

SPG8000
Master Sync / Clock Reference Generator
Technical Reference



077-0747-00

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SPG8000

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Contacting Tektronix

Tektronix, Inc.
14150 SW Karl Braun Drive
P.O. Box 500
Beaverton, OR 97077
USA

For product information, sales, service, and technical support:

- In North America, call 1-800-833-9200.
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Preface

This manual provided detailed operating information about the SPG8000 Master Sync / Clock Reference Generator.

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.		✓	✓

System timing

Frame reset signals

The SPG8000 uses the three frame reset signals described below to output different video formats simultaneously.

FRAME RESET 1

This frame reset signal runs at 2.997 Hz and supports the 1/1.001 system signal, and is used by the following video formats. These signals are synchronized with each other.

NTSC	1080 23.98sF	30 fps DF LTC
525-270	1080 29.97p	23.98 fps LTC
1080 23.98p	1080 59.94i	
	1080 59.94p ¹	
	720 59.94p	

FRAME RESET 2

This frame reset signal runs at 6.250 Hz and is used only for PAL, 625, or HD / LTC formats with 50 Hz or 25 Hz frame rates. These signals are synchronized with each other.

PAL	1080 25p	25 fps LTC
625-270	1080 50i	
	1080 50p ¹	

FRAME RESET 3

This frame reset signal runs at 3.000 Hz and is used for HD / LTC formats with 60 Hz, 30 Hz or 24 Hz frame rates. These signals are synchronized with each other.

1080 24p	24 fps LTC
1080 24sF	25 fps LTC
1080 30p	30 fps LTC ²
1080 60p ¹	
1080 60i	
720 60p	

¹ Option 3G only (requires Option SDI).

² Not drop frame.

Frame reset signal 1 is not synchronized with frame reset signals 2 or 3 unless Option GPS is installed. When Option GPS is installed, the frame reset signal 1 synchronization is related to the frame reset signals 2 and 3 through the GPS epoch timing.

GPS signal quality (Option GPS only)

The SPG8000 generator uses Figures of Merit (FOM) to measure and track GPS signal quality.

Figures of Merit (FOM)

These numbers are a compendium of the GPS signal quality and the processes that occur as the instrument progresses through the states needed to lock on to the GPS signal. The FOM provides a simple scale to evaluate the state of the GPS lock.

The FOM drives the external reference indicator (LED) on the front panel of the mainframe. When in internal mode, the external LED is off. When in external mode and the FOM is ≥ 6 , the LED is steady green. When the FOM is < 6 , the LED is flashing green.

The FOM provides the scale by which you can set the signal warning threshold. (See page 57, *REF button menu*.)

You can see the current status of GPS signal quality using FOM in the STATUS button menu. The following table lists the figures of merit and their descriptions.

Table 1: Figures of merit for GPS signal quality (Option GPS only)

Figure of merit (FOM)	Indicator	Description
0	No signal	This means that no usable satellite signals are detected. This is normal for a short time after the signal is applied, but if it lasts more than a minute or so, then it usually means one of the following: that there is a problem in the antenna or cable, the antenna is blocked from direct line of sight to the satellites, or the power is not getting to the antenna.
1	Low signal	This means that some signal is detected, but that the signal quality is too low for extraction of useful timing or position information. This is a normal situation for a short duration, but if it persists, the causes are likely to be similar to those for FOM state 0.
2	Acquire satellites	This means that the instrument is receiving data from the satellites and is determining which signals to use.
3	Bad position	This means that the instrument detects that the stored position is different from the current position. In this case, the instrument will automatically go to FOM state 4 and reacquire the position.

Table 1: Figures of merit for GPS signal quality (Option GPS only) (cont.)

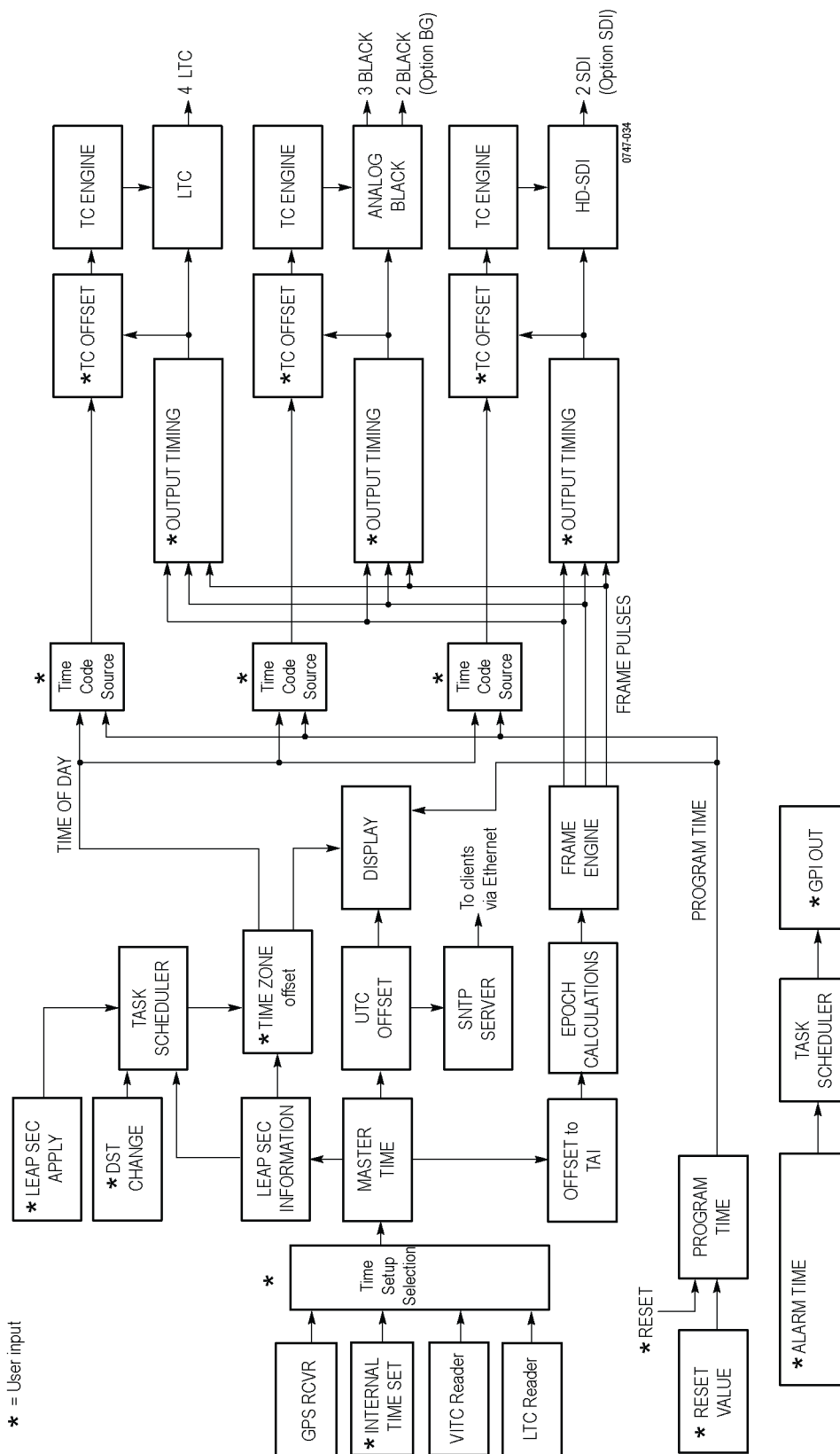
Figure of merit (FOM)	Indicator	Description
4	Acquire position	This means that the instrument is acquiring multiple fixes of the satellite position and averaging this into a new position to store in flash. This state will also be displayed if you manually perform a new position acquisition. This state normally lasts 60 seconds with good GPS signal quality.
5	Adjust phase	This means that the instrument is adjusting the time base or frame timing to correctly line up with the GPS signal.
6	Locked > Signal quality is ≤ 16	These states indicate that the phase of the frame signals is within 150 ns of the GPS signal. The number of arrows indicates the signal quality. It is normal for this to vary with the time of day as the different satellites move through their orbits, as well as with changes in weather and other conditions.
7	Locked >> Signal quality is > 16	
8	Locked >>> Signal quality is > 26	
9	Locked >>>> Signal quality is > 42	
10	Locked >>>>> Signal quality is > 68	
11	Locked >>>>>> Signal quality is > 110	

NOTE. The duration of some states depends on the strength of the received GPS signal. If the antenna only has access to part of the sky, or if the cable loss between the antenna and the receiver is too large, then it may take significantly longer to progress up to the higher entries in the FOM table.

Time flow block diagram

The following time flow diagram shows time information is used at different points in the system. In particular, it illustrates how the different user inputs and configuration settings combine with the time base to create the timecode. An asterisk (*) denotes points of possible user input.

NOTE. In the following descriptions of the time flow block diagram, Option GPS is required where GPS functionality is described.



SPG8000 Technical Reference

GPS RCVR. Option GPS is required to use the GPS Receiver feature. The GPS signal can be selected as the source for a time of day clock used for timecode outputs, and as a phase reference for video outputs. The GPS signal carries the time represented as the number of weeks and number of seconds since the GPS Epoch (0:00:00 UTC, January 6 1980). For example, 12:00:00 UTC on November 5, 2008 is represented as 1504 weeks plus 302,400 seconds. An additional 14 leap seconds that have passed between January 1980 and November 2008 are also signalled in messages from the GPS satellite system.

Internal Time Set *. Option GPS is required for the GPS/NTP portion of the Internal Time Set feature. If you want to set Time Setup to internal mode, enter the current date and time and then set the Time Setup to Internal in order to transfer that time to the Master Time. The time zone offset and leap second information is used to convert local time to a master time that is equivalent to GPS time. This allows the Epoch and NTP processes to work the same for both internal and GPS time modes. Set the local time zone offset before setting the internal time.

VITC Reader. When the SPG8000 is genlocked to NTSC or PAL, the Vertical Interval Timecode on the genlock reference input can be decoded and used as the time source. This time can be viewed on the status bar, and is used as the time source for all the time code outputs. Since the phase of the video signals are set by the genlock, the epoch system does not operate from the VITC input.

LTC Reader. When the reference source is set to INTERNAL, NTSC, PAL or HD SYNC, the LTC signal applied to the LTC 1 input can be used as the time source. This time can be viewed on the status bar and is used as a time source for all the time code outputs. Since the LTC reader does not provide date and time information, the epoch system does not operate from the LTC input.

Time Setup Selection. Option GPS is required to use GPS as the reference source. The possible Time code sources depend on the selected Reference source. If GPS signal is the selected reference source, then GPS or internal time is available. If Genlock is the selected reference source, then VITC or internal time is available. If Internal is the selected reference source, then internal time is the time code source.

If VITC is the time code source, then the time synchronization Mode needs to be set. There are three choices. Synchronize now sets the time when the user presses the ENTER button (if the incoming time is valid and stable). Synchronize once sets the time once when a valid and stable time code is detected. Follow sets the time every time a new stable and valid time is detected.

Master Time. The Master Time is the basis for all timecode outputs and for the phase reference of all video outputs.

Leap Seconds. Leap second information is stored and then updated by satellite every 20 to 30 minutes.

Offset to TAI. TAI is the International Atomic Time, represented as the number of seconds since the epoch of 0:00:00 January 1, 1958. Proposed standard SMPTE 404M defines the SMPTE Epoch at that same moment. There are exactly 8040 days and 19 leap seconds between the SMPTE Epoch (TAI) and the GPS Epoch.

Epoch Calculations. Option GPS is required to use Epoch Calculations feature. The number of seconds since the SMPTE Epoch is used to precisely align video frames with the Master Time clock. For example, an NTSC system operates at 29.97 frames per second (30 fps/1.001), so there are precisely 30,000 frames every 1001 seconds. By knowing the total number of seconds since the SMPTE Epoch, when all video frames were perfectly aligned, the instrument can determine "where" the GPS pulse-per-second signal is located with respect to video framing.

Frame Engine. The frame engine supplies frame pulse signals based on the SMPTE Epoch to each video output. This ensures that they are properly aligned with respect to the calculated phase for the selected video format of each output.

Output Timing. Each video output has an independent offset that can be specified to shift that output in order to align the video and LTC signals in the studio. This time adjustment does not affect the timecode that is applied to that output; the signal and timecode stay together as the timing is changed. The timing offset range and resolution depend on the signal. See the specific output menu for details.

Leap Second Information. Option GPS is required to use the Leap Second Information feature. The GPS signal indicates the number of leap seconds between GPS time and UTC. As of December 31, 2008, a total of 34 leap seconds are required for the adjustment between TAI and UTC. This information only stays current when a GPS signal is connected. On instrument boot up, stored leap second information is used, and an asterisk appears next to the time in the status screen until the leap second information from the GPS signal is received.

Time Zone Offset *. The SPG8000 has a selectable offset between UTC and the local time, usually representing the local time zone. This offset can be specified in hours+minutes+seconds, allowing specification of time zones that do not align with the usual hours-only offset, or for other applications not related to time zones. You can also use this setting to set the internal time to calculate "backwards" to the Master Time.

When the input time source is set to VITC, the instrument works similar to how it works in internal mode, pre-correcting the master time of day by the time zone offset. This pre-correction assumes that the incoming time code has the correct local time, and causes the outgoing time codes to nominally match the incoming ones, regardless of time-zone offset. This means that when switching from GPS to VITS mode, the time-zone offset usually does not need to change. However, if the time code synchronization mode is set to "Synchronize now" or "Synchronize once", and the time-zone offset is changed after the time-code sync has occurred, then the time-zone change offsets the incoming and outgoing time codes until the user reasserts the time synchronization.

Leap Second Apply *. Leap seconds, when required, are added on June 30, and/or December 31, at 23:59:60 UTC. That is, the minute preceding midnight has 61 seconds instead of 60, numbered 0..60 instead of 0..59. This might be an inconvenient time to make a local clock adjustment. For example, this is during prime time for the North American Eastern Time Zone. Therefore, the SPG8000 gives the option of deferring the leap second adjustment (if any) on these dates for up to 24 hours.

DST Change *. Daylight Saving Time (DST) changes twice a year in many time zones, but some locations do not observe daylight savings time. The SPG8000 has a user programmable DST adjustment to the time zone offset that is made by adding or subtracting a specified amount from the current time setting. The scheduled date and time of the change must be programmed into the instrument. There are two methods for scheduling the DST offset:

- **Once.** In Once mode, the DST offset is applied only once on the date and time you specify. Set the DST offset to either add or subtract an hour from the time zone offset, depending on whether DST is starting or ending in your location.
- **Recurring.** In Recurring mode, the DST offset is applied when the DST START date and time that you specify occurs, and is removed when the DST END date and time that you specify occurs. The recurring DST offset can only be a positive number, such as one hour. The DST START/END dates are formatted as the DST rules are written (e.g., DST starts on the First Sunday in March at 02:00). For example, to change to daylight savings time, schedule the system to add one hour to the time zone offset at 02:00:00 (local time) on March 6, 2011. To return to standard time, schedule the system to remove the DST offset at 02:00:00 on November 6, 2011. At the scheduled time and date, the DST change is added to the time zone offset as seen from the instrument display. You can then program the next scheduled DST change.

VITC may have DST shift already applied. To avoid duplicating DST shifts, disable the DST SCHEDULER if the time of day reference has DST applied.

Task Scheduler. The task scheduler is responsible for triggering scheduled events at the appropriate time. This includes DST changes, deferred leap second adjustments, and triggered alarm outputs.

NTP Server. Option GPS is required to use the NTP server. The SPG8000 includes an implementation of the Network Time Protocol, using the network interface of the instrument. The NTP server is automatic; when the Master time is set to GPS and the instrument acquires a valid time, the server will respond with valid NTP packets to time requests from NTP clients. When the Master time is set to GPS, the server always responds with UTC time only. It is the responsibility of the NTP client (PC workstation, file server, etc.) to be configured with the correct time zone offset. The NTP Server will also respond with valid NTP packets when the Master time is set to Internal mode.

When using VITC input as the time reference, the NTP service is not available.

TC Offset *. Every timecode output has an independent offset (hours, minutes, seconds, frames) that can be added to the value of the selected timecode source.

TC Engine. The timecode engine runs at the rate specified through the user interface and generates the actual timecode bits needed for each output.

LTC. The instrument has four independent linear timecode outputs. Each output can be set independently with regard to timecode format, module timing, and timecode delay.

Analog Black. The standard instrument provides three analog sync outputs. Each output can be configured as NTSC or PAL black burst (with optional VITC insertion) or HD trilevel sync. Option BG adds two additional analog sync outputs which can be similarly configured.

HD-SDI. Option SDI provides two independent HD-SDI test signal generators, for which ancillary timecode (ATC) can be added.

Program Time. As an alternate to the local time of day, a program time counter can be used as a timecode source for any output. This counter can represent elapsed time, such as the timecode associated with program content during the editing process, for example.

Reset Value. The program time counter will start counting from the specified reset value. Program time can be reset to this value at any time using either the user interface or a general purpose interface (GPI) input.

Alarm Time. An alarm can be set to generate when the program time counter matches a predefined value. For example, you can specify the start timecode of your program content at 01:00:00:00. The program time can be initialized to 00:59:00:00 to start a one minute leader before the program. The alarm time could be set at 00:59:55:00 to signal a five second countdown before the program start, perhaps to signal a change from color bars to black within the pre-program leader.

GPI Out. The instrument has two General Purpose Interface (GPI) outputs, either of which may be configured to begin when the program time matches a specified alarm time.

Web user interface

You can remotely control the SPG8000 using the 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. (See Figure 2.)

NOTE. *The Web user interface must be enabled from the System menu on the instrument front-panel before it can be accessed from a Web browser. (See page 129, SYSTEM button menu.)*

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.

NOTE. *The Web user interface requires Javascript to run.*

Elements of the Web user interface

The following figure highlights elements of the Web user interface window. Some display elements are dependent on certain options being installed in the instrument.

NOTE. A red exclamation mark next to a menu item indicates that an alert exists. Click the item to view the alert details.

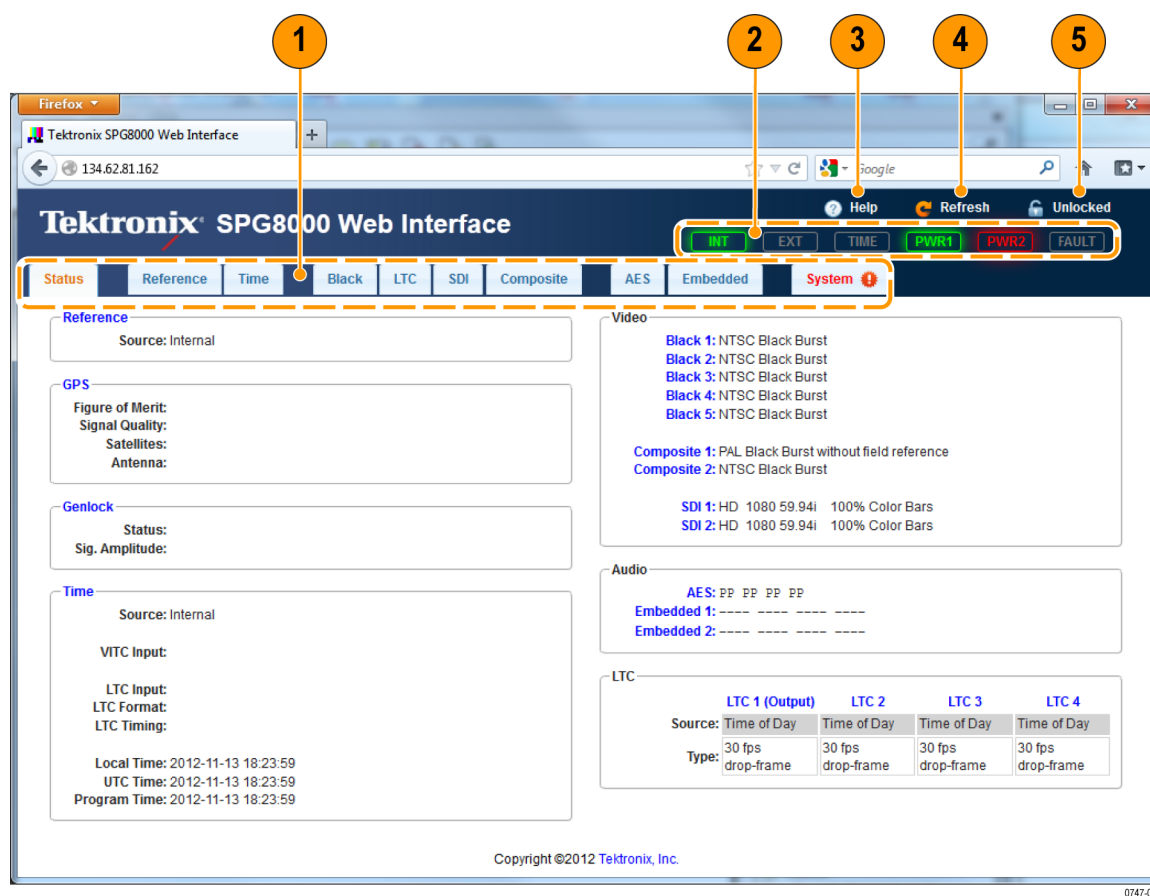


Figure 2: Example SPG8000 Web User Interface window

Table 2: Elements of the Web user interface

Item number	Description
1	<p>Menu tabs. Click a tab to access one of the following menus:</p> <ul style="list-style-type: none"> ■ Status menu: Use this menu to view the status of various instrument functions. You cannot make changes to instrument settings from the Status menu. For more information, see the <i>STATUS button menu</i> section. (See page 125.) ■ Reference menu: Use this menu to view or change the signal reference, GPS, or genlock timing settings for the instrument. For more information, see the <i>REF button menu</i> section. (See page 57.) ■ Time menu: Use this menu to view or change the time settings in the instrument. The settings are divided between the Time of Day, Daylight Savings Time, Leap Second, Program Time, and Jam Sync submenus. Click on the arrow next to the desired submenu to access that menu. For more information, see the <i>TIME button menu</i> section. (See page 167.) ■ Black menu: Use this menu to view or change the settings for the Black outputs. Option BG must be installed to access the settings for the Black 4 and Black 5 outputs. You can also configure the Black 1–3 and Black 4–5 tri-level sync signals. Click on the arrow next to the desired Black output to access the menu for that output. For more information, see the <i>BLACK button menus</i> section. (See page 29.) ■ LTC menu: Use this menu to view or change the settings for the LTC outputs. Click on the arrow next to the desired LTC output to access the menu for that output. For more information, see the <i>LTC button menu</i> section. (See page 53.) ■ SDI menu (Option SDI only): Use this menu to view or change the settings for the SDI outputs. Click on the arrow next to the desired SDI output to access the menu for that output. For more information, see the <i>SDI button menu</i> section. (See page 67.) ■ Composite menu (Option BG only): Use this menu to view or change the settings for the Composite outputs. Click on the arrow next to the desired Composite output to access the menu for that output. For more information, see the <i>CMPST button menu</i> section. (See page 41.) ■ AES menu: For all instruments, use the AES button menu to view or change the settings for the Word Clock (48 kHz) output. When Option AG is installed, use this menu to configure the AES audio output settings. For more information, see the <i>AES button menu</i> section. (See page 23.) ■ Embedded menu (Option SDI only): Use this menu to view or change the embedded audio settings for the SDI outputs. Click on the arrow next to the desired SDI output to access the menu for that output. For more information, see the <i>EMBED button menu</i> section. (See page 47.) ■ System menu: Use this menu to view or change general instrument settings and to view diagnostic results. The system settings includes Status, Presets, General Settings, SNMP Settings, GPI Settings, Options, and Diagnostics submenus. Click on the arrow next to the desired setting group to access the submenu for that group. For more information, see the <i>SYSTEM button menu</i> section. (See page 129.)

Table 2: Elements of the Web user interface (cont.)

Item number	Description
2	<p>Indicators matching the indicators on the front panel of the instrument:</p> <ul style="list-style-type: none">■ INT and EXT: Indicates the status of the reference signal used to time signals. Click on INT or EXT to view the reference status on the Status menu tab.■ TIME: Indicates the status of the selected time input. Click on TIME to view the time status on the Status menu tab.■ PWR1 and PWR2: Indicates the status of the Power Supply modules. Click on PWR1 or PWR2 to view the status of the Power Supply modules on the System menu tab.■ FAULT: Indicates the status of the instrument hardware. Click on FAULT to view the status of any faults on the System menu tab. <p>For information about the possible states for each indicator, see the <i>SPG8000 Quick Start User Manual</i>.</p>
3	Click on Help to open a separate browser window that opens to the Tektronix SPG product Web page.
4	Click on Refresh to refresh the Web user interface.
5	Locked / Unlocked. Indicates whether the instrument front panel is locked or unlocked. Click to toggle the setting.

SNMP remote control

When the SPG8000 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. If you intend to use SNMP commands to control the instrument, you must configure SNMP parameters.

SNMP configuration

The following table shows the SNMP parameters you can set using the SYSTEM button SNMP submenu or the Web user interface.

Table 3: SNMP parameters

Setting	Description
Enable SNMP	Use this setting to turn on or off the remote access using SNMP.
Enable Traps	Use this setting to turn on or off the traps that are sent out through SNMP.
SNMP Traps	<p>Use this setting to enable or disable the following traps. For more information about each trap, see the <i>SNMP TRAPS submenu</i> section. (See page 143.)</p> <ul style="list-style-type: none">■ Main fan fault■ Voltage error■ Temperature error■ GPS signal missing ¹■ Genlock input missing■ Loss of lock■ Near loss of lock■ VITC/LTC missing■ LTC out of SMPTE specifications■ GPS FOM (Figure of Merit) ¹■ Alarm time■ PS1 fault■ PS2 fault■ PS1 TWH (Temperature Weighted Hours)■ PS2 TWH (Temperature Weighted Hours)

¹ These traps are available only when Option GPS is installed.

Table 3: SNMP parameters (cont.)

Trap Destinations	<p>Use this setting to set the IP addresses to which SNMP traps are sent through SNMP. Traps can be sent to up to four addresses when error conditions are detected.</p> <p>NOTE. <i>A value of all zeroes for the address will disable that trap output.</i></p>
Public Community	<p>Use this setting to set the Public Community string. This string is effectively a password. Without this string, SNMP commands cannot read values from the instrument.</p> <p>NOTE. <i>The Public String is necessary for SNMP access to read values from the instrument.</i></p>
Private Community	<p>Use this setting to set the Private Community string. This string is effectively a password. Without this string, SNMP commands cannot change values in the instrument.</p> <p>NOTE. <i>The Private String is necessary for SNMP access to write changes into the instrument.</i></p>

Download the MIB

You can download the SPG8000 MIB file using the System tab on the SPG8000 Web user interface. (See page 9, *Web user interface*.)

How to backup/restore presets and user data

You can use the BACKUP/RESTORE item in the SYSTEM button menu to backup or restore the instrument presets and all user data using a USB drive that is connected to the instrument. You can use the backup and restore functions to duplicate settings and signal files between different SPG8000 generators.

How the backup and restore operations work

During the backup operation, files are copied to a directory named “SpgBackup” in the root directory of the USB drive. The restore operation expects to copy files from this same directory.

All of the copy operations will create new directories/files on either the SPG8000 or the USB drive as needed. If a file with the same name exists in the destination location, it will be overwritten. However, if a file exists in the destination location and not in the source location, the file will be left alone. Therefore, the restore and backup operations act as an overlay, and do not guarantee that there will not be additional files left in the destination location that did not exist in the source location.

Presets

When presets are copied, only the MSTATEX.YY files and enough directory structure to hold them in their correct locations (for example, SDI7/PRESET/MSTATE4.P00) will be copied or created.

NOTE. The preset file names use the format MSTATEX.PYY. In this example, X denotes the slot name, YY denotes the preset number (there are 13 possible presets). Separate presets are stored for each individual mainframe slot.

Only presets that have content are copied or written by the backup/restore processes. This is because only presets that have been saved have files associated with them and the backup/restore process copies only those files. Any preset that has never been saved will not have an associated file and therefore will not be copied.

All user data

When all of the user data is copied, every user file except for the FPGA configuration files will be copied. This function is useful in that all user-created files can be saved, restored, or copied to other SPG8000 instruments.

User files are defined as any file that exists in the /app/F0 directory on the instrument. The files in this directory can include presets, signal files, frame picture files, logo files, sequence files, and for Option SDI, can also include text and font files. The user data files do not include the application software or any Linux files.

Memory requirements

It is recommended that you use the FLASH MEMORY readout in the SYSTEM button menu to determine how much memory is available on the instrument before you perform a restore operation. Here is how much memory is required:

- If you are backing up or restoring only presets, you will need up to 1 MB of free space on the USB drive or in the flash memory of the instrument.
- If you are backing up or restoring all of the user data in the instrument, you will need up to 96 MB of free space on the USB drive or in the flash memory of the instrument.

If the backup or restore operation runs out of memory on the USB drive or the flash memory on the instrument before the operation is complete, the operation will copy as much data as it can and will then display an error message stating that the backup or restore operation was incomplete because the drive or device is full.

Backup/restore procedure

1. Connect a USB drive to the SPG8000 generator.
2. Press the **SYSTEM** button to select **SYSTEM : PRESET**.
3. Verify the status of the USB drive:
 - a. Press the up (▲) or down (▼) arrow button to select **SYSTEM : USB <status>**.
 - b. Verify that the USB status is **Mounted**.
 - c. If the status is Not Mounted, press the **ENTER** button to mount the USB drive.
4. Press the up (▲) or down (▼) arrow button to select **SYSTEM : BACKUP/RESTORE**.
5. Press the left (◀) or right (▶) arrow button to select one of the following:
 - **Backup Presets to USB**
 - **Backup All User Data to USB**
 - **Restore Presets from USB**
 - **Restore All User Data from USB**
6. Press the **ENTER** button to start the selected backup or restore operation.
7. A warning message is displayed asking you to verify the operation. Press the **ENTER** button to proceed or press the **BACK** button to cancel the operation.

8. Monitor the progress of the file copy operation:
 - a. During the first stage of the copy process, the display shows the names of the files as they are copied. Depending on the size of the files being copied, this may take a couple of minutes.
 - b. When all of the files have been copied, the message “Finishing copy...” is displayed while the file system buffers are emptied. This message may appear for a couple of minutes.
 - c. When the backup or restore operation is complete, the message “Backup completed successfully” or “Restore completed successfully” is displayed before the menu display returns to normal.

NOTE. *If the USB drive or the flash memory on the instrument fills up before the backup or restore operation completes, an error message is displayed. Press the ENTER or BACK button to clear the error message. (See page 16, Memory requirements.)*

9. After the backup or restore operation is complete, press the up (▲) or down (▼) arrow button to select **SYSTEM : USB (Mounted)**.
10. Press the **ENTER** button to unmount the USB drive. After the message “You may now safely remove the USB drive” is displayed, the menu readout should change to **SYSTEM : USB (Not mounted)**.
11. Remove the USB drive from the instrument.

How to adjust the oven oscillator without Option GPS

The only adjustment in the SPG8000 is for the frequency of the master clock oscillator. 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.

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

Adjustment methods

You can calibrate the oscillator using GPS or reference signals such as NTSC Burst or CW. If you are not using a GPS reference signal, the reference signal from a frequency signal generator must be at the correct frequency.

If your SPG8000 generator has Option GPS installed, you should use a GPS signal to adjust the master clock frequency. When you use a GPS signal to adjust the master clock, the calibration can be performed while the instrument is in service, which avoids any system downtime or any warm-up period. The instructions for using a GPS signal to adjust the oven oscillator are located in the *Installation* section of the *SPG8000 Quick Start User Manual*.

If you do not have Option GPS installed or if you do not have access to a GPS signal, you will need to take the instrument out of service to adjust the master clock using an input from a frequency generator.

Requirements for adjustment

Before proceeding, note the following requirements.

Warm-up period The instrument requires a 20 minute warm-up time in a +20 °C to +30 °C environment before it is adjusted. Adjustments done before the operating temperature has stabilized may cause errors in performance. In addition, the signal generator requires appropriate warm-up time to meet the frequency accuracy.

Required equipment The following table lists the equipment required to adjust the master clock frequency using a frequency signal generator.

Table 4: Equipment required to adjust the master clock using a signal generator

Item	No.	Minimum requirement	Recommended equipment
Frequency standard	1	Frequency: 10 MHz $\pm 1 \times 10^{-9}$ Amplitude: 8 dBm	Tektronix GPS7 locked to GPS or equivalent Spectracom/Pendulum 6689
75 Ω BNC cable	1	Length: 42 inches	Tektronix part number 012-0074-00

Adjustment procedure

Perform the following procedure to adjust the frequency of the master clock using a reference signal from a frequency generator.

1. Set the output of the frequency generator as follows:

Frequency: 10.000000 MHz

Output level: 8 dBm

2. Use the 75 Ω BNC cable to connect the REF connector on the SPG8000 generator to the output of the frequency generator as shown in the following figure.

NOTE. You can use a Tektronix TG700 or TG8000 signal generator with a GPS7 module installed to produce the 10 MHz frequency standard.

In this case, ensure that the GPS7 module is locked to a GPS signal in fine mode. Configure the Black 3 output of the GPS7 module to output a 10 MHz sine wave. Connect the GPS7 module Black 3 output to the REF input on the SPG8000 you are testing.

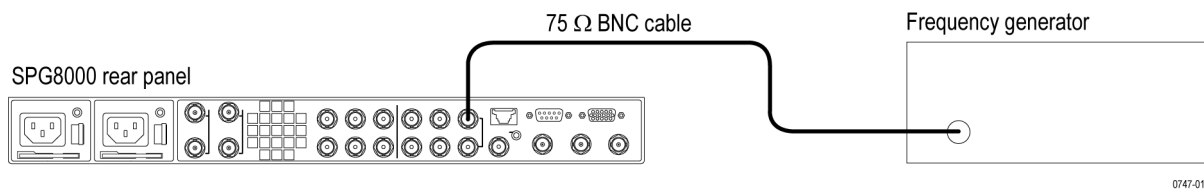


Figure 3: Equipment connection for adjusting the master clock frequency using a frequency generator

3. Restart the instrument in Factory mode:
 - a. Press and hold the **STATUS**, **ENTER**, and **Front Panel ENABLE** buttons simultaneously.
 - b. Continue holding the buttons until the message **SPG8000 Booting...** displays.
 - c. When the message **SPG8000 Booting...** displays, release the **STATUS** and **ENTER** buttons. Continue holding the **Front Panel ENABLE** button.
 - d. When the message **SPG8000 Start up with Factory Mode** displays, release the **Front Panel ENABLE** button.
4. Let the instrument warm up for 20 minutes before proceeding.

5. Set the reference source to CW as follows:
 - a. Press the **REF** button to display the REFERENCE menu.
 - b. Press the left (◀) or right (▶) arrow button to select **CW**, and then press the **ENTER** button.
6. Press the **SYSTEM** button to display the SYSTEM menu.
7. Press the up (▲) or down (▼) arrow button to select **SYSTEM : CALIBRATE OVEN**, and then press the **ENTER** button.
8. A message will be displayed asking you to verify that you want to execute the calibration. Press the **ENTER** button to proceed with the calibration.
9. Verify that the message **CALIBRATION result = xxxxxxx** is displayed. The result should be seven characters near the value of **2,097,152**. Press the **ENTER** button to exit the calibration mode.
10. Verify the calibration:
 - a. Press the **SYSTEM** button to display 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 submenu.
 - c. Press the up (▲) or down (▼) arrow button to select **SYSTEM : DIAGNOSTICS : CALIBRATION**.
 - d. Check that the CAL value is less than **2.5 e⁻⁶**.

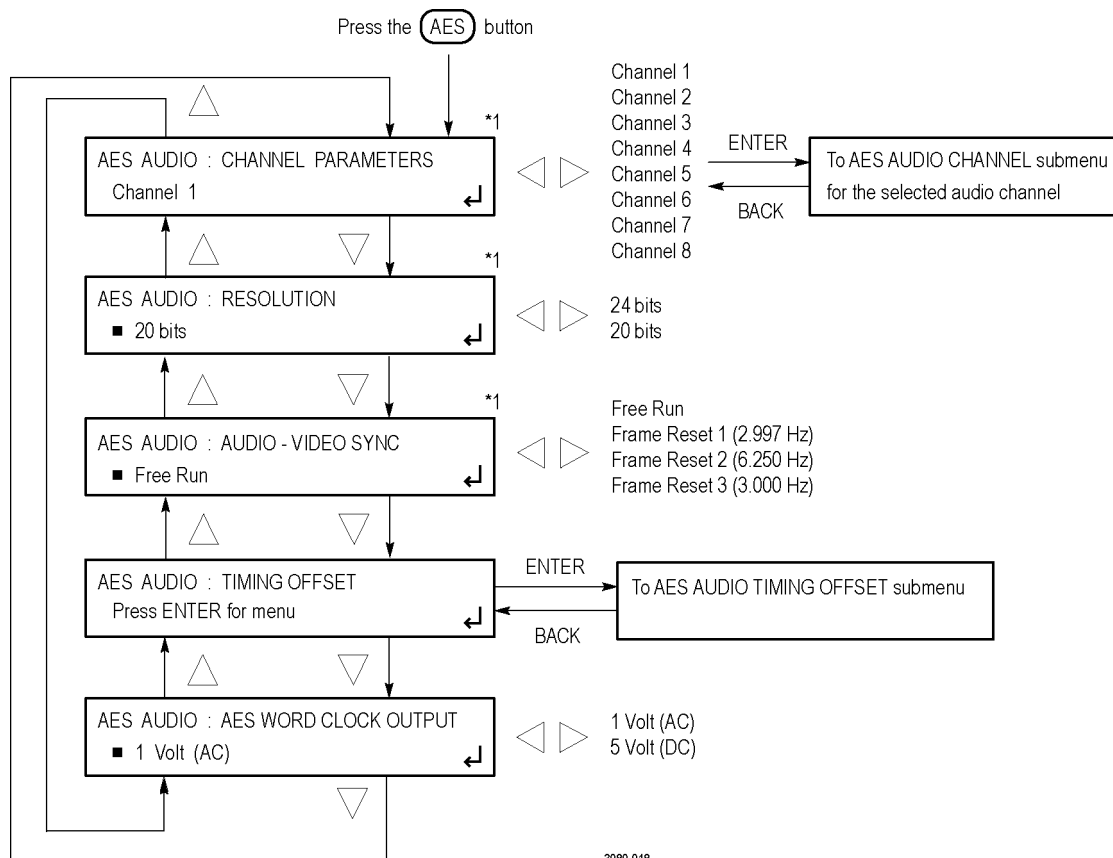
NOTE. *If the CAL value is greater than 2.6 e⁻⁶, then the oscillator oven may need to be serviced.*

AES button menu

For all instruments, use the AES button menu to view and configure the timing offset and voltage of the Word Clock (48 kHz) output.

When Option AG is installed, use this menu to 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 4: AES button menu diagram

CHANNEL PARAMETERS. This menu item is available only when Option AG is installed. Selects the audio channel for which the parameters are to be set (from Channel 1 to Channel 8). Use the left (◀) or right (▶) arrow button to make the channel selection.

Press the front-panel **ENTER** button to access the **AES AUDIO CHANNEL** submenu for the selected channel. Use this submenu to set the frequency, amplitude, and audio click insertion for the audio channel. (See page 25, *AES AUDIO CHANNEL submenu (Option AG only).*)

RESOLUTION. This menu item is available only when Option AG is installed. Sets the resolution of the serial digital audio signal data. Use the left (◀) or right (▶) arrow button to select **24 bits** or **20 bits**. Press the **ENTER** button to enable the selection.

AUDIO-VIDEO SYNC. This menu item is available only when Option AG is installed. Selects the frame reset signal that is synchronized with the digital audio signals. Use the left (◀) or right (▶) arrow button to make the selection.

The selection items are **Free Run**, **Frame Reset 1 (2.997 Hz)**, **Frame Reset 2 (6.250 Hz)**, and **Frame Reset 3 (3.000 Hz)**. For Free Run, the audio signal is not synchronized with any of the frame reset signals. Press the **ENTER** button to enable the selection.

NOTE. *If the frame reset signal used by the audio signals is reset by the change of the video format, the audio signal timing is also reset.*

TIMING OFFSET. Press the **ENTER** button to access the **AES TIMING OFFSET** submenu. Use this submenu to set the timing offset of the audio signal outputs relative to the genlock signal or the internal reference signal. (See page 26.)

AES WORD CLOCK OUTPUT. Sets the signal level of the Word Clock output. Use the left (◀) or right (▶) arrow button to select **1 Volt (AC)** or **5 Volt (DC)**. Press the **ENTER** button to enable the selection.

AES AUDIO CHANNEL submenu (Option AG only)

The following menu opens for the selected AES audio channel when you press ENTER in the AES button menu with CHANNEL PARAMETERS selected. (See Figure 4 on page 23.)

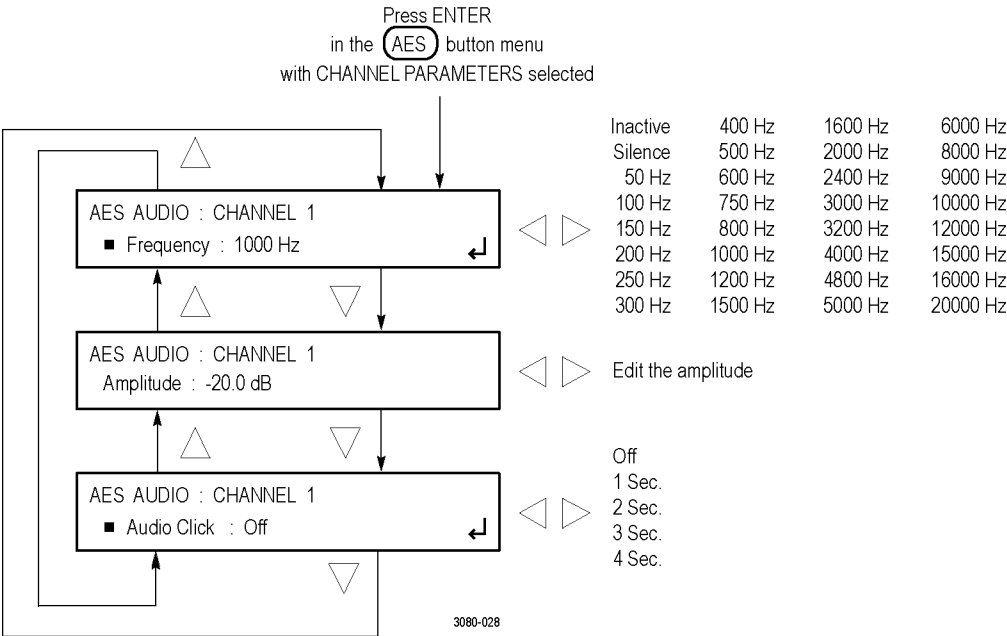


Figure 5: AES AUDIO CHANNEL submenu diagram (Option AG only)

Frequency. Sets the audio signal frequency for the selected audio channel. Use the left (◀) or right (▶) arrow button to make the selection. Press the **ENTER** button to enable the selection. The choices are:

Inactive	400 Hz	1600 Hz	6000 Hz
Silence	500 Hz	2000 Hz	8000 Hz
50 Hz	600 Hz	2400 Hz	9600 Hz
100 Hz	750 Hz	3000 Hz	10000 Hz
150 Hz	800 Hz	3200 Hz	12000 Hz
200 Hz	1000 Hz	4000 Hz	15000 Hz
250 Hz	1200 Hz	4800 Hz	16000 Hz
300 Hz	1500 Hz	5000 Hz	20000 Hz

When **Inactive** is selected, audio data output is disabled.

Amplitude. Sets the audio signal amplitude for the selected audio channel. Use the left (◀) or right (▶) arrow button to set the value from -60 dBFS to 0 dBFS in 1 dBFS steps.

Audio click. Inserts audio clicks in the selected audio channel. The audio tone, if any, is turned off for an interval around the audio click. Use the left (◀) or right (▶) arrow button to make the selection. The choices are **OFF**, **1 Sec.**, **2 Sec.**, **3 Sec.**, and **4 sec.** Press the **ENTER** button to enable the selection.

Audio Click becomes valid when you select **1 Sec.** to **4 Sec.** for the Audio Click rate. When Audio Click is valid, Audio Tone is turned off for 0.25 seconds around the click. For example, if you select **3 Sec.** for the click rate, the audio tone will be output for 2.75 seconds, and silent for 0.25 seconds; the click occurs during this silence. When Audio Click is **OFF**, the Audio Tone selected with the Frequency setting is output continuously. Audio Click makes it easy to identify any of the four output channels.

AES TIMING OFFSET submenu

The following menu opens for the selected AES audio channel when you press ENTER in the AES button menu with TIMING OFFSET selected. (See Figure 4 on page 23.)

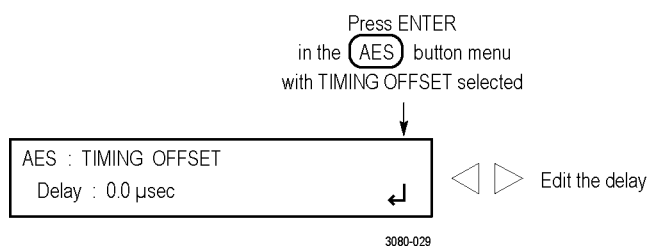


Figure 6: AES TIMING OFFSET submenu diagram (Option AG only)

Use the left (◀) or right (▶) arrow button to change the timing offset value in 1 μs steps. You can set the value from -160 ms to +160 ms. A minus value is set as **Advance** and a plus value is set as **Delay**.

