BLACK outputs. Press the BLACK button repeatedly to select the desired BLACK output (1–5). BLACK outputs 1–3 are standard; BLACK outputs 4–5 are available with Option BG only. The following figures show the menu diagram for the BLACK button.



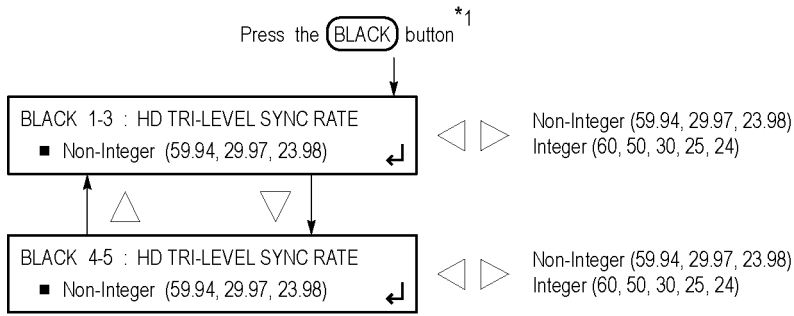
- *1 Press the **BLACK** button repeatedly to select the desired BLACK output (1-5) or to select the desired group of Black outputs (1-3 or 4-5). BLACK outputs 1-3 are standard; BLACK outputs 4-5 are available with Option BG only. When you select a group of BLACK outputs, you can set whether a non-integer or an integer clock will be used for the HD tri-level sync rate for those outputs.
- *2 These menu items are available only for non-HD formats.
- *3 These menu items are available only for the BLACK 2 output.
- *4 These menu items appear only when the HD tri-level sync for the selected BLACK output is set to non-integer.
- *5 These menu items appear only when the HD tri-level sync for the selected BLACK output is set to integer.
- *6 The CW 10 MHz format selection appears only when the BLACK 3 output is selected. When CW 10 MHz is the selected output format, the other menu selections are not available.

Continued on next page

3080-034a

Figure 13: BLACK button menu diagram – part 1

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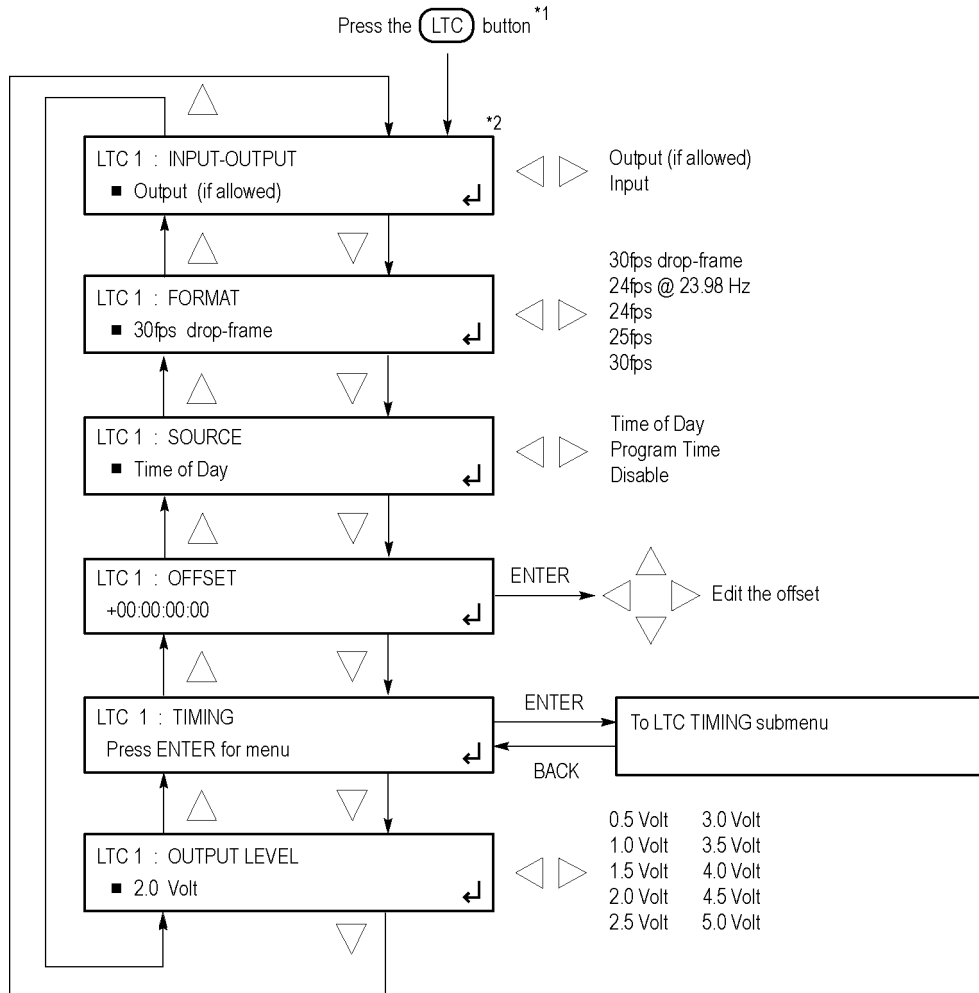
^{*1} Press the **BLACK** button repeatedly to select the desired BLACK output (1-5) or to select the desired group of Black outputs (1-3 or 4-5). BLACK outputs 1-3 are standard; BLACK outputs 4-5 are available with Option BG only. When you select a group of BLACK outputs, you can set whether a non-integer or an integer clock will be used for the HD tri-level sync rate for those outputs.

3080-034b

Figure 14: BLACK button menu diagram – part 2

LTC button menu diagram

Press the LTC button to view and configure the LTC inputs and outputs on the GPI/LTC port. (See page 61, *General Purpose Interface (GPI and GPI/LTC) ports.*) Press the LTC button repeatedly to select the desired LTC signal (1–4). The following figure shows the menu diagram for the LTC button.



*1 Press the **LTC** button repeatedly to select the desired LTC signal (1-4).

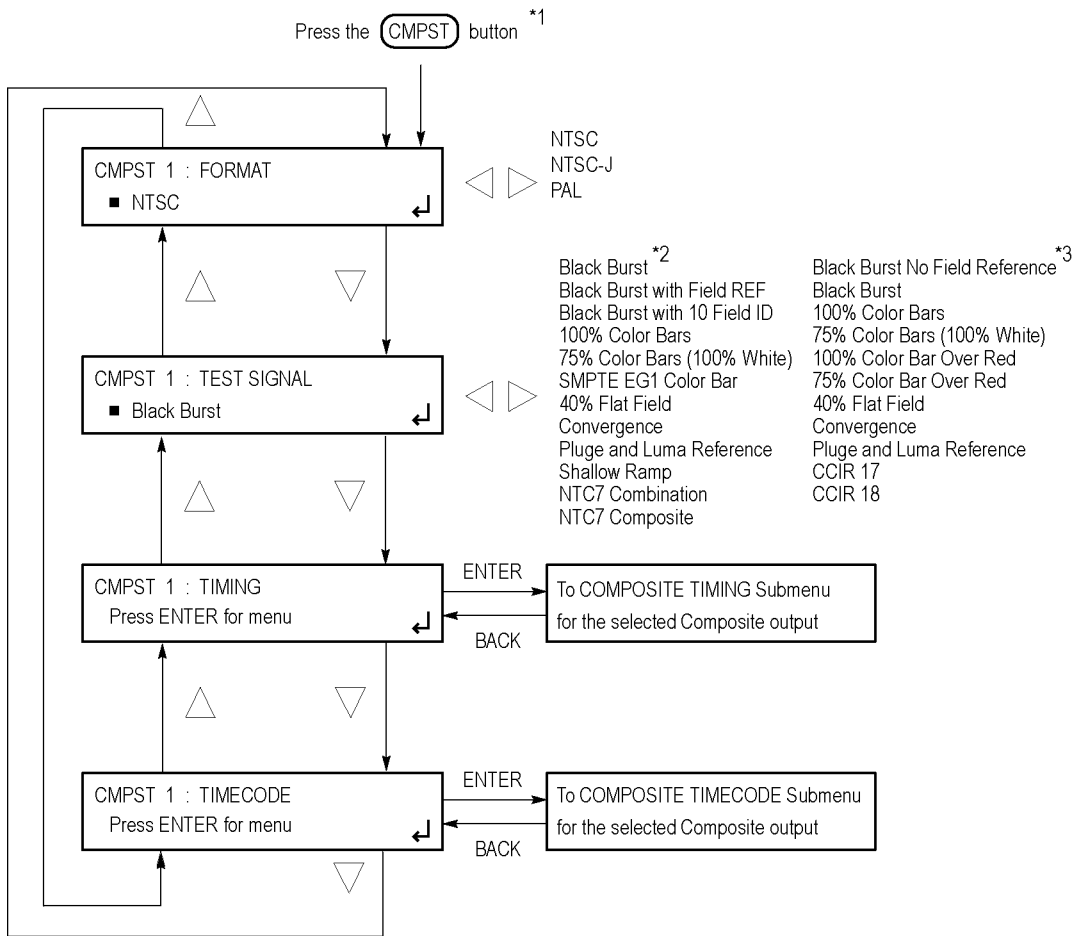
*2 This menu item appears only for LTC 1.