NOTE. You can reset the timing offset to zero by pressing the left (◀) and right (▶) arrow buttons simultaneously.

You cannot adjust the timing offset when Free Run is selected as the AUDIO-VIDEO SYNC mode. (See page 23, AES button menu.)

AES button menu factory default settings

The following table shows the settings for the AES button menu that are reset when you use the PRESET submenu to recall the factory default settings. (See page 136, *PRESET submenu*.)

Table 5: AES button menu factory default settings

Menu item name	Settings
CHANNEL PARAMETERS ¹ (CHANNEL 1 to CHANNEL 8)	
Frequency	1000 Hz
Amplitude	-20.0 dBFS
Audio Click	OFF
RESOLUTION ¹	20 bits
AUDIO-VIDEO SYNC ¹	Free Run
TIMING OFFSET (Delay or Advance)	0.0 μ sec
AES WORD CLOCK OUTPUT	1 Volt (AC)

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

BLACK button menu

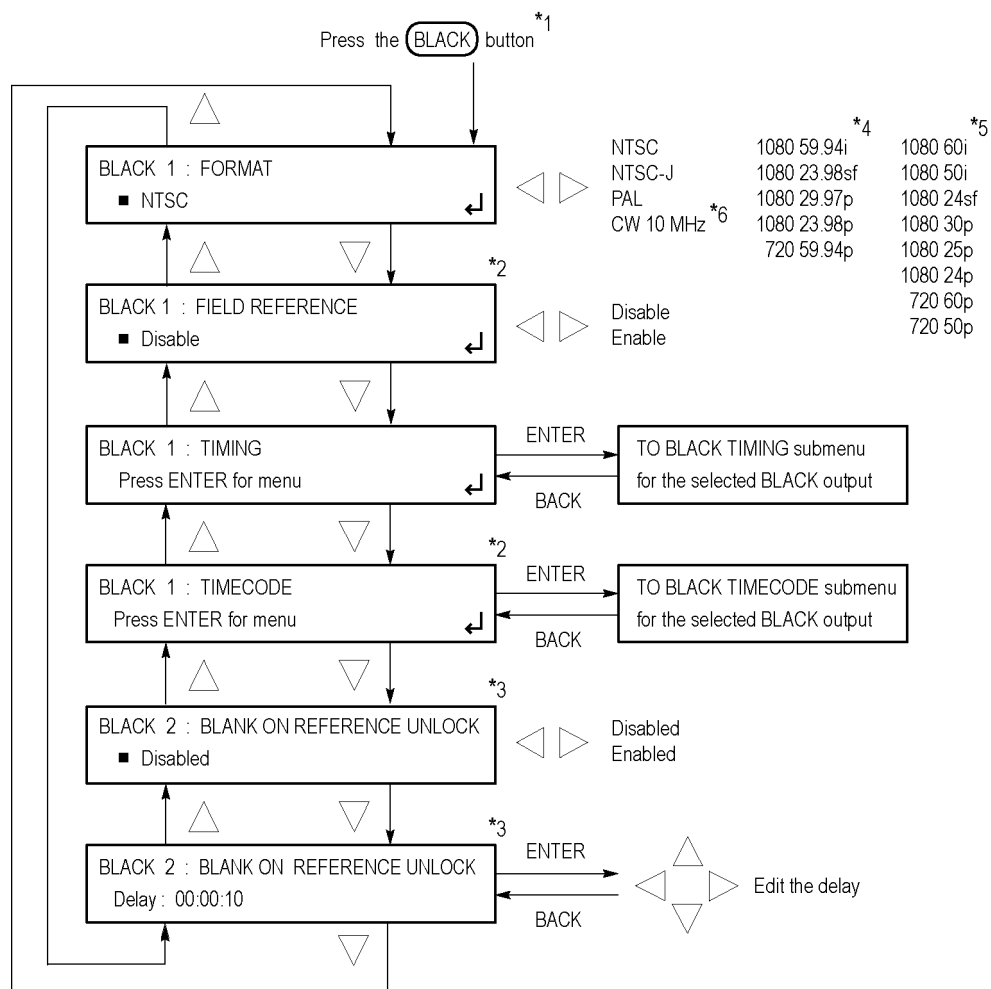
Use the BLACK button menu to view and configure the BLACK outputs. BLACK outputs 1–3 are standard; BLACK outputs 4–5 are available only with Option BG.

BLACK output selection

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) for which to set the HD tri-level sync rate.

NOTE. *BLACK outputs 1–3 are a group that must use the same HD tri-level sync rate. Likewise, BLACK outputs 4–5 are a group that must use the same HD tri-level sync rate. Both groups can output the same rate or they can output different rates.*

The figures on the following pages 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.

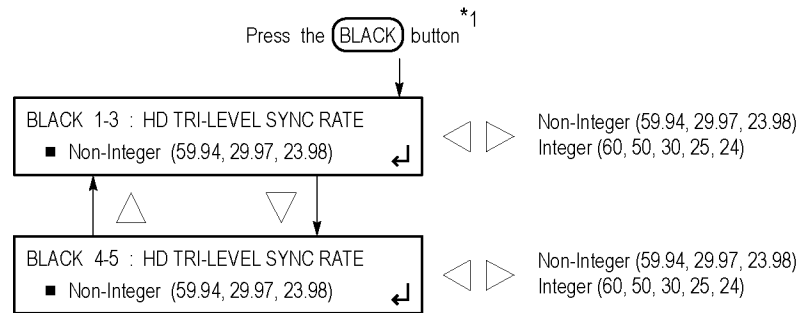
^{*6} The CW 10 MHz format selection appears only when the BLACK 3 output is selected. When CW 10 MHz is the selected output format, the other menu selections are not available.

Continued on next page

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Figure 7: BLACK button menu diagram – part 1

Continued from previous page



^{*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.

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Figure 8: BLACK button menu diagram – part 2

BLACK button menu descriptions

FORMAT. Use the left (◀) or right (▶) arrow button to select the signal format for the selected BLACK output. Press the **ENTER** button to enable the format selection.

The available format choices depend on the following: (See Figure 7.)

- The CW 10 MHz format appears only for the BLACK 3 output. When CW 10 MHz is the selected output format, the other BLACK menu items are unavailable for the BLACK 3 output.
- The available HD output formats depend on whether the HD tri-level sync rate for the selected BLACK output is set to integer or non-integer. (See Table 6.)

Table 6: BLACK output formats

Non-integer formats	Integer formats
NTSC	NTSC
NTSC-J	NTSC-J
PAL	PAL
CW 10 MHz ¹	CW 10 MHz ¹
1080 59.94i	1080 60i
1080 23.98sf	1080 50i
1080 29.97p	1080 24sf
1080 23.98p	1080 30p
720 59.94p	1080 25p
	1080 24p
	720 60p
	720 50p

¹ The CW 10 MHz format selection appears only for the BLACK 3 output.

FIELD REFERENCE. This menu item is available only for non-HD formats. Use the left (◀) or right (▶) arrow button to select **Enable** or **Disable** for the field reference on the selected BLACK output. Press the **ENTER** button to enable the selection.

TIMING. Press the **ENTER** button to access the BLACK TIMING submenu. Use this submenu to set the vertical and/or horizontal timing offset for the selected BLACK output. (See page 34, *BLACK TIMING submenu*.)

TIMECODE. This menu item is available only for non-HD formats. Press the **ENTER** button to access the BLACK TIMECODE submenu. Use this submenu to set the timecode parameters for the selected BLACK output. (See page 36, *BLACK TIMECODE submenu*.)

BLANK ON REFERENCE UNLOCK. This menu item is available only for the BLACK 2 output. Use the left (◀) or right (▶) arrow button to select **Enabled** or **Disabled** for the blanking function when a loss of lock to the reference signal is detected. When enabled, the BLACK 2 output will be blanked for as long as the loss of lock condition occurs. The purpose of this function is to trigger a downstream change-over unit.

NOTE. *When the BLACK 2 output is configured to blank on the loss of reference lock, the output should not be used for normal reference applications.*

BLANK ON REFERENCE UNLOCK DELAY. This menu item is available only for the BLACK 2 output. When the Blank on Reference Unlock function is enabled, use this menu item to set the amount of time delay before the BLACK 2 output will be blanked when a loss of lock to the reference signal is detected. The purpose of the delay is to reduce false alarms by allowing a set amount of time for the loss of lock condition to clear before the BLACK 2 output is blanked.

Press the **ENTER** button and then use the arrow buttons to set the delay in HH:MM:SS. Use the left (◀) or right (▶) arrow button to select a time digit and then use the up (▲) or down (▼) arrow button to set the value of the time digit. After you edit the time delay, press the **ENTER** button to confirm the setting.

HD TRI-LEVEL SYNC RATE. 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) for which to set the HD tri-level sync rate.

NOTE. *The BLACK outputs 1–3 are a group that must use the same HD tri-level sync rate (integer or non-integer). Likewise, the BLACK outputs 4–5 (Option BG only) are a group that must use the same HD tri-level sync rate. Both groups can output the same rate or they can output different rates.*

The HD tri-level sync rate setting limits which signal formats are available for the selected group of BLACK outputs.

Use the left (◀) or right (▶) arrow button to select **Non-Integer (59.94, 29.97, 23.98)** or **Integer (60, 50, 30, 25, 24)**. Press the **ENTER** button to enable the selection.

BLACK TIMING submenu

The following menu opens for the selected BLACK output when you press ENTER in the BLACK button menu with TIMING selected. (See Figure 7 on page 30.)

Use this menu to adjust the timing offset of the selected BLACK output relative to the internal reference signal.

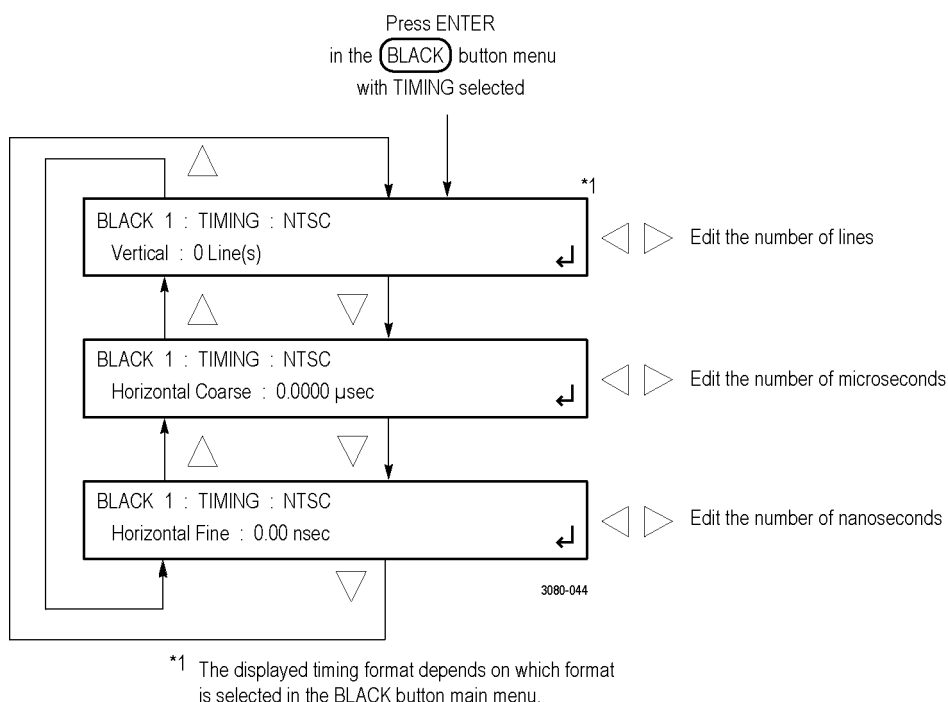


Figure 9: BLACK TIMING submenu diagram

Use the up (▲) or down (▼) arrow button to select a timing parameter, and then use the left (◀) or right (▶) arrow button to adjust the parameter. The range of the timing adjustment depends on the format of the selected BLACK output.

Vertical. Use the left (◀) or right (▶) arrow button to adjust the vertical offset of the selected BLACK output in 1 line increments.

Horizontal Coarse. Use the left (◀) or right (▶) arrow button to adjust the horizontal offset of the selected BLACK output. The offset adjusts in increments based on the format of the selected BLACK output.

Horizontal Fine. Use the left (◀) or right (▶) arrow button to adjust the horizontal offset of the selected BLACK output. The offset adjusts in increments based on the format of the selected BLACK output.

NOTE. You can reset the timing offset to zero by pressing the left (◀) and right (▶) arrow buttons simultaneously.

If you are using the 50, 59.94 or 60 Hz progressive sync as a genlock source, as well as LTC as a time-code source, there are two possible alignments for the resulting system. Alignment can be checked by looking at the LTC timing status screen. If the timing is near zero, then it is aligned. If the timing is near a frame of offset, then it is not aligned.

You will need to unlock and re-lock the reference to achieve the desired alignment if this is important to the application you are using. Alternatively, you can use a lower frame rate video reference like NTSC, PAL, or 1080i tri-level.

Table 7: BLACK output timing adjustment ranges

Format name	Line settings	Coarse settings (μs)	Fine settings (ns)
NTSC	± 525	± 63.5556	± 10.00
PAL	± 1250	± 64.0000	± 10.00
1080 60i	± 562	± 29.6296	± 10.00
1080 59.94i	± 562	± 29.6593	± 10.00
1080 50i	± 562	± 35.5556	± 10.00
1080 24sF	± 562	± 37.0370	± 10.00
1080 23.98sF	± 562	± 37.0741	± 10.00
1080 30p	± 562	± 29.6296	± 10.00
1080 29.97p	± 562	± 29.6593	± 10.00
1080 25p	± 562	± 35.5556	± 10.00
1080 24p	± 562	± 37.0370	± 10.00
1080 23.98p	± 562	± 37.0741	± 10.00
720 60p	± 375	± 22.2222	± 10.00
720 59.94p	± 375	± 22.2444	± 10.00
720 50p	± 375	± 26.6667	± 10.00

BLACK TIMECODE submenu

The following menu opens for the selected BLACK output when you press ENTER in the BLACK button menu with TIMECODE selected. (See Figure 7 on page 30.)

NOTE. This submenu is available only when a non-HD format is set as the signal format of the selected BLACK output.

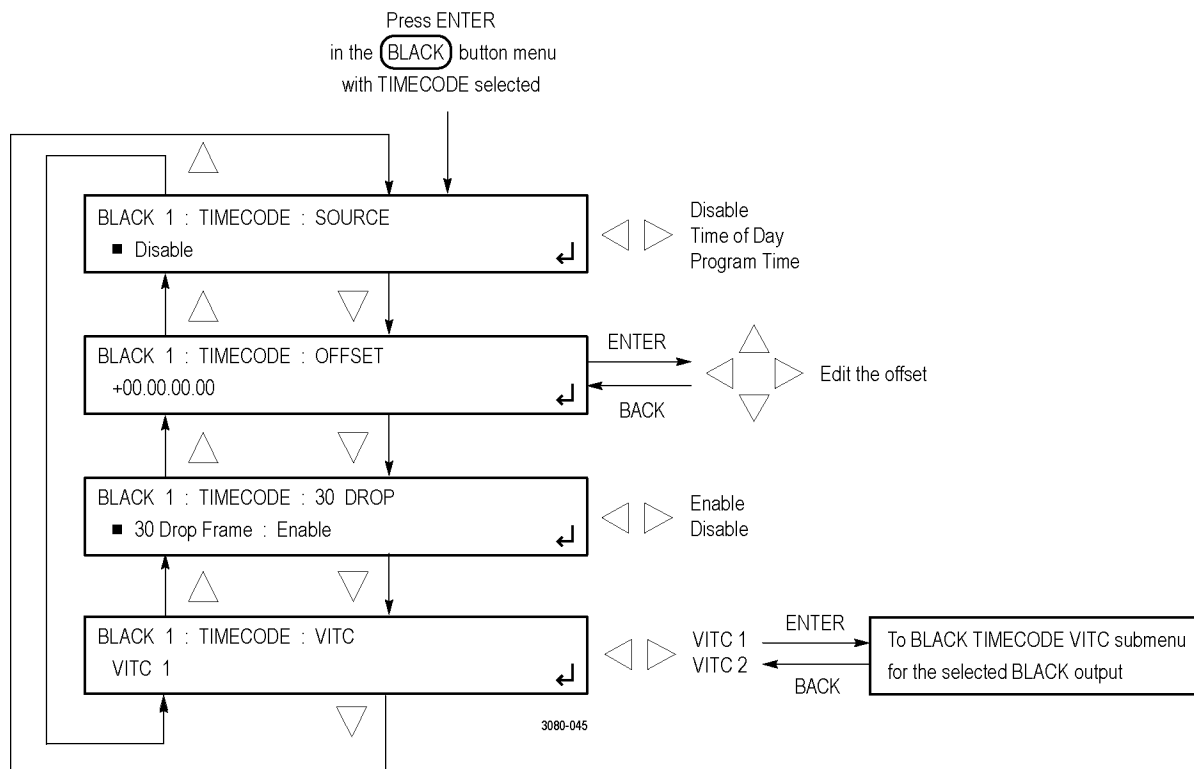


Figure 10: BLACK TIMECODE submenu diagram

SOURCE. Use the left (◀) or right (▶) arrow button to select the timecode source from the following choices:

- **Disable:** Disables the timecode function for the selected Black output.
- **Time of Day:** Uses the time of day as determined by the time of day menu.
- **Program Time:** Uses the program time counter as the timecode.

NOTE. *In addition to enabling the timecode source, at least one line must be specified and enabled to carry VITC using the BLACK TIMECODE VITC submenu below.*

OFFSET. Use this menu item to set an offset for the selected black output, relative to the selected timecode source. You can enter a time offset of up to $\pm 23:59:59:29$ (maximum frame value depends on the frame rate of the video signal).

Press the **ENTER** button, and then use the left (◀) or right (▶) arrow button to select a digit in the offset value to change. An underline character appears under the selected offset digit.

After you select an offset digit, use the up (▲) or down (▼) arrow button to change the value of the digit. Repeat for each digit as required for your offset. Press the **ENTER** to confirm the offset change.

30 DROP. Use the left (◀) or right (▶) arrow button to **Enable** or **Disable** the 30 Drop Frame mode. Most applications will prefer drop-frame compensation VITC on NTSC, but if needed, it can be disabled by this menu. This menu item appears only when NTSC or NTSC-J is set as the signal format for the selected BLACK output.

VITC. Use this menu item to insert the same VITC signal on 1 or 2 lines of the vertical interval. Use the left (◀) or right (▶) arrow button to select the desired VITC signal: VITC 1 or VITC2.

Select VITC 1 for one line and VITC 2 for the second line. Select the VITC output you want to configure, and then press the **ENTER** button to enter the VITC submenu for the selected output. (See page 38, *BLACK TIMECODE VITC submenu*.)

BLACK TIMECODE VITC submenu

The following menu opens for the selected VITC signal when you press ENTER in the BLACK TIMECODE submenu with VITC selected. (See Figure 10 on page 36.)

Use this menu to enable or disable the output of a VITC signal on the selected line.

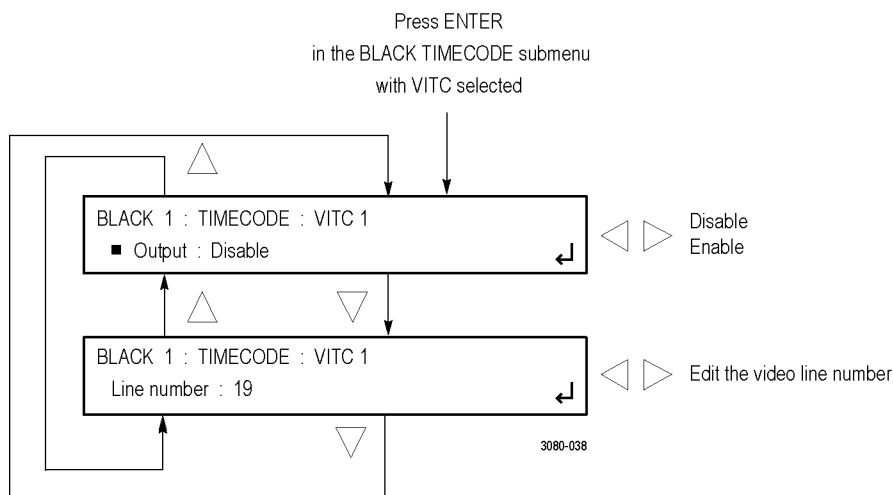


Figure 11: BLACK TIMECODE VITC submenu diagram

OUTPUT. Use this menu item to enable or disable insertion of a VITC signal on the selected line. Use the left (◀) or right (▶) arrow button to select **Output: Enable** or **Output: Disable**. Press the **ENTER** button to confirm the selection.

Line number. Use this menu item to select the video line on which the selected VITC signal will be inserted. Use the left (◀) or right (▶) arrow button to select the video line number.

For NTSC, you can select lines from line 10 to 20 (lines 14 and 16 are recommended). For PAL, you can select lines between 6 and 22 (lines 19 and 21 are recommended). Press the **ENTER** button to confirm the selection.

BLACK button menu factory default settings

The following table shows the settings for the BLACK button menu that are reset when you use the PRESET submenu to recall the factory default settings. (See page 136, *PRESET submenu*.)

Table 8: BLACK button menu factory default settings

Menu item name	Settings
BLACK 1 to BLACK 5 ¹	
FORMAT	NTSC
FIELD REFERENCE ²	Disable
TIMING	Vertical: 0 Line(s) Horizontal Coarse: 0.0000 µsec Horizontal Fine: 0.00 nsec
TIMECODE ²	SOURCE: Disable OFFSET: +00:00:00:00 30 DROP FRAME: Enable ³ VITC 1 Output: Disable Line Number: NTSC/NTSC-J: 14 PAL: 19 VITC 2 Output: Disable Line Number: NTSC/NTSC-J: 16 PAL: 21
BLANK ON REFERENCE UNLOCK ⁴	Disabled
BLANK ON REFERENCE UNLOCK Delay ⁴	00:00:10
BLACK 1–3: HD TRI-LEVEL SYNC RATE	Non-integer
BLACK 4–5: HD TRI-LEVEL SYNC RATE ¹	Non-integer

¹ BLACK outputs 4–5 are available only when Option BG is installed.

² These menu items appear only for non-HD formats.

³ This menu item appears only when the format is set to NTSC.

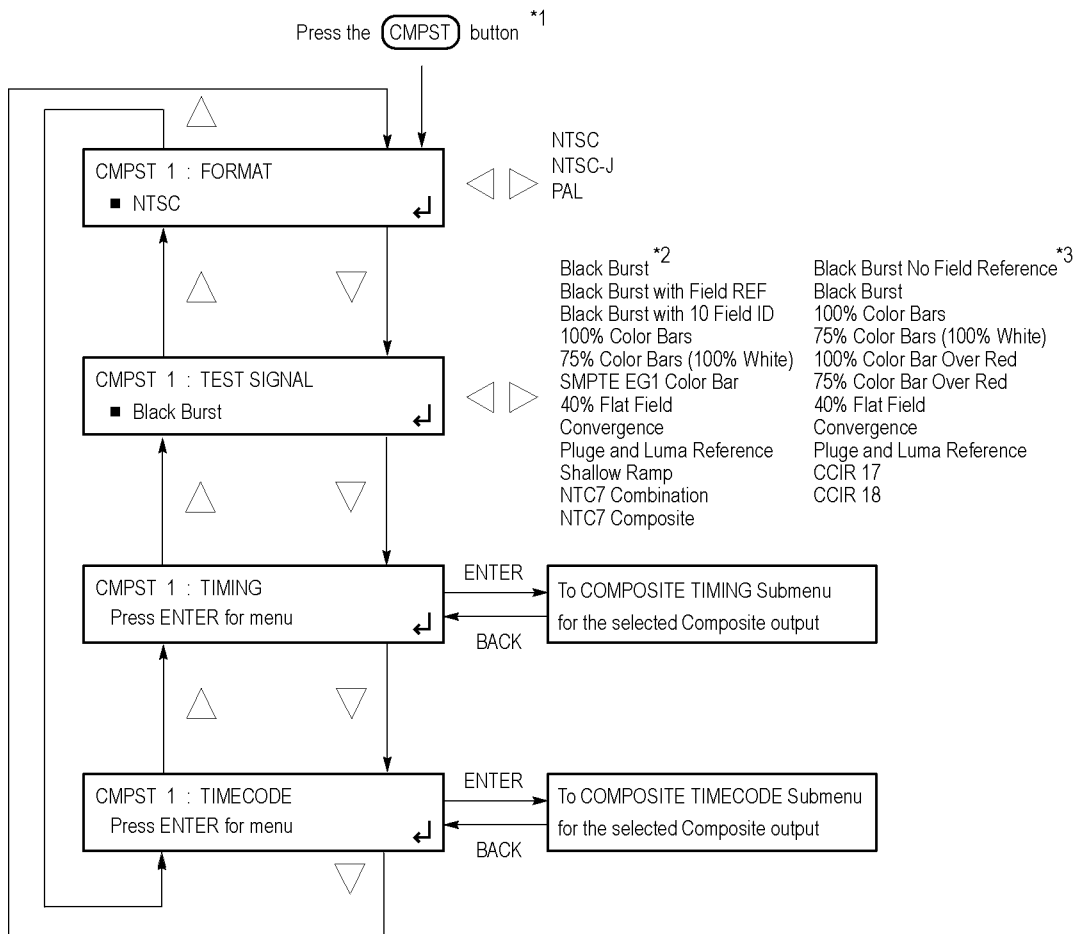
⁴ These menu items appear only for the BLACK 2 output.

CMPST button menu (Option BG only)

When Option BG is installed, press the CMPST button to view and configure the composite video outputs. The following figures show the menu diagrams for the CMPST button.

Composite output selection

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



^{*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.

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Figure 12: CMPST button menu diagram

CMPST button menu descriptions

FORMAT. Use the left (◀) or right (▶) arrow button to select the desired signal formats in the following table. Press the **ENTER** button to confirm the selection.

NOTE. *When you change the signal format, synchronization shock will occur.*

TEST SIGNAL. Use the left (◀) or right (▶) arrow button to select the desired test signal. Press the **ENTER** button to confirm the selection. The available signals depend on the selected format (NTSC/NTSC-J or PAL).

Table 9: COMPOSITE output test signals

NTSC or NTSC-J format	PAL format
Black Burst	Black Burst No Field Reference
Black Burst with Field REF	Black Burst
Black Burst with 10 Field ID	100% Color Bars
100% Color Bars	75% Color Bars (100% White)
75% Color Bars (100% White)	100% Color Bar Over Red
SMPTE EG1 Color Bar	75% Color Bar Over Red
40% Flat Field	40% Flat Field
Convergence	Convergence
Pluge and Luma Reference	Pluge and Luma Reference
Shallow Ramp	CCIR 17
NTC7 Combination	CCIR 18
NTC7 Composite	

TIMING. Press the **ENTER** button to access the COMPOSITE TIMING submenu, which allows you to set the timing offset for the selected black signal output. (See page 43, *COMPOSITE TIMING submenu*.)

TIMECODE. Press the **ENTER** button to access the COMPOSITE TIMECODE submenu, which allows you to set timecode parameters for the selected BLACK output. (See page 44, *COMPOSITE TIMECODE submenu*.)

COMPOSITE TIMING submenu

The following menu opens for the selected Composite output when you press ENTER in the CMPST button menu with TIMING selected. (See Figure 12 on page 41.)

Use this submenu to adjust the timing offset of the selected BLACK output relative to the genlock signal or the internal reference signal. Use the up (▲) or down (▼) arrow button to select between Vertical and Horizontal offset.

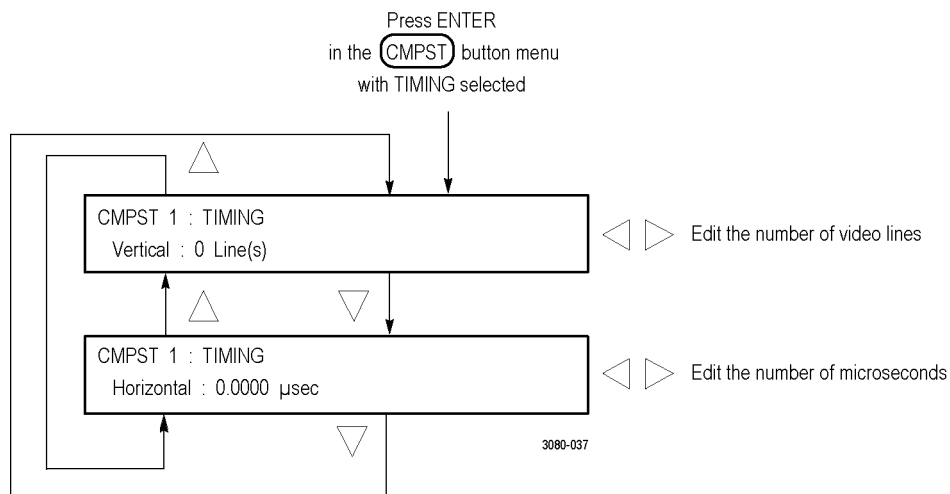


Figure 13: COMPOSITE TIMING submenu diagram

NOTE. You can reset the timing offset to zero by pressing the left (◀) or right (▶) arrow buttons simultaneously. The horizontal timing can be adjusted only in clock cycle increments.

Vertical. Use the left (◀) or right (▶) arrow button to adjust the vertical timing by $\pm \frac{1}{2}$ a color frame. (See Table 10.)

Horizontal. Use the left (◀) or right (▶) arrow button to adjust the horizontal offset. You can set the value from -1 line to +1 line in one clock steps (18.5 ns).

Table 10: Timing adjustment ranges for composite output signals

Format name	Vertical line settings	Horizontal time settings (µs)
NTSC/NTSC-J	± 525	± 63.5556
PAL	± 1250	± 64.0000

COMPOSITE TIMECODE submenu

The following menu opens for the selected composite output when you press ENTER in the CMPST button menu with TIMECODE selected. (See Figure 12 on page 41.)

Use this submenu to set timecode parameters for the selected output.

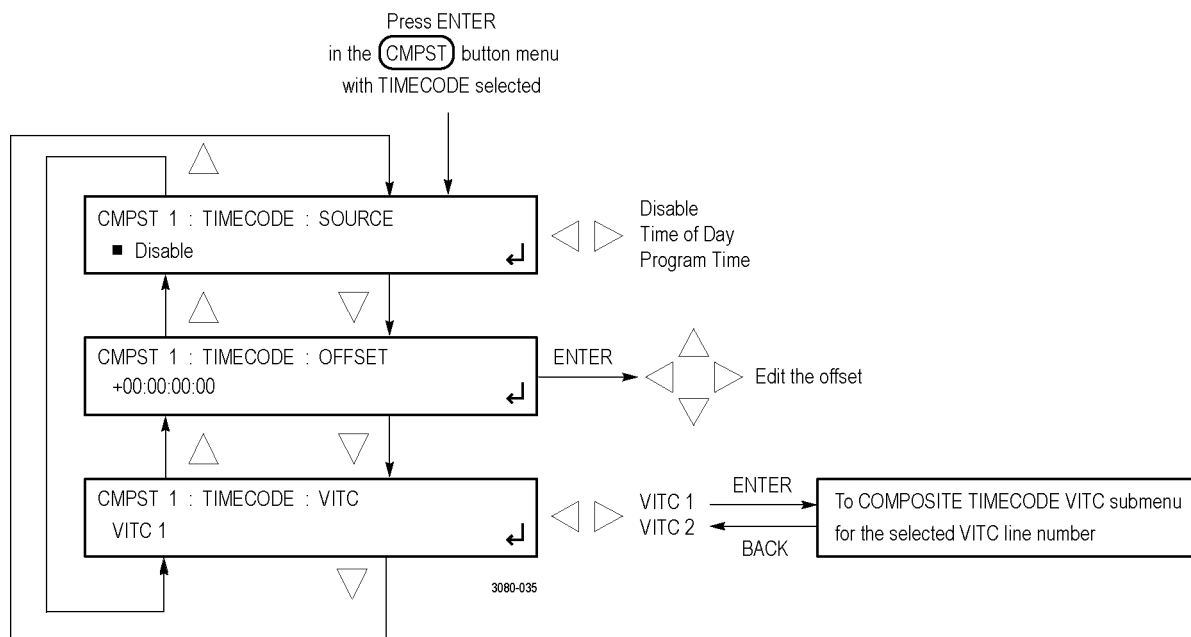


Figure 14: COMPOSITE TIMECODE submenu diagram

SOURCE. Use the left (◀) or right (▶) arrow button to select the timecode source from the following choices:

- **Disable:** Disables the timecode function for the composite outputs.
- **Time of Day:** Uses the time of day as determined from the GPS antenna (Option GPS only).
- **Program Time:** Uses the program time counter as the timecode.

OFFSET. Use this menu item to set a time offset for the composite outputs from the timecode input. You can enter a time offset of up to $\pm 23:59:59:29$ (maximum frame value depends on the frame rate of the video signal) of the GPS timecode (hours : minutes : seconds : video frames). Press the **ENTER** button, and then use the left (◀) or right (▶) arrow button to select a digit in the offset value to change. An underline character appears under the selected offset digit.

After you select an offset digit, use the up (▲) or down (▼) arrow button to change the value of the digit. Repeat for each digit as required for you offset. Press the **ENTER** to confirm the offset change.

VITC. Allows inserting the same VITC signal on 1 or 2 lines of the vertical interval. Use the left (◀) or right (▶) arrow button to select the desired VITC signal: VITC 1 or VITC2.

Select VITC 1 for one line and VITC 2 for the second line. Select the VITC signal you want to configure, and then press the **ENTER** button to enter the VITC submenu for the selected signal. (See page 45, *COMPOSITE TIMECODE VITC submenu*.)

COMPOSITE TIMECODE VITC submenu

The following menu opens for the selected Composite output when you press **ENTER** in the CMPST TIMECODE submenu with VITC selected. (See Figure 14 on page 44.)

Use this menu to enable or disable the output of the VITC signal and to select the video line on which the VITC signal will be inserted.

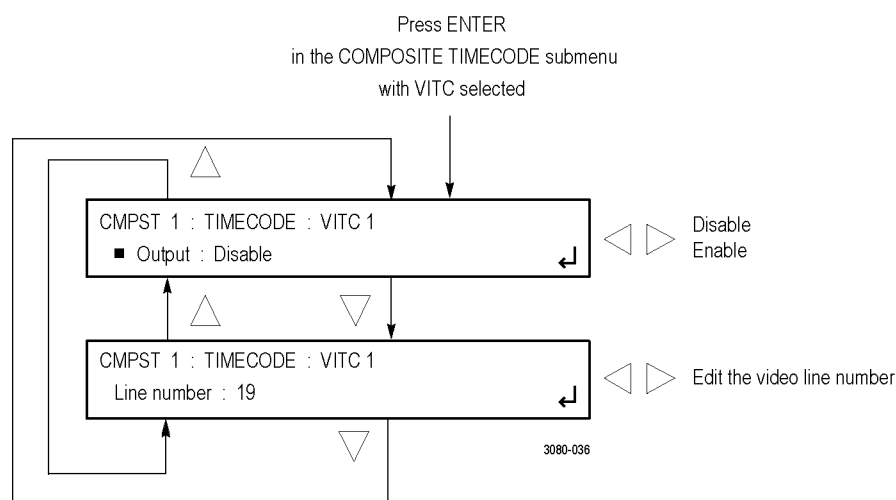


Figure 15: COMPOSITE TIMECODE VITC submenu diagram

Output. Use this menu item to enable or disable insertion of a VITC on the selected line. Use the left (◀) or right (▶) arrow button to select **Output: Enable** or **Output: Disable**. Press the **ENTER** button to confirm the selection.

Line number. Use this menu item to select the video line on which the VITC signal will be inserted. Use the left (◀) or right (▶) arrow button to select the video line number. The line number range varies by format: you can select from line 10 to line 20 for NTSC, and from line 6 through line 22 for PAL. Press the **ENTER** button to confirm the selection.

CMPST button menu factory default settings

The following table shows the settings for the CMPST button menu that are reset when you use the PRESET submenu to recall the factory default settings. (See page 136, *PRESET submenu*.)

Table 11: CMPST button menu factory default settings

Menu item name	Settings
CMPST 1 or CMPST 2	
FORMAT	NTSC
TEST SIGNAL	NTSC/NTSC-J: Black Burst PAL: Black Burst No Field Reference
TIMING	Vertical: 0 Line(s) Horizontal: 0.0000 μ sec
TIMECODE	SOURCE: Disable OFFSET: +00:00:00:00 30 DROP FRAME: Enable ¹ VITC 1 Output: Disable Line Number: NTSC/NTSC-J: 14 PAL: 19 VITC 2 Output: Disable Line Number: NTSC/NTSC-J: 16 PAL: 21

¹ This menu item appears only when the format is set to NTSC or NTSC-J.

EMBED button menu (Option SDI only)

When Option SDI is installed, press the EMBED button to view and configure the embedded audio settings on the SDI video outputs. Use this menu to select the audio group for subsequent audio channel configuration, and to configure audio group parameters.

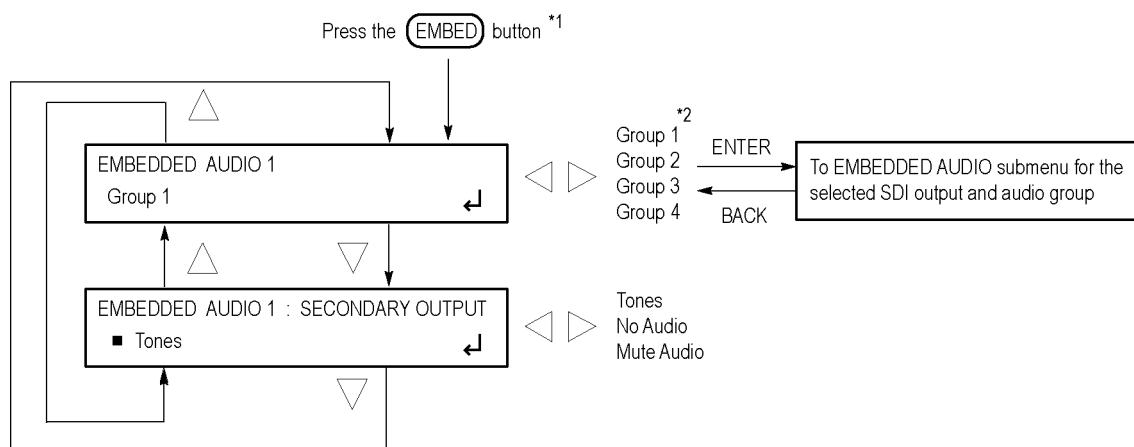
You may select audio group 1, 2, 3, or 4 for all SD, HD, and 3G Level A formats. For 3G Level B formats, you may select audio group 1, 2, 3, or 4 for both Link A and Link B. Press the left (◀) or right (▶) arrow button to make the selection. When the desired audio group and Link are displayed, press the **ENTER** button to access the menu for that group.

In each group you can enable or disable the embedded audio, select a specific channel, and set the sampling mode. Use the up (▲) or down (▼) arrow button to change the menu items. Press the **ENTER** button to select a specific channel. While in the Audio Channel submenu, you can set the embedded audio frequency, amplitude, and click rate for the channel.

Embedded audio output selection

Press the **EMBED** button repeatedly to select the embedded audio on the desired SDI outputs. **EMBEDDED AUDIO 1** selects the SDI 1 outputs and **EMBEDDED AUDIO 2** selects the SDI 2 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 between Link A and Link B for each audio group.

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Figure 16: EMBED button menu diagram

EMBED button menu descriptions

GROUP. Use the left (◀) or right (▶) arrow button to select the desired audio group (1–4). When Option 3G is installed and the SDI signal format is set to 3G Level B, you can select between Link A and Link B for each audio group.

Press the **ENTER** button to enter the EMBEDDED AUDIO GROUP submenu where you can configure the parameters of the selected audio group. (See page 49, *EMBEDDED AUDIO GROUP submenu*.)

SECONDARY OUTPUT. Use the left (◀) or right (▶) arrow button to select one of the following signals for the secondary (bottom) BNC connector of the selected SDI output: **Tones**, **No Audio**, or **Mute Audio**. Press the **ENTER** button to confirm the selection.

The SDI 1B audio output is the same format and sample structure as the SDI 1A audio output. The same is true for the SDI 2 connectors.

EMBEDDED AUDIO GROUP submenu

The following menu opens for the selected SDI output and audio group when you press ENTER in the EMBED button menu with EMBEDDED AUDIO Group selected. (See Figure 16.)

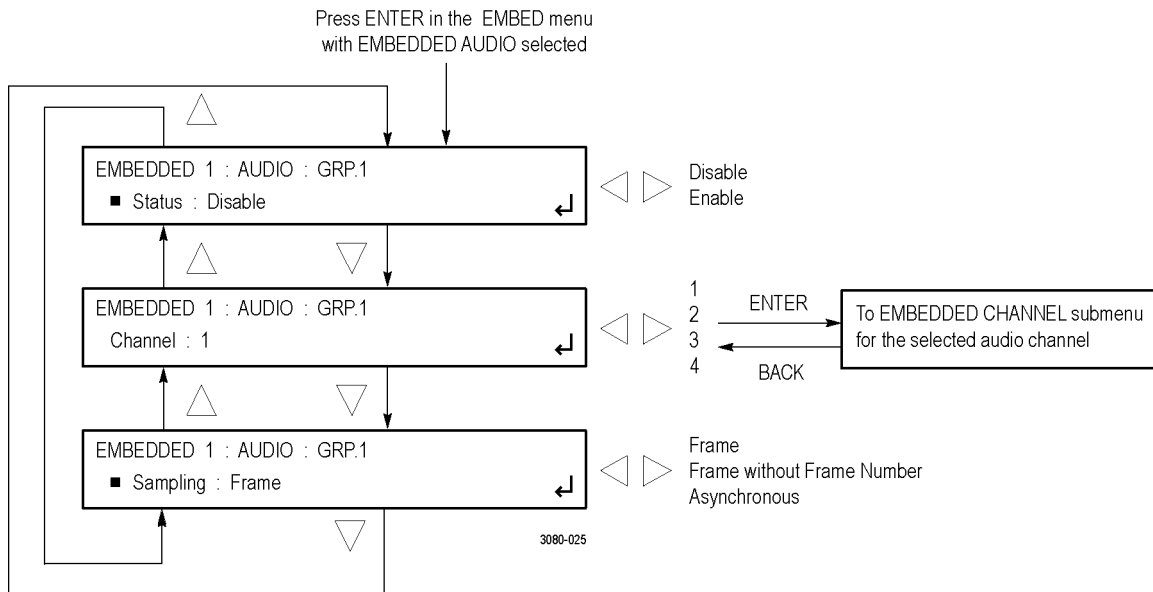


Figure 17: EMBEDDED AUDIO GROUP submenu diagram

Status. Use this menu item to enable or disable the embedded audio output for the selected audio group. Use the left (◄) or right (►) arrow button to select **Enable** or **Disable**, and then press the **ENTER** button to confirm the selection.

Channel. Use the left (◄) or right (►) arrow button to choose the desired audio channel (1, 2, 3, or 4), and then press the **ENTER** button to enter the EMBEDDED AUDIO CHANNEL submenu for the selected channel and audio group. Use this submenu to enable or disable the audio output and to set the frequency, amplitude, click rate, and channel origin ID for the selected audio channel. (See page 50, *EMBEDDED AUDIO CHANNEL submenu*.)

Sampling. Use this menu item to set the sampling alignment status bits for the selected audio group's Audio Control Packet (ACP). Use the left (◄) or right (►) arrow button to select between **Frame**, **Frame without Frame Number**, and **Asynchronous**. Press the **ENTER** button to confirm the selection.

EMBEDDED AUDIO CHANNEL submenu

The following menu opens for the selected SDI output, audio group and channel when you press ENTER in the EMBEDDED AUDIO submenu with Channel selected. (See Figure 67.)

Use this submenu to enable or disable the audio output and to set the frequency, amplitude, click rate, and channel origin ID for the selected audio channel.

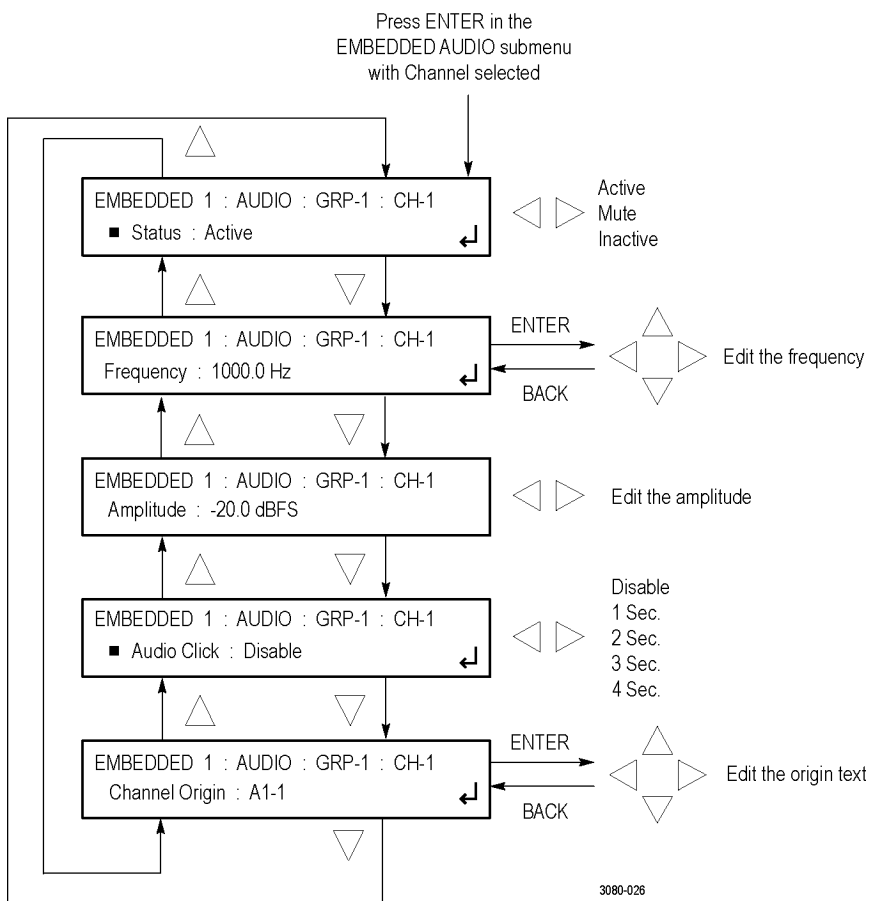


Figure 18: EMBEDDED CHANNEL submenu diagram

Status. Use this menu item to set the status of the individual audio channel. Use the left (◀) or right (▶) arrow button to select between **Active**, **Inactive**, and **Mute**. Press the **ENTER** button to confirm the selection.

Frequency. Use this menu item to set the frequency of the Embedded Audio signal from 10.0 Hz to 20 kHz, in steps of 0.5 Hz. Press the **ENTER** button to enter the adjustment mode, then use the left (◀) and right (▶) arrow buttons to position the cursor, and then use the up (▲) and down (▼) arrow buttons to set the number for that position. Press the **ENTER** button again to confirm the new frequency.

Amplitude. Use this menu item to set the audio amplitude from –60 dBFS to 0 dBFS, in steps of 1 dBFS. Use the left (◀) and right (▶) arrow buttons to set the amplitude, and then press the **ENTER** button to confirm the selection.

Audio Click. Use this menu item to set the audio click rate to one click every one, two, three, or four seconds, or turn the click off. Use the left (◀) or right (▶) arrow button to select the click rate, and then press the **ENTER** button to confirm the selection.

Channel Origin. Use this menu item to set a channel origin ID of up to four ASCII characters. Press the **ENTER** button, and then use the left (◀) and right (▶) arrow buttons to position the cursor, and then use the up (▲) and down (▼) arrow buttons to set the ID. Press the **ENTER** button to confirm the new Channel Origin ID.

EMBED button menu factory default settings

The following table shows the settings for the EMBED button menu that are reset when you use the PRESET submenu to recall the factory default settings. (See page 136, *PRESET submenu*.)

Table 12: EMBED button menu factory default settings

Menu item name	Settings
EMBEDDED AUDIO 1 or EMBEDDED AUDIO 2	
Group 1–4	Status: Disable
Group 1–4 (Link A) ¹	Channel
Group 1–4 (Link B) ¹	Status: Active
	Frequency: 1000.0 Hz
	Amplitude: –20 dBFS
	Audio Click: Disable
	Channel Origin: A1-1 through A4-4
	Sampling: Frame
SECONDARY OUTPUT	Tones

¹ The Level B settings are available only when Option 3G is installed and when the SDI output mode is set to 3G-Level B. (See page 67, *SDI button menu (Option SDI only)*.)

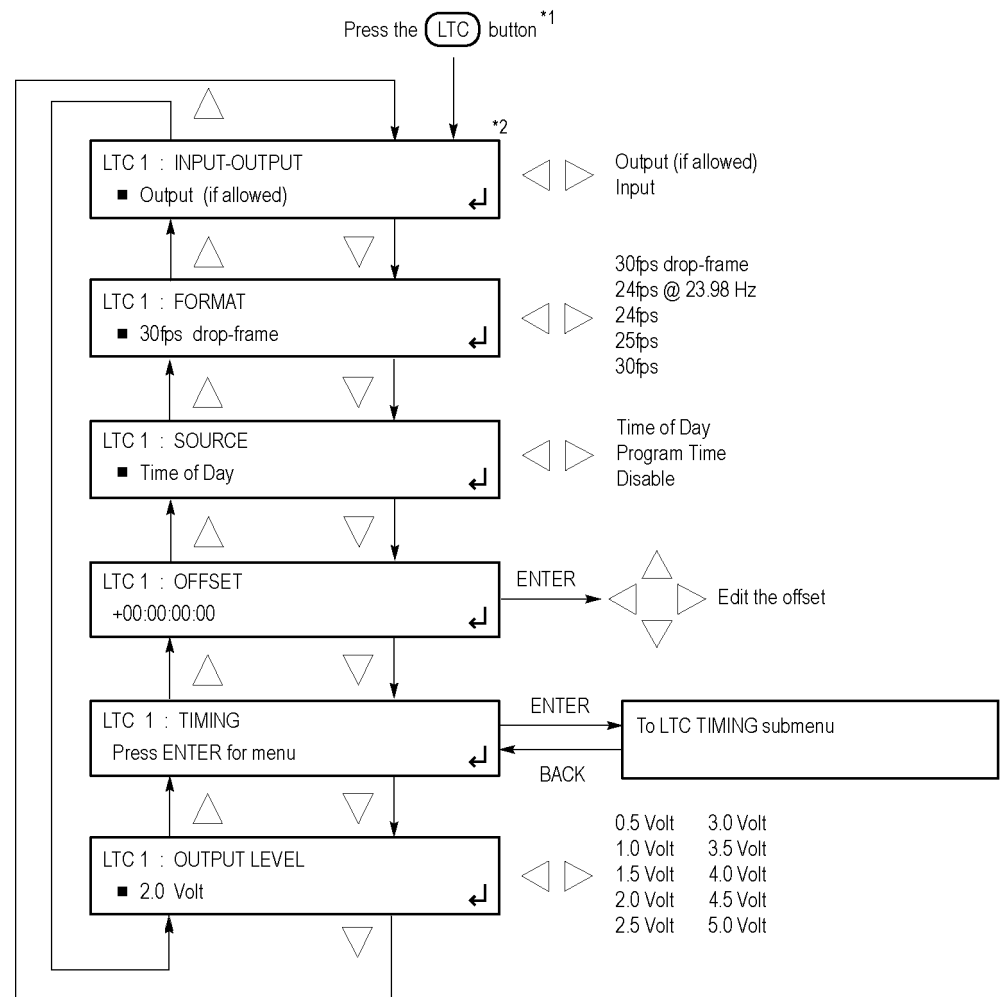
LTC button menu

Press the LTC button to view and configure the LTC inputs and outputs on the GPI/LTC port. Use the up (▲) or down (▼) arrow button to move through the menu items.

LTC input/output selection

Press the **LTC** button repeatedly to select the LTC signal (1–4) to configure.

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.

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Figure 19: LTC button menu diagram

LTC button menu descriptions

INPUT-OUTPUT. This menu item appears only when LTC 1 is selected. Use the left (◀) or right (▶) arrow button to set the function of LTC 1 to **INPUT** or **OUTPUT (if allowed)**. When LTC is selected as the time of day reference, LTC 1 is forced to be an input.

FORMAT. Use the left (◀) or right (▶) arrow button to select from the following LTC output signal formats:

Table 13: LTC output signal formats

Format	Rate	Delay range
24fps @ 23.98 Hz	24 fps at 23.98 Hz	±20.85 ms
24fps	24 fps at 24 Hz	±20.83 ms
25fps	25 fps at 25 Hz	±20.00 ms
30fps	30 fps at 30 Hz	±16.67 ms
30fps drop-frame	30 fps drop frame at 29.97 Hz	±16.68 ms

SOURCE. Use the left (◀) or right (▶) arrow button to select from the following LTC signal sources:

- **Disable:** Disables the LTC outputs.
- **Time of Day:** Uses the Time of Day counter as the timecode.
- **Program Time:** Uses the Program Time counter as the timecode.

OFFSET. Press the **ENTER** button, and then use the left (◀) or right (▶) arrow button to select a digit in the LTC offset value to change. An underline character appears under the selected offset digit. The time digits take the following form: HH:MM:SS:FF.

After you select an offset digit, use the up (▲) or down (▼) arrow button to change the value of the digit. Repeat for each digit as required for your offset. Press the **ENTER** to confirm the offset change.

TIMING. Press the **ENTER** button to access the LTC TIMING submenu for the selected LTC output. (See page 55, *LTC TIMING submenu*.)

OUTPUT LEVEL. Use the left (◀) or right (▶) arrow button to set the signal level of the selected LTC output between 0.5 V and 5.0 V in 0.5 V steps. Press the **ENTER** button to confirm the selection.

LTC TIMING submenu

The following menu opens for the selected LTC signal when you press ENTER in the LTC button menu with TIMING selected. (See Figure 19.)

Use this menu to set the delay used for all the signal formats. Use the left (◀) or right (▶) arrow button to set the delay. Press the **ENTER** button to confirm the selection.

The following figure shows the LTC TIMING submenu.

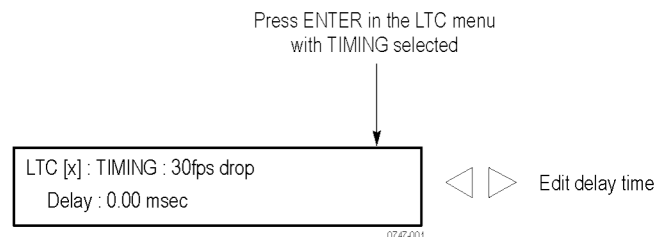


Figure 20: LTC TIMING submenu diagram

LTC button menu factory default settings

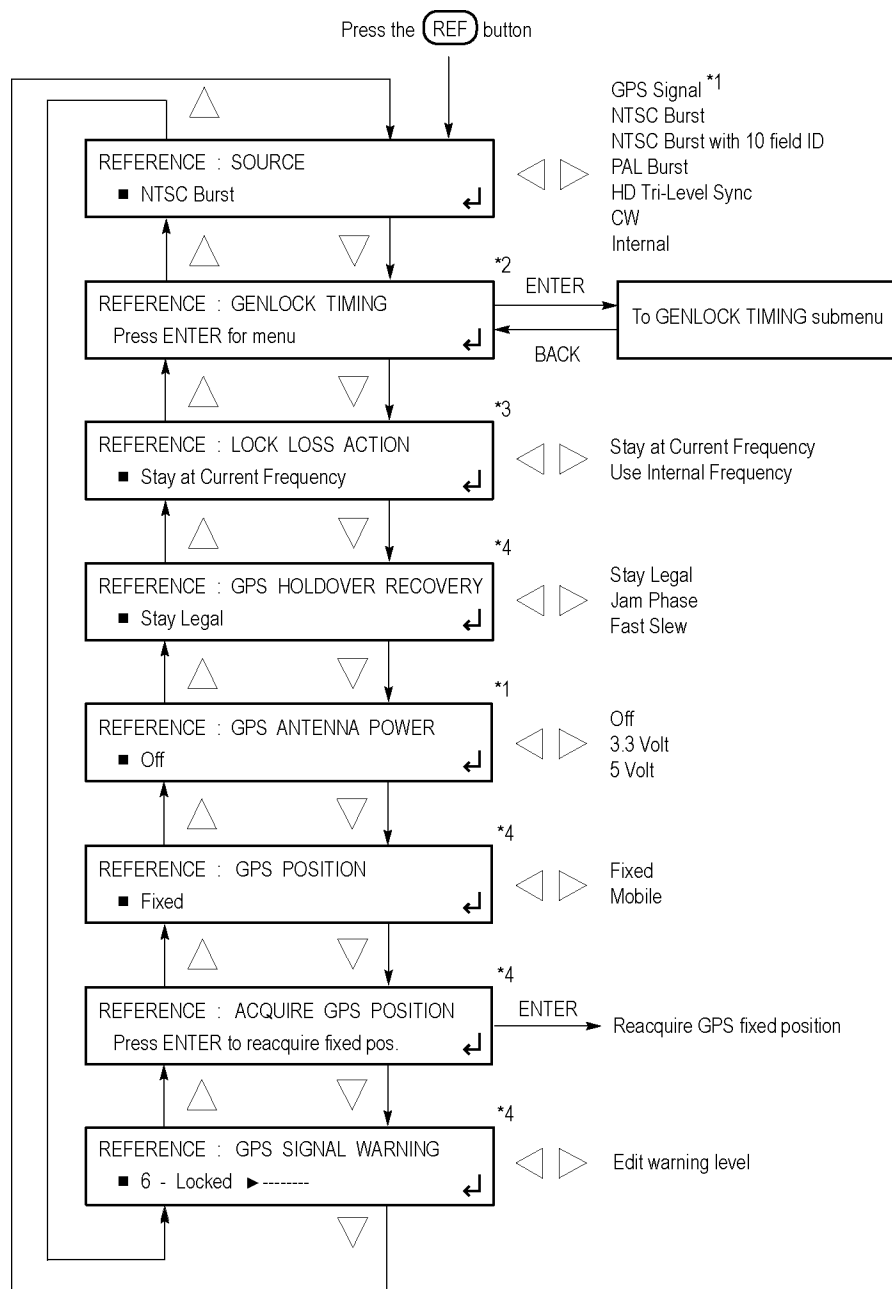
The following table shows the settings for the LTC button menu that are reset when you use the PRESET submenu to recall the factory default settings. (See page 136, *PRESET submenu*.)

Table 14: LTC button menu factory default settings

Menu item name	Settings
LTC 1 to LTC 4	
INPUT-OUTPUT (LTC 1 only)	Output (if allowed)
FORMAT	30 fps drop frame
SOURCE	Time of Day
OFFSET	+ 00:00:00:00
TIMING	Delay: 0.00 msec
OUTPUT LEVEL	2.0 Volt

REF button menu

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.

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Figure 21: REF button menu diagram

SOURCE. Use the left (◀) or right (▶) arrow button to set the reference source for the module timing. Select one of the following references, and then press the **ENTER** button to confirm the selection.

- **Internal:** Uses the internal clock frequency setting as the timing reference.
- **GPS Signal:** This menu item appears only when Option GPS is installed. Uses the GPS signal input as the timing reference.
- **NTSC Burst:** Uses the NTSC black burst signal applied to the **REF** input connector as the timing reference.
- **NTSC Burst with 10 Field ID:** Uses the NTSC black burst with 10 Field ID signal applied to the **REF** input connector as the timing reference.
- **PAL Burst:** Uses the PAL black burst signal applied to the **REF** input connector as the timing reference.
- **HD Tri-Level Sync:** Uses the HDTV trilevel signal applied to the **REF** input connector as the timing reference.
- **CW:** Uses the 1, 3.58, 4.43, 5, or 10 MHz continuous wave signal applied to the **REF** input connector as the timing reference.

GENLOCK TIMING. This menu item appears only when GPS Signal is not the selected reference source. This menu item does not appear when the reference source is set to Internal.

Adjusts the timing offset of the input signal relative to the internal reference signal. Press the **ENTER** button to access the GENLOCK TIMING submenu. (See page 63, *GENLOCK TIMING submenu*.)

LOCK LOSS ACTION. This menu item does not appear when the reference source is set to Internal. Use the left (◀) or right (▶) arrow button to select the action that the module will make when a loss of lock condition is detected. This can happen for example, if the GPS antenna signal is lost. Select one of the following actions, and then press the **ENTER** button to confirm the selection.

- **Stay at Current Frequency:** Sets the module timing to keep operating at the current frequency until the reference signal is recovered.
- **Use Internal Frequency:** Sets the module timing to switch to the internal frequency setting until the reference signal is recovered.

GPS HOLDOVER RECOVERY. This menu item appears only when Option GPS is installed and GPS Signal is the selected reference source. Use the left (◀) or right (▶) arrow button to select how the module timing responds when the reference signal is recovered after a loss of lock. Select one of the following recovery modes, and then press the **ENTER** button to confirm the selection.

NOTE. *If the module timing is off by more than 20 ms when the GPS signal is recovered, the module 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 module 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 module 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 module timing to match the recovered GPS signal immediately but will typically cause a sync “shock” to the system.
- **Fast Slew:** Adjusts the module timing to match the recovered GPS signal at a rate 25 times faster than the legal rate without jumping.

GPS ANTENNA POWER. This menu item appears only when Option GPS is installed. The GPS ANT connector on the rear panel can supply DC power for a connected GPS antenna. Use the left (◀) or right (▶) arrow button to select from the following antenna power settings:



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.*

- **OFF:** No power is supplied to the GPS antenna.
- **3.3 V:** Supplies 3.3 V DC to power the GPS antenna.
- **5 V:** Supplies 5 V DC to power the GPS antenna.

When the GPS ANT connector is configured to provide power to the antenna, the rear-panel POWER 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 GPS7 module. If a splitter is used on the antenna, it may appear as a short at DC but still pass through the RF signal, which would allow the GPS to function.
- Displays solid green if the current load of the antenna is within the nominal range.

GPS POSITION. This menu item appears only when Option GPS is installed and GPS Signal is the selected reference source. Use the left (◀) or right (▶) arrow button to select **Fixed** or **Mobile**. The Fixed and Mobile settings define how the GPS receiver calculates the time and position information.

In fixed mode, an averaged position is stored in flash memory, and only the time is calculated each second. This provides greater stability of the time information, and allows operation with fewer satellites. This mode is well suited to broadcast-type installations where the antenna and mainframe do not move.

Mobile mode recalculates both the position and time each second. This allows for compensation of velocity and acceleration, so the frequency and timing information stay correct while moving, at the expense of some stability. This mode is required if the antenna and mainframe are moving.

For applications where the position changes occasionally, but where the antenna and unit are not moving, then either mode may be applicable. Mobile mode may boot up faster since it does not need to average 60 fixes to establish a fixed location. However, fixed mode can run with fewer satellites once the position is stored.

ACQUIRE GPS POSITION. This menu item appears only when Option GPS is installed and GPS Signal is the selected reference source. Press the **ENTER** button to erase the saved position, and then reacquire and save a new averaged position. Note that the GPS signal quality might indicate low or no signal during this process.

NOTE. *The module must make 60, 1 second GPS readings with at least four satellites to acquire the position. How long this takes depends on various conditions. If there are less than four satellites, a reading cannot be taken.*

GPS SIGNAL WARNING. This menu item appears only when Option GPS is installed and GPS Signal is the selected reference source. This function provides a warning that the antenna signal has degraded. Set this level below the normal range experienced as a function of time of day, weather, or other variables. To configure the output warning, use the REF button menu. (See page 57, *REF button menu*.) Use the left (◀) or right (▶) arrow button to select the FOM (quality of the GPS signal) value that will trigger warning indicators. (See page 2, *Figures of Merit (FOM)*.)

GENLOCK TIMING submenu

The GENLOCK TIMING submenu is available only when GPS Signal is not the selected reference source. This submenu is not available when the reference source is set to Internal.

The following menu opens when you press ENTER in the REF button menu with GENLOCK TIMING selected. (See Figure 21 on page 58.)

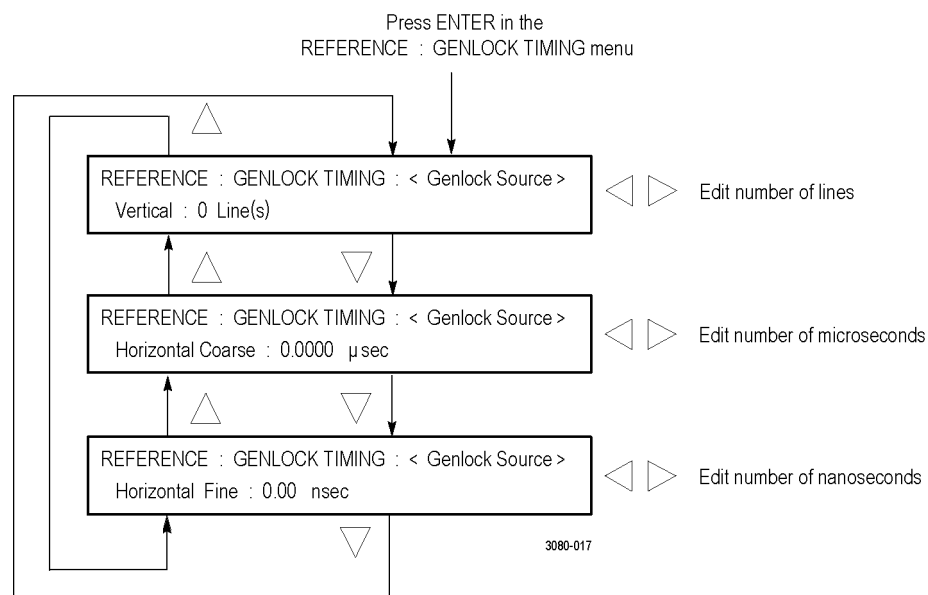


Figure 22: GENLOCK TIMING submenu diagram

Use the up (▲) or down (▼) arrow button to select a timing parameter, and then use the left (◀) or right (▶) arrow button to adjust the parameter. The range of the timing adjustment depends on the selected signal format. (See Table 15.)

- **Vertical:** Use the left (◀) or right (▶) arrow button to adjust the Genlock vertical offset in 1 line increments.
- **Horizontal Coarse:** Use the left (◀) or right (▶) arrow button to adjust the Genlock horizontal offset in 0.0185 μ sec increments.
- **Horizontal Fine:** Use the left (◀) or right (▶) arrow button to adjust the Genlock horizontal offset in 0.1 nsec increments.

NOTE. You can reset the timing offset to zero by pressing the left (◀) and right (▶) arrow buttons simultaneously.

If you are using the 50, 59.94 or 60 Hz progressive sync as a genlock source, as well as LTC as a time-code source, there are two possible alignments for the resulting system. Alignment can be checked by looking at the LTC timing status screen. If the timing is near zero, then it is aligned. If the timing is near a frame of offset, then it is not aligned.

You will need to unlock and re-lock the reference to achieve the desired alignment if this is important to the application you are using. Alternatively, you can use a lower frame rate video reference like NTSC, PAL, or 1080i tri-level.

Table 15: Timing adjustment ranges for reference input signals

Format name	Line settings	Coarse settings (μ s)	Fine settings (ns)
NTSC	± 525	± 63.5556	± 10.00
PAL	± 1250	± 64.0000	± 10.00
1080 60i	± 562	± 29.6296	± 10.00
1080 59.94i	± 562	± 29.6593	± 10.00
1080 50i	± 562	± 35.5556	± 10.00
1080 24sF	± 562	± 37.0370	± 10.00
1080 23.98sF	± 562	± 37.0741	± 10.00
1080 30p	± 562	± 29.6296	± 10.00
1080 29.97p	± 562	± 29.6593	± 10.00
1080 25p	± 562	± 35.5556	± 10.00
1080 24p	± 562	± 37.0370	± 10.00
1080 23.98p	± 562	± 37.0741	± 10.00
720 60p	± 375	± 22.2222	± 10.00
720 59.94p	± 375	± 22.2444	± 10.00
720 50p	± 375	± 26.6667	± 10.00

REF button menu factory default settings

The following table shows the settings for the REF button menu that are reset when you use the PRESET submenu to recall the factory default settings. (See page 136, *PRESET submenu*.)

Table 16: REF button menu factory default settings

Menu item name	Settings
REFERENCE	
SOURCE ¹	Without Option GPS: NTSC Burst With Option GPS: GPS Signal
GENLOCK TIMING ²	Vertical: 0 Line(s) Horizontal Coarse: 0.0000 μ sec Horizontal Fine: 0.00 nsec
LOSS LOCK ACTION ³	Stay at current frequency
GPS HOLDOVER RECOVERY ⁴	Stay legal
GPS ANTENNA POWER ⁵	Off
GPS POSITION ⁴	Fixed
GPS SIGNAL WARNING ⁴	6 – Locked > - - - -

¹ The default reference source depends on whether Option GPS is installed.

² This menu item appears only when GPS Signal is not the reference source.

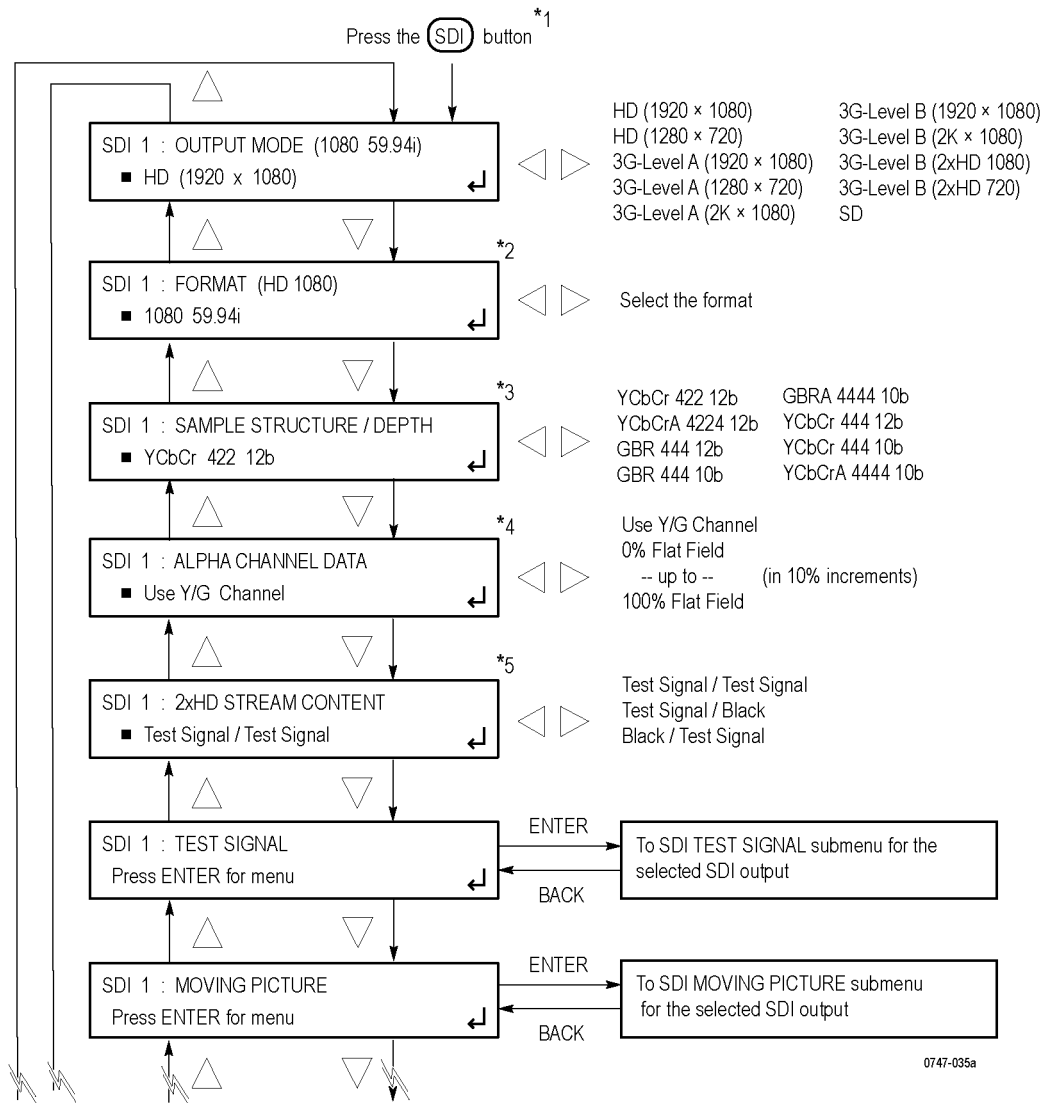
³ This menu item does not appear when the reference source is set to Internal.

⁴ These menu items appear only when Option GPS is installed and the reference source is set to GPS Signal.

⁵ This menu item appears only when Option GPS is installed.

SDI button menu (Option SDI only)

When Option SDI is installed, press the SDI button to view and configure the signals on the SDI video outputs. The following figures show the menu diagrams 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.

Continued on next page

Figure 23: SDI button menu diagram – part 1

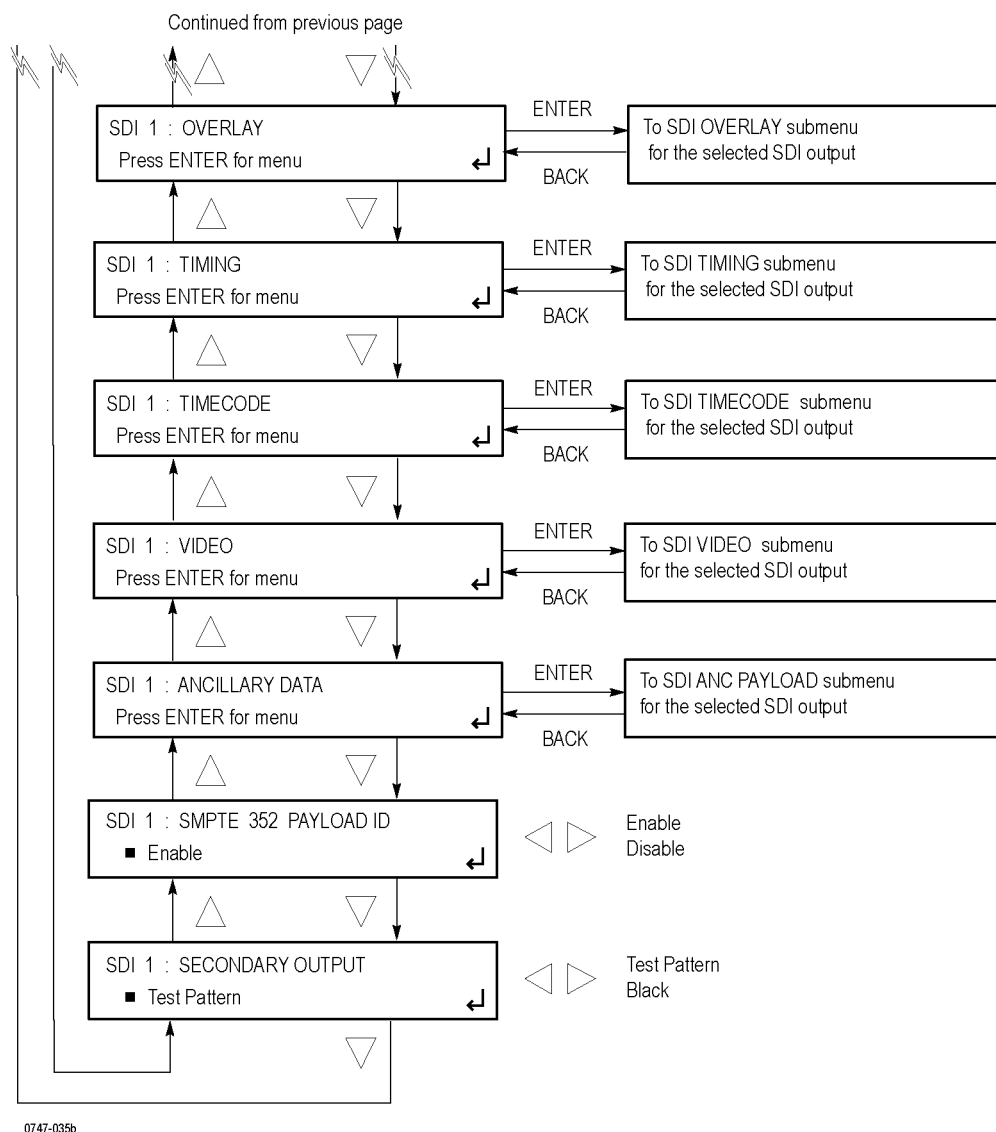


Figure 24: SDI button menu diagram – part 2

OUTPUT MODE. Select SD or HD mode, or set the 3G-SDI serial link multiplexing method to Level A or Level B (Option 3G only). Use the left (◀) or right (▶) arrow button to select from the choices listed below. Press the **ENTER** button to confirm the selection. (See Figure 23.)

NOTE. You can read more about selecting and generating an SDI output signal. (See page 107, How to select an SDI output signal.)

- **SD:** Provides a SMPTE 259 compliant signal that runs at 270 Mbps.
- **HD (1920 × 1080):** Provides a 1080-line, SMPTE 274M compliant signal.
- **HD (1280 × 720):** Provides a 720-line, SMPTE 296M compliant signal.
- **3G-Level A:** (Option 3G only) This is one way of constructing the 3 Gb/s serial data stream, as described in SMPTE 425. For the mapping structure 1 signals such as 1080p50, 1080p59.94 and 1080p60, a Level A stream looks similar to HD video (as defined in SMPTE 292), except the data rate is twice as fast. In Level A, the lines are sent in order, consecutively. For other mapping structures, the video is at a lower frame rate, but has more bits and/or includes more channels. Refer to the SMPTE 425 standard for details on the Level A mapping method.

The following 3G Level A signals are available:

- **(1920 x 1080).** The output is a 1080-line, SMPTE 425 compliant signal.
- **(1280 x 720).** The output is a 720-line, SMPTE 425 compliant signal.
- **(2k x 1080).** This output provides 2048 × 1080 resolution signals, primarily for digital cinema applications.
- **3G-Level B:** (Option 3G only) This is an alternate way of constructing the 3 Gb/s serial data stream, as described in SMPTE 425. A Level B stream looks similar to dual link (as defined in SMPTE 372M). The serial data is constructed by interleaving the two links of the dual link video signal. As a result, some formats will have the serial data take two lines worth of time to propagate. This has implications for the effects of the pathological signals, and can confuse the definition of timing adjustments. Refer to the SMPTE 372M and SMPTE 425 standards for more information.

The following 3G Level B signals are available:

- **(1920 x 1080).** The output is a 1080-line, SMPTE 425 compliant signal.
- **(2k x 1080).** This output provides 2048 × 1080 resolution signals, primarily for digital cinema applications.
- **(2xHD 1080).** This output provides two standard 1080-line SMPTE 292 HD streams in the same format. Select between Test Signal/Test Signal or Test Signal/Black for the two streams.
- **(2xHD 720).** This output provides two standard 720-line SMPTE 292 HD streams in the same format. Select between Test Signal/Test Signal or Test Signal/Black for the two streams.

FORMAT. Use the left (◀) or right (▶) arrow button to select the signal format for the selected SDI output. The available format choices depend on the selected OUTPUT MODE setting above. Press the **ENTER** button to enable the format selection.

SAMPLE STRUCTURE/DEPTH. (Option 3G only) When the output mode is set to a non-fast-progressive format, the SAMPLE STRUCTURE/DEPTH menu is available. There are several sample structures to choose from. Press the left (◀) or right (▶) arrow buttons to scroll through the available options. When the desired sample structure is displayed, press the **ENTER** button to select it.

3G Level A / Level B formats (720 line)

- GBR 444 10b
- YCbCr 444 10b
- GBRA 4444 10b
- YCbCrA 4444 10b

2K line formats

- XYZ 444 12b
- GBR 444 12b

NOTE. For SD, HD, and 3G fast-progressive formats, the color space / sample structure / depth is always YCbCr 422 10 bit.

ALPHA CHANNEL DATA. This menu item appears only when the sample structure is set to “+A” for 3G signal formats. Selects the data to be placed on the alpha channel when a sample structure that includes an alpha channel is selected. The channel can contain a duplicate of the Y or G channel data or a flat field signal. Use the left (◀) or right (▶) arrow button to select **Use Y/G Channel** or to select a 0% to 100% Flat Field in 10% increments, and then press the **ENTER** button to enable the selection.

2×HD STREAM CONTENT. This menu item appears only when the signal format is set to 2×HD. Selects the content for the first and second HD signals on link A and link B. Use the left (◀) or right (▶) arrow button to select **Test Signal / Test Signal**, **Test Signal / Black**, or **Black / Test Signal**, and then press the **ENTER** button to enable the selection.

TEST SIGNAL. This menu item allows you to access test signal sets when the module is in generator mode. Select this menu item, and then press the **ENTER** button to access the SDI TEST SIGNAL submenu. (See page 72, *SDI TEST SIGNAL submenu*.)

Once you have accessed the submenu, you can select a test signal from a signal set. For example, when you select the **COLOR BAR** signal set, a signal in the Color Bars signal set is output. Use the left (◀) or right (▶) arrow button to select a different signal from the Color Bars signal set.

MOVING PICTURE. Scrolls the active picture area of the output test signal. Select this menu item, and then press the **ENTER** button to access the SDI MOVING PICTURE submenu. (See page 81, *SDI MOVING PICTURE submenu*.)

OVERLAY. Selects an item (logo, text, or circle) that is overlaid on the output test signal and sets the blinking mode for the overlay. Select this menu item, and then press the **ENTER** button to access the SDI OVERLAY submenu. (See page 83, *SDI OVERLAY submenu*.)

TIMING. Sets the timing offset of the serial digital video outputs relative to the internal reference signal (frame reset signal). This allows you to adjust the timing of this module relative to another module or to an external reference (such as Genlock or GPS). Select this menu item, and then press the **ENTER** button to access the SDI TIMING submenu. (See page 92, *SDI TIMING submenu*.)

TIMECODE. Use this menu to set timecode parameters for the selected output. Press the **ENTER** button to access the SDI TIMECODE submenu. (See page 93, *SDI TIMECODE submenu*.)

VIDEO. Enables or disables the individual components of the output serial stream, such as YCbCr, RGB, or XYZ and allows the edge-shaping filter to be enabled or disabled on the video. Also allows the A/V timing mode to be invoked. For SD formats, Error Detection and Handling (EDH) packets can be enabled or disabled. Select this menu item, and then press the **ENTER** button to access the SDI VIDEO submenu. (See page 94, *SDI VIDEO submenu*.)

ANCILLARY DATA. Use this menu to define and control the user-defined ancillary data payload insertion. Press the **ENTER** button to access the SDI ANC PAYLOAD submenu. (See page 97, *SDI ANC PAYLOAD submenu*.)

SMPTE 352 PAYLOAD ID. Use the left (◀) or right (▶) arrow button to **Enable** or **Disable** the SMPTE 352M Payload Identifier, and then press the **ENTER** button to confirm the selection.

NOTE. *The SMPTE 352M payload identifier is a required element for a compliant 3 Gb/s signal stream. The payload identifier is optional for SD and HD formats.*

SECONDARY OUTPUT. Use the left (◀) or right (▶) arrow button to select a **Test Pattern** signal or a **Black** signal for the secondary BNC connector. Press the **ENTER** button to confirm the selection.

When set to the Test Pattern selection for channel 1, the SDI 1A and SDI 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.

When set to the Black selection for channel 1, the SDI 1B black signal is the same format and sample structure as the SDI 1A output. The same is true for the channel 2 connectors when Black is set as the Secondary Output selection for channel 2.

SDI TEST SIGNAL submenu

The instrument comes with a standard set of test signals already installed. (See Table 17.)

You can also download enhanced test signals. (See Table 18.)

When Option 3G is installed, you can also select to output 3G test signals.

NOTE. For information about how to install and transfer signal sets and other user files, see the *SPG8000 Quick Start User Manual*. You can find this manual on the Product Documentation CD that shipped with your instrument and also on the Web at www.tektronix.com/downloads.

The following figure shows the SDI TEST SIGNAL submenu.

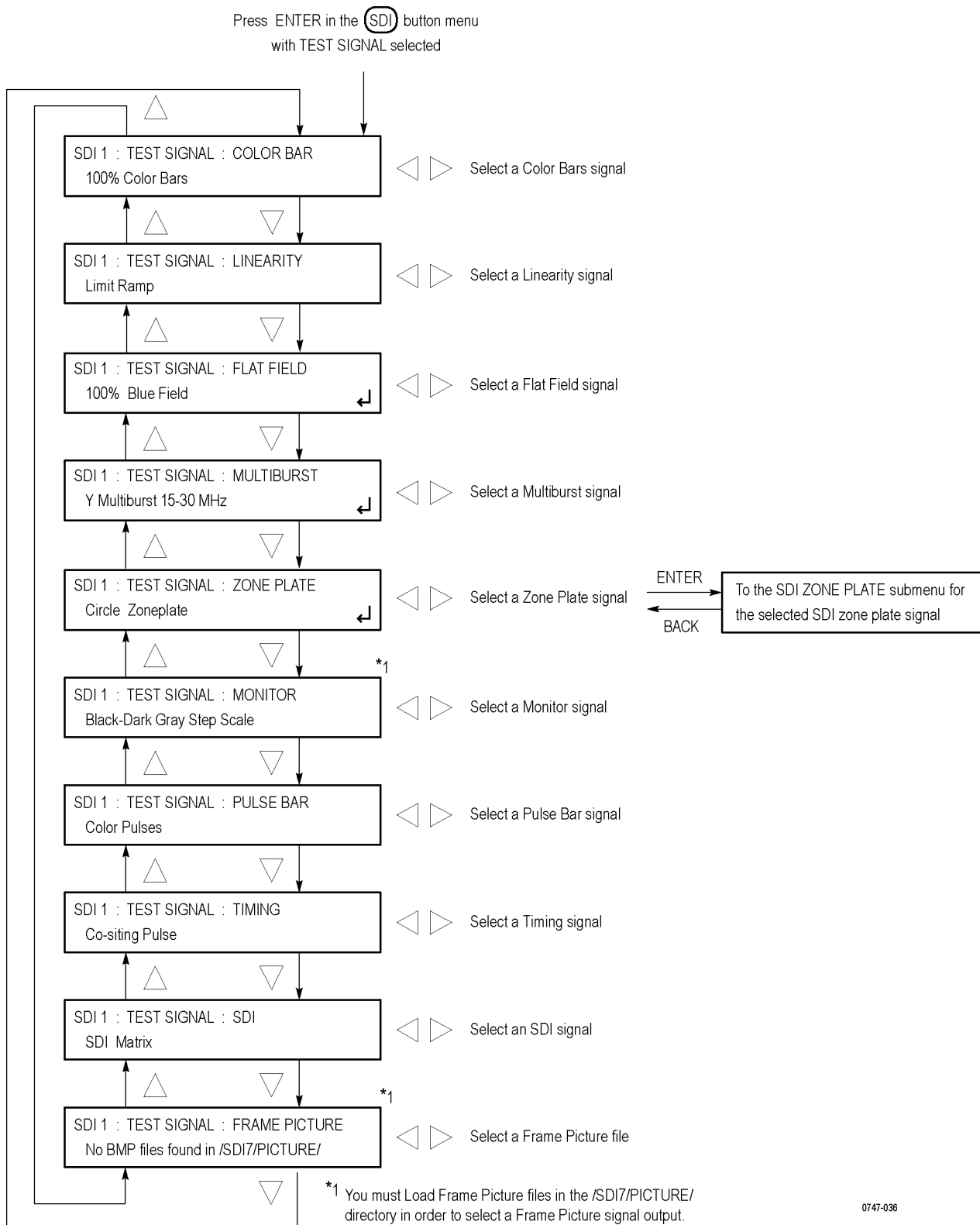


Figure 25: SDI TEST SIGNAL submenu diagram

The following tables list the signals assigned to each test signal set and the signals that can be selected in the signal set when the module is in generator mode. For example, when you select the **COLOR BAR** signal set, a signal in the Color Bars signal set is output. Use the left (◀) or right (▶) arrow button to select a different signal from the Color Bars signal set.

NOTE. *Picture displays work best with uncompressed BMP images (24 bits and 32 bits true color). Picture displays do not work with RLE8 or RLE4 BMP compression.*

Table 17: Standard SDI test signal sets

Signal set	Signals in the signal set	Description
COLOR BAR	100% Color Bars, 75% Color Bars (100% White), 75% Color Bars (75% White)	Eight full-height bars of white, yellow, cyan, green, magenta, red, blue, and black. This pattern is available with three variations, at 100% value for all bars, at 75% value for colors and 100% for white, and at 75% value for all bars.
	100% Color Bars Over Red, 75% Color Bars Over Red	These variations on color bars are available only in the 625 50i format of the SD output mode. They consist of the 75% or 100% color bars signal on the top half of the raster, and a matching 75% or 100% red field on the lower half.
	SMPTE EG1 Color Bars	Color bars per SMPTE EG 1-1990. This pattern includes 75% color bars, reverse blue bars, -I and +Q sections, black, white, and pluge sections. Note that this pattern is only available for YCbCr formats, since the -I and +Q sections contain color components outside of the legal RGB gamut. For the SD output mode, this pattern is available only for the 525-line 59.94i format.
	SMPTE RP219 Color Bars	Color bars per SMPTE RP 219-2002. This pattern is intended for 16:9 aspect ratio displays, with additional elements as compared to EG1 bars. The SDI implementation includes -I and +Q sections, but unlike the similar sections in EG1 bars, they have additional luminance to stay within RGB gamut. The -2% patch of the pluge section is clipped to 0% black for XYZ formats. For SD, the color bars are the 4:3 aspect ratio version, as if converted from the 16:9 image with a center cut.
	SMPTE EG432-1 Color Accuracy	Split-screen color bars using values from SMPTE RP 431-2-2007. The upper half of the pattern is essentially the same as 100% color bars, corresponding to the “-1” set of colors defined in Table A.4 of the RP. The lower half is a set of desaturated color bars, corresponding to the “-2” color patch values.