3080-031

Figure 15: LTC button menu diagram

CMPST button menu diagram (Option BG only)

Press the CMPST button to view and configure the composite video outputs. The following figure shows the menu diagram for the CMPST button.



*1 Press the **CMPST** button repeatedly to select the desired composite output (1 or 2).

*2 These test signals are available only when the format is set to NTSC OR NTSC-J.

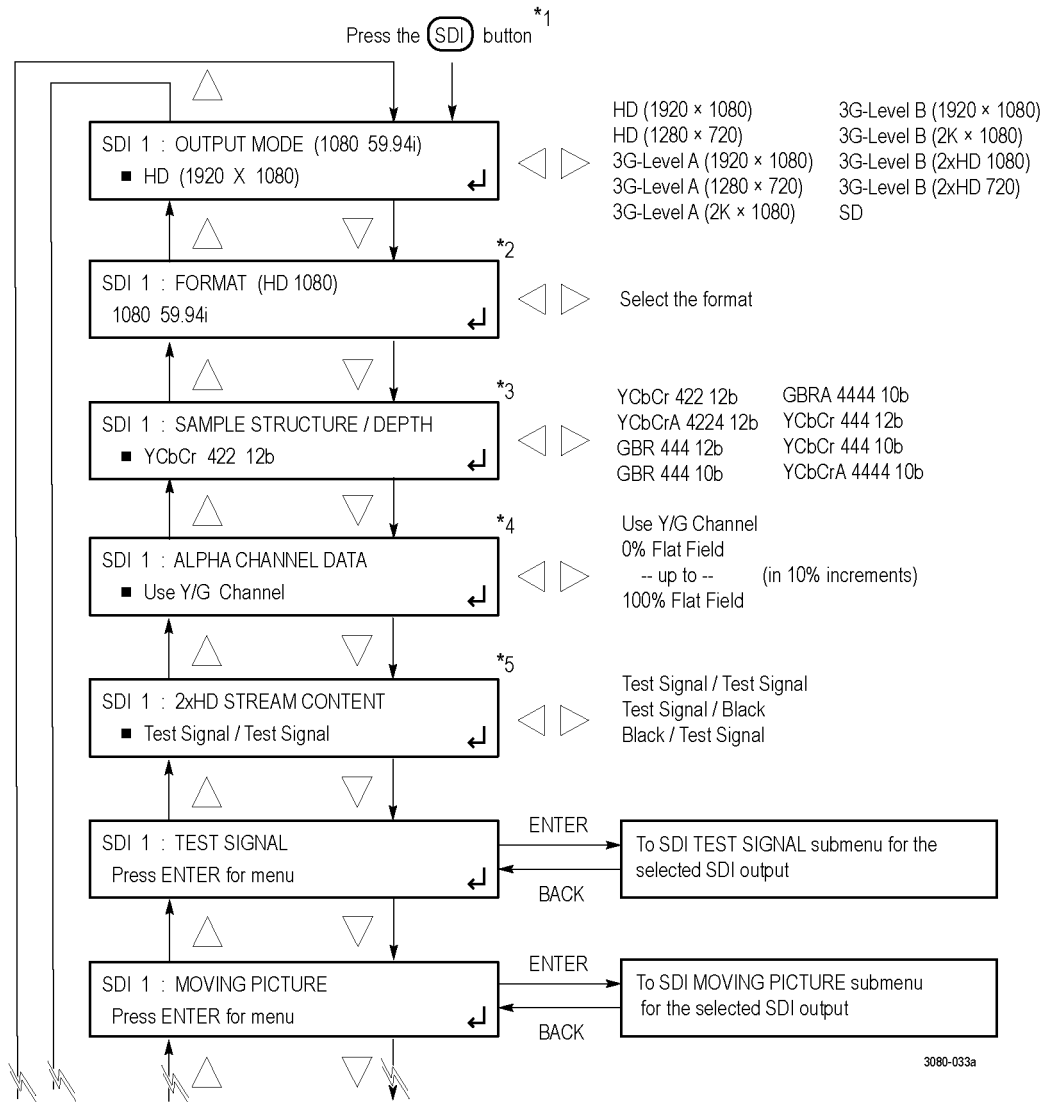
*3 These test signals are available only when the format is set to PAL.

3080-027

Figure 16: CMPST button menu diagram (Option BG only)

SDI button menu diagram (Option SDI only)

Press the SDI button to view and configure the signals on the SDI video outputs. The following figures show the menu diagram for the SDI button.



- *1 Press the **(SDI)** button repeatedly to select the desired SDI output (1 or 2).
- *2 The available formats depend on the OUTPUT MODE setting.
- *3 This selection is available only for 3G formats (2K formats limited to GBR 444 and XYZ 444 color spaces).
- *4 This selection is available only for 3G formats with YCbCrA or GBRA sample structures.
- *5 This selection is available only for 2xHD output mode.

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Figure 17: SDI button menu diagram (Option SDI only) – part 1

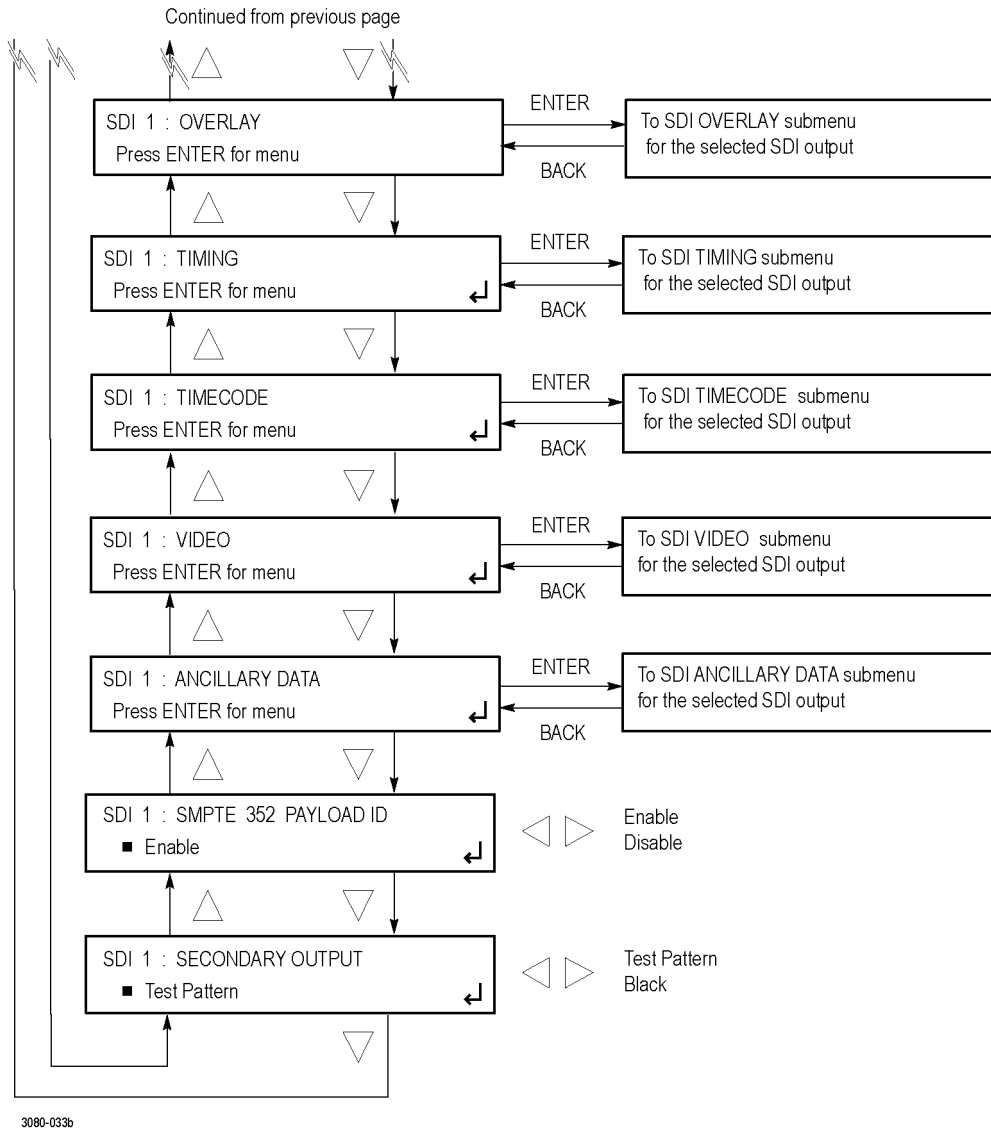
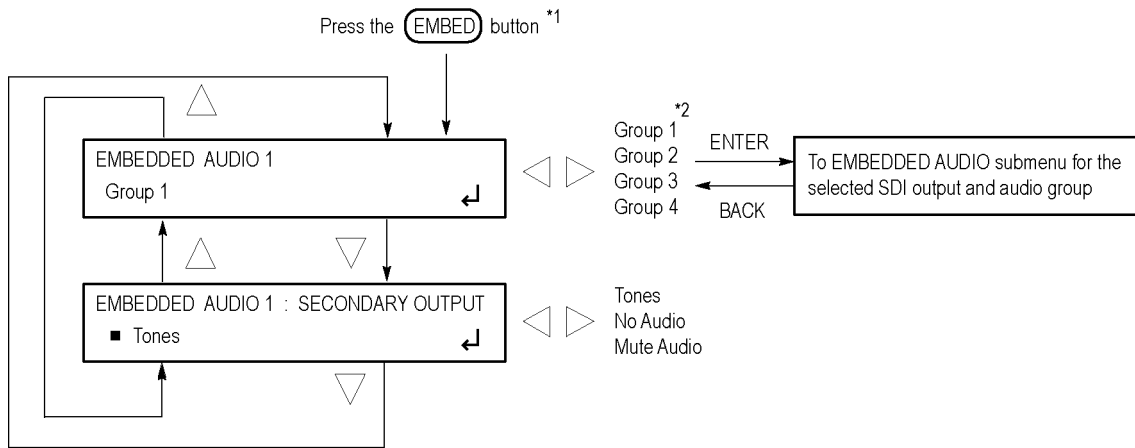