Table 17: Standard SDI test signal sets (cont.)

Signal set	Signals in the signal set	Description
LINEARITY	5 Step Staircase, 10 Step Staircase	Series of vertical bars of equal steps on all three channels. These patterns are color-independent so they will appear differently in YCbCr, RGB, or XYZ color spaces. Since the range of valid levels is not evenly divisible by 5 or 10 steps, the first and last bars slightly exceed the valid range, but are still well within legal limits. For example, the valid range for 10-bit YCbCr formats is from 64–940 for the Y channel (876 steps) and from 64–960 for the Cb/Cr channels (896 steps). Therefore, the level of the first bar is 62 and the level of the last bar is 942/962, which results in equal step sizes across the pattern.
	Valid Ramp, Y Valid Ramp, B-Y Valid Ramp, R-Y Valid Ramp	The Valid Ramp is a matrix of three different ramps, designed to test the video component channels for YCbCr, and for gamut range testing in all color spaces. These three ramps are also available as individual patterns that span the picture width. First, the Y Valid Ramp spans from black to white, across the valid range of the luminance (Y) channel. Next, the B–Y Valid Ramp spans from yellow to cyan, across the valid range of the Cb color difference channel. Last, the R–Y Valid Ramp spans from cyan to red, across the valid range of the Cr color difference channel.
	3 Channel Ramp	Wide ramp from the lower valid value to the upper valid value for all three channels. This pattern is color-independent, so it will appear differently in YCbCr, RGB, or XYZ color spaces. On each side of the ramp there are small plateaus at the blanking level (black) and at the valid level.
	Limit Ramp	Wide ramp that spans the legal limit range (4–1019 for 10-bit formats and 16–4079 for 12-bit formats) for all three channels. On each side of the ramp there are small plateaus at the blanking level, the valid level, and the limit level.
	Shallow Ramp Matrix	Vertical matrix of shallow ramps that together span the range between legal limits (4–1019 for 10-bit formats and 16–4079 for 12-bit formats). Each bit value is held for 16 pixels for 10-bit formats and for 4 pixels for 12-bit formats. There is overlap between the end of one ramp and the start of the next ramp.
	Color Ramp Matrix	Vertical matrix of ramps across the colors available in the valid RGB gamut. Each set of ramps transitions between adjacent hues: red–yellow–green–cyan–magenta–blue–red. From the top of the pattern, the first three rows of ramps are at 25%, 50%, and 75% saturation. The fourth row of ramps includes fully saturated colors at 100% value. The next three rows of ramps are at 75%, 50%, and 25% value. The bottom row of ramps is monochrome.

Table 17: Standard SDI test signal sets (cont.)

Signal set	Signals in the signal set	Description
FLAT FIELD	0% Flat Field (Black), 50% Flat Field, 100% Flat Field (White)	Full-frame monochrome flat fields. The factory installed patterns include 0% (black), 50%, and 100% (white). You can install extended signal sets, which include additional patterns for the remaining 10% increments. (See Table 18 on page 80.)
	100% Red Field, 100% Green Field, 100% Blue Field, 100% Cyan Field, 100% Magenta Field, 100% Yellow Field	Full-frame color flat fields. The factory installed patterns include each of six colors (red, green, blue, cyan, magenta, and yellow) at 100% value. You can install enhanced signal sets, which include additional patterns for these six colors at 75% value. (See Table 18 on page 80.)
	10% Flat Field, 20% Flat Field, 30% Flat Field, 40% Flat Field, 60% Flat Field, 70% Flat Field, 80% Flat Field, 90% Flat Field	Full-frame monochrome flat fields available in individual patterns from 10% to 90% in 10% increments. These signals are not part of the factory installed signal sets. You must install the enhanced signal sets to access these signals. (See Table 18 on page 80.)
	75% Red Field, 75% Green Field, 75% Blue Field, 75% Cyan Field, 75% Magenta Field, 75% Yellow Field	Full-frame color flat fields available in individual patterns of 75% value for each of six colors (red, green, blue, cyan, magenta, and yellow). These signals are not part of the factory installed signal sets. You must install the enhanced signal sets to access these signals. (See Table 18 on page 80.)
	Black to White-1, Black to White-2, Black to White-3, Black to White-4, Black to White-5, Black to White-6, Black to White-7, Black to White-8, Black to White-9, Black to White-10, Black to Gray-1, Black to Gray-2, Black to Gray-3, Black to Gray-4, Black to Gray-5, Black to Gray-6, Black to Gray-7, Black to Gray-8, Black to Gray-9, Black to Gray-10	Full-frame monochrome flat fields representing the individual steps in the SMPTE EG 432-1 step-scale patterns available under the MONITOR button. These signals are not part of the factory installed signal sets. You must install the enhanced signal sets to access these signals. (See Table 18 on page 80.)
	Red-1 Field, Red-2 Field, Green-1 Field, Green-2 Field, Blue-1 Field, Blue-2 Field, Cyan-1 Field, Cyan-2 Field, Magenta-1 Field, Magenta-2 Field, Yellow-1 Field, Yellow-2 Field	Full-frame color flat fields representing the individual colors in the SMPTE EG 432-1 color-accuracy patterns available under the COLOR BAR button. These signals are not part of the factory installed signal sets. You must install the enhanced signal sets to access these signals.

Table 17: Standard SDI test signal sets (cont.)

Signal set	Signals in the signal set	Description
MULTIBURST		<p>Multiburst pattern consisting of five or six sine wave packets, each of fixed frequency. This pattern is typically used for frequency response testing for one or three video channels. The packets have a 60% amplitude range upon a 50% level, therefore range between 20% and 80% levels.</p> <p>For comparison to these peak limits, flat pedestals at 80% and 20% levels are present on the left side of the pattern. The set of packet frequencies used in each pattern is determined by the maximum bandwidth of the output format.</p> <p>For 4:2:2 YCbCr formats, one multiburst pattern consists only of a Y channel signal, up to the maximum frequency limit, and the second multiburst pattern is identical for all three channels, up to half of the Y channel frequency limit.</p> <p>For 4:4:4 formats, each multiburst pattern is identical for all three channels.</p>
	Multiburst 0.5–2.75 MHz	(SD formats only) Three channel pattern with packet frequencies of 0.5, 1.0, 1.5, 2.0, and 2.75 MHz.
	Y Multiburst 0.5–5.75 MHz	(SD formats only) Y channel pattern with packet frequencies of 0.5, 1.0, 2.0, 3.0, 4.0 and 5.75 MHz.
	Multiburst 1–15 MHz	(HD and 3G formats only) Three channel pattern with packet frequencies of 1, 3, 6, 9, 12, and 15 MHz.
	Y Multiburst 15–30 MHz	(HD formats only) Y channel pattern with packet frequencies of 15, 18, 21, 24, 27, and 30 MHz.
	Multiburst 15–30 MHz	(4:4:4 and fast-progressive 3G formats only) Three channel pattern with packet frequencies of 15, 18, 21, 24, 27, and 30 MHz.
	Y Multiburst 35–60 MHz	(Fast-progressive 3G formats only) Y channel pattern with packet frequencies of 35, 40, 45, 50, 55, and 60 MHz.
ZONE PLATE	Circle, Diagonal Sine, H Sine, H Sweep, V Sine, V Sweep, Custom-1, Custom-2	Zone plate test signal with real-time parametric controls. Select a zone plate signal and press the ENTER button to adjust the parametric controls. (See page 111, <i>SDI Zone plate signals</i> .)
MONITOR	ChromaDuMonde	Color reference chart, used with permission of DSC Laboratories. The pattern consists of a series of DSC standard color patches representing the six primary colors, 18 evenly spaced intermediate colors, and four skin tone reference patches. The 24 primary and intermediate colors will show as a hexagonal shape on a vectorscope display, providing a reference for comparison with a camera-generated image of a physical DSC ChromaDuMonde chart. The pattern also includes an 11-step crossed grayscale section and a center section with 0% black and 100% white patches.

Table 17: Standard SDI test signal sets (cont.)

Signal set	Signals in the signal set	Description
	SMPTE 303M Color Reference	Color reference chart per SMPTE 303M, also known as the GretagMacbeth ColorChecker® chart. Note that cyan patch #18 cannot be reproduced properly in the RGB and XYZ color spaces because the red component lies at approximately -14%, which exceeds legal limits for RGB formats. This patch will appear as a cyan and black checkerboard pattern, where the cyan patches are of a different hue than the full cyan patch as seen in YCbCr formats because the red component is clipped at 0%. The color values used from SMPTE 303M are those with respect to the D ₆₅ illuminant.
	Black-White Step Scale, Black-Dark Gray Step Scale	Gray scale patterns per §6.9 of SMPTE EG 432-1-2007. A series of ten different monochrome patches at increasing luminance values is centered on a gray background, to verify gray scale tracking. The ten steps of the black to white scale are normalized gamma-corrected values of 1/10 to 1 and the ten steps of the black to dark gray scale are 1/31 to 10/31.
	Pluge and Luma Reference	Includes two elements to assist in black and white balance. The left side of the pattern contains a pluge pattern, with three vertical bars of -2%, 0%, and +2% black. The right side of the pattern contains four gray boxes corresponding to luminance levels of 110 mV, 200 mV, 450 mV, and 700 mV (100% white) in the analog domain. The -2% patch of the pluge section is clipped to 0% black for XYZ formats.
	Checkerboard	4×4 grid of alternating black and white patches, used to measure intra-frame contrast per §6.8 of SMPTE SMPTE EG 432-1-2007.
	Window	White square centered on a black background. This pattern can be used as an alternative to a full-field white pattern when it is desirable for the average picture level (APL) to approximate normal program content.
	Production Aperture	Includes single-pixel wide lines at the extreme edges of the active video area, marking the complete production aperture. Vertical lines are implemented as single-sample pulses with no edge filtering, so this pattern is not legal as a broadcast signal.
	Clean Aperture	Grid pattern per SMPTE RP 187-1995. The clean aperture is marked by the outer markers, with overscan markers at approximate 2.5% increments. The center 4:3 section of a 16:9 image has an additional set of aperture and overscan markers. Each line on the grid is implemented with two horizontal lines or a double-width pulse centered on two samples, because the actual aperture boundary and the center of the image each lie midway between lines and samples.
	Convergence	Grid pattern of equal size squares, with a dot at the center of each square. Each line and dot is implemented as a single horizontal line or single-sample pulse. This pattern is used to verify convergence of RGB channels, and no color fringing should be visible on the white lines and dots when the channels are aligned.

Table 17: Standard SDI test signal sets (cont.)

Signal set	Signals in the signal set	Description
PULSE BAR	2T Pulse and Bar	<p>Two pulses of 2T half-amplitude width and full-scale amplitude. A positive pulse is added to a base level at the minimum valid value, and a negative pulse is added to a bar level at the maximum valid value. The 2T pulse is used for Short Time response testing and the bar is used for Line Time response testing.</p> <p>The type of 2T pulse depends on the signal format:</p> <ul style="list-style-type: none"> ■ For SD-525 format, this is a 2T4 pulse ■ For SD-625 format, this is a 2T5 pulse ■ For HD and slow-progressive 3G formats, this is a 2T30 pulse ■ For 3G fast progressive formats, this is a 2T60 pulse ■ For 4:2:2 formats, chroma pulses are at half the bandwidth
	Color Pulses	<p>Eight color pulses of 2T half-amplitude width upon black and white backgrounds. The upper half of the pattern has positive pulses on a black background, testing each combination of the three color channels. The lower half of the pattern has a white background, so negative pulses are used to result in the same line colors. For example, the yellow pulse in the upper half is 100% red plus 100% green, resulting in yellow on a black background. At the same horizontal location in the lower half, a pulse of -100% blue added to the white background also results in a yellow line.</p>
TIMING	Co-siting Pulse	<p>One single-sample wide pulse in the center of the image, used to show the timing relationship and alignment between chroma and luma channels. Different amplitudes are used to distinguish the three channels.</p>

Table 17: Standard SDI test signal sets (cont.)

Signal set	Signals in the signal set	Description
SDI	Equalizer Test	Full-field equalizer test pattern per SMPTE RP 198-1998. This pattern consists of alternate 10-bit words, 300h and 198h, regardless of the current sampling structure and format. For 10-bit 4:2:2 YCbCr HD-SDI formats, the Y samples carry the 198h words and the Cb/Cr samples carry the 300h words, resulting in a magenta-shaded field for this pattern. For other formats, these same 10-bit word values will result in different color representations. This pattern also includes the polarity control word, such that the first sample in the active picture in every other frame is 190h instead of 198h.
	PLL Test	Full-field phase-locked loop test pattern per SMPTE RP 198-1998. This pattern consists of alternate 10-bit words, 200h and 110h, regardless of the current sampling structure and format. It appears as a 24% gray field in 10-bit 4:2:2 YCbCr formats, but as different colors in other formats.
	SDI Matrix	Matrix pattern, with the equalizer test pattern (300h 198h) in the upper half of the field and the PLL test pattern (200h 110h) in the lower half of the field.
FRAME PICTURE	Frame Picture	Picture rendered from user-supplied BMP files stored in the PICTURE directory of the mainframe memory. Use the left or right arrow button to select a test signal from the list. (See page 110, <i>SDI picture file generation</i> .)

Table 18: Enhanced SDI test signal sets

Enhanced signal set	Description
Monochrome fields	Includes all monochrome flat fields from 0% to 100% in 10% increments
Color fields	Includes color fields for six primary and secondary colors at both 100% and 75% values
SMPTE RP431-2 color patches	Includes full field patterns for each of the Black-White and Black-Dark Gray steps, plus the “-1” and “-2” color patches

SDI MOVING PICTURE submenu

Use this menu to scroll the active picture area of the serial digital video signal up/down or left/right (or randomly), when in generator mode. Use the up (▲) or down (▼) arrow button to scroll through the menu shown below.

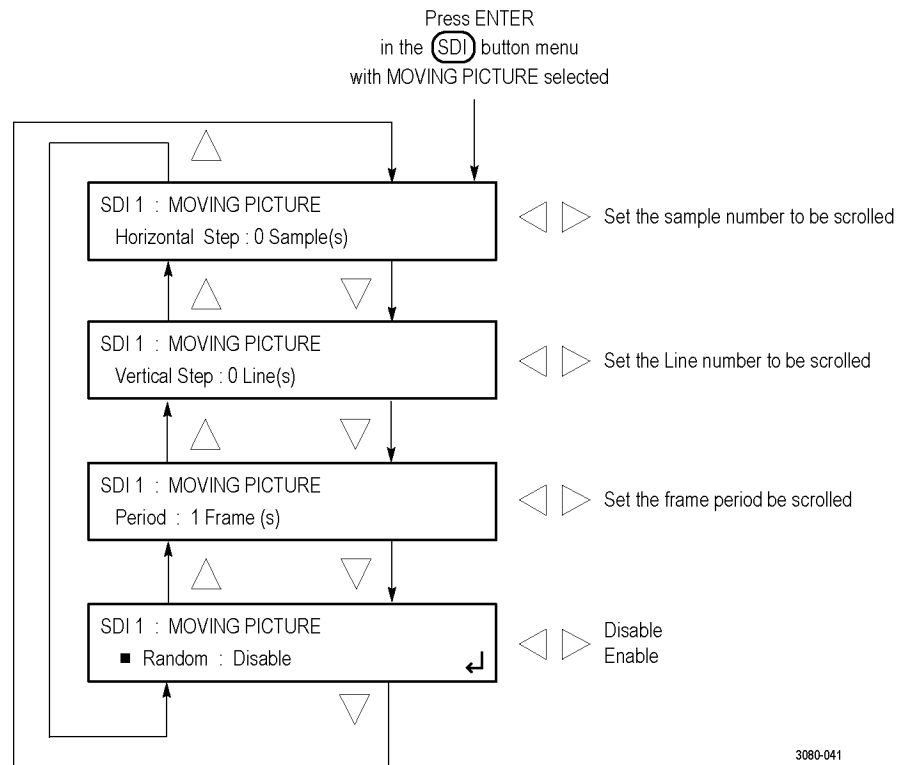


Figure 26: SDI MOVING PICTURE submenu diagram

NOTE. The Moving Picture function is not available with zone plate or multiburst signals. However, zone plate signals may be defined with motion in the zone plate parameters. (See page 112, To modify a zone plate signal.)

The Moving Picture function is enabled whenever the H Step or V Step parameter is set to a value other than 0.

When Moving Picture is enabled, the circle and text overlays remain static regardless of the signal type (standard test signal or “frame (.BMP) picture”). However, the logo overlay remains static for only standard test signals, but continues to move when used with a “frame (.BMP) picture.”

Horizontal Step. Sets the number of samples to be scrolled per frame set in the **Period** menu item. Use the left (◀) or right (▶) arrow button to set the value from -252 to +252 in 4-sample steps.

Vertical Step. Sets the number of lines to be scrolled per frame set in the **Period** menu item. Use the left (◀) or right (▶) arrow button to set the value from -252 to +252 in 1-line steps.

Period. Sets the time interval between occurrences of the scrolling. Use the left (◀) or right (▶) arrow button to set the value from 1 to 16 in 1-frame steps.

Random. Sets whether or not the picture scrolls randomly. Use the left (◀) or right (▶) arrow button to select between **Disable** and **Enable**. Press the **ENTER** button to confirm the selection.

SDI OVERLAY submenu

Use this menu to select an item (logo, ID text, circle, or burnt-in timecode) to overlay on the output test signal, and to set the blinking mode for the overlay. Use the up (▲) or down (▼) arrow button to scroll through the menu.

NOTE. You can store overlay functions, including text, in the instrument presets so that the overlay is restored on power up. (See page 136, PRESET submenu.)

The following figure shows the SDI OVERLAY submenu.

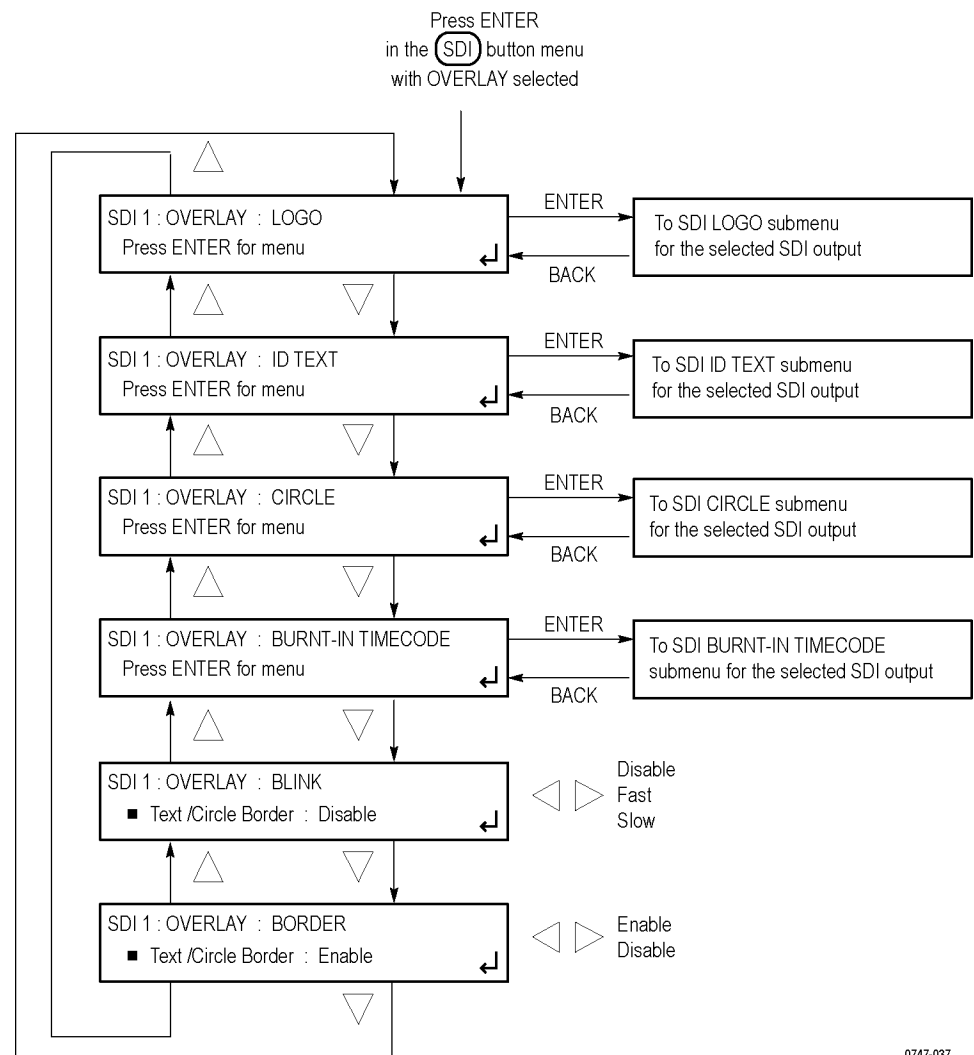


Figure 27: SDI OVERLAY submenu diagram

LOGO. Select this menu item, and then press the **ENTER** button to access the SDI OVERLAY LOGO submenu where you can select a logo to overlay the output signal in a specified position. (See page 85, *SDI OVERLAY LOGO submenu*.)

ID TEXT. Select this menu item, and then press the **ENTER** button to access the SDI OVERLAY ID TEXT submenu where you can edit the text to overlay the output signal in a specified position. (See page 87, *SDI OVERLAY ID TEXT submenu*.)

CIRCLE. Select this menu item, and then press the **ENTER** button to access the SDI OVERLAY CIRCLE submenu where you can specify a circle size and position to overlay the output signal. (See page 90, *SDI OVERLAY CIRCLE submenu*.)

BURNT-IN TIMECODE. Select this menu item, and then press the **ENTER** button to access the SDI OVERLAY BURNT-IN TIMECODE submenu where you can enable or disable the burnt-in timecode, and set the size and position of the timecode overlay on the output signal. (See page 91, *SDI OVERLAY BURNT-IN TIMECODE submenu*.)

BLINK. Sets the blinking mode for the enabled overlay. Use the left (◀) or right (▶) arrow button to select one of the following blink modes, and then press the **ENTER** button to confirm the selection.

- **Disable:** Disables the blinking function of the overlay.
- **Fast:** Sets the overlay to blink at approximately 0.5 second intervals.
- **Slow:** Sets the overlay to blink at approximately 1.0 second intervals.

BORDER. Displays a black border around the text and circle overlays when enabled. Select this menu item, and then use the left (◀) or right (▶) arrow button to select **Enable** or **Disable**. Press the **ENTER** button to confirm the selection.

NOTE. Turn on the border to provide cleaner transitions between the overlay and the test signal. This is especially useful for 4:2:2 format signals, which may have some ringing when the border is turned off.

SDI OVERLAY LOGO submenu

Use this menu to select a logo to overlay on the output test signal and to set the display position of the logo. Use the up (▲) or down (▼) arrow button to scroll through the menu. The following figure shows the SDI OVERLAY LOGO submenu.

NOTE. To display a logo, you need to create a logo file (.bmp) and use FTP or a USB memory device to copy the file to the SDI7/LOGO directory on the instrument. The file must be installed in the LOGO folder. Files installed in the wrong directory location will be ignored by the instrument. The instructions for installing custom files are in the SPG8000 Quick Start User Manual. Refer to the SPG8000 PC Tools Technical Reference for detailed information about how to create a logo file.

Logo displays work best with the uncompressed BMP images (24 bits and 32 bits true color). Logo displays do not work with RLE8 or RLE4 BMP compression.

BMP files are not scaled for each raster size. For example, a 320×240 size bitmap will be rendered as 320×240 pixels regardless of the current raster area. The bitmap would occupy about 25% of the active video for the SD-525 format, but less than 4% of a 1920×1080 picture. Therefore, you might need to choose a bitmap size appropriate for the target display resolution when using the logo overlay.

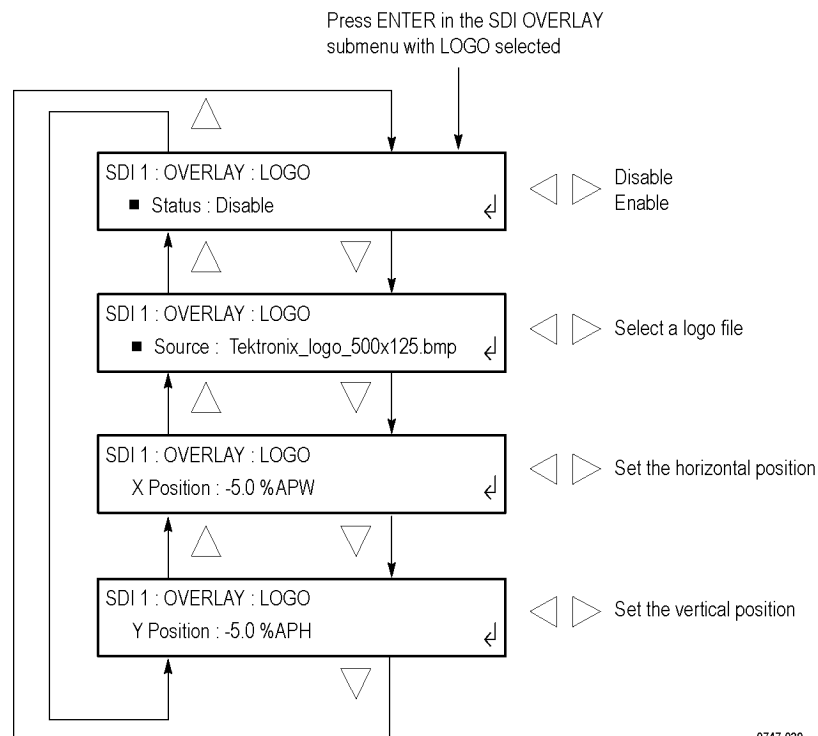


Figure 28: SDI OVERLAY LOGO submenu

Status. Displays the status of the logo overlay display. Use the left (◀) or right (▶) arrow button to select **Disable** or **Enable**. Press the **ENTER** button confirm the selection.

Source. Displays the selected logo file. Use the left (◀) or right (▶) arrow button to select a logo file stored in the SDI7/LOGO directory. Press the **ENTER** button confirm the selection.

The default logo is the "first" file in the SDI7/LOGO directory, as sorted by the date of the logo file (oldest first). If the factory-provided logo files are installed, the default logo is "Tektronix_logo_500x125.bmp."

However, if the user has removed the factory-provided logo files and added their own custom files, then the default logo will be the oldest file installed in the SDI7/LOGO directory.

NOTE. *The position of the logo overlay is referenced from the lower right of the active raster area.*

X Position. Sets the horizontal position of the logo. The position is set as a percentage of active picture width. Use the left (◀) or right (▶) arrow button to change the position. You can set the value from -100.0% to -1.0% in 0.1% steps. Press the **ENTER** button confirm the selection.

Y Position. Sets the vertical position of the logo. The position is set as a percentage of active picture height. Use the left (◀) or right (▶) arrow button to change the position. You can set the value from -100.0% to -1.0% in 0.1% steps. Press the **ENTER** button confirm the selection.

**SDI OVERLAY ID TEXT
submenu**

Use this menu to create text or to select a text file that will be overlaid on the output test signal, and to set the display position of the text.

NOTE. *You can store overlay functions, including text, in the instrument presets so that the overlay is restored on power up.*

Displaying Text. To display a text overlay, you need to either enter a text string or create a text file (.txt) and use FTP or a USB memory device to copy the file to the SDI7/TEXT directory on the instrument. The file must be installed in the TEXT folder. Files installed in the wrong directory location will be ignored by the instrument. The instructions for installing custom files are located in the *SPG8000 Quick Start User Manual*.

When the string is entered from the front panel, it is limited to 30 characters in length, and may contain only standard ASCII characters. When a text file is used, any Unicode character supported by the default font can be displayed. The text file can be encoded as plain 7-bit ASCII text, or UTF-8 encoding when extended Unicode characters are used. The text file can also include embedded newline characters to create text overlays spanning multiple lines.

Font Files. The instrument uses a TrueType font to render text overlays; the default typeface is Deja Vu Sans. The font file is named “default.ttf” and is stored in the SDI7 directory of the instrument memory.

The instrument supports Latin, Cyrillic, Greek, and symbol character sets for use with the text overlay. Using FTP, you can download an alternate TrueType font file. Make sure that the font file is renamed to “default.ttf” and that the instrument is rebooted for the new font to take effect. The instructions for using FTP or a USB memory device to install font files are located in the *SPG8000 Quick Start User Manual*.

The original Deja Vu Sans file can be recovered from the *SPG8000 SW Library and Documentation CD* if necessary.

The following figure shows the SDI OVERLAY ID TEXT submenu. Use the up (▲) or down (▼) arrow button to change the menu items.

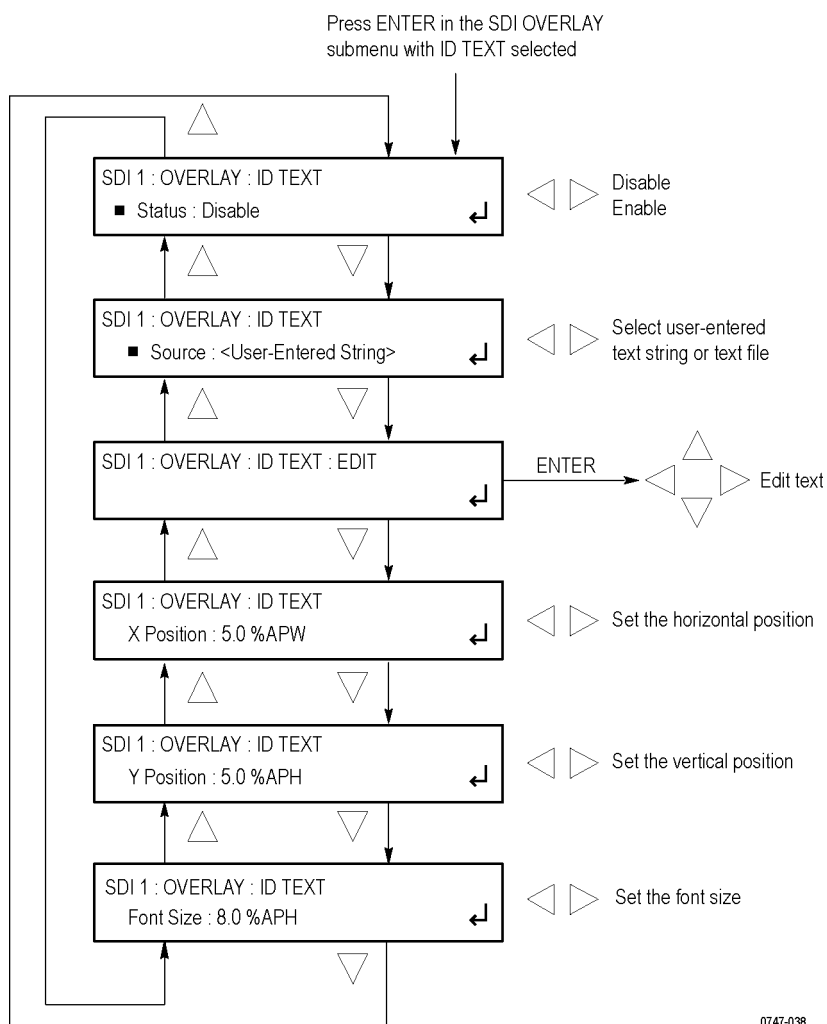


Figure 29: SDI OVERLAY ID TEXT submenu

Status. Displays the status of the ID Text overlay display. Use the left (◀) or right (▶) arrow button to select between **Enable** and **Disable**, and then press the **ENTER** button to confirm the selection.

Source. Displays the user-entered text string or the selected text file. Use the left (◀) or right (▶) arrow button to select text string to be entered from the front panel or a text file stored in the SDI7/TEXT directory. Press the **ENTER** button confirm the selection.

EDIT. Edits the text you want to display on the output test signal. Perform the following steps to edit the text:

NOTE. *You can use up to 30 characters for the logo text. Use the blank character to erase unneeded character(s).*

1. Use the left (◀) or right (▶) arrow button to select **EDIT**, and then press the **ENTER** button to enable the text edit mode.
2. Use the left (◀) or right (▶) arrow button to move the underscore character (_) to the character you want to change.
3. Use the up (▲) or down (▼) arrow button to select the desired character.
4. After you enter all of the desired characters, press the **ENTER** button to exit the text editing mode.

NOTE. *The position of the text overlay is referenced from the top left of the active picture.*

X Position. Sets the horizontal position of the text. The position is set as a percentage of active picture width. Use the left (◀) or right (▶) arrow button to change the position. You can set the value from 0.0% to 99.0% in 0.1% steps. Press the **ENTER** button confirm the selection.

Y Position. Sets the vertical position of the text. The position is set as a percentage of active picture height. Use the left (◀) or right (▶) arrow button to change the position. You can set the value from 0.0% to 99.0% in 0.1% steps. Press the **ENTER** button confirm the selection.

Font Size. Sets the font size of the text. The size is set as a percentage of active picture height. Use the left (◀) or right (▶) arrow button to change the font size. You can set the value from 1.0% to 100.0% in 0.1% steps. Press the **ENTER** button confirm the selection.

SDI OVERLAY CIRCLE submenu

Use this menu to overlay a circle on the output test signal and set the display position of the circle. Use the up (▲) or down (▼) arrow button to change the menu items. The following figure shows the SDI OVERLAY CIRCLE submenu.

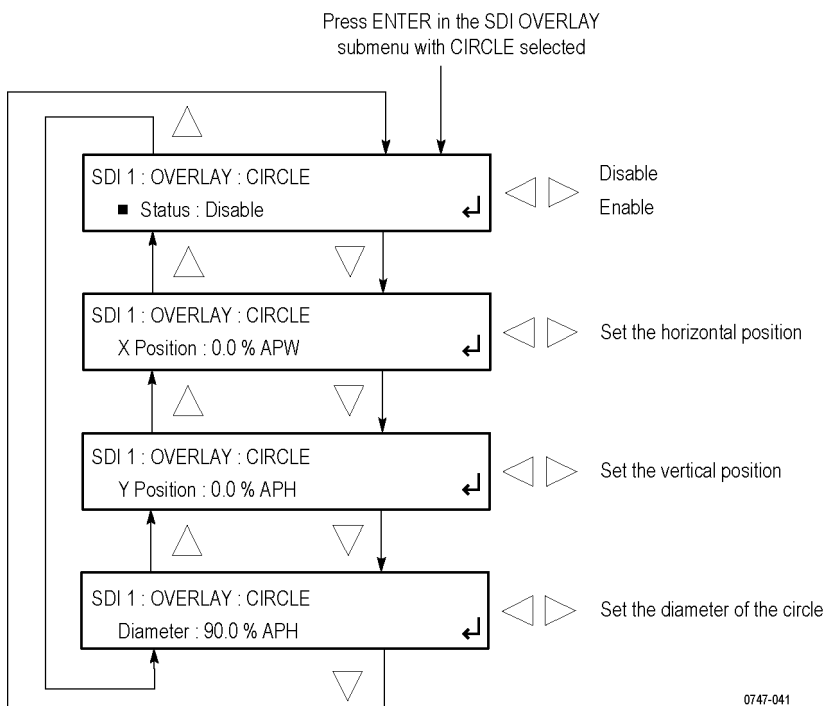


Figure 30: SDI OVERLAY CIRCLE submenu

Status. Enables or disables the circle overlay. Use the left (◀) or right (▶) arrow button to select between **Enable** and **Disable**. Press the **ENTER** button to confirm the selection.

NOTE. The position of the circle overlay is referenced from the center of the active picture.

X Position. Sets the horizontal position of the circle. The position is set as a percentage of active picture width. Use the left (◀) or right (▶) arrow button to change the position. You can set the value from -50.0% to 50.0% in 0.1% steps.

Y Position. Sets the vertical position of the circle. The position is set as a percentage of active picture height. Use the left (◀) or right (▶) arrow button to change the position. You can set the value from -50.0% to 50.0% in 0.1% steps.

Diameter. Sets the diameter of the circle. The diameter is set as a percentage of active picture height. Use the left (◀) or right (▶) arrow button to change the value. You can set the value from 0.0% to 100.0% in 0.1% steps.

SDI OVERLAY BURNT-IN TIMECODE submenu

Use this menu to overlay a timecode on the output test signal and set the display position of the timecode. Use the up (▲) or down (▼) arrow button to change the menu items. The following figure shows the SDI OVERLAY BURNT-IN TIMECODE submenu.

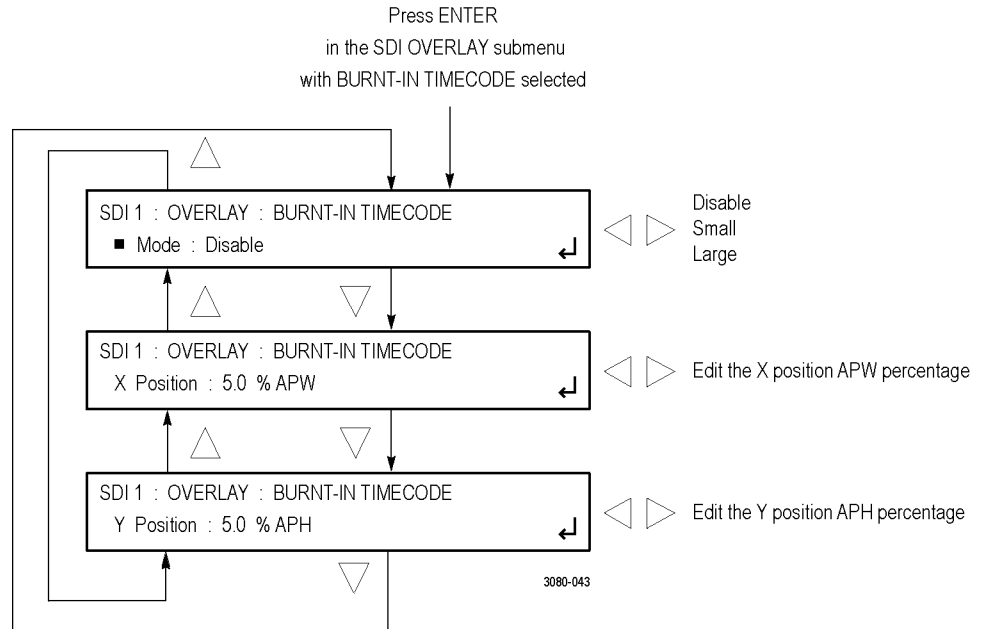


Figure 31: SDI OVERLAY BURNT-IN TIMECODE submenu

Mode. Enables or disables the burnt-in timecode. Use the left (◀) or right (▶) arrow button to select between **Enable**, **Small**, and **Large**. Press the **ENTER** button to confirm the selection.

X Position. Sets the horizontal position of the timecode. The position is set as a percentage of active picture width. Use the left (◀) or right (▶) arrow button to change the position. You can set the value from -50.0% to 50.0% in 0.1% steps.

Y Position. Sets the vertical position of the timecode. The position is set as a percentage of active picture height. Use the left (◀) or right (▶) arrow button to change the position. You can set the value from -50.0% to 50.0% in 0.1% steps.

SDI TIMING submenu

Use this menu to adjust the timing offset of the serial digital video outputs relative to the internal reference signal (frame reset signal). Use the up (▲) or down (▼) arrow button to change the menu items. The following figure shows the SDI TIMING submenu.

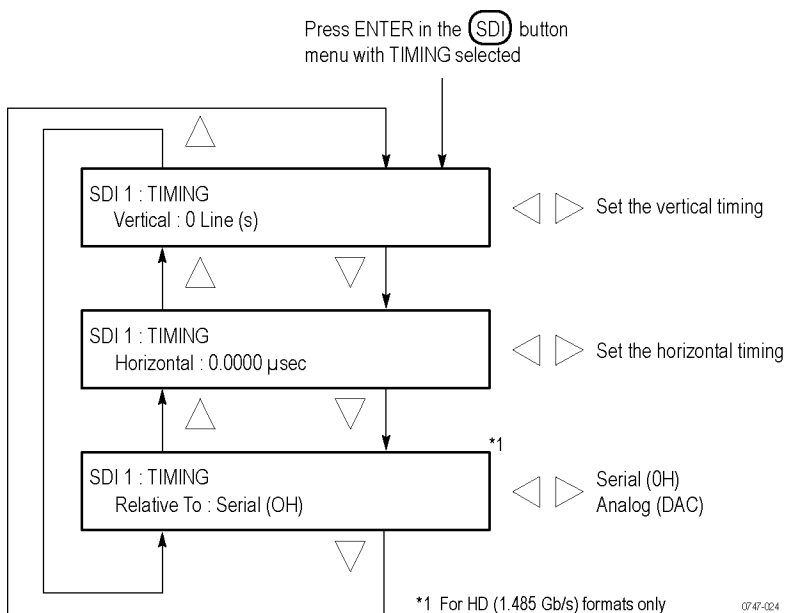


Figure 32: SDI TIMING submenu diagram

Vertical. Sets the vertical timing offset using the left (◀) and right (▶) arrow buttons. You can set the value from $-\frac{1}{2}$ to $+\frac{1}{2}$ frame in 1-line steps.

NOTE. A “line” of timing refers to the timing as if it were a raster scanning a CRT. This may not be the same as the time that a line of data is present on the serial link because of the way that Level B signals are interleaved.

Horizontal. Sets the horizontal timing offset using the left (◀) and right (▶) arrow buttons. You can set the value from -1 to $+1$ line in 1-clock steps.

NOTE. You can reset the timing offset to zero by pressing the left (◀) and right (▶) arrow buttons simultaneously.

Relative To. Sets the Zero Timing D-to-A compensation factor on or off for HD (1.485 Gb/s) and SD (270 Mb/s) formats only. In the serial mode (default), the output timing does not include compensation for the delay through a nominal D-to-A converter. Use the left (◀) or right (▶) arrow button to set the relative timing to either Serial (0H) or Analog (DAC).

SDI TIMECODE submenu

Use this menu to set ancillary timecode (ATC) parameters for the selected output. Use the up (▲) or down (▼) arrow button to scroll through the menu. The following figure shows the SDI TIMECODE submenu.

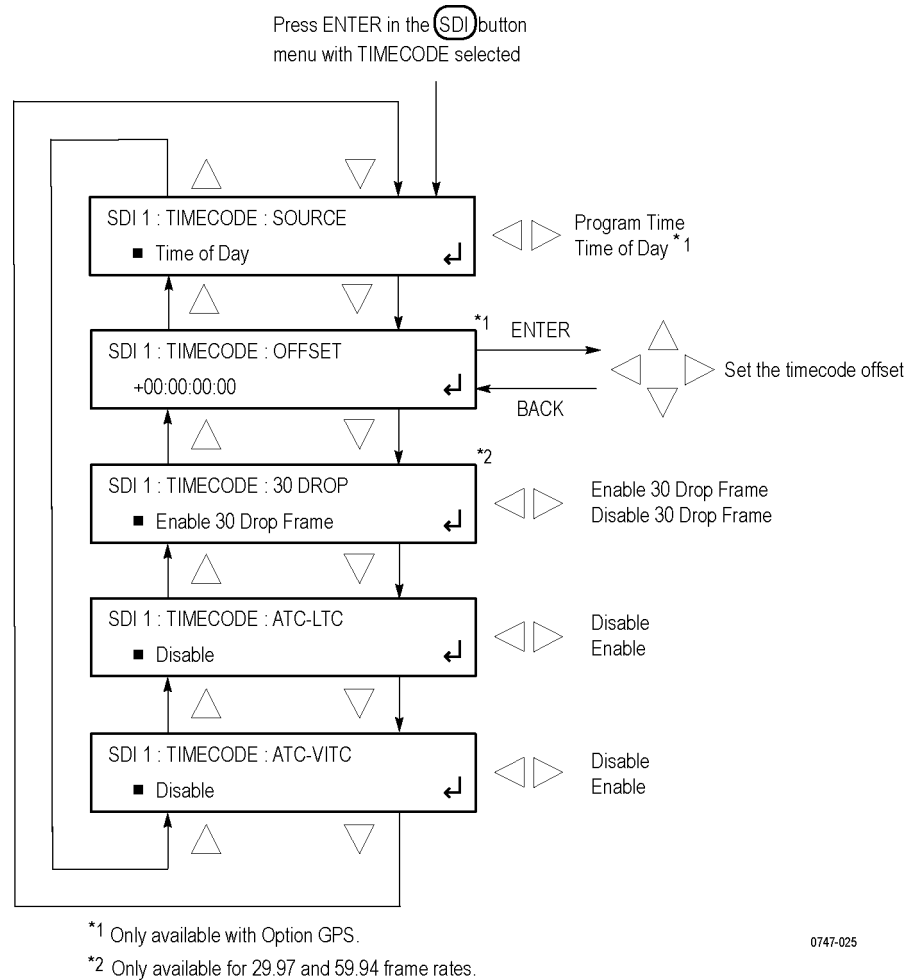


Figure 33: SDI TIMECODE submenu diagram

SOURCE. Use the left (◀) or right (▶) arrow button to select the timecode source from the following choices:

- **PROGRAM TIME:** Uses the program time counter as the timecode.
- **TIME OF DAY:** Uses the time of day, as determined by the GPS module. This menu item is available only if Option GPS is installed in the instrument.

Offset. Use this menu item to set a Timecode Offset for the SDI outputs. This is an offset from the timecode source (Time of Day or Program Time) from the GPS module. Press the **ENTER** button to enter the adjustment mode. Use the left (◀) and right (▶) arrow buttons to position the cursor, and then use the up (▲) and down (▼) arrow buttons to adjust the offset. Press the **ENTER** button to confirm the offset. This menu item is available only when Option GPS is installed in the instrument.

30 DROP. Use this menu to enable or disable the Drop Frame mode for the 30 frame per second timecode format. Use the left (◀) and right (▶) arrow buttons to select between **Enable 30 Drop Frame** and **Disable 30 Drop Frame**. Press the **ENTER** button to confirm the selection. This menu item is available only when the frame or field rate for the current format is 29.97 or 59.94.

ATC-LTC. Use this menu item to enable or disable the Ancillary Linear time code type of ANC packets. Use the left (◀) and right (▶) arrow buttons to select between **Enable** and **Disable**, and then press the **ENTER** button to confirm the selection.

ATC-VITC. Use this menu item to enable or disable the Ancillary Vertical Interval time code type of ANC packets. Use the left (◀) and right (▶) arrow buttons to select between **Enable** and **Disable**, and then press the **ENTER** button to confirm the selection.

SDI VIDEO submenu

Use this menu to modify the video output signal. You can enable or disable individual video components, enable or disable edge filtering on each video line, enable or disable Error Detection and Handling (EDH) packet insertion (SD formats only), and enable or display the AV Timing mode.

Use the up (▲) or down (▼) arrow button to scroll through the menu. The following figure shows the SDI VIDEO submenu.

NOTE. *The items in this menu modify the signal output to make it non-standard. To indicate that the signal is non-standard, an asterisk “*” is inserted at the beginning of the signal name displayed on the STATUS menu.*

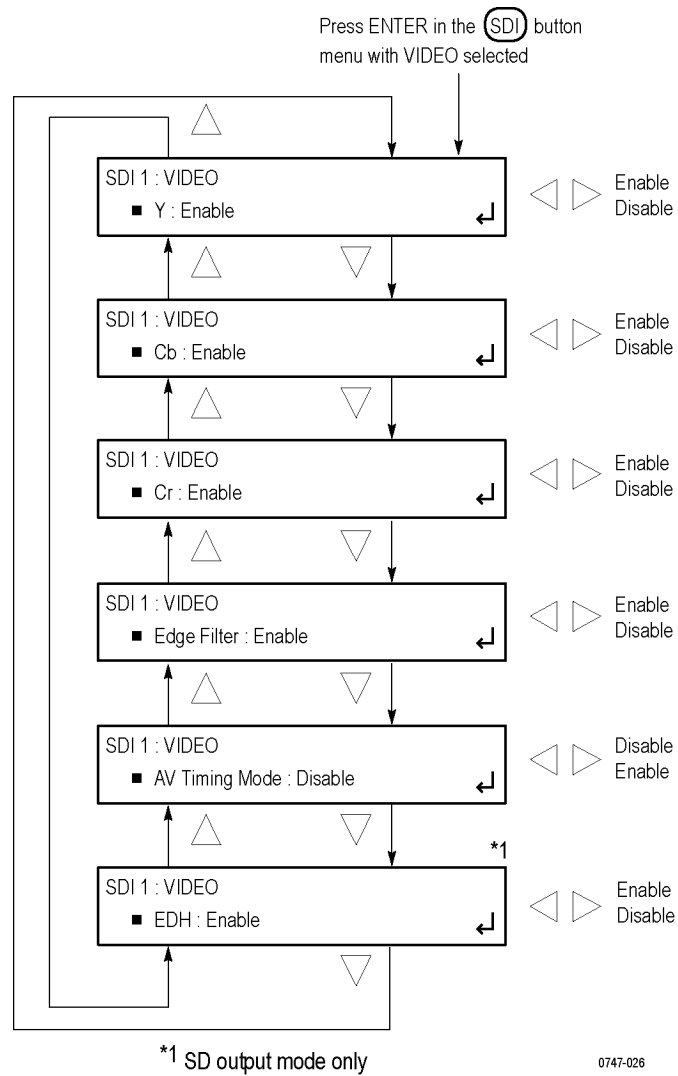


Figure 34: SDI VIDEO submenu diagram

Y. Turns the Y component (YCbCr format), G component (GBR format), or X component (XYZ format) of the serial digital video signal on or off. Use the left (◀) or right (▶) arrow button to select between **Enable** and **Disable**. Press the **ENTER** button to confirm the selection.

Cb. Turns the Cb component (YCbCr format), B component (GBR format), or Y component (XYZ format) of the serial digital video signal on or off. Use the left (◀) or right (▶) arrow button to select between **Enable** and **Disable**. Press the **ENTER** button to confirm the selection.

Cr. Turns the Cr component (YCbCr format), R component (GBR format), or Z component (XYZ format) of the serial digital video signal on or off. Use the left (◀) or right (▶) arrow button to select between **Enable** and **Disable**. Press the **ENTER** button to confirm the selection.

Edge Filter. Enables or disables the Edge Filter on serial digital video signals that have a filter. This control has no effect on signals without a filter. Use the left (◀) or right (▶) arrow button to select between **Enable** and **Disable**. Press the **ENTER** button to confirm the selection.

When the edge filter is enabled, certain data transitions between two levels are run through a low-pass filter to set rise times, pulse widths, and to prevent ringing. If the filter is disabled, the edges will not be filtered. The filter should not be disabled in broadcast environments.

Edge filtering is not necessary in certain environments, such as digital cinema applications and several types of picture monitors and projectors. In these cases, disabling the edge filtering will result in instantaneous level changes for adjacent color bars.

AV Timing Mode. Turns the AV Timing Mode on or off. Use the left (◀) or right (▶) arrow button to select between **Enable** and **Disable**. Press the **ENTER** button to confirm the selection.

In the AV Timing mode, the video and audio are continuously cycled between being on as configured for 1 second then set to black and muted for 4 seconds. Use this signal to measure the AV delay through a system with the AV Timing mode on an appropriate Tektronix waveform monitor or rasterizer.

EDH. (SD output mode only) Turns the insertion of EDH packets on or off. Use the left (◀) or right (▶) arrow button to select between **Enable** and **Disable**. Press the **ENTER** button to confirm the selection.

SDI ANC PAYLOAD submenu

The ancillary data payload can carry non-video information, such as an Active Format Description (AFD), Closed Caption information, or other metadata.

NOTE. *The ancillary inserter can place the data packet anywhere in the field and can overwrite any of the ancillary or video data with a few exceptions; the inserter will not overwrite embedded audio or CRC. Use care to not overwrite important information.*

Use this menu to set the ancillary data payload structure. The ancillary data payload can include information to supplement the video stream, including the Data Identifier (DID), Secondary Data Identifier (SDID), Data Count (DC), User Data Words (UDW), and a Checksum (CS).

The Data Identifier (DID) and Secondary Data Identifier (SDID) indicate the type of data contained in the packet.

The Data Count indicates the number of User Data Words to follow, and the User Data Words (UDW) comprise the actual payload carried in the ancillary data. The instrument addresses User Data Words 000 through 254.

The following figures show the SDI ANC PAYLOAD submenu.

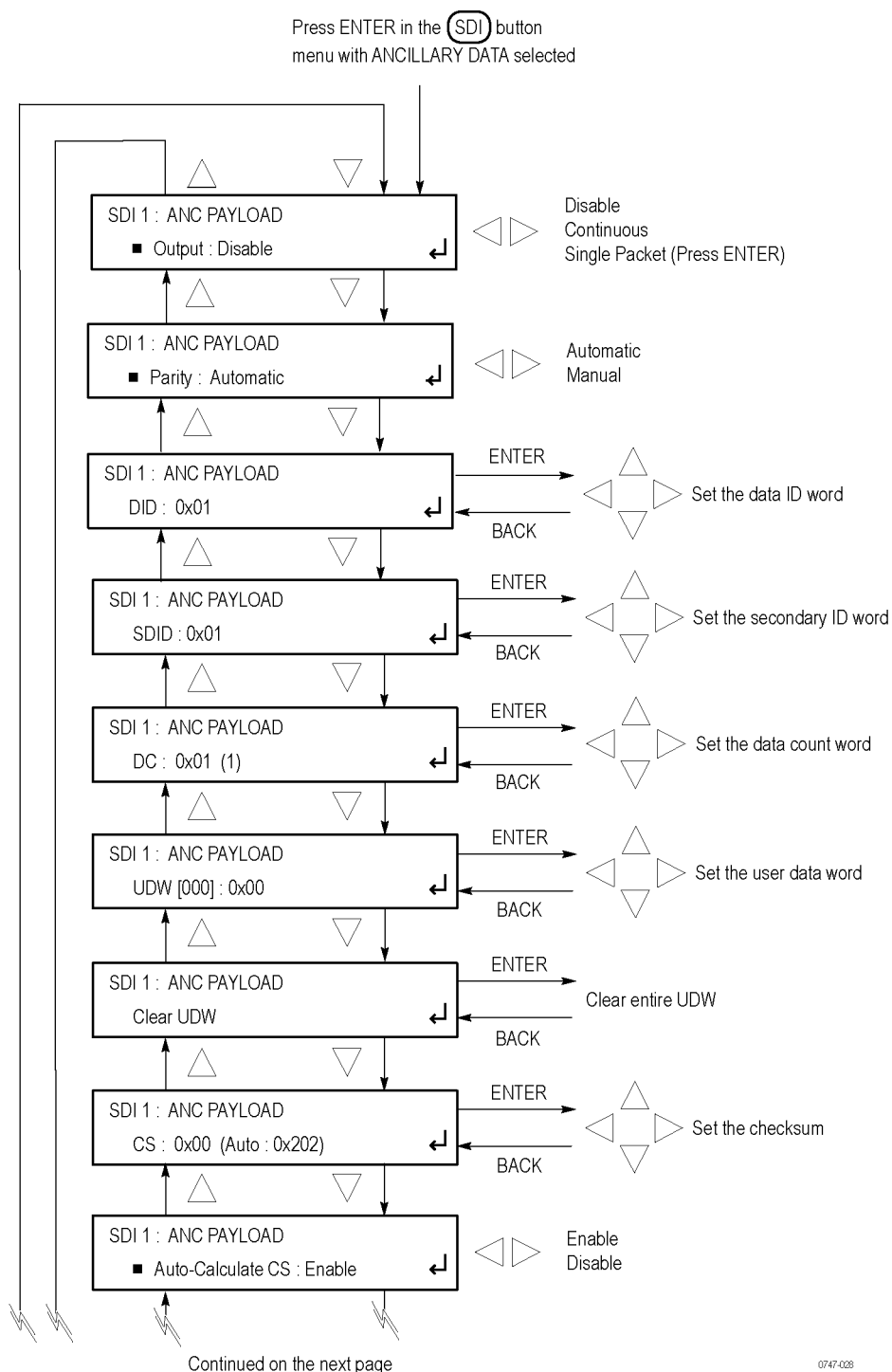


Figure 35: SDI ANC PAYLOAD submenu diagram – part 1

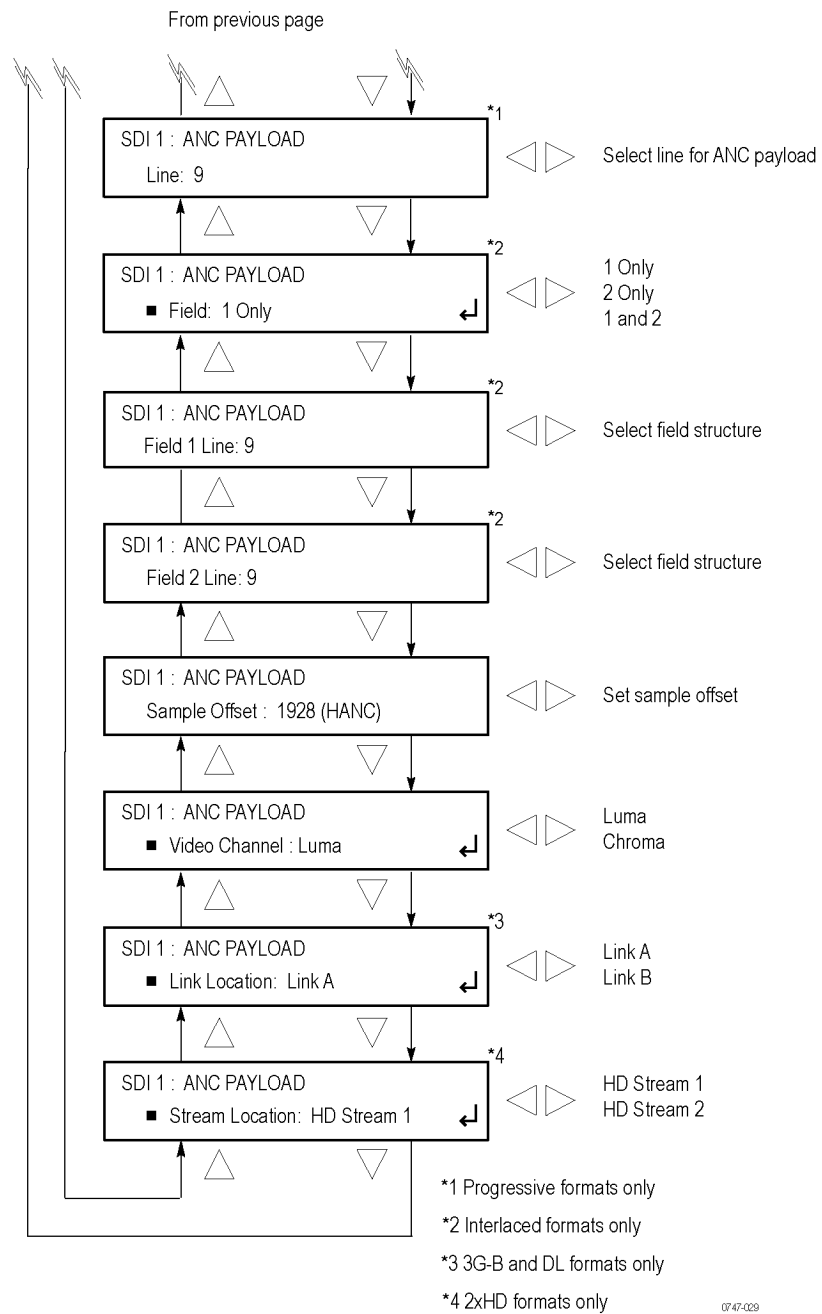


Figure 36: SDI ANC PAYLOAD submenu diagram – part 2

Output. Use the left (◀) and right (▶) arrow buttons to select between **Disable**, **Continuous**, and **Single Packet (Press ENTER)**. Press the **ENTER** button to confirm the selection.

When Single Packet (Press ENTER) is selected, each time you press the ENTER button, one packet on one field is inserted into the SDI video signal.

Parity. Use the left (◀) and right (▶) arrow buttons to select between **Automatic** and **Manual** parity. Automatic parity is an 8-bit mode, while Manual parity allows 10-bits. If a 10-bit word is entered while in manual parity and the module is later set to automatic parity, the correct 8 bits will be sent. The entire 10-bit word is in system memory, though, so if the module is then reset to manual parity the entire 10-bit word entered by the user will be transmitted.

DID. Press the **ENTER** button to edit the Data ID word. You can set the Data ID from 0x00 to 0xFF (in 8-bit mode), or from 0x000 to 0x3FF (in 10-bit mode). Use the left (◀) and right (▶) arrow buttons to position the cursor, and then use the up (▲) and down (▼) arrow buttons to set the number for that position. Press the **ENTER** button to confirm the Data ID and exit Data ID editing.

SDID. Press the **ENTER** button to edit the Secondary ID word. You can set the Secondary ID from 0x00 to 0xFF (in 8-bit mode), or from 0x000 to 0x3FF (in 10-bit mode). Use the left (◀) and right (▶) arrow buttons to position the cursor, and then use the up (▲) and down (▼) arrow buttons to set the number for that position. Press the **ENTER** button to confirm the Secondary ID and exit Secondary ID editing.

DC. Press the **ENTER** button to edit the Data Count word, to show the number of User Data Words to follow. You can set the Data Count from 0x00 to 0xFF (in 8-bit mode), or from 0x000 to 0x3FF (in 10-bit mode). Use the left (◀) and right (▶) arrow buttons to position the cursor, and then use the up (▲) and down (▼) arrow buttons to set the number for that position. Press the **ENTER** button to confirm the Data Count and exit Data Count editing.

UDW. Use this menu item to set a User Data Word. Use the left (◀) and right (▶) arrow buttons to select the User Data Word you wish to edit, from word 000 through word 254, and then press the **ENTER** button to edit that User Data Word. You can set the User Data Word from 0x00 to 0xFF (in 8-bit mode), or from 0x000 to 0x3FF (in 10-bit mode). Use the left (◀) and right (▶) arrow buttons to position the cursor, and then use the up (▲) and down (▼) arrow buttons to set the number for that position. Press the **ENTER** button to confirm the User Data Word and exit User Data Word editing for that word.

NOTE. *To make this process easier, you can use the PC-based TG Setup application. This application also allows you to import and export User Data Words as CSV files.*

CLEAR UDW. Use this menu item to clear the entire User Data Word. Press the **ENTER** button to enter the CLEAR UDW mode, which will present the following dialog:

*	Clear entire UDW?	*
*	Yes : ENTER / No : BACK	*

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Press the **ENTER** button to clear the User Data Word and exit CLEAR UDW, or press the **BACK** button to exit without clearing the User Data Word.

CS. Use this menu item to set the Checksum. Press the **ENTER** button to edit the Checksum. You can set the Checksum from 0x00 to 0xFF (in 8-bit mode), or from 0x000 to 0x3FF (in 10-bit mode). Use the left (◀) and right (▶) arrow buttons to position the cursor, and then use the up (▲) and down (▼) arrow buttons to set the number for that position. Press the **ENTER** button to confirm the Checksum and exit Checksum editing.

Auto-Calculate CS. Use this menu item to enable or disable checksum auto-calculation. Use the left (◀) and right (▶) arrow buttons to select between **Enable** or **Disable**, and then press the **ENTER** button to confirm the choice.

NOTE. Different video modes and formats have different ranges of lines and pixels in their active and ANC spaces. Users should be careful to change the line, field and sample offset parameters of the ANC insertion feature after changing video modes or formats to be sure the ANC data is programmed as desired.

If the line number or sample offset are left at values outside the allowed range for a given format, the packet will not be inserted in the stream. Alternatively if these parameters are left at values near the end of active or ANC space, the packet may overwrite other elements of the stream such as EAV and SAV.

Line. Use this menu item to set the line to carry the ancillary data payload. Use the left (◀) and right (▶) arrow buttons to set the line number. This menu item is available only in progressive formats.

Field. Use this menu item to set the Field to carry the ancillary data payload. Use the left (◀) and right (▶) arrow buttons to select between **1 Only**, **2 Only**, or **1 and 2**. This menu item is available only in interlaced formats.

Field 1 Line: <line number>. Use this menu item to set the line in Field 1 to carry the ancillary data payload. Use the left (◀) and right (▶) arrow buttons to set the line number. This menu item is available only in interlaced formats.

Field 2 Line: <line number>. Use this menu item to set the line in Field 2 to carry the ancillary data payload. Use the left (◀) and right (▶) arrow buttons to set the line number. This menu item is available only in interlaced formats.

Sample Offset. Use this menu item to set the sample number where the ancillary data header will be. This is the first word of the ancillary data packet.

NOTE. *Be sure to change the sample offset when you change the raster size. Otherwise, the ANC insertion may occur in an unexpected place or even be outside the raster structure. The sample offset is set relative to SAV in order to use standard sample numbering. However, this means that the most normal location at the start of HANC varies as a function of raster size.*

Video Channel. Use this menu item to set the video channel to Luma or Chroma. Use the left (◀) and right (▶) arrow buttons to make the selection, and then press the **ENTER** button to confirm it.

Link Location. Use this menu item to set the link location to Link A or Link B. Use the left (◀) and right (▶) arrow buttons to make the selection, and then press the **ENTER** button to confirm it. This menu item is available only in 3G-B formats.

Stream Location. Use the left (◀) and right (▶) arrow buttons to select **HD Stream 1** or **HD Stream 2**, and then press the **ENTER** button to confirm the selection. This menu item is available only in 2×HD formats.

SDI ancillary data payload example

As an example, one of the ancillary data payloads that can be easily generated by the instrument is the Active Format Description (AFD). AFD is a method of identifying the active area of the video picture to be displayed. Using AFD the aspect ratio of the picture can be automatically optimized for the display being used. AFD is defined in SMPTE 2016-1, and mapping AFD and bar data is defined in SMPTE 2016-3. The packet format appears as shown here:

NOTE. *This is an example only. Inserting an AFD packet will not affect the SDI video produced.*

DID: 0x41
SDID: 0x05
DC: 8

UDW[000]	0	AFD Code				AR	0	0
UDW[001]	0	0	0	0	0	0	0	0
UDW[002]	0	0	0	0	0	0	0	0
UDW[003]	T	B	L	R	0	0	0	0
UDW[004]	First bar data (b8 – b15)							
UDW[005]	First bar data (b0 – b7)							
UDW[006]	Second bar data (b8 – b15)							
UDW[007]	Second bar data (b0 – b7)							

CS: automatic calculation

Where AR = aspect ratio (1=16:9, 0=4:3), T = top bar data flag, B= bottom bar data flag, L = left bar data flag, and R = right bar data flag.

Note that these are all eight-bit values for the respective User Data Word. The instrument will automatically calculate the parity bits when Parity is set to Automatic, which is the default.

Most AFD codes do not require bar data information; only the first user data word needs to be defined. For example, one common AFD code for a 16:9 coded frame is “1001” (9), which indicates a 4:3 image, horizontally centered, with pillarboxes, as shown in the following figure:

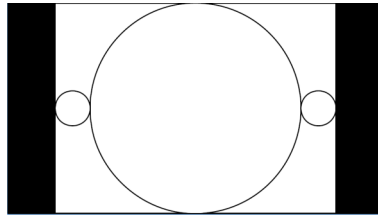


Figure 37: AFD code “1001” for a 16:9 coded frame

Therefore, for this AFD code set the data words as follows:

```
UDW [000]: 0x4C
UDW [001]: 0x00
UDW [002]: 0x00
UDW [003]: 0x00
UDW [004]: 0x00
UDW [005]: 0x00
UDW [006]: 0x00
UDW [007]: 0x00
```

The AFD ancillary data packet should be located in the active line portion of the vertical ancillary space (VANC), but no earlier than the second line after the RP 168 switch point. Line 9 with a sample offset of 0 (first word of active video, immediately after SAV) is a suitable location. The selected video channel should be “Luma” for most ancillary packets, including AFD. Finally, set the **ANC PAYLOAD Output** mode to **Continuous** to start AFD insertion of the active test signal. For this example, the SMPTE RP 219 color bars are an effective test pattern, because the center section of the 16:9 test signal contains the original 4:3 aspect ratio SMPTE pattern.

SDI button menu factory default settings

The following table shows the settings for the SDI button menu that are reset when you use the PRESET submenu to recall the factory default settings. (See page 136, *PRESET submenu*.)

The default settings are identical for the SDI 1 and SDI 2 outputs.

Table 19: SDI button menu factory default settings

Menu item name	Settings
OUTPUT MODE	HD (1920 × 1080)
FORMAT	1080 59.94i
SAMPLE STRUCTURE/DEPTH ¹	YCbCr 4:2:2 10b
ALPHA CHANNEL DATA ²	Use Y/G Channel
2xHD STREAM CONTENT ³	Test Signal / Test Signal
TEST SIGNAL	
COLOR BAR	100% Color Bars
LINEARITY	Limit Ramp
FLAT FIELD	100% Blue Field
MULTIBURST	Y Multiburst 15–30 MHz
ZONE PLATE	Circle Zoneplate
MONITOR	Black-Dark Gray Step Scale
PULSE BAR	Color Pulses
TIMING	Co-siting Pulse
SDI	SDI Matrix
FRAME PICTURE ⁴	No BMP files found in /SDI7/PICTURE/
MOVING PICTURE	
Horizontal Step	0 Sample(s)
Vertical Step	0 Line(s)
Period	1 Frame(s)
Random	Disable

Table 19: SDI button menu factory default settings (cont.)

Menu item name	Settings
OVERLAY : LOGO	
Status	Disable
Source	Tektronix_logo_500x125.bmp
	<p>NOTE. The default logo is the "first" file in the SDI7/LOGO directory, as sorted by the date of the logo file (oldest first). If the factory-provided logo files are installed, the default logo is "Tektronix_logo_500x125.bmp."</p> <p>However, if the user has removed the factory-provided logo files and added their own custom files, then the default logo will be the oldest file installed in the SDI7/LOGO directory.</p>
X Position	-5 % APW
Y Position	-5 % APH
OVERLAY : ID TEXT	
Status	Disable
Source	User-entered string
X Position	5.0 % APW
Y Position	5.0 % APH
Font Size	8.0 % APH
OVERLAY : CIRCLE	
Status	Disable
X Position	0.0 % APW
Y Position	0.0 % APH
Diameter	90.0 % APH
OVERLAY : BURNT-IN TIMECODE	
Mode	Disable
X Position	5.0 % APW
Y Position	5.0 % APH
OVERLAY : BLINK	
Text/Circle Blink	Off
OVERLAY : BORDER	
Text/Circle Border	Enable

Table 19: SDI button menu factory default settings (cont.)

Menu item name	Settings
TIMING	
Vertical	0 Line(s)
Horizontal	0.0000 μ s
Relative To ⁵	Serial (0H)
TIMECODE	
SOURCE ⁶	Without Option GPS: Program Time With Option GPS: Time of Day
OFFSET ⁷	+00:00:00:00
30 DROP ⁸	Enable 30 Drop Frame
ATC-LTC	Disable
ATC-VITC	Disable
VIDEO	
Y	Enable
Cb	Enable
Cr	Enable
Edge Filter	Enable
AV Timing Mode	Disable
EDH ⁹	Enable
ANC PAYLOAD	
Output	Disable
Parity	Automatic
DID	0x01
SDID	0x00
DC	0x01 (1)
UDW	0x00
CS	0x00 (Auto: 0x202)
Auto-Calculate CS	Enable
Field	1 Only
Field 1 Line	9
Field 2 Line	9
Sample Offset	1928 (VANC)
Video Channel	Luma
Link Location ¹⁰	Link A
Stream Location ³	HD Stream 1

Table 19: SDI button menu factory default settings (cont.)

Menu item name	Settings
SMPTE 352 PAYLOAD ID	Enable
SECONDARY OUTPUT	Test Pattern

- ¹ This menu item is available only when Option 3G is installed and when a 3G-SDI 2K format is selected.
- ² This menu item is available only when Option 3G is installed and when a 3G-SDI format is selected with YCbCrA or GBRA sample structure.
- ³ This menu item is available only when Option 3G is installed and when a 3G-SDI 2xHD format is selected.
- ⁴ You must load frame picture files into the /SDI7/PICTURE/ directory in order to select a frame picture signal for output.
- ⁵ This menu item is available only for HD (1.485 Gb/s) formats.
- ⁶ The default timecode source depends on whether Option GPS is installed.
- ⁷ This menu item is available only when Option GPS is installed.
- ⁸ This menu item is available only for non-integer frame rates.
- ⁹ This menu item is available only when the output mode is set to SD.
- ¹⁰ This menu item is available only when Option 3G is installed and when a 3G-Level B format is selected.

How to select an SDI output signal

To select an output signal, perform the following procedure to generate either 3 Gb/s SDI, 1.5 Gb/s HD-SDI, or 270 Mb/s SD video test signals:

1. Select the output mode. (See page 68, *OUTPUT MODE*.)
2. Select the signal format. (See page 70, *FORMAT*.)
3. Select the sample structure and depth. (See page 70, *SAMPLE STRUCTURE/DEPTH*.)
4. Select the test signal that you want to generate. (See page 72, *SDI TEST SIGNAL submenu*.)

Available SDI output signals

The following tables list the available SDI output signals and their associated structure.

Table 20: SDI (Option 3G only) – 3G Level A (1920 × 1080)

Structure			59.94i	50i	60i	23.98p	24p	25p	29.97p	30p	50p	59.94p	60p	23.98psf	24psf	25psf	29.97psf	30psf
YCbCr	4:4:4	12b	X	X	X	X	X	X	X	X				X	X	X	X	X
		10b	X	X	X	X	X	X	X	X				X	X	X	X	X
YCbCr+A		10b	X	X	X	X	X	X	X	X				X	X	X	X	X
YCbCr	4:2:2	12b	X	X	X	X	X	X	X	X				X	X	X	X	X
		10b									X	X	X					
GBR	4:4:4	12b	X	X	X	X	X	X	X	X								
		10b	X	X	X	X	X	X	X	X				X	X	X	X	X
GBR+A		10b	X	X	X	X	X	X	X	X				X	X	X	X	X

Table 21: SDI Option 3G only) – 3G Level A (1280 × 720)

Structure			59.94i	50i	60i	23.98p	24p	25p	29.97p	30p	50p	59.94p	60p	23.98psf	24psf	25psf	29.97psf	30psf
YCbCr	4:4:4	10b				X	X	X	X	X	X	X	X					
YCbCr+A	4:4:4	10b				X	X	X	X	X	X	X	X					
GBR	4:4:4	10b				X	X	X	X	X	X	X	X					
GBR+A	4:4:4	10b				X	X	X	X	X	X	X	X					

Table 22: SDI (Option 3G only) – 3G Level A (2K × 1080)

Structure			59.94i	50i	60i	23.98p	24p	25p	29.97p	30p	50p	59.94p	60p	23.98psf	24psf	25psf	29.97psf	30psf
XYZ	4:4:4	12b				X	X	X	X	X				X	X	X	X	X
GBR						X	X	X	X	X				X	X	X	X	X

Table 23: SDI (Option 3G only) – 3G Level B (1920 × 1080)

Structure			59.94i	50i	60i	23.98p	24p	25p	29.97p	30p	50p	59.94p	60p	23.98psf	24psf	25psf	29.97psf	30psf
YCbCr	4:4:4	12b	X	X	X	X	X	X	X	X				X	X	X	X	X
		10b	X	X	X	X	X	X	X	X				X	X	X	X	X
YCbCr+A		10b	X	X	X	X	X	X	X	X				X	X	X	X	X
YCbCr	4:2:2	12b	X	X	X	X	X	X	X	X				X	X	X	X	X
		10b									X	X	X					
YCbCr+A		12b	X	X	X	X	X	X	X	X				X	X	X	X	X
GBR	4:4:4	12b	X	X	X	X	X	X	X	X				X	X	X	X	X
		10b	X	X	X	X	X	X	X	X				X	X	X	X	X
GBR+A		10b	X	X	X	X	X	X	X	X				X	X	X	X	X

Table 24: SDI (Option 3G only) – 3G Level B (2K × 1080)

Structure			59.94i	50i	60i	23.98p	24p	25p	29.97p	30p	50p	59.94p	60p	23.98psf	24psf	25psf	29.97psf	30psf
XYZ	4:4:4	12b				X	X	X	X	X				X	X	X	X	X
GBR						X	X	X	X	X				X	X	X	X	X

Table 25: SDI (Option 3G only) – 3G Level B (2×HD 1080)

Structure			59.94i	50i	60i	23.98p	24p	25p	29.97p	30p	50p	59.94p	60p	23.98psf	24psf	25psf	29.97psf	30psf
YCbCr	4:2:2	10b	X	X	X	X	X	X	X	X				X	X	X	X	X

Table 26: SDI (Option 3G only) – 3G Level B (2×HD 720)

Structure			59.94i	50i	60i	23.98p	24p	25p	29.97p	30p	50p	59.94p	60p	23.98psf	24psf	25psf	29.97psf	30psf
YCbCr	4:2:2	10b				X	X	X	X	X	X	X	X					

Table 27: SDI – HD-SDI (1920 × 1080)

Structure			59.94i	50i	60i	23.98p	24p	25p	29.97p	30p	50p	59.94p	60p	23.98psf	24psf	25psf	29.97psf	30psf
YCbCr	4:2:2	10b	X	X	X	X	X	X	X	X				X	X	X	X	X

Table 28: SDI – HD-SDI (1280 × 720)

Structure			59.94i	50i	60i	23.98p	24p	25p	29.97p	30p	50p	59.94p	60p	23.98psf	24psf	25psf	29.97psf	30psf
YCbCr	4:2:2	10b				X	X	X	X	X	X	X	X					

Table 29: SDI – SD-525 (720 × 486)

Structure			59.94i	50i	60i	23.98p	24p	25p	29.97p	30p	50p	59.94p	60p	23.98psf	24psf	25psf	29.97psf	30psf
YCbCr	4:2:2	10b	X															

Table 30: SDI – SD-625 (720 × 576)

Structure			59.94i	50i	60i	23.98p	24p	25p	29.97p	30p	50p	59.94p	60p	23.98psf	24psf	25psf	29.97psf	30psf
YCbCr	4:2:2	10b		X														

SDI picture file generation

Frame pictures are .bmp files that are used to generate pictures. For information about how to install your own custom frame pictures, see the *How to transfer or install user files* section in the *SPG8000 Quick Start User Manual*.

When generating signals from frame pictures, the instrument does not filter the video signal except at the left and right borders of the raster. The unfiltered signal allows users to control exactly what is generated and to create stressful patterns.

The instrument allows picture files to be used at resolutions larger and smaller than the native size of the picture file. If the picture image is larger than needed, it will be truncated and only the upper left corner of the image will be displayed. If the picture file resolution is smaller than the output raster, then the image will be displayed in the upper left corner of the output, and black will be shown in the rest of the image.

The combination of not filtering and the use of nonnative image sizes has the potential to cause problems in several areas:

- If the video in the frame picture file has fast transitions that exceed the normal video limits, then the final output may ring excessively and therefore not be appropriate for transmission. In most cases, the picture file should be processed to limit the edge speed before it is downloaded to the instrument.
- If the video in the frame picture file is not shaped at the edges of the raster, then there may be ringing if the signal is put in motion. If this is a concern, then the picture file should be processed to have gradual transitions at the edges before it is downloaded.
- If the frame picture file is used at a raster that is smaller than the native size of the file, then it will be truncated at the output raster size which may create unshaped edges. These will be masked for normal operation, but will be exposed if the signal is set in motion. If this is a problem, then the user should create a second version of the picture file that has the desired native raster size and has shaped edges.
- If a frame picture file is used at a raster size greater than the native size of the file, then the two edges will inherently end up somewhere inside the output raster image. If the file has unshaped edges, then the output may have excessive ringing even when not in motion. If this is a concern, then the picture file should be processed to have gradual transitions at the edges before it is downloaded.

SDI Zone plate signals

Zone plate video test patterns, or simply “zone plates”, are important tools for the evaluation of video processing systems and techniques.

They are called zone plates because the classical circular pattern looks like an optical zone plate (which uses the principles of Fresnel diffraction to focus and intensify light). Today, however, the name has been applied to a wide variety of stationary and “moving” test patterns.

The following figure shows two enlarged optical zone plates. The white areas are transparent and the black areas are opaque. The precise spacing of the rings focuses and intensifies light that passes through the plate.

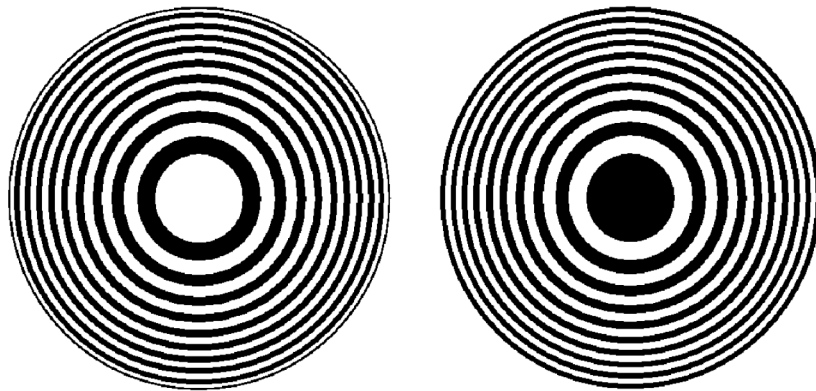


Figure 38: Optical zone plates (enlarged)

When Option SDI is installed, the instrument generates electronic zone plate signals, and can be configured to provide a near infinite number of test patterns. Six basic patterns are predefined (Circle, Diagonal, Horizontal Sine, Horizontal Sweep, Vertical Sine, and Vertical Sweep) for convenience. These patterns all have an overall, or pattern control, parameter.

Pattern control parameters are unique to the specific predefined signals, and are only found as the first item of the specific signal menu. User-created zone plate signals saved as Custom-1 or Custom-2 do not have pattern control parameters. The dependent parameters are common to all of the zone plate signals, and are found below the pattern control parameter in the menu for each zone plate signal.

Altering the pattern control parameter will make changes to the test signal while maintaining the basic pattern. For example, the pattern control parameter for the Circle zone plate signal is the Circle Frequency parameter. The Circle Frequency parameter controls the maximum frequency of the circle. You may alter the Circle Frequency at will, and the system will adjust four other dependent parameters to maintain the pattern as a circle. However, if you alter the underlying dependent parameters individually the pattern may change to be something other than a circle.

After changes have been made you can save the new signal as a custom zone plate signal.

To use a zone plate signal

Zone plate signals can be accessed from the SDI button TEST SIGNAL submenu. (See page 72, *SDI TEST SIGNAL submenu*.) Here is an example of how you can use zone plate signals to simplify a common task.

One common task is measuring the horizontal frequency response of a system. With a typical swept-frequency generator you would apply a signal such as a 1 MHz to 30 MHz sweep with markers every 5 MHz. Then you try to estimate the frequency of the 3 dB roll-off point by interpolating the position of the 3 dB point between the markers.

The instrument's adjustable zone plate signal provides a better way:

- The H Sweep Zoneplate pattern control parameter is the H Sweep Frequency, which controls the upper frequency limit of the sweep (the swept-to frequency).
 - Simply adjust the H Sweep Frequency until the system roll-off is at –3 dB.
 - Read the frequency directly from the instrument display.
- The H Sine Zoneplate, which provides a constant frequency horizontal sine signal instead of a swept signal, can be used to reduce error in measuring attenuation at a given frequency.
 - Set the Horz. Frequency parameter to a low value and measure the amplitude of the entire line.
 - Next, calculate the –3 dB point ($0.707 \times$ the low frequency amplitude).
 - Finally, increase the Horz. Frequency parameter until the system response for the whole line is at the calculated –3 dB level, and read the –3 dB frequency directly from the instrument display.
- Since the ZP Amplitude parameter is adjustable for each of these signals, you can measure the response at 100%, 60%, or any other level as needed.

These same techniques can be used to measure vertical or diagonal response, by selecting the appropriate zoneplate signal.

To modify a zone plate signal

There are times when a specific test case requires a modified zone plate signal. By making and saving changes to the zone plate parameters you can create a new signal that is based on the selected signal, and then save that new signal. Changes you make affect only the new signal; the standard zone plate signal used as a basis for the new signal is not changed.

Before making changes, make sure you are familiar with both the zone plate pattern control parameters and zone plate pattern dependent parameters. (See page 114, *Zone plate pattern control parameters*.) (See page 116, *Zone plate dependent parameters*.)

Perform the following steps to change a zone plate signal's parameters:

1. Press the **SDI** button and use the down (▼) arrow button to navigate to TEST SIGNAL. Press the **ENTER** button to access the TEST SIGNAL submenu.
2. Use the down (▼) arrow button to navigate to ZONE PLATE.
3. Use the left (◀) or right (▶) arrow button to select a zone plate signal from the provided six standard zone plate signals (Circle, Diagonal, H Sine, H Sweep, V Sine, and V Sweep), or two user-defined signals (Custom-1 Zoneplate or Custom-2 Zoneplate).
4. When the desired zone plate signal is displayed, press the **ENTER** button to enter the zone plate parameter menu. If **Circle Zoneplate** was displayed, for example, the display changes to:

SDI 1 : ZONE PLATE : CIRCLE SWEEP
Circle Frequency: x c/aph

07/47/031

which shows the zone plate signal (CIRCLE SWEEP) and the pattern control parameter (Circle Frequency). As mentioned earlier, each of the standard zone plate signals have a pattern control parameter that is unique to that signal:

Zone plate signal	Pattern control parameter
Circle	Circle frequency: [x] c/aph ¹
Diagonal	Diag. Frequency: [x] c/aph ¹
H Sine	Horiz. Frequency: [x] MHz
H Sweep	H Sweep Frequency: [x] MHz
V Sine	Vert. Frequency: [x] c/aph ¹
V Sweep	V Sweep Frequency: [x] c/aph ¹

¹ c/aph = cycles per active picture height

5. While the pattern control parameter is displayed, you can use the left (◀) or right (▶) arrow button to modify it. This will modify the signal while maintaining the basic pattern.

NOTE. Press the left (◀) and right (▶) arrow buttons at the same time to reset any parameter.

6. Use the up (▲) or down (▼) arrow button to scroll through the parameters menu which, for the predefined signals, starts with it's unique pattern control parameter as shown in the table above, and then continues through the list of dependent parameters. At each parameter, whether it's a pattern control parameter or a dependent parameter, you can use the left (◀) or right (▶) arrow button to modify it.

7. When you are done altering parameters, scroll to the **Save As:** menu item at the bottom of the menu and use the left (◀) or right (▶) arrow button to select **User Custom 1** or **User Custom 2**.
8. Press the **ENTER** button to save the modified signal.

Zone plate pattern control parameters

NOTE. *Zone plate variations can be sinusoidal, square, or triangular. These discussions of zone plated parameters will refer to sinusoidal variations for convenience.*

Zone plate patterns are made up of sinusoidal variations in luminance, with the “peaks” of the sine waves resulting in white areas on the video screen and the wave “troughs” shown as gray or black. The cycles can occur in all three of the video dimensions: horizontally, or along each line of the picture; vertically, or “down” the video frame; and temporally (with time). The three dimensions are often referred to by the shorthand designations of X, Y, and T.

The luminance of any point in the picture, physically on the screen and in time, is determined by the value of sine at that particular point; the value of sine follows from the phase of the cycle at that point; and (by the definition of a zone plate) the phase of any point is determined by the equation:

$$\phi_{xyt} = k_{\phi} + k_X(x) + k_Y(y) + k_T(t) + k_{XT}(xt) + k_{YT}(yt) + k_{XY}(xy) + \frac{1}{2}k_{X^2}(x^2) + \frac{1}{2}k_{Y^2}(y^2) + \frac{1}{2}k_{T^2}(t^2)$$

where x, y, and t are the coordinates of the point in question and k_{ϕ} , k_X , k_Y , k_T , k_{XT} , k_{YT} , k_{XY} , k_{X^2} , k_{Y^2} , and k_{T^2} are constants.

All instrument zone plate patterns are defined with coefficients of ten parameters that correspond to the constants in the above equation. Note that while the possibilities are virtually endless, most common zone plates are defined with only one or two parameters, while the coefficients of the remaining parameters are kept at zero.

The instrument generates six standard zone plate signals: circle frequency, diagonal frequency, horizontal sine frequency, horizontal sweep frequency, vertical sine frequency, and vertical sweep frequency. Each standard zone plate signal has a pattern control parameter. (See Table 31.) This pattern control parameter is unique to the zone plate signal it is associated with.

When you first enter the zone plate parameters menu for a signal, the pattern control parameter for that signal is displayed. The pattern control parameter controls the basic pattern frequency by adjusting the dependent parameters. For example, if you change the CIRCLE SWEEP Circle Frequency, the generator adjusts four of the dependent parameters to keep the circle round.

Table 31: Zone plate pattern control parameters

Zone plate signal	Pattern control parameter	Parameter definition
Circle	Circle Frequency (maximum c/aph)	The circle frequency is actually the equivalent of the maximum vertical sinusoid frequency at the very top and bottom of the screen (see the discussion of the K_V^2 parameter). Adjusting the circle frequency has the simple effect of increasing or decreasing the maximum frequency at the outer edges of the pattern. However, this adjustment actually changes the coefficients of four of the zone plate parameters to keep the pattern round and centered on the screen.
Diagonal	Diagonal Frequency (equivalent c/aph)	The diagonal frequency is $\sqrt{2}$ times the vertical and horizontal frequencies (c/aph). Adjusting the diagonal sine frequency changes both the K_X and K_Y coefficients.
H Sine	Horizontal Frequency (MHz)	The horizontal frequency reported on the display is the real time frequency of the sine wave that causes the vertical bar pattern. The maximum frequency is half of the clock frequency used by the generator for the active video standard (for example, $74.25 \text{ MHz}/2 = 37.125 \text{ MHz}$).
H Sweep	H Sweep Frequency (maximum MHz, or multiple)	For horizontal sweep frequencies up to half of the video standard's sampling frequency, f_s , the displayed value is the maximum (or swept to) frequency of the sine wave. For numbers greater than $f_s/2$, dividing the displayed value by the sampling frequency will give the number of complete DC-($f_s/2$)-DC cycles per line. For example, in a standard with sampling frequency of 74.25 MHz, a horizontal sweep frequency of 148.5 MHz will result in approximately two complete frequency sweeps across the picture.
V Sine	Vertical Frequency (c/aph)	The vertical frequency is actually the K_V coefficient. The maximum frequency (c/aph) corresponds to the number of active video lines in a field of the active video standard. For example, when an 1125-line system is output (which has 1080 active lines), K_V can be any value between -540 and 540.
V Sweep	V Sweep Frequency (maximum c/aph, or multiple)	The vertical sweep frequency is actually the K_V^2 coefficient. For numbers greater than maximum, dividing the displayed value by that maximum will give twice the number of complete DC-max-DC sweeps per field (sweeps = $(K_V^2/K_V)/2$). For example, in a standard with 1080 lines per field, a vertical sweep frequency of 2160 c/aph ² would result in one complete frequency sweep down the picture.