Figure 18: SDI button menu diagram (Option SDI only) – part 2

EMBED button menu diagram (Option SDI only)

Press the EMBED button to view and configure the embedded audio settings on the SDI video outputs. The following figure shows the menu diagram for the EMBED button.



*1 Press the EMBED button repeatedly to select the embedded audio for the desired SDI output (1 or 2).

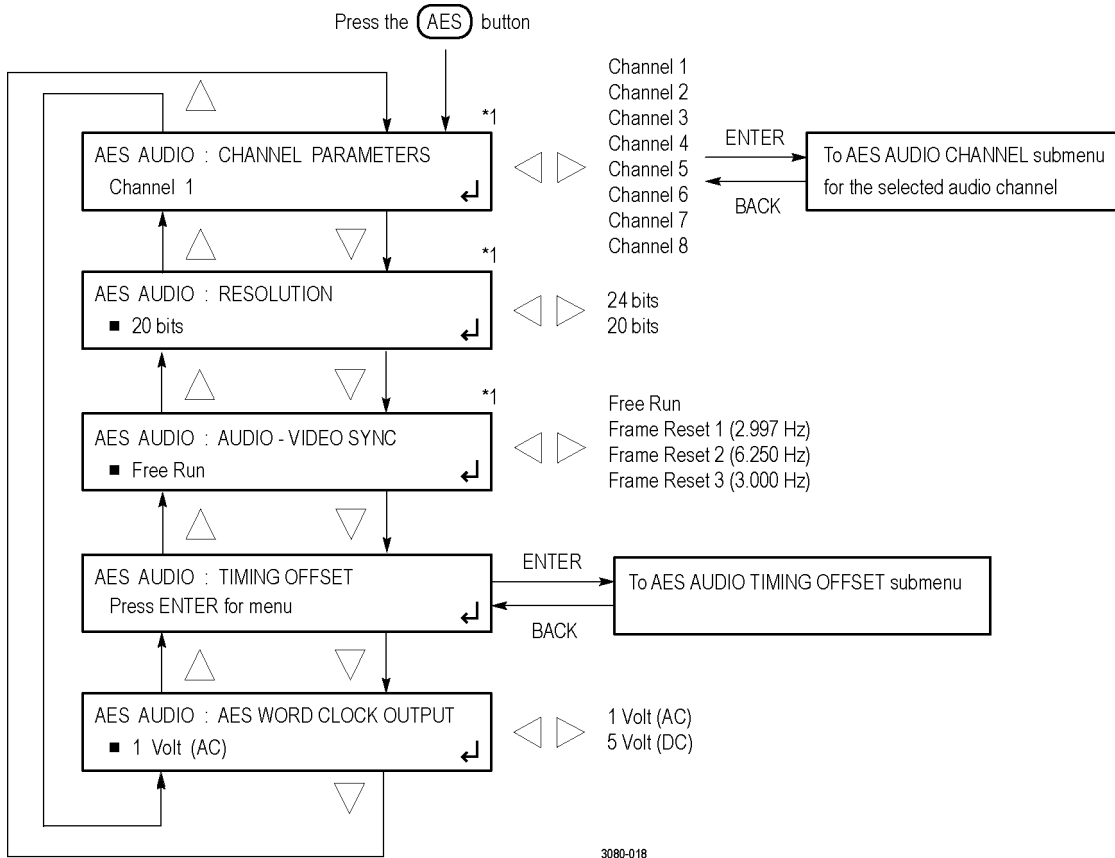
*2 Option 3G only: When the SDI signal format is set to 3G Level B, you can select groups 1-4 for link A or select groups 1-4 for link B.

3080-019

Figure 19: EMBED button menu diagram (Option SDI only)

AES button menu diagram

Press the AES button to view and configure the Word Clock output timing offset and voltage. When Option AG is installed, use this menu to also configure the AES audio output settings such as the frequency, amplitude, resolution, timing offset, and audio/video synchronization. The following figure shows the main menu diagram for the AES button.



*1 These menu items appear only when Option AG is installed.

Figure 20: AES button menu diagram

Remote control

Web user interface

When the Web user interface is enabled in the SYSTEM menu, you can use a Web browser to remotely access the instrument. When you enter the IP address of the instrument in a supported Web browser, the SPG8000 Web Interface opens as shown in the following figure. Click the various tabs to access the instrument settings and controls as you would using the front panel buttons.

Operational considerations. It is recommended that a maximum of four simultaneous users be connected to the instrument using the Web interface. If more users are connected, it may result in lower performance and inconsistent behavior.

Some front panel operations may interrupt or reduce the performance of the Web interface. For example, the Web server may experience temporary delays when a large file is being transferred using the USB port or when many buttons are being pressed on the front panel.

Levels of control. Use the SYSTEM menu to control the level of instrument access from a Web browser. You can allow full control or read-only access. When the Web user interface is disabled, no instrument access is allowed using a Web browser.

Supported Web browsers. For best results, use Google Chrome, Mozilla Firefox, Safari, or Internet Explorer 9.0 or later when you connect to the SPG8000 Web Interface.