Zone plate dependent parameters

Below the pattern control parameter in each of the parameter menus are the dependent parameters. The dependent parameters are the same for all the zone plate patterns. Use the up (▲) or down (▼) arrow button to scroll through the parameter menu. If desired, use the left (◀) or right (▶) arrow button to change the parameter.

NOTE. Press the left (◀) and right (▶) arrow buttons at the same time to reset any parameter to its default value.

If you adjust any one of the dependent parameters individually, the pattern control parameter will become invalid, and you will see this message:

*	Top param will be invalid. Continue?	*
*	Yes : ENTER / No : BACK	*

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The zone plate dependent parameters are discussed here, in the order in which they appear below the pattern control parameter, when using the down (▼) arrow button to scroll through the parameter menu. The Custom-1 and Custom-2 signal selections do not have pattern control parameters, and start with the Zone Plate Amplitude Parameter.

Zone plate amplitude parameter.

Display name: ZP Amplitude

Units: mV

Use this parameter to adjust the zone plate signal amplitude from 0.0 mV to 798.0 mV, in 0.5 mV increments. The default value is 700 mV.

K_x parameter.

Display name: KX (H Freq.)

Units: cycles/active picture height (c/aph)

K_x denotes the initial constant horizontal frequency of the pattern. To see the effects of changing this coefficient, set a waveform monitor to view the video lines. Note that the units are cycles per active picture height. The number of cycles in a line will depend on the width-to-height aspect ratio of the active format. For example, K_x = 9.0 will result in approximately 12 cycles per line in a format with a 4:3 aspect ratio; the same setting will yield about 16 cycles per line when the ratio is 16:9.

To estimate the equivalent absolute frequency of the sine wave (i.e., to convert from c/aph to c/s, or Hz), use the formula

$$f_{eq} \approx K_X \times R_{l:av} \times R_{aspect} \times N_{lines} \times f_{frame}$$

where

R_{aspect} = the aspect ratio (width ÷ height)

N_{lines} = the number of lines per frame

f_{frame} = the frame rate

R_{l:av} = the ratio of line length to the length of the active video

The maximum frequency is (±) half of the active format's sampling frequency. In formats that use a 74.25 MHz clock, for example, the maximum value of KX will correspond to a sine frequency of 37.1 MHz.

The Horizontal Sine zone plate, for example, is a “K_x-only” zone plate. (See Figure 39.)

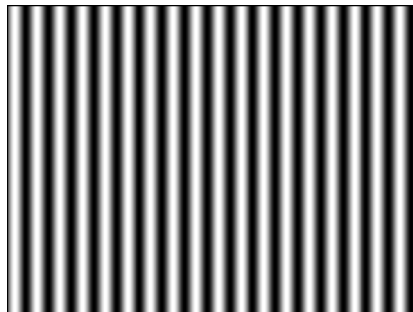


Figure 39: A “K_x-only” zone plate

K_X^2 parameter.Display name: KX^2 (H Sweep.)Units: c/aph per active picture height (c/aph²)

The K_X^2 (H Sweep) parameter sets the increase (or decrease) in the horizontal frequency as a function of position along the video line. When K_X^2 alone is applied, the result resembles a common sweep test signal. Again, use a waveform monitor to look at (all) the video lines to see the effects of K_X^2 . When K_X is 0.0, setting K_X^2 to 9 will result in the line waveform changing from DC to 9 c/aph in the width equal to one “active picture height.” As with K_X , the ending frequency will depend on the aspect ratio of the active video format. For example, in a 16:9 format with a K_X of -9.0, a K_X^2 coefficient of 9.0 will cause the waveform to increase to DC in one “aph.” The frequency will continue to increase to approximately 7.0 c/aph by the end of the line.

Use this formula to calculate K_X and K_X^2 terms for a sweep with the DC point at mid-screen:

$$K_X = \left(-\frac{1}{2}R_{aspect}\right) \times K_X^2$$

where R_{aspect} is the aspect ratio (width ÷ height) of the active format.

The Horizontal Sweep zone plate (H Sweep) is a “ K_X^2 -only” zone plate. (See Figure 40.)

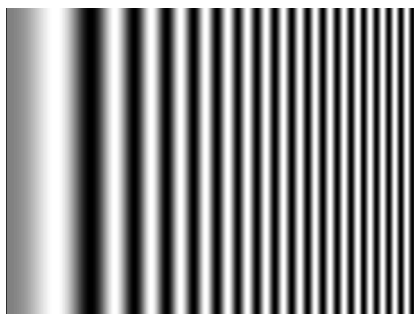


Figure 40: A “ K_X^2 -only” zone plate

K_{XY} parameter.

Display name: KXY (V Ch. H Freq.)

Units: c/aph per active picture height (c/aph²)

The K_{XY} (V Ch. H Freq.) parameter sets the change in horizontal frequency as a function of the vertical position in the video frame. To see the effects of this parameter, set the waveform monitor to view one selected line only. Then, with K_{XY} set to approximately 25 (all other coefficients left at 0.0), look at line waveforms from top to bottom of the frame. The horizontal frequency increases slightly on each succeeding line, reaching 25 c/aph on the last line of active video. The result can be thought of as a vertically arranged “sweep” signal.

K_Y parameter.

Display name: KY (V Freq.)

Units: cycles per active picture height (c/aph)

The K_Y (V Freq.) parameter sets the initial *vertical* frequency of the pattern (it is analogous to K_X rotated 90° clockwise). To see the effects of this parameter, set it to a low number and adjust a waveform monitor to view one or two fields of the instrument SDI output. The variation in the (dc) voltage level from line to line will give the field waveform the appearance of a sampled sine wave, especially at a K_Y of around 5 to 10 c/aph (the sinusoid can become difficult to discern at higher frequencies). Note that in the Y (vertical) parameters, the c/aph units translate directly into visible cycles down the frame.

The Vertical Sine zone plate is a “K_Y-only” zone plate. (See Figure 41.)



Figure 41: A “K_Y-only” zone plate

K_Y^2 parameter.

Display name: KY^2 (V Sweep).

Units: c/aph per active picture height (c/aph²)

The K_Y^2 (V Sweep) parameter sets the increase (or decrease) in vertical frequency down the frame. (K_Y^2 compares to K_X^2 as K_Y compares to K_X .) Again, a good way to see the effect of K_Y^2 is to view the field on a waveform monitor. With KY set to 0.0, a K_Y^2 coefficient of 10 will result in the apparent vertical sine wave changing from DC to 10 c/aph from the top of the picture to the bottom.

To center the “DC point” at mid-screen, set K_Y^2 to -2 times K_Y .

The Vertical Sweep zone plate is a “ K_Y^2 -only” zone plate. (See Figure 42.)



Figure 42: A “ K_Y^2 -only” zone plate

K parameter.

Display name: K (Phase)

Units: cycles

The K_\emptyset parameter is the initial phase of the pattern; it cannot create a pattern by itself. To see the effects of this adjustment, first set the K_X coefficient to approximately 0.75 and set a waveform monitor to view the line waveform. Then adjust K_\emptyset . The sine wave will begin on each line at the selected point in the cycle. Note that 0.25 cycle corresponds to a phase of 90 degrees (or $\pi/2$ radians); recall that the sine of 90° is 1.0 and the sine of -90° is -1.0 . When $K_\emptyset = 0.25$, the pattern will begin in the upper left corner of the screen as white; when $K_\emptyset = -0.25$, the beginning will be black.

K_{XT} parameter.

Display name: KXT (T Ch. H Freq.)

Units: c/aph per second (c/aph/s)

The K_{XT} (T Ch. H Freq.) parameter controls the change in horizontal sine frequency over time. Setting K_{XT} to 1.0, for example, causes the horizontal frequency to increase by one c/aph each second. If K_X is 0.0, then the frequency will be 10 c/aph after ten seconds, 20 c/aph after twenty seconds, and so forth. The frequency will increase until it reaches the maximum for the active format, then the phase of the signal will “flip” by 180° (the sine wave will become “negative”) and the frequency will continue to “increase” through DC, when the cycle will begin again.

K_{YT} parameter.

Display name: KYT (V Ch. V Freq.)

Units: c/aph per second (c/aph/s)

The K_{YT} (V Ch. V Freq.) parameter controls the change in vertical sine frequency over time. Setting K_{YT} to 1.0, for example, causes the vertical frequency to increase by one c/aph each second. If K_Y is initially 0.0, then the frequency will be 10 c/aph after ten seconds, 20 c/aph after twenty seconds, and so forth. The frequency will increase until it reaches the maximum for the active format, then the phase of the signal will “flip” by 180° (the frequency will become “negative”) and the frequency will continue to increase through DC in a repetitive cycle.

K_T parameter.

Display name: KT (T Freq.)

Units: cycles per second (c/s)

The K_T (T Freq.) parameter, if used alone, does not create a “pattern.” Rather, the entire screen will cycle (sinusoidally) between white and black. The effect will be similar on either line or field display of a waveform monitor.

Typically, a small K_T coefficient is set to add apparent motion to a standard circle, sine wave, or sweep pattern. To see the picture effects of this parameter, select any of the standard zone plates and vary K_T. Note that the K_T coefficient may be positive or negative; the sign will determine the direction of the pattern’s motion.

K_T^2 parameter.Display name: K_T^2 (T Sweep)Units: cycles per second per second (c/s^2)

The K_T^2 (T Sweep) parameter sets the change in temporal frequency over time. If K_T is initially 0.0, setting K_T^2 to 1.0 will result in an apparent K_T of 10.0 after ten seconds, 20.0 after twenty seconds, and so forth. The temporal frequency will increase to maximum, return to 0.0, and repeat the cycle as long as the value of K_T^2 remains greater than zero.

Y/G/X parameter. This parameter displays one of the three signal components: the Y component for a YC_bC_r sample structure, the G component for a GBR sample structure, or the X component for an XYZ sample structure. Use the left (◀) or right (▶) arrow button to set the component to **ON** or **OFF**.

Cb/B/Y parameter. This parameter displays one of the three signal components: the C_b component for a YC_bC_r sample structure, the B component for a GBR sample structure, or the Y component for an XYZ sample structure. Use the left (◀) or right (▶) arrow button to set the component to **ON** or **OFF**.

Cr/R/Z parameter. This parameter displays one of the three signal components: the C_r component for a YC_bC_r sample structure, the R component for a GBR sample structure, or the Z component for an XYZ sample structure. Use the left (◀) or right (▶) arrow button to set the component to **ON** or **OFF**.

NOTE. When the sampling structure for the current format uses the YC_bC_r color space, the default settings enable only the Y channel. This results in the familiar black to white zone plate patterns. When the RGB color space is used the default settings enable all three channels, also resulting in the black to white zone plate patterns. A colored zone plate pattern can be created by enabling or disabling individual channels. When the XYZ color space is used, the resultant patterns will show some chroma in all combinations of the X/Y/Z channel settings, due to the inherent encoding of this color space.

Waveform Shape parameter. Use the Waveform Shape parameter to set the waveform to a Sine, Triangle, or Square wave.

T Reset parameter. Use the T Reset parameter to reset the time coordinate (t in the zone plate equation) of the pattern to zero. When the T Reset parameter is first set to **Enable**, the time coordinate is reset to zero and there is no apparent motion in the zone plate, even if any of the time coefficients (K_{XT} , K_{YT} , K_T , or K_T^2) are non-zero. Enabling the T Reset parameter does not set the other parameters to zero.

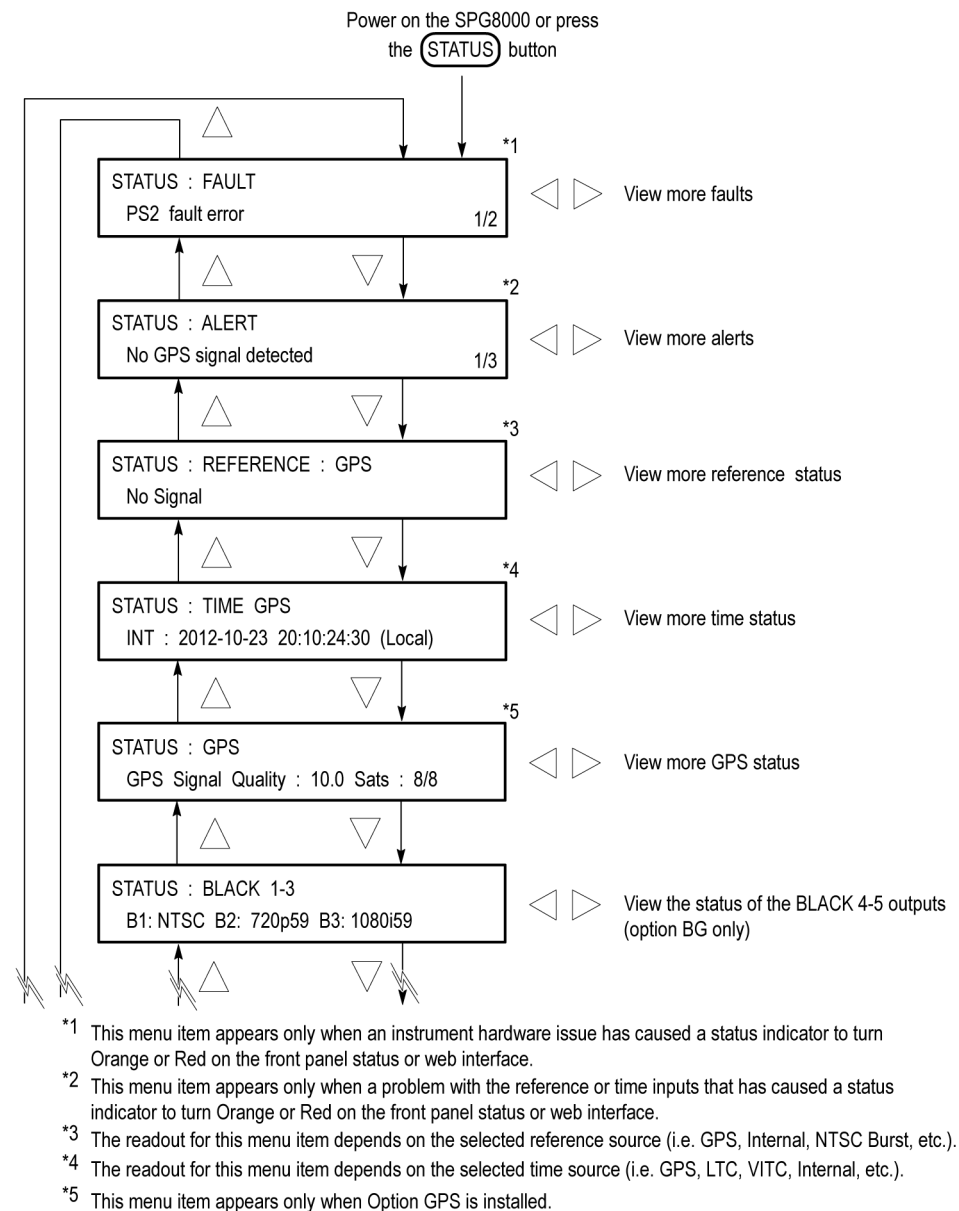
If you then alter any of the K parameters, the temporal (t) coordinate will be allowed to change to match. Subsequent changes to K parameters will first reset the time coordinate (t), and then allow it to change with the K parameter.

Disable allows the zone plate time coordinate to increment continuously. When T Reset is set to **Disable** resetting all of the time coefficients (K_{XT} , K_{YT} , K_T , and K_T^2) to zero will stop the apparent zone plate motion but the temporal coordinate will remain where it is, even if it has moved to an off-screen position. You must **Enable** the T Reset parameter to reset the temporal coordinate to zero.

To completely disable all motion and reset the pattern, set all of the time related K parameters to zero and set the T Reset parameter to **Enable**.

STATUS button menu

Press the STATUS button to view the current status of instrument settings such as the signal reference source, GPS signal 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.



Continued on next page

0747-002

Figure 43: STATUS button menu diagram – part 1

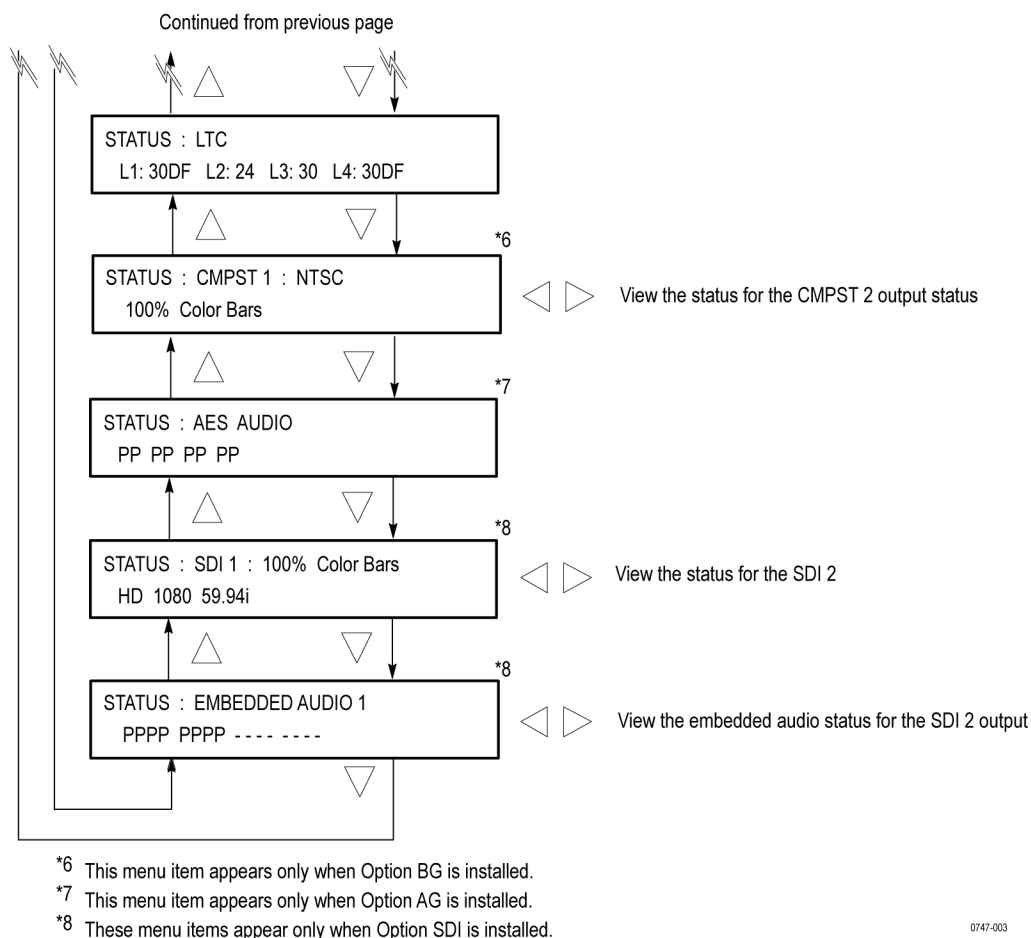


Figure 44: STATUS button menu diagram – part 2

FAULT. This menu item appears only when an instrument hardware issue has caused a status indicator to turn orange or red on the instrument front panel or on the Web user interface. If there are multiple faults, a readout appears in the bottom right corner indicating the number of faults.

In the STATUS button menu diagram (See Figure 43.), the readout shows “1/2,” which indicates that you are viewing fault message 1 out of 2 available messages. Use the left (◀) or right (▶) arrow button to view additional fault messages. For more information about specific fault messages, use the SYSTEM button DIAGNOSTIC submenu. (See page 157, *DIAGNOSTICS submenu*.)

ALERT. This menu item appears only when a problem with the reference or time inputs has caused a status indicator to turn orange or red on the instrument front panel or on the Web user interface. If there are multiple alerts, a readout appears in the bottom right corner indicating the number of alerts. In the STATUS button menu diagram, the readout shows “1/3,” which indicates that you are viewing alert message 1 out of 3 available messages. (See Figure 43.) Use the left (◀) or right (▶) arrow button to view additional fault messages.

REFERENCE. This menu item lists the currently selected reference source on the top line and displays the status of that source on the second line. Use the left (◀) or right (▶) arrow button to view additional reference status messages. The readout depends on the selected reference source (i.e. GPS, Internal, NTSC Burst, etc.).

TIME. This menu item lists the currently selected timing source on the top line and displays the status of that source on the second line. Use the left (◀) or right (▶) arrow button to view additional timing status messages. The readout depends on the selected time source (i.e. GPS, LTC, VITC, Internal, etc.).

GPS. This menu item appears only when Option GPS is installed. The readout shows the GPS signal quality, the number of satellites used, and the status of the GPS antenna. Use the left (◀) or right (▶) arrow button to view additional GPS status messages.

BLACK. This menu item displays the current format for each of the BLACK outputs (1–3). If Option BG is installed, use the left (◀) or right (▶) arrow button to view the status of the BLACK 4–5 outputs.

LTC. This menu item displays the current format for each of the LTC outputs (1–4). If LTC 1 is configured to be an input, the display shows “Input” as the status for that signal.

CMPST. This menu item appears only when Option BG is installed. The readout shows the format and test signal on the selected composite output (1 or 2). Use the left (◀) or right (▶) arrow button to toggle the display between the two composite outputs.

AES AUDIO. This menu item appears only when Option AG is installed. The readout shows the status of the audio on each of the AES audio channels. The readout shows “P” when audio is present and shows “–” when audio is not present.

SDI. This menu item appears only when Option SDI is installed. The readout shows the format and test signal on the selected SDI output (1 or 2). Use the left (◀) or right (▶) arrow button to toggle the display between the two SDI outputs.

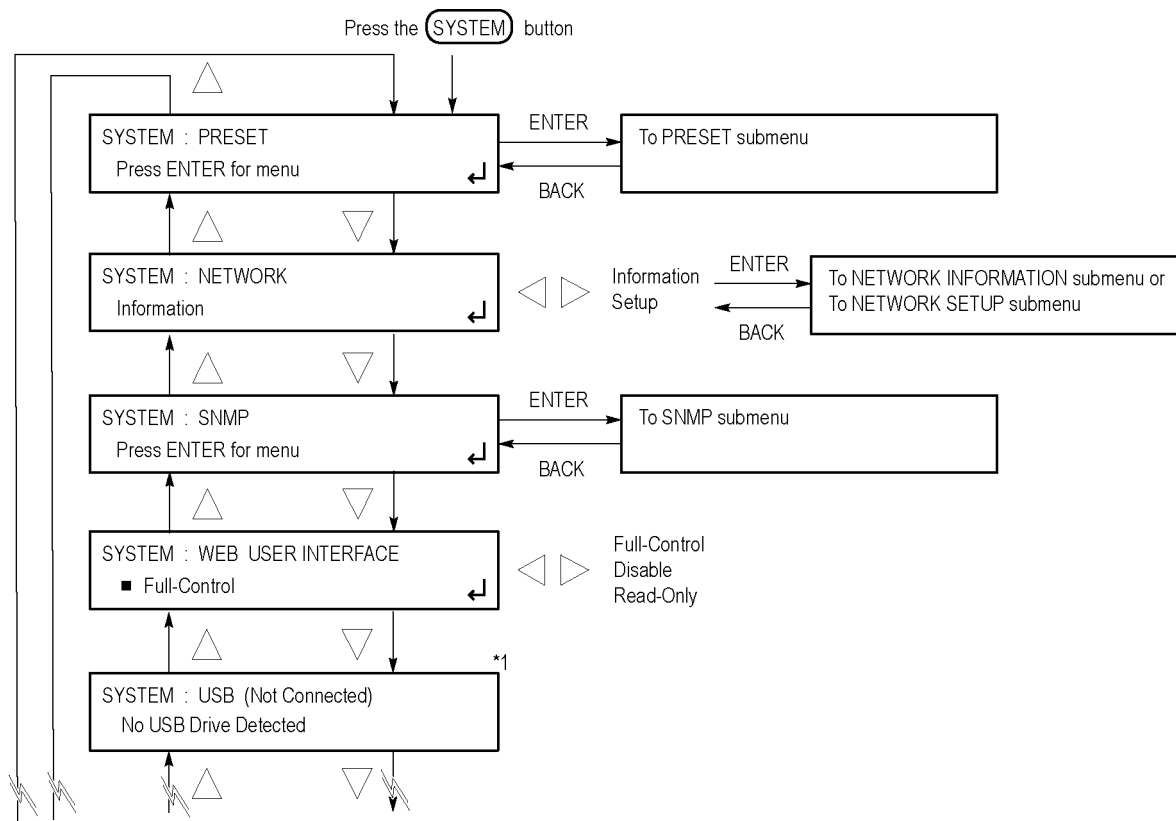
EMBEDDED AUDIO. This menu item appears only when Option SDI is installed. The readout shows the status of the audio on each of the embedded audio groups and channels for the selected SDI output. The readout shows “P” when audio is present and shows “–” when audio is not present. Use the left (◀) or right (▶) arrow button to toggle the display between the two SDI outputs.

SYSTEM button menu

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

Figure 45: SYSTEM button menu diagram – part 1

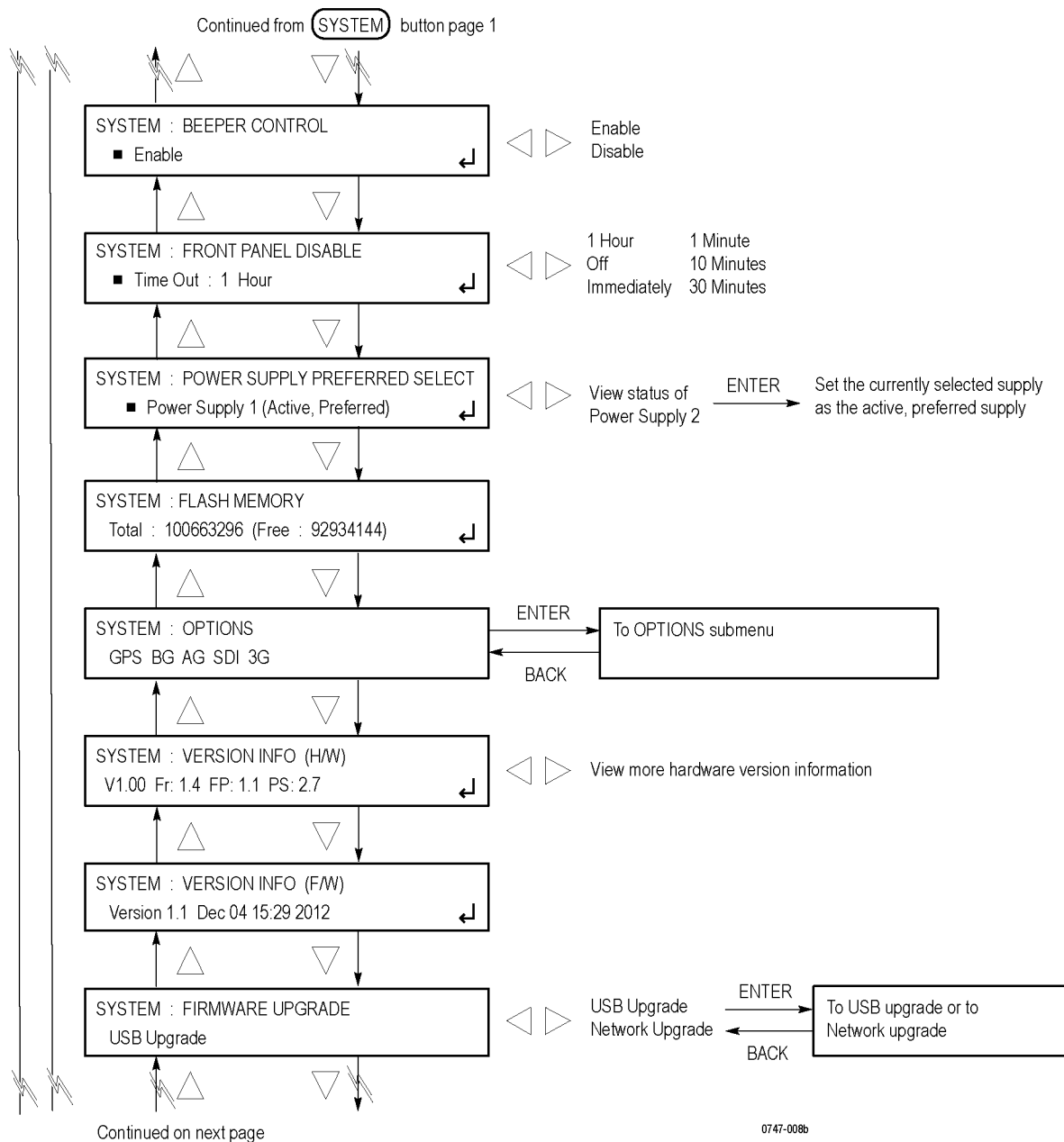


Figure 46: SYSTEM button menu diagram – part 2

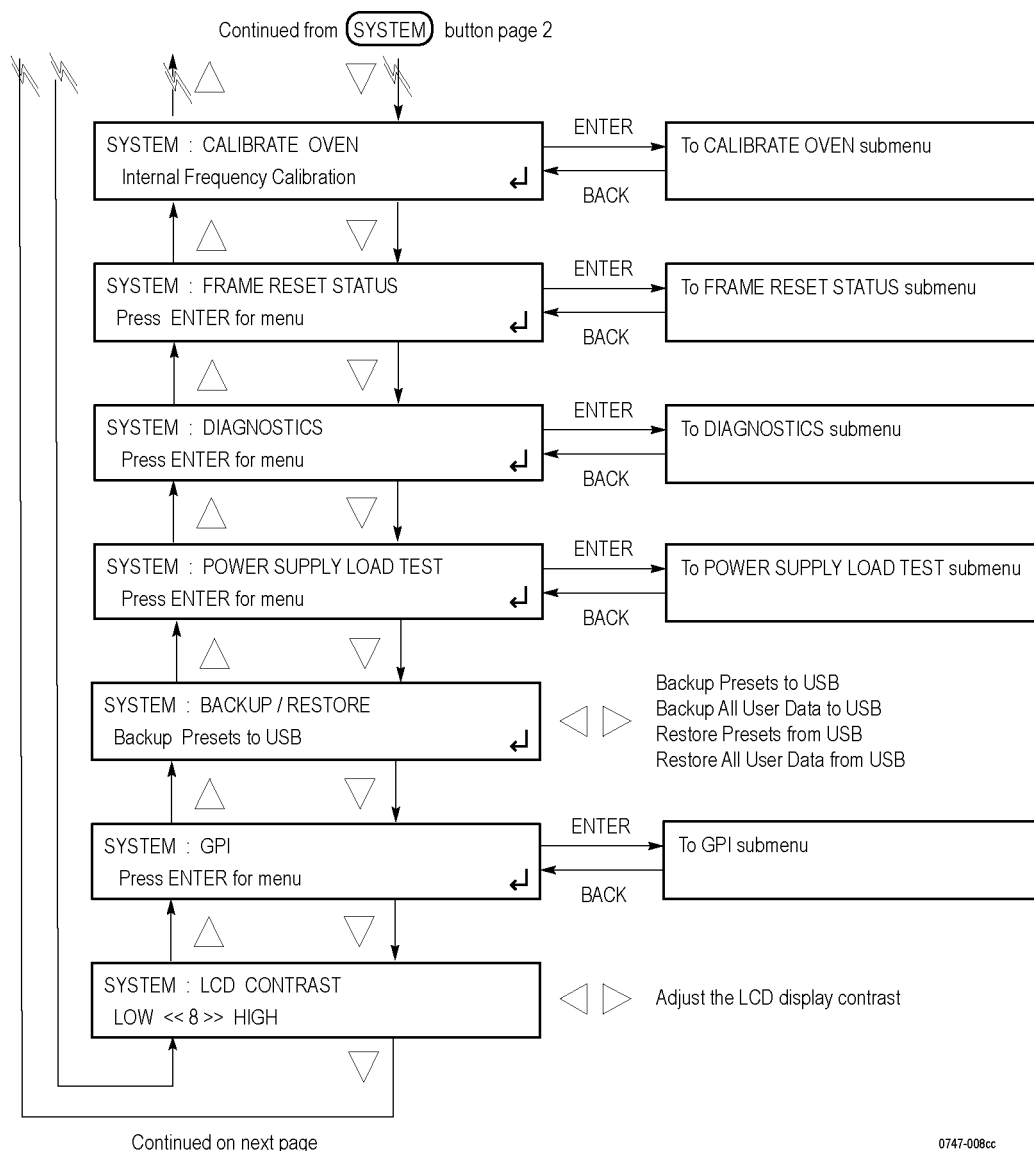


Figure 47: SYSTEM button menu diagram – part 3

PRESET. Recalls instrument settings saved as a preset, or saves the current instrument settings as a preset. Select this menu item and then press the **ENTER** button to access the PRESET submenu. (See page 136, *PRESET submenu*.)

NETWORK. Displays or sets the current network parameters of the 10/100/1000 BASE-T port on the instrument. Use the left (◀) or right (▶) arrow button to toggle between the following two selections:

- **Information.** Select Information and press the **ENTER** button to access the NETWORK INFO submenu. (See page 138.)
- **Setup.** Select Setup and press the **ENTER** button to access the NET SETUP submenu. (See page 139.)

SNMP. Enables or disables SNMP (Simple Network Management Protocol), and configures up to four IP addresses to receive SNMP traps. Select this menu item and then press the **ENTER** button to access the SNMP submenu. (See page 140, *SNMP submenu*.)

WEB USER INTERFACE. Disables or sets the control limits for the SPG8000 Web User Interface (See page 9, *Web user interface*.). Use the left (◀) or right (▶) arrow button to select between the following options. Press the **ENTER** button to confirm the selection.

- **Full-Control.** Allows a user to have full control of instrument settings when using the Web User Interface.
- **Disable.** Disables the instrument from being accessed by the Web User Interface.
- **Read-Only.** Allows a user to have read-only access to instrument settings when using the Web User Interface.

USB <status>. Displays the current status of the USB port:

- **Not Connected** is displayed when no USB drive is connected to the instrument.
- **Not Mounted** is displayed when a USB drive is connected to the instrument but is not mounted. Press the **ENTER** button to mount the drive. Normally, a USB drive will automatically mount when connected to the instrument.
- **Mounted** is displayed when a USB drive is connected to the instrument and is mounted. Press the **ENTER** button to safely unmount the drive. The message You May Now Safely Remove USB Drive appears when it is safe to remove the drive.



CAUTION. *To prevent the loss of data on the USB drive, be sure to unmount the USB drive before you remove the drive from the instrument.*

BACKUP/RESTORE. Backs up or restores the instrument presets or all user data using a USB drive. Use the left (◀) or right (▶) arrow button to select the type of backup or restore operation, and then press the **ENTER** button to perform the operation. (See page 15, *How to backup/restore presets and user data*.)

GPI. Configures the General Purpose Interface (GPI) inputs and outputs. Press the **ENTER** button to access the GPI submenu. (See page 147, *GPI submenu*.)

LCD CONTRAST. Adjusts the contrast of the LCD display. Use the left (◀) or right (▶) arrow button to decrease or increase the display contrast.

BEEPER CONTROL. Enables or disables the beeper function in the instrument. When enabled, the beeper alerts the user when a fan fault condition has been detected. Use the left (◀) or right (▶) arrow button to select **Enable** or **Disable**. Press the **ENTER** button to confirm the selection.

FRONT PANEL DISABLE. Sets the time-out period until the front-panel buttons are disabled. Use the left (◀) or right (▶) arrow button to select from the following choices: Off, Immediately, 1 Minute, 10 Minutes, 30 Minutes, and 1 Hour. Press the **ENTER** button to enable the selection.

When you select any of these time-out periods (except Off), the front-panel buttons are disabled when that time passes without a button push. If this happens, press and hold the FRONT PANEL ENABLE button for a few seconds to restart the time-out counter and enable the front-panel buttons.

POWER SUPPLY PREFERRED SELECT. When two Power Supply modules are installed in the instrument (Option DPW) and both are connected to power, this menu item selects which of the two supplies is the preferred (active) supply. Use the left (◀) or right (▶) arrow button to select Power Supply 1 or Power Supply 2.

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 how to operate an instrument with two power supplies, see the SPG8000 Quick Start User Manual.*

FLASH MEMORY. Displays the total amount of flash memory that is installed in the instrument and displays the amount of memory that remains free (available). The flash memory is used by the custom test signal, frame picture, logo, font, and text overlay files that you install in the instrument. When the amount of available memory is low, you may need to delete some of these custom files from memory before you can install new files.

OPTIONS. Displays which options are installed in the instrument. The possible option readouts are **GPS**, **BG**, **AG**, **SDI**, and **3G**. If no options are installed, **None** is displayed.

To view the module ID and to enable Option 3G, select this menu item, and then press the **ENTER** button to access the OPTIONS submenu. (See page 154, *OPTIONS submenu*.)

VERSION INFO (H/W). Displays the hardware versions of the various components in the instrument. The available displays depend on the hardware options installed in the instrument. Use the left (◀) or right (▶) arrow button to view all of the hardware version readouts.

The display below lists the following hardware versions: CPU, main FPGA (Frame), Front Panel Board (FP), and Power Supply Combiner Board (PS).

```
SYSTEM : VERSION INFO (H/W)
V0.13 Fr:1.4 FP:1.1 PS:2.7
```

0747-017

The display below lists the following hardware versions for the base instrument: Black/GPS board PLD, and both of the Black/GPS board FPGA versions (DO and BB).

```
SYSTEM : VERSION INFO (H/W)
V1.7 DO:34 BB:46
```

0747-018

The display below lists the following hardware versions: Option BG PLD, and both of the Option BG FPGA versions (BG1 and BG3).

```
SYSTEM : VERSION INFO (H/W)
V1.2 BG1:33 BG3:36
```

0747-019

The display below lists the following hardware versions: Option AG PLD, and the Option AG FPGA version (AUD).

```
SYSTEM : VERSION INFO (H/W)
V1.1 AUD:08
```

0747-020

The display below lists the following hardware versions: Option SDI PLD, and the Option SDI FPGA version (G) and build date (year, month, day, time).

```
SYSTEM : VERSION INFO (H/W)
V2.5 G:1.7 2012-11-8 14:30
```

0747-021

VERSION INFO (F/W). Displays the firmware version number installed in the instrument and the date and time of the firmware build. The date and time are in the format <month, date, time, year>.

FIRMWARE UPGRADE. Selects the type of firmware upgrade (USB or Network) to be performed and initiates the upgrade process. Use the left (◀) or right (▶) arrow button to select **USB** or **Network**, and then press the **ENTER** button to start the upgrade process. See the *How to upgrade the instrument firmware* section in the *SPG8000 Quick Start User Manual* for more information.

CALIBRATE OVEN. Calibrates the frequency of the internal oscillator of the instrument. You can calibrate the oscillator using one of the following two methods:

- **GPS signal.** If Option GPS is installed in the instrument, you can use a GPS signal to calibrate the oscillator without removing the instrument from service. See the *Oven oscillator calibration* section in the *SPG8000 Quick Start User Manual* for instructions on how to use a GPS signal to adjust the oscillator.
- **Frequency reference signal.** If Option GPS is not installed in the instrument or if you do not have access to a GPS signal, you can use a frequency reference signal such as NTSC Burst or CW to calibrate the oscillator. In this case, you must remove the instrument from service in order to calibrate the oscillator. (See page 19, *How to adjust the oven oscillator without Option GPS*.)

FRAME RESET STATUS. Displays the status of the frame reset signals used in the instrument. Select this menu item and press the **ENTER** button to access the FRAME RESET STATUS submenu. (See page 155, *FRAME RESET STATUS submenu*.)

Refer to *Frame reset signals* for detailed information about how the frame reset signals are used. (See page 1.)

DIAGNOSTICS. Displays the results of diagnostic tests for various components of the instrument. When you select this menu item and then press the **ENTER** button, you access the DIAGNOSTICS submenu. (See page 157, *DIAGNOSTICS submenu*.)

NOTE. When the instrument is in Factory mode, you can view additional diagnostic results and initiate special diagnostic tests. See the *SPG8000 Service Manual* for more information about the Factory mode diagnostics.

POWER SUPPLY LOAD TEST. The instrument must have two Power Supply modules installed (Option DPW) and connected to power in order to run this load test. The load test checks that the Power Supply module that is configured as the backup supply is operational and ready to be configured as the primary (preferred) supply.

This menu item allows you to manually perform the load test. While the instrument is in operation, this test is automatically performed once every 24 hours. When you enter the POWER SUPPLY LOAD TEST submenu, you can view the results of the previous load test for the backup supply.

When you select this menu item and then press the **ENTER** button, you access the POWER SUPPLY LOAD TEST submenu. (See page 164, *POWER SUPPLY LOAD TEST submenu*.)

PRESET submenu

Use this menu to recall instrument settings saved as a preset or save the current instrument settings to a preset. Use the up (▲) or down (▼) arrow button to scroll through the menu items. (See Figure 48.)

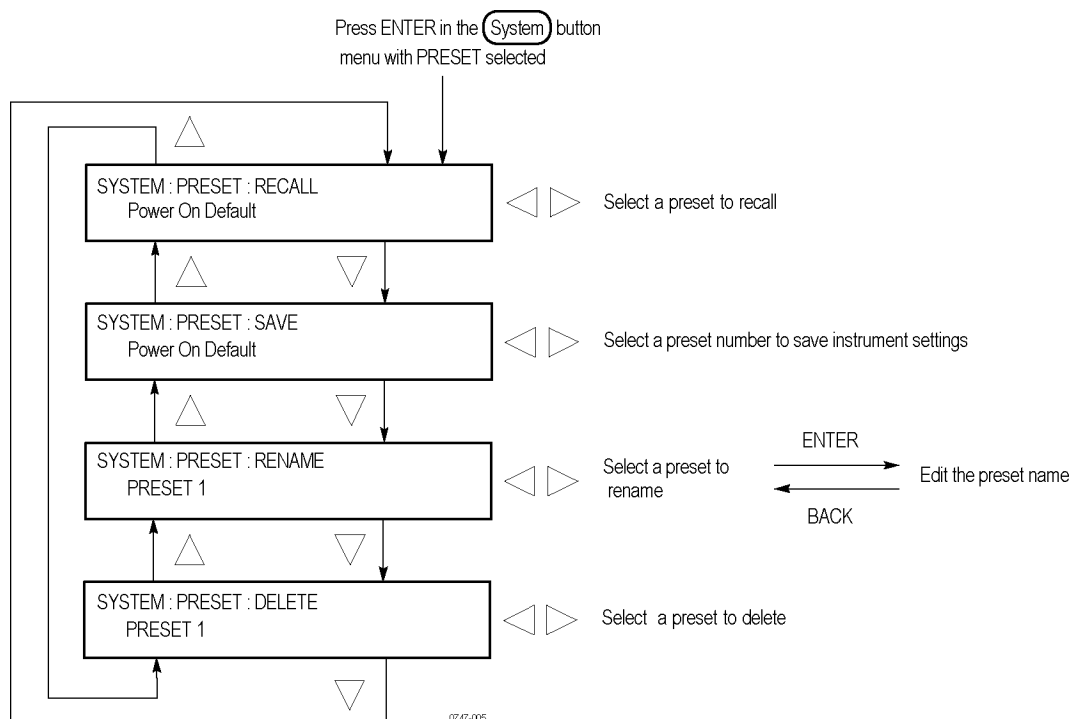


Figure 48: PRESET submenu

The following three presets are named at the factory and can be used for your own application:

- **Power On Default:** Use this preset to save instrument settings that you want automatically loaded when the instrument powers on. If one of the seven presets is selected in the mainframe GPI (General Purpose Interface), that preset takes precedence over this Power On Default preset. You cannot assign this preset name to another preset.

NOTE. *If you want to save network parameters to a preset, use the Power On Default preset.*

- **User Default:** Use this preset to save user-specified default settings. If you save new instrument settings in this preset, a confirmation message appears to prevent overwriting.

- **Factory Default:** Use this preset to reset the mainframe and all of the installed modules to the factory default settings. Some SYSTEM button menu settings are not affected when the factory default settings are recalled. (See page 166, *SYSTEM button menu factory default settings*.)

RECALL. Recalls instrument settings saved in the selected preset. Use the left (◀) or right (▶) arrow button to select a different preset, and then press the **ENTER** button to implement the selection. While the preset is loading into the instrument, the name of the selected preset blinks. When the loading is complete, the blinking stops.

SAVE. Saves the current instrument settings to one of the 14 available presets. Use the left (◀) or right (▶) arrow button to select the destination preset, and then press the **ENTER** button to implement the selection.

RENAME. Renames the selected preset. Perform the following steps to rename a preset:

1. Use the left (◀) or right (▶) arrow button to select the preset you want to rename.
2. Press the **ENTER** button twice to begin editing the preset name. The underscore character () appears under the first letter of the preset name.
3. Use the left (◀) or right (▶) arrow button to move the underscore character to the letter you want to modify.
4. Use the up (▲) or down (▼) arrow button to select the new character. The available characters include the full alphabet, numerals from 0 to 9, and many standard ASCII symbols. The text strings may contain up to 32 characters.
5. Enter all of the desired characters then press **ENTER** button.
6. Press the **BACK** button twice to exit the PRESET submenu. This returns to the top of the mainframe main menu.
7. Press the **ENTER** button to reenter the PRESET submenu.
8. Use the up (▲) or down (▼) arrow button to select the SAVE menu item.
9. Use the left (◀) or right (▶) arrow button to select the preset name edited in step 4.
10. Press **ENTER** button to save the preset with the new name.

DELETE. Deletes the contents of the specified preset. Use the left (◀) or right (▶) arrow button to select the preset you want to delete, and then press the **ENTER** button to implement the selection. You cannot delete the following presets: Power on Default, User Default, and Factory Default.

NETWORK INFO submenu

Use this menu to display all of the current network parameters. Use the up (▲) or down (▼) arrow button to select a network parameter and display the assigned address. The following selections are available: **IP Address**, **Subnet Mask**, **Gateway Address**, **MAC Address**, and **DHCP Server**.

The following figure shows NETWORK INFO submenu.

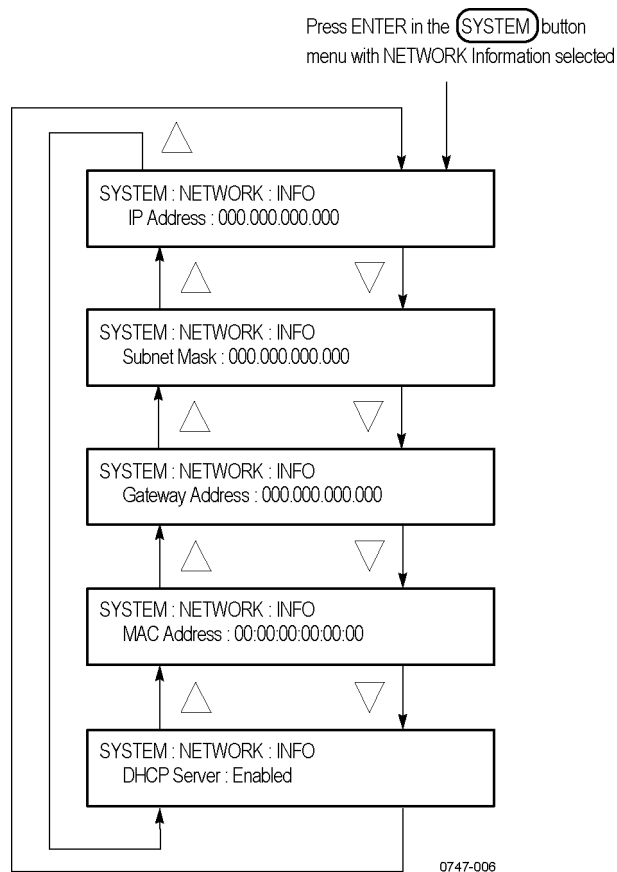


Figure 49: NETWORK INFO submenu

NET SETUP submenu

Use this menu to set the network parameters for the 10/100/1000 BASE-T port on the instrument, which will be used when you remotely control the instrument using a PC and when you transfer files between the instrument and a PC. Refer to the *SPG8000 Quick Start User Manual* for detailed information about connecting the instrument to a PC. Use the up (▲) or down (▼) arrow button to scroll through the menu items. The following figure shows the NET SETUP submenu.

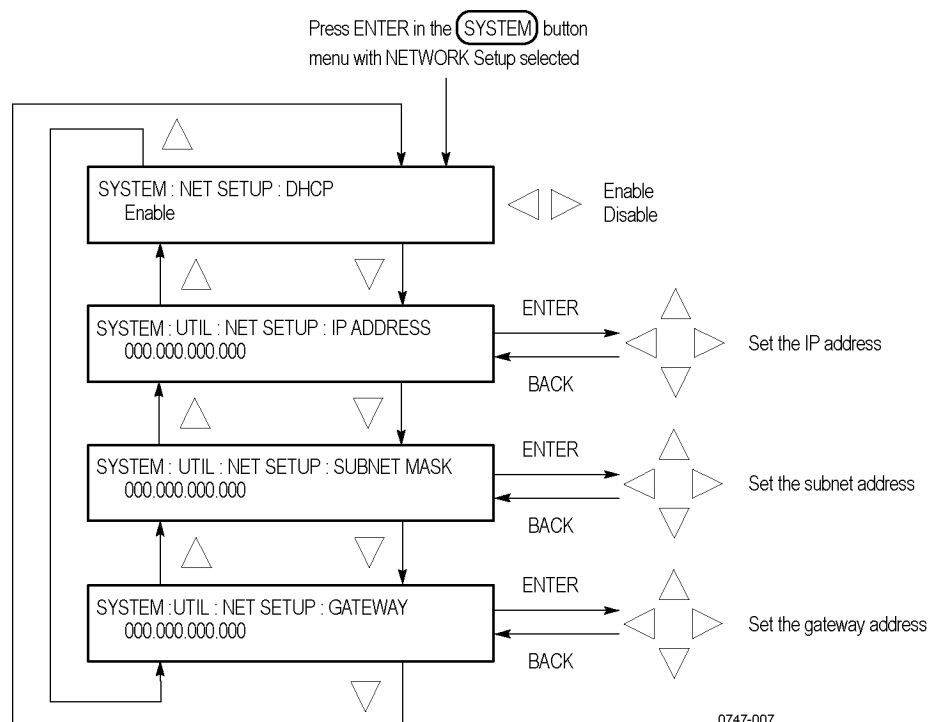


Figure 50: NET SETUP submenu

DHCP. Enables or disables the instrument to receive IP address settings using the DHCP (Dynamic Host Configuration Protocol) service on your network. Use the left (◀) or right (▶) arrow button to select between **Enabled** and **Disabled**. Press the **ENTER** button to implement the selection. If you select Disable in this menu, you will need to set network address values in each of the following menu items.

NOTE. Under some network environments, the instrument might 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.

IP ADDRESS. Sets the IP address of the instrument. When no value is set, the default value is used. If DHCP service is enabled, the IP address obtained from the DHCP server is used instead of the address entered here. Refer to *Manually setting a network address* below for instructions on how to enter an address.

NOTE. *If you enter blank characters for the IP address, the network function of the instrument becomes invalid.*

SUBNET MASK. Sets the subnet address of the instrument. When no value is set, the default value is used. If DHCP service is enabled, the subnet address obtained from the DHCP server is used instead of the address entered here. Refer to *Manually setting a network address* below for instructions on how to enter an address.

GATEWAY ADDR. Sets the gateway address of the instrument. Refer to *Manually setting a network address* below for instructions on how to enter an address.

Manually setting a network address. Use the following procedure to manually enter a network address:

1. Press the **ENTER** button to enter the edit mode to input the address.
2. Use the left (◀) or right (▶) arrow button to move the underscore character (_), and use the up (▲) or down (▼) arrow button to enter the address value.
3. After you enter the address value, press the **ENTER** button to enable the address.

SNMP submenu

Use this submenu to enable or disable SNMP (Simple Network Management Protocol) remote control of the instrument and to configure up to four IP addresses to receive SNMP traps. Use the up (▲) or down (▼) arrow button to scroll through the menu items. The following figure shows the SNMP submenu.

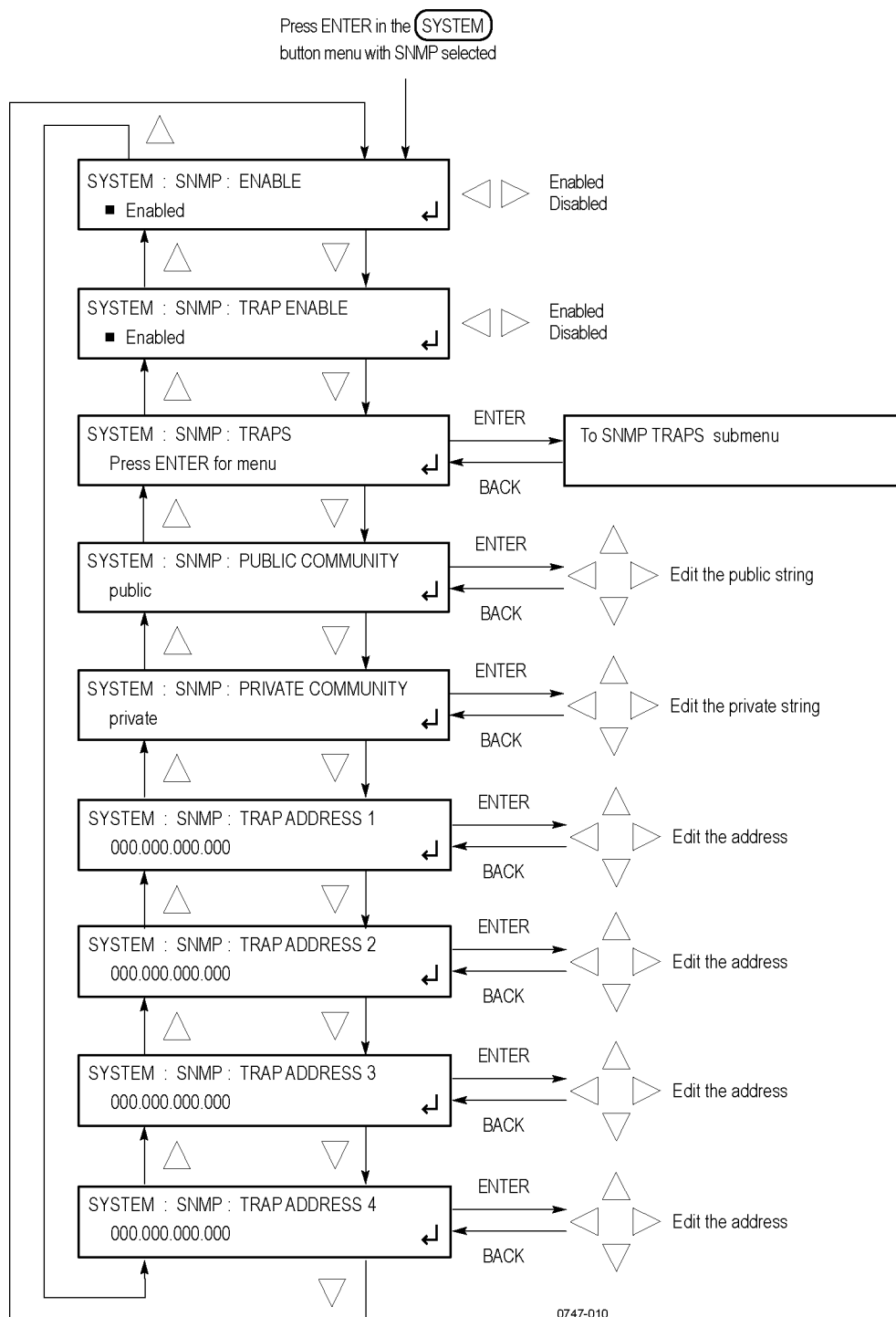


Figure 51: SNMP submenu diagram

ENABLE. Enables or disables SNMP communication with the instrument. Use the left (◀) or right (▶) arrow button to select **Enabled** or **Disabled**. Press the **ENTER** button to confirm the selection.

TRAP ENABLE. Enables or disables the instrument from sending SNMP traps. Use the left (◀) or right (▶) arrow button to select **Enabled** or **Disabled**. Press the **ENTER** button to confirm the selection.

TRAPS. Selects which instrument conditions will trigger an SNMP trap to be sent. Select this menu item and then press the **ENTER** button to access the SNMP TRAPS submenu. (See page 143, *SNMP TRAPS submenu*.)

PUBLIC COMMUNITY. Sets the Public Community string, which is effectively a password and is required before SNMP commands can read values from the instrument. The default string value is “public”. Select this menu item and press the **ENTER** button to edit the string. Use the left (◀) or right (▶) arrow button to select one of the available 16 characters, and then use the up (▲) or down (▼) arrow button to edit the selected character. Press the **ENTER** button to confirm the string selection.

PRIVATE COMMUNITY. Sets the Private Community string, which is effectively a password and is required before SNMP commands can read or write changes into the instrument. The default string value is “private”. Select this menu item and press the **ENTER** button to edit the string. Use the left (◀) or right (▶) arrow button to select one of the available 16 characters, and then use the up (▲) or down (▼) arrow button to edit the selected character. Press the **ENTER** button to confirm the string selection.

TRAP ADDRESS 1–4. Sets the IP addresses for SNMP traps. You can configure up to four IP addresses to which SNMP traps will be sent when error conditions are detected. Use the SNMP TRAPS submenu to select which instrument conditions will trigger SNMP traps to be sent. (See page 143, *SNMP TRAPS submenu*.)

NOTE. *The default value for the SNMP trap addresses is all zeroes, which disables the trap outputs.*

To edit a trap address, use the up (▲) or down (▼) arrow button to select the desired trap address (1–4), and then press the **ENTER** button. Use the left (◀) or right (▶) arrow button to select one of the address digits, and then use the up (▲) or down (▼) arrow button to edit the selected address digit. Press the **ENTER** button to confirm the trap address selection.

SNMP TRAPS submenu

Selects which instrument conditions will trigger an SNMP trap to be sent. Use the up (▲) or down (▼) arrow button to scroll through the menu items. The following figure shows the SNMP TRAPS submenu.

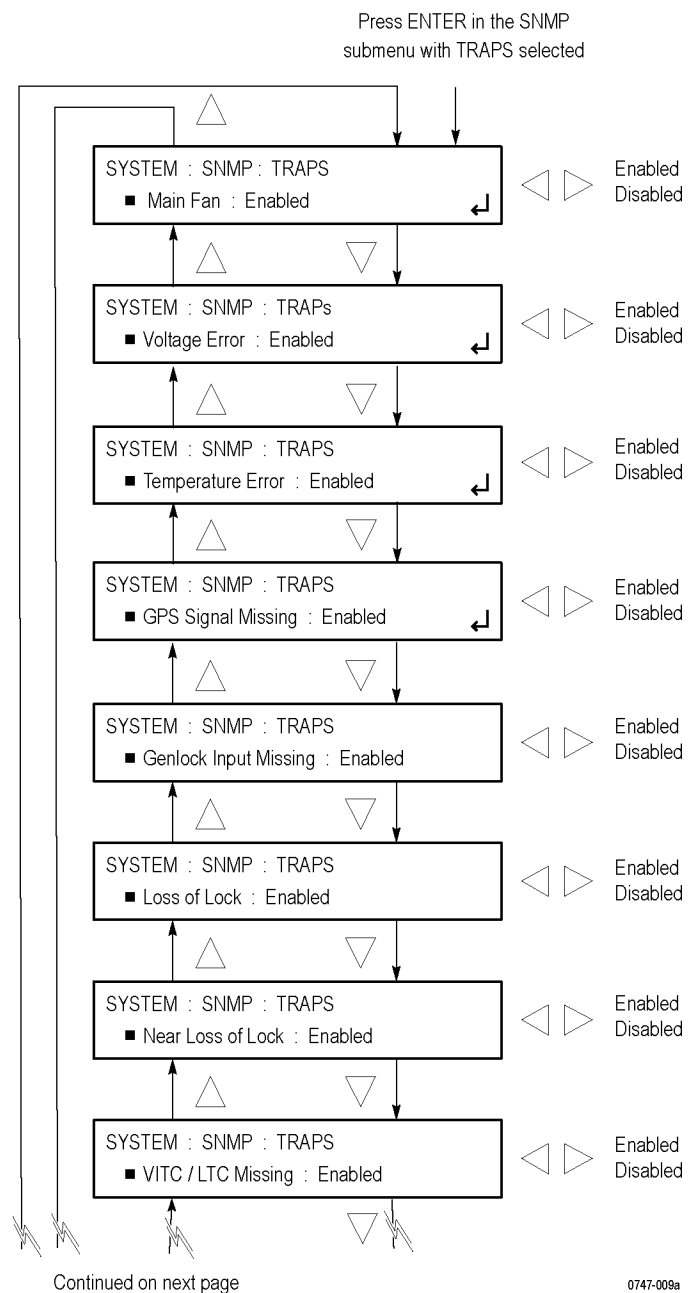


Figure 52: SNMP TRAPS submenu diagram – part 1

Continued from previous page

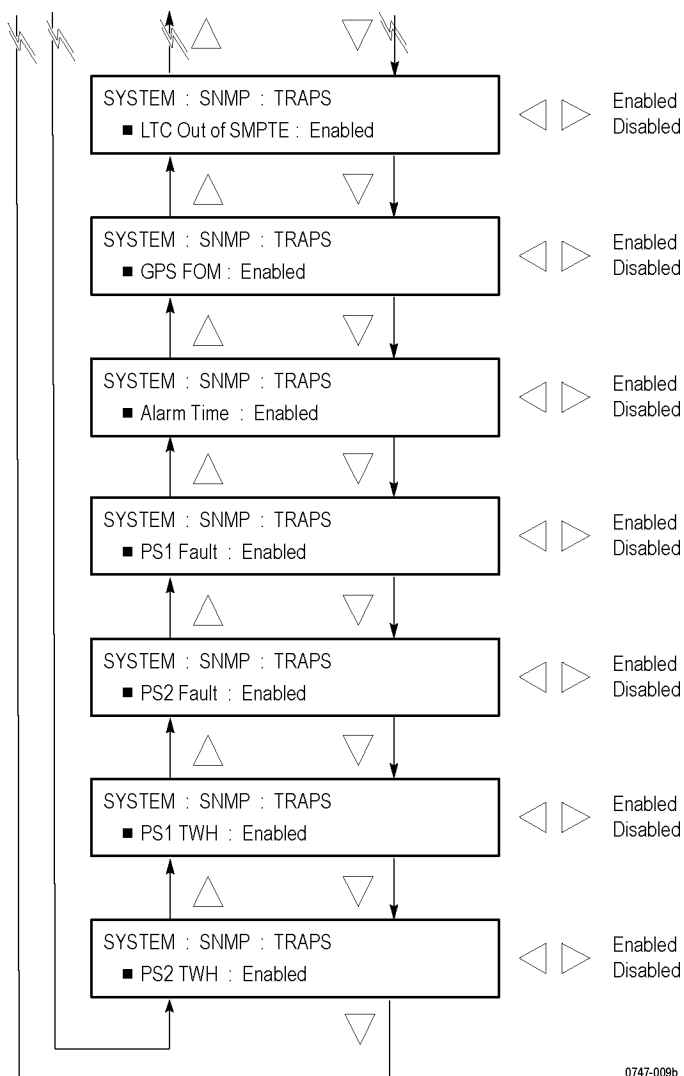


Figure 53: SNMP TRAPS submenu diagram – part 2

Main Fan. When enabled, sends an SNMP trap when a fault with the main fan in the instrument is detected. Use the left (◀) or right (▶) arrow button to select **Enabled** or **Disabled**. Press the **ENTER** button to confirm the selection.

Voltage Error. When enabled, sends an SNMP trap when a voltage error in the instrument is detected. Use the left (◀) or right (▶) arrow button to select **Enabled** or **Disabled**. Press the **ENTER** button to confirm the selection.

You can use the **DIAGNOSTICS** submenu to view the current instrument voltages. (See page 157, *DIAGNOSTICS submenu*.)

Temperature Error. When enabled, sends an SNMP trap when a temperature error in the instrument is detected. Use the left (◀) or right (▶) arrow button to select **Enabled** or **Disabled**. Press the **ENTER** button to confirm the selection.

You can use the **DIAGNOSTICS** submenu to view the current instrument temperatures. (See page 157, *DIAGNOSTICS submenu*.)

GPS Signal Missing. When enabled, sends an SNMP trap when a loss of the GPS input signal to the instrument is detected. Use the left (◀) or right (▶) arrow button to select **Enabled** or **Disabled**. Press the **ENTER** button to confirm the selection.

Genlock Input Missing. When enabled, sends an SNMP trap when a loss of the genlock reference input signal to the instrument is detected. Use the left (◀) or right (▶) arrow button to select **Enabled** or **Disabled**. Press the **ENTER** button to confirm the selection.

Loss of Lock. When enabled, sends an SNMP trap when a loss of lock to the GPS or genlock reference input signal to the instrument is detected. Use the left (◀) or right (▶) arrow button to select **Enabled** or **Disabled**. Press the **ENTER** button to confirm the selection.

Near Loss of Lock. When enabled, sends an SNMP trap when a near loss of lock to the GPS or genlock reference input signal to the instrument is detected. The threshold for near loss of lock is approximately 2×10^{-6} from the ends of the tune range. Use the left (◀) or right (▶) arrow button to select **Enabled** or **Disabled**. Press the **ENTER** button to confirm the selection.

VITC/LTC Missing. When enabled, sends an SNMP trap when a loss of the VITC or LTC output signal from the instrument is detected. Use the left (◀) or right (▶) arrow button to select **Enabled** or **Disabled**. Press the **ENTER** button to confirm the selection.

LTC Out of SMPTE. When enabled, sends an SNMP trap when the LTC input signal to the instrument is detected to be noncompliant with the SMPTE standard. Use the left (◀) or right (▶) arrow button to select **Enabled** or **Disabled**. Press the **ENTER** button to confirm the selection.

GPS FOM. When enabled, sends an SNMP trap when the quality of the GPS input signal to the instrument is detected to be below the quality level limit configured in the REF button menu. (See page 62, *GPS SIGNAL WARNING*.) Use the left (◀) or right (▶) arrow button to select **Enabled** or **Disabled**. Press the **ENTER** button to confirm the selection.

Alarm Time. When enabled, sends an SNMP trap when the program time counter matches the Alarm Time value configured in the TIME button menu. (See page 175, *ALARM TIME*.) Use the left (◀) or right (▶) arrow button to select **Enabled** or **Disabled**. Press the **ENTER** button to confirm the selection.

PS1 Fault. When enabled, sends an SNMP trap when a fault with Power Supply 1 is detected. Use the left (◀) or right (▶) arrow button to select **Enabled** or **Disabled**. Press the **ENTER** button to confirm the selection.

PS2 Fault. When enabled, sends an SNMP trap when a fault with Power Supply 2 is detected. Use the left (◀) or right (▶) arrow button to select **Enabled** or **Disabled**. Press the **ENTER** button to confirm the selection.

PS1 TWH. When enabled, sends an SNMP trap when the Power Supply 1 is detected to have exceeded the temperature weighted hours limit. Use the left (◀) or right (▶) arrow button to select **Enabled** or **Disabled**. Press the **ENTER** button to confirm the selection.

PS2 TWH. When enabled, sends an SNMP trap when the Power Supply 2 is detected to have exceeded the temperature weighted hours limit. Use the left (◀) or right (▶) arrow button to select **Enabled** or **Disabled**. Press the **ENTER** button to confirm the selection.

GPI submenu

Configures the General Purpose Interface (GPI) inputs and outputs. Use the up (▲) or down (▼) arrow button to scroll through the menu items. See the *SPG8000 Quick Start User Manual* for information about the GPI interface.

The following figure shows the GPI submenu.

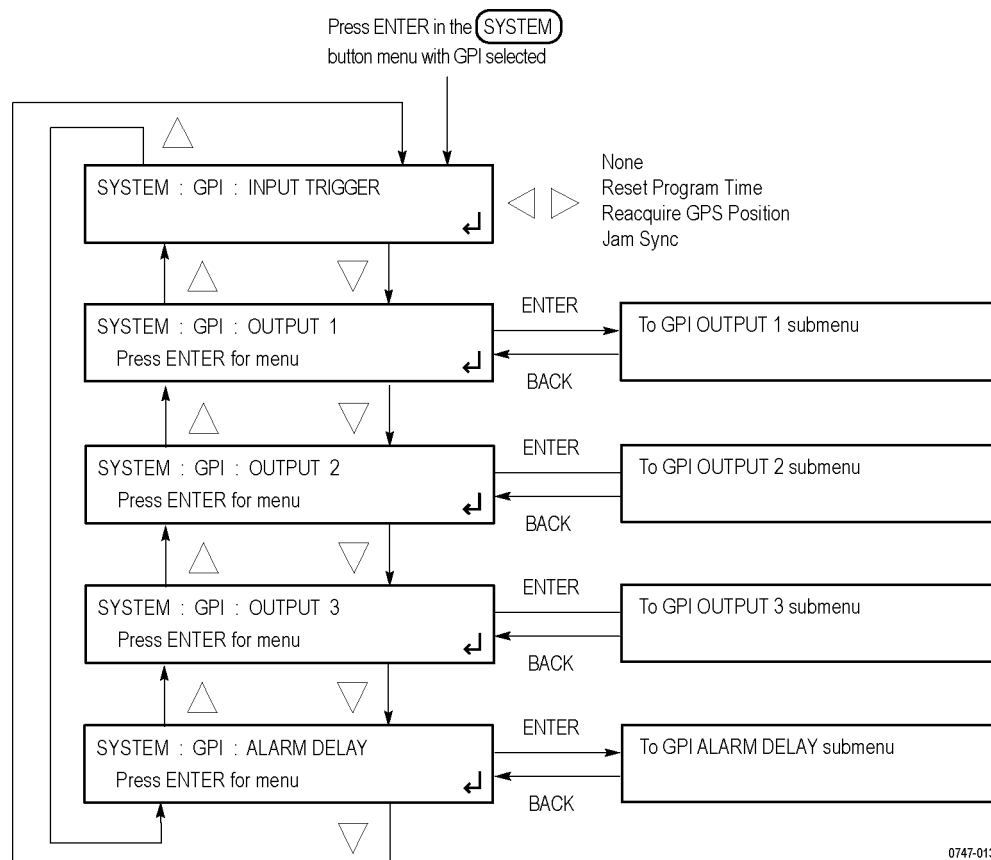


Figure 54: GPI submenu diagram

INPUT TRIGGER. Use this menu item to configure pin 4 of the GPI port connector to trigger the instrument to perform one of the functions listed below.

Use the left (◀) or right (▶) arrow button to select from the following trigger actions:

- **None.** Disables the GPI Input Trigger function.
- **Reset Program Time.** Resets the program time of the instrument.
- **Reacquire GPS Position.** When Option GPS is installed, forces the instrument to reacquire the GPS position from the GPS antenna input.
- **Jam Sync.** Immediately synchronizes the instrument timecode to the selected time source for each output.

NOTE. *A daily Jam Sync should be performed on systems running at non-integer frame rates.*

OUTPUT 1. Configures which instrument faults will trigger an output signal on GPI output 1. The GPI output 1 signal corresponds to pin 2 on the GPI port connector and to pin 1 on the GPI/LTC port connector.

Select this menu item and then press the **ENTER** button to access the GPI OUTPUT 1 submenu. (See page 149, *GPI OUTPUT <1, 2, or 3> submenu.*)

OUTPUT 2. Configures which instrument faults will trigger an output signal on GPI output 2. The GPI output 2 signal corresponds to pin 3 on the GPI port connector and to pin 2 on the GPI/LTC port connector.

Select this menu item and then press the **ENTER** button to access the GPI OUTPUT 2 submenu. (See page 149, *GPI OUTPUT <1, 2, or 3> submenu.*)

OUTPUT 3. Configures which instrument faults will trigger an output signal on GPI output 3. The GPI output 3 signal corresponds to pin 6 on the GPI port connector. The GPI output 3 signal does not appear on the GPI/LTC port connector.

Select this menu item and then press the **ENTER** button to access the GPI OUTPUT 3 submenu. (See page 149, *GPI OUTPUT <1, 2, or 3> submenu.*)

ALARM DELAY. Configures the delay for each of the GPO Lock and GPO Time error and warning conditions. Select this menu item and then press the **ENTER** button to access the GPI ALARM DELAY submenu. (See page 152, *GPI ALARM DELAY submenu.*)

**GPI OUTPUT <1, 2, or 3>
submenu**

Configures which instrument faults will trigger an output signal on the selected GPI output (1, 2 or 3). Each GPI output is separately configured. Use the up (▲) or down (▼) arrow button to scroll through the menu items.

Each GPI output corresponds to specific pins on the GPI and GPI/LTC port connectors as follows:

- **GPI output 1:** Pin 2 on the GPI port connector and pin 1 on the GPI/LTC port connector.
- **GPI output 2:** Pin 3 on the GPI port connector and pin 2 on the GPI/LTC port connector.
- **GPI output 3:** Pin 6 on the GPI port connector. The GPI output 3 signal does not appear on the GPI/LTC port connector.

The following figure shows the GPI OUTPUT submenu for each of the GPI outputs.

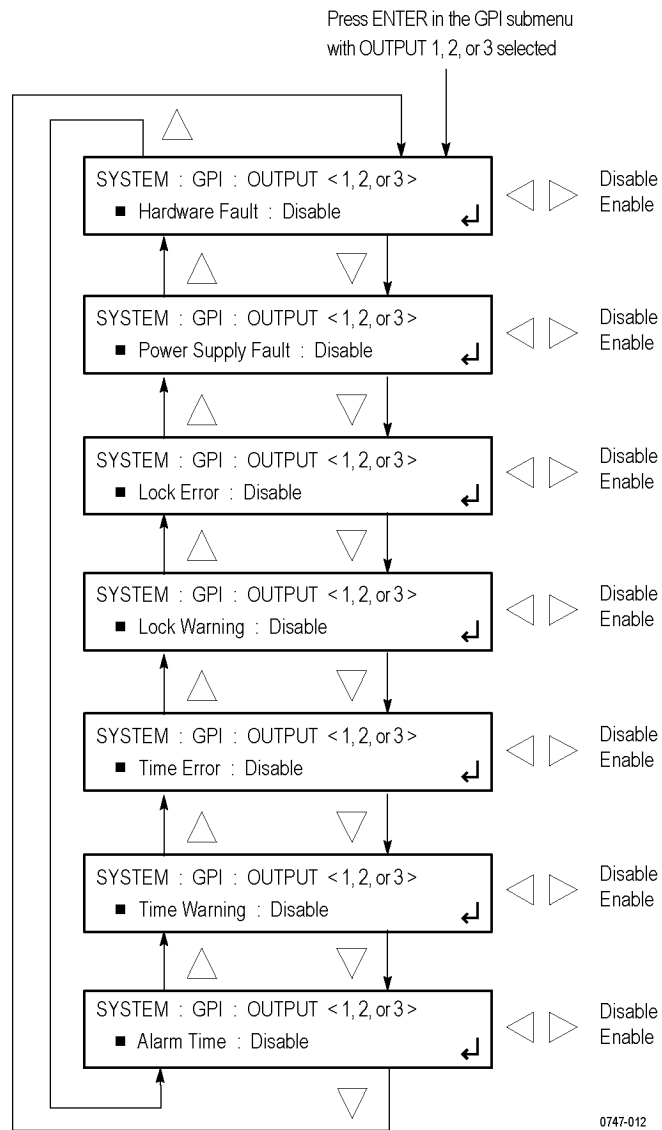


Figure 55: GPI OUTPUT <1, 2, or 3> submenu diagram

Hardware Fault. When enabled, sends an alarm signal to the selected GPI output when a hardware fault in the instrument is detected. Use the left (◀) or right (▶) arrow button to select **Enable** or **Disable**. Press the **ENTER** button to confirm the selection. Use the System button **DIAGNOSTICS** submenu to view information for all conditions that can trigger this fault. (See page 157, *DIAGNOSTICS submenu*.)

Power Supply Fault. When enabled, sends an alarm signal to the selected GPI output when a fault with either Power Supply module is detected. Use the left (◀) or right (▶) arrow button to select **Enable** or **Disable**. Press the **ENTER** button to confirm the selection.

Lock Error. When enabled, sends an alarm signal to the selected GPI output when a loss of lock to the GPS or genlock reference input signal to the instrument is detected. Use the left (◀) or right (▶) arrow button to select **Enable** or **Disable**. Press the **ENTER** button to confirm the selection.

Lock Warning. When enabled, sends an alarm signal to the selected GPI output when a near loss of lock to the GPS or genlock reference input signal to the instrument is detected. The threshold for near loss of lock is approximately $2 \times 10e-6$ from the ends of the tune range. Use the left (◀) or right (▶) arrow button to select **Enable** or **Disable**. Press the **ENTER** button to confirm the selection.

Time Error. When enabled, sends an alarm signal to the selected GPI output when the selected time input is invalid. For example, if LTC is the selected time input and the signal is missing or discontinuous. Use the left (◀) or right (▶) arrow button to select **Enable** or **Disable**. Press the **ENTER** button to confirm the selection.

Time Warning. When enabled, sends an alarm signal to the selected GPI output when the selected time input is present and valid, but not meeting all expectations. For example, if LTC is the selected time input but the timing between LTC and the genlock input does not meet the SMPTE 12M specification. Use the left (◀) or right (▶) arrow button to select **Enable** or **Disable**. Press the **ENTER** button to confirm the selection.

Alarm Time. When enabled, sends an alarm signal to the selected GPI output for the one second when the program time counter matches the Alarm Time value configured in the TIME button menu. (See page 175, *ALARM TIME*.) Use the left (◀) or right (▶) arrow button to select **Enable** or **Disable**. Press the **ENTER** button to confirm the selection.

GPI ALARM DELAY submenu

Configures the delay for each of the GPO Lock and GPO Time error and warning conditions. The purpose of the delay settings is to reduce the number of false alarms by allowing time for the fault condition to clear before an alarm signal is sent. The default delay is 10 seconds for each of the error and warning conditions. The delay is applied to all three GPI output signals.

The following figure shows the GPI ALARM DELAY submenu.

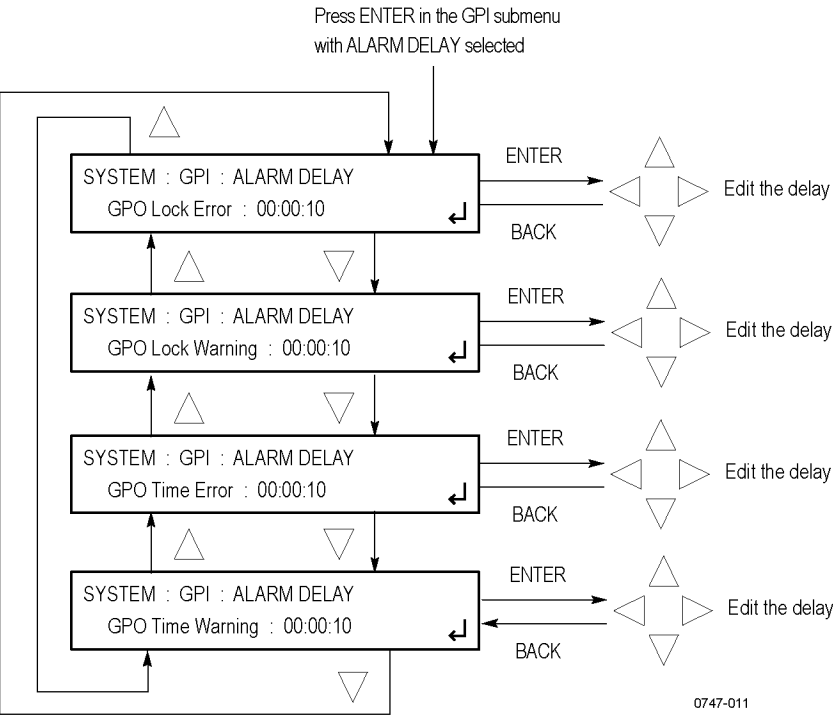


Figure 56: GPI ALARM DELAY submenu diagram

GPO Lock Error. Sets the delay time before a GPI alarm signal is sent when a loss of lock to the GPS or genlock reference input signal to the instrument is detected.

Select this menu item and press the **ENTER** button to edit the delay. Use the left (◀) or right (▶) arrow button to select one of the time digits (HH:MM:SS), and then use the up (▲) or down (▼) arrow button to edit the selected digit. Press the **ENTER** button to confirm the delay selection.

GPO Lock Warning. Sets the delay time before a GPI alarm signal is sent when a near loss of lock to the GPS or genlock reference input signal to the instrument is detected. The threshold for near loss of lock is approximately 2×10^{-6} from the ends of the tune range.

Select this menu item and press the **ENTER** button to edit the delay. Use the left (◀) or right (▶) arrow button to select one of the time digits (HH:MM:SS), and then use the up (▲) or down (▼) arrow button to edit the selected digit. Press the **ENTER** button to confirm the delay selection.

GPO Time Error. Sets the delay time before a GPI alarm signal is sent when the instrument detects that the selected time input is invalid. For example, if LTC is the selected time input and the signal is missing or discontinuous.

Select this menu item and press the **ENTER** button to edit the delay. Use the left (◀) or right (▶) arrow button to select one of the time digits (HH:MM:SS), and then use the up (▲) or down (▼) arrow button to edit the selected digit. Press the **ENTER** button to confirm the delay selection.

GPO Time Warning. Sets the delay time before a GPI alarm signal is sent when the instrument detects that the selected time input is present and valid, but not meeting all expectations. For example, if LTC is the selected time input but the timing between LTC and the genlock input does not meet the SMPTE 12M specification.

Select this menu item and press the **ENTER** button to edit the delay. Use the left (◀) or right (▶) arrow button to select one of the time digits (HH:MM:SS), and then use the up (▲) or down (▼) arrow button to edit the selected digit. Press the **ENTER** button to confirm the delay selection.

OPTIONS submenu

Displays which options are installed in the instrument and allows you to enter the option key for Option 3G.

The following figure shows the OPTIONS submenu.

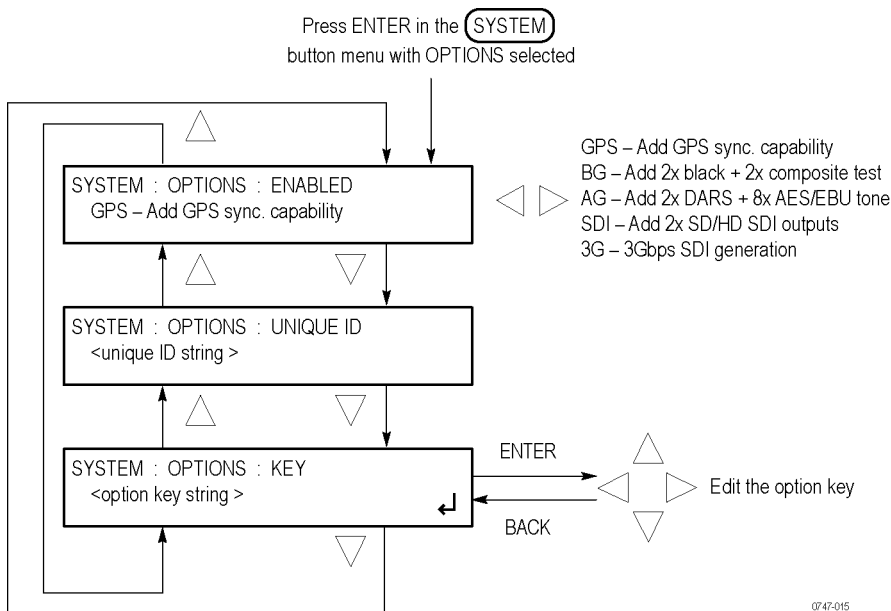


Figure 57: OPTIONS submenu diagram

ENABLED. Displays details about each of the options that are installed in the instrument. Use the left (◀) or right (▶) arrow button to view each of the option descriptions. Depending on which options are installed in the instrument, the following option readouts may appear:

- GPS – Add GPS sync. capability
- BG – Add 2x black + 2x composite test
- AG – Add 2x DARS + 8x AES/EBU tone
- SDI – Add 2x SD/HD SDI outputs
- 3G – 3Gbps SDI generation

If no options are installed, **None** is displayed.

UNIQUE ID. Displays the unique ID number assigned to the instrument. You will need to provide this ID number when you order Option 3G.

KEY. Displays the option key assigned to the instrument. If you order Option 3G as an upgrade to the instrument, you will be supplied a new option key that you must enter using this menu item in order to enable Option 3G.

To enter a new option key, perform the following steps:

1. Press the **ENTER** button to enter the option key edit mode. The underscore character () appears under the first character of the option key.
2. Use the up (**▲**) or down (**▼**) arrow button to select the first character of the option key.
3. Use the left (**◀**) or right (**▶**) arrow button to move the underscore character to the next character in the option key.
4. Enter all of the option key characters, and then press the **ENTER** button to confirm the selections.

FRAME RESET STATUS submenu

Displays the three frame reset signals in the instrument and shows which, if any, instrument outputs are currently using each frame signal. Refer to *Frame reset signals* for detailed information about how the frame reset signals are used. (See page 1.)

Use the up (**▲**) or down (**▼**) arrow button to scroll through the menu items. The following figure shows the FRAME RESET STATUS submenu.

NOTE. The characters represent an output connector on the instrument. For example, B1 represents the BLACK 1 connector.

When the instrument is genlocked, the text “(GL)” appears at the end of the line for the frame reset that is being used by the genlock function. The following figure indicates that the instrument is genlocked using the FRAME RESET 1 signal.

As shown in the following figure for FRAME RESET 3, no module name is displayed when a frame reset signal is not being used by any of the instrument outputs.

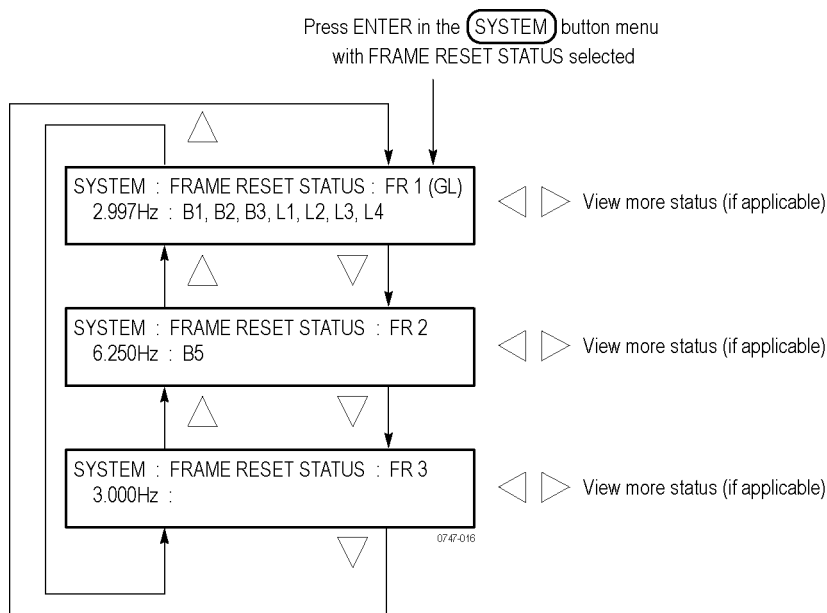


Figure 58: FRAME RESET STATUS submenu diagram

For each of the frame reset signals, if several outputs are using the same frame reset signal, use the left (◀) or right (▶) arrow button to view all of the outputs using the selected frame reset signal.

The characters shown after the clock frequency represent an output connector on the instrument. Depending on which options are installed in the instrument, the following characters may appear: For example, B1 represents the BLACK 1 connector.

- **All instruments:** B1, B2, and B3 represent the BLACK 1–3 connectors. L1, L2, L3, and L4 represent the LTC 1–4 connectors.
- **Option BG:** B4 and B5 represent the BLACK 4–5 connectors. C1 and C2 represent the COMPOSITE 1–2 connectors.
- **Option SDI:** S1 and S2 represent the SDI 1–2 connectors.

When the instrument is genlocked, the text “(GL)” appears at the end of the line for the frame reset that is being used by the genlock function. As shown in the submenu diagram above, the instrument is genlocked using the FRAME RESET 1 signal.

As shown in the submenu diagram above for FRAME RESET 3, no outputs are displayed after the clock frequency when a frame reset signal is not being used by any of the video outputs.