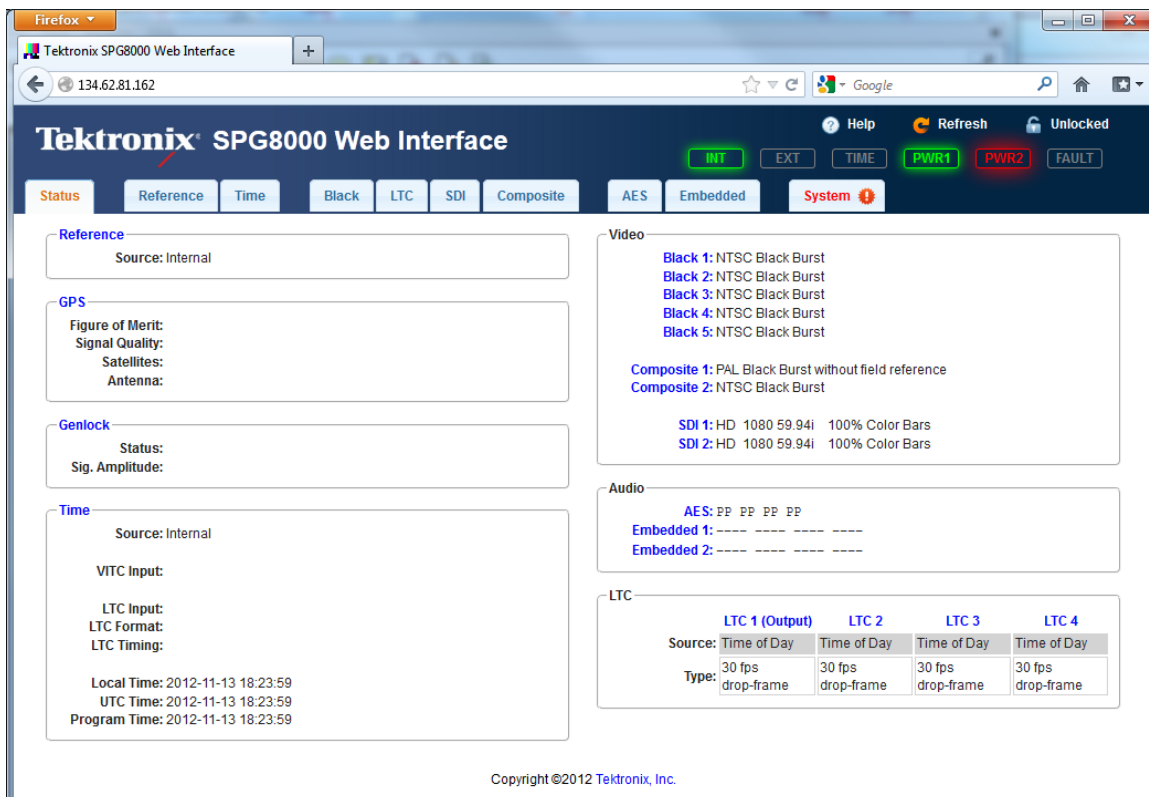


Figure 21: Example SPG8000 Web Interface window

General Purpose Interface (GPI and GPI/LTC) ports

This section describes how to configure and use the GPI ports. The instrument provides two ports on the rear panel to serve as a General Purpose Interface (GPI). With the GPI, you can recall any of the first seven available presets and output up to three alarm signals. See *GPI port* and *GPI/LTC port* for the pin assignments of the two ports. (See page 41.) (See page 42.)

NOTE. Several of the signals in the 9-pin GPI port and the 15-pin GPI/LTC port are shared between the two connectors. For example, when an alarm is configured to be output on the GPI 1 signal, the alarm appears on both the GPI and GPI/LTC ports.

Signal requirements for the GPI connectors. The following figure shows the signal requirements for the GPI connector. Use the input signals to recall a preset and use the output signals as an alarm signal. Frame ground is used for the ground return. When using a shielded LAN cable (shielded twisted pair cable), you can use the shield of the cable as ground.

Table 11: Signal requirements for the GPI connector

Function	Level
Input	High > 2.4 V or open (connected to an internal 10 k Ω pull-up resistor) Low < 0.8 V or ground (input impedance: 10 k Ω) Timing: Ignores pulses < 40 ms and always detects pulses > 60 ms
Output	Low < 0.4 V or ground (when sinking 250 mA; maximum on-resistance 2 Ω)

To recall a preset. You can recall any of the first seven presets by combinations of signal levels for pins 1, 2, and 3 of the GPI connector. The following table shows the combinations of signal levels for the pins and the preset number to be recalled.

Table 12: Signal level combinations and the corresponding preset for the GPI port

Pin 7	Pin 8	Pin 9	Preset number
High	High	Low	1
High	Low	High	2
High	Low	Low	3
Low	High	High	4
Low	High	Low	5
Low	Low	High	6
Low	Low	Low	7

All of the input signals are active low. When the signal level(s) for the specified pin(s) goes from High to Low, the corresponding preset is recalled. For example, when the signal level for pin 3 goes from High to Low, preset 1 is recalled.

NOTE. The time required to change the instrument settings depends on the contents of the selected preset.

GPI input signal configuration. You can use the SYSTEM : GPI : INPUT TRIGGER menu to configure pin 4 of the GPI port connector to trigger the instrument to perform one of the following functions:

- Reset the program time
- Reacquire the GPS position (Option GPS only)
- Force a jam sync

To output an alarm signal. The SPG8000 can output three alarm signals from the GPI and GPI/LTC connectors when internal errors occur. Two of the alarm signals are present on both connectors. Alarms can be generated from pins 2, 3, and 6 on the GPI port connector and from pins 1 and 2 of the GPI/LTC port connector. Since the output signal is an active low; the signal level goes from High to Low when any errors occur.

In addition to the alarm signals on the GPI and GPI/LTC ports, you can configure the BLACK 2 output to send an alarm signal when the signal reference lock is lost. When the reference lock is lost, the output signal from the BLACK 2 connector turns off for as long as the error condition exists.

NOTE. *Many of the error conditions can be configured for a delay to reduce false alarms. If an error condition occurs and then clears before the delay time has counted down, then no alarm signal will be sent.*

You can use the SYSTEM : GPI menu (See page 47, SYSTEM button menu diagram.) to enable an alarm signal output when one of the following internal conditions occurs:

- Hardware fault (such as the fan stops working)
- Power supply fault
- Genlock lock error or warning (for example, the instrument cannot lock to a genlock signal or the frequency of the genlock signal and the internal reference have shifted considerably, and the SPG8000 is near loss of lock. The threshold for near loss of lock is approximately 2×10^{-6} from the ends of the tune range.
- Genlock timing error or warning

SNMP traps

When the SPG8000 generator is connected to an Ethernet network, you can configure the instrument to send SNMP traps to an NMS (Network Management Station) when certain errors are detected. Use the SYSTEM : SNMP menu to configure the IP addresses of the traps destinations and to select which errors will generate traps. See the *SPG8000 Technical Reference* manual for instructions on how to enable and configure the instrument to send SNMP traps.

Presets

Presets allow you to save multiple instrument configuration settings so that you can quickly recall the settings when needed. You can save up to 15 different instrument configurations, including a power-up default setting and a user default setting.

For example, you can configure three different presets so that the instrument can easily switch between generating different video formats such as NTSC, PAL, or HD. Use the SYSTEM : PRESET menu to save, recall, rename, or delete instrument presets.

The following instrument settings are stored in non-volatile memory and are not saved as part of the preset system:

- The preferred supply configuration setting
- Network configuration settings such as the IP address, gateway address and subnet mask
- SNMP trap addresses

How to upgrade the instrument firmware

Tektronix releases software and firmware updates for products to add new features and to fix product problems. You can find the latest firmware for your product at the Tektronix Web site (www.tektronix.com/downloads).

Before you begin the upgrade

Before you begin the upgrade, perform the following steps to determine if the firmware on your instrument should be upgraded and to backup your user files.



CAUTION. *The firmware upgrade process replaces all installed user files with the factory default files. To prevent the loss of your user files, including custom test signals, logo and ID text overlays, and saved presets, be sure to backup all of your user data before you perform the upgrade. The following procedure includes instructions for backing up your user data.*

1. Power on the instrument.
2. Verify the current firmware version installed on the instrument:
 - a. Press the **SYSTEM** button to access the SYSTEM menu.
 - b. Press the up (▲) or down (▼) arrow button to select **SYSTEM : VERSION INFO (F/W)**.
 - c. In the second line of the display, note the firmware version number of the instrument.

Installed firmware version number	
--	--

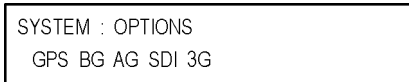
3. Verify the latest version of software at the Tektronix Web site:
 - a. On a computer, use a Web browser to navigate to the following Tektronix Web site:
`http://www.tektronix.com/downloads`
 - b. On the Downloads Finder Web page, search by model number (such as SPG8000) and filter by software and software type to locate the firmware-upgrade package for the instrument.
 - c. Note the latest version number of the firmware-upgrade package(s).

Web site firmware version number	
---	--

4. If the latest firmware version at the Web site is the same as the version installed on your instrument, you do not need to upgrade the instrument firmware.
5. If the latest firmware version at the Web site is newer than the version on your instrument, download the latest firmware package to your computer.
6. After the firmware package ZIP file is downloaded, extract the following files into the directory of your choice: `transfer.exe` and `firmware.pkg`.

NOTE. *If a `readme.txt` file is included in the firmware package, be sure to read the file before you upgrade the firmware.*

7. If the firmware in your instrument needs to be upgraded, verify which options are currently installed before you install the software. After you install the upgrade, you will verify that any previously installed options are still enabled.
 - a. Connect the instrument and computer to your local Ethernet network. (See page 10, *Network installation*.)
 - b. Connect the power cable to power on the instrument.
 - c. Press the **SYSTEM** button to access the SYSTEM menu.
 - d. Press the up (▲) or down (▼) arrow button to select **SYSTEM : OPTIONS**. The second line of the display lists the installed options. The available options are GPS, BG, AG, SDI, and 3G as shown below.



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- e. Make a note of the installed options.
8. If the firmware in your instrument needs to be upgraded, to prevent the loss of your user files, be sure to backup your user files as described in the section *To transfer user files from an instrument to a USB drive*. (See page 73.) You will restore the user files at the end of the upgrade procedure.



CAUTION. To prevent the loss of your user files, be sure to use the **Backup All User Data to USB** option in the backup procedure.

Firmware upgrade overview

There are two methods for upgrading the instrument firmware:

- Using a USB memory device (See page 65, *USB firmware upgrade*.)
- Using an Ethernet network (requires a Windows PC) (See page 67, *Network firmware upgrade*.)

The time required to complete the firmware upgrade is approximately 10 minutes.



CAUTION. The instrument automatically reboots at the end of the upgrade process. Do not perform the upgrade while the instrument is in use as a sync reference.

Once the instrument has started to erase internal flash, do not remove power from the instrument. If you do so, the instrument flash may be corrupted and you will have to run the recovery procedure. (See page 70, *Firmware upgrade troubleshooting*.)

NOTE. If power to the instrument is lost before it begins erasing the internal flash, you can restart the firmware upgrade after the instrument reboots. If the instrument displays only a blank screen after power is reapplied, see the troubleshooting section for help. (See page 70, *Firmware upgrade troubleshooting*.)

If you have loaded the SPG8000 memory with a large number of test signals or frame picture files, you may not be able to upgrade the instrument firmware because the memory is too full. If you receive a memory error while attempting to upgrade the firmware, you need to delete some of the test signal or frame picture files and then perform the upgrade.

USB firmware upgrade

Use the following steps to upgrade the instrument firmware using a USB memory device.

1. Insert a USB memory device into a USB port of the computer containing the latest instrument firmware.
2. On the computer, navigate to the USB device.
3. On the USB device, create a directory named **SpgUpgrd**.



CAUTION. To prevent upgrade failure, be sure to correctly name the upgrade directory. The directory name is case sensitive, with the “S” and the “U” in SpgUpgrd being upper case.

4. Open the SpgUpgrd directory and copy the firmware.pkg file from the downloaded ZIP file to the USB device. The USB device should have a directory path of **SpgUpgrd\firmware.pkg**.
5. Eject and safely remove the USB device from the computer.
6. If necessary, power on the instrument and wait for the instrument to fully boot up before inserting the USB device into the front-panel USB port on the instrument.
7. Press the **SYSTEM** button to access the SYSTEM menu.
8. Verify that the USB device is properly installed by pressing the up (▲) or down (▼) arrow button to select **SYSTEM : USB (Mounted)**.

NOTE. The display will read “Mounted” if the USB device is properly installed. If the display reads “Unmounted”, try to reinstall the USB device.

If the instrument still does not recognize the USB device, attempt this procedure again using a different USB device from a well known brand that is 16 GB or less.

9. Press the up (▲) or down (▼) arrow button to select **SYSTEM : FIRMWARE UPGRADE**.
10. Press the left (◀) or right (▶) arrow button to select **USB Upgrade**, and then press the **ENTER** button. A confirmation message is displayed as shown below.

NOTE. If the instrument displays the message **ERROR: SpgUpgrd/firmware.pkg not found**, make sure you have the correct directory path on the USB device and then restart this procedure at step 6.

* Upgrade firmware 1.1 to X.X? *
* Yes : ENTER / No : BACK *

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Network firmware upgrade

Use the following steps to upgrade the instrument firmware using a network connection:

1. Connect the instrument and a Windows PC to your local Ethernet network or directly connect the instrument to a Windows PC. (See page 10, *Network installation*.)
2. Power on the instrument.
3. Prepare the instrument for the firmware upgrade:
 - a. Press the **SYSTEM** front panel button.
 - b. Press the up (▲) or down (▼) arrow button to select **SYSTEM : FIRMWARE UPGRADE**.
 - c. Press the left (◀) or right (▶) arrow button to select **Network Upgrade**, and then press the **ENTER** button. A confirmation message is displayed as shown below.

```
*      Begin network firmware upgrade?      *
```

```
*      Yes : ENTER / No : BACK              *
```

3080-008

- d. A second confirmation is displayed as shown below to remind you that the upgrade will delete all user-created files on the instrument.



CAUTION. *If you did not backup your user files as part of the upgrade preparation process, it is recommended that you press the BACK button to cancel the upgrade and then backup your user files before performing the upgrade. The instructions for backing up user files is described in the section To transfer user files from an instrument to a USB drive. (See page 73.) You will restore the user files at the end of the upgrade procedure.*

```
*!      User data will be lost. Continue?      !*
```

```
*      Yes : ENTER / No : BACK              *
```

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- e. Press the **ENTER** button to proceed with the upgrade or press the **BACK** button to cancel the upgrade.
- f. When you press ENTER, a **Waiting for network connection** message is displayed along with the IP address of the instrument. This indicates the instrument is ready to be upgraded. An example display is shown below.

```
Waiting for network connection ...
```

```
IP Address : XXX.XXX.XXX.XXX (DHCP)
```

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4. Perform the firmware upgrade:
 - a. On the PC, double-click the **transfer.exe** file to launch the transfer program.
 - b. Type the IP address or DNS name of the instrument you are upgrading, and then press **Enter**. This starts the firmware upgrade process. Messages indicating the progress of the upgrade appear in the transfer program window and on the instrument display.



CAUTION. Once the instrument has started to erase internal flash, do not remove power from the instrument. If you do so, the instrument flash may be corrupted and you will have to run the recovery procedure. (See page 70, Firmware upgrade troubleshooting.)

NOTE. The upgrade will not proceed until all of the firmware data is transferred to the instrument. Once the upgrade has started, the instrument will attempt to complete the upgrade even if it loses contact with transfer.exe. So that you can monitor the progress of the upgrade, it is suggested that you do not close the transfer.exe window until the transfer utility asks for another IP address.

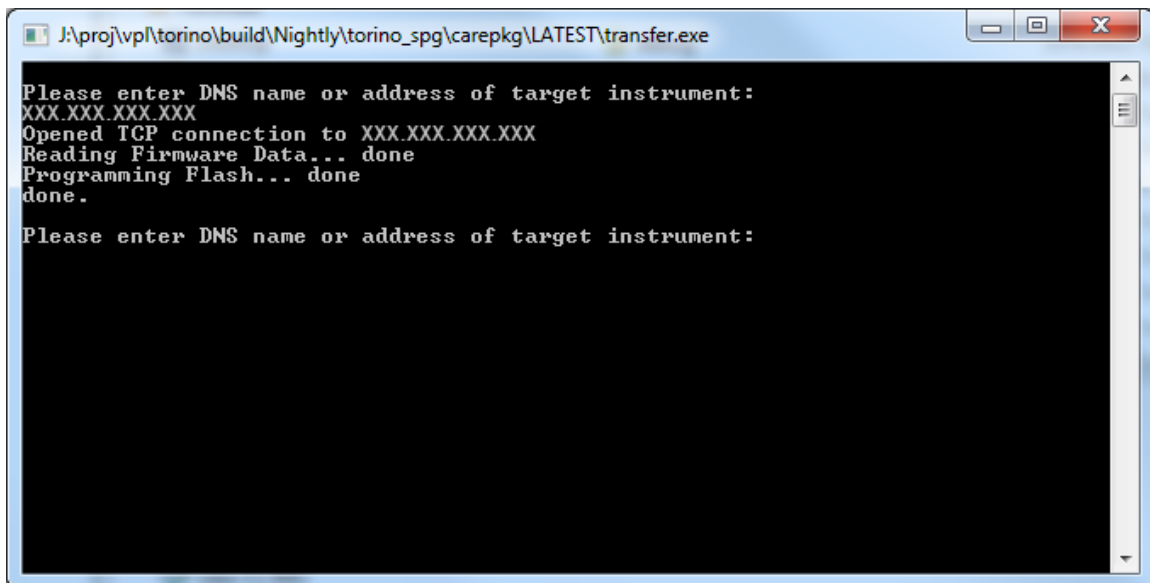


Figure 22: Sample of transfer.exe window after the upgrade is complete

5. If the instrument does not reboot at the completion of the firmware upgrade, remove and then reconnect the power cable.
6. Proceed to *Verify the firmware upgrade and reinstall user files.* (See page 69.)

Verify the firmware upgrade and reinstall user files

1. After the instrument reboots at the end of the upgrade process, press the **SYSTEM** button to access the SYSTEM menu.
2. Press the up (▲) or down (▼) arrow button to select **SYSTEM : OPTIONS**. The second line of the display lists the installed options. The available options are GPS, BG, AG, SDI, and 3G as shown below.

```
SYSTEM : OPTIONS
GPS BG AG SDI 3G
```

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3. Verify that the options listed match those that you noted before the upgrade.
4. Press the up (▲) or down (▼) arrow button to select **SYSTEM : VERSION INFO (FW)**. The second line of the display lists the installed firmware version.
5. Verify that the displayed firmware version is the same version as the firmware package you used to perform the upgrade.
6. If you backed up your user files before you upgraded the firmware, reinstall your user files as described in the section *To install user files from a USB drive to an instrument*. (See page 74.)



CAUTION. To prevent the loss of your user files, be sure to use the **Restore All User Data from USB** option in the restore procedure.