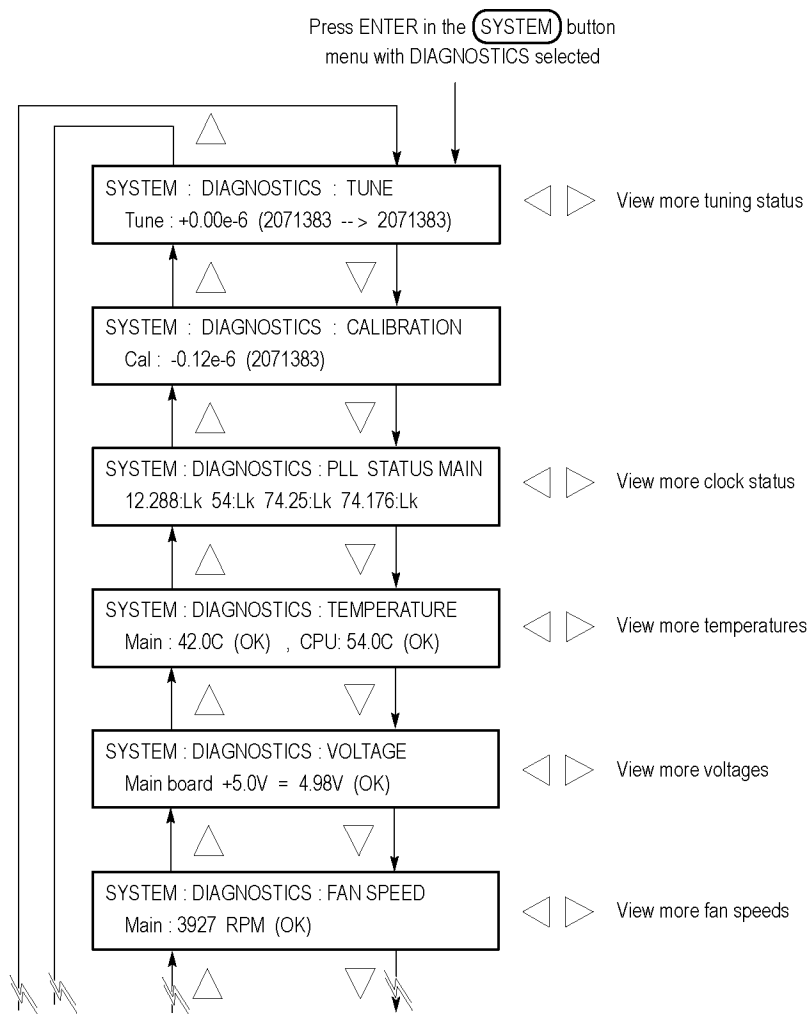
DIAGNOSTICS submenu

Displays the results of diagnostic tests for various components of the instrument.

NOTE. *The DIAGNOSTICS submenu provides information on all of the conditions that drive the FAULT light on the front panel, and the Hardware fault selection on the GPI.*

When the instrument is in Factory mode, you can view additional diagnostic results and initiate specific diagnostic tests for servicing the instrument. See the SPG8000 Service Manual for more information about the Factory mode diagnostics.

Use the up (▲) or down (▼) arrow button to scroll through the menu items. The following figures show the DIAGNOSTICS submenu.



Continued on next page

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Figure 59: DIAGNOSTICS submenu diagram – part 1

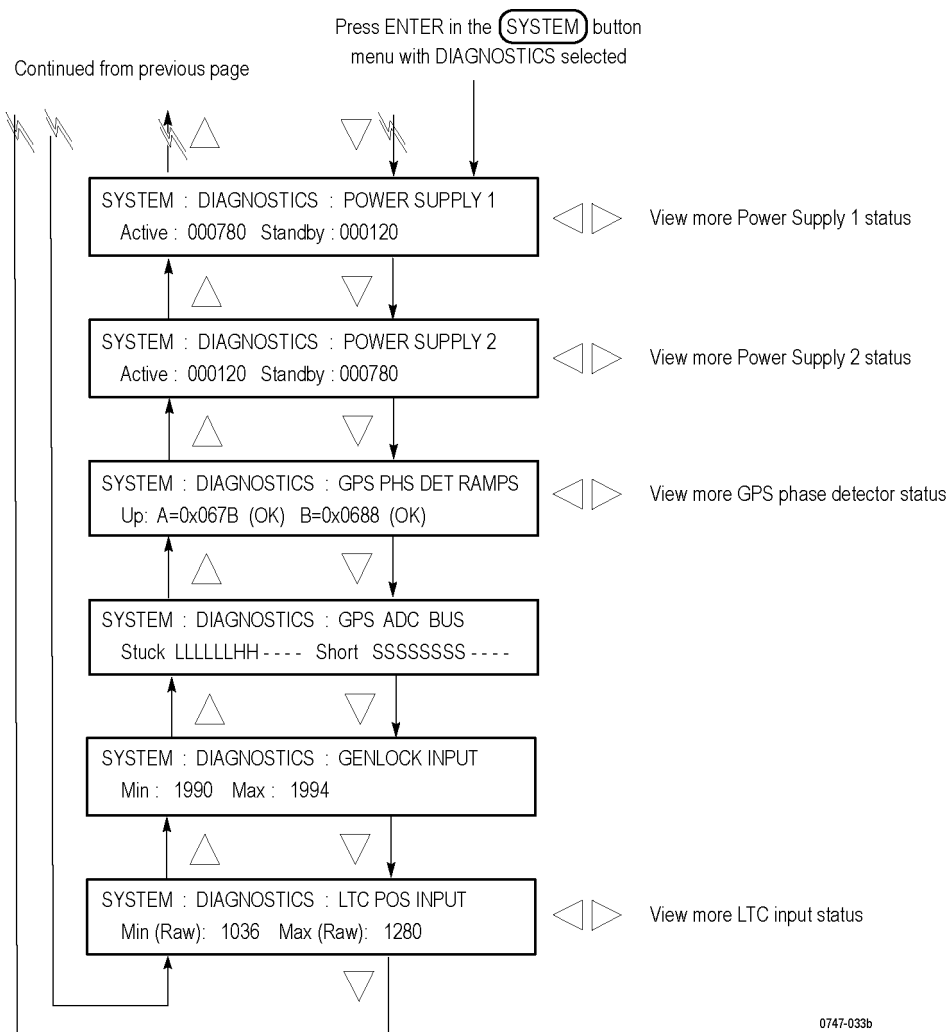


Figure 60: DIAGNOSTICS submenu diagram – part 2

TUNE. Displays the following information about the tuning status of the internal oscillator. Use the left (◀) or right (▶) arrow button to view all of the oscillator tuning status information.

- **Tune value:** Displays how far the instrument is deviating from the calibrated internal frequency of the internal oscillator in order to lock to an external reference input. One value of this readout is to determine if the instrument oscillator needs to be calibrated. If the instrument is locked to a traceable reference, then any tune value indicates error in the instrument calibration. For example, if the instrument is locked to GPS and the Tune readout is more than $\pm 0.1 \text{ e-6}$, then you should consider calibrating the internal frequency of the instrument using the CALIBRATE OVEN menu item in the SYSTEM button menu. (See page 135.)

The first part of the Tune readout indicates the fractional amount of deviation from the calibrated frequency. For example, if you use a reference signal to lock to a video source that is 5 parts per million high, then the readout will say “+5.00e-6”. This allows you to measure the frequency of the reference input and to see if the input is near the end of the available tuning range. If the instrument is in internal reference mode, the tune value should be 0.00 e-6 and the integer values will equal the calibration value (CAL readout).

NOTE. *The TUNE display will show non-zero deviation values only when the signal reference source is not configured as INTERNAL in the REF button menu. (See page 57.)*

The integer values indicate the actual tuning control word. The allowed range of the tuning control word is 0 to 4,194,304. The first number is the current value of the word and the second number is the target value for the tuning control loop. In most cases, these two values are the same. However, in the case where the instrument needs to make a large frequency change to achieve signal lock, then depending on the instrument mode, the value may slew slowly to the target value to stay inside the allowed slew rate for reference systems. In this case, the first number will slew over seconds or minutes until it equals the value of the second number. If the instrument is taking a long time to lock to an external reference signal, the Tune readout may provide valuable information about what is happening.

- **Phase value:** Displays the phase between the GPS pulse per second and the internal master time. A Tektronix Customer Service Representative may request these values for troubleshooting installation issues, should they occur.
- **DDS value:** Displays the DDS code that is tuning the oscillator. This is useful for checking if the instrument is getting close to the end of the oven oscillator tune range.

- **GPS lock status:** Displays the status of the GPS lock function:
 - **Boot** indicates that the function is still in special modes needed to get started.
 - **Coarse** indicates that the function is still tracking significant changes in the timing.
 - **Fine** indicates that the function has stabilized to the point that the loop only needs to make small changes.

CALIBRATION. Displays the tuning control word for the calibrated frequency of the mainframe oscillator and how far the instrument is deviating from the calibrated frequency to achieve a lock to the internal reference.

The first part of the CALIBRATION readout indicates the fractional amount of deviation from the calibrated frequency. For example, a readout of “0.59e-6” indicates a fractional correction of 0.59 parts per million. When a calibration of the instrument oscillator is performed, the CALIBRATION readout values will typically change. Over the life of the oscillator oven, the expected frequency drift is $\pm 2.5 \text{ e-6}$, so this number should always be in this range. If the fractional number is not within this range, then the instrument may have been miscalibrated, or the oscillator oven may have drifted out of specification since the last calibration. In this case, you should consider calibrating the internal frequency of the instrument using the CALIBRATE OVEN menu item in the SYSTEM button menu. (See page 135.)

PLL STATUS MAIN. Displays the following information about the internal clocks used to drive the video outputs. Use the left (◀) or right (▶) arrow button to view all of the clock information.

- **PLL STATUS MAIN:** Displays the frequency in MHz and the lock status for each of the internal clocks used to drive the video outputs. All of the clocks should show a status of locked (LK) during normal instrument operation.
- **PLL STATUS SDI:** Displays the following information about the clocks used to generate SDI signals (Option SDI only).
 - **Flex0:** Indicates the state of the flexible clock generator for output channel 1 (SDI 1A and SDI 1B connectors). This readout should show Lock (locked). An Unlk (unlocked) reading might indicate a problem with the Option SDI board or with the instrument.
 - **Flex1:** Indicates the state of the flexible clock generator for output channel 2 (SDI 2A and SDI 2B connectors). This readout should show Lock (locked). An Unlk (unlocked) reading might indicate a problem with the Option SDI board or with the instrument.

- **DDS STATUS SDI:** Displays the following information about the clocks used to generate SDI signals (Option SDI only).
 - **DDS0 Phase:** Indicates that the flex clock circuit is correctly aligned with the internal frame pulse for output channel 1 (SDI 1A and SDI 1B connectors). This readout should show Lock (locked). An Unlk (unlocked) reading might indicate a problem with the Option SDI board or with the instrument.
 - **DDS1 Phase:** Indicates that the flex clock circuit is correctly aligned with the internal frame pulse for output channel 1 (SDI 2A and SDI 2B connectors). This readout should show Lock (locked). An Unlk (unlocked) reading might indicate a problem with the Option SDI board or with the instrument.

TEMPERATURE. Displays the temperature of various internal components. **OK** is displayed as the status when a temperature is within the operating range; **WARN** is displayed when a temperature is out of range.

VOLTAGE. Displays the voltages of various internal components. **OK** is displayed as the status when a voltage is within the operating range; **WARN** is displayed when a voltage is out of range.

The Voltage readouts include the status of the RTC (Real Time Controller) battery power level. The following status messages may appear:

- **> 40% (OK)** indicates the battery power is good.
- **20% to 40% (WARN)** indicates the battery power is getting low and should be replaced soon.
- **< 20% (LOW)** indicates that the battery should be replaced immediately.

FAN SPEED. Displays the current fan speeds in RPM followed by the status. **OK** is displayed as the status when the fan operation is within range; **WARN** is displayed when the fan operation is out of range.

The initial display shows the speed of the main fan. Use the left (◀) or right (▶) arrow button to view the fan speed(s) on the installed Power Supply module(s).

POWER SUPPLY <1 or 2>. Displays information about the selected Power Supply module (1 or 2). Use the left (◀) or right (▶) arrow button to view all of the following information:

- **Active:** Displays the number of hours that the selected supply has been the preferred (active) supply.
- **Standby:** Displays the number of hours that the selected supply has been the backup (standby) supply.

- **Tmp Wtd:** Displays the number of temperature weighted hours that the selected supply has been in operation versus a limit of 131,400 hours. **OK** is displayed as the status when number of temperature weighted hours is within the operating limit; **WARN** is displayed when the number of hours exceeds the limit. For critical applications, you may want to replace the power supply periodically to prevent down time.

The instrument uses a log to track the number of hours that a Power Supply module has been powering the instrument. The expected life of a Power Supply module varies with the temperature and load. For a fully-loaded instrument in a 25 °C room, the power supply is specified to last at least 15 years (131,400 hours). For a lightly loaded instrument with only one or two modules running a 25 °C, the power supply should last 20 years (175,000 hours).

At the maximum room temperature, the expected life of the power supply is significantly less. For example, for a fully loaded instrument operating at 50 °C room temperature, the expected life of the power supply is 5 years (43,800 hours). The temperature-weighted hours (TWH) accounts for variations in the operating environment and displays a number normalized to 25 °C operation. Therefore, if the TWH is near the 131,400 recommended limit, then you should consider replacing the supply.

- **+12.0V:** Displays the status of the +12 V supply. **OK** is displayed as the status when the voltage is within the operating range; **WARN** is displayed when the voltage is out of range.
- **Mfg Date:** Displays the manufacturing date of the selected supply. The readout includes the time (HH:MM:SS) and the date (day, month, year).

GPS PHS DET RAMPS. This diagnostic monitors voltage ramps used in the GPS phase detector (Option GPS only). Use the left (◀) or right (▶) arrow button to view all of the voltage information. **OK** is displayed as the status when a voltage is within the nominal range; **WARN** is displayed when a voltage is out of range. If these voltage ramps are outside the nominal range, it means that the instrument should be serviced.

GPS ADC BUS. This diagnostic displays the condition of the Genlock input circuit (Option GPS only):

NOTE. *If no input is applied to the Genlock input circuit, then the ADC bits will be moving and so may appear stuck. This is not an indication of a problem.*

- **Stuck:** A 12-bit display showing the bits stuck high (H), low (L), or OK (-).
- **Short:** A 12-bit display showing any shorted adjacent lines (SS) (-).

GENLOCK INPUT. This diagnostic displays the following:

- **Min:** The minimum value from the genlock ADC for the present input signal.
- **Max:** The maximum value from the genlock ADC for the present input signal.

LTC POS INPUT. This diagnostic displays the following information about the positive or negative LTC input. Use the left (◀) or right (▶) arrow button to toggle the display between the positive and negative LTC inputs.

- **Min (Raw):** The minimum raw ADC values of the positive or negative LTC input.
- **Max (Raw):** The maximum raw ADC values of the positive LTC input.

POWER SUPPLY LOAD TEST submenu

The instrument must have two Power Supply modules installed (Option DPW) and connected to power in order to run this load test. The load test checks that the Power Supply module that is configured as the backup supply is operational and ready to be configured as the primary (preferred) supply.

This submenu allows you to manually perform the load test. While the instrument is in operation, this test is automatically performed once every 24 hours. When you enter the POWER SUPPLY LOAD TEST submenu, you can view the results of the previous load test for the backup supply.

Use the up (▲) or down (▼) arrow button to scroll through the menu items. The following figure shows the POWER SUPPLY LOAD TEST submenu.

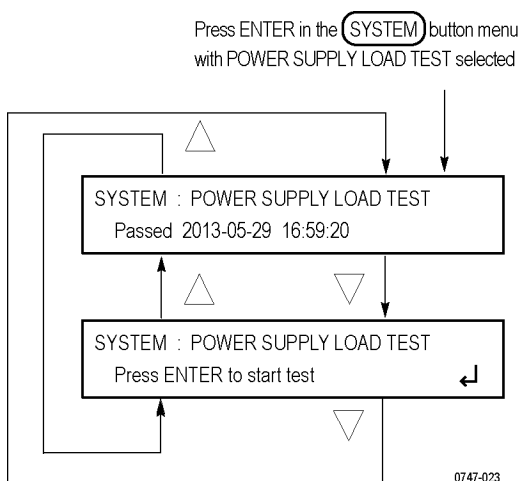


Figure 61: POWER SUPPLY LOAD TEST submenu diagram

Passed/Failed. Shows the status of the previous load test for the supply currently configured to be the backup (standby) supply along with the date (year, month, day) and time (HH:MM:SS) of the last test.

Press ENTER to start test. Use this menu item to initiate the load test. During the test, a status message appears. After the test is complete, the test results are displayed. For example, if Power Supply 2 is configured to be the backup supply, the message “Pass: Backup supply PS2 loadtest” is displayed. Press the **BACK** button to exit the load test.

NOTE. *If you have only one power supply installed that is connected to power, an error message will appear if you attempt to run this test.*

If you attempt to run the load test immediately after changing the preferred supply configuration or if you rerun the test immediately after running the test a first time, an error message may appear stating that the load needs to cool down before the test can be run. The error message includes an estimate of the time needed for the load to cool down before you can run the test. An example message in this situation is “Error: cooldown, 1 min 40 sec left.”

SYSTEM button menu factory default settings

The following table shows the settings for the SYSTEM button menu that are reset when you use the PRESET submenu to recall the factory default settings. (See page 136, *PRESET submenu*.)

The following SYSTEM button menu settings are not restored when you recall the factory default settings:

- LCD contrast
- Front panel time-out period
- Network parameters
- SNMP parameters
- Web user interface control setting
- Beeper control setting
- Power supply preference selection (Option DPW only)

Table 32: SYSTEM button menu factory default settings

Menu item name	Settings
GPI	
INPUT TRIGGER	None
OUTPUT <1–3>	
Hardware Fault	Disable
Power Supply Fault	Disable
Lock Error	Disable
Lock Warning	Disable
Time Error	Disable
Time Warning	Disable
Alarm Time	Disable
ALARM DELAY	
GPO Lock Error	00:00:10
GPO Lock Warning	00:00:10
GPO Time Error	00:00:10
GPO Time Warning	00:00:10

TIME button menu

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.

Use the up (▲) or down (▼) arrow button to scroll through the menu items. The following figure shows the TIME button menu diagram.

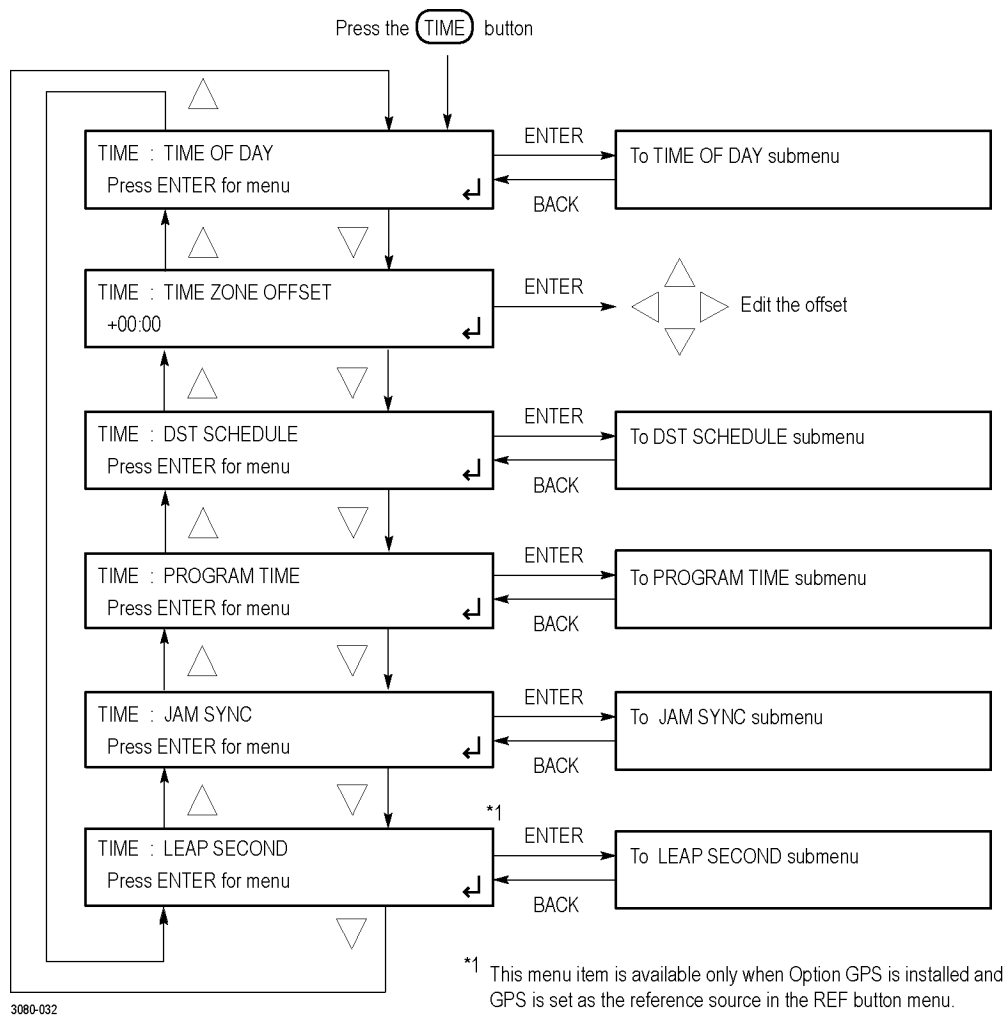


Figure 62: TIME button menu diagram

TIME OF DAY. Sets the time of day reference that will be used by the instrument. The possible reference choices change depending on the selected reference source (See page 57, *REF button menu*.).

Select this menu item and press the **ENTER** button to access the TIME OF DAY submenu. (See page 169.)

TIME ZONE OFFSET. Sets the time zone offset for your location in reference to UTC. Select this menu item and press the **ENTER** button to enter the edit mode.

To edit the offset, use the left (◀) or right (▶) arrow button to select a digit in the offset value to change. An underline character appears under the selected offset digit. The date and time digits take the following form: ±HH:MM. After you select the offset polarity or an offset digit, use the up (▲) or down (▼) arrow button to change the polarity or the value of the digit. Repeat for each digit as required for your local offset. Press the **ENTER** button to confirm the offset change.

NOTE. *When the DST schedule is set to Once and the DST event occurs, the scheduled offset will be added to the time zone offset and the DST schedule will be cleared. This allows for a new schedule to be set up for any time in the future. (See page 172, DST SCHEDULE submenu.)*

DST SCHEDULE. Configures how the instrument handles Daylight Saving Time. Select this menu item and press the **ENTER** button to access the DST SCHEDULE submenu. (See page 172.)

PROGRAM TIME. Configures the program time parameters for the instrument. Select this menu item and press the **ENTER** button to access the PROGRAM TIME submenu. (See page 174.)

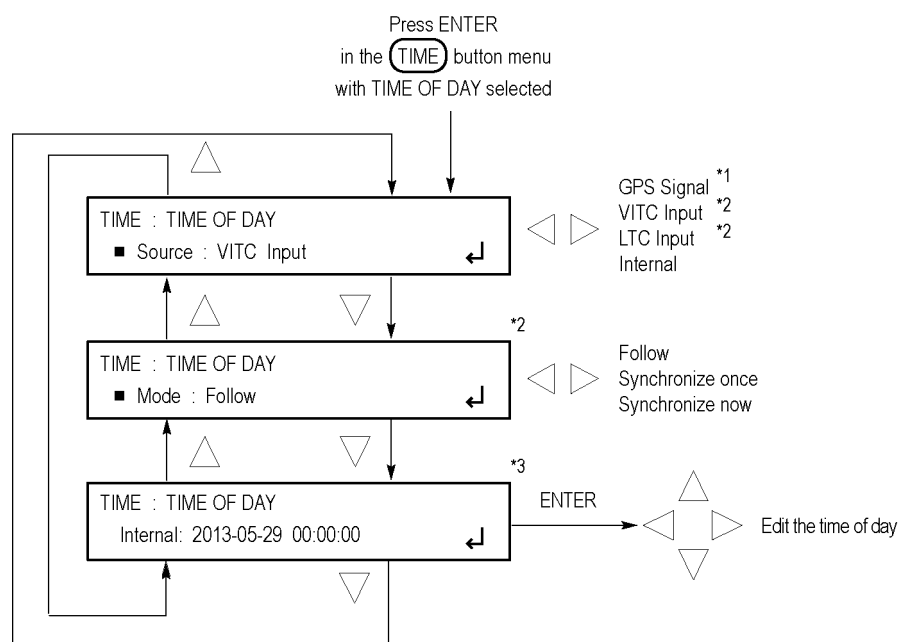
Program time is used to create time code that is not locked to time of day. This is useful if the time code is intended to start at a uniform time for multiple takes of a production.

JAM SYNC. Configures the parameters for the Jam Sync function. Use the function to immediately synchronize the instrument timecode with the selected time source for each output or to regularly schedule a synchronization. Select this menu item and press the **ENTER** button to access the JAM SYNC submenu. (See page 176.)

LEAP SECOND. Schedules when the instrument applies leap seconds (Option GPS only). When Option GPS is installed and GPS is selected as the reference source in the REF button menu, select this menu item and press the **ENTER** button to access the LEAP SECOND submenu. (See page 178.)

TIME OF DAY submenu

Sets the time of day reference that will be used by the instrument when the reference source is set to internal in the REF button menu. Use the up (▲) or down (▼) arrow button to scroll through the menu items. The following figure shows the TIME OF DAY submenu diagram.



*1 This selection appears only when GPS is set as the reference source.

*2 These selections appear only when GPS is not set as the reference source.

*3 This selection appears only when the TIME OF DAY source is set to Internal.

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Figure 63: TIME OF DAY submenu diagram

Source. Use the left (◀) or right (▶) arrow button to select from the following timecode reference sources:

- **GPS Signal:** This menu item appears only when Option GPS is installed. If GPS Signal is selected, the time from the GPS receiver is used to derive the time of day. This menu item is only available if GPS Signal is the selected reference source in the REF button menu.

NOTE. *When you select GPS signal as the timecode reference source, then depending on the GPS signal availability, it can take a while for the instrument to lock to the GPS signal. During the time before the instrument locks to the GPS signal, the instrument uses time based on the internal real time clock.*

- **VITC Input:** Selects the vertical interval time code as the timecode reference. VITC is only available when the Reference Source is set to a video Genlock signal.

NOTE. *When the VITC or LTC inputs are used as time-of-day sources, the hh:mm:ss:ff settings will be synchronized to the VITC or LTC source (if present). However, the yyyy-mm-dd settings will be set from the most recent valid source (GPS or internal/manual).*

- **LTC Input:** Selects the LTC time code input as the timecode reference. This menu item is only available when the function of the LTC connector is set to Input.
- **Internal:** Enables the Internal Time of Day mode. When the timecode reference is set to Internal, an additional menu setting appears where you can set the time manually (like setting any clock) and then activate the time-of-day change.



CAUTION. *When Internal is selected as the timecode reference, the time-of-day will not be automatically changed. (See page 3-132, How to set the time-of-day in Internal mode.)*

Mode. When VITC or LTC is selected as the Time of Day source, use the left (◀) or right (▶) arrow button to select from the following synchronization modes:

- **Follow:** The time of day follows the VITC or LTC on the input signal if the signal is stable for at least 100 consecutive frames.
- **Synchronize once:** The VITC or LTC on the input signal is continuously monitored until a stable signal is received (at least 100 consecutive frames). At that time, the time of day synchronizes (once) to this reference.
- **Synchronize now:** The time of day attempts to synchronize with the VITC or LTC on the input signal when the ENTER button is pressed. A total of ten attempts to synchronize are made. After ten attempts, no further attempts are made to synchronize regardless if synchronization occurred or failed. A stable signal of at least 100 consecutive frames is needed.

Internal. When the Time of Day source is set to Internal, use this menu item to manually enter the date and time and to activate the time-of-day change.

Select this menu item and perform the following steps to set the Time of Day in Internal mode:

1. Press the **ENTER** button to enter the date and time edit mode.
2. Use the left (◀) or right (▶) arrow button to select a digit in the time offset to change. An underline character appears under the selected time digit. The date and time digits take the following form: YYYY-MM-DD HH:MM:SS.
3. After you select an offset digit, use the up (▲) or down (▼) arrow button to change the value of the digit. Repeat for each digit as required for your date and time.



CAUTION. When you press the ENTER button, this applies the start time and date offset. Typically, this causes a disruption to the syncs, so care should be taken to verify the date and time are correct before activating the time-of-day setting for Internal mode.

4. Press the **ENTER** button to confirm the change and set the time.

NOTE. The manual time of day setting is not automatically reapplied when the instrument power is cycled. If the instrument powers on in Internal mode, the time of day will be acquired from the real time clock in the instrument.

The time zone offset must be set to maintain the correct relationship between UTC and local time.

DST SCHEDULE submenu

Configures how the instrument handles Daylight Saving Time. Use the up (▲) or down (▼) arrow button to scroll through the menu items. The following figure shows the DST SCHEDULE submenu diagram.

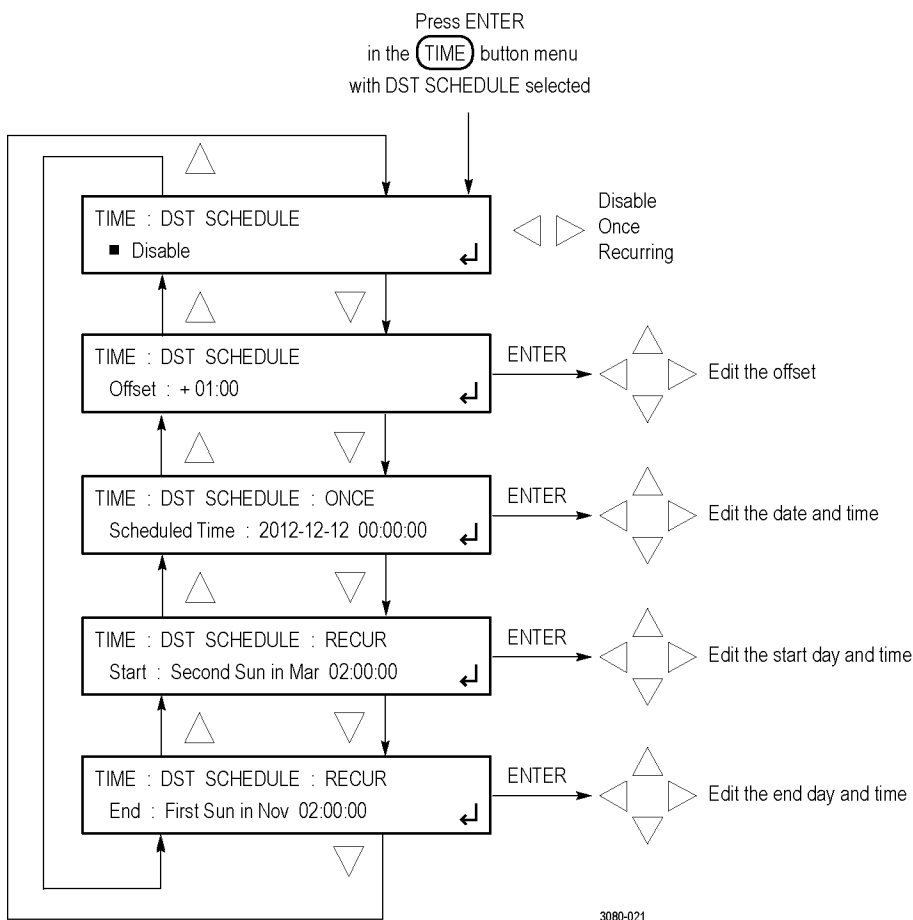


Figure 64: DST SCHEDULE submenu diagram

Disable. Use the left (◀) or right (▶) arrow button to set the DST schedule function to one of the following:

- **Disable:** Use this menu item to disable the DST schedule function.
- **Once:** Use this menu item to schedule a specific calendar date and time to apply or remove the daylight savings time offset. For example, “2011-03-06 02:00:00.”
- **Recurring:** Use this menu item to set up relative dates and times to apply and remove the DST offset. For example, “1st Sun of Oct 02:00:00.”

Offset. Use this menu item to set the DST offset that will be applied when either the Once event or the DST START event occurs at the user-scheduled time.

Press the **ENTER** button, and then use the left (◀) or right (▶) arrow button to select a digit in the DST offset value to change. An underline character appears under the selected offset digit. The date and time digits take the following form: HH:MM. When the DST Schedule function is set to Recurring, this offset can only be a positive number.

After you select an offset digit, use the up (▲) or down (▼) arrow button to change the value of the digit. Repeat for each digit as required for your offset. Press the **ENTER** to confirm the offset change.

ONCE. Press the **ENTER** button, and then use the left (◀) or right (▶) arrow button to select a digit in the DST setup value to change. An underline character appears under the selected digit. The date and time digits take the following form: YYYY-MM-DD HH:MM:SS.

After you select a digit, use the up (▲) or down (▼) arrow button to change the value of the digit. Repeat for each digit as required for your date and time. Press the **ENTER** to confirm the change.

NOTE. *When the DST Once event occurs, the scheduled offset will be either added to or subtracted from the time zone offset, and the DST schedule will be cleared. This allows for a new schedule to be set up for any time in the future.*

VITC may have DST shift already applied. To avoid duplicating DST shifts, disable the DST SCHEDULER if the time of day reference has DST applied.

RECUR <Start / End>. There are two Recurring selections: Start and End. The DST Start time is the time when the DST offset you enter will be added to the time zone offset. The DST End time is the time when the DST offset will be removed.

The DST Start and DST End times are edited in the same manner. Press the **Enter** button, and then use the left (◀) or right (▶) arrow button to select a digit in the DST START or DST END value to change. An underline character appears under the selected digit. The date and time digits take the following form: Week-Day-Month HH:MM:SS. After you select a digit, use the up (▲) or down (▼) arrow button to change the value of the digit. Repeat for each digit as required for your date and time.

For example, if you enter First-Sun-Mar 02:00:00 for the DST Start time, the DST offset you entered would be added to the time zone offset on the first Sunday in March at 2 AM. The Week field can be set to the First, Second, Third, Fourth, or Last. Press the **ENTER** to confirm the change.

NOTE. *If you enable the Recurring function at a time between the Start and End settings, the DST offset is immediately applied when you press the ENTER button.*

PROGRAM TIME submenu

Configures the program time parameters for the instrument. Program time is used to create time code that is not locked to time of day. This is useful if the time code is intended to start at a uniform time for multiple takes of a production.

Use the up (▲) or down (▼) arrow button to scroll through the menu items. The following figure shows the PROGRAM TIME submenu diagram.

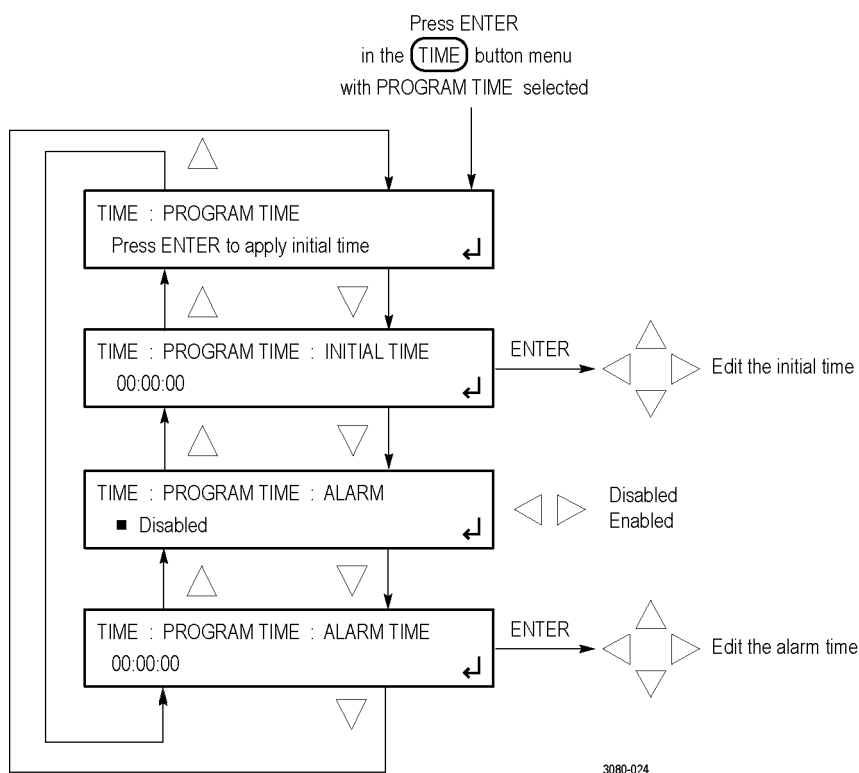


Figure 65: PROGRAM TIME submenu diagram

PROGRAM TIME. Applies the initial program time configured in the INITIAL TIME menu item below. Select this menu item and press the **ENTER** button to apply the configured Initial Time.

NOTE. *You can use the INPUT TRIGGER setting in the SYSTEM : GPI submenu to configure pin 4 of the GPI port connector to trigger the instrument to reset the program time. (See page 147, GPI submenu.)*

INITIAL TIME. Enters the initial program time. Select this menu item and press the **ENTER** button to edit the Initial Time setting.

Use the left (◀) or right (▶) arrow button to select a digit in the Program Time counter to change. An underline character appears under the selected digit. The date and time digits take the following form: HH:MM:SS.

After you select a digit, use the up (▲) or down (▼) arrow button to change the value of the digit. Repeat for each digit as required. Press the **ENTER** to confirm the change.

ALARM. Enables or disables the Alarm Time function. Use the left (◀) or right (▶) arrow button to select **Enabled** or **Disabled**. Press the **ENTER** button to confirm the selection.

ALARM TIME. Enters the Alarm Time schedule setting. Using the GPI connector, the Alarm Time function can be used to drive a light or similar indicator of alarm occurrences at a specific time in a program. Select this menu item and press the **ENTER** button to edit the Alarm Time.

Use the left (◀) or right (▶) arrow button to select a digit in the Alarm Time schedule to change. An underline character appears under the selected digit. The date and time digits take the following form: HH:MM:SS.

After you select a digit, use the up (▲) or down (▼) arrow button to change the value of the digit. Repeat for each digit as required. Press the **ENTER** to confirm the setting.

NOTE. *You can use the SYSTEM : GPI OUTPUT submenu to configure the GPI port connector to output a signal when the Alarm Time setting is reached. (See page 149, GPI OUTPUT <1, 2, or 3> submenu.)*

JAM SYNC submenu

Configures the parameters for the Jam Sync function. Use the function to immediately synchronize the instrument timecode with the selected time source for each output or to regularly schedule a synchronization.

NOTE. A daily Jam Sync should be performed on systems running at non-integer frame rates.

Use the up (▲) or down (▼) arrow button to scroll through the menu items. The following figure shows the JAM SYNC submenu diagram.

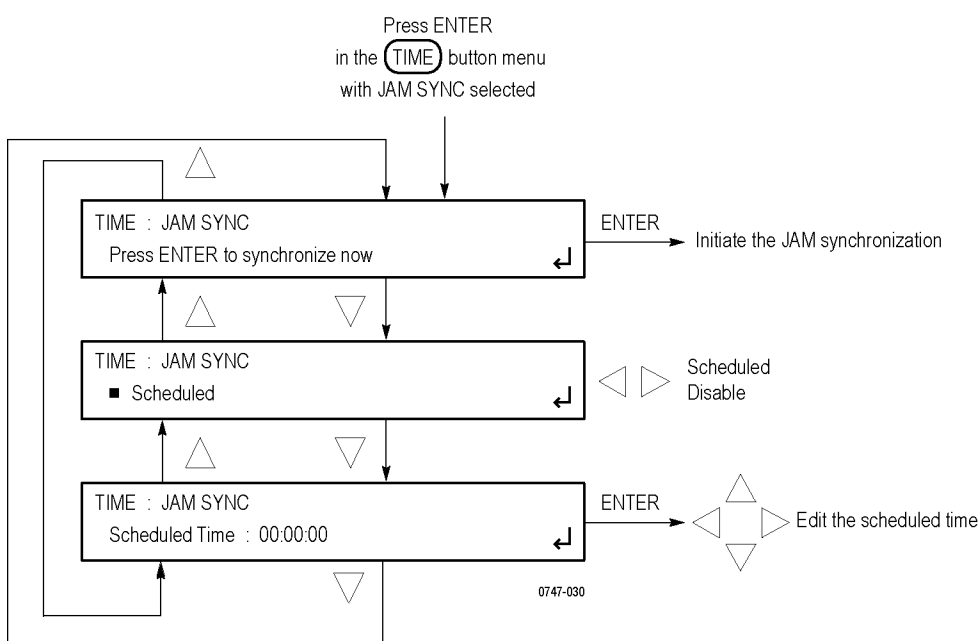


Figure 66: JAM SYNC submenu diagram

Press ENTER to synchronize now. Immediately synchronizes the module timecode with the GPS signal timecode. Select this menu item and press the **ENTER** button to initiate the synchronization process.

Scheduled/Disable. Enables or disables the Jam Sync function. Use the left (◀) or right (▶) arrow button to select **Scheduled** or **Disable**. When set to Scheduled, the Jam Sync function will be applied at the time configured using the Scheduled Time menu item below.

Scheduled Time. Configures the scheduled time for the daily Jam Sync function. Select this menu item and press the **ENTER** button to enter the edit mode. Use the left (◀) or right (▶) arrow button to select a digit in the Jam Sync schedule to change. An underline character appears under the selected digit. The date and time digits take the following form: HH:MM:SS.

After you select a digit, use the up (▲) or down (▼) arrow button to change the value of the digit. Repeat for each digit as required. Press the **ENTER** to confirm the change.

NOTE. *You can use the INPUT TRIGGER setting in the SYSTEM : GPI submenu to configure pin 4 of the GPI port connector to trigger the instrument to force a Jam Sync. (See page 147, GPI submenu.)*

LEAP SECOND submenu (Option GPS only)

When Option GPS is installed and GPS is selected as the reference source in the REF button menu, you can use this submenu to schedule when leap seconds are implemented.

For many applications, it might be fine to apply the leap second at midnight UTC. However, for some time zones this might cause a disruption during a critical programming time slot. The LEAP SECOND submenu allows the leap second to be deferred up to 24 hours.

NOTE. The LEAP SECOND submenu is only available when GPS is configured as the reference source in the REF button menu.

Use the up (▲) or down (▼) arrow button to scroll through the menu items. The following figure shows the LEAP SECOND submenu diagram.

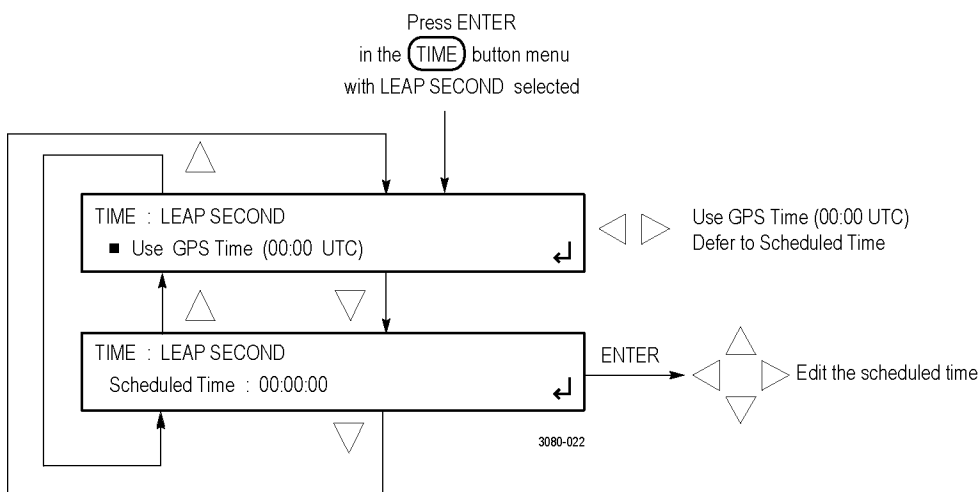


Figure 67: LEAP SECOND submenu diagram

Use GPS Time/Defer to Scheduled Time. Selects when the leap second will be applied. Use the left (◀) or right (▶) arrow button to select one of the following options:

- **Use GPS Time (00:00 UTC):** Applies the leap second adjustment immediately when signalled by the GPS system at 23:59:60 UTC on June 30 or December 31 (as appropriate), regardless of the local time.
- **Defer to Scheduled Time.** Applies the leap second at the deferred time configured using the Scheduled Time menu item below.

Scheduled Time. Schedules a deferred time to apply the leap second adjustment. Select this menu item and press the **ENTER** button to access the edit mode.

Use the left (◀) or right (▶) arrow button to select a digit in the schedule time to change. An underline character appears under the selected digit. The date and time digits take the following form: HH:MM:SS.

After you select a digit, use the up (▲) or down (▼) arrow button to change the value of the digit. Repeat for each digit as required. Press the **ENTER** to confirm the change.

TIME button menu factory default settings

The following table shows the settings for the TIME button menu that are reset when you use the PRESET submenu to recall the factory default settings. (See page 136, *PRESET submenu*.)

Table 33: TIME button menu factory default settings

Menu item name	Settings
TIME OF DAY	
Source ¹	Without Option GPS or when the Reference source is not GPS: VITC Input With Option GPS: GPS Signal
Mode	Follow
Internal Time of Day	2008-01-01 00:00:00
TIME ZONE OFFSET	+00:00
DST SCHEDULE	
Mode	Disable
Offset	+01:00
ONCE Scheduled Time	2008-01-01 00:00:00
RECUR Start	Second Sun in Mar 02:00:00
RECUR End	First Sun in Nov 02:00:00
PROGRAM TIME	
INITIAL TIME	00:00:00
ALARM	Disabled
ALARM TIME	00:00:00
JAM SYNC	
Mode	Scheduled
Scheduled Time	00:00:00
LEAP SECOND ²	
Mode	Use GPS Time (00:00 UTC)
Scheduled Time	00:00:00

¹ The default Time of Day source depends on whether Option GPS is installed and whether the Reference source is set to GPS.

² This menu item is only available when Option GPS is installed and when the Reference source is set to GPS Signal.

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