Firmware upgrade troubleshooting

If a power failure occurs during the upgrade and the instrument has a blank screen when you reapply power, perform the following procedure.

1. Connect an Ethernet cable between the instrument and your computer or local Ethernet network.
2. Remove the power cable to turn off the instrument.
3. Press and hold the STATUS button and then reconnect the power cable. Continue to hold the STATUS button until the message **Select upgrade network speed:** appears on the top line of the LCD display.
4. Press the left (◀) or right (▶) arrow button to select a network speed (10BaseT, 100BaseT, or 1000BaseT), and then press the **ENTER** button. If you do not know your network speed, the 100BaseT selection is recommended.
5. When the message **Select upgrade network mode:** is displayed, press the left (◀) or right (▶) arrow button to select from the following modes and then press the **ENTER** button.
 - **DHCP** – Use this selection if the instrument is connected to a network with DHCP support. An IP address will be assigned to the instrument from your network server.
 - **Local IP (192.168.1.1)** – Use this selection if the instrument is connected to a network without DHCP support or is connected to a standalone computer, and you want to use the factory default, static IP address of 192.168.1.1 for the upgrade.

NOTE. When you select either the Local IP or the Saved static IP upgrade mode, you cannot edit the displayed IP address. The IP address cannot be edited when the instrument is in recovery mode.

- **Saved static IP (IP address)** – Use this selection if the instrument is connected to a network without DHCP support or is connected to a standalone computer, and you want to use the previously saved static IP address assigned to the instrument for the upgrade. The saved IP address is displayed.
 - **Quit and continue booting** – Use this selection to quit the upgrade process and leave the instrument in its current condition.
6. If you did not select Quit and continue booting in the previous step, the top line of the instrument display will show the message **Waiting for network connection** and the second line will list an IP address. Make a note of the displayed IP address.
 7. Enter the IP address you noted in the previous step into the upgrade transfer application window on your PC to restart the upgrade process.



CAUTION. To prevent upgrade failure, leave the instrument power on during the upgrade process. The upgrade process may take up to 15 minutes to complete.

8. When the upgrade is complete, the instrument should reboot. If it does not, cycle the power.

If you continue to experience an upgrade problem, contact Tektronix customer support or your local Tektronix representative for assistance.

How to transfer or install user files

You can use either an FTP client or a USB drive to transfer user files between instruments or to install user files directly on the instrument.

User files include test signals, logo overlays, and ID text overlay files. To install custom user files, the signal files must be installed in the proper directory on the instrument. (See page 75, *File structure required to install custom user files.*)

NOTE. *If you install new test signal files, you must reboot the instrument before you can output the new test signals. You do not need to reboot the instrument before you can use newly installed frame picture files, logo overlay files, or text string overlay files.*

To transfer or install user files using FTP

Perform the following steps to transfer or install user files using FTP:

1. Connect the SPG8000 generator to your local Ethernet network or to a standalone Windows PC. (See page 10, *Network installation.*)
2. On a computer connected to the same network as the SPG8000 generator, open an FTP client such as Windows Explorer.
3. In the Windows Explorer command box, enter "ftp://IP address", where IP address is the network address assigned to the SPG8000 generator.

NOTE. *Some FTP clients may ask for login credentials. In this case, login with a user name of "anonymous" and no password.*

4. The Windows Explorer window should immediately connect to the instrument and show the SPG8000 file structure as shown below.

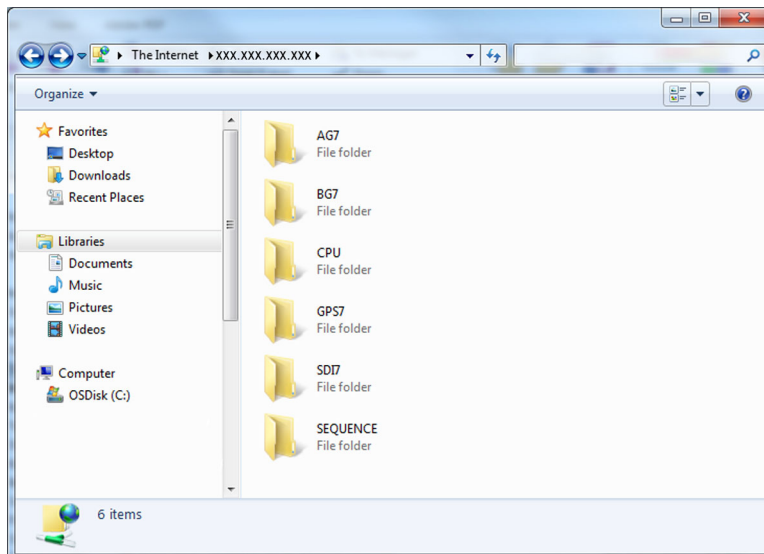


Figure 23: Example FTP view of the SPG8000 file structure

5. Use Windows Explorer to drag and drop user files to or from the SPG8000 generator.



CAUTION. *If you are installing custom signal files on the instrument such as test signals or logo and ID text overlays, the signal files must be installed in the proper directory. Custom user files installed in the wrong directory location will be ignored by the instrument. (See page 75, File structure required to install custom user files.)*

NOTE. *If the flash memory on the instrument fills up before the copy operation completes, an error message similar to the one below is displayed. Click **OK** to clear the error message. You can use the **SYSTEM : FLASH MEMORY** menu selection to view the amount of free memory in the instrument.*

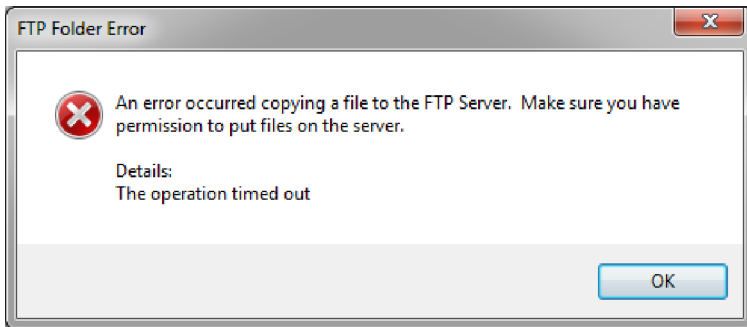


Figure 24: Example FTP error message when flash memory is full

6. After you are done transferring files, close the Windows Explorer window.

To transfer or install user files using a USB drive

You can use a USB drive connected to the USB port on the front of the instrument to transfer or install user files.

To transfer user files from an instrument to a USB drive. Perform the following steps to transfer user files from an SPG8000 generator to a USB drive:

1. Insert a USB memory device into the USB port on the front of the instrument.
2. Verify that the USB device is properly installed:
 - a. Press the **SYSTEM** button to access the SYSTEM menu.
 - b. Use the up (▲) or down (▼) arrow button to select **SYSTEM : USB (Mounted)**.

NOTE. The display will read "Mounted" if the USB device is properly installed. If the display reads "Unmounted" or "Not Connected", try to reinstall the USB device.

If the instrument still does not recognize the USB device, attempt this procedure again using a different USB device from a well known brand that is 16 GB or less.

3. Use the up (▲) or down (▼) arrow button to select **SYSTEM : BACKUP/RESTORE**.
4. Use the left (◀) or right (▶) arrow button to select one of the following options, and then press the **ENTER** button.
 - Select **Backup Presets to USB** if you want to transfer only the stored presets from the instrument.
 - Select **Backup All User Data to USB** if you want to transfer all user data including stored presets and user-created text, logo, picture, and test signal files.
5. In the overwrite confirmation display, press the **ENTER** button to perform the selected backup function.
6. During the backup process, progress messages are displayed. When the message **Backup completed successfully** is displayed, press any button to return to the SYSTEM menu display.
7. Use the up (▲) or down (▼) arrow button to select **SYSTEM : USB (Mounted)**.
8. Press the **ENTER** button to safely unmount the USB device. You can now use the USB device to transfer the saved files to another SPG8000 generator or to restore user files after a firmware upgrade.

To install user files from a USB drive to an instrument. Perform the following steps to install user files from a USB drive to an instrument:



CAUTION. *In addition to transferring files from one instrument to another, you can use the Restore All User Data From USB function to directly install user-created text, logo, picture, and signal files on the instrument. In order to install user files, the files must be organized in specific directories on the USB drive. (See page 75, File structure required to install custom user files.)*

1. Insert a USB memory device containing the user files you want to install on the SPG8000 generator into the USB port on the front of the instrument.
2. Verify that the USB device is properly installed:
 - a. Press the **SYSTEM** button to access the SYSTEM menu.
 - b. Use the up (▲) or down (▼) arrow button to select **SYSTEM : USB (Mounted)**.

NOTE. *The display will read "Mounted" if the USB device is properly installed. If the display reads "Unmounted" or "Not Connected", try to reinstall the USB device.*

If the instrument still does not recognize the USB device, attempt this procedure again using a different USB device from a well known brand that is 16 GB or less.

3. Use the up (▲) or down (▼) arrow button to select **SYSTEM : BACKUP/RESTORE**.
4. Use the left (◀) or right (▶) arrow button to select one of the following options, and then press the **ENTER** button.
 - Select **Restore Presets From USB** if you want to install only the stored presets from another instrument.
 - Select **Restore All User Data From USB** if you want to transfer all user data including stored presets and user-created text, logo, picture, and signal files.
5. In the overwrite confirmation display, press the **ENTER** button to perform the selected restore function.
6. During the restore process, progress messages are displayed. When the message **Restore completed successfully** is displayed, press any button to return to the SYSTEM menu display.
7. Use the up (▲) or down (▼) arrow button to select **SYSTEM : USB (Mounted)**.
8. Press the **ENTER** button to safely unmount the USB device.

File structure required to install custom user files. In order to install custom user files from a USB drive, the files must be organized in the file structure described below. You can create the proper file structure by performing the Backup All User Data to USB function. You can then copy the directory structure from the USB drive to your computer. (See page 73, *To transfer user files from an instrument to a USB drive.*)



CAUTION. *If you are installing custom signal files on the instrument such as test signals or logo and ID text overlays, the signal files must be installed in the associated subdirectory for the file type in the SDI7 directory. Custom user files installed in the wrong directory location will be ignored by the instrument.*

The directory names listed below are case sensitive.

- A directory named **SpgBackup** is required at the top level of the USB drive.
- In the SpgBackup directory, a subdirectory named **SDI7** is required.
- In the SDI7 directory, subdirectories with the following names are required:

NOTE. *All of the following subdirectories are not required to be in the SDI7 directory in order to be able to install user files. You only need the subdirectories related to the type of user files you are installing on the instrument. For example, if you are going to install only logo files, you need to have only the LOGO subdirectory exist in the SDI7 directory.*

See the SPG8000 Technical Reference manual for more information about the requirements for the following file types.

- LOGO – Use this directory to install only logo overlay files. The logo files must have a .bmp file name extension.
- PICTURE – Use this directory to install only frame picture files for use as test signals. The frame picture files must have a .bmp file name extension.
- SIGNAL – Use this directory to install only test signal files. The test signal files must have a .xml file name extension.
- TEXT – Use this directory to install only ID text overlay files. The ID text files must have a .txt file name extension.

The following figure shows how the required directory structure for installing custom user files looks using Windows Explorer.

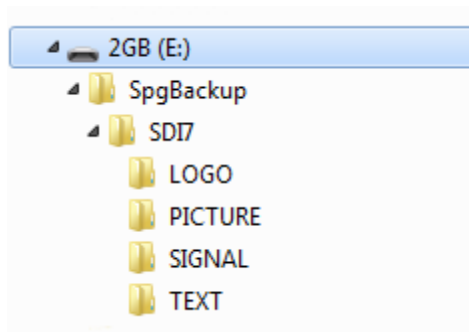


Figure 25: File structure for installing custom user files

How to operate an instrument with two power supplies (Option DPW only)

The standard instrument has one Power Supply module installed. With Option DPW, a second hot-swappable, redundant (backup) Power Supply module is provided. When two Power Supply modules are installed in the instrument, one is configured as the primary supply and the other is configured as the backup supply.

In the event that the primary supply fails, the backup supply automatically provides power to maintain instrument operation. You can remove and replace a failed supply without having to remove the instrument from operation. (See page 78, *To hot-swap a Power Supply module.*)

If you need to remove one of the two supplies for repair and you do not have a replacement supply available, be sure to install a blank power supply cover into the empty power supply slot (Tektronix part number 200-5254-XX).

Power supply status

The status of the Power Supply modules can be viewed from the front or rear of the instrument. On the front panel, the PWR1 and PWR2 indicators illuminate using various colors to show the status of the Power Supply modules. The rear panel of each Power Supply module has a STATUS LED that matches the status shown on the PWR1 and PWR2 indicators. (See page 34, *PWR1 and PWR2 indicators.*)

You can use the SYSTEM menu to perform a load test on the backup supply and to view voltage levels in the instrument.

Temperature weighted hours (TWH)

The instrument keeps track of the age of a Power Supply module by calculating the temperature weighted hours (TWH). You can view the TWH of each installed supply using the SYSTEM : DIAGNOSTICS menu.

TWH calculation method. When the outside air temperature is at 25 °C or cooler, the Power Supply module is expected to last 15 years. As the outside air temperature rises to the maximum operating temperature of 50 °C, the expected life of the supply decreases to 5 years. Every hour, the instrument measures the outside temperature and increments the temperature weighted hours count in response to the measured temperature.

When the TWH value reaches a value of 131,400, then the associated PWR1 or PWR2 indicator will be set to orange to indicate that the supply should be replaced.

NOTE. *When two Power Supply modules are installed, the active supply runs warmer than the backup supply. Therefore, the TWH of the active supply will increase faster than the backup supply.*

To configure the preferred (active) supply

Perform the following steps to configure which Power Supply module is the preferred (active) supply:

NOTE. The preferred supply configuration only applies if two Power Supply modules are installed and both of the supplies are connected to a power source. If there are two Power Supply modules installed but one of the supplies has a failure, the good supply will be used to power the instrument regardless of the preferred supply configuration.

The recommended usage strategy is to configure one supply as preferred, and use the second supply only in case the first supply has a failure. This usage strategy allows the backup supply to have the maximum remaining life when it is needed.

The preferred supply configuration is not saved as part of the preset system. Therefore, the preferred supply configuration will not change when you activate any of the system presets, including the Factory Default preset. (See page 62, Presets.)

1. Check the status of the front-panel PWR1 and PWR2 indicators:

- Bright green indicates the preferred (active) supply.
- Dim green indicates the inactive (backup) supply.

NOTE. If the color of the PWR1 or PWR2 indicators is other than bright or dim green, service the faulty Power Supply module before proceeding. (See page 34, PWR1 and PWR2 indicators.)

2. Check the temperature weighted hours of the installed supplies:

NOTE. It is recommended that you configure the supply with the most temperature weighted hours to be used as the primary preferred supply. This allows for the newer supply to be preserved so it can provide the best possible backup should the primary supply fail. (See page 76, Temperature weighted hours (TWH).)

- a. Press the **SYSTEM** button to access the SYSTEM menu.
- b. Press the up (▲) or down (▼) arrow button to select **SYSTEM : DIAGNOSTICS**, and then press the **ENTER** button to access the DIAGNOSTICS menu.
- c. Press the up (▲) or down (▼) arrow button to select **SYSTEM : DIAGNOSTICS : POWER SUPPLY 1**. The second line of the display will list the number of hours the supply has been the active supply and the backup supply.
- d. Press the right (▶) arrow button to display the number of temperature weighted hours of the first supply as shown below. Note the number of hours of hours shown.

SYSTEM : DIAGNOSTICS : POWER SUPPLY 1
 Tmp Wtd: 0000677 (OK)(limit:131400)

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- e. Press the up (▲) or down (▼) arrow button to select **SYSTEM : DIAGNOSTICS : POWER SUPPLY 2**.
 - f. Press the right (▶) arrow button to display the number temperature weighted hours of the second supply. Note the number of hours of hours shown.
3. If the Power Supply module with the greatest number of temperature weighted hours is not the currently the preferred supply, then continue this procedure. Otherwise, you do not need to change the preferred supply configuration.

4. If you want to change the preferred supply configuration, press the **SYSTEM** button to access the SYSTEM menu.
5. Press the up (▲) or down (▼) arrow button to select **SYSTEM : POWER SUPPLY PREFERRED SELECT**.
6. Press the left (◀) or right (▶) arrow button to display the supply you want to be the primary (active) supply: Power Supply 1 or Power Supply 2. The second line of the display shows the supply status: **Active**, **Preferred** or **Inactive**.

NOTE. *When viewed from the front of the instrument, Power Supply 1 is the left Power Supply module and Power Supply 2 is the right Power Supply module. This matches the orientation of the PWR1 and PWR2 indicators on the front panel.*

7. If status of the supply is Inactive, press the **ENTER** button to change the status to Active, Preferred. The front-panel indicator for the selected supply should change to bright green.

To hot-swap a Power Supply module

This procedure describes how to replace a Power Supply module while the instrument is in operation. Perform the following steps to hot-swap a Power Supply module:



WARNING. *Disconnect the power cord from the Power Supply module before you remove the module from the instrument. Also, do not connect a power cord to the Power Supply module while the module is not installed in the instrument. There are dangerous high voltages inside the module when the power cord is connected.*



CAUTION. *To prevent an unexpected shutdown of the instrument, be sure to unplug the correct power cord if you are replacing a faulty Power Supply module. (See Figure 26.)*

When viewed from the front of the instrument, Power Supply 1 is the left Power Supply module and Power Supply 2 is the right Power Supply module. This matches the orientation of the PWR1 and PWR2 indicators on the front panel. The STATUS LED on the rear panel of each Power Supply module will match the status shown by the front-panel PWR1 and PWR 2 indicators.

1. Remove the power cable from the Power Supply module that you are removing or replacing.
2. Pull out the handle located at the bottom of the supply. (See Figure 26.)
3. While pushing the retaining latch to the left, use the handle to pull the Power Supply module out of the instrument.
4. Insert the replacement supply into the instrument until it latches into place.
5. If necessary, push the handle of the supply into the storage position.
6. Connect the power cable to the Power Supply module you installed.
7. Check that the status of the Power Supply module you just installed is bright or dim green. (See page 34, *PWR1 and PWR2 indicators*.)
8. If desired, change the preferred supply configuration. (See page 77, *To configure the preferred (active) supply*.)

NOTE. *It is recommended that you configure the supply with the most temperature weighted hours to be used as the primary preferred supply. This allows for the newer supply to be preserved so it can provide the best possible backup should the primary supply fail. For more information about temperature weighted hours, see the SPG8000 Technical Reference manual.*

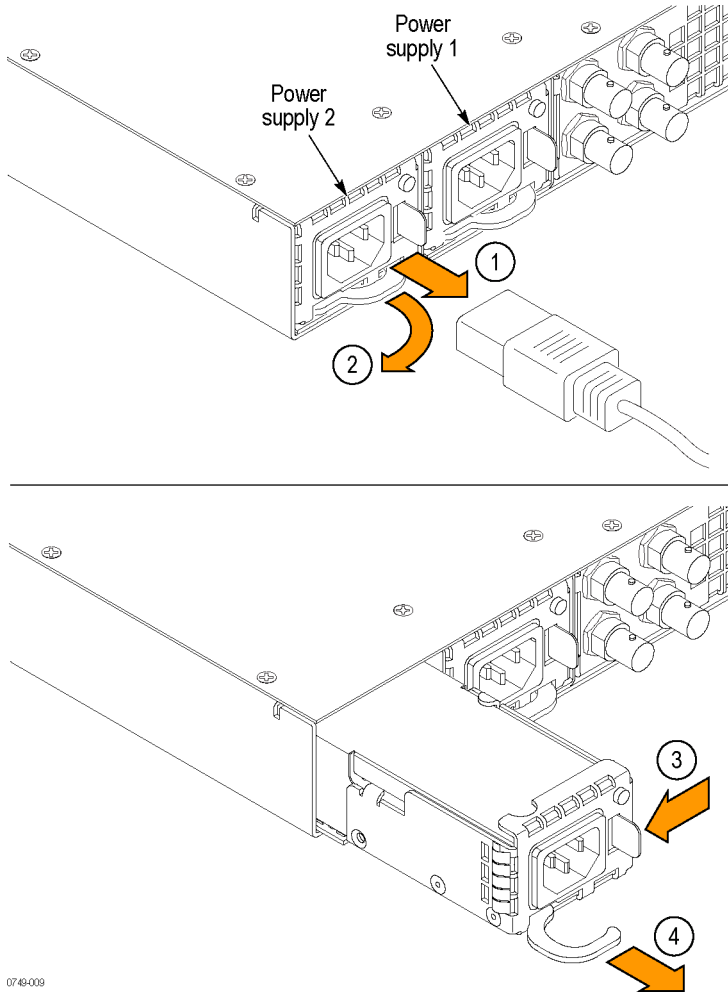


Figure 26: Removing a Power Supply module

How to enter the option key (Option 3G only)

If you ordered Option 3G as an upgrade to your existing instrument, you must enter the option key that was supplied with the upgrade in order to enable the 3G software option.

NOTE. Option SDI must be installed in the instrument before Option 3G can be enabled.

If you ordered Option 3G at the same time you ordered the instrument, the instrument was shipped from the factory with the option already enabled.

Each option key applies to only one instrument. You will need to enter the option key only once. Locate the option key document, and then perform the following steps to enter the option key:

NOTE. This procedure uses the instrument front panel to enter the option key. You can also use the SPG8000 Web interface to remotely enter the option key. Refer to the SPG8000 Technical Reference for information about using the SPG8000 Web interface to enter the option key.

1. Press the front-panel **SYSTEM** button to access the SYSTEM menu.
2. Press the up (▲) or down (▼) arrow button until **SYSTEM : OPTIONS** is displayed.
3. The second line of the display lists the options installed in the instrument. As shown below, check that **SDI** is listed and that **3G** is not listed. This verifies that Option SDI is installed and that Option 3G is not enabled.

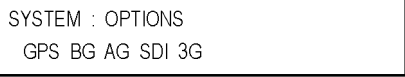


A rectangular box representing a display screen. The text inside the box is arranged in two lines: the first line reads "SYSTEM : OPTIONS" and the second line reads "GPS BG AG SDI".

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4. Press the **ENTER** button to enter the OPTIONS submenu.
5. Press the up (▲) or down (▼) arrow button until **SYSTEM : OPTIONS : UNIQUE ID** is displayed.
6. Verify that the displayed ID matches the module ID listed on the option key document.

7. Enter the option key:
 - a. Press the up (▲) or down (▼) arrow button to select **SYSTEM : OPTIONS : KEY**. The existing option key string is displayed.
 - b. Press the **ENTER** button to enter the option key edit mode. The underscore character () appears under the first character of the option key.
 - c. Use the up (▲) or down (▼) arrow button to select the first character of the option key.
 - d. Use the left (◀) or right (▶) arrow button to move the underscore character to the next character in the option key.
 - e. Enter all of the option key characters, and then press **ENTER** button to confirm the selection.
 - f. Press the **BACK** button to exit the OPTIONS submenu and return to the SYSTEM menu.
8. Check that Option 3G is enabled:
 - a. From the SYSTEM menu, press the up (▲) or down (▼) arrow button until **SYSTEM : OPTIONS** is displayed.
 - b. Check that **3G** is displayed in the second line of the display. This verifies that Option 3G has been enabled.



```
SYSTEM : OPTIONS
GPS BG AG SDI 3G
```

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- c. If Option 3G is not enabled, use the **SYSTEM : OPTIONS : UNIQUE ID** display and the **SYSTEM : OPTIONS : KEY** display to verify that you are updating the correct instrument and that you entered the new option key correctly.

How to use Stay Genlock®

About Stay Genlock®

Stay GenLock® is a digital genlock technology developed by Tektronix to provide additional robustness and stability for genlocked Sync Pulse Generators (SPGs), as in a master/slave configuration.

If the external reference is removed from the genlock input, the SPG8000 generator must use the internal oscillator as a frequency reference. Although the OXCO is a precision component, small frequency differences are inevitable. However, the Stay GenLock® technology maintains a history of the clock frequency, and therefore attempts to hold the last stable frequency before genlock was lost.

See the *Video Sync Pulse Generator and Electronic Changeover Unit System Integration Technical Reference* manual for more information about the Stay Genlock® function.

How to enable Stay Genlock® on the SPG8000 generator

To enable the Stay GenLock® function on the SPG8000 generator, perform the following steps:

1. Press the front-panel **REFERENCE** button to access the REFERENCE menu.
2. Use the up (▲) or down (▼) arrow button to display **REFERENCE : LOCK LOSS ACTION**.
3. Use the left (◀) or right (▶) arrow button to display **Stay at Current Frequency**, and then press the **ENTER** button to confirm the selection.

Lock recovery. The SPG8000 generator includes settings for selecting how the instrument timing responds when the reference signal is recovered after a loss of lock. Perform the following steps to select the recovery mode.

1. Press the front-panel **REFERENCE** button to access the REFERENCE menu.
2. Use the up (▲) or down (▼) arrow button to display **REFERENCE : GPS HOLDOVER RECOVERY**.
3. Use the left (◀) or right (▶) arrow button to select one of the following modes, and then press the **ENTER** button to confirm the selection.

NOTE. *If the instrument timing is off by more than 20 ms when the GPS signal is recovered, the SPG8000 forces a jam phase timing recovery. In genlock mode, a jam sync may occur if the timing has drifted more than 20 ns.*

- Stay Legal: Adjusts the instrument timing to match the recovered GPS signal while staying within the specified frequency offset and frequency rate of change specifications for NTSC and PAL reference signals.

NOTE. *It can take a long time for the SPG8000 to recover in this mode since it takes about 300 seconds to correct each 64 μ s line of timing error.*

- Jam Phase: Adjusts the instrument timing to match the recovered GPS signal immediately but will typically cause a sync “shock” to the system.
- Fast Slew: Adjusts the instrument timing to match the recovered GPS signal at a rate 25 times faster than the legal rate without jumping.

